YMC EUROPE GMBH
The Selectivity Company

YMC
CLASSIC COLUMNS

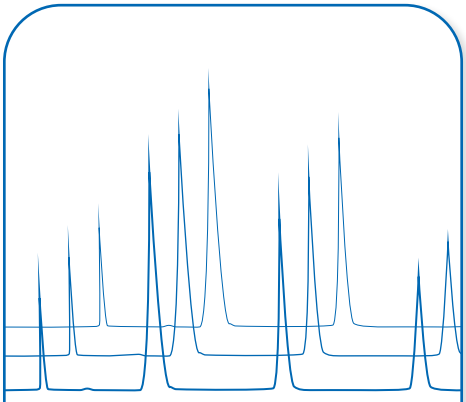
Selectivity

Reproducibility

Reliability

Long-Term Supply

Worldwide Availibility



www.ymc.eu

Worldwide Availability

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Fax + 41 61 561 80 59
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www.ymcchina.com

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Gateway West
Singapore 189720

If any of your requirements for selecting a chromatography vendor are not addressed in this general catalogue, please contact "your" YMC office below or a local authorised distributor (refer to www.ymc.eu). You will find that YMC is always highly responsive to customer requirements, and feedback is guaranteed.

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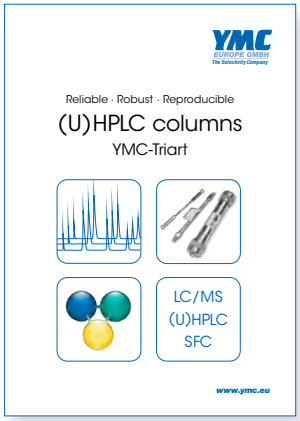
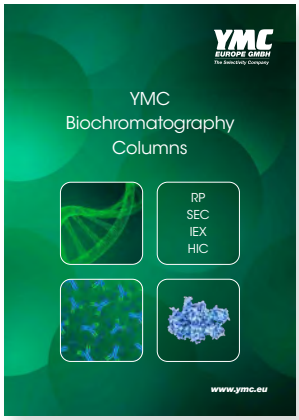
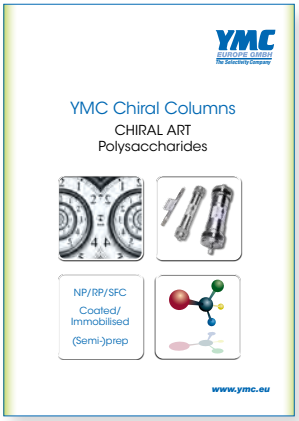
Please inquire for the corresponding catalogues



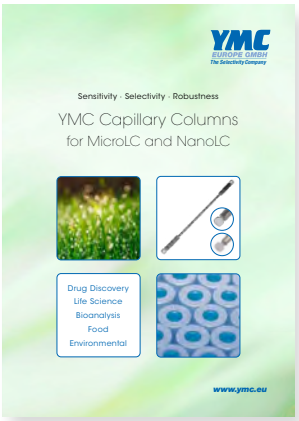
YMC-Triart (U)HPLC columns



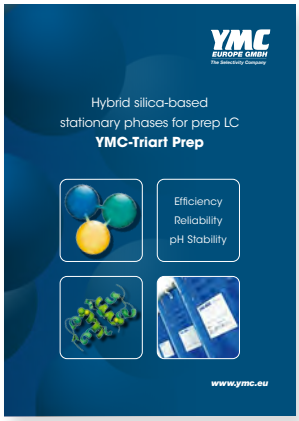
YMC Biochromatography Columns



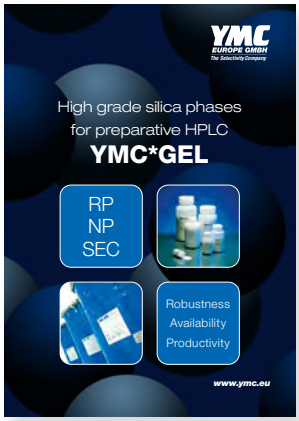
YMC Chiral Columns



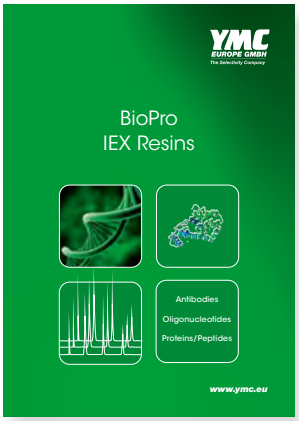
YMC Capillary Columns



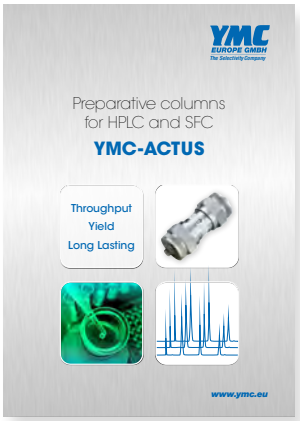
Stationary phases for prep LC



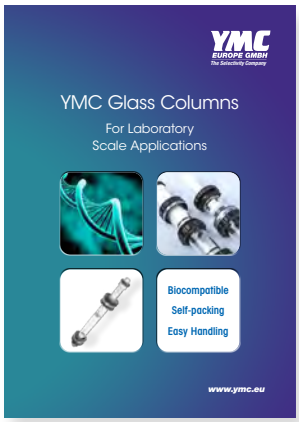
YMC*GEL



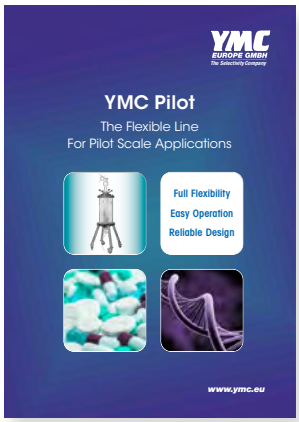
BioPro IEX Resins



YMC-Actus



YMC Glass Columns



YMC Pilot

YMC Pilot^{PLUS}

京都市

Kyoto *Japan*

YMC´s hometown Kyoto, officially Kyoto City (Kyōto-shi), is the capital city of Kyoto Prefecture, located in the Kansai region of Japan. It is best known in Japanese history for being the former Imperial capital of Japan for more than one thousand years, as well as a major part of the Kyoto-Osaka-Kobe metropolitan area. In Japanese, Kyoto was previously called Kyō, Miyako, or Kyō no Miyako. In the 11th century, the city was renamed Kyoto („capital city"), from the Chinese calligraphic, jingdu. After the city of Edo was renamed Tokyo (meaning „Eastern Capital") in 1868, and the seat of the Emperor was moved there, Kyoto was for a short time known as Saikyō (meaning „Western Capital").

Kyoto is also sometimes called the thousand-year capital.

Company Profile

YMC is a leading specialist supplier of high performance products for liquid chromatography, with headquarters in Kyoto, Japan, and with subsidiaries in Europe with qualified/authorized distributors, the USA, India, China, Korea, Taiwan and Singapore.

Our mission statement is our ambition to provide chromatographic solutions for any compound from its discovery through scale-up into production and its ultimate quality control in the laboratory. YMC can always be expected to provide meaningful support, chromatographic tools and assistance for routine R&D, fast LC/UHPLC, high-throughput screening, LC-MS, automation or process-scale engineering.

As a leading global supplier of high performance products for liquid chromatography, YMC is always striving to be highly innovative.
The most recent and interesting premium products from YMC include:

pH and temperature stable (U)HPLC columns and bulk phases: YMC-Triart

Applications using 100% aqueous solvents as well as the separation of similar substances are possible. This allows the whole range of substance polarity to be analysed. Full scalability ensures up- and down-scaling from UHPLC ↔ HPLC ↔ prep scale. Now available in 7 different selectivities for analytical applications.
Bulk media in 10, 15, or 20 µm makes YMC-Triart support available in large quantities for process separations.

Coated and immobilised polysaccharides: CHIRAL ART Polysaccharides

For use in normal phase, reversed phase, polar organic and SFC modes with remarkable stability. Available in prepacked columns with 3 or 5 µm particles as well as in multi-kilogram bulk scale materials with 10 or 20 µm particles at extremely attractive, competitive prices.

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

YMC Europe GmbH, Dinslaken, Germany

Company Profile

YMC Nano/MicroLC columns

Highly efficient separations using small sample sizes and low flow rates with Nano- or MicroLC/MS systems with high sensitivity are now possible with YMC capillary columns. Available packed with every YMC reversed phase, normal phase /HILIC stationary phase in very robust column hardware. The choice of standard 1/16 inch or 1/32 inch fittings allows these columns to be used in all Nano- or MicroLC systems.
However, it is not only product specification that demonstrates YMC qualities, but also the perceived ethical values of having expert people contribute competent and consistent performance along with exceptional reliability even for the most difficult and demanding separations. YMC strive to exceed expectations, worldwide and with guaranteed long-term supply.
Hands-on support services are offered by Komatsu/Japan, Dinslaken/Germany and Noida/India: local application laboratories and the Komatsu factory provide method development, optimisation and scale-up as well as custom synthesis and toll manufacturing (GMP-compliant) from milligram to ton scale.
Facilities include preparative HPLC, fraction concentration equipment, crystallisation, vacuum filtration, vacuum drying, freeze drying, all supported by state-of-the-art analytical instrumentation. YMC workshops are available with a well-defined balance of theory and practical work at either novice or advanced levels, all of which can be customised to individual requirements.

Supply

Extensive local inventory and highly competent order processing staffa ensure speedy product supply to virtually any destination. In addition, authorized YMC International Distributors are encouraged to maintain local inventory, too, occasionally complemented by consignment products provided by YMC, so that lead times are brought down to a minimum.

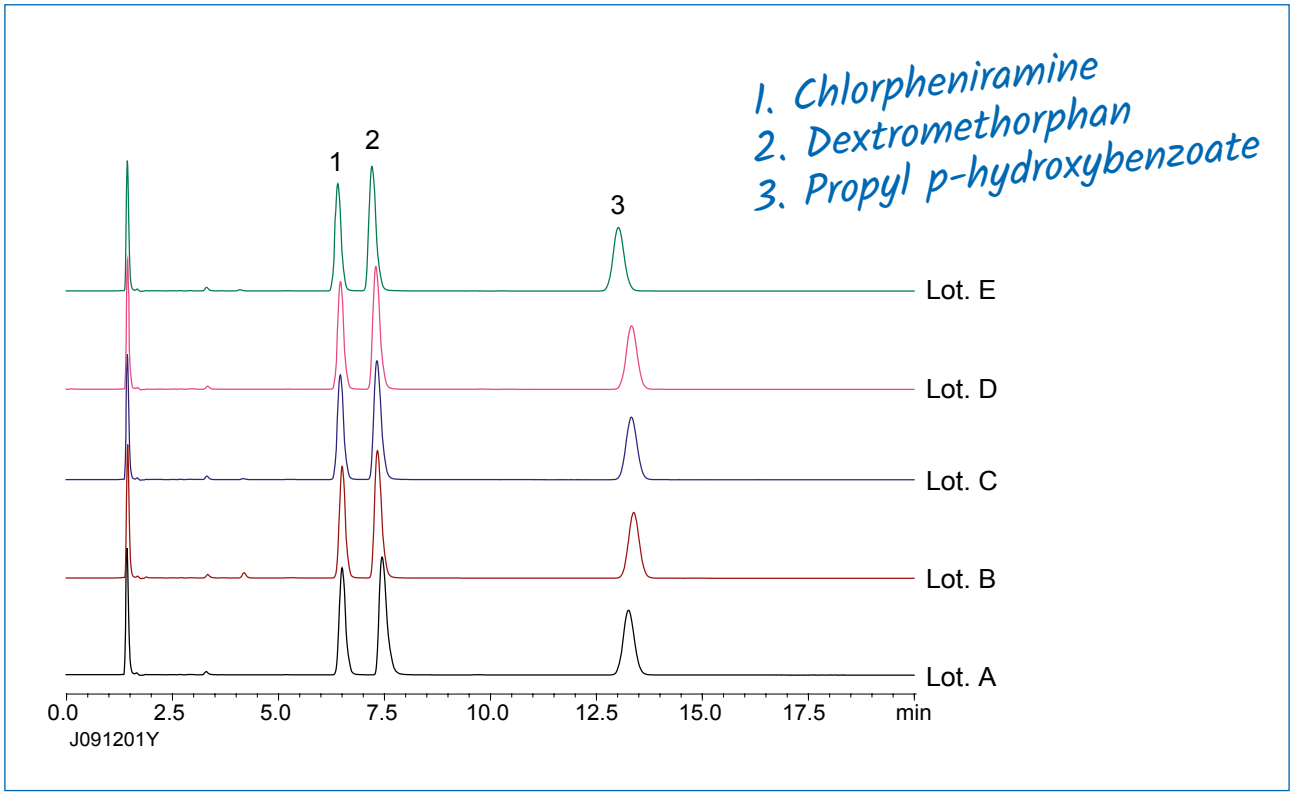
Method Validation Kits

- ***for documentation of robustness and reproducibility***
- ***three analytical columns from specified lots***

Validation kit

Contains three analytical columns packed with stationary phases from three different batches, in order to solely test the robustness of the particular method.

Available dimensions:
Length: 30 or 33, 50, 75, 100, 150, 250, 300 mm
ID: 2.0, 2.1, 3.0, 4.0, 4.6 or 8.0 mm



To order a validation kit simply use the ordering number for the column of interest, e.g. TA12SP9-10Q1PT and add V2: **TA12SP9-10Q1PTV2.**

For details on YMC selectivities and the International Product Code please refer to the product sections in this catalogue or specific brochures.

Achiral/Chiral Method Development Kits by YMC

- ***available with YMC-Triart, YMC-Pack Pro and CHIRAL ART columns***
- ***selection of 3 column chemistries***
- ***choice of 3 different column dimensions***
- ***very attractive pricing***

In order to offer a convenient solution for method developers, YMC is now offering different price attractive Method Development Kits for both achiral and chiral separations.

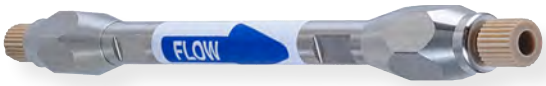
The Method Development Kits will be available with a selection of 3 different YMC-Triart (U)HPLC columns, YMC-Pack Pro Family columns or CHIRAL ART columns.

50 mm length
(example)

- YMC-Triart C18
- YMC-Triart C18 ExRS
- YMC-Triart Phenyl

or

150 mm length
(example)



- CHIRAL ART Amylose-SA
- CHIRAL ART Cellulose-SB
- CHIRAL ART Cellulose-SC

Available dimensions:
Length: 50, 150 mm
ID: 2.0, 2.1 or 4.6 mm

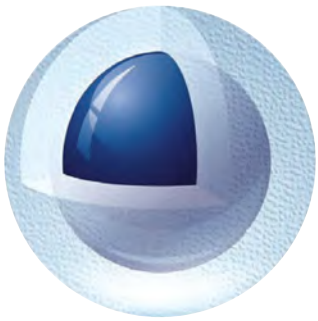
Achiral Kits Available

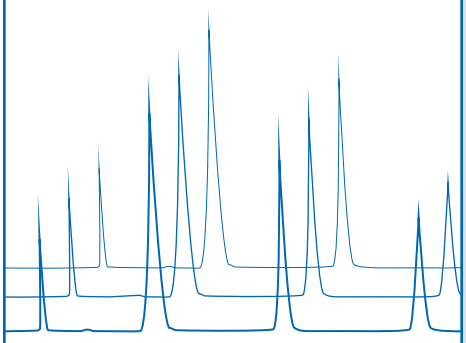
Product Family	Modifications	Particle Size	Dimensions	Part No.
YMC-Triart	C18 / C18 ExRS /Phenyl	1.9 µm	50 x 2.1 mm ID	TATARTPHSP9-05Q1PT
	C18 / C8 / Phenyl			TATOTPHSP9-05Q1PT
	C18 / PFP / Diol-HILIC			TATPFTDHSP9-05Q1PT
	C18 / C18 ExRS / Phenyl	3 µm		TATARTPHS03-05Q1PTH
	C18 / C8 / Phenyl			TATOTPHS03-05Q1PTH
	C18 / PFP / Diol-HILIC			TATPFTDHS03-05Q1PTH
ProFamily	C18 / Hydrosphere C18 / C18 RS	3 µm	50 x 2.0 mm ID	ASHSRSS03-0502WT

Chiral Kits Available

Product Family	Modifications	Particle Size	Dimensions	Part No.
CHIRAL ART	Amylose-SA Cellulose-SB Cellulose-SC	3 µm	50 x 4.6 mm ID	KSAKSBKSCS03-0546WT
	Amylose-C Cellulose-C Cellulose-SC			KANKCNKSCS03-0546WT
	Amylose-SA Cellulose-SB Cellulose-SC		150 x 4.6 mm ID	KSAKSBKSCS03-1546WT
	Amylose-C Cellulose-C Cellulose-SC			KANKCNKSCS03-1546WT

Meteoric Core





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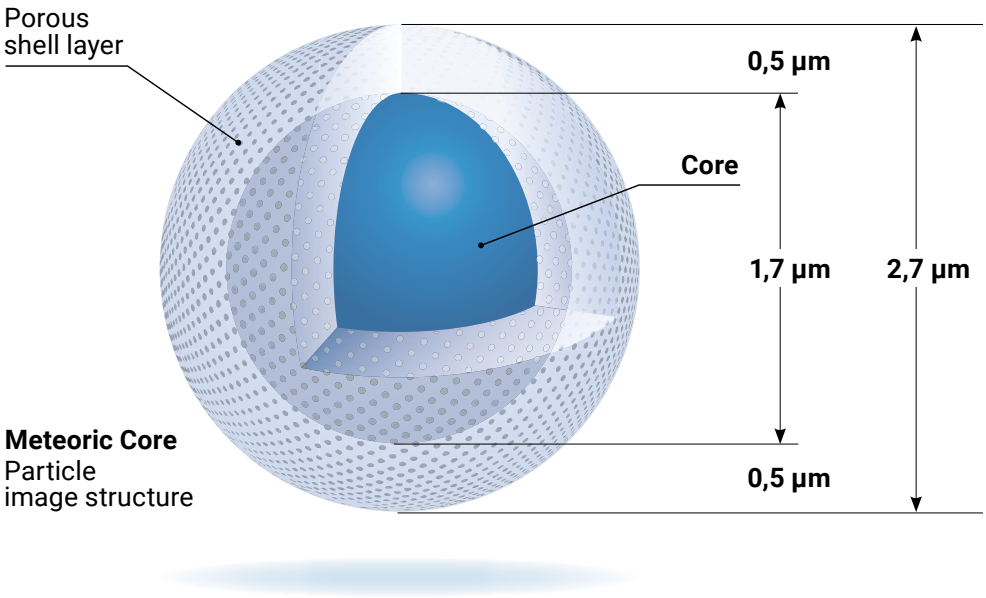
Meteoric Core

Introduction

Core Shell Columns for UHPLC and HPLC

Meteoric Core is a core-shell material optimised for ultra fast separations with outstanding resolution. Excellent peak shapes for basic and coordinating compounds are possible due to a large pH-range of 1.5 to 10 (to pH 9 for C8). It is also an ideal choice for LC/MS applications due to low column bleeding.



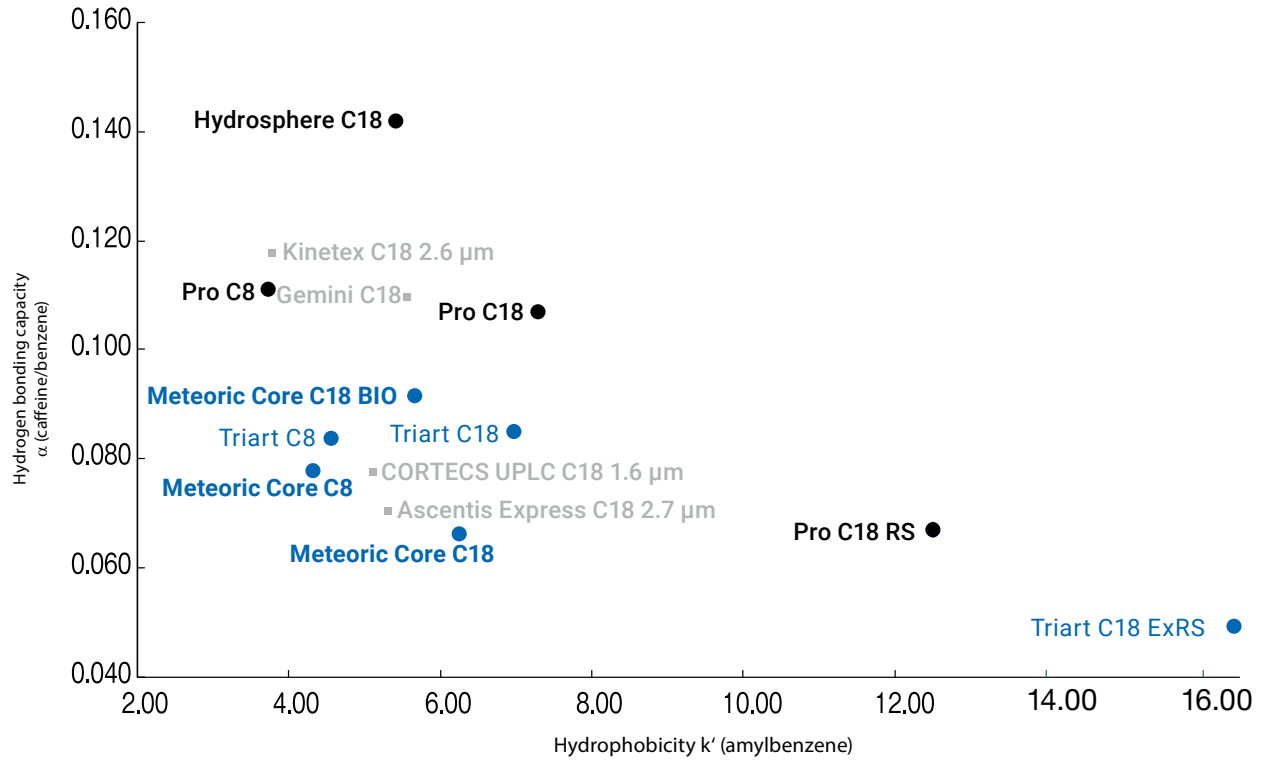
Core-Shell columns for UHPLC & HPLC

- *ultra fast separation with outstanding resolution*
- *excellent peak shape for basic and coordinating compounds*
- *wide pH application range*
- *high lot-to-lot reproducibility*

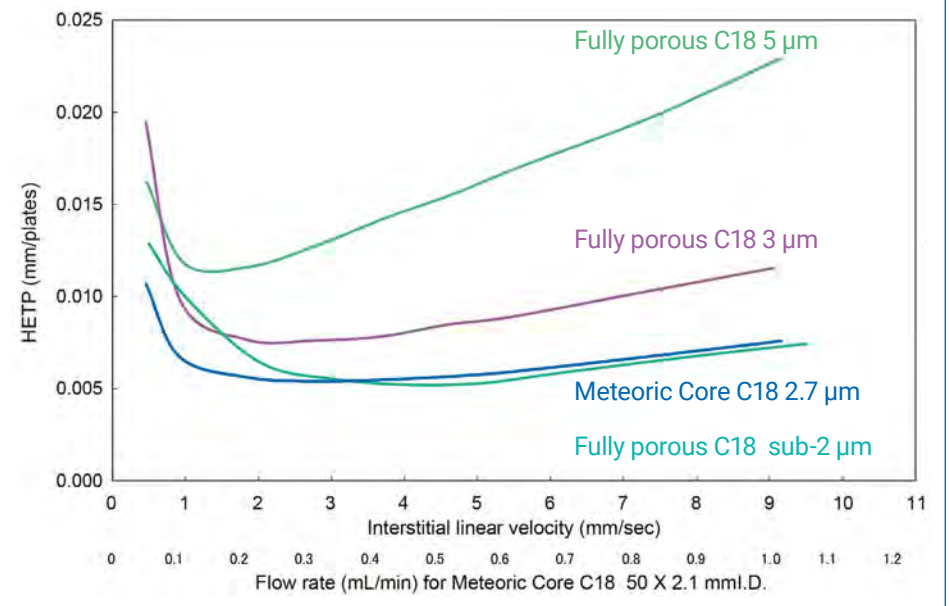
Specifications	Meteoric Core C18	Meteoric Core C18 BIO	Meteoric Core C8
Base particle	Core-Shell type silica gel		
Particle size / µm	2.7	2.7	2.7
Pore size / nm	8	16	8
Specific surface area / m^2/g	150	90	150
Bonding	Trifunctional	Trifunctional	Trifunctional
Carbon content / %	7	5	5
End capping	Yes	Yes	Yes
Pressure limit	60 MPa (8,700 psi)	60 MPa (8,700 psi)	60 MPa (8,700 psi)
pH range	1.5–10	1.5–10	1.5–9
Temperature	pH < 7: 70 °C pH > 7: 50 °C	pH < 7: 70 °C pH > 7: 50 °C	pH < 7: 60 °C pH > 7: 40 °C
USP Classification	pH > 7: 50 °C	L1	L7

Meteoric Core

Selectivity Chart



Van Deemter Curves: Correlation between linear velocity and column efficiency



Column: 50 x 2.0 or 2.1 mm ID
Eluent: acetonitrile / water (60/40)
Temperature: 25 °C
Sample: butyl benzoate
Detection: UV at 270 nm

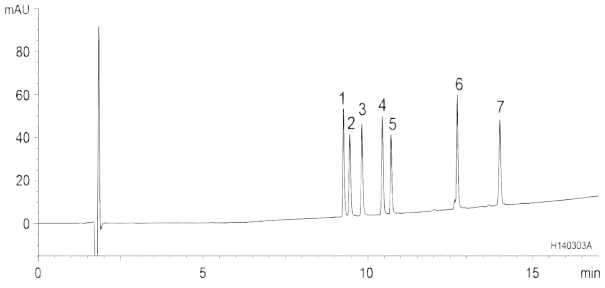
Meteoric Core C18 has high column efficiency which is almost equivalent to sub-2 µm columns over a wide range of flow rates.

Meteoric Core

Applications

Peptides

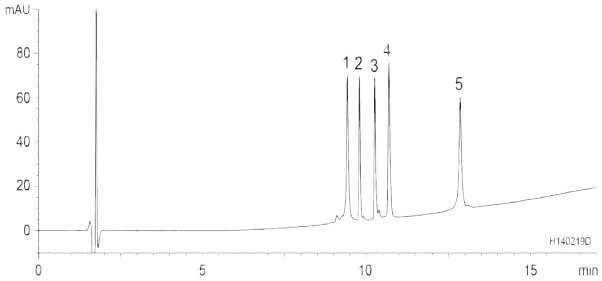
1. BAM-12P (MW1,425)
2. [D-Ala^2,Met^5]-Enkephalinamide (MW 587)
3. Met-Enkephalin (MW 574)
4. [D-Ala^2,Met^5]-Enkephalin (MW 588)
5. α-Endorphin (MW1,746)
6. β-Endorphin (MW1,859)
7. γ-Endorphin (MW3,465)



Column:	Meteoric Core BIO (2.7 µm, 6 nm) 150 x 2.1 mm ID
Part No.:	CAW16SQ7-15Q1PT
Eluent:	A) Water / TFA (100/0.1) B) Acetonitrile / TFA (100/0.1)
Gradient:	15-55%B (0-15 min), 55% B (15-17 min)
Flow rate:	0.2 mL/min
Temperature:	40°C
Detection:	220 nm

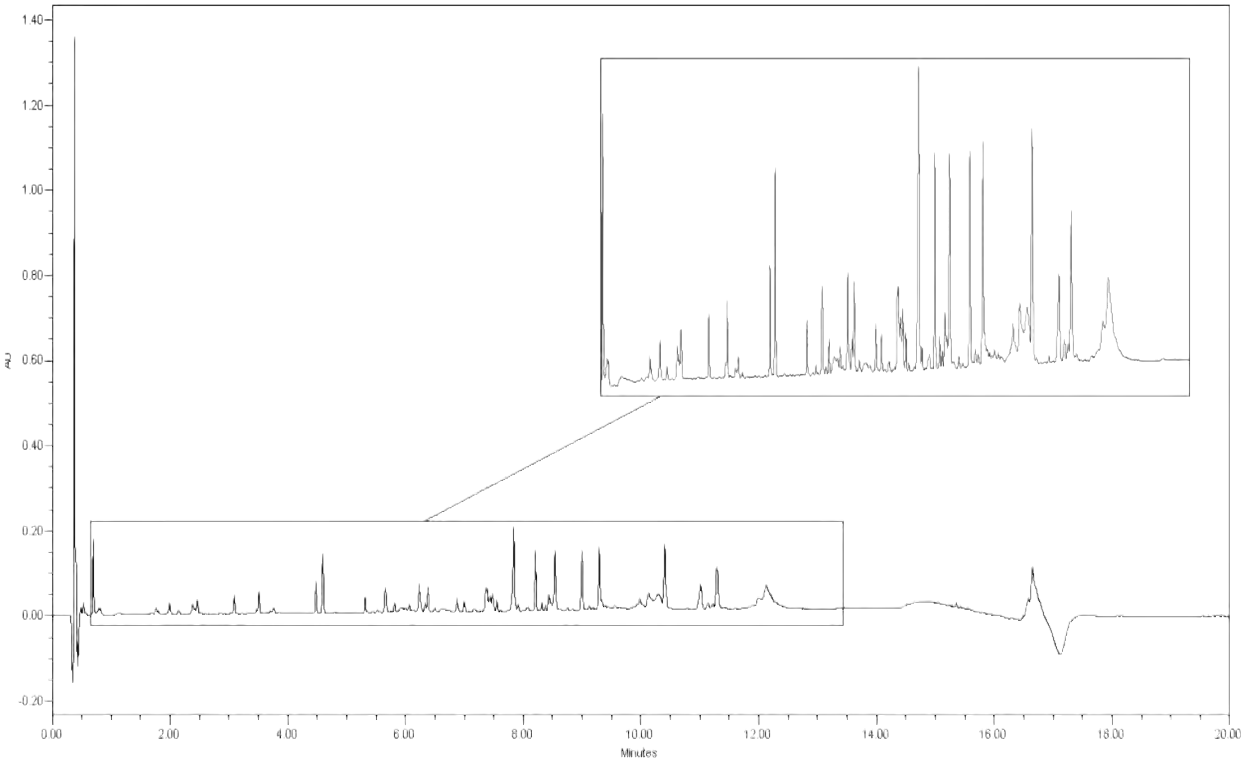
Peptides/Proteins

1. Cytochrome c (MW 12,400)
2. Insulin (bovine) (MW 5,700)
3. Amyloid β-protein (MW 4,300)
4. Lysozyme (MW 14,000)
5. α-Chymotrypsinogen A (MW 25,700)



Column:	Meteoric Core BIO (2.7 µm, 16 nm) 150 x 2.1 mm ID
Part No.:	CAW16SQ7-15Q1PT
Eluent:	A) Water / TFA (100/0.1) B) Acetonitrile / TFA (100/0.1)
Gradient:	20-70% B (0-15 min), 70% B (15-17 min)
Flow rate:	0.2 mL/min
Temperature:	40°C
Detection:	220 nm

Avastin Peptide Map – Trypsin Digest

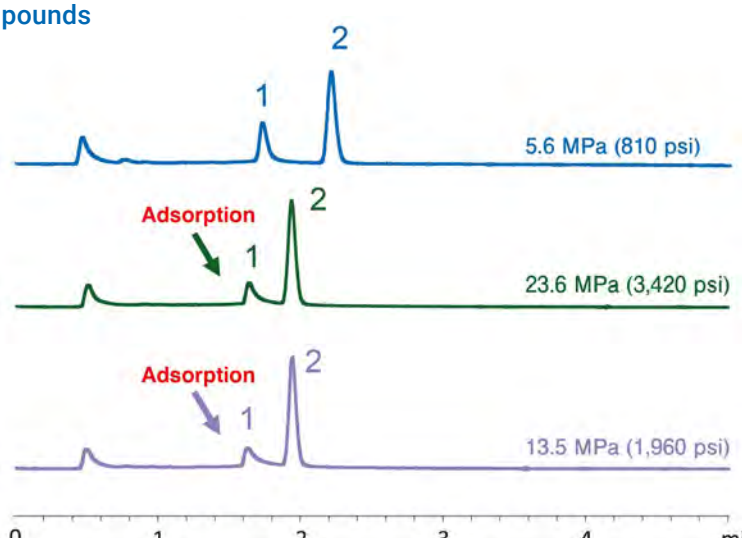


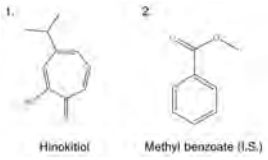
Meteoric Core BIO (2.7 µm, 16 nm) 100 x 2.1 mm ID

Part No.:	CAW16SQ7-10Q1PT
Eluent:	A) Water / TFA (100/0.1) B) Acetonitrile / TFA (100/0.1)
Gradient:	2-4% B (0-14 min), 45-100% B (14-16 min), 100-2% B (16-20 min)
Inj. Volume:	10 µL
Temperature:	40°C
Detection:	215 nm
Flow rate:	0.6 mL/min
Overall runtime:	20 minutes

Meteoric Core

Coordinating Compounds

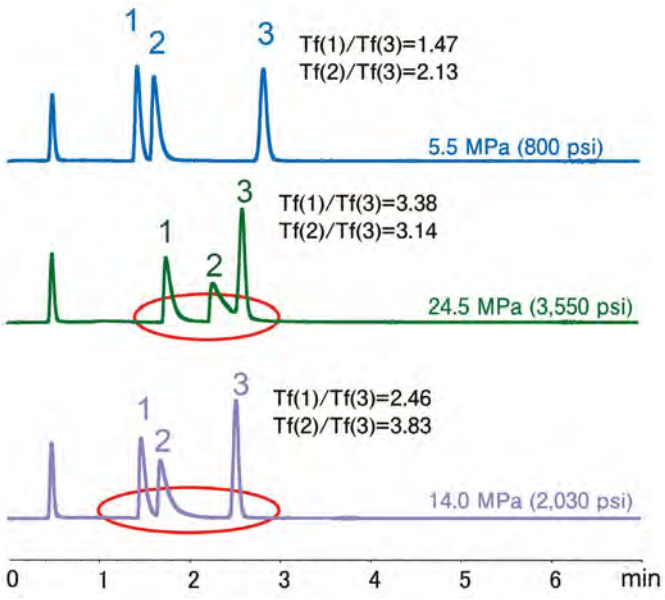




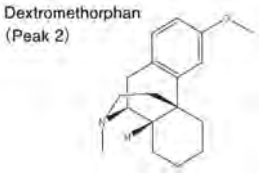
Column:	50 x 2.1 mm ID
Eluent:	acetonitrile / 0.1% phosphoric acid (40/60)
Flow rate:	0.2 mL/min
Temperature:	40 °C
Detection:	UV at 254 nm

Meteoric Core C18 is able to provide excellent peak shapes for coordinating compounds which are often adsorbed by a column, as a result of a strong interaction with impurities such as trace amounts of metal ions. Meteoric Core is suitable for the quantitative analysis of coordinating compounds.

Basic Compounds



1. Chlorpheniramine
2. Dextromethorphan
3. Propyl p-hydroxybenzoate (I.S.)



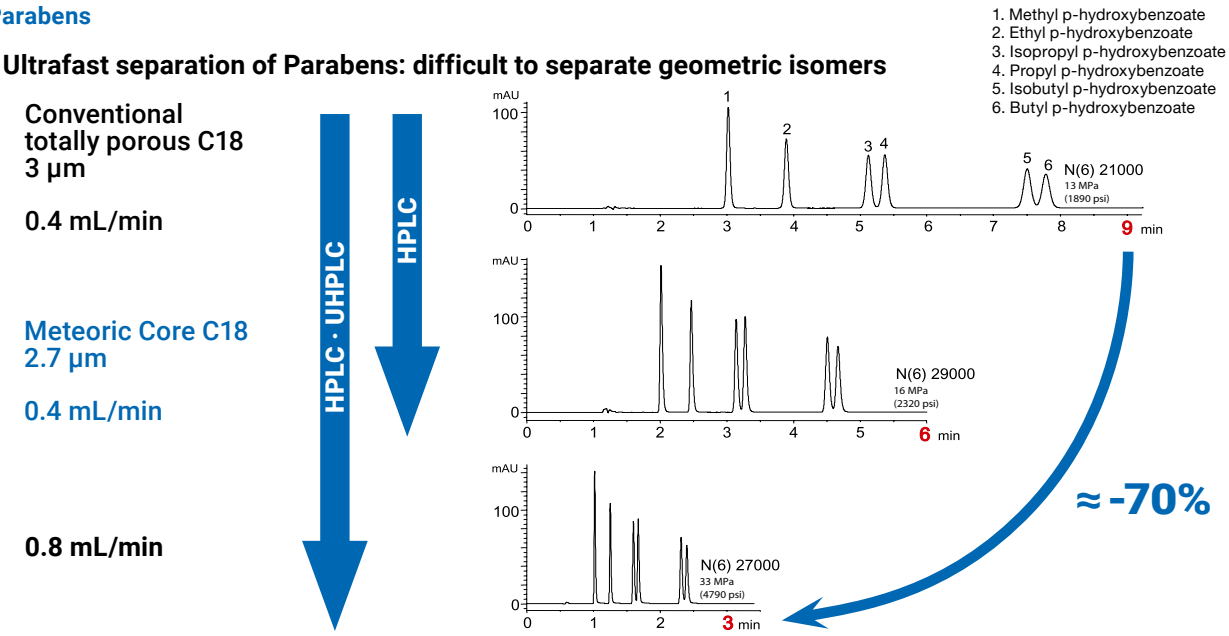
Column:	50 x 2.1 mm ID
Eluent:	20 mM KH_2PO_4-K_2HPO_4 (pH 6.9) / acetonitrile (65/35)
Flow rate:	0.2 mL/min
Temperature:	40 °C
Detection:	UV at 235 n

Meteoric Core C18 columns are high resolution columns which provide excellent peak shapes for basic compounds compared to competitors' sub-2 µm core-shell columns. Chromatographers can expect ultrafast analysis of basic compounds with highly quantitative and sensitive analysis when using Meteoric Core C18.

Meteoric Core

Parabens

Ultrafast separation of Parabens: difficult to separate geometric isomers

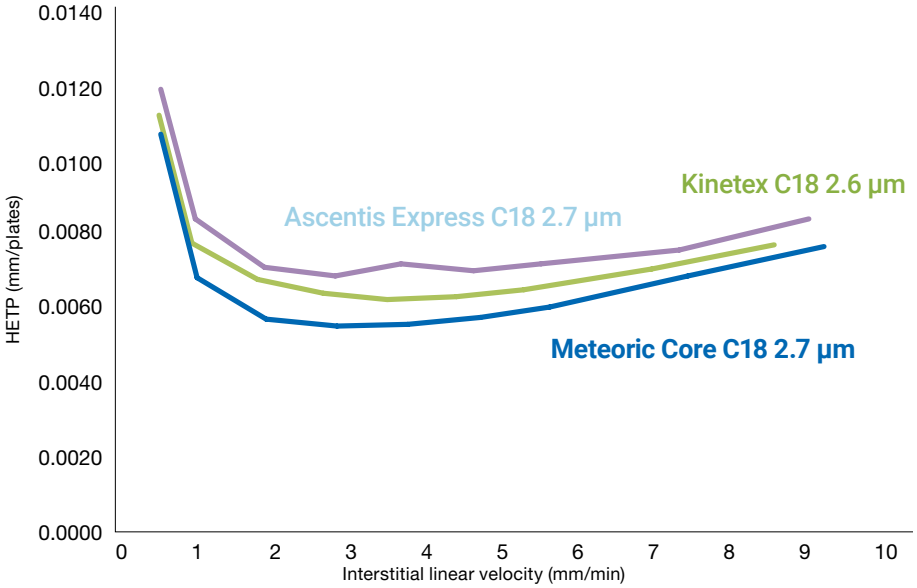


Column: 150 x 3.0 mm ID
Eluent: acetonitrile / water (50/50)
Temperature: 30 °C
Detection: UV at 270 nm

Meteoric Core C18 can shorten the analysis time by two thirds compared to a conventional totally porous C18 column with the same column dimensions and under the same analytical conditions. In addition, it maintains the same efficiency at double the flow rate. This allows a further decrease in analysis time by one third without loss of resolution, and at an operating pressure of less than 5,000 psi.

QC-Data

Correlation between linear velocity and column efficiency

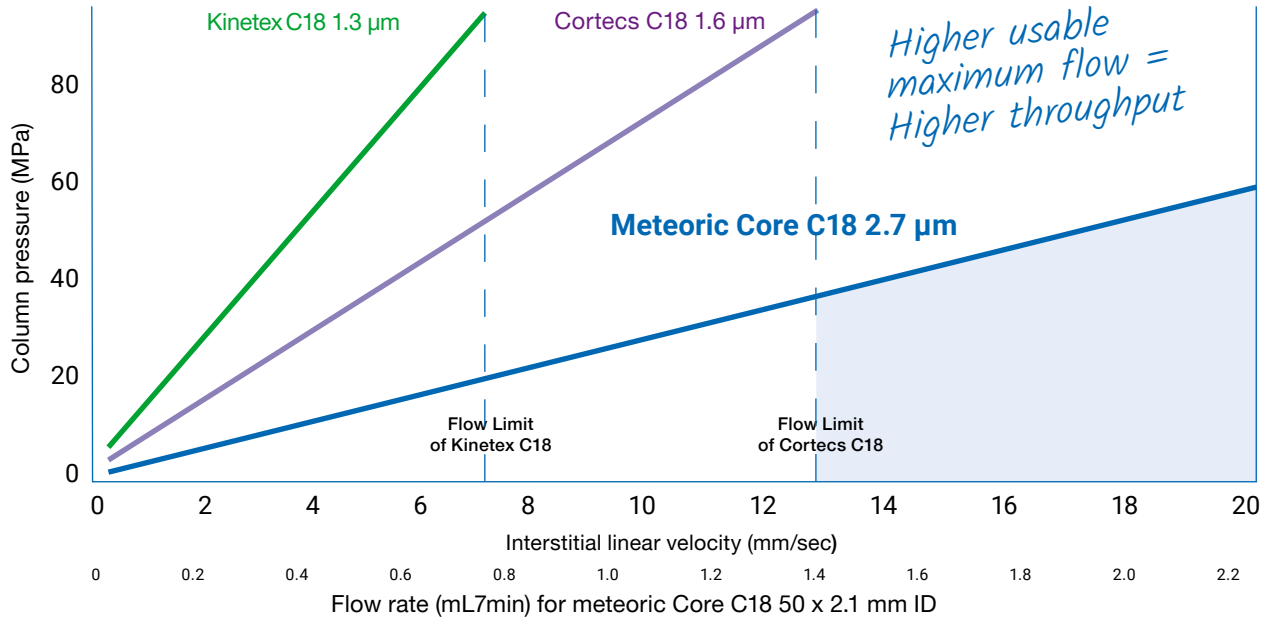


Column: 50 x 2.0 or 2.1 mm ID
Eluent: acetonitrile / water (60/40)
Temperature: 25 °C
Sample: butyl benzoate
Detection: UV at 270 nm

Meteoric Core C18 shows outstanding column efficiencies over a wide flow range.

QC-Data

Lower backpressure enables higher throughput

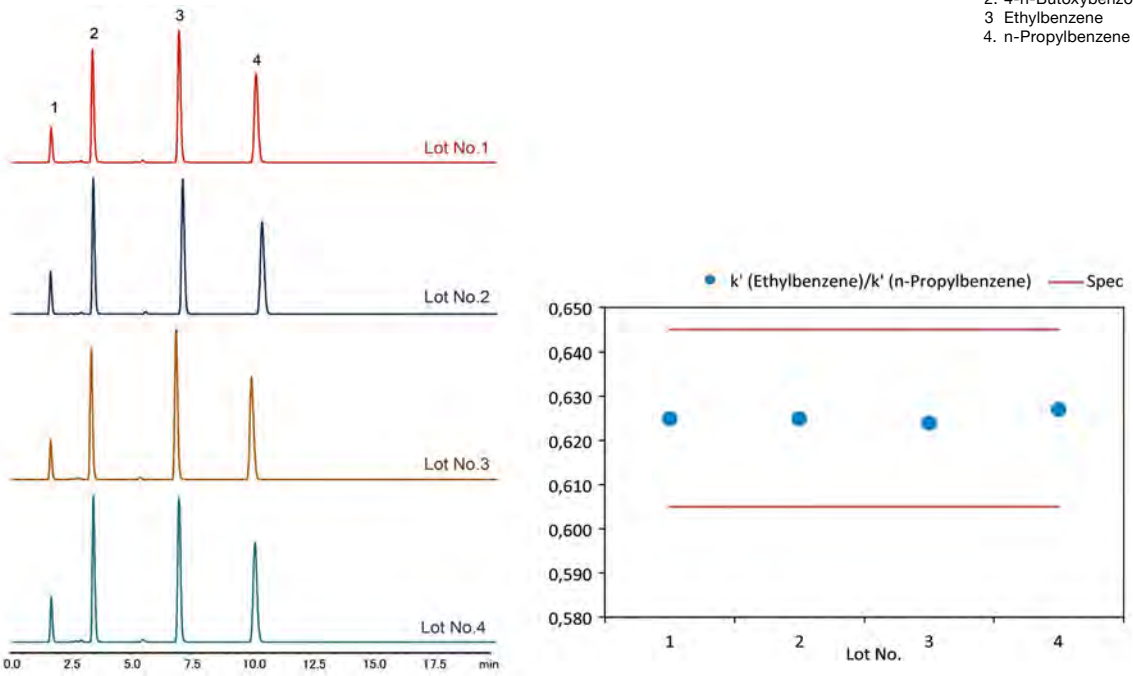


Column:	50 x 2.0 or 2.1 mm ID
Eluent:	acetonitrile / water (60/40)
Temperature:	25 °C
Sample:	butyl benzoate
Detection:	UV at 270 nm

The operating pressure of Meteoric Core is one half to one fifth of sub-2 µm Core-Shell type columns. High throughput analysis using Meteroric Core could be expected even with longer length columns since the usable maximum flow rate is higher than that of competitors' sub-2 µm Core-Shell products.

Batch-to-batch reproducibility

1. Uracil
2. 4-n-Butoxybenzoic acid
3 Ethylbenzene
4. n-Propylbenzene



Column:	Meteoric Core C18 (2.7 µm) 150 x 3.0 mm ID	Temperature:	37 °C
Part No.:	CAS08SQ7-1503PT	Detection:	UV at 254 nm
Eluent:	20 mM KH_2PO_4-H_3PO_4 (pH 3.5) / acetonitrile (40/60)		
Flow rate:	0.4 mL/min		

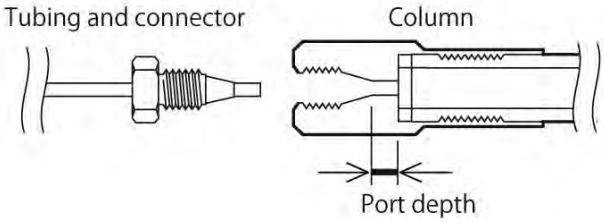
Ordering Information

2.7 µm (U)HPLC columns

Phase	Column ID [mm]	Column length (mm)					Precolumn filter* 0.5 µm
		30	50	75	100	150	(pack of 3)
Meteoric Core C18	2.1 3.0 4.6	CAS08SQ7-03Q1PT CAS08SQ7-0303PT CAS08SQ7-0346PT	CAS08SQ7-05Q1PT CAS08SQ7-0503PT CAS08SQ7-0546PT	CAS08SQ7-L5Q1PT CAS08SQ7-L503PT CAS08SQ7-L546PT	CAS08SQ7-10Q1PT CAS08SQ7-1003PT CAS08SQ7-1046PT	CAS08SQ7-15Q1PT CAS08SQ7-1503PT CAS08SQ7-1546PT	XRPRCS35
Meteoric Core C18 BIO	2.1 3.0 4.6	CAW16SQ7-03Q1PT CAW16SQ7-0303PT CAW16SQ7-0346PT	CAW16SQ7-05Q1PT CAW16SQ7-0503PT CAW16SQ7-0546PT	CAW16SQ7-L5Q1PT CAW16SQ7-L503PT CAW16SQ7-L546PT	CAW16SQ7-10Q1PT CAW16SQ7-1003PT CAW16SQ7-1046PT	CAW16SQ7-15Q1PT CAW16SQ7-1503PT CAW16SQ7-1546PT	
Meteoric Core C8	2.1 3.0 4.6	COS08SQ7-03Q1PT COS08SQ7-0303PT COS08SQ7-0346PT	COS08SQ7-05Q1PT COS08SQ7-0503PT COS08SQ7-0546PT	COS08SQ7-L5Q1PT COS08SQ7-L503PT COS08SQ7-L546PT	COS08SQ7-10Q1PT COS08SQ7-1003PT COS08SQ7-1046PT	COS08SQ7-15Q1PT COS08SQ7-1503PT COS08SQ7-1546PT	

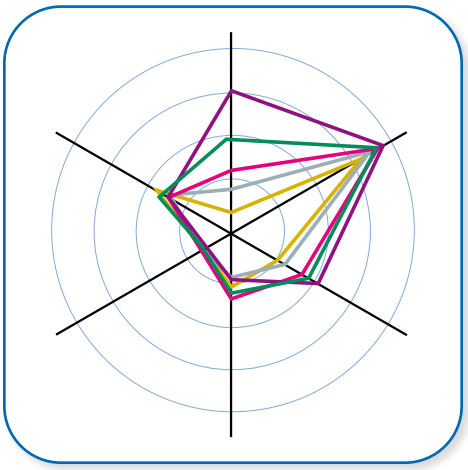
*Holder required, part no. XRPRCS03

Column end fitting and column connections

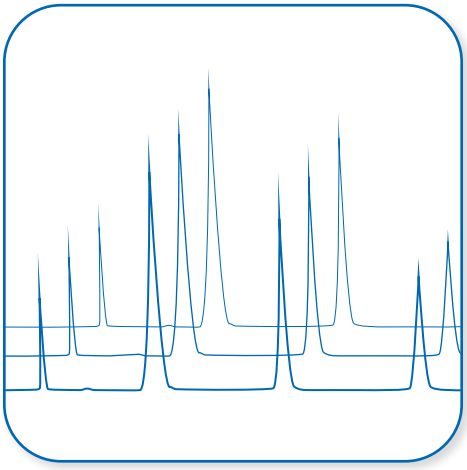


The end of the product number	Port depth	Style of endfitting
PT	2 mm	UPLC compatible (Parker) style

UPLC is a registered trademark of Waters Corporation.



YMC
*Pro*Family



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YMC-Pack *Pro* C8.....36–37

YMC-Pack *Pro* C4.....38–39

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Hydrosphere C18..... 44–45

Ultra Fast LC Columns.....46–51

Ordering Information.....52–53

YMC *Pro*Family

- ***YMC-Pack ProFamily based on ultra high purity silica***
- ***Hydrosphere C18 for stability in aqueous mobile phases***
- ***every packed column supplied with:***
  - *lot certificate*
  - *test chromatogram*

Specifications	*Pro* C18	*Pro* C8	*Pro* C4	*Pro* C18 RS	Hydrosphere C18
Particle size / µm	2; 3; 5	3; 5	3; 5	3; 5	2; 3; 5
Pore size / nm	12	12	12	8	12
Surface area / m^2g^{-1}	330	330	330	510	330
Carbon content / %	16	10	7	22	12
pH range	2.0 – 8.0	2.0 – 7.5	2.0 – 7.5	1.0 – 10.0	2.0 – 8.0
Metal content	(Randomly selected lots)				
Al / ppm	0.3	0.2	0.6	0.3	0.7
Fe / ppm	2.8	2.5	2.9	0.1	1.2
Na / ppm	0.3	1.4	1.0	1.3	0.7
Ti / ppm	0.1	0.1	0.1	0.1	0.1

YMC *Pro*Family

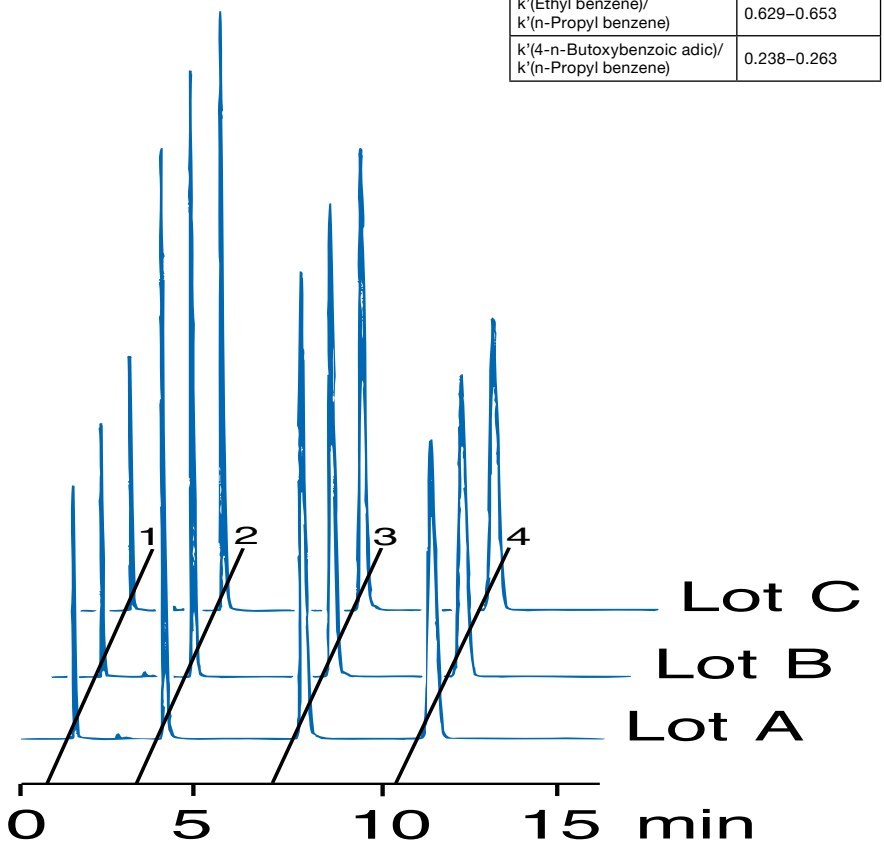
Properties

Strict quality control is enforced during the manufacturing of the underlying silica, bonding of the stationary phase, endcapping and column packing operations to supply high performance columns of high reproducible quality over a long period of time.

Lot-to-lot reproducibility of YMC-Pack Pro C18

1. Uracil
2. 4-n-Butoxybenzoic acid
3. Ethyl benzene
4. n-Propyl benzene

HPLC-Test A	Specification
k'(Ethyl benzene)/ k'(n-Propyl benzene)	0.629–0.653
k'(4-n-Butoxybenzoic adic)/ k'(n-Propyl benzene)	0.238–0.263



HPLC Test A
Column: 150 x 4.6 mm ID
Eluent: 20 mM KH_2PO_4-H_3PO_4 (pH 3.5) / acetonitrile (40/60, v/v)
Flow rate: 1.0 mL/min
Detection: UV at 254nm
Temperature: 37 °C

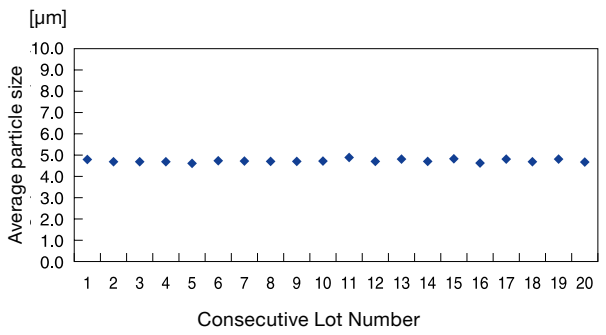
YMC *Pro*Family

Underlying silica gel support

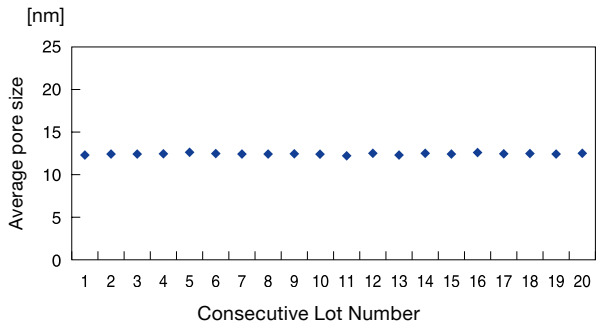
The physical properties of silica gel have a great effect on the selectivity and performance of the bonded packing. For the purpose of supplying columns of stable quality, the physical properties of silica gel used for packing such as particle size, pore size, specific surface area, pore volume and amount of metal contamination have to be strictly controlled.

Physical properties (*Pro* C18, 5 µm, 12 nm)

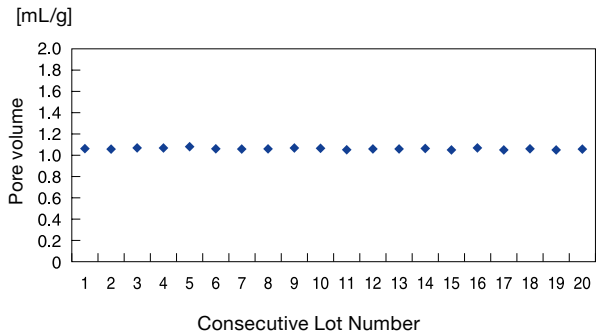
Particle size



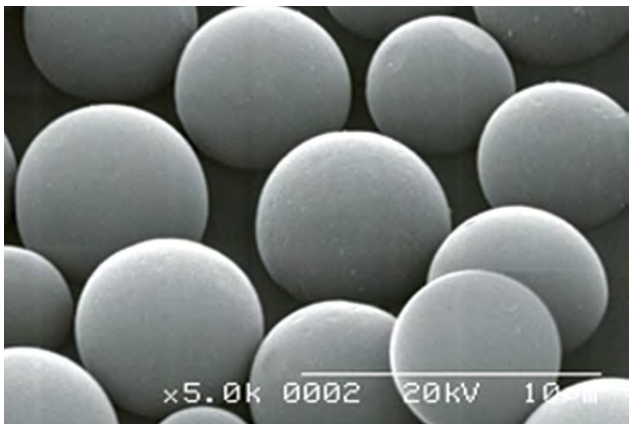
Pore size



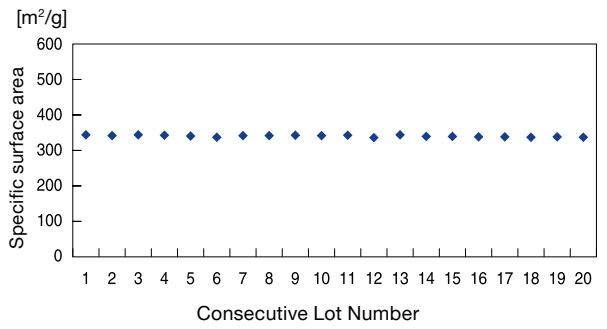
Pore volume



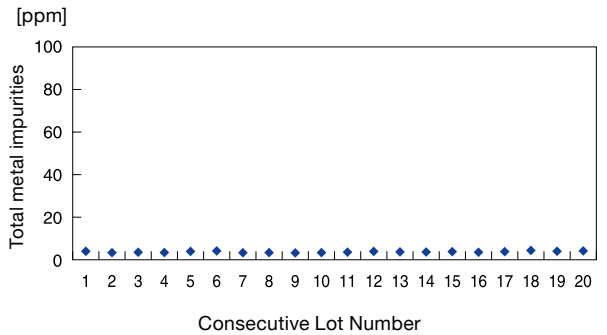
Silica Support Material (5 µm, 12 nm)



Specific surface area



Amount of metal content



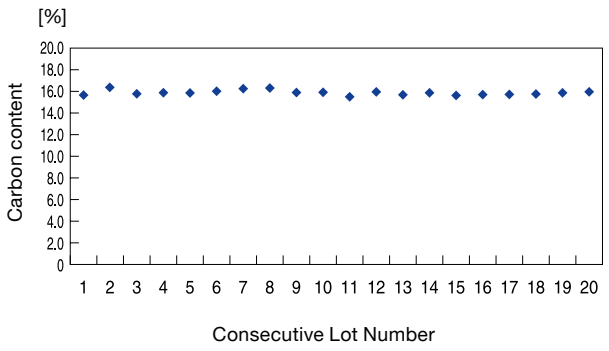
YMC *Pro*Family

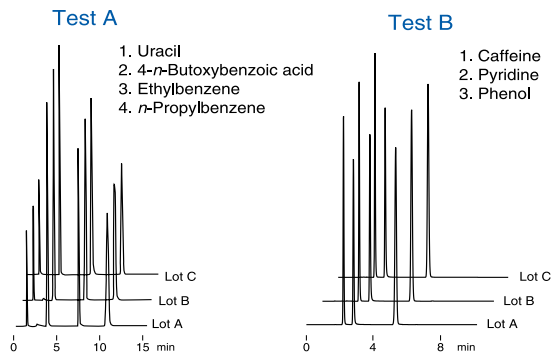
Packing material

Excellent reproducibility of the Pro C18 is shown not only in the separation of hydrophobic compounds but also in that of hydrophilic, basic, and acidic compounds.

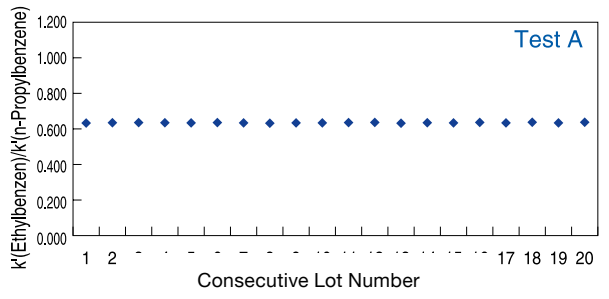
Pro C18 5 µm, Reproducibility between batches

Percent Carbon Content

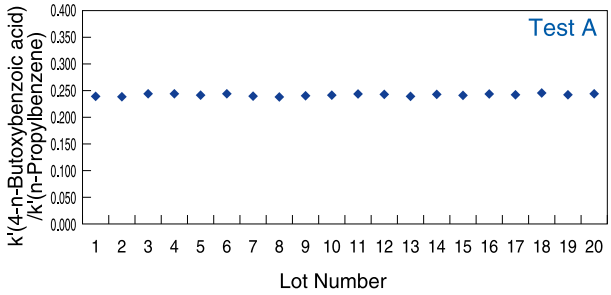




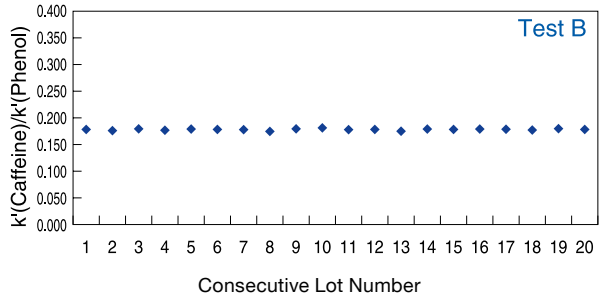
Hydrophobicity



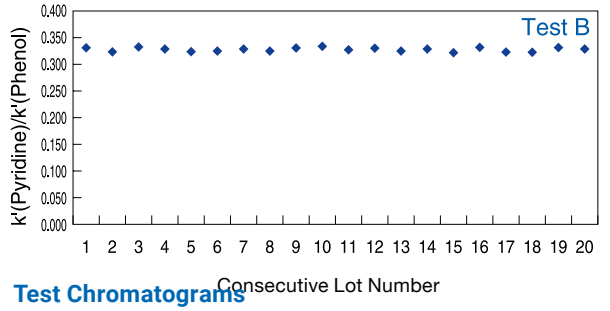
Acidic compounds



Hydrogen bonding ability



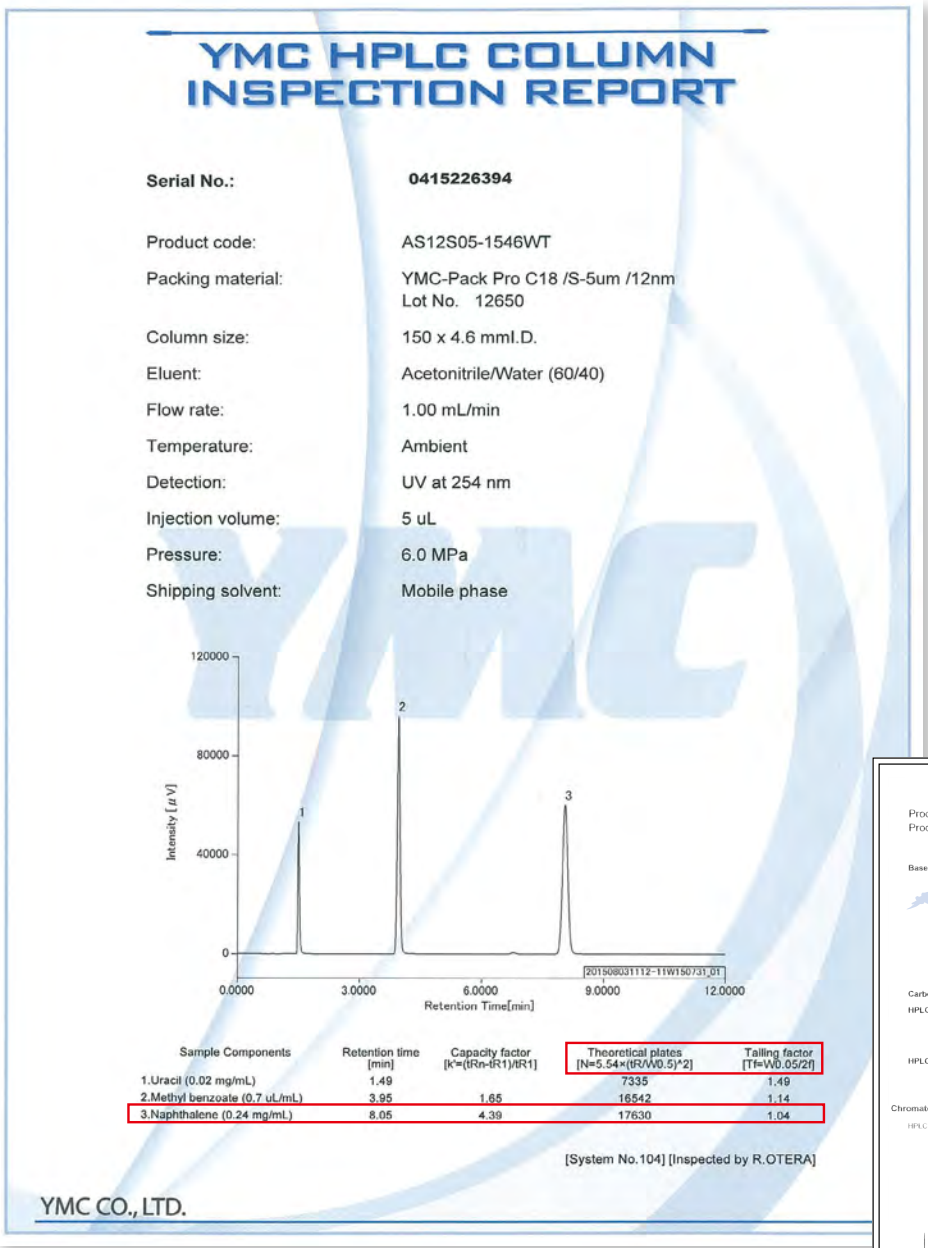
Basic compounds



Test Chromatograms

YMC *Pro*Family

Individual Column Test



YMC HPLC COLUMN INSPECTION REPORT

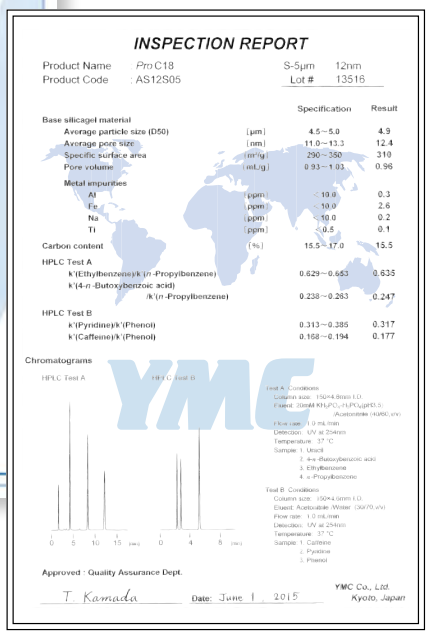
Serial No.:	0415226394
Product code:	AS12S05-1546WT
Packing material:	YMC-Pack Pro C18 /S-5um /12nm Lot No. 12650
Column size:	150 x 4.6 mmI.D.
Eluent:	Acetonitrile/Water (60/40)
Flow rate:	1.00 mL/min
Temperature:	Ambient
Detection:	UV at 254 nm
Injection volume:	5 uL
Pressure:	6.0 MPa
Shipping solvent:	Mobile phase

Sample Components	Retention time [min]	Capacity factor [k'=(tRn-tR1)/tR1]	Theoretical plates [N=5.54×(tR/W0.5)^2]	Tailing factor [Tf=W0.05/2f]
1.Uracil (0.02 mg/mL)	1.49		7335	1.49
2.Methyl benzoate (0.7 uL/mL)	3.95	1.65	16542	1.14
3.Naphthalene (0.24 mg/mL)	8.05	4.39	17630	1.04

[System No.104] [Inspected by R.OTERA]

YMC CO., LTD.

Individual Lot Test



INSPECTION REPORT

Product Name Pro C18 S-5μm 12nm
Product Code : AS12S05 Lot # 13516

		Specification	Result
Base silicagel material			
Average particle size (D50)	[μm]	4.5 ~ 5.0	4.9
Average pore size	[nm]	11.0 ~ 13.3	12.4
Specific surface area	[m²/g]	290 ~ 350	310
Pore volume	[mL/g]	0.93 ~ 1.03	0.96
Metal impurities			
Al	[ppm]	≤ 10.0	0.3
Fe	[ppm]	≤ 10.0	2.6
Na	[ppm]	≤ 10.0	0.2
Ti	[ppm]	≤ 0.5	0.1
Carbon content	[%]	15.5 ~ 17.0	15.5
HPLC Test A			
k'(Ethylbenzene)/k'(n-Propylbenzene)		0.629 ~ 0.653	0.635
k'(4-n-Butoxybenzoic acid) /k'(n-Propylbenzene)		0.238 ~ 0.263	0.247
HPLC Test B			
k'(Pyridine)/k'(Phenol)		0.313 ~ 0.385	0.317
k'(Caffeine)/k'(Phenol)		0.168 ~ 0.194	0.177

Chromatograms

Approved : Quality Assurance Dept.

T. Kamada Date: June 1, 2015

YMC Co., Ltd. Kyoto, Japan

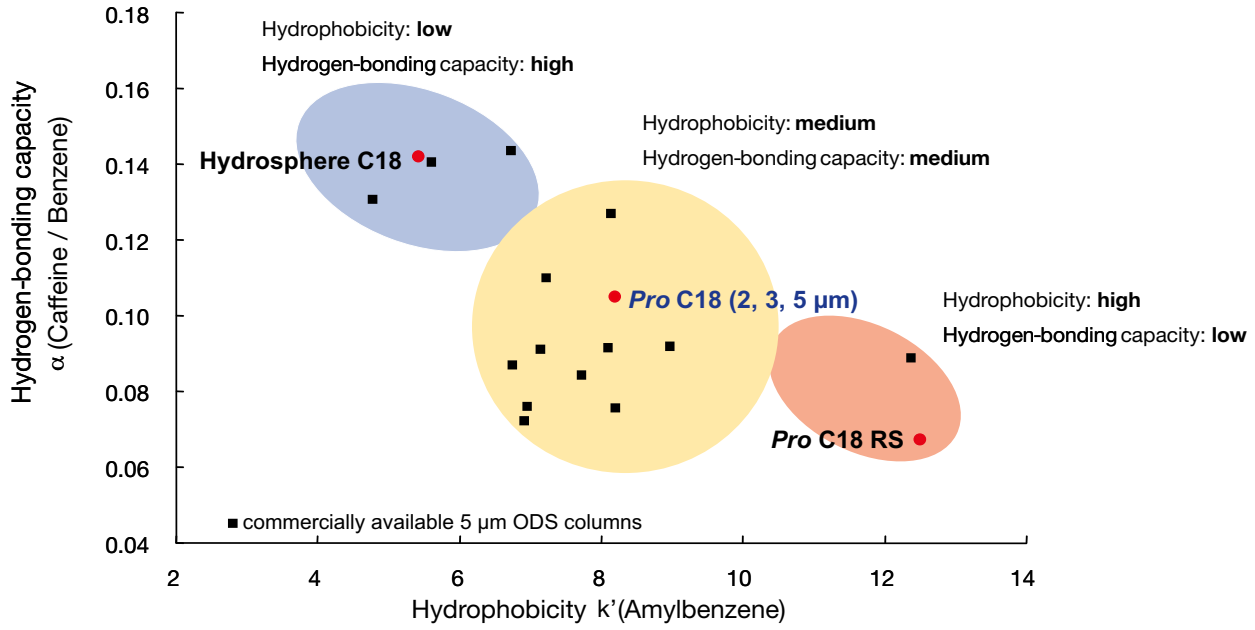
Indicates the efficiency of the column retention characteristics and symmetry of the test peaks.

To give our customers an insight into the strict criteria with regard to the silica base, the bonded final product and the reproducible chromatographic behaviour, each column of the ProFamily is supplied with a lot inspection report and an individual column test chromatogram. The first report illustrates the narrow window for physical parameters such as particle size distribution or surface area and the reproducibility of chemical properties. The test chromatogram illustrates the efficiency of the column with a guaranteed minimum performance of 100,000 theoretical plates for 150 and 250 x 4.6 mm ID and a tailing factor of 0.90 to 1.15 (at 5% peak height for 5 µm particle size).

YMC *Pro*Family

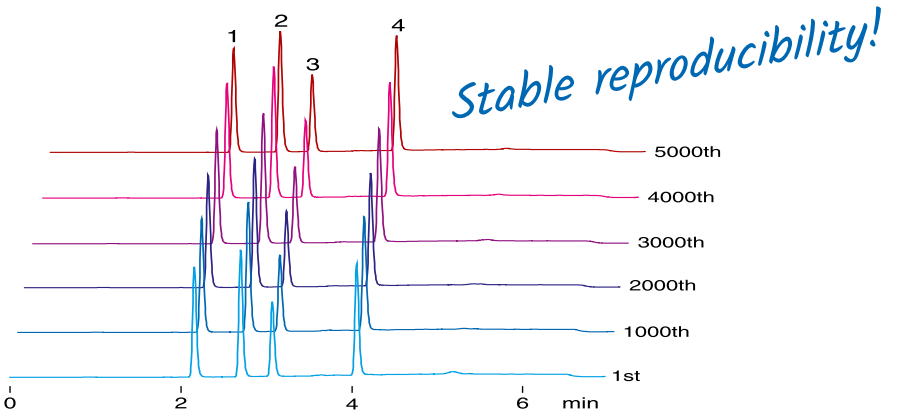
Comparison of separative selectivity

The selectivity characteristics of each column are shown using hydrophobicity and hydrogen-bonding ability as indicators. The *Pro*Family series of ODS phases is designed to make Hydrosphere C18 and YMC-Pack *Pro* C18 RS have contrasting separation characteristics, with standard YMC-Pack *Pro* C18 in between. Also, *Pro* C8 and C4 have different selectivity from the ODS phases. By choosing one from these 5 types of columns, one can easily optimise the separation of polar and non-polar compounds.

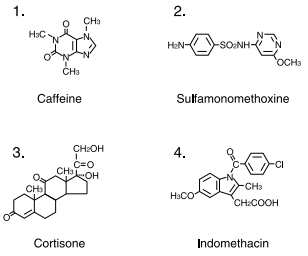


Stability for repetitive analysis

The long-term stability of a YMC-Pack *Pro* C18 (3 µm) short column used in repeated analysis is shown below. There is no change found in the separation of all compounds after 5000 injections (8 hours/day for 5 months) during gradient analysis.



	tR(4)	N(4)	Rs(4-3)
1st	4.06	37700	11.86
1000th	4.05	37600	11.85
2000th	4.05	37600	11.84
3000th	4.05	37600	11.84
4000th	4.06	37800	11.84
5000th	4.06	37800	11.86



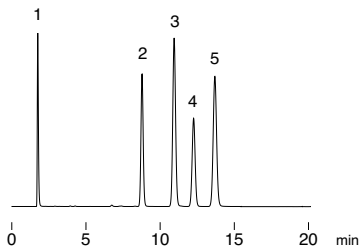
Column: YMC-Pack *Pro* C18 (3 µm, 12 nm) 50 x 4.6 mm ID
Eluent: A) water / formic acid /100/0.05)
B) acetonitrile / formic acid (100/0.05)
10-90% B (0-3 min, linear), 90% B (3-5 min), 10% B (5-9 min)
Flow rate: 1.0 mL/min
Temperature: 37 °C
Detection: UV at 254 nm

YMC *Pro*Family

Hydrophobicity and steric selectivity

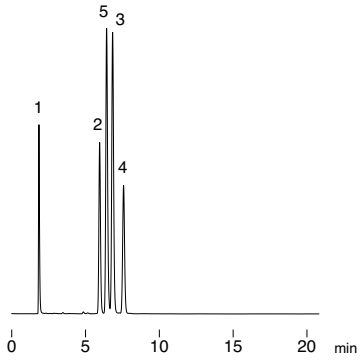
This comparison shows the different properties of the *Pro*Family members giving a good indication on their potential for method development. The compounds 1. uracil (dead volume marker) 2. n-butylbenzene 3. o-terphenyl 4. n-amylbenzene and 5. triphenylene are used to determine the hydrophobicity (2. and 4.) and the steric selectivity (3. and. 5.) of each *Pro*Family member under unbuffered chromatographic conditions.

YMC-Pack Pro C18



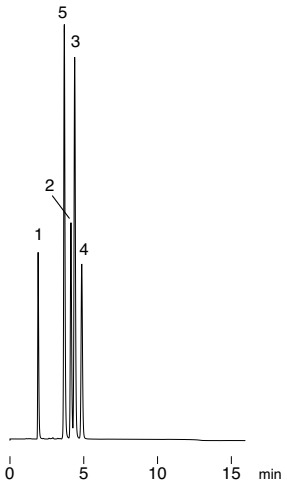
balanced hydrogen bonding, capacity and hydrophobicity

YMC-Pack Pro C8



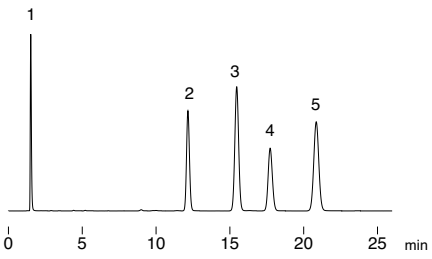
lower hydrophobicity

YMC-Pack Pro C4



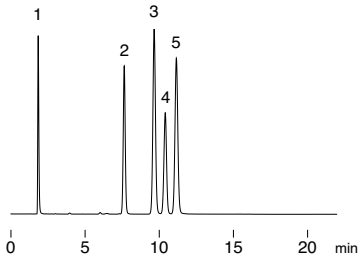
lowest hydrophobicity

YMC-Pack Pro C18 RS



highest carbon load

Hydrosphere C18



high polar recognition

Column:	150 x 4.6 mm ID
Eluent:	methanol / water (80/20)
Flow rate:	1.0 mL/min
Temperature:	37° C
Detection:	UV at 254 nm

1. Uracil
2. *n*-Butylbenzene
3. *o*-Terphenyl
4. *n*-Amylbenzene
5. Triphenylene

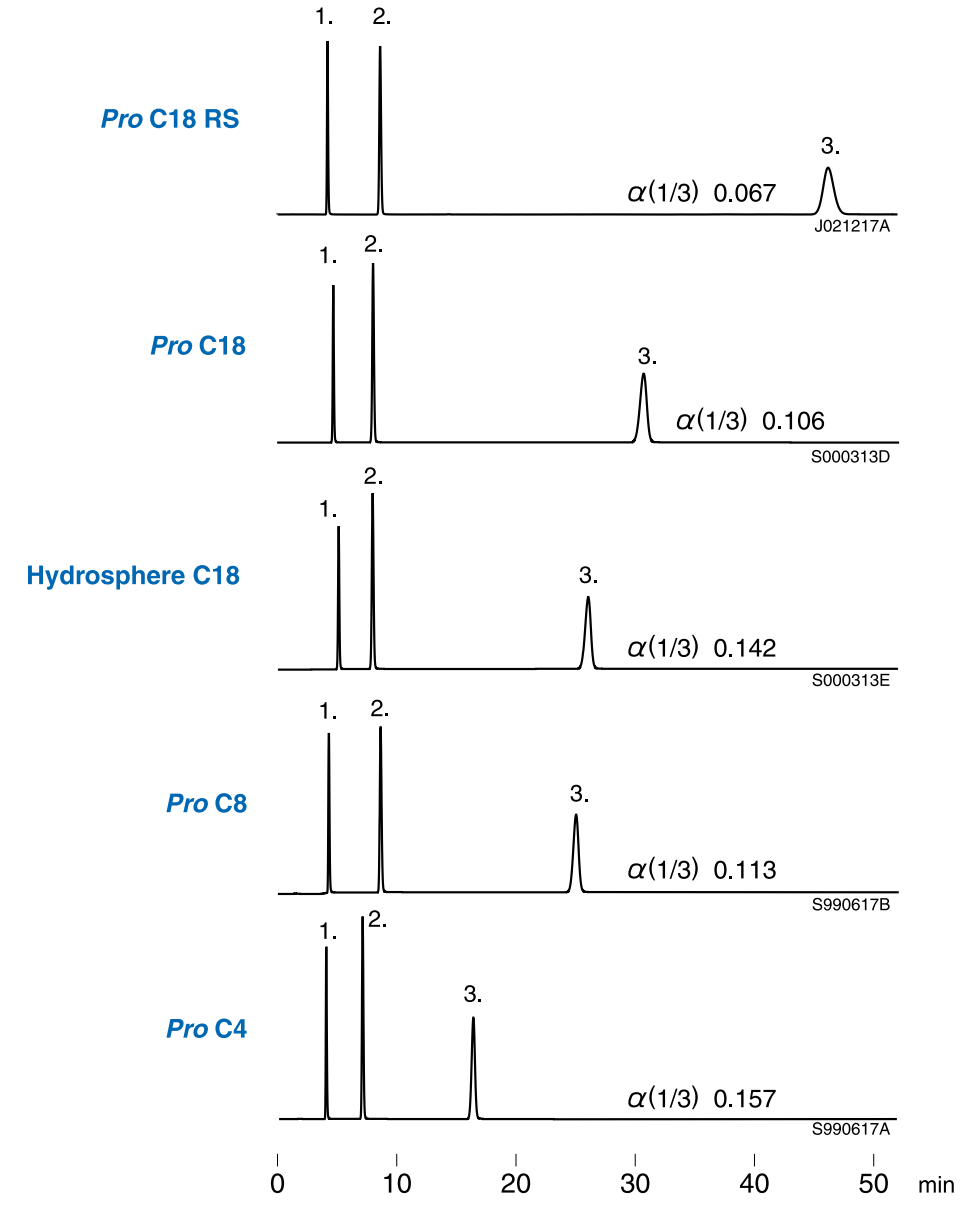
The whole *Pro*Family covers a large area of hydrophobicity and steric selectivity, as presented in this comparison, which offers the opportunity to accomplish optimisation of chromatographic methods even for complicated separation problems.

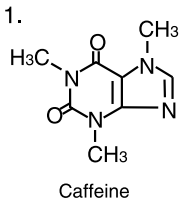
YMC *Pro*Family

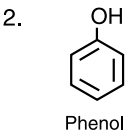
Hydrogen bonding capacity

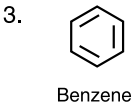
Hydrogen bonding capacity is evaluated by examining the relative retention coefficient as a (caffeine/benzene). Among the *Pro*Family series both Hydrosphere C18, with low density of C18, and YMC-Pack *Pro* C4, with short alkyl chain, have high hydrogen-bonding capacity. Benzene with non-polar groups is retained according to hydrophobicity of the packing, while retention of caffeine and phenol (hydrophilic compounds), is greatly affected by hydrogen-bonding capacity, and these packings have similar retention time, but show different selectivity.

Hydrogen bonding capacity









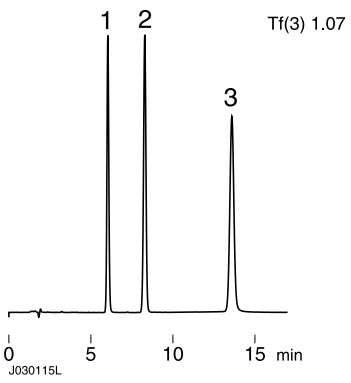
Column: 150 x 4.6 mm ID
Eluent: methanol / water (30/70)
Flow rate: 1.0 mL/min
Temperature: 37° C
Detection: UV at 254 nm

YMC *Pro*Family

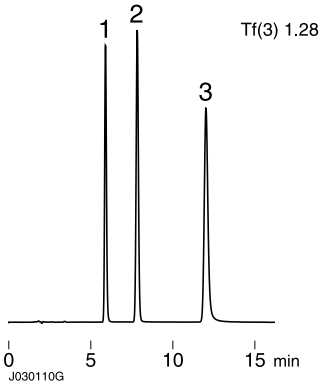
Acidic and basic compounds

Acidic compounds

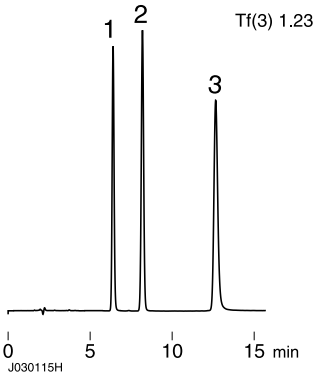
Pro C18 RS



Pro C18



Hydrosphere C18

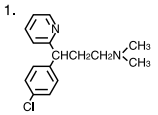


Column: 150 x 4.6 mm ID
Eluent: 20 mM CH_3COONa-CH_3COOH (pH 4.4) / acetonitrile (80/20)
Flow rate: 1.0 mL/min
Temperature: 37° C
Detection: UV at 230 nm

1. p-Hydroxyacetophenone (I.S.)
2. Sorbic acid
3. Dehydroacetic acid

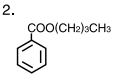
Basic compounds

1.



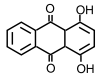
Chlorpheniramine

2.



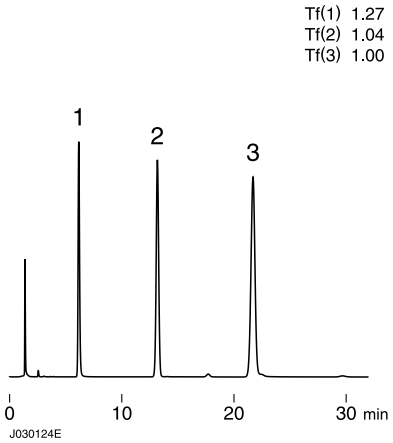
n-Butylbenzoate (I.S.)

3.

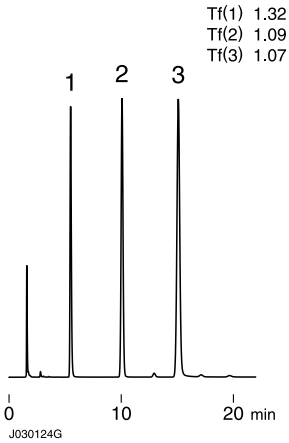


Quinizarin

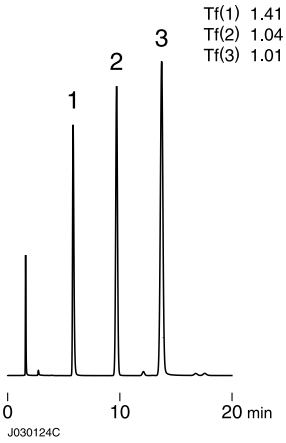
Pro C18 RS



Pro C18



Hydrosphere C18



Column: 150 x 4.6 mm ID
Eluent: 20 mM KH_2PO_4-K_2HPO_4 (pH 6.9) / methanol (30/70)
Flow rate: 1.0 mL/min
Temperature: 37° C
Detection: UV at 254 nm

YMC-Pack *Pro* C18

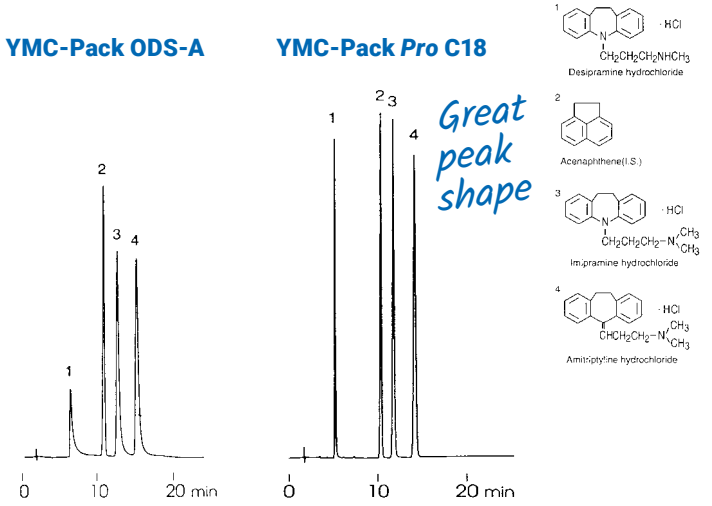
- ***specifically designed for pharmaceutical and biotechnical R&D***
- ***extreme narrow specifications***
- ***high lot-to-lot reproducibility***
- ***high column-to-column reproducibility***
- ***ideal for basic, acidic and polar compounds***

Specifications	YMC-Pack *Pro* C18
Particle size / µm	2; 3; 5
Pore size / nm	12
Surface area / m^2g^{-1}	330
Carbon content / %	16
Recommended pH range	2.0 – 8.0

Properties

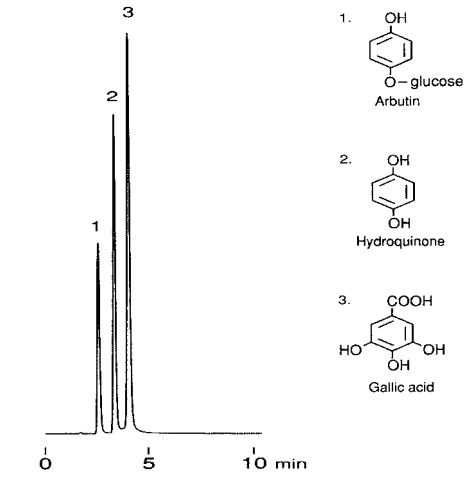
YMC-Pack *Pro* C18 is based on an ultra pure silica support, which is used for the whole *Pro*Family. Due to a proprietary endcapping process especially designed for this type of silica, YMC-Pack *Pro* C18 is perfectly suitable for the separation of acidic and basic molecules. The inertness of the silica makes it an excellent choice for the analysis of drugs or metabolites, compounds that are susceptible to polar interactions with residual silanol groups and metal impurities as demonstrated in the following comparison. The extreme basic substances are selected to prove the very good performance of YMC-Pack *Pro* C18 in regard to their separation and the peak performance that cannot be achieved with classical materials.

Basic compounds: Tricyclic antidepressants



Column: YMC-Pack *Pro* C18 (5 µm, 12 nm) 150 x 4.6 mm ID
Eluent: 20 mM potassium phosphate buffer (pH 6.9) / methanol (25/75)
Flow rate: 1.0 mL/min
Temperature: 37°C
Detection: UV at 254 nm

LC-MS compatible separations



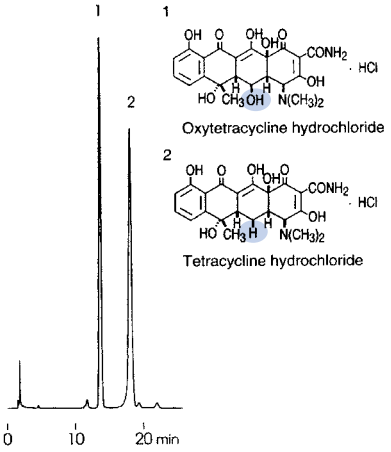
Column: YMC-Pack *Pro* C18 (3 µm, 12 nm) 50 x 2.0 mm ID
Eluent: 10 mM CH_3COONH_4 / methanol (45/55)
Flow rate: 0.2 mL/min
Temperature: 37° C
Detection: UV at 254 nm

YMC-Pack *Pro* C18

Applications

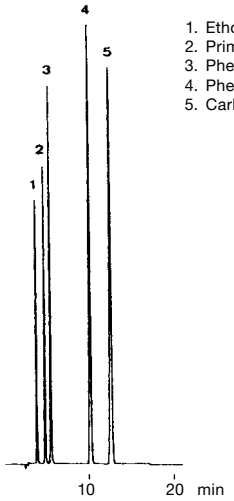
This small collection of applications can only give a brief insight into the multiple applications for *Pro* C18.

Tetracycline antibiotics



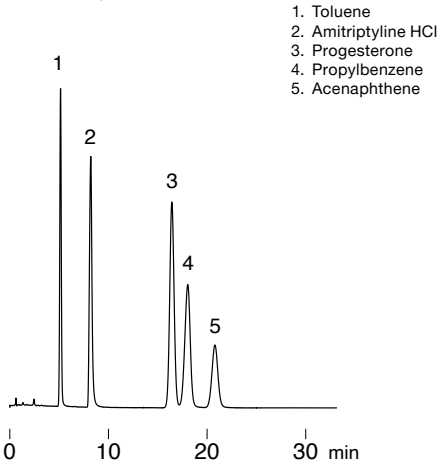
Column:	YMC-Pack *Pro* C18 (5 µm, 12 nm) 150 x 4.6 mm ID
Part No.:	AS12S05-1546WT
Eluent:	acetonitrile / 10 mM oxalic acid (10/90)
Flow:	1.0 mL/min
Detection:	UV at 280 nm, 0.13 AUFS
Temperature:	37 °C
Injection:	6 µL (0.2 mg/mL)

Antiepileptics



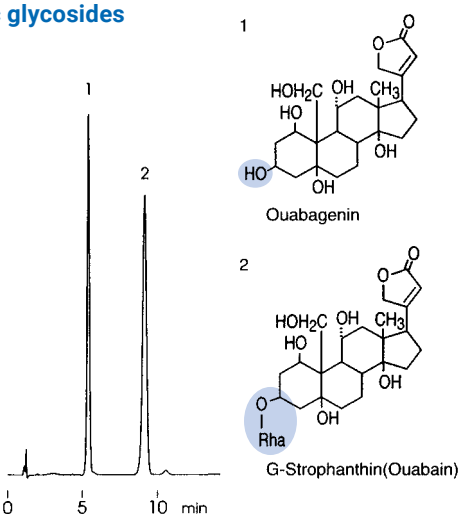
Column:	YMC-Pack *Pro* C18 (5 µm, 12 nm) 150 x 4.6 mm ID
Part No.:	AS12S05-1546WT
Eluent:	50 mM $NH_4H_2PO_4$-$(NH_4)_2HPO_4$ (pH 6.7) / methanol (50/50)
Flow:	0.7 mL/min
Detection:	UV at 215 nm, 0.32 AUFS
Temperature:	37 °C
Injection:	8 µL (0.035 p 0.7 mg/mL)

Baseline separation of compounds with different polarity



Column:	YMC-Pack *Pro* C18 (3 µm, 12 nm) 75 x 2.0 mm ID
Part No.:	AS12S03-L502WT
Eluent:	methanol / water / TFA (5/95/0.5)
Flow:	0.2 mL/min
Detection:	UV at 280 nm, 0.16 AUFS
Temperature:	30 °C
Injection:	1 µL (0.2 – 0.5 mg/mL)

Cardiac glycosides



Column:	YMC-Pack *Pro* C18 (5 µm, 12 nm) 75 x 4.6 mm ID
Part No.:	AS12S05-L546WT
Eluent:	acetonitrile / water (10/90)
Flow:	1.0 mL/min
Detection:	UV at 220 nm, 0.26 AUFS
Temperature:	37 °C
Injection:	5 µL (0.2, 0.4 mg/mL)

For more applications please refer to our "Application Data Collections" or contact us directly.

Column Care

YMC Pack *Pro* C18 is stable towards hydrolysis between pH 2.0-8.0. Remove acid and buffer salts before storage. Store the column in methanol / water = 70/30. For detailed information please refer to the "Column Care and Use Instructions" which can be downloaded from www.ymc.eu/download-library.html.

YMC-Pack *Pro* C8

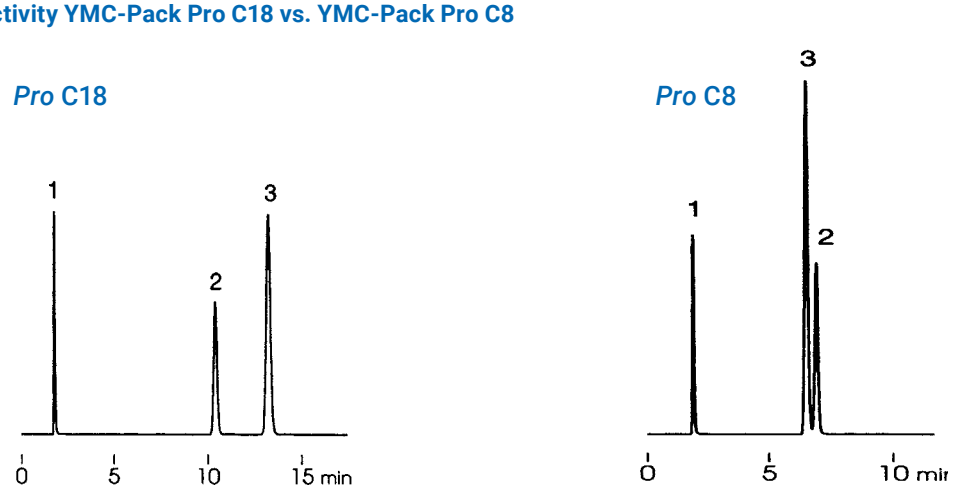
- ***extremely broad selectivity pattern***
- ***good alternative to C18 phases***
- ***suitable for all types of organic molecules, especially basic pharmaceuticals***

Specifications	YMC-Pack *Pro* C8
Particle size / µm	3; 5
Pore size / nm	12
Surface area / m^2g^{-1}	330
Carbon content / %	10
Recommended pH range	2.0 – 7.5

General

Within the *Pro*Family, the YMC-Pack *Pro* C8 provides an additional, less hydrophobic stationary phase for all types of compounds, but especially for basic and metal chelating substances. For many applications regarding the separation of peptides, nucleic acids and similar compounds with LC-MS detection, conventional C8-stationary phases require ion pair reagents and ion-suppression to obtain satisfactory separation and low detection limits. In contrast, *Pro* C8 with its ultra pure silica allows the analysis without these modifiers but still generates excellent chromatograms. In addition to the reduced hydrophobicity of YMC-Pack *Pro* C8 compared with YMC-Pack *Pro* C18, the different steric selectivity offers new possibilities in method optimisation as demonstrated in the figure below:

Steric selectivity YMC-Pack Pro C18 vs. YMC-Pack Pro C8



Column: 150 x 4.6 mm ID
Eluent: methanol / water (80/20)
Flow rate: 1.0 mL/min
Temperature: 37° C
Detection: UV at 254 nm

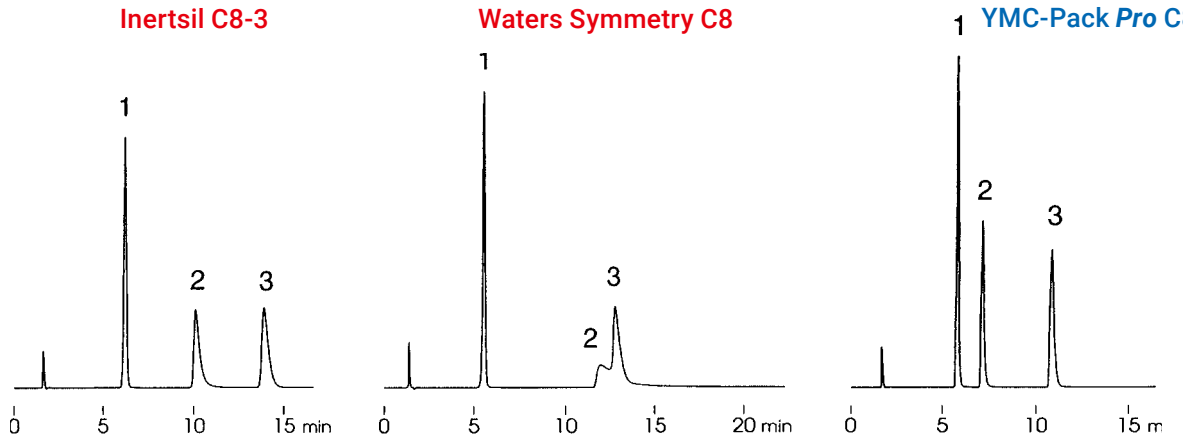
The reversed elution order of triphenylene and o-terphenyl for the shorter C8 chains of YMC-Pack *Pro* C8 illustrates the different steric recognition for steric-demanding substances.

YMC-Pack *Pro* C8

YMC-Pack *Pro* C8 is a member of the *Pro*Family and as a result gives excellent peak shapes even for basic substances, due to its low metal content and the endcapping procedure, which is identical to that used for YMC-Pack *Pro* C18. This shall be demonstrated in the comparison below where YMC-Pack *Pro* C8 outperforms competitive state of the art products.

Peak performance of YMC-Pack Pro C8 for basic substances, Histamine antagonists

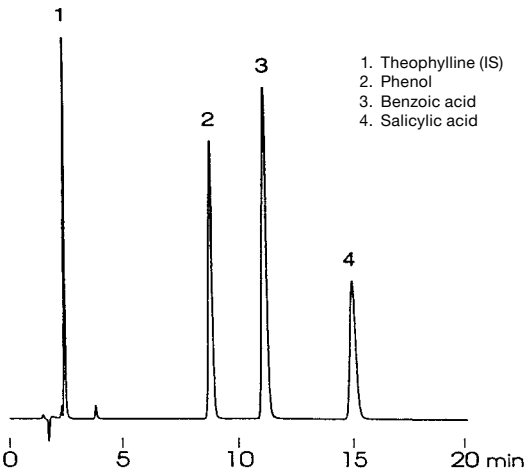
1. Butyl *p*-hydrosybenzoate (I.S.)
2. Chlorpheniramine maleate
3. Diphenhydramine hydrochloride



Column:	150 x 4.6 mm ID
Eluent:	20 mM KH_2PO_4-K_2HPO_4 (pH 6.9) / methanol (35/65)
Flow rate:	1.0 mL/min
Temperature:	37° C
Detection:	UV at 260 nm, 0.26 AUFS

No need for ion pair reagents, Disinfectants

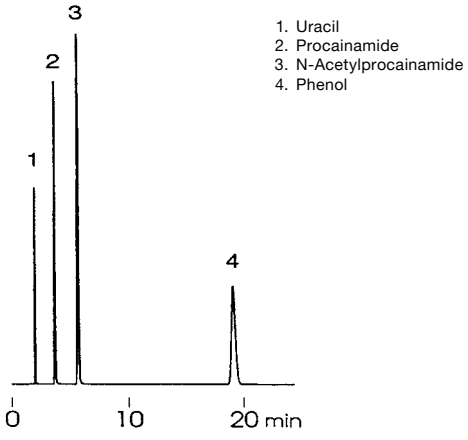
1. Theophylline (IS)
2. Phenol
3. Benzoic acid
4. Salicylic acid



Column:	YMC-Pack *Pro* C8 (5 µm, 12 nm) 150 x 4.6 mm ID
Part No.:	OS12S05-1546WT
Eluent:	acetonitrile / 20 mM H_3PO_4 (20/80)
Flow rate:	1.0 mL/min
Temperature:	37° C
Detection:	UV at 270 nm, 0.32 AUFS

Good peak performance for acidic and basic compounds

1. Uracil
2. Procainamide
3. N-Acetylprocainamide
4. Phenol



Column:	YMC-Pack *Pro* C8 (5 µm, 12 nm) 150 x 4.6 mm ID
Part No.:	OS12S05-1546WT
Eluent:	20 mM KH_2PO_4-K_2HPO_4 (pH 6.9) / acetonitrile (90/10)
Flow rate:	1.0 mL/min
Temperature:	37° C
Detection:	UV at 254 nm, 0.32 AUFS

Column Care

YMC-Pack *Pro* C8 is stable towards hydrolysis between pH 2.0-7.5. Remove acid and buffer salts before storage. Store the column in methanol / water = 70/30.
For detailed information please refer to the "Column Care and Use Instructions" which can be downloaded from www.ymc.eu/download-library.html.

YMC-Pack *Pro* C4

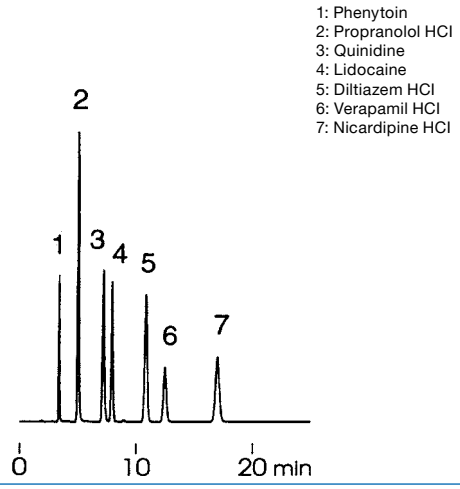
- ***proprietary endcapping in order to minimise the effect of residual silanols***
- ***for polar organic molecules, especially basic pharmaceuticals and peptides***
- ***ideal for fast chromatography***

Specifications	YMC-Pack *Pro* C4
Particle size / µm	3; 5
Pore size / nm	12
Surface area / m^2g^{-1}	330
Carbon content / %	7
Recommended pH range	2.0 – 7.5

General

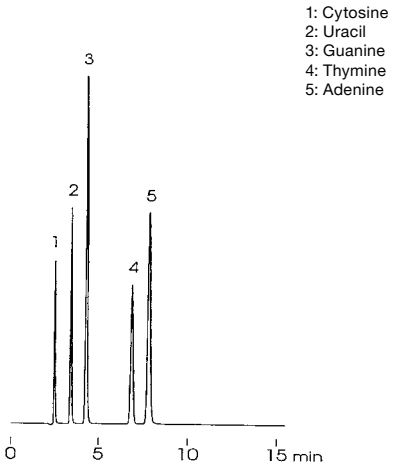
More than 80% of the reversed phase analyses are accomplished on octyl or octadecyl phases. Because of this overwhelming majority, many chromatographers neglect other selectivities that might be better suited to their separation, such as butyl phases. With *Pro* C4, YMC offers a stationary phase based on the well-known ultra pure silica of the *Pro*Family. Compared to a C18 phase with the same eluent, this less hydrophobic material gives shorter retention times for non-polar compounds while the retention time of polar analytes are virtually unaffected. This makes the *Pro* C4 an interesting alternative especially when short analysis times are required. For this reason, mixtures with a wide range of component polarity are best analysed by short chains, such as YMC-Pack *Pro* C4. Within the *Pro*Family, YMC-Pack *Pro* C4 is the selectivity of choice to reduce time of analysis in combination with the given advantages of the *Pro*Family, namely the high purity silica support and the low metal content, which result in excellent peak performance as below.

Efficient separation of pharmaceutical drugs, Antiarrhythmic drugs



Column: YMC-Pack *Pro* C4 (5 µm, 12 nm) 150 x 4.6 mm ID
Part No.: BS12S05-1546WT
Eluent: 20 mM KH_2PO_4-K_2HPO_4 (pH 6.9) / methanol (40/60)
Flow rate: 1.0 mL/min
Temperature: 37° C
Detection: UV at 220 nm

Fast separation of nucleic acid bases, Nucleic acid bases

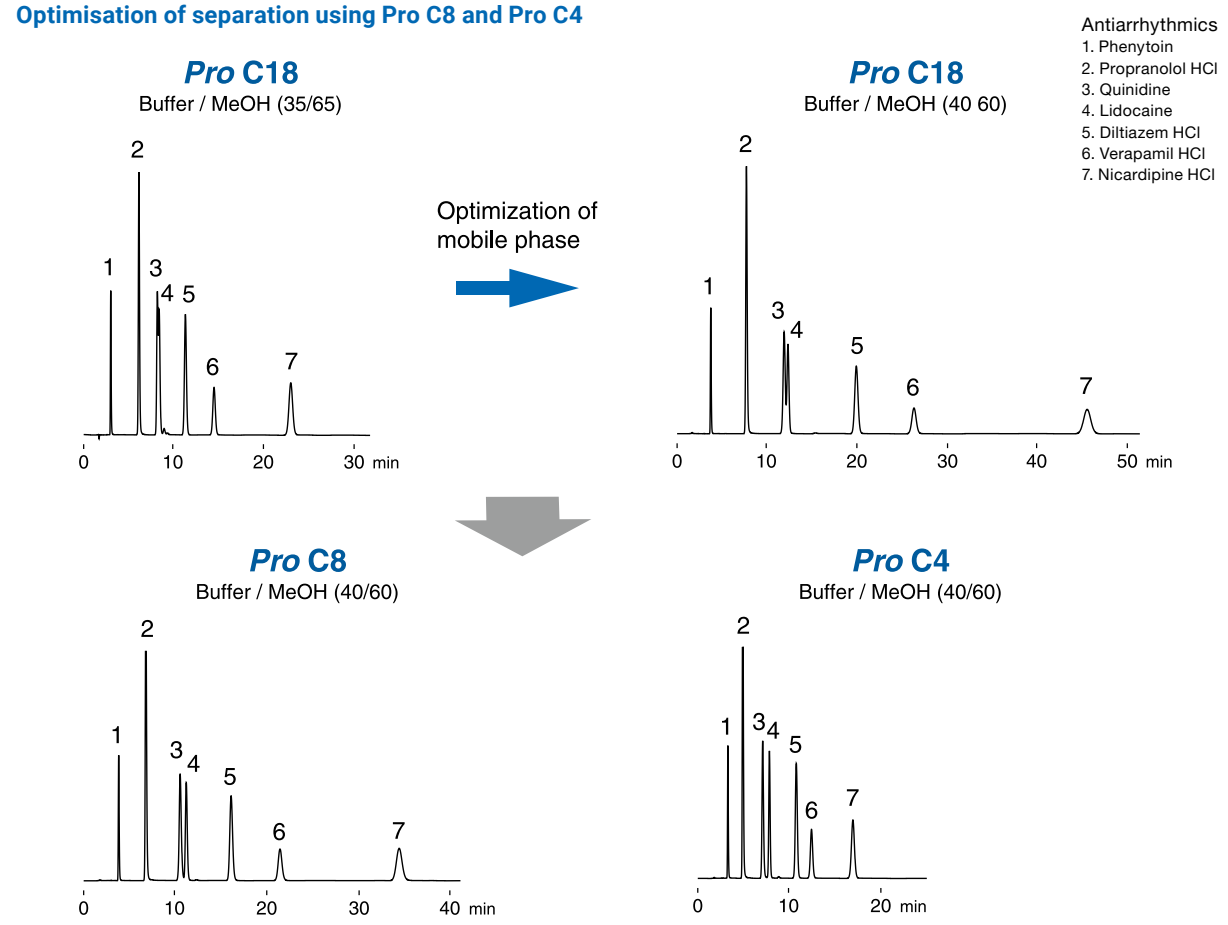


Column: YMC-Pack *Pro* C4 (5 µm, 12 nm) 150 x 4.6 mm ID
Part No.: BS12S05-1546WT
Eluent: 20 mM KH_2PO_4
Flow rate: 1.0 mL/min
Temperature: 37° C
Detection: UV at 254 nm

YMC-Pack *Pro* C4

The comparison shown below demonstrates that YMC-Pack *Pro* C4 is the column of choice when fast HPLC is required. There is almost no difference in retention times for the first three compounds whilst Nicardipine HCl elutes faster on YMC-Pack *Pro* C4 due to its lower polarity.

Optimisation of separation using Pro C8 and Pro C4



Column: 150 x 4.6 mm ID
Eluent: 20 mM KH_2PO_4 -K_2HPO_4 (pH 6.9) / methanol
Flow rate: 1.0 mL/min
Temperature: 37° C
Detection: UV at 220 nm

For more applications please refer to our "Application Data Collections" or contact us directly.

Column Care

YMC-Pack Pro C4 is stable towards hydrolysis between pH 2.0-7.5. Remove acid and buffer salts before storage. Store the column in methanol / water = 70/30. Clogged inlet frits often can be cleaned by changing the flow direction or replacement. For detailed information please refer to the "Column Care and Use Instructions" which can be downloaded from www.ymc.eu/download-library.html.

YMC-Pack *Pro* C18 RS

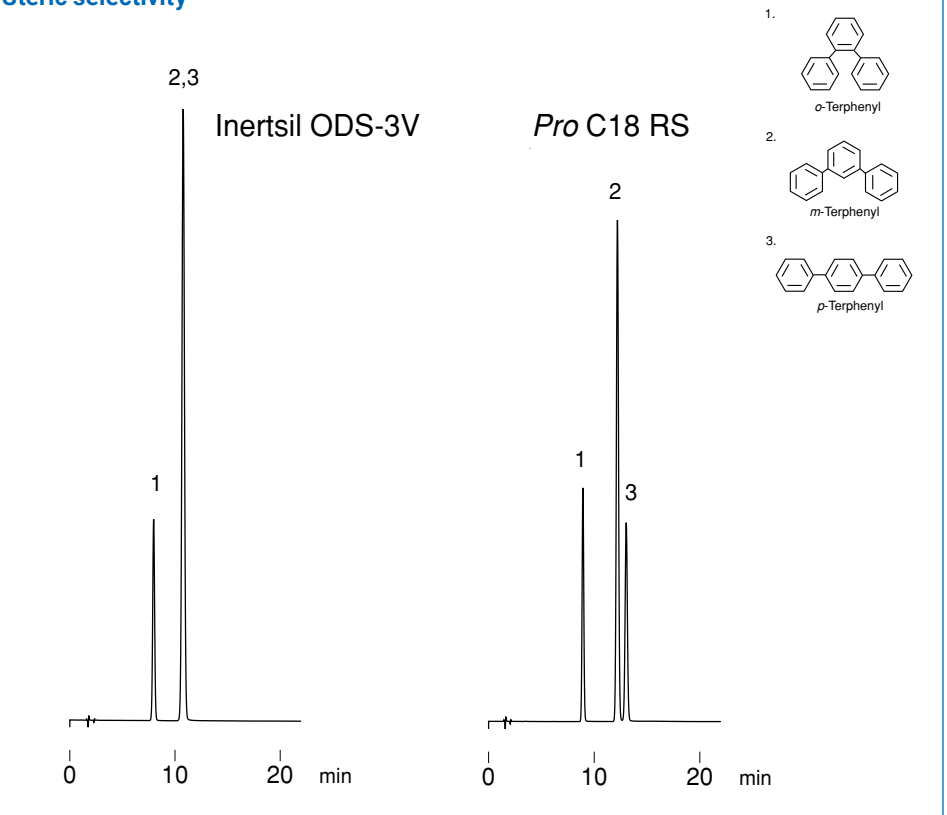
- ***strongly hydrophobic due to carbon content of 22%***
- ***exhibits extraordinary steric selectivity***
- ***extended pH and temperature stability***
- ***for the separation of hydrophobic, acidic and basic molecules***

Specifications	YMC-Pack *Pro* C18 RS
Particle size / µm	3; 5
Pore size / nm	8
Surface area / m^2g^{-1}	510
Carbon content / %	22
Recommended pH range	1.0 – 10.0*

General

The relatively high carbon load of YMC-Pack *Pro* C18 RS with 22% amplifies the selectivity's ability to discriminate between closely related compounds such as positional or steric isomers. A good system to test this steric selectivity is a mixture of o-, m- and p-terphenyl separated under methanol/water conditions. These three compounds differ only in their three-dimensional structure and not in their hydrophobicity or polarity. YMC-Pack *Pro* C18 RS recognizes even slight steric differences as shown in the chromatogram on the right, whilst a more conventional carbon load (15%) C18 chemistry does not.

Steric selectivity



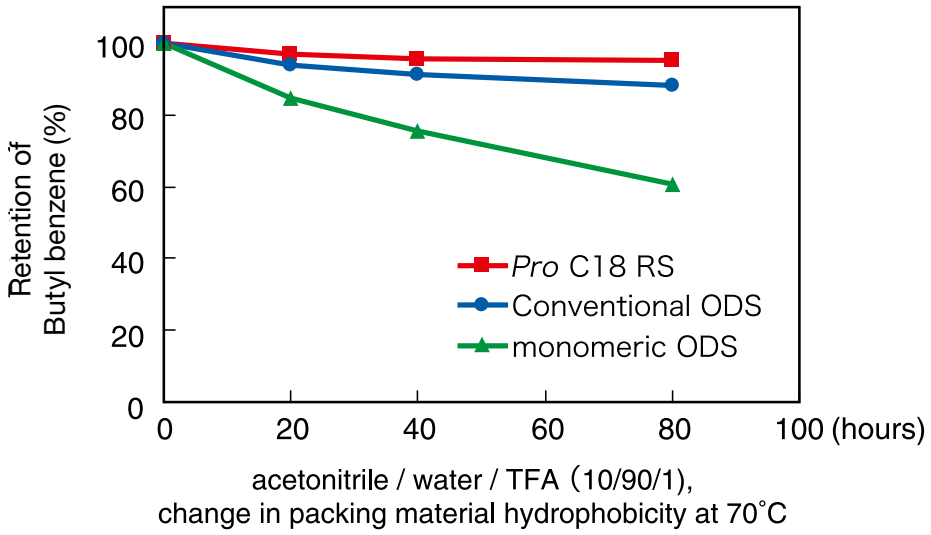
Column: 150 x 4.6 mm ID
Eluent: methanol / water (85/15)
Flow rate: 1.0 mL/min
Temperature: 37° C
Detection: UV at 254 nm

YMC-Pack *Pro* C18 RS

Stability under acidic conditions

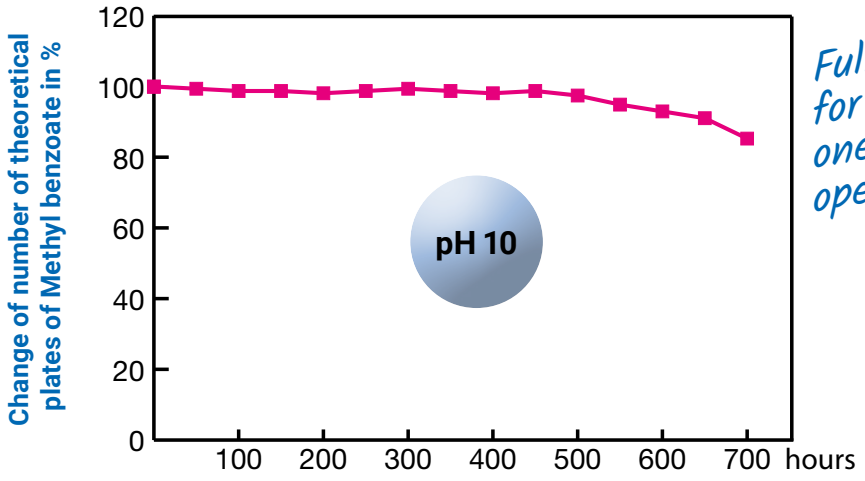
pH 1

The hydrophobicity of *Pro* C18 RS is hardly changed under the harsh condition (pH: 1, temp.: 70 °C).



Note: When assessing pH stability data, please take care to certify that complete chromatographic conditions are presented.

Stability under basic conditions



Full stability for 3 month one shift operation!

For pH 10, a borate buffer system (20 mM H_3BO_3-NaOH (pH 9.8) / methanol 50/50 at 30 °C) was selected to be continuously pumped through the column, while checking the number of theoretical plates for methyl benzoate every 50 hours.

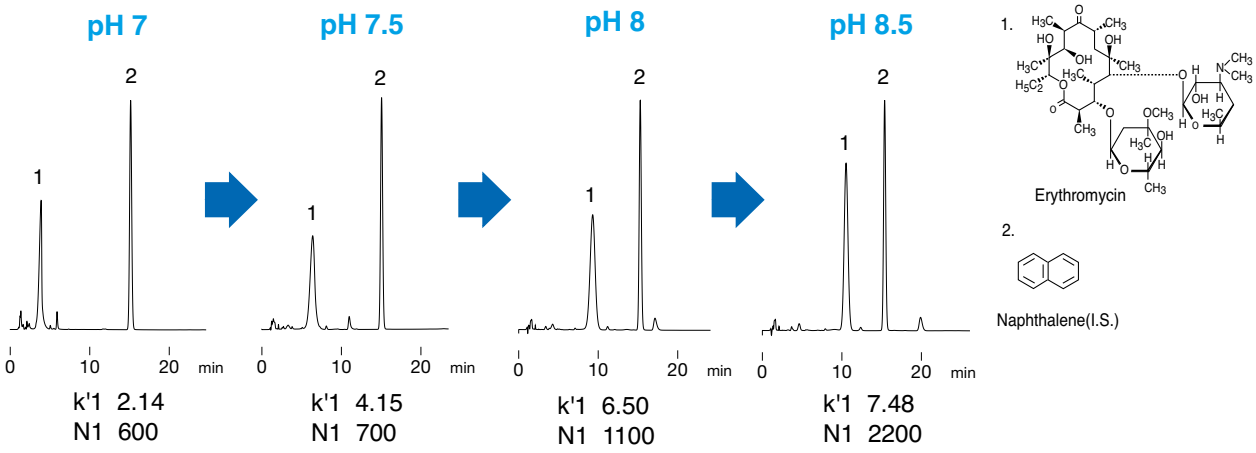
Basic eluents may significantly affect silicas and traditional bonding chemistries. Therefore, stability data should be considered only after verifying that the buffer system used maintains the selected pH during preparation and use. Furthermore, it must be verified that the eluent is not recycled, since the "active" basic sites may equilibrate to a saturation level with time, resulting in no further interactions taking place. Consequently, only continuous flow of "fresh" and thoroughly buffered eluent will provide accurate and meaningful performance data.

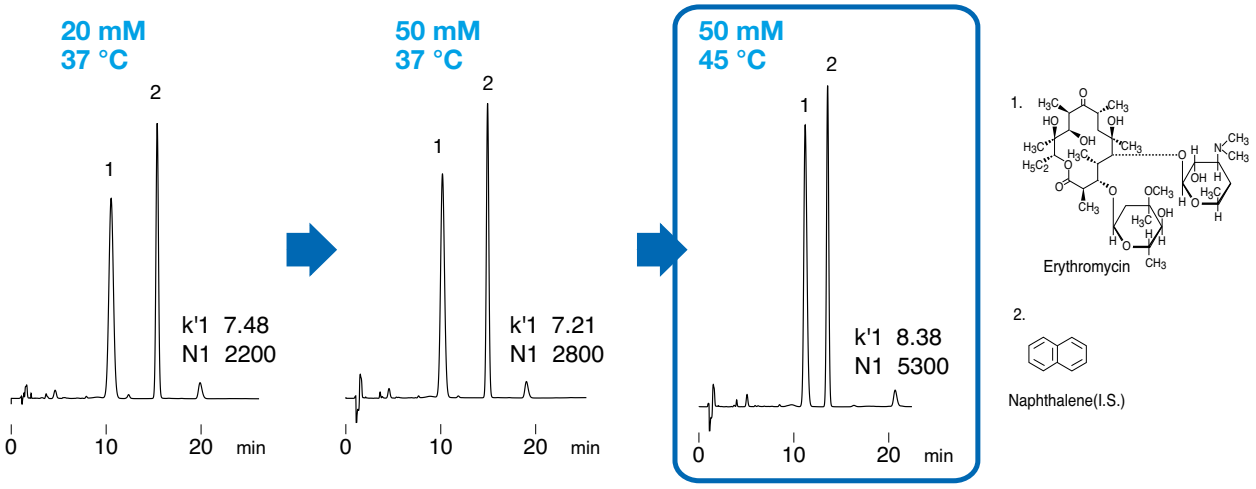
YMC-Pack *Pro* C18 RS

YMC-Pack *Pro* C18 RS:

Ideal for the separation of steric demanding compounds and/or for use under broader pH conditions!

Method optimization





Column:	YMC-Pack *Pro* C18 RS (5 µm, 8 nm) 150 x 4.6 mm ID
Part No.:	RS08S05-1546WT
Eluent:	potassium phosphate buffer (pH 8.5) / acetronitrile (50/50)
Flow rate:	1.0 mL/min
Temperature:	37° C
Detection:	UV at 210 nm

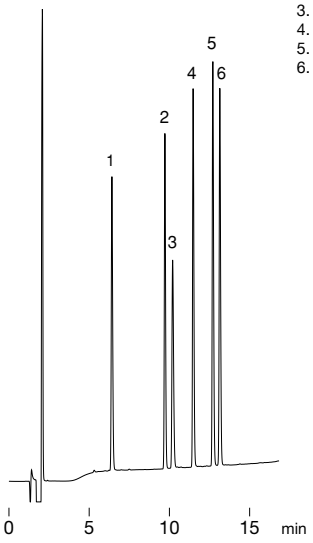
YMC-Pack *Pro* C18 RS

Applications

The specific properties of YMC-Pack *Pro* C18 RS make it an excellent choice for the separation of non-polar structurally related analytes. The extended resistance towards acidic and basic conditions not only widens the possibilities in method development but also provides further selectivities for demanding separations such as LC-MS or combinatorial chemistry of: **positional isomers, large hydrophobic molecules, basic and acidic compounds, peptides.**

Peptides: LC-MS conditions

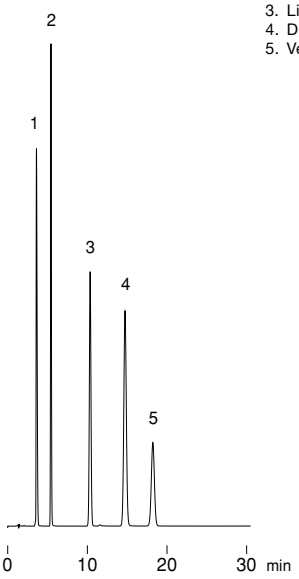
1. [Arg^8]-Vasopressin
2. Oxytocin
3. Bradykinin
4. Angiotensin II
5. Leu-Enkephalin
6. Angiotensin I



Column:	YMC-Pack *Pro* C18 RS (5 µm, 8 nm) 150 x 4.6 mm ID
Part No.:	RS08S05-1546WT
Eluent:	A: water / TFA (100/0.1) B: acetonitrile / TFA (100/0.1)
Gradient:	15-35% B (0-15 min)
Flow:	1.0 mL/min
Detection:	UV, 220 nm, 0.32 AUFS
Temperature:	37 °C
Injection:	20 µL (0.05 mg/mL)

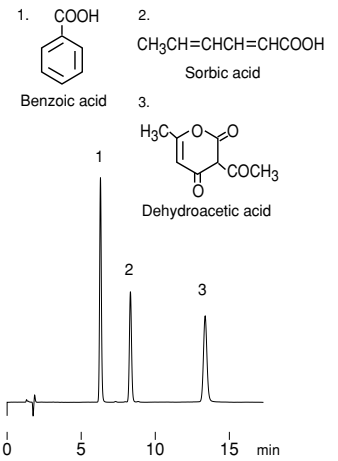
Drugs: LC-MS conditions

1. Flurbiprofen
2. Methyl benzoate
3. Lidocaine
4. Diltiazem HCl
5. Verapamil HCl



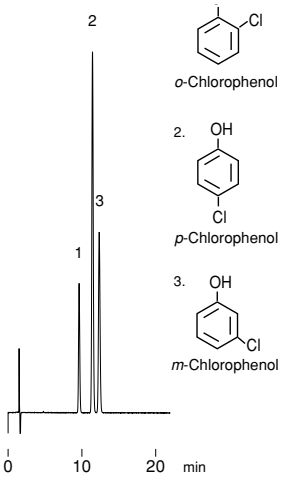
Column:	YMC-Pack *Pro* C18 RS (5 µm, 8 nm) 150 x 4.6 mm ID
Part No:	RS08S05-1546WT
Eluent:	20 mM CH_3COONH_4-NH_3 (pH 8.9) / methanol (35/65)
Flow:	1.0 mL/min
Detection:	UV, 220 nm, 0.64 AUFS
Temperature:	30 °C
Injection:	10 µL (0.1 mg/mL, 0.036 µL/mL)

Food preservatives



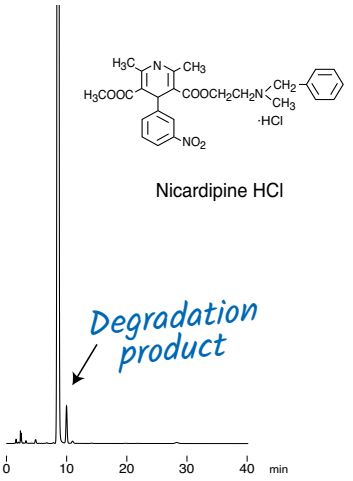
Column:	YMC-Pack *Pro* C18 RS (5 µm, 8 nm) 150 x 4.6 mm ID
Part No.:	RS08S05-1546WT
Eluent:	20 mM CH_3COONa - CH_3COOH (pH 4.3) / acetonitrile (80/20)
Flow:	1.0 mL/min
Detection:	UV at 230 nm, 0.26 AUFS
Temperature:	37 °C
Injection:	10 µL (0.02 mg/mL)

Chlorophenol isomers



Column:	YMC-Pack *Pro* C18 RS (5 µm, 8 nm) 150 x 4.6 mm ID
Part No.:	RS08S05-1546WT
Eluent:	acetonitrile / water / acetic acid (30/70/1)
Flow:	1.0 mL/min
Detection:	UV at 230 nm, 0.32 AUFS
Temperature:	37 °C
Injection:	10 µL (0.1 - 0.2 mg/mL)

Nicardipine hydrochloride



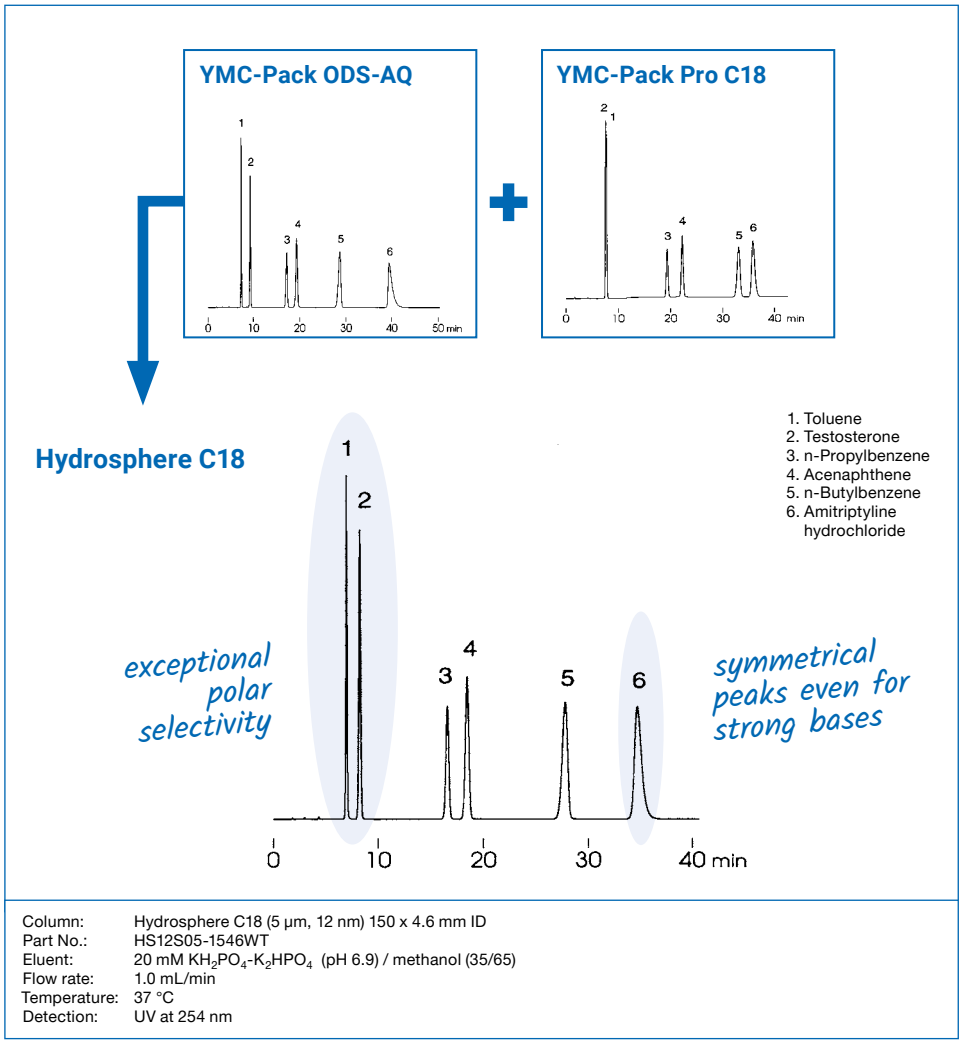
Column:	YMC-Pack *Pro* C18 RS (5 µm, 8 nm) 150 x 4.6 mm ID
Part No.:	RS08S05-1546WT
Eluent:	20 mM KH_2PO_4-K_2HPO_4 (pH 6.9) / methanol (25/75)
Flow:	1.0 mL/min
Detection:	UV at 254 nm, 0.32 AUFS
Temperature:	37 °C
Injection:	10 µL

For more applications please refer to our "Application Data Collections" or contact us directly.

Hydrosphere C18

- ***stable under the use of 100% aqueous eluent***
- ***"hydrophilic" C18 surface for enhanced polar recognition***
- ***no need for ion pair reagents***
- ***based on highly inert, ultrapure, pH neutral silica***
- ***specifically designed for pharmaceutical and biotechnology R&D***

Specifications	Hydrosphere C18
Particle size / µm	2; 3; 5
Pore size / nm	12
Surface area / m^2g^{-1}	330
Carbon content / %	12
Recommended pH range	2.0 – 8.0



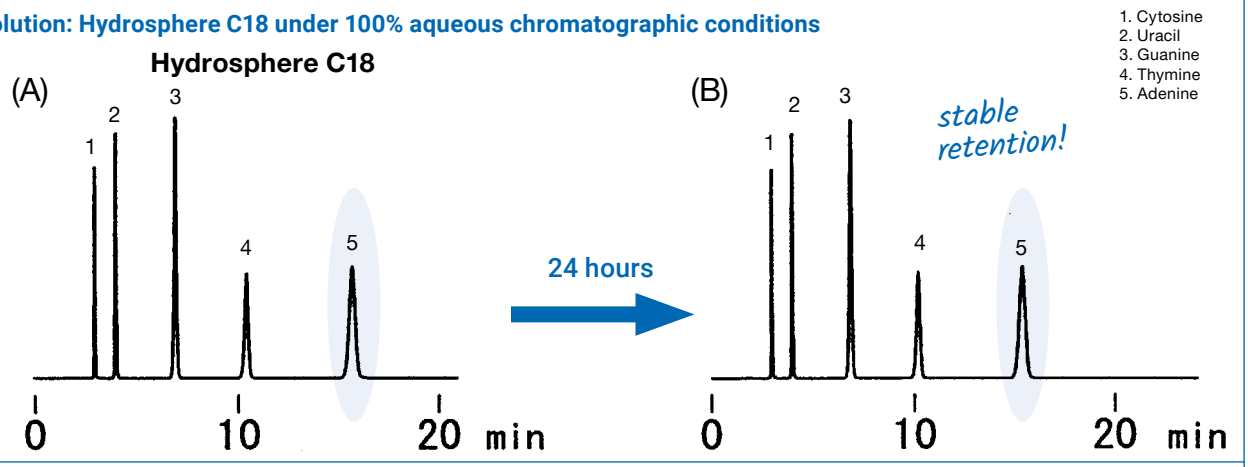
Column: Hydrosphere C18 (5 µm, 12 nm) 150 x 4.6 mm ID
Part No.: HS12S05-1546WT
Eluent: 20 mM KH_2PO_4-K_2HPO_4 (pH 6.9) / methanol (35/65)
Flow rate: 1.0 mL/min
Temperature: 37 °C
Detection: UV at 254 nm

General

The separation of polar compounds in many cases requires highly aqueous mobile phase conditions to achieve sufficient retention on the stationary phase. Conventional reversed phase selectivities do not give reproducible results under these conditions due mainly to the collapse of the C18 chains, Hydrosphere C18 has been developed, on the ultra pure silica support of the *Pro*Family, as the next generation of speciality phases following the well known YMC-Pack ODS-AQ, which was developed in 1987 and is still a very interesting selectivity option for these purposes.

Hydrosphere C18

Solution: Hydrosphere C18 under 100% aqueous chromatographic conditions

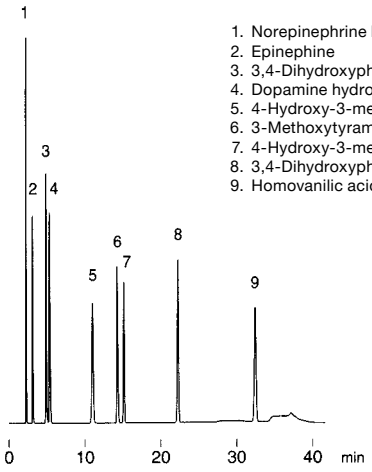


Column: Hydrosphere C18 (5 µm, 12 nm) 150 x 4.6 mm ID
Part No.: HS12S05-1546WT
Eluent: 20 mM KH_2PO_4-K_2HPO_2 (pH 6.9)
Flow rate: 1.0 mL/min
Temperature: 37 °C
Detection: UV at 254 nm

After use, the column was stored overnight without any washing procedure. The next day, the application was continued.

Its "hydrophilic" C18 surface gives Hydrosphere C18 the capability to show stable retention times even after 24 hours under these chromatographic conditions.

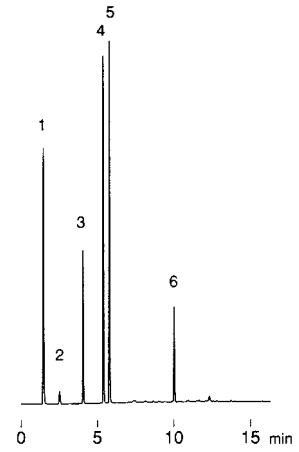
No ion pair reagent required



1. Norepinephrine hydrochloride
2. Epinephine
3. 3,4-Dihydroxyphenylalanine (DOPA)
4. Dopamine hydrochloride
5. 4-Hydroxy-3-methoxymandelic acid
6. 3-Methoxytyramine hydrochloride
7. 4-Hydroxy-3-methoxyphenylglycol
8. 3,4-Dihydroxyphenylacetic acid
9. Homovanilic acid

Catecholamines
Column: Hydrosphere C18 (5 µm, 12 nm) 150 x 4.6 mm ID
Part No.: HS12S05-1546WT
Eluent: A) 50 mM KH_2PO_4 - H_3PO_4 (pH 3.1)
B) 50 mM KH_2PO_4 - H_3PO_4 (pH 3.1) / acetonitrile (90/10)
0% B (0-5 min), 0-100% B (5-25 min, linear), 100% B (25-35 min)
Flow rate: 1.0 mL/min
Temperature: 30 °C
Detection: UV at 280 nm, 0.64 AUFS
Injection: 10 µL (0.15 - 0.25 mg/mL)

Efficient separation of complex substance mixtures



1. Pyridoxine HCl
2. Maleic acid
3. Neostigmine methylsulfate
4. Naphazoline HCl
5. Chlorpheniramine
6. Glycyrrhizin

Ingredients in an eye drop
Column: Hydrosphere C18 (3 µm, 12 nm) 50 x 4.6 mm ID
Part No.: HS12S03-0546WT
Eluent: A) 20 mM KH_2PO_4 - H_3PO_4 (pH 2.5)
B) acetonitrile
0-60% B (0-10 min), 60% B (10-15 min)
Flow rate: 1.0 mL/min
Temperature: 37 °C
Detection: UV at 265 nm, 0.128 AUFS
Injection: 5 µL (0.03 - 0.3 mg/mL)

For more applications please refer to our "Application Data Collections" or contact us directly.

Column Care

Hydrosphere C18 is stable towards hydrolysis between pH 2.0-8.0 in up to 100% aqueous systems and a maximum of 50 °C. Remove acid and buffer salts before storage. Store the column in methanol / water = 70/30.
For detailed information please refer to the "Column Care and Use Instructions" which can be downloaded from www.ymc.eu/download-library.html.

Ultra Fast LC Columns

- ***YMC Pack ProFamily chemistries, based on ultra high purity silica, provide excellent resolution for a wide range of analytes***
- ***YMC-UltraHT LC columns provide considerable time saving without resort to ultra high pressures***
- ***YMC-UltraHT LC columns achiev ultra fast separations even with conventional HPLC equipment***
- ***fully up- and down-scalable selectivity***

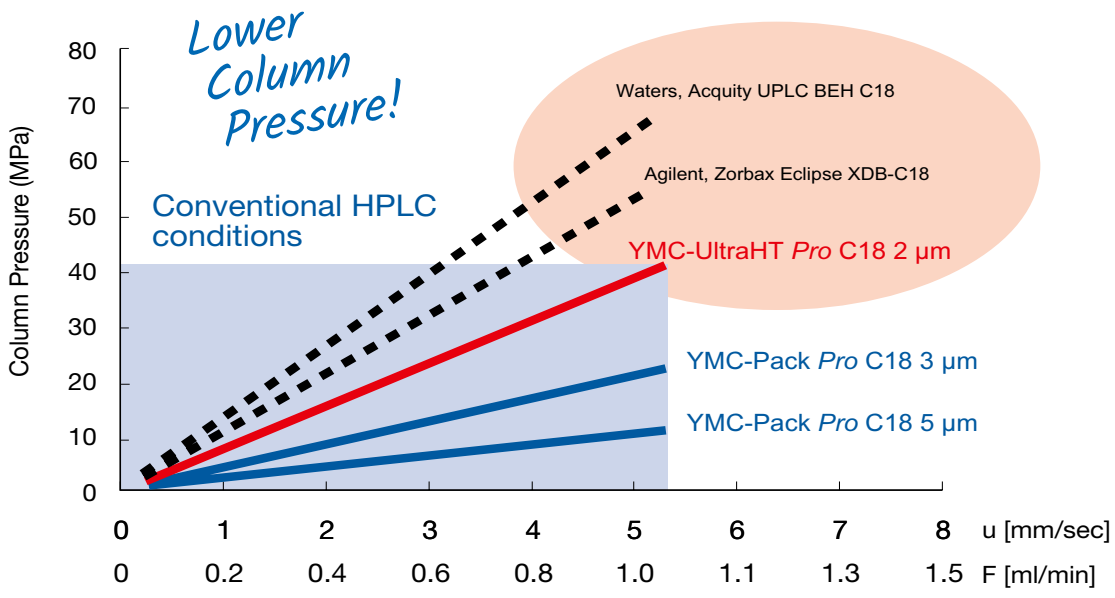
Specifications	YMC-UltraHT *Pro* C18	YMC-UltraHT Hydrosphere C18
Particle size / µm	2	2
Pore size / nm	12	12
Surface area / m^2g^{-1}	330	330
Carbon content / %	16	12
Recommended pH range	2.0 – 8.0	2.0 – 8.0

Features of Packing Material

When starting to focus on Ultra Fast LC through the use of small particles, very high back pressures have to be considered and a balance sought. The extensive experience in silica production enables YMC to provide small particles with an extremely narrow particle size distribution which results in low back pressures.

YMC's UltraHT *Pro* C18 columns offer outstanding efficiency for Fast LC without exhibiting extremely high back pressure values which can be obtained with sub-2 µm particles from other manufacturers. Therefore YMC's UltraHT *Pro* C18 may not require dedicated HPLC equipment for providing outstanding column performances.

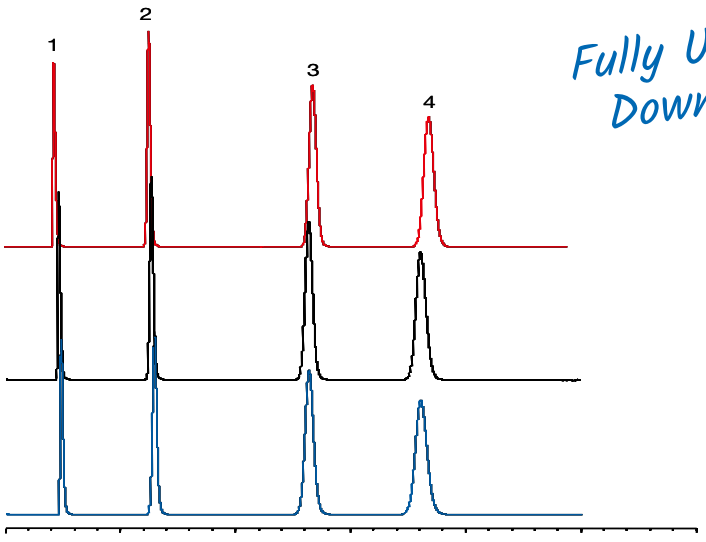
Column Pressure



Columns: 50 x 2.0 or 2.1 mm ID
Eluent: acetonitrile / water (60/40)
Temperature: 25 °C
Sample: Butyl benzoate

The introduction of YMC-UltraHT *Pro* C18 2 µm allows easy downscaling of existing methods which use YMC-Pack *Pro* C18 3 µm and 5 µm.

Reproducibility Comparison



1. Uracil
2. Methyl benzoate
3. Naphthalene
4. Butyl benzoate

Fully Up- and Downscalable!

YMC-UltraHT *Pro* C18 2 µm

YMC-Pack *Pro* C18 3 µm

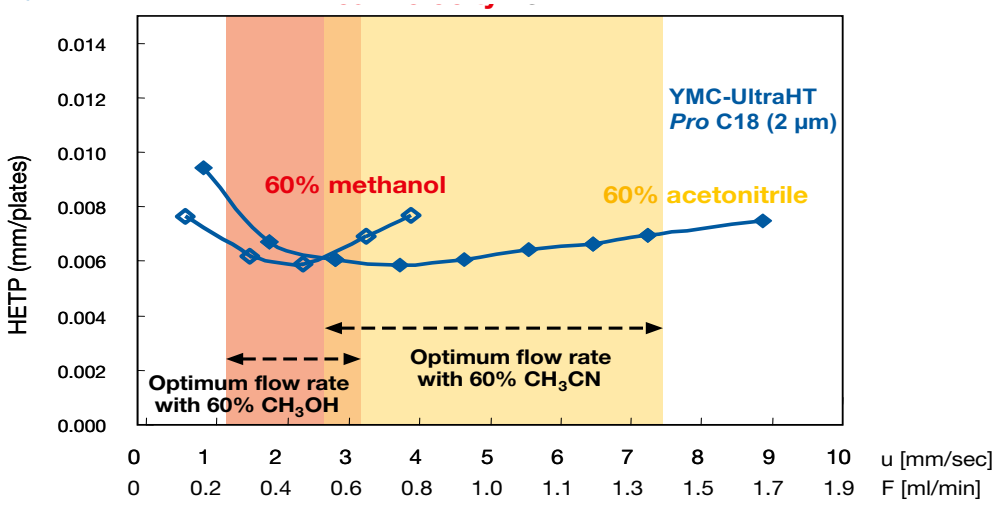
YMC-Pack *Pro* C18 5 µm

Column: 50 x 2.0 or 2.1 mm ID
Eluent: acetonitrile / water (60/40)
Temperature: 25 °C
Detection: UV at 270 nm

Features of Packing Material

The graph below shows the dependency of "Height Equivalent of the Theoretical Plate" (HETP) and the linear velocity in the presence of different organic solvents. When methanol is used, the optimum HETP is achieved within a different range of velocity compared to when acetonitrile is used due to their different viscosities. Therefore the optimum range of flow rate changes with the organic solvent. The maximum resolution is obtained by optimising flow rate, temperature, and organic solvent in order to achieve the optimum back pressure.

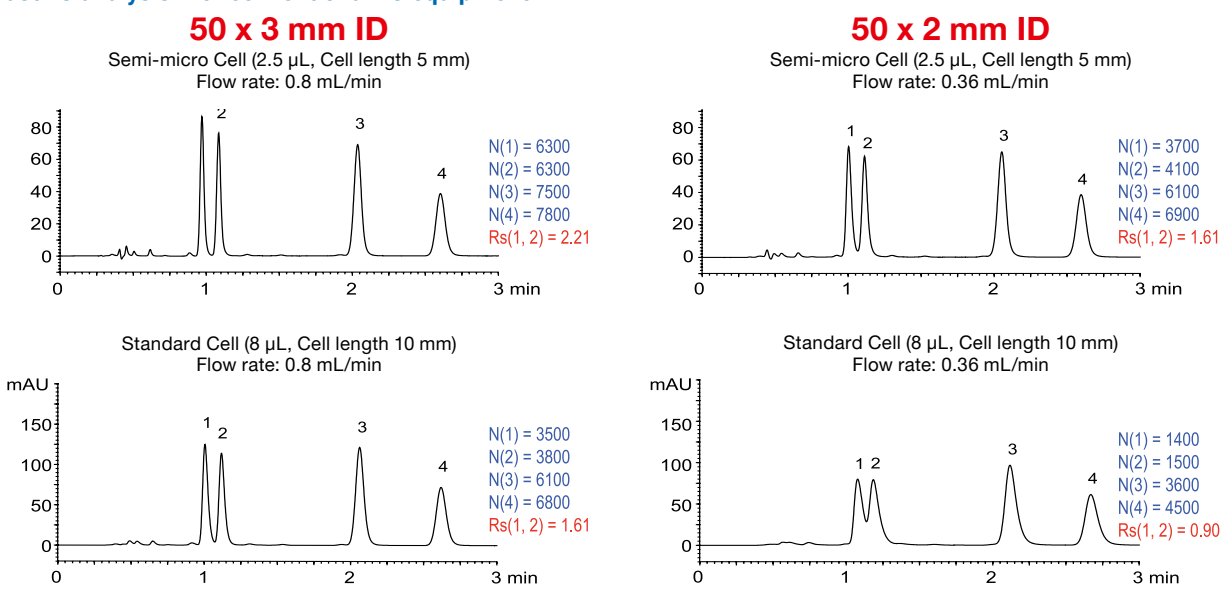
Linear velocity versus HETP



Column: YMC-UltraHT *Pro* C18 (2 µm) 50 x 2.0 mm ID
Temperature: 25 °C
Sample: Butyl benzoate

Since YMC-UltraHT columns provide substantially lower pressure drop than most competitive 2 µm or sub-2 µm media, high flow rates can be achieved without generating excessive back pressure and without the need for specialised equipment. Nevertheless, 3 mm ID columns are less affected by the diffusion volume than 2 mm ID columns. Therefore, it is necessary to reduce the system "dead" volume in order to obtain outstanding chromatographic performances with 2 mm ID columns.

Fast LC analysis with conventional LC equipment



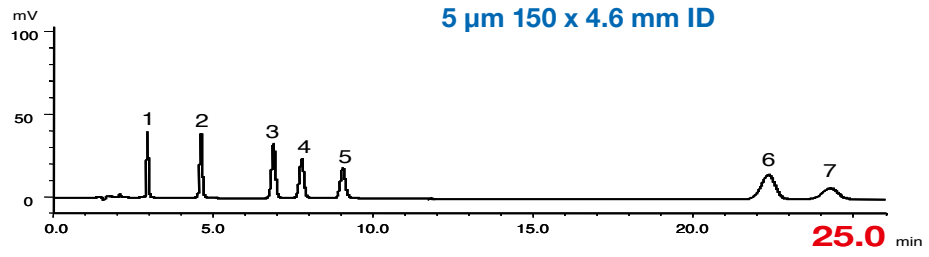
Column: YMC-UltraHT *Pro* C18
Eluent: acetonitrile / 20 mM KH_2PO_4 (10/90)
Temperature: 37 °C
Detection: UV at 260 nm

1. Uracil
2. Methyl benzoate
3. Naphthalene
4. Butyl benzoate

Downscale of Methods

Conventional LC Method

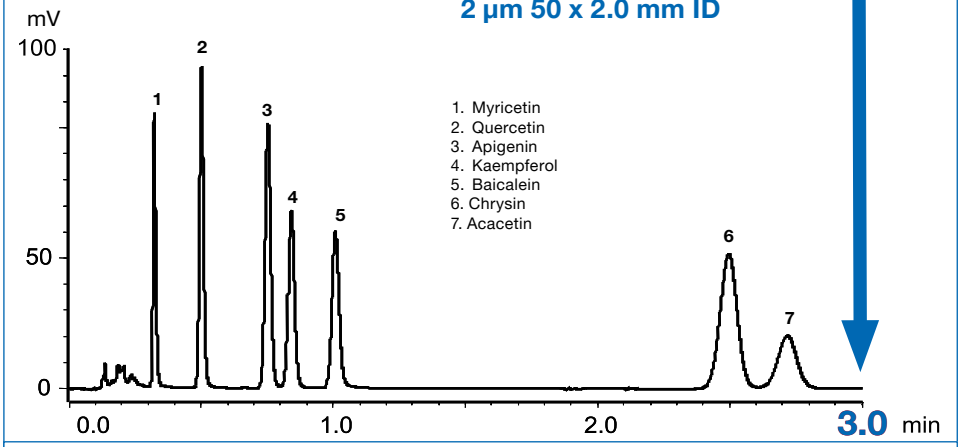
YMC-Pack *Pro* C18
5 µm 150 x 4.6 mm ID



Part No.: AS12S05-1546WT
Eluent: acetonitrile/water/formic acid (35/65/0.1)
Flow rate: 1.0 mL/min (1.00 mm/sec)
Temperature: 40 °C
Detection: UV at 260 nm
Pressure: 1230 psi (83 bar, 8.3 MPa)

Ultra Fast LC Method

YMC-UltraHT *Pro* C18
2 µm 50 x 2.0 mm ID

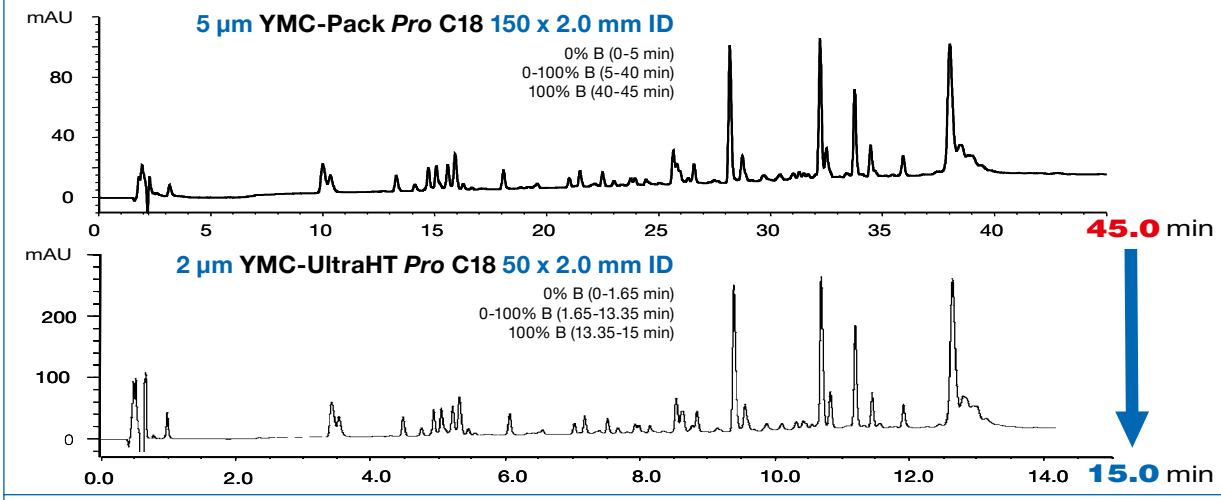


Part No.: AS12S02-0502WT
Eluent: acetonitrile / water / formic acid (35/65/0.1)
Flow rate: 0.6 mL/min (3.18 mm/sec)
Temperature: 40 °C
Detection: UV at 260 nm
Pressure: 4350 psi (292 bar, 29.2 MPa)

Due to the production processes used to manufacture YMC-Pack *Pro*-Family, methods can be easily downscaled with unchanged selectivity.
As the examples shown demonstrate, conventional HPLC methods can be transferred easily to Ultra Fast LC methods by choosing YMC-UltraHT columns to gain efficiency and significantly reduce analysis time.

The application of HPLC to biologically relevant separations is an existing and rapidly growing field. YMC-UltraHT *Pro* C18 provides outstanding chromatographic performance, which is more than capable of meeting the challenge of peptide mapping, where a large number of peptide fragments are generated from enzymatic digestion.

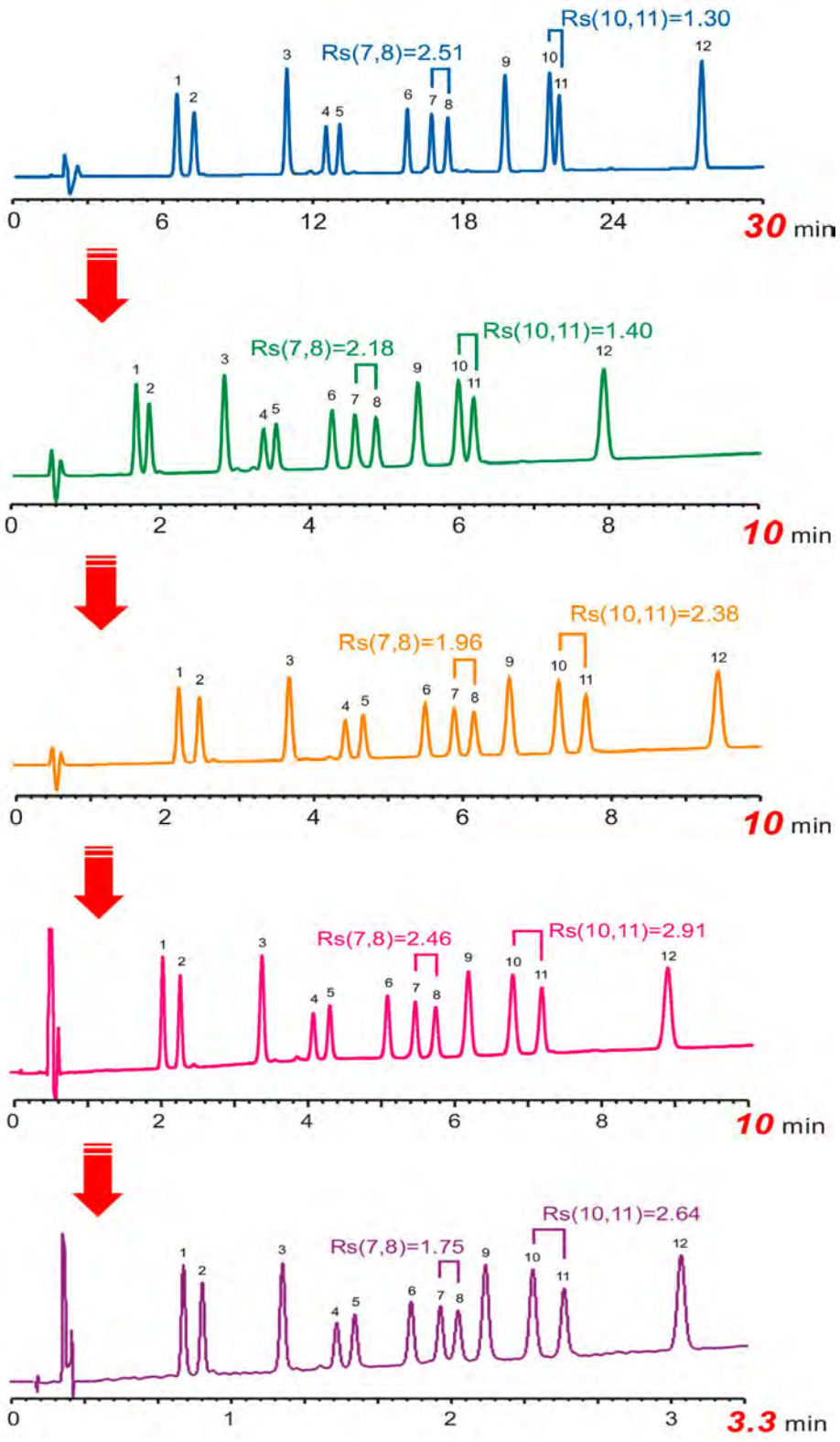
Peptide mapping



Part No.: AS12S05-1502WT (top)
AS12S02-0502WT (bottom)
Eluent: A) acetonitrile / water / TFA (10/90/0.1)
B) acetonitrile / water / TFA (35/65/0.1)
Flow rate: 0.2 mL/min
Temperature: 37 °C
Detection: UV at 220 nm
Sample: Tryptic digest of Cytochrome *c* (5 mg/mL; 37 °C; 24h)

Downscale of Methods

Method transfer from conventional LC to Ultra Fast LC



150 x 4.6 mm ID, 5 µm
15-35% ACN (0-30 min)
1.0 mL/min
10 µL Inj.

50 x 4.6 mm ID, 3 µm
15-35% ACN (0-10 min)
1.5 mL/min
3 µL Inj.

50 x 4.6 mm ID, 3 µm
12.5-35% ACN (0-10 min)
1.5 mL/min
3 µL Inj.

50 x 2.0 mm ID, 2 µm
12.5-35% ACN (0-10 min)
0.3 mL/min
0.6 µL Inj.

50 x 2.0 mm ID, 2 µm
12.5-35% ACN (0-3.3 min)
0.9 mL/min
0.6 µL Inj.

Columns: Hydrosphere C18
Eluent: A: water / acetic acid (100/3)
B: acetonitrile / acetic acid (100/3)
Temperature: 35 °C
Detection: UV at 254 nm

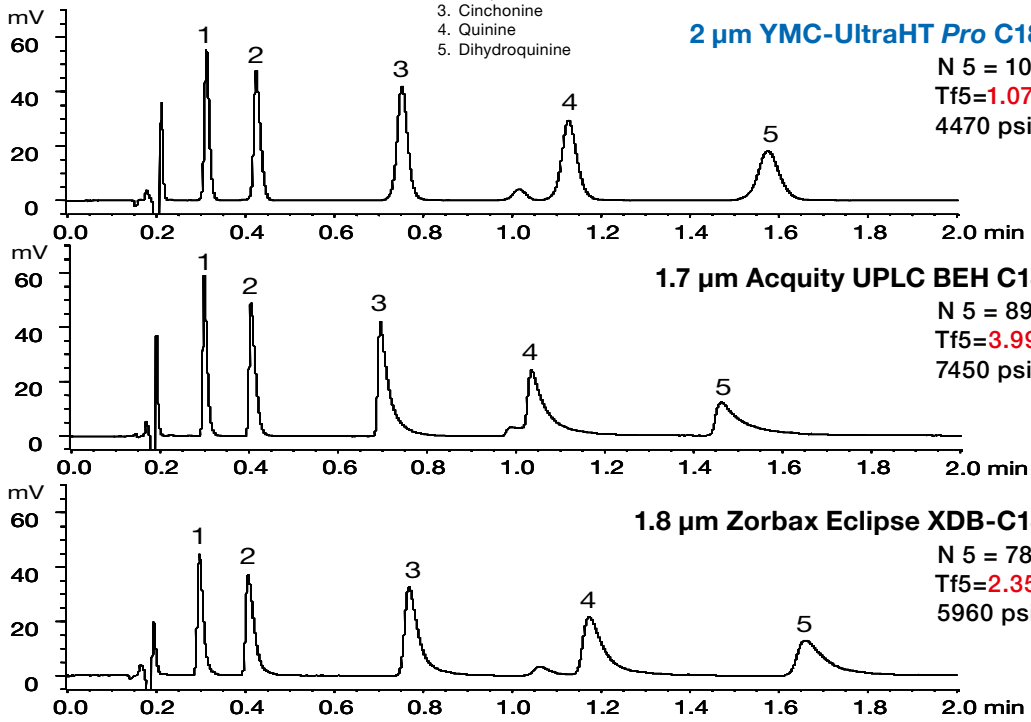
1. Daidzin
2. Glycitin
3. Genistin
4. 6'-O-Malonyldaidzin
5. 6'-O-Malonylglycitin
6. 6'-O-Acetyldaidzin
7. 6'-O-Acetylglycitin
8. 6'-O-Malonylgenistin
9. Daidzein
10. Glycitein
11. 6'-O-Acetylgenistin
12. Genistein

Downscale of Methods

Why not take the pressure out of Fast LC!

Peak performance

1. Scopolamine
2. Atropine
3. Cinchonine
4. Quinine
5. Dihydroquinine



2 µm YMC-UltraHT *Pro* C18, 50 x 2.0 mm ID
N 5 = 106,000 /m
Tf5=1.07
4470 psi (300 bar, 30 MPa)

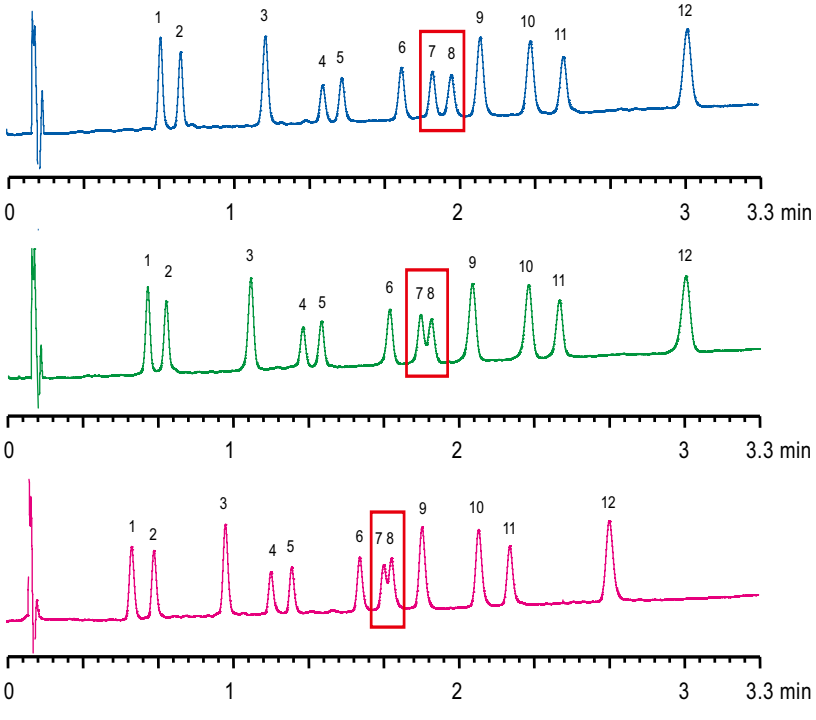
1.7 µm Acquity UPLC BEH C18, 50 x 2.1 mm ID
N 5 = 89,000 /m
Tf5=3.99
7450 psi (500 bar, 50 MPa)

1.8 µm Zorbax Eclipse XDB-C18, 50 x 2.1 mm ID
N 5 = 78,000 /m
Tf5=2.35
5960 psi (400 bar, 40 MPa)

With YMC-UltraHT *Pro* C18 you have all the efficiency you need to develop your Fast LC methods with none of the pressure or heat some would have you believe is essential!

Peak performance

1. Daidzin
2. Glycitin
3. Genistin
4. 6'-O-Malonyldaidzin
5. 6'-O-Malonylglycitin
6. 6'-O-Acetyldaidzin
7. 6'-O-Acetylglycitin
8. 6'-O-Malonylgenistin
9. Daidzein
10. Glycitein
11. 6'-O-Acetylgenistin
12. Genistein



2 µm YMC-UltraHT Hydrosphere C18, 50 x 2.0 mm ID
7449 psi (500 bar, 50 MPa)

2 µm YMC-UltraHT *Pro* C18, 50 x 2.0 mm ID
8044 psi (540 bar, 54 MPa)

1.8 µm Zorbax SB-C18, 50 x 2.1 mm ID
11,470 psi (770 bar, 77 MPa)

Ordering Information

2 µm UltraHT Fast LC columns

Phase	Column ID [mm]	Column length [mm]				Guard cartridges* with 10 mm length
		50	100	150	250	(pack of 5)
YMC-Pack *Pro* C18	2.0 3.0	AS12S02-0302WT –	AS12S02-0502WT AS12S02-0503WT	AS12S02-1002WT AS12S02-1003WT	AS12S02-1502WT AS12S02-1503WT	AS12S02-01Q1GC AS12S02-0103GC
Hydrosphere C18	2.1 3.0	HS12S02-0302WT –	HS12S02-0502WT HS12S02-0503WT	HS12S02-1002WT HS12S02-1003WT	HS12S02-1502WT HS12S02-1503WT	HS12S02-01Q1GC HS12S02-0103GC

3 µm HPLC columns (Waters type hardware, WT)

Phase	Column ID [mm]	Column length [mm]				Guard cartridges* with 10 mm length
		50	100	150	250	(pack of 5)
YMC-Pack *Pro* C18	2.0 2.1 3.0 4.0 4.6	AS12S03-0502WT AS12S03-05Q1WT AS12S03-0503WT AS12S03-0504WT AS12S03-0546WT	AS12S03-1002WT AS12S03-10Q1WT AS12S03-1003WT AS12S03-1004WT AS12S03-1046WT	AS12S03-1502WT AS12S03-15Q1WT AS12S03-1503WT AS12S03-1504WT AS12S03-1546WT	AS12S03-2502WT AS12S03-25Q1WT AS12S03-2503WT AS12S03-2504WT AS12S03-2546WT	AS12S03-01Q1GC AS12S03-01Q1GC AS12S03-0103GC AS12S03-0104GC AS12S03-0104GC
YMC-Pack *Pro* C18 RS	2.0 2.1 3.0 4.0 4.6	RS08S03-0502WT RS08S03-05Q1WT RS08S03-0503WT RS08S03-0504WT RS08S03-0546WT	RS08S03-1002WT RS08S03-10Q1WT RS08S03-1003WT RS08S03-1004WT RS08S03-1046WT	RS08S03-1502WT RS08S03-15Q1WT RS08S03-1503WT RS08S03-1504WT RS08S03-1546WT	RS08S03-2502WT RS08S03-25Q1WT RS08S03-2503WT RS08S03-2504WT RS08S03-2546WT	RS08S03-01Q1GC RS08S03-01Q1GC RS08S03-0103GC RS08S03-0104GC RS08S03-0104GC
Hydrosphere C18	2.0 2.1 3.0 4.0 4.6	HS12S03-0502WT HS12S03-05Q1WT HS12S03-0503WT HS12S03-0504WT HS12S03-0546WT	HS12S03-1002WT HS12S03-10Q1WT HS12S03w-1003WT HS12S03-1004WT HS12S03-1046WT	HS12S03-1502WT HS12S03-15Q1WT HS12S03-1503WT HS12S03-1504WT HS12S03-1546WT	HS12S03-2502WT HS12S03-25Q1WT HS12S03-2503WT HS12S03-2504WT HS12S03-2546WT	HS12S03-01Q1GC HS12S03-01Q1GC HS12S03-0103GC HS12S03-0104GC HS12S03-0104GC
YMC-Pack *Pro* C8	2.0 2.1 3.0 4.0 4.6	OS12S03-0502WT OS12S03-05Q1WT OS12S03-0503WT OS12S03-0504WT OS12S03-0546WT	OS12S03-1002WT OS12S03-10Q1WT OS12S03-1003WT OS12S03-1004WT OS12S03-1046WT	OS12S03-1502WT OS12S03-15Q1WT OS12S03-1503WT OS12S03-1504WT OS12S03-1546WT	OS12S03-2502WT OS12S03-25Q1WT OS12S03-2503WT OS12S03-2504WT OS12S03-2546WT	OS12S03-01Q1GC OS12S03-01Q1GC OS12S03-0103GC OS12S03-0104GC OS12S03-0104GC
YMC-Pack *Pro* C4	2.0 2.1 3.0 4.0 4.6	BS12S03-0502WT BS12S03-05Q1WT BS12S03-0503WT BS12S03-0504WT BS12S03-0546WT	BS12S03-1002WT BS12S03-10Q1WT BS12S03-1003WT BS12S03-1004WT BS12S03-1046WT	BS12S03-1502WT BS12S03-15Q1WT BS12S03-1503WT BS12S03-1504WT BS12S03-1546WT	BS12S03-2502WT BS12S03-25Q1WT BS12S03-2503WT BS12S03-2504WT BS12S03-2546WT	BS12S03-01Q1GC BS12S03-01Q1GC BS12S03-0103GC BS12S03-0104GC BS12S03-0104GC

*Guard cartridge holder required, part no. XPGCH-Q1

Ordering Information

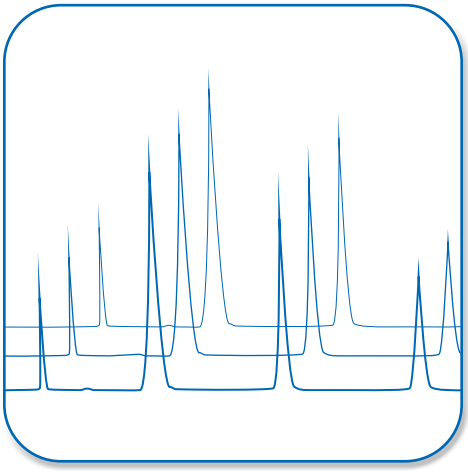
5 µm HPLC columns (Waters type hardware, WT)

Phase	Column ID [mm]	Column length [mm]				Guard cartridges* with 10 mm length
		50	100	150	250	(pack of 5)
YMC-Pack *Pro* C18	2.0	AS12S05-0502WT	AS12S05-1002WT	AS12S05-1502WT	AS12S05-2502WT	AS12S05-01Q1GC
	2.1	AS12S05-05Q1WT	AS12S05-10Q1WT	AS12S05-15Q1WT	AS12S05-25Q1WT	AS12S05-01Q1GC
	3.0	AS12S05-0503WT	AS12S05-1003WT	AS12S05-1503WT	AS12S05-2503WT	AS12S05-0103GC
	4.0	AS12S05-0504WT	AS12S05-1004WT	AS12S05-1504WT	AS12S05-2504WT	AS12S05-0104GC
	4.6	AS12S05-0546WT	AS12S05-1046WT	AS12S05-1546WT	AS12S05-2546WT	AS12S05-0104GC
YMC-Pack *Pro* C18 RS	2.0	RS08S05-0502WT	RS08S05-1002WT	RS08S05-1502WT	RS08S05-2502WT	RS08S05-01Q1GC
	2.1	RS08S05-05Q1WT	RS08S05-10Q1WT	RS08S05-15Q1WT	RS08S05-25Q1WT	RS08S05-01Q1GC
	3.0	RS08S05-0503WT	RS08S05-1003WT	RS08S05-1503WT	RS08S05-2503WT	RS08S05-0103GC
	4.0	RS08S05-0504WT	RS08S05-1004WT	RS08S05-1504WT	RS08S05-2504WT	RS08S05-0104GC
	4.6	RS08S05-0546WT	RS08S05-1046WT	RS08S05-1546WT	RS08S05-2546WT	RS08S05-0104GC
Hydrosphere C18	2.0	HS12S05-0502WT	HS12S05-1002WT	HS12S05-1502WT	HS12S05-2502WT	HS12S05-01Q1GC
	2.1	HS12S05-05Q1WT	HS12S05-10Q1WT	HS12S05-15Q1WT	HS12S05-25Q1WT	HS12S05-01Q1GC
	3.0	HS12S05-0503WT	HS12S05-1003WT	HS12S05-1503WT	HS12S05-2503WT	HS12S05-0103GC
	4.0	HS12S05-0504WT	HS12S05-1004WT	HS12S05-1504WT	HS12S05-2504WT	HS12S05-0104GC
	4.6	HS12S05-0546WT	HS12S05-1046WT	HS12S05-1546WT	HS12S05-2546WT	HS12S05-0104GC
YMC-Pack *Pro* C8	2.0	OS12S05-0502WT	OS12S05-1002WT	OS12S05-1502WT	OS12S05-2502WT	OS12S05-01Q1GC
	2.1	OS12S05-05Q1WT	OS12S05-10Q1WT	OS12S05-15Q1WT	OS12S05-25Q1WT	OS12S05-01Q1GC
	3.0	OS12S05-0503WT	OS12S05-1003WT	OS12S05-1503WT	OS12S05-2503WT	OS12S05-0103GC
	4.0	OS12S05-0504WT	OS12S05-1004WT	OS12S05-1504WT	OS12S05-2504WT	OS12S05-0104GC
	4.6	OS12S05-0546WT	OS12S05-1046WT	OS12S05-1546WT	OS12S05-2546WT	OS12S05-0104GC
YMC-Pack *Pro* C4	2.0	BS12S05-0502WT	BS12S05-1002WT	BS12S05-1502WT	BS12S05-2502WT	BS12S05-01Q1GC
	2.1	BS12S05-05Q1WT	BS12S05-10Q1WT	BS12S05-15Q1WT	BS12S05-25Q1WT	BS12S05-01Q1GC
	3.0	BS12S05-0503WT	BS12S05-1003WT	BS12S05-1503WT	BS12S05-2503WT	BS12S05-0103GC
	4.0	BS12S05-0504WT	BS12S05-1004WT	BS12S05-1504WT	BS12S05-2504WT	BS12S05-0104GC
	4.6	BS12S05-0546WT	BS12S05-1046WT	BS12S05-1546WT	BS12S05-2546WT	BS12S05-0104GC

*Guard cartridge holder required, part no. XPGCH-Q1

For other dimensions, please contact your YMC representative or YMC directly by phone (+49 (0)2064 427-0), by mail (info@ymc.eu) or use our online chat on our homepage (www.ymc.eu).

YMC
RP-Classics



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HPLC Columns YMC RP-Classics

Introduction

HPLC Columns for Reversed Phase Chromatography

In order to succeed in HPLC, the choice of the optimal selectivity is essential to establish efficient separation conditions.
The best suited packing material depends significantly on the characteristics of the separation conditions, which should be thoroughly considered.

For this purpose YMC offers a wide variety of selectivities applicable to HPLC from nano-scale analysis to large scale isolation. Within this chapter the world renown YMC-Pack ODS-Series (YMC-Pack ODS-AQ, YMC-Pack ODS-A, YMC-Pack ODS-AM, YMC-Pack ODS-AL) and other phases are described.

YMC-Pack ODS-AQ

- *"hydrophilic" C18*
- *balanced surface chemistry*
- *polar recognition*
- *metabolite recognition*

Specifications	YMC-Pack ODS-AQ	
Particle size / µm	3; 5	3; 5
Pore size / nm	12	20
Surface area / m^2g^{-1}	330	175
Carbon content / %	14	10
Recommended pH range	2.0 – 7.5	2.0 – 7.5

General

YMC-Pack ODS-AQ 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-Pack ODS-AQ exhibits a different selectivity to that of traditional C18 stationary phases. This difference in selectivity of YMC-Pack ODS-AQ can be used to advantage for HPLC separations, which are difficult to achieve with conventional C18 columns.

Selectivity Data

The proprietary YMC derivatisation process creates the different selectivity of YMC-Pack ODS-AQ, 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-Pack ODS-AQ stationary phase leads to strong retentions of polar sample solutes even in aqueous eluents.

These properties of YMC-Pack ODS-AQ are beneficial for separations 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 these high aqueous content mobile phases as shown opposite. They appear less lipophilic with densely folded C18 chains. However, in similar mobile phases, YMC-Pack ODS-AQ maintains its brush-like C18 chain structure and its lipophilic properties and provides excellent retention of polar compounds.

Applications

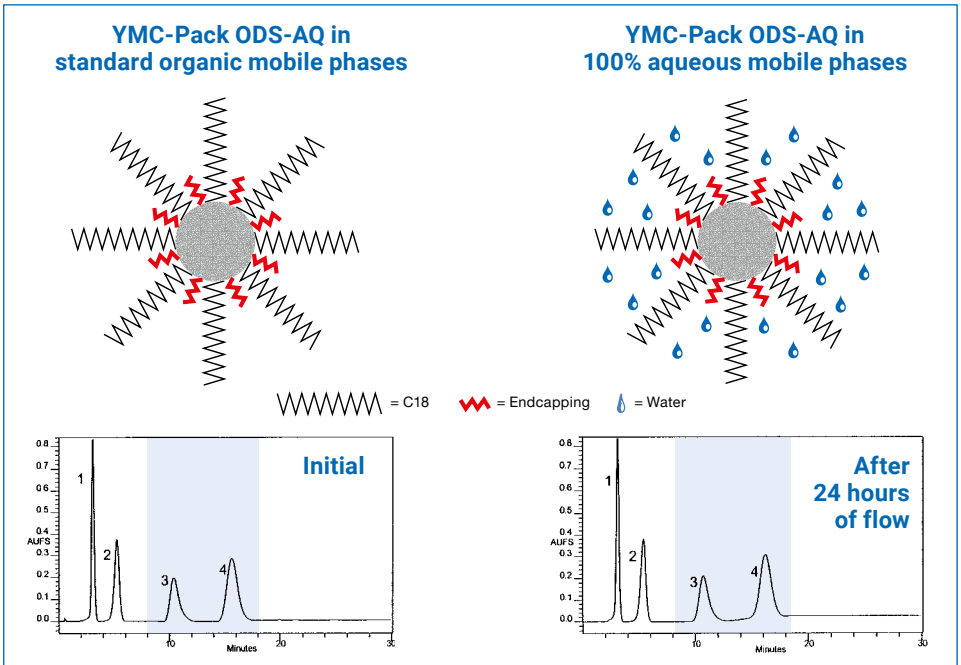
YMC-Pack ODS-AQ is able to resolve compounds with minor differences in polarity from closely related chemical structures. As a result, YMC-Pack ODS-AQ is an excellent tool for the separation of drugs and corresponding metabolites, pesticides and degradation products, or peptides and protein digests etc.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

Genuine linear scale-up from analytical to large scale separations is easily achievable with YMC products such as YMC-Pack ODS-AQ, where particle sizes from 3 to 50 µm are available in large lot sizes up to several hundred kilograms, if needed. This, together with the outstanding selectivity of YMC-Pack ODS-AQ, make it an essential tool to enhance the productivity of large scale chromatographic processes.

YMC-Pack ODS-AQ

Comparison of ODS-AQ vs. Conventional ODS

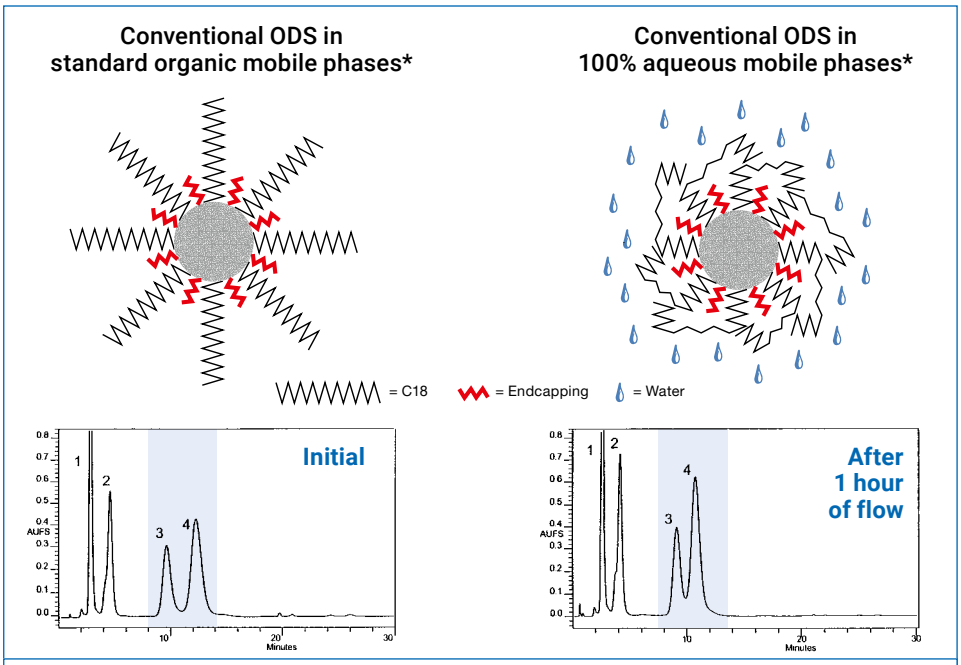
Stable retention time!



YMC-Pack ODS-AQ:

Column: YMC-Pack ODS-AQ, 250 x 10 mm ID
Mobile Phase: 100% water
Compounds: Highly polar and very water soluble

Retention time loss!

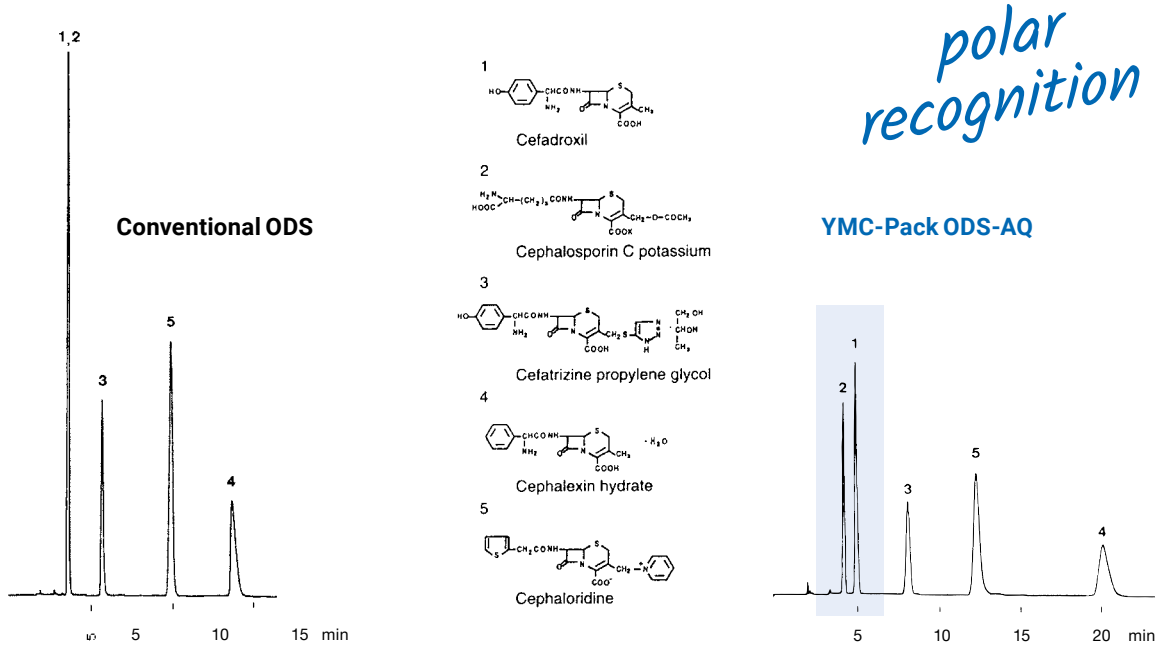


Conventional ODS-Column:

Column: YMC-Pack ODS-A, 250 x 10 mm ID
Mobile Phase: 100% water
Compounds: Highly polar and very water soluble

YMC-Pack ODS-AQ

Exceptional performance for the separation of polar compounds

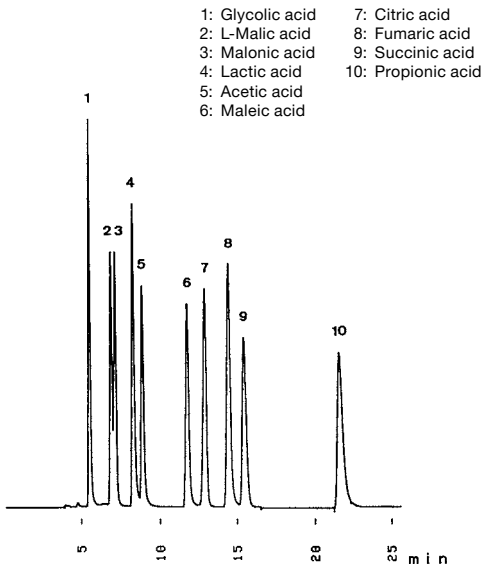


Cephalosporin antibiotics

Column:	YMC-Pack ODS-AM (5 µm, 12 nm) 150 x 4.6 mm ID
Part No.:	AM12S05-1546WT
Eluent:	methanol / water / acetic acid (10/85/5)
Flow:	1.0 mL/min
Detection:	UV at 260 nm, 0.16 AUFS
Temperature:	37 °C

Column:	YMC-Pack ODS-AQ (5 µm, 12 nm) 150 x 4.6 mm ID
Part No.:	AQ12S05-1546WT
Eluent:	methanol / water / acetic acid (10/85/5)
Flow:	1.0 mL/min
Detection:	UV at 260 nm, 0.16 AUFS
Temperature:	37 °C

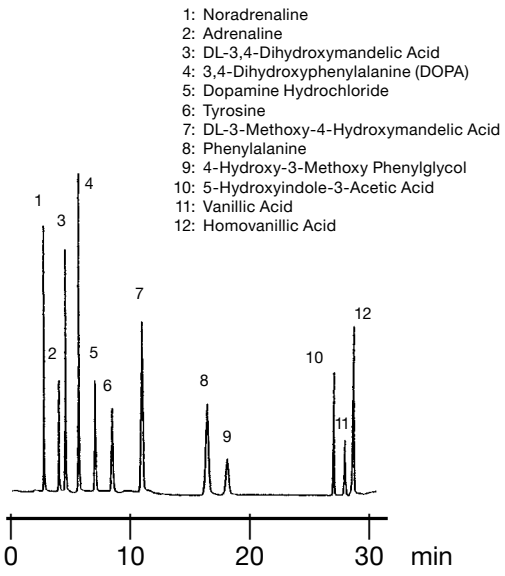
Strong retention in aqueous eluents



Crude drugs

Column:	YMC-Pack ODS-AQ (5 µm, 12 nm) 250 x 4.6 mm ID
Part No.:	AQ12S05-2546WT
Eluent:	20 mM H_3PO_4-NaH_2PO_4 (pH 2.8)
Flow:	0.7 mL/min
Detection:	UV at 220 nm, 0.08 AUFS
Temperature:	30 °C
Injection:	10 µL (0.007 ~ 1.8 mg/mL)

No need for ion pair reagents

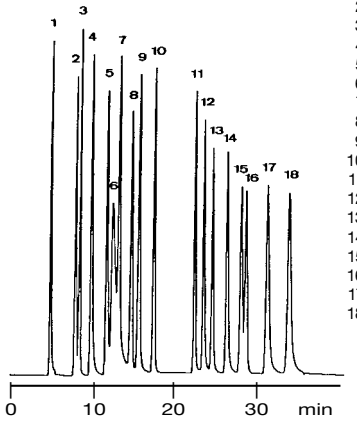


Catecholamines

Column:	YMC-Pack ODS-AQ (5 µm, 12 nm) 250 x 4.6 mm ID
Part No.:	AQ12S05-2546WT
Eluent:	A: phosphate puffer (100 mM, pH 3.0) B: acetonitrile
Gradient:	99% A (0-20 min), 85% A (20-25 min)
Flow:	1.5 mL/min
Detection:	UV at 210 nm
Temperature:	Room temperature

YMC-Pack ODS-AQ

Separation of biomolecules

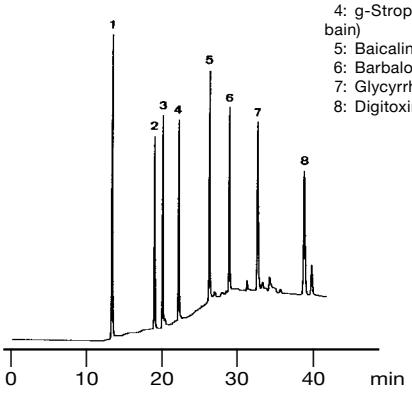


1: Cytosine
2: Cytidine
3: Uracil
4: Deoxycytidine
5: Guanine
6: Adenine
7: Hypoxanthine
8: Uridine
9: Xanthine
10: Thymine
11: Inosine
12: Guanosine
13: Deoxyinosine
14: Deoxyguanosine
15: Xanthosine
16: Thymidine
17: Adenosine
18: Deoxyadenosine

Nucleosides

Column:	YMC-Pack ODS-AQ (5µm, 12 nm) 250 x 4.6 mm ID
Part No.:	AQ12S05-2546WT
Eluent:	A = 20 mM CH_3COOH-CH_3COONH_4 (pH 3.5) B = 20 mM CH_3COOH-CH_3COONH_4 (pH 3.5) / methanol = 90/10 (v/v)
Gradient:	30% B (0-5 min), 30-100% B (5-13 min, linear), 100% B (13-40 min)
Flow:	0.7 mL/min
Detection:	UV at 260 nm
Temperature:	30 °C

Excellent choice for a broad chromatographic application range



1: Arbutin
2: Salicin
3: Esculine
4: g-Strophanthin (Quabain)
5: Baicalin
6: Barbaloin
7: Glycyrrhizin
8: Digitoxin

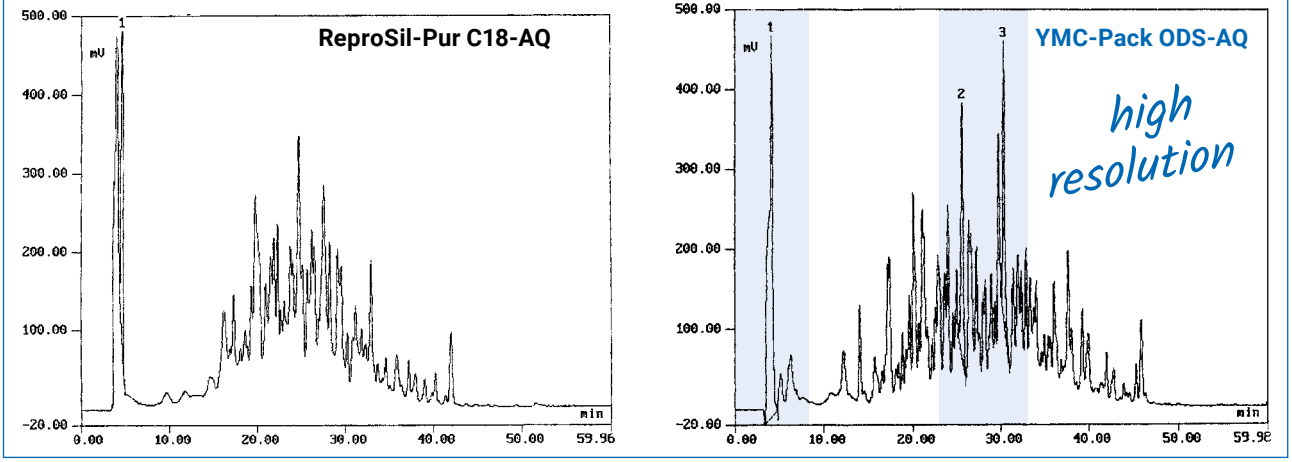
Crude drugs

Column:	YMC-Pack ODS-AQ (5 µm, 12 nm) 250 x 4.6 mm ID
Part No.:	AQ12S05-2546WT
Eluent:	A: methanol / $NH_4H_2PO_4$ (20 mM) = 5/95 B: methanol / $NH_4H_2PO_4$ (20 mM) = 80/20
Gradient:	0-100% B (0-20 min, linear), 100% B (20-40 min)
Flow:	0.6 mL/min
Detection:	UV at 250 nm
Temperature:	30 °C

Comparison of YMC-Pack ODS-AQ with competitive products

Since 1985, YMC-Pack ODS-AQ has consistently increased its popularity due to its novel selectivity pattern towards polar compounds and its ability to withstand 100% aqueous conditions. Today, more than 30 (!) years later, many new analytical and preparative methods are still being developed on YMC-Pack ODS-AQ chemistry despite various AQ-type products being introduced by our competitors; phases with supposedly "identical" selectivity or with exotic bonding techniques designed to generate performance characteristics similar to those of YMC-Pack ODS-AQ. However, genuine YMC-Pack ODS-AQ still represents today a fully competitive state-of-the-art high performance stationary phase, despite the complementary YMC innovations, namely YMC-Triart C18 and Hydrosphere, C18 as potential in-house competitors.

Tryptic digest of BSA



By courtesy of Dr. Manfred Raida, IPF Hannover

For more applications please refer to our "Application Data Collections" or contact us directly.

Column care

The recommended pH range for YMC-Pack ODS-AQ is 2.0 – 7.5 in up to 100% aqueous systems and a maximum of 50 °C. Remove acid and buffer salts before storage. Store the column in methanol / water = 70/30. Clogged inlet frits often can be cleaned by changing the flow direction. For detailed information please refer to the "Column Care and Use Instructions" which can be downloaded from www.ymc.eu/download-library.html

YMC-Pack ODS-A

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

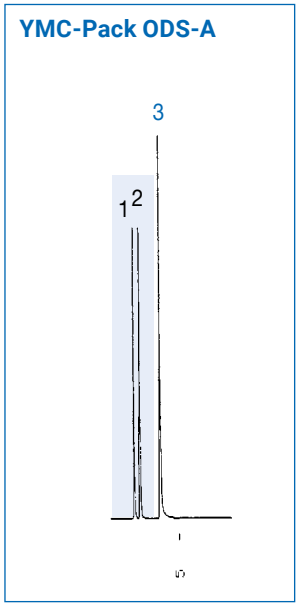
Specifications	YMC-Pack ODS-A		
Particle size / µm	3; 5	3; 5	5
Pore size / nm	12	20	30
Surface area / m^2g^{-1}	330	175	100
Carbon content / %	17	12	7
Recommended pH range	2.0 – 7.5	2.0 – 7.5	2.0 – 7.5

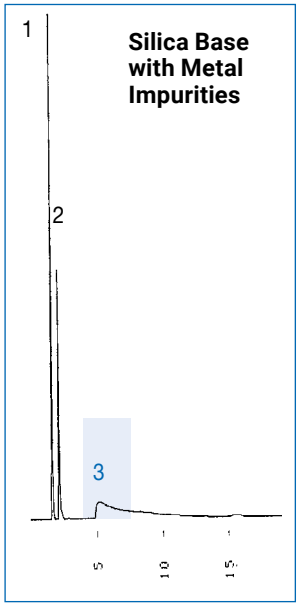
General

YMC-Pack ODS-A, YMC's classical reversed phase packing material, is renowned worldwide because of its unique performance and reproducibility. Due to the high quality, YMC-Pack ODS-A is widely used for the validation of analytical HPLC methods and for long-term reproducible preparative HPLC processes.

Properties

The production of the base silica for YMC-Pack ODS-A and its subsequent derivatisation are performed in large bulk batches. Exhaustive endcapping reduces reliably the activity of silanol groups and minimises nonspecific secondary interaction.
In addition to standard methods, like determination of adsorption isotherms, particle size distribution and carbon content (see table above), YMC uses an extensive range of analytical methods to ensure constant and reproducible selectivity of the reversed phase packings.
The base of YMC-Pack ODS-A 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 such as 8-hydroxyquinoline or acetyl acetone, which easily form coordinating complexes with metal ions on the silica surface. As coordinating functional groups are frequent structural components in pharmaceutical compounds, high purity packings such as YMC-Pack ODS-A are needed for reproducible separation of these compounds without secondary retention or tailing.
YMC-Pack ODS-A is also available in preparative particle sizes.





Column:	YMC-Pack ODS-A (12 nm, 5 µm) 150 x 4.6 mm ID
Eluent:	KH_2PO_4 (20 mM, pH 7.6) / methanol = 40/60
Flow:	1.0 mL/min
Detection:	UV, 254 nm
Temperature:	37 °C
Substances:	1. Uracil 2. Acetylacetone 3. 8-Hydroxyquinoline

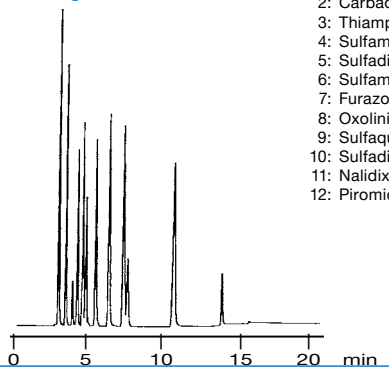
YMC-Pack ODS-A

Applications

YMC-Pack ODS-A is frequently used for pharmaceutical, biochemical and environmental applications as well as for separations in the field of food technology. YMC-Pack ODS-A is available in particle sizes from 3 to 50 µm. As the selectivity is identical throughout the whole range, these phases are ideal for scale-up from analytical to preparative process scale.

Antibacterial agents

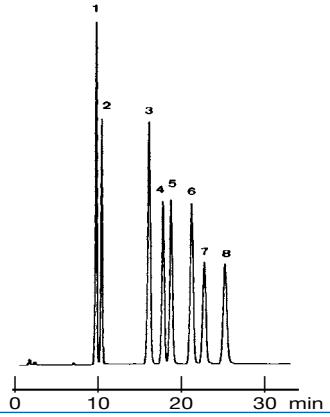
1: Olaquindox
2: Carbadox
3: Thiamphenicol
4: Sulfamerazine
5: Sulfadimidine
6: Sulfamonomethoxine
7: Furazolidone
8: Oxolinic Acid
9: Sulfaquinoxaline
10: Sulfadimethoxine
11: Nalidixic Acid
12: Piromidic Acid



Column:	YMC-Pack ODS-A (5 µm, 12 nm) 250 x 4.6 mm ID
Part No.:	AA12S05-2546WT
Eluent:	A: ACN / $NH_4H_2PO_4$ (50 mM) = 10/90 B: ACN / $NH_4H_2PO_4$ (50 mM) = 80/20
Gradient:	25% B (0-5 min), 25-100% B (5-15 min), 100% B (15-20 min)
Flow:	1.0 mL/min
Detection:	UV, 240 nm
Temperature:	37 °C

Adrenocorticosteroids

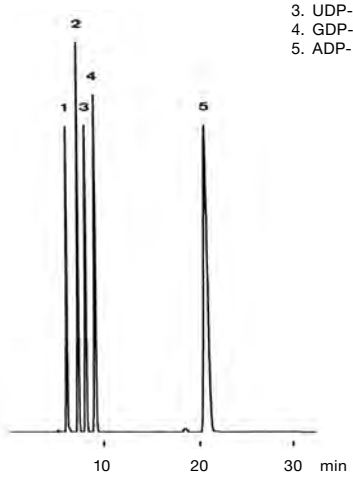
1: Hydrocortisone
2: Cortisone
3: Methylprednisolone
4: Betamethasone
5: Dexamethasone
6: Corticosterone
7: Beclomethasone
8: Triamcinolone Acetonide



Column:	YMC-Pack ODS-A (5 µm, 12 nm) 150 x 4.6 mm ID
Part No.:	AA12S05-1546WT
Eluent:	ACN / H_2O = 27/73
Flow:	1.0 mL/min
Detection:	UV, 260 nm
Temperature:	37 °C

Sugar nucleotides

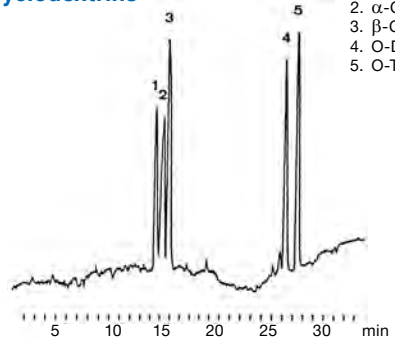
1. CDP-D-glucose
2. UDP-D-glucose
3. UDP-N-acetyl-D-glucosamine
4. GDP-D-mannose
5. ADP-D-glucose



Column:	YMC-Pack ODS-A (5 µm, 12 nm) 250 x 4.6 mm ID
Part No.:	AA12S05-2546WT
Eluent:	20 mM triethylamine-acetic acid (pH 5.7) / acetonitrile (9/1)
Flow rate:	1.0 mL/min
Detection:	UV at 260 nm, 0.16 AUFS
Temperature:	37 °C
Injection:	5 µL (0.27 ~ 0.71 mg/mL)

Cyclodextrins

1. γ-Cyclodextrin
2. α-Cyclodextrin
3. β-Cyclodextrin
4. O-Dimethyl-β-Cyclodextrin
5. O-Trimethyl-β-Cyclodextrin



Column:	YMC-Pack ODS-A (5 µm, 12 nm) 150 x 4.6 mm ID
Part No.:	AA12S05-1546WT
Eluent:	A: water B: methanol 2% B (0-5 min), 2-30% B (5-15 min, linear), 30-100% B (15-20 min, linear), 100% B (20-30 min)
Flow rate:	1.0 mL/min
Detection:	Evaporative Mass Analyzer (ACS Ltd.) Temp 150 Time Constant 5 PMT 3 Attenuation 16 Pressure 20 psi
Temperature:	30 °C
Injection:	200 µL (1.5 ~ 15 mg/mL)

Column care

The recommended pH range for using YMC-Pack ODS-A columns is 2.0-7.5. Remove acid and buffer salts before storage. Store the column in methanol/water = 50/50. If columns are affected by undesired contaminants or clogged inlet frits which cause back pressure increases flush the column with THF in the opposite flow direction. For detailed information please refer to the "Column Care and Use Instructions" which can be downloaded from www.ymc.eu/download-library.html

YMC-Pack ODS-AM

- *high quality analytical C18*
- *tightly specified*
- *long term reproducibility*
- *for method validation*
- *for method registration*

Specifications	YMC-Pack ODS-AM
Particle size / µm	3; 5
Pore size / nm	12
Surface area / m^2g^{-1}	330
Carbon content / %	10
Recommended pH range	2.0 – 7.5

General

Validation and registration of analytical HPLC methods require the long term reproducibility of the entire analytical process. The high consistency in the quality of HPLC packings and columns plays a key role for validated HPLC analysis.

Therefore, YMC created ODS-AM, a high quality reversed phase C18 HPLC packing material to meet the most stringent demands for validated analytical HPLC processes.

Properties

YMC-Pack ODS-AM is produced in large lots using high purity YMC silica as a base material and a multi stage synthesis process. For the derivatisation, monomeric bonding chemistry is applied followed by an extensive endcapping process to reduce the silanol activity.

The resulting YMC-Pack ODS-AM packing is extensively tested to ensure compliance with specifications set for very low variations in physicochemical properties.

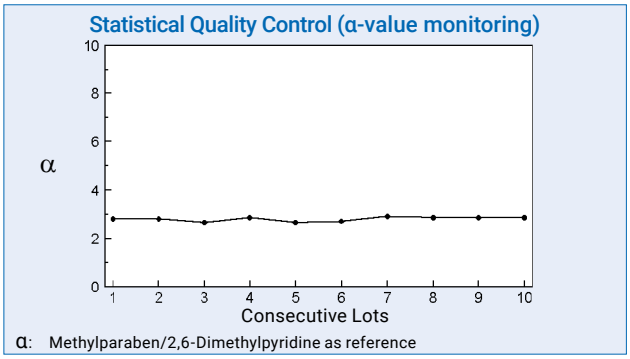
In addition, YMC-Pack ODS-AM packings and columns have to pass numerous proprietary chromatographic tests to meet the narrow quality specification range with regard to:

- selectivity pattern
- column resolution
- absolute retention
- peak symmetry

YMC applies various tests to perform statistical quality control for reversed phase HPLC packings. The α-value test of methylparaben and 2,6-dimethylpyridine for instance, is very sensitive and is routinely used to monitor the retention and the selectivity properties of YMC-Pack ODS-AM.

Methylparaben is a moderately polar, inert compound. It is retained solely by a RP mechanism, with minimal secondary interactions with residual silanol groups. 2,6-dimethylpyridine, however, represents a lipophilic amine compound which has a high potential of unspecific interaction with unreacted acidic silanols. An increase in retention of 2,6-dimethylpyridine and hence lower α-values would indicate incomplete C18 bonding and/or ineffective endcapping. YMC specifies for ODS-AM that the statistical α-value of methylparaben and 2,6-dimethylpyridine be 2.77 +/- 0.20.

The rigorous quality control and the quality assurance system applied by YMC minimises the variation in retention and selectivity of YMC-Pack ODS-AM columns. Due to the guaranteed long term reproducibility, YMC-Pack ODS-AM columns often are the final choice for establishing validated HPLC analysis.



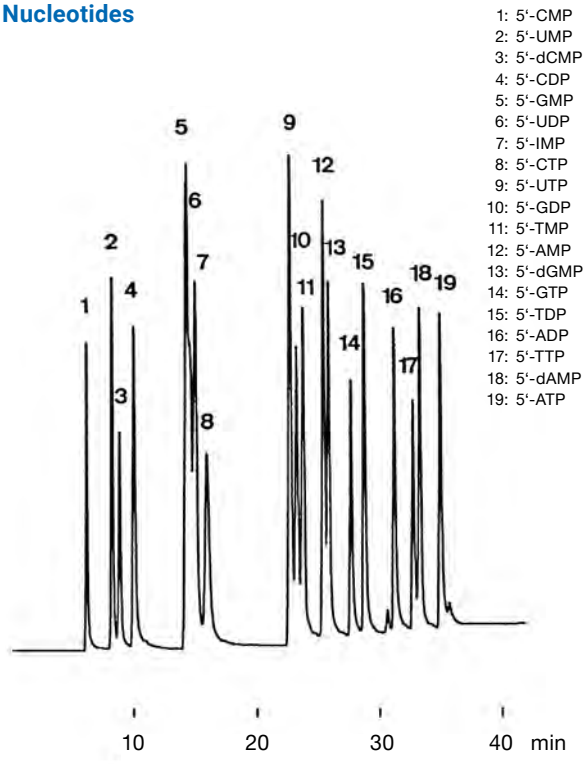
α: Methylparaben/2,6-Dimethylpyridine as reference

YMC-Pack ODS-AM

Applications

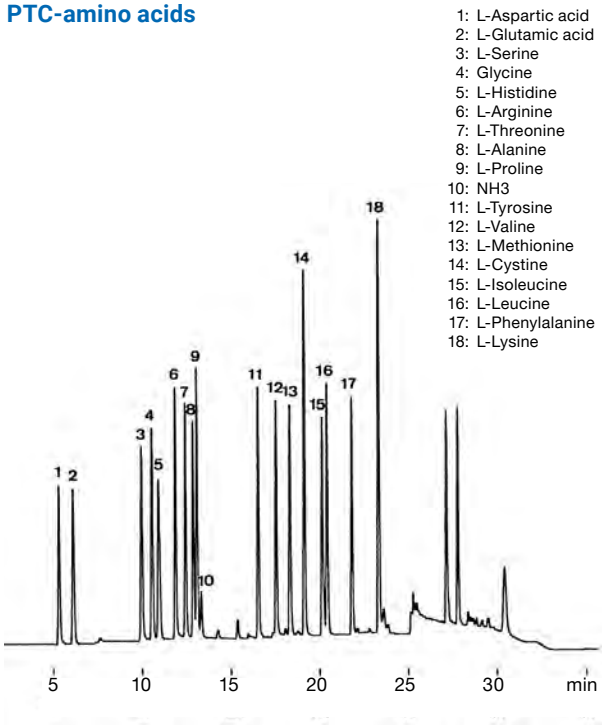
ODS-AM has an appropriate selectivity for polar to moderately nonpolar pharmaceuticals, organic intermediates, biological and natural products found in the chemical and pharmaceutical industry.

Nucleotides



Column:	YMC-Pack ODS-AM (5 µm, 12 nm) 250 x 4.6 mm ID
Part No.:	AM12S05-2546WT
Eluent:	A = 0.2 M triethylamine-acetic acid (pH 6.6) B = 0.2 M triethylamine-acetic acid (pH 6.6) / ACN (95/5)
Gradient:	4% B (0-10 min), 4-100% B (10-35 min, linear), 100% B (35-50 min)
Flow:	1.0 mL/min
Detection:	UV at 260 nm, 0.16 AUFS
Temperature:	30 °C
Injection:	14 µL (0.029 ~ 0.16 mg/mL)

PTC-amino acids



Column:	YMC-Pack ODS-AM (5 µm, 12 nm) 250 x 4.6 mm ID
Part No.:	AM12S05-2546WT
Eluent:	A = 60 mM CH_3COONa - CH_3COOH (pH 6.6) / ACN (94/6) B = 60 mM CH_3COONa - CH_3COOH (pH 6.6) / ACN (40/60)
Gradient:	0-55% B (0-20 min, linear), 100% B (20-25 min), 0% B (25-35 min)
Flow:	1.0 mL/min
Detection:	UV at 250 nm, 0.08 AUFS
Temperature:	37 °C
Injection:	5 µL (62.5 pmol/µL)
Sample:	PTC derivatives

Column Care

The recommended pH range for using YMC-Pack ODS-AM columns is 2.0-7.5. Remove acid and buffer salts before storage. Store the column in methanol/water = 50/50. If columns are affected by undesired contaminants or clogged inlet frits which cause back pressure increases, flush the column with THF in the opposite flow direction. For detailed information please refer to the "Column Care and Use Instructions" which can be downloaded from www.ymc.eu/download-library.html

YMC-Pack ODS-AL

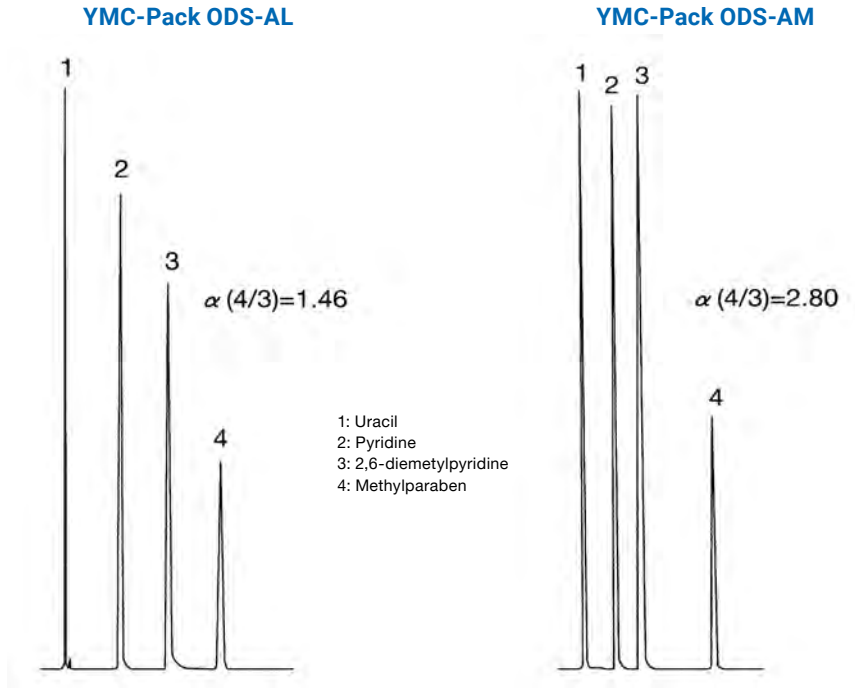
- ***residual silanols for mixed-mode separations***
- ***same high ligand density as other YMC ODS phases***
- ***unique selectivity for polar compounds***
- ***not endcapped***

Specifications	YMC-Pack ODS-AL
Particle size / µm	5
Pore size / nm	12
Surface area / m^2g^{-1}	330
Carbon content / %	17
Recommended pH range	2.0 – 7.5

General

YMC-Pack ODS-AL uses not only hydrophobic interaction but also secondary interactions with reactive residual silanol groups to affect separation. This results in a different selectivity from conventional ODS columns. When ionic interactions are involved, it is preferable to use a buffer in the mobile phase to achieve reproducible separations.

Effects of silanol groups

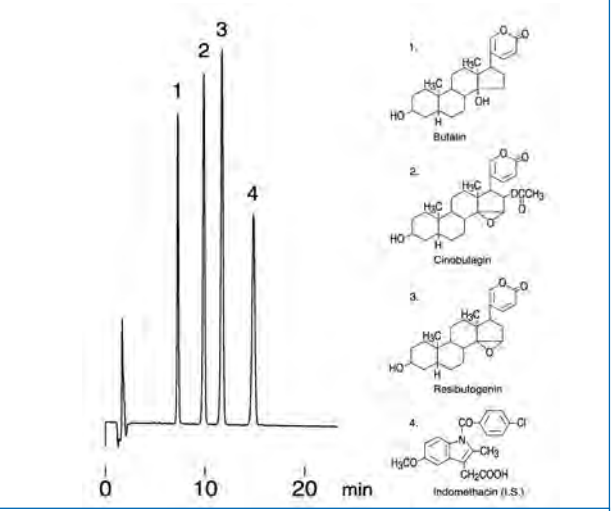


The separation factor (α) of internal standards methylparaben / 2,6-dimethylpyridine for YMC-Pack ODS-AL, which is not endcapped is different to that of YMC-Pack ODS-AM. Due to the residual silanol groups, YMC-Pack ODS-AL shows higher retention of pyridines.

YMC-Pack ODS-AL

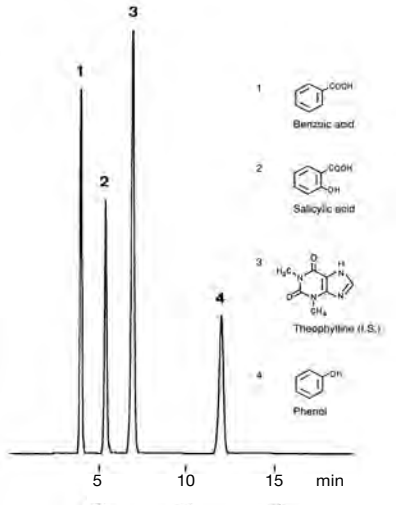
Applications

Steroids from toad venom



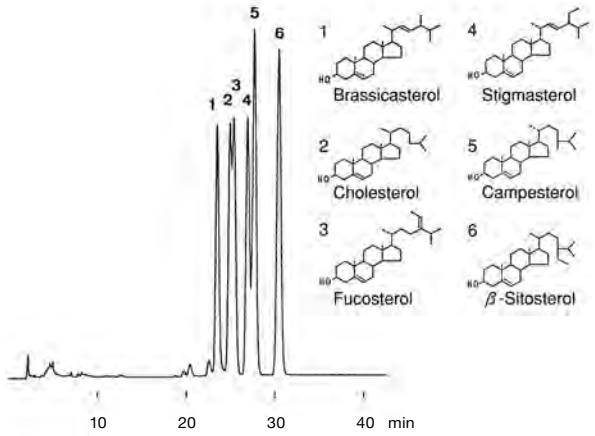
Column:	YMC-Pack ODS-AL (5 µm, 12 nm) 150 x 4.6 mm ID
Part No.:	AL12S05-1546WT
Eluent:	ACN / 0.1% phosphoric acid (45/55)
Flow:	1.0 mL/min
Detection:	UV at 300 nm, 0.08 AUFS
Temperature:	40 °C
Injection:	10 µL (0.04 ~ 0.08 mg/mL)

Disinfectants



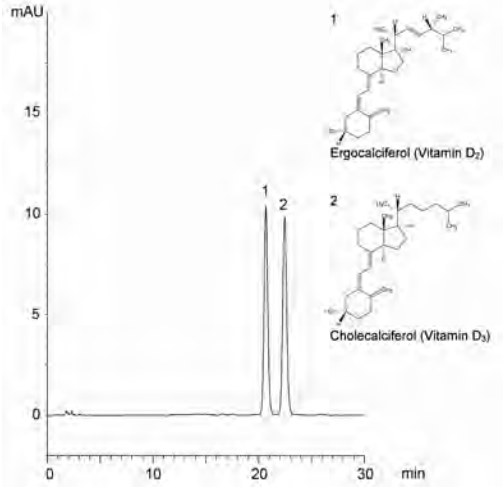
Column:	YMC-Pack ODS-AL (5 µm, 12 nm) 150 x 4.6 mm ID
Part No.:	AL12S05-1546WT
Eluent:	100 mM KH_2PO_4-Na_2HPO_4 (pH 7.0) / methanol (75/25)
Flow:	0.8 mL/min
Detection:	UV at 270 nm, 0.13 AUFS
Temperature:	30 °C

Sterols



Column:	YMC-Pack ODS-AL (5 µm, 12 nm) 250 x 4.6 mm ID
Part No.:	AL12S05-2546WT
Eluent:	methanol / water (100/2)
Flow:	0.8 mL/min
Detection:	UV at 210 nm, 0.32 AUFS
Temperature:	37 °C
Injection:	10 µL (0.4 ~ 1 mg/mL)

Vitamin D2 and Vitamin D3



Column:	YMC-Pack ODS-AL (5 µm, 12 nm) 150 x 4.6 mm ID
Part No.:	AL12S05-1546WT
Eluent:	acetonitrile / water (95/5)
Flow:	1.0 mL/min
Detection:	UV at 265 nm
Temperature:	40 °C
Injection:	10 µL (0.01 mg/mL)

Column Care

The recommended pH range for using YMC-Pack ODS-AL columns is 2.0-7.5. Remove acid and buffer salts before storage. Store the column in methanol/water = 50/50. If columns are affected by undesired contaminants or clogged inlet frits which cause back pressure increases, flush the column with THF in the opposite flow direction. For detailed information please refer to the "Column Care and Use Instructions" which can be downloaded from www.ymc.eu/download-library.html

YMC-Pack Polymer C18

- ***hydrophilic polymethacrylate support***
- ***excellent reproducibility of C18 chemistry integral to polymer matrix***
- ***no silanol or metal contaminants***
- ***pH stable from pH 2–13***
- ***compatible with all standard reversed phase solvents***

Specifications	YMC-Pack Polymer C18
Particle size / µm	6
Pore size / nm	proprietary
Surface area / m^2g^{-1}	n/a
Carbon content / %	10
Recommended pH range	2.0 – 13.0

General

YMC-Pack Polymer C18 is a reversed phase liquid chromatography packing which provides a broad range of solvent choices and a pH range from 2.0–13. YMC-Pack Polymer C18 is manufactured from a hydrophilic methacrylate polymer which is cross-linked with C18 ligand-containing reagents. YMC-Pack Polymer C18 offers a maximum application range: a wide variety of compounds such as organic acids, organic amines, peptides, pharmaceuticals and proteins can be separated using YMC-Pack Polymer C18.

Properties

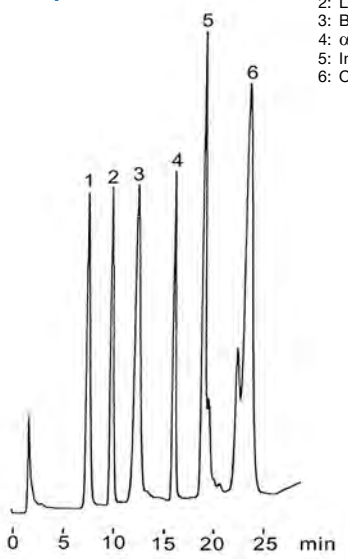
YMC-Pack Polymer C18 is prepared from a hydrophilic methacrylate polymer bonded with a hydro-phobic octadecylsilane reagent to make the C18 functionality an integral part of the polymeric structure. This gives a three-dimensional polymer matrix which is not based on a silica gel support.
As such, it has no residual silanols or metal impurities to interfere with the separation of basic organic compounds.
YMC-Pack Polymer C18 is compatible with all common reversed phase eluents such as water, methanol, acetonitrile and THF. Virtually all aqueous buffers and acid modifiers, such as TFA and phosphoric acid, as well as base modifiers such as sodium hydroxide and ammonium hydroxide can be used. Since it resists shrinking and swelling, YMC-Pack Polymer C18 can be used with eluents ranging in composition from 100% aqueous to 100% organic component.
In addition, YMC-Pack Polymer C18 can easily be sterilised by flushing with 0.1M NaOH in 20% acetonitrile/water.
The selectivity and retention of YMC-Pack Polymer C18 is similar to standard ODS phases, due to its hydrophobic bonding on a hydrophilic support. Consequently, its selectivity is closer to that of silica-based C18 supports than to styrene/DVB-based supports.
It should be noted that interactions between aromatic or conjugated systems and the methacrylate backbone provides slightly greater retention when compared to silica-based ODS columns, whereas highly aliphatic compounds show greater retention on silica-based ODS supports.
YMC-Pack Polymer C18 is also available in preparative particle sizes.

YMC-Pack Polymer C18

Applications

Peptides and proteins

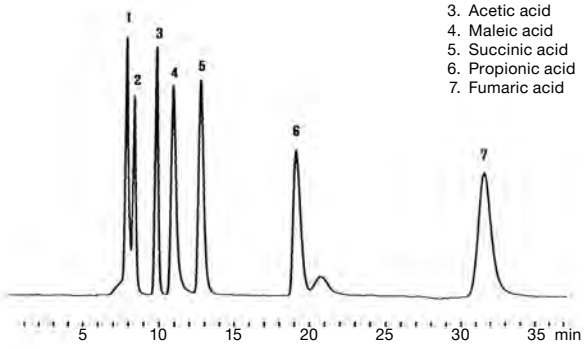
1: Met-Enkephalin
2: Leu-Enkephalin
3: BSA
4: α-Mating factor
5: Insulin
6: Ovalbumin



Column:	YMC-Pack Polymer C18 150 x 4.6 mm ID
Part No.:	PC99S06-1546WT
Eluent:	A = acetonitrile / water / TFA (20/80/0.05) B = acetonitrile / water / TFA (45/55/0.05) 0-100% B (0-30 min, linear)
Flow:	1.0 mL/min
Detection:	UV at 220 nm, 0.32 AUFS
Temperature:	30 °C
Injection:	30 µL

Organic acids

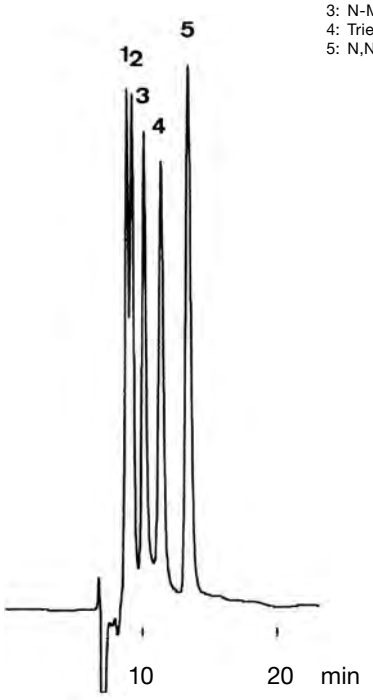
1. L-Mailic acid
2. Lactic acid
3. Acetic acid
4. Maleic acid
5. Succinic acid
6. Propionic acid
7. Fumaric acid



Column:	YMC-Pack Polymer C18 250 x 4.6 mm ID
Part No.:	PC99S06-2546WT
Eluent:	0.1% TFA
Flow:	0.5 mL/min
Detection:	UV at 220 nm, 0.08 AUFS
Temperature:	30 °C
Injection:	10 µL (0.016 ~ 2.2 mg/mL)

Aminoalcohols

1: Ethanolamine
2: Diethanolamine
3: N-Methylethanolamine
4: Triethanolamine
5: N,N-Dimetylethanolamine



Column:	YMC-Pack Polymer C18 250 x 6.0 mm ID
Part No.:	PC99S06-2506WT
Eluent:	100 mM Na_2HPO_4 / 100 mM NaOH (60/40, pH 12.0)
Flow:	0.6 mL/min
Detection:	UV at 215 nm, 0.32 AUFS
Temperature:	20 °C
Injection:	50 µL (0.2 ~ 3.0 mg/mL)

Column Care

YMC-Pack Polymer C18 is stable towards hydrolysis between pH 2.0–13.0. Remove acid and buffer salts before storage. Store the column in methanol / water = 70/30. If columns are affected by undesired contaminants or clogged inlet frits which cause back pressure increases, flush the column with THF in the opposite flow direction. For detailed information please refer to the "Column Care and Use Instructions" which can be downloaded from www.ymc.eu/download-library.html

YMCbasic

- ***alternative bonding approach to reduce peak tailing of basic pharmaceuticals***
- ***no need for ion pair reagents or amine modifiers***
- ***complementing selectivity to C8 and C18 materials***

Specifications	YMCbasic
Particle size / µm	3; 5
Pore size / nm	20
Surface area / m^2g^{-1}	175
Carbon content / %	7.0
Recommended pH range	2.0 – 7.5

General

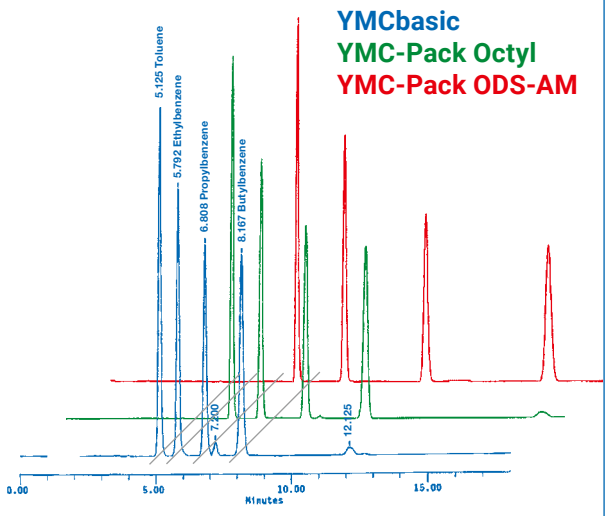
The proprietary derivatisation procedure for YMCbasic allows YMC to produce a material with controlled surface coverage, which shows excellent lot-to-lot reproducibility as a result of closely monitoring both the production of the silica support and the bonding process.
The resulting YMCbasic material shows a different hydrophobicity to C8 or C18 phases as shown in the diagram on this page. Finally, it represents an interesting alternative to short chain selectivities.

Applications

The result is a phase with true reversed phase characteristics, high resolution and excellent peak symmetry for basic compounds without the need for ion pair reagents or amine modifiers (see separation of anilines using acetonitrile / water eluent). Unlike many base-deactivated phases, YMCbasic is also suitable for separation of acidic compounds, showing slight retention of highly polar acid compounds such as maleate. YMCbasic provides a complementing selectivity seen with conventional C8 and C18 materials, but without peak tailing for basic compounds.

YMCbasic is also available in preparative particle sizes.

Hydrophobicity of YMCbasic versus YMC-Pack Octyl and YMC-Pack ODS-AM

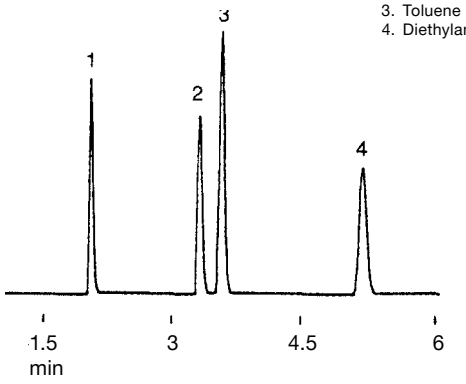


Column: 250 x 4.6 mm ID
Eluent: acetonitrile / water (75/25)
Flow: 1.0 mL/min
Detection: UV at 254 nm

YMCbasic

Anilines and aromatic compounds

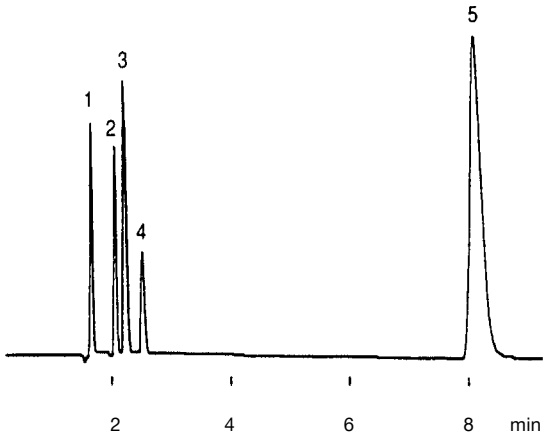
1. Phenol
2. Dimethylaniline
3. Toluene
4. Diethylaniline



Column:	YMCbasic (5 µm) 250 x 4.6 mm ID
Part No.:	BA99S05-2546WT
Eluent:	acetonitrile / water (60/40)
Flow:	2.0 mL/min
Detection:	UV at 254 nm

Cough/cold medicine

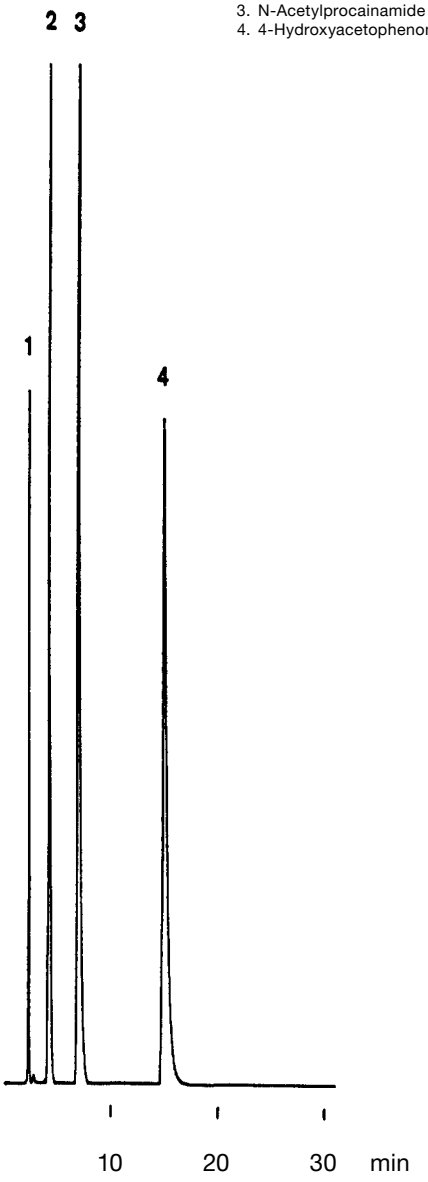
1. Maleate
2. Phenylpropanolamine
3. Pseudoephedrine
4. Scopalamine
5. Chlorpheniramine



Column:	YMCbasic (5 µm) 250 x 4.6 mm ID
Part No.:	BA99S05-2546WT
Eluent:	acetonitrile / 0.05 mM KH_2PO_4 (pH 3.2) (15/85)
Flow:	2.0 mL/min
Detection:	UV at 254 nm

Basic compounds

1. Uracil
2. Procainamide
3. N-Acetylprocainamide
4. 4-Hydroxyacetophenone



Column:	YMCbasic (5 µm) 150 x 4.6 mm ID
Part No.:	BA99S05-1546WT
Eluent:	20 mM K_2HPO_4-KH_2PO_4 (pH 6.9) / acetonitrile (92/8)
Flow:	1.0 mL/min
Detection:	UV at 254 nm, 0.32 AUFS
Temperature:	37 °C
Injection:	10 µL (30 ~ 300 µg/mL)

Column Care

The recommend pH range for YMCbasic is 2.0–7.5. Remove acid and buffer salts before storage. Store the column in methanol/ water = 70/30. Clogged inlet frits often can be cleaned by changing the flow direction or replacement.

For detailed information please refer to the “Column Care and Use Instructions” which can be downloaded from www.ymc.eu/download-library.html

YMC-Pack C_8

- ***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***

Specifications	YMC-Pack C_8		
Particle size / µm	3; 5	5	5
Pore size / nm	12	20	30
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-Pack C_8 is one of YMC's most commonly used bonded phases and an excellent alternative to C18 selectivities. Due to its moderate hydrophobicity, retention times tend to be shorter than those for ODS phases.

YMC-Pack C_8 is suitable for a wide range of sample types including pharmaceuticals and biologicals with a relatively high hydrophobicity.

Properties

YMC-Pack C_8 is prepared by exhaustive bonding of a monomeric octylsilane to totally spherical and porous silica gel. The bonded phase is then treated with an exhaustive endcapping process to ensure a high surface coverage leading to a moderate 10% carbon loading on the standard 12 nm pore material. Compared to C18 phases, retention times for hydrophobic molecules will be shorter on C8 material due to the reduced carbon load.
YMC-Pack C_8 is ideally suited for the separation of many compounds that are too strongly retained on C18 phases or which require greater retention than provided by C4 materials.

It is one of the most versatile reversed phase materials and should be considered for the development of new methods. Available in three porosities, YMC-Pack C_8 material will separate many classes of compounds including pharmaceuticals, organic chemicals, peptides, protein and other biological molecules. For preparative applications, choose the smallest pore size which provides adequate retention and resolution. This is because sample loading is generally proportional to surface area. Smaller porosity media provide greater surface area and hence greater loadability. YMC-Pack C_8 is also available in preparative particle sizes.

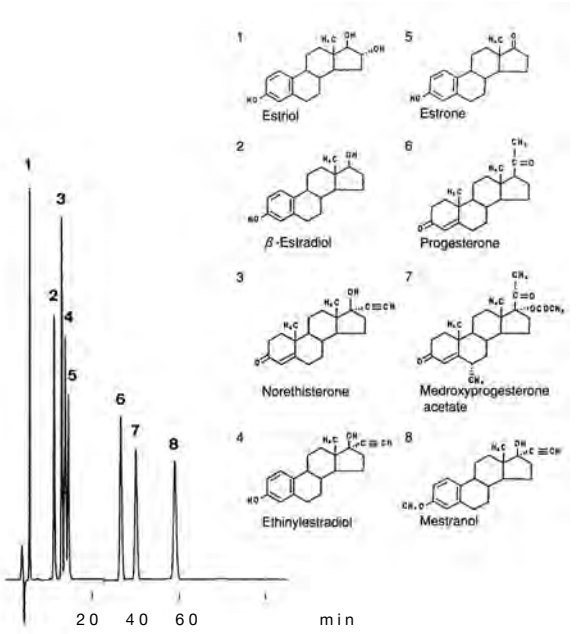
Column care

YMC-Pack C_8 is stable towards hydrolysis between pH 2.0-7.5. Remove acid and buffer salts before storage. Store the column in methanol / water = 70/30. If columns are affected by undesired contaminants or clogged inlet frits which cause back pressure increases, flush the column with THF in the opposite flow direction. For detailed information please refer to the "Column Care and Use Instructions" which can be downloaded from www.ymc.eu.

YMC-Pack C_8

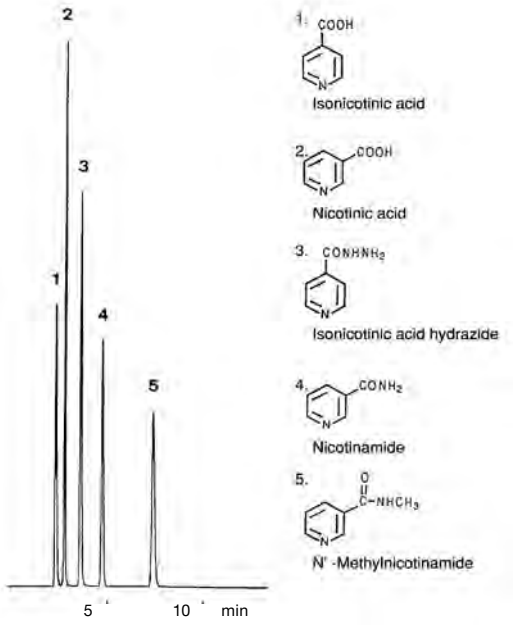
Applications

Estrogens and progestins



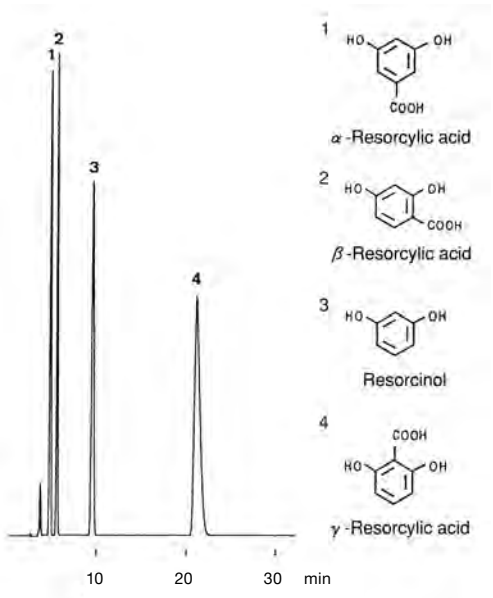
Column:	YMC-Pack C_8 (Octyl) (5 µm, 12 nm) 250 x 4.6 mm ID
Part No.:	OC12S05-2546WT
Eluent:	acetonitrile / THF / water (46/4/50)
Flow:	0.7 mL/min
Detection:	UV at 230 nm, 0.16 AUFS
Temperature:	30 °C
Injection:	7 µL (0.1 mg/mL)

Nicotinic acid analogues



Column:	YMC-Pack C_8 (Octyl) (5 µm, 12 nm) 150 x 4.6 mm ID
Part No.:	OC12S05-1546WT
Eluent:	acetonitrile / 20 mM KH_2PO_4 (5/95)
Flow:	1.0 mL/min
Detection:	UV at 260 nm, 0.64 AUFS
Temperature:	30 °C
Injection:	13 µL (0.2 mg/mL)

Resorcylic acid isomers



Column:	YMC-Pack C_8 (Octyl) (5 µm, 12 nm) 150 x 4.6 mm ID
Part No.:	OC12S05-1546WT
Eluent:	methanol / 100 mM KH_2PO_4 (10/90)
Flow:	0.8 mL/min
Detection:	UV at 285 nm, 0.16 AUFS
Temperature:	37 °C

YMC-Pack Ph

- ***fully endcapped, monomeric phenyl phase directly bonded***
- ***unique selectivity due to π - π interactions***
- ***preferential retention of aromatic compounds***
- ***alternative selectivity to C18, C8 or C4 bonded phases for the analysis of peptides and other biomolecules***

Specifications	YMC-Pack Ph	
Particle size / µm	3; 5	5
Pore size / nm	12	30
Surface area / m^2g^{-1}	330	100
Carbon content / %	9	3
Recommended pH range	2.0 – 7.5	2.0 – 7.5

General

YMC-Pack Ph is a high density bonded phase (9% carbon load on 12 nm silica) which is fully endcapped. This results in a superior bonded phase with proven performance and exceptional lifetime for a phenyl reversed phase column.

Properties

YMC-Pack Ph 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 also provide a useful alternative to C18 or C4 phases for the separation of peptides and proteins on both small pore (12 nm) and wide pore (30 nm) materials. Retention is decreased on wide pore phenyl phases relative to 12 nm phenyl material due to the lower surface area of the wide pore material.

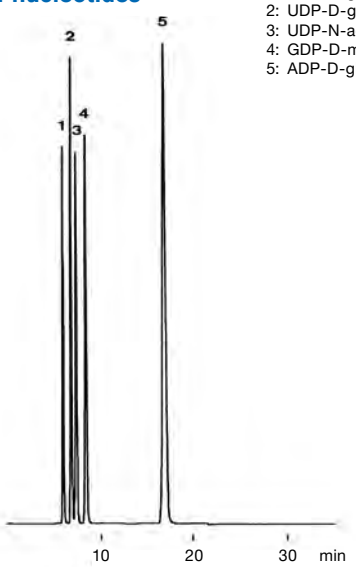
YMC-Pack Ph is also available in preparative particle sizes.

YMC-Pack Ph

Applications

Sugar nucleotides

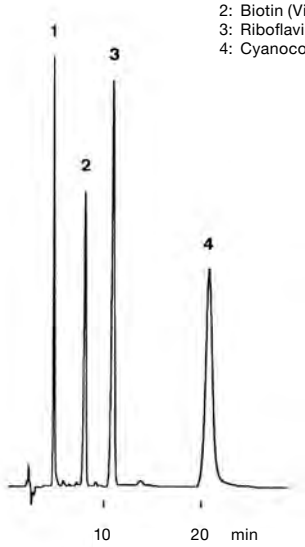
1: CDP-D-glucose
2: UDP-D-glucose
3: UDP-N-acetyl-D-glucosamine
4: GDP-D-mannose
5: ADP-D-glucose



Column:	YMC-Pack Ph (5 µm, 12 nm) 250 x 4.6 mm ID
Part No.:	PH12S05-2546WT
Eluent:	100 mM triethylamine-acetic acid (pH 6.0)
Flow:	1.0 mL/min
Detection:	UV at 260 nm, 0.16 AUFS
Temperature:	37 °C
Injection:	5 µL (0.27 ~ 0.71 mg/mL)

Water-soluble vitamins

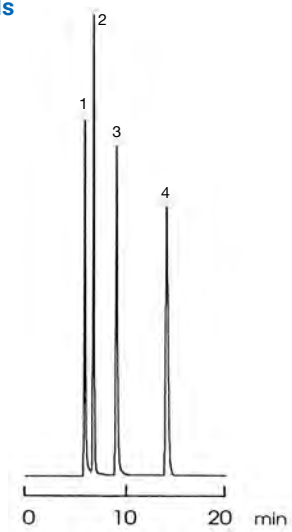
1: π-Aminobenzoic acid (PABA)
2: Biotin (Vitamin H)
3: Riboflavin (Vitamin B_2)
4: Cyanocobalamin (Vitamin B_{12})



Column:	YMC-Pack Ph (5 µm, 12 nm) 150 x 4.6 mm ID
Part No.:	PH12S05-1546WT
Eluent:	acetonitrile / 50 mM $NH_4H_2PO_4$ (10/90)
Flow:	1.0 mL/min
Detection:	UV at 210 nm, 0.16 AUFS
Temperature:	37 °C
Injection:	10 µL (0.02 ~ 0.30 mg/mL)

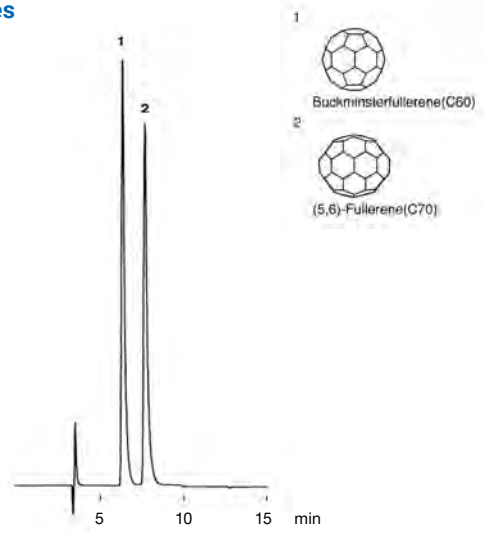
Polyphenols

1: Pyrogallol
2: Hydroquinone
3: Catechol
4: Phenol



Column:	YMC-Pack Ph (5 µm, 12 nm) 250 x 4.6 mm ID
Part No.:	PH12S05-2546WT
Eluent:	5 mM acetic acid
Flow:	1.0 mL/min
Detection:	UV at 280 nm, 0.32 AUFS
Temperature:	25 °C
Injection:	20 µL

Fullerenes



Column:	YMC-Pack Ph (5 µm, 12 nm) 150 x 6.0 mm ID
Part No.:	PH12S05-1506WT
Eluent:	hexane / 2-propanol (50/50)
Flow:	1.0 mL/min
Detection:	UV at 350 nm, 0.08 AUFS
Temperature:	ambient (25 °C)
Injection:	4 µL (0.125 mg/mL)

Column care

YMC-Pack Ph is stable towards hydrolysis between pH 2.0–7.5. Remove acid and buffer salts before storage. Store the column in methanol/water = 70/30. If columns are affected by undesired contaminants or clogged inlet frits which cause back pressure increases, flush the column with THF in the opposite flow direction. For detailed information please refer to the "Column Care and Use Instructions" which can be downloaded from www.ymc.eu/download-library.html

YMC-Pack C_4

- ***low hydrophobicity material***
- ***high coverage monomeric bonded chemistry***
- ***ideally suited for separation of biological materials***

Specifications	YMC-Pack C_4		
Particle size / µm	3; 5	5	5
Pore size / nm	12	20	30
Surface area / m^2g^{-1}	330	175	100
Carbon content / %	47	5	3
Recommended pH range	2.0 - 7.5	2.0 - 7.5	2.0 - 7.5

General

Due to shorter alkyl chains YMC-Pack C_4 has a lower hydrophobicity than both C18 and C8 phases. Therefore retention times of non-polar samples tend to be shorter on YMC-Pack C_4, making it an ideal choice for faster separations.

Properties

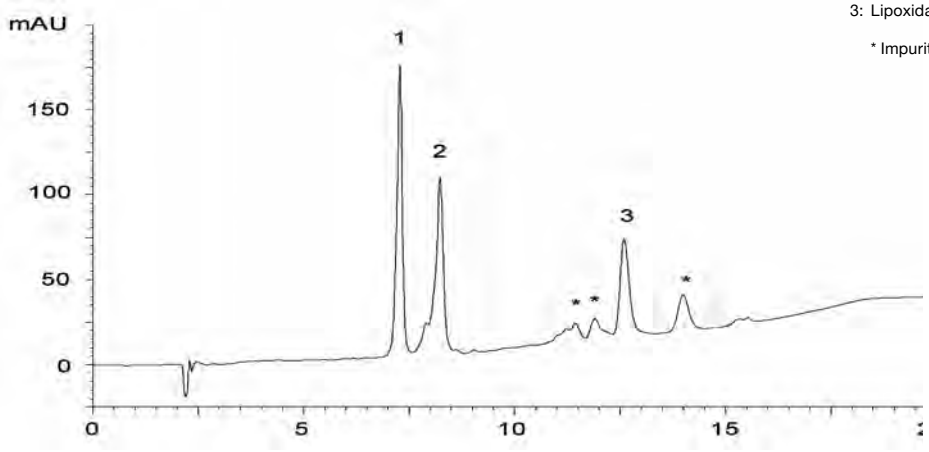
YMC-Pack C_4 phases are less hydrophobic and generally require more aqueous buffer than C8 or C18 phases. When compared to C8 or C18 packings using the same eluent, YMC-Pack C_4 shows significantly shorter retention times for nonpolar compounds. Retention of polar compounds, however, is not significantly affected.

Therefore, mixtures with a wide range of component polarity are best separated by YMC-Pack C_4. This is because the butyl bonded phase gives shorter retention times while still maintaining high resolution when compared to longer chain bonded chemistries.

Proteins (MW 66,000 – 96,000)*

1: BSA (MW 66,000)
2: Conalbumin (Chicken egg white) (MW 77,000)
3: Lipoxidase (Soybean) (MW 96,000)

* Impurities in commercial lipoxidase

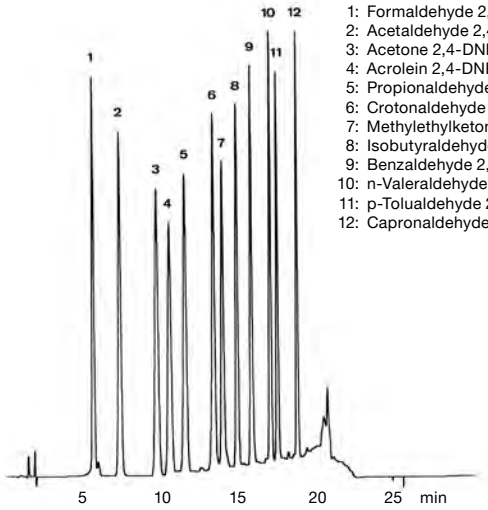


Column: YMC-Pack C_4 (5 µm, 30 nm) 150 x 4.6 mm ID
Eluent: A = water / TFA (100/0.1)
B = acetonitrile / 2-propanol / TFA (50/50/0.1); 30-75% B (0-15 min), 75% B (15-20 min)
Flow: 1.0 mL/min
Detection: UV at 220 nm
Temperature: 37 °C
Injection: 10 µL (0.25 ~ 1.0 mg/mL)

YMC-Pack C_4

Applications

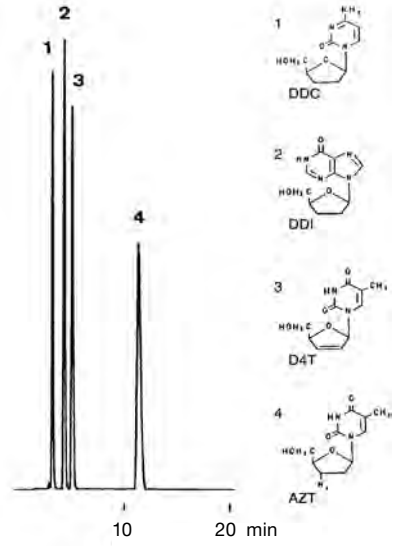
2,4-Dinitrophenylhydrazones of aldehydes and ketones



1: Formaldehyde 2,4-DNPH
2: Acetaldehyde 2,4-DNPH
3: Acetone 2,4-DNPH
4: Acrolein 2,4-DNPH
5: Propionaldehyde 2,4-DNPH
6: Crotonaldehyde 2,4-DNPH
7: Methylethylketone 2,4-DNPH
8: Isobutyraldehyde 2,4-DNPH
9: Benzaldehyde 2,4-DNPH
10: n-Valeraldehyde 2,4-DNPH
11: p-Tolualdehyde 2,4-DNPH
12: Capronaldehyde 2,4-DNPH

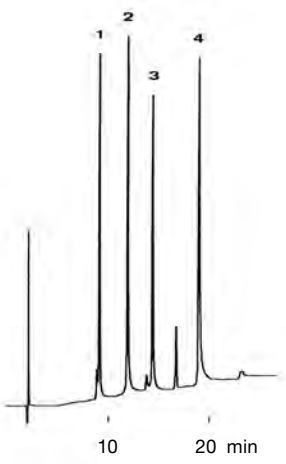
Column:	YMC-Pack C_4 (5 µm ,12 nm) 150 x 4.6 mm ID
Part No.:	BU12S05-1546WT
Eluent:	A = tetrahydrofuran / water (10/90) B = acetonitrile; 35% B (0-7 min), 35-65% B (7-18 min, linear),
Gradient:	100% B (18-19 min), 35% B (19-35 min)
Flow:	1.5 mL/min
Detection:	UV at 360 nm, 0.01 AUFS
Temperature:	30 °C
Injection:	11 µL (0.0025 mg/mL)

Anti-human immunodeficiency virus (HIV) agents



Column:	YMC-Pack C_4 (5 µm, 12 nm) 150 x 4.6 mm ID
Part No.:	BU12S05-1546WT
Eluent:	methanol / 10 mM KH_2PO_4 (10/60)
Flow:	1.0 mL/min
Detection:	UV at 254 nm, 0.16 AUFS
Temperature:	37 °C
Injection:	7 µL (0.125 mg/mL)

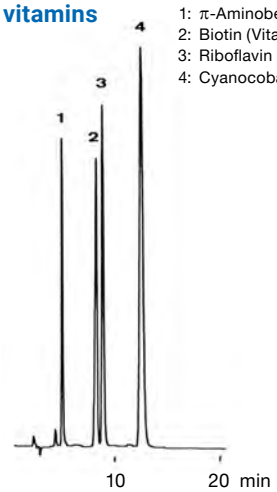
Proteins



1: Ribonuclease A
2: Cytochrome *c*
3: Lysozyme
4: Myoglobin

Column:	YMC-Pack C_4 (5 µm, 30 nm) 150 x 4.6 mm ID
Part No.:	BU30S05-1546WT
Eluent:	A) acetonitrile / water / TFA (5/95/0.1) B) acetonitrile / water / TFA (60/40/0.1)
Flow:	1.0 mL/min
Detection:	UV at 220 nm, 0.32 AUFS
Temperature:	37 °C
Injection:	16 µL (0.16 ~ 0.33 mg/mL)

Water-soluble vitamins



1: π-Aminobenzoic acid (PABA)
2: Biotin (Vitamin H)
3: Riboflavin (Vitamin B_2)
4: Cyanocobalamin (Vitamin B_{12})

Column:	YMC-Pack C_4 (5 µm, 12 nm) 150 x 4.6 mm ID
Part No.:	BU12S05-1546WT
Eluent:	acetonitrile / 50 mM $NH_4H_2PO_4$ (10/90)
Flow:	1.0 mL/min
Detection:	UV at 210 nm, 0.16 AUFS
Temperature:	37 °C
Injection:	10 µL (0.02 ~ 0.30 mg/mL)

Column care

YMC-Pack C_4 is stable towards hydrolysis between pH 2.0–7.5. Remove acid and buffer salts before storage. Store the column in methanol / water = 70/30. If columns are affected by undesired contaminants or clogged inlet frits which cause back pressure increases, flush the column with THF in the opposite flow direction. For detailed information please refer to the "Column Care and Use Instructions" which can be downloaded from www.ymc.eu/download-library.html

YMC-Pack TMS

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

Specifications	YMC-Pack TMS
Particle size / µm	3; 5
Pore size / nm	12
Surface area / m^2g^{-1}	330
Carbon content / %	4
Recommended pH range	2.0 – 7.5

General

YMC-Pack TMS is a bonded phase suitable for samples that exhibit strong retention characteristics and are difficult or impossible to separate on conventional reversed phase or normal phase columns.

Properties

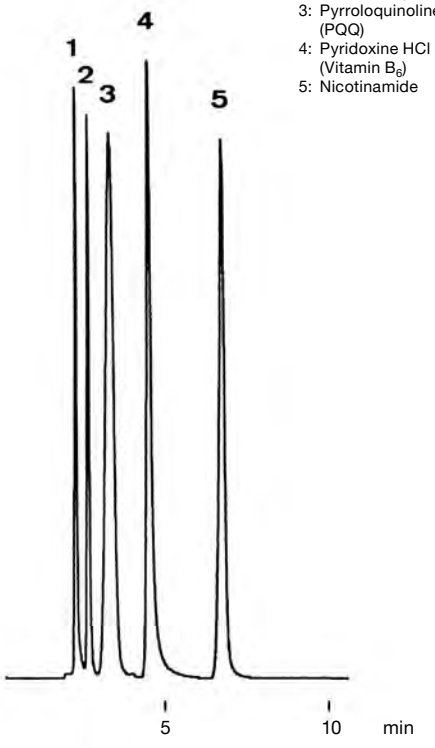
YMC-Pack TMS is bonded with trimethylmonochlorosilane to create a phase with intermediate polarity for separation of extremely hydrophobic compounds using conventional reversed phase solvents and of highly polar compounds using normal phase solvents.
The chemistry of YMC-Pack TMS (C1) is also well-suited for the analysis of multifunctional compounds. Selectivity characteristics of a C1 bonded phase can be unique, and samples must be tested to determine the suitability of the phase.
YMC-Pack TMS is also available in preparative particle sizes.

YMC-Pack TMS

Applications

Water-soluble vitamins

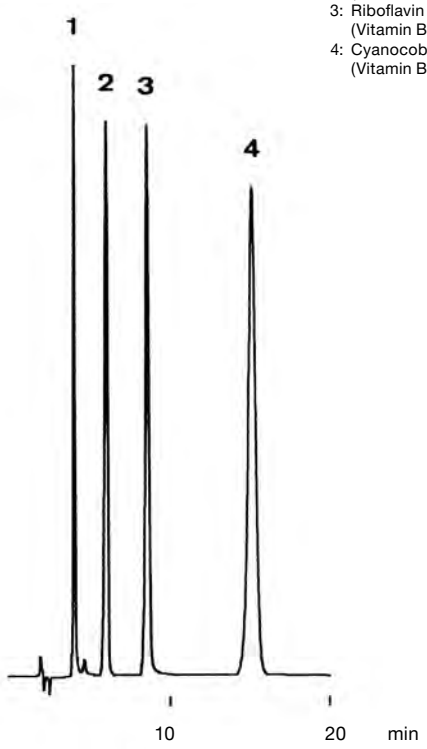
1: L-Ascorbic acid (Vitamin C)
2: Orotic acid (Vitamin B_{13})
3: Pyrroloquinoline quinone (PQQ)
4: Pyridoxine HCl (Vitamin B_6)
5: Nicotinamide



Column:	YMC-Pack TMS (5 µm, 12 nm) 150 x 4.6 mm ID
Part No.:	TM12S05-1546WT
Eluent:	100 mM CH_3COOH / 100 mM CH_3COONH_4 (30/70, pH 5.1)
Flow:	1.0 mL/min
Detection:	UV at 254 nm, 0.16 AUFS
Temperature:	37 °C
Injection:	10 µL (0.04 ~ 0.20 mg/mL)

Water-soluble vitamins

1: π-Aminobenzoic acid (PABA)
2: Biotin (Vitamin H)
3: Riboflavin (Vitamin B_2)
4: Cyanocobalamin (Vitamin B_{12})



Column:	YMC-Pack TMS (5 µm, 12 nm) 150 x 4.6 mm ID
Part No.:	TM12S05-1546WT
Eluent:	acetonitrile / 50 mM $NH_4H_2PO_4$ (10/90)
Flow:	1.0 mL/min
Detection:	UV at 210 nm, 0.16 AUFS
Temperature:	37 °C
Injection:	10 µL (0.02 ~ 0.30 mg/mL)

Column Care

YMC-Pack TMS is stable towards hydrolysis between pH 2.0–7.5. Remove acid and buffer salts before storage. Store the column in methanol / water = 70/30. If columns are affected by undesired contaminants or clogged inlet frits which cause back pressure increases, flush the column with THF in the opposite flow direction. For detailed information please refer to the "Column Care and Use Instructions" which can be downloaded from www.ymc.eu/download-library.html

YMC-Pack CN

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

Specifications	YMC-Pack CN	
Particle size / µm	3; 5	5
Pore size / nm	12	30
Surface area / m^2g^{-1}	330	100
Carbon content / %	7	3
Recommended pH range	2.0 – 7.5	2.0 – 7.5

General

In reversed phase mode, cyano (nitrile) phases are the most polar and least retentive of all reversed phase supports. Extremely hydrophobic compounds, which do not elute on standard C18 and C8 columns with typical reversed phase eluents, can be separated using cyano phases. Separations using reversed and normal phase and HILIC mechanisms can be carried out using this material.

Properties

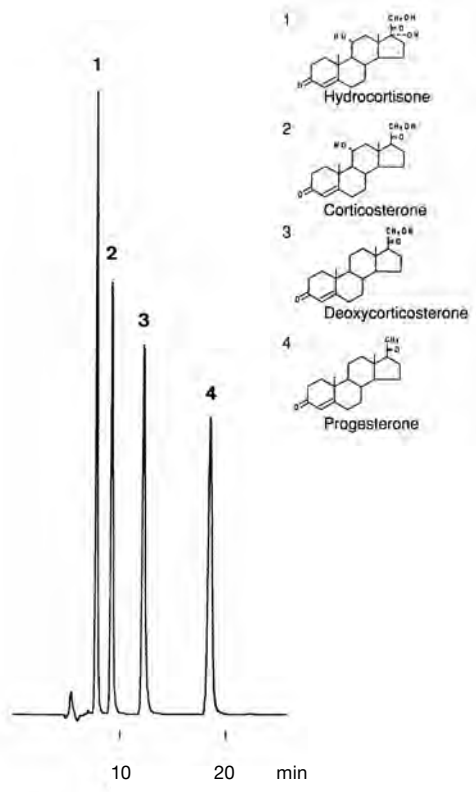
The cyano chemistry of YMC-Pack CN provides a different selectivity from both phenyl and standard aliphatic (C18, C8 or C4) reversed phases. It is useful for quick and simple analysis of compounds that differ greatly in hydrophobicity, without the need to use gradient elution chromatography. Cyano packings also provide an alternative to silica material in normal phase chromatography, where bonded normal phase packings have the advantage of faster equilibration, more uniform surface activity and increased resistance to dissolution.

To extend column lifetime continued switching between normal and reversed phase solvents should be avoided. YMC-Pack CN is also available in preparative particle sizes.

YMC-Pack CN

Applications

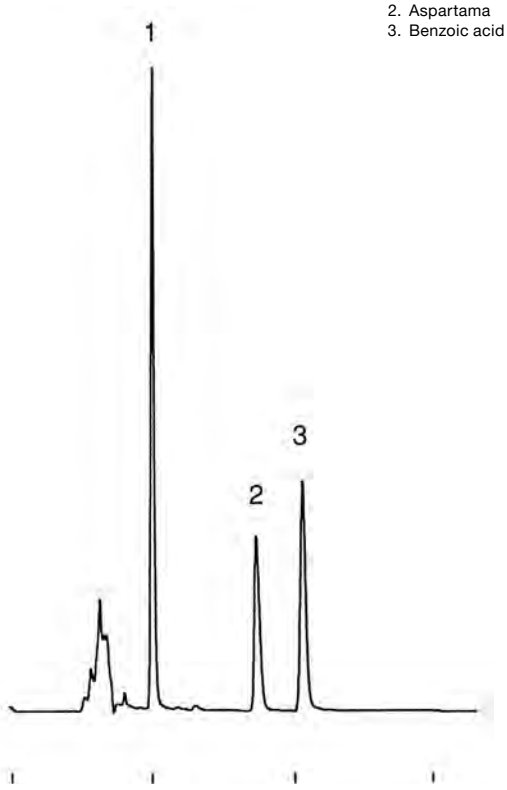
Steroids



Column:	YMC-Pack CN (5 µm, 12 nm) 250 x 4.6 mm ID
Part No.:	CN12S05-2546WT
Eluent:	acetonitrile / water (40/60)
Flow:	0.6 mL/min
Detection:	UV at 254 nm, 0.32 AUFS
Temperature:	30 °C
Injection:	3 µL (0.25 mg/mL)

Aspartame in a soft drink

1. Caffeine
2. Aspartama
3. Benzoic acid



Column:	YMC-Pack CN (5 µm, 12 nm) 250 x 4.6 mm ID
Part No.:	CN12S05-2546WT
Eluent:	acetonitrile / water / TFA (15/85/0.05)
Flow:	0.5 mL/min
Detection:	UV at 220 nm, 0.64 AUFS
Temperature:	30 °C
Injection:	5 µL

Column Care

YMC-Pack CN is stable towards hydrolysis between pH 2.0–7.5. Remove acid and buffer salts before storage. For detailed information please refer to the “Column Care and Use Instructions” which can be downloaded from www.ymc.eu/download-library.html

Ordering Information

12 nm, 3 µm HPLC columns (Waters type hardware, WT)

Phase	Column ID [mm]	Column length [mm]				Guard cartridges* with 10 mm length
		50	100	150	250	(pack of 5)
YMC-Pack ODS-AQ	2.0	AQ12S03-0502WT	AQ12S03-1002WT	AQ12S03-1502WT	AQ12S03-2502WT	AQ12S03-01Q1GC
	2.1	AQ12S03-05Q1WT	AQ12S03-10Q1WT	AQ12S03-15Q1WT	AQ12S03-25Q1WT	AQ12S03-01Q1GC
	3.0	AQ12S03-0503WT	AQ12S03-1003WT	AQ12S03-1503WT	AQ12S03-2503WT	AQ12S03-0103GC
	4.0	AQ12S03-0504WT	AQ12S03-1004WT	AQ12S03-1504WT	AQ12S03-2504WT	AQ12S03-0104GC
	4.6	AQ12S03-0546WT	AQ12S03-1046WT	AQ12S03-1546WT	AQ12S03-2546WT	AQ12S03-0104GC
YMC-Pack ODS-A	2.0	AA12S03-0502WT	AA12S03-1002WT	AA12S03-1502WT	AA12S03-2502WT	AA12S03-01Q1GC
	2.1	AA12S03-05Q1WT	AA12S03-10Q1WT	AA12S03-15Q1WT	AA12S03-25Q1WT	AA12S03-01Q1GC
	3.0	AA12S03-0503WT	AA12S03-1003WT	AA12S03-1503WT	AA12S03-2503WT	AA12S03-0103GC
	4.0	AA12S03-0504WT	AA12S03-1004WT	AA12S03-1504WT	AA12S03-2504WT	AA12S03-0104GC
	4.6	AA12S03-0546WT	AA12S03-1046WT	AA12S03-1546WT	AA12S03-2546WT	AA12S03-0104GC
YMC-Pack ODS-AM	2.0	AM12S03-0502WT	AM12S03-1002WT	AM12S03-1502WT	AM12S03-2502WT	AM12S03-01Q1GC
	2.1	AM12S03-05Q1WT	AM12S03-10Q1WT	AM12S03-15Q1WT	AM12S03-25Q1WT	AM12S03-01Q1GC
	3.0	AM12S03-0503WT	AM12S03-1003WT	AM12S03-1503WT	AM12S03-2503WT	AM12S03-0103GC
	4.0	AM12S03-0504WT	AM12S03-1004WT	AM12S03-1504WT	AM12S03-2504WT	AM12S03-0104GC
	4.6	AM12S03-0546WT	AM12S03-1046WT	AM12S03-1546WT	AM12S03-2546WT	AM12S03-0104GC
YMC-Pack C8	2.0	OC12S03-0502WT	OC12S03-1002WT	OC12S03-1502WT	OC12S03-2502WT	OC12S03-01Q1GC
	2.1	OC12S03-05Q1WT	OC12S03-10Q1WT	OC12S03-15Q1WT	OC12S03-25Q1WT	OC12S03-01Q1GC
	3.0	OC12S03-0503WT	OC12S03-1003WT	OC12S03-1503WT	OC12S03-2503WT	OC12S03-0103GC
	4.0	OC12S03-0504WT	OC12S03-1004WT	OC12S03-1504WT	OC12S03-2504WT	OC12S03-0104GC
	4.6	OC12S03-0546WT	OC12S03-1046WT	OC12S03-1546WT	OC12S03-2546WT	OC12S03-0104GC
YMC-Pack C4	2.0	BU12S03-0502WT	BU12S03-1002WT	BU12S03-1502WT	BU12S03-2502WT	BU12S03-01Q1GC
	2.1	BU12S03-05Q1WT	BU12S03-10Q1WT	BU12S03-15Q1WT	BU12S03-25Q1WT	BU12S03-01Q1GC
	3.0	BU12S03-0503WT	BU12S03-1003WT	BU12S03-1503WT	BU12S03-2503WT	BU12S03-0103GC
	4.0	BU12S03-0504WT	BU12S03-1004WT	BU12S03-1504WT	BU12S03-2504WT	BU12S03-0104GC
	4.6	BU12S03-0546WT	BU12S03-1046WT	BU12S03-1546WT	BU12S03-2546WT	BU12S03-0104GC
YMC-Pack Ph	2.0	PH12S03-0502WT	PH12S03-1002WT	PH12S03-1502WT	PH12S03-2502WT	PH12S03-01Q1GC
	2.1	PH12S03-05Q1WT	PH12S03-10Q1WT	PH12S03-15Q1WT	PH12S03-25Q1WT	PH12S03-01Q1GC
	3.0	PH12S03-0503WT	PH12S03-1003WT	PH12S03-1503WT	PH12S03-2503WT	PH12S03-0103GC
	4.0	PH12S03-0504WT	PH12S03-1004WT	PH12S03-1504WT	PH12S03-2504WT	PH12S03-0104GC
	4.6	PH12S03-0546WT	PH12S03-1046WT	PH12S03-1546WT	PH12S03-2546WT	PH12S03-0104GC
YMC-Pack TMS	2.0	TM12S03-0502WT	TM12S03-1002WT	TM12S03-1502WT	TM12S03-2502WT	TM12S03-01Q1GC
	2.1	TM12S03-05Q1WT	TM12S03-10Q1WT	TM12S03-15Q1WT	TM12S03-25Q1WT	TM12S03-01Q1GC
	3.0	TM12S03-0503WT	TM12S03-1003WT	TM12S03-1503WT	TM12S03-2503WT	TM12S03-0103GC
	4.0	TM12S03-0504WT	TM12S03-1004WT	TM12S03-1504WT	TM12S03-2504WT	TM12S03-0104GC
	4.6	TM12S03-0546WT	TM12S03-1046WT	TM12S03-1546WT	TM12S03-2546WT	TM12S03-0104GC
YMC-Pack CN	2.0	CN12S03-0502WT	CN12S03-1002WT	CN12S03-1502WT	CN12S03-2502WT	CN12S03-01Q1GC
	2.1	CN12S03-05Q1WT	CN12S03-10Q1WT	CN12S03-15Q1WT	CN12S03-25Q1WT	CN12S03-01Q1GC
	3.0	CN12S03-0503WT	CN12S03-1003WT	CN12S03-1503WT	CN12S03-2503WT	CN12S03-0103GC
	4.0	CN12S03-0504WT	CN12S03-1004WT	CN12S03-1504WT	CN12S03-2504WT	CN12S03-0104GC
	4.6	CN12S03-0546WT	CN12S03-1046WT	CN12S03-1546WT	CN12S03-2546WT	CN12S03-0104GC

20 nm, 3 µm HPLC columns (Waters type hardware, WT)

Phase	Column ID [mm]	Column length [mm]				Guard cartridges* with 10 mm length
		50	100	150	250	(pack of 5)
YMC-Pack ODS-AQ	2.0	AQ20S03-0502WT	AQ20S03-1002WT	AQ20S03-1502WT	AQ20S03-2502WT	AQ20S03-01Q1GC
	2.1	AQ20S03-05Q1WT	AQ20S03-10Q1WT	AQ20S03-15Q1WT	AQ20S03-25Q1WT	AQ20S03-01Q1GC
	3.0	AQ20S03-0503WT	AQ20S03-1003WT	AQ20S03-1503WT	AQ20S03-2503WT	AQ20S03-0103GC
	4.0	AQ20S03-0504WT	AQ20S03-1004WT	AQ20S03-1504WT	AQ20S03-2504WT	AQ20S03-0104GC
	4.6	AQ20S03-0546WT	AQ20S03-1046WT	AQ20S03-1546WT	AQ20S03-2546WT	AQ20S03-0104GC
YMC-Pack ODS-A	2.0	AA20S03-0502WT	AA20S03-1002WT	AA20S03-1502WT	AA20S03-2502WT	AA20S03-01Q1GC
	2.1	AA20S03-05Q1WT	AA20S03-10Q1WT	AA20S03-15Q1WT	AA20S03-25Q1WT	AA20S03-01Q1GC
	3.0	AA20S03-0503WT	AA20S03-1003WT	AA20S03-1503WT	AA20S03-2503WT	AA20S03-0103GC
	4.0	AA20S03-0504WT	AA20S03-1004WT	AA20S03-1504WT	AA20S03-2504WT	AA20S03-0104GC
	4.6	AA20S03-0546WT	AA20S03-1046WT	AA20S03-1546WT	AA20S03-2546WT	AA20S03-0104GC
YMCbasic	2.0	BA99S03-0502WT	BA99S03-1002WT	BA99S03-1502WT	BA99S03-2502WT	BA99S03-01Q1GC
	2.1	BA99S03-05Q1WT	BA99S03-10Q1WT	BA99S03-15Q1WT	BA99S03-25Q1WT	BA99S03-01Q1GC
	3.0	BA99S03-0503WT	BA99S03-1003WT	BA99S03-1503WT	BA99S03-2503WT	BA99S03-0103GC
	4.0	BA99S03-0504WT	BA99S03-1004WT	BA99S03-1504WT	BA99S03-2504WT	BA99S03-0104GC
	4.6	BA99S03-0546WT	BA99S03-1046WT	BA99S03-1546WT	BA99S03-2546WT	BA99S03-0104GC

*Guard cartridge holder required, part no. XPGCH-Q1

Ordering Information

12 nm, 5 µm HPLC columns (Waters type hardware, WT)

Phase	Column ID [mm]	Column length [mm]				Guard cartridges* with 10 mm length
		50	100	150	250	(pack of 5)
YMC-Pack ODS-AQ	2.0	AQ12S05-0502WT	AQ12S05-1002WT	AQ12S05-1502WT	AQ12S05-2502WT	AQ12S05-01Q1GC
	2.1	AQ12S05-05Q1WT	AQ12S05-10Q1WT	AQ12S05-15Q1WT	AQ12S05-25Q1WT	AQ12S05-01Q1GC
	3.0	AQ12S05-0503WT	AQ12S05-1003WT	AQ12S05-1503WT	AQ12S05-2503WT	AQ12S05-0103GC
	4.0	AQ12S05-0504WT	AQ12S05-1004WT	AQ12S05-1504WT	AQ12S05-2504WT	AQ12S05-0104GC
	4.6	AQ12S05-0546WT	AQ12S05-1046WT	AQ12S05-1546WT	AQ12S05-2546WT	AQ12S05-0104GC
YMC-Pack ODS-A	2.0	AA12S05-0502WT	AA12S05-1002WT	AA12S05-1502WT	AA12S05-2502WT	AA12S05-01Q1GC
	2.1	AA12S05-05Q1WT	AA12S05-10Q1WT	AA12S05-15Q1WT	AA12S05-25Q1WT	AA12S05-01Q1GC
	3.0	AA12S05-0503WT	AA12S05-1003WT	AA12S05-1503WT	AA12S05-2503WT	AA12S05-0103GC
	4.0	AA12S05-0504WT	AA12S05-1004WT	AA12S05-1504WT	AA12S05-2504WT	AA12S05-0104GC
	4.6	AA12S05-0546WT	AA12S05-1046WT	AA12S05-1546WT	AA12S05-2546WT	AA12S05-0104GC
YMC-Pack ODS-AM	2.0	AM12S05-0502WT	AM12S05-1002WT	AM12S05-1502WT	AM12S05-2502WT	AM12S05-01Q1GC
	2.1	AM12S05-05Q1WT	AM12S05-10Q1WT	AM12S05-15Q1WT	AM12S05-25Q1WT	AM12S05-01Q1GC
	3.0	AM12S05-0503WT	AM12S05-1003WT	AM12S05-1503WT	AM12S05-2503WT	AM12S05-0103GC
	4.0	AM12S05-0504WT	AM12S05-1004WT	AM12S05-1504WT	AM12S05-2504WT	AM12S05-0104GC
	4.6	AM12S05-0546WT	AM12S05-1046WT	AM12S05-1546WT	AM12S05-2546WT	AM12S05-0104GC
YMC-Pack ODS-AL	2.0	AL12S05-0502WT	AL12S05-1002WT	AL12S05-1502WT	AL12S05-2502WT	AL12S05-01Q1GC
	2.1	AL12S05-05Q1WT	AL12S05-10Q1WT	AL12S05-15Q1WT	AL12S05-25Q1WT	AL12S05-01Q1GC
	3.0	AL12S05-0503WT	AL12S05-1003WT	AL12S05-1503WT	AL12S05-2503WT	AL12S05-0103GC
	4.0	AL12S05-0504WT	AL12S05-1004WT	AL12S05-1504WT	AL12S05-2504WT	AL12S05-0104GC
	4.6	AL12S05-0546WT	AL12S05-1046WT	AL12S05-1546WT	AL12S05-2546WT	AL12S05-0104GC
YMC-Pack C8	2.0	OC12S05-0502WT	OC12S05-1002WT	OC12S05-1502WT	OC12S05-2502WT	OC12S05-01Q1GC
	2.1	OC12S05-05Q1WT	OC12S05-10Q1WT	OC12S05-15Q1WT	OC12S05-25Q1WT	OC12S05-01Q1GC
	3.0	OC12S05-0503WT	OC12S05-1003WT	OC12S05-1503WT	OC12S05-2503WT	OC12S05-0103GC
	4.0	OC12S05-0504WT	OC12S05-1004WT	OC12S05-1504WT	OC12S05-2504WT	OC12S05-0104GC
	4.6	OC12S05-0546WT	OC12S05-1046WT	OC12S05-1546WT	OC12S05-2546WT	OC12S05-0104GC
YMC-Pack C4	2.0	BU12S05-0502WT	BU12S05-1002WT	BU12S05-1502WT	BU12S05-2502WT	BU12S05-01Q1GC
	2.1	BU12S05-05Q1WT	BU12S05-10Q1WT	BU12S05-15Q1WT	BU12S05-25Q1WT	BU12S05-01Q1GC
	3.0	BU12S05-0503WT	BU12S05-1003WT	BU12S05-1503WT	BU12S05-2503WT	BU12S05-0103GC
	4.0	BU12S05-0504WT	BU12S05-1004WT	BU12S05-1504WT	BU12S05-2504WT	BU12S05-0104GC
	4.6	BU12S05-0546WT	BU12S05-1046WT	BU12S05-1546WT	BU12S05-2546WT	BU12S05-0104GC
YMC-Pack Ph	2.0	PH12S05-0502WT	PH12S05-1002WT	PH12S05-1502WT	PH12S05-2502WT	PH12S05-01Q1GC
	2.1	PH12S05-05Q1WT	PH12S05-10Q1WT	PH12S05-15Q1WT	PH12S05-25Q1WT	PH12S05-01Q1GC
	3.0	PH12S05-0503WT	PH12S05-1003WT	PH12S05-1503WT	PH12S05-2503WT	PH12S05-0103GC
	4.0	PH12S05-0504WT	PH12S05-1004WT	PH12S05-1504WT	PH12S05-2504WT	PH12S05-0104GC
	4.6	PH12S05-0546WT	PH12S05-1046WT	PH12S05-1546WT	PH12S05-2546WT	PH12S05-0104GC
YMC-Pack TMS	2.0	TM12S05-0502WT	TM12S05-1002WT	TM12S05-1502WT	TM12S05-2502WT	TM12S05-01Q1GC
	2.1	TM12S05-05Q1WT	TM12S05-10Q1WT	TM12S05-15Q1WT	TM12S05-25Q1WT	TM12S05-01Q1GC
	3.0	TM12S05-0503WT	TM12S05-1003WT	TM12S05-1503WT	TM12S05-2503WT	TM12S05-0103GC
	4.0	TM12S05-0504WT	TM12S05-1004WT	TM12S05-1504WT	TM12S05-2504WT	TM12S05-0104GC
	4.6	TM12S05-0546WT	TM12S05-1046WT	TM12S05-1546WT	TM12S05-2546WT	TM12S05-0104GC
YMC-Pack CN	2.0	CN12S05-0502WT	CN12S05-1002WT	CN12S05-1502WT	CN12S05-2502WT	CN12S05-01Q1GC
	2.1	CN12S05-05Q1WT	CN12S05-10Q1WT	CN12S05-15Q1WT	CN12S05-25Q1WT	CN12S05-01Q1GC
	3.0	CN12S05-0503WT	CN12S05-1003WT	CN12S05-1503WT	CN12S05-2503WT	CN12S05-0103GC
	4.0	CN12S05-0504WT	CN12S05-1004WT	CN12S05-1504WT	CN12S05-2504WT	CN12S05-0104GC
	4.6	CN12S05-0546WT	CN12S05-1046WT	CN12S05-1546WT	CN12S05-2546WT	CN12S05-0104GC

*Guard cartridge holder required, part no. XPGCH-Q1

Ordering Information

20 nm, 5 µm HPLC columns (Waters type hardware, WT)

Phase	Column ID [mm]	Column length [mm]				Guard cartridges* with 10 mm length
		50	100	150	250	(pack of 5)
YMC-Pack ODS-AQ	2.0	AQ20S05-0502WT	AQ20S05-1002WT	AQ20S05-1502WT	AQ20S05-2502WT	AQ20S05-01Q1GC
	2.1	AQ20S05-05Q1WT	AQ20S05-10Q1WT	AQ20S05-15Q1WT	AQ20S05-25Q1WT	AQ20S05-01Q1GC
	3.0	AQ20S05-0503WT	AQ20S05-1003WT	AQ20S05-1503WT	AQ20S05-2503WT	AQ20S05-0103GC
	4.0	AQ20S05-0504WT	AQ20S05-1004WT	AQ20S05-1504WT	AQ20S05-2504WT	AQ20S05-0104GC
	4.6	AQ20S05-0546WT	AQ20S05-1046WT	AQ20S05-1546WT	AQ20S05-2546WT	AQ20S05-0104GC
YMC-Pack ODS-A	2.0	AA20S05-0502WT	AA20S05-1002WT	AA20S05-1502WT	AA20S05-2502WT	AA20S05-01Q1GC
	2.1	AA20S05-05Q1WT	AA20S05-10Q1WT	AA20S05-15Q1WT	AA20S05-25Q1WT	AA20S05-01Q1GC
	3.0	AA20S05-0503WT	AA20S05-1003WT	AA20S05-1503WT	AA20S05-2503WT	AA20S05-0103GC
	4.0	AA20S05-0504WT	AA20S05-1004WT	AA20S05-1504WT	AA20S05-2504WT	AA20S05-0104GC
	4.6	AA20S05-0546WT	AA20S05-1046WT	AA20S05-1546WT	AA20S05-2546WT	AA20S05-0104GC
YMC-Pack C8	2.0	OC20S05-0502WT	OC20S05-1002WT	OC20S05-1502WT	OC20S05-2502WT	OC20S05-01Q1GC
	2.1	OC20S05-05Q1WT	OC20S05-10Q1WT	OC20S05-15Q1WT	OC20S05-25Q1WT	OC20S05-01Q1GC
	3.0	OC20S05-0503WT	OC20S05-1003WT	OC20S05-1503WT	OC20S05-2503WT	OC20S05-0103GC
	4.0	OC20S05-0504WT	OC20S05-1004WT	OC20S05-1504WT	OC20S05-2504WT	OC20S05-0104GC
	4.6	OC20S05-0546WT	OC20S05-1046WT	OC20S05-1546WT	OC20S05-2546WT	OC20S05-0104GC
YMC-Pack C4	2.0	BU20S05-0502WT	BU20S05-1002WT	BU20S05-1502WT	BU20S05-2502WT	BU20S05-01Q1GC
	2.1	BU20S05-05Q1WT	BU20S05-10Q1WT	BU20S05-15Q1WT	BU20S05-25Q1WT	BU20S05-01Q1GC
	3.0	BU20S05-0503WT	BU20S05-1003WT	BU20S05-1503WT	BU20S05-2503WT	BU20S05-0103GC
	4.0	BU20S05-0504WT	BU20S05-1004WT	BU20S05-1504WT	BU20S05-2504WT	BU20S05-0104GC
	4.6	BU20S05-0546WT	BU20S05-1046WT	BU20S05-1546WT	BU20S05-2546WT	BU20S05-0104GC
YMC-Pack Protein RP	2.0	PR99S05-0502WT	PR99S05-1002WT	PR99S05-1502WT	PR99S05-2502WT	PR99S05-01Q1GC
	2.1	PR99S05-05Q1WT	PR99S05-10Q1WT	PR99S05-15Q1WT	PR99S05-25Q1WT	PR99S05-01Q1GC
	3.0	PR99S05-0503WT	PR99S05-1003WT	PR99S05-1503WT	PR99S05-2503WT	PR99S05-0103GC
	4.0	PR99S05-0504WT	PR99S05-1004WT	PR99S05-1504WT	PR99S05-2504WT	PR99S05-0104GC
	4.6	PR99S05-0546WT	PR99S05-1046WT	PR99S05-1546WT	PR99S05-2546WT	PR99S05-0104GC
YMCbasic	2.0	BA99S05-0502WT	BA99S05-1002WT	BA99S05-1502WT	BA99S05-2502WT	BA99S05-01Q1GC
	2.1	BA99S05-05Q1WT	BA99S05-10Q1WT	BA99S05-15Q1WT	BA99S05-25Q1WT	BA99S05-01Q1GC
	3.0	BA99S05-0503WT	BA99S05-1003WT	BA99S05-1503WT	BA99S05-2503WT	BA99S05-0103GC
	4.0	BA99S05-0504WT	BA99S05-1004WT	BA99S05-1504WT	BA99S05-2504WT	BA99S05-0104GC
	4.6	BA99S05-0546WT	BA99S05-1046WT	BA99S05-1546WT	BA99S05-2546WT	BA99S05-0104GC

*Guard cartridge holder required, part no. XPGCH-Q1

Ordering Information

30 nm, 5 µm HPLC columns (Waters type hardware, WT)

Phase	Column ID [mm]	Column length [mm]				Guard cartridges* with 10 mm length
		50	100	150	250	(pack of 5)
YMC-Pack ODS-A	2.0	AA30S05-0502WT	AA30S05-1002WT	AA30S05-1502WT	AA30S05-2502WT	AA30S05-01Q1GC
	2.1	AA30S05-05Q1WT	AA30S05-10Q1WT	AA30S05-15Q1WT	AA30S05-25Q1WT	AA30S05-01Q1GC
	3.0	AA30S05-0503WT	AA30S05-1003WT	AA30S05-1503WT	AA30S05-2503WT	AA30S05-0103GC
	4.0	AA30S05-0504WT	AA30S05-1004WT	AA30S05-1504WT	AA30S05-2504WT	AA30S05-0104GC
	4.6	AA30S05-0546WT	AA30S05-1046WT	AA30S05-1546WT	AA30S05-2546WT	AA30S05-0104GC
YMC-Pack C8	2.0	OC30S05-0502WT	OC30S05-1002WT	OC30S05-1502WT	OC30S05-2502WT	OC30S05-01Q1GC
	2.1	OC30S05-05Q1WT	OC30S05-10Q1WT	OC30S05-15Q1WT	OC30S05-25Q1WT	OC30S05-01Q1GC
	3.0	OC30S05-0503WT	OC30S05-1003WT	OC30S05-1503WT	OC30S05-2503WT	OC30S05-0103GC
	4.0	OC30S05-0504WT	OC30S05-1004WT	OC30S05-1504WT	OC30S05-2504WT	OC30S05-0104GC
	4.6	OC30S05-0546WT	OC30S05-1046WT	OC30S05-1546WT	OC30S05-2546WT	OC30S05-0104GC
YMC-Pack C4	2.0	BU30S05-0502WT	BU30S05-1002WT	BU30S05-1502WT	BU30S05-2502WT	BU30S05-01Q1GC
	2.1	BU30S05-05Q1WT	BU30S05-10Q1WT	BU30S05-15Q1WT	BU30S05-25Q1WT	BU30S05-01Q1GC
	3.0	BU30S05-0503WT	BU30S05-1003WT	BU30S05-1503WT	BU30S05-2503WT	BU30S05-0103GC
	4.0	BU30S05-0504WT	BU30S05-1004WT	BU30S05-1504WT	BU30S05-2504WT	BU30S05-0104GC
	4.6	BU30S05-0546WT	BU30S05-1046WT	BU30S05-1546WT	BU30S05-2546WT	BU30S05-0104GC
YMC-Pack Ph	2.0	PH30S05-0502WT	PH30S05-1002WT	PH30S05-1502WT	PH30S05-2502WT	PH30S05-01Q1GC
	2.1	PH30S05-05Q1WT	PH30S05-10Q1WT	PH30S05-15Q1WT	PH30S05-25Q1WT	PH30S05-01Q1GC
	3.0	PH30S05-0503WT	PH30S05-1003WT	PH30S05-1503WT	PH30S05-2503WT	PH30S05-0103GC
	4.0	PH30S05-0504WT	PH30S05-1004WT	PH30S05-1504WT	PH30S05-2504WT	PH30S05-0104GC
	4.6	PH30S05-0546WT	PH30S05-1046WT	PH30S05-1546WT	PH30S05-2546WT	PH30S05-0104GC
YMC-Pack CN	2.0	CN30S05-0502WT	CN30S05-1002WT	CN30S05-1502WT	CN30S05-2502WT	CN30S05-01Q1GC
	2.1	CN30S05-05Q1WT	CN30S05-10Q1WT	CN30S05-15Q1WT	CN30S05-25Q1WT	CN30S05-01Q1GC
	3.0	CN30S05-0503WT	CN30S05-1003WT	CN30S05-1503WT	CN30S05-2503WT	CN30S05-0103GC
	4.0	CN30S05-0504WT	CN30S05-1004WT	CN30S05-1504WT	CN30S05-2504WT	CN30S05-0104GC
	4.6	CN30S05-0546WT	CN30S05-1046WT	CN30S05-1546WT	CN30S05-2546WT	CN30S05-0104GC

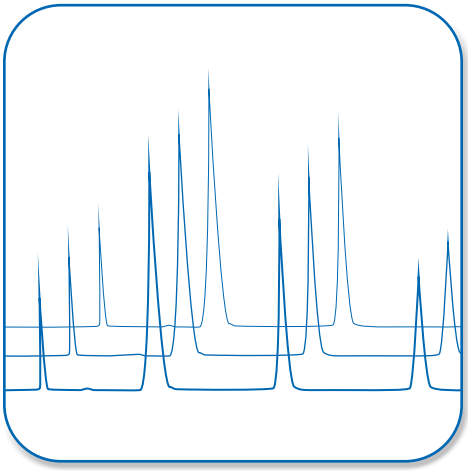
6 µm HPLC columns (Waters type hardware, WT)

Phase	Column ID [mm]	Column length [mm]				Guard cartridges* with 10 mm length
		50	100	150	250	(pack of 5)
YMC-Pack Polymer C18	2.0	PC99S06-0502WT	PC99S06-1002WT	PC99S06-1502WT	PC99S06-2502WT	PC99S06-01Q1GC
	2.1	PC99S06-05Q1WT	PC99S06-10Q1WT	PC99S06-15Q1WT	PC99S06-25Q1WT	PC99S06-01Q1GC
	3.0	PC99S06-0503WT	PC99S06-1003WT	PC99S06-1503WT	PC99S06-2503WT	PC99S06-0103GC
	4.0	PC99S06-0504WT	PC99S06-1004WT	PC99S06-1504WT	PC99S06-2504WT	PC99S06-0104GC
	4.6	PC99S06-0546WT	PC99S06-1046WT	PC99S06-1546WT	PC99S06-2546WT	PC99S06-0104GC

*Guard cartridge holder required, part no. XPGCH-Q1

For other dimensions, please contact your YMC representative or YMC directly by phone (+49 (0)2064 427-0), by mail (info@ymc.eu) or use our online chat on our homepage (www.ymc.eu).

Normal Phase Classics



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Normal Phase

Introduction

HPLC Columns for Normal Phase Chromatography

Whilst historically it was the earliest form of HPLC, normal phase separations have recently less attention due to the belief that it is complicated and unpredictable. But normal-phase chromatography is a powerful tool for the separation of positional isomers that are difficult to separate in reversed-phase mode. Due to a rigid surface in comparison with the more flexible carbon chains of reversed phase stationary phases the analytes are effected by well defined steric interaction with polar groups.
This section gives a comprehensive overview of the stationary phases available from YMC for the use in normal phase separation mode. YMC offers columns packed with non-bonded silica or packed with silica gel modified with polar groups.

YMC-Pack SIL

- *ultra 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*

Specifications	YMC-Pack SIL	
Particle size / µm	3; 5	3; 5
Pore size / nm	6	12
Surface area / m^2g^{-1}	450	330
Recommended pH range	2.0 – 7.5	2.0 – 7.5

General

Due to the highly sophisticated production process YMC's spherical silica material shows outstanding performance and great lot-to-lot reproducibility.
The reason for this can be summarised in two main qualities: very narrow physical and chemical product specifications and outstanding purity.

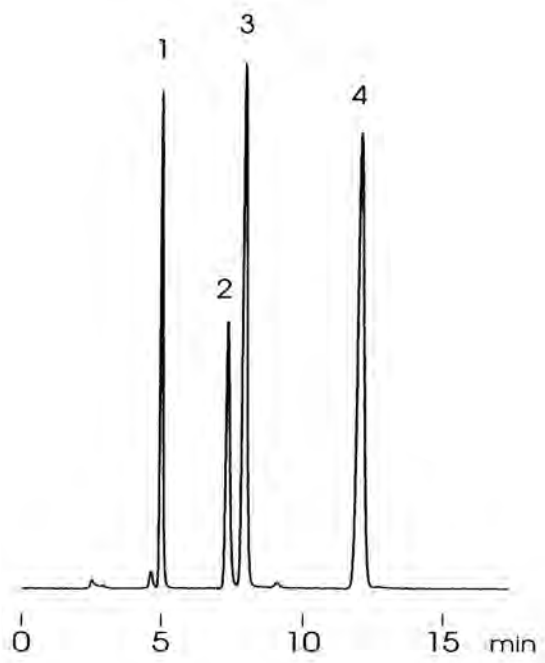
Properties

The high purity YMC-Pack SIL allows almost total sample recovery because the low content of impurities such as residual metals reduces non-specific sample adsorption. This also prevents unusual peak-shapes thereby encouraging higher sample loading. In addition, the porous structure of the spheres gives a high surface area which further improves sample loading.

Compared with irregular silica, YMC's spherical material is subject to a much lower degree of mechanical degradation during packing and usage. This results in lower backpressures and extended column life times due to the absence of 'fines'.
Since YMC spherical silica is the basis for most YMC bonded phases, this is a further reason for the premium quality of YMC stationary phases as far as backpressure and chromatographic stability is concerned.
YMC-Pack SIL is also available in preparative particle sizes, e.g. 10 - 20 - 50 µm (YMC*Gel SIL-HG) and in multiton scale.

Ultra High Purity Silica

1. α-Tocopherol
2. β-Tocopherol
3. γ-Tocopherol
4. δ-Tocopherol



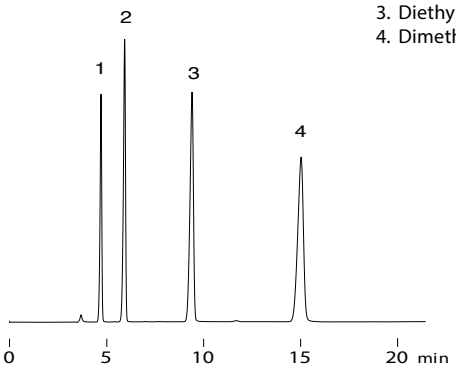
Column: YMC-Pack SIL (5 µm, 12 nm) 250 x 4.6 mm ID
Part No.: SL12S05-2546WT
Eluent: hexane / 2-propanol / acetic acid (1000/6/5)
Flow: 1.4 mL/min
Detection: FLS at Ex 298 nm, Em 325 nm
Temperature: 35 °C
Injection: 20 µL (5 ~ 20 mg/mL)

YMC-Pack SIL

Separation characteristics of normal-phase packing media

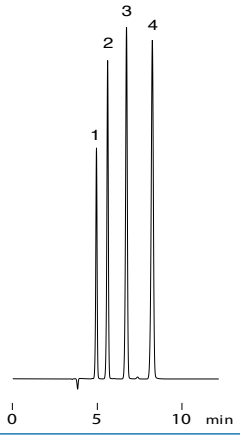
Silica gel

YMC-Pack SIL
(12 nm, 5 µm)

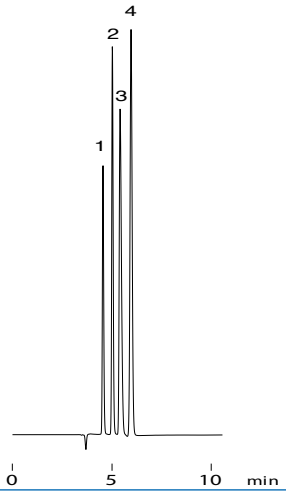


Chemically bonded packing material

YMC-Pack Diol-NP
(12 nm, 5 µm)

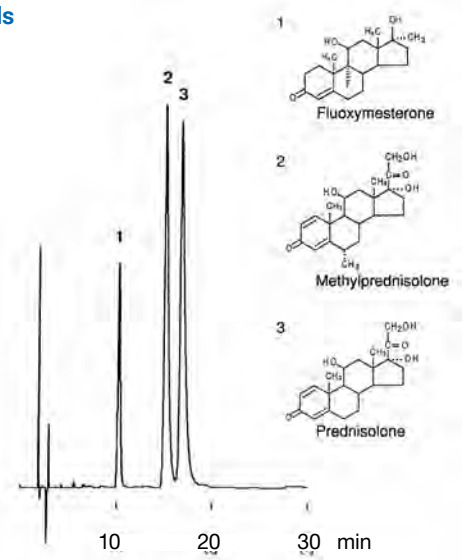


YMC-Pack CN
(12 nm, 5 µm)



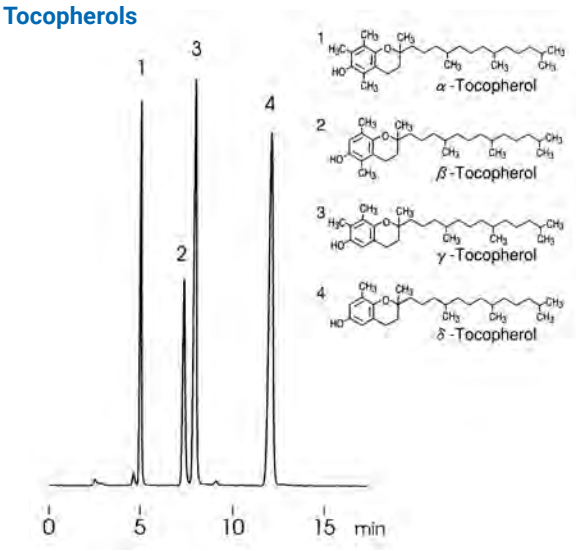
Column: 250 x 4.6 mm ID
Eluent: n-hexane / ethyl acetate (90/10)
Flow: 1.0 ml/min
Detection: UV at 254 nm
Temperature: 30 °C

Steroids



Column: YMC-Pack SIL (5 µm, 6 nm) 250 x 4.6 mm ID
Part No.: SL06S05-2546WT
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)

Tocopherols



Column: YMC-Pack SIL (5 µm, 12 nm) 150 x 4.6 mm ID
Part No.: SL12S05-1546WT
Eluent: hexane / THF / acetic acid (97/3/0.25)
Flow: 1.0 mL/min
Detection: UV at 295 nm, 0.08 AUFS
Temperature: 30 °C
Injection: 10 µL (0.20 ~ 0.31 mg/mL)

Column care

YMC-Pack SIL is stable towards hydrolysis between pH 2.0–7.5. Remove acid and buffer salts before storage. For detailed information please refer to the "Column Care and Use Instructions" which can be downloaded from www.ymc.eu/download-library.html

YMC-Pack PVA-Sil

- ***bonded phase alternative to silica for normal phase applications***
- ***consistent surface activity, unaffected by water***
- ***vinyl alcohol polymerised silica support***
- ***suitable for supercritical fluid chromatography (SFC)***

Specifications	YMC-Pack PVA-Sil
Particle size / µm	5
Pore size / nm	2
Surface area / m^2g^{-1}	330
Recommended pH range	2.0 – 9.5

Polyvinyl Alcohol Functionalised Silica

PVA-Sil is prepared from a 5 micron 12nm silica support which is bonded with a monomolecular polymer coating of vinyl alcohol. The polymerised PVA completely covers both external and internal surfaces of the silica support, protecting it against aggressive, high pH buffers and solvents.

Normal phase alternative to Silica

PVA-Sil, which possesses a polyvinyl alcohol (PVA) surface chemistry, is an excellent alternative to silica gel or other polar bonded phases which are used in normal phase chromatography. In many situations it exhibits better performance characteristics and a unique selectivity and can often resolve compounds that behave poorly on silica. The alcohol functionality present on PVA-Sil is better suited for troublesome compounds, such organic bases, than acidic silanols present in unbonded silica.

Highly stable and reproducible

Since PVA-Sil is a bonded stationary phase, it can be washed with solvents of any polarity, from hexane through water, without altering the surface activity. Therefore selectivity, retention and resolution are reproducible regardless of the column's previous history. This is not true of bare silica, which easily becomes completely deactivated following the introduction of even small quantity of water.

Provides high sample recovery

The surface of PVA-Sil is very uniform without the highly active acidic silanol sites on bare silica which can cause decomposition of sensitive molecules. Because of consistent surface activity, PVA-Sil exhibits neither non-specific irreversible adsorption nor sample degradation. This is a problem often encountered with bare silica columns. The lack of non-specific adsorption and the uniformity of the polyvinyl alcohol bonded surface means that, unlike silica, PVA-Sil can be reused over and over without fear of contamination or carryover. Sample recoveries on PVA-Sil typically average 90% or higher.

Excellent choice for packed column SFC

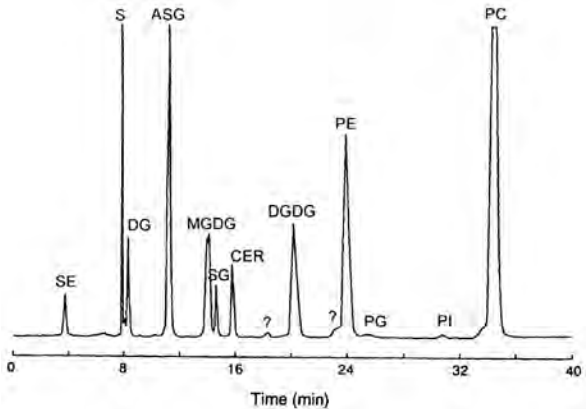
The PVA polymer shell on PVA-Sil deactivates the silica support while providing a hydrophilic surface. YMC-Pack PVA-Sil columns are well suited for SFC separations.

Column Care

YMC-Pack PVA-Sil is stable towards hydrolysis between pH 2.0-9.5. Remove acid and buffer salts before storage. For detailed information please refer to the "Column Care and Use Instructions" which can be downloaded from www.ymc.eu/download-library.html

YMC-Pack PVA-Sil

Analysis of Potato Lipids



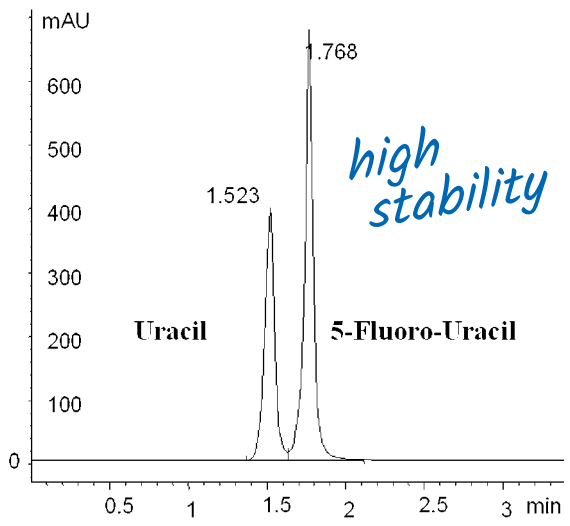
Column:	YMC-Pack PVA-Sil (5 µm, 12 nm) 250 x 4.6 mm ID						
Part No.:	PV12S05-2546WT						
Flow rate:	1 to 2 mL/min						
Mobile Phase:	A: iso-hexane / methyl ter butyl ether (98:2)						
	B: propan-2-ol / ACN / $CHCl_3$ / CH_3OOH (84:8:8:0.025)						
	C: propan-2-ol / water / triethylamine (50:50:0.2)						
Gradient:							
Tmin:	0	5	15	40	40.1	45	50
B%:	0	20	52	52	70	0	0
C%:	0	0	4	14	0	0	0
Flow (mL/mn):	1	1	1	1.4	1.4	2	2

Nebuliser temperature: 25 °C, Evaporation temperature: 35 °C

S:	Sterols	SE: Sterol Esters	SG: Steryl glycosides
MGDG:	Monogalactosyldiacylglycerols		DGDG: Digalactosyldiacylglycerols
PE:	Phosphatidylethanolamine		PG: Phosphatidyl glycerols
PC:	Phosphatidylcholine		ASG: Acylsterylglycosides
PI:	Phosphatidylinositol		DG: Diacylglycerol
CER:	Cerebrosides		

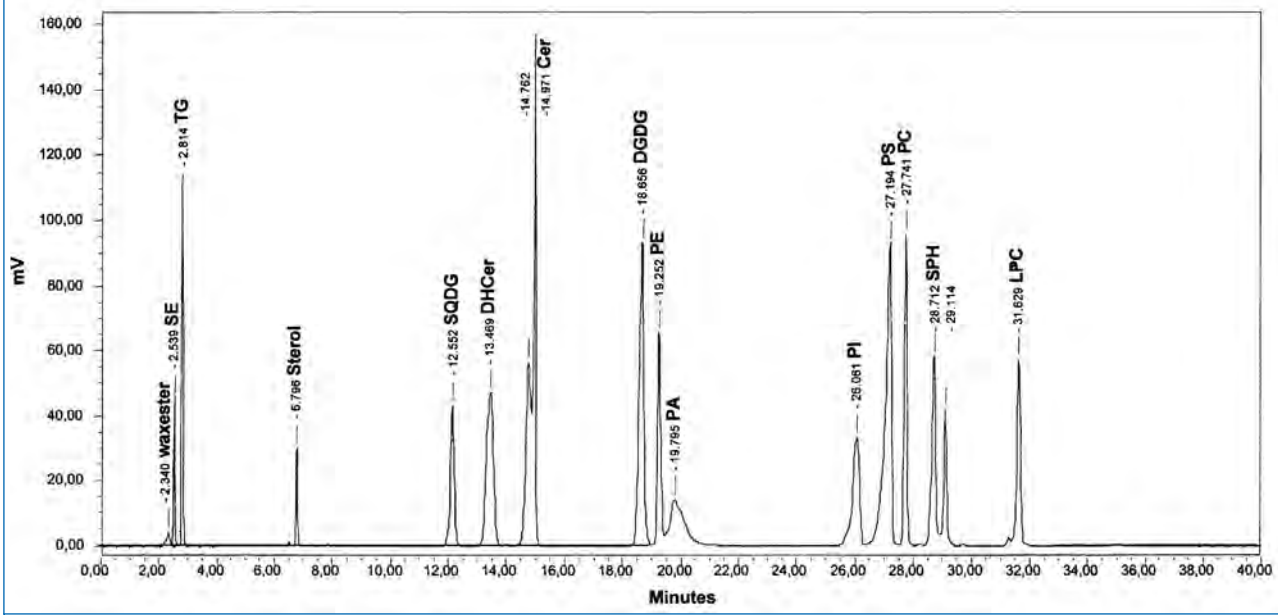
Literature: W.W. Christie; R.A. Urwin, J. high Resol. Chromatogr., Vol. 18 (1995) p.97–100

Uracil (in HILIC-mode)



Column:	YMC-Pack PVA-Sil (5 µm, 12 nm) 100 x 3.0 mm ID
Part No.:	PV12S05-1003WT
Eluent:	acetonitrile / CH_3COONH_4; 200 mM, pH 5,5 isocratic (95/5)
Flow rate:	0.9 mL/min
Detection:	UV at 275 nm

Analysis of Lipids



Column:	YMC-Pack PVA-Sil (5 µm, 12 nm) 250 x 4.0 mm ID				
Part No.:	PV12S05-2504WT				
Eluent:	A: n-hexane / tert-methylbutyl ether (98:2)				
	B: isopropanol / acetonitrile / chloroform / acetic acid (84:8:8:0.025)				
	C: isopropanol / water / triethylamine (50:50:0.2) plus 5 mM ammonium sulfate				
Flow rate:	1 mL/min				
Detector:	ELSD				

SE:	steryl oleate		PE:	PE-dipalmitoyl	
TG:	TAG/tripentadecanoin		PA:	PA-diheptadecanoyl	
Sterol:	stigmasterol/sitosterol		PI:	PI-diheptadecanoyl	
SQDG:	sulfoquinovosyldiacylglycerol		PS:	PS-diheptadecanoyl	
DHCer:	dehydroxycerebroside		PC:	PC-diheptadecanoyl	
Cer:	cerebroside		SPH:	sphingomyelin	
DGDG:	digalactosyldiacylglycerol		LPC:	lysophosphatidylcholine	

Literature: JAOCS, Vol. 80, no. 8 (2003) p. 747-753

YMC-Pack CN

- ***silica gel chemically bound with cyanopropyl groups***
- ***faster column equilibration than normal silica gel***

Specifications	YMC-Pack CN	
Particle size / µm	3; 5	5
Pore size / nm	12	30
Surface area / m^2g^{-1}	330	100
Carbon content / %	7	3
Recommended pH range	2.0 – 7.5	2.0 – 7.5

General

Cyano packings also provide an alternative to silica material in normal phase chromatography, where bonded normal phase packings have the advantage of faster equilibration, more uniform surface activity and increased resistance to dissolution.

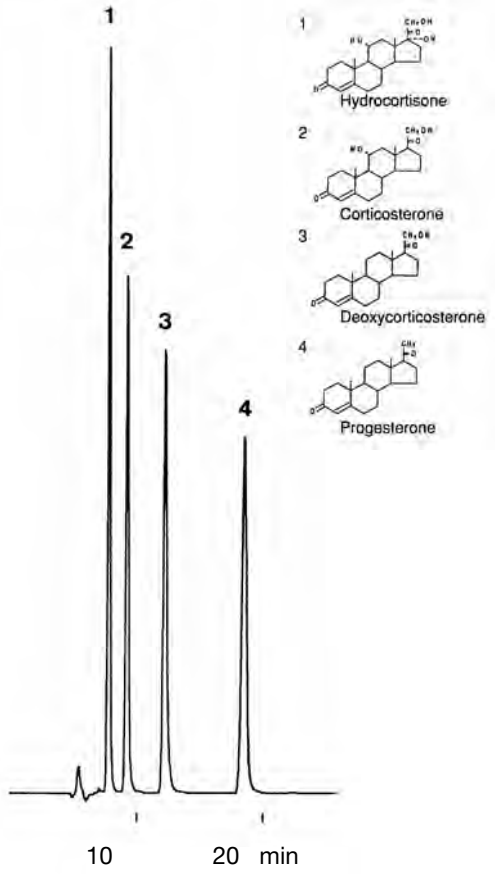
To extend column lifetime continued switching between normal and reversed phase solvents should be avoided. Both reversed and normal phase separations can be carried out on this material.
YMC-Pack CN is also available in preparative particle sizes.

YMC-Pack CN

YMC-Pack CN Separation Modes

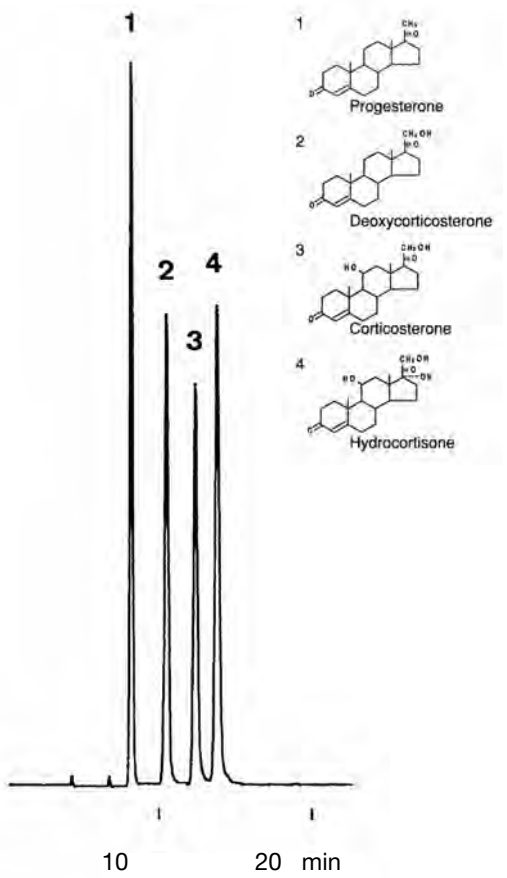
YMC-Pack CN can be used either in reversed phase and normal phase modes since it provides cyanopropyl groups of medium polarity. It can be employed in reversed phase mode with an aqueous mobile phase of higher polarity and in normal phase mode with a lower polarity than the stationary phase. This results in an important phenomenon for large-scale work; the elution order will be inverted by use of the alternate separation mode.

Steroids in reversed phase



Column:	YMC-Pack CN (5 µm, 12 nm) 250 x 4.6 mm ID
Part No.:	CN12S05-2546WT
Eluent:	acetonitrile / water (40/60)
Flow:	0.6 mL/min
Detection:	UV at 254 nm, 0.32 AUFS
Temperature:	30 °C
Injection:	3 µL (0.25 mg/mL)

Steroids in normal phase



Column:	YMC-Pack CN (5 µm, 12 nm) 250 x 4.6 mm ID
Part No.:	CN12S05-2546WT
Eluent:	hexane / methanol / dichloromethane (75/20/5)
Flow:	0.6 mL/min
Detection:	UV at 254 nm, 0.32 AUFS
Temperature:	30 °C
Injection:	3 µL (0.25 mg/mL)

Column care

YMC-Pack CN is stable towards hydrolysis between pH 2.0-7.5. Remove acid and buffer salts before storage. For detailed information please refer to the “Column Care and Use Instructions” which can be downloaded from www.ymc.eu/download-library.html

YMC-Pack Diol-NP

- ***good selectivity without excessive retention***
- ***high product recovery rate***
- ***high preparative loading***
- ***reproducibility***
- ***improved peak shape versus bare silica***
- ***gel filtration on a silica based material for aqueous size separations***

Specifications	YMC-Pack Diol-NP	
Particle Size / µm	5	5
Pore Size / nm	6	12
Surface area / m^2g^{-1}	450	330
Recommended pH range (NP)	2.0 – 7.5	2.0 – 7.5
Recommended pH range (SEC)	5.0 – 7.5	5.0 – 7.5

General

In normal phase mode the YMC-Pack Diol stationary phase is a versatile alternative to silica. The bonded phase's hydroxyl groups provide good selectivity without excessive retention, since hydrogen bonding with the diol layer is not as strong as with the silanols on a bare silica surface.

Diol columns also provide improved reproducibility when compared with bare silica.
Diol packings are suitable for separations using reversed phase techniques or molecular weight determination of proteins by gel filtration.

Properties

As with all YMC silica based bonded phases, YMC-Pack Diol starts with a base silica support of exceptional purity. YMC manufacturing and quality control procedures ensure that the silica has a very low residual metal content. 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-dihydroxypropane ligands, provides high preparative loading.

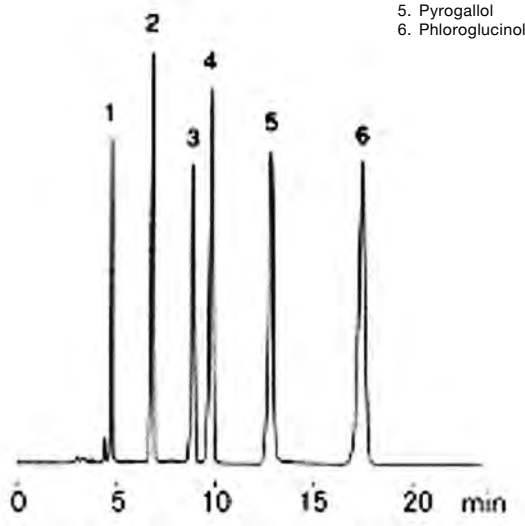
YMC-Pack Diol SEC columns for separation and MW determination of biomolecules may be found in the YMC BioLC catalogue.
YMC-Pack Diol packings can be cleaned repeatedly with methanol, or even water. When combined with the high mechanical strength of the pure base silica, this washability means that YMC*Gel Diol packings provide longer column life than underivatised silica.
YMC-Pack Diol is also available in preparative particle sizes.

YMC-Pack Diol-NP

Application

Separations of phenols

1. Phenol
2. Catechol
3. Resorcinol
4. Hydroquinone
5. Pyrogallol
6. Phloroglucinol



Column:	YMC-Pack Diol-NP (DN) (5 µm, 12 nm) 250 x 4.6 mm ID
Part No.:	DN12S05-2546WT
Eluent:	hexane / ethanol (80/20)
Flow rate:	1.0 mL/min
Temperature:	30 °C
Detection:	UV at 254 nm

Column care

YMC-Pack Diol is stable towards hydrolysis between pH 5.0-7.5 in reversed phase mode (DL) and pH 2.0-7.5 in normal phase mode (DN). Remove acid and buffer salts before storage. For detailed information please refer to the “Column Care and Use Instructions” which can be downloaded from www.ymc.eu/download-library.html

YMC-Pack Polyamine II

- *amino phase with polymeric surface*
- *exclusively 2° and 3° amino groups*
- *stable towards hydrolysis and oxidation*
- *high recovery*
- *excellent life-time*
- *saccharides and derivatives*
- *nucleotides*
- *tocopherols*
- *for RP- and NP-mode separations*

Specifications	YMC-Pack Polyamine II
Particle size / µm	5
Pore size / nm	12
Surface area / m^2g^{-1}	n/a
Carbon content / %	n/a
Recommended pH range	2.0 - 7.5

General

The chromatographic separation and the reliable quantitation of saccharides is increasingly important in many areas of food technology, life science and in pharmaceutical industry.

For these particular applications, YMC provides YMC-Pack Polyamine II, a polymer amino phase.

Properties

YMC-Pack Polyamine II is based on ultra-pure YMC silica as a support material. The functionality of the stationary phase is achieved by a covalently bonded polymer layer containing secondary (2°) and tertiary (3°) amino groups. The 2° and 3° amino groups of YMC-Pack Polyamine II are only weakly nucleophilic, exhibiting a significantly reduced reactivity against carbonyl compounds. Therefore, unlike conventional amino phases with primary n-propyl-amino ligands, YMC-Pack Polyamine II does not tend to the formation of Schiff's bases or other stable condensation products. In addition, the 2° and 3° amino groups of the polymer layer are to a large extent resistant to oxidation and hydrolysis (see figure next page).

The low reactivity of the 2° and 3° amino groups preserves the long-term retention characteristics and selectivity of YMC-Pack Polyamine II.
Compared to conventional amino phases, one of their most outstanding benefits is the significantly prolonged lifetime. As the silica matrix is completely polymer coated, even the short-term use of basic eluents up to pH 10.5 is possible.
Reducing sugars are often adsorbed irreversibly to conventional amino phases, which causes problems in their recovery and quantitation. In YMC-Pack Polyamine II columns however, the adsorption of reducing sugars plays only a minor role. As a result, a high recovery of these compounds can be obtained which is beneficial for accurate and reliable quantitation.

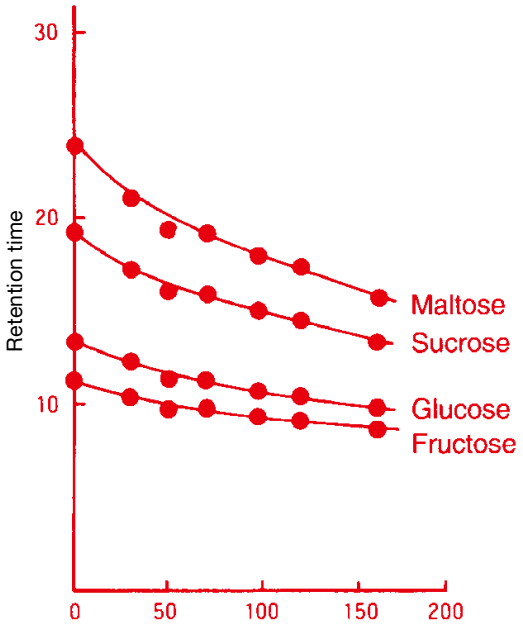
Column Care

YMC-Pack Polyamine II is stable towards hydrolysis between pH 2.0-9.0. Remove acid and buffer salts before storage. For detailed information please refer to the "Column Care and Use Instructions" which can be downloaded from www.ymc.eu/download-library.html

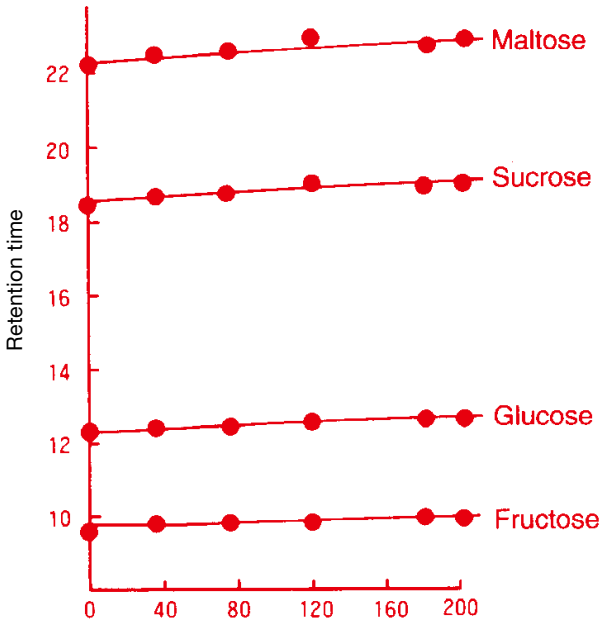
YMC-Pack Polyamine II

Stability of amino type packings

[a] conventional amino phase



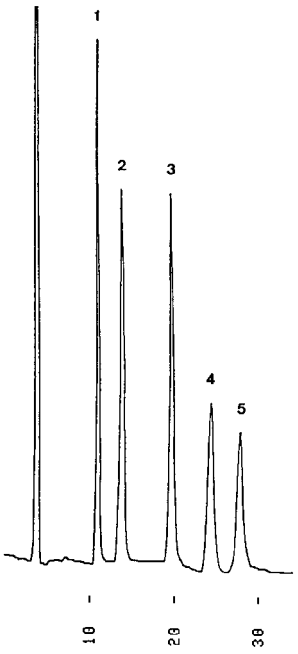
[b] YMC-Pack Polyamine II



continuous flow of distilled water /h

Mono- and Di-saccharides

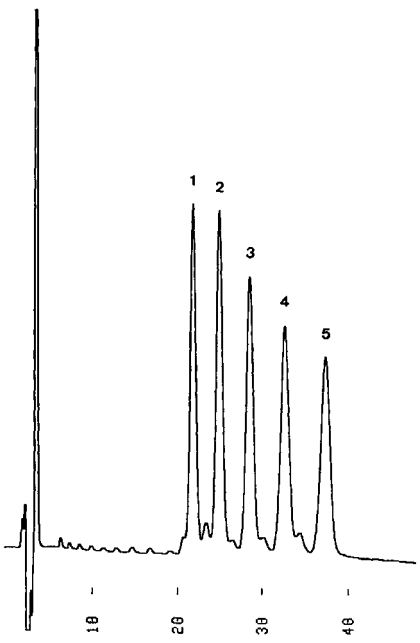
1: Fructose
2: Glucose
3: Sucrose
4: Maltose
5: Lactose



Column:	YMC-Pack Polyamine II (5 µm, 12 nm) 250 x 4.6 mm ID
Part No.:	PB12S05-2546WT
Eluent:	ACN/H_2O = 75/25
Flow:	1.0 ml/min
Detection:	RI, 32x10^{-6} RIU/FS
Temperature:	26 °C

Malto-oligosaccharides

1: Maltoundecaose (G_{11})
2: Maltododecaose (G_{12})
3: Maltotridecaose (G_{13})
4: Maltotetradecaose (G_{14})
5: Maltopentadecaose (G_{15})



Column:	YMC-Pack Polyamine II (5 µm, 12 nm) 250 x 4.6 mm ID
Part No.:	PB12S05-2546WT
Eluent:	ACN/H_2O = 55/45
Flow:	1.0 ml/min
Detection:	RI, 32 x 10^{-6} RIU/FS
Temperature:	26 °C

YMC-Pack NH_2

- ***primary amine (-NH2) functionality***
- ***stable, high coverage monomeric bonded chemistry***
- ***available in analytical, semi-prep and preparative column sizes***

Specifications	YMC-Pack NH_2
Particle size / µm	3; 5
Pore size / nm	12
Surface area / m^2g^{-1}	330
Recommended pH range	2.0– 7.5

General

YMC-Pack NH_2 packings are specifically useful for the analysis of mono- and polysaccharides under aggressive normal phase elution conditions. They can also be used in place of silica for conventional normal phase chromatography using nonpolar solvents.

Properties

YMC-Pack NH_2 is based on a monomeric bonding of a primary propylamine functionality to YMC's spherical, ultra pure, high surface area silica with a mean pore diameter of 12 nm. The amine functionality provides retention and allows the separation of polar compounds under aggressive normal phase elution conditions, e.g. the analysis of mono- and polysaccharides using acetonitrile/water eluents. (Since YMC-Pack NH_2 packings operate under normal phase/HILIC elution conditions, water, which is more polar than acetonitrile, is the stronger solvent.) YMC-Pack NH_2 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.

YMC-Pack NH_2 is also available in preparative particle sizes.

Column Care

YMC-Pack NH_2 is stable towards hydrolysis between pH 2.0-7.5. Remove acid and buffer salts before storage. For detailed information please refer to the "Column Care and Use Instructions" which can be downloaded from www.ymc.eu/download-library.html

YMC-Pack TMS

- ***intermediate polarity between normal phase silica and other alkyl bonded reversed phases***
- ***operates in either normal phase, or reversed phase mode***

Specifications	YMC-Pack TMS
Particle size / µm	3; 5
Pore size / nm	12
Surface area / m^2g^{-1}	330
Carbon content / %	4
Recommended pH range	2.0 – 7.5

General

YMC-Pack TMS is a bonded phase suitable for samples that exhibit strong retention characteristics and are difficult or impossible to separate on conventional reversed phase or normal phase packings.

Properties

YMC-Pack TMS 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 TMS is also well-suited for the analysis of multifunctional compounds. Selectivity characteristics of a C1 bonded phase can be unique, and samples must be tested to determine the applicability of the phase.
YMC-Pack TMS is also available in preparative particle sizes.

Column Care

YMC-Pack TMS is stable towards hydrolysis between pH 2.0-7.5. Remove acid and buffer salts before storage. Store the column in methanol / water = 70 / 30. Clogged inlet frits often can be cleaned by changing the flow direction or replacement.

For detailed information please refer to the “Column Care and Use Instructions” which can be downloaded from www.ymc.eu/download-library.html

Ordering Information

6 nm, 3 µm HPLC columns (Waters type hardware, WT)

Phase	Column ID [mm]	Column length [mm]				Guard cartridges* with 10 mm length
		50	100	150	250	(pack of 5)
YMC-Pack Sil	2.0	SL06S03-0502WT	SL06S03-1002WT	SL06S03-1502WT	SL06S03-2502WT	SL06S03-01Q1GC
	2.1	SL06S03-05Q1WT	SL06S03-10Q1WT	SL06S03-15Q1WT	SL06S03-25Q1WT	SL06S03-01Q1GC
	3.0	SL06S03-0503WT	SL06S03-1003WT	SL06S03-1503WT	SL06S03-2503WT	SL06S03-0103GC
	4.0	SL06S03-0504WT	SL06S03-1004WT	SL06S03-1504WT	SL06S03-2504WT	SL06S03-0104GC
	4.6	SL06S03-0546WT	SL06S03-1046WT	SL06S03-1546WT	SL06S03-2546WT	SL06S03-0104GC

12 nm, 3 µm HPLC columns (Waters type hardware, WT)

Phase	Column ID [mm]	Column length [mm]				Guard cartridges* with 10 mm length
		50	100	150	250	(pack of 5)
YMC-Pack SIL	2.0	SL12S03-0502WT	SL12S03-1002WT	SL12S03-1502WT	SL12S03-2502WT	SL12S03-01Q1GC
	2.1	SL12S03-05Q1WT	SL12S03-10Q1WT	SL12S03-15Q1WT	SL12S03-25Q1WT	SL12S03-01Q1GC
	3.0	SL12S03-0503WT	SL12S03-1003WT	SL12S03-1503WT	SL12S03-2503WT	SL12S03-0103GC
	4.0	SL12S03-0504WT	SL12S03-1004WT	SL12S03-1504WT	SL12S03-2504WT	SL12S03-0104GC
	4.6	SL12S03-0546WT	SL12S03-1046WT	SL12S03-1546WT	SL12S03-2546WT	SL12S03-0104GC
YMC-Pack NH2	2.0	NH12S03-0502WT	NH12S03-1002WT	NH12S03-1502WT	NH12S03-2502WT	NH12S03-01Q1GC
	2.1	NH12S03-05Q1WT	NH12S03-10Q1WT	NH12S03-15Q1WT	NH12S03-25Q1WT	NH12S03-01Q1GC
	3.0	NH12S03-0503WT	NH12S03-1003WT	NH12S03-1503WT	NH12S03-2503WT	NH12S03-0103GC
	4.0	NH12S03-0504WT	NH12S03-1004WT	NH12S03-1504WT	NH12S03-2504WT	NH12S03-0104GC
	4.6	NH12S03-0546WT	NH12S03-1046WT	NH12S03-1546WT	NH12S03-2546WT	NH12S03-0104GC
YMC-Pack TMS	2.0	TM12S03-0502WT	TM12S03-1002WT	TM12S03-1502WT	TM12S03-2502WT	TM12S03-01Q1GC
	2.1	TM12S03-05Q1WT	TM12S03-10Q1WT	TM12S03-15Q1WT	TM12S03-25Q1WT	TM12S03-01Q1GC
	3.0	TM12S03-0503WT	TM12S03-1003WT	TM12S03-1503WT	TM12S03-2503WT	TM12S03-0103GC
	4.0	TM12S03-0504WT	TM12S03-1004WT	TM12S03-1504WT	TM12S03-2504WT	TM12S03-0104GC
	4.6	TM12S03-0546WT	TM12S03-1046WT	TM12S03-1546WT	TM12S03-2546WT	TM12S03-0104GC
YMC-Pack CN	2.0	CN12S03-0502WT	CN12S03-1002WT	CN12S03-1502WT	CN12S03-2502WT	CN12S03-01Q1GC
	2.1	CN12S03-05Q1WT	CN12S03-10Q1WT	CN12S03-15Q1WT	CN12S03-25Q1WT	CN12S03-01Q1GC
	3.0	CN12S03-0503WT	CN12S03-1003WT	CN12S03-1503WT	CN12S03-2503WT	CN12S03-0103GC
	4.0	CN12S03-0504WT	CN12S03-1004WT	CN12S03-1504WT	CN12S03-2504WT	CN12S03-0104GC
	4.6	CN12S03-0546WT	CN12S03-1046WT	CN12S03-1546WT	CN12S03-2546WT	CN12S03-0104GC

6 nm, 5 µm HPLC columns (Waters type hardware, WT)

Phase	Column ID [mm]	Column length [mm]				Guard cartridges* with 10 mm length
		50	100	150	250	(pack of 5)
YMC-Pack Sil	2.0	SL06S05-0502WT	SL06S05-1002WT	SL06S05-1502WT	SL06S05-2502WT	SL06S05-01Q1GC
	2.1	SL06S05-05Q1WT	SL06S05-10Q1WT	SL06S05-15Q1WT	SL06S05-25Q1WT	SL06S05-01Q1GC
	3.0	SL06S05-0503WT	SL06S05-1003WT	SL06S05-1503WT	SL06S05-2503WT	SL06S05-0103GC
	4.0	SL06S05-0504WT	SL06S05-1004WT	SL06S05-1504WT	SL06S05-2504WT	SL06S05-0104GC
	4.6	SL06S05-0546WT	SL06S05-1046WT	SL06S05-1546WT	SL06S05-2546WT	SL06S05-0104GC

*Guard cartridge holder required, part no. XPGCH-Q1

Ordering Information

12 nm, 5 µm HPLC columns (Waters type hardware, WT)

Phase	Column ID [mm]	Column length [mm]				Guard cartridges* with 10 mm length
		50	100	150	250	(pack of 5)
YMC-Pack SIL	2.0	SL12S05-0502WT	SL12S05-1002WT	SL12S05-1502WT	SL12S05-2502WT	SL12S05-01Q1GC
	2.1	SL12S05-05Q1WT	SL12S05-10Q1WT	SL12S05-15Q1WT	SL12S05-25Q1WT	SL12S05-01Q1GC
	3.0	SL12S05-0503WT	SL12S05-1003WT	SL12S05-1503WT	SL12S05-2503WT	SL12S05-0103GC
	4.0	SL12S05-0504WT	SL12S05-1004WT	SL12S05-1504WT	SL12S05-2504WT	SL12S05-0104GC
	4.6	SL12S05-0546WT	SL12S05-1046WT	SL12S05-1546WT	SL12S05-2546WT	SL12S05-0104GC
YMC-Pack PVA-Sil	2.0	PV12S05-0502WT	PV12S05-1002WT	PV12S05-1502WT	PV12S05-2502WT	PV12S05-01Q1GC
	2.1	PV12S05-05Q1WT	PV12S05-10Q1WT	PV12S05-15Q1WT	PV12S05-25Q1WT	PV12S05-01Q1GC
	3.0	PV12S05-0503WT	PV12S05-1003WT	PV12S05-1503WT	PV12S05-2503WT	PV12S05-0103GC
	4.0	PV12S05-0504WT	PV12S05-1004WT	PV12S05-1504WT	PV12S05-2504WT	PV12S05-0104GC
	4.6	PV12S05-0546WT	PV12S05-1046WT	PV12S05-1546WT	PV12S05-2546WT	PV12S05-0104GC
YMC-Pack Diol-NP	2.0	DN12S05-0502WT	DN12S05-1002WT	DN12S05-1502WT	DN12S05-2502WT	DN12S05-01Q1GC
	2.1	DN12S05-05Q1WT	DN12S05-10Q1WT	DN12S05-15Q1WT	DN12S05-25Q1WT	DN12S05-01Q1GC
	3.0	DN12S05-0503WT	DN12S05-1003WT	DN12S05-1503WT	DN12S05-2503WT	DN12S05-0103GC
	4.0	DN12S05-0504WT	DN12S05-1004WT	DN12S05-1504WT	DN12S05-2504WT	DN12S05-0104GC
	4.6	DN12S05-0546WT	DN12S05-1046WT	DN12S05-1546WT	DN12S05-2546WT	DN12S05-0104GC
YMC-Pack Polyamine II	2.0	PB12S05-0502WT	PB12S05-1002WT	PB12S05-1502WT	PB12S05-2502WT	PB12S05-01Q1GC
	2.1	PB12S05-05Q1WT	PB12S05-10Q1WT	PB12S05-15Q1WT	PB12S05-25Q1WT	PB12S05-01Q1GC
	3.0	PB12S05-0503WT	PB12S05-1003WT	PB12S05-1503WT	PB12S05-2503WT	PB12S05-0103GC
	4.0	PB12S05-0504WT	PB12S05-1004WT	PB12S05-1504WT	PB12S05-2504WT	PB12S05-0104GC
	4.6	PB12S05-0546WT	PB12S05-1046WT	PB12S05-1546WT	PB12S05-2546WT	PB12S05-0104GC
YMC-Pack NH2	2.0	NH12S05-0502WT	NH12S05-1002WT	NH12S05-1502WT	NH12S05-2502WT	NH12S05-01Q1GC
	2.1	NH12S05-05Q1WT	NH12S05-10Q1WT	NH12S05-15Q1WT	NH12S05-25Q1WT	NH12S05-01Q1GC
	3.0	NH12S05-0503WT	NH12S05-1003WT	NH12S05-1503WT	NH12S05-2503WT	NH12S05-0103GC
	4.0	NH12S05-0504WT	NH12S05-1004WT	NH12S05-1504WT	NH12S05-2504WT	NH12S05-0104GC
	4.6	NH12S05-0546WT	NH12S05-1046WT	NH12S05-1546WT	NH12S05-2546WT	NH12S05-0104GC
YMC-Pack TMS	2.0	TM12S05-0502WT	TM12S05-1002WT	TM12S05-1502WT	TM12S05-2502WT	TM12S05-01Q1GC
	2.1	TM12S05-05Q1WT	TM12S05-10Q1WT	TM12S05-15Q1WT	TM12S05-25Q1WT	TM12S05-01Q1GC
	3.0	TM12S05-0503WT	TM12S05-1003WT	TM12S05-1503WT	TM12S05-2503WT	TM12S05-0103GC
	4.0	TM12S05-0504WT	TM12S05-1004WT	TM12S05-1504WT	TM12S05-2504WT	TM12S05-0104GC
	4.6	TM12S05-0546WT	TM12S05-1046WT	TM12S05-1546WT	TM12S05-2546WT	TM12S05-0104GC
YMC-Pack CN	2.0	CN12S05-0502WT	CN12S05-1002WT	CN12S05-1502WT	CN12S05-2502WT	CN12S05-01Q1GC
	2.1	CN12S05-05Q1WT	CN12S05-10Q1WT	CN12S05-15Q1WT	CN12S05-25Q1WT	CN12S05-01Q1GC
	3.0	CN12S05-0503WT	CN12S05-1003WT	CN12S05-1503WT	CN12S05-2503WT	CN12S05-0103GC
	4.0	CN12S05-0504WT	CN12S05-1004WT	CN12S05-1504WT	CN12S05-2504WT	CN12S05-0104GC
	4.6	CN12S05-0546WT	CN12S05-1046WT	CN12S05-1546WT	CN12S05-2546WT	CN12S05-0104GC

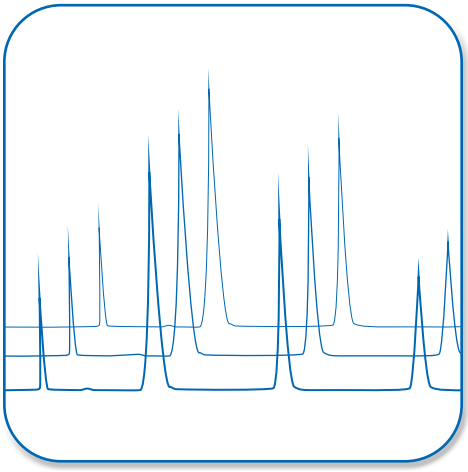
30 nm, 5 µm HPLC columns (Waters type hardware, WT)

Phase	Column ID [mm]	Column length [mm]				Guard cartridges* with 10 mm length
		50	100	150	250	(pack of 5)
YMC-Pack CN	2.0	CN30S05-0502WT	CN30S05-1002WT	CN30S05-1502WT	CN30S05-2502WT	CN30S05-01Q1GC
	2.1	CN30S05-05Q1WT	CN30S05-10Q1WT	CN30S05-15Q1WT	CN30S05-25Q1WT	CN30S05-01Q1GC
	3.0	CN30S05-0503WT	CN30S05-1003WT	CN30S05-1503WT	CN30S05-2503WT	CN30S05-0103GC
	4.0	CN30S05-0504WT	CN30S05-1004WT	CN30S05-1504WT	CN30S05-2504WT	CN30S05-0104GC
	4.6	CN30S05-0546WT	CN30S05-1046WT	CN30S05-1546WT	CN30S05-2546WT	CN30S05-0104GC

*Guard cartridge holder required, part no. XPGCH-Q1

For other dimensions, please contact your YMC representative or YMC directly by phone (+49 (0)2064 427-0), by mail (info@ymc.eu) or use our online chat on our homepage (www.ymc.eu).

Speciality Columns



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Speciality Columns

Introduction

Unique bonded phases

The YMC's Speciality Columns represents major advances in modern chromatography. In order to obtain maximum separation and resolution, selectivity has to be optimised. YMC is dedicated to produce speciality phases, which are designed to provide robust, reliable and easy transferable methods for specific applications. For this reason, YMC introduce YMC Carotenoid and YMC PAH phases, which are designed to show high recognition for structurally similar polar and nonpolar carotenoids and polyaromatic hydrocarbons, respectively.
In addition, YMC's J'sphere columns are a series of packings, which offer a range of different hydrophobicity controlled by the alternative process of C18 chain density.

YMC Carotenoid

- *C30 chains*
- *very lipophilic*
- *exceptional selectivity pattern*
- *isomer recognition*
- *LC-MS applications*
- *polar carotenes*
- *polar and nonpolar xanthophylls*
- *steroids*
- *retinols*
- *fat-soluble vitamins*

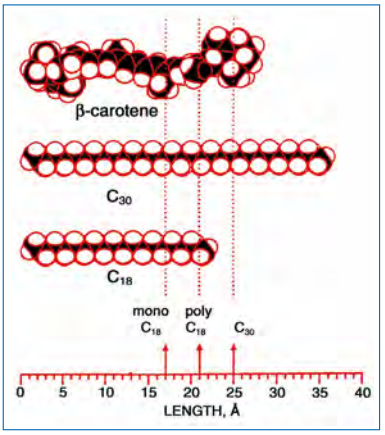
Specifications	YMC Carotenoid
Particle size / µm	3; 5
Pore size / nm	proprietay
Surface area / m^2g^{-1}	proprietary
Carbon content / %	proprietary
Recommended pH range	2.0 – 7.5

General

The separation of geometric and positional isomers is a challenging task in reversed phase chromatography. Subtle molecular differences have to be recognized and resolved by this particular stationary phase. Sander et al. have conclusively shown that polymeric C30 HPLC stationary phases are able to discriminate isomeric structures of long chain molecules [1,2].

Properties

Compared to classical C18 stationary phases, YMC Carotenoid is much more hydrophobic. Even when pure organic eluents are applied, many sample solutes are retained. The use of non-aqueous reversed phase mobile phases facilitates 100% solvent recycling and LC-MS applications. The YMC Carotenoid stationary phase provides sufficient phase thickness to enhance interaction with long chained molecules (see figure on right). Therefore, geometric and positional isomers of conjugated double bonding systems are recognised and resolved by the YMC Carotenoid phase.
The resolving power of YMC Carotenoid for isomers can be verified by the separation of carotenoids, which has been subject of considerable research efforts in the past. Carotenoids are found in a variety of natural sources including fruits and vegetables. In addition, carotenoids are considered as potential drugs for cancer intervention or prevention.
Despite the complexity of carotenoid extracts and the minor shape differences between carotenoid isomers, the separation, identification and quantification of these compounds can be achieved by using YMC Carotenoid columns.



Comparison of the film thickness of C18 and C30 stationary phases with the molecular length of β-carotene (determined with Small Angle Neutron Scattering (SANS)).

Application

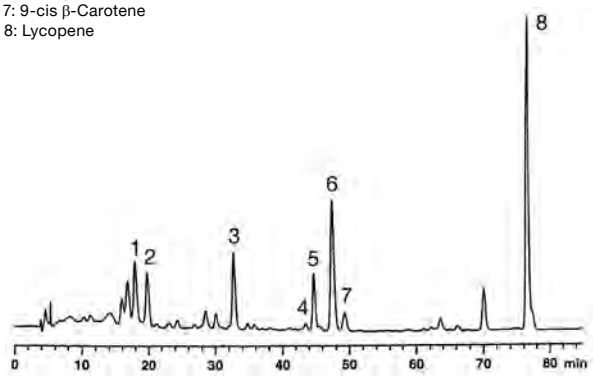
YMC Carotenoid columns are successfully used in the food industry, for the analysis of vitamin formulations, in environmental analysis, and for the control of algal growth. Other potential applications include the separation of prostaglandins and leucotrienes.

YMC Carotenoid

Separation of natural compounds

Extract of SRM 2383, NIST food standard[a]

1: Lutein
2: Zeaxanthin
3: β-Cryptoxanthin
4: 13-cis β-Carotene
5: α-Carotene
6: trans β-Carotene
7: 9-cis β-Carotene
8: Lycopene

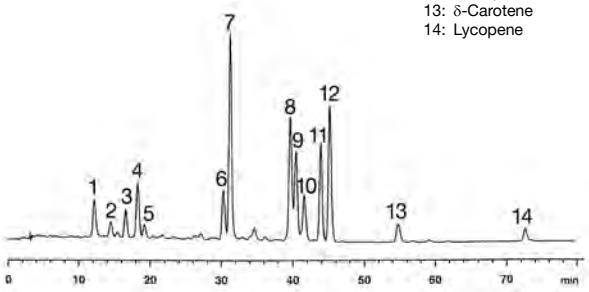


Column:	YMC Carotenoid (5 µm) 250 x 4.6 mm ID
Part No.:	CT99S05-2546WT
Eluent:	A: MeOH / MTBE / H_2O = 81/15/4 / B: MeOH / MTBE / H_2O = 6/90/4
Gradient:	0-100% B (90 min)
Flow:	1.0 mL/min
Detection:	UV at 450 nm
Temperature:	ambient

Carotene and Xanthophyll standard[a]

Gradient elution was performed by ternary gradient elution. Mobile phase B) is not miscible in this proportion. For binary gradient elution, MeOH/MTBE/water(7/90/3) is suitable as mobile phase B).

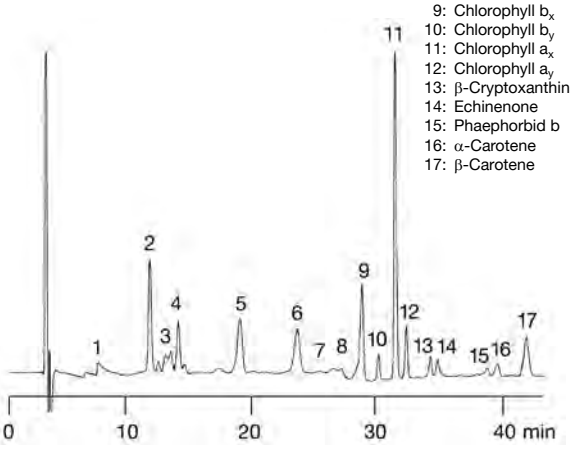
1: Astaxanthin
2: Capsanthin
3: Lutein
4: Zeaxanthin
5: Canthaxanthin
6: β-Cryptoxanthin
7: Echinenone
8: 15-cis β-Carotene
9: 13-cis β-Carotene
10: α-Carotene
11: trans β-Carotene
12: 9-cis β-Carotene
13: δ-Carotene
14: Lycopene



Column:	YMC Carotenoid (5 µm) 250 x 4.6 mm ID
Part No.:	CT99S05-2546WT
Eluent:	A: MeOH / MTBE / H_2O= 81/15/4 / B: MeOH / MTBE / H_2O= 6/90/4
Gradient:	1-100% B (90 min)
Flow:	1.0 mL/min
Detection:	UV at 450 nm
Temperature:	ambient

Carotenoid pigments in algae[b]

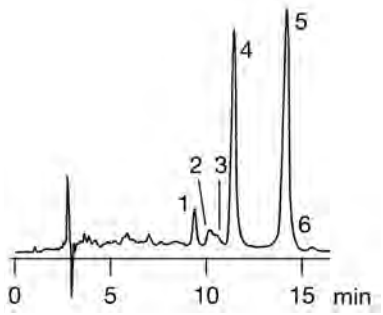
1: Chlorophyll c_1+c_2
2: Fucoxanthin
3: Neoxanthin
4: Violaxanthin
5: Diadinoxanthin
6: Lutein
7: Zeaxanthin
8: Diatoxanthin
9: Chlorophyll b_x
10: Chlorophyll b_y
11: Chlorophyll a_x
12: Chlorophyll a_y
13: β-Cryptoxanthin
14: Echinenone
15: Phaephorbid b
16: α-Carotene
17: β-Carotene



Column:	YMC Carotenoid (5 µm) 250 x 4.6 mm ID
Part No.:	CT99S05-2546WT
Eluent:	A: methanol / acetone = 60/40 B: acetone / H_2O = 60/40
Gradient:	60-30% B (0-3 min), 30% B (3-22 min), 30-10% B (22-26 min), 10% B (26-41.5 min), 10-60% B (41.5-45 min)
Flow:	0.5 mL/min
Detection:	UV at 450 nm
Temperature:	35 °C

Carotene isomers from commercially available capsules[a]

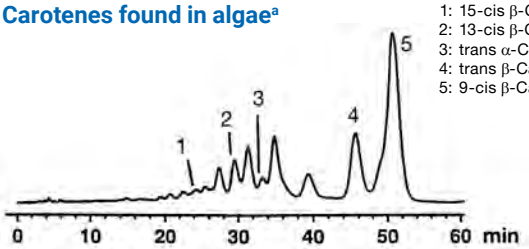
1: 15-cis β-Carotene
2: 13-cis β-Carotene
3: 13'-cis β-Carotene
4: α-Carotene
5: β-Carotene
6: α-Carotene



Column:	YMC Carotenoid (5 µm) 250 x 4.6 mm ID
Part No.:	CT99S05-2546WT
Eluent:	EtOH / MeOH / THF = 75/20/5
Flow:	1.0 mL/min
Detection:	UV at 450 nm
Temperature:	ambient

Carotenes found in algae[a]

1: 15-cis β-Carotene
2: 13-cis β-Carotene
3: trans α-Carotene
4: trans β-Carotene
5: 9-cis β-Carotene



Column:	YMC Carotenoid (5 µm) 250 x 4.6 mm ID
Part No.:	CT99S05-2546WT
Eluent:	MeOH / MTBE = 80/20
Flow:	2.0 mL/min
Detection:	UV at 450 nm
Temperature:	35 °C

References
[1] Sander, L.C. and S.A. Wise; J. Chromatogr. 1993, 656, 335-351
[2] Sander, L.C. et al.; Anal. Chem. 1994, 66, 1667-1674
[3] Block, G. and L. Langseth, "Antioxidant Vitamins and Disease Prevention", Food Technology July 1994

[a] Courtesy of L.C. Sander, NIST, Gaithersburg, NC, USA
[b] Courtesy of J. Schmid, Institut für Seenforschung, Langenargen, Germany

YMC PAH

- ***specifically designed for the analysis of Polynuclear Aromatic Hydrocarbons***
- ***provides the resolution necessary for a fast identification and quantification for PAHs***

Specifications	YMC PAH
Particle size / µm	3; 5
Pore size / nm	proprietay
Surface area / m^2g^{-1}	proprietary
Carbon content / %	proprietary
Recommended pH range	2.0 – 6.5

General

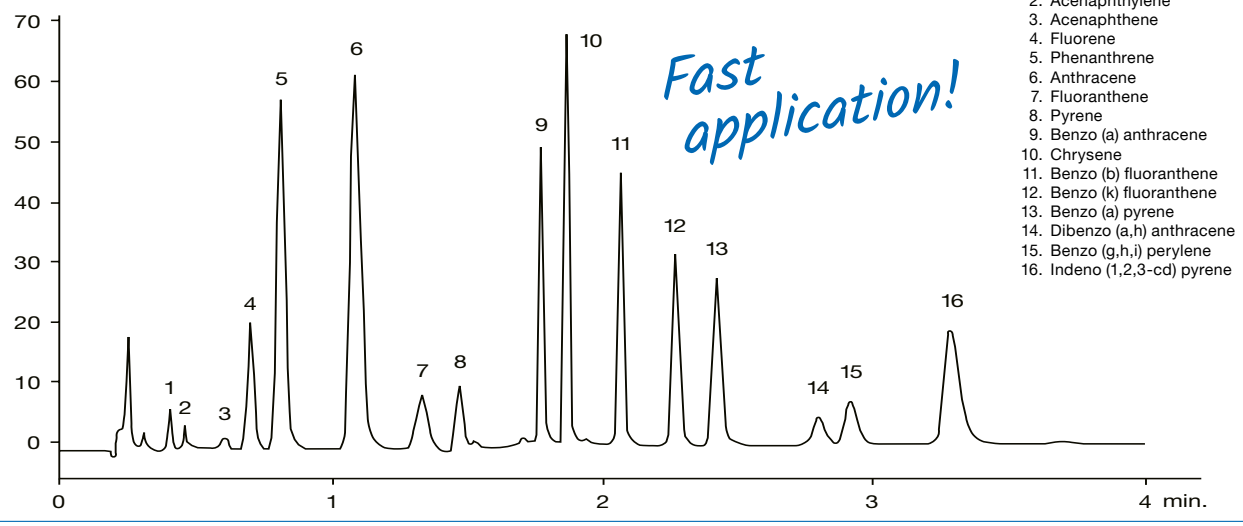
Polynuclear Aromatic Hydrocarbons (PAHs) are among the most frequently monitored environmental contaminants. YMC PAH columns have been specifically developed for the highly demanding analysis of Polynuclear Aromatic Hydrocarbons.

Standard and official methods for the analysis of PAHs are found in compendia for air, drinking water, waste water, solid waste, and food analysis. Many of these methods specify HPLC, usually with UV or fluorescence detection, as recommended analytical procedure.

Properties

The YMC PAH columns provide narrow symmetrical peak shapes and its resolving ability leads to an easy identification and quantification for PAHs. The optimised selectivity of YMC PAH columns results in a separation with enough space for wavelength changes by the use of fluorescence detectors.

16 PAH according to EPA 610



1. Naphthalene
2. Acenaphthylene
3. Acenaphthene
4. Fluorene
5. Phenanthrene
6. Anthracene
7. Fluoranthene
8. Pyrene
9. Benzo (a) anthracene
10. Chrysene
11. Benzo (b) fluoranthene
12. Benzo (k) fluoranthene
13. Benzo (a) pyrene
14. Dibenzo (a,h) anthracene
15. Benzo (g,h,i) perylene
16. Indeno (1,2,3-cd) pyrene

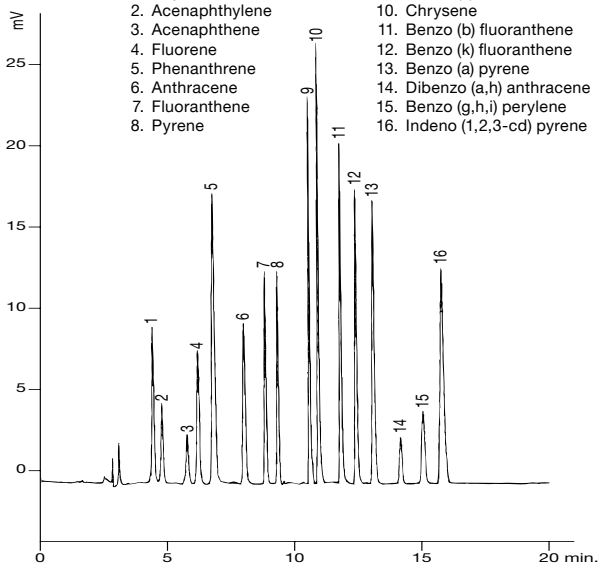
Column: YMC PAH (3 µm) 50 x 4.0 mm ID
Part No.: YP99S03-0504WT
Eluent: A) methanol / water (80/20) B) acetonitrile
Flow rate: 2.0 mL/min
Temperature: 24 °C
Detection: UV at 254 nm Gradient

Time [min]	A	B
0.0	90%	10%
0.5	90%	10%
1.0	0%	100%
4.0	0%	100%

YMC PAH

16 PAH according to EPA 610

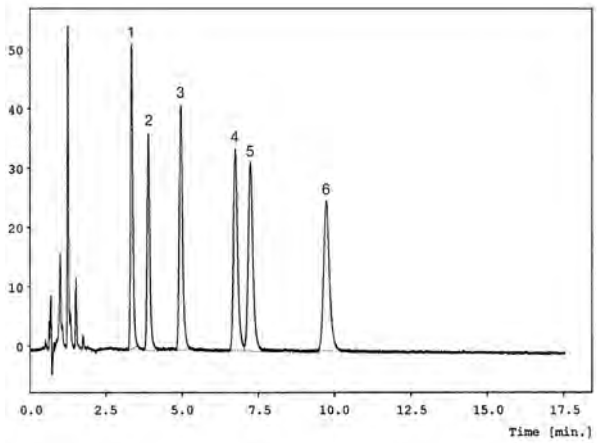
1. Naphthalene
2. Acenaphthylene
3. Acenaphthene
4. Fluorene
5. Phenanthrene
6. Anthracene
7. Fluoranthene
8. Pyrene
9. Benzo (a) anthracene
10. Chrysene
11. Benzo (b) fluoranthene
12. Benzo (k) fluoranthene
13. Benzo (a) pyrene
14. Dibenzo (a,h) anthracene
15. Benzo (g,h,i) perylene
16. Indeno (1,2,3-cd) pyrene



		Gradient		
Column:	YMC PAH (5 µm) 250 x 3.0 mm ID	Time [min]	A	B
Part No.:	YP99S05-2503WT	0,0	90%	10%
Eluent:	A) MeOH / water (80/20)	4	90%	10%
	B) acetonitrile	7	0%	100%
Flow rate:	0.43 mL/min	25	0%	100%
Temperature:	30 °C			
Detection:	UV at 254 nm			
Injection:	5 µL			

PCB separation according EPA

1. PCB 52
2. PCB 28
3. PCB 101
4. PCB 138
5. PCB 153
6. PCB 180



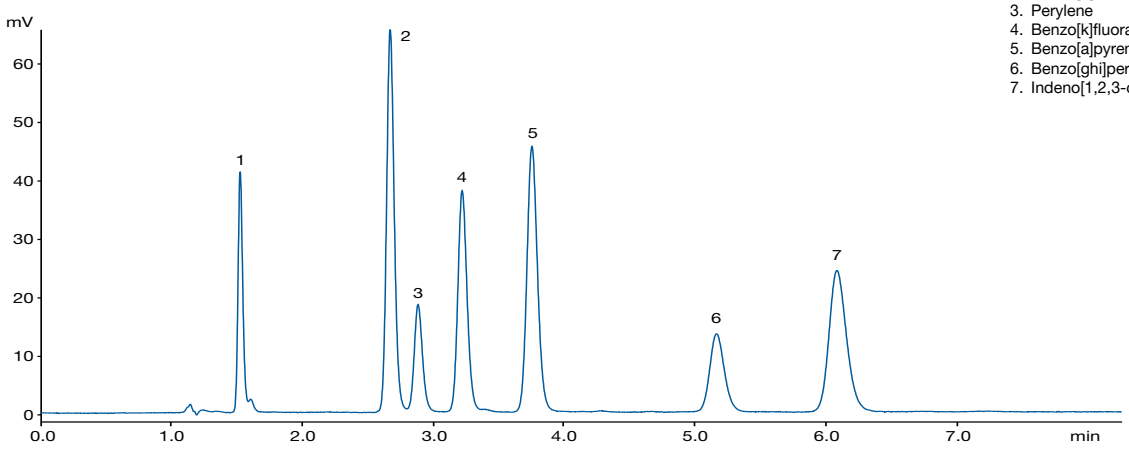
Column:	YMC PAH (3 µm) 100 x 3.0 mm ID
Part No.:	YP99S05-1003WT
Eluent:	acetonitrile / water (75/25)
Flow rate:	0.6 mL/min
Temperature:	30 °C
Detection:	UV at 220 nm

Polynuclear Aromatic Hydrocarbons (PAHs) are ubiquitous xenobiotics which are known or suspected carcinogens. According to the German Trinkwasserverordnung (TVO) six PAH have to be quantified. Moreover Perylene, which is often present in the samples under investigation, has to be fully resolved in order to avoid coelutions and therefore questionable results.

The chromatogram below shows the successful separation of all seven substances with a YMC PAH column as stationary and an acetonitrile/methanol mixture as a simple isocratic mobile phase. The elution time has been reduced to approximately six minutes with excellent resolution without the need for gradient elution.

7 PAH according to EPA 610

1. Fluoranthene
2. Benzo[b]fluoranthene
3. Perylene
4. Benzo[k]fluoranthene
5. Benzo[a]pyrene
6. Benzo[ghi]perylene
7. Indeno[1,2,3-cd]pyrene



Column:	YMC PAH (5 µm) 125 x 4.0 mm ID
Part No.:	YP99S05-R504WT
Eluent:	acetonitrile / methanol (95/5)
Flow rate:	1.0 mL/min
Temp.:	25 °C
Detection:	UV at 254 nm
Inj.-vol.:	5 µL

J'sphere ODS

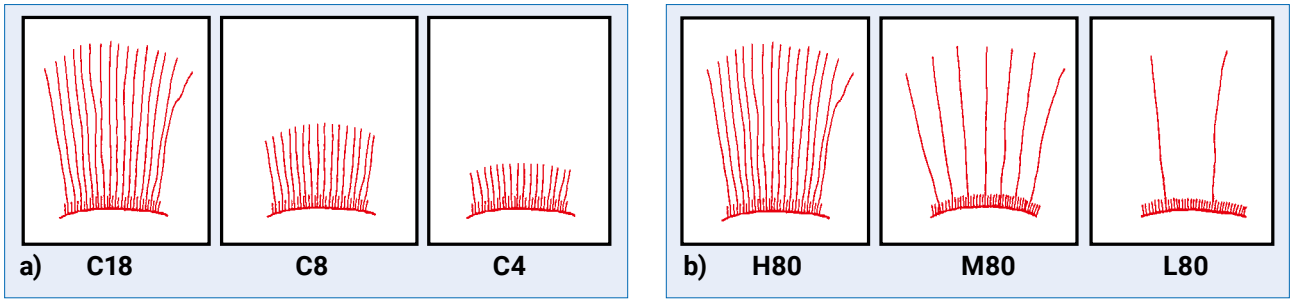
- ***high quality RP columns***
- ***high surface silica, 8 nm, 4 µm***
- ***polarity range created solely by C18***
- ***bonding density***
- ***metabolite recognition***
- ***high siloxane content***
- ***additional selectivity through H-bonding***

- ***a selectivity concept designed for***
  - quality control
  - pharmaceuticals
  - organic intermediates
  - hormones, steroids

Specifications	J´sphere ODS-H80	J´sphere ODS-M80	J´sphere ODS-L80
Particle size / µm	4	4	4
Pore size / nm	8	8	8
Surface area / m^2g^{-1}	510	510	510
Carbon content / %	22	14	9
Recommended pH range	1.0 – 9.0	2.0 – 7.5	2.0 – 7.5

General

Alkyl chains of different lengths, including C18, C8 and C4, are commonly used for bonding during the synthesis of conventional reversed stationary phases of different polarity. YMC however, have applied another approach for creating divergent polarities and improving the consistency in the synthesis of reversed phase packings. With J'sphere ODS, the alkyl chain length is kept constant (as C18), but the content of C18 groups on the silica surface is varied to produce the three different J'sphere ODS packings with graduated hydrophobicity (see figure below).



a: Conventional

b: YMC J'sphere ODS

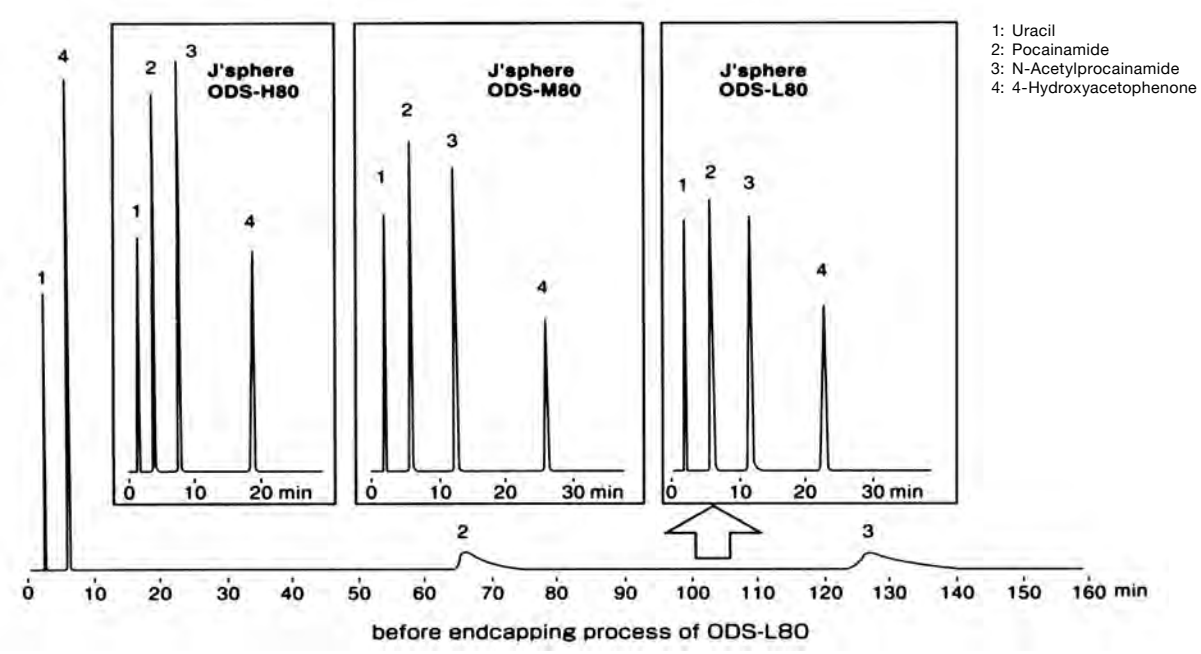
Schematic comparison of reversed phases of different polarity.

Physico-Chemical Properties

J'sphere ODS packings are based on a spherical, ultra pure, high surface area silica with a mean pore diameter of 8 nm and a mean particle diameter of 4 µm. J'sphere silica has a very homogeneous surface providing additional siloxane groups. They are almost of the same nature as ether groups and they are able to form H-bonding which is of great importance for the retentivity and selectivity of J'sphere ODS bonded phases.

J'sphere ODS

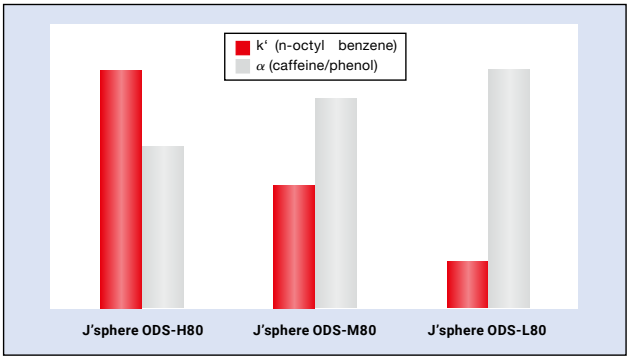
An elaborate endcapping process is applied to react the remaining silanols to effectively suppress the undesired non-specific interactions (see figure below).



Column: 150 x 4.6 mm
Eluent: acetonitrile / K_2HPO_4-KH_2PO_4 (20 mM, pH 6.9) = 8/92
Flow: 1.0 mL/min
Detection: UV at 254 nm
Temperature: 37 °C

Three types of ODS are processed by endcapping technology to minimize the effect of residual silanol as much as possible.

The stepwise decrease of hydrophobicity in the J'sphere ODS-H80, M80 and L80 series is accompanied by a corresponding increase in the H-bonding capacity (see figure right). If a sample molecule is susceptible to H-bonding, the resulting interaction represents additional retention and enhances the selectivity in RP separations.



Hydrophobicity (indicated by k' for n-octyl benzene) and H-bonding capacity (indicated by a of caffeine/phenol) of J'sphere ODS columns.

Selectivity Data

The exclusive use of C18 groups makes the hydrophobic interaction identical for all three types of J'sphere ODS packings; only the degree of hydrophobicity, i.e. the polarity, is varied.
In addition to the hydrophobic interaction, the surface siloxane groups of J'sphere ODS packings provide a pronounced H-bonding capacity contributing additional selectivity.

The ability to interact strongly via H-bonding, creates the opportunity to make use of an additional degree of freedom in selectivity. The "controlled hydrogen bonding capacity" of YMC J'sphere ODS packings represents an efficient tool for the chromatographic discrimination of closely related compounds presenting only minor molecular differences.

J'sphere ODS

Applications

J'sphere ODS-H80

J'sphere ODS-H80 is the most hydrophobic stationary phase in this series. It is densely covered with polymeric bonded C18 groups yielding a high carbon content and providing a strong, dominant, lipophilic interaction wit the nonpolar sites of the sample molecules. However, the abil ity to form H-bonding gives additional selectivity, which is essential for difficult separations, such as drug and corresponding metabolite discrimination. Even stereoisomers can be separated by J'sphere ODS-H80 columns.

J'sphere ODS-M80

The lower coverage of C18 monomeric bonded groups in J'sphere ODS-M80 provides moderate hydrophobicity. As the lipophilic character is decreased, the H-bonding capacity becomes more and more important. J'sphere ODS-M80 has a pronounced balanced polarity which is extraordinary flexible and allows application to a wide variety of separation problems. Depending on the separation, J'sphere ODS-M80 columns can be operated over a very broad range of eluent polarity. J'sphere ODS-M80 columns are a very adaptable tool in various fields in analytical HPLC including drug analysis and QC.

J'sphere ODS-L80

J'sphere ODS-L80 has a low polymeric bonded C18 coverage, providing only minor hydrophobic retention. The extremely high H-bonding capacity makes J'sphere ODS-L80 very useful for the separation of polar compounds. Such compounds frequently have molecular sites which are susceptible to H-bonding and hence, are easily separated by a H-bonding mechanism.

Conclusion

By using the graduated properties of J'sphere ODS columns, a great variety of chemical and pharmaceutical applications can be achieved. YMC J'sphere ODS analytical columns are a good choice for the analysis of pharmaceuticals, organic intermediates, metabolites etc., due to their concept of fine-tuned approach by using different H-bonding capacities.

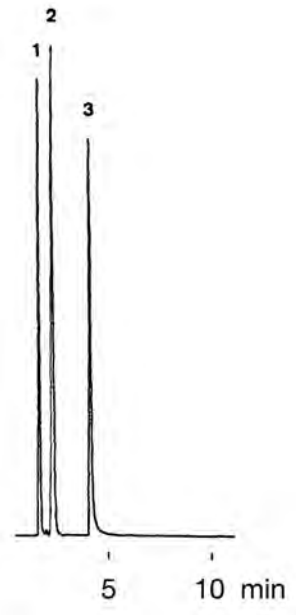
Quality Specifications

Based on the experience in high performance analytical selectivities and large scale silicas synthesis and bonded phases, the long term availability of high quality analytical J'sphere ODS columns is guaranteed. Sophisticated selectivity tests for quality control ensure reproducible separations. These quality control tests guarantee the customer long term reproducible performance, which is essential for the validated analytical HPLC methods.

J'sphere ODS-H80

Elution profile of complexing agents

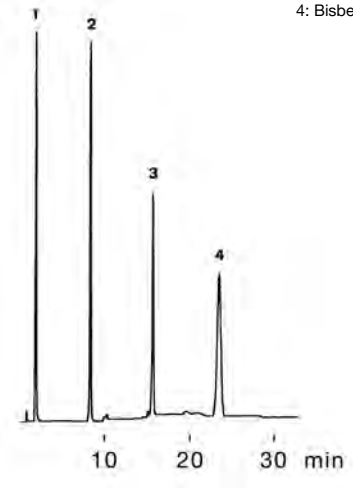
1: Uracil
2: Acetylacetone
3: 8-Quinolinol



Column:	J'sphere ODS-H80 (8 nm, 4 µm) 150 x 4.6 mm ID
Part No.:	JH08S04-1546WT
Eluent:	K_2HPO_4-KH_2PO_4 (20 mM, pH 6.9) / methanol = 40/60
Flow:	1.0 mL/min
Detection:	UV at 254 nm
Temperature:	37 °C

Thiamine and derivatives

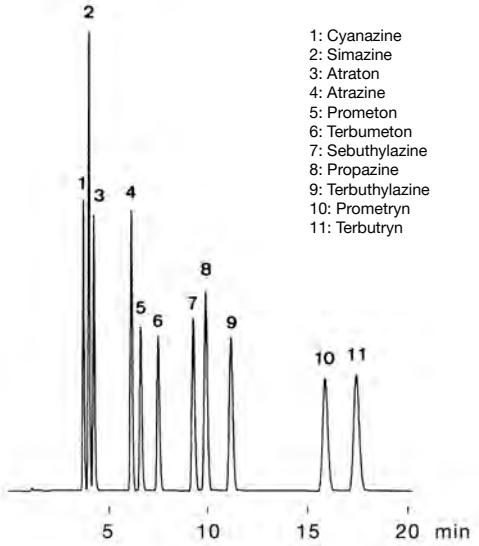
1: Thiamine HCl
2: Benfothiamine
3: Dicethiamine HCl
4: Bisbenthiamine



Column:	J'sphere ODS-H80 (8 nm, 4 µm) 75 x 4.6 mm ID
Part No.:	JH08S04-L546WT
Eluent:	A: $(NH_4)_2HPO_4$ (50 mM) B: methanol / $(NH_4)_2HPO_4$ (50 mM) = 60/40
Gradient:	10-100% B (0-15 min, linear), 100% B (15-30 min)
Flow:	1.0 mL/min
Detection:	UV at 260 nm
Temperature:	37 °C

Triazine herbicides

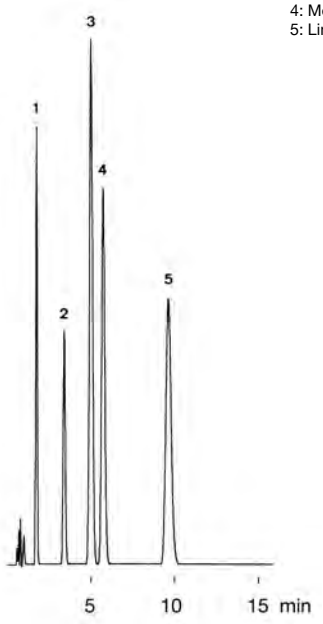
1: Cyanazine
2: Simazine
3: Atraton
4: Atrazine
5: Prometon
6: Terbumeton
7: Sebuthylazine
8: Propazine
9: Terbuthylazine
10: Prometryn
11: Terbutryn



Column:	J'sphere ODS-H80 (8 nm, 4 µm) 150 x 4.6 mm ID
Part No.:	JH08S04-1546WT
Eluent:	acetonitrile / $NH_4H_2PO_4$ (50 mM) = 45/55
Flow:	1.0 mL/min
Detection:	UV at 230 nm
Temperature:	37 °C

Urea herbicides

1: Metoxuron
2: Isoproturon
3: Diuron
4: Metobromuron
5: Linuron

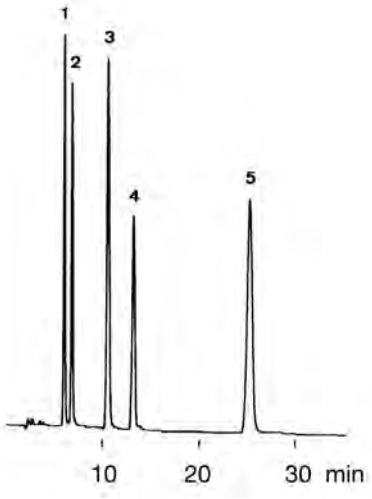


Column:	J'sphere ODS-H80 (8 nm, 4 µm) 150 x 4.6 mm ID
Part No.:	JH08S04-1546WT
Eluent:	THF / H_2O = 30/70
Flow:	1.0 mL/min
Detection:	UV at 260 nm
Temperature:	37 °C

J'sphere ODS-M80

Catechins

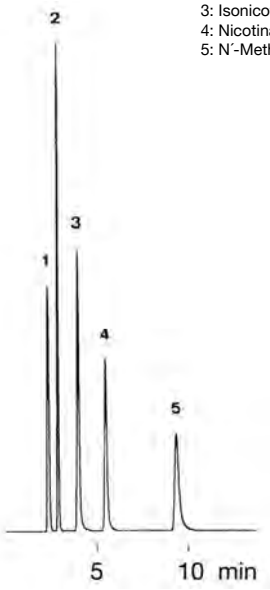
1: (-)-Epigallocatechin
2: (+)-Catechin
3: (-)-Epigallocatechin gallate
4: (-)-Epicatechin
5: (-)-Epicatechin gallate



Column:	J'sphere ODS-M80 (8 nm, 4 µm) 150 x 4.6 mm ID
Part No.:	JM08S04-1546WT
Eluent:	KH_2PO_4-H_3PO_4 (pH 2.4) / methanol = 75/25
Flow:	0.8 mL/min
Detection:	UV at 280 nm
Temperature:	37 °C

Nicotinic acid analogues

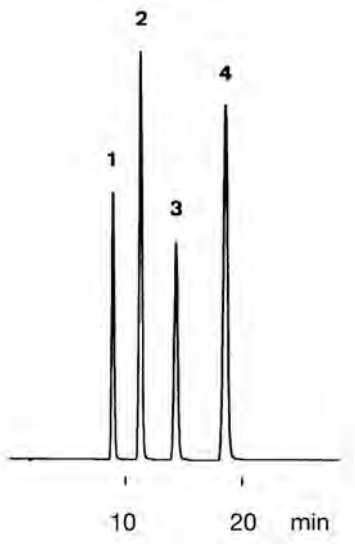
1: Isonicotinic acid
2: Nicotinic acid
3: Isonicotinic acid hydrazide
4: Nicotinamide
5: N´-Methylnicotinamide



Column:	J'sphere ODS-M80 (8 nm, 4 µm) 150 x 4.6 mm ID
Part No.:	JM08S04-1546WT
Eluent:	acetonitrile / KH_2PO_4 (20 mM) = 5/95
Flow:	1.0 mL/min
Detection:	UV at 260 nm
Temperature:	30 °C

Aflatoxins

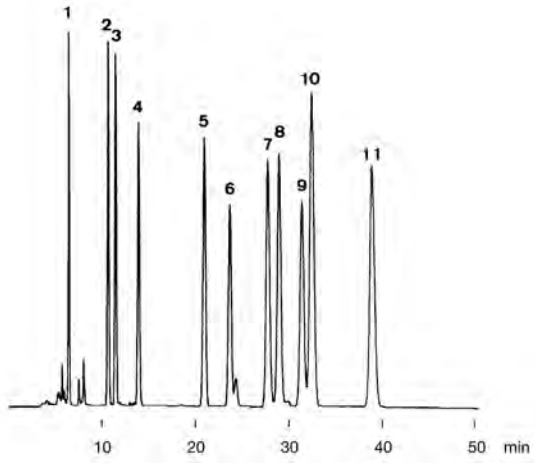
1: Aflatoxin G_2
2: Aflatoxin G_1
3: Aflatoxin B_2
4: Aflatoxin B_1



Column:	J'sphere ODS-M80 (8 nm, 4 µm) 150 x 4.6 mm ID
Part No.:	JM08S04-1546WT
Eluent:	methanol / water = 40/60
Flow:	1.0 mL/min
Detection:	UV at 365 nm
Temperature:	37 °C

Cephalosporin antibiotics

1: Cefsulodin sodium
2: Cephalexin hydrate
3: Cefaclor
4: Cephradine
5: Cephaloglycin
6: Cephapirin sodium
7: Cefotaxime sodium
8: Cephaloridine
9: Cefazolin sodium
10: Cefuroxime sodium
11: Cefoxitin sodium

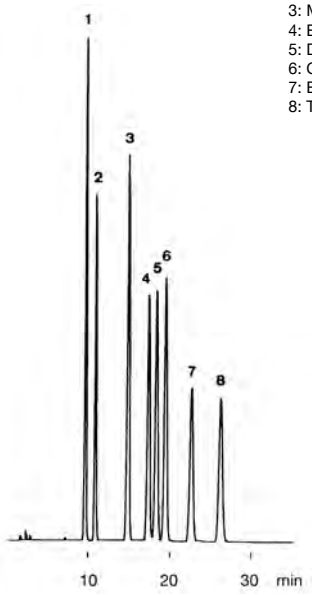


Column:	J'sphere ODS-M80 (8 nm, 4 µm) 250 x 4.6 mm ID
Part No.:	JM08S04-2546WT
Eluent:	acetonitrile / KH_2PO_4 (100 mM) = 10/90
Flow:	0.8 mL/min
Detection:	UV at 260 nm
Temperature:	37 °C

J'sphere ODS-L80

Adrenocorticosteroids

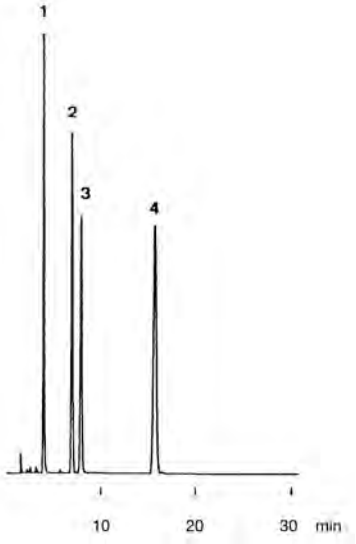
1: Hydrocortisone
2: Cortisone
3: Methylprednisolone
4: Betamethasone
5: Dexamethasone
6: Corticosterone
7: Beclomethasone
8: Triamcinolone acetonide



Column:	J'sphere ODS-L80 (8 nm, 4 µm) 150 x 4.6 mm ID
Part No.:	JL08S04-1546WT
Eluent:	acetonitrile / water = 27/73
Flow:	1.0 mL/min
Detection:	UV at 260 nm
Temperature:	37 °C

Saikosaponins

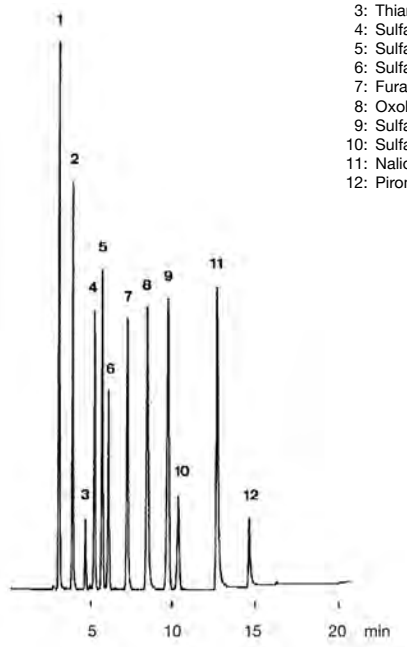
1: Saikosaponin c
2: Saikosaponin a
3: Saikosaponin b_2
4: Saikosaponin d



Column:	J'sphere ODS-L80 (8 nm, 4 µm) 150 x 4.6 mm ID
Part No.:	JL08S04-1546WT
Eluent:	acetonitrile / water = 38/62
Flow:	1.0 mL/min
Detection:	UV at 210 nm
Temperature:	37 °C

Antibacterial agents

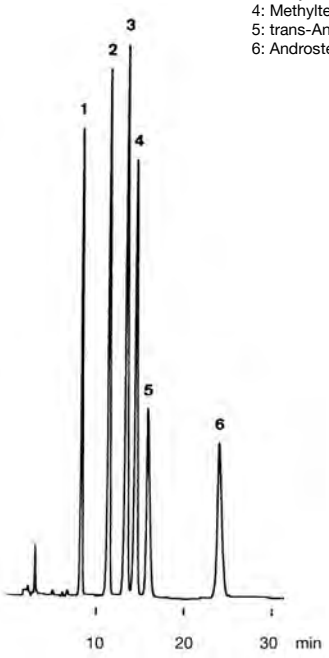
1: Olaquindox
2: Carbadox
3: Thiamphenicol
4: Sulfamerazine
5: Sulfadimidine
6: Sulfamonomethoxine
7: Furazolidone
8: Oxolinic acid
9: Sulfaquinoxaline
10: Sulfadimethoxine
11: Nalidixic acid
12: Piromidic acid



Column:	J'sphere ODS-L80 (8 nm, 4 µm) 250 x 4.6 mm ID
Part No.:	JL08S04-2546WT
Eluent:	A: acetonitrile / $NH_4H_2PO_4$ (50 mM) = 10/90 B: acetonitrile / $NH_4H_2PO_4$ (50 mM) = 80/20
Gradient:	25% B (0-5 min), 25-100% B (5-15 min), 100% B (15-20 min)
Flow:	1.0 mL/min
Detection:	UV at 240 nm
Temperature:	37 °C

Androgens

1: Fluoxymesterone
2: Testosterone
3: Dehydoisoandrosterone
4: Methyltestosterone
5: trans-Androsterone
6: Androsterone



Column:	J'sphere ODS-L80 (8 nm, 4 µm) 150 x 4.6 mm ID
Part No.:	JL08S04-1546WT
Eluent:	methanol / acetonitrile / water = 45/15/40
Flow:	0.8 mL/min
Detection:	UV at 210 nm
Temperature:	30 °C

Ordering Information

3/4 µm HPLC columns (Waters type hardware, WT)

Phase	Column ID [mm]	Column length [mm]				Guard cartridges* with 10 mm length
		50	100	150	250	(pack of 5)
YMC Carotenoid	2.0	CT99S03-0502WT	CT99S03-1002WT	CT99S03-1502WT	CT99S03-2502WT	CT99S03-01Q1GC
	2.1	CT99S03-05Q1WT	CT99S03-10Q1WT	CT99S03-15Q1WT	CT99S03-25Q1WT	CT99S03-01Q1GC
	3.0	CT99S03-0503WT	CT99S03-1003WT	CT99S03-1503WT	CT99S03-2503WT	CT99S03-0103GC
	4.0	CT99S03-0504WT	CT99S03-1004WT	CT99S03-1504WT	CT99S03-2504WT	CT99S03-0104GC
	4.6	CT99S03-0546WT	CT99S03-1046WT	CT99S03-1546WT	CT99S03-2546WT	CT99S03-0104GC
YMC PAH	2.0	YP99S03-0502WT	YP99S03-1002WT	YP99S03-1502WT	YP99S03-2502WT	YP99S03-01Q1GC
	2.1	YP99S03-05Q1WT	YP99S03-10Q1WT	YP99S03-15Q1WT	YP99S03-25Q1WT	YP99S03-01Q1GC
	3.0	YP99S03-0503WT	YP99S03-1003WT	YP99S03-1503WT	YP99S03-2503WT	YP99S03-0103GC
	4.0	YP99S03-0504WT	YP99S03-1004WT	YP99S03-1504WT	YP99S03-2504WT	YP99S03-0104GC
	4.6	YP99S03-0546WT	YP99S03-1046WT	YP99S03-1546WT	YP99S03-2546WT	YP99S03-0104GC
J'sphere ODS-H80	2.0	JH08S04-0502WT	JH08S04-1002WT	JH08S04-1502WT	JH08S04-2502WT	JH08S04-01Q1GC
	2.1	JH08S04-05Q1WT	JH08S04-10Q1WT	JH08S04-15Q1WT	JH08S04-25Q1WT	JH08S04-01Q1GC
	3.0	JH08S04-0503WT	JH08S04-1003WT	JH08S04-1503WT	JH08S04-2503WT	JH08S04-0103GC
	4.0	JH08S04-0504WT	JH08S04-1004WT	JH08S04-1504WT	JH08S04-2504WT	JH08S04-0104GC
	4.6	JH08S04-0546WT	JH08S04-1046WT	JH08S04-1546WT	JH08S04-2546WT	JH08S04-0104GC
J'sphere ODS-M80	2.0	JM08S04-0502WT	JM08S04-1002WT	JM08S04-1502WT	JM08S04-2502WT	JM08S04-01Q1GC
	2.1	JM08S04-05Q1WT	JM08S04-10Q1WT	JM08S04-15Q1WT	JM08S04-25Q1WT	JM08S04-01Q1GC
	3.0	JM08S04-0503WT	JM08S04-1003WT	JM08S04-1503WT	JM08S04-2503WT	JM08S04-0103GC
	4.0	JM08S04-0504WT	JM08S04-1004WT	JM08S04-1504WT	JM08S04-2504WT	JM08S04-0104GC
	4.6	JM08S04-0546WT	JM08S04-1046WT	JM08S04-1546WT	JM08S04-2546WT	JM08S04-0104GC
J'sphere ODS-L80	2.0	JL08S04-0502WT	JL08S04-1002WT	JL08S04-1502WT	JL08S04-2502WT	JL08S04-01Q1GC
	2.1	JL08S04-05Q1WT	JL08S04-10Q1WT	JL08S04-15Q1WT	JL08S04-25Q1WT	JL08S04-01Q1GC
	3.0	JL08S04-0503WT	JL08S04-1003WT	JL08S04-1503WT	JL08S04-2503WT	JL08S04-0103GC
	4.0	JL08S04-0504WT	JL08S04-1004WT	JL08S04-1504WT	JL08S04-2504WT	JL08S04-0104GC
	4.6	JL08S04-0546WT	JL08S04-1046WT	JL08S04-1546WT	JL08S04-2546WT	JL08S04-0104GC

5 µm HPLC columns (Waters type hardware, WT)

Phase	Column ID [mm]	Column length [mm]				Guard cartridges* with 10 mm length
		50	100	150	250	(pack of 5)
YMC Carotenoid	2.0	CT99S05-0502WT	CT99S05-1002WT	CT99S05-1502WT	CT99S05-2502WT	CT99S05-01Q1GC
	2.1	CT99S05-05Q1WT	CT99S05-10Q1WT	CT99S05-15Q1WT	CT99S05-25Q1WT	CT99S05-01Q1GC
	3.0	CT99S05-0503WT	CT99S05-1003WT	CT99S05-1503WT	CT99S05-2503WT	CT99S05-0103GC
	4.0	CT99S05-0504WT	CT99S05-1004WT	CT99S05-1504WT	CT99S05-2504WT	CT99S05-0104GC
	4.6	CT99S05-0546WT	CT99S05-1046WT	CT99S05-1546WT	CT99S05-2546WT	CT99S05-0104GC
YMC PAH	2.0	YP99S05-0502WT	YP99S05-1002WT	YP99S05-1502WT	YP99S05-2502WT	YP99S05-01Q1GC
	2.1	YP99S05-05Q1WT	YP99S05-10Q1WT	YP99S05-15Q1WT	YP99S05-25Q1WT	YP99S05-01Q1GC
	3.0	YP99S05-0503WT	YP99S05-1003WT	YP99S05-1503WT	YP99S05-2503WT	YP99S05-0103GC
	4.0	YP99S05-0504WT	YP99S05-1004WT	YP99S05-1504WT	YP99S05-2504WT	YP99S05-0104GC
	4.6	YP99S05-0546WT	YP99S05-1046WT	YP99S05-1546WT	YP99S05-2546WT	YP99S05-0104GC

*Guard cartridge holder required, part no. XPGCH-Q1

For other dimensions, please contact your YMC representative or YMC directly by phone (+49 (0)2064 427-0), by mail (info@ymc.eu) or use our online chat on our homepage (www.ymc.eu).

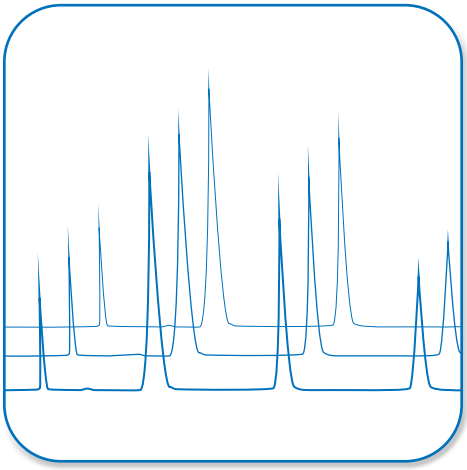
Technical Information

Column Handling

FAQ´s

Troubleshooting

and more



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Technical Information

Introduction

Technical Information

YMC produces chromatography packing materials and HPLC columns under very strict Quality Control procedures and supplies to customers only those products which pass the strict Quality Assurance tests prior to shipment.
In order to ensure the best performance and long column life, the following instructions should be followed for all packed columns.

Column Handling

- ***Shipping solvent***
- ***Mobile phase considerations***
- ***Mobile phase replacement and column cleaning***
- ***Guard columns***
- ***Column back pressures***
- ***Temperature***

1. Shipping solvent

The solvent used for shipping the column is described on the COLUMN INSPECTION REPORT or in the COLUMN CARE AND USE INSTRUCTIONS. Please determine the miscibility of this solvent with the mobile phase used in your analysis to prevent immiscibility problems. If you intend to store the column for any length of time, you should replace the mobile phase in the column with the shipping solvent or solvent specified in the column inspection report.

2. Mobile phase considerations

Reversed phase columns can be used with both aqueous and nonaqueous solvents. However, repeated alternating between solvents with extremely different polarities can result in loss of column performance. Typical general organic solvents include acetonitrile, methanol and THF.
Cyano columns can be used in both normal and reversed phase modes. However, a column should be dedicated for use in only one separation mode and not switched between normal and reversed phase modes as this can result in loss of column performance. When using the column in a normal phase mode, replace the solvent in the column with isopropanol. (Make sure that the flow rate is set so that the pressure does not exceed 15 MPa during solvent exchange.) Silica columns are usually used with nonaqueous solvents such as n-hexane, chloroform or other weak solvents with the addition of isopropanol, ethyl acetate or similar as appropriate to allow elution of high polarity components.
All Amino columns (i.e. both YMC-Pack Polyamine II and YMC-Pack Amino) can be used with both aqueous and nonaqueous solvents. However, repeated alternating of solvents with extremely different polarities can result in loss of column performance.
Solvent should flow in the direction of the arrow (as indicated on the column label) for normal use, although reversed flow for washing will not affect column stability.
The pH ranges for stability of every type of column varies by product. For specific information please refer to COLUMN CARE AND USE INSTRUCTIONS, downloadable from www.ymc.eu, of each column.

3. Mobile phase replacement and column cleaning (general methods)

a) Reversed phase columns
When a mobile phase which contains no buffers or salts is used, wash the column with an eluent consisting of the same solvents as that of the mobile phase, but with a higher organic solvent concentration.
When a mobile phase containing buffers or salts is used, this should first be replaced with an eluent containing the same ratio of water and organic solvent as the mobile phase but which has no buffer or salt components. If the concentration of buffer or salts used is less than 100 mM, it can be replaced directly with approximately 60% acetonitrile in water. After using a column near the usable pH limit, washing the column with water alone may cause column deterioration. Instead wash the column with a mixture of water and organic solvent containing no buffer or salt components or alternatively 60% acetonitrile in water to remove the aggressive pH eluents.
Should the column back pressure increase, wash the column in the reverse direction (the opposite direction of the arrow shown on the column label) making sure that the detector is not in line with the solvent stream. A solution having the same composition as that of the mobile phase, but with a higher organic solvent concentration and no added salts or buffers is usually used as the cleaning solution. However consideration should be given to the characteristics of sample so that a solvent which easily dissolves the sample is chosen.

Column Handling

When macromolecules, including proteins and sugars, adsorb onto the column, it is usually difficult to wash them off with organic solvents. When columns are used to analyse samples containing such macromolecules, it is preferable to pretreat the sample and/or use a guard column.

b) Normal phase columns

Wash the column with a solution having the same solvents as that of the mobile phase, but with an increased content of high polar component concentration. If polar compounds absorb on the column, flush with isopropanol or similar solvent.

Before storing a column used with a mobile phase containing acid or alkali, replace the eluent with a simple solvent or solvent/water mixture (for example replace n-hexane/isopropanol/acetic acid (90/10/0.1) with n-hexane/isopropanol (90/10) for storage).

RECOMMENDED COLUMN CLEANING AND REGENERATING PROCEDURES

Use the cleaning routine that matches the properties of the column and what you believe is contaminating it. Flush columns with 20 column volumes (80 mL total for 4.6 x 250 mm column) of HPLC-grade solvents. Run columns in reverse flow direction, with the outlet disconnected from the detector. Cleaning efficiency is increased by increasing mobile phase temperature to 35-55°C. If the column performance is poor after regenerating and cleaning, please feel free to contact YMC directly either by phone (+49 (0) 2064 427-0), by mail (info@ymc.eu) or use online chat on our homepage (www.ymc.eu).

Silica-/Hybrid-/Core-Shell-based particles

Non-polar-bonded phases (Carotenoid, C18, Octyl, YMCbasic J'sphere, Phenyl, PFP, Butyl, TMS)

Polar Samples	Non-polar Samples	Proteinaceous Samples
1. Water	1. Isopropanol	Option 1: Inject repeated aliquots of DMSO
2. Methanol	2. THF	Option 2: Gradient of 10 to 90% B where:
3. THF	3. Dichlormethane	A = 0.1% TFA in water
4. Methanol	4. Hexane	B = 0.1% TFA in CH_2CN
5. Water	5. Isopropanol	Option 3: Flush column with 7M guanidine
6. Mobile phase	6. Mobile phase	HCl, or 7M urea

Polar-bonded phases (Cyano, Diol, Amino, PVA-Sil, Silica):

Polar Samples	Non-polar Samples
1. Water	1. Chloroform
2. Methanol	2. Methanol
3. THF	3. Dichlormethane
4. Methanol	4. Heptane or Isocyanate
5. Water	5. Isopropanol
6. Mobile phase	6. Mobile phase

Polymer-based particles: Polymer C18

1. Flush column with mobile phase but omit buffers or salts (i.e. just organic and water, acetonitrile is preferable)
2. Run a gradient to 100% organic
3. Flush with twenty column volumes of THF
4. Flush with twenty column volumes of acetonitrile
5. Run a gradient back to starting mobile phase conditions, ommitting buffers and salts
6. Re-equilibrate in mobile phase

4. Guard columns

YMC recommends that you always use a guard column with the same packing material and of the recommended inner diameter for your column (see table).

A YMC guard column is normally composed of a cartridge holder and a guard cartridge. The cartridge holder can be used repeatedly.

Where different cartridge lengths are available, only chose the longer cartridge when samples containing high levels of contaminants are present to increase the time between cartridge changes.

Guard cartridges should be changed frequently in order to maximise their protection of the main column. Cartridge holders should be connected to the main column using the shortest length of tubing possible. This tubing should be of an appropriate inner diameter for the flow rate and pressure to be used.

Samples containing particulate matter MUST always be pre-filtered (at least 0.45 µm but 0.2 µm is preferred and essential for UHPLC) before being injected onto a column.

Column ID [mm]	Recommended Guard Cartridge ID [mm]
1.0	2.1
2.0 / 2.1	2.1
3.0	3.0
4.0	4.0
4.6	4.0*
10	10
20	20
30	30

*As a result of intense testing of the compatibility of different hardware concepts no negative influence of a 4.0 mm ID guard cartridge combined with a 4.6 mm ID main column was observed.
Therefore, we recommend the use of 4.0 mm ID guards with a 4.6 mm ID analytical column.

Column Handling

5. Column Back Pressures

Column back pressure is a function of several parameters, including

- particle size and distribution
- packing porosity and bonded phase coating levels
- column length and inner diameter
- solvent flow rate, viscosity and temperature

Typically for a column packed with 12 nm, 5 µm ODS phase and pumped at ambient temperature with methanol:water (70:30) at 1 mL/min the back pressure should be less than 25 MPa (250 bar, 3,750 psi) for 250 x 4.6 mm ID.
For wide pore (20 or 30 nm) 5 µm ODS phase and pumped at ambient temperature with methanol:water (70:30) at 1 mL/min the back pressure should be less than 17 MPa (170 bar, 2,550 psi) for 250 x 4.6 mm ID.
We recommend using a column at below the maximum operating pressure to ensure maximum column life.

Column ID [mm]	Maximum Operating Pressure [MPa]	[bar]	[psi]
YMC-Triart 1.9 µm	100	1,000	15,000
YMC-Triart 3/5 µm[1]	45 (20/25)	450 (200/250)	6,525 (3,000/3,750)
Meteoric Core 2.7 µm	60	600	8,700
YMC UltraHT 2 µm	50	500	7,500
YMC-Pack Diol UHPLC 2 µm	45	450	6,525

Column ID [mm]	Maximum Operating Pressure [MPa]	[bar]	[psi]
0.075	55	550	7,975
0.1	55	550	7,975
0.3	55 / 60[2]	550 / 600[2]	7,975 / 8,700[2]
0.5	55 / 60[2]	550 / 600[2]	7,975 / 8,700[2]
1.0	20 / 25[3]	200 / 250[3]	3,000 / 3,750[3]
2.0 / 2.1	20 / 25[3]	200 / 250[3]	3,000 / 3,750[3]
3.0	20 / 25[3]	200 / 250[3]	3,000 / 3,750[3]
4.0	20 / 25[3]	200 / 250[3]	3,000 / 3,750[3]
4.6	20 / 25[3]	200 / 250[3]	3,000 / 3,750[3]
6.0	20 / 25[3]	200 / 250[3]	3,000 / 3,750[3]
8.0	20 / 25[3]	200 / 250[3]	3,000 / 3,750[3]
10	10	100	1,500
20 / 30	10	100	1,500
YMC-Actus 20 / 30	30	300	4,500
YMC-Actus 50	20	200	2,900

[1] previous hardware in brackets

[2] The first figure is for particle sizes of 2/3/5 µm, the second figure is for particle size of 1.9 µm.

[3] The first figure is for up to 150 mm column length, the second figure is for 250 mm column length.

6. Temperature

The upper temperature limit for silica and bonded phases is 50 °C (90 °C for YMC-Triart C18/C18 ExRS/C8/C4, 70 °C for Meteoric Core C18/C18 BIO at pH=7 or lower). However YMC recommends using columns between 20 and 40 °C because certain conditions of pH or mobile phase composition may affect column lifetime. For recommended column temperatures for other column types, please refer to the instruction manual included with each column.

Mobile Phases for RP Columns

Mobile Applications for reversed phase columns

The composition of mobile phase greatly affects the separation in HPLC. To optimise a separation, it is necessary to consider the interaction between the solutes, stationary (or solid) phase, as well as the mobile phase.

For reversed phase columns, the most commonly used in HPLC, various mobile phases are available. Attention needs to be paid to a number of points when deciding on the mobile phase composition.

The variable factors to be considered include:

- miscibility of solvents
- effects on detection methods (eg., UV or MS)
- effects on the column
- column deterioration due to pressure or pH)
- separation reproducibility
- stability of solutes

Typical solvents for ODS columns and some helpful tips for establishing optimum separation conditions are described below.

General solvents

Water, acetonitrile, methanol and tetrahydrofuran (THF) are the important solvents for use with reversed phase columns.
It is important to use high purity water purified by ion-exchange, distillation, reverse osmosis, etc. The presence of organic substances or ionic impurities may cause problems, including ghost peaks during short wavelength UV detection or high sensitivity gradient elution systems.
Acetonitrile is frequently used as an HPLC solvent, due to its low UV absorption and low viscosity. Methanol has a higher viscosity and often shows different separation selectivity to that obtained using acetonitrile. THF is used occasionally to influence selectivity in conjunction with acetonitrile and methanol, due to the cyclic ether structure of THF. THF has several adverse properties for a solvent for HPLC; it has:

- significant UV absorption
- high viscosity
- a tendency to form peroxides, especially as the use of antioxidants can give rise to ghost peaks.

Appropriate separating conditions can be obtained by using these three solvents plus water individually or in combination.

Buffers and reagents

Acetic acid, formic acid, phosphoric acid and trifluoroacetic acid (TFA) are generally used as acidic modifiers. The buffers normally used include phosphate and acetate buffers (sodium, potassium, ammonium). Monobasic phosphates provide a pH of 4.6 and are used as convenient pH adjusters rather than buffers.
In order to separate ionic compounds, such as amines and carboxylic acids, with good repeatability, the pH of mobile phase must be adjusted so that it is 1 (or preferably 2) units away from the pKa of the solute. At or near the pKa, peak broadening or splitting may be observed as the free acid/base and its salt coexist.
Most buffers are used at a concentration of about 10 mM. However, depending on dissociation of solutes and interactions with the stationary phase, this can be raised to 100 mM.

When acids or alkalis which degrade reversed phases are used, caution must be taken regarding their concentrations and pH. TFA and phosphoric acid are usually used at concentrations of 0.1% or less. Acetonitrile/water (approx 60/40) solution is a convenient storage solvent after use of acids or buffers (salts).
Tetrabutylammonium salts and sodium perchlorate may be used as ion pair reagents for retention of highly polar compounds on reversed phase columns or for improvement of separation and peak shape. When these additives are used, it is necessary to use a reagent with the shortest alkyl chains available. If sodium dodecylsulfate, (SDS; which contains long alkyl chains) is used, it may be retained on the column phase and can cause problems with repeatability.

Other solvents for HPLC

Ethanol, 2-propanol, ethyl acetate, or chloroform may be used in the mobile phase (particularly in normal phase separations) in order to improve retention or separation of solutes. In some cases, hexane is used as a mobile phase.

When a hydrophobic solvent is added to a mobile phase, care must be taken with regards to the miscibility with the mobile phase existing in the column and a separate wash stage should be included before changing the eluent.

HPLC Column Performance

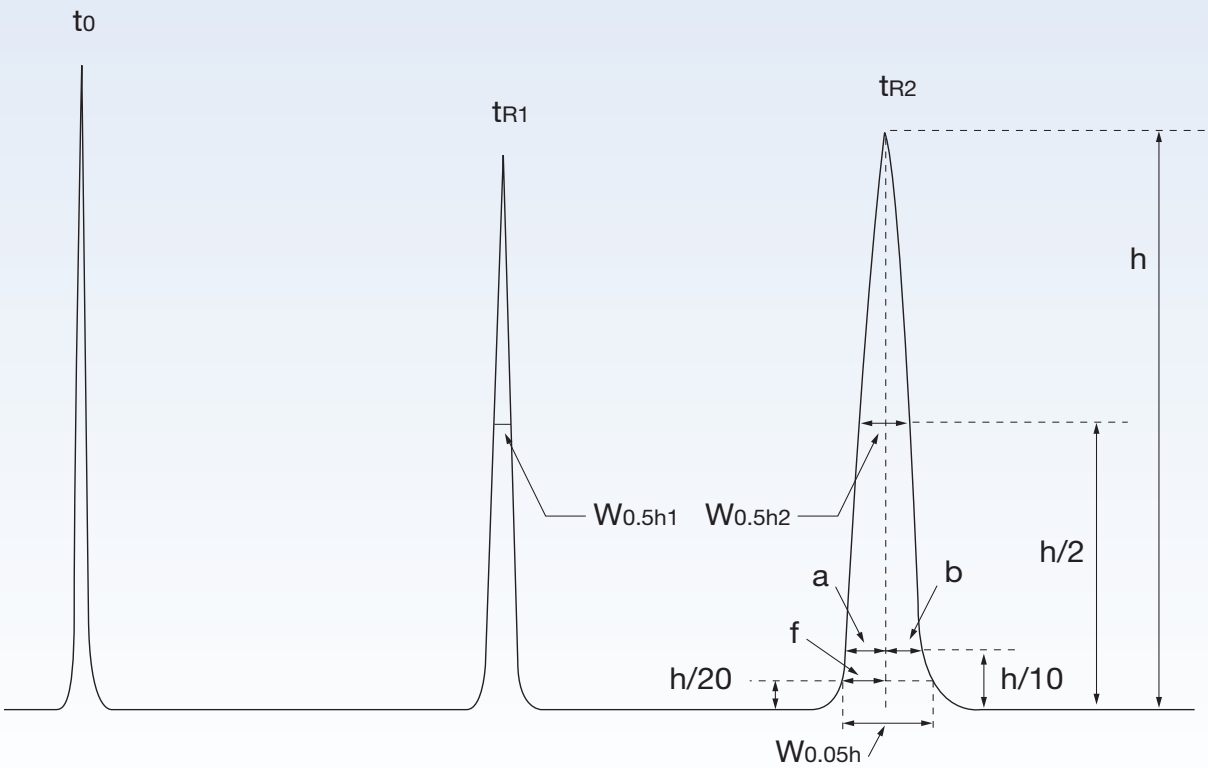
HPLC Column Performance

Important factors used to evaluate column performance include column efficiency, capacity, separation characteristics of solutes, peak shape and column pressure. The parameters used to assess column performance by YMC are defined below. Column efficiency, an important characteristic for evaluation of column performance, is generally measured in terms of theoretical plate number. This is calculated using peak width at half-height.
Narrower peak widths result in higher theoretical plate numbers. Longer columns and smaller packing material particle size also result in higher theoretical plate numbers. Due to a variety of factors, one column does not always show the same theoretical plate number. This may be caused by differences between linear velocity and solute diffusion in the column or because of interaction between solutes and the mobile phase or the stationary phase.

For these reasons, column efficiency is solute specific and the measurement of efficiency must be conducted under nearly identical HPLC conditions for results to be directly comparable.

Retention and separation characteristics for solutes on the column are evaluated by the capacity factor and separation factor values.
These values are indices of the packing material characteristics and, in contrast to the retention time, are independent of column inner diameter and length.

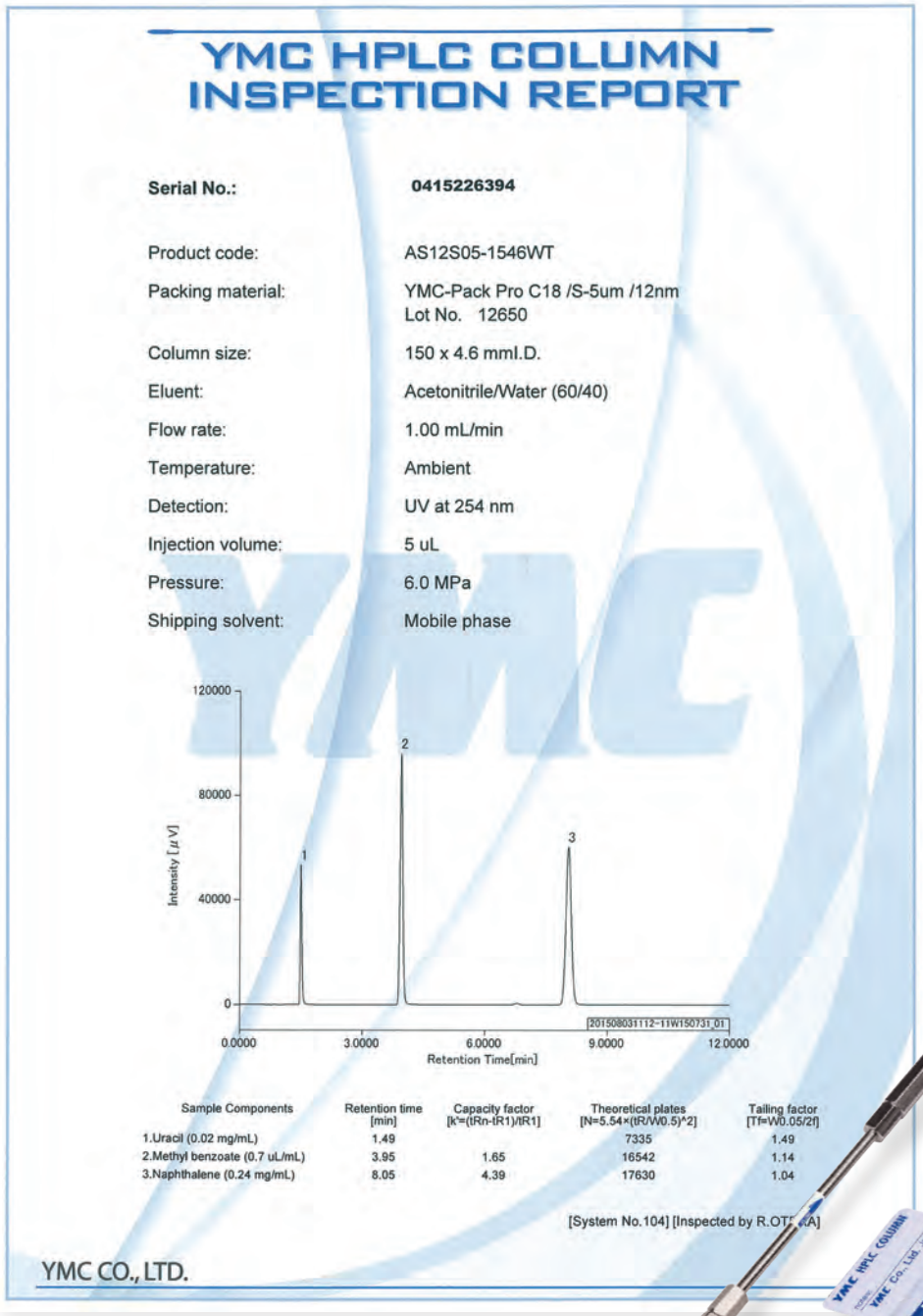
Elution peak shape is also an important factor for evaluation of column performance. The asymmetry factor is a relatively simple measurement, usually calculated at 10% of peak height.



t_0	Void volume, Column dead-time	
t_R	Retention time	
h	Peak height	
$W_{0.5h}$	Peak width at half-height	
N	Theoretical plate number	$N=5.54 \times (t_R / W_{0.5h})^2$
k'	Capacity factor	$k'=(t_R - t_0) / t_0$
α	Separation factor	$\alpha= k'_2 / k'_1$
R_S	Resolution	$R_S= 1.18 \times (t_{R2}-t_{R1}) / (W_{0.5h1} + W_{0.5h2})$
A_S	Asymmetry factor	$A_S=b / a$
T_f	Tailing factor	$Tf= W_{0.5h} / 2f$

Inspection Reports

Formation



YMC HPLC COLUMN
INSPECTION REPORT

Serial No.:	0415226394
Product code:	AS12S05-1546WT
Packing material:	YMC-Pack Pro C18 /S-5um /12nm Lot No. 12650
Column size:	150 x 4.6 mmI.D.
Eluent:	Acetonitrile/Water (60/40)
Flow rate:	1.00 mL/min
Temperature:	Ambient
Detection:	UV at 254 nm
Injection volume:	5 uL
Pressure:	6.0 MPa
Shipping solvent:	Mobile phase

Sample Components	Retention time [min]	Capacity factor [k'=(tRn-tR1)/tR1]	Theoretical plates [N=5.54×(tR/W0.5)^2]	Tailing factor [Tf=W0.05/2f]
1.Uracil (0.02 mg/mL)	1.49		7335	1.49
2.Methyl benzoate (0.7 uL/mL)	3.95	1.65	16542	1.14
3.Naphthalene (0.24 mg/mL)	8.05	4.39	17630	1.04

[System No.104] [Inspected by R.OT[illegible]A]

YMC CO., LTD.

YMC employs strict quality control of packing materials to ensure lot-to-lot and column-to-column reproducibility. All packed columns are subject to performance tests and only those columns which meet strict specifications are shipped to customers.
A test report (see below) is shipped with each column. The test method shown on this inspection report is not only a method used for column performance evaluation but can also be used as a test method for determination of column life. We provide full details of all the analytical conditions, used test method, including compounds analysed, sample concentration, eluent composition, etc. to allow the end user to reproduce these tests.

FAQ Frequently Asked Questions

What is "Endcapping"?

Conventional ODS (C18) packing materials are silica gel bonded with octadecyl groups. This is the result of reaction between silanol groups on the silica surface and octadecyl groups. However some active silanol groups remain after the reaction. It is impossible for all the silanol groups to react because of steric hindrance of octadecyl groups. Such residual silanol groups create a secondary interaction in chromatography, which, in many cases, affects on chromatograms by causing peak tailing of basic compounds or irreversible absorption to the column. Therefore, a secondary silanisation reaction with residual silanol groups using a small reagent (typically trimethylsilane) should be performed. This process is called "endcapping".

Are there ODS columns used with 100% aqueous mobile phase?

YMC-Triart C18, Hydrosphere C18 and YMC-Pack ODS-AQ columns can be used with 100% aqueous mobile phase. With conventional ODS columns, retention time becomes shortened due to the incompatibility between water molecules and the silica bonded surface with high hydrophobicity. Water tends to be expelled from the pores on material and the C18 chains "collapse" onto themselves. The retention time is hardly affected for YMC-Triart C18, Hydrosphere C18 and YMC-Pack ODS-AQ columns because the silica surface is capable of solvation between mobile phase and hydrophilic silica surface as a result of the reduced C18 functional group density and the proprietary modification process.

What is the upper limit of column pressure?

Column length of 150 mm or less and diameters less than 10 mm:
20 MPa (200 bar, 3,000 psi)
Column length of 250 mm or greater and diameters less than 10 mm:
25 MPa (250 bar, 3,750 psi)
UHPLC columns (1.9 µm):
100 MPa (1,000 bar, 15,000 psi)
Triart columns (3/5 µm; novel column hardware):
45 MPa (450 bar, 6,525 psi)
YMC-Pack Diol UHPLC (2 µm):
45 MPa (450 bar, 6,525 psi)

How should we store the columns?

When columns are not used for a long time, they should be stored in a cool place after replacing the eluent with the shipping solvent as described in the Inspection Report. Do not store the column in the mobile phase with salt or acid, even for very short times. Close the airtight stopper tightly to prevent the solvent from evaporating.

How can we evaluate the performance of columns?

Repeat the performance test using exactly the same conditions as the Inspection Report which accompanies the column at the time of purchase. Columns which show no change in retention time, theoretical plate number, peak asymmetry, etc are acceptable for further use.
Columns which show no change in these parameters after several years of use may, however, have changes in separation characteristics for certain types of compounds such as ionic species. It is advisable to avoid using such columns for method development as reproducibility compared to new columns may not be possible.

FAQ

How do I clean the columns?

1. To remove strongly adsorbed hydrophobic material; pump the column in the reverse direction with eluent with a greater elution ability than mobile phase. For example, for cleaning reversed phase columns, use an eluent with increased ratio of organic modifier and flush the column with at least 10 column volumes.
2. To recondition the gel surface condition caused by damage resulting in generation of active silanol groups, and observed as irregularities in peak asymmetry and retention time. Washing with acidic solvents can be effective in such cases. Typically a mixed solvent of 0.1% aqueous phosphoric acid solution and organic solvent (between 10 and 60% organic content) can return the silanol groups to the dissociation state.

Do we need guard columns?

YMC recommend the use of guard columns, particularly if the samples being analysed contain a high level of contaminants. This will extend the useful lifetime of a column, particularly if replaced at frequent intervals. We recommend that guard columns are packed with the same packing material as the analytical column. Guard columns with different material may cause abnormalities in peak asymmetries and reproducibility. YMC guard cartridges are particularly economic when frequent replacement is required.

What is required in system and flow rate for using semi-micro columns?

Recommended flow rates for semi-micro column (1.0 to 3.0 mm inner diameters) are:

1.0 mm ID	0.05 mL/min
2.1 mm ID	0.2 mL/min
3.0 mm ID	0.4 mL/min

This can be increased if the column length is short and the system back pressure is low. Such columns can be used in conventional HPLC systems but it is advisable to use short lengths of smaller diameter connection tubing and detector flow cells which are optimised for low flow rates.

How do I carry out a scale-up of a method?

Step 1: Determine separation conditions by using analytical columns.
Step 2: Study the preparative scale. Select the particle size of the packing material and the inner diameter of column appropriate for the sample volume.
Step 3: Optimise the separation conditions using analytical columns with inner diameter of 4.6 mm or 6.0 mm packed with the packing material selected for the preparative separation (scout column). If the particle size of the packing material is the same as in the Step 1, this process can be omitted. If the preparative column is more than 100 mm ID, it is advisable to insert another step with a scout column of 20 mm ID in order to accurately predict loadability and calculate the running costs.
Step 4: Proceed with the preparative separation.

FAQ Frequently Asked Questions

What should I do when the column pressure increases?

Depending on the reasons for increased pressure, the following procedures are recommended:
Blocked frits: Flush the column in reverse flow as described in "column handling". Reduce the flow rate in order to keep the column pressure within recommended limits whilst flushing the column.
Contamination of the packing material: Wash the column in reverse flow as described in "column handling".
If pressure increases occur frequently despite treatment as above, it is recommended that sample pretreatment or the use of guard columns is employed to prevent the problem occurring in the first place.

What are the solutions for poor peak shapes?

The following solutions are recommended, depending on the cause.
Inappropriate Mobile phase: If pKa of the analyte and pH of mobile phase are close for ionic analytes , it will result in poor peak shape. Set the pH of mobile phase at least 1 (or better 2) units from pKa.
Effect of solvent used to dissolve sample: If the dissolving solvent of sample and mobile phase are not the same, it causes defects in the peak shape. Dilute the sample solution with mobile phase or reduce the injection volume.
Overloading sample injection: Overloading the column will cause defects in the peak shape. Reduce injection volume and/or the sample concentration.
Insufficient equilibration time: When the difference in pH between the current and a previous mobile phase is wide or the buffer concentration of mobile phase is low, column equilibration may take some time
Column contamination and degradation: If the column is contaminated, wash the column as described in "column handling". If the column is degraded, it is not possible to regenerate it and it should be replaced.
System problems: Dispersion of the sample may occur within the tubing between the injector and the column or within the flow cell of detector which can result in peak tailing and/or broadening. Optimisation of the system for use with semi-micro use should be performed.

What are the solutions for ghost peaks?

The following solutions are recommended, depending on the cause.
Injector fouling: If the ghost peak(s) appears when injecting only mobile phase (no sample), wash the injector.
Gradient Analysis: When hydrophobic impurities are eluted by a stronger solvent, they appear as ghost peaks. Clean the column as described in the Instruction Manual. If this does not eliminate them, they are probably due impurities of solvent. Use a higher grade solvent, purified specifically for HPLC or alternatively install a guard column between the solvent delivery pump and the mixing chamber or injector.

What should I do if columns dry out?

Flush the column with a solvent such as methanol for all bonded phase silica or hexane for non bonded silica and remove trapped air using a flow rate such that the column pressure is about half that normally used for analysis. When all the air has been removed, check the column performance by running a test chromatogram under the conditions stated on the original Column Inspection Report.

FAQ

What should I do if the column fails to provide reproducibility?

This can arise for a number of reasons:
Inappropriate mobile phase conditions:
It may become difficult to obtain reproducibility when analysing ionic compounds, if the pH of mobile phase is not controlled or the buffer concentration is low. Increase the buffer concentration.
Retention time can fluctuate widely due to a slight variance of pH when the pH of a mobile phase is set too close to the pKa of analyte. Set the pH of the mobile phase to be at least 1 (or preferably 2) units away from the pKa.
System variance: It may be difficult to obtain reproducibility in chromatograms when using different HPLC systems. Where possible the manufacture of pumps, detectors and injectors should be the same, otherwise differences in extra column volume from mixing chamber, detector cell and plumbing will result in poor reproducibility between systems. Also, with column heaters from different manufacturers, there may be an effect on the retention time due to the set temperature being different between the 2 systems. Use of the same system throughout a sequence of analysis is recommendable.
Column histories: Reproducibility between chromatograms may not be obtained when using different columns of the same type. This is due to differences in the columns' prior histories. For example, changes in the chemistry of the surface of the packing material can arise by use of mobile phases containing ion pair reagents or when strongly hydrophobic material (especially proteins) becomes adsorbed on the column. Dedicating a column to a specific application is recommended.
Using 100% aqueous mobile phase: Reproducibility of chromatograms obtained on conventional ODS columns will not be obtained when using 100% aqueous mobile phase due to the short retention times obtained. Columns which can be used in 100% aqueous mobile phase are recommended. YMC recommends the use of either YMC-Triart C18, Hydrosphere C18 or YMC-Pack ODS-AQ which are designed to be used in 100% aqueous mobile phase.
Grade difference in mobile phase: Reproducibility between chromatograms may not be obtained when using different grade of solvent in a mobile phase. Impurities contained in a solvent can act like salts in mobile phase and affect the separation. Solvent in HPLC grade is recommendable.

I still have poor retention after adding ion pair reagent to mobile phase. Why?

This is caused by excess of ion pair reagent. In general, the higher the concentration of ion pair reagent, the greater the retention. However, if the concentration of ion pair reagent is above a certain level, the retention may become poor because of micelle formation. Good separations are achieved when the concentration of ion pair reagent is between 5 mM to 20 mM. YMC recommend that the lowest possible concentration is used to avoid short column life.

Please feel free to contact YMC with any issue either by phone (+49 (0) 2064 427-0), by mail (info@ymc.eu) or use our online chat on our homepage (www.ymc.eu).

Troubleshooting

1. Consideration of solvent grade for reversed phase LC

Reversed phase liquid chromatography frequently employs organic solvents such as methanol, acetonitrile or tetrahydrofuran. Although HPLC grade products of these types of solvents are available, it seems some users have trouble when using a reagent grade solvent instead of HPLC grade. This results in them wasting considerable amounts of time. How do the two solvent grades differ?

Methanol and acetonitrile

Reagent grade solvents contain larger amounts of UV absorbing impurities than HPLC grade solvents do, which makes it difficult to use them for gradient elution or trace analysis, especially when the detection requires short wavelength. This gives rise to significant increases in baseline noise or detection sensitivity.

In some cases (or at some wavelengths) it might be possible to use a reagent grade solvent, but we recommend the use of HPLC grade solvents whenever possible.

Tetrahydrofuran

Tetrahydrofuran easily generates peroxides. To prevent this, the solvent generally contains antioxidants which can cause ghost peaks. As a result, solvent containing no antioxidants should be used in HPLC.

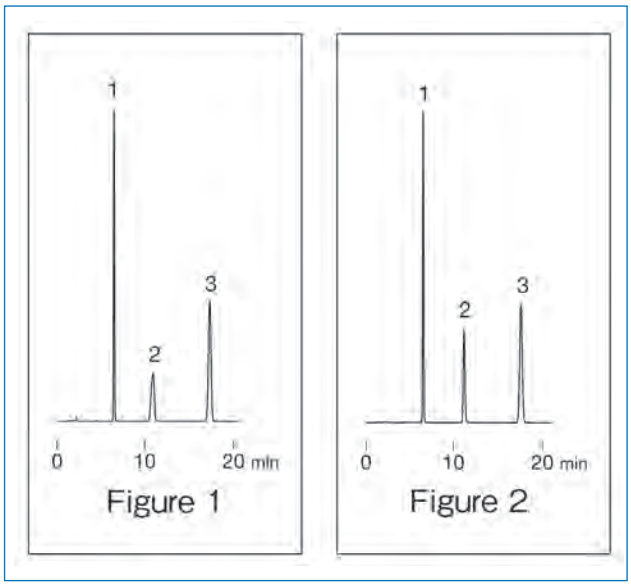
The peroxides in tetrahydrofuran also have a marked effect on the baseline stability (with differences between grades and between different suppliers being greater than for other organic solvents), which leads to the recommendation that HPLC grade solvent with little or no impurities should be used.

2. Eluent conditions

Although a column is frequently thought to be the cause of HPLC analysis not providing the correct chromatogram, many failures can be attributed to causes other than the column, including improper maintenance operations. This discussion illustrates the case in which the grade of a solvent affects the peak shapes. In the chromatogram for basic compound analysis, using an eluent of acetonitrile/water, Peak 2 represents the basic compound.

The figures on the right show chromatograms from two identical separations except that the acetonitrile used was of different grades. One used HPLC grade (Figure 1); the other used reagent grade (Figure 2). While the peak shape was broadened with HPLC grade acetonitrile, it was much improved when using reagent grade. The differences in peak shapes which were observed were also found to be dependent on the different makers even though they were of the same specific grade. This may be the effect of traces of impurities contained in acetonitrile behaving in the same way as modifiers added to an eluent.

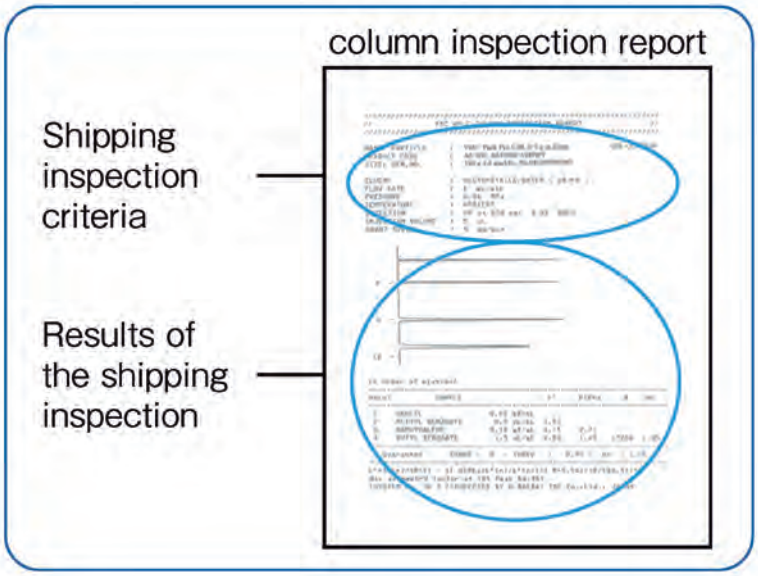
Replacing eluent with acetonitrile / 5 mM ammonium acetate produced the chromatogram shown in Figure 2 irrespective of the grade of solvent. To avoid the influence of different grades, solvents specifically made for HPLC must be used. Even compounds which have groups which can dissociate can be analysed with eluent containing no acid or salt, although eluents with additives such as salt must be used when reproducibility is important.

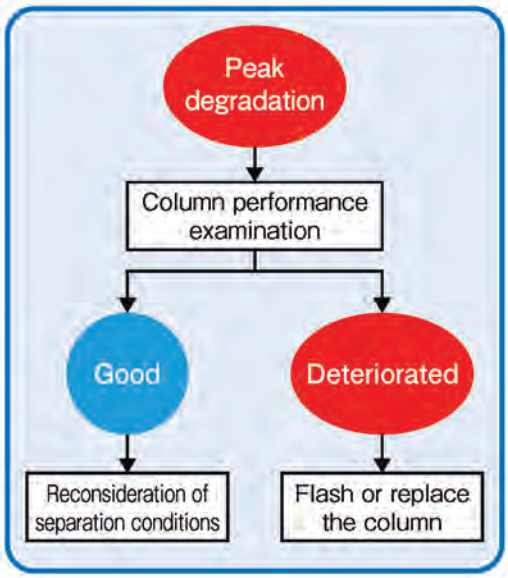


Troubleshooting

3. Peak shape anomalies

A common problem encountered during HPLC operations is peak shape anomalies such as peak tailing or split peaks. In order to remove these problems, the cause must be precisely determined. The majority of cases are the result of inappropriate conditions for the separation; including inappropriate selection of column or solvent, or use of an old column which has a void to the packing at the top of the packing. Here we discuss the method of determining the cause of the problem with peak shapes.
The simplest way is to test the column performance using the "shipping inspection criteria" as described in the Column Inspection Report which is included with every column. If the examination reveals no peak shape anomaly, then the cause will be the result of inappropriate selection of separation condition. The separation condition such as eluent selection must be reconsidered. If, on the contrary, the same examination reveals any anomaly, the column may be the problem. Flushing (to remove the impurity could have accumulated on the column) or replacement of the column is necessary. We recommend examining column performances on a regular basis and always under the identical conditions.





YMC provide sufficient analytical information, including sample concentration, in the Column Inspection Reports to allow customers to evaluate the performance of the column using standard compounds.

4. Column Pressure Increases

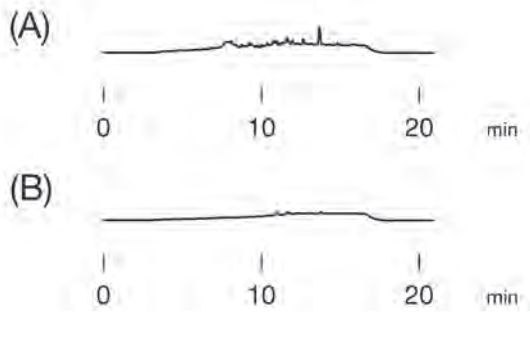
Pressure increase is a common problem in HPLC. Some of the reasons for pressure increases in reversed phase chromatography are discussed below.
If the system pressure increases, you should first disconnect the column and run the system to determine the line pressure. If the line pressure is high, the tubing may be clogged or damaged. If there is no excessive line pressure, then the column pressure may be high and the column needs cleaning. Cleaning by pumping in the reversed direction can be very effective. Generally, the relative proportion of the organic solvent in a mobile phase should be increased when washing, to speed up removal of bound material. However, the key consideration is to choose, in accordance with the characteristics of the sample, an appropriate solvent that will easily dissolve the adsorbed material and not cause precipitation. Reversed phase separations often cause protein to be adsorbed by the packing material which results in high pressure. This problem can be overcome effectively by gradient washing with acetonitrile/ water containing 0.1% TFA, rather than washing with an organic solvent. If the cause of high back pressure is believed to be the result of insoluble material in samples or precipitation of a sample during separation, washing or replacing the inlet frit may be successful.
However, once high back pressures occur, it frequently becomes difficult to restore performance despite washing, etc. It is far better to prevent increased column pressure from occurring by simple sample preparation such as protein removal or filtration and using a guard column to protect the analytical column.

Troubleshooting

5. The Cause of the Ghost Peaks

As part of a test of a gradient method a chromatogram was run without a sample being injected. A number of peaks were obtained, as in trace (A). When a similar test was performed, but with the column disconnected, the ghost peaks disappeared, as in trace (B). This led to the idea that the column was at fault.
However, despite flushing and replacing the column, the baseline could not be improved. Several other factors were then examined; the cause was found to be water used to prepare the mobile phase. Standard distilled water (which is inadequate for HPLC) had been mistakenly used. When HPLC grade distilled water was used, an excellent baseline as in trace (B) was obtained.
Water purity can have a great impact on gradient elution. Even HPLC grade distilled water will become contaminated with time, causing ghost peaks. This will have no significant influence on isocratic elution methods, but it will cause problems in gradient elution methods.
In gradient elution methods, a column is equilibrated with an eluent with low organic content. This allows impurities in the eluent to be adsorbed and concentrated in the column. After starting the analysis, the amount of organic solvent increases and impurities begin to elute from the column, resulting in ghost peaks.

The heights of the ghost peaks are dependent on the duration of equilibration (the amount of contaminant adsorbed during equilibration).
Such ghost peaks do not appear when the column is disconnected because there is nothing to adsorb and concentrate the impurities during the equilibration stage. Therefore, in gradient analysis, the grade and storage conditions of all solvents requires great care.



Eluent: A) water / TFA (100/0.1)
B) acetonitrile / TFA (100/0.1)
Gradient: 0-60% B (0-10 min), 60% B (10-15 min)
Detection: UV at 254 nm

6. pH Adjustment of Eluents

Analysis of ionic compounds by reversed phase HPLC has to be performed with the pH of eluent controlled using acid or buffering agent. However, separation at a pH which is not the optimum for the compound of interest can cause problems such as double peak or peak broadening. Even if the peak shape is satisfactory, retention time reproducibility may not be obtained in some cases. The relation between retention of benzoic acid and pH value is a good example; although the retention time (measured as k') varies little when the pH is in the range 2 - 3.5, it varies widely when the pH ranges is in the range 3.5 - 4.5. The pKa of benzoic acid is 4.2 and it is noticeable that the region where the retention time varies most widely is near the pKa. If the eluent pH is adjusted to a value near the pKa, the results may not be reproducible due to very small variations of the pH adjustment having a large impact on the retention time. In fact, the eluent pH variation of just 0.1 will affect the separation significantly. Therefore, it is recommended that the eluent pH should be more than 1 unit away from the pKa.
If the pKa of the analyte is unknown, the eluent pH should be adjusted to within the value where the impact on the separation seems minimal, after having evaluated the relation between the eluent pH and the retention time by using several eluents with their pH values adjusted to be slightly different from each other.

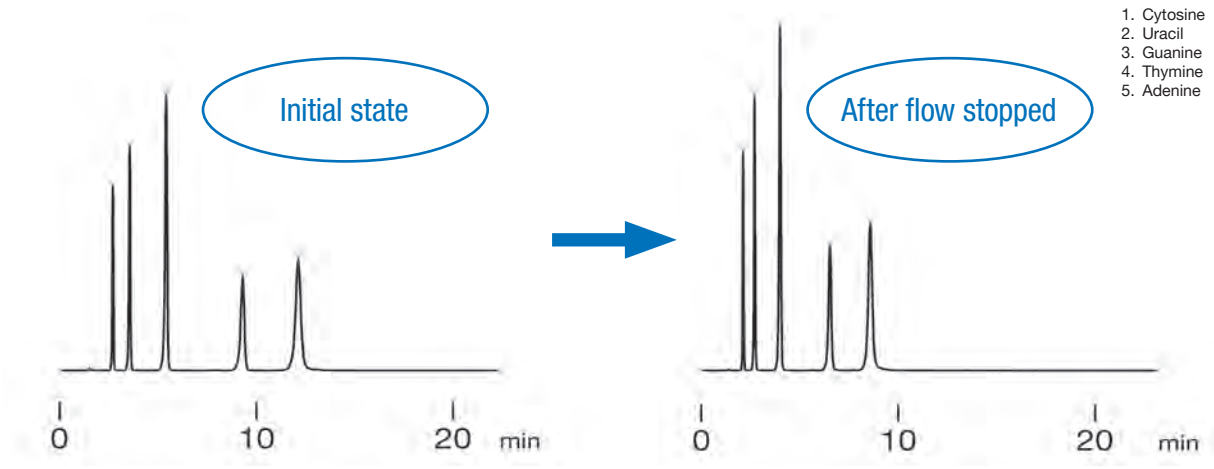
Troubleshooting

7. Regenerating Columns

In reversed phase HPLC, column deterioration can cause poor peak shapes and/or reduced retention times. The column deterioration is the result of changes in the packing material's structure, such as the loss of bonded phase (eg C18 chains) or dissolution of the silica gel base material. Should this occur, columns are difficult to restore and reuse.

If 100% aqueous mobile phase is used in an ODS column, a sharp reduction in retention times of compounds can arise (as in the figure below). Whilst some may think this reduction in retention time is due to column deterioration, this is not the case. In this case, the cause is due to the decrease of apparent hydrophobicity of the packing material due to polarity difference between the water and the C18 functional groups, leading the C18 chains to collapsing onto themselves. In some cases where this occurs, the initial retention times can be restored by flushing the column with 10 times its volume of mobile phase containing 50% organic solvent.

This decreases the repulsion between the eluent and the C18 chains and allows them to return to their normal pendant state. However, YMC recommend that columns specifically intended for 100% aqueous eluents should be used to prevent this problem arising.



After the first day´s analysis, the column was stored overnight with stopped flow. Reanalysis was conducted the day after.

Column:	150 x 4.6 mm ID
Eluent:	20 mM KH_2PO_4-K_2HPO_4 (pH 6.9)
Flow rate:	1.0 mL/min
Temperature:	37 °C
Detection:	UV at 254 nm

Essential Data

Conversion factors

Pressure

MPa	bar	psi	kgf/cm^2	atm
1	10	145.04	10.20	9.87
0.1	1	14.504	1.020	0.987
6.90x10^{-3}	0.069	1	0.070	0.068
0.0981	0.981	14.223	1	0.968
0.101	1.013	14.696	1.033	1

Length

m	in	ft	yd	mile
1	39.37	3.28	1.094	6.21x10^{-4}
0.025	1	0.083	0.028	0.15x10^{-4}
0.305	12	1	0.33	1.89x10^{-4}
0.91	36	3	1	5.68x10^{-4}
1609.3	63360	5280	1760	1

Weight

kg	oz	lb
1	35.274	2.204
0.0283	1	0.0625
0.454	16	1

Volume

l	gal(UK)	gal(US)
1	0.22	0.26
4.55	1	1.201
3.79	0.83	1

Temperature

K	°F	°C
0	-459.67	-273.15
255.37	0	-17.8
273.15	32	0
298.15	77	25
310.93	100	37.8
373.15	212	100

formula: °C=(°F-32)x5/9 °F=°Cx9/5+32

Ratio Scale

ppb	ppm	%
1	10^{-3}	10^{-7}
10^{3}	1	10^{-4}
10^{7}	10^{4}	1

SI Prefixes

da (deca)	h (hecto)	k (kilo)	M (mega)	G (giga)	T (tera)	P (peta)	E (exa)	Z (zetta)	Y (yotta)
10^{1}	10^{2}	10^{3}	10^{6}	10^{9}	10^{12}	10^{15}	10^{18}	10^{21}	10^{24}

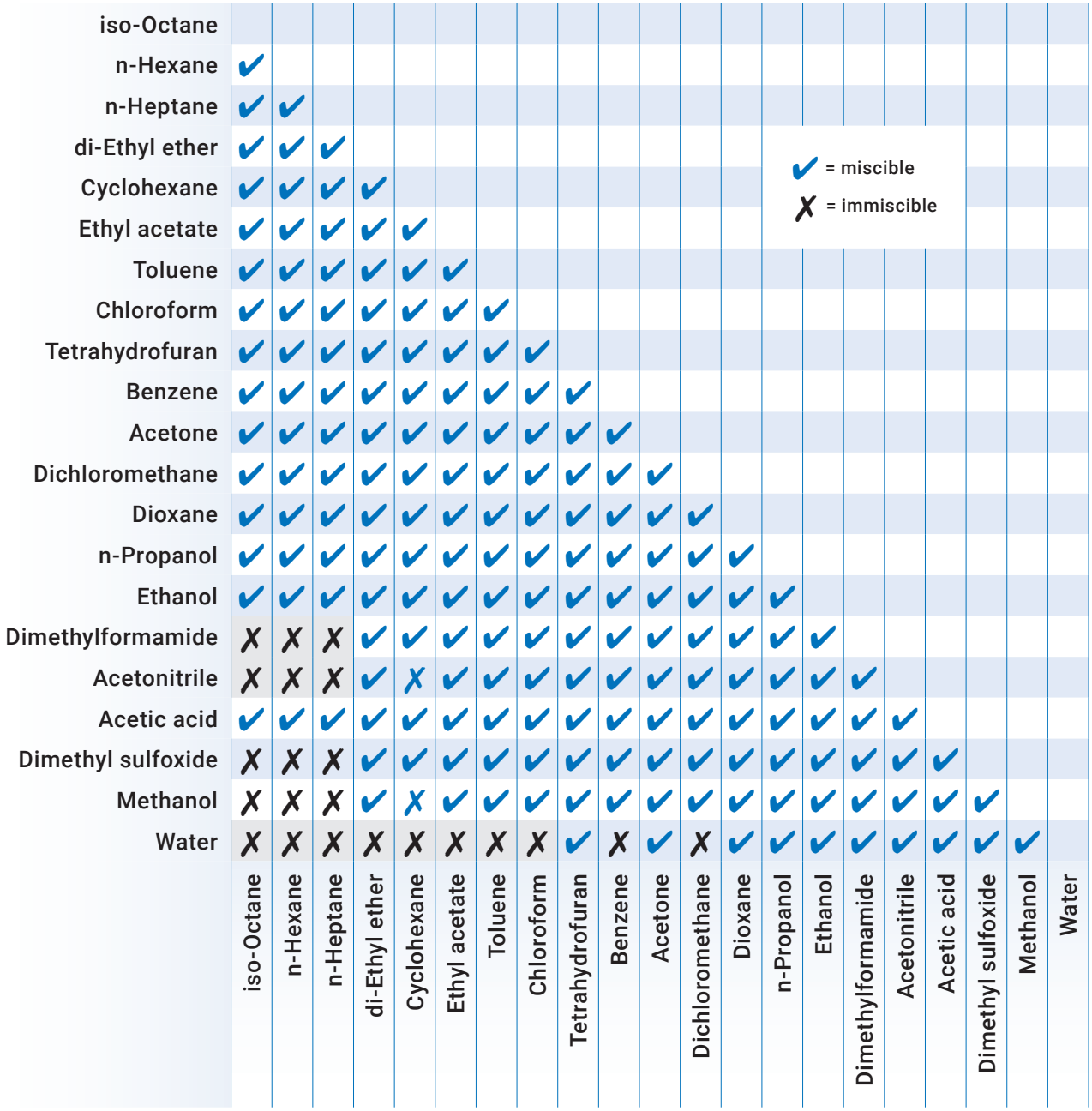
d (deci)	c (centi)	m (milli)	μ (micro)	n (nano)	p (pico)	f (femto)	a (atto)	z (zepto)	y (yocto)
10^{-1}	10^{-2}	10^{-3}	10^{-6}	10^{-9}	10^{-12}	10^{-15}	10^{-18}	10^{-21}	10^{-24}

1 Å (ångström) = 0.1 nm = 10^{-10} m

Linear scale-up

Inner Diameter	1.0	2.0	3.0	4.6	10.0	20.0	30.0	50.0
Scale-Up factor	0.0473	0.189	0.425	1	4.73	18.90	42.53	118.15

Essential Data



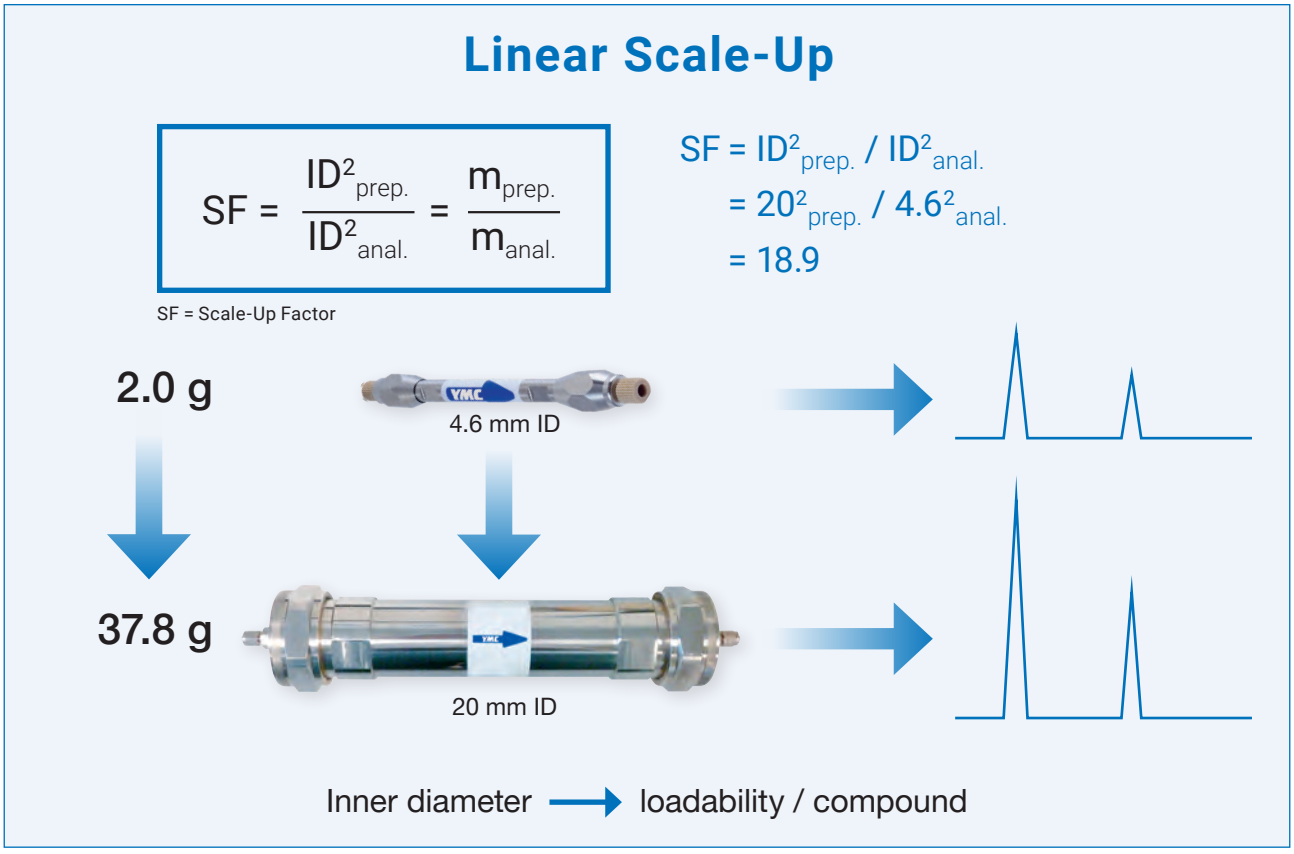
Linear Scale-Up

In order to simplify your scale-up the three most important scale-up factors are summarised.

Scalable factor SF	ID "Linear Scale-Up"	Column length	Column length and ID "Volume"
	$SF = \frac{ID^2_{prep.}}{ID^2_{anal.}}$	$SF = \frac{L_{prep.}}{L_{anal.}}$	$SF = \frac{ID^2_{prep.}}{ID^2_{anal.}} / \frac{L^2_{prep.}}{L^2_{anal.}}$
Impact	Flow rate Eluent composition	Retention time Cycle time Plate number	Amount of adsorbent

Linear Scale-Up

In most cases it is beneficial to develop a semi-preparative method on an analytical scale column. The analytical separation carried out on a 150 x 4.6 mm ID column has to be scaled up to 150 x 20 mm ID. Therefore the chromatographic parameters such as flow rate and column load have to be adjusted according to the following equation:



Guideline for Sample Load according to column ID

Column ID (mm)	Scale–Up factor	Loadability (mg)
4.6	1	1–4
10	4.7	5–20
20	18.9	20–80
30	42.5	40–160
50	118	80–350
75	266	270–980
100	472	470–1,900
150	1,060	1,000–4,200

Preparative Column Selection Guide

Optimisation of preparative chromatography

The main task for a preparative chromatographer is to find the suitable system. In order to simplify the considerations YMC developed a **"Preparative Column Selection Guide"**.

			Lab scale → Production scale								
Column inner diameter [mm ID]			**4.6**	10	20	30	50	100	200	500	1,000
Cross sectional area ratio			**1.0**	4.7	19	42	118	473	1,890	11,800	47,300
Example of calculation	**Flow rate** [ml/min]		**0.5**	2.4	9.5	21	60	235	950	6,000 (6 L)	24,000 (24 L)
			1.0	4.7	19	42	120	470	1,900	12,000 (12 L)	47,000 (47 L)
	Loading [mg]		**5**	25	100	220	600	2,500	10,000	60,000 (60 g)	240,000 (240 g)
HIGH **Column efficiency, Pressure, Costs** **LOW**	**Particle size** [µm]	**5**	+++	+++	+++	+++	++	+	+		
		10	++	+++	+++	+++	+++	++	++	++	++
		10–20	+	++	++	++	+++	+++	+++	++	++
		15–30		+	+	+	++	+++	+++	+++	++
		50~					+	++	++	+++	+++

+++ Most appropriate, ++ Appropriate, + Depending on purpose

The **"Preparative Column Selection Guide"** will help to select:

1. the column ID for the required sample loading
2. the particle size for optimum efficiency
3. the column length for the necessary resolution

Scale-Up

The YMC Scale-Up is defined by 4 steps:

1. Analytical Scale: Method Development
Determine separation conditions by using analytical columns packed with different stationary phases and various conditions.

2. Study the preparative scale. Select the particle size of the packing material and the inner diameter of column appropriate for the sample volume.

3. Optimise the separation conditions and perform loadability studies using analytical columns with inner diameter of 4.6 mm or 6.0 mm packed with the packing material selected for the preparative separation (scout column). If the particle size of the packing material is the same as in the Step 1, this process can be omitted. If the preparative column is more than 100 mm ID, it is advisable to insert another step with a scout column of 20 mm ID in order to accurately predict loadability and calculate the running costs.

4. Proceed with the preparative separation with scale-up of chromatographic parameters such as flow rate/ column ID/ sample load as necessary. From all the given steps above the most demanding step will be the scale-up of the chromatographic parameters in order to meet the preparative demands. There are a number of scalable parameters: flow rate, column ID, sample load, tubing ID, sample injection concentration, volume of sample loop, consumption of solvent, dead volume, fraction mass, size of the detector cell.

YMC Order Guide

The product listing at the end of each chapter represent commonly used standard column dimension.
In order to identify any specific product version and part number, please see the example and the table below.

Full listing of all chemistries and dimensions

Gel Code								Hardware Code					
Chemistry code		Pore size [nm]		Particle shape		Particle size [µm]		Length [mm]		Inner diameter [mm]		Column type	
YMC Carotenoid	CT	6	06	**spherical**	**S**	**1.9**	**P9**	5	E5	0.075	E8	Parker type HPLC	PTH
YMC-Triart C18	**TA**	8	08			2.0	02	10	01	0.1	F0	**Parker type UHPLC**	**PT**
YMC-Triart Bio C18	TA	**12**	**12**			2.3	Q3	20	02	0.3	H0	Parker type metal-free	PTP
YMC-Pack Pro C18 RS	RS	16	16			2.7	Q7	30	03	0.5	J0	Parker type bioinert coated	PTC
Hydrosphere C18	HS	20	20			3.0	03	33	H3	1.0	01	Biocompatible PEEK	WP
Meteoric Core C18	CAS	25	25			4.0	04	**50**	**05**	**2.0**	**02**	Waters type	WT
Meteoric Core C18 BIO	CAW	30	30			5.0	05	75	L5	2.1	Q1	Analytical guard cartridges	GC
YMC-Pack ODS-A	AA	100	A0			6.0	06	100	10	3.0	03	Capillary 1/16"	AU
YMC-Pack ODS-AM	AM	proprietary	99			10	11	125	R5	4.0	04	Capillary 1/32"	RU
YMC-Pack ODS-AQ	AQ	non-porous	00			15	16	150	15	4.6	46	Actus semi prep. 20/30 mm ID	WX
YMC-Pack ODS-AL	AL					20	21	250	25	6.0	06	Actus semi prep. 50 mm ID, 1/8"	DX
J'sphere ODS-H80	JH					30	30	300	30	8.0	08	Actus semi prep. 50 mm ID, 1/16"	AX
J'sphere ODS-M80	JM					50	50	500	50	10	10	Semi prep. 10 mm ID/ UHPLC guard cartridges	CC
J'sphere ODS-L80	JL					60	60			20	20	Semi prep. guard cartidge 20/30 mm ID	CCN
YMC-Pack PAH	YP					75	75			30	30	Semi prep. guard	WTG
YMC-Pack PolymerC18	PC									50	53	Alcyon SFC	WTS
YMC-Triart C8	TO												
YMC-Pack Pro C8	OS												
Meteoric Core C8	COS												
YMC-Pack C8	OC												
YMCbasic	BA												
YMC-Triart Phenyl	TPH												
YMC-Pack Ph (Phenyl)	PH												
YMC-Triart PFP	TPF												
YMC-Triart Bio C4	TB												
YMC-Pack Pro C4	BS												
YMC-Pack C4	BU												
YMC-Pack Protein-RP	PR												
YMC-Pack TMS (C1)	TM												

Example

YMC-Triart C18		12 nm		Spherical		1.9 µm		50 mm		2.0 mm		Parker Type UHPLC	
	TA		12		S		P9		05		02		PT

Your part number: TA12SP9-0502PT (Example)

YMC Order Guide

Full listing of all chemistries and dimensions

Gel Code								Hardware Code					
Chemistry code		Pore size [nm]		Particle shape		Particle size [µm]		Length [mm]		Inner diameter [mm]		Column type	
YMC-Pack PVA-Sil	PV	6	06	**spherical**	**S**	1.9	P9	5	E5	0.075	E8	Parker type HPLC	PTH
YMC-Pack Polyamine II	PB	8	08			2.0	02	10	01	0.1	F0	Parker type UHPLC	PT
YMC-Pack NH2 (Amino)	NH	12	12			2.3	Q3	20	02	0.3	H0	Parker type metal-free	PTP
YMC-Triart SIL (SFC)	TS	16	16			2.7	Q7	30	03	0.5	J0	Parker type bioinert coated	PTC
YMC-Triart Diol-HILIC	TDH	20	20			3.0	03	33	H3	1.0	01	Biocompatible PEEK	WP
YMC-Pack Diol NP	DN	25	25			4.0	04	50	05	2.0	02	**Waters type**	**WT**
YMC-Pack SIL	SL	30	30			5.0	05	75	L5	2.1	Q1	Analytical guard cartridges	GC
CHIRAL ART Amylose-C	KAN	100	A0			6.0	06	100	10	**3.0**	**03**	Capillary 1/16"	AU
CHIRAL ART Amylose-C Neo	KBN	**proprietary**	**99**			10	11	125	R5	4.0	04	Capillary 1/32"	RU
CHIRAL ART Cellulose-C	KCN	non-porous	00			15	16	**150**	**15**	4.6	46	Actus semi prep. 20/30 mm ID	WX
CHIRAL ART Amylose-SA	**KSA**					20	21	250	25	6.0	06	Actus semi prep. 50 mm ID, 1/8"	DX
CHIRAL ART Cellulose-SB	KSB					30	30	300	30	8.0	08	Actus semi prep. 50 mm ID, 1/16"	AX
CHIRAL ART Cellulose-SC	KSC					50	50	500	50	10	10	Semi prep. 10 mm ID/ UHPLC guard cartridges	CC
CHIRAL ART Cellulose-SJ	KSJ					60	60			20	20	Semi prep. guard cartidge 20/30 mm ID	CCN
CHIRAL ART Cellulose-SZ	KSZ					75	75			30	30	Semi prep. guard	WTG
YMC-Pack Diol (SEC)	DL									50	53	Alcyon SFC	WTS
YMC-SEC MAB	DLM												
BioPro IEX QA	QA												
BioPro IEX SP	SP												
BioPro IEX QF	QF												
BioPro IEX SF	SF												
BioPro HIC HT	BHH												
BioPro HIC BF	BHB												

* for YMC-Triart Diol (SFC) add "B" at the end of the part number! Example: TDH12S03-1503PTH**B**

Example

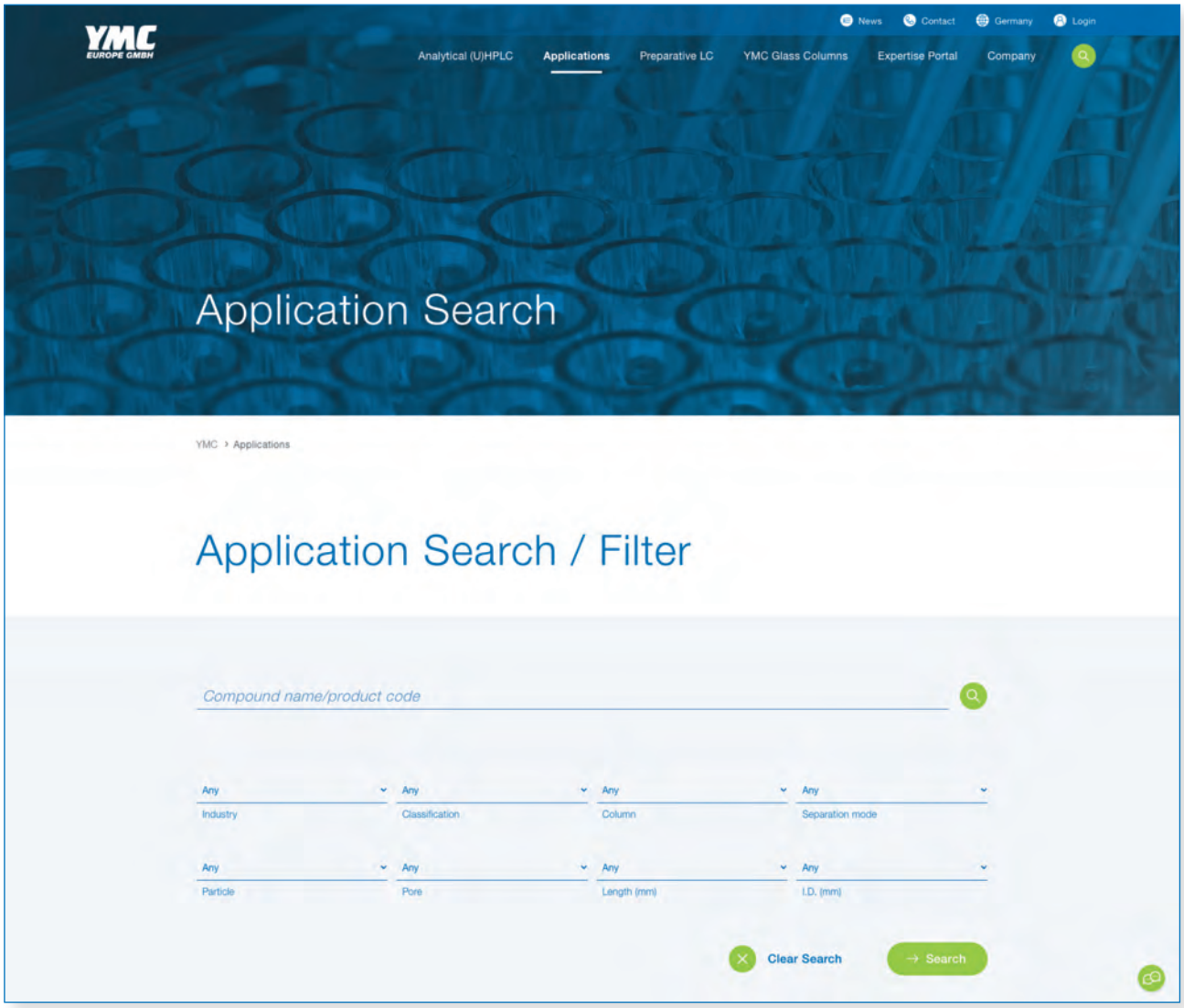
CHIRAL ART Amylose-SA		Proprietary		Spherical		3.0 µm		150 mm		3.0 mm		Waters Type	
	KSA		99		S		03		15		03		WT

Your part number: KSA99S03-1503WT (Example)

YMC Application Database

Application Search

In order to get full access to more than 900 YMC applications please visit our homepage www.ymc.eu/applications.html, where you can easily search for substances, colums, separation modes, etc.



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