YMC

High grade silica phases for preparative HPLC

YMC*GEL

RP
NP
SEC

Robustness
Availability
Productivity

Company profile

YMC is a leading specialist supplier of high performance products for liquid chromatography (LC), with headquarters in Kyoto, Japan, and with subsidiaries in the USA, India, China, Korea, Taiwan, Singapore and Europe.
The main focus of YMC's activities lies in the separation and purification of valuable substances for the pharmaceutical, biotechnology and chemical industry.

Chromatography products for the laboratory and production

- *Analytical high performance liquid chromatography (HPLC & UHPLC) columns and accessories*
- *Laboratory glass columns*
- *Packed bed columns*
- *Bulk chromatography media on silica-, polymer-and hybrid-basis*
- *Flash chromatography*
- *Preparative LC/HPLC systems*
- *Custom purification and method development*

YMC Co., Ltd. manufacturing facility in Komatsu, Japan

Content

Introduction

YMC has more than 35 years experience in the manufacture of silica-based stationary phases for high pressure liquid chromatography (HPLC).

The substantial investment into facilities and staff represent YMC's ongoing commitment towards high quality products and technical support. The company's state-of-the-art silica production facilities allow for large batches of more than 500 kg/lot. Our large-scale bonding site has allowed lots of over 200 kg of bonded silica to become routine operations.

Besides innovations in the field of hybrid silica (YMC-Triart) and polymeric ion-exchange resins (YMC-Bio-Pro) YMC has achieved considerable improvements in the manufacture of its classical silica base. This gave rise to an improved generation of stationary phases with superior physical attributes:

YMC*Gel High Grade (HG)-series

Due to its improved mechanical stability and its more uniform pore and particle size distribution the benefits of YMC*Gel HG-series products are:

- **Higher sample load**
- **Less backpressure**
- **increased lifetime**
- **More repackings possible**
- **More efficient column packing**

YMC*Gel silica products are now available as YMC*Gel HG-series

Availability

YMC provides an extensive selection of more than 16 fully scalable stationary phases from 1.9 to 150 µm in various pore sizes and specifications to address virtually any separation need. In addition, YMC can also custom manufacture most products with specific properties, e.g. defined pore size and/or carbon content, to provide optimal suitability to individual separations. This unique choice of selectivities meets the highest demand in conventional column separations and also dynamic axial or dynamic radial compression columns and simulated moving bed (SMB) techniques.

Bulk Packing Material

Preparative and process scale YMC bulk packing materials (10 to 150 µm) can be obtained in gram to multi-ton scale quantities. YMC's advanced production facilities are able to manufacture multi-ton quantities of silica per annum, with large batches in excess of 500 kg/lot. YMC's large-scale bonding plants have a capacity of more than 200 kg/lot.

Long Term Supply

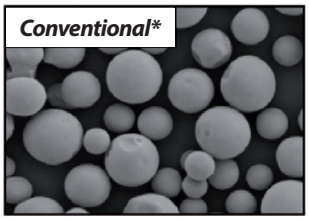
In order to meet increasing demands in analytical and preparative chromatography, chromatographers highly depend on a reliable source of supply throughout a validated method. Therefore, YMC will never knowingly change or modify an existing product which has any such customer base. Any product improvements will result in an entirely new YMC product.

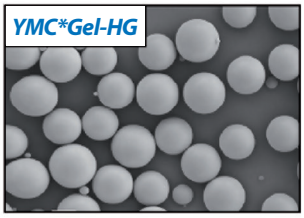
World Wide Availability

Pre-packed columns and bulk materials are available worldwide through a dedicated support network headed by YMC operations in Japan, the US and in Europe to ensure facile method transfer between research and production sites across the world.

Improved silica base for better performance

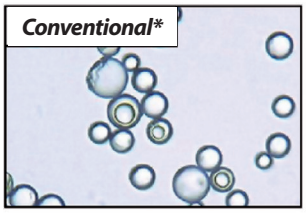
Improvements in the production process of the base silica yield particles with higher mechanical stability and more uniform particle and pore size distribution (see microscopy images below).

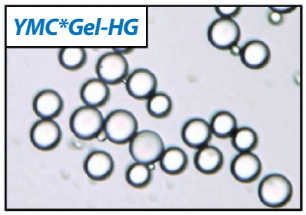




Reduced backpressure and improved chromatographic efficiency due to more uniform particle size distribution.

Optical microscope image





Better column packing efficiency and less fines due to reduction of "balloon particles".

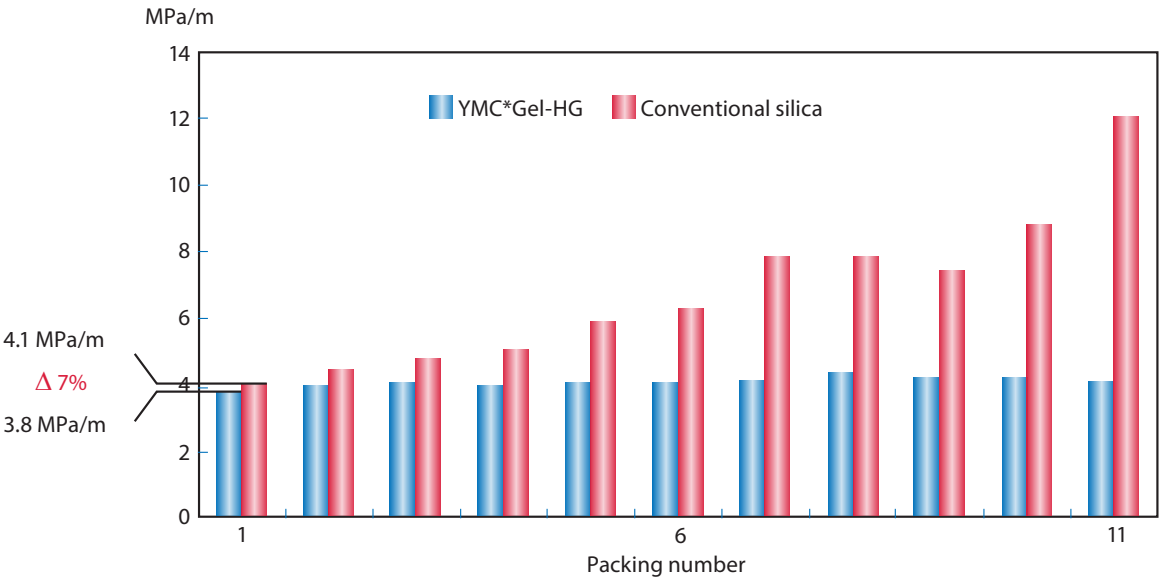
* for illustration purposes a section highlighting chipped particles and balloon particles was chosen

Improvement	Customer advantage
• Improved morphology and mechanical stability	• Higher productivity due to longer usage of bulk material • Less fines • Reduced backpressure • More repackings possible
• Narrower particle size distribution	• Reduced backpressure • Increased productivity due to higher flowrates at constant pressure • More efficient columns due to faster column packing
• Narrower pore size distribution	• Higher (over-) loading capacity • Sharper peaks due to less Eddy diffusion

Tangible improvements for your processes

A narrower particle size distribution with lower tendency for the HG-silica material to produce fines translates directly into a reduced backpressure of preparative processes.

On average a 7% backpressure reduction can be seen, which increases drastically with each repacking step.



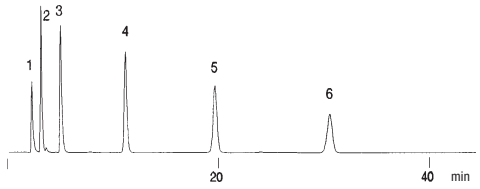
*Discover optimum selectivity with YMC*Gel HG-series silica products*

The basis for every successful separation is the selection of the appropriate stationary phase. YMC offers one of the world's largest portfolios of selectivities, designed to handle even the most difficult and demanding separations.

With the choice of more than 16 preparative selectivities YMC is able to solve virtually any separation need. Many of these stationary phases are fully scalable and often available in a wide range of pore sizes from 6 to 100 nm and particle sizes from 1.9 to 150 µm. In addition to that, most YMC products can be further customised in terms of optimised pore size, endcapping and/or carbon content to allow maximum efficiency for individual separations.

The retention characteristics of YMC's most popular preparative selectivities are shown in the chromatograms below. Conditions were selected to simulate a broad application range on both basic and acidic compounds.

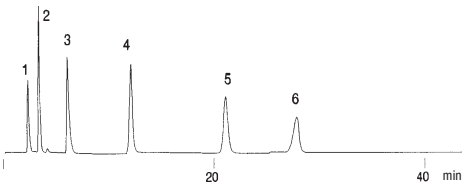
YMC*Gel ODS-A-HG*



1: Uracil
2: 4-Hydroxybenzoic acid
3: Diphenhydramine
4: MPPH
5: Diazepam
6: Toluene

Column:	250 x 4.0 mm
Eluent:	580 ml phoshate buffer, 50 mM pH 2.3 plus 420 ml ACN
Flow rate:	1.0 ml/min
Detection:	UV at 230 nm

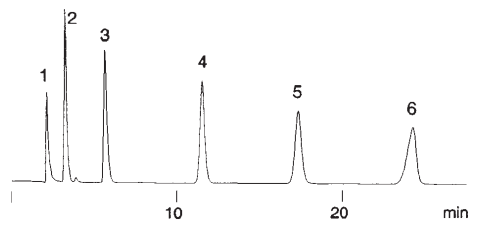
YMC*Gel ODS-AQ-HG*



1: Uracil
2: 4-Hydroxybenzoic acid
3: Diphenhydramine
4: MPPH
5: Diazepam
6: Toluene

Column:	250 x 4.0 mm
Eluent:	580 ml phoshate buffer, 50 mM pH 2.3 plus a420 ml ACN
Flow rate:	1.0 ml/min
Detection:	UV at 230 nm

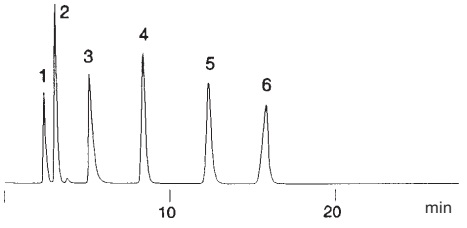
YMC*Gel C8-HG (Octyl)*



1: Uracil
2: 4-Hydroxybenzoic acid
3: Diphenhydramine
4: MPPH
5: Diazepam
6: Toluene

Column:	250 x 4.0 mm
Eluent:	580 ml phoshate buffer, 50 mM pH 2.3 plus 420 ml ACN
Flow rate:	1.0 ml/min
Detection:	UV at 230 nm

YMCbasic*



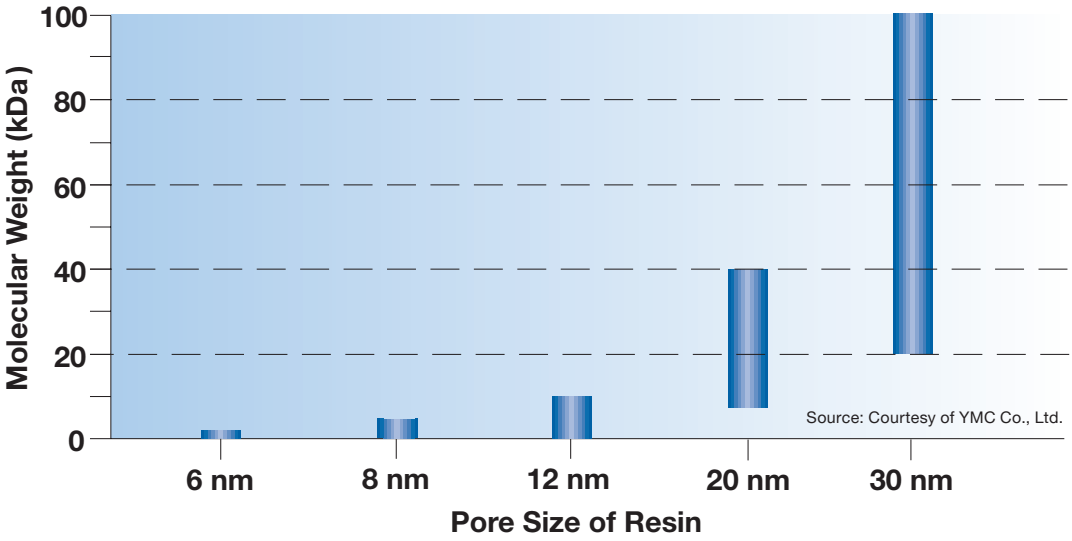
1: Uracil
2: 4-Hydroxybenzoic acid
3: Diphenhydramine
4: MPPH
5: Diazepam
6: Toluene

Column:	250 x 4.0 mm
Eluent:	580 ml phoshate buffer, 50 mM pH 2.3 plus 420 ml ACN
Flow rate:	1.0 ml/min
Detection:	UV at 230 nm

* Source: Courtesy of YMC Co., Ltd.

Impact of Pore Size Differences

YMC*Gel is available in a variety of different pore sizes which are usually matched to sample molecule sizes. Pore sizes can also be used to adjust ligand density and hence retention characteristics of a bonded phase, since the size of the pores also affects the total media surface area in a packed column.



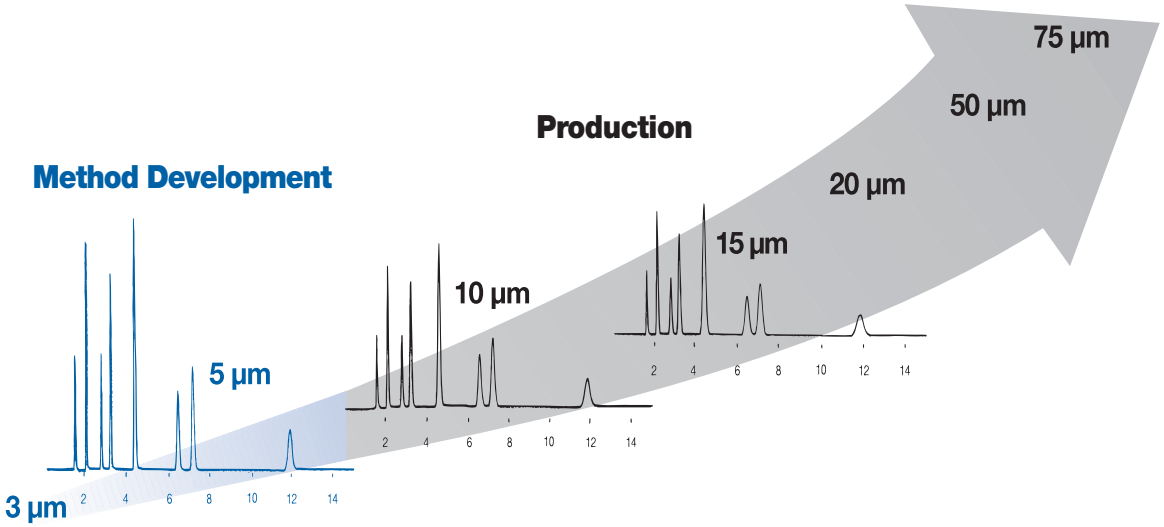
Please note extended molecular weight range when applying SEC.

Pore Size (nm)	**Surface Area** (m2/g)	**Recommendation**
12	330	• Suitable for the majority of separations • For most organic compounds • For peptides less than 20 kDa • Higher surface area and sample loading than 20 nm and 30 nm media
20	175	• For peptides and smaller proteins from 10 kDa to 50 kDa • For bulky organic compounds • Higher surface area and higher sample loading than 30 nm media
30	100	• For large proteins and biomolecules larger than 40 kDa • For organic compounds with excessive retention on smaller pore materials

Further pore sizes available on request

Scalability and Particle Size

YMC simplifies the process of scaling-up by offering more than 16 fully scalable selectivities with particle sizes ranging from 1.9 to 150 µm which maintain the integrity of the separation throughout the entire scale-up. Custom pore and particle sizes available on request.



Scale up with YMC*Gel!

Quality Control

YMC's Quality Assurance

YMC has more than 35 years experience in manufacturing high quality bonded phases. During these years, YMC has built its reputation on the supply of consistently high quality, highly reproducible HPLC media and columns. To maintain this high level of quality, all YMC products must pass stringent internal performance criteria at every stage of manufacture. These rigorous quality control procedures and tight production specifications guarantee consistency in silica purity, particle size, pore size, bonding, endcapping and performance.

Quality control of the silica supports

The rigorous quality control procedure set by YMC starts with the YMC*Gel HG-series silica supports. The silica support is tested against demanding specifications, which include particle size and distribution, pore size and distribution, surface area, pore volume, pH and metal content, etc. Only when the bulk silica satisfies the strict criteria for each parameter the lot can be allowed to proceed to bonding.

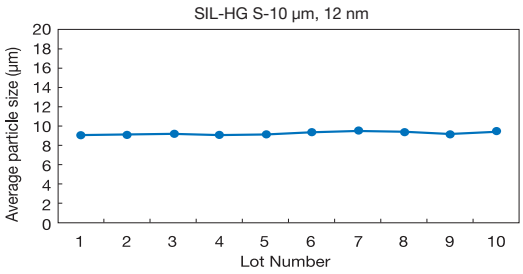


Fig. 1: 10 batches of YMC*Gel SIL-HG S-10 µm, 12 nm with respect to average particle size

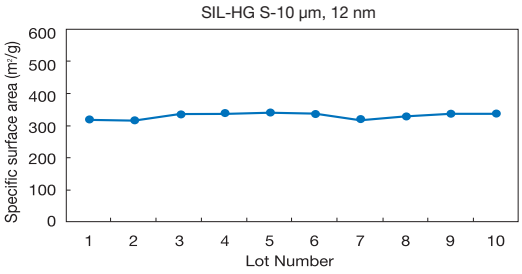


Fig. 2: 10 batches of YMC*Gel SIL-HG S-10 µm, 12 nm with respect to specific surface area

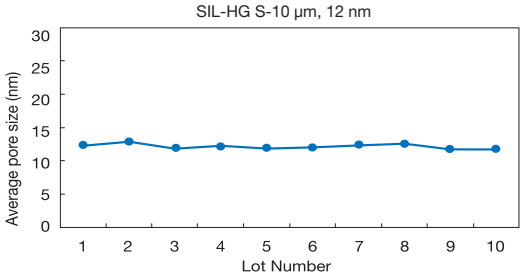


Fig. 3: 10 batches of YMC*Gel SIL-HG S-10 µm, 12 nm with respect to average pore size

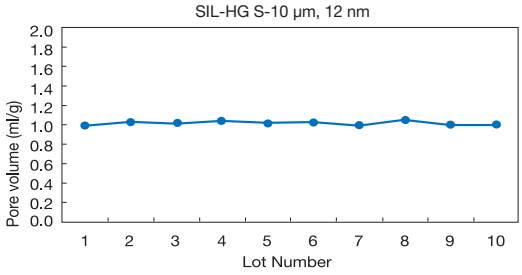


Fig. 4: 10 batches of YMC*Gel SIL-HG S-10 µm, 12 nm with respect to pore volume

Quality control of the bonded media

YMC's rigorous quality control is reflected in the reproducible separations obtained by the chromatographer. Every bonded lot is evaluated for reproducibility to ensure consistent performance with chromatographic tests for:

- hydrophobicity
- performance with acidic compounds
- performance with basic compounds
- performance with coordination compounds

Only materials which meet YMC's stringent quality standards are given a YMC*Gel HG-series bonding lot number. All test data on the unbonded silica and the bonded product is retained for further reference.

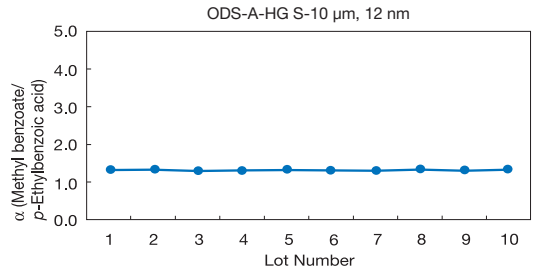


Fig. 5: Batch to batch reproducibility of YMC*Gel ODS-A-HG S-10 µm, 12 nm with respect to acidic compounds

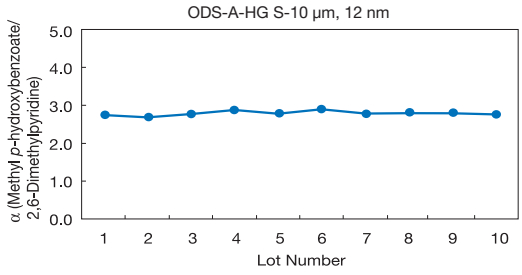


Fig. 6: Batch to batch reproducibility of YMC*Gel ODS-A-HG S-10 µm, 12 nm with respect to basic compounds

Economy of preparative processes

In preparative chromatography the objective is to isolate a maximum quantity of product of the defined purity at the lowest cost possible within the shortest time.
The total costs of a preparative separation process include variable operating costs for solvents, waste processing, column packing, and labour as well as fixed costs for equipment, including the column, pumps, tanks, etc. All these aspects have to be considered carefully when developing a method for a purification process.
Method development for an economic preparative separation process requires optimisation of:

1. **Selectivity**
2. **Loading level**
3. **Efficiency**

In a previous study[1)] we were able to show that the costs for eluents are the most important expense factor in purification processes. The costs for eluents account for as much as 88% of the total costs of a separation process.

By optimising an established purification process the total production costs per kilogram could be reduced from 17,162 $/kg to 1,070 $/kg! Furthermore, the annual production capacity could be increased from a total of 1,780 kg to 3,560 kg.

Comparison of cost performance of insulin production

	Established conditions	Optimised conditions
1 cycle time Eluent Flow rate* Packing material	30 min (48 times/day) Acetonitrile 17 l C18, 10 µm	15 min (96 times/day) Methanol 8.6 l C8, 15 µm
Eluent cost Cost of gel	15,102 $ / kg insulin 1,132 $ / kg insulin	96% Decrease 90% Decrease

* By using 600 mm ID column

1) K. Morishita, Y. Yamada, M. Omote, N. Kuriyama: "Development of an effective purification method for peptides and proteins using silica gel based reversed phase packing material", YMC Co.Ltd, 2006


Cost
17,162 $ / kg
Optimisation
1,070 $ / kg
Product per year
3,560 kg
Optimisation
1,780 kg

Available YMC*Gel HG-series products

PRODUCT	PHASE CODE	BONDING	PHASE DESCRIPTION
ODS-A-HG	AAG	C18	high performance C18 silica
ODS-AQ-HG	AQG	C18	"hydrophilic" endcapping, for 100% aqueous eluent systems, substantially increased retention of polar compounds
C8-HG (Octyl)	OCG	C8	C8 phase, high coverage monomeric bonding chemistry
C4-HG (Butyl)	BUG	C4	C4 phase, less hydrophobic surface structure than C8 packing material
TMS-HG (C1)	TMG	C1	trimethylsilane bonding, excellent hydrolytic stability
Ph-HG (Phenyl)	PHG	Phenyl	monomeric bonded phenyl, the π electron interaction gives a separation selectivity different from ODS
NH_2-HG (Amino)	NHG	Aminopropyl	primary amino derivative, high coverage monomeric bonding chemistry, suitable for HILIC
CN-HG (Cyano)	CNG	Cyanopropyl	for RP and NP applications, useful also for SFC and HILIC
Diol-HG	DLG	Diol	for normal phase applications, high recovery for biological material, suitable for HILIC and SFC
SIL-HG (Silica)	SLG	—	ultra high purity, high mechanical stability, suitable for HILIC and SFC

Available Products for Specific Applications

PRODUCT	PHASE CODE	BONDING	PHASE DESCRIPTION
YMCbasic	BA	C8	specifically designed for the separation of basic compounds and peptides
YMC Omega	OMG	proprietary	specifically designed for the separation of polyunsaturated fatty acids

Analytical grades (3 and 5 µm) are routinely available in pre-packed columns. Particle sizes as indicated. If not listed, please ask for quotation. Multi ton capacity. Customized packing materials available on request. Pore sizes in parenthesis on request.

*Not all combinations available.

**With respect to pore size.

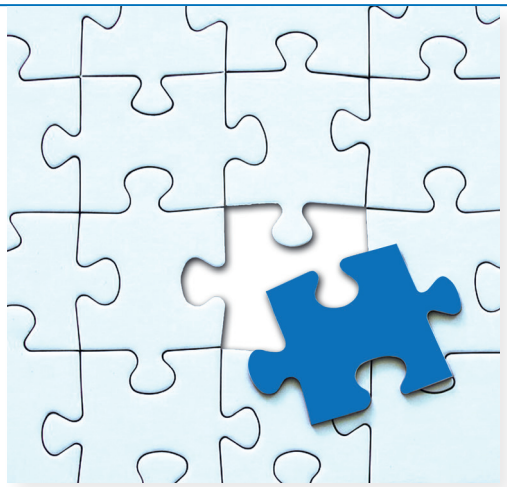
PORE SIZE* (nm)	PARTICLE SIZE* (µm spherical)	CARBON LOAD** (%C)	pH	TYPICAL APPLICATIONS
(6); 12; 20; 30	10; 15; 20; 50	17; 12; 7	2.0–7.5	pharmaceuticals, vitamins, peptides, PTC-amino acids, general purpose phase
(6); 8; 12; 20	10; 15; 20; 50	15; 14; 10	2.0–7.5	polar compounds, pharmaceuticals, antibiotics, peptides and proteins,nucleic acids, amino acids and nucleotides
(6); 12; 20; 30	10; 15; 20; 50	10; 7; 4	2.0–7.5	proteins and peptides, estrogens, general purpose phase
(6); 12; 20; 30	10; 15; 20; 50	7; 5; 3	2.0–7.5	biological separations, polar compounds, proteins
(6); 12; (20; 30)	10; 15; 20; 50	4	2.0–7.5	water-soluble vitamins
(6); 12; (20; 30)	10; 15; 20; 50	9	2.0–7.5	phenols, fullerenes, sweeteners, aromatics
(6); 12; (20; 30)	10; 15; 20; 50	3	2.0–7.5	saccharides, nucleotides, water-soluble vitamins
(6); 12; (20; 30)	10; 15; 20; 50	7	2.0–7.5	proteins, steroids, catechols, for SFC applications
(6); 12; 20; 30	10; 15; 20; 50	–	2.0–7.5	polar natural products, pharmaceuticals, for HILIC and SFC applications
(6); 12; 20; 30	10; 15; 20; 50	–	–	small organic molecules, fat-soluble vitamins, tocopherols, steroids

PORE SIZE* (nm)	PARTICLE SIZE* (µm spherical)	CARBON LOAD** (%C)	pH	TYPICAL APPLICATIONS
20	10; 15; 20	7	2.0–7.5	basic molecules w/o modifiers, peptides
proprietary	10; 20; 50	15	2.0–7.5	polyunsaturated fatty acids, EPA, DHA

Regulatory support file available under non-disclosure agreement. Customised material available on request.
Used in validated cGMP-manufacturing processes. DMF registered with FDA.

*YMC*Gel ODS-A-HG*

- **fully endcapped C18 material**
- **highly versatile ODS phase**
- **for polar to moderately nonpolar pharmaceuticals, organic chemicals, biologicals and natural products**



YMC*Gel ODS-A-HG	Specification		
Pore size / nm	12	20	30
Particle size / µm	10; 15; 20; 50	10; 15; 20	10; 15; 20
Surface area / m^2g^{-1}	330	175	100
Carbon Content / %	17	12	7
Recommended pH range	2.0–7.5	2.0–7.5	2.0–7.5

General

YMC*Gel ODS-A-HG is YMC's versatile octadecylsilane (ODS) C18 reversed phase packing material, suitable for a wide variety of applications. Due to its excellent performance and reproducibility it is a fully scalable C18 phase for large-scale preparative purification processes.

Properties

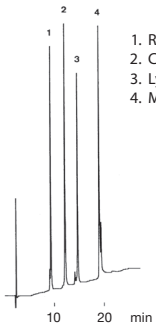
The production of the base silica for YMC*Gel ODS-A-HG, and the subsequent derivatisation process, are both both performed in large bulk batches. Exhaustive endcapping reliably reduces the activity of residual silanol groups and minimises non-specific secondary retention. In addition to standard characterisation methods, such as the determination of adsorption isotherms, particle size distribution and carbon content, YMC applies an extensive range of analytical methods to ensure consistent and reproducible selectivity of its HG-series products.

The base material used for YMC*Gel ODS-A-HG is YMC's high purity silica. This premium silica contains only very low levels of metal contaminants and so prevents significant tailing of sample molecules that easily form coordination complexes with metal ions on the silica surface.

YMC*Gel ODS-A-HG is available in 10, 15, 20 and 50 µm particle sizes. As the selectivity is identical throughout the whole particle size range, this phase is ideal for small- and large-scale purifications.

Applications (Examples)

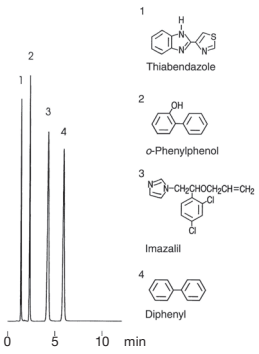
Peptides



1. Ribonuclease A (MW = 13.700)
2. Cytochrome c (MW = 12.400)
3. Lysozyme (MW = 14.400)
4. Myoglobin (MW = 17.000)

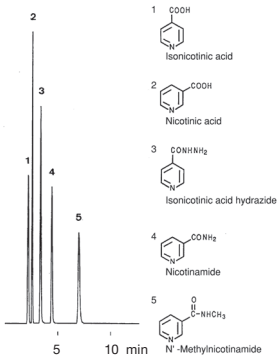
Column:	YMC-Pack ODS-A (30 nm, 5 µm) 150 x 4.6 mm ID
Eluent:	A) acetonitrile / water / TFA (5/95/0.1) B) acetonitrile / water / TFA (60/40/0.1) 30-90% B (0-20 min, linear), 90% B (20-25 min)
Flow rate:	1.0 ml/min
Temperature:	37 °C
Detection:	UV at 220 nm, 0.32 AUFS
Injection:	16 µl (0.16 ~ 0.33 mg/ml)

Fungicides



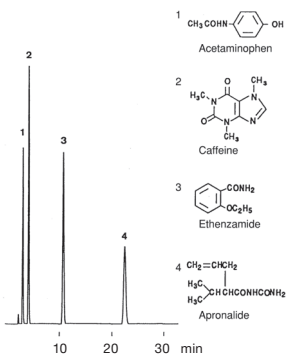
Column:	YMC-Pack ODS-A (12 nm, 5 µm) 75 x 4.6 mm ID
Eluent:	methanol / 20 mM $NH_4H_2PO_4$ (70/30)
Flow rate:	1.0 ml/min
Temperature:	37 °C
Detection:	UV at 230 nm, 0.32 AUFS
Injection:	10 µl (0.02 ~ 0.20 mg/ml)

Nicotinic acid analogues



Column:	YMC-Pack ODS-A (12 nm, 5 µm) 150 x 4.6 mm ID
Eluent:	acetonitrile / 20 mM KH_2PO_4 (5/95)
Flow rate:	1.0 ml/min
Temperature:	30 °C
Detection:	UV at 260 nm, 0.64 AUFS
Injection:	13 µl (0.2 mg/ml)

Analgesics



Column:	YMC-Pack ODS-A (12 nm, 5 µm) 150 x 4.6 mm ID
Eluent:	methanol / water (40/60)
Flow rate:	0.7 ml/min
Temperature:	30 °C
Detection:	UV at 220 nm, 0.51 AUFS
Injection:	5 µl (0.02 ~ 2.0 mg/ml)

Ordering Information

Pore Size (nm)	Particle Size (µm)	Product Code
12	10	AAG12S11
	15	AAG12S16
	20	AAG12S21
	50	AAG12S50
20	10	AAG20S11
	15	AAG20S16
	20	AAG20S21

Pore Size (nm)	Particle Size (µm)	Product Code
30	10	AAG30S11
	15	AAG30S16
	20	AAG30S21

Pack Sizes: 100 g; 500 g; 1 kg; 5 kg; 10 kg; 25 kg

NOTE: customised particle sizes and pore sizes are available on request. Contact YMC Europe GmbH for details and ordering information.

YMC*Gel ODS-AQ-HG

- **"hydrophilic" C18 phase for 100% aqueous applications**
- **for the separation of highly polar compounds, including metabolites and nucleotides**

YMC*Gel ODS-AQ-HG	Specification		
Pore size / nm	8	12	20
Particle size / µm	10; 15; 20	10; 15; 20; 50	10; 15; 20
Surface area / m^2g^{-1}	510	330	175
Carbon Content / %	15	14	10
Recommended pH range	2.0–7.5	2.0–7.5	2.0–7.5

General

YMC*Gel ODS-AQ-HG is a C18 reversed phase silica-based HPLC packing material specifically designed for use in 100% aqueous eluents. As a result of the proprietary derivatisation process, YMC*Gel ODS-AQ-HG exhibits a different selectivity to that of traditional C18 stationary phases. This difference in selectivity of YMC*Gel ODS-AQ-HG can be used to advantage for HPLC separations, which are difficult to achieve with conventional C18 columns, especially for polar compounds.

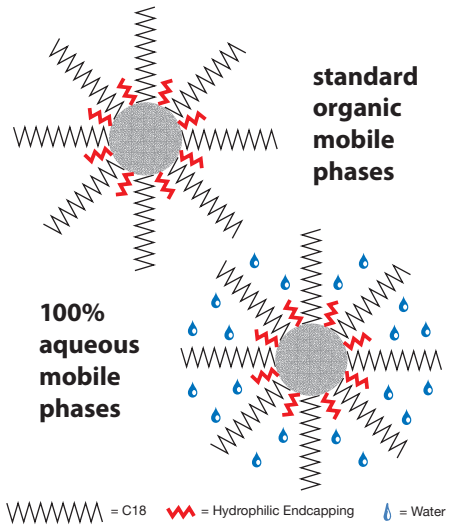
Properties

The proprietary YMC derivatisation process creates the different selectivity of YMC*Gel ODS-AQ-HG, where:
1. The activity of acidic unreacted silanols is reduced, allowing moderately basic compounds to be eluted with little or no peak tailing.
2. The balanced hydrophilic/lipophilic nature of the YMC*Gel ODS-AQ-HG stationary phase leads to strong retention of polar solutes even in aqueous eluents.
These properties of YMC*Gel ODS-AQ-HG are beneficial for the separation of polar organic compounds, which tend not to be retained or are unresolved when conventional C18 columns are used.
Many conventional ODS packings lose their ability to retain polar compounds in highly aqueous mobile phases as shown on the next . They appear less lipophilic with densely folded C18 chains. However, in similar mobile phases, YMC*Gel ODS-AQ-HG maintains its brush-like C18 chain structure and its lipophilic properties and provides excellent retention of polar compounds.

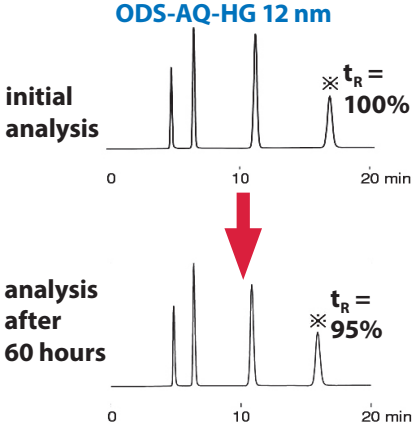
Applications

YMC*Gel ODS-AQ-HG is able to resolve compounds with minor differences in polarity from closely related chemical structures. As a result, YMC*Gel ODS-AQ-HG is an excellent tool for the separation of drugs and their corresponding metabolites, pesticides and their degradation products, or peptides and protein digests etc. This capability of "polar recognition" opens up a broad range of application for YMC*Gel ODS-AQ-HG in life sciences and pharmacology.

YMC*Gel ODS-AQ-HG in standard organic and 100% aqueous mobile phases



ODS-AQ-HG 12 nm



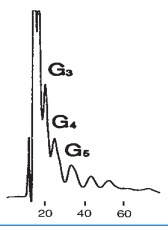
Column:	YMC*Gel ODS-AQ-HG
Dimension:	250 x 6.0 mm
Eluent:	20 mM KH_2PO_4-K_2HPO_4 (pH 6.9)
Flow rate:	1.7 ml/min
Temperature:	37°C
Detection:	UV at 254 nm

Large scale purification of malto-oligosaccharides from enzyme reaction liquid

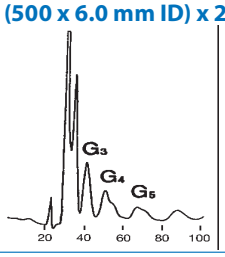
Column length

Column:	YMC-Pack ODS-AQ-HG (12 nm, 50 µm)
Eluent:	water
Flow rate:	0.7 ml/min
Detection:	UV at 190 nm

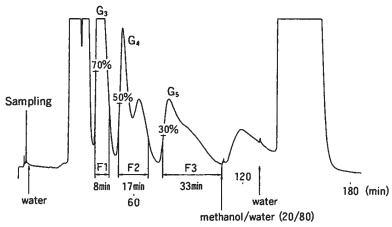
500 x 6.0 mm ID



(500 x 6.0 mm ID) x 2



Large scale purification

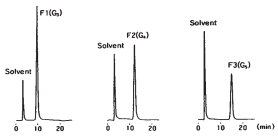


Loading 225 g $\left[2.25\ g \times \left(\frac{200\ mm\ ID}{20\ mm\ ID}\right)^2\right]$

F1 (G_3)		F2 (G_4)		F3 (G_5)	
Purity	100%	Purity	100%	Purity	100%
Collection	30.0 g	Collection	22.3 g	Collection	22.8 g
Recovery	74%	Recovery	70%	Recovery	78%

Column:	YMC-Pack ODS-AQ-HG (12 nm, 50 µm) 1000 x 200 mm ID
Flow rate:	800 ml/min
Detection:	UV at 190 nm
Injection:	700 ml (225 g)

Fraction analysis



Column:	YMC-Pack NH_2-HG (12 nm, 5 µm) 250 x 4.6 mm ID
Eluent:	acetonitrile / water (65/35)
Flow rate:	1.0 ml/min
Detection:	RI

Source: Courtesy of YMC Co., Ltd.

Ordering Information

Pore Size (nm)	Particle Size (µm)	Product Code
8	10	AQG08S11
	15	AQG08S16
	20	AQG08S21
12	10	AQG12S11
	15	AQG12S16
	20	AQG12S21
	50	AQG12S50

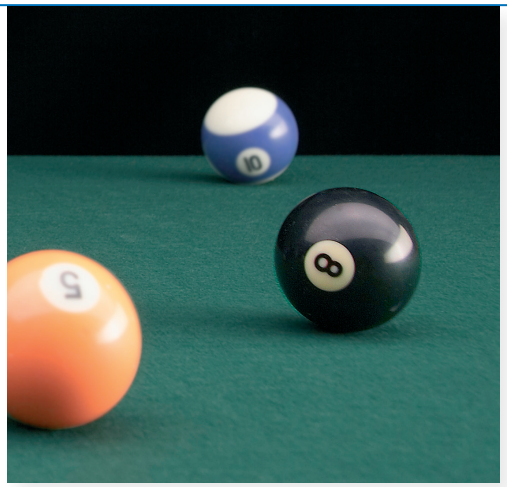
Pore Size (nm)	Particle Size (µm)	Product Code
20	10	AQG20S11
	15	AQG20S16
	20	AQG20S21

Pack Sizes: 100 g; 500 g; 1 kg; 5 kg; 10 kg; 25 kg

NOTE: customised particle sizes and pore sizes are available on request. Contact YMC Europe GmbH for details and ordering information.

*YMC*Gel C8-HG (Octyl)*

- **alternative phase to C18 with moderate hydrophobicity**
- **fully endcapped, high coverage monomeric bonded chemistry**
- **ideal for method development and routine separations**
- **excellent retention for all types of organic molecules, especially peptides, proteins and pharmaceuticals**



YMC*Gel C8-HG (Octyl)	Specification		
Pore size / nm	12	20	30
Particle size / µm	10; 15; 20; 50	10; 15; 20	10; 15; 20
Surface area / m^2g^{-1}	330	175	100
Carbon Content / %	10	7	4
Recommended pH range	2.0–7.5	2.0–7.5	2.0–7.5

General

YMC*Gel C8-HG is one of YMC's most versatile bonded phases and an excellent alternative to C18 selectivities. Due to its moderate hydrophobicity, YMC*Gel C8-HG is well suited for the separation of hydrophobic compounds which are too strongly retained on C18 phases or for samples that require greater retention than provided by C4 packings. Compared to C18 phases, retention times of non-polar compounds will be lower on C8 material due to the reduced carbon load.

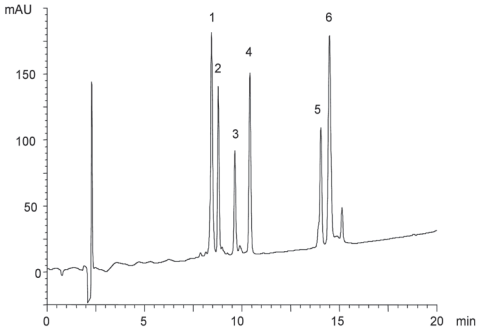
Properties

YMC*Gel C8-HG is prepared by exhaustive bonding of a monomeric octylsilane to YMC's totally spherical and porous, high grade silica gel. The functionalised silica is then treated with a thorough endcapping process. This produces a moderate 10% carbon loading on YMC's standard 12 nm pore material.
Available in three standard porosities, 12, 20 and 30 nm, YMC*Gel C8-HG packings will separate many classes of compounds including pharmaceuticals, organic chemicals, peptides, proteins and other biological molecules, making it ideal for method development. For optimum yield in preparative applications, choose the smallest pore size that provides adequate retention and resolution. This is because sample loading is generally proportional to surface area. Smaller pore packings provide a greater surface area and hence greater loadability.

Applications (Examples)

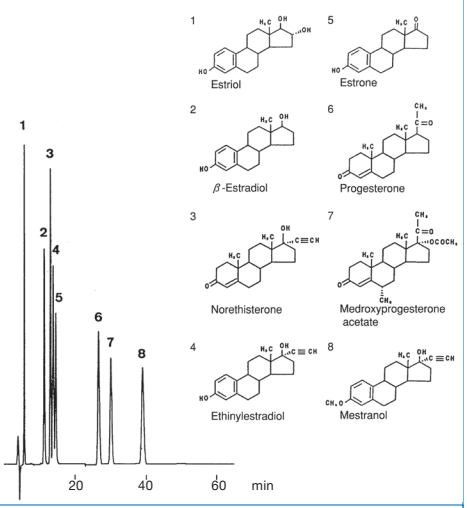
Peptides and proteins (MW 4,330-17,000)

1. Cytochrome c (Horse heart) (MW 12,400)
2. Insulin (Bovine pancreas) (MW 5,733)
3. Amyloid β-protein (1-40) (MW 4,330)
4. Lysozyme (Chicken egg white) (MW 14,300)
5. a-Lactalbumin (Human milk) (MW 14,100)
6. Myoglobin (Horse skeletal muscle) (MW 17,000)



Column: YMC-Pack C8 (Octyl), (20 nm, 5 µm) 150 x 4.6 mm ID
Eluent: A) water / TFA (100/0.1)
B) acetonitrile / TFA (100/0.1)
25–60% B (0–20 min)
Flow rate: 1.0 ml/min
Temperature: 37 °C
Detection: UV at 220 nm
Injection: 10 µl (0.1 ~ 0.2 mg/ml)

Estrogens and progestins



Column: YMC-Pack C8 (Octyl), (12 nm, 5 µm) 250 x 4.6 mm ID
Eluent: acetonitrile / THF / water (46/4/50)
Flow rate: 0.7 ml/min
Temperature: 30 °C
Detection: UV at 230 nm, 0.16 AUFS
Injection: 7 µl (0.1 mg/ml)

Ordering Information

Pore Size (nm)	Particle Size (µm)	Product Code
12	10	OCG12S11
	15	OCG12S16
	20	OCG12S21
	50	OCG12S50
20	10	OCG20S11
	15	OCG20S16
	20	OCG20S21

Pore Size (nm)	Particle Size (µm)	Product Code
30	10	OCG30S11
	15	OCG30S16
	20	OCG30S21

Pack Sizes: 100 g; 500 g; 1 kg; 5 kg; 10 kg; 25 kg

NOTE: customised particle sizes and pore sizes are available on request. Contact YMC Europe GmbH for details and ordering information.

YMC*Gel C4-HG (Butyl)

- **low hydrophobicity phase**
- **high coverage monomeric bonding**
- **fully endcapped**
- **ideally suited for the separation of biomolecules, especially non-polar peptides and proteins**

YMC*Gel C4-HG (Butyl)	Specification		
Pore size / nm	12	20	30
Particle size / µm	10; 15; 20; 50	10; 15; 20	10; 15; 20
Surface area / m^2g^{-1}	330	175	100
Carbon Content / %	7	5	3
Recommended pH range	2.0–7.5	2.0–7.5	2.0–7.5

General

Due to shorter alkyl chains YMC*Gel C4-HG has a lower hydrophobicity than both C18 and C8 phases. As a result retention times for non-polar samples tend to be shorter on YMC*Gel C4-HG, making it an ideal choice for faster separations.

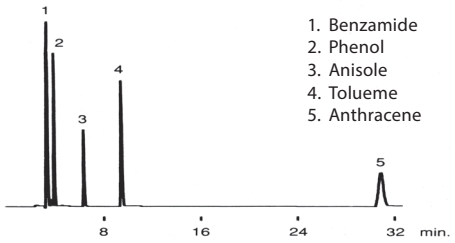
Properties

YMC*Gel C4-HG packings are less hydrophobic and generally require more aqueous conditions than C8 or C18 packings. When using the same eluent, YMC*Gel C4-HG shows significantly shorter retention times for non-polar compounds than either C8 or C18 phases while still maintaining high resolution. Retention of polar compounds, however, is not affected significantly. Therefore, YMC*Gel C4-HG is ideally suited for separating complex samples with a wide range of component polarity.

YMC*Gel C4-HG is available in three porosities to allow optimum separations of virtually any molecular weight compound. The 12 nm phase is used extensively for non-polar peptides which have very long retention times on C8 and C18. The 20 nm and 30 nm pore butyl phases effectively resolve many classes of proteins and biopolymers. The wide pore butyl chemistry allows minimal distortion of tertiary conformation of large biomolecules and results in fractions that are pure, concentrated and retain high biological activity.

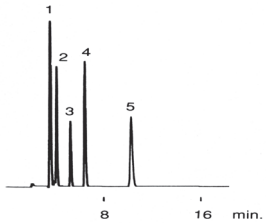
Comparison of Sample Analysis Time for C18 vs C4

YMC-Pack ODS-A 250 x 4.6 mm ID



1. Benzamide
2. Phenol
3. Anisole
4. Toluene
5. Anthracene

YMC-Pack C4 (Butyl) 250 x 4.6 mm ID



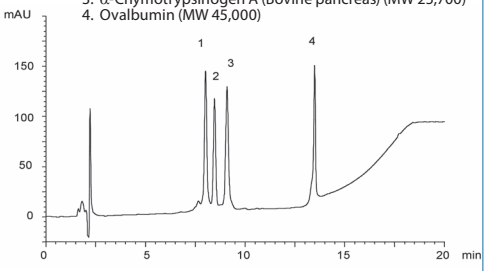
1. Benzamide
2. Phenol
3. Anisole
4. Toluene
5. Anthracene

Eluent: methanol / water (75/25)
Flow rate: 1.0 ml/min
Detection: UV at 254 nm

Applications (Examples)

Proteins

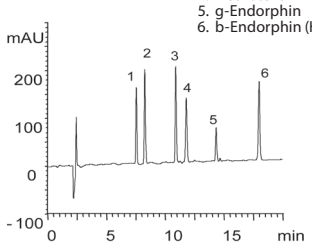
1. b-Lactoglobulin B (Bovine milk) (MW 18,300)
2. b-Lactoglobulin A (Bovine milk) (MW 18,400)
3. α-Chymotrypsinogen A (Bovine pancreas) (MW 25,700)
4. Ovalbumin (MW 45,000)



Column:	YMC-Pack C4 (30 nm, 5 µm) 150 x 4.6 mm ID
Eluent:	A) water / TFA (100/0.1)
	B) acetonitrile / TFA (100/0.1)
	40-50% B (0-10 min), 50-90% B (10-15 min), 90% B (15-20 min)
Flow rate:	1.0 ml/min
Temperature:	37 °C
Detection:	UV at 220 nm
Injection:	10 µl (0.2 ~ 0.3 mg/ml)

Peptides

1. Oxytocin (MW 1,007)
2. Met-Enkephalin (MW 574)
3. Leu-Enkephalin (MW 556)
4. Neurotensin (MW 1,673)
5. g-Endorphin (MW 1,859)
6. b-Endorphin (Human) (MW 3,465)

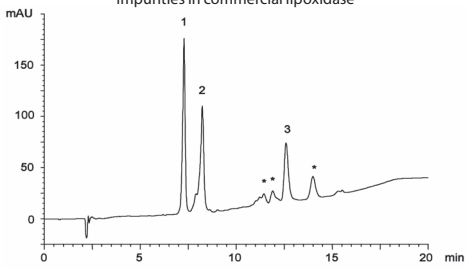


Column:	YMC-Pack C4 (12 nm, 5 µm), 150 x 4.6 mm ID
Eluent:	A) water / TFA (100/0.1)
	B) acetonitrile / TFA (100/0.1)
	20-40% B (0–20 min)
Flow rate:	1.0 ml/min
Temperature:	37 °C
Detection:	UV at 220 nm
Injection:	10 µl

Proteins

1. BSA (MW 66,000)
2. Conalbumin (Chicken egg white) (MW 77.000)
3. Lipoxidase (Soybean) (MW 96,000)

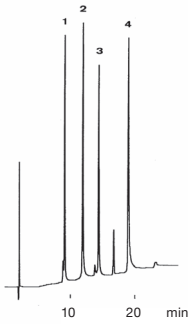
* Impurities in commercial lipoxidase



Column:	YMC-Pack C4 (30 nm, 5 µm) 150 x 4.6 mm ID
Eluent:	A) water / TFA (100/0.1)
	B) acetonitrile / 2-propanol / TFA (50/50/0.1)
	30-75% B (0-15 min), 75% B (15-20 min)
Flow rate:	1.0 ml/min
Temperature:	37 °C
Detection:	UV at 220 nm
Injection:	10 µl (0.25 ~ 1.0 mg/ml)

Proteins

1. Ribonuclease A
2. Cytochrome c
3. Lysozyme
4. Myoglobin



Column:	YMC-Pack C4 (30 nm, 5 µm), 150 x 4.6 mm ID
Eluent:	A) acetonitrile / water / TFA (5/95/0.1)
	B) acetonitrile / water / TFA (60/40/0.1)
	30-90%B (0-20 min, linear), 90%B (20-25 min)
Flow rate:	1.0 ml/min
Temperature:	37 °C
Detection:	UV at 220 nm, 0.32 AUFS
Injection:	16 µl, (0.16 ~ 0.33 mg/ml)

Ordering Information

Pore Size (nm)	Particle Size (µm)	Product Code
12	10	BUG12S11
	15	BUG12S16
	20	BUG12S21
	50	BUG12S50
20	10	BUG20S11
	15	BUG20S16
	20	BUG20S21

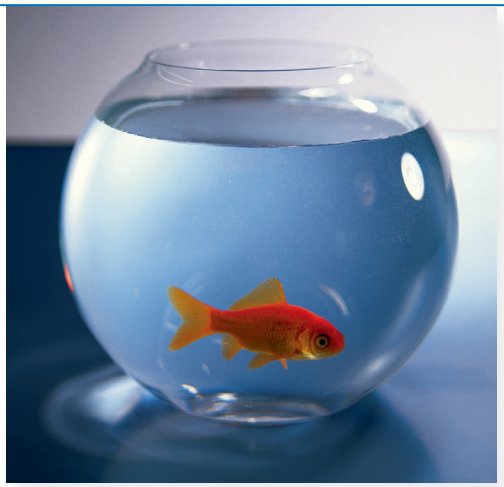
Pore Size (nm)	Particle Size (µm)	Product Code
30	10	BUG30S11
	15	BUG30S16
	20	BUG30S21

Pack Sizes: 100 g; 500 g; 1 kg; 5 kg; 10 kg; 25 kg

NOTE: customised particle sizes and pore sizes are available on request. Contact YMC Europe GmbH for details and ordering information.

YMC*Gel TMS-HG (C1)

- **stationary phase with the lowest hydrophobicity of all reversed phase packing materials**
- **intermediate polarity between normal phase silica and other alkyl bonded reversed phases**
- **for fast separations of higly hydrphobic compounds**
- **alternative to C18 for the separation of hydrophilic compounds**



YMC*Gel TMS-HG (C1)	Specification		
Pore size / nm	12	20	30
Particle size / µm	10; 15; 20; 50	10; 15; 20	10; 15; 20
Surface area / m^2g^{-1}	330	175	100
Carbon Content / %	4	on request	on request
Recommended pH range	2.0–7.5	2.0–7.5	2.0–7.5

General

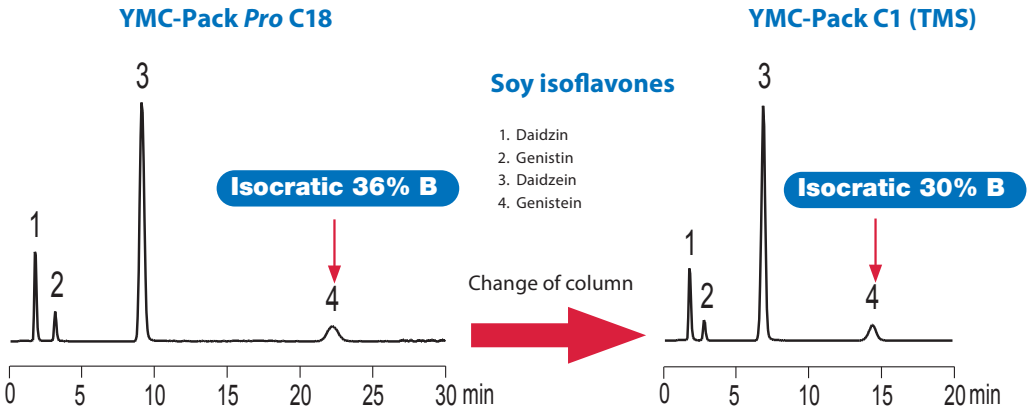
YMC*Gel TMS-HG shows lower retention due to hydrophobic interaction than all other reversed phase packing materials. It is useful for fast separations of highly hydrophobic samples that exhibit strong retention characteristics and are difficult or impossible to separate on conventional reversed phase packings. In addition, YMC*Gel TMS-HG can sometimes achieve greater retention and better separations of hydrophilic compounds than other reversed phase columns.

Properties

YMC*Gel TMS-HG is bonded with trimethylmonochlorosilane to create a phase with intermediate polarity for separation of extremely hydrophobic compounds using conventional reversed phase solvents and of highly polar compounds using normal phase solvents.
The chemistry of YMC*Gel TMS-HG is also well-suited for the analysis of multifunctional compounds. Selectivity characteristics of a TMS bonded phase can be unique, and samples must be tested to determine the suitability of the phase.

Example

Simple separation condition using TMS



Column:	YMC-Pack TMS (C1), 50 x 2.0 mm ID
Eluent:	A) water / formic acid (100/0.05)
	B) acetonitrile / water / formic acid (50/50/0.05)
Flow:	0.2 ml/min
Temperature:	37 °C
Detection:	ESI positive mode

Ordering Information

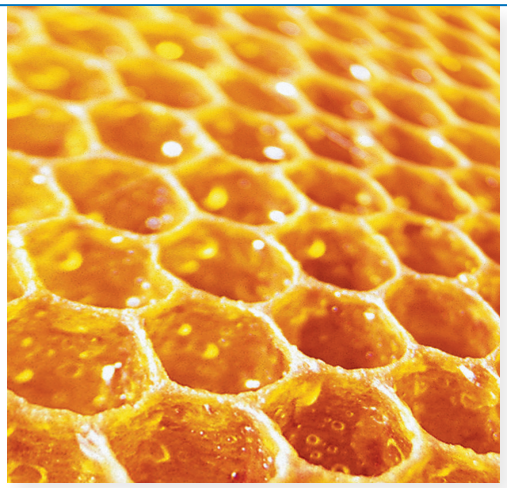
Pore Size (nm)	Particle Size (µm)	Product Code
12	10	TMG12S11
	15	TMG12S16
	20	TMG12S21
	50	TMG12S50
20	10	TMG20S11
	15	TMG20S16
	20	TMG20S21

Pore Size (nm)	Particle Size (µm)	Product Code
30	10	TMG30S11
	15	TMG30S16
	20	TMG30S21

Pack Sizes: 100 g; 500 g; 1 kg; 5 kg; 10 kg; 25 kg

NOTE: customised particle sizes and pore sizes are available on request. Contact YMC Europe GmbH for details and ordering information.

*YMC*Gel Ph-HG (Phenyl)*



- **fully endcapped, monomeric phenyl phase**
- **unique selectivity due to π - π interactions**
- **preferential retention of aromatic compounds**
- **alternative selectivity to C18 or C4 bonded phases for the analysis of peptides and other biomolecules**

YMC*Gel Ph-HG (Phenyl)	Specification		
Pore size / nm	12	20	30
Particle size / µm	10; 15; 20; 50	10; 15; 20	10; 15; 20
Surface area / m^2g^{-1}	330	175	100
Carbon Content / %	9	on request	on request
Recommended pH range	2.0–7.5	2.0–7.5	2.0–7.5

General

YMC*Gel Ph-HG (Phenyl) is a high density bonded phase (9% carbon load on 12 nm silica) and is fully end-capped. This results in a superior bonded phase with proven performance and exceptional lifetime for a phenyl reversed phase column.

Properties

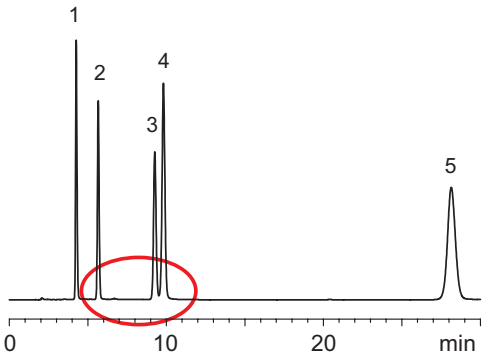
YMC*Gel Ph-HG (Phenyl) provides a unique selectivity when compared to aliphatic straight chain reversed phases such as C18, C8 or C4. The π-electrons of the phenyl groups can interact with aromatic residues of an analyte molecule in addition to hydrophobic interactions to increase retention relative to non-aromatic species.

Phenyl phases are convenient for the separation of aromatic compounds and provide a useful alternative to C18 or C4 phases for the separation of peptides and other biomolecules.

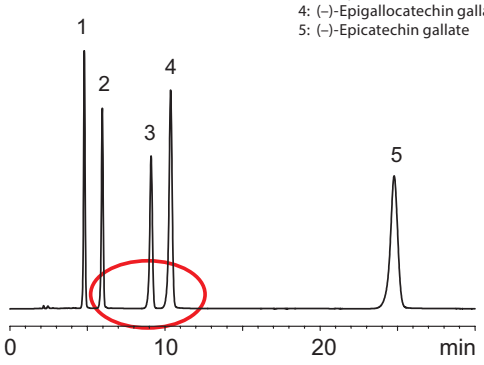
Example

Simple separation conditions using YMC-Pack Phenyl

YMC-Pack *Pro* C18
acetonitrile/water/TFA (12/88/0.1)



YMC-Pack Phenyl
acetonitrile/water/TFA (12/88/0.1)



Catechins

1: (–)-Epigallocatechin
2: (+)-Catechin
3: (–)-Epicatechin
4: (–)-Epigallocatechin gallate
5: (–)-Epicatechin gallate

Column: 150 x 4.6 mm ID
Flow rate: 1.0 ml/min
Temperature: 37 °C
Detection: UV at 280 nm

Ordering Information

Pore Size (nm)	Particle Size (µm)	Product Code
12	10	PHG12S11
	15	PHG12S16
	20	PHG12S21
	50	PHG12S50
20	10	PHG20S11
	15	PHG20S16
	20	PHG20S21

Pore Size (nm)	Particle Size (µm)	Product Code
30	10	PHG30S11
	15	PHG30S16
	20	PHG30S21

Pack Sizes: 100 g; 500 g; 1 kg; 5 kg; 10 kg; 25 kg

NOTE: customised particle sizes and pore sizes are available on request. Contact YMC Europe GmbH for details and ordering information.

YMC*Gel NH_2-HG (Amino)

- primary amine (-NH_2) functionality
- stable, high coverage monomeric bonded chemistry
- for aqueous normal phase separations of carbohydrate compounds
- in place of silica for conventional normal phase chromatography using nonpolar solvents
- for HILIC separations of highly polar compounds
- no endcapping

YMC*Gel NH_2-HG (Amino)	Specification		
Pore size / nm	12	20	30
Particle size / µm	10; 15; 20; 50	10; 15; 20	10; 15; 20
Surface area / m^2g^{-1}	330	175	100
Carbon Content / %	3	on request	on request
Recommended pH range	2.0–7.5	2.0–7.5	2.0–7.5

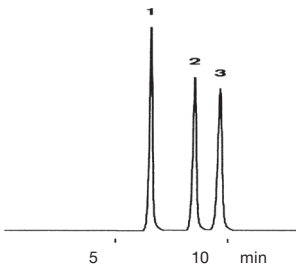
General

YMC*Gel NH_2-HG is specifically used for the analysis of carbohydrate-type materials under aqueous normal phase elution conditions. It can also be used in place of silica for conventional normal phase chromatography using nonpolar solvents and for HILIC separations of highly polar compounds.

Properties

YMC*Gel NH_2-HG is based on a monomeric bonding of a primary propylamine functionality to YMC's spherical, high purity, high surface area HG-silica with a mean pore diameter of 12 nm. The amine functionality provides retention and allows the separation of polar compounds under aqueous normal phase elution conditions, e.g. the analysis of carbohydrate-type materials from monosaccharides to polysaccharides using acetonitrile/water eluents. When YMC*Gel NH_2-HG operates under normal phase elution conditions, water, which is more polar than acetonitrile, is the stronger solvent, meaning that it can be used in HILIC mode as an alternative approach for the separation of highly polar compounds. YMC*Gel NH_2-HG can also be used for the separation of isomers of tocopherols and other organic soluble compounds such as paraffins, olefins and aromatics under conventional normal phase conditions.In aqueous low pH buffers the amino phase becomes a weak anion exchanger capable of separating negatively charged molecules.

Water-soluble vitamins



1. 

Nicotinic acid

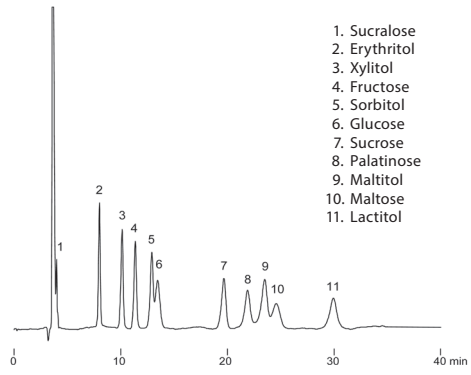
2. Erythorbic acid (iso-Vitamin C)

3. 

L-Ascorbic acid (Vitamin C)

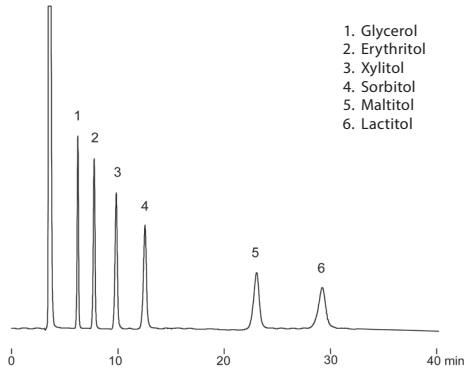
Column:	250 x 4.6 mm ID (5 µm, 12 nm)
Eluent:	acetonitrile / 50 mM $NH_4H_2PO_4$ (80/20)
Flow rate:	1.0 ml/min
Temperature:	40 °C
Detection:	UV at 250 nm, 0.16 AUFS
Injection:	10 µl (0.05-0.1 mg/ml)

Sugars and Sweeteners



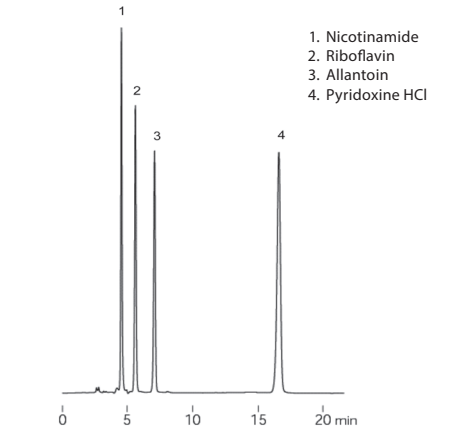
Column:	YMC-Pack NH_2 (12 nm, 5 µm) 250 x 4.6 mm ID
Eluent:	acetonitrile / water (75/25)
Flow:	1.0 ml/min
Detection:	RI
Temperature:	25 °C
Injection:	5 µl (5.0 mg/ml)

Sugar alcohols



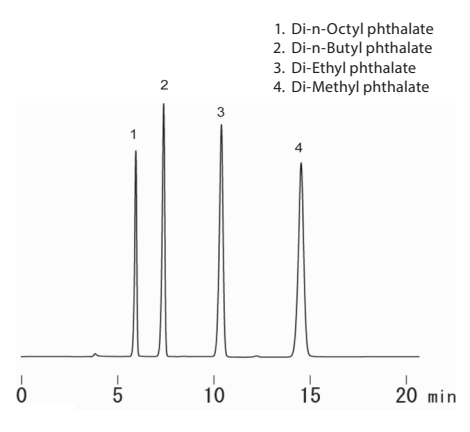
Column:	YMC-Pack NH_2 (12 nm, 5 µm) 250 x 4.6 mm ID
Eluent:	acetonitrile / water (75/25)
Flow:	1.0 ml/min
Detection:	RI
Temperature:	25 °C
Injection:	5 µl (5.0 mg/ml)

HILIC application: water-soluble vitamins



Column:	YMC-Pack NH_2 (12 nm, 5 µm) 250 x 4.6 mm ID
Eluent:	50 mM $NH_4H_2PO_4$ - H_3PO_4 (pH 2.5) / ACN (20/80)
Flow:	1.0 ml/min
Detection:	UV at 210 nm, 0.064 AUFS
Temperature:	37°C
Injection:	8 µl (0.01 ~ 0.04 mg/ml)

Non-aqueous mobile phase conditions



Column:	YMC-Pack NH_2 (12 nm, 5 µm) 250 x 4.6 mm ID
Eluent:	*n*-hexane / ethyl acetate (90/10)
Flow:	1.0 ml/min
Detection:	UV at 254 nm
Temperature:	30°C
Injection:	10 µl (0.5 mg/ml)

Ordering Information

Pore Size (nm)	Particle Size (µm)	Product Code
12	10	NHG12S11
	15	NHG12S16
	20	NHG12S21
	50	NHG12S50
20	10	NHG20S11
	15	NHG20S16
	20	NHG20S21

Pore Size (nm)	Particle Size (µm)	Product Code
30	10	NHG30S11
	15	NHG30S16
	20	NHG30S21

Pack Sizes: 100 g; 500 g; 1 kg; 5 kg; 10 kg; 25 kg

NOTE: customised particle sizes and pore sizes are available on request. Contact YMC Europe GmbH for details and ordering information.

YMC*Gel CN-HG (Cyano phase)

- **for normal, reversed phase and HILIC applications**
- **silica gel with cyanopropyl functionality**
- **faster column equilibration than normal silica gel**
- **most polar reversed phase column**
- **fully endcapped**

YMC*Gel CN-HG (Cyano)	Specification		
Pore size / nm	12	20	30
Particle size / µm	10; 15; 20; 50	10; 15; 20	10; 15; 20
Surface area / m^2g^{-1}	330	175	100
Carbon Content / %	7	on request	on request
Recommended pH range	2.0–7.5	2.0–7.5	2.0–7.5

General

Cyano phases are the most polar and least retentive of all reversed phase packings. Extremely hydrophobic compounds, which do not elute on standard C18 and C8 packings with typical reversed phase eluents, can be separated using cyano phases. Separations using normal phase, reversed phase and HILIC conditions can be carried out using this material.

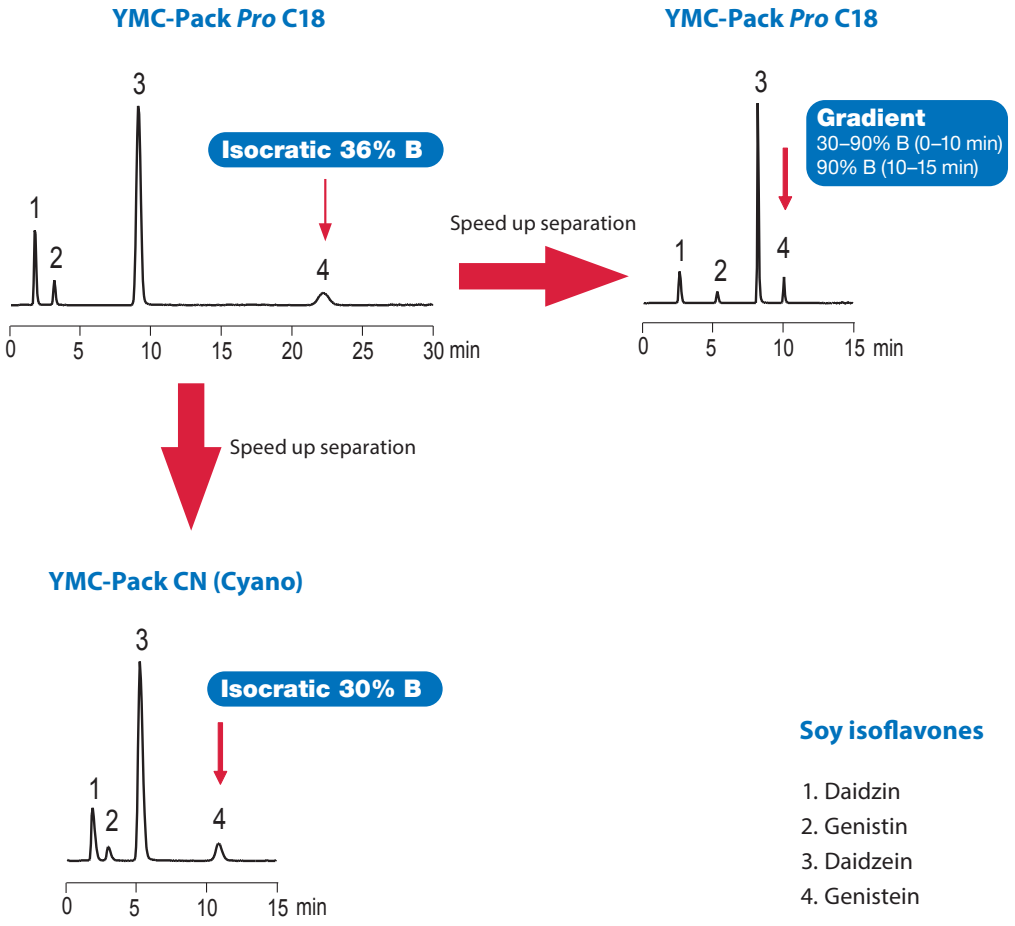
Properties

YMC*Gel CN-HG (Cyano) provides a different selectivity from both phenyl and standard aliphatic (C18, C8 or C4) reversed phase packings. It is useful for quick and simple analysis of compounds that differ greatly in hydrophobicity, without the need to use gradient elution chromatography, making it an ideal phase for preparative separations.

Cyano packings also provide an alternative to silica for normal phase chromatography, where bonded normal phase packings have the advantage of faster equilibration, more uniform surface activity and increased resistance to dissolution compared to nonbonded silica. To extend column lifetime continued switching between normal and reversed phase solvents should be avoided.

Example

Fast separations without the need to use gradient elution chromatography



Column:	50 x 2.0 mm ID
Eluent:	A) water / formic acid (100/0.05) B) acetonitrile / water / formic acid (50/50/0.05)
Flow:	0.2 ml/min
Temperature:	37 °C
Detection:	ESI positive mode

Source: Courtesy of YMC Co., Ltd.

Ordering Information

Pore Size (nm)	Particle Size (µm)	Product Code
12	10	CNG12S11
	15	CNG12S16
	20	CNG12S21
	50	CNG12S50
20	10	CNG20S11
	15	CNG20S16
	20	CNG20S21

Pore Size (nm)	Particle Size (µm)	Product Code
30	10	CNG30S11
	15	CNG30S16
	20	CNG30S21

Pack Sizes: 100 g; 500 g; 1 kg; 5 kg; 10 kg; 25 kg

NOTE: customised particle sizes and pore sizes are available on request. Contact YMC Europe GmbH for details and ordering information.

YMC*Gel Diol-HG

For Normal Phase applications:

- **Diol endcapping**
- **versatile alternative to silica**
- **bonded phase reproducibility**
- **good selectivity without excessive retention**
- **high preparative throughput**
- **for polar natural products, metabolites, lipids**

For aqueous GPC applications:

- **high mechanical stability**
- **for molecular weight determination of proteins, peptides and sugars**

YMC*Gel Diol-HG	Specification		
Pore size / nm	12	20	30
Particle size / µm	10; 15; 20; 50	10; 15; 20	10; 15; 20
Surface area / m^2g^{-1}	330	175	100
Carbon Content / %	—	—	—
Recommended pH range	2.0–7.5	2.0–7.5	2.0–7.5

A Normal Phase Alternative to Silica

YMC*Gel Diol-HG is a versatile alternative to nonbonded silica for normal phase separations. The bonded phase hydroxyl groups provide good selectivity without excessive retention, because hydrogen bonding with the diol layer is not as strong as the silanols on a nonbonded silica surface. Diol columns also provide improved reproducibility and stability when compared with nonbonded silica.

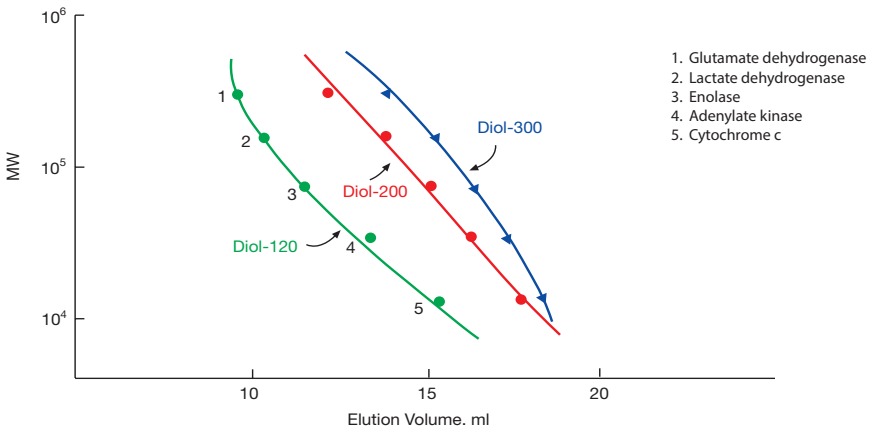
As with all YMC silica-based bonded phases, YMC*Gel Diol-HG starts with a base silica support of exceptional purity and mechanical stability. The silica purity greatly reduces non-specific sample adsorption, thereby providing excellent sample recovery. The high surface area, together with the large number of available sites for interaction of the 1,2-dihydroxypropyl ligands, provides high preparative loading.

YMC*Gel Diol-HG can be cleaned repeatedly with methanol or even water, thus ensuring a longer column life than for underivatised silica.

Silica-based aqueous GPC/SEC medium

The silica-based YMC*Gel Diol-HG is a rugged and efficient size exclusion material. It is generally used for the separation of biomolecules and pharmaceuticals. As the non-specific adsorptive sites have been eliminated it exhibits better performance characteristics for size separations than nonbonded silica. YMC*Gel Diol-HG is available in three porosities: 12, 20 and 30 nm. Diol-12 is most suitable for the separation of peptides or oligosaccharides with molecular weights of 10,000 or less, whereas Diol-20, and -30 (either used individually or in combination) are suitable for separations of proteins and other water-soluble compounds with molecular weights of 10,000 to several hundred thousands.

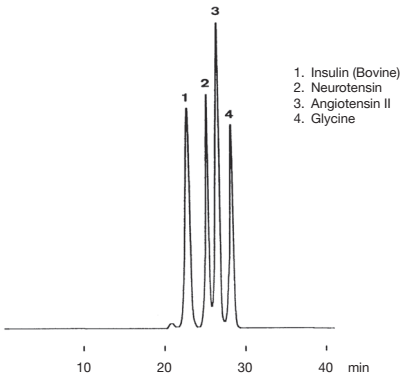
GPC applications: proteins and peptides



Column: YMC-Pack Diol (5 µm) 500 x 8.0 mm ID
Eluent: 0.1M KH_2PO_4-K_2HPO_4 (pH 7.0) containing 0.2M NaCl
Flow rate: 0.7 ml/min
Temperature: ambient
Detection: UV at 280 nm

Source: Courtesy of YMC Co., Ltd.

Normal Phase application: peptides



Column: YMC-Pack Diol-120 (12 nm, 5 µm) 500 x 8.0 mm ID x 2
Eluent: 0.1 M KH_2PO_4-K_2HPO_4 (pH 7.0) containing 0.2 M NaCl / acetonitrile (70/30)
Flow: 0.7 ml/min
Detection: UV at 215 nm, 0.16 AUFS
Temperature: ambient (25 °C)
Injection: 25 µl (0.07 ~ 5.3 mg/ml)

Source: Courtesy of YMC Co., Ltd.

Ordering Information

Pore Size (nm)	Particle Size (µm)	Product Code
12	10	DLG12S11
	15	DLG12S16
	20	DLG12S21
	50	DLG12S50
20	10	DLG20S11
	15	DLG20S16
	20	DLG20S21

Pore Size (nm)	Particle Size (µm)	Product Code
30	10	DLG30S11
	15	DLG30S16
	20	DLG30S21

Pack Sizes: 100 g; 500 g; 1 kg; 5 kg; 10 kg; 25 kg

NOTE: customised particle sizes and pore sizes are available on request. Contact YMC Europe GmbH for details and ordering information.

*YMC*Gel SIL-HG (Silica)*

- **high purity silica**
- **high mechanical stability**
- **highly porous, totally spherical particles**
- **fully scalable for analytical, semi-prep, preparative and process scale applications**
- **convenient for separating small organic compounds with similar structures**
- **no endcapping**

YMC*Gel SIL-HG (Silica)	Specification		
Pore size / nm	12	20	30
Particle size / µm	10; 15; 20; 50	10; 15; 20	10; 15; 20
Surface area / m^2g^{-1}	330	175	100
Carbon Content / %	—	—	—
Recommended pH range	2.0–7.5	2.0–7.5	2.0–7.5

General

YMC*Gel SIL-HG is a fully scalable, high purity silica gel, which provides excellent batch-to-batch reproducibility and high sample recoveries. The totally porous spherical particles are mechanically and chemically stable, yet provide high surface area for greater sample loading and increased resolution.

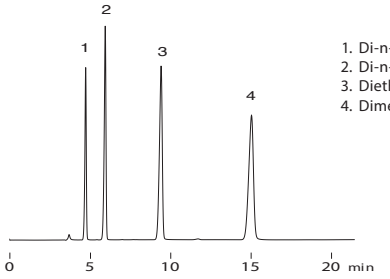
Properties

High purity YMC*Gel SIL-HG combines superior performance, excellent batch-to-batch reproducibility and long column life times. The homogeneous surface, the narrow and symmetrical pore size distribution, and the narrow particle size distribution provide excellent separation characteristics and a low pressure drop.
YMC*Gel SIL-HG provides high yields and optimal sample recovery because its virtually free from impurities, e.g. heavy metals, which can cause non-specific sample adsorption and thus lower sample recovery.
The mechanical strength of the spherical silica particles prevents the formation of fines and high backpressures. Therefore, YMC*Gel SIL-HG is ideal for use in all kinds of dynamic axial compression systems.
Furthermore, the mechanically and chemically stable YMC*Gel SIL-HG is the ideal support material for YMC bonded phase chemistries.
YMC*Gel SIL-HG is completely scaleable: YMC offers numerous particle size ranges and distributions for preparative LC between 10 and 50 µm with batch sizes in excess of 500 kg/Lot.

Separation characteristics of normal-phase packing media

Silica gel

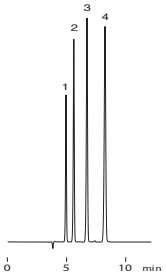
YMC-Pack SIL
(12 nm, 5 µm)



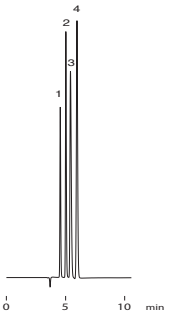
1. Di-n-octyl phthalate
2. Di-n-butyl phthalate
3. Diethyl phthalate
4. Dimethyl phthalate

Chemically bonded packing material

YMC-Pack Diol-NP
(12 nm, 5 µm)



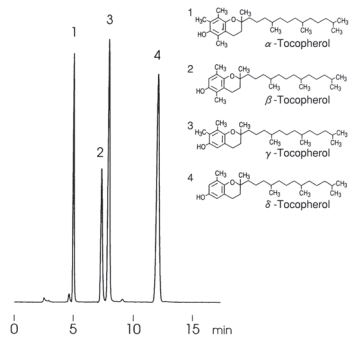
YMC-Pack CN (Cyano)
(12 nm, 5 µm)



Column:	250 x 4.6 mm ID
Eluent:	n-hexane / ethyl acetate (90/10)
Flow:	1.0 ml/min
Detection:	UV at 254 nm
Temperature:	30 °C

Source: Courtesy of YMC Co., Ltd.

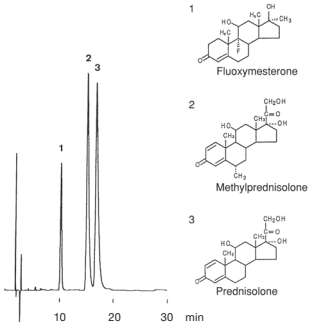
Tocopherols



Column:	YMC-Pack SIL (12 nm, 5 µm) 250 x 4.6 mm ID
Eluent:	hexane / 2-propanol / acetic acid (1000/6/5)
Flow:	1.4 ml/min
Detection:	FLS at Ex 298 nm, Em 325 nm
Temperature:	35 °C
Injection:	20 µl (5 ~ 20 mg/ml)

Source: Courtesy of YMC Co., Ltd.

Steroids



Column:	YMC-Pack SIL (6 nm, 5 µm) 250 x 4.6 mm ID
Eluent:	hexane / THF / acetic acid (60/40/1)
Flow:	1.5 ml/min
Detection:	UV at 250 nm, 0.16 AUFS
Temperature:	30 °C
Injection:	10 µl (0.25 mg/ml)

Source: Courtesy of YMC Co., Ltd.

Ordering Information

Pore Size (nm)	Particle Size (µm)	Product Code
12	10	SLG12S11
	15	SLG12S16
	20	SLG12S21
	50	SLG12S50
20	10	SLG20S11
	15	SLG20S16
	20	SLG20S21

Pore Size (nm)	Particle Size (µm)	Product Code
30	10	SLG30S11
	15	SLG30S16
	20	SLG30S21

Pack Sizes: 100 g; 500 g; 1 kg; 5 kg; 10 kg; 25 kg

NOTE: customised particle sizes and pore sizes are available on request. Contact YMC Europe GmbH for details and ordering information.

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