

HALO[®]

PCS

C18 | PHENYL-HEXYL | PEPTIDE

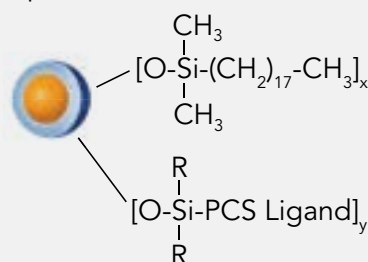
POSITIVELY EXCEPTIONAL PERFORMANCE
FOR BASIC COMPOUNDS



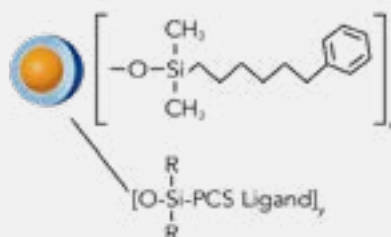
HALO® PCS (Positive Charged Surface)

POSITIVELY EXCEPTIONAL RESULTS FOR BASIC COMPOUNDS

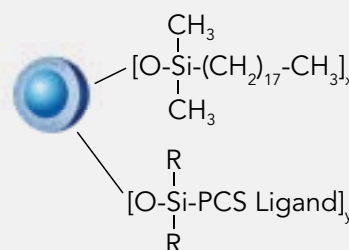
Built upon proven Fused-Core® technology for speed and efficiency, the HALO® PCS column products are positively charged surface chemistries designed to deliver improved peak shapes for basic compounds observed with standard C18 and Phenyl-Hexyl chemistries. Ideal for use with low ionic strength mobile phases, HALO® PCS maintains peak symmetry at higher loading capacities and provides alternate selectivities from other C18 and Phenyl-Hexyl bonded phases. Available in both a 90 Å and 160 Å pore size for small molecule and peptide analysis. The columns are optimized to deliver performance for reproducible, high efficiency LC and LCMS separations.



HALO 90 Å PCS C18



HALO 90 Å PCS PHENYL-HEXYL



HALO 160 Å PCS C18

FEATURES: PCS C18 AND PCS PHENYL-HEXYL for Small Molecule Separations

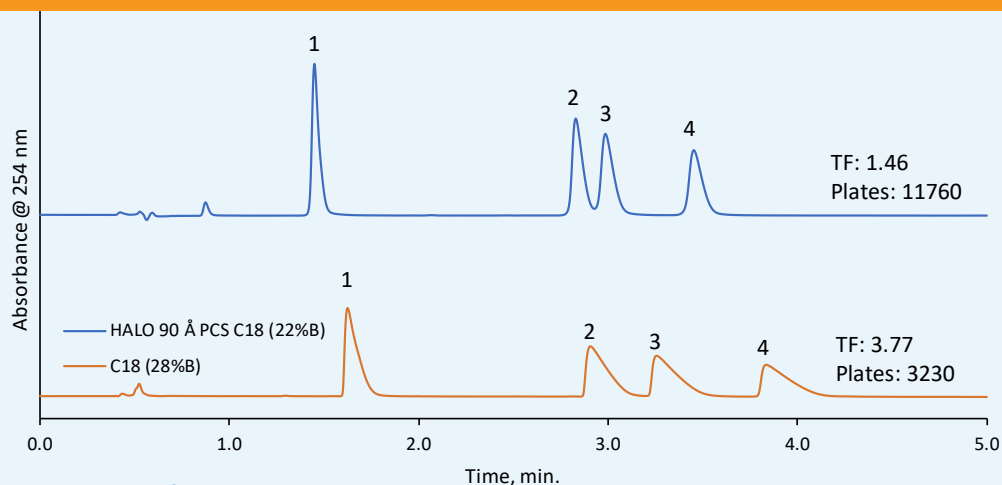
- Excellent peak shape and increased loading capacity for basic compounds
- UHPLC and LCMS compatible
- Alternate L1 selectivity (PCS C18)
- Alternate L11 selectivity (PCS Phenyl-Hexyl)
- Built upon Fused-Core® technology for fast, efficient and reliable separations

FEATURES: PCS C18 for Peptide Separations

- Significantly improved peak widths and symmetry for basic peptides compared to traditional peptide C18 stationary phases
- Designed for performance with formic acid avoiding LCMS signal suppression from TFA
- UHPLC and LCMS compatible
- Alternate L1 selectivity with optimized pore size for peptide separations

SEPARATION USING HALO® PCS C18 COMPARED TO C18

A mix of four antidepressants is separated using the HALO 90 Å PCS C18 column. The positive charged surface (PCS) stationary phase is ideal for basic analytes when using low ionic strength mobile phases such as formic acid. Improved tailing factor and efficiency are observed when compared to a traditional (uncharged) C18 stationary phase.



TEST CONDITIONS:

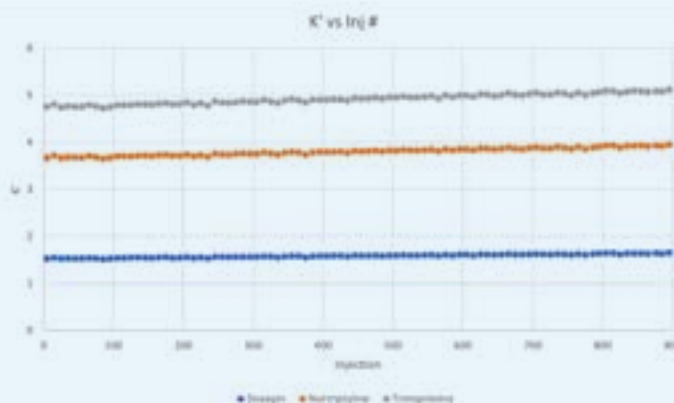
Column: HALO 90 Å PCS C18, 2.7 μ m, 2.1 x 100 mm
Part Number: 92812-617
Column: C18, 2.7 μ m, 2.1 x 100 mm
Mobile Phase A: Water, 0.1% Formic Acid
Mobile Phase B: Acetonitrile, 0.1% Formic Acid
Isocratic: HALO® PCS C18: 22 %B C18: 28 %B
Flow Rate: 0.4 mL/min.
Back Pressure: 242 bar
Temperature: 30 °C
Injection: 0.5 μ L (31 μ g)
Sample Solvent: 75/25 Water/ACN
Wavelength: PDA, 254 nm
Flow Cell: 1 μ L
Data Rate: 40 Hz
Response Time: 0.05 sec.
LC System: Shimadzu Nexera X2

PEAK IDENTITIES:

- | | |
|------------------|------------------|
| 1. Doxepin | 3. Amitriptyline |
| 2. Nortriptyline | 4. Trimipramine |

STABILITY

Panel of antidepressants screened with 900 injections demonstrating the excellent stability of HALO® PCS C18.

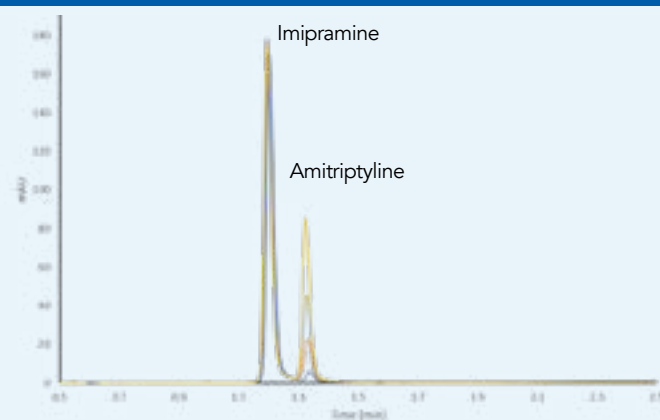


TEST CONDITIONS:

Column: HALO 90 Å PCS C18, 2.7 μ m, 2.1 x 100 mm
Part Number: 92812-617
Mobile Phase:
A: Water, 0.1% Formic Acid
B: Acetonitrile, 0.1% Formic Acid
Isocratic: 20 %B
Flow Rate: 0.6 mL/min.
Back Pressure: 244 bar
Temperature: 60 °C
Injection: 0.5 μ L
Sample Solvent: 80/20 Water/ ACN
Wavelength: PDA, 254 nm
Flow Cell: 1 μ L
Data Rate: 40 Hz
Response Time: 0.025 sec.
LC System: Shimadzu Nexera X2

LOADABILITY ADVANTAGE

Over the range of 0.75 to 15 ng injected on the column, the HALO® PCS Phenyl-Hexyl maintains baseline resolution under formic acid mobile phase conditions.



TEST CONDITIONS:

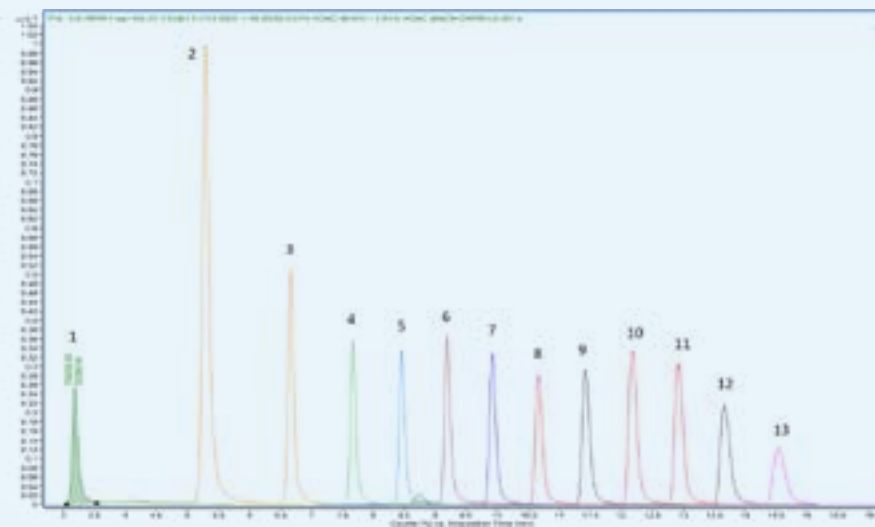
Column: HALO 90 Å PCS Phenyl-Hexyl, 2.7 μ m, 2.1 x 100 mm
Mobile Phase:
A: Water + 0.1% Formic
B: ACN + 0.1% Formic
Gradient:

Time	%B
0.0	25
3.0	35
3.1	85
3.6	85
3.7	25
5.0	25

Flow Rate: 0.4 mL/min.
Back Pressure: 242 bar
Temperature: 35 °C
Injection: 1.0 μ L
Sample Solvent: 75/25 Water/ACN
Wavelength: PDA, 254 nm
Flow Cell: 1 μ L
Data Rate: 100 Hz
Response Time: 0.025 sec.
LC System: Shimadzu Nexera X2

SEPARATION OF SHORT AND LONG CHAIN PFAS USING HALO® PCS C18

HALO® PCS C18 exhibits retention of both short chain and long chain PFAS compounds, which is advantageous for those investigating a broad range of PFAS compounds.



PEAK IDENTITIES:

1. Trifluoroacetic acid - (TFA)
2. Perfluoropropionic acid - (PFPrA)
3. Perfluorobutanoic acid - (PFBA)
4. Perfluoropentanoic acid - (PFPeA)
5. Perfluorohexanoic acid - (PFHxA)
6. Perfluoroheptanoic acid - (PFHpA)
7. Perfluorooctanoic acid - (PFOA)
8. Perfluorononanoic acid - (PFNA)
9. Perfluorodecanoic acid - (PFDA)
10. Perfluoroundecanoic acid - (PFUnA)
11. Perfluorododecanoic acid - (PFDoA)
12. Perfluorotridecanoic acid - (PFTTrA)
13. Perfluorotetradecanoic acid - (PFTA)

TEST CONDITIONS:

Column: HALO 90 Å PCS C18, 2.7 μ m,
2.1 x 100 mm
Part Number: 92812-617
Delay Column: HALO® PFAS Delay,
2.7 μ m, 3.0 x 50 mm
Part Number: 92113-415
Mobile Phase A: Water/ 0.01% Acetic Acid
Mobile Phase B: ACN/ 0.01% Acetic Acid

Gradient: Time %B
0.0 20
5.0 80
12.0 90
18.0 90
18.1 20
23.0 END
Flow Rate: 0.5 mL/min.

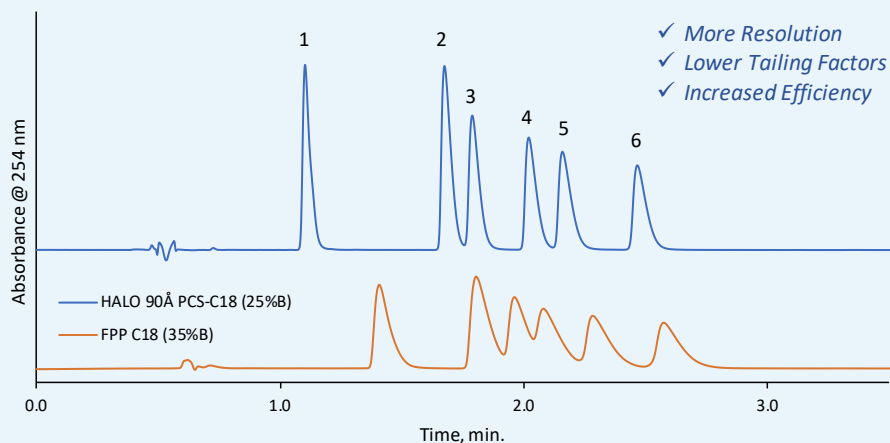
Temperature: 40 °C
Detection: -ESI MS/MS
Injection Volume: 2.0 μ L
MS System: Agilent 6400 series
LC System: Agilent 1200 series
Data Courtesy of: Center for
PFAS Solutions (New Castle, DE)

MS CONDITIONS:

Gas Temp: 130 °C
Nebulizer: 25 psi
Gas Flow: 11 L/min
Sheath Gas Heater: 250 °C
Capillary: 3500 V

FUSED-CORE® ADVANTAGE

As shown in this basic drug panel of antidepressants, the HALO® Fused-Core® PCS technology tolerates a higher sample load of basic compounds compared to the competitor fully porous C18 column. The positive charged surface (PCS) stationary phase is ideal for basic analytes when using low ionic strength mobile phases such as formic acid.



PEAK IDENTITIES:

- | | | |
|----------------|------------------|------------------|
| 1. Doxepin | 3. Imipramine | 5. Amitriptyline |
| 2. Desipramine | 4. Nortriptyline | 6. Trimipramine |

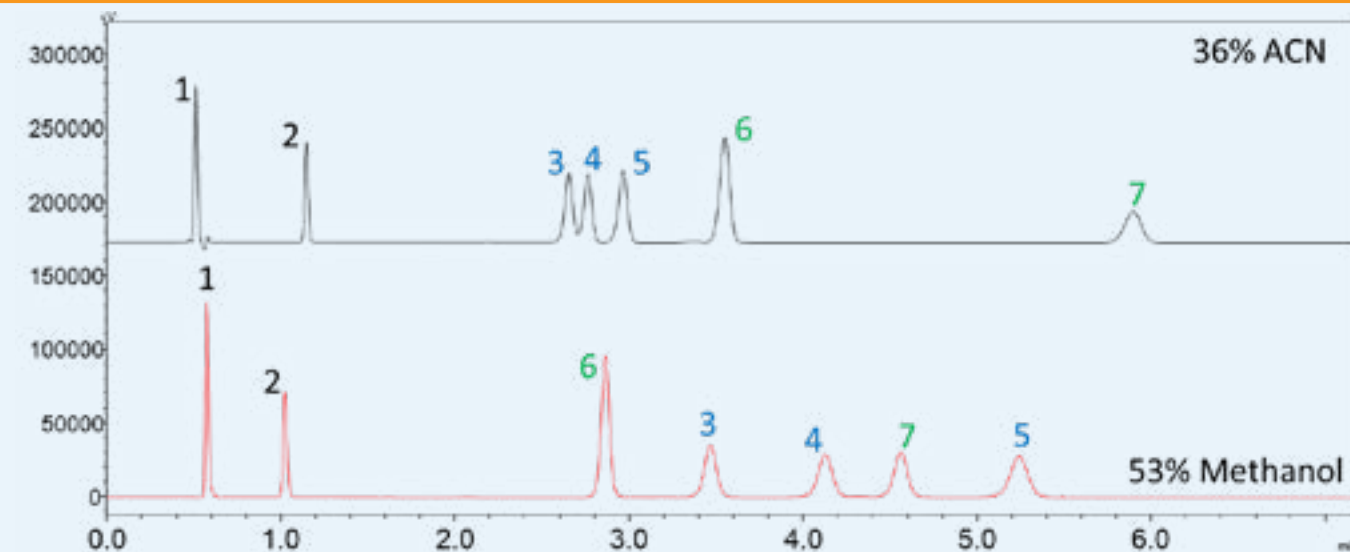
TEST CONDITIONS:

Column: HALO 90 Å PCS C18, 2.7 μ m, 2.1 x 100 mm
Part Number: 92812-617
Competitor Column: FPP C18, 3 μ m, 2.1 x 100 mm
Mobile Phase A: Water, 0.1% Formic Acid
Mobile Phase B: Acetonitrile, 0.1% Formic Acid
Isocratic: HALO® PCS C18: 25 %B
FPP C18: 35 %B
Flow Rate: 0.4 mL/min.
Back Pressure: 267 bar
Temperature: 35 °C
Injection: 0.5 μ L (40 μ g)
Sample Solvent: 75/25 Water/ ACN
Wavelength: PDA, 254 nm
Flow Cell: 1 μ L
Data Rate: 100 Hz
Response Time: 0.025 sec.
LC System: Shimadzu Nexera X2

HALO 90 Å PCS PHENYL-HEXYL

EFFECT OF ORGANIC MODIFIER ON HALO® PCS PHENYL-HEXYL

By using methanol with HALO® PCS Phenyl-Hexyl, the pi-pi interactions are enhanced between the analytes and the phenyl stationary phase, resulting in increased retention for peaks 3, 4, and 5 (bases) and decreased retention for peaks 6 and 7 - (neutrals).



TEST CONDITIONS:

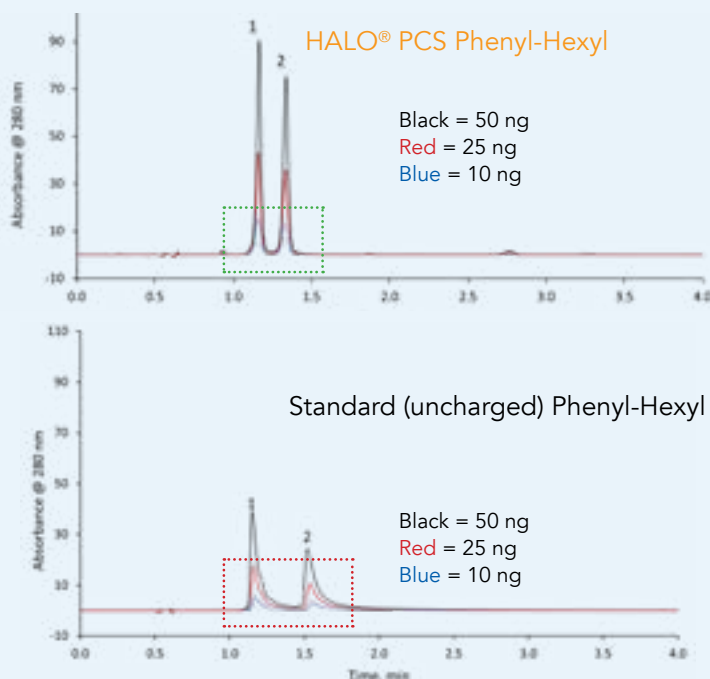
Column: HALO 90 Å PCS Phenyl-Hexyl, 2.7 μ m, 2.1 x 100 mm
 Mobile Phase
 A: Water/ 0.1% Formic Acid
 B: ACN or Methanol/ 0.1% Formic Acid
 Isocratic: 36(ACN)/53(Methanol) %B
 Instrument: Nexera
 Injection: 0.5 μ l Benzo QA Mix
 Temperature: 30 $^{\circ}$ C
 Flow Rate: 0.4 mL/min.

PEAK IDENTITIES:

- | | |
|------------------|----------------------------|
| 1. Uracil | 5. Diazepam |
| 2. Phenol | 6. 1-chloro-4-nitrobenzene |
| 3. Oxazepam | 7. Naphthalene |
| 4. Flunitrazepam | |

DEMONSTRATION OF PEAK SHAPE IMPROVEMENT & LOADABILITY WITH HALO® PCS

HALO® PCS Phenyl-Hexyl shows sharp, symmetrical peaks from 10-50 ng of each tetracycline antibiotic injected on the column. The peak widths are 50% smaller with HALO® PCS Phenyl-Hexyl compared to standard Phenyl-Hexyl.



PEAK IDENTITIES:

1. Oxytetracycline
2. Tetracycline

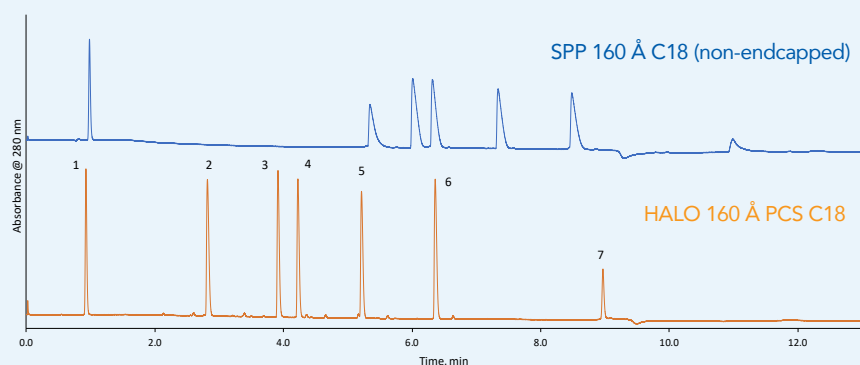
TEST CONDITIONS:

Column: 2.7 μ m, 2.1 x 100 mm phase as labeled
 Mobile Phase
 A: Water/ 0.1% Formic Acid
 B: Acetonitrile/ 0.1% Formic Acid
 Isocratic:
 12 %B HALO® PCS Phenyl-Hexyl
 18 %B SPP Phenyl-Hexyl
 Flow Rate: 0.4 mL/min.
 Instrument: Nexera
 Injection: 0.2, 0.5, 1.0 μ l (10,25,50 ng)
 Temperature: 35 $^{\circ}$ C

HALO 160 Å PCS C18 PEPTIDE

THE PCS ADVANTAGE

A synthetic panel of basic peptides is screened on the HALO 160 Å PCS C18 compared to the traditional C18 stationary phase. While using low ionic strength mobile phases such as formic acid the positively charged surface stationary phase shows significantly better peak widths and symmetry for more basic peptides when compared to a traditional non-encapped peptide C18 stationary phase.



PEAK IDENTITIES:

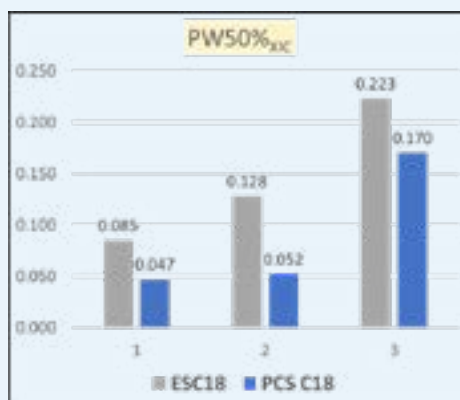
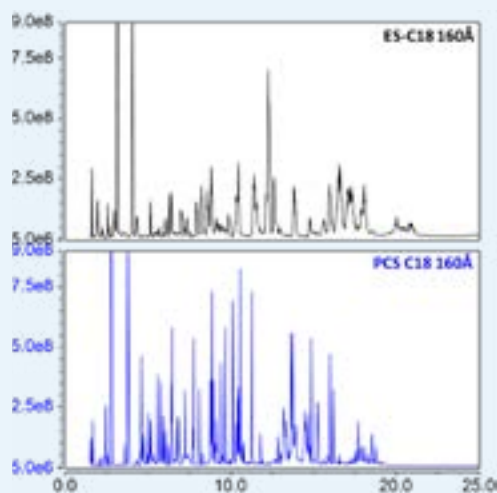
- | | |
|-------------------------------------|-------------------------------------|
| 1. Uracil | 5. S4Y2 Sequence: Ac-RGVGYLGLGK-NH2 |
| 2. S1Y Sequence: RGAGGLYLGLK-NH2 | 6. S5Y Sequence: Ac-RGVGYLGLGK-NH2 |
| 3. S2Y Sequence: Ac-RGGGGLYLGLK-NH2 | 7. Insulin Chain B Oxidized |
| 4. S3Y Sequence: Ac-RGAGGLYLGLK-NH2 | |

TEST CONDITIONS:

Column: HALO 160 Å PCS C18, 2.7 µm, 2.1 x 100 mm
 Part Number: 92812-617
 Comparison Column: SPP 160 Å C18, 2.7 µm, 2.1 x 100mm
 Mobile Phase A: Water/ 0.1% Formic Acid
 Mobile Phase B: Acetonitrile/ 0.1% Formic Acid
 Gradient: Time %B
 0.0 2
 10.0 35
 Flow Rate: 0.3 mL/min.
 Temperature: 30 °C
 Injection Volume: 1.0 µL
 Wavelength: PDA, 280 nm
 Flow Cell: 1 µL
 Data Rate: 100 Hz
 Response Time: 0.025 sec.
 LC System: Shimadzu Nexera X2

IMPROVING PEAK WIDTH USING HALO® PCS C18

A separation of Trastuzumab tryptic digest is performed on two HALO® columns, the 160 Å ES-C18 and the 160 Å PCS C18 phases. By using a positively charged stationary phase (PCS C18) with low ionic conditions allows for an alternative selectivity and better separation of the peptides.



TEST CONDITIONS:

Column: HALO 160 Å ES-C18, 2.7 µm, 2.1 x 150 mm
 Part Number: 92122-702
 Column: HALO 160 Å PCS C18, 2.7 µm, 2.1 x 150 mm
 Part Number: 92112-717
 Mobile Phase A: Water + 0.1% Formic Acid
 Mobile Phase B: Acetonitrile + 0.1% Formic Acid
 Gradient: Time %B
 0.0 3
 30.0 50
 30.1 95
 33.0 95
 33.1 3
 37.0 3
 Flow Rate: 0.4 mL/min.
 Pressure: 465 bar
 Temperature: 60 °C
 Injection Volume: 1 µL
 Sample: Trastuzumab Tryptic Digest (1.25 µg/µL)
 Sample Solvent: Refer to Digestion Procedure
 LC System: Shimadzu Nexera X2

#	Tryptic Peptide	XIC	t _R (min)
1	AEDTAVYYQ[Carbamidomethyl]ISR	667.7877 [m/z]	ES-C18: 6.41 PCS C18: 4.60
2	TPEVTQ[Carbamidomethyl]VVVDVSHEDPEVK	713.6807 [m/z]	ES-C18: 12.28 PCS C18: 10.11
3	TVAAPSVIFPPSDEQLK	973.5171 [m/z]	ES-C18: 17.12 PCS C18: 14.47

MS CONDITIONS:

System: QExactive HF
 ESI positive polarity
 300-2000 m/z
 Source voltage: 3.2kV
 Sheath Gas: 40
 Aux Gas: 20

Aux Gas Temp: 275°C
 Capillary Temp: 320°C
 µscans: 1
 Max Injection Time: 200 msec
 S-Lens RF: 50

ATTRIBUTE	90 Å PCS C18	90 Å PCS Phenyl-Hexyl	160 Å PCS C18
Ligand	dimethyloctadecylsilane	6-phenylhexyldimethylsilane	dimethyloctadecylsilane
Particle Size (µm)	2.7	2.7	2.7
Pore Size (Å)	90	90	160
USP #	L1	L11	L1
Carbon Load (%)	7.4	6.1	5.0
Surface Area(m ² /g)	125	125	90
Endcapped (Y/N)	Yes	Yes	Yes
Low pH Limit/Max T	2/60 °C	2/60 °C	2/60 °C
High pH Limit/Max T	7/40 °C	7/40 °C	7/40 °C
100% Aqueous Compatible	Yes	Yes	Yes

PART NUMBERS

Dimensions: ID x Length (in mm)	90 Å PCS C18	90 Å PCS Phenyl-Hexyl	160 Å PCS C18
1.5 x 50	9281X-417	9281X-418	9211X-417
1.5 x 100	9281X-617	9281X-618	9211X-617
1.5 x 150	9281X-717	9281X-718	9211X-717
2.1 x 50	92812-417	92812-418	92112-417
2.1 x 100	92812-617	92812-618	92112-617
2.1 x 150	92812-717	92812-718	92112-717
3.0 x 50	92813-417	92813-418	92113-417
3.0 x 100	92813-617	92813-618	92113-617
3.0 x 150	92813-717	92813-718	92113-717
4.6 x 50	92814-417	92814-418	92114-417
4.6 x 100	92814-617	92814-618	92114-617
4.6 x 150	92814-717	92814-718	92114-717
4.6 x 250	92814-917	92814-918	

HALO® GUARD COLUMNS 3 PACK			
Dimensions: ID x Length (in mm)	90 Å PCS C18	90 Å PCS Phenyl-Hexyl	160 Å PCS C18
2.1 x 5	92812-117	92812-118	92112-117
3.0 x 5	92813-117	92813-118	92113-117
4.6 x 5	92814-117	92814-118	92114-117
Guard Column Holder		94900-001	

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halocolumns.com

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