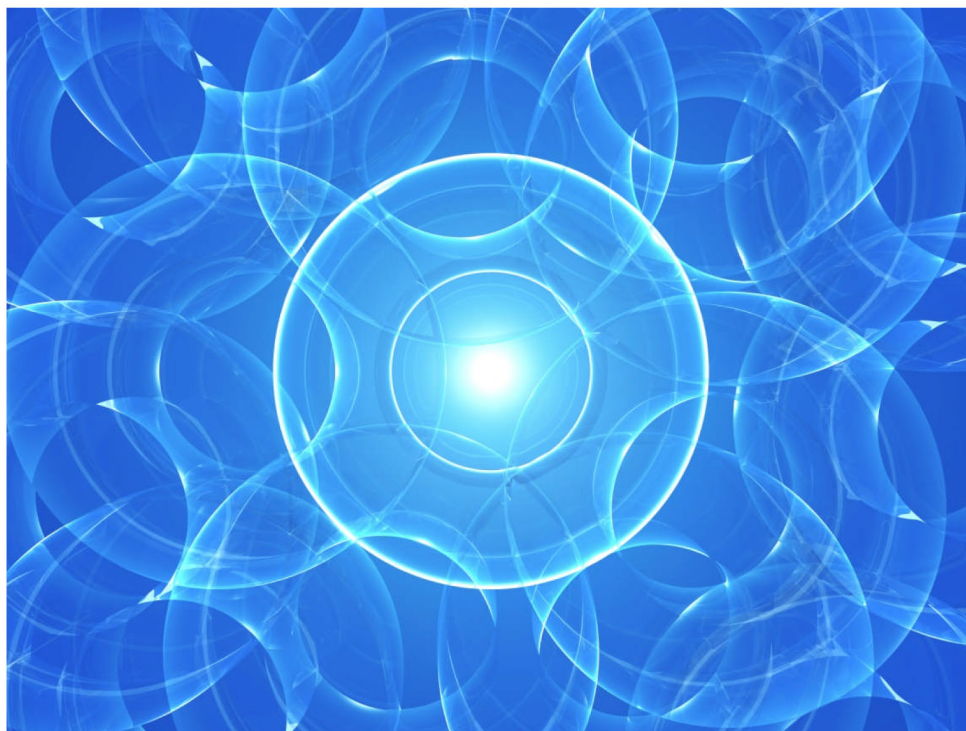




HPLC column

# SunShell



**Core Shell Particle**



  
**AZAFORNUTA**  
www.obrnutafaza.hr  
info@obrnutafaza.hr

**ChromaNik Technologies Inc.**

“SunShell “ is a core shell silica column made by ChromaNik Technologies.

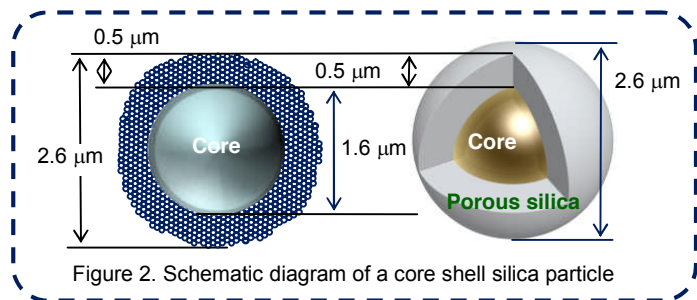
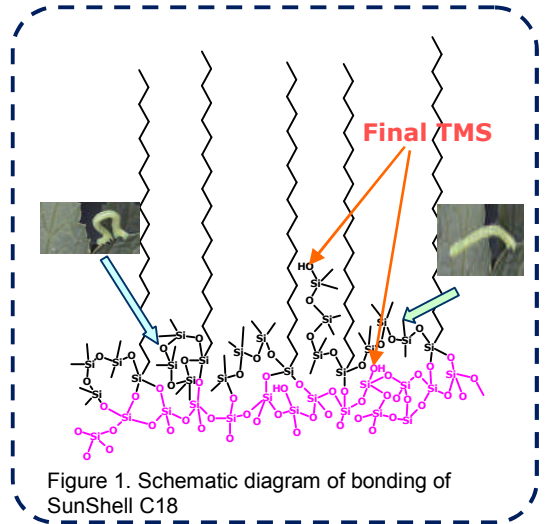


# The next generation to Core Shell particle

## Superficially porous silica

### Features of SunShell

- \*1.6 μm of core and 0.5 μm of superficially porous silica layer
- \*Same efficiency and high throughput as a Sub 2μm particle
- \*Same pressure as a 3 μm particle (less than a half then a sub 2μm particle)
- \*Same chemistry as Sunniest technology (reference figure 1)
- \*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

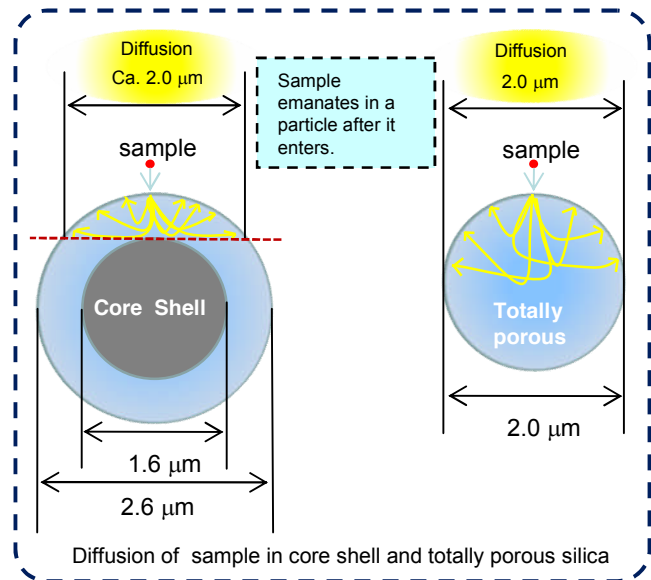
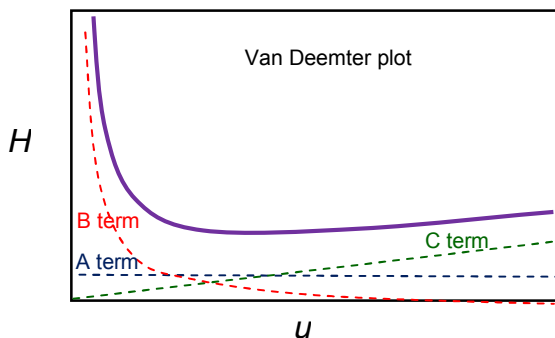


### Why does a 2.6 μm core shell particle show the same performance as a sub 2 mm particle?

Van Deemter Equation

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

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



### 2.6 μm of Core shell particle

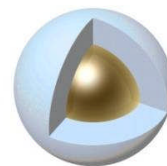
A term decreases ← Narrow particle size distribution

A of  $Ad_p$  decreases as  $d_p$  is same and both are 2.6 μm.

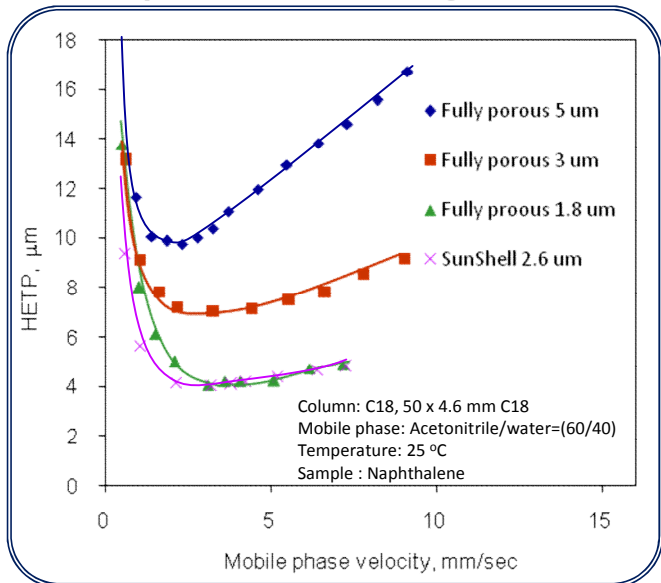
B term decreases } ← Thin porous layer  
 C term decreases }

Mass transfer distance becomes short, and diffusion width becomes narrow on one particle as shown in the above.

to compare with 2.6 μm of fully porous particle



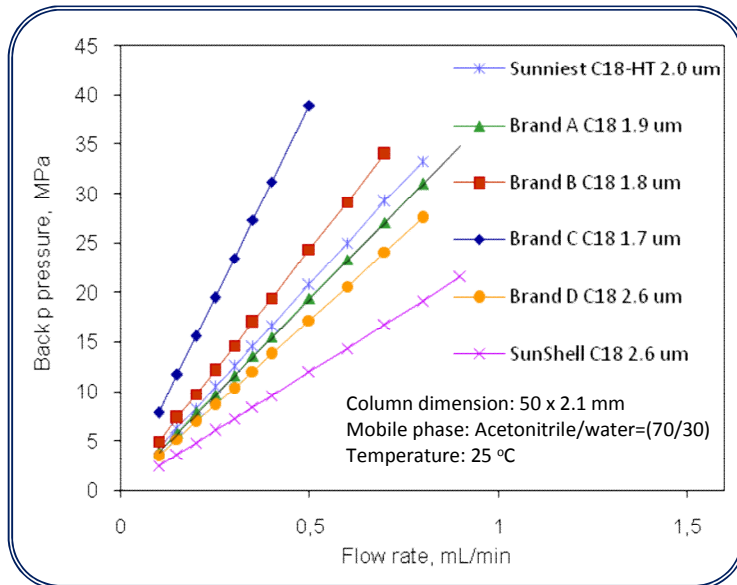
### Comparison of Plate Height Plots



SunShell C18 shows the same efficiency as sub 2 μm C18.

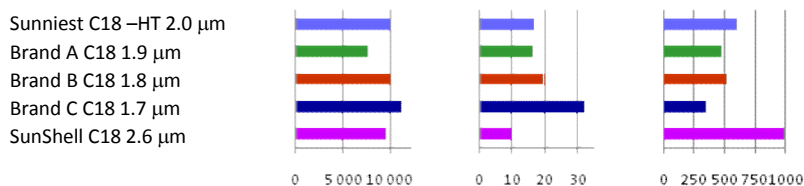
Furthermore back pressure of SunShell C18 is less than a half to compare with sub 2 μm C18

### Comparison of Back Pressure for High Throughput Columns



### Comparison of Performance by Plate/Pressure

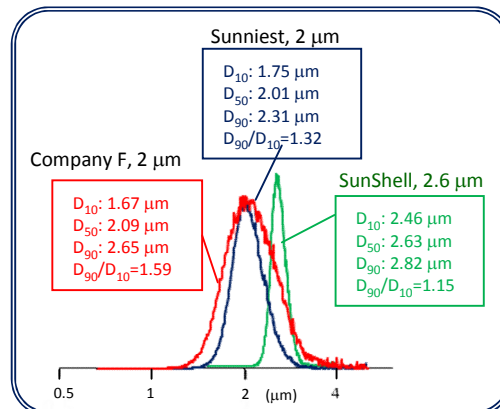
| Column                  | Plate  | Back press. (MPa) | Plate/back press. |
|-------------------------|--------|-------------------|-------------------|
| Sunniest C18 –HT 2.0 μm | 9,900  | 16.7              | 593               |
| Brand A C18 1.9 μm      | 7,660  | 16.3              | 470               |
| Brand B C18 1.8 μm      | 10,100 | 19.6              | 515               |
| Brand C C18 1.7 μm      | 11,140 | 32.0              | 348               |
| SunShell C18 2.6 μm     | 9,600  | 9.7               | 990               |



Column: 50 x 2.1 mm C18, Mobile phase: Acetonitrile/water=(70/30), Temperature: 25 °C

Under a constant backpressure condition, SunShell C18 shows more than 2 times higher performance to compare with totally porous C18s.

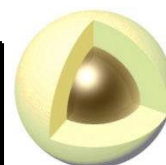
### Comparison of Particle Size Distribution



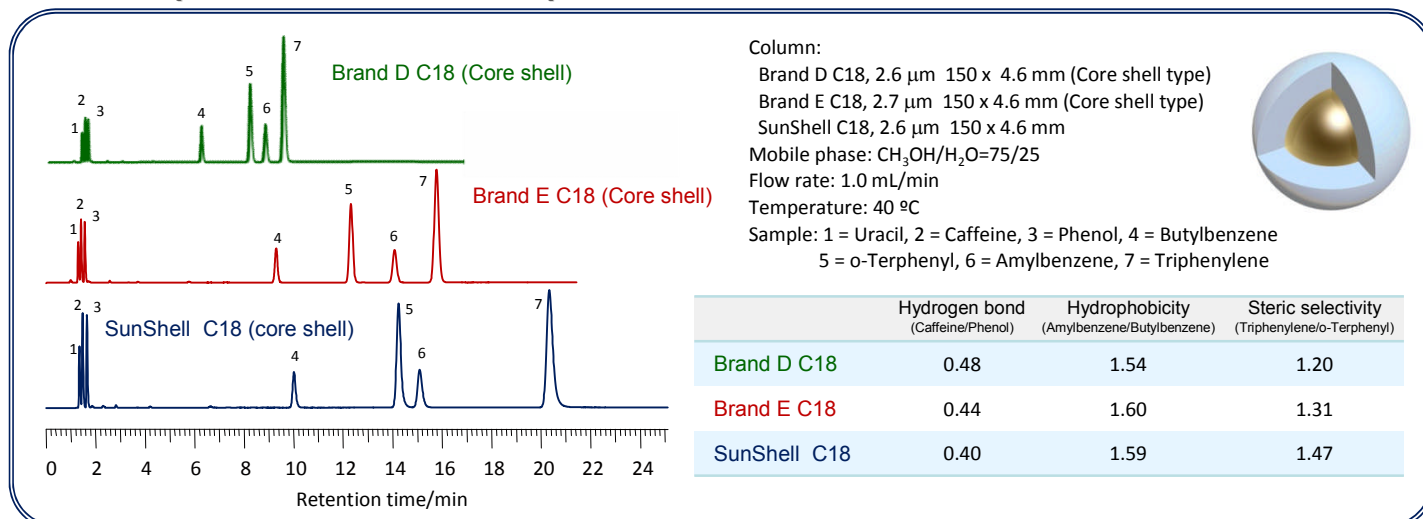
SunShell shows the narrowest particle size distribution. D90/D10 value is applied to evaluate particle size distribution. D90/D10 of SunShell is 1.15 and extremely low.

## □ Characteristics of SunShell C18

|              | Core shell silica  |                    |   | C18                |              |                            |                    |
|--------------|--------------------|--------------------|---|--------------------|--------------|----------------------------|--------------------|
|              | Particle size (mm) | Pore diameter (nm) | Specific surface area (m <sup>2</sup> /g) | Carbon content (%) | Bonded phase | Maximum operating pressure | Available pH range |
| SunShell C18 | 2.6                | 9                  | 150                                       | 7                  | C18          | 60 MPa or 8,570 psi        | 1.5 - 10           |

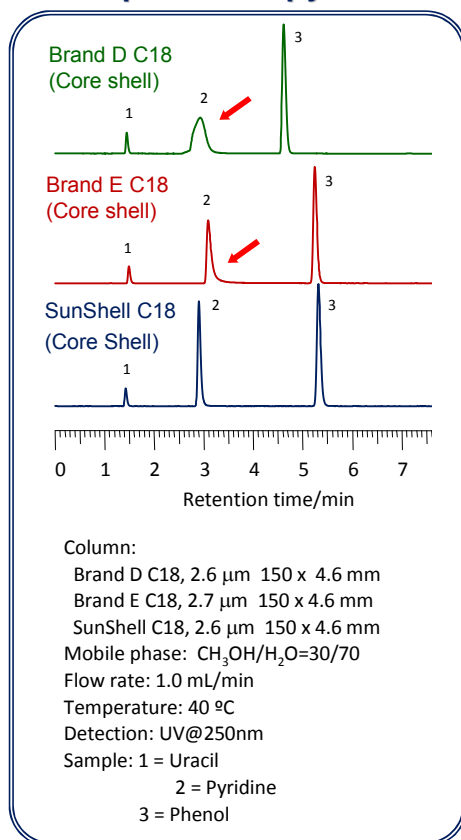


## □ Comparison of standard samples between core shell C18s



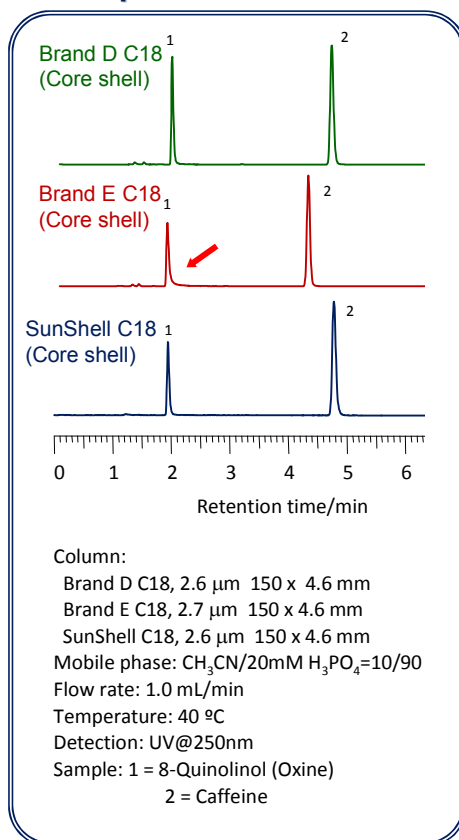
Retention of standard samples was compared for three kinds of core shell type C18. Brand D C18 showed only a half retention to compare with SunShell C18. Steric selectivity becomes large when ligand density on the surface is high. SunShell C18 has the largest steric selectivity so that it has the highest ligand density. This leads the longest retention time.

### Comparison of pyridine



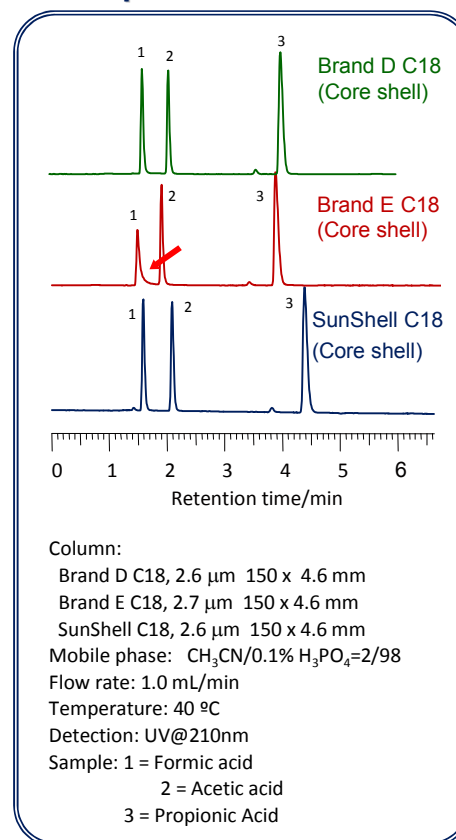
Residual silanol groups make pyridine be tailing under methanol/water mobile phase condition. Only SunShell C18 shows a sharp peak for pyridine.

### Comparison of Oxine



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



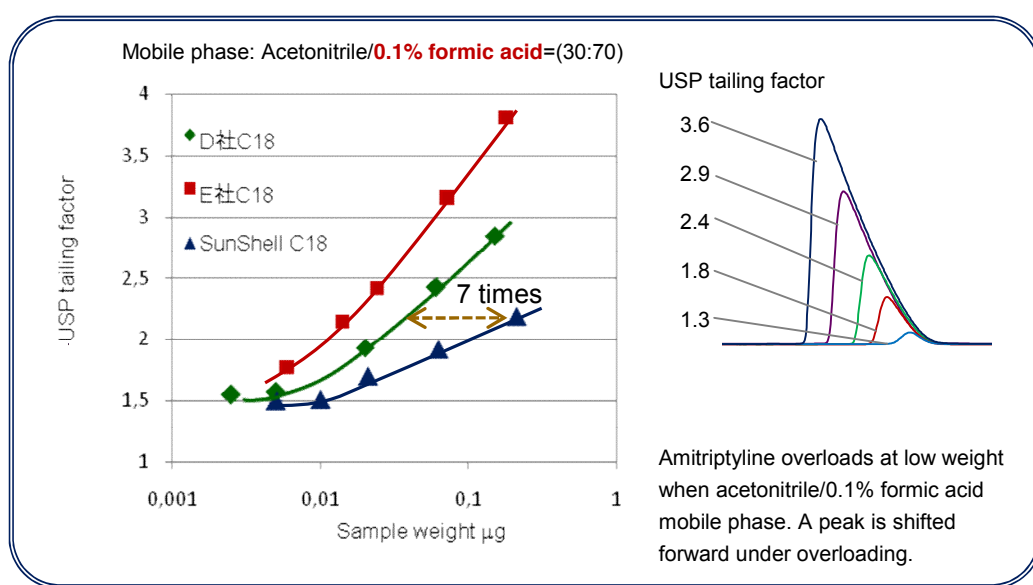
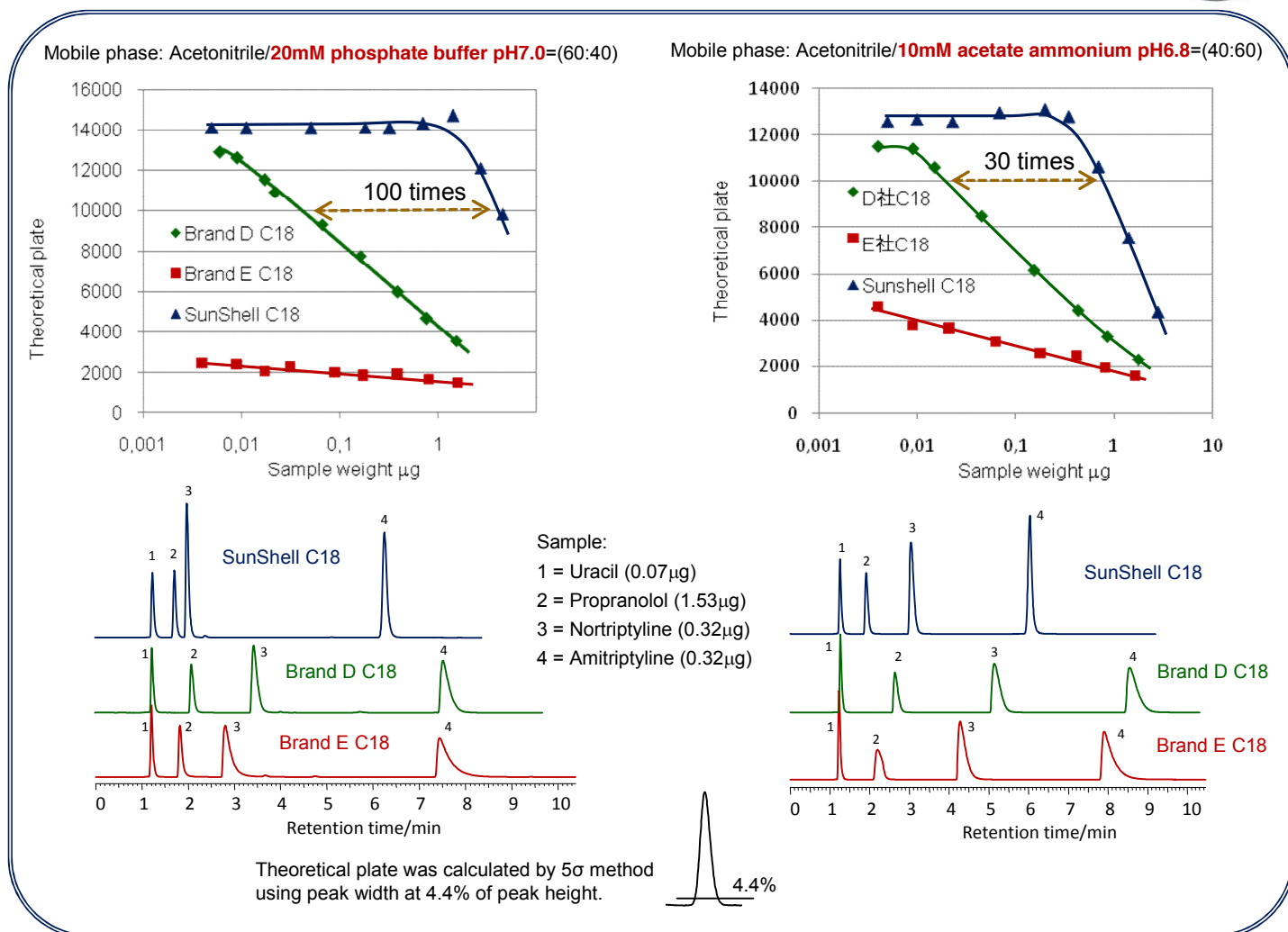
Formic acid is used as an indicator for an acidic inertness. SunShell and brand D C18 show a sharp peak.

## Loading capacity of amitriptyline as a basic compound

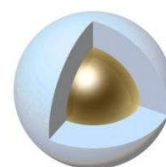
Amitriptyline overloads much more at acetonitrile/buffer mobile phase than methanol/buffer. Three kinds of core shell C18 was compared loading capacity of amitriptyline at three different mobile phases.



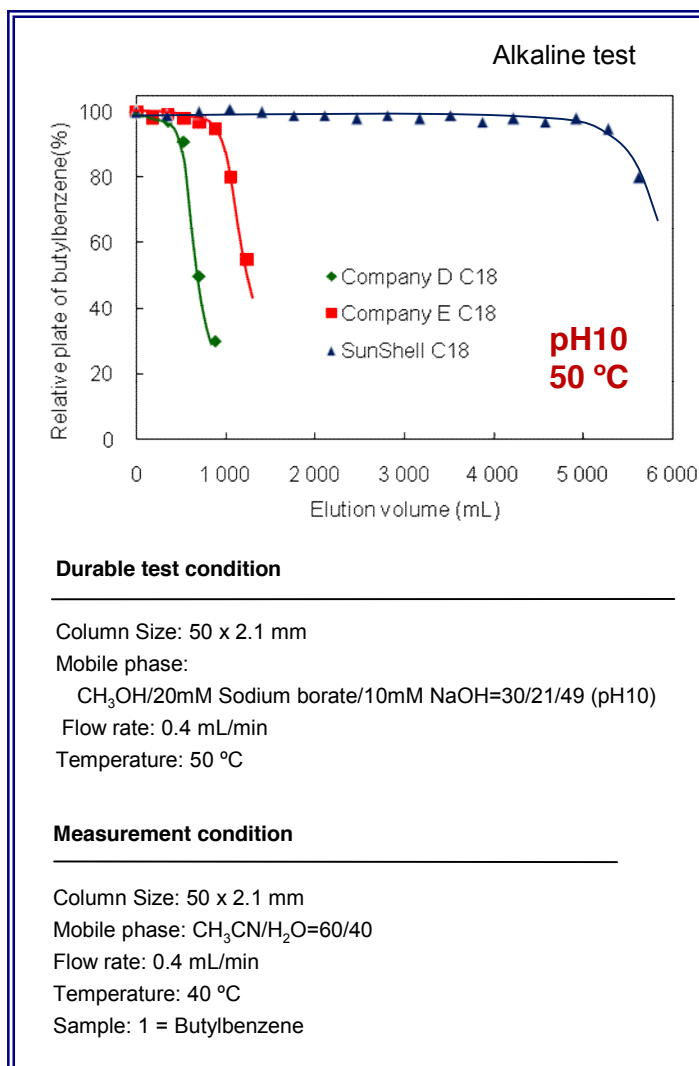
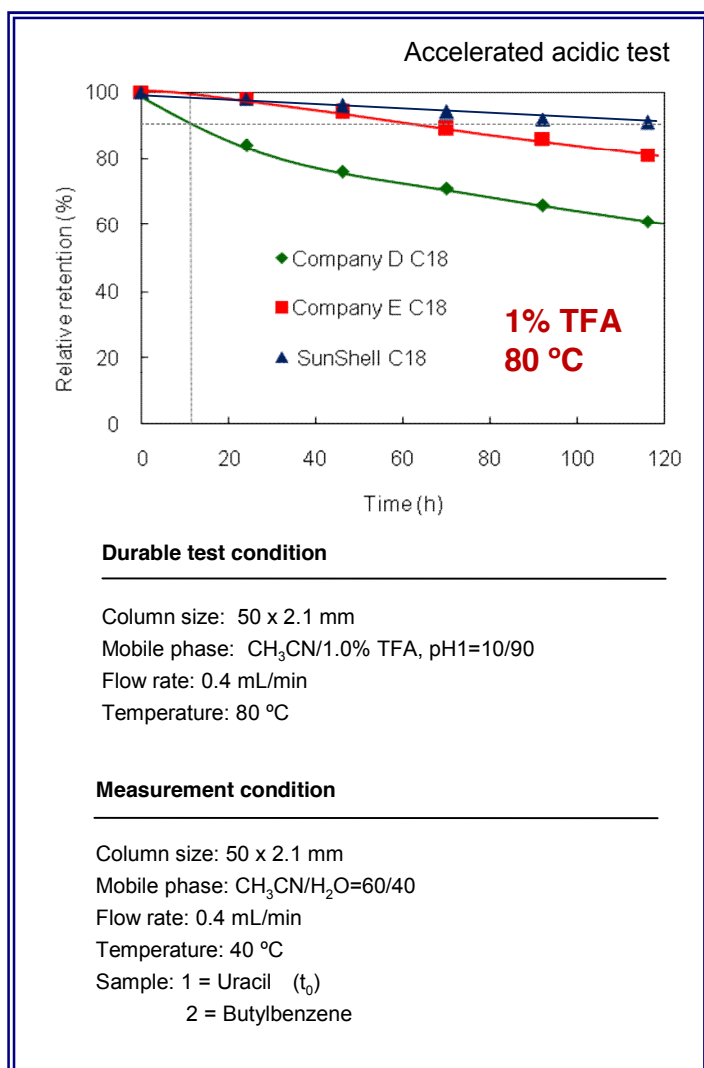
Common condition: Column dimension, 150 x 4.6 mm, flow rate; 1.0 mL/min, temperature; 40°C



Brand D 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 Brand D C18 was only one hundredth to compare with SunShell C18 under acetonitrile/20mM phosphate buffer pH7.0=(60:40) mobile phase. Brand E C18 always showed poor peak of amitriptyline.



## □ Evaluation of Stability



Stability under acidic pH condition 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.<sup>1-3)</sup>

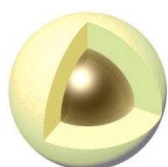
□ SunShell C18 has kept 90% retention for 100 hours under such a severe condition. SunShell C18 is 5 to 10 times more stable than the other core shell C18.

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.

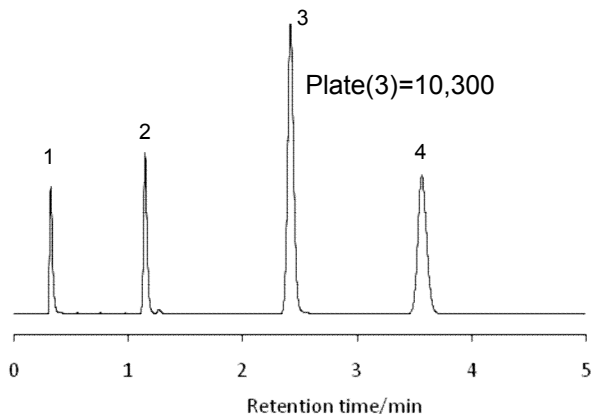
□ SunShell C18 can be used at the pH range from 1.5 to 10.





## Efficiency of SunShell C18

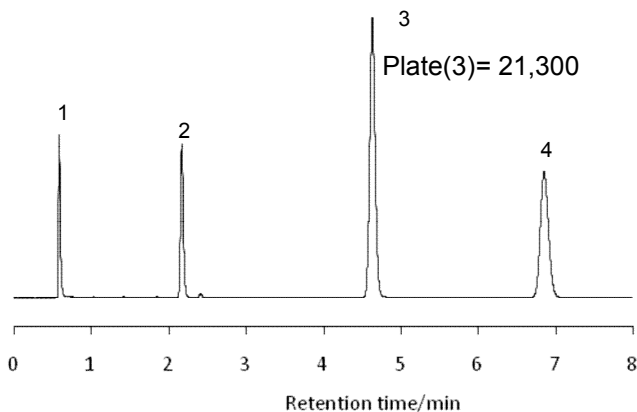
Column dimension: 50 x 2.1 mm



Column: SunShell C18, 2.6  $\mu$ m 50 x 2.1 mm  
 Mobile phase: CH<sub>3</sub>CN/H<sub>2</sub>O=60/40  
 Flow rate: 0.3 mL/min  
 Pressure: 7 MPa  
 Temperature: 23 °C

**Low Backpressure**

Column dimension: 100 x 2.1 mm

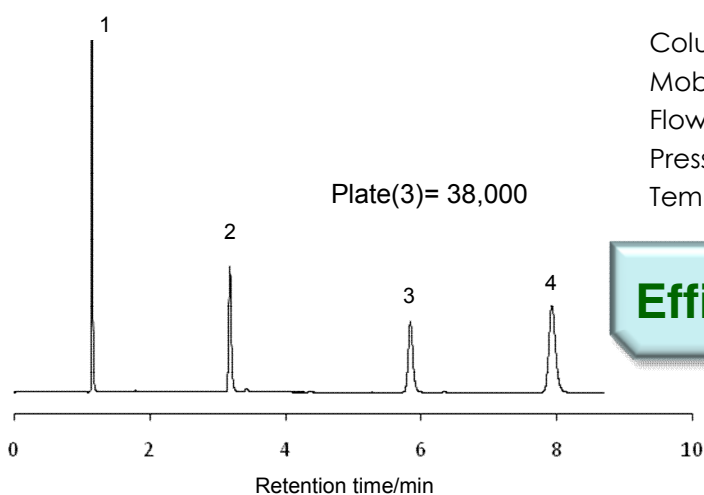


Column: SunShell C18, 2.6  $\mu$ m 100 x 2.1 mm  
 Mobile phase: CH<sub>3</sub>CN/H<sub>2</sub>O=60/40  
 Flow rate: 0.3 mL/min  
 Pressure: 12.5 MPa  
 Temperature: 25 °C

**Sub 2  $\mu$ m Efficiency**

Sample: 1 = Uracil  
 2 = Toluene  
 3 = Acenaphthene  
 4 = Butylbenzene

Column dimension: 150 x 4.6 mm



Column: SunShell C18, 2.6  $\mu$ m 150 x 4.6 mm  
 Mobile phase: CH<sub>3</sub>CN/H<sub>2</sub>O=70/30  
 Flow rate: 1.0 mL/min  
 Pressure: 11.5 MPa  
 Temperature: 25 °C

**Efficiency=253,000 plate/m**

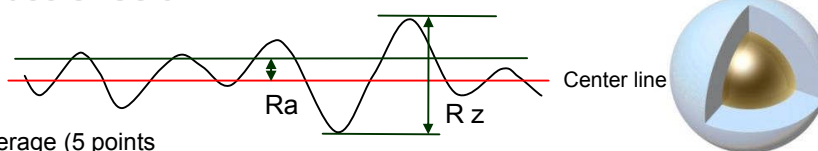


## • Surface Roughness on Inner Surface of Column

### Parameter of surface roughness

Ra: Average roughness from center line

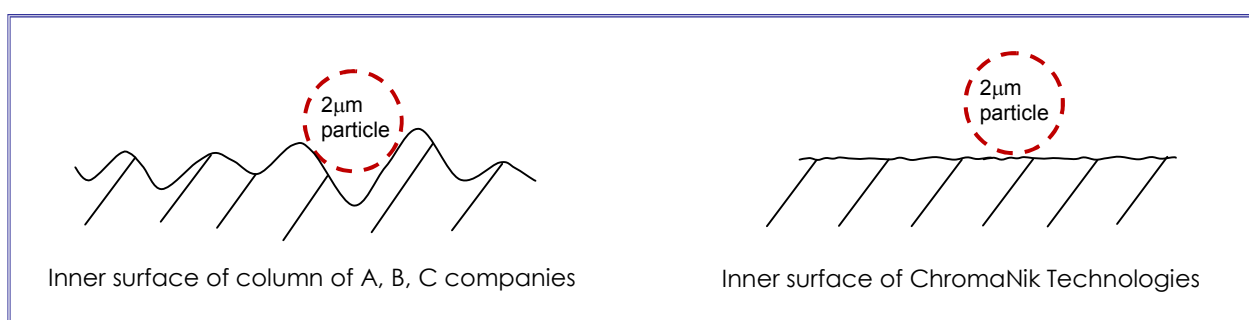
Rz: Roughness calculated from 10 points average (5 points of maximum and 5 points of minimum)



Schematic diagram of surface roughness

|    | G company          | Y company          | S1 company         | S2 company         | W company          | ChromaNik Technologies |
|----|--------------------|--------------------|--------------------|--------------------|--------------------|------------------------|
| Ra | 0.34 $\mu\text{m}$ | 0.32 $\mu\text{m}$ | 0.37 $\mu\text{m}$ | 0.03 $\mu\text{m}$ | 0.20 $\mu\text{m}$ | 0.01 $\mu\text{m}$     |
| Rz | 1.88 $\mu\text{m}$ | 1.62 $\mu\text{m}$ | 1.91 $\mu\text{m}$ | 0.19 $\mu\text{m}$ | 0.90 $\mu\text{m}$ | 0.10 $\mu\text{m}$     |

It is considered that surface roughness affects column performance. Surface asperity of ChromaNik Technologies column with 2.1 mm i.d. and 3.0 mm i.d. is 1/30 to 1/20 to compare with that of GL Sciences, YMC, Shimadzu and Waters columns. ChromaNik Technologies provides a column with very smooth surface which is the most suitable for 2.6  $\mu\text{m}$  core shell particle packing.



### Ordering information of SunSell C18

| Inner diameter(mm) | 2.1            | 3.0            | 4.6            |
|--------------------|----------------|----------------|----------------|
| Length (mm)        | Catalog number | Catalog number | Catalog number |
| 20                 | CB6921         | CB6321         | CB6421         |
| 30                 | CB6931         | CB6331         | CB6431         |
| 50                 | CB6941         | CB6341         | CB6441         |
| 75                 | CB6951         | CB6351         | CB6451         |
| 100                | CB6961         | CB6361         | CB6461         |
| 150                | CB6971         | CB6371         | CB6471         |

### Local Dealer:

## Next phases, C8, PFP and HILIC-Amide

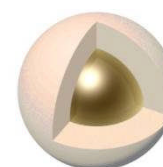
Coming soon



### Global Sales

#### Biotech AB

Box 133, 439 23 Onsala, Sweden  
 TEL: +46 300 569180  
 FAX: + 46 300 569181  
 E-mail: info@biotech.se  
 URL: www.biotech.se



### 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

“SunShell “ is a core shell silica column made by ChromaNik Technologies.

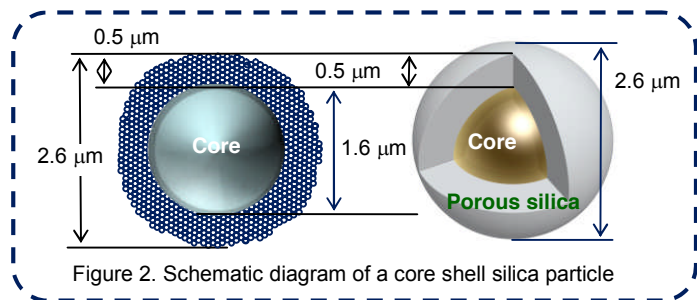
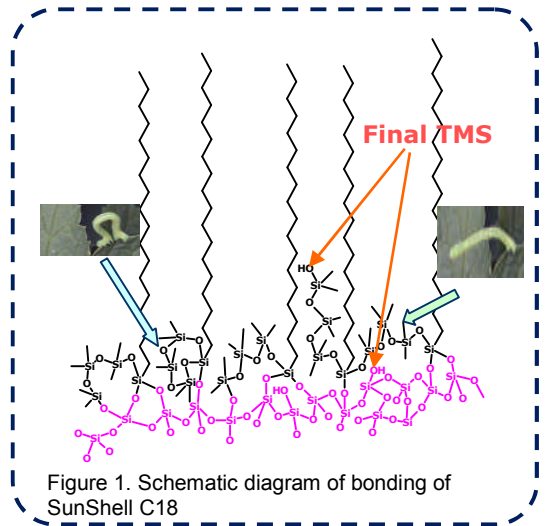


# The next generation to Core Shell particle

## Superficially porous silica

### Features of SunShell

- \*1.6 μm of core and 0.5 μm of superficially porous silica layer
- \*Same efficiency and high throughput as a Sub 2μm particle
- \*Same pressure as a 3 μm particle (less than a half then a sub 2μm particle)
- \*Same chemistry as Sunniest technology (reference figure 1)
- \*Good peak shape for all compounds such as basic, acidic and chelating compounds
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- \* Low breeding

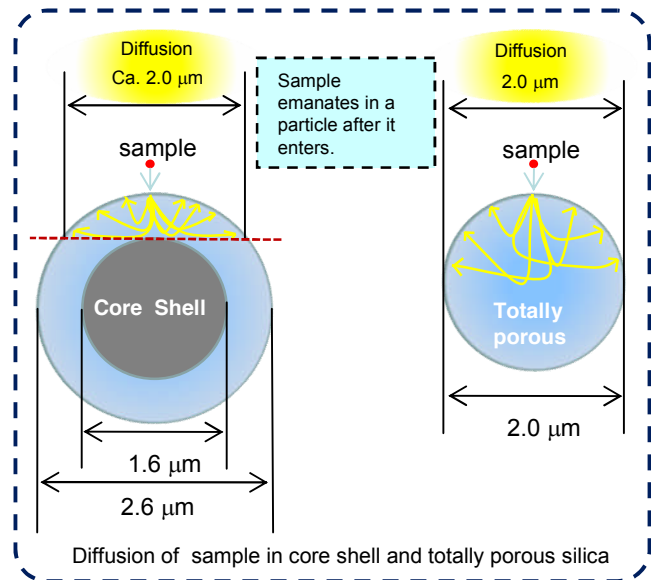
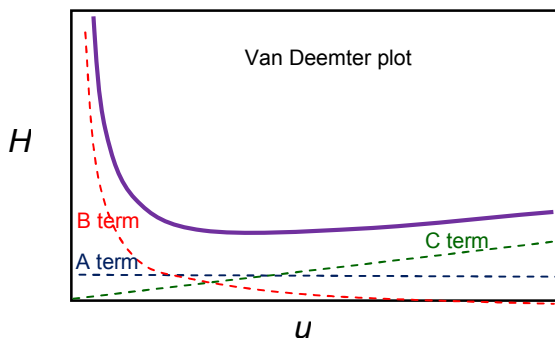


### Why does a 2.6 μm core shell particle show the same performance as a sub 2 mm particle?

Van Deemter Equation

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

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



### 2.6 μm of Core shell particle

A term decreases ← Narrow particle size distribution

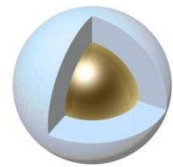
A of  $Ad_p$  decreases as  $d_p$  is same and both are 2.6 μm.

B term decreases } ← Thin porous layer

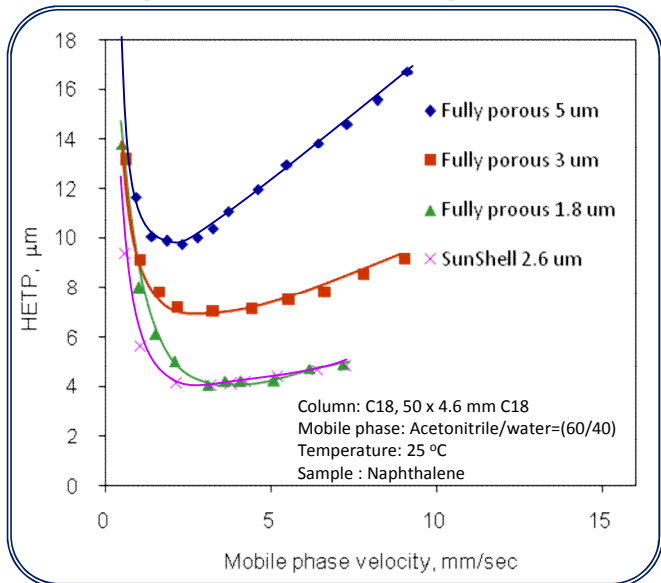
C term decreases }

Mass transfer distance becomes short, and diffusion width becomes narrow on one particle as shown in the above.

to compare with 2.6 μm of fully porous particle

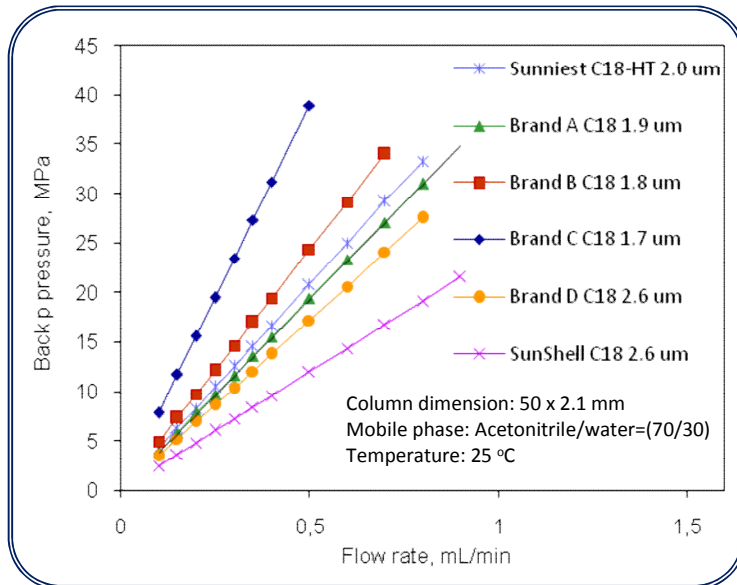


### Comparison of Plate Height Plots

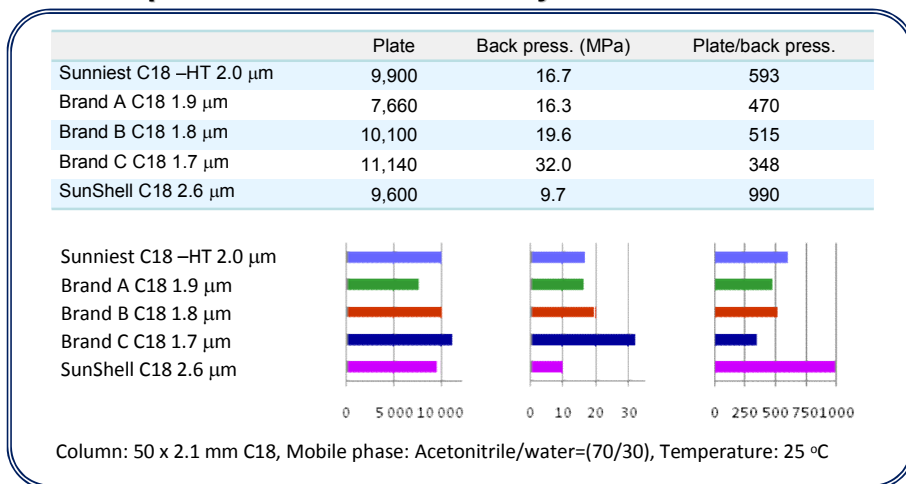


SunShell C18 shows the same efficiency as sub 2 μm C18. Furthermore back pressure of SunShell C18 is less than a half to compare with sub 2 μm C18

### Comparison of Back Pressure for High Throughput Columns

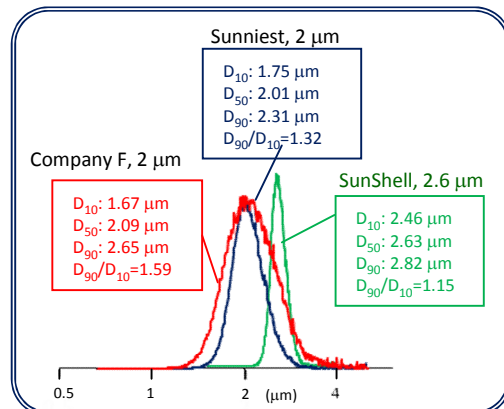


### Comparison of Performance by Plate/Pressure



Under a constant backpressure condition, SunShell C18 shows more than 2 times higher performance to compare with totally porous C18s.

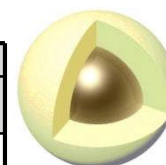
### Comparison of Particle Size Distribution



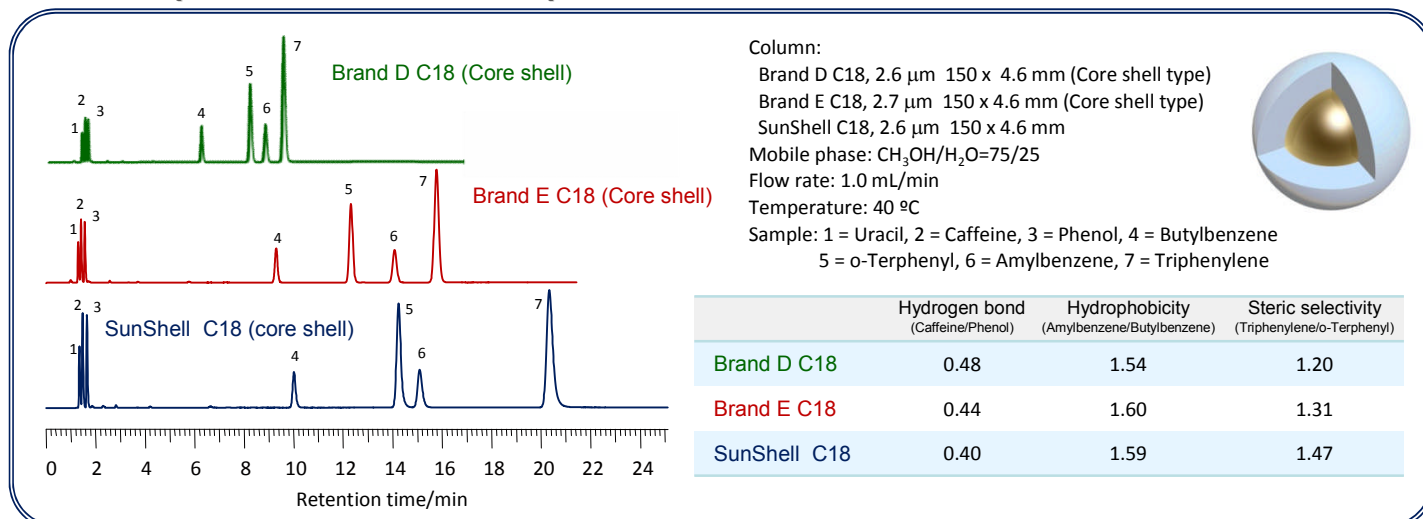
SunShell shows the narrowest particle size distribution. D90/D10 value is applied to evaluate particle size distribution. D90/D10 of SunShell is 1.15 and extremely low.

## □ Characteristics of SunShell C18

|              | Core shell silica  |                    |   | C18                |              |                            |                    |
|--------------|--------------------|--------------------|---|--------------------|--------------|----------------------------|--------------------|
|              | Particle size (mm) | Pore diameter (nm) | Specific surface area (m <sup>2</sup> /g) | Carbon content (%) | Bonded phase | Maximum operating pressure | Available pH range |
| SunShell C18 | 2.6                | 9                  | 150                                       | 7                  | C18          | 60 MPa or 8,570 psi        | 1.5 - 10           |

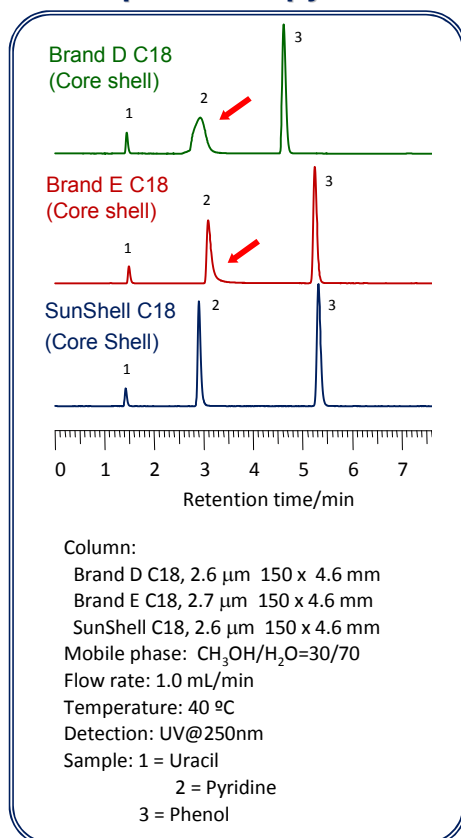


## □ Comparison of standard samples between core shell C18s



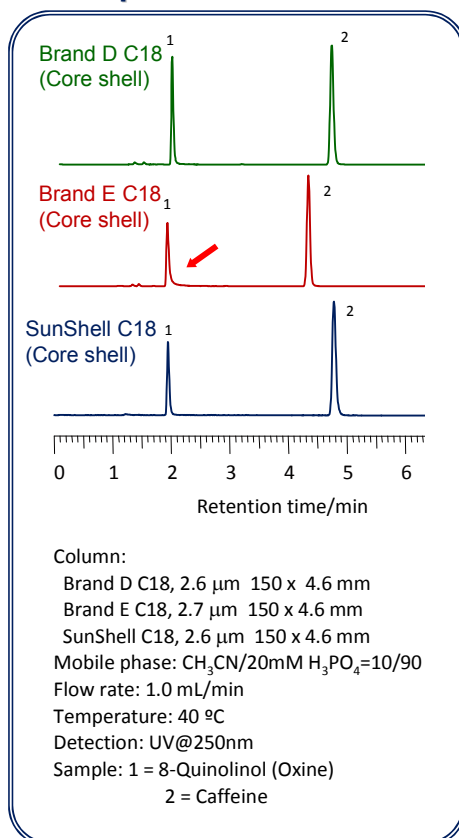
Retention of standard samples was compared for three kinds of core shell type C18. Brand D C18 showed only a half retention to compare with SunShell C18. Steric selectivity becomes large when ligand density on the surface is high. SunShell C18 has the largest steric selectivity so that it has the highest ligand density. This leads the longest retention time.

### Comparison of pyridine



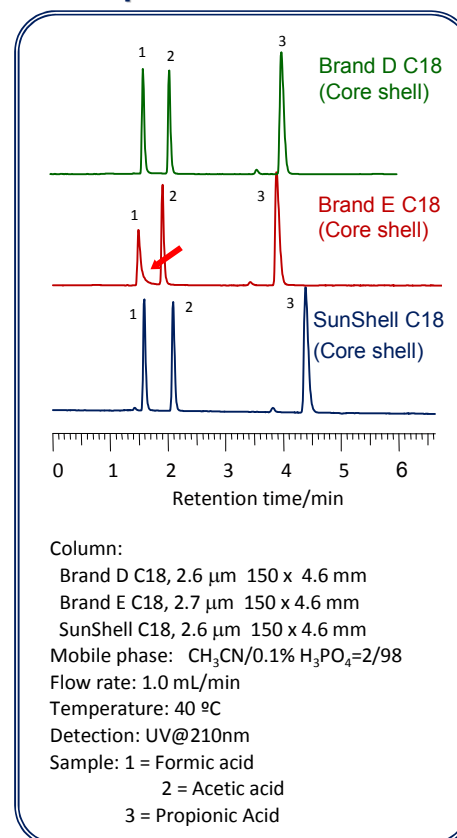
Residual silanol groups make pyridine be tailing under methanol/water mobile phase condition. Only SunShell C18 shows a sharp peak for pyridine.

### Comparison of Oxine



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



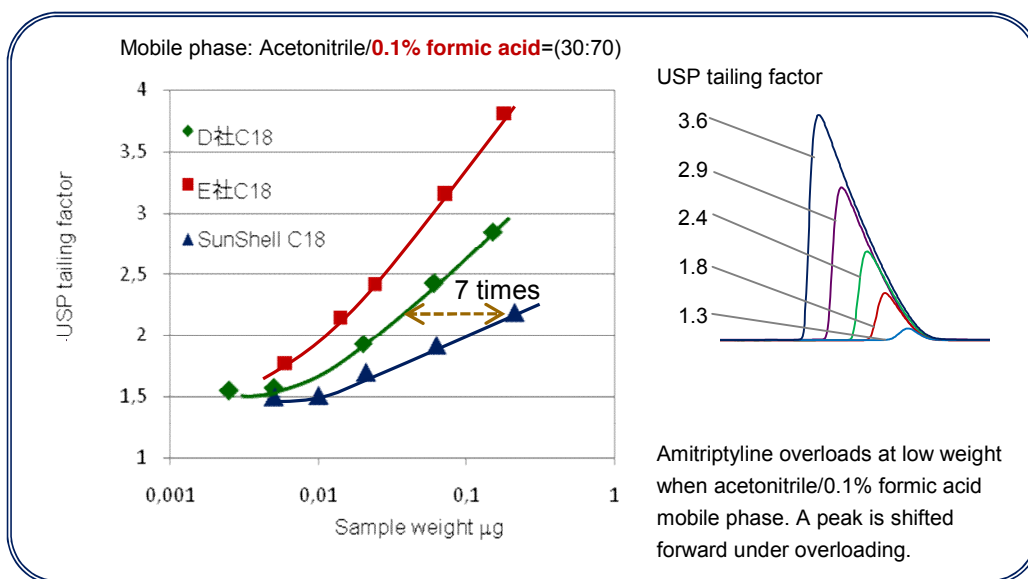
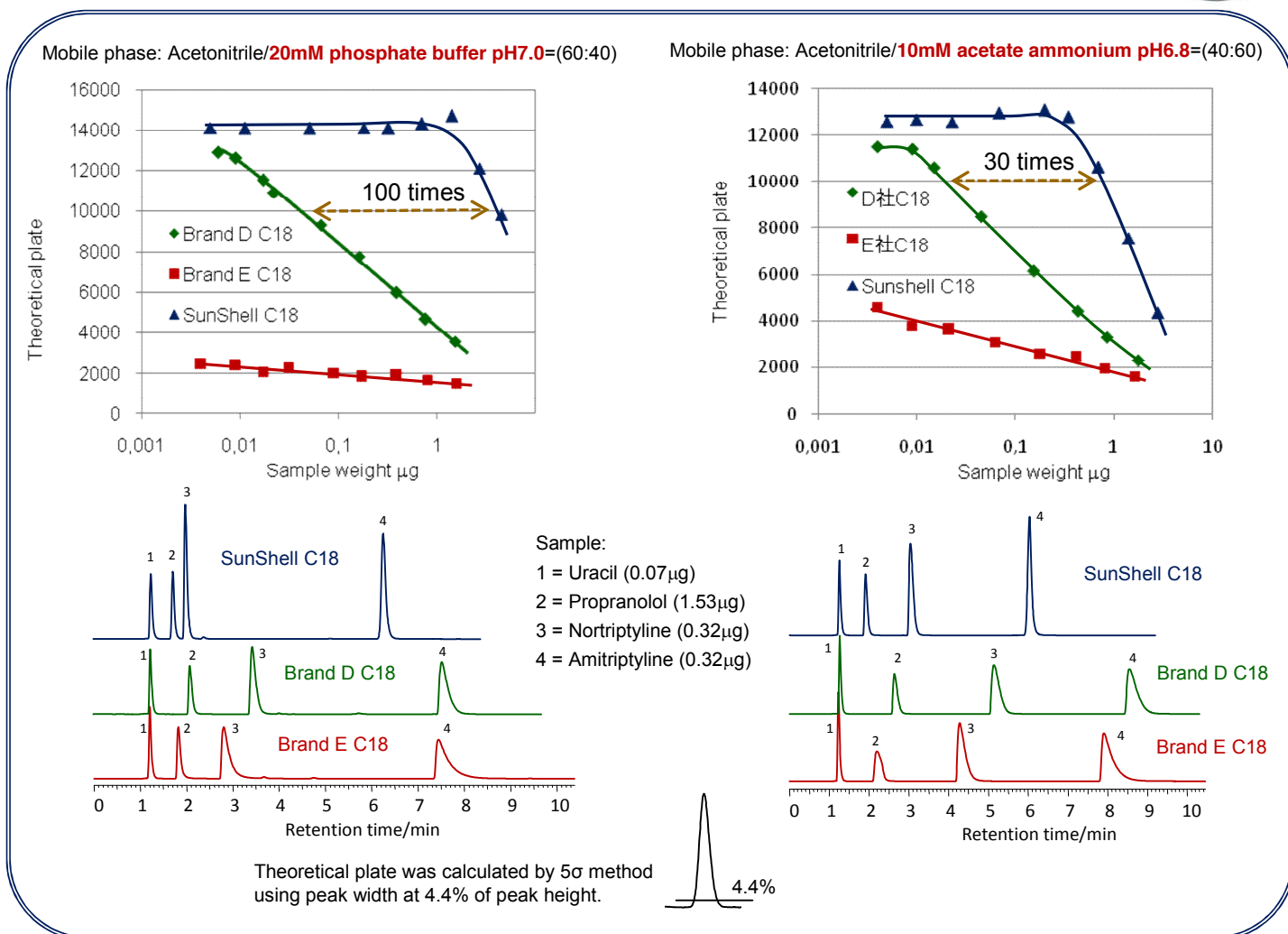
Formic acid is used as an indicator for an acidic inertness. SunShell and brand D C18 show a sharp peak.

## Loading capacity of amitriptyline as a basic compound

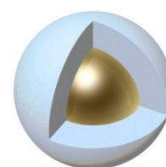
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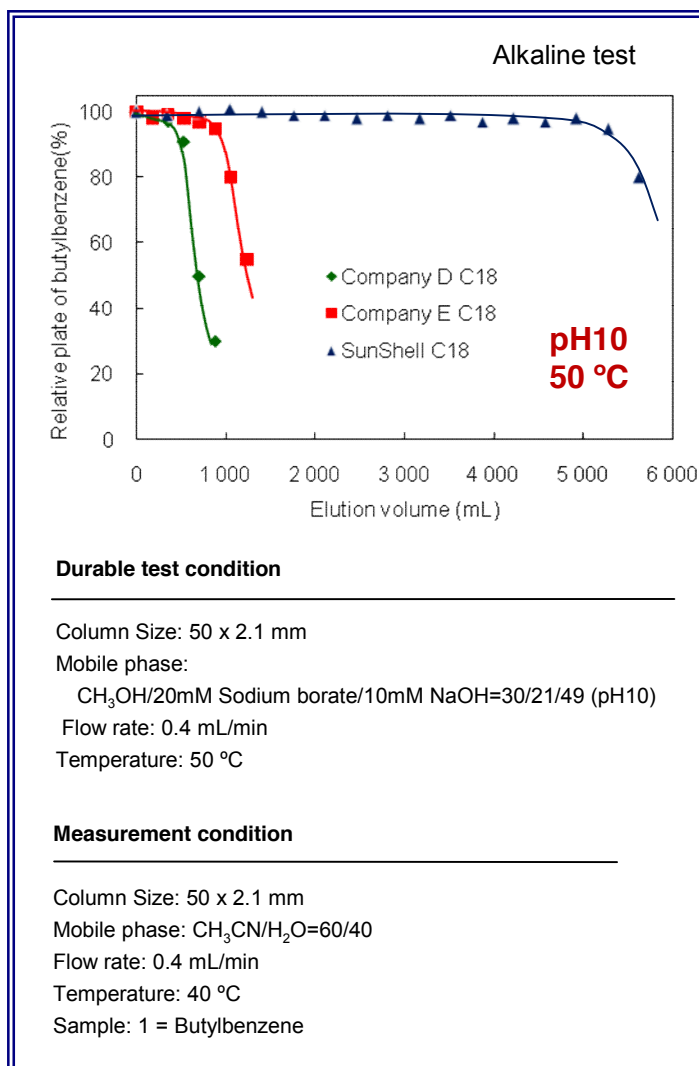
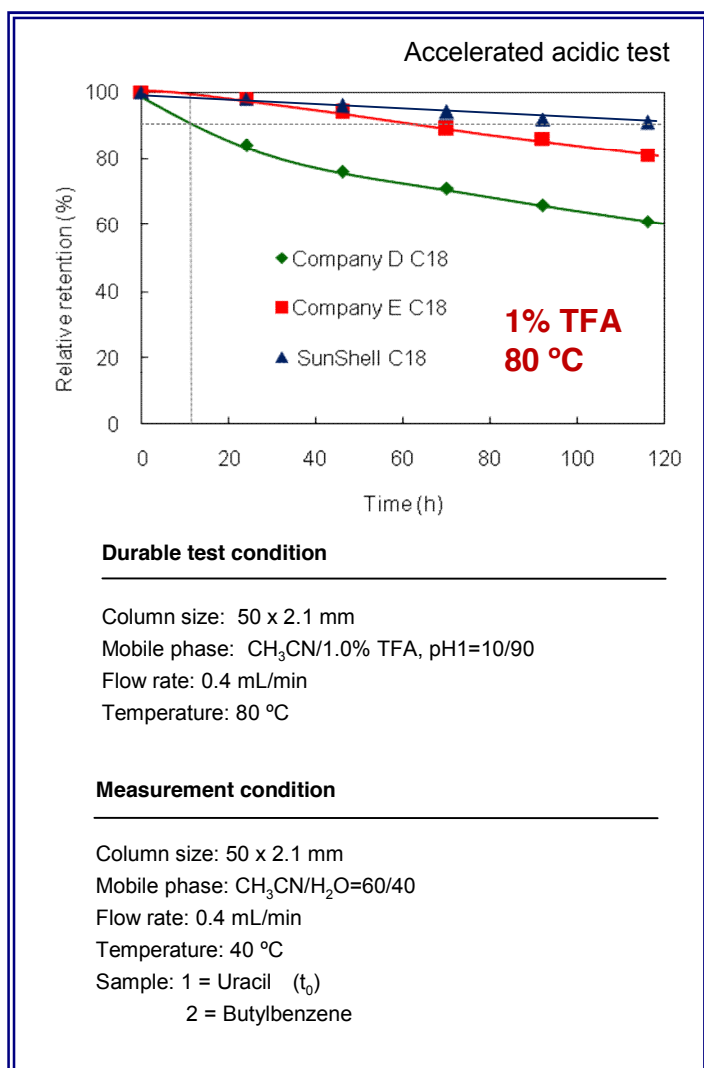
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## □ Evaluation of Stability



Stability under acidic pH condition 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.<sup>1-3)</sup>

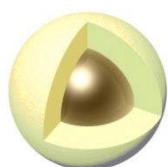
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Elevated temperature of 10 °C makes column life be one third. The other company shows stability test at ambient (room temperature). If room temperature is 25 °C, column life at room temperature (25 °C) is sixteen times longer than that at 50 °C.

□ 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.

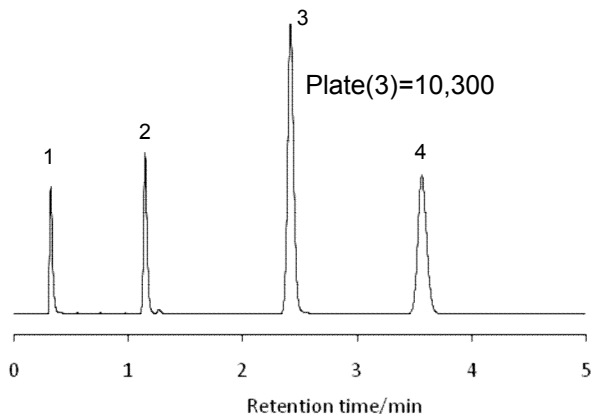
□ SunShell C18 can be used at the pH range from 1.5 to 10.





## Efficiency of SunShell C18

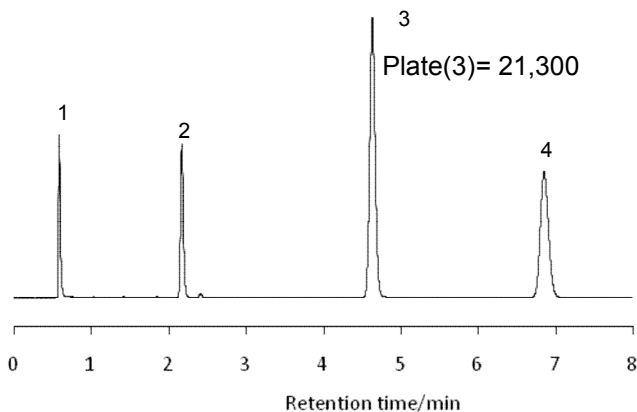
Column dimension: 50 x 2.1 mm



Column: SunShell C18, 2.6  $\mu$ m 50 x 2.1 mm  
 Mobile phase: CH<sub>3</sub>CN/H<sub>2</sub>O=60/40  
 Flow rate: 0.3 mL/min  
 Pressure: 7 MPa  
 Temperature: 23 °C

**Low Backpressure**

Column dimension: 100 x 2.1 mm

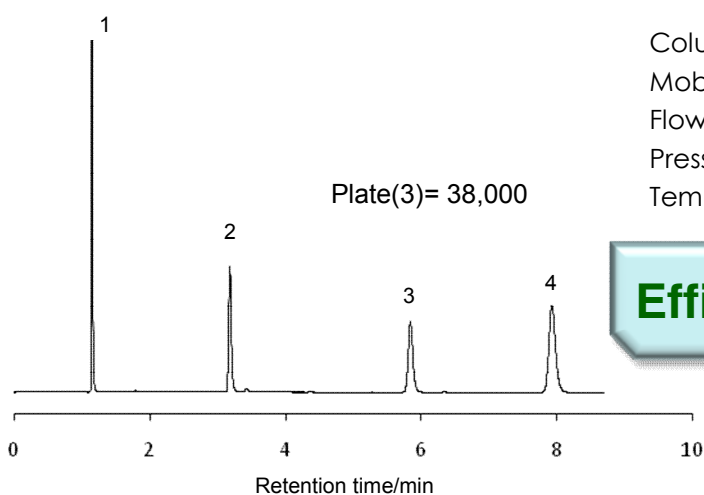


Column: SunShell C18, 2.6  $\mu$ m 100 x 2.1 mm  
 Mobile phase: CH<sub>3</sub>CN/H<sub>2</sub>O=60/40  
 Flow rate: 0.3 mL/min  
 Pressure: 12.5 MPa  
 Temperature: 25 °C

**Sub 2  $\mu$ m Efficiency**

Sample: 1 = Uracil  
 2 = Toluene  
 3 = Acenaphthene  
 4 = Butylbenzene

Column dimension: 150 x 4.6 mm



Column: SunShell C18, 2.6  $\mu$ m 150 x 4.6 mm  
 Mobile phase: CH<sub>3</sub>CN/H<sub>2</sub>O=70/30  
 Flow rate: 1.0 mL/min  
 Pressure: 11.5 MPa  
 Temperature: 25 °C

**Efficiency=253,000 plate/m**

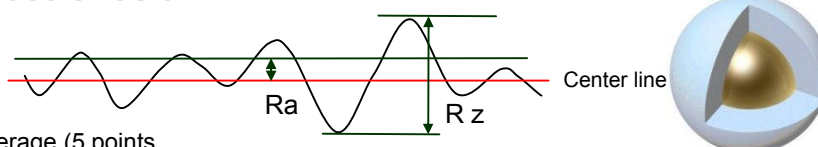


## • Surface Roughness on Inner Surface of Column

### Parameter of surface roughness

Ra: Average roughness from center line

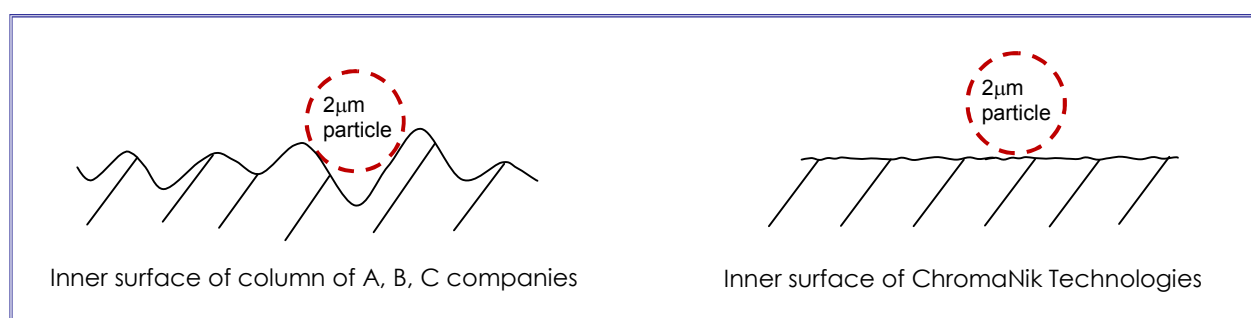
Rz: Roughness calculated from 10 points average (5 points of maximum and 5 points of minimum)



Schematic diagram of surface roughness

|    | G company          | Y company          | S1 company         | S2 company         | W company          | ChromaNik Technologies |
|----|--------------------|--------------------|--------------------|--------------------|--------------------|------------------------|
| Ra | 0.34 $\mu\text{m}$ | 0.32 $\mu\text{m}$ | 0.37 $\mu\text{m}$ | 0.03 $\mu\text{m}$ | 0.20 $\mu\text{m}$ | 0.01 $\mu\text{m}$     |
| Rz | 1.88 $\mu\text{m}$ | 1.62 $\mu\text{m}$ | 1.91 $\mu\text{m}$ | 0.19 $\mu\text{m}$ | 0.90 $\mu\text{m}$ | 0.10 $\mu\text{m}$     |

It is considered that surface roughness affects column performance. Surface asperity of ChromaNik Technologies column with 2.1 mm i.d. and 3.0 mm i.d. is 1/30 to 1/20 to compare with that of GL Sciences, YMC, Shimadzu and Waters columns. ChromaNik Technologies provides a column with very smooth surface which is the most suitable for 2.6  $\mu\text{m}$  core shell particle packing.



### Ordering information of SunSell C18

| Inner diameter(mm) | 2.1            | 3.0            | 4.6            |
|--------------------|----------------|----------------|----------------|
| Length (mm)        | Catalog number | Catalog number | Catalog number |
| 20                 | CB6921         | CB6321         | CB6421         |
| 30                 | CB6931         | CB6331         | CB6431         |
| 50                 | CB6941         | CB6341         | CB6441         |
| 75                 | CB6951         | CB6351         | CB6451         |
| 100                | CB6961         | CB6361         | CB6461         |
| 150                | CB6971         | CB6371         | CB6471         |

### Local Dealer:

## Next phases, C8, PFP and HILIC-Amide

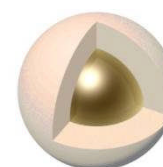
Coming soon



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