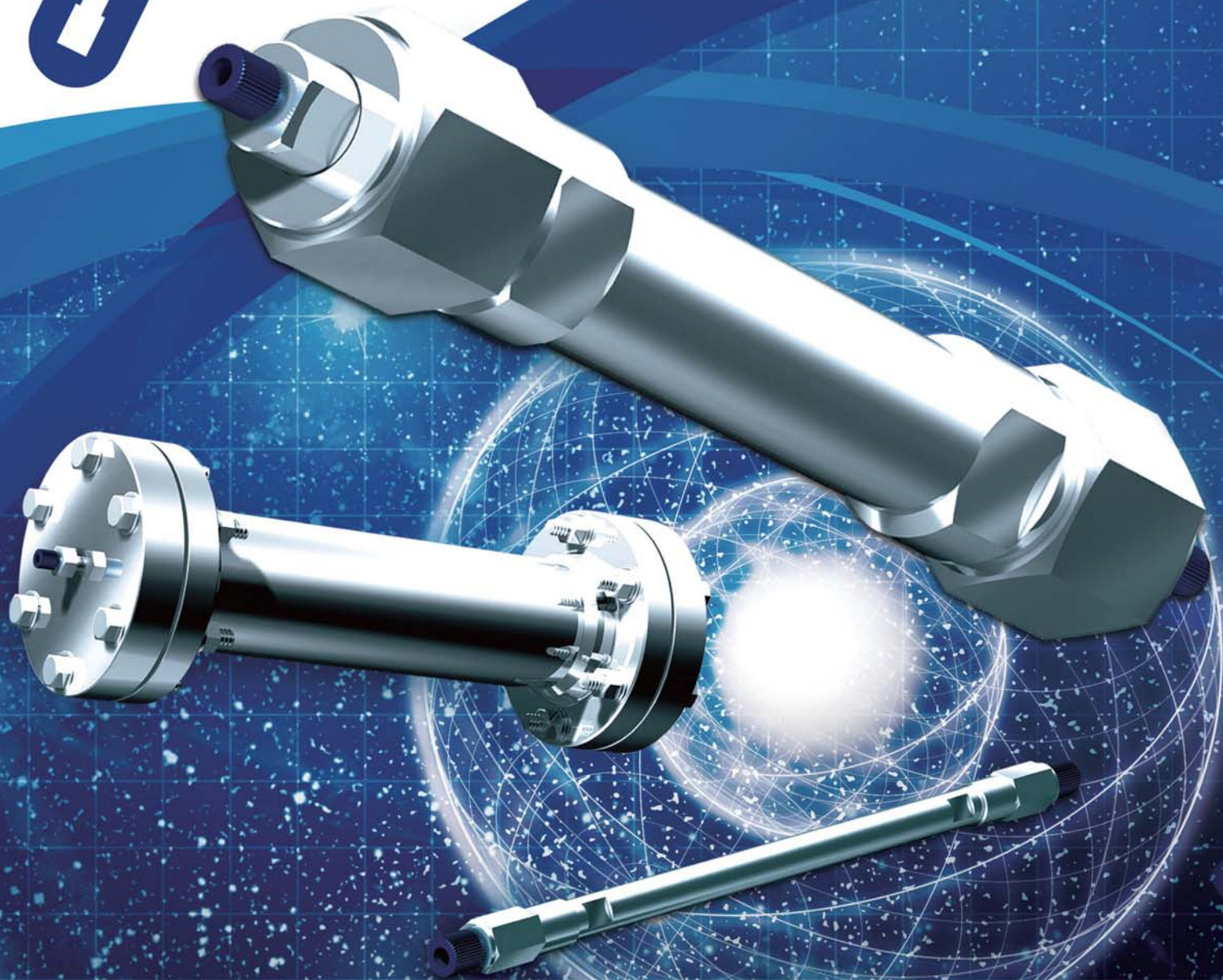




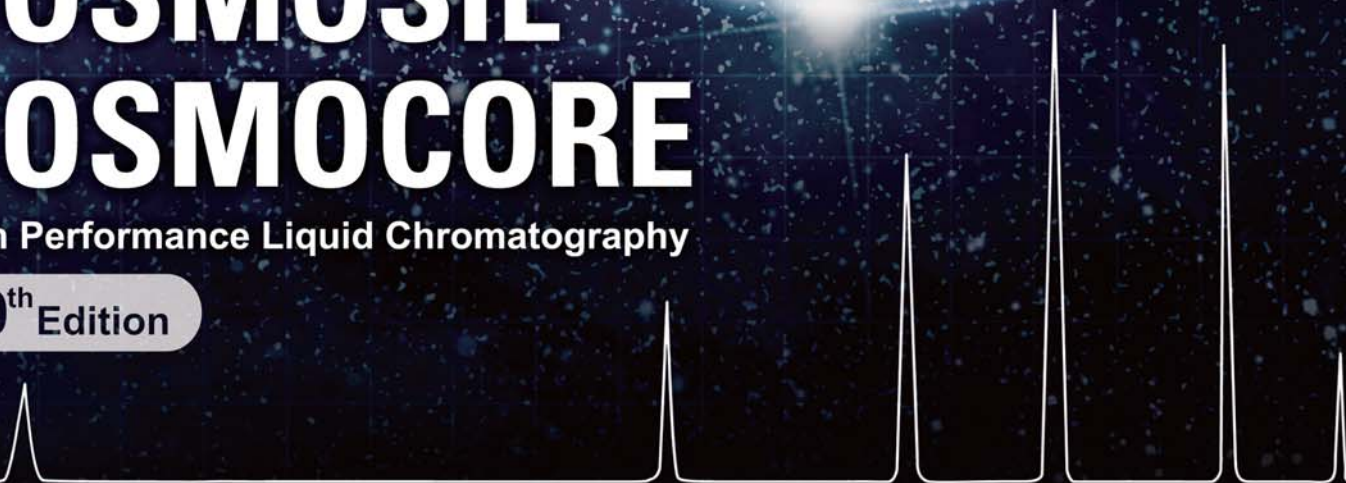
**COSMOSIL**



# COSMOSIL COSMOCORE

High Performance Liquid Chromatography

10<sup>th</sup> Edition







# COSMOSIL Applications

COSMOSIL Application has more than 7,600 applications using COSMOSIL columns. Setting optimal HPLC experimental parameters is an important process that requires experience and time. COSMOSIL Applications provide you with sample analysis conditions for widely used ODS columns and our specialty columns.

- Over 7,600 applications
- Easy to search

**COSMOSIL HPLC Columns**

General info. of COSMOSIL/COSMOGEL  
COSMOSIL Columns List by Phase

- Standard Reversed Phase Columns
- Specialty Reversed Phase Columns
- Ultra-High Performance Columns
- Normal Phase Columns

**Related Products**

- Preparative Packing Materials
- Related Products

- Hydrophilic Interaction Columns
- Saccharide Separation Columns
- Protein Separation Columns (Wide Pore Columns)
- Fullerene Separation Columns
- Carbon Nanotubes Separation Columns

▶ COSMOSIL Applications  
Application Search  
Over 7,000 Data

Reference Lists

Click

Visit COSMOSIL top page at  
<http://www.nacalai.co.jp/global/cosmosil/>

Sample Name  contains (Keyword search) ▼

CAS number  (ex:498-02-2)

Category (If no checkbox is clicked, the search will be performed in all categories.)

Amino acids & derivatives  Peptides & Proteins  Nucleic acids & relative compounds

Drugs & related compounds  Antibiotics  Vitamins

Steroids  Indoles  Natural products

Carbohydrates & derivatives  Glyceride  Oil

Column name (If no checkbox is clicked, the search will be performed in all columns.)

C18-EB  C18-MS-II  C18-AR-II  C18-PAQ

COSMOCORE C18  Cholester  PFP  mNap

PYE  NPE  PBr  CN-MS

C8-MS  C4-MS  TMS-MS  PE-MS

SL-II  HILIC  Sugar-D  NH2-MS

Particle Size  ALL ▼

Application No.  (ex:AP-1206)

Result/Page  20 ▼

Click

- Applications are searched by
1. Sample Category
  2. Sample Name
  3. CAS No.
  4. Column Name
  5. Particle Size

Search Result

COSMOSIL Application

Search condition (Application No=AP-1206)

[TOP]

Results 1 (1-1)

Data No.	Data Name	Particle Size	Column
Sample		CAS No.	
AP-1206	Dichlorophenol	5	mNAP
2	chlorophenol		576-24-9
2	chlorophenol		120-03-2
2	chlorophenol		583-78-8
2,6	Dichlorophenol		87-65-0
3,4	Dichlorophenol		95-77-2
3,5	Dichlorophenol		591-35-5

Click

COSMOSIL Application

COSMOSIL Application

**COSMOSIL Application Data**

$\text{H}_2\text{O}/\text{MeCN}$       $\text{C18-EB}$       $\text{mNAP}$

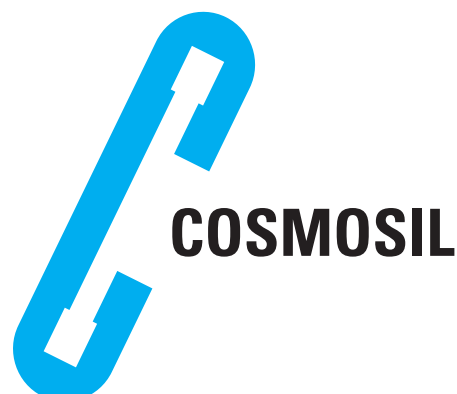
click to enlarge

Data No. AP-1024

Data Name Berberine

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## COSMOSIL / COSMOGEL Packing Material List

### Core-Shell Columns

Sample	Separation Mode	Packing Material	Bonded Phase	Bonding Type	Average Particle Size (µm)	Average Pore Size (Å)	Carbon Content (%)	Special Features and Applications	USP Category	Page
Organic compounds (low M.W.)	Reversed phase	C18	Octadecyl group	Polymeric	2.6	90	7	Multi-purpose C18 column	L1	5, 6
		Cholester	Cholesteryl group	Mono-meric			-	Usable under the same condition as C18. Unique rigid cholesteryl structure improves separation.	L101	5, 8
		PBr <sup>NEW</sup>	Pentabromobenzyl group				-	Separate hydrophilic compounds under reversed-phase conditions.	-	5,10

### HPLC Columns

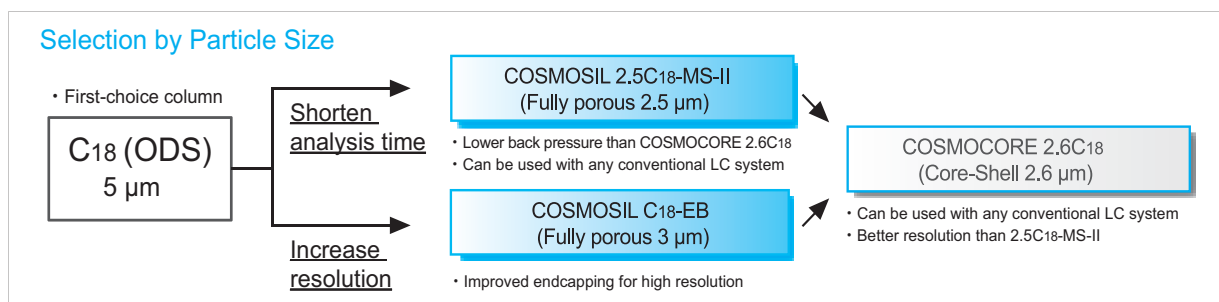
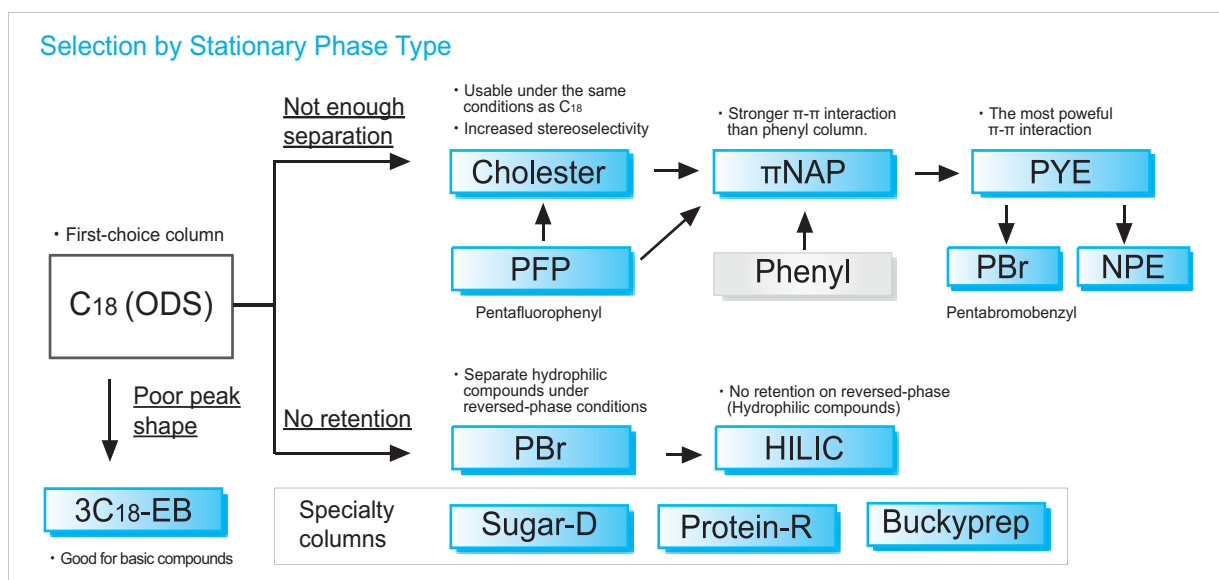
Sample	Separation Mode	Packing Material	Bonded Phase	Bonding Type	Average Particle Size (µm)	Average Pore Size (Å)	Carbon Content (%)	Special Features and Applications	USP Category	Page		
Organic compounds (low M.W.)	Reversed phase	C18-MS-II	Octadecyl group	Mono-meric	2.5	130	18	Multi-purpose C18 column	L1	14, 15		
		3, 5,15			120	16						
		C18-AR-II		Polymeric	3, 5,15	120	17	Features strong acid resistance, good for acidic compounds and peptides.		14, 17		
		C18-PAQ			5,15		11	Good for hydrophilic compounds, and stable performance under 100% aqueous conditions.			14, 19	
		C18-EB	Mono-meric	3	14.5	Good for basic compounds	14, 21					
		Cholester	Cholesteryl group	Mono-meric	2.5	130	21	Usable under the same conditions as C18. Unique rigid cholesteryl structure improves separation.	L101	22, 23		
		5			120	20						
		PBr	Pentabromobenzyl group	5	120	8	Separate hydrophilic compounds under reversed-phase conditions.	22, 25				
		πNAP	Naphthylethyl group	Mono-meric	2.5	130	14	Stronger π-π interaction than phenyl column.	-	22, 26		
		5	120		11							
		PYE	Pyrenylethyl group	18	The most powerful π-π interaction	22, 28						
		NPE	Nitrophenylethyl group	9	Separation utilizing dipole-dipole interaction.	22, 29						
		PFP	Pentafluorophenyl group	10	Separation utilizing weak dipole-dipole interaction.	L43	30, 31					
		CN-MS	Cyanopropyl group	5	120	7	Enables separation of different hydrophobic samples without using gradients.	L10	30, 32			
	C22-AR-II	Docosyl group	Polymeric	19	Alkyl chain columns, excluding C18 column	-	30, 33					
	C8-MS	Octyl group	Mono-meric	10		L7						
	C4-MS	Butyl group		7		L26						
	TMS-MS	Trimethyl group		5		L13						
	PE-MS	Phenylethyl group	10	π-π interaction	L11							
	Normal phase	SL-II	--	-	3, 5,15	120	-	Suitable for preparative separation.	L3	34		
Hydrophilic interaction		HILIC	Triazole	-	2.5	130	-	Retains highly polar compounds that would not be retained in a C18 column.	L104	35		
	5				120							
Mono- and Oligo-saccharides	Hydrophilic interaction	Sugar-D	Secondary/Tertiary amine	-	5	-	-	A novel stationary phase for mono- and oligosaccharides.	-	37, 38		
		NH2-MS	Aminopropyl group	Polymeric	120	4	Primary amino bonded column	L8	37, 39			
Proteins	Reversed phase	Protein-R	Octadecyl group	Polymeric	5	300	-	Wide-pore column with the advantages of both C18 and C4	L1	40		
		C18-AR-300					12					
		C8-AR-300	7				Wide pore type				L1	41
		C4-AR-300	6									
		Ph-AR-300	7									
	Gel permeation	Diol-120-II	Diol group	-	5	120	-	Silica-based gel filtration column Sample MW (Protein) 5,000-100,000 Da	L20	43		
		Diol-300-II				300						
		Diol-1000-II <sup>NEW</sup>				1000					Silica-based gel filtration column Sample MW (Protein) 10,000-700,000 Da	
	Ion-exchange	IEX Type Q	Trimethylaminopropyl type	-	5	1000	-	Anion-exchange type (purification)	-	45		
		IEX Type Q-N				-		Anion-exchange type (ultra-fast analysis, precise analysis)				
		IEX Type S	Sulfopropyl type			1000		Cation-exchange type (purification)				
		IEX Type S-N				-		Cation-exchange type (ultra-fast analysis, precise analysis)				
		IEX Type M	Trimethylaminopropyl type /Sulfopropyl type			1000		Amphoteric ion-exchange type (purification)				
		IEX Type M-N				-		Amphoteric ion-exchange type (precise analysis)				
	Hydrophobic interaction	HIC	--	-	5	300	-	Little loss in enzyme activity and the tertiary structure of proteins	-	47		

Sample	Separation Mode	Packing Material	Bonded Phase	Bonding Type	Average Particle Size (µm)	Average Pore Size (Å)	Carbon Content (%)	Special Features and Applications	USP Category	Page
Fullerenes	--	Buckyprep	Pyrenylpropyl group	Monomeric	5	120	17	Standard column for fullerene separation.		48, 49
		Buckyprep-D	Nitro-carbazoyl group				-	Good for derivatized fullerenes		48, 50
		Buckyprep-M	Phenothiazinyl group				13	Good for metallofullerenes		48, 51
		PBB	Pentabromobenzyl group				8	Good for preparative separation of C <sub>60</sub> or C <sub>70</sub> .		48, 52
		NPE	Nitrophenylethyl group				9	Separation of derivatized fullerenes		48, 53
		PYE	Pyrenylethyl group				18	Separation of fullerenes		48, 52
Carbon nanotubes	Gel permeation	CNT-300	Hydrophilic group (neutral)	-	5		300	Separation of soluble carbon nanotubes.		54
		CNT-1000					1000			
		CNT-2000					2000			

## SFC Columns

Sample	Separation Mode	Packing Material	Bonded Phase	Bonding Type	Average Particle Size (µm)	Average Pore Size (Å)	Carbon Content (%)	Special Features and Applications	USP Category	Page
-	SFC	HP <b>NEW</b>	3-Hydroxyphenyl group	Polymeric	3, 5	120	-	Good for hydrophilic compounds. Stronger retention for basic compounds than PY	-	55, 56
		PY <b>NEW</b>	Pyridinyl group					Similar separation properties as 2-Ethylpyridine, with stronger retention.		
		Quinoline <b>NEW</b>	Quinoline group					Alternate selectivity to HP and PY.		
		Cholester	Cholesteryl group	Monomeric	2.5, 5	130	21	Usable under the same conditions as C <sub>18</sub> . Unique rigid cholesteryl structure improves separation.	L101	55, 59
		PBr	Pentabromobenzyl group		5	120	8	Separate hydrophilic compounds under reversed-phase conditions.		55, 59

## Column Selection Guide



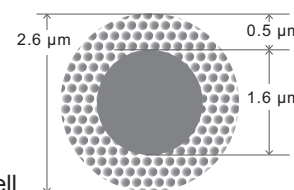
# I. HPLC Columns

## 1. Core-Shell Columns

### (1) COSMOCORE Series

#### About Core-Shell Particles

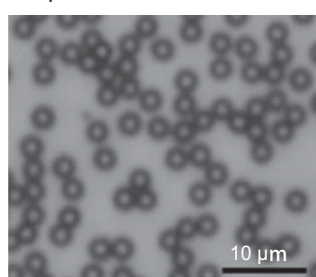
Core-shell particles consist of a nonporous core inside a porous shell. By using these core-shell particles, one can achieve sharper peaks compared to fully porous silica gel particles of the same diameter.



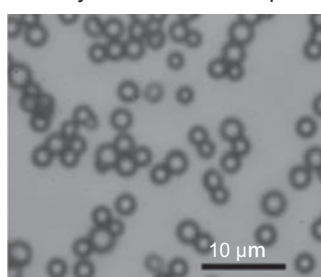
Schematic diagram of a silica particle

#### 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.



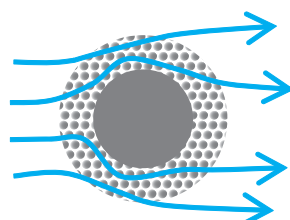
COSMOCORE 2.6C18 (200x)



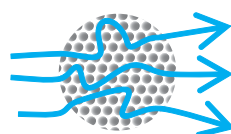
Fully porous 1.7 μm particles (200x)

#### 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.



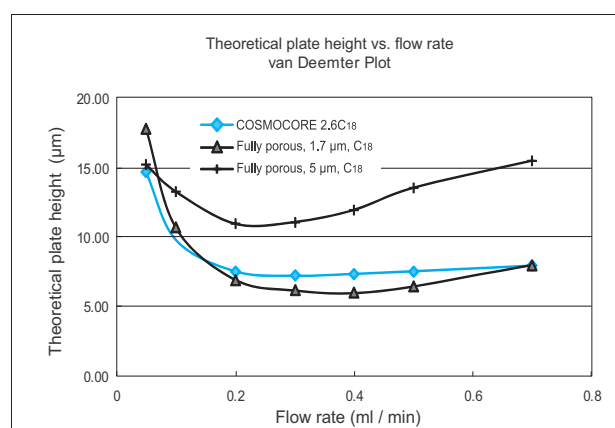
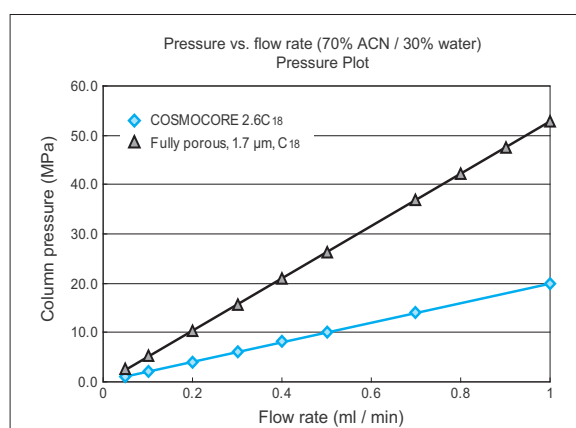
COSMOCORE 2.6C18



Fully porous sub-2 μm particle

#### Reduced Back Pressure and Faster Analyses

COSMOCORE 2.6C18 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. x 50 mm  
Mobile phase: Acetonitrile / Water = 70 / 30

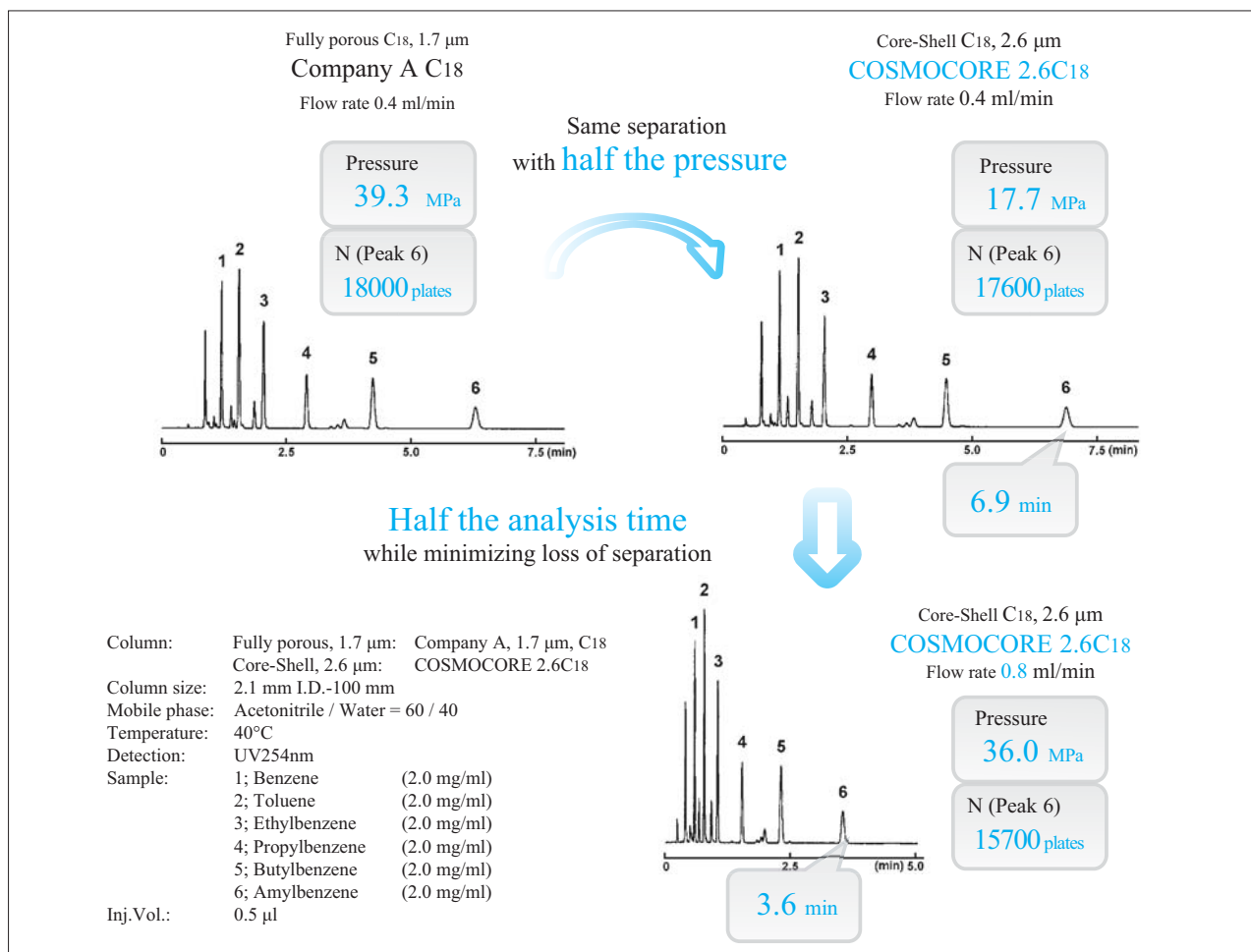
Temperature: 40°C  
Sample: Amylbenzene



## 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.



## Specifications

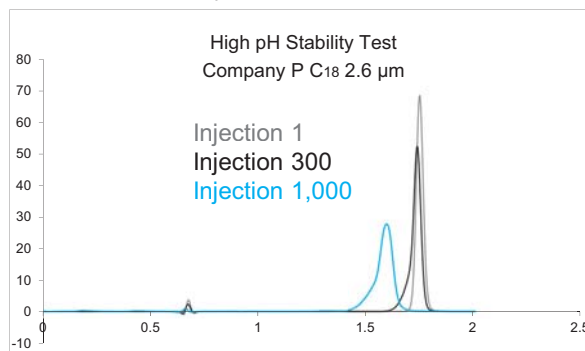
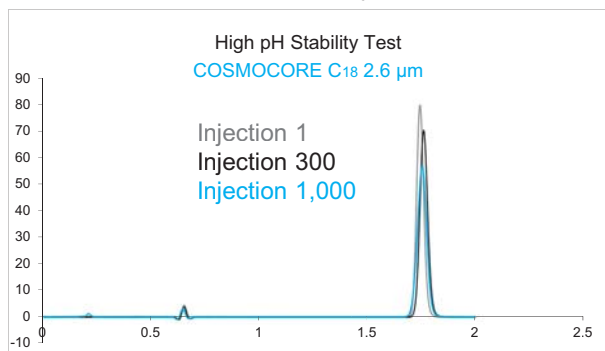
Packing Material	2.6C18	2.6Cholester	2.6PBr
Silica Gel	Core-shell type silica gel		
Average Particle Size	2.6 µm		
Average Core Diameter	1.6 µm		
Average Pore Size	approx. 90 Å		
Specific Surface Area	approx. 150 m <sup>2</sup> /g		
Bonded Phase Structure			
Bonded Phase	Octadecyl group	Cholesteryl group	Pentabromobenzyl Group
Main interaction	Hydrophobic interaction	Hydrophobic interaction Molecular shape selectivity	Hydrophobic interaction Dispersion force
End-Capping Treatment	Near-perfect treatment		
Usable pH Range	1.5 - 10	2 - 7.5	
Maximum Pressure	60 MPa		

# COSMOCORE 2.6C<sub>18</sub>

- 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)

## Excellent pH Stability

Under accelerated pH 10.4, 40°C stability test, COSMOCORE C<sub>18</sub> shows superior stability compared with other core-shell C<sub>18</sub> phases.



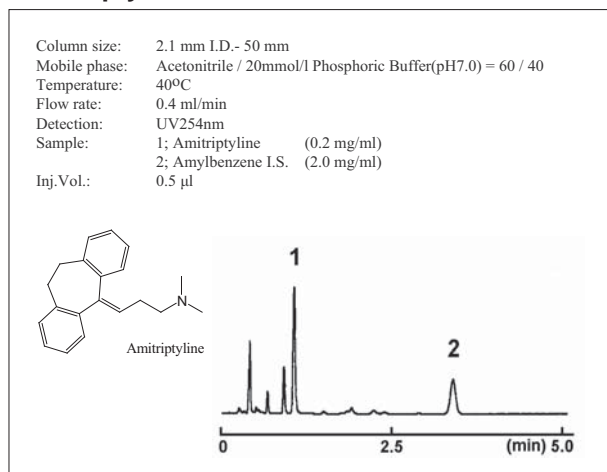
Column size: 2.1 mm x 100 mm  
 Sample: Caffeine (0.05 mg/ml)  
 Flow rate: 0.4 ml/min.  
 Mobile phase: 0.35% Ammonium hydroxide/ acetonitrile = 90/10 (pH 10.4)  
 Injection volume: 1 µl  
 Temperature: 40 °C

## Sharp Peaks with Many Types of Compounds

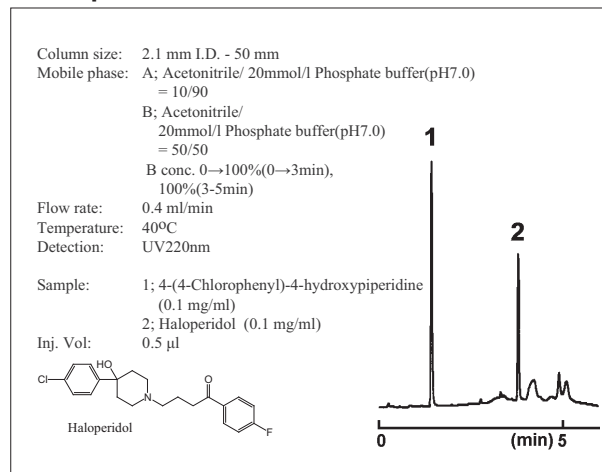
COSMOCORE 2.6C<sub>18</sub> features a special end capping treatment that effectively shields residual silanol groups, yielding sharp peaks for basic compounds and metal coordination complexes.

### Basic Compounds

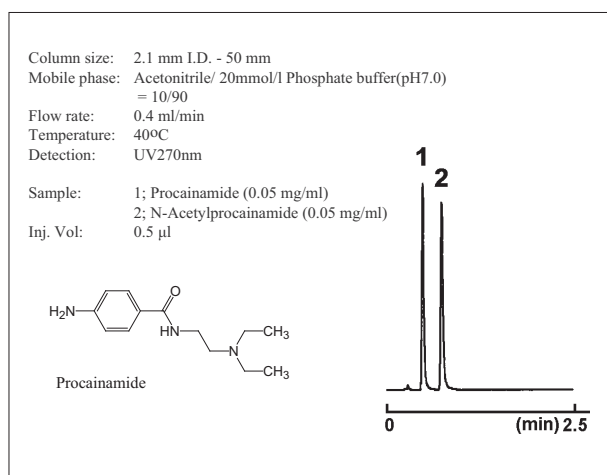
#### • Amitriptyline



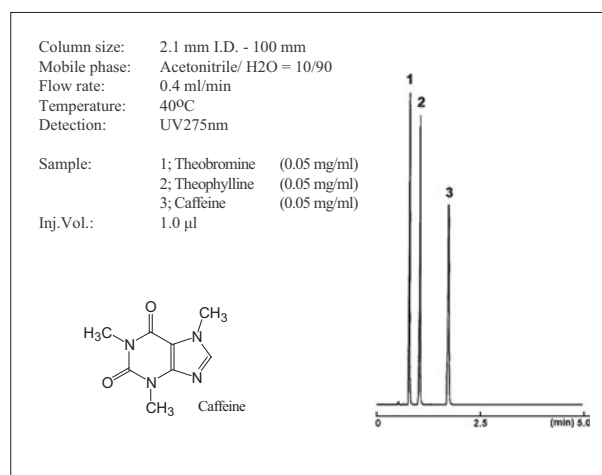
#### • Haloperidol



#### • Procainamide



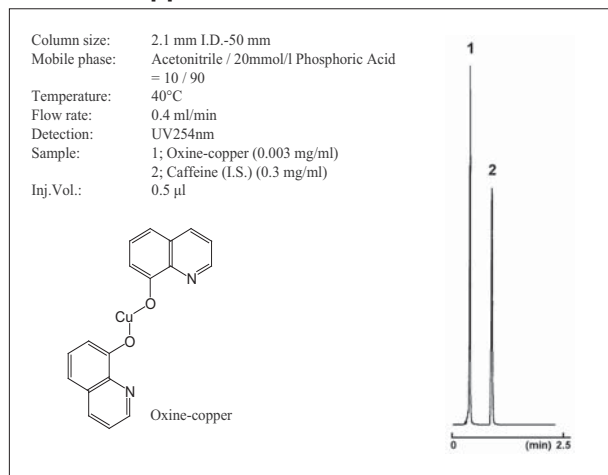
#### • Caffeine





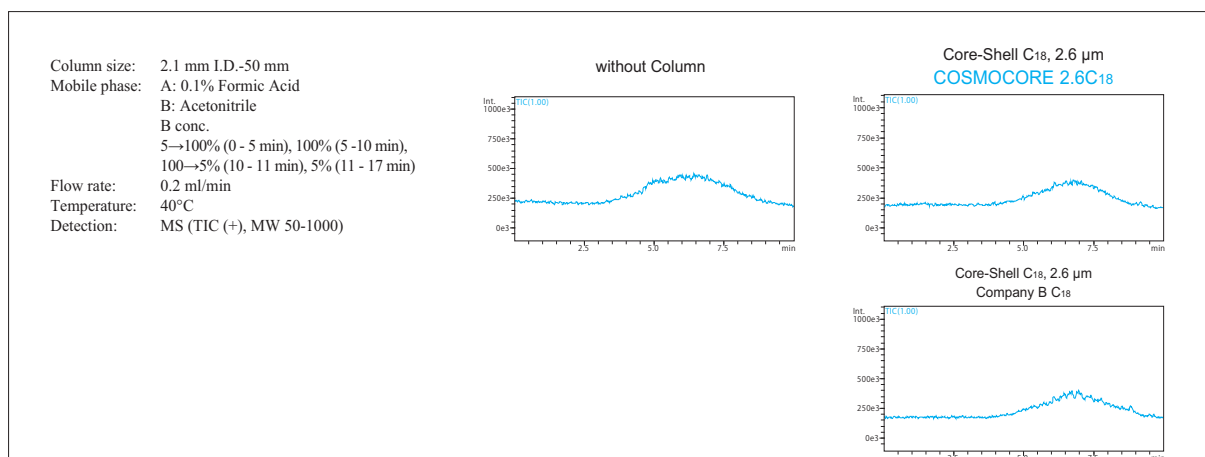
## Metal Coordination Complexes

### • Oxine-Copper



## Low Bleed-Suitable for LC-MS

COSMOCORE 2.6C<sub>18</sub> has low column bleed and consequently low MS noise level.



## Ordering Information

### • Analytical Columns (Particle Size: 2.6 µm)

#### COSMOCORE 2.6C<sub>18</sub> Packed Columns

Column Size I.D. x Length (mm)	Product Number	Column Size I.D. x Length (mm)	Product Number	Column Size I.D. x Length (mm)	Product Number
2.1 x 30	12632-31	3.0 x 30	12611-01	4.6 x 30	12601-31
2.1 x 50	12631-41	3.0 x 50	12609-51	4.6 x 50	12600-41
2.1 x 75	12630-51	3.0 x 75	12608-61	4.6 x 75	12599-91
2.1 x 100	12614-71	3.0 x 100	12607-71	4.6 x 100	12598-01
2.1 x 150	12612-91	3.0 x 150	12602-21	4.6 x 150	12597-11
				4.6 x 250	12596-21

COSMOCORE's connector is the same type as Waters UPLC® columns.

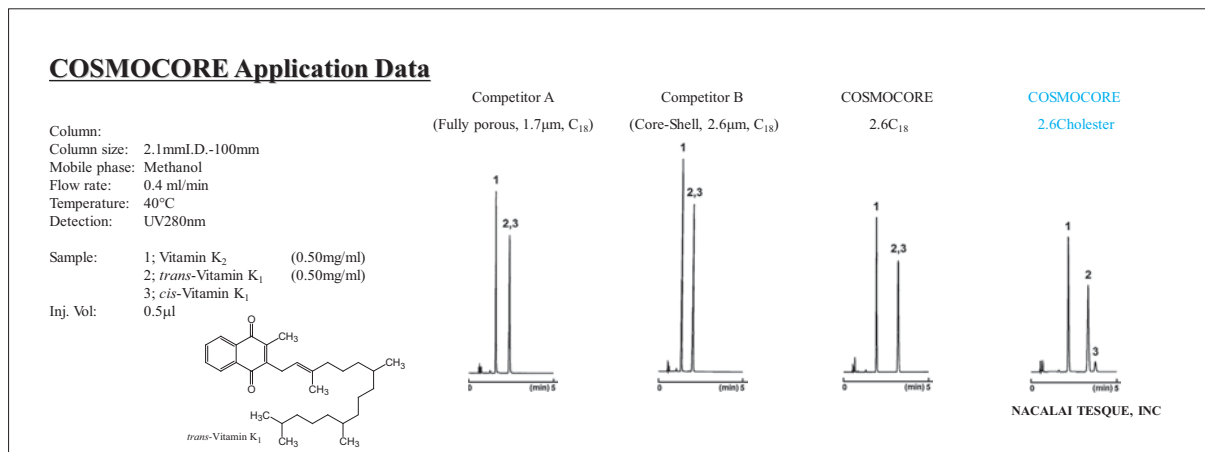
For UHPLC-compatible prefilters, refer to page 13.

# COSMOCORE 2.6Cholester

- Cholesterol-bonded reversed-phase core-shell column
- Usable under the same conditions as C<sub>18</sub> columns
- Better selectivity for cis-trans isomers, and natural products

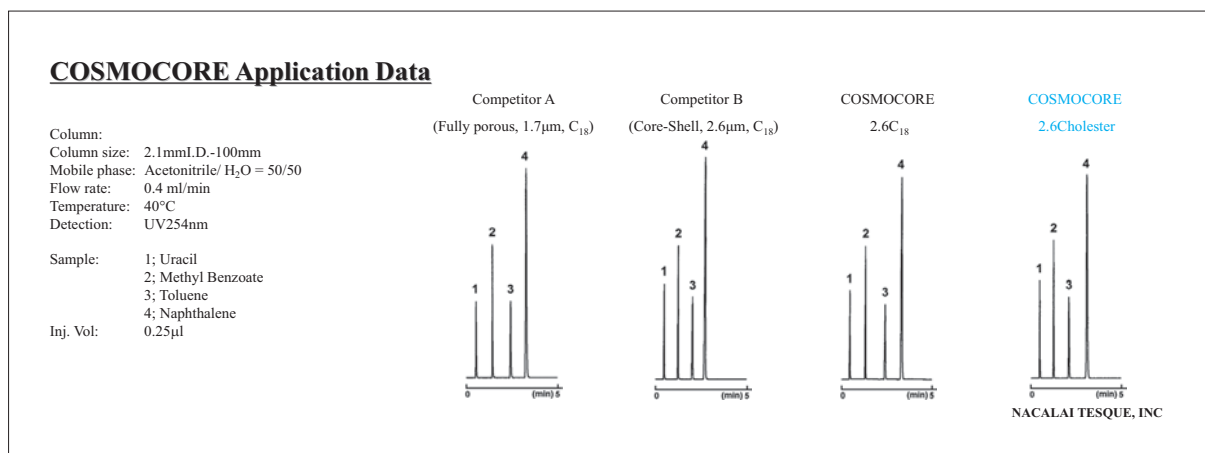
## Comparison with C<sub>18</sub>

COSMOCORE 2.6Cholester offers improved separation for cis-trans isomers than C<sub>18</sub> under typical reversed-phase mobile phase.



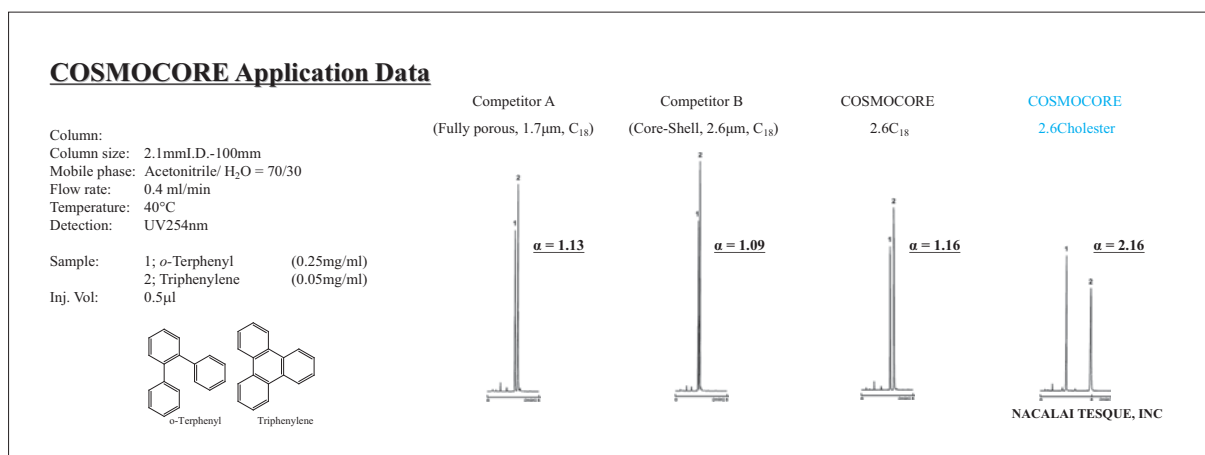
## Separation Properties

COSMOCORE 2.6Cholester has about the same hydrophobicity as C<sub>18</sub>. It is not necessary to change the analytical conditions when replacing C<sub>18</sub> Columns with COSMOCORE 2.6Cholester.



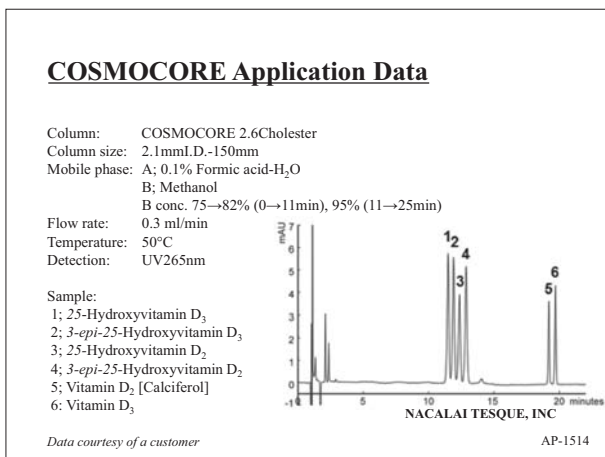
## Molecular Shape Selectivity

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

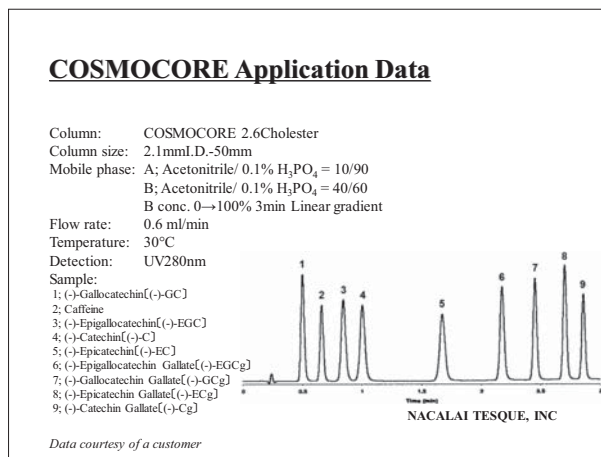


## Applications

### • Vitamin D metabolites



### • Catechins



## Ordering Information

### • Analytical Columns (Particle Size: 2.6 µm)

#### COSMOCORE 2.6Cholester Packed Column

Column Size I.D. x Length (mm)	Product Number	Column Size I.D. x Length (mm)	Product Number	Column Size I.D. x Length (mm)	Product Number
2.1 x 30	12858-91	3.0 x 30	12863-11	4.6 x 30	12869-51
2.1 x 50	12859-81	3.0 x 50	12864-01	4.6 x 50	12870-11
2.1 x 75	12860-41	3.0 x 75	12866-81	4.6 x 75	12871-01
2.1 x 100	12861-31	3.0 x 100	12867-71	4.6 x 100	12872-91
2.1 x 150	12862-21	3.0 x 150	12868-61	4.6 x 150	12873-81
				4.6 x 250	12875-61

COSMOCORE's connector is the same type as Waters UPLC® columns.  
 For UHPLC-compatible prefilters, refer to page 13.

# COSMOCORE 2.6PBr

- Separate hydrophilic compounds under reversed-phase conditions
- Retain hydrophilic compounds longer than C<sub>18</sub>
- Greater sample loading capacity than HILIC
- High performance similar to sub-2 μm particles with lower back pressure

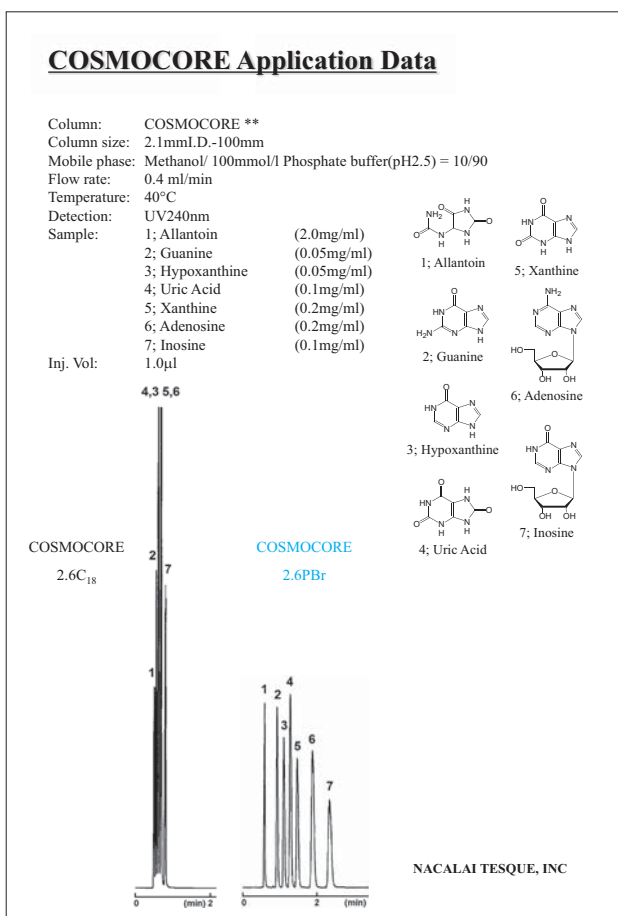
< Suitable Samples >

- Hydrophilic compounds
- Nucleic acids and derivatives
- Surfactants
- Glycosides
- Peptides

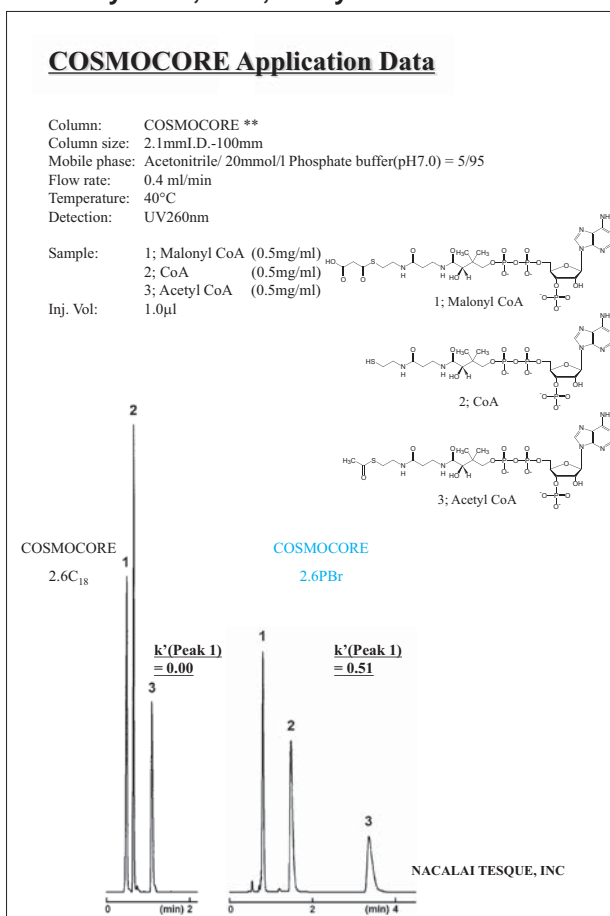
## Separation of Hydrophilic Compounds (low retention on C<sub>18</sub>)

COSMOCORE 2.6PBr retains hydrophilic compounds stronger than C<sub>18</sub> columns under the same reversed-phase conditions.

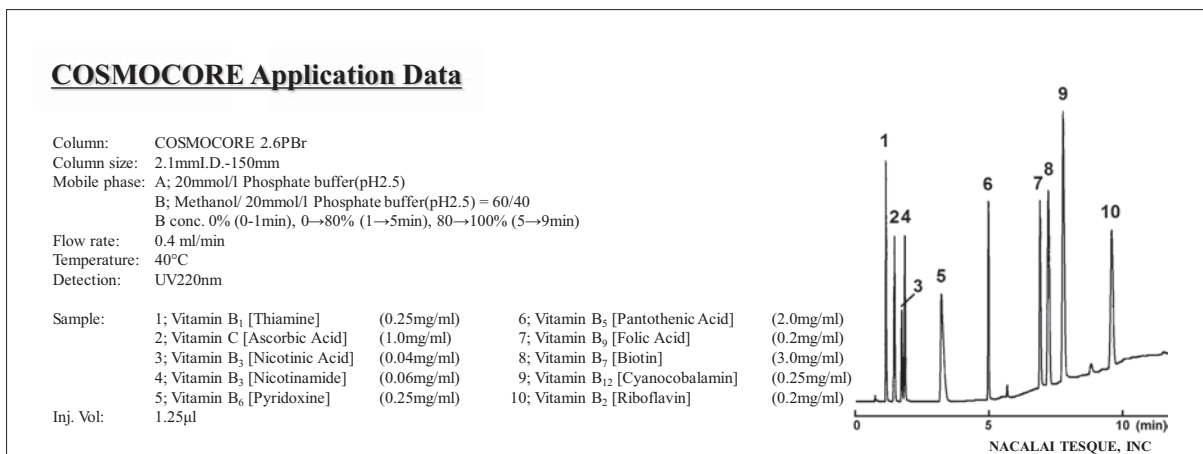
### • Nucleic Acid Metabolites



### • Malonyl CoA, CoA, Acetyl CoA



### • Water-Soluble Vitamins

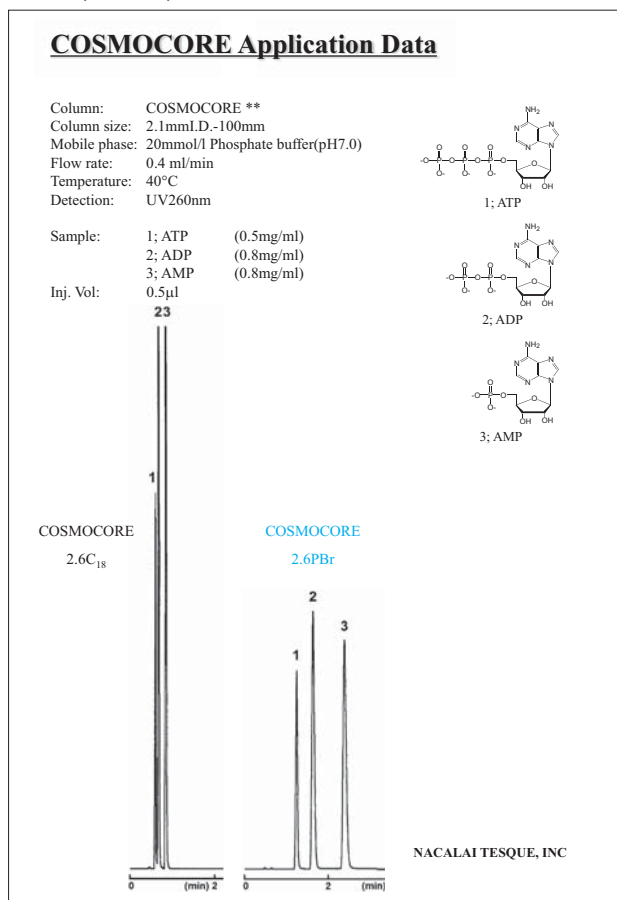




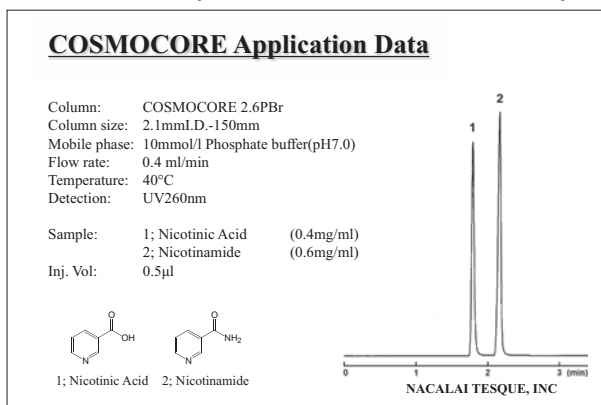
## Separation of Hydrophilic Compounds (compounds with similar hydrophobicity)

COSMOCORE 2.6PBr can separate compounds with similar hydrophobicity, utilizing several kinds of molecular interactions, including dispersion force generated by the bromine atoms.

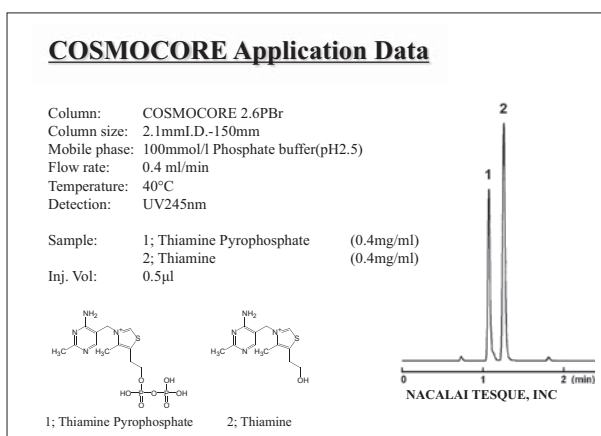
### • ATP, ADP, AMP



### • Vitamin B3 (Nicotinic Acid, Nicotinamide)



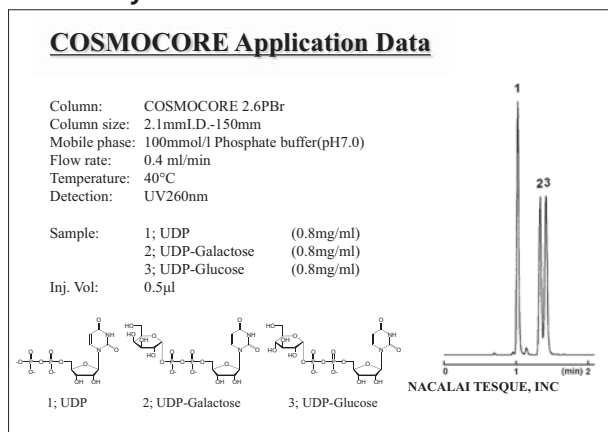
### • Thiamine Pyrophosphate, Thiamine



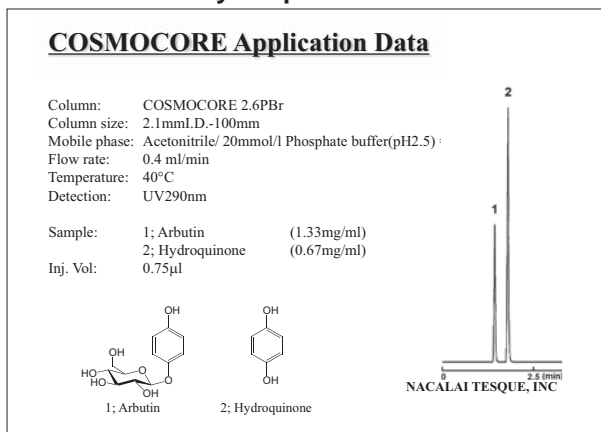
## Separation of Hydrophilic Compounds (Glycosides)

Glycosides with identical aglycones but different glycosyl groups can also be separated.

### • UDP Glycosides



### • Arbutin and Hydroquinone



## Ordering Information

### • Analytical Columns (Particle Size: 2.6 µm)

#### COSMOCORE 2.6PBr Packed Column

Column Size I.D. x Length (mm)	Product Number	Column Size I.D. x Length (mm)	Product Number	Column Size I.D. x Length (mm)	Product Number
2.1 x 30	13692-21	3.0 x 30	13698-61	4.6 x 30	13705-51
2.1 x 50	13693-11	3.0 x 50	13699-51	4.6 x 50	13712-51
2.1 x 75	13694-01	3.0 x 75	13700-01	4.6 x 75	13714-31
2.1 x 100	13695-91	3.0 x 100	13701-91	4.6 x 100	13715-21
2.1 x 150	13697-71	3.0 x 150	13703-71	4.6 x 150	13719-81
				4.6 x 250	13734-71

COSMOCORE's connector is the same type as Waters UPLC® columns.

For UHPLC-compatible prefilters, refer to page 13.

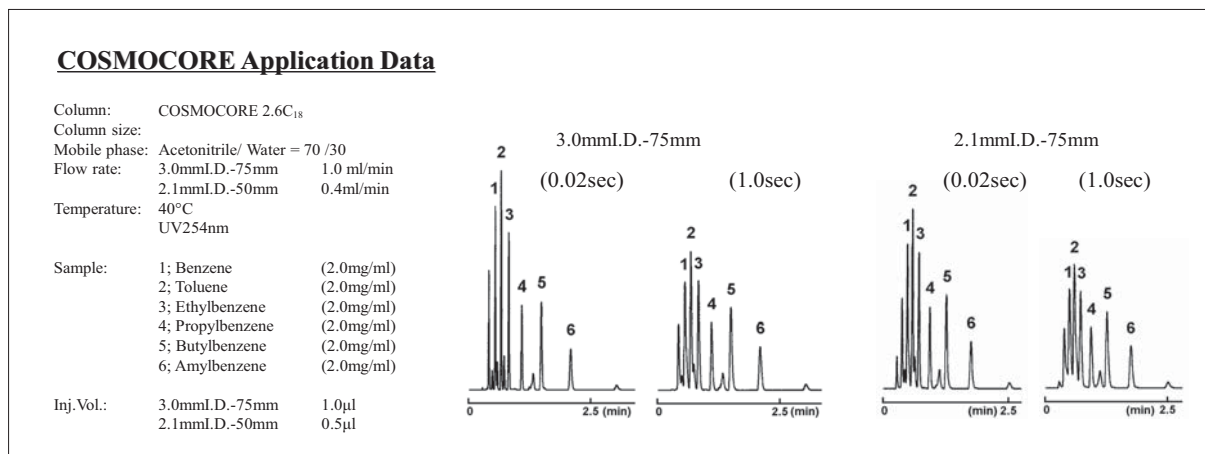
## (2) Instrument Settings and Compatibility

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

COSMOCORE columns are designed for use with UHPLC instruments. In addition, due to their low backpressure, they can be used with conventional instruments. However, it is necessary to change the following settings.

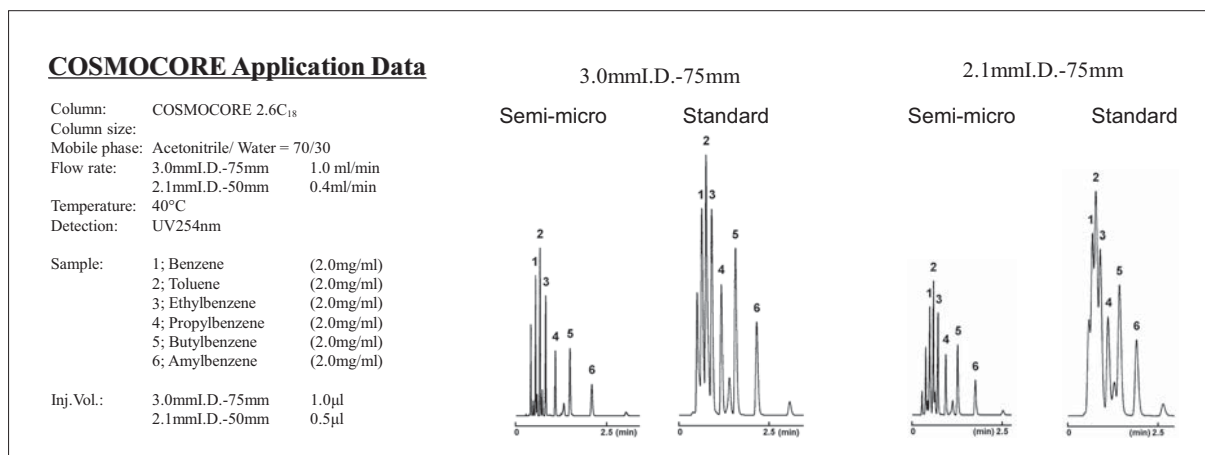
### Detector Response Time

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.



### 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).



### 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

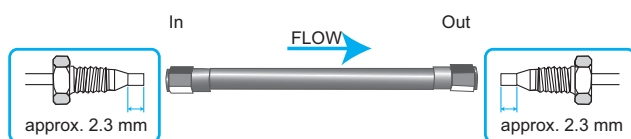
	HPLC	UHPLC
Connector Shape	 approx. 3.3 mm	 approx. 2.3 mm

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.

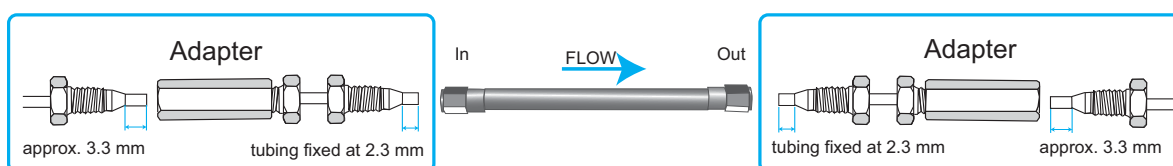


### 2) HPLC instrument fittings

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

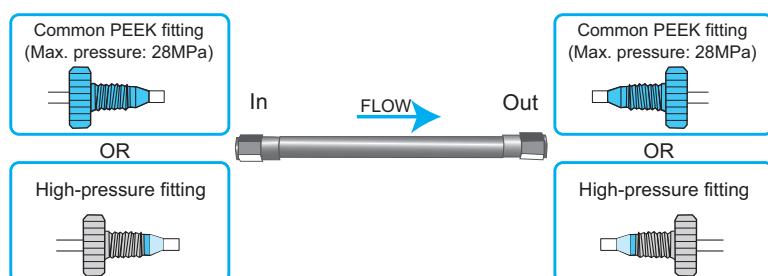
#### SUS ferrules (HPLC) fixed on the tubing

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.



## Ordering Information

### • Adapter List

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

### • UHPLC-compatible prefilter

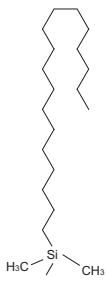
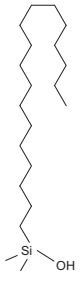
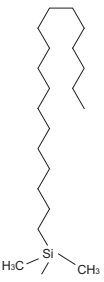
Product Name	In	Out	Contents	Product Number	PKG Size
U-Fil UHPLC-compatible prefilter	UHPLC	UHPLC	Filter: 0.5 µm	12571-31	1 SET
	HPLC	UHPLC	Tubing connecting diameter: 1/16	12572-21	1 SET
U-Fil replacement filter	-	-	Filter: 0.5 µm Material: SUS316L	15767-91	5 units / PKG

## 2. HPLC Columns

### (1) Reversed Phase Columns

#### C<sub>18</sub> (ODS) Series

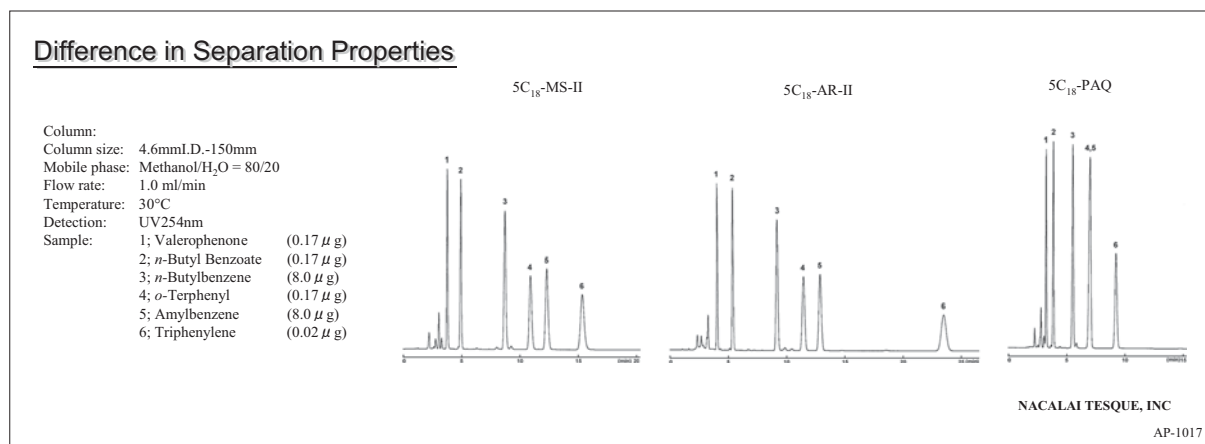
#### Specifications

Packing Material	C <sub>18</sub> -MS-II	C <sub>18</sub> -AR-II	C <sub>18</sub> -PAQ	C <sub>18</sub> -EB
Silica Gel	High purity porous spherical silica			
Average Particle Size	2.5, 3, 5, 15 µm	3, 5, 15 µm	5, 15 µm	3 µm
Average Pore Size	approx. 120 Å			
Specific Surface Area	approx. 300 m <sup>2</sup> /g			
Bonded Phase Structure				
Bonded Phase	Octadecyl group			
Bonding Type	Monomeric	Polymeric		Monomeric
Main Interaction	Hydrophobic interaction			
End-Capping Treatment	Near-perfect treatment			
Carbon Content	approx. 16%	approx. 17%	approx. 11%	approx. 14.5%
Usable pH Range	2~10*	1.5~7.5*	2~7.5	2~10*
Features	•Multi-purpose C <sub>18</sub> Column	•Features strong acid resistance. •Good for acidic compounds and peptides.	•Good for hydrophilic compounds. •Stable performance under 100% aqueous conditions.	•Good for basic compounds

\*Optimal pH range of silica-based columns is between 2 and 7.5. Extreme pH may significantly decrease column lifetime.

#### Difference in Separation Properties (5 µm)

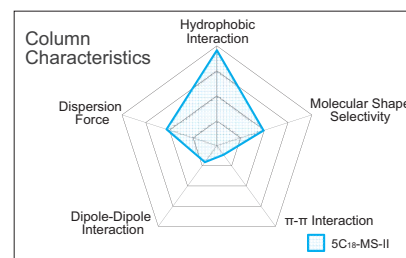
COSMOSIL 5C<sub>18</sub>-AR-II retains planar compounds (such as triphenylene) longer compared to COSMOSIL 5C<sub>18</sub>-MS-II. COSMOSIL 5C<sub>18</sub>-PAQ has shorter retention time, and retains polar compounds (Such as valerophenone, *n*-butyl benzoate) longer.





# COSMOSIL C<sub>18</sub>-MS-II

- First-choice column of our ODS series
  - Multi-purpose C<sub>18</sub> column
  - High reproducibility
  - A wide range of applications
- < Suitable Samples >
- Low-M.W. Compounds



## Separation Property

The COSMOSIL 5C<sub>18</sub>-MS-II is a well-balanced column with better basic performance, such as sharper peaks for basic compounds and chelating compounds, strong hydrophobic interaction, low analytical pressure, and high theoretical plate number. COSMOSIL 5C<sub>18</sub>-MS-II is the first-choice column for reversed-phase chromatography.

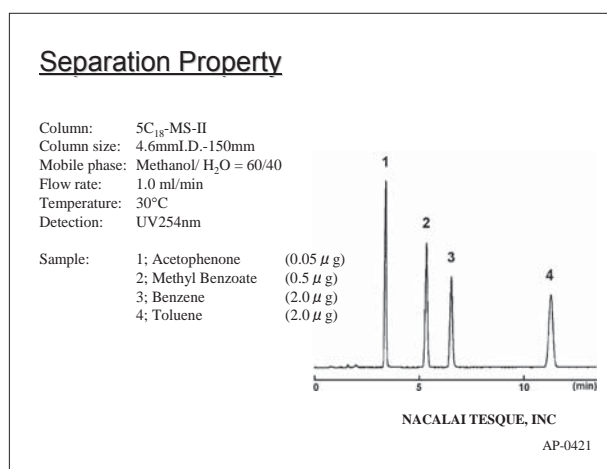
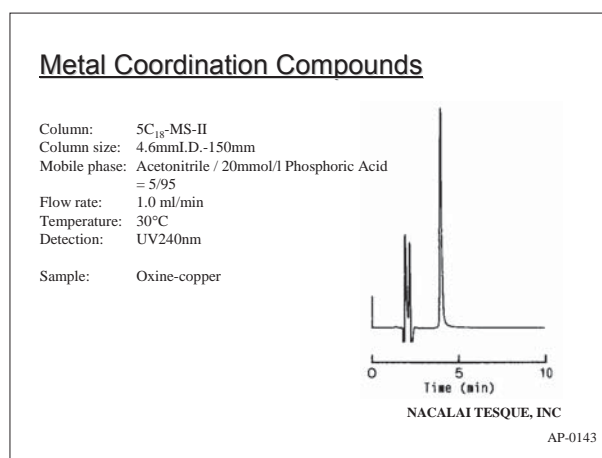
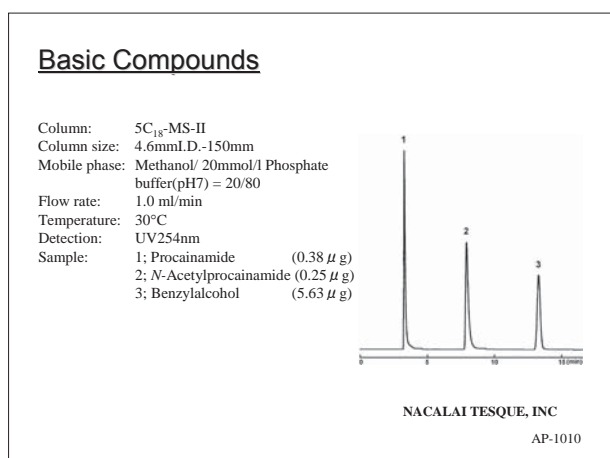


Table. Comparison of hydrophobic interaction, analytical pressure, and theoretical plate number

Column	Hydrophobic Interaction α (Toluene/Benzene)	Pressure (MPa)	Theoretical Plate Number (Toluene)
COSMOSIL 5C <sub>18</sub> -MS-II	1.96	8.3	14300
Company A C <sub>18</sub>	1.99	13.0	16800
Company B C <sub>18</sub>	1.94	8.0	14000
Company C C <sub>18</sub>	1.69	11.2	5600
Company D C <sub>18</sub>	1.84	10.5	14200

## Analysis of Basic Compounds and Metal Coordination Compounds

The COSMOSIL 5C<sub>18</sub>-MS-II column, taking advantage of a new end-capping treatment, can replace the original COSMOSIL C<sub>18</sub> (ODS) column. A new end-capping treatment with polar groups for shielding effect has significantly improved peak shape for basic compounds. Ultra pure silica gel with low trace-metal content is used for COSMOSIL columns; thus the columns provide excellent peak shapes for chelating compounds.



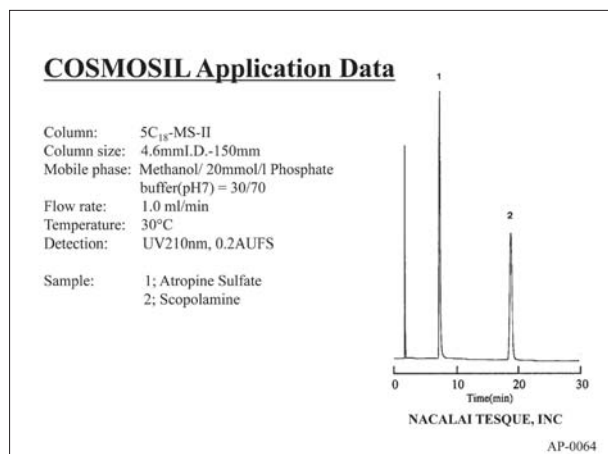
## High Reproducibility

The strict quality control system of Nacalai Tesque ensures the quality of the silica gel and bonding and end capping process, reducing variation between lots. We support customers with an individual Inspection Report which accompanies each and every COSMOSIL, COSMOCORE and COSMOGEL packed column (except guard columns) and an additional Certificate of Analysis for the COSMOSIL 5C<sub>18</sub>-MS-II (4.6 mm I.D. x 150 mm and 4.6 mm I.D. x 250 mm).

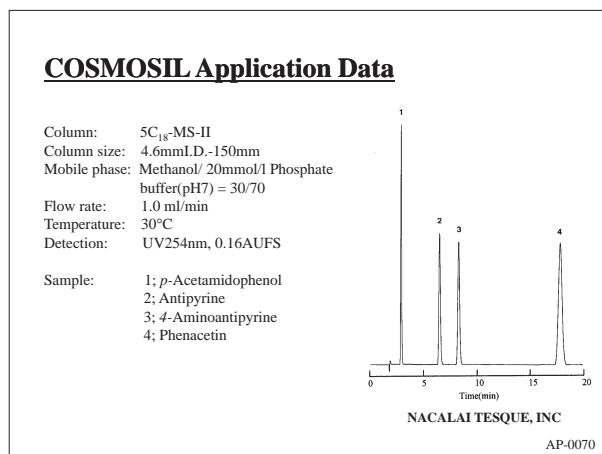
## A Wide Range of Applications

A wide selection of applications, e.g. drug molecules, is available to achieve appropriate separation parameters for target samples.

### • Parasympatholytic Agents



### • Analgesic Antipyretic Drugs



## Ordering Information

### • Analytical / Preparative Columns (Particle Size: 5 µm)

#### COSMOSIL 5C<sub>18</sub>-MS-II Packed Column

Column Size I.D. x Length (mm)	Product Number	Column Size I.D. x Length (mm)	Product Number
1.0 x 50	02824-31	4.6 x 100	38018-91
1.0 x 150	02896-01	4.6 x 150*	38019-81
2.0 x 30	05876-71	4.6 x 150 3 lots set	09397-73
2.0 x 50	04355-21	4.6 x 250*	38020-41
2.0 x 100	05597-31	6.0 x 150	38021-31
2.0 x 150	38025-91	6.0 x 250	38022-21
2.0 x 250	05761-61	10 x 50	05789-21
3.0 x 100	05458-51	10 x 150	34355-91
3.0 x 150	34245-31	10 x 250	38023-11
3.0 x 250	34254-11	20 x 150	05091-41
4.6 x 30	34341-61	20 x 250	38024-01
4.6 x 50	38017-01	28 x 250	05760-71

#### COSMOSIL 5C<sub>18</sub>-MS-II Guard Column

Column Size I.D. x Length (mm)	Product Number
4.6 x 10	38014-31
4.6 x 10 Cartridge**	38015-89
10 x 20	38016-11
20 x 20	05790-81
20 x 50	34371-71
28 x 50	34347-01

\* Validated columns

\*\* 2 cartridges included. Guard cartridge holder required; refer to page 71.

### • Preparative Columns (Particle Size: 15 µm)

#### COSMOSIL 15C<sub>18</sub>-MS-II Packed Column

Column Size I.D. x Length (mm)	Product Number
28 x 250	34525-61
50 x 250	05886-41
50 x 500	34531-71

#### COSMOSIL 15C<sub>18</sub>-MS-II Guard Column

Column Size I.D. x Length (mm)	Product Number
28 x 50	05885-51
50 x 50	34527-41

### • Fast LC Column (Particle Size: 3 µm)

#### COSMOSIL 3C<sub>18</sub>-MS-II Packed Column

Column Size I.D. x Length (mm)	Product Number
2.0 x 50	05514-01
4.6 x 10	38065-71
4.6 x 50	38066-61
4.6 x 100	38067-51

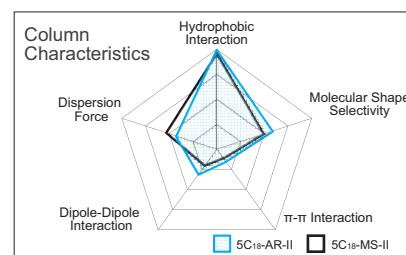
### • Analytical Columns (Particle Size: 2.5 µm)

#### COSMOSIL 2.5C<sub>18</sub>-MS-II Packed Column

Column Size I.D. x Length (mm)	Product Number	Column Size I.D. x Length (mm)	Product Number
2.0 x 50	08994-31	3.0 x 50	08997-01
2.0 x 75	08995-21	3.0 x 75	08998-91
2.0 x 100	08996-11	3.0 x 100	08999-81

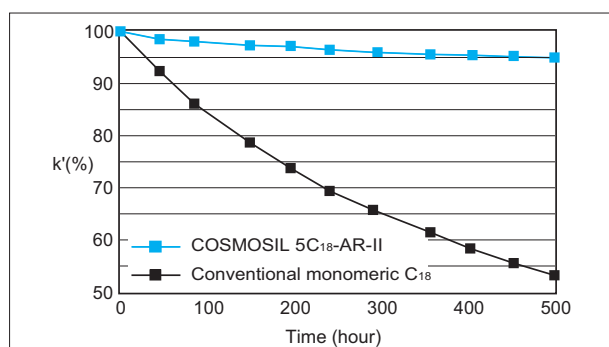
# COSMOSIL C<sub>18</sub>-AR-II

- Features strong acid resistance
- < Suitable Samples >
- Peptides, acidic compounds, etc.



## Acid Resistance

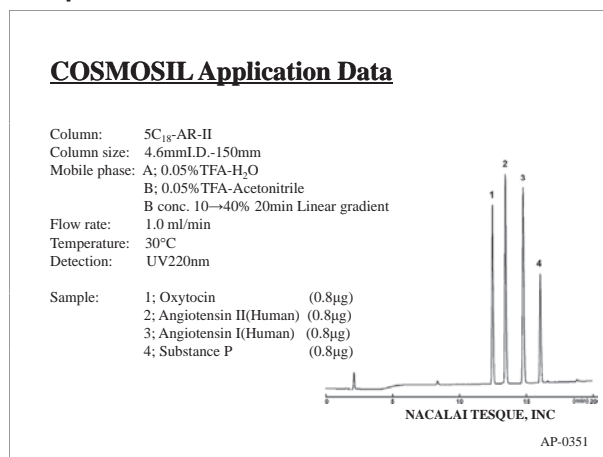
The COSMOSIL 5C<sub>18</sub>-AR-II packed column features a polymeric type of C<sub>18</sub> reversed phase material. The acidic resistance of COSMOSIL 5C<sub>18</sub>-AR-II is much improved compared with commercially available monomeric type octadecyl stationary phases. It retains high performance even with acidic mobile phases commonly used to separate acidic compounds and peptides.



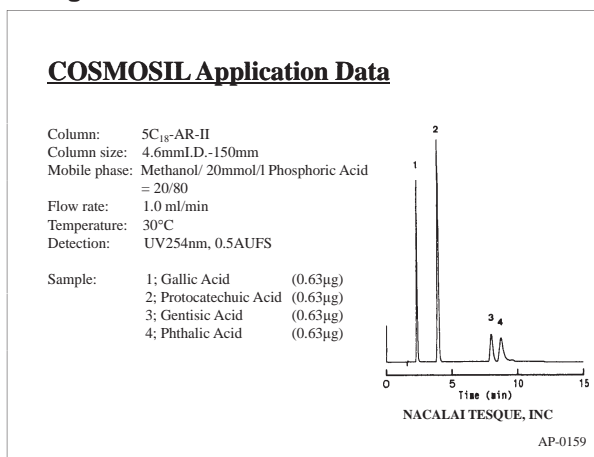
Decomposition test in 0.1% Trifluoroacetic acid solution at 60°C.  
Capacity factor (k') = Naphthalene,  
Mobile phase: Methanol / H<sub>2</sub>O=70/30

## Applications

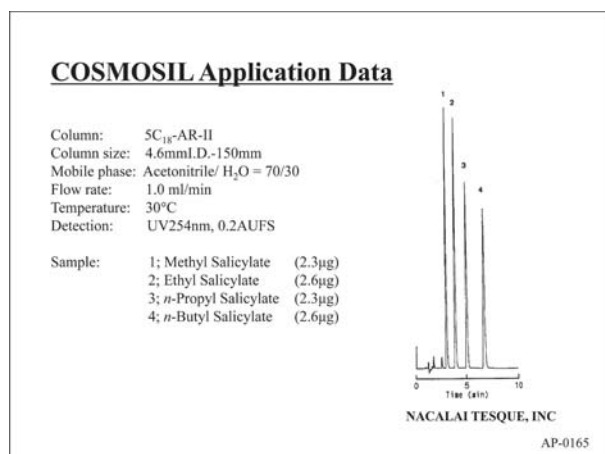
### • Peptides



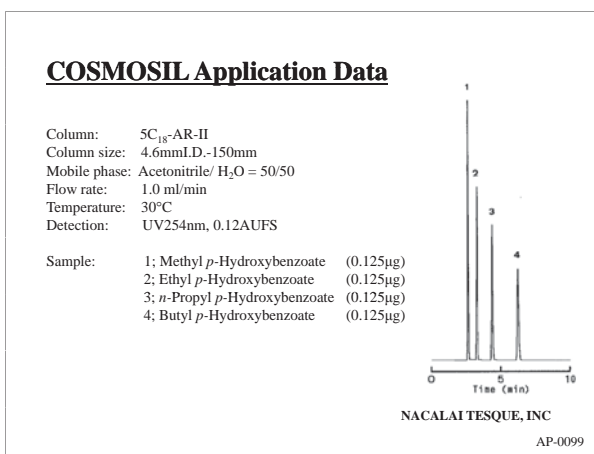
### • Organic Acids



### • Salicylic Acid Esters

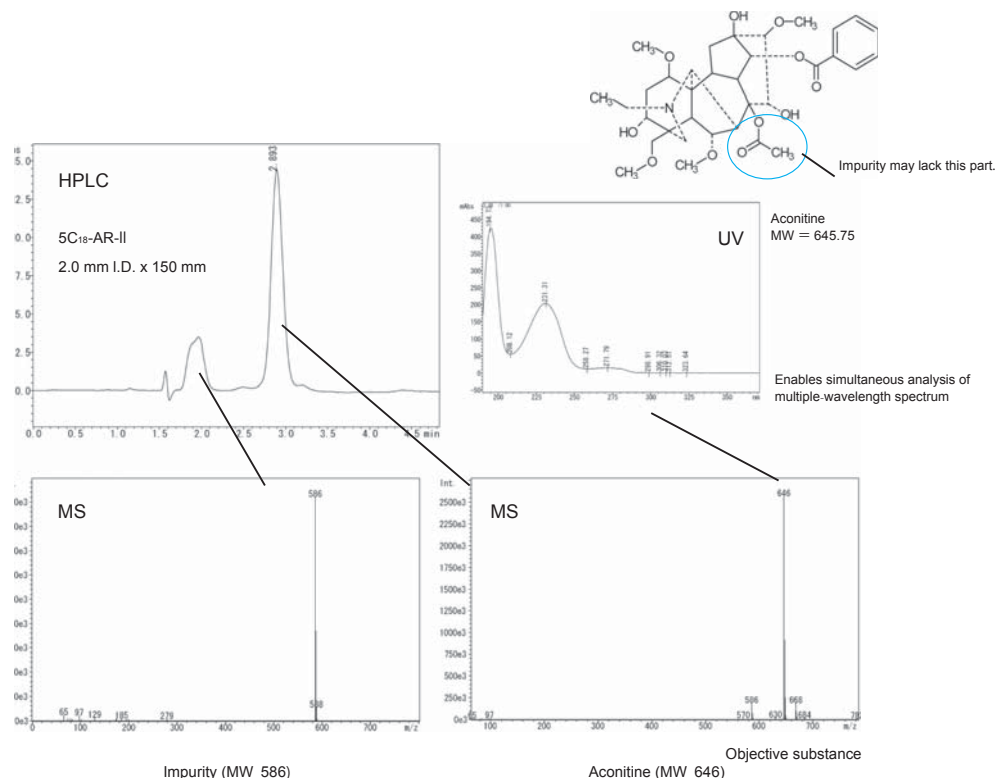


### • Parabens



## LC/MS Applications

- Identification of herbal medicine constituents by LC/MS



## Ordering Information

- Analytical / Preparative Columns (Particle Size: 5 µm)

### COSMOSIL 5C<sub>18</sub>-AR-II Packed Column

Column Size I.D. x Length (mm)	Product Number
1.0 x 50	02955-21
1.0 x 150	02951-61
2.0 x 30	05098-71
2.0 x 50	34400-81
2.0 x 100	34469-11
2.0 x 150	37992-51
2.0 x 250	05272-71
3.0 x 100	05791-71
3.0 x 150	38028-61
3.0 x 250	38029-51
4.6 x 30	05877-61
4.6 x 50	38142-51

Column Size I.D. x Length (mm)	Product Number
4.6 x 100	38143-41
4.6 x 150*	38144-31
4.6 x 150 3 lots set	09396-83
4.6 x 250*	38145-21
6.0 x 150	38146-11
6.0 x 250	38147-01
10 x 50	05369-21
10 x 150	34350-41
10 x 250	38149-81
20 x 150	34316-01
20 x 250	38150-41
28 x 250	34362-91

### COSMOSIL 5C<sub>18</sub>-AR-II Guard Column

Column Size I.D. x Length (mm)	Product Number
4.6 x 10	38141-61
4.6 x 10 Cartridge**	38008-89
10 x 20	38148-91
20 x 20	34458-51
20 x 50	34479-81
28 x 50	34363-81

\* Validated columns

\*\* 2 cartridges included. Guard cartridge holder required; refer to page 71.

- Preparative Columns (Particle Size: 15 µm)

### COSMOSIL 15C<sub>18</sub>-AR-II Packed Column

Column Size I.D. x Length (mm)	Product Number
28 x 250	37978-51
50 x 250	38058-71
50 x 500	05884-61

### COSMOSIL 15C<sub>18</sub>-AR-II Guard Column

Column Size I.D. x Length (mm)	Product Number
28 x 50	38030-11
50 x 50	38057-81

- Fast LC Column (Particle Size: 3 µm)

### COSMOSIL 3C<sub>18</sub>-AR-II Packed Column

Column Size I.D. x Length (mm)	Product Number
2.0 x 50	05478-91
4.6 x 10	38068-41
4.6 x 50	38069-31
4.6 x 100	38070-91

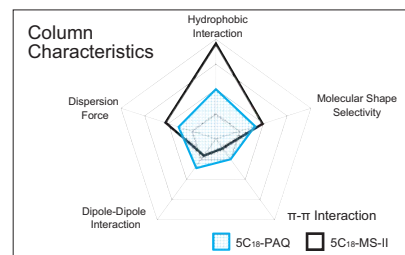


# COSMOSIL C<sub>18</sub>-PAQ

- Compatible with 100% water based mobile phase

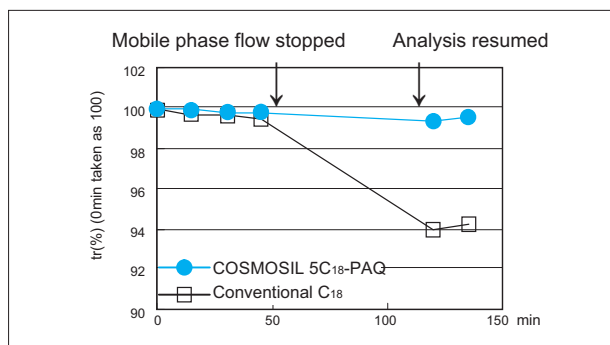
< Suitable Samples >

- Hydrophilic compounds
- Organic acids, nucleic acid bases, etc.



## Stable Performance

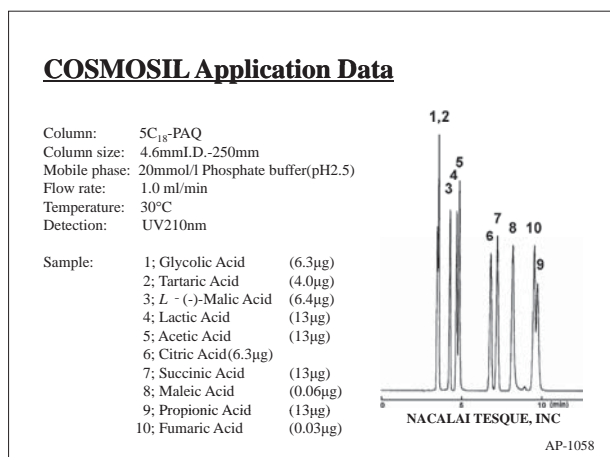
Stable performance under 100% aqueous conditions



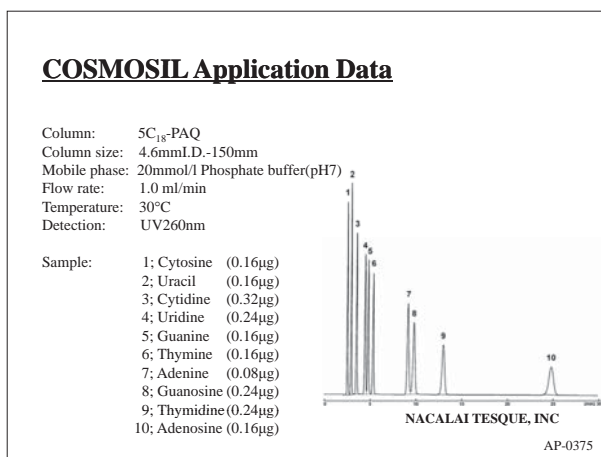
The figure shows the change of retention time for thymine with 100% aqueous mobile phase (20 mmol/l phosphate buffer, pH 7). The sample was analyzed 4 times (1 hour). Flow of mobile phase was then stopped for 1 hour. The sample was analyzed under the same conditions again after 1 hour. The conventional C<sub>18</sub> column showed change of retention time, but COSMOSIL 5C<sub>18</sub>-PAQ maintained stable retention time.

## Applications

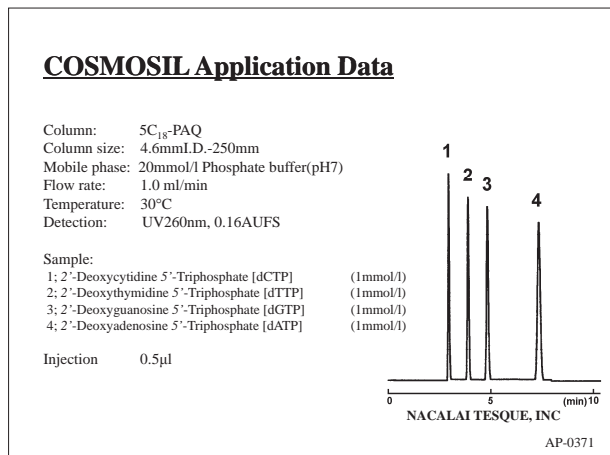
- Organic Acids



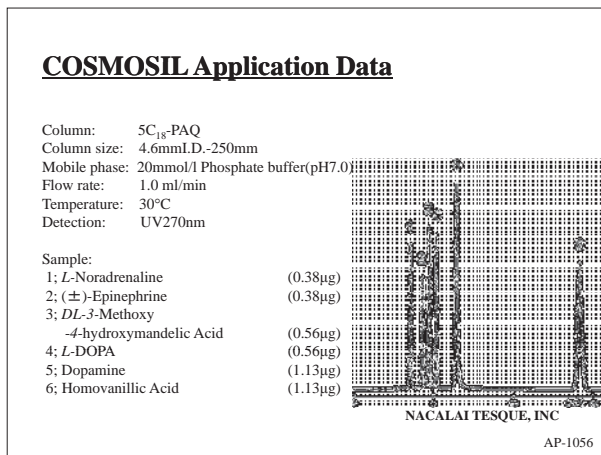
- Nucleobases and Nucleosides



- dNTPs



- Catecholamines



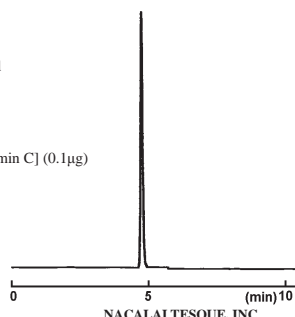
## Applications

### • Ascorbic Acid

#### COSMOSIL Application Data

Column: 5C<sub>18</sub>-PAQ  
 Column size: 4.6mm I.D.-250mm  
 Mobile phase: 20mmol/l Phosphoric Acid  
 Flow rate: 1.0 ml/min  
 Temperature: 30°C  
 Detection: UV245nm, 0.16AUFS

Sample: L(+)-Ascorbic Acid [Vitamin C] (0.1µg)



NACALAI TESQUE, INC

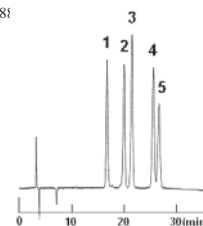
AP-0372

### • 2-Phenylethyl Glycosides

#### COSMOSIL Application Data

Column: 5C<sub>18</sub>-PAQ  
 Column size: 4.6mm I.D.-150mm  
 Mobile phase: Acetonitrile/ Methanol/ H<sub>2</sub>O = 8/4/8  
 Flow rate: 1.0 ml/min  
 Temperature: 30°C  
 Detection: UV210nm

Sample: 1; 2-Phenylethyl-β-melibioside  
 2; 2-Phenylethyl-β-gentiobioside  
 3; 2-Phenylethyl-β-lactoside  
 4; 2-Phenylethyl-β-cellobioside  
 5; 2-Phenylethyl-β-maltoside



NACALAI TESQUE, INC

Data courtesy of Dr. K. Sakata, Dr. B. Shimizu, Institute for Chemical Research, Kyoto University

## Ordering Information

### • Analytical / Preparative Columns (Particle Size: 5 µm)

#### COSMOSIL 5C<sub>18</sub>-PAQ Packed Column

Column Size I.D. x Length (mm)	Product Number	Column Size I.D. x Length (mm)	Product Number
1.0 x 50	05792-61	4.6 x 100	05799-91
1.0 x 150	05793-51	4.6 x 150	02486-71
2.0 x 30	05878-51	4.6 x 250	02485-81
2.0 x 50	05794-41	6.0 x 150	34419-61
2.0 x 100	05470-71	6.0 x 250	05800-41
2.0 x 150	34449-71	10 x 50	05801-31
2.0 x 250	05795-31	10 x 150	34466-41
3.0 x 100	05796-21	10 x 250	34376-21
3.0 x 150	05797-11	20 x 150	34476-11
3.0 x 250	05798-01	20 x 250	34373-51
4.6 x 30	05879-41	28 x 250	34456-71
4.6 x 50	34451-21		

#### COSMOSIL 5C<sub>18</sub>-PAQ Guard Column

Column Size I.D. x Length (mm)	Product Number
4.6 x 10	02484-91
10 x 20	34457-61
20 x 20	05803-11
20 x 50	05804-01
28 x 50	34455-81

### • Preparative Columns (Particle Size: 15 µm)

#### COSMOSIL 15C<sub>18</sub>-PAQ Packed Column

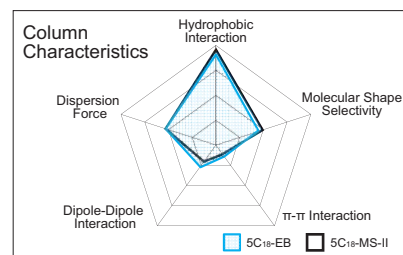
Column Size I.D. x Length (mm)	Product Number
28 x 250	05888-21
50 x 250	05890-71
50 x 500	05891-61

#### COSMOSIL 15C<sub>18</sub>-PAQ Guard Column

Column Size I.D. x Length (mm)	Product Number
28 x 50	05887-31
50 x 50	05889-11

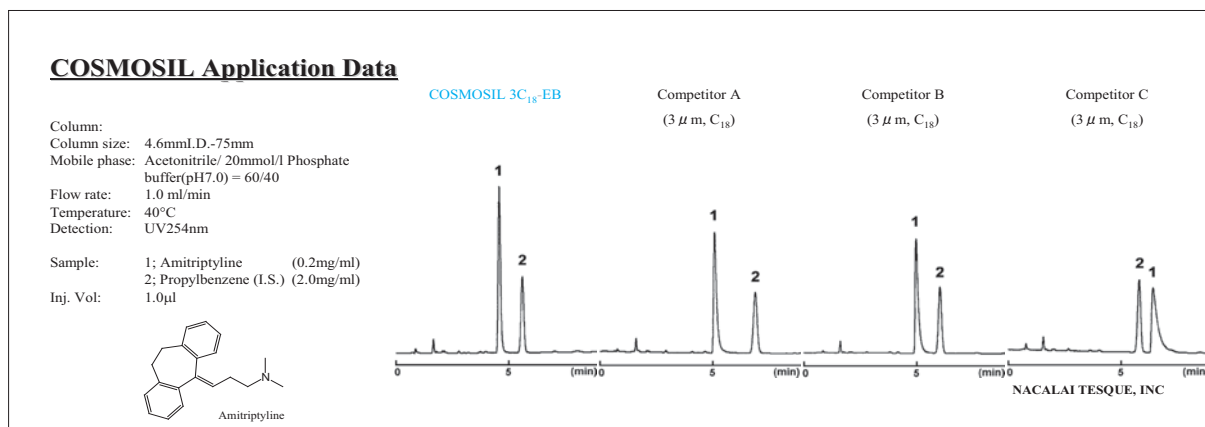
# COSMOSIL C<sub>18</sub>-EB

- 3 µm C<sub>18</sub> column with reduced tailing and high resolution
  - Usable with simple mobile phases
- < Suitable Samples >
- For quality control of drugs
  - Compounds that induce peak tailing, such as basic compounds



## Analysis of Basic Compounds

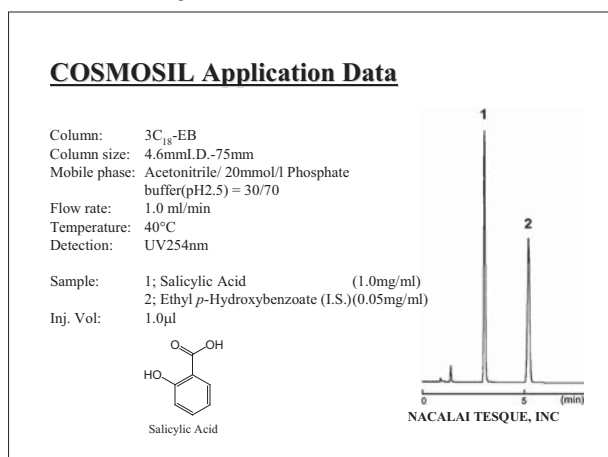
COSMOSIL 3C<sub>18</sub>-EB uses a new end-capping method to reduce the number of residual silanol groups, which can cause peak tailing with basic compounds.



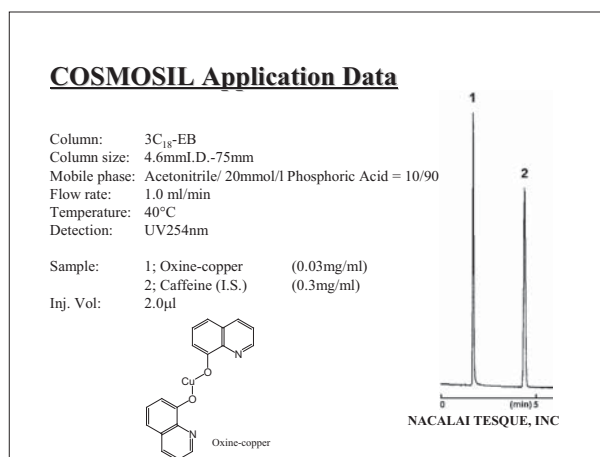
## Analysis of Acidic Compounds and Metal Coordination Compounds

COSMOSIL 3C<sub>18</sub>-EB utilizes a new end-capping method and high-purity silica gel to reduce tailing with metal coordination compounds.

### • Acidic Compounds



### • Metal Coordination Compounds



## Ordering Information

- Analytical Columns (Particle Size: 3 µm)

### COSMOSIL 3C<sub>18</sub>-EB Packed Column

Column Size I.D. x Length (mm)	Product Number
2.0 x 50	09794-21
2.0 x 75	09795-11
2.0 x 100	09796-01
2.0 x 150	09797-91
2.0 x 250	09798-81
3.0 x 50	09799-71
3.0 x 75	09800-21
3.0 x 100	09811-81

Column Size I.D. x Length (mm)	Product Number
3.0 x 150	09814-51
3.0 x 250	09827-91
4.6 x 50	09840-01
4.6 x 75*	09841-91
4.6 x 100*	09842-81
4.6 x 150*	09843-71
4.6 x 250	09844-61

### COSMOSIL 3C<sub>18</sub>-EB Guard Column

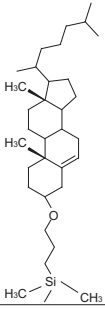
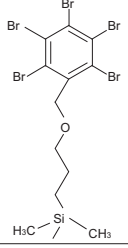
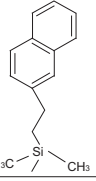
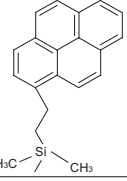
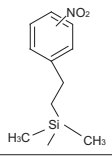
Column Size I.D. x Length (mm)	Product Number
2.0 x 10 Cartridge**	11892-74
4.6 x 10	09839-41
4.6 x 10 Cartridge**	11890-94

\* Validated columns

\*\* 2 cartridges included. Guard cartridge holder required; refer to page 71.

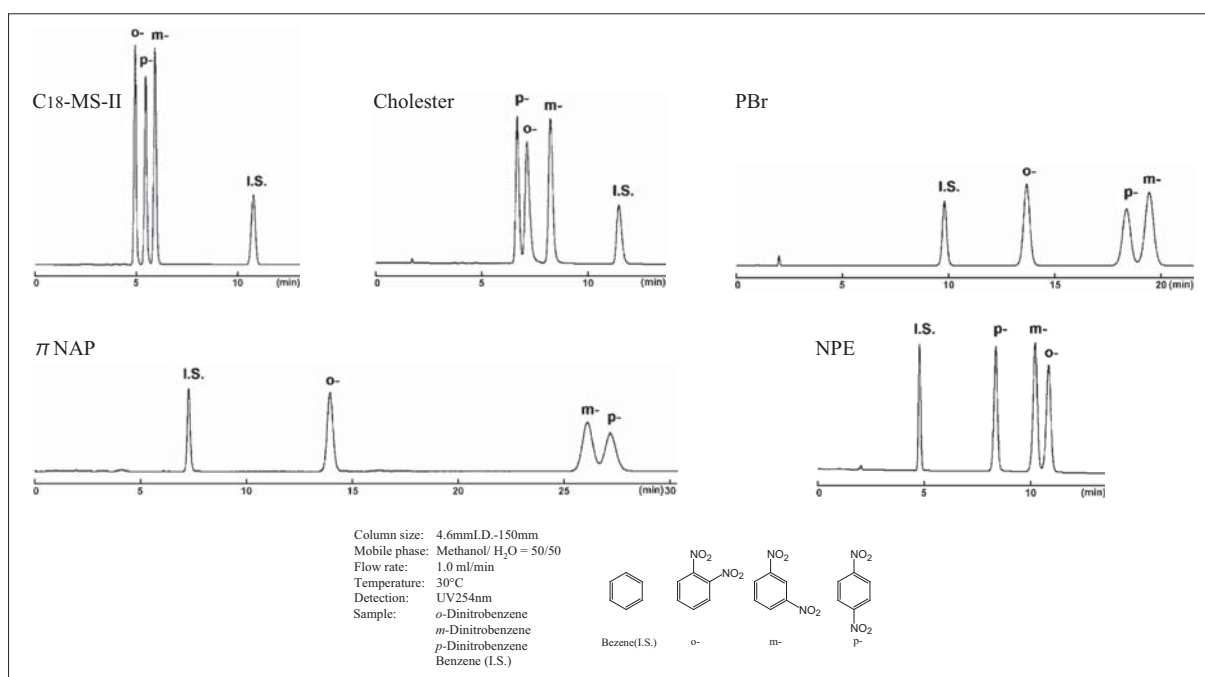
## Reversed Phase Specialty Columns

### Specifications

Packing Material	Cholester	PBr	$\pi$ NAP	PYE	NPE
Silica Gel	High purity porous spherical silica				
Average Particle Size	2.5, 5 $\mu$ m	5 $\mu$ m	2.5, 5 $\mu$ m	5 $\mu$ m	
Average Pore Size	approx. 120 Å				
Specific Surface Area	approx. 300 m <sup>2</sup> /g				
Bonded Phase Structure					
Bonded Phase	Cholesteryl group	Pentabromobenzyl group	Naphtylethyl group	Pyrenylethyl group	Nitrophenylethyl group
Bonding Type	Monomeric				
Main Interaction	Hydrophobic interaction Molecular shape selectivity	Hydrophobic interaction Dispersion force	Hydrophobic interaction $\pi$ - $\pi$ interaction	Hydrophobic interaction $\pi$ - $\pi$ interaction Dispersion force Molecular shape selectivity	Hydrophobic interaction $\pi$ - $\pi$ interaction Dipole-dipole interaction
End-Capping Treatment	Near-perfect treatment				
Carbon Content	approx. 20%	approx. 8%	approx. 11%	approx. 18%	approx. 9%
pH Range	2-7.5				
Features	<ul style="list-style-type: none"> <li>• Usable under the same conditions as C<sub>18</sub></li> <li>• High molecular shape selectivity</li> </ul>	<ul style="list-style-type: none"> <li>• Separate hydrophilic compounds under reversed-phase conditions</li> </ul>	<ul style="list-style-type: none"> <li>• Stronger <math>\pi</math>-<math>\pi</math> interaction than phenyl columns</li> </ul>	<ul style="list-style-type: none"> <li>• Very strong <math>\pi</math>-<math>\pi</math> interaction</li> </ul>	<ul style="list-style-type: none"> <li>• Strong dipole-dipole interaction</li> </ul>

### Selectivity for positional isomers of dinitrobenzene

Different stationary phase exhibits different selectivity due to the use of forces that C<sub>18</sub> (hydrophobic interaction) does not have. By using these columns, you can achieve separation that cannot be done using only C<sub>18</sub>.



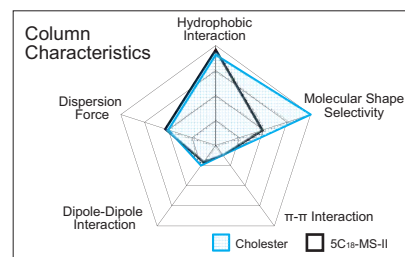


# COSMOSIL Cholester

- Cholesterol-bonded stationary phase
- Increased stereoselectivity and improved resolution for geometric isomers
- Usable under the same conditions as C<sub>18</sub>

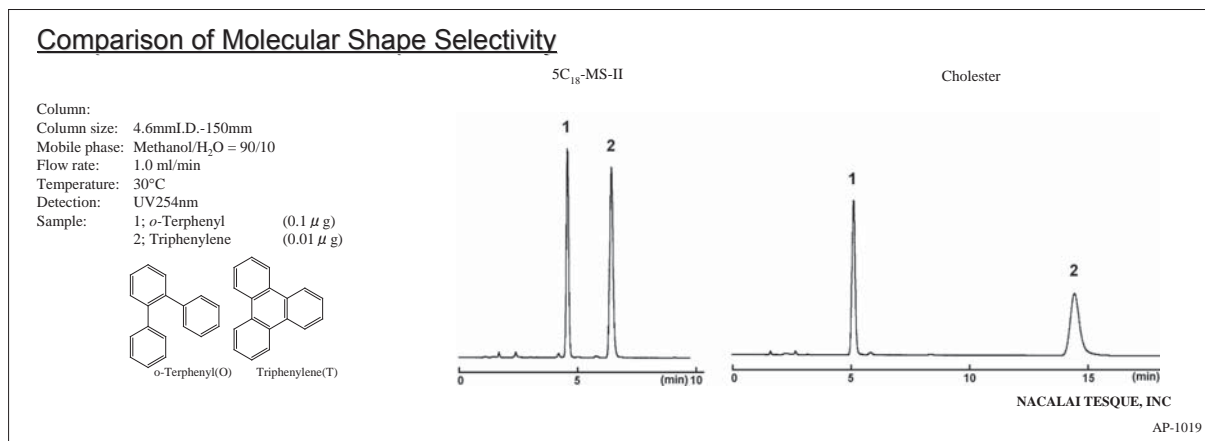
< Suitable Samples >

- Natural compounds, polyphenols, catechins, fat-soluble vitamins and flavones



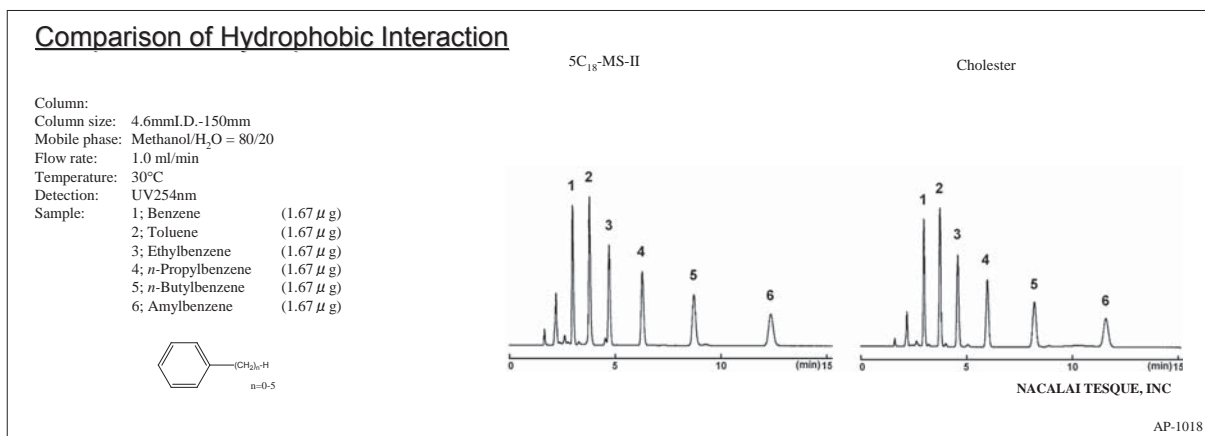
## Molecular Shape Selectivity

The stationary phase of Cholester has a very rigid structure and can distinguish different molecular shapes. Cholester retains planar triphenylene longer than non-planar *o*-terphenyl.



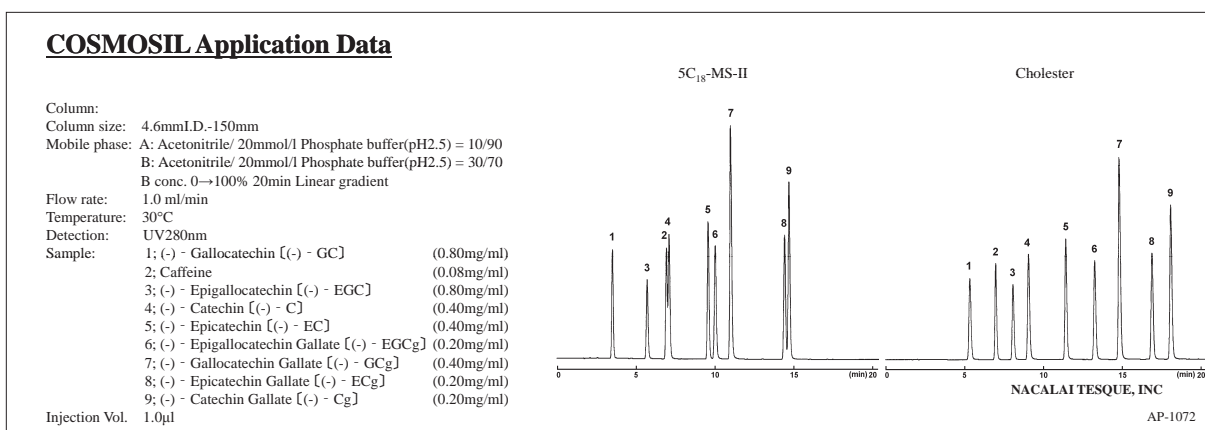
## Hydrophobic Interaction

The below figure shows the comparison of hydrophobic interactions with competitor's C<sub>18</sub> columns. Cholester provides about the same hydrophobicity as alkyl group bonded types (C<sub>18</sub>, C<sub>30</sub>). It is not necessary to change the analytical conditions when replacing C<sub>18</sub> or C<sub>30</sub> columns with Cholester.



## Applications

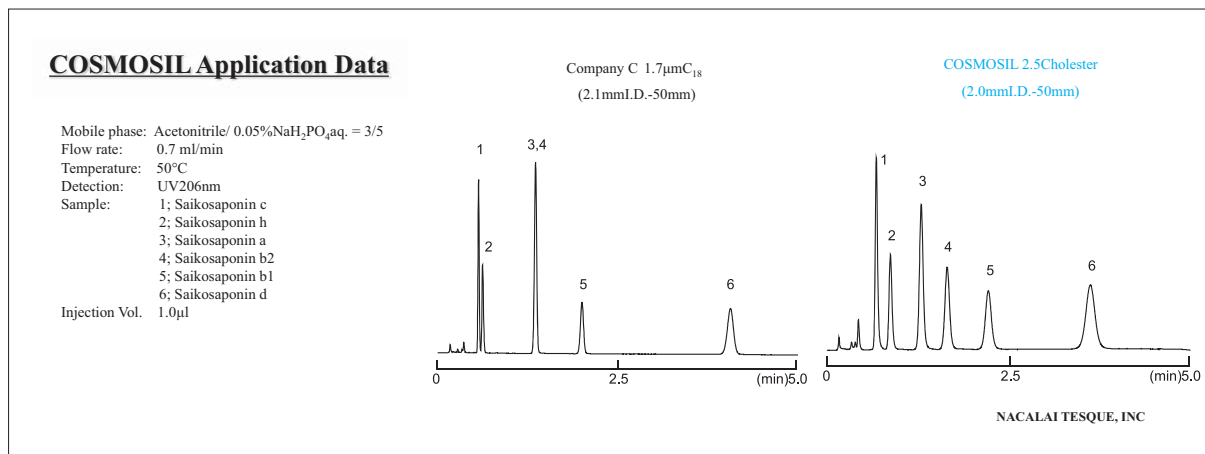
- Catechins



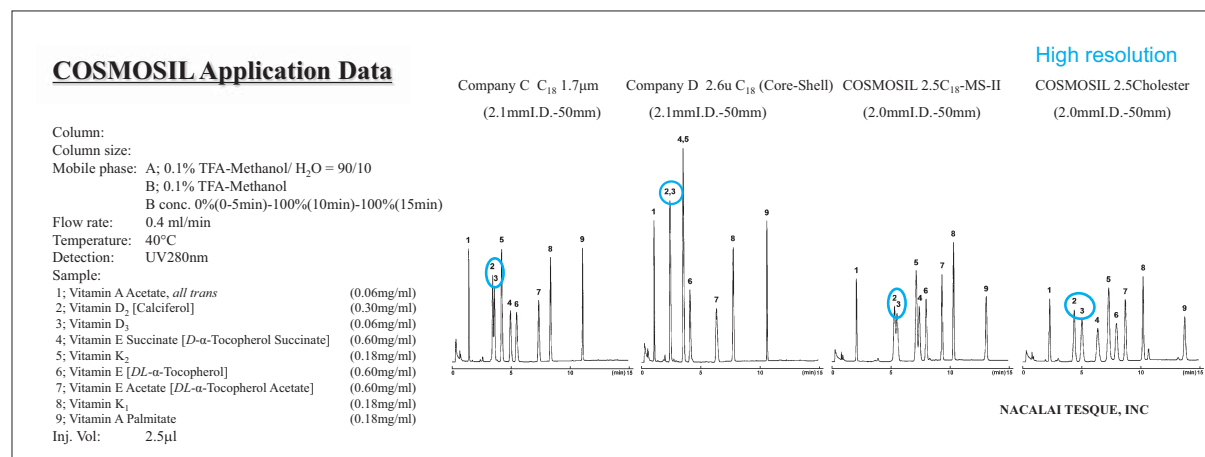
## Applications (Continued)

2.5 µm particles yield better performance and shorter analysis time compared to 5 µm particles.

### • Saikosaponins



### • Water-Soluble Vitamins



## Ordering Information

### • Analytical / Preparative Columns (Particle Size: 5 µm)

#### COSMOSIL Cholester Packed Column

Column Size I.D. x Length (mm)	Product Number
1.0 x 150	05968-71
1.0 x 250	05969-61
2.0 x 30	08565-51
2.0 x 50	06352-91
2.0 x 100	06948-01
2.0 x 150	05971-11
2.0 x 250	05972-01
3.0 x 150	05973-91
3.0 x 250	05974-81

#### COSMOSIL Cholester Guard Column

Column Size I.D. x Length (mm)	Product Number
4.6 x 10	05975-71
10 x 20	05978-41
20 x 20	05980-91
20 x 50	05981-81
28 x 50	05983-61

Column Size I.D. x Length (mm)	Product Number
4.6 x 150*	05976-61
4.6 x 150 3 lots set*	07970-03
4.6 x 250*	05977-51
10 x 150	08011-91
10 x 250	05979-31
20 x 150	06088-71
20 x 250	05982-71
28 x 250	05985-41

\* Validated Columns

### • Analytical (Particle Size: 2.5 µm)

#### COSMOSIL 2.5Cholester Packed Column

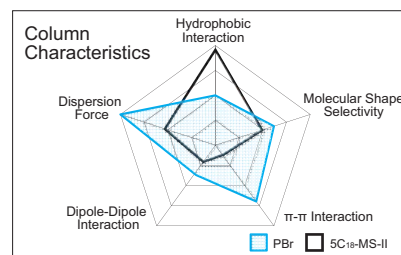
Column Size I.D. x Length (mm)	Product Number	Column Size I.D. x Length (mm)	Product Number
2.0 x 50	09000-01	3.0 x 50	09049-91
2.0 x 75	09047-11	3.0 x 75	09050-51
2.0 x 100	09048-01	3.0 x 100	09051-41

# COSMOSIL PBr

- Pentabromobenzyl-bonded stationary phase
- Separate hydrophilic compounds in reversed-phase conditions

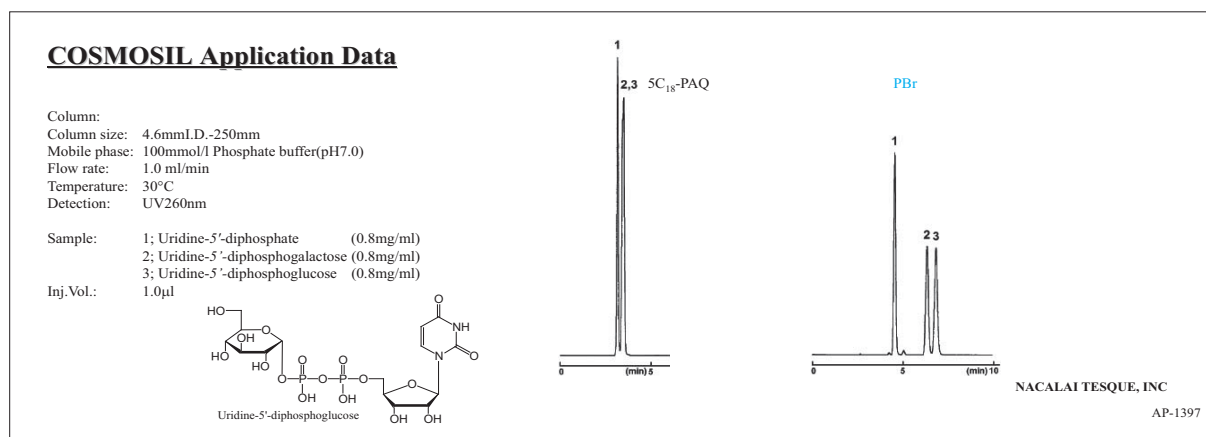
< Suitable Samples >

- Hydrophilic compounds
- Nucleotides, peptides, catecholamines and oligosaccharides



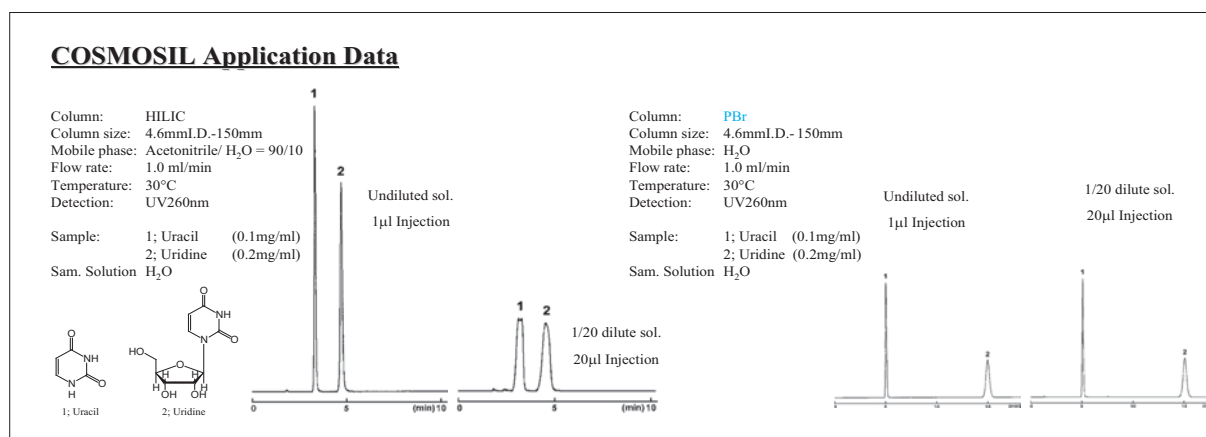
## Comparison with C18

COSMOSIL PBr retains hydrophilic compounds stronger than C18 columns under the same reversed-phase conditions.



## Comparison with HILIC

HILIC is widely recognized as a method for separating hydrophilic compounds. However, because it differs from the commonly used reversed-phase mode, setting mobile phase conditions can be difficult. In addition, the use of acetonitrile in high concentration can cause problems with peak shape when using water as a sample solvent. COSMOSIL PBr can retain hydrophilic compounds under reversed-phase conditions, and maintains good peak shape even when injecting large amounts of water.



## Ordering Information

- Analytical / Preparative Columns (Particle Size: 5 µm)

### COSMOSIL PBr Packed Column

Column Size I.D. x Length (mm)	Product Number	Column Size I.D. x Length (mm)	Product Number
2.0 x 100	13245-81	10 x 50	13253-71
2.0 x 150	12392-81	10 x 100	13254-61
2.0 x 250	13247-61	10 x 150	13255-51
3.0 x 50	12592-61	10 x 250	12397-31
3.0 x 100	13249-41	20 x 50	13257-31
3.0 x 150	13250-01	20 x 100	13258-21
3.0 x 250	13251-91	20 x 150	13259-11
4.6 x 50	13252-81	20 x 250	12398-21
4.6 x 150	12394-61	28 x 100	13260-71
4.6 x 250	12395-51	28 x 150	13261-61
		28 x 250	13262-51

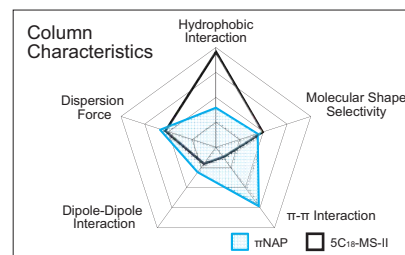
### COSMOSIL PBr Guard Column

Column Size I.D. x Length (mm)	Product Number
4.6 x 10 Ctridge*	12444-14
10 x 20	12396-41
20 x 20	13256-41

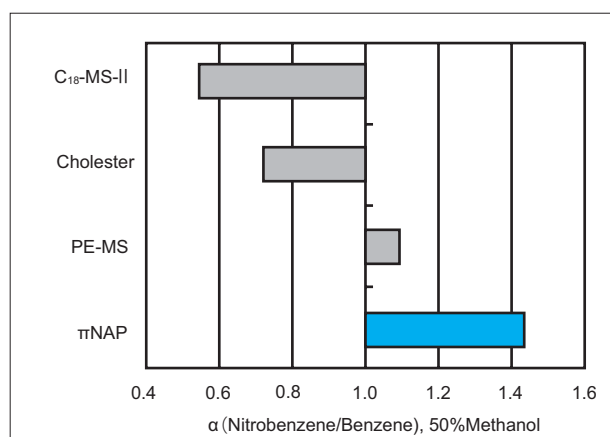
\* 2 cartridges included. Guard cartridge holder required; refer to page 71.

# COSMOSIL $\pi$ NAP

- Naphthalene-bonded stationary phase
  - Enhanced  $\pi$ - $\pi$  interactions
- < Suitable Samples >
- Aromatic compounds and positional isomers



## Comparison of $\pi$ - $\pi$ Interactions

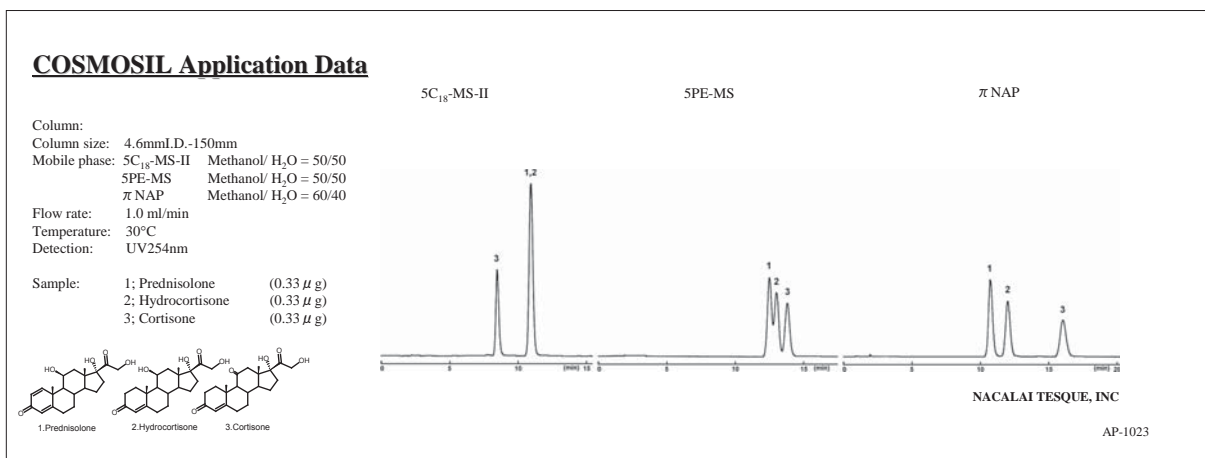


COSMOSIL  $\pi$ NAP shows stronger  $\pi$ - $\pi$  interactions than phenyl columns. Its two fused aromatic rings retain nitrobenzene stronger than phenyl columns.

Figure. Comparison of  $\pi$ - $\pi$  interaction

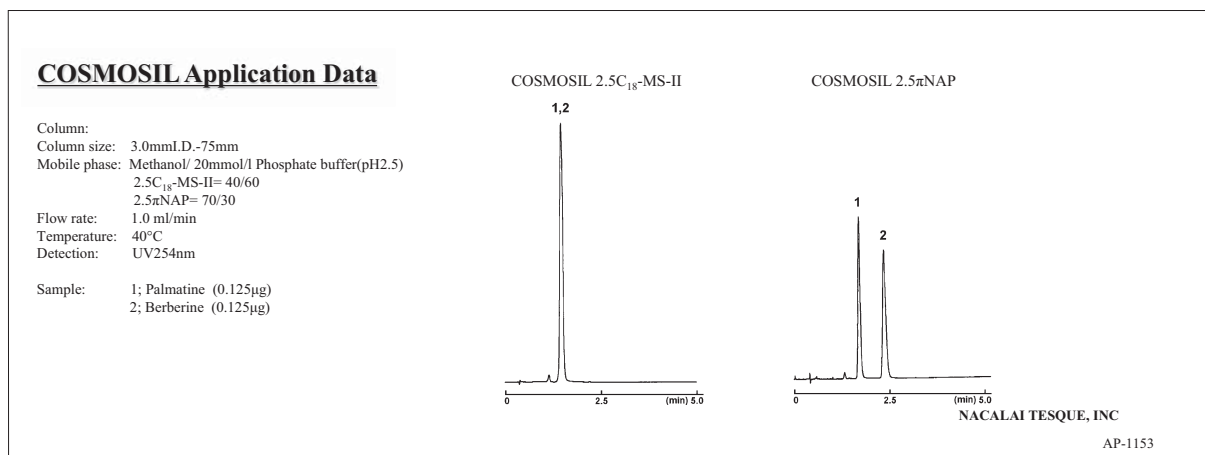
## Applications

### • Adrenal Cortical Hormones



2.5  $\mu$ m particles yield better performance and shorter analysis time compared to 5  $\mu$ m particles.

### • Berberine



## Ordering Information

- Analytical / Preparative Columns (Particle Size: 5 µm)

### **COSMOSIL πNAP Packed Column**

Column Size I.D. x Length (mm)	Product Number	Column Size I.D. x Length (mm)	Product Number
1.0 x 150	08076-61	3.0 x 250	08081-81
1.0 x 250	08077-51	4.6 x 150	08085-41
2.0 x 30	08566-41	4.6 x 250	08086-31
2.0 x 50	08567-31	10 x 150	08088-11
2.0 x 100	08299-51	10 x 250	08089-01
2.0 x 150	08078-41	20 x 150	08092-41
2.0 x 250	08079-31	20 x 250	08093-31
3.0 x 150	08080-91	28 x 250	08095-11

### **COSMOSIL πNAP Guard Column**

Column Size I.D. x Length (mm)	Product Number
4.6 x 10	08082-71
10 x 20	08087-21
20 x 20	08090-61
20 x 50	08091-51
28 x 50	08094-21

- Analytical Columns (Particle Size: 2.5 µm)

### **COSMOSIL πNAP Packed Column**

Column Size I.D. x Length (mm)	Product Number	Column Size I.D. x Length (mm)	Product Number
2.0 x 50	06062-91	3.0 x 50	06054-01
2.0 x 75	06051-31	3.0 x 75	06055-91
2.0 x 100	06052-21	3.0 x 100	06057-71

I. HPLC Columns

II. SFC Columns

III. Preparative Packing Materials

IV. Related Products



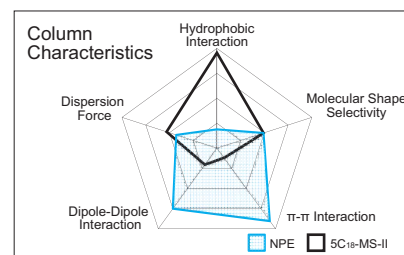


# COSMOSIL NPE

- Nitrophenylethyl-bonded stationary phase
- Separation with dipole-dipole and  $\pi$ - $\pi$  interactions

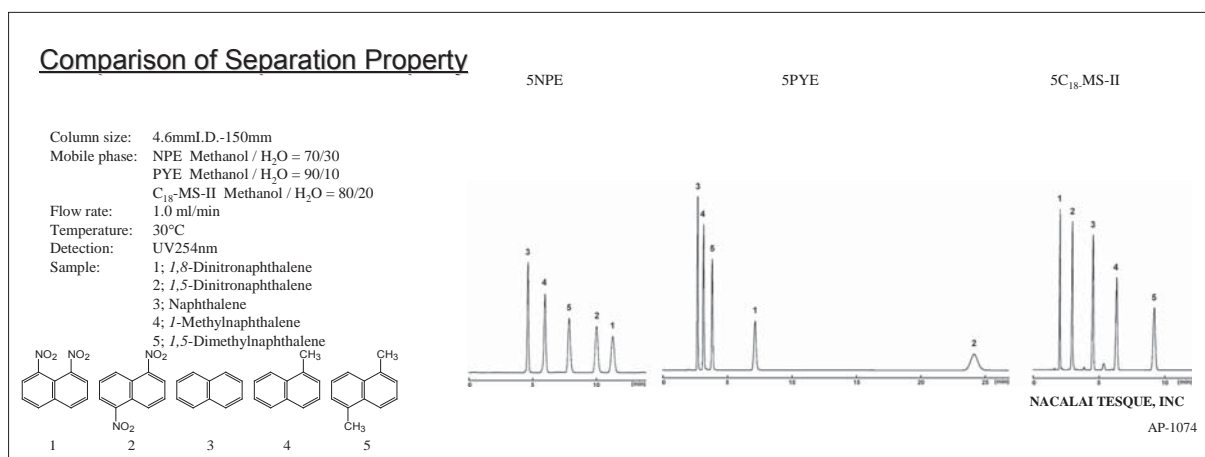
< Suitable Samples >

- Isomers and nitro compounds



## Selectivity for Dipole-Dipole Interactions

COSMOSIL NPE strongly retains 1,8-dinitronaphthalene because of the strong dipole formed by the two nitro groups positioned on the same side of naphthalene.



## Caution

1. Methanol is recommended as a mobile phase for COSMOSIL NPE. Acetonitrile is not recommended because it has many  $\pi$  electrons and interferes with  $\pi$ - $\pi$  interactions between the sample and the stationary phase.
2. The stationary phase of COSMOSIL NPE, nitrophenyl group, has a large UV absorption. When the stationary phase detaches from silica gel and elutes, even a slight quantity can be detected and causes baseline noise. In such a case, wash the column with tetrahydrofuran. Detachment of a small amount of the stationary phase does not deteriorate a column's separation ability.
3. COSMOSIL NPE column is not suitable for gradient analysis.

## Ordering Information

- Analytical / Preparative Columns (Particle Size: 5  $\mu$ m)

### COSMOSIL 5NPE Packed Column

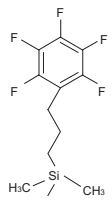
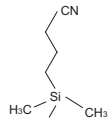
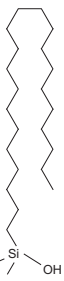
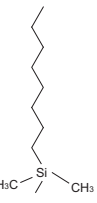
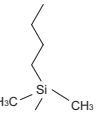

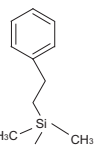
Column Size I.D. x Length (mm)	Product Number
1.0 x 150	05897-01
2.0 x 150	34328-51
2.0 x 250	34379-91

### COSMOSIL 5NPE Guard Column

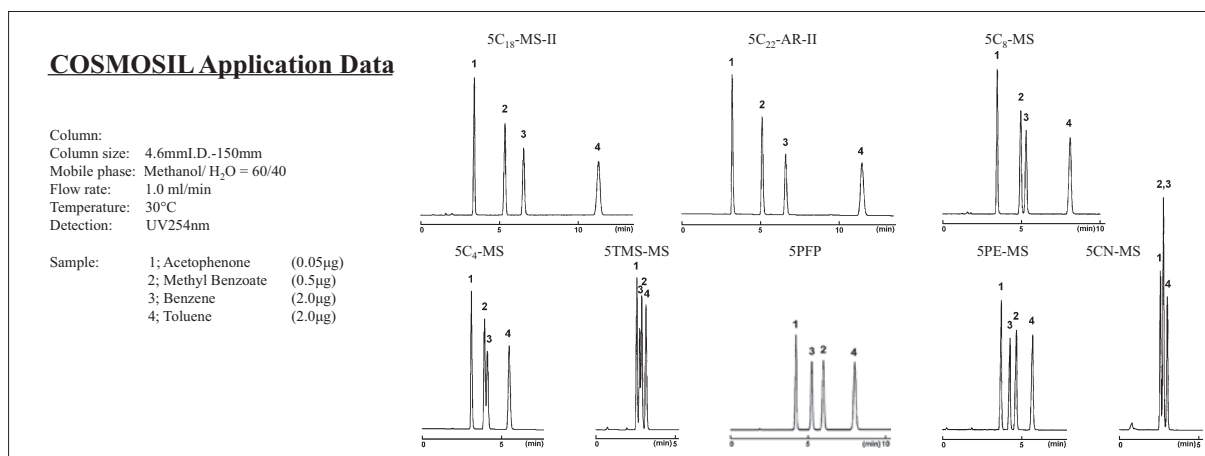
Column Size I.D. x Length (mm)	Product Number	Column Size I.D. x Length (mm)	Product Number
4.6 x 150	37902-21	4.6 x 10	37904-01
4.6 x 250	37990-71	10 x 20	38045-31
10 x 250	05469-11	20 x 20	05868-81
20 x 250	38046-21	20 x 50	05869-71

## Other Reversed Phase Columns

### Specifications

Packing Material	PFP	CN-MS	C <sub>22</sub> -AR-II	C <sub>8</sub> -MS	C <sub>4</sub> -MS	TMS-MS	PE-MS	
Silica Gel	High purity porous spherical silica							
Average Particle Size	5 µm							
Average Pore Size	approx. 120 Å							
Specific Surface Area	approx. 300 m <sup>2</sup> /g							
Bonded Phase Structure								
Bonded Phase	Pentafluorophenyl group	Cyanopropyl group	Dococyl group	Octyl group	Butyl group	Trimethyl group	Phenylethyl group	
Bonding Type	Monomeric		Polymeric	Monomeric				
Main Interaction	Hydrophobic interaction π-π interaction Dipole-dipole	Hydrophobic interaction π-π interaction	Hydrophobic interaction				Hydrophobic interaction π-π interaction	
End-Capping Treatment	Near-perfect treatment							
Carbon Content	approx. 10%	approx. 7%	approx. 19%	approx. 10%	approx. 7%	approx. 5%	approx. 10%	
pH Range	2-7.5							

### Difference in Separation Characteristics



# COSMOSIL PFP

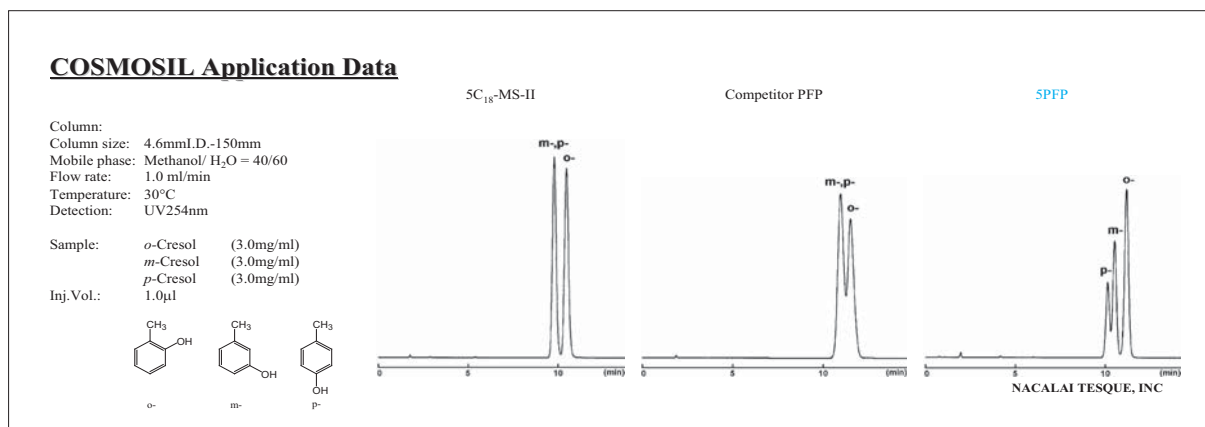
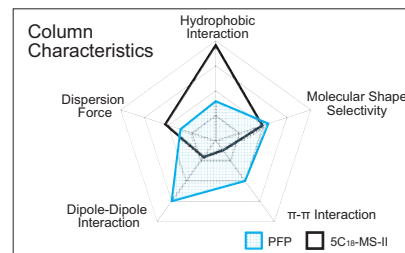
- Pentafluorophenyl-bonded stationary phase
- Alternative selectivity to C<sub>18</sub> columns

< Suitable Samples >

- Vitamin E, structural isomers and fluorides

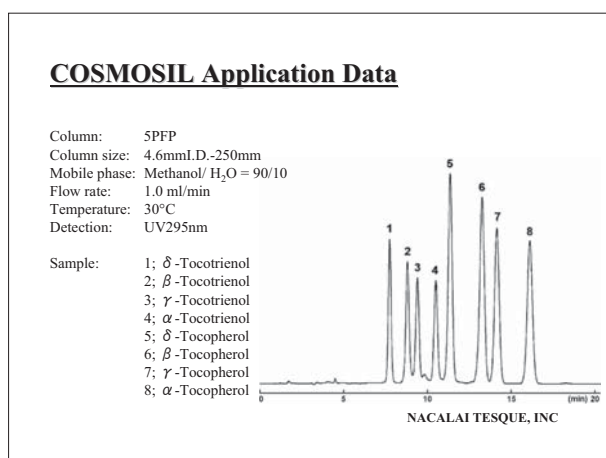
## Alternative Selectivity to C<sub>18</sub> Columns

COSMOSIL PFP provides different selectivity from C<sub>18</sub> Columns. Furthermore, it offers improved separation compared to other PFP columns.

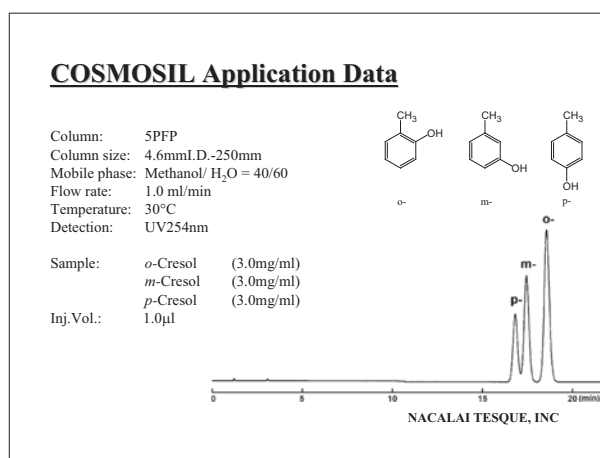


## Applications

### • Vitamin E



### • Cresol Isomers



## Ordering Information

- Analytical / Preparative Columns (Particle Size: 5 µm)

### COSMOSIL 5PFP Packed Column

Column Size I.D. x Length (mm)	Product Number	Column Size I.D. x Length (mm)	Product Number
2.0 x 50	13263-41	10 x 50	13272-21
2.0 x 100	13264-31	10 x 100	13273-11
2.0 x 150	12381-21	10 x 150	13274-01
2.0 x 250	13265-21	10 x 250	12386-71
3.0 x 50	13266-11	20 x 50	13276-81
3.0 x 100	13267-01	20 x 100	13277-71
3.0 x 150	13268-91	20 x 150	13278-61
3.0 x 250	13269-81	20 x 250	12387-61
4.6 x 50	13270-41	28 x 100	13280-11
4.6 x 100	13271-31	28 x 150	13281-01
4.6 x 150	12383-01	28 x 250	13282-91
4.6 x 250	12384-91		

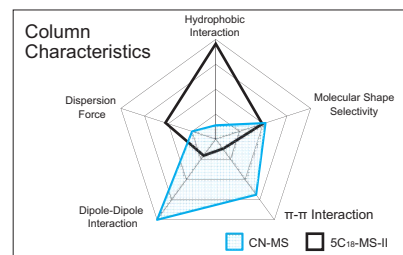
### COSMOSIL 5PFP Guard Column

Column Size I.D. x Length (mm)	Product Number
4.6 x 10 Cartridge*	12443-24
10 x 20	12385-81
20 x 20	13275-91
28 x 50	13279-51

\* 2 cartridges included. Guard cartridge holder required; refer to page 71.

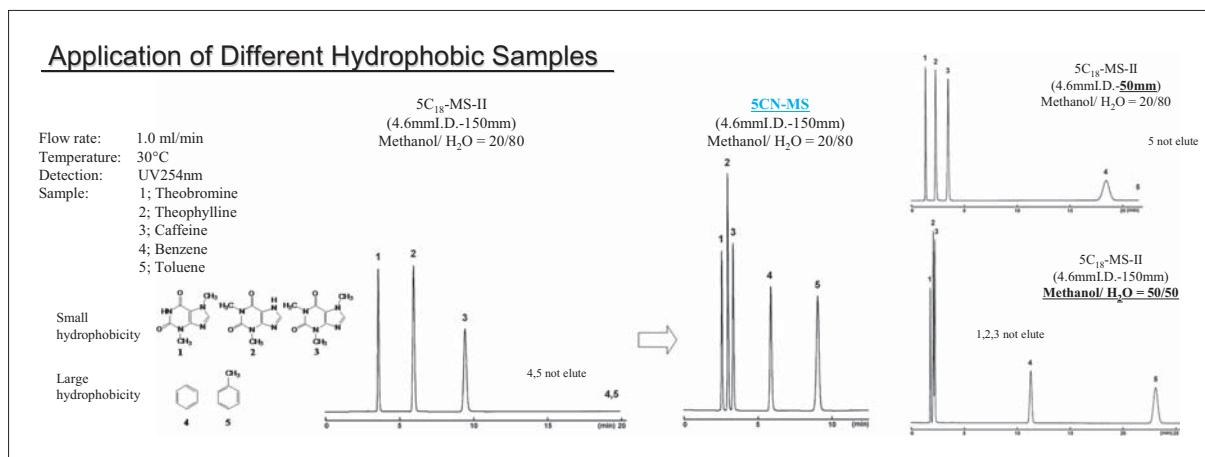
# COSMOSIL CN-MS

- Cyanopropyl-bonded stationary phase
  - Enables separation of different hydrophobic samples without using gradient
- < Suitable Samples >
- Mixtures of natural compounds



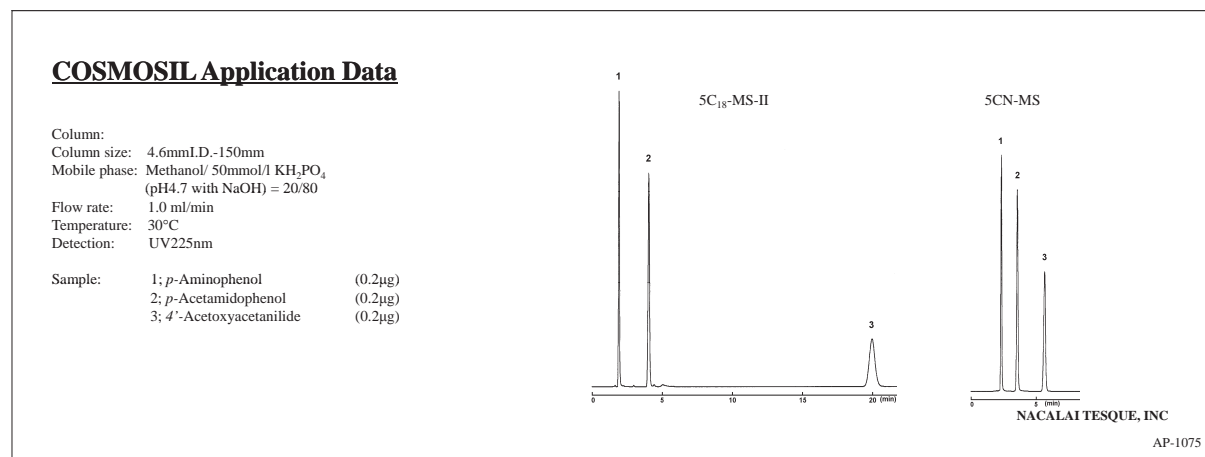
## Rapid Analysis

Gradient elution is commonly used for the samples containing both polar and non-polar compounds. However, gradient elution may cause reproducibility problems depending on the gradient mixer and pump, and needs equilibration time for each analysis. COSMOSIL 5CN-MS offers rapid analysis and great reproducibility using isocratic elution mode.



## Applications

- Acetoaminophen



## Ordering Information

- Analytical / Preparative Columns (Particle Size: 5 µm)

### COSMOSIL 5CN-MS Packed Column

Column Size I.D. x Length (mm)	Product Number	Column Size I.D. x Length (mm)	Product Number
4.6 x 50	38233-61	6.0 x 150	38237-21
4.6 x 100	38234-51	6.0 x 250	38238-11
4.6 x 150	38235-41	10 x 250	38239-01
4.6 x 250	38236-31	20 x 250	38240-61

### COSMOSIL 5CN-MS Guard Column

Column Size I.D. x Length (mm)	Product Number
4.6 x 10	38231-81
10 x 20	38232-71



# COSMOSIL C<sub>22</sub>-AR-II, C<sub>8</sub>-MS, C<sub>4</sub>-MS, TMS-MS, PE-MS

## Ordering Information

- Analytical / Preparative Columns (Particle Size: 5 µm)

### COSMOSIL 5C<sub>22</sub>-AR-II Packed Column

Column Size I.D. x Length (mm)	Product Number	Column Size I.D. x Length (mm)	Product Number
4.6 x 50	05848-41	6.0 x 150	05850-91
4.6 x 100	05849-31	6.0 x 250	05851-81
4.6 x 150	04598-51	10 x 250	04969-91
4.6 x 250	04599-41	20 x 250	05183-41

### COSMOSIL 5C<sub>22</sub>-AR-II Guard Column

Column Size I.D. x Length (mm)	Product Number
4.6 x 10	04881-21
10 x 20	05554-81

### COSMOSIL 5C<sub>8</sub>-MS Packed Column

Column Size I.D. x Length (mm)	Product Number	Column Size I.D. x Length (mm)	Product Number
4.6 x 50	38153-11	6.0 x 150	38157-71
4.6 x 100	38154-01	6.0 x 250	38158-61
4.6 x 150	38155-91	10 x 250	38159-51
4.6 x 250	38156-81	20 x 250	38160-11

### COSMOSIL 5C<sub>8</sub>-MS Guard Column

Column Size I.D. x Length (mm)	Product Number
4.6 x 10	38151-31
10 x 20	38152-21

### COSMOSIL 5C<sub>4</sub>-MS Packed Column

Column Size I.D. x Length (mm)	Product Number	Column Size I.D. x Length (mm)	Product Number
4.6 x 50	38163-81	6.0 x 150	38167-41
4.6 x 100	38164-71	6.0 x 250	38168-31
4.6 x 150	38165-61	10 x 250	38169-21
4.6 x 250	38166-51	20 x 250	38170-81

### COSMOSIL 5C<sub>4</sub>-MS Guard Column

Column Size I.D. x Length (mm)	Product Number
4.6 x 10	38161-01
10 x 20	38162-91

### COSMOSIL 5TMS-MS Packed Column

Column Size I.D. x Length (mm)	Product Number	Column Size I.D. x Length (mm)	Product Number
4.6 x 50	38173-51	6.0 x 150	38177-11
4.6 x 100	38174-41	6.0 x 250	38178-01
4.6 x 150	38175-31	10 x 250	38179-91
4.6 x 250	38176-21	20 x 250	38180-51

### COSMOSIL 5TMS-MS Guard Column

Column Size I.D. x Length (mm)	Product Number
4.6 x 10	38171-71
10 x 20	38172-61

### COSMOSIL 5PE-MS Packed Column

Column Size I.D. x Length (mm)	Product Number	Column Size I.D. x Length (mm)	Product Number
4.6 x 50	38183-21	6.0 x 150	38187-81
4.6 x 100	38184-11	6.0 x 250	38188-71
4.6 x 150	38185-01	10 x 250	38189-61
4.6 x 250	38186-91	20 x 250	38190-21

### COSMOSIL 5PE-MS Guard Column

Column Size I.D. x Length (mm)	Product Number
4.6 x 10	38181-41
10 x 20	38182-31

## (2) Normal Phase Columns

# COSMOSIL SL-II

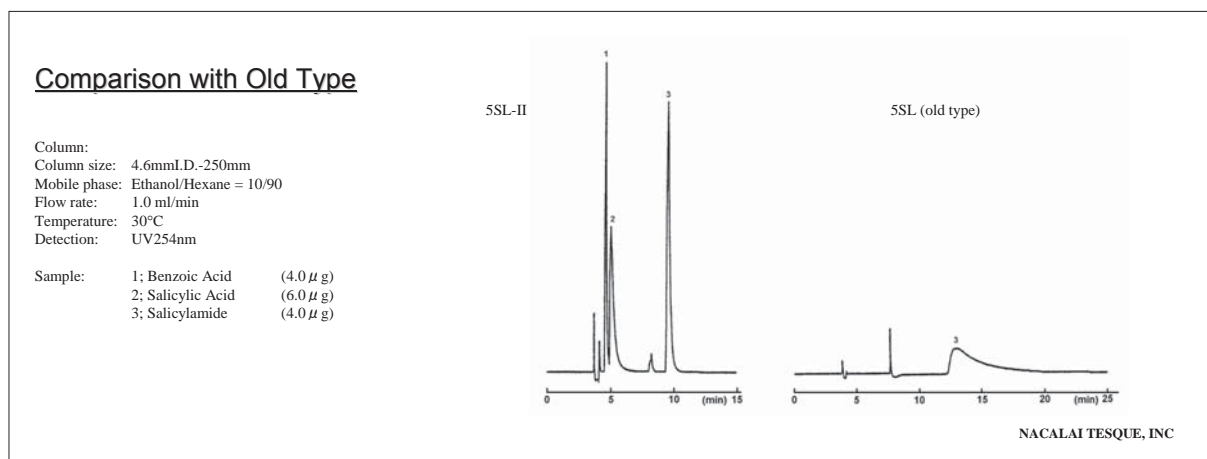
- High purity silica gel (>99.99%) with special treatment
- Suitable for preparative separation

### Specifications

Packing Material	SL-II
Silica Gel	High purity porous spherical silica
Average Particle Size	3, 5, 15 µm
Average Pore Size	approx. 120 Å
Specific Surface Area	approx. 300 m <sup>2</sup> /g
Features	<ul style="list-style-type: none"> <li>• High purity silica gel (&gt;99.99%) with special treatment</li> <li>• Suitable for preparative separation (higher resolution than medium-pressure or open chromatography)</li> </ul>

### Comparison with Old Type

COSMOSIL SL-II with high purity silica gel offers better peak shape for phenols with a simple mobile phase of ethanol or hexane. No acetic acid additives were required, unlike for the old type silica.



### Ordering Information

- Analytical / Preparative Columns (Particle Size: 5 µm)

#### COSMOSIL 5SL-II Packed Column

Column Size I.D. x Length (mm)	Product Number
4.6 x 50	37999-81
4.6 x 100	38000-01
4.6 x 150	38001-91
4.6 x 250	38002-81

#### COSMOSIL 5SL-II Guard Column

Column Size I.D. x Length (mm)	Product Number
6.0 x 150	38003-71
6.0 x 250	38004-61
10 x 250	38005-51
20 x 250	38006-41
28 x 250	34358-61

#### COSMOSIL 5SL-II Guard Column

Column Size I.D. x Length (mm)	Product Number
4.6 x 10	37997-01
10 x 20	37998-91
20 x 20	05874-91
20 x 50	05875-81
28 x 50	34359-51

- Preparative Columns (Particle Size : 15 µm)

#### COSMOSIL 15SL-II Packed Column

Column Size I.D. x Length (mm)	Product Number
28 x 250	05893-41
50 x 250	05895-21
50 x 500	05896-11

#### COSMOSIL 15SL-II Guard Column

Column Size I.D. x Length (mm)	Product Number
28 x 50	05892-51
50 x 50	05894-31

- Fast LC column (Particle Size: 3 µm)

#### COSMOSIL 3SL-II Packed Column

Column Size I.D. x Length (mm)	Product Number
4.6 x 10	38059-61
4.6 x 50	38060-21
4.6 x 100	38061-11

### (3) Hydrophilic Interaction Columns

## COSMOSIL HILIC

- Triazole bonded stationary phase
- Enhanced hydrophilic interaction
- Unique anion-exchange mechanism

< Suitable Samples >

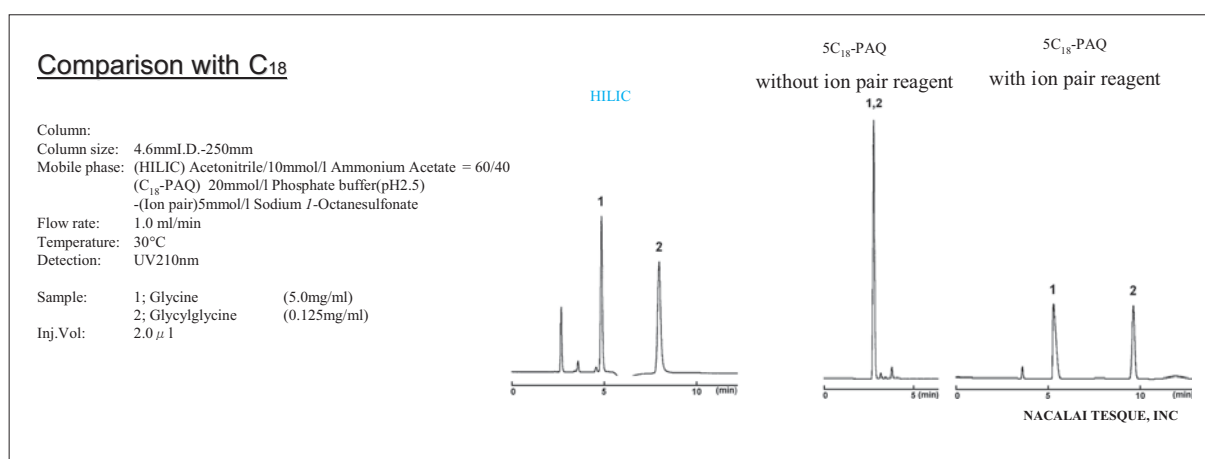
- Hydrophilic compounds that would not be retained in reversed phase chromatography
- Melamine and water-soluble vitamins

### Specifications

Packing Material	HILIC
Silica Gel	High purity porous spherical silica
Average Particle Size	2.5, 5 $\mu\text{m}$
Average Pore Size	approx. 120 $\text{\AA}$
Specific Surface Area	approx. 300 $\text{m}^2/\text{g}$
Bonded Phase	Triazole
Interaction	Hydrophilic interaction, anion exchange
Target Substance	Hydrophilic compounds, acidic compounds
Features	Suitable for compounds not retained by $\text{C}_{18}$

### Comparison with $\text{C}_{18}$

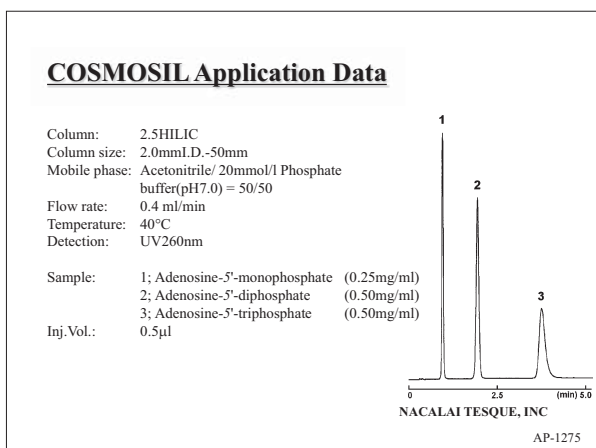
The hydrophilic interaction chromatography is a variation of normal phase chromatography where a polar stationary phase is used with a mobile phase which contains a high concentration of water-miscible organic solvent and a low concentration of aqueous eluent. The main retention mechanism is the partitioning of the polar analytes between the polar stationary and the non-polar mobile phase. As it is also called "aqueous normal phase", the elution order is similar to that of normal phase and the sample elution is in the order of increasing hydrophilicity. Without using ion-pair reagent COSMOSIL HILIC retains highly polar analytes that would not be retained in reversed phase chromatography. It also shows a weak anion-exchange mechanism with the positively charged stationary phase, thus acidic compounds are strongly retained.



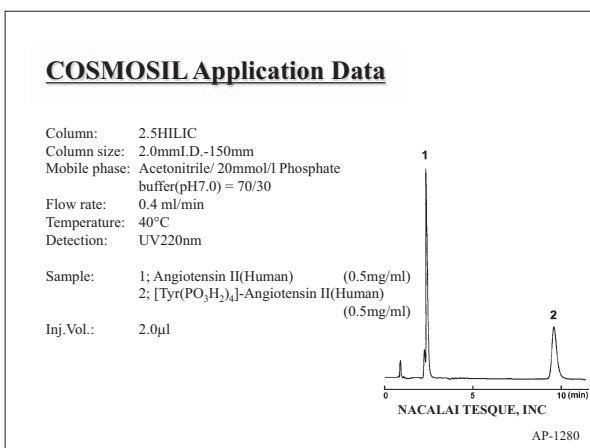
## Applications

2.5 µm particles yield better performance and shorter analysis time compared to 5 µm particles.

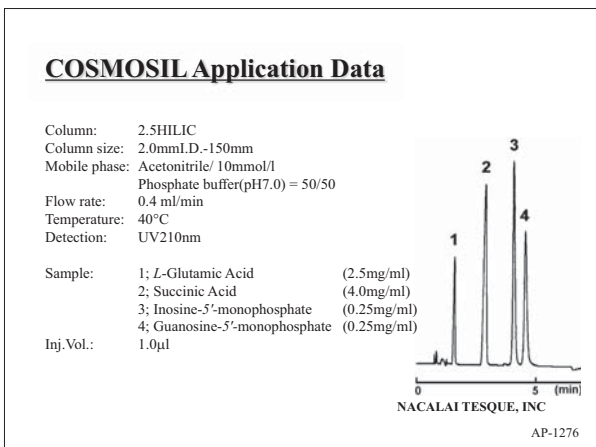
### • Nucleotides



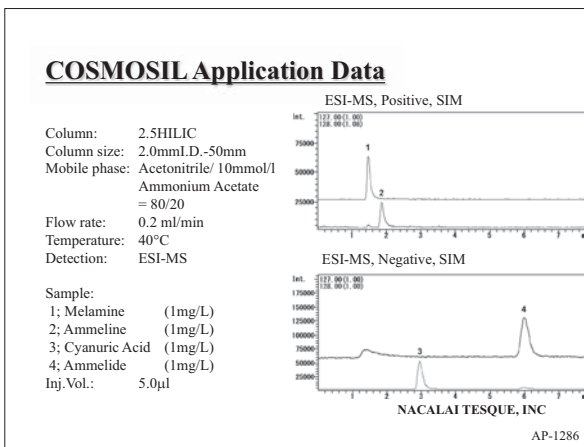
### • Phosphorylated Peptide



### • Umami Components



### • Melamine



## Ordering Information

### • Analytical / Preparative Columns (Particle Size: 5 µm)

#### COSMOSIL HILIC Packed Column

Column Size I.D. x Length (mm)	Product Number
1.0 x 150	07869-11
1.0 x 250	07870-71
2.0 x 30	08568-21
2.0 x 50	07052-91
2.0 x 100	08569-11
2.0 x 150	07054-71
2.0 x 250	07489-91
3.0 x 150	07871-61
3.0 x 250	07872-51

Column Size I.D. x Length (mm)	Product Number
4.6 x 150*	07056-51
4.6 x 150 3 lots set	09385-23
4.6 x 250*	07057-41
10 x 250	07059-21
20 x 250	07060-81
28 x 250	07875-21

\* Validated Columns

#### COSMOSIL HILIC Guard Column

Column Size I.D. x Length (mm)	Product Number
4.6 x 10	07055-61
10 x 20	07058-31
20 x 20	07854-91
20 x 50	07873-41
28 x 50	07874-31

### • Analytical Columns (Particle Size: 2.5 µm)

#### COSMOSIL HILIC Packed Column

Column Size I.D. x Length (mm)	Product Number
2.0 x 50	11766-21
2.0 x 75	11768-01
2.0 x 100	11769-91
2.0 x 150	11770-51

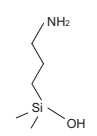
Column Size I.D. x Length (mm)	Product Number
3.0 x 50	11771-41
3.0 x 75	11772-31
3.0 x 100	11773-21
3.0 x 150	11773-21

## (4) Mono- and Oligosaccharide Analysis Columns

### Introduction

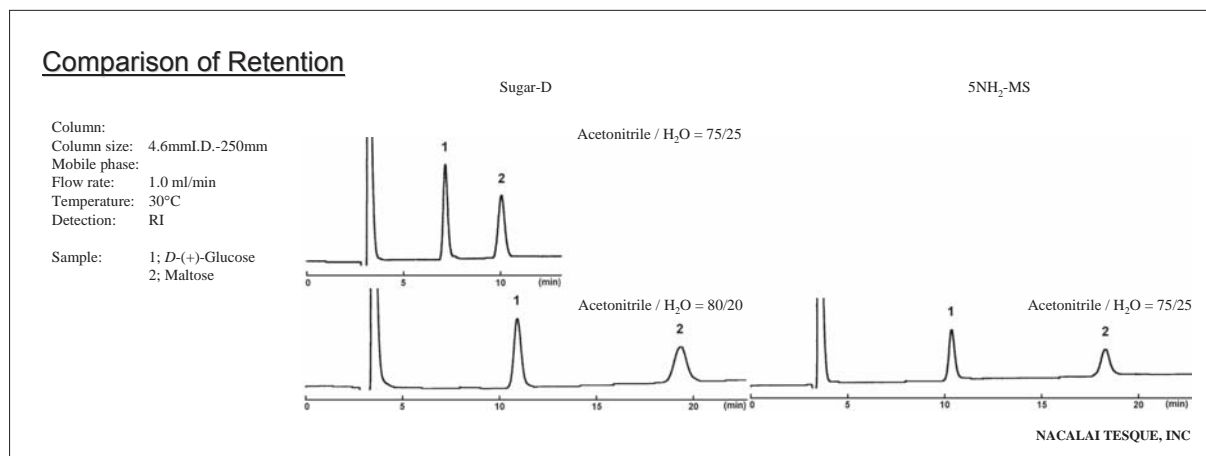
Saccharides are not retained on standard C<sub>18</sub> columns because of their low hydrophobicity. COSMOSIL Sugar-D and NH<sub>2</sub>-MS are specifically designed for separation of saccharides. COSMOSIL C<sub>18</sub>-PAQ is recommended for hydrophobic glycosides or saccharide derivatives.

### Specifications

Packing Material	Sugar-D	NH <sub>2</sub> -MS
Silica Gel	High purity porous spherical silica	
Average Particle Size	5 μm	
Average Pore Size	—	approx. 120 Å
Specific Surface Area	—	approx. 300 m <sup>2</sup> /g
Bonded Phase Structure	—	
Bonded Phase	Secondary/tertiary amine	Aminopropyl group
Bonding Type	—	Polymeric
Target Substances	Monosaccharides, oligosaccharides	
End-Capping Treatment	—	Near-perfect treatment
Carbon Content	—	approx. 4%
Features	<ul style="list-style-type: none"> <li>•First choice for saccharide analysis</li> <li>•High durability</li> <li>•Good quantitative analysis</li> </ul>	<ul style="list-style-type: none"> <li>•Different selectivity from Sugar-D</li> </ul>

### Comparison of Retention

The conventional aminopropyl column is slightly more retentive than Sugar-D. The retention time can be adjusted by increasing the concentration of acetonitrile in the mobile phase by 5%-10% as shown below.



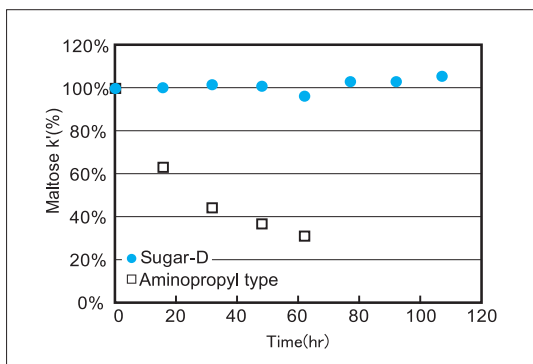


# COSMOSIL Sugar-D

- Novel stationary phase for saccharides
- Superior durability compared to conventional amino columns
- Minimized undesirable adsorption

## Comparison of Durability

The decrease of retention time was compared between COSMOSIL Sugar-D and conventional aminopropyl bonded stationary phase with a severe 100% water eluent between tests. The capacity factor of Sugar-D did not decrease.

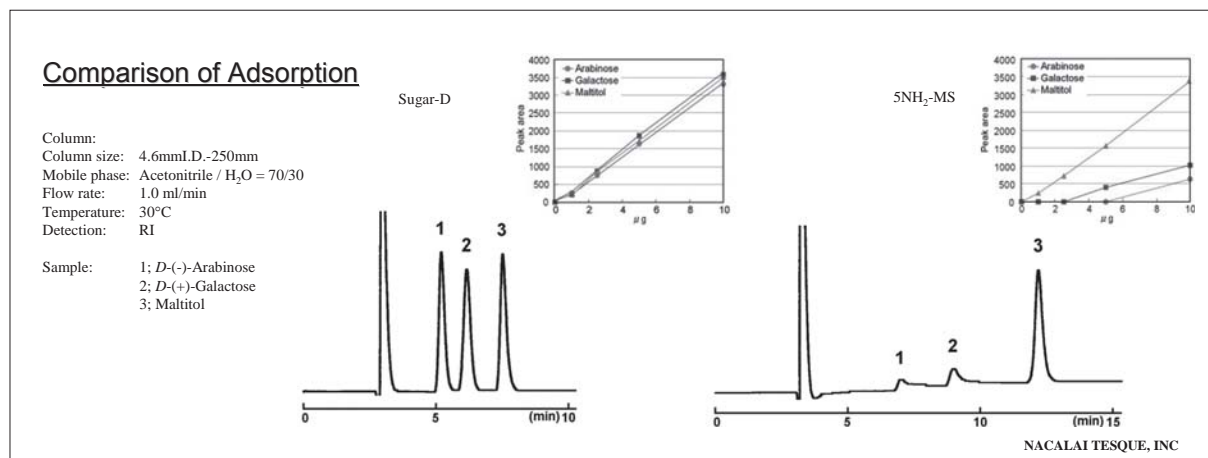


### Decomposition Condition

Solution	Water
Flow Rate	1.0 ml/min
Temperature	Room Temperature
Column	4.6 mm I.D. x 250 mm
Mobile Phase	Acetonitrile : Water = 70 : 30
Flow Rate	1.0 ml/min
Temperature	30°C
Detection	RI
Sample	Maltose

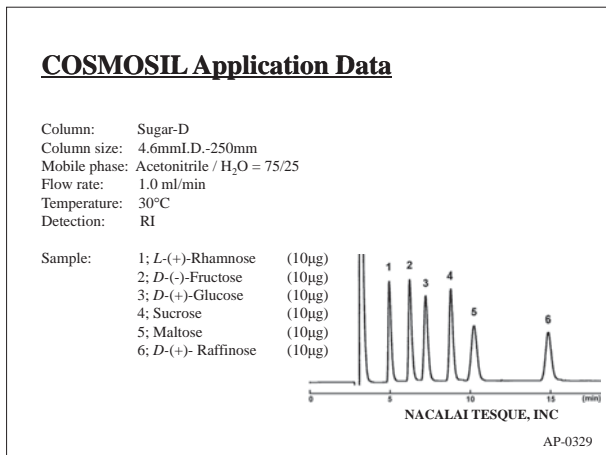
## Comparison of Adsorption

Certain types of saccharides, such as arabinose or galactose, are partially or temporarily adsorbed on conventional aminopropyl stationary phases, causing tailing or no elution at all. COSMOSIL Sugar-D provides superior separation and high recovery for these saccharides.

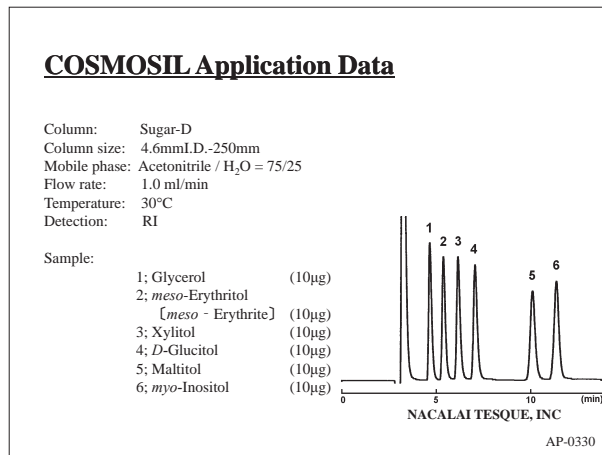


## Applications

### • Mono- and Oligosaccharides

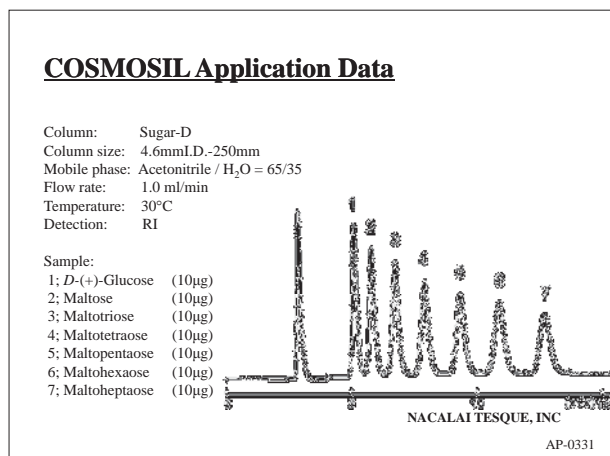


### • Polyols

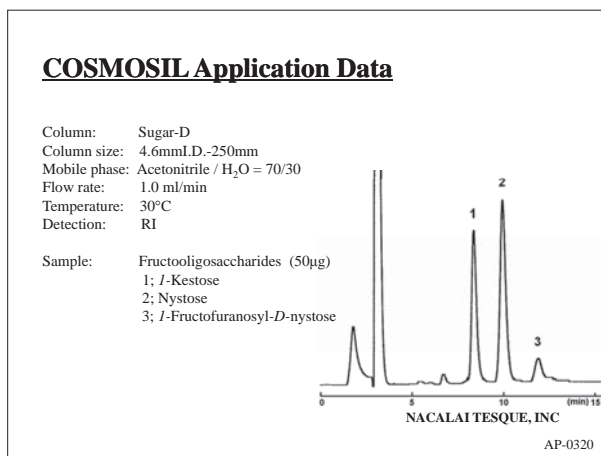


## Applications

### • Oligomaltoses



### • Oligofructoses



## Ordering Information

### • Analytical / Preparative Columns (Particle Size : 5 µm)

#### COSMOSIL Sugar-D Packed Column

Column Size I.D. x Length (mm)	Product Number
2.0 x 250	05689-31
3.0 x 150	05690-91
3.0 x 250	05691-81

#### COSMOSIL Sugar-D Guard Column

Column Size I.D. x Length (mm)	Product Number
4.6 x 10	05394-81
10 x 20	05696-31
20 x 50	05694-51

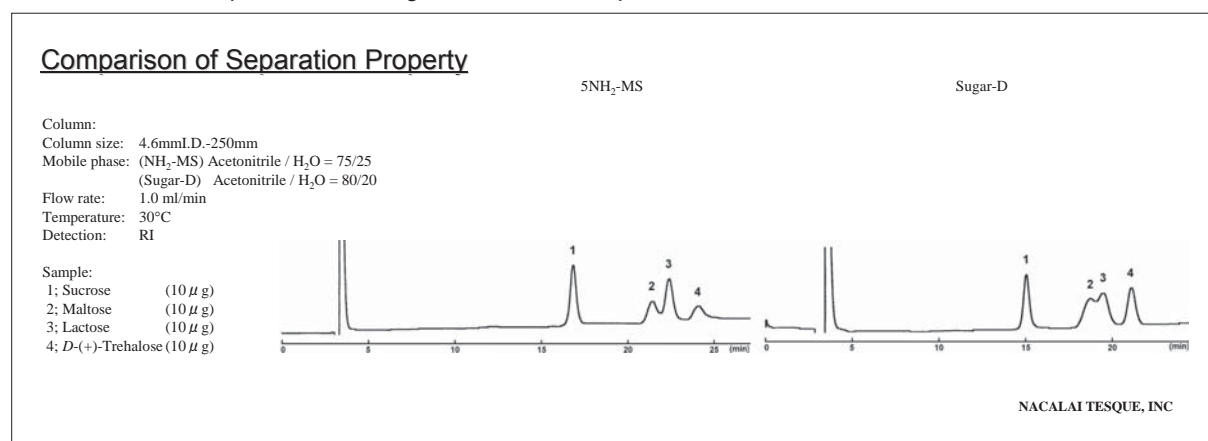
Column Size I.D. x Length (mm)	Product Number
4.6 x 150	05395-71
4.6 x 250	05397-51
10 x 250	05692-71
20 x 250	05693-61

## COSMOSIL NH<sub>2</sub>-MS

- Aminopropyl-bonded stationary phase
- Different selectivity from Sugar-D

### Comparison of Adsorption

NH<sub>2</sub>-MS offers better separation than Sugar-D for some samples.



## Ordering Information

### • Analytical / Preparative Columns (Particle Size: 5 µm)

#### COSMOSIL 5NH<sub>2</sub>-MS Packed Column

Column Size I.D. x Length (mm)	Product Number
4.6 x 150	38245-11
4.6 x 250	38246-01

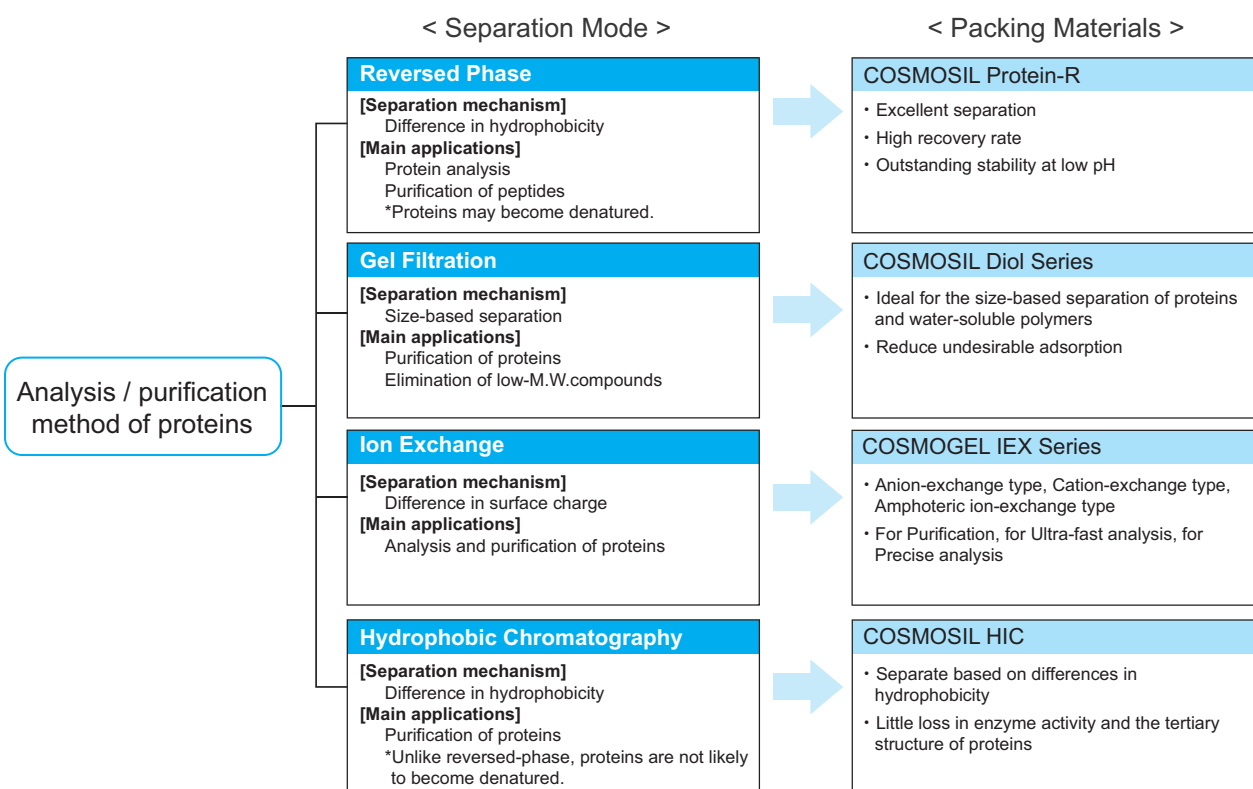
#### COSMOSIL 5NH<sub>2</sub>-MS Guard Column

Column Size I.D. x Length (mm)	Product Number
4.6 x 10	38241-51
10 x 20	38242-41
20 x 50	06093-91

Column Size I.D. x Length (mm)	Product Number
10 x 250	38249-71
20 x 250	38250-31

## (5) Protein Separation Columns

### Protein separation with HPLC



### Reversed Phase Columns

## COSMOSIL Protein-R

- Excellent separation
- High recovery rate
- Outstanding stability at low pH

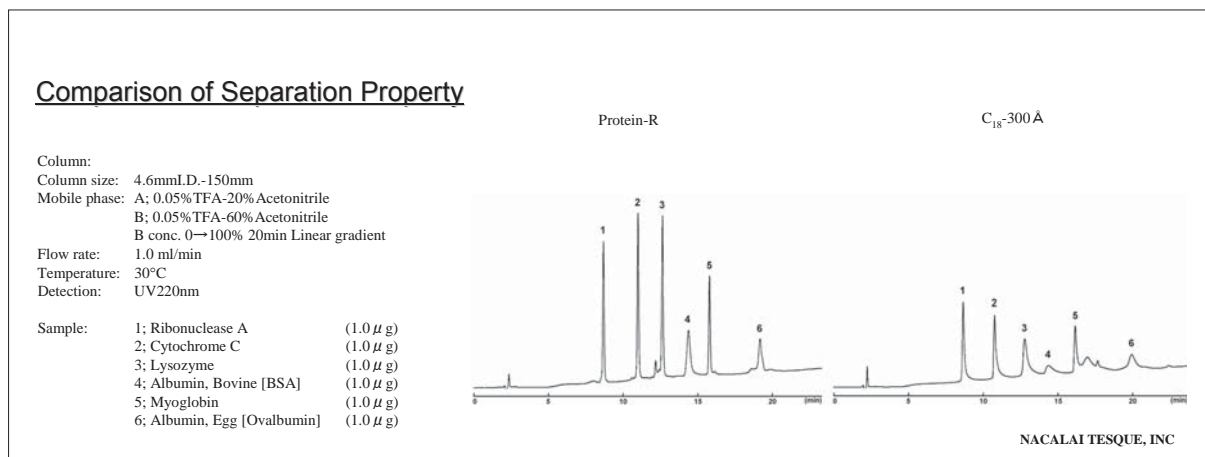
### Specifications

Packing Material	Protein-R
Silica Gel	High purity porous spherical silica
Average Particle Size	5 µm
Average Pore Size	approx. 300 Å
Specific Surface Area	approx. 150 m <sup>2</sup> /g
Bonded Phase	Octadecyl group
Bonding Type	Polymeric
Main Interaction	Hydrophobic interaction
End-Capping Treatment	Near-perfect treatment
pH Range	1.5-7.5*
Features	• High recovery rate • Acid-resistant

\*Optimal pH range of silica-based columns is between 2 and 7.5. Extreme pH may significantly decrease column lifetime.

## Comparison of Separation

Protein-R shows sharper peaks for proteins than conventional C<sub>18</sub> wide-pore columns.



## Ordering Information

- Analytical / Preparative Columns (Particle Size: 5 μm)

### COSMOSIL Protein-R Packed Column

Column Size I.D. x Length (mm)	Product Number	Column Size I.D. x Length (mm)	Product Number
2.0 x 150	06514-71	10 x 150	06529-91
4.6 x 50	06525-31	10 x 250	06530-51
4.6 x 150	06526-21	20 x 150	06531-41
4.6 x 250	06527-11	20 x 250	06532-31

### COSMOSIL Protein-R Guard Column

Column Size I.D. x Length (mm)	Product Number
4.6 x 10	06518-31
10 x 20	06528-01
20 x 20	08692-81

## COSMOSIL C<sub>18</sub>-AR-300, C<sub>8</sub>-AR-300, C<sub>4</sub>-AR-300, Ph-AR-300

- Wide-pore reversed-phase column
- 4 types of phases (octadecyl, octyl, butyl and phenyl)

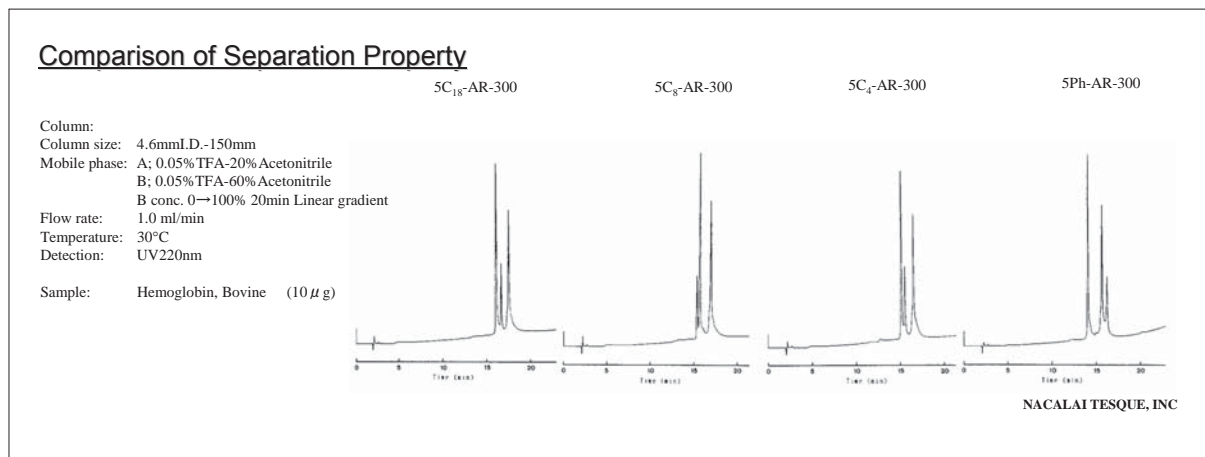
## Specifications

Packing Material	5C <sub>18</sub> -AR-300	5C <sub>8</sub> -AR-300	5C <sub>4</sub> -AR-300	5Ph-AR-300
Silica Gel	High purity porous spherical silica			
Average Particle Size	5 μm			
Average Pore Size	300 Å			
Specific Surface Area	150 m <sup>2</sup> /g			
Bonded Phase Structure				
Bonded Phase	Octadecyl group	Octyl group	Butyl group	Phenyl group
Bonding Type	Polymeric			
Main Interaction	Hydrophobic interaction			Hydrophobic interaction π-π interaction
End-Capping Treatment	Near-perfect treatment			
pH Range	1.5-7.5*			
Carbon Content	approx. 12%	approx. 7%	approx. 6%	approx. 7%

\*Optimal pH range of silica-based columns is between 2 and 7.5. Extreme pH may significantly decrease column lifetime.

## Comparison of Separation

COSMOSIL AR-300 packed column series offers 3 types of alkyl phases and a phenyl phase.



## Ordering Information

- Analytical / Preparative Columns (Particle Size: 5 μm)

### COSMOSIL 5C<sub>18</sub>-AR-300 Packed Column

Column Size I.D. x Length (mm)	Product Number	Column Size I.D. x Length (mm)	Product Number
4.6 x 50	37911-01	10 x 150	37917-41
4.6 x 150	37913-81	10 x 250	37918-31
4.6 x 250	37914-71	20 x 150	37919-21
		20 x 250	37920-81

### COSMOSIL 5C<sub>18</sub>-AR-300 Guard Column

Column Size I.D. x Length (mm)	Product Number
4.6 x 10	37910-11
10 x 20	37965-11

### COSMOSIL 5C<sub>8</sub>-AR-300 Packed Column

Column Size I.D. x Length (mm)	Product Number	Column Size I.D. x Length (mm)	Product Number
4.6 x 50	37951-81	10 x 150	34345-21
4.6 x 150	37953-61	10 x 250	34247-11
4.6 x 250	37954-51	20 x 150	05861-51
		20 x 250	34364-71

### COSMOSIL 5C<sub>8</sub>-AR-300 Guard Column

Column Size I.D. x Length (mm)	Product Number
4.6 x 10	37950-91
10 x 20	34464-61

### COSMOSIL 5C<sub>4</sub>-AR-300 Packed Column

Column Size I.D. x Length (mm)	Product Number	Column Size I.D. x Length (mm)	Product Number
4.6 x 50	37956-31	10 x 150	34249-91
4.6 x 150	37958-11	10 x 250	38047-11
4.6 x 250	37959-01	20 x 150	34477-01
		20 x 250	38048-01

### COSMOSIL 5C<sub>4</sub>-AR-300 Guard Column

Column Size I.D. x Length (mm)	Product Number
4.6 x 10	37955-41
10 x 20	05862-41

### COSMOSIL 5Ph-AR-300 Packed Column

Column Size I.D. x Length (mm)	Product Number	Column Size I.D. x Length (mm)	Product Number
4.6 x 50	37961-51	10 x 150	05865-11
4.6 x 150	37963-31	10 x 250	34267-51
4.6 x 250	37964-21	20 x 150	05866-01
		20 x 250	34468-21

### COSMOSIL 5Ph-AR-300 Guard Column

Column Size I.D. x Length (mm)	Product Number
4.6 x 10	37960-61
10 x 20	34268-41



## Gel Filtration Columns (Aqueous)

# COSMOSIL Diol-120-II, Diol-300-II, Diol-1000-II

- Ideal for the size-based separation of proteins and water-soluble polymers
- Reduce undesirable adsorption

### Specifications

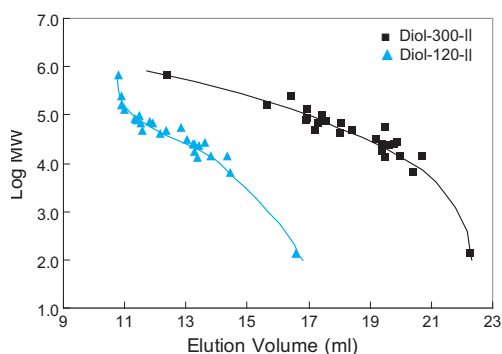
Packing Material	5Diol-120-II	5Diol-300-II	5Diol-1000-II
Silica Gel	High purity porous spherical silica <sup>(1)</sup>		
Average Particle Size	5 µm		
Average Pore Size	approx. 120 Å	approx. 300 Å	approx. 1000 Å <sup>(2)</sup>
Bonded Phase	Diol group		
Target Substances	Proteins, water soluble polymers		
Flow Rate	0.5-1.0 (ml/min)		
Selection of Pore Size (protein)	MW 5,000-100,000	MW 10,000-700,000	-
Selection of Pore Size (water-soluble polymers)	MW 1,000-20,000	MW 5,000-100,000	MW 50,000-500,000

(1) With the silica-based gel, organic solvents, including methanol and acetonitrile, can be used.

(2) If you require pore sizes greater than 1000 Å, please contact us.

### Calibration Curve

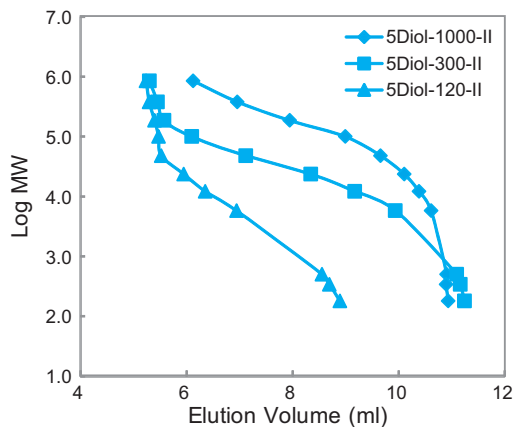
#### • Calibration Curve of Proteins



Column COSMOSIL 5Diol-II (7.5 mm I.D. x 600 mm)  
 Mobile Phase 20mmol/l Phosphate Buffer (pH7.0)+100mmol/l Na<sub>2</sub>SO<sub>4</sub>  
 Flow Rate 1.0ml/min  
 Temperature 30°C

Sample	M.W.	Sample	M.W.
Thyroglobulin	660,000	Peroxidase	40,000
Catalase	250,000	Carbonic Anhydrase	30,000
Glucose Oxidase	160,000	α-Chymotrypsinogen A	25,700
Uricase	128,000	α-Chymotrypsin	25,200
Choline Oxidase	95,000	Trypsinogen	24,000
Transferrin	85,000	Trypsin (bovine)	23,300
Conalbumin	77,500	Myoglobin	17,000
Malate Dehydrogenase	70,000	Lysozyme	14,300
α-Glucosidase	68,500	Ribonuclease A	13,700
Albumin (BSA)	66,000	Cytochrome C	12,400
α-Amylase	52,500	Aprotinin	6,500
Fetuin	48,000	Gly-Gly	132
Albumin (Ovalbumin)	45,000		

#### • Linear pullulan calibration curve

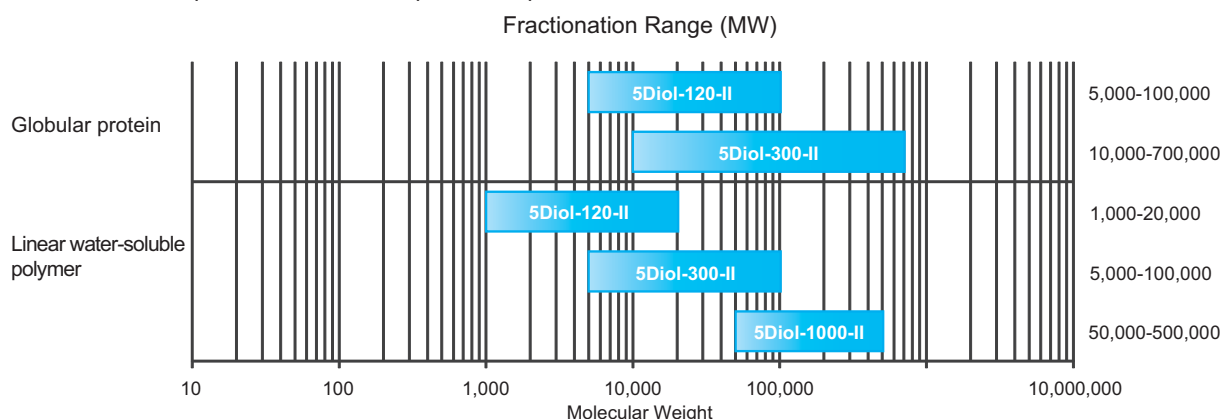


Column COSMOSIL 5Diol-II (7.5 mm I.D. x 300 mm)  
 Mobile Phase Water  
 Flow Rate 1.0ml/min  
 Temperature 30°C  
 Detection RI  
 Sample Linear pullulan

Sample	M.W.
1; P-800	853,000
2; P-400	380,000
3; P-200	186,000
4; P-100	100,000
5; P-50	48,000
6; P-20	23,700
7; P-10	12,200
8; P-5	5,800
9; Maltotriose	504
10; Maltose	342
11; Glucose	180

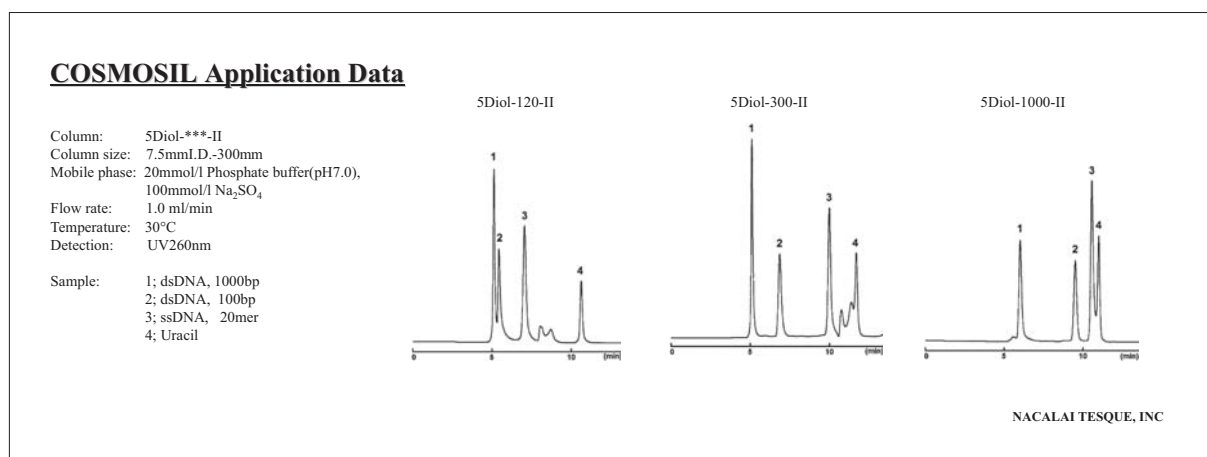
## Molecular Weight Range

Globular molecules have smaller apparent size compared to linear molecules of the same weight. Therefore, globular molecules can be separated with smaller pores compared to linear molecules.



## Application

### • DNA



## Ordering Information

### • Analytical / Preparative Columns (Particle Size: 5 µm)

#### COSMOSIL 5Diol-120-II Packed Column

Column Size I.D. x Length (mm)	Product Number
7.5 x 300	38050-51
7.5 x 600	38051-41

#### COSMOSIL 5Diol-120-II Guard Column

Column Size I.D. x Length (mm)	Product Number
7.5 x 50	38049-91

#### COSMOSIL 5Diol-300-II Packed Column

Column Size I.D. x Length (mm)	Product Number
7.5 x 300	38053-21
7.5 x 600	38054-11

#### COSMOSIL 5Diol-300-II Guard Column

Column Size I.D. x Length (mm)	Product Number
7.5 x 50	38052-31

#### COSMOSIL 5Diol-1000-II Packed Column

Column Size I.D. x Length (mm)	Product Number
7.5 x 300	13338-71

#### COSMOSIL 5Diol-1000-II Guard Column

Column Size I.D. x Length (mm)	Product Number
7.5 x 50	13337-81

## Ion Exchange Columns

# COSMOGEL IEX Series

- Available in 3 different ion-exchange modes (Anion-exchange type, Cation-exchange type, Amphoteric ion-exchange type)
- Available for 3 different application areas (for Purification, for Ultra-fast analysis, for Precise analysis)
- For separation of biopolymers such as proteins or nucleic acids

### Specifications

Packing Material	Type Q	Type Q-N	Type S	Type S-N	Type M	Type M-N
Gel	Hydrophilic polymer					
Average Particle Size	5 µm					
Average Pore Size	1000 Å	Non-porous	1000 Å	Non-porous	1000 Å	Non-porous
Functional Group	-CH <sub>3</sub> N <sup>+</sup> (CH <sub>3</sub> ) <sub>3</sub>		-(CH <sub>2</sub> ) <sub>3</sub> SO <sub>3</sub> <sup>-</sup>		-CH <sub>3</sub> N <sup>+</sup> (CH <sub>3</sub> ) <sub>3</sub> + -(CH <sub>2</sub> ) <sub>3</sub> SO <sub>3</sub> <sup>-</sup>	
Protein Binding Capacity	110-150 mg	12-20 mg	70-100 mg	10-18 mg	55-75 mg(BSA)/ml 35-50 mg(IgG)/ml	6-10 mg(BSA)/ml 5-9 mg(IgG)/ml
Column Size I.D. x Length (mm)	4.6 x 50	4.6 x 30 4.6 x 100	4.6 x 50	4.6 x 30 4.6 x 100	4.6 x 50	4.6 x 100
Column Material	PEEK					
Connection	Waters Type					

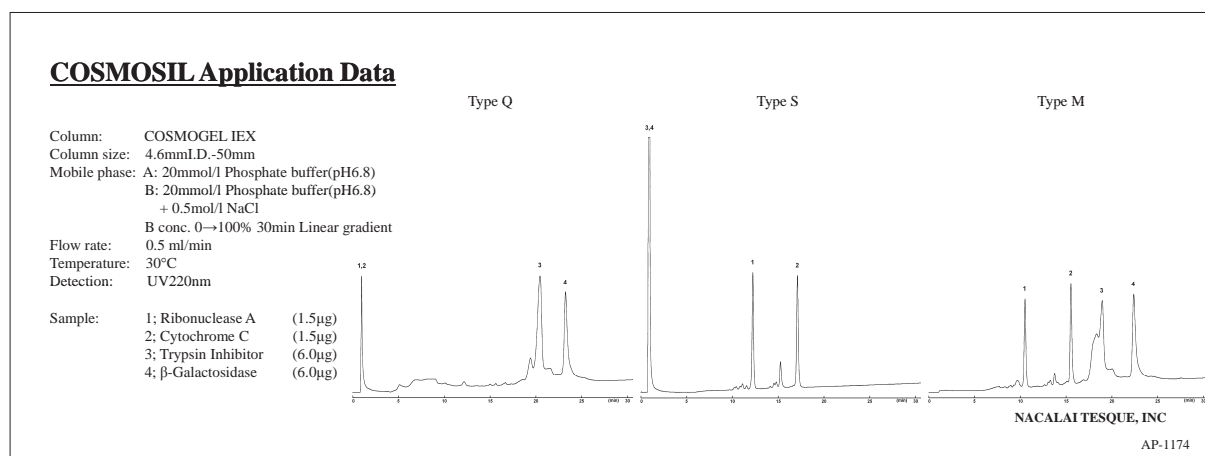
### Type of Packing Material

COSMOGEL IEX Series are available in amphoteric ion-exchange type in which two kinds of packing materials are mixed, as well as in widely used anion-exchange type and cation-exchange type.

Type of Packing Material	Target Sample	Average Pore Size	
		Porous (1000 Å )	Non-porous
Anion-Exchange Type	Acidic proteins / DNA	Type Q	Type Q-N
Cation-Exchange Type	Basic proteins	Type S	Type S-N
Amphoteric Ion-Exchange Type	All proteins	Type M	Type M-N

### Comprehensive isolation of proteins by amphoteric ion-exchange type (Type M)

The amphoteric ion-exchange type enables the simultaneous separation of BOTH acidic and basic proteins in one application.



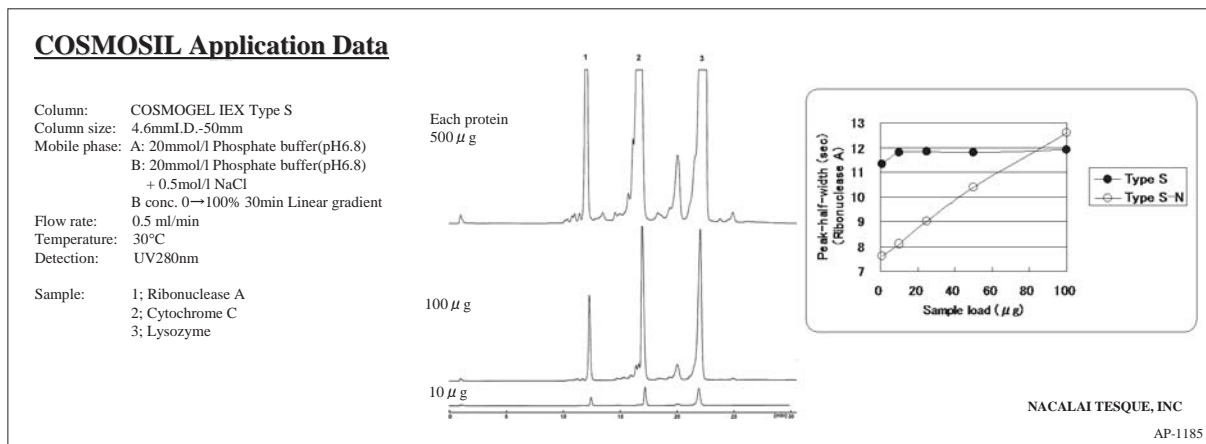
### Type of Column

COSMOGEL IEX columns are available for 3 types of applications:

Application	Pore Size	Column Size I.D. x Length (mm)	Column		
For Purification	Porous (1000 Å )	4.6 × 50	Type Q	Type S	Type M
For Precise Analysis	Non-porous	4.6 × 100	Type Q-N	Type S-N	Type M-N
For Ultra-Fast Analysis	Non-porous	4.6 × 30	Type Q-N	Type S-N	—

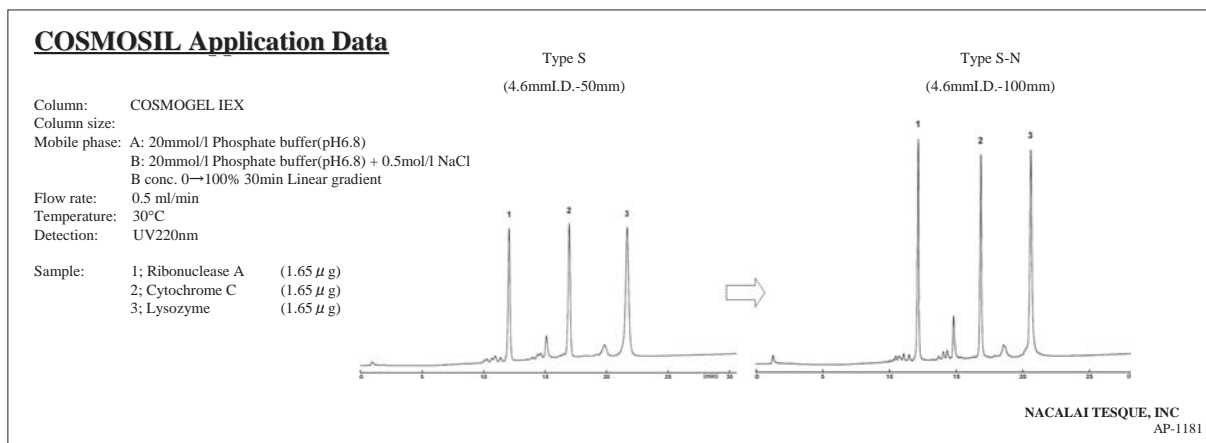
### For Purification: Type Q, Type S, Type M

Porous packing materials have higher binding capacity for proteins than the non-porous type, which means that peak shape does not spread even with injection of a large volume of sample. Therefore they are highly suitable for purification of large samples.



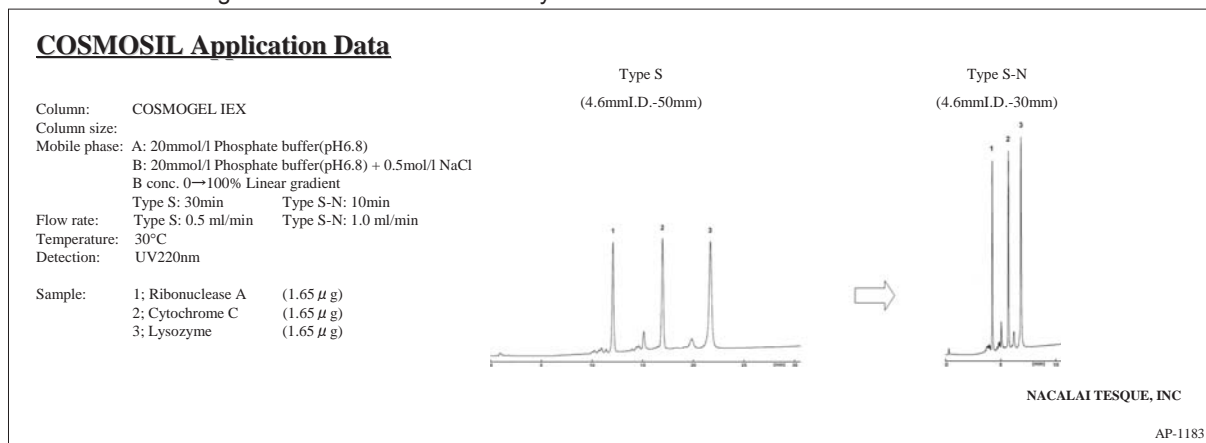
### For Precise Analysis: Type Q-N, Type S-N, Type M-N

Non-porous packing materials reduce spreading of samples in packing materials, resulting in high resolution separation for precise analysis, such as quality control of antibody preparations. The longer column length also contributes to the sharper peaks.



### For Ultra-fast Analysis: Type Q-N, Type S-N

Non-porous packing materials are not much affected by high flow rate and thus the materials are suitable for fast analysis. The shorter column length contributes to the fast analysis.



### Ordering Information

Ion Exchange Mode	Product Name	Application	Column Size I.D. x Length (mm)	Product Number
Anion-exchange Type	COSMOGEL IEX Type Q	For Purification	4.6 x 50	06266-31
	COSMOGEL IEX Type Q-N	For Ultra-fast Analysis	4.6 x 30	06264-51
	COSMOGEL IEX Type Q-N	For Precise Analysis	4.6 x 100	06258-41
Cation-exchange Type	COSMOGEL IEX Type S	For Purification	4.6 x 50	06252-01
	COSMOGEL IEX Type S-N	For Ultra-fast Analysis	4.6 x 30	06251-11
	COSMOGEL IEX Type S-N	For Precise Analysis	4.6 x 100	06250-21
Amphoteric Ion-exchange Type	COSMOGEL IEX Type M	For Purification	4.6 x 50	06248-71
	COSMOGEL IEX Type M-Nz	For Precise Analysis	4.6 x 100	06244-11

## Hydrophobic Interaction Columns

# COSMOSIL HIC

- Separate based on differences in hydrophobicity
- Little loss in enzyme activity and the tertiary structure of proteins

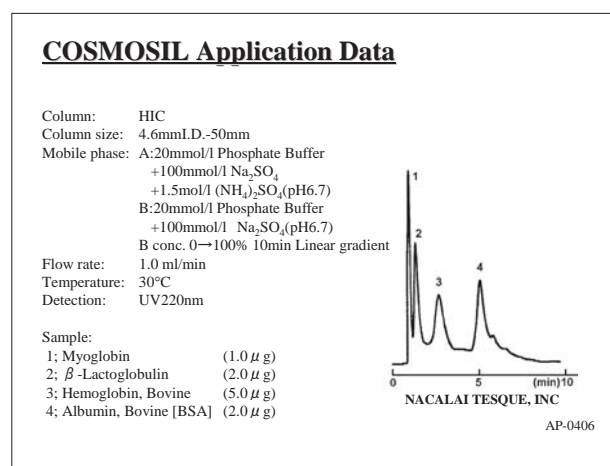
### Specifications

Packing Material	HIC
Silica Gel	High purity porous spherical silica
Average Particle Size	5 µm
Average Pore Size	approx. 300 Å
Specific Surface Area	approx. 150 m <sup>2</sup> /g
Main Interaction	Hydrophobic interaction

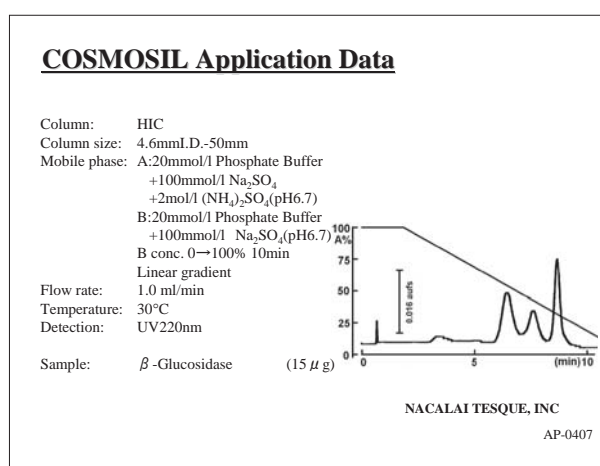
### Applications

A buffer with high salt concentration, usually 1-2 mol/l of (NH<sub>4</sub>)<sub>2</sub>SO<sub>4</sub>, is used as an initial mobile phase for adsorption of samples to a weakly hydrophobic stationary phase. The elution is done with a decreasing salt gradient. The application in the lower left shows that myoglobin elutes earlier than BSA under the buffer with high salt concentration, suggesting that myoglobin is less hydrophobic than BSA.

#### • Separation of Protein Standards



#### • Separation of β-Glucosidase



### Ordering Information

- Analytical Columns (Particle Size: 5 µm)

#### COSMOSIL 5HIC Packed Column

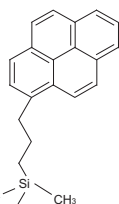
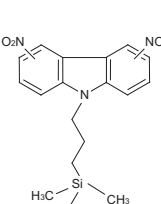
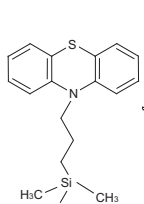
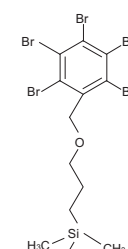
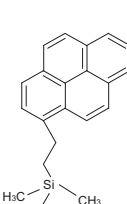
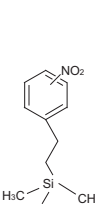
Column Size I.D. x Length (mm)	Product Number
4.6 x 50	04263-21

## (6) Columns for Fullerene Separation

### Introduction

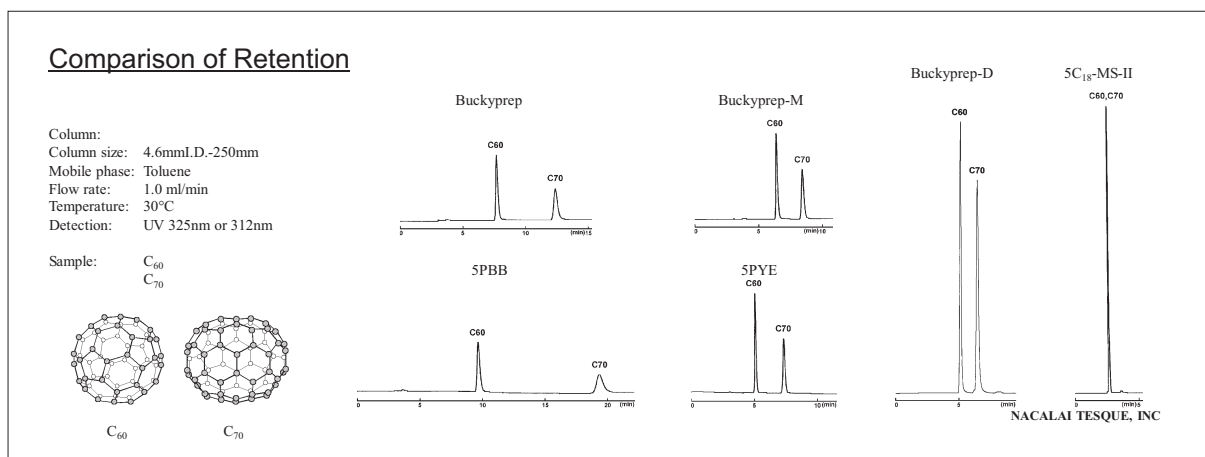
Separation of fullerenes, especially preparative scale separation, on conventional HPLC columns is always problematic due to the low solubility and low recovery rate of fullerenes. COSMOSIL offers a variety of columns designed for preparative scale separation of fullerenes, including higher fullerenes, metallofullerenes and fullerene derivatives.

### Specifications

Packing Material	Buckyprep	Buckyprep-D	Buckyprep-M	PBB	PYE	NPE
Silica Gel	High purity porous spherical silica					
Average Particle Size	5 µm					
Average Pore Size	approx. 120 Å					
Specific Surface Area	approx. 300 m <sup>2</sup> /g					
Bonded Phase Structure						
Bonded Phase	Pyrenylpropyl group	Nitro-carbazoyl group	Phenothiazinyl group	Pentabromobenzyl group	Pyrenylethyl group	Nitrophenylethyl group
Bonding Type	Monomeric					
End-Capping Treatment	Near-perfect treatment		None	Near-perfect treatment		
Carbon Content	approx. 17%	-	approx. 13%	approx. 8%	approx. 18%	approx. 9%
Features	• Standard column for fullerene separation.	• For separation of derivatized fullerenes	• Designed to separate metallofullerenes	• Designed for preparative separation of C <sub>60</sub> , C <sub>70</sub>	• Separation of fullerene and structural isomers	• Separation of fullerene derivatives

### Comparison of Retention

The figure below shows the retention time of C<sub>60</sub> and C<sub>70</sub> in toluene. COSMOSIL fullerene separation columns (Buckyprep, Buckyprep-D, Buckyprep-M, PBB and PYE) exhibit high fullerene retention with toluene, so they can easily separate C<sub>60</sub> and C<sub>70</sub>.



### Suggested Solvents for Fullerene Separation

Solvent	Solubility of C <sub>60</sub> (mg/ml)	Features
Toluene	3.2	The most commonly used solvent.
<i>n</i> -Hexane	0.046	Weaker eluent than toluene
<i>n</i> -Heptane	--	
Methanol	0.001	
2-Propanol	--	
Acetonitrile	0.018	Weaker eluent than toluene. Recommended as a washing solvent for Buckyprep-D.

Solvent	Solubility of C <sub>60</sub> (mg/ml)	Features
Chlorobenzene	7.0	Stronger eluent than toluene. Recommended for higher fullerenes.
<i>o</i> -Dichlorobenzene	27.0	Stronger eluent than chlorobenzene.
1,2,4-Trichlorobenzene	21.3	Strongest eluent. Recommended as a washing solvent.

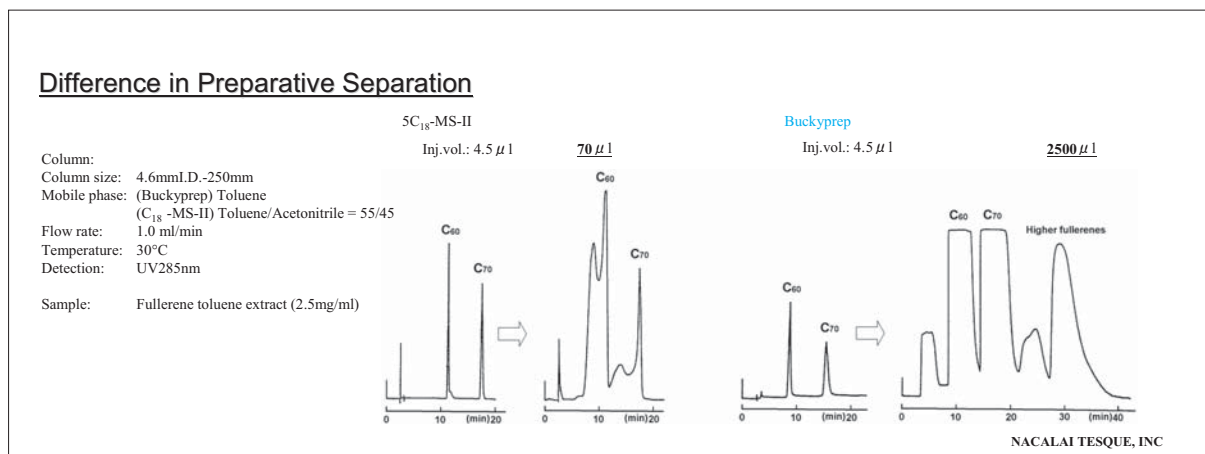


# COSMOSIL Buckyprep

- Standard column for fullerene separation
- Excellent separation for higher and derivatized fullerenes

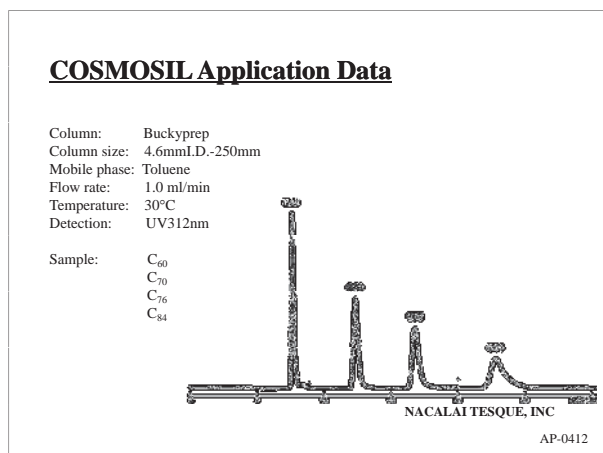
## Difference in Preparative Separation

Buckyprep can be used with toluene, the most commonly-used solvent in fullerene separation. Because tailing does not occur, you can inject about 35 times more sample than with a C<sub>18</sub> column.

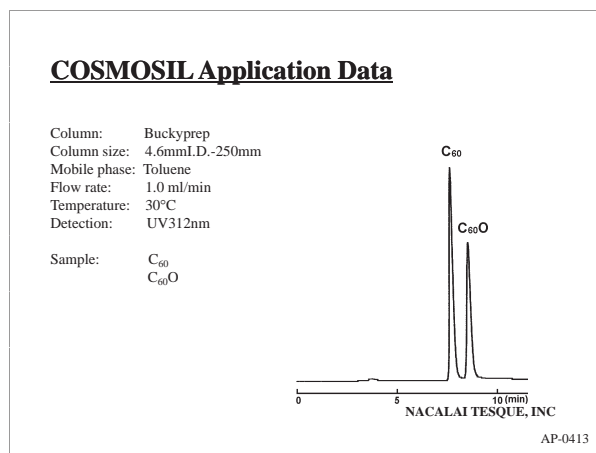


## Applications

### • Higher Fullerenes



### • Oxidized Fullerenes



## Ordering Information

- Analytical / Preparative Columns (Particle Size: 5 μm)

### COSMOSIL Buckyprep Packed Column

### COSMOSIL Buckyprep Guard Column

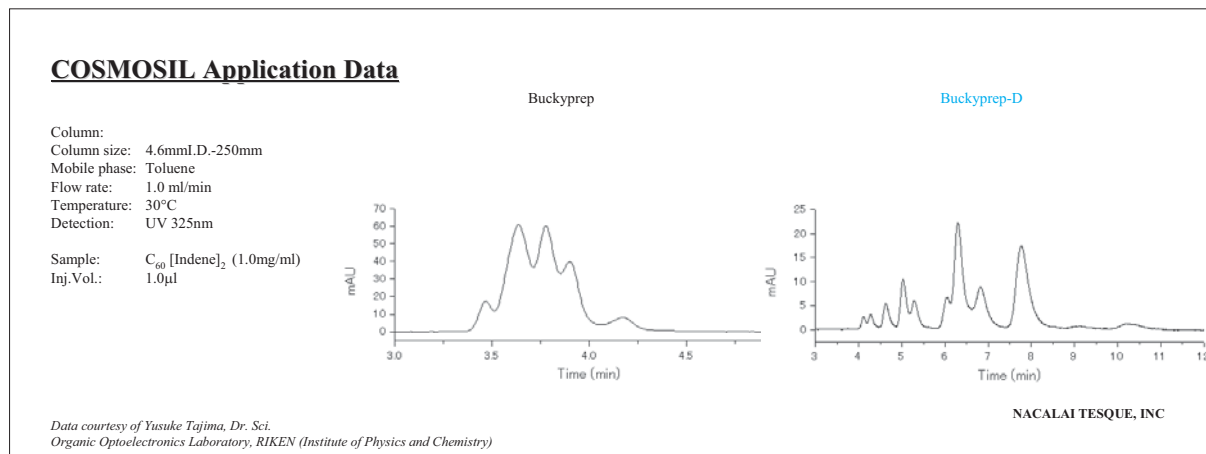
Column Size I.D. x Length (mm)	Product Number	Column Size I.D. x Length (mm)	Product Number
4.6 x 250	37977-61	4.6 x 10	37983-71
10 x 250	37981-91	10 x 20	37984-61
20 x 250	37982-81	20 x 50	34374-41
28 x 250	34346-11	28 x 50	05871-21

# COSMOSIL Buckyprep-D

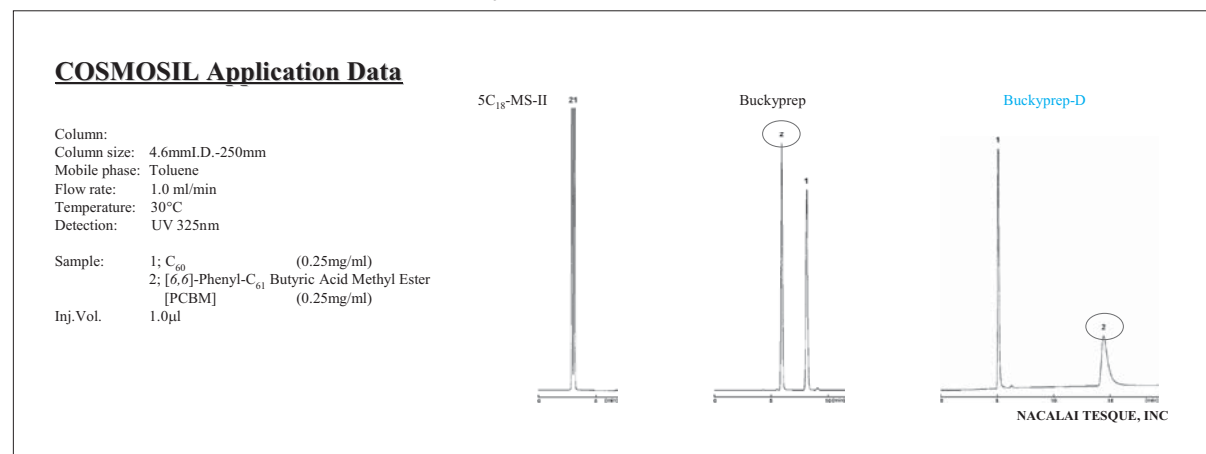
- For preparative separation of derivatized fullerenes
- For separation of derivatized fullerenes such as C<sub>60</sub>-indene (used for organic thin-film solar cell)

## Applications

Buckyprep-D offers improved separation for C<sub>60</sub>-indene, a derivatized fullerene that has received much attention as an n-type semiconductor material for organic thin-film solar cells.



Buckyprep-D retains derivatized fullerenes longer than C<sub>60</sub>. Therefore it is more suitable for preparative separation of derivatized fullerenes than our conventional Buckyprep column.



## Note

The baseline of Buckyprep-D is less stable relative to other fullerene columns. To stabilize baseline, let acetonitrile run through for 10 minutes before analysis.

## Ordering Information

- Analytical / Preparative Columns (Particle Size: 5 µm)

### COSMOSIL Buckyprep-D Packed Column

Column Size I.D. x Length (mm)	Product Number
4.6 x 50	09646-61
4.6 x 250	09647-51
10 x 250	09650-91
20 x 250	09651-81

### COSMOSIL Buckyprep-D Guard Column

Column Size I.D. x Length (mm)	Product Number
4.6 x 10	09611-01
10 x 20	09613-81
20 x 50	09614-71

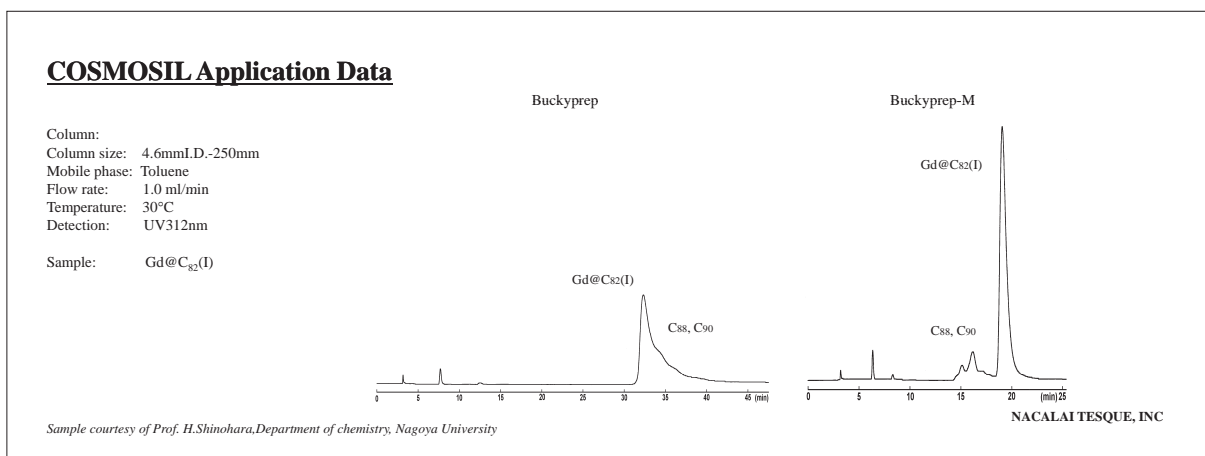
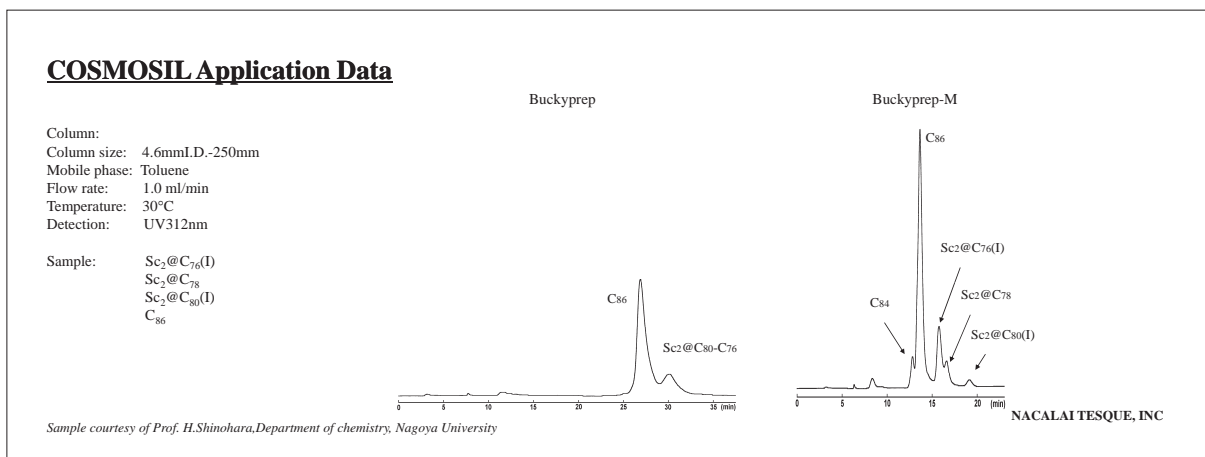
# COSMOSIL Buckyprep-M

- Different selectivity from Buckyprep
- Excellent separation for metallofullerenes

## Applications

### Metallofullerenes

COSMOSIL Buckyprep-M is a phenothiazinyl-bonded silica-based column specifically designed for metallofullerene separation. Metallofullerenes are retained more strongly than other fullerenes on this column. COSMOSIL Buckyprep-M is also effective for the separation of higher fullerenes and fullerene derivatives.



## Ordering Information

- Analytical / Preparative Columns (Particle Size: 5 µm)

### COSMOSIL Buckyprep-M Packed Column

Column Size I.D. x Length (mm)	Product Number
4.6 x 250	04138-71
10 x 250	04141-11
20 x 250	04142-01
28 x 250	05873-01

### COSMOSIL Buckyprep-M Guard Column

Column Size I.D. x Length (mm)	Product Number
4.6 x 10	04139-61
10 x 20	04140-21
20 x 50	34474-31
28 x 50	05872-11

# COSMOSIL PBB

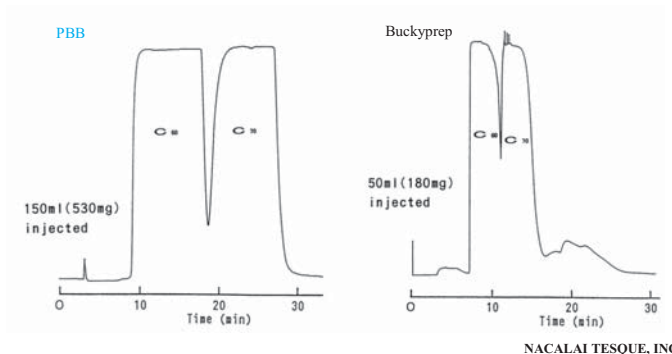
- Can be used with *o*-dichlorobenzene or carbon disulfide
- Suitable for preparative scale separation

## Applications

The loading capacity of COSMOSIL PBB for C<sub>60</sub> and C<sub>70</sub> can be three times greater than COSMOSIL Buckyrep.

### Preparative Separation of Fullerenes

Column:  
 Column size: 20mm I.D.-250mm  
 Mobile phase: Toluene  
 Flow rate: 18 ml/min  
 Temperature: Room temperature  
 Detection: UV285nm  
 Sample: Crude fullerenes (3.5mg/ml)



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## Ordering Information

- Analytical / Preparative Columns (Particle Size: 5 µm)

### COSMOSIL 5PBB Packed Column

Column Size I.D. x Length (mm)	Product Number
4.6 x 250	37980-01
10 x 250	37985-51
20 x 250	37986-41

### COSMOSIL 5PBB Guard Column

Column Size I.D. x Length (mm)	Product Number
4.6 x 10	37987-31
10 x 20	37988-21
20 x 50	34375-31

# COSMOSIL NPE

- Different selectivity from Buckyrep or PBB
- Excellent separation for derivatized fullerenes

## Applications

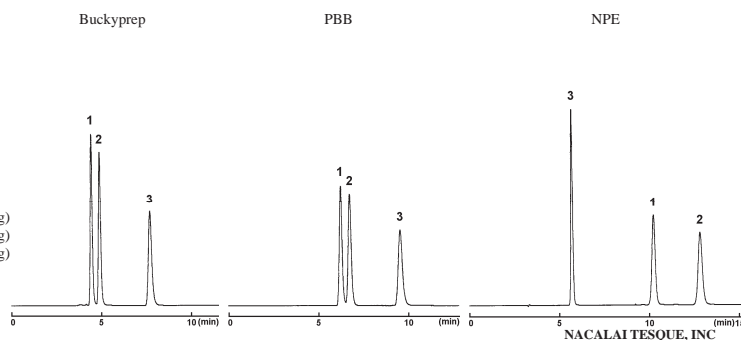
- **PCBM, PCBB**

COSMOSIL NPE retains derivatized C<sub>60</sub> stronger than C<sub>60</sub>.

### COSMOSIL Application Data

Column:  
 Column size: 4.6mm I.D.-250mm  
 Mobile phase: (Buckyrep, PBB) Toluene  
 (NPE) Toluene/ Hexane = 25/75  
 Flow rate: 1.0 ml/min  
 Temperature: 30°C  
 Detection: UV325nm

Sample:  
 1; [6,6]-Phenyl-C<sub>61</sub> Butyric Acid Methyl Ester [PCBM] (1.5µg)  
 2; [6,6]-Phenyl-C<sub>61</sub> Butyric Acid Butyl Ester [PCBB] (1.5µg)  
 3; C<sub>60</sub> (1.5µg)



NACALAI TESQUE, INC

Hexane added to mobile phase due to NPE's weak retention.

## Ordering Information

- Analytical / Preparative Columns (Particle Size: 5 µm)

### COSMOSIL 5NPE Packed Column

Column Size I.D. x Length (mm)	Product Number
4.6 x 150	37902-21
4.6 x 250	37990-71
10 x 250	05469-11
20 x 250	38046-21

### COSMOSIL 5NPE Guard Column

Column Size I.D. x Length (mm)	Product Number
4.6 x 10	37904-01
10 x 20	38045-31
20 x 50	05869-71

## COSMOSIL PYE

## Ordering Information

- Analytical / Preparative Columns (Particle Size: 5 µm)

### COSMOSIL 5PYE Packed Column

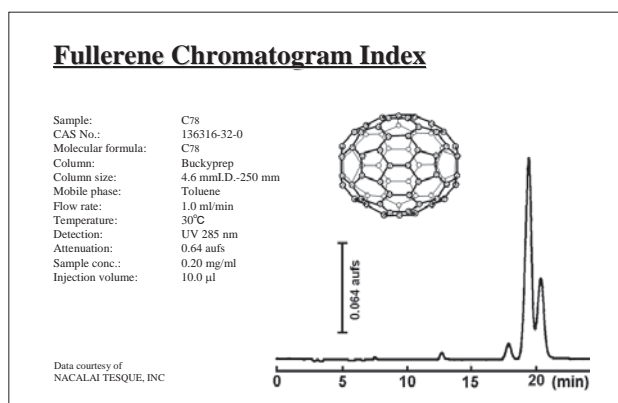
Column Size I.D. x Length (mm)	Product Number
4.6 x 250	37989-11
10 x 250	37996-11
20 x 250	38044-41
28 x 250	34300-91

### COSMOSIL 5PYE Guard Column

Column Size I.D. x Length (mm)	Product Number
4.6 x 10	37903-11
10 x 20	38041-71
20 x 50	34475-21

## Fullerene Chromatogram Index

Fullerene Chromatogram Index includes more than 100 chromatograms. If you are interested in this index, please feel free to e-mail us at [info.intl@nacalai.com](mailto:info.intl@nacalai.com). The online version is available at the website of The Fullerenes, Nanotubes and Graphene Research Society below.



The Fullerenes, Nanotubes and Graphene Research Society

Website: [http://fullerene-jp.org/en/chromato\\_index\\_3.pdf](http://fullerene-jp.org/en/chromato_index_3.pdf)

## (7) Columns for Soluble Carbon Nanotube Separation

# COSMOSIL CNT-300, CNT-1000, CNT-2000

- Size-based separation of soluble carbon nanotubes
- Three pore sizes (300 Å , 1000 Å , 2000 Å )
- High durability

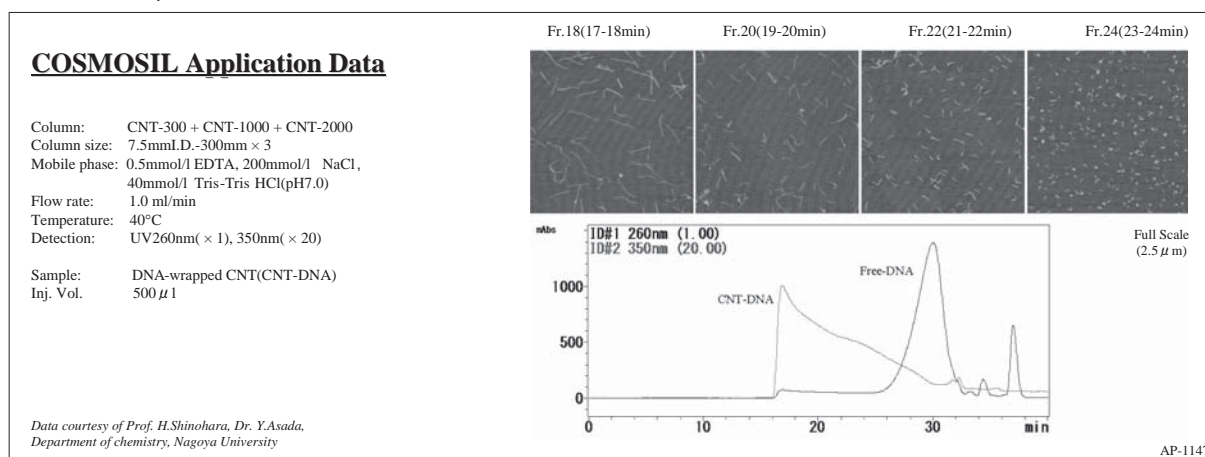
### Specifications

Packing Material	CNT-300	CNT-1000	CNT-2000
Silica Gel	High purity porous spherical silica		
Average Particle Size	5 µm		
Average Pore Size	approx. 300 Å	approx. 1000 Å	approx. 2000 Å
Bonded Phase	Hydrophilic group (neutral)		
pH Range	2-7.5		
Pressure	15 MPa and below		

### Applications

#### • Carbon Nanotubes

COSMOSIL CNT columns offer improved separation for DNA-wrapped carbon nanotubes by connecting three columns with different pore sizes.



### Ordering Information

- Analytical Columns (Particle Size: 5µm)

#### COSMOSIL CNT-300 Packed Column

Column Size I.D. x Length (mm)	Product Number
7.5 x 300	09195-71

#### COSMOSIL CNT-300 Guard Column

Column Size I.D. x Length (mm)	Product Number
7.5 x 50	09194-81

#### COSMOSIL CNT-1000 Packed Column

Column Size I.D. x Length (mm)	Product Number
7.5 x 300	09197-51

#### COSMOSIL CNT-1000 Guard Column

Column Size I.D. x Length (mm)	Product Number
7.5 x 50	09196-61

#### COSMOSIL CNT-2000 Packed Column

Column Size I.D. x Length (mm)	Product Number
7.5 x 300	09199-31

#### COSMOSIL CNT-2000 Guard Column

Column Size I.D. x Length (mm)	Product Number
7.5 x 50	09198-41



## II. SFC Columns

Supercritical Fluid Chromatography (SFC) has become more attractive because it offers some advantages over HPLC, such as high speed, unique selectivity and environmentally friendly separations. Many conventional normal-phase stationary phases, such as diol, amino and cyano, have been used for SFC applications. However, these phases present limitations for separations. COSMOSIL SFC Columns have been developed to enhance the capability of SFC separations.

### COSMOSIL SFC Columns

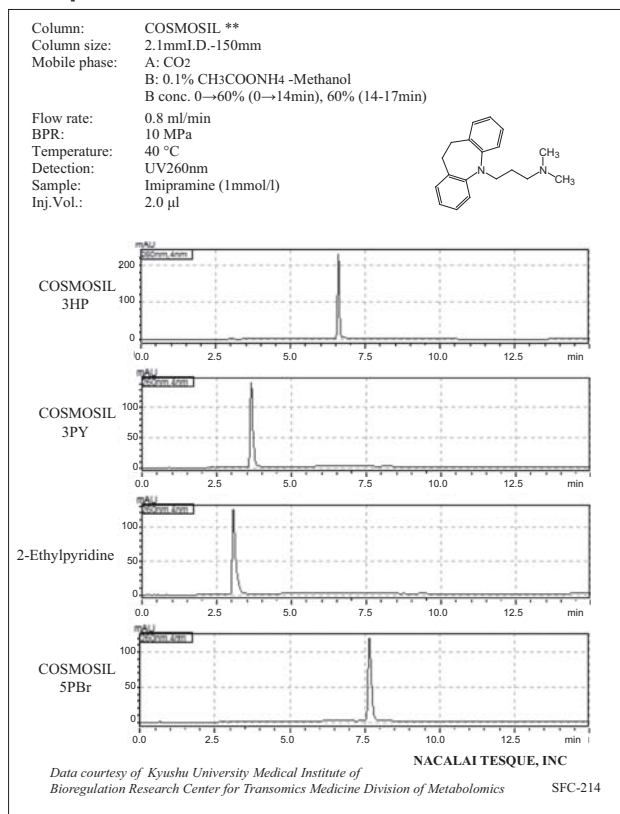
Nacalai Tesque has developed columns specially designed for SFC in collaboration with Nacalai USA and Pfizer, Inc. Global R&D: COSMOSIL HP, PY (equivalent to 2-ethylpyridine) and Quinoline. In addition to these, our HPLC columns Cholester and PBr have been tested for use with SFC.

Packing Material	HP	PY	Quinoline		Cholester		PBr
Average Particle Sizes	3, 5 µm		2.5 µm	5 µm	2.5 µm	5 µm	5 µm
Average Pore Sizes	120 Å		130 Å	120 Å	130 Å	120 Å	120 Å
Specific Surface Area	300 m <sup>2</sup> /g		330 m <sup>2</sup> /g	300 m <sup>2</sup> /g	330 m <sup>2</sup> /g	300 m <sup>2</sup> /g	300 m <sup>2</sup> /g
Bonded Phase Structure							
Bonded Phase	3-Hydroxyphenyl group	Pyridinyl group	Quinoline group		Cholesteryl group		Pentabromobenzyl group

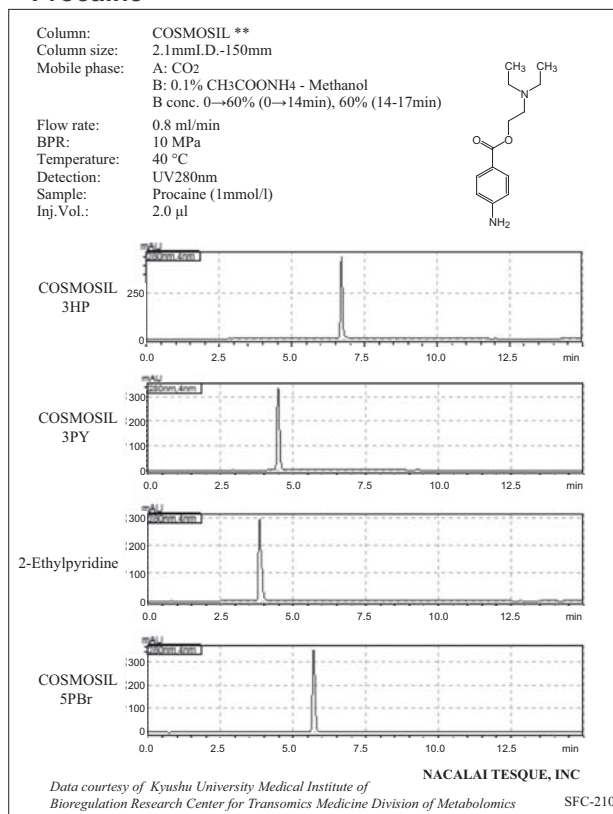
### Pharmaceutical Analysis

Each phase has different retention properties.

#### • Imipramine

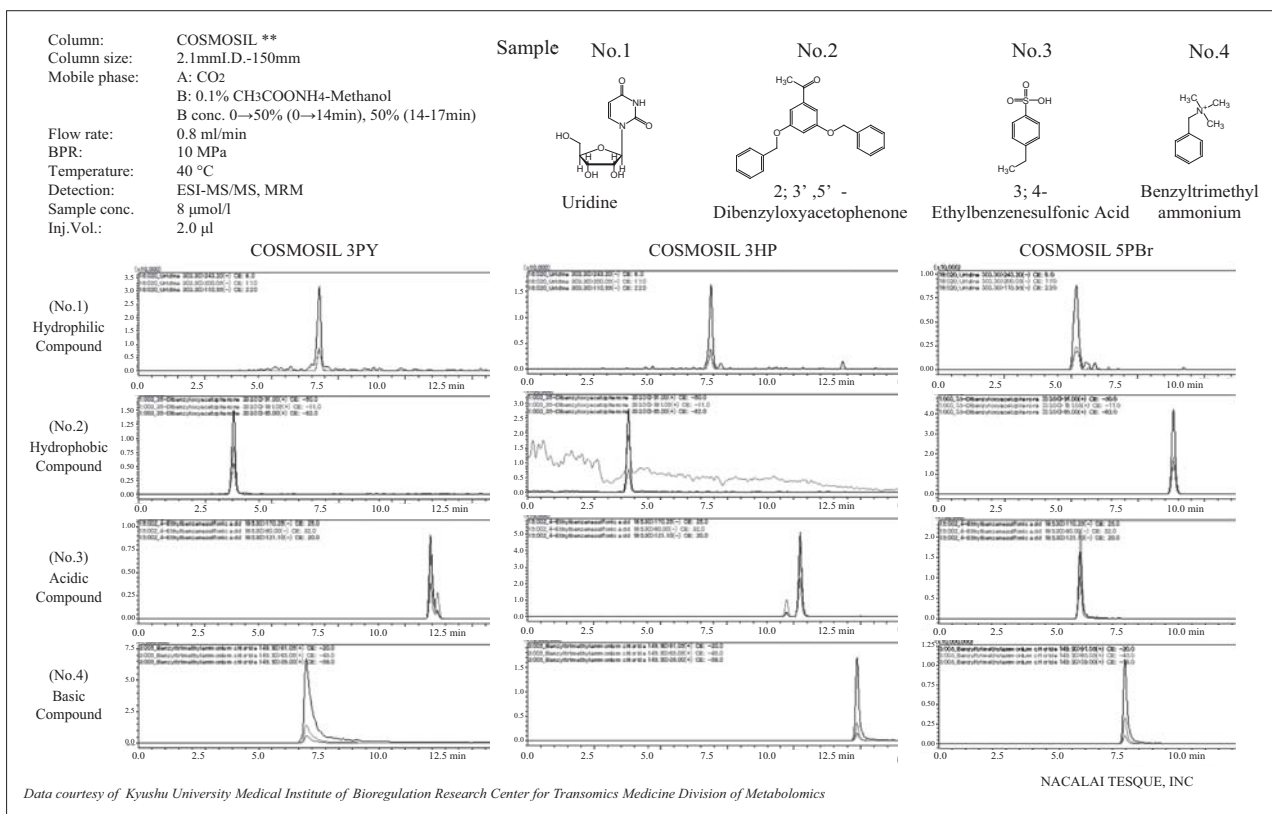


#### • Procaine



## Comparison of Retention Behavior

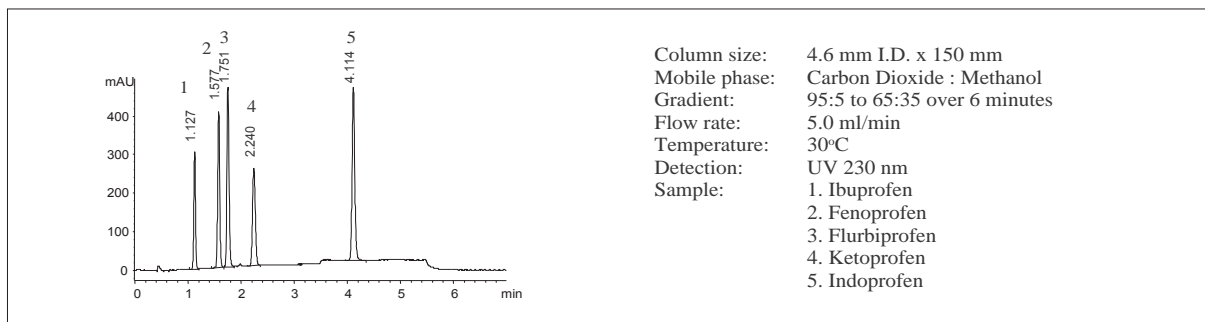
The following three stationary phases were evaluated for their retention of hydrophilic, hydrophobic, acidic and basic compounds. COSMOSIL HP and PY elute hydrophobic compounds first and retain hydrophilic compounds longer, whereas PBr elutes in the reverse order, exhibiting high retention for hydrophobic compounds. HP had the longest retention for basic compounds.



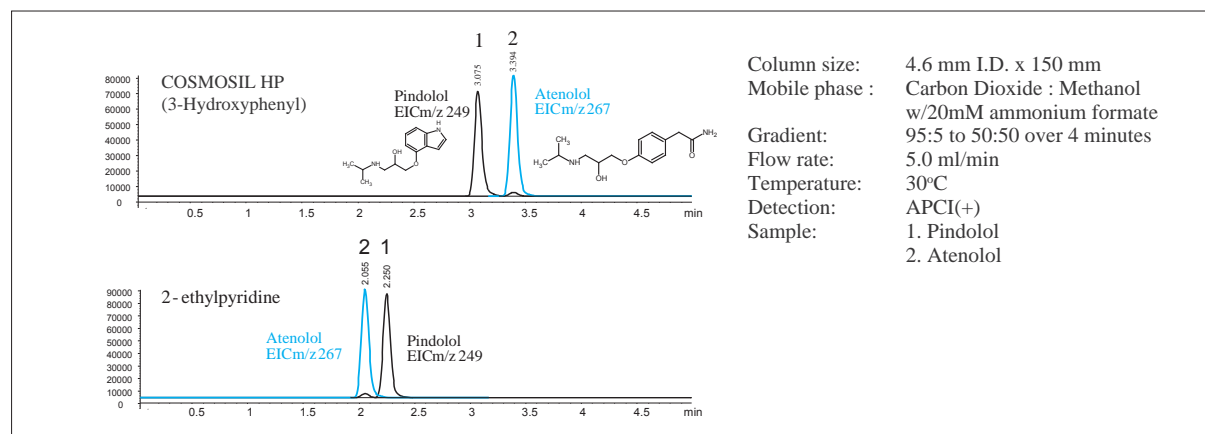
# COSMOSIL HP (3-Hydroxyphenyl)

## Applications

### • Non-steroidal anti-inflammatory drugs



### • Beta Blockers (Peak elution order reversal under identical conditions)



## Ordering Information

- Analytical / Preparative Columns

(Particle Size: 5 µm)

### COSMOSIL 5HP (3-Hydroxyphenyl) Packed Columns

Column Size I.D. x Length (mm)	Product Number
2.0 x 150	13787-91
4.6 x 250	13788-81
10 x 250	13789-71
20 x 250	13790-31

### COSMOSIL 5HP (3-Hydroxyphenyl) Guard Columns

Column Size I.D. x Length (mm)	Product Number
10.0 x 20	13791-21

(Particle Size: 3 µm)

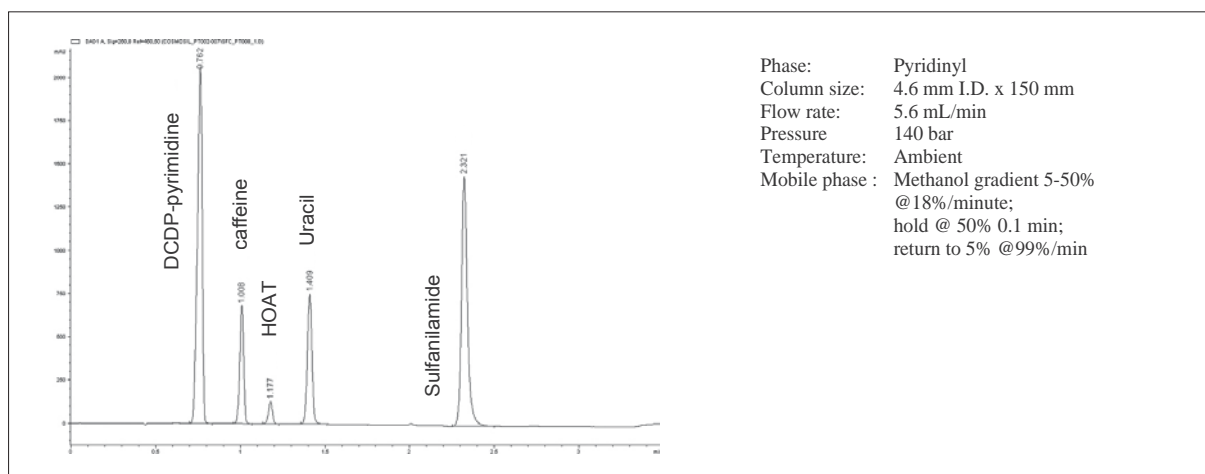
### COSMOSIL 3HP (3-Hydroxyphenyl) Packed Columns

Column Size I.D. x Length (mm)	Product Number
2.0 x 150	13792-11
4.6 x 250	13793-01

## COSMOSIL PY (Pyridinyl)

### Applications

- Hydrophilic organics



## Ordering Information

- Analytical / Preparative Columns

(Particle Size: 5 µm)

### COSMOSIL 5PY (Pyridinyl) Packed Columns

Column Size I.D. x Length (mm)	Product Number
2.0 x 150	13818-81
4.6 x 250	13827-61
10 x 250	13828-51
20 x 250	13829-41

### COSMOSIL 5PY (Pyridinyl) Guard Columns

Column Size I.D. x Length (mm)	Product Number
10.0 x 20	13830-01

(Particle Size: 3 µm)

### COSMOSIL 3PY (Pyridinyl) Packed Columns

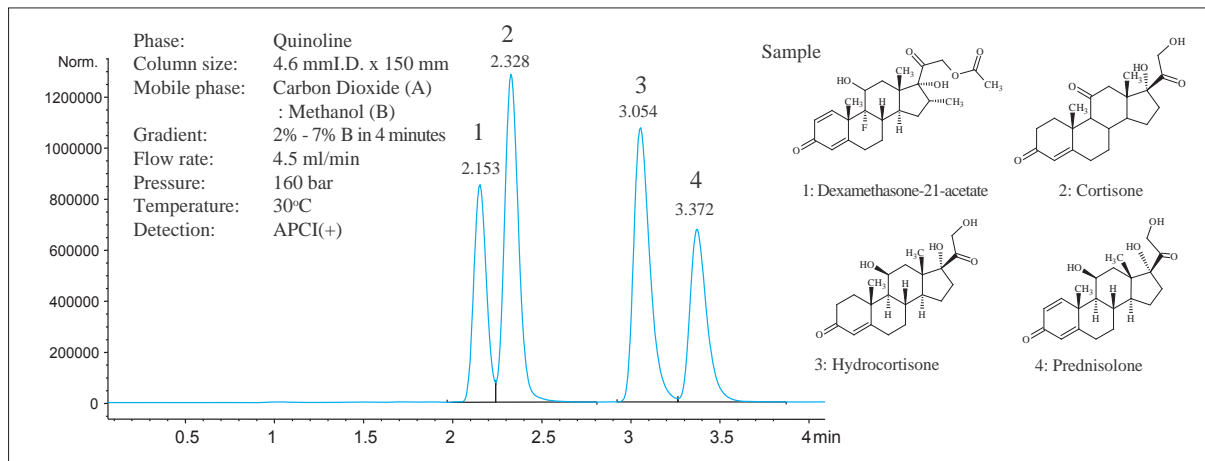
Column Size I.D. x Length (mm)	Product Number
2.0 x 150	13831-91
4.6 x 250	13832-81

# COSMOSIL Quinoline

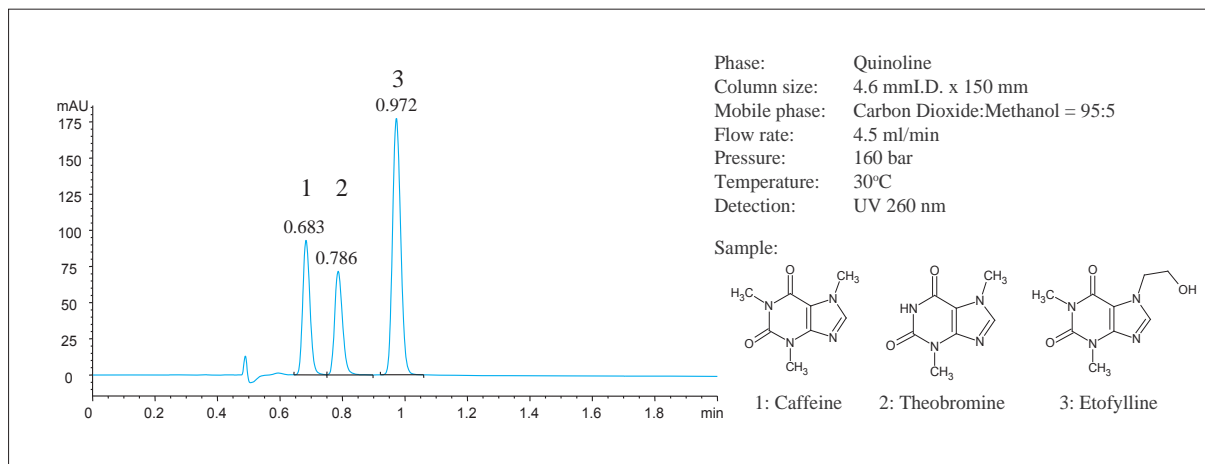
The structural similarities between polar lipids, such as cholesterol and related analogs, have posed chromatographic and spectrometric challenges to analysts interested in quantifying these potential biomarkers. COSMOSIL Quinoline has been developed to improve the separation of these structural isomers utilizing the  $\pi$ - $\pi$  interactions and structural rigidity of the naphthylethyl phase and the hydrogen bonding of the pyridine phase.

## Applications

### • Steroids



### • Caffeine analogs



## Ordering Information

### • Analytical / Preparative Columns

(Particle Size: 5  $\mu$ m)

(Particle Size: 2.5  $\mu$ m)

#### COSMOSIL Quinoline Packed Column

Column Size I.D. x Length (mm)	Product Number
2.0 x 150	Inquire
4.6 x 100	Inquire
4.6 x 150	Inquire
10.0 x 150	Inquire
20.0 x 150	Inquire

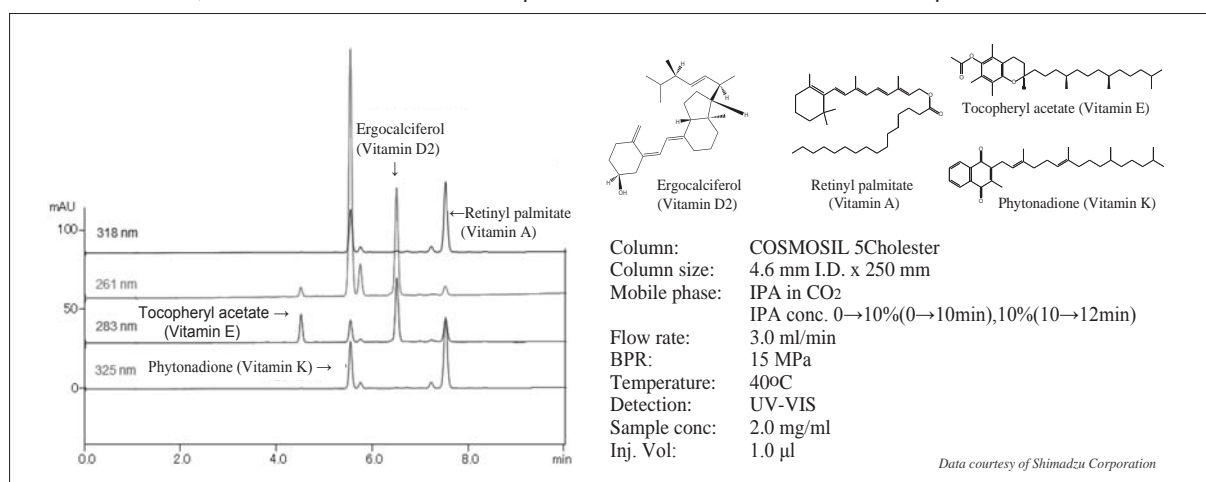
#### COSMOSIL Quinoline Packed Column

Column Size I.D. x Length (mm)	Product Number
3.0 x 50	Inquire
3.0 x 100	Inquire
3.0 x 150	Inquire

## COSMOSIL Cholester

### Fat-Soluble Vitamin Analysis

When used with SFC, COSMOSIL Cholester can separate fat-soluble vitamins and their impurities.



COSMOSIL Cholester exhibits strong retention for fat-soluble vitamins and is suitable for on-line SFE-SFC using Shimadzu's Nexera UC. The online extraction from food also produced triglyceride impurities, which were successfully separated from the vitamins.

### Ordering Information

For ordering information for COSMOSIL Cholester, refer to page 24.

## COSMOSIL PBr

### Ordering Information

For ordering information for COSMOSIL PBr, refer to page 25.

# III. Preparative Packing Materials

## Normal and Reversed Phase Packing Materials

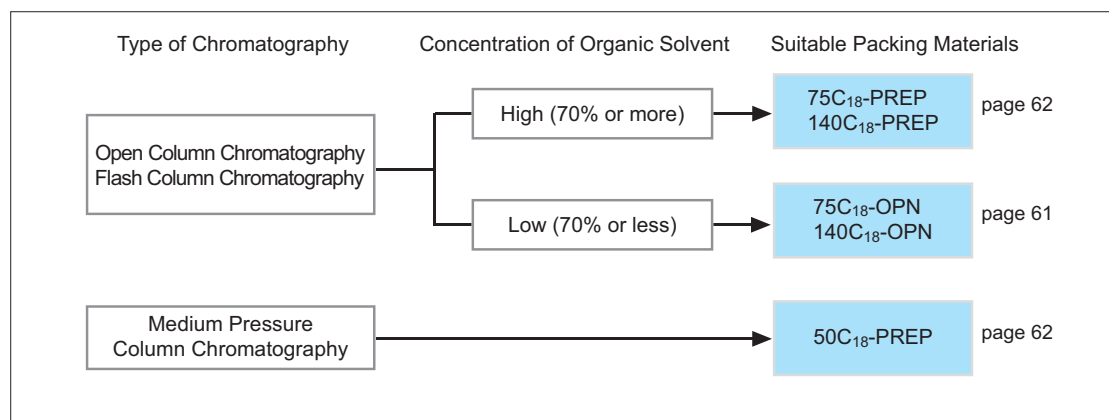
### Introduction

Open column chromatography is an excellent and easy technique for large-scale preparation and purification at low cost. COSMOSIL offers both normal and reversed phase packing materials based on totally porous spherical silica, which provides higher separation, less pressure and higher reproducibility than irregular silica.

### Specifications

Packing Material	C <sub>18</sub> -OPN	C <sub>18</sub> -PREP	Silica Gel 60 (Neutral)
Silica Gel	High purity porous spherical silica		
Average Particle Size	75, 140 µm	50, 75, 140 µm	75, 140 µm
Average Pore Size	approx. 120 Å		approx. 60 Å
Specific Surface Area	approx. 300 m <sup>2</sup> /g		approx. 500 m <sup>2</sup> /g
Bonded Phase	Octadecyl group		None
Carbon Content	—	approx. 19%	0%
Residual Silanol Group	Yes	None	—
Application	Open column chromatography / Flash column chromatography		
	Reversed phase chromatography		Normal phase chromatography

### Selection Guide (Reversed Phase)





# COSMOSIL C<sub>18</sub>-OPN

- A new “Water-Wet” C<sub>18</sub> packing material for reversed phase open column chromatography
- Usable under 100% aqueous eluents

## Characteristic

The external surface of the C<sub>18</sub>-OPN gel is coated with hydrophilic group to increase wettability of the gel, and the octadecyl group is bonded within the pore of the gel. Conventional reversed phase C<sub>18</sub> packing materials are restricted to about 30-50% water in the mobile phase. The COSMOSIL C<sub>18</sub>-OPN is a new “Water-Wet” C<sub>18</sub> packing material developed for reversed phase open column chromatography. The C<sub>18</sub>-OPN material can be used in 100% aqueous eluents.

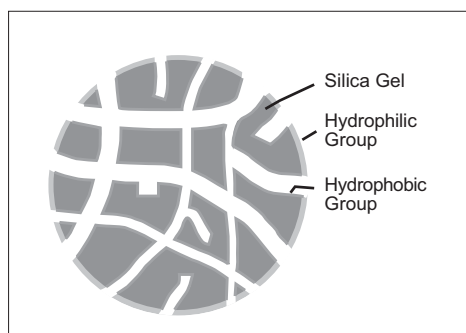


Figure 1. Structure of C<sub>18</sub>-OPN



Figure 2. Packing material in water

Left: C<sub>18</sub>-OPN provides good resolution

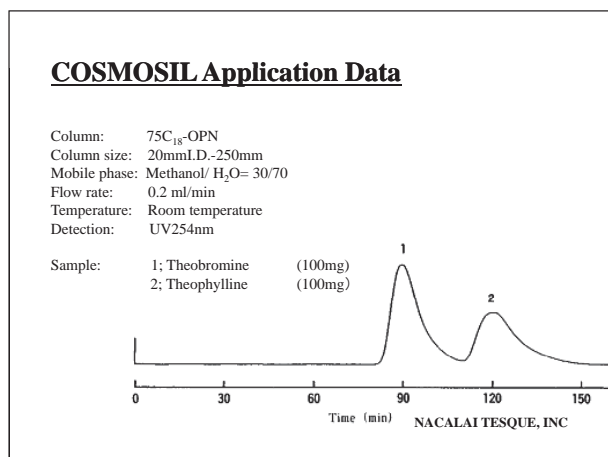
Can be used with low concentration of organic solvent on open, flash column chromatography.

Right: C<sub>18</sub>-PREP float up

Use with 70% or more organic solvent on open, flash column chromatography.

## Applications

- Separation of hydrophilic compounds in aqueous solution



In reversed phase chromatography, hydrophilic compounds such as theobromine and theophylline could be separated under low concentration of organic solvent. The figure shows they are clearly separated by reversed open column chromatography with 70% water.

## Ordering Information

### COSMOSIL C<sub>18</sub>-OPN

Product Name	Average Particle Size	Product Number	PKG Size
COSMOSIL 75C <sub>18</sub> -OPN	75µm	37842-66	100 g
		37842-95	500 g
		37842-11	1 kg
COSMOSIL 140C <sub>18</sub> -OPN	140µm	37878-16	100 g
		37878-45	500 g
		37878-61	1 kg

# COSMOSIL C<sub>18</sub>-PREP

- Standard reversed phase packing material for open chromatography
- Endcapped
- 3 particle sizes (50, 75, 140 µm)

## Particle Size, Flow Rate and Theoretical Plate Number

Because reversed phase chromatography employs a mobile phase of high viscosity such as methanol and water, the flow rate is lower than that of normal phase chromatography, which uses mobile phase of low viscosity such as hexane and ethyl acetate.

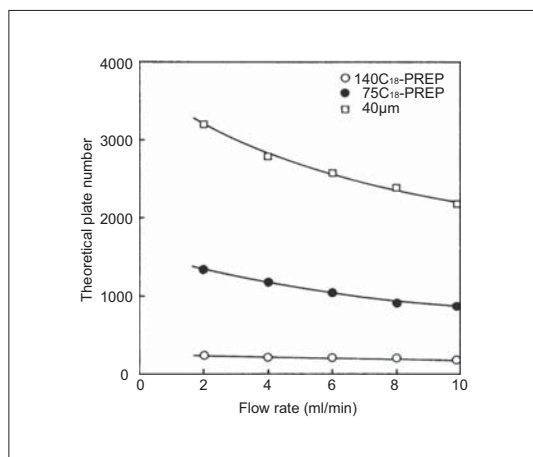


Figure 1. Flow rate against theoretical plate number  
Column size: 20 mm I.D. x 300 mm

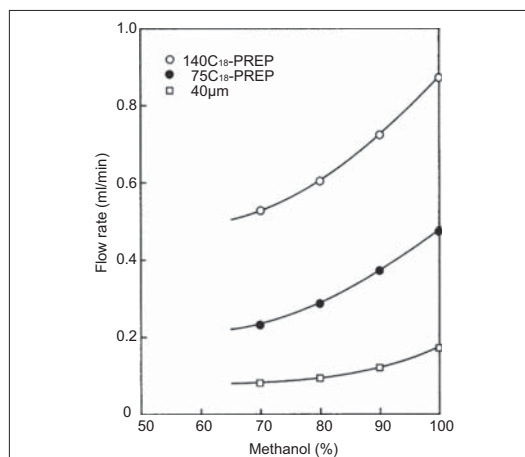
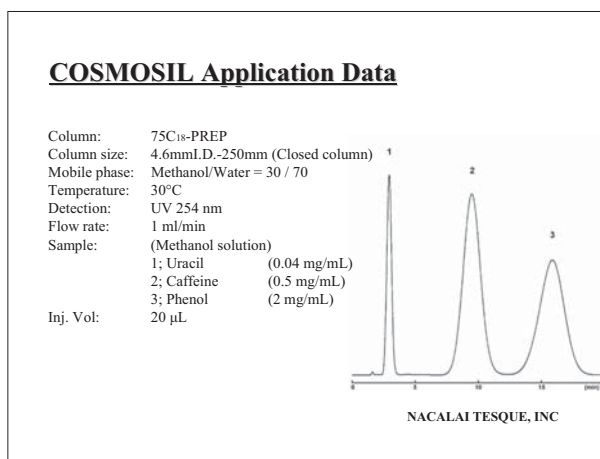
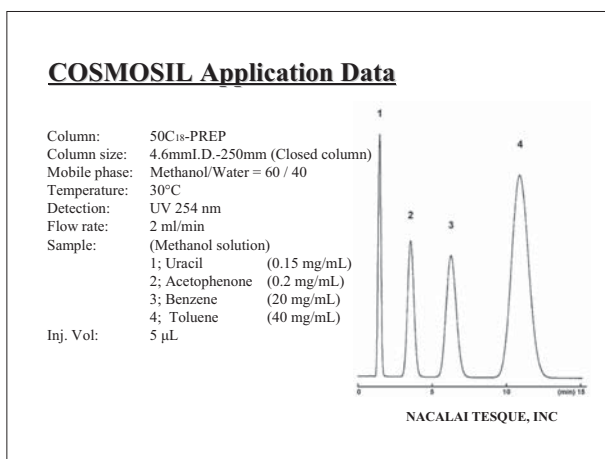


Figure 2. Concentration of methanol against flow rate  
Column size: 10 mm I.D. x 180 mm bed height  
(gravitational liquid flow)

## Performance Evaluation



## Ordering Information

### COSMOSIL C<sub>18</sub>-PREP

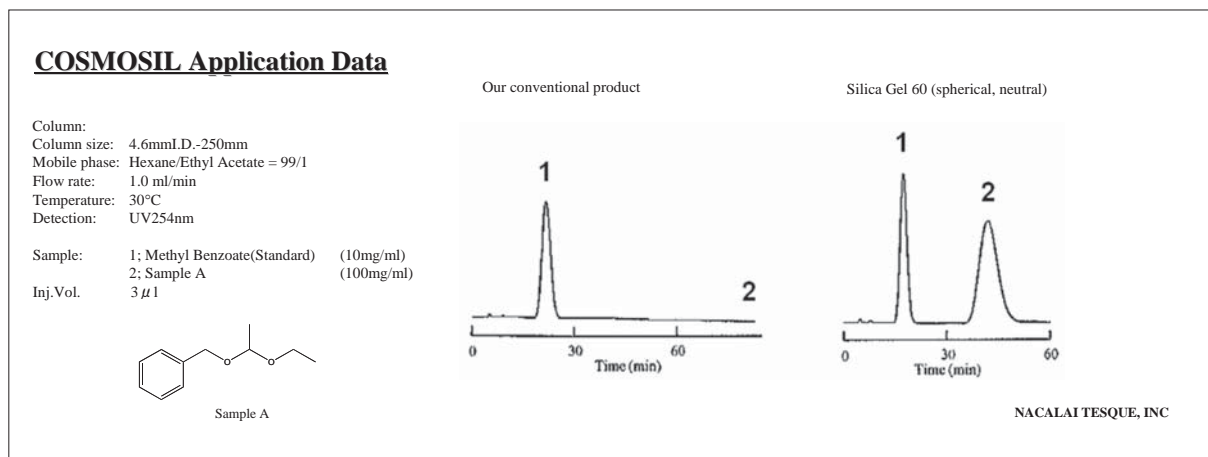
Product Name	Average Particle Size	Product Number	PKG Size
COSMOSIL 50C <sub>18</sub> -PREP	50 µm	12065-84	100 g
		12065-55	500 g
		12065-71	1 kg
COSMOSIL 75C <sub>18</sub> -PREP	75 µm	12061-24	100 g
		12061-95	500 g
		12061-11	1 kg
COSMOSIL 140C <sub>18</sub> -PREP	140 µm	12063-04	100 g
		12063-75	500 g
		12063-91	1 kg

# Silica Gel (Spherical, Neutral)

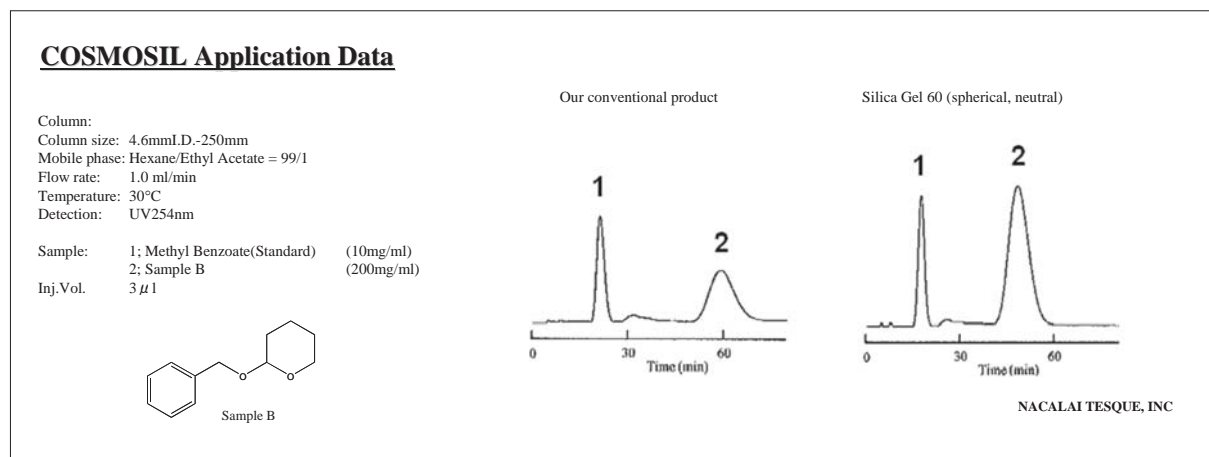
- The pH of silica gel is adjusted to neutral
- Suitable for the separation of pH-sensitive compounds

## Comparison with Conventional Silica Gel

### • Purification of Acetals -1



### • Purification of Acetals -2



## Ordering Information

### Silica gel 60 (Spherical, Neutral)

Product Name	Average Particle Size	Product Number	PKG Size
Silica Gel 60 (Spherical, Neutral) for Column Chromatograph	75 µm	30511-64	100 g
		30511-35	500 g
		30511-51	1 kg
		30511-06	5 kg
		30511-22	25 kg
	140 µm	30518-94	100 g
		30518-65	500 g
		30518-81	1 kg

# Silica Gel (for Column Chromatography)

## [Ordering Information](#)

### Silica Gel (Spherical)

Product Name	Average Particle Size	Average Pore Size	Grade	Product Number	PKG Size
Silica Gel 60, Spherical	approx. 70 ~ 230 mesh	60 Å	SP	30731-71	1 kg
				30731-42	25 kg
Silica Gel 120, Spherical	approx. 70 ~ 230 mesh	120 Å	SP	30734-41	1 kg

### Silica Gel (Irregular)

Product Name	Average Particle Size	Average Pore Size	Grade	Product Number	PKG Size
Silica Gel 60	approx. 70 ~ 230 mesh	60 Å	SP	30724-55	500 g
				30724-71	1 kg
				30724-84	5 kg
				30724-42	25 kg
	approx. 230 ~ 400 mesh	60 Å	SP	30721-85	500 g
				30721-01	1 kg
				30721-14	5 kg

I. HPLC Columns

II. SFC Columns

III. Preparative Packing Materials

IV. Related Products

## IV. Related Products

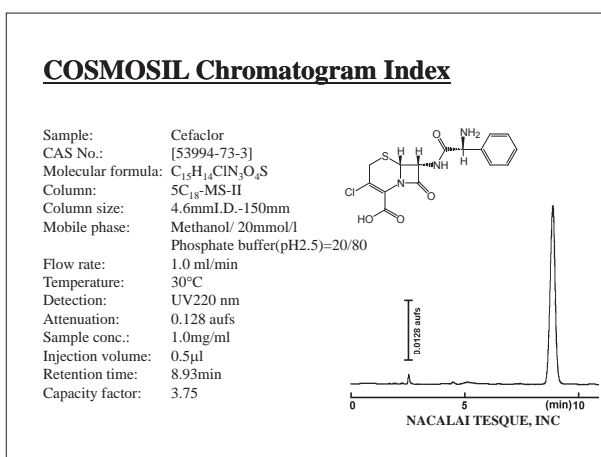
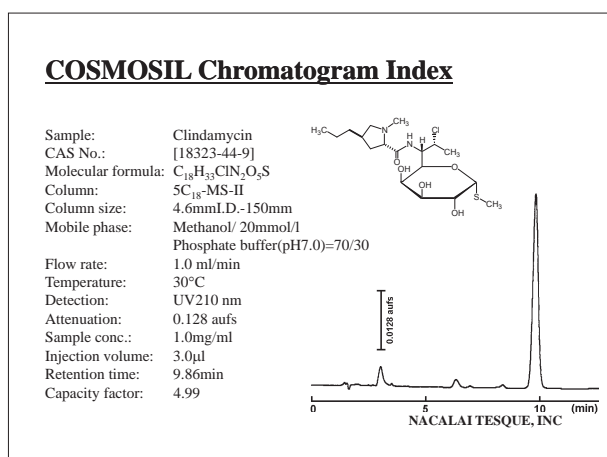
### 1. Reagents for Mobile Phase Preparation

#### Phosphate Buffer Solution (pH 2.5) (5X)

- pH-adjusted
- Filtered (0.2 µm)
- UV, fluorescence tested
- Easily prepare the mobile phases used in COSMOSIL applications

#### How to Prepare

Dilute this product with HPLC grade distilled water (1 part buffer solution : 4 parts water) to make the 20 mmol/l phosphate buffer used in the following COSMOSIL applications.



#### Ordering Information

##### Phosphate Buffer Solution (5X)

Product Name	Grade	Product Number	PKG Size
Phosphate Buffer Solution (pH 2.5) (5X)	SP	08969-71	1 L
Phosphate Buffer Solution (pH 7.0) (5X)	SP	08968-81	1 L

## Stock Solutions for HPLC

#### Ordering Information

Product Name	Grade	Product Number	PKG Size
1mol/l-Ammonium Formate Solution	SP	12235-54	100 ml
1mol/l-Ammonium Acetate Solution	SP	12236-44	100 ml

## Premixed Eluents for HPLC

#### Ordering Information

Product Name	Grade	Product Number	PKG Size
0.1vol% Formic Acid-Acetonitrile	SP	12578-61	1 L
		12578-03	3 L
0.1vol% Formic Acid-Distilled Water	SP	12582-91	1 L
		12582-33	3 L
0.1vol% Trifluoroacetic Acid-Acetonitrile	SP	12583-81	1 L
		12583-23	3 L
0.1vol% Trifluoroacetic Acid-Distilled Water	SP	12584-13	3 L

# Additives

## Ordering Information

Product Name	Grade	Product Number	PKG Size
Acetic Acid	SP	08963-02	25 ml
Formic Acid	SP	08965-82	25 ml
Phosphoric Acid, Ortho	SP	08964-92	25 ml
Trifluoroacetic Acid	SP	34840-21	5 x 1 ml
		34840-76	5 x 1.5 ml
		34840-63	5 x 3 ml
		34840-34	10 ml

# Ion-pair Reagents

## Ordering Information

### For Basic Samples

### (R-SO<sub>3</sub><sup>-</sup>Na<sup>+</sup>)

Product Name	R:	Grade	Product Number	PKG Size
Sodium 1-Butanesulfonate	C <sub>4</sub> H <sub>9</sub> -	SP	31331-94	5 g
Sodium 1-Pentanesulfonate	C <sub>5</sub> H <sub>11</sub> -	SP	31730-64	5 g
			31730-22	25 g
Sodium 1-Hexanesulfonate	C <sub>6</sub> H <sub>13</sub> -	SP	31529-24	5 g
			31529-82	25 g
Sodium 1-Heptanesulfonate	C <sub>7</sub> H <sub>15</sub> -	SP	31528-34	5 g
			31528-92	25 g
Sodium 1-Octanesulfonate	C <sub>8</sub> H <sub>17</sub> -	SP	31729-04	5 g
			31729-62	25 g
Sodium 1-Nonanesulfonate	C <sub>9</sub> H <sub>19</sub> -	SP	31626-44	5 g
Sodium 1-Decanesulfonate	C <sub>10</sub> H <sub>21</sub> -	SP	31429-34	5 g
Sodium 1-Dodecanesulfonate	C <sub>12</sub> H <sub>25</sub> -	SP	31426-64	5 g
Sodium Lauryl Sulfate	**	SP	31623-32	25 g

### 0.5M Solution

Sodium 1-Butanesulfonate	C <sub>4</sub> H <sub>9</sub> -	SP	31332-84	5 x 10 ml
Sodium 1-Hexanesulfonate	C <sub>6</sub> H <sub>13</sub> -	SP	31532-64	10 ml
			31532-06	5 x 10 ml
Sodium 1-Octanesulfonate	C <sub>8</sub> H <sub>17</sub> -	SP	31733-34	10 ml
			31733-76	5 x 10 ml

### For Acidic Samples

### (C<sub>4</sub>H<sub>9</sub>)<sub>4</sub>N<sup>+</sup>X<sup>-</sup>

Product Name	X <sup>-</sup> :	Grade	Product Number	PKG Size
Tetra- <i>n</i> -butylammonium Bromide	-Br	SP	32824-72	25 g
Tetra- <i>n</i> -butylammonium Chloride	-Cl	EP	32935-64	5 g
			32935-22	25 g
Tetra- <i>n</i> -butylammonium Hydrogensulfate	-HSO <sub>4</sub>	GR	32924-62	25 g
Tetra- <i>n</i> -butylammonium Iodide	-I	SP	32905-54	5 g
			32905-12	25 g
Tetra- <i>n</i> -butylammonium Perchlorate	-ClO <sub>4</sub>	SP	32906-44	5 g
			32906-02	25 g
Tetra- <i>n</i> -butylammonium Phosphate	-H <sub>2</sub> PO <sub>4</sub>	SP	32929-54	5 g

### 0.5M Solution

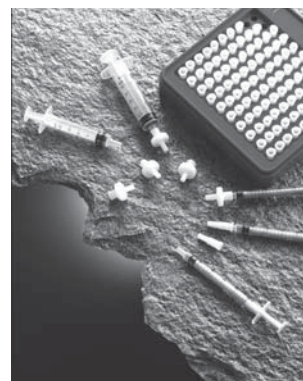
Tetra- <i>n</i> -butylammonium Phosphate	-H <sub>2</sub> PO <sub>4</sub>	SP	32926-26	10 ml
			32926-84	5 x 10 ml



## 2. Products for Sample Preparation

### Cosmonice Filter

- For sample filtration
- Just attach a filter on top of a syringe



#### W Series (aqueous solution)

The W series uses a new material of low-adsorptive and low-extractive PVDF (poly vinylidenedifluoride) filter, which can be used with various solvents. They are able to minimize the loss of proteins in the small amount of sample, and prevent secondary contamination during prefiltration.

#### S Series (organic solvents)

The S series uses a PTFE (poly tetrafluoroethylene) filter, which shows strong resistance for solvents, acids, and alkalis. It is best for prefiltration of samples extracted with solvents such as chloroform and tetrahydrofuran.

#### Ordering Information

##### Cosmonice Filter

Product Name	Diameter (mm)	Pore Size (µm)	Process Volume	Hold-up Volume	Product Number	PKG Size
Cosmonice Filter W (aqueous)	4	0.45	1 ml or less	< 10 µl	06543-04	100 pkg
	13	0.45	0.5~10 ml	< 30 µl	06544-94	100 pkg
Cosmonice Filter S (solvent)	4	0.45	1 ml or less	< 10 µl	06541-24	100 pkg
	13	0.45	0.5~10 ml	< 30 µl	06542-14	100 pkg

Connection Inlet: luer-lock; Outlet: luer-slip, Connectable to needles  
Housing : polyethylene

### Cosmospin Filter

- For sample filtration
- Easy to use by centrifugation
- Omnipore hydrophilic PTFE membrane filter



#### Ordering Information

##### Cosmospin Filter

Product Name	Pore Size (µm)	Maximum Sample Volume	Hold-up Volume	Maximum Centrifugal Force	Rotor Size (fixed-angle)	Filtration Area	Color	Product Number	PKG Size
Cosmospin Filter G	0.2	0.4 ml	5 µl	5000 x g	1.5 ml	0.2 cm <sup>2</sup>	Brown	06549-44	100 pkg
Cosmospin Filter H	0.45	0.4 ml	5 µl	5000 x g	1.5 ml	0.2 cm <sup>2</sup>	White	06540-34	100 pkg

Dimensions: 10.6 mm diameter x 45 mm  
Membrane: Omnipore hydrophilic PTFE  
Sample reservoir and collection tube: Polypropylene

# Labeling Reagents

## Ordering Information

Product Name	Grade	Storage	Product Number	PKG Size
Dabsyl Chloride	SP	Room temp.	10427-91	1 g
3,5-Dinitrobenzoyl Chloride (DNBC)	SP	Dark and Cool	13530-44	5 g
NBD Chloride	SP	Refrigerator	24113-61	1 g
o-Phthalaldehyde (OPA)	SP	Refrigerator	27824-61	1 g
			27824-74	5 g
			27824-32	25 g

I. HPLC Columns

II. SFC Columns

III. Preparative Packing Materials

IV. Related Products

## 3. Column Care Products

### Introduction

It is important to preserve a column by washing it with suitable cleaning methods before storing it under appropriate conditions to obtain stable data and prolong the column lifetime.

### Applicable Columns

Cleaning Solution Kit and Storage Solution for Reversed Phase HPLC Columns is only applicable to reversed phase HPLC columns, such as COSMOSIL C<sub>18</sub>-MS-II, AR-II, PAQ, EB, Cholester, πNAP, PYE, PBr and COSMOCORE 2.6C<sub>18</sub>, 2.6Cholester and 2.6PBr. Please note that this product is not suitable for Sugar-D, HILIC, normal phase or ion exchange columns.

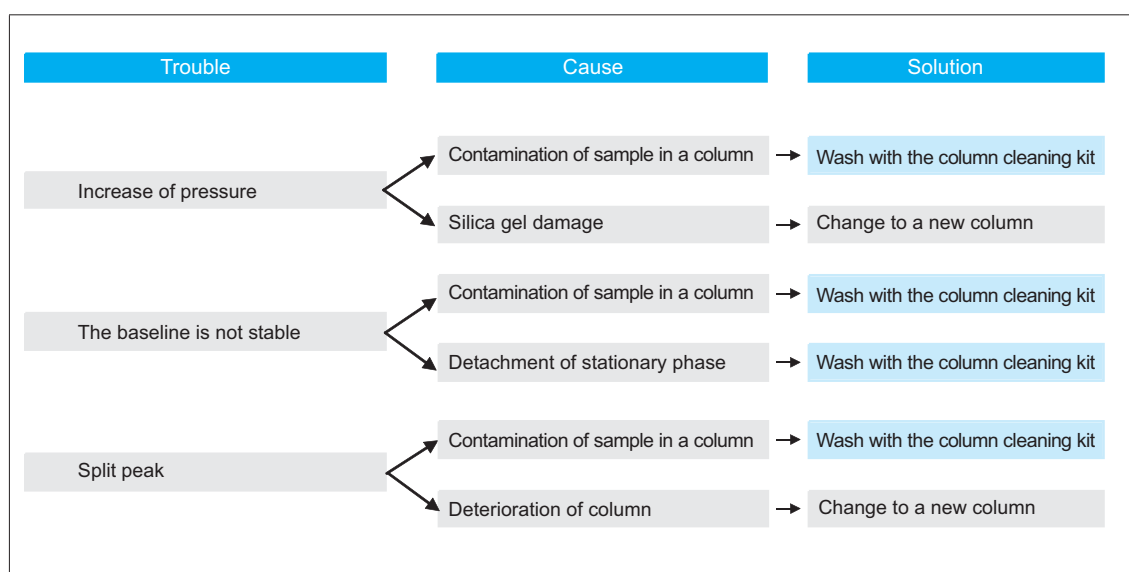
## Cleaning Solution Kit for Reversed Phase HPLC Columns

### Components

Product Name	Main Components	PKG Size	Quantity	Container
Cleaning Solution A	Methanol	500 ml	2	Brown Glass Bottle
Cleaning Solution B	Tetrahydrofuran, Methanol	500 ml	1	Brown Glass Bottle

### Application

Cleaning Solution Kit for Reversed Phase HPLC Columns is designed for washing away contaminant adsorption and stationary phase shedding. If you experience the following symptoms, please try their corresponding solution first.



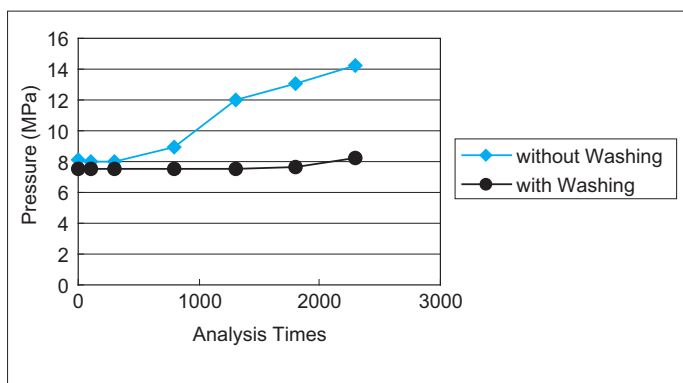
### Procedure

(For 4.6 mm I.D. x 150 mm)

- Replace solvent with HPLC-grade distilled water (1 ml/min, 30 min).  
(\*This step is for mobile phases containing high concentration buffer. If you are using a salt-free mobile phase, please start from step (2).)
- Run the Cleaning Solution A through the column for 15 min at a flow rate of 1ml/min.
- Run the Cleaning Solution B through the column at a flow rate of 1ml/min until the baseline becomes stable (approx. 15 min).
- Run the Cleaning Solution A through the column for 15 min. The column is ready for storage.

### Example of pressure difference between washed and unwashed columns

The figure shows a pressure comparison between washed and unwashed columns using Cleaning Solution Kit. Repeated analysis of natural products was conducted using COSMOSIL 5C<sub>18</sub>-MS-II (4.6 mm I.D. x 150 mm).

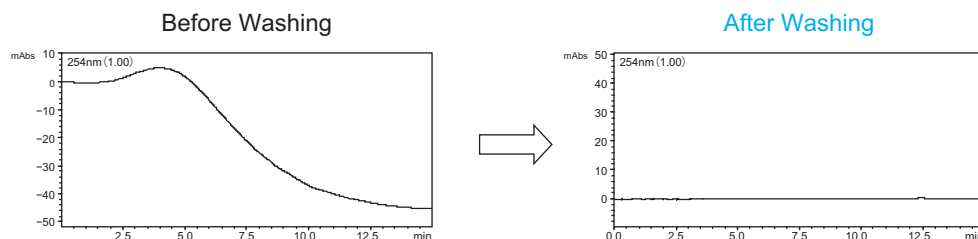


(Condition)  
 Column: COSMOSIL 5C<sub>18</sub>-MS-II (4.6 mm I.D. x 150 mm)  
 Mobile phase: Methanol / H<sub>2</sub>O = 70 / 30  
 Flow rate: 1.0ml/min  
 Temperature: 40°C

As shown in the figure above, the column pressure increases if you use column continuously without washing. If you wash the column, you can extend the column life time and ease the pressure burden on your HPLC equipment.

### Example of a Stable Baseline

The baseline may be unstable if sample components with very long retention remain in the column or stationary phase shedding occurs. Especially when analyzing crude samples that have components with a wide range of chemical characteristics, some unwanted components may be strongly retained in the column and slowly elute out in subsequent runs. The resulting unstable baseline can be eliminated by washing the column with the Cleaning Solution Kit.



### Ordering Information

Product Name	Grade	Product Number	PKG Size
Cleaning Solution for Reversed Phase HPLC Columns	SP	08966-30	1 kit

## Storage Solution for Reversed Phase HPLC Columns

Storage Solution for Reversed Phase HPLC Columns is designed for storing columns under suitable conditions.

### Procedure

(For 4.6 mm I.D. x 150 mm)

- Replace solvent with HPLC-grade distilled water. (1 ml/min, 30 min)  
 (\*This step is for mobile phases containing high concentration buffer. If you are using a salt-free mobile phase, please start from step(2).)
- Run the Storage Solution through the column for 15 min at a flow rate of 1ml/min, and store.

### Ordering Information

Product Name	Grade	Product Number	PKG Size
Storage Solution for Reversed Phase HPLC Columns	SP	08967-20	1 kit (500 ml)

## 4. COSMOSIL HPLC Accessories

### Ordering Information

#### COSMOSIL Guard Cartridge Holder

I.D.	Product Number	PKG Size
2.0 mm	11884-71	1 PKG
4.6 mm	38009-79	1 PKG



Guard Cartridge Holder is required for Guard Cartridge.

#### COSMOSIL Column Prefilter

Product Number	PKG Size
39361-19	1 PKG



COSMOSIL Column Prefilter employs filter with smaller pore size (1  $\mu\text{m}$ ) than that of column frit (2  $\mu\text{m}$ ).

#### COSMOSIL Column Spare Filter for Prefilter

Product Number	PKG Size
39539-09	2 PKG



Column spare filter for prefilter

#### COSMOSIL Column Connecting Tube

I.D.	Product Number	PKG Size
0.1 mm	12570-41	1 PKG
0.25 mm	37843-69	1 PKG



For connecting columns





COSMOSIL

# COSMOSIL Technical Notes

For our COSMOSIL FAQ, troubleshooting, and technical information, please visit our web site at <http://www.nacalai.co.jp/global/cosmosil/>.

**COSMOSIL HPLC Columns**

General Info. of COSMOSIL/COSMOGEL  
COSMOSIL Columns List by Phase

- Standard Reversed Phase Columns
- Specialty Reversed Phase Columns
- Ultra-High Performance Columns
- Normal Phase Columns

**Related Products**

- Preparative Packing Materials
- Related Products
- Prefiltration Tools
- Fatty Acid Methylation **NEW**

► Natural Compounds  
Crude Drug Standards  
Plant Extract Standards

- Hydrophilic Interaction Columns
- Saccharide Separation Columns
- Protein Separation Columns (Wide Pore Columns)
- Fullerene Separation Columns
- Carbon Nanotubes Separation Columns

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FAQ  
Troubleshooting  
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**Technical Notes**

FAQ and Troubleshooting

[FAQ and Troubleshooting](#)

**Technical Information**

- Preparation of Mobile Phase for HPLC (PDF 158 KB)
- Inner Diameter of Column(scale down and scale up) (PDF 344 KB)
- Troubleshooting for Increased Pressure (PDF 149 KB)
- Sample Pretreatment for HPLC (PDF 682 KB)
- Baseline Noise in Gradient Elution (PDF 155 KB)
- Effect of Guard Column (PDF 642 KB)
- Selectivity of Packing Materials in Reversed Phase Liquid Chromatography (PDF 1,504 KB)
- Methods in Developing Mobile Phase Condition for C18 Column (PDF 253 KB)
- Comparison with Old Type COSMOSIL (PDF 473 KB)

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**FAQ and Troubleshooting**

• FAQ

Q1	What is the pressure limit of column?
Q2	What is the flow rate limit?
Q3	What is the recommended pH range?
Q4	What is the concentration of buffer and salt?
Q5	How do I adjust mobile phase?
Q6	What solvent grade should I use for the mobile phase?
Q7	What is the difference between acetonitrile and methanol?
Q8	Which mobile phase can be used for LC/MS or ELSD detector?
Q9	What should I pay attention to when I use ion-pairing reagents?
Q10	What flow direction should I use for the mobile phase?
Q11	What is the recommended temperature range of columns?
Q12	What is the shipping solvent?
Q13	How do I wash columns?
Q14	How do I store columns?
Q15	How long does a column last?

### 3. Troubleshooting for Increased Pressure

**Introduction**

Repeated analysis may increase back pressure. Continuous use of HPLC columns under high pressure can cause deterioration and overload of the equipment. Therefore, it is important to monitor column back pressure regularly and solve the problem timely.

**Identification of the Clogging Site**

The back pressure increase can be due to clogging of a column or clogging of the equipment. First of all, identify the clogging site.

Schematic Diagram of HPLC

1. Suction Filter → 2. Pump → 3. Line Filter → 4. Column Pre-Filter → 5. Injector → 6. Guard Column → 7. Analytical Column → 8. Detector





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