SHIMADZU
Excellence in Science

S-COS-B18B
#2021 Issue

Shimadzu Consumables Catalogue

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S-COS-B18B #2021 Issue

CoreFocus

The Smart Choice In Consumables SHIMADZU

For over 140 years, Shimadzu has continued to be your trusted partner by providing leading-edge analytical instruments. Now we further support your success through borderless delivery of the high quality consumable products that solve everyday challenges. All this is for the pursuit of our corporate philosophy "Contributing to Society through Science and Technology".

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CoreFocus
SHIMADZU

UHPLC/HPLC Columns and LC Accessories

Column Selection Guide

Selection by Support Materials

Packing Materials

- **Silica Gel Type**
  - Shim-pack XR, VP, MAqC-ODS, G Series, FC-ODS, Velox Series, Arata C18
  - Shim-pack UC Series
  - Shim-pack Diol Series
  - Shim-pack WAX/WCX Series
- **Organic Silica Hybrid**
  - Shim-pack Scepter Series
- **Polymer Type**
  - Shim-pack GPC Series
  - Shim-pack IC Series
  - Shim-pack Amino, SCR, ISA/ISC Series

Selection by Separation Modes

Silica Gel Type

- **Reversed Phase**
  - ODS/C18 (Shim-pack XR, VP, MAqC, G, FC Series, Velox, Scepter)
  - Shim-pack GIST C18-AQ
  - Shim-pack GIS C18-P
  - Shim-pack GIS RP-Shield
  - C8 (Shim-pack XR, VP, G Series)
  - Phenyl (Shim-pack XR, VP, G Series)
  - Shim-pack GIST Phenyl-Hexyl
  - Shim-pack Velox Biphenyl
  - Shim-pack Velox PFPP, Shim-pack Scepter PFPP

  } Low molecular-weight compounds
- **Normal Phase**
  - Shim-pack GIS CN ..... Steroid hormones
  - Shim-pack XR-SIL ..... Phospholipids
  - Shim-pack GIST NH2 ..... Saccharides, tocopherols
- **HILIC Mode**
  - Shim-pack GIS HILIC, Velox HILIC, Scepter HILIC ..... Polar compounds
- **Ion Exchange**
  - Shim-pack WAX (weakly basic anion exchange) ..... Nucleotides, proteins
  - Shim-pack WCX (weakly acidic cation exchange) ..... Proteins
- **Gel Filtration**
  - Shim-pack Diol Series ..... Proteins
  - Shim-pack Bio Diol Series ..... MAb, oligonuclestides, carbonydrates, proteins

Polymer Type

- **Ion Exchange**
  - Shim-pack IC Series ..... Inorganic ions
  - Shim-pack Amino, ISC Series ..... Amino acids, guanidines
  - Shim-pack ISA Series ..... Saccharides
  - Shim-pack Bio IEX ..... Peptides, oligonuclestides, biopharmaceutical, proteins, nucleic acids
- **Ion Exclusion**
  - Shim-pack SCR-101H, SCR-102H ..... Organic acids
  - Shim-pack Fast-OA ..... Organic acids
- **GPC**
  - Shim-pack GPC Series ..... Synthetic high polymers

Selection by Column Particle Sizes

- HPLC Columns
  - Analytical Columns
    - High-Speed Analysis
      - 1.6 µm, 2.2 µm — Shim-pack XR-ODS III, Arata C18
      - 1.8 µm, 2.7 µm — Shim-pack Velox Series
      - 1.9 µm, 2 µm, 2.2 µm, 3 µm — Shim-pack G, XR Series, Scepter Series
    - Conventional Analysis
      - ≥3 µm — Shim-pack VP, MAqC-ODS, G Series, FC-ODS, Arata C18, Velox Series, Scepter Series
  - Preparative Columns
    - 5 µm, 10 µm — Shim-pack G Series, Scepter Series
    - 15 µm — Shim-pack PREP Series

Selection of ODS columns

- High-Speed Analysis
  - With Certificate of Compliance for Validation
    - Shim-pack XR-ODS (Pressure tolerance: 35MPa) A-28
    - Shim-pack XR-ODS II (Pressure tolerance: 60MPa) A-30
    - Shim-pack XR-ODS III (Pressure tolerance: 100MPa) A-30
  - Wider pH Range
    - Shim-pack Scepter C18 / HD-C18 (pH range: 1 - 12) A-16
    - Shim-pack GIST/GIST-HP C18 (pH range: 1 - 10) A-38
  - Rapid Separation and Wider pH Range
    - Shim-pack GISS/GISS-HP C18 (pH range: 1 - 10) A-42
  - Stronger Retentivity
    - Shim-pack Scepter C18 / HD-C18 ..... A-16
    - Shim-pack GIS/GIS-HP C18 ..... A-44
  - Strong Retentivity of Highly Polar Compounds
    - Shim-pack GIST/GIST-HP C18-AQ A-38
- Conventional Analysis
  - With Certificate of Compliance for Validation
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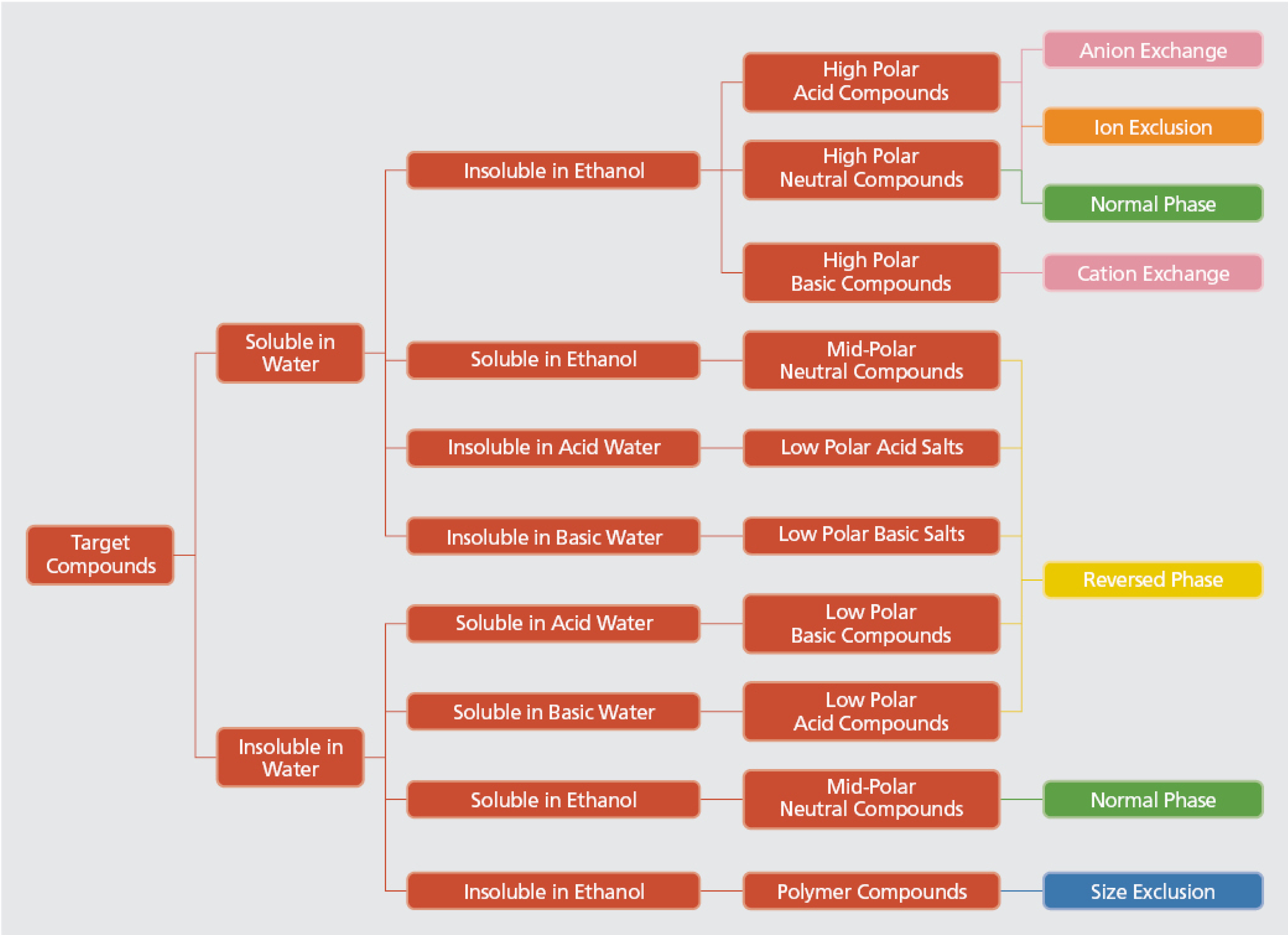
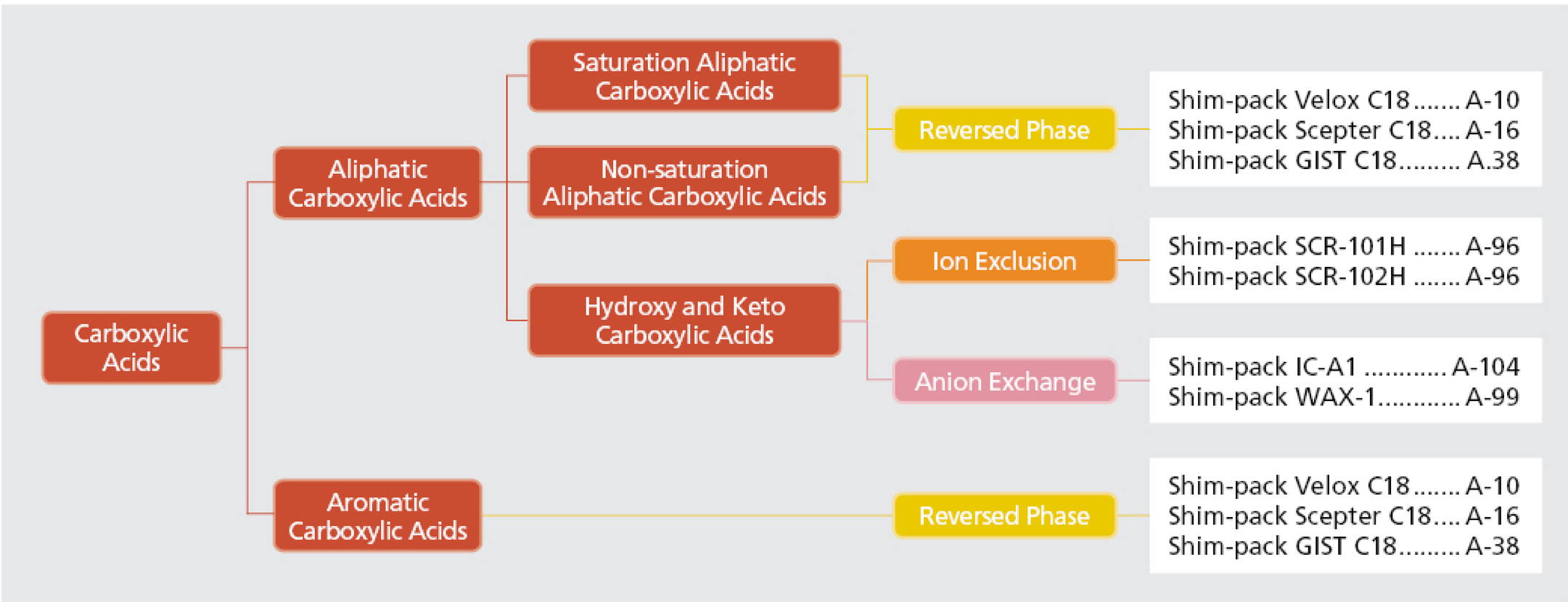
  - Wider pH Range
    - Shim-pack Scepter C18 / HD-C18 (pH range: 1 - 12) A-16
    - Shim-pack GIST C18 (pH range: 1 - 10) A-38
  - Stronger Retentivity
    - Shim-pack GIS C18 ..... A-44
    - Shim-pack FC-ODS (pH range: 1.5 - 9) A-67
    - Shim-pack Scepter HD C18 ..... A-17
  - Higher Steric Selectivity
    - Shim-pack GIS C18-P A-46
  - Different Elution Pattern
    - Shim-pack GIS RP-Shield A-48
  - Higher Cost-Performance
    - Shim-pack GWS C18 ..... A-49
  - Strong Retentivity of Basic Compounds
    - Shim-pack MAqC-ODS A-36

Column Selection Guide

Column Selection by Target Compounds



Column Selection by Target Compounds



Column Selection by Target Compounds

- **Amino Acids**
  - **Free Amino Acids**
    - **HILIC Mode**
      - Shim-pack Scepter Dio-HILIC A-21
    - **Cation Exchange**
      - Shim-pack AMINO-LI ..... A-95 (Post-column derivation fluorescing with OPA)
  - **Protein-hydrolyzed Amino Acids**
    - **Cation Exchange**
      - Shim-pack AMINO-NA ..... A-95 (Post-column derivation fluorescing with OPA)
    - **Reversed Phase (Pre-column derivatization)**
      - Shim-pack Velox C18 ..... A-10
      - Shim-pack Scepter C18 ..... A-16
      - Shim-pack GIST C18 ..... A-38
    - **Reversed Phase + Ion Pair**
      - Shim-pack Velox C18 ..... A-10
      - Shim-pack Scepter C18 ..... A-16
      - Shim-pack GIST C18 ..... A-38

- **Peptides Proteins**
  - **Peptides**
    - **Reversed Phase**
      - Shim-pack Velox C18 ..... A-10
      - Shim-pack Scepter C18 ..... A-16
      - Shim-pack Arata Peptide C18 ..... A-27
      - Shim-pack GIST C18 ..... A-38
      - Shim-pack GISS C18 ..... A-42
  - **Proteins**
    - **Reversed Phase**
      - Shim-pack Scepter C4 ..... A-22
    - **Gel Filtration**
      - Shim-pack Diol Series A-85
      - Shim-pack Bio Diol A-77
    - **Cation Exchange**
      - Shim-pack Bio IEX SP/SP-NP A-77
      - Shim-pack WCX-1 ..... A-99
    - **Anion Exchange**
      - Shim-pack Bio IEX Q/Q-NP A-77
      - Shim-pack WAX-2 ..... A-99
    - **Hydrophobic Interaction**
      - Shim-pack Bio HIC A-133

- **Sugars**
  - **Monosaccharides**
    - **HILIC Mode**
      - Shim-pack GIST NH2 ..... A-60
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      - Shim-pack SCR-101N/C/P A-96
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    - **Anion Exchange**
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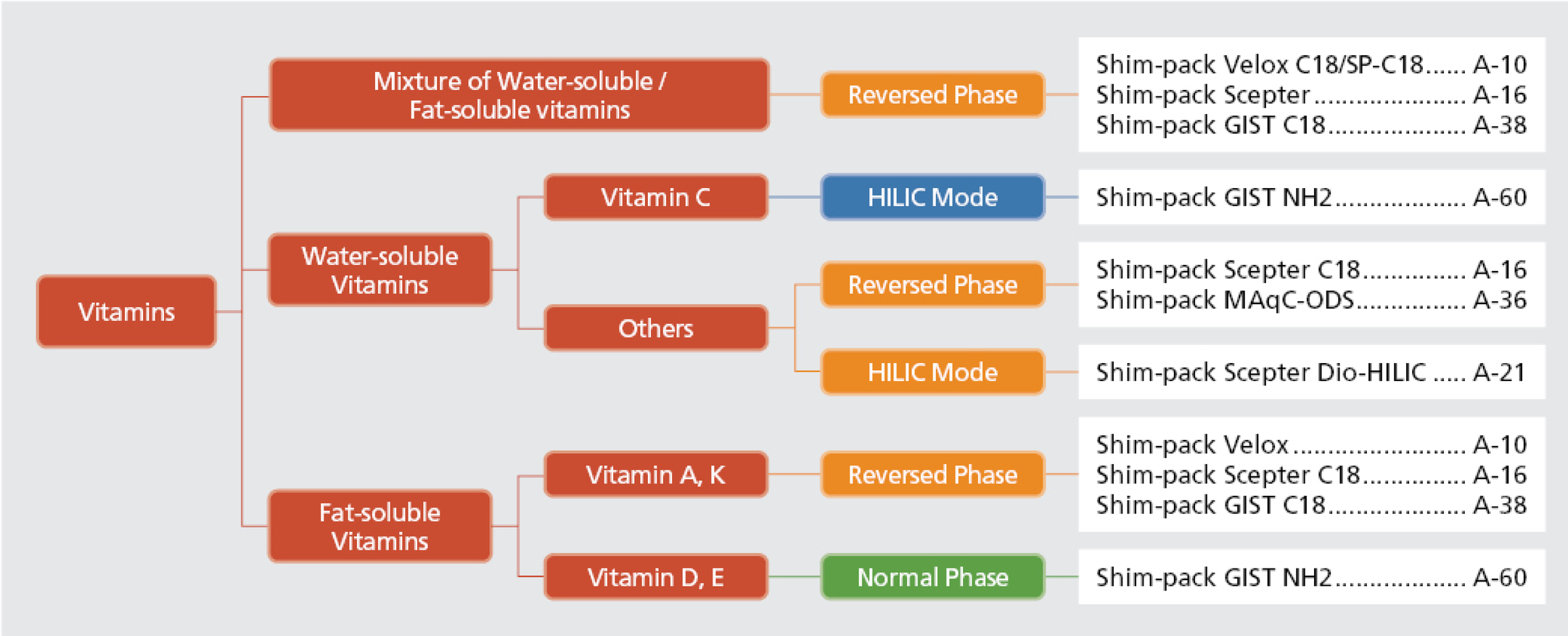
    - **HILIC Mode**
      - Shim-pack GIST NH2 ..... A-60
  - **Derivatized Sugars**
    - **Reversed Phase**
      - Shim-pack Velox C18 ..... A-10
      - Shim-pack Scepter C18 ..... A-16
      - Shim-pack GIST C18 ..... A-38

Column Selection Guide

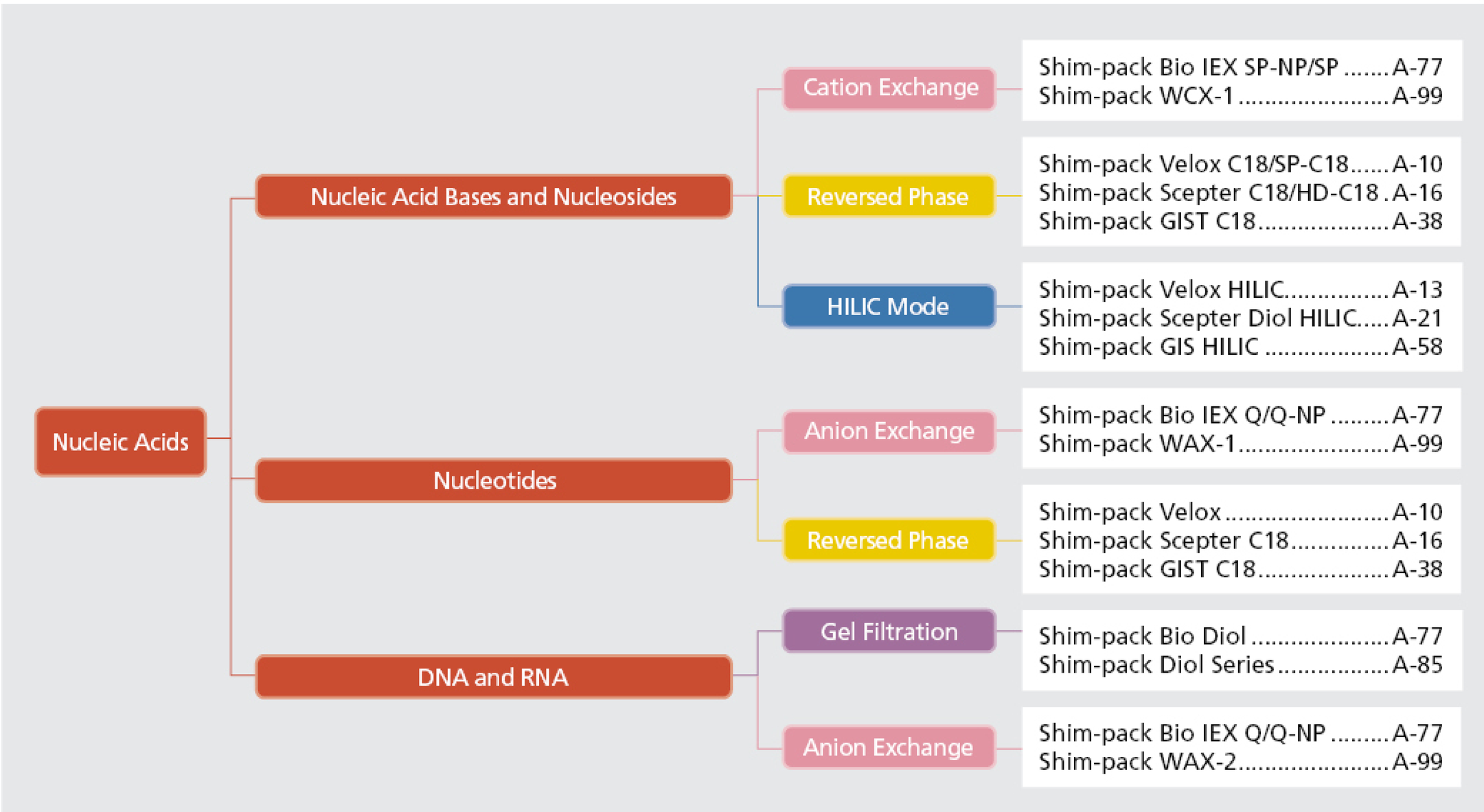
Column Selection by Target Compounds



Water-soluble Vitamins	
Vitamin B1 (thiamin)	UV (270 nm) RF (Post-column derivatization)
Vitamin B2 (riboflavin)	UV (270 nm) RF (Post-column derivatization)
Vitamin B3 (niacin)	UV (260 nm)
Vitamin B5 (pantothenic acid)	UV (205 nm)
Vitamin B6 (pyridoxine)	UV (290 nm)
Vitamin B12 (cyanocobalamine)	UV (280 nm)
Vitamin BT (carnitine)	UV (210 nm) RI
Vitamin C (ascorbic acid)	UV (245 nm)
Vitamin H (biotin)	UV (210 nm)
Vitamin M (folic acid)	UV (280 nm)
Vitamin P (hesperidin)	UV (265 nm)

Fat-soluble Vitamins	
Vitamin A (retinol)	UV (325 nm) RF (Ex. 340 nm, Em. 460 nm)
Vitamin D	UV (265 nm)
Vitamin E (tocopherol)	UV (295 nm) RF (Ex. 295 nm, Em. 325 nm)
Vitamin K	UV (250 nm) RF (Post-column derivatization)

* The above wavelength values are approximate values. It is possible to be influenced by the state of mobile phase.



Selection by USP

USP Code	Packing	Shim-pack HPLC Columns	Page
L1	Octadecyl silane chemically bonded to porous or non-porous silica or ceramic micro-particles, 1.5 to 10 µm in diameter, or a monolithic rod.	Shim-pack Velox C18	A-10
		Shim-pack Velox SP-C18	A-11
		Shim-pack Scepter C18	A-16
		Shim-pack Scepter HD-C18	A-17
		Shim-pack Arata C18	A-25
		Shim-pack XR-ODS	A-28
		Shim-pack XR-ODS II	A-30
		Shim-pack XR-ODS III	A-30
		Shim-pack VP-ODS	A-32
		Shim-pack GIST C18	A-38
		Shim-pack GIST C18-AQ	A-40
		Shim-pack GISS C18	A-42
		Shim-pack GIS C18	A-44
		Shim-pack GIS C18-P	A-46
		Shim-pack GIS RP-Shield	A-48
		Shim-pack GWS C18	A-49
		Shim-pack Solar C18	A-66
		Shim-pack FC-ODS	A-67
		Shim-pack UC GIS II	A-90
		Mastro2™ C18	A-88
		ULTRON VX-ODS	A-116
		STR ODS-II	A-119
		STR ODS-M	A-120
L3	Porous silica particles, 1.5 to 10 µm in diameter, or a monolithic silica rod.	Shim-pack Velox HILIC	A-13
		Shim-pack XR-SIL	A-28
		Shim-pack UC Sil	A-90
		Shim-pack UC Sil II	A-91
		ULTRON VX-SIL	A-115
L7	Octylsilane chemically bonded to totally or superficially porous silica particles, 1.5 to 10 µm in diameter, or a monolithic silica rod.	Shim-pack Scepter C8	A-18
		Shim-pack XR-C8	A-28
		Shim-pack VP-C8	A-33
		Shim-pack GIST C8	A-50
		Shim-pack Solar C8	A-66
		ULTRON VX-Octyl	A-117
L8	An essentially monomolecular layer of aminopropylsilane chemically bonded to totally porous silica gel support, 1.5 to 10 µm in diameter, or a monolithic silica rod.	Shim-pack GIST NH2	A-60
		Shim-pack UC NH2	A-90
L10	Nitrile groups chemically bonded to porous silica particles, 1.5 to 10 µm in diameter, or a monolithic silica rod.	Shim-pack GIS CN	A-64
		Shim-pack UC CN	A-90
L11	Phenyl groups chemically bonded to porous silica particles, 1.5 to 10 µm in diameter, or a monolithic silica rod.	Shim-pack Velox Biphenyl	A-12
		Shim-pack Scepter Phenyl	A-20
		Shim-pack XR-Phenyl	A-28
		Shim-pack VP-Phenyl	A-32
		Shim-pack GIST Phenyl	A-52
		Shim-pack GIST Phenyl-Hexyl	A-54
		Shim-pack UC Phenyl	A-90
L17	Strong cation-exchange resin consisting of sulfonated cross-linked styrene-divinylbenzene copolymer in the hydrogen form, 6 to 12 µm in diameter.	Shim-pack SCR-101H	A-96
		ULTRON PS-80H	A-105
L19	Strong cation-exchange resin consisting of sulfonated cross-linked styrene-divinylbenzene copolymer in the calcium form, 5 - 15 µm in diameter.	Shim-pack SCR-101C	A-96
		ULTRON PS-80C	A-113
L20	Dihydroxypropane groups chemically bonded to porous silica or hybrid particles, 1.5 to 10 µm in diameter, or a monolithic silica rod.	Shim-pack Scepter Diol-HILIC	A-21
		Shim-pack GIS HILIC	A-58
		Shim-pack UC Diol	A-90
		Shim-pack UC Diol II	A-91
		Shim-pack Diol-150	A-85
		Shim-pack Diol-300	A-85
		Shim-pack Bio Diol	A-77
L21	A rigid, spherical styrene-divinylbenzene copolymer, 3 to 30 µm in diameter.	Shim-pack GPC Series	A-83
L22	A cation-exchange resin made of porous polystyrene gel with sulfonic acid groups, 5 - 15 µm in diameter.	Shim-pack IC-C1	A-101
		Shim-pack AMINO-LI	A-95
		Shim-pack AMINO-NA	A-95
		Shim-pack ISC	A-97
L23	An anion-exchange resin made of porous polymethacrylate or polyacrylate gel with quartenary ammonium groups, 7 - 12 µm in size.	Shim-pack IC-A1	A-104
L26	Butyl silane chemically bonded to totally porous silica particles, 1.5 to 10 µm in diameter.	Shim-pack Scepter C4	A-22
L33	Packing having the capacity to separate dextrans by molecular size over a range of 4,000 to 500,000 Da. It is spherical, silica-based, and processed to provide pH stability.	Shim-pack Bio Diol	A-77
L34	Strong cation exchange resin consisting of sulfonated crosslinked styrene-divinylbenzene copolymer in the lead form, 9µm in diameter.	ULTRON PS-80P	A-113
L43	Pentafluorophenyl groups chemically bonded to silica particles by a propyl spacer, 1.5 to 10 µm in diameter.	Shim-pack Velox PFPP	A-12
		Shim-pack Scepter PFPP	A-19
		Shim-pack GIST PFPP	A-56
		Mastro2™ PFP	A-88
L45	Beta cyclodextrin bonded to porous silica particles, 5 to 10 µm in diameter.	ULTRON ES-CD	A-112
		ULTRON ES-PhCD	A-112
L57	A chiral-recognition protein, ovomucoid, chemically bonded to silica particles, about 5 µm in diameter, with a pore size of 120 Å.	ULTRON ES-OVM	A-110
L58	Strong cation-exchange resin consisting of sulfonated cross-linked styrene-divinylbenzene copolymer in the sodium form, about 6 to 30 µm diameter.	Shim-pack SCR-101N	A-96
		ULTRON PS-80N	A-113
L59	Packing for the size-exclusion separations of proteins (separation by molecular weight) over the range of 5 to 7000 kDa. The packing is spherical 1.5 - 10 µm, silica or hybrid packing with a hydrophilic coating.	Shim-pack Diol-150	A-85
		Shim-pack Diol-300	A-85
		Shim-pack Bio Diol	A-77
L68	Spherical, porous silica, 10 µm or less in diameter, the surface of which has been covalently modified with alkyl amide groups and not endcapped.	Shim-pack GIST Amide	A-62
L101	Cholesteryl groups bonded to porous or non-porous silica or ceramic micro-particles, 1.5 to 10 µm in diameter, or a monolithic rod.	Shim-pack UC-Choles	A-91
L104	Triazole groups chemically bonded to porous silica particles, 1.5 to 10 µm in diameter.	Shim-pack UC-Triazole	A-91

Maximize LC Separation Performance with Core Shell Technology

Designed to maximize performance of LC systems, Shimadzu's Shim-pack Velox columns with core shell technology enable you to achieve increased separations and faster analysis times on any LC platform.

Whether developing a high efficiency LC separation method, transferring an existing method for increased throughput while maintaining resolution, or are trying to improve the resolution of a complex separation, Shim-pack Velox columns will satisfy your needs.

Column ruggedness is critical to any LC analysis and Shim-pack Velox core-shell columns deliver excellent column lifetime for even the most challenging sample matrices.

Shim-pack Velox column will deliver

- Increased resolution with maximum efficiency → improving separation and detection
- Faster separation without sacrificing performance → maximizing laboratory productivity and reducing cost of analysis
- Increased sample throughput → reducing overall analysis time
- Superior ruggedness → reducing cost of analysis
- Excellent reproducibility → maintaining analysis and data integrity

Column Selection Guide for Different LC Platforms

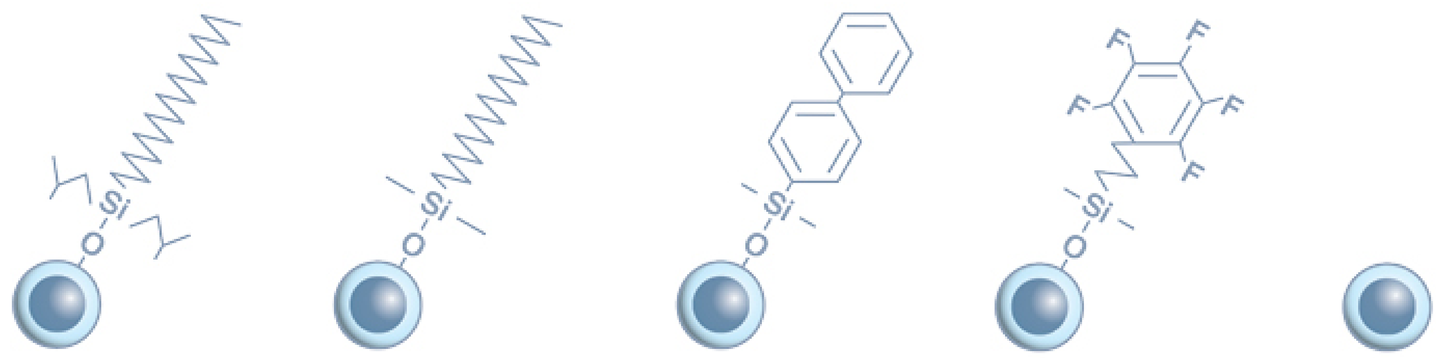
Column particle sizes and column volumes affect chromatography results significantly if the column configuration does not match the LC system. As column particle size is reduced, or the column volume (ID and/or the length of the columns) decreases, the necessity for a lower dispersion system is increased.

Choosing the optimal column configuration for your LC system allows you to achieve improved chromatography. The following table summarizes the starting recommendations of column configuration for each LC system.

	Prominence	Prominence-i plus	Nexera XR	Nexera-i plus	Nexera X2
LC System	HPLC		UHPLC-like	UHPLC	
Particle size	2.7 µm & 5 µm		2.7 µm	1.8 µm & 2.7 µm	
Column I.D.	4.6 mm (3.0 mm)		3.0 mm (2.1 mm)	2.1 mm	
Column Length	100-250 mm		50-100 mm	150 mm	

Column Chemistries

Combining highly efficient core shell particle technology with a wide range of surface chemistries provides you with the best opportunity for optimal resolution. With different chemistry characteristics, Shim-pack Velox columns are suitable for use in a wide variety of applications and challenging separations.

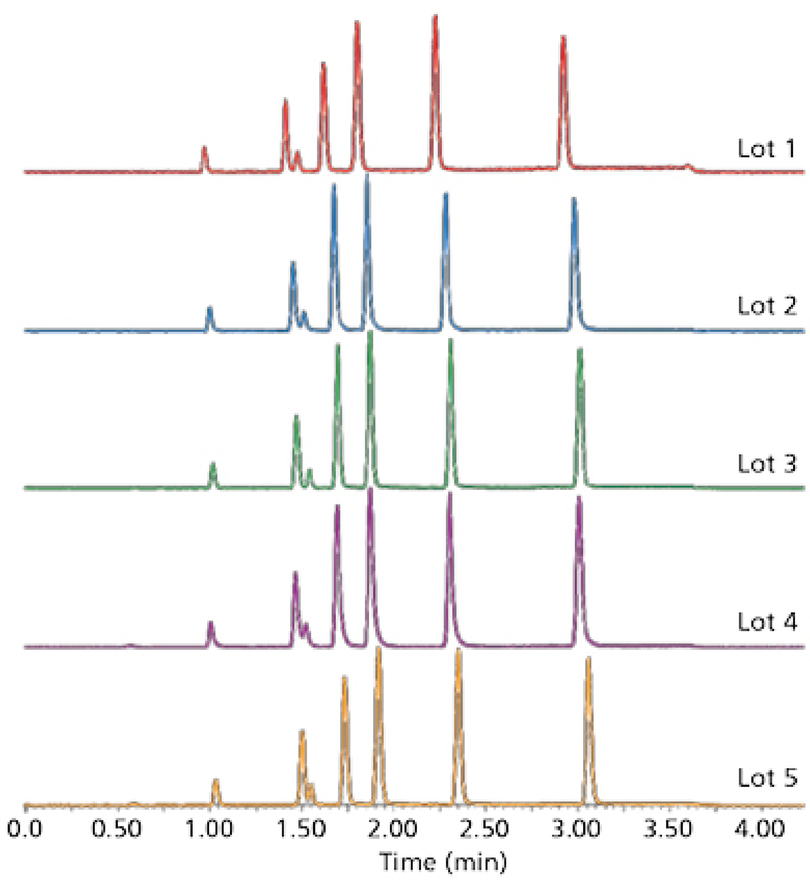


		SP-C18	C18	Biphenyl	PFPP	HILIC
USP Classification		L1	L1	L11	L43	L3
Ligand type		Sterically protected C18	C18	Biphenyl	Pentafluorophenyl propyl	None
Particle Size (µm)		1.8, 2.7, 5	1.8, 2.7, 5	1.8, 2.7, 5	1.8, 2.7, 5	2.7
Pore size (Å)		90	90	90	90	90
Suraface Area	1.8 µm	125 m^2/g	125 m^2/g	125 m^2/g	125 m^2/g	-
	2.7 µm	130 m^2/g	130 m^2/g	130 m^2/g	130 m^2/g	130 m^2/g
	5 µm	100 m^2/g	100 m^2/g	100 m^2/g	100 m^2/g	-
Carbon Load	1.8 µm	7 %	9 %	7 %	4 %	-
	2.7 µm	7 %	7 %	7 %	4 %	NA
	5 µm	5 %	5 %	5 %	3 %	-
End-Cap		No	YES	YES	No	No
pH range		1.0-8.0	2.0-8.0	1.5-8.0	2.0-8.0	2.0-8.0
Max Pressure	1.8 µm	100 MPa*	100 MPa*	100 MPa*	100 MPa*	-
	2.7 µm	60 MPa	60 MPa	60 MPa	60 MPa	60 MPa
	5 µm	40 MPa	40 MPa	40 MPa	40 MPa	-

* For maximum lifetime, recommended maximum pressure for 1.8 µm particles is 80MPa.

Lot to Lot Reproducibility

We understand that lot to lot consistent performance of columns is required to maximize your laboratory performance. From one lot to the next, every Shim-pack Velox column you purchase will perform consistently.



Compounds (50 ng/mL)

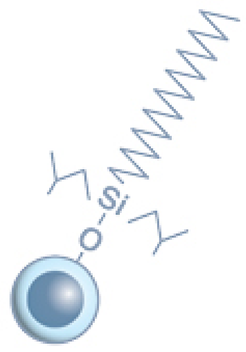
1. Cortisol
2. 11-Deoxycortisol
3. Estradiol
4. Boldenone
5. Testosterone
6. Androstenedione
7. Progesterone

Conditions

Column	:	Shim-pack Velox Biphenyl 2.7 µm, 3.0×100 mm (P/N: 227-32016-03)
Flow Rate	:	0.7 mL/min
Column Temp.	:	30 °C
Sample Dilulent	:	Initial mobile phase
Injection Volume	:	5 µL
Mobile Phase A	:	0.1 % formic acid in water
Mobile Phase B	:	0.1 % formic acid in acetonitrile Gradient: 40 % B (0 min) 80 % B (3 min)

Shim-pack Velox SP-C18

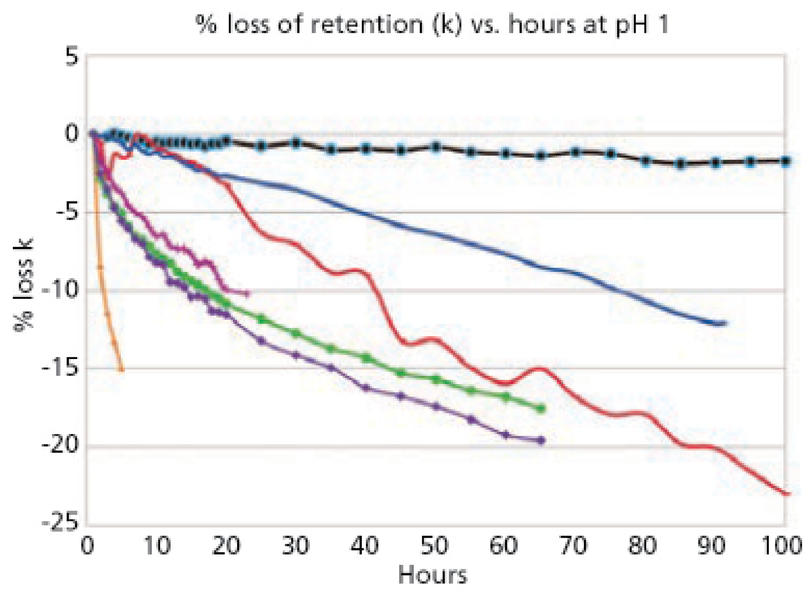
Designed and intended specifically for use under low pH condition, Shim-pack Velox SP (Sterically Protected)-C18 offers a well balanced retention profile with a long life time even under harsh, acidic condition needed for LC/MS(/MS) analysis.



- Sterically protected to resist strongly acidic (pH 1-8) mobile phase condition
- Well balanced retention profile
- Suitable for LC/MS(/MS) analysis

Low pH Stability

Sterically protected ligand provides extended low pH stability for the core shell particle. Shim-pack Velox SP-C18 columns maintain a stable retention profile under strongly acidic mobile phase condition (pH1) .



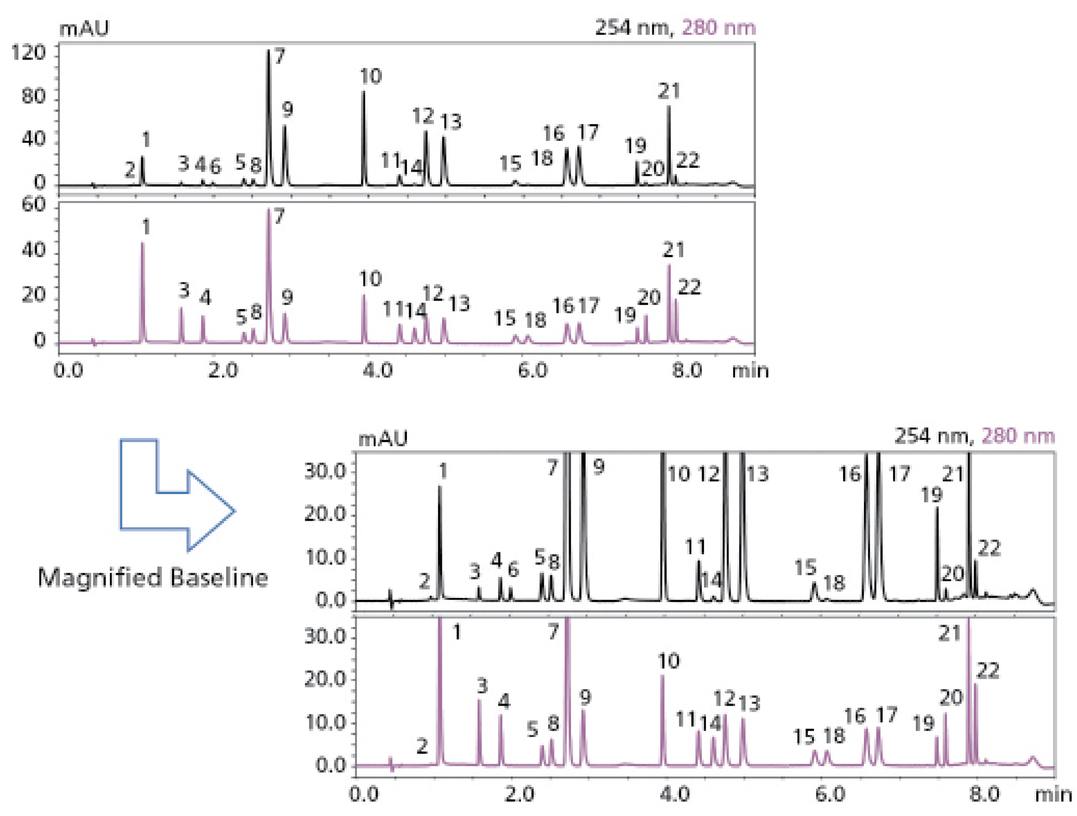
Conditions

Flow Rate	:	0.6 mL/min
Column Temp.	:	60 °C
Mobile Phase A	:	0.1 % TFA in water
Mobile Phase B	:	Acetonitrile
Gradient	:	45 % B (0 min – 7.5 min) → 5 % B (7.51 min – 50 min) 100 % B (55 min) → 45 % B (55.01 min → 60 min)

- Shim-pack Velox SP-C18 Brand A FPP C18
- Brand B FPP C18
- Brand C FPP C18
- Brand D Core-shell C18
- Brand E Core-shell C18
- Brand F Core-shell C18

Simultaneous Analysis of 22 Preservative Agents

More than 20 compounds used as the preservative agent for industrial products like foods and cosmetics can can be separated by Shim-pack Velox SP-C18. The simultaneous determination and quantitation of multiple target compounds are possible in a wide range of commercial product within acceptable analytical times.



Preservative agents

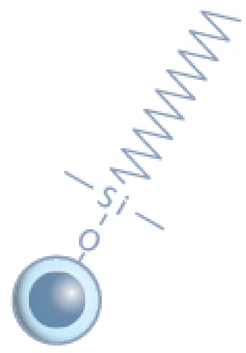
1. 2-methyl-4-Isothiazolin-3-one
2. 2-Bromo-2-Nitro-1,3-propanediol
3. Salicylic Acid
4. Isothiazolinones
5. Benzoic Acid
6. Benzyl Alcohol
7. Sorbic Acid
8. 2-Phenoxyethanol
9. Methyl Paraben
10. Ethyl Paraben
11. Methyl Benzoate
12. Isopropyl Paraben
13. Propyl Paraben
14. 4-Chloro-3-Methylphenol
15. Ethyl Benzoate
16. Isobutyl 4-Hydroxybenzoate
17. Butyl Paraben
18. Chloroxylenol
19. Phenyl Benzoate
20. Clorofene
21. Triclocarban
22. Triclosan

LC Conditions

Column	:	Shim-pack Velox SP-C18, 2.7 µm, 3.0×100 mm (PN: 227-32004-03)
Flow Rate	:	1.0 mL/min
Column Temp.	:	45 °C
Mobile Phase A	:	NaH2PO4 aq. (25 mM, pH3.8)
Mobile Phase B	:	MeOH/ACN = 9/1
Gradient	:	8 %B (0 min) → 30 % B (0.7 min – 2.7 min) 47 % B (2.71 min – 5min) → 52 % B (6 min) 80 %B (7 min – 8 min) → 8 %B (9.01 min -10 min)
Injection Volume	:	1 µL
Conc.	:	50 mg/L

Shim-pack Velox SP-C18

Shim-pack Velox C18 is a traditional end-capped C18-bonded phase which offers the highest hydrophobic retention of any Shim-pack Velox phases and is applicable to a wide range of applications such as pharmaceutical, food, environmental and clinical and neutrals at moderately low and mid-range pH.



- General purpose column for reversed-phase chromatography
- Highest hydrophobic retention among Shim-pack Velox series
- Compatible with moderately acidic to neutral mobile phases (pH 2-8)

Method Transfer for Cyanocobalamin Analysis within the USP Allowable Adjustment

The assay of cyanocobalamin (a synthetic form of vitamin B12) with 5 µm fully-porous ODS column described in the USP monograph is transferred to a new method with Shim-pack Velox C18 2.7 µm column, within USP allowable adjustments. Analytical time and solvent consumption can be saved with transferred methods while meeting the requirements of system suitability.

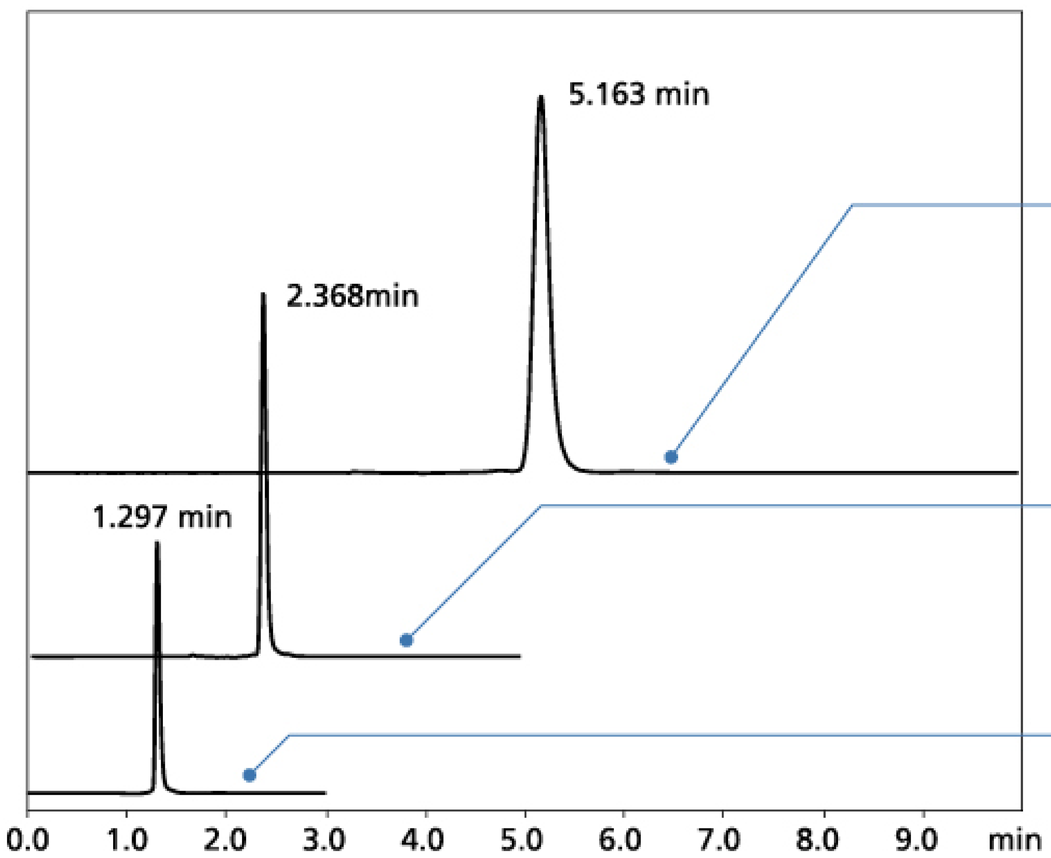
USP requirement of Chromatography <621>

When the column size is changed, the following conditions should be met;

1) *L/dp* ratio : within -25 % to +50 %
   or
   Number of theoretical plates (N): within -25 % to +50 % (For SPP)
2) Flow rate : *Based on particle size and internal diameter and ±50%

$$* F_2 = F_1 \times \frac{dc_2^2 \times dp_1}{dc_1^2 \times dp_2}$$

L : Column length
dp : Particle size
F : Flow rate
dc : Internal diameter of the column



Original Method
Column : Shim-pack VP-ODS (5 µm, 4.6×150 mm)
Flow rate : 0.5 mL/min
Injection Volume : 100 µL
Column temp. : 25 °C
Detection : UV 361 nm

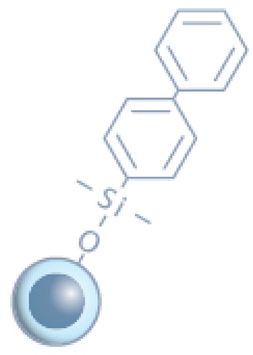
Faster Method
Column : Shim-pack Velox C18 (2.7 µm, 4.6×100 mm)
Flow rate : 0.50 mL/min
Injection Volume : 67 µL
Column temp. : 25 °C
Detection : UV 361 nm

Optimized Method
Column : Shim-pack Velox C18 (2.7 µm, 4.6×100 mm)
Flow rate : 0.93 mL/min
Injection Volume : 67 µL
Column temp. : 25 °C
Detection : UV 361 nm

Column	L/dp	Flow rate (mL/min)	N	System suitability test result (Requirement: %RSD < 2.0 %)
VP-ODS (5 µm, 4.6×150 mm)	30,000	0.50	5,244	tR: 0.025 % Area: 0.175 % (n=6)
Velox C18 (2.7 µm, 4.6×100 mm)	37,037 (+23 %)	0.50	9,497 (+81 %)	tR: 0.035 % Area: 0.103 % (n=6)
		0.93	4,466 (-15 %)	tR: 0.084 % Area: 0.220 % (n=6)

Shim-pack Velox Biphenyl

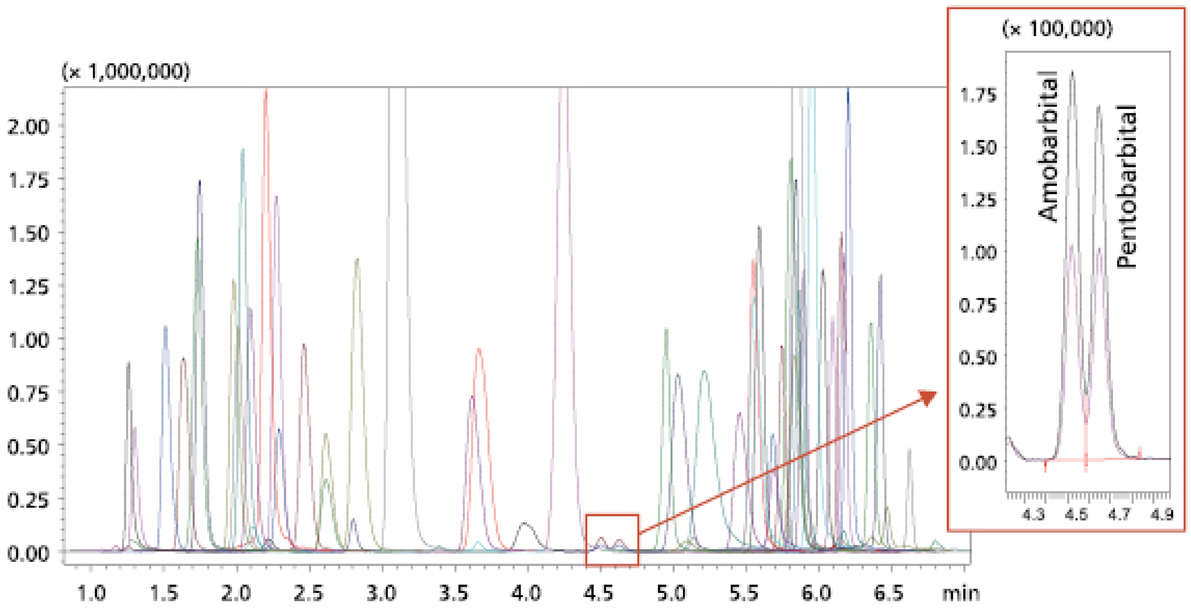
Shim-pack Velox Biphenyl provides enhanced retention of aromatic compounds. It is useful for fast separations in bioanalytical applications due to the increased retention of early eluting analytes such as dipolar, unsaturated and conjugated analytes.



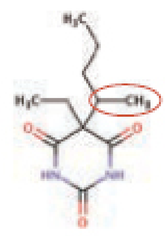
- Complementary selectivity to alkyl phases
- Enhanced separation of aromatic compounds
- Ideal for increasing sensitivity and selectivity in LC/MS(/MS) analysis

Separating the Structural Isomers

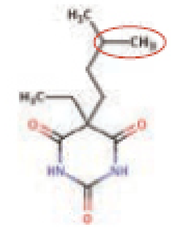
Even under the condition where 56 drugs of abuse and metabolites in human urine are quantitated within 10 minutes, two structural isomers, amobarmital and pentobarbital, which have been historically difficult to separate due to their similarity in chemical structures, could be relatively well resolved with shim-pack Velox Biphenyl column.



Chromatogram of 56 compounds in human urine spiked at the cut off concentration



Amobarbital
5-ethyl-5-(3-methylbutyl)-1,3-diazinane-2,4,6-trione



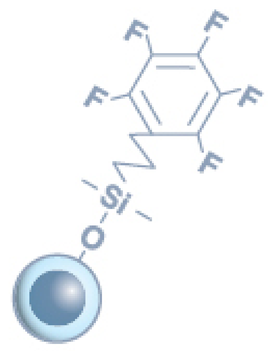
Pentobarbital
5-ethyl-5-pentan-2-yl-1,3-diazinane-2,4,6-trione

Conditions

System	:	Nexera UHPLC System / LCMS-8050
Column	:	Shim-pack Velox Biphenyl 2.7 µm, 2.1 mm × 100 mm (PN: 227-32015-03)
Column Temp.	:	30 °C
Flow Rate	:	0.5 mL/min
Mobile Phase A	:	0.15 mM ammonium fluoride in water
Mobile Phase B	:	Methanol
Gradient	:	20 % B (0 min) → 48 % B (1.5 min) → 53 % B (4 min) 100 %B (6 min - 7.5 min) → 20 % B (7.51 min - 9.5 min)
Sample preparation	:	Enzymatically hydrolyzed human urine was spiked with target compounds between 10 - 1000 % of the required cut off concentration. Samples were subsequently diluted 5x with 0.1 % formic acid.

Shim-pack Velox PFPP

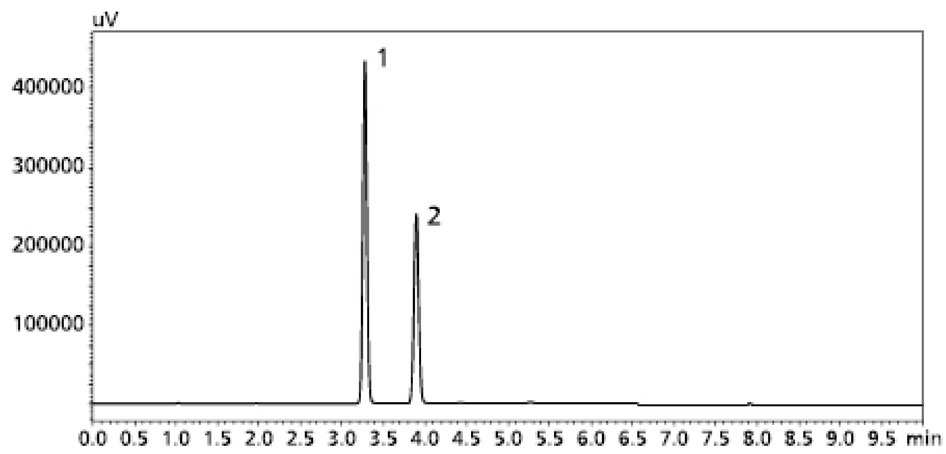
Shim-pack Velox PFPP (Pentafluorophenylpropyl) provides an alternative selectivity to C18 columns and is suitable for the analysis of halogenated compounds, positional isomers and charged bases.



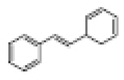
- Alternative selectivity to C18 columns
- Suitable for positional isomers and halogenated compounds
- Offers increased retention for charged bases

Good Separation of Cis / Trans Stilbene

Cis and trans isomers of stilbene that are difficult to resolve with an ODS column due to their similarity in hydrophobicity can be well separated with Shim-pack Velox PFPP column.



1. cis-Stilbene



2. trans-Stilbene

LC Conditions

Column	:	Shim-pack Velox PFPP, 2.7 µm, 3.0×100 mm (PN: 227-32022-04)
Column Temp.	:	40 °C
Flow Rate	:	0.4 mL/min
Mobile Phase	:	Methanol/Water = 9/1
Detection	:	UV 254 nm
Sample	:	1. cis-Stilbene, 2. trans-Stilbene
Injection Volume	:	1 µL

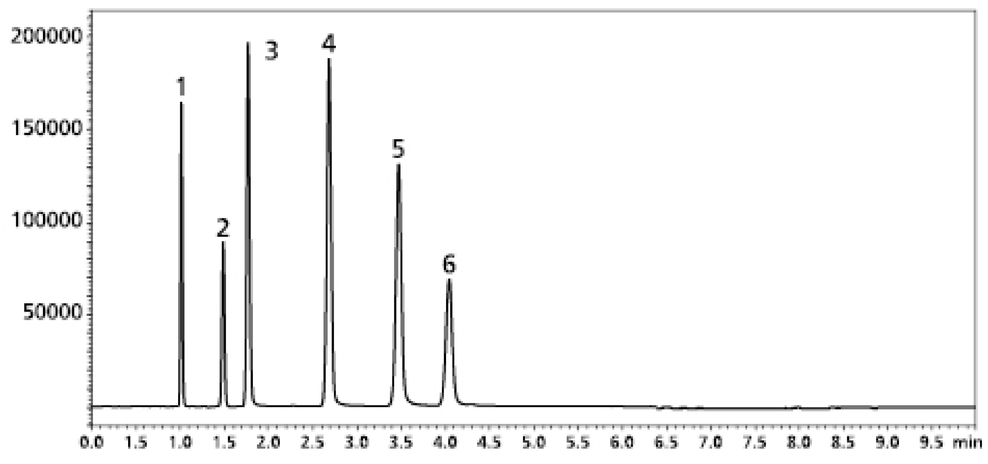
Shim-pack Velox HILIC

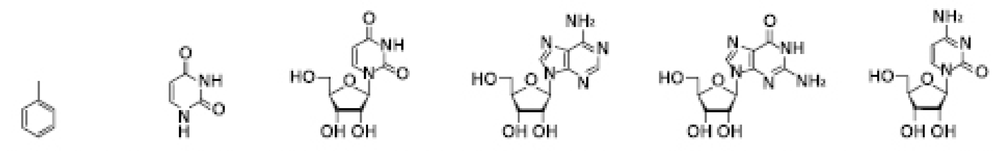
Hydrophilic interaction chromatography (HILIC) is an increasingly popular separation mode that can be used to improve the retention of challenging polar analytes. Shim-pack Velox HILIC using unbonded core shell particles is specifically designed for this application.

- Orthogonal selectivity to reversed phase chromatography
- Increased retention of polar analytes
- Increased MS sensitivity
- Direct compatibility with sample preparation eluates

Retention of Nucleosides

Nucleosides are polar molecules that are not well retained on reversed phase LC columns due to their hydrophilic nature are well retained and separated with Shim-pack Velox HILIC column.





1. Toluene 2. Uracil 3. Uridine 4. Adenosine 5. Guanosine 6. Cytidine

LC Conditions

Column	:	Shim-pack Velox HILIC, 2.7 µm, 3.0×100 mm (PN: 227-32026-02)
Column Temp.	:	30 °C
Flow Rate	:	0.4 mL/min
Mobile Phase	:	Acetonitrile/20mM AcONH4aq.=9/1
Detection	:	UV 254 nm
Sample	:	1. Toluene, 2. Uracil, 3. Uridine, 4. Adenosine, 5. Guanosine, 6. Cytidine
Injection Volume	:	1 µL

Shim-pack Velox 1.8 µm Columns

Chemistry	SP-C18		C18		Biphenyl		PFPP	
I.D. (mm) / Length (mm)	2.1	3.0	2.1	3.0	2.1	3.0	2.1	3.0
30	227-32001-01	-	227-32007-01	-	227-32013-01	-	227-32019-01	-
50	227-32001-02	227-32002-01	227-32007-02	227-32008-01	227-32013-02	227-32014-01	227-32019-02	227-32020-01
100	227-32001-03	227-32002-02	227-32007-03	227-32008-02	227-32013-03	227-32014-02	227-32019-03	227-32020-02
150	227-32001-04	-	227-32007-04	-	227-32013-04	-	227-32019-04	-

Shim-pack Velox 2.7 µm Columns

Chemistry	SP-C18			C18			Biphenyl		
I.D. (mm) / Length (mm)	2.1	3.0	4.6	2.1	3.0	4.6	2.1	3.0	4.6
30	227-32003-01	227-32004-01	227-32005-01	227-32009-01	227-32010-01	227-32011-01	227-32015-01	227-32016-01	227-32017-01
50	227-32003-02	227-32004-02	227-32005-02	227-32009-02	227-32010-02	227-32011-02	227-32015-02	227-32016-02	227-32017-02
100	227-32003-03	227-32004-03	227-32005-03	227-32009-03	227-32010-03	227-32011-03	227-32015-03	227-32016-03	227-32017-03
150	227-32003-04	227-32004-04	227-32005-04	227-32009-04	227-32010-04	227-32011-04	227-32015-04	227-32016-04	227-32017-04

Chemistry	PFPP			HILIC		
I.D. (mm) / Length (mm)	2.1	3.0	4.6	2.1	3.0	4.6
30	227-32021-01	227-32022-01	227-32023-01	227-32025-01	-	-
50	227-32021-02	227-32022-02	227-32023-02	227-32025-02	227-32026-01	227-32027-01
100	227-32021-03	227-32022-03	227-32023-03	227-32025-03	227-32026-02	227-32027-02
150	227-32021-04	227-32022-04	227-32023-04	227-32025-04	227-32026-03	227-32027-03

Core Shell Columns

Shim-pack Velox 5 µm Columns

Chemistry	SP-C18	C18	Biphenyl	PFPP
I.D. (mm) / Length (mm)	4.6			
30	227-32006-01	227-32012-01	227-32018-01	227-32024-01
50	227-32006-02	227-32012-02	227-32018-02	227-32024-02
100	227-32006-03	227-32012-03	227-32018-03	227-32024-03
150	227-32006-04	227-32012-04	227-32018-04	227-32024-04

Shim-pack Velox EXP Guard Column Cartridge (3 pk)

Type	1.8 µm				2.7 µm				
I.D. x L (mm)	SP-C18	C18	Biphenyl	PFPP	SP-C18	C18	Biphenyl	PFPP	HILIC
2.1 x 5	227-32028-01	227-32031-01	227-32034-01	227-32037-01	227-32029-01	227-32032-01	227-32035-01	227-32038-01	227-32040-01
3.0 x 5	227-32028-02	227-32031-02	227-32034-02	227-32037-02	227-32029-02	227-32032-02	227-32035-02	227-32038-02	227-32040-02
4.6 x 5	-	-	-	-	227-32029-03	227-32032-03	227-32035-03	227-32038-03	227-32040-03

Type	5 µm			
I.D. x L (mm)	SP-C18	C18	Biphenyl	PFPP
4.6 x 5	227-32030-01	227-32033-01	227-32036-01	227-32039-01

*Shim-pack Velox EXP Direct Connect Holder : 227-32041-01

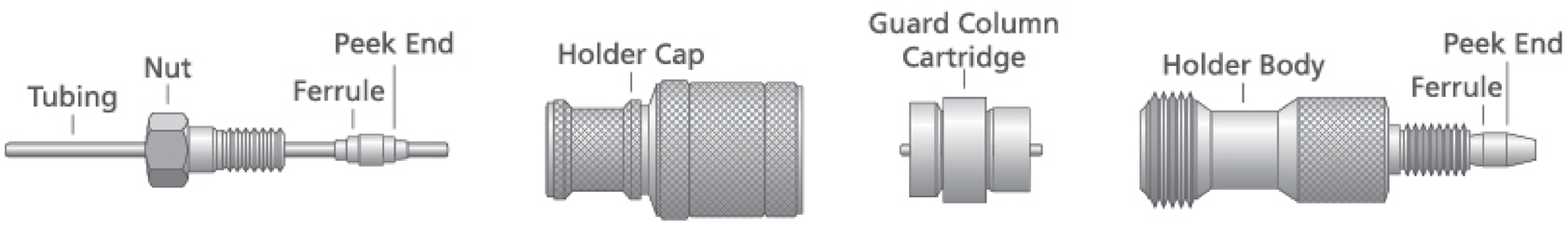
Shim-pack Velox UHPLC Pre-column (0.2 µm)

1pc	227-32042-01
5pcs	227-32042-02
10pcs	227-32042-03

*For more pre-column options, please refer to page 110

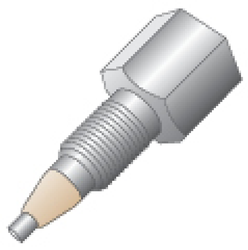
Shim-pack Velox EXP Guard Column

Free-turning architecture lets you change cartridges by hand without breaking inlet / outlet fluid connections — no tools needed.
Guard column cartridges require Shim-pack Velox EXP Direct Connect Holder (227-32041-01)



Shim-pack Velox UHPLC Precolumn Filter (0.2 µm)

To minimize extra column volume and maximize UHPLC sample throughput with SPE, SLE, or other sample preparation techniques, pair 1.8 µm Shim-pack Velox UHPLC columns with an Shim-pack Velox UHPLC Precolumn filter instead of a guard cartridge.



Shim-pack Scepter LC Columns

Excellent stability & performance could be achieved under a wide range of LC conditions

Excellent stability and performance could be achieved under a wide range of LC conditions with Shim-pack Scepter LC columns, which are the next generation organic silica hybrid based columns. With different chemistry characteristics, Shim-pack Scepter columns are effective for method development/scouting with suitability for use in a wide variety of applications.

With different particle sizes (1.9 µm, 3 µm, 5 µm) and different column dimensions, Shim-pack Scepter LC columns are fully scalable between UHPLC, HPLC and preparative LC making method transfer seamless between different laboratory instrumentation.

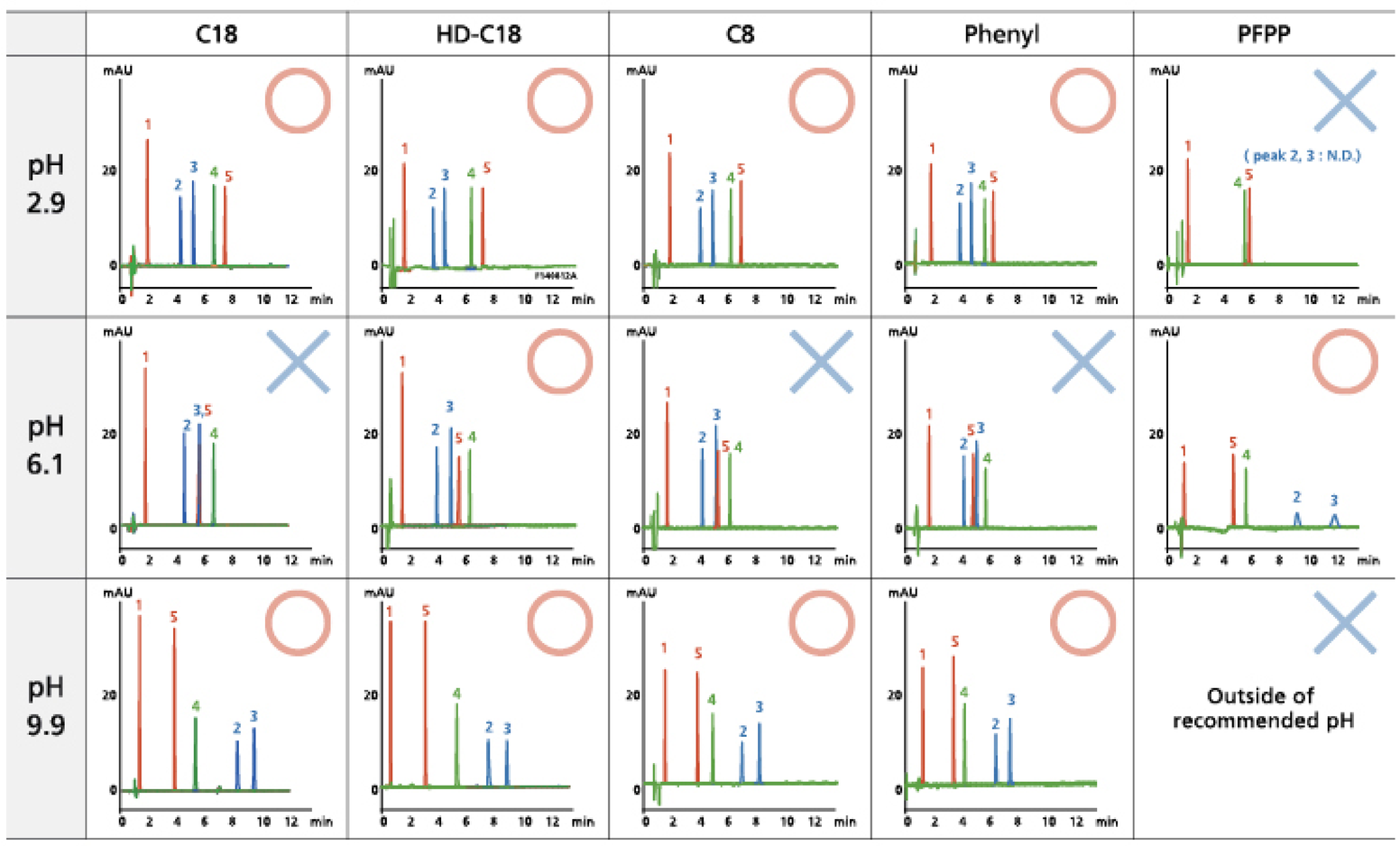
Shim-pack Scepter Chemistries

Shim-pack Scepter	Reversed Phase						HILIC
	C18	HD-C18	C8	Pheny	PFPP	C4	Diol-HILIC
Ligand Type	Trifunctional C18 Generic Purpose Type	Trifunctional C18 High Density Type	Trifunctional C8	Trifunctional Phenylbutyl	Trifunctional Pentafluorophenylpropyl	Butyl group	Trifunctional Dihydroxypropyl
Particle	Organic Silica Hybrid						
Particle Size	1.9 µm, 3 µm, 5 µm						
Pore Size	12 nm	8 nm	12 nm			30 nm	12 nm
End Capping	Proprietary				None	Proprietary	None
pH Range	1 - 12			1 - 10	1 - 8	1 - 10	2 - 10
100% aqueous condition	Yes	No	No	Yes	Yes	No	N/A
USP Classification	L1	L1	L7	L11	L43	L26	L20

Method Scouting Utilize excellent stability & performance under a wide range of LC conditions

With excellent stability under a wide range of LC conditions, Shim-pack Scepter LC columns are effective for method scouting combining mobile phase pH and organic modifier.

Comparison of Chromatograms using Gradient condition with Acetonitrile



Analytes

1. Saccharin (pKa = 2.2)
2. Dextromethorphan (pKa = 8.3)
3. Amitriptyline (pKa = 9.4)
4. N-Butyl paraben (pKa = 8.3)
5. Ibupurofen (pKa = 4.4)

For Shim-pack Scepter C4, please refer to page A-22

Shim-pack Scepter C18

Analytical columns

Particle Size (µm)	I.D. (mm) / Length (mm)	2.0	2.1	3.0	4.0	4.6	Pressure Tolerance (MPa)
1.9	20	227-31011-01	227-31012-01	-	-	-	100
	30	227-31011-02	227-31012-02	-	-	-	
	50	227-31011-03	227-31012-03	227-31013-01	-	-	
	75	227-31011-04	227-31012-04	227-31013-02	-	-	
	100	227-31011-05	227-31012-05	227-31013-03	-	-	
	150	227-31011-06	227-31012-06	227-31013-04	-	-	
3	20	-	227-31014-01	-	-	-	45
	33	-	227-31014-02	-	-	227-31016-01	
	50	-	227-31014-03	227-31015-01	-	227-31016-02	
	75	-	227-31014-04	227-31015-02	-	227-31016-03	
	100	-	227-31014-05	227-31015-03	-	227-31016-04	
	150	-	227-31014-06	227-31015-04	-	227-31016-05	
	250	-	-	-	-	227-31016-06	
5	20	-	227-31017-01	-	-	-	45
	33	-	227-31017-02	-	-	227-31020-01	
	50	-	227-31017-03	227-31018-01	-	227-31020-02	
	75	-	227-31017-04	227-31018-02	-	227-31020-03	
	100	-	227-31017-05	227-31018-03	-	227-31020-04	
	150	-	227-31017-06	227-31018-04	227-31019-01	227-31020-05	
	250	-	-	-	227-31019-02	227-31020-06	

Analytical Guard cartridge columns and holder

Particle Size (µm)	I.D. (mm) / Length (mm)	2.1	3.0	4.0	Holder
1.9	5	227-31120-01	227-31120-02	-	227-31170-01
3	10	227-31121-01	227-31122-01	227-31123-01	227-31172-03
	20	227-31121-02	227-31122-02	227-31123-02	227-31172-04
5	10	227-31124-01	227-31125-01	227-31126-01	227-31172-03
	20	227-31124-02	227-31125-02	227-31126-02	227-31172-04

Preparative columns

Particle Size (µm)	I.D. (mm) / Length (mm)	10.0	20.0	30.0	Pressure Tolerance (MPa)
5	50	-	227-31102-01	227-31103-01	30
	75	-	-	227-31103-02	
	100	-	227-31102-02	227-31103-03	
	150	227-31101-01	227-31102-03	227-31103-04	
	250	227-31101-02	227-31102-04	227-31103-05	

Prep Guard cartridge columns

Particle Size (µm)	I.D. (mm) / Length (mm)	10.0	Holder
5	10	227-31127-01	227-31171-01

Shim-pack Scepter HD-C18

Analytical columns

Particle Size (µm)	I.D. (mm) / Length (mm)	2.0	2.1	3.0	4.0	4.6	Pressure Tolerance (MPa)
1.9	20	227-31025-01	227-31026-01	-	-	-	100
	30	227-31025-02	227-31026-02	-	-	-	
	50	227-31025-03	227-31026-03	227-31027-01	-	-	
	75	227-31025-04	227-31026-04	227-31027-02	-	-	
	100	227-31025-05	227-31026-05	227-31027-03	-	-	
	150	227-31025-06	227-31026-06	227-31027-04	-	-	
3	20	-	227-31028-01	-	-	-	45
	33	-	227-31028-02	-	-	227-31030-01	
	50	-	227-31028-03	227-31029-01	-	227-31030-02	
	75	-	227-31028-04	227-31029-02	-	227-31030-03	
	100	-	227-31028-05	227-31029-03	-	227-31030-04	
	150	-	227-31028-06	227-31029-04	-	227-31030-05	
	250	-	-	-	-	227-31030-06	
5	20	-	227-31031-01	-	-	-	45
	33	-	227-31021-01	-	-	227-31024-01	
	50	-	227-31021-02	227-31022-01	-	227-31024-02	
	75	-	227-31021-03	227-31022-02	-	227-31024-03	
	100	-	227-31021-04	227-31022-03	-	227-31024-04	
	150	-	227-31021-05	227-31022-04	227-31023-01	227-31024-05	
	250	-	-	-	227-31023-02	227-31024-06	

Analytical Guard cartridge columns

Particle Size (µm)	I.D. (mm) / Length (mm)	2.1	3.0	4.0	Holder
1.9	5	227-31128-01	227-31128-02	-	227-31170-01
3	10	227-31129-01	227-31130-01	227-31131-01	227-31172-03
	20	227-31129-02	227-31130-02	227-31131-02	227-31172-04
5	10	227-31132-01	227-31133-01	227-31134-01	227-31172-03
	20	227-31132-02	227-31133-02	227-31134-02	227-31172-04

Preparative columns

Particle Size (µm)	I.D. (mm) / Length (mm)	10.0	20.0	30.0	Pressure Tolerance (MPa)
5	50	-	227-31105-01	227-31106-01	30
	75	-	-	227-31106-02	
	100	-	227-31105-02	227-31106-03	
	150	227-31104-01	227-31105-03	227-31106-04	
	250	227-31104-02	227-31105-04	227-31106-05	

Prep Guard cartridge columns

Particle Size (µm)	I.D. (mm) / Length (mm)	10.0	Holder
5	10	227-31135-01	227-31171-01

Shim-pack Scepter C8

Analytical columns

Particle Size (µm)	I.D. (mm) / Length (mm)	2.0	2.1	3.0	4.0	4.6	Pressure Tolerance (MPa)
1.9	20	227-31032-01	227-31033-01	-	-	-	100
	30	227-31032-02	227-31033-02	-	-	-	
	50	227-31032-03	227-31033-03	227-31034-01	-	-	
	75	227-31032-04	227-31033-04	227-31034-02	-	-	
	100	227-31032-05	227-31033-05	227-31034-03	-	-	
	150	227-31032-06	227-31033-06	227-31034-04	-	-	
3	20	-	227-31035-01	-	-	-	45
	33	-	227-31035-02	-	-	227-31037-01	
	50	-	227-31035-03	227-31036-01	-	227-31037-02	
	75	-	227-31035-04	227-31036-02	-	227-31037-03	
	100	-	227-31035-05	227-31036-03	-	227-31037-04	
	150	-	227-31035-06	227-31036-04	-	227-31037-05	
	250	-	-	-	-	227-31037-06	
5	20	-	227-31038-01	-	-	-	45
	33	-	227-31038-02	-	-	227-31041-01	
	50	-	227-31038-03	227-31039-01	-	227-31041-02	
	75	-	227-31038-04	227-31039-02	-	227-31041-03	
	100	-	227-31038-05	227-31039-03	-	227-31041-04	
	150	-	227-31038-06	227-31039-04	227-31040-01	227-31041-05	
	250	-	-	-	227-31040-02	227-31041-06	

Analytical Guard cartridge columns

Particle Size (µm)	I.D. (mm) / Length (mm)	2.1	3.0	4.0	Holder
1.9	5	227-31136-01	227-31136-02	-	227-31170-01
3	10	227-31137-01	227-31138-01	227-31139-01	227-31172-03
	20	227-31137-02	227-31138-02	227-31139-02	227-31172-04
5	10	227-31140-01	227-31141-01	227-31142-01	227-31172-03
	20	227-31140-02	227-31141-02	227-31142-02	227-31172-04

Preparative columns

Particle Size (µm)	I.D. (mm) / Length (mm)	10.0	20.0	30.0	Pressure Tolerance (MPa)
5	50	-	227-31108-01	227-31109-01	30
	75	-	-	227-31109-02	
	100	-	227-31108-02	227-31109-03	
	150	227-31107-01	227-31108-03	227-31109-04	
	250	227-31107-02	227-31108-04	227-31109-05	

Prep Guard cartridge columns

Particle Size (µm)	I.D. (mm) / Length (mm)	10.0	Holder
5	10	227-31143-01	227-31171-01

Shim-pack Scepter PFPP

Analytical columns

Particle Size (µm)	I.D. (mm) / Length (mm)	2.0	2.1	3.0	4.0	4.6	Pressure Tolerance (MPa)
1.9	20	227-31052-05	227-31053-01	-	-	-	100
	30	227-31052-06	227-31053-02	-	-	-	
	50	227-31052-01	227-31053-03	227-31054-01	-	-	
	75	227-31052-02	227-31053-04	227-31054-02	-	-	
	100	227-31052-03	227-31053-05	227-31054-03	-	-	
	150	227-31052-04	227-31053-06	227-31054-04	-	-	
3	20	-	227-31055-01	-	-	-	45
	33	-	227-31055-02	-	-	227-31057-01	
	50	-	227-31055-03	227-31056-01	-	227-31057-02	
	75	-	227-31055-04	227-31056-02	-	227-31057-03	
	100	-	227-31055-05	227-31056-03	-	227-31057-04	
	150	-	227-31055-06	227-31056-04	-	227-31057-05	
	250	-	-	-	-	227-31057-06	
5	20	-	227-31058-01	-	-	-	45
	33	-	227-31058-02	-	-	227-31061-01	
	50	-	227-31058-03	227-31059-01	-	227-31061-02	
	75	-	227-31058-04	227-31059-02	-	227-31061-03	
	100	-	227-31058-05	227-31059-03	-	227-31061-04	
	150	-	227-31058-06	227-31059-04	227-31060-01	227-31061-05	
	250	-	-	-	227-31060-02	227-31061-06	

Analytical Guard cartridge columns

Particle Size (µm)	I.D. (mm) / Length (mm)	2.1	3.0	4.0	Holder
1.9	5	227-31150-01	227-31150-02	-	227-31170-01
3	10	227-31151-01	227-31152-01	227-31153-01	227-31172-03
	20	227-31151-02	227-31152-02	227-31153-02	227-31172-04
5	10	227-31154-01	227-31155-01	227-31156-01	227-31172-03
	20	227-31154-02	227-31155-02	227-31156-02	227-31172-04

Preparative columns

Particle Size (µm)	I.D. (mm) / Length (mm)	10.0	20.0	30.0	Pressure Tolerance (MPa)
5	50	-	227-31111-01	227-31112-01	30
	75	-	-	227-31112-02	
	100	-	227-31111-02	227-31112-03	
	150	227-31110-01	227-31111-03	227-31112-04	
	250	227-31110-02	227-31111-04	227-31112-05	

Prep Guard cartridge columns

Particle Size (µm)	I.D. (mm) / Length (mm)	10.0	Holder
5	10	227-31157-01	227-31171-01

Shim-pack Scepter Phenyl

Analytical columns

Particle Size (µm)	I.D. (mm) / Length (mm)	2.0	2.1	3.0	4.0	4.6	Pressure Tolerance (MPa)
1.9	20	227-31062-05	227-31063-01	-	-	-	100
	30	227-31062-06	227-31063-02	-	-	-	
	50	227-31062-01	227-31063-03	227-31064-01	-	-	
	75	227-31062-02	227-31063-04	227-31064-02	-	-	
	100	227-31062-03	227-31063-05	227-31064-03	-	-	
	150	227-31062-04	227-31063-06	227-31064-04	-	-	
3	20	-	227-31065-01	-	-	-	45
	33	-	227-31065-02	-	-	227-31067-01	
	50	-	227-31065-03	227-31056-01	-	227-31067-02	
	75	-	227-31065-04	227-31066-02	-	227-31067-03	
	100	-	227-31065-05	227-31066-03	-	227-31067-04	
	150	-	227-31065-06	227-31066-04	-	227-31067-05	
	250	-	-	-	-	227-31067-06	
5	20	-	227-31068-01	-	-	-	45
	33	-	227-31068-02	-	-	227-31071-01	
	50	-	227-31068-03	227-31069-01	-	227-31071-02	
	75	-	227-31068-04	227-31069-02	-	227-31071-03	
	100	-	227-31068-05	227-31069-03	-	227-31071-04	
	150	-	227-31068-06	227-31069-04	227-31070-01	227-31071-05	
	250	-	-	-	227-31070-02	227-31071-06	

Analytical Guard cartridge columns

Particle Size (µm)	I.D. (mm) / Length (mm)	2.1	3.0	4.0	Holder
1.9	5	227-31158-01	227-31158-02	-	227-31170-01
3	10	227-31159-01	227-31160-01	227-31161-01	227-31172-03
	20	227-31159-02	227-31160-02	227-31161-02	227-31172-04
5	10	227-31162-01	227-31163-01	227-31164-01	227-31172-03
	20	227-31162-02	227-31163-02	227-31164-02	227-31172-04

Preparative columns

Particle Size (µm)	I.D. (mm) / Length (mm)	10.0	20.0	30.0	Pressure Tolerance (MPa)
5	50	-	227-31114-01	227-31115-01	30
	75	-	-	227-31115-02	
	100	-	227-31114-02	227-31115-03	
	150	227-31113-01	227-31114-03	227-31115-04	
	250	227-31113-02	227-31114-04	227-31115-05	

Prep Guard cartridge columns

Particle Size (µm)	I.D. (mm) / Length (mm)	10.0	Holder
5	10	227-31165-01	227-31171-01

Diol-HILIC

Analytical columns

Particle Size (µm)	I.D. (mm) / Length (mm)	2.0	2.1	3.0	4.0	4.6	Pressure Tolerance (MPa)
1.9	20	-	-	-	-	-	100
	30	-	-	-	-	-	
	50	227-31042-03	227-31043-03	227-31044-03	-	-	
	75	227-31042-01	227-31043-01	227-31044-01	-	-	
	100	227-31042-02	227-31043-02	227-31044-02	-	-	
	150	-	-	-	-	-	
3	20	-	227-31045-01	-	-	-	45
	33	-	227-31045-02	-	-	227-31047-01	
	50	-	227-31045-03	227-31046-01	-	227-31047-02	
	75	-	227-31045-04	227-31046-02	-	227-31047-03	
	100	-	227-31045-05	227-31046-03	-	227-31047-04	
	150	-	227-31045-06	227-31046-04	-	227-31047-05	
	250	-	-	-	-	227-31047-06	
5	20	-	227-31048-01	-	-	-	45
	33	-	227-31048-02	-	-	227-31051-01	
	50	-	227-31048-03	227-31049-01	-	227-31051-02	
	75	-	227-31048-04	227-31049-02	-	227-31051-03	
	100	-	227-31048-05	227-31049-03	-	227-31051-04	
	150	-	227-31048-06	227-31049-04	227-31050-01	227-31051-05	
	250	-	-	-	227-31050-02	227-31051-06	

Analytical Guard cartridge columns

Particle Size (µm)	I.D. (mm) / Length (mm)	2.1	3.0	4.0	Holder
3	10	227-31144-01	227-31145-01	227-31146-01	227-31172-03
	20	227-31144-02	227-31145-02	227-31146-02	227-31172-04
5	10	227-31147-01	227-31148-01	227-31149-01	227-31172-03
	20	227-31147-02	227-31148-02	227-31149-02	227-31172-04

Shim-pack Scepter C4

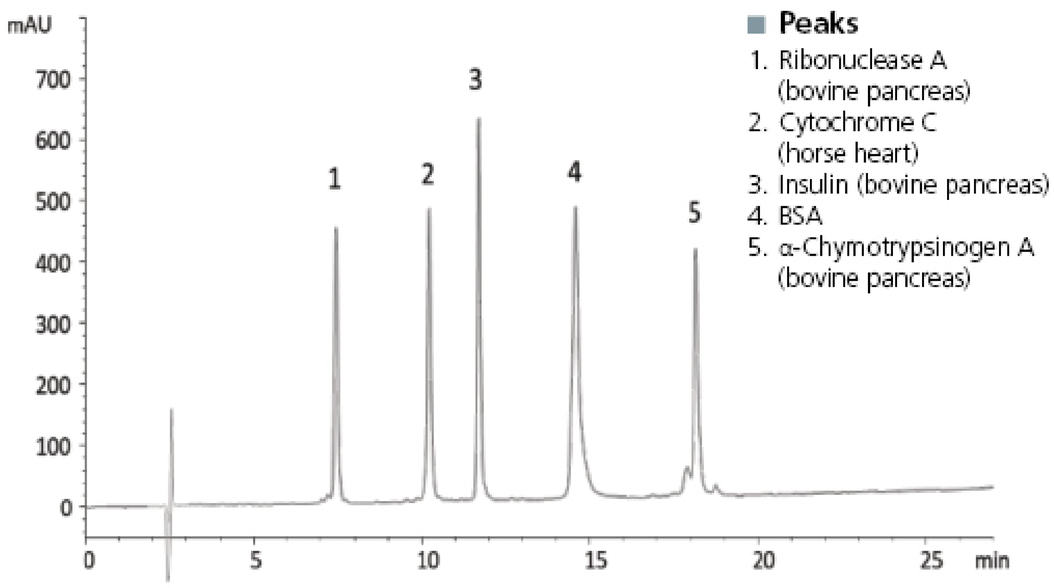
Design for biomolecules separations

Shim-pack Scepter C4 is a wide-bore C4 column that uses an organic silica hybrid base which is suitable for separation of proteins such as monoclonal antibodies. The column can be used for analysis of proteins with a molecular weight of up to approximately 150,000 and is suitable for analysis of antibodies as it is very stable even under acidic or high-temperature conditions because an organic silica hybrid base is used. It is also effective for high-sensitivity analysis on LC/MS as it provides good peak shapes even when using a formic acid mobile phase with low ion paring effect. In addition, it is effective for separation of highly-hydrophobic proteins, nucleotides and small molecules that are hard to separate using a regular C18 column.

Bonded Phase	Butyl Groups
Particle Size	1.9µm, 3µm, 5µm
Pore Size	30 nm
End-capping	Yes
pH Range	1 to 10
USP Code	L26

Analysis Examples

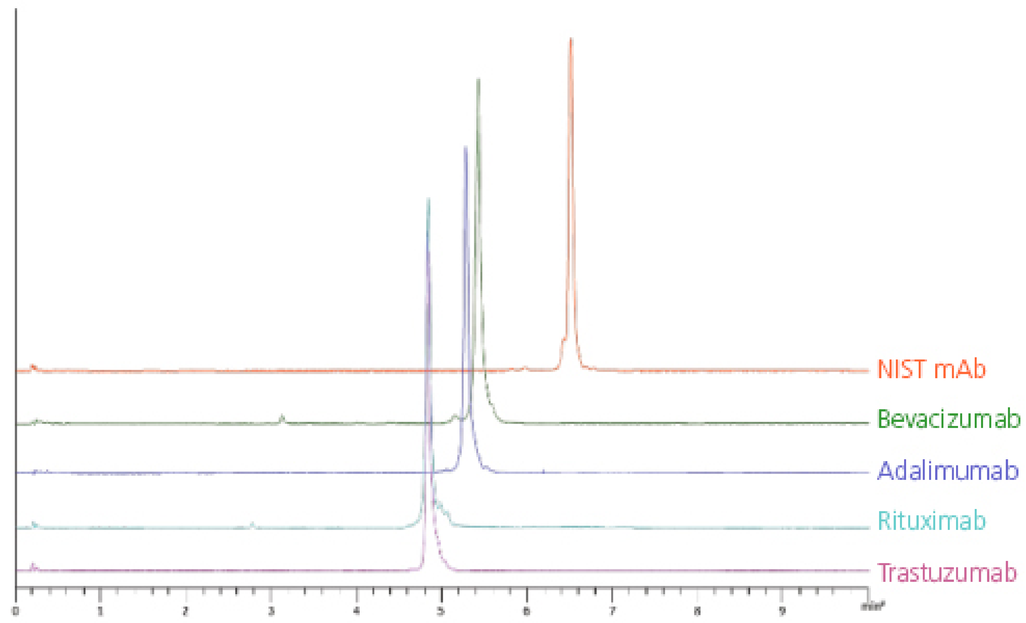
Analysis of Proteins



Conditions

Column	: Shim-pack Scepter C4 (5 µm, 150 x 3.0 mm I.D.) (P/N: 227-31181-04)
Mobile Phase	: A) Water/TFA (100/0.1) B) Acetonitrile/TFA (100/0.1) 20-60%B (0-27 min), 90%B (27-35 min), 20%B (35-50 min)
Flow Rate	: 0.4 mL/min
Col. Temp.	: 70 °C
Detection	: UV at 220 nm
Injection Vol.	: 10 µL (0.25 – 0.50 mg/mL) Column

Analysis of Monoclonal Antibodies



Conditions

Column	: Shim-pack Scepter C4 (1.9 µm, 50 x 2.1 mm I.D.) (P/N: 227-31175-03)
Mobile Phase	: A) Water/TFA (100/0.1) B) Acetonitrile/TFA (100/0.1) 25-45%B (0-10 min)
Flow Rate	: 0.4 mL/min
Col. Temp.	: 80 °C
Detection	: UV at 280 nm
Injection Vol.	: 2 µL
Sample Conc.	: 0.2 mg/mL

Analytical columns

Particle Size (µm)	I.D. (mm) / Length (mm)	2.1	3.0	4.0	4.6	Pressure Tolerance (MPa)
1.9	20	227-31175-01	-	-	-	100
	30	227-31175-02	227-30817-02	-	-	
	50	227-31175-03	227-31176-01	-	-	
	100	227-31175-04	227-31176-02	-	-	
	125	227-31175-05	227-31176-03	-	-	
	150	227-31175-06	227-31176-04	-	-	
3	20	227-31177-01	-	-	-	45
	33	227-31177-02	-	-	227-31179-01	
	50	227-31177-03	227-31178-01	-	227-31179-02	
	75	227-31177-04	227-31178-02	-	227-31179-03	
	100	227-31177-05	227-31178-03	-	227-31179-04	
	150	227-31177-06	227-31178-04	-	227-31179-05	
	250	-	-	-	227-31179-06	
5	20	227-31180-01	-	-	-	45
	33	227-31180-02	-	-	227-31183-01	
	50	227-31180-03	227-31181-01	-	227-31183-02	
	75	227-31180-04	227-31181-02	-	227-31183-03	
	100	227-31180-05	227-31181-03	227-31182-01	227-31183-04	
	150	227-31180-06	227-31181-04	227-31182-02	227-31183-05	
	250	-	-	-	227-31183-06	

Analytical Guard cartridge columns

Particle Size (µm)	I.D. (mm) / Length (mm)	2.1	3.0	4.0	Holder
1.9	5	227-31187-01	227-31187-02	-	227-31170-01
3	10	227-31188-01	227-31189-01	227-31190-01	227-31172-01
	20	227-31188-02	227-31189-02	227-31190-02	227-31172-02
5	10	227-31191-01	227-31192-01	227-31193-01	227-31172-01
	20	227-31191-02	227-31192-02	227-31193-02	227-31172-02

Preparative columns

Particle Size (µm)	I.D. (mm) / Length (mm)	10	20	30	Pressure Tolerance (MPa)
5	50	-	227-31185-01	227-31186-01	30
	75	-	-	227-31186-02	
	100	-	227-31185-02	227-31186-03	
	150	227-31184-01	227-31185-03	227-31186-04	
	250	227-31184-02	227-31185-04	227-31186-05	

Preparative guard cartridges columns

Particle Size (µm)	I.D. (mm) / Length (mm)	10	20	30	Holder
5	10	227-31194-01	227-31195-01	227-31196-01	227-31171-01

Shim-pack Arata LC Columns

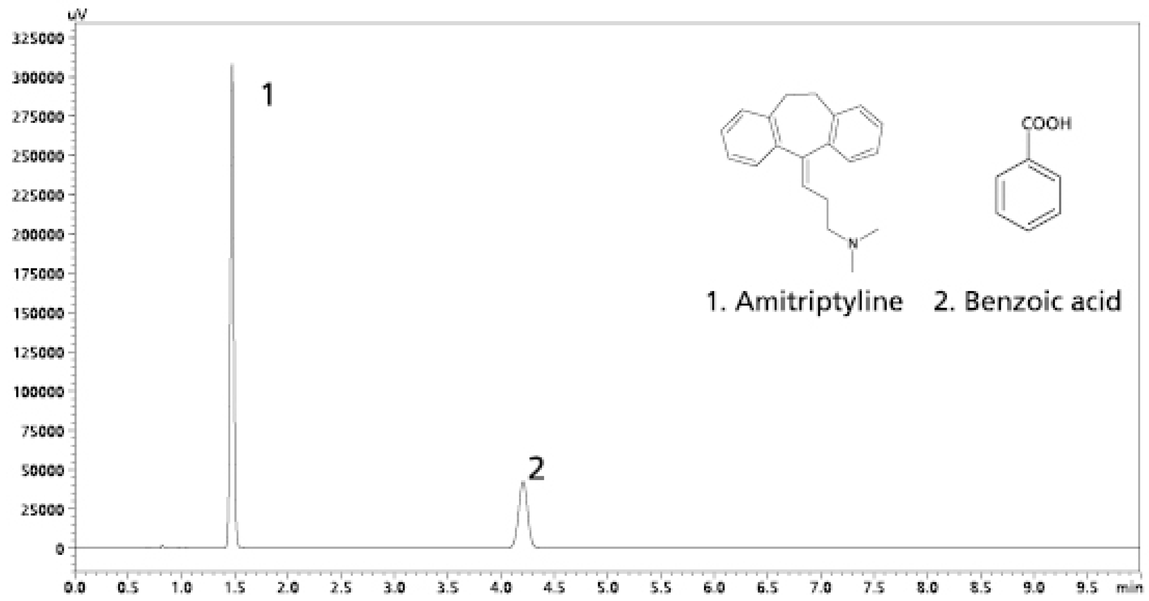
Unprecedented Resolution and Peak Shape of Basic Compounds

Even for LC columns that claim to be designed for basic compounds, adequate resolution often can not be obtained due to problems such as leading of highly polar basic compounds, peak shape deterioration of acidic compounds, or long equilibration time required for low ionic strength acidic mobile phase.

All of these issues have been solved with Shim-pack Arata that was specifically designed to give unmatched peak shape for basic compounds.

Unmatched Peak Shape (Elegantly Designed for A Wide Range of Compounds)

Unmatched peak shape of basic compounds could be achieved while maintaining good peak shape for acidic compounds with Shim-pack Arata LC columns. Even with low ionic strength acidic mobile phase, such as 0.1% formic acid containing mobile phase, excellent peak shape of both amitriptyline (a basic compound) and benzoic acid (an acidic compound) could be achieved.



Analysis of Amitriptyline and Benzoic Acid with The Mobile Phase with 0.1% Formic Acid

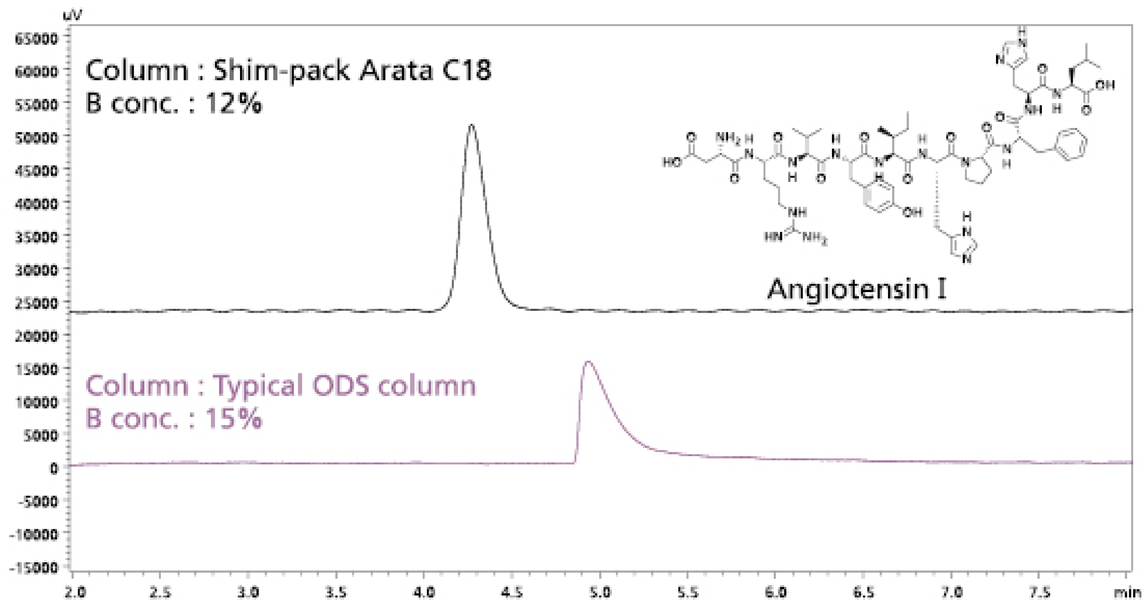
Analytical Conditions

Column	:	Shim-pack Arata C18
Mobile Phase	:	0.1% HCOOH in H2O / CH3CN = 70 / 30
Flow Rate	:	0.4 mL/min
Detection	:	254 nm
Column Temp.	:	40 °C
Inj. Volume	:	2 µL

* Gel Lot QC test analytical condition

Excellent Separation Performance for Peptides (Even with Weak Ion Paring Acids)

In order to obtain good peak shape of peptides under reversed phase chromatography, TFA containing mobile phases are frequently used which the ion pairing effect is relatively strong. However, TFA could cause ion suppression in LC/MS (/MS) analysis. Excellent peak shape and separation performance for peptides could be achieved on the Shim-pack Arata LC column even with 0.1 % formic acid (weak ion paring acid) containing mobile phase.



Analysis of Angiotensin I Using Isocratic Mobile Phase
with 0.1% Formic Acid (Shim-pack Arata C18 vs. Typical ODS)

Analytical Conditions

Column	:	Shim-pack Arata C18
Mobile Phase	:	A: 0.1% HCOOH in H2O
	:	B: 0.1% HCOOH in CH3CN
Flow Rate	:	0.4 mL/min
Detection	:	214 nm
Column Temp.	:	40 °C
Inj. Volume	:	1 µL
Sample	:	Angiotensin
Vial	:	TORAST-H™ Bio Vial

* Gel Lot QC test analytical condition

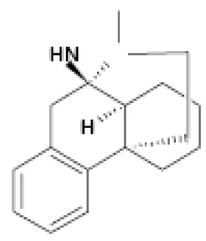
Column	Asymmetry
Shim-pack Arata C18	1.26
Typical ODS column	6.94

* Peptide is usually analyzed using gradient condition. Isocratic condition was used for this application in order to show the difference of LC columns more clearly. Result using gradient condition on Shim-pack Arata C18 was also evaluated and it was confirmed that angiotensin was fully eluted from the column with isocratic condition.

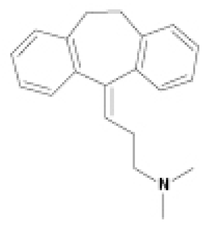
** Acetonitrile concentration was adjusted in order that the retention time of peptide on each column become similar.

Rapid Equilibration (Even with Low Ionic Strength Acidic Mobile Phases)

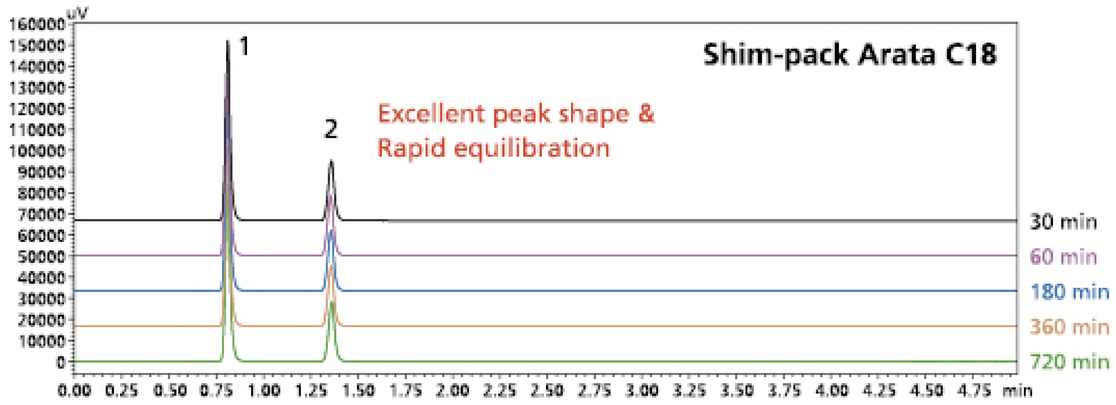
When analyzing basic compounds on a typical ODS column with low ionic strength acidic mobile phase, peak shape and long equilibration times are common problems. Shim-pack Arata LC columns can be rapidly equilibrated in low ionic strength acidic mobile phases yielding excellent peak shape and stable retention times.



1. Dextromethorphan



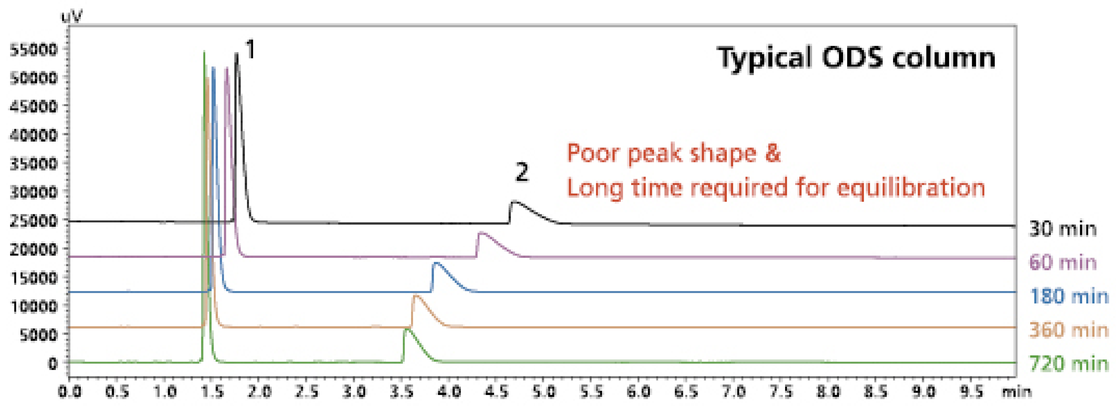
2. Amitriptyline



■ **Analytical Conditions**

Instruments	:	NexeraX2MP_M30A (STD Cell)
Column	:	Shim-pack Arata C18 (3.0 × 75 mm, 2.2 µm) Typical ODS column (3.0 × 75 mm, sub 2 µm),
Mobile Phase	:	0.1% HCOOH in H2O / CH3CN = 70 / 30
Flow Rate	:	0.4 mL/min
Detection	:	280 nm
Column Temp.	:	40 °C
Inj. Volume	:	2 µL
Sample	:	Amitriptyline, Dextromethorphan

	Compounds	Equilibration Time (min)	10	30	60	120	180	240	360	480	600	720	CV(%)
1	Dextromethorphan	Retention Time (min)	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.2
		Symmetry Factor	1.20	1.19	1.19	1.18	1.18	1.18	1.18	1.18	1.18	1.18	0.6
2	Amitriptyline	Retention Time (min)	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	0.3
		Symmetry Factor	1.06	1.07	1.06	1.06	1.06	1.06	1.06	1.06	1.06	1.06	0.3



* Both were new columns (shipping solvent : acetonitrile) and equilibrated with mobile phase without any conditioning. Basic drugs were analyzed after a certain period of time of equilibration and RT and symmetry factor of the drugs were compared.

	Compounds	Equilibration Time (min)	10	30	60	120	180	240	360	480	600	720	CV(%)
1	Dextromethorphan	Retention Time (min)	1.9	1.8	1.7	1.6	1.5	1.5	1.5	1.4	1.4	1.4	10.4
		Symmetry Factor	3.28	3.14	3.01	2.70	2.63	2.56	2.51	2.49	2.56	2.49	10.2
2	Amitriptyline	Retention Time (min)	5.3	4.7	4.3	4.0	3.9	3.8	3.7	3.6	3.5	3.6	13.5
		Symmetry Factor	4.23	4.23	4.35	4.22	4.13	4.17	4.09	4.02	3.99	3.90	3.1

Comparison of Column Equilibration in The Mobile Phase with 0.1% Formic Acid (Shim-pack Arata C18 vs. Typical ODS Column)

Shim-pack Arata C18

Particle Size (µm)	I.D. (mm) / Length (mm)	2.0	3.0	4.6
2.2	50	227-32801-01	227-32802-01	-
	75	227-32801-02	227-32802-02	-
	100	227-32801-03	227-32802-03	-
	150	227-32801-04	227-32802-04	227-32805-04
	250	-	-	227-32805-05
5.0	50	227-32803-01	227-32804-01	227-32805-01
	75	227-32803-02	227-32804-02	227-32805-02
	100	227-32803-03	227-32804-03	227-32805-03
	150	227-32803-04	227-32804-04	227-32805-04
	250	-	-	227-32805-05

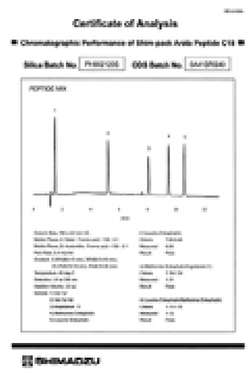
Shim-pack Arata Peptide Columns

Excellent Seperation Performance of Peptides

Typically, in order to obtain good peak shape of peptides under reversed phase chromatography, TFA containing mobile phases are frequently used which the ion pairing effect is relatively strong. However, TFA could cause ion suppression in LC/MS(/MS) analysis. Excellent peak shape and separation performance for peptides could be achieved on the Shim-pack Arata LC column even under formic acid (weak ion paring acid) containing mobile phase conditions, which are suitable for LC/MS(/MS) without the use of typical ion pairing agents.

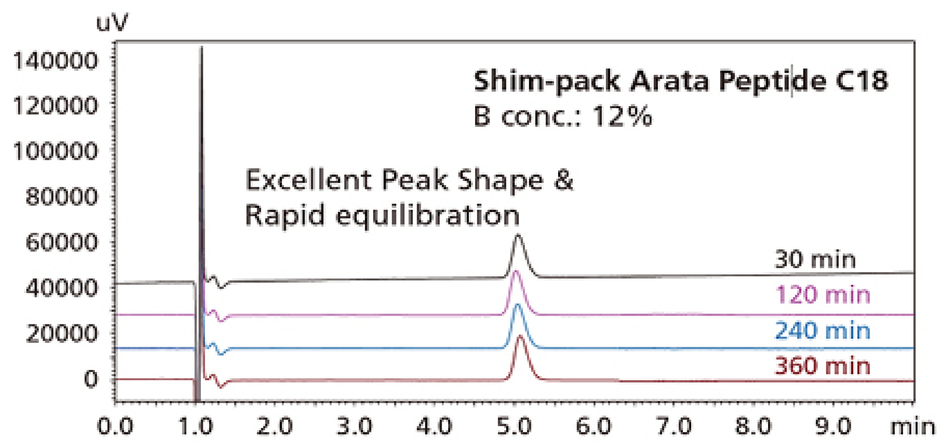
Increased Assurance of Peptide Analysis ~ Shim-pack Arata Peptide C 18 column ~

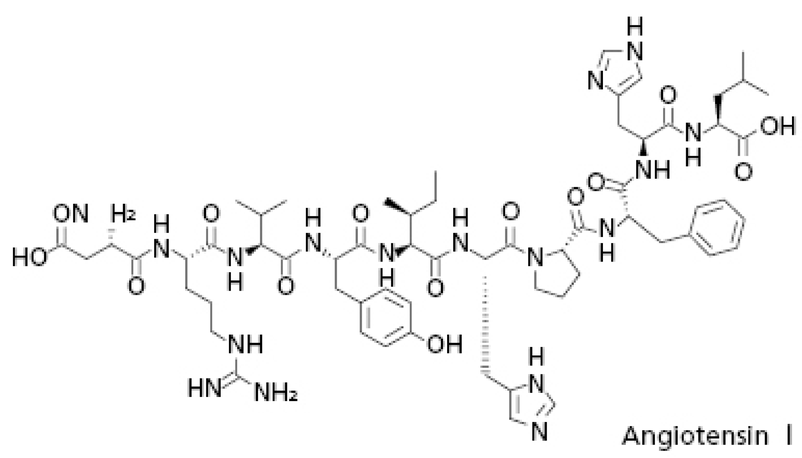
In order to ensure lot-to-lot reproducibility in peptide analysis, each lot of Shim-pack Arata Peptide C18material is tested using a mixture of peptide standards in addition to the standard Shim-pack Arata C18 lot QCtest. This test is carried out under severe condition using 0.1 % formic acid mobile phase to help ensure consistent column performance for requirements of customers under regulated requirements.use of typical ion pairing agents.



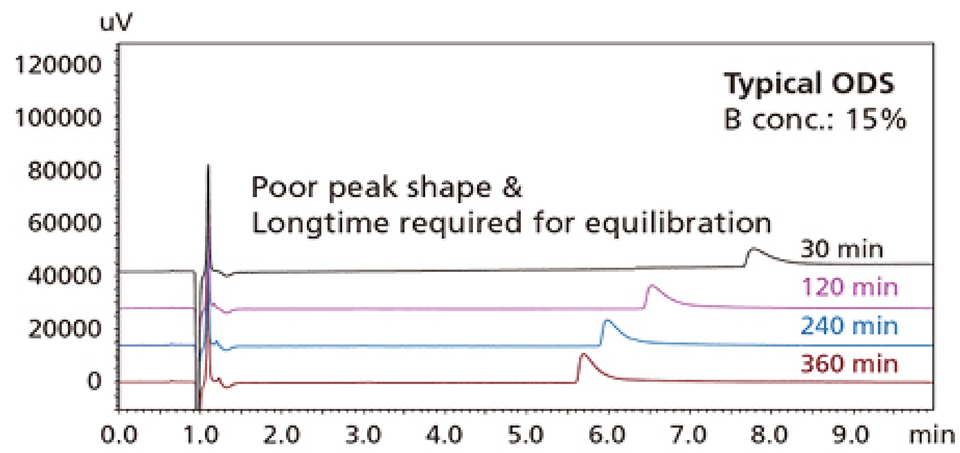
Excellent Seperation Performance of Peptides

When analyzing peptides on a typical ODS column with 0.1% formic acid mobile phase, not only poor peak shape but also long equilibration time required to obtain stable retention times and area is a common problem. Shim-pack Arata Peptide C18 columnscan be rapidly equilibrated even in 0.1% formic acid containing mobile phase, achieving excellent peak shape, stable retention andarea of peptides at the same time.





Compounds	Equilibration time (min)	30	60	120	180	240	360	CV
Angiotensin I	Retention time (min)	5.05	5.03	5.03	5.03	5.04	5.06	0.3
	Symmetry factor	1.26	1.24	1.25	1.25	1.24	1.25	0.4
	Area	2.17×10^5	2.13×10^5	2.26×10^5	2.25×10^5	2.23×10^5	2.24×10^5	1.9



Analytical Conditions
LC system : NexeraX2 MP_SPD20A (Semi-micro Cell)
LC column :
Shim-pack Arata Peptide C18 (3.0 × 75 mm, 2.2 µm)
Typical ODS (3.0 × 75 mm, Sub 2 µm)
Mobile Phase A : 0.1% HCOOH in H2O
Mobile Phase B : 0.1% HCOOH in CH3CN
Flow rate : 0.4 mL/min

Detection : 214 nm
Column temp. : 40 °C
Injection volume : 1 µL
Sample : Angiotensin I
Vial : Torast-H Bio Vial

*Peptide is usually analyzed using gradient conditions. Isocratic condition was used for this application in order to show the difference of LC columns more clearly. Acetonitrile concentration was adjusted in order that the retention time of peptide on each column become similar.

Compounds	Equilibration time (min)	30	60	120	180	240	360	CV
Angiotensin I	Retention time (min)	7.78	7.15	6.53	6.20	5.98	5.82	11.0
	Symmetry factor	4.89	4.38	4.85	4.87	4.93	4.92	3.9
	Area	1.65×10^5	1.58×10^5	1.76×10^5	1.78×10^5	1.83×10^5	1.84×10^5	5.3

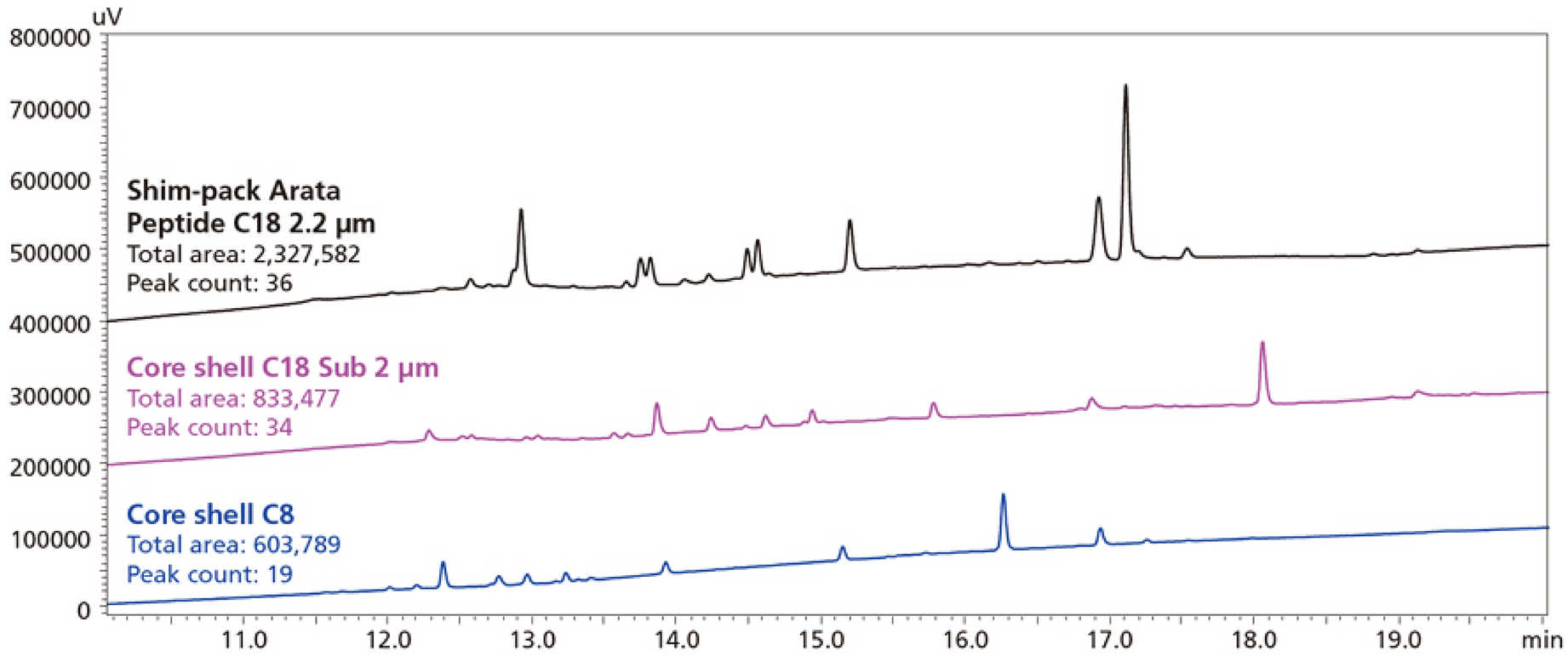
Both columns were new columns (shipping solvent: acetonitrile) and equilibrated with mobile phase without any conditioning. Angiotensin I was analyzed after a certain period of equilibration and retention time, symmetry factor and area of Angiotensin I were compared. The typical ODS showed poor peak symmetry and unstable retention time even after 360 minutes of equilibration. In contrast, Shim-pack Arata peptide C18 already showed stable retention after 30 minutes of equilibration and excellent peak shape was obtained.

High Peptide Recovery enabled by Shim-pack Arata technology

Since the adsorption of peptides to particles is minimized, high recovery of peptides is ensured and excellent peptide analysis can be provided by Shim-pack Arata Peptide C18 column.

Analysis of Tryptic Digest of Myoglobin

Peptides are known to show non-specific adsorption to particles of LC columns. A Shim-pack Arata Peptide C18 column showed high recovery of peptides.



Analytical Conditions

LC System : NexeraX2MP_M30A (STD Cell)
LC Column : Shim-pack Arata Peptide C18 (2.0 × 150 mm, 2.2 µm)
Core shell Peptide C18 (2.1×150 mm, sub 2 µm)
Core shell C8 (2.1 ×150 mm, sub 4 µm)
Mobile Phase A : 0.1% HCOOH in H2O
Mobile Phase B : 0.1% HCOOH in CH3CN
Gradient : 2%B (0-5 min)→45%B (20 min)→100%B (20.01 – 25 min)
→2%B (25.01 – 30 min)

Detection : 214 nm
Column temp. : 40 °C
Injection volume : 1 µL
Sample : Angiotensin I
Vial : Torast-H Bio Vial

Tryptic digest of myoglobin was analyzed using Shim-pack Arata Peptide C18 (2.2 µm), Core shell C18 (sub 2 µm) and a Core shell C8 (sub 4 µm). Compared to the other two columns, Shim-pack Arata Peptide C18 showed significantly larger peak area, which suggests that higher recovery could be obtained with Shim-pack Arata Peptide C18 column.

Shim-pack Arata Peptide C18

Particle Size (µm)	I.D. (mm) / Length (mm)	2.0
2.2	50	227-32806-01
	100	227-32806-02
	150	227-32806-03

Shim-pack XR Series

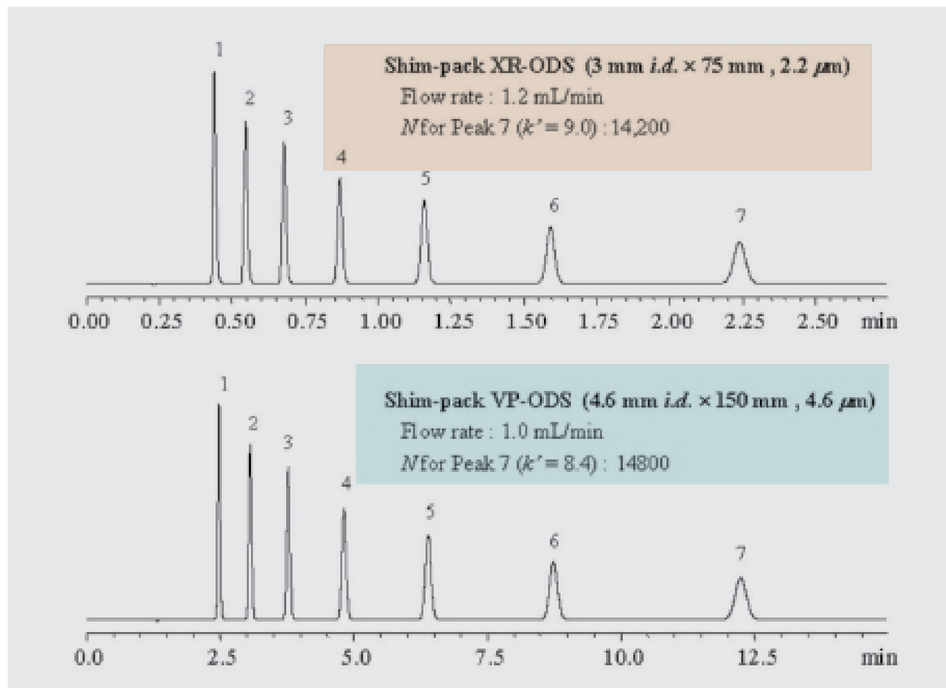
Shim-pack XR Series Columns Offer Versatility and Fast Analysis

Shim-pack XR Series columns use a 2.2 µm packing particle size and offer a skillful balance between resolution efficiency and pressure. An XR Series column provides resolution equivalent to a general-purpose column with 5 µm packing particle size (Shim-pack VP-ODS), but significantly reduces the analysis time. The pressure on the column under many analysis conditions does not exceed 35 MPa. Consequently, ultrafast analysis can be comfortably performed on an existing instrument.

	Shim-pack XR-ODS	Shim-pack XR-C8	Shim-pack XR-Phenyl	Shim-pack XR-SIL
Particle Size (µm)	2.2	2.2	2.2	2.2
Pore Size (nm)	12	12	12	12
Surface Area (m2/g)	340	340	340	340
Carbon Loading	18%	11%	11%	–
Pressure Tolerance (MPa)	35	35	35	20
Pore Volume (mL/g)	1.05	1.05	1.05	1.05
End-capping	Yes	Yes	Yes	–
Bonding Type	Monomeric	Monomeric	Monomeric	–
pH Range	2 - 7.5	2 - 7.5	2 - 7.5	–
USP Code	L1	L7	L11	L3

Shim-pack XR-ODS Permits Simple Switching from Conventional Analysis

The two chromatograms to the right show differences in analysis times when using different columns. The lower chromatogram is the result of analysis using a Shimadzu Shim-pack VP-ODS general-purpose column. The upper chromatogram is from analysis with a Shim-pack XR-ODS fast analysis column. As both Shim-pack VP-ODS and Shim-pack XR-ODS offer identical resolution properties, Shim-pack XR-ODS maintains the resolution while significantly reducing analysis times.



For more information of smooth transfer of methods from high-speed analysis to conventional analysis, please refer to page A-34

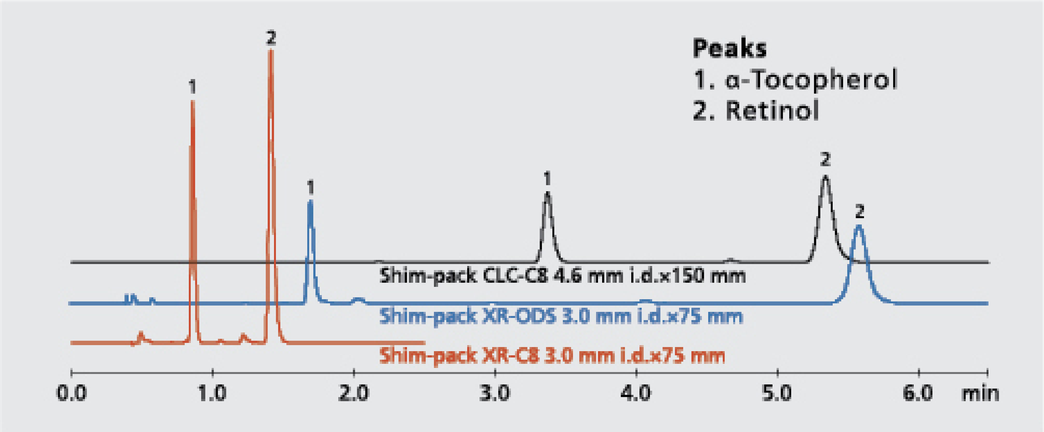
Shim-pack XR Series Comprehensive Product Range

In addition to the versatile Shim-pack XR-ODS that is bonded with the C18 group, the comprehensive Shim-pack XR Series product range includes the Shim-pack XR-C8 that is bonded with the C8 group to give different retention behavior to ODS, Shim-pack XR-Phenyl that is bonded with the phenylpropyl group, and the normal-phase Shim-pack XR-SIL silica column that achieves higher speeds.

Analysis Examples

Analysis of Fat-Soluble Vitamins

The fat-soluble vitamins E (tocopherol) and A (retinol) were analyzed. The Shim-pack XR-C8 column achieves higher speed than a conventional C8 column.

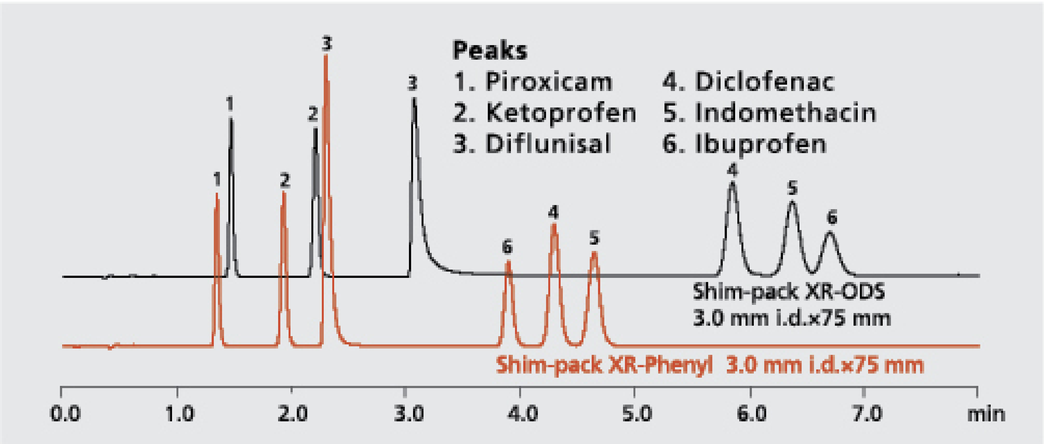


■ **Conditions**

Column	: Shim-pack XR-C8 (75 mmL. × 3.0 mmI.D., 2.2 µm) (P/N: 228-59902-93)
Mobile Phase	: Methanol
Flow Rate	: 1.0 mL/min
Col. Temp.	: 40 °C
Detection	: UV 290 nm

Analysis of Non-Steroidal Anti-Inflammatory Drug

The column was switched from Shim-pack XR-ODS to Shim-pack XR-Phenyl to improve the resolution.
The difference in retention properties between the ODS group and the phenylpropyl group improves the peak shape, controls the resolution, and reduces the analysis time.

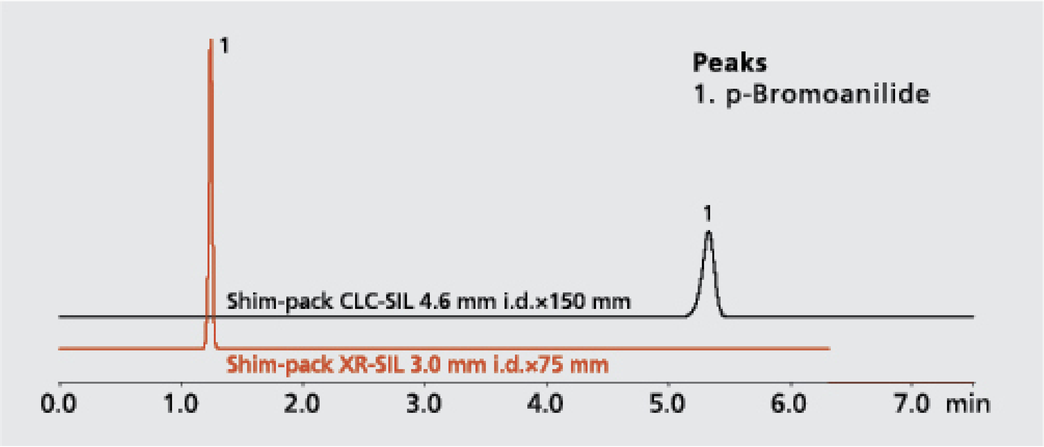


■ **Conditions**

Column	: Shim-pack XR-Phenyl (75 mmL. × 3.0 mmI.D., 2.2 µm) (P/N: 228-59904-93)
Mobile Phase	: A) 20 mmol/L Phosphate buffer solution (pH 2.5) B) Acetonitrile A/B = 30/20 (v/v)
Flow Rate	: 1.0 mL/min
Col. Temp.	: 40 °C
Detection	: UV 220 nm

Fast Normal-Phase Analysis

Organic solvents are used as the mobile phase for normal-phase analysis. Due to environmental considerations, it is necessary to reduce the consumption of mobile phase compared with normal reversed-phase analysis. The Shim-pack XR-SIL silica column increases the speed of normal-phase analysis while reducing the consumption of mobile phase. In this example, the analysis time is reduced by 80 % while maintaining the flow rate, thereby reducing the overall mobile phase consumption to 20 % or less.



■ **Conditions**

Column	: Shim-pack XR-SIL (75 mmL. × 3.0 mmI.D., 2.2 µm) (P/N: 228-59906-92)
Mobile Phase	: Hexane / Ethanol = 90/10 (v/v)
Flow Rate	: 1.0 mL/min
Col. Temp.	: 40 °C
Detection	: UV 254 nm