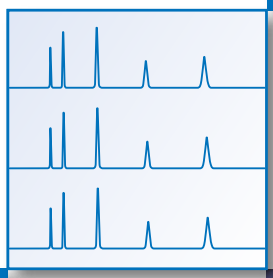
YMC EUROPE GMBH

GENERAL CATALOGUE 2017/2018



RP
NP
HILIC

CHIRAL
SFC
BIO-LC

(U)HPLC
Micro-LC
HPLC

Worldwide Availability

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.de). You will find that YMC is always highly responsive to customer requirements, and feedback is guaranteed.

YMC CO., LTD.

YMC Karasuma-Gojo Bld. 284 Daigo-cho,
Karasuma Nisiiru Gojo-dori Shimogyo-ku,
Kyoto 600-8106 Japan
TEL. +81(0)75-342-4515, FAX +81(0)75-342-4550
www.ymc.co.jp

YMC Europe GmbH

Schöttmannshof 19
D-46539 Dinslaken
Germany
TEL. +49(0)2064/427-0, FAX +49(0)2064/427-222
www.ymc.de

YMC America, Inc.

941 Marcon Boulevard Suite 201
Allentown, PA18109 USA
TEL. +1-610-266-8650, FAX +1-610-266-8652
www.ymcamerica.com

YMC India Ltd.

A-154, Eros Boulevard Hilton Complex Plot No. 13-B
District Centre Mayur Vihar Phase-I New Dehli-110091
India
TEL. +91-11-45041601, FAX +91-11-45041901
www.ymcindia.com

YMC Korea Co., Ltd.

310 Woolim W-City, 618 Sampyeong-dong,
Bundang-gu, Sungnam-si, Gyeonggi-do
463-400 Korea
TEL. +82-31-716-1631, FAX +82-31-716-1630
www.ymckorea.com

YMC Co., Ltd. Shanghai Rep. Office

Far East International Plaza A2404
No. 319 Xianxia Road, Shanghai 200051
P.R. China
TEL: +86-21-6235-1388, FAX: +86-21-6235-1398
www.ymcchina.com

YMC Taiwan Co., Ltd.

1F., No. 76, Ln. 191, Sec. 3, Minquan E. Rd.,
Songshan Dist., Taipei City 105,
Taiwan (R.O.C.)
TEL. +886-3-2150-630, FAX +886-3-2150-286
www.ymctaiwan.com

YMC Singapore Tradelinks Pte. Ltd.

6 Indus Road, #13-09 Emerald Park, Tower 1,
Singapore 169588
TEL.+65-9023-7617
www.ymc.sg

What's new?

Method Development and Validation Kits

- chiral and achiral kits
- documentation of robustness & reproducibility
- very attractive pricing

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Versatile (U)HPLC Columns with 6 Modifications: YMC-Triart

- robustness
- pH stability (1-12)
- steric recognition

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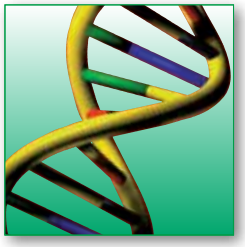

UHPLC SEC Columns: YMC-Pack Diol 2 µm

- excellent reproducibility
- improved resolution
- long-term stability

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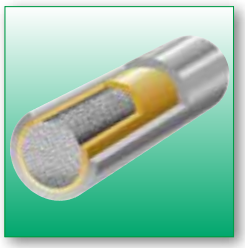

Metal-free Hardware for Biochromatography

- for analysis of coordinating compounds
- high pressure tolerance
- PEEK-lined stainless steel

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Coated and Immobilised Polysaccharides: CHIRAL ART

- NP/RP / SFC & SMB
- analytical to preparative LC/SFC
- extremely attractive pricing

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Supercritical Fluid Chromatography Columns: Alcyon SFC

- solvent consumption reduced
- fast separation with high resolution
- chiral and achiral stationary phases

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Contents

Chiral Columns

Alcyon SFC

Speciality Columns

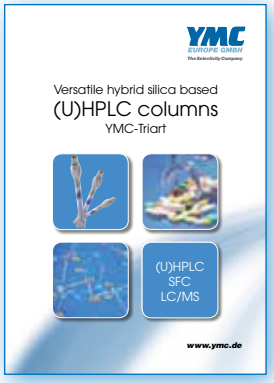
Flash

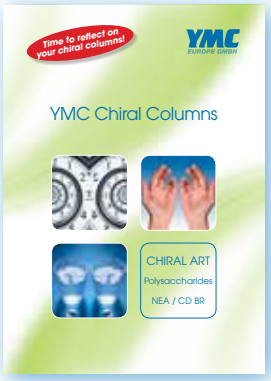
Preparative & Process LC

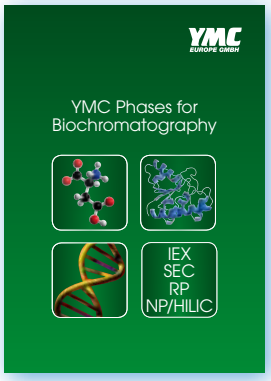
Miscellaneous

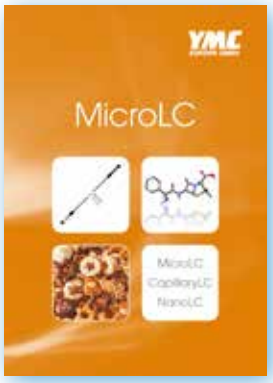
Literature available (Selection)

Analytical

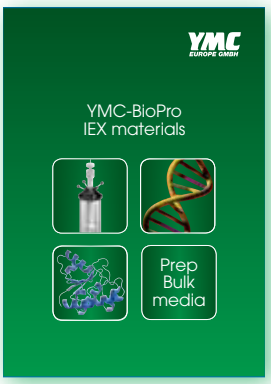








Preparative



Also available: Posters, Product Information, Technical Guide Lines, Manuals, DMF / RSF / CoA, etc.

[Kinka|ku-ji] *japanese*

Kinkaku-ji (Temple of the Golden Pavilion), also known as Rokuon-ji (Deer Garden Temple), is a Zen Buddhist temple in Kyoto, Japan. The garden complex is an excellent example of Muromachi period garden design. The Muromachi period is considered to be a classical age of Japanese garden design. The correlation between buildings and its settings were greatly emphasized during this period. It was a way to integrate the structure within the landscape in an artistic way. The garden designs were characterized by a reduction in scale, a more central purpose, and a distinct setting. A minimalistic approach was brought to the garden design, by recreating larger landscapes in a smaller scale around a structure.
It is designated as a National Special Historic Site and a National Special Landscape, and it is one of 17 locations comprising the Historic Monuments of Ancient Kyoto World Heritage Site. It is also one of the most popular buildings in Japan, attracting a large number of visitors annually.

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.

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

YMC Europe GmbH, Dinslaken, Germany

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 6 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 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.

Company Profile

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.

Hands-on support services are offered by Komatsu/Japan, Dinslaken/Germany, San Diego/California/USA 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.

Supply

Extensive local inventory and highly competent order processing staff 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.

The ideal laboratory resource: www.ymc.de

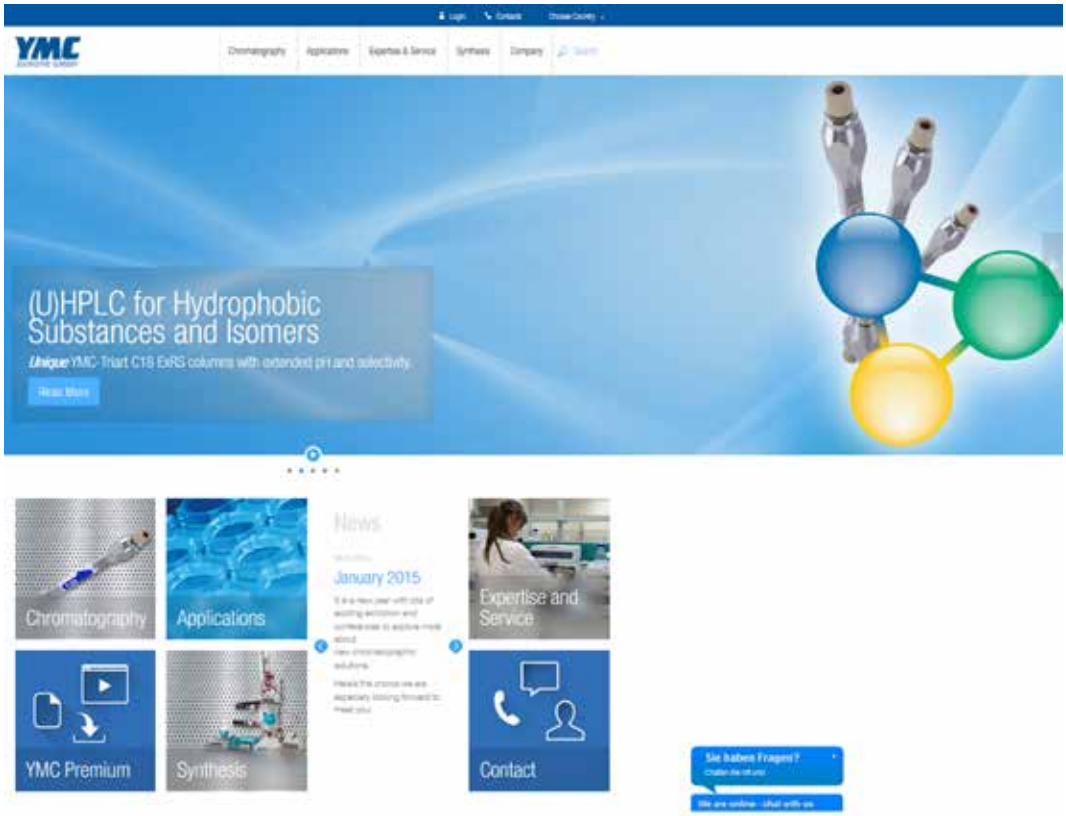
- **more than 750 pages full of professional information**
- **extensive applications database**
- **extensive number of documents available for downloading**
- **support services including regulatory compliance information**

YMC Europe's website is a powerful tool for chromatography application support and product knowledge for the pharmaceutical, chemical, biochemical, environmental, food and beverage industries.

Chromatography:

The full spectrum of YMC's products for micro/nano LC, (U)HPLC, analytical LC and preparative separations:

- RP, IEX, SEC, HILIC, NP and SFC columns
- UHPLC and HPLC products
- Capillary columns to fit the majority of nano/microLC systems
- YMC-Triart Prep bulk: the bulk media with enhanced pH stability available in industrial scale quantities
- CHIRAL ART: coated/immobilised cost-efficient YMC chiral bulk media and HPLC columns*
- Column technologies: laboratory and pilot scale glass columns, DAC prep/pilot steel columns



* Prep 10 µm or 20 µm freely available

The ideal laboratory resource: www.ymc.de

Applications:

Free access to YMC's own application database: with over 2,500 different compounds in more than 750 state-of-the-art applications!

Expertise and Service:

Overview on all the support YMC can provide, e.g.:

- Method development and (chiral) phase screening services to support you with the selection of the most appropriate YMC column and/or method conditions.
- Custom purifications from laboratory to pilot or process scale performed in Dinslaken, Germany or Komatsu, Japan.
- Troubleshooting support for most common questions.

YMC Premium:

Download section exclusively for registered members. Here you can find all downloadable documents, which are only accessible after login, e.g. in-depth product information, price lists, regulatory support documentation etc.

Contact:

All possible contact details including direct contact numbers, call-back service, phone numbers and email addresses.

In addition, you can find the direct contact details for your product specialist on each of the corresponding product pages.

Direct Answers to Your Questions!

Please contact YMC via our (free) online chat for immediate answers to technical or commercial issues or to arrange for personal discussions at your site; YMC specialists are available to respond to your questions and issues on www.ymc.de!

To find out more please visit our website at www.ymc.de and see what extra value YMC Europe can offer you at no extra cost!

Method Validation Kits by YMC

- **three analytical columns from specified lots**
- **validation kit 1: consists of two columns from one lot and one column from a second lot**
- **validation kit 2: consists of three columns from three different lots**
- **for documentation of robustness and reproducibility**

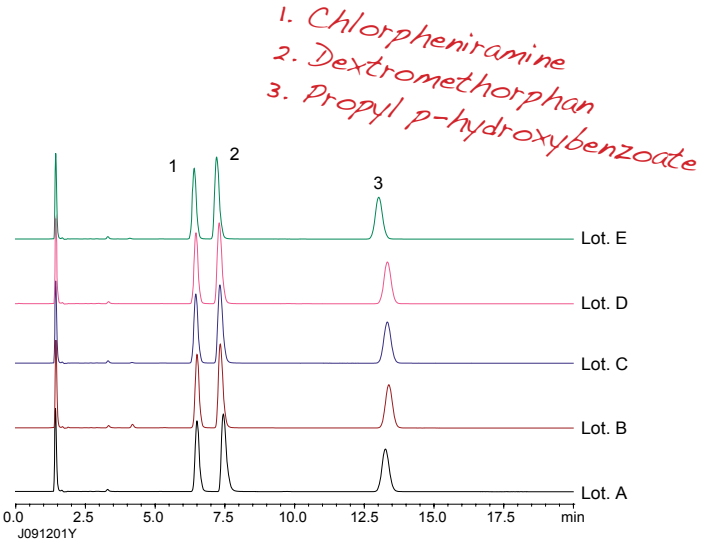
Due to different approaches to validation, YMC offers two different versions of validation column kits.

Validation kit 1:

contains two columns from a single bonding batch and one column from a different bonding batch. Each column comes with its own test chromatogram. The two matched columns are used to confirm that characteristics unique to a single column, such as artefacts due to the column packing process are not affecting your results. The third column is used to assess whether batch-to-batch variations of a bonded phase affect your method. This is a test of the robustness of the method and provides assurance that the method will give reliable results over the life of your product.

Validation kit 2:

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



Batch Reservation Service

Occasionally, a critical analytical method will not prove as robust as you would prefer. Columns from a particular media batch may be the only way that you can, for example, isolate a critical process impurity. In such cases, YMC will reserve a specific batch of material for the use of an individual customer. YMC will also reserve prepacked columns for release according to a pre-arranged schedule. Call YMC or contact your YMC representative for details.

Available dimensions:

Length: 30 or 33, 50, 75,100, 150 mm

ID: 2 or 2.1, 3, 4, 4.6, 6 mm

Validation kit 1 (consists of two columns from one batch and one column from a second batch):
To order a validation kit 1 simply use the ordering number for the column of interest, e.g. **TO12SP9-10Q1PT** and add **V1: TO121SP9-10Q1PTV1.**

Validation kit 2 (consists of three columns from three different batches):
To order a validation kit 2 simply use the ordering number for the column of interest, e.g. **TA12SP9-05Q1PT** and add **V2: TA12SP9-05Q1PTV2.**
For details on YMC selectivities and the International Product Code please refer to the specific product sections in this catalogue.

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)

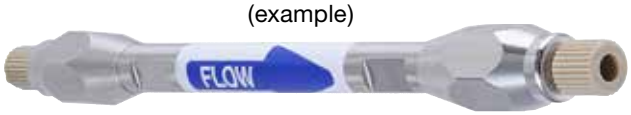
YMC-Triart C18

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 or 2.1, 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

Transfer

Scalable particles:
EASY
UHPLC ↔ HPLC

Flexible

pH = 1 – 12
Temp. up to 70°C
100% aqueous conditions

Universal

YMC-Triart
for acidic, basic and neutral analytes

YMC-Triart

Contents

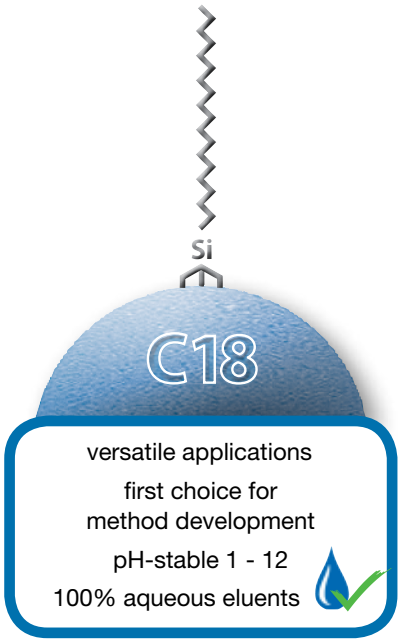
Introduction

Chromatographers always seek to push the limits of HPLC columns to greater extremes to allow them to perform day-to-day with ever-changing pH, buffers and temperature ranges. The column for the laboratory of today must be suitable for harsh pH conditions in combination with high temperature ranges without sacrificing selectivity.

In order to meet these goals, YMC developed a novel particle technology. The revolutionary production technique provides a silica-organic hybrid stationary phase, which provides an outstandingly narrow pore size and particle size distribution. This in turn, results in low back pressures and high loadability.

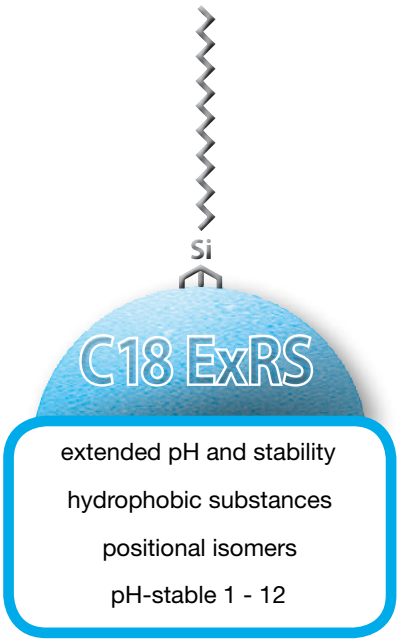
Phases Overview

YMC-Triart C18



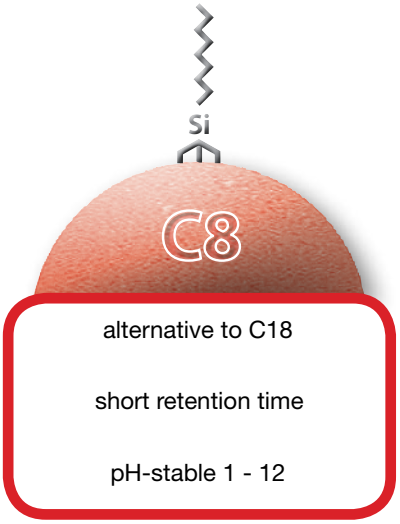
versatile applications
first choice for method development
pH-stable 1 - 12
100% aqueous eluents

YMC-Triart C18 ExRS



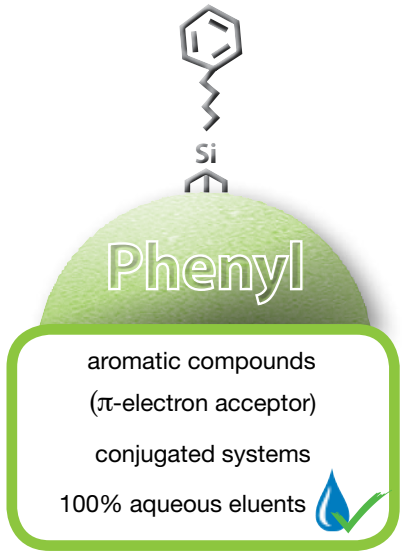
extended pH and stability
hydrophobic substances
positional isomers
pH-stable 1 - 12

YMC-Triart C8



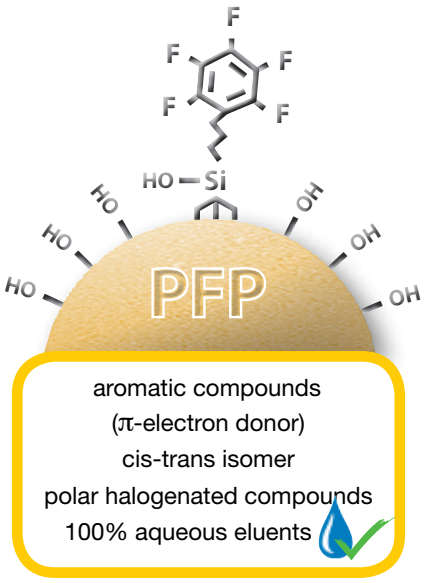
alternative to C18
short retention time
pH-stable 1 - 12

YMC-Triart Phenyl



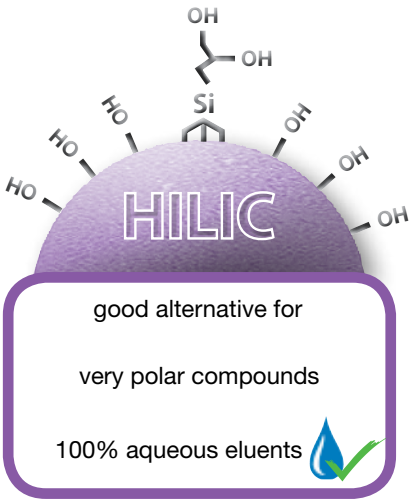
aromatic compounds
(π-electron acceptor)
conjugated systems
100% aqueous eluents

YMC-Triart PFP



aromatic compounds
(π-electron donor)
cis-trans isomer
polar halogenated compounds
100% aqueous eluents

YMC-Triart Diol-HILIC



good alternative for
very polar compounds
100% aqueous eluents

YMC-Triart

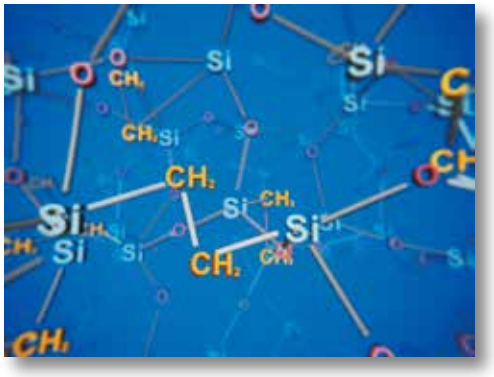
Specification

	YMC-Triart C18	YMC-Triart C18 ExRS	YMC-Triart C8	YMC-Triart Phenyl	YMC-Triart PFP	YMC-Triart Diol-HILIC
Base	organic/inorganic silica					
Stationary phase	C18 (USP L1)	C18 (USP L1)	C8 (USP L7)	Phenyl (USP L11)	Pentafluoro-phenyl (USP L43)	Diol (USP L20)
Particle size	1.9, 3 and 5 µm					
Pore size	12 nm	8 nm	12 nm	12 nm	12 nm	12 nm
Specific surface	360 m^2/g	430 m^2/g	360 m^2/g	360 m^2/g	360 m^2/g	360 m^2/g
Carbon content	20%	25%	17%	17%	15%	—
Bonding	trifunctional					
Endcapping	multi-stage	multi-stage	multi-stage	multi-stage	none	none
pH range	1 ~ 12	1 ~ 12	1 ~ 12	1 ~ 10	1 ~ 8	2 ~ 10
Temp. range	pH 1-7: 70 °C, pH 7-12: 50 °C	pH 1-7: 70 °C, pH 7-12: 50 °C	pH 1-7: 70 °C, pH 7-12: 50 °C	50°C	50°C	50°C
100% aqueous eluents	✓	✗	✗	✓	✓	✓

Particle technology

YMC-Triart is a versatile material prepared using tightly controlled particle formation technology which has been adapted from micro-reactor technology. This recently developed production process results in exceptionally narrow particle and pore size distributions.

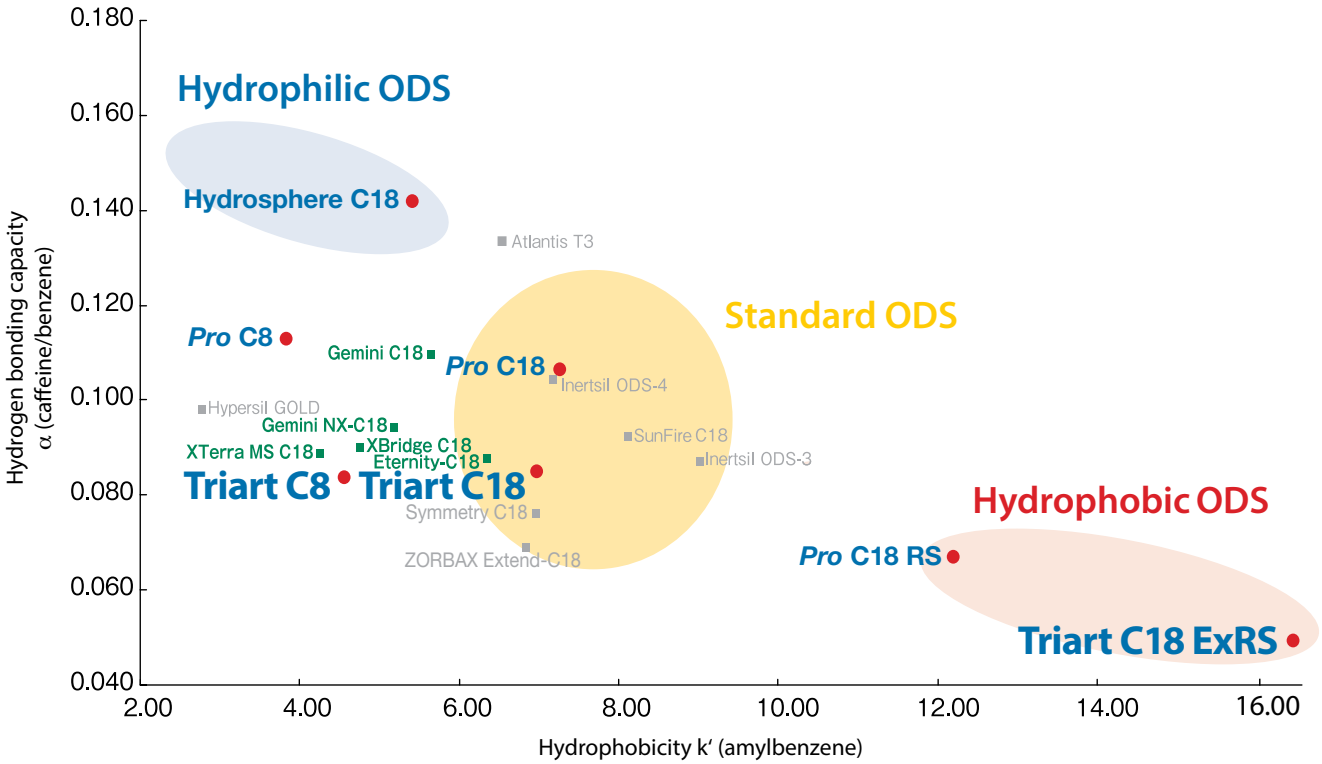
With YMC-Triart, challenging pH and high temperature conditions are no longer a limitation to the day-to-day work in laboratories. Most importantly, due to its unique particle composition, a balanced hydrophobicity and silanol activity are achieved which makes YMC-Triart a “First Choice” column in method development.



* Application data by courtesy YMC Co., Ltd.

YMC-Triart

“First choice” column for method development



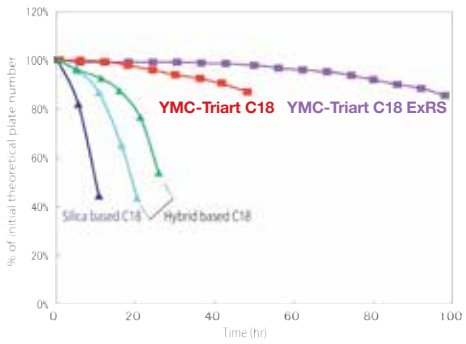
Conventional hybrid silica-based ODS columns tend to be less hydrophobic than silica-based columns. YMC-Triart C18 has a higher carbon load, giving it a hydrophobicity comparable to that of standard ODS columns, thereby making it a “versatile first-choice” column for method development.

On the other hand, YMC-Triart C18 ExRS has been designed to provide contrastingly different separation characteristics!

pH & Temperature

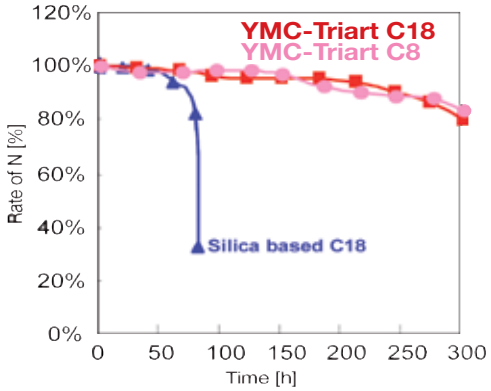
Versatile wide pH stability

Phosphate buffer (pH 11.5, 40 °C)*



Column:	5 µm, 150 x 4.6 mm ID
Part No.:	TA12S05-1546WT
Eluent:	50 mM K_2HPO_4-K_3PO_4 (pH 11.5) / methanol (90/10)
Flow rate:	1.0 mL/min
Temperature:	40 °C
Sample:	benzyl alcohol

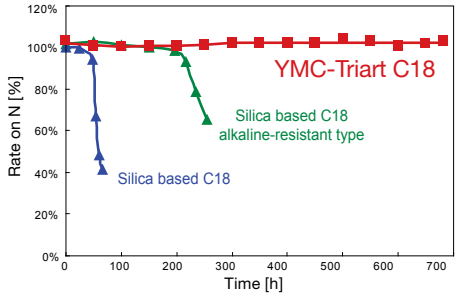
Triethylamine (pH 11.5, 40 °C)*



Column:	5 µm, 150 x 4.6 mm ID
Part No.:	TA12S05-1546WT
Eluent:	50 mM triethylamine (pH 11.5) / methanol (90/10)
Flow rate:	1.0 mL/min
Temperature:	40 °C
Sample:	benzyl alcohol

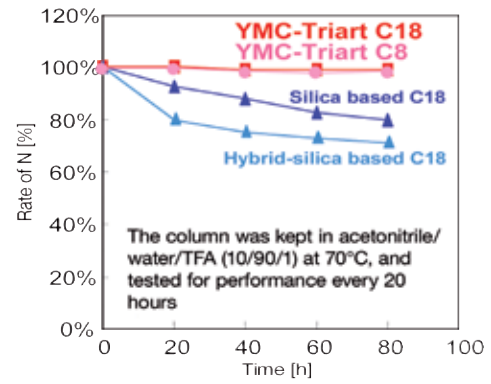
Stability at high temperature

pH 6.9, 70 °C*



Column:	5 µm, 50 x 2.0 mm ID
Part No.:	TA12S05-0502WT
Eluent:	20 mM KH_2PO_4-K_2HPO_4 (pH 6.9) / acetonitrile (90/10)
Flow rate:	0.2 mL/min
Temperature:	70 °C
Sample:	phenol

pH 1, 70 °C*



Column:	5 µm, 50 x 2.0 mm ID
Part No.:	TA12S05-0502WT
Eluent:	acetonitrile / water (60/40)
Flow rate:	0.2 mL/min
Temperature:	37 °C
Sample:	butyl benzoate

YMC-Triart phases show great chemical stability due to the highly developed hybrid-silica matrix. Even under high pH or high temperature conditions, the lifetime of YMC-Triart phases is more than 10x greater than conventional reversed phase columns.

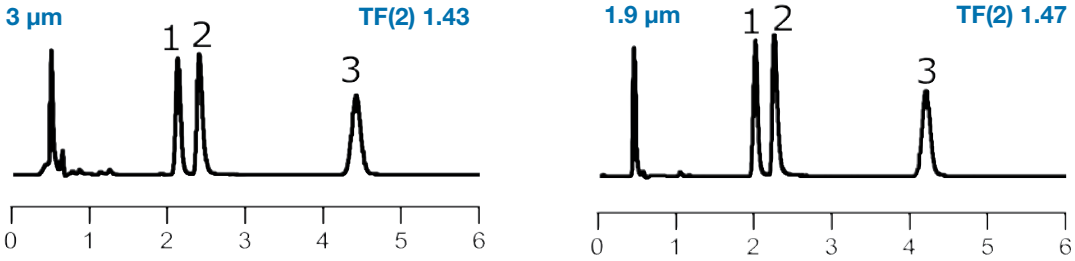
* Application data by courtesy YMC Co., Ltd.

Transfer HPLC ⟷ UHPLC

Secure your method transfer!

Differences in selectivity, retention time, and also peak shapes between different particle sizes of commercially available C18 phases in the same brand (or an alternative as recommended by its manufacturer) have been observed.

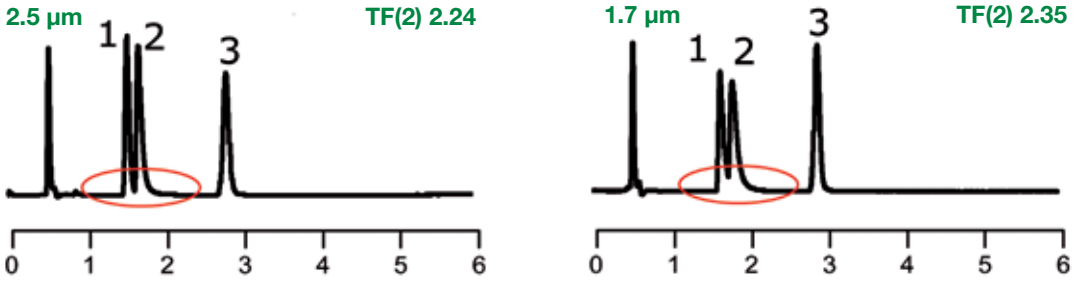
YMC-Triart C18



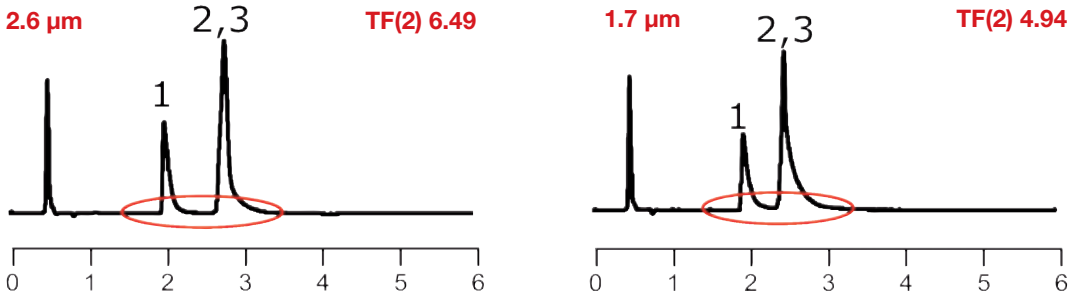
YMC has addressed this issue of method transfer. YMC-Triart columns show identical selectivity and excellent peak shapes for basic compounds for all 3.0 µm to 1.9 µm particle sizes. It allows predictable scale up from UHPLC to conventional HPLC and even to semi-preparative LC, and vice versa.

Case Studies**

X-Bridge BEH C18 and Acquity UPLC BEH C18



Kinetex™ C18



Kinetex™ C18 columns show significant peak tailing and have limited scalability due to lack of larger particle sizes.

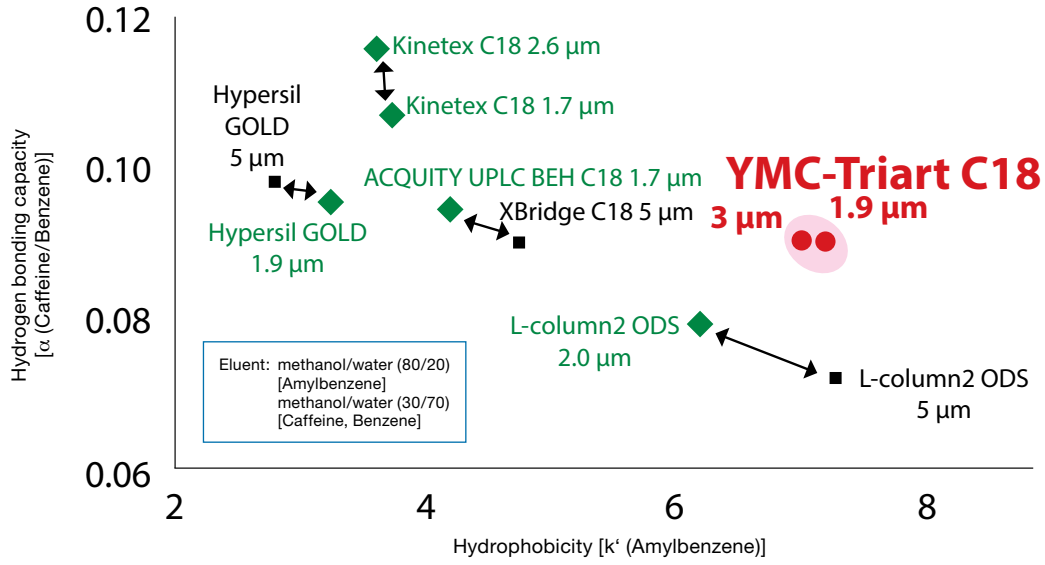
Column:	50 x 2.0 mm ID or 2.1 mm ID
Eluent:	20 mM KH_2PO_4-K_2HPO_4 (pH 6.9) / acetonitrile (65/35)
Temperature:	40 °C
Flow rate:	0.2 mL/min
Detection:	UV at 235 nm

1. Chlorpheniramine (basic)
2. Dextromethorphan (basic)
3. Propyl paraben (internal standard)

** These observations might not be representative for all applications.

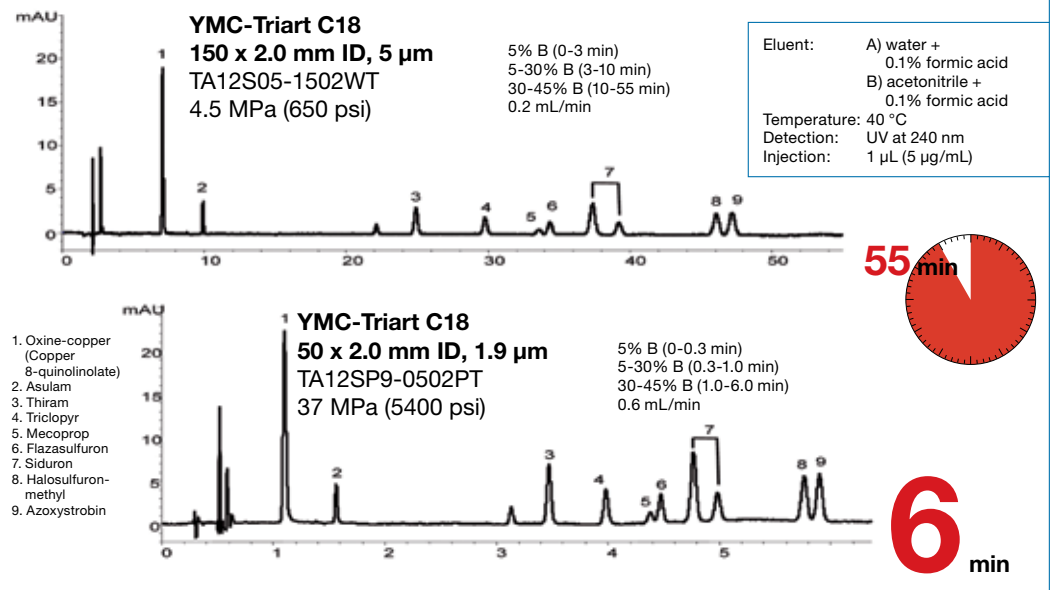
Transfer HPLC ⟷ UHPLC

Evaluation of method transfer performance!*



With the introduction of UHPLC, sub-2 µm particles became necessary. Therefore, smaller particles have been added to existing column lines. Consequently, sub-2 µm particles may exhibit differences in chromatographic performance.
By introducing YMC-Triart, YMC provides matching chromatographic behaviour for all particles sizes!

Method transfer between HPLC ⟷ UHPLC*

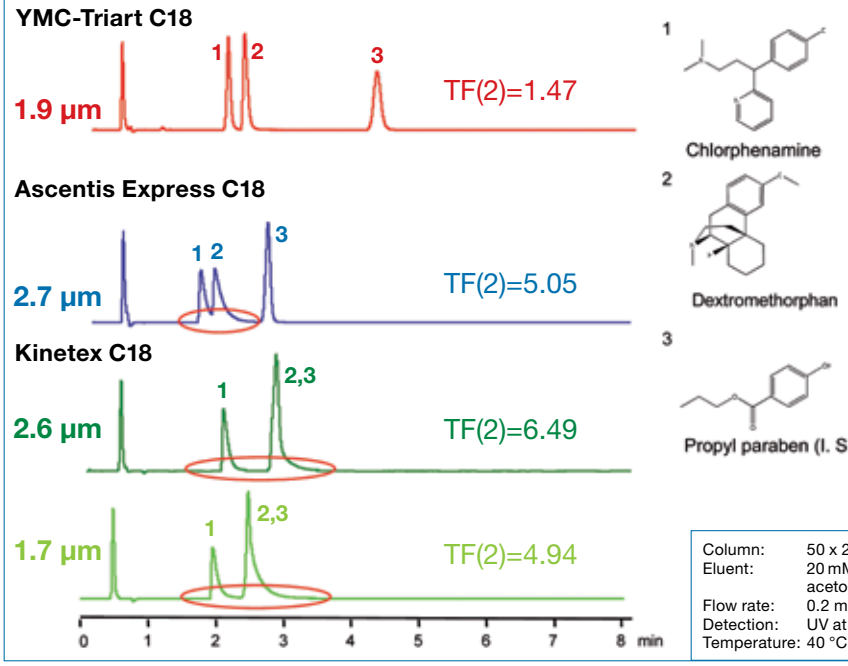


When transferring the 55 min HPLC method to UHPLC scale, the resolution remains the same although the separation time is reduced to only 6 min.

* Application data by courtesy YMC Co., Ltd.

UHPLC

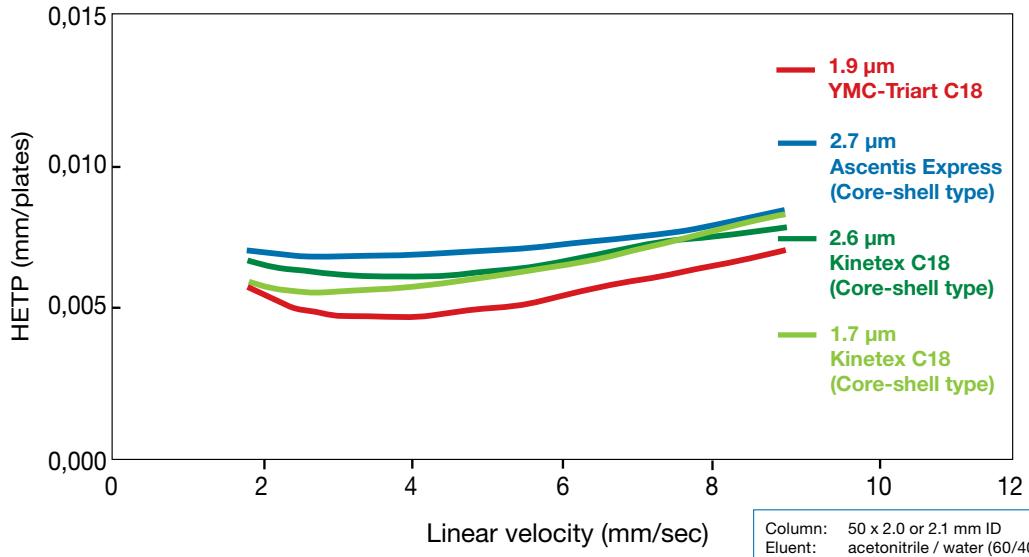
Higher resolution and good loadability*



Column:	50 x 2.0 or 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
Detection:	UV at 235 nm
Temperature:	40 °C

YMC-Triart C18 shows superior resolution to the other three phases thereby allowing considerable higher loadability.

Lower HETP means higher resolution!*

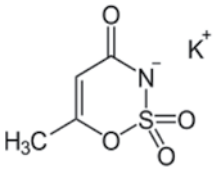


Column:	50 x 2.0 or 2.1 mm ID
Eluent:	acetonitrile / water (60/40)
Detection:	UV at 254 nm
Sample:	Butyl benzoate

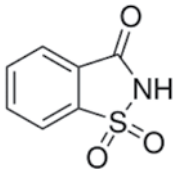
YMC-Triart C18 always shows the lowest HETP compared to the three Core-Shell products over the range of linear velocity applied.

UHPLC & MS

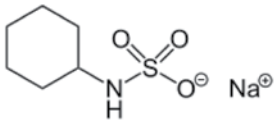
Determination of Artificial Sweeteners with LC-MS/MS



Acesulfam-K

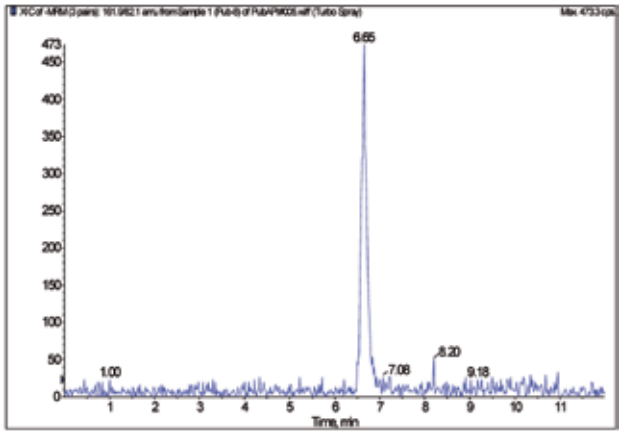


Saccharin

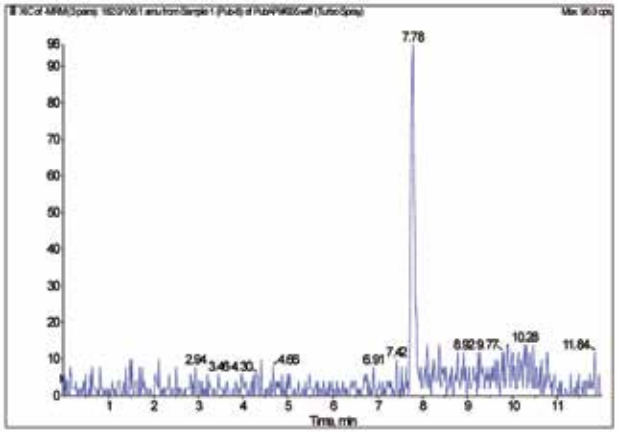


Cyclamat-Na

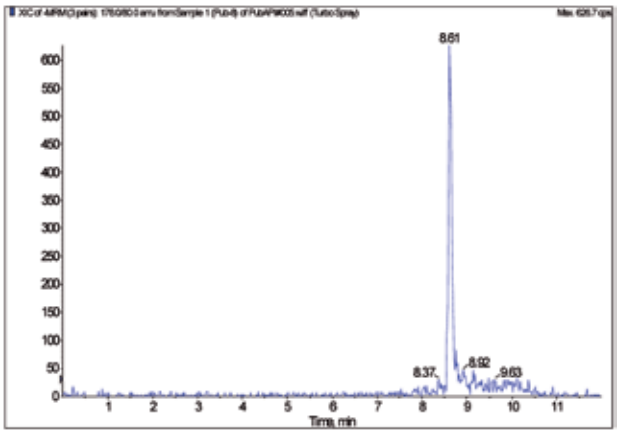
➔ Non-biological markers of wastewater entries in ground and surface water



Extracted Ion Chromatogram (XIC) of Acesulfam-K, 0.1 µg/L



Extracted Ion Chromatogram (XIC) of Saccharin, 0.1 µg/L



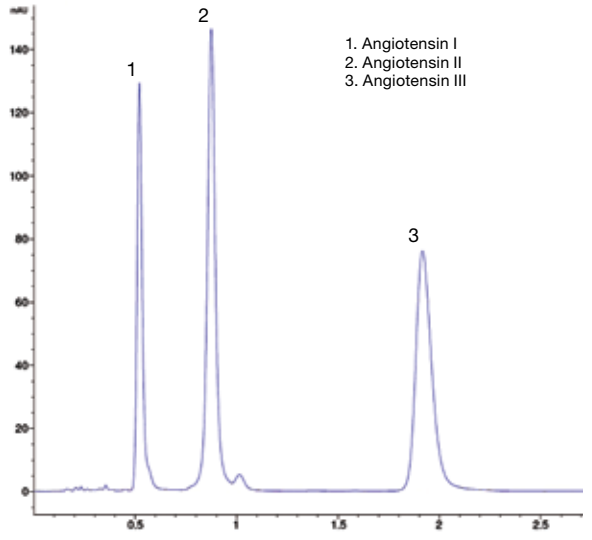
Extracted Ion Chromatogram (XIC) of Cyclamat-Na, 0.1 µg/L

Column:	YMC-Triart C18 (12 nm, 1.9 µm) 100 x 3.0 mm ID
Part No.:	TA12SP9-1003PT
LC-System:	Agilent 1100 HPLC system and CTC Analytics HTC-Pal Autosampler
MS/MS System:	Applied Biosystems MDS Sciex API 4000, ESI negative
Temperature:	35°C
Flow rate:	0.3 mL/min
Injection:	40 µL, direct injection
Eluent:	A: H_2O (containing 10 mmol NH_4 formate)
	B: MeOH (containing 10 mmol NH_4 formate)
Gradient:	Time 0 6.0 6.1 12.0
	% B 2 75 2 2

by courtesy of: Thomas Class, Sandro Jooß
PTRL Europe, Helmoholtzstraße 22, Science Park I, D-89081 Ulm

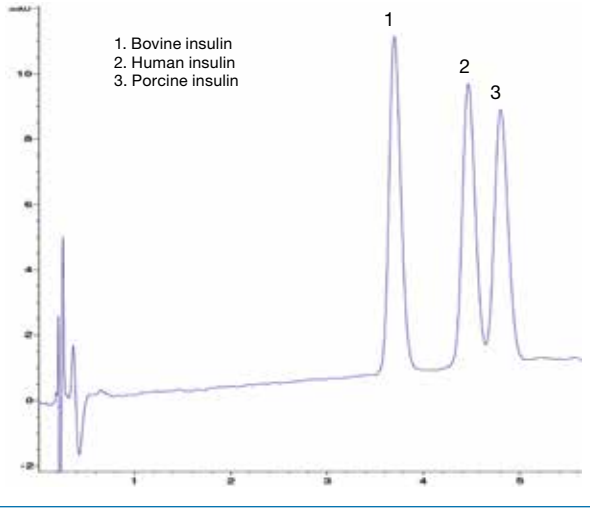
UHPLC

Angiotensin I, II and III



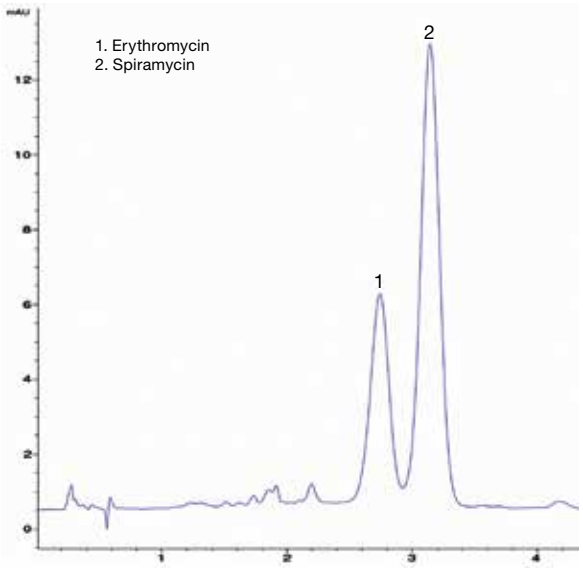
Column:	YMC-Trairt C18 (12 nm, 1.9 µm) 50 x 2.0 mm ID
Part No.:	TA12SP9-0502PT
Eluent:	20 mM KH_2PO_4 + K_2HPO_4 (pH 7.9) / acetonitrile (22/78)
Flow rate:	0.7 mL/min
Detection:	UV at 220 nm
Pressure:	720 bar
Injection:	0.5 µL
Temperature:	40 °C

Insulin



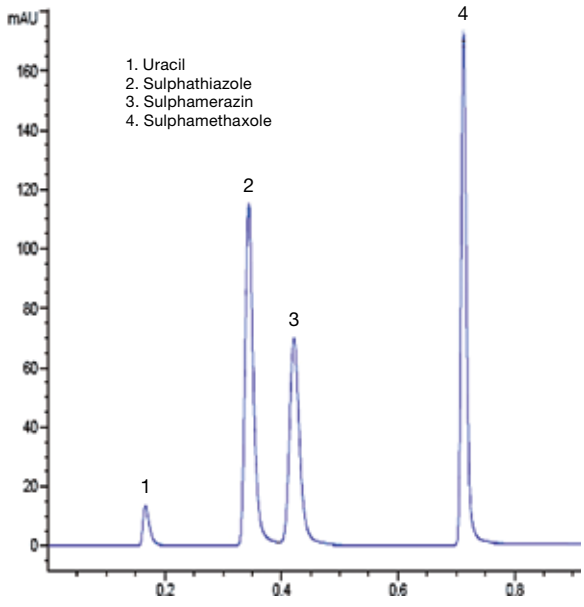
Column:	YMC-Trairt C18 (12 nm, 1.9 µm) 50 x 2.0 mm ID
Part No.:	TA12SP9-0502PT
Eluent:	A) H_2O + 0.1% TFA B) acetonitrile + 0.1% TFA
Gradient:	30% B (0 min); 30-32% B (0-5 min); 32% B (55 min)
Flow rate:	0.6 mL/min
Detection:	UV at 220 nm
Pressure:	611 bar
Injection:	0.5 µL
Temperature:	30 °C

Macrolide antibiotics



Column:	YMC-Trairt C18 (12 nm, 1.9 µm) 50 x 2.0 mm ID
Part No.:	TA12SP9-0502PT
Eluent:	A) 20 mM K_2HPO_4 + 20 mM KH_2PO_4 (pH 7.9) B) acetonitrile
Gradient:	60% B (0.5 min); 60-70% B (0.5-1.5 min); 70% B (3.5 min)
Flow rate:	0.45 mL/min
Detection:	UV at 210 nm
Pressure:	520 bar
Injection:	1 µL
Temperature:	50 °C

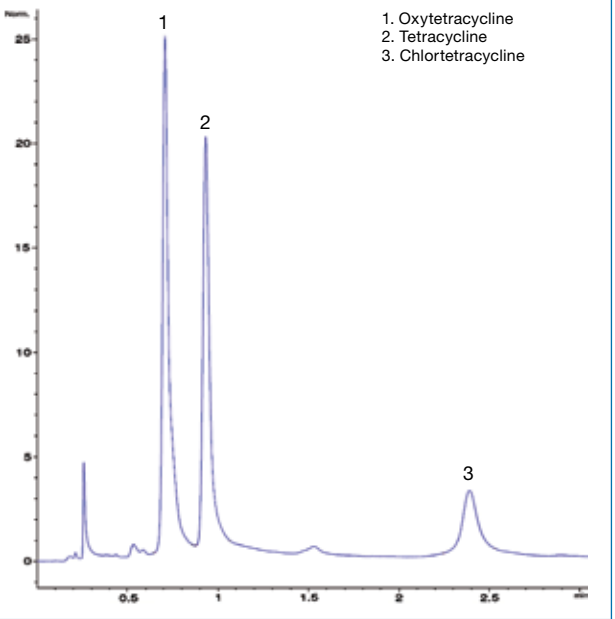
Sulpha drugs



Column:	YMC-Trairt C18 (12 nm, 1.9 µm) 50 x 2.0 mm ID
Part No.:	TA12SP9-0502PT
Eluent:	H_2O + formic acid (pH 2.5) / acetonitrile (75/25)
Flow rate:	0.75 mL/min
Detection:	UV at 280 nm
Pressure:	740 bar
Injection:	0.5 µL
Temperature:	50 °C

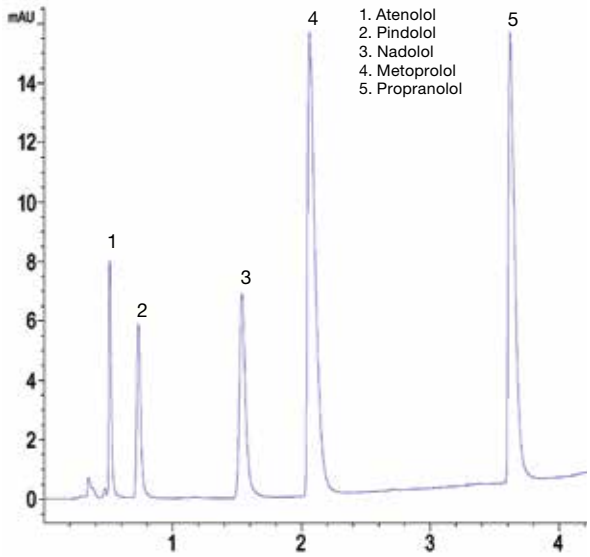
UHPLC

Tetracycline antibiotics



Column:	YMC-Trairt C18 (12 nm, 1.9 µm) 50 x 2.0 mm ID
Part No.:	TA12SP9-0502PT
Eluent:	5 mM CH_3COONH_4 / acetonitrile (87/13)
Flow rate:	0.65 mL/min
Detection:	UV at 280 nm
Pressure:	662 bar
Injection:	1 µL
Temperature:	40 °C

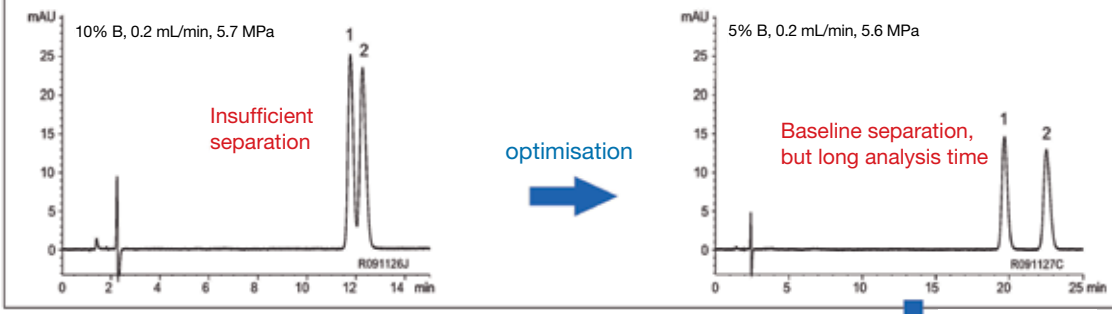
Betablockers



Column:	YMC-Trairt C18 (12 nm, 1.9 µm) 50 x 2.0 mm ID
Part No.:	TA12SP9-0502PT
Eluent:	A) 20 mM CH_3COONH_4 + ammonia (pH 9.0) B) acetonitrile
Gradient:	25% B (1.0 min); 75% B (1-6 min)
Flow rate:	0.35 mL/min
Detection:	UV at 254 nm
Pressure:	450 bar
Injection:	1 µL
Temperature:	40 °C

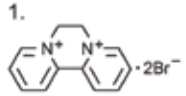
Fast LC for conventional HPLC*

YMC-Triart C18, 5 µm, 150 x 2.0 mm ID



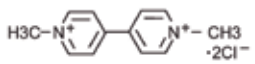
Down scaling

1.



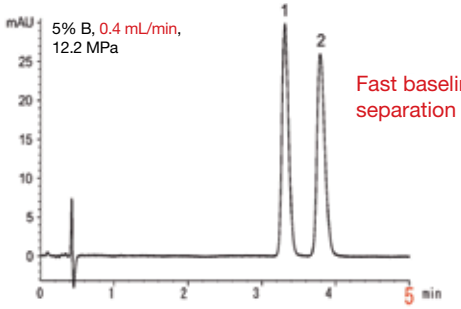
Diquat

2.



Paraquat

YMC-Triart C18, 3 µm, 50 x 2.0 mm ID



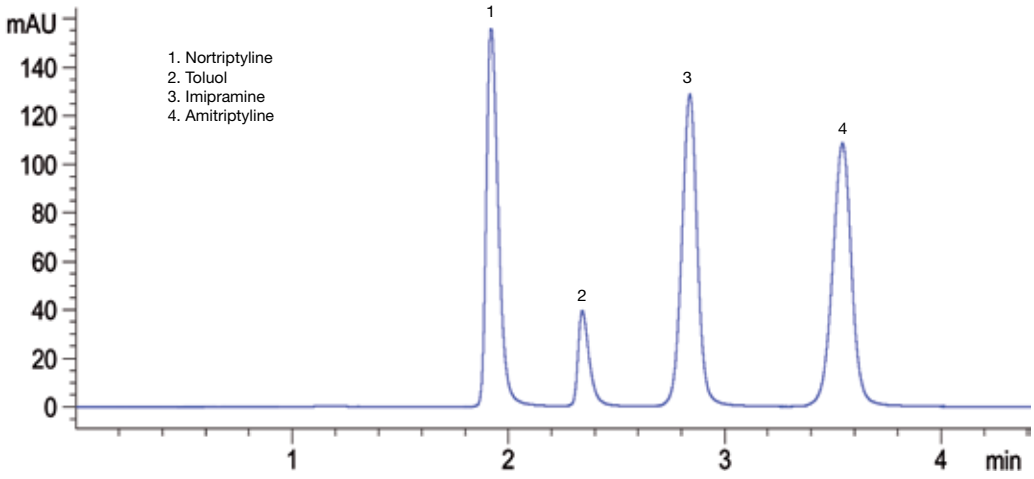
Eluent:	A) water / HFBA* (100/0.1) B) acetonitrile / HFBA* (100/0.1)
Temperature:	37 °C
Detection:	UV at 290 nm
Injection:	1 µL (0.1 mg/mL)

*heptafluorobutyric acid

* Application data by courtesy YMC Co., Ltd.

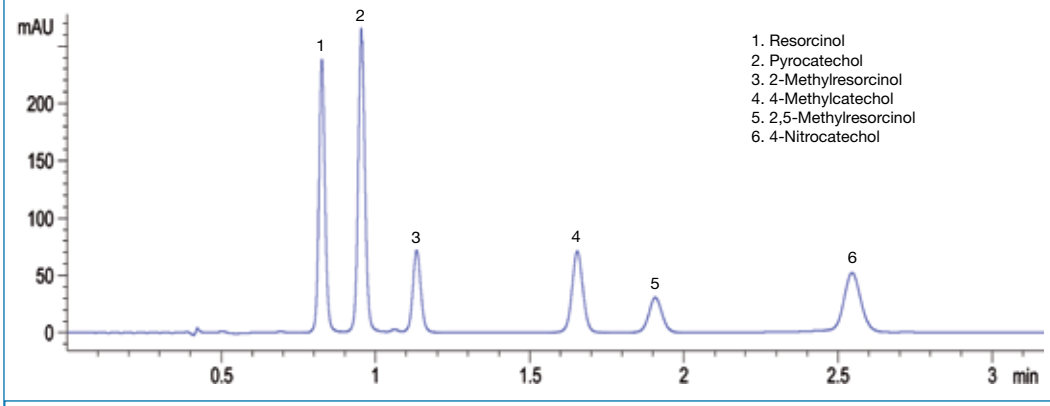
UHPLC

Antidepressants



Column: YMC-Triart Phenyl (1.9 µm) 100 x 2.0 mm ID
Part No.: TPH12SP9-1002PT
Eluent: methanol / 25 mM KH_2PO_4 (pH 6.0) (65/35)
Flow rate: 0.4 mL/min
Detection: UV at 254 nm
Injection: 2 µL
Temperature: 25 °C

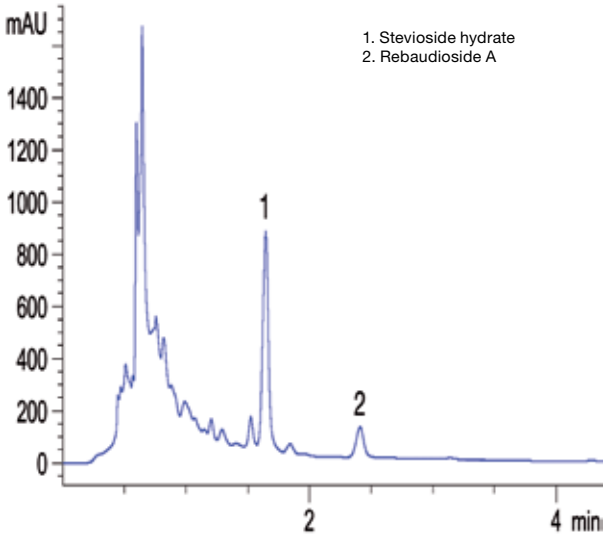
Resorcinol



Column: YMC-Triart PFP (1.9 µm) 100 x 2.0 mm ID
Part No.: TPF12SP9-1002PT
Eluent: water + 0.1% formic acid / acetonitrile + 0.1% formic acid (85/15)
Flow rate: 0.8 mL/min
Detection: UV at 270 nm
Injection: 0.5 µL
Temperature: 25 °C

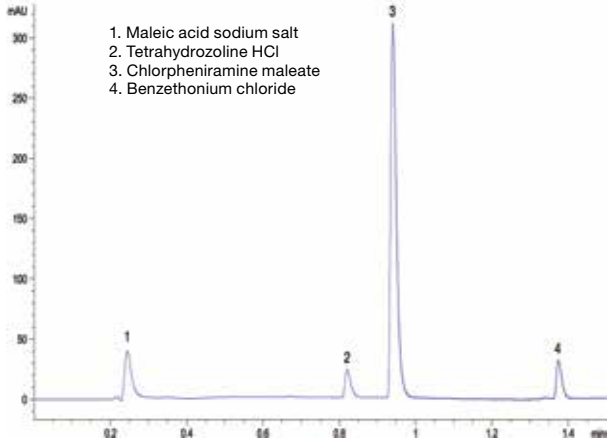
UHPLC

Stevia leaves



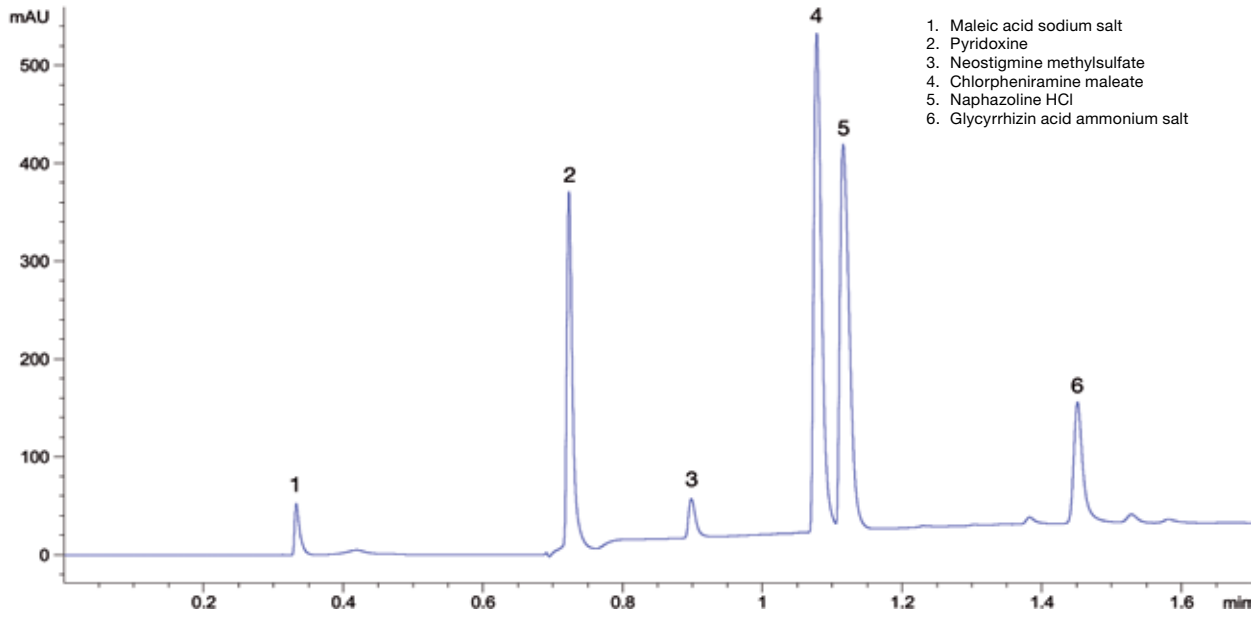
Column:	YMC-Triart Diol-HILIC (1.9 µm) 100 x 3.0 mm ID
Part No.:	TDH12SP9-1003PT
Eluent:	acetonitrile / water (85/15)
Flow rate:	1 mL/min
Detection:	UV at 200 nm
Injection:	2 µL
Temperature:	30 °C

Nasal spray



Column:	YMC-Triart C18 (1.9 µm, 12 nm) 50 x 2.0 mm ID
Part No.:	TA12SP9-0502PT
Eluent:	A) water + 0.05% TFA / B) methanol (50/50)
Gradient:	min A B 0 80 20 0.5 10 90 1.2 0 100
Flow rate:	0.6 mL/min
Detection:	UV at 260 nm
Injection:	0.2 µL
Temperature:	40 °C

Eye drop formulation



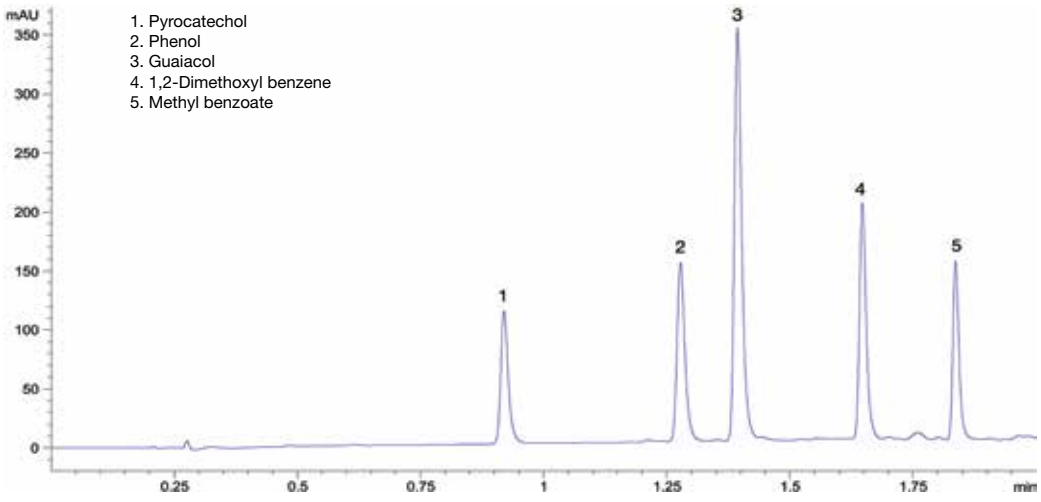
Column:	YMC-Triart C18 (1.9 µm, 12 nm) 50 x 2.0 mm ID
Part No.:	TA12SP9-0502PT
Eluent:	A water + 0.05% TFA B) acetonitrile
Flow rate:	0.6 mL/min
Detection:	UV at 265 nm
Injection:	0.5 µL
Temperature:	40 °C

Gradient:

min	A	B
0	100	0
1	50	50
1.5	50	50
1.7	10	90

UHPLC

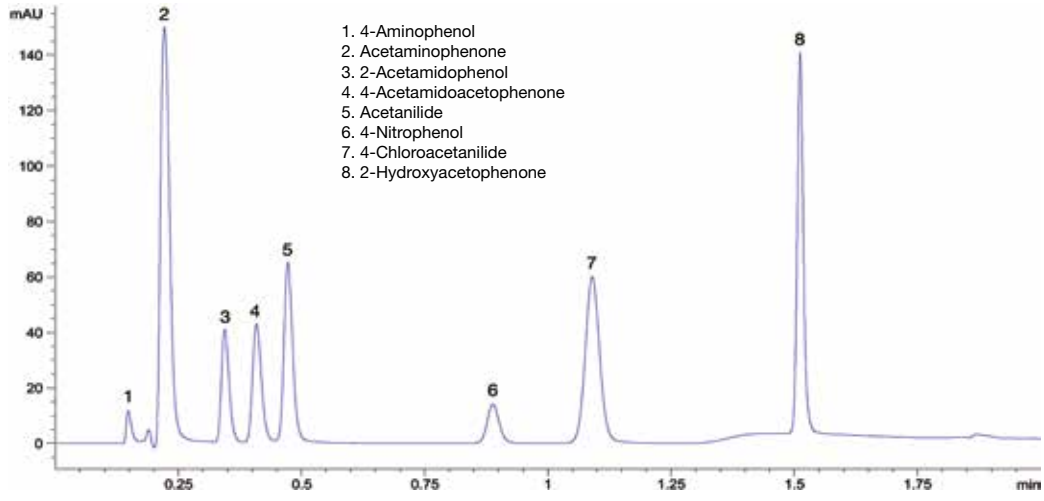
Guaiacol and impurities



1. Pyrocatechol
2. Phenol
3. Guaiacol
4. 1,2-Dimethoxyl benzene
5. Methyl benzoate

Column: YMC-Triart C18 (1.9 µm, 12 nm) 50 x 2.0 mm ID
Part No.: TA12SP9-0502PT
Eluent: water / acetonitrile (50/50)
Flow rate: 0.7 mL/min
Detection: UV at 254 nm
Injection: 0.5 µL
Temperature: 40 °C

Paracetamol



1. 4-Aminophenol
2. Acetaminophenone
3. 2-Acetamidophenol
4. 4-Acetamidoacetophenone
5. Acetanilide
6. 4-Nitrophenol
7. 4-Chloroacetanilide
8. 2-Hydroxyacetophenone

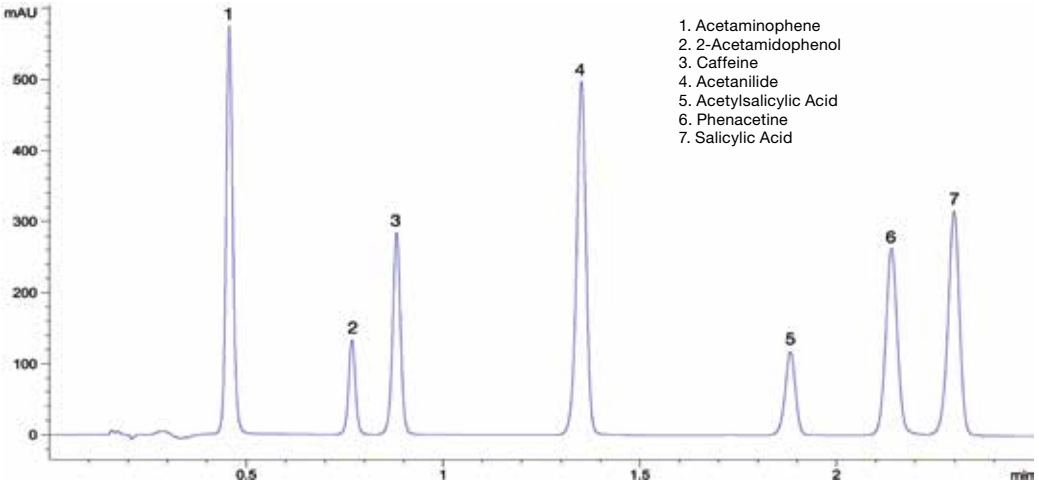
Column: YMC-Triart C18 (1.9 µm, 12 nm) 50 x 2.0 mm ID
Part No.: TA12SP9-0502PT
Eluent: A) water + formic acid (pH 2.5) / B) acetonitrile
Flow rate: 0.7 mL/min
Detection: UV at 254 nm
Injection: 0.5 µL
Temperature: 40 °C

Gradient:

min	A	B
0	70	30
1	70	30
1.5	20	80
2	20	80

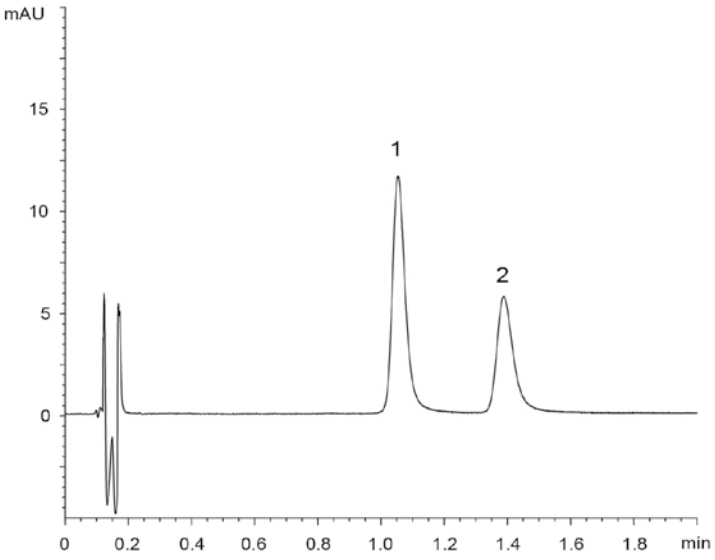
UHPLC

7 Analgesics

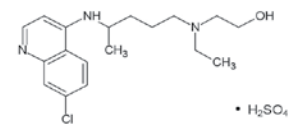


Column: YMC-Triart C18 (1.9 µm, 12 nm) 50 x 2.0 mm ID
Part No.: TA12SP9-0502PT
Eluent: water + formic acid (pH 2.5) / acetonitrile (50/50)
Flow rate: 0.8 mL/min
Detection: UV at 240 nm
Injection: 1 µL
Temperature: 40 °C

Hydroxychloroquine and chloroquine

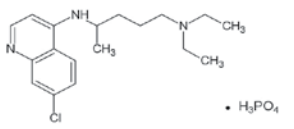


1



Hydroxychloroquine sulfate

2



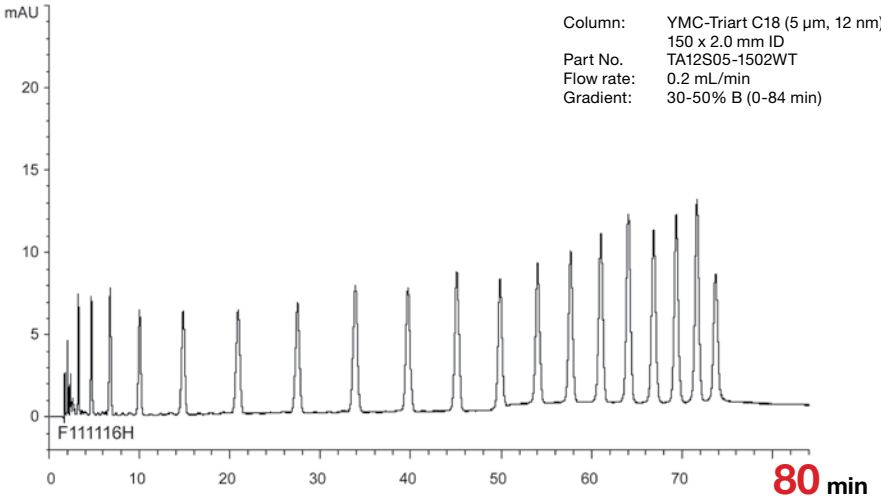
Chloroquine phosphate

Column: YMC-Triart C18 (1.9 µm, 12 nm) 50 x 2.0 mm ID
Part No.: TA12SP9-0502PT
Eluent: 20 mM HCOOH-$HCOONH_4$ (pH 4.3) / acetonitrile (90/10)
Flow rate: 1.0 mL/min
Detection: UV at 254 nm
Injection: 2 µL (10 µg/mL)
Temperature: 25 °C

UHPLC

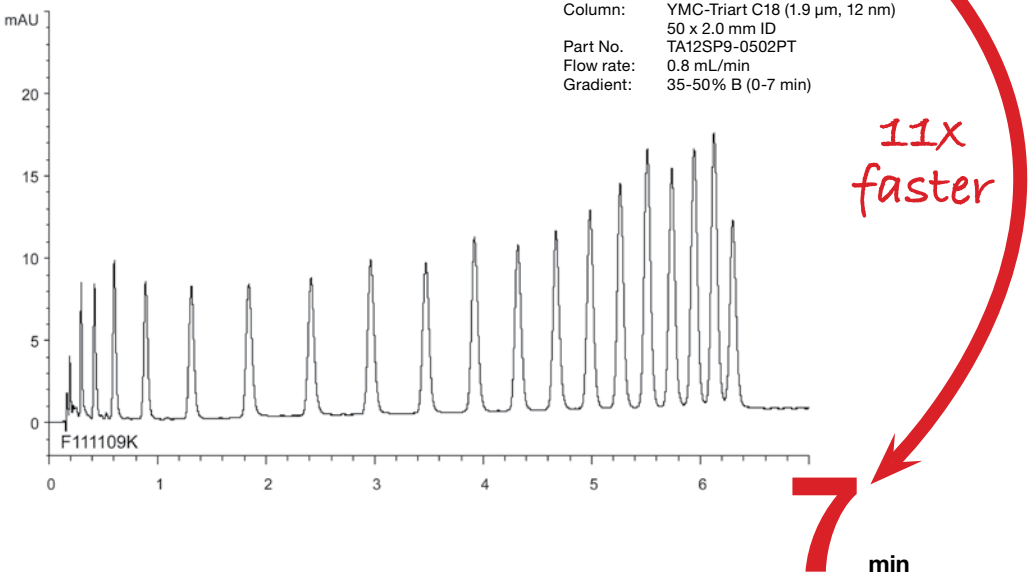
Oligonucleotides $d(T)_{2-20}$ method transfer from HPLC to UHPLC*

Conventional LC method



Column: YMC-Triart C18 (5 µm, 12 nm) 150 x 2.0 mm ID
Part No. TA12S05-1502WT
Flow rate: 0.2 mL/min
Gradient: 30-50% B (0-84 min)

UHPLC method



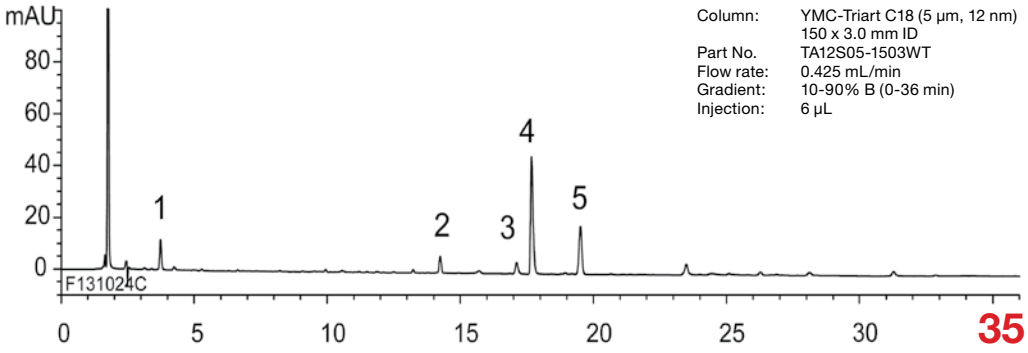
Column: YMC-Triart C18 (1.9 µm, 12 nm) 50 x 2.0 mm ID
Part No. TA12SP9-0502PT
Flow rate: 0.8 mL/min
Gradient: 35-50% B (0-7 min)

Eluent: A) 10 mM di-n-butylamine-acetic acid (pH 6.0)
B) methanol
Detection: UV at 269 nm
Injection: 1 µL (5 nmol/mL)
Temperature: 37 °C

UHPLC

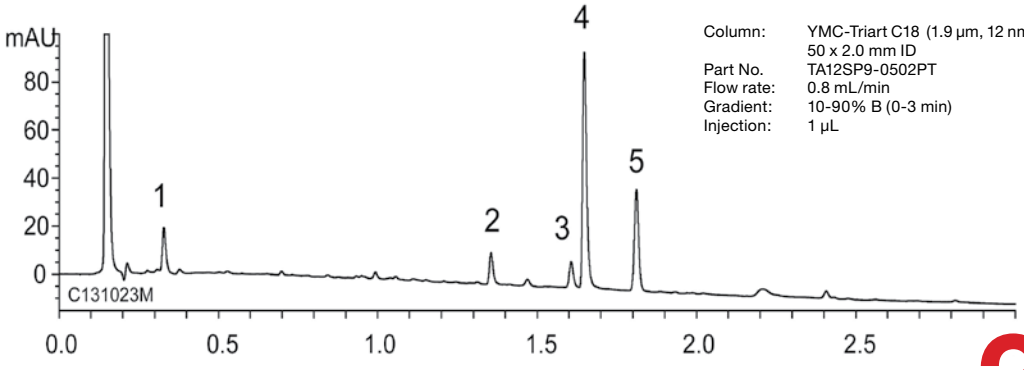
Duloxetine and its degradation products

(A) HPLC method



Column: YMC-Triart C18 (5 µm, 12 nm) 150 x 3.0 mm ID
Part No. TA12S05-1503WT
Flow rate: 0.425 mL/min
Gradient: 10-90% B (0-36 min)
Injection: 6 µL

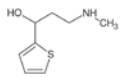
(B) UHPLC method



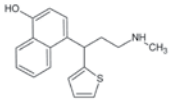
Column: YMC-Triart C18 (1.9 µm, 12 nm) 50 x 2.0 mm ID
Part No. TA12SP9-0502PT
Flow rate: 0.8 mL/min
Gradient: 10-90% B (0-3 min)
Injection: 1 µL

11x faster

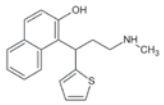
3 min

1. 

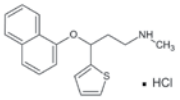
Amino alcohol
(3-Methylamino-1-thiophen-2-yl-propan-1-ol)

2. 

Para isomer
(4-(3-Methylamino-1-thiophen-2-yl-propyl)-naphthalen-1-ol))

3. 

Ortho isomer
(2-(3-Methylamino-1-thiophen-2-yl-propyl)-naphthalen-1-ol)

4. 

Duloxetine hydrochloride

5. 

α-Naphthol

Eluent: A) 10 mM CH_3COONH_4 (pH 6.0)
B) acetonitrile
Detection: UV at 230 nm
Temperature: 30 °C
Sample: Oxidative degradation products of duloxetine hydrochloride*

* Sample preparation was performed as described by Veera Reddy. Arava et al. Der Pharma Chemica, 2012 4 (4): 1735-1741

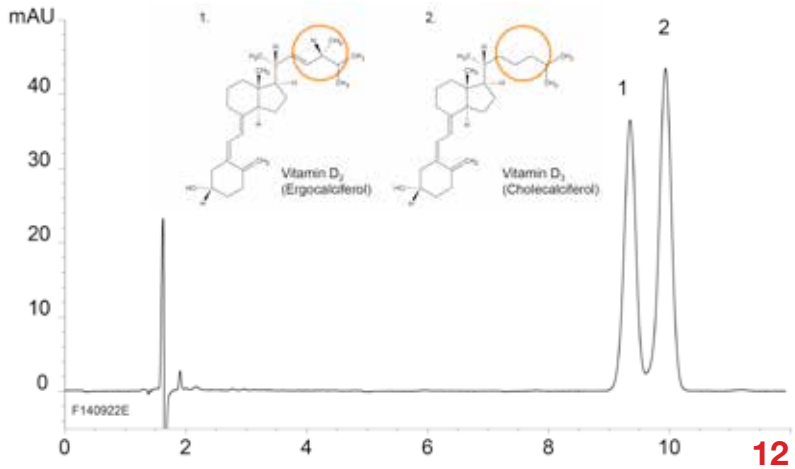
* Application data by courtesy YMC Co., Ltd.

YMC-Triart C18 ExRS

Structural analogs*

HPLC method
5 µm; 150 x 3 mm ID

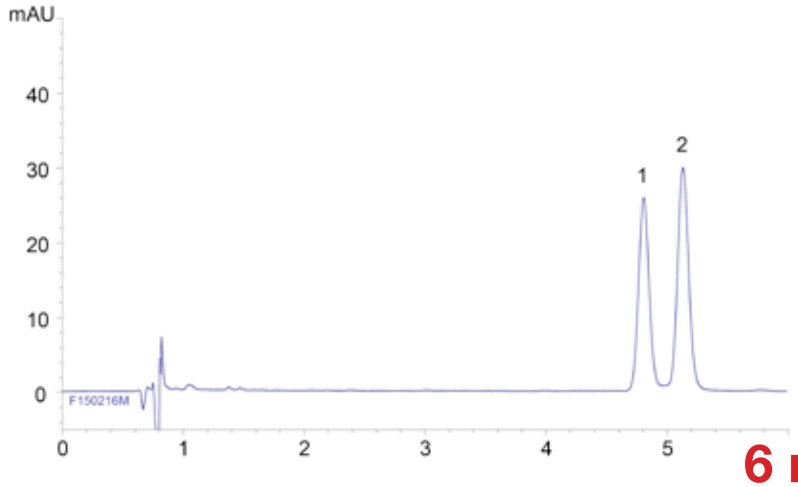
0.425 mL/min



12 min

UHPLC method
1.9 µm; 75 x 2.1 mm ID

0.21 mL/min



-50%

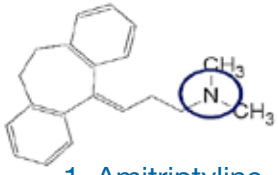
6 min

Part No.:	TAR08S05-1503PTH / TAR08SP9-L5Q1PT
Eluent:	THF / acetonitrile (10/90)
Flow rate:	0.425 ml/min
Detection:	UV at 265 nm
Temperature:	30 °C

YMC-Triart C18 ExRS

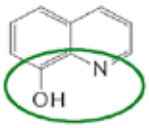
High hydrophobicity & high steric recognition ability*

Basic Compound



1. Amitriptyline

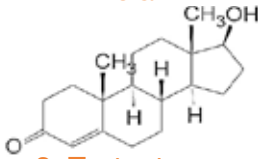
Coordination Compound



2. 8-Quinolinol

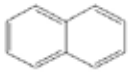
Neutral Compounds

Polar



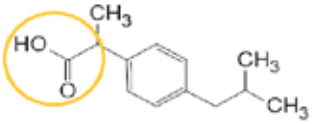
3. Testosterone

π-π interaction



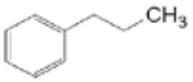
4. Naphthalene

Acidic Compound



5. Ibuprofen

Hydrophobic



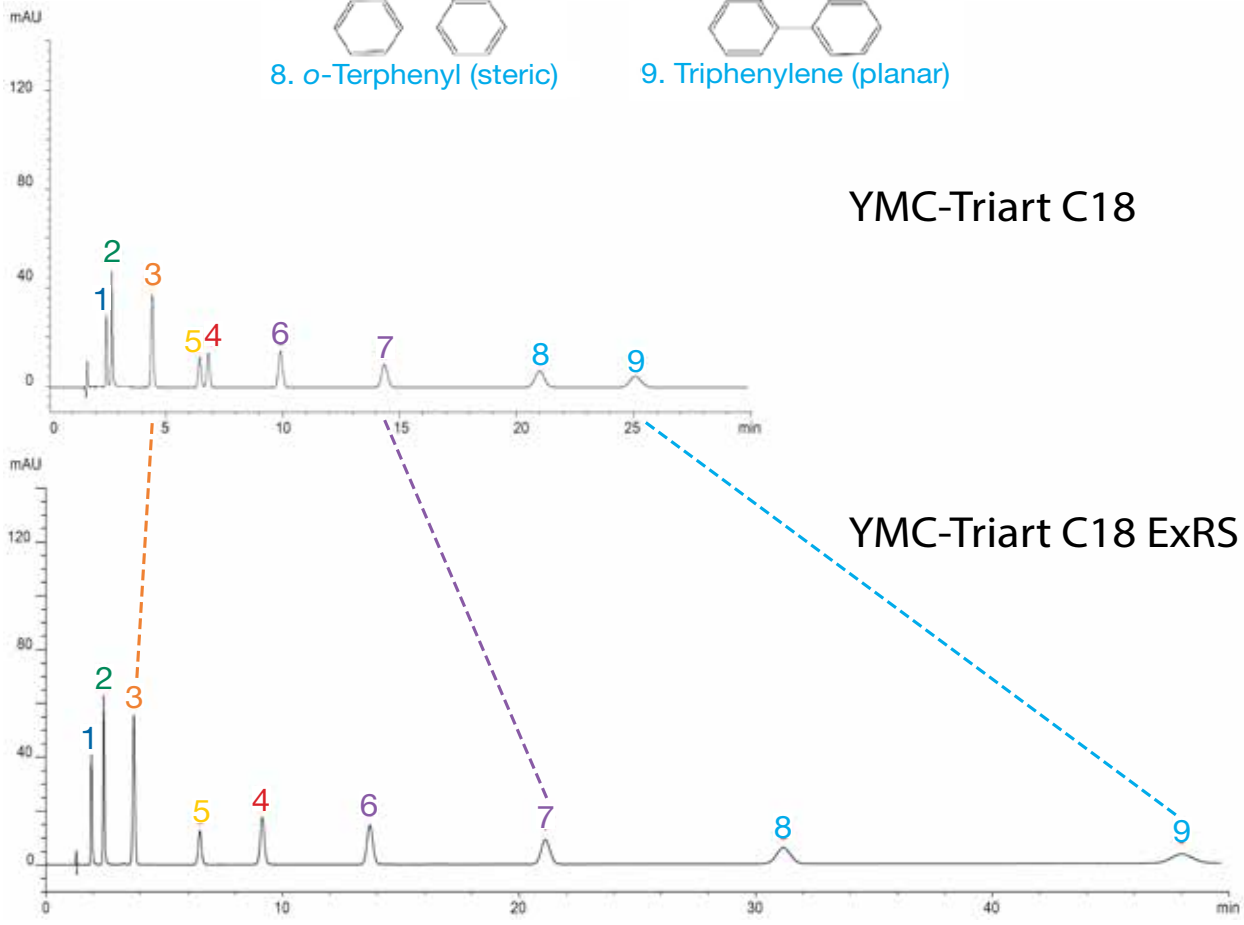
6. *n*-Propylbenzene

7. *n*-Butylbenzene

Steric Cognitive Ability

8. *o*-Terphenyl (steric)

9. Triphenylene (planar)



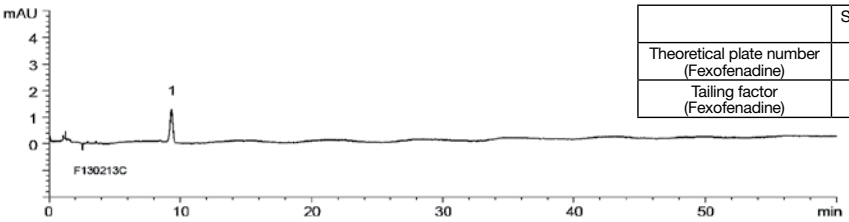
Column:	5 µm, 150 x 3.0 ID
Part No.:	TA12S05-1503PTH / TAR08S05-1503PTH
Eluent:	20 mM $HCOOH-HCOONH_4$ (pH 4.3) / acetonitrile (90/10)
Flow rate:	1.0 mL/min
Detection:	UV at 254 nm
Injection:	2 µL (10 µg/mL)
Temperature:	25 °C

* Application data by courtesy YMC Co., Ltd.

YMC-Triart Phenyl

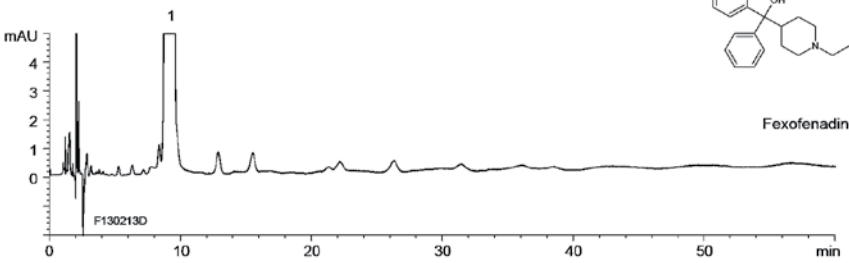
Fexofenadine hydrochloride (Japanese Pharmacopoeia)*

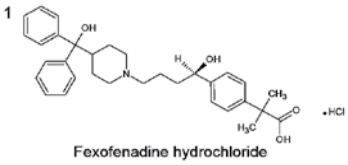
A) Standard solution *1 (0.001 mg/mL fexofenadine hydrochloride)



	System suitability requirement	result
Theoretical plate number (Fexofenadine)	≥ 8000	10100
Tailing factor (Fexofenadine)	≤ 2.0	1.00

B) Sample solution *1 (1 mg/mL fexofenadine hydrochloride)





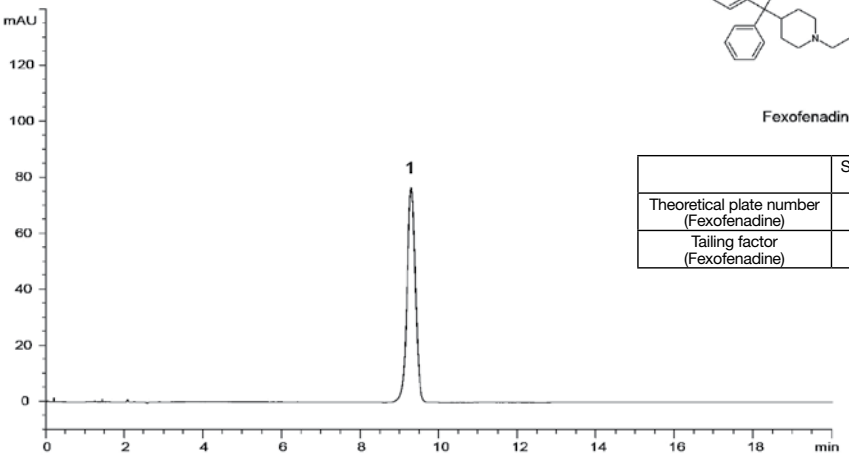
Fexofenadine hydrochloride

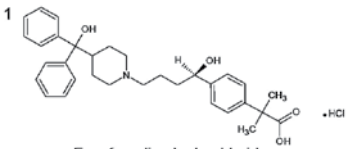
Column: YMC-Triart Phenyl (5 µm, 12 nm) 250 x 4.6 mm ID
Part No.: TPH12S05-2546WT
Eluent: acetonitrile / buffer *2 / triethylamine (350/650/3)
*2 Dissolve 7.51 g of NaH_2PO_4-$2H_2O$ and 0.96 g of $NaClO_4$-H_2O in 1000 mL water, adjust pH 2.0 with H_3PO_4
Flow rate: 2.0 mL/min (adjust the flow rate so that the retention time of fexofenadine is about 9 min)
Detection: UV at 220 nm
Injection: 20 µL
Temperature: 25 °C
(The Japanese Pharmacopoeia 16th; related substances)

*1 *All standard and sample solutions were prepared from fexofenadine hydrochloride supplied as a reagent for laboratory use.*

Fexofenadine hydrochloride (Japanese Pharmacopoeia)*

Standard solution *1 (0.06 mg/mL fexofenadine hydrochloride)





Fexofenadine hydrochloride

	System suitability requirement	result
Theoretical plate number (Fexofenadine)	≥ 8000	9500
Tailing factor (Fexofenadine)	≤ 2.0	0.98

Column: YMC-Triart Phenyl (5 µm, 12 nm) 250 x 4.6 mm ID
Part No.: TPH12S05-2546WT
Eluent: acetonitrile / buffer *2 / triethylamine (350/650/3)
*2 Dissolve 7.51 g of NaH_2PO_4-$2H_2O$ and 0.96 g of $NaClO_4$-H_2O in 1000 mL water, adjust pH 2.0 with H_3PO_4
Flow rate: 2.0 mL/min (adjust the flow rate so that the retention time of fexofenadine is about 9 min)
Detection: UV at 220 nm
Injection: 20 µL
Temperature: 25 °C
(The Japanese Pharmacopoeia 16th; assay)

*1 *Standard solutions was prepared from fexofenadine hydrochloride supplied as a reagent for laboratory use.*

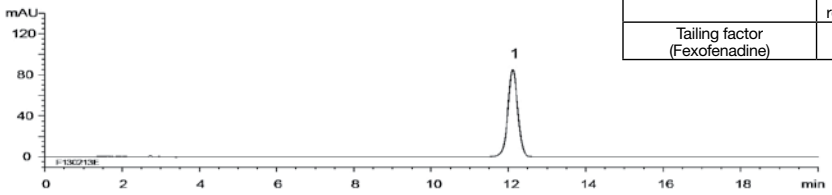
YMC-Triart Phenyl

Fexofenadine hydrochloride (US Pharmacopoeia)*

A) Assay preparation *1 (assay), Reference solution *1 (related compounds)

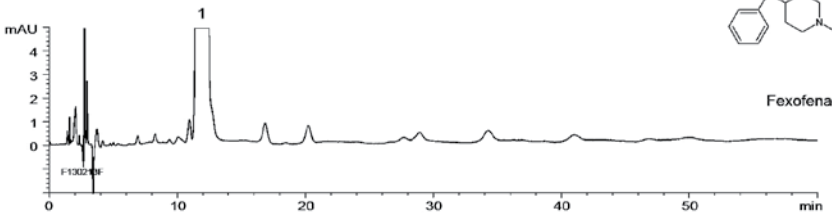
(0.06 mg/mL fexofenadine hydrochloride)

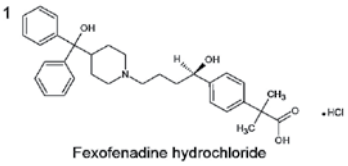
	System suitability requirement (assay)	result
Tailing factor (Fexofenadine)	≤ 2.0	1.00



B) Test solution *1 (related compounds)

(1 mg/mL fexofenadine hydrochloride)





Fexofenadine hydrochloride

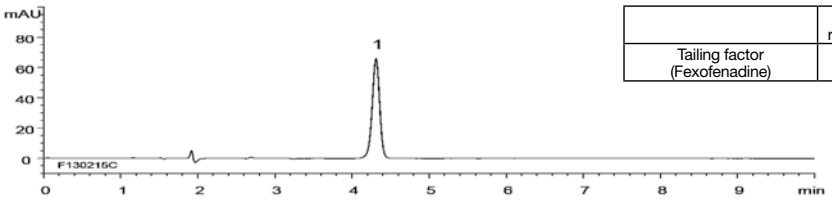
Column: YMC-Triart Phenyl (5 µm, 12 nm) 250 x 4.6 mm ID
Part No.: TPH12S05-2546WT
Eluent: acetonitrile / buffer *2 / triethylamine (350/650/3)
*2 Dissolve 7.51 g of NaH_2PO_4-$2H_2O$ and 0.96 g of $NaClO_4$-H_2O in 1000 mL water, adjust pH 2.0 with H_3PO_4
Flow rate: 1.5 mL/min
Detection: UV at 220 nm
Injection: 20 µL
Temperature: 25 °C
(The United States Pharmacopoeia 36th; assay, related compounds)

1 All standard and sample solutions were prepared from fexofenadine hydrochloride supplied as a reagent for laboratory use.

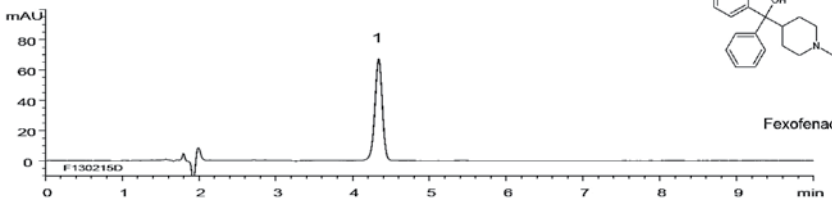
Fexofenadine hydrochloride (US Pharmacopoeia)*

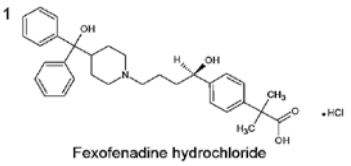
A) Standard solution *1 (0.015 mg/mL fexofenadine hydrochloride)

	System suitability requirement (assay)	result
Tailing factor (Fexofenadine)	≤ 2.0	0.95



B) Sample solution *2 (0.018 mg/mL fexofenadine hydrochloride)





Fexofenadine hydrochloride

Column: YMC-Triart Phenyl (5 µm, 12 nm) 250 x 4.6 mm ID
Part No.: TPH12S05-2546WT
Eluent: acetonitrile / buffer *3 (9/16)
*3 Add 15 mL of acetonitrile/triethylamine (1/1) to 1000 mL of acetic acid/water (17/9983), adjust pH 5.25 with H_3PO_4
Flow rate: 1.5 mL/min
Detection: UV at 220 nm
Injection: 20 µL
Temperature: 35 °C
(The United States Pharmacopoeia 36th; assay)

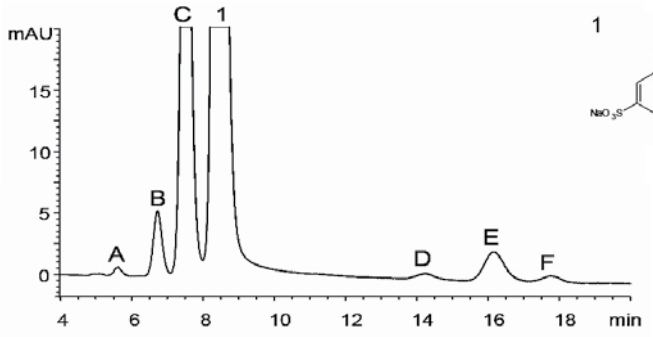
1 Standard solution was prepared from fexofenadine hydrochloride supplied as a reagent for laboratory use.
2 Sample solution was prepared from fexofenadine hydrochloride tablets.

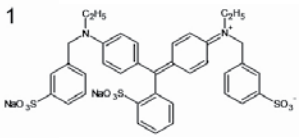
* Application data by courtesy YMC Co., Ltd.

YMC-Triart Phenyl

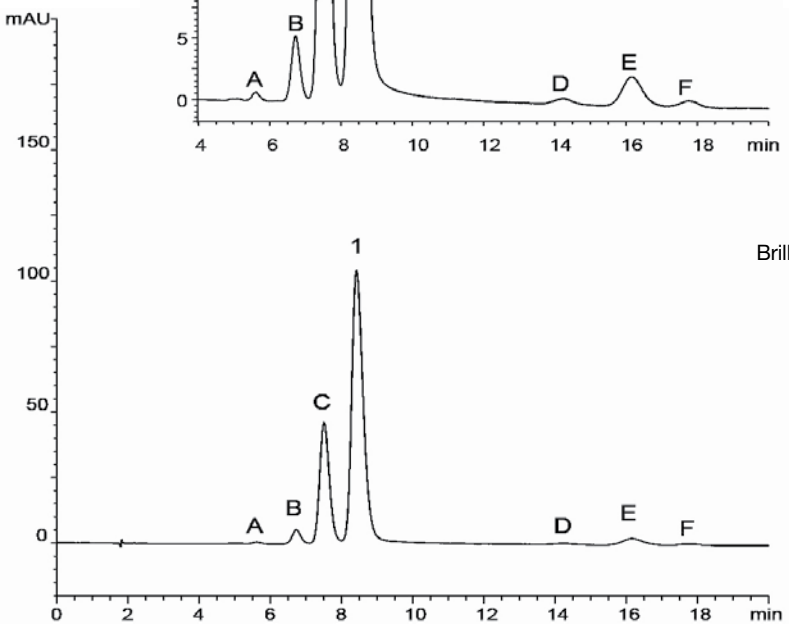
Analysis of coal tar dye (Brilliant blue FCF) and its impurities*

Enlarged chromatogram





Brilliant blue FCF

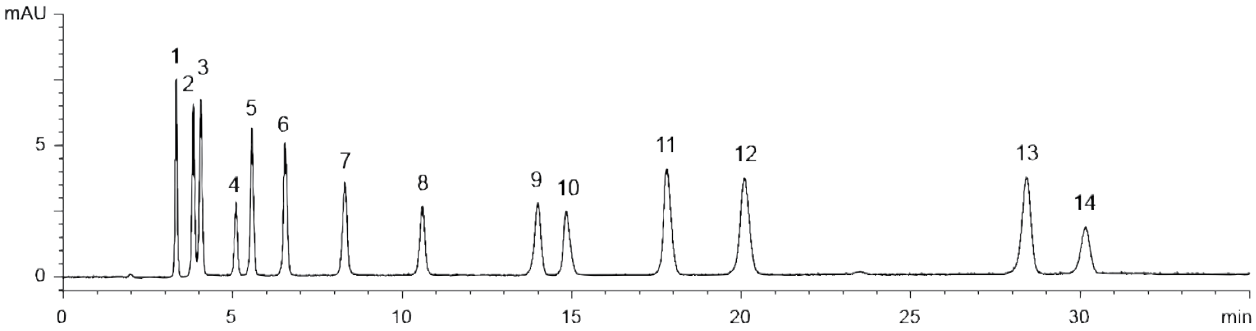


A-E:
Impurities in
Brilliant blue FCF reagent

Column:	YMC-Triart Phenyl (5 µm, 12 nm) 150 x 3.0 mm ID
Part No.:	TPH12S05-1503WT
Eluent:	water + 0.1% phosphoric acid / methanol (55/45)
Flow rate:	0.425 mL/min
Detection:	UV at 630 nm
Injection:	2.0 µL
Temperature:	40 °C

YMC-Triart PFP

Catecholamines, serotonin, and their precursors and metabolites*



1 Noradrenaline hydrochloride (NA) (Norepinephrine hydrochloride)

2 3,4-Dihydroxymandelic acid (DOMA)

3 3,4-Dihydroxyphenylalanine (DOPA)

4 Tyrosine (Tyr)

5 Adrenaline hydrochloride (A) (Epinephrine hydrochloride)

6 Dopamine hydrochloride (DA)

7 Vanillylmandelic acid (VMA)

8 3-Methoxy-4-hydroxyphenylglycol (MHPG)

9 3,4-Dihydroxyphenylacetic acid (DOPAC)

10 3-Methoxytyramine hydrochloride (3MT)

11 Serotonin hydrochloride (5-Hydroxytryptamine hydrochloride, 5HT)

12 Tryptophan (Trp)

13 5-Hydroxyindoleacetic acid (5HIAA)

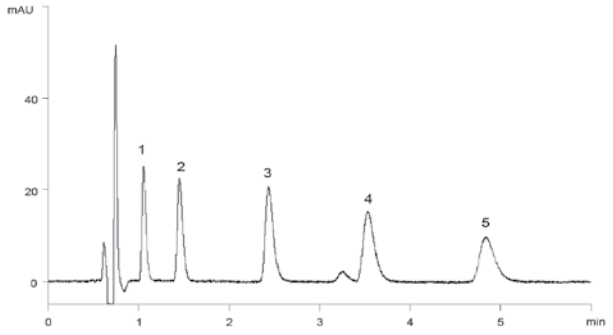
14 Homovanillic acid (HVA)

Column:	YMC-Triart PFP (3 µm, 12 nm) 150 x 3.0 mm ID
Part No.:	TPF12S03-1503WT
Eluent:	A) 10 mM formic acid B) methanol containing 10 mM formic acid 0-20% B (0-30 min), 20% B (30-35 min)
Flow rate:	0.425 mL/min
Detection:	UV at 280 nm
Injection:	4 µL (5 µg/mL)
Temperature:	25 °C

* Application data by courtesy YMC Co., Ltd.

Pharmaceuticals

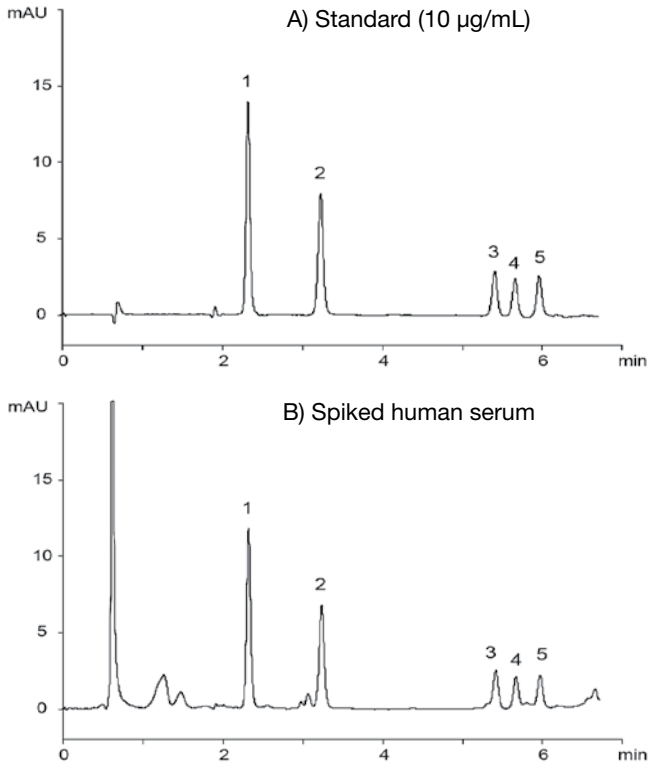
Separation of alkaloids*

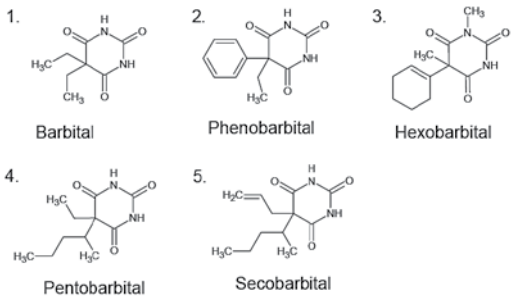


1. Scopolamine
2. Atropine
3. Cinchonine
4. Quinine
5. Dihydroquinine

Column:	YMC-Triart C18 (5 µm, 12 nm) 50 x 2.0 mm ID
Part No.:	TA12S05-0502WT
Eluent:	20 mM CH_3COOH-CH_3COONH_4 (pH 4.9) / acetonitrile (80/20)
Flow rate:	0.2 mL/min
Temperature:	40 °C
Detection:	UV at 220 nm
Injection:	1 µL (0.02-0.1 mg/mL)

Barbiturates in human serum*





Solid-phase extraction method
YMC Dispo SPE C18 100 mg/1mL

Condition
2 mL methanol
2 mL water

Load
500 µL spiked human serum solution (each 10 µg)

Elute
500 µL methanol/water (85/15)

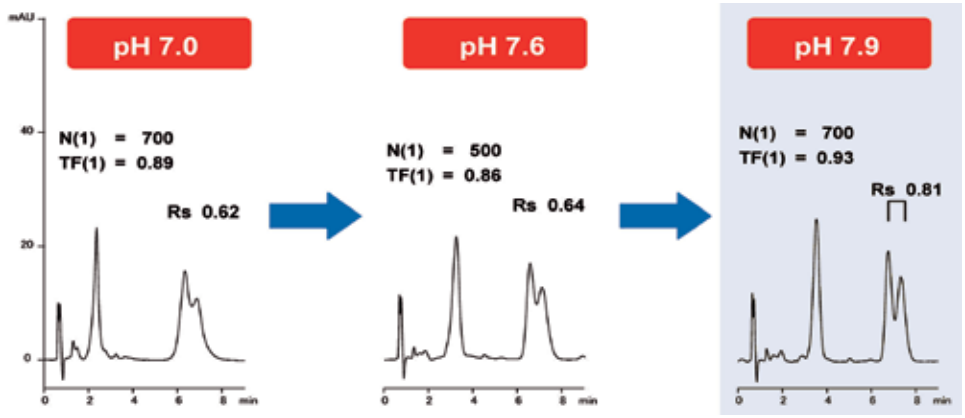
Dilute
500 µL 20 mM ammonium formate buffer (pH 9.5)

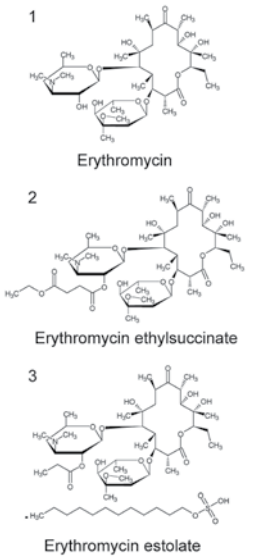
Column:	YMC-Triart C18 (5 µm, 12 nm) 50 x 2.0 mm ID
Part No.:	TA12S05-0502WT
Eluent:	A) 20 mM $HCOONH_4$-NH_3 (pH 9.5) B) methanol
Gradient:	0-90% B (0-7 min)
Flow rate:	0.2 mL/min
Temperature:	25 °C
Detection:	UV at 240 nm
Injection:	1 µL

Pharmaceuticals

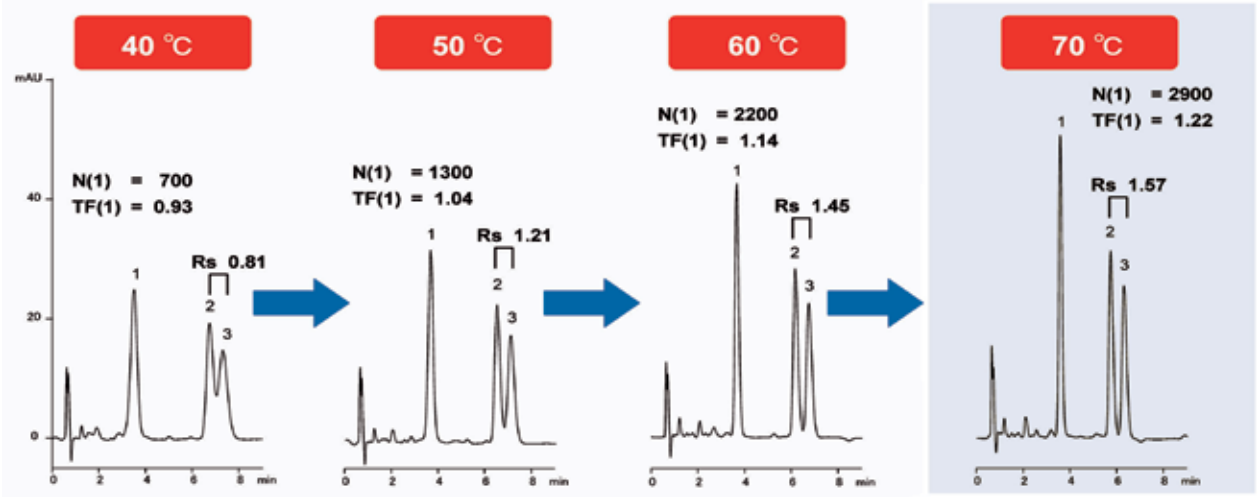
Erythromycin at elevated pH and temperature*

1. Optimisation of pH

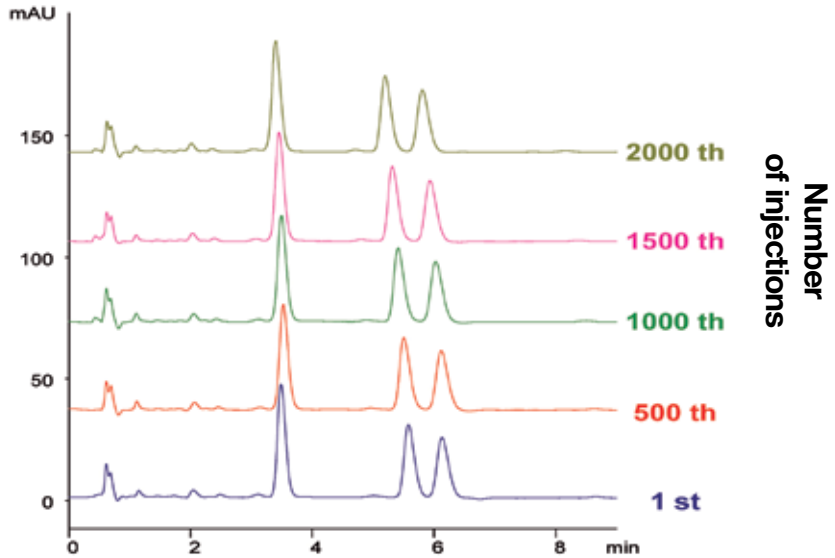




2. Optimisation of temperature (pH 7.9)



3. Stability test: pH 7.9, 70 °C

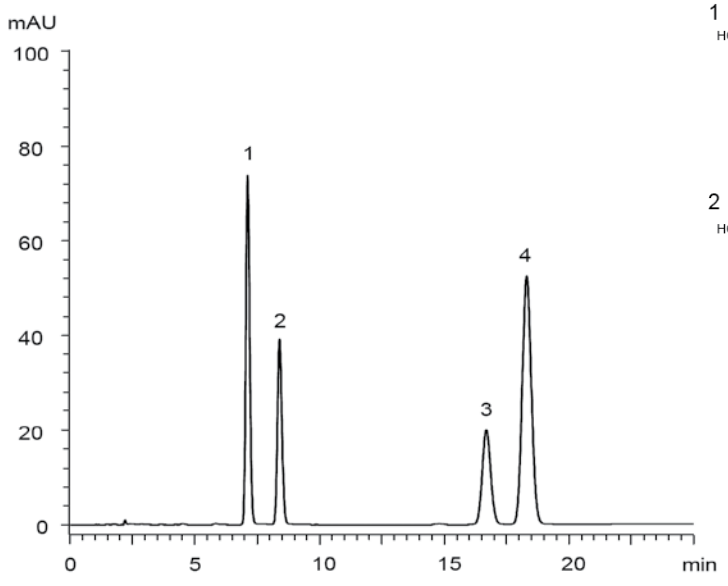


Column:	YMC-Triart C18 (3 µm, 12 nm) 50 x 2.0 mm ID
Part No.:	TA12S03-0502WT
Eluent:	20 mM KH_2PO_4-K_2HPO_4 / acetonitrile / methanol (40/45/15)
Flow rate:	0.2 mL/min
Detection:	UV at 210 nm

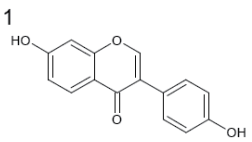
* Application data by courtesy YMC Co., Ltd.

Pharmaceuticals

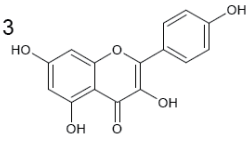
Separation of flavonoids*



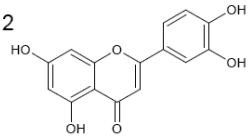
1 Daidzein



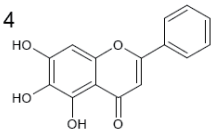
3 Kaempferol



2 Luteolin

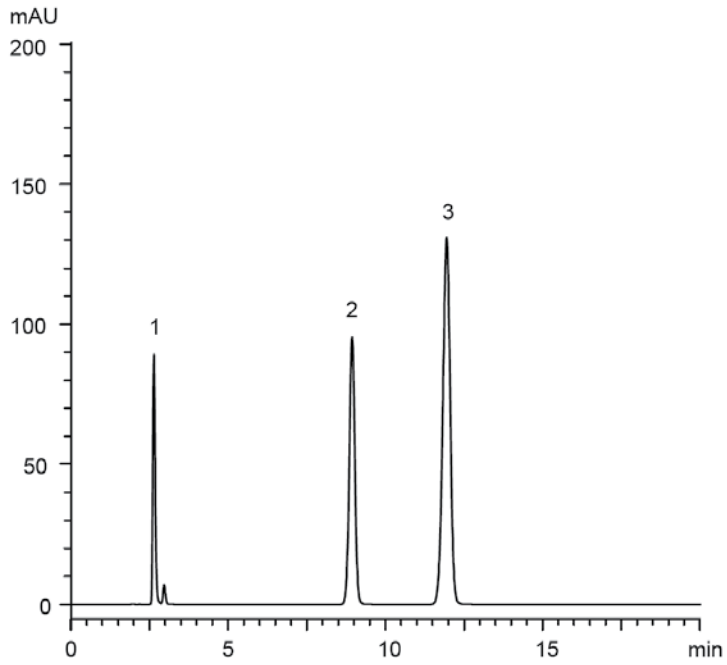


4 Baicalein

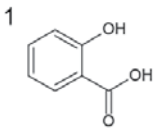


Column:	YMC-Triart C18 (5 µm, 12 nm) 150 x 3.0 mm ID
Part No.:	TA12S05-1503WT
Eluent:	acetonitrile / 10 mM H_3PO_4 (30/70)
Flow rate:	0.425 mL/min
Temperature:	37 °C
Detection:	UV at 280 nm
Injection:	2 µL (50 µg/mL)

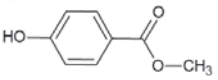
Separation of aromatic carboxylic acids*



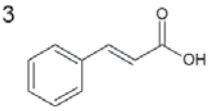
1 Salicylic acid



2 Methyl *p*-hydroxybenzoate (I.S.)



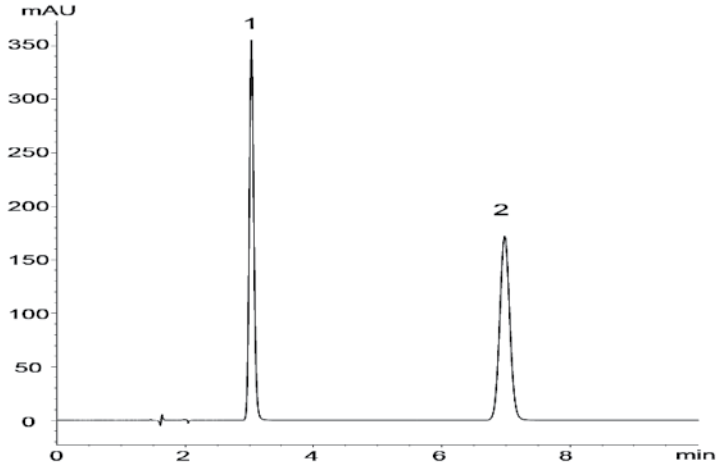
3 *trans*-Cinnamic acid



Column:	YMC-Triart C18 (5 µm, 12 nm) 150 x 3.0 mm ID
Part No.:	TA12S05-1503WT
Eluent:	10 mM CH_3COOH-CH_3COONH_4 (pH 4.2) / acetonitrile (75/25)
Flow rate:	0.425 mL/min
Temperature:	40 °C
Detection:	UV at 254 nm
Injection:	4 µL (0.02 ~ 0.3 mg/mL)

Pharmaceuticals

Aciclovir syrup and injection*

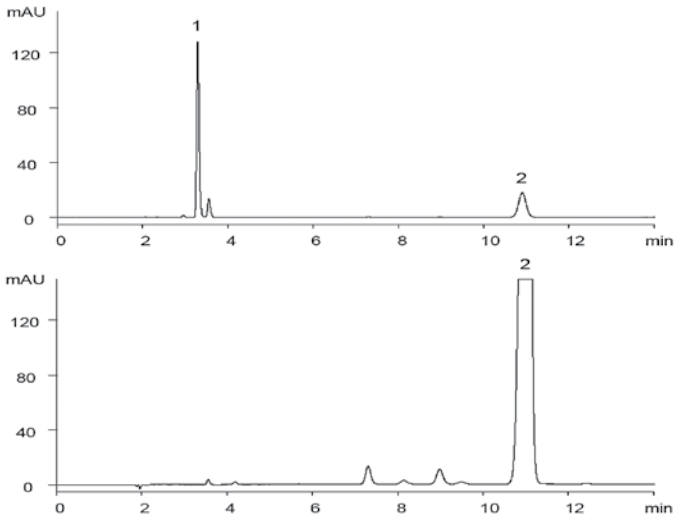


1. Nicotinic acid

2. Aciclovir

Column:	YMC-Triart C18 (5 µm, 12 nm) 150 x 4.6 mm ID
Part No.:	TA12S05-1546WT
Eluent:	phosphate buffer* / methanol (95/5) *Dissolve 1.45 g of H_3PO_4 and 25 mL of 1 mol/l CH_3COOH in water to make 900 mL → adjust pH 2.5 by 1 mol/l NaOH → add water to make 1000 mL
Flow rate:	1.0 mL/min
Temperature:	25 °C
Detection:	UV at 254 nm
Injection:	20 µL (0.05 mg/mL, 0.032 mg/mL)

Clindamycin hydrochloride*

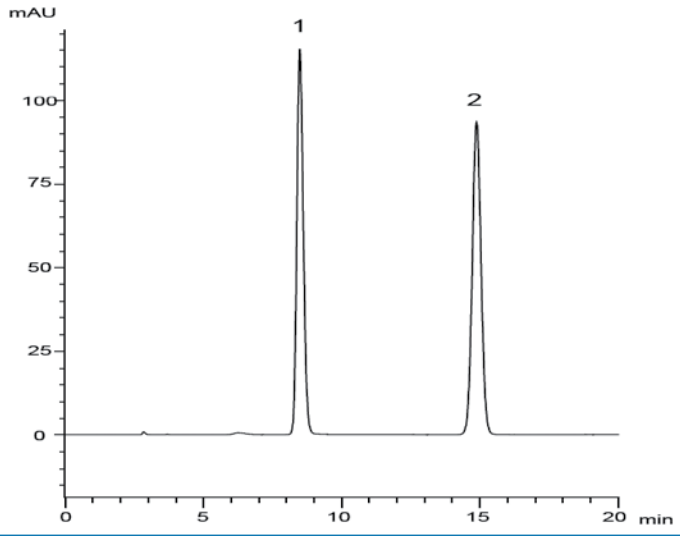


1. Lincomycin hydrochloride

2. Clindamycin hydrochloride

Column:	YMC-Triart C18 (5 µm, 12 nm) 250 x 4.6 mm ID
Part No.:	TA12S05-2546WT
Eluent:	50 mM KH_2PO_4 (pH 7.5 adjusted by 8 M KOH) / acetonitrile (55/45)
Flow rate:	1.0 mL/min
Temperature:	25 °C
Detection:	UV at 210 nm
Injection:	10 µL

Analysis of amlodipine besilate*



1. Amlodipine besilate

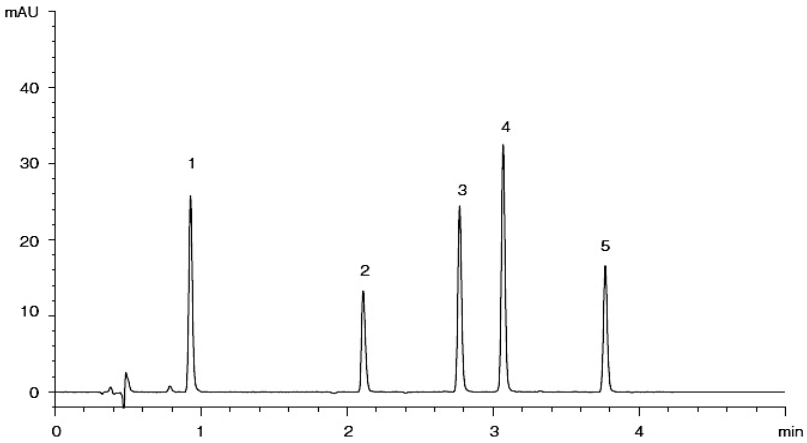
2. Isobutyl *p*-hydroxybenzoate

Column:	YMC-Triart C18 (5 µm, 12 nm) 150 x 3.0 mm ID
Part No.:	TA12S05-1503WT
Eluent:	10 mM CH_3COOH-CH_3COONH_4 (pH 4.2) / acetonitrile (75/25)
Flow rate:	0.425 mL/min
Temperature:	40 °C
Detection:	UV at 254 nm
Injection:	4 µL (0.02 ~ 0.3 mg/mL)

* Application data by courtesy YMC Co., Ltd.

Pharmaceuticals

Basic drugs*

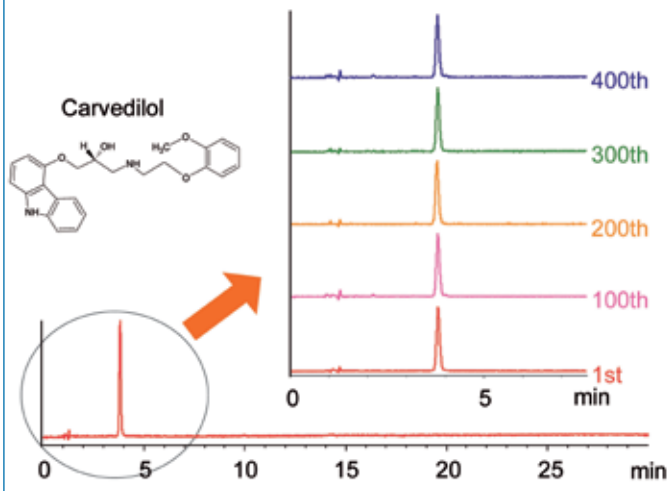


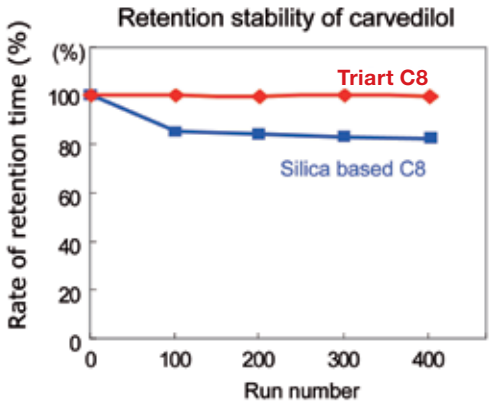
1. Hydrochlorothiazide
2. Amlodipine besilate
3. Valsartan
4. Atorvastatin calcium hydrate
5. Candesartan cilexetil

YMC-Triart C8

Column:	YMC-Triart C8 (3 µm, 12 nm), 50 x 2.0 mm ID	Flow rate:	0.4 mL/min
Part No.:	TO12S03-0502WT	Temperature:	30 °C
Eluent:	A) water / formic acid (100/0.1)	Detection:	UV at 254 nm
	B) acetonitrile / formic acid (100/0.1)	Injection:	2 µL (10-20 µg/mL)
	10-90% B (0-5 min), 90% B (5-7 min)		

Sequential analysis of Carvedilol*





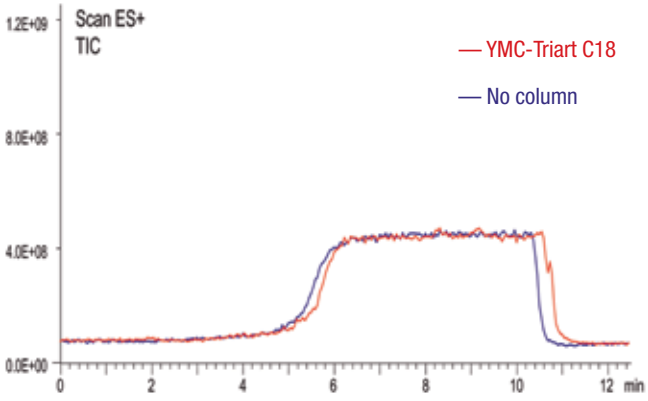
YMC-Triart C8

Column:	YMC-Triart C8 (5 µm, 150 x 2.0 mm ID)
Part No.:	TO12S05-1502WT
Eluent:	phosphate buffer (pH 2.0)* / acetonitrile (65/35)
	*Dissolve 2.72 g of KH_2PO_4 in 900 mL water, adjust pH 2.0 with H_3PO_4 and add water to make 1000 mL
Flow rate:	0.28 mL/min (adjust the flow rate so that the retention time of carvedilol is about 4 min)
Temperature:	55 °C
Detection:	UV at 240 nm

No change in retention time is observed even under a high pH and at an elevated temperature.

LC/MS

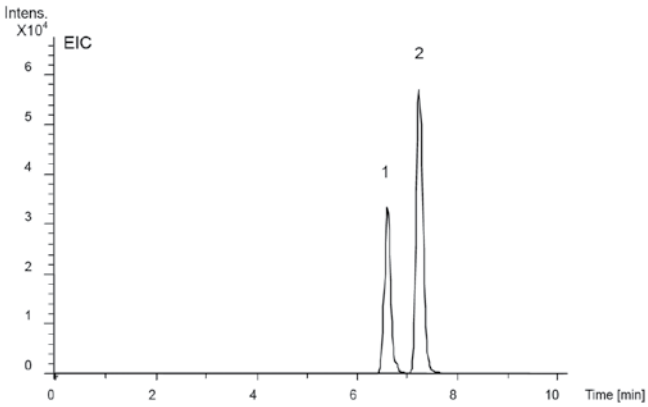
LC/MS compatibility*



Column:	5 µm, 50 x 2.0 mm ID
Part No.:	TA12S05-0502WT
Eluent:	A) water / formic acid (100/0.1) B) acetonitrile / formic acid (100/0.1) 5% B (0-1 min), 5-100% B (1-5 min), 100% B (5-10 min), 100-5% B (10-10.1 min), 5% B (10.1-12.5 min)
Flow rate:	0.4 mL/min
Temperature:	40 °C
Detection:	ESI positive, TIC (Mass Range: 50-1000)

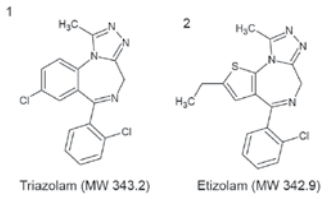
Column bleeding, caused by the fragments of stationary phase, is the main reason for background noise and restrictions on detection limits. No bleed is observed in the test of total ion current (TIC) measured by LC/MS with blank or with YMC-Triart C18. So in terms of the signal/noise ratio (S/N ratio), YMC-Triart C18 can be expect to not only reduce the background noise but to also increase the sensitivity of the analysis.

LC/MS analysis of benzodiazepine derivates



Peak 1: 100ng_mL_RB4_01_2291.d: EIC 343.051±0.01+All MS
Peak 2: 100ng_mL_RB4_01_2291.d: EIC 343.078±0.01+All MS

Courtesy of J. Watanabe, Bruker Daltonics K. K.

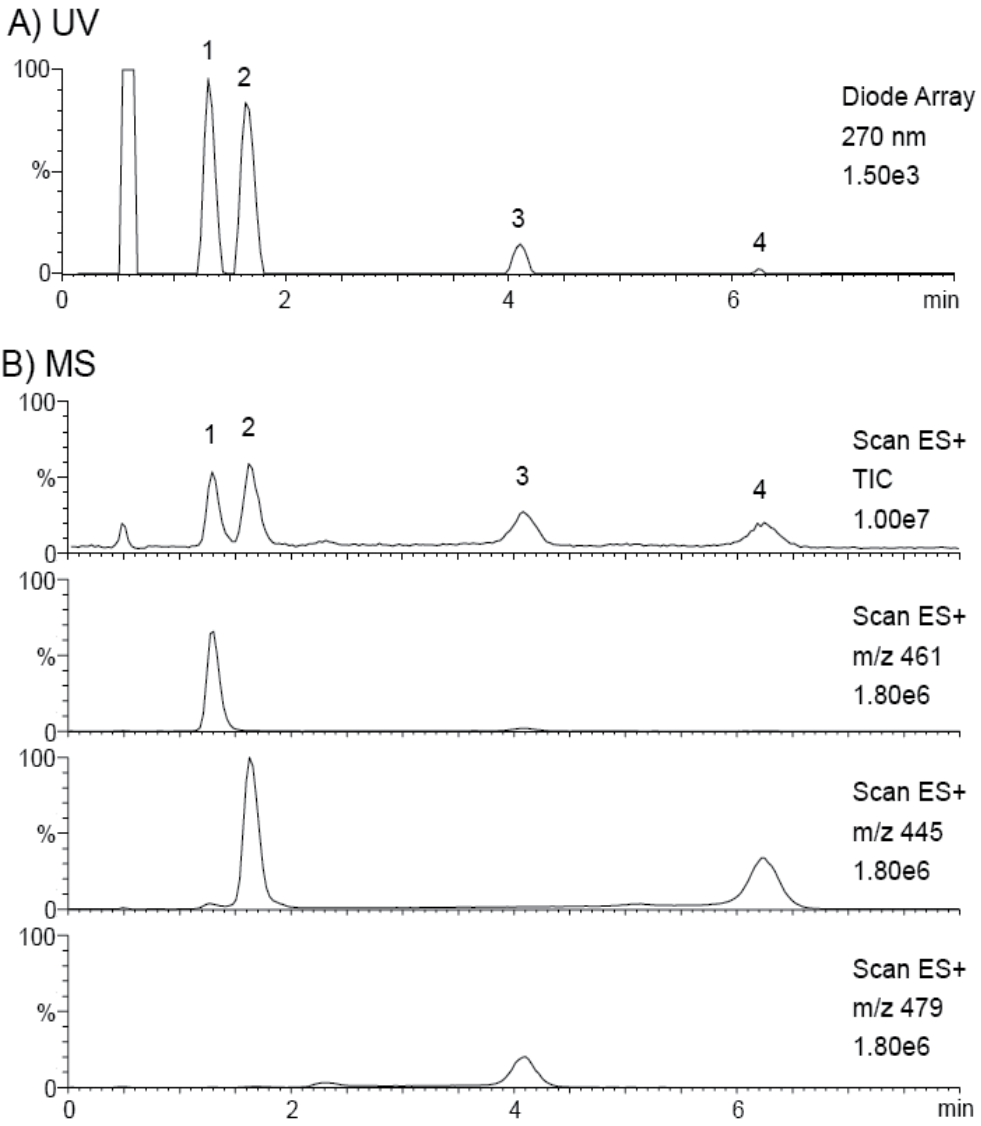


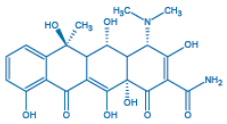
Column:	YMC-Triart C18 (5 µm, 12 nm) 50 x 2.0 mm ID
Part No.:	TA12S05-0502WT
Eluent:	A) 10 mM formic acid B) acetonitrile
Gradient:	25-50% B (0-10 min)
Flow rate:	0.2 mL/min
Temperature:	40 °C
Detection:	Bruker Daltonics micrOTOF, ESI, positive mode
Injection:	5 µL (100 ng/mL)

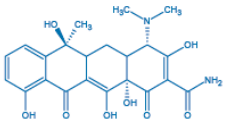
* Application data by courtesy YMC Co., Ltd.

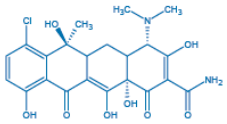
LC/MS

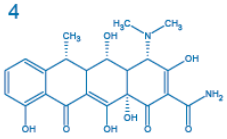
LC/MS analysis of tetracycline antibiotics*

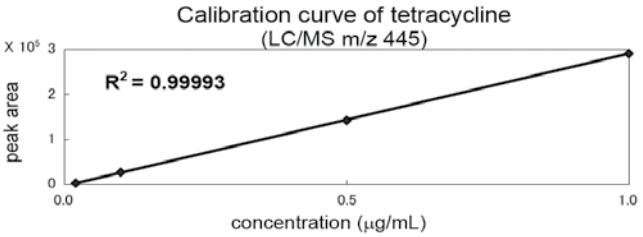


1

Oxytetracycline
(MW 460.4)

2

Tetracycline
(MW 444.4)

3

Chlortetracycline
(MW 478.8)

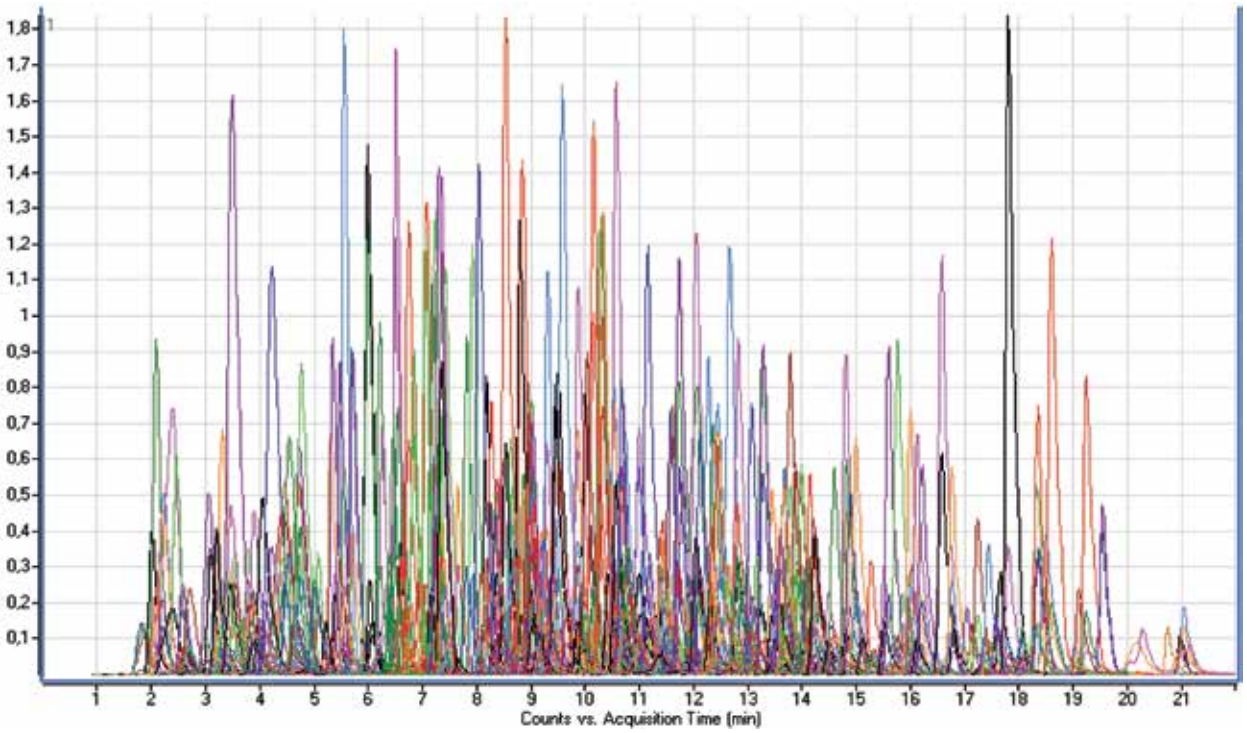
4

Doxycycline
(MW 444.4)



Column:	YMC-Triart C18 (5 µm, 12 nm) 50 x 2.0 mm ID
Part No.:	TA12S05-0502WT
Eluent:	acetonitrile / water / formic acid (15/85/0.1)
Flow rate:	0.4 mL/min
Temperature:	40 °C
Detection:	A) UV at 270 nm
	B) ESI positive-mode
Injection:	10 µL (1 µg/mL)

LC/MS

Analysis of 360 pesticides in a single run



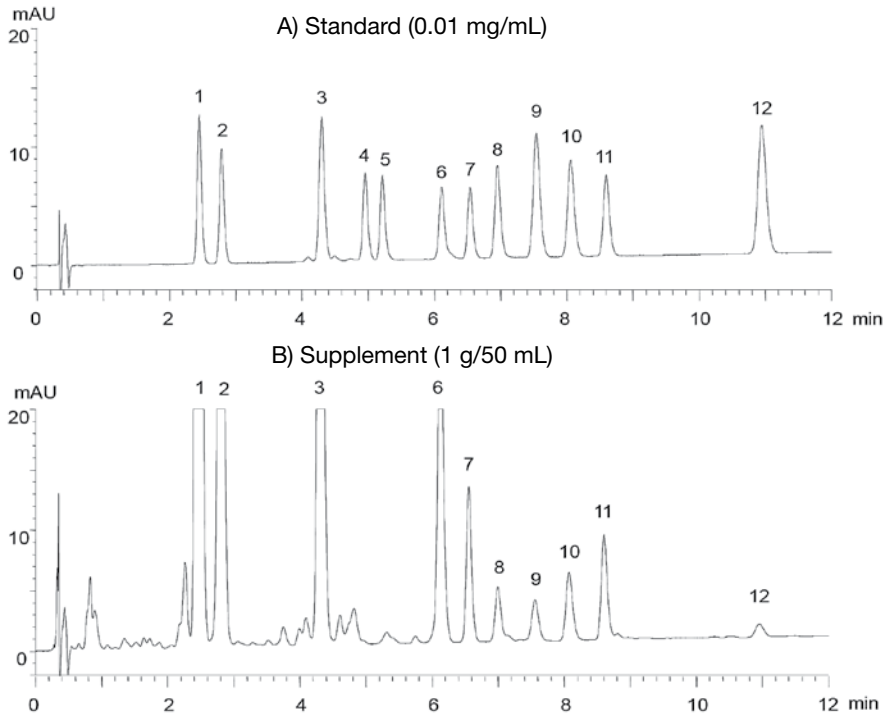
Column:	YMC-Triart C18 (3 µm) 100 x 2.0 mm ID	Injection:	5 µL
Part No.:	TA12S03-1002WT	Gradient:	0 min: 30% B, 0.1 min: 50% B, 18 min: 100% B, 21 min: 100% B, 21.01 min: 30% B, 29 min: 30% B
Eluent:	A) 5 mM ammonium formate / water B) 5 mM ammonium formate / methanol	Total run time:	30 min
Flow rate:	0.25 mL/min	Sample:	100 ng/mL pesticide mix in acetonitrile
Temperature:	45 °C		

by courtesy of: József László
WIREC, WESSLING International Research and Educational Centre Nonprofit Co. (Hungary)

* Application data by courtesy YMC Co., Ltd.

Food

Soy isoflavones in supplement*



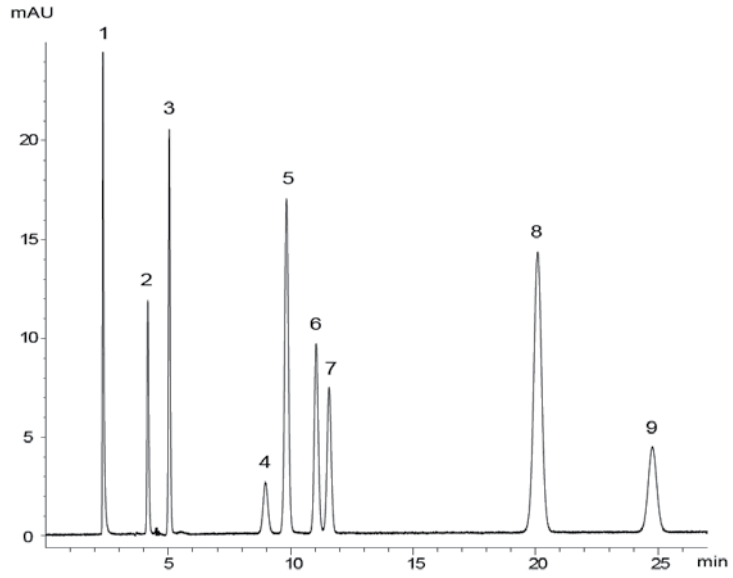
1. Daidzin
2. Glycitin
3. Genistin
4. 6"-*O*-Malonyldaidzin
5. 6"-*O*-Malonylglycitin
6. 6"-*O*-Acetyldaidzin
7. 6"-*O*-Acetylglycitin
8. 6"-*O*-Malonylgenistin
9. Daidzein
10. Glycitein
11. 6"-*O*-Acetylgenistin
12. Genistein

Sample preparation method

Supplement
← 50% aqueous ethanol
Stirred at r.t. for 1 hr
Filtration
Injection

Column:	YMC-Triart C18 (3 µm, 12 nm) 50 x 2.0 mm ID	Gradient:	5-40% B (0-12 min)
Part No.:	TA12S03-0502WT	Flow rate:	0.4 mL/min
Eluent:	A) acetonitrile / water / HCOOH (10/90/0.1) B) acetonitrile / water / HCOOH (60/40/0.1)	Temperature: Detection: Injection:	25 °C UV at 254 nm 2 µL

Separation of water-soluble vitamins*

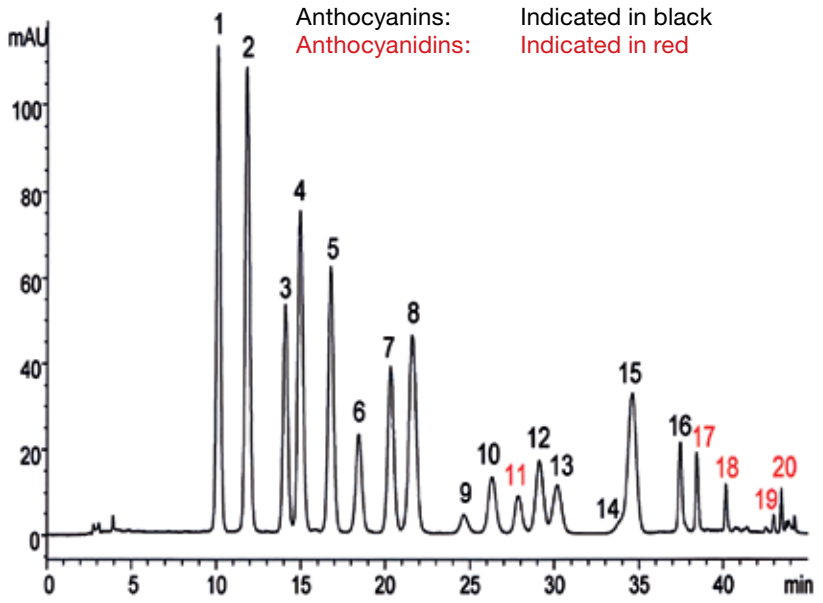


1. Thiamine HCl (Vitamin B_1)
2. Pyridoxine HCl (Vitamin B_6)
3. Nicotinamide
4. Cyanocobalamin (Vitamin B_{12})
5. L-Ascorbic acid 2-glucoside
6. L-Ascorbic acid (Vitamin C)
7. Erythorbic acid
8. Riboflavin (Vitamin B_2)
9. Nicotinic acid

Column:	YMC-Triart C18 (5 µm, 12 nm) 250 x 4.6 mm ID
Part No.:	TA12S05-2546WT
Eluent:	phospate buffer* / acetonitrile (90/10) * Dissolve 1.4 g KH_2PO_4 in 800 mL water → add 26 mL 10% TBA·OH → adjust pH 5.2 by 20% H_3PO_4 → add water to make 1000 mL
Flow rate:	0.8 mL/min
Temperature:	40 °C
Detection:	UV at 260 nm
Injection:	10 µL (5 µg/mL)

Food

Analysis of anthocyanins and anthocyanidins*



1. Delphinidin-3-*O*-galactoside
2. Delphinidin-3-*O*-glucoside
3. Cyanidin-3-*O*-galactoside
4. Delphinidin-3-*O*-arabinoside
5. Cyanidin-3-*O*-glucoside
6. Petunidin-3-*O*-galactoside
7. Cyanidin-3-*O*-arabinoside
8. Petunidin-3-*O*-glucoside
9. Peonidin-3-*O*-galactoside
10. Petunidin-3-*O*-arabinoside
11. Delphinidin
12. Peonidin-3-*O*-glucoside
13. Malvidin-3-*O*-galactoside
14. Peonidin-3-*O*-arabinoside
15. Malvidin-3-*O*-glucoside
16. Malvidin-3-*O*-arabinoside
17. Cyanidin
18. Petunidin
19. Peonidin
20. Malvidin

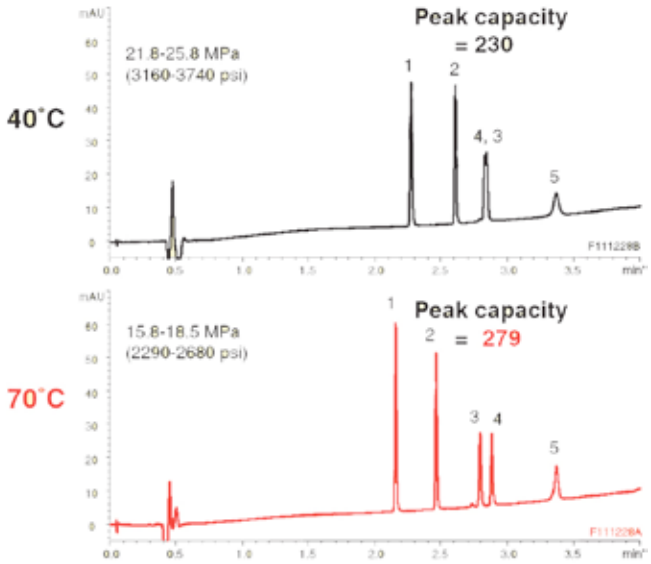
Column:	YMC-Triart C18 (5 µm, 12 nm) 250 x 4.6 mm ID
Part No.:	TA12S05-2546WT
Eluent:	A) water / formic acid (90/10) B) acetonitrile / methanol / water / formic acid (22.5/22.5/40/10)
Gradient:	20-28% B (0-30 min), 28-70% B (30-40 min), 100% B (40-45 min)
Flow rate:	1.0 mL/min
Temperature:	25 °C
Detection:	UV/VIS at 535 nm
Sample:	commercial bilberry powder (1.25 mg/mL)

* Application data by courtesy YMC Co., Ltd.

Peptides

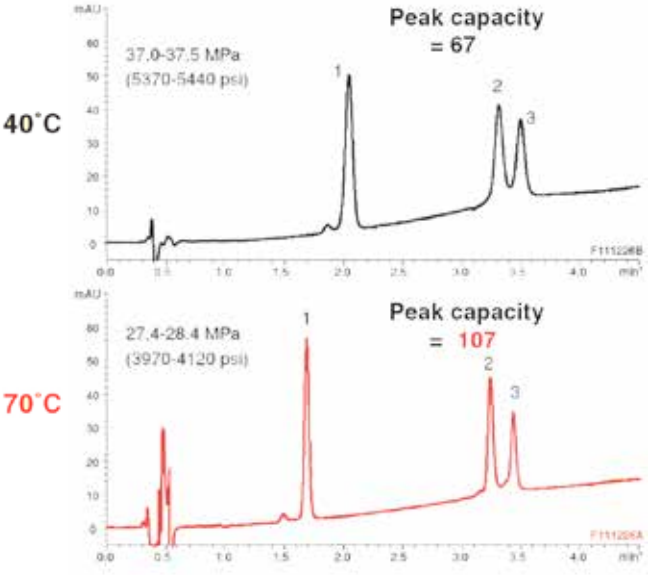
Highly efficient RP-HPLC separation of proteins and peptides using high temperature*

Mixture A (MW 500-18,400)



Analytes	MW	Peak width 1/2 (min)	
		40 °C	70 °C
Mixture A			
1. Oxytocin	1,007	0.017	0.014
2. Leu-Enkephalin	556	0.015	0.015
3. β-Endorphin	3,465	—	0.016
4. Insulin	5,733	—	0.015
5. β-Lactoglobulin A	18,400	0.043	0.030
Mixture B			
1. Lysozyme	14,300	0.069	0.044
2. α-Chymotrypsinogen	25,700	0.080	0.049
3. β-Lactoglobulin A	18,400	0.080	0.048

Mixture B (MW 14,300-25,700)



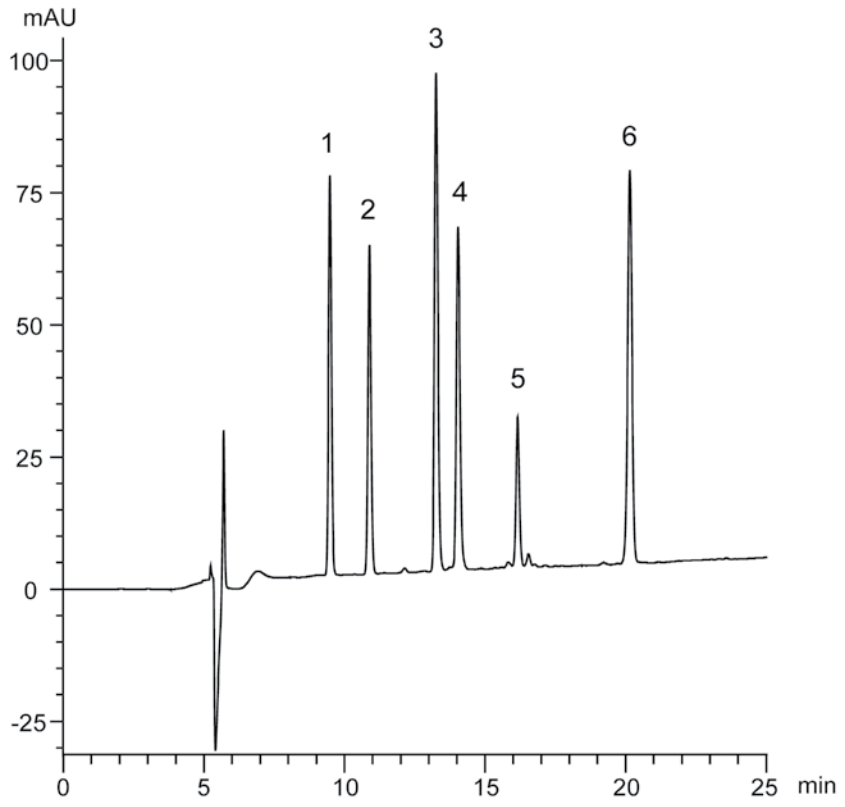
Column: YMC-Triart C18 (1.9 µm, 12 nm) 50 x 2.0 mm ID
Part-No.: TA12SP9-0502WT
Eluent: A) water / TFA (100/0.1)
B) acetonitrile / TFA (100/0.1) - mixture A
B) acetonitrile / 2-propanol / TFA (50/50/0.1) - mixture B
Gradient: 10-80% B (0-5 min) - mixture A
30-60% B (0-5 min) - mixture B

Flow rate: 0.4 mL/min
Detection: UV at 220 nm
Injection: 1 µL (50 µg/mL) - condition A
1 µl (250 µg/mL) - condition B
System: Agilent 1200SL

PC (peak capacity) = 1 + (gradient time / peak width*)
*peak width = $2W_{0.5h}$ average

Peptides

Peptides (MW 556 - 3,465)*



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

Column:	YMC-Triart C18 (5 µm, 12 nm) 150 x 2.0 mm ID
Part No.:	TA12S05-1502WT
Eluent:	A) water + 0.1% TFA B) acetonitrile + 0.1% TFA 20-45% B (0-25 min)
Flow rate:	0.2 mL/min
Temperature:	37 °C
Detection:	UV at 220 nm
Injection:	2 mL (0.075 ~ 0.25 mg/mL)

* Application data by courtesy YMC Co., Ltd.

YMC-Triart “AQ”

YMC-Triart C18

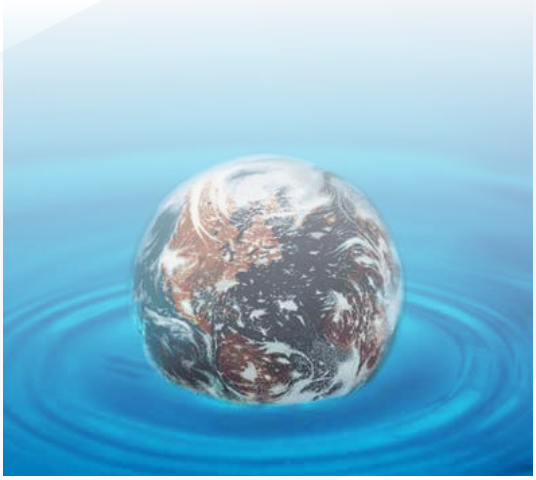
General

The use of 100% water eluent has been a challenge in HPLC analysis for decades. Even today, many C18 materials suffer from unacceptable short lifetime, because the C18 chains collapse and this reduces the separation performance drastically. As a pioneer in this field, YMC has offered a product as early as the 80’s, which presents a synonym for stability under aqueous conditions:

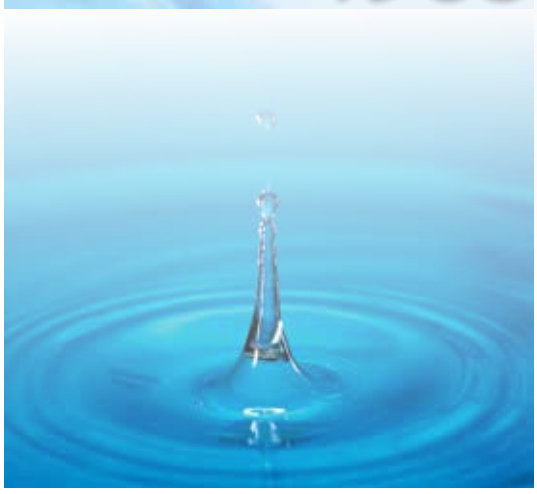
YMC-Pack ODS-AQ.

“AQ”-type phases are particularly suitable for the separation of polar substances, metabolites, pesticides, degradation products, peptides and protein digests.

2000

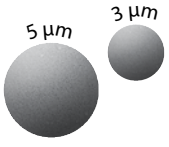


1985



YMC-Pack ODS-AQ

- “hydrophilic” C18
- balanced surface chemistry
- polar recognition
- metabolite recognition



YMC-Triart “AQ”

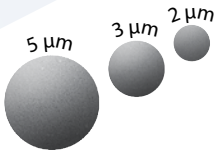
YMC-Triart C18

2013

Hydrosphere C18

A new, ultrapure silica base was introduced whilst adapting the surface chemistry to maintain the “AQ”-type properties.

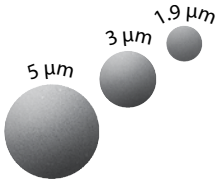
- “hydrophilic” C18 surface for enhanced polar recognition
- stable when used with 100% aqueous eluent
- no need for ion pair reagents
- addition of 2 µm particle size for Fast-LC (YMC-Pack UltraHT)



YMC-Triart "AQ" = YMC-Triart C18

The latest YMC technology platform consists of a “hybrid-style” substrate with enhanced stability against

- pH 1-12
- temp. up to 70°C
- 100% H_2O



Therefore, YMC-Triart provides freedom in method development, robustness and enhanced column lifetimes for reproducible results, day after day, year after year. YMC-Triart is fully scalable within (U)HPLC ↔ HPLC with its 1.9 – 3 – 5 micron particle sizes in order to facilitate lab-to-lab method transfer.

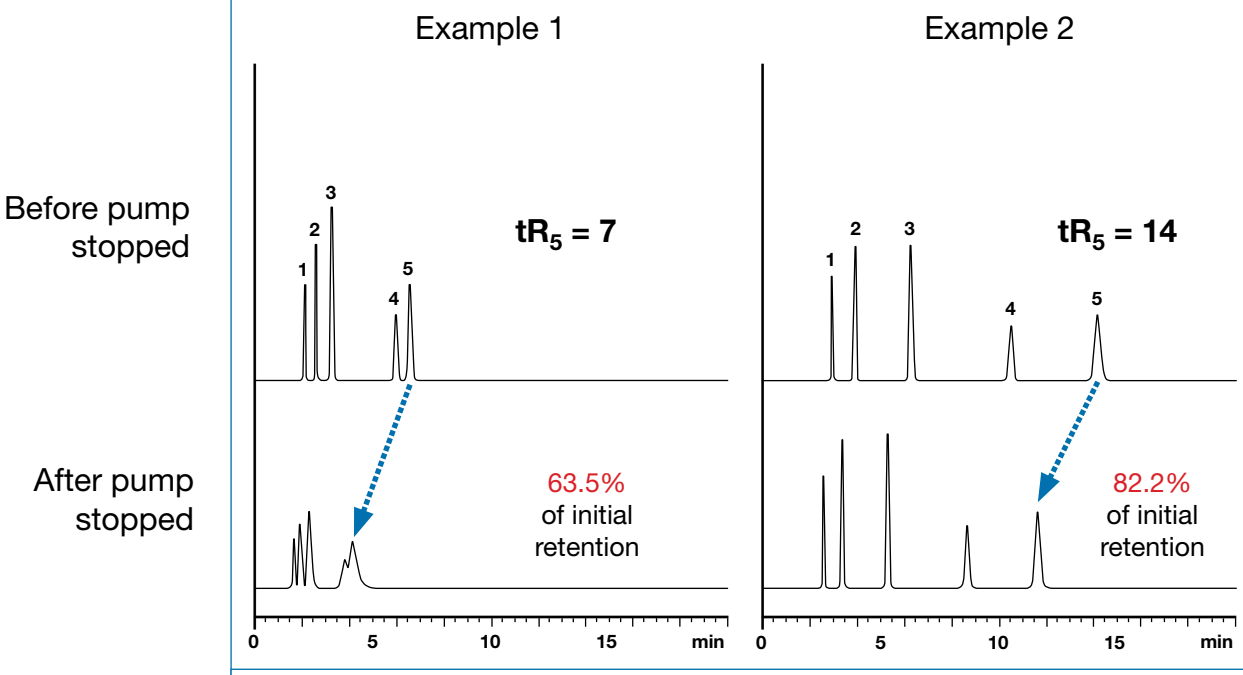
* Application data by courtesy YMC Co., Ltd.

YMC-Triart “AQ”

YMC-Triart C18

Problem with conventional C18 columns

Aqueous conditions deteriorate column performance*

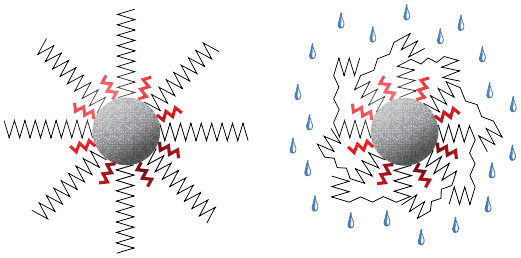


Column:	5 µm, 150 x 4.6 mm ID XBridge C18 (Example 1) and Atlantis T3 (Example 2)
Eluent:	20 mM KH_2PO_4-K_2HPO_4 (pH 6.9)
Flow rate:	1.0 mL/min
Temperature:	37°C
Detection:	UV at 254 nm

Sample:	1. Cytosine 2. Uracil 3. Guanine 4. Thymine 5. Adenine

Why?

Image of C18 surface hydration



The columns used for applications involving 100% aqueous buffers provide shorter retention times after the flow was stopped between analyses.

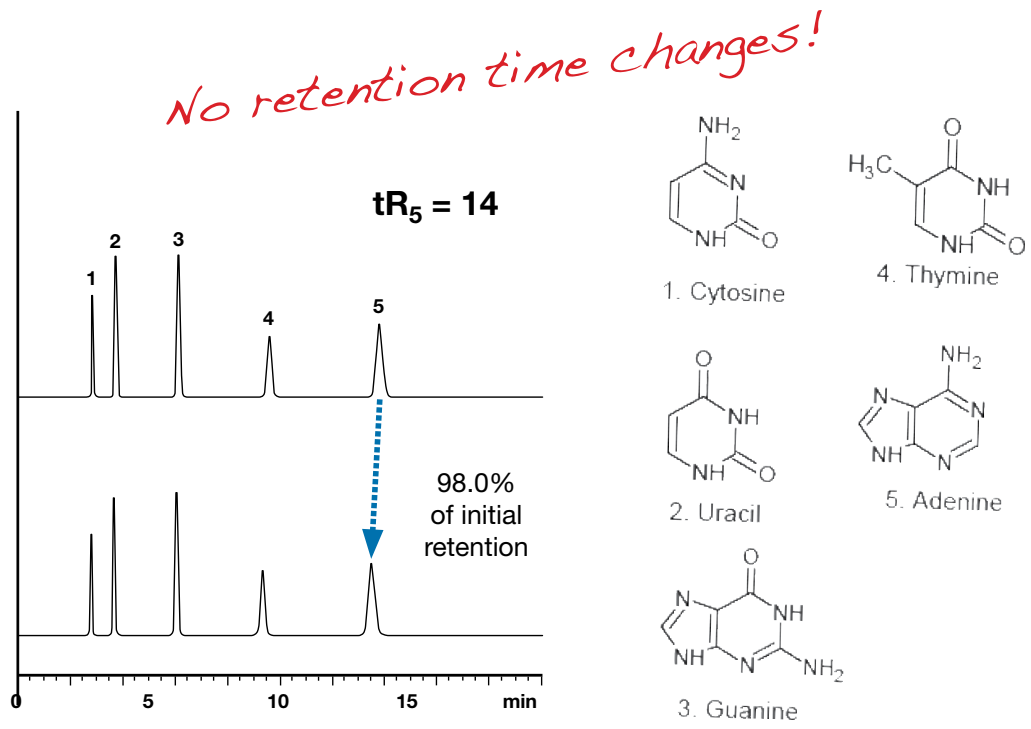
This behaviour is caused by poor hydration of the phase. Polar compounds cannot easily distribute between the mobile phase and the stationary phase.

YMC-Triart “AQ”

YMC-Triart C18

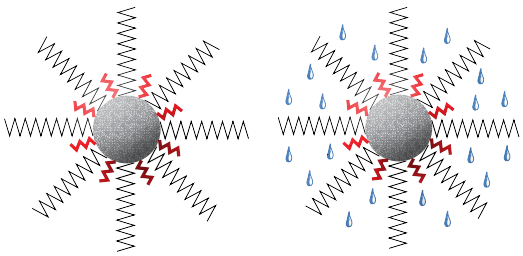
Solution with YMC-Triart C18

Reproducible stable performance!*



Column:	YMC-Triart C18 (5 µm, 12 nm) 150 x 4.6 mm ID
Part No.:	TA12S05-1546WT
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

Image of C18 surface hydration



When Triart C18 columns are used for applications involving 100% aqueous buffers, the retention times are unchanged after the flow was stopped between analyses.

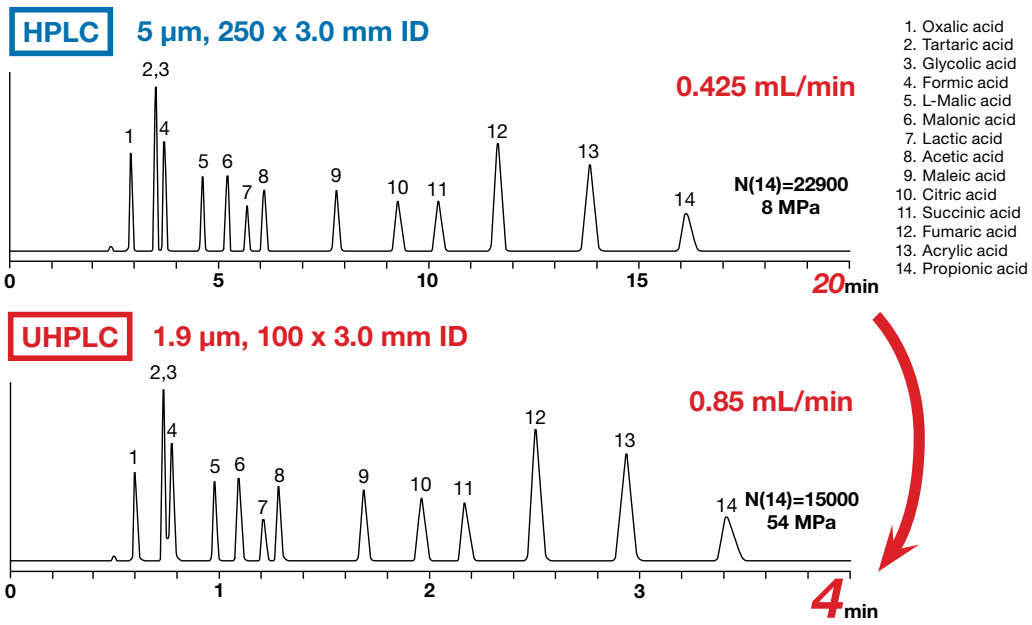
This is due to the improved hydration of the phase. Polar compounds can easily distribute between the mobile phase and the stationary phase.

* Application data by courtesy YMC Co., Ltd.

YMC-Triart “AQ”

YMC-Triart C18

From the inventors of AQ-columns:
YMC-Triart C18 "validated" for AQ-conditions!*



Column:	YMC-Triart C18
Eluent:	20 mM H_3PO_4
Flow rate:	0.425 mL/min
Temperature:	37°C
Detection:	220 nm

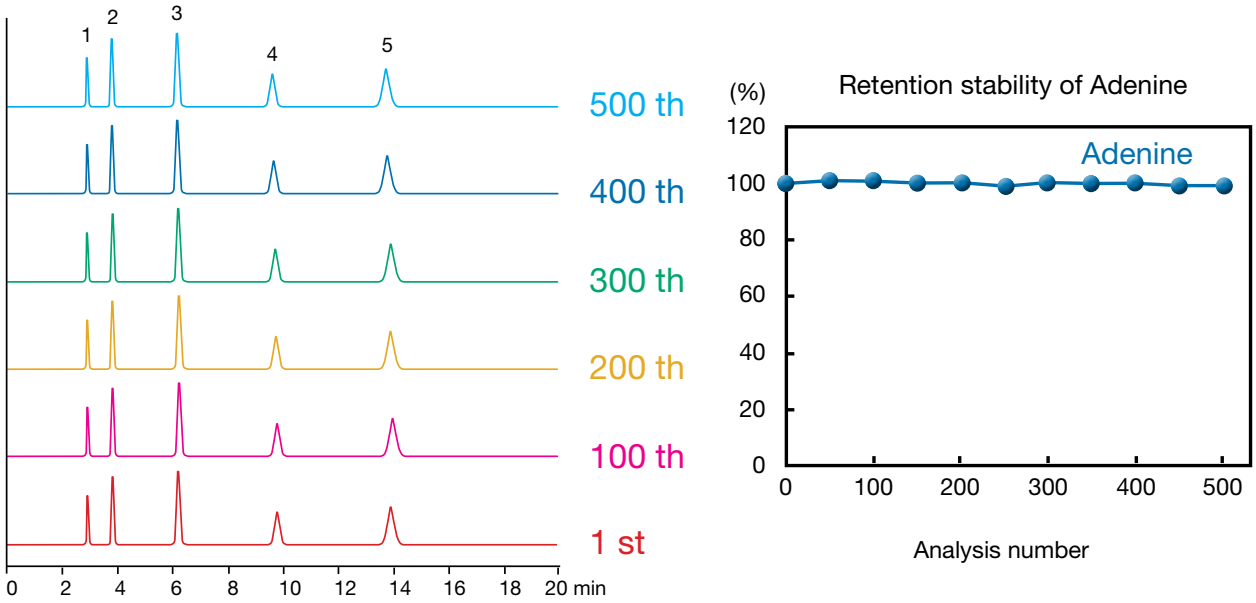
100% aqueous conditions!

Stable under harsh conditions: pH 1-12 and temperature up to 70°C.
Stable retention times with 100% aqueous eluents!
Reproducible results day after day, column to column and lab to lab!

YMC-Triart “AQ”

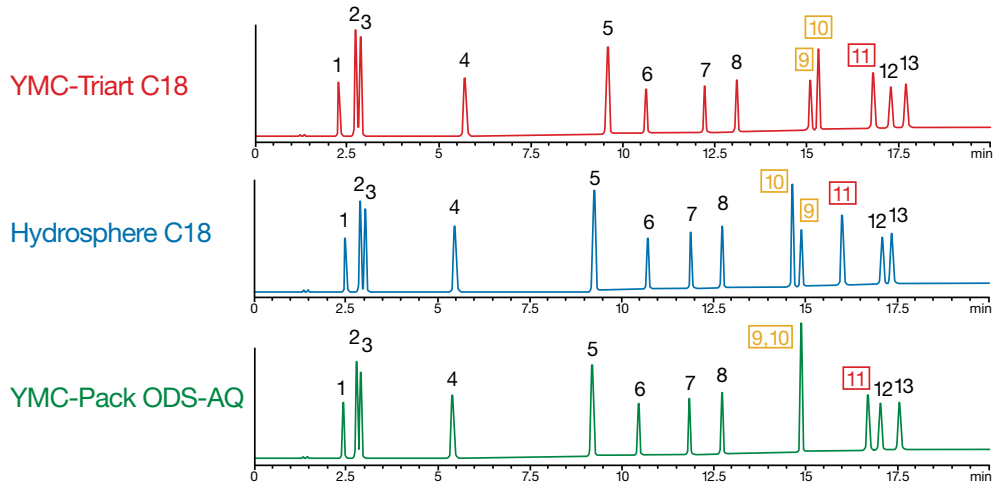
YMC-Triart C18

Proven reliability*



Column:	YMC-Triart C18 (5 µm, 12 nm) 150 x 3.0 mm ID
Part No.:	TA12S05-1530WT
Eluent:	20 mM KH_2PO_4-K_2HPO_4 (pH 6.9)
Flow rate:	0.425 mL/min
Temperature:	37°C
Detection:	UV at 254 nm
Sample:	1. Cytosine 2. Uracil 3. Guanine 4. Thymine 5. Adenine

No change is found in the separation parameters including retention times, even after 500 injections when using YMC-Triart C18.



1. L-Ascorbic acid 2-glucoside
2. L-Ascorbic acid
3. D-Isoascorbic acid
4. Nicotinic acid
5. Nicotinamide
6. D-(+)-Pantothenic acid calcium salt
7. Pyridoxal hydrochloride
8. Pyridoxine hydrochloride
9. Folic acid
10. Thiamine hydrochloride
11. Cyanocobalamin
12. D-Biotin
13. Riboflavin

Column:	3 µm, 150 x 3.0 mm ID
Part No.:	TA12S05-1530WT
Eluent:	A) 20 mM KH_2PO_4-H_3PO_4 (pH 2.8) containing 5 mM $CH_3(CH_2)5SO_3Na$ B) 20 mM KH_2PO_4-H_3PO_4 (pH 2.8) / acetonitrile (80/20) containing 5 mM $CH_3(CH_2)5SO_3Na$
Flow rate:	0.425 mL/min
Temperature:	40°C
Detection:	210 nm

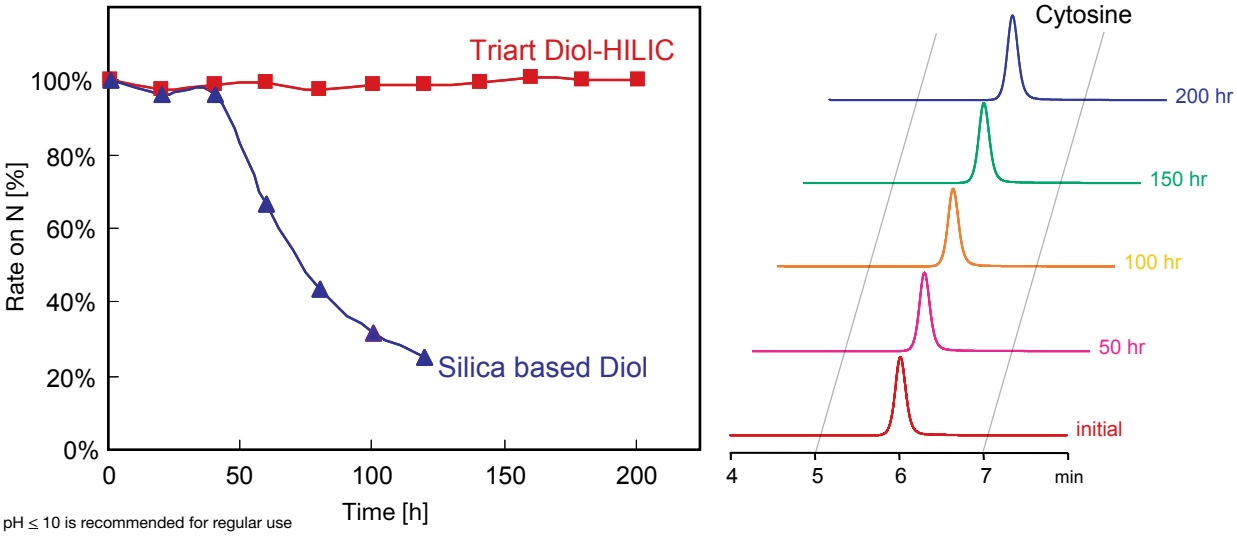
Retention behaviour of water-soluble vitamins on three YMC ODS phases which can be used with 100% aqueous mobile phases is compared. The retention times and peak elution order for folic acid (peak 9), thiamine hydrochloride (peak 10) and cyanocobalamin (peak 11) are different for the three phases due to the balance of hydrophobicity and hydrogen bonding capacity differing between the three phases.

* Application data by courtesy YMC Co., Ltd.

HILIC

Great stability and reproducibility at high pH*

Stability in high pH (pH 11, 50 °C)**

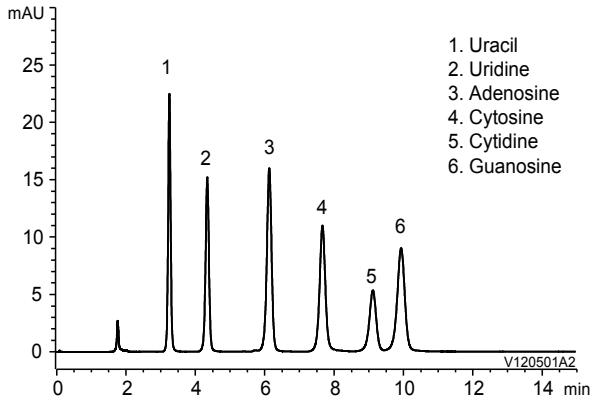


** pH ≤ 10 is recommended for regular use

Column:	5 µm, 150 x 4.6 mm ID	Flow rate:	1.0 mL/min
Part No.:	TDH12S05-1546WT	Temperature:	50 °C
Eluent:	acetonitrile / water / NH_3 (90/10/0.1) pH 11.3	Sample:	Cytosine

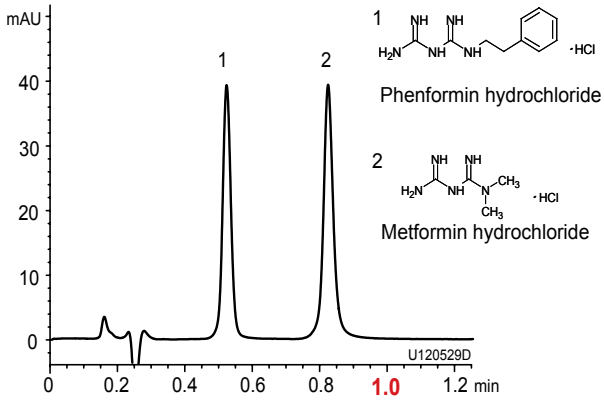
YMC-Triart Diol-HILC offers highly reproducible separations even at high pH and high temperature. The lifetime of YMC-Triart Diol-HILIC is much longer than that of conventional silica-based Diol columns.

Nucleosides and bases*



Column:	YMC-Triart Diol-HILIC (5 µm, 12 nm) 150 x 3.0 mm ID
Part No.:	TDH12S05-1503WT
Eluent:	100 mM CH_3COONH_4 / acetonitrile (10/90)
Flow rate:	0.425 mL/min
Temperature:	30 °C
Detection:	UV at 254 nm
Injection:	2 µL (5 ~ 10 µg/mL)

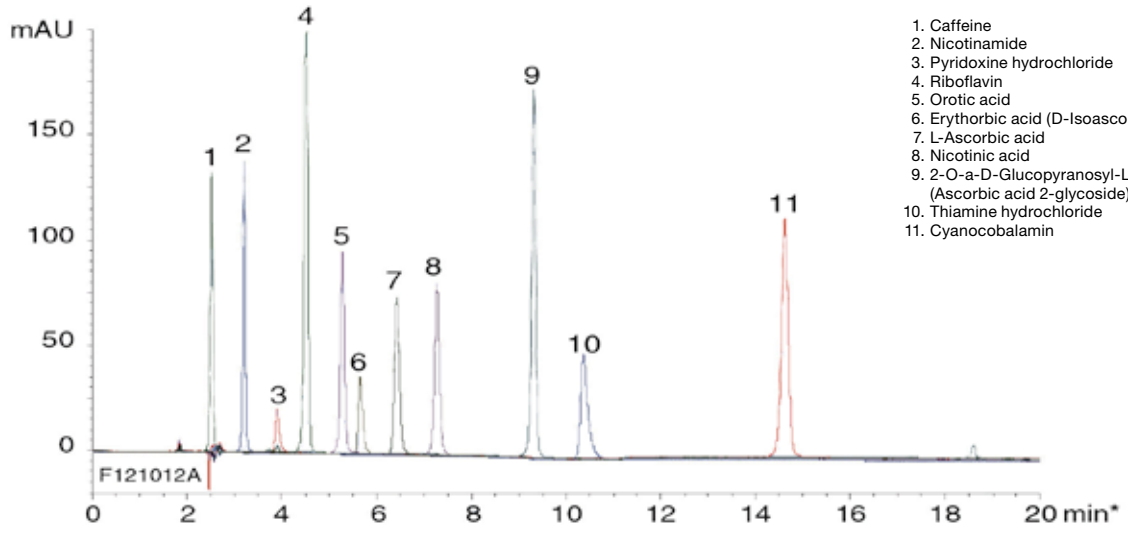
Diabetes drugs*



Column:	YMC-Triart Diol-HILIC (1.9 µm, 12 nm) 50 x 2.0 mm ID
Part No.:	TDH12SP9-0502PT
Eluent:	100 mM HCOOH-$HCOONH_4$ (pH 3.7) / acetonitrile (10/90)
Flow rate:	0.8 mL/min
Temperature:	25 °C
Detection:	UV at 235 nm
Injection:	2 µL (10 µg/mL)

HILIC

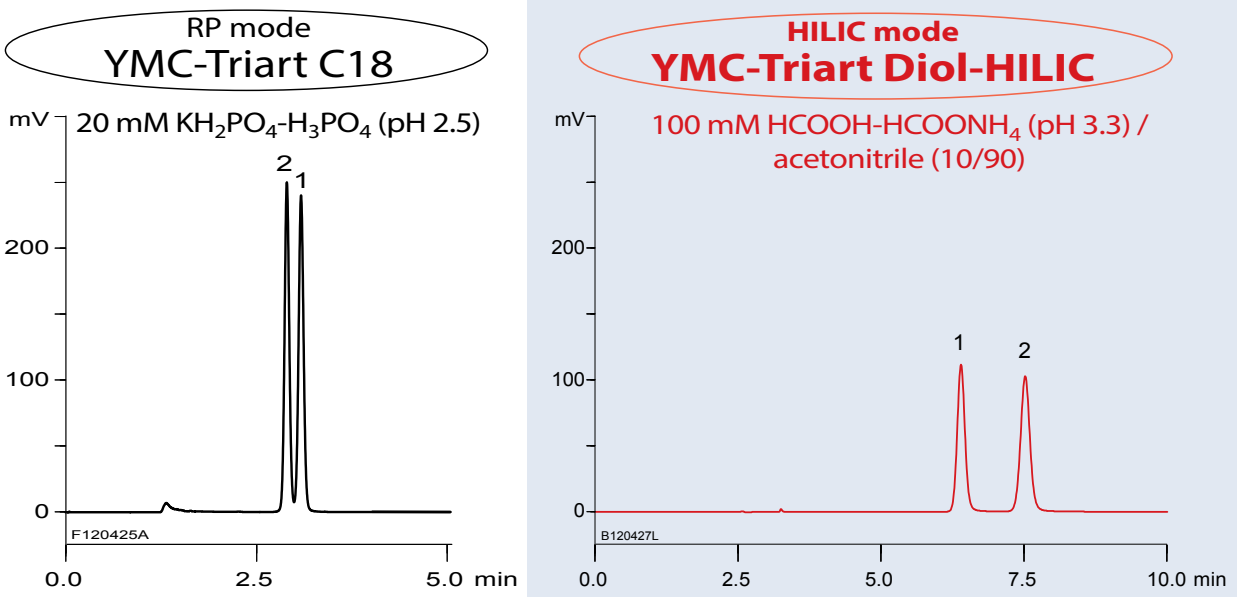
Water soluble vitamins*

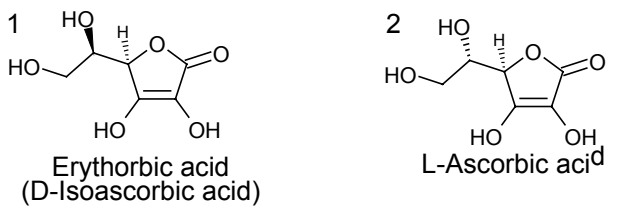


1. Caffeine
2. Nicotinamide
3. Pyridoxine hydrochloride
4. Riboflavin
5. Orotic acid
6. Erythorbic acid (D-Isoascorbic acid)
7. L-Ascorbic acid
8. Nicotinic acid
9. 2-O-a-D-Glucopyranosyl-L-ascorbid acid (Ascorbic acid 2-glycoside)
10. Thiamine hydrochloride
11. Cyanocobalamin

Column: YMC-Triart Diol-HILIC (5 µm, 12 nm) 150 x 3.0 mm ID
Part No.: TDH12S05-1503PTH
Eluent: A) acetonitrile / 200 mM HCOOH-HCOONH4 (pH 3.6) / water (90/5/5)
B) acetonitrile / 200 mM HCOOH-HCOONH4 (pH 3.6) / water (50/5/45)
Gradient: 0-75% B (0-20 min)
Flow rate: 0.425 mL/min
Temperature: 40 °C
Detection: UV at 254 nm
Injection: 4 µL (50 µg/mL)

Polar and hydrophilic compounds*





Erythorbic acid
(D-Isoascorbic acid)

L-Ascorbic acid

Column: 5 µm, 150 x 3.0 mm ID
Flow rate: 0.425 mL/min
Temperature: 40 °C
Detection: UV at 254 nm
Injection: 4 µL (0.05 mg/mL)

YMC-Triart C18 (RP) shows very weak retention and poor resolution of L-ascorbic acid and its stereoisomer (erythorbic acid) even if 100% aqueous mobile phase is used. However, YMC-Triart Diol-HILIC shows strong retention and good resolution of these compounds with mobile phase containing 90% organic solvent.

* Application data by courtesy YMC Co., Ltd.

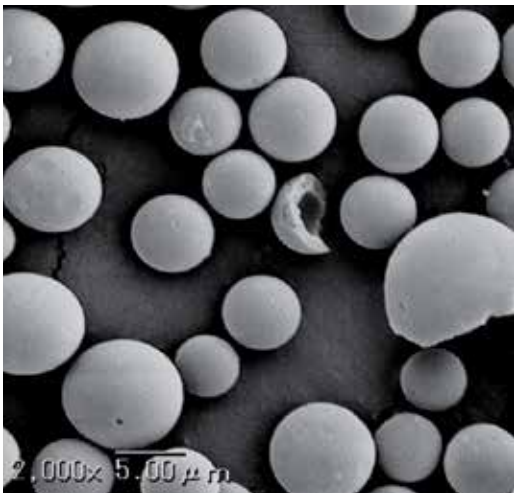
QC Data

YMC-Triart: Improved quality of particles

Uniform spherical particles

YMC-Triart

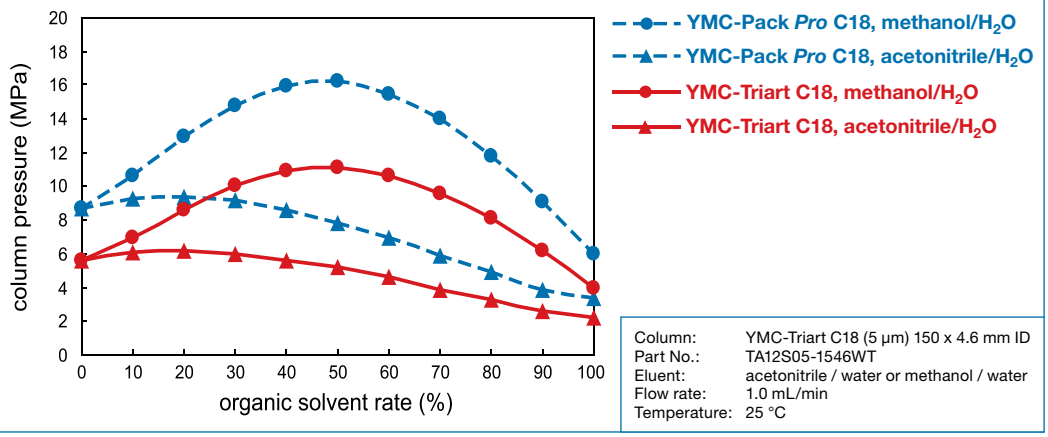
X-Bridge HILIC



by courtesy of YMC Co., Ltd.

The uniform spherical particle support is used for all YMC-Triart phases. The particles are produced using **micro-reactor** technology for the granulation process. This results in reduction of the back-pressure and leads to more reproducibility in surface modification.

Low column back-pressure*



Column:	YMC-Triart C18 (5 µm) 150 x 4.6 mm ID
Part No.:	TA12S05-1546WT
Eluent:	acetonitrile / water or methanol / water
Flow rate:	1.0 mL/min
Temperature:	25 °C

The revolutionary production technique, adapted from micro-reactor flow technology, produces a silica/organic hybrid stationary phase, with outstanding narrow pore size and particle size distributions which result in low back pressures.

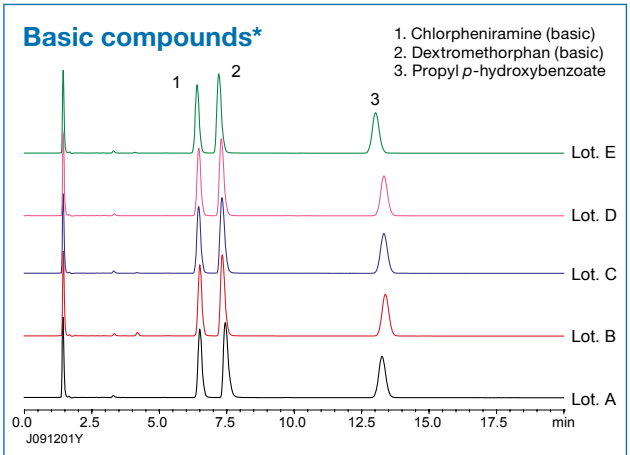
YMC-Triart is designed for use under a wide range of conditions. Elution with higher viscosity methanol (compared with acetonitrile), YMC-Triart generates lower pressure (approx 30% lower than with conventional phases).

QC Data

Excellent reproducibility of YMC-Triart phases is available even for the analysis of basic and coordination compounds which normally exhibit tailing and adsorption effects.

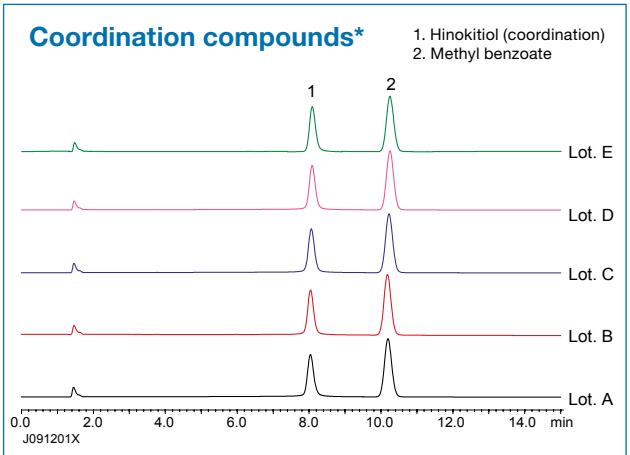
Batch-to-batch reproducibility

Basic compounds*



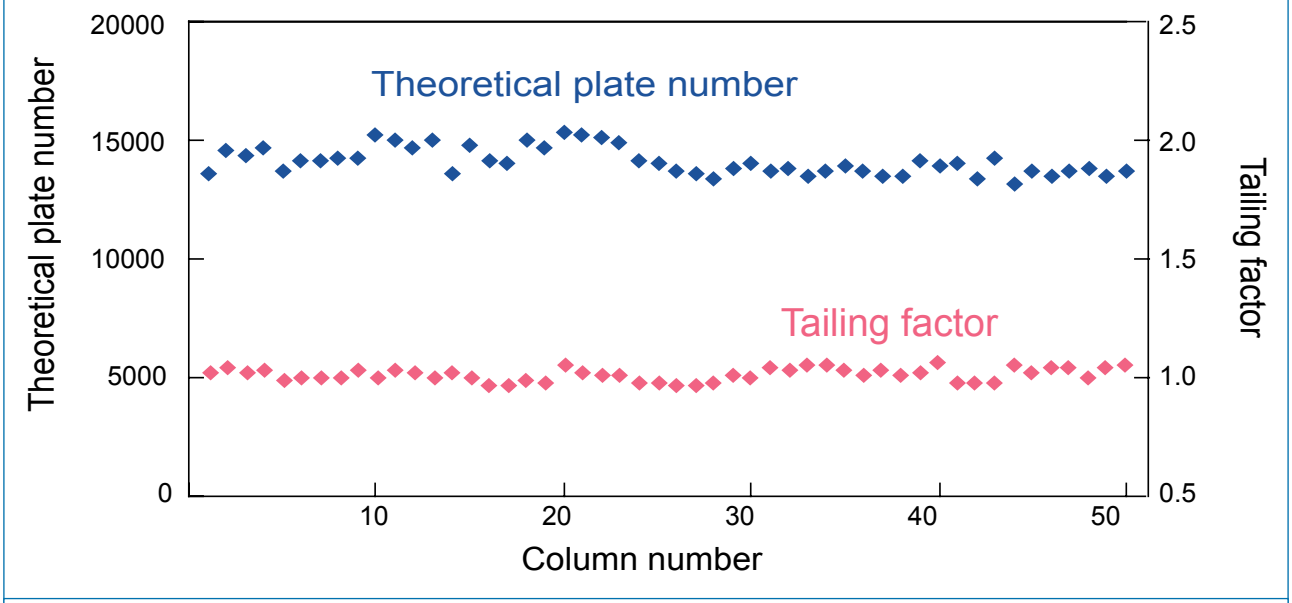
Column:	YMC-Triart C18 (5 µm) 150 x 3.0 mm ID
Part No.:	TA12S05-1503WT
Eluent:	20 mM KH_2PO_4 (pH 6.9) / acetonitrile (65/35)
Flow rate:	0.425 mL/min
Temperature:	40 °C
Detection:	UV at 235 nm

Coordination compounds*



Column:	YMC-Triart C18 (5 µm) 150 x 3.0 mm ID
Part No.:	TA12S05-1503WT
Eluent:	acetonitrile / 0.1% H_3PO_4 (40/60)
Flow rate:	0.425 mL/min
Temperature:	40 °C
Detection:	UV at 254 nm

The reproducibility of packed columns is shown below in terms of theoretical plate number (N) and tailing factor (Tf). YMC-Triart packed columns exhibit a very narrow range of variation.

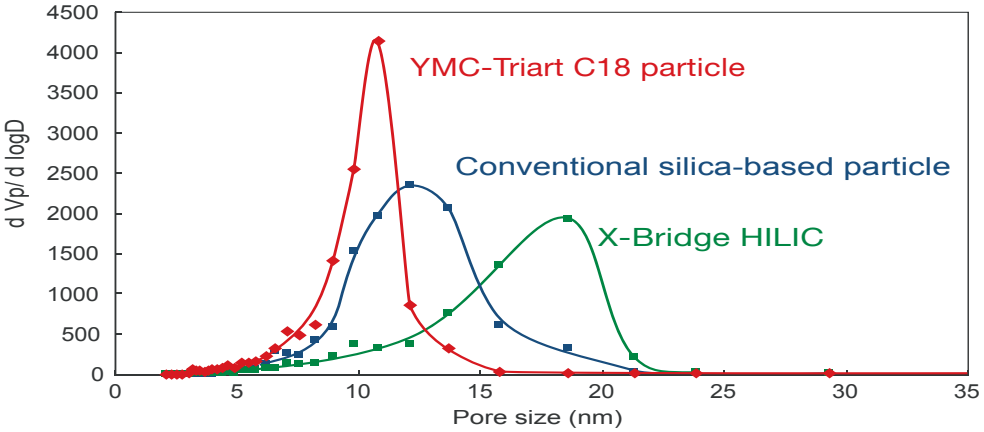


Column:	YMC-Triart C18 (5 µm) 150 x 4.6 mm ID	Flow rate:	1.0 mL/min
Part No.:	TA12S05-1546WT	Temperature:	ambient
Eluent:	acetonitrile / water (40/60)	Sample:	butyl benzoate

* Application data by courtesy YMC Co., Ltd.

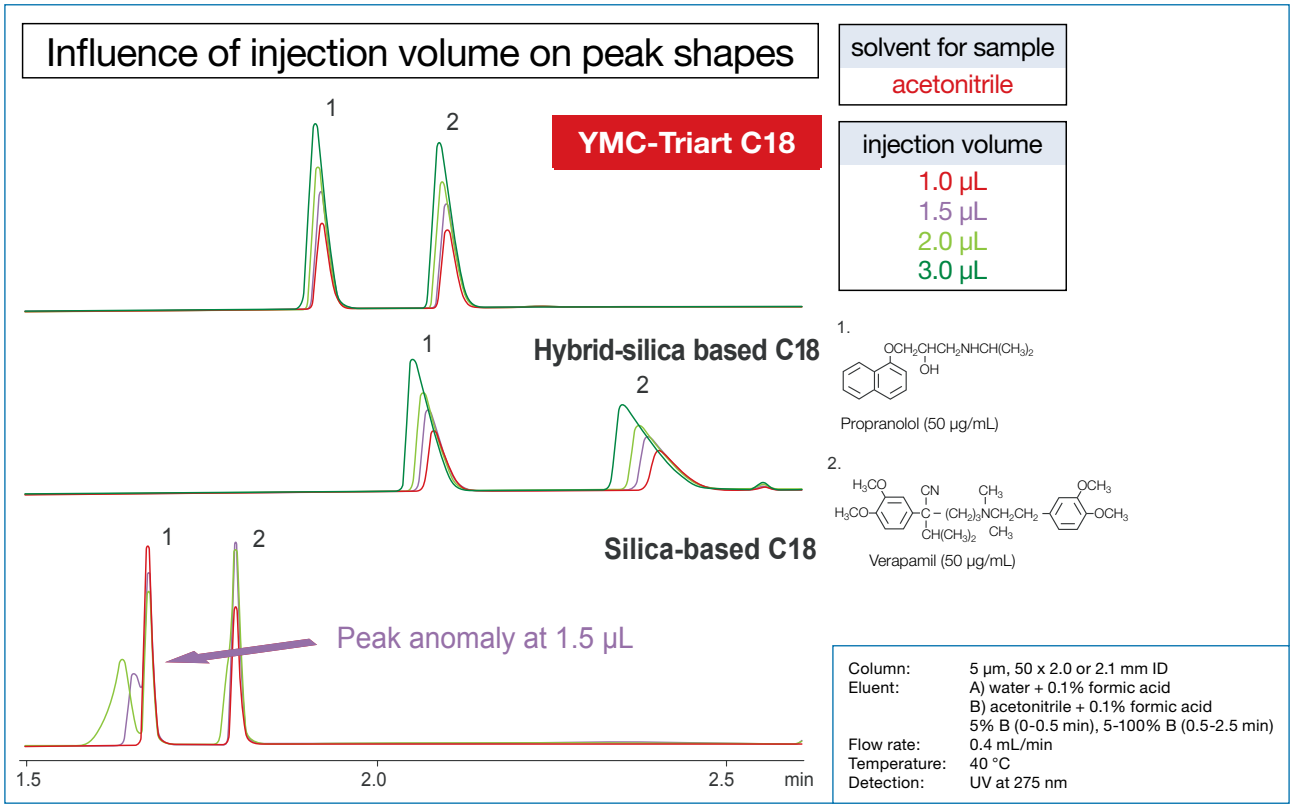
QC Data

Narrow pore distribution



This figure shows the pore size distributions of some competitive material. Comparing the pore size distributions shows that YMC-Triart has a narrower distribution which results in sharper peak shapes.

Improved loadability



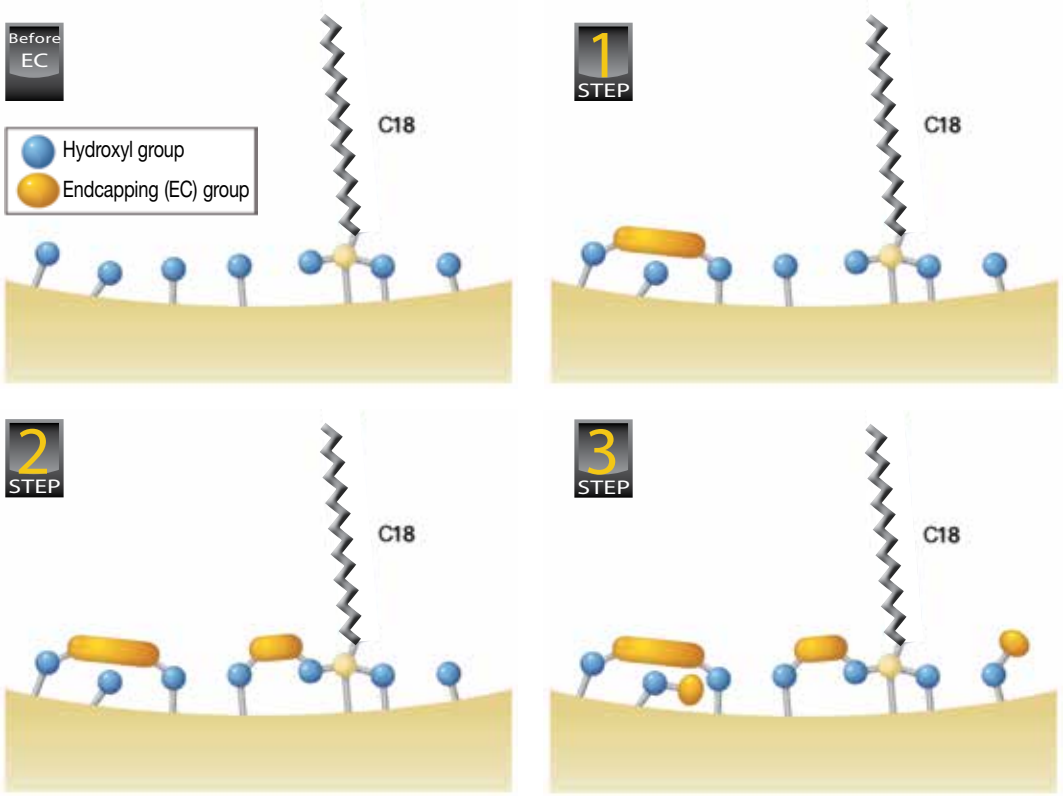
In order to prevent peak errors, there is a limit to the injection volume when a sample is injected in high elution solvents (such as 100% acetonitrile). Compared with traditional columns, more than double the injection volume can be injected into YMC-Triart columns as a result of the extremely narrow particle size distribution.

QC Data

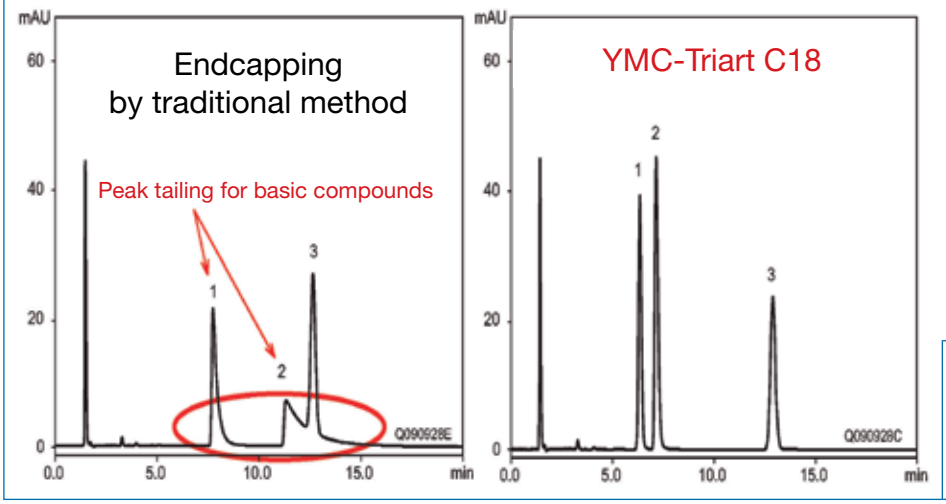
Multi-stage endcapping

After bonding the alkyl chain, there are highly reactive and less reactive silanols on the surface. In traditional bonding processes, these are reacted with a single endcapping-compound in one step. However, the highly reactive silanols can be hydrolysed easily which contributes to the poor stability. The less reactive silanols are hard to endcap which results in poor resolution due to peak tailing.

YMC-Triart phases use an innovation in endcapping called “multistage endcapping” for its surface modification process. By using a number of compounds with different reactivities in successive steps, all silanols can be capped to the maximum extent.



The chromatographic result of a “good” endcapping is demonstrated:



Ingredients in cough/cold medication:

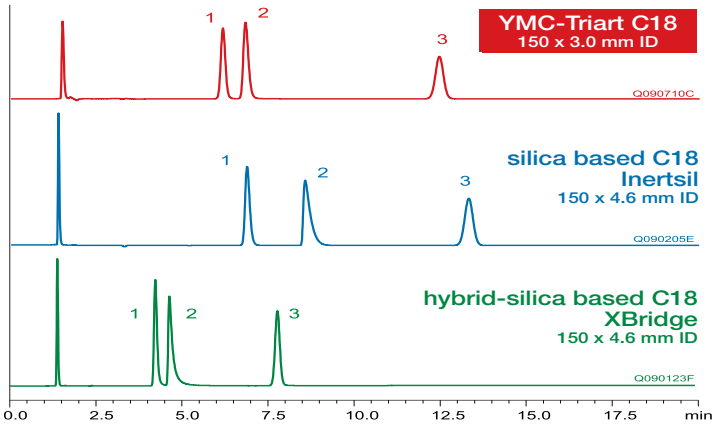
1. Chlorpheniramine
2. Dextromethorphan
3. Propyl *p*-hydroxybenzoate

Column:	5 µm, 150 x 3.0 mm ID
Part No.:	TA12S05-1503WT
Eluent:	20 mM KH_2PO_4-K_2HPO_4 (pH 6.9) / acetonitrile (65/35)
Flow rate:	0.425 mL/min
Temperature:	40 °C
Detection:	UV at 235 nm

* Application data by courtesy YMC Co., Ltd.

QC Data

Basic compounds*



Ingredients in a cough/cold medication

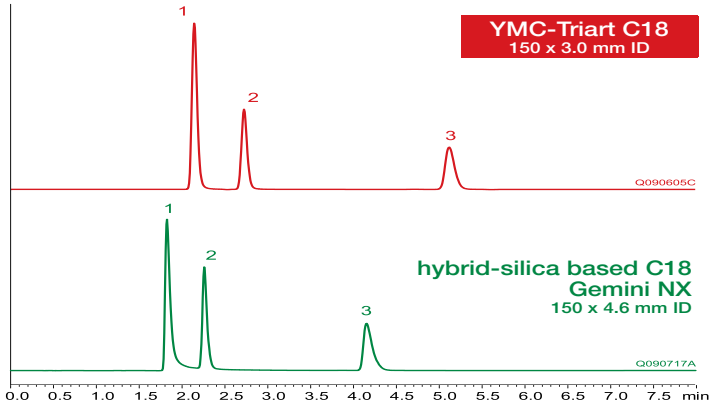
1. Chlorpheniramine
2. Dextromethorphan
3. Propyl *p*-hydroxybenzoate

excellent peak shape

Column:	5 µm, 150 x 3.0 or 150 x 4.6 mm ID
Eluent:	20 mM KH_2PO_4-K_2HPO_4 (pH 6.9) / acetonitrile (65/35)
Flow rate:	0.425 mL/min for 3.0 mm ID 1.0 mL/min for 4.6 mm ID
Temperature:	40 °C
Detection:	UV at 235 nm

The innovative surface modification technology results in excellent peak shapes even for basic compounds that often exhibit peak tailing with conventional silica- and hybrid silica-based reversed phase columns.

Acidic compounds*



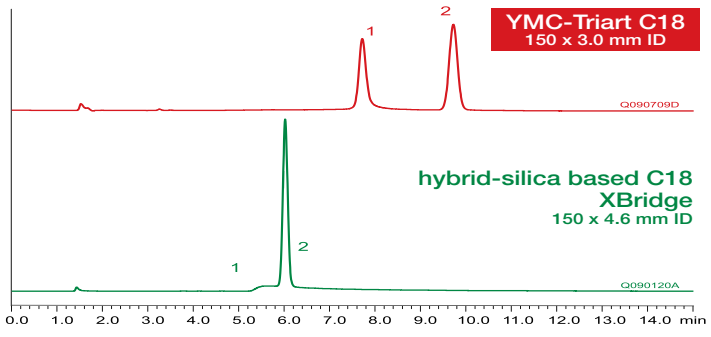
Organic acid

1. Formic acid
2. Acetic acid
3. Propionic acid

Column:	5 µm, 150 x 3.0 or 150 x 4.6 mm ID
Eluent:	methanol / water + 0.1% H_3PO_4 (5/95)
Flow rate:	0.425 mL/min for 3.0 mm ID 1.0 mL/min for 4.6 mm ID
Temperature:	37 °C
Detection:	UV at 210 nm

YMC-Triart phases are synthesised using methodology adapted from micro-reactor technology. This technique ensures a reduction of impurities that contribute to peak tailing during the analysis of some types acidic compounds.

Coordinating compounds*



Hinokitiol

1. Hinokitiol
2. Methyl benzoate

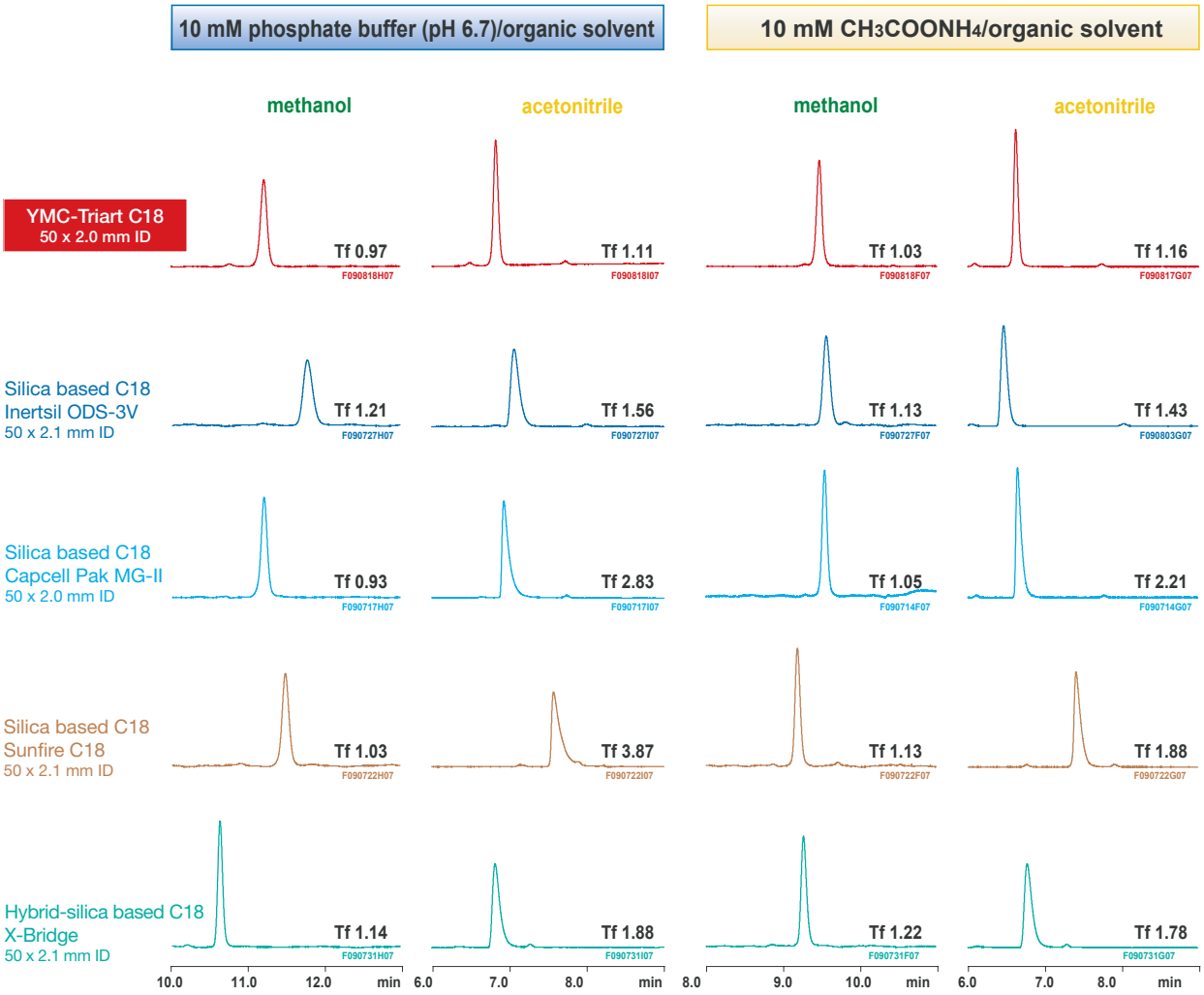
low metal impurities

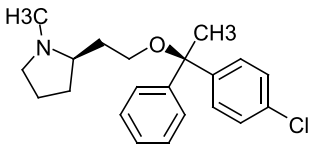
Column:	5 µm, 150 x 3.0 or 150 x 4.6 mm ID
Eluent:	acetonitrile / water + 0.1% H_3PO_4 (40/60)
Flow rate:	0.425 mL/min for 3.0 mm ID 1.0 mL/min for 4.6 mm ID
Temperature:	40 °C
Detection:	UV at 254 nm

YMC-Triart phases have an extremely low level of metal impurities, much lower than conventional products, ensuring excellent peak shape for coordination compounds.

QC Data

Comparison of clemastine analysis*





Clemastine

Column:	5 µm, 50 x 2.0 or 50 x 2.1 mm ID
Eluent:	A) 10 mM KH_2PO_4-K_2HPO_4 (pH 6.7) or 10 mM CH_3COONH_4
	B) methanol or acetonitrile
	5-90% B (0-10 min), 90% B (10-15 min)
Flow rate:	0.2 mL/min
Temperature:	25 °C
Detection:	UV at 230 nm

Clemastine is a well-known basic compound which readily exhibits peak tailing with conventional ODS columns. YMC-Triart C18 provides sharp separations with many different buffer/solvent compositions.

* Application data by courtesy YMC Co., Ltd.

Ordering Information

YMC-Triart 1.9 µm UHPLC columns (max. pressure 1,000 bar)

Phase	Column ID (mm)	Column length (mm)						Guard cartridges* with 5 mm length
		20	30	50	75	100	150	(pack of 3)
C18	2.0	TA12SP9-0202PT	TA12SP9-0302PT	TA12SP9-0502PT	TA12SP9-L502PT	TA12SP9-1002PT	TA12SP9-1502PT	TA12SP9-E5Q1CC**
	2.1	TA12SP9-02Q1PT	TA12SP9-03Q1PT	TA12SP9-05Q1PT	TA12SP9-L5Q1PT	TA12SP9-10Q1PT	TA12SP9-15Q1PT	TA12SP9-E5Q1CC**
	3.0	—	—	TA12SP9-0503PT	TA12SP9-L503PT	TA12SP9-1003PT	TA12SP9-1503PT	TA12SP9-E503CC
C18 ExRS	2.0	TAR08SP9-0202PT	TAR08SP9-0302PT	TAR08SP9-0502PT	TAR08SP9-L502PT	TAR08SP9-1002PT	TAR08SP9-1502PT	TAR08SP9-E5Q1CC**
	2.1	TAR08SP9-02Q1PT	TAR08SP9-03Q1PT	TAR08SP9-05Q1PT	TAR08SP9-L5Q1PT	TAR08SP9-10Q1PT	TAR08SP9-15Q1PT	TAR08SP9-E5Q1CC**
	3.0	—	—	TAR08SP9-0503PT	TAR08SP9-L503PT	TAR08SP9-1003PT	TAR08SP9-1503PT	TAR08SP9-E503CC
C8	2.0	T012SP9-0202PT	T012SP9-0302PT	T012SP9-0502PT	T012SP9-L502PT	T012SP9-1002PT	T012SP9-1502PT	T012SP9-E5Q1CC**
	2.1	T012SP9-02Q1PT	T012SP9-03Q1PT	T012SP9-05Q1PT	T012SP9-L5Q1PT	T012SP9-10Q1PT	T012SP9-15Q1PT	T012SP9-E5Q1CC**
	3.0	—	—	T012SP9-0503PT	T012SP9-L503PT	T012SP9-1003PT	T012SP9-1503PT	T012SP9-E503CC
Phenyl	2.0	TPH12SP9-0202PT	TPH12SP9-0302PT	TPH12SP9-0502PT	TPH12SP9-L502PT	TPH12SP9-1002PT	TPH12SP9-1502PT	TPH12SP9-E5Q1CC**
	2.1	TPH12SP9-02Q1PT	TPH12SP9-03Q1PT	TPH12SP9-05Q1PT	TPH12SP9-L5Q1PT	TPH12SP9-10Q1PT	TPH12SP9-15Q1PT	TPH12SP9-E5Q1CC**
	3.0	—	—	TPH12SP9-0503PT	TPH12SP9-L503PT	TPH12SP9-1003PT	TPH12SP9-1503PT	TPH12SP9-E503CC
PFP	2.0	TPF12SP9-0202PT	TPF12SP9-0302PT	TPF12SP9-0502PT	TPF12SP9-L502PT	TPF12SP9-1002PT	TPF12SP9-1502PT	TPF12SP9-E5Q1CC**
	2.1	TPF12SP9-02Q1PT	TPF12SP9-03Q1PT	TPF12SP9-05Q1PT	TPF12SP9-L5Q1PT	TPF12SP9-10Q1PT	TPF12SP9-15Q1PT	TPF12SP9-E5Q1CC**
	3.0	—	—	TPF12SP9-0503PT	TPF12SP9-L503PT	TPF12SP9-1003PT	TPF12SP9-1503PT	TPF12SP9-E503CC
HILIC	2.0	TDH12SP9-0202PT	TDH12SP9-0302PT	TDH12SP9-0502PT	TDH12SP9-L502PT	TDH12SP9-1002PT	TDH12SP9-1502PT	TDH12SP9-E5Q1CC**
	2.1	TDH12SP9-02Q1PT	TDH12SP9-03Q1PT	TDH12SP9-05Q1PT	TDH12SP9-L5Q1PT	TDH12SP9-10Q1PT	TDH12SP9-15Q1PT	TDH12SP9-E5Q1CC**
	3.0	—	—	TDH12SP9-0503PT	TDH12SP9-L503PT	TDH12SP9-1003PT	—	—

*Guard cartridge holder required, part no. XPCHUHP
**Guard cartridge: 2.1 mm ID

For other dimensions please refer to page 386-387
For method validation and development kits refer to page 12-13

Ordering Information

YMC-Triart 3 µm high pressure rated analytical columns (max. pressure 450 bar)

Phase	Column ID (mm)	Column length (mm)							Guard cartridges* with 10 mm length
		20	33	50	75	100	150	250	(pack of 5)
C18	2.1	TA12S03-02Q1PTH	TA12S03-H3Q1PTH	TA12S03-05Q1PTH	TA12S03-L5Q1PTH	TA12S03-10Q1PTH	TA12S03-15Q1PTH	—	TA12S03-01Q1GC
	3.0	—	—	TA12S03-0503PTH	TA12S03-L503PTH	TA12S03-1003PTH	TA12S03-1503PTH	—	TA12S03-0103GC
	4.6	—	TA12S03-H346PTH	TA12S03-0546PTH	TA12S03-L546PTH	TA12S03-1046PTH	TA12S03-1546PTH	TA12S03-2546PTH	TA12S03-0104GC
C18 ExRS	2.1	TAR08S03-02Q1PTH	TAR08S03-H3Q1PTH	TAR08S03-05Q1PTH	TAR08S03-L5Q1PTH	TAR08S03-10Q1PTH	TAR08S03-15Q1PTH	—	TAR08S03-01Q1GC
	3.0	—	—	TAR08S03-0503PTH	TAR08S03-L503PTH	TAR08S03-1003PTH	TAR08S03-1503PTH	—	TAR08S03-0103GC
	4.6	—	TAR08S03-H346PTH	TAR08S03-0546PTH	TAR08S03-L546PTH	TAR08S03-1046PTH	TAR08S03-1546PTH	TAR08S03-2546PTH	TAR08S03-0104GC
C8	2.1	T012S03-02Q1PTH	T012S03-H3Q1PTH	T012S03-05Q1PTH	T012S03-L5Q1PTH	T012S03-10Q1PTH	T012S03-15Q1PTH	—	T012S03-01Q1GC
	3.0	—	—	T012S03-0503PTH	T012S03-L503PTH	T012S03-1003PTH	T012S03-1503PTH	—	T012S03-0103GC
	4.6	—	T012S03-H346PTH	T012S03-0546PTH	T012S03-L546PTH	T012S03-1046PTH	T012S03-1546PTH	T012S03-2546PTH	T012S03-0104GC
Phenyl	2.1	TPH12S03-02Q1PTH	TPH12S03-H3Q1PTH	TPH12S03-05Q1PTH	TPH12S03-L5Q1PTH	TPH12S03-10Q1PTH	TPH12S03-15Q1PTH	—	TPH12S03-01Q1GC
	3.0	—	—	TPH12S03-0503PTH	TPH12S03-L503PTH	TPH12S03-1003PTH	TPH12S03-1503PTH	—	TPH12S03-0103GC
	4.6	—	TPH12S03-H346PTH	TPH12S03-0546PTH	TPH12S03-L546PTH	TPH12S03-1046PTH	TPH12S03-1546PTH	TPH12S03-2546PTH	TPH12S03-0104GC
PFP	2.1	TPF12S03-02Q1PTH	TPF12S03-H3Q1PTH	TPF12S03-05Q1PTH	TPF12S03-L5Q1PTH	TPF12S03-10Q1PTH	TPF12S03-15Q1PTH	—	TPF12S03-01Q1GC
	3.0	—	—	TPF12S03-0503PTH	TPF12S03-L503PTH	TPF12S03-1003PTH	TPF12S03-1503PTH	—	TPF12S03-0103GC
	4.6	—	TPF12S03-H346PTH	TPF12S03-0546PTH	TPF12S03-L546PTH	TPF12S03-1046PTH	TPF12S03-1546PTH	TPF12S03-2546PTH	TPF12S03-0104GC
HILIC	2.1	TDH12S03-02Q1PTH	TDH12S03-H3Q1PTH	TDH12S03-05Q1PTH	TDH12S03-L5Q1PTH	TDH12S03-10Q1PTH	TDH12S03-15Q1PTH	—	TDH12S03-01Q1GC
	3.0	—	—	TDH12S03-0503PTH	TDH12S03-L503PTH	TDH12S03-1003PTH	TDH12S03-1503PTH	—	TDH12S03-0103GC
	4.6	—	TDH12S03-H346PTH	TDH12S03-0546PTH	TDH12S03-L546PTH	TDH12S03-1046PTH	TDH12S03-1546PTH	TDH12S03-2546PTH	TDH12S03-0104GC

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

YMC-Triart 5 µm high pressure rated analytical columns (max. pressure 450 bar)

Phase	Column ID (mm)	Column length (mm)							Guard cartridges* with 10 mm length
		20	33	50	75	100	150	250	(pack of 5)
C18	2.1	TA12S05-02Q1PTH	TA12S05-H3Q1PTH	TA12S05-05Q1PTH	TA12S05-L5Q1PTH	TA12S05-10Q1PTH	TA12S05-15Q1PTH	—	TA12S05-01Q1GC
	3.0	—	—	TA12S05-0503PTH	TA12S05-L503PTH	TA12S05-1003PTH	TA12S05-1503PTH	—	TA12S05-0103GC
	4.6	—	TA12S05-H346PTH	TA12S05-0546PTH	TA12S05-L546PTH	TA12S05-1046PTH	TA12S05-1546PTH	TA12S05-2546PTH	TA12S05-0104GC
C18 ExRS	2.1	TAR08S05-02Q1PTH	TAR08S05-H3Q1PTH	TAR08S05-05Q1PTH	TAR08S05-L5Q1PTH	TAR08S05-10Q1PTH	TAR08S05-15Q1PTH	—	TAR08S05-01Q1GC
	3.0	—	—	TAR08S05-0503PTH	TAR08S05-L503PTH	TAR08S05-1003PTH	TAR08S05-1503PTH	—	TAR08S05-0103GC
	4.6	—	TAR08S05-H346PTH	TAR08S05-0546PTH	TAR08S05-L546PTH	TAR08S05-1046PTH	TAR08S05-1546PTH	TAR08S05-2546PTH	TAR08S05-0104GC
C8	2.1	T012S05-02Q1PTH	T012S05-H3Q1PTH	T012S05-05Q1PTH	T012S05-L5Q1PTH	T012S05-10Q1PTH	T012S05-15Q1PTH	—	T012S05-01Q1GC
	3.0	—	—	T012S05-0503PTH	T012S05-L503PTH	T012S05-1003PTH	T012S05-1503PTH	—	T012S05-0103GC
	4.6	—	T012S05-H346PTH	T012S05-0546PTH	T012S05-L546PTH	T012S05-1046PTH	T012S05-1546PTH	T012S05-2546PTH	T012S05-0104GC
Phenyl	2.1	TPH12S05-02Q1PTH	TPH12S05-H3Q1PTH	TPH12S05-05Q1PTH	TPH12S05-L5Q1PTH	TPH12S05-10Q1PTH	TPH12S05-15Q1PTH	—	TPH12S05-01Q1GC
	3.0	—	—	TPH12S05-0503PTH	TPH12S05-L503PTH	TPH12S05-1003PTH	TPH12S05-1503PTH	—	TPH12S05-0103GC
	4.6	—	TPH12S05-H346PTH	TPH12S05-0546PTH	TPH12S05-L546PTH	TPH12S05-1046PTH	TPH12S05-1546PTH	TPH12S05-2546PTH	TPH12S05-0104GC
PFP	2.1	TPF12S05-02Q1PTH	TPF12S05-H3Q1PTH	TPF12S05-05Q1PTH	TPF12S05-L5Q1PTH	TPF12S05-10Q1PTH	TPF12S05-15Q1PTH	—	TPF12S05-01Q1GC
	3.0	—	—	TPF12S05-0503PTH	TPF12S05-L503PTH	TPF12S05-1003PTH	TPF12S05-1503PTH	—	TPF12S05-0103GC
	4.6	—	TPF12S05-H346PTH	TPF12S05-0546PTH	TPF12S05-L546PTH	TPF12S05-1046PTH	TPF12S05-1546PTH	TPF12S05-2546PTH	TPF12S05-0104GC
HILIC	2.1	TDH12S05-02Q1PTH	TDH12S05-H3Q1PTH	TDH12S05-05Q1PTH	TDH12S05-L5Q1PTH	TDH12S05-10Q1PTH	TDH12S05-15Q1PTH	—	TDH12S05-01Q1GC
	3.0	—	—	TDH12S05-0503PTH	TDH12S05-L503PTH	TDH12S05-1003PTH	TDH12S05-1503PTH	—	TDH12S05-0103GC
	4.6	—	TDH12S05-H346PTH	TDH12S05-0546PTH	TDH12S05-L546PTH	TDH12S05-1046PTH	TDH12S05-1546PTH	TDH12S05-2546PTH	TDH12S05-0104GC

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

Novel column hardware technology with increased pressure rating; specifications for the individual bonding chemistries remain identical irrespective of the column hardware format selected.

Ordering Information

YMC-Triart 3 µm analytical columns (max. pressure 200/250 bar)

Phase	Column ID (mm)	Column length (mm)							Guard cartridges* with 10 mm length
		20	30	50	75	100	150	250	(pack of 5)
C18	2.0	TA12S03-0202WT	TA12S03-0302WT	TA12S03-0502WT	TA12S03-L502WT	TA12S03-1002WT	TA12S03-1502WT	—	TA12S03-01Q1GC
	3.0	—	—	TA12S03-0503WT	TA12S03-L503WT	TA12S03-1003WT	TA12S03-1503WT	—	TA12S03-0103GC
	4.6	—	—	TA12S03-0546WT	TA12S03-L546WT	TA12S03-1046WT	TA12S03-1546WT	TA12S03-2546WT	TA12S03-0104GC
C8	2.0	T012S03-0202WT	T012S03-0302WT	T012S03-0502WT	T012S03-L502WT	T012S03-1002WT	T012S03-1502WT	—	T012S03-01Q1GC
	3.0	—	—	T012S03-0503WT	T012S03-L503WT	T012S03-1003WT	T012S03-1503WT	—	T012S03-0103GC
	4.6	—	—	T012S03-0546WT	T012S03-L546WT	T012S03-1046WT	T012S03-1546WT	T012S03-2546WT	T012S03-0104GC
Phenyl	2.0	TPH12S03-0202WT	TPH12S03-0302WT	TPH12S03-0502WT	TPH12S03-L502WT	TPH12S03-1002WT	TPH12S03-1502WT	—	TPH12S03-01Q1GC
	3.0	—	—	TPH12S03-0503WT	TPH12S03-L503WT	TPH12S03-1003WT	TPH12S03-1503WT	—	TPH12S03-0103GC
	4.6	—	—	TPH12S03-0546WT	TPH12S03-L546WT	TPH12S03-1046WT	TPH12S03-1546WT	TPH12S03-2546WT	TPH12S03-0104GC
PFP	2.0	TPF12S03-0202WT	TPF12S03-0302WT	TPF12S03-0502WT	TPF12S03-L502WT	TPF12S03-1002WT	TPF12S03-1502WT	—	TPF12S03-01Q1GC
	3.0	—	—	TPF12S03-0503WT	TPF12S03-L503WT	TPF12S03-1003WT	TPF12S03-1503WT	—	TPF12S03-0103GC
	4.6	—	—	TPF12S03-0546WT	TPF12S03-L546WT	TPF12S03-1046WT	TPF12S03-1546WT	TPF12S03-2546WT	TPF12S03-0104GC
HILIC	2.0	TDH12S03-0202WT	TDH12S03-0302WT	TDH12S03-0502WT	TDH12S03-L502WT	TDH12S03-1002WT	TDH12S03-1502WT	—	TDH12S03-01Q1GC
	3.0	—	—	TDH12S03-0503WT	TDH12S03-L503WT	TDH12S03-1003WT	TDH12S03-1503WT	—	TDH12S03-0103GC
	4.6	—	—	TDH12S03-0546WT	TDH12S03-L546WT	TDH12S03-1046WT	TDH12S03-1546WT	TDH12S03-2546WT	TDH12S03-0104GC

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

YMC-Triart 5 µm analytical columns (max. pressure 200/250 bar)

Phase	Column ID (mm)	Column length (mm)							Guard cartridges* with 10 mm length
		20	30	50	75	100	150	250	(pack of 5)
C18	2.0	TA12S05-0202WT	TA12S05-0302WT	TA12S05-0502WT	TA12S05-L502WT	TA12S05-1002WT	TA12S05-1502WT	—	TA12S05-01Q1GC
	3.0	—	—	TA12S05-0503WT	TA12S05-L503WT	TA12S05-1003WT	TA12S05-1503WT	—	TA12S05-0103GC
	4.6	—	—	TA12S05-0546WT	TA12S05-L546WT	TA12S05-1046WT	TA12S05-1546WT	TA12S05-2546WT	TA12S05-0104GC
	10**	—	—	—	—	—	TA12S05-1510WT	TA12S05-2510WT	TA12S05-0110CC
C8	2.0	T012S05-0202WT	T012S05-0302WT	T012S05-0502WT	T012S05-L502WT	T012S05-1002WT	T012S05-1502WT	—	T012S05-01Q1GC
	3.0	—	—	T012S05-0503WT	T012S05-L503WT	T012S05-1003WT	T012S05-1503WT	—	T012S05-0103GC
	4.6	—	—	T012S05-0546WT	T012S05-L546WT	T012S05-1046WT	T012S05-1546WT	T012S05-2546WT	T012S05-0104GC
	10**	—	—	—	—	—	T012S05-1510WT	T012S05-2510WT	T012S05-0110CC
Phenyl	2.0	TPH12S05-0202WT	TPH12S05-0302WT	TPH12S05-0502WT	TPH12S05-L502WT	TPH12S05-1002WT	TPH12S05-1502WT	—	TPH12S05-01Q1GC
	3.0	—	—	TPH12S05-0503WT	TPH12S05-L503WT	TPH12S05-1003WT	TPH12S05-1503WT	—	TPH12S05-0103GC
	4.6	—	—	TPH12S05-0546WT	TPH12S05-L546WT	TPH12S05-1046WT	TPH12S05-1546WT	TPH12S05-2546WT	TPH12S05-0104GC
	10**	—	—	—	—	—	TPH12S05-1510WT	TPH12S05-2510WT	TPH12S05-0110CC
PFP	2.0	TPF12S05-0202WT	TPF12S05-0302WT	TPF12S05-0502WT	TPF12S05-L502WT	TPF12S05-1002WT	TPF12S05-1502WT	—	TPF12S05-01Q1GC
	3.0	—	—	TPF12S05-0503WT	TPF12S05-L503WT	TPF12S05-1003WT	TPF12S05-1503WT	—	TPF12S05-0103GC
	4.6	—	—	TPF12S05-0546WT	TPF12S05-L546WT	TPF12S05-1046WT	TPF12S05-1546WT	TPF12S05-2546WT	TPF12S05-0104GC
	10**	—	—	—	—	—	TPF12S05-1510WT	TPF12S05-2510WT	TPF12S05-0110CC
HILIC	2.0	TDH12S05-0202WT	TDH12S05-0302WT	TDH12S05-0502WT	TDH12S05-L502WT	TDH12S05-1002WT	TDH12S05-1502WT	—	TDH12S05-01Q1GC
	3.0	—	—	TDH12S05-0503WT	TDH12S05-L503WT	TDH12S05-1003WT	TDH12S05-1503WT	—	TDH12S05-0103GC
	4.6	—	—	TDH12S05-0546WT	TDH12S05-L546WT	TDH12S05-1046WT	TDH12S05-1546WT	TDH12S05-2546WT	TDH12S05-0104GC

*Guard cartridge holder required, part no. XPGCH-Q1 (2.1, 3, 4 mm ID)
XPCHSPW1 (10 mm ID)
**Max. pressure 100 bar

Ordering Information

YMC-Triart, 5 µm in ACTUS high-throughput semipreparative hardware (max. pressure 300 bar)

Phase	Column ID (mm)	Column length (mm) 50	75	100	150	250
C18	20.0	TA12S05-0520WX	—	TA12S05-1020WX	TA12S05-1520WX	TA12S05-2520WX
	30.0	TA12S05-0530WX	TA12S05-L530WX	TA12S05-1030WX	TA12S05-1530WX	TA12S05-2530WX
C18 ExRS	20.0	TAR08S05-0520WX	—	TAR08S05-1020WX	TAR08S05-1520WX	TAR08S05-2520WX
	30.0	TAR08S05-0530WX	TAR08S05-L530WX	TAR08S05-1030WX	TAR08S05-1530WX	TAR08S05-2530WX
C8	20.0	T012S05-0520WX	—	T012S05-1020WX	T012S05-1520WX	T012S05-2520WX
	30.0	T012S05-0530WX	T012S05-L530WX	T012S05-1030WX	T012S05-1530WX	T012S05-2530WX
Phenyl	20.0	TPH12S05-0520WX	—	TPH12S05-1020WX	TPH12S05-1520WX	TPH12S05-2520WX
	30.0	TPH12S05-0530WX	TPH12S05-L530WX	TPH12S05-1030WX	TPH12S05-1530WX	TPH12S05-2530WX
PFP	20.0	TPF12S05-0520WX	—	TPF12S05-1020WX	TPF12S05-1520WX	TPF12S05-2520WX
	30.0	TPF12S05-0530WX	TPF12S05-L530WX	TPF12S05-1030WX	TPF12S05-1530WX	TPF12S05-2530WX

YMC-Triart, preparative bulk media

YMC-Triart C18-S			YMC-Triart C8-S		
Pore size (nm)	Particle size (µm)	Product Code	Pore size (nm)	Particle size (µm)	Product Code
12	10	TAS12S11	20	10	TOS20S11
	15	TAS12S16		15	TOS20S16
	20	TAS12S21		20	TOS20S21

Available in pack sizes 100 g, 500 g, 1 kg, 5 kg, 25 kg

YMC-Actus

Contents

Introduction

Fast semi-preparative chromatography

Semi-preparative chromatography is the link between analytical HPLC and preparative LC. Even though the chromatographic systems used for semi-preparative LC are not as large as preparative LC systems, the objectives remain the same:

- Purification and isolation of maximum sample quantity
- Savings in time and costs.

With YMC-Actus, time is on your side!

YMC-Actus

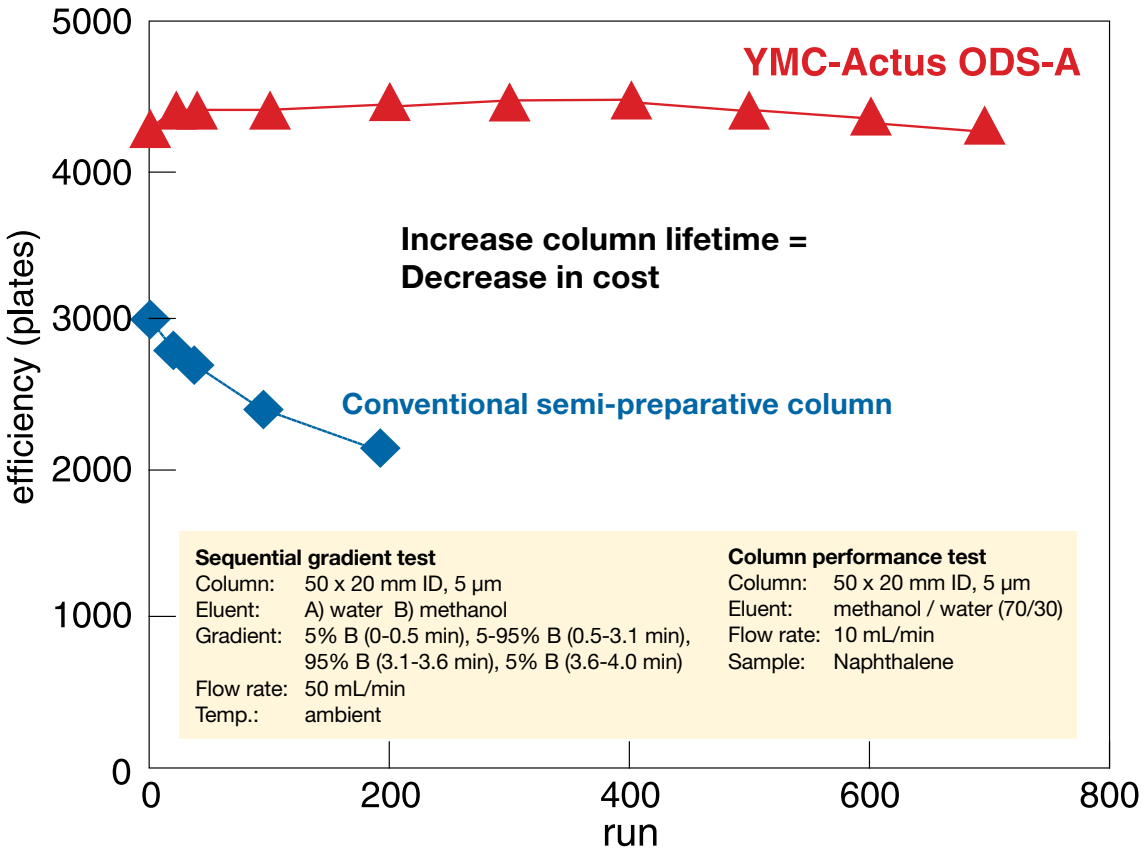
Cost efficiency

Rapid pressure changes under high-speed gradient conditions may lead to column degradation and loss of column performance.

With YMC-Actus, a specific hardware and packing technology has been applied to these semi-preparative columns to provide a uniform packing density, which results in a longer lifetime than conventional semi-preparative columns.

In order to determine the quality of the packing, the column performance has been evaluated every 100 runs with a sequential high-throughput gradient.

YMC-Actus columns offer outstanding efficiency without compromising resolution. Furthermore, YMC-Actus columns provide reliable results, even after exposure to severe, rapid gradient conditions and multiple injections.



Sequential gradient test
Column: 50 x 20 mm ID, 5 µm
Eluent: A) water B) methanol
Gradient: 5% B (0-0.5 min), 5-95% B (0.5-3.1 min), 95% B (3.1-3.6 min), 5% B (3.6-4.0 min)
Flow rate: 50 mL/min
Temp.: ambient

Column performance test
Column: 50 x 20 mm ID, 5 µm
Eluent: methanol / water (70/30)
Flow rate: 10 mL/min
Sample: Naphthalene

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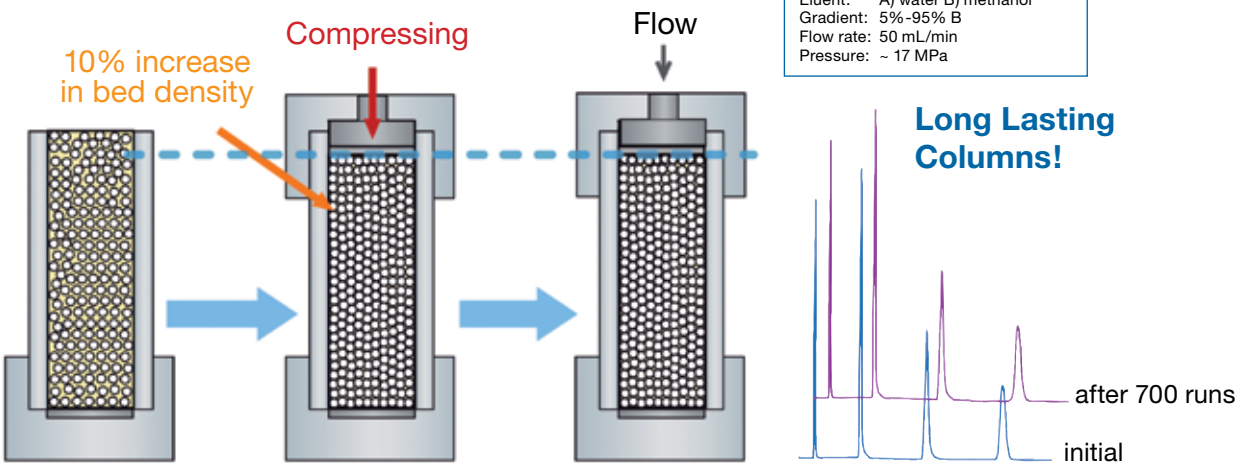
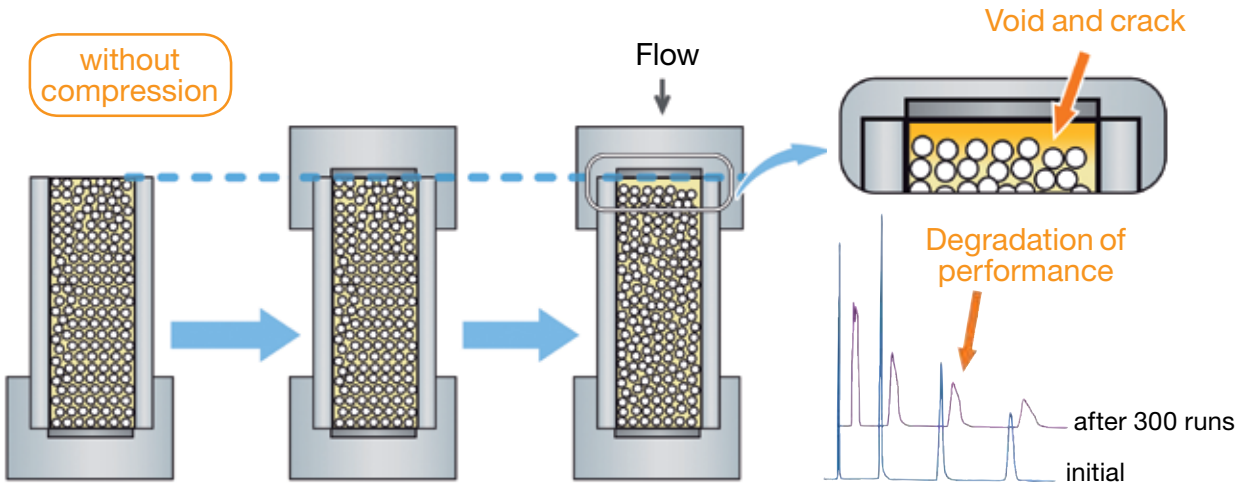
How to obtain long lasting columns?

YMC-Actus series columns are semi-preparative HPLC columns that have excellent column stability and efficiency as a result of applying axial compression technology. YMC-Actus series columns show high stability under high flow rate or steep gradient conditions which are desirable for milligram scale preparative HPLC of various compounds.

YMC-Actus Column Packing



Conventional Column Packing



Uniformly high density packing is necessary for highly efficient and stable HPLC columns.

DAC (Dynamic Axial Compression) columns are widely used for preparative separation in pilot or production scale. This allows uniformly high density packing and prevents formation of voids.

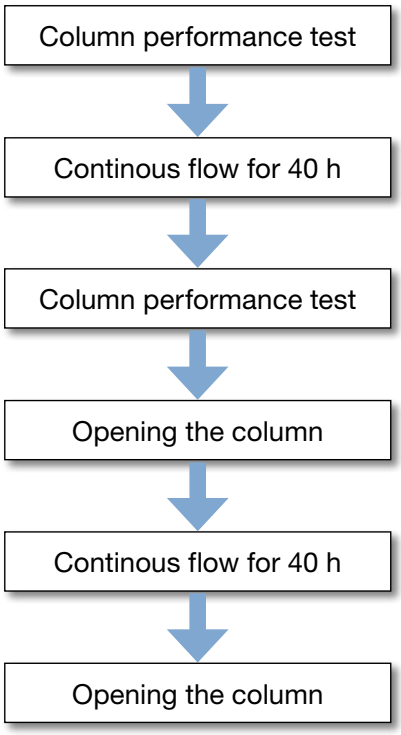
YMC-Actus series columns have been developed by applying this Axial Compression Technology to semi-prep column production. The column bed is compressed appropriately when attaching the inlet end assembly of the newly designed YMC-Actus hardware. It provides increased bed density (10% higher than conventional columns) and bed uniformity.

* Application data by courtesy YMC Co., Ltd.

YMC-Actus

Secured hardware stability*

A study has been performed using the 50 mm ID YMC-Actus columns for 80 hours at a constant maximum column pressure. An initial column performance test and after 40 hours was carried out. No significant changes in performance were observed after hours of continuous pressurisation.



Column continuous flow

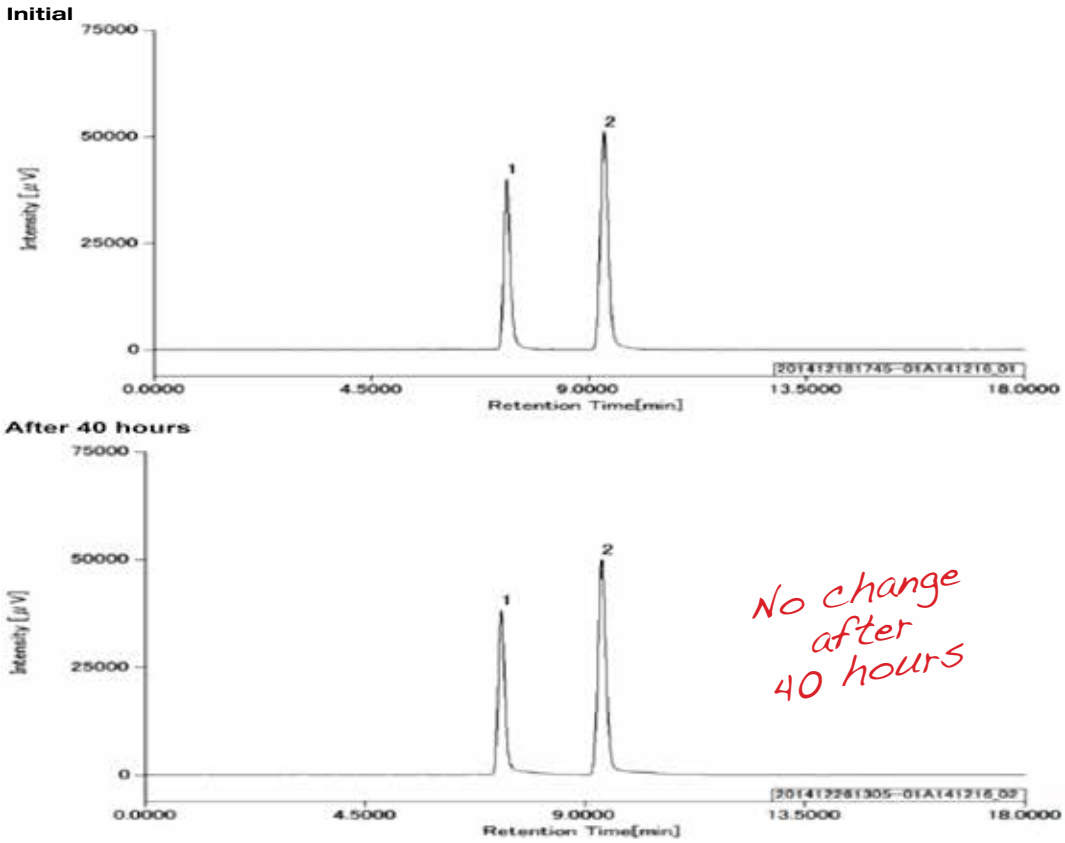
Column:	YMC-Actus SIL (12 nm, 5 µm) 250 x 50 mm ID
Part.-No.:	SL12S05-2553DX
Eluent:	*n*-hexane / ethanol (90/10)
Flow rate:	240 mL/min
Pressure:	200 bar
Temperature:	ambient

Column performance test

Column:	YMC-Actus SIL (12 nm, 5 µm) 250 x 50 mm ID
Eluent:	*n*-hexane / ethanol (90/10)
Flow rate:	50 mL/min
Temperature:	ambient
Detection:	UV at 254 nm
Sample:	1. Toluene (500 µL/mL) 2. Nitrobenzene (10 µL/mL)
Injection:	20 µL

YMC-Actus columns remain stable even after use at maximum pressure!

YMC-Actus



Step	Theoretical plate number N*	Tailing factor Tf*	Backpressure (bar)
Initial	**16,093**	**1.18**	**20**
After 40 h	**15,693**	**1.16**	**22**

*values for nitrobenzene (peak 2)

The inlet frit was inspected after 40 and 80 hours. On opening, neither frit distortion nor gel leakage was observed.

* Application data by courtesy YMC Co., Ltd.

YMC-Actus

Effective method development on purification

In order to develop a successful semi-preparative method it is beneficial to proceed the following steps:

Step 1: **Developing a well optimised separation on analytical scale**
Step 2: **Loading study on analytical scale**
Step 3: **Scale-up to semi-preparative column dimensions**
Step 4: **Quality Control**

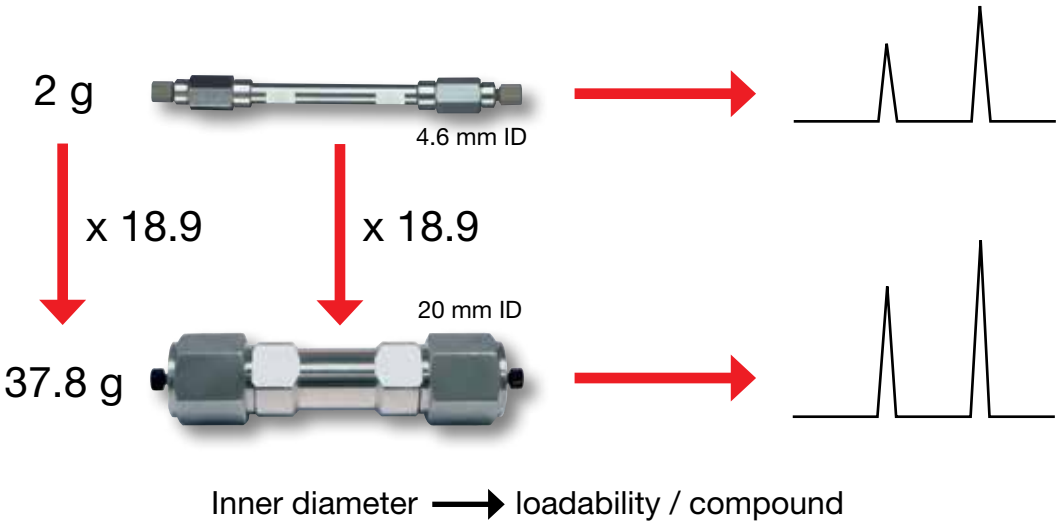
Linear Scale-Up

$$SF = \frac{\Pi^2_{ID,\,prep}}{\Pi^2_{ID,\,anal.}} = \frac{m_{prep}}{m_{anal.}}$$

$$SF = r^2_{ID,\,prep} \,/\, r^2_{ID,\,analytical}$$

$$SF = 20^2_{ID,\,prep} \,/\, 4.6^2_{ID,\,analytical}$$

$$SF = 18.9$$



Inner diameter ⟶ loadability / compound

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
50	118	80-350
75	266	270-980
100	472	470-1900
150	1060	1000-4200

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Example: Separation of Clindamycin as basic drug

Step 1: Development of analytical method

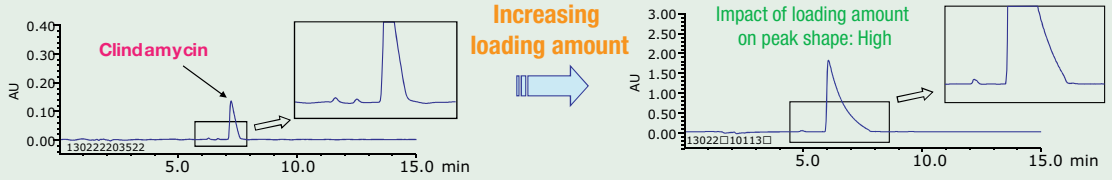
YMC-Triart C18 5 µm, 150 x 4.6 mm ID

0.01 mg Loading
(10 µL injection, 1.0 mg/mL in water)

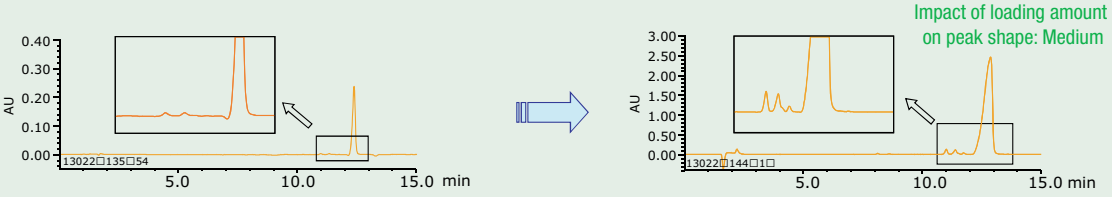
0.5 mg Loading
(10 µL injection, 50 mg/mL in water)

Increasing loading amount

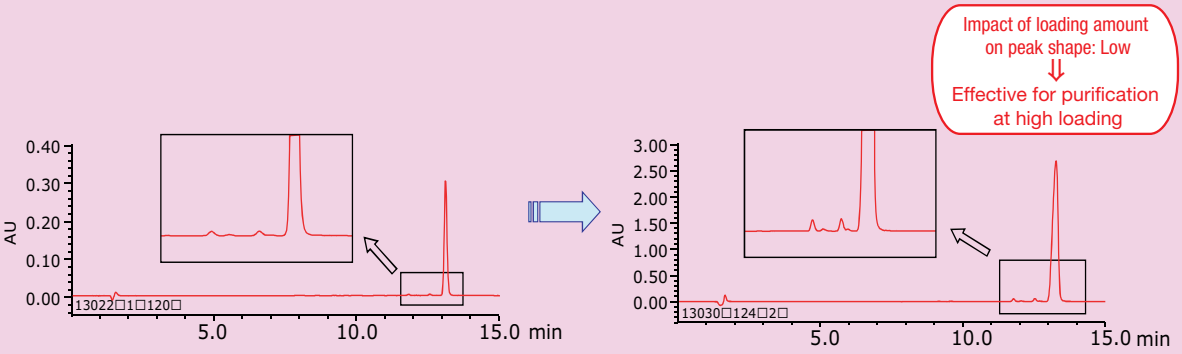
pH 2.7

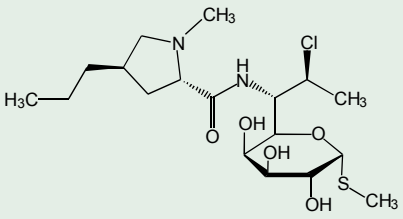


pH 6.7



pH 9.8





Clindamycin (pKa=7.6)

Part No.:	TA12S05-1546WT
Eluent:	A) 20 mM HCOOH for pH 2.7 20 mM $HCOONH_4$ for pH 6.7 20 mM $HCOONH_4$-NH3 for pH 9.8 B) acetonitrile 10-75%B (0-15 min)
Flow rate:	1.0 mL/min
Temperature:	25 °C
Detection:	UV at 210 nm
Pressure:	7.0 MPa

* Application data by courtesy YMC Co., Ltd.

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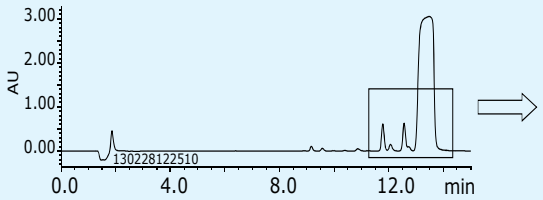
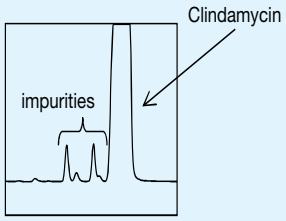
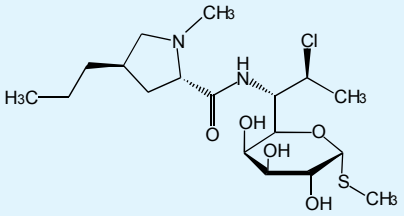
Step 2: Loading study for Clindamycin

YMC-Triart C18 5 µm, 150 x 4.6 mm ID

pH 9.8 — 2.5 mg Loading
(50 µL injection, 50 mg/mL in water)







Clindamycin (pKa=7.6)

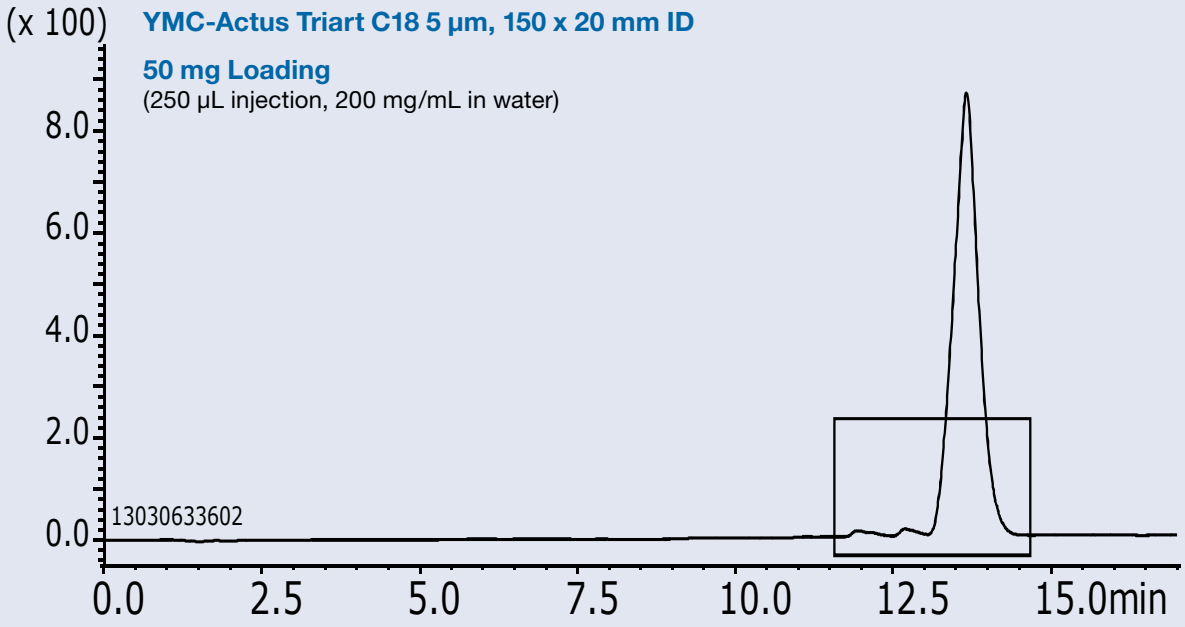
Scaling up to semi-preparative scale

Part No.:	TA12S05-1546WT
Eluent:	A) 20 mM $HCOONH_4$-NH3 for pH 9.8 B) acetonitrile 10-75%B (0-15 min)
Flow rate:	1.0 mL/min
Temperature:	25 °C
Detection:	UV at 210 nm
Pressure:	7.0 MPa

Step 3: Scale-up

YMC-Actus Triart C18 5 µm, 150 x 20 mm ID

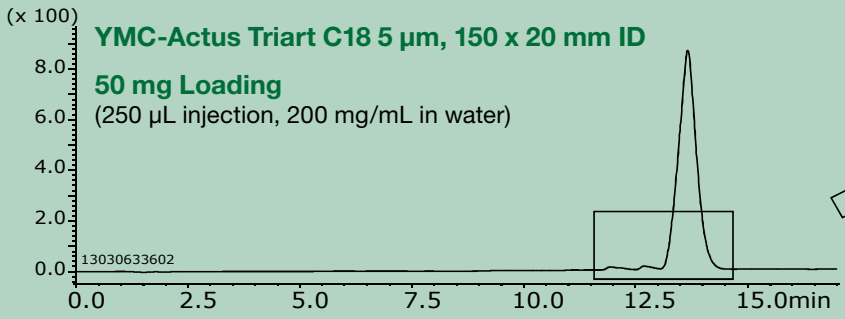
50 mg Loading
(250 µL injection, 200 mg/mL in water)



Part No.:	TA12S05-1520WX
Eluent:	A) 20 mM $HCOONH_4$-NH_3 (pH 9.8) B) acetonitrile 10-75%B (0-15 min)
Flow rate:	18.9 mL/min
Temperature:	ambient
Detection:	UV at 210 nm
Pressure:	8.4 MPa

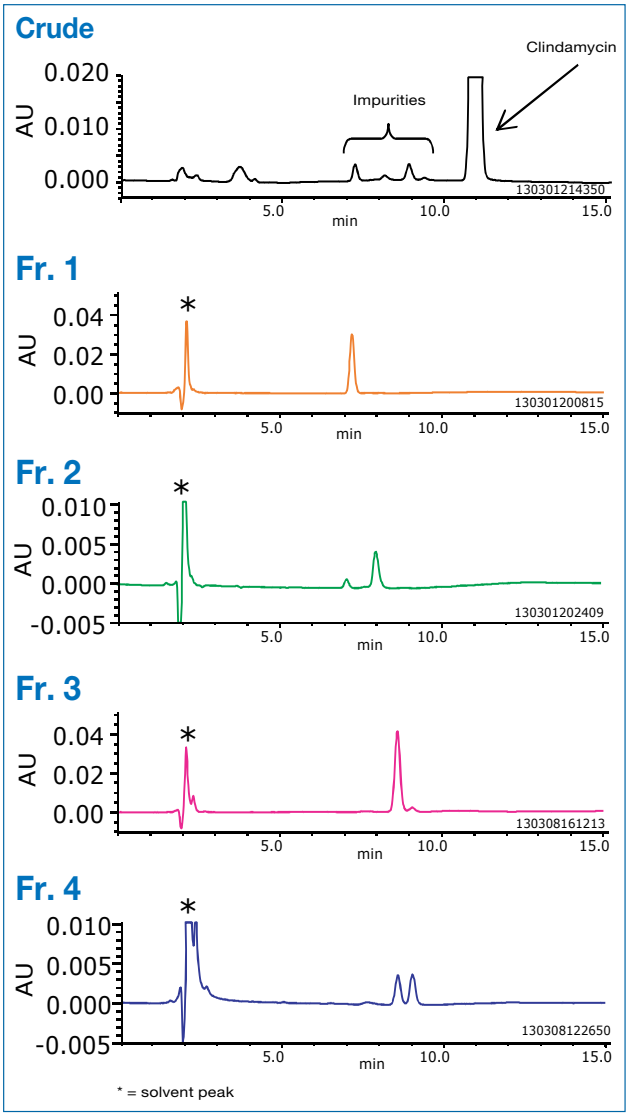
YMC-Actus

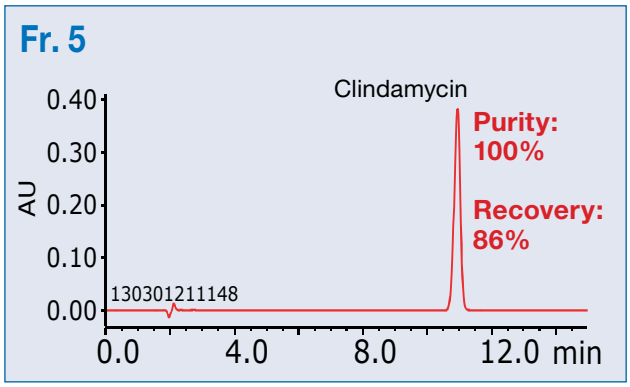
Step 4: Quality Control/Proof of concept



Part No.:	TA12S05-1520WX
Eluent:	A) 20 mM $HCOONH_4$-NH_3 (pH 9.8) B) acetonitrile 10-75%B (0-15 min)
Flow rate:	18.9 mL/min
Temperature:	ambient
Detection:	UV at 210 nm
Pressure:	8.4 MPa

Analysis of fractions





Column:	YMC-Triart C18 (5 µm) 150 x 4.6 mm ID
Part No.:	TA12S05-1546WT
Eluent:	50 mM KH_2PO_4 (pH 7.5 adjusted by 8 M KOH)/acetonitrile (55/45)
Flow rate:	1.0 mL/min
Temperature:	25 °C
Detection:	UV at 210 nm
Injection:	20 µL

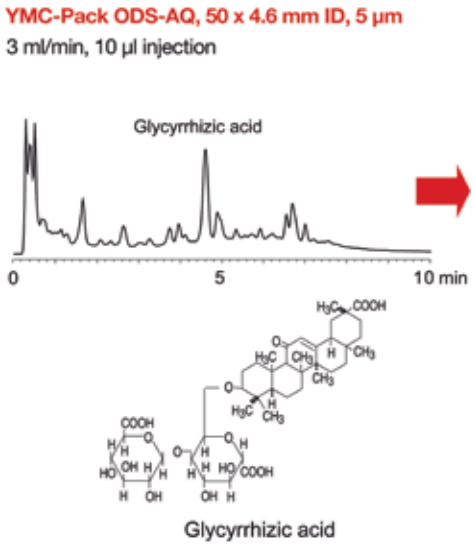
* Application data by courtesy YMC Co., Ltd.

YMC-Actus

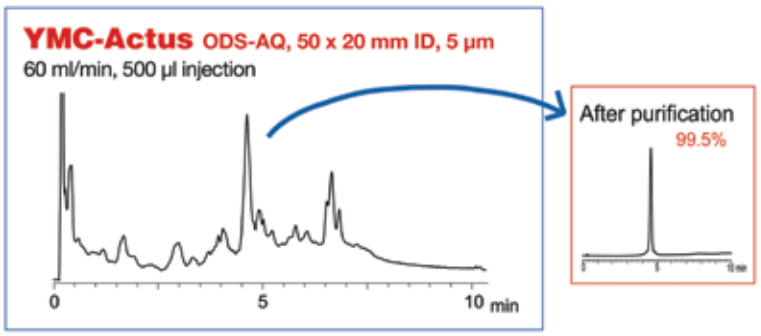
Excellent stability and efficiency under fast gradient conditions at high flow rate

Glycyrrhizic acid in herbal medicine*

Analysis

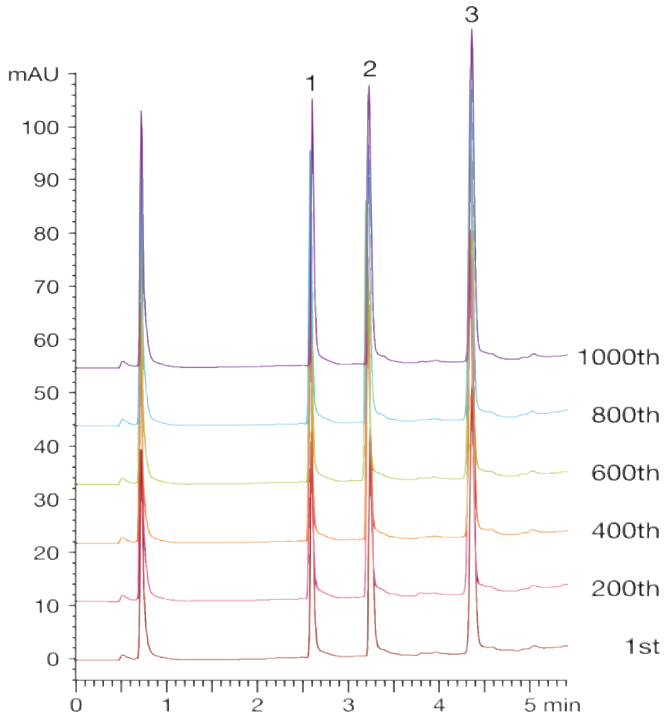


Purification



Part No.:	AQ12S05-0546WT (analytical column) AQ12S05-0520WX (semi prep. column)
Eluent:	A) water / acetic acid (99/1) B) methanol / acetic acid (99/1) 20% B (0-2 min), 20-45% B (2-7 min), 45% B (7-10 min)
Temperature:	ambient
Detection:	UV at 260 nm
Sample:	water / methanol / acetic acid extract of commercially available herb medicine (0.1 g/mL)

Available for high-throughput purification: Injection in DMSO



1. Ethenzamide
2. Clemastine fumarate
3. Ibuprofen

Column:	YMC-Actus *Pro* C18 RS (5 µm, 8 nm) 50 x 20 mm ID
Part No.:	RS08S05-0520WX
Eluent:	A) water / TFA (100/0.1) B) acetonitrile / TFA (100/0.1)
Gradient:	10-90% B (0-3 min), 90% B (3-5 min), 10% B (5-10 min)
Flow rate:	20 mL/min
Temperature:	ambient
Detection:	UV at 270 nm
Injection:	100 µL (0.2-2 mg/mL in DMSO)

As shown in this overlay of chromatograms, YMC-Actus columns provide outstanding stability and reproducibility for the separation of pharmaceuticals dissolved in 100% DMSO, even after 1,000 injections under the test conditions. This verifies that YMC-Actus columns are ideal for high-throughput purification in drug discovery.

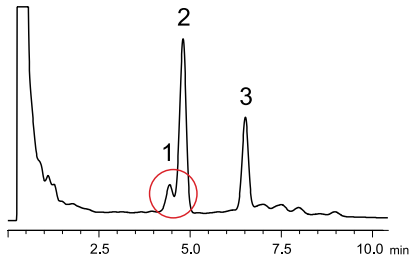
YMC-Actus

Excellent separation of compounds with similar structure

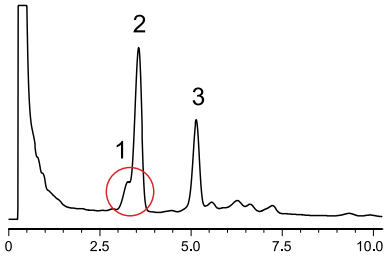
Capsaicinoids in red pepper*

Analysis 50 x 4.6 mm ID, 5 µm
2.0 mL/min, 20 µL injection

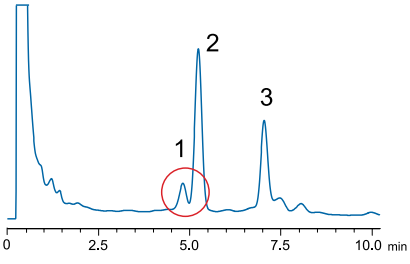
Phenomenex Luna C18

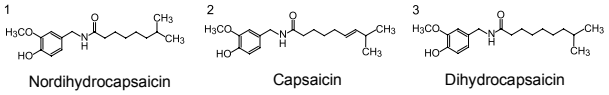


Waters XBridge C18



YMC-Pack *Pro* C18 RS

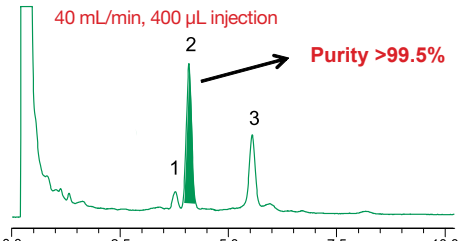




Nordihydrocapsaicin | Capsaicin | Dihydrocapsaicin

Purification

YMC-Actus *Pro* C18 RS, 50 x 20 mm ID 5 µm
40 mL/min, 400 µL injection



Eluent:	A) methanol / water / TFA (50/50/0.1) B) methanol / TFA (100/0.1) 0-30% B (0-5 min), 30% B (5-10 min)
Temperature:	25 °C for 50 x 4.6 mm ID ambient for 50 x 20 mm ID
Detection:	UV at 280 nm
Sample:	methanol extract of a commercial red pepper (1 g / 3 mL)

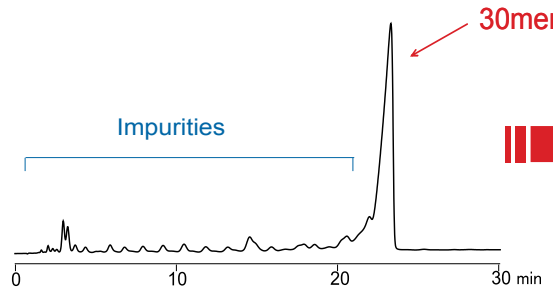
Outstanding separation of highly polar compounds

Crude synthetic 30mer oligonucleotide*

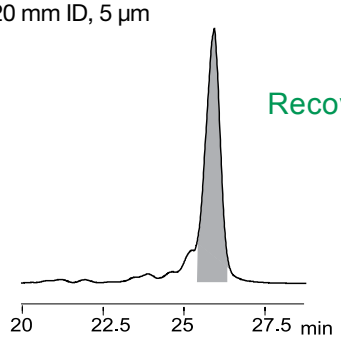
Analysis 1.0 mL/min, 5 µL injection

Purification 19 mL/min, 100 µL injection

Hydrosphere C18
50 x 4.6 mm ID, 5 µm



YMC-Actus Hydrosphere C18
50 x 20 mm ID, 5 µm



purity>99%

Part No.:	HS12S05-0546WT (analytical column) HS12S05-0520WX (semi prep. column)
Eluent:	A) 10 mM DBA-acetic acid (pH 6.0) / methanol (60/40) B) 10 mM DBA-acetic acid (pH 6.0) / methanol (20/80) 10-35% B (0-30 min)
Temperature:	ambient
Detection:	UV at 269 nm
Sample:	synthetic oligonucleotide (100 µM)

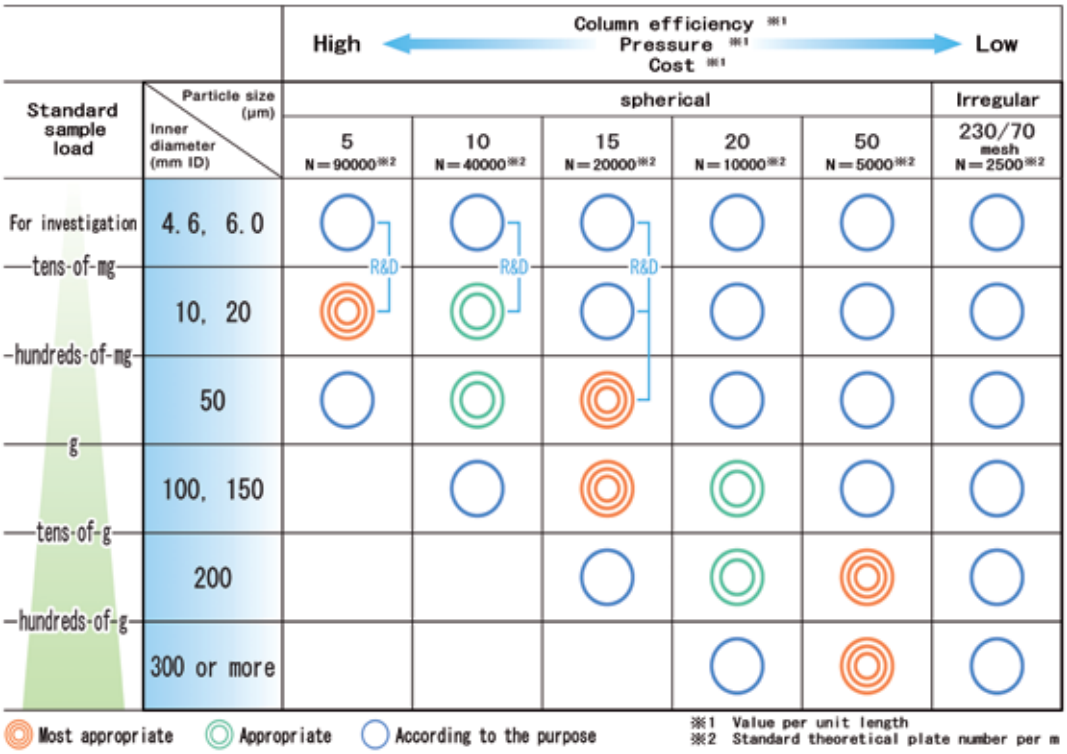
* Application data by courtesy YMC Co., Ltd.

YMC Actus

Preparative Column Selection Finder

Optimisation of preparative chromatography!

The main task for a preparative chromatographer is to find the most suitable system as quickly as possible. In order to simplify the process YMC has developed a “Preparative Column Selection Guide”.



R&D Scale-up Kit: Analytical and semipreparative columns packed with a stationary phase from the same lot.

The “Preparative Column Selection Guide” will help in the selection of:-

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

R&D Kits

To minimise the problems that the process of scale-up may introduce, YMC offers YMC R&D kits, which consist of one analytical column and one YMC-Actus column packed with exactly the same packing material from the same production lot. Therefore, no further method development is needed, just a simple linear scale-up calculation.

YMC Actus

Scale-Up

YMC linear scale-up is achieved in 4 steps:

1. Analytical scale method development.

Determine the optimum separation conditions by using analytical columns packed with different stationary phases and various elution conditions.

2. Consider 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 having inner diameters of 4.6 mm or 6.0 mm packed with the packing material selected for the preparative separation (i.e. a 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 an intermediate 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.

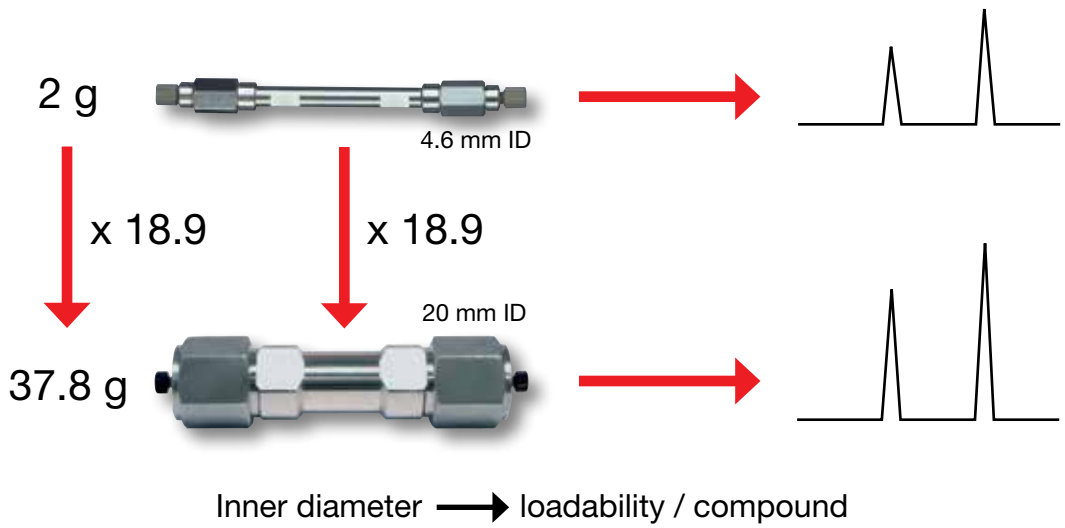
The most demanding step in this process will be the scale-up of the chromatographic parameters in order to meet the preparative demands.

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.

How to adjust the scalable factors?

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

Scalable factor SF	Internal Diameter “Linear Scale-Up”	Column length “Time”	Column length and ID “Volume”
	$SF = r^2_{ID,\ prep} / r^2_{ID,\ anal.}$	$SF = l_{ID,\ prep} / l_{ID,\ anal.}$	$SF = (r^2_{ID,\ prep} / r^2_{ID,\ anal.}) / (l_{ID,\ prep} / l_{ID,\ anal.})$
Impact	Flow rate Eluent composition	Retention time Cycle time Plate number	Amount of adsorbent



Inner diameter → loadability / compound

* Application data by courtesy YMC Co., Ltd.

Ordering Information

High stability semi-preparative columns

Packing material	Particle size [µm]	Pore size [nm]	Column size length x ID [mm]	Product Code
YMC-Triart C18	5	12	50 x 20 100 x 20 150 x 20 250 x 20 50 x 30 75 x 30 100 x 30 150 x 30 250 x 30 100 x 50 150 x 50 250 x 50	TA12S05-0520WX TA12S05-1020WX TA12S05-1520WX TA12S05-2520WX TA12S05-0530WX TA12S05-L530WX TA12S05-1030WX TA12S05-1530WX TA12S05-2530WX on request on request on request
YMC-Triart C18 ExRS	5	8	50 x 20 100 x 20 150 x 20 250 x 20 50 x 30 75 x 30 100 x 30 150 x 30 250 x 30 100 x 50 150 x 50 250 x 50	TAR08S05-0520WX TAR08S05-1020WX TAR08S05-1520WX TAR08S05-2520WX TAR08S05-0530WX TAR08S05-L530WX TAR08S05-1030WX TAR08S05-1530WX TAR08S05-2530WX on request on request on request
YMC-Triart C8	5	12	50 x 20 100 x 20 150 x 20 250 x 20 50 x 30 75 x 30 100 x 30 150 x 30 250 x 30 100 x 50 150 x 50 250 x 50	TO12S05-0520WX TO12S05-1020WX TO12S05-1520WX TO12S05-2520WX TO12S05-0530WX TO12S05-L530WX TO12S05-1030WX TO12S05-1530WX TO12S05-2530WX on request on request on request
YMC-Triart Phenyl	5	12	50 x 20 100 x 20 150 x 20 250 x 20 50 x 30 75 x 30 100 x 30 150 x 30 250 x 30 100 x 50 150 x 50 250 x 50	TPH12S05-0520WX TPH12S05-1020WX TPH12S05-1520WX TPH12S05-2520WX TPH12S05-0530WX TPH12S05-L530WX TPH12S05-1030WX TPH12S05-1530WX TPH12S05-2530WX on request on request on request
YMC-Triart PFP	5	12	50 x 20 100 x 20 150 x 20 250 x 20 50 x 30 75 x 30 100 x 30 150 x 30 250 x 30 100 x 50 150 x 50 250 x 50	TPF12S05-0520WX TPF12S05-1020WX TPF12S05-1520WX TPF12S05-2520WX TPF12S05-0530WX TPF12S05-L530WX TPF12S05-1030WX TPF12S05-1530WX TPF12S05-2530WX on request on request on request
YMC-Pack *Pro* C18	5	12	50 x 20 100 x 20 150 x 20 250 x 20 50 x 30 75 x 30 100 x 30 150 x 30 250 x 30 100 x 50 150 x 50 250 x 50	AS12S05-0520WX AS12S05-1020WX AS12S05-1520WX AS12S05-2520WX AS12S05-0530WX AS12S05-L530WX AS12S05-1030WX AS12S05-1530WX AS12S05-2530WX on request on request on request

Ordering Information

High stability semi-preparative columns

Packing material	Particle size [µm]	Pore size [nm]	Column size length x ID [mm]	Product Code
Hydrosphere C18	5	12	50 x 20 100 x 20 150 x 20 250 x 20 50 x 30 75 x 30 100 x 30 150 x 30 250 x 30 100 x 50 150 x 50 250 x 50	HS12S05-0520WX HS12S05-1020WX HS12S05-1520WX HS12S05-2520WX HS12S05-0530WX HS12S05-L530WX HS12S05-1030WX HS12S05-1530WX HS12S05-2530WX on request on request on request
YMC-Pack *Pro* C18 RS	5	8	50 x 20 100 x 20 150 x 20 250 x 20 50 x 30 75 x 30 100 x 30 150 x 30 250 x 30 100 x 50 150 x 50 250 x 50	RS08S05-0520WX RS08S05-1020WX RS08S05-1520WX RS08S05-2520WX RS08S05-0530WX RS08S05-L530WX RS08S05-1030WX RS08S05-1530WX RS08S05-2530WX on request on request on request
YMC-Pack *Pro* C8	5	12	50 x 20 100 x 20 150 x 20 250 x 20 50 x 30 75 x 30 100 x 30 150 x 30 250 x 30 100 x 50 150 x 50 250 x 50	OS12S05-0520WX OS12S05-1020WX OS12S05-1520WX OS12S05-2520WX OS12S05-0530WX OS12S05-L530WX OS12S05-1030WX OS12S05-1530WX OS12S05-2530WX on request on request on request
YMC-Pack ODS-A	5	12	50 x 20 100 x 20 150 x 20 250 x 20 50 x 30 75 x 30 100 x 30 150 x 30 250 x 30 100 x 50 150 x 50 250 x 50	AA12S05-0520WX AA12S05-1020WX AA12S05-1520WX AA12S05-2520WX AA12S05-0530WX AA12S05-L530WX AA12S05-1030WX AA12S05-1530WX AA12S05-2530WX on request on request on request
YMC-Pack ODS-AQ	5	12	50 x 20 100 x 20 150 x 20 250 x 20 50 x 30 75 x 30 100 x 30 150 x 30 250 x 30 100 x 50 150 x 50 250 x 50	AQ12S05-0520WX AQ12S05-1020WX AQ12S05-1520WX AQ12S05-2520WX AQ12S05-0530WX AQ12S05-L530WX AQ12S05-1030WX AQ12S05-1530WX AQ12S05-2530WX on request on request on request
YMCbasic	5	20	50 x 20 100 x 20 150 x 20 250 x 20 50 x 30 75 x 30 100 x 30 150 x 30 250 x 30 100 x 50 150 x 50 250 x 50	BA99S05-0520WX BA99S05-1020WX BA99S05-1520WX BA99S05-2520WX BA99S05-0530WX BA99S05-L530WX BA99S05-1030WX BA99S05-1530WX BA99S05-2530WX on request on request on request

Ordering Information

High stability semi-preparative columns

Packing material	Particle size [µm]	Pore size [nm]	Column size length x ID [mm]	Product Code
YMC-Triart Prep C18-S	10	12	50 x 20 100 x 20 150 x 20 250 x 20 50 x 30 75 x 30 100 x 30 150 x 30 250 x 30 100 x 50 150 x 50 250 x 50	TAS12S11-0520WX TAS12S11-1020WX TAS12S11-1520WX TAS12S11-2520WX TAS12S11-0530WX TAS12S11-L530WX TAS12S11-1030WX TAS12S11-1530WX TAS12S11-2530WX on request on request on request
YMC-Triart Prep C18-S	15	12	50 x 20 100 x 20 150 x 20 250 x 20 50 x 30 75 x 30 100 x 30 150 x 30 250 x 30 100 x 50 150 x 50 250 x 50	TAS12S16-0520WX TAS12S16-1020WX TAS12S16-1520WX TAS12S16-2520WX TAS12S16-0530WX TAS12S16-L530WX TAS12S16-1030WX TAS12S16-1530WX TAS12S16-2530WX on request on request on request
YMC-Triart Prep C18-S	20	12	50 x 20 100 x 20 150 x 20 250 x 20 50 x 30 75 x 30 100 x 30 150 x 30 250 x 30 100 x 50 150 x 50 250 x 50	TAS12S21-0520WX TAS12S21-1020WX TAS12S21-1520WX TAS12S21-2520WX TAS12S21-0530WX TAS12S21-L530WX TAS12S21-1030WX TAS12S21-1530WX TAS12S21-2530WX on request on request on request
YMC-Triart Prep C8-S	10	20	50 x 20 100 x 20 150 x 20 250 x 20 50 x 30 75 x 30 100 x 30 150 x 30 250 x 30 100 x 50 150 x 50 250 x 50	TOS20S11-0520WX TOS20S11-1020WX TOS20S11-1520WX TOS20S11-2520WX TOS20S11-0530WX TOS20S11-L530WX TOS20S11-1030WX TOS20S11-1530WX TOS20S11-2530WX on request on request on request
YMC-Triart Prep C8-S	15	20	50 x 20 100 x 20 150 x 20 250 x 20 50 x 30 75 x 30 100 x 30 150 x 30 250 x 30 100 x 50 150 x 50 250 x 50	TOS20S16-0520WX TOS20S16-1020WX TOS20S16-1520WX TOS20S16-2520WX TOS20S16-0530WX TOS20S16-L530WX TOS20S16-1030WX TOS20S16-1530WX TOS20S16-2530WX on request on request on request
YMC-Triart Prep C8-S	20	20	50 x 20 100 x 20 150 x 20 250 x 20 50 x 30 75 x 30 100 x 30 150 x 30 250 x 30 100 x 50 150 x 50 250 x 50	TOS20S21-0520WX TOS20S21-1020WX TOS20S21-1520WX TOS20S21-2520WX TOS20S21-0530WX TOS20S21-L530WX TOS20S21-1030WX TOS20S21-1530WX TOS20S21-2530WX on request on request on request

Ordering Information

High stability semi-preparative columns

Packing material	Particle size [µm]	Pore size [nm]	Column size length x ID [mm]	Product Code
YMC Omega	10	—	50 x 20 100 x 20 150 x 20 250 x 20 50 x 30 75 x 30 100 x 30 150 x 30 250 x 30 100 x 50 150 x 50 250 x 50	OMG99S11-0520WX OMG99S11-1020WX OMG99S11-1520WX OMG99S11-2520WX OMG99S11-0530WX OMG99S11-L530WX OMG99S11-1030WX OMG99S11-1530WX OMG99S11-2530WX on request on request on request

Guard cartridges

Packing material	Particle size [µm]	Pore size [nm]	Column size length x ID [mm]	Product Code [pack of 2]
YMC-Triart C18	5	12	10 x 20 10 x 30	TA12S05-0120CC TA12S05-0130CC
YMC-Triart C18 ExRS	5	8	10 x 20 10 x 30	TAR08S05-0120CC TAR08S05-0130CC
YMC-Triart C8	5	12	10 x 20 10 x 30	T012S05-0120CC T012S05-0130CC
YMC-Triart Phenyl	5	12	10 x 20 10 x 30	TPH12S05-0120CC TPH12S05-0130CC
YMC-Triart PFP	5	12	10 x 20 10 x 30	TPF12S05-0120CC TPF12S05-0130CC
YMC-Pack *Pro* C18	5	12	10 x 20 10 x 30	AS12S05-0120CC AS12S05-0130CC
Hydrosphere C18	5	12	10 x 20 10 x 30	HS12S05-0120CC HS12S05-0130CC
YMC-Pack *Pro* C18 RS	5	8	10 x 20 10 x 30	RS08S05-0120CC RS08S05-0130CC
YMC-Pack *Pro* C8	5	12	10 x 20 10 x 30	OS12S05-0120CC OS12S05-0130CC
YMC-Pack ODS-A	5	12	10 x 20 10 x 30	AA12S05-0120CC AA12S05-0130CC
YMC-Pack ODS-AQ	5	12	10 x 20 10 x 30	AQ12S05-0120CC AQ12S05-0130CC
YMCbasic	5	20	10 x 20 10 x 30	BA99S05-0120CC BA99S05-0130CC
Triart Prep C18-S	10	12	10 x 20 10 x 30	TAS12S11-0120CC TAS12S11-0130CC
	15	12	10 x 20 10 x 30	TAS12S16-0120CC TAS12S16-0130CC
	20	12	10 x 20 10 x 30	TAS12S21-0120CC TAS12S21-0130CC
Triart Prep C8-S	10	20	10 x 20 10 x 30	TOS20S11-0120CC TOS20S11-0130CC
	15	20	10 x 20 10 x 30	TOS20S16-0120CC TOS20S16-0130CC
	20	20	10 x 20 10 x 30	TOS20S21-0120CC TOS20S21-0130CC
Omega	10	—	10 x 20 10 x 30	OMG99S11-0120CC OMG99S11-0130CC

Guard cartridges holder: 20 mm guard column ID: XPCHSPW2; 30 mm guard column ID: XPCHSPW3


YMC HPLC COLUMN
AQ12S03-15H0AU
150 x 0.3 mm ID
Ser.-No. 9022917654

MicroLC

Contents

Introduction

Miniaturisation of liquid chromatography in combination with mass spectrometry has several advantages including improvements in sensitivity, especially at low concentration levels and dramatically reduced solvent consumption, compared to conventional HPLC or UHPLC. With further method optimisation, run times can also be reduced giving further savings in solvent use or time.

To meet the requirements of MicroLC/CapillaryLC/NanoLC YMC offers capillary columns specifically designed to use with the corresponding chromatography systems.

YMC Capillary Column Hardware

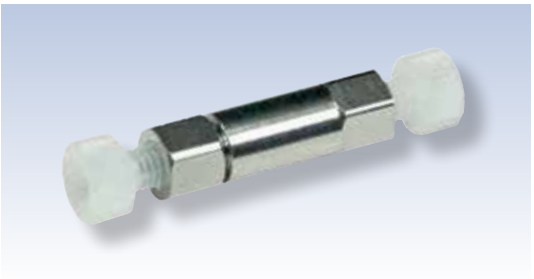
Capillary columns

All YMC phases are available packed in capillary columns. They are compatible with all NanoLC/MicroLC/MS systems. Capillary columns are suitable for extremely low sample volumes and low flow rates. They are available either with 1/16” connections (10-32 thread) or with 1/32” connections (6-40 thread).

Pressure stability

Pressure stability of the phase is dependent on particle size:
2/3 µm: 550 bar / 7,975 psi
1.9 µm: 600 bar / 8,700 psi.

The hardware is pressure rated at
690 bar / 10,000 psi.

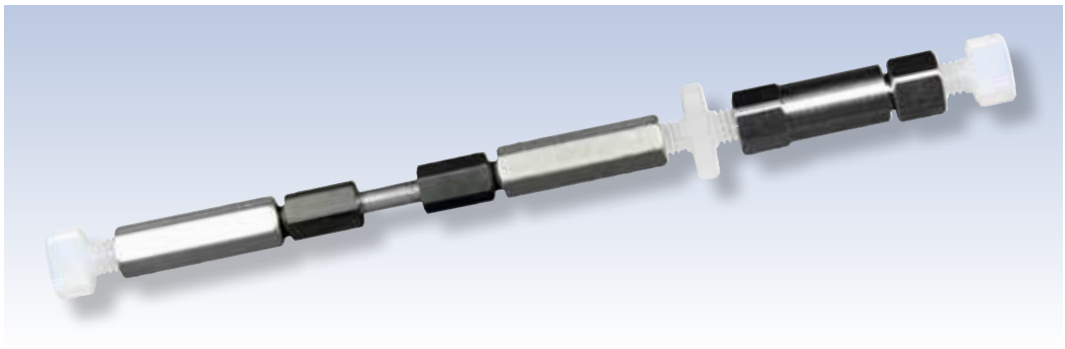


1/16” Guard column 5 mm x 300 µm

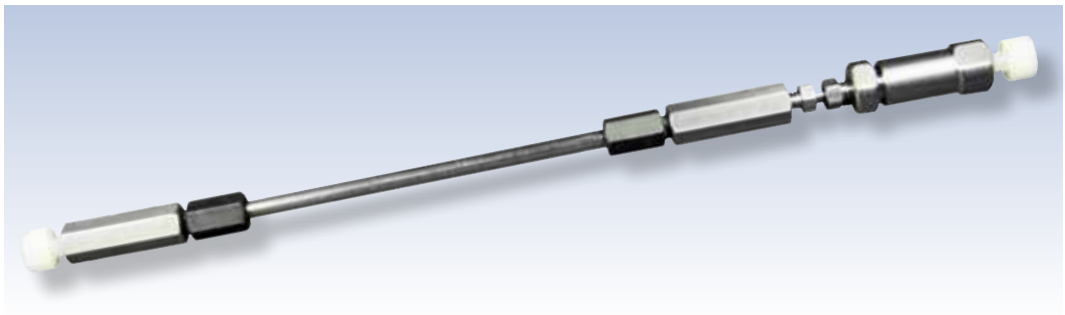
Guard columns

Guard columns are recommended for challenging matrices or for the use as trapping columns.

YMC Capillary Column Hardware



1/16” Guard column coupled to a 1/16” analytical column



1/32” Guard column coupled to a 1/32” analytical column

Guard columns are connected directly to the analytical column using the column couplers supplied.

1/32” (top), 1/16” (bottom)
Column coupler

Column coupler

A column coupler is supplied with every pack of capillary guard cartridges to guarantee the optimum connection with low dead volume. A polymer-based (PCTFE) coupler is provided for 1/16” columns (bottom), while a stainless steel coupler is provided for 1/32” columns (top). Every coupler can be purchased separately if required.

* Application data by courtesy YMC Co., Ltd.

Gluten in Flour and Cookies

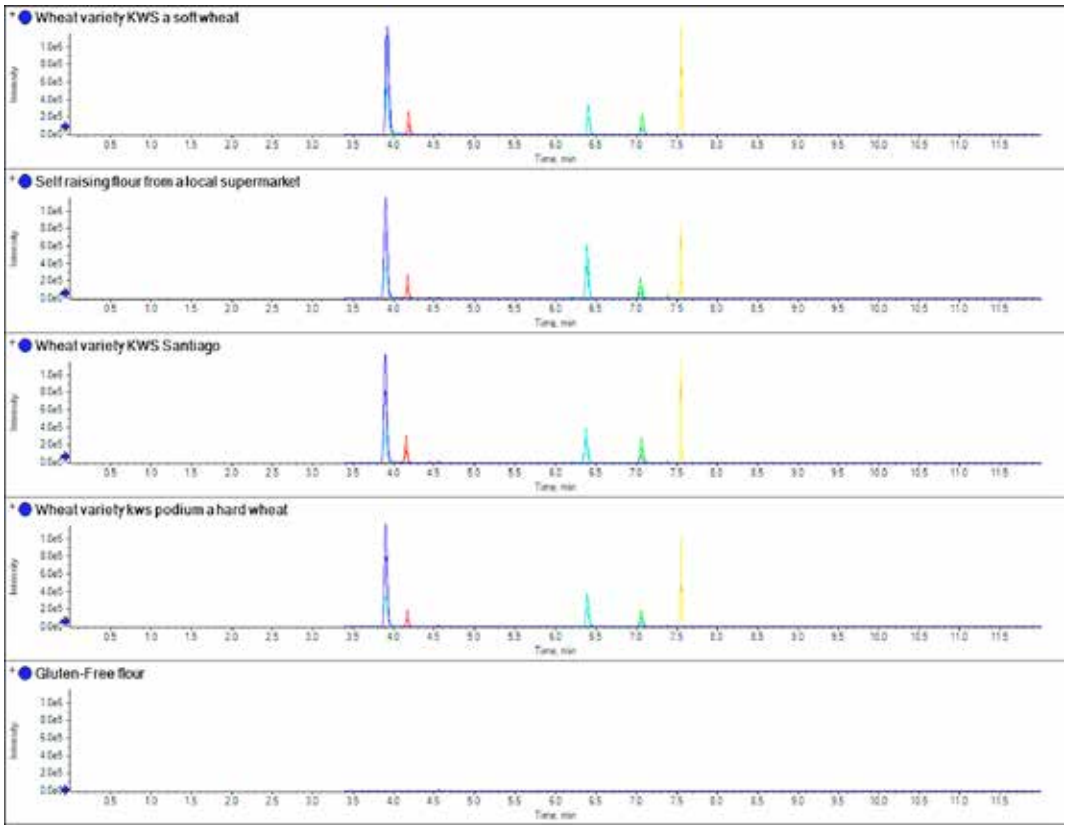
Gluten and food safety

Gluten can cause allergic responses and even celiac disease if an intolerance occurs. The intolerance level is often depending on the gluten variety, which is relevant to the use of oats having low effect on celiac suffers.

So far, ELISA based on R5 antibody detection is used. This assay can detect the presence of barley, rye and wheat, but cannot differentiate between them. It is not sensitive to oats. Further, it has the disadvantage of giving false positive or negative results due to either unspecific binding to the protein region or changes in the protein structure by processing.

MicroLC-MS/MS using YMC-Triart C18 capillary columns can not only detect gluten markers in processed food, but it can also distinguish between varieties.

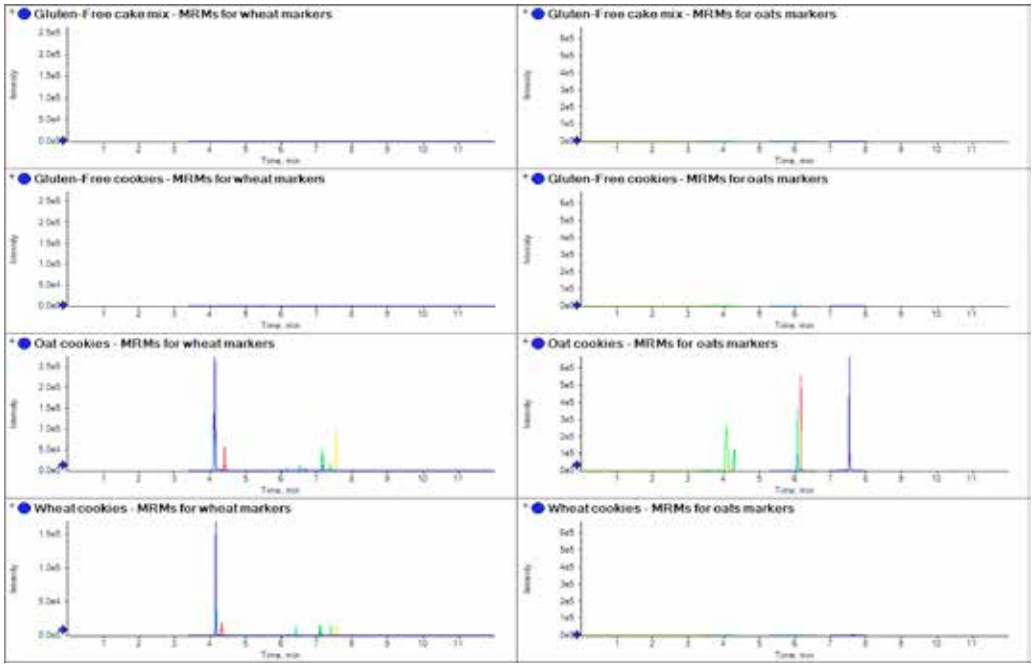
Here, five different flour samples including a gluten-free and a supermarket self raising flour were analysed for wheat peptide markers. In all the flours except the gluten-free one, wheat peptide markers can be found.



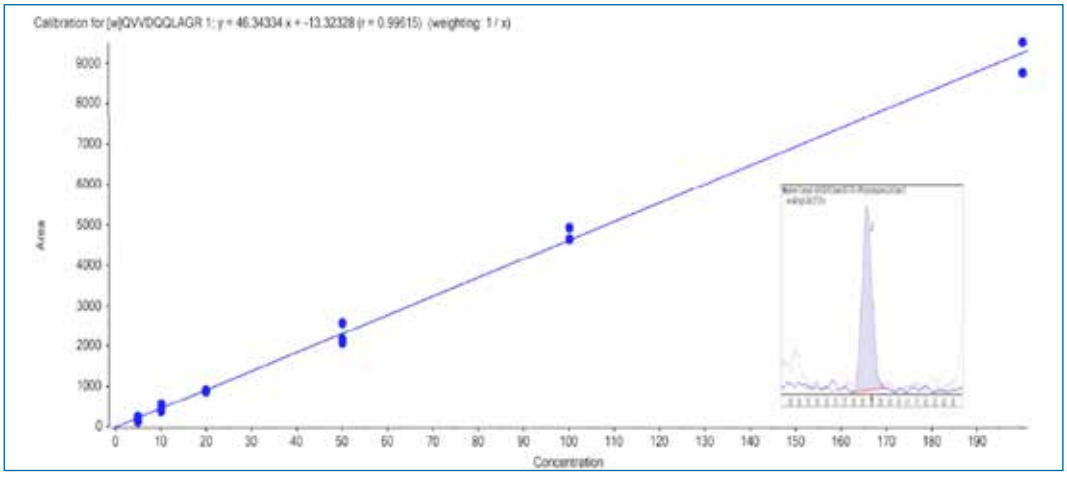
The comparison of separate extracts of several samples of wheat obtained from single variety grain samples, as well as a sample of gluten-free flour and the self raising flour obtained from a local supermarket.

Gluten in Flour and Cookies

With the help of MicroLC-MS/MS it is further possible to detect markers in processed food and also distinguish between varieties. In the oat cookies, wheat and oats markers were detected while in the wheat cookies only wheat peptide markers were found. The gluten-free products were actually gluten free, as no markers where detectable.



Column:	YMC-Triart C18 (12 nm, 3 µm) 100 x 0.5 mm ID, 1/32" OD	Flow:	25 µL/min (MicroLC)
Part No.:	TA12S03-10J0RU	Injection:	10 µL
LC-System:	Eksigent ekspert MicroLC 200	Eluent:	A: H_2O + 0.1% FAC
MS/MS-System:	AB SCIEX 5500 QTRAP, ESI		B: acetonitrile + 0.1% FAC
Temperature:	40°C	Gradient:	Time 0 – 1 min 6 min 8 min 9 min 9.2 min 12 min
			% B 5 25 95 95 5 5



The calibration line obtained from the spiking of gliadin, a specific wheat protein, into gluten-free wheat from the range of 5–200 ppm for wheat peptide 3. Inlayed in the calibration line is the chromatogram for the 10 ppm spike of gliadin into gluten-free flour.

By courtesy of: Stephen Lock, SCIEX, Warrington (UK)

Literature:
Heick, J.; Fischer, M.; Pöpping, B. First screening method for the simultaneous detection of seven allergens by liquid chromatography mass spectrometry. J. Chromatogr. A 2011, 1218, 938–943.

Allergens in Wine

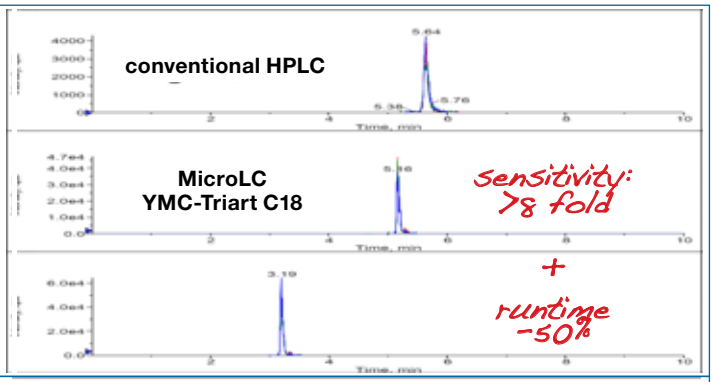
Food watch for wine

In response to a wine survey, where casein was found in trace amounts (<2 ppm), the European Food Safety Authority (EFSA) concluded, in 2011, that wine fined with casein, caseinate or milk products can cause adverse reactions in sensitive individuals. In addition, a new EU legislation (concerning labelling) pointed out that, if fining reagents such as casein, egg ovalbumin, etc. are used in processing, methods for detection of these products in wine are needed.

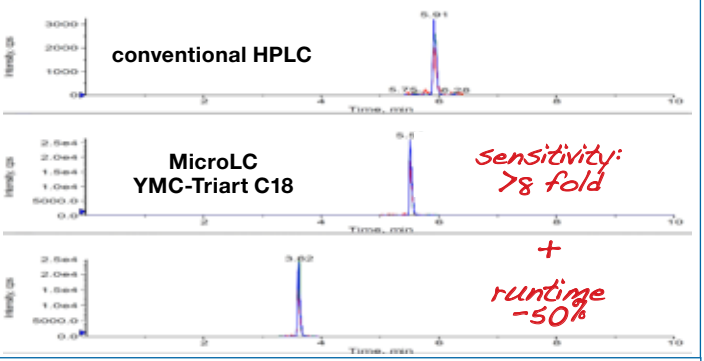
With this MicroLC method using a YMC-Triart C18 capillary column various milk and egg markers can be detected simultaneously in white wine. Due to a detection limit below 100 ppb, the requirements of detecting trace amounts are met.

The initial results for column selection show a typical sensitivity increase of between 4 and 12 fold in S/N-ratio when switching from high to micro flow. The results clearly demonstrate an improvement in sensitivity when moving to MicroLC which is not lost when the analysis time is further shortened to a runtime of 5.5 min to speed up the analysis. In addition, the reduced analysis time also reduces solvent consumption through the use of MicroLC.

Casein peptide



Egg peptide

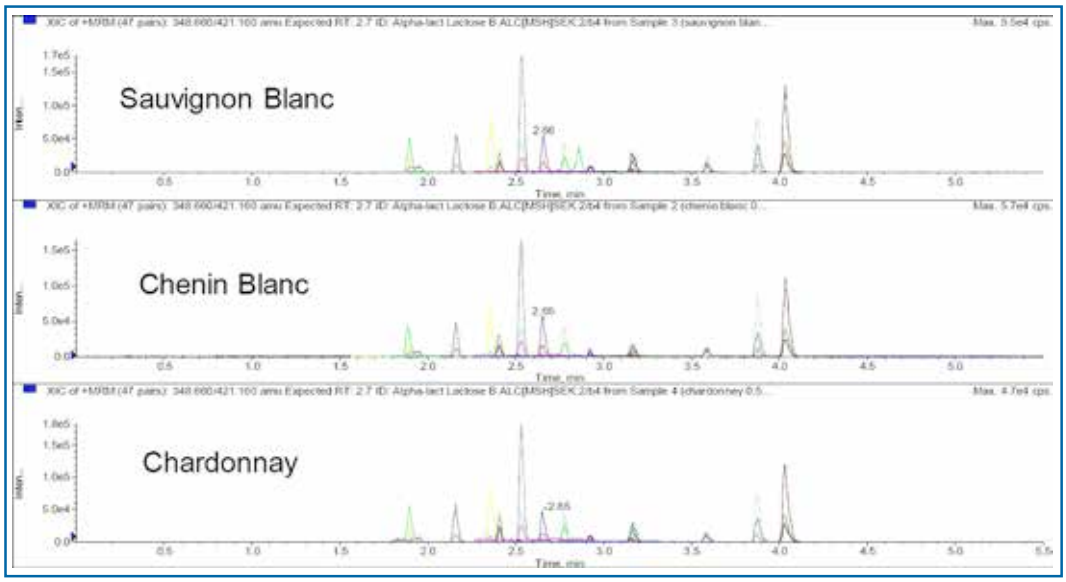


Columns:	**YMC-Triart C18** (12 nm, 3 µm) 50 x 0.5 mm ID, 1/32" OD (MicroLC) Kinetex XB-C18 (10 nm, 2.6 µm) 50 x 2.1 mm ID (HPLC)	Injection:	10 µL
Part No.:	TA12S03-05J0RU	Eluent:	A: H_2O + 0.1% FAC B: acetonitrile + 0.1% FAC
LC-System:	Shimadzu Nexera XR (HPLC); Eksigent ekspert MicroLC 200	HPLC Gradient:	Time 0 - 2 8 8.2- 9 9.1 - 10 % B 2 60 95 2
MS/MS-System:	AB SCIEX 5500 QTRAP, ESI	MicroLC Gradient:	Time 0 - 0.3 4 4.1- 4.3 4.4 – 5.5 % B 2 40 95 2
Temperature:	40°C		
Flow:	300 µL/min (HPLC); 25 µL/min (MicroLC)		

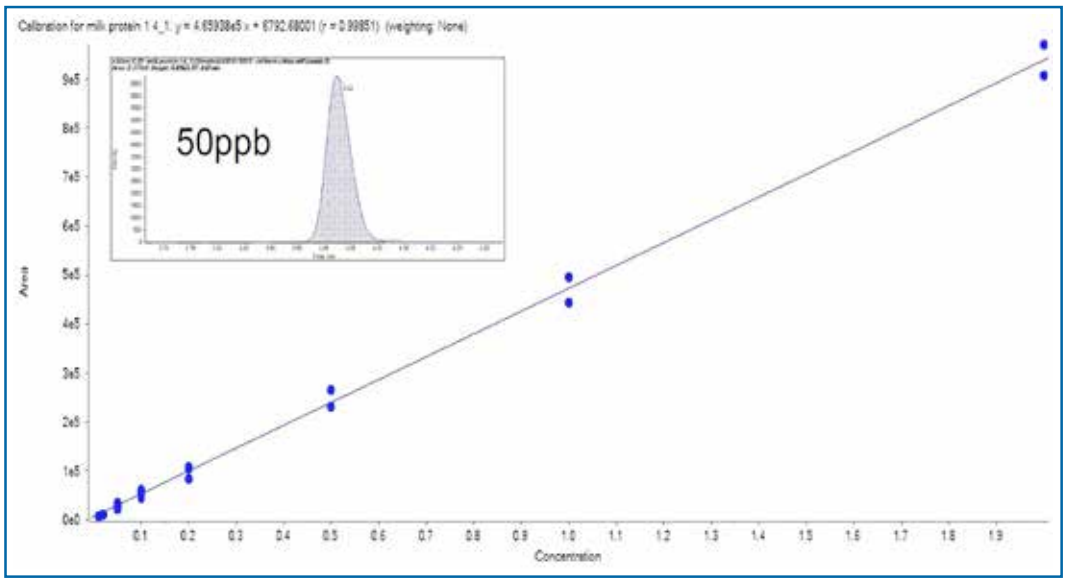
Comparison of HPLC vs. MicroLC using a white wine spiked with 1 ppm casein peptide (top) and an egg peptide (bottom).

Allergens in Wine

The LC-MS/MS approach has the additional advantage of being a potential multi allergen screen where different allergens, such as egg and milk, can be detected by a single method.



On the YMC-Triart C18 capillary column MicroLC-MS/MS analysis was performed. 3 different white wines spiked with 0.5 ppm samples of milk and egg proteins were analysed. Furthermore, it was possible to detect and identify several milk and egg proteins in one run.



A casein peptide is spiked into a Sauvignon Blanc (0.05 – 2 ppm) to demonstrate linearity and sensitivity. Linearity is provided without use of any internal standards. The inset chromatogram for 50 ppb spiked sample demonstrates highest sensitivity.

By courtesy of: Stephen Lock, SCIEX, Warrington (UK)

Literature:
Scientific Opinion related to a notification from the International Organization of Vine and Wine on casein/caseinate/milk products to be used in the manufacture of wine as clarification processing aids pursuant to Article 6, paragraph 11 of Directive 200/13/EC – for permanent exemption from labelling, EFSA Journal 2011, 9(10), 2384.
Commission Regulation (EU) No 1266/2010 of 22 December 2010 amending Directive 2007/68/EC as regards labelling requirements for wines, 2010.

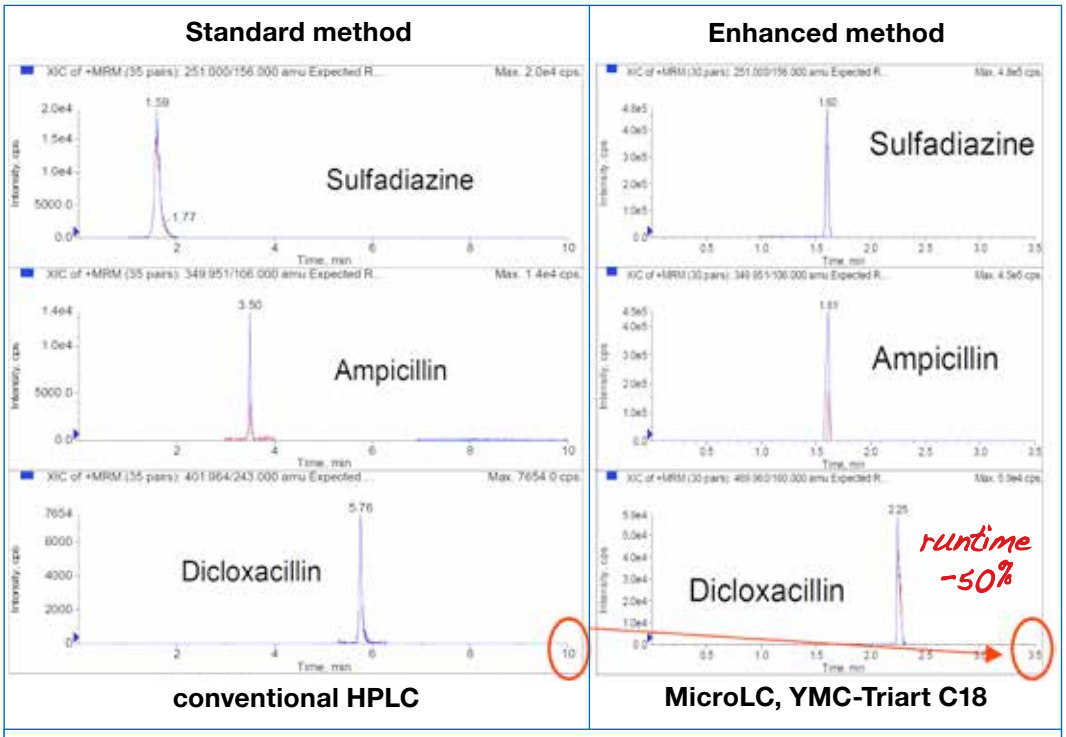
Veterinary Drug Residues in Food

Veterinary drug residues legislated in the EU

The levels and presence of veterinary drug residues in food of animal origin are legislated in the EU with limits often varying with the drug residue [4].

The MicroLC method on a YMC-Triart C18 capillary column easily fulfils the requirements of the current EU legislation. A gain in signal by a factor of more than 8-fold when switching from high to micro flow for some components is observed.

The chromatograms clearly demonstrate an improvement in sensitivity when moving to MicroLC. It is not lost when the analysis time of 10 min is further shortened to a run time of 3.5 min to speed up the analysis. Furthermore, the cut in analyse time provides great potential of cost savings by up to 90% in regards to solvents.

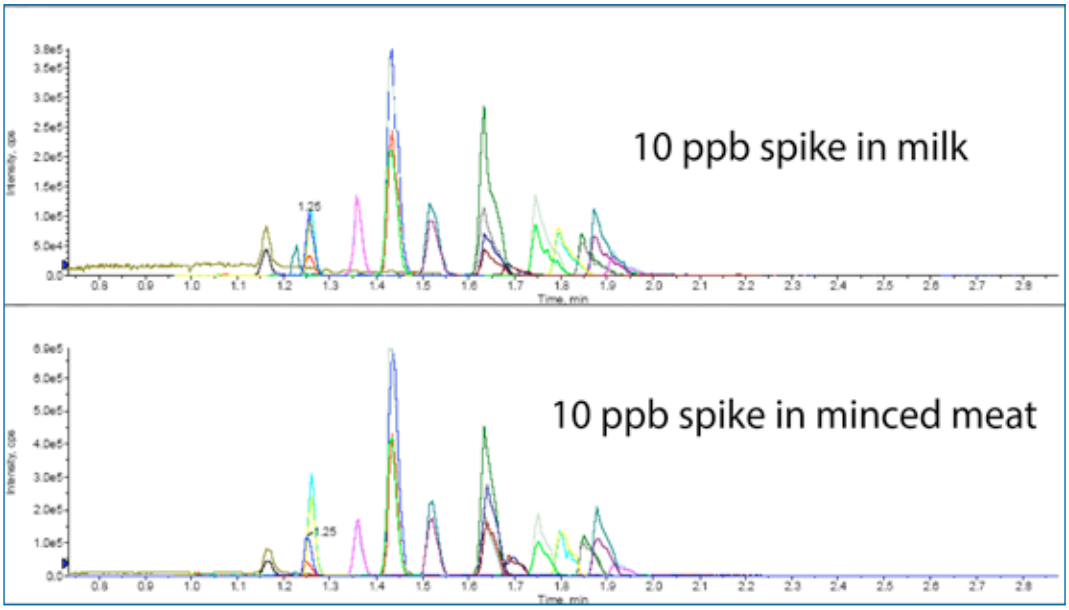


Columns:	**YMC-Triart C18** (12 nm, 3 µm) 50 x 0.5 mm ID, 1/32" OD (MicroLC) Kinetex XB-C18 (10 nm, 2.6 µm) 50 x 2.1 mm ID (HPLC)	Temperature:	60°C
		Flow:	600 µL/min (HPLC) 30 µL/min (MicroLC)
		Injection:	2 µL
Part No.:	TA12S03-05J0RU	Eluent:	A: H_2O + 0.1% FAC B: acetonitrile + 0.1% FAC
LC-System:	Shimadzu Nexera XR (HPLC) Eksigent ekspert MicroLC 200	Enhanced Gradient:	Time 0 - 0.5 1.7 1.8 - 2.3 2.4 - 3.5 % B 2 65 100 2
MS/MS-System:	AB SCIEX 5500 QTRAP, ESI		

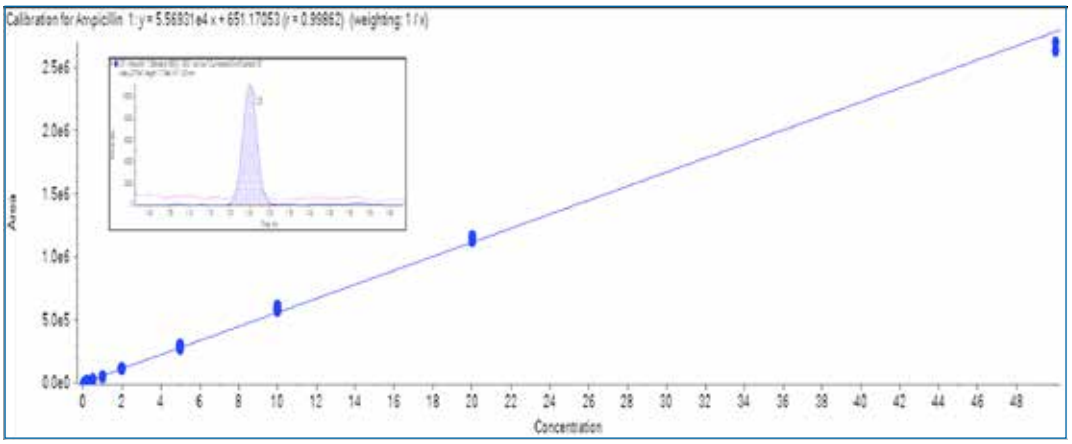
Comparison of 3 different 1 ppb standard solutions separated by a standard HPLC method using a Kinetex C18 column (left) and the MicroLC method using a YMC-Triart C18 capillary column (right).

Veterinary Drug Residues in Food

The MicroLC/MS/MS approach has the additional advantage of being a potential drug residue screen where different residues can be detected by a single method.



In the final analysis a total of 32 multiple reaction monitoring (MRM) transitions were evaluated for 15 veterinary drug residues over a 3.5 minute run time on the YMC-Triart C18 capillary column. Milk and meat samples have been spiked at a 10 ppb level with standard compounds. The recoveries from meat were generally higher and it shows that recoveries are affected by the matrix.



Linearity and sensitivity of this method is demonstrated for Ampicillin from 0.05 – 50 ppb. Linearity is provided without use of any internal standards. The inset chromatogram for a 0.5 ppb spiked sample demonstrates the high level of sensitivity.

By courtesy of: Stephen Lock, SCIEX, Warrington (UK)

Literature:
Commission Regulation (EU) No 37/2010 of 22 December 2010 on pharmacologically active substances and their classification regarding maximum residue limits in foodstuffs of animal origin, 2010.

Dimensions and Part Numbers

YMC capillary columns are available with 1/16” (10-32 thread) or with 1/32” (6-40 thread) connections. All column part numbers indicate the connection size by use of additional terminal letters:

1/**16**” fittings end with **AU**

1/**32**” fittings end with **RU**

The specific part number for a given column consists of two parts describing chemistry and dimension/hardware details. Both parts of the part number can be taken from the tables below:

First part (chemistry) of the part number

YMC-Triart Columns

Description	Partial Part No.
YMC-Triart C18 ExRS, 8 nm, 1.9 µm	TAR08SP9
YMC-Triart C18 ExRS, 8 nm, 3 µm	TAR08S03
YMC-Triart C18 ExRS, 8 nm, 5 µm	TAR08S05
YMC-Triart C18, 12 nm, 1.9 µm	TA12SP9
YMC-Triart C18, 12 nm, 3 µm	TA12S03
YMC-Triart C18, 12 nm, 5 µm	TA12S05
YMC-Triart C8, 12 nm, 1.9 µm	T012SP9
YMC-Triart C8, 12 nm, 3 µm	T012S03
YMC-Triart C8, 12 nm, 5 µm	T012S05
YMC-Triart Diol-HILIC, 12 nm, 1.9 µm	TDH12SP9
YMC-Triart Diol-HILIC, 12 nm, 3 µm	TDH12S03
YMC-Triart Diol-HILIC, 12 nm, 5 µm	TDH12S05
YMC-Triart PFP, 12 nm, 1.9 µm	TPF12SP9
YMC-Triart PFP, 12 nm, 3 µm	TPF12S03
YMC-Triart PFP, 12 nm, 5 µm	TPF12S05
YMC-Triart Phenyl, 12 nm, 1.9 µm	TPH12SP9
YMC-Triart Phenyl, 12 nm, 3 µm	TPH12S03
YMC-Triart Phenyl, 12 nm, 5 µm	TPH12S05

YMC *Pro*Family columns

Description	Partial Part No.
YMC-UltraHT *Pro* C18, 12 nm, 2 µm	AS12S02
YMC-Pack *Pro* C18, 12 nm, 3 µm	AS12S03
YMC-Pack *Pro* C18, 12 nm, 5 µm	AS12S05
YMC-UltraHT Hydrosphere C18, 12 nm, 2 µm	HS12S02
Hydrosphere C18, 12 nm, 3 µm	HS12S03
Hydrosphere C18, 12 nm, 5 µm	HS12S05
YMC-Pack *Pro* C8, 12 nm, 3 µm	OS12S03
YMC-Pack *Pro* C8, 12 nm, 5 µm	OS12S05
YMC-Pack *Pro* C4, 12 nm, 3 µm	BS12S03
YMC-Pack *Pro* C4, 12 nm, 5 µm	BS12S05
YMC-Pack *Pro* C18 RS, 8 nm, 3 µm	RS08S03
YMC-Pack *Pro* C18 RS, 8 nm, 5 µm	RS08S05

Important Note:

For use with Ekisgent Micro- and NanoLC systems, order columns with 1/32” (6-40 thread) end-fitting and use either Eksigent 6/40 fitting p/n 5019621 or VALCO p/n ZNF.5FPK.

Dimensions and Part Numbers

A selection of other YMC columns*

Description	Partial Part No.
YMC-Pack ODS-A, 12 nm, 5 µm YMC-Pack ODS-A, 20 nm, 5 µm YMC-Pack ODS-A, 30 nm, 5 µm	AA12S05 AA20S05 AA30S05
YMC-Pack ODS-AQ, 12 nm, 5 µm YMC-Pack ODS-AQ, 20 nm, 5 µm	AQ12S05 AQ20S05
J'sphere H80, 8 nm, 4 µm J'sphere M80, 8 nm, 4 µm J'sphere L80, 8 nm, 4 µm	JH08S04 JM08S04 JL08S04
YMC-Pack C8 (Octyl), 20 nm, 5 µm YMC-Pack C8 (Octyl), 30 nm, 5 µm	OC20S05 OC30S05
YMCbasic, 20 nm, 3 µm YMCbasic, 20 nm, 5 µm	BA99S03 BA99S05
YMC-Pack C4 (Butyl), 20 nm, 5 µm YMC-Pack C4 (Butyl), 30 nm, 5 µm	BU20S05 BU30S05
YMC-Pack Ph (Phenyl), 12 nm, 5 µm YMC-Pack Ph (Phenyl), 30 nm, 5 µm	PH12S05 PH30S05
YMC Carotenoid (C30), 3 µm YMC Carotenoid (C30), 5 µm	CT99S03 CT99S05

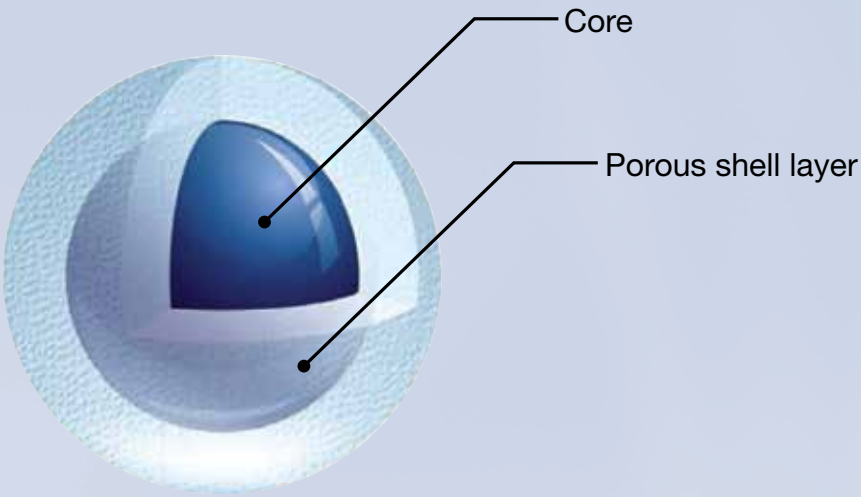
Description	Partial Part No.
YMC-Pack TMS (C1), 12 nm, 5 µm	TM12S05
YMC-Pack CN (Cyano), 12 nm, 5 µm YMC-Pack CN (Cyano), 30 nm, 5 µm	CN12S05 CN30S05
YMC-Pack Diol-NP, 6 nm, 5 µm YMC-Pack Diol-NP, 12 nm, 5 µm YMC-Pack Diol-NP, 20 nm, 5 µm YMC-Pack Diol-NP, 30 nm, 5 µm	DN06S05 DN12S05 DN20S05 DN30S05
YMC-Pack NH_2 (Amino), 12 nm, 5 µm	NH12S05
YMC-Pack Polyamine II, 12 nm, 5 µm	PB12S05
YMC-Pack PVA-Sil, 12 nm, 5 µm	PV12S05
YMC-Pack SIL (Silica), 6 nm, 5 µm YMC-Pack SIL (Silica), 12 nm, 5 µm YMC-Pack SIL (Silica), 20 nm, 5 µm YMC-Pack SIL (Silica), 30 nm, 5 µm	SL06S05 SL12S05 SL20S05 SL30S05

*Other YMC phases are available on request

Second part (dimension/hardware) of the part number

Column ID [µm]	Fitting [inch]	Column length				5 mm [guard column] pack of 3
		50 mm	75 mm	100 mm	150 mm	
75	1/32	-05E8RU	-L5E8RU	-10E8RU	-15E8RU	—
100	1/32	-05F0RU	-L5F0RU	-10F0RU	-15F0RU	—
300	1/32	-05H0RU	-L5H0RU	-10H0RU	-15H0RU	-E5H0RU
500	1/32	-05J0RU	-L5J0RU	-10J0RU	-15J0RU	-E5J0RU
75	1/16	-05E8AU	-L5E8AU	-10E8AU	-15E8AU	—
100	1/16	-05F0AU	-L5F0AU	-10F0AU	-15F0AU	—
300	1/16	-05H0AU	-L5H0AU	-10H0AU	-15H0AU	-E5H0AU
500	1/16	-05J0AU	-L5J0AU	-10J0AU	-15J0AU	-E5J0AU

Example: Triart C18, 12 nm, 5 µm, 100 mm x 300 µm, 1/16” => TA12S05-10H0AU



Meteoric Core

Particle Image Structure

Meteoric Core

Contents

Introduction

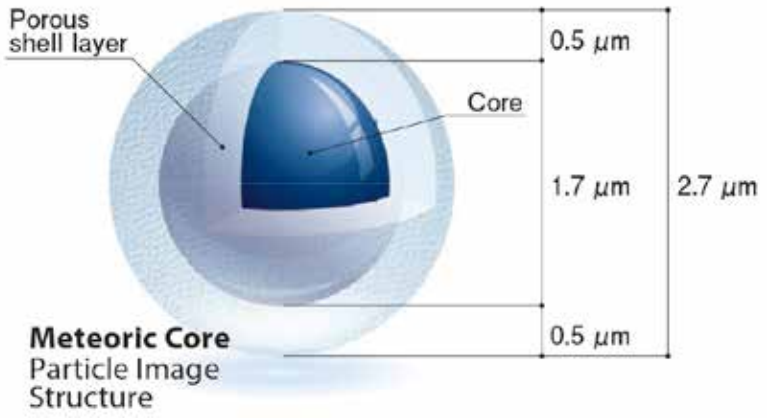
Core Shell Columns for UHPLC and HPLC

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

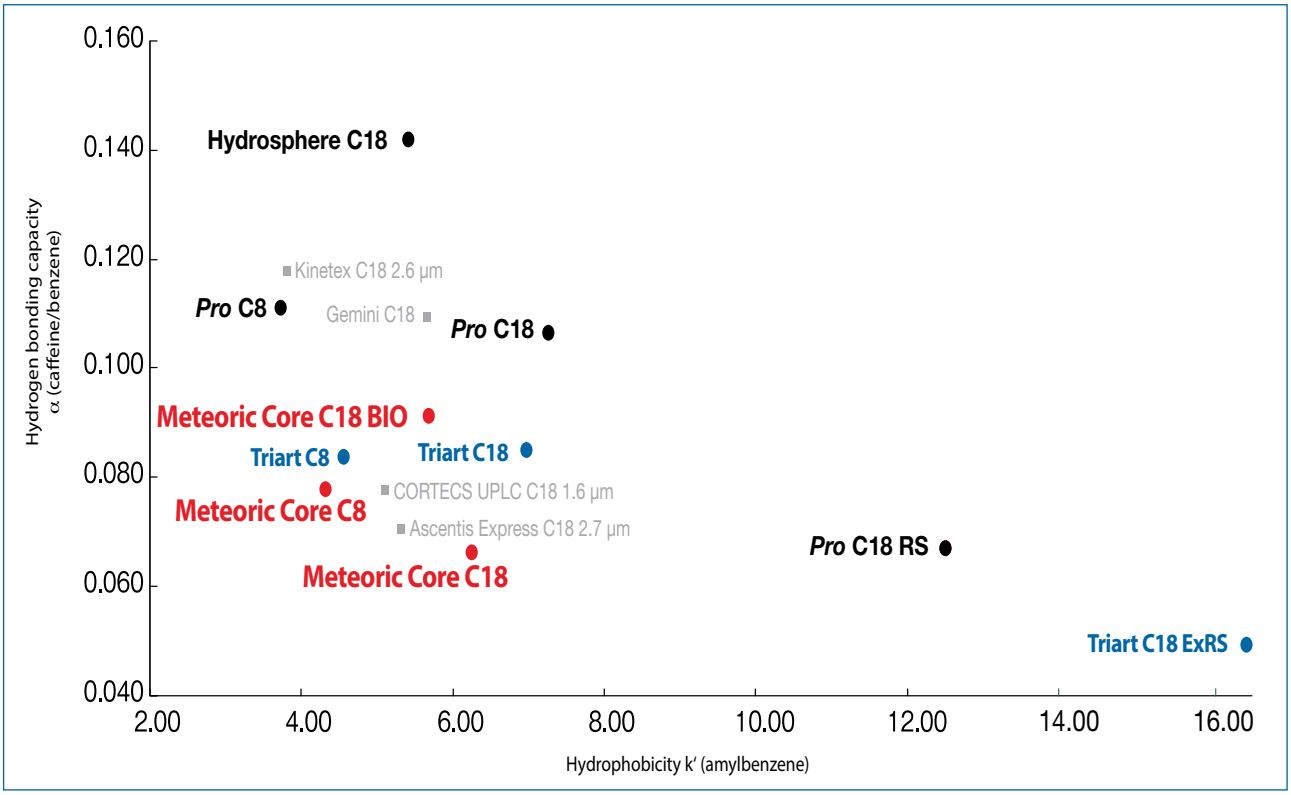
- ultra fast separation with outstanding resolution
- excellent peak shape for basic and coordinating compounds
- wide pH application range
- low column bleed, ideal for LC/MS

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 / 8700 psi	60 MPa / 8700 psi	60 MPa / 8700 psi
pH range	1.5-10	1.5-10	1.5-9
Temperature	70 °C (< pH 7), 50 °C (> pH 7)	70 °C (< pH 7), 50 °C (> pH 7)	60 °C (< pH 7), 40 ° C (> pH 7)
USP Classification	L1	L1	L7

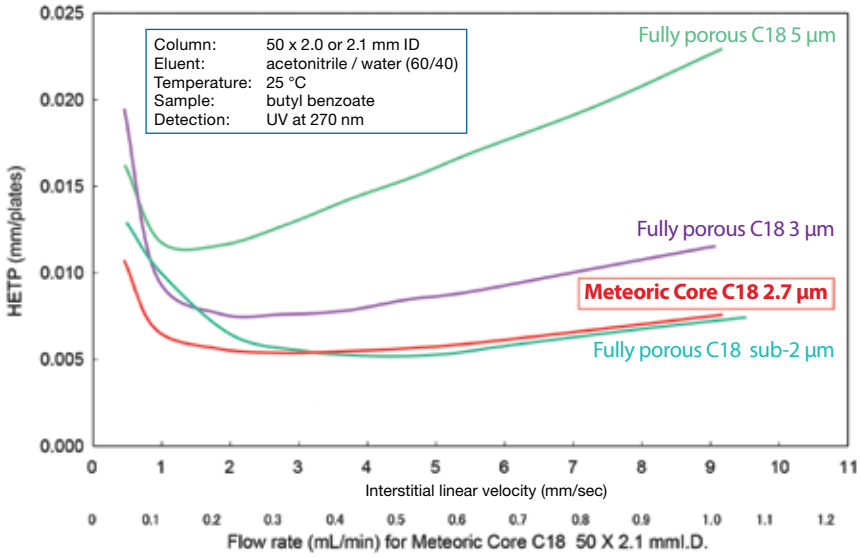


Meteoric Core

Selectivity Chart



Van Deemter Curves: Correlation between linear velocity and column efficiency



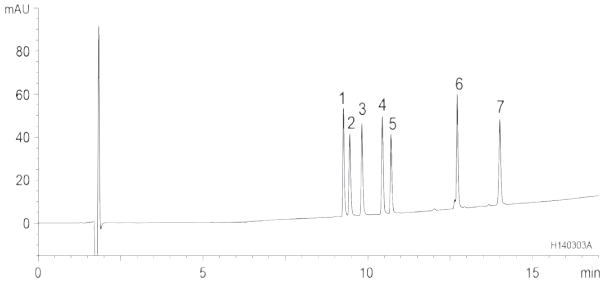
Meteoric Core C18 has high column efficiency which is almost equivalent to sub-2 µm columns over a wide range of flow rates.

* Application data by courtesy YMC Co., Ltd.

Meteoric Core

Applications

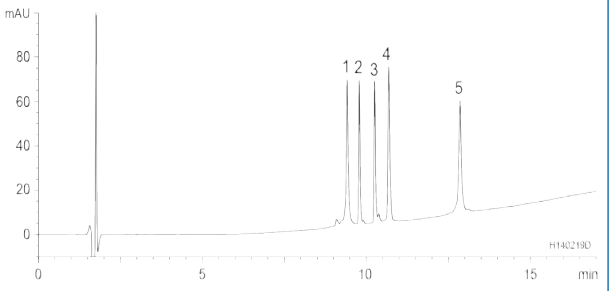
Peptides



1. BAM-12P (MW 1,425)
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 (MW 1,746)
6. β-Endorphin (MW 1,859)
7. γ-Endorphin (MW 3,465)

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

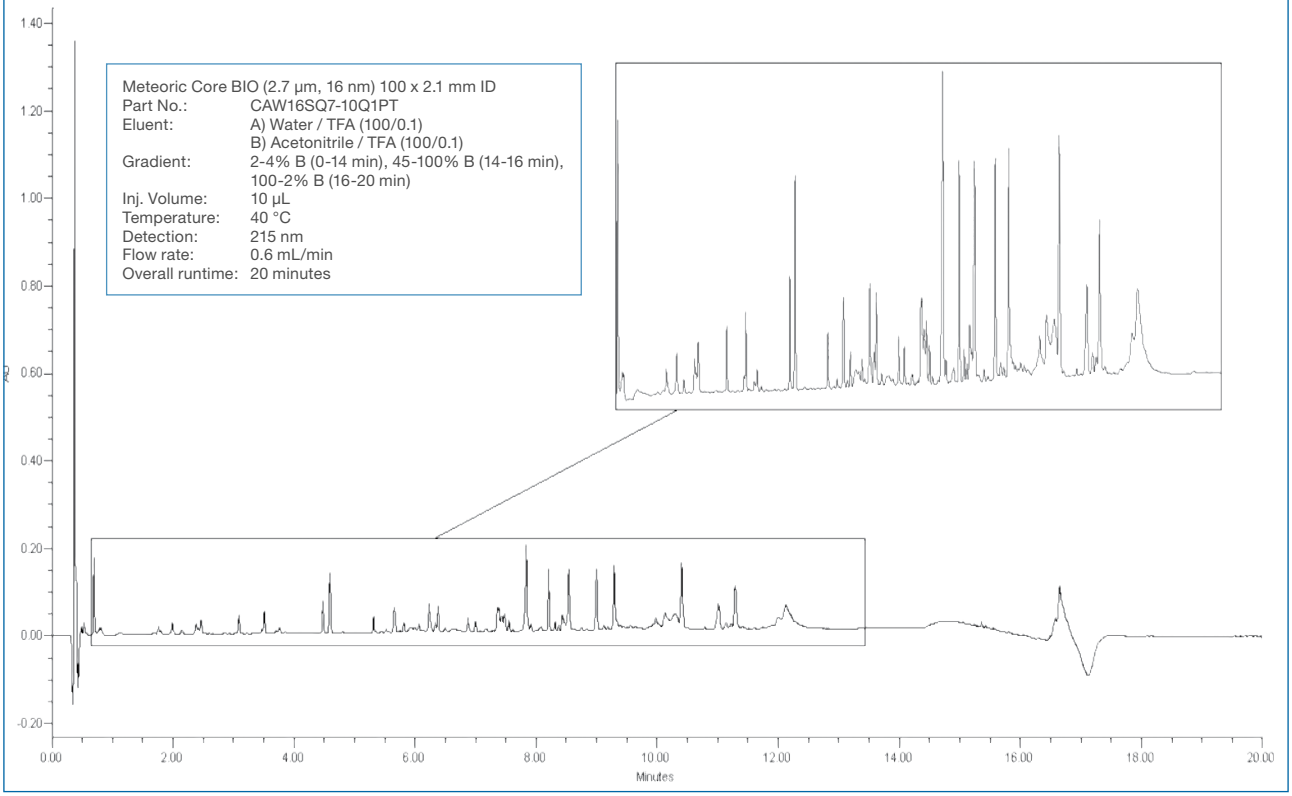


1. Cytochrome c (MW 12,400)
2. Insulin (bovine) (MW 5,700)
3. Amyloid β-protein (MW 4,300)
4. Lysozyme (MW 14,000)
5. α-Chymotrypsinogen A (MW 25,700)

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

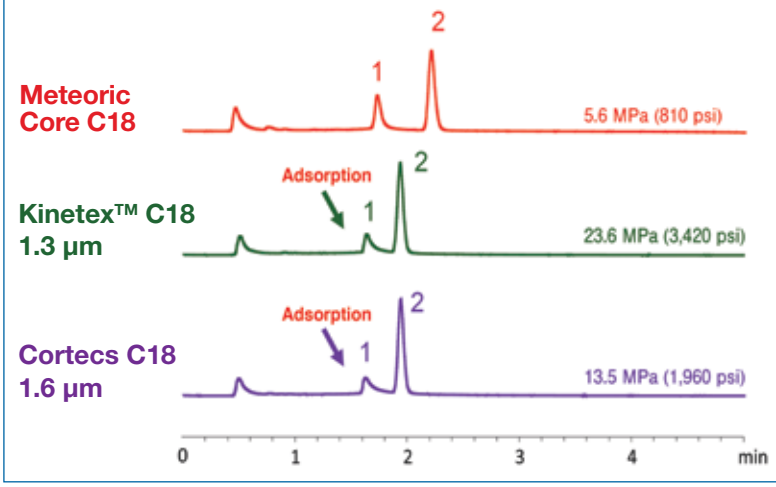
Avastin Peptide Map - Trypsin Digest

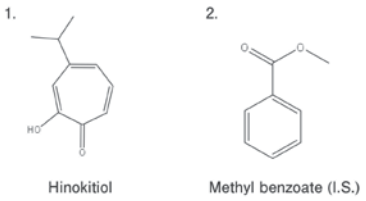
Meteoric Core BIO (2.7 µm, 16 nm) 100 x 2.1 mm ID	
Part No.:	CAW16SQ7-10Q1PT
Eluent:	A) Water / TFA (100/0.1) B) Acetonitrile / TFA (100/0.1)
Gradient:	2-4% B (0-14 min), 45-100% B (14-16 min), 100-2% B (16-20 min)
Inj. Volume:	10 µL
Temperature:	40 °C
Detection:	215 nm
Flow rate:	0.6 mL/min
Overall runtime:	20 minutes



Meteoric Core

Coordinating Compounds

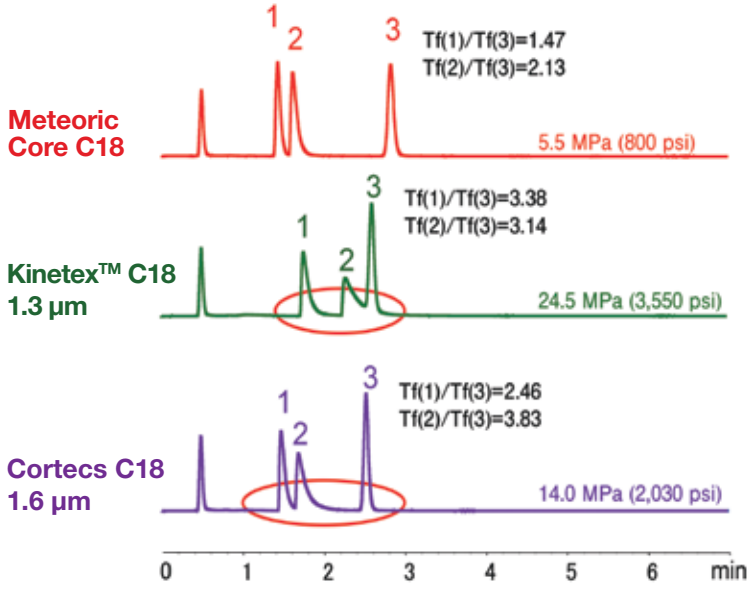


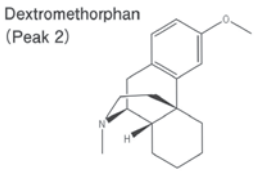


Column:	50 x 2.1 mm ID
Eluent:	acetonitrile / 0.1% phosphoric acid (40/60)
Flow rate:	0.2 mL/min
Temperature:	40 °C
Detection:	UV at 254 nm

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





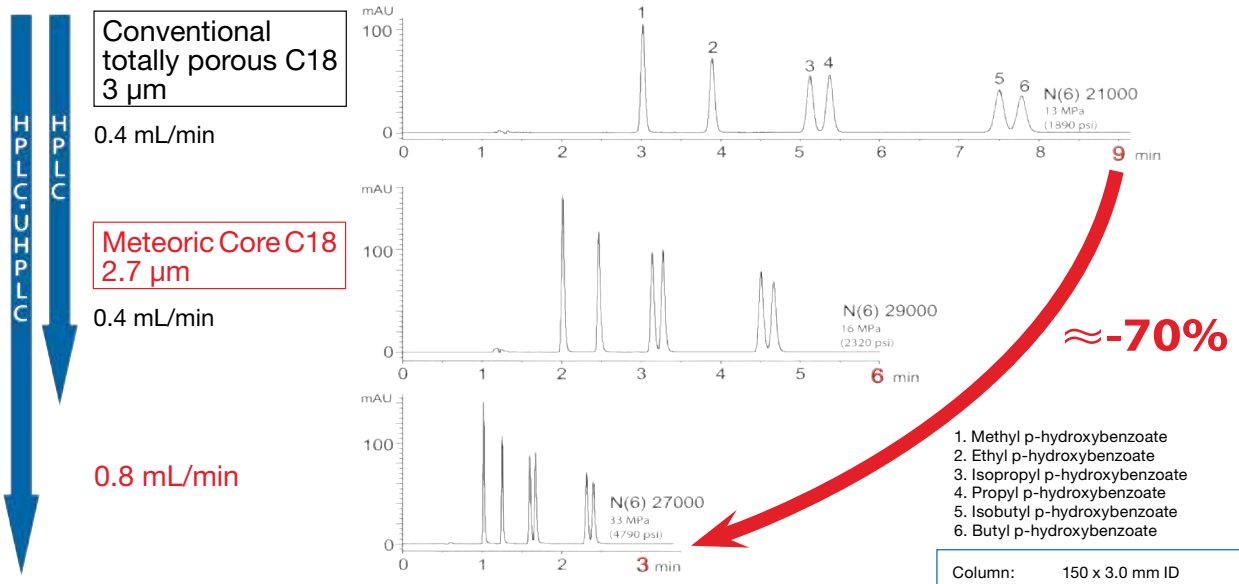
Column:	50 x 2.1 mm ID
Eluent:	20 mM KH_2PO_4-K_2HPO_4 (pH 6.9) / acetonitrile (65/35)
Flow rate:	0.2 mL/min
Temperature:	40 °C
Detection:	UV at 235 nm
Sample:	1. Chlorpheniramine 2. Dextromethorphan 3. Propyl p-hydroxybenzoate (I.S.)

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

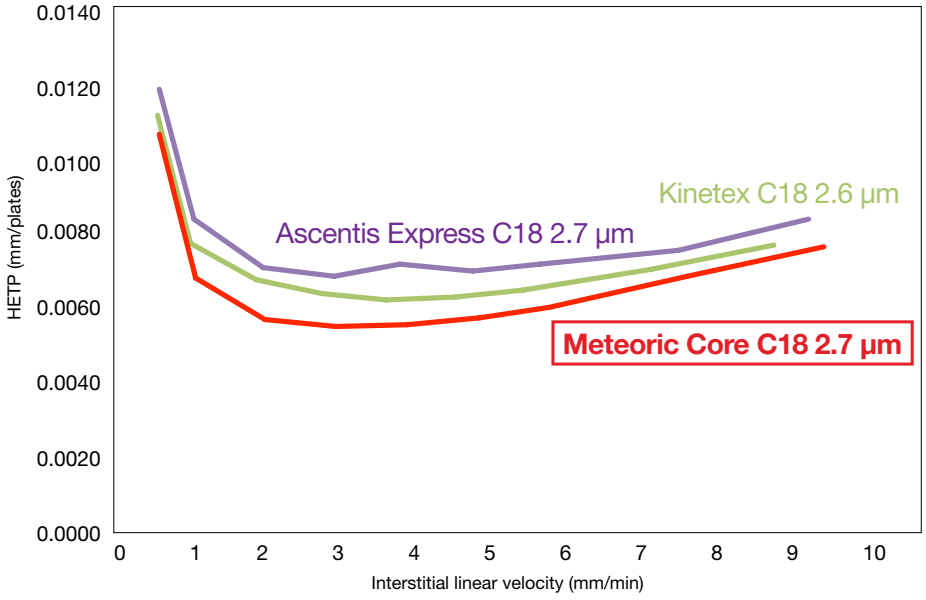


Column:	150 x 3.0 mm ID
Eluent:	acetonitrile / water (50/50)
Temperature:	30 °C
Detection:	UV at 270 nm

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

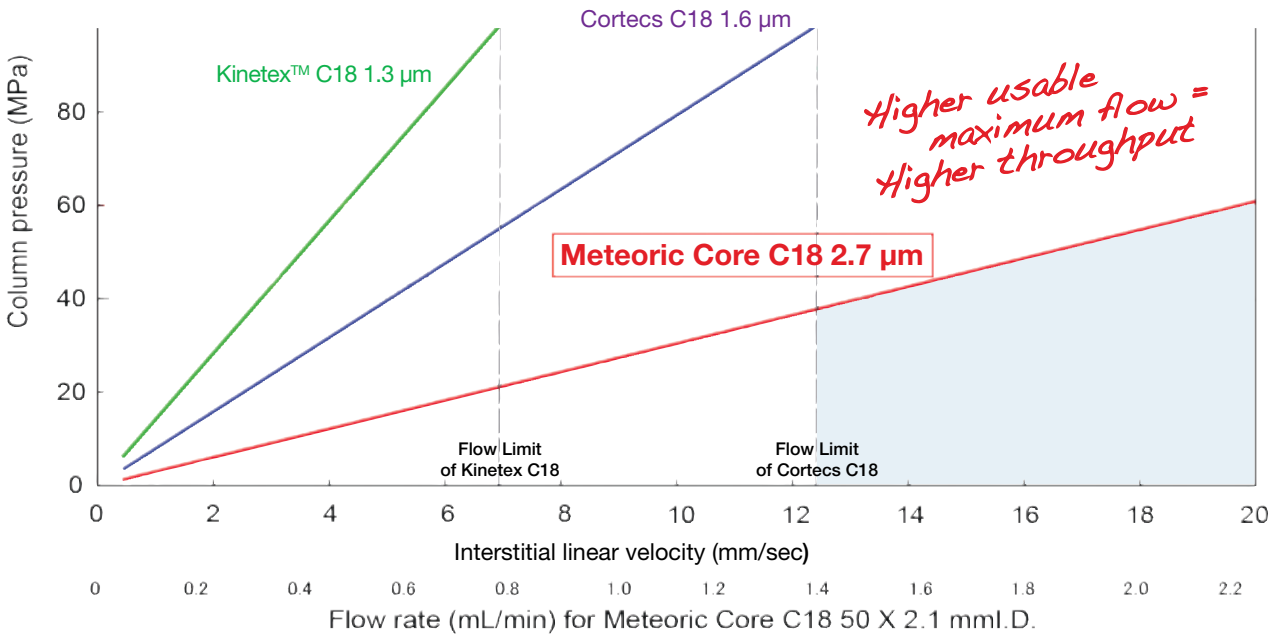


Meteoric Core C18 shows outstanding column efficiencies over a wide flow range.

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

QC-Data

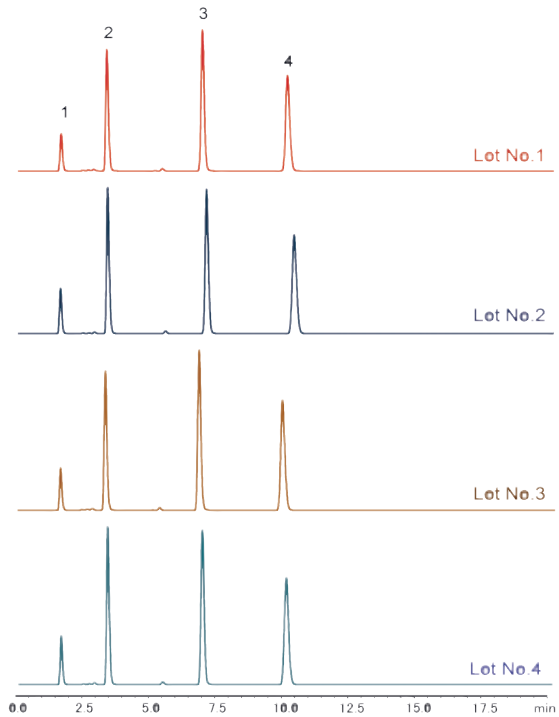
Lower backpressure enables higher throughput

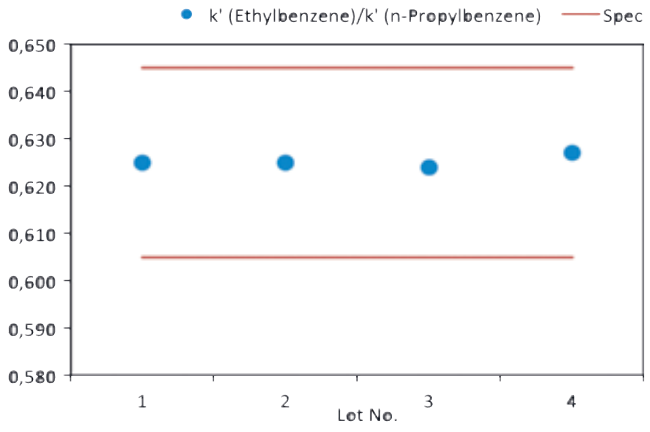


Column:	50 x 2.0 or 2.1 mm ID
Eluent:	acetonitrile / water (60/40)
Temperature:	25 °C
Sample:	butyl benzoate
Detection:	UV at 270 nm

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





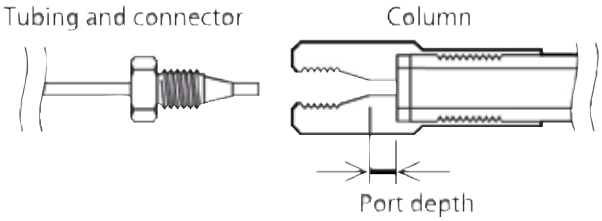
Column:	Meteoric Core C18 (2.7 µm) 150 x 3.0 mm ID
Part No.:	CAS08SQ7-1503PT
Eluent:	20 mM KH_2PO_4-H_3PO_4 (pH 3.5) / acetonitrile (40/60)
Flow rate:	0.4 mL/min
Temperature:	37 °C
Detection:	UV at 254 nm
Sample:	1. Uracil 2. 4-n-Butoxybenzoic acid 3. Ethylbenzene 4. n-Propylbenzene

Ordering Information

Meteoric Core

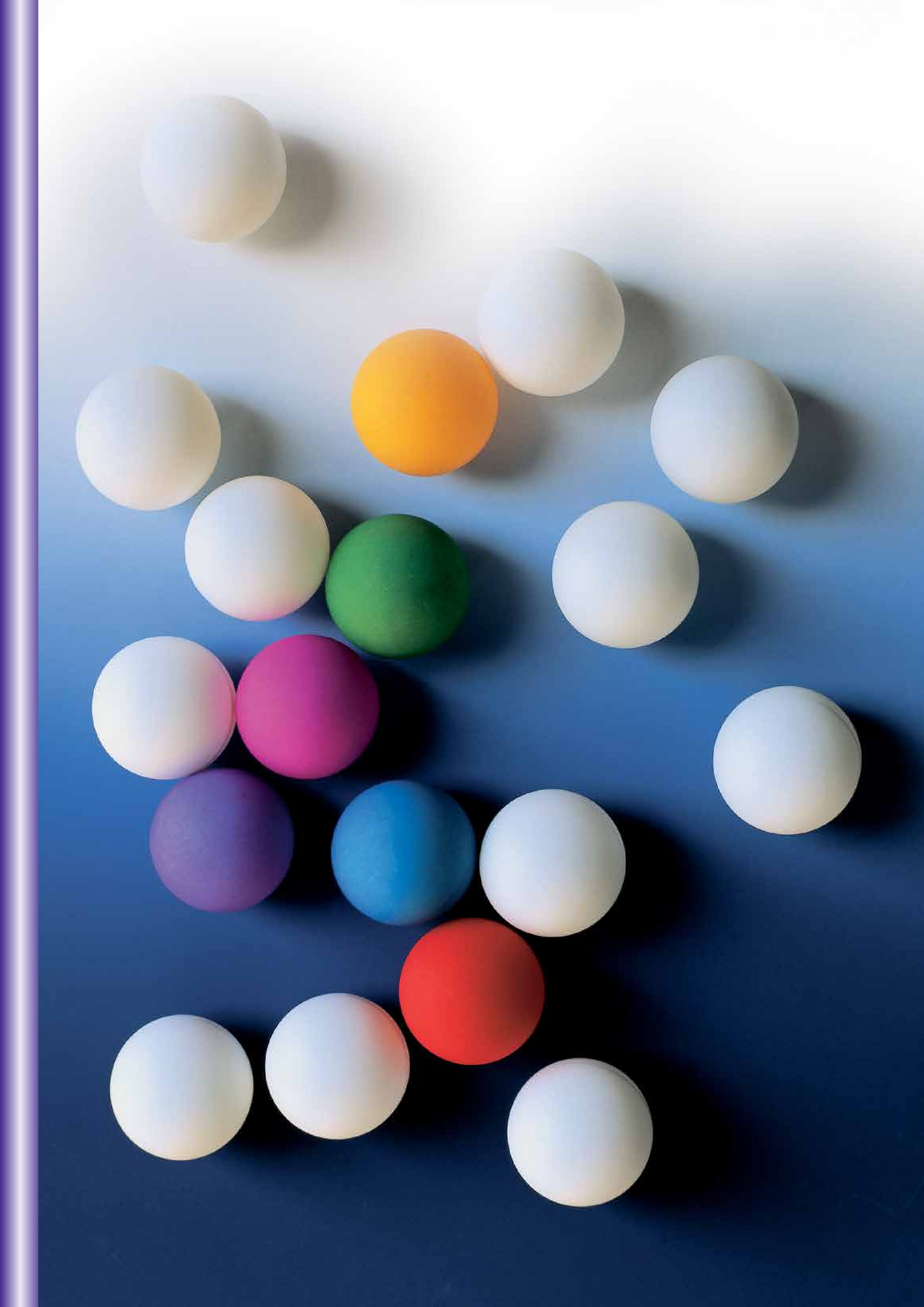
Particle size [µm]	Column size length x ID [mm]	Part number		
		Meteoric Core C18	Meteoric Core C18 BIO	Meteoric Core C8
2.7	30 x 2.1	CAS08SQ7-03Q1PT	CAW16SQ7-03Q1PT	COS08SQ7-03Q1PT
	50 x 2.1	CAS08SQ7-05Q1PT	CAW16SQ7-05Q1PT	COS08SQ7-05Q1PT
	75 x 2.1	CAS08SQ7-L5Q1PT	CAW16SQ7-L5Q1PT	COS08SQ7-L5Q1PT
	100 x 2.1	CAS08SQ7-10Q1PT	CAW16SQ7-10Q1PT	COS08SQ7-10Q1PT
	150 x 2.1	CAS08SQ7-15Q1PT	CAW16SQ7-15Q1PT	COS08SQ7-15Q1PT
	30 x 3.0	CAS08SQ7-0303PT	CAW16SQ7-0303PT	COS08SQ7-0303PT
	50 x 3.0	CAS08SQ7-0503PT	CAW16SQ7-0503PT	COS08SQ7-0503PT
	75 x 3.0	CAS08SQ7-L503PT	CAW16SQ7-L503PT	COS08SQ7-L503PT
	100 x 3.0	CAS08SQ7-1003PT	CAW16SQ7-1003PT	COS08SQ7-1003PT
	150 x 3.0	CAS08SQ7-1503PT	CAW16SQ7-1503PT	COS08SQ7-1503PT
	30 x 4.6	CAS08SQ7-0346PT	CAW16SQ7-0346PT	COS08SQ7-0346PT
	50 x 4.6	CAS08SQ7-0546PT	CAW16SQ7-0546PT	COS08SQ7-0546PT
	75 x 4.6	CAS08SQ7-L546PT	CAW16SQ7-L546PT	COS08SQ7-L546PT
	100 x 4.6	CAS08SQ7-1046PT	CAW16SQ7-1046PT	COS08SQ7-1046PT
	150 x 4.6	CAS08SQ7-1546PT	CAW16SQ7-1546PT	COS08SQ7-1546PT

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

Contents

Introduction

HPLC Columns for Ultra Fast LC

Nowadays, especially in the pharmaceutical industry, the need for Ultra Fast LC and Rapid Resolution is still growing due to the continuous demand for high throughput analysis in research & development and quality control.

Specifications for YMC-UltraHT columns have been designed to provide powerful chromatographic improvements, in terms of velocity and resolution, even with conventional HPLC equipment. Since YMC-UltraHT columns provides a 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.

For effective high throughput separations, YMC offers a wide range of high performance HPLC columns which allow Ultra Fast analytical HPLC with conventional equipment. Due to the down-scalability of the majority of YMC's stationary phases, the time needed for a single analysis can be reduced to less than 60 seconds, depending on the sample conditions.

YMC *Pro*Family

One of the main challenges in RP-HPLC is the quantitation of ionisable compounds including drugs, degradation products, etc. For this purpose symmetrical, sharp peaks are required to provide highest resolution and reliable integration. The stationary phases of the YMC *Pro*Family fullfil these demands making them an excellent choice for the pharmaceutical and biotechnology industries. This product line consists of the three C18-phases: YMC-Pack *Pro* C18 RS (with high carbon load [22%]), YMC-Pack *Pro* C18 and Hydrosphere C18 ("AQ-type") together with the C8- and C4-phases: YMC-Pack *Pro* C8 and YMC-Pack *Pro* C4.

Ultra Fast LC Columns

- **YMC Pack *Pro*Family 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 achieve 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

General

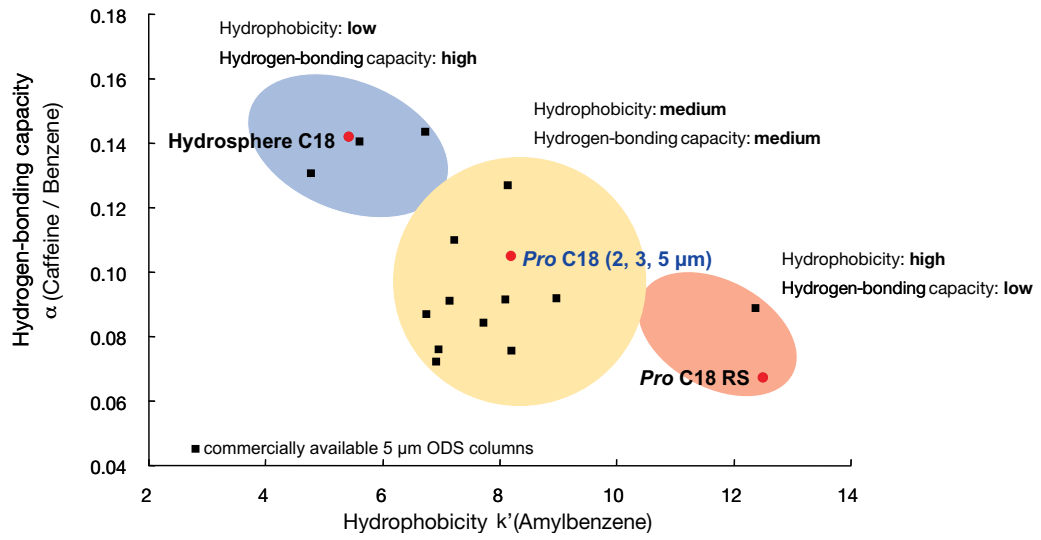
Since the introduction of the *Pro*Family series of phases, YMC-Pack *Pro* C18 has proved to be one of the first choices for a wide range of HPLC applications in pharmaceutical and biotechnological research and production, where efficiency and reliability are a major demand.

In many cases, the separation of highly polar compounds 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 to mainly collapse of the C18 chains. Therefore, YMC developed Hydrosphere C18 in order to overcome the loss in retention. Now, this outstanding chromatographic behaviour has been transferred to YMC-UltraHT Hydrosphere C18.

YMC-Pack *Pro* C18 is a well-established C18 silica-based column, which provides a medium balance of hydrogen-bonding capacity and hydrophobicity, as shown below. Conversely, Hydrosphere C18 is optimal selectivity for the separation of highly polar compounds.

Ultra Fast LC Columns

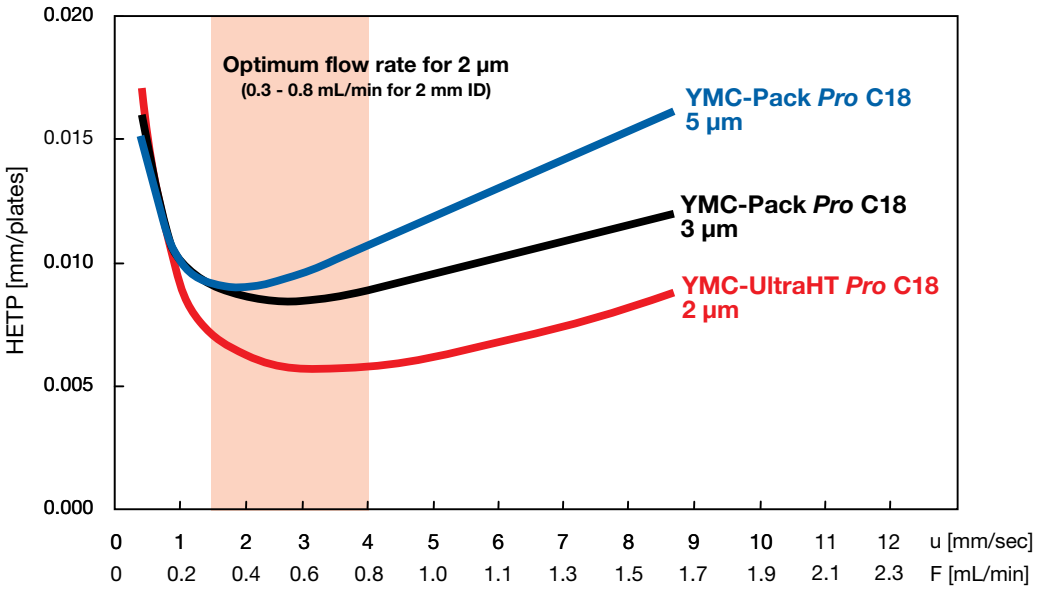
Selectivity-Chart*



Why smaller particles?

Ever since in the beginning of HPLC, more-demanding analytical problems have required a progressive improvement in separation efficiency. The challenges include ever more complex analytes and the reduction in analysis times to keep up with the increasing numbers of samples. In addition to reducing the column dimensions and increasing flow rates, the implementation of small particles is a powerful tool to increase efficiency.

Van Deemter Plot*



The van Deemter equation describes the "Height Equivalent of the Theoretical Plate" (HETP) as a function of the linear velocity (u) by

$$H = A+B/u+C*u$$

where A, B and C are constants and u is the mobile phase linear velocity measured in mm/sec.

The resulting van Deemter plots show the reduction of HETP when using smaller particle sizes of YMC-Pack *Pro* C18 with an additional shift of the minimum value to higher flow rates.

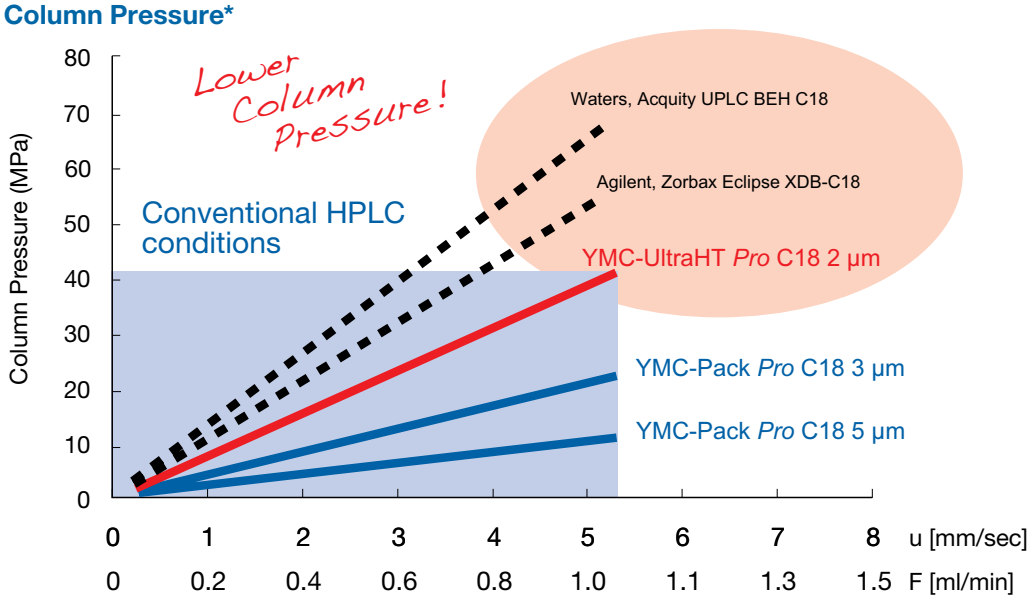
* Application data by courtesy YMC Co., Ltd.

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.

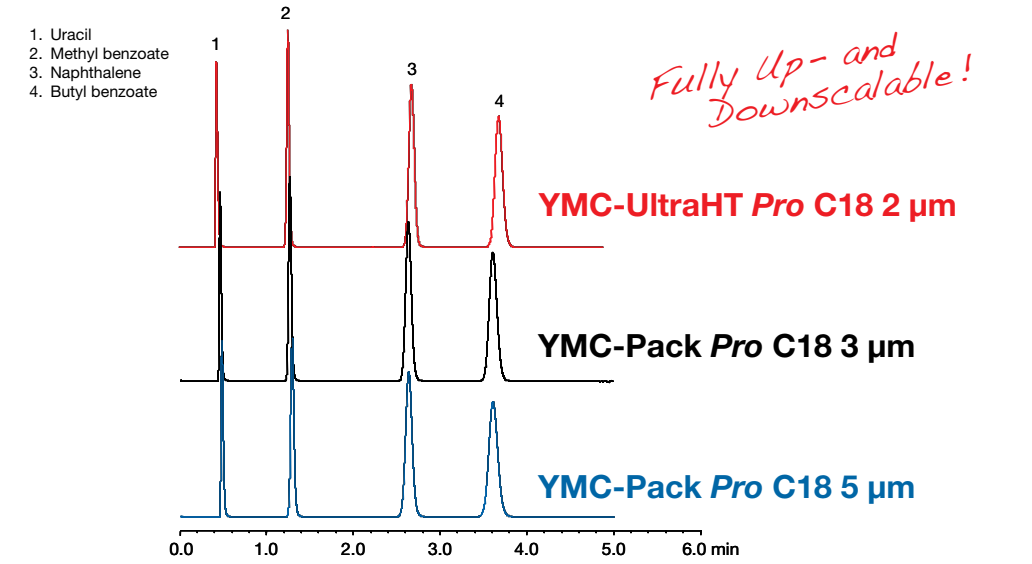
Column Pressure*



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*



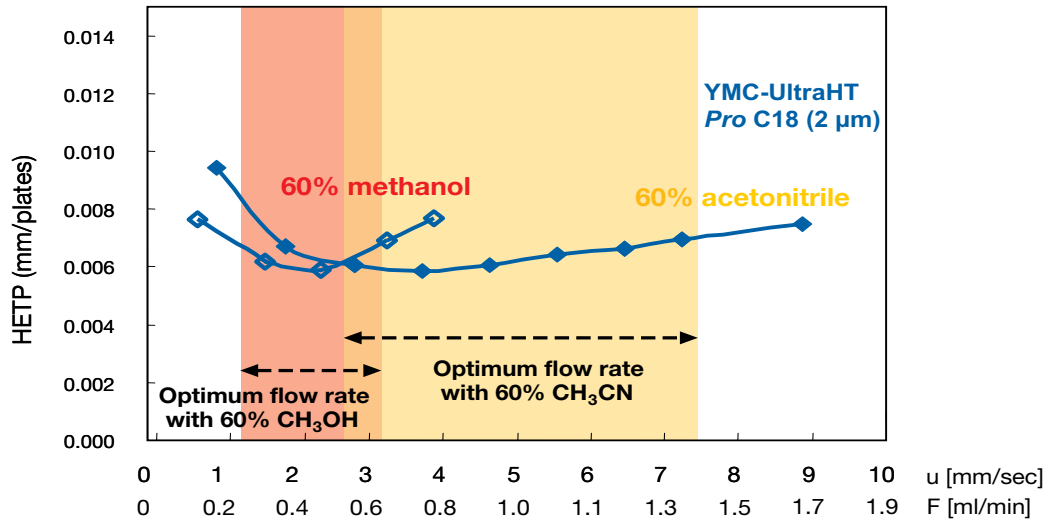
Column: 50 x 2.0 or 2.1 mm ID
Eluent: acetonitrile / water (60/40)
Temperature: 25 °C
Detection: UV at 270 nm

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*



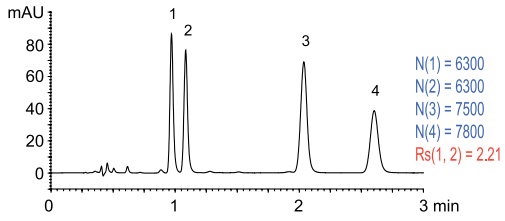
Column: YMC-UltraHT *Pro* C18 (2 µm) 50 x 2.0 mm ID
Temperature: 25 °C
Sample: Butyl benzoate

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.

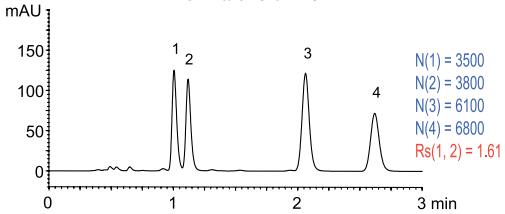
Fast LC analysis with conventional LC equipment*

50 x 3 mm ID

Semi-micro Cell (2.5 µL, Cell length 5 mm)
Flow rate: 0.8 mL/min

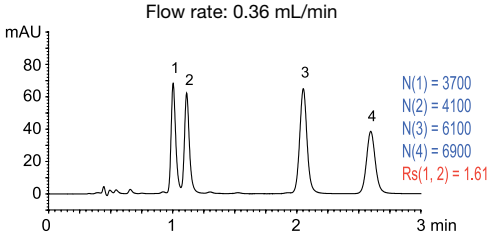


Standard Cell (8 µL, Cell length 10 mm)
Flow rate: 0.8 mL/min

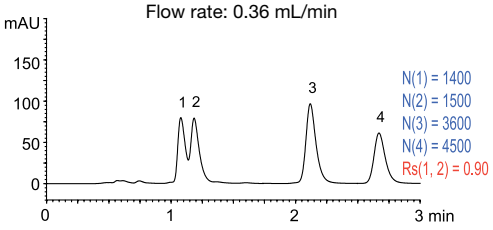


50 x 2 mm ID

Semi-micro Cell (2.5 µL, Cell length 5 mm)
Flow rate: 0.36 mL/min



Standard Cell (8 µL, Cell length 10 mm)
Flow rate: 0.36 mL/min



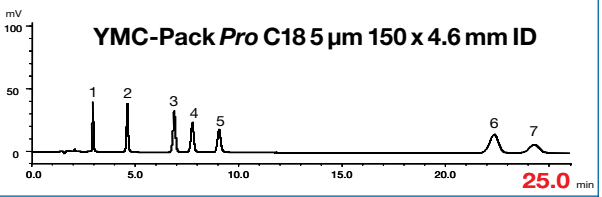
Column: YMC-UltraHT *Pro* C18
Eluent: acetonitrile / 20 mM KH_2PO_4 (10/90)
Temperature: 37 °C
Detection: UV at 260 nm

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

* Application data by courtesy YMC Co., Ltd.

Downscale of Methods

Conventional LC Method*

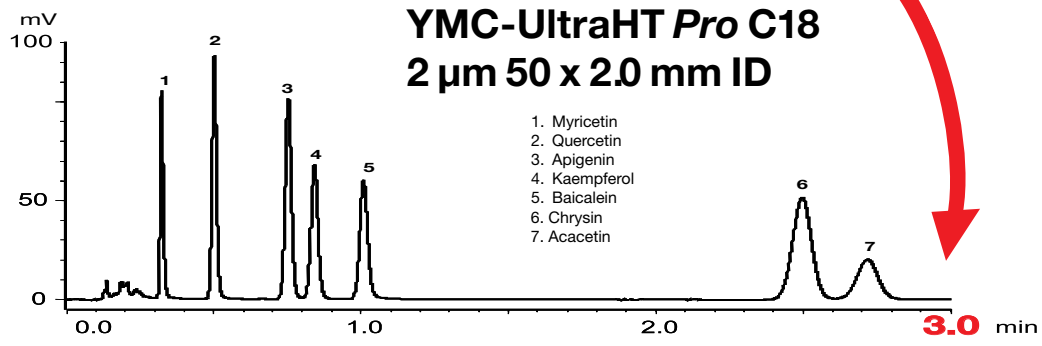


Part No.:	AS12S05-1546WT
Eluent:	acetonitrile / water / formic acid (35/65/0.1)
Flow rate:	1.0 mL/min (1.00 mm/sec)
Temperature:	40 °C
Detection:	UV at 260 nm
Pressure:	**1230 psi (83 bar, 8.3 MPa)**

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.

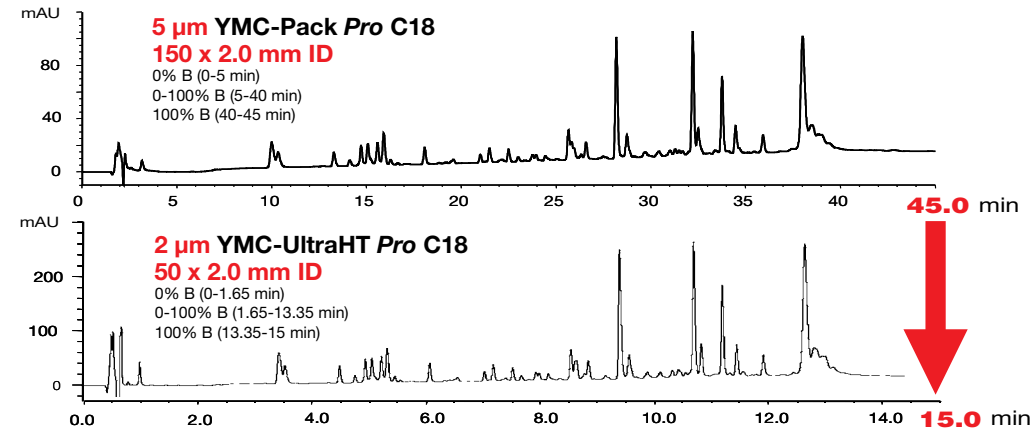
Ultra Fast LC Method*



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)**

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.

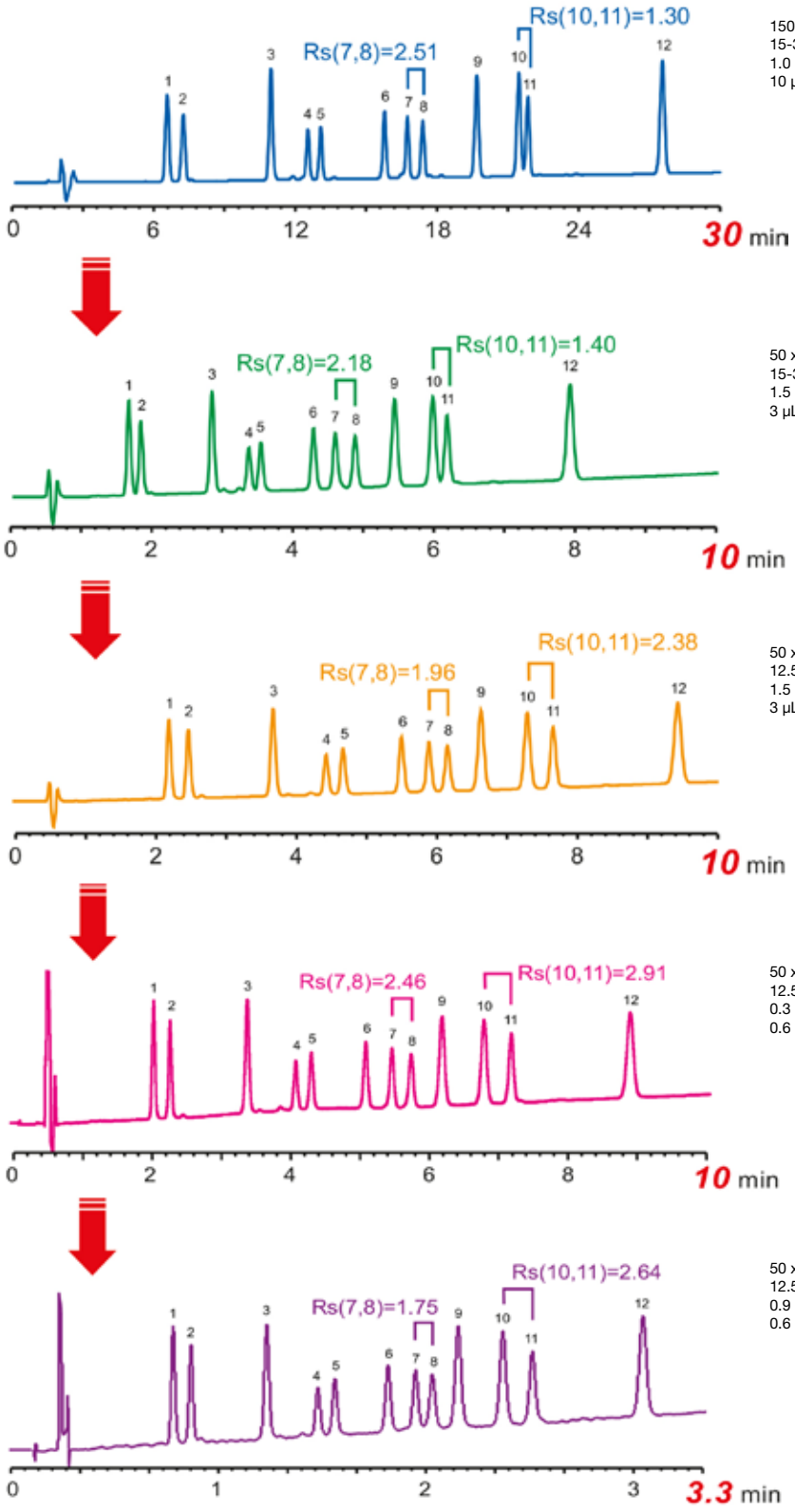
Peptide mapping*



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*



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

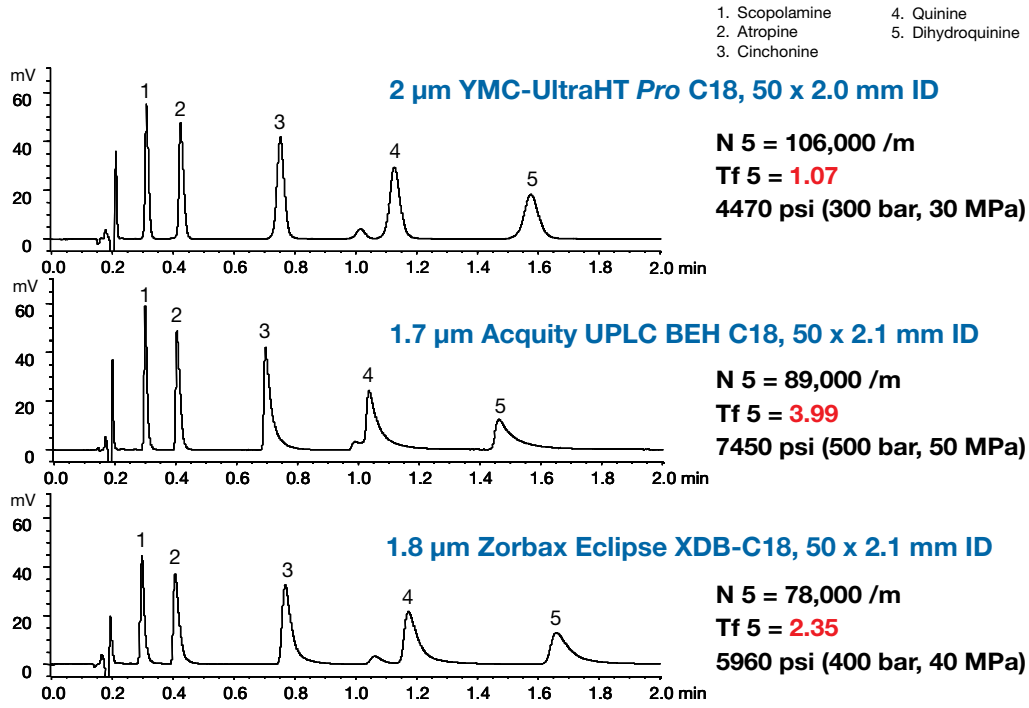
1. Daidzin
2. Glycitin
3. Genistin
4. 6'-O-Malonyldaidzin
5. 6'-O-Malonylglycitin
6. 6'-O-Acetyldaidzin
7. 6'-O-Acetylglycitin
8. 6'-O-Malonylgenistin
9. Daidzein
10. Glycitein
11. 6'-O-Acetylgenistin
12. Genistein

* Application data by courtesy YMC Co., Ltd.

Downscale of Methods

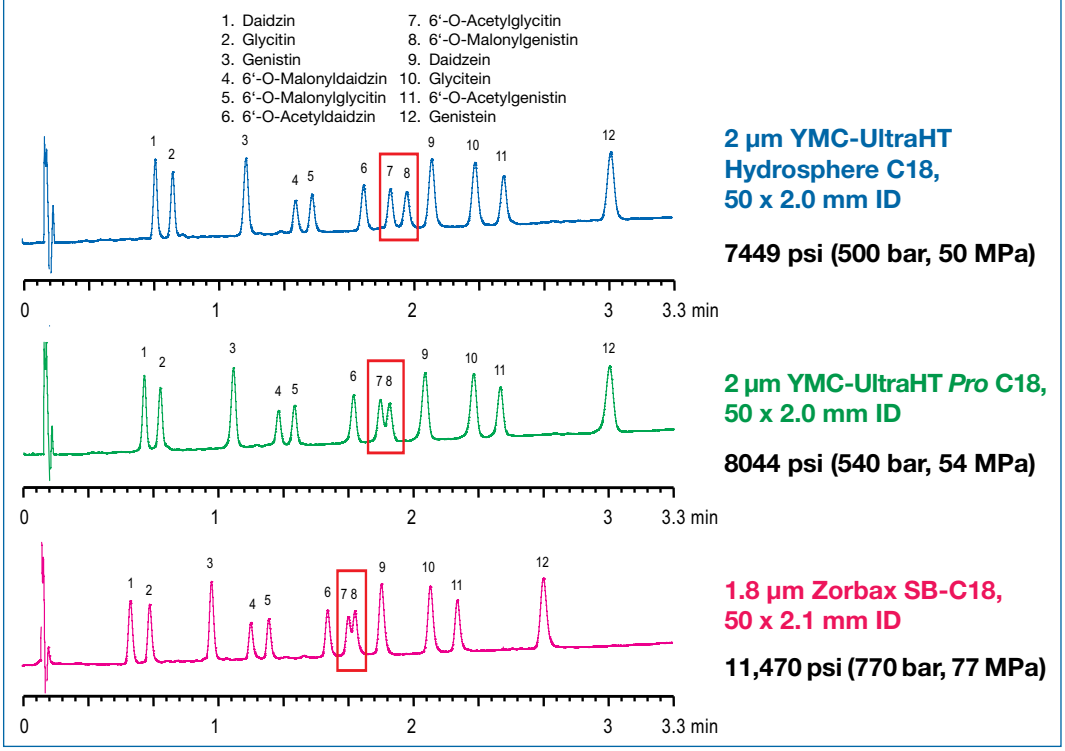
Why not take the pressure out of Fast LC!

Peak performance*



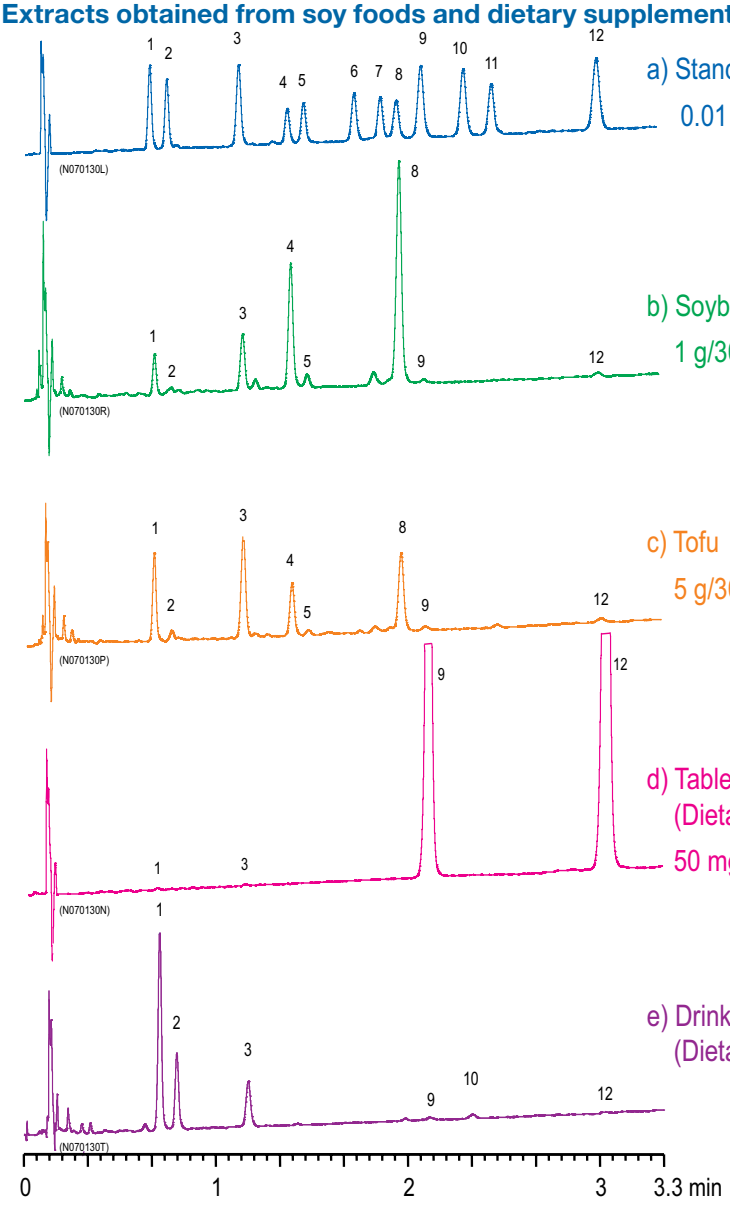
With YMC-UltraHT *Pro* C18 you have all the efficiency you need to develop your Fast LC methods with none of the pressure or heat some would have you believe is essential!

Peak performance*



Downscale of Methods

Extracts obtained from soy foods and dietary supplements*



1. Daidzin (D)
2. Glycitin (Gl)
3. Genistin (G)
4. 6'-O-Malonyldaidzin (MD)
5. 6'-O-Malonylglycitin (MGl)
6. 6'-O-Acetyldaidzin (AD)
7. 6'-O-Acetylglycitin (AGl)
8. 6'-O-Malonylgenistin (MG)
9. Daidzein (De)
10. Glycitein (Gle)
11. 6'-O-Acetylgenistin (AG)
12. Genistein (Ge)

Sample preparation method

Sample b-d / Sample e

← 50% aqueous ethanol

Stirred at r.t. for 1 hr.

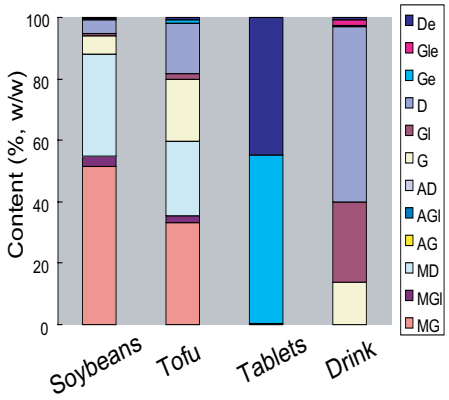
Filtration (Filter paper No. 5A)

Filtration (0.2 µm YMC Duo-Filter)

Injection (0.6 µl)

Column:	YMC-UltraHT Hydrosphere C18 (2 µm) 50 x 2.0 mm ID
Part No.:	HS12S02-0502WT
Flow rate:	0.9 mL/min
Temperature:	35°C
Detection:	UV at 254 nm
Injection:	0.6 µL
Eluent:	A) water/ acetic acid (100/3) B) acetonitrile / acetic acid (100/3)
Gradient:	12.5-30% acetonitrile (0-3.3 min)

Content of isoflavones in soy foods and dietary supplements



* Application data by courtesy YMC Co., Ltd.

YMC *Pro*Family

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

	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

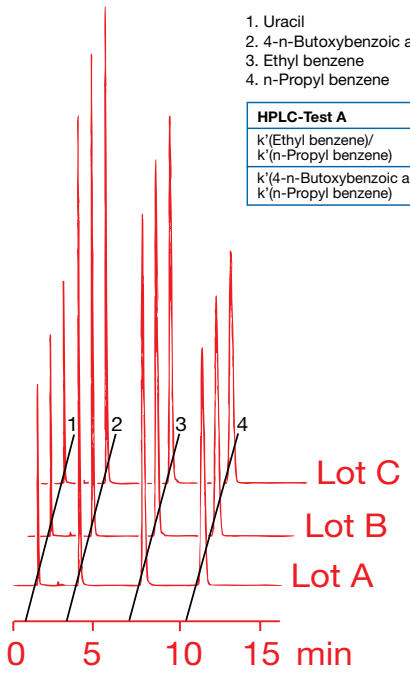
Properties

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 (pH3.5) / acetonitrile (40/60,v/v)
Flow rate: 1.0 mL/min
Detection: UV at 254nm
Temperature: 37 °C

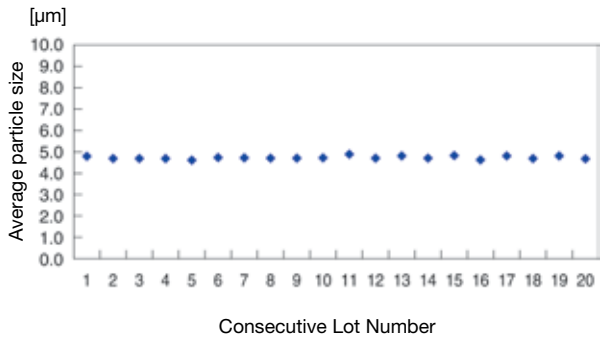
YMC *Pro*Family

Underlying silica gel support

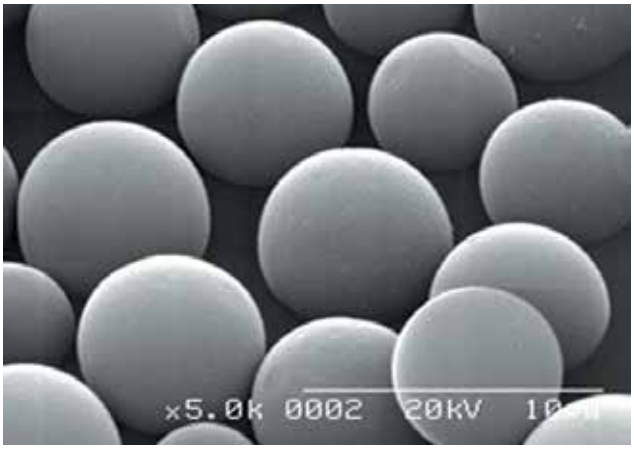
The physical properties of silica gel have a great effect on the selectivity and performance of the bonded packing. For the purpose of supplying columns of stable quality, the physical properties of silica gel used for packing such as particle size, pore size, specific surface area, pore volume and amount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

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

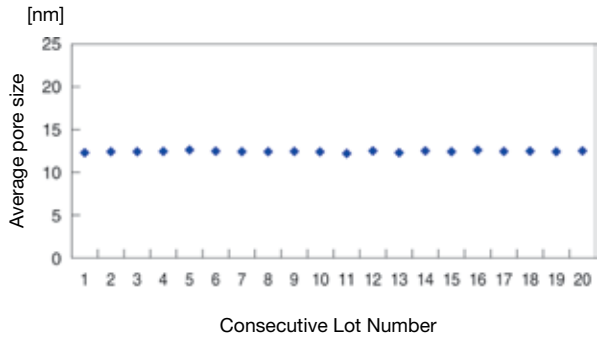
Particle size*



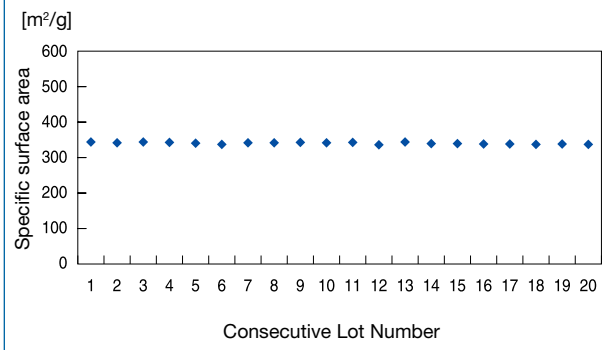
Silica Support Material (5 µm, 12 nm)



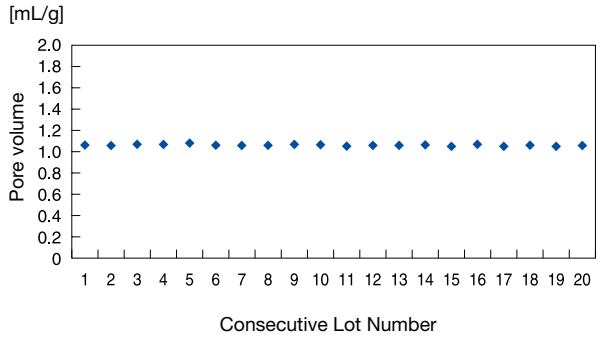
Pore size*



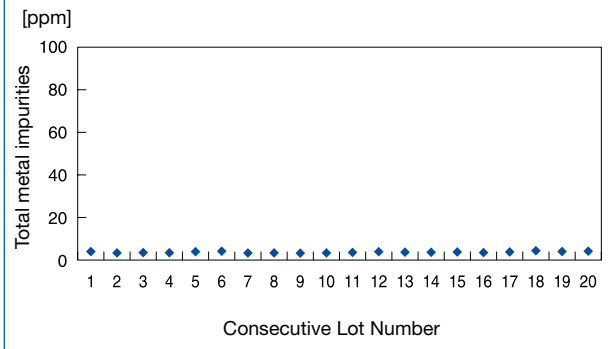
Specific surface area*



Pore volume*



Amount of metal content*



* Application data by courtesy YMC Co., Ltd.

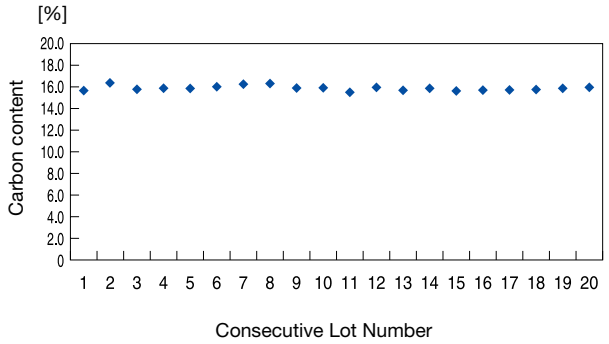
YMC *Pro*Family

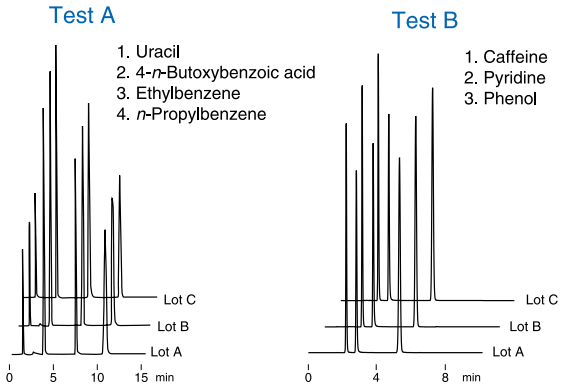
Packing material

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.

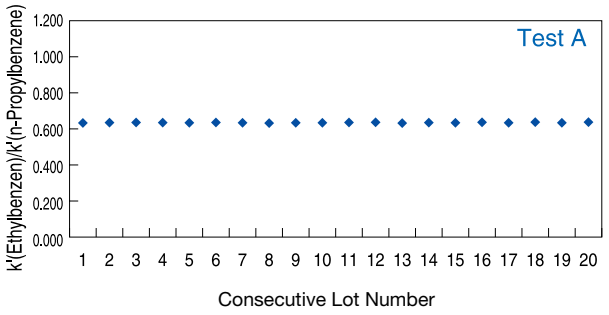
Pro C18 5 µm, Reproducibility between batches

Percent Carbon Content*

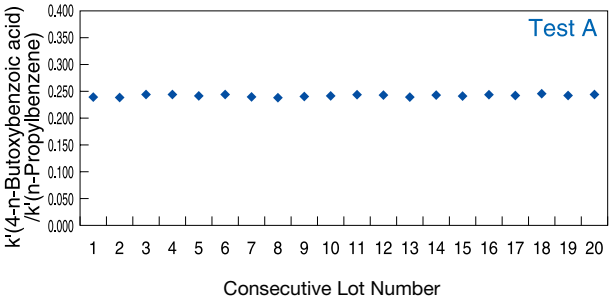




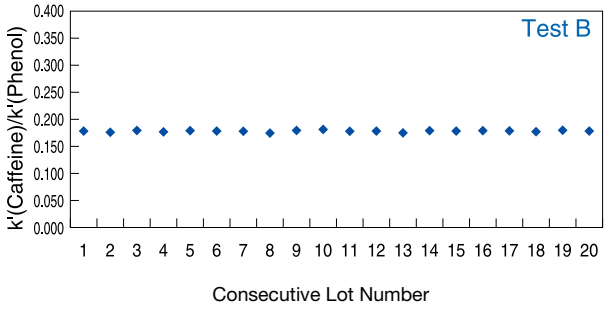
Hydrophobicity*



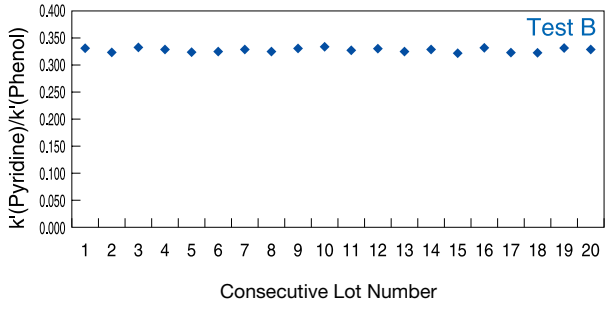
Acidic compounds*



Hydrogen bonding ability*

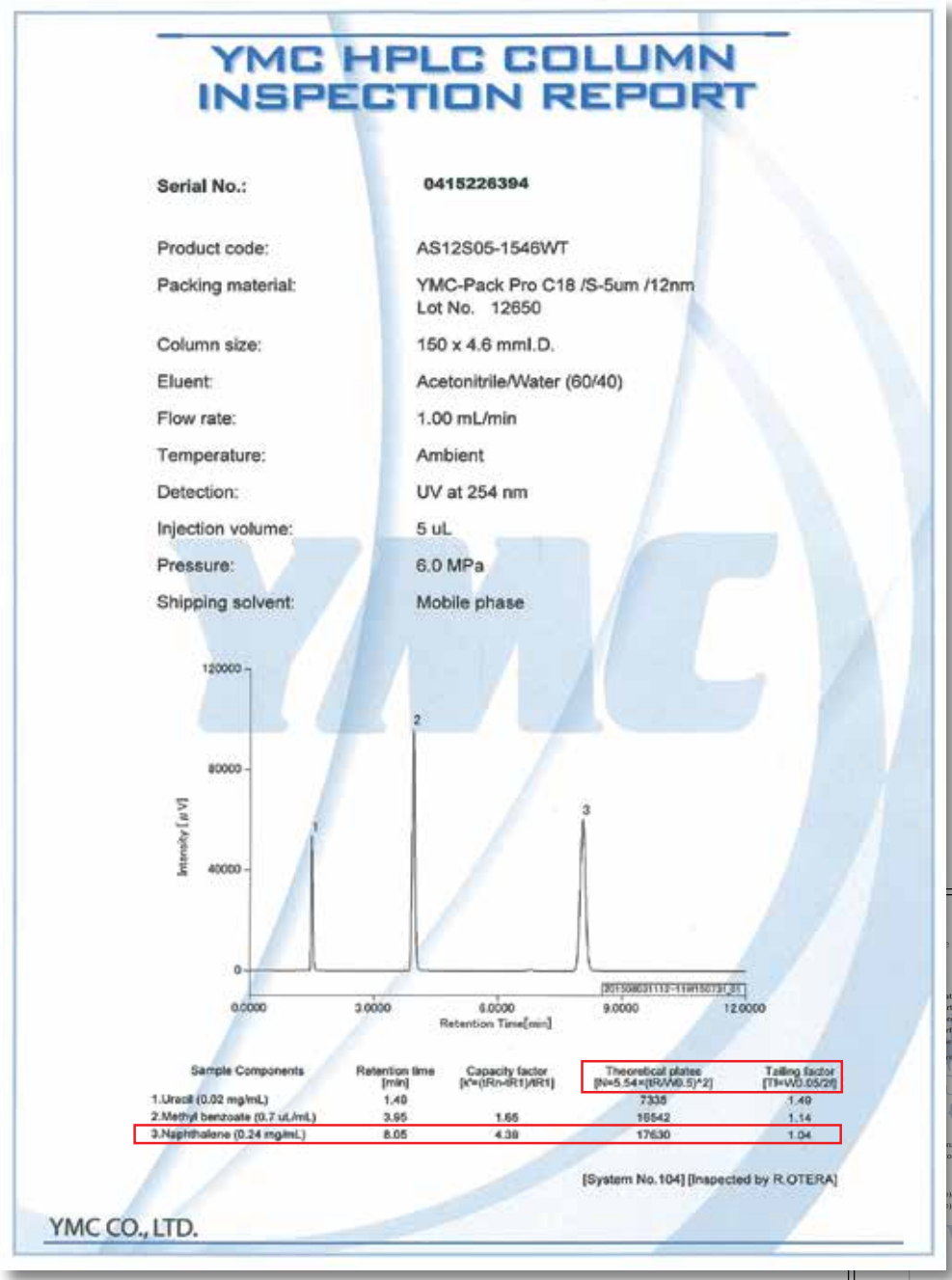


Basic compounds*



Individual Column Test

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 *Pro*Family 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 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

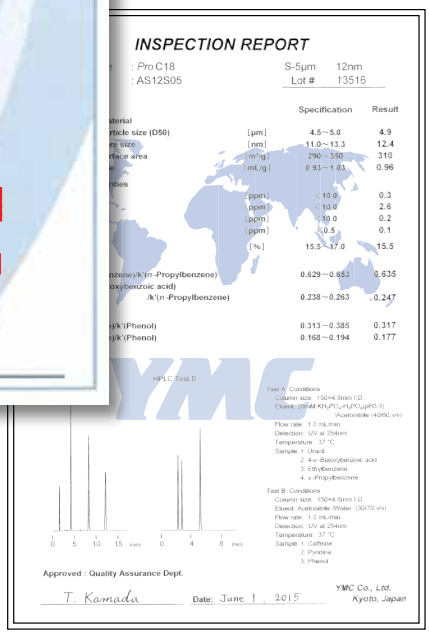
Sample Components	Retention time [min]	Capacity factor [k'=(tRn-tR1)/tR1]	Theoretical plates [N=5.54×(tR/W0.5)^2]	Tailing factor [T=W0.05/2f]
1.Uracil (0.02 mg/mL)	1.40		7335	1.49
2.Methyl benzoate (0.7 uL/mL)	3.95	1.65	16542	1.14
3.Naphthalene (0.24 mg/mL)	8.05	4.38	17630	1.04

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

YMC CO., LTD.

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

Individual Lot Test



INSPECTION REPORT

: *Pro*C18 S-5µm 12nm
: AS12S05 Lot # 13516

		Specification	Result
Particle size (D50)	[µm]	4.5～5.0	4.9
Pore size	[nm]	11.0～13.3	12.4
Surface area	[m²/g]	290～350	310
	[mL/g]	0.93～1.03	0.96
	[ppm]	< 10.0	0.3
	[ppm]	< 10.0	2.6
	[ppm]	< 10.0	0.2
	[ppm]	< 0.5	0.1
	[%]	15.5～17.0	15.5
k'(*n*-Propylbenzene)		0.629～0.653	0.635
k'(*n*-Propylbenzene)		0.238～0.263	0.247
k'(Phenol)		0.313～0.385	0.317
k'(Phenol)		0.168～0.194	0.177

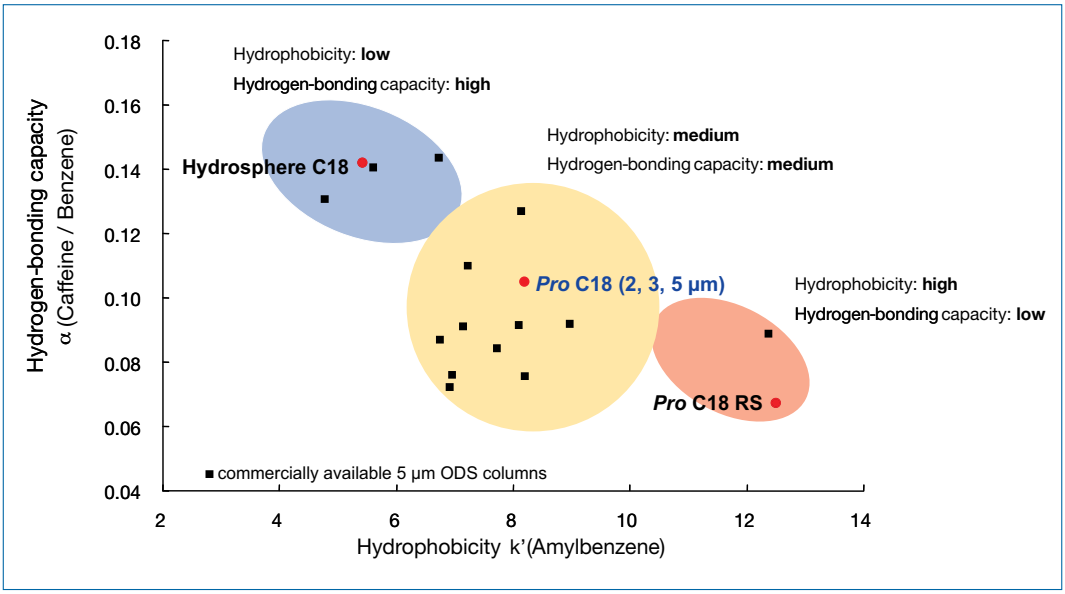
Approved : Quality Assurance Dept.
T. Kamada Date: June 1, 2015
YMC Co., Ltd. Kyoto, Japan

* Application data by courtesy YMC Co., Ltd.

YMC *Pro*Family

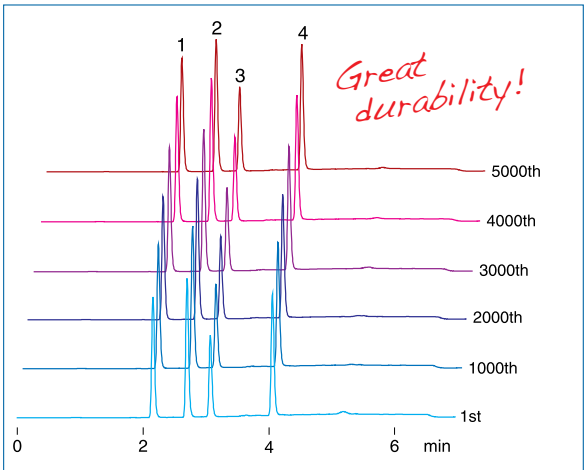
Comparison of separative selectivity

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.



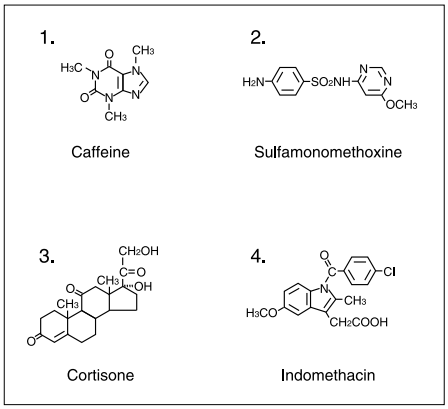
Stability for repetitive analysis

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.



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

	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



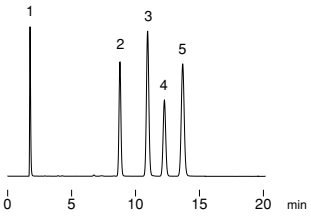
YMC *Pro*Family

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.

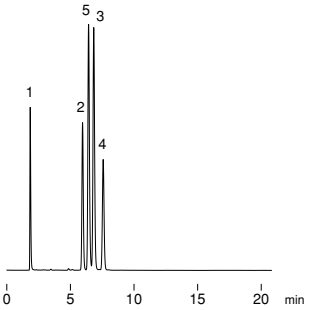
The compounds 1. uracil (dead volume marker) 2. n-butylbenzene 3. o-terphenyl 4. n-amylbenzene and 5. triphenylene are used to determine the hydrophobicity (2. and 4.) and the steric selectivity (3. and. 5.) of each *Pro*Family member under unbuffered chromatographic conditions.

YMC-Pack *Pro* C18



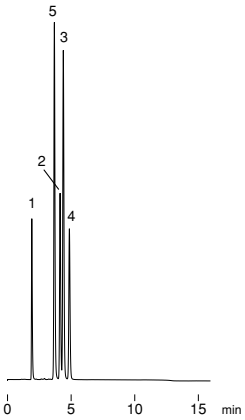
balanced hydrogen bonding, capacity and hydrophobicity

YMC-Pack *Pro* C8



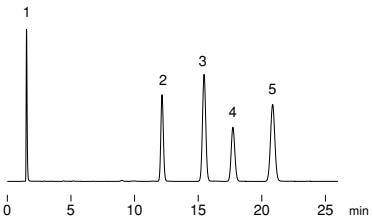
lower hydrophobicity

YMC-Pack *Pro* C4



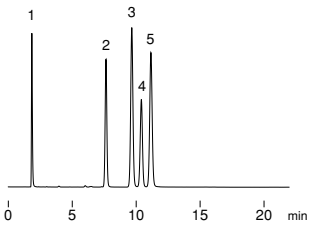
lowest hydrophobicity

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.

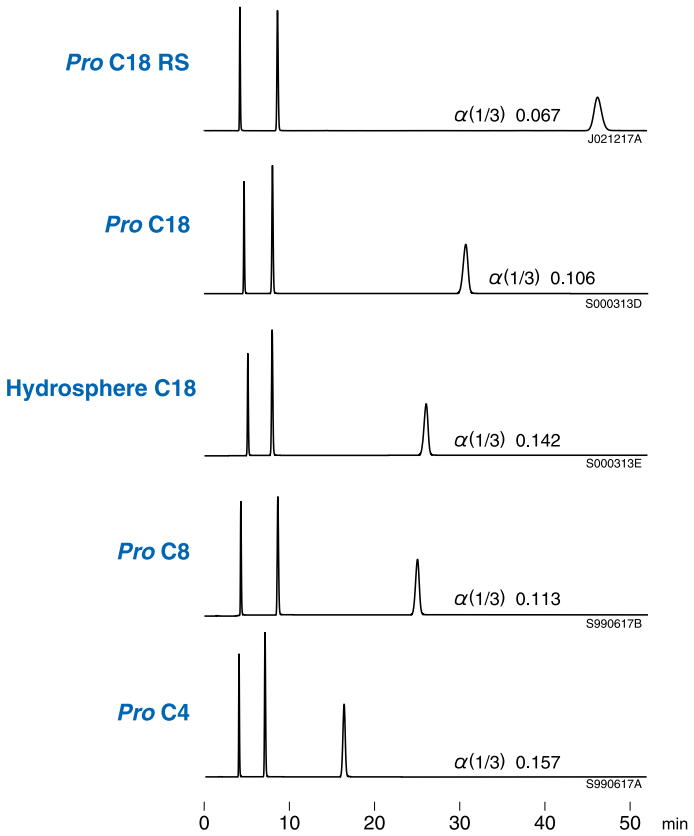
* Application data by courtesy YMC Co., Ltd.

YMC *Pro*Family

Hydrogen bonding capacity

Hydrogen bonding capacity is evaluated by examining the relative retention coefficient as α (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*



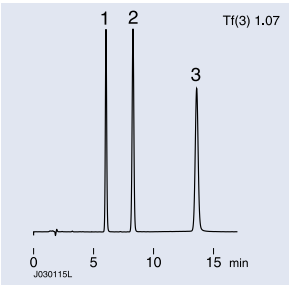
Column:	150 x 4.6 mm ID
Eluent:	methanol / water (30/70)
Flow rate:	1.0 mL/min
Temperature:	37° C
Detection:	UV at 254 nm

YMC *Pro*Family

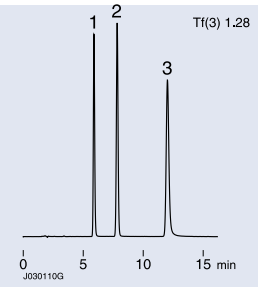
Acidic and basic compounds

Acidic compounds*

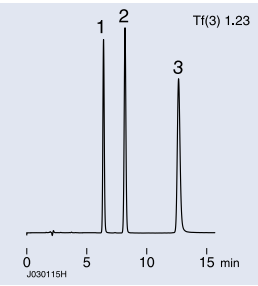
***Pro* C18 RS**



***Pro* C18**



Hydrosphere C18

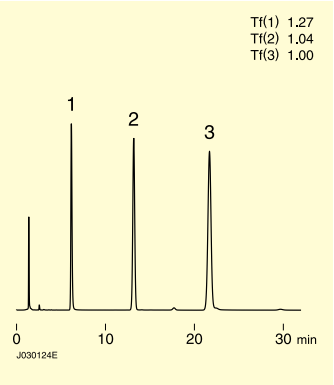


Column: 150 x 4.6 mm ID
Eluent: 20 mM CH_3COONa-CH_3COOH (pH 4.4) / acetonitrile (80/20)
Flow rate: 1.0 mL/min
Temperature: 37° C
Detection: UV at 230 nm

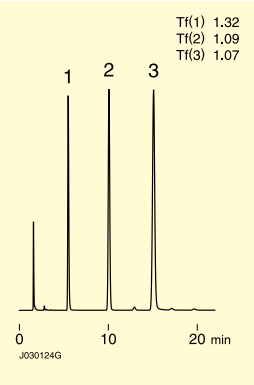
1. *p*-Hydroxyacetophenone (I.S.)
2. Sorbic acid
3. Dehydroacetic acid

Basic compounds*

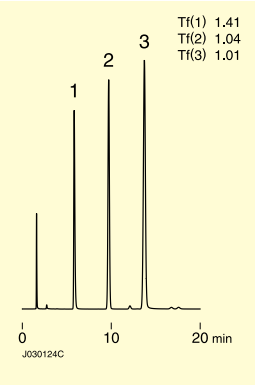
***Pro* C18 RS**

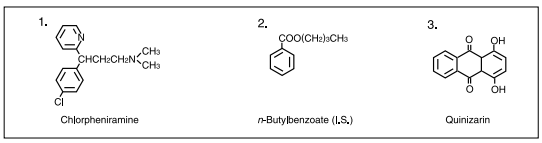


***Pro* C18**



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

* Application data by courtesy YMC Co., Ltd.

YMC-Pack *Pro* C18

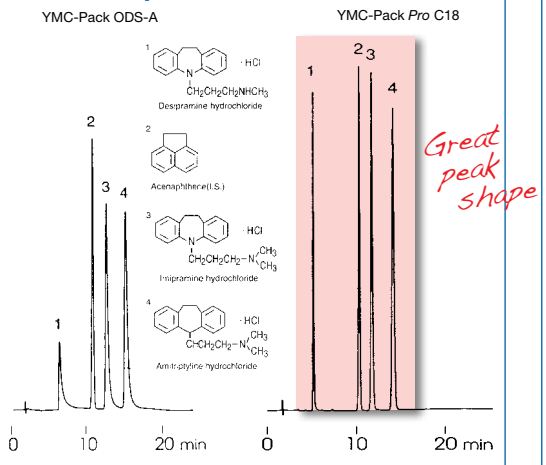
- **specifically designed for pharmaceutical and biotechnical R&D**
- **extreme narrow specifications**
- **high lot-to-lot reproducibility**
- **high column-to-column reproducibility**
- **ideal for basic, acidic and polar compounds**

YMC-Pack *Pro* C18	Specification
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

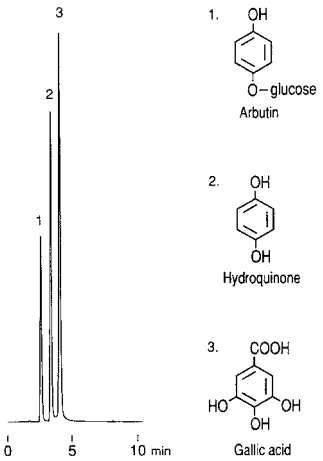
YMC-Pack *Pro* C18 is based on an ultra pure silica support, which is used for the whole *Pro*Family. Due to a proprietary endcapping process especially designed for this type of silica, YMC-Pack *Pro* C18 is perfectly suitable for the separation of acidic and basic molecules. The inertness of the silica 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*



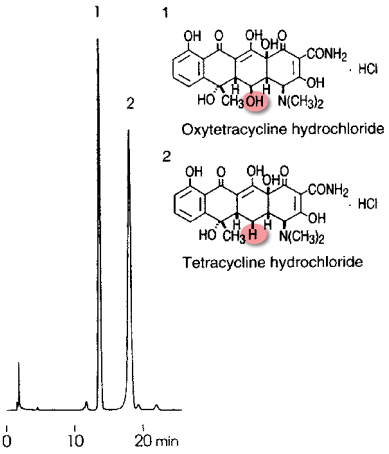
Column: YMC-Pack *Pro* C18 (3 µm, 12 nm) 50 x 2.0 mm ID
Eluent: 10 mM CH_3COONH_4 / methanol (45/55)
Flow rate: 0.2 mL/min
Temperature: 37° C
Detection: UV at 254 nm

YMC-Pack *Pro* C18

Application

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

Tetracycline antibiotics*

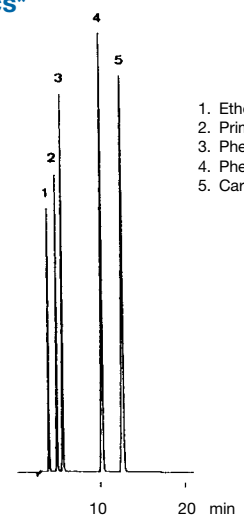


1 Oxytetracycline hydrochloride

2 Tetracycline hydrochloride

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)

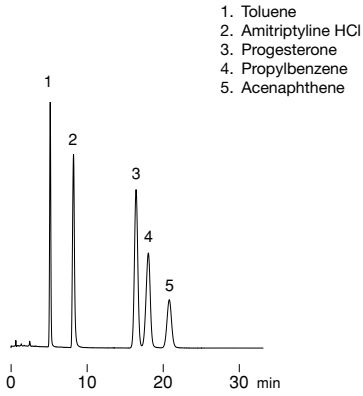
Antiepileptics*



1. Ethosuximide
2. Primidone
3. Phenobarbital sodium salt
4. Phenytoin
5. Carbamazepine

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)

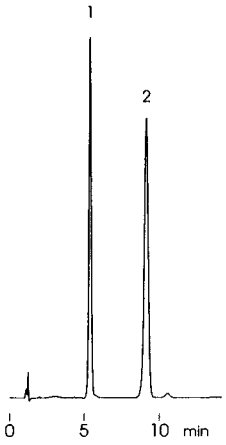
Baseline separation of compounds with different polarity*



1. Toluene
2. Amitriptyline HCl
3. Progesterone
4. Propylbenzene
5. Acenaphthene

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*



1 Ouabagenin

2 G-Strophanthin(Ouabain)

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.de/support-documentation.html.

* Application data by courtesy YMC Co., Ltd.

YMC-Pack *Pro* C8

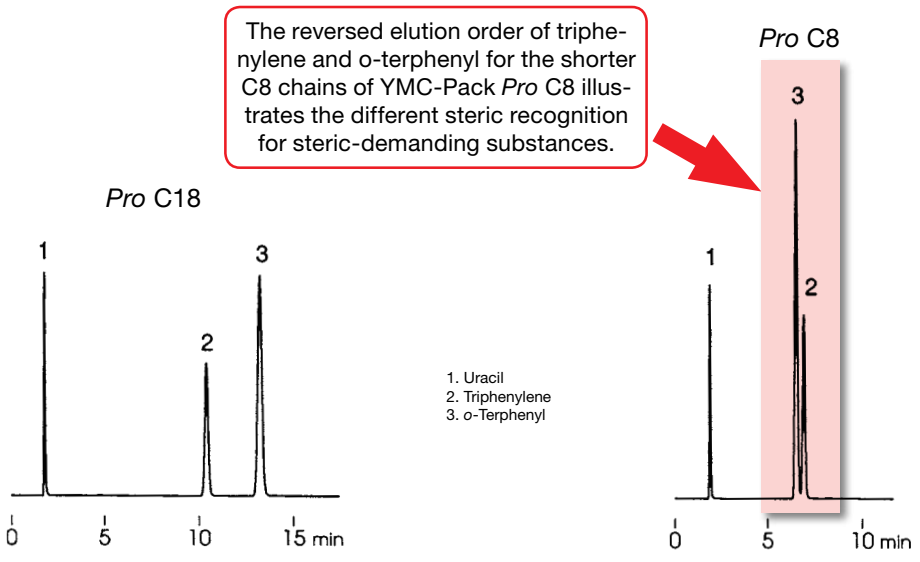
- **extremely broad selectivity pattern**
- **good alternative to C18 phases**
- **suitable for all types of organic molecules, especially basic pharmaceuticals**

YMC-Pack *Pro* C8	Specification
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*



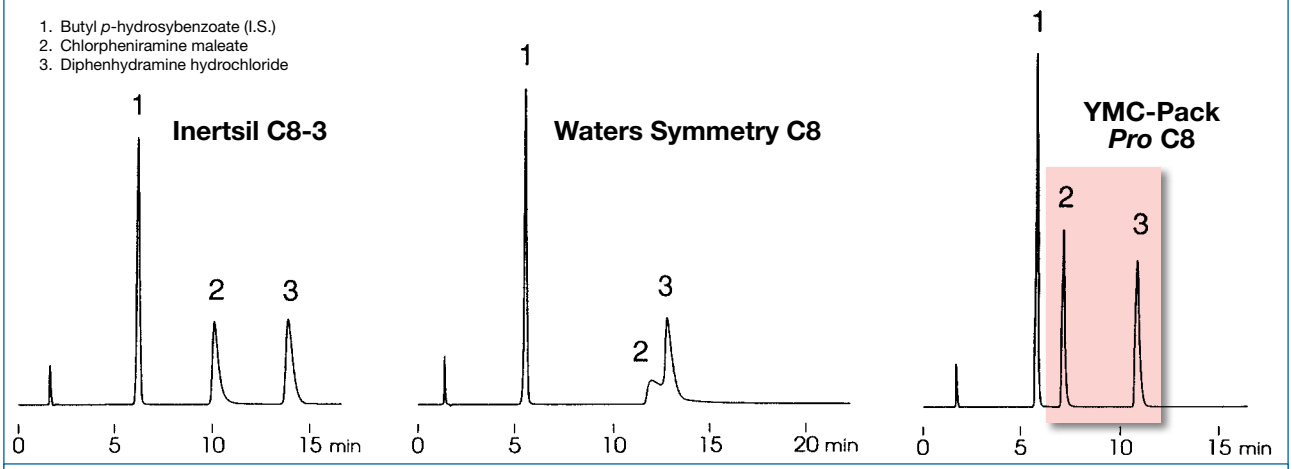
Column: 150 x 4.6 mm ID
Eluent: methanol / water (80/20)
Flow rate: 1.0 mL/min
Temperature: 37° C
Detection: UV at 254 nm

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*

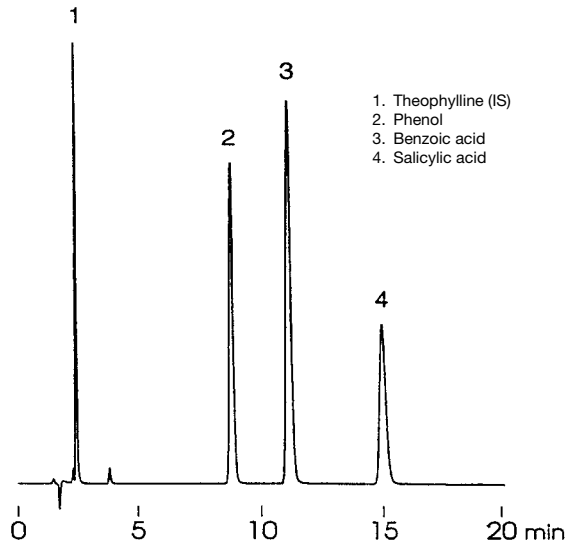
1. Butyl *p*-hydrosybenzoate (I.S.)
2. Chlorpheniramine maleate
3. Diphenhydramine hydrochloride



Histamine antagonists

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

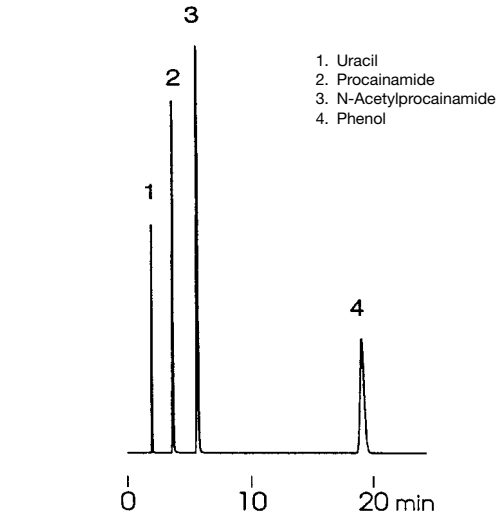
No need for ion pair reagents*



Disinfectants

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*



Basic compounds

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

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

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.de/support-documentation.html.

* Application data by courtesy YMC Co., Ltd.

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**

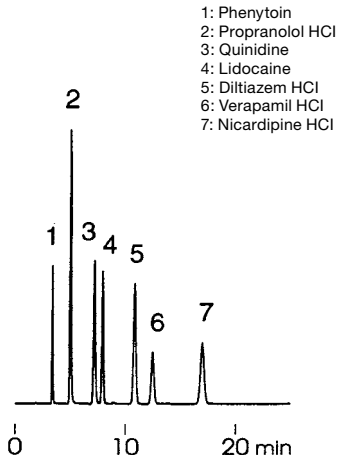
YMC-Pack *Pro* C4	Specification
Particle size / µm	3; 5
Pore size / nm	12
Surface area / m^2g^{-1}	330
Carbon content / %	7
Recommended pH range	2.0 - 7.5

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.

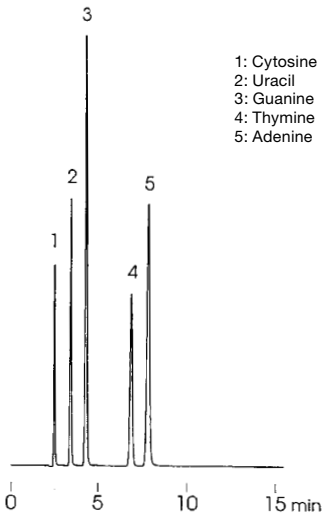
Within the *Pro*Family, YMC-Pack *Pro* C4 is the selectivity of choice to reduce time of analysis in combination with the given advantages of the *Pro*Family, namely the high purity silica support and the low metal content, which result in excellent peak performance as below.

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*

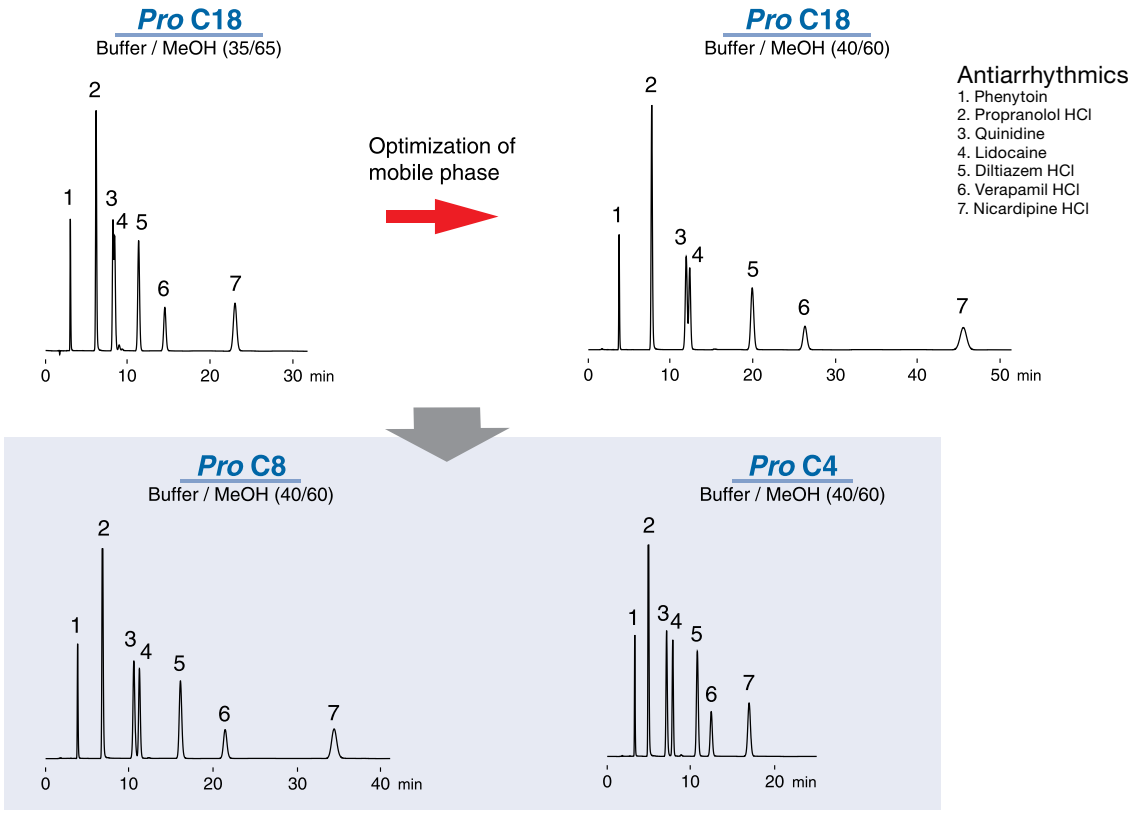


Nucleic acid bases
Column: YMC-Pack *Pro* C4 (5 µm, 12 nm) 150 x 4.6 mm ID
Part No.: BS12S05-1546WT
Eluent: 20 mM KH_2PO_4
Flow rate: 1.0 mL/min
Temperature: 37° C
Detection: UV at 254 nm

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.de/support-documentation.html.

* Application data by courtesy YMC Co., Ltd.

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**

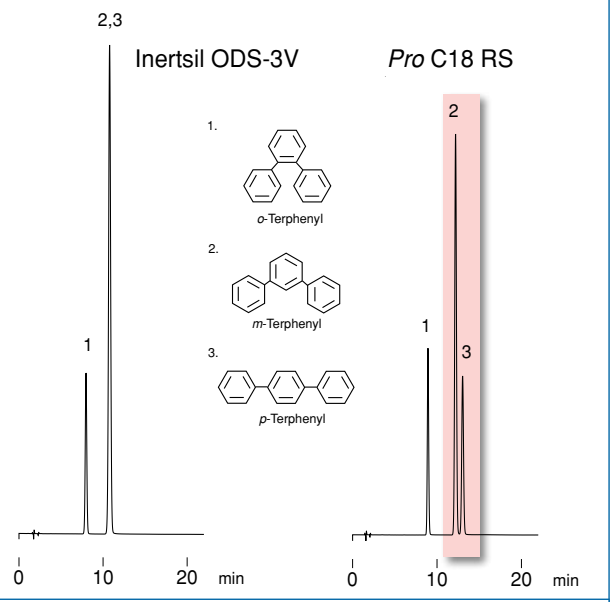
YMC-Pack *Pro* C18 RS	Specification
Particle size / µm	3; 5
Pore size / nm	8
Surface area / m^2g^{-1}	510
Carbon content / %	22
Recommended pH range	1.0 - 10.0*

* it is recommended to use at least 10% organic solvent composition near the pH limits and over 50% at pH values above pH 9.0 to preserve column lifetimes

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*



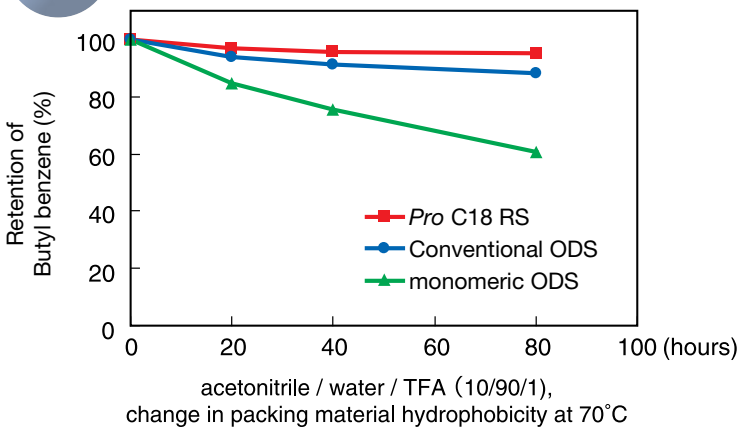
Column: 150 x 4.6 mm ID
Eluent: methanol / water (85/15)
Flow rate: 1.0 mL/min
Temperature: 37° C
Detection: UV at 254 nm

YMC-Pack *Pro* C18 RS

Stability under acidic conditions*

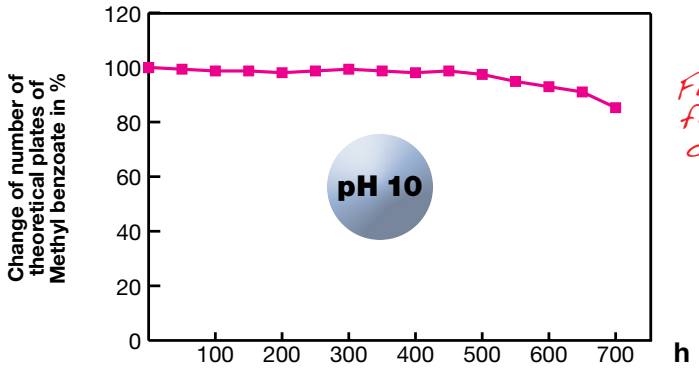
pH 1

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*



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.

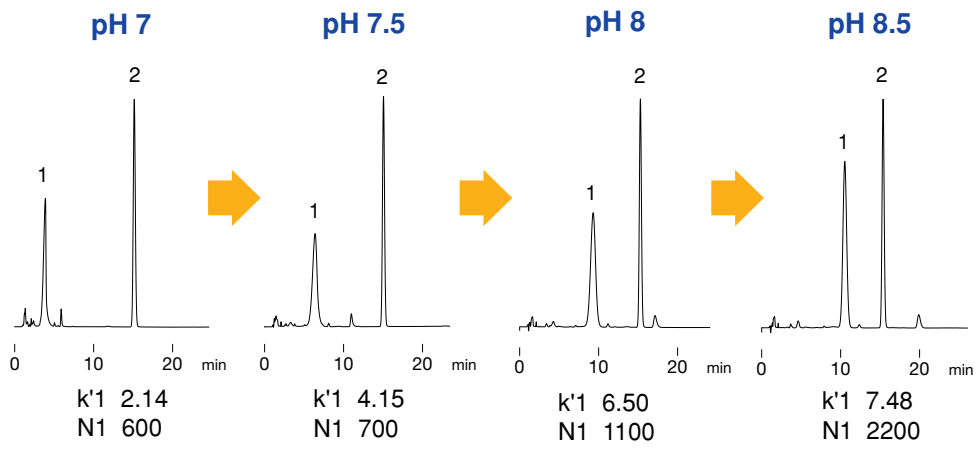
Basic eluents may significantly affect silicas and traditional bonding chemistries. Therefore, stability data should be considered only after verifying that the buffer system used maintains the selected pH during preparation and use. Furthermore, it must be verified that the eluent is not recycled, since 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.

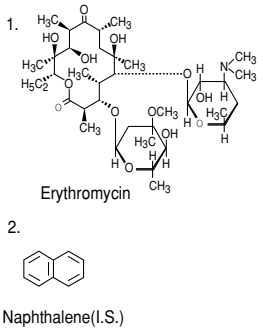
* Application data by courtesy YMC Co., Ltd.

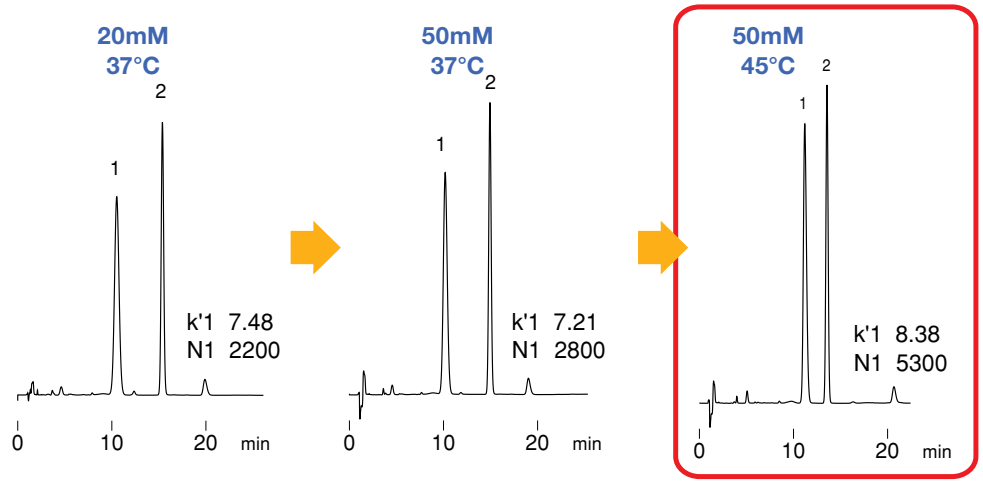
YMC-Pack *Pro* C18 RS

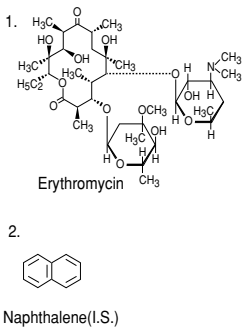
YMC-Pack *Pro* C18 RS: Ideal for the separation of steric demanding compounds and/or for use under broader pH conditions!

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

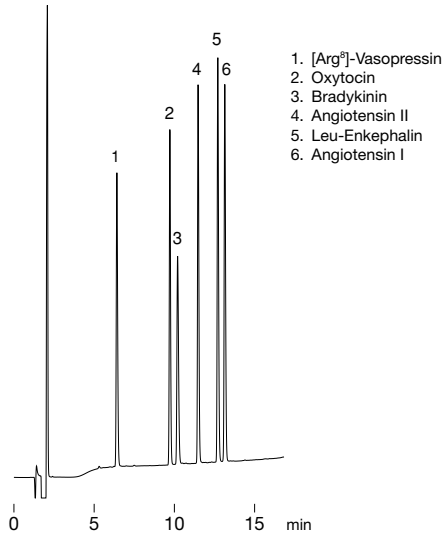
YMC-Pack *Pro* C18 RS

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:

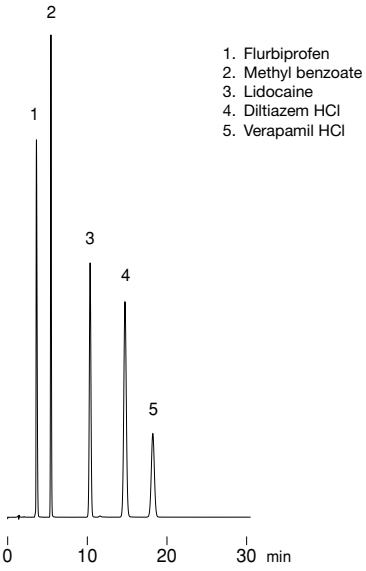
positional isomers, large hydrophobic molecules, basic and acidic compounds, peptides

Peptides: LC-MS conditions*



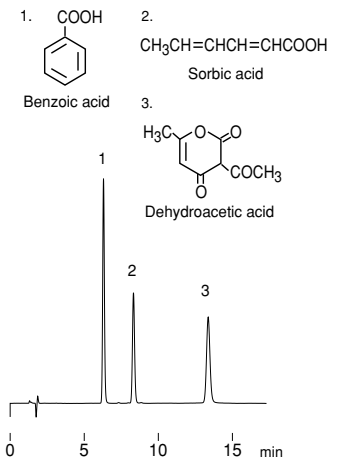
Column:	YMC-Pack *Pro* C18 RS (5 µm, 8 nm) 150 x 4.6 mm ID
Part No.:	RS08S05-1546WT
Eluent:	A: water / TFA (100/0.1) B: acetonitrile / TFA (100/0.1)
Gradient:	15-35% B (0-15 min)
Flow:	1.0 mL/min
Detection:	UV, 220 nm, 0.32 AUFS
Temperature:	37 °C
Injection:	20 µL (0.05 mg/mL)

Drugs: LC-MS conditions*



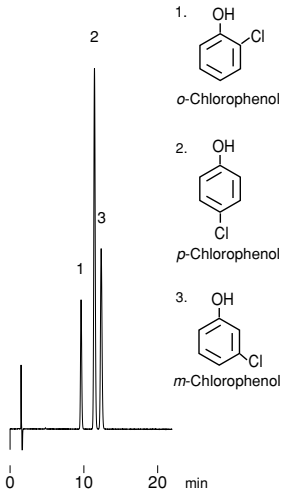
Column:	YMC-Pack *Pro* C18 RS (5 µm, 8 nm) 150 x 4.6 mm ID
Part No:	RS08S05-1546WT
Eluent:	20 mM CH_3COONH_4-NH_3 (pH 8.9) / methanol (35/65)
Flow:	1.0 mL/min
Detection:	UV, 220 nm, 0.64 AUFS
Temperature:	30 °C
Injection:	10 µL (0.1 mg/mL, 0.036 µL/mL)

Food preservatives*



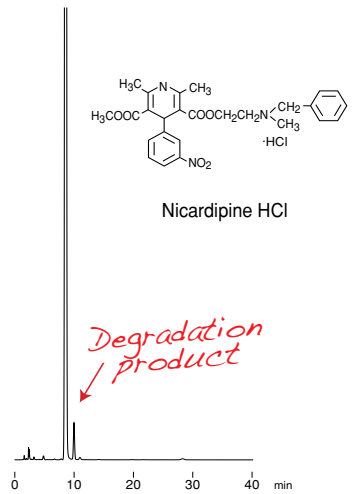
Column:	YMC-Pack *Pro* C18 RS (5 µm, 8 nm) 150 x 4.6 mm ID
Part No.:	RS08S05-1546WT
Eluent:	20 mM CH_3COONa - CH_3COOH (pH 4.3) / acetonitrile (80/20)
Flow:	1.0 mL/min
Detection:	UV at 230 nm, 0.26 AUFS
Temperature:	37 °C
Injection:	10 µL (0.02 mg/mL)

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*



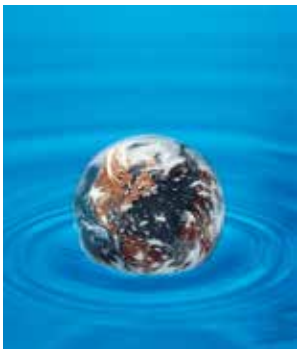
Column:	YMC-Pack *Pro* C18 RS (5 µm, 8 nm) 150 x 4.6 mm ID
Part No.:	RS08S05-1546WT
Eluent:	20 mM KH_2PO_4-K_2HPO_4 (pH 6.9) / methanol (25/75)
Flow:	1.0 mL/min
Detection:	UV at 254 nm, 0.32 AUFS
Temperature:	37 °C
Injection:	10 µL

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

* Application data by courtesy YMC Co., Ltd.

Hydrosphere C18

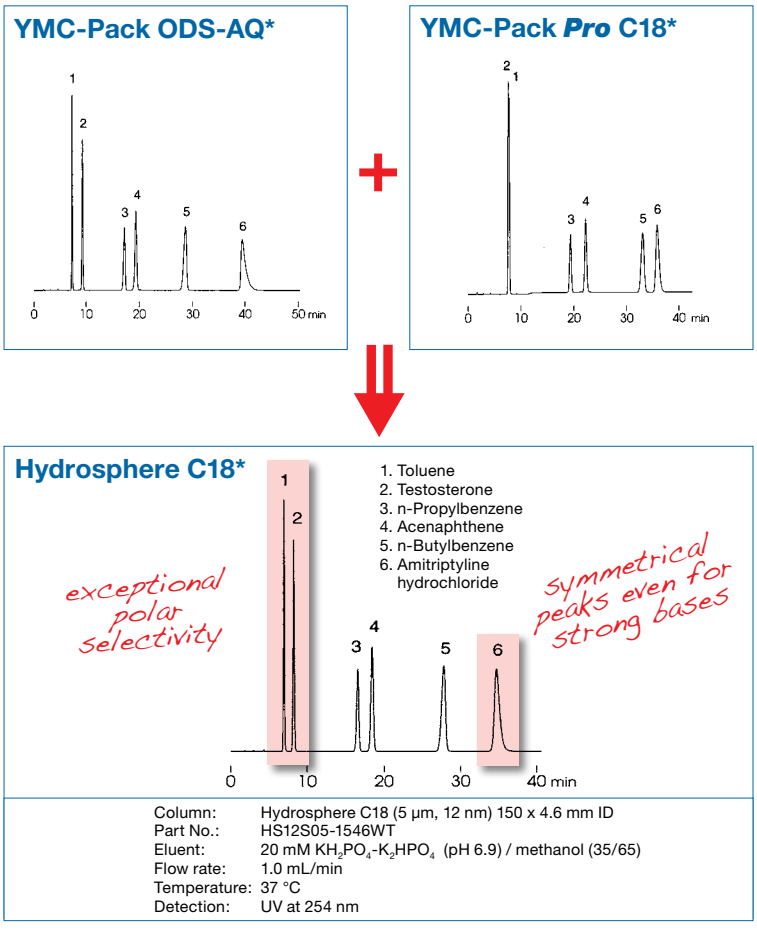
- **stable under the use of 100% aqueous eluent**
- **“hydrophilic” C18 surface for enhanced polar recognition**
- **no need for ion pair reagents**
- **based on highly inert, ultrapure, pH neutral silica**
- **specifically designed for pharmaceutical and biotechnology R&D**



Hydrosphere C18	Specification
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

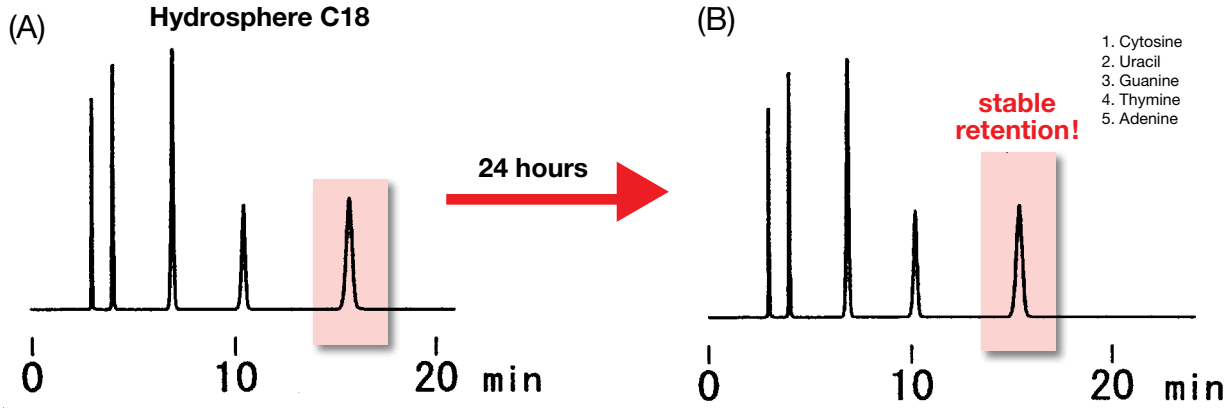
General

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*

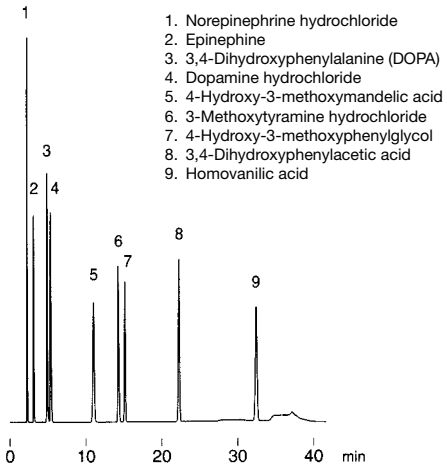


Column: Hydrosphere C18 (5 µm, 12 nm) 150 x 4.6 mm ID
Part No.: HS12S05-1546WT
Eluent: 20 mM KH_2PO_4-K_2HPO_2 (pH 6.9)
Flow rate: 1.0 mL/min
Temperature: 37 °C
Detection: UV at 254 nm

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

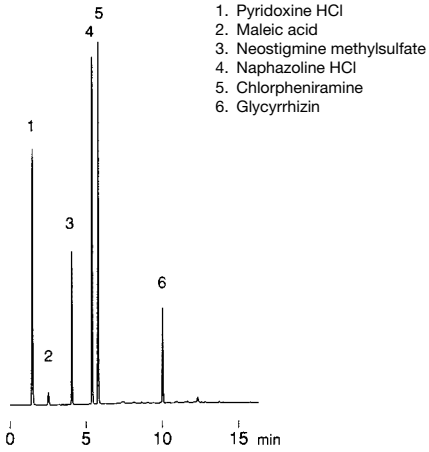
Its "hydrophilic" C18 surface gives Hydrosphere C18 the capability to show stable retention times even after 24 hours under these chromatographic conditions.

No ion pair reagent required*



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: 1.0 mL/min
Detection: UV at 280 nm, 0.64 AUFS
Temperature: 30 °C
Injection: 10 µL (0.15 - 0.25 mg/mL)

Efficient separation of complex substance mixtures*



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.de/support-documentation.html.

* Application data by courtesy YMC Co., Ltd.

Ordering Information

YMC-Pack *Pro* C18

Phase dimension	Column ID [mm]	Column length [mm]					Guard cartridges* with 10 mm length [pack of 5]
		30 (WT) / 33 (QT)	50	100	150	250	
12 nm 2 µm	2.0	AS12S02-0302WT	AS12S02-0502WT	AS12S02-1002WT	AS12S02-1502WT	—	—
	3.0	—	AS12S02-0503WT	AS12S02-1003WT	AS12S02-1503WT	—	—
	4.6	—	AS12S02-0546WT	—	—	—	—
12 nm 3 µm	2.1	AS12S03-H3Q1QT	AS12S03-05Q1QT	AS12S03-10Q1QT	AS12S03-15Q1QT	AS12S03-25Q1QT	AS12S03-01Q1GC
	3.0	AS12S03-H303QT	AS12S03-0503QT	AS12S03-1003QT	AS12S03-1503QT	AS12S03-2503QT	AS12S03-0103GC
	4.0	AS12S03-H304QT	AS12S03-0504QT	AS12S03-1004QT	AS12S03-1504QT	AS12S03-2504QT	AS12S03-0104GC
	4.6	AS12S03-0346WT	AS12S03-0546WT	AS12S03-1046WT	AS12S03-1546WT	AS12S03-2546WT	AS12S03-0104GC
12 nm 5 µm	2.1	AS12S05-H3Q1QT	AS12S05-05Q1QT	AS12S05-10Q1QT	AS12S05-15Q1QT	AS12S05-25Q1QT	AS12S05-01Q1GC
	3.0	AS12S05-H303QT	AS12S05-0503QT	AS12S05-1003QT	AS12S05-1503QT	AS12S05-2503QT	AS12S05-0103GC
	4.0	AS12S05-H304QT	AS12S05-0504QT	AS12S05-1004QT	AS12S05-1504QT	AS12S05-2504QT	AS12S05-0104GC
	4.6	AS12S05-0346WT	AS12S05-0546WT	AS12S05-1046WT	AS12S05-1546WT	AS12S05-2546WT	AS12S05-0104GC

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

YMC-Pack *Pro* C8

Phase dimension	Column ID [mm]	Column length [mm]					Guard cartridges* with 10 mm length [pack of 5]
		30 (WT) / 33 (QT)	50	100	150	250	
12 nm 3 µm	2.1	OS12S03-H3Q1QT	OS12S03-05Q1QT	OS12S03-10Q1QT	OS12S03-15Q1QT	OS12S03-25Q1QT	OS12S03-01Q1GC
	3.0	OS12S03-H303QT	OS12S03-0503QT	OS12S03-1003QT	OS12S03-1503QT	OS12S03-2503QT	OS12S03-0103GC
	4.0	OS12S03-H304QT	OS12S03-0504QT	OS12S03-1004QT	OS12S03-1504QT	OS12S03-2504QT	OS12S03-0104GC
	4.6	OS12S03-0346WT	OS12S03-0546WT	OS12S03-1046WT	OS12S03-1546WT	OS12S03-2546WT	OS12S03-0104GC
12 nm 5 µm	2.1	OS12S05-H3Q1QT	OS12S05-05Q1QT	OS12S05-10Q1QT	OS12S05-15Q1QT	OS12S05-25Q1QT	OS12S05-01Q1GC
	3.0	OS12S05-H303QT	OS12S05-0503QT	OS12S05-1003QT	OS12S05-1503QT	OS12S05-2503QT	OS12S05-0103GC
	4.0	OS12S05-H304QT	OS12S05-0504QT	OS12S05-1004QT	OS12S05-1504QT	OS12S05-2504QT	OS12S05-0104GC
	4.6	OS12S05-0346WT	OS12S05-0546WT	OS12S05-1046WT	OS12S05-1546WT	OS12S05-2546WT	OS12S05-0104GC

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

YMC-Pack *Pro* C4

Phase dimension	Column ID [mm]	Column length [mm]					Guard cartridges* with 10 mm length [pack of 5]
		30 (WT) / 33 (QT)	50	100	150	250	
12 nm 3 µm	2.1	BS12S03-H3Q1QT	BS12S03-05Q1QT	BS12S03-10Q1QT	BS12S03-15Q1QT	BS12S03-25Q1QT	BS12S03-01Q1GC
	3.0	BS12S03-H303QT	BS12S03-0503QT	BS12S03-1003QT	BS12S03-1503QT	BS12S03-2503QT	BS12S03-0103GC
	4.0	BS12S03-H304QT	BS12S03-0504QT	BS12S03-1004QT	BS12S03-1504QT	BS12S03-2504QT	BS12S03-0104GC
	4.6	BS12S03-0346WT	BS12S03-0546WT	BS12S03-1046WT	BS12S03-1546WT	BS12S03-2546WT	BS12S03-0104GC
12 nm 5 µm	2.1	BS12S05-H3Q1QT	BS12S05-05Q1QT	BS12S05-10Q1QT	BS12S05-15Q1QT	BS12S05-25Q1QT	BS12S05-01Q1GC
	3.0	BS12S05-H303QT	BS12S05-0503QT	BS12S05-1003QT	BS12S05-1503QT	BS12S05-2503QT	BS12S05-0103GC
	4.0	BS12S05-H304QT	BS12S05-0504QT	BS12S05-1004QT	BS12S05-1504QT	BS12S05-2504QT	BS12S05-0104GC
	4.6	BS12S05-0346WT	BS12S05-0546WT	BS12S05-1046WT	BS12S05-1546WT	BS12S05-2546WT	BS12S05-0104GC

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

Ordering Information

YMC-Pack *Pro* C18 RS

Phase dimension	Column ID [mm]	Column length [mm]					Guard cartridges* with 10 mm length [pack of 5]
		30 (WT) / 33 (QT)	50	100	150	250	
8 nm 3 µm	2.1	RS08S03-H3Q1QT	RS08S03-05Q1QT	RS08S03-10Q1QT	RS08S03-15Q1QT	RS08S03-25Q1QT	RS08S03-01Q1GC
	3.0	RS08S03-H303QT	RS08S03-0503QT	RS08S03-1003QT	RS08S03-1503QT	RS08S03-2503QT	RS08S03-0103GC
	4.0	RS08S03-H304QT	RS08S03-0504QT	RS08S03-1004QT	RS08S03-1504QT	RS08S03-2504QT	RS08S03-0104GC
	4.6	RS08S03-0346WT	RS08S03-0546WT	RS08S03-1046WT	RS08S03-1546WT	RS08S03-2546WT	RS08S03-0104GC
8 nm 5 µm	2.1	RS08S05-H3Q1QT	RS08S05-05Q1QT	RS08S05-10Q1QT	RS08S05-15Q1QT	RS08S05-25Q1QT	RS08S05-01Q1GC
	3.0	RS08S05-H303QT	RS08S05-0503QT	RS08S05-1003QT	RS08S05-1503QT	RS08S05-2503QT	RS08S05-0103GC
	4.0	RS08S05-H304QT	RS08S05-0504QT	RS08S05-1004QT	RS08S05-1504QT	RS08S05-2504QT	RS08S05-0104GC
	4.6	RS08S05-0346WT	RS08S05-0546WT	RS08S05-1046WT	RS08S05-1546WT	RS08S05-2546WT	RS08S05-0104GC

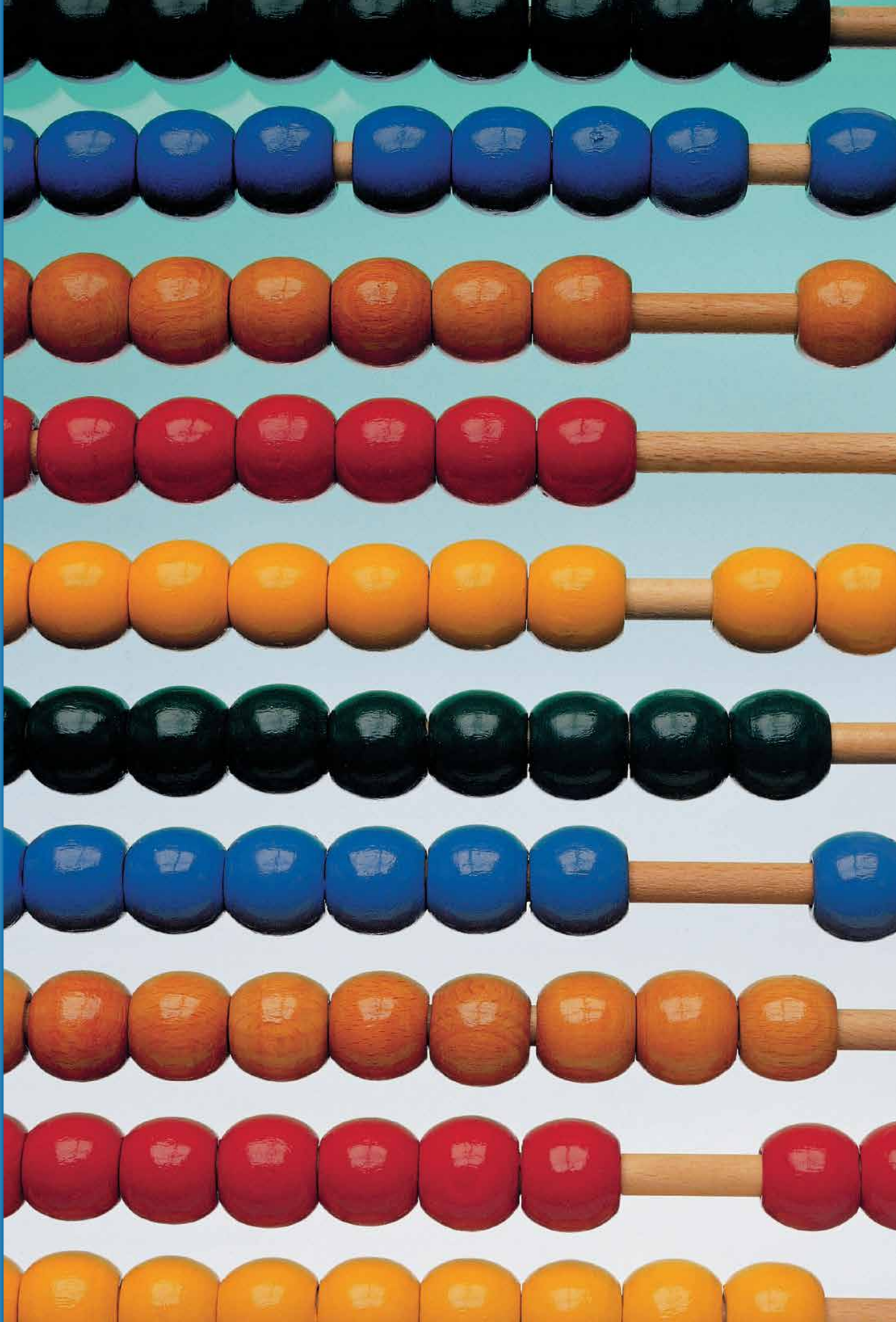
*Guard cartridge holder required, part no. XPGCH-Q1

Hydrosphere C18

Phase dimension	Column ID [mm]	Column length [mm]					Guard cartridges* with 10 mm length [pack of 5]
		30 (WT) / 33 (QT)	50	100	150	250	
12 nm 2 µm	2.1	HS12S02-0302WT	HS12S02-0502WT	HS12S02-1002WT	HS12S02-1502WT	—	—
	3.0	—	HS12S02-0503WT	HS12S02-1003WT	HS12S02-1503WT	—	—
	4.6	—	HS12S02-0546WT	—	—	—	—
12 nm 3 µm	2.1	HS12S03-H3Q1QT	HS12S03-05Q1QT	HS12S03-10Q1QT	HS12S03-15Q1QT	HS12S03-25Q1QT	HS12S03-01Q1GC
	3.0	HS12S03-H303QT	HS12S03-0503QT	HS12S03-1003QT	HS12S03-1503QT	HS12S03-2503QT	HS12S03-0103GC
	4.0	HS12S03-H304QT	HS12S03-0504QT	HS12S03-1004QT	HS12S03-1504QT	HS12S03-2504QT	HS12S03-0104GC
	4.6	HS12S03-0346WT	HS12S03-0546WT	HS12S03-1046WT	HS12S03-1546WT	HS12S03-2546WT	HS12S03-0104GC
12 nm 5 µm	2.1	HS12S05-H3Q1QT	HS12S05-05Q1QT	HS12S05-10Q1QT	HS12S05-15Q1QT	HS12S05-25Q1QT	HS12S05-01Q1GC
	3.0	HS12S05-H303QT	HS12S05-0503QT	HS12S05-1003QT	HS12S05-1503QT	HS12S05-2503QT	HS12S05-0103GC
	4.0	HS12S05-H304QT	HS12S05-0504QT	HS12S05-1004QT	HS12S05-1504QT	HS12S05-2504QT	HS12S05-0104GC
	4.6	HS12S05-0346WT	HS12S05-0546WT	HS12S05-1046WT	HS12S05-1546WT	HS12S05-2546WT	HS12S05-0104GC

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

For other dimensions please refer to page 386-387
For method validation and development kits refer to page 12-13



HPLC Columns YMC RP-Classics

Contents

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**

YMC-Pack ODS-AQ	Specification	
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.

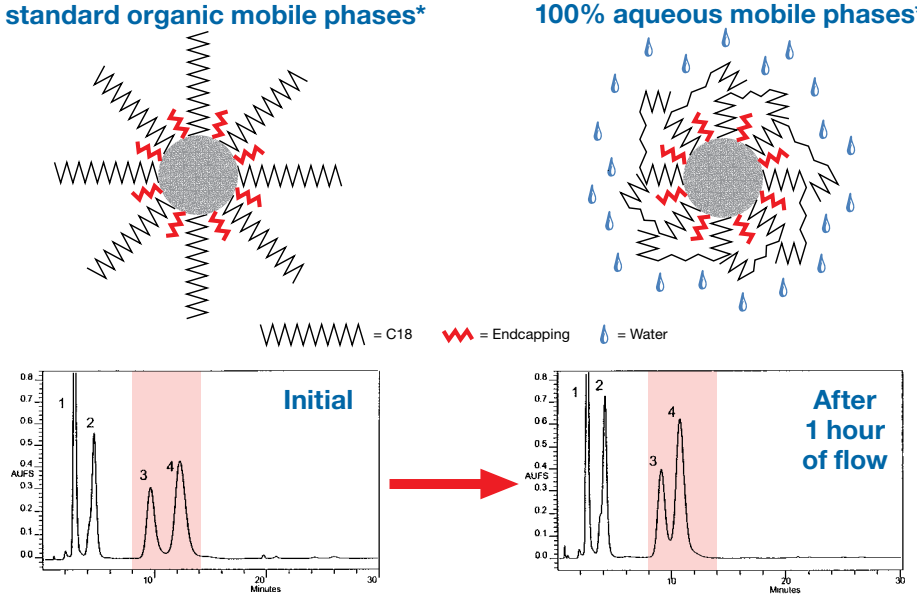
Genuine linear scale-up from analytical to large scale separations is easily achievable with YMC products such as YMC-Pack ODS-AQ, where particle sizes from 3 to 50 µm are available in large lot sizes up to several hundred kilograms, if needed. This, together with the outstanding selectivity of YMC-Pack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

Conventional ODS-Column:

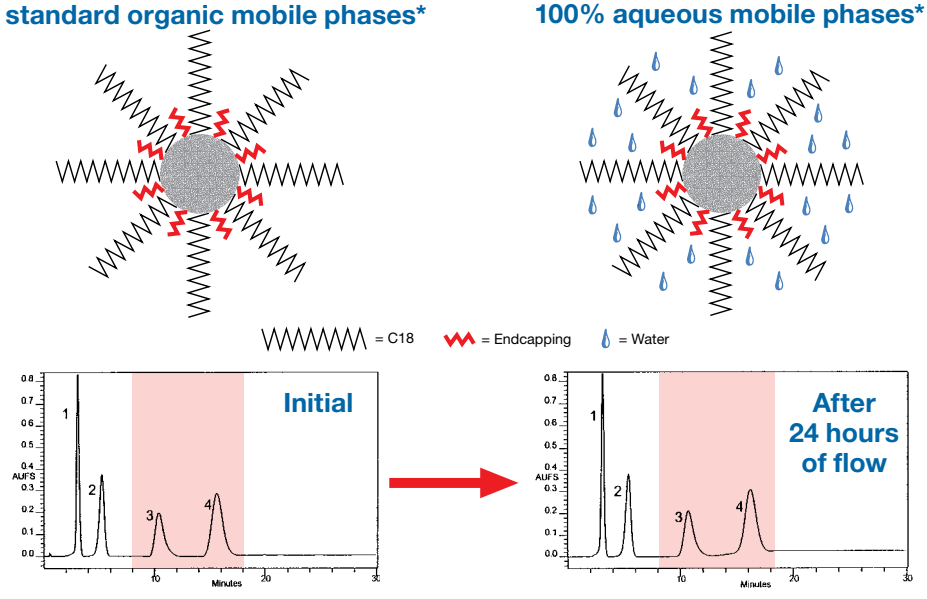
Retention time loss!



Column: YMC-Pack ODS-A (25 µm, 12 nm) 250 x 10 mm ID
Mobile Phase: 100% water
Compounds: Highly polar and very water soluble

YMC-Pack ODS-AQ:

Stable retention times!

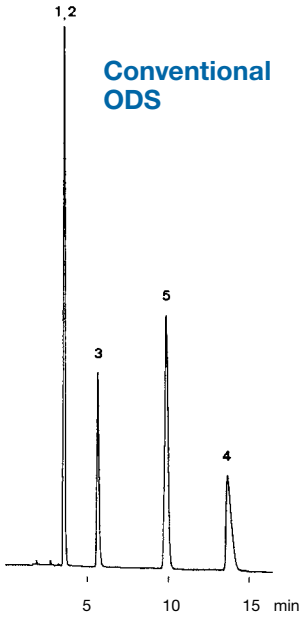


Column: YMC-Pack ODS-AQ (25 µm, 12 nm) 250 x 10 mm ID
Mobile Phase: 100% water
Compounds: Highly polar and very water soluble

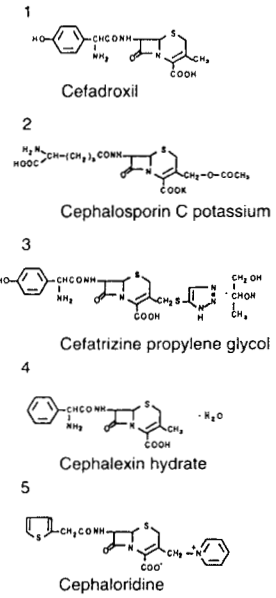
* Application data by courtesy YMC Co., Ltd.

YMC-Pack ODS-AQ

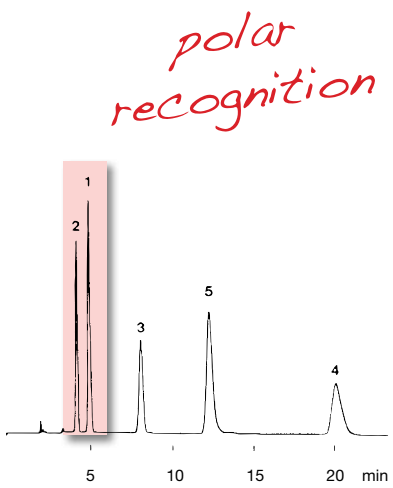
Exceptional performance for the separation of polar compounds*



Conventional ODS



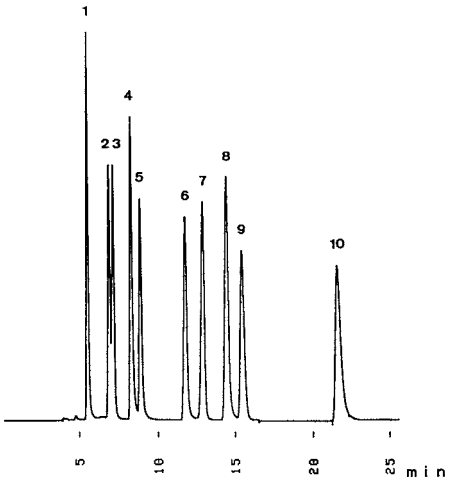
YMC-Pack ODS-AQ



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

Cephalosporin antibiotics
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

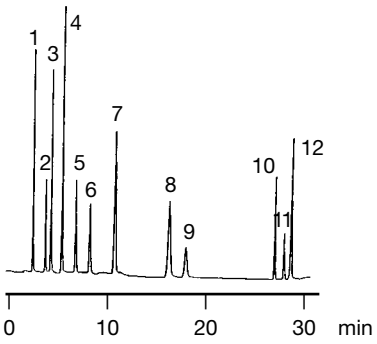
Strong retention in aqueous eluents*



1: Glycolic acid
2: L-Malic acid
3: Malonic acid
4: Lactic acid
5: Acetic acid
6: Maleic acid
7: Citric acid
8: Fumaric acid
9: Succinic acid
10: Propionic acid

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*

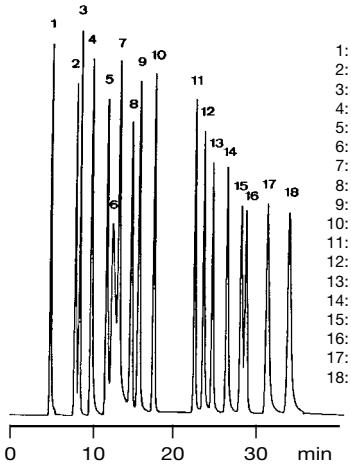


1: Noradrenaline
2: Adrenaline
3: DL-3,4-Dihydroxymandelic Acid
4: 3,4-Dihydroxyphenylalanine (DOPA)
5: Dopamine Hydrochloride
6: Tyrosine
7: DL-3-Methoxy-4-Hydroxymandelic Acid
8: Phenylalanine
9: 4-Hydroxy-3-Methoxy Phenylglycol
10: 5-Hydroxyindole-3-Acetic Acid
11: Vanillic Acid
12: Homovanillic Acid

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*

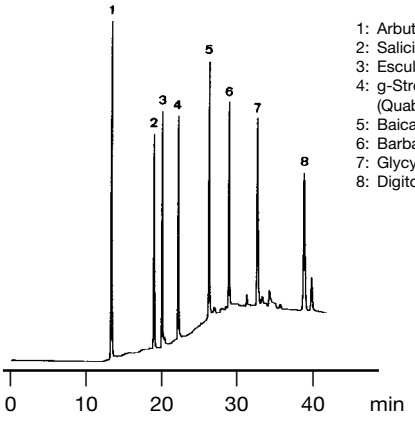


1: Cytosine
2: Cytidine
3: Uracil
4: Deoxycytidine
5: Guanine
6: Adenine
7: Hypoxanthine
8: Uridine
9: Xanthine
10: Thymine
11: Inosine
12: Guanosine
13: Deoxyinosine
14: Deoxyguanosine
15: Xanthosine
16: Thymidine
17: Adenosine
18: Deoxyadenosine

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

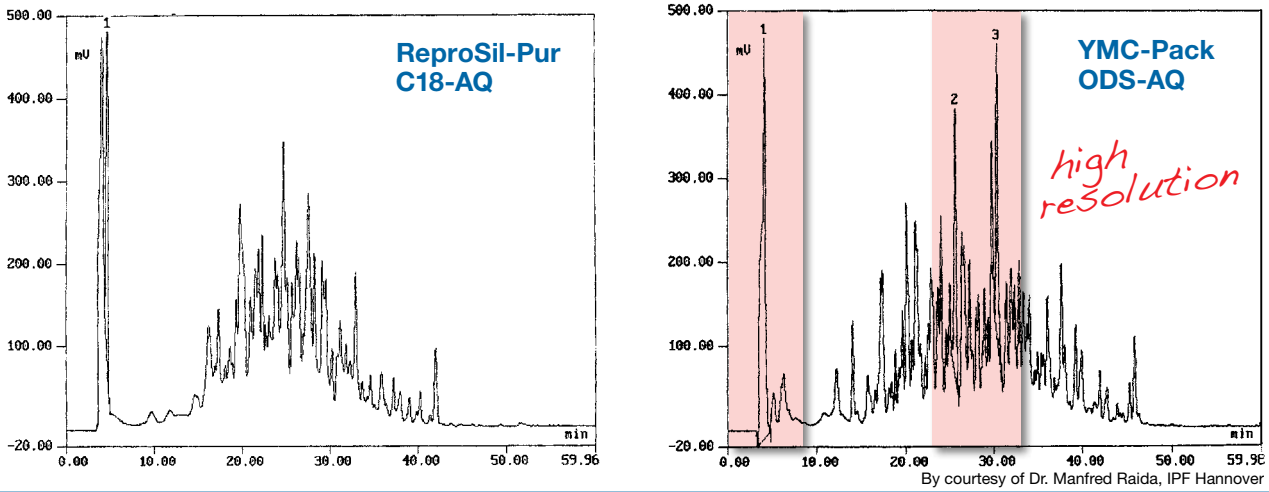
Crude drugs

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.de/support-documentation.html.

* Application data by courtesy YMC Co., Ltd.

YMC-Pack ODS-A

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

YMC-Pack ODS-A	Specification		
Particle Size / µm	**3; 5**	**3; 5**	**3; 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.

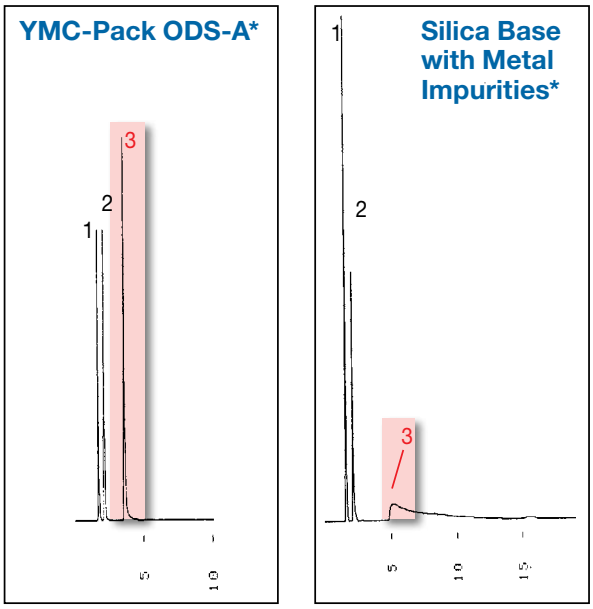
Properties

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

Coordinating compounds

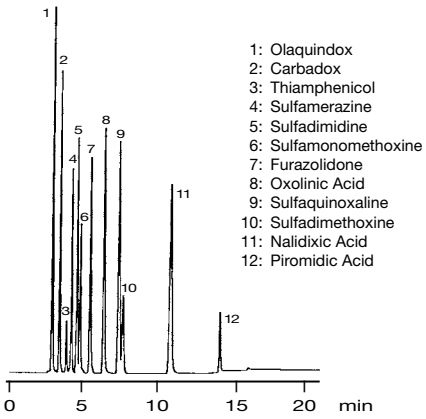
YMC-Pack ODS-A

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.

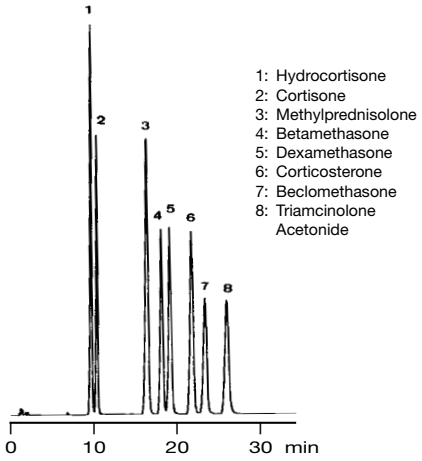
YMC-Pack ODS-A is available in particle sizes from 3 to 50 µm. As the selectivity is identical throughout the whole range, these phases are ideal for scale-up from analytical to preparative process scale.

Antibacterial agents*



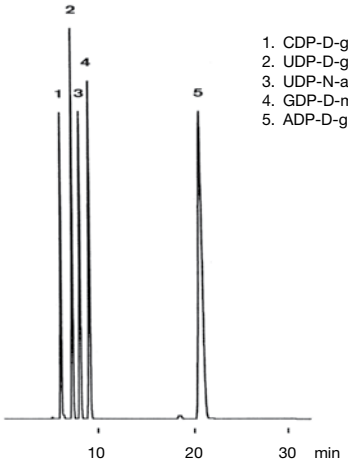
Column:	YMC-Pack ODS-A (5 µm, 12 nm) 250 x 4.6 mm ID
Part No.:	AA12S05-2546WT
Eluent:	A: ACN / $NH_4H_2PO_4$ (50 mM) = 10/90 B: ACN / $NH_4H_2PO_4$ (50 mM) = 80/20
Gradient:	25% B (0-5 min), 25-100% B (5-15 min), 100% B (15-20 min)
Flow:	1.0 mL/min
Detection:	UV, 240 nm
Temperature:	37 °C

Adrenocorticosteroids*



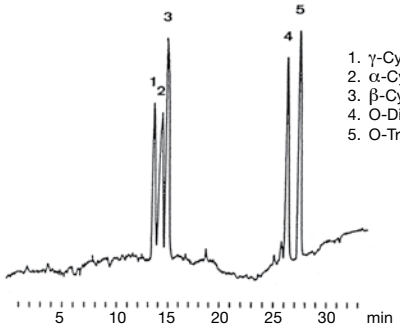
Column:	YMC-Pack ODS-A (5 µm, 12 nm) 150 x 4.6 mm ID
Part No.:	AA12S05-1546WT
Eluent:	ACN / H_2O = 27/73
Flow:	1.0 mL/min
Detection:	UV, 260 nm
Temperature:	37 °C

Sugar nucleotides*



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*



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.de/support-documentation.html.

* Application data by courtesy YMC Co., Ltd.

YMC-Pack ODS-AM

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

YMC-Pack ODS-AM	Specification
Particle Size / µm	3; 5
Pore Size / nm	12
Surface area / m^2g^{-1}	330
Carbon content / %	17
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.

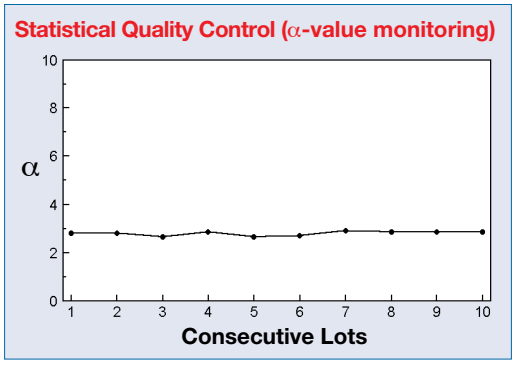
Properties

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



α: **Methylparaben/2,6-Dimethylpyridine as reference**

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.

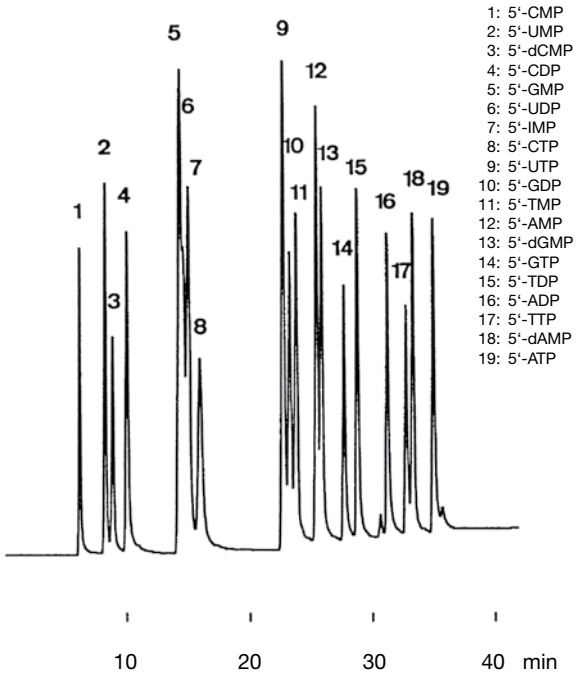
Due to the guaranteed long term reproducibility, YMC-Pack ODS-AM columns often are the final choice for establishing validated HPLC analysis.

YMC-Pack ODS-AM

Applications

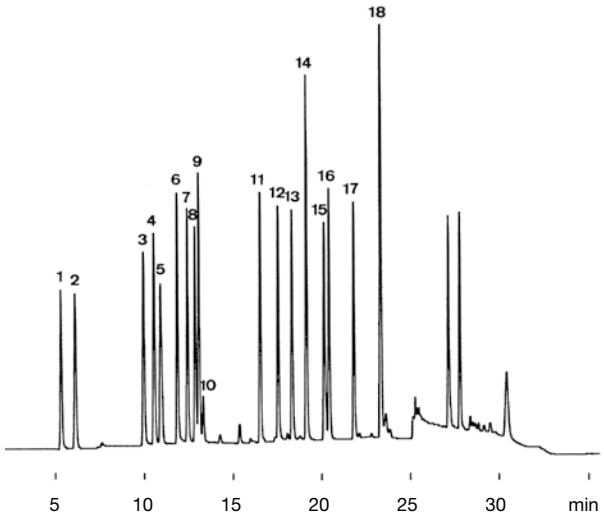
ODS-AM has an appropriate selectivity for polar to moderately nonpolar pharmaceuticals, organic intermediates, biological and natural products found in the chemical and pharmaceutical industry.

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*



1: L-Aspartic acid	10: NH3
2: L-Glutamic acid	11: L-Tyrosine
3: L-Serine	12: L-Valine
4: Glycine	13: L-Methionine
5: L-Histidine	14: L-Cystine
6: L-Arginine	15: L-Isoleucine
7: L-Threonine	16: L-Leucine
8: L-Alanine	17: L-Phenylalanine
9: L-Proline	18: L-Lysine

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.de/support-documentation.html.

* Application data by courtesy YMC Co., Ltd.

YMC-Pack ODS-AL

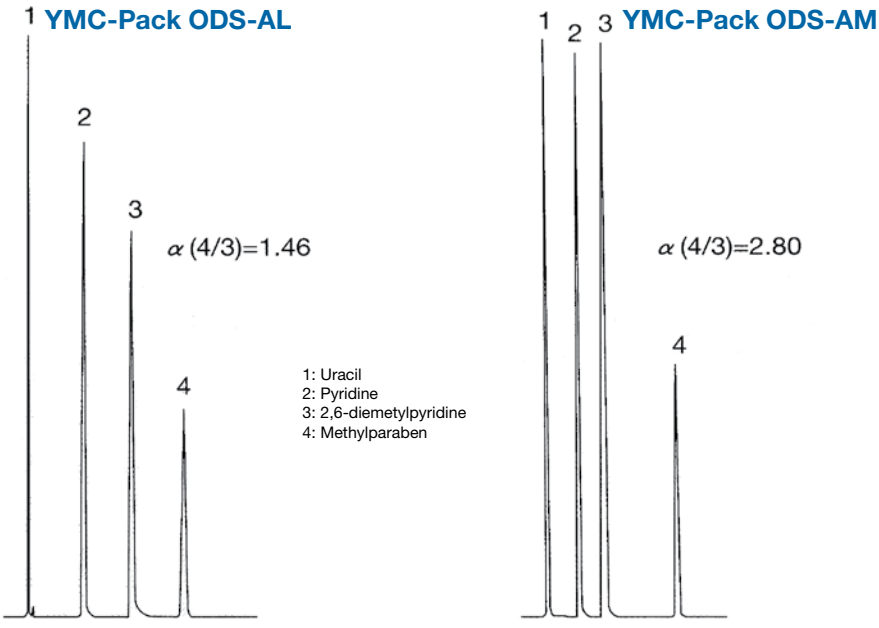
- **residual silanols for mixed-mode separations**
- **same high ligand density as other YMC ODS phases**
- **unique selectivity for polar compounds**
- **not endcapped**

YMC-Pack ODS-AL	Specification
Particle Size / µm	3; 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*

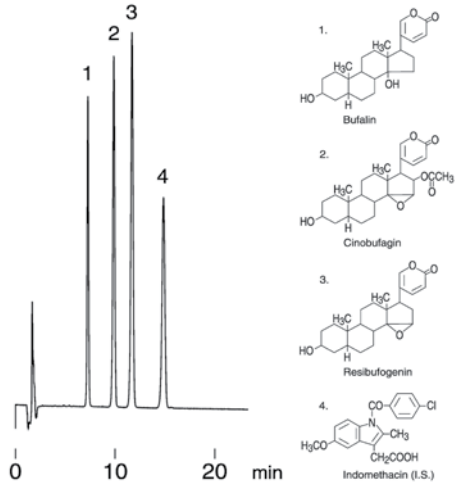


The separation factor (α) of internal standards methylparaben / 2,6-dimethylpyridine for YMC-Pack ODS-AL, which is not endcapped is different to that of YMC-Pack ODS-AM. Due to the residual silanol groups, YMC-Pack ODS-AL shows higher retention of pyridines.

YMC-Pack ODS-AL

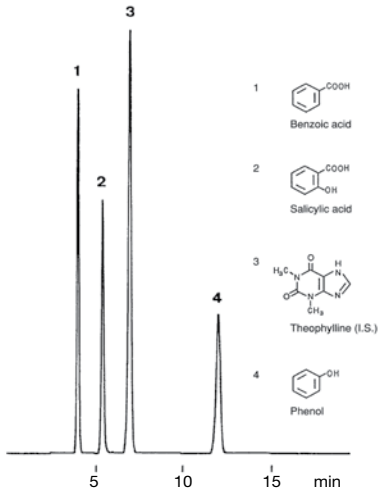
Applications

Steroids from toad venom*



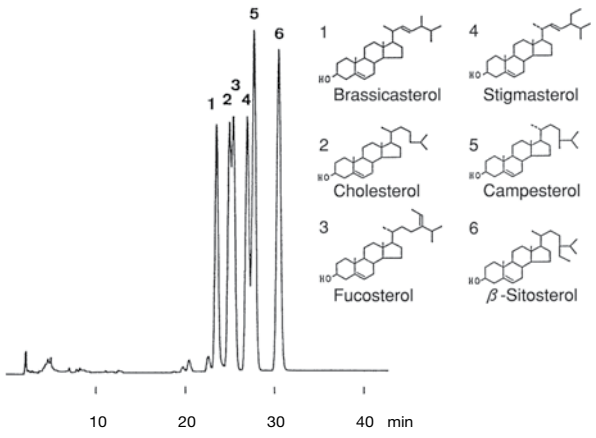
Column:	YMC-Pack ODS-AL (5 µm, 12 nm) 150 x 4.6 mm ID
Part No.:	AL12S05-1546WT
Eluent:	ACN / 0.1% phosphoric acid (45/55)
Flow:	1.0 mL/min
Detection:	UV at 300 nm, 0.08 AUFS
Temperature:	40 °C
Injection:	10 µL (0.04 ~ 0.08 mg/mL)

Disinfectants*



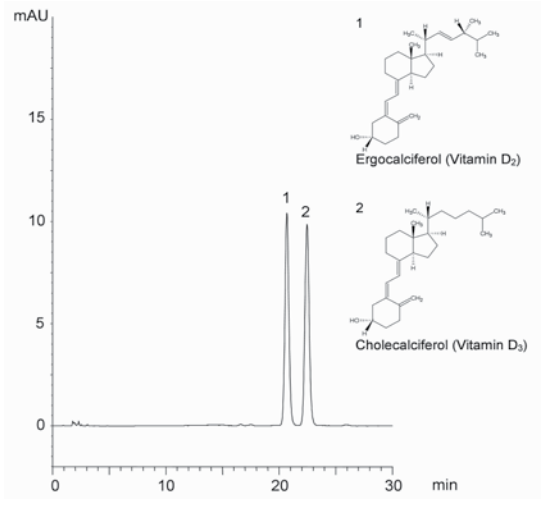
Column:	YMC-Pack ODS-AL (5 µm, 12 nm) 150 x 4.6 mm ID
Part No.:	AL12S05-1546WT
Eluent:	100 mM KH_2PO_4-Na_2HPO_4 (pH 7.0) / methanol (75/25)
Flow:	0.8 mL/min
Detection:	UV at 270 nm, 0.13 AUFS
Temperature:	30 °C
Injection:	3 µL (0.1 ~ 0.8 mg/mL)

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.de/support-documentation.html.

* Application data by courtesy YMC Co., Ltd.

YMC-Pack PolymerC18

- **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**

YMC-Pack PolymerC18	Specification
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 PolymerC18 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 PolymerC18 is manufactured from a hydrophilic methacrylate polymer which is cross-linked with C18 ligand-containing reagents. YMC-Pack PolymerC18 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 PolymerC18.

Properties

YMC-Pack PolymerC18 is prepared from a hydrophilic methacrylate polymer bonded with a hydrophobic 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 PolymerC18 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 PolymerC18 can be used with eluents ranging in composition from 100% aqueous to 100% organic component.

In addition, YMC-Pack PolymerC18 can easily be sterilised by flushing with 0.1M NaOH in 20% acetonitrile/water.

The selectivity and retention of YMC-Pack PolymerC18 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.

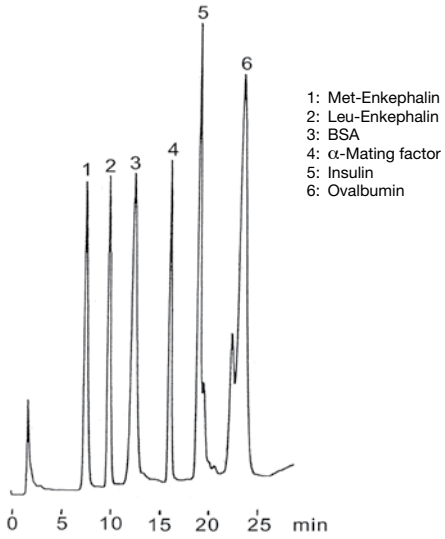
It should be noted that interactions between aromatic or conjugated systems and the methacrylate backbone provides slightly greater retention when compared to silica-based ODS columns, whereas highly aliphatic compounds show greater retention on silica-based ODS supports.

YMC-Pack PolymerC18 is also available in preparative particle sizes.

YMC-Pack PolymerC18

Applications

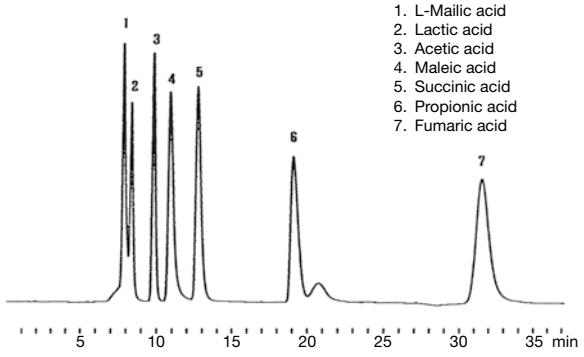
Peptides and proteins*



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

Column:	YMC-Pack PolymerC18 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

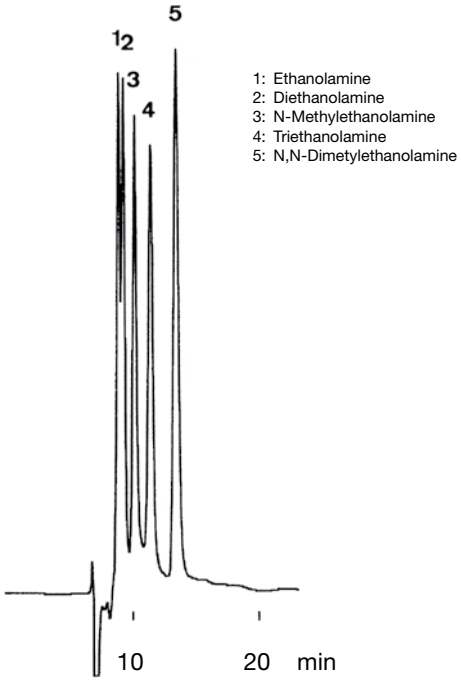
Organic acids*



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 PolymerC18 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 PolymerC18 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

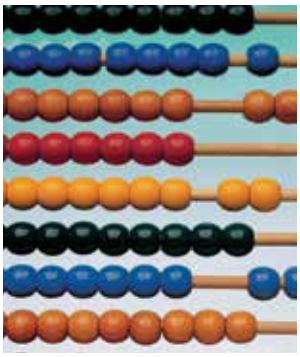
YMC-Pack PolymerC18 is stable towards hydrolysis between pH 2.0-13.0. Remove acid and buffer salts before storage. Store the column in methanol / water = 70/30. If columns are affected by undesired contaminants or clogged inlet frits which cause back pressure increases, flush the column with THF in the opposite flow direction.

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

* Application data by courtesy YMC Co., Ltd.

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**



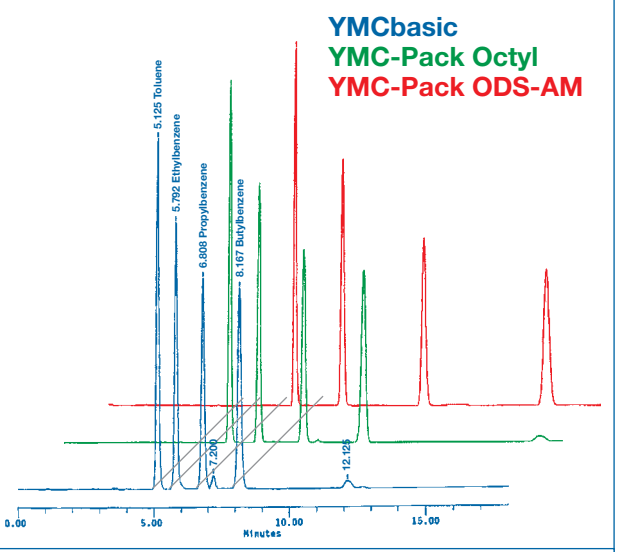
YMCbasic	Specification
Particle size / µm	3; 5
Pore size / nm	20
Surface area / m^2g^{-1}	175
Carbon content / %	7.0
Recommended pH range	2.0 - 7.5

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.

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

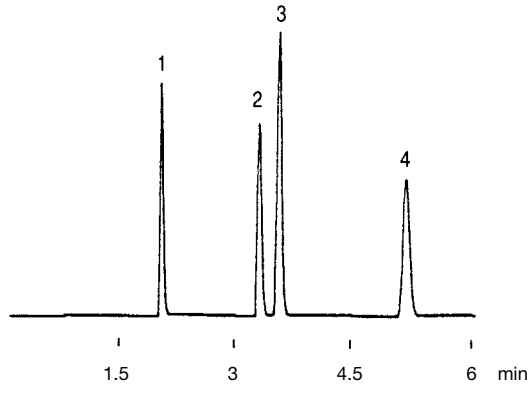
Applications

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.

YMCbasic

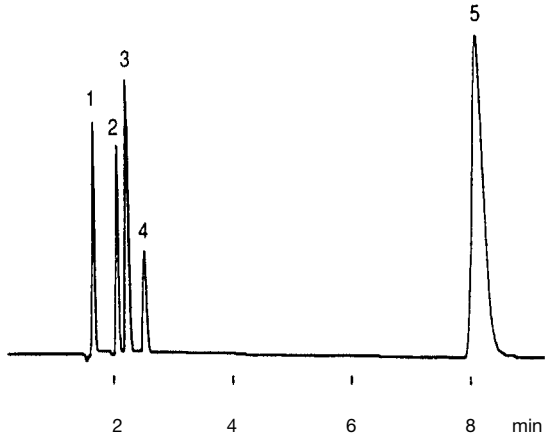
Anilines and aromatic compounds*



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

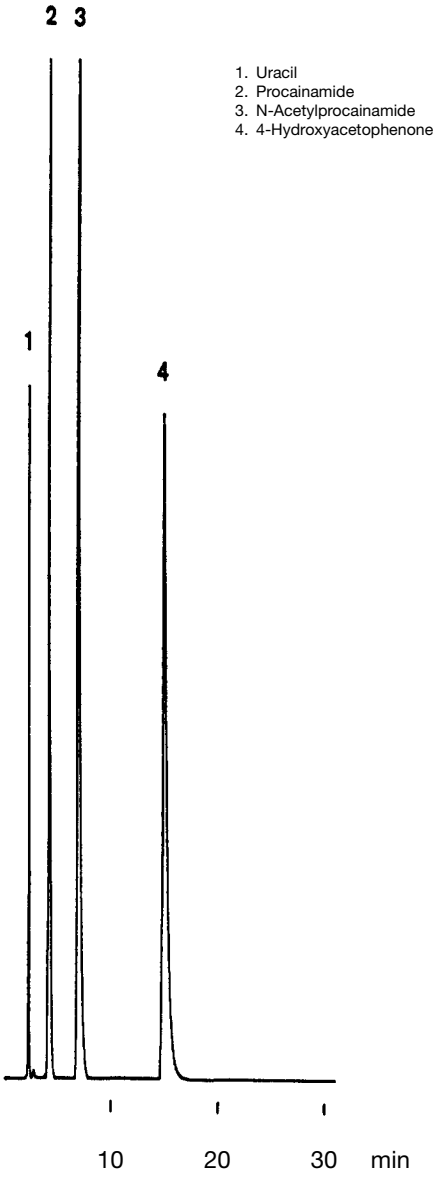
Cough/cold medicine*



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)

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

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.de/support-documentation.html.

* Application data by courtesy YMC Co., Ltd.

YMC-Pack C_8 (Octyl)

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

YMC-Pack C_8	Specification		
Particle Size / µm	3; 5	3; 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 (Octyl) is also available in preparative particle sizes.

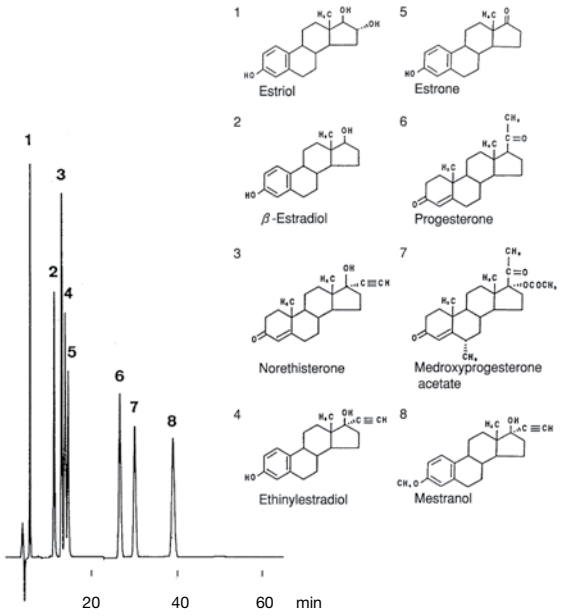
Column care

YMC-Pack C_8 (Octyl) 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.de.

YMC-Pack C_8 (Octyl)

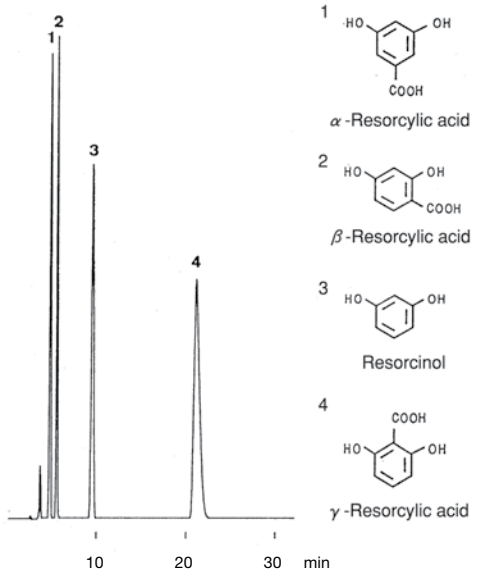
Applications

Estrogens and progestins*



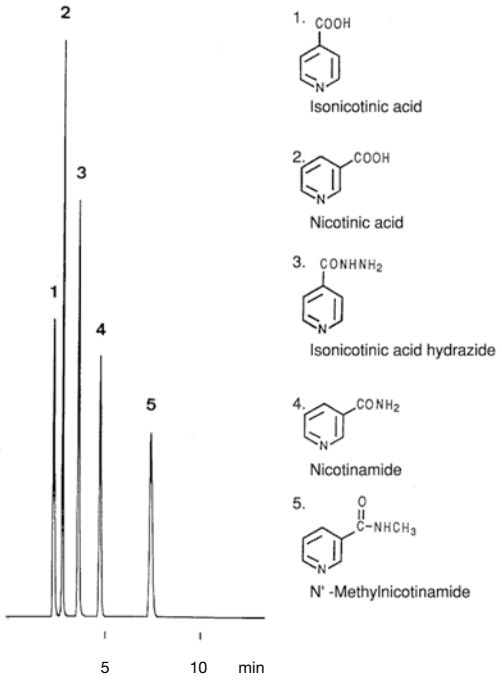
Column:	YMC-Pack C_8 (Octyl) (5 µm, 12 nm) 250 x 4.6 mm ID
Part No.:	OC12S05-2546WT
Eluent:	acetonitrile / THF / water (46/4/50)
Flow:	0.7 mL/min
Detection:	UV at 230 nm, 0.16 AUFS
Temperature:	30 °C
Injection:	7 µL (0.1 mg/mL)

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
Injection:	10 µL (0.05 ~ 0.4 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)

* Application data by courtesy YMC Co., Ltd.

YMC-Pack Ph (Phenyl)

- **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**

YMC-Pack Ph	Specification	
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 (Phenyl) 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

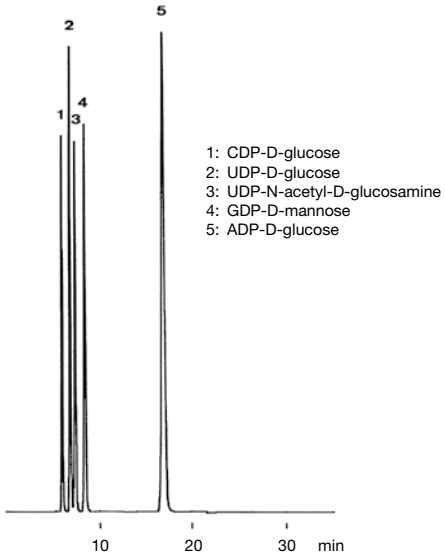
YMC-Pack Ph (Phenyl) provides a unique selectivity when compared to aliphatic straight chain reversed phases such as C18, C8 or C4. The π-electrons of the phenyl groups can interact with aromatic residues of an analyte molecule in addition to hydrophobic interactions to increase retention relative to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

Phenyl phases are convenient for the separation of aromatic compounds and 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 (Phenyl) is also available in preparative particle sizes.

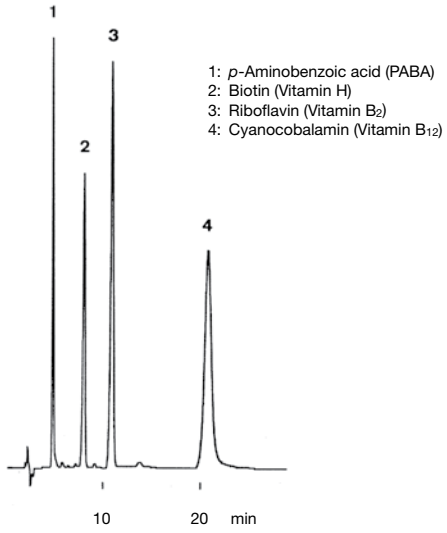
YMC-Pack Ph (Phenyl)

Sugar nucleotides*



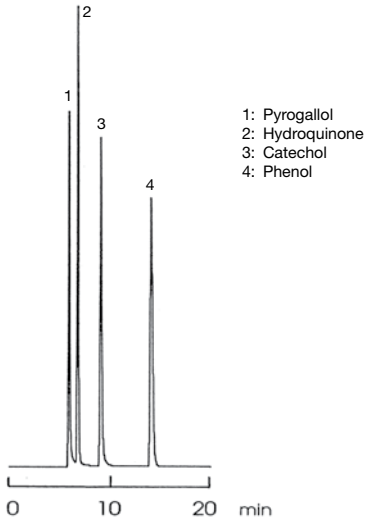
Column:	YMC-Pack Ph (5 µm, 12 nm) 250 x 4.6 mm ID
Part No.:	PH12S05-2546WT
Eluent:	100 mM triethylamine-acetic acid (pH 6.0)
Flow:	1.0 mL/min
Detection:	UV at 260 nm, 0.16 AUFS
Temperature:	37 °C
Injection:	5 µL (0.27 ~ 0.71 mg/mL)

Water-soluble vitamins*



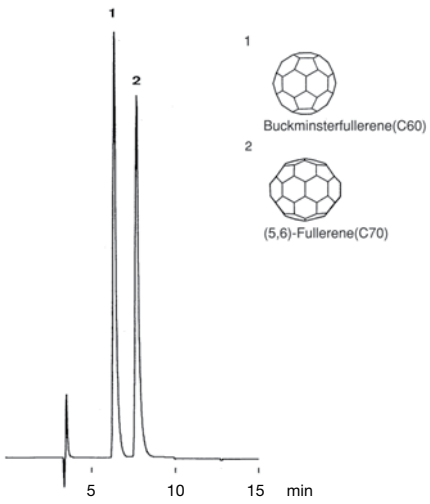
Column:	YMC-Pack Ph (5 µm, 12 nm) 150 x 4.6 mm ID
Part No.:	PH12S05-1546WT
Eluent:	acetonitrile / 50 mM $NH_4H_2PO_4$ (10/90)
Flow:	1.0 mL/min
Detection:	UV at 210 nm, 0.16 AUFS
Temperature:	37 °C
Injection:	10 µL (0.02 ~ 0.30 mg/mL)

Polyphenols*



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 (Phenyl) 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.de/support-documentation.html.

* Application data by courtesy YMC Co., Ltd.

YMC-Pack C_4 (Butyl)

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

YMC-Pack C_4	Specification		
Particle Size / µm	**3; 5**	**3; 5**	**3; 5**
Pore Size / nm	**12**	**20**	**30**
Surface area / m^2g^{-1}	**330**	**175**	**100**
Carbon content / %	**7**	**5**	**3**
Recommended pH range	**2.0 - 7.5**	**2.0 - 7.5**	**2.0 - 7.5**

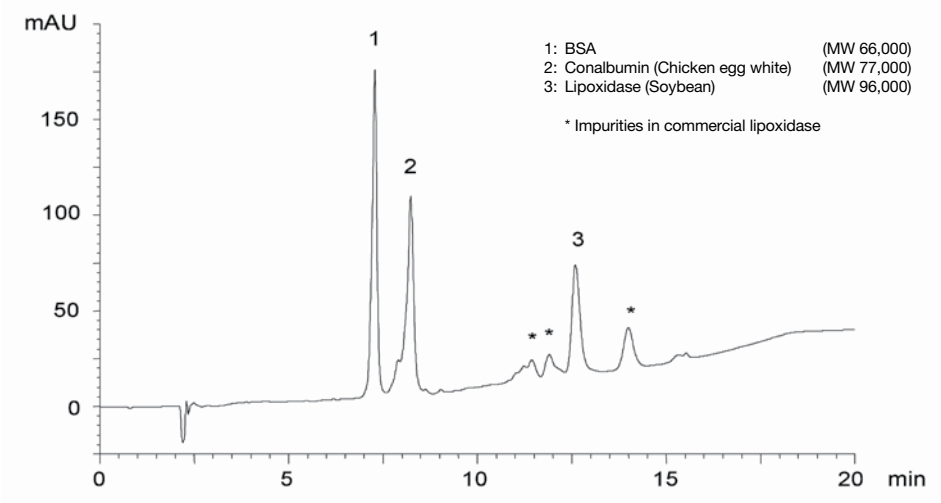
General

Due to shorter alkyl chains YMC-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.

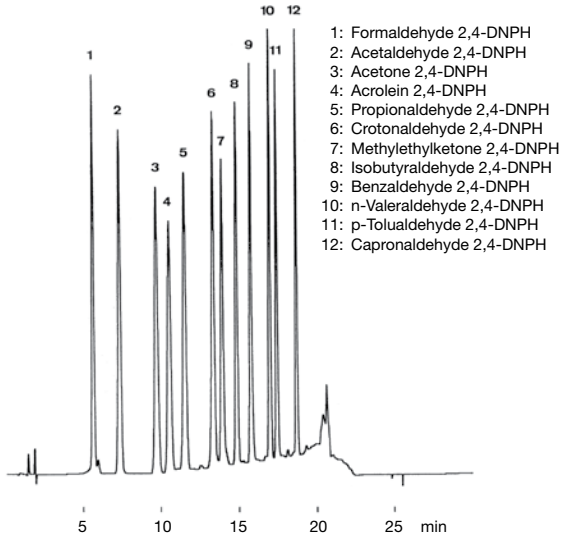
Proteins (MW 66,000 – 96,000)*



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 (Butyl)

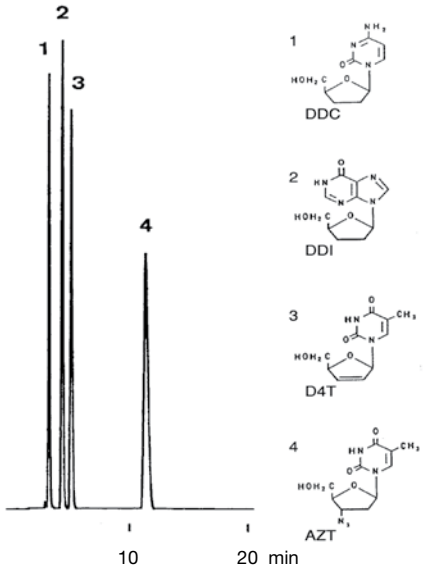
2,4-Dinitrophenylhydrazones of aldehydes and ketones*



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

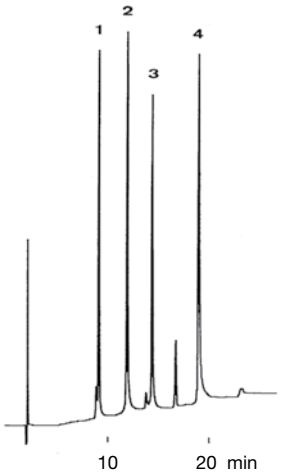
Column:	YMC-Pack C_4 (5 µm ,12 nm) 150 x 4.6 mm ID
Part No.:	BU12S05-1546WT
Eluent:	A = tetrahydrofuran / water (10/90) B = acetonitrile; 35% B (0-7 min), 35-65% B (7-18 min, linear), 100% B (18-19 min), 35% B (19-35 min)
Flow:	1.5 mL/min
Detection:	UV at 360 nm, 0.01 AUFS
Temperature:	30 °C
Injection: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

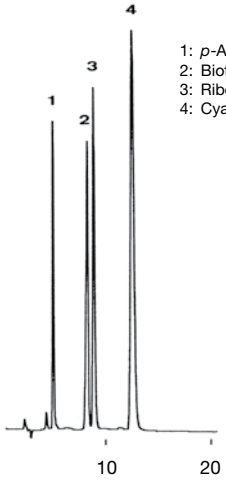
Proteins*



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: *p*-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.de/support-documentation.html.

* Application data by courtesy YMC Co., Ltd.

YMC-Pack TMS (C1)

- **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**

YMC-Pack TMS	Specification
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 C1 (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

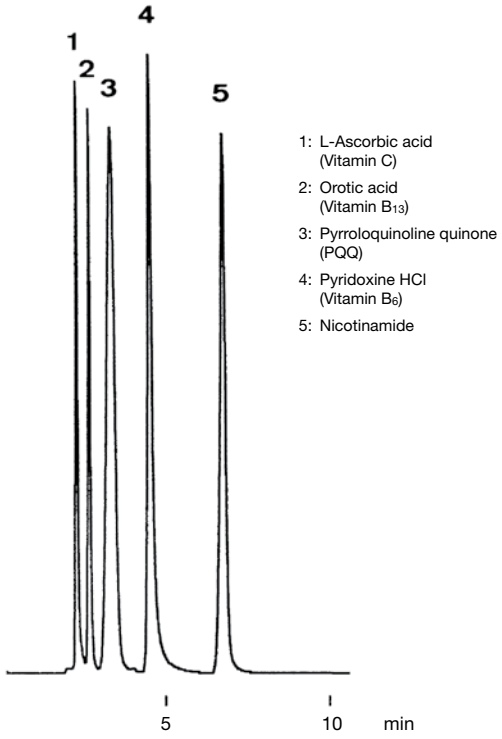
YMC-Pack TMS (C1) is bonded with trimethylmonochlorosilane to create a phase with intermediate polarity for separation of extremely hydrophobic compounds using conventional reversed phase solvents and of highly polar compounds using normal phase solvents.

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 (C1) is also available in preparative particle sizes.

YMC-Pack TMS (C1)

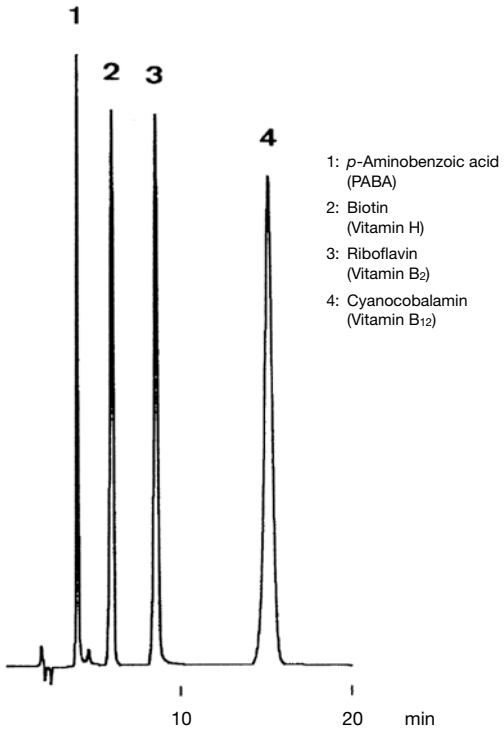
Water-soluble vitamins*



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 (C1) (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: *p*-Aminobenzoic acid (PABA)
2: Biotin (Vitamin H)
3: Riboflavin (Vitamin B_2)
4: Cyanocobalamin (Vitamin B_{12})

Column:	YMC-Pack TMS (C1) (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 (C1) 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.de/support-documentation.html.

* Application data by courtesy YMC Co., Ltd.

YMC-Pack CN (Cyano)

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

YMC-Pack CN	Specification	
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 (Cyano) 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.

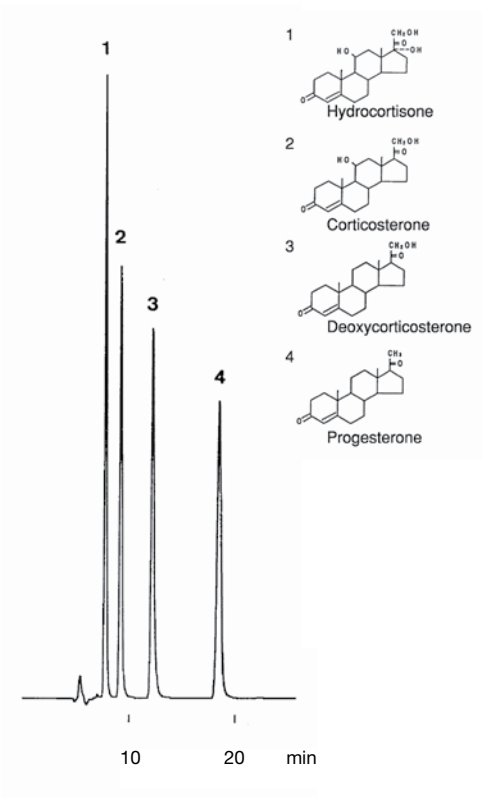
Cyano packings also provide an alternative to silica material in normal phase chromatography, where bonded normal phase packings have the advantage of faster equilibration, more uniform surface activity and increased resistance to dissolution.

To extend column lifetime continued switching between normal and reversed phase solvents should be avoided.

YMC-Pack CN (Cyano) is also available in preparative particle sizes.

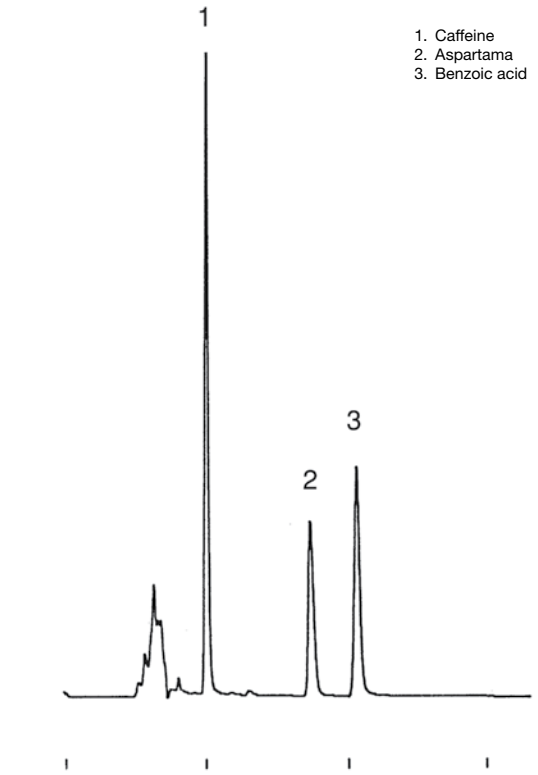
YMC-Pack CN (Cyano)

Steroids*



Column:	YMC-Pack CN (Cyano) (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*



Column:	YMC-Pack CN (Cyano) (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 (Cyano) 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.de/support-documentation.html.

* Application data by courtesy YMC Co., Ltd.

Ordering Information

YMC-Pack ODS-AQ

Phase dimension	Column ID [mm]	Column length [mm]					Guard cartridges* with 10 mm length [pack of 5]
		30 (WT) / 33 (QT)	50	100	150	250	
12 nm 3 µm	2.1	AQ12S03-H3Q1QT	AQ12S03-05Q1QT	AQ12S03-10Q1QT	AQ12S03-15Q1QT	AQ12S03-25Q1QT	AQ12S03-01Q1GC
	3.0	AQ12S03-H303QT	AQ12S03-0503QT	AQ12S03-1003QT	AQ12S03-1503QT	AQ12S03-2503QT	AQ12S03-0103GC
	4.0	AQ12S03-H304QT	AQ12S03-0504QT	AQ12S03-1004QT	AQ12S03-1504QT	AQ12S03-2504QT	AQ12S03-0104GC
	4.6	AQ12S03-0346WT	AQ12S03-0546WT	AQ12S03-1046WT	AQ12S03-1546WT	AQ12S03-2546WT	AQ12S03-0104GC
20 nm 3 µm	2.1	AQ20S03-H3Q1QT	AQ20S03-05Q1QT	AQ20S03-10Q1QT	AQ20S03-15Q1QT	AQ20S03-25Q1QT	AQ20S03-01Q1GC
	3.0	AQ20S03-H303QT	AQ20S03-0503QT	AQ20S03-1003QT	AQ20S03-1503QT	AQ20S03-2503QT	AQ20S03-0103GC
	4.0	AQ20S03-H304QT	AQ20S03-0504QT	AQ20S03-1004QT	AQ20S03-1504QT	AQ20S03-2504QT	AQ20S03-0104GC
	4.6	AQ20S03-0346WT	AQ20S03-0546WT	AQ20S03-1046WT	AQ20S03-1546WT	AQ20S03-2546WT	AQ20S03-0104GC
12 nm 5 µm	2.1	AQ12S05-H3Q1QT	AQ12S05-05Q1QT	AQ12S05-10Q1QT	AQ12S05-15Q1QT	AQ12S05-25Q1QT	AQ12S05-01Q1GC
	3.0	AQ12S05-H303QT	AQ12S05-0503QT	AQ12S05-1003QT	AQ12S05-1503QT	AQ12S05-2503QT	AQ12S05-0103GC
	4.0	AQ12S05-H304QT	AQ12S05-0504QT	AQ12S05-1004QT	AQ12S05-1504QT	AQ12S05-2504QT	AQ12S05-0104GC
	4.6	AQ12S05-0346WT	AQ12S05-0546WT	AQ12S05-1046WT	AQ12S05-1546WT	AQ12S05-2546WT	AQ12S05-0104GC
20 nm 5 µm	2.1	AQ20S05-H3Q1QT	AQ20S05-05Q1QT	AQ20S05-10Q1QT	AQ20S05-15Q1QT	AQ20S05-25Q1QT	AQ20S05-01Q1GC
	3.0	AQ20S05-H303QT	AQ20S05-0503QT	AQ20S05-1003QT	AQ20S05-1503QT	AQ20S05-2503QT	AQ20S05-0103GC
	4.0	AQ20S05-H304QT	AQ20S05-0504QT	AQ20S05-1004QT	AQ20S05-1504QT	AQ20S05-2504QT	AQ20S05-0104GC
	4.6	AQ20S05-0346WT	AQ20S05-0546WT	AQ20S05-1046WT	AQ20S05-1546WT	AQ20S05-2546WT	AQ20S05-0104GC

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

YMC-Pack ODS-A

Phase dimension	Column ID [mm]	Column length [mm]					Guard cartridges* with 10 mm length [pack of 5]
		30 (WT) / 33 (QT)	50	100	150	250	
12 nm 3 µm	2.1	AA12S03-H3Q1QT	AA12S03-05Q1QT	AA12S03-10Q1QT	AA12S03-15Q1QT	AA12S03-25Q1QT	AA12S03-01Q1GC
	3.0	AA12S03-H303QT	AA12S03-0503QT	AA12S03-1003QT	AA12S03-1503QT	AA12S03-2503QT	AA12S03-0103GC
	4.0	AA12S03-H304QT	AA12S03-0504QT	AA12S03-1004QT	AA12S03-1504QT	AA12S03-2504QT	AA12S03-0104GC
	4.6	AA12S03-0346WT	AA12S03-0546WT	AA12S03-1046WT	AA12S03-1546WT	AA12S03-2546WT	AA12S03-0104GC
20 nm 3 µm	2.1	AA20S03-H3Q1QT	AA20S03-05Q1QT	AA20S03-10Q1QT	AA20S03-15Q1QT	AA20S03-25Q1QT	AA20S03-01Q1GC
	3.0	AA20S03-H303QT	AA20S03-0503QT	AA20S03-1003QT	AA20S03-1503QT	AA20S03-2503QT	AA20S03-0103GC
	4.0	AA20S03-H304QT	AA20S03-0504QT	AA20S03-1004QT	AA20S03-1504QT	AA20S03-2504QT	AA20S03-0104GC
	4.6	AA20S03-0346WT	AA20S03-0546WT	AA20S03-1046WT	AA20S03-1546WT	AA20S03-2546WT	AA20S03-0104GC
12 nm 5 µm	2.1	AA12S05-H3Q1QT	AA12S05-05Q1QT	AA12S05-10Q1QT	AA12S05-15Q1QT	AA12S05-25Q1QT	AA12S05-01Q1GC
	3.0	AA12S05-H303QT	AA12S05-0503QT	AA12S05-1003QT	AA12S05-1503QT	AA12S05-2503QT	AA12S05-0103GC
	4.0	AA12S05-H304QT	AA12S05-0504QT	AA12S05-1004QT	AA12S05-1504QT	AA12S05-2504QT	AA12S05-0104GC
	4.6	AA12S05-0346WT	AA12S05-0546WT	AA12S05-1046WT	AA12S05-1546WT	AA12S05-2546WT	AA12S05-0104GC
20 nm 5 µm	2.1	AA20S05-H3Q1QT	AA20S05-05Q1QT	AA20S05-10Q1QT	AA20S05-15Q1QT	AA20S05-25Q1QT	AA20S05-01Q1GC
	3.0	AA20S05-H303QT	AA20S05-0503QT	AA20S05-1003QT	AA20S05-1503QT	AA20S05-2503QT	AA20S05-0103GC
	4.0	AA20S05-H304QT	AA20S05-0504QT	AA20S05-1004QT	AA20S05-1504QT	AA20S05-2504QT	AA20S05-0104GC
	4.6	AA20S05-0346WT	AA20S05-0546WT	AA20S05-1046WT	AA20S05-1546WT	AA20S05-2546WT	AA20S05-0104GC
30 nm 5 µm	2.1	AA30S05-H3Q1QT	AA30S05-05Q1QT	AA30S05-10Q1QT	AA30S05-15Q1QT	AA30S05-25Q1QT	AA30S05-01Q1GC
	3.0	AA30S05-H303QT	AA30S05-0503QT	AA30S05-1003QT	AA30S05-1503QT	AA30S05-2503QT	AA30S05-0103GC
	4.0	AA30S05-H304QT	AA30S05-0504QT	AA30S05-1004QT	AA30S05-1504QT	AA30S05-2504QT	AA30S05-0104GC
	4.6	AA30S05-0346WT	AA30S05-0546WT	AA30S05-1046WT	AA30S05-1546WT	AA30S05-2546WT	AA30S05-0104GC

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

YMC-Pack ODS-AM

Phase dimension	Column ID [mm]	Column length [mm]					Guard cartridges* with 10 mm length [pack of 5]
		30 (WT) / 33 (QT)	50	100	150	250	
12 nm 3 µm	2.1	AM12S03-H3Q1QT	AM12S03-05Q1QT	AM12S03-10Q1QT	AM12S03-15Q1QT	AM12S03-25Q1QT	AM12S03-01Q1GC
	3.0	AM12S03-H303QT	AM12S03-0503QT	AM12S03-1003QT	AM12S03-1503QT	AM12S03-2503QT	AM12S03-0103GC
	4.0	AM12S03-H304QT	AM12S03-0504QT	AM12S03-1004QT	AM12S03-1504QT	AM12S03-2504QT	AM12S03-0104GC
	4.6	AM12S03-0346WT	AM12S03-0546WT	AM12S03-1046WT	AM12S03-1546WT	AM12S03-2546WT	AM12S03-0104GC
12 nm 5 µm	2.1	AM12S05-H3Q1QT	AM12S05-05Q1QT	AM12S05-10Q1QT	AM12S05-15Q1QT	AM12S05-25Q1QT	AM12S05-01Q1GC
	3.0	AM12S05-H303QT	AM12S05-0503QT	AM12S05-1003QT	AM12S05-1503QT	AM12S05-2503QT	AM12S05-0103GC
	4.0	AM12S05-H304QT	AM12S05-0504QT	AM12S05-1004QT	AM12S05-1504QT	AM12S05-2504QT	AM12S05-0104GC
	4.6	AM12S05-0346WT	AM12S05-0546WT	AM12S05-1046WT	AM12S05-1546WT	AM12S05-2546WT	AM12S05-0104GC

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

Ordering Information

YMC-Pack ODS-AL

Phase dimension	Column ID [mm]	Column length [mm]					Guard cartridges* with 10 mm length [pack of 5]
		30 (WT) / 33 (QT)	50	100	150	250	
12 nm 3 µm	2.1	AL12S03-H3Q1QT	AL12S03-05Q1QT	AL12S03-10Q1QT	AL12S03-15Q1QT	AL12S03-25Q1QT	AL12S03-01Q1GC
	3.0	AL12S03-H303QT	AL12S03-0503QT	AL12S03-1003QT	AL12S03-1503QT	AL12S03-2503QT	AL12S03-0103GC
	4.0	AL12S03-H304QT	AL12S03-0504QT	AL12S03-1004QT	AL12S03-1504QT	AL12S03-2504QT	AL12S03-0104GC
	4.6	AL12S03-0346WT	AL12S03-0546WT	AL12S03-1046WT	AL12S03-1546WT	AL12S03-2546WT	AL12S03-0104GC
12 nm 5 µm	2.1	AL12S05-H3Q1QT	AL12S05-05Q1QT	AL12S05-10Q1QT	AL12S05-15Q1QT	AL12S05-25Q1QT	AL12S05-01Q1GC
	3.0	AL12S05-H303QT	AL12S05-0503QT	AL12S05-1003QT	AL12S05-1503QT	AL12S05-2503QT	AL12S05-0103GC
	4.0	AL12S05-H304QT	AL12S05-0504QT	AL12S05-1004QT	AL12S05-1504QT	AL12S05-2504QT	AL12S05-0104GC
	4.6	AL12S05-0346WT	AL12S05-0546WT	AL12S05-1046WT	AL12S05-1546WT	AL12S05-2546WT	AL12S05-0104GC

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

YMC-Pack PolymerC18

Phase dimension	Column ID [mm]	Column length [mm]					Guard cartridges* with 10 mm length [pack of 5]
		30 (WT) / 33 (QT)	50	100	150	250	
6 µm	2.1	PC99S06-H3Q1QT	PC99S06-05Q1QT	PC99S06-10Q1QT	PC99S06-15Q1QT	PC99S06-25Q1QT	PC99S06-01Q1GC
	3.0	PC99S06-H303QT	PC99S06-0503QT	PC99S06-1003QT	PC99S06-1503QT	PC99S06-2503QT	PC99S06-0103GC
	4.0	PC99S06-H304QT	PC99S06-0504QT	PC99S06-1004QT	PC99S06-1504QT	PC99S06-2504QT	PC99S06-0104GC
	4.6	PC99S06-0346WT	PC99S06-0546WT	PC99S06-1046WT	PC99S06-1546WT	PC99S06-2546WT	PC99S06-0104GC

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

YMC-Pack C_8

Phase dimension	Column ID [mm]	Column length [mm]					Guard cartridges* with 10 mm length [pack of 5]
		30 (WT) / 33 (QT)	50	100	150	250	
12 nm 3 µm	2.1	OC12S03-H3Q1QT	OC12S03-05Q1QT	OC12S03-10Q1QT	OC12S03-15Q1QT	OC12S03-25Q1QT	OC12S03-01Q1GC
	3.0	OC12S03-H303QT	OC12S03-0503QT	OC12S03-1003QT	OC12S03-1503QT	OC12S03-2503QT	OC12S03-0103GC
	4.0	OC12S03-H304QT	OC12S03-0504QT	OC12S03-1004QT	OC12S03-1504QT	OC12S03-2504QT	OC12S03-0104GC
	4.6	OC12S03-0346WT	OC12S03-0546WT	OC12S03-1046WT	OC12S03-1546WT	OC12S03-2546WT	OC12S03-0104GC
20 nm 3 µm	2.1	OC20S03-H3Q1QT	OC20S03-05Q1QT	OC20S03-10Q1QT	OC20S03-15Q1QT	OC20S03-25Q1QT	OC20S03-01Q1GC
	3.0	OC20S03-H303QT	OC20S03-0503QT	OC20S03-1003QT	OC20S03-1503QT	OC20S03-2503QT	OC20S03-0103GC
	4.0	OC20S03-H304QT	OC20S03-0504QT	OC20S03-1004QT	OC20S03-1504QT	OC20S03-2504QT	OC20S03-0104GC
	4.6	OC20S03-0346WT	OC20S03-0546WT	OC20S03-1046WT	OC20S03-1546WT	OC20S03-2546WT	OC20S03-0104GC
12 nm 5 µm	2.1	OC12S05-H3Q1QT	OC12S05-05Q1QT	OC12S05-10Q1QT	OC12S05-15Q1QT	OC12S05-25Q1QT	OC12S05-01Q1GC
	3.0	OC12S05-H303QT	OC12S05-0503QT	OC12S05-1003QT	OC12S05-1503QT	OC12S05-2503QT	OC12S05-0103GC
	4.0	OC12S05-H304QT	OC12S05-0504QT	OC12S05-1004QT	OC12S05-1504QT	OC12S05-2504QT	OC12S05-0104GC
	4.6	OC12S05-0346WT	OC12S05-0546WT	OC12S05-1046WT	OC12S05-1546WT	OC12S05-2546WT	OC12S05-0104GC
20 nm 5 µm	2.1	OC20S05-H3Q1QT	OC20S05-05Q1QT	OC20S05-10Q1QT	OC20S05-15Q1QT	OC20S05-25Q1QT	OC20S05-01Q1GC
	3.0	OC20S05-H303QT	OC20S05-0503QT	OC20S05-1003QT	OC20S05-1503QT	OC20S05-2503QT	OC20S05-0103GC
	4.0	OC20S05-H304QT	OC20S05-0504QT	OC20S05-1004QT	OC20S05-1504QT	OC20S05-2504QT	OC20S05-0104GC
	4.6	OC20S05-0346WT	OC20S05-0546WT	OC20S05-1046WT	OC20S05-1546WT	OC20S05-2546WT	OC20S05-0104GC
30 nm 5 µm	2.1	OC30S05-H3Q1QT	OC30S05-05Q1QT	OC30S05-10Q1QT	OC30S05-15Q1QT	OC30S05-25Q1QT	OC30S05-01Q1GC
	3.0	OC30S05-H303QT	OC30S05-0503QT	OC30S05-1003QT	OC30S05-1503QT	OC30S05-2503QT	OC30S05-0103GC
	4.0	OC30S05-H304QT	OC30S05-0504QT	OC30S05-1004QT	OC30S05-1504QT	OC30S05-2504QT	OC30S05-0104GC
	4.6	OC30S05-0346WT	OC30S05-0546WT	OC30S05-1046WT	OC30S05-1546WT	OC30S05-2546WT	OC30S05-0104GC

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

* Application data by courtesy YMC Co., Ltd.

Ordering Information

YMC-Pack C_4

Phase dimension	Column ID [mm]	Column length [mm]					Guard cartridges* with 10 mm length [pack of 5]
		30 (WT) / 33 (QT)	50	100	150	250	
12 nm 3 µm	2.1	BU12S03-H3Q1QT	BU12S03-05Q1QT	BU12S03-10Q1QT	BU12S03-15Q1QT	BU12S03-25Q1QT	BU12S03-01Q1GC
	3.0	BU12S03-H303QT	BU12S03-0503QT	BU12S03-1003QT	BU12S03-1503QT	BU12S03-2503QT	BU12S03-0103GC
	4.0	BU12S03-H304QT	BU12S03-0504QT	BU12S03-1004QT	BU12S03-1504QT	BU12S03-2504QT	BU12S03-0104GC
	4.6	BU12S03-0346WT	BU12S03-0546WT	BU12S03-1046WT	BU12S03-1546WT	BU12S03-2546WT	BU12S03-0104GC
20 nm 3 µm	2.1	BU20S03-H3Q1QT	BU20S03-05Q1QT	BU20S03-10Q1QT	BU20S03-15Q1QT	BU20S03-25Q1QT	BU20S03-01Q1GC
	3.0	BU20S03-H303QT	BU20S03-0503QT	BU20S03-1003QT	BU20S03-1503QT	BU20S03-2503QT	BU20S03-0103GC
	4.0	BU20S03-H304QT	BU20S03-0504QT	BU20S03-1004QT	BU20S03-1504QT	BU20S03-2504QT	BU20S03-0104GC
	4.6	BU20S03-0346WT	BU20S03-0546WT	BU20S03-1046WT	BU20S03-1546WT	BU20S03-2546WT	BU20S03-0104GC
12 nm 5 µm	2.1	BU12S05-H3Q1QT	BU12S05-05Q1QT	BU12S05-10Q1QT	BU12S05-15Q1QT	BU12S05-25Q1QT	BU12S05-01Q1GC
	3.0	BU12S05-H303QT	BU12S05-0503QT	BU12S05-1003QT	BU12S05-1503QT	BU12S05-2503QT	BU12S05-0103GC
	4.0	BU12S05-H304QT	BU12S05-0504QT	BU12S05-1004QT	BU12S05-1504QT	BU12S05-2504QT	BU12S05-0104GC
	4.6	BU12S05-0346WT	BU12S05-0546WT	BU12S05-1046WT	BU12S05-1546WT	BU12S05-2546WT	BU12S05-0104GC
20 nm 5 µm	2.1	BU20S05-H3Q1QT	BU20S05-05Q1QT	BU20S05-10Q1QT	BU20S05-15Q1QT	BU20S05-25Q1QT	BU20S05-01Q1GC
	3.0	BU20S05-H303QT	BU20S05-0503QT	BU20S05-1003QT	BU20S05-1503QT	BU20S05-2503QT	BU20S05-0103GC
	4.0	BU20S05-H304QT	BU20S05-0504QT	BU20S05-1004QT	BU20S05-1504QT	BU20S05-2504QT	BU20S05-0104GC
	4.6	BU20S05-0346WT	BU20S05-0546WT	BU20S05-1046WT	BU20S05-1546WT	BU20S05-2546WT	BU20S05-0104GC
30 nm 5 µm	2.1	BU30S05-H3Q1QT	BU30S05-05Q1QT	BU30S05-10Q1QT	BU30S05-15Q1QT	BU30S05-25Q1QT	BU30S05-01Q1GC
	3.0	BU30S05-H303QT	BU30S05-0503QT	BU30S05-1003QT	BU30S05-1503QT	BU30S05-2503QT	BU30S05-0103GC
	4.0	BU30S05-H304QT	BU30S05-0504QT	BU30S05-1004QT	BU30S05-1504QT	BU30S05-2504QT	BU30S05-0104GC
	4.6	BU30S05-0346WT	BU30S05-0546WT	BU30S05-1046WT	BU30S05-1546WT	BU30S05-2546WT	BU30S05-0104GC

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

YMC-Pack Ph (Phenyl)

Phase dimension	Column ID [mm]	Column length [mm]					Guard cartridges* with 10 mm length [pack of 5]
		30 (WT) / 33 (QT)	50	100	150	250	
12 nm 3 µm	2.1	PH12S03-H3Q1QT	PH12S03-05Q1QT	PH12S03-10Q1QT	PH12S03-15Q1QT	PH12S03-25Q1QT	PH12S03-01Q1GC
	3.0	PH12S03-H303QT	PH12S03-0503QT	PH12S03-1003QT	PH12S03-1503QT	PH12S03-2503QT	PH12S03-0103GC
	4.0	PH12S03-H304QT	PH12S03-0504QT	PH12S03-1004QT	PH12S03-1504QT	PH12S03-2504QT	PH12S03-0104GC
	4.6	PH12S03-0346WT	PH12S03-0546WT	PH12S03-1046WT	PH12S03-1546WT	PH12S03-2546WT	PH12S03-0104GC
12 nm 5 µm	2.1	PH12S05-H3Q1QT	PH12S05-05Q1QT	PH12S05-10Q1QT	PH12S05-15Q1QT	PH12S05-25Q1QT	PH12S05-01Q1GC
	3.0	PH12S05-H303QT	PH12S05-0503QT	PH12S05-1003QT	PH12S05-1503QT	PH12S05-2503QT	PH12S05-0103GC
	4.0	PH12S05-H304QT	PH12S05-0504QT	PH12S05-1004QT	PH12S05-1504QT	PH12S05-2504QT	PH12S05-0104GC
	4.6	PH12S05-0346WT	PH12S05-0546WT	PH12S05-1046WT	PH12S05-1546WT	PH12S05-2546WT	PH12S05-0104GC
30 nm 5 µm	2.1	PH30S05-H3Q1QT	PH30S05-05Q1QT	PH30S05-10Q1QT	PH30S05-15Q1QT	PH30S05-25Q1QT	PH30S05-01Q1GC
	3.0	PH30S05-H303QT	PH30S05-0503QT	PH30S05-1003QT	PH30S05-1503QT	PH30S05-2503QT	PH30S05-0103GC
	4.0	PH30S05-H304QT	PH30S05-0504QT	PH30S05-1004QT	PH30S05-1504QT	PH30S05-2504QT	PH30S05-0104GC
	4.6	PH30S05-0346WT	PH30S05-0546WT	PH30S05-1046WT	PH30S05-1546WT	PH30S05-2546WT	PH30S05-0104GC

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

YMC-Pack TMS

Phase dimension	Column ID [mm]	Column length [mm]					Guard cartridges* with 10 mm length [pack of 5]
		30 (WT) / 33 (QT)	50	100	150	250	
12 nm 3 µm	2.1	TM12S03-H3Q1QT	TM12S03-05Q1QT	TM12S03-10Q1QT	TM12S03-15Q1QT	TM12S03-25Q1QT	TM12S03-01Q1GC
	3.0	TM12S03-H303QT	TM12S03-0503QT	TM12S03-1003QT	TM12S03-1503QT	TM12S03-2503QT	TM12S03-0103GC
	4.0	TM12S03-H304QT	TM12S03-0504QT	TM12S03-1004QT	TM12S03-1504QT	TM12S03-2504QT	TM12S03-0104GC
	4.6	TM12S03-0346WT	TM12S03-0546WT	TM12S03-1046WT	TM12S03-1546WT	TM12S03-2546WT	TM12S03-0104GC
12 nm 5 µm	2.1	TM12S05-H3Q1QT	TM12S05-05Q1QT	TM12S05-10Q1QT	TM12S05-15Q1QT	TM12S05-25Q1QT	TM12S05-01Q1GC
	3.0	TM12S05-H303QT	TM12S05-0503QT	TM12S05-1003QT	TM12S05-1503QT	TM12S05-2503QT	TM12S05-0103GC
	4.0	TM12S05-H304QT	TM12S05-0504QT	TM12S05-1004QT	TM12S05-1504QT	TM12S05-2504QT	TM12S05-0104GC
	4.6	TM12S05-0346WT	TM12S05-0546WT	TM12S05-1046WT	TM12S05-1546WT	TM12S05-2546WT	TM12S05-0104GC

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

Ordering Information

YMC-Pack CN (Cyano)

Phase dimension	Column ID [mm]	Column length [mm]					Guard cartridges* with 10 mm length [pack of 5]
		30 (WT) / 33 (QT)	50	100	150	250	
12 nm 3 µm	2.1	CN12S03-H3Q1QT	CN12S03-05Q1QT	CN12S03-10Q1QT	CN12S03-15Q1QT	CN12S03-25Q1QT	CN12S03-01Q1GC
	3.0	CN12S03-H303QT	CN12S03-0503QT	CN12S03-1003QT	CN12S03-1503QT	CN12S03-2503QT	CN12S03-0103GC
	4.0	CN12S03-H304QT	CN12S03-0504QT	CN12S03-1004QT	CN12S03-1504QT	CN12S03-2504QT	CN12S03-0104GC
	4.6	CN12S03-0346WT	CN12S03-0546WT	CN12S03-1046WT	CN12S03-1546WT	CN12S03-2546WT	CN12S03-0104GC
12 nm 5 µm	2.1	CN12S05-H3Q1QT	CN12S05-05Q1QT	CN12S05-10Q1QT	CN12S05-15Q1QT	CN12S05-25Q1QT	CN12S05-01Q1GC
	3.0	CN12S05-H303QT	CN12S05-0503QT	CN12S05-1003QT	CN12S05-1503QT	CN12S05-2503QT	CN12S05-0103GC
	4.0	CN12S05-H304QT	CN12S05-0504QT	CN12S05-1004QT	CN12S05-1504QT	CN12S05-2504QT	CN12S05-0104GC
	4.6	CN12S05-0346WT	CN12S05-0546WT	CN12S05-1046WT	CN12S05-1546WT	CN12S05-2546WT	CN12S05-0104GC
30 nm 5 µm	2.1	CN30S05-H3Q1QT	CN30S05-05Q1QT	CN30S05-10Q1QT	CN30S05-15Q1QT	CN30S05-25Q1QT	CN30S05-01Q1GC
	3.0	CN30S05-H303QT	CN30S05-0503QT	CN30S05-1003QT	CN30S05-1503QT	CN30S05-2503QT	CN30S05-0103GC
	4.0	CN30S05-H304QT	CN30S05-0504QT	CN30S05-1004QT	CN30S05-1504QT	CN30S05-2504QT	CN30S05-0104GC
	4.6	CN30S05-0346WT	CN30S05-0546WT	CN30S05-1046WT	CN30S05-1546WT	CN30S05-2546WT	CN30S05-0104GC

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

YMCbasic

Phase dimension	Column ID [mm]	Column length [mm]					Guard cartridges* with 10 mm length [pack of 5]
		30 (WT) / 33 (QT)	50	100	150	250	
3 µm	2.1	BA99S03-H3Q1QT	BA99S03-05Q1QT	BA99S03-10Q1QT	BA99S03-15Q1QT	BA99S03-25Q1QT	BA99S03-01Q1GC
	3.0	BA99S03-H303QT	BA99S03-0503QT	BA99S03-1003QT	BA99S03-1503QT	BA99S03-2503QT	BA99S03-0103GC
	4.0	BA99S03-H304QT	BA99S03-0504QT	BA99S03-1004QT	BA99S03-1504QT	BA99S03-2504QT	BA99S03-0104GC
	4.6	BA99S03-0346WT	BA99S03-0546WT	BA99S03-1046WT	BA99S03-1546WT	BA99S03-2546WT	BA99S03-0104GC
5 µm	2.1	BA99S05-H3Q1QT	BA99S05-05Q1QT	BA99S05-10Q1QT	BA99S05-15Q1QT	BA99S05-25Q1QT	BA99S05-01Q1GC
	3.0	BA99S05-H303QT	BA99S05-0503QT	BA99S05-1003QT	BA99S05-1503QT	BA99S05-2503QT	BA99S05-0103GC
	4.0	BA99S05-H304QT	BA99S05-0504QT	BA99S05-1004QT	BA99S05-1504QT	BA99S05-2504QT	BA99S05-0104GC
	4.6	BA99S05-0346WT	BA99S05-0546WT	BA99S05-1046WT	BA99S05-1546WT	BA99S05-2546WT	BA99S05-0104GC

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

For other dimensions please refer to page 386-387

Normal Phase Chemistries

Contents

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 (Silica)

- **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**

YMC-Pack SIL	Specification			
Particle Size / µm	3; 5	3; 5	3; 5	5
Pore Size / nm	6	12	20	30
Surface area / m^2g^{-1}	450	330	175	100
Recommended pH range	2.0 - 7.5	2.0 - 7.5	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

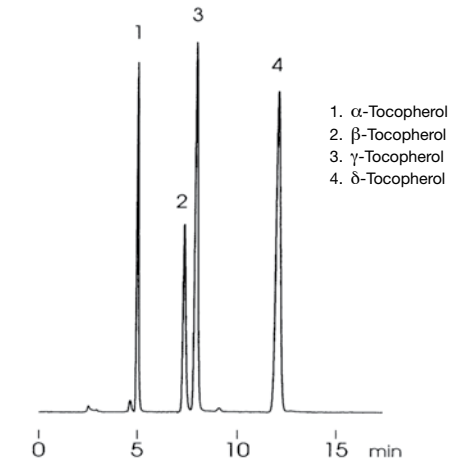
The high purity YMC-Pack SIL (Silica) allows almost total sample recovery because the low content of impurities such as residual metals reduces non-specific sample adsorption. This also prevents unusual peak-shapes thereby encouraging higher sample loading. In addition, the porous structure of the spheres 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 (Silica) is also available in preparative particle sizes, e.g. 10 - 20 - 50 µm (YMC*Gel SIL-HG) and in multi-ton scale (refer to page 344-347).

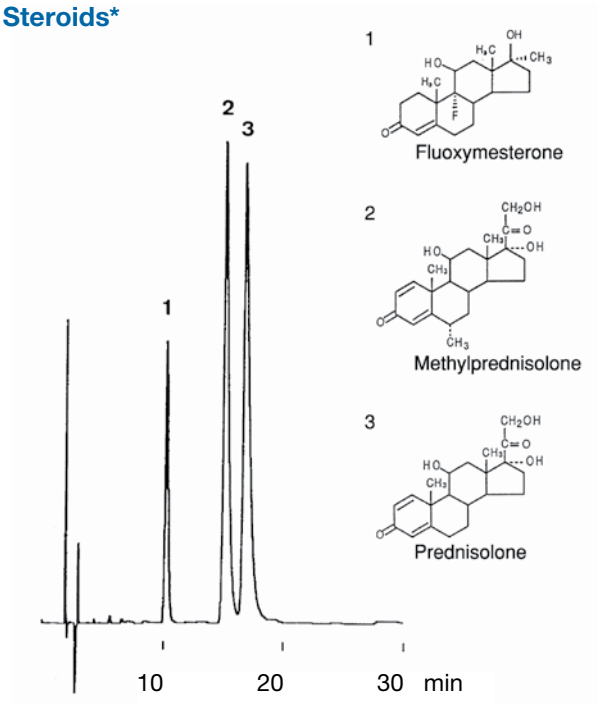
Ultra High Purity Silica*



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)

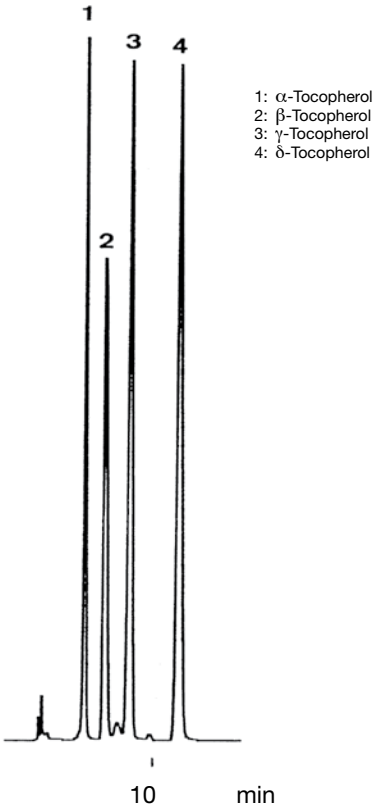
YMC-Pack SIL (Silica)

Steroids*



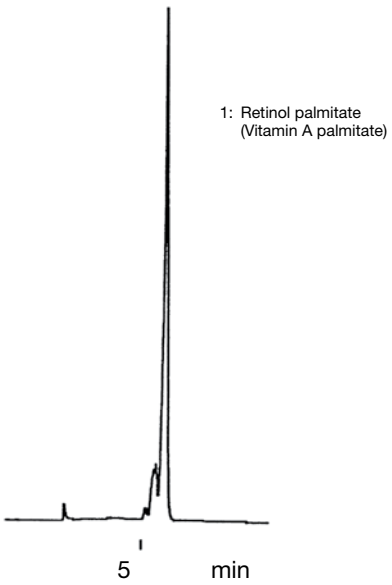
Column:	YMC-Pack SIL (5 µm, 6 nm) 250 x 4.6 mm ID
Part No.:	SL06S05-2546WT
Eluent:	hexane / THF / acetic acid (60/40/1)
Flow:	1.5 mL/min
Detection:	UV at 250 nm, 0.16 AUFS
Temperature:	30 °C
Injection:	10 µL (0.25 mg/mL)

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)

Vitamin A fatty acid ester*



Column:	YMC-Pack SIL (5 µm, 12 nm) 150 x 4.6 mm ID
Part No.:	SL12S05-1546WT
Eluent:	cyclohexane / dichloromethane / acetic acid (100/0.5/0.5)
Flow:	1.0 mL/min
Detection:	UV at 350 nm, 0.32 AUFS
Temperature:	30 °C
Injection:	5 µL (1.0 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.de/support-documentation.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)**

YMC-Pack PVA-Sil	Specification
Particle Size / µm	5
Pore Size / nm	12
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

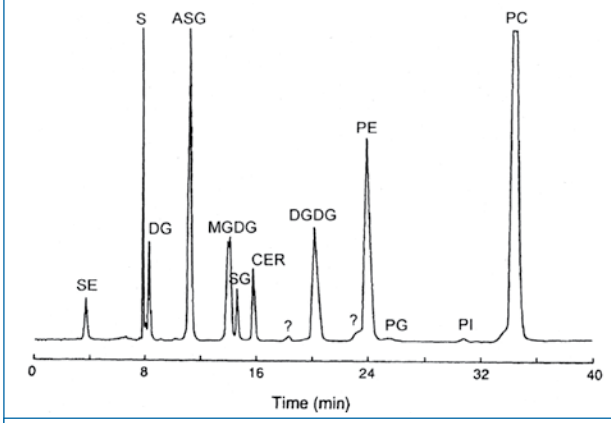
The PVA polymer shell on PVA-Sil deactivates the silica support while providing a hydrophilic surface. YMC-Pack PVA-Sil columns are well suited for SFC separations.

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.de/support-documentation.html.

YMC-Pack PVA-Sil

Analysis of Potato Lipids*



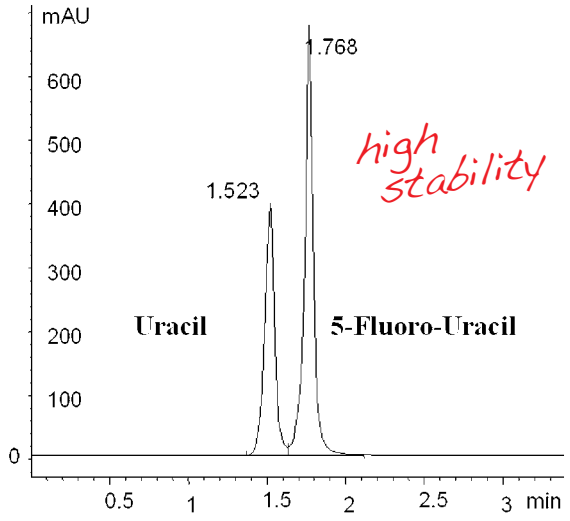
Column:	YMC-Pack PVA-Sil (5 µm, 12 nm) 250 x 4.6 mm ID						
Part No.:	PV12S05-2546WT						
Flow rate:	1 to 2 mL/min						
Mobile Phase:	A: iso-hexane / methyl ter butyl ether (98:2)						
	B: propan-2-ol / ACN / $CHCl_3$ / CH_3OOH (84:8:8:0.025)						
	C: propan-2-ol / water / triethylamine (50:50:0.2)						
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		

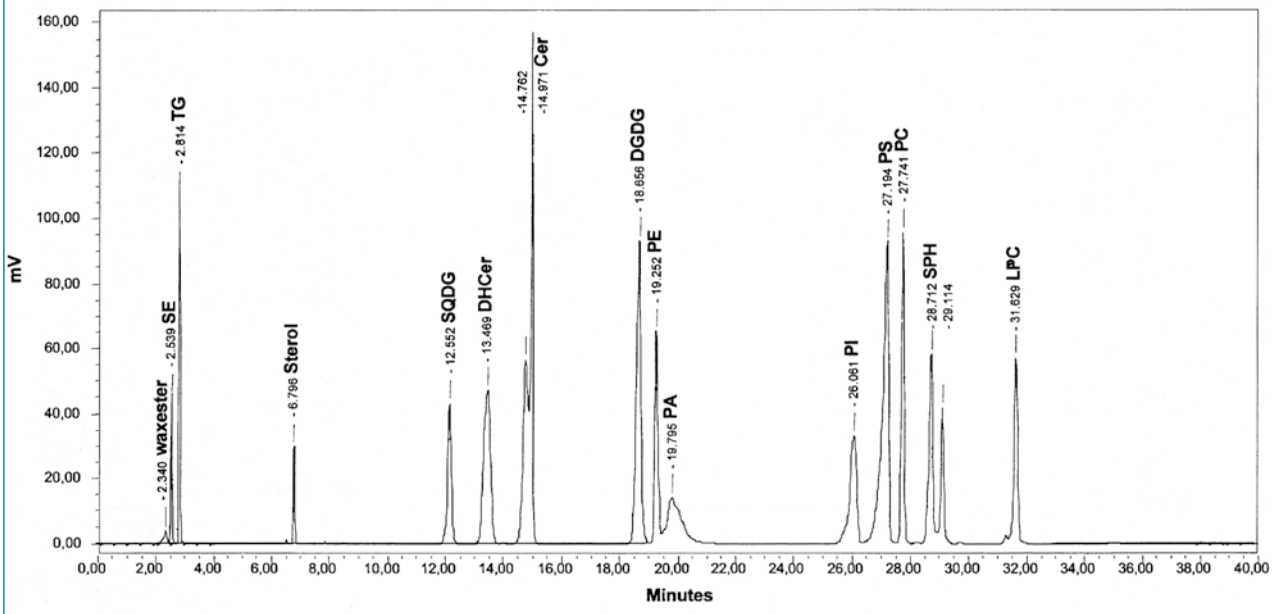
Literature: W.W. Christie; R.A. Urwin, J. high Resol. Chromatogr., Vol. 18 (1995) p.97 - 100

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	SE:	steryl oleate	PE:	PE-dipalmitoyl
Part No.:	PV12S05-2504QT	TG:	TAG/tripentadecanoin	PA:	PA-diheptadecanoyl
Eluent:	A: n-hexane / tert-methylbutyl ether (98:2)	Sterol:	stigmasterol/sitosterol	PI:	PI-diheptadecanoyl
	B: isopropanol / acetonitrile / chloroform / acetic acid (84:8:8:0.025)	SQDG:	sulfoquinovosyldiacylglycerol	PS:	PS-diheptadecanoyl
	C: isopropanol / water / triethylamine (50:50:0.2)	DHCer:	dehydroxycerebroside	PC:	PC-diheptadecanoyl
	plus 5 mM ammonium sulfate	Cer:	cerebroside	SPH:	sphingomyelin
Flow rate:	1 mL/min	DGDG:	digalactosyldiacylglycerol	LPC:	lysophosphatidylcholine
Detector:	ELSD				

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

YMC-Pack CN (Cyano)

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

YMC-Pack CN	Specification	
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.

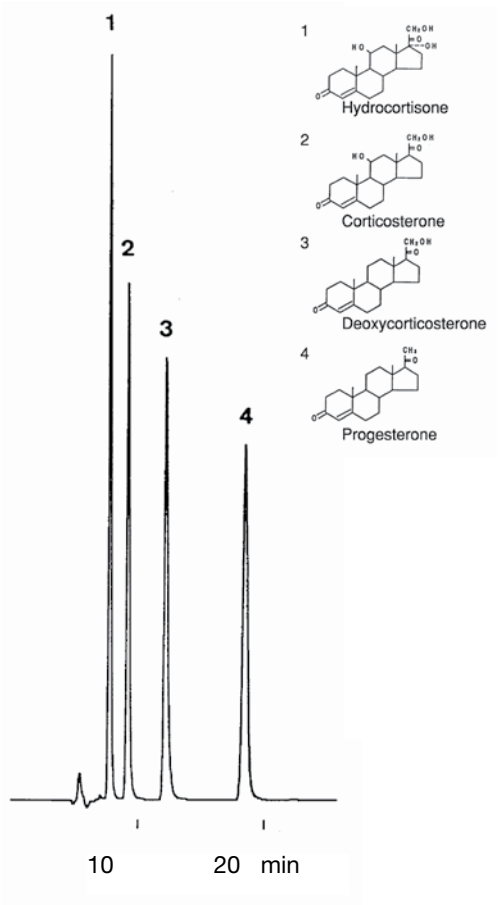
YMC-Pack CN (Cyano) is also available in preparative particle sizes.

YMC-Pack CN (Cyano)

YMC-Pack CN Separation Modes

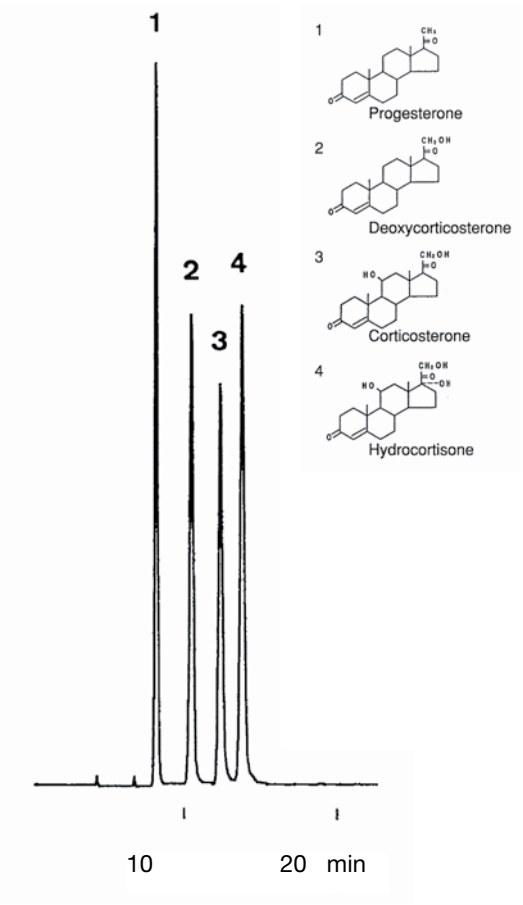
YMC-Pack CN can be used either in reversed phase and normal phase modes since it provides cyanopropyl groups of medium polarity. It can be employed in reversed phase mode with an aqueous mobile phase of higher polarity and in normal phase mode with a lower polarity than the stationary phase. This results 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.de/support-documentation.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**

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

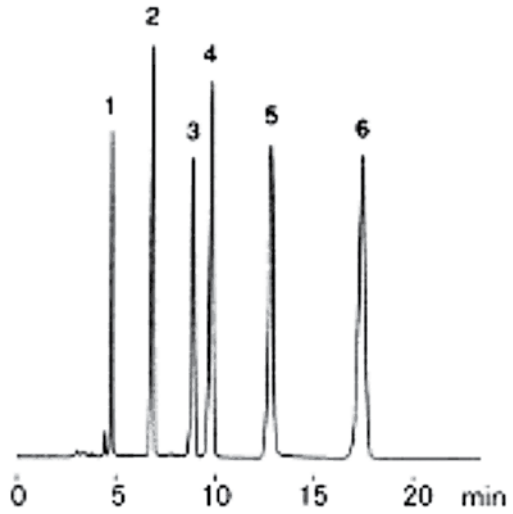
YMC-Pack Diol SEC columns for separation and MW determination of biomolecules may be found on page 203-218.

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

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.de/support-documentation.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**

YMC-Pack Polyamine II	Specification
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.

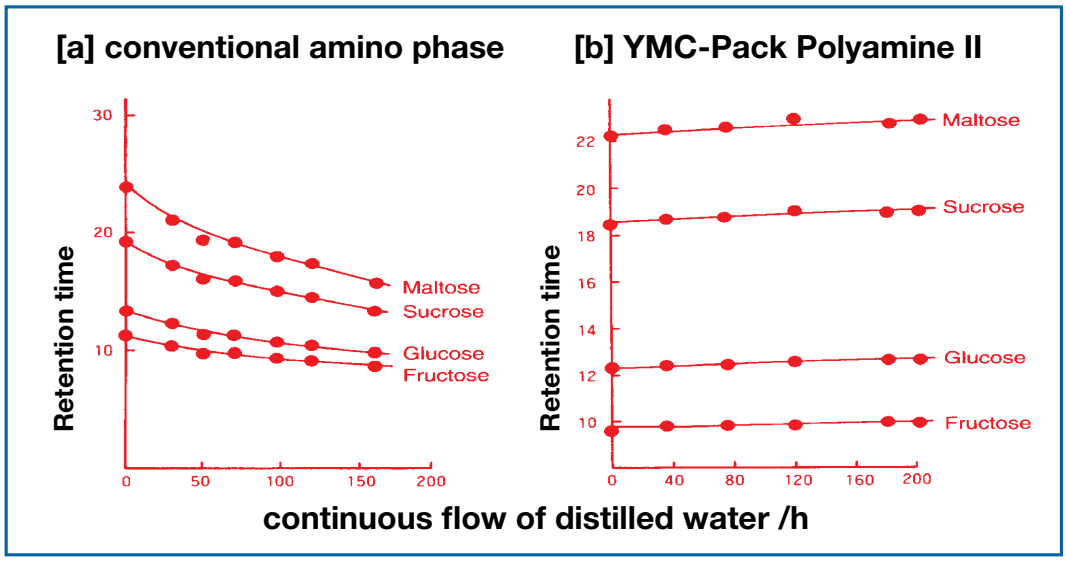
Reducing sugars are often adsorbed irreversibly to conventional amino phases, which causes problems in their recovery and quantitation. In YMC-Pack Polyamine II columns however, the adsorption of reducing sugars plays only a minor role. As a result, a high recovery of these compounds can be obtained which is beneficial for accurate and reliable quantitation.

Column care

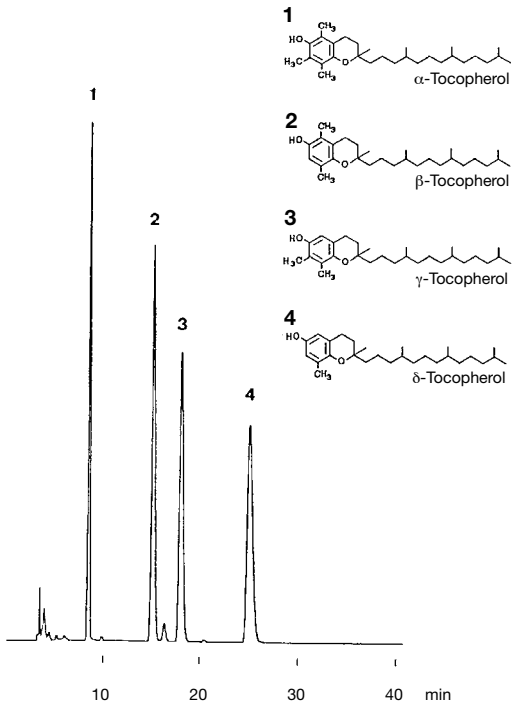
YMC-Pack Polyamine II is stable towards hydrolysis between pH 2.0-9.0. Remove acid and buffer salts before storage. For detailed information please refer to the "Column Care and Use Instructions" which can be downloaded from www.ymc.de/support-documentation.html.

YMC-Pack Polyamine II

Stability of amino type packings*



Tocopherols*



Column:	YMC-Pack Polyamine II (5 µm, 12 nm) 250 x 4.6 mm ID
Part No.:	PB12S05-2546WT
Eluent:	hexane / ethylacetate = 70/30
Flow:	1.0 mL/min
Detection:	UV, 295 nm
Temperature:	30 °C

YMC-Pack NH_2 (Amino)

- **primary amine (-NH_2) functionality**
- **stable, high coverage monomeric bonded chemistry**
- **available in analytical, semi-prep and preparative column sizes**

YMC-Pack NH_2	Specification
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 (Amino) 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 (Amino) 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 (Amino) 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 (Amino) is also available in preparative particle sizes.

Column care

YMC-Pack NH_2 (Amino) 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.de/support-documentation.html.

YMC-Pack TMS (C1)

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

YMC-Pack TMS	Specification
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 (C1) 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 (C1) 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 (C1) is also available in preparative particle sizes.

Column care

YMC-Pack TMS (C1) 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.de/support-documentation.html.

Ordering Information

YMC-Pack SIL

Phase dimension	Column ID [mm]	Column length [mm]					Guard cartridges* with 10 mm length [pack of 5]
		30 (WT) / 33 (QT)	50	100	150	250	
6 nm 3 µm	2.1	SL06S03-H3Q1QT	SL06S03-05Q1QT	SL06S03-10Q1QT	SL06S03-15Q1QT	SL06S03-25Q1QT	SL06S03-01Q1GC
	3.0	SL06S03-H303QT	SL06S03-0503QT	SL06S03-1003QT	SL06S03-1503QT	SL06S03-2503QT	SL06S03-0103GC
	4.0	SL06S03-H304QT	SL06S03-0504QT	SL06S03-1004QT	SL06S03-1504QT	SL06S03-2504QT	SL06S03-0104GC
	4.6	SL06S03-0346WT	SL06S03-0546WT	SL06S03-1046WT	SL06S03-1546WT	SL06S03-2546WT	SL06S03-0104GC
12 nm 3 µm	2.1	SL12S03-H3Q1QT	SL12S03-05Q1QT	SL12S03-10Q1QT	SL12S03-15Q1QT	SL12S03-25Q1QT	SL12S03-01Q1GC
	3.0	SL12S03-H303QT	SL12S03-0503QT	SL12S03-1003QT	SL12S03-1503QT	SL12S03-2503QT	SL12S03-0103GC
	4.0	SL12S03-H304QT	SL12S03-0504QT	SL12S03-1004QT	SL12S03-1504QT	SL12S03-2504QT	SL12S03-0104GC
	4.6	SL12S03-0346WT	SL12S03-0546WT	SL12S03-1046WT	SL12S03-1546WT	SL12S03-2546WT	SL12S03-0104GC
20 nm 3 µm	2.1	SL20S03-H3Q1QT	SL20S03-05Q1QT	SL20S03-10Q1QT	SL20S03-15Q1QT	SL20S03-25Q1QT	SL20S03-01Q1GC
	3.0	SL20S03-H303QT	SL20S03-0503QT	SL20S03-1003QT	SL20S03-1503QT	SL20S03-2503QT	SL20S03-0103GC
	4.0	SL20S03-H304QT	SL20S03-0504QT	SL20S03-1004QT	SL20S03-1504QT	SL20S03-2504QT	SL20S03-0104GC
	4.6	SL20S03-0346WT	SL20S03-0546WT	SL20S03-1046WT	SL20S03-1546WT	SL20S03-2546WT	SL20S03-0104GC
6 nm 5 µm	2.1	SL06S05-H3Q1QT	SL06S05-05Q1QT	SL06S05-10Q1QT	SL06S05-15Q1QT	SL06S05-25Q1QT	SL06S05-01Q1GC
	3.0	SL06S05-H303QT	SL06S05-0503QT	SL06S05-1003QT	SL06S05-1503QT	SL06S05-2503QT	SL06S05-0103GC
	4.0	SL06S05-H304QT	SL06S05-0504QT	SL06S05-1004QT	SL06S05-1504QT	SL06S05-2504QT	SL06S05-0104GC
	4.6	SL06S05-0346WT	SL06S05-0546WT	SL06S05-1046WT	SL06S05-1546WT	SL06S05-2546WT	SL06S05-0104GC
12 nm 5 µm	2.1	SL12S05-H3Q1QT	SL12S05-05Q1QT	SL12S05-10Q1QT	SL12S05-15Q1QT	SL12S05-25Q1QT	SL12S05-01Q1GC
	3.0	SL12S05-H303QT	SL12S05-0503QT	SL12S05-1003QT	SL12S05-1503QT	SL12S05-2503QT	SL12S05-0103GC
	4.0	SL12S05-H304QT	SL12S05-0504QT	SL12S05-1004QT	SL12S05-1504QT	SL12S05-2504QT	SL12S05-0104GC
	4.6	SL12S05-0346WT	SL12S05-0546WT	SL12S05-1046WT	SL12S05-1546WT	SL12S05-2546WT	SL12S05-0104GC
20 nm 5 µm	2.1	SL20S05-H3Q1QT	SL20S05-05Q1QT	SL20S05-10Q1QT	SL20S05-15Q1QT	SL20S05-25Q1QT	SL20S05-01Q1GC
	3.0	SL20S05-H303QT	SL20S05-0503QT	SL20S05-1003QT	SL20S05-1503QT	SL20S05-2503QT	SL20S05-0103GC
	4.0	SL20S05-H304QT	SL20S05-0504QT	SL20S05-1004QT	SL20S05-1504QT	SL20S05-2504QT	SL20S05-0104GC
	4.6	SL20S05-0346WT	SL20S05-0546WT	SL20S05-1046WT	SL20S05-1546WT	SL20S05-2546WT	SL20S05-0104GC
30 nm 5 µm	2.1	SL30S05-H3Q1QT	SL30S05-05Q1QT	SL30S05-10Q1QT	SL30S05-15Q1QT	SL30S05-25Q1QT	SL30S05-01Q1GC
	3.0	SL30S05-H303QT	SL30S05-0503QT	SL30S05-1003QT	SL30S05-1503QT	SL30S05-2503QT	SL30S05-0103GC
	4.0	SL30S05-H304QT	SL30S05-0504QT	SL30S05-1004QT	SL30S05-1504QT	SL30S05-2504QT	SL30S05-0104GC
	4.6	SL30S05-0346WT	SL30S05-0546WT	SL30S05-1046WT	SL30S05-1546WT	SL30S05-2546WT	SL30S05-0104GC

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

YMC-Pack PVA-Sil

Phase dimension	Column ID [mm]	Column length [mm]					Guard cartridges* with 10 mm length [pack of 5]
		30 (WT) / 33 (QT)	50	100	150	250	
12 nm 5 µm	2.1	PV12S05-H3Q1QT	PV12S05-05Q1QT	PV12S05-10Q1QT	PV12S05-15Q1QT	PV12S05-25Q1QT	PV12S05-01Q1GC
	3.0	PV12S05-H303QT	PV12S05-0503QT	PV12S05-1003QT	PV12S05-1503QT	PV12S05-2503QT	PV12S05-0103GC
	4.0	PV12S05-H304QT	PV12S05-0504QT	PV12S05-1004QT	PV12S05-1504QT	PV12S05-2504QT	PV12S05-0104GC
	4.6	PV12S05-0346WT	PV12S05-0546WT	PV12S05-1046WT	PV12S05-1546WT	PV12S05-2546WT	PV12S05-0104GC

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

YMC-Pack CN (Cyano)

Phase dimension	Column ID [mm]	Column length [mm]					Guard cartridges* with 10 mm length [pack of 5]
		30 (WT) / 33 (QT)	50	100	150	250	
12 nm 3 µm	2.1	CN12S03-H3Q1QT	CN12S03-05Q1QT	CN12S03-10Q1QT	CN12S03-15Q1QT	CN12S03-25Q1QT	CN12S03-01Q1GC
	3.0	CN12S03-H303QT	CN12S03-0503QT	CN12S03-1003QT	CN12S03-1503QT	CN12S03-2503QT	CN12S03-0103GC
	4.0	CN12S03-H304QT	CN12S03-0504QT	CN12S03-1004QT	CN12S03-1504QT	CN12S03-2504QT	CN12S03-0104GC
	4.6	CN12S03-0346WT	CN12S03-0546WT	CN12S03-1046WT	CN12S03-1546WT	CN12S03-2546WT	CN12S03-0104GC
12 nm 5 µm	2.1	CN12S05-H3Q1QT	CN12S05-05Q1QT	CN12S05-10Q1QT	CN12S05-15Q1QT	CN12S05-25Q1QT	CN12S05-01Q1GC
	3.0	CN12S05-H303QT	CN12S05-0503QT	CN12S05-1003QT	CN12S05-1503QT	CN12S05-2503QT	CN12S05-0103GC
	4.0	CN12S05-H304QT	CN12S05-0504QT	CN12S05-1004QT	CN12S05-1504QT	CN12S05-2504QT	CN12S05-0104GC
	4.6	CN12S05-0346WT	CN12S05-0546WT	CN12S05-1046WT	CN12S05-1546WT	CN12S05-2546WT	CN12S05-0104GC
30 nm 5 µm	2.1	CN30S05-H3Q1QT	CN30S05-05Q1QT	CN30S05-10Q1QT	CN30S05-15Q1QT	CN30S05-25Q1QT	CN30S05-01Q1GC
	3.0	CN30S05-H303QT	CN30S05-0503QT	CN30S05-1003QT	CN30S05-1503QT	CN30S05-2503QT	CN30S05-0103GC
	4.0	CN30S05-H304QT	CN30S05-0504QT	CN30S05-1004QT	CN30S05-1504QT	CN30S05-2504QT	CN30S05-0104GC
	4.6	CN30S05-0346WT	CN30S05-0546WT	CN30S05-1046WT	CN30S05-1546WT	CN30S05-2546WT	CN30S05-0104GC

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

Ordering Information

YMC-Pack Diol-NP

Phase dimension	Column ID [mm]	Column length [mm]					Guard cartridges* with 10 mm length [pack of 5]
		30 (WT) / 33 (QT)	50	100	150	250	
6 nm 5 µm	2.1	DN06S05-H3Q1QT	DN06S05-05Q1QT	DN06S05-10Q1QT	DN06S05-15Q1QT	DN06S05-25Q1QT	DN06S05-01Q1GC
	3.0	DN06S05-H303QT	DN06S05-0503QT	DN06S05-1003QT	DN06S05-1503QT	DN06S05-2503QT	DN06S05-0103GC
	4.0	DN06S05-H304QT	DN06S05-0504QT	DN06S05-1004QT	DN06S05-1504QT	DN06S05-2504QT	DN06S05-0104GC
	4.6	DN06S05-0346WT	DN06S05-0546WT	DN06S05-1046WT	DN06S05-1546WT	DN06S05-2546WT	DN06S05-0104GC
12 nm 5 µm	2.1	DN12S05-H3Q1QT	DN12S05-05Q1QT	DN12S05-10Q1QT	DN12S05-15Q1QT	DN12S05-25Q1QT	DN12S05-01Q1GC
	3.0	DN12S05-H303QT	DN12S05-0503QT	DN12S05-1003QT	DN12S05-1503QT	DN12S05-2503QT	DN12S05-0103GC
	4.0	DN12S05-H304QT	DN12S05-0504QT	DN12S05-1004QT	DN12S05-1504QT	DN12S05-2504QT	DN12S05-0104GC
	4.6	DN12S05-0346WT	DN12S05-0546WT	DN12S05-1046WT	DN12S05-1546WT	DN12S05-2546WT	DN12S05-0104GC
20 nm 5 µm	2.1	DN20S05-H3Q1QT	DN20S05-05Q1QT	DN20S05-10Q1QT	DN20S05-15Q1QT	DN20S05-25Q1QT	DN20S05-01Q1GC
	3.0	DN20S05-H303QT	DN20S05-0503QT	DN20S05-1003QT	DN20S05-1503QT	DN20S05-2503QT	DN20S05-0103GC
	4.0	DN20S05-H304QT	DN20S05-0504QT	DN20S05-1004QT	DN20S05-1504QT	DN20S05-2504QT	DN20S05-0104GC
	4.6	DN20S05-0346WT	DN20S05-0546WT	DN20S05-1046WT	DN20S05-1546WT	DN20S05-2546WT	DN20S05-0104GC
30 nm 5 µm	2.1	DN30S05-H3Q1QT	DN30S05-05Q1QT	DN30S05-10Q1QT	DN30S05-15Q1QT	DN30S05-25Q1QT	DN30S05-01Q1GC
	3.0	DN30S05-H303QT	DN30S05-0503QT	DN30S05-1003QT	DN30S05-1503QT	DN30S05-2503QT	DN30S05-0103GC
	4.0	DN30S05-H304QT	DN30S05-0504QT	DN30S05-1004QT	DN30S05-1504QT	DN30S05-2504QT	DN30S05-0104GC
	4.6	DN30S05-0346WT	DN30S05-0546WT	DN30S05-1046WT	DN30S05-1546WT	DN30S05-2546WT	DN30S05-0104GC

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

YMC-Pack Polyamine II

Phase dimension	Column ID [mm]	Column length [mm]					Guard cartridges* with 10 mm length [pack of 5]
		30 (WT) / 33 (QT)	50	100	150	250	
12 nm 5 µm	2.1	PB12S05-H3Q1QT	PB12S05-05Q1QT	PB12S05-10Q1QT	PB12S05-15Q1QT	PB12S05-25Q1QT	PB12S05-01Q1GC
	3.0	PB12S05-H303QT	PB12S05-0503QT	PB12S05-1003QT	PB12S05-1503QT	PB12S05-2503QT	PB12S05-0103GC
	4.0	PB12S05-H304QT	PB12S05-0504QT	PB12S05-1004QT	PB12S05-1504QT	PB12S05-2504QT	PB12S05-0104GC
	4.6	PB12S05-0346WT	PB12S05-0546WT	PB12S05-1046WT	PB12S05-1546WT	PB12S05-2546WT	PB12S05-0104GC

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

YMC-Pack NH_2 (Amino)

Phase dimension	Column ID [mm]	Column length [mm]					Guard cartridges* with 10 mm length [pack of 5]
		30 (WT) / 33 (QT)	50	100	150	250	
12 nm 3 µm	2.1	NH12S03-H3Q1QT	NH12S03-05Q1QT	NH12S03-10Q1QT	NH12S03-15Q1QT	NH12S03-25Q1QT	NH12S03-01Q1GC
	3.0	NH12S03-H303QT	NH12S03-0503QT	NH12S03-1003QT	NH12S03-1503QT	NH12S03-2503QT	NH12S03-0103GC
	4.0	NH12S03-H304QT	NH12S03-0504QT	NH12S03-1004QT	NH12S03-1504QT	NH12S03-2504QT	NH12S03-0104GC
	4.6	NH12S03-0346WT	NH12S03-0546WT	NH12S03-1046WT	NH12S03-1546WT	NH12S03-2546WT	NH12S03-0104GC
12 nm 5 µm	2.1	NH12S05-H3Q1QT	NH12S05-05Q1QT	NH12S05-10Q1QT	NH12S05-15Q1QT	NH12S05-25Q1QT	NH12S05-01Q1GC
	3.0	NH12S05-H303QT	NH12S05-0503QT	NH12S05-1003QT	NH12S05-1503QT	NH12S05-2503QT	NH12S05-0103GC
	4.0	NH12S05-H304QT	NH12S05-0504QT	NH12S05-1004QT	NH12S05-1504QT	NH12S05-2504QT	NH12S05-0104GC
	4.6	NH12S05-0346WT	NH12S05-0546WT	NH12S05-1046WT	NH12S05-1546WT	NH12S05-2546WT	NH12S05-0104GC

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

YMC-Pack TMS (C1)

Phase dimension	Column ID [mm]	Column length [mm]					Guard cartridges* with 10 mm length [pack of 5]
		30 (WT) / 33 (QT)	50	100	150	250	
12 nm 3 µm	2.1	TM12S03-H3Q1QT	TM12S03-05Q1QT	TM12S03-10Q1QT	TM12S03-15Q1QT	TM12S03-25Q1QT	TM12S03-01Q1GC
	3.0	TM12S03-H303QT	TM12S03-0503QT	TM12S03-1003QT	TM12S03-1503QT	TM12S03-2503QT	TM12S03-0103GC
	4.0	TM12S03-H304QT	TM12S03-0504QT	TM12S03-1004QT	TM12S03-1504QT	TM12S03-2504QT	TM12S03-0104GC
	4.6	TM12S03-0346WT	TM12S03-0546WT	TM12S03-1046WT	TM12S03-1546WT	TM12S03-2546WT	TM12S03-0104GC
12 nm 5 µm	2.1	TM12S05-H3Q1QT	TM12S05-05Q1QT	TM12S05-10Q1QT	TM12S05-15Q1QT	TM12S05-25Q1QT	TM12S05-01Q1GC
	3.0	TM12S05-H303QT	TM12S05-0503QT	TM12S05-1003QT	TM12S05-1503QT	TM12S05-2503QT	TM12S05-0103GC
	4.0	TM12S05-H304QT	TM12S05-0504QT	TM12S05-1004QT	TM12S05-1504QT	TM12S05-2504QT	TM12S05-0104GC
	4.6	TM12S05-0346WT	TM12S05-0546WT	TM12S05-1046WT	TM12S05-1546WT	TM12S05-2546WT	TM12S05-0104GC

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

For other dimensions please refer to page 386-387

YMC Phases for Biochromatography

Contents

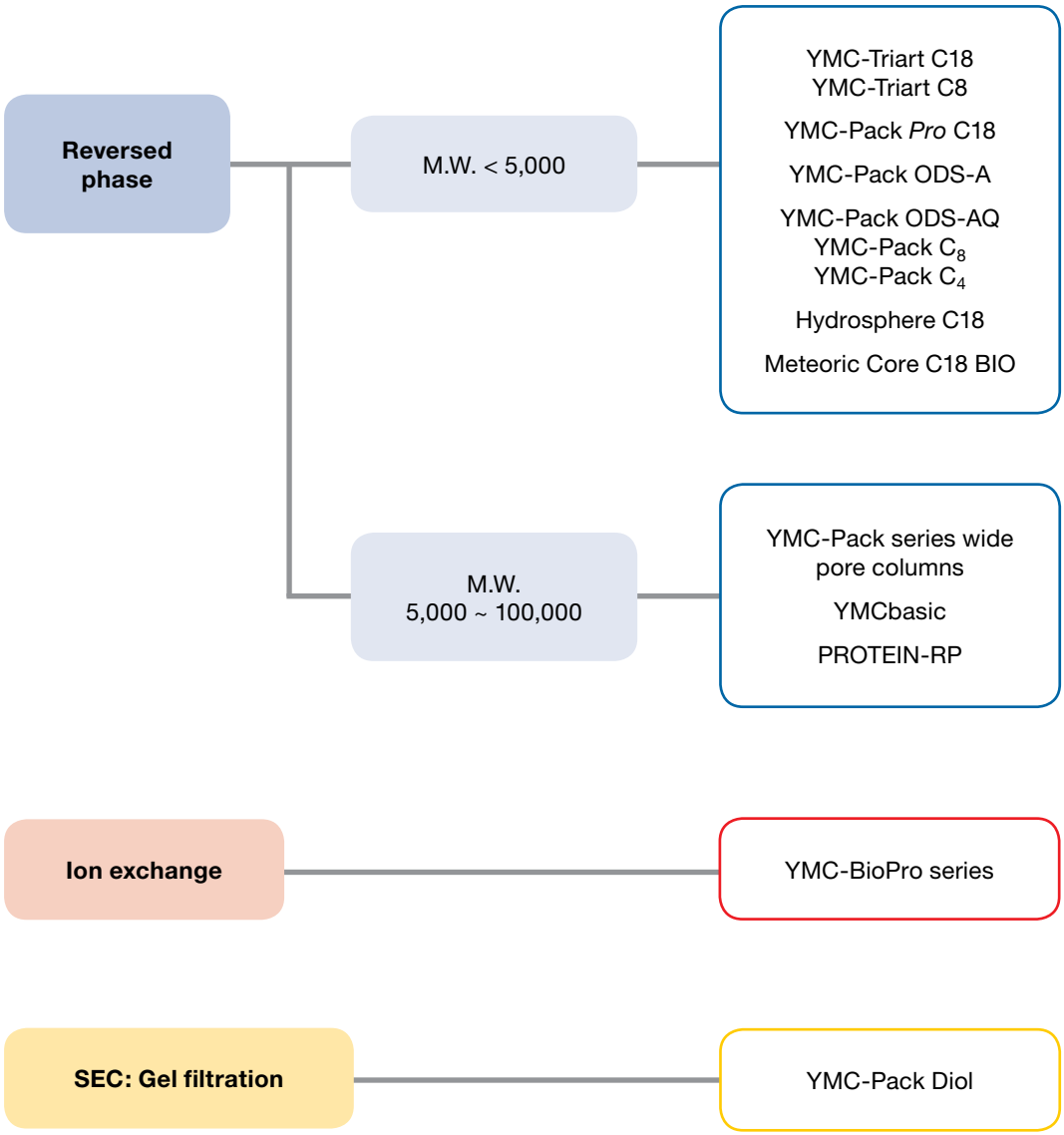
Introduction

HPLC Columns for Biochromatography

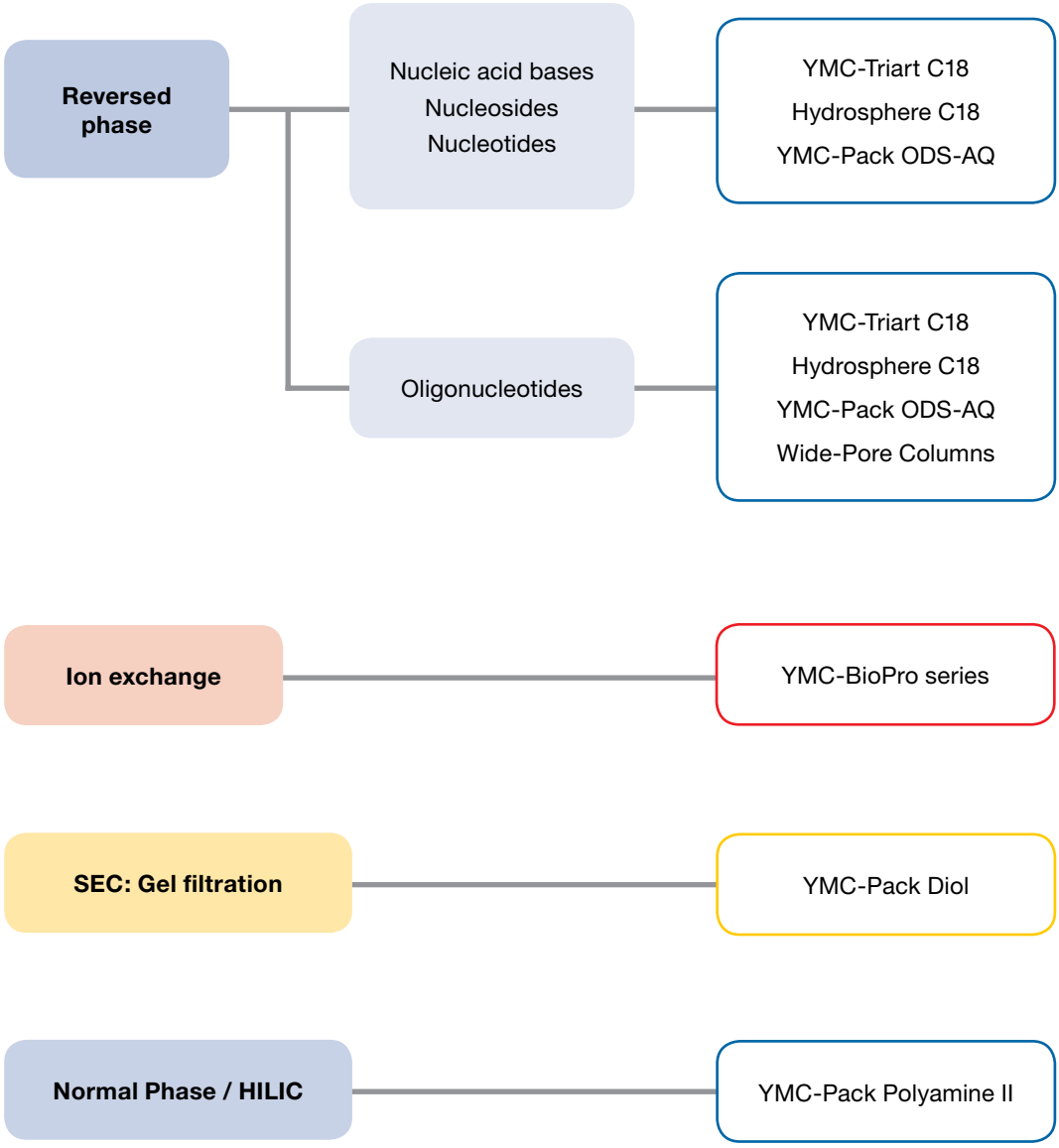
Historically, small molecules have played the major role in diagnosis and therapy. However with the recent developments in the fields of genomics, proteomics and metabolomics, biological molecules have become an important tool for the treatment of diseases or for help in the understanding of biological processes.

YMC has always played an important role in the provision of materials for bioseparations. With the constant driving force of innovation, the focus has always been on column design and stationary phase manufacturing. As a consequence, YMC offers state-of-the-art reversed phase, ion-exchange, size exclusion and normal phase/HILIC columns and bulk materials designed specifically for biochromatography.

Proteins and Peptides Phase Selection

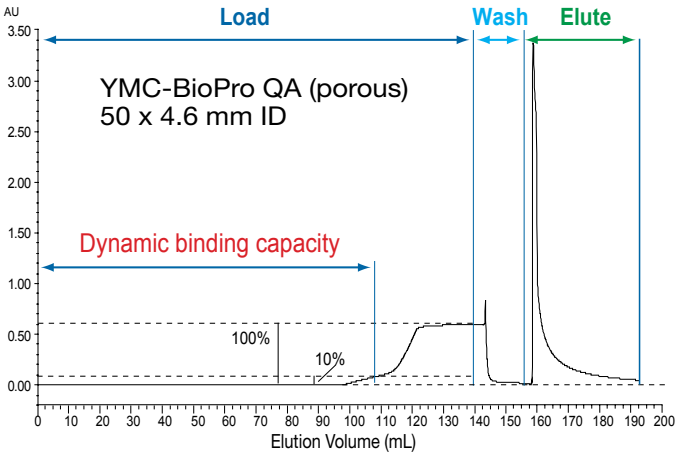


Nucleic Acids Phase Selection



Polysaccharides Phase Selection

Determination of DBC*



* Application data by courtesy YMC Co., Ltd.

Before determination, equilibrate the column with equilibration buffer.

Step 1: Load

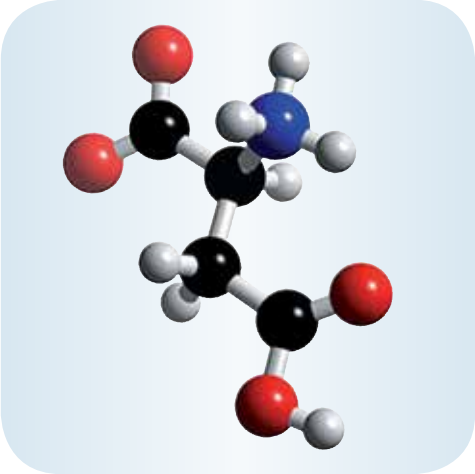
A protein solution of known concentration is continuously loaded at the desired flow rate and the absorbance of the eluate is monitored until full saturation is achieved (100% UV absorbance of the pure sample solutions).

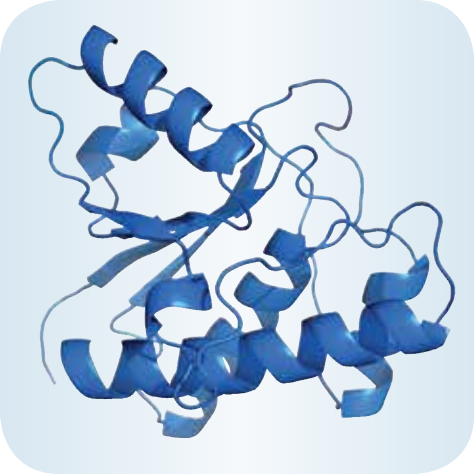
Step 2: Wash

Wash the column with equilibration buffer until no more protein elutes (0% UV absorbance).

Step 3: Elute

The DBC of the medium is a measure of the volume of protein solution that has been applied up to a specific breakthrough point (usually 5 or 10%).





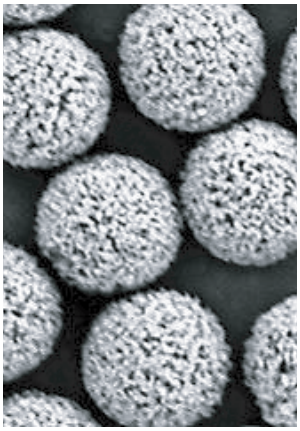
IEX

YMC-BioPro series

- **porous or non-porous hydrophilic polymers with low nonspecific adsorption**
- **excellent binding capacity and recovery of biomolecules**
- **very high resolution**
- **also available as bulk media in 10, 20, 30 or 75 µm**

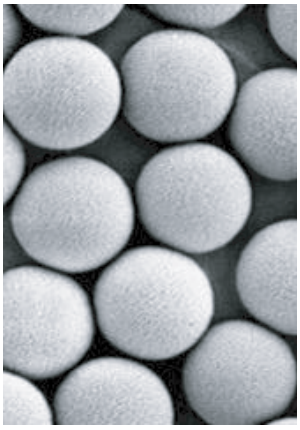
YMC-BioPro Series	YMC-BioPro QA	YMC-BioPro SP
Matrix	porous polymer beads	porous polymer beads
Pore size / nm	100	100
Particle size / µm	5	5
Charged group	$-CH_2N^+(CH_3)_3$	$-(CH_2)_3SO_3^-$
Counter ion	Cl^-	Na^+
Available pH range	2.0 - 12.0	2.0 - 12.0

Also available in 10, 20, 30 or 75 µm for preparative scale



Porous polymer beads

YMC-BioPro Series	YMC-BioPro QA-F	YMC-BioPro SP-F
Matrix	non-porous polymer beads	non-porous polymer beads
Pore size / nm	non-porous	non-porous
Particle size / µm	3; 5	3; 5
Charged group	$-CH_2N^+(CH_3)_3$	$-(CH_2)_3SO_3^-$
Counter ion	Cl^-	Na^+
Available pH range	2.0 - 12.0	2.0 - 12.0



Non-porous polymer beads

General

YMC-BioPro series ion exchange columns are available in QA and SP chemistries, based on 5 µm porous (QA or SP columns) or on 3 or 5 µm non-porous (QA-F and SP-F columns) hydrophilic polymer beads. The porous materials offer excellent binding capacity with unusually high efficiency and low operating pressure, whilst the non-porous particles offer high efficiency, exceptional resolution and low operating pressures.

YMC-BioPro series

High binding capacity and high recovery for porous type

The porous versions of YMC-BioPro show high dynamic binding capacity and excellent recovery, making them useful for semi-preparative separations of proteins and antibodies.

Comparison of dynamic binding capacity (DBC) for BSA

	Dynamic binding capacity (mg/mL-gel, 10% breakthrough)	Eluted amount (mg/mL-gel)	Recovery* (%)
YMC-BioPro QA	**126**	**120**	**95**
Mono Q (GE Healthcare)	**100**	**35**	**35**
BioAssist Q (Tosoh Bioscience)	**73**	**58**	**79**

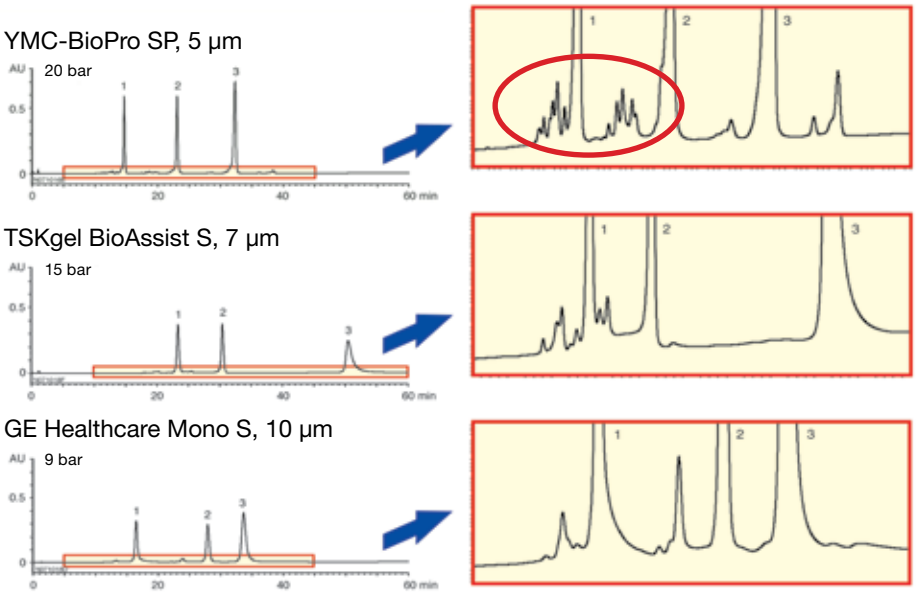
* Recovery: (Eluted amount/Dynamic binding capacity) x 100

High recovery rates for YMC-BioPro

Compared with conventional porous polymer anion exchange columns, YMC-BioPro QA gives higher DBC and recovery rates. This indicates that YMC-BioPro has a much lower nonspecific adsorption compared to conventional columns.

Superior resolution

Comparison of standard protein separation on YMC-BioPro SP and commercial SP or S type products*



Eluent: A) 20 mM KH_2PO_4-K_2HPO_4 (pH 6.8)
B) 20 mM KH_2PO_4-K_2HPO_4 (pH 6.8) containing 0.5 M NaCl
Gradient: 0-100%B (0-60 min)
Flow rate: YMC-BioPro SP, TSKgel BioAssist S 0.5 mL/min
GE Healthcare Mono S 0.59 mL/min
Temperature: 25°C
Detection: UV at 220 nm
Injection: YMC-BioPro SP, TSKgel BioAssist S 20 µL
GE Healthcare Mono S 23.6 µL

Sample: 1. Ribonuclease A (0.5 mg/mL)
2. Cytochrome *c* (0.5 mg/mL)
3. Lysozyme (0.5 mg/mL)

Superior resolution

Only YMC-BioPro is available in smaller particle size and therefore provides superior resolution.

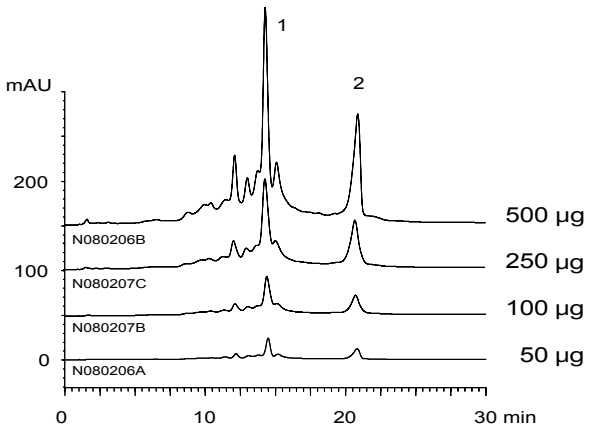
* Application data by courtesy YMC Co., Ltd.

YMC-BioPro QA/SP

Applications for porous YMC-BioPro

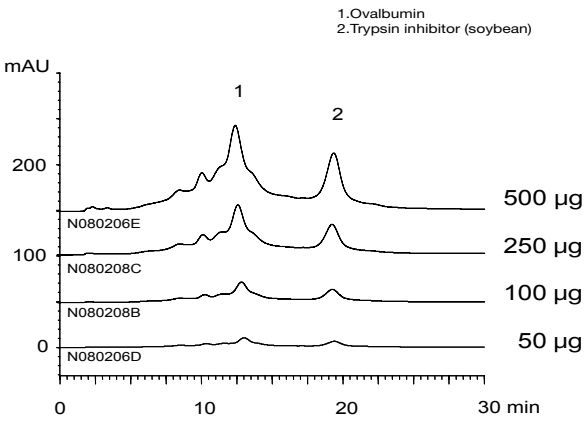
Loading study for YMC-BioPro QA (porous) – Proteins*

YMC-BioPro QA
5 µm, 100 nm (50 x 4.6 mm ID)



Part No.:	QAA0S05-0546WP	Flow rate:	0.5 mL/min
Eluent:	A) 20 mM Tris-HCl (pH 8.1) B) 20 mM Tris-HCl (pH 8.1) containing 0.5 M NaCl	Temperature: Detection: Injection:	25°C UV at 280 nm 100 µL
Gradient:	10-80%B (0-30 min)		

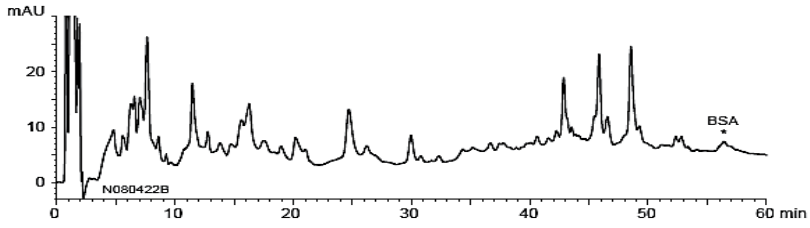
GE Healthcare (Mono Q)
10 µm (50 x 5.0 mm ID)



Eluent:	A) 20 mM Tris-HCl (pH 8.1) B) 20 mM Tris-HCl (pH 8.1) containing 0.5 M NaCl	Flow rate: Temperature: Detection: Injection:	0.5 mL/min 25°C UV at 280 nm 100 µL
Gradient:	10-80%B (0-30 min)		

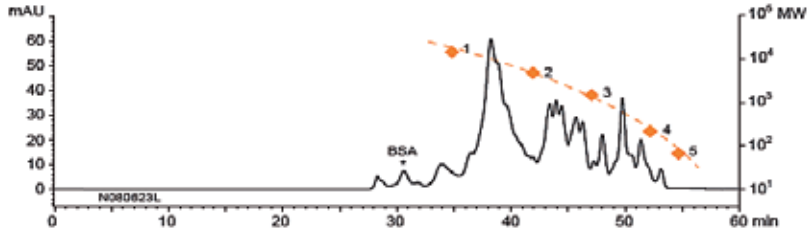
Peptide mapping*

IEX: YMC-BioPro QA 5 µm, 50 x 4.6 mm ID



Part No.:	QAA0S05-0546WP
Eluent:	A) 20 mM Tris-HCl (pH 8.6) B) 20 mM Tris-HCl (pH 8.6) + 0,5 M NaCl 0-15% B (0-30 min), 15-60% B (30-60 min)
Flow rate:	0.5 mL/min
Temperature:	25 °C
Detection:	UV at 220 nm
Injection:	20 µL

SEC: YMC-Pack Diol-120 x Diol-60 5 µm, 500 x 8.0 mm ID x 2

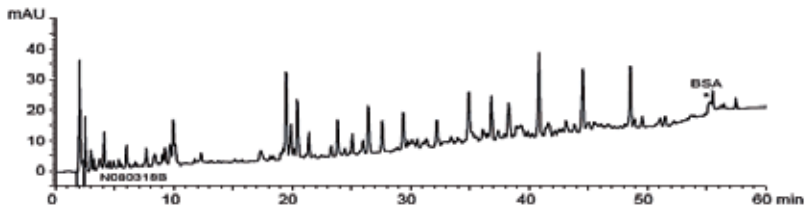


Calibration curve of proteins and peptides

1. Myoglobin	(MW	17,000)
2. Insulin (Bovine)	(MW	5,700)
3. Neurotensine	(MW	1,672)
4. Tetraglyzine	(MW	246)
5. Glycine	(MW	75)

Part Nos.:	DL12S05-5008WT + DL06S05-5008WT
Eluent:	0.1 M KH_2PO_4-K_2HPO_4 (pH 7.0) + 0.2 M NaCl / acetonitrile (70/30)
Flow rate:	0.7 mL/min
Temperature:	25 °C
Detection:	UV at 220 nm
Injection:	5 µL

RP: YMCbasic 5 µm, 150 x 2.0 mm ID

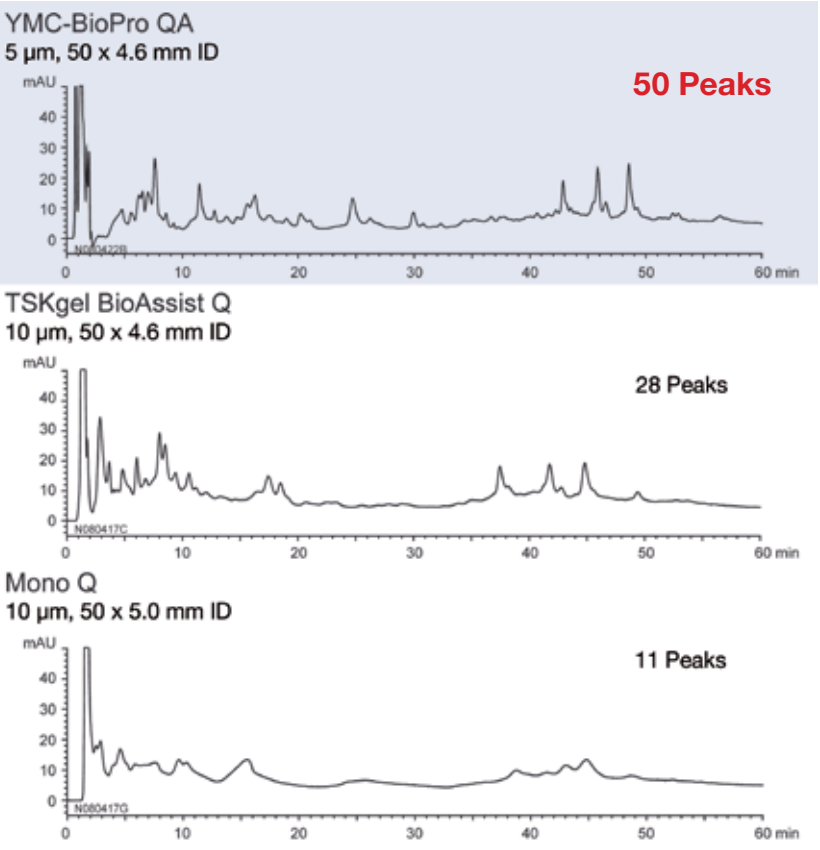


Tryptic digest of BSA (MW: 66,000)

Part No.:	BA99S05-1502WT
Eluent:	A) water / TFA (100/0.1) B) acetonitrile / TFA (100/0.1) 5-35% B (0-50 min), 35-45% B (50-55 min) 45% B (55-60 min)
Flow rate:	0.2 mL/min
Temperature:	37 °C
Detection:	UV at 220 nm
Injection:	1 µL

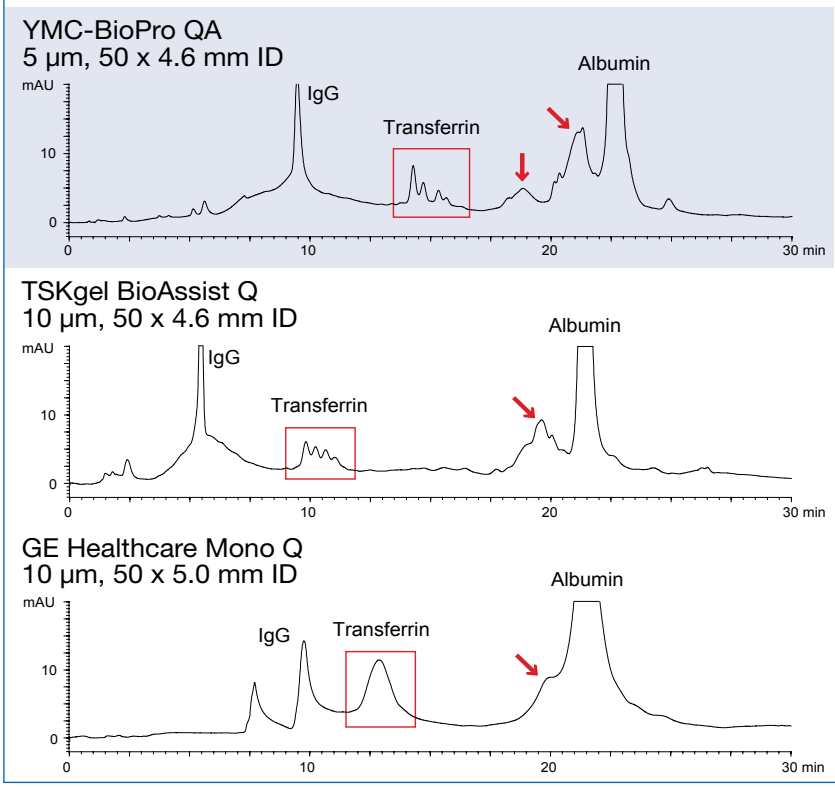
YMC-BioPro QA/SP

Peptide mapping of tryptic digest of BSA*



Eluent:	A) 20 mM Tris-HCl (pH 8.6) B) 20 mM Tris-HCl (pH 8.6) containing 0.5 M NaCl
Gradient:	0-15%B (0-30 min), 15-60%B (30-60 min)
Flow rate:	0.5 mL/min
Temperature:	25°C
Detection:	UV at 220 nm
Injection:	20 µL
Sample:	Tryptic digest of BSA

Separation of proteins in human serum on YMC-BioPro QA and commercial Q type products*



For high resolution YMC-BioPro QA/SP, porous IEX material, is recommended!

Eluent	: A) 20 mM Tris-HCl (pH 8.6) B) 20 mM Tris-HCl (pH 8.6) containing 0.5 M NaCl
Gradient	: 0-30%B (0-15 min), 30-100%B (15-30 min)
Flow rate	: 0.5 mL/min
Temperature	: 25 °C
Detection	: UV at 280 nm
Injection	: 20 µL
Sample	: Human serum (100 µL/mL)

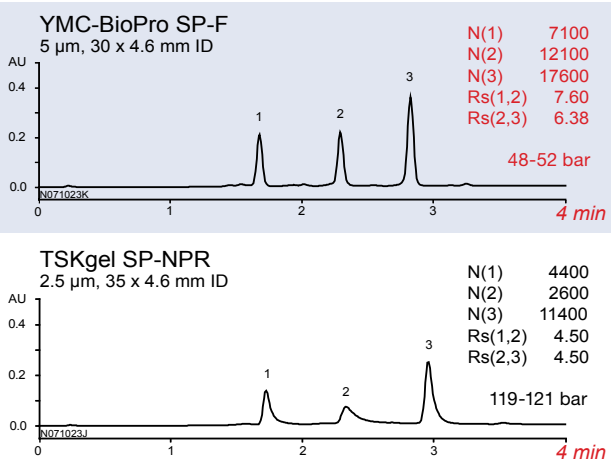
* Application data by courtesy YMC Co., Ltd.

YMC-BioPro QA-F/SP-F

Applications for non-porous YMC-BioPro: High Throughput IEX

Comparison of standard protein separation on YMC-BioPro SP-F and a commercial SP-type product*

high plate count



YMC-BioPro SP-F elutes the proteins as sharper peaks without peak-tailing than TSKgel SP-NPR.

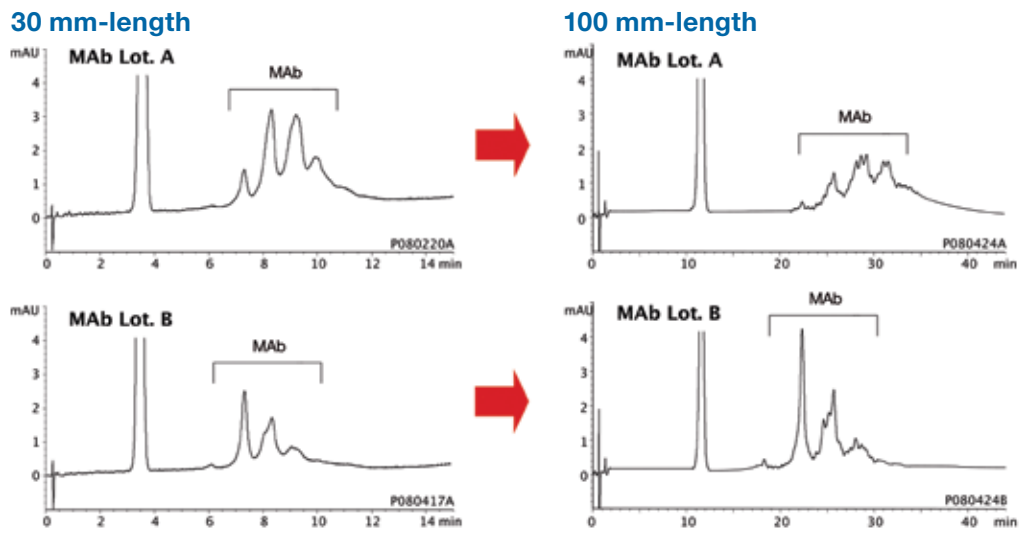
Despite the larger particle size, the theoretical plate count for YMC-BioPro SP-F is higher than that for TSKgel SP-NPR.

Eluent:	A) 20 mM KH_2PO_4-K_2HPO_4 (pH 6.8) B) 20 mM KH_2PO_4-K_2HPO_4 (pH 6.8) containing 0.5 M NaCl
Gradient:	YMC-BioPro SP-F 0-100%B (0-4 min) TSKgel SP-NPR 0-100%B (0-4.67 min)
Flow rate:	1.5 mL/min
Temperature:	25°C
Detection:	UV at 220 nm
Injection:	20 µL
Sample:	1. Ribonuclease A (0.1 mg/mL) 2. Cytochrome c (0.1 mg/mL) 3. Lysozyme (0.1 mg/mL)

Compared to the competitor's column, YMC-BioPro SP-F shows higher theoretical plate counts, excellent peak shapes, and lower backpressure. This makes YMC-BioPro SP-F most suitable for high-throughput analysis.

MAb analysis on non-porous YMC-BioPro QA-F*

Comparison of 30 mm-length and 100 mm-length



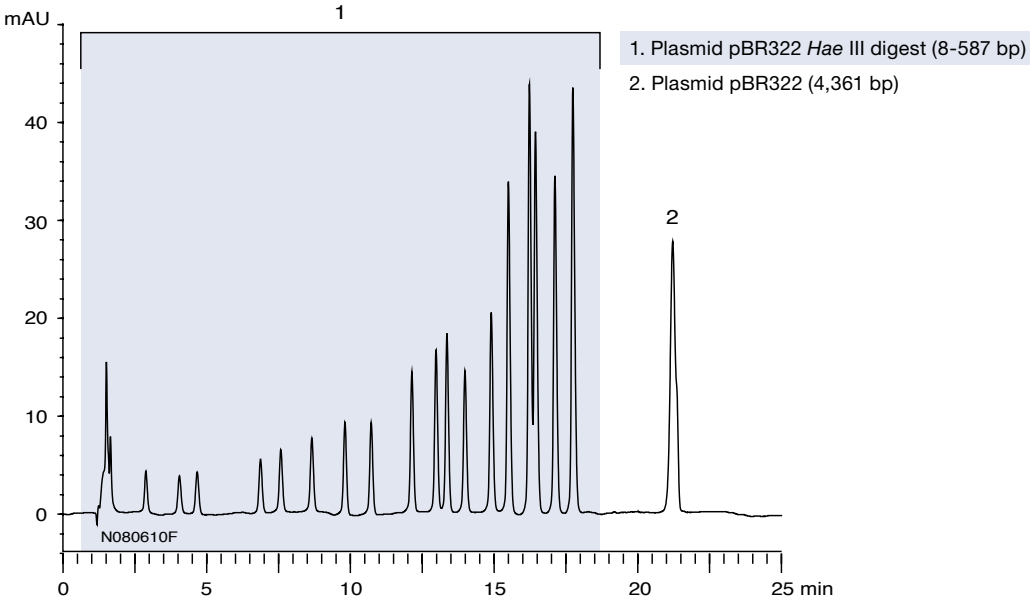
Column:	YMC-BioPro QA-F 30 x 4.6 mm ID YMC-BioPro QA-F 100 x 4.6 mm ID	Flow rate:	1.0 mL/min
Part Nos.:	QF00S05-0346WP QF00S05-1046WP	Temperature:	25 °C
Eluent:	A) 20 mM Tris-HCl (pH 8.1) B) 20 mM Tris-HCl (pH 8.1) containing 0.5 M NaCl 10-25%B (0-18 min) for 30 mm length column 10-25%B (0-60 min) for 100 mm length column	Detection:	UV at 220 nm
		Injection:	10 mL for 30 mm length column 14 mL for 100 mm length column
		Sample:	Monoclonal mouse IgG1 (0.1 mg/mL) (Purified by DEAE chromatography, containing NaN_3)

Two different lots of commercially available MAb, purified by DEAE chromatography, are separated on 30 mm and 100 mm length of YMC-BioPro QA-F columns. The lot-to-lot variability of MAb is observed and the resolution is greater on the 100 mm column.

YMC-BioPro QA-F/SP-F

Applications for non-porous YMC-BioPro: High Resolution IEX

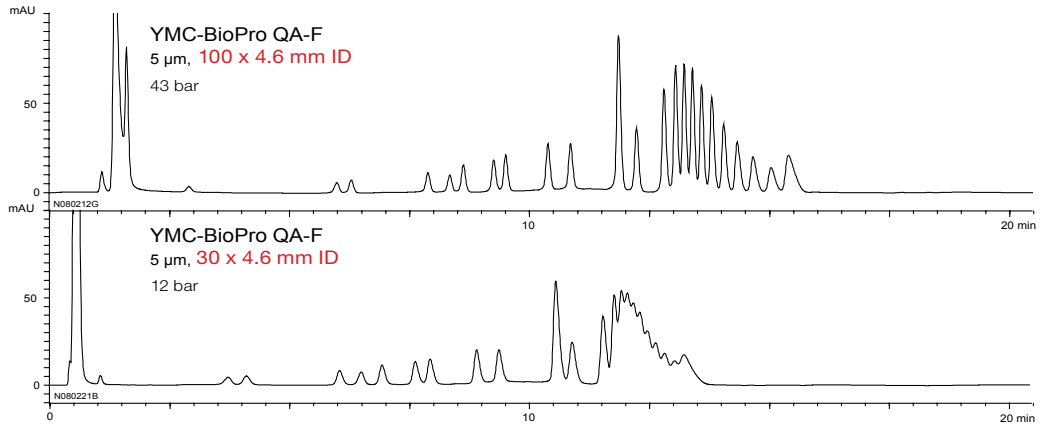
High resolution analysis on non-porous YMC-BioPro QA-F*



Column:	YMC-BioPro QA-F (5 µm) 100 x 4.6 mm ID	Temperature:	35°C
Part No.:	QF00S05-1046WP	Detection:	UV at 260 nm
Eluent:	A) 20 mM Tris-HCl (pH 8.1)	Injection:	10 µL
	B) 20 mM Tris-HCl (pH 8.1) containing 1.0 M NaCl	Sample:	Plasmid pBR322 Hae III digest (0.13 mg/mL)
Gradient:	70-85%B (0-20 min), 85%B (20-25 min)		Plasmid pBR322 (0.03 mg/mL)
Flow rate:	0.5 mL/min		

Excellent resolution in analysis of complex mixtures

Comparison of DNA fragment separation on 100 mm and 30 mm length YMC-BioPro QA-F columns*



Eluent:	A) 20 mM Tris-HCl (pH 8.1) containing 0.5 M NaCl	Temperature:	25°C
	B) 20 mM Tris-HCl (pH 8.1) containing 1.0 M NaCl	Detection:	UV at 260 nm
Gradient:	40-100%B (0-30 min)	Injection	: 20 µL
Flow rate:	0.5 mL/min	Sample	: 1 kb DNA Ladder (0.25 mg/mL)

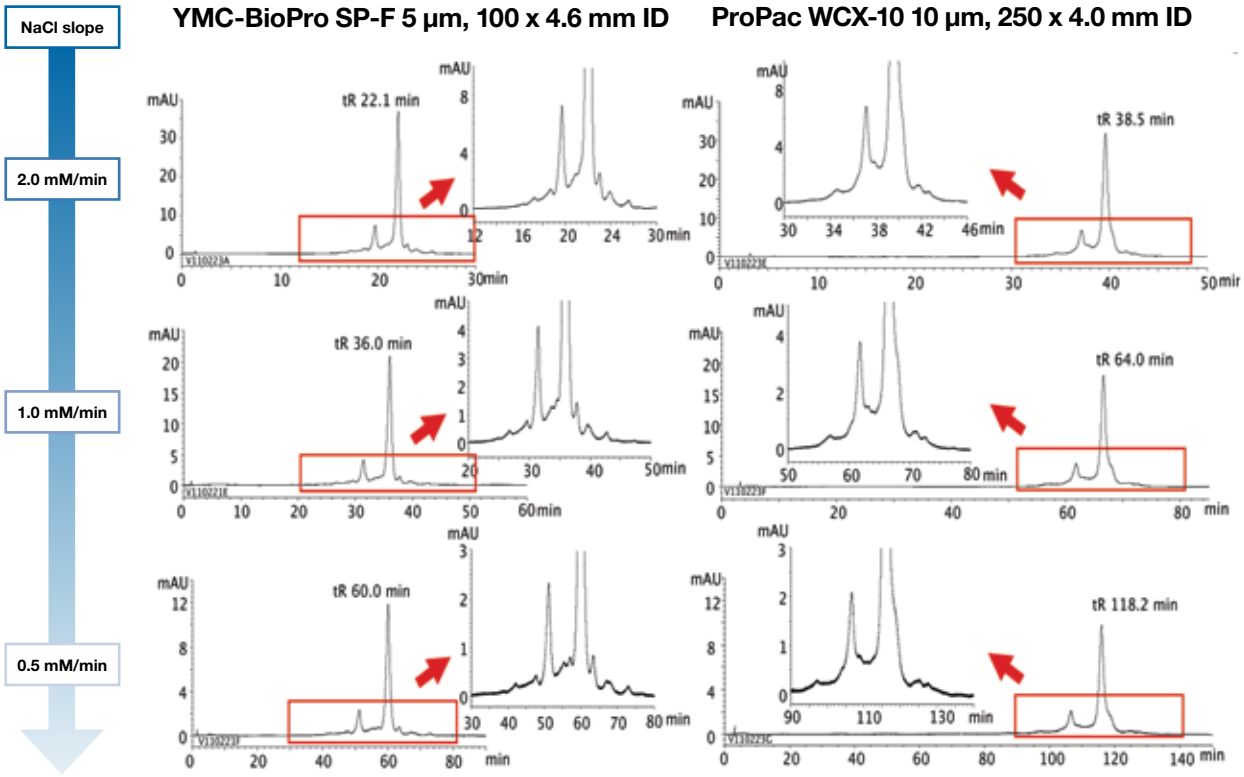
* Application data by courtesy YMC Co., Ltd.

YMC-BioPro QA-F/SP-F

MAb analysis on non-porous type cation-exchange columns*

Comparison of SCX (YMC-BioPro SP-F) and WCX (ProPac WCX-10) under the same gradient condition

MAb: Humanised monoclonal IgG1



Eluent:	A) 20 mM MES-NaOH (pH 5.6)
	B) 20 mM MES-NaOH (pH 5.6) containing 0.2 M NaCl
Initial gradient conc.:	35% B (70 mM NaCl)
Gradient slope:	1% B/min (2 mM NaCl/min), 0,5% B (1 mM NaCl/min), 0.25% B (0.5 mM NaCl/min)
Flow rate:	180 cm/hr (0.5 mL/min for 100 x 4.6 mm ID, 0.378 mL/min for 250 x 4.0 mm ID)
Temperature:	30 °C
Detection:	UV at 280 nm
Sample:	MAb (Humanised monoclonal IgG) (1 mg/mL)

The separation of MAb is compared on SCX (YMC-BioPro SP-F) and WCX (ProPac WCX-10) under the same gradient conditions at pH 5.6. The lower NaCl slope provides better resolution of minor peaks of MAb. YMC-BioPro SP-F can achieve the higher resolution of MAb than the competitor column under any conditions.

BioPro Q75/S75

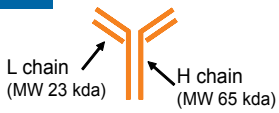
Capture purification by ion-exchange chromatography (IEX)

Two step purification of IgY to produce reference standard material from crude egg yolk extract*

Crude extract from egg yolk containing IgY

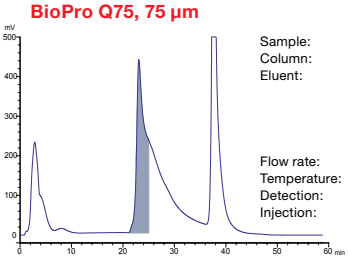
IgY (MW 170 kda)

Crude extract is the supernatant after precipitation of the lipids and lipoproteins from egg yolk.



Step 1: Capture purification by ion-exchange chromatography (IEX)

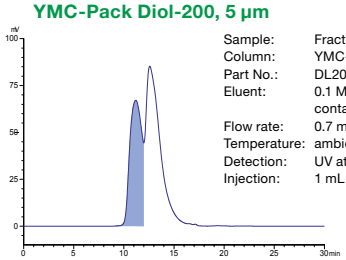
BioPro Q75, 75 µm



Sample:	Crude extract from egg yolk
Column:	YMC-BioPro Q75 (75 µm) 50 x 4.6 mm ID
Eluent:	A) 20 mM Tris-HCl (pH 8.1) B) 20 mM Tris-HCl (pH 8.1) containing 0.5 M NaCl 10% B (0-15 min), 30% B (15-30 min), 90% B (30-40 min)
Flow rate:	0.5 mL/min (180 cm/hr)
Temperature:	ambient
Detection:	UV at 280 nm
Injection:	1 mL (approx. 20 mg protein)

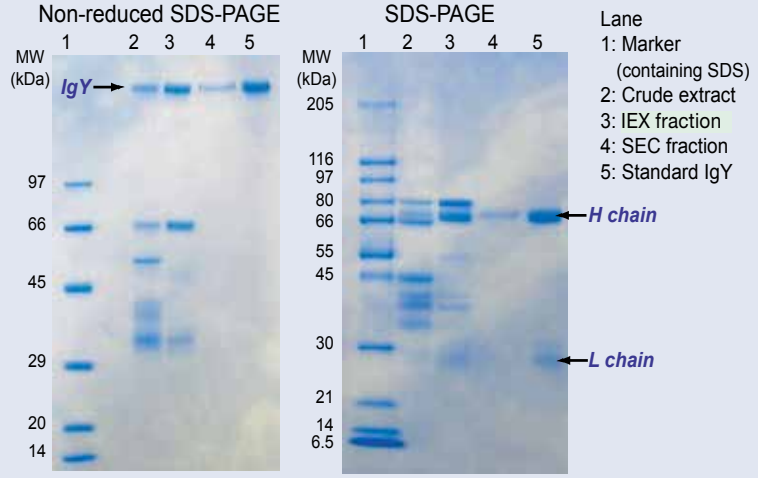
Step 2: Final purification by size-exclusion chromatography (SEC)

YMC-Pack Diol-200, 5 µm

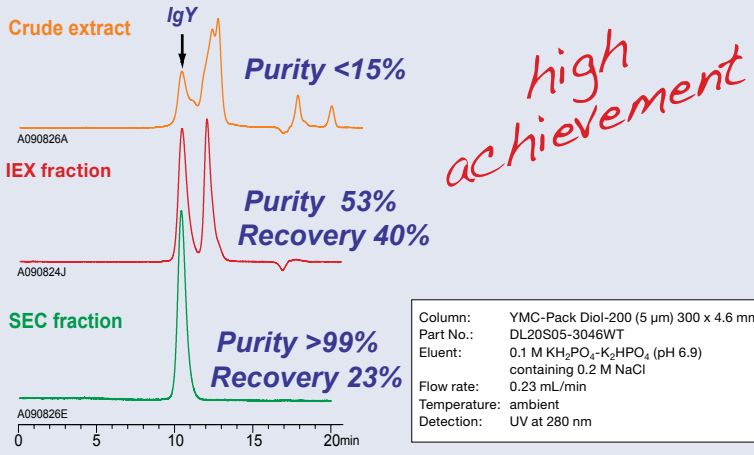


Sample:	Fraction from capture purification by IEC
Column:	YMC-Pack Diol-200 (5 µm) 300 x 8.0 mm ID
Part No.:	DL20S05-3008WT
Eluent:	0.1 M KH_2PO_4-K_2HPO_4 (pH 6.9) containing 0.2 M NaCl
Flow rate:	0.7 mL/min (84 cm/hr)
Temperature:	ambient
Detection:	UV at 280 nm
Injection:	1 mL (approx. 0.45 mg IgY)

SDS-PAGE analysis of crude and purified fraction



SEC analysis of crude and purified fraction



high achievement

Column:	YMC-Pack Diol-200 (5 µm) 300 x 4.6 mm ID
Part No.:	DL20S05-3046WT
Eluent:	0.1 M KH_2PO_4-K_2HPO_4 (pH 6.9) containing 0.2 M NaCl
Flow rate:	0.23 mL/min
Temperature:	ambient
Detection:	UV at 280 nm

* Application data by courtesy YMC Co., Ltd.

Preparative Screening Kits

The YMC-BioPro Ion Exchange Screening Kits consist of columns that are packed with resins designed for the separation of proteins, nucleotides, and other biomolecules. The various types of kit offer significant advantages and efficiencies for resin screening and purification method development.

Laboratory scale column sizes

1 mL Type (26 x 7.0 mm ID)

- Resin screening
- Purification method development

5 mL Type (26 x 15.6 mm ID)

- Purification method development
- Loadability studies

Specification

	Strong Anion Exchanger BioPro (SmartSep) Q	Strong Cation Exchanger BioPro (SmartSep) S	Weak Anion Exchanger BioPro DA	Weak Cation Exchanger BioPro CM
Matrix	Porous hydrophilic polymer		Porous methacrylate polymer	
Particle size (µm)	30, 75	30, 75	60	60
Ion exchanger	$-CH_2N^+(CH_3)_3$	$-CH_2CH_2CH_2CH_2SO_3^-$	$-R-N(CH_3)_2$	-R-COOH
pH range	2 - 12	2 - 12	Regular use: 3 - 12 Short term: 1 - 13	Regular use: 3 - 12 Short term: 1 - 13

Ordering information

3 µm analytical columns

Phase	Column ID [mm]	Column length [mm]		
		30	50	100
YMC-BioPro QA-F	4.6	QF00S03-0346WP	QF00S03-0546WP	QF00S03-1046WP
YMC-BioPro SP-F	4.6	SF00S03-0346WP	SF00S03-0546WP	SF00S03-1046WP

5 µm analytical columns

Phase	Column ID [mm]	Column length [mm]		
		30	50	100
YMC-BioPro QA	4.6	—	QAA0S05-0546WP	QAA0S05-1046WP
YMC-BioPro SP	4.6	—	SPA0S05-0546WP	SPA0S05-1046WP
YMC-BioPro QA-F	4.6	QF00S05-0346WP	QF00S05-0546WP	QF00S05-1046WP
YMC-BioPro SP-F	4.6	SF00S05-0346WP	SF00S05-0546WP	SF00S05-1046WP

Other dimensions on demand

Bulk media, strong exchangers

Phase	Particle Size	Part No.
BioPro SmartSep Q10	10 µm	QSA0S10
BioPro SmartSep S10	10 µm	SSA0S10
BioPro SmartSep Q20	20 µm	QSA0S20
BioPro SmartSep S20	20 µm	SSA0S20
BioPro SmartSep Q30	30 µm	QSA0S30
BioPro SmartSep S30	30 µm	SSA0S30
BioPro Q75	75 µm	QAA0S75
BioPro S75	75 µm	SPA0S75

Conventional YMC-BioPro Q10/S10 (QAA0S10/SPA0S10) and Q30/S30 (QAA0S30/SPA0S30) available on request.

Bulk media, weak exchangers

Phase	Particle Size	Part No.
BioPro DA60	60 µm	DAM99S60
BioPro CM60	60 µm	CMM9960

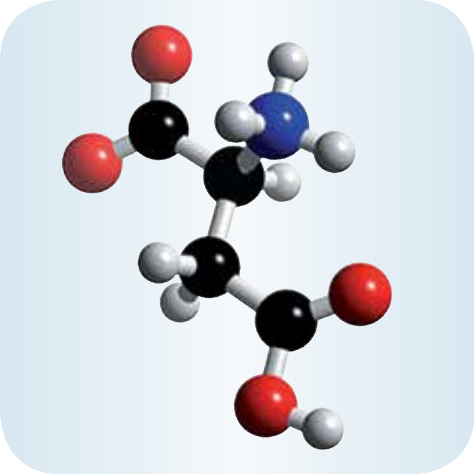
For further information about YMC-BioPro bulk media please refer to page 350-353.

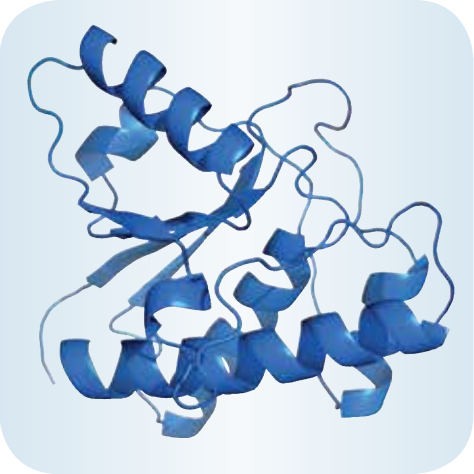
* Application data by courtesy YMC Co., Ltd.

Ordering information

Preparative Screening Kits

Product name	Particle Size	Specification	Column volume	Product number
Ion Exchange Selection Kit (BioPro Q75/S75/DA60/CM60)	75 µm / 60 µm	1 each of 4 phases	1 mL	BPIESKS99-01PK
BioPro Q75	75 µm	pack of 5	1 mL 5 mL	BPQAA0S75-01PK BPQAA0S75-05PK
BioPro SmartSep Q30	30 µm	pack of 5	1 mL 5 mL	BPQSA0S30-01PK BPQSA0S30-05PK
BioPro S75	75 µm	pack of 5	1 mL 5 mL	BPSPA0S75-01PK BPSPA0S75-05PK
BioPro SmartSep S30	30 µm	pack of 5	1 mL 5 mL	BPSSA0S30-01PK BPSSA0S30-05PK
BioPro DA60	60 µm	pack of 5	1 mL 5 mL	BPDAM99S60-01PK BPDAM99S60-05PK
BioPro CM60	60 µm	pack of 5	1 mL 5 mL	BPCMM99S60-01PK BPCMM99S60-05PK





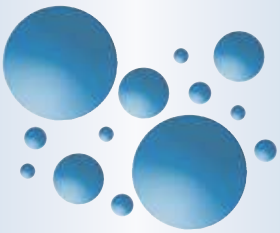
SEC

YMC-Pack Diol

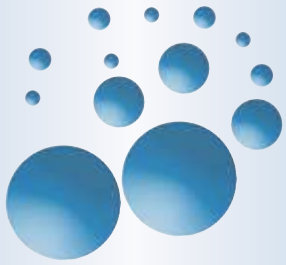
What is special about YMC SEC columns?

- **applicable to proteins, peptides, carbohydrates and nucleic acid components**
- **2 µm for UHPLC**
- **scalability from 2 or 3 µm to 20 µm**
- **reproducibility with minimal secondary interactions**
- **cost-efficiency**

YMC-Pack Diol	Diol-60 for peptides and small proteins	Diol-120 for intermediate proteins	Diol-200 for large proteins	Diol-300 for very large proteins
Particle Size / µm	3; 5	3; 5	2; 3; 5	2; 3; 5
Pore Size / nm	6	12	20	30
Surface area / m^2g^{-1}	450	330	175	100
Recommended pH range	5.0 - 7.5	5.0 - 7.5	5.0 - 7.5	5.0 - 7.5



1. Injection



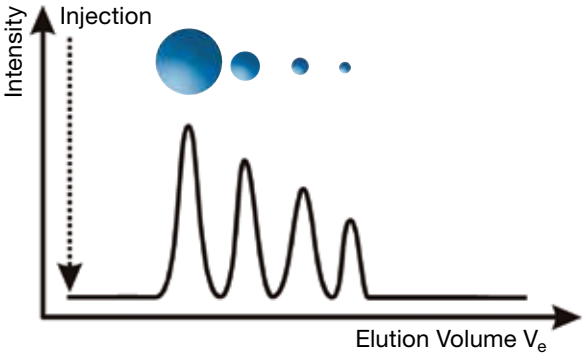
2. Separation

3. Elution of Fraction

Principles of separation

Molecules with shapes such as rigid rods, random chains and spheres but with the same molecular weight behave differently in SEC. The principle of separation is based on differences in the hydrodynamic radius of the molecules in solution.
Molecules with a larger radius elute earlier and those with the smallest radius are retained longer.

The separation limit is such that only those compounds which differ by more than 10% in MW can be separated by SEC.



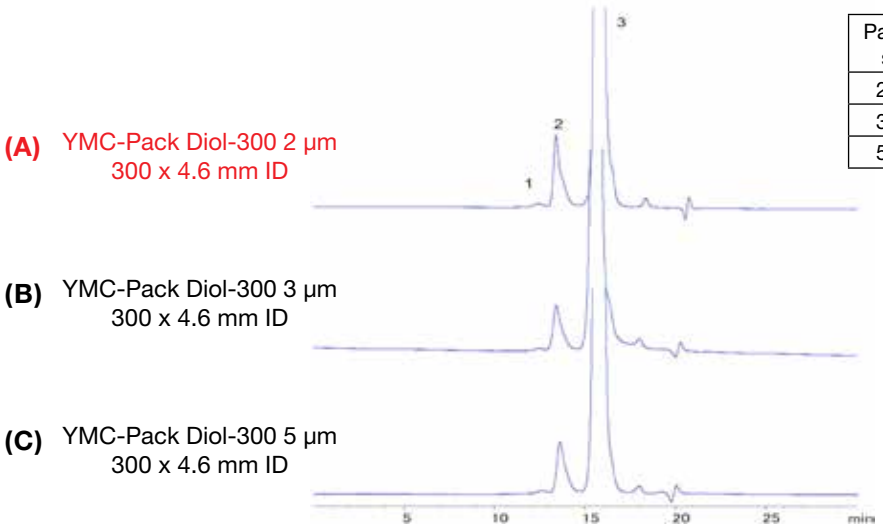
small molecules = long retention time
bigger molecules = short retention time

Large molecules exit the column more rapidly as they cannot permeate the porous structure of stationary phase. Smaller ones with the lowest hydrodynamic volume elute with longer retention times because they are able to penetrate some or all of the pores of the stationary phase. Molecules of intermediate size elute in an intermediate position.

YMC-Pack Diol UHPLC

Benefits of using smaller particles

Higher resolution for analysis of monoclonal antibodies*



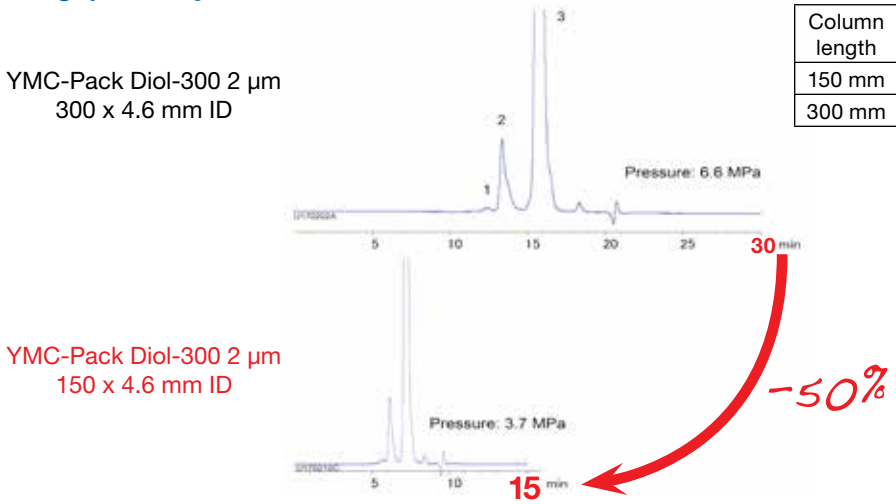
Particle size	Rs (1,2)	Rs (2,3)	N (3)
2 µm	1.17	4.15	16,200
3 µm	1.03	3.18	10,400
5 µm	0.88	2.67	**8,500**

Columns: YMC-Pack Diol-300, 300 x 4.6 mm ID
Part Nos.: (A) DL30S02-3046PTH
(B) DL30S03-3046WT
(C) DL30S05-3046WT
Eluent: 0.1 M KH_2PO_4-K_2HPO_4 (pH 7.0) containing 0.2 M NaCl
Flow rate: 0.2 mL/min
Temperature: ambient
Detection: UV at 280 nm
Sample: Humanised monoclonal antibody

All three particle sizes show identical separation patterns for monoclonal antibody analysis. This allows easy method transfer between HPLC and UHPLC. A method developed using conventional HPLC can be directly transferred to UHPLC using a 2 µm YMC-Pack Diol column.

YMC-Pack Diol UHPLC columns greatly improve the resolution between aggregates and the monomer peak. Furthermore, a shoulder peak which elutes after the monomer peak can partially be separated using the 2 µm column.

High throughput analysis of monoclonal antibodies*



Column length	Rs (1,2)	Rs (2,3)	N (3)
150 mm	0.85	2.75	8,700
300 mm	1.17	4.15	16,200

Columns: YMC-Pack Diol-300, 150 or 300 x 4.6 mm ID
Part Nos.: DL30S02-3046PTH / DL30S02-1546PTH
Eluent: 0.1 M KH_2PO_4-K_2HPO_4 (pH 7.0) containing 0.2 M NaCl
Flow rate: 0.2 mL/min
Temperature: ambient
Detection: UV at 280 nm
Sample: Humanised monoclonal antibody

By using a 150 mm length column, 50% shorter run time can be achieved with the same resolution as for a 5 µm 300 mm length column. Doubling the throughput can be achieved.

The backpressure was only 6.6 MPa even for the 300 mm column. Therefore, YMC-Pack Diol 2 µm columns can be used with both UHPLC and HPLC.

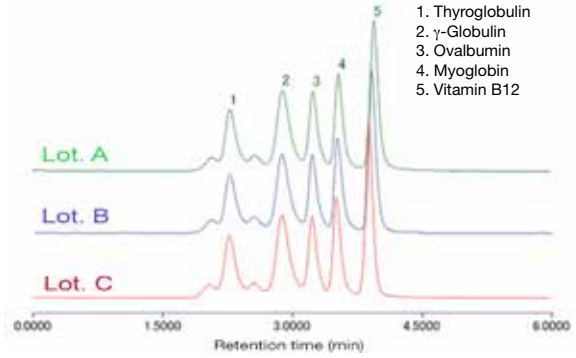
* Application data by courtesy YMC Co., Ltd.

YMC-Pack Diol UHPLC

Reproducibility and stability data

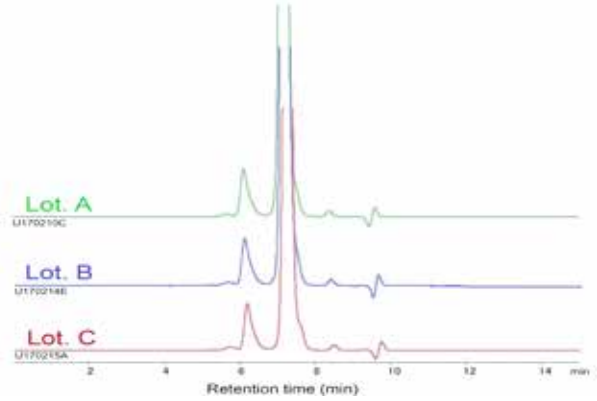
Excellent batch to batch reproducibility*

Standard proteins



Column:	YMC-Pack Diol-300 (2 µm) 150 x 4.6 mm ID
Part No.:	DL30S02-1546PTH
Eluent:	0.1 M NaH_2PO_4-Na_2HPO_4 (pH 7.0) containing 0.2 M NaCl
Flow rate:	0.5 mL/min
Temperature:	ambient
Detection:	UV at 280 nm
Sample:	Standard proteins

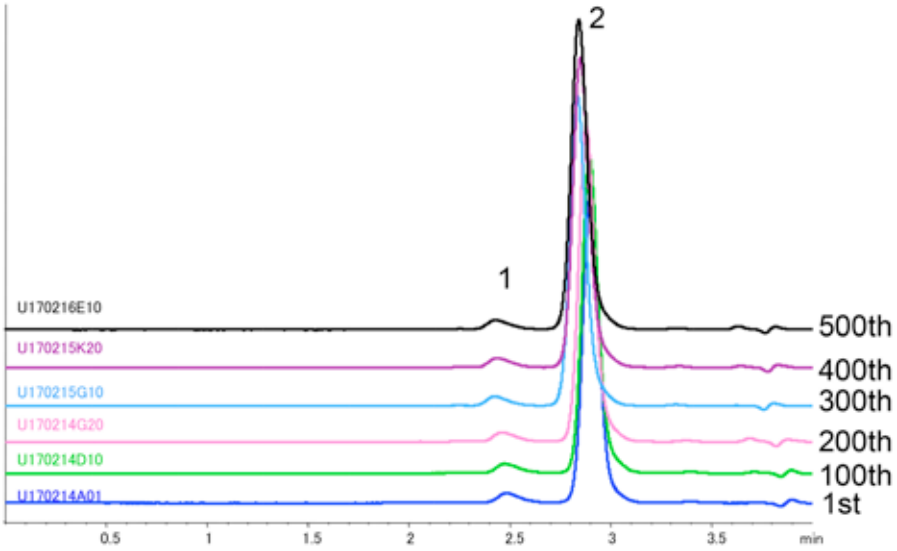
Humanised monoclonal antibody



Column:	YMC-Pack Diol-300 (2 µm) 150 x 4.6 mm ID
Part No.:	DL30S02-1546PTH
Eluent:	0.1 M KH_2PO_4-K_2HPO_4 (pH 7.0) containing 0.2 M NaCl
Flow rate:	0.2 mL/min
Temperature:	25°C
Detection:	UV at 280 nm
Sample:	Humanised monoclonal antibody

YMC-Pack Diol UHPLC columns have excellent batch-to-batch reproducibility. This makes YMC-Pack Diol 2 µm columns the ideal choice for the quality control of bio-based drugs including monoclonal antibodies.

Long-term stability*



Column:	YMC-Pack Diol-300, 2 µm, 150 x 4.6 mm ID
Part No.:	DL30S02-1546PTH
Eluent:	0.1 M KH_2PO_4-K_2HPO_4 (pH 7.0) containing 0.2 M NaCl
Flow rate:	0.5 mL/min
Temperature:	25°C
Detection:	UV at 280 nm
Sample:	Humanised monoclonal antibody

YMC-Pack Diol UHPLC columns maintain their performance for more than 500 injections of sample during monoclonal antibody analysis. This ensures reproducible and reliable quality control of bio-based drugs including monoclonal antibodies.

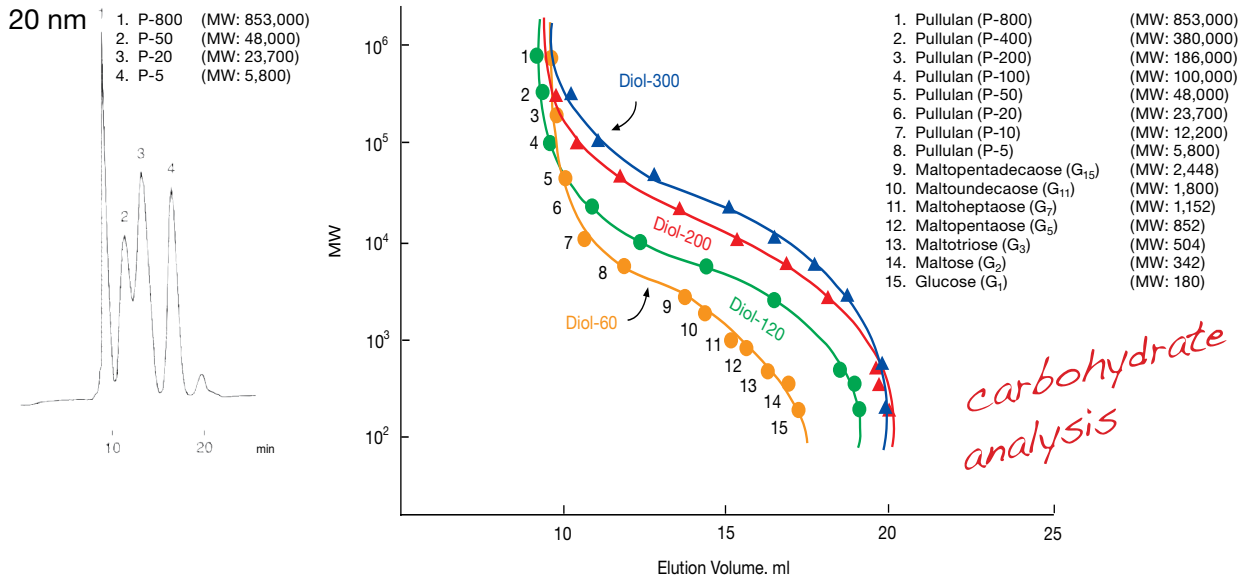
YMC-Pack Diol

Column Selection Tool

YMC-Pack Diol-60	**for MW < 10,000**
YMC-Pack Diol-120	**for MW 5,000 to 100,000**
YMC-Pack Diol-200	**for MW 5,000 to 300,000**
YMC-Pack Diol-300	**for MW 20,000 to 1,000,000**

SEC Applications for YMC-Pack Diol*

For molecular weight determination of oligosaccharides and polysaccharides



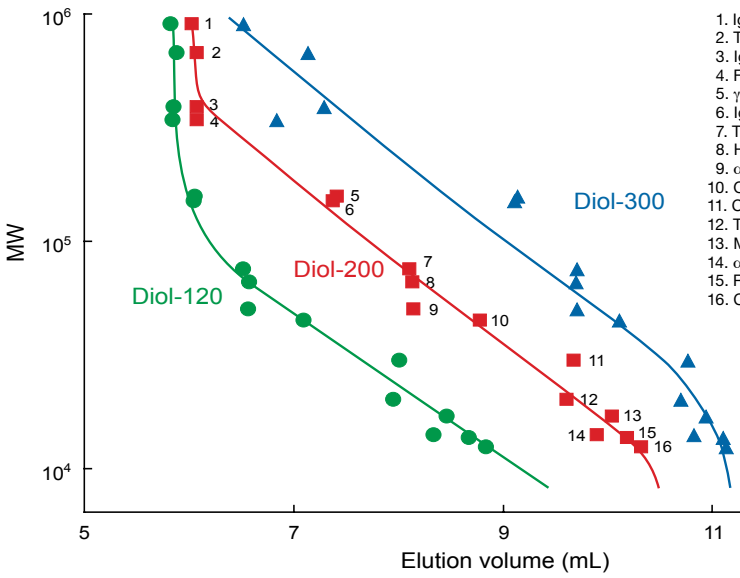
Column: YMC-Pack Diol (20 nm) 500 x 8.0 mm ID
Eluent: water
Flow rate: 1.0 mL/min
Temperature: ambient
Detection: RI

* Application data by courtesy YMC Co., Ltd.

YMC-Pack Diol

SEC Applications for YMC-Pack Diol*

For separation of proteins with molecular weights from 10.000 to several 100.000

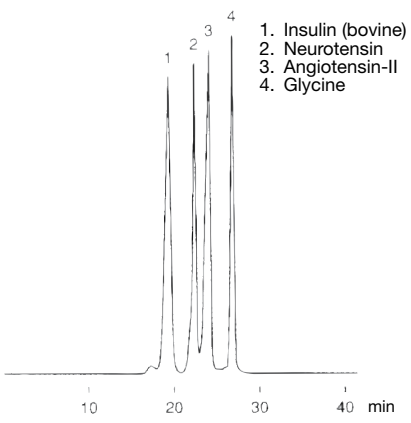


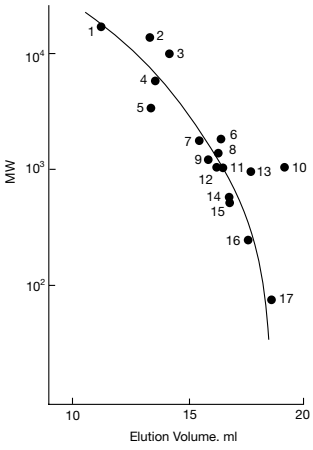
	MW
1. IgM	900,000
2. Thyroglobulin	670,000
3. IgA	390,000
4. Fibrinogen	340,000
5. γ-Globulin	158,000
6. IgG	150,000
7. Transferrin	75,000
8. HSA (human serum albumin)	66,000
9. α1-Antitrypsin	50,000
10. Ovalbumin	45,000
11. Carbonic anhydrase	30,000
12. Trypsin inhibitor	20,100
13. Myoglobin	17,000
14. α-Lactalbumin	14,100
15. Ribonuclease A	13,700
16. Cytochrome *c*	12,400

large pore size = large MW's

Column:	YMC-Pack Diol, 300 x 8.0 mm ID	Temperature:	25 °C
Eluent:	0.1 M KH_2PO_4-K_2HPO_4 (pH 7.0) containing 0.2 M NaCl	Detection:	UV at 280 nm
Flow rate:	0.5 mL/min		

For separation of proteins with molecular weights below 10.000





		(MW: 17,000)
1. Myoglobin		(MW: 17,000)
2. Ribonuclease A		(MW: 13,700)
3. Cytochrome *c*		(MW: 12,400)
4. Insulin (bovine)		(MW: 5,700)
5. Insulin B chain		(MW: 3,496)
6. α-Mating factor		(MW: 1,684)
7. Neurotensin		(MW: 1,672)
8. Angiotensin-I		(MW: 1,296)
9. CCK-octapeptide		(MW: 1,143)
10. Bradykinin		(MW: 1,060)
11. Angiotensin-II		(MW: 1,040)
12. Oxytocin		(MW: 1,007)
13. Angiotensin-III		(MW: 931)
14. Met-enkephalin		(MW: 573)
15. Leu-enkephalin		(MW: 555)
16. Tetraglycine		(MW: 246)
17. Glycine		(MW: 75)

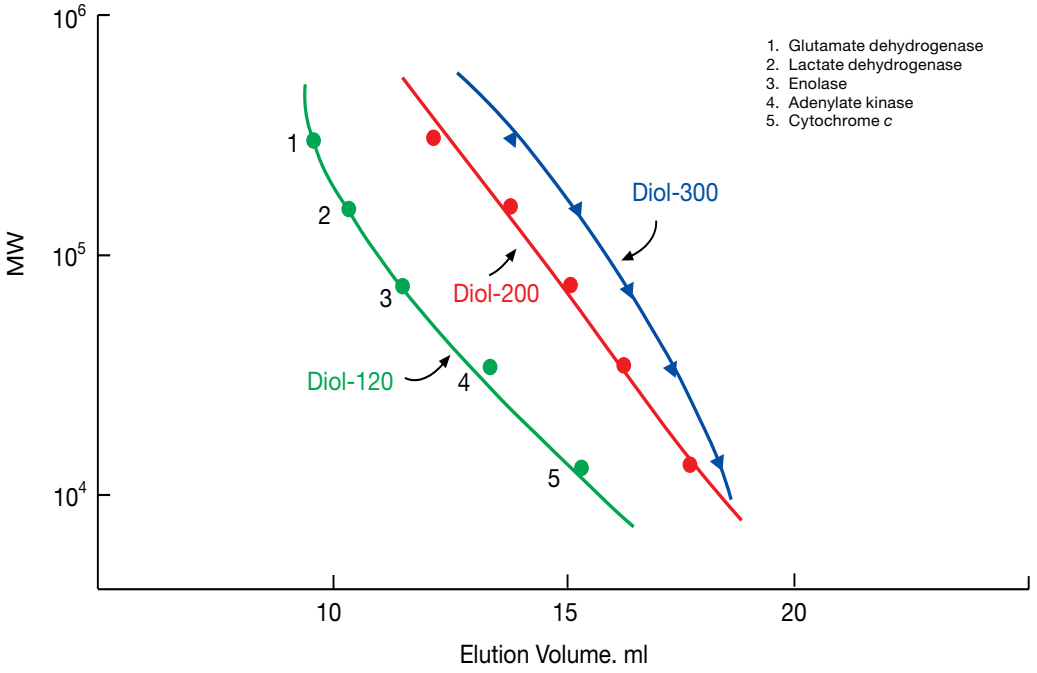
small pore size = small MW's

Column:	YMC-Pack Diol (6 nm) 500 x 8.0 mm ID	Flow rate:	0.7 mL/min
Part No.:	DL06S05-5008WT	Temperature:	ambient
Eluent:	0.1 M KH_2PO_4-K_2HPO_4 (pH 7) containing 0.2 M NaCl / acetonitrile (70/30)	Detection:	UV at 215 nm

YMC-Pack Diol

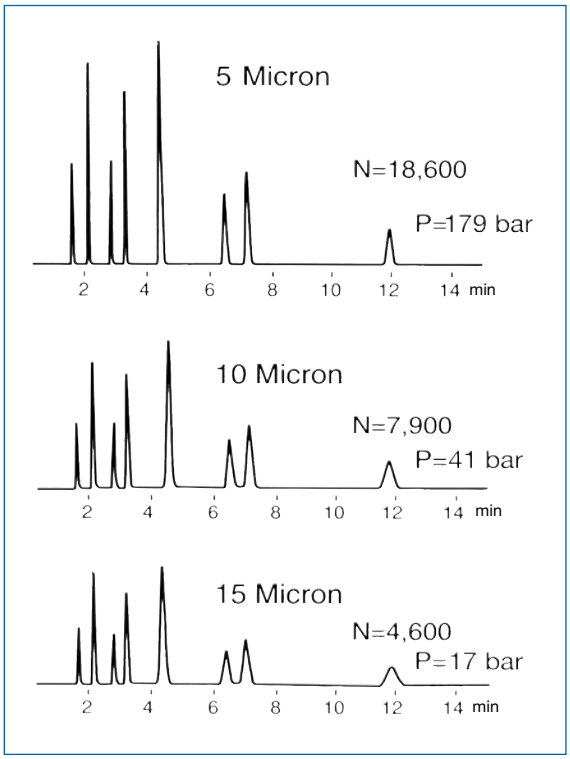
High flexibility

Proteins and Peptides*



Column:	YMC-Pack Diol, 500 x 8.0 mm ID
Part No.:	DL20S05-5008WT
Eluent:	0.1M KH_2PO_4-K_2HPO_4 (pH 7.0) containing 0.2M NaCl
Flow rate:	0.7 mL/min
Temperature:	ambient
Detection:	UV at 280 nm

Scalability



YMC guarantees a seamless, reproducible scale up through all particle sizes for all stationary phases

For further information about Diol bulk media please refer to page 344-347.

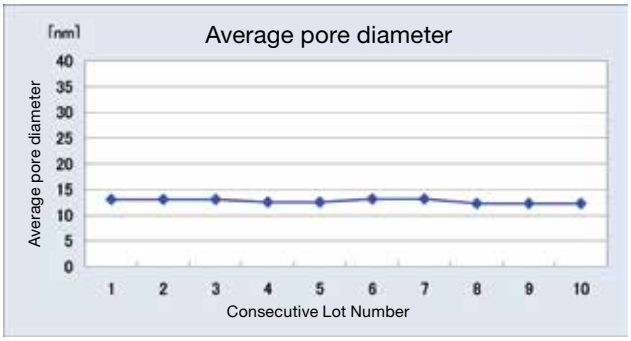
* Application data by courtesy YMC Co., Ltd.

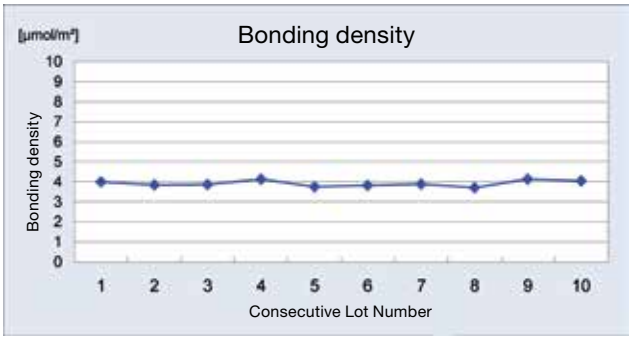
YMC-Pack Diol

Reproducibility

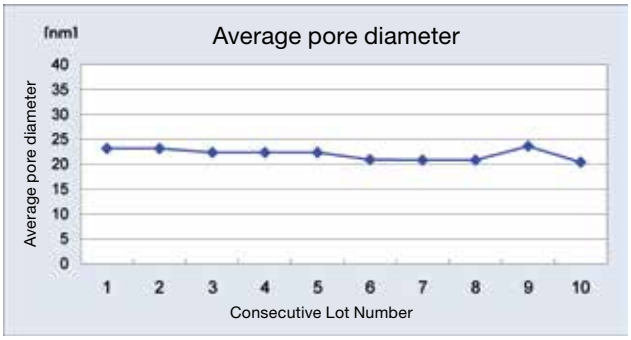
YMC-Pack Diol columns have the reputation, not only for their high versatility and excellent cost/performance ratio, but also for their high degree of lot-to-lot reproducibility.

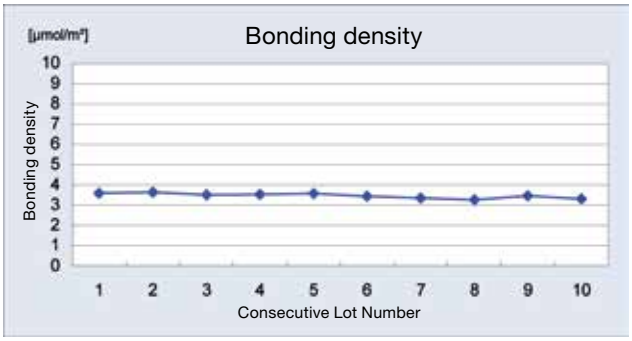
YMC-Pack Diol-120*



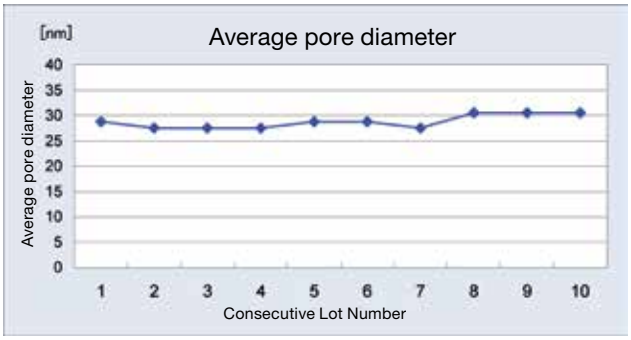


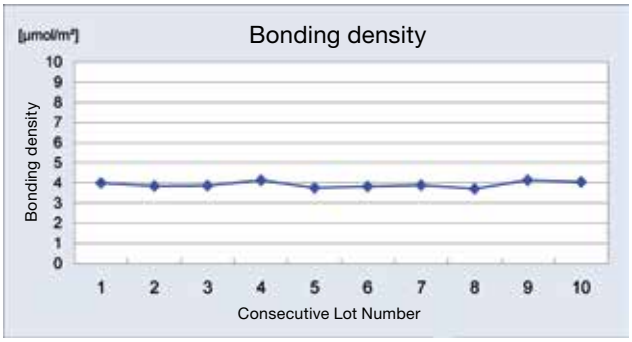
YMC-Pack Diol-200*





YMC-Pack Diol-300*

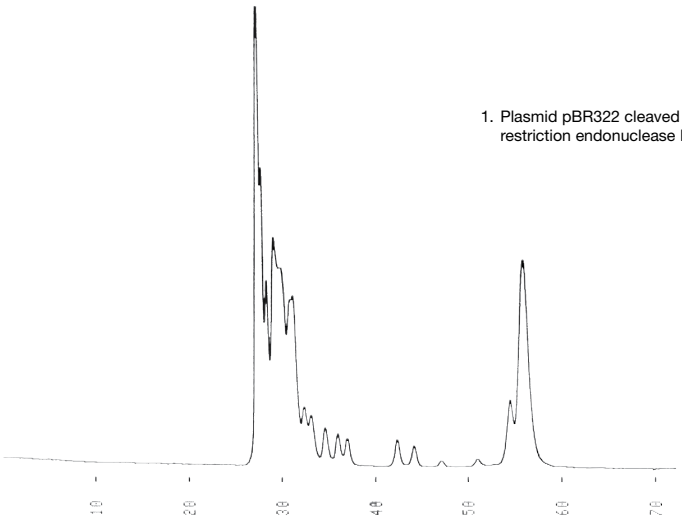




YMC-Pack Diol

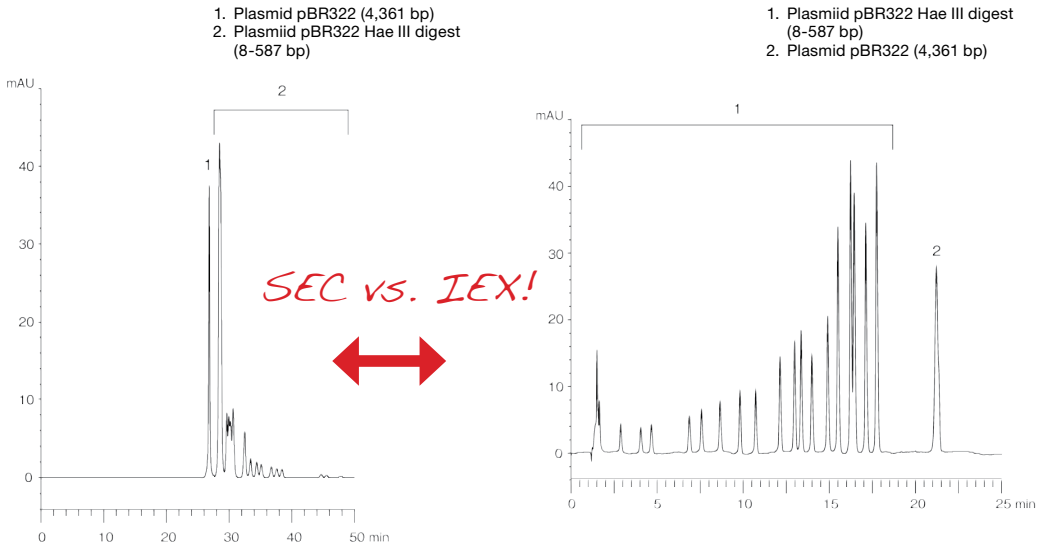
SEC Applications for YMC-Pack Diol*

Plasmid pBR322 restriction fragment



Column:	YMC-Pack Diol-300 + Diol-200, 500 x 8.0 mm ID x 2	Temperature:	ambient (26 °C)
Part Nos.:	DL30S05-5008WT + DL20S05-5008WT	Detection:	UV at 260 nm, 0.01 AUFS
Eluent:	0.1M KH_2PO_4-K_2HPO_4 (pH 7.0) containing 0.2M NaCl	Injection:	3 µL (0.49 mg/mL)
Flow rate:	0.7 mL/min	Sample:	Plasmid pBR322 cleaved with restriction endonuclease Msp I

Plasmid pBR322 restriction and pBR322 Hae III restriction fragment



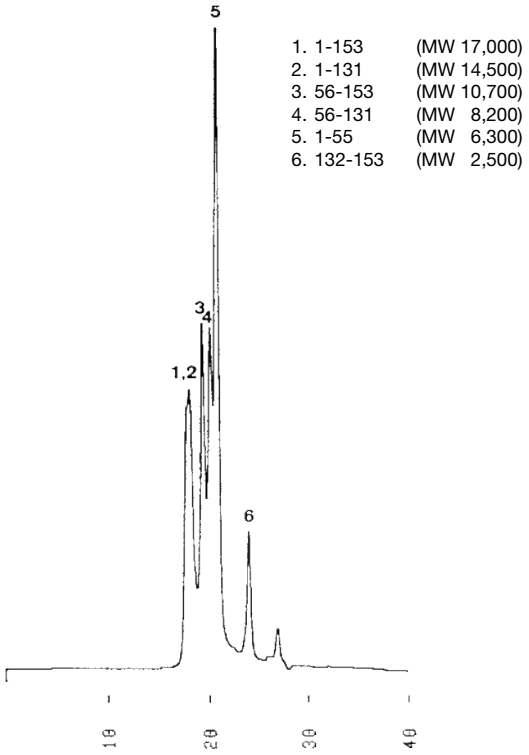
Columns:	YMC-Pack Diol-300 + Diol-200, 500 x 8.0 mm ID x 2	Column:	YMC-BioPro QA-F (5 µm), 100 x 4.6 mm ID
Part Nos.:	DL30S05-5008WT DL20S05-5008WT	Part No.:	QF00S05-1046WP
Eluent:	0.1 M KH_2PO_4-K_2HPO_4 (pH 7.0) containing 0.2 M NaCl	Eluent:	A) 20 mM Tris-HCl (pH 8.1) B) 20 mM Tris-HCl (pH 8.1) containing 0.1 M NaCl
Flow rate:	0.7 mL/min	Gradient:	70-85% B (0-20 min), 85% B (20-25 min)
Temperature:	ambient (25 °C)	Flow rate:	0.5 mL/min
Detection:	UV at 260 nm	Temperature:	35 °C
Injection:	10 µL	Detection:	UV at 260 nm
		Injection:	10 µL

* Application data by courtesy YMC Co., Ltd.

YMC-Pack Diol

SEC Applications for YMC-Pack Diol*

Peptide fragments from myoglobin

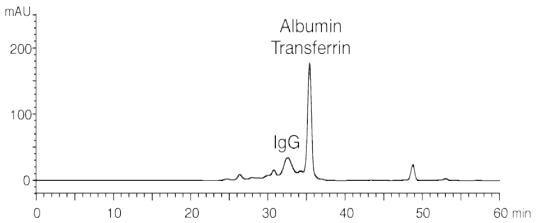


1. 1-153 (MW 17,000)
2. 1-131 (MW 14,500)
3. 56-153 (MW 10,700)
4. 56-131 (MW 8,200)
5. 1-55 (MW 6,300)
6. 132-153 (MW 2,500)

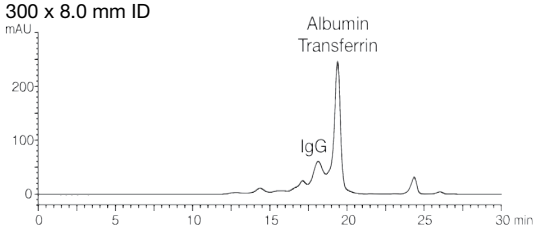
Column: YMC-Pack Diol-120, 500 x 8.0 mm ID
Part No.: DL12S05-5008WT
Eluent: 0.1 M KH_2PO_4-K_2HPO_4 (pH 7.0) containing 0.2 M NaCl/acetonitrile (70/30)
Flow rate: 0.7 mL/min
Temperature: ambient (25 °C)
Detection: UV at 215 nm, 0.32 AUFS
Injection: 20 µL (2.0 mg/mL)
Sample: Cyanogen bromide cleavages of horse heart myoglobin. Molecular Weight Marker for proteins, manufactured by Fluka Chemie AG.

Proteins in human serum

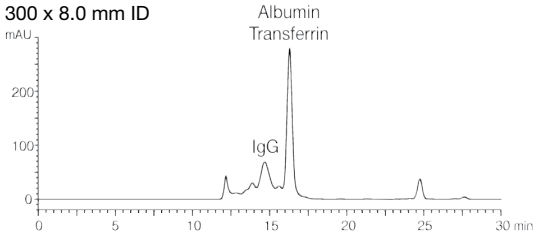
YMC-Pack Diol-300 + Diol-200
300 x 8.0 mm ID x 2



YMC-Pack Diol-300
300 x 8.0 mm ID

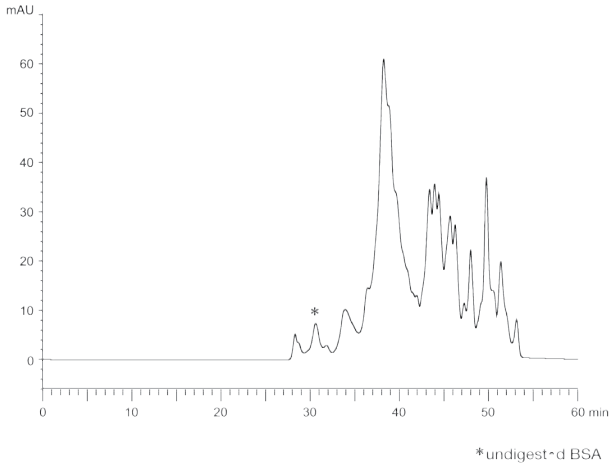


YMC-Pack Diol-200
300 x 8.0 mm ID



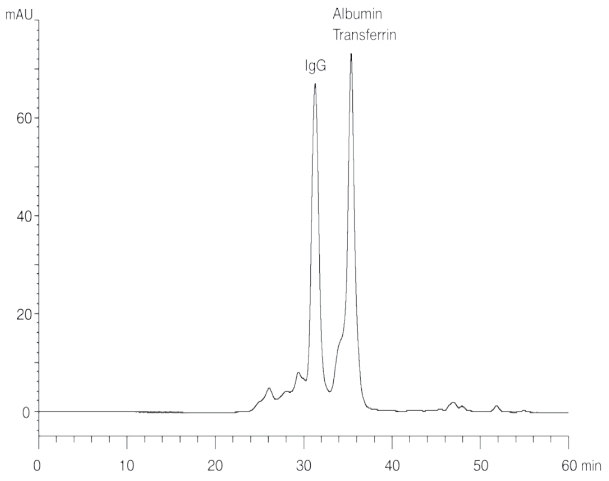
Eluent: 0.1 M KH_2PO_4-K_2HPO_4 (pH 7.0) containing 0.2 M NaCl
Flow rate: 0.5 mL/min
Temperature: ambient (25 °C)
Detection: UV at 280 nm
Injection: 20 µL
Sample: Human serum (100 µL/mL)

Peptide mapping



Columns: YMC-Pack Diol-120 + Diol-60, 500 x 8.0 mm ID x 2
Part Nos.: DL12S05-5008WT + DL06S05-5008WT
Eluent: 0.1 M KH_2PO_4-K_2HPO_4 (pH 7.0) containing 0.2 M NaCl/acetonitrile (70/30)
Flow rate: 0.7 mL/min
Temperature: ambient (25 °C)
Detection: UV at 220 nm
Injection: 5 µL
Sample: Tryptic digest of BSA

Proteins in mouse ascites fluid

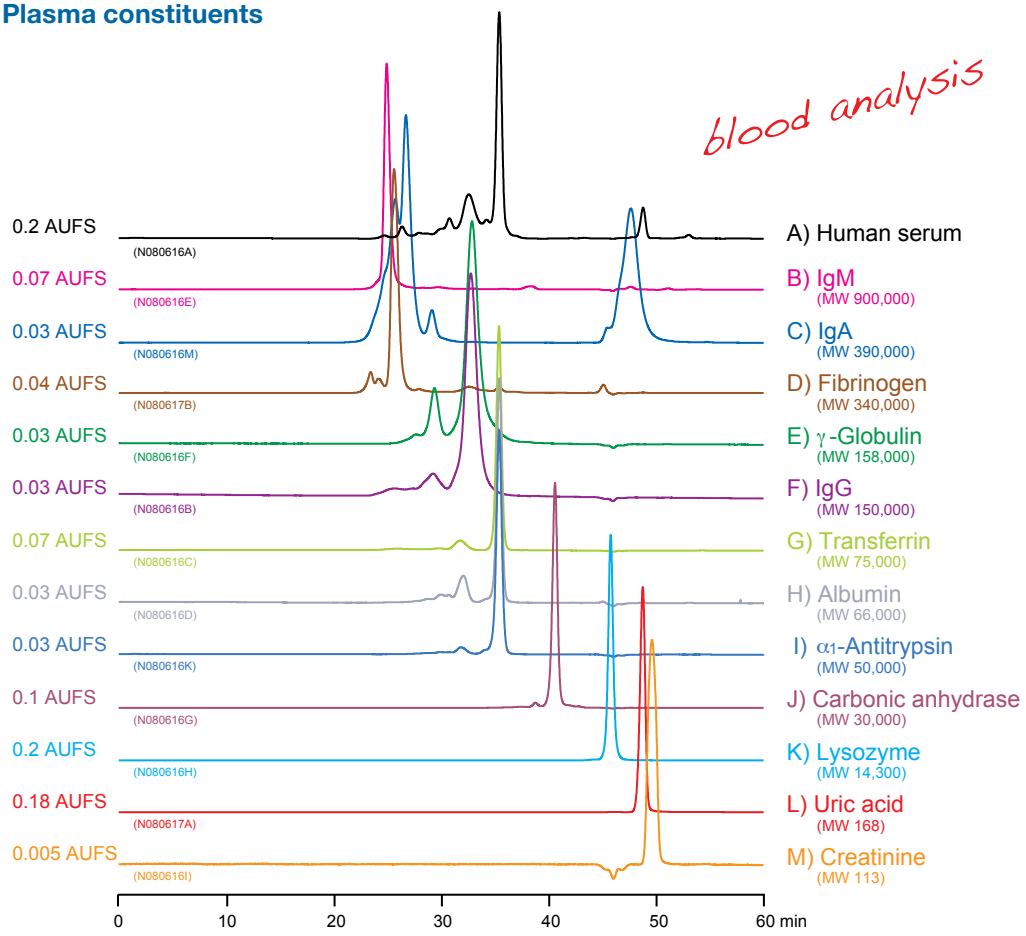


Columns: YMC-Pack Diol-300 + Diol-200, 300 x 4.6 mm ID x 2
Part Nos.: DL30S05-3046WT + DL20S05-3046WT
Eluent: 0.1 M KH_2PO_4-K_2HPO_4 (pH 7.0)
Flow rate: 0.17 mL/min
Temperature: ambient (25 °C)
Detection: UV at 220 nm
Injection: 10 µL (60 times dilution with water)

YMC-Pack Diol

SEC Applications for YMC-Pack Diol*

Plasma constituents



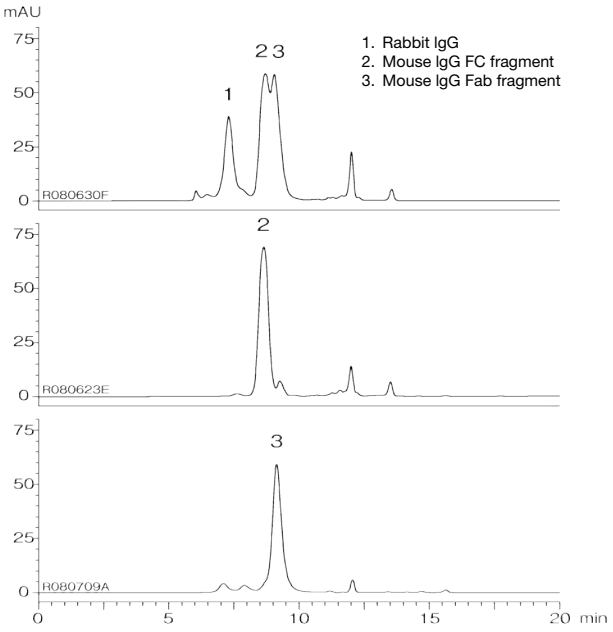
Columns:	YMC-Pack Diol-300 + Diol-200, 300 x 8.0 mm ID x 2	Temperature:	ambient (25 °C)
Part Nos.:	DL30S05-3008WT + DL20S05-3008WT	Detection:	UV at 280 nm
Eluent:	0.1 M $KH_2PO_4K_2HPO_4$ (pH 7.0) containing 0.2 M NaCl	Injection:	20 µL (L: 1 µL)
Flow rate:	0.5 mL/min	Sample:	A) 100 µL/mL; B-M) 1.0 mg/mL

* Application data by courtesy YMC Co., Ltd.

YMC-Pack Diol

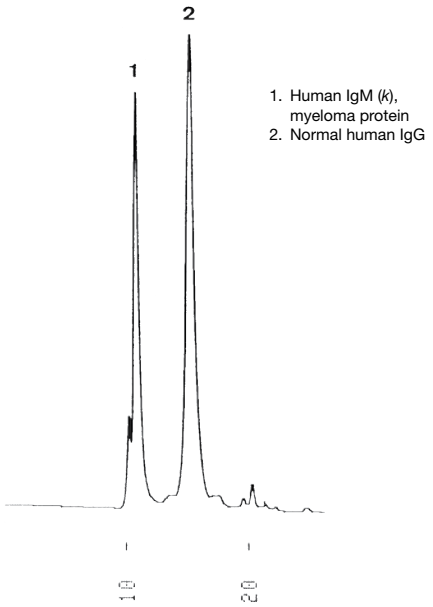
SEC Applications for YMC-Pack Diol*

IgG, Fab and Fc fragments



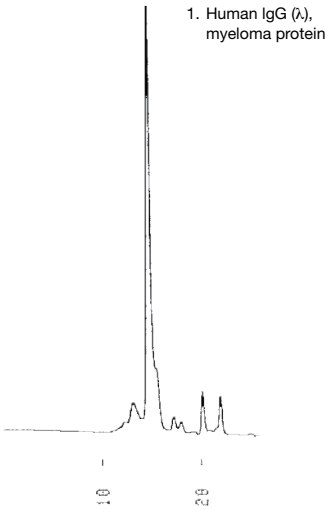
Column: YMC-Pack Diol-200, 300 x 8.0 mm ID
Part No.: DL20S05-3008WT
Eluent: 0.1 M KH_2PO_4-K_2HPO_4 (pH 6.9) containing 0.2 M NaCl
Flow rate: 1.0 mL/min
Temperature: ambient (27 °C)
Detection: UV at 220 nm
Injection: 5 µL (0.4, 0.5 mg/mL)

Human Immunglobulin



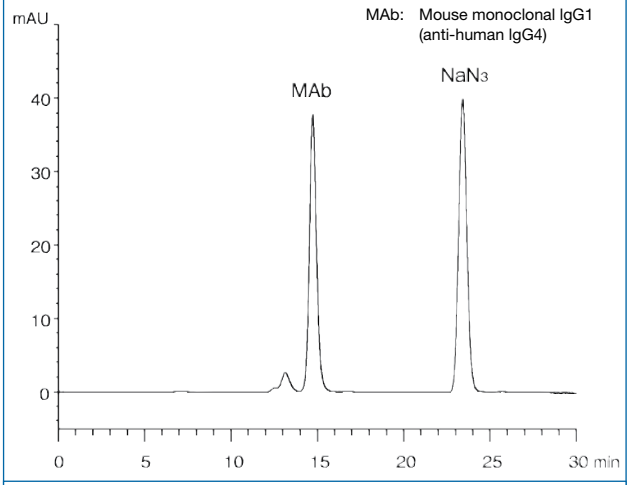
Column: YMC-Pack Diol-300, 500 x 8.0 mm ID
Part No.: DL30S05-5008WT
Eluent: 0.1 M NaH_2PO_4-Na_2HPO_4 (pH 6.8) containing 0.1 M Na_2SO_4
Flow rate: 1.0 mL/min
Temperature: ambient (24 °C)
Detection: UV at 280 nm, 0.04 AUFS
Injection: 40 µL (0.5 mg/mL)

Human IgG (λ), myeloma protein



Columns: YMC-Pack Diol-300 + Diol-200, 500 x 8.0 mm ID x 2
Part Nos.: DL30S05-5008WT + DL20S05-5008WT
Eluent: 0.1 M KH_2PO_4-K_2HPO_4 (pH 7.0) containing 0.2 M NaCl
Flow rate: 0.7 mL/min
Temperature: ambient (25 °C)
Detection: UV at 260 nm
Injection: 10 µL

Monoclonal antibody (MAb)



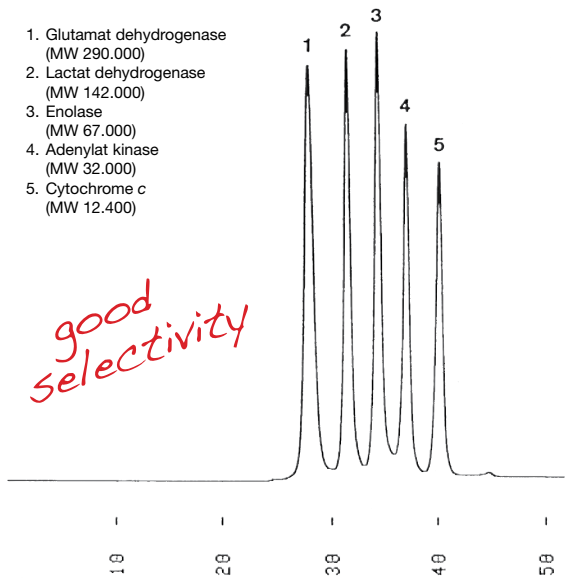
Column: YMC-Pack Diol-200, 300 x 4.6 mm ID
Part No.: DL20S05-3046WT
Eluent: 0.1 M KH_2PO_4-K_2HPO_4 (pH 7.0)
Flow rate: 0.17 mL/min
Temperature: ambient (25 °C)
Detection: UV at 220 nm
Injection: 10 µL
Sample: a commercially available mouse monoclonal IgG1 (0.05 mg/mL) (purified by DEAE chromatography, containing NaN_3)

YMC-Pack Diol

SEC Applications for YMC-Pack Diol*

Proteins for molecular weight markers

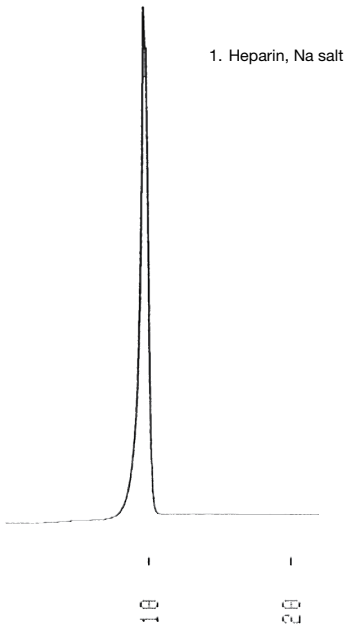
1. Glutamat dehydrogenase (MW 290.000)
2. Lactat dehydrogenase (MW 142.000)
3. Enolase (MW 67.000)
4. Adenylat kinase (MW 32.000)
5. Cytochrome *c* (MW 12.400)



Columns:	YMC-Pack Diol-200, 500 x 8.0 mm ID + 300 x 8.0 mm ID
Part Nos.:	DL20S05-5008WT + DL20S05-3008WT
Eluent:	0.1M KH_2PO_4-K_2HPO_4 (pH 7.0) containing 0.2M NaCl
Flow rate:	0.7 mL/min
Temperature:	ambient (26 °C)
Detection:	UV at 280 nm, 0.08 AUFS
Injection:	15 µL (100 µL/1 vial)
Sample:	MW-Marker (HPLC) manufactured by ORIENTAL YEAST CO., LTD.

Heparin

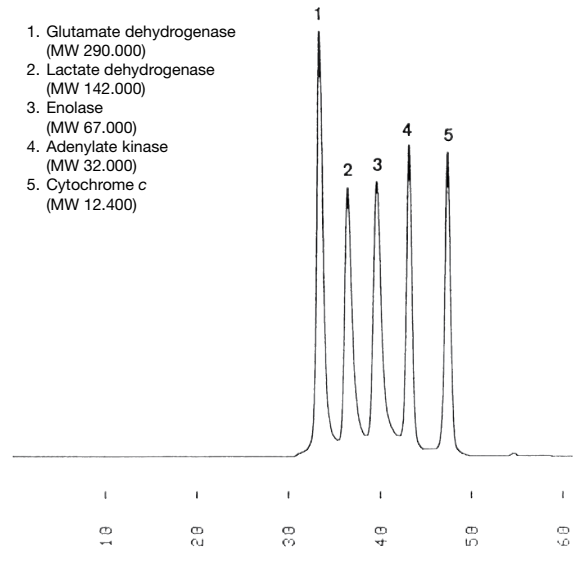
1. Heparin, Na salt



Column:	YMC-Pack Diol-300, 500 x 8.0 mm ID
Part No.:	DL30S05-5008WT
Eluent:	water
Flow rate:	1.0 mL/min
Temperature:	ambient (24 °C)
Detection:	RI, 32 x 10^{-6} RIU/FS
Injection:	20 µL (5.0 mg/mL)

Proteins for molecular weight markers

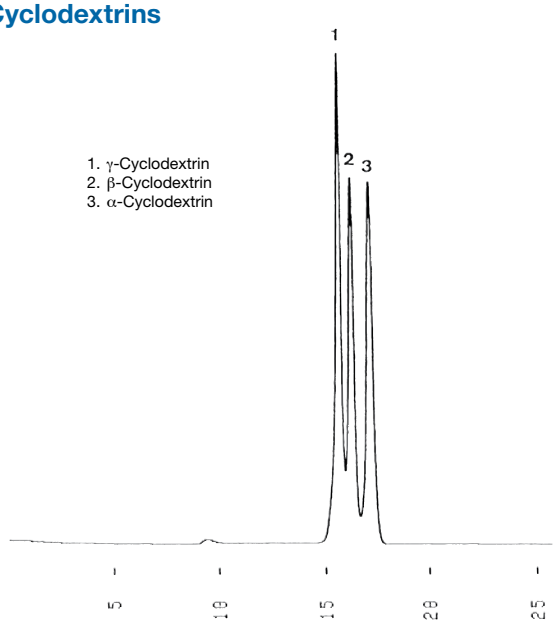
1. Glutamate dehydrogenase (MW 290.000)
2. Lactate dehydrogenase (MW 142.000)
3. Enolase (MW 67.000)
4. Adenylate kinase (MW 32.000)
5. Cytochrome *c* (MW 12.400)



Columns:	YMC-Pack Diol-120 + Diol-300, 500 x 8.0 mm ID x 2
Part Nos.:	DL12S05-5008WT + DL30S05-5008WT
Eluent:	0.1M KH_2PO_4-K_2HPO_4 (pH 7.0) containing 0.2M NaCl
Flow rate:	0.7 mL/min
Temperature:	ambient (26 °C)
Detection:	UV at 280 nm, 0.08 AUFS
Injection:	15 µL (100 µL/1 vial)
Sample:	MW-Marker (HPLC) manufactured by ORIENTAL YEAST CO., LTD.

Cyclodextrins

1. γ-Cyclodextrin
2. β-Cyclodextrin
3. α-Cyclodextrin



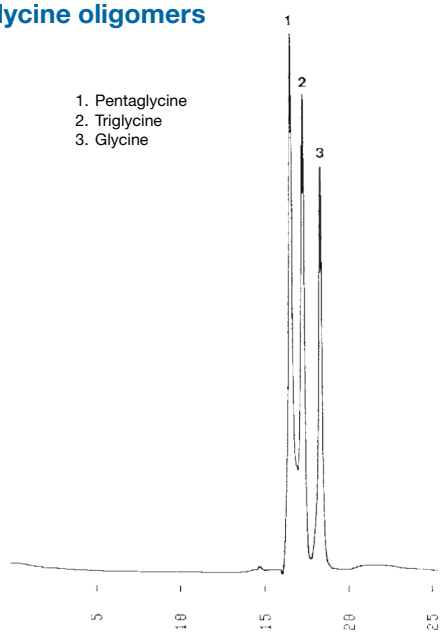
Column:	YMC-Pack Diol 60, 500 x 8.0 mm ID
Part No.:	DL06S05-5008WT
Eluent:	water
Flow rate:	1.0 mL/min
Temperature:	ambient (24 °C)
Detection:	RI 32 x 10-6 RIU/FS
Injection:	30 µL (1.67 mg/mL)

* Application data by courtesy YMC Co., Ltd.

YMC-Pack Diol

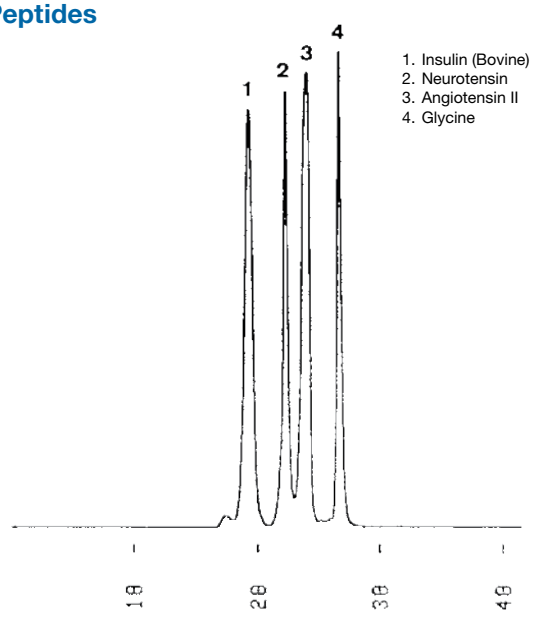
SEC Applications for YMC-Pack Diol*

Glycine oligomers



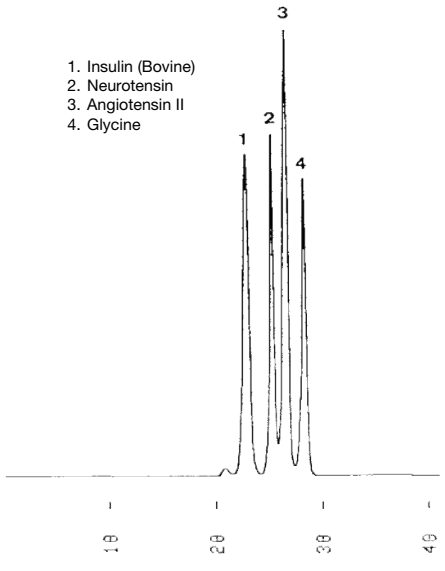
Column:	YMC-Pack Diol-60, 500 x 8.0 mm ID
Part No.:	DL06S05-5008WT
Eluent:	0.1M KH_2PO_4-K_2HPO_4 (pH 7.0) / acetonitrile (70/30)
Flow rate:	1.0 mL/min
Temperature:	ambient (24 °C)
Detection:	UV at 215 nm, 0.08 AUFS
Injection:	20 µL (0.25 ~ 2.5 mg/mL)

Peptides



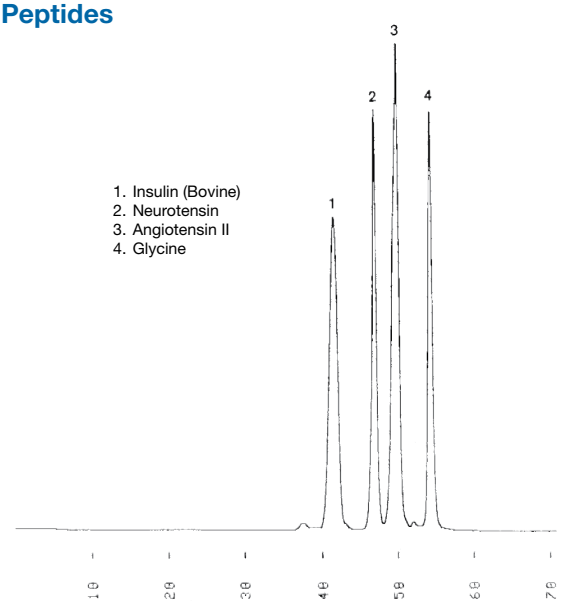
Column:	YMC-Pack Diol-60, 500 x 8.0 mm ID
Part No.:	DL06S05-5008WT
Eluent:	0.1M KH_2PO_4-K_2HPO_4 (pH 7.0) / containing 0.2 M NaCl / acetonitrile (70/30)
Flow rate:	0.7 mL/min
Temperature:	ambient (25 °C)
Detection:	UV at 215 nm, 0.16 AUFS
Injection:	25 µL (0.07 ~ 5.3 mg/mL)

Peptides



Column:	YMC-Pack Diol-120, 500 x 8.0 mm ID
Part No.:	DL12S05-5008WT
Eluent:	0.1M KH_2PO_4-K_2HPO_4 (pH 7.0) / containing 0.2 M NaCl / acetonitrile (70/30)
Flow rate:	0.7 mL/min
Temperature:	ambient (25 °C)
Detection:	UV at 215 nm, 0.16 AUFS
Injection:	25 µL (0.07 ~ 5.3 mg/mL)

Peptides



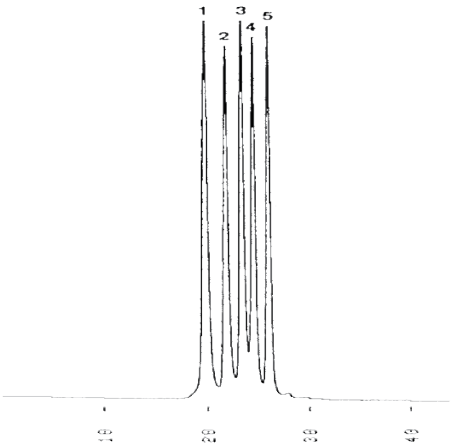
Columns:	YMC-Pack Diol-120 + 60, 500 x 8.0 mm ID x 2
Part Nos.:	DL12S05-5008WT + DL06S05-5008WT
Eluent:	0.1M KH_2PO_4-K_2HPO_4 (pH 7.0) / containing 0.2 M NaCl / acetonitrile (70/30)
Flow rate:	0.7 mL/min
Temperature:	ambient (25 °C)
Detection:	UV at 215 nm, 0.16 AUFS
Injection:	25 µL (0.07 ~ 5.3 mg/mL)

YMC-Pack Diol

SEC Applications for YMC-Pack Diol*

Proteins for molecular weight markers

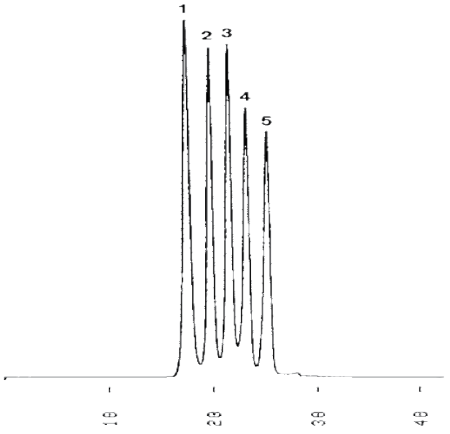
1. Glutamate dehydrogenase (MW 290,000)
2. Lactate dehydrogenase (MW 142,000)
3. Enolase (MW 67,000)
4. Adenylate kinase (MW 32,000)
5. Cytochrome c (MW 12,400)



Column:	YMC-Pack Diol-300, 500 x 8.0 mm ID
Part No.:	DL30S05-5008WT
Eluent:	0.1 M KH_2PO_4-K_2HPO_4 (pH 7.0) containing 0.2 M NaCl
Flow rate:	0.7 mL/min
Temperature:	ambient (26 °C)
Detection:	UV at 280 nm, 0.08 AUFS
Injection:	15 µL (100 µL / 1 vial)
Sample:	MW-Marker (HPLC), manufactured by ORIENTAL YEAST CO., LTD.

Proteins for molecular weight markers

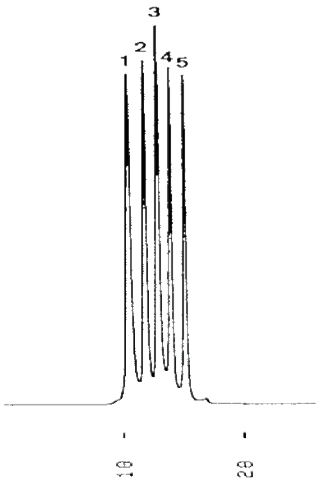
1. Glutamate dehydrogenase (MW 290,000)
2. Lactate dehydrogenase (MW 142,000)
3. Enolase (MW 67,000)
4. Adenylate kinase (MW 32,000)
5. Cytochrome c (MW 12,400)



Column:	YMC-Pack Diol-200, 500 x 8.0 mm ID
Part No.:	DL20S05-5008WT
Eluent:	0.1 M KH_2PO_4-K_2HPO_4 (pH 7.0) containing 0.2 M NaCl
Flow rate:	0.7 mL/min
Temperature:	ambient (26 °C)
Detection:	UV at 280 nm, 0.08 AUFS
Injection:	15 µL (100 µL / 1 vial)
Sample:	MW-Marker (HPLC), manufactured by ORIENTAL YEAST CO., LTD.

Proteins for molecular weight markers

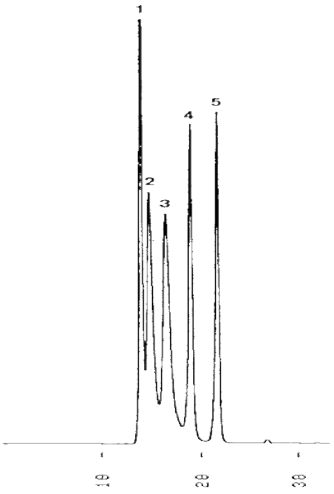
1. Glutamate dehydrogenase (MW 290,000)
2. Lactate dehydrogenase (MW 142,000)
3. Enolase (MW 67,000)
4. Adenylate kinase (MW 32,000)
5. Cytochrome c (MW 12,400)



Column:	YMC-Pack Diol-200, 300 x 8.0 mm ID
Part No.:	DL20S05-3008WT
Eluent:	0.1 M KH_2PO_4-K_2HPO_4 (pH 7.0) containing 0.2 M NaCl
Flow rate:	0.7 mL/min
Temperature:	ambient (26 °C)
Detection:	UV at 280 nm, 0.08 AUFS
Injection:	15 µL (100 µL / 1 vial)
Sample:	MW-Marker (HPLC), manufactured by ORIENTAL YEAST CO., LTD.

Proteins for molecular weight markers

1. Glutamate dehydrogenase (MW 290,000)
2. Lactate dehydrogenase (MW 142,000)
3. Enolase (MW 67,000)
4. Adenylate kinase (MW 32,000)
5. Cytochrome c (MW 12,400)



Column:	YMC-Pack Diol-120, 500 x 8.0 mm ID
Part No.:	DL12S05-5008WT
Eluent:	0.1 M KH_2PO_4-K_2HPO_4 (pH 7.0) containing 0.2 M NaCl
Flow rate:	0.7 mL/min
Temperature:	ambient (26 °C)
Detection:	UV at 280 nm, 0.08 AUFS
Injection:	15 µL (100 µL / 1 vial)
Sample:	MW-Marker (HPLC), manufactured by ORIENTAL YEAST CO., LTD.

* Application data by courtesy YMC Co., Ltd.

Ordering Information

YMC-Pack Diol UHPLC, 2 µm

Phase dimension	Column ID [mm]	Column length [mm]	
		150	300
20 nm 2 µm	4.6	DL20S02-1546PTH	DL20S02-3046PTH
30 nm 2 µm	4.6	DL30S02-1546PTH	DL30S02-3046PTH

YMC-Pack Diol, 3 µm

Phase dimension	Column ID [mm]	Column length [mm]	
		250	300
6 nm 3 µm	4.6 6.0 8.0	DL06S03-2546WT — —	DL06S03-3046WT DL06S03-3006WT DL06S03-3008WT
12 nm 3 µm	4.6 6.0 8.0	DL12S03-2546WT — —	DL12S03-3046WT DL12S03-3006WT DL12S03-3008WT
20 nm 3 µm	4.6 6.0 8.0	DL20S03-2546WT — —	DL20S03-3046WT DL20S03-3006WT DL20S03-3008WT
30 nm 3 µm	4.6 6.0 8.0	DL30S03-2546WT — —	DL30S03-3046WT DL30S03-3006WT DL30S03-3008WT

YMC-Pack Diol, 5 µm

Phase dimension	Column ID [mm]	Column length [mm]		
		250	300	500
6 nm 5 µm	4.6 6.0 8.0 10.0	DL06S05-2546WT DL06S05-2506WT — DL06S05-2510WT	DL06S05-3046WT DL06S05-3006WT DL06S05-3008WT DL06S05-3010WT	— DL06S05-5006WT DL06S05-5008WT DL06S05-5010WT
12 nm 5 µm	4.6 6.0 8.0 10.0	DL12S05-2546WT DL12S05-2506WT — DL12S05-2510WT	DL12S05-3046WT DL12S05-3006WT DL12S05-3008WT DL12S05-3010WT	— DL12S05-5006WT DL12S05-5008WT DL12S05-5010WT
20 nm 5 µm	4.6 6.0 8.0 10.0	DL20S05-2546WT DL20S05-2506WT — DL20S05-2510WT	DL20S05-3046WT DL20S05-3006WT DL20S05-3008WT DL20S05-3010WT	— DL20S05-5006WT DL20S05-5008WT DL20S05-5010WT
30 nm 5 µm	4.6 6.0 8.0 10.0	DL30S05-2546WT DL30S05-2506WT — DL30S05-2510WT	DL30S05-3046WT DL30S05-3006WT DL30S05-3008WT DL30S05-3010WT	— DL30S05-5006WT DL30S05-5008WT DL30S05-5010WT

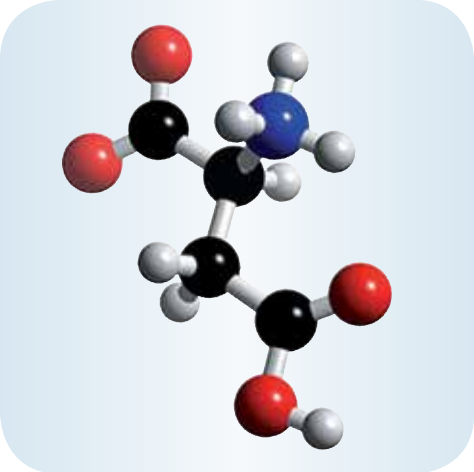
Guard Columns are available for the different column dimensions.
For more details please contact us: Phone: 02064-427-0 or E-Mail: info@ymc.de.

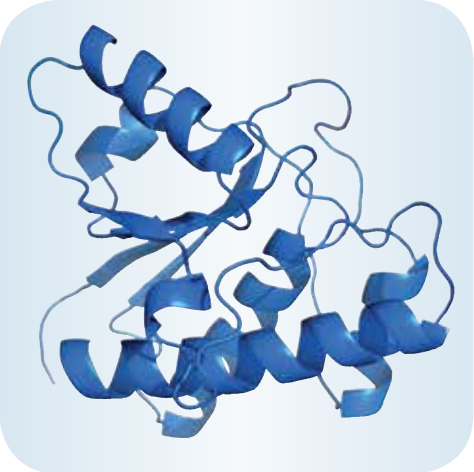
Bulk media

Phase	Pore Size	Particle Size	Part No.
YMC*Gel Diol-HG	12	10 µm 15 µm 20 µm	DLG12S11 DLG12S16 DLG12S21
YMC*Gel Diol-HG	20	10 µm 15 µm 20 µm	DLG20S11 DLG20S16 DLG20S21
YMC*Gel Diol-HG	30	10 µm 15 µm 20 µm	DLG30S11 DLG30S16 DLG30S21

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

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





RP

Bioseparation Columns

- YMC-Pack ODS-A: C18 with wide pore size for separation of peptides and proteins
- YMC-Pack ODS-AQ: “hydrophilic” C18
- C8 with wide pore size for separation of relatively highly hydrophobic compounds
- C4 with wide pore size for different selectivity from C18

C18-Selectivities for peptides	YMC-Triart C18	YMC-Pack *Pro* C18	YMC-Pack ODS-A
Particle size / µm	1.9; 3; 5	2; 3; 5	3; 5
Pore size / nm	12	12	12; 20; 30
Carbon content / %	20	16	17; 12; 7
pH range	1.0 - 12.0	2.0 - 8.0	2.0 - 7.5

C18-Selectivities for peptides	YMC-Pack ODS-AQ	Hydrosphere C18	Meteoric Core C18 BIO
Particle size / µm	3; 5	2; 3; 5	2.7
Pore size / nm	12; 20	12	16
Carbon content / %	14; 10	12	5
pH range	2.0 - 7.5	2.0 - 8.0	1.5 - 10.0

C8-Selectivities for peptides and proteins	YMC-Triart C8	YMC-Pack C_8	YMCbasic
Particle size / µm	1.9; 3; 5	3; 5	3; 5
Pore size / nm	12	12; 20; 30	20
Carbon content / %	20	10; 7; 4	7
pH range	1.0 - 12.0	2.0 - 7.5	2.0 - 7.5

C4-Selectivities or equivalent for peptides and proteins	YMC-Pack C_4	YMC-Pack PROTEIN-RP
Particle size / µm	3; 5	5
Pore size / nm	12; 20; 30	20
Carbon content / %	7; 5; 3	4
pH range	2.0 - 7.5	1.5 - 7.5

Bioseparation Columns

Chromatographers know the problems during method development: "Which phase is suitable and allows a simple and robust separation?"

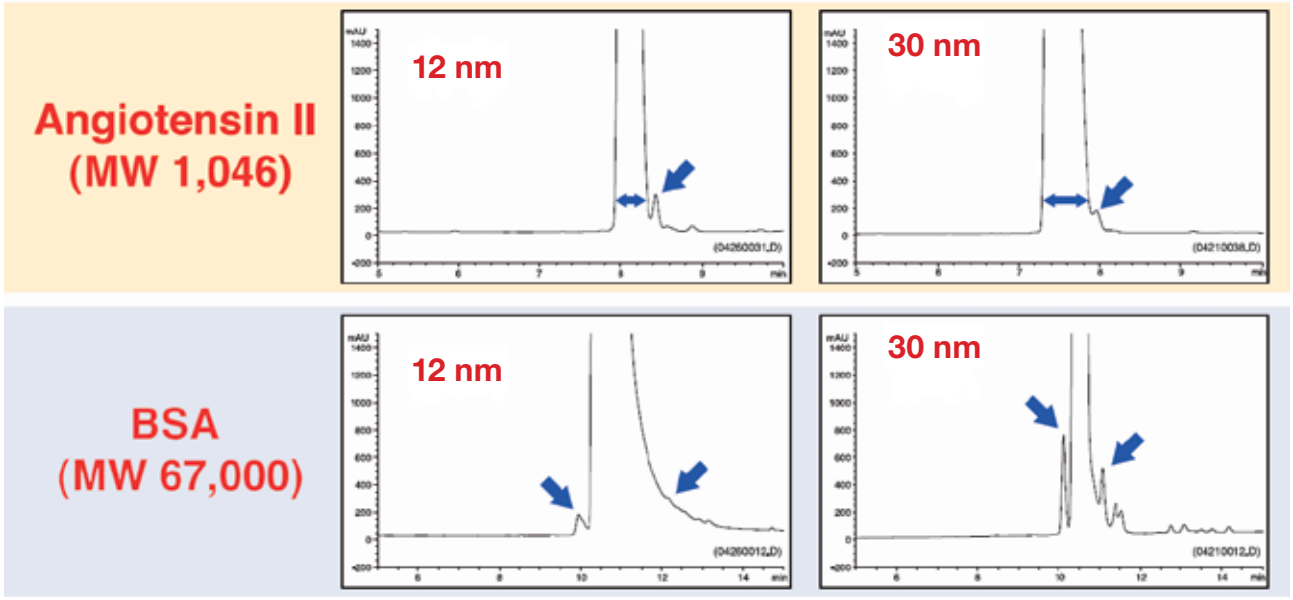
In the field of biochromatography, phase selection is a key to success!

With the YMC "Column Selection Tool" for Bio-LC, stationary phase selection is almost too easy.

As shown in the table (below), the C18 column with 12 nm pore size is suitable for small peptides up to a MW 5000. The best efficiency for large peptides or small proteins can be obtained by employing a C8 phase characterised by a 20 nm pore size. Furthermore, most proteins are eluted effectively by a C4 column with 30 nm.

However, the separation may also be influenced by the hydrophobicity of the peptide/protein and the nature of the column's bonded phase. Therefore, for initial method development, it might be useful, in the first instance, to follow the arrow shown in the table for method optimisation.

Comparison of peaks on C4 with 12 nm and 30 nm pore sizes*



For smaller peptides a small pore size is more successful. Larger molecules are separated much better with larger pore sizes!

Column Selection Tool*

MW		C18	C8	C4
5000	12 nm	◎	○	△
20000	20 nm	○	◎	○
100000	30 nm	△	○	◎

◎ : excellent, ○ : good, △ : moderate

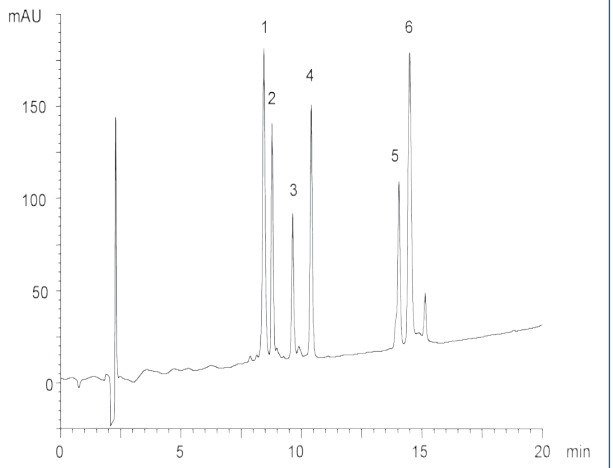
* Application data by courtesy YMC Co., Ltd.

Bioseparation Columns

Peptide and Protein Applications*

Peptides and Proteins

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

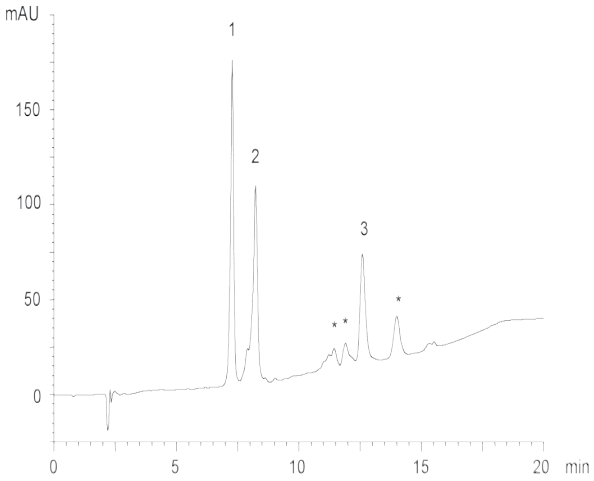


Column:	YMC-Pack C8 (5 µm, 20 nm) 150 x 4.6 mm ID
Part No.:	OC20S05-1546WT
Eluent:	A) water / TFA (100/0.1)
	B) acetonitrile / TFA (100/0.1)
Gradient:	25-60% B (0-20 min)
Flow rate:	1.0 mL/min
Temperature:	37 °C
Detection:	UV at 220 nm
Injection:	10 µL (0.1 ~ 0.2 mg/mL)

Proteins

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

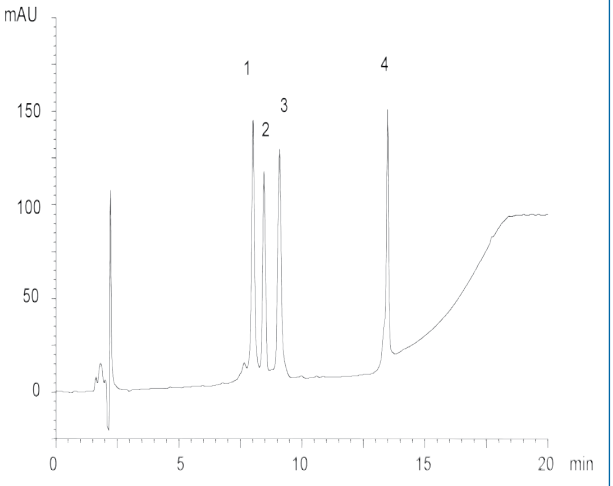
* Impurities in commercial lipoxidase



Column:	YMC-Pack C4 (5 µm, 30 nm) 150 x 4.6 mm ID
Part No.:	BU30S05-1546WT
Eluent:	A) water / TFA (100/0.1)
	B) acetonitrile / 2-propanol / TFA (50/50/0.1)
Gradient:	30-75% B (0-15 min), 75% B (15-20 min)
Flow rate:	1.0 mL/min
Temperature:	37 °C
Detection:	UV at 220 nm
Injection:	10 µL (0.25 ~ 1.0 mg/mL)

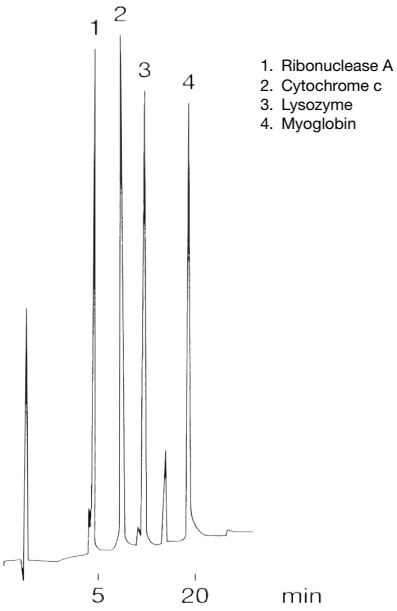
Proteins

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



Column:	YMC-Pack C4 (5 µm, 30 nm) 150 x 4.6 mm ID
Part No.:	BU30S05-1546WT
Eluent:	A) water / TFA (100/0.1)
	B) acetonitrile / TFA (100/0.1)
Gradient:	40-50% B (0-10 min), 50-90% B (10-15 min), 90% B (15-20 min)
Flow rate:	1.0 mL/min
Temperature:	37 °C
Detection:	UV at 220 nm
Injection:	10 µL (0.2 ~ 0.3 mg/mL)

Proteins



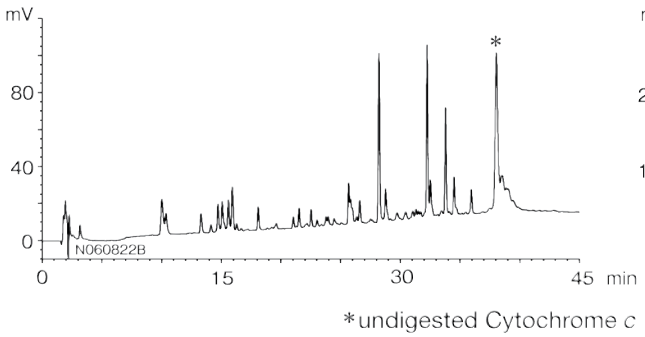
1. Ribonuclease A
2. Cytochrome c
3. Lysozyme
4. Myoglobin

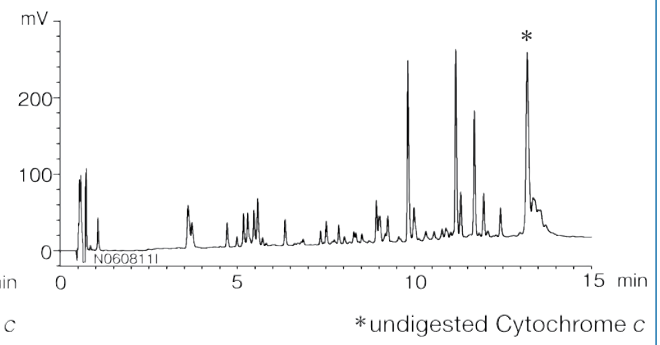
Column:	YMC-Pack C4 (5 µm, 30 nm) 150 x 4.6 mm ID
Part No.:	BU30S05-1546WT
Eluent:	A) acetonitrile / water / TFA (5/95/0.1)
	B) acetonitrile / water / TFA (60/40/0.1)
Gradient:	30%-90% B (0-20 min., linear), 90% B (20-50 min)
Flow rate:	1.0 mL/min
Temperature:	37 °C
Detection:	UV at 220 nm

Bioseparation Columns

Peptide and Protein Applications*

Peptide mapping - excellent reproducibility between 5 µm and 2 µm



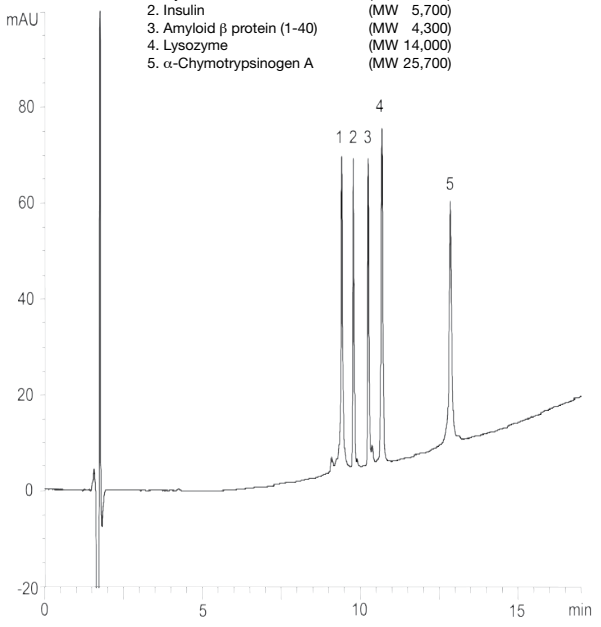


Column:	YMC-Pack *Pro* C18 (5 µm, 12 nm) 150 × 2.0 mm ID
Part No.:	AS12S05-1502WT
Eluent:	A) acetonitrile/water/trifluoroacetic acid (10/90/0.1) B) acetonitrile/water/trifluoroacetic acid (35/65/0.1)
Gradient:	Time A (in %) B (in %) 0 100 0 5 100 0 40 0 100 45 0 100
Flow rate:	0.2 mL/min
Temperature:	37 °C
Detection:	UV at 220 nm
Injection:	1 µL
Sample:	Tryptic digest of Cytochrome c

Column:	YMC-UltraHT *Pro* C18 (2 µm, 12 nm) 50 × 2.0 mm ID
Part No.:	AS12S02-0502WT
Eluent:	A) acetonitrile/water/trifluoroacetic acid (10/90/0.1) B) acetonitrile/water/trifluoroacetic acid (35/65/0.1)
Gradient:	Time A (in %) B (in %) 0 100 0 1.65 100 0 13.35 0 100 15.00 0 100
Flow rate:	0.2 mL/min
Temperature:	37 °C
Detection:	UV at 220 nm
Injection:	1 µL
Sample:	Tryptic digest of Cytochrome c

Peptides and proteins

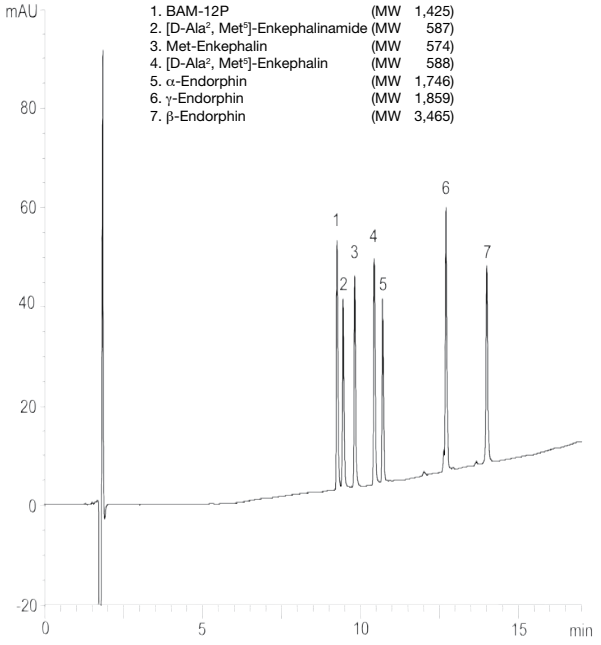
1. Cytochrome *c* (MW 12,400)
2. Insulin (MW 5,700)
3. Amyloid β protein (1-40) (MW 4,300)
4. Lysozyme (MW 14,000)
5. α-Chymotrypsinogen A (MW 25,700)



Column:	Meteoric Core C18 BIO (2.7 µm, 16 nm) 150 × 2.1 mm ID
Part No.:	CAW08SQ7-15Q1PT
Eluent:	A) water/TFA (100/0.1) B) acetonitrile/TFA (100/0.1) 20-70% B (0-15 min), 70% B (15-17 min)
Flow rate:	0.2 mL/min
Temperature:	40 °C
Detection:	UV at 220 nm
Injection:	2 µL (0.05-0.2 mg/mL)
Pressure:	12.8-16.1 MPa (1860-2330 psi)

Peptides

1. BAM-12P (MW 1,425)
2. [D-Ala², Met⁵]-Enkephalinamide (MW 587)
3. Met-Enkephalin (MW 574)
4. [D-Ala², Met⁵]-Enkephalin (MW 588)
5. α-Endorphin (MW 1,746)
6. γ-Endorphin (MW 1,859)
7. β-Endorphin (MW 3,465)



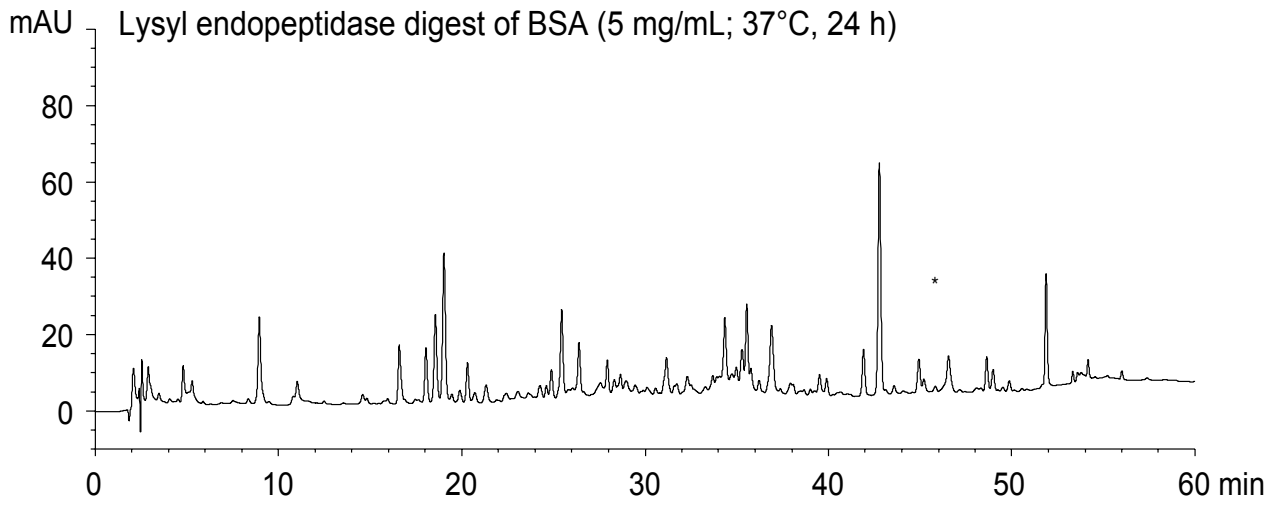
Column:	Meteoric Core C18 BIO (2.7 µm, 16 nm) 150 × 2.1 mm ID
Part No.:	CAW08SQ7-15Q1PT
Eluent:	A) water/TFA (100/0.1) B) acetonitrile/TFA (100/0.1) 15-55% B (0-15 min), 55% B (15-17 min)
Flow rate:	0.2 mL/min
Temperature:	40 °C
Detection:	UV at 220 nm
Injection:	2 µL (0.02-0.5 mg/mL)
Pressure:	14.9-16.1 MPa (2160-2330 psi)

* Application data by courtesy YMC Co., Ltd.

Bioseparation Columns

Peptide and Protein Applications*

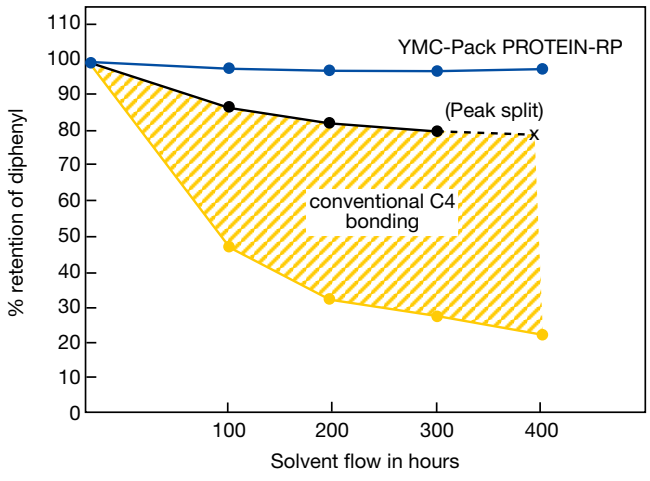
Peptide mapping

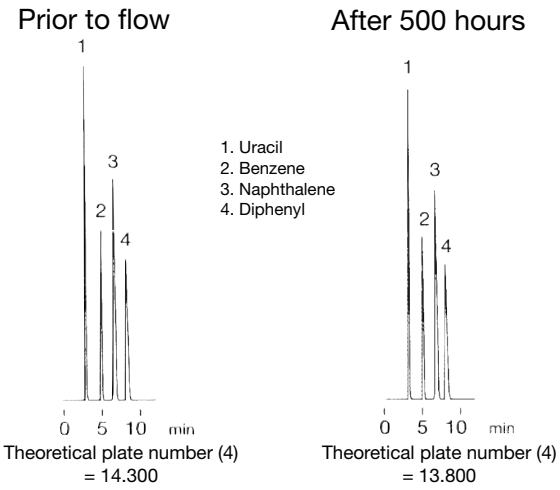


Column: YMCbasic (5 µm) 150 x 2.0 mm ID
Part No.: BA99S05-1502WT
Eluent: A) water / TFA (94/6) B) acetonitrile / TFA (100/0.1)
Gradient: 5-35% B (0-50 min), 35-45% B (50-55 min), 45% B (55-60 min)
Flow rate: 0.2 mL/min
Temperature: 37 °C
Detection: UV at 220 nm
Injection: 1 µL

* undigested BSA

Improved stability when used with TFA solution





Theoretical plate number (4) = 14.300

Theoretical plate number (4) = 13.800

Flow conditions
Eluent: water / TFA (100/0.1)
Flow rate: 1.0 mL/min
Temperature: ambient

Measurement conditions
Column: YMC-Pack PROTEIN-RP (5 µm) 250 x 4.6 mm ID
Part No.: PR99S05-2546WT
Eluent: acetonitrile / water (40/60)
Flow rate: 1.0 mL/min
Temperature: 30° C
Detection: UV at 254 nm, 0.32 AUFS

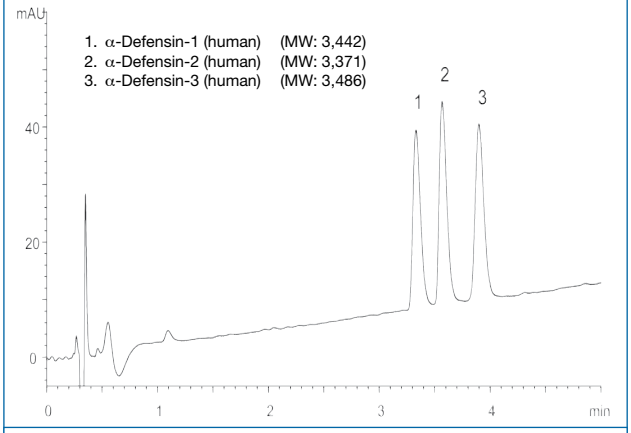
The selectivity of YMC-Pack PROTEIN-RP is different from that seen with conventional wide pore butyl phases and it is specifically suited for the protein analysis.

In the applications on the following pages it effectively separates both low molecular weight compounds and high molecular weight proteins, with equally good peak shapes being obtained.

Bioseparation Columns

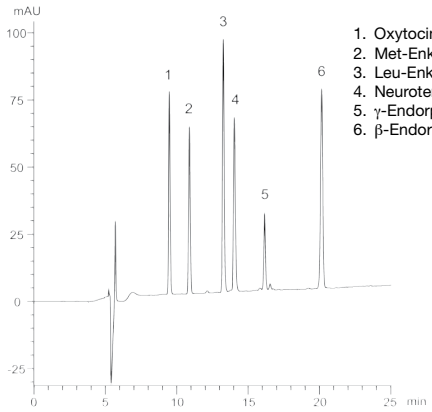
Peptide and Protein Applications*

Antimicrobial peptides



Column:	YMC-Triart C18 (1.9 µm, 12 nm) 50 x 2.0 mm ID
Part No.:	TA12SP9-0502PT
Eluent:	A) water / formic acid (100/0.1)
	B) 2-propanol / acetonitrile / formic acid (50/50/0.08)
Gradient:	10%-25% B (0-10 min)
Flow rate:	0.4 mL/min
Temperature:	70 °C
Detection:	UV at 220 nm
Injection:	1 µL (50 µg/mL)

Peptides

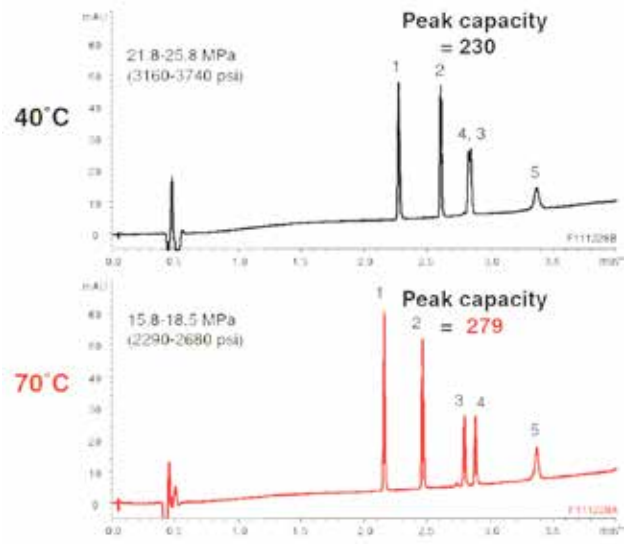


1. Oxytocin (MW: 1,007)
2. Met-Enkephalin (MW: 574)
3. Leu-Enkephalin (MW: 556)
4. Neurotensin (MW: 1,673)
5. γ-Endorphin (MW: 1,859)
6. β-Endorphin (MW: 3,465)

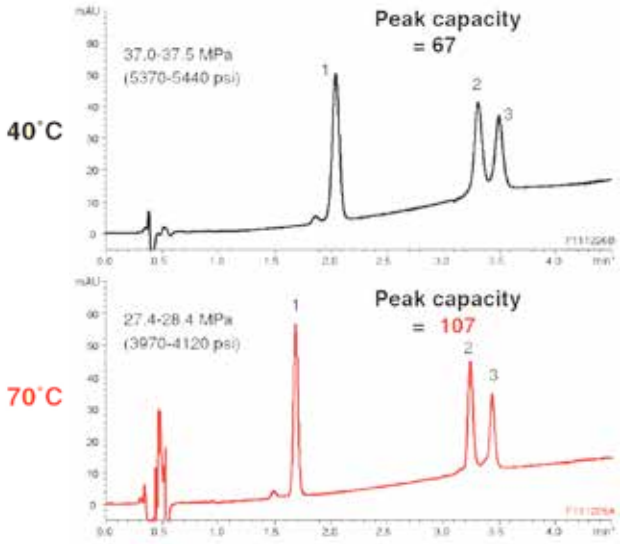
Column:	YMC-Triart C18 (5 µm, 12 nm) 150 x 2.0 mm ID
Part No.:	TA12S05-1502WT
Eluent:	A) water / TFA (100/0.1)
	B) acetonitrile / TFA (100/0.1)
Gradient:	20%-45% B (0-25 min)
Flow rate:	0.2 mL/min
Temperature:	37 °C
Detection:	UV at 220 nm
Injection:	2 µL (0.075 ≈ 0.25 mg/mL)

Highly efficient RP-HPLC separation of proteins and peptides using high temperature

Mixture 1 (MW 500-18,400)



Mixture 2 (MW 14,300-25,700)



Column:	YMC-Triart C18 (1.9 µm, 12 nm) 50 x 2.0 mm ID
Part-No.:	TA12SP9-0502WT
Eluent:	A) water / TFA (100/0.1)
	B) acetonitrile / TFA (100/0.1) - mixture 1
	B) acetonitrile / 2-propanol / TFA (50/50/0.1) - mixture 2
Gradient:	10-80% B (0-5 min) - mixture 1
	30-60% B (0-5 min) - mixture 2
Flow rate:	0.4 mL/min
Detection:	UV at 220 nm
Injection:	1 µL (50 µg/mL) - mixture 1
	1 µl (250 µg/mL) - mixture 2
System:	Agilent 1200SL

Analytes	MW	Peak width 1/2 (min)	
		40 °C	70 °C
Mixture 1			
1. Oxytocin	1,007	0.017	0.014
2. Leu-Enkephalin	556	0.015	0.015
3. β-Endorphin	3,465	—	0.016
4. Insulin	5,733	—	0.015
5. β-Lactoglobulin A	18,400	0.043	0.030
Mixture 2			
1. Lysozyme	14,300	0.069	0.044
2. α-Chymotrypsinogen	25,700	0.080	0.049
3. β-Lactoglobulin A	18,400	0.080	0.048

PC (peak capacity) = 1 + (gradient time / peak width*)
*peak width = $2W_{0.5h}$ average

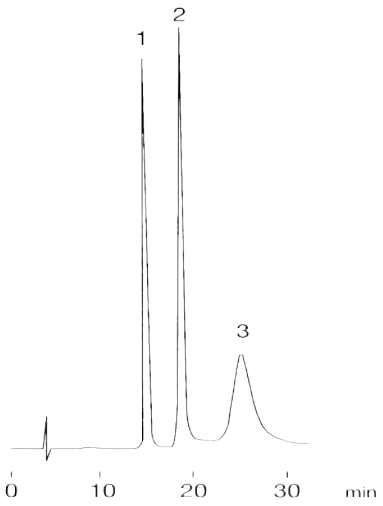
* Application data by courtesy YMC Co., Ltd.

Bioseparation Columns

Peptide and Protein Applications*

Proteins

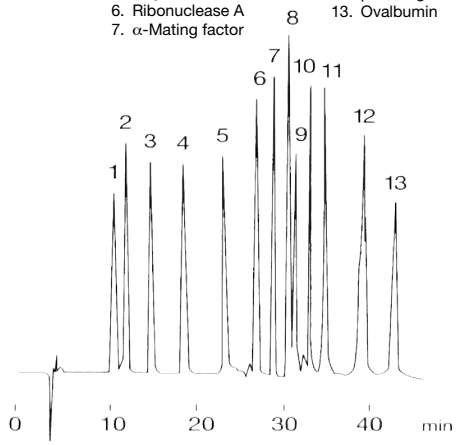
1. Cytochrome c (MW: 12.400, 5 µg)
2. BSA (MW: 66.000, 25 µg)
3. Ferritin (MW: 440.000,10 µg)



Column:	YMC-Pack Protein-RP (5 µm) 250 x 4.6 mm ID
Part No.:	PR99S05-2546WT
Eluent:	A) water / TFA (100/0.1)
	B) acetonitrile / TFA (100/0.1)
Gradient:	30%-90% B (0-45 min., linear)
Flow rate:	1.0 mL/min
Temperature:	ambient
Detection:	UV at 280 nm, 0.04 AUFS

Proteins and peptides

1. Met-Enkephalin
2. Leu-Enkephalin
3. Oxytocin
4. Bradykinin
5. Angiotensin I
6. Ribonuclease A
7. α-Mating factor
8. Insulin (bovine)
9. Cytochrome c
10. Lysozyme
11. BSA
12. β-Lactoglobulin
13. Ovalbumin

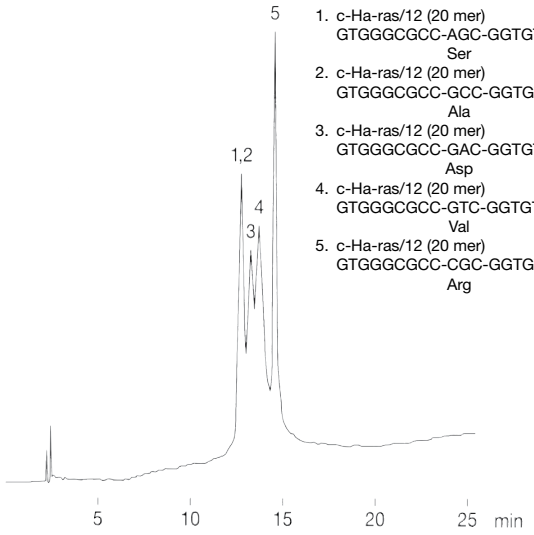


Column:	YMC-Pack Protein-RP (5 µm) 250 x 4.6 mm ID
Part No.:	PR99S05-2546WT
Eluent:	A) water / TFA (100/0.1)
	B) acetonitrile / TFA (100/0.1)
Gradient:	10%-90% B (0-60 min., linear)
Flow rate:	1.0 mL/min
Temperature:	ambient
Detection:	UV at 220 nm, 0.32 AUFS

Oligonucleotide Applications*

Oligonucleotides

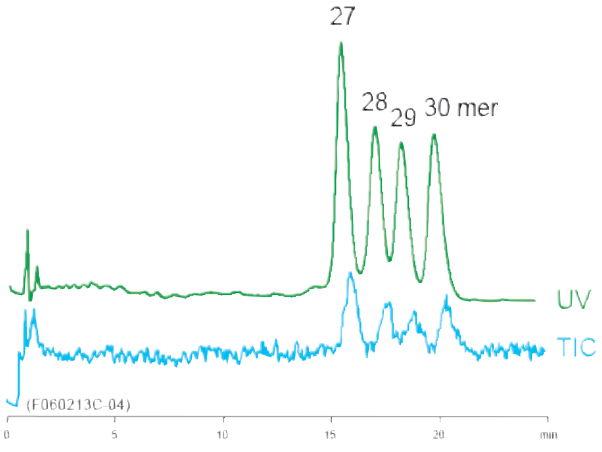
1. c-Ha-ras/12 (20 mer)
GTGGGCGCC-AGC-GGTGTGGG
Ser
2. c-Ha-ras/12 (20 mer)
GTGGGCGCC-GCC-GGTGTGGG
Ala
3. c-Ha-ras/12 (20 mer)
GTGGGCGCC-GAC-GGTGTGGG
Asp
4. c-Ha-ras/12 (20 mer)
GTGGGCGCC-GTC-GGTGTGGG
Val
5. c-Ha-ras/12 (20 mer)
GTGGGCGCC-CGC-GGTGTGGG
Arg



Column:	YMC-Pack ODS-A (5 µm, 30 nm) 150 x 4.6 mm ID
Part No.:	AA30S05-1546WT
Eluent:	A) 100 mM Triethylamine-acetic acid (pH 6.5) / acetonitrile (94/6)
	B) 100 mM Triethylamine-acetic acid (pH 6.5) / acetonitrile (85/15)
Gradient:	0%-100% B (0-25 min, linear)
Flow rate:	1.0 mL/min
Temperature:	30 °C
Detection:	UV at 260 nm

LC-MS analysis of synthetic 27-30 mer oligonucleotides

Sample: Primer of DNA sequencing
5'-CCGCTCGAGCTAAAAAAAGCCTGTGTTACC-3' (30 mer)

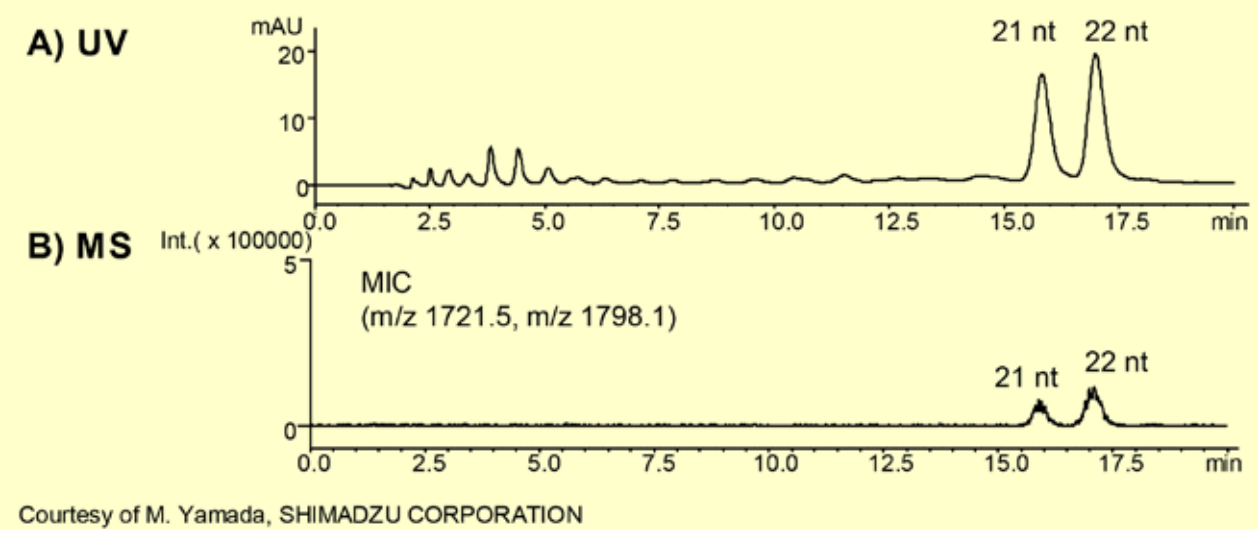


Column:	YMC Hydrosphere C18 (3 µm) 50 x 2.0 mm ID
Part No.:	HS12S03-0502WT
Eluent:	A) 10 mM DBAA (pH 6.0)
	B) Mobile phase A / acetonitrile (50/50)
Gradient:	58%-62% B (0-20 min), 62% B (20-25 min)
Flow rate:	0.2 mL/min
Temperature:	35 °C
Detection:	UV at 269 nm and ESI negative-mode
Injection:	1 µL (10 pmol/component)

Bioseparation Columns

Oligonucleotide Applications*

LC/MS analysis of miRNA



5'-pUGG AGU GUG ACA AUG GUG UUG-3' (21 nt, MW 6890.1)
5'-pUGG AGU GUG ACA AUG GUG UUG U-3' (22 nt, MW 7196.3)

Column:	YMC-Triart C18 (3 µm, 12 nm), 150 X 2.0 mm ID	Detection:	A) UV at 260 nm B) ESI-negative mode
Part No.:	TA12S03-1502WT	Injection:	4 µL (5 nmol/mL)
Eluent:	A) 10 mM di-n-butylamine-acetic acid (pH 7.5) B) 10 mM di-n-butylamine-acetic acid (pH 7.5)/acetonitrile (50/50)62-72%B (0-20 min)	System:	LC) Shimadzu Prominence MS) Shimadzu LCMS2020
Flow rate:	0.2 mL/min		
Temperature:	30°C		

Purification of synthetic 30mer oligonucleotide

Analysis 1.0 mL/min, 5 µL injection

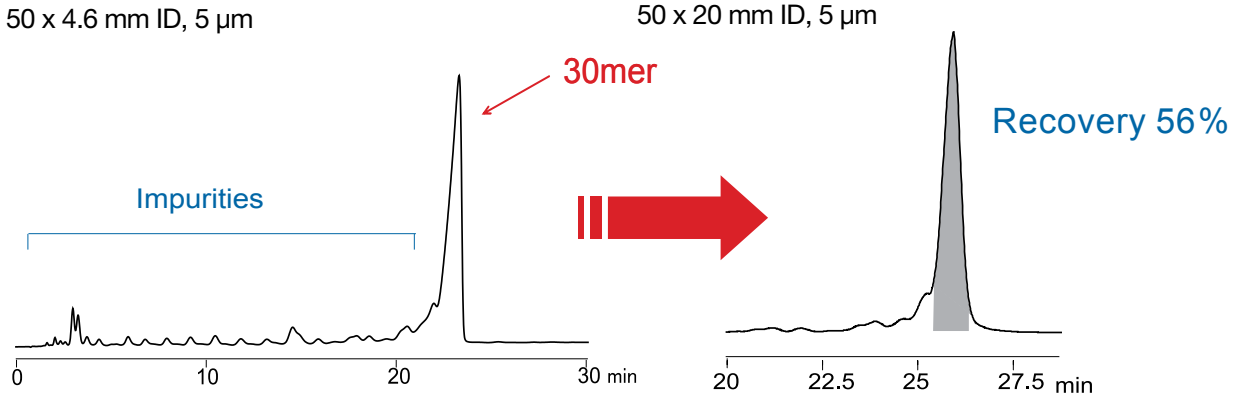
Hydrosphere C18

50 x 4.6 mm ID, 5 µm

Purification 19 mL/min, 100 µL injection

YMC-Actus Hydrosphere C18

50 x 20 mm ID, 5 µm



purity>99%

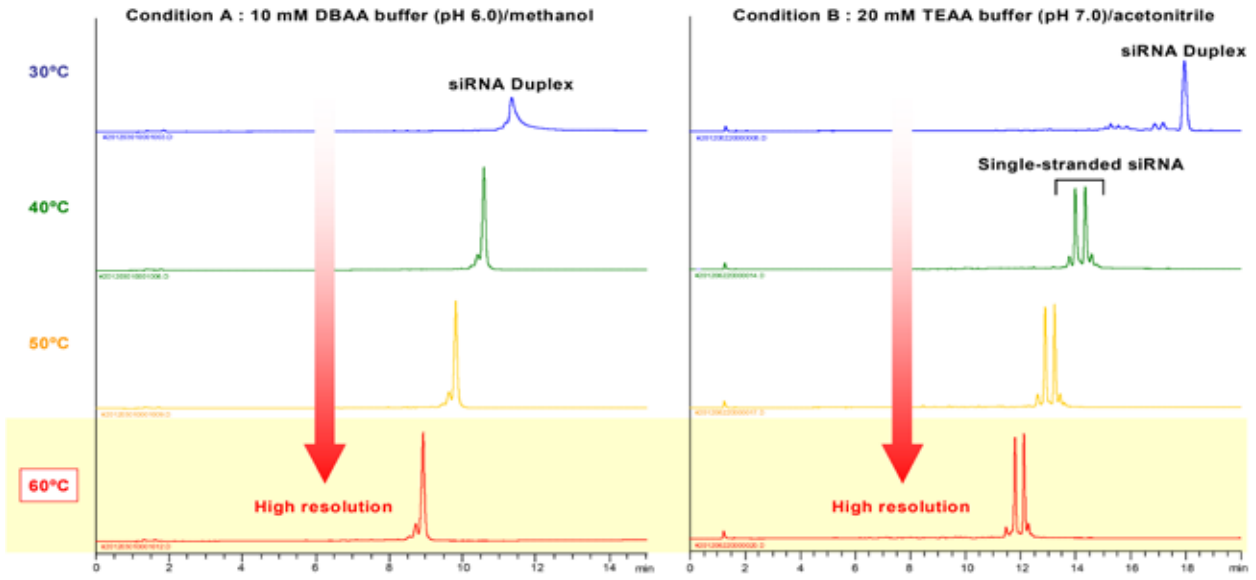
Part Nos.:	HS12S05-0546WT HS12S05-0520WX
Eluent:	A) 10 mM DBA-acetic acid (pH 6.0) / methanol (60/40) B) 10 mM DBA-acetic acid (pH 6.0) / methanol (20/80)
Gradient:	10%-35% B (0-30 min.)
Temperature:	ambient
Detection:	UV at 269 nm
Sample:	synthetic oligonucleotide (100 µM)

* Application data by courtesy YMC Co., Ltd.

Bioseparation Columns

Oligonucleotide Applications*

Effect of mobile phase and column temperature on separation of siRNA duplex

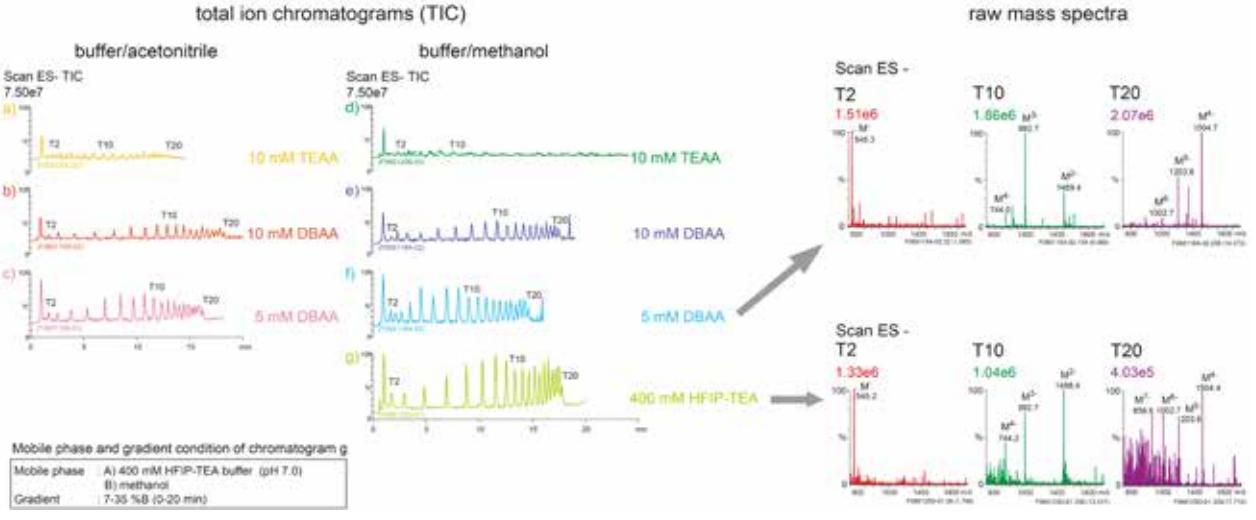


Crude synthetic siRNA duplex (19 bp): 5'-CGU ACG CGG AAU ACU UCG AdTdT-3'
3'-dTdTGCA UGC GCC UUA UGA AGC U-5'

Column: YMC-Triart C18 (1.9 µm, 12 nm) 100 x 2.0 mm ID
Part No.: TA12SP9-1002PT
Flow rate: 0.2 mL/min
Detection: UV at 269 nm
Injection: 1 µL (5 nmol/mL)
System: Agilent 1290

Condition A Eluent: A) 10 mM di-n-butylamine-acetic acid (pH 6.0)
B) methanol
35-60%B (0-15 min)
Condition B Eluent: A) 20 mM triethylamine-acetic acid (pH 7.0)
B) acetonitrile
5-12%B (0-20 min)

Influences of mobile phase conditions on intensity of ESI-MS

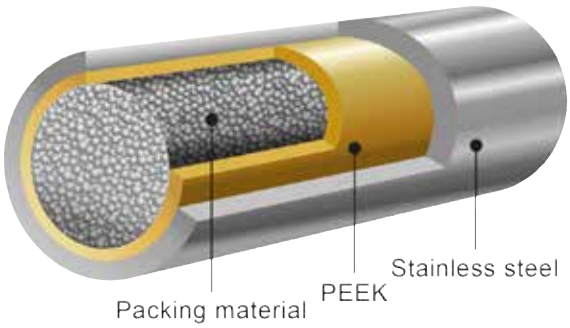


Column: Hydrosphere C18 (3 µm) 50 x 2.0 mm
Part No.: HS12S03-0502WT
Flow rate: 0.2 mL/min
Temperature: 35°C
Detection: ESI negative mode
Injection: 5 µL (25 pmol/component)
a) Eluent: A) 10 mM TEAA buffer (pH 6.0)
B) eluent A/acetonitrile (80/20)
Gradient: 50-65% B (0-20 min)
b/c) Eluent: A) 10/5 mM DBAA buffer (pH 6.0)
B) eluent A/acetonitrile (50/50)
Gradient: 30-75% B (0-20 min)
d) Eluent: A) 10 mM TEAA buffer (pH 6.0)
B) eluent A/methanol (50/50)
Gradient: 44-50% B (0-25 min)
e/f) Eluent: A) 10/5 mM DBAA buffer (pH 6.0)
B) eluent A/methanol (20/80)
Gradient: 42-70% B (0-20 min)
g) Eluent: A) 400 mM HFIP-TEA buffer (pH 7.0)
B) methanol
Gradient: 7-35% B (0-20 min)

Bioseparation Columns

Metal-free column hardware suitable for oligonucleotide analysis

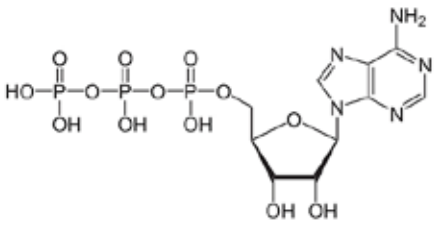
	YMC-Triart C18	YMC-Triart C8
Particle Size	1.9, 3, 5 µm	
Inner layer	PEEK	
Outer layer	Stainless steel	
Frit	PEEK	
Pressure limit	1.9 µm: 100 MPa (15,000 psi) 3/5 µm: 45 MPa (6,525 psi)	



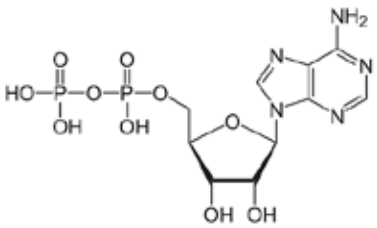
YMC-Triart C18 ExRS, Phenyl, PFP and Diol-HILIC are also available in metal-free hardware.

Improved sensitivity for coordination compounds*

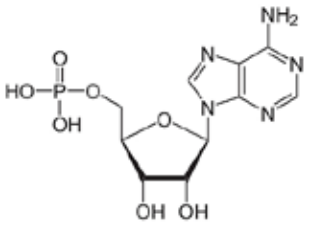
1. ATP



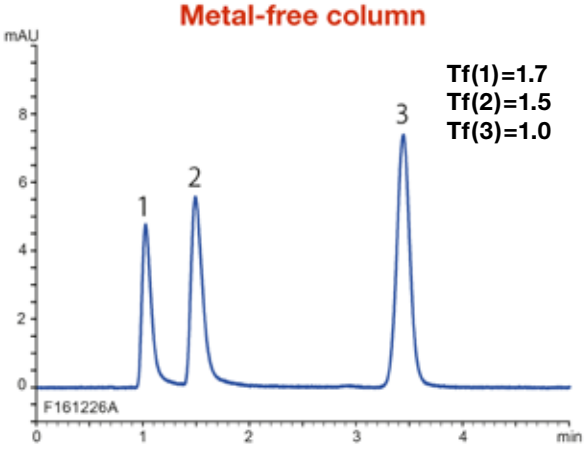
2. ADP



3. AMP

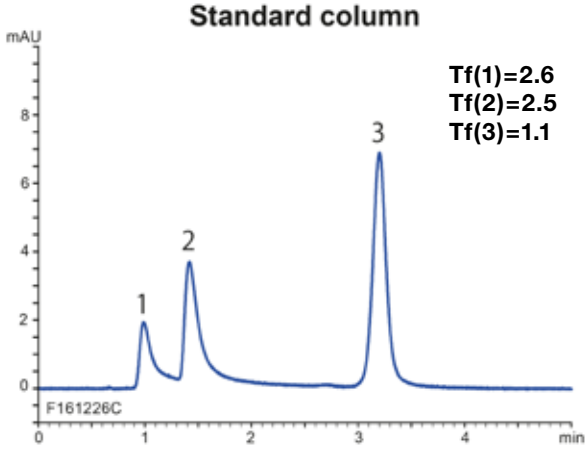


Metal-free column



Tf(1)=1.7
Tf(2)=1.5
Tf(3)=1.0

Standard column



Tf(1)=2.6
Tf(2)=2.5
Tf(3)=1.1

Column:	YMC-Triart C18 (3 µm) 50 x 2.1 mm ID
Part Nos.:	TA12S03-05Q1PTP (metal-free) or TA12S03-05Q1PTH (regular hardware)
Eluent:	5 mM $HCOONH_4$
Flow rate:	0.21 mL/min
Temperature:	25°C
Detection:	UV at 265 nm
Injection:	1 mL (10 mg/mL)

Metal coordinating compounds, which have a phosphate group in their structure tend to show poor peak shape by interacting with metals, such as the stainless steel in column bodies and frits. By using the metal-free column hardware, better peak shapes can be expected. Nucleotides with phosphate groups show better peak shapes when compared to the regular column hardware. The metal-free column hardware is very suitable for highly sensitive analyses using LC/MS.

* Application data by courtesy YMC Co., Ltd.

Ordering Information

12 nm, 1.9 µm analytical columns

Phase	Column ID [mm]	Column length [mm]			
		30	50	100	150
YMC-Triart C18	2.0 3.0	TA12SP9-0302PT —	TA12SP9-0502PT TA12SP9-0503PT	TA12SP9-1002PT TA12SP9-1003PT	TA12SP9-1502PT TA12SP9-1503PT
YMC-Triart C8	2.0 3.0	T012SP9-0302PT —	T012SP9-0502PT T012SP9-0503PT	T012SP9-1002PT T012SP9-1003PT	T012SP9-1502PT T012SP9-1503PT

12 nm, 2 µm analytical columns

Phase	Column ID [mm]	Column length [mm]			
		30	50	100	150
YMC-UltraHT *Pro* C18	2.0 3.0	AS12S02-0302WT AS12S02-0303WT	AS12S02-0502WT AS12S02-0503WT	AS12S02-1002WT AS12S02-1003WT	AS12S02-1502WT AS12S02-1503WT
YMC-UltraHT Hydrosphere C18	2.0 3.0	HS12S02-0302WT HS12S02-0303WT	HS12S02-0502WT HS12S02-0503WT	HS12S02-1002WT HS12S02-1003WT	HS12S02-1502WT HS12S02-1503WT

12/16 nm, 2.7/3 µm analytical columns, C18

Phase	Column ID [mm]	Column length [mm]	
		150	250
YMC-Triart C18	2.1 3.0 4.6	TA12S03-15Q1PTH TA12S03-1503PTH TA12S03-1546PTH	— — TA12S03-2546PTH
YMC-Triart C8	2.1 3.0 4.6	T012S03-15Q1PTH T012S03-1503PTH T012S03-1546PTH	— — T012S03-2546PTH
YMC-Pack ODS-A (C18)	2.1 3.0 4.6	AA12S03-15Q1QT AA12S03-1503QT AA12S03-1546WT	AA12S03-25Q1QT AA12S03-2503QT AA12S03-2546WT
YMC-Pack ODS-AQ (C18)	2.1 3.0 4.6	AQ12S03-15Q1QT AQ12S03-1503QT AQ12S03-1546WT	AQ12S03-25Q1QT AQ12S03-2503QT AQ12S03-2546WT
YMC-Pack *Pro* C18	2.1 3.0 4.6	AS12S03-15Q1QT AS12S03-1503QT AS12S03-1546WT	AS12S03-25Q1QT AS12S03-2503QT AS12S03-2546WT
Hydrosphere C18	2.1 3.0 4.6	HS12S03-15Q1QT HS12S03-1503QT HS12S03-1546WT	HS12S03-25Q1QT HS12S03-2503QT HS12S03-2546WT
Meteoric Core C18 BIO	2.1 3.0 4.6	CAW16SQ7-15Q1PT CAW16SQ7-1503PT CAW16SQ7-1546PT	— — —

12/20 nm, 3 µm analytical columns, C8 & C4

Phase	Column ID [mm]	Column length [mm]	
		150	250
YMC-Pack C_8	2.1 3.0 4.6	OC12S03-15Q1QT OC12S03-1503QT OC12S03-1546WT	— OC12S03-2503QT OC12S03-2546WT
YMCbasic (eq. C8)	2.1 3.0 4.6	BA99S03-15Q1QT BA99S03-1503QT BA99S03-1546WT	— BA99S03-2503QT BA99S03-2546WT
YMC-Pack C_4	2.1 3.0 4.6	BU12S03-15Q1QT BU12S03-1503QT BU12S03-1546WT	— BU12S03-2503QT BU12S03-2546WT

Guard Columns are available for the different column dimensions.
For more details please contact us: Phone 02064-427-0 or email info@ymc.de.

Ordering Information

12 nm, 5 µm analytical columns, C18

Phase	Column ID [mm]	Column length [mm]	
		150	250
YMC-Triart C18	2.1 3.0 4.6	TA12S05-15Q1PTH TA12S05-1503PTH TA12S05-1546PTH	— — TA12S05-2546PTH
YMC-Triart C8	2.1 3.0 4.6	T012S05-15Q1PTH T012S05-1503PTH T012S05-1546PTH	— — T012S05-2546PTH
YMC-Pack ODS-A (C18)	2.1 3.0 4.6	AA12S05-15Q1QT AA12S05-1503QT AA12S05-1546WT	AA12S05-25Q1QT AA12S05-2503QT AA12S05-2546WT
YMC-Pack ODS-AQ (C18)	2.1 3.0 4.6	AQ12S05-15Q1QT AQ12S05-1503QT AQ12S05-1546WT	AQ12S05-25Q1QT AQ12S05-2503QT AQ12S05-2546WT
YMC-Pack *Pro* C18	2.1 3.0 4.6	AS12S05-15Q1QT AS12S05-1503QT AS12S05-1546WT	AS12S05-25Q1QT AS12S05-2503QT AS12S05-2546WT
Hydrosphere C18	2.1 3.0 4.6	HS12S05-15Q1QT HS12S05-1503QT HS12S05-1546WT	HS12S05-25Q1QT HS12S05-2503QT HS12S05-2546WT

12/20 nm, 5 µm analytical columns, C8 & C4

Phase	Column ID [mm]	Column length [mm]	
		150	250
YMC-Pack C_8	2.1 3.0 4.6	OC12S05-15Q1QT OC12S05-1503QT OC12S05-1546WT	OC12S05-25Q1QT OC12S05-2503QT OC12S05-2546WT
YMCbasic (eq. C8)	2.1 3.0 4.6	BA99S05-15Q1QT BA99S05-1503QT BA99S05-1546WT	BA99S05-25Q1QT BA99S05-2503QT BA99S05-2546WT
YMC-Pack C_4	2.1 3.0 4.6	BU12S05-15Q1QT BU12S05-1503QT BU12S05-1546WT	BU12S05-25Q1QT BU12S05-2503QT BU12S05-2546WT
YMC-Pack PROTEIN-RP (eq. C4)	2.1 3.0 4.6	PR99S05-15Q1QT PR99S05-1503QT PR99S05-1546WT	PR99S05-25Q1QT PR99S05-2503QT PR99S05-2546WT

12 nm, 1.9 µm metal-free analytical columns*

Phase	Column ID [mm]	Column length [mm]		
		50	100	150
YMC-Triart C18	2.1	TA12SP9-05Q1PTP	TA12SP9-10Q1PTP	TA12SP9-15Q1PTP
YMC-Triart C8	2.1	T012SP9-05Q1PTP	T012SP9-10Q1PTP	T012SP9-15Q1PTP

12 nm, 3 µm metal-free analytical columns*

Phase	Column ID [mm]	Column length [mm]		
		50	100	150
YMC-Triart C18	2.1 4.6	TA12S03-05Q1PTP TA12S03-0546PTP	TA12S03-10Q1PTP TA12S03-1046PTP	TA12S03-15Q1PTP TA12S03-1546PTP
YMC-Triart C8	2.1 4.6	T012S03-05Q1PTP T012S03-0546PTP	T012S03-10Q1PTP T012S03-1046PTP	T012S03-15Q1PTP T012S03-1546PTP

Ordering Information

12 nm, 5 µm metal-free analytical columns*

Phase	Column ID [mm]	Column length [mm]		
		50	100	150
YMC-Triart C18	2.1 4.6	TA12S05-05Q1PTP TA12S05-0546PTP	TA12S05-10Q1PTP TA12S05-1046PTP	TA12S05-15Q1PTP TA12S05-1546PTP
YMC-Triart C8	2.1 4.6	TO12S05-05Q1PTP TO12S05-0546PTP	TO12S05-10Q1PTP TO12S05-1046PTP	TO12S05-15Q1PTP TO12S05-1546PTP

*YMC-Triart C18 ExRS, Phenyl, PFP and Diol-HILIC are also available in metal-free hardware.

For other dimensions please refer to page 386-387

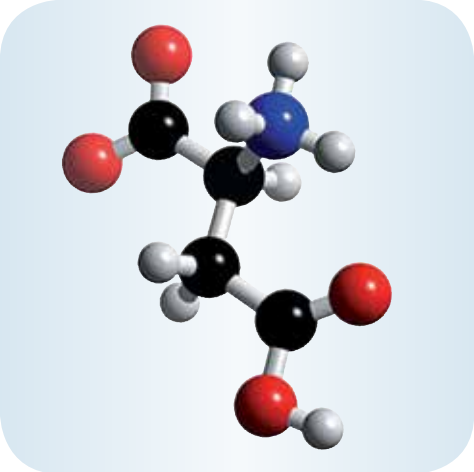
12/20 nm, 5 µm semi-preparative columns

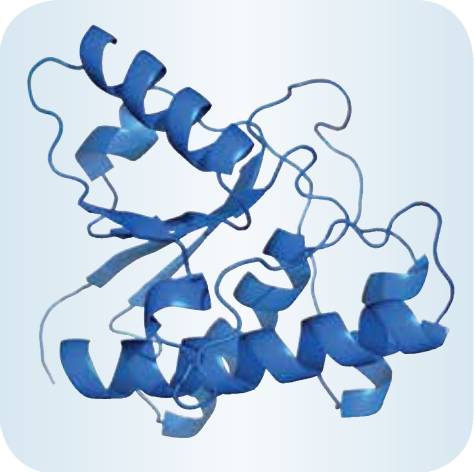
Phase	Column ID [mm]	Column length [mm]	
		150	250
YMC-Triart C18*	10 20 30	TA12S05-1510WT TA12S05-1520WX TA12S05-1530WX	TA12S05-2510WT TA12S05-2520WX TA12S05-2530WX
YMC-Triart C8*	10 20 30	TO12S05-1510WT TO12S05-1520WX TO12S05-1530WX	TO12S05-2510WT TO12S05-2520WX TO12S05-2530WX
YMC-Pack ODS-A (C18)*	10 20 30	AA12S05-1510WT AA12S05-1520WX AA12S05-1530WX	AA12S05-2510WT AA12S05-2520WX AA12S05-2530WX
YMC-Pack ODS-AQ (C18)*	10 20 30	AQ12S05-1510WT AQ12S05-1520WX AQ12S05-1530WX	AQ12S05-2510WT AQ12S05-2520WX AQ12S05-2530WX
YMC-Pack *Pro* C18*	10 20 30	AS12S05-1510WT AS12S05-1520WX AS12S05-1530WX	AS12S05-2510WT AS12S05-2520WX AS12S05-2530WX
Hydrosphere C18*	10 20 30	HS12S05-1510WT HS12S05-1520WX HS12S05-1530WX	HS12S05-2510WT HS12S05-2520WX HS12S05-2530WX
YMC-Pack C_8	10 20 30	OC12S05-1510WT OC12S05-1520WT OC12S05-1530WT	OC12S05-2510WT OC12S05-2520WT OC12S05-2530WT
YMCbasic (eq. C8)*	10 20 30	BA99S05-1510WT BA99S05-1520WX BA99S05-1530WX	BA99S05-2510WT BA99S05-2520WX BA99S05-2530WX
YMC-Pack C_4	10 20 30	BU12S05-1510WT BU12S05-1520WT BU12S05-1530WT	BU12S05-2510WT BU12S05-2520WT BU12S05-2530WT
YMC-Pack PROTEIN-RP (eq. C4)	10 20 30	PR99S05-1510WT PR99S05-1520WT PR99S05-1530WT	PR99S05-2510WT PR99S05-2520WT PR99S05-2530WT

Guard Columns are available for the different column dimensions.
For more details please contact your local YMC subsidiary.

* Columns with 20/30 mm ID available in YMC-Actus hardware. For further information on YMC-Actus please refer to page 69-81.

For further information about our preparative bulk materials please refer to page 338-349.





NP/
HILIC

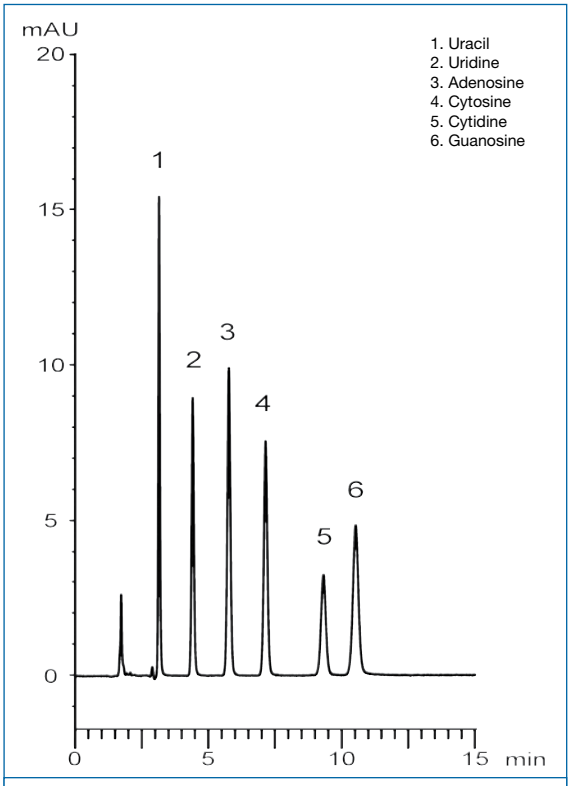
NP / HILIC

Hydrophilic Interaction Chromatography (HILIC)

Hydrophilic Interaction Chromatography is a technique which has attracted more and more attention because it offers an alternative approach for the separation of highly polar compounds. The method itself, although it has been known for more than 25 years, has become more popular recently due to the introduction of several specialised HILIC phases. However it is not so well known that HILIC separations can be accomplished using any highly polar stationary phase.
This opens up a large range of materials which are suitable for HILIC separations. HILIC separations traditionally use a highly polar stationary phase and a non polar mobile phase e.g. functionalised silica with a hydrophilic coating and an acetonitrile/water mixture (90/10) for small molecules but separations of larger biomolecules is becoming increasingly more popular.

YMC Columns for HILIC	YMC-Pack Silica	YMC-Pack PVA-Sil	YMC-Pack Polyamine II	YMC-Pack Amino	YMC-Pack Diol	YMC-Triart Diol-HILIC
Particle size / µm	3; 5	5	5	3; 5	5	1.9; 3; 5
Pore size / nm	6; 12; 20; 30	12	12	12	12; 20; 30	12
pH range	2.0 - 7.5	2.0 - 9.5	2.0 - 7.5	2.0 - 7.5	2.0 – 7.5	2.0 - 10.0

Nucleosides and bases



Column:	YMC-Pack Diol-NP (5µm 12nm) 150 x 2.0 mm ID)
Part No:	DL12S05-1502WT
Eluent:	water / acetonitrile (10/90) containing 10 mM CH_3COONH_4
Flow rate:	0.2 mL/min
Temperature:	30 °C
Detection:	UV at 254 nm

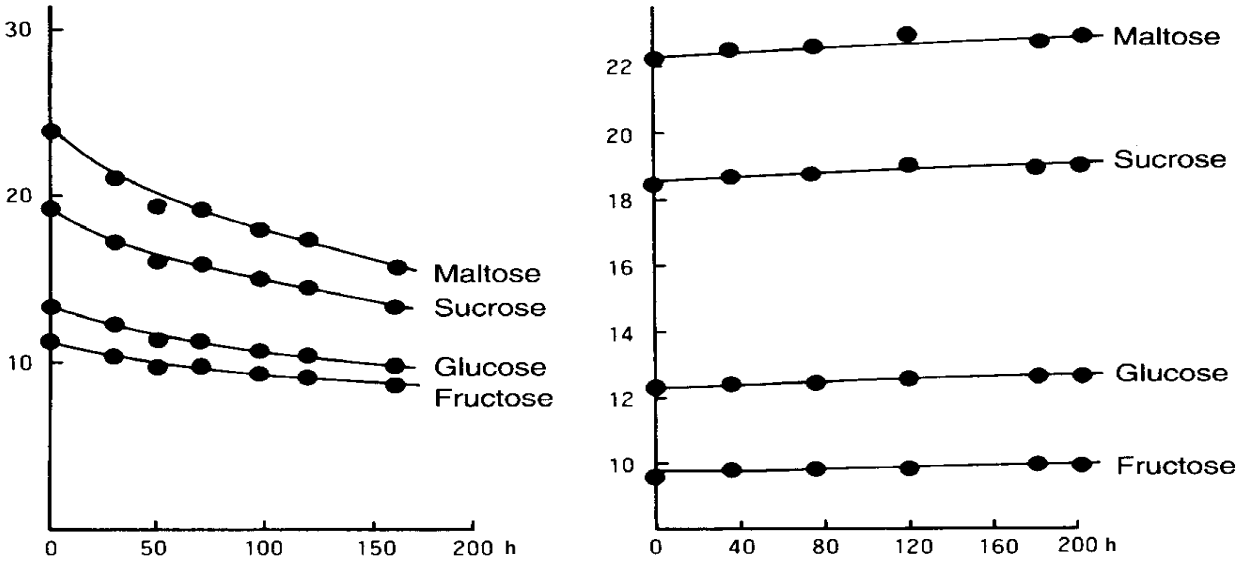
Outstanding Retention and Resolution with YMC HILIC!

YMC-Pack Polyamine II

YMC-Pack Polyamine II is a unique phase, based on ultrapure 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 towards carbonyl compounds.

Therefore, unlike conventional amino phases with primary n-propylamino ligands, YMC-Pack Polyamine II does not form Schiff 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 (as shown in the figure below).

Stability of amino type packings

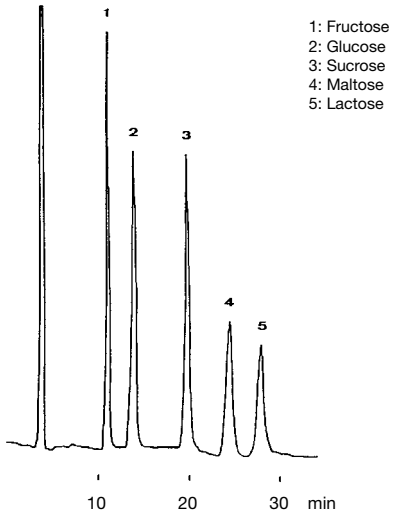


a) conventional amino phase

b) YMC-Pack Polyamine II

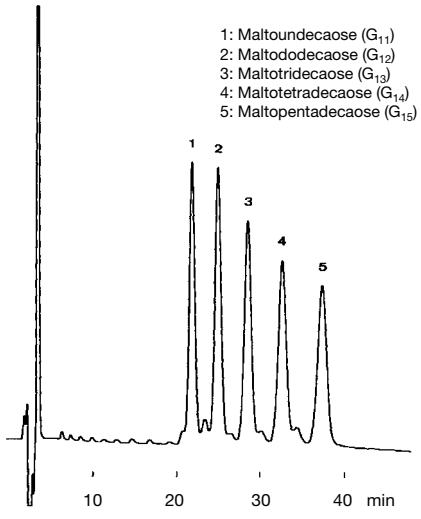
Applications

Mono- and Di-saccharides



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

Malto-oligosaccharides

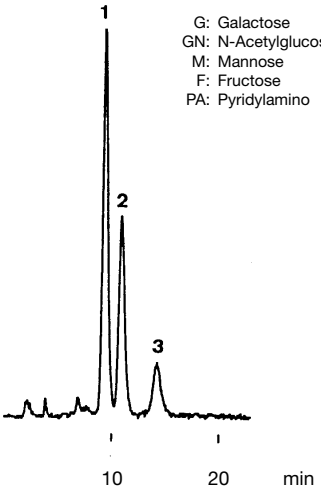


Column:	YMC-Pack Polyamine II (5 µm) 250 x 4.6 mm ID
Part No.:	PB12S05-2546WT
Eluent:	ACN / H_2O = 55/45
Flow rate:	1.0 mL/min
Detection:	RI, 32 x 10^{-6} RIU/FS
Temperature:	26 °C

* Application data by courtesy YMC Co., Ltd.

YMC-Pack Polyamine II

Pyridylamino (PA)-Sugar chains



G: Galactose
GN: N-Acetylglucosamine
M: Mannose
F: Fructose
PA: Pyridylamino

1:PA Sugar Chain 014, N-Acetyllactosamine-type agalacto tetraantennary

GN(β1♦6)
GN(β1♦2) — M(α1♦6)
GN(β1♦4)
GN(β1♦2) — M(α1♦3)
→ M(β1♦4)GN(β1♦4)GN-PA

2:PA Sugar Chain 001, N-Acetyllactosamine-type biantennary

G(β1♦4)GN(β1♦2)M(α1♦6)
G(β1♦4)GN(β1♦2)M(α1♦3)
→ M(β1♦4)GN(β1♦4)GN-PA

3:PA Sugar Chain 002, N-Acetyllactosamine-type triantennary

G(β1♦4)GN(β1♦2) — M(α1♦6)
G(β1♦4)GN(β1♦4)
G(β1♦4)GN(β1♦2) — M(α1♦3)
→ M(β1♦4)GN(β1♦4)GN-PA

Column: YMC-Pack Polyamine II (5 µm) 150 x 4.6 mm ID
Part No.: PB12S05-1546WT
Eluent: methanol / $NH_4H_2PO_4$ (20 mM) = 80/20
Flow rate: 1.0 mL/min
Detection: fluoresence, Ex.320 nm, Em. 400 nm, 4 mV/FS
Temperature: 37 °C

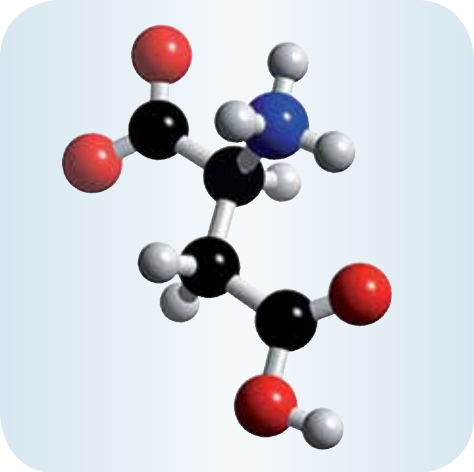
Ordering Information

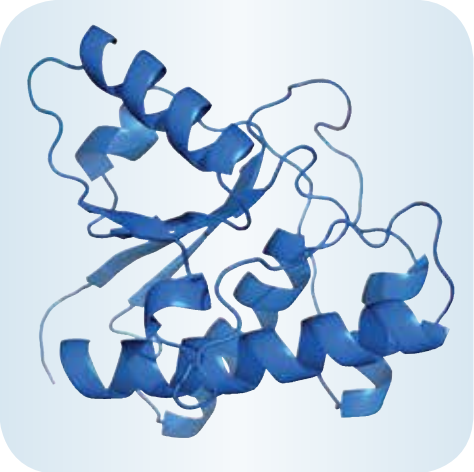
YMC-Pack Polyamine II, 12 nm, 5 µm

Phase dimension	Column ID [mm]	Column length [mm]					Guard cartridges* with 10 mm length [pack of 5]
		30 (WT) / 33 (QT)	50	100	150	250	
12 nm 5 µm	2.1	PB12S05-H3Q1QT	PB12S05-05Q1QT	PB12S05-10Q1QT	PB12S05-15Q1QT	PB12S05-25Q1QT	PB12S05-01Q1GC
	3.0	PB12S05-H303QT	PB12S05-0503QT	PB12S05-1003QT	PB12S05-1503QT	PB12S05-2503QT	PB12S05-0103GC
	4.0	PB12S05-H304QT	PB12S05-0504QT	PB12S05-1004QT	PB12S05-1504QT	PB12S05-2504QT	PB12S05-0104GC
	4.6	PB12S05-0346WT	PB12S05-0546WT	PB12S05-1046WT	PB12S05-1546WT	PB12S05-2546WT	PB12S05-0104GC

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

For more details please contact us: Phone 02064-427-0 or E-Mail info@ymc.de.

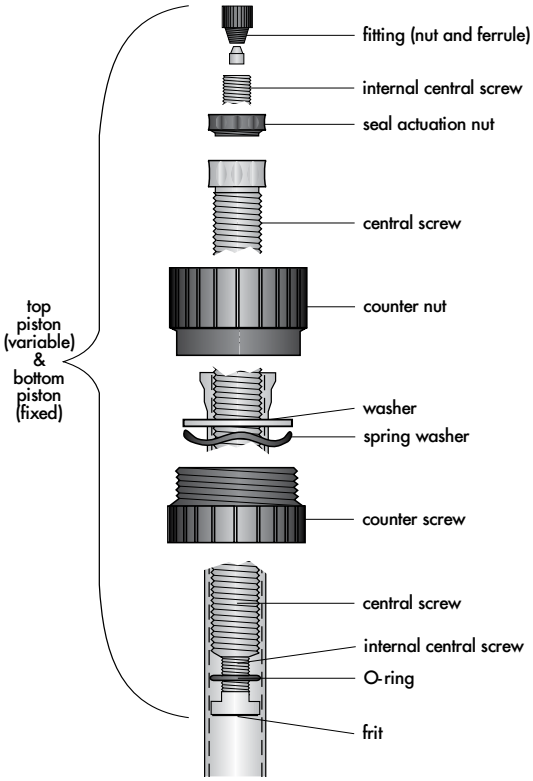




GLASS
COLUMNS

ECO Glass Columns

- **biocompatible**
- **solvent resistant version (optional)**
- **easy to use**
- **low temperature application**
- **2 adjustable length plungers (Multivario) supplied on request**
- **compatible with any LC system**
- **water-jacketed version available on request**
- **FDA, BSE/TSE certificates available**



ECO Column ID 10-50 mm

General

ECO columns are glass columns for almost all types of soft gel and low pressure (pressure limit 5 - 30 bar) liquid chromatography applications. With a choice of one or two adjustable length plungers, they are available in two forms: AB (aqueous buffer) for use with aqueous buffers and cold room applications and SR (solvent resistant) for all forms of normal and reversed phase chromatography.

ECO columns are produced by high-precision CNC manufacturing. They are competitively priced and equipped with a screw-lock system which makes it possible to open and seal the column simply and quickly. Each column passes a quality control pressure test. A water-jacketed option can be supplied on request.

Versions available

Version	Temperature Range [°C]	Plunger	Seal	Frit
ECO AB (Aqueous Buffer)	4 - 40	POM	Viton® O-ring EPDM	Porous glass (ID 10 - 50 mm) Polyethylene (ID 70 - 80 mm)
ECO SR (Solvent Resistant)	4 - 40	PVDF	Kalrez® O-ring	Porous glass (ID 10 - 50 mm) Stainless steel (ID 70 - 80 mm)

ECO Glass Columns

Characteristics

Pressure limit: 5 - 30 bar (depending on diameter)

Temperature range: aqueous buffer version (AB): 4 - 40 °C
solvent resistant version (SR): 4 - 40 °C

Wetted parts: borosilicate glass
aqueous buffer version (AB): POM, sintered glass frit and Viton® seal (ID 10 - 50 mm)
POM, polyethylene frit and EPDM seal (ID 70 - 80 mm)
solvent resistant version (SR): PVDF, sintered glass frit and Kalrez® seal (ID 10 - 50 mm)
PVDF, stainless steel frit and Karlez® seal (ID 70 - 80 mm)

Diameters: 10 mm, 15 mm, 25 mm, 50 mm, 70 mm, 80 mm

Bed lengths: 120 mm, 200 mm, 450 mm, 750 mm, 1000 mm

Height adjustment: Adjustable plunger provides up to 120 mm bed height adjustment (2 adjustable plungers supplied on request).

Connections: The columns are supplied with different adaptors to allow direct connection to any LC-system.

Specifications

		Vario		Multivario	
ID [mm]	Pressure limit [bar]	Bed length [mm]	Volume [mL]	Bed length [mm]	Volume [mL]
10	30	0 - 120 80 - 200 330 - 450 630 - 750 880 - 1000	0 - 9 7 - 15 28 - 35 54 - 58 75 - 78	0 - 120 0 - 200 220 - 450 520 - 750 780 - 1000	0 - 9 0 - 15 19 - 35 44 - 58 66 - 78
15	25	0 - 120 80 - 200 330 - 450 630 - 750 880 - 1000	0 - 19 14 - 32 58 - 73 111 - 122 156 - 163	0 - 120 0 - 200 210 - 450 510 - 750 760 - 1000	0 - 19 0 - 32 37 - 73 90 - 122 134 - 163
25	15	0 - 120 80 - 200 330 - 450 630 - 750 880 - 1000	0 - 60 50 - 100 190 - 230 365 - 390 510 - 520	0 - 120 0 - 200 220 - 450 520 - 750 770 - 1000	0 - 60 0 - 100 130 - 230 300 - 390 445 - 520
50	10	0 - 120 80 - 200 330 - 450 630 - 750 880 - 1000	0 - 235 180 - 390 730 - 885 1390 - 1480 1945 - 1970	0 - 120 0 - 200 230 - 450 530 - 750 780 - 1000	0 - 235 0 - 390 510 - 885 1170 - 1480 1725 - 1970
70	5	—	—	0-120 0-200 70-450 370-750 620-1000	0-425 0-710 290-1610 1530-2680 2530-3570
80	5	—	—	0-120 0-200 70-450 370-750 620-1000	0-560 0-940 380-2120 1980-3530 3320-4710

Accessories supplied

All columns: 1x frit removal tool / 2x plugs, PTFE (1/4“-28G)

and for each specific diameter the following tubing, nuts and ferrules:

ID 10–15 mm: 1x 1m FEP-tubing (0.8 x 1.6 mm); 4x 1/4“-28G nuts and ferrules (collapsible) for 1/16“ tubing; 2x M6 nuts and ferrules for 1/16“ tubing and 2x 10-32 nuts and ferrules for 1/16“ tubing

ID 25–80 mm: 1x 1m FEP-tubing (1.6 or 2.4 x 3.2 mm); 4x 1/4“-28G nuts and ferrules (collapsible) for 1/8“ tubing and 2x M6 nuts and ferrules for 1/8“ tubing

Ordering guide

The part numbers for the columns contain information on the column type, inner diameter, column length, plunger type, frit porosity and seal (O-ring) material.

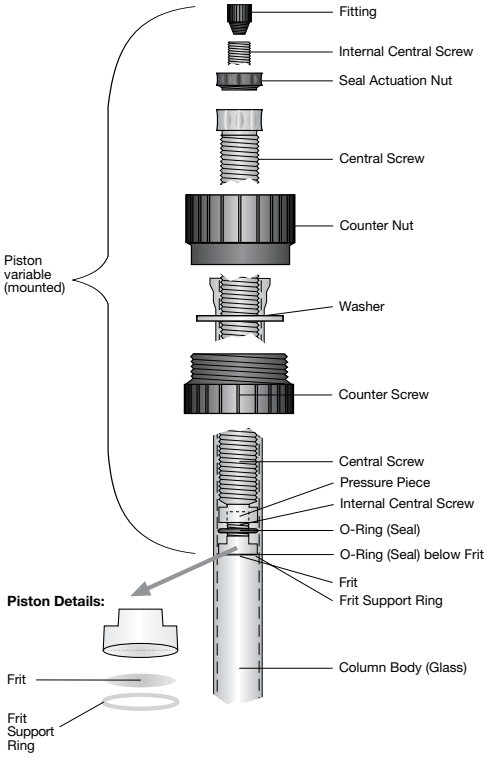
Inner diameter ID [mm]*	Pressure limit [bar]	Order code
10	30	ECO10/
15	25	ECO15/
25	15	ECO25/
50	10	ECO50/
70	5	ECO70/
80	5	ECO80/

* Columns with inner diameter of 20 and 32 mm are available upon request

Max. bed length [mm]	Order code
120	120
200	200
450	450
750	750
1000	999
Longer columns are available on request.	

No. of adjustable plungers	Order code
1 adjustable plunger (Vario)	V
2 adjustable plungers (Multivario)	M
up to 120 mm bed variability each	

Frit porosity [µm]	Order code
10	0
16 - 40	3
40 - 100	4
Other frit porosities are available on request.	



ECO Column ID 70-80mm

Column version	Seal O-ring material	Order code
ECO AB (Aqueous Buffer)	Viton® / EPDM	V / E
ECO SR (Solvent Resistant)	Kalrez®	K

Option	Order code
Water-jacket version*	-K
*(only in combination with Multi Vario plunger)	

Ordering guide

Examples

To order an aqueous buffer ECO column with an inner diameter of 15 mm, a column length of 120 mm, with 1 adjustable plunger and a frit porosity of 16 - 40 µm, a Viton O-ring and without the water-jacket option, please use the corresponding part number ECO15/120V3V.

Part Number: ECO15/120V3V

Example	ECO	15/	120	V	3	V
Column type	ECO					
Inner diameter		15/				
Max. bed length			120			
Plunger type				V		
Frit porosity					3	
Seal O-ring material						V

To order a solvent resistant ECO column with an inner diameter of 10 mm, a column length of 120 mm, with 2 adjustable plungers and a frit porosity of 10 µm, a Kalrez O-ring and with the water-jacket option, please use the corresponding part number ECO10/120M0K-K.

Part Number: ECO10/120M0K-K

Example	ECO	10/	120	M	0	K	-K
Column type	ECO						
Inner diameter		10/					
Column length			120				
Plunger type				M			
Frit porosity					0		
Seal O-ring material						K	
Water-jacket version							-K

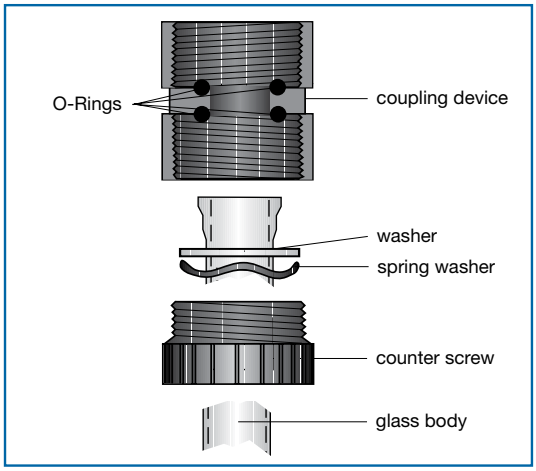
Packing Adaptors

The ECO series packing adaptors consist of a column coupler and an empty glass body. These must be of the same diameter as the column to be packed and must only be used as packing adaptors, not for extending the length of a column body. The length of the additional glass body used should be selected to allow:

- Double the volume of slurry compared to the required packed bed volume if packing silica materials
- Triple the volume of slurry for softer packing materials

The product manual supplied with each column contains detailed examples of dry packing and slurry packing techniques.

For ordering information please see next page.



column coupler

Ordering information for ECO packing adaptors

Inner Diameter*	Description	Length	Part Number
10	Column Coupler (no Glass Body) including Viton® O-Ring		ECO10KU/V-2
15	Column Coupler (no Glass Body) including Viton® O-Ring		ECO15KU/V-2
25	Column Coupler (no Glass Body) including Viton® O-Ring		ECO25KU/V-2
50	Column Coupler (no Glass Body) including Viton® O-Ring		ECO50KU/V-2
70	Column Coupler (no Glass Body) including EPDM O-Ring		ECO70KU/E-2
80	Column Coupler (no Glass Body) including EPDM O-Ring		ECO80KU/E
10	Glass Body for use with Column Coupler	120 200 450 750 1000	ECO10/120 ECO10/200 ECO10/450 ECO10/750 ECO10/999
15	Glass Body for use with Column Coupler	120 200 450 750 1000	ECO15/120 ECO15/200 ECO15/450 ECO15/750 ECO15/999
25	Glass Body for use with Column Coupler	120 200 450 750 1000	ECO25/120 ECO25/200 ECO25/450 ECO25/750 ECO25/999
50	Glass Body for use with Column Coupler	120 200 450 750 1000	ECO50/120 ECO50/200 ECO50/450 ECO50/750 ECO50/999
70	Glass Body for use with Column Coupler	120 200 450 750 1000	ECO70/120 ECO70/200 ECO70/450 ECO70/750 ECO70/999
80	Glass Body for use with Column Coupler	120 200 450 750 1000	ECO80/120 ECO80/200 ECO80/450 ECO80/750 ECO80/999

* Column Couplers for columns with inner diameter of 20 and 32 mm are available upon request

ECO^{PLUS} Glass Columns

- **Suitable for universal use**
- **Biocompatible**
- **Simple to use**
- **Compatible to any LC system**
- **Height-adjustable pistons at both ends**
- **Suitable for cold rooms from 4 - 40 °C (with polyethylene piston and EPDM O ring)**
- **SR-Version resistant to organic solvents (SR = Solvent Resistant)**
- **FDA, BSE/TSE certificates available**

General

Biochromatography is widely applied in high-performance downstream processing techniques that can be used for a range of compounds, such as proteins, peptides or nucleic acids. When using various chromatographic techniques such as ion exchange, affinity or gel permeation chromatography, increasingly high-performance separation media are used and, as a result, higher demands are made on the quality of the column hardware.
ECO^{PLUS} glass columns meet the highest criteria for professional laboratory use. Particular attention has been paid to the column volume ranges that are as wide as possible (0.4 - 982 mL) and to the high pressure resistance (up to 80 bar / 1160 psi), so that high flow rates and performance/efficiency can be achieved.
We have selected high-quality, inert materials to make sure ECO^{PLUS} glass columns are biocompatible and offer the best conditions for high recovery with no loss of bio-activity of your biomolecules. Thanks to the “Quick-Lock” seal and the two adjustable pistons, the columns are fully adjustable and easy to use.
Given the wide range of diameters, frit porosities and lengths available, you can use ECO^{PLUS} glass columns for the most diverse of applications.

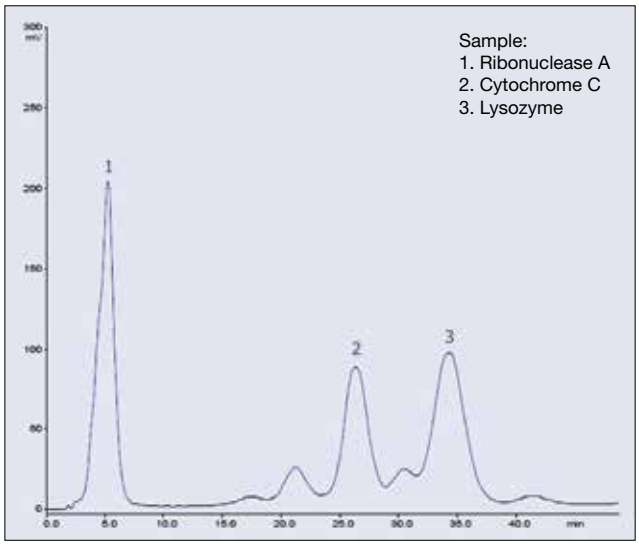
”Quick-Lock“ Fitting

No more than a quarter turn is needed to seal the column.
Piston height adjustment is done by turning the locked “Quick-Lock” Fitting.

Application Examples

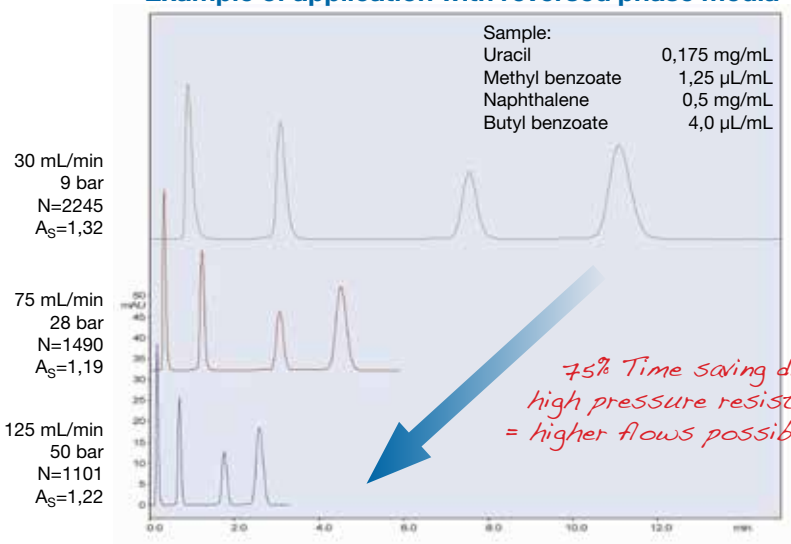
In reversed phase and adsorption chromatography, the possibilities for using glass columns are often limited due to high back pressures generated by small particles. The high pressure resistance of the ECO^{PLUS} glass columns allow you to achieve high flow rates for demanding separations. The example shows that this enables a considerable acceleration of the separation, which means that you can achieve significant time savings.

Separation of a standard test mixture of proteins



Column:	ECO^{PLUS} 250 x 15 mm ID
Stationary phase:	BioPro S30, 30 µm (bed length 170 mm)
Mobile phase:	A) 20 mM KH_2PO_4*K_2HPO_4 (pH 6.8)
	B) 20 mM KH_2PO_4*K_2HPO_4 (pH 6.8) containing 0.5 M NaCl
Gradient:	40-80% B
Flow rate:	6 mL/min
Temperature:	25°C
Detection:	UV at 220 nm
Injection:	100 µl

Example of application with reversed phase media



Column:	ECO^{PLUS} 125 x 25 mm ID
Stationary phase:	YMC*Gel ODS-AQ, 10 µm, 12 nm, 8 cm bed length
Flow rate:	30 mL/min - 75 mL/min - 125 mL/min
Mobile phase:	ACN/H_2O (50:50)
Injection:	500 µL
Detection:	UV at 254 nm

Product options

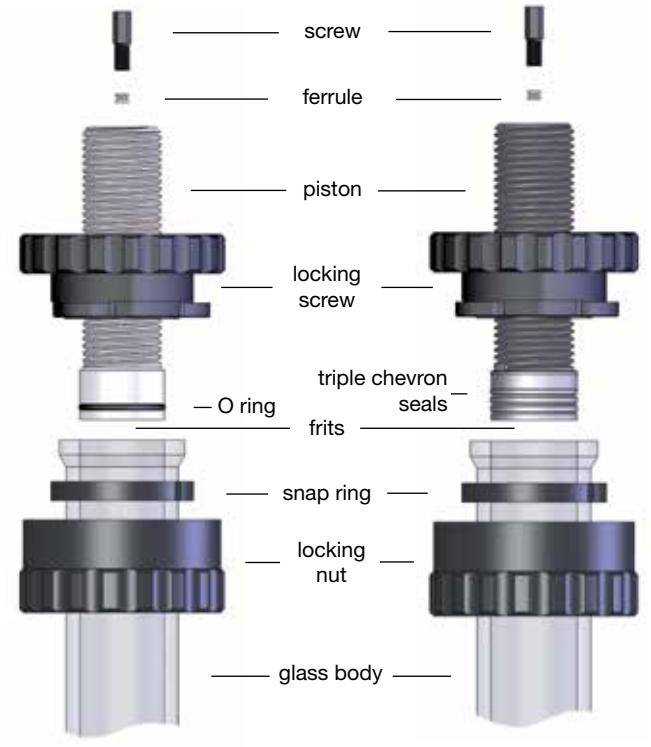
ECO^{PLUS} laboratory glass columns are routinely available in three different lengths (125, 250, and 500 mm) and three combinations of pistons (Short, Short/Long, Long) in order to accommodate different volume configurations.

5 mm ID | 10 mm ID | 15 mm ID | 25 mm ID | 35 mm ID | 50 mm ID

The modular construction allows for a range of piston variations to provide the ideal column volume.

Standard Version for Aqueous Buffers (AB)

Optional Version Solvent Resistant (SR)



ECO^{PLUS} glass columns are multi-purpose columns for all liquid chromatography applications (with pressure limits of 30 to 80 bar (435 to 1160 psi) - depending on column diameter as shown in the table on the next page). ECO^{PLUS} glass columns are available in two versions:

Standard Version

(AB = Aqueous Buffer) for aqueous buffers and applications in cold rooms.

Optional Version

(SR = Solvent Resistant) for normal and reversed phase chromatography.

The height-adjustable pistons (standard) at each end of the ECO^{PLUS} glass column with Teflon ribs (SR-version) are suitable for the entire spectrum of normal phase and reversed phase chromatography as well as biochromatography above ambient temperature.

All ECO^{PLUS} glass columns are made with high-precision CNC machines and undergo several rigorous quality controls before they are delivered.

ECO^{PLUS} Glass Columns

Versions available / materials used / components in contact with media

All the columns are made of borosilicate glass 3.3 (calibrated precision glass - KPG®)

Version*	Temperature range [°C]	max. Pressure [bar]	Piston	Seal	Frits
ECO^{PLUS} AB (Aqueous Buffer)	4 - 40	ID 05 mm: 80 ID 10 mm: 80 ID 15 mm: 70 ID 25 mm: 50 ID 35 mm: 40 ID 50 mm: 30	Polyethylene	O ring EPDM (ethylene-propylene-diene-M-class rubber)	Column ID 5-50 mm: Polyethylene
ECO^{PLUS} SR (Solvent Resistant)	16 - 40	ID 05 mm: 80 ID 10 mm: 50 ID 15 mm: 50 ID 25 mm: 50 ID 35 mm: 40 ID 50 mm: 15	PTFE (Teflon)	PTFE (Teflon)	Column ID 5-15 mm: sintered glass Column ID 25-50 mm: Stainless steel (SS)

* Material certificates for wetted parts are available upon request.

Specifications

ID [mm]	Pressure limit [bar]	short plungers		short/long plunger		long plungers	
		Bed length [mm]	Volume [ml]	Bed length [mm]	Volume [ml]	Bed length [mm]	Volume [ml]
5	AB = 80 SR = 80	30 - 125 150 - 250 400 - 500	0.6 - 2.4 3.0 - 4.9 7.9 - 9.8	0 - 125 70 - 250 320 - 500	0 - 2.4 1.4 - 4.9 6.3 - 9.8	0 - 125 0 - 250 240 - 500	0 - 2.4 0 - 4.9 4.8 - 9.8
10	AB = 80 SR = 50	40 - 125 160 - 250 410 - 500	3.2 - 9.8 13 - 19 33 - 39	0 - 125 80 - 250 330 - 500	0 - 9.8 6.2 - 19 26 - 39	0 - 125 0 - 250 250 - 500	0 - 9.8 0 - 19 20 - 39
15	AB = 70 SR = 50	30 - 125 155 - 250 405 - 500	6 - 22 28 - 44 72 - 88	0 - 125 75 - 250 325 - 500	0 - 22 14 - 44 58 - 88	0 - 125 0 - 250 245 - 500	0 - 22 0 - 44 44 - 88
25	AB = 50 SR = 50	30 - 125 160 - 250 410 - 500	15 - 60 80 - 120 205 - 245	0 - 125 80 - 250 330 - 500	0 - 60 40 - 120 165 - 245	0 - 125 0 - 250 250 - 500	0 - 60 0 - 120 125 - 245
35	AB = 40 SR = 40	35 - 125 160 - 250 410 - 500	35 - 120 155 - 240 395 - 480	0 - 125 80 - 250 330 - 500	0 - 120 80 - 240 320 - 480	0 - 125 0 - 250 250 - 500	0 - 120 0 - 240 245 - 480
50	AB = 30 SR = 15	40 - 125 170 - 250 415 - 500	80 - 245 335 - 490 815 - 980	0 - 125 90 - 250 340 - 500	0 - 245 180 - 490 670 - 980	0 - 125 0 - 250 255 - 500	0 - 245 0 - 490 500 - 980

Standard accessories (included with the column)

All glass columns include: 1x frit removal tool / 2x plugs, PTFE (1/4”-28G),

plus the screws, ferrules and capillaries required to link up to any LC system, depending on the tube ID:

ID 5 mm: 1x 1m ETFE 1/16” capillary tubing pre-assembled / 4x ¼”-28G screws / ferrules for 1/16” tubing / 2x M6 screws / ferrules for 1/16” tubing / 2 x 10-32 screws / ferrules for 1/16“ tubing.

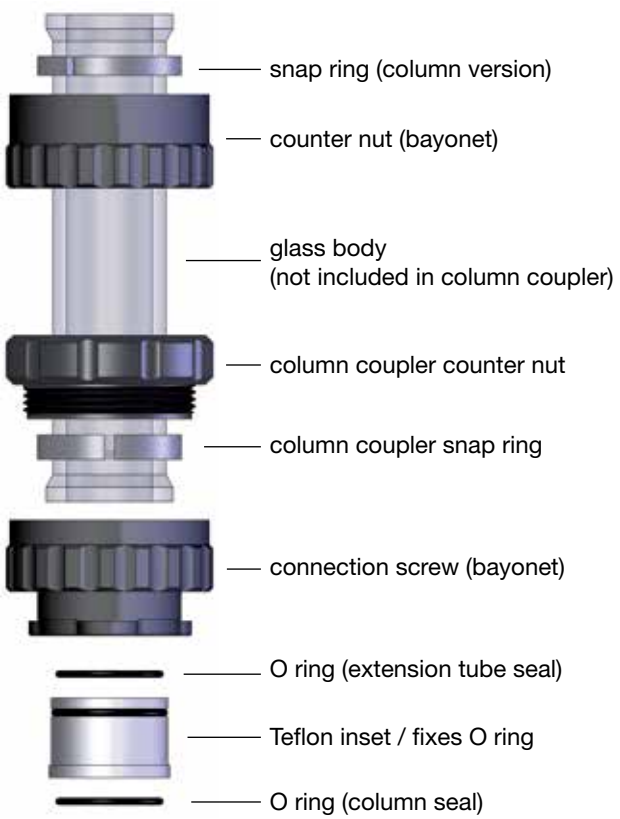
ID 10 – 15 mm: 1x 1m FEP 1/16” capillary tubing (0.8 x 1.6 mm) / 4x ¼”-28G screws / ferrules for 1/16” tubing / 2x M6 screws / ferrules for 1/16” tubing / 2x 10-32 screws / ferrules for 1/16” tubing.

ID 25 – 50 mm: 1x 1m FEP 1/8” capillary tubing (1.6 x 3.2 mm) / 4x ¼”-28G screws / ferrules for 1/8” tubing / 2x M6 screws / ferrules for 1/8” tubing.

ECO^{PLUS} Glass Columns

Accessories / Replacement parts

To allow packing of a glass column, you can use the ECO^{PLUS} column coupler to join a glass body to a column. For this to work, it must have the same inside diameter as the column. The length of the extra glass body required for column packing depends on the packing material being used and can be calculated from the packing instructions for the chosen packing material.



Column couplers consist of:

- ECO^{PLUS} connection screw with Teflon insert (assembled)
- Column coupler counter screw with snap ring
- Counter nut (bayonet) with snap ring
- AB-version has two sets (4 items) of Viton® O rings
- SR-version has two Kalrez® O rings

ECO^{PLUS} column coupler

Column ID [mm]	AB Version column couplers* Part No.	SR Version column couplers* Part No.
5	TAC05KU-AB	TAC05KU-SR
10	TAC10KU-AB	TAC10KU-SR
15	TAC15KU-AB	TAC15KU-SR
25	TAC25KU-AB	TAC25KU-SR
35	TAC35KU-AB	TAC35KU-SR
50	TAC50KU-AB	TAC50KU-SR

* the column coupler does not include a glass body: please order this separately

ECO^{PLUS} glass bodies

Column ID [mm]	max. bed length 125 mm Part No.	max. bed length 250 mm Part No.	max. bed length 500 mm Part No.
5	TAC05/125-2	TAC05/250-2	TAC05/500-2
10	TAC10/125-2	TAC10/250-2	TAC10/500-2
15	TAC15/125-2	TAC15/250-2	TAC15/500-2
25	TAC25/125-2	TAC25/250-2	TAC25/500-2
35	TAC35/125-2	TAC35/250-2	TAC35/500-2
50	TAC50/125-2	TAC50/250-2	TAC50/500-2

Ordering guide

The part number for an ECO^{PLUS} glass column consists the identification of the inner diameter, maximum bed length, piston set type, frit porosity and material, plus the model type (SR or AB version).

To order a solvent resistant ECO^{PLUS} glass column with an inner diameter of 25 mm, a maximum bed length of 500 mm, 2 short pistons and stainless steel frits with a porosity of 2 µm, the part number would be: TAC25/500S2-SR-2 (see example).

Combination options	TAC05/ (5 mm ID) TAC10/ (10 mm ID) TAC15/ (15 mm ID) TAC25/ (25 mm ID) TAC35/ (35 mm ID) TAC50/ (50 mm ID)	125 (125 mm max. bed length) 250 (250 mm max. bed length) 500 (500 mm max. bed length)	— Standard version has 2 short pistons: no product coding required; For other versions, please insert either: SL (1 short/1 long piston) or L (2 long pistons)	PE Polyethylene (AB-Version) G Sintered glass (SR-Version with ≤ 15 mm ID) S Stainless steel (SS) (SR-Version with ≥ 25 mm ID)	2 (2 µm) 5 (5 µm only polyethylene frits available) 0 (10 µm)	-AB-2 (aqueaous buffer) -SR-2 (solvent restistant)
Example	TAC25/	500		S	2	-SR-2
Inner diameter	25 mm					
max. bed length		500 mm				
Piston type						
Frit material				Stainless steel		
Frit porosity					2 µm	
Version						SR-Version

Pilot Glass and DAU Columns

For information on YMC Pilot glass columns and YMC DAU (dynamic axial compression) columns, please request the corresponding brochures.

Chiral Columns

Contents

Introduction

HPLC Columns for Optical Isomer Separation

Chirality has become vitally important in the production of pharmaceuticals, agrochemicals, food and related products due to the different pharmacological or taste/odour effects which the different optical isomers can present. The pharmacological effects can range from no activity through undesirable effects to having potentially life threatening adverse effects. This has led to the development of highly efficient CHIRAL stationary phases (CSP) for analytical and preparative scale separations.

If the CSP is available in two enantiomeric configurations the elution order of enantiomeric pairs can be reversed.

This is particularly useful when the two isomers are not present in equal quantities; a later eluting minor component can often be hidden by the tail of a major peak but on reversal of elution order can be totally resolved from the major component.

CHIRAL ART
Coated Polysaccharide Derivatives Series

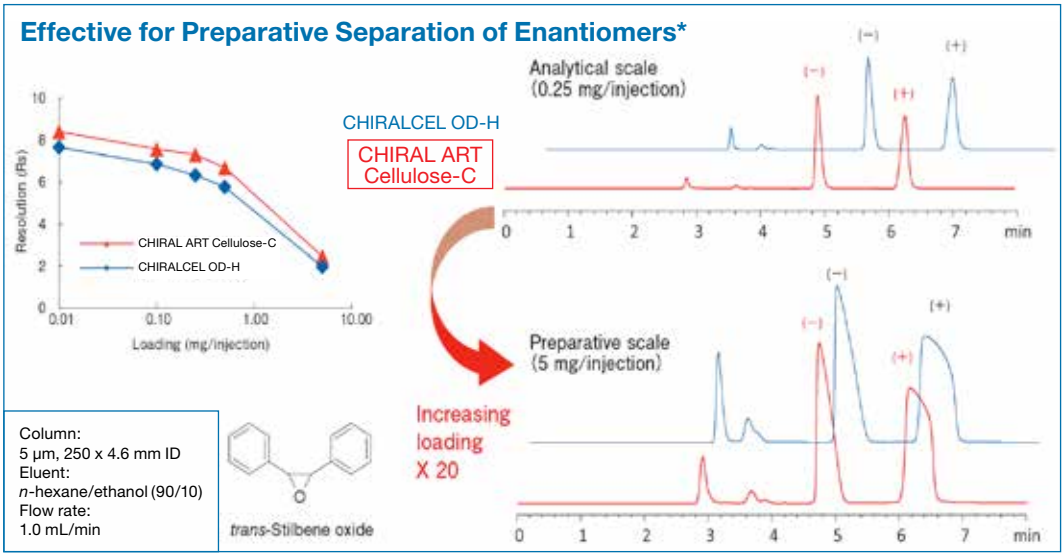
- **polysaccharide chiral selectors**
- **wide application range**
- **with high stability, also for SFC/SMB**
- **HPLC columns and preparative grade bulk media with particle sizes of 3, 5, 10 or 20 µm available**
- **extremely attractive pricing**

Introduction

A family of coated chiral polysaccharide phases has been developed by YMC, designed to supply superior products which are competitively priced compared to established vendors. In addition – and typical of YMC – fully scalable preparative grades are available in large quantities.

Mobile phase and sample solvent

The silica packing material is coated with the polysaccharide derivative. Therefore trace quantities of a solvent which might potentially dissolve the polysaccharide derivative (eg. THF, acetone, ethyl acetate, chloroform, dichloromethane, DMSO, DMF, etc.) should be eliminated. These solvents must be avoided in the mobile phase and the sample solvent.



CHIRAL ART
Coated Polysaccharide Derivatives Series

Specifications	CHIRAL ART Amylose-C	CHIRAL ART Cellulose-C
Particle size	3, 5, 10, 20 µm	
CHIRAL selector	Amylose tris (3,5-dimethylphenylcarbamate)	Cellulose tris (3,5-dimethylphenylcarbamate)
USP	L51	L40
Type	Coated type	
Separation mode	Normal Phase / SFC	
Shipping solvent	*n*-hexane / 2-propanol (90/10)	
Temp. range	0-40 °C	
Pressure limit	30 MPa (4350 psi)	
Recommended flow rate	4.6 mm ID: 0.5 - 1.0 mL/min (Max. flow rate: 3.0 mL/min) 10 mm ID: 2.5 - 5.0 mL/min (Max. flow rate: 15 mL/min)	

Product Line-up

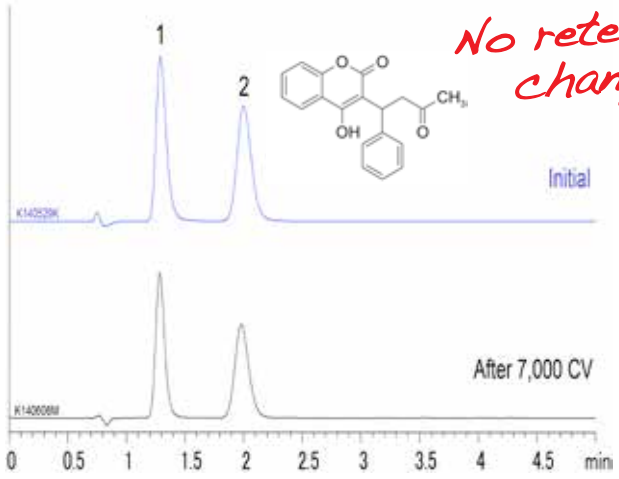
Product name	Particle size [µm]	Chiral selector	Type	Competitive product
CHIRAL ART Amylose-C	3 5 10 20	Amylose tris (3,5-dimethylphenylcarbamate)	Coated	CHIRALPAK® AD, AD-H, AD-3
CHIRAL ART Cellulose-C		Cellulose tris (3,5-dimethylphenylcarbamate)	Coated	CHIRALCEL® OD, OD-H, OD-3

* Application data by courtesy YMC Co., Ltd.

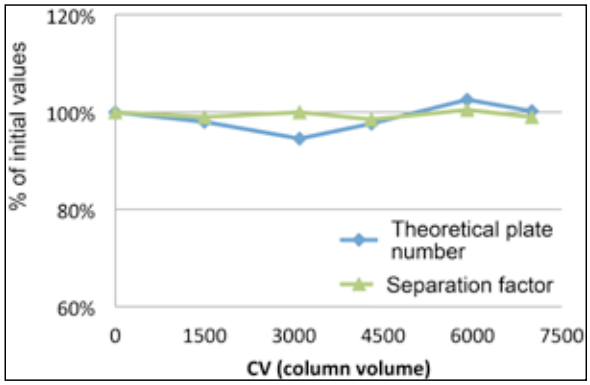
Coated Polysaccharides

Enhanced stability using TFA

Stability evaluation with Warfarin*

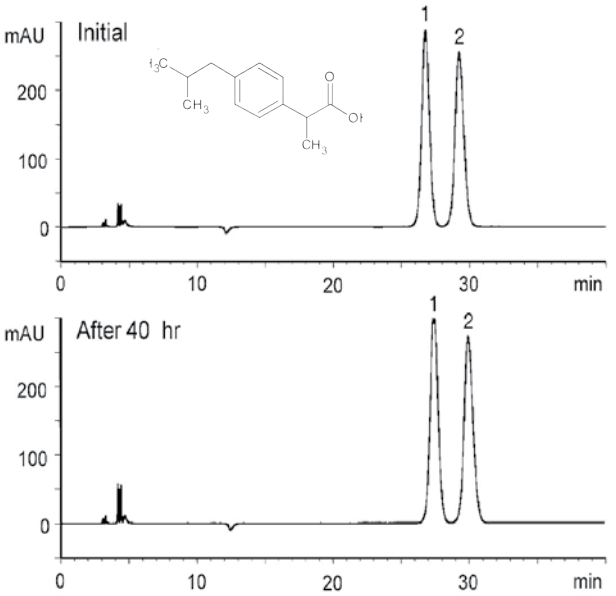


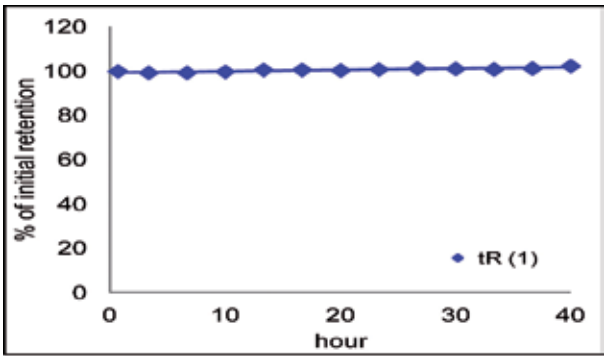
No retention time changes!

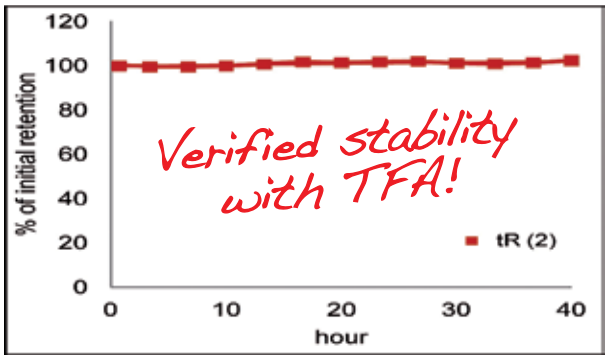


Column:	CHIRAL ART Amylose-C (5 µm) 50 x 3.0 mm ID
Part No.:	KAN99S05-0503WT
Eluent:	*n*-hexane / ethanol / TFA (70/30/0.1)
Flow rate:	0.425 mL/min
Temperature:	25°C
Detection:	UV at 254 nm

Repeated analysis of Ibuprofen*







Verified stability with TFA!

Column:	CHIRAL ART Amylose-C (5 µm) 250 x 4.6 mm ID
Part No.:	KAN99S05-2546WT
Eluent:	*n*-hexane / 2-propanol / TFA (99/1/0.1)
Flow rate:	1.0 mL/min
Temperature:	25°C
Detection:	UV at 220 nm
Injection:	10 µL (1 mg/mL)

TFA can be challenging for coated amylose phases with regards to stability and lifetime. CHIRAL ART Amylose-C however shows long-term stability using mobile phases containing TFA. The retention behaviour and column efficiency remain completely unaffected.

Coated Polysaccharides

Full scalability from 3 to 20 µm*

3 µm

150 x 4.6 mm ID
at 1.0 mL/min

5 µm

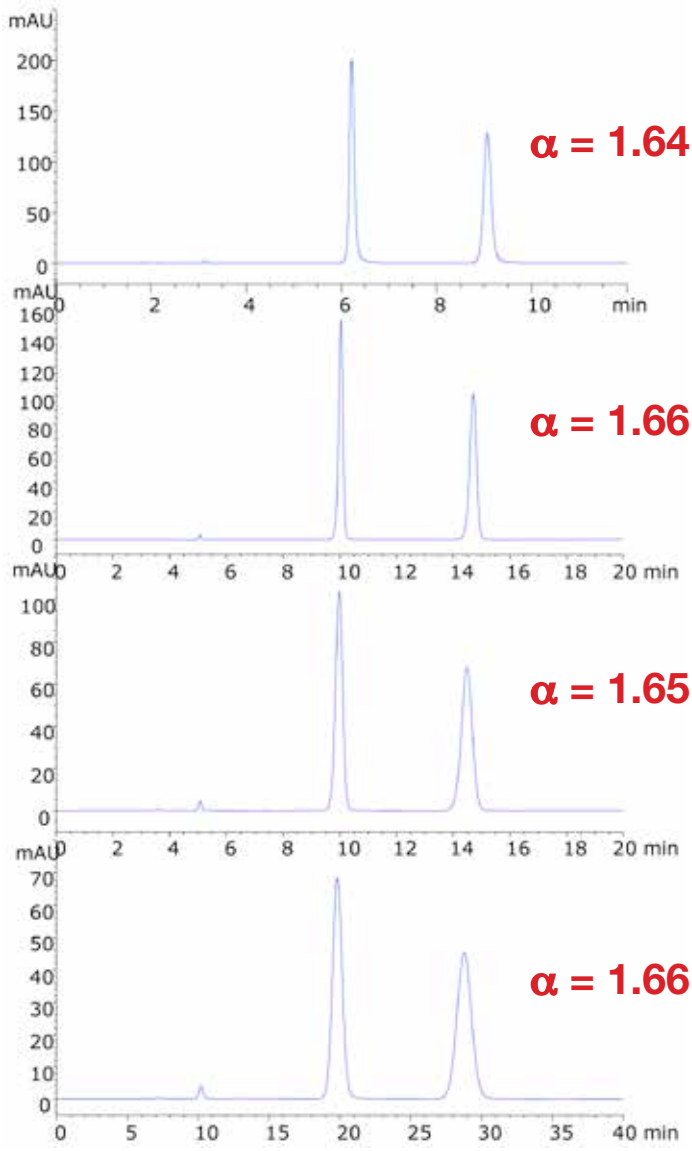
250 x 4.6 mm ID
at 1.0 mL/min

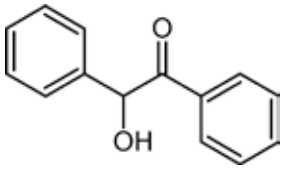
10 µm

250 x 4.6 mm ID
at 1.0 mL/min

20 µm

250 x 4.6 mm ID
at 0.5 mL/min





Benzoin

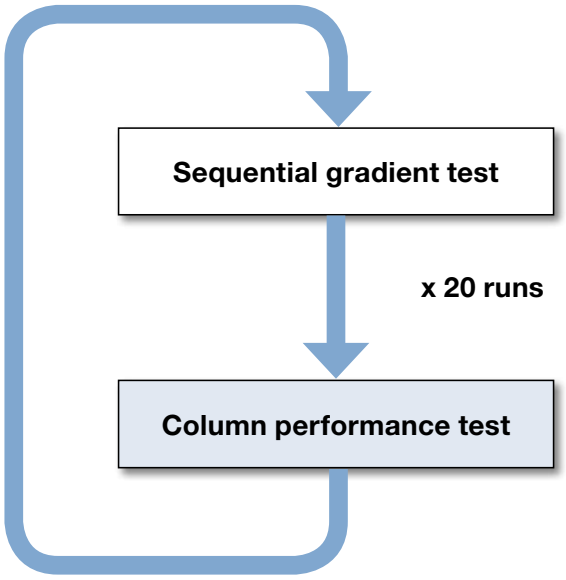
Column:	CHIRAL ART Cellulose-C
Eluent:	*n*-hexane / 2-propanol (90/10)
Flow rate:	1.0 mL/min (for 3, 5, 10 µm) 0.5 mL/min (for 20 µm)
Temperature:	25°C
Detection:	UV at 254 nm
Sample:	Benzoin
Injection:	10 µl (0.1 mg/mL)

CHIRAL ART shows identical selectivity and excellent peak shapes for materials with particle sizes from 3 µm to 20 µm. It allows predictable scale up from analytical LC to semi-preparative or preparative LC, and vice versa. Screening and method development can be done on small particle sizes and the results can easily be transferred to larger particle sizes.

* Application data by courtesy YMC Co., Ltd.

Coated Polysaccharides

Extended packing stability*

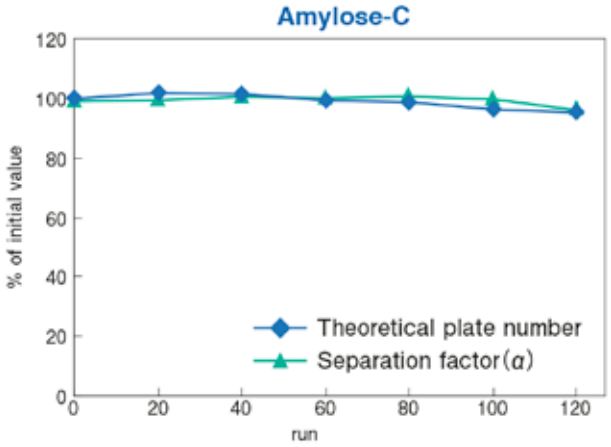


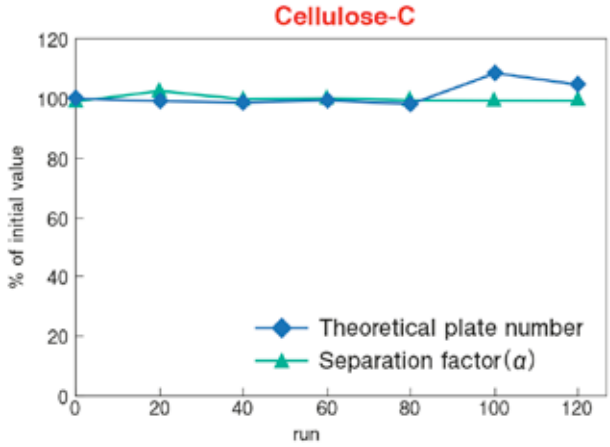
Sequential gradient test

Column:	5 µm, 250 x 4.6 mm ID
Eluent:	A) *n*-hexane, B) ethanol
	0-100% B (0-15 min)
Flow rate:	**3.0 mL/min**
Pressure:	**10-30 MPa/run**
Temperature:	37 °C

Column performance test

Column:	5 µm, 250 x 4.6 mm ID
Eluent:	*n*-hexane/ethanol (90/10)
Flow rate:	1.0 mL/min
Temperature:	37 °C
Detection:	UV at 230 nm
Sample:	*trans*-Stilbene oxide





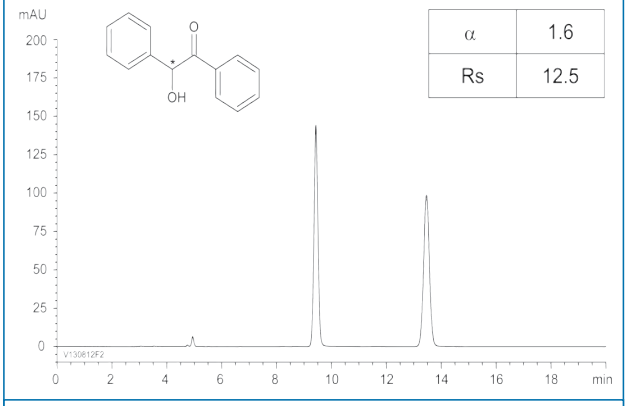
Coated Polysaccharides

Applications

Benzoin*

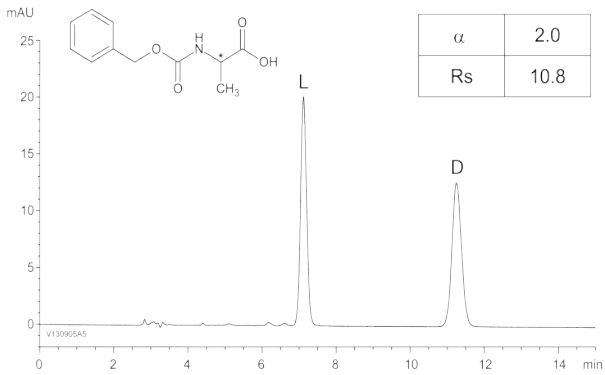
Column: CHIRAL ART Amylose-C (5 µm) 250 x 4.6 mm ID
Part No.: KAN99S05-2546WT
Eluent: *n*-hexane / 2-propanol (90/10)
Flow: 1.0 mL/min
Temperature: 25°C
Detection: UV at 254 nm
Injection: 10 µL (0.1 mg/mL)

Benzoin*



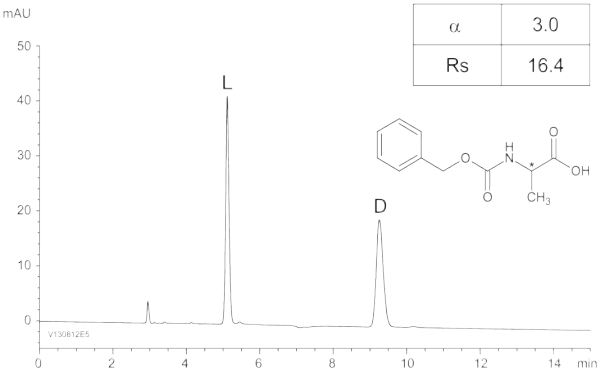
Column: CHIRAL ART Cellulose-C (5 µm) 250 x 4.6 mm ID
Part No.: KCN99S05-2546WT
Eluent: *n*-hexane / 2-propanol (90/10)
Flow: 1.0 mL/min
Temperature: 25°C
Detection: UV at 254 nm
Injection: 10 µL (0.1 mg/mL)

N-CBZ-DL-Alanine*



Column: CHIRAL ART Amylose-C (5 µm) 250 x 4.6 mm ID
Part No.: KAN99S05-2546WT
Eluent: *n*-hexane / 2-propanol / TFA (80/20/0.1)
Flow: 1.0 mL/min
Temperature: 25°C
Detection: UV at 254 nm
Injection: 10 µL (1 mg/mL)

N-CBZ-DL-Alanine*

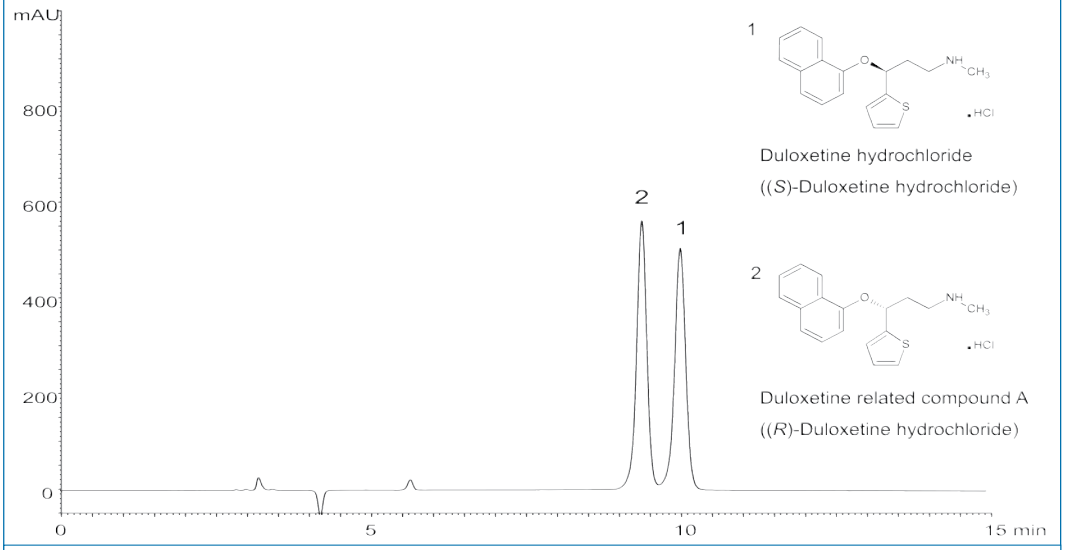


Column: CHIRAL ART Cellulose-C (5 µm) 250 x 4.6 mm ID
Part No.: KCN99S05-2546WT
Eluent: *n*-hexane / 2-propanol / TFA (80/20/0.1)
Flow: 1.0 mL/min
Temperature: 25°C
Detection: UV at 254 nm
Injection: 10 µL (1 mg/mL)

* Application data by courtesy YMC Co., Ltd.

Coated Polysaccharides

Duloxetine hydrochloride*

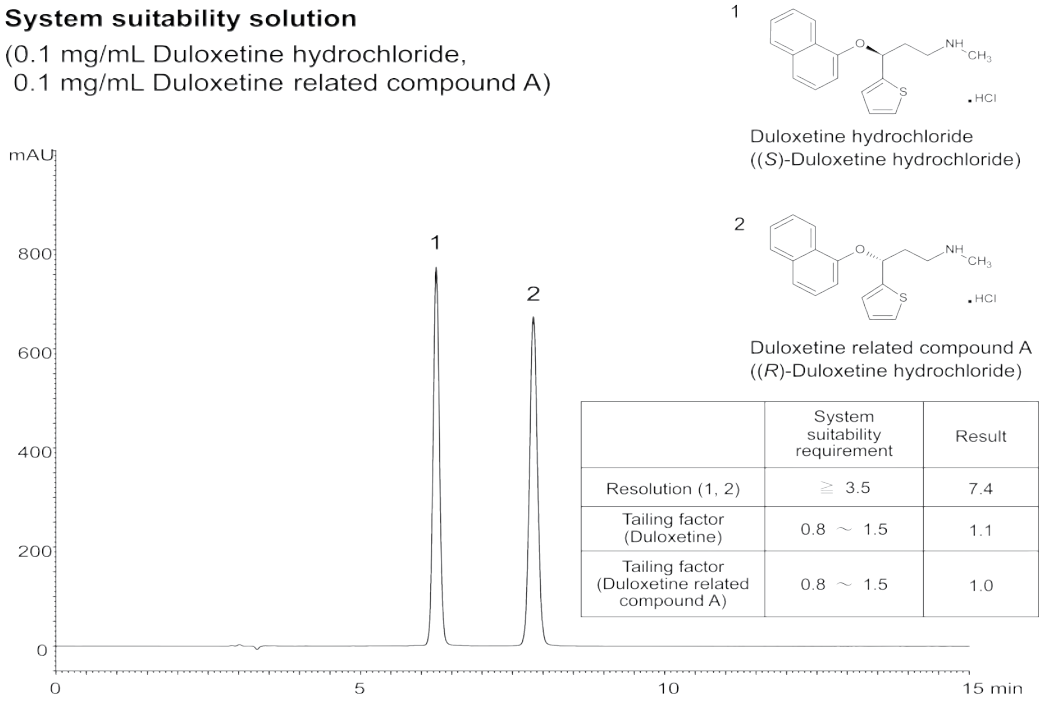


Column:	CHIRAL ART Amylose-C (5 µm) 250 x 4.6 mm ID	Temperature:	30°C
Part No.:	KAN99S05-2546WT	Detection:	UV at 230 nm
Eluent:	*n*-hexane / ethanol / diethylamine (95/5/0.2)	Injection:	10 µL (0.1 mg/mL)
Flow:	1.0 mL/min		

Duloxetine hydrochloride*

System suitability solution

(0.1 mg/mL Duloxetine hydrochloride,
0.1 mg/mL Duloxetine related compound A)



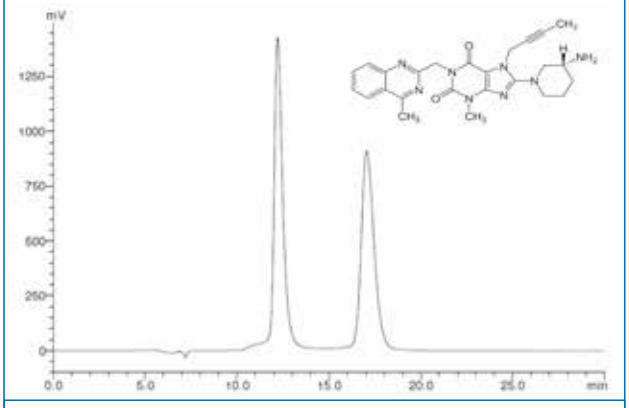
	System suitability requirement	Result
Resolution (1, 2)	≧ 3.5	7.4
Tailing factor (Duloxetine)	0.8 ~ 1.5	1.1
Tailing factor (Duloxetine related compound A)	0.8 ~ 1.5	1.0

Column:	CHIRAL ART Cellulose-C (5 µm) 250 x 4.6 mm ID	Temperature:	40°C
Part No.:	KCN99S05-2546WT	Detection:	UV at 230 nm
Eluent:	*n*-hexane / ethanol / diethylamine (83/17/0.2)	Injection:	10 µL
Flow:	1.0 mL/min		

(The United States Pharmacopeia 37th; Limit of Duloxetine related compound A)

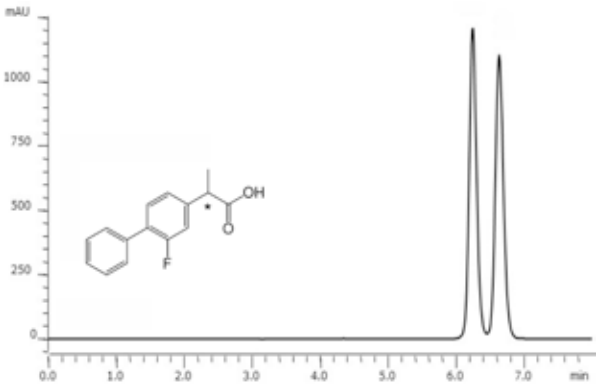
Coated Polysaccharides

Linagliptin**



Column:	CHIRAL ART Amylose-C (5 µm) 250 x 4.6 mm ID
Part No.:	KAN99S05-2546WT
Eluent:	ethanol / methanol / diethylamine (90/10/0.1)
Flow rate:	0.5 mL/min
Temperature:	30°C
Detection:	UV at 225 nm
Injection:	20 µL (0.2 mg/mL)

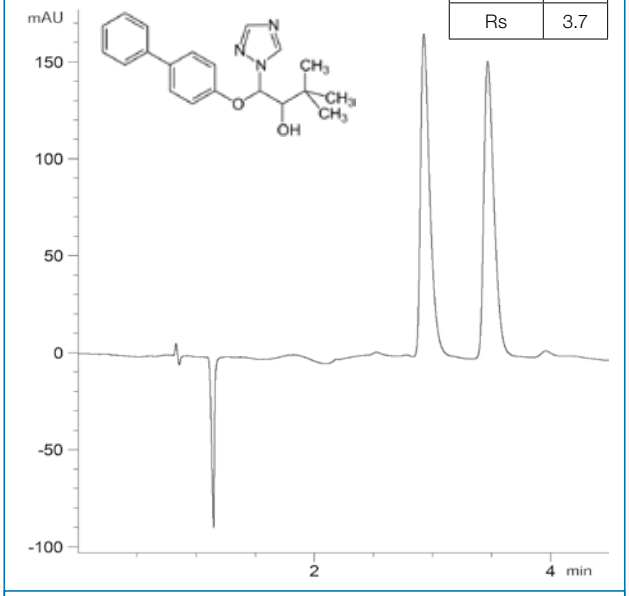
Flurbiprofen*



Column:	CHIRAL ART Cellulose-C (5 µm) 250 x 4.6 mm ID
Part No.:	KCN99S05-2546WT
Eluent:	*n*-hexane / 2-propanol / TFA (95/5/0.1)
Flow rate:	1.0 mL/min
Temperature:	25°C
Detection:	UV at 254 nm
Injection:	5 µL (1.0 mg/mL)

Bitertanol

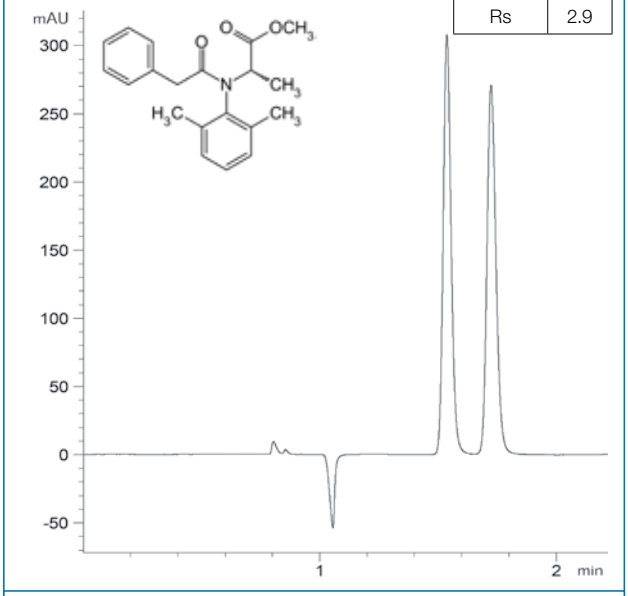
α	1.2
Rs	3.7



Column:	CHIRAL ART Cellulose-C (3 µm) 150 x 3.0 mm ID
Part No.:	KCN99S03-1503WT
Eluent:	*n*-hexane / 2-propanol / diethylamine (95/5/0.1)
Flow rate:	1.0 mL/min
Temperature:	40°C
Detection:	UV at 220 nm
Injection:	5 µL (1.25 mg/mL)

Benalaxyl

α	1.2
Rs	2.9

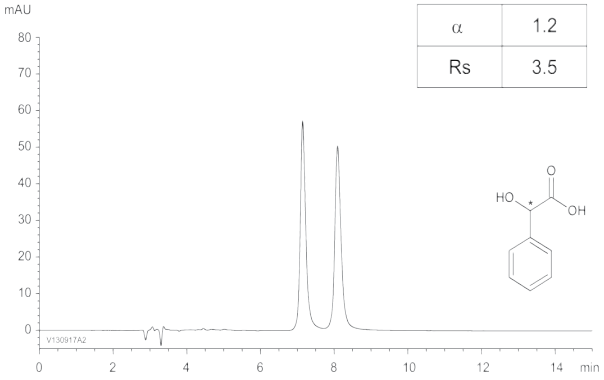


Column:	CHIRAL ART Cellulose-C (3 µm) 150 x 3.0 mm ID
Part No.:	KCN99S03-1503WT
Eluent:	*n*-hexane / 2-propanol / diethylamine (80/20/0.1)
Flow rate:	1.0 mL/min
Temperature:	25°C
Detection:	UV at 220 nm
Injection:	2 µL (1.0 mg/mL)

* Application data by courtesy YMC Co., Ltd.

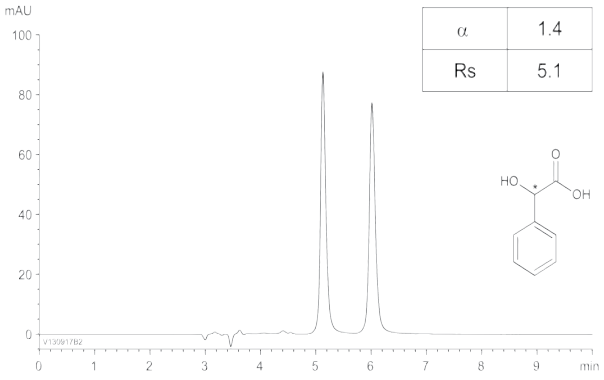
Coated Polysaccharides

DL-Mandelic acid*



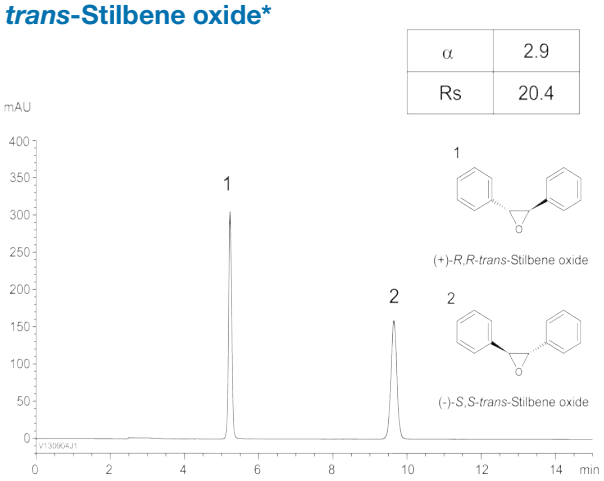
Column:	CHIRAL ART Amylose-C (5 µm) 250 x 4.6 mm ID
Part No.:	KAN99S05-2546WT
Eluent:	*n*-hexane / 2-propanol / TFA (80/20/0.1)
Flow:	1.0 mL/min
Temperature:	25°C
Detection:	UV at 254 nm
Injection:	20 µL (1 mg/mL)

DL-Mandelic acid*



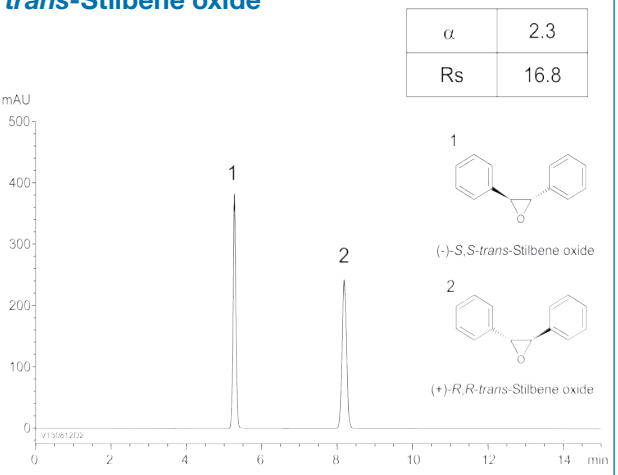
Column:	CHIRAL ART Cellulose-C (5 µm) 250 x 4.6 mm ID
Part No.:	KCN99S05-2546WT
Eluent:	*n*-hexane / 2-propanol / TFA (80/20/0.1)
Flow:	1.0 mL/min
Temperature:	25°C
Detection:	UV at 254 nm
Injection:	20 µL (1 mg/mL)

trans-Stilbene oxide*



Column:	CHIRAL ART Amylose-C (5 µm) 250 x 4.6 mm ID
Part No.:	KAN99S05-2546WT
Eluent:	*n*-hexane / 2-propanol (90/10)
Flow:	1.0 mL/min
Temperature:	25°C
Detection:	UV at 230 nm
Injection:	5 µL (0.1 mg/mL)

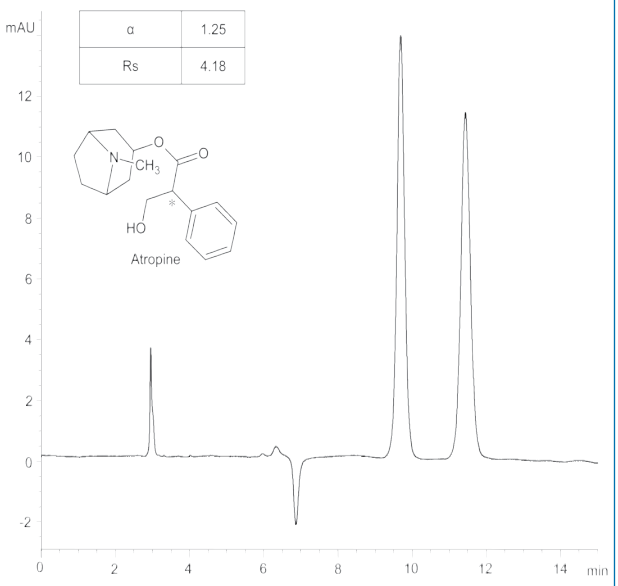
trans-Stilbene oxide*



Column:	CHIRAL ART Cellulose-C (5 µm) 250 x 4.6 mm ID
Part No.:	KCN99S05-2546WT
Eluent:	*n*-hexane / 2-propanol (90/10)
Flow:	1.0 mL/min
Temperature:	25°C
Detection:	UV at 230 nm
Injection:	5 µL (0.1 mg/mL)

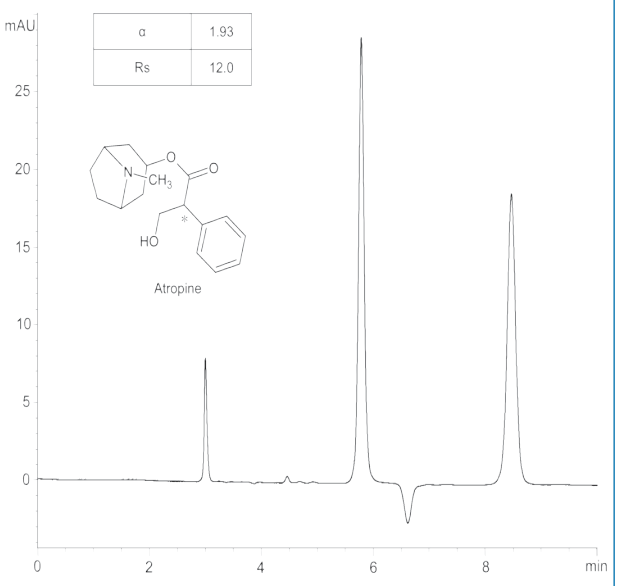
Coated Polysaccharides

Atropine*



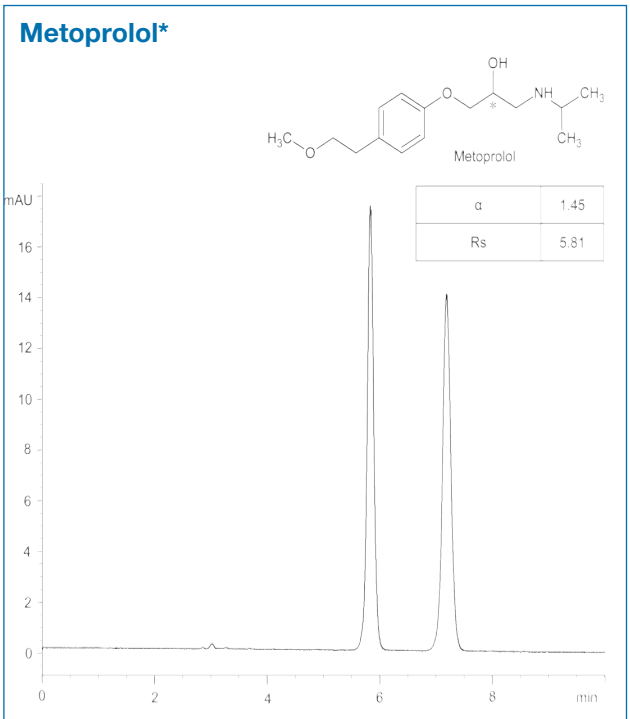
Column:	CHIRAL ART Amylose-C (5 µm) 250 x 4.6 mm ID
Part No.:	KAN99S05-2546WT
Eluent:	*n*-hexane / ethanol / ethanolamine (87/13/0.1)
Flow:	1.0 mL/min
Temperature:	25°C
Detection:	UV at 230 nm
Injection:	2 µL (1 mg/mL)

Atropine*



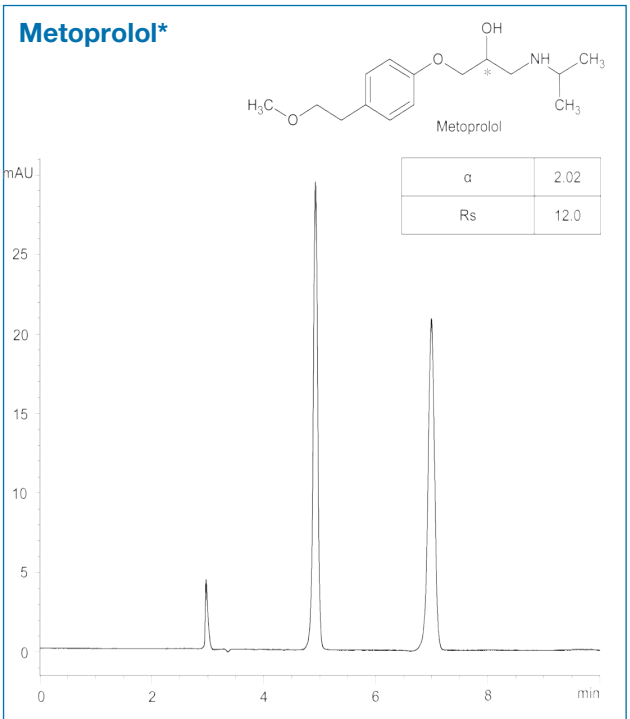
Column:	CHIRAL ART Cellulose-C (5 µm) 250 x 4.6 mm ID
Part No.:	KCN99S05-2546WT
Eluent:	*n*-hexane / ethanol / ethanolamine (90/10/0.1)
Flow:	1.0 mL/min
Temperature:	25°C
Detection:	UV at 230 nm
Injection:	2 µL (1 mg/mL)

Metoprolol*



Column:	CHIRAL ART Amylose-C (5 µm) 250 x 4.6 mm ID
Part No.:	KAN99S05-2546WT
Eluent:	*n*-hexane / ethanol / ethanolamine (80/20/0.1)
Flow:	1.0 mL/min
Temperature:	25°C
Detection:	UV at 254 nm
Injection:	5 µL (1 mg/mL)

Metoprolol*



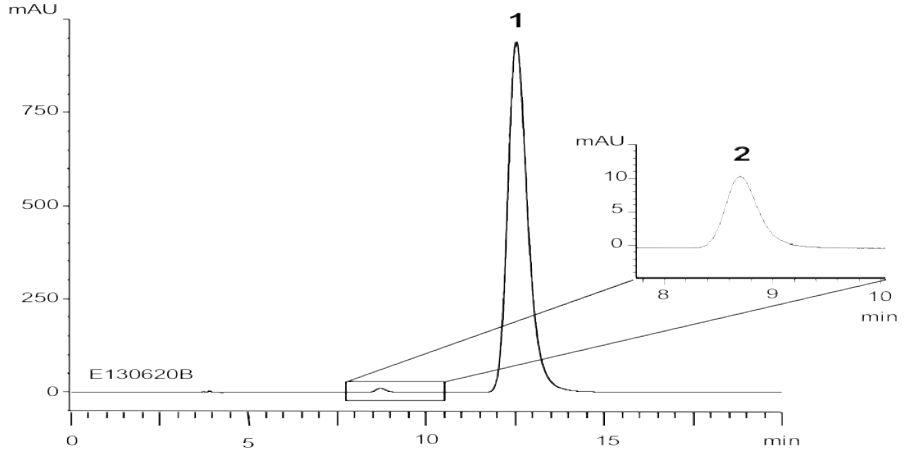
Column:	CHIRAL ART Cellulose-C (5 µm) 250 x 4.6 mm ID
Part No.:	KCN99S05-2546WT
Eluent:	*n*-hexane / ethanol / ethanolamine (90/10/0.1)
Flow:	1.0 mL/min
Temperature:	25°C
Detection:	UV at 254 nm
Injection:	5 µL (1 mg/mL)

* Application data by courtesy YMC Co., Ltd.

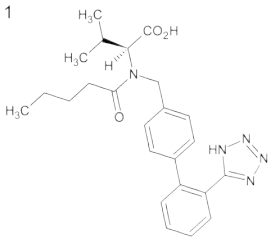
Coated Polysaccharides

Valsartan* (The United States Pharmacopeia)

Test solution*
(1.0 mg/mL Valsartan)

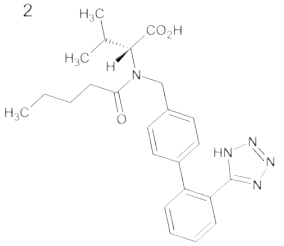


1



Valsartan

2

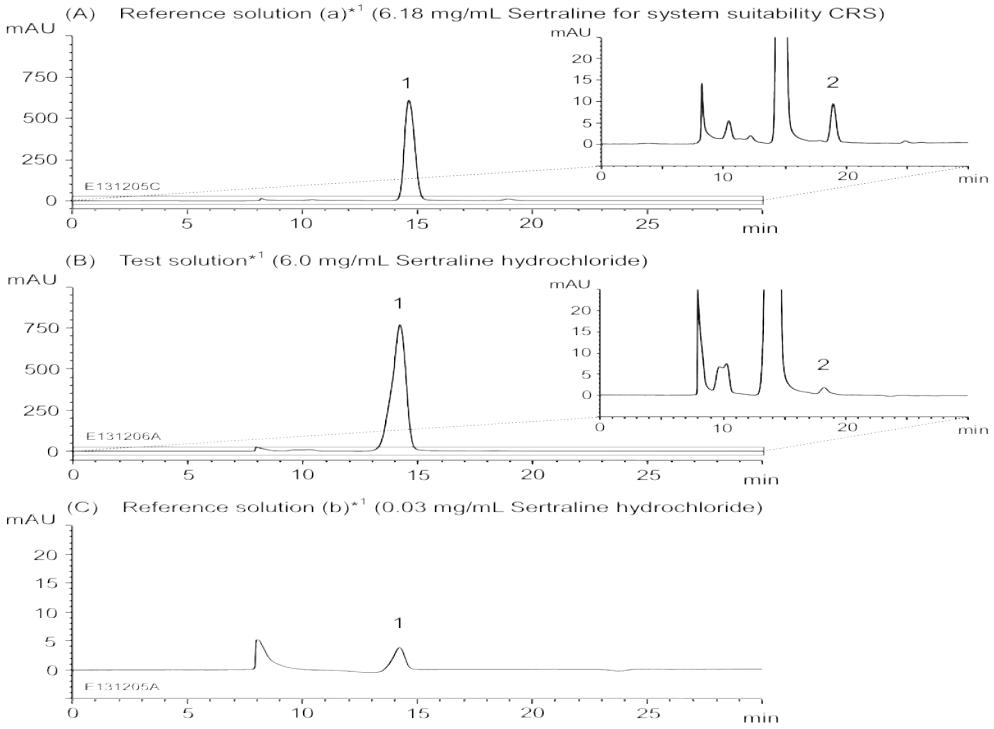


Valsartan enantiomer
(Valsartan related compound A)

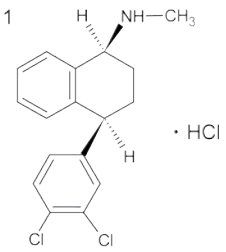
* Test solution was prepared from Valsartan supplied as a reagent for laboratory use.

Column:	CHIRAL ART Cellulose-C (5 µm) 250 x 4.6 mm ID	Temperature:	25°C
Part No.:	KCN99S05-2546WT	Detection:	UV at 230 nm
Eluent:	*n*-hexane / 2-propanol / trifluoroacetic acid (85/15/0.1)	Injection:	10 µL
Flow:	0.8 mL/min	(The United States Pharmacopeia 34th, Related compounds)	

Sertraline hydrochloride* (The European Pharmacopeia)

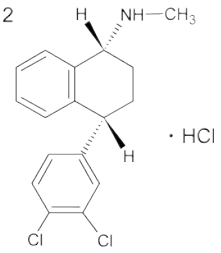


1



Sertraline hydrochloride

2



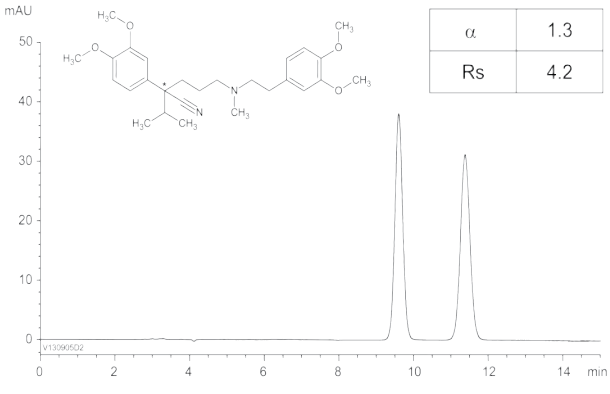
Sertraline hydrochloride
(enantiomer)

*1 Test solution and Reference solution were prepared from Sertraline hydrochloride supplied as a reagent for laboratory use.

Column:	CHIRAL ART Amylose-C (5 µm) 250 x 4.6 mm ID	Temperature:	25°C
Part No.:	KAN99S05-2546WT	Detection:	UV at 275 nm
Eluent:	mixture*2 / *n*-hexane (70/30)	Injection:	20 µL
	*2 *n*-hexane / 2-propanol / diethylamine (75/25/1)	(The draft for The European Pharmacopeia, Enantiomeric purity)	
Flow:	0.4 mL/min		

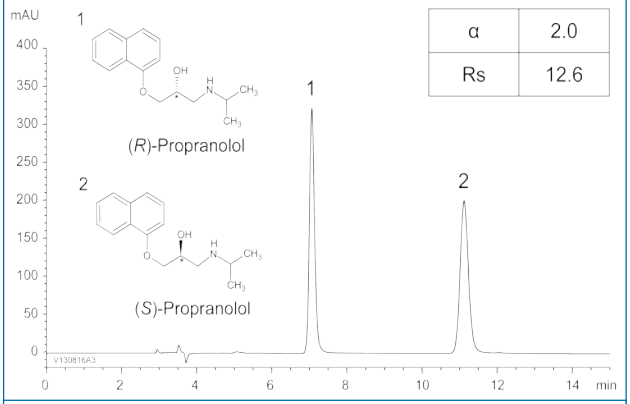
Coated Polysaccharides

Verapamil*



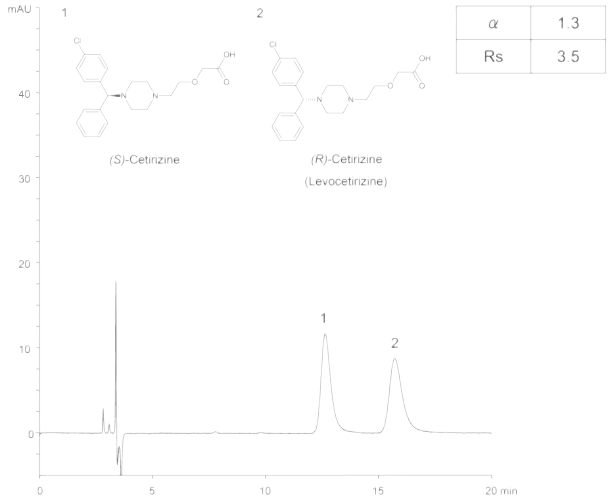
Column: CHIRAL ART Amylose-C (5 µm) 250 x 4.6 mm ID
Part No.: KAN99S05-2546WT
Eluent: *n*-hexane / 2-propanol / diethylamine (90/10/0.1)
Flow: 1.0 mL/min
Temperature: 25°C
Detection: UV at 254 nm
Injection: 10 µL (1 mg/mL)

Propanolol*



Column: CHIRAL ART Cellulose-C (5 µm) 250 x 4.6 mm ID
Part No.: KCN99S05-2546WT
Eluent: *n*-hexane / 2-propanol / diethylamine (80/20/0.1)
Flow: 1.0 mL/min
Temperature: 25°C
Detection: UV at 230 nm
Injection: 10 µL (0.1 mg/mL)

Cetirizine*



Column: CHIRAL ART Cellulose-C (5 µm) 250 x 4.6 mm ID
Part No.: KCN99S05-2546WT
Eluent: *n*-hexane / 2-propanol / formic acid / diethylamine (70/30/0.1/0.1)
Flow: 1.0 mL/min
Temperature: 25°C
Detection: UV at 230 nm
Injection: 2 µL (200 µg/mL)

Column Care

The recommended pH range for using CHIRAL ART coated polysaccharide columns is 3.5-6.5. Store the column in n-hexane/2-propanol = 90/10. If columns are affected by undesired contaminants or clogged inlet frits which cause back pressure increases, flush the column with ethanol.

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

* Application data by courtesy YMC Co., Ltd.

CHIRAL ART
Immobilised Polysaccharide Derivatives Series

- **applicable for normal and reversed phase modes**
- **more flexibility due to wide range of usable solvents**
- **highly robust, also suitable for SFC/SMB**
- **remarkably reduced background signal**
- **HPLC columns and preparative grade bulk media with particle sizes of 3, 5, 10 or 20 µm available**
- **extremely attractive pricing**

Introduction

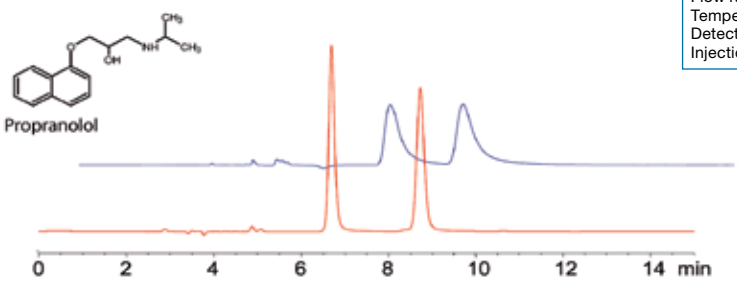
CHIRAL ART polysaccharides derivatives are a series of chiral separation columns / packing materials with high stereo-selectivity. They are suitable for separations of a wide range of chiral compounds, cis-trans isomers and geometric isomers. The range of particle sizes and column dimensions available offer outstanding cost effectiveness for analytical to preparative separations.

Immobilised Type

CHIRAL ART immobilised polysaccharide derivatives can be used either in normal phase or in reversed phase modes. They are available in HPLC columns and in preparative grades, in large (multi kg) quantities.

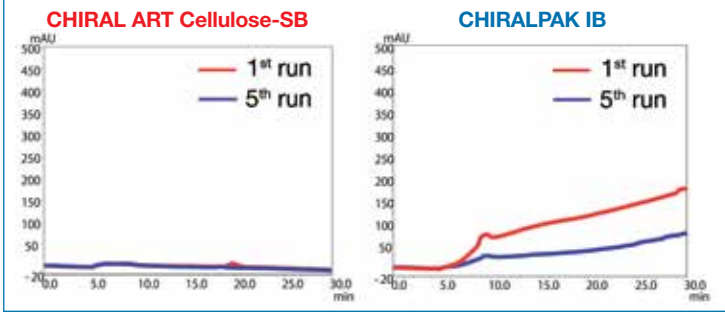
Excellent peak shape*

Column:	5 µm, 250 x 4.6 mm ID
Eluent:	*n*-hexane / IPA / DEA (80/20/0.1)
Flow rate:	1.0 mL/min
Temperature:	25 °C
Detection:	230 nm
Injection:	10 µL (0.1 mg/mL)



CHIRAL ART polysaccharides derivatives provide excellent peak shapes for ionic and metal coordinating compounds.

Low Column Bleeding*



Gradient test	
Column:	5 µm, 250 x 4.6 mm ID
Eluent:	A) *n*-hexane / B) ethanol
	2-80% B (0-30 min),
	80-2% B (30-30.1 min),
	2% B (30.1-60 min)
Flow rate:	1.0 mL/min
Temperature:	25 °C
Detection:	UV at 230 nm

CHIRAL ART
Immobilised Polysaccharide Derivatives Series

Item	CHIRAL ART Amylose-SA	CHIRAL ART Cellulose-SB	CHIRAL ART Cellulose-SC
Particle size	3, 5, 10, 20 µm	3, 5, 10, 20 µm	3, 5, 10, 20 µm
CHIRAL selector	Amylose tris (3,5-dimethylphenyl-carbamate)	Cellulose tris (3,5-dimethylphenyl-carbamate)	Cellulose tris (3,5-dichlorophenyl-carbamate)
USP	L99	—	—
Type	Immobilised type		
Separation mode	Normal Phase / Reversed Phase / SFC		
Shipping solvent	*n*-hexane / 2-propanol (90/10)		
Usable pH-range	2.0 - 9.0		
Pressure limit	30 MPa (4350 psi)		
Recommended flow rate	4.6 mm ID: 0.5 - 1.0 mL/min (Max. flow rate: 3.0 mL/min) 10 mm ID: 2.5 - 5.0 mL/min (Max. flow rate: 15 mL/min)		

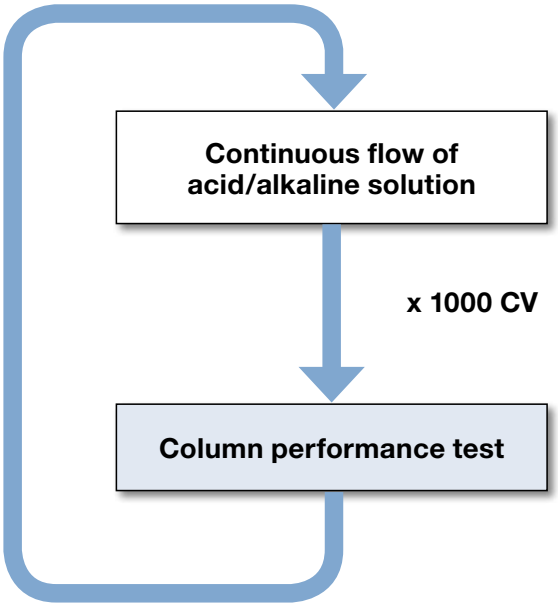
Product Line-up

Product name	Particle size [µm]	CHIRAL selector	Type	Competitive product
CHIRAL ART Amylose-SA	3	Amylose tris (3,5-dimethylphenylcarbamate)	Immobilised	CHIRALPAK® IA, IA-3
CHIRAL ART Cellulose-SB	5 10	Cellulose tris (3,5-dimethylphenylcarbamate)		CHIRALPAK® IB, IB-3
CHIRAL ART Cellulose-SC	20	Cellulose tris (3,5-dichlorophenylcarbamate)		CHIRALPAK® IC, IC-3

* Application data by courtesy YMC Co., Ltd.

Immobilised Polysaccharides

Wide usable pH range*



Continuous flow of acid/alkaline solution

Column:	CHIRAL ART Cellulose-SB 5 µm, 50 x 4.6 mm ID
Eluent:	buffer/methanol (90/10)
Flow rate:	1.0 mL/min

Acidic condition

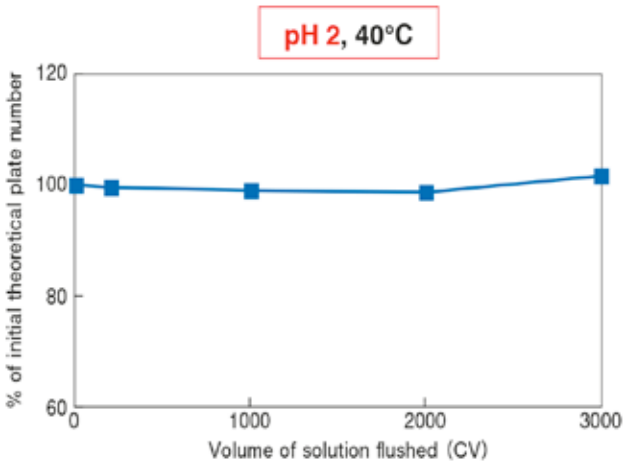
Buffer:	0.1% H_3PO_4 (**pH 2**)
Temperature:	40 °C

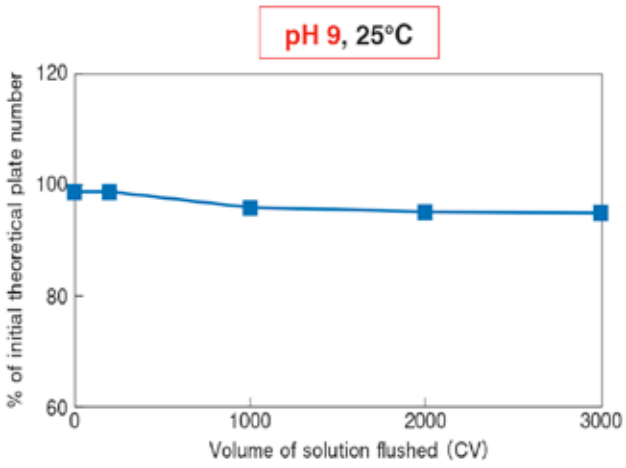
Basic condition

Buffer:	20 mM NH_4HCO_3-DEA (**pH 9**)
Temperature:	25 °C

Column performance test

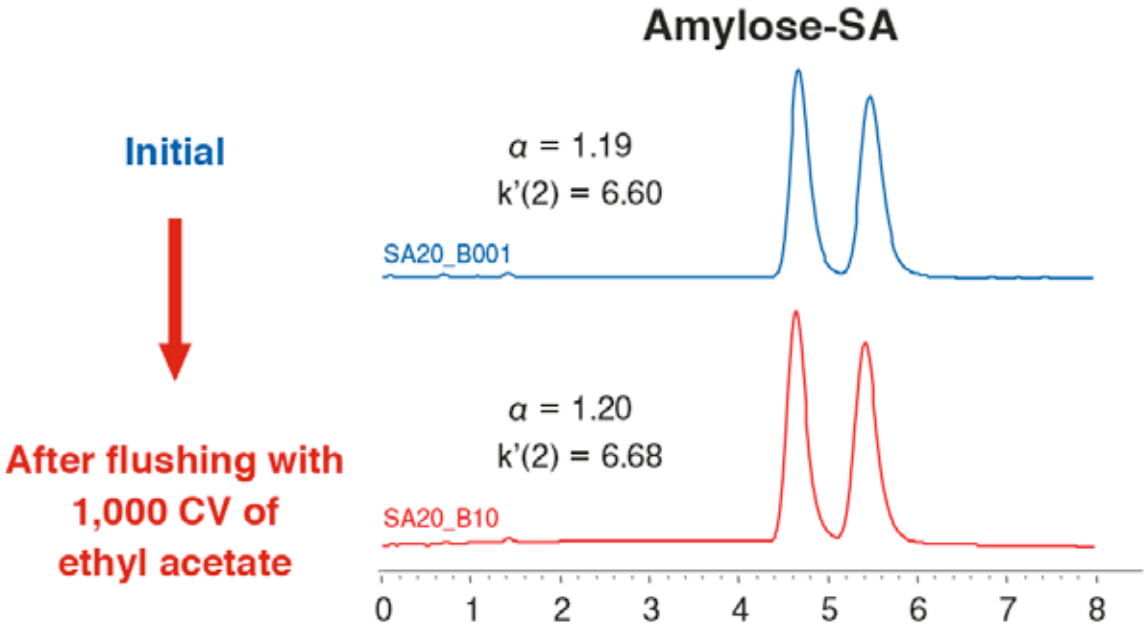
Column:	CHIRAL ART Cellulose-SB 5 µm, 50 x 4.6 mm ID
Eluent:	acetonitrile/water (30/70)
Flow rate:	1.0 mL/min
Temperature:	25 °C
Detection:	UV at 254 nm
Sample:	Benzoin

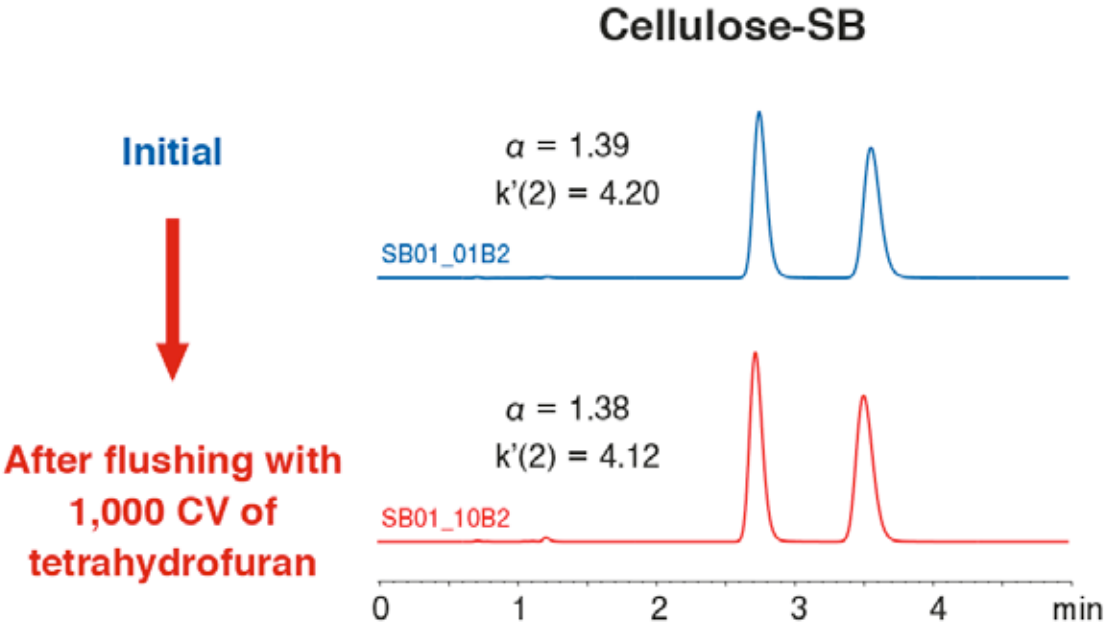




Immobilised Polysaccharides

High stability against various solvents*





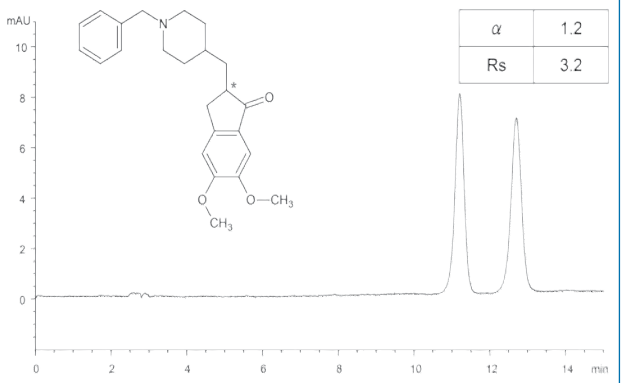
Column:	5 µm, 50 x 4.6 mm ID	Flow rate:	1.0 mL/min
Eluent:	*n*-hexane / 2-propanol (95/5)	Temperature:	25°C
		Sample:	Benzoin

* Application data by courtesy YMC Co., Ltd.

Immobilised Polysaccharides

Applications

Donepezil*

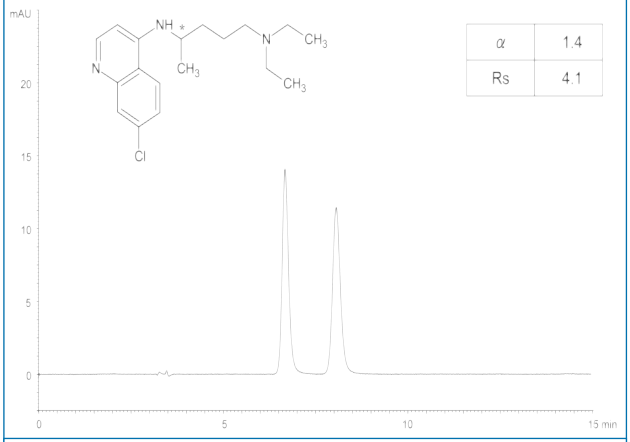


Column:	CHIRAL ART Cellulose-SB (5 µm) 250 x 4.6 mm ID
Part No.:	KSB99S05-2546WT
Eluent:	20 mM NH_4HCO_3-diethylamine (pH 9.0) / acetonitrile (40/60)
Flow rate:	1.0 mL/min
Temperature:	25°C
Detection:	UV at 254 nm
Injection:	2 µL (200 µg/mL)

Donepezil*

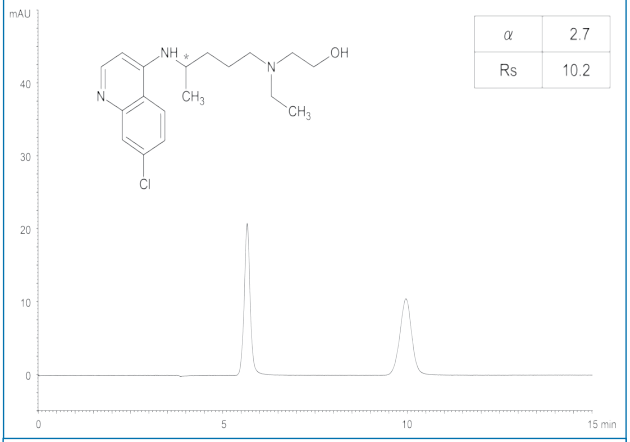
Column:	CHIRAL ART Amylose-SA (5 µm) 250 x 4.6 mm ID
Part No.:	KSA99S05-2546WT
Eluent:	*n*-hexane / 2-propanol / diethylamine (80/20/0.1)
Flow rate:	1.0 mL/min
Temperature:	25°C
Detection:	UV at 230 nm

Chloroquine*



Column:	CHIRAL ART Amylose-SA (5 µm) 250 x 4.6 mm ID
Part No.:	KSA99S05-2546WT
Eluent:	methyl tert-butyl ether / ethanol / diethylamine (95/5/0.1)
Flow rate:	1.0 mL/min
Temperature:	25°C
Detection:	UV at 344 nm
Injection:	5 µL (100 µg/mL)

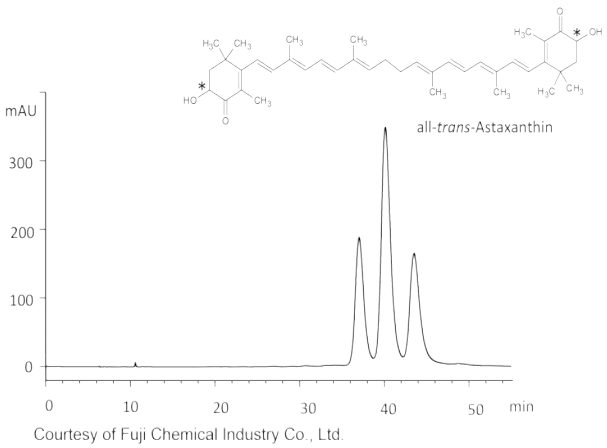
Hydroxychloroquine*



Column:	CHIRAL ART Amylose-SA (5 µm) 250 x 4.6 mm ID
Part No.:	KSA99S05-2546WT
Eluent:	methyl tert-butyl ether / ethanol / diethylamine (90/10/0.1)
Flow rate:	1.0 mL/min
Temperature:	25°C
Detection:	UV at 344 nm
Injection:	5 µL (100 µg/mL)

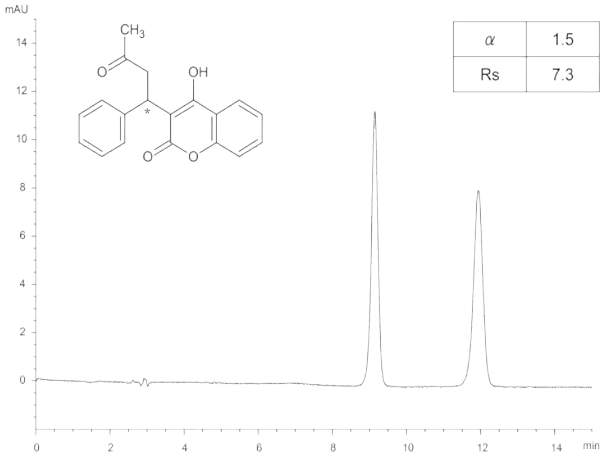
Immobilised Polysaccharides

Astaxanthin*



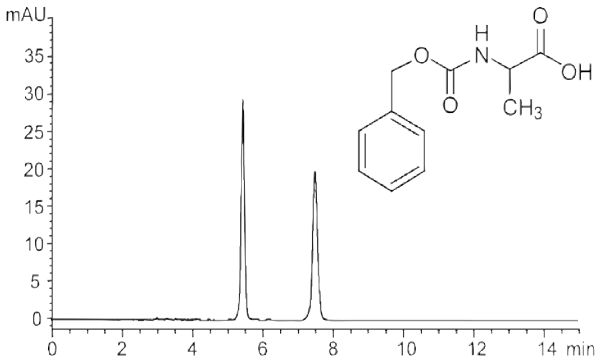
Column:	CHIRAL ART Cellulose-SB (5 µm) 250 x 4.6 mm ID
Part No.:	KSB99S05-2546WT
Eluent:	*n*-hexane / THF (85/15)
Flow rate:	0.5 mL/min
Temperature:	25°C
Detection:	UV at 476 nm

Warfarin*



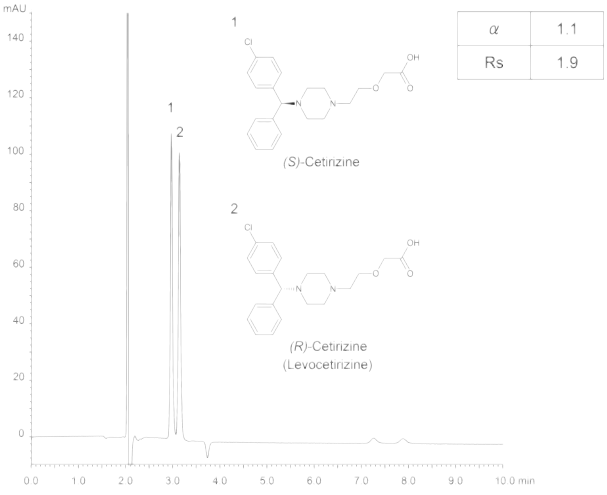
Column:	CHIRAL ART Cellulose-SB (5 µm) 250 x 4.6 mm ID
Part No.:	KSB99S05-2546WT
Eluent:	acetonitrile / 20 mM phosphoric acid (50/50)
Flow rate:	1.0 mL/min
Temperature:	25°C
Detection:	UV at 254 nm
Injection:	2 µL (200 µg/mL)

CBZ-Alanine*



Column:	CHIRAL ART Cellulose-SB (5 µm) 250 x 4.6 mm ID
Part No.:	KSB99S05-2546WT
Eluent:	*n*-hexane / 2-propanol / TFA (80/20/0.1)
Flow rate:	1.0 mL/min
Temperature:	25°C
Detection:	UV at 254 nm

Cetirizine*

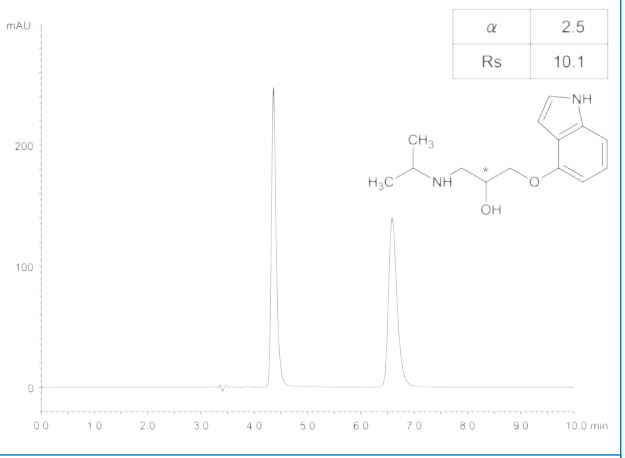


Column:	CHIRAL ART Cellulose-SB (3 µm) 150 x 4.6 mm ID
Part No.:	KSB99S03-1546WT
Eluent:	acetonitrile / formic acid / diethylamine (100/0.1/0.1)
Flow rate:	1.0 mL/min
Temperature:	25°C
Detection:	UV at 230 nm
Injection:	2 µL (200 µg/mL)

* Application data by courtesy YMC Co., Ltd.

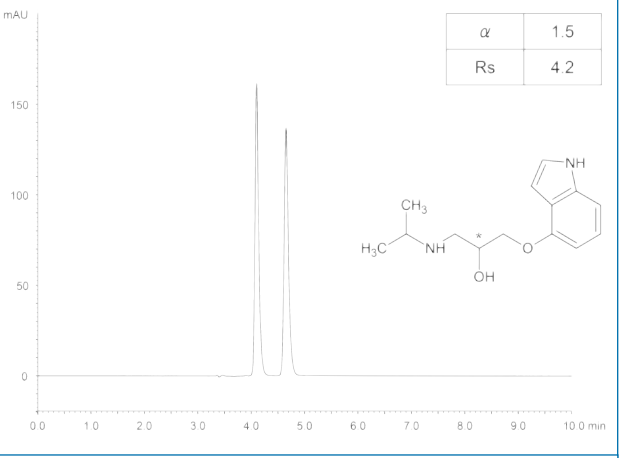
Immobilised Polysaccharides

Pindolol*



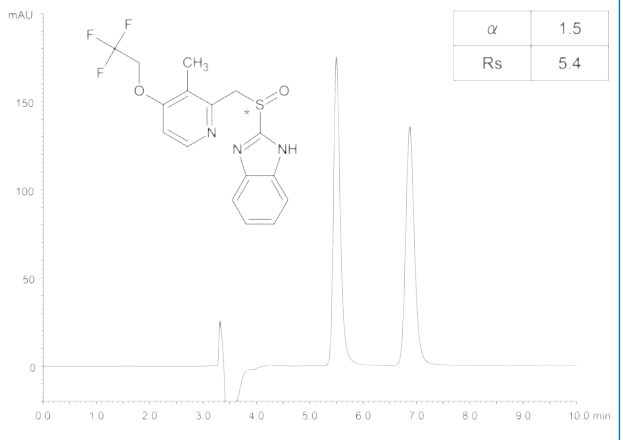
Column:	CHIRAL ART Cellulose-SB (5 µm) 250 x 4.6 mm ID
Part No.:	KSB99S05-2546WT
Eluent:	*n*-hexane / ethanol / diethylamine (40/60/0.1)
Flow rate:	1.0 mL/min
Temperature:	25°C
Detection:	UV at 265 nm
Injection:	10 µL (100 µg/mL)

Pindolol*



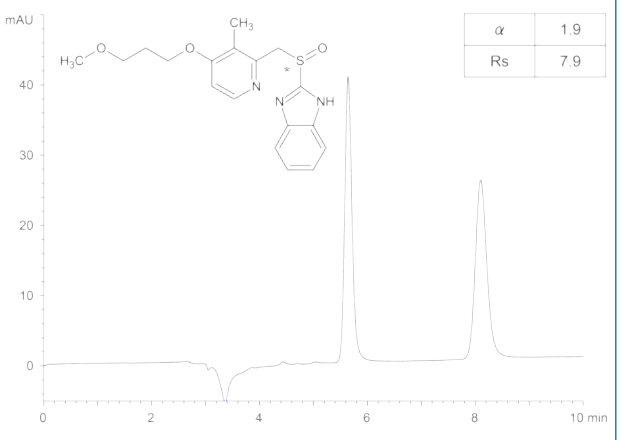
Column:	CHIRAL ART Cellulose-SB (5 µm) 250 x 4.6 mm ID
Part No.:	KSB99S05-2546WT
Eluent:	methanol / diethylamine (100/0.1)
Flow rate:	1.0 mL/min
Temperature:	25°C
Detection:	UV at 265 nm
Injection:	10 µL (100 µg/mL)

Lansoprazole*



Column:	CHIRAL ART Amylose-SA (5 µm) 250 x 4.6 mm ID
Part No.:	KSA99S05-2546WT
Eluent:	ethyl acetate / ethanol / diethylamine (95/5/0.1)
Flow rate:	1.0 mL/min
Temperature:	25°C
Detection:	UV at 290 nm
Injection:	10 µL (100 µg/mL)

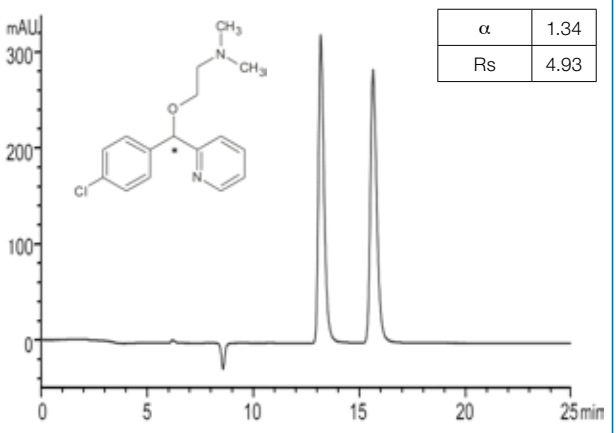
Rabeprazole*



Column:	CHIRAL ART Cellulose-SC (5 µm) 250 x 4.6 mm ID
Part No.:	KSC99S05-2546WT
Eluent:	ethyl acetate / 2-propanol / diethylamine (95/5/0.1)
Flow rate:	1.0 mL/min
Temperature:	25°C
Detection:	UV at 290 nm
Injection:	5 µL (100 µg/mL)

Immobilised Polysaccharides

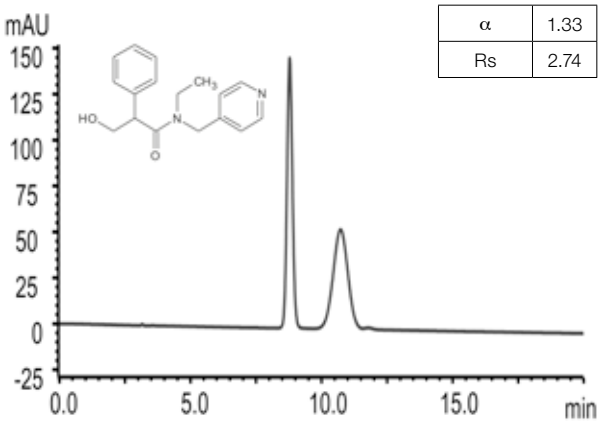
Carbinoxamine*



α	1.34
Rs	4.93

Column: CHIRAL ART Amylose-SA (5 µm) 250 x 4.6 mm ID
Part No.: KSA99S05-2546WT
Eluent: *n*-hexane / isopropanol / diethylamine (90/10/0.1)
Flow rate: 0.5 mL/min
Temperature: 25°C
Detection: UV at 230 nm
Injection: 5 µL (1.0 mg/mL)

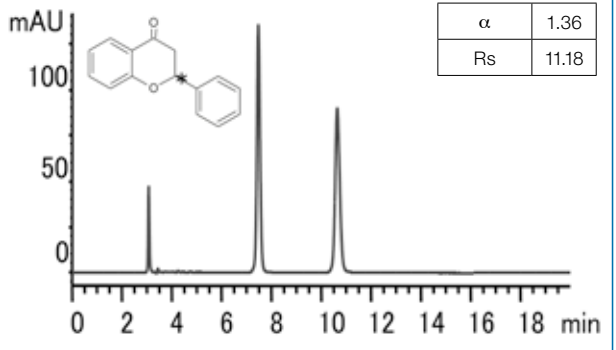
Tropicamide*



α	1.33
Rs	2.74

Column: CHIRAL ART Cellulose-SC (5 µm) 250 x 4.6 mm ID
Part No.: KSC99S05-2546WT
Eluent: *n*-hexane / ethanol / diethylamine (55/45/0.1)
Flow rate: 1.0 mL/min
Temperature: 25°C
Detection: UV at 254 nm
Injection: 10 µL (1.0 mg/mL)

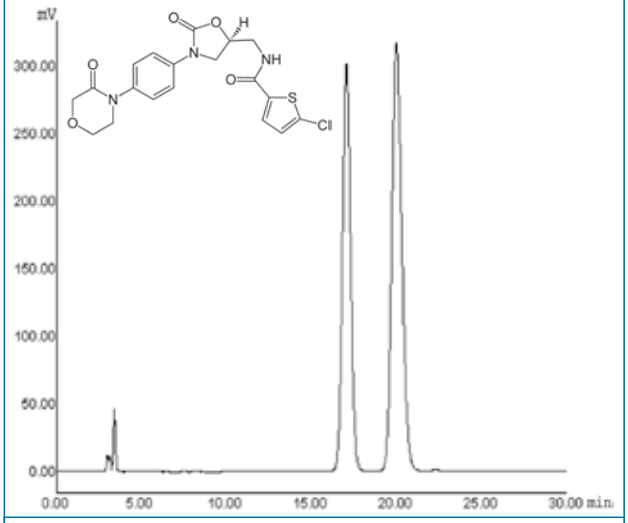
Flavanone*



α	1.36
Rs	11.18

Column: CHIRAL ART Amylose-SA (5 µm) 250 x 4.6 mm ID
Part No.: KSA99S05-2546WT
Eluent: *n*-hexane / 2-propanol / diethylamine (90/10/0.1)
Flow rate: 1.0 mL/min
Temperature: 25°C
Detection: UV at 254 nm
Injection: 10 µL (0.1 mg/mL)

Rivaroxaban**

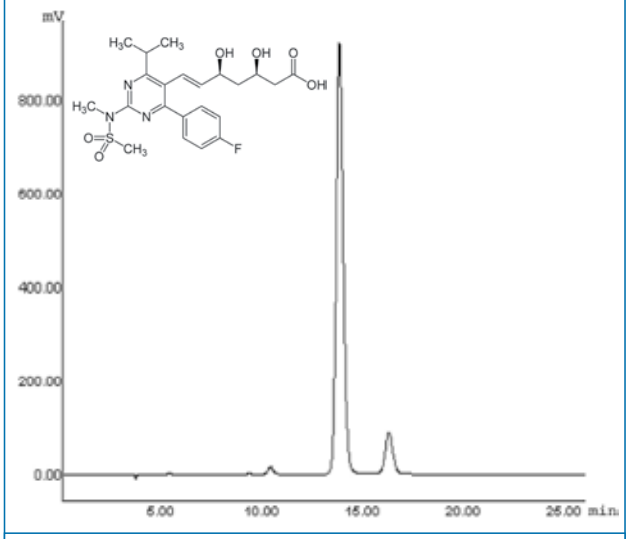


Column: CHIRAL ART Cellulose-SB (5 µm) 250 x 4.6 mm ID
Part No.: KSB99S05-2546WT
Eluent: *n*-hexane / ethanol / trifluoroacetic acid (50/50/0.1)
Flow rate: 1.0 mL/min
Temperature: 35°C
Detection: UV at 250 nm
Injection: 20 µL (0.5 mg/mL)

* Application data by courtesy YMC Co., Ltd. ** Application data by courtesy YMC India Pvt. Ltd.

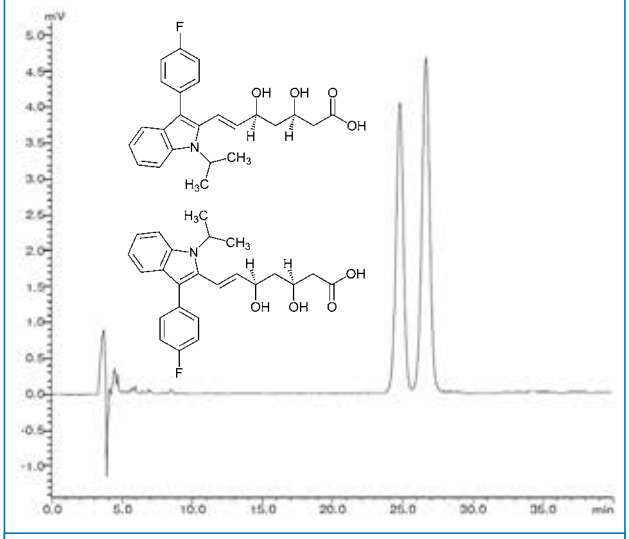
Immobilised Polysaccharides

Rosuvastatin**



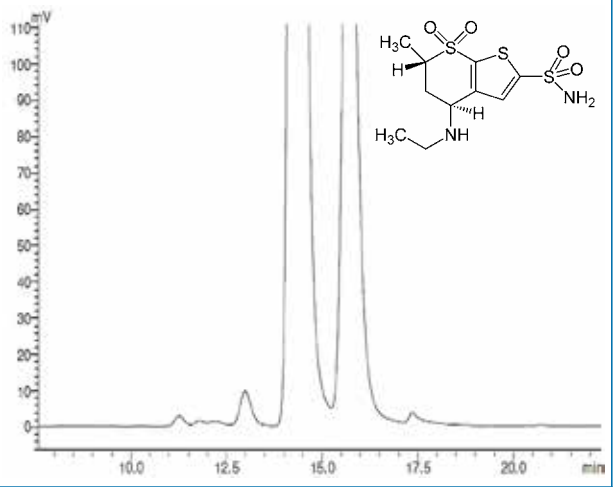
Column:	CHIRAL ART Cellulose-SB (5 µm) 250 x 4.6 mm ID
Part No.:	KSB99S05-2546WT
Eluent:	*n*-hexane / ethanol / trifluoroacetic acid (85/15/0.1)
Flow rate:	1.0 mL/min
Temperature:	25°C
Detection:	UV at 242 nm
Injection:	20 µL (0.5 mg/mL)

Fluvastatin**



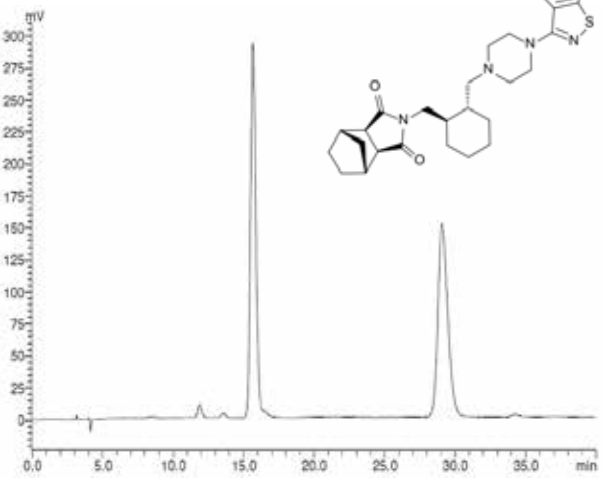
Column:	CHIRAL ART Cellulose-SB (5 µm) 250 x 4.6 mm ID
Part No.:	KSB99S05-2546WT
Eluent:	water / acetonitrile / formic acid (65/35/0.1)
Flow rate:	1.0 mL/min
Temperature:	25°C
Detection:	UV at 300 nm
Injection:	20 µL (5 mg/mL)

Dorzolamide**



Column:	CHIRAL ART Cellulose-SC (5 µm) 250 x 4.6 mm ID
Part No.:	KSC99S05-2546WT
Eluent:	*n*-hexane / ethanol / diethylamine (80/20/0.1))
Flow rate:	1.0 mL/min
Temperature:	25°C
Detection:	UV at 254 nm
Injection:	20 µL (0.25 mg/mL)

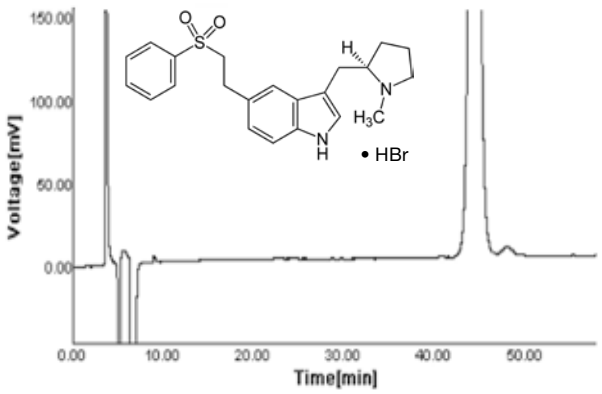
Lurasidone**



Column:	CHIRAL ART Cellulose-SB (5 µm) 250 x 4.6 mm ID
Part No.:	KSB99S05-2546WT
Eluent:	*n*-hexane / isopropanol / diethylamine (90/10/0.2)
Flow rate:	1.0 mL/min
Temperature:	25°C
Detection:	UV at 230 nm
Injection:	20 µL (0.5 mg/mL)

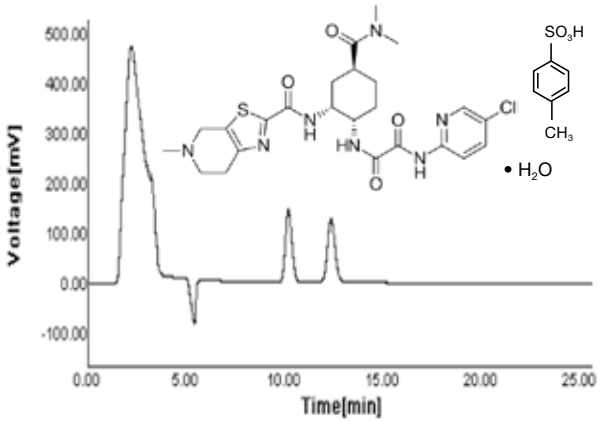
Immobilised Polysaccharides

Eletriptan hydrobromide**



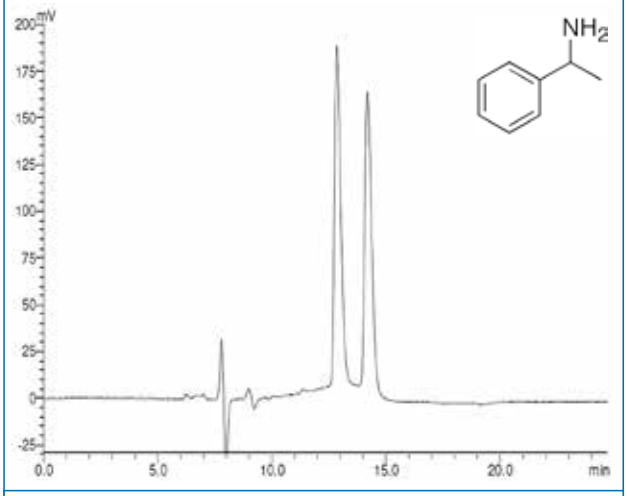
Column:	CHIRAL ART Cellulose-SB (5 µm) 250 x 4.6 mm ID
Part No.:	KSB99S05-2546WT
Eluent:	*n*-hexane / ethanol / trifluoroacetic acid / diethylamine (85/15/0.5/0.5)
Flow rate:	0.8 mL/min
Temperature:	10°C
Detection:	UV at 223 nm
Injection:	20 µL (0.2 mg/mL)

Edoxaban tosylate hydrate**



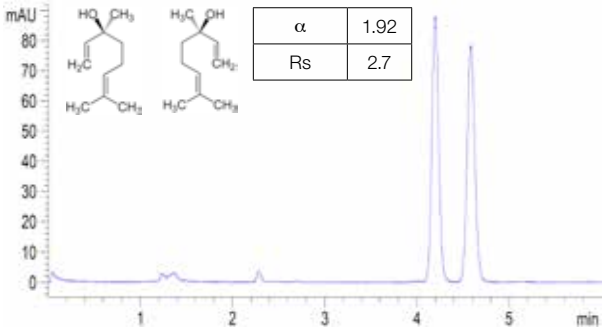
Column:	CHIRAL ART Cellulose-SC (5 µm) 250 x 4.6 mm ID
Part No.:	KSC99S05-2546WT
Eluent:	*n*-hexane / ethanol / ethanolamine (55/45/0.01)
Flow rate:	1.0 mL/min
Temperature:	25°C
Detection:	UV at 210 nm
Injection:	20 µL (0.5 mg/mL)

DL-Phenylethyl amine**



Column:	CHIRAL ART Cellulose-SB (5 µm) 250 x 4.6 mm ID
Part No.:	KSB99S05-2546WT
Eluent:	*n*-hexane / isopropanol / diethylamine (90/10/0.2)
Flow rate:	0.5 mL/min
Temperature:	25°C
Detection:	UV at 220 nm
Injection:	20 µL (2.5 mg/mL)

Linalool



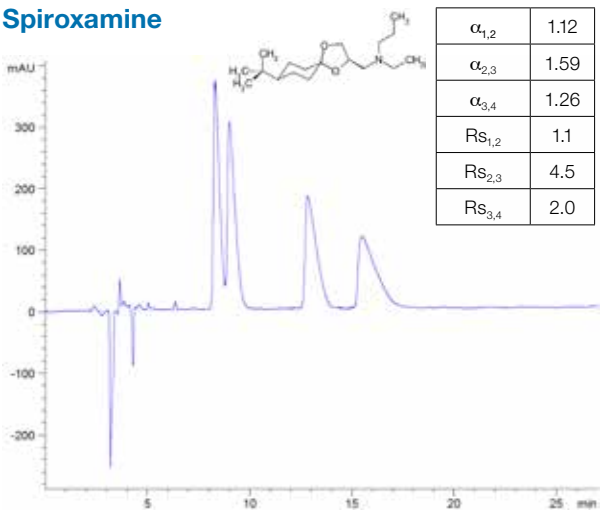
α	1.92
Rs	2.7

Column:	CHIRAL ART Amylose-SA (3 µm) 150 x 3.0 mm ID
Part No.:	KSA99S03-1503WT
Eluent:	water / acetonitrile (42/58)
Flow rate:	0.4 mL/min
Temperature:	35°C
Detection:	UV at 210 nm
Injection:	1 µL (0.5 µL/mL)

** Application data by courtesy YMC India Pvt. Ltd.

Immobilised Polysaccharides

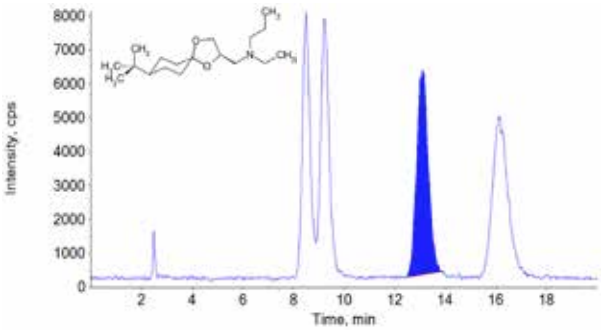
Spiroxamine



$\alpha_{1,2}$	1.12
$\alpha_{2,3}$	1.59
$\alpha_{3,4}$	1.26
$Rs_{1,2}$	1.1
$Rs_{2,3}$	4.5
$Rs_{3,4}$	2.0

Column: CHIRAL ART Amylose-SA (3 µm) 150 x 3.0 mm ID
Part No.: KSA99S03-1503WT
Eluent: water / ethanol / diethylamine (27.5/72.5/0.1)
Flow rate: 0.25 ml/min
Temperature: 30 °C
Detection: UV at 210 nm
Injection: 10 µL (10 mg/mL)

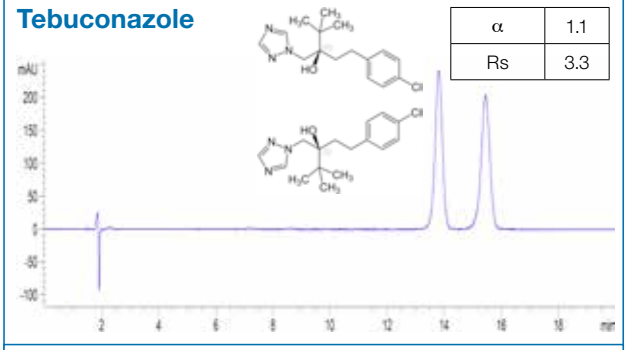
Spiroxamine



By courtesy of Sven Stuke, Bayer AG, Division Cropscience

Column: CHIRAL ART Amylose-SA (3 µm) 150 x 3.0 mm ID
Part No.: KSA99S03-1503WT
Eluent: A/B (25/75)
A: water / ethanol +10 mM ammonium carbonate (90/10)
B: water / ethanol +10 mM ammonium carbonate (10/90)
Flow rate: 0.3 ml/min
Temperature: 30 °C
Detection: ESI-MS/MS
Injection: 1 µL (1 µg/L)
post-column make-up via T-peace with 0.3 mL/min 1% formic acid in water/ methanol 50/50.

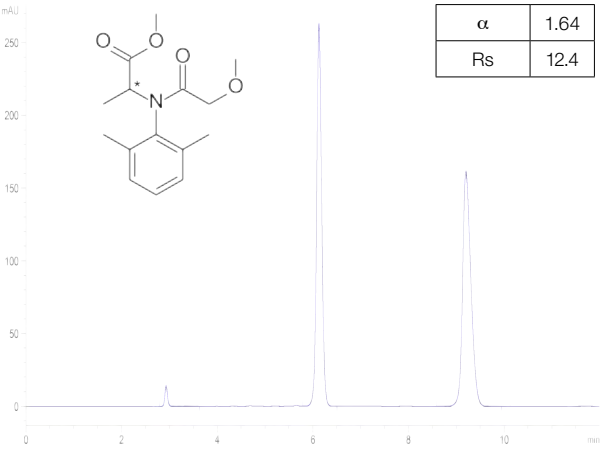
Tebuconazole



α	1.1
Rs	3.3

Column: CHIRAL ART Cellulose-SC (3 µm) 150 x 3.0 mm ID
Part No.: KSC99S03-1503WT
Eluent: water / acetonitrile / formic acid (60/40/0.1)
Flow rate: 0.43 ml/min
Temperature: 25 °C
Detection: UV at 220 nm
Injection: 2 µL (1 mg/mL)

Metalaxyl

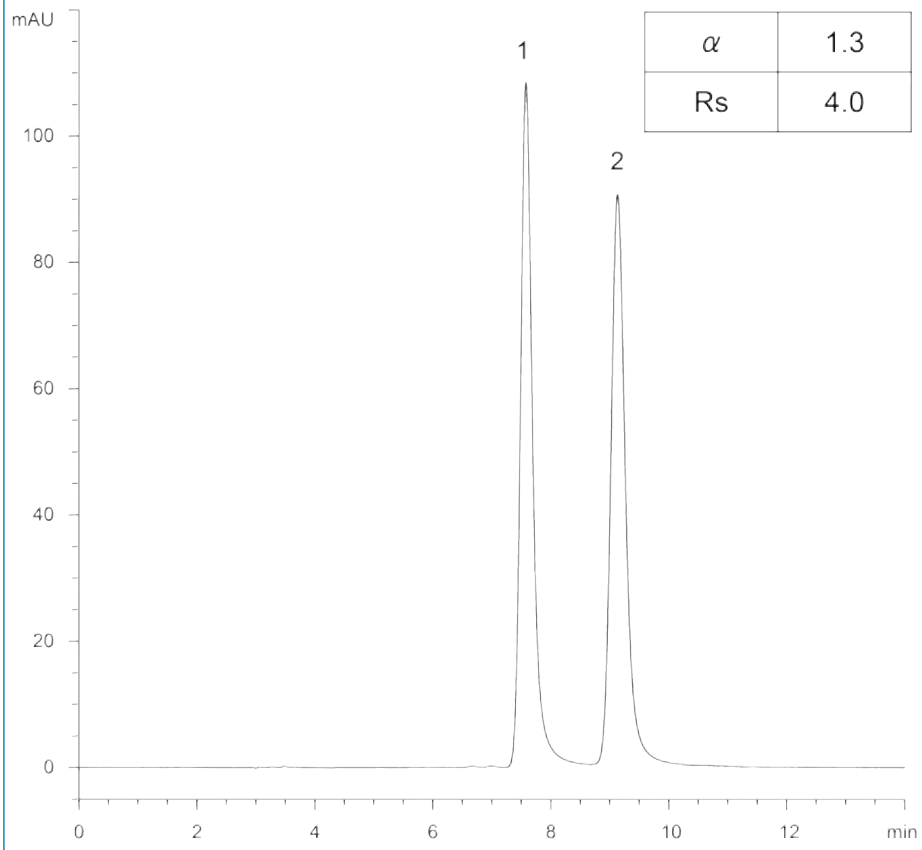


α	1.64
Rs	12.4

Column: CHIRAL ART Cellulose-SB (5 µm) 250 × 4.6 mm ID
Part No.: KSB99S05-2546WT
Mobile Phase: THF / *n*-hexane (30/70, premixed)
Flow Rate: 1 mL/min
Detection: 230 nm
Temperature: 25°C
Injection: 20 µL (1 mg/mL dissolved in mobile phase)
Sample: Metalaxyl (PESTANAL®, Sigma-Aldrich)

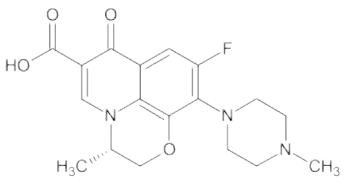
Immobilised Polysaccharides

Ofloxacin (Levofloxacin)*



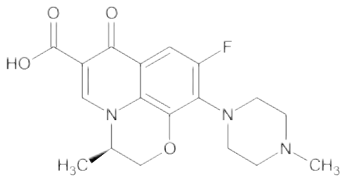
α	1.3
Rs	4.0

1



(S)-(-)-Ofloxacin
(Levofloxacin)

2



(R)-(+)-Ofloxacin

Column: CHIRAL ART Cellulose-SC (5 µm) 250 x 4.6 mm ID
Part No.: KSC99S05-2546WT
Eluent: *tert*-butyl methyl ether / ethanol / acetic acid / ethylenediamine (50/50/0.1/0.1)
Flow rate: 1.0 mL/min
Temperature: 40°C
Detection: UV at 300 nm

Column Care

The recommended pH range for using CHIRAL ART immobilised polysaccharide columns is 2.0-9.0. Remove acid and buffer salts before storage. Store the column in *n*-hexane/2-propanol = 90/10 (NP) or methanol/water = 50/50 (RP). If columns are affected by undesired contaminants or clogged inlet frits which cause back pressure increases, flush the column (in the reversed direction) with ethanol.

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

* Application data by courtesy YMC Co., Ltd.

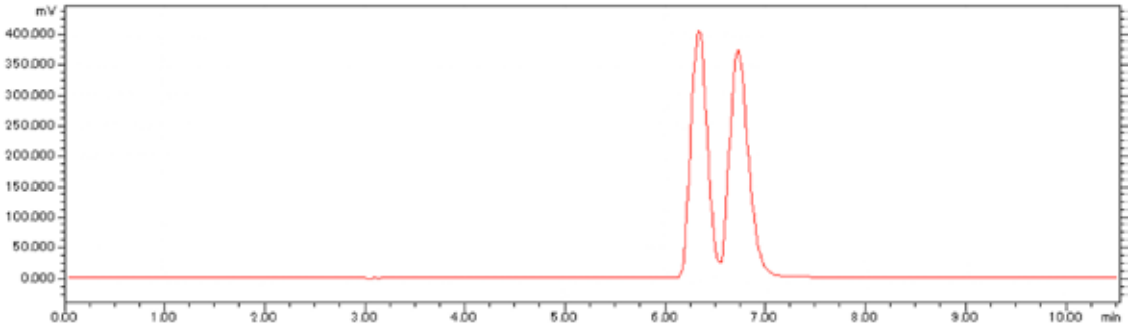
High Performance Chiral Purifications with YMC-Actus CHIRAL ART (Semi-)Preparative Columns

Cost efficiency

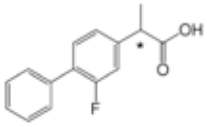
Rapid pressure changes under high-speed gradient conditions can lead to column degradation and loss of column performance. As with all YMC-Actus columns, a specific hardware and packing technology has been applied to these (semi-)preparative columns to provide a uniform packing density, which results in a longer lifetime than conventional semi-preparative columns.

(Semi-)preparative CHIRAL ART columns are available only in YMC-Actus hardware. YMC-Actus CHIRAL ART columns offer outstanding efficiency without compromising resolution. Furthermore, YMC-Actus CHIRAL ART columns provide reliable results, even after exposure to severe, rapid gradient conditions and multiple injections.

High Loadability with YMC-Actus CHIRAL ART*



Column: YMC-Actus CHIRAL ART Cellulose-C (5 µm) 250 x 30 mm ID
Part No.: KSC99S05-2530WX
Eluent: *n*-hexane / 2-propanol / TFA (95/5/0.1)
Flow rate: 45 mL/min
Detection: UV 280 nm
Injection: 585 µL (20 mg/mL)



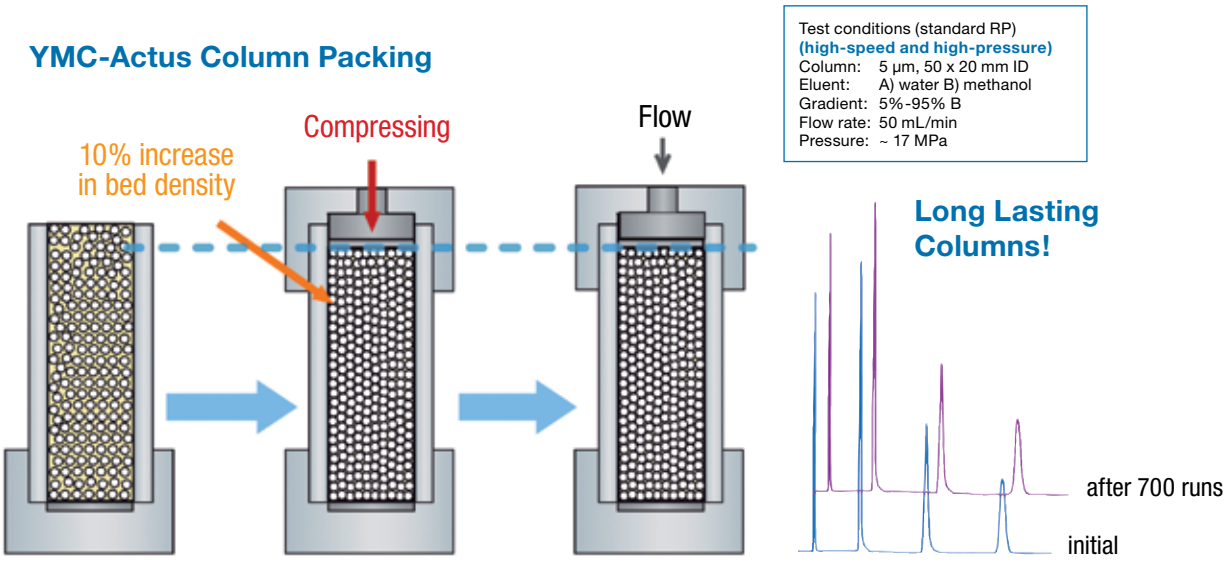
Flurbiprofen

High Performance Chiral Purifications with YMC-Actus CHIRAL ART (Semi-)Preparative Columns

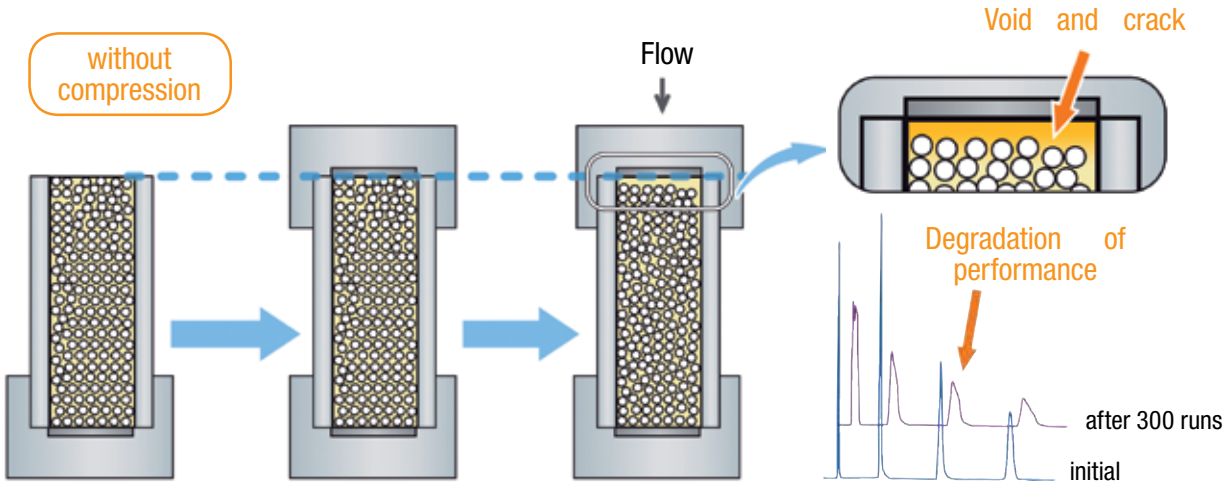
How to obtain long lasting columns?

YMC-Actus series columns are semi-preparative HPLC columns that have excellent column stability and efficiency as a result of applying axial compression technology. YMC-Actus series columns show high stability under high flow rate or steep gradient conditions which are desirable for milligram scale preparative HPLC of various compounds.

YMC-Actus Column Packing



Conventional Column Packing



Uniformly high density packing is necessary for highly efficient and stable HPLC columns.

DAC (Dynamic Axial Compression) columns are widely used for preparative separation in pilot or production scale. This allows uniformly high density packing and prevents formation of voids.

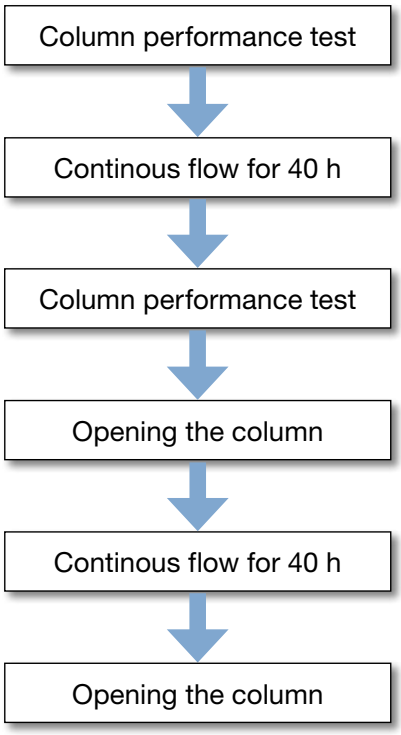
YMC-Actus series columns have been developed by applying this Axial Compression Technology to semi-prep column production. The column bed is compressed appropriately when attaching the inlet end assembly of the newly designed YMC-Actus hardware. It provides increased bed density (10% higher than conventional columns) and bed uniformity.

* Application data by courtesy YMC Co., Ltd.

YMC-Actus CHIRAL ART

Secured hardware stability*

A study has been performed using the 50 mm ID YMC-Actus columns for 80 hours at a constant maximum column pressure. An initial column performance test and after 40 hours was carried out. No significant changes in performance were observed after hours of continuous pressurisation.



Column continuous flow

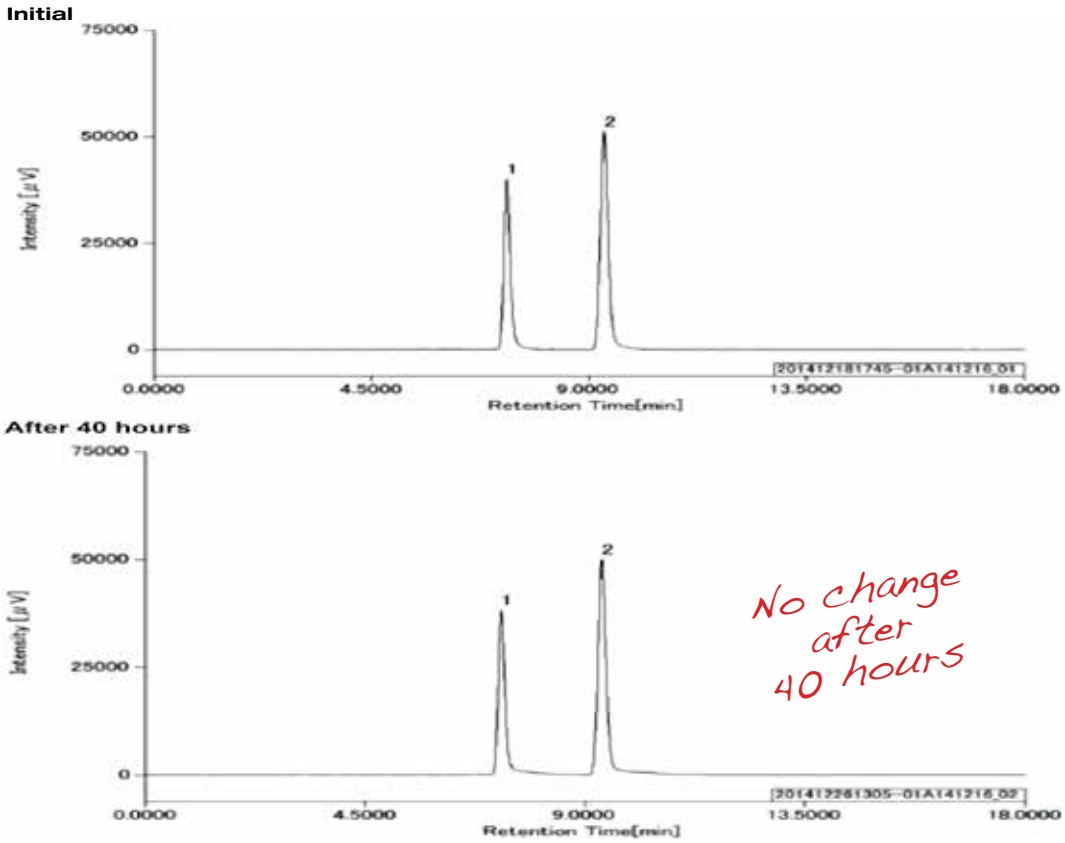
Column:	YMC-Actus SIL (12 nm, 5 µm) 250 x 50 mm ID
Part.-No.:	SL12S05-2553DX
Eluent:	*n*-hexane / ethanol (90/10)
Flow rate:	240 mL/min
Pressure:	200 bar
Temperature:	ambient

Column performance test

Column:	YMC-Actus SIL (12 nm, 5 µm) 250 x 50 mm ID
Eluent:	*n*-hexane / ethanol (90/10)
Flow rate:	50 mL/min
Temperature:	ambient
Detection:	UV at 254 nm
Sample:	1. Toluene (500 µL/mL) 2. Nitrobenzene (10 µL/mL)
Injection:	20 µL

YMC-Actus columns remain stable even after use at maximum pressure!

YMC-Actus CHIRAL ART



Step	Theoretical plate number N*	Tailing factor Tf*	Backpressure (bar)
Initial	16,093	1.18	20
After 40 h	15,693	1.16	22

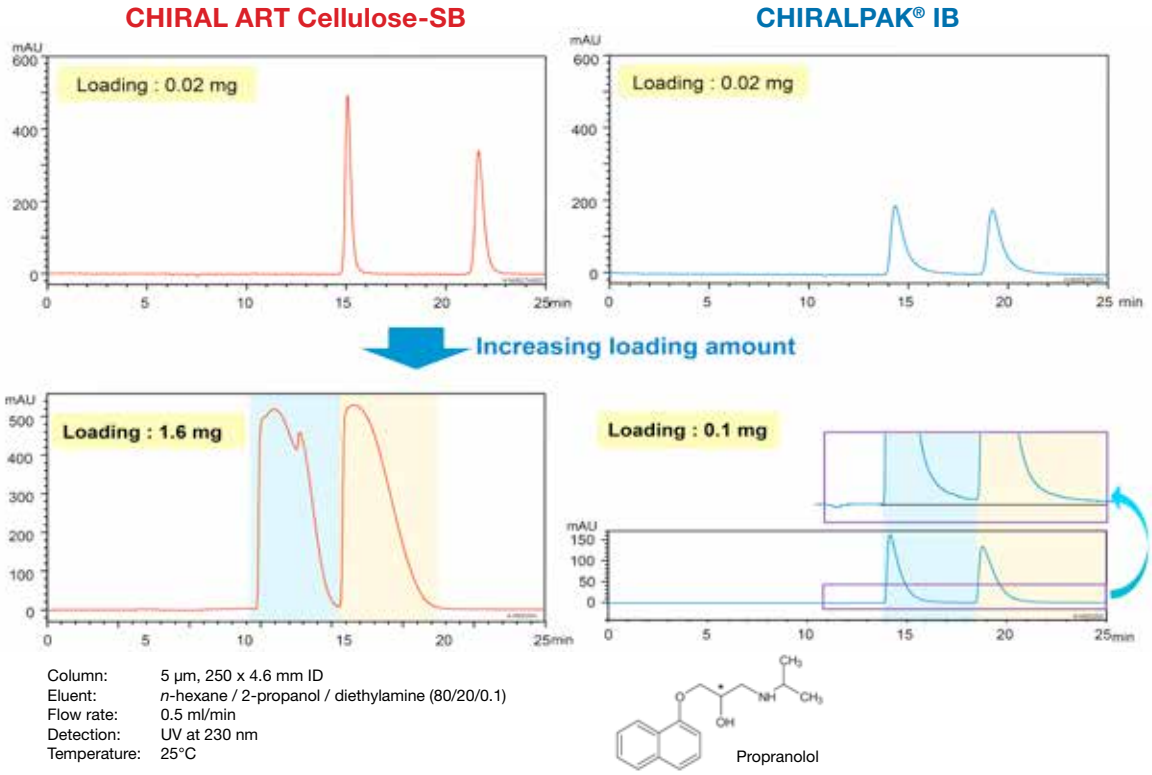
*values for nitrobenzene (peak 2)

The inlet frit was inspected after 40 and 80 hours. On opening, neither frit distortion nor gel leakage was observed.

* Application data by courtesy YMC Co., Ltd.

Efficient Purification Using YMC-Actus CHIRAL ART

Analytical Scale Loading Studies*



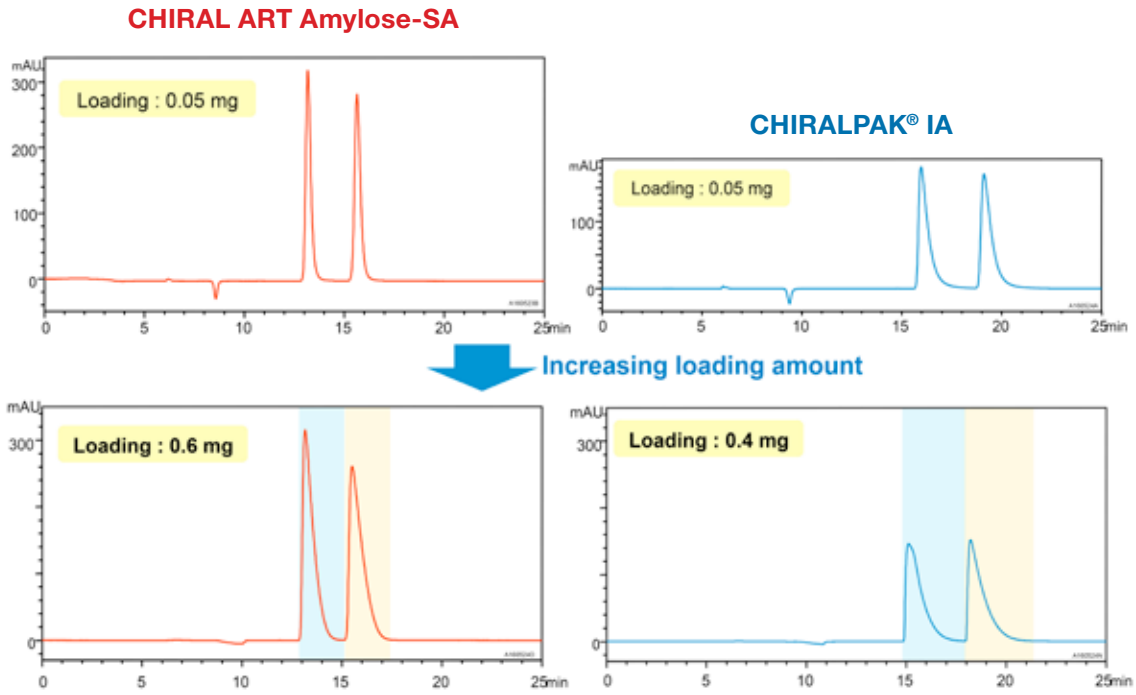
For the competitor's product, loading amount of more than 0.1 mg was not possible because the enantiomeric excess of the 2nd peak was already less than 98%ee with a loading amount of 0.1 mg.

	CHIRAL ART Cellulose-SB		CHIRALPAK® IB	
	1st peak	2nd peak	1st peak	2nd peak
Enantiomeric excess	>99.9%ee	99.3%ee	>99.9%ee	97.9%ee
Recovery	99%	99%	99%	97%
Productivity (mg/h)	3.1	3.3	0.3	0.3

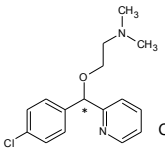
Calculated for repeated injections every 15 minutes (CHIRAL ART Cellulose-SB) and every 10 minutes (CHIRALPAK® IB).

The calculated maximum loading amount on CHIRAL ART Cellulose-SB of 1.6 mg was 10 times larger than that obtained for the competitor's product due to the large differences in the peak shapes, even though the interval between repeat injections was higher!

Efficient Purification Using YMC-Actus CHIRAL ART



Column: 5 µm, 250 x 4.6 mm ID
Eluent: *n*-hexane / 2-propanol / diethylamine (90/10/0.1)
Flow rate: 0.5 ml/min
Detection: UV at 230 nm
Temperature: 25°C



Carbinoxamine

	CHIRAL ART Amylose-SA		CHIRALPAK® IA	
	1st peak	2nd peak	1st peak	2nd peak
Enantiomeric excess	>99.9%ee	99.4%ee	>99.9%ee	98.9%ee
Recovery	99%	99%	99%	98%
Productivity (mg/h)	2.9	2.9	1.5	1.4

*Calculated for repeated injections every 6 minutes (CHIRAL ART Amylose-SA) and every 8 minutes (CHIRALPAK® IA).

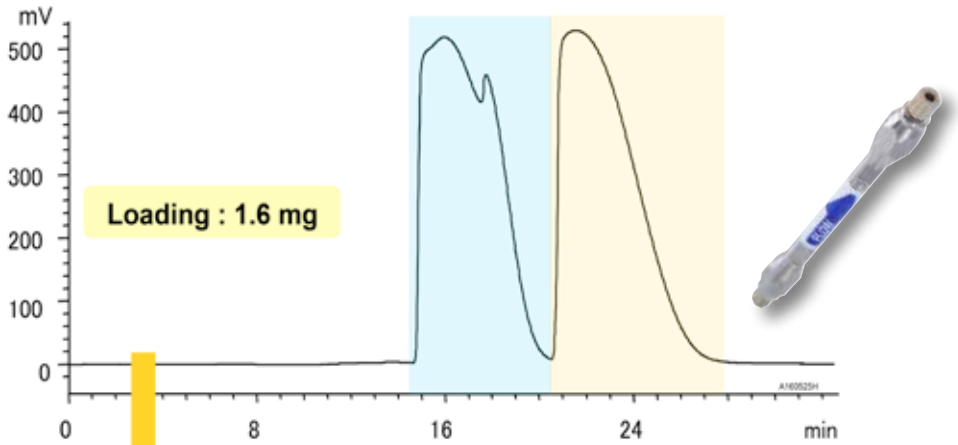
The calculated maximum loading amount on CHIRAL ART Amylose-SA was double that obtained for the competitor's product due to the good peak shape with no tailing, which also allowed increased productivity.

* Application data by courtesy YMC Co., Ltd.

Efficient Purification Using YMC-Actus CHIRAL ART

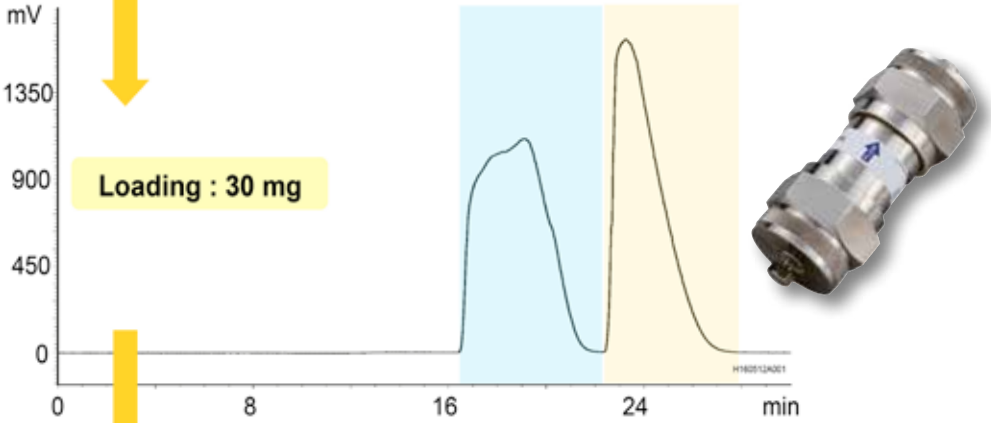
Scale-up with YMC-Actus CHIRAL ART*

Analytical
5 µm, 250 x 4.6 mm ID
at 0.5 ml/min
linear velocity : 0.5 mm/s



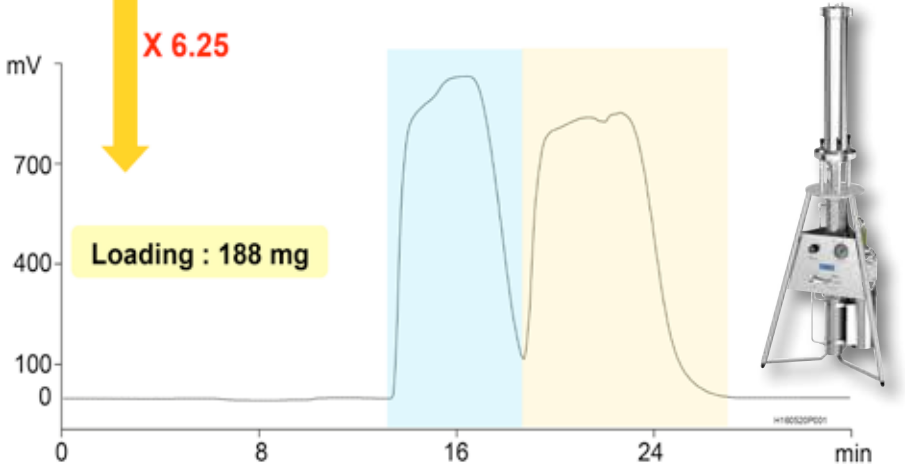
X 18.9

Semi-preparative
5 µm, 250 x 20 mm ID
at 9.5 ml/min
linear velocity : 0.5 mm/s



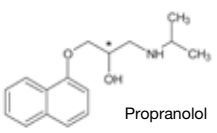
X 6.25

Preparative
10 µm, 250 x 50 mm ID
at 59 ml/min
linear velocity : 0.5 mm/s



Preparative column was packed with Dynamic Axial Compression.

Chiral
stationary phase: CHIRAL ART Cellulose-SB
Eluent: *n*-hexane / 2-propanol / diethylamine (80/20/0.1)
Detection: UV at 237 nm
Temperature: ambient



Propranolol

Efficient Purification Using YMC-Actus CHIRAL ART

	Analytical 250 x 4.6 mm ID		YMC-Actus Semi-preparative 250 x 20 mm ID		Self-packed DAC Preparative 250 x 50 mm ID	
	1st peak	2nd peak	1st peak	2nd peak	1st peak	2nd peak
Enantiomeric excess	>99.9%ee	99.3%ee	99.9%ee	99.8%ee	99.1%ee	99.3%ee
Recovery	99%	99%	97%	99%	99%	94%
Productivity (mg/h)	3.1	3.3	58.6	62.4	366	390

Linear scale-up was performed using the appropriate scale-up factors. The Dynamic Axial Compression Column self-packed with CHIRAL ART Cellulose-SB 10 µm can be easily and linearly scaled-up for a greater purification scale. The final productivity is 366 and 390 mg/h respectively for peak 1 and 2.

* Application data by courtesy YMC Co., Ltd.

Chiral Separations in SFC Mode

Chiral SFC columns by YMC

2 options are available:

- **SFC compatible LC columns: CHIRAL ART (p. 252-279)***
- **SFC dedicated columns: Alcyon SFC CSP**

*A statement is available to confirm the usability in SFC mode.

CHIRAL ART LC columns are interchangeable between NP/RP mode and SFC mode with a simple solvent switch. All you need to do is flush your column with 10 column volumes of 100% isopropanol before switching to final conditions in the new mode. This applies to switching from LC to SFC and vice versa.

Specifications Alcyon SFC CSP columns

CHIRAL	Alcyon SFC Coated Polysaccharides		Alcyon SFC Immobilised Polysaccharides		
	Alcyon SFC CSP Amylose-C	Alcyon SFC CSP Cellulose-C	Alcyon SFC CSP Amylose-SA	Alcyon SFC CSP Cellulose-SB	Alcyon SFC CSP Cellulose-SC
Particle size	3, 5, µm				
Chiral Selector	Amylose tris (3,5-dimethyl-phenylcarbamate)	Cellulose tris (3,5-dimethyl-phenylcarbamate)	Amylose tris (3,5-dimethyl-phenylcarbamate)	Cellulose tris (3,5-dimethyl-phenylcarbamate)	Cellulose tris (3,5-dichloro-phenylcarbamate)
USP	L51	L40	L99	—	—
Shipping Solvent	2-propanol				
Usable pH-range	3.5 - 6.5	3.5 - 6.5	2.0 - 9.0	2.0 - 9.0	2.0 - 9.0
Tempera-ture range	0-40°C				
Pressure limit	2.1, 3.0 and 4.6 mm ID: 30 MPa (4350 psi) 10 and 20 mm ID: 20 MPa (2980 psi)				

Product Line-up

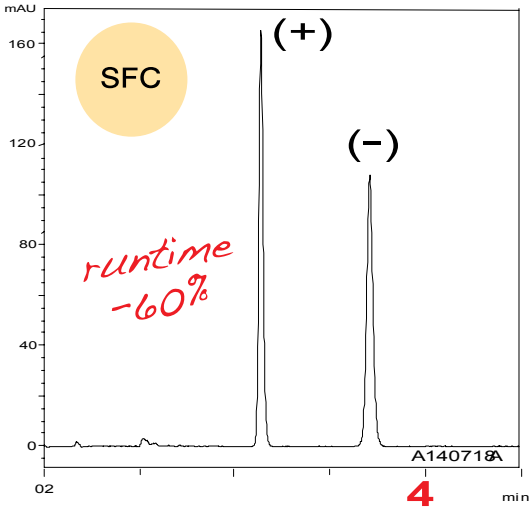
PRODUCT NAME	Particle size [µm]	Type	Alternative YMC LC product	Competitive product
Alcyon SFC CSP Amylose-C	3 5	Coated	CHIRAL ART Amylose-C	CHIRALPAK® AD-H (SFC), AD-3
Alcyon SFC CSP Cellulose-C			CHIRAL ART Cellulose-C	CHIRALCEL® OD-H (SFC), OD-3
Alcyon SFC CSP Amylose-SA		Immobilised	CHIRAL ART Amylose-SA	CHIRALPAK® IA (SFC), IA-3
Alcyon SFC CSP Cellulose-SB			CHIRAL ART Cellulose-SB	CHIRALPAK® IB (SFC), IB-3
Alcyon SFC CSP Cellulose-SC			CHIRAL ART Cellulose-SC	CHIRALPAK® IC (SFC), IC-3

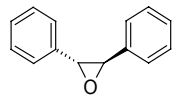
Properties of Alcyon SFC CSP Columns

Alcyon SFC columns are specifically packed in SFC dedicated hardware, tested under SFC conditions and supplied with a test certificate under SFC conditions. The stationary phase used in Alcyon SFC columns is identical to that used in the corresponding CHIRAL ART columns.

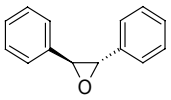
Chiral Separations in SFC Mode

Fast separation with high resolution*

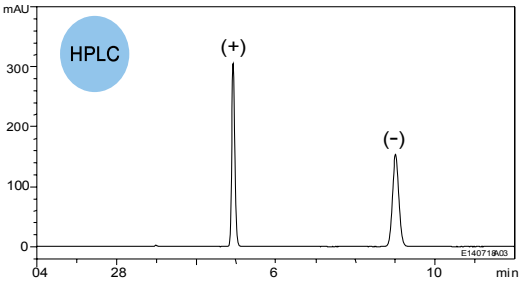




(+)-*R,R-trans*-Stilbene oxide



(-)-*S,S-trans*-Stilbene oxide

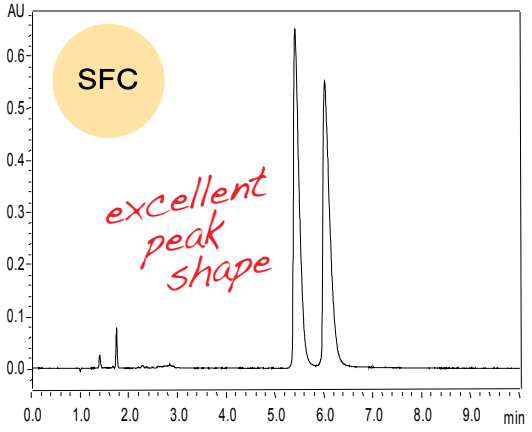


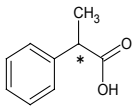
Column: **Alcyon SFC CSP Amylose-C** (5 µm) 250 x 4.6 mm ID
Part No.: KAN99S05-2546WTS
Eluent: CO_2 / methanol (60/40)
Flow: 3.0 mL/min
Temperature: 40°C
Detection: UV at 220 nm
Back pressure: 17.2 MPa (2500 psi)

Column: CHIRAL ART Amylose-C (5 µm) 250 x 4.6 mm ID
Part No.: KAN99S05-2546WT
Eluent: *n*-hexane / 2-propanol (90/10)
Flow: 1.0 mL/min
Temperature: 25°C
Detection: UV at 220 nm

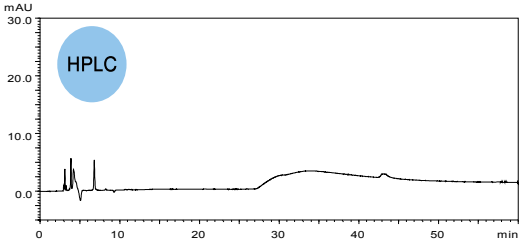
Faster chiral separation of trans-stilbene oxide is achieved using supercritical fluid chromatography compared to HPLC as the separation mode. Lower viscosity and larger diffusion coefficients for supercritical fluid provide rapid separations of both chiral and achiral compounds.

Excellent peak shape using mobile phase without the addition of an acid*





2-Phenylpropionic acid



Column: **Alcyon SFC CSP Cellulose-C** (5 µm) 250 x 4.6 mm ID
Part No.: KCN99S05-2546WTS
Eluent: CO_2 / methanol (98/2)
Flow: 3.0 mL/min
Temperature: 35°C
Detection: UV at 220 nm
Back pressure: 10.3 MPa (2000 psi)

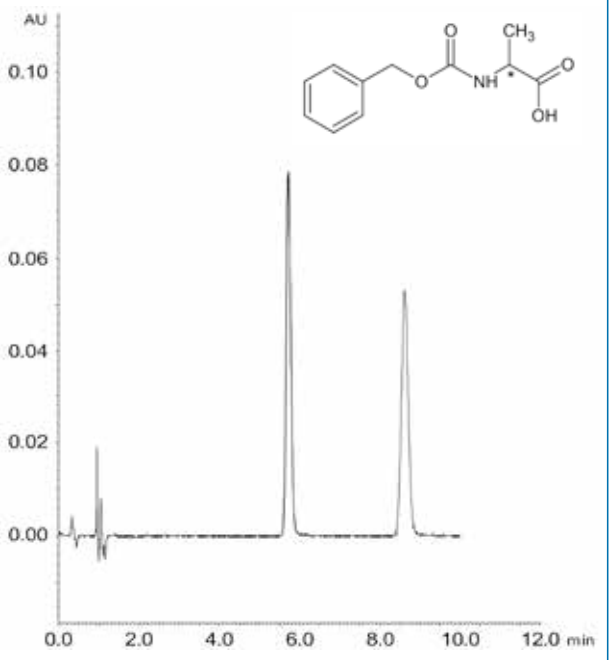
Column: CHIRAL ART Cellulose-C (5 µm) 250 x 4.6 mm ID
Part No.: KCN99S05-2546WT
Eluent: *n*-hexane / 2-propanol (99/1)
Flow: 1.0 mL/min
Temperature: 25°C
Detection: UV at 220 nm

Excellent peak shape of 2-phenylpropionic acid is obtained using SFC chiral separation. Under HPLC conditions, the peak shape is very broad with mobile phase containing no additives such as an acid. With SFC, on the other hand, peak shapes are very good just with a mixture of CO_2 and methanol. It is thought that supercritical carbon dioxide acts as a weak acid.

* Application data by courtesy YMC Co., Ltd.

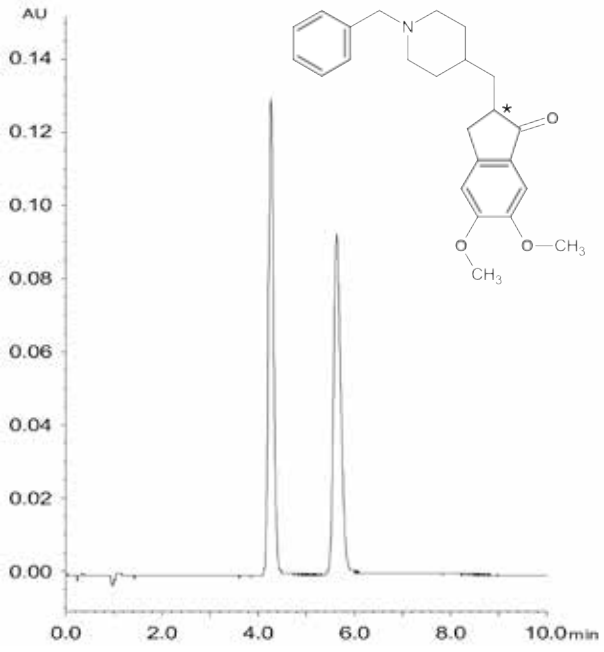
Applications

N-CBZ-DL-Alanine*



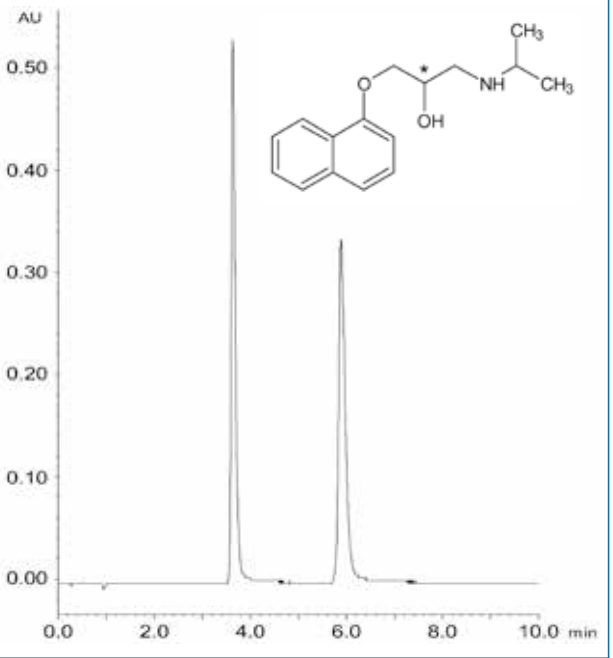
Column:	Alcyon SFC CSP Amylose-C (5 µm) 250 x 4.6 mm ID
Part No.:	KAN99S05-2546WTS
Eluent:	CO_2 / 2-propanol containing 0.1% TFA (90/10)
Flow rate:	3.0 mL/min
Temperature:	35°C
Detection:	UV at 215 nm
Backpressure:	13.8 MPa (2000 psi)
Injection:	5 µL (1.0 mg/mL)

Donepezil*



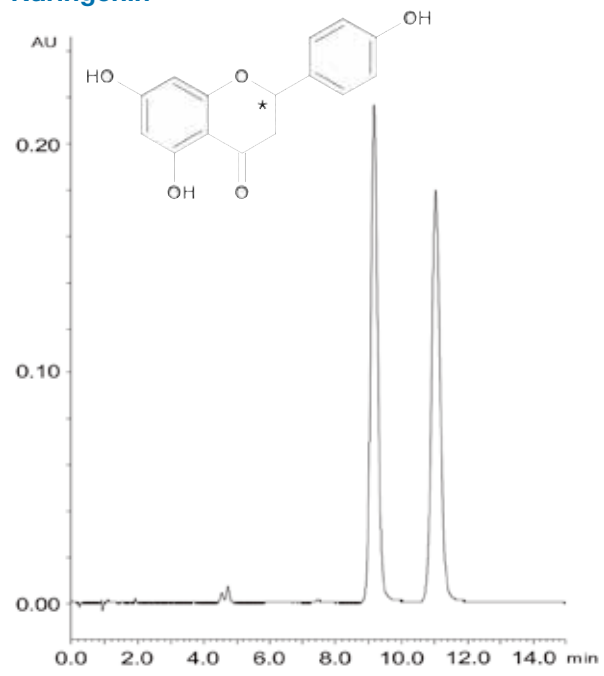
Column:	Alcyon SFC CSP Cellulose-C (5 µm) 250 x 4.6 mm ID
Part No.:	KCN99S05-2546WTS
Eluent:	CO_2 / 2-propanol containing 0.1% DEA (70/30)
Flow rate:	3.0 mL/min
Temperature:	35°C
Detection:	UV at 268 nm
Backpressure:	13.8 MPa (2000 psi)
Injection:	5 µL (1.0 mg/mL)

Propranolol*



Column:	Alcyon SFC CSP Cellulose-C (5 µm) 250 x 4.6 mm ID
Part No.:	KCN99S05-2546WTS
Eluent:	CO_2 / methanol containing 0.1% DEA (80/20)
Flow rate:	3.0 mL/min
Temperature:	35°C
Detection:	UV at 230 nm
Backpressure:	13.8 MPa (2000 psi)
Injection:	5 µL (1.0 mg/mL)

Naringenin*



Column:	Alcyon SFC CSP Cellulose-SB (5 µm) 250 x 4.6 mm ID
Part No.:	KSB99S05-2546WTS
Eluent:	CO_2 / 2-propanol (80/20)
Flow rate:	3.0 mL/min
Temperature:	35°C
Detection:	UV at 220 nm
Backpressure:	13.8 MPa (2000 psi)
Injection:	5 µL (1.0 mg/mL)

Method Screening Strategy for Polysaccharide Phases

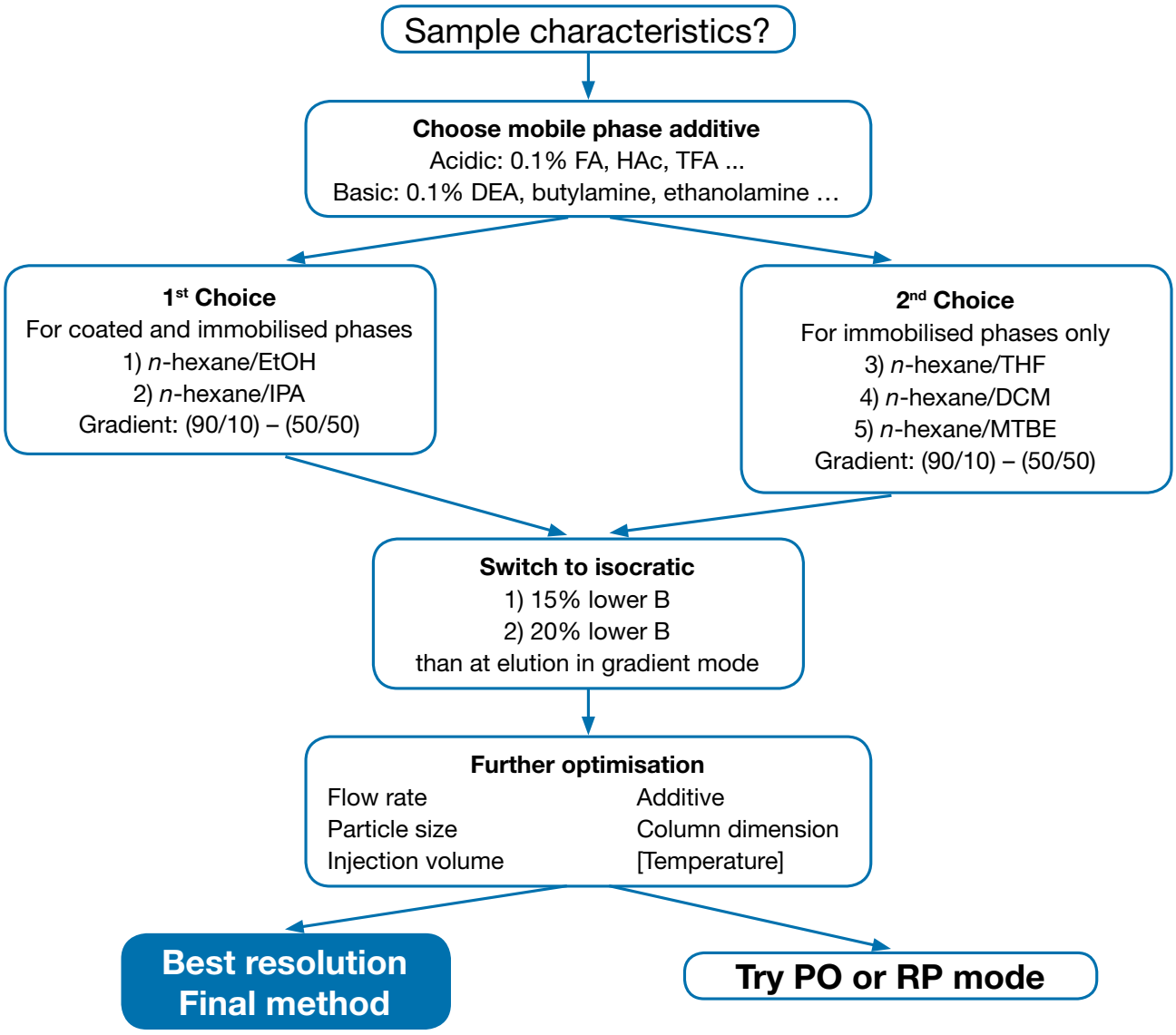
When NP mode, when RP mode?

CHIRAL ART columns can be used in NP and RP mode. Coated CHIRAL ART are dedicated for use in NP mode only, while immobilised CHIRAL ART columns can be opterated in both modes.

It is recommended to start screening in NP mode first as the success rates are usually much higher. YMC's screening success rate in NP mode is >95%, while it is <5% only in RP mode.

However, beside the success rate there can be specific reasons for RP mode, e.g. use of MS as detection mode.

NP Screening Strategy



For Polar Organic (PO) mode, methanol, ethanol or mixtures of both can be used as well as acetonitrile or mixtures of methanol and acetonitrile. RP mode can only be applied to immobilised polysaccharide phases.

It is essential to make sure of the miscibility of the organic solvents. When switching from alkane/alcohol solvents to polar organic solvents (methanol, acetonitrile etc), run an intermediate wash with at least ten column volumes of ethanol or 2-propanol.

It is important to remember that a column used with polar organic solvents (such as methanol/ethanol, methanol/acetonitrile) as a mobile phase should be dedicated to this specific mode of application.

* Application data by courtesy YMC Co., Ltd.

Method Screening Strategy

Use of Screening Gradients

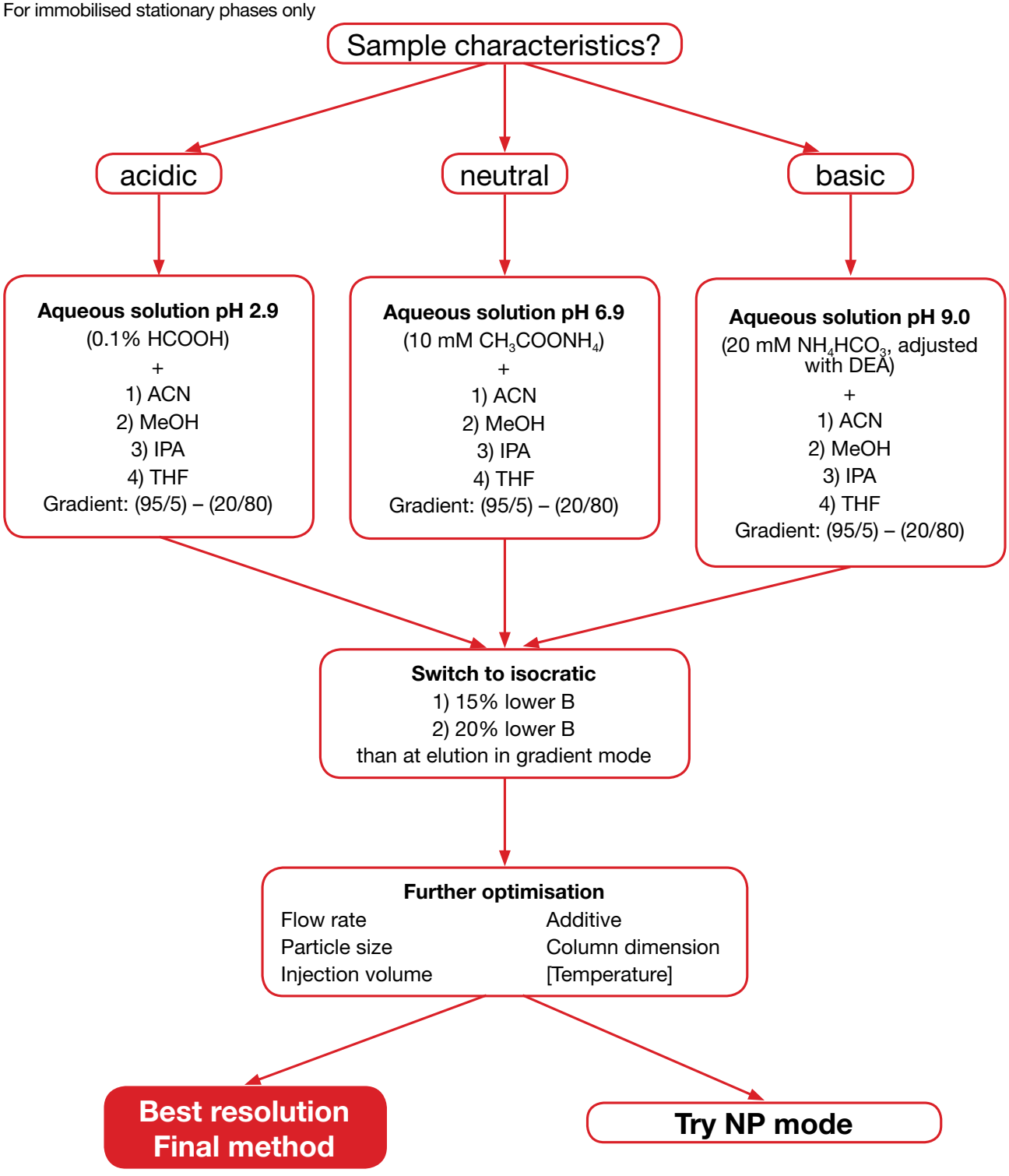
YMC recommends using a gradient based screening strategy as it is much faster than isocratic screening when using different mobile phase compositions.

Different strategies are recommended for each separation mode.

➔ For a more detailed overview on the different strategies, also refer to the whitepaper "*Chiral LC & SFC Method Development*" that can be downloaded from the YMC Europe homepage.

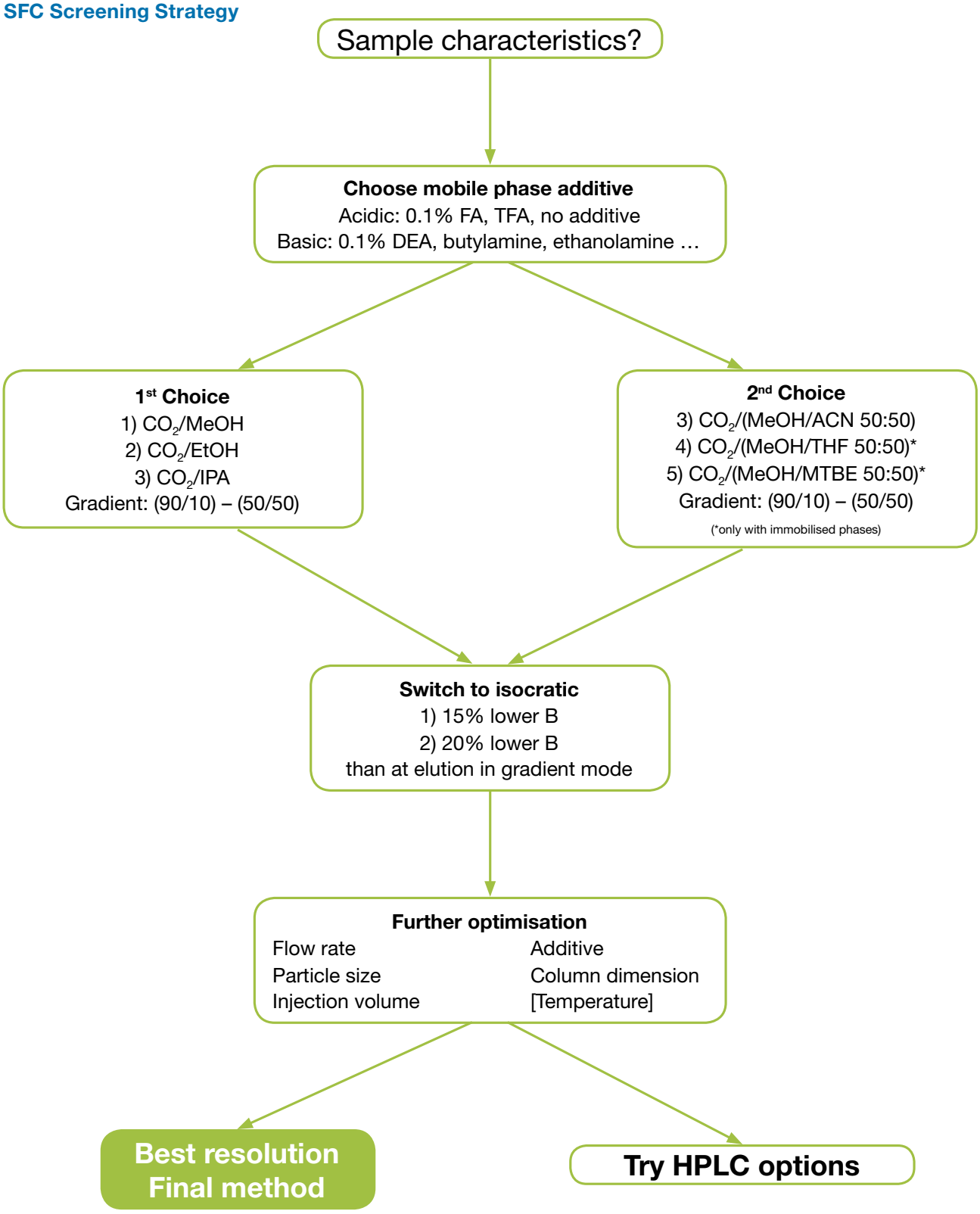
RP Screening Strategy

For immobilised stationary phases only



Method Screening Strategy

SFC Screening Strategy



Abbreviations used:

FA (formic acid); HAc (acetic acid); TFA (trifluoroacetic acid); DEA (diethylamine); EtOH (ethanol); IPA (2-propanol); THF (tetrahydrofuran); DCM (dichloromethane); MTBE (methyl tert-butyl ether); ACN (acetonitrile); MeOH (methanol)

* Application data by courtesy YMC Co., Ltd.

How to Choose the Correct Chiral Column

YMC Database

A selection of chiral applications can be found at http://ymc.de/applications.html. Here, you can search for chiral applications already known for your compounds.

Test Columns or Screening Kits

You can request a test column to initially test a chiral column before finally buy it if it works for your application. If the column is not suitable, simply return it without any further requirements.

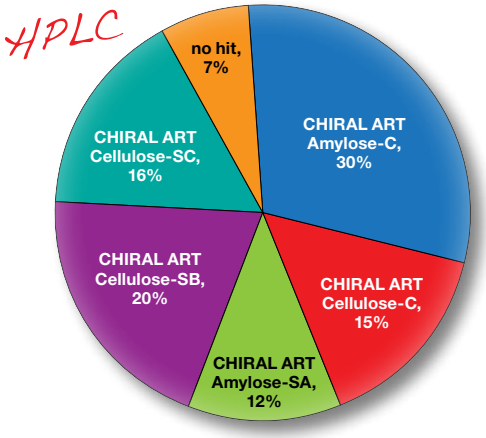
Alternatively you can choose one of the YMC method development kits (see page 13) or request a customised screening kit with 2, 3, 4 or 5 different CHIRAL ART phases. You only need to contact your local YMC contact for details.

FREE Chiral Screening Service

- >90% success rate
- Rapid screening within a short period of time
- Screening according to your requirements: e.g. RP-mode, MS-compatibility etc.
- Screening on all available CHIRAL ART phases and further YMC CHIRAL phases if needed
- Results presented in a detailed report
- Confidentiality Agreements can be arranged as necessary

Success Rate

- Hit criteria : Rs>1.5
- Hit database: compiled from 300 samples (199 LC/101 SFC) supplied for contract service
- The 5 CHIRAL ART phases available so far can cover >90% of chiral separations
- Hit ratios varied between 6% and 34% for each of the 5 phases
- About 95% of the LC applications are in NP/PO mode, while 5% are in RP mode

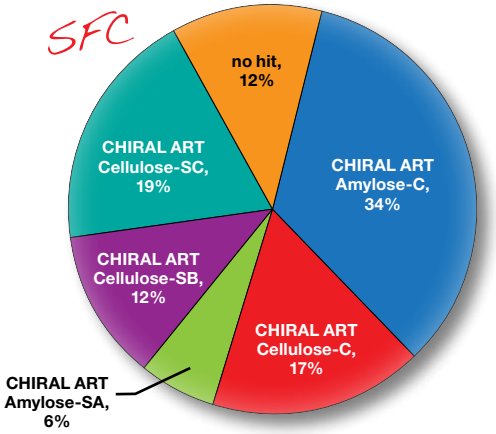


Method Development

- Method development based on phase screening
- According to your requirements

Preparative and Process Scale-Up

- Phase screening
- Preparative method development
- Small scale purification



Contract Purification of Chiral Compounds

In addition to chiral screening which can be carried out at our German or Japanese facilities, YMC now offer contract purification of chiral compounds at a range of scales and by different techniques.

Highly productive

Highly efficient preparative separation methods
(recycling chromatography, SFC, SMB)

Highly reliable

Extensive expertise and excellent performance
in scaling up of chromatographic purification

Cost competitive

Competitively priced YMC chiral packing materials used

Applicable to various scales

Equipped with dynamic axial compression columns with
a maximum inner diameter of up to 1000 mm and HPLC systems
with pumps up to a maximum flow rate of 50 L/min

GMP compliant purification service

Scale	several mg - tens of g			tens of g - several tons		
Location	Kyoto Research Laboratories			YMC Komatsu Works		
	System	Column ID	Purpose	System	Column ID	Purpose
Equipment	Preparative HPLC LC-Forte/R	20, 30 mm	Purification of trace impurities, recycling purification of enantiomers	Dynamic Axial Compression Columns + K-Prep system	100 – 1000 mm max. flow rate 0.5 – 50 L/min	Production-scale purification of enantiomers
	K-Prep LAB	50 mm	Single column purification with stacked injection			
	Preparative SFC	20, 30 mm	Preparative SFC purification of enantiomers	Large SMB (Planned)		Production-scale purification of API
	SMB	20, 30 mm	Continuous purification, Simulation for scaling up SMB processes			
						

* Application data by courtesy YMC Co., Ltd.

YMC CHIRAL NEA(R)(S)

- **normal and reversed phase mode**
- **reversal of elution order**
- **nonpolar to medium polar compounds**
- **available in bulk quantities**

YMC CHIRAL NEA(R)(S)	Specification
Particle Size / µm	5
Pore Size / nm	30
Surface area / m^2g^{-1}	proprietary
Carbon content / %	proprietary
Recommended pH range	2.0 - 6.5 (reversed phase)

Properties

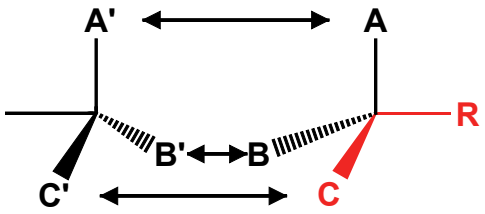
Although separation modes are chosen according to the purpose of separation, it is recommended to use one column dedicated for one separation mode in order to maximise the lifetime of the column.
In normal phase mode YMC CHIRAL NEA allows the separation of a wide range of non-polar to moderately polar compounds.
The separation mechanisms involve a combination of:

- π-π interactions
- hydrogen bonding
- dipole interactions
- steric effects.

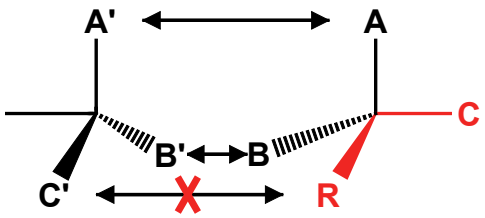
For a successful separation at least three points of interaction between the CSP and the target compound must exist. Occasionally, for analytical separations, there may be a need to derivatise the sample with, for example π-donating groups such as dinitobenzoyl, dinitrophenylurea or dinitrophenylcarbamate groups. In some cases, the increase in detectability can offset the disadvantages of derivatisation

Chiral Separation Mechanism

3 points of interaction: separation



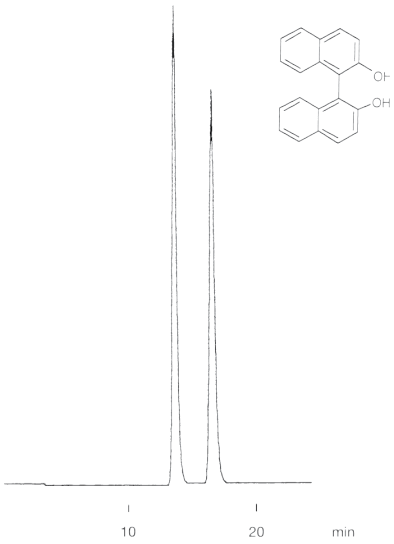
2 points of interaction: no separation



YMC CHIRAL NEA(R)(S)

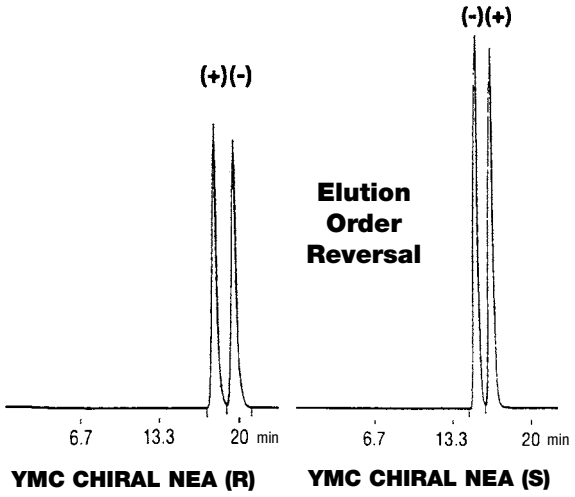
Applications used in normal phase mode

1,1'-Bi-2-Naphthol*



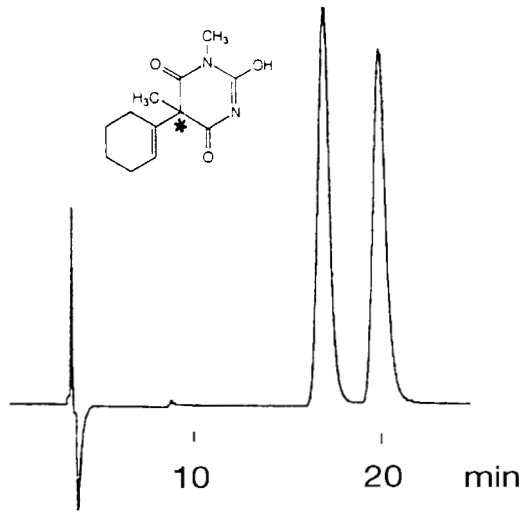
Column: YMC CHIRAL NEA (R) 250 x 4.6 mm ID
Part No.: CR30S05-2546WT
Eluent: *n*-hexane / dichloromethane / ethanol (70/30/2)
Flow rate: 1.0 mL/min
Temperature: 25°C
Detection: UV at 254 nm

2,2,2-Trifluoro-1-(9-anthryl) ethanol*



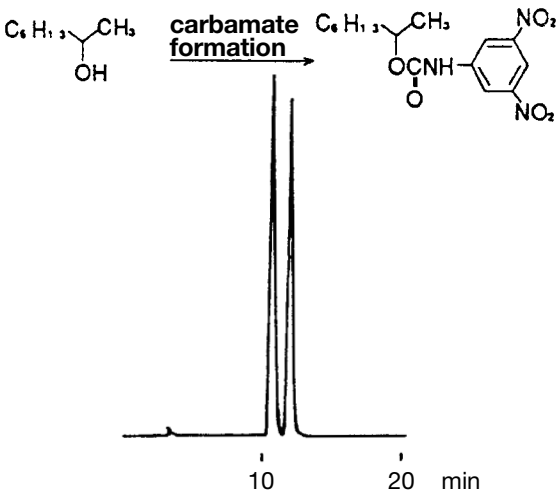
Column: YMC CHIRAL NEA (R) and YMC CHIRAL NEA (S) 250 x 4.6 mm ID
Part No.: CR30S05-2546WT and CS30S05-2546WT
Eluent: *n*-hexane / dichloromethane / ethanol (70/30/1)
Flow rate: 0.5 mL/min
Temperature: 25°C
Detection: UV at 254 nm

Hexobarbital*



Column: YMC CHIRAL NEA (R) 250 x 4.6 mm ID
Part No.: CR30S05-2546WT
Eluent: *n*-hexane / CH_2Cl_2 / ethanol (90/10/2)
Flow rate: 1.0 mL/min
Temperature: ambient
Detection: UV at 220 nm

1-Phenylethanol



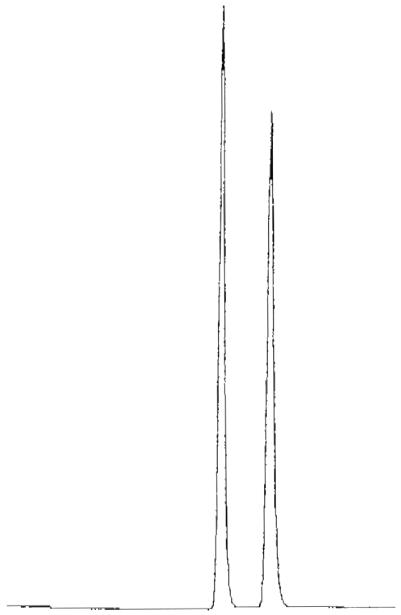
Column: YMC CHIRAL NEA (R) 250 x 4.6 mm ID
Part No.: CR30S05-2546WT
Eluent: *n*-hexane / CH_2Cl_2 / ethanol (90/10/5)
Flow rate: 1.0 mL/min
Temperature: 35°C
Detection: UV at 254 nm

* Application data by courtesy YMC Co., Ltd.

YMC CHIRAL NEA(R)(S)

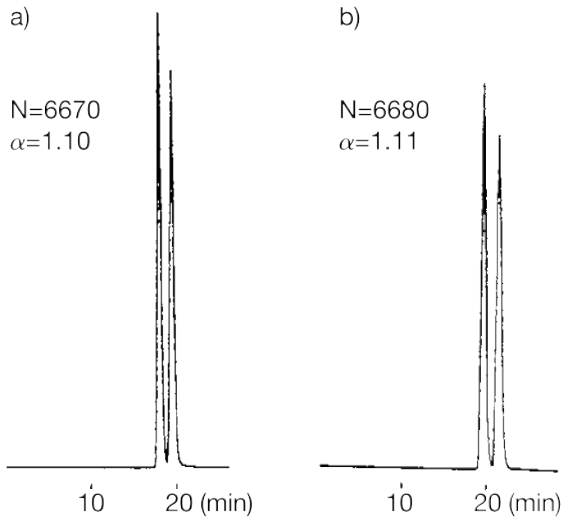
Applications used in reversed phase mode

1,1'-Bi-2-Naphthol*



Column:	YMC CHIRAL NEA (R) 250 x 4.6 mm ID
Part No.:	NR30S05-2546WT
Eluent:	acetonitrile / water (50/50)
Flow:	1.0 mL/min
Pressure:	80 bar
Detection:	UV at 235 nm
Injection:	1.0 µL (2.8 mg/mL)
Temperature:	ambient

Propranolol · HCl*



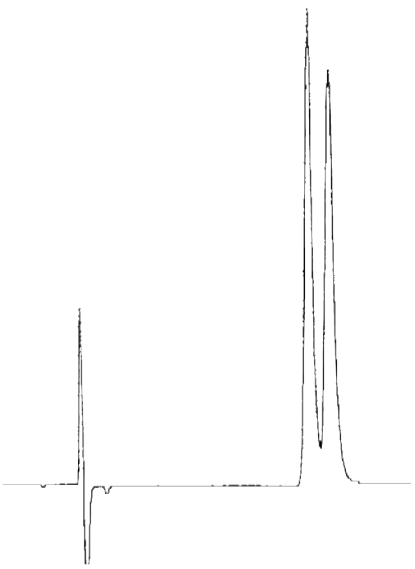
a)

Column:	YMC CHIRAL NEA (R) 250 x 4.6 mm ID
Part No.:	NR30S05-2546WT
Eluent:	acetonitrile / 0.5M $NaClO_4$ (40/60)
Flow:	1.0 mL/min
Temperature:	ambient
Time:	100 hours

b)

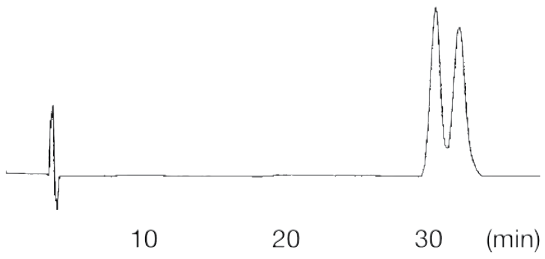
Eluent:	acetonitrile / 0.5M $NaClO_4$ (40/60)
Flow:	1.0 mL/min
Temperature:	ambient
Detection:	UV at 254 nm

Hexobarbital*



Column:	YMC CHIRAL NEA (R) 250 x 4.6 mm ID
Part No.:	NR30S05-2546WT
Eluent:	acetonitrile / water (30/70)
Flow:	0.7 mL/min
Detection:	UV at 210 nm
Injection:	1.0 µL (1.2 mg/mL)
Temperature:	ambient

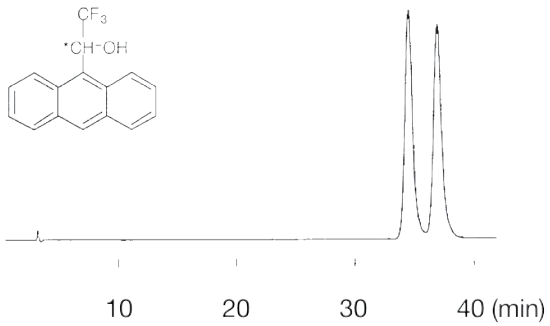
CBZ-Phenylalanine (Z-Phe-OH)*



Column:	YMC CHIRAL NEA (R) 250 x 4.6 mm ID
Part No.:	NR30S05-2546WT
Eluent:	0.5M $NaClO_4$-$HClO_4$ (pH 2.0) / acetonitrile (70/30)
Flow:	1.0 mL/min
Detection:	UV at 254 nm
Injection:	10 µL (1.5 mg/mL)
Temperature:	ambient

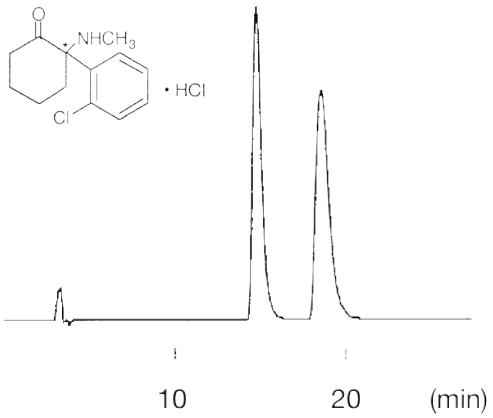
YMC CHIRAL NEA(R)(S)

2,2,2-Trifluoro-1-(9-anthryl)-ethanol*



Column:	YMC CHIRAL NEA (R) 250 x 4.6 mm ID
Part No.:	NR30S05-2546WT
Eluent:	acetonitrile / water (40/60)
Flow:	1.0 mL/min
Detection:	UV at 254 nm
Injection:	1.0 µL (0.14 mg/mL)
Temperature:	ambient

Ketamine · HCl*



Column:	YMC CHIRAL NEA (R) 250 x 4.6 mm ID
Part No.:	NR30S05-2546WT
Eluent:	acetonitrile / 0.5M $NaClO_4$ (40/60)
Flow:	1.0 mL/min
Detection:	UV at 268 nm
Injection:	10 µL (1.4 mg/mL)
Temperature:	ambient

Column Care

The recommended pH range for using YMC CHIRAL NEA(R)(S) columns is 2.0-6.5. 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.de/support-documentation.html.

* Application data by courtesy YMC Co., Ltd.

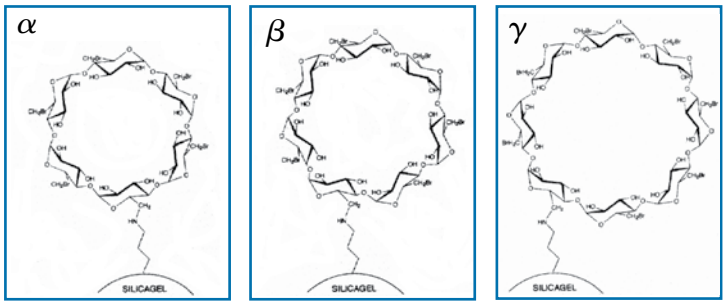
YMC CHIRAL CD BR

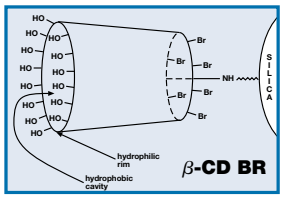
- **reversed phase**
- **polar pharmaceuticals**
- **positional isomers**
- **water-soluble compounds**

YMC CHIRAL CD BR	Specification
Particle Size / µm	5
Pore Size / nm	12
Surface area / m^2g^{-1}	proprietary
Carbon content / %	proprietary
Recommended pH range	3.5 - 6.5

Properties

YMC CHIRAL CD BR columns offer an alternative approach to enantioseparation. Covalent bonding of a bromide derivative of a cyclodextrin to YMC silica provides a novel CSP. The bromide derivative, in which the primary hydroxyl groups at carbon 6 are substituted for bromine, provides a different chiral selectivity to the 'normal' cyclodextrins. These cyclodextrin bromide derivatives are used in reversed phase mode to separate a wide range of polar, water-soluble compounds. In addition they will separate, under similar conditions, positional isomers of substituted aromatic compounds.

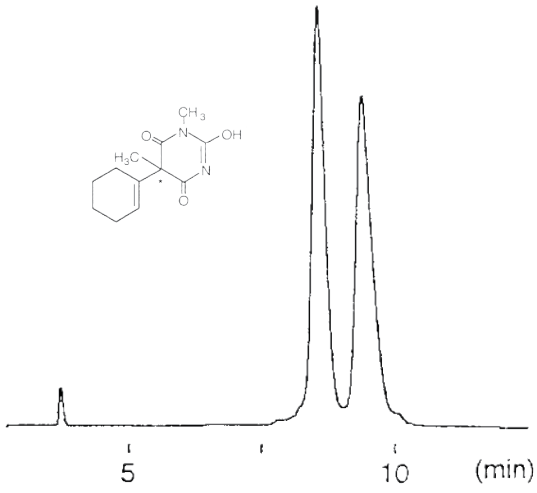




YMC CHIRAL CD BR

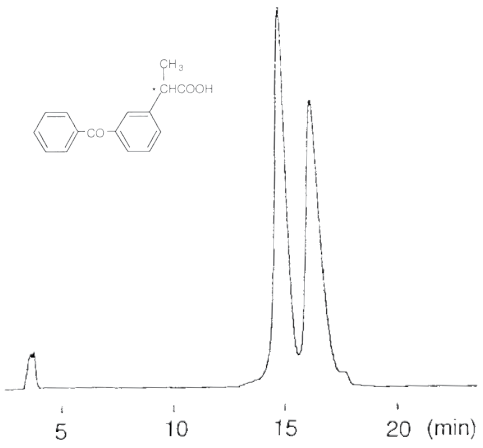
Applications

Hexobarbital*



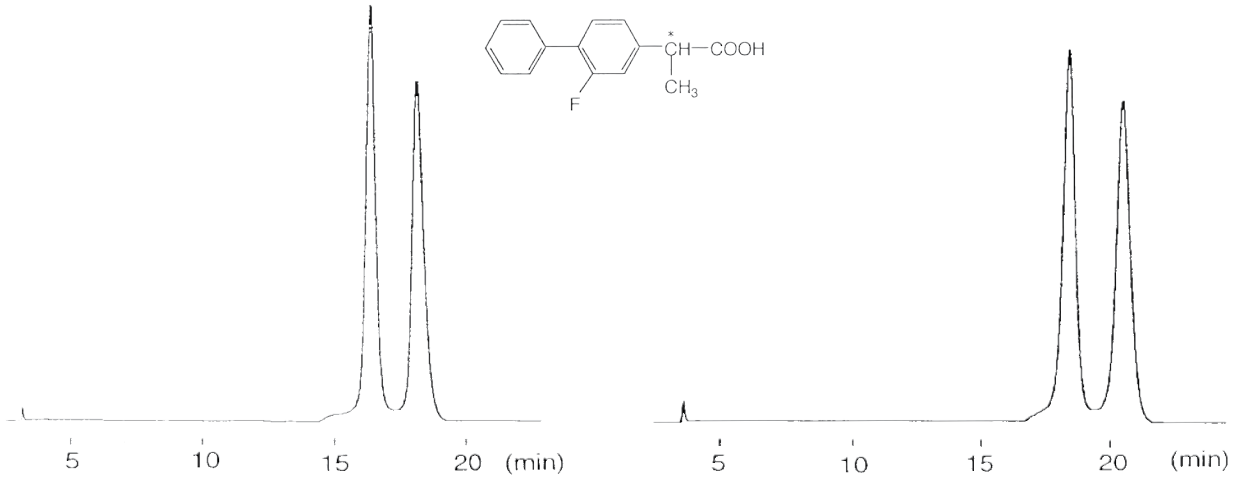
Column:	YMC CHIRAL β-CD BR 250 x 4.6 mm ID
Part No.:	DB12S05-2546WT
Eluent:	0.1M acetic acid-triethylamine in water (pH5.6) / methanol (30/70)
Flow:	1.0 mL/min
Temperature:	30°C
Detection:	UV at 254 nm
Injection:	5 µL (1 mg/mL)

Ketoprofen*



Column:	YMC CHIRAL β-CD BR 250 x 4.6 mm ID
Part No.:	DB12S05-2546WT
Eluent:	0.1M acetic acid-triethylamine in water (pH5.6) / methanol (30/70)
Flow:	1.0 mL/min
Temperature:	25°C
Detection:	UV at 254 nm
Injection:	10 µL (1 mg/mL)

Flurbiprofen*



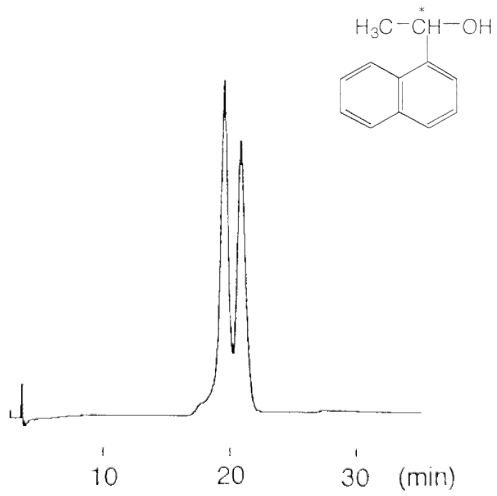
Column:	YMC CHIRAL β-CD BR 250 x 4.6 mm ID
Part No.:	DB12S05-2546WT
Eluent:	0.1M acetic acid-triethylamine in water (pH4.0) / acetonitrile (10/90)
Flow:	1.0 mL/min
Temperature:	25°C
Detection:	UV at 254 nm
Injection:	2 µL (1 mg/mL)

Column:	YMC CHIRAL γ-CD BR 250 x 4.6 mm ID
Part No.:	DG12S05-2546WT
Eluent:	0.1M acetic acid-triethylaminein water (pH4.0) / methanol (30/70)
Flow:	1.0 mL/min
Temperature:	25°C
Detection:	UV at 254 nm
Injection:	2 µL (1 mg/mL)

* Application data by courtesy YMC Co., Ltd.

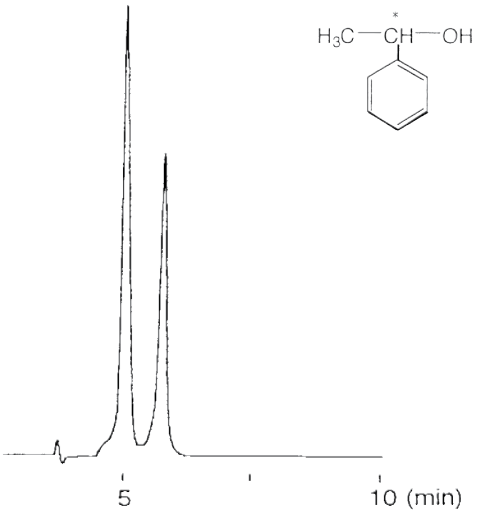
YMC CHIRAL CD BR

1-(1-naphthyl)-ethylalcohol*



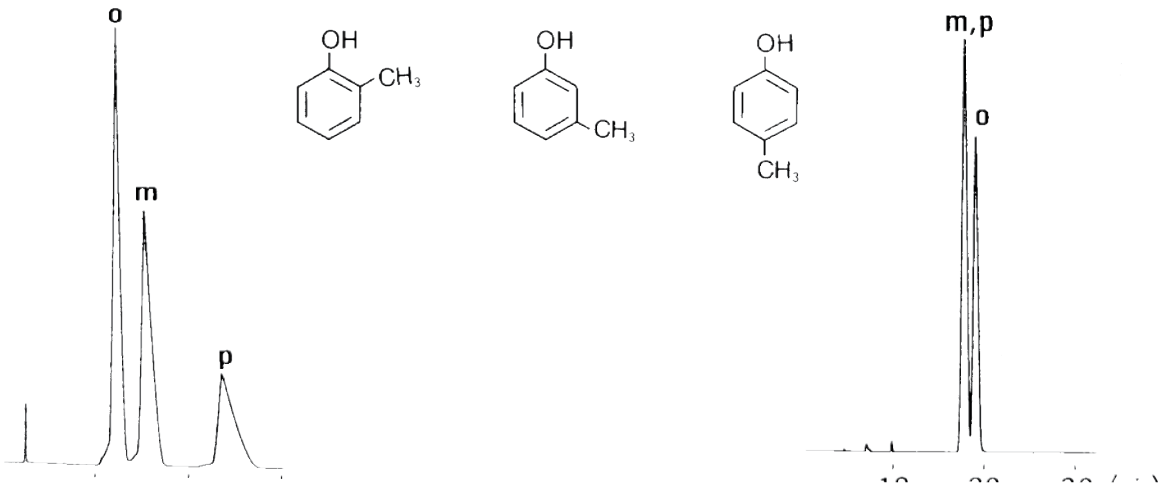
Column:	YMC CHIRAL γ-CD BR 250 x 4.6 mm ID
Part No.:	DG12S05-2546WT
Eluent:	0.1M $AcOH_{aq}$-TEA (Triethylamine)$_{aq}$ (pH5.6) / methanol (90/10)
Flow:	1.0 mL/min
Temperature:	30°C
Detection:	UV at 254 nm
Injection:	5 µL (1 mg/mL)

Phenylethylalcohol*



Column:	YMC CHIRAL γ-CD BR 250 x 4.6 mm ID
Part No.:	DG12S05-2546WT
Eluent:	0.1M $AcOH_{aq}$-TEA (Triethylamine)$_{aq}$ (pH4.0) / methanol (90/10)
Flow:	1.0 mL/min
Temperature:	30°C
Detection:	UV at 254 nm
Injection:	5 µL (10 mg/mL)

Cresols*

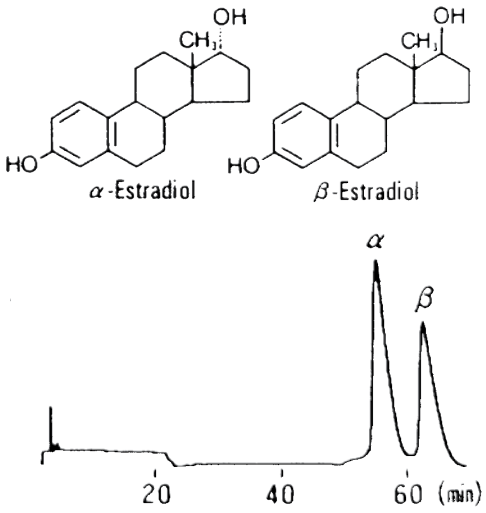


Column:	YMC CHIRAL β-CD BR 250 x 4.6 mm ID
Part No.:	DB12S05-2546WT
Eluent:	methanol / water (20/80)
Flow:	1.0 mL/min
Temperature:	ambient
Detection:	UV at 254 nm

Column:	YMC Pack ODS-AM 250 x 4.6 mm ID
Part No.:	AM12S05-2546WT
Eluent:	methanol / water (40/60)
Flow:	1.0 mL/min
Temperature:	ambient
Detection:	UV at 254 nm

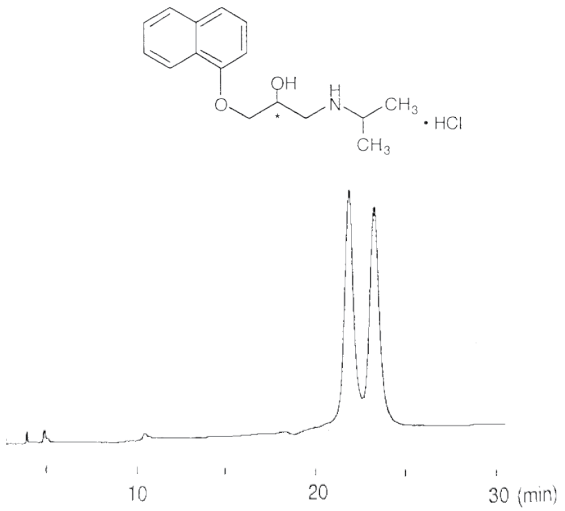
YMC CHIRAL CD BR

Estradiols*



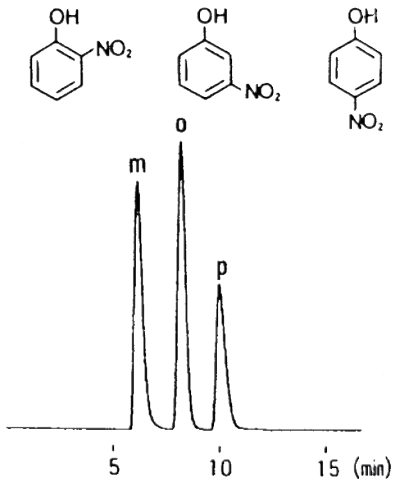
Column:	YMC CHIRAL γ-CD BR 250 x 4.6 mm ID
Part No.:	DG12S05-2546WT
Eluent:	methanol / water (50/50)
Flow:	1.0 mL/min
Temperature:	30°C
Detection:	UV at 230 nm

Propranolol HCl*



Column:	YMC CHIRAL γ-CD BR 250 x 4.6 mm ID
Part No.:	DG12S05-2546WT
Eluent:	acetonitrile / methanol / acetic acid / triethylamine (99/1/0.3/0.25)
Flow:	1.0 mL/min
Temperature:	25°C
Detection:	UV at 254 nm
Injection:	5 µL (1 mg/mL)

Nitrophenols*



Column:	YMC CHIRAL α-CD BR 250 x 4.6 mm ID
Part No.:	DA12S05-2546WT
Eluent:	0.1M CH_3COOH-CH_3COONa (pH4.0) / methanol (90/10)
Flow:	1.0 mL/min
Temperature:	25°C
Detection:	UV at 254 nm

Column Care

The recommended pH range for using YMC CHIRAL CD BR columns is 3.5-6.5. 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.de/support-documentation.html.

* Application data by courtesy YMC Co., Ltd.

Ordering Information

CHIRAL ART Amylose-C

Phase dimension	Column ID [mm]	Column length [mm]			Guard cartridges* with 10 mm length
		50	100	150	
3 µm	2	KAN99S03-0502WT	KAN99S03-1002WT	KAN99S03-1502WT	KAN99S03-01Q1GC (pack of 5)
	3	KAN99S03-0503WT	KAN99S03-1003WT	KAN99S03-1503WT	KAN99S03-0103GC (pack of 5)
	4.6	KAN99S03-0546WT	KAN99S03-1046WT	KAN99S03-1546WT	KAN99S03-0104GC (pack of 5)

Phase dimension	Column ID [mm]	Column length [mm]		Guard cartridges* with 10 mm length
		150	250	
5 µm	2	KAN99S05-1502WT	KAN99S05-2502WT	KAN99S05-01Q1GC (pack of 5)
	4.6	KAN99S05-1546WT	KAN99S05-2546WT	KAN99S05-0104GC (pack of 5)
	10	—	KAN99S05-2510WT	KAN99S05-0110CC (pack of 2)
	20	—	KAN99S05-2520WX	KAN99S05-0120CC (pack of 2)
	30	—	KAN99S05-2530WX	KAN99S05-0130CC (pack of 2)

Alcyon CSP SFC Amylose-C

Phase dimension	Column ID [mm]	Column length [mm]			
		50	100	150	250
3 µm	2.1	—	—	KAN99S03-15Q1WTS	—
	3	KAN99S03-0503WTS	KAN99S03-1003WTS	KAN99S03-1503WTS	—
	4.6	—	—	KAN99S03-1546WTS	KAN99S03-2546WTS

Phase dimension	Column ID [mm]	Column length [mm]	
		150	250
5 µm	2.1	KAN99S05-15Q1WTS	—
	4.6	KAN99S05-1546WTS	KAN99S05-2546WTS
	10	—	KAN99S05-2510WTS
	20	—	KAN99S05-2520WTS

Ordering Information

CHIRAL ART Cellulose-C

Phase dimension	Column ID [mm]	Column length [mm]			Guard cartridges* with 10 mm length
		50	100	150	
3 µm	2	KCN99S03-0502WT	KCN99S03-1002WT	KCN99S03-1502WT	KCN99S03-01Q1GC (pack of 5)
	3	KCN99S03-0503WT	KCN99S03-1003WT	KCN99S03-1503WT	KCN99S03-0103GC (pack of 5)
	4.6	KCN99S03-0546WT	KCN99S03-1046WT	KCN99S03-1546WT	KCN99S03-0104GC (pack of 5)

Phase dimension	Column ID [mm]	Column length [mm]		Guard cartridges* with 10 mm length
		150	250	
5 µm	2	KCN99S05-1502WT	KCN99S05-2502WT	KCN99S05-01Q1GC (pack of 5)
	4.6	KCN99S05-1546WT	KCN99S05-2546WT	KCN99S05-0104GC (pack of 5)
	10	—	KCN99S05-2510WT	KCN99S05-0110CC (pack of 2)
	20	—	KCN99S05-2520WX	KCN99S05-0120CC (pack of 2)
	30	—	KCN99S05-2530WX	KCN99S05-0130CC (pack of 2)

Alcyon CSP SFC Cellulose-C

Phase dimension	Column ID [mm]	Column length [mm]			
		50	100	150	250
3 µm	2.1	—	—	KCN99S03-15Q1WTS	—
	3	KCN99S03-0503WTS	KCN99S03-1003WTS	KCN99S03-1503WTS	—
	4.6	—	—	KCN99S03-1546WTS	KCN99S03-2546WTS

Phase dimension	Column ID [mm]	Column length [mm]	
		150	250
5 µm	2.1	KCN99S05-15Q1WTS	—
	4.6	KCN99S05-1546WTS	KCN99S05-2546WTS
	10	—	KCN99S05-2510WTS
	20	—	KCN99S05-2520WTS

Ordering Information

CHIRAL ART Amylose-SA

Phase dimension	Column ID [mm]	Column length [mm]			Guard cartridges* with 10 mm length
		50	100	150	
3 µm	2	KSA99S03-0502WT	KSA99S03-1002WT	KSA99S03-1502WT	KSA99S03-01Q1GC (pack of 5)
	3	KSA99S03-0503WT	KSA99S03-1003WT	KSA99S03-1503WT	KSA99S03-0103GC (pack of 5)
	4.6	KSA99S03-0546WT	KSA99S03-1046WT	KSA99S03-1546WT	KSA99S03-0104GC (pack of 5)

Phase dimension	Column ID [mm]	Column length [mm]		Guard cartridges* with 10 mm length
		150	250	
5 µm	2	KSA99S05-1502WT	KSA99S05-2502WT	KSA99S05-01Q1GC (pack of 5)
	4.6	KSA99S05-1546WT	KSA99S05-2546WT	KSA99S05-0104GC (pack of 5)
	10	—	KSA99S05-2510WT	KSA99S05-0110CC (pack of 2)
	20	—	KSA99S05-2520WX	KSA99S05-0120CC (pack of 2)
	30	—	KSA99S05-2530WX	KSA99S05-0130CC (pack of 2)

Alcyon CSP SFC Amylose-SA

Phase dimension	Column ID [mm]	Column length [mm]			
		50	100	150	250
3 µm	2.1	—	—	KSA99S03-15Q1WTS	—
	3	KSA99S03-0503WTS	KSA99S03-1003WTS	KSA99S03-1503WTS	—
	4.6	—	—	KSA99S03-1546WTS	KSA99S03-2546WTS

Phase dimension	Column ID [mm]	Column length [mm]	
		150	250
5 µm	2.1	KSA99S05-15Q1WTS	—
	4.6	KSA99S05-1546WTS	KSA99S05-2546WTS
	10	—	KSA99S05-2510WTS
	20	—	KSA99S05-2520WTS

Ordering Information

CHIRAL ART Cellulose-SB

Phase dimension	Column ID [mm]	Column length [mm]			Guard cartridges* with 10 mm length
		50	100	150	
3 µm	2	KSB99S03-0502WT	KSB99S03-1002WT	KSB99S03-1502WT	KSB99S03-01Q1GC (pack of 5)
	3	KSB99S03-0503WT	KSB99S03-1003WT	KSB99S03-1503WT	KSB99S03-0103GC (pack of 5)
	4.6	KSB99S03-0546WT	KSB99S03-1046WT	KSB99S03-1546WT	KSB99S03-0104GC (pack of 5)

Phase dimension	Column ID [mm]	Column length [mm]		Guard cartridges* with 10 mm length
		150	250	
5 µm	2	KSB99S05-1502WT	KSB99S05-2502WT	KSB99S05-01Q1GC (pack of 5)
	4.6	KSB99S05-1546WT	KSB99S05-2546WT	KSB99S05-0104GC (pack of 5)
	10	—	KSB99S05-2510WT	KSB99S05-0110CC (pack of 2)
	20	—	KSB99S05-2520WX	KSB99S05-0120CC (pack of 2)
	30	—	KSB99S05-2530WX	KSB99S05-0130CC (pack of 2)

Alcyon CSP SFC Cellulose-SB

Phase dimension	Column ID [mm]	Column length [mm]			
		50	100	150	250
3 µm	2.1	—	—	KSB99S03-15Q1WTS	—
	3	KSB99S03-0503WTS	KSB99S03-1003WTS	KSB99S03-1503WTS	—
	4.6	—	—	KSB99S03-1546WTS	KSB99S03-2546WTS

Phase dimension	Column ID [mm]	Column length [mm]	
		150	250
5 µm	2.1	KSB99S05-15Q1WTS	—
	4.6	KSB99S05-1546WTS	KSB99S05-2546WTS
	10	—	KSB99S05-2510WTS
	20	—	KSB99S05-2520WTS

Ordering Information

CHIRAL ART Cellulose-SC

Phase dimension	Column ID [mm]	Column length [mm]			Guard cartridges* with 10 mm length
		50	100	150	
3 µm	2	KSC99S03-0502WT	KSC99S03-1002WT	KSC99S03-1502WT	KSC99S03-01Q1GC (pack of 5)
	3	KSC99S03-0503WT	KSC99S03-1003WT	KSC99S03-1503WT	KSC99S03-0103GC (pack of 5)
	4.6	KSC99S03-0546WT	KSC99S03-1046WT	KSC99S03-1546WT	KSC99S03-0104GC (pack of 5)

Phase dimension	Column ID [mm]	Column length [mm]		Guard cartridges* with 10 mm length
		150	250	
5 µm	2	KSC99S05-1502WT	KSC99S05-2502WT	KSC99S05-01Q1GC (pack of 5)
	4.6	KSC99S05-1546WT	KSC99S05-2546WT	KSC99S05-0104GC (pack of 5)
	10	—	KSC99S05-2510WT	KSC99S05-0110CC (pack of 2)
	20	—	KSC99S05-2520WX	KSC99S05-0120CC (pack of 2)
	30	—	KSC99S05-2530WX	KSC99S05-0130CC (pack of 2)

Alcyon CSP SFC Cellulose-SC

Phase dimension	Column ID [mm]	Column length [mm]			
		50	100	150	250
3 µm	2.1	—	—	KSC99S03-15Q1WTS	—
	3	KSC99S03-0503WTS	KSC99S03-1003WTS	KSC99S03-1503WTS	—
	4.6	—	—	KSC99S03-1546WTS	KSC99S03-2546WTS

Phase dimension	Column ID [mm]	Column length [mm]	
		150	250
5 µm	2.1	KSC99S05-15Q1WTS	—
	4.6	KSC99S05-1546WTS	KSC99S05-2546WTS
	10	—	KSC99S05-2510WTS
	20	—	KSC99S05-2520WTS

*Guard cartridge holder required, part no. XPGCH-Q1 (2.1, 3, 4 mm ID)
XPCHSPW1 (10 mm ID)
XPCHSPW2 (20 mm ID)
XPCHSPW3 (30 mm ID)

Several other dimensions or particle sizes available. Check www.ymc.de/chiral-columns.html

Ordering Information

Normal Phase: YMC CHIRAL NEA(R)(S)

Phase dimension	Column ID [mm]	Column length [mm]				Guard cartridges* with 10 mm length [pack of 5]
		50	100	150	250	
30 nm 5 µm NEA(R)	4.6	CR30S05-0546WT	CR30S05-1046WT	CR30S05-1546WT	CR30S05-2546WT	CR30S05-0104GC
30 nm 5 µm NEA(S)	4.6	CS30S05-0546WT	CS30S05-1046WT	CS30S05-1546WT	CS30S05-2546WT	CS30S05-0104GC

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

Reversed Phase: YMC CHIRAL NEA(R)(S)

Phase dimension	Column ID [mm]	Column length [mm]				Guard cartridges* with 10 mm length [pack of 5]
		50	100	150	250	
30 nm 5 µm NEA(R)	4.6	NR30S05-0546WT	NR30S05-1046WT	NR30S05-1546WT	NR30S05-2546WT	NR30S05-0104GC
30 nm 5 µm NEA(S)	4.6	NS30S05-0546WT	NS30S05-1046WT	NS30S05-1546WT	NS30S05-2546WT	NS30S05-0104GC

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

α-CD BR: YMC CHIRAL CD BR

Phase dimension	Column ID [mm]	Column length [mm]				Guard cartridges* with 10 mm length [pack of 5]
		50	100	150	250	
12 nm 5 µm	4.6	DA12S05-0546WT	—	DA12S05-1546WT	DA12S05-2546WT	DA12S05-0104GC

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

β-CD BR: YMC CHIRAL CD BR

Phase dimension	Column ID [mm]	Column length [mm]				Guard cartridges* with 10 mm length [pack of 5]
		50	100	150	250	
12 nm 5 µm	4.6	DB12S05-0546WT	—	DB12S05-1546WT	DB12S05-2546WT	DB12S05-0104GC

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

γ-CD BR: YMC CHIRAL CD BR

Phase dimension	Column ID [mm]	Column length [mm]				Guard cartridges* with 10 mm length [pack of 5]
		50	100	150	250	
12 nm 5 µm	4.6	DG12S05-0546WT	—	DG12S05-1546WT	DG12S05-2546WT	DG12S05-0104GC

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

For other dimensions please refer to page 386-387
For method validation and development kits refer to page 12-13


ELCN
ELCN
ELCN

Alcyon SFC Columns

Contents

Introduction

The advantages of Supercritical Fluid Chromatography (SFC) compared to Liquid Chromatography include faster separations, ease of sample recovery, reduced solvent consumption and therefore costs. To meet the needs of this mode of separation, YMC has introduced a range of achiral and chiral products dedicated for use in SFC: Alcyon.

The column hardware is specifically designed for SFC applications. Each Alcyon SFC column is delivered with a column inspection report prepared in SFC mode to allow easy comparisons of standard tests without any requirement to change separation mode.

Alcyon SFC

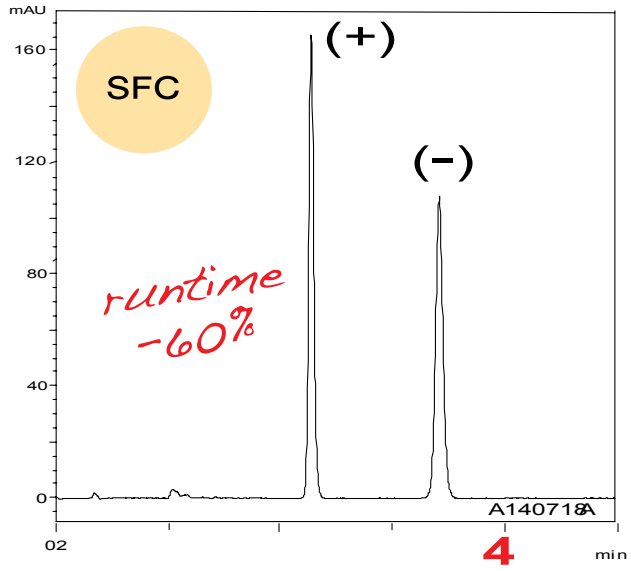
- cost efficient: reduced solvent consumption!
- time saving: faster separations with high resolution
- flexible: chiral and achiral stationary phases
- column inspection report under SFC conditions

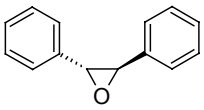
CHIRAL	Alcyon Coated Polysaccharides		Alcyon Immobilised Polysaccharides		
	Alcyon SFC CSP Amylose-C	Alcyon SFC CSP Cellulose-C	Alcyon SFC CSP Amylose-SA	Alcyon SFC CSP Cellulose-SB	Alcyon SFC CSP Cellulose-SC
Particle Size	3; 5 µm				
Chiral selector	Amylose tris (3,5-dimethyl-phenylcarbamate)	Cellulose tris (3,5-dimethyl-phenylcarbamate)	Amylose tris (3,5-dimethyl-phenylcarbamate)	Cellulose tris (3,5-dimethyl-phenylcarbamate)	Cellulose tris (3,5-dichloro-phenylcarbamate)
USP	L51	L40	L99	—	—
Shipping solvent	2-propanol	2-propanol	2-propanol	2-propanol	2-propanol
Usable pH range	3.5 - 6.5	3.5 - 6.5	2.0 - 9.0	2.0 - 9.0	2.0 - 9.0
Temperature range	0-40°C				
Pressure limit	2.1, 3.0 and 4.6 mm ID: 30 MPa (4350 psi) 10 and 20 mm ID: 20 MPa (2980 psi)				

ACHIRAL	Alcyon SFC Triart C18	Alcyon SFC Triart Diol	Alcyon SFC Triart PFP	Alcyon SFC CN	Alcyon SFC SIL
	$-C_{18}H_{37}$	$-CH_2CHCH_2$ OHOH	$-(CH_2)_3$ 	$-(CH_2)_3-CN$	-OH
USP	L1	L20	L43	L10	L3
Particle size / µm	5	5	5	5	5
Pore size / nm	12	12	12	12	12
pH range	1.0 - 12.0	2.0 - 10.0	1.0 - 8.0	2.0 - 7.5	2.0 - 7.5
Shipping solvent	2-propanol	2-propanol	2-propanol	2-propanol	2-propanol
Pressure limit	2.1 and 4.6 mm ID: 30 MPa (4350 psi) 10 and 20 mm ID: 20 MPa (2980 psi)				

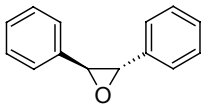
Alcyon SFC

Fast separation with high resolution

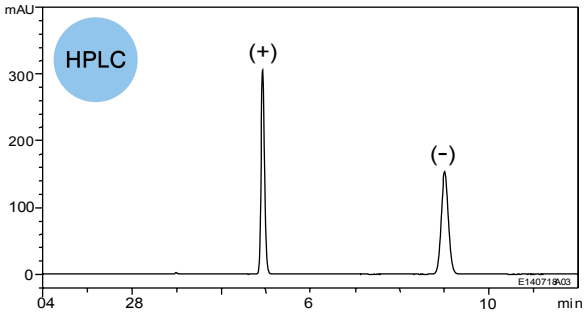




(+)-*R,R-trans*-Stilbene oxide



(-)-*S,S-trans*-Stilbene oxide

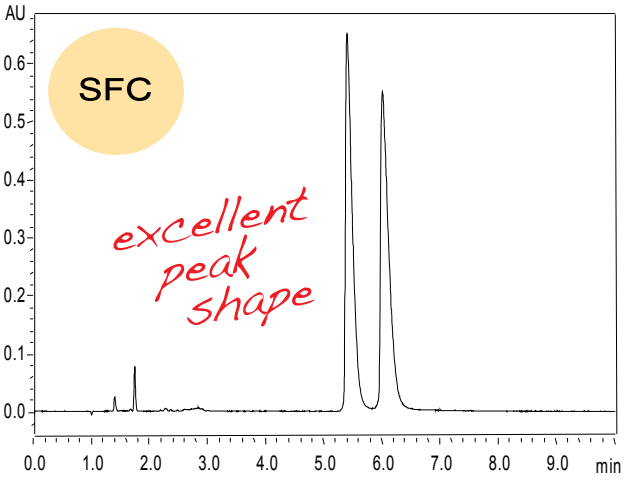


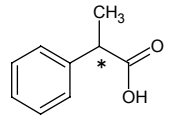
Column:	**Alcyon SFC CSP Amylose-C** (5 µm) 250 x 4.6 mm ID
Part No.:	KAN99S05-2546WTS
Eluent:	CO_2 / methanol (80/20)
Flow:	3.0 mL/min
Temperature:	40°C
Detection:	UV at 220 nm
Back pressure:	17.2 MPa (2500 psi)

Column:	CHIRAL ART Amylose-C (5 µm) 250 x 4.6 mm ID
Part No.:	KAN99S05-2546WT
Eluent:	*n*-hexane / 2-propanol (90/10)
Flow:	1.0 mL/min
Temperature:	25°C
Detection:	UV at 220 nm

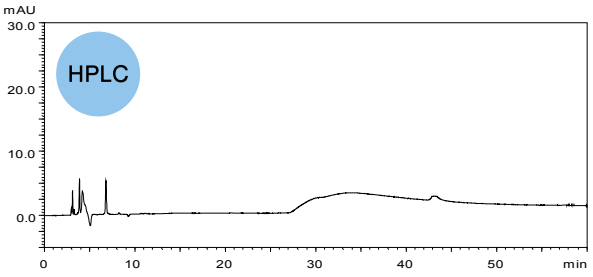
Faster chiral separation of *trans*-stilbene oxide is achieved using supercritical fluid chromatography compared to HPLC as the separation mode. Lower viscosity and larger diffusion coefficients for supercritical fluid provide rapid separations of both chiral and achiral compounds.

Excellent peak shape using mobile phase without the addition of acid modifier





2-Phenylpropionic acid



Column:	**Alcyon SFC CSP Cellulose-C** (5 µm) 250 x 4.6 mm ID
Part No.:	KCN99S05-2546WTS
Eluent:	CO_2 / methanol (98/2)
Flow:	3.0 mL/min
Temperature:	35°C
Detection:	UV at 220 nm
Back pressure:	10.3 MPa (2000 psi)

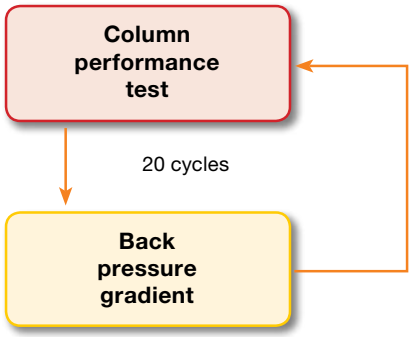
Column:	CHIRAL ART Cellulose-C (5 µm) 250 x 4.6 mm ID
Part No.:	KCN99S05-2546WT
Eluent:	*n*-hexane / 2-propanol (99/1)
Flow:	1.0 mL/min
Temperature:	25°C
Detection:	UV at 220 nm

Excellent peak shape of 2-phenylpropionic acid is obtained using SFC chiral separation. Under HPLC conditions, the peak shape is very broad with mobile phase containing no additives such as an acid. With SFC, on the other hand, peak shapes are very good just with a mixture of CO_2 and methanol. It is thought that supercritical carbon dioxide acts as an acid.

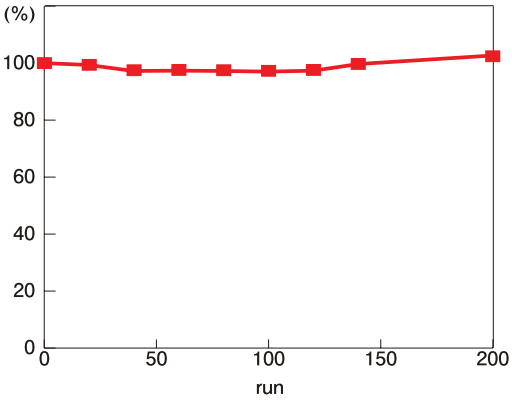
* Application data by courtesy YMC Co., Ltd.

Alcyon SFC

High column stability under repeated back pressure gradient condition



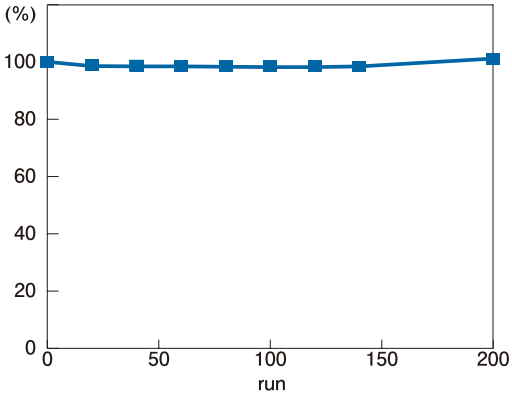
Stability of theoretical plate number



Stability test

Column:	**Alcyon SFC CSP Amylose-C** (5 µm) 250 x 4.6 mm ID
Part No.:	KAN99S05-2546WTS
Eluent:	CO_2 / methanol (80/20)
Flow:	1.0 mL/min
Temperature:	50°C
Back pressure:	10.3 MPa (1500 psi) - 24.1 MPa (3500 psi) (0-10 min) 10.3 MPa (1500 psi) (10-13 min)

Stability of retention time



Column performance test (every 20 gradient cycles)

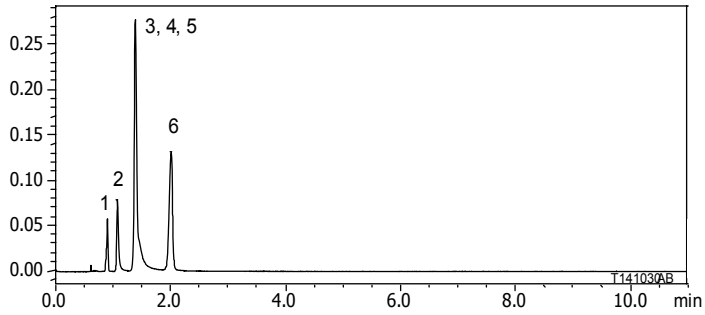
Column:	**Alcyon SFC CSP Amylose-C** (5 µm) 250 x 4.6 mm ID
Part No.:	KAN99S05-2546WTS
Eluent:	CO_2 / methanol (80/20)
Flow:	3.0 mL/min
Temperature:	50°C
Detection:	UV at 220 nm
Back pressure:	10.3 MPa (1500 psi)
Sample:	*trans*-stilbene oxide

Results for the sequential analysis under back pressure gradient conditions using Alcyon SFC CSP Amylose-C are shown above. Theoretical plate numbers and retention times are maintained even after the sequential gradient test. Alcyon SFC columns have excellent stability under such demanding conditions.

Alcyon SFC

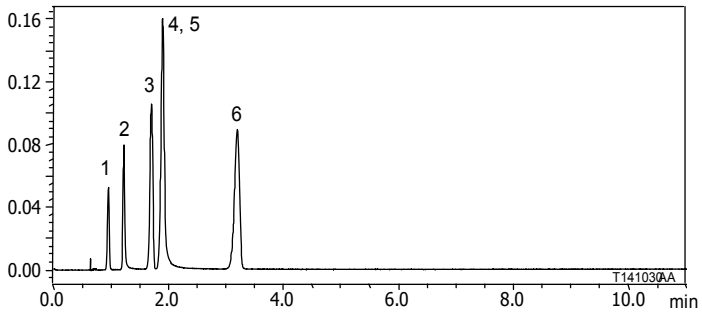
Separation of phenols

Alcyon SFC CN

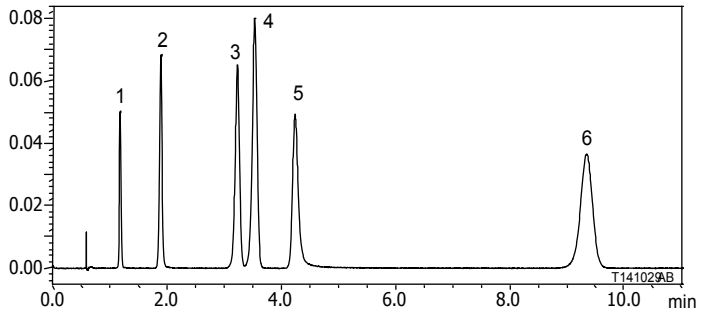


1. Phenol
3. Resorcinol
5. Pyrogallol
2. Catechol
4. Hydroquinone
6. Phloroglucinol

Alcyon SFC SIL



Alcyon SFC Triart Diol



Column:	(5 µm) 250 x 4.6 mm ID
Eluent:	**CO_2 / methanol (88/12)**
Flow:	3.0 mL/min
Temperature:	30°C
Detection:	UV at 230 nm
Back pressure:	10.3 MPa (2000 psi)

The results for the analysis of six phenols using three different achiral columns are shown. Alcyon SFC Triart Diol shows the best separation in this case.

* Application data by courtesy YMC Co., Ltd.

Ordering Information

CHIRAL

Particle size	Column size length x ID [mm]	Product number				
		Coated type		Immobilised type		
		Alcyon SFC CSP Amylose-C	Alcyon SFC CSP Cellulose-C	Alcyon SFC CSP Amylose-SA	Alcyon SFC CSP Cellulose-SB	Alcyon SFC CSP Cellulose-SC
5 µm	150 x 2.1	KAN99S05-15Q1WTS	KCN99S05-15Q1WTS	KSA99S05-15Q1WTS	KSB99S05-15Q1WTS	KSC99S05-15Q1WTS
	150 x 4.6	KAN99S05-1546WTS	KCN99S05-1546WTS	KSA99S05-1546WTS	KSB99S05-1546WTS	KSC99S05-1546WTS
	250 x 4.6	KAN99S05-2546WTS	KCN99S05-2546WTS	KSA99S05-2546WTS	KSB99S05-2546WTS	KSC99S05-2546WTS
	250 x 10	KAN99S05-2510WTS	KCN99S05-2510WTS	KSA99S05-2510WTS	KSB99S05-2510WTS	KSC99S05-2510WTS
	250 x 20	KAN99S05-2520WTS	KCN99S05-2520WTS	KSA99S05-2520WTS	KSB99S05-2520WTS	KSC99S05-2520WTS

Particle size	Column size length x ID [mm]	Product number				
		Coated type		Immobilised type		
		Alcyon SFC CSP Amylose-C	Alcyon SFC CSP Cellulose-C	Alcyon SFC CSP Amylose-SA	Alcyon SFC CSP Cellulose-SB	Alcyon SFC CSP Cellulose-SC
3 µm	50 x 3.0	KAN99S03-0503WTS	KCN99S03-0503WTS	KSA99S03-0503WTS	KSB99S03-0503WTS	KSC99S03-0503WTS
	100 x 3.0	KAN99S03-1003WTS	KCN99S03-1003WTS	KSA99S03-1003WTS	KSB99S03-1003WTS	KSC99S03-1003WTS
	150 x 2.1	KAN99S03-15Q1WTS	KCN99S03-15Q1WTS	KSA99S03-15Q1WTS	KSB99S03-15Q1WTS	KSC99S03-15Q1WTS
	150 x 3.0	KAN99S03-1503WTS	KCN99S03-1503WTS	KSA99S03-1503WTS	KSB99S03-1503WTS	KSC99S03-1503WTS
	150 x 4.6	KAN99S03-1546WTS	KCN99S03-1546WTS	KSA99S03-1546WTS	KSB99S03-1546WTS	KSC99S03-1546WTS
	250 x 4.6	KAN99S03-2546WTS	KCN99S03-2546WTS	KSA99S03-2546WTS	KSB99S03-2546WTS	KSC99S03-2546WTS

ACHIRAL

Particle size	Column size length x ID [mm]	Product number				
		Alcyon SFC Triart C18	Alcyon SFC Triart Diol	Alcyon SFC Triart PFP	Alcyon SFC CN	Alcyon SFC SIL
5 µm	150 x 2.1	TA12S05-15Q1WTS	TDN12S05-15Q1WTS	TPF12S05-15Q1WTS	CN12S05-15Q1WTS	SL12S05-15Q1WTS
	150 x 4.6	TA12S05-1546WTS	TDN12S05-1546WTS	TPF12S05-1546WTS	CN12S05-1546WTS	SL12S05-1546WTS
	250 x 4.6	TA12S05-2546WTS	TDN12S05-2546WTS	TPF12S05-2546WTS	CN12S05-2546WTS	SL12S05-2546WTS
	250 x 10	TA12S05-2510WTS	TDN12S05-2510WTS	TPF12S05-2510WTS	CN12S05-2510WTS	SL12S05-2510WTS
	250 x 20	TA12S05-2520WTS	TDN12S05-2520WTS	TPF12S05-2520WTS	CN12S05-2520WTS	SL12S05-2520WTS

Ordering Information

Additional SFC columns

Particle size	Column size length x ID [mm]	Product number			
		YMC-Pack 2-Ethyl pyridine	YMC-Pack Diethylaminopropyl	YMC-Pack Propyl acetamide	YMC-Pack Pyridine amide
5 µm	250 x 4.6	EP06S05-2546PS	DE06S05-2546PS	PP06S05-2546PS	PY06S05-2546PS
	250 x 21.2	EP06S05-2521PS	DE06S05-2521PS	PP06S05-2521PS	PY06S05-2521PS
	250 x 30	EP06S05-2530PS	DE06S05-2530PS	PP06S05-2530PS	PY06S05-2530PS

3 and 10 µm available on request

Speciality Columns

Contents

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**

- **polar carotenes**
- **polar and nonpolar xanthophylls**
- **steroids**
- **retinols**
- **fat-soluble vitamins**
- **LC-MS applications**

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

General

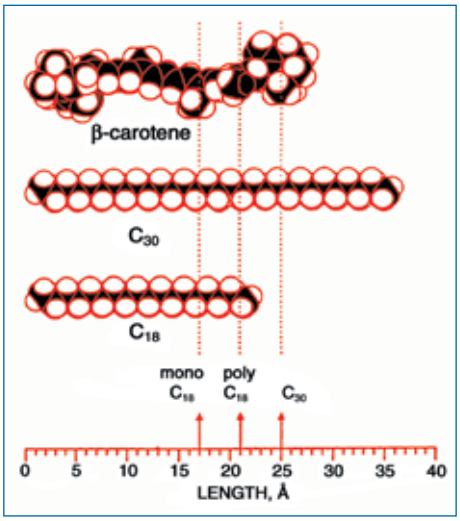
The separation of geometric and positional isomers is a challenging task in reversed phase chromatography. Subtle molecular differences have to be recognized and resolved by this particular stationary phase. Sander et al. have conclusively shown that polymeric C30 HPLC stationary phases are able to discriminate 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)).

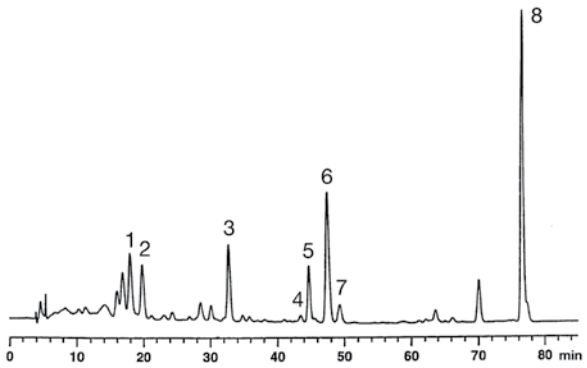
Applications

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

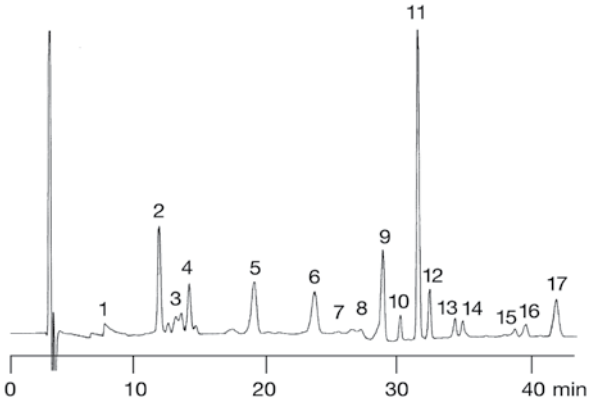
Extract of SRM 2383, NIST food standard[a]



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

Carotenoid pigments in algae[b]



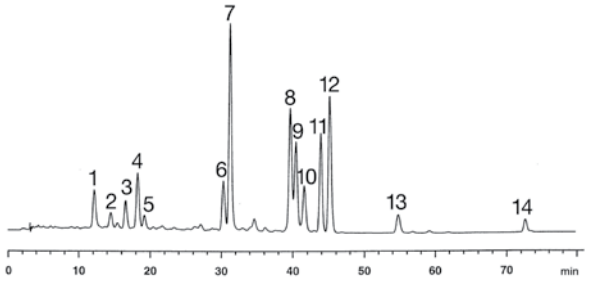
1: Chlorophyll c_1+c_2
2: Fucoxanthin
3: Neoxanthin
4: Violaxanthin
5: Diadinoxanthin
6: Lutein
7: Zeaxanthin
8: Diatoxanthin
9: Chlorophyll b_x
10: Chlorophyll b_y
11: Chlorophyll a_x
12: Chlorophyll a_y
13: β-Cryptoxanthin
14: Echinenone
15: Phaephorbid b
16: α-Carotene
17: β-Carotene

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

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

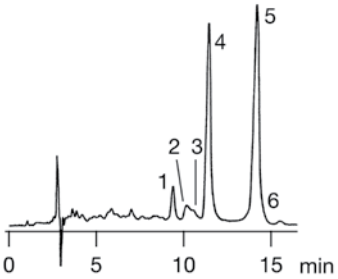
Carotene and Xanthophyll standard[a]



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

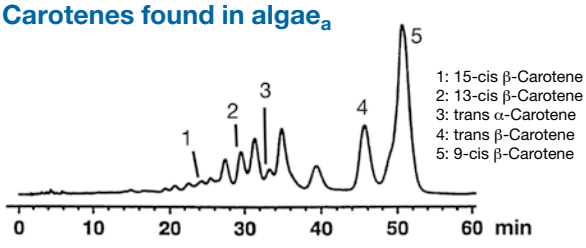
Carotene isomers from commercially available capsules[a]



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

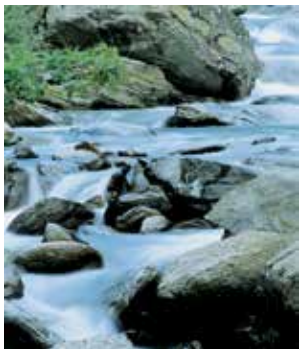
Column:	YMC Carotenoid (5 µm) 250 x 4.6 mm ID
Part No.:	CT99S05-2546WT
Eluent:	MeOH / MTBE = 80/20
Flow:	2.0 mL/min
Detection:	UV at 450 nm
Temperature:	3 °C

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

* Application data by courtesy YMC Co., Ltd.

YMC PAH

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



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

General

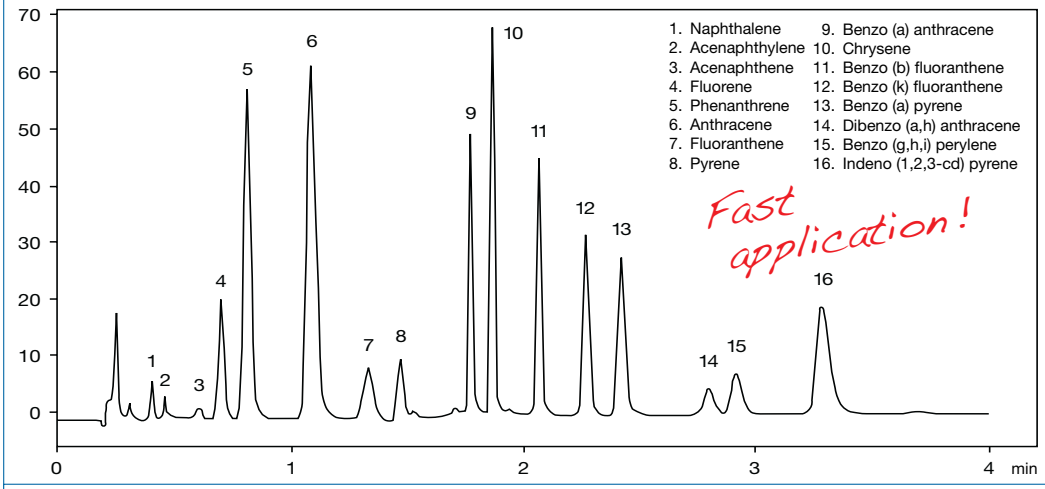
Polynuclear Aromatic Hydrocarbons (PAHs) are among the most frequently monitored environmental contaminants. YMC PAH columns have been specifically developed for the highly demanding analysis of Polynuclear Aromatic Hydrocarbons.

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

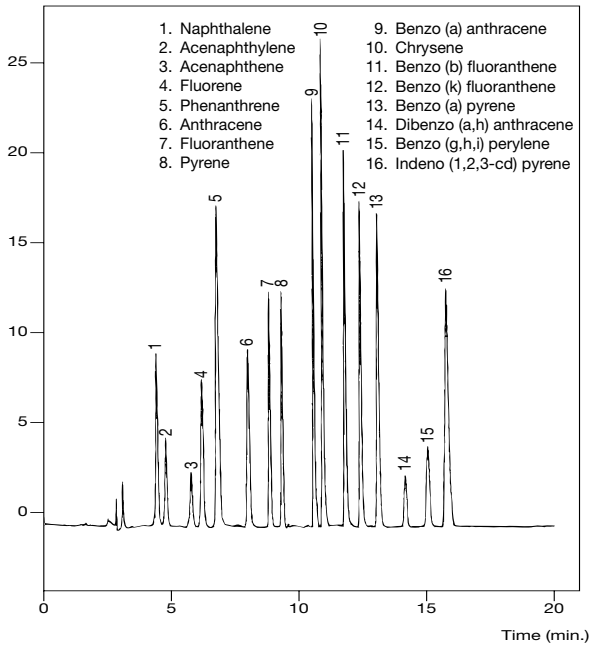


Column:	YMC PAH (3 µm) 50 x 4.0 mm ID
Part No.:	YP99S03-0504QT
Eluent:	A) methanol / water (80/20) B) acetonitrile
Flow rate:	2.0 mL/min
Temperature:	24 °C
Detection:	UV at 254 nm

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

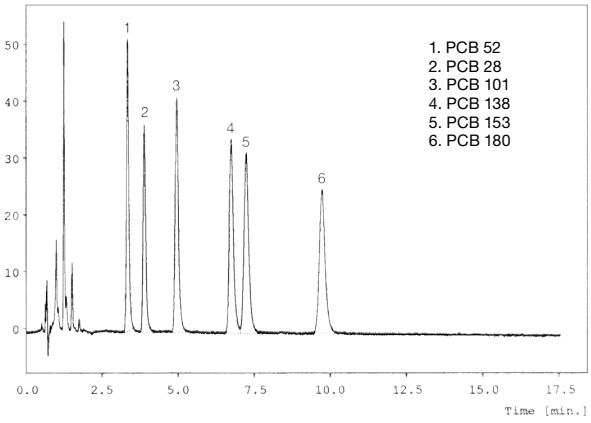
YMC PAH

16 PAH according to EPA 610



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

PCB separation according EPA

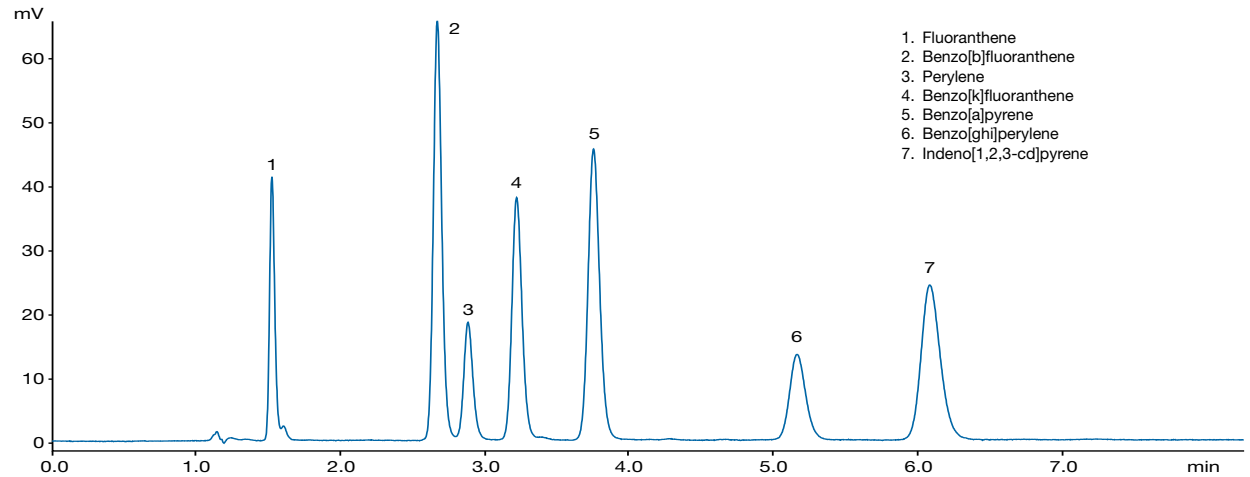


Column:	YMC PAH (3 µm) 100 x 3.0 mm ID
Part No.:	YP99S05-1003QT
Eluent:	CH_3CN / water (75/25)
Flow rate:	0.6 mL/min
Temperature:	30 °C
Detection:	UV at 220 nm

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

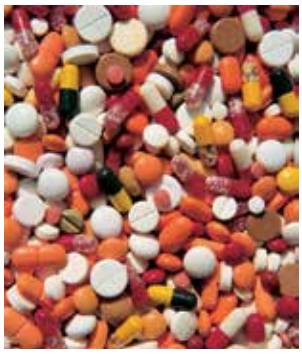


Column:	YMC PAH (5 µm) 125 x 4.0 mm ID
Part No.:	YP99S05-R504QT
Eluent:	acetonitrile / methanol (95/5)
Flow rate:	1.0 mL/min
Temp.:	25 °C
Detection:	UV at 254 nm
Inj.-vol.:	5 µL

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

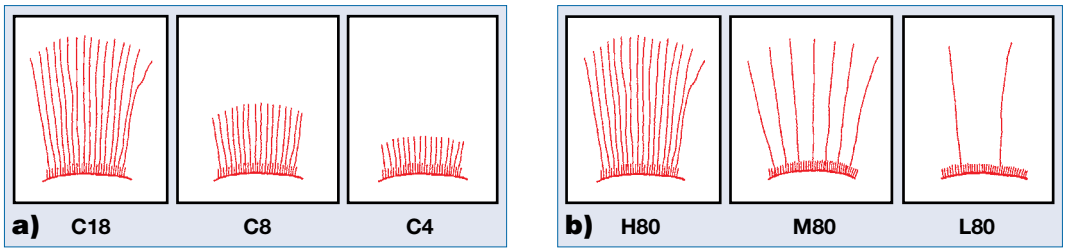
a selectivity concept designed for
- quality control
- pharmaceuticals
- organic intermediates
- hormones, steroids



J'sphere ODS	JH	JM	JL
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.

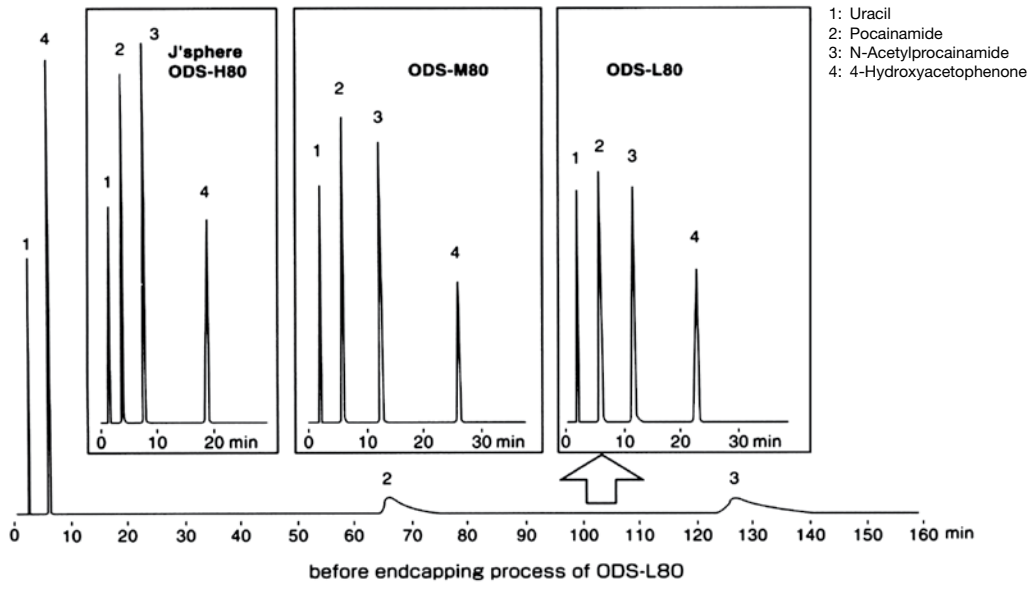
Physico-Chemical Properties

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

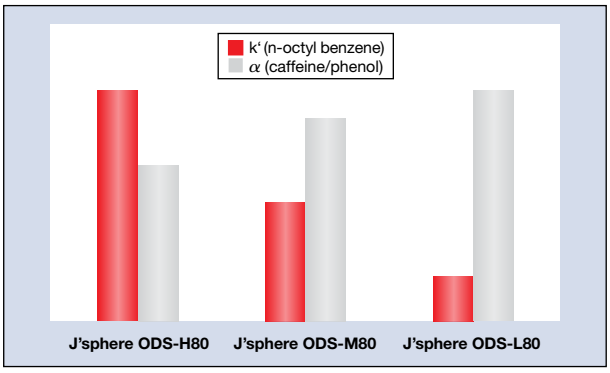
An elaborate endcapping process is applied to react the remaining silanols to effectively suppress the undesired non-specific interactions (see figure below).



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 α 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.

* Application data by courtesy YMC Co., Ltd.

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 with the nonpolar sites of the sample molecules. However, the ability 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

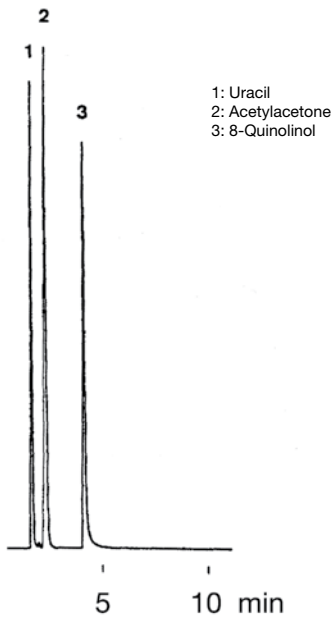
By using the graduated properties of J'sphere ODS columns, a great variety of chemical and pharmaceutical applications can be achieved. YMC J'sphere ODS analytical columns are a good choice for the analysis of pharmaceuticals, organic intermediates, metabolites etc., due to their concept of fine-tuned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

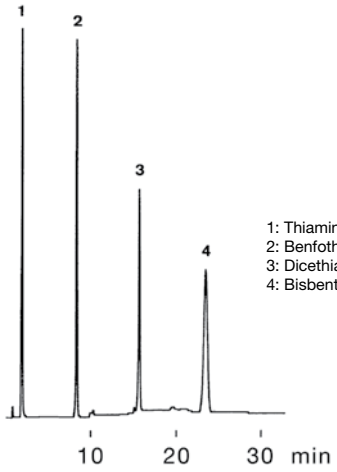
Elution profile of complexing agents*



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

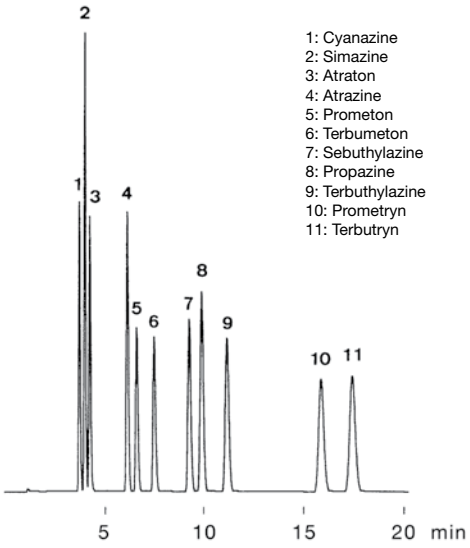
Thiamine and derivatives*



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

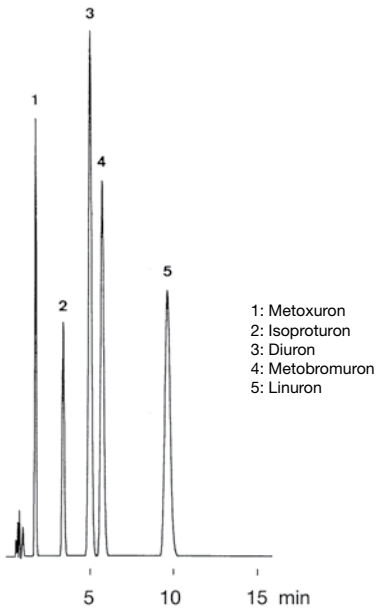
Triazine herbicides*



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*



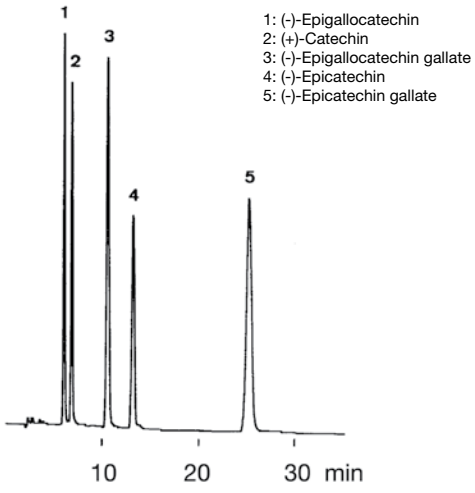
1: Metoxuron
2: Isoproturon
3: Diuron
4: Metobromuron
5: Linuron

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

* Application data by courtesy YMC Co., Ltd.

J'sphere ODS-M80

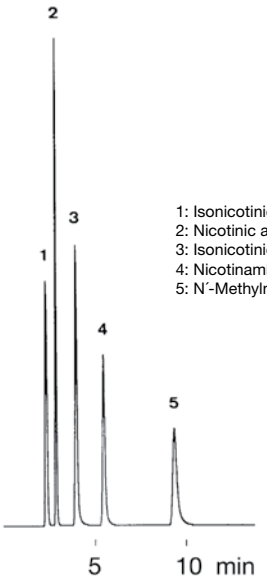
Catechins*



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

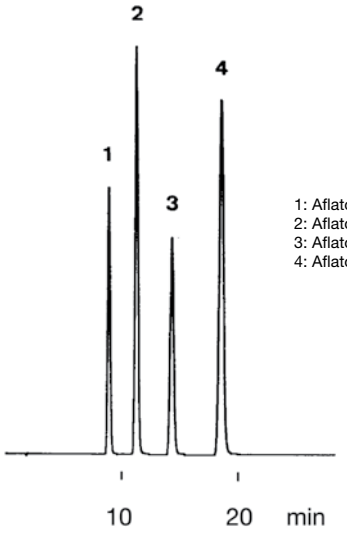
Nicotinic acid analogues*



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

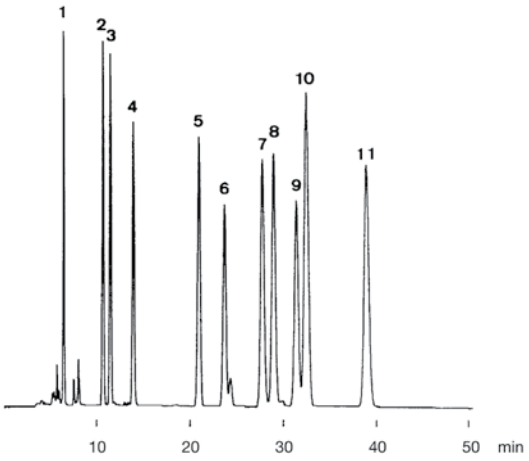
Aflatoxins*



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*

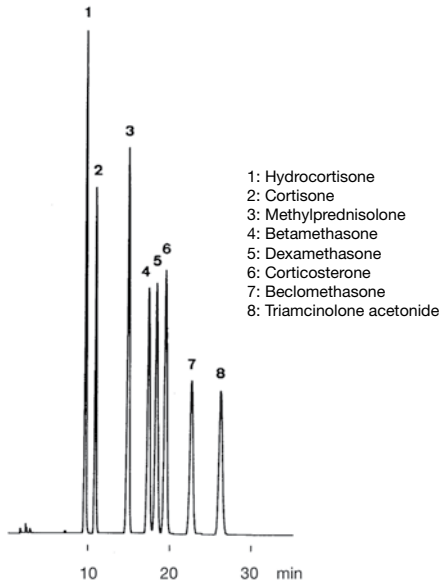


1: Cefsulodin sodium
2: Cephalexin hydrate
3: Cefaclor
4: Cephradine
5: Cephaloglycin
6: Cephapirin sodium
7: Cefotaxime sodium
8: Cephaloridine
9: Cefazolin sodium
10: Cefuroxime sodium
11: Cefoxitin sodium

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

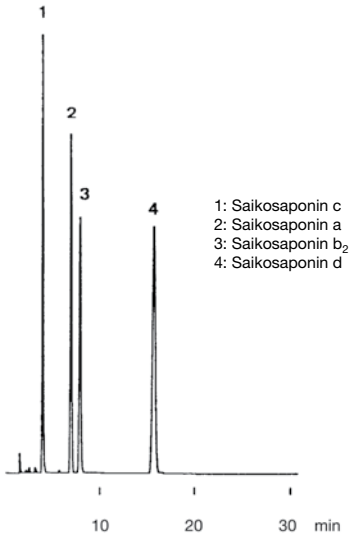
Adrenocorticosteroids*



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

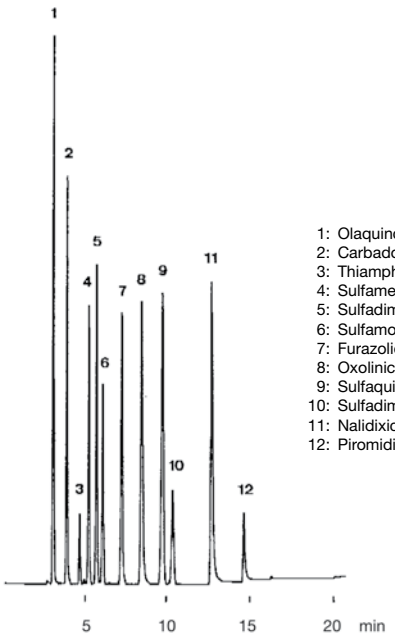
Saikosaponins*



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

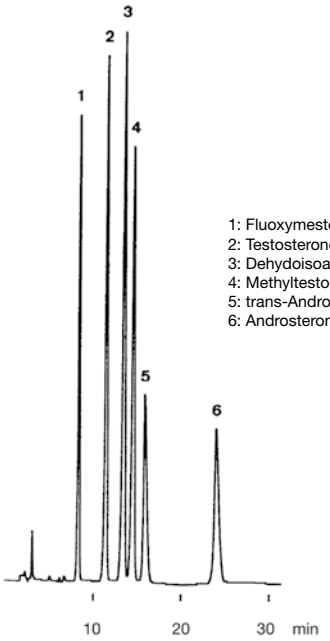
Antibacterial agents*



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

* Application data by courtesy YMC Co., Ltd.

Ordering Information

YMC Carotenoid

Phase dimension	Column ID [mm]	Column length [mm]					Guard cartridges* with 10 mm length [pack of 5]
		30 (WT) / 33 (QT)	50	100	150	250	
3 µm	2.1	CT99S03-H3Q1QT	CT99S03-05Q1QT	CT99S03-10Q1QT	CT99S03-15Q1QT	CT99S03-25Q1QT	CT99S03-01Q1GC
	3.0	CT99S03-H303QT	CT99S03-0503QT	CT99S03-1003QT	CT99S03-1503QT	CT99S03-2503QT	CT99S03-0103GC
	4.0	CT99S03-H304QT	CT99S03-0504QT	CT99S03-1004QT	CT99S03-1504QT	CT99S03-2504QT	CT99S03-0104GC
	4.6	CT99S03-0346WT	CT99S03-0546WT	CT99S03-1046WT	CT99S03-1546WT	CT99S03-2546WT	CT99S03-0104GC
5 µm	2.1	CT99S05-H3Q1QT	CT99S05-05Q1QT	CT99S05-10Q1QT	CT99S05-15Q1QT	CT99S05-25Q1QT	CT99S05-01Q1GC
	3.0	CT99S05-H303QT	CT99S05-0503QT	CT99S05-1003QT	CT99S05-1503QT	CT99S05-2503QT	CT99S05-0103GC
	4.0	CT99S05-H304QT	CT99S05-0504QT	CT99S05-1004QT	CT99S05-1504QT	CT99S05-2504QT	CT99S05-0104GC
	4.6	CT99S05-0346WT	CT99S05-0546WT	CT99S05-1046WT	CT99S05-1546WT	CT99S05-2546WT	CT99S05-0104GC

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

YMC PAH

Phase dimension	Column ID [mm]	Column length [mm]					Guard cartridges* with 10 mm length [pack of 5]
		30 (WT) / 33 (QT)	50	100	150	250	
3 µm	2.1	YP99S03-H3Q1QT	YP99S03-05Q1QT	YP99S03-10Q1QT	YP99S03-15Q1QT	YP99S03-25Q1QT	YP99S03-01Q1GC
	3.0	YP99S03-H303QT	YP99S03-0503QT	YP99S03-1003QT	YP99S03-1503QT	YP99S03-2503QT	YP99S03-0103GC
	4.0	YP99S03-H304QT	YP99S03-0504QT	YP99S03-1004QT	YP99S03-1504QT	YP99S03-2504QT	YP99S03-0104GC
	4.6	—	YP99S03-0546KT	—	—	—	YP99S03-0104GC
5 µm	2.1	YP99S05-H3Q1QT	YP99S05-05Q1QT	YP99S05-10Q1QT	YP99S05-15Q1QT	YP99S05-25Q1QT	YP99S05-01Q1GC
	3.0	YP99S05-H303QT	YP99S05-0503QT	YP99S05-1003QT	YP99S05-1503QT	YP99S05-2503QT	YP99S05-0103GC
	4.0	YP99S05-H304QT	YP99S05-0504QT	YP99S05-1004QT	YP99S05-1504QT	YP99S05-2504QT	YP99S05-0104GC
	4.6	—	—	—	YP99S05-1546KT	YP99S05-2546KT	YP99S05-0104GC

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

J'sphere ODS-H80

Phase dimension	Column ID [mm]	Column length [mm]					Guard cartridges* with 10 mm length [pack of 5]
		30 (WT) / 33 (QT)	50	100	150	250	
8 nm 4 µm	2.1	JH08S04-H3Q1QT	JH08S04-05Q1QT	JH08S04-10Q1QT	JH08S04-15Q1QT	JH08S04-25Q1QT	JH08S04-01Q1GC
	3.0	JH08S04-H303QT	JH08S04-0503QT	JH08S04-1003QT	JH08S04-1503QT	JH08S04-2503QT	JH08S04-0103GC
	4.0	JH08S04-H304QT	JH08S04-0504QT	JH08S04-1004QT	JH08S04-1504QT	JH08S04-2504QT	JH08S04-0104GC
	4.6	JH08S04-0346WT	JH08S04-0546WT	JH08S04-1046WT	JH08S04-1546WT	JH08S04-2546WT	JH08S04-0104GC

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

J'sphere ODS-M80

Phase dimension	Column ID [mm]	Column length [mm]					Guard cartridges* with 10 mm length [pack of 5]
		30 (WT) / 33 (QT)	50	100	150	250	
8 nm 4 µm	2.1	JM08S04-H3Q1QT	JM08S04-05Q1QT	JM08S04-10Q1QT	JM08S04-15Q1QT	JM08S04-25Q1QT	JM08S04-01Q1GC
	3.0	JM08S04-H303QT	JM08S04-0503QT	JM08S04-1003QT	JM08S04-1503QT	JM08S04-2503QT	JM08S04-0103GC
	4.0	JM08S04-H304QT	JM08S04-0504QT	JM08S04-1004QT	JM08S04-1504QT	JM08S04-2504QT	JM08S04-0104GC
	4.6	JM08S04-0346WT	JM08S04-0546WT	JM08S04-1046WT	JM08S04-1546WT	JM08S04-2546WT	JM08S04-0104GC

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

J'sphere ODS-L80

Phase dimension	Column ID [mm]	Column length [mm]					Guard cartridges* with 10 mm length [pack of 5]
		30 (WT) / 33 (QT)	50	100	150	250	
8 nm 4 µm	2.1	JL08S04-H3Q1QT	JL08S04-05Q1QT	JL08S04-10Q1QT	JL08S04-15Q1QT	JL08S04-25Q1QT	JL08S04-01Q1GC
	3.0	JL08S04-H303QT	JL08S04-0503QT	JL08S04-1003QT	JL08S04-1503QT	JL08S04-2503QT	JL08S04-0103GC
	4.0	JL08S04-H304QT	JL08S04-0504QT	JL08S04-1004QT	JL08S04-1504QT	JL08S04-2504QT	JL08S04-0104GC
	4.6	JL08S04-0346WT	JL08S04-0546WT	JL08S04-1046WT	JL08S04-1546WT	JL08S04-2546WT	JL08S04-0104GC

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

For other dimensions please refer to page 386-387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Flash Cartridges

Contents

Introduction

Flash Cartridges

Traditionally, irregular shaped silica, typically with particles sizes of 40-63 µm, has been successfully used for sample clean-up and fast workup after chemical synthesis. Also, this type of silica represents cost-effective media, yet with ever improved reproducibility, for standard applications.

Applying spherical silica will greatly enhance resolution - in less time, for more challenging demands. Spherical silica generates substantially less back pressure so that increased flow rates can be applied.

Flash Cartridges

YMC-DispoPackAT Flash Cartridges - high quality products for your purification success

YMC-DispoPackAT cartridges are available in different volumes taking from 12 g to 800 g of packing material. The product finder on the next page provides indicative data on how to choose a cartridge size, depending on sample volume. Apart from straight silica, the following standard bonding options are available: NH_2 (Amino), Diol and ODS (C18).

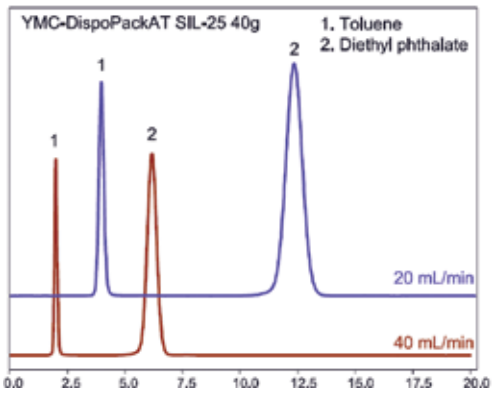
In order to verify the efficiency or to compare the differences, please request evaluation samples from YMC or authorized YMC Distributors.

Main advantages:

- **Compatible with all common Flash Systems (e.g. ISCO, Interchim, Agilent, Grace, Büchi …)**
- **Fast and easy installation using Luer/Luer-Lock-connectors**
- **Using 25 µm material: 50% time saving through high resolution at high flow-conditions**
- **High reproducibility**

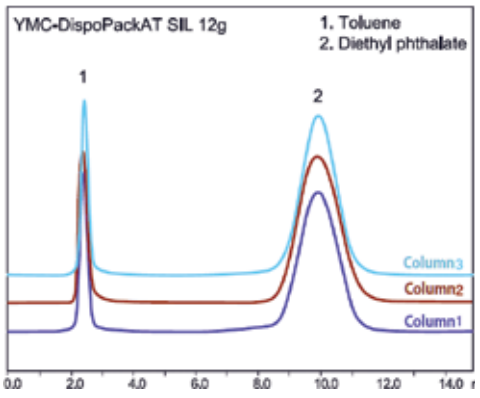
Flash Cartridges	Traditional	Premium
Shape	irregular	spherical
Base	silica	silica
Particle size / µm	40-63	25
Pore size / nm	SIL 6; NH_2, Diol, ODS 15	8
Column connection	Luer / Luer lock	Luer / Luer lock
Pressure tolerance	13.8 bar (300 g & 800 g 12.4 bar)	13.8 bar (300 g & 800 g 12.4 bar)
Available bondings	SIL, NH_2, Diol, ODS	SIL, NH_2, Diol, ODS
Available sizes / g	12, 40, 120, 300, 800	12, 40, 120, 300, 800

50% time saving*



Eluent: n-hexane / ethyl acetate (90/10)
Detection: UV at 254 nm

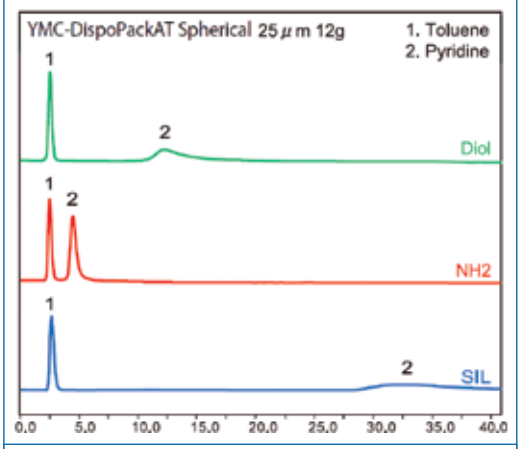
High reproducibility*



Eluent: n-hexane / ethyl acetate (90/10)
Flow rate: 10 mL/min
Detection: UV at 254 nm

Flash Cartridges

Normal Phase*

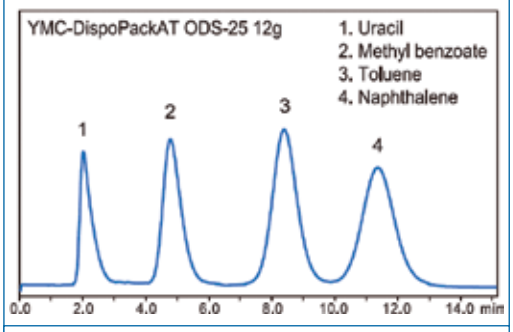


Eluent: n-hexane / ethyl acetate (80/20)
Flow rate: 10 mL/min
Detection: UV at 254 nm

Application Examples Normal Phase:

e.g. carotenoids, phthalates, phenones, steroids ...

Reversed Phase*



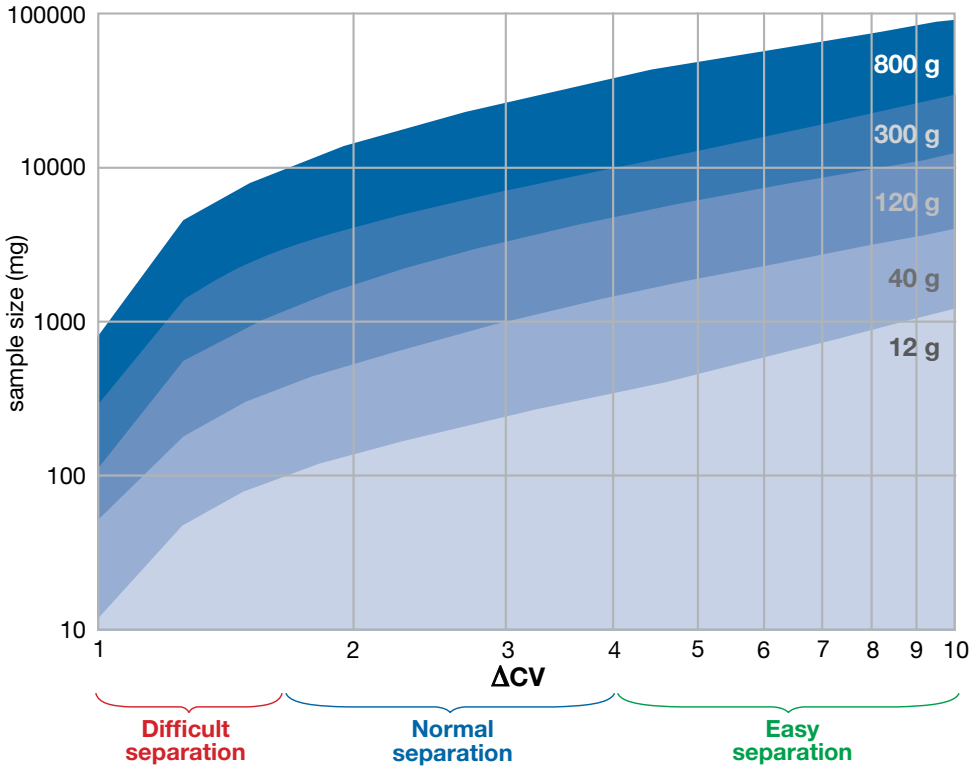
Eluent: methanol / water (70/30)
Flow rate: 10 mL/min
Detection: UV at 254 nm

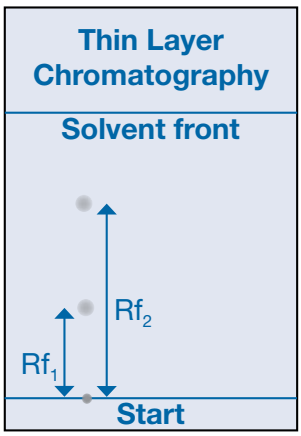
Application Examples Reversed Phase:

e.g. polar organic compounds, polar heterocyclic compounds, peptides

Product Finder

The table on page 300 will help you choose the appropriate flash cartridge for your application. You only need to decide on the particle size and shape and the desired bonding. Calculation of appropriate cartridge size? Subtraction of the reciprocal retention factors yields the ΔCV-value. You can find the most appropriate cartridge size by checking the diagram with the ΔCV-value and the sample size you like to purify.





RF: Retention Factor

CV: Column Volume

CV = 1/RF

ΔCV = 1/RF1-1/RF2

* Application data by courtesy YMC Co., Ltd.

Ordering Information

Traditional: Irregular (Particle Size 40 – 63 µm)

Product	Size [g]	Pack Qty	Part number
YMC-DispoPackAT **SIL**	12 40 120 300 800	24 12 6 1 1	DPA12SLK06I5224 DPA40SLK06I5212 DPAA2SLK06I5206 DPAC0SLK06I5201 DPAH0SLK06I5201
YMC-DispoPackAT **NH_2**	12 40 120 300 800	24 12 6 1 1	DPA12NHK15I5224 DPA40NHK15I5212 DPAA2NHK15I5206 DPAC0NHK15I5201 DPAH0NHK15I5201
YMC-DispoPackAT **Diol**	12 40 120 300 800	24 12 6 1 1	DPA12DLK15I5224 DPA40DLK15I5212 DPAA2DLK15I5206 DPAC0DLK15I5201 DPAH0DLK15I5201
YMC-DispoPackAT **ODS**	12 40 120 300 800	24 12 6 1 1	DPA12ABK15I5224 DPA40ABK15I5212 DPAA2ABK15I5206 DPAC0ABK15I5201 DPAH0ABK15I5201

Premium: Spherical (Particle Size 25 µm)

Product	Size [g]	Pack Qty	Part number
YMC-DispoPackAT **SIL-25**	12 40 120 300 800	24 12 6 1 1	DPA12SLK08S2524 DPA40SLK08S2512 DPAA2SLK08S2506 DPAC0SLK08S2501 DPAH0SLK08S2501
YMC-DispoPackAT **NH_2-25**	12 40 120 300 800	24 12 6 1 1	DPA12NHK08S2524 DPA40NHK08S2512 DPAA2NHK08S2506 DPAC0NHK08S2501 DPAH0NHK08S2501
YMC-DispoPackAT **Diol-25**	12 40 120 300 800	24 12 6 1 1	DPA12DLK08S2524 DPA40DLK08S2512 DPAA2DLK08S2506 DPAC0DLK08S2501 DPAH0DLK08S2501
YMC-DispoPackAT **ODS-25**	12 40 120 300 800	24 12 6 1 1	DPA12ABK08S2524 DPA40ABK08S2512 DPAA2ABK08S2506 DPAC0ABK08S2501 DPAH0ABK08S2501

Preparative & Process LC

Contents

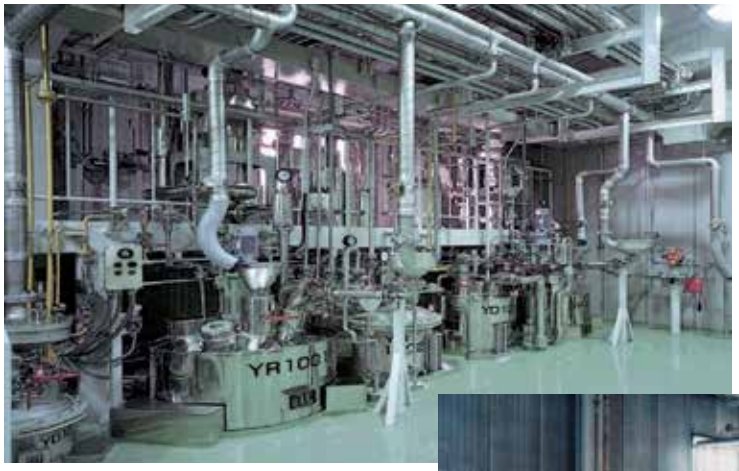
Introduction

YMC is one of the very few global players in the market that meet the challenging demands in preparative scale chromatography. Our ambition is to provide chromatographic solutions for any compound from its discovery through scale-up to production and its quality control in the lab, as well as positive, active support, chromatographic tools and technical assistance at every stage.

Preparative & Process LC

In order to optimise preparative processes the employed bulk needs to provide:

- **optimised selectivity → maximum output per run**
- **mechanical stability → cost efficiency**
- **reproducibility → reliability**



Preparative & Process LC

YMC of today maintains three technology platforms:

- **chemically re-enforced pH-stable YMC-Triart Prep with C18, C8 and customised (e.g. quarternary ammonium) surface chemistries**

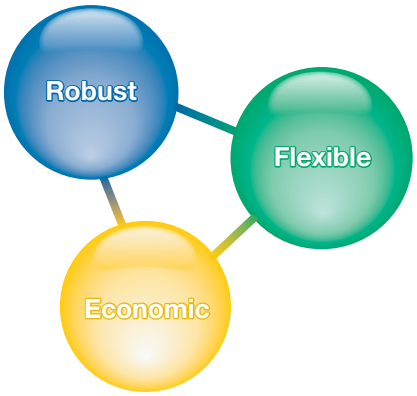
- **high grade silica phases for preparative HPLC with improved mechanical stability, including polysaccharide phases for chiral applications (see page 252-279)**

- **high resolution IEX prep media in 10, 20, 30 or 75 µm particle sizes with an annual capacity beyond 40,000 litres**

In addition to product supply, YMC is proud to be recognised for outstanding technical support by dedicated people with a mission to exceed expectations. YMC will happily share expertise and proactively contribute to make customers successful in their daily work. YMC support teams are located in Japan, China, Korea, Taiwan, Singapore, India and the USA in addition to Germany which provides support for the EMEA countries together with a network of authorised distributors who supply additional local support.

YMC-Triart Prep

- **extended pH range**
- **mechanical stability**
- **high loadability**
- **CIP with NaOH solutions applicable**
- **up to 4-fold longer lifetimes**
- **multi-ton capacity**



Specifications	YMC-Triart Prep C18-S	YMC-Triart Prep C8-S
Base material	inorganic/organic hybrid silica	
Particle size / µm	10, 15, 20	10, 15, 20
Pore size / nm	12	20
Surface area / m^2g^{-1}	360	220
Bonding	trifunctional	trifunctional
End-capping	yes	yes
Flexible pH range	2.0 ~ 10.0	2.0 ~ 10.0

General

YMC-Triart Prep is chemically stable up to pH 10.0. This provides more flexibility for method development and allows for more efficient cleaning-in-place (CIP) procedures. From real life process development work YMC-Triart Prep has been shown to outperform traditional silica-based materials 2- to 4-fold in terms of stability. Longer column lifetimes lead to more kilogram of product produced per kilogram of stationary phase.

Why not choose the better media?

Particle technology

YMC-Triart Prep materials provide improved particle and pore size distributions which result in reduction of backpressures and increased sample loadabilities are achieved during preparative operation.

With YMC-Triart Prep previously challenging pH and high temperature conditions can be used for demanding applications even in the day-to-day work in laboratories or production. Most importantly, due to its unique particle composition, a balanced hydrophobicity and silanol activity is achieved which makes YMC-Triart Prep a **"First Choice"** material in method development!

Homogeneous and uniform particles

YMC-Triart (12 nm, 5 µm)

YMC-Triart Prep (20 nm, 15 µm)

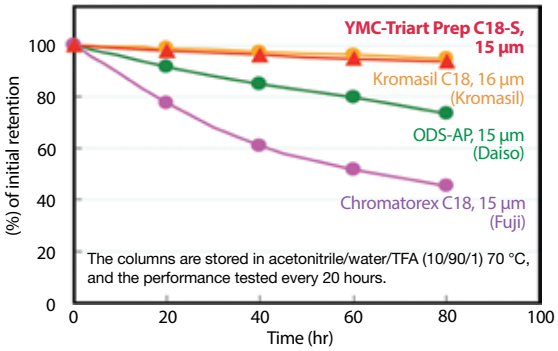
X-Bridge HILIC (13.5 nm, 5 µm)

by courtesy of YMC Co., Ltd.

YMC-Triart Prep

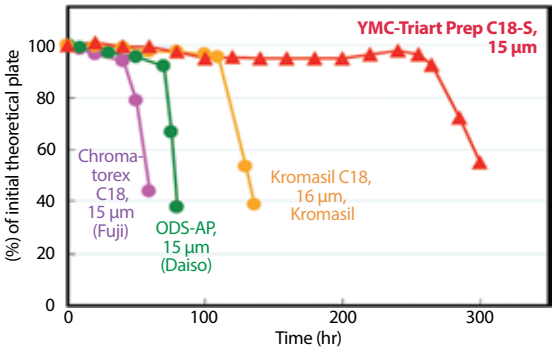
Excellent pH stability

Acidic condition (pH 1, 70 °C)*



Column:	250 x 6.0 mm ID
Eluent:	acetonitrile / water (60/40)
Flow rate:	1.7 mL/min
Temperature:	37 °C
Detection:	UV at 254 nm
Sample:	butyl benzoate

Alkaline condition (pH 11.5, 50 °C)*



Column:	150 x 4.6 mm ID
Eluent:	50 mM TEA in methanol / 50 mM TEA in water (pH 11.5) (20/80, v/v)
Flow rate:	1.0 mL/min
Detection:	UV at 254 nm
Sample:	caffeine

At high pH YMC-Triart Prep C18-S shows lifetimes of up to 4 times longer compared to conventional silica materials. This enables new separations to be carried out at high pH which are not possible with silica materials. Furthermore, the material can endure more CIP-cycles than conventional phases used in industrial processes.

Advantages of YMC-Triart Prep

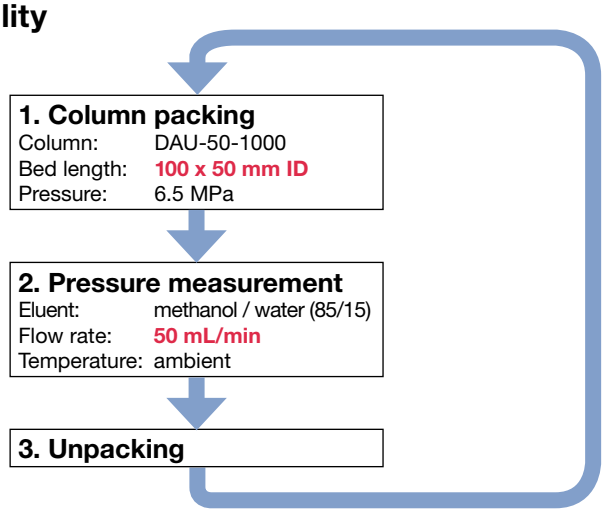
Improvement	Your benefit
pH-stability 2.0 ~ 10.0	More stable to CIP-conditions Method development
Chemical and mechanical stability	Cost savings High production throughput Increased lifetimes
Uniform particle size	Improved packing = improved chromatographic performance = reduced backpressure
Narrow pore size distribution	High loadability
100% aqueous conditions	Separation of polar substances Method development

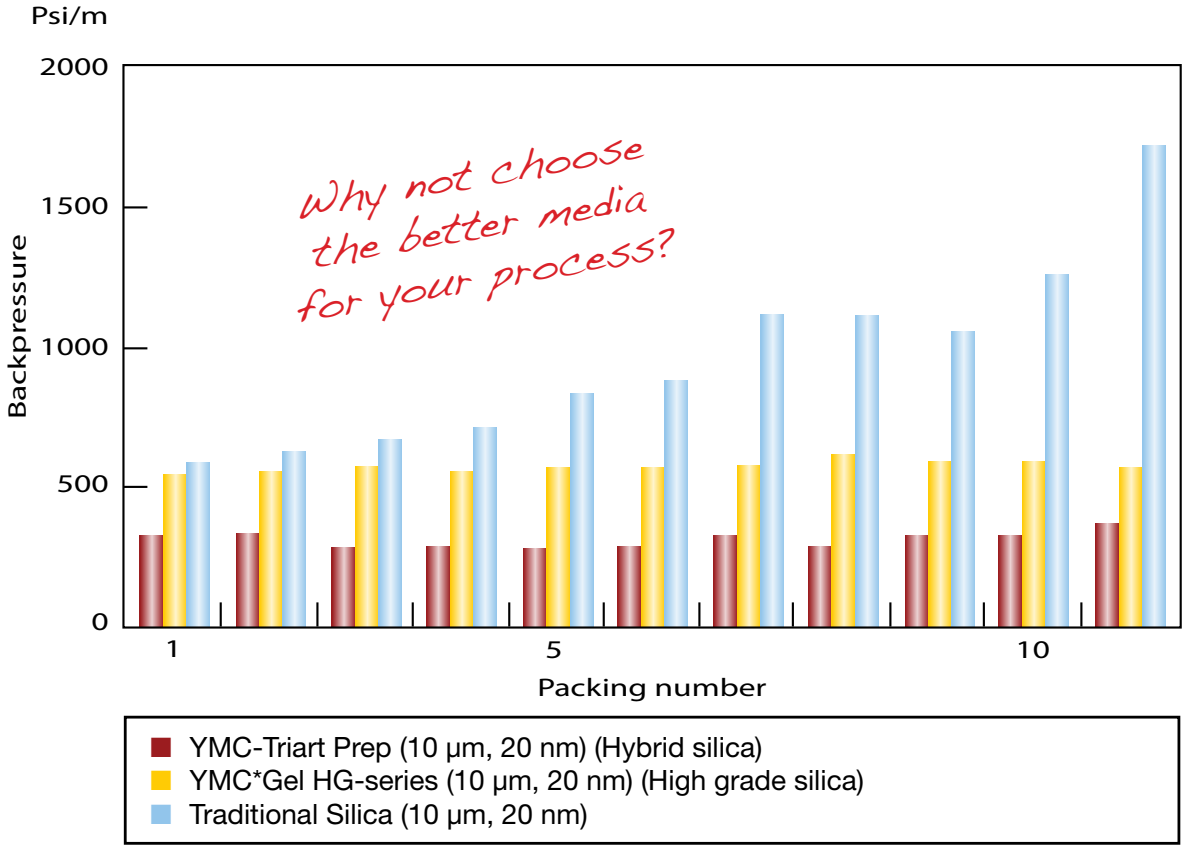
This makes YMC-Triart Prep "first choice" material for method development and process optimisation!

* Application data by courtesy YMC Co., Ltd.

YMC-Triart Prep

Mechanical stability

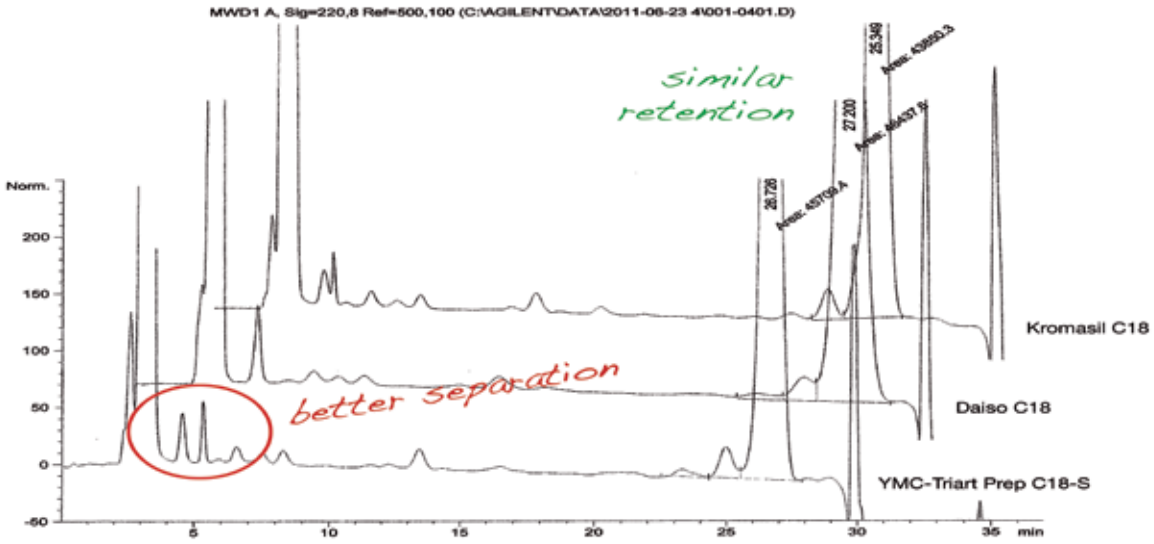




Shearing and crushing of silica particles lead to the formation of fines, which result in an increased backpressure. By using mechanically stable, spherical particles the formation of fines can be reduced.
Here, high mechanical stability of YMC-Triart Prep is demonstrated by means of repeated packing of a DAC column. Even after more than 10 repacking cycles using the same material the pressure does not increase. The absence of fines is demonstrated by a constant backpressure.

YMC-Triart Prep

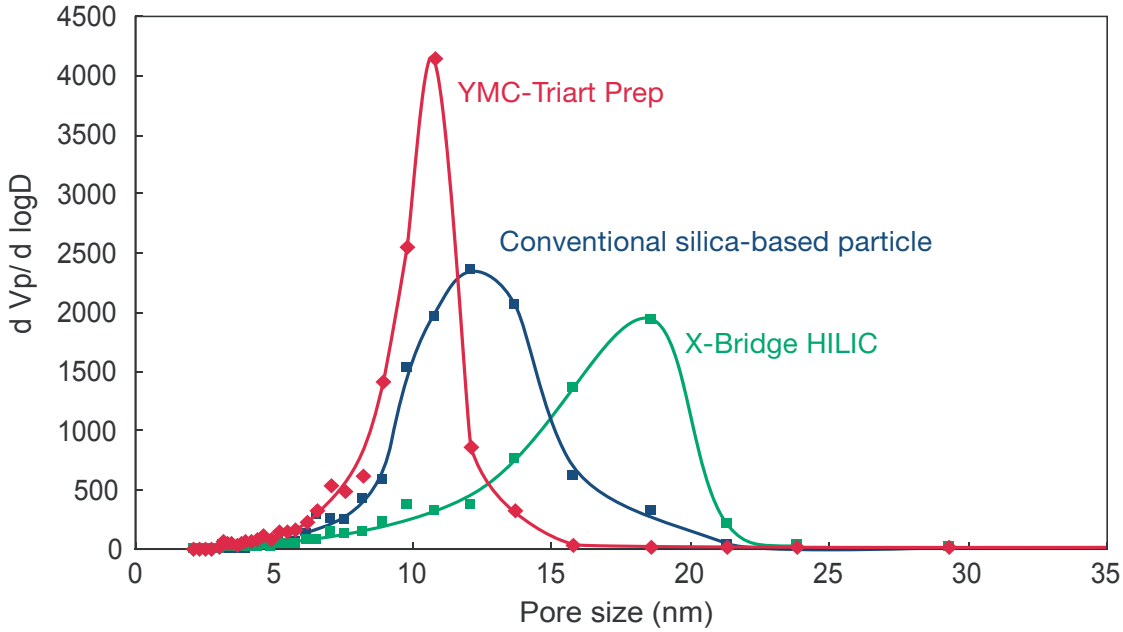
YMC Triart Prep C18-S vs. competitor material (client data)



Client data confirms that YMC-Triart Prep C18-S shows retention for hydrophobic compounds comparable to conventional silica materials. At the same time polar molecules are exceptionally well separated.

Client data shows non-optimized scouting runs performed on the respective C18 material packed into 250 x 4.6 mm ID columns.

Narrow pore distribution*



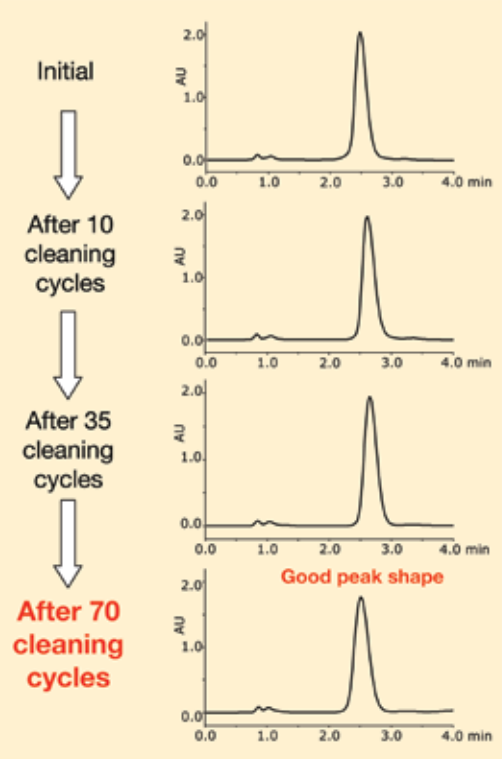
A narrow pore size distribution of a stationary phase beneficially affects peak width and sample loading in liquid chromatography. YMC-Triart Prep C18-S exhibits a narrower pore size distribution. This results in improved peak shapes and higher sample loading in your preparative processes.

* Application data by courtesy YMC Co., Ltd.

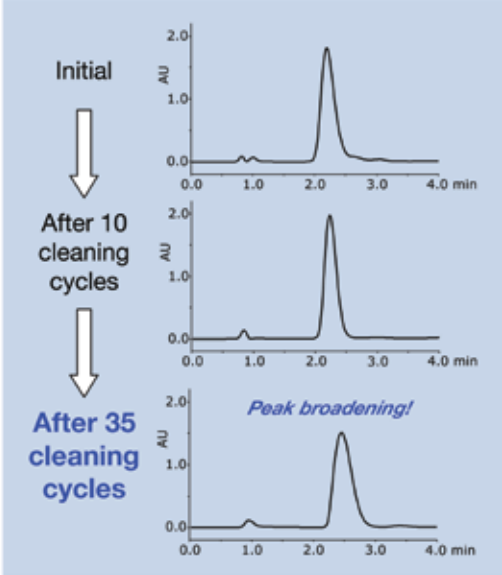
YMC-Triart Prep

CIP performance of YMC-Triart Prep C8-S

YMC-Triart Prep C8-S (10 µm, 20 nm)*



Silica based C8 material (10 µm, 20 nm)*



Column:	50 x 4.6 mm ID
Eluent:	A) water / TFA (100/0.1) B) acetonitrile / TFA (100/0.1) 29-36% B (0-2 min), 36% B (2-3 min), 29% B (3-6 min)
Flow rate:	1.0 mL/min
Temperature:	25 °C
Detection:	UV at 220 nm
Injection:	6 µL
Sample:	10 mg/mL insulin bovine + human serum (2:1)

Column lifetime extended by factor > 2

In insulin production repeated injections of a solution of insulin in human plasma/serum are carried out. Consequently, absorption of impurities on the surface of the packing material reduces the retention capacity of the column.

Methodology: At this point a wash step with an alkaline solution (e.g. 0.1 M NaOH) removes the impurities and restores the full capacity of the column.

Problem: Silica materials are unsuitable for alkaline wash conditions, because of their limited stability at high pH.

Solution: Hybrid silica-based YMC-Triart Prep has an excellent stability at high pH. It is amenable to alkaline wash conditions and longer column lifetime.
This in turn reduces production costs: Lower consumption of packing material and less downtimes due to column repacking. An extension of column lifetime by a factor of more than two has been achieved!

* Application data by courtesy YMC Co., Ltd.

Ordering Information

YMC-Triart Prep C18-S			YMC-Triart Prep C8-S		
Pore size (nm)	Particle size (µm)	Product Code	Pore size (nm)	Particle size (µm)	Product Code
12	10	TAS12S11	20	10	TOS20S11
	15	TAS12S16		15	TOS20S16
	20	TAS12S21		20	TOS20S21

Typical pack sizes:
Laboratory scale: 100 g - 5 kg PE bottle
Industrial scale: 5 kg - 50 kg in double lined PE bags inside metal drum
Larger pack sizes on request

Other particle and pore size combinations on request.
Examples of existing customised material:
TAS08S11, TOS12S11, TOS12S16, TQP12S21

Regulatory support file available under non-disclosure agreement.
Used in validated cGMP-manufacturing processes.

Customised material available on request.
DMF registered with FDA.

YMC*Gel HG-Series

- **Higher sample load**
- **Lower backpressure**
- **Longer column usage**
- **More repackings possible**
- **More efficient column packing**

General

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

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

Besides innovations in the field of hybrid silica (YMC-Triart) and polymeric ion-exchange resins (BioPro) YMC dedicated considerable effort into improving chromatographic properties of silica based materials.

Availability

YMC provides an extensive selection of more than 20 fully scalable stationary phases from 1.9 to 50 µm in various pore sizes and specifications to address virtually any separation need. In addition, YMC can also custom manufacture products with specific properties, e.g. defined pore size and/or carbon content, to provide optimal suitability to individual separations. This unique choice of selectivities meets the highest demand in conventional column separations and also dynamic axial or dynamic radial compression columns and simulated moving bed (SMB) techniques.

Bulk Packing Material

Preparative and process scale YMC bulk packing materials (10 to 50 µm) can be obtained in gram to multi-ton scale quantities. YMC's advanced production facilities are able to manufacture multi-ton quantities of silica per annum, with large batches in excess of 500 kg/lot. YMC's large-scale bonding plants have a capacity of more than 200 kg/lot.

Long Term Supply

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

World Wide Availability

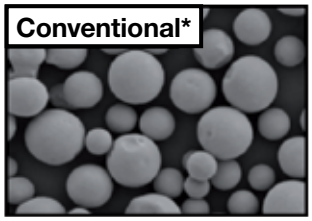
Pre-packed columns and bulk materials are available worldwide through a dedicated support network headed by YMC operations in Japan, the US and in Europe to ensure facile method transfer between research and production sites across the world.

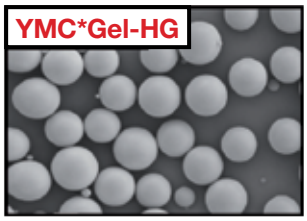
YMC*Gel HG-Series

Improved silica base for better performance

Improvements in the production process of the base silica yield particles with higher mechanical stability and more uniform particle and pore size distribution.

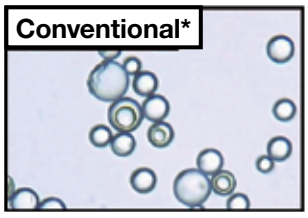
SEM image

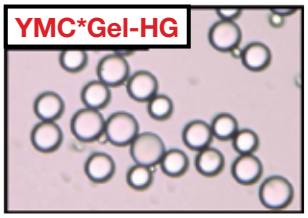




Reduced backpressure and improved chromatographic efficiency due to more uniform particle size distribution.

Optical microscope image





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

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

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

YMC*Gel HighGrade (HG)-series

Go for the better!

YMC*Gel HG-Series

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

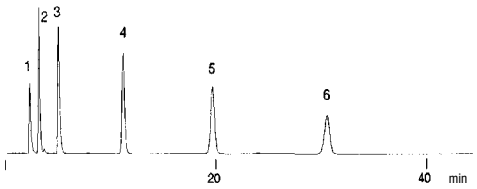
The basis for every successful separation is the selection of the appropriate stationary phase. YMC offers one of the world's largest portfolios of selectivities, designed to handle even the most demanding separations.

Your benefits:

- **10 preparative phase chemistries → solving virtually any separation need**
- **full scalability**
- **pore sizes from 8 to 30 nm**
- **particle sizes from 10 to 50 µm**
- **customised bulk properties (pore size, carbon content, endcapping)**

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

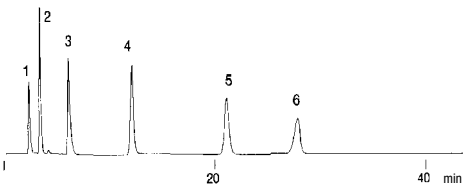
YMC*Gel ODS-A-HG*



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

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

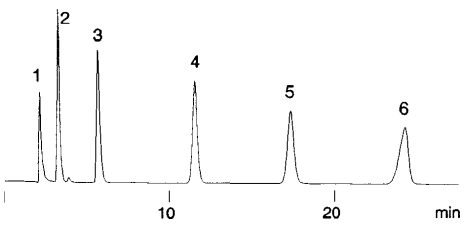
YMC*Gel ODS-AQ-HG*



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

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

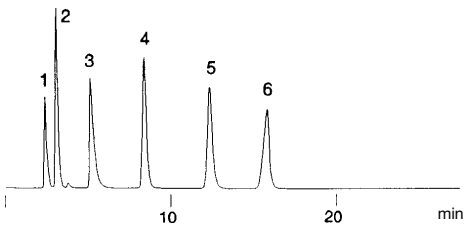
YMC*Gel C8-HG (Octyl)*



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

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

YMCbasic*



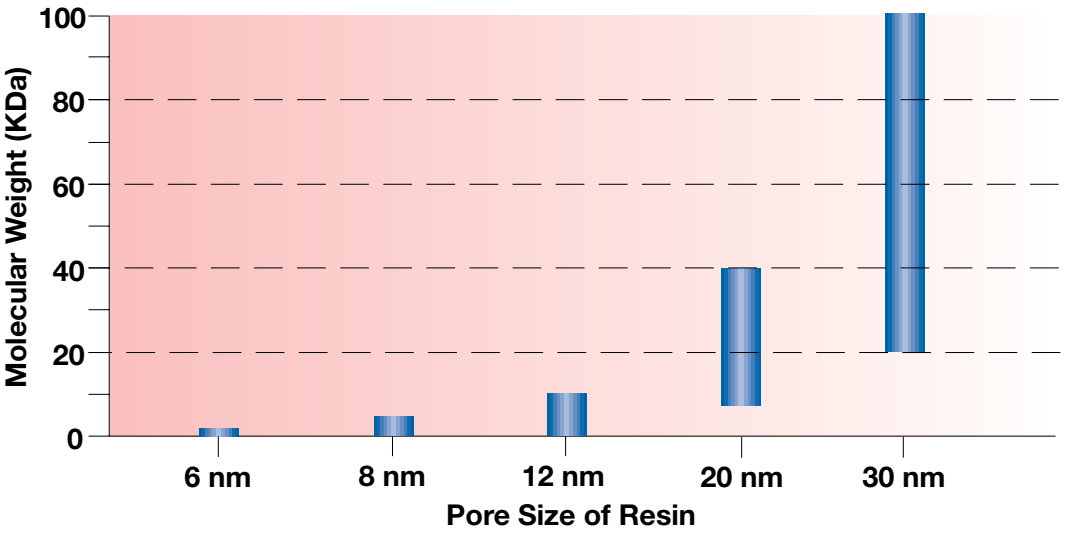
1: Uracil
2: 4-Hydroxybenzoic acid
3: Diphenhydramine
4: MPPH
5: Diazepam
6: Toluene

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

YMC*Gel HG-Series

Impact of Pore Size Differences*

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



Please note extended molecular weight range when applying SEC.

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

Further pore sizes available on request.

* Application data by courtesy YMC Co., Ltd.

Available YMC*Gel HG-Series Products

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

Available Products for Specific Applications

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

Analytical grades (3 and 5 µm) are routinely available in pre-packed columns. Particle sizes as indicated.
If not listed, please ask for quotation.
Multi-ton capacity. Customised packing materials available on request. Pore sizes in parenthesis on request.
*Not all combinations available.
**With respect to pore size.

Available YMC*Gel HG-Series Products

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

Available Products for Specific Applications

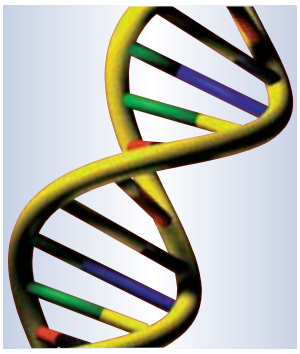
	PORE SIZE* (nm)	PARTICLE SIZE* (µm)	CARBON LOAD** (%C)	pH	TYPICAL APPLICATIONS
	20	10; 15; 20	7	2.0-7.5	basic molecules w/o modifiers, peptides
	proprietary	10; 20; 50	15	2.0-7.5	polyunsaturated fatty acids, EPA, DHA

Regulatory support file available under non-disclosure agreement.
Used in validated cGMP-manufacturing processes.

Customised material available on request.
DMF registered with FDA.

BioPro - IEX Ion Exchange Media

- **high dynamic binding capacity**
- **low non-specific adsorption**
- **excellent recovery**
- **easy removal**
- **cleaning-in-place with NaOH solutions applicable**



BioPro

Ion exchange chromatography (IEX) is widely used in the analysis and purification of bio-molecules. Using reversible charge-charge interactions offers several advantages in comparison to other chromatographic methods, e.g. high capacity and fast throughput. Therefore, IEX is often used in the capture or intermediate purification of bio-molecules.

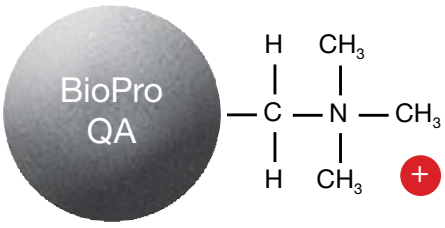
BioPro is a series of ion exchange resins specifically designed for use in bio-chromatography. This media is based on a hydrophilic polymer matrix, with a particle size of 10, 20, 30 or 75 µm. It is available as a strong anion exchanger (BioPro QA) or a strong cation exchanger (BioPro SP). BioPro offers a high dynamic binding capacity (DBC), together with low non-specific adsorption and excellent recovery.

Currently, BioPro is manufactured in lot sizes up to 200 L. In future, lot sizes up to 1,200 L will be available.

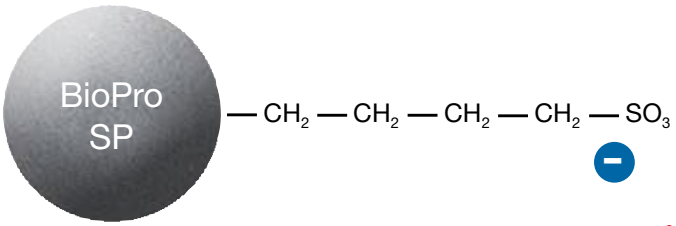
Examples of possible preparative applications of BioPro resins:

Antibody purification	Protein purification	Peptide purification
Trastuzumab **Bevacizumab** **IgG, Antibody variants**	**Histones** **Interferon** **Factor VIII, Factor IX**	**Insulin**

Particle technology



Strong anion exchanger



Strong cation exchanger

N.B.: Fully porous particles

BioPro - IEX Ion Exchange Media

BioPro SmartSep for intermediate purifications and polishing

BioPro Series	BioPro SmartSep Q10	BioPro SmartSep Q20	BioPro SmartSep Q30	BioPro SmartSep S10	BioPro SmartSep S20	BioPro SmartSep S30
Ion exchange type	strong anion exchanger			strong cation exchanger		
Charged group	-R-$N^+(CH_3)_3$			-R-SO_3^-		
Matrix	Hydrophilic polymer beads					
Pore size	Porous					
Compression factor	1.1 - 1.4					
Particle size	10 µm	20 µm	30 µm	10 µm	20 µm	30 µm
Pressure resistance	Regular use: 3 MPa Max.: 4 MPa	Regular use: 2 MPa Max.: 3 MPa		Regular use: 3 MPa Max.: 4 MPa	Regular use: 2 MPa Max.: 3 MPa	
Ion-exchange capacitiy	min. 0.08 meq/ml-resin			min. 0.08 meq/ml-resin		
Dynamic binding capacity	min. 100 mg/ml-resin (BSA)			min. 100 mg/ml-resin (lysozyme)		

BioPro for capture

BioPro Series	BioPro Q75	BioPro S75
Ion exchange type	strong anion exchanger	strong cation exchanger
Charged group	-R-$N^+(CH_3)_3$	-R-SO_3^-
Matrix	Hydrophilic polymer beads	
Pore size	Porous	
Compression factor	1.1 - 1.4	
Particle size	75 µm	
Pressure resistance	0.3 MPa	
Ion-exchange capacitiy	min. 0.10 meq/ml-resin	
Dynamic binding capacity	min. 160 mg/ml-resin (BSA)	

Regulatory support file available under non-disclosure agreement.
Used in validated cGMP-manufacturing processes.

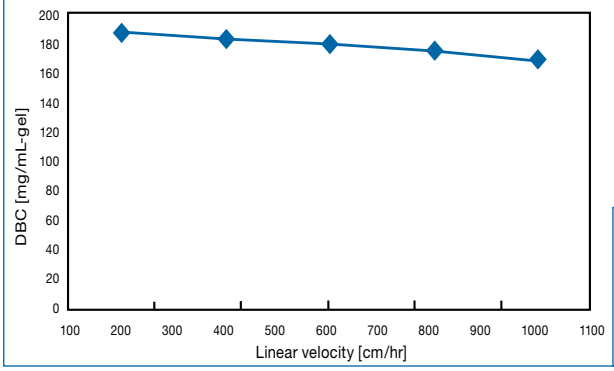
Customized material available on request.
DMF registered with FDA.

Advantages of BioPro

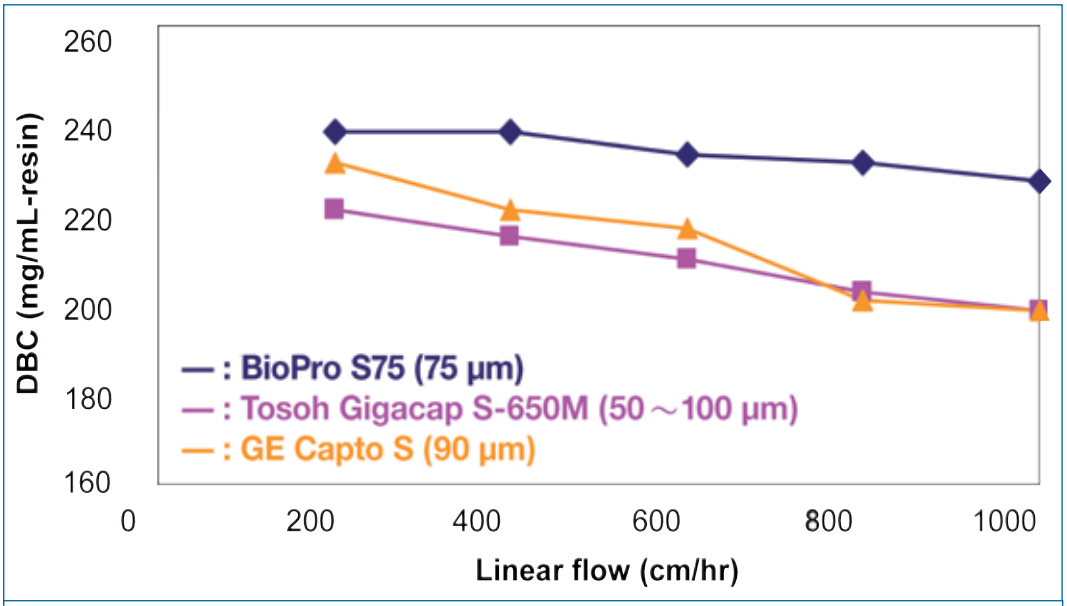
Improvement	Your benefit
Excellent flow properties	**Low backpressure High production throughput**
Highly uniform particle and pore size distribution	**Easy and efficient column packing Improved chromatographic performance**
pH stability	**Stable towards CIP-conditions Flexibility in method development**
High dynamic binding capacity at high flow rates	**High loadability Process more raw material**
Flexible production capacities	**Column filling from a single lot**
Economic resin	**Cost effective**

BioPro - IEX Ion Exchange Media

Excellent DBC at high linear flow rates*



Column: BioPro Q75, 50 x 5.0 mm ID
Sample: 1.5 mg/mL BSA
Equilibration buffer: 20 mM Tris-HCl (pH 8.6)
Elution buffer: 20 mM Tris-HCl (pH 8.6) cont. 0.5 NaCl
Detection: UV at 280 nm
Determined at 10% breakthrough.



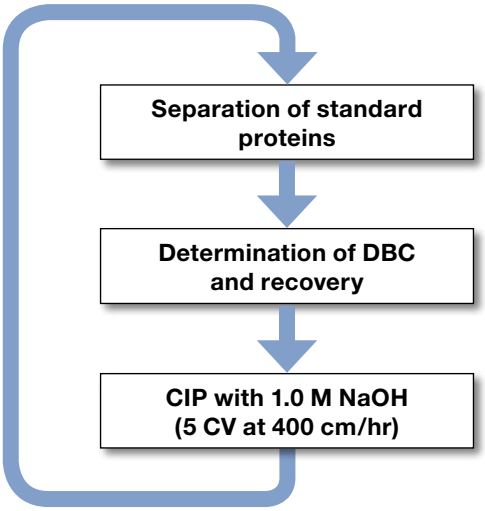
Column: BioPro S75, 50 x 5.0 mm ID
Sample: 1.0 mg/mL Lysozym in equilibration buffer
Equilibration buffer: 20 mM Glycine-NaOH (pH 9.0)
Elution buffer: 20 mM Glycine-NaOH (pH 9.0) with 0.5 M NaCl
Detection: UV at 300 nm

High sample loading at high flow rates is determined by the dynamic binding capacity of an ion exchange resin.
The dynamic binding capacity of BioPro is excellent even at high flow rates. When compared to similar competitor products it consistently exhibits a higher dynamic binding capacity. This results in higher sample loading in your preparative processes.

BioPro - IEX Ion Exchange Media

Cleaning-in-place (CIP) performance of BioPro

Test protocol



Column: BioPro S75, 50 x 5.0 mm ID

Conditions of standard protein separation

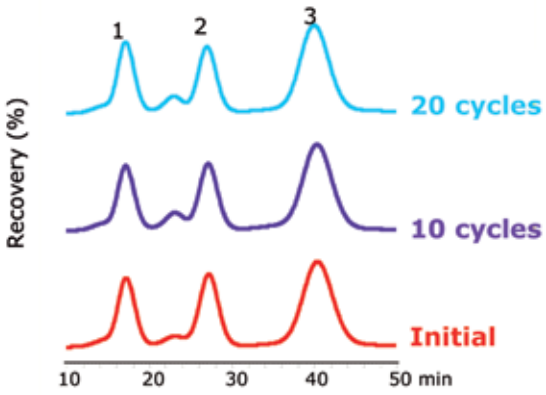
Eluent: A) 20 mM NaH2PO4-Na2HPO4 (pH 6.8)
B) 20 mM NaH2PO4-Na2HPO4 (pH 6.8) containing 0.5 M NaCl
Gradient: 0-100% B (0-60 min, Linear)
Flow rate: 0.59 mL/min (180 cm/hr)
Temperature: 25 °C
Detection: UV at 220 nm
Injection: 24 µL

Conditions of DBC determination

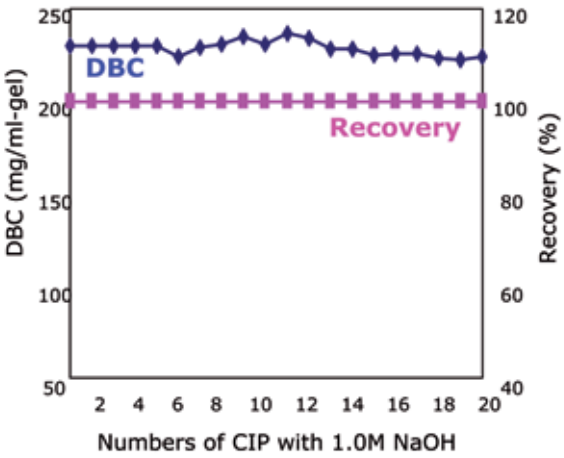
Equilibration buffer: 20 mM Glycine-NaOH(pH 9.0)
Elution buffer: 0.5 M NaCl in equilibration buffer
Flow rate: 2.62 mL/min (800 cm/hr)
Sample: 1.0 mg/mL Lysozyme in equilibration buffer
Temperature: ambient (25 °C)
Detection: UV at 300 nm
DBC is determined at 10% breakthrough.

CIP performance of BioPro

Separation of standard proteins*



DBC and recovery*



BioPro is well suited for alkaline CIP procedures.
The dynamic binding capacity (DBC) and the selectivity are unaffected by 20 cycles of CIP with 1.0 M NaOH. The recovery of proteins is maintained at 100%, which demonstrates the absence of nonspecific adsorption of proteins of this hydrophilic resin.

* Application data by courtesy YMC Co., Ltd.

Preparative Screening Kits

The BioPro Ion Exchange Screening Kits consist of columns that are packed with resins designed for the separation of proteins, nucleotides, and other biomolecules. The various types of kit offer significant advantages and efficiencies for resin screening and purification method development.

Laboratory scale column sizes

1 mL Type (26 x 7.0 mm ID)

- Resin screening
- Purification method development

5 mL Type (26 x 15.6 mm ID)

- Purification method development
- Loadability studies

Specification

	Strong Anion Exchanger BioPro (SmartSep) Q	Strong Cation Exchanger BioPro (SmartSep) S	Weak Anion Exchanger BioPro DA	Weak Cation Exchanger BioPro CM
Matrix	Porous hydrophilic polymer		Porous methacrylate polymer	
Particle size (µm)	30, 75	30, 75	60	60
Ion exchanger	$-CH_2N^+(CH_3)_3$	$-CH_2CH_2CH_2CH_2SO_3^-$	$-R-N(CH_3)_2$	-R-COOH
pH range	2 - 12	2 - 12	Regular use: 3 - 12 Short term: 1 - 13	Regular use: 3 - 12 Short term: 1 - 13

Ordering Information

Strong anion exchanger BioPro Q

Product	Particle Size	Code	Pack Sizes*					
			50 ml	250 ml	1 L	5 L	10 L	20 L
BioPro SmartSep Q10	10 µm	QSA0S10	✔	✔	✔	✔	✔	✔
BioPro SmartSep Q20	20 µm	QSA0S20	✔	✔	✔	✔	✔	✔
BioPro SmartSep Q30	30 µm	QSA0S30	✔	✔	✔	✔	✔	✔
BioPro Q75	75 µm	QAA0S75	✔	✔	✔	✔	✔	✔

Strong cation exchanger BioPro S

Product	Particle Size	Code	Pack Sizes*					
			50 ml	250 ml	1 L	5 L	10 L	20 L
BioPro SmartSep S10	10 µm	SSA0S10	✔	✔	✔	✔	✔	✔
BioPro SmartSep S20	20 µm	SSA0S20	✔	✔	✔	✔	✔	✔
BioPro SmartSep S30	30 µm	SSA0S30	✔	✔	✔	✔	✔	✔
BioPro S75	75 µm	SPA0S75	✔	✔	✔	✔	✔	✔

* Larger or customised pack sizes are available on request.
** Conventional BioPro Q30/S30 (QAA0S30/SPA0S30) available on request.

Technical Information

Contents

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.de, 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.

Column Handling

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.

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.de) or use online chat on our homepage (www.ymc.de).

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.

Column ID (mm)	Recommended Guard Cartridge ID (mm)
1.0	1.0
2.0 / 2.1	2.1
3.0	3.0
4.0	4.0
4.6	4.0* (4.6*)
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.

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 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, 3750 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, 2550 psi) for 250 x 4.6 mm ID.

We recommend using a column at below the maximum operating pressure to ensure maximum column life.

	Maximum Operating Pressure [MPa]	[bar]	[psi]
YMC-Triart 1.9 µm	100	1000	15000
YMC-Triart 3/5 µm[1]	45	450	6525
Meteoric Core 2.7 µm	60	600	8700
YMC UltraHT 2 µm	50	500	7500
YMC-Pack Diol UHPLC 2 µm	45	450	6525

Column ID [mm]	Maximum Operating Pressure [MPa]	[bar]	[psi]
0.075	55/60[2]	550/600[2]	7975/8700[2]
0.1	55/60[2]	550/600[2]	7975/8700[2]
0.3	55/60[2]	550/600[2]	7975/8700[2]
0.5	55/60[2]	550/600[2]	7975/8700[2]
1.0	20/25[3]	200/250[3]	3000/3750[3]
2.0	20/25[3]	200/250[3]	3000/3750[3]
3.0	20/25[3]	200/250[3]	3000/3750[3]
4.0	20/25[3]	200/250[3]	3000/3750[3]
4.6	20/25[3]	200/250[3]	3000/3750[3]
6.0	20/25[3]	200/250[3]	3000/3750[3]
8.0	20/25[3]	200/250[3]	3000/3750[3]
10	10	100	1500
20	10	100	1500
30	10	100	1500
YMC-Actus 20/30	30	300	4500
YMC-Actus 50	20	200	2900

[1] Novel column hardware technology with increased pressure rating (PTH type).

[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 (70°C for YMC-Triart C18/C18 ExRS/C8, 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 phases 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.

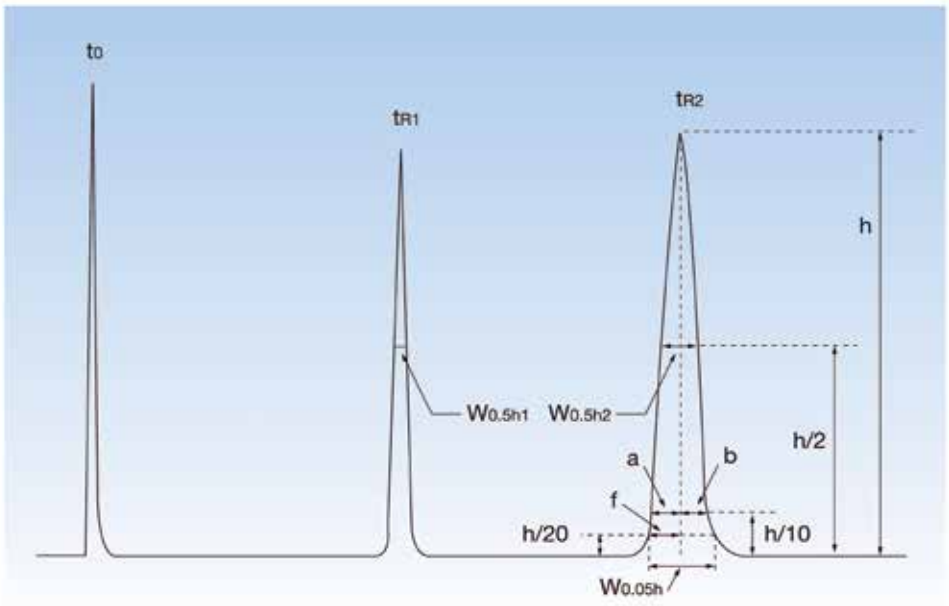
Column efficiency, an important characteristic for evaluation of column performance, is generally measured in terms of theoretical plate number. This is calculated using peak width at half-height. Narrower peak widths result in higher theoretical plate numbers. Longer columns and smaller packing material 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.



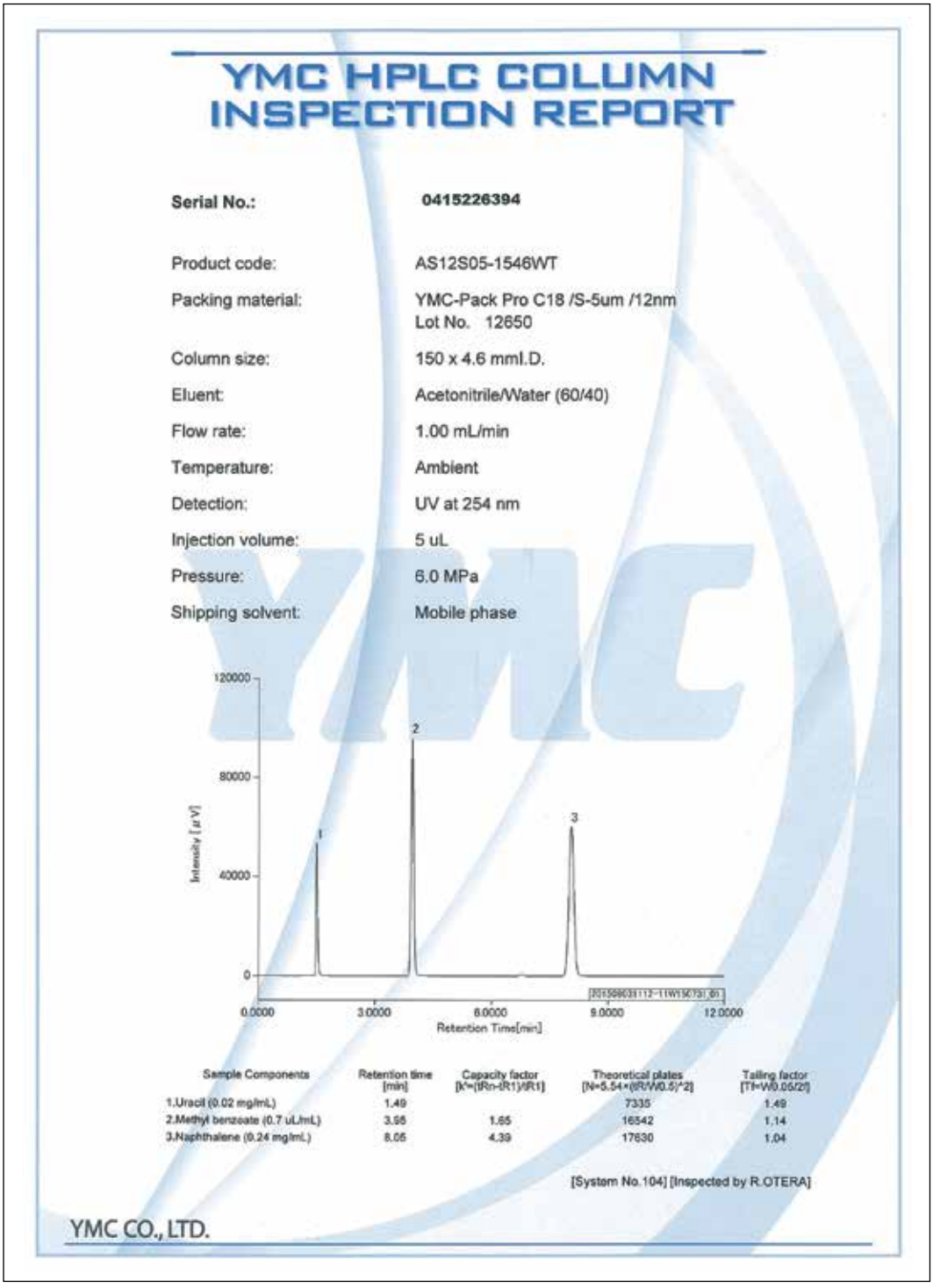
t_0	Void volume. Column dead-time	
t_R	Retention time	
h	Peak height	
$W_{0.5h}$	Peak width at half-height	
N	Theoretical plate number	$N=5.54\times (t_R/W_{0.5h})^2$
k'	Capacity factor	$k'=(t_R-t_0)/t_0$
α	Separation factor	$\alpha=k'_2/k'_1$
R_s	Resolution	$Rs=1.18\times (t_{R2}-t_{R1})/(W_{0.5h1}+W_{0.5h2})$
A_s	Asymmetry factor	As=b/a
Tf	Tailing factor	$Tf=W_{0.05h}/2f$

Inspection Reports

Formation

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.



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-(R1)/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.

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.

Frequently Asked Questions

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.

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 on page 326-327. 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 on page 358-359.

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 on page 358-359. 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.

Frequently Asked Questions

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.de) or use our online chat on our homepage (www.ymc.de).

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.

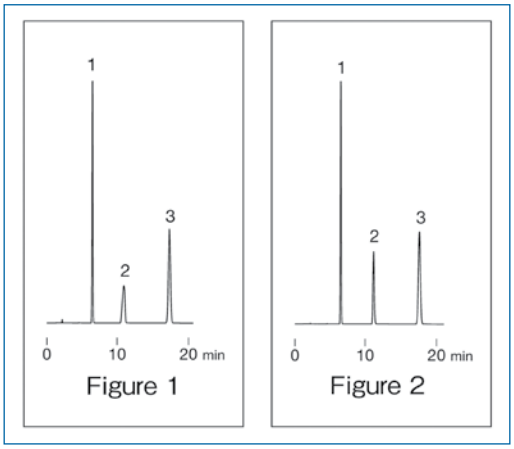
Tetrahydrofuran

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



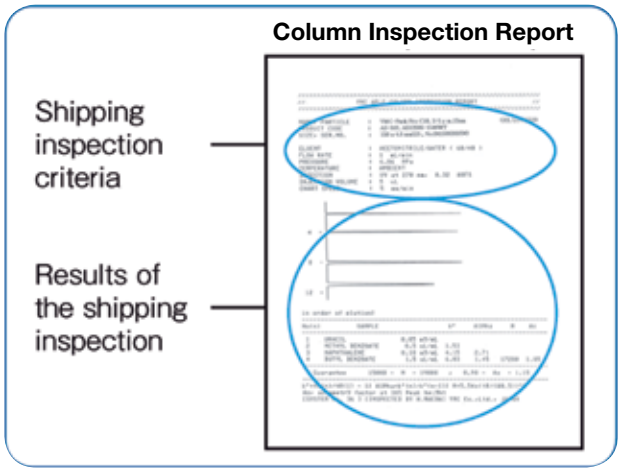
the chromatogram shown in Figure 2 irrespective of the grade of solvent. To avoid the influence of different grades, solvents specifically made for HPLC must be used. Even compounds which have groups which can dissociate can be analysed with eluent containing no acid or salt, although eluents with additives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

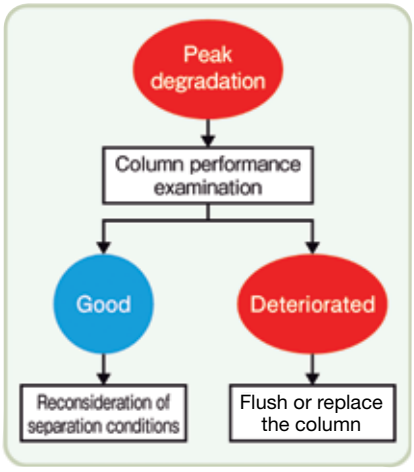
Troubleshooting

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.

* Application data by courtesy YMC Co., Ltd.

Troubleshooting

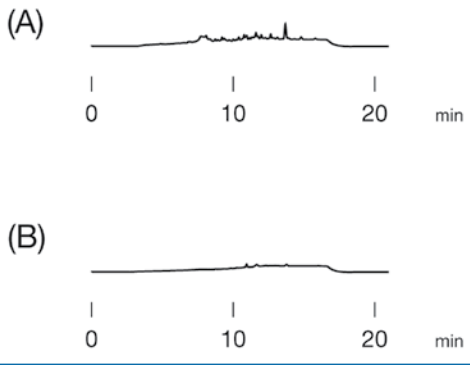
5. The Cause of the Ghost Peaks

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)
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.

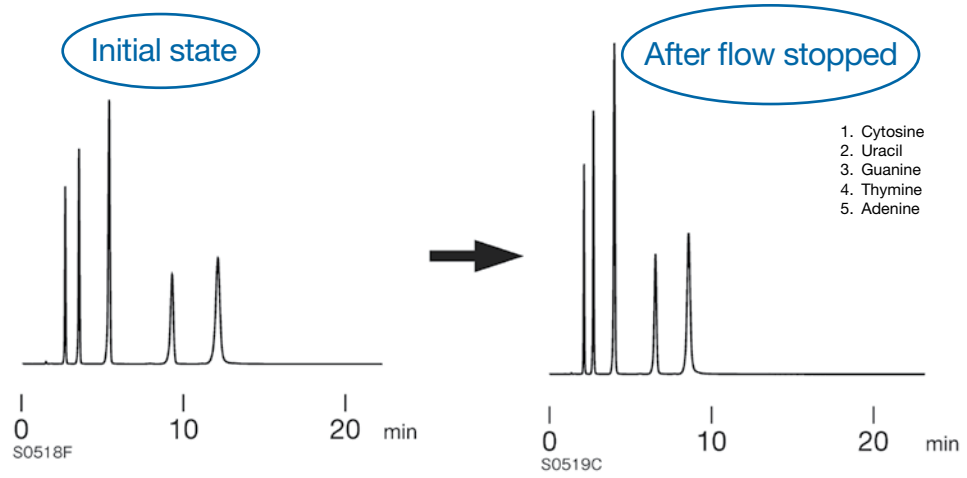
Troubleshooting

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

* Application data by courtesy YMC Co., Ltd.

Essential Data

Conversion factors

Pressure

MPa	bar	psi	kgf/cm²	atm
1	10	145.04	10.20	9.87
0.1	1	14.504	1.020	0.987
6.90×10^{-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	6.21×10^{-4}
0.025	1	0.083	0.028	0.15×10^{-4}
0.305	12	1	0.33	1.89×10^{-4}
0.91	36	3	1	5.68×10^{-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

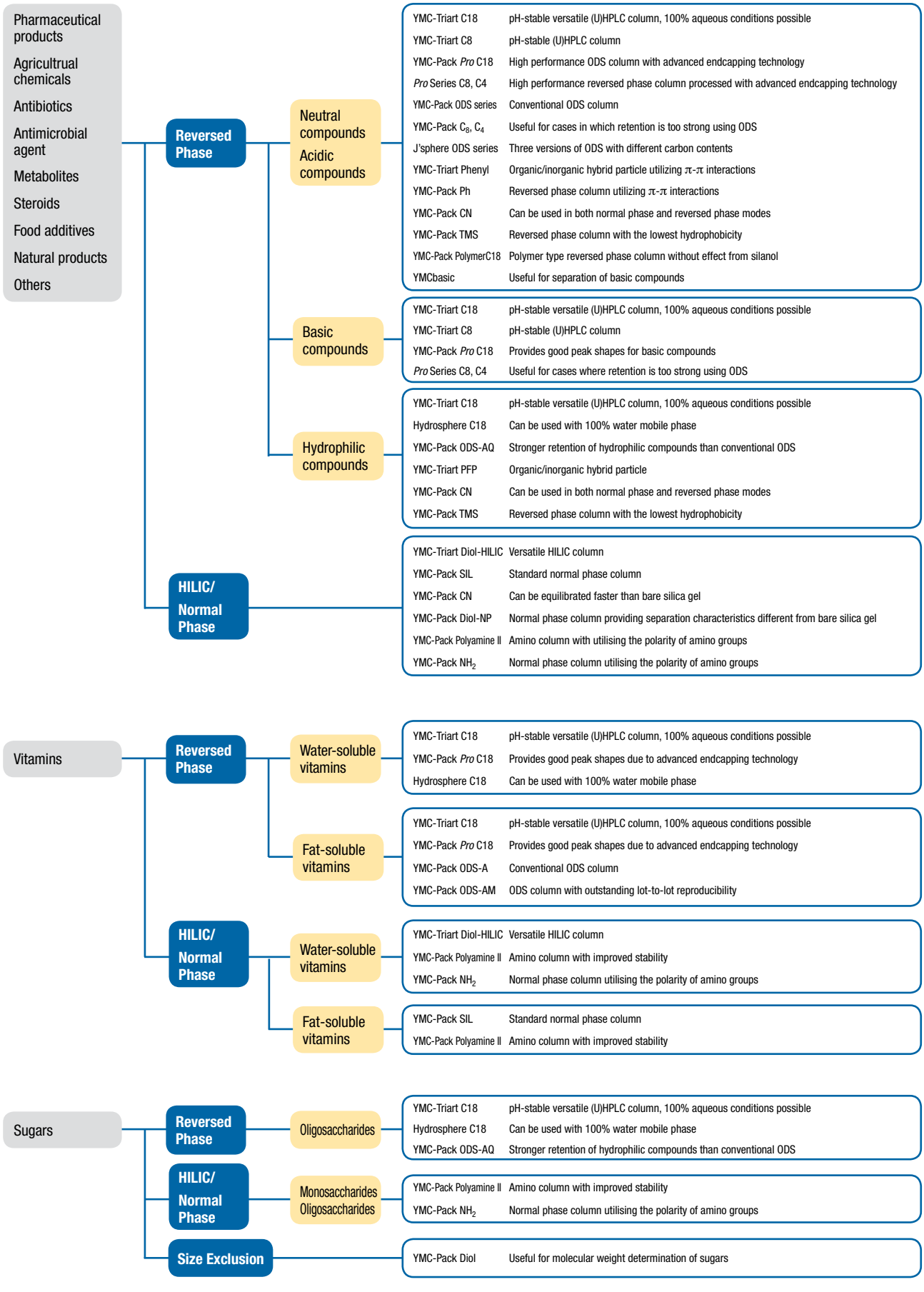
Solvent Miscibility Table

✔ = miscible

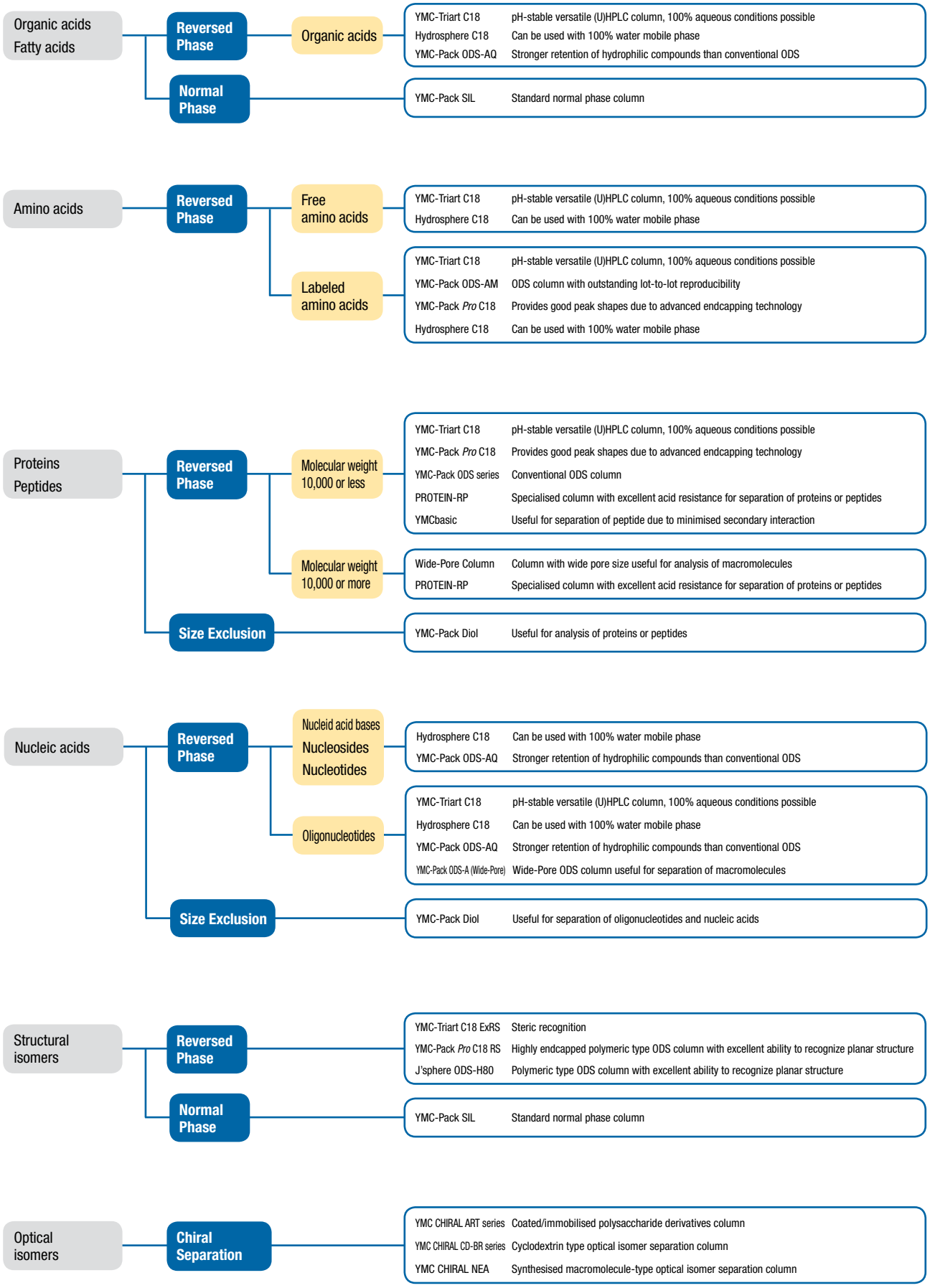
X = immiscible

	iso-Octane	n-Hexane	n-Heptane	di-Ethyl ether	Cyclohexane	Ethyl acetate	Toluene	Chloroform	Tetrahydrofuran	Benzene	Acetone	Dichloromethane	Dioxane	n-Propanol	Ethanol	Dimethylformamide	Acetonitrile	Acetic acid	Dimethyl sulfoxide	Methanol	Water
iso-Octane																					
n-Hexane	✔																				
n-Heptane	✔	✔																			
di-Ethyl ether	✔	✔	✔																		
Cyclohexane	✔	✔	✔	✔																	
Ethyl acetate	✔	✔	✔	✔	✔																
Toluene	✔	✔	✔	✔	✔	✔															
Chloroform	✔	✔	✔	✔	✔	✔	✔														
Tetrahydrofuran	✔	✔	✔	✔	✔	✔	✔	✔													
Benzene	✔	✔	✔	✔	✔	✔	✔	✔	✔												
Acetone	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔											
Dichloromethane	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔										
Dioxane	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔									
n-Propanol	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔								
Ethanol	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔							
Dimethylformamide	X	X	X	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔						
Acetonitrile	X	X	X	✔	X	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔					
Acetic acid	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔				
Dimethyl sulfoxide	X	X	X	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔			
Methanol	X	X	X	✔	X	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔		
Water	X	X	X	X	X	X	X	X	✔	X	✔	X	✔	✔	✔	✔	✔	✔	✔	✔	

Column Selection Guide



Column Selection Guide



YMC Recommended Phase Alternatives by Manufacturer

Column	YMC Alternative	YMC Recommended Alternative
PHENOMENEX		
Aeris PEPTIDE XB-C18	Meteoric Core C18	Meteoric Core C18
Aeris WIDEPORE C4	—	YMC-Pack Protein-RP
Aeris WIDEPORE XB-C18	—	Meteoric Core C18 BIO
Aeris WIDEPORE XB-C8	—	YMC-Pack C8
Clarity Oligo-MS	Meteoric Core C18	Meteoric Core C18
Clarity Oligo-RP	YMC-Triart C18	YMC-Triart C18
Clarity Oligo-SAX	—	YMC-BioPro QA
Clarity Oligo-XT	Meteoric Core C18	Meteoric Core C18
Gemini C18	YMC-Triart C18	YMC-Triart C18
Gemini C6-Phenyl	YMC-Triart Phenyl	YMC-Triart Phenyl
Gemini NX-C18	YMC-Triart C18	YMC-Triart C18
Kinetex C18	Meteoric Core C18	Meteoric Core C18
Kinetex C8	Meteoric Core C8	Meteoric Core C8
Kinetex EVO C18	—	Meteoric Core C18
Kinetex HILIC	—	YMC-Triart Diol-HILIC
Kinetex PFP	—	YMC-Triart PFP
Kinetex Phenyl-Hexyl	—	YMC-Triart Phenyl
Kinetex XB C18	—	Meteoric Core C18
Luna C18	YMC-Pack Pro C18	YMC-Triart C18
Luna C18(2)	YMC-Pack Pro C18	YMC-Triart C18
Luna C8	YMC-Pack Pro C8	YMC-Triart C8
Luna C8(2)	YMC-Pack Pro C8	YMC-Triart C8
Luna CN	YMC-Pack CN	YMC-Pack CN
Luna HILIC	YMC-Pack Diol	YMC-Triart Diol-HILIC
Luna NH_2	YMC-Pack NH_2 (Amino)	YMC-Pack NH_2 (Amino)
Luna Omega C18	YMC-Triart C18	YMC-Triart C18
Luna Omega Polar C18	—	YMC-Triart C18
Luna Omega PS C18	—	YMC-Triart C18
Luna PFP (2)	YMC-Triart PFP	YMC-Triart PFP
Luna Phenyl-Hexyl	—	YMC-Triart Phenyl
Luna SCX	—	YMC-BioPro SP
Luna Silica (2)	YMC-Pack SIL	YMC-Pack SIL
Lux Amylose-1	CHIRAL ART Amylose-C	CHIRAl ART Amylose-C
Lux Cellulose-1	CHIRAL ART Cellulose-C	CHIRAL ART Cellulose-C
Lux i-Cellulose-5	CHIRAL ART Cellulose-SC	CHIRAL ART Cellulose-SC
Phenogel 100A	—	YMC-Pack Diol-120
Synergi Fusion-RP	—	YMC-Triart C18
Synergi Hydro-RP	YMC-Pack ODS-AQ	YMC-Triart C18
Yarra SEC-2000	—	YMC-Pack Diol-120
Yarra SEC-3000	YMC-Pack Diol-300	YMC-Pack Diol-300
WATERS		
ACQUITY UPLC CSH C18	—	YMC-Triart C18
ACQUITY UPLC CSH Fluoro-Phenyl	—	YMC-Triart PFP
ACQUITY UPLC CSH Phenyl-Hexyl	—	YMC-Triart Phenyl
ACQUITY UPLC HSS-T3	—	YMC-Triart C18
ACQUITY UPLC-BEH Amide	—	YMC-Triart Diol-HILIC

Column	YMC Alternative	YMC Recommended Alternative
WATERS *(continued)*		
ACQUITY UPLC-BEH-C18	YMC-Triart C18	YMC-Triart C18
ACQUITY UPLC-BEH-C8	YMC-Triart C8	YMC-Triart C8
ACQUITY UPLC-BEH-HILIC	—	YMC-Triart Diol-HILIC
ACQUITY UPLC-BEH-Phenyl	YMC-Triart Phenyl	YMC-Triart Phenyl
ACQUITY UPLC-BEH-Shield-RP-18	—	YMC-Triart C18
ACQUITY UPLC-HSS C18	—	YMC-Triart C18
CORTECS C18	Meteoric Core C18	YMC-Triart C18
CORTECS C18+	—	Meteoric Core C18
CORTECS C8	Meteoric Core C8	YMC-Triart C8
CORTECS HILIC	—	YMC-Triart Diol-HILIC
CORTECS Phenyl	—	YMC-Triart Phenyl
SunFire C18	YMC-Pack Pro C18	YMC-Triart C18
SunFire C8	YMC-Pack Pro C8	YMC-Triart C8
SunFire Silika	YMC-Pack SIL	YMC-Pack SIL
Symmetry C18	YMC-Pack Pro C18	YMC-Triart C18
Symmetry C8	YMC-Pack Pro C8	YMC-Triart C8
Symmetry300 C18	YMC-Pack ODS-A, 300 A	YMC-Pack ODS-A, 300 A
Symmetry300 C4	YMC-Pack C4, 300 A	YMC-Pack C4, 300 A
SymmetryShield RP18	—	YMC-Triart C18
SymmetryShield RP8	—	YMC-Triart C8
XBridge BEH C18	YMC-Triart C18	YMC-Triart C18
XBridge BEH C8	YMC-Triart C8	YMC-Triart C8
XBridge BEH HILIC	—	YMC-Triart Diol-HILIC
XBridge BEH Phenyl	YMC-Triart Phenyl	YMC-Triart Phenyl
XTerra MS C18	YMC-Triart C18	YMC-Triart C18
XTerra MS C8	YMC-Triart C8	YMC-Triart C8
XTerra Phenyl	YMC-Triart Phenyl	YMC-Triart Phenyl
XTerra RP18	YMC-Triart C18	YMC-Triart C18
XTerra RP8	YMC-Triart C8	YMC-Triart C8
AGILENT		
Polaris Amide-C18	—	YMC-Triart C18
Polaris C18-A	YMC-Pack ODS-A	YMC-Triart C18
Polaris C18-Ether	—	YMC-Triart C18
Polaris C8-A	—	YMC-Triart C8
Polaris C8-Ether	—	YMC-Triart C8
Polaris NH_2	YMC-Pack NH_2	YMC-Pack NH_2
Polaris Si-A	YMC-Pack SIL	YMC-Pack SIL
Poroshell 120 Bonus-RP	—	Meteoric Core C18
Poroshell 120 EC-C18	Meteoric Core C18	Meteoric Core C18
Poroshell 120 EC-C8	Meteoric Core C8	Meteoric Core C8
Poroshell 120 HILIC	—	YMC-Triart Diol-HILIC
Poroshell 120 PFP	—	YMC-Triart PFP
Poroshell 120 Phenyl-Hexyl	—	YMC-Triart Phenyl
Poroshell 120 StableBond SB-C18	—	YMC-Pack ODS-AL
Poroshell HPH-C18	—	Meteoric Core C18

YMC Recommended Phase Alternatives by Manufacturer

Column	YMC Alternative	YMC Recommended Alternative
AGILENT *(continued)*		
Poroshell HPH-C8	—	Meteoric Core C8
Pursuit C18	YMC-Pack ODS-A	YMC-Triart C18
Pursuit C8	YMC-Pack Octyl	YMC-Triart C8
Pursuit Diphenyl	—	YMC-Triart Phenyl
Pursuit PAH	YMC PAH	YMC PAH
Pursuit PFP	—	YMC-Triart PFP
ZORBAX Eclipse PAH	YMC PAH	YMC PAH
ZORBAX Eclipse Phenyl-Hexyl	—	YMC-Triart Phenyl
ZORBAX Eclipse Plus C18	YMC-Pack Pro C18	YMC-Triart C18
ZORBAX Eclipse Plus C8	YMC-Pack Pro C8	YMC-Triart C8
ZORBAX Eclipse XDB-C18	YMC-Pack Pro C18	YMC-Triart C18
ZORBAX Eclipse XDB-C8	YMC-Pack Pro C8	YMC-Triart C8
ZORBAX Eclipse XDB-CN	YMC-Pack CN	YMC-Pack CN
ZORBAX Eclipse XDB-Phenyl	YMC-Pack Ph	YMC-Triart Phenyl
ZORBAX Extend C18	—	YMC-Triart C18
ZORBAX HILIC Plus	—	YMC-Triart Diol-HILIC
ZORBAX StableBond SB-Aq	—	YMC-Pack ODS-AQ
ZORBAX StableBond SB-C18	—	YMC-Pack ODS-AL
ZORBAX StableBond SB-C8	—	YMC-Triart C8
ZORBAX StableBond SB-CN	—	YMC-Pack CN
ZORBAX StableBond SB-Phenyl	—	YMC-Triart Phenyl
SIGMA-ALDRICH + MERCK MILLIPORE		
Amino apHera	—	YMC-Pack Polyamine II
Ascentis C18	—	YMC-Triart C18
Ascentis C8	—	YMC-Triart C8
Ascentis ES-Cyano	—	YMC-Pack CN
Ascentis Express C18	Meteoric Core C18	Meteoric Core C18
Ascentis Express C8	Meteoric Core C8	Meteoric Core C8
Ascentis Express ES-Cyano	—	YMC-Pack CN
Ascentis Express F5	—	YMC-Triart PFP
Astec CYCLOBOND I 2000	—	YMC CHIRAL CD BR
Discovery BIOWide Pore C18	YMC-Pack ODS-A	YMC-Pack ODS-A
Discovery C18	YMC-Pack ODS-A	YMC-Triart C18
Discovery HS C18	YMC-Pack ODS-A	YMC-Triart C18
Discovery HS F5	—	YMC-Triart PFP
LiChrosorb RP-18	YMC-Pack Pro C18	YMC-Triart C18
LiChrosorb RP-8	YMC-Pack Pro C8	YMC-Triart C8
LiChrosorb Si 100	YMC-Pack SIL	YMC-Pack SIL
LiChrospher 100 CN	YMC-Pack CN	YMC-Pack CN
LiChrospher 100 Diol	YMC-Pack Diol	YMC-Triart Diol-HILIC
LiChrospher 100 NH_2	YMC-Pack NH_2	YMC-Pack NH_2
LiChrospher 100 RP-18	YMC-Pack ODS-AL	YMC-Triart C18

Column	YMC Alternative	YMC Recommended Alternative
SIGMA-ALDRICH + MERCK MILLIPORE *(continued)*		
LiChrospher 100 RP-18 endcapped	YMC-Pack Pro C18	YMC-Triart C18
LiChrospher 100 RP-8	—	YMC-Pack Pro C8
LiChrospher 100 RP-8 endcapped	YMC-Pack Pro C8	YMC-Triart C8
LiChrospher Si 100	YMC-Pack SIL	YMC-Pack SIL
LiChrospher Si 60	YMC-Pack SIL, 60 A	YMC-Pack SIL, 60 A
Purospher RP-18	YMC-Pack Pro C18 RS	YMC-Triart C18 ExRS
Purospher RP-18 endcapped	YMC-Pack Pro C18 RS	YMC-Triart C18 ExRS
Purospher RP-18 HC	—	YMC-Pack ODS-AL
Purospher STAR NH_2	YMC-Pack NH_2	YMC-Pack NH_2
Purospher STAR RP-18 endcapped	YMC-Pack ODS-AQ	YMC-Triart C18
Purospher STAR RP-18 endcapped UHPLC	—	YMC-Triart C18
Purospher STAR RP-8 encapped	YMC-Pack Pro C8	YMC-Triart C8
Purospher STAR Si	YMC-Pack SIL	YMC-Pack SIL
Superspher 100 RP-18	YMC-Pack Pro C18	YMC-Triart C18
Superspher 100 RP-18 encapped	YMC-Pack Pro C18	YMC-Triart C18
Superspher Si 60	YMC-Pack SIL	YMC-Pack SIL
Titan C18 UHPLC	YMC-Triart C18	YMC-Triart C18
THERMO FISHER SCIENTIFIC		
Accucore 150 C18	Meteoric Core C18 BIO	Meteoric Core C18 BIO
Accucore C18	Meteoric Core C18	Meteoric Core C18
Accucore C30	—	YMC Carotenoid
Accucore C8	Meteoric Core C8	Meteoric Core C8
Accucore HILIC	—	YMC-Triart Diol-HILIC
Accucore PFP	—	YMC-Triart PFP
Accucore Phenyl-Hexyl	—	YMC-Triart Phenyl
Accucore Polar Premium	—	Meteoric Core C18 BIO
Accucore RP-MS	Meteoric Core C18	Meteoric Core C18
Hypersil GOLD Amino	—	YMC-Pack NH_2
Hypersil GOLD aQ	YMC-Pack ODS-AQ	YMC-Triart C18
Hypersil GOLD C18	YMC-Pack Pro C18	YMC-Triart C18
Hypersil GOLD C4	YMC-Pack C4	YMC-Pack Pro C4
Hypersil GOLD C8	YMC-Pack Pro C8	YMC-Triart C8
Hypersil GOLD Cyano	YMC-Pack CN	YMC-Pack CN
Hypersil GOLD PFP	—	YMC-Triart PFP
Hypersil GOLD Phenyl	—	YMC-Triart Phenyl
Hypersil GOLD SAX	—	YMC-BioPro QA
Hypersil GOLD Silica	YMC-Pack SIL	YMC-Pack SIL
Syncronis Amino	YMC-Pack Amino	YMC-Pack Amino
Syncronis aQ C18	YMC-Pack ODS-AQ	YMC-Triart C18
Syncronis C18	YMC-Pack Pro C18	YMC-Triart C18
Syncronis C8	YMC-Pack Pro C8	YMC-Triart C8
Syncronis Phenyl	YMC-Pack Ph	YMC-Triart Phenyl
Syncronis Silica	YMC-Pack SIL	YMC-Pack SIL

* Application data by courtesy YMC Co., Ltd.

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"
	$SF = r^2_{ID, prep} / r^2_{ID, anal.}$	$SF = l_{ID, prep} / l_{ID, anal.}$	$SF = (r^2_{ID, prep} / r^2_{ID, anal.}) / (l_{ID, prep} / l_{ID, anal.})$
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:

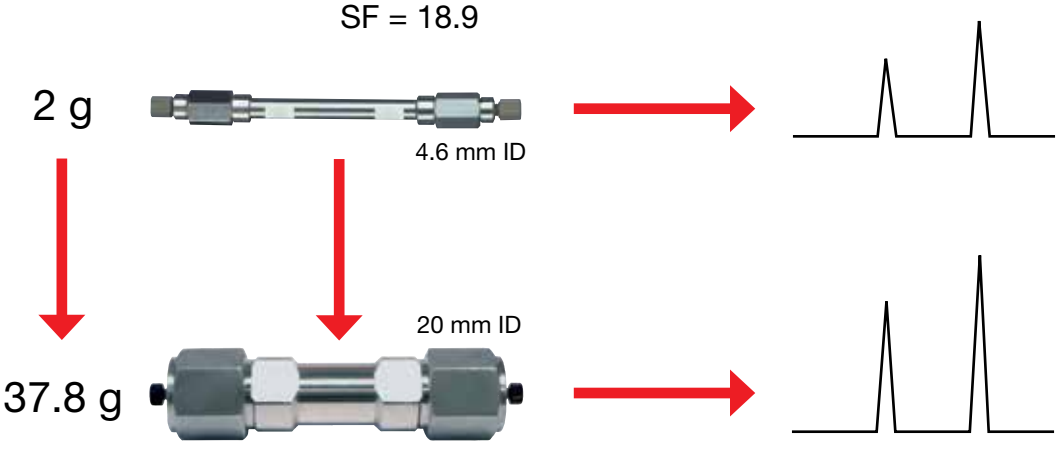
Linear Scale-Up

$$SF = \frac{\Pi^2_{ID, prep}}{\Pi^2_{ID, anal.}} = \frac{m_{prep}}{m_{anal.}}$$

$$SF = r^2_{ID, prep} / r^2_{ID, analytical}$$

$$SF = 20^2_{ID, prep} / 4.6^2_{ID, analytical}$$

$$SF = 18.9$$



Inner diameter → loadability / compound

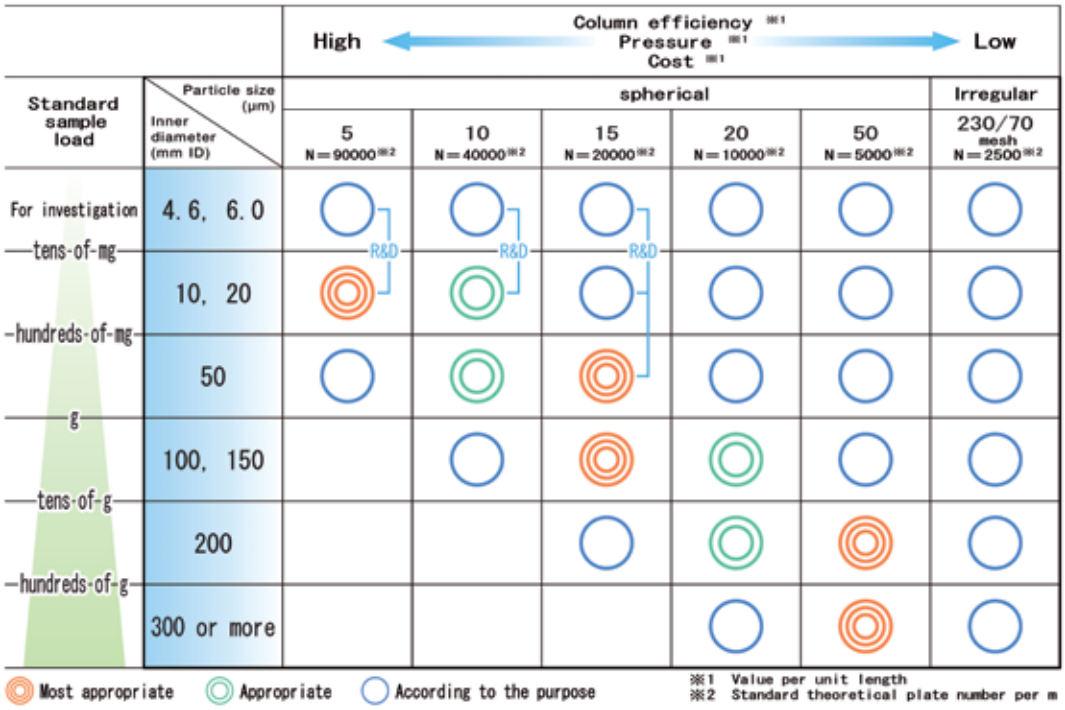
Guideline for Sample Load according to column ID

Column ID (mm)	Scale-Up factor	Loadability (mg)
4.6	1	1-4
10	4.7	5-20
20	18.9	20-80
50	118	80-350
75	266	270-980
100	472	470-1900
150	1060	1000-4200

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”.



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.

* Application data by courtesy YMC Co., Ltd.

Substance Index

To get full access to more than 750 YMC applications please visit our homepage www.ymc.de, where you can easily search for substances, phases etc.

Substance Index

Substance Index

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Ordering Information 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	PTH
YMC-Triart C18	TA	8	08			2.0	02	10	01	0.1	F0	Parker type UHPLC	PT
YMC-Triart C18 ExRS	TAR	12	12			2.7	Q7	20	02	0.3	H0	Parker type metal-free	PTP
YMC-Pack *Pro* C18	AS	16	16			3.0	03	30	03	0.5	J0	Quick Seal	QT
YMC-Pack *Pro* C18 RS	RS	20	20			4.0	04	33	H3	1.0	01	Quick Seal cartridge	QC
Hydrosphere C18	HS	30	30			5.0	05	50	05	2.0	02	Biocompatible PEEK	WP
Meteoric Core C18	CAS	100	A0			6.0	06	75	L5	2.1	Q1	Waters type	WT
Meteoric Core C18 BIO	CAW	proprietary	99			10	11	100	10	3.0	03	Analytical guard cartridges	GC
YMC-Pack ODS-A	AA	non-porous	00			15	16	125	R5	4.0	04	Capillary 1/16” fittings	AU
YMC-Pack ODS-AM	AM					20	21	150	15	4.6	46	Capillary 1/32” fittings	RU
YMC-Pack ODS-AQ	AQ					30	30	250	25	6.0	06	Actus semi prep. 20/30 mm ID	WX
J’sphere ODS-H80	JH					50	50	300	30	8.0	08	Actus semi prep. 50 mm ID	DX
J’sphere ODS-M80	JM					60	60	500	50	10	10	Semi prep./UHPLC guard cartridges	CC
J’sphere ODS-L80	JL					75	75			20	20	Semi prep. guard	WTG
YMC-Pack ODS-AL	AL									30	30	Alcyon SFC	WTS
YMC-Pack PAH	YP									50	53		
YMC-Pack PolymerC18	PC												
YMC-Triart C8	TO												
YMC-Pack *Pro* C8	OS												
Meteoric Core C8	COS												
YMC-Pack C8 (Octyl)	OC												
YMCbasic	BA												
YMC-Triart Phenyl	TPH												
YMC-Pack Ph (Phenyl)	PH												
YMC-Triart PFP	TPF												
YMC-Pack *Pro* C4	BS												
YMC-Pack C4 (Butyl)	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)

Ordering Information 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	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			2.7	Q7	20	02	0.3	H0	Parker type metal-free	PTP
YMC-Pack CN (Cyano)	CN	16	16			3.0	03	30	03	0.5	J0	Quick Seal	QT
YMC-Triart Diol-HILIC	TDH	20	20			4.0	04	33	H3	1.0	01	Quick Seal cartridge	QC
YMC-Triart Diol (SFC)	TDL	30	30			5.0	05	50	05	2.0	02	Biocompatible PEEK	WP
YMC-Pack Diol NP	DN	100	A0			6.0	06	75	L5	2.1	Q1	Waters type	WT
YMC-Pack SIL (Silica)	SL	proprietary	99			10	11	100	10	3.0	03	Analytical guard cartridges	GC
CHIRAL ART Amylose-C	KAN	non-porous	00			15	16	125	R5	4.0	04	Capillary 1/16” fittings	AU
CHIRAL ART Cellulose-C	KCN					20	21	150	15	4.6	46	Capillary 1/32” fittings	RU
CHIRAL ART Amylose-SA	KSA					30	30	250	25	6.0	06	Actus semi prep. 20/30 mm ID	WX
CHIRAL ART Cellulose-SB	KSB					50	50	300	30	8.0	08	Actus semi prep. 50 mm ID	DX
CHIRAL ART Cellulose-SC	KSC					60	60	500	50	10	10	Semi prep./UHPLC guard cartridges	CC
YMC Chiral NEA (R) (NP)	CR					75	75			20	20	Semi prep. guard	WTG
YMC Chiral NEA (S) (NP)	CS									30	30	Alcyon SFC	WTS
YMC Chiral NEA (R) (RP)	NR									50	53		
YMC Chiral NEA (S) (RP)	NS												
YMC Chiral CD BR α	DA												
YMC Chiral CD BR β	DB												
YMC Chiral CD BR γ	DG												
YMC-Pack Diol (SEC)	DL												
YMC-BioPro QA	QA												
YMC-BioPro SP	SP												
YMC-BioPro QA-F	QF												
YMC-BioPro SP-F	SF												

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)

Please note that combinations of features cannot be selected at random, but only from the possible specifications for a chosen stationary phase. These can be determined from the individual product sections in this catalogue or from our homepage www.ymc.de.

For more details

contact your local distributor or

YMC Europe GmbH, Schöttmannshof 19, D-46539 Dinslaken, Phone: +49 (0) 2064 / 427-0,
Fax +49 (0) 2064 / 427-222, e-mail: info@ymc.de, homepage: www.ymc.de

Analytical stationary phases

		PRODUCT	PHASE (silica-based unless stated)	END-CAPPED	USP CLASS NO.
Reversed Phase	C30	Carotenoid	proprietary polymeric bonding chemistry	—	L62
	C18	Triart C18 ExRS	pH-stable organic/inorganic hybrid particle for steric recognition	yes	L1
		Triart C18	pH-stable organic/inorganic hybrid particle, 100% aqueous conditions possible	yes	L1
		Pro C18	very low residual non-specific interactions	yes	L1
		UltraHT	2 µm *Pro* C18 for fast and ultra fast separations		
		Pro C18 RS	high carbon load with polymeric bonding C18	yes	L1
		Hydrosphere C18	can be used in 100% aqueous eluent	yes	L1
		UltraHT	2 µm Hydrosphere C18 for fast and ultra fast separations		
		Meteoric Core C18	silica based Core-Shell particle	yes	L1
		Meteoric Core C18 BIO	silica based Core-Shell particle	yes	L1
		ODS-A	one of the YMC's international bestsellers	yes	L1
		ODS-AM	high performance C18 column for validated methods operation	yes	L1
		ODS-AQ	"hydrophilic" endcapping, for 100% aqueous eluent systems	yes	L1
		J'sphere ODS	C18-family with differently controlled hydrophobicity for method development	yes	L1
		ODS-AL	traditional C18 for "mixed mode" separations	no	L1
		PolymerC18	polymethacrylate matrix, wide pH applicability	—	—
	C8	Triart C8	pH-stable organic/inorganic hybrid particle	yes	L7
		Pro C8	C8, with very low residual non-specific interactions	yes	L7
		Meteoric Core C8	silica based Core-Shell particle	yes	L7
		C_8 (Octyl)	traditional C8	yes	L7
		YMCbasic	monomeric bonded chains of C8 and smaller	—	L7
		Ph (Phenyl)	monomeric bonded phenyl	yes	L11
		Triart Phenyl	polymeric bonding phenyl butyl, organic/inorganic hybrid particle	yes	L11
		Triart PFP	polymeric bonding PFP propyl, organic/inorganic hybrid particle	no	L43
	C4	*Pro* C4	C4, with very low residual non-specific interactions	yes	L26
		C_4 (Butyl)	traditional C4	yes	L26
		Protein-RP	high stability, good recovery rates	—	L26
		YMC-PAH	proprietary bonding chemistry	—	—
		TMS (C1)	trimethyl silane	—	L13
Normal Phase / HILIC		PVA-SIL	polyvinyl alcohol bonded on silica support	—	L24
		Polyamine II	mixed secondary and tertiary amino derivative	—	—
		NH_2 (Amino)	primary amino derivate	—	L8
		CN (Cyano)	useful for SFC applications, can be used in RP mode	yes	L10
		Triart-Diol HILIC	versatile HILIC phase, organic/inorganic hybrid particle	—	L20
		Diol (DN)	versatile alternative to silica for normal phase separations	—	L20
		SIL (Silica)	ultra high purity, high mechanical stability	—	L3
IEX		BioPro QA / SP	high ion exchange capacity, porous hydrophilic polymer	—	—
		BioPro QA-F / SP-F	high ion exchange capacity, non-porous hydrophilic polymer	—	—
SEC		Diol-60, -120	versatile phase for gel filtration separations	—	L20
		Diol-200, -300			
Chiral		Amylose-C	coated derivative [alternative to CHIRALPAK® AD-H, AD-3]	—	L51
		Cellulose-C	coated derivative [alternative to CHIRALCEL® OD-H, OD-3]	—	L40
		Amylose-SA	immobilised derivative [alternative to CHIRALPAK® IA, IA-3]	—	L99
		Cellulose-SB	immobilised derivative [alternative to CHIRALPAK® IB, IB-3]	—	—
		Cellulose-SC	immobilised derivative [alternative to CHIRALPAK® IC, IC-3]	—	—
		NEA (R)(S)	polymeric 1-naphthylethylamine	—	—
		α-, β-, γ-CD BR	α-, β-, γ-bromo-cyclodextrin	—	—

routinely available from YMC

PARTICLE SIZE (µm spherical)	PORE SIZE (nm)	CARBON LOAD (%C)	pH	TYPICAL APPLICATIONS	Page
3, 5	proprietary	proprietary	2.0-7.5	isomeric carotenes, retinols, steroids, fat-soluble vitamins	284
1.9, 3, 5	8	25	1.0-12.0	stereoisomers and hydrophobic analytes	14
1.9, 3, 5	12	20	1.0-12.0	acidic, neutral, basic compounds, "versatile" stationary phase	14
3, 5	12	16	2.0-8.0	antioxidants, metabolites	122
2					106
3, 5	8	22	1.0-10.0	acidic and basic compounds	128
3, 5	12	12	2.0-8.0	strong polar compounds, water-soluble vitamins	132
2					106
2.7	8	7	1.5-10	basic, coordinating compounds, fast separations	96
2.7	16	5	1.5-10	peptides, proteins, fast separations	96
3, 5	12, 20, 30	17, 12, 7	2.0-7.5	general purpose phase	142
3, 5	12	17	2.0-7.5	purines, phenols, PTC-amino acids, angiotensins, alkaloids	144
3, 5	12, 20	14, 10	2.0-7.5	strong polar compounds	138
4	8	22, 14, 9 (JH, JM, JL)	1.0-9.0 (JH) 2.0-7.5 (JM+JL)	positional isomers, complexing agents, pharmaceuticals	288
5	12	17	2.0-7.5	tocopherols, fat-soluble vitamins, disinfectants	146
6	proprietary	10	2.0-13.0	phenols, anilines, quaternary amines	148
1.9, 3, 5	12	17	1.0-12.0	acidic, neutral, basic and chelating compounds, metabolites, "versatile" stationary phase	14
3, 5	12	10	2.0-7.5	acidic, neutral, basic and chelating compounds, drugs and metabolites	124
2.7	8	5	1.5-9.0	basic, coordinating compounds, fast separations	96
3, 5	12, 20, 30	10, 7, 4	2.0-7.5	proteins and peptides, estrogens, general purpose phase	152
3, 5	20	7	2.0-7.5	basic molecules w/o modifiers, anilines, alkaloids, antidepressants	150
3, 5	12, 30	9, 3	2.0-7.5	phenols, fullerenes, sweeteners	154
1.9, 3, 5	12	17	1.0-10.0	pharmaceuticals, sweeteners	14
1.9, 3, 5	12	15	1.0-8.0	halogenated and polar compounds	14
3, 5	12	7	2.0-7.5	polar acidic, neutral, basic and chelating compounds, polar peptides	126
3, 5	12, 20, 30	7, 5, 3	2.0-7.5	biological separations, polar compounds	156
5	20	4	1.5-7.5	proteins, peptides	214
3, 5	proprietary	proprietary	2.0-8.0	polyaromatic hydrocarbons	286
3, 5	12	4	2.0-7.5	water-soluble vitamins	158,179
5	12	—	2.0-9.5	phospholipids, retinoids, lipids	170
5	12	—	2.0-7.5	malto-oligosaccharides, tocopherols, nucleotides, sugars	176
3, 5	12	—	2.0-7.5	sugars, nucleotides, water-soluble vitamins	178
3, 5	12, 30	7, 3	2.0-7.5	proteins, steroids, catechols	160,172
1.9, 3, 5	12	—	2.0-10.0	small organic molecules, water-soluble vitamins	14
5	6, 12	—	2.0-7.5	small organic molecules, fat-soluble vitamins, tocopherols	174
3, 5	6, 12	—	2.0-7.5	small organic molecules, fat-soluble vitamins, tocopherols	168
5	100	—	2.0-12.0	proteins, peptides, nucleotides	188
3, 5	—	—	2.0-12.0	proteins, peptides, nucleotides	188
3, 5	6, 12	—	5.0-7.5	peptides, proteins, malto-oligosaccharides	200
2, 3, 5	20, 30				
3, 5	proprietary	—	—	chiral compounds in NP, SFC modes	244
3, 5	proprietary	—	—	chiral compounds in NP, SFC modes	244
3, 5	proprietary	—	2.0-9.0	*cis-trans* and geometric isomers in NP, RP, SFC modes	254
3, 5	proprietary	—	2.0-9.0	*cis-trans* and geometric isomers in NP, RP, SFC modes	254
3, 5	proprietary	—	2.0-9.0	*cis-trans* and geometric isomers in NP, RP, SFC modes	254
5	30	—	2.0-6.5	nonpolar to medium polar optical isomers for NP, RP modes	262
5	12	—	3.5-6.5	optical and positional isomers in RP mode	266

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