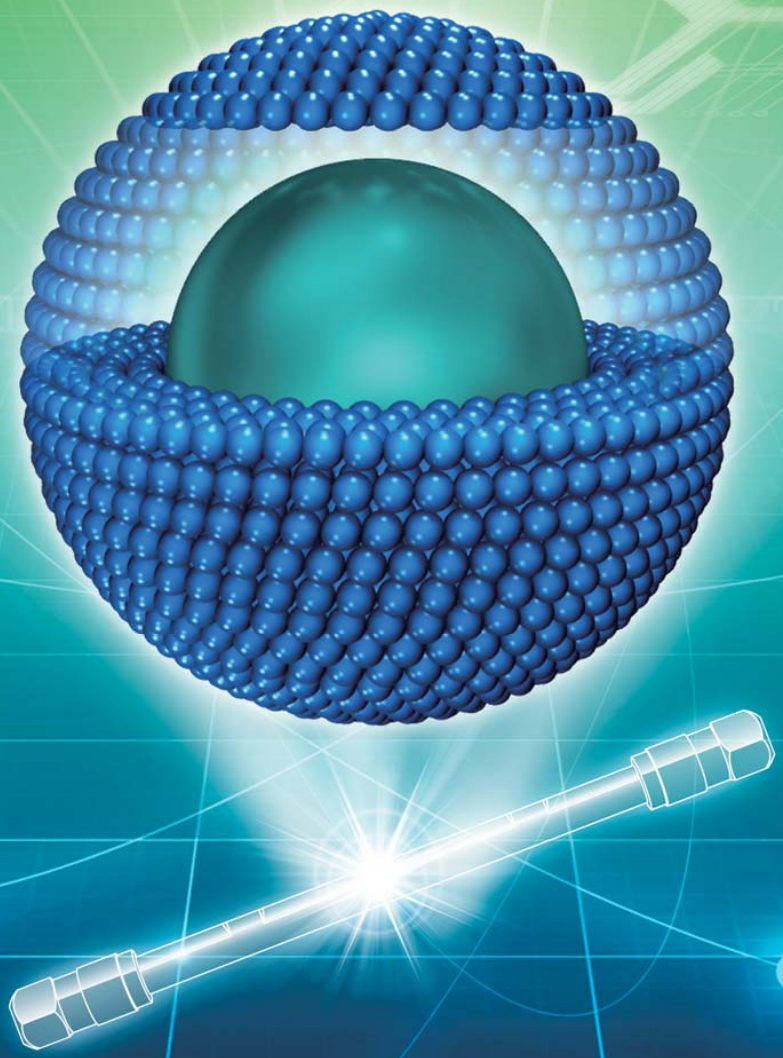
COSMOCORE

COSMOCORE

Core-Shell Particle for UHPLC resolution

2.6C18
2.6CHOLESTER





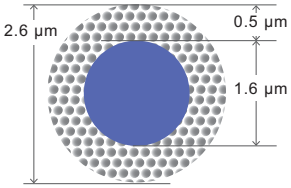
COSMOCORE 2.6C18

Features

- ***Ultra-high performance LC results with conventional HPLC equipment***
- ***Same number of theoretical plates as sub-2 µm columns with half the back pressure***
- ***Increased loading capacity***
- ***Excellent pH stability (1.5-10)***

About Core-Shell Particles

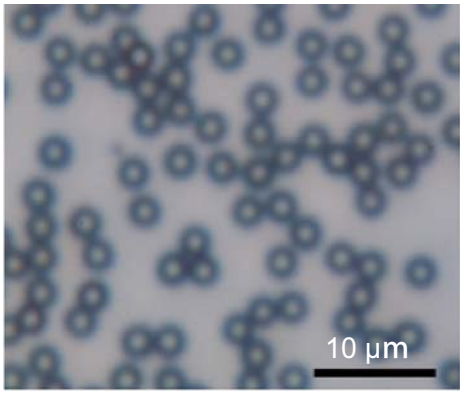
Core-shell particles consist of a nonporous core inside a porous shell. By using these core-shell particles, one can achieve sharper peaks compared to fully porous silica gel particles of the same diameter.



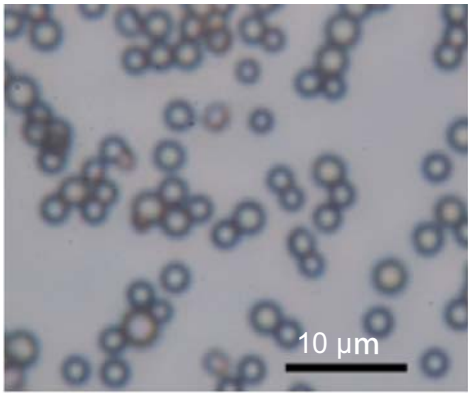
Schematic diagram of a silica particle

Uniform Particle Size Distribution Compared to 1.7 µm Particles

Compared to fully porous particles, core-shell particles have a more uniform particle diameter, therefore core-shell particles can be packed in the column more uniformly to minimize sample diffusion.



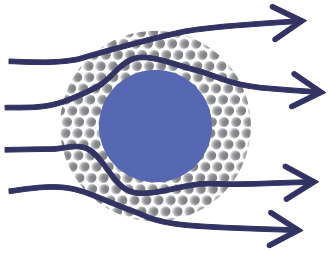
COSMOCORE 2.6C18 (200x)



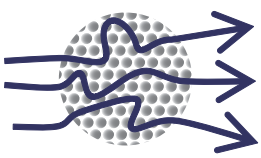
Fully porous 1.7 µm particles (200x)

Mass Transfer Equivalent to Fully Porous sub-2 µm Particles

Mass transfer refers to the time it takes for a sample molecule to enter and leave a particle. In general, lower mass transfer time corresponds to less diffusion and sharper peaks. Even though COSMOCORE 2.6C18 has a larger particle diameter than fully porous sub-2 µm particles, the mass transfer characteristics are similar.

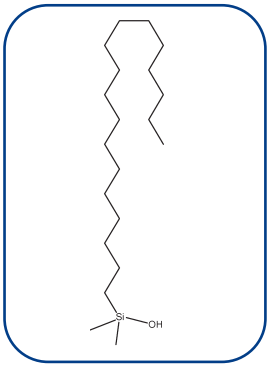


COSMOCORE 2.6C18



Fully porous sub-2 µm particle

	2.6C18
Silica gel	Core-shell type silica
Average particle size	2.6 µm
Core average diameter	1.6 µm
Average pore size	approx. 90 Å
Specific surface area	approx. 150 m^2/g
Stationary phase	Octadecyl group
Bonding type	Polymeric
Main interaction	Hydrophobic interaction
Endcapping treatment	Yes
Carbon load	approx. 7%
Usable pH range	1.5-10
Maximum puressure	60MPa

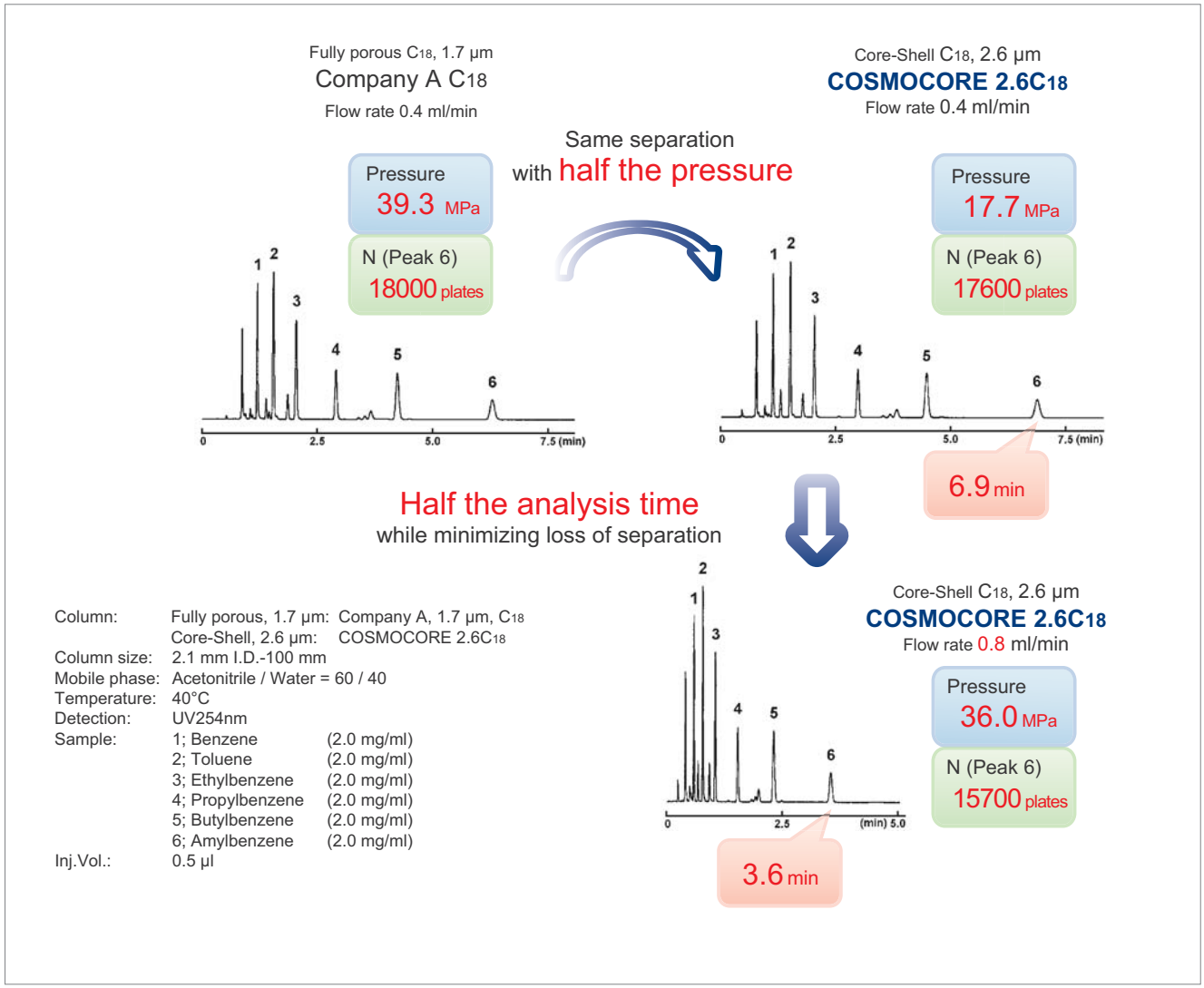


Bonded phase structure

Same performance and lower back pressure compared to sub-2 µm particles

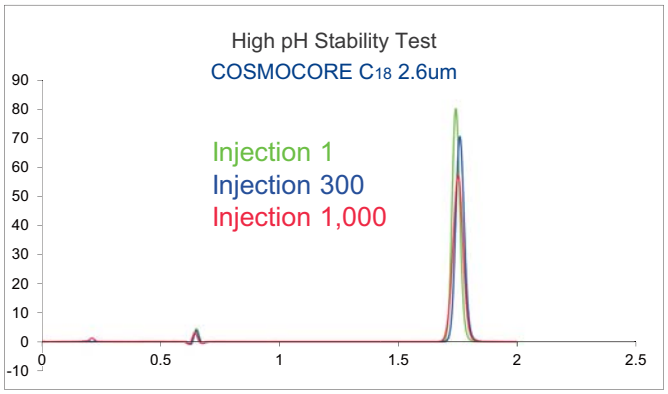
- **Reduced Back Pressure**

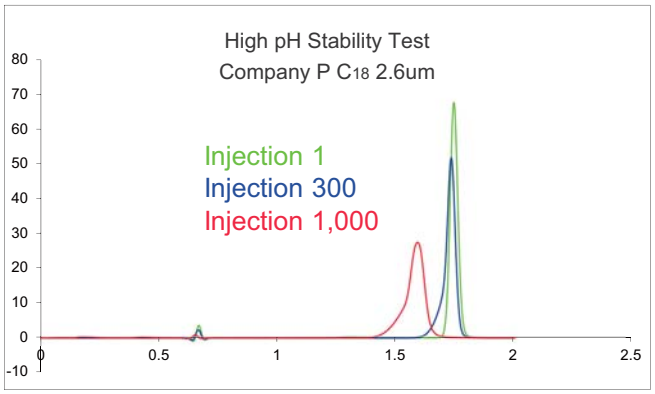
COSMOCORE 2.6C18 maintains the same performance as sub-2 µm particles with half the back pressure.



Excellent pH Stability

Under accelerated pH 10.4, 40°C stability test, COSMOCORE C_{18} column shows superior stability compared with other core shell C_{18} phases.

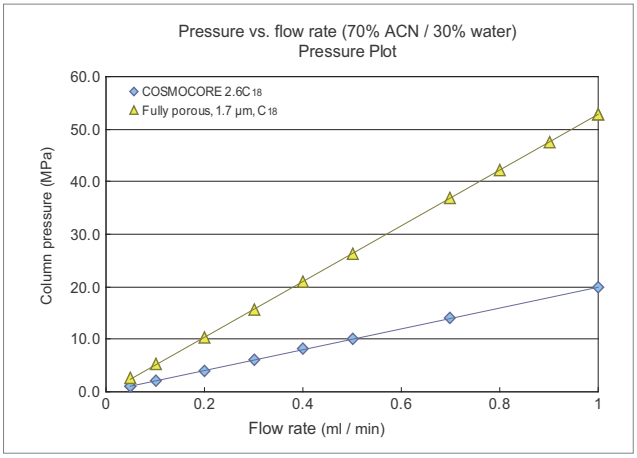


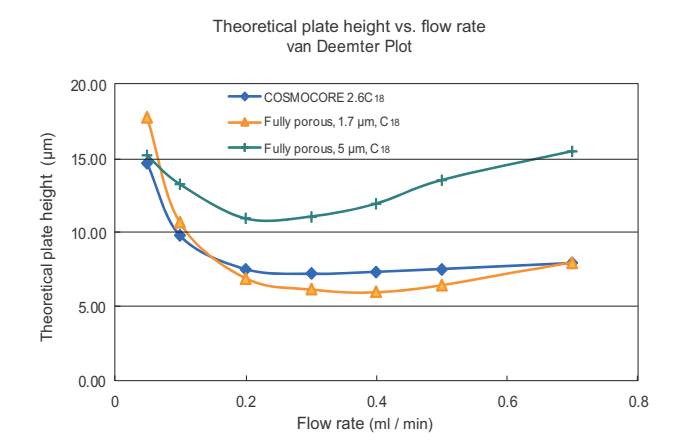


Column size: .1 mm x 100 mm, Mobile phase: 0.35% Ammonium hydroxide/ Acetonitrile = 90/10 (pH 10.4), Sample: Caffeine 0.05 mg/ml, Injection volume: 1µl
Flow rate: 0.4 ml/min., Temperature: 40 °C

Reduced Back Pressure and Faster Analyses

COSMOCORE 2.6C_{18} delivers performance equivalent to sub-2 µm particles at faster flow rate and analysis time while maintaining a lower back pressure. COSMOCORE can also be used in longer column size to gain additional resolution.





Column size: 2.1 mm I.D. - 50 mm, Mobile phase: Acetonitrile / Water = 70 / 30, Temperature: 40ºC, Sample:Amylbenzene

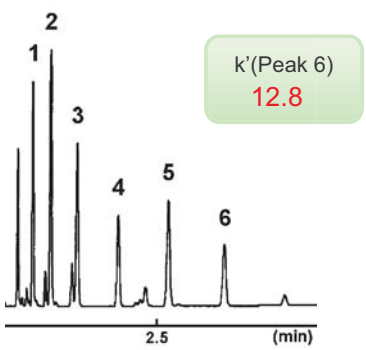
Higher retention and loading capacity than competitors' core-shell columns

- **Retention**

COSMOCORE 2.6C_{18} features high retention and better separation compared to other core-shell columns.

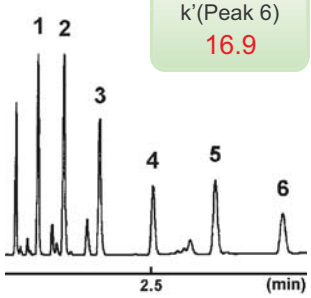
Column size:	2.1 mm I.D.-50 mm	
Mobile phase:	A: Acetonitrile / Water = 50 / 50	
	B: Acetonitrile / Water = 70 / 30	
	B conc. 0→100% (0-4 min), 100% (4-5 min)	
Flow rate:	0.4 ml/min	
Temperature:	40°C	
Detection:	UV254nm	
Sample:	1; Benzene	(2.0 mg/ml)
	2; Toluene	(2.0 mg/ml)
	3; Ethylbenzene	(2.0 mg/ml)
	4; Propylbenzene	(2.0 mg/ml)
	5; Butylbenzene	(2.0 mg/ml)
	6; Amylbenzene	(2.0 mg/ml)
Inj.Vol.:	0.5 µl	

Core-Shell C_{18}, 2.6 µm
Company B C_{18}



k'(Peak 6)
12.8

Core-Shell C_{18}, 2.6 µm
COSMOCORE 2.6C_{18}



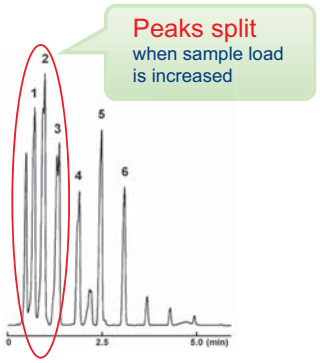
k'(Peak 6)
16.9

- **Higher Loading Capacity**

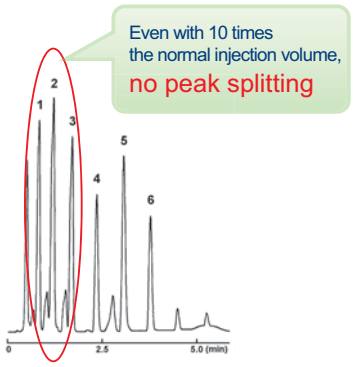
In general, core-shell particles have less surface area and less bonded phase than fully porous particles. COSMOCORE 2.6C18, however, with a large amount of bonded phase, exhibits both high retention and high loading capacity. When injecting 5-10 times more sample volumes in trace component analysis, COSMOCORE minimizes peak splitting due to sample overloading.

Column size: 2.1 mm I.D.-50 mm
Mobile phase: A: Acetonitrile / Water = 50 / 50
B: Acetonitrile / Water = 80 / 20
B conc. 0→100% (0 - 4 min), 100% (4 - 5 min)
Flow rate: 0.4 ml/min
Temperature: 40°C
Detection: UV254nm
Sample: 1; Benzene (2.0 mg/ml)
2; Toluene (2.0 mg/ml)
3; Ethylbenzene (2.0 mg/ml)
4; Propylbenzene (2.0 mg/ml)
5; Butylbenzene (2.0 mg/ml
6; Amylbenzene (2.0 mg/ml)
Inj.Vol.: 5 µl

Core-Shell C18, 2.6 µm
Company B C18



Core-Shell C18, 2.6 µm
COSMOCORE 2.6C18



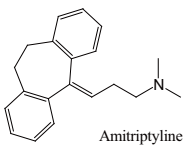
Sharp Peaks with Many Types of Compounds

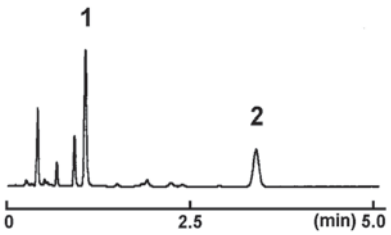
COSMOCORE 2.6C18 features a special end capping treatment that effectively shields residual silanol groups, yielding sharp peaks for basic compounds and metal coordination complexes.

Basic compounds

- **Amitriptyline**

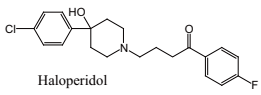
Column size: 2.1 mm I.D.- 50 mm
Mobile phase: Acetonitrile / 20mmol/l Phosphoric Buffer(pH7.0) = 60 / 40
Temperature: 40ºC
Flow rate: 0.4 ml/min
Detection: UV254nm
Sample: 1; Amitriptyline (0.2 mg/ml)
2; Amylbenzene I.S. (2.0 mg/ml)
Inj.Vol.: 0.5 µl

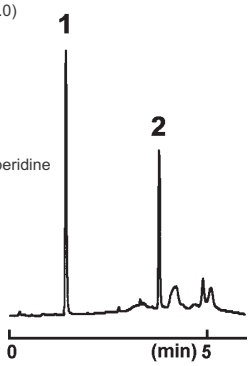




- **Haloperidol**

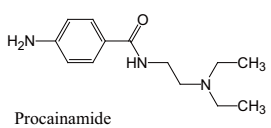
Column size: 2.1 mm I.D. - 50 mm
Mobile phase: A; Acetonitrile/ 20mmol/l Phosphate buffer(pH7.0) = 10/90
B; Acetonitrile/ 20mmol/l Phosphate buffer(pH7.0) = 50/50
B conc. 0→100%(0→3min), 100%(3-5min)
Flow rate: 0.4 ml/min
Temperature: 40ºC
Detection: UV220nm
Sample: 1; 4-(4-Chlorophenyl)-4-hydroxypiperidine (0.1 mg/ml)
2; Haloperidol (0.1 mg/ml)
Inj. Vol: 0.5 µl

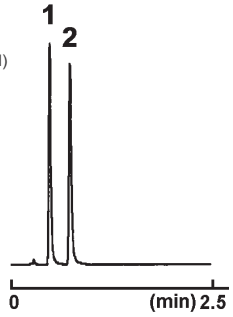




- **Procainamide**

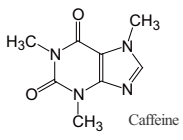
Column size: 2.1 mm I.D. - 50 mm
Mobile phase: Acetonitrile/ 20mmol/l Phosphate buffer(pH7.0) = 10/90
Flow rate: 0.4 ml/min
Temperature: 40ºC
Detection: UV270nm
Sample: 1; Procainamide (0.05 mg/ml)
2; N-Acetylprocainamide (0.05 mg/ml)
Inj. Vol: 0.5 µl

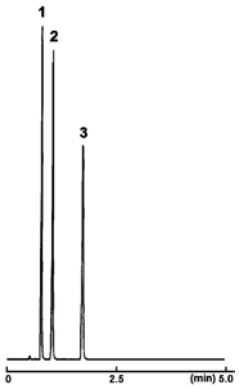




- **Caffeine**

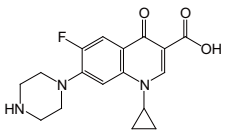
Column size: 2.1 mm I.D. - 100 mm
Mobile phase: Acetonitrile/ H2O = 10/90
Flow rate: 0.4 ml/min
Temperature: 40ºC
Detection: UV275nm
Sample: 1; Theobromine (0.05 mg/ml)
2; Theophylline (0.05 mg/ml)
3; Caffeine (0.05 mg/ml)
Inj.Vol.: 1.0 µl



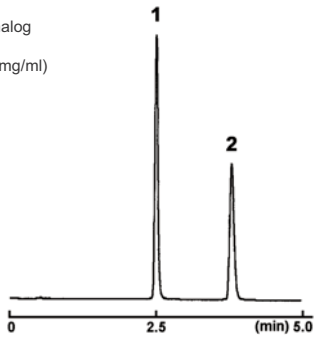


- **Ciprofloxacin**

Column size: 2.1 mm I.D. - 100 mm
Mobile phase: Acetonitrile/20mmol/l Phosphate buffer(pH2.5) = 10/90
Flow rate: 0.4 ml/min
Temperature: 40ºC
Detection: UV278nm
Sample: 1; Ciprofloxacin
Ethylenediamine Analog
(0.05 mg/ml)
2; Ciprofloxacin (0.05 mg/ml)
Inj. Vol: 0.5 µl



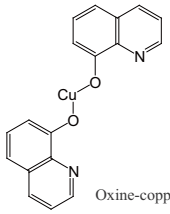
Ciprofloxacin



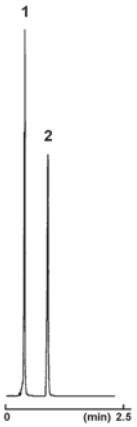
Metal coordination complexes

- **Oxine-copper**

Column size: 2.1 mm I.D.-50 mm
Mobile phase: Acetonitrile / 20mmol/l Phosphoric Acid
= 10 / 90
Temperature: 40°C
Flow rate: 0.4 ml/min
Detection: UV254nm
Sample: 1; Oxine-copper (0.003 mg/ml)
2; Caffeine (I.S.) (0.3 mg/ml)
Inj.Vol.: 0.5 µl



Oxine-copper

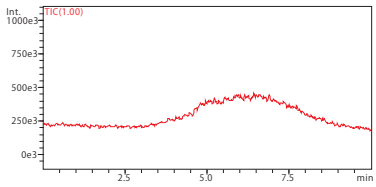


Low Bleed - Suitable for LC-MS

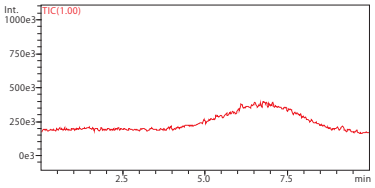
COSMOCORE 2.6C18 has low column bleed and consequently low MS noise level.

Column size: 2.1 mm I.D.-50 mm
Mobile phase: A: 0.1% Formic Acid
B: Acetonitrile
B conc.
5→100% (0 - 5 min), 100% (5 -10 min),
100→5% (10 - 11 min), 5% (11 - 17 min)
Flow rate: 0.2 ml/min
Temperature: 40°C
Detection: MS (TIC (+), MW 50-1000)

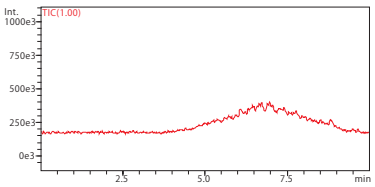
without Column



Core-Shell C18, 2.6 µm
COSMOCORE 2.6C18



Core-Shell C18, 2.6 µm
Company B C18

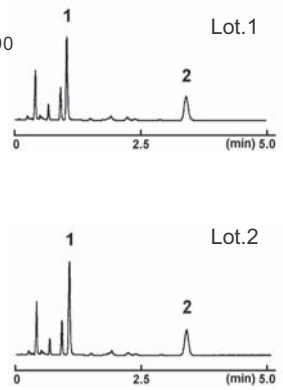


Differences between Lots

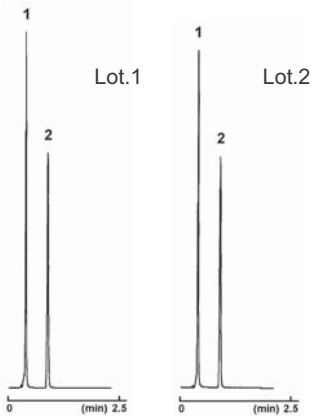
COSMOCORE 2.6C18 has great lot-to-lot reproducibility.

Column: COSMOCORE 2.6C18 (Lot.1 / Lot.2)
Column size: 2.1 mm I.D. - 50 mm
Mobile phase: **Basic compounds**
Acetonitrile / 20mmol/l Phosphate Buffer(pH7.0) = 60 / 40
Metal coordination complexes
Acetonitrile / 20mmol/l Phosphoric Acid = 10 / 90
Flow rate: 0.4 ml/min
Temperature: 40°C
Detection: UV254nm
Sample: **Basic compounds**
1; Amitriptyline (0.2 mg/ml)
2; Amylbenzene (2.0 mg/ml)
Metal coordination complexes
1; Oxine-copper (0.003 mg/ml)
2; Caffeine (0.3 mg/ml)
Inj. Vol.: 0.5 µl

Basic compounds



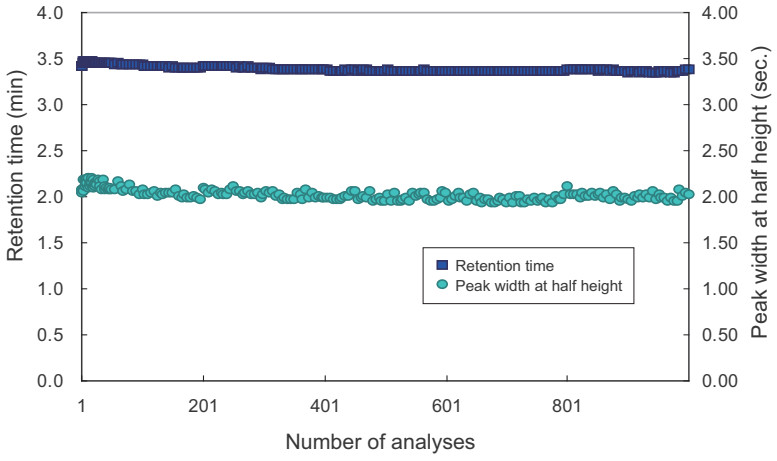
Metal coordination complexes



Durability Test

COSMOCORE 2.6C18 exhibits high durability. Even after analyzing amitriptyline 1000 times, there is no significant deterioration in retention or peak shape.

<Durability test: 1000 consecutive analyses>



Test conditions
Column: COSMOCORE 2.6C18
Column size: 2.1 mm I.D. - 50 mm
Mobile phase: A: 0.1% TFA/Water
B: 0.1% TFA/Acetonitrile
B conc.
5→90%(0-3 min), 90→3%(3-3.01 min),
5%(3.01-6 min)
Flow rate: 0.4 ml/min
Temperature: 40°C
Detection: UV236nm
Sample: Amitriptyline (0.2 mg/ml)
Inj. Vol: 1.0 µl

Ordering Information

• COSMOCORE 2.6C18 Column

Column Size	Product Number
2.1 mm I.D. x 30 mm	12632-31
2.1 mm I.D. x 50 mm	12631-41
2.1 mm I.D. x 75 mm	12630-51
2.1 mm I.D. x 100 mm	12614-71
2.1 mm I.D. x 150 mm	12612-91

Column Size	Product Number
3.0 mm I.D. x 30 mm	12611-01
3.0 mm I.D. x 50 mm	12609-51
3.0 mm I.D. x 75 mm	12608-61
3.0 mm I.D. x 100 mm	12607-71
3.0 mm I.D. x 150 mm	12602-21

Column Size	Product Number
4.6 mm I.D. x 30 mm	12601-31
4.6 mm I.D. x 50 mm	12600-41
4.6 mm I.D. x 75 mm	12599-91
4.6 mm I.D. x 100 mm	12598-01
4.6 mm I.D. x 150 mm	12597-11
4.6 mm I.D. x 250 mm	12596-21

COSMOCORE`s connector is the same type as Waters UPLC Columns. Other sizes may be available.

• UHPLC-compatible prefilter

Product Name	Product Number	In	Out	Contents	PKG Size
U-Fil UHPLC-compatible prefilter	12571-31	UHPLC	UHPLC	Filter: 0.5 µm	1 PKG
	12572-21	HPLC	UHPLC	Tubing connecting diameter: 1/16	1 PKG
U-Fil replacement filter	28150	-	-	Filter: 0.5 µm, Material: SUS316L	5 PKG/ Pack

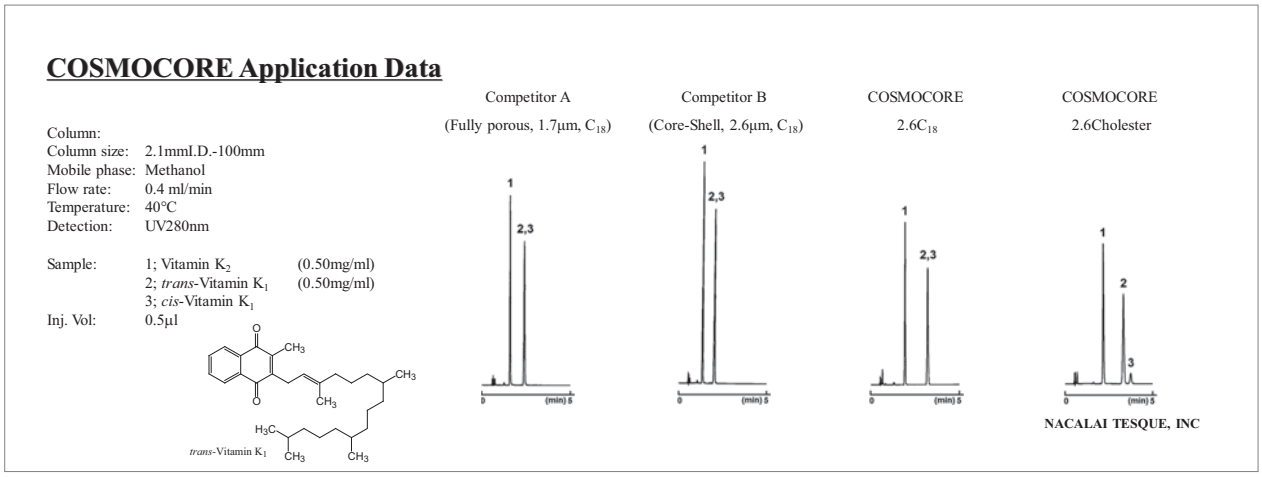


COSMOCORE 2.6Cholester

- ***Cholesterol-bonded reversed-phase core-shell column***
- ***Usable under the same conditions as C_{18} columns***
- ***Better selectivity for cis-trans isomers, polyphenols, and natural products***

Comparison with C_{18}

COSMOCORE 2.6Cholester offers improved separation for cis-trans isomers than C18 under typical reversed-phase mobile phase.



About Core-Shell 2.6Cholester Particles

COSMOCORE 2.6Cholester is packed with cholesterol-bonded 2.6 µm core-shell particles (Figure 1 and 2). It can achieve low pressure compared to fully-porous sub-2 µm columns (Figure 3).

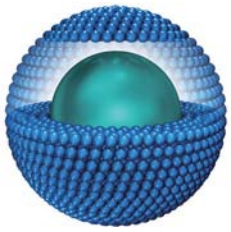


Figure 1: Core-Shell Particle

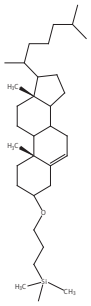


Figure 2: Bonded Cholestrol Stationary Phase

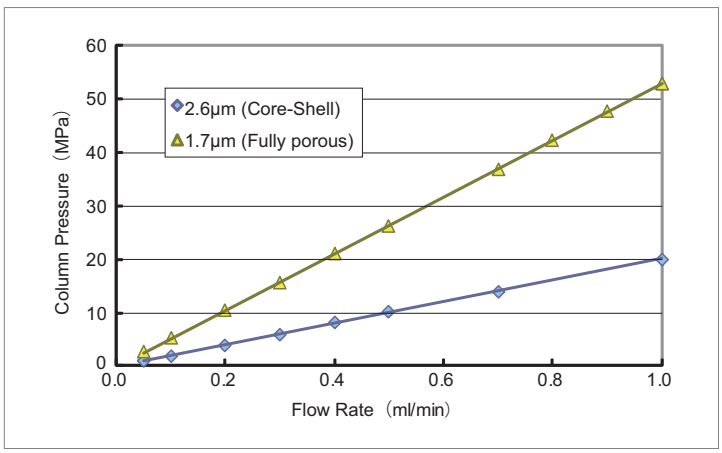


Figure 3: Comparison of Column Pressure
Column size 2.1mmI.D.-100mm, Mobile Phase Acetonitrile/Water=70/30, Temperature: 40°C

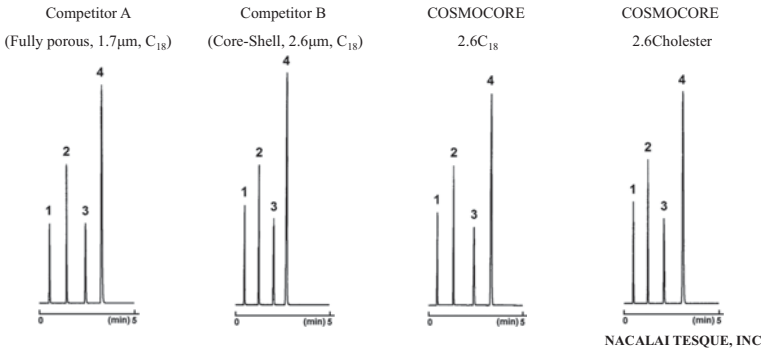
Separation Properties

COSMOCORE 2.6Cholester has about the same hydrophobicity as C_{18}. It is not necessary to change the analytical conditions when replacing C_{18} Columns with COSMOCORE 2.6Cholester.

COSMOCORE Application Data

Column:
Column size: 2.1mmI.D.-100mm
Mobile phase: Acetonitrile/ H_2O = 50/50
Flow rate: 0.4 ml/min
Temperature: 40°C
Detection: UV254nm

Sample: 1; Uracil
2; Methyl Benzoate
3; Toluene
4; Naphthalene
Inj. Vol: 0.25µl



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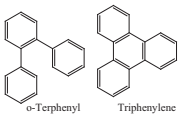
Molecular Shape Selectivity

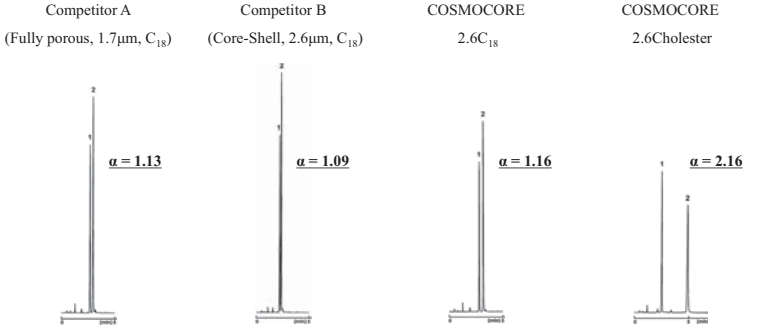
COSMOCORE 2.6Cholester has excellent shape slectivity due to its structural rigidity. COSMOCORE 2.6Cholester retains planar triphenylene longer than non planar o-terphenyl.

COSMOCORE Application Data

Column:
Column size: 2.1mmI.D.-100mm
Mobile phase: Acetonitrile/ H_2O = 70/30
Flow rate: 0.4 ml/min
Temperature: 40°C
Detection: UV254nm

Sample: 1; *o*-Terphenyl (0.25mg/ml)
2; Triphenylene (0.05mg/ml)
Inj. Vol: 0.5µl





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Applications

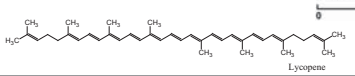
● Separation of natural components (Tomato components)

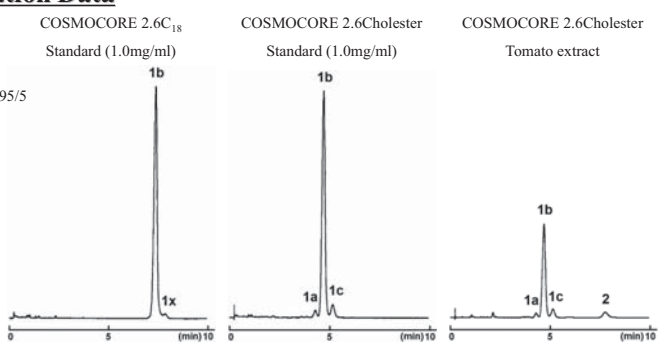
Lycopene exists in many cis-trans isomers. COSMOCORE 2.6Cholester separates these compounds better than C_{18}.

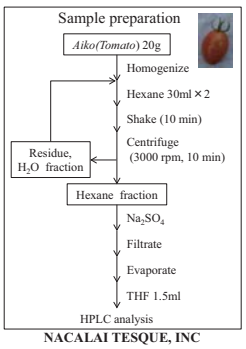
COSMOCORE Application Data

Column:
Column size: 3.0mmI.D.-50mm
Mobile phase: (2.6C_{18}) Acetonitrile/ H_2O = 95/5
(2.6Cholester) Acetonitrile
Flow rate: 1.0 ml/min
Temperature: 40°C
Detection: UV470nm

Sample: 1; Lycopene
2; *β*-Carotene
Inj. Vol: 0.5µl







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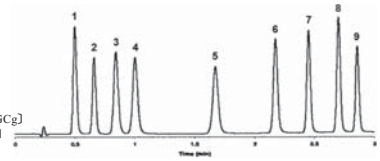
●Separation of Catechin

COSMOCORE Application Data

Column: COSMOCORE 2.6Cholester
Column size: 2.1mmI.D.-50mm
Mobile phase: A; Acetonitrile/ 0.1% H_3PO_4 = 10/90
B; Acetonitrile/ 0.1% H_3PO_4 = 40/60
B conc. 0→100% 3min Linear gradient
Flow rate: 0.6 ml/min
Temperature: 30°C
Detection: UV280nm
Sample:
1; (-)-Gallocatechin〔(-)-GC〕
2; Caffeine
3; (-)-Epigallocatechin〔(-)-EGC〕
4; (-)-Catechin〔(-)-C〕
5; (-)-Epicatechin〔(-)-EC〕
6; (-)-Epigallocatechin Gallate〔(-)-EGCg〕
7; (-)-Gallocatechin Gallate〔(-)-GCg〕
8; (-)-Epicatechin Gallate〔(-)-ECg〕
9; (-)-Catechin Gallate〔(-)-Cg〕



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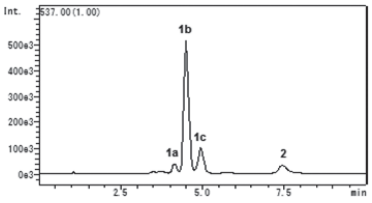
Data courtesy of a customer

●Apply to LC/MS

COSMOCORE Application Data

Column: COSMOCORE 2.6Cholester
Column size: 3.0mmI.D.-50mm
Mobile phase: Acetonitrile
Flow rate: 1.0 ml/min
Temperature: 40°C
Detection: APCI-MS, Positive, SIM
Sample: Tomato extract
1; Lycopene
2; β-Carotene
Inj. Vol: 0.5µl



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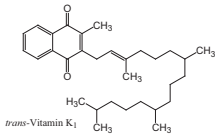
Scaling Up from Analytical to Preparative Separation

COSMOCORE 2.6Cholestrer has the same functional group as the fully-porous COSMOSIL Cholester 5 µm silica packing material. Therefore, the separation pattern in COSMOCORE 2.6Cholester is maintained when scaling up to preparative separation with 5 µm COSMOSIL Cholester.

COSMOCORE Application Data

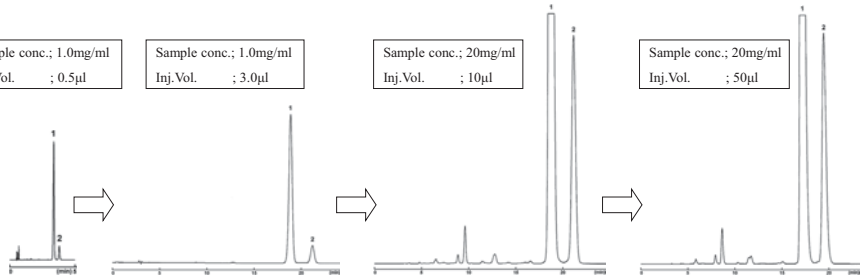
Column:
Column size:
Mobile phase: Methanol
Flow rate: (2.1mmI.D.) 0.4 ml/min
(4.6mmI.D.) 1.0 ml/min
(10.0mmI.D.) 5.0 ml/min
Temperature: 40°C
Detection: UV280nm

Sample: 1; *trans*-Vitamin K_1
2; *cis*-Vitamin K_1



trans-Vitamin K_1

	COSMOCORE 2.6Cholester (2.1mmI.D.-100mm)	COSMOSIL Cholester (5 µm) (4.6mmI.D.-250mm)	COSMOSIL Cholester (5 µm) (10mmI.D.-250mm)
	Sample conc.; 1.0mg/ml Inj.Vol. ; 0.5µl	Sample conc.; 1.0mg/ml Inj.Vol. ; 3.0µl	Sample conc.; 20mg/ml Inj.Vol. ; 10µl	Sample conc.; 20mg/ml Inj.Vol. ; 50µl



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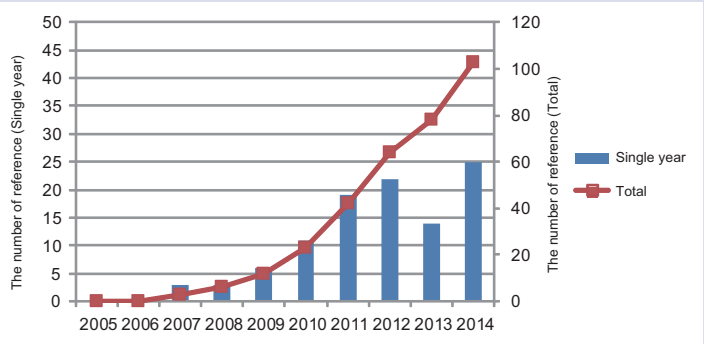
References to COSMOSIL Cholesterol Bonded-Stationary Phase



The number of COSMOSIL Cholester reference has grown to over 100 since its introduction in 2005.
(Reference Search: Google Scholar, as of July 2014)

Figure 1: The number of references to COSMOSIL Cholester and 2.5Cholester

Specifications

Packing Material	COSMOCORE 2.6Cholester	COSMOCORE 2.6C18	COSMOSIL 5Cholester
Silica gel	Core-shell type silica gel		High purity porous spherical silica
Average particle size	2.6µm		5µm
Average pore size	approx. 90 Å		approx. 120 Å
Specific surface area	approx. 150m^2/g		approx. 300m^2/g
Stationary phase	Cholesteryl Group	Octadecyl group	Cholesteryl Group
Endcapping treatment	Yes		
Usable pH range	2 – 7.5	1.5 – 10	2 – 7.5
Maximum puressure	60MPa		20MPa

Ordering Information

・COSMOCORE 2.6Cholester Packed Column

Column Size	Product Number
2.1 mm I.D. x 30 mm	12858-91
2.1 mm I.D. x 50 mm	12859-81
2.1 mm I.D. x 75 mm	12860-41
2.1 mm I.D. x 100 mm	12861-31
2.1 mm I.D. x 150 mm	12862-21

Column Size	Product Number
3.0 mm I.D. x 30 mm	12863-11
3.0 mm I.D. x 50 mm	12864-01
3.0 mm I.D. x 75 mm	12866-81
3.0 mm I.D. x 100 mm	12867-71
3.0 mm I.D. x 150 mm	12868-61

Column Size	Product Number
4.6 mm I.D. x 30 mm	12869-51
4.6 mm I.D. x 50 mm	12870-11
4.6 mm I.D. x 75 mm	12871-01
4.6 mm I.D. x 100 mm	12872-91
4.6 mm I.D. x 150 mm	12873-81
4.6 mm I.D. x 250 mm	12875-61

COSMOCORE`s connector is the same type as Waters UPLC® Columns.

・UHPLC-compatible prefilter

Product Name	Product Number	In	Out	Description	PKG Size
U-Fil UHPLC-compatible prefilter	12571-31	UHPLC	UHPLC	Filter: 0.5 µm	1 PKG
	12572-21	HPLC	UHPLC	Tubing connecting diameter: 1/16	1 PKG
U-Fil replacement filter	28150	-	-	Filter: 0.5 µm, Material: SUS316L	5 PKG/ Pack

Instrument settings and compatibility

● When using with a conventional (non-UHPLC) instrument

COSMOCORE 2.6C_{18} is designed for use with UHPLC instruments. In addition, due to its low backpressure, it can be used with conventional instruments. However, it is necessary to change the following settings.

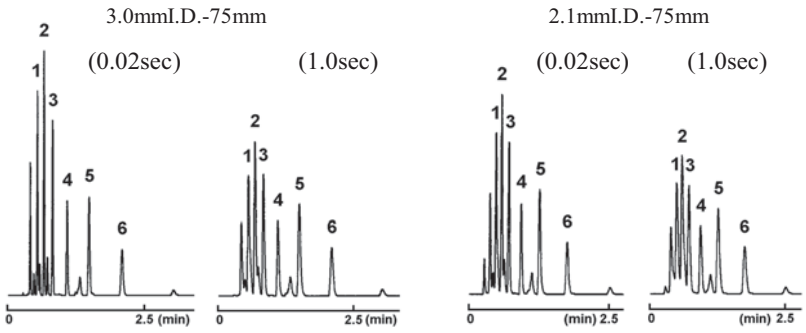
1. Detector response time

Because UHPLC analyses are done at high flow rates, a slow response time can adversely affect peak shape. We recommend setting the response time to 0.1 sec or less.

Column: COSMOCORE 2.6C_{18}
Column size:
Mobile phase: Acetonitrile/ Water = 70 /30
Flow rate: 3.0mmI.D.-75mm 1.0 ml/min
2.1mmI.D.-50mm 0.4ml/min
Temperature: 40°C
UV254nm

Sample: 1; Benzene (2.0mg/ml)
2; Toluene (2.0mg/ml)
3; Ethylbenzene (2.0mg/ml)
4; Propylbenzene (2.0mg/ml)
5; Butylbenzene (2.0mg/ml)
6; Amylbenzene (2.0mg/ml)

Inj.Vol.: 3.0mmI.D.-75mm 1.0µl
2.1mmI.D.-50mm 0.5µl



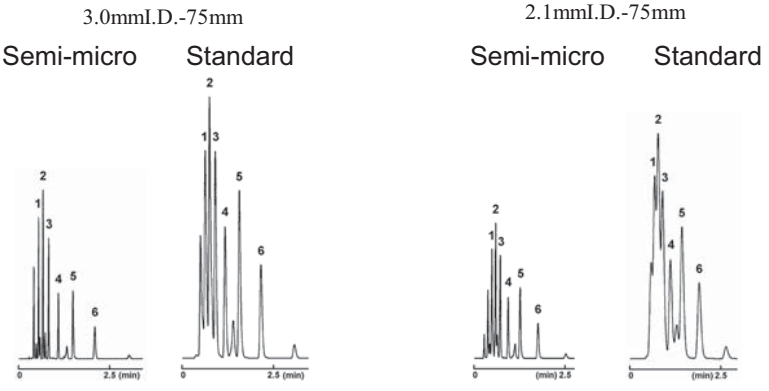
2. Other instrument parameters

UHPLC is more vulnerable to the effects of dead volume than conventional chromatography. When using a 2.1 mm I.D. column, please use a semi-micro detector cell, injector, and piping (0.1mm).

Column: COSMOCORE 2.6C_{18}
Column size:
Mobile phase: Acetonitrile/ Water = 70/30
Flow rate: 3.0mmI.D.-75mm 1.0 ml/min
2.1mmI.D.-50mm 0.4ml/min
Temperature: 40°C
Detection: UV254nm

Sample: 1; Benzene (2.0mg/ml)
2; Toluene (2.0mg/ml)
3; Ethylbenzene (2.0mg/ml)
4; Propylbenzene (2.0mg/ml)
5; Butylbenzene (2.0mg/ml)
6; Amylbenzene (2.0mg/ml)

Inj.Vol.: 3.0mmI.D.-75mm 1.0µl
2.1mmI.D.-50mm 0.5µl



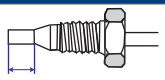
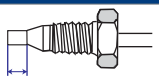
● Fittings and adapters

COSMOCORE columns use the same connectors as Waters UPLC® (UHPLC) columns. This is different from our conventional COSMOSIL columns, which use the conventional Waters HPLC-compatible connectors. (UPLC® is a registered trademark of Waters Corporation.)

1. Differences between end fitting

Connection type		Column	
		HPLC(COSMOSIL)	UHPLC (COSMOCORE)
Instrument	HPLC	No adapter required	Adapter required
	UHPLC	Adapter required	No adapter required

HPLC: Conventional Waters-compatible connector
UHPLC: Waters UPLC®-compatible connector

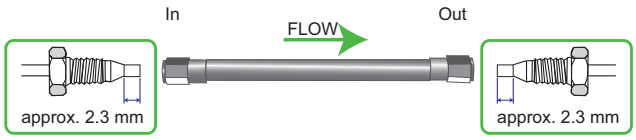
	HPLC	UHPLC
Connector shape	 approx. 3.3 mm	 approx. 2.3 mm

The length of tubing that extends from the ferrule differs from HPLC to UHPLC.

2. COSMOCORE-compatible fittings

1) UHPLC instrument fittings

No adapter needed; just connect as-is.

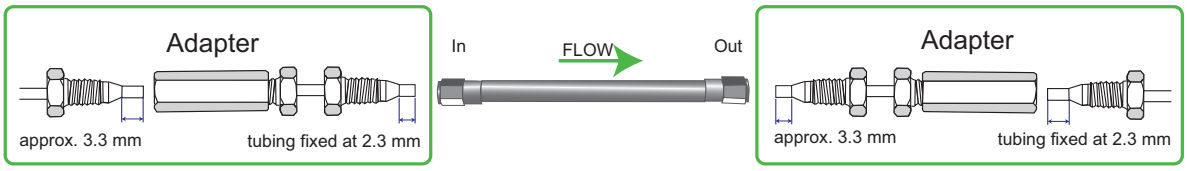


2) HPLC instrument fittings

An adapter or movable (high-pressure) fitting is required to connect the fittings to the column. See the examples for different fittings below.

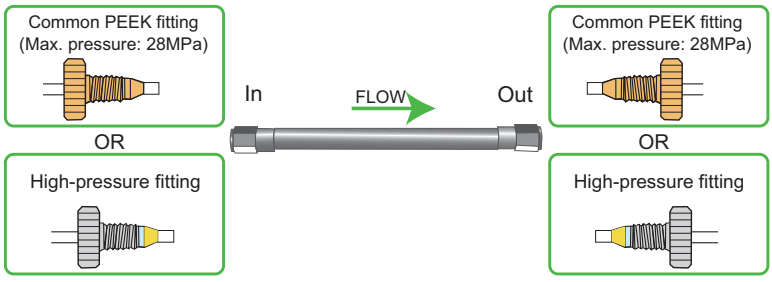
● SUS ferrules (HPLC) fixed on the tubing

The column can be connected by using an adapter (SUS union + tubing fixed to UHPLC length).



●PEEK fittings

PEEK fittings do not fix the length of tubing at the end, so they can be used with both types of column. However, please be cautious of their pressure tolerance.



Adapter list

Name	Product Number	Description	PKG Size
Low & Zero Dead Volume Union	P0402	Material: SUS Bore diameter: 0.35 mm	1 PKG
COSMOSIL Column Connecting Tube (0.1 mm I.D.)	12570-41	I.D.: 0.1 mm	1 PKG
COSMOSIL Column Connecting Tube (0.25 mm I.D.)	37843-69	I.D.: 0.25 mm	1 PKG

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