ChromaNik Technologies Inc.

HPLC & UHPLC Column Manufacturer

HPLC: High Performance Liquid Chromatography

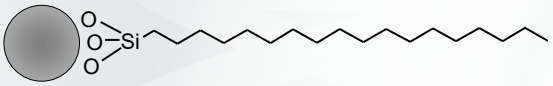
SunShell, Sunniest, SunArmor & Sunrise

SUNSHELL, SUNNIEST, SUNARMOR & SUNRISE

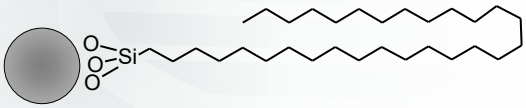
STATIONARY PHASE

Reversed phase

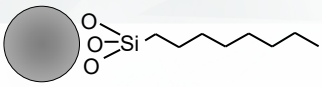
C18, C18-WP, C18-HT, C18-SAC



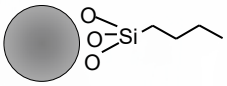
RP-AQUA, C30



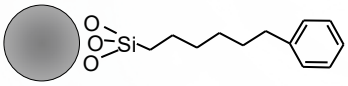
C8, C8-30, C8-30HT



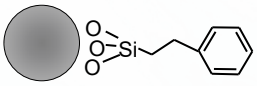
C4-30, C4-100



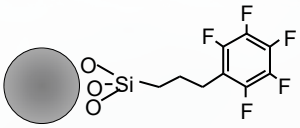
Phenyl



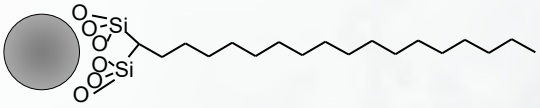
PhE



PFP

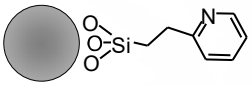


HFC18-16, HFC18-30



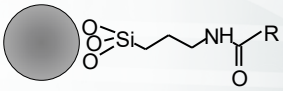
SFC

2EP

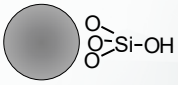


HILIC

HILIC-Amide



HILIC-S



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

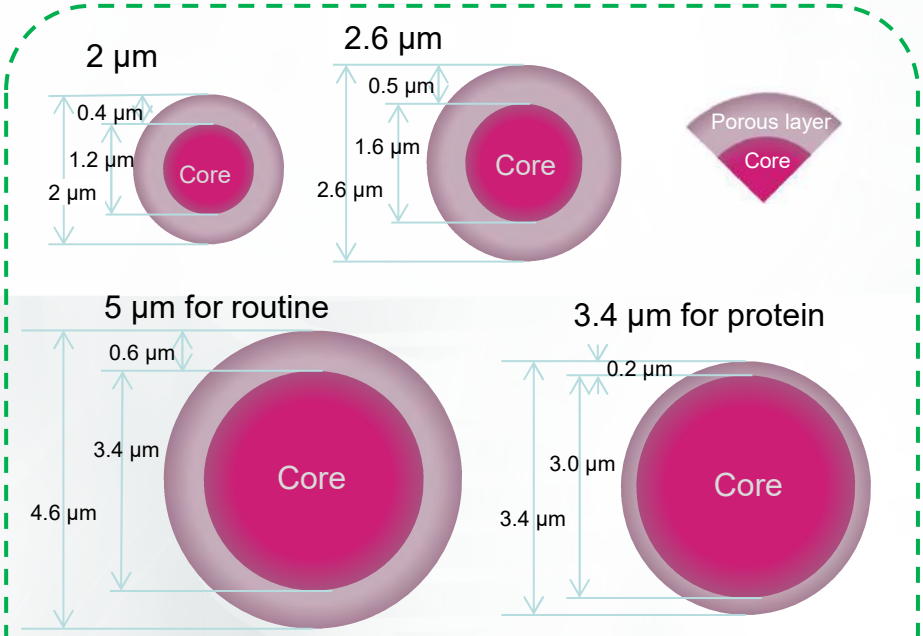
The next generation to Core Shell particle

SUNSHELL

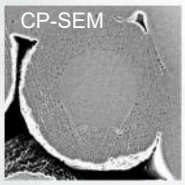
Superficially porous silica

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

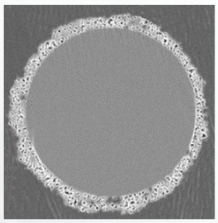
* 1.2 µm, 1.6 µm, 3.0 µm and 3.4 µm of core diameter and 0.4 µm, 0.5 µm, 0.2 µm and 0.6 µm of superficially porous silica layer thickness
*Higher efficiency and higher throughput to compare with totally porous silica with same size
*Same chemistry as Sunniest technology (reference page 6)
*Good peak shape for all compounds such as basic, acidic and chelating compounds
*High stability (pH range for SunShell C18, 1.5 to 10) * Low breeding



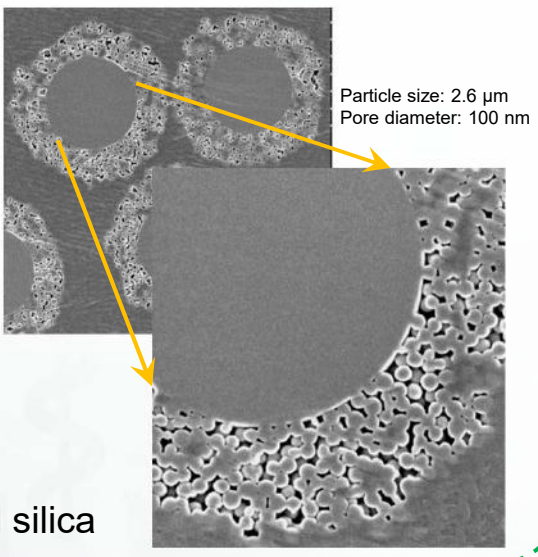
Schematic diagram of a core shell silica particle, 2.0, 2.6, 3.4 and 4.6 µm



Particle size: 2.6 µm
Pore diameter: 16 nm



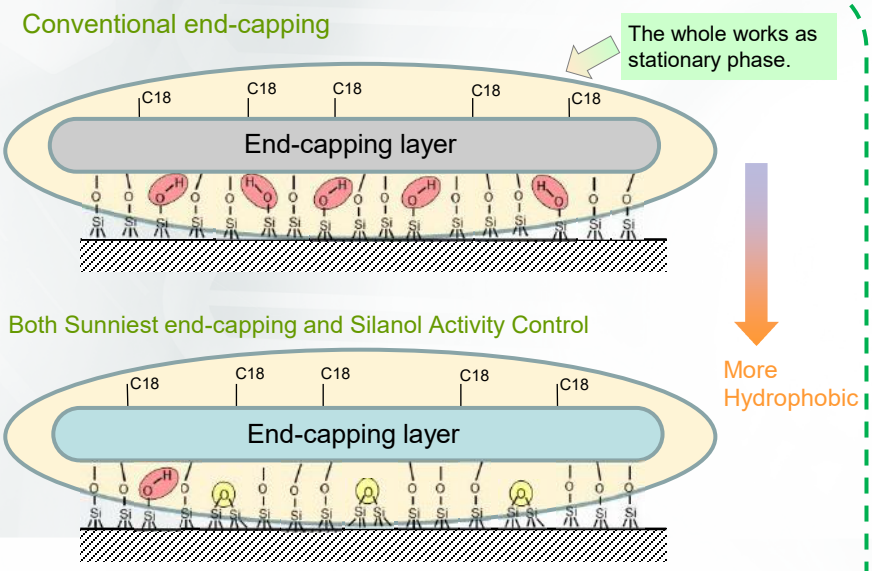
Particle size: 3.4 µm
Pore diameter: 30 nm



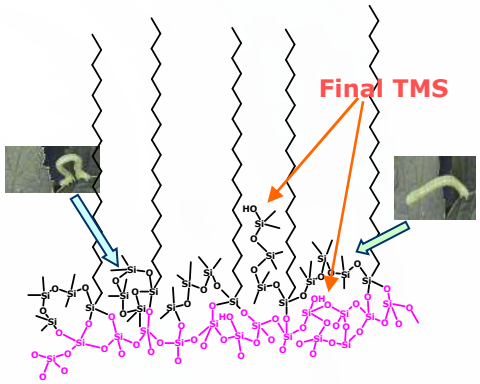
Electron micrograph of core shell silica

Unique end-capping by new concept

This figure 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. A residual silanol group 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.

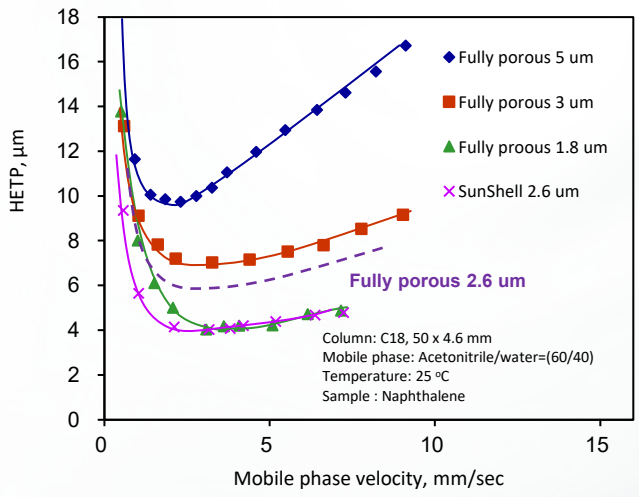


State of stationary phase with unique end-capping and comparison of hydrophobicity



Schematic diagram of bonding of SunShell C18

An end-capping of hexamethyltrisiloxane works as an arm. This arm moves like a Geometrid caterpillar, so that a functional group on the tip of the arm can bond with a silanol group which is located anywhere.
Finally TMS reagent is bonded to a remaining silanol group.

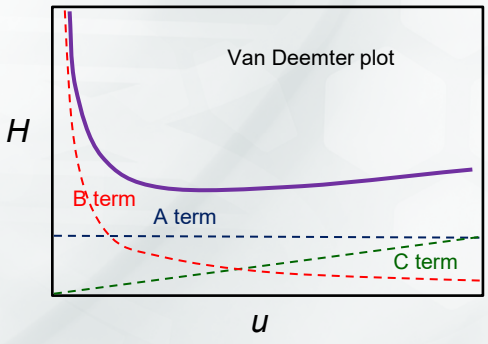


Comparison of plate height plots

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



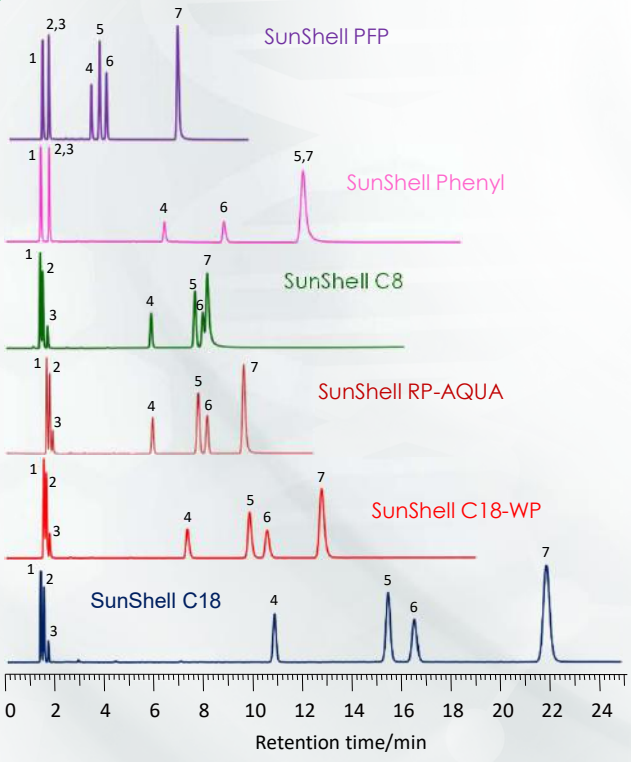
SunShell C18 shows same efficiency as a sub 2 µm C18. In comparison between fully porous 2.6 µm and core shell 2.6 µm (SunShell), SunShell shows lower values for A term, B term and C term of Van Deemter equation. The core shell structure leads higher performance to compare with the fully porous structure.

Specification of SunShell

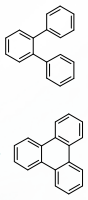
	Core shell silica				Bonding phase					
	Particle size (µm)	Core size (µm)	Pore size (nm)	Specific surface area (m^2/g)	Carbon loading (%)	Stationary phase	USP L line	End-capping	Maximum pressure	pH range
SunShell C18	2.0 µm	1.2 µm	9 nm	120 m^2/g	6.5%	C18	L1	Sunniest endcapping	100 MPa	1.5 - 10
SunShell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

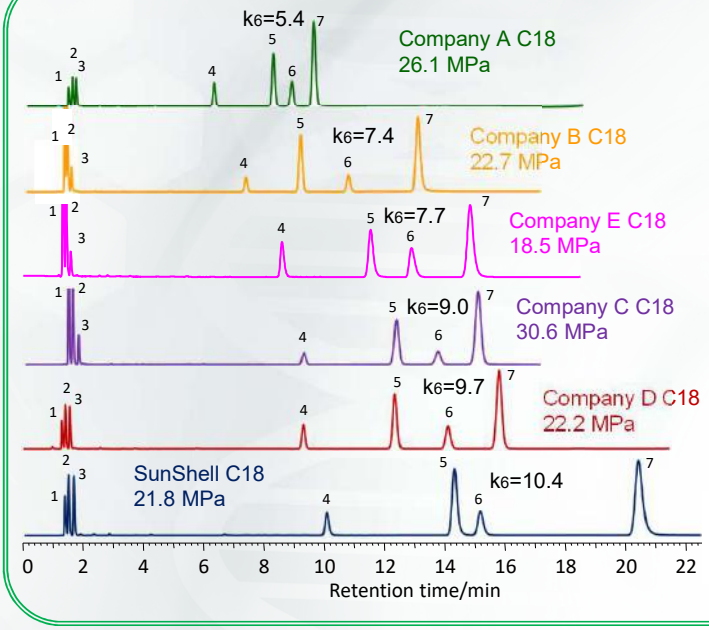


	Hydrogen bonding (Caffeine/Phenol)	Hydrophobicity (Amylbenzene/Butylbenzene)	Steric selectivity (Triphenylene/o-Terphenyl)
PFP	1.00	1.31	2.38
Phenyl	1.00	1.48	1.01
C8	0.32	1.46	1.08
RP-AQUA	0.52	1.52	1.30
C18-WP	0.40	1.55	1.35
SunShell C18	0.39	1.60	1.46

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

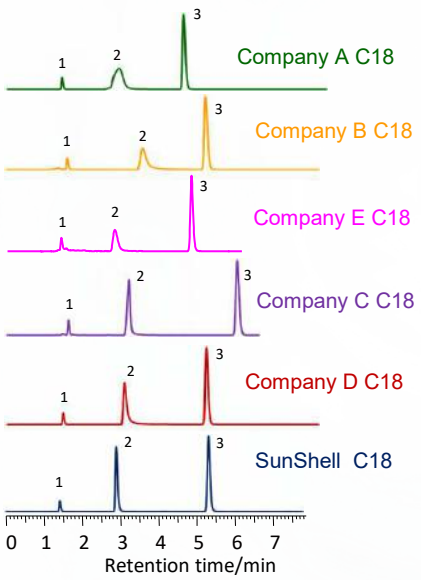


Column: Company A C18, 2.6 µm 150 x 4.6 mm (26.1 MPa, 30,800 plate)
Company B C18, 2.6 µm 150 x 4.6 mm (22.7 MPa , 31,600 plate)
Company E C18, 2.7 µm 150 x 4.6 mm (18.5 MPa , 23,300 plate)
Company C C18, 2.7 µm 150 x 4.6 mm (30.6 MPa , 30,200 plate)
Company D C18, 2.7 µm 150 x 4.6 mm (22.2 MPa , 31,800 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 °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)
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 six 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.

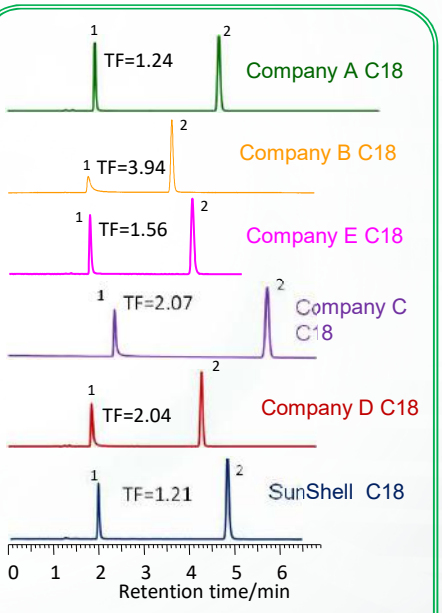
Comparison of pyridine



Column dimension: 150 x 4.6 mm
Mobile phase: CH_3OH/H_2O=30/70
Flow rate: 1.0 mL/min
Temperature: 40 °C
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.

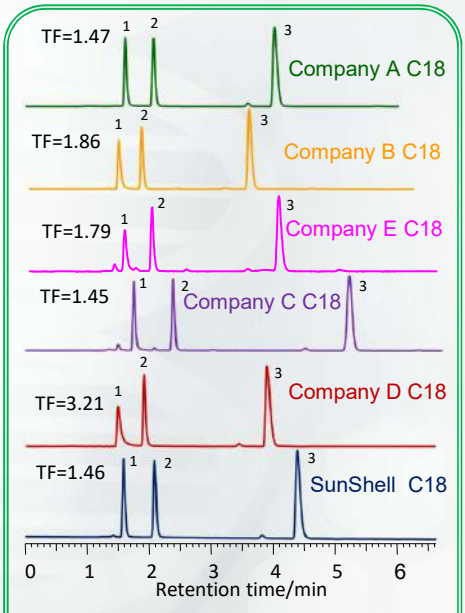
Comparison of Oxine



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 °C
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 °C
Detection: UV@210nm
Sample: 1 = Formic acid
2 = Acetic acid
3 = Propionic Acid

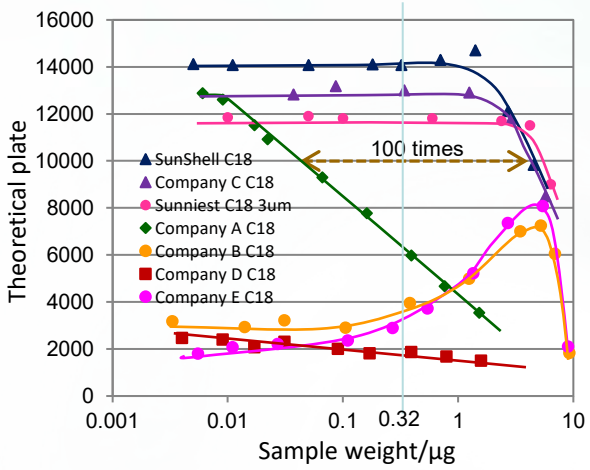
Formic acid is used as an indicator for a acidic inertness. SunShell and Company A and C C18 show a sharp peak.

Loading capacity of amitriptyline as a basic compound

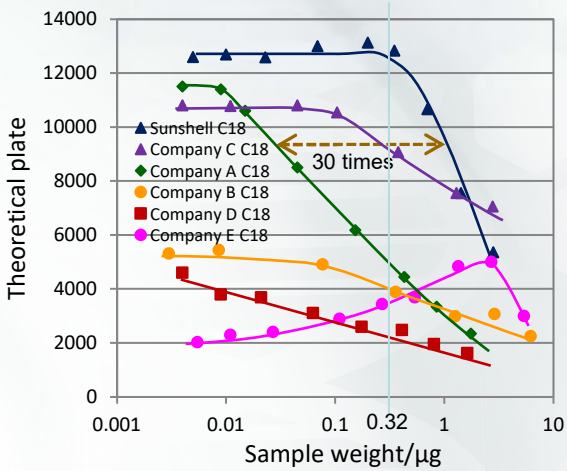
Amitriptyline overlords much more at acetonitrile/buffer mobile phase than methanol/buffer. Three kinds of core shell C18s were compared loading capacity of amitriptyline at three different mobile phases.

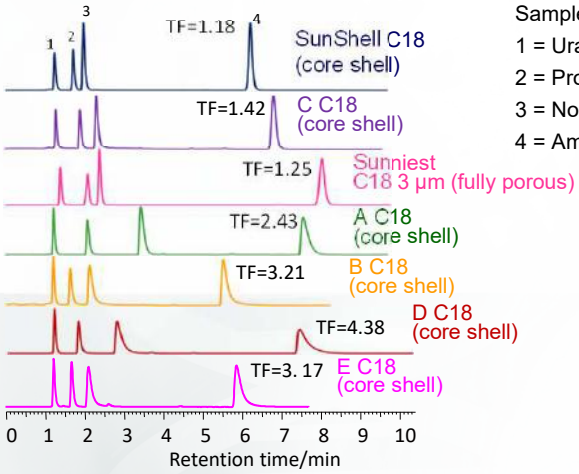
Common condition: Column dimension,150 x 4.6 mm, flow rate; 1.0 mL/min, temperature; 40 °C

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

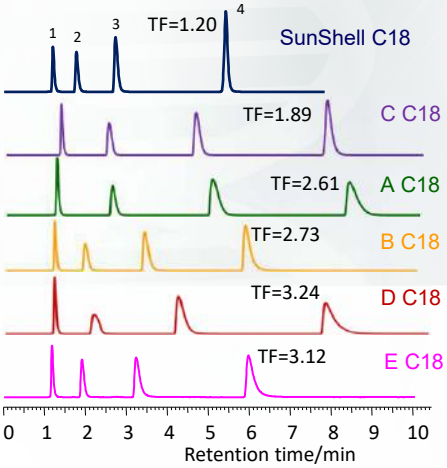


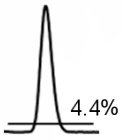
Mobile phase: Acetonitrile/**10mM acetate ammonium pH6.8**=(40:60)





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

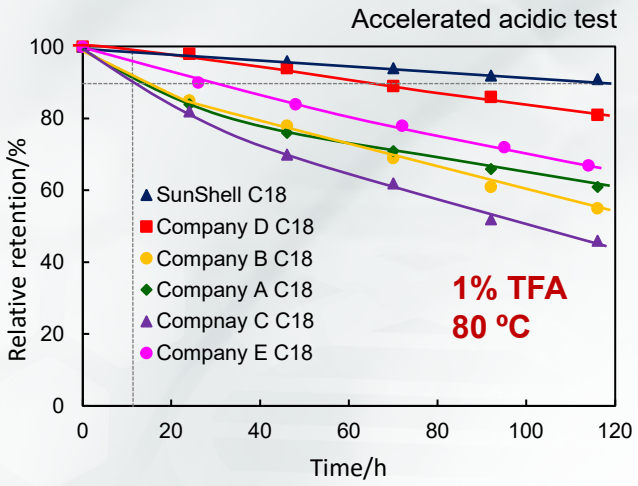
	Carbon loading (%)	Specific surface area [a] (m^2/g)	Pore volume [a] (mL)	Pore diameter [a] (nm)
SunShell C18	7.3 (7)[b]	125 (150)[b]	0.261	8.34 (9)[b]
Ascentis Express C18	8.0	133 (150)[b]	0.278	8.20 (9)[b]
PoroShell C18 EC	8.5 (8)[b]	135 (130)[b]	0.414	12.3 (12)[b]
Accucore C18	8.8 (9)[b]	130 (130)[b]	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]

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

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

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 μg of amitriptyline while SunShell C18 overloaded at more than from 0.3 to 1 μg 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

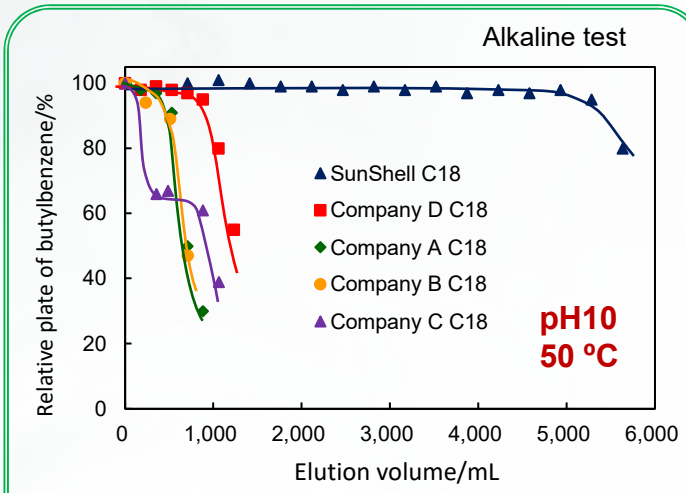
Column size: 50 x 2.1 mm
Mobile phase: CH_3CN/1.0% TFA, pH1=10/90
Flow rate: 0.4 mL/min
Temperature: 80 ºC

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 ºC
Sample: 1 = Uracil (t_0)
2 = Butylbenzene

Stability under acidic pH condition was evaluated at 80 ºC 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 ºC

Measurement condition

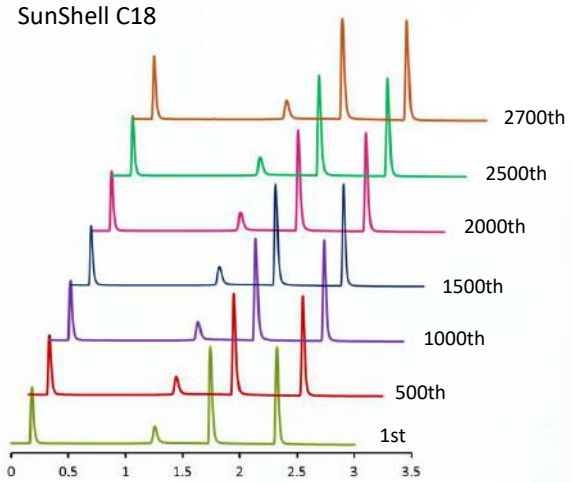
Column Size: 50 x 2.1 mm
Mobile phase: CH_3CN/H_2O=60/40
Flow rate: 0.4 mL/min
Temperature: 40 ºC
Sample: 1 = Butylbenzene

Stability under basic pH condition was evaluated at 50 ºC using methanol/Sodium borate buffer pH 10 (30:70) as a 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 ºC makes column life be one third. The other company shows stability test at ambient (room temperature). If room temperature is 25 ºC, column life at room temperature (25 ºC) is sixteen times longer than that at 50 ºC.

★ 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

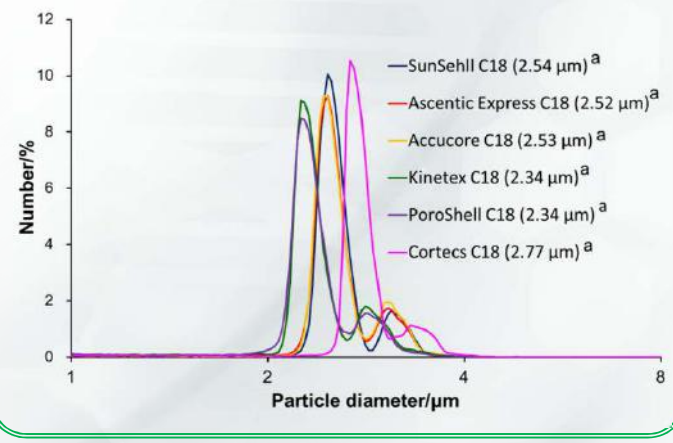


Column: SunShell C18, 2.6 µm 50 x 2.1 mm
Mobile phase: A) 10 mM Ammonium bicarbonate pH 9.5
B) Acetonitrile
Gradient program:

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

Flow rate: 0.5 mL/min
Temperature: 40 ºC
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

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	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	------	------	

Totally porous silica

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).

n: 1, 2 , 3 or 4

X: Cl, OCH_3, OCH_2CH_3 etc.

Fig. 1 Novel C18 reagent

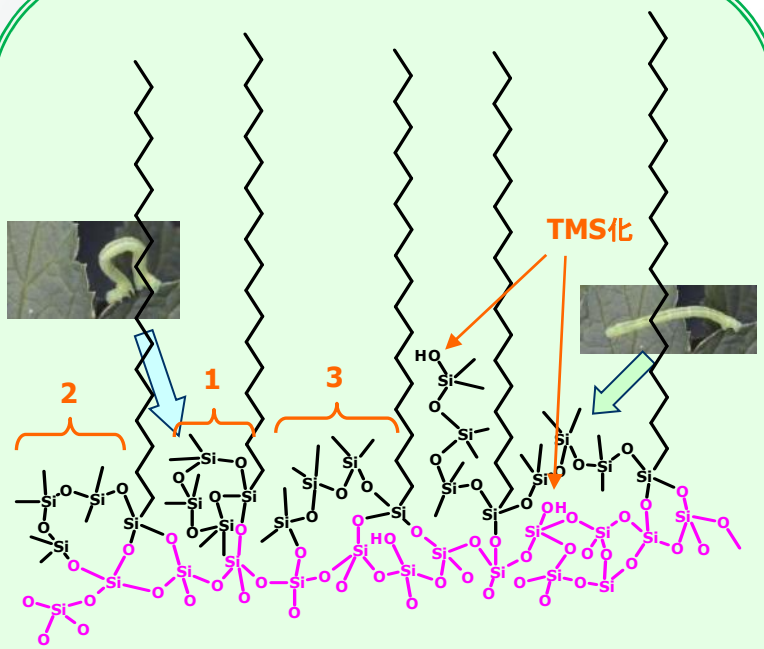


Fig. 2 Schematic diagram of bonding of novel silyl-reagent on silica surface

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 C30 bonding offers Performance in 100% aqueous conditions, and shows enhanced retention of polar compounds.

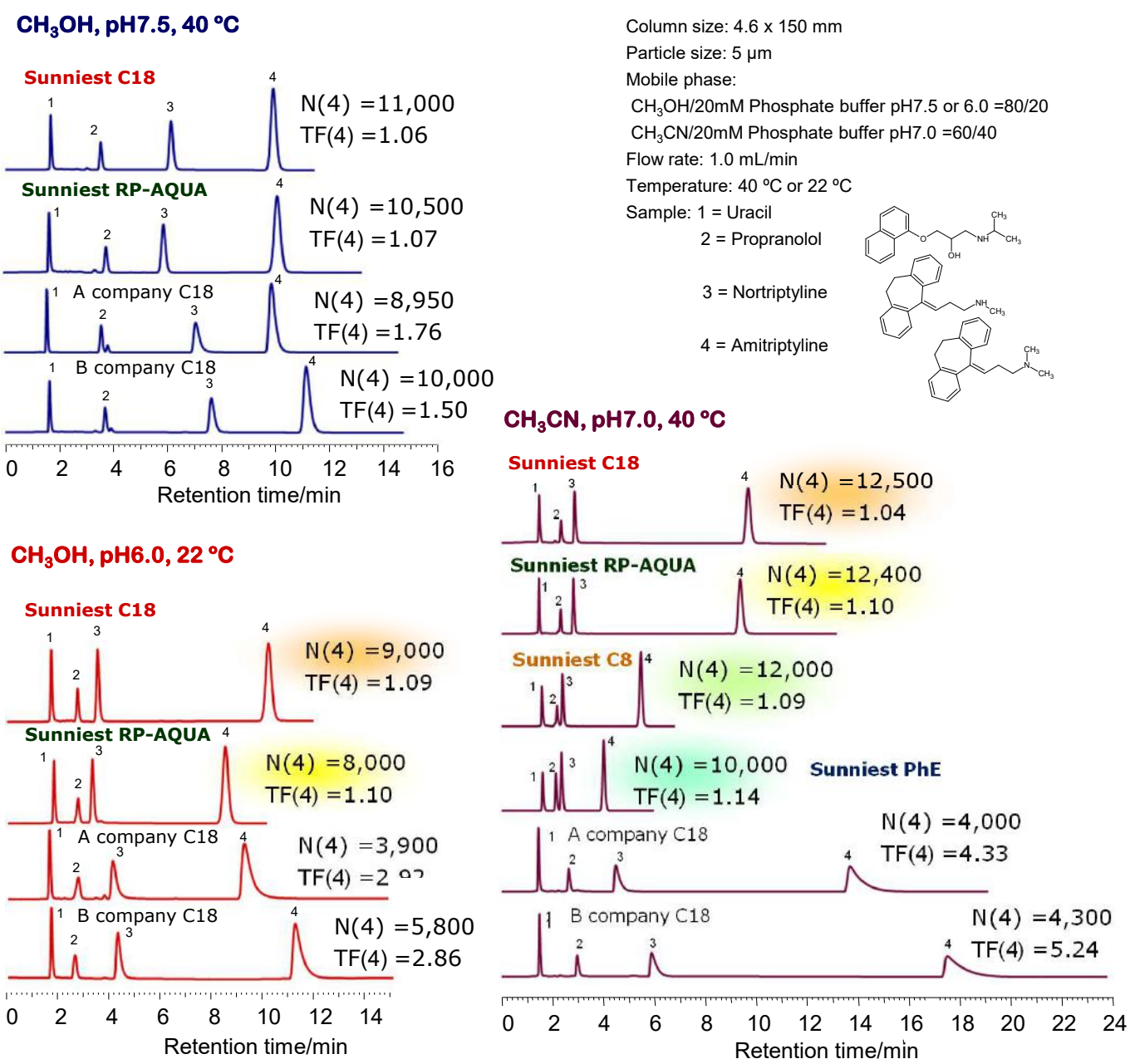
Specification of Sunniest

	Particle size (μm)	Pore diameter (nm)	Specific surface area (m^2/g)	Carbon content (%)	Bonded phase	pH range	USP L line
Sunniest C18	3 and 5	12	340	16	C18	1.5 - 10	L1
Sunniest C18-HT	2	10	340	16	C18	1.5 - 10	L1
Sunniest RP-AQUA	3 and 5	12	340	16	C30	2 - 8	L62
Sunniest C8	3 and 5	12	340	10	C8	1.5 - 9	L7
Sunniest PhE	3 and 5	12	340	10	Phenylethyl	1.5 - 8	L11
Sunniest PFP	5	12	340	10	Pentafluorophenyl	2 - 8	L43

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

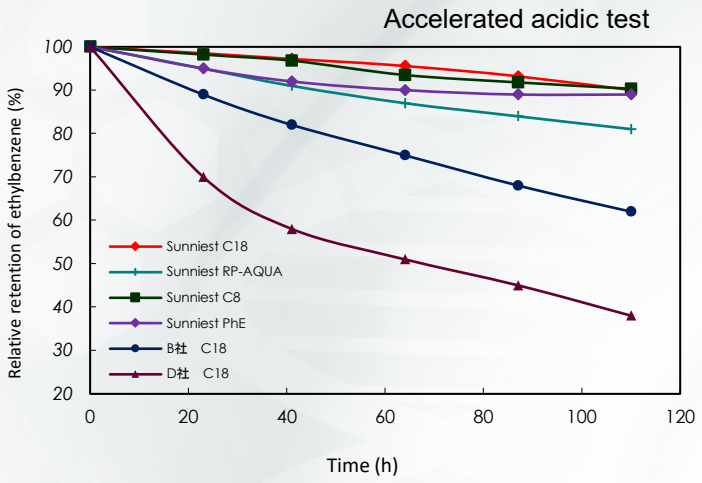


Amitriptyline is widely used to evaluate residual silanol groups on the C18 stationary phase. Peak shape of Amitriptyline was compared under 3 kinds of conditions such as methanol/phosphate buffer/40 ºC, methanol/phosphate buffer/22 ºC and acetonitrile/phosphate buffer/40 ºC. Majority of the HPLC columns offered good peak shapes under methanol/phosphate buffer/40 ºC conditions. However using Mobile phase of acetonitrile/phosphate buffer/40 ºC, 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

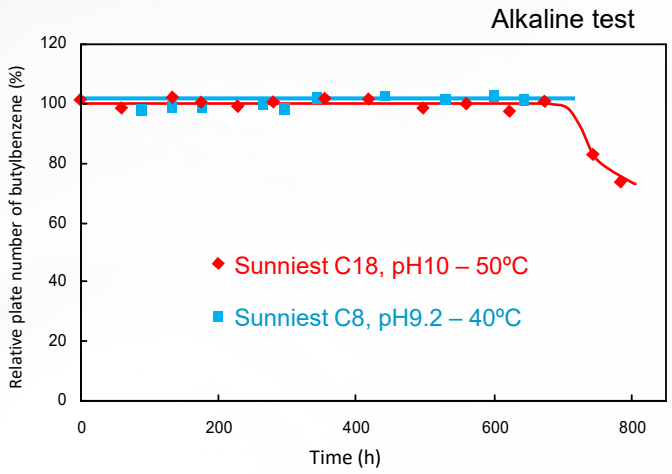


Durable test condition

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

Measurement condition

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



Durable test condition

Column: Sunniest C18, C8, 5 µm 4.6 x 150 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 ºC, C8 - 40 ºC

Measurement condition

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

Stability under acidic pH conditions was evaluated at 80 ºC using acetonitrile/1% trifluoroacetic acid solution (10:90) as a mobile phase. 100% aqueous mobile phase expels from the pore of packing materials by capillarity and packing materials don'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 C30 ligand length the Sunniest RP-AQUA is less stable than Sunniest C18. However, Sunniest RP-AQUA C30 column with HMODTS bonding along with end capping offers longer column life in comparison to other RP Aqua columns.

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**, 1309 (2004).
4) N. Nagae, BUNSEKI KAGAKU, **59**, 193 (2010).

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

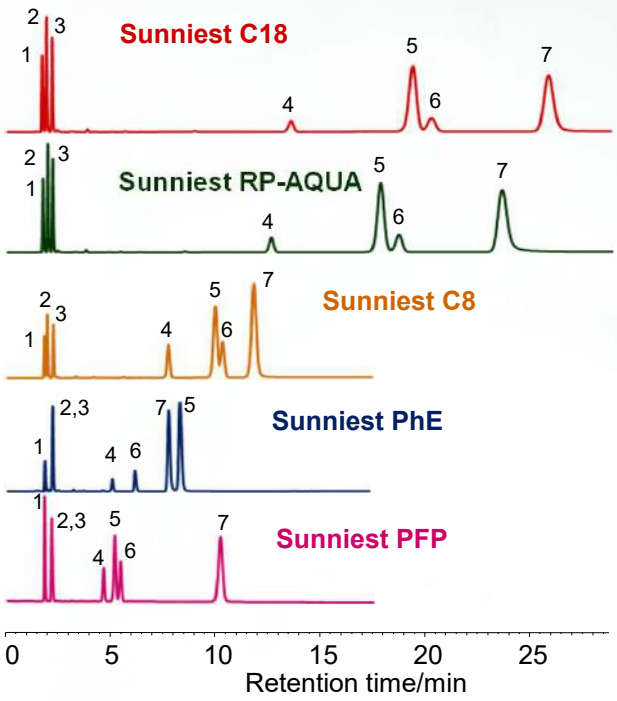
Elevated temperature of 10 ºC makes column life be one third. When Sunniest C18 column is used at 40 ºC, column life becomes 2,000 hours. Most of the HPLC columns stability data is offered at ambient room temperature alternate 25 ºC at pH 1-10 units..At temperature of 25 ºC, the column life is sixteen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

★ 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..

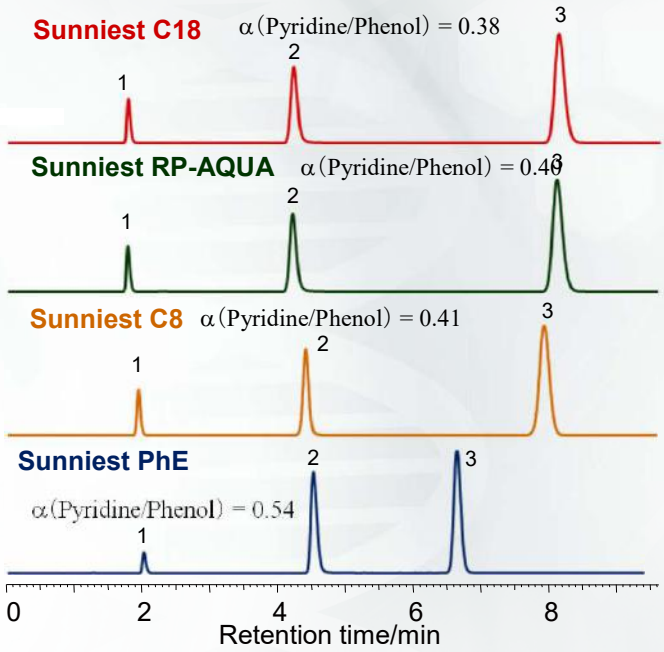
Sunniest C18,C18-HT, Sunniest RP-AQUA SunniestC8,PhE,PFP

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 ºC
Pressure: 5.4 MPa
Sample: 1 = Uracil, 2 = Caffeine, 3 = Phenol,
4 = Butylbenzene, 5 = o-Terphenyl, 6 = Amylbenzene,
7 = Triphenylene,

Separation of pyridine and phenol

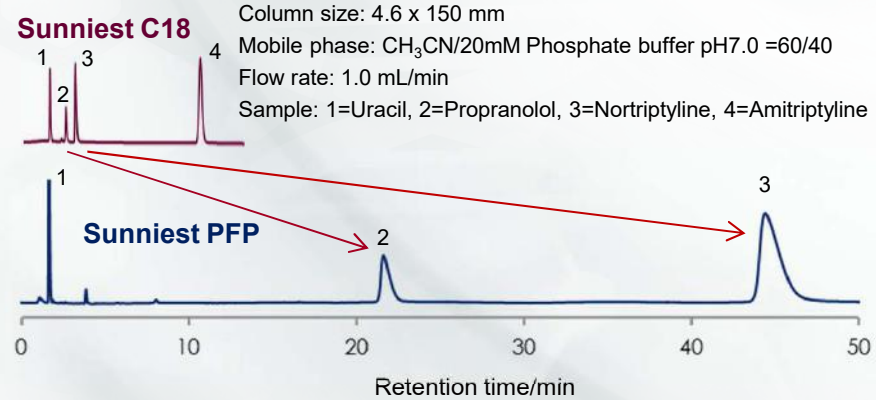


Column: Sunniest C18, 5 μm 4.6x150 mm
Sunniest RP-AQUA, 5 μm 4.6x150mm
Sunniest C8, 5 μm 4.6x150 mm
Sunniest PhE, 3 μm 4.6x150 mm
Mobile phase: CH_3OH/H_2O=30/70
Flow rate: 1.0 mL/min
Temperature: 40 ºC
Detection: UV@250nm
Sample: 1 = Uracil, 2 = Pyridine, 3 = Phenol

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.

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.

Ordering information of Sunniest

Inner diameter [mm]	Length [mm]	Sunniest C18, 3µm Catalog number	Sunniest C18, 5µm Catalog number	Sunniest RP-AQUA, 3µm Catalog number	Sunniest RP-AQUA, 5µm Catalog number	Sunniest C8, 3µm Catalog number	Sunniest C8, 5µm Catalog number
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
4.0	10	—	EB3A1H	—	ER3A1H	—	EC3A1H
4.6	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
10.0	250	—	EB3781	—	ER3781	—	EC3781
20.0	50	—	EB3841	—	ER3841	—	EC3841
	150	—	EB3871	—	ER3871	—	EC3871
	250	—	EB3881	—	ER3881	—	EC3881

Inner diameter [mm]	Length [mm]	Sunniest PhE, 3µm Catalog number	Sunniest PhE, 5µm Catalog number	Sunniest PFP, 5µm Catalog number
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, 2µm Catalog number
2.1	30	EB1931
	50	EB1941
	75	EB1951
	100	EB1961
3.0	30	EB1331
	50	EB1341
	100	EB1361

Cartridge and holder

Ordering information of cartridge type guard column of Sunniest

Description	Particle size	Catalog number
Sunniest C18, 5 µm Guard cartridge column (1-pak + Holder) 4 x 10 mm	5 µm	EB3A1H
Sunniest RP-AQUA, 5 µm Guard cartridge column (1-pak + Holder) 4 x 10 mm	5 µm	ER3A1H
Sunniest C8, 5 µm Guard cartridge column (1-pak + Holder) 4 x 10 mm	5 µm	EC3A1H
Sunniest C18, 5 µm Guard cartridge (4-pak) 4 x 10 mm	5 µm	EB3A1C
Sunniest RP-AQUA, 5 µm Guard cartridge (4-pak) 4 x 10 mm	5 µm	ER3A1C
Sunniest C8, 5 µm Guard cartridge (4-pak) 4 x 10 mm	5 µm	EC3A1C
Sunniest Guard cartridge holder 4 x 10 mm	---	HOLA1C

Totally porous silica

SunArmor C18, RP-AQUA, NH2

SunArmor

★Development of a novel silyl-reagent which bonded with multifunctional end-capping reagents

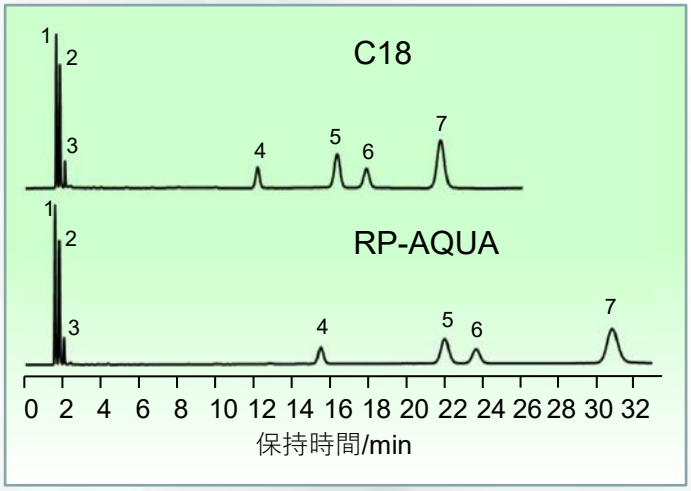
Specification of SunArmor

	Particle size (μm)	Pore diameter (nm)	Specific surface area (m^2/g)	Carbon loading (%)	Ligand	pH range for usage	USP Category
SunArmor C18	3 and 5	12	340	17	C18	2 - 12	L1
SunArmor RP-AQUA	3 and 5	12	340	18	C30	2 - 10	L62
SunArmor NH2	3 and 5	12	340	6.5	Aminopropyl	2 - 12	L8

Parameter using standard samples

Evaluation of hydrogen bonding, hydrophobicity and steric selectivity

Separation of standard samples using SunArmor C18, RP-AQUA



Condition

Column: SunArmor C18, RP-AQUA 5 μm , 150 x 4.6 mm
Mobile phase: CH_3OH/H_2O=75/25
Flow rate: 1.0 mL/min
Temperature: 40 ºC
Sample:

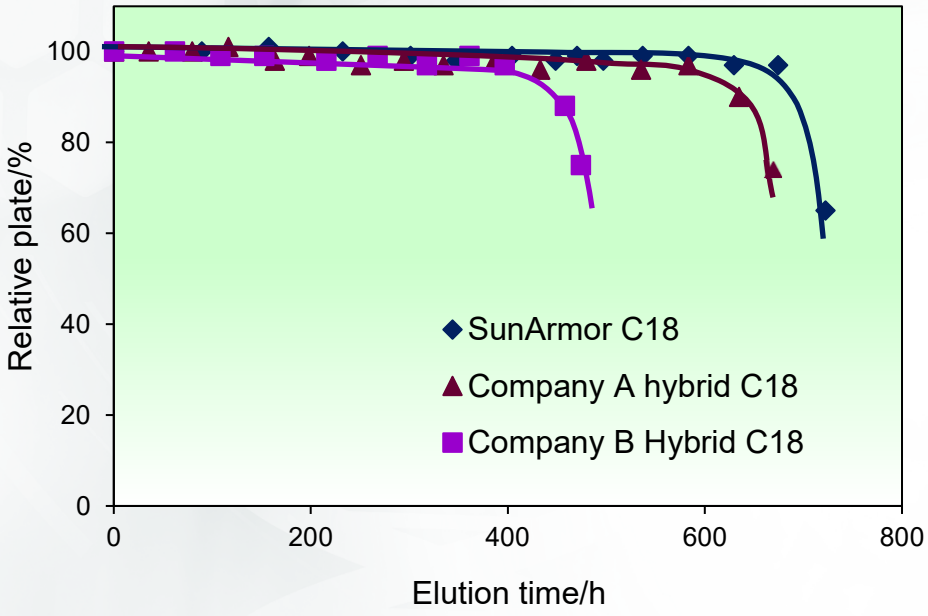
1 = Uracil
2 = Caffeine
3 = Phenol
4 = Butylbenzene
5 = o-Terphenyl
6 = Amylbenzene
7 = Triphenylene

	Hydrogen bonding (Caffeine/Phenol)	Hydrophobicity (Amylbenzene/Butylbenzene)	Steric selectivity (Triphenylene/o-Terphenyl)
SunArmor C18	0.40	1.54	1.35
SunArmor RP-AQUA	0.48	1.59	1.43

Stability under basic pH condition

SunArmor C18

Almost same stability to compare with the hybrid C18s.



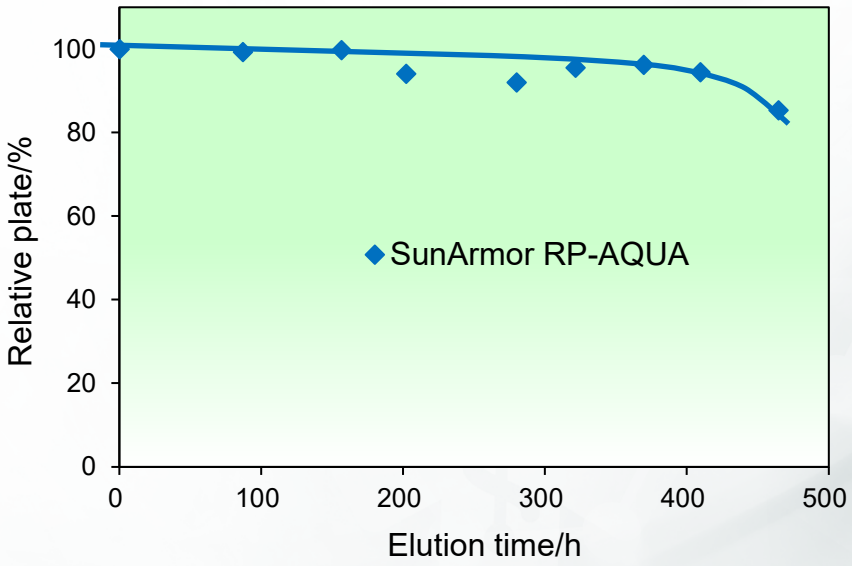
Durable test condition
Column size: 50 x 2.1 mm
Mobile phase: CH_3OH/10mM Ammonium bicarbonate (pH10.5)=30/70
Flow rate: 0.8 mL/min
Temperature: 60 ºC

Measurement condition
Column size: 50 x 2.1 mm
Mobile phase: CH_3CN/H_2O=60/40
Flow rate: 0.2 mL/min
Temperature: 40 ºC
Sample: 1 = Butylbenzene

Stability under basic pH condition

SunArmor RP-AQUA

Stability under 100% aqueous basic pH10 condition

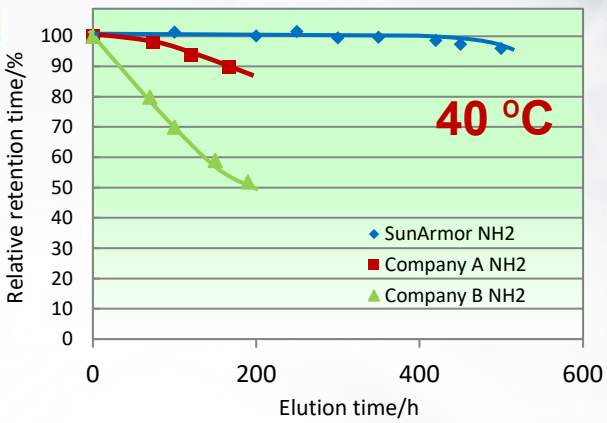


Durable test condition
Column size: 50 x 2.1 mm
Mobile phase:
10mM Ammonium bicarbonate (pH10.0)
Flow rate: 0.2 mL/min
Temperature: 40 ºC

Measurement condition
Column size: 50 x 2.1 mm
Mobile phase: CH_3CN/H_2O=70/30
Flow rate: 0.2 mL/min
Temperature: 40 ºC
Sample: 1 = Butylbenzene

Stability of SunArmor NH2

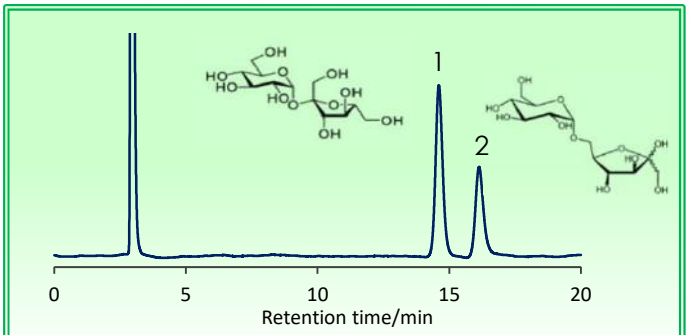
SunArmor NH2



Duration test condition

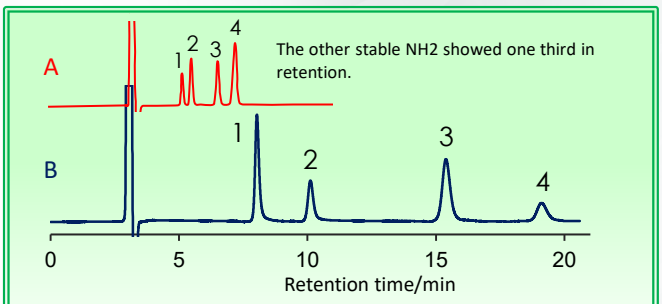
Column: SunArmor NH2 5 µm, 250 x 4.6 mm
Other NH2 5 µm, 250 x 4.6 mm
Mobile phase: Acetonitrile/water = 75/25
Flow rate: 1.0 mL/min,
Temperature: 40 °C
Detector: RI
Sample: Sucrose

Separation of sucrose and palatinose



Column: SunArmor NH2, 5 µm 250 x 4.6 mm
Mobile phase: Acetonitrile/50 mM ammonium acetate=75/25
Flow rate: 1.0 mL/min, Temperature: 40 °C
Detection: RI, Sample: 1 = Sucrose, 2 = Palatinose

Comparison of retention time



Column: A=Other stable NH2, 5 µm 250 x 4.6 mm
B=SunArmor NH2, 5 µm 250 x 4.6 mm
Mobile phase: Acetonitrile/Water = 75/25,
Flow rate: 1.0 mL/min, Temperature: 40 °C,
Detection: RI,
Sample: 1= Fructose, 2= Glucose, 3= Sucrose, 4= Maltose

★Hydrophobic end-capping makes retention short while hydrophilic end-capping keeps retention. Furthermore, hydrophilic end-capping makes stability high. SunArmor NH2 shows large retention and high stability.

Ordering information of SunArmor

	Inner diameter (mm)	2.0	3.0	4.6	10	20	USP category
	Length (mm)	Catalog number	Catalog number	Catalog number	Catalog number	Catalog number	
SunArmor C18, 3 µm	30	HB2231	------	------	------	------	L1
	50	HB2241	HB2341	HB2441	------	------	
	75	HB2251	------	-----	------	------	
	100	HB2261	HB2361	HB2461	------	------	
	150	HB2271	HB2371	HB2471	------	------	
	250	------	HB2381	HB2481	------	------	
SunArmor C18, 5 µm	50	HB3241	HB3341	HB3441	------	------	L1
	100	HB3261	HB3361	HB3461	------	------	
	150	HB3271	HB3371	HB3471	------	------	
	250	HB3281	HB3381	HB3481	HB3781	HB3881	
SunArmor RP-AQUA, 3 µm	30	HR2231	------	------	------	------	L62
	50	HR2241	HR2341	HR2441	------	------	
	75	HR2251	------	-----	------	------	
	100	HR2261	HR2361	HR2461	------	------	
	150	HR2271	HR2371	HR2471	------	------	
	250	------	HR2381	HR2481	------	------	
SunArmor RP-AQUA , 5 µm	50	HR3241	HR3341	HR3441	------	------	L62
	100	HR3261	HR3361	HR3461	------	------	
	150	HR3271	HR3371	HR3471	------	------	
	250	HR3281	HR3381	HR3481	HR3781	HR3881	
SunArmor NH2, 3 µm	150	HN2271	------	HN2471	------	------	L8
	250	HN2281	------	HN2481	------	------	
SunArmor NH2, 5 µm	150	HN3271	------	HN3471	------	------	L8
	250	HN3281	------	HN3481	HN3781	HN3881	

Ordering information of cartridge type guard column of SunArmor

Description	Particle size	Catalog number
SunArmor C18, 5 µm Guard cartridge column (1-pak + Holder) 4 x 10mm	5 µm	HB3A1H
SunArmor RP-AQUA, 5 µm Guard cartridge column (1-pak + Holder) 4 x 10mm	5 µm	HR3A1H
SunArmor C18, 5 µm Guard cartridge (4-pak) 4 x 10mm	5 µm	HB3A1C
SunArmor RP-AQUA, 5 µm Guard cartridge (4-pak) 4 x 10mm	5 µm	HR3A1C
SunArmor Guard cartridge holder	---	HOLA1C

Cartridge and holder

Sunrise C30, C18-SAC

Totally porous silica

Name	Stationary phase	Carbon content	Ligand density	Particle size
C30 Triacontyl		18%	1.7 μmol/m²	3 μm, 5 μm
C18-SAC Octadecyl		14%	2.1 μmol/m²	3 μm, 5 μm

pH range of C30: pH2～pH8, C18-SAC: pH2～pH7.5

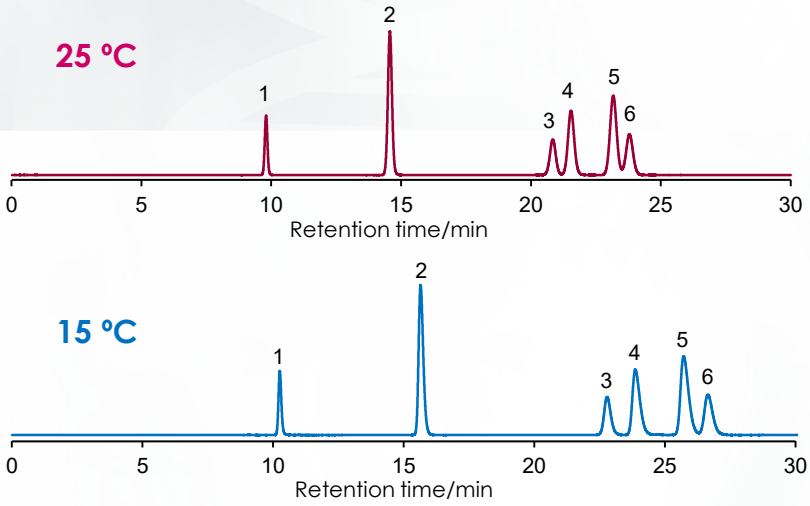
Silica support
Surface area: 340 m²/g
Pore volume: 1.0 mL/g
Pore diameter: 12 nm

End-capping
Trimethylsilyl group (TMS)
C18-SAC is not end-capped.

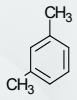
Sunrise C30

■ A long alkyl chain improves both separation of fat-soluble compounds to compare with C18 phase and an excellent reproducibility in retention under high aqueous conditions.
■ Furthermore, a suitable ligand density of C30 allows to be obtained a shape peak shape even if more than 50% aqueous mobile phase is used.
■ Different selectivity

Separation of xylene isomers

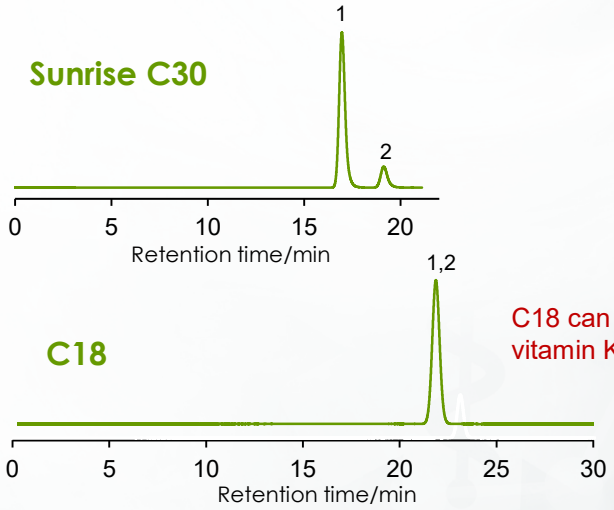


Column: Sunrise C30 3 μm, 4.6 x 250 mm
Mobile phase: CH_3OH/H_2O=70:30
Flow rate: 0.7 mL/min
Temperature: 25 °C and 15 °C
Detection: UV@250nm
Sample: BTEX
1 = Benzene
2 = Toluene
3 = Ethylbenzene
4 = o-Xylene
5 = m-Xylene
6 = p-Xylene



Sunrise C30 or C28 can separate xylene isomers although conventional C18 can't. The lower a temperature, the better a separation of isomers.

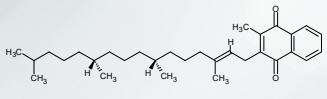
Separation of vitamin K1 isomers



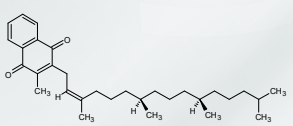
C18 can not separate vitamin K1 isomers.

Column: Sunrise C30 3 μm, 150 x 4.6 mm
Company A C18 3 μm, 150 x 4.6mm
Mobile phase: Methanol
Flow rate: 1.0 mL/min
Temperature: 15 °C
Detection: UV@250 nm
Sample: Vitamin K1 isomers (trans and cis)

1 = trans



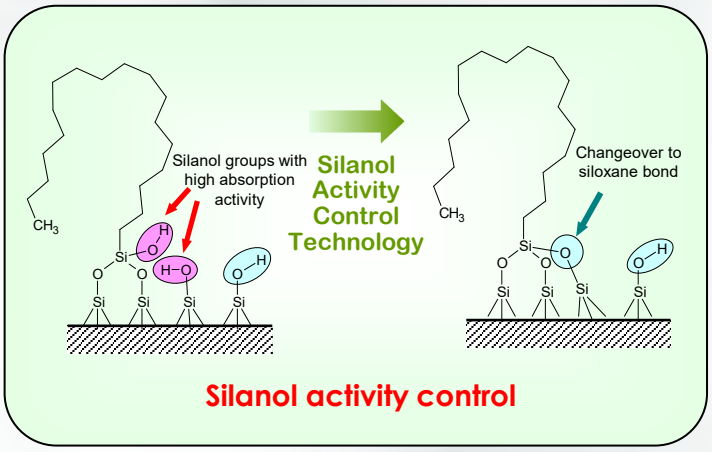
2 = cis



Sunrise C18-SAC

Silanol activity control technology

ChromaNik developed the technique that decreased only silanol groups with high absorption activity to a basic compound and remained effective silanol groups on the stationary phase. Silanol activity control and no end-capping led the existence of silanol groups with high hydration which created a new and unique reversed-phase separation mode including hydrogen bond and ion-exchange interaction. Furthermore, silanol activity controlling, then end-capping technique improved a peak shape of a basic compound exceedingly.

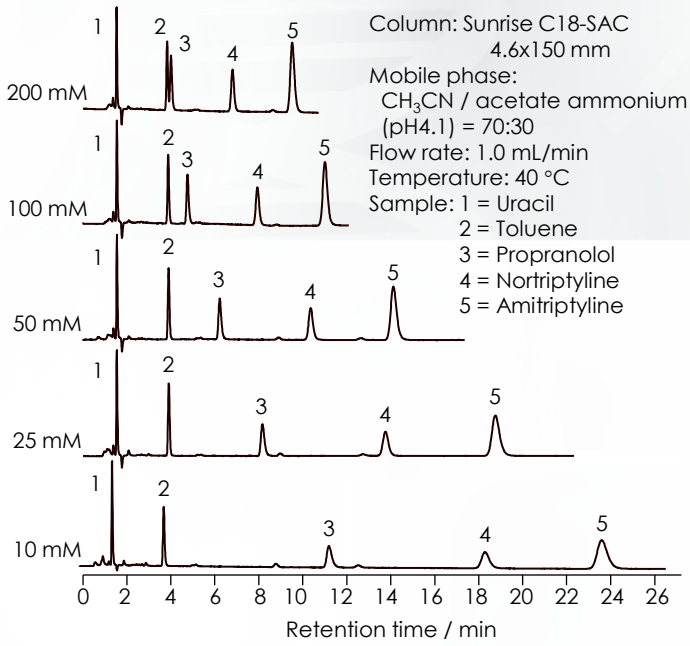


◆ Feature of Sunrise C18-SAC

Sunrise C18-SAC is bonded with octadecylsilane on a pure silica gel and controlled its silanol activity without end-capping. Its carbon content is 14%.

- The "2nd Choice" column which takes advantage of effective silanol groups interaction
- Reducing silanol groups with high adsorption activity
- The new separation mechanism including hydrogen bond and ion-exchange interaction
- Effective for separation of a basic compound and a polar compound
- Different selectivity and improvement of separation without changing a mobile phase

Separation of basic compounds with ammonium acetate: Effect of salt concentration(Sunrise C18-SAC)



Ordering information of Sunrise

Inner diameter [mm]	Length [mm]	Sunrise C30, 3µm Catalog number	Sunrise C30, 5µm Catalog number	Sunrise C18-SAC, 3µm Catalog number	Sunrise C18-SAC, 5µm Catalog number
2.0	50	SM2241	SM3241	SA2241	SA3241
	75	SM2251	—	SA2251	—
	100	SM2261	SM3261	SA2261	SA3261
	150	SM2271	SM3271	SA2271	SA3271
4.6	10	SM2411	SM3411	SA2411	SA3411
	50	SM2441	SM3441	SA2441	SA3441
	75	SM2451	—	SA2451	—
	100	SM2461	SM3461	SA2461	SA3461
	150	SM2471	SM3471	SA2471	SA3471
	250	SM2481	SM3481	—	SA3481
10.0	250	—	SM3781	—	SA3781
20.0	250	—	SM3881	—	SA3881

Manufacturer
ChromaNik Technologies Inc.
6-3-1 Namiyoke, Minato-ku, Osaka, 552-0001 Japan
TEL: +81-6-6581-0885 FAX: +81-6-6581-0890
E-mail: info@chromanik.co.jp
URL: http://chromanik.co.jp

1905