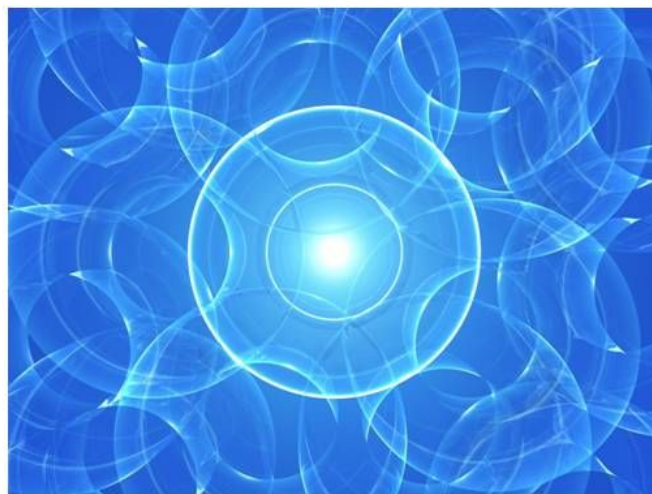




HPLC column

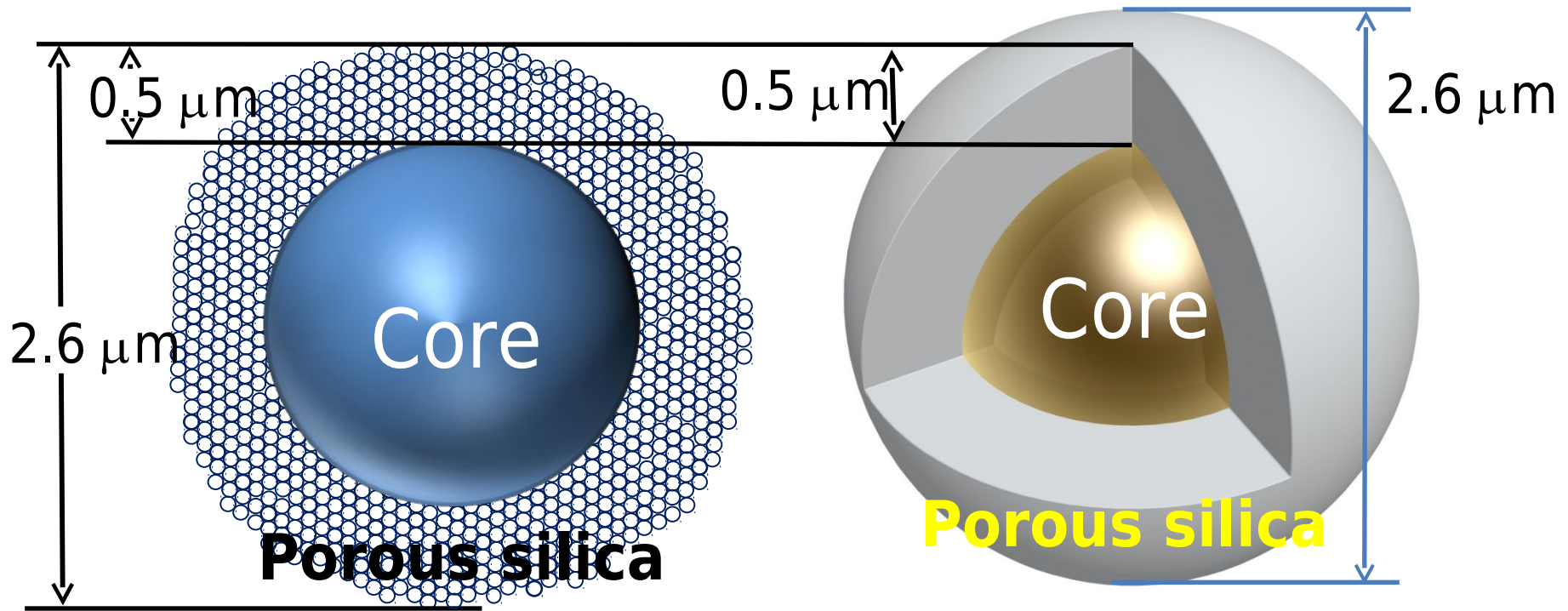
SunShell



Core Shell Particle



Schematic Diagram of Core Shell silica

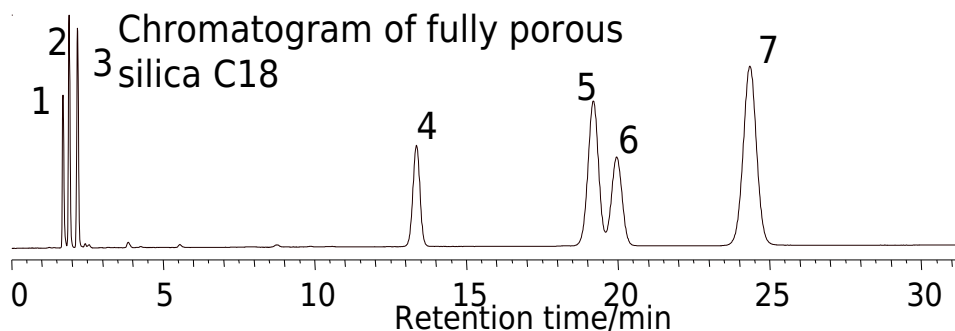


Particle diameter: $2.6 \mu\text{m}$, Core diameter: $1.6 \mu\text{m}$, Thickness of porous silica: $0.5 \mu\text{m}$

Pore volume: 0.30mL/g , Specific surface area: $150 \text{ m}^2/\text{g}$, Pore diameter: 9 nm
The ratio of porous silica volume: 77%

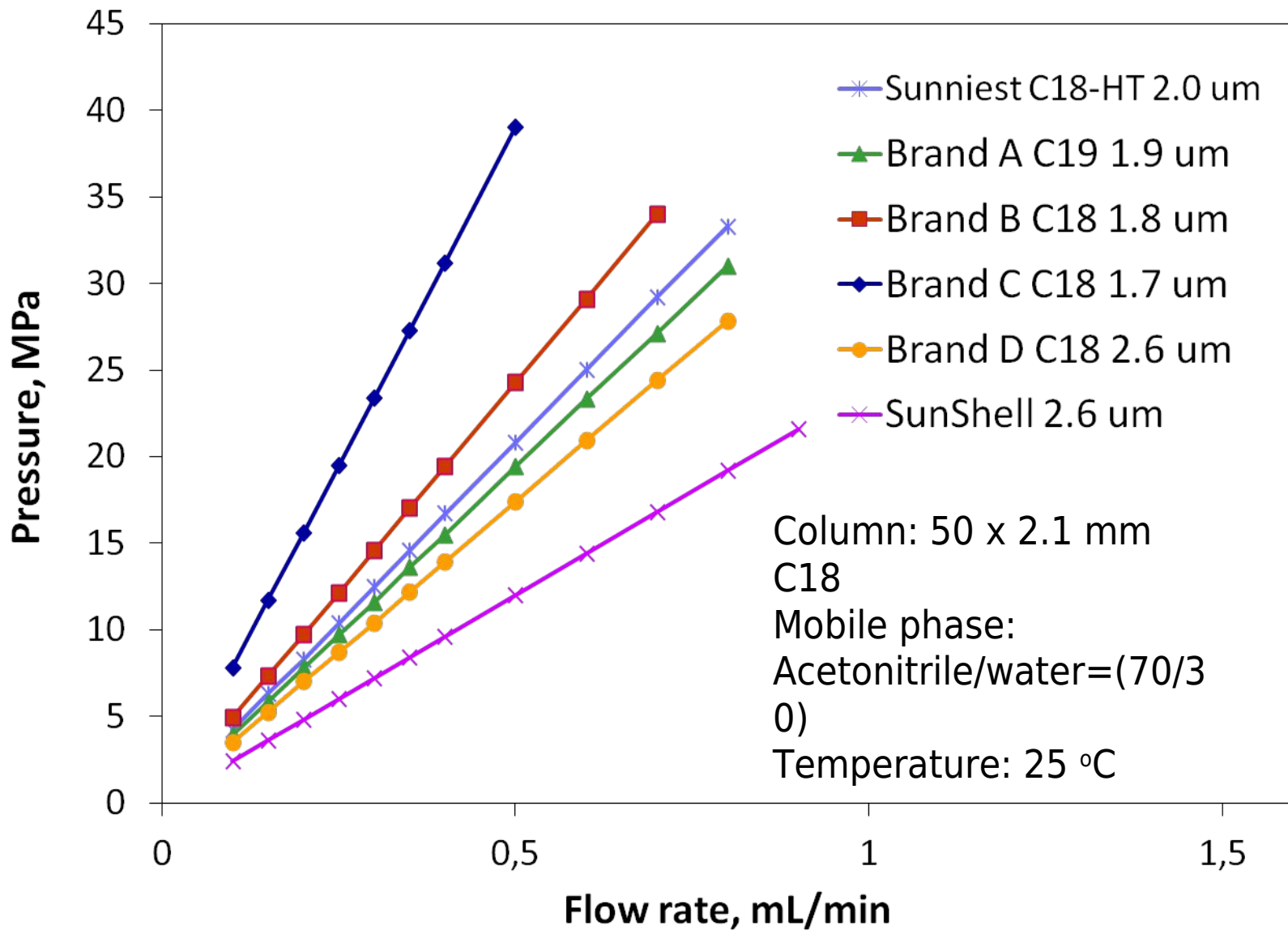
Comparison of retention between fully porous silica C18 and core shell silica

	Fully porous silica C18 Sunniest C18 5 μm		Core shell silica C18 SunShell C18 2.6 μm		Core shell silica C18 Brand D C18 2.6 μm	
	Retention time (t_R)	Retention factor (k)	Retention time (t_R)	Retention factor (k)	Retention time (t_R)	Retention factor (k)
1 = Uracil	1.70	0	1.35	0	1.36	0
2 = Caffeine	1.90	0.12	1.47	0.09	1.49	0.10
3 = Phenol	2.17	0.28	1.65	0.22	1.61	0.18
4 = Butylbenzene	13.35	6.85	10.01	6.41	6.19	3.55
5 = o-Terphenyl	19.19	10.29	14.24	9.55	8.15	4.99
6 = Amylbenzene	19.96	10.74	15.09	10.18	8.75	5.43
7 = Triphenylene	24.35	13.32	20.33	14.06	9.44	5.94

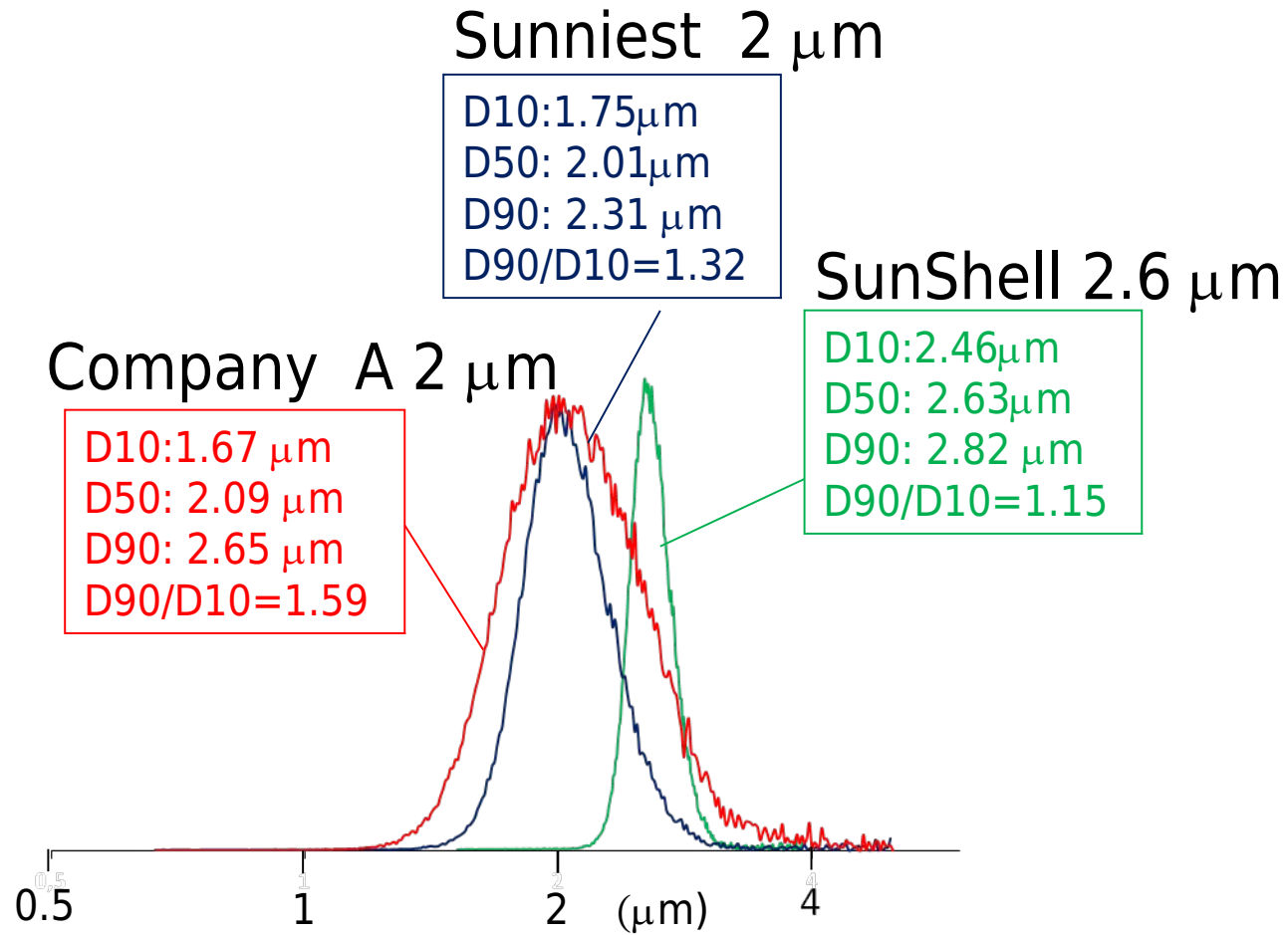


Mobile phase: Methanol/water(75:25)
 Temperature: 40°C
 Column dimension: 150 x 4.6 mm
 Flow rate: 1.0 mL/min

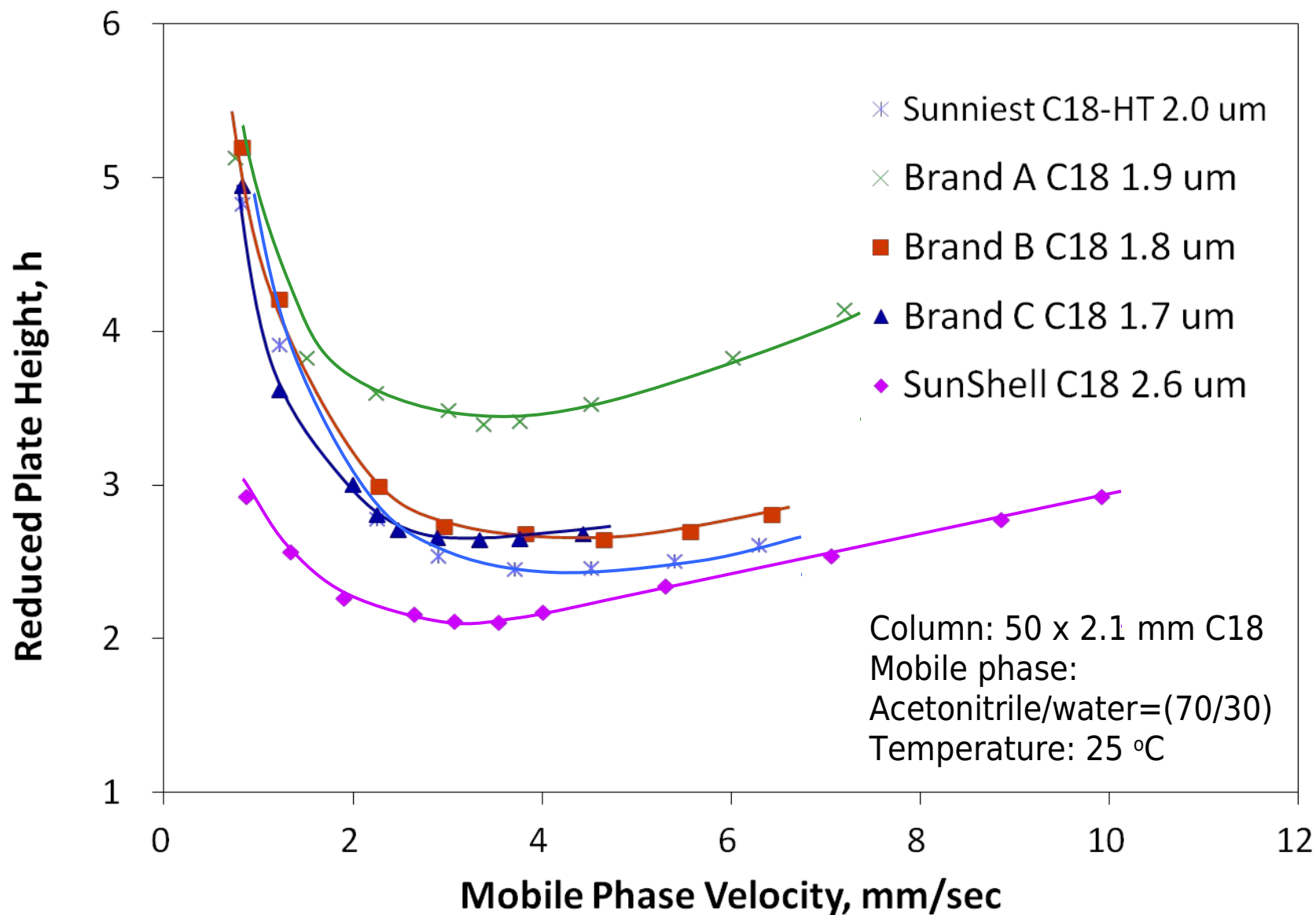
Comparison of Back Pressure for High Through Put Columns



Comparison of Particle Size Distribution

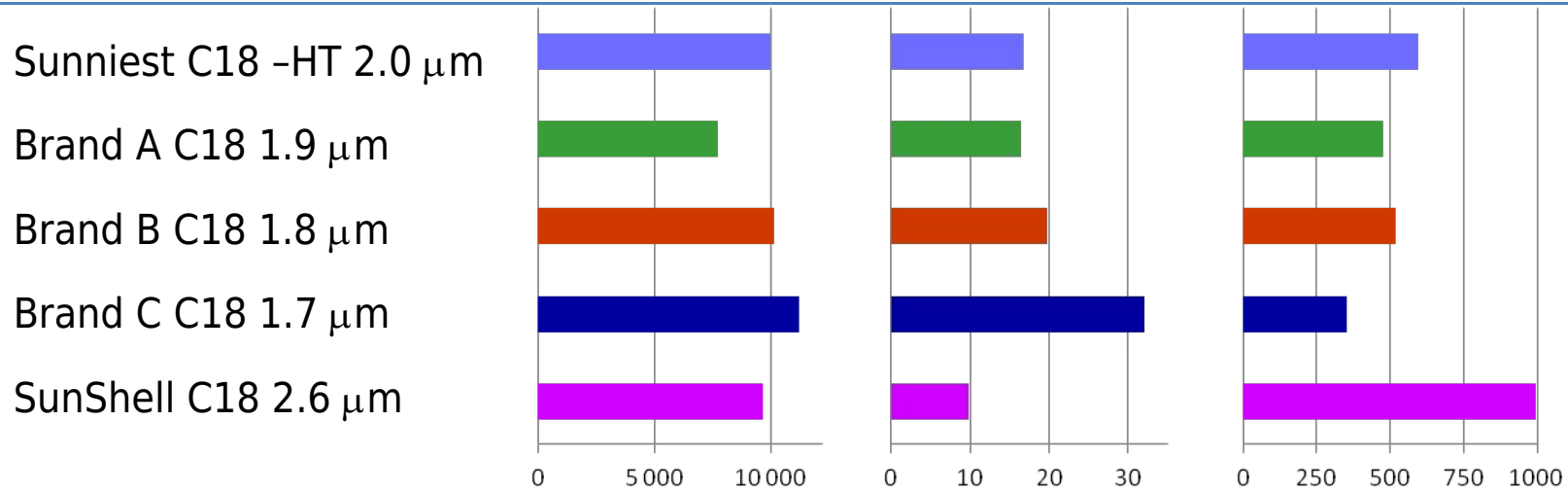


Comparison of Reduced Plate Height Plots



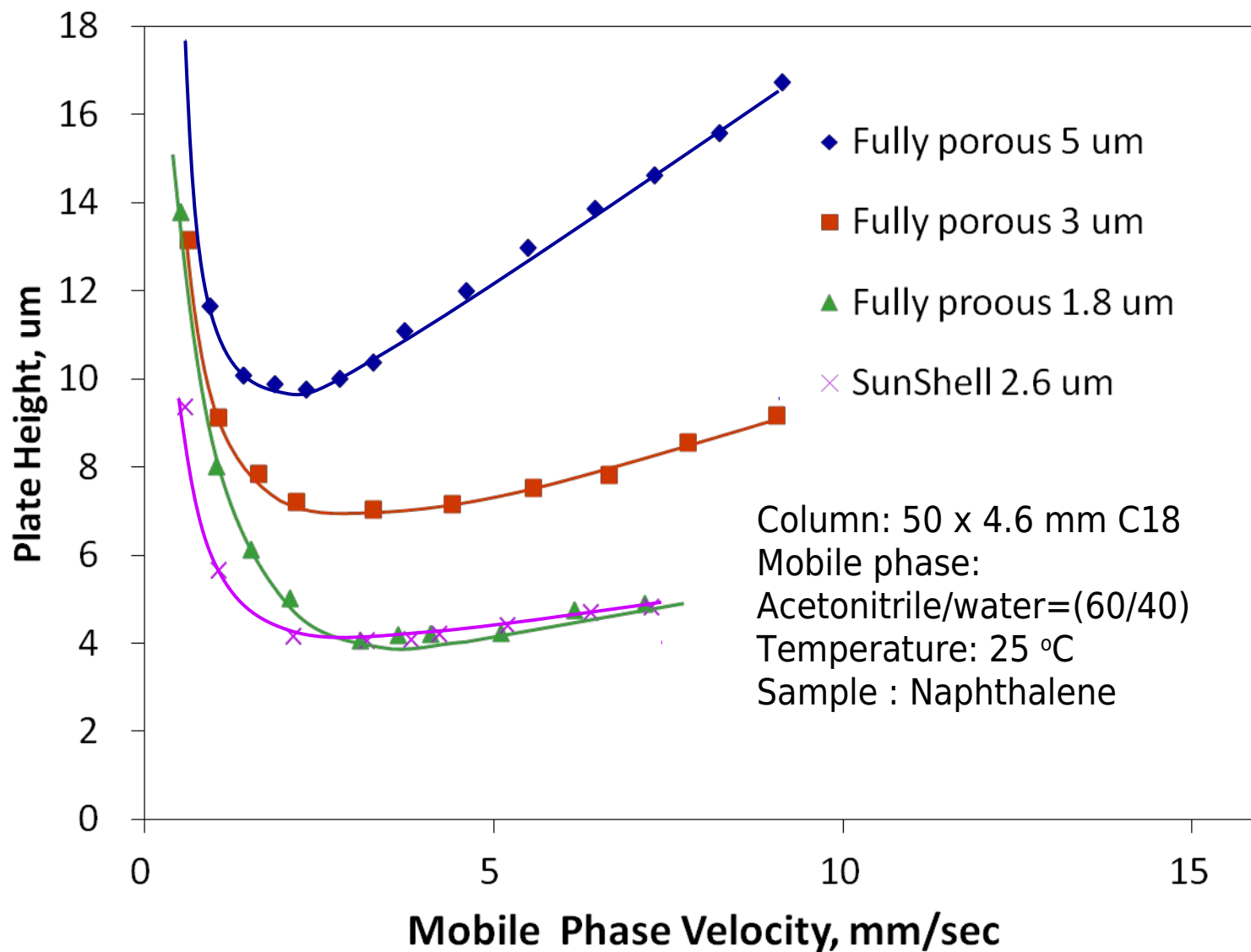
Comparison of Performance by Plates/Pressure

	Plates	Pressure(MPa)	Plates/pressure
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

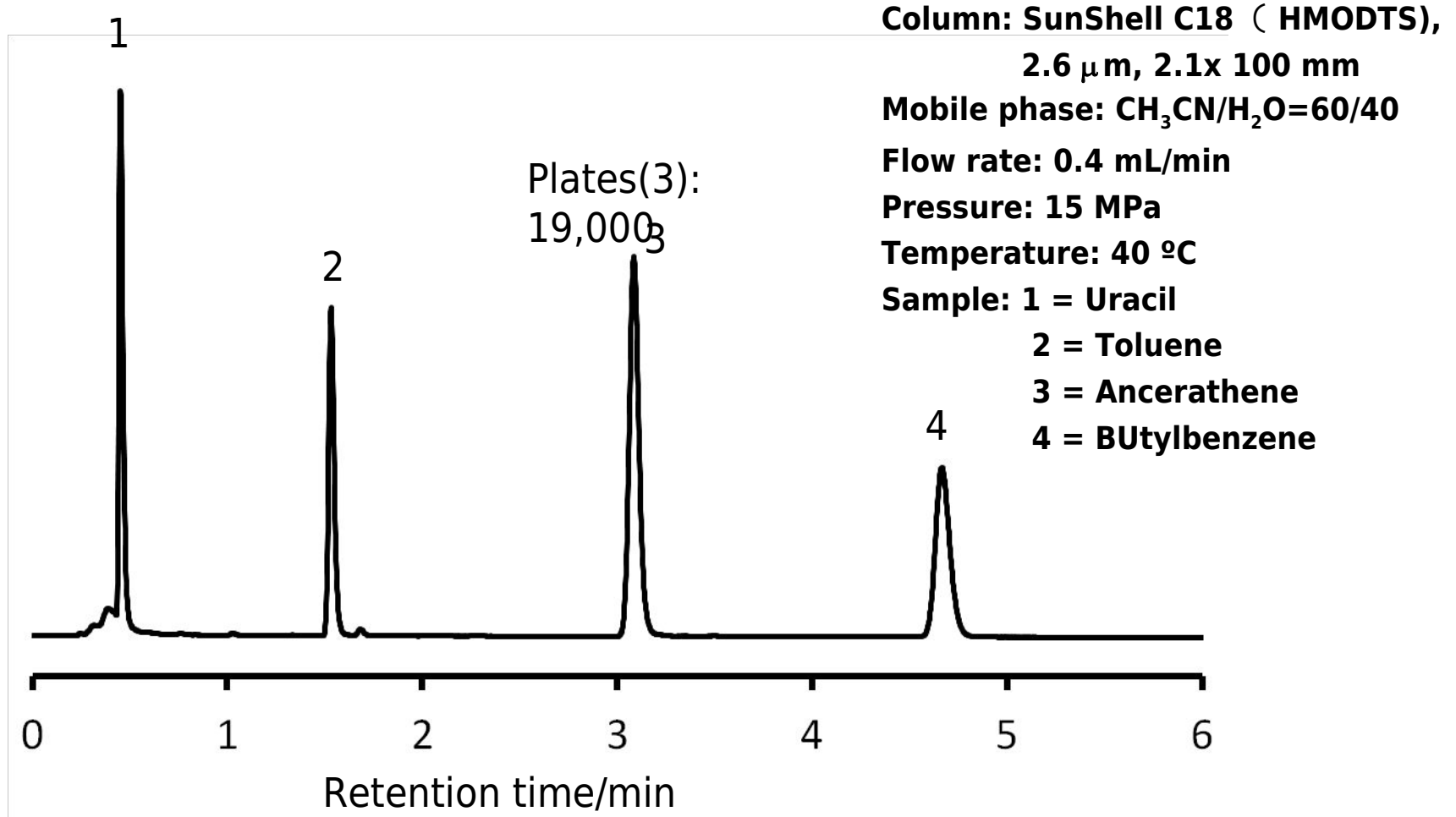


Column: 50 x 2.1 mm C18, Mobile phase: Acetonitrile/water=(70/30), Temperature: 25 °C

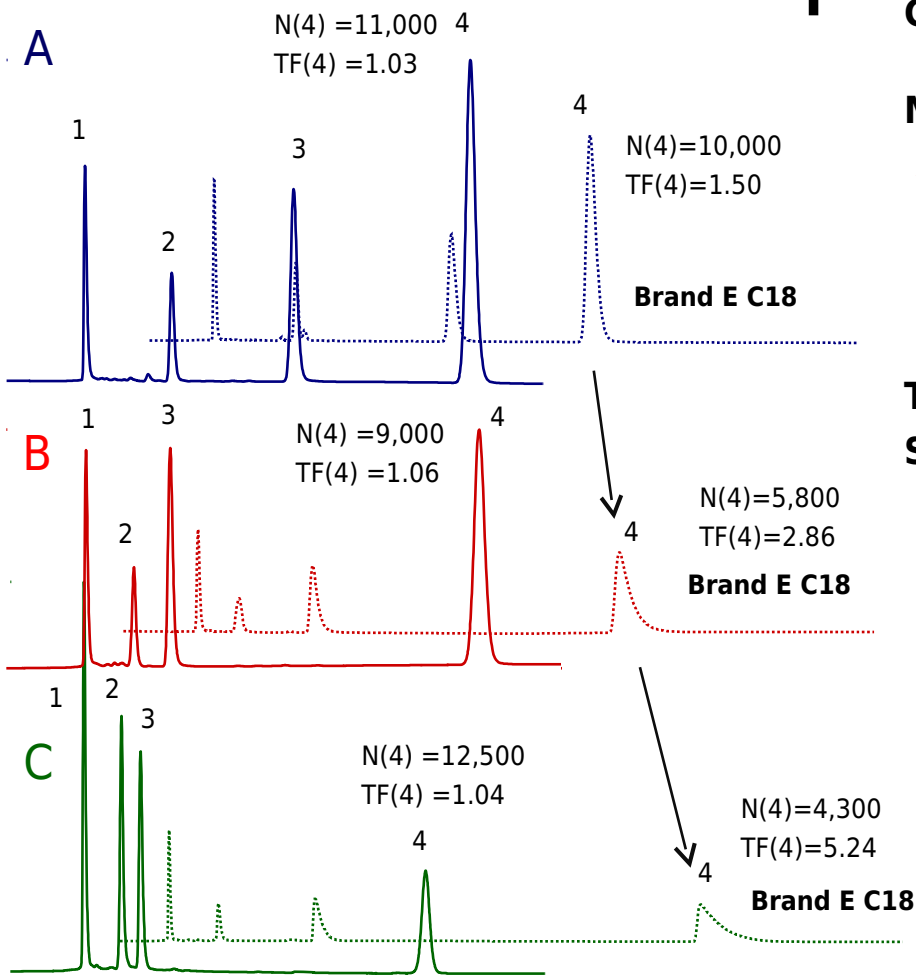
Comparison of Plate Height Plots



Chromatogram of standard samples of SunShell C18



Comparison of basic compounds I



Column: Sunniest C18, 5 μ m 150 x 4.6 mm
 Re: Brand E C18, 5 μ m 150 x 4.6 mm

Mobile phase:

A) CH₃OH/20mM Phosphate buffer pH7.5 = 80/20

B) CH₃OH/20mM Phosphate buffer pH6.0 = 80/20

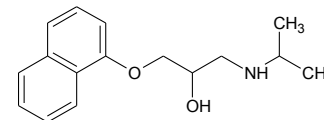
C) CH₃CN/20mM Phosphate buffer pH7.0 = 60/40

Flow rate: 1.0 mL/min

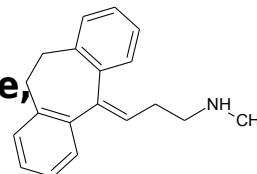
Temperature: 40 °C for **A**, **C** and **D**, 22 °C for **B**

Sample: 1 = Uracil,

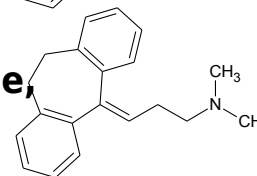
2 = Propranolol,



3 = Nortriptyline,



4 = Amitriptyline,



TF: USP tailing factor

Comparison of basic compounds II

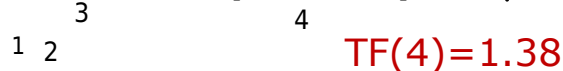
A Sunniest C18 (HMODTS), 5 μm



B Sunniest C18-HT(HMODTS), 2 μm



C SunShell C18(HMODTS), 2.6 μm core shell type



D Brand D C18, 2.6 μm core shell type



E Brand E C18, 5 μm



Column size: 150 x 4.6 mm for A, D and E

100 x 2.1 mm for B and C

Mobile phase:

$\text{CH}_3\text{CN}/20\text{mM}$ Phosphate buffer

0=60/40

Flow rate: 1.0 mL/min for A, D, and E

0.4 mL/min for B and C

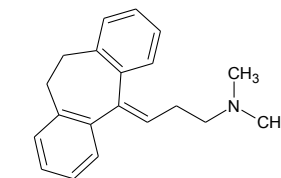
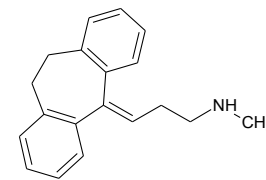
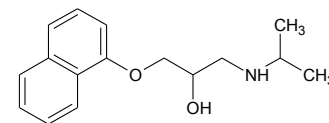
Temperature: 40 $^\circ\text{C}$

Sample: 1 = Uracil

2 = Propranolol

3 = Nortriptyline

4 = Amitriptyline



TF: USP tailing factor

Plate theory 1

Mobile phase 1	Mobile phase 2	Mobile phase 3	Mobile phase 4
Stationary phase 1	Stationary phase 1	Stationary phase 1	Stationary phase 1

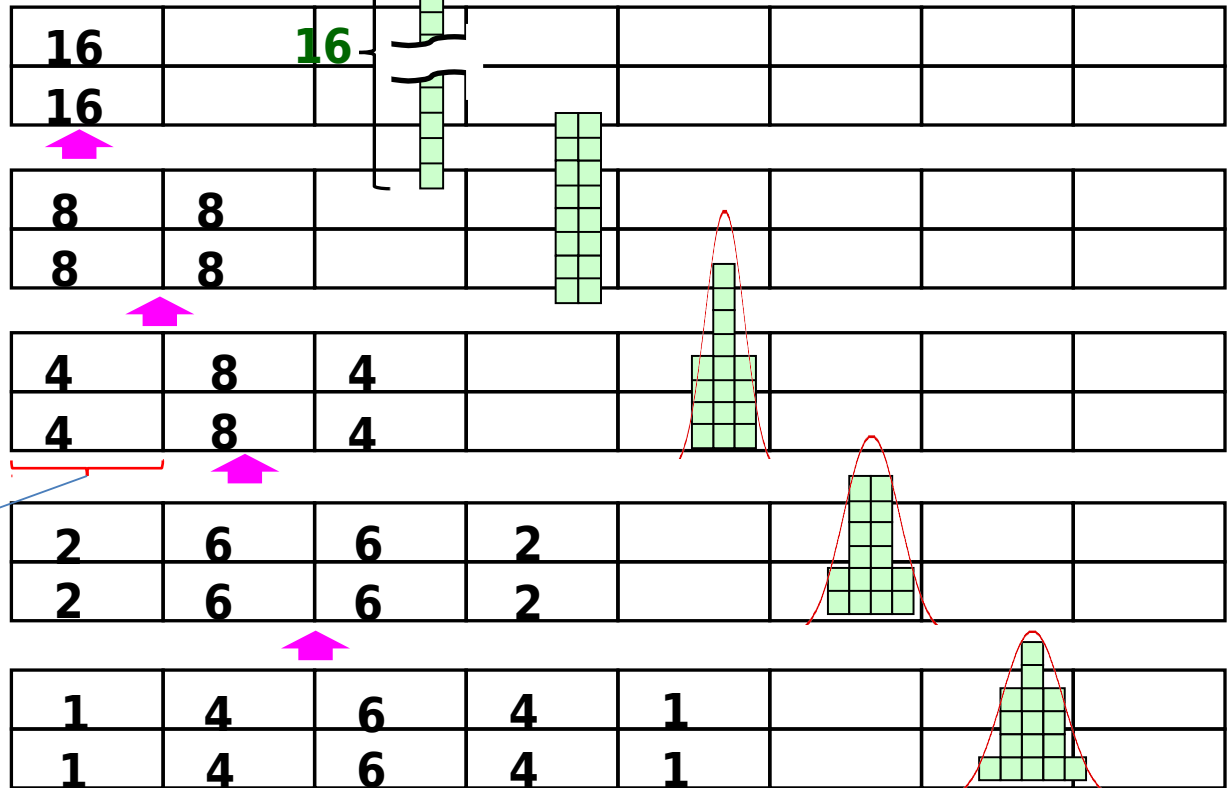


Mobile phase new	Mobile phase 1	Mobile phase 2	Mobile phase 3
Stationary phase 1	Stationary phase 2	Stationary phase 3	Stationary phase 4

Only mobile phase moves.

When partition coefficient is one

Inject 32 μg of sample



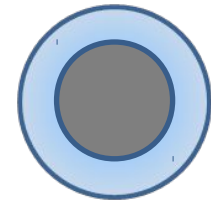
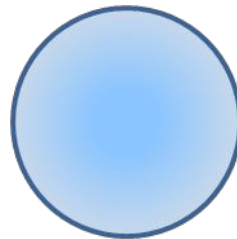
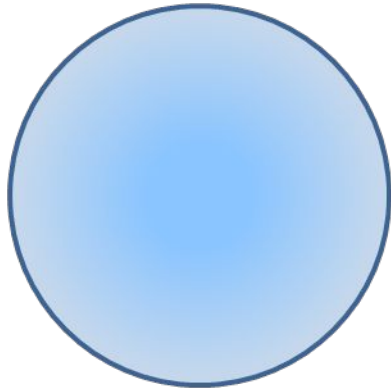
Height equivalent to a theoretical plate (HETP)

Increase of plate number

Need low HETP

$$\text{HETP} \approx 2.2 \times D_p$$

(D_p : Particle diameter)



Particle diameter

5 μm

3 μm

2 μm

2.6 μm

HETP

11.0 μm

6.6 μm

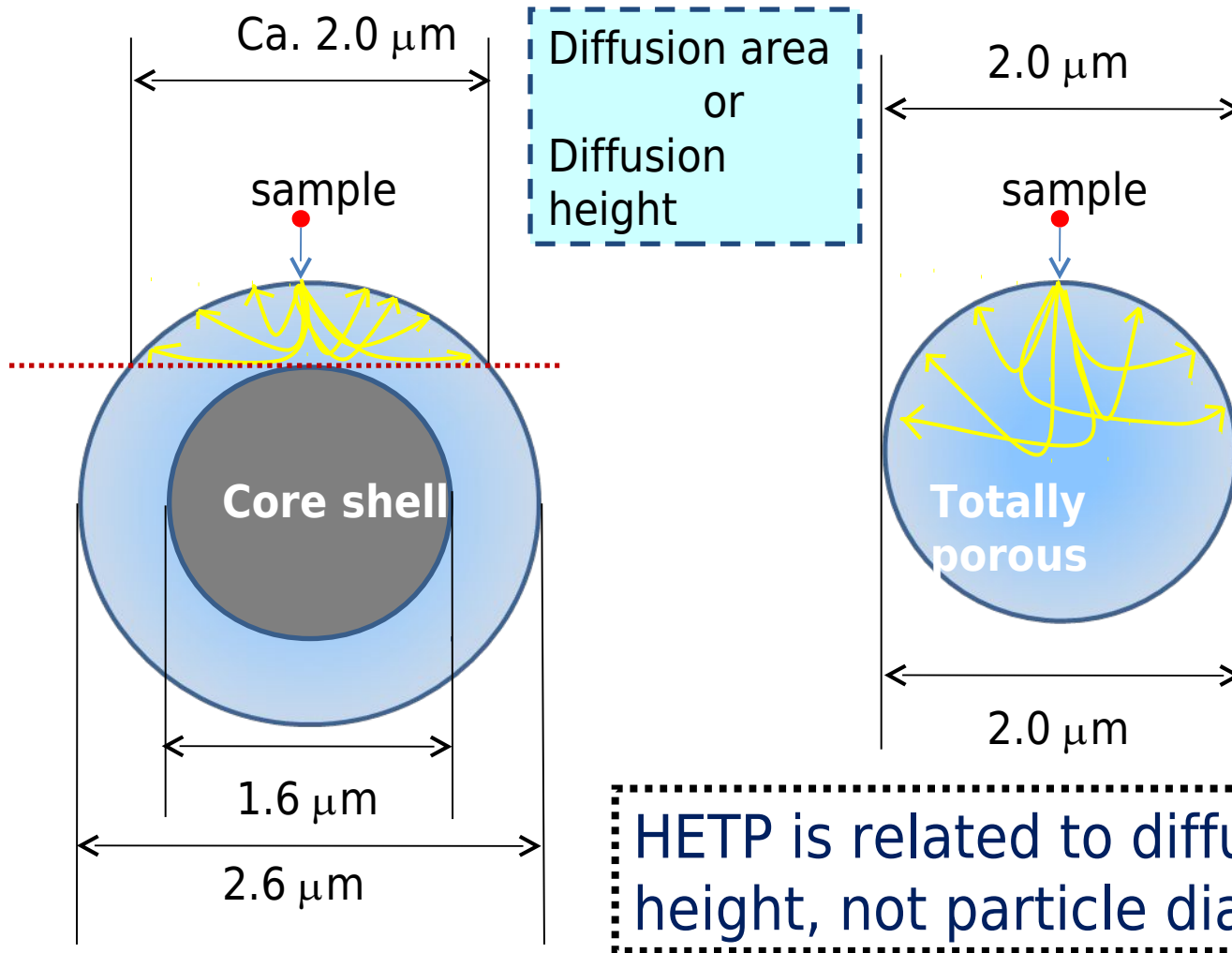
4.4 μm

4.4 μm

The smaller particle diameter, the lower HETP.



Comparison between core shell and totally porous particles



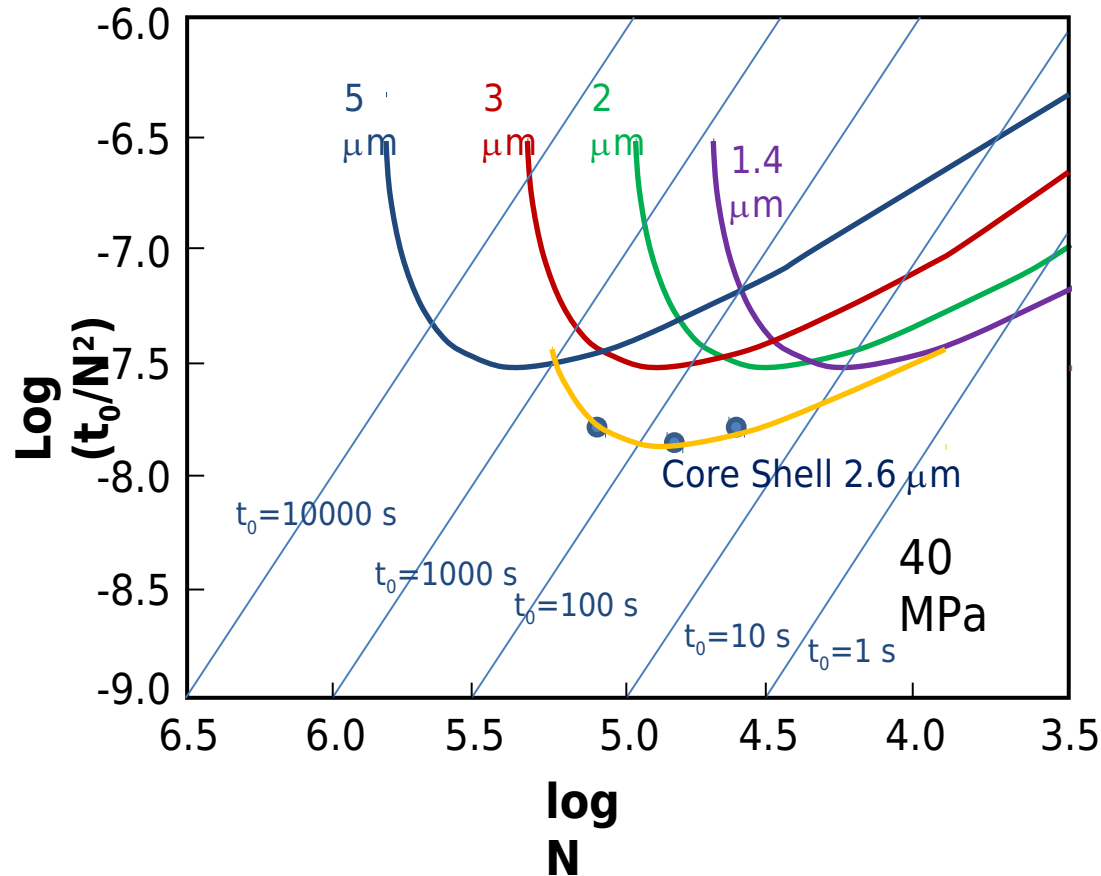
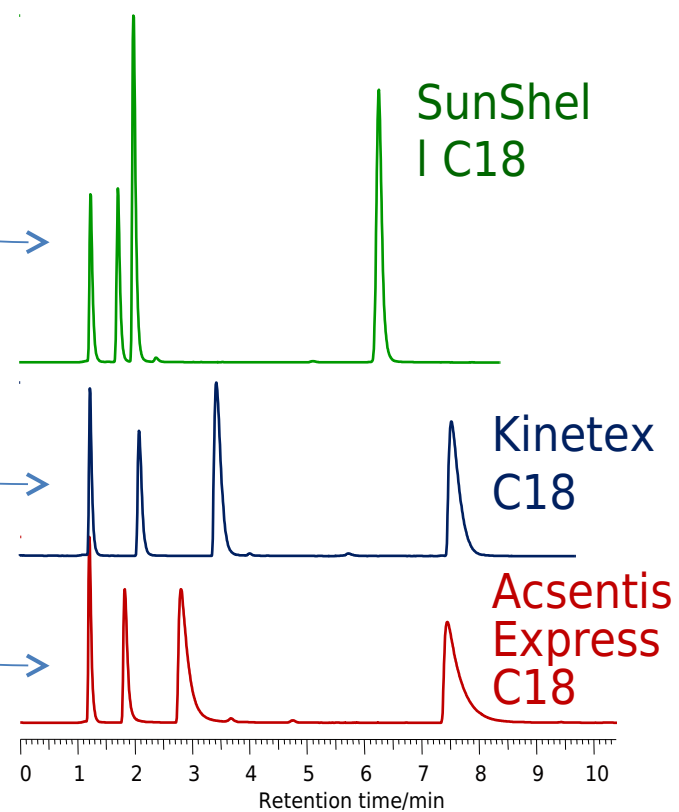
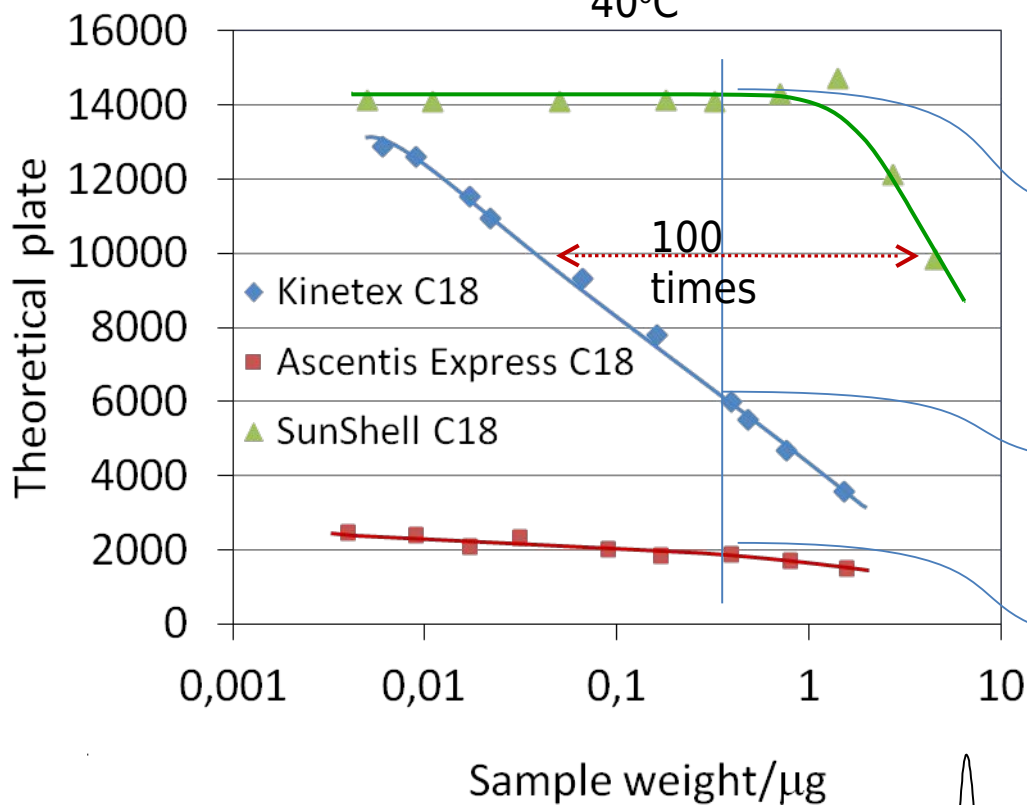


Figure 1. Kinetic plot analysis at 40 MPa.

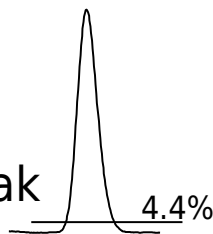
The curves for particulate columns were obtained by assuming $\eta=0.00046 \text{ Pa s}$, $\phi=700$, $Dm=2.22 \times 10^{-9} \text{ m}^2/\text{s}$, Knox equation, $h=0.65\nu^{1/3}+2/\nu+0.08\nu$, Dp , totally porous 1.4, 2.0, 3.0, 5.0 μm , core shell 2.6 μm .

Loading capacity of amitriptyline I

Mobile phase: Acetonitrile/20mM phosphate buffer pH7.0=(60:40)
 Column dimension: 150 x 4.6 mm, Flow rate: 1.0 mL/min, Temp.: 40°C



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

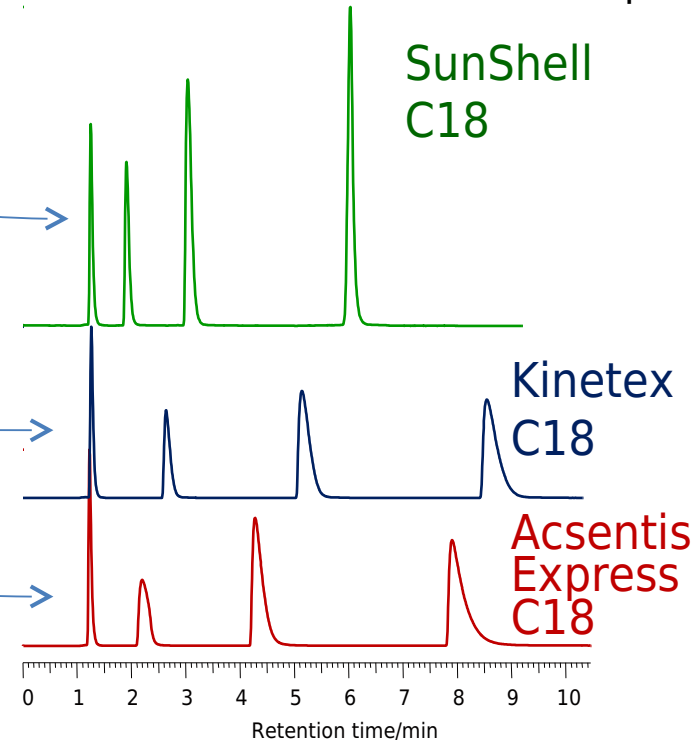
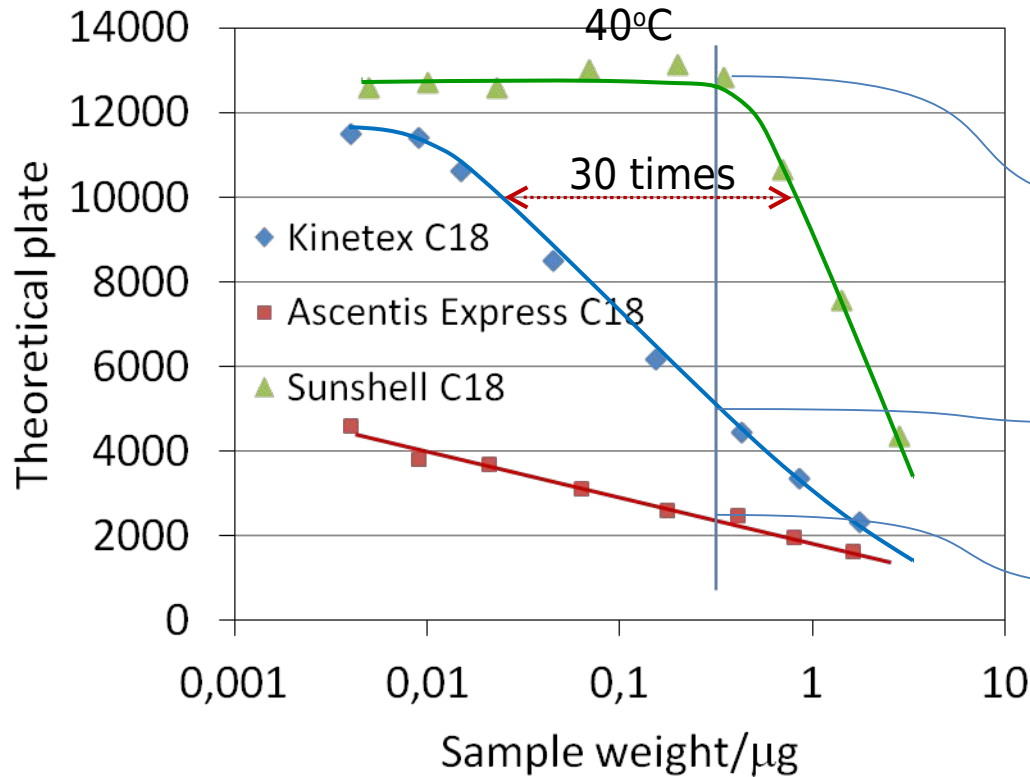


Sample: 1=Uracil,
 2=Propranolol,
 3= Nortriptyline,
 4=Amitriptyline

Loading capacity of amitriptyline II

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

Column dimension: 150 x 4.6 mm, Flow rate: 1.0 mL/min, Temp.:
40°C

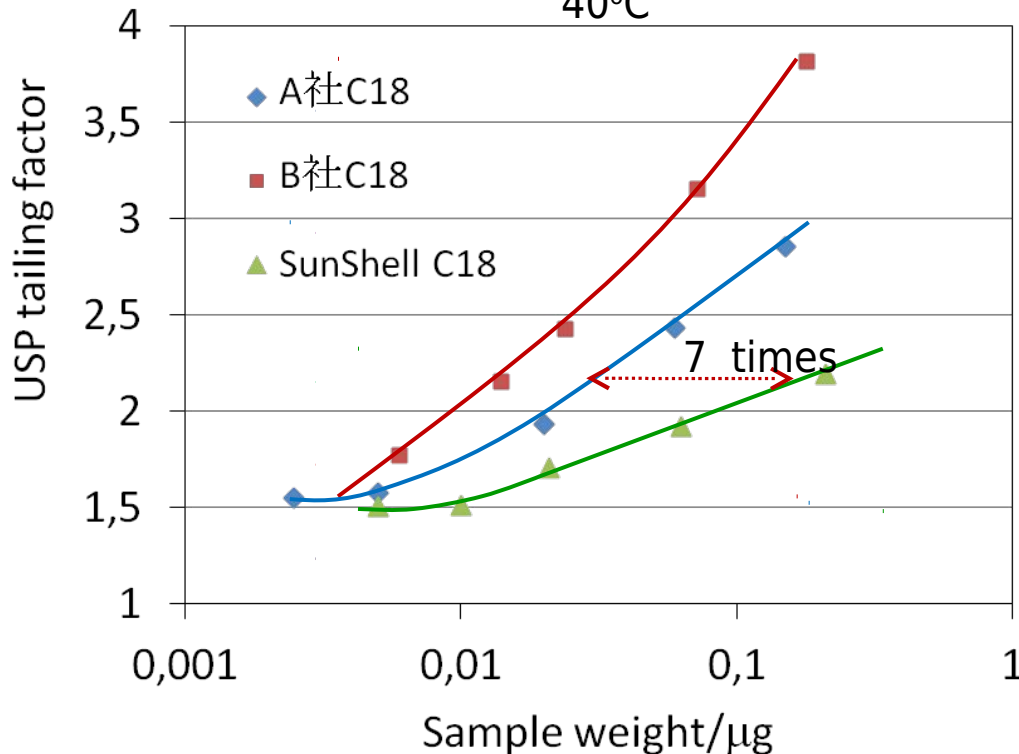


Sample: 1=Uracil,
2=Propranolol,
3= Nortriptyline,
4=Amitriptyline

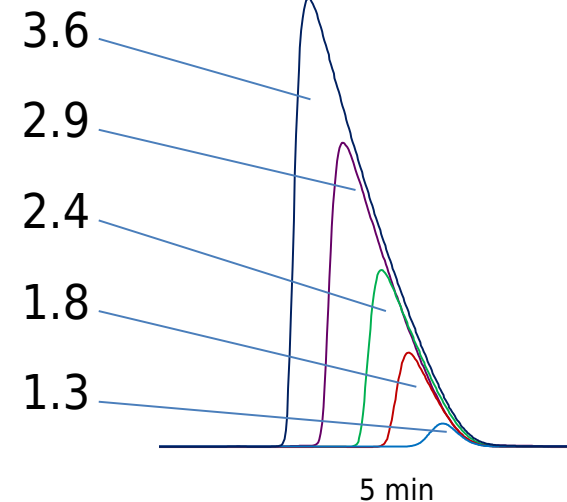
Loading capacity of amitriptyline III

Mobile phase: Acetonitrile/0.1% formic acid=(30:70)

Column dimension: 150 x 4.6 mm, Flow rate: 1.0 mL/min, Temp.: 40°C

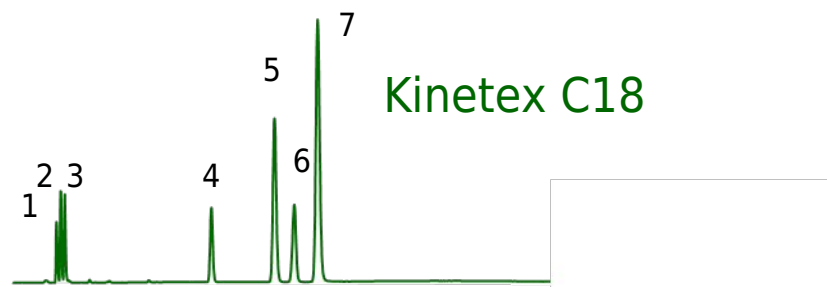


USP Tailing factor

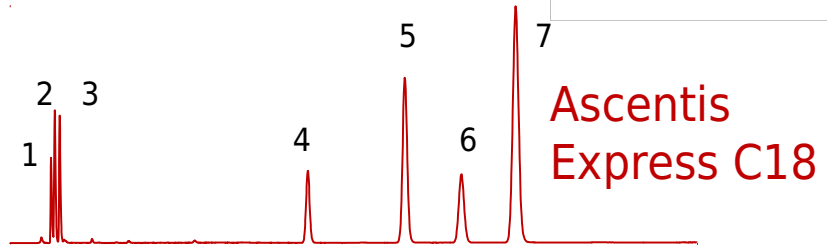


In the case of using acetonitrile /0.1% formic acid as a mobile phase, amitriptyline peak shows more tailing because a loading capacity decreases in an acidic, low-ionic-strength mobile phase.

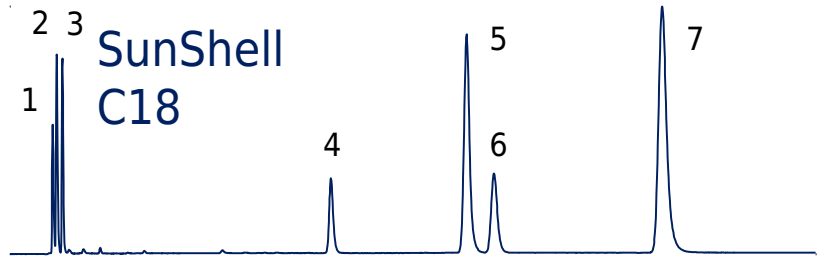
Comparison of standard samples



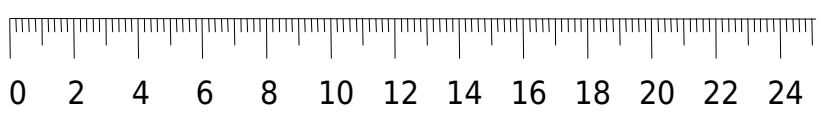
Kinetex C18



Ascentis Express C18



SunShell C18



Retention time/min

Column:

Brand A C18, 2.6 μm 150 x 4.6 mm (Core shell type)

Brand B C18, 2.7 μm 150 x 4.6 mm (Core shell type)

SunShell C18, 2.6 μm 150 x 4.6 mm

Mobile phase: $\text{CH}_3\text{OH}/\text{H}_2\text{O}=75/25$

Flow rate: 1.0 mL/min

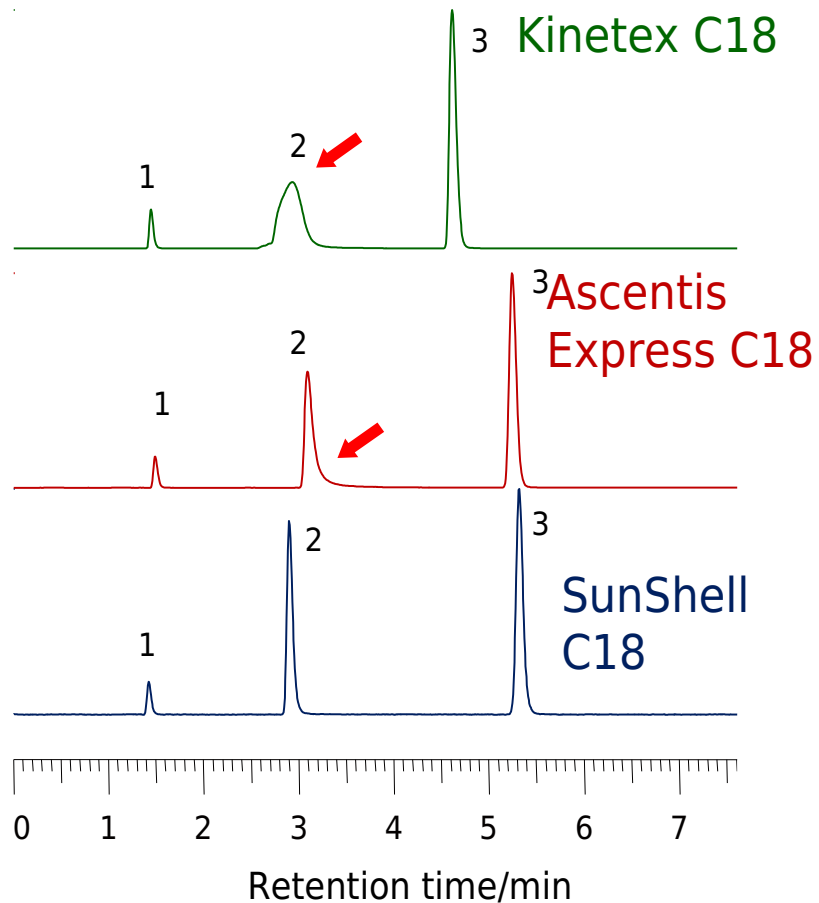
Temperature: 40 $^\circ\text{C}$

Sample: 1 = Uracil, 2 = Caffeine, 3 = Phenol, 4 = Butylbenzene

5 = o-Terphenyl, 6 = Amylbenzene, 7 = Triphenylene

	Hydrogen bond Caffeine/Phenol	Hydrophobicity Amylbenzene/Butylbenzene	Steric selectivity Triphenylene/o-Terphenyl
Kinetex C18	0.48	1.54	1.20
Ascentis Express C18	0.44	1.60	1.31
SunShell C18	0.40	1.59	1.47

Comparison of pyrdine



Column:

Brand A C18, 2.6 μm 150 x 4.6 mm

Brand B C18, 2.7 μm 150 x 4.6 mm

SunShell C18, 2.6 μm 150 x 4.6 mm

Mobile phase: $\text{CH}_3\text{OH}/\text{H}_2\text{O}=30/70$

Flow rate: 1.0 mL/min

Temperature: 40 $^\circ\text{C}$

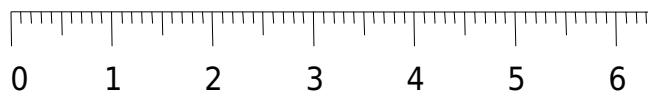
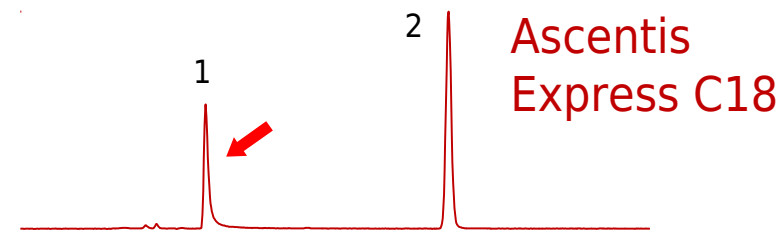
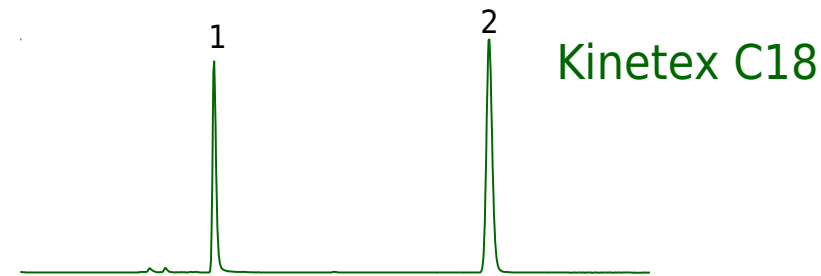
Detection: UV@250nm

Sample: 1 = Uracil

2 = Pyridine

3 = Phenol

Comparison of oxine, metal chelating compound



Retention time/min

Column:

Brand A C18, 2.6 μm 150 x 4.6 mm

Brand B C18, 2.7 μm 150 x 4.6 mm

SunShell C18, 2.6 μm 150 x 4.6

mm

Mobile phase: $\text{CH}_3\text{CN}/20\text{mM}$

$\text{H}_3\text{PO}_4=10/90$

Flow rate: 1.0 mL/min

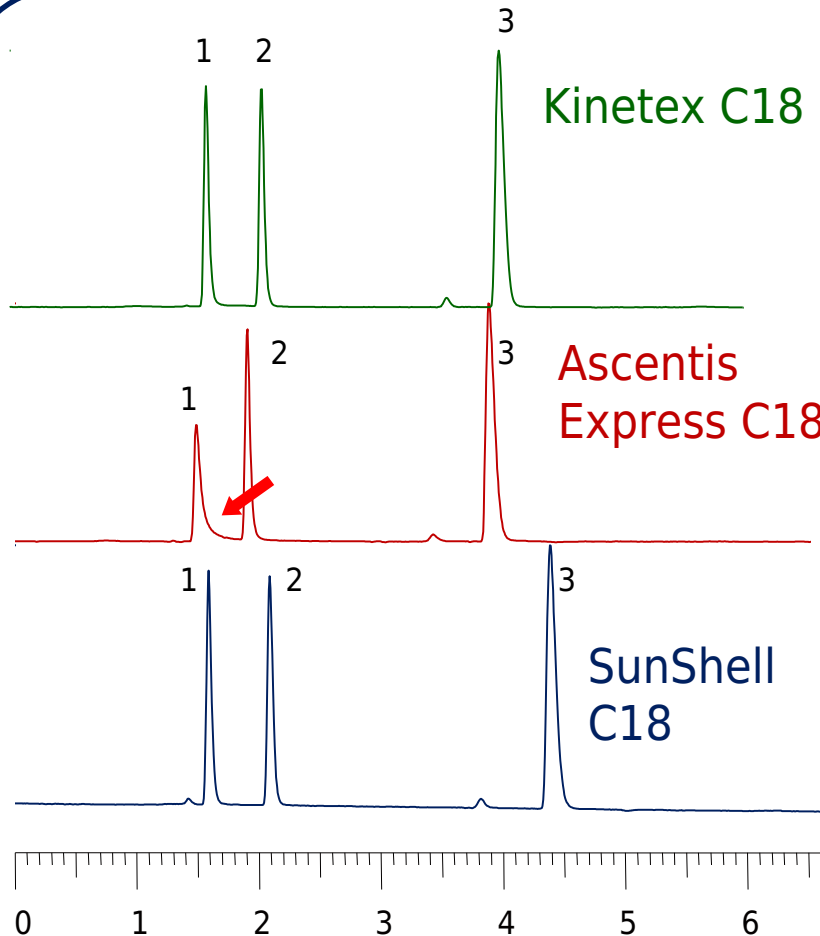
Temperature: 40 $^\circ\text{C}$

Detection: UV@250nm

Sample: 1 = 8-Quinolol (Oxine)

2 = Caffeine

Comparison of formic acid



Kinetex C18

Ascentis Express C18

SunShell C18

Column:

Brand A C18, 2.6 μm 150 x 4.6 mm

Brand B C18, 2.7 μm 150 x 4.6 mm

SunShell C18, 2.6 μm 150 x 4.6 mm

Mobile phase: $\text{CH}_3\text{CN}/0.1\% \text{H}_3\text{PO}_4=2/98$

Flow rate: 1.0 mL/min

Temperature: 40 $^\circ\text{C}$

Detection: UV@210nm

Sample: 1 = Formic acid

2 = Acetic acid

3 = Propionic Acid

Retention time/min