ChromaNik Technologies Inc.

HPLC & UHPLC Column Manufacturer

MICROCOLUMN

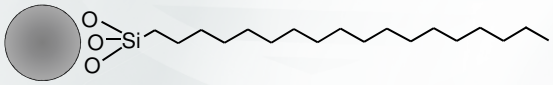
ChromaNik Technologies Inc.

SUNSHELL & SUNNIEST

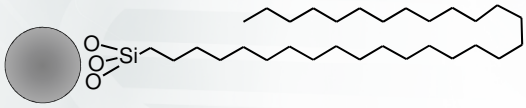
STATIONARY PHASE

Reversed phase

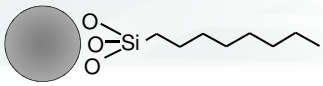
C18, C18-WP, C18-HT



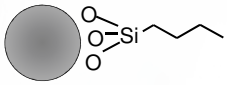
RP-AQUA, C30



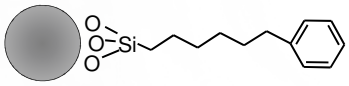
C8, C8-30, C8-30HT



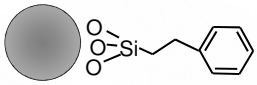
C4-30, C4-100



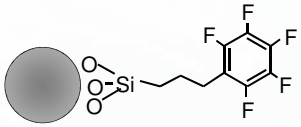
Phenyl



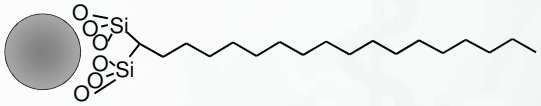
PhE



PFP

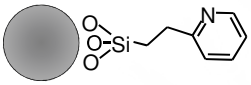


HFC18-16, HFC18-30



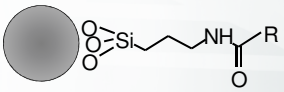
SFC (Supercritical Fluid Chromatography)

2EP

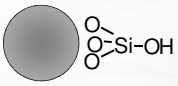


HILIC
(Hydrophilic Interaction Liquid Chromatography)

HILIC-Amide



HILIC-S



"SunShell " is a core shell silica column made by ChromaNIk Technologies.

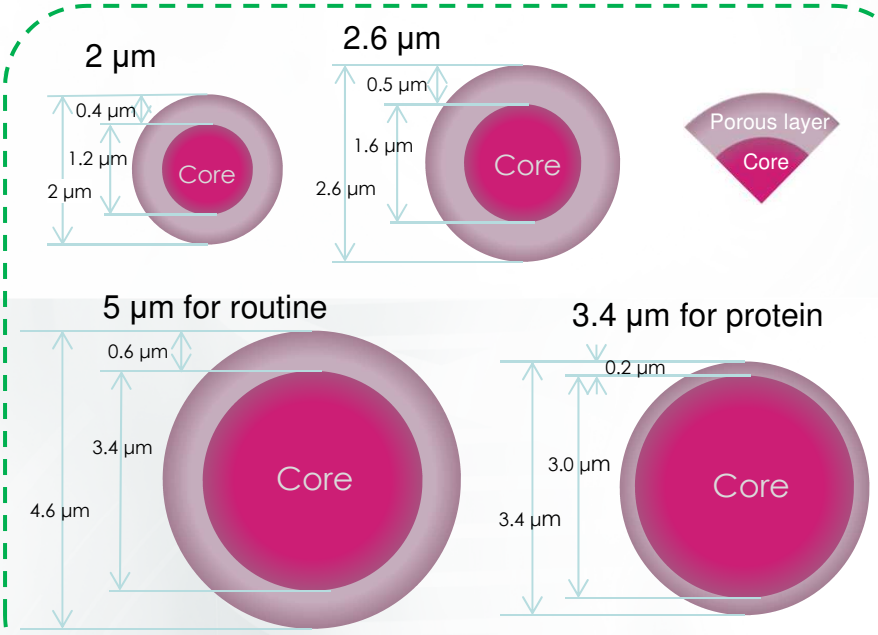
SunShell

The next generation to Core Shell particle

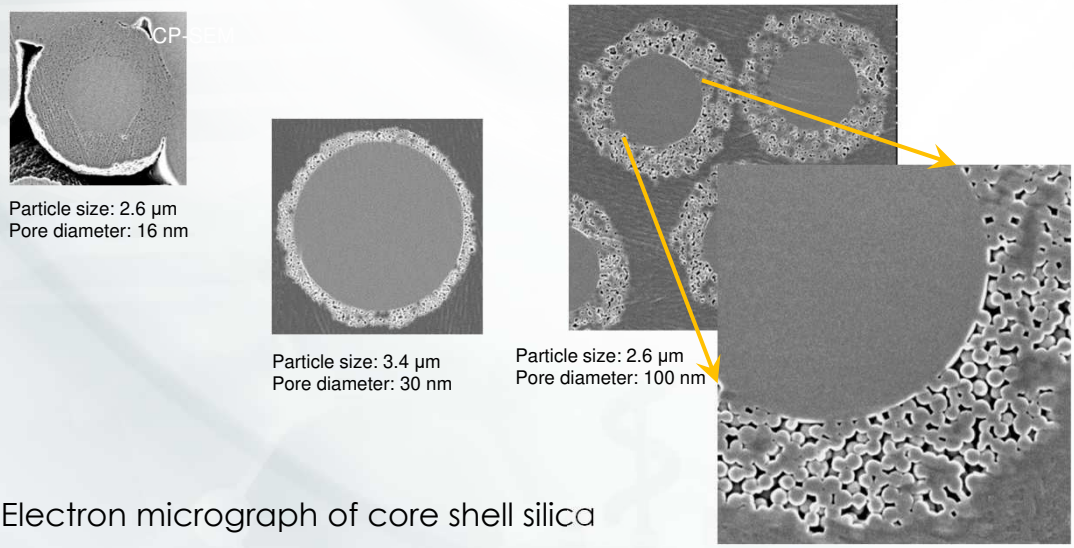
Superficially porous silica

Feature of SunShell with 2 µm, 2.6 µm, 3.4 µm and 5 µm

*1.6 µm, 3.0 µm and 3.4 µm of core and 0.5 µm, 0.2 µm and 0.6 µm of superficially porous silica layer
*Same efficiency and high throughput as a Sub 2 µm and 3 µm particle
*Same pressure as a 3 µm and 5 µm particle
*Same chemistry as Sunniest technology (reference below figure)
*Good peak shape for all compounds such as basic, acidic and chelating compounds
*High stability (pH range for SunShell C18, 1.5 to 10)
* Low breeding



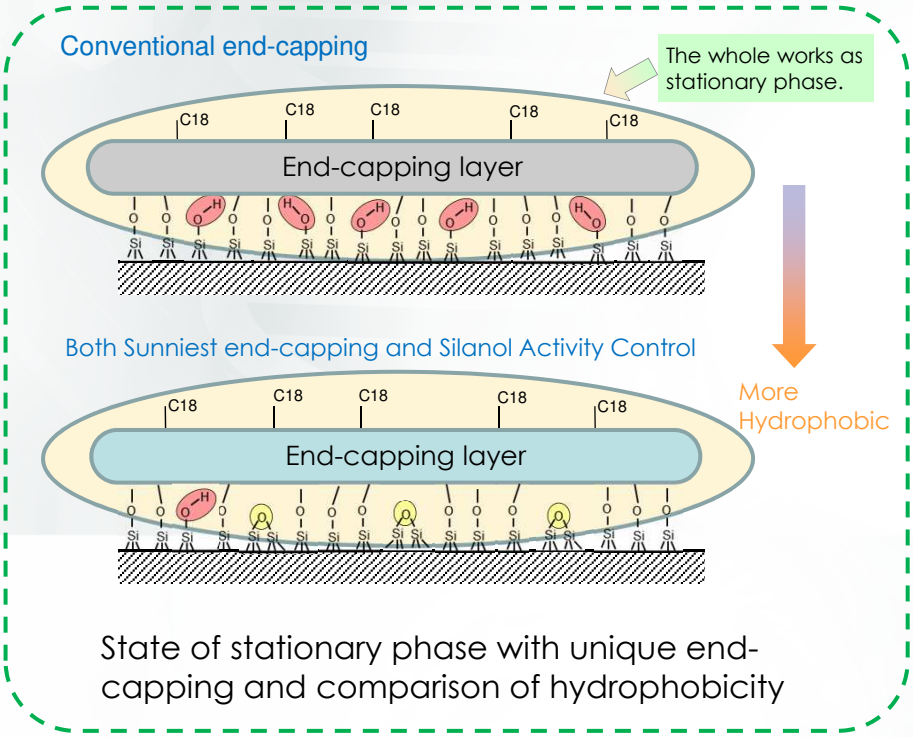
Schematic diagram of a core shell silica particle, 2.0, 2.6, 3.4 and 5 µm



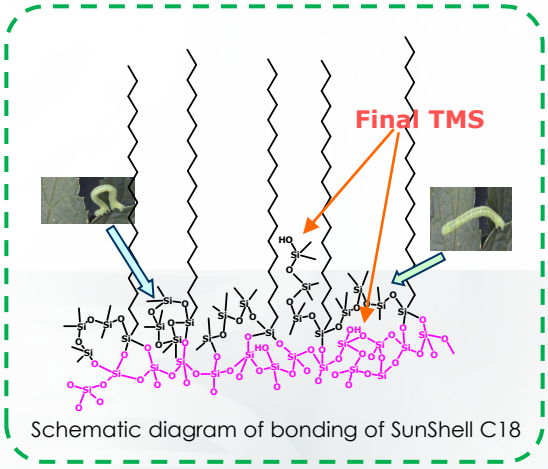
Electron micrograph of core shell silica

Unique end-capping by new concept

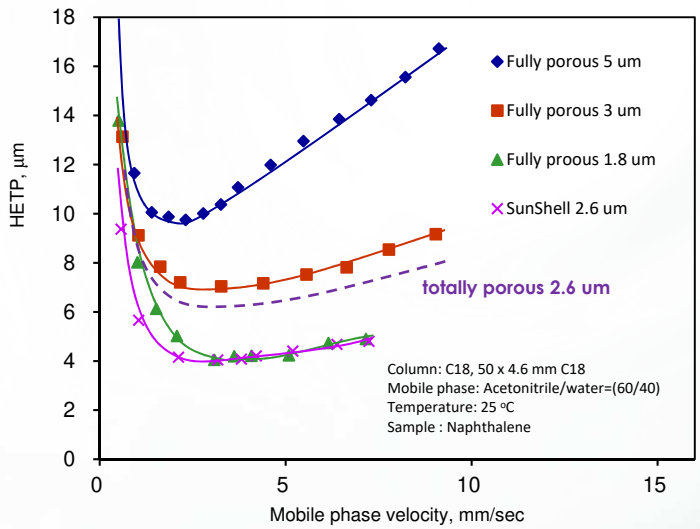
This slide shows comparison of hydrophobicity between two C18 stationary phases. We developed silanol activity control technique which was a reaction at extremely high temperature. This technique makes residual silanol groups change to siloxane bond. The upper one is a C18 phase with conventional end-capping and the lower one is a C18 phase with both Sunniest end-capping and silanol activity control. Residual silanol groups contributes as a polar site and makes hydrophobicity of stationary phase decrease. On the other hand siloxane bond in the lower one doesn't make hydrophobicity decrease. Consequently the lower one is more hydrophobic than the upper one.



State of stationary phase with unique end-capping and comparison of hydrophobicity



Schematic diagram of bonding of SunShell C18

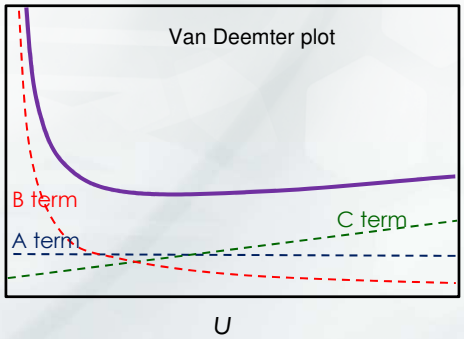


Comparison of plate height plots

Van Deemter Equation

$$H = Ad_p + B\frac{D_m}{u} + C\frac{d_p^2}{D_m}u$$

A term : Eddy diffusion(dp is particle diameter)
B term : Longitudinal diffusion
(Dm is diffusion coefficient)
C term : Mass transfer

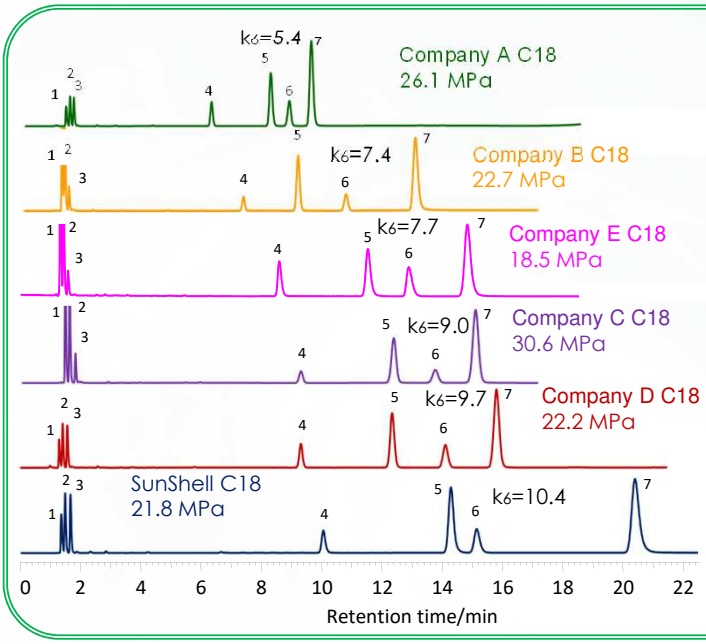


SunShell C18 shows same efficiency as a sub 2 µm C18. In comparison between fully porous 2.6 µm and core shell 2.6 µm (SunShell), SunShell shows lower values for A term, B term and C term of Van Deemter equation. The core shell structure leads higher performance to compare with the fully porous structure.

Comparison of core shell 2.6 µm columns

Used columns
1. Kinetex C18, 2.6 µm
2. Accucore C18, 2.6 µm
3. PoroShell C18 EC, 2.7 µm
4. Ascentis Express C18, 2.7 µm
5. Cortecs C18, 2.7 µm
6. SunShell C18, 2.6 µm

Comparison of standard samples between core shell C18s

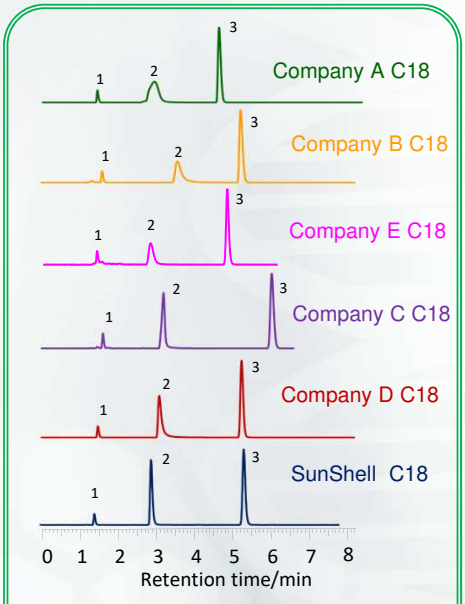


Column: Company A C18, 2.6 µm 150 x 4.6 mm (26.1 Mpa, 30,800 plate)
Company B C18, 2.6 µm 150 x 4.6 mm (22.7 MPa , 31,600 plate)
Company W C18, 2.7 µm 150 x 4.6 mm (18.5 MPa , 23,300 plate)
Company C C18, 2.7 µm 150 x 4.6 mm (30.6 MPa , 30,200 plate)
Company D C18, 2.7 µm 150 x 4.6 mm (22.2 MPa , 31,800 plate)
SunShell C18, 2.6 µm 150 x 4.6 mm (21.8 MPa , 31,900 plate)
Mobile phase: CH_3OH/H_2O=75/25
Flow rate: 1.0 mL/min, Temperature: 40 ºC
Sample: 1 = Uracil, 2 = Caffeine, 3 = Phenol, 4 = Butylbenzene
5 = o-Terphenyl, 6 = Amylbenzene, 7 = Triphenylene

	Hydrogen bonding (Caffeine/Phenol)	Hydrophobicity (Amylbenzene/Butylbenzene)	Steric selectivity (Triphenylene/o-Terphenyl)
Company A C18	0.48	1.54	1.20
Company B C18	0.35	1.56	1.50
Company E C18	0.38	1.59	1.32
Company C C18	0.42	1.57	1.25
Company D C18	0.44	1.60	1.31
SunShell C18	0.39	1.60	1.46

Retention of standard samples and back pressure were compared for five kinds of core shell type C18s. Company A C18 showed only a half retention to compare with SunShell C18. Steric selectivity becomes large when ligand density on the surface is high. SunShell C18 has the largest steric selectivity so that it has the highest ligand density. This leads the longest retention time.

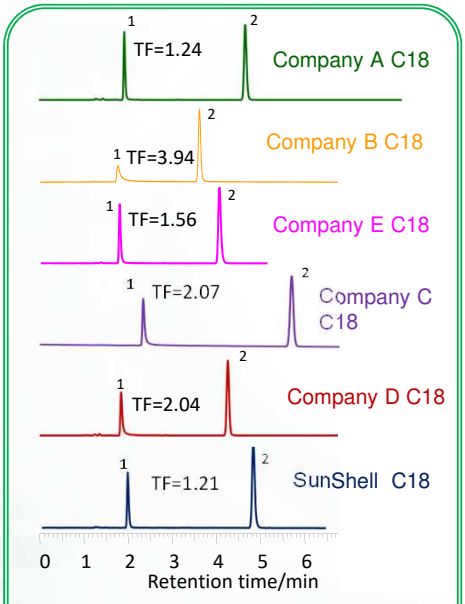
Comparison of pyridine



Column dimension: 150 x 4.6 mm
Mobile phase: CH_3OH/H_2O=30/70
Flow rate: 1.0 mL/min
Temperature: 40 ºC
Detection: UV@250nm
Sample: 1 = Uracil
2 = Pyridine
3 = Phenol

Residual silanol groups make pyridine be tailing under methanol/water mobile phase condition. SunShell C18 shows a sharp peak for pyridine.

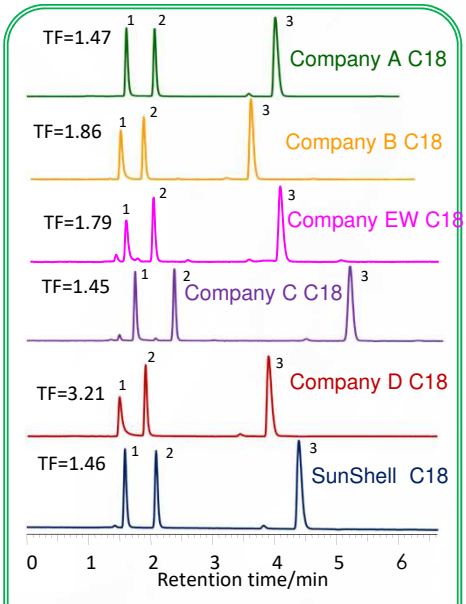
Comparison of Oxine



Column dimension: 150 x 4.6 mm
Mobile phase: CH_3CN/20mM H_3PO_4=10/90
Flow rate: 1.0 mL/min
Temperature: 40 ºC
Detection: UV@250nm
Sample: 1 = 8-Quinolinol (Oxine)
2 = Caffeine

8-Quinolinol (Oxine) is a metal chelating compound. Metal impurities in the core shell particle leads the tailing for oxine peak.

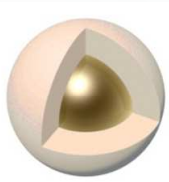
Comparison of formic acid



Column dimension: 150 x 4.6 mm
Mobile phase: CH_3CN/0.1% H_3PO_4=2/98
Flow rate: 1.0 mL/min
Temperature: 40 ºC
Detection: UV@210nm
Sample: 1 = Formic acid
2 = Acetic acid
3 = Propionic Acid

Formic acid is used as an indicator for a acidic inertness. SunShell and Company A and C C18 show a sharp peak.

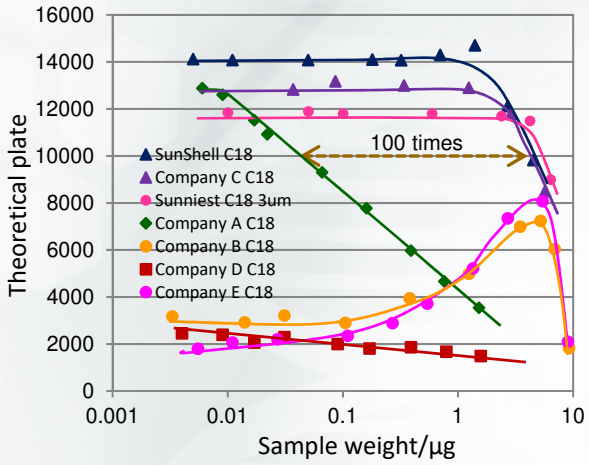
Loading capacity of amitriptyline as a basic compound



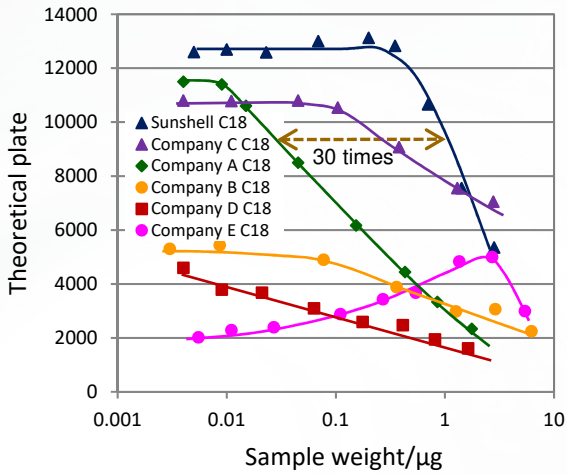
Amitriptyline overlords much more at acetonitrile/buffer mobile phase than methanol/buffer. Three kinds of core shell C18s were compared loading capacity of amitriptyline at three different mobile phases.

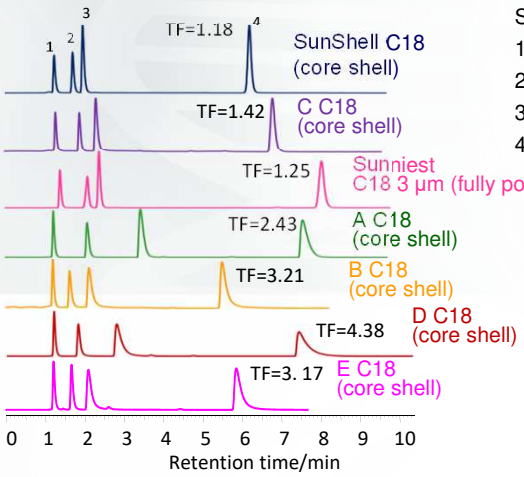
Common condition: Column dimension,150 x 4.6 mm, flow rate; 1.0 mL/min, temperature; 40 °C

Mobile phase: Acetonitrile/**20mM phosphate buffer pH7.0**=(60:40)

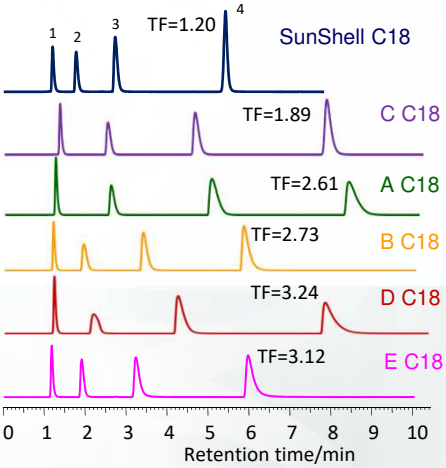


Mobile phase: Acetonitrile/**10mM acetate ammonium pH6.8**=(40:60)

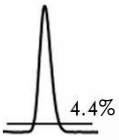




Sample:
1 = Uracil (0.07µg)
2 = Propranolol (1.53µg)
3 = Nortriptyline (0.32µg)
4 = Amitriptyline (0.32µg)



Theoretical plate was calculated by 5σ method using peak width at 4.4% of peak height.



Physical properties

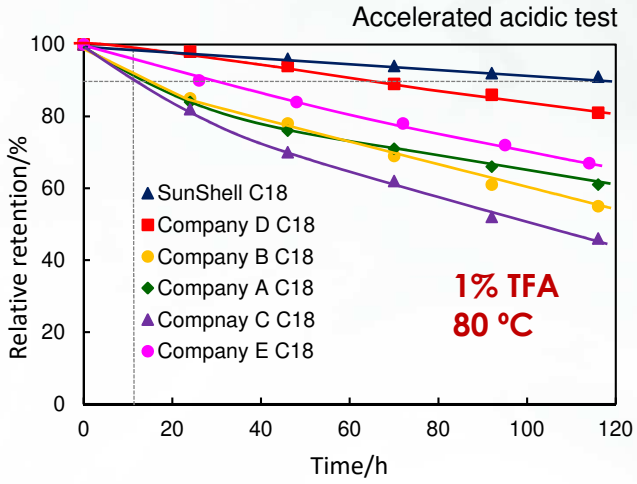
	Carbon loading (%)	Specific surface area [a] (m^2/g)	Pore volume [a] (mL)	Pore diameter [a] (nm)
SunShell C18	7.3 (7)[b]	125 (150)[b]	0.261	8.34 (9)[b]
Ascentis Express C18	8.0	133 (150)[b]	0.278	8.20 (9)[b]
PoroShell C18 EC	8.5 (8)[b]	135 (130)[b]	0.414	12.3 (12)[b]
Accucore C18	8.8 (9)[b]	130 (130)[b]	0.273	8.39 (8)[b]
Cortecs C18	7.3 (6.6)[b]	113	0.264	9.32
Kinetex C18	4.9 (12 effective)[b]	102 (200 effective)[b]	0.237	9.25 (10)[b]

Comparison column
1. Kinetex C18, 2.6 µm
2. Accucore C18, 2.6 µm
3. PoroShell C18 EC, 2.7 µm
4. Ascentis Express C18, 2.7 µm
5. Cortecs C18 2.7 µm
6. SunShell C18, 2.6 µm

a. Measured after sintered at 600 degree Celsius for 8 hours.
b. Value cited in company brochure or literature

All columns are core shell type. All columns sized 150 x 4.6 mm except for company E show 38,000 to 40,000 plates for a neutral compound. However regarding a basic compound like amitriptyline, SunShell C18 and company C C18 showed a good peak, while Company A, B and D C18 showed a poor peak. Company A C18 overloaded at more than 0.01 mg of amitriptyline while SunShell C18 overloaded at more than from 0.3 to 1 mg of amitriptyline. Surprisingly loading capacity of company A C18 was only one hundredth to compare with SunShell C18 under acetonitrile/20mM phosphate buffer pH7.0=(60:40) mobile phase. Company D C18 always showed poor peak of amitriptyline.

◆Evaluation of Stability



Durable test condition

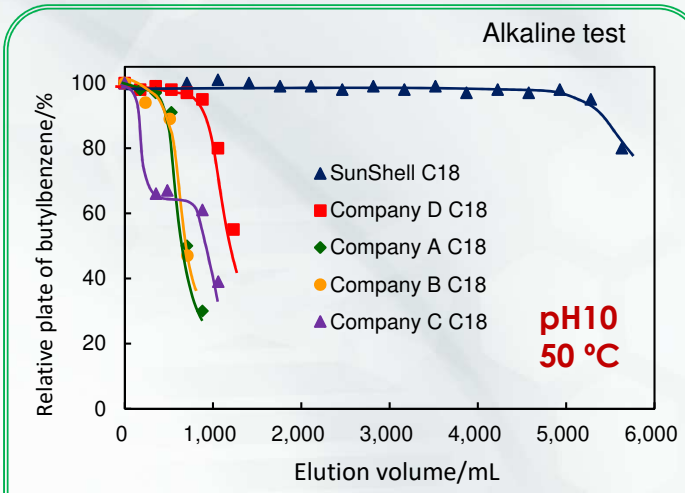
Column size: 50 x 2.1 mm
Mobile phase: CH_3CN/1.0% TFA, pH1=10/90
Flow rate: 0.4 mL/min
Temperature: 80 °C

Measurement condition

Column size: 50 x 2.1 mm
Mobile phase: CH_3CN/H_2O=60/40
Flow rate: 0.4 mL/min
Temperature: 40 °C
Sample: 1 = Uracil (t_0)
2 = Butylbenzene

Stability under acidic pH condition was evaluated at 80 °C using acetonitrile/1% trifluoroacetic acid solution (10:90).

★Sunshell C18 has kept 90% retention for 100 hours under such a severe condition. SunShell C18 is 5 to 10 times more stable than the other core shell C18.



Durable test condition

Column Size: 50 x 2.1 mm
Mobile phase:
CH_3OH/20mM Sodium borate/10mM NaOH=30/21/49 (pH10)
Flow rate: 0.4 mL/min
Temperature: 50 °C

Measurement condition

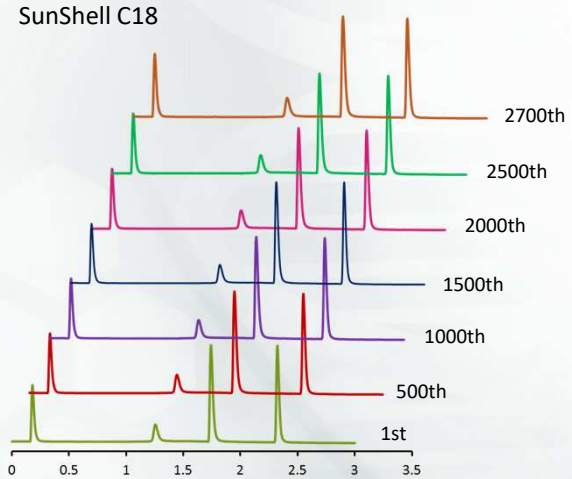
Column Size: 50 x 2.1 mm
Mobile phase: CH_3CN/H_2O=60/40
Flow rate: 0.4 mL/min
Temperature: 40 °C
Sample: 1 = Butylbenzene

Stability under basic pH condition was evaluated at 50 °C using methanol/Sodium borate buffer pH 10 (30:70) as mobile phase. Sodium borate is used as a alkaline standard solution for pH meter, so that its buffer capacity is high.

Elevated temperature of 10 °C makes column life be one third. The other company shows stability test at ambient (room temperature). If room temperature is 25 °C, column life at room temperature (25 °C) is sixteen times longer than that at 50 °C.

★ SunShell C18 is enough stable even if it is used under pH 10 condition. Regarding stability under basic pH condition, there is little C18 column like SunShell C18 except for hybrid type C18. It is considered that our end-capping technique leads high stability.

◆Continuous analysis under pH9.5 condition

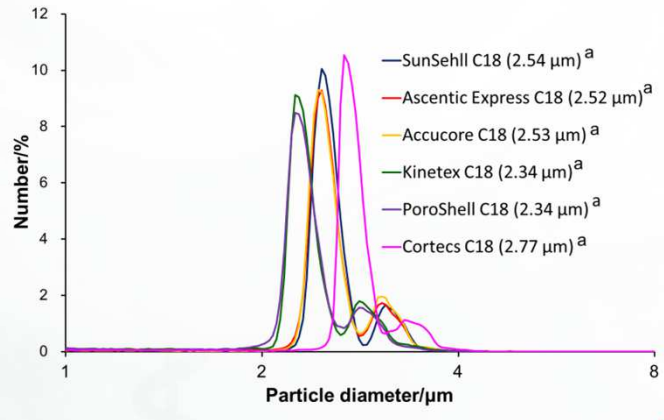


Column: SunShell C18, 2.6 µm 50 x 2.1 mm
Mobile phase: A) 10 mM Ammonium bicarbonate pH 9.5
B) Acetonitrile
Gradient program:

Time (min)	0	1	3	3.1	5
%B	30	90	90	30	30

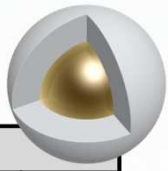
Flow rate: 0.5 mL/min
Temperature: 40 °C
Detection: UV@250 nm
Sample: 1=Uracil, 2=Propranolol, 3= Nortriptyline, 4=Amitriptyline

◆Comparison of particle size



*Measured using Beckman Coulter Multisizer 3 after C18 materials were sintered at 600 degree Celsius for 8 hours. The measured value of each sintered core shell silica is considered to be different from that of the original core shell silica.

a. Median particle size

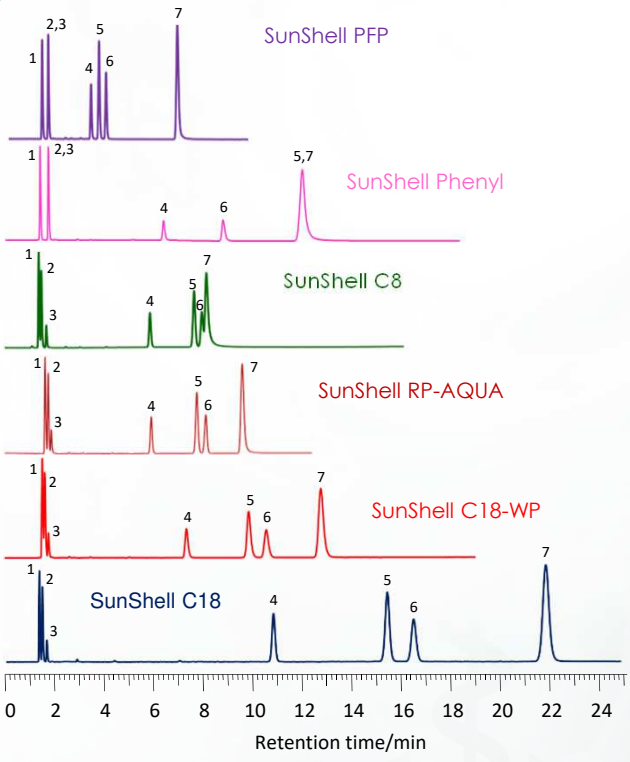


◆ Characteristics of SunShell phases

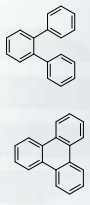
	Core shell silica				Bonding phase					
	Particle size	Pore diameter	Core Size	Specific surface area	Carbon content	Bonded phase	USP L line	End-capping	Maximum operating pressure	Available pH range
SunShell C18	2.0 µm	9 nm	1.2 µm	120 m^2/g	6.5%	C18	L1	Sunniest endcapping	100 MPa	1.5 - 10
SunShell C18	2.6 µm	9 nm	1.6 µm	150 m^2/g	7%	C18	L1	Sunniest endcapping	60 MPa	1.5 - 10
SunShell C18	4.6 µm	9 nm	3.4 µm	90 m^2/g	5.5%	C18	L1	Sunniest endcapping	50 MPa	1.5 - 10
SunShell C18-WP	2.6 µm	16 nm	1.6 µm	90 m^2/g	5%	C18	L1	Sunniest endcapping	60 MPa	1.5 - 10
SunShell RP-AQUA	2.6 µm	16 nm	1.6 µm	90 m^2/g	4%	C28	Equivalent to L62	Sunniest endcapping	60 MPa	2 - 8[a]
SunShell C8	2.6 µm	9 nm	1.6 µm	150 m^2/g	4.5%	C8	L7	Sunniest endcapping	60 MPa	1.5 - 9
SunShell Phenyl	2.6 µm	9 nm	1.6 µm	150 m^2/g	5%	Phenylhexyl	L11	Sunniest endcapping	60 MPa	1.5 - 9
SunShell PFP	2.6 µm	9nm	1.6 µm	150 m^2/g	4.5%	Pentafluorophenyl	L43	TMS endcapping	60 MPa	2 - 8
SunShell C30	2.6 µm	12 nm	1.6 µm	95 m^2/g	7%	C30	L62	TMS endcapping	60 MPa	1.5 - 9
SunShell 2-EP	2.6 µm	9 nm	1.6 µm	150 m^2/g	2.5%	2-Ethylpyridine	For SFC	No	60 MPa	2 – 7.5
SunShell HILIC-Amide	2.6 µm	9 nm	1.6 µm	150 m^2/g	3%	Amide	L68	No	60 MPa	2 - 8
SunShell HILIC-S	2.6 µm	9 nm	1.6 µm	150 m^2/g	0%	Bare silica	L3	No	60 MPa	1 - 5
SunShell C18-WP	2.6 µm	16 nm	1.6 µm	90 m^2/g	5 %	C18	L1	Sunniest endcapping	60 MPa	1.5 - 10
SunShell HFC18-16	2.6 µm	16 nm	1.6 µm	90 m^2/g	2.5%	C18	L1	Sunniest endcapping	60 MPa	1.5 – 9
SunShell HFC18-30	2.6 µm	30 nm	1.6 µm	40 m^2/g	1.3%	C18	L1	Sunniest endcapping	60 MPa[b]	1.5 - 9
SunShell C8-30	2.6 µm	30 nm	1.6 µm	40 m^2/g	1.2%	C8	L7	Sunniest endcapping	60 MPa[b]	1.5 – 9
SunShell C8-30HT	3.4 µm	30 nm	3.0 µm	15 m^2/g	0.5%	C8	L7	Sunniest endcapping	60 MPa	1.5 – 9
SunShell C4-30	2.6 µm	30 nm	1.6 µm	40 m^2/g	0.9%	C4	L26	Sunniest endcapping	60 MPa[b]	1.5 – 9
SunShell C4-100	2.6 µm	100 nm	1.6 µm	22 m^2/g	0.6%	C4	L26	Sunniest endcapping	60 MPa[b]	1.5 – 9

a) Under 100% aqueous condition
b) 50MPa, 7141psi for 4.6 mm i.d. column

◆Separation of standard samples



Column: SunShell C18, C18-WP, RP-AQUA, C8, Phenyl, PFP, 2.6 µm
150 x 4.6 mm
Mobile phase: CH_3OH/H_2O=75/25
Flow rate: 1.0 mL/min
Temperature: 40 °C
Sample: 1 = Uracil
2 = Caffeine
3 = Phenol
4 = Butylbenzene
5 = o-Terphenyl
6 = Amylbenzene
7 = Triphenylene



	Hydrogen bonding (Caffeine/Phenol)	Hydrophobicity (Amylbenzene/Butylbenzene)	Steric selectivity (Triphenylene/o-Terphenyl)
PFP	1.00	1.31	2.38
Phenyl	1.00	1.48	1.01
C8	0.32	1.46	1.08
RP-AQUA	0.52	1.52	1.30
C18-WP	0.40	1.55	1.35
SunShell C18	0.39	1.60	1.46

Ordering information of SunShell

	Inner diameter (mm)	1.0	2.1	3.0	4.6	USP category
	Length (mm)	Catalog number	Catalog number	Catalog number	Catalog number	
SunShell C18, 2 µm	50	------	CB1941	------	------	L1
	100	------	CB1961	------	------	
	150	------	CB1971	------	------	
SunShell C18, 2.6 µm	30	------	CB6931	CB6331	CB6431	
	50	CB6141	CB6941	CB6341	CB6441	
	75	------	CB6951	CB6351	CB6451	
	100	CB6161	CB6961	CB6361	CB6461	
	150	CB6171	CB6971	CB6371	CB6471	
	250	------	------	CB6381	CB6481	
SunShell C18, 5 µm	150	------	------	CB3371	CB3471	
	250	------	------	CB3381	CB3481	
SunShell C8, 2.6 µm	30	------	CC6931	CC6331	CC6431	L7
	50	------	CC6941	CC6341	CC6441	
	75	------	CC6951	CC6351	CC6451	
	100	------	CC6961	CC6361	CC6461	
	150	------	CC6971	CC6371	CC6471	
SunShell PFP, 2.6 µm	30	------	CF6931	CF6331	CF6431	L43
	50	------	CF6941	CF6341	CF6441	
	75	------	CF6951	CF6351	CF6451	
	100	------	CF6961	CF6361	CF6461	
	150	------	CF6971	CF6371	CF6471	
SunShell C18-WP, 2.6 µm	30	------	CW6931	CW6331	CW6431	L1
	50	------	CW6941	CW6341	CW6441	
	75	------	CW6951	CW6351	CW6451	
	100	------	CW6961	CW6361	CW6461	
	150	------	CW6971	CW6371	CW6471	
SunShell RP-AQUA, 2.6 µm	30	------	CR6931	CR6331	CR6431	Equivalent to L62
	50	CR6141	CR6941	CR6341	CR6441	
	75	------	CR6951	CR6351	CR6451	
	100	CR6161	CR6961	CR6361	CR6461	
	150	CR6171	CR6971	CR6371	CR6471	
SunShell Phenyl, 2.6 µm	30	------	CP6931	CP6331	CP6431	L11
	50	------	CP6941	CP6341	CP6441	
	75	------	CP6951	CP6351	CP6451	
	100	------	CP6961	CP6361	CP6461	
	150	------	CP6971	CP6371	CP6471	
SunShell C30, 2.6 µm	30	------	CT6931	CT6331	------	L62
	50	------	CT6941	CT6341	------	
	75	------	CT6951	CT6351	------	
	100	------	CT6961	CT6361	------	
	150	------	CT6971	CT6371	------	
SunShell 2-EP, 2.6 µm	30	------	CE6931	CE6331	CE6431	
	50	------	CE6941	CE6341	CE6441	
	75	------	CE6951	CE6351	CE6451	
	100	------	CE6961	CE6361	CE6461	
	150	------	CE6971	CE6371	CE6471	
SunShell HILIC-Amide, 2.6 µm	30	------	CH6931	CH6331	CH6431	L68
	50	------	CH6941	CH6341	CH6441	
	75	------	CH6951	CH6351	CH6451	
	100	------	CH6961	CH6361	CH6461	
	150	------	CH6971	CH6371	CH6471	
SunShell HILIC-S, 2.6 µm	50	------	CU6941	------	------	L3
	100	------	CU6961	------	------	
	150	------	CU6971	------	------	
SunShell HFC18-16, 2.6 µm	50	------	CG6941	CG6341	CG6441	L1
	100	------	CG6961	CG6361	CG6461	
	150	------	CG6971	CG6371	CG6471	
SunShell HFC18-30, 2.6 µm	50	------	C46941	C46341	C46441	L1
	100	------	C46961	C46361	C46461	
	150	------	C46971	C46371	C46471	
SunShell C8-30, 2.6 µm	50	------	C36941	C36341	C36441	L7
	100	------	C36961	C36361	C36461	
	150	------	C36971	C36371	C36471	
SunShell C8-30HT, 3.4 µm	50	------	C56941	------	------	L7
	100	------	C56961	------	------	
	150	------	C56971	------	------	
SunShell C4-30, 2.6 µm	50	------	C26941	C26341	C26441	L26
	100	------	C26961	C26361	C26461	
	150	------	C26971	C26371	C26471	
SunShell C4-100, 2.6 µm	50	------	C66941	------	------	L26
	100	------	C66961	------	------	
	150	------	C66971	------	------	

Sunniest C18, C18-HT, RP-AQUA, C8, PhE, PFP

A Novel Bonding Technique

The “State of Art” trifunctional silyl-reagent was developed as shown in Fig.1. This Unique silyl-bonded reagent (HMODTS)can bond with any silanol groups on Silica Sorbent surface as shown in Fig.2.It can expand and contract by itself in Caterpillar manner. This technique can substantially minimize the contribution of residual silanol groups on Reverses phase stationary phase.

Finally an end-capping was done with trimethylsilyl-reagent (TMS).

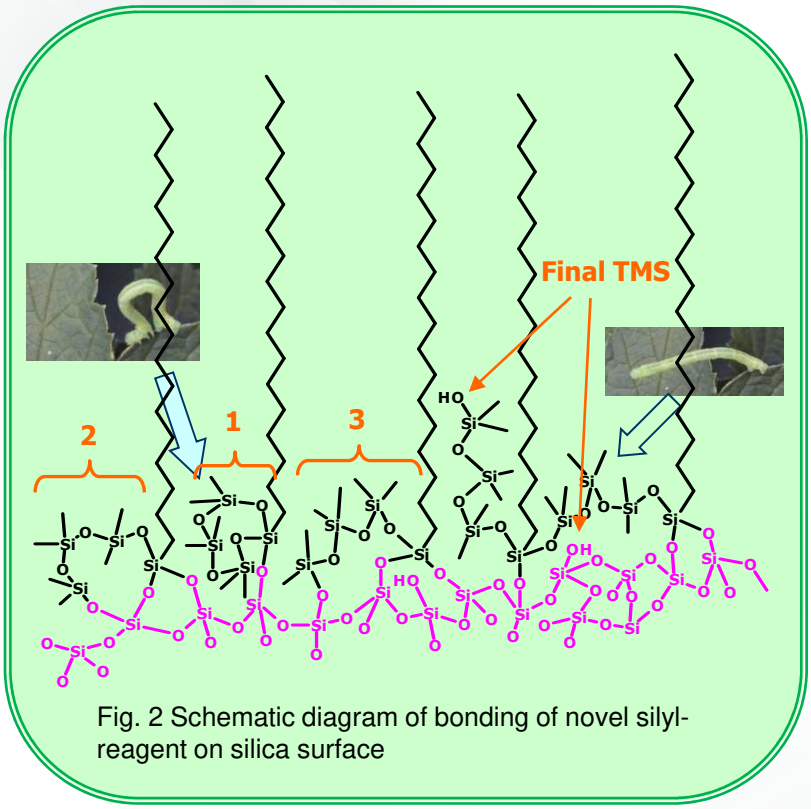
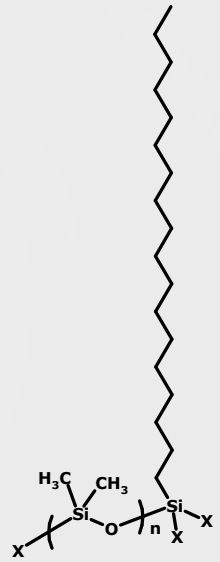


Fig. 2 Schematic diagram of bonding of novel silyl-reagent on silica surface



n: 1, 2 , 3 or 4

X: Cl, OCH_3, OCH_2CH_3 etc.

Fig. 1 Novel C18 reagent

Features

★ Little residual silanol groups by an unique bonding technique

★Excellent stability, especially under acidic pH conditions

★ Sharp peak shape for acidic, basic and chelating compounds

★RP-AQUA with C28 bonding offers Performance in 100% aqueous conditions, and shows enhanced retention of polar compounds.

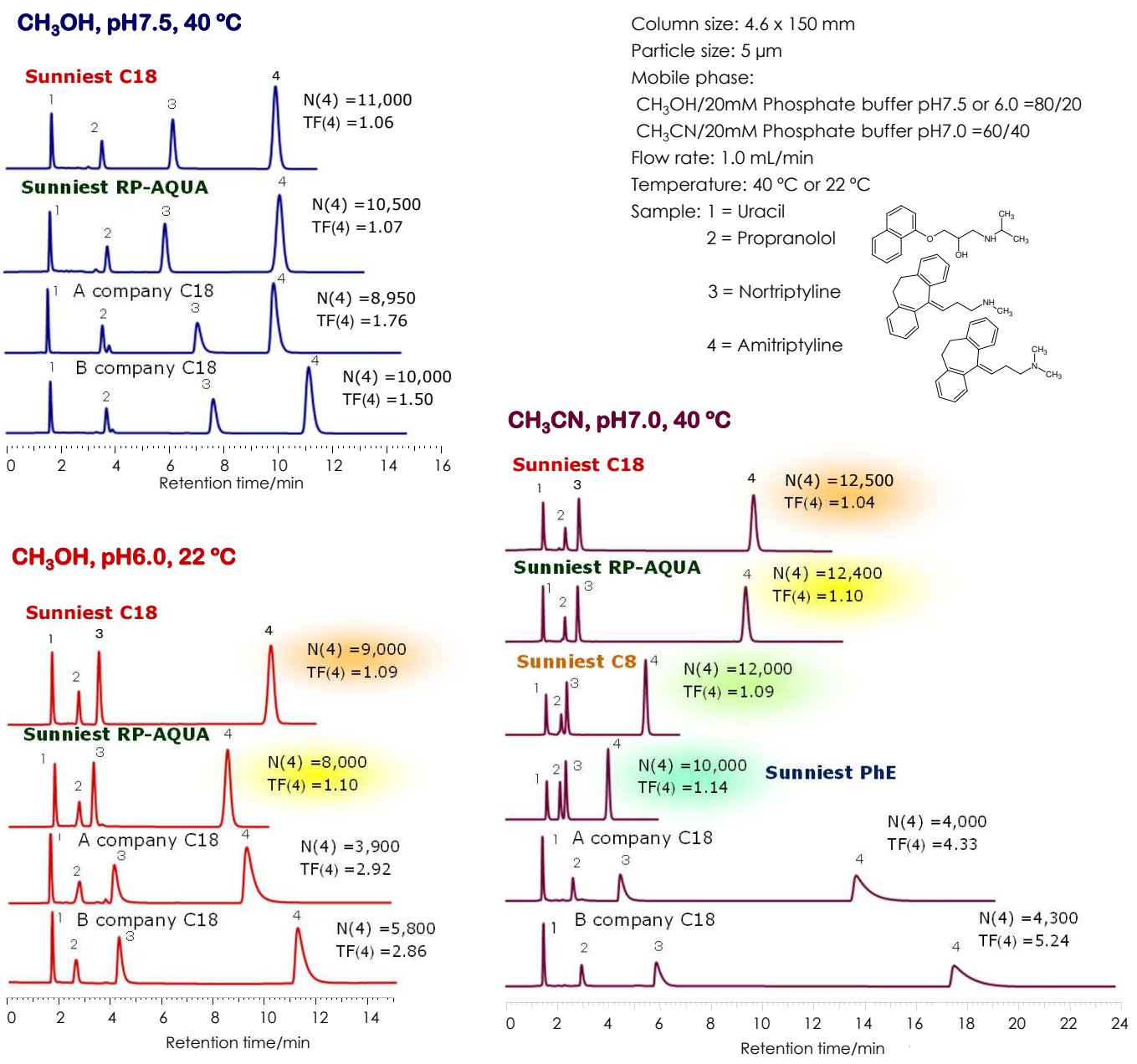
Characteristics of Sunniest

	Particle size (μm)	Pore diameter (nm)	Specific surface area (m^2/g)	Carbon content (%)	Bonded point	USP L line	pH range
Sunniest C18	3 and 5	12	340	16	C18	L1	1.5 - 10
Sunniest C18-HT	2	10	340	16	C18	L1	1.5 - 10
Sunniest RP-AQUA	3 and 5	12	340	16	C28	Equivalent to L62	2 - 8
Sunniest C8	3 and 5	12	340	10	C8	L7	1.5 - 9
Sunniest PhE	3 and 5	12	340	10	Phenylethyl	L11	1.5 - 8
Sunniest PFP	5	12	340	10	Pentafluorophenyl	L43	2 - 8

Sunniest C18,C18-HT, Sunniest RP-AQUA SunniestC8,PhE,PFP

◆Evaluation of End-capping

Comparison of plates number (N) and USP tailing factor (TF) of amitriptyline

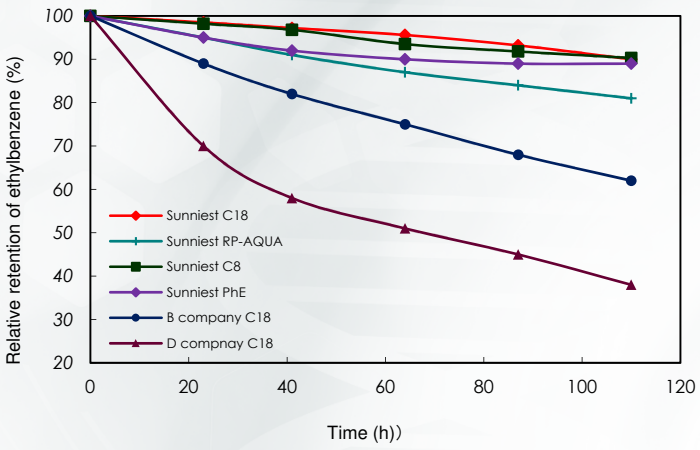


Amitriptyline is widely used to evaluate residual silanol groups on the C18 stationary phase. Peak shape of Amitriptyline was compared under 3 kinds of conditions such as methanol/phosphate buffer/40 °C, methanol/phosphate buffer/22 °C and acetonitrile/phosphate buffer/40 °C. Majority of the HPLC columns offered good peak shapes under methanol/phosphate buffer/40 °C conditions. However using Mobile phase of acetonitrile/phosphate buffer/40 °C, most of the columns(Refer column A and B) offered high extent of Tailing unlike Sunniest columns offering a symmetrical peak.

Sunniest C18, RP-AQUA and C8 columns allow to use a wide range of mobile phase without peak tailing because of extremely low content of residual silanol groups on the stationary phase.

Sunniest C18,C18-HT, Sunniest RP-AQUA SunniestC8,PhE,PFP

◆Stability under acidic and basic pH conditions

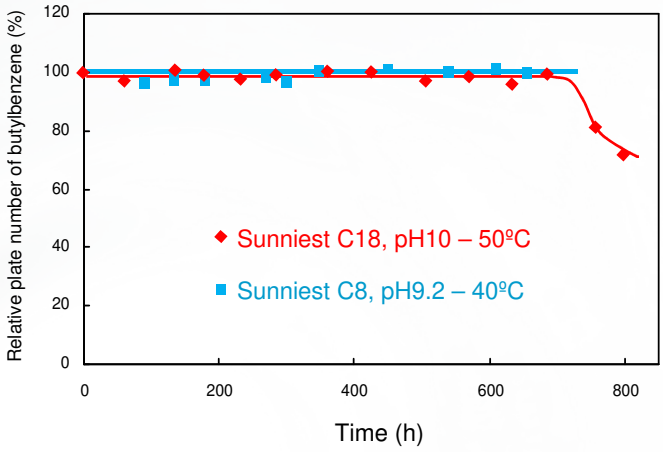


Durable test condition

Column size: 150 x 4.6 mm
Mobile phase: CH_3CN/1.0% TFA (pH1) = 10/90
Flow rate: 1.0 mL/min
Temperature: 80 °C

Measurement condition

Column size: 150 x 4.6 mm
Mobile phase: CH_3CN/H_2O=60/40
Flow rate: 1.0 mL/min
Temperature: 40 °C
Sample: 1 = Uracil
2 = Ethylbenzene



Durable test condition

Column: Sunniest C18, C8, 5 µm 150 x 4.6 mm
Mobile phase:
C18: CH_3OH/20mM Sodium borate/10mM NaOH=30/21/49 (pH10)
C8: CH_3OH/20mM Sodium borate (pH9.2) =30/70
Flow rate: 1.0 mL/min
Temperature: C18 - 50 °C, C8 - 40 °C

Measurement condition

Column: Sunniest C18, C8, 5µm 150 x 4.6 mm
Mobile phase: CH_3OH/H_2O=75/25
Flow rate: 1.0 mL/min
Temperature: 40 °C
Sample: 1 = Butylbenzene

Stability under acidic pH conditions was evaluated at 80 °C using acetonitrile/1% trifluoroacetic acid solution (10:90) as mobile phase. 100% aqueous mobile phase expels from the pore of packing materials by capillarity and packing materials doesn't deteriorate. 10% acetonitrile in a mobile phase allows an accurate evaluation.[1-3)]

★Sunniest C18 has kept 90% retention for 100 hours under severe conditions of acetonitrile /1% trifluoroacetic acid solution (pH 1)at 80 deg C.

Our Unique HMODTS bonding technique offers significant enhancement of column life,

Considering the Sunniest RP-AQUA C28 ligand length the Sunniest RP-AQUA is less stable than Sunniest C18. However, Sunniest RP-AQUA C28 column with HMODTS bonding along with end capping offers longer column life in comparison to other RP Aqua columns.

Stability under basic pH conditions was evaluated at 50 °C using methanol/Sodium borate buffer pH 10 (30:70) as mobile phase. Sodium borate is used as a alkaline standard solution for pH meter, so that its buffer capacity is high.

Elevated temperature of 10 °C makes column life be one third. When Sunniest C18 column is used at 40 °C, column life becomes 2,000 hours. Most of the HPLC columns stability data is offered at ambient room temperature alternate 25 °C at pH 1-10 units..At temperature of 25°C,the column life is sixteen times longer than that at 50 °C.

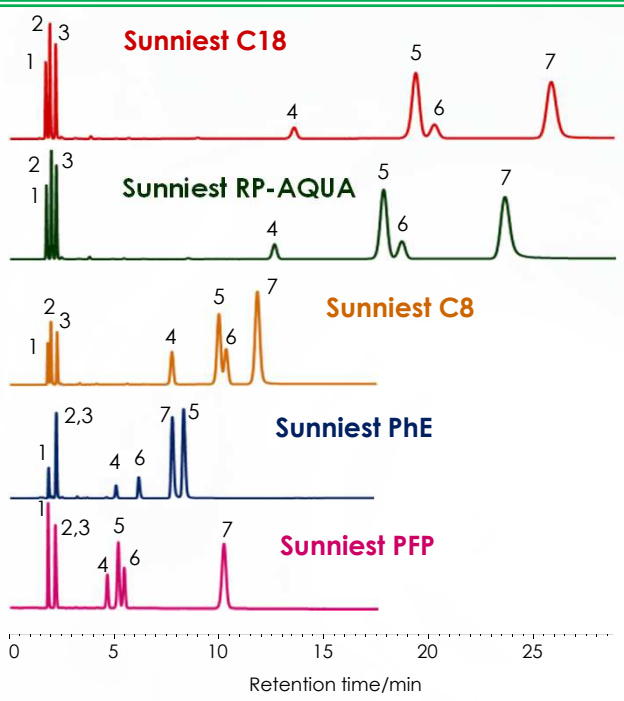
★ Sunniest C18 offers performance at elevated pH and temperature. Regarding stability under basic pH condition, there are very few C18 column like Sunniest C18 & Hybrid type C18 which can sustain and offer performance under such challenging conditions of high temperature and pH. It is considered that our double end-capping & base deactivation technique leads higher stability.

★ Sunniest C18 has operational pH Range from 1.5 to 10. Sunniest C8,Phenyl has operational pH Range 1.5 to 9 and Sunniest RP-Aqua and Pentafluorophenyl (PFP) at pH 2-8..

1) N. Nagae, T. Enami and S. Doshi, LC/GC North America October 2002.
2) T. Enami and N. Nagae, American Laboratory October 2004.
3) T. Enami and N. Nagae, BUNSEKI KAGAKU, 53 (2004) 1309.

Sunniest C18,C18-HT,
Sunniest RP-AQUA
SunniestC8,PhE,PFP

◆Separation of standard samples



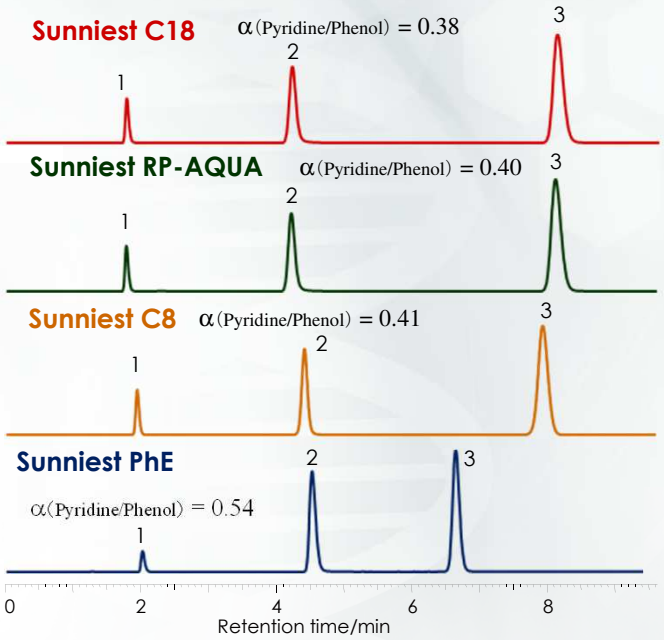
Column: Sunniest C18, 5 µm 4.6x150 mm
Sunniest RP-AQUA, 5 µm 4.6x150mm
Sunniest C8, 5 µm 4.6x150 mm
Sunniest PhE, 3 µm 4.6x150 mm
Sunniest PFP, 5 µm 4.6x150 mm
Mobile phase: CH_3OH/H_2O=75/25
Flow rate: 1.0 mL/min
Temperature: 40 °C
Pressure: 5.4 MPa
Sample: 1 = Uracil,
2 = Caffeine,
3 = Phenol,
4 = Butylbenzene, (N=15,700)
5 = o-Terphenyl, (N=15,000)
6 = Amylbenzene, (N=15,300)
7 = Triphenylene, (N=14,500)

N is plate number of the above Sunniest C18.

	C18	RP-AQUA	C8	PhE	PFP
Hydrophobicity					
α(Amylbenzene/Butylbenzene)	1.56	1.56	1.43	1.34	1.29
Hydrogen bonding capacity					
α(Caffeine/Phenol)	0.43	0.49	0.33	1.00	1.00
Steric selectivity					
α(Triphenylene/o-Terphenyl)	1.37	1.36	1.23	0.92	2.51
Residual silanol activity					
α(Pyridine/Phenol)	0.38	0.40	0.41	0.54	-----

Sunniest C18 shows not only high efficiency but also low column pressure.

◆Separation of pyridine and phenol



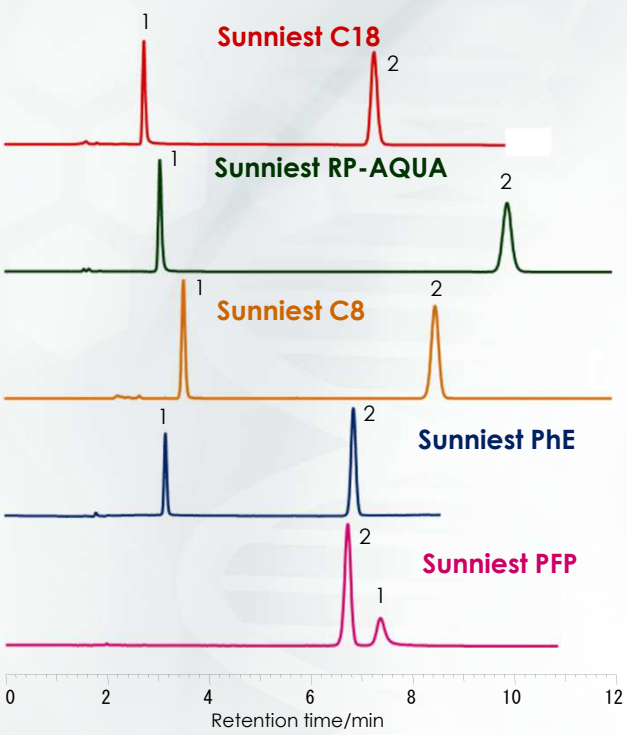
Column: Sunniest C18, 5 µm 4.6x150 mm
Sunniest RP-AQUA, 5 µm 4.6x150mm
Sunniest C8, 5 µm 4.6x150 mm
Sunniest PhE, 3 µm 4.6x150 mm
Mobile phase: CH_3OH/H_2O=30/70
Flow rate: 1.0 mL/min
Temperature: 40 °C
Detection: UV@250nm
Sample: 1 = Uracil
2 = Pyridine
3 = Phenol

Separation factor of pyridine and phenol is said to show the amount of residual silanol groups. The lower a value of separation factor, the less an effect of residual silanol groups.

All Sunniest columns show one of the lowest value.

Sunniest C18,C18-HT, Sunniest RP-AQUA SunniestC8,PhE,PFP

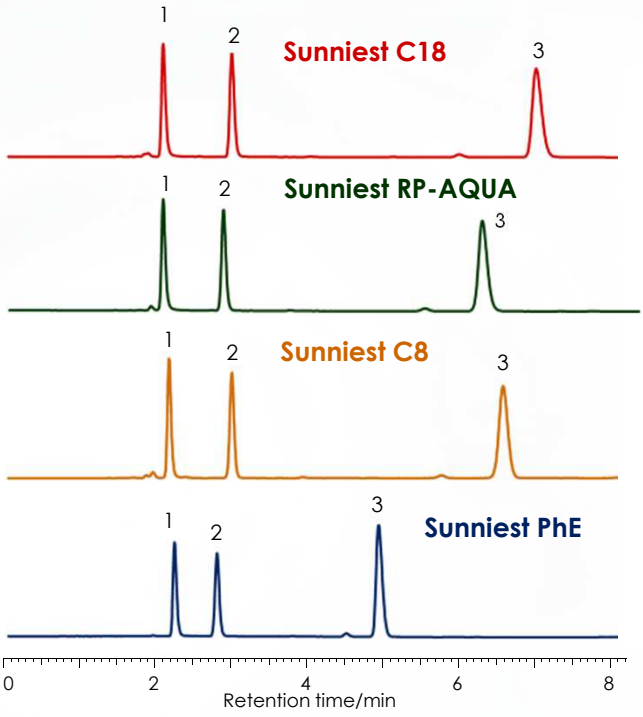
◆Separation of a chelating compound



Column: Sunniest C18, 5 µm 4.6x150 mm
Sunniest RP-AQUA, 5 µm 4.6x150mm
Sunniest C8, 5 µm 4.6x150 mm
Sunniest PhE, 3 µm 4.6x150 mm
Sunniest PFP, 5 µm 4.6x150 mm
Mobile phase: CH_3CN/20mM H_3PO_4=10/90
Flow rate: 1.0 mL/min
Temperature: 40 °C
Detection: UV@250nm
Sample: 1 = 8-Quinolinol
2 = Caffeine

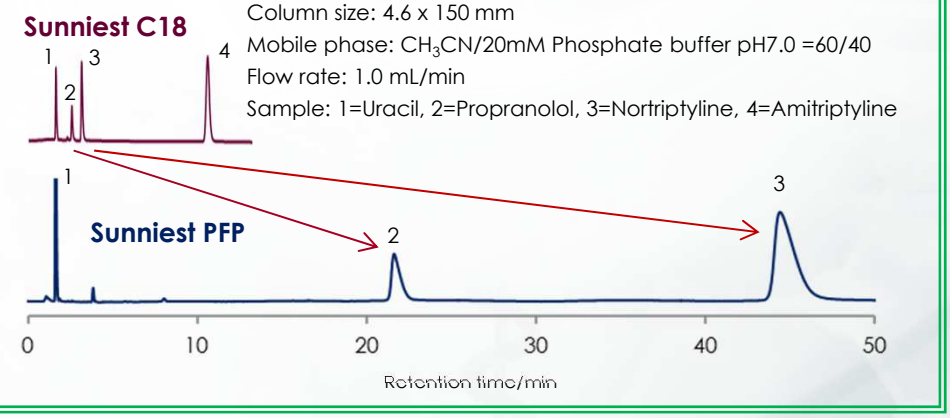
★Sunniest C18, RP-AQUA, C8 ,PhE and PFP are inert for a metal chelating compound and acidic and basic compounds, so that they show symmetrical peaks of each compound.

◆Separation of acidic compounds



Column: Sunniest C18, 5 µm 4.6x150 mm
Sunniest RP-AQUA, 5 µm 4.6x150mm
Sunniest C8, 5 µm 4.6x150 mm
Sunniest PhE, 3 µm 4.6x150 mm
Mobile phase: CH_3CN/0.1% H_3PO_4=2/98
Flow rate: 1.0 mL/min
Temperature: 40 °C
Detection: UV@210nm
Sample: 1 = Formic acid
2 = Acetic acid
3 = Propionic Acid

◆Retention comparison between C18 and PFP



Column size: 4.6 x 150 mm
Mobile phase: CH_3CN/20mM Phosphate buffer pH7.0 =60/40
Flow rate: 1.0 mL/min
Sample: 1=Uracil, 2=Propranolol, 3=Nortriptyline, 4=Amitriptyline

★PFP retains a cation such a nortriptyline much longer than a C18.

Sunniest C18, C18-HT
Sunniest RP-AQUA Sunniest C8
Sunniest PhE Sunniest PFP

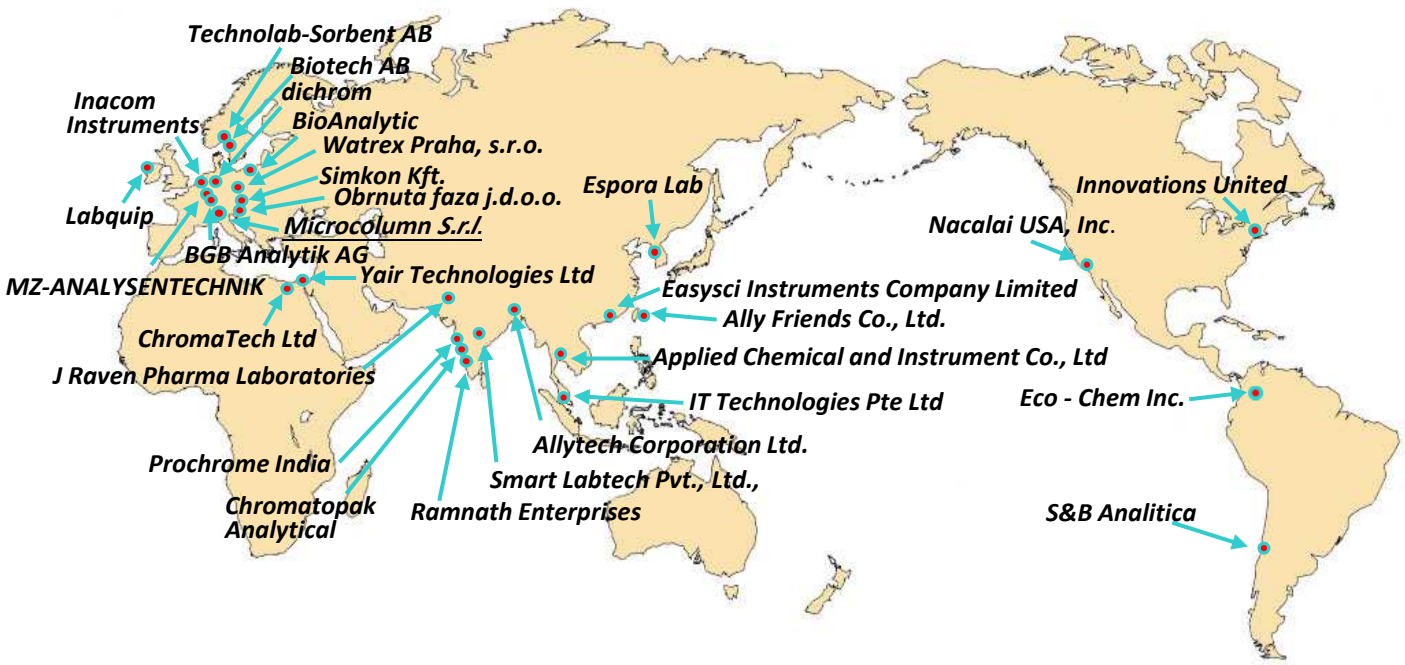
✻ Sunniest Ordering information

Inner diameter [mm]	Length [mm]	Sunniest C18, 3µm Catalog No. USP L1	Sunniest C18, 5µm Catalog No. USP L1	Sunniest RP-AQUA, 3µm Catalog No. USP Equivalent to L62	Sunniest RP-AQUA, 5µm Catalog No. USP Equivalent to L62	Sunniest C8, 3µm Catalog No. USP L7	Sunniest C8, 5µm Catalog No. USP L7
2.0	50	EB2241	EB3241	ER2241	ER3241	EC2241	EC3241
	75	EB2251	—	ER2251	—	EC2251	—
	100	EB2261	EB3261	ER2261	ER3261	EC2261	EC3261
	150	EB2271	EB3271	ER2271	ER3271	EC2271	EC3271
	250	EB2281	EB3281	ER2281	ER3281	EC2281	EC3281
3.0	50	EB2341	EB3341	ER2341	ER3341	EC2341	EC3341
	100	EB2361	EB3361	ER2361	ER3361	EC2361	EC3361
	150	EB2371	EB3371	ER2371	ER3371	EC2371	EC3371
	250	EB2381	EB3381	ER2381	ER3381	EC2381	EC3381
4.6	10	EB2411	EB3411	ER2411	ER3411	EC2411	EC3411
	50	EB2441	EB3441	ER2441	ER3441	EC2441	EC3441
	75	EB2451	—	ER2451	—	EC2451	—
	100	EB2461	EB3461	ER2461	ER3461	EC2461	EC3461
	150	EB2471	EB3471	ER2471	ER3471	EC2471	EC3471
	250	EB2481	EB3481	ER2481	ER3481	EC2481	EC3481
10	250	—	EB3781	—	ER3781	—	EC3781
20	50	—	EB3841	—	ER3841	—	EC3841
	150	—	EB3871	—	ER3871	—	EC3871
	250	—	EB3881	—	ER3881	—	EC3881

Inner diameter [mm]	Length [mm]	Sunniest PhE, 3 µm Catalog No. USP L11	Sunniest PhE, 5 µm Catalog No. USP L11	Sunniest PFP, 5 µm Catalog No. USP L43
2.0	50	EP2241	EP3241	—
	75	EP2251	—	—
	100	EP2261	EP3261	—
	150	EP2271	EP3271	—
	250	EP2281	EP3281	—
3.0	50	EP2341	EP3341	—
	100	EP2361	EP3361	—
	150	EP2371	EP3371	—
	250	EP2381	EP3381	—
4.6	10	—	EP3411	—
	50	EP2441	EP3441	EF3441
	75	EP2451	—	—
	100	EP2461	EP3461	EF3461
	150	EP2471	EP3471	EF3471
	250	EP2481	EP3481	EF3481
10.0	250	—	EP3781	—
20.0	50	—	EP3841	—
	150	—	EP3871	—
	250	—	EP3881	—

Inner diameter [mm]	Length [mm]	Sunniest C18-HT, 2 µm Catalog No. USP L1
2.1	30	EB1931
	50	EB1941
	75	EB1951
	100	EB1961
3.0	30	EB1331
	50	EB1341
	75	EB1351
	100	EB1361

✻ Distributor



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