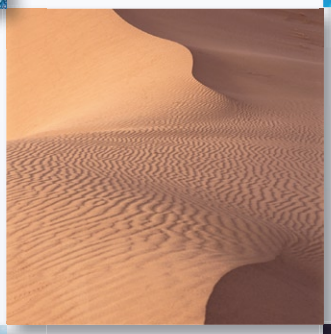
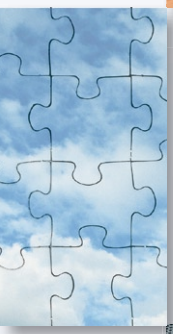
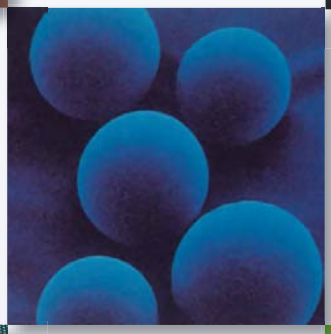
YMC EUROPE GMBH

GENERAL CATALOGUE 2013/2014







UHPLC
HPLC
BIO-LC

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

YMC Co., Ltd.

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Kyoto 600-8106 Japan
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www.ymc.co.jp

YMC Europe GmbH

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D-46539 Dinslaken
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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.

CX - 07, 3rd Floor, Lobe - 1,
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TEL. +91(0)120-4276020 - 25, FAX +91(0)120-4276026
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YMC Korea Co., Ltd.

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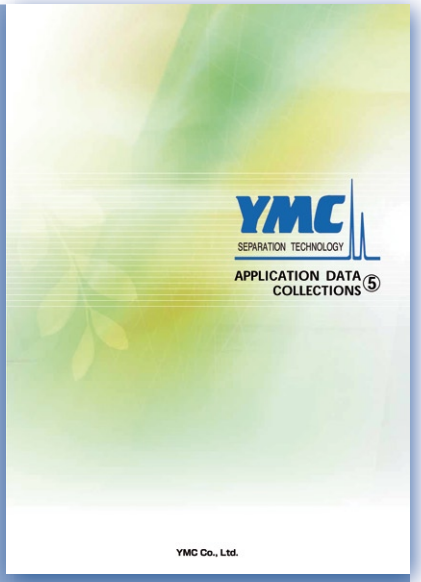
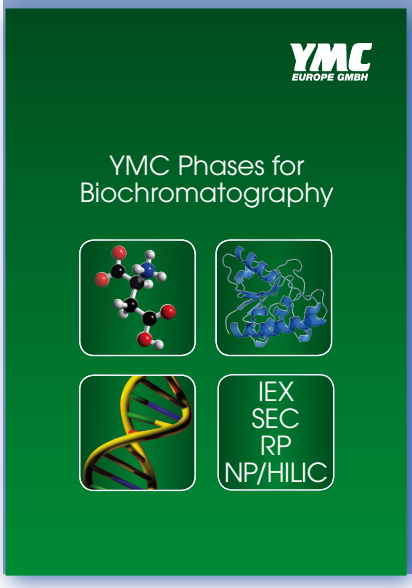
TEL. +886-3-2150-630, FAX +886-3-2150-286
www.ymctaiwan.com

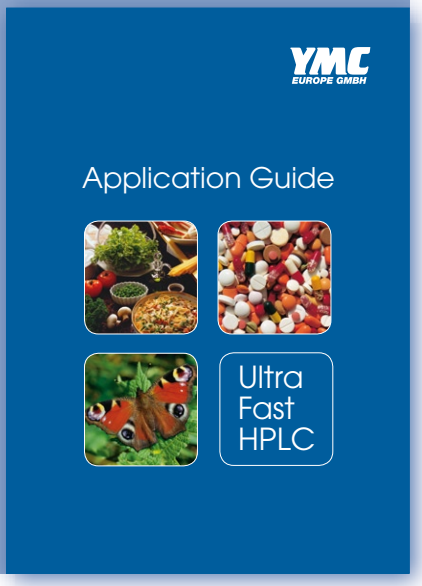
Contents

Available Literature (Selection)

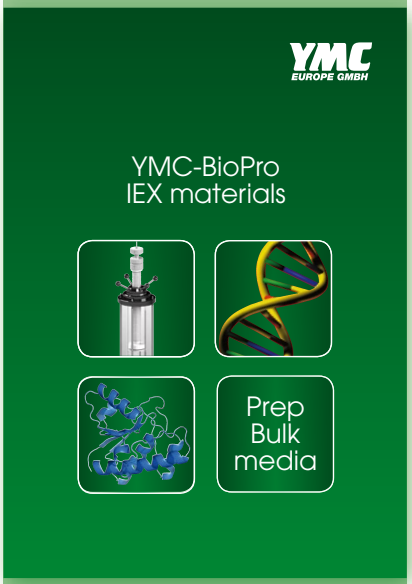
Analytical







Preparative



Also available:

Posters

Product Information

Technical Guide Lines

Manuals

DMF / RSF / CoA

etc.

What's new?

Versatile (U)HPLC-hybrid columns

With YMC-Triart challenging pH-stability and high temperatures are no longer a limitation to your work.

YMC-Triart C18, C8 and HILIC-Diol in their particle sizes of 1.9 µm, 3 µm, 5 µm or 10 µm combined with various column dimensions makes it suitable for any LC-equipment: (U)HPLC, semi-preparative to process scale bulk. Process scale particle sizes are available in multi-ton scale.

page 13

YMC-Actus for fast semi-preparative HPLC high throughput separations

Semi-preparative chromatography is the link between analytical HPLC and preparative LC. Even though the chromatographic systems used for semi-preparative LC do not reach the size of 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!

page 43

YMC-DispoPackAT Flash Cartridges - high quality products for your purification success

By using the new cartridges with 25 µm spherical silica you are able to obtain higher resolution in less than half of the time, compared to classical 40/63 irregular particles.

YMC-DispoPackAT is available in sizes ranging from 12 g to 800 g and in following functional groups: SIL (silica gel), NH_2 (amino), Diol, and ODS (C18).

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Substance Index

In order to facilitate the search for applications, the substance index contains 1091 substances and it will provide reference to the corresponding page in the catalogue or in the "YMC Application Data Collections ⑤", respectively.

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[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 the USA, in India, China, Korea, Taiwan and Europe.

As a mission statement, it 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

Today, YMC has developed beyond their traditional, yet still high performance silica-based materials to produce three new, distinct high technology platforms:

- **a new generation of silica-based materials for process chromatography, YMC HG-series, with enhanced physical and chemical properties**

- **a methacrylate-based, porous and non-porous bead for ion exchange chromatography (IEX) from analytical to process scale with particle sizes from 5 to 75 µm**

- **YMC-Triart, a new hybrid-style organic/inorganic particle, a "global first" which provides a fully scalable series of products from analytical to process scale. Available in up to multi-ton capacity per year and with major benefits regarding mechanical/chemical stability which result in enhanced column lifetime.**

However, it is not only product specification that demonstrates YMC qualities, but also the perceived ethical values of having people willingly contribute competent and consistent performance along with exceptional reliability even for difficult and demanding separations. YMC strive to exceed expectations – day after day, year after year – with worldwide availability 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. The “live experience” by YMC specialists added value aspect to make customers successful in their work: for robust, valid and fast methods in the lab, with high sensitivity, and increased output. YMC training courses 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, Allentown/PA, USA and Dinslaken/Germany: local application laboratories and the Komatsu factory provide method development, optimisation and scale-up as well as custom synthesis and toll manufacturing from milligram to ton scale.

Supply

Extensive local inventory and highly motivated order processing staff ensure speedy product supply to virtually any destination. Individual items are stocked based on statistical consumption or customised as specified by purchasing officers or procurement agreements in place for just-in-time supply. 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.

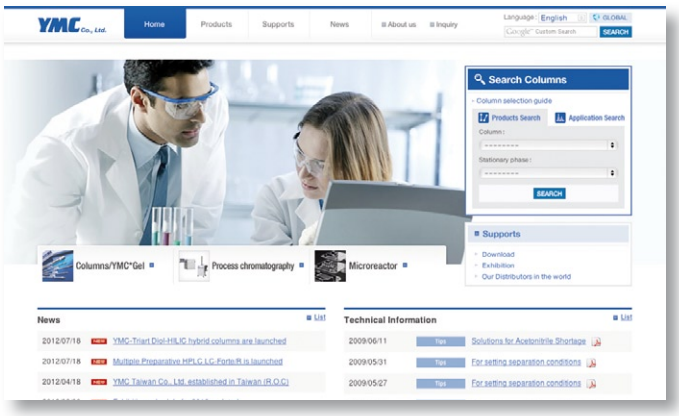
YMC Websites

- **more than 700 pages full of useful information**
- **detailed description of more than 80 stationary phases**
- **extensive applications database**
- **latest news at a glance on the homepage**

Although we have put all our efforts into providing you with the best information on the successful implementation of YMC products for liquid chromatography in this catalogue, printed documents by nature remain unidirectional media compared with lively internet platforms.

www.ymc.co.jp

for Asia



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for the Americas

www.ymc.de

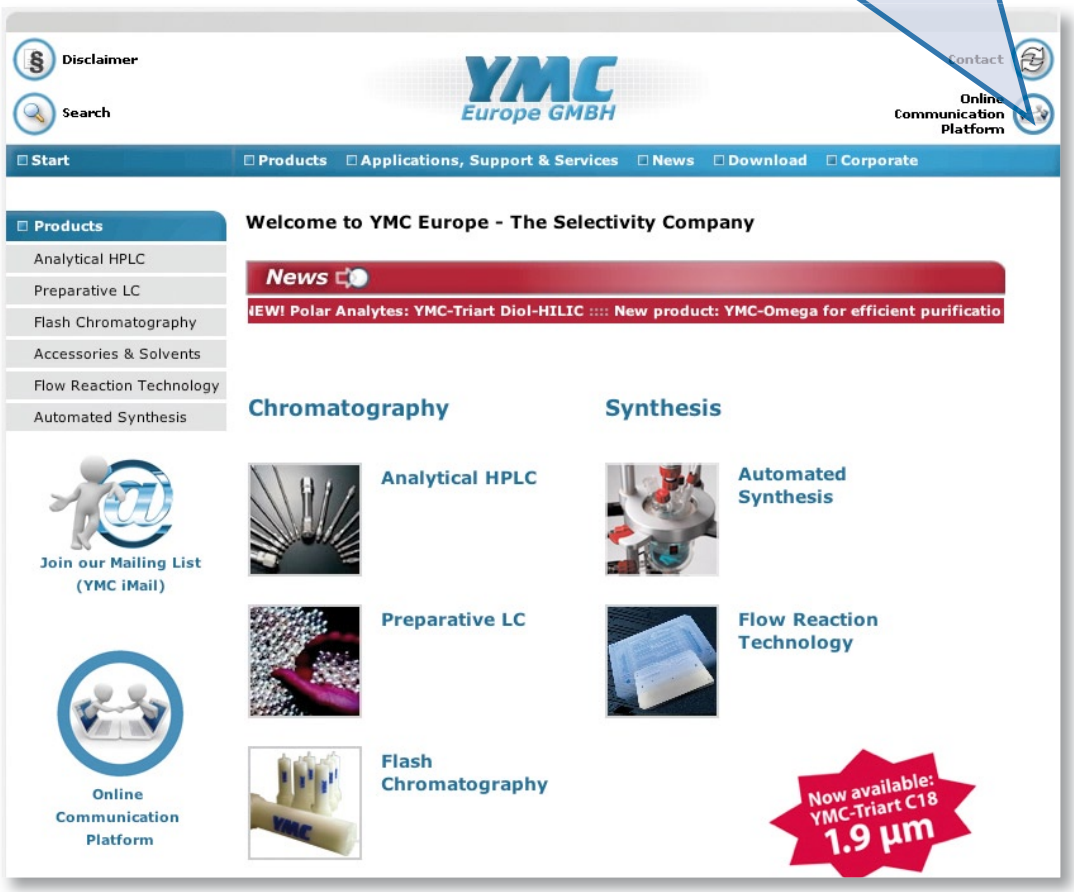
for EMEA Countries

YMC Website “www.ymc.de”

Instead of simply reproducing this catalogue in an internet format, you will find that www.ymc.de incorporates many additional features: updates, various commonly used contact information, downloads, search and useful links, an application database as well as taking the challenge with our new “YMC Online Communication Platform”. OCP will bring you – online – to the desk of an experienced product specialist for your personal, direct access to online support, which can include technical questions, requests for specific application methods or “simple questions” such as local supply facilities or product information. Visit us at www.ymc.de.

“Online Communication Platform - OCP”:

Our online communication platform is a new and unique alternative way to contact YMC Europe in addition to phone or email. You can ask our product specialists for technical support or you can be transferred to our sales administration team if you have a supply question. Try out the next generation of online customer support.



“News”:

Get all the latest information and be up-to-date by choosing www.ymc.de. YMC continuously develops new products to facilitate the routine in laboratories. In addition new brochures, applications and other support can be found at a glance and can be downloaded immediately. You will also be able to read our latest YMC Newsletter or browse in our news archive.

“Contact”:

If you just want to know the “classical” contact information including phone number, email and postal address.

“Download area”:

You will find applications, brochures, publications, support information and much more in pdf-file format in our download area.

Transfer

Scalable particles:
EASY
UHPLC ↔ HPLC

Flexible

YMC-Triart:
pH 1-12
Temperatures
up to 70°C

Universal

YMC-Triart
for acidic, basic and
neutral analytes

YMC-Triart

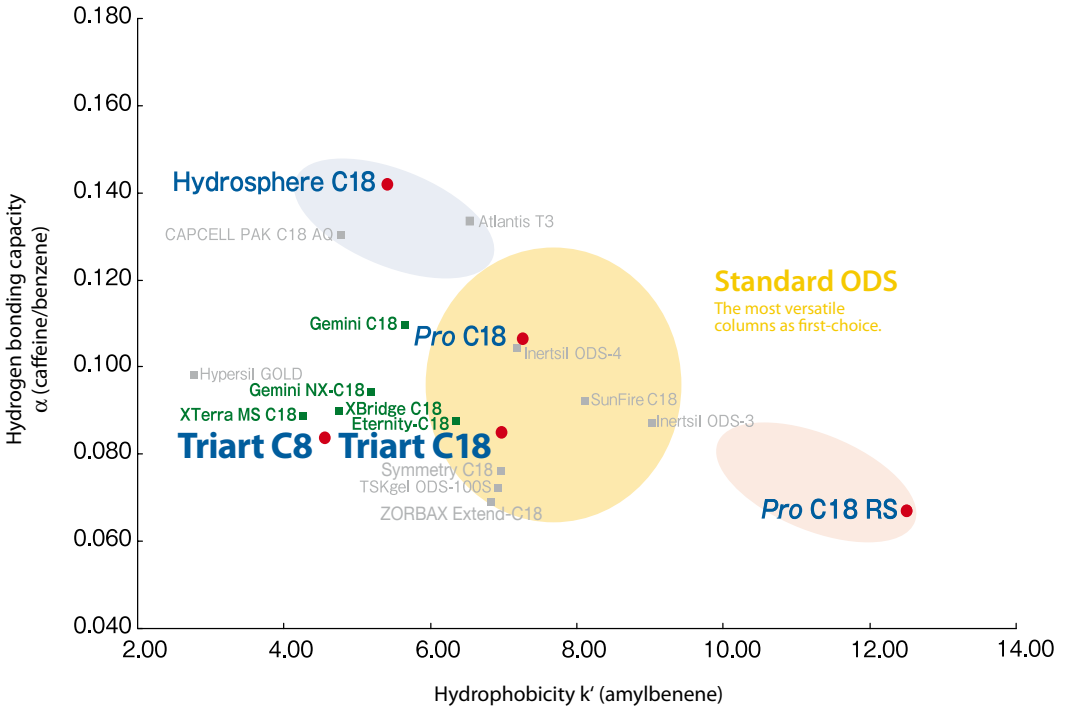
Contents

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 addition narrow, symmetrical peak shapes are necessary in order to cope with rapid analysis of demanding samples. This has required manufacturers to seek more innovative ways to produce suitable stationary phases.

In order to meet these goals, YMC has developed a new particle technology. This is based on a multi-layered particle produced via a tightly controlled granulation technology which has been adapted from micro-reactor technology. The revolutionary production technique provides a multi-layer 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 load-ability.

First choice column for method development



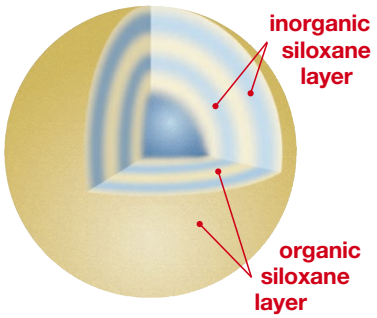
Conventional hybrid silica-based ODS columns tend to be less hydrophobic than silica-based columns. YMC-Triart C18 has a higher carbon load, giving it a hydrophobicity comparable to that of standard ODS columns, thereby making it a "versatile first-choice" column for method development.

Particle technology

YMC-Triart is a multi-layered 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.

YMC-Triart hybrid structure

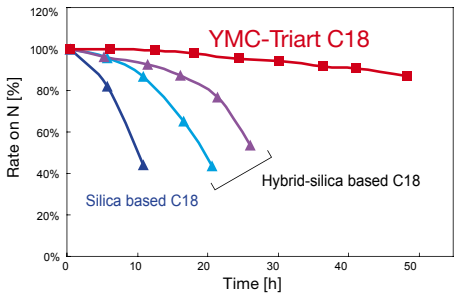


Specification	YMC-Triart C18	YMC-Triart C8	YMC-Triart Diol-HILIC
Base	organic/inorganic silica	organic/inorganic silica	organic/inorganic silica
Stationary phase	C18 (as USP L1)	C8 (as USP L7)	Diol (as USP L20)
Particle size	1.9, 3 and 5 µm	1.9, 3 and 5 µm	1.9, 3 and 5 µm
Pore size	12 nm	12 nm	12 nm
Bonding	polymeric type	polymeric type	—
End-capping	multi-stage endcapping	multi-stage endcapping	—
pH range	1 ~ 12	1 ~ 12	2 ~ 10
Temperature range (upper limit)	pH 1-7: 70 °C, pH 7-12: 50 °C	pH 1-7: 70 °C, pH 7-12: 50 °C	50 °C

pH & temperature

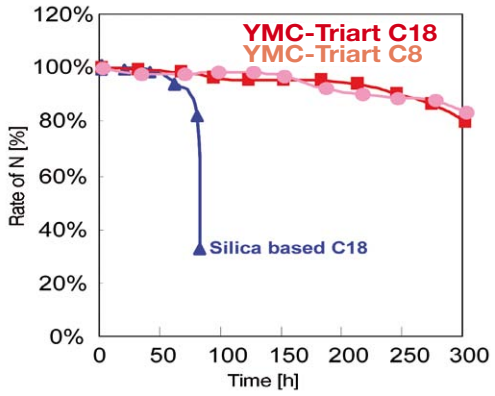
Versatile wide pH stability

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

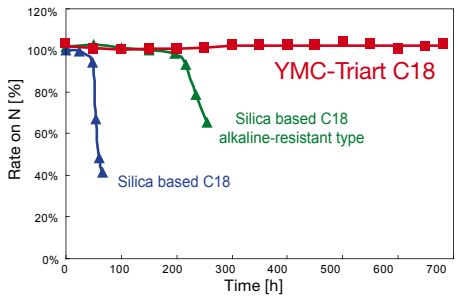
Triethylamine (pH 11.5, 40 °C)*



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

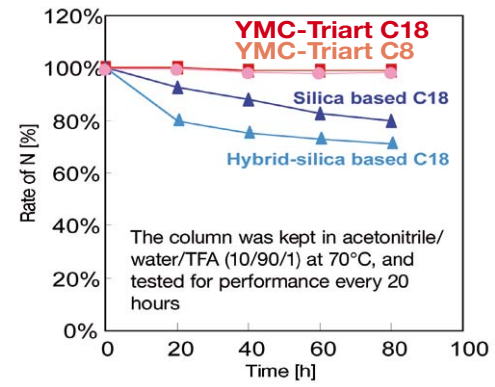
Stability at high temperature

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:	70 °C
Sample:	butyl benzoate

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

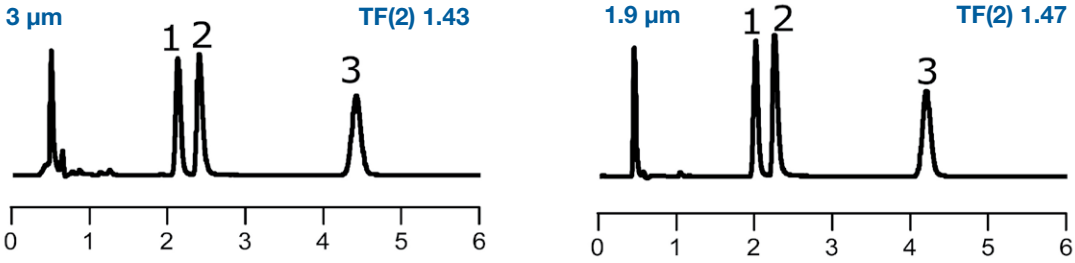
* Application data by courtesy YMC Co., Ltd.

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 manufacture) have been observed.

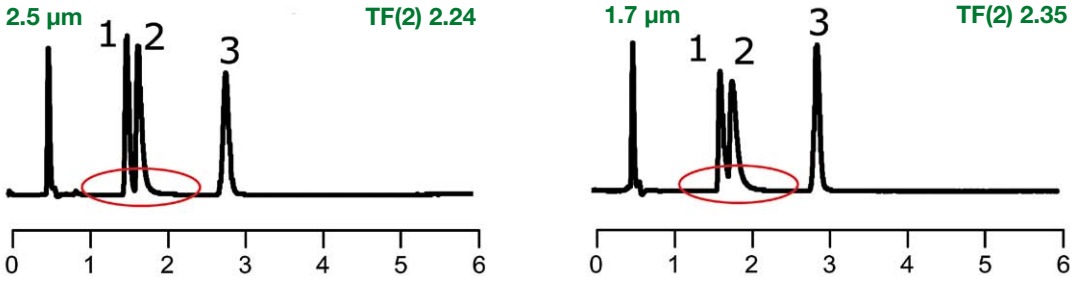
YMC-Triart C18



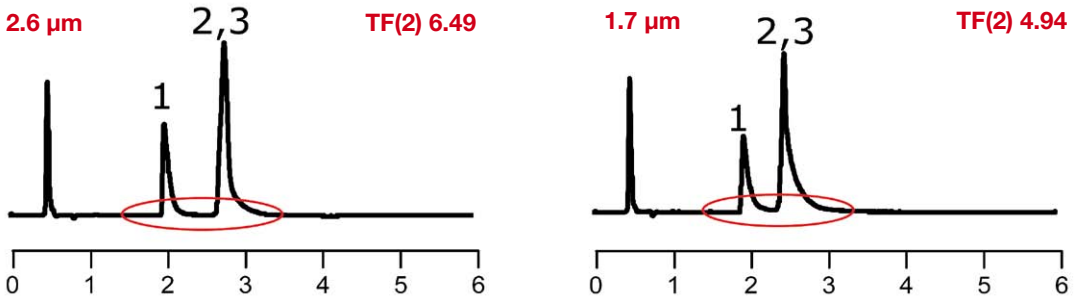
YMC has adressed this issue of method transfer. YMC-Triart columns show identical selectivity and excellent peak shapes for basic compounds for all 3.0 µm to 1.9 µm particle sizes. It allows predictable scale up from UHPLC to conventional HPLC and even to semi-preparative LC, and vice versa.

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.

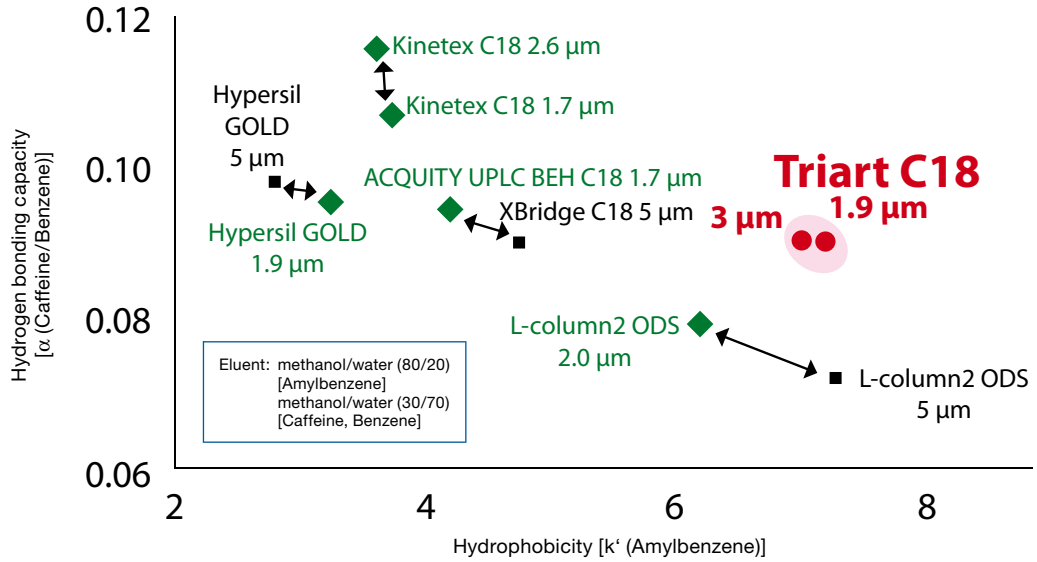
Column:	50 x 2.0 mm ID or 2.1 mm ID
Eluent:	20 mM KH_2PO_4-K_2HPO_4 (pH 6.9) / acetonitrile (65/35)
Temperature:	40 °C
Flow rate:	0.2 ml/min
Detection:	UV at 235 nm

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

** These observations might not be representative for all applications but have been reported in some cases.

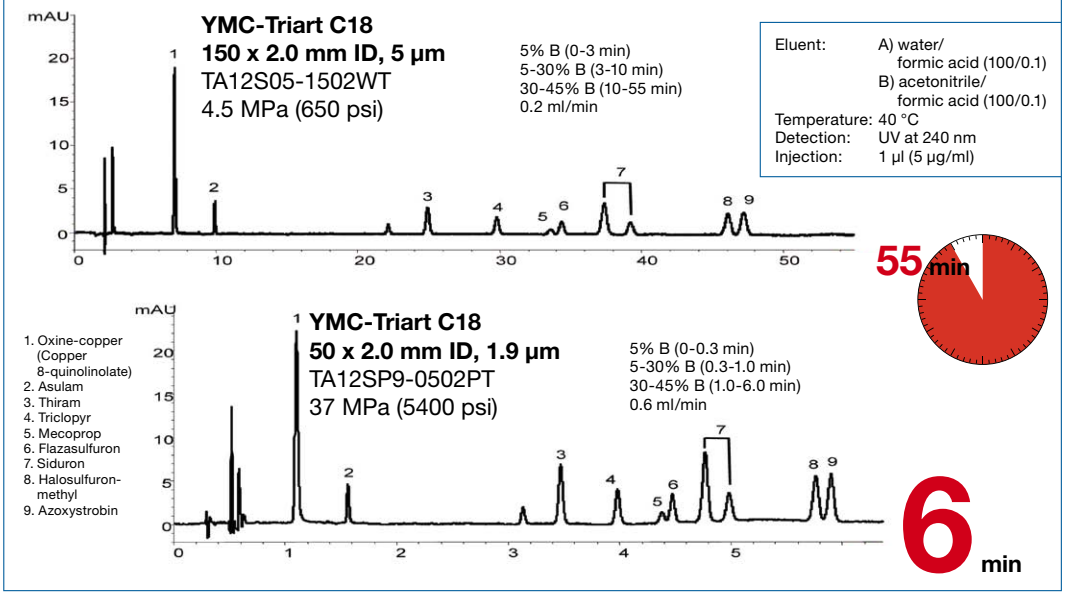
Transfer HPLC ⟷ UHPLC

Evaluation of method transfer performance!*



With the introduction of UHPLC, sub-2-µm particles became neccessary. 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!

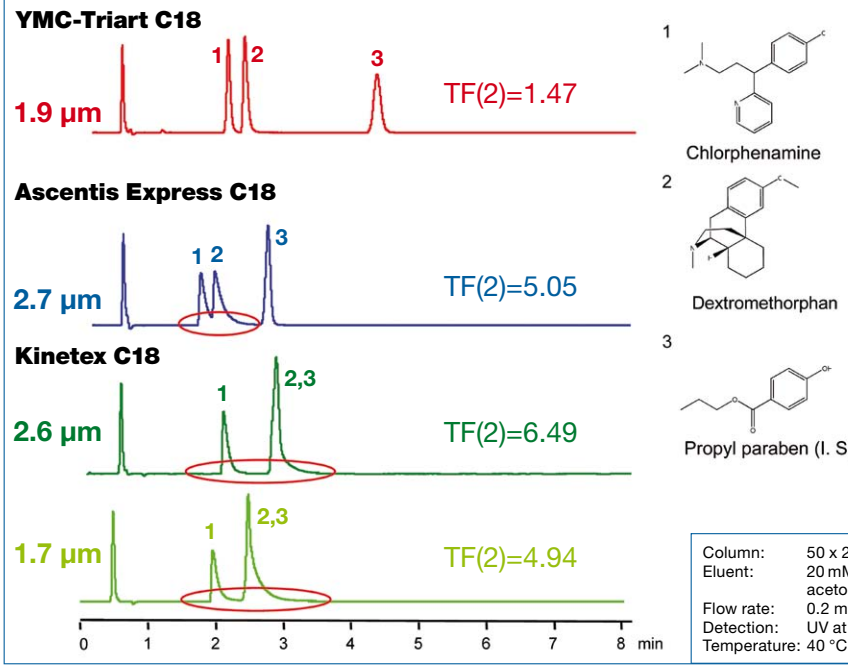
Method transfer between HPLC ⟷ UHPLC*



* Application data by courtesy YMC Co., Ltd.

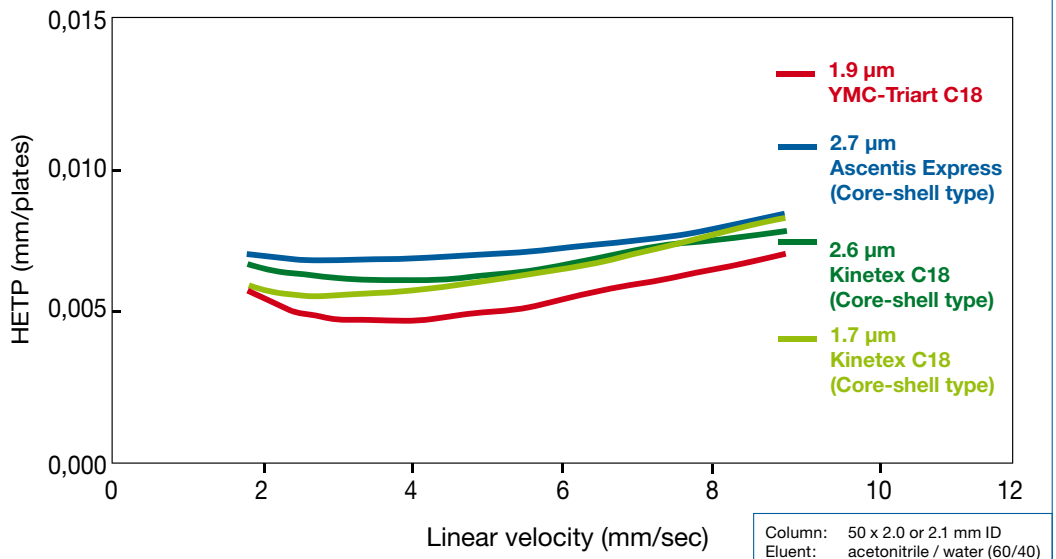
UHPLC

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

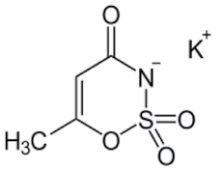
Lower HETP means higher resolution!*



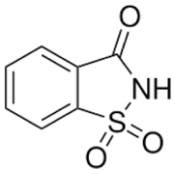
Column:	50 x 2.0 or 2.1 mm ID
Eluent:	acetonitrile / water (60/40)
Detection:	UV at 254 nm
Sample:	Butyl benzoate

UHPLC & MS

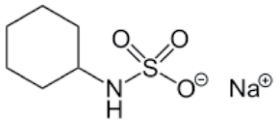
Determination of Artificial Sweeteners with LC-MS/MS



Acesulfam-K

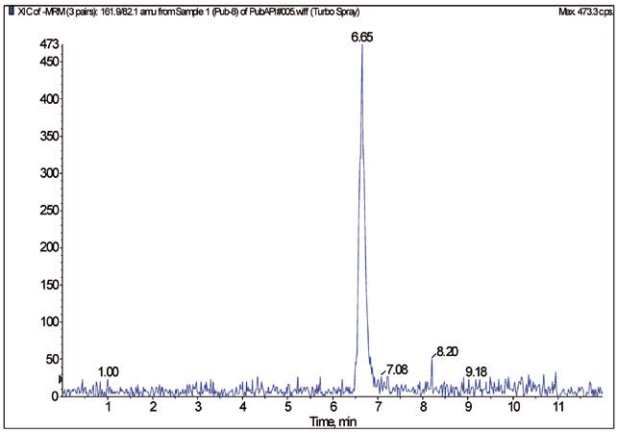


Saccharin

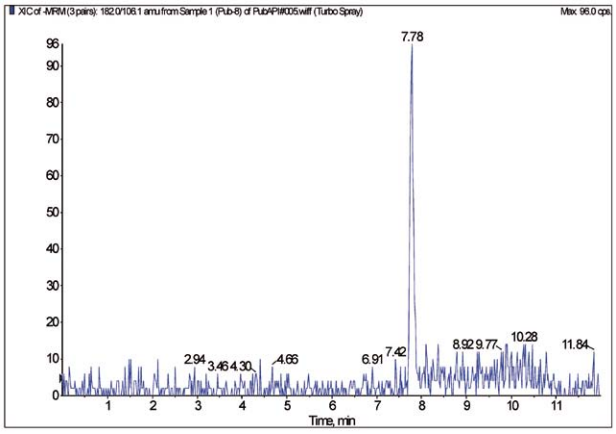


Cyclamat-Na

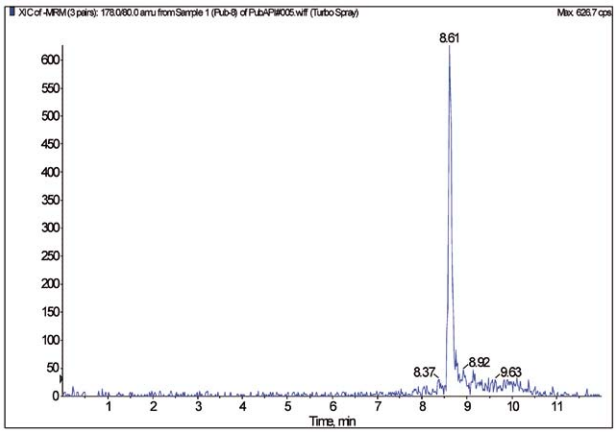
➔ Non-biological markers of wastewater entries in ground and surface water



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



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



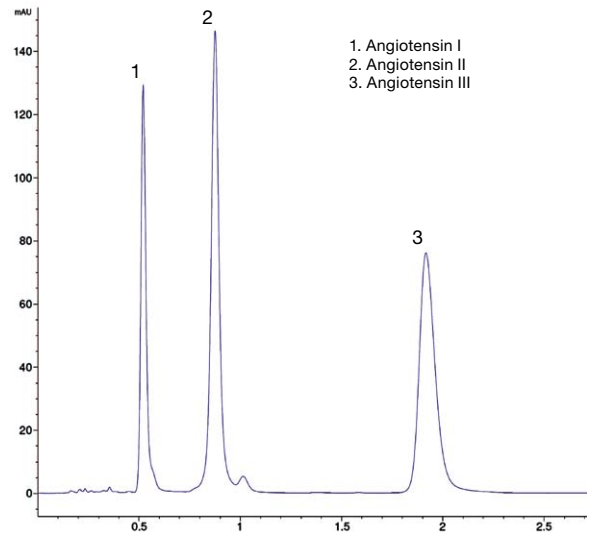
Extracted Ion Chromatogram (XIC) of Cyclamat-Na, 0.1 µg/L

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

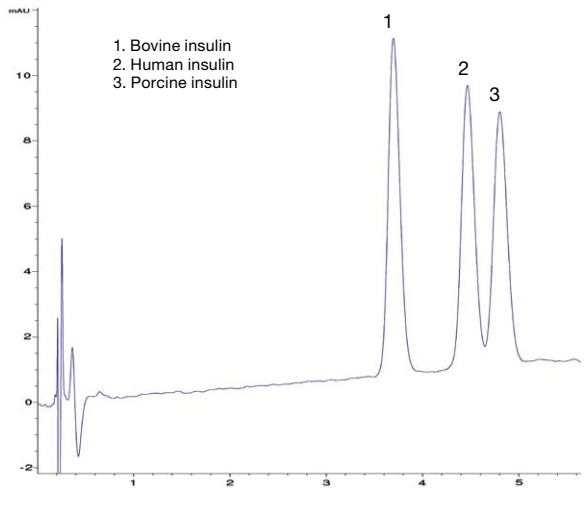
UHPLC

Angiotensin I, II and III*



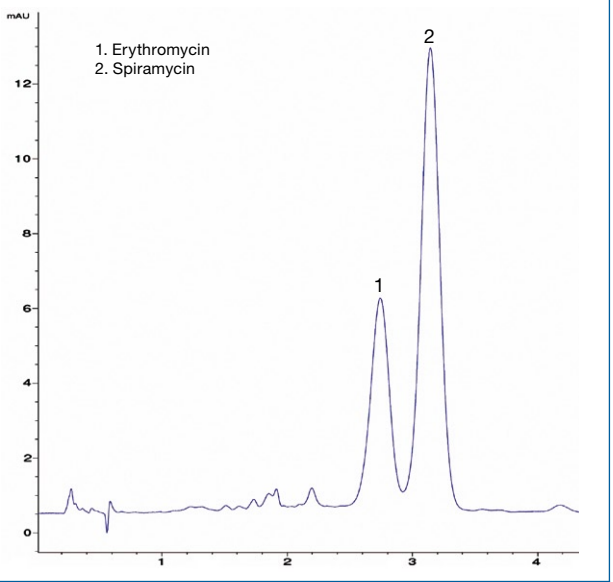
Column:	YMC-Trairt C18, 12 nm, 1.9 µm, 50 x 2.0 mm ID
Part No.:	TA12SP9-0502PT
Eluent:	20 mM KH_2PO_4 + K_2HPO_4 (pH 7.9) / acetonitrile (22/78)
Flow rate:	0.7 ml/min
Detection:	UV at 220 nm
Pressure:	720 bar
Injection:	0.5 µl
Temperature:	40 °C

Insulin*



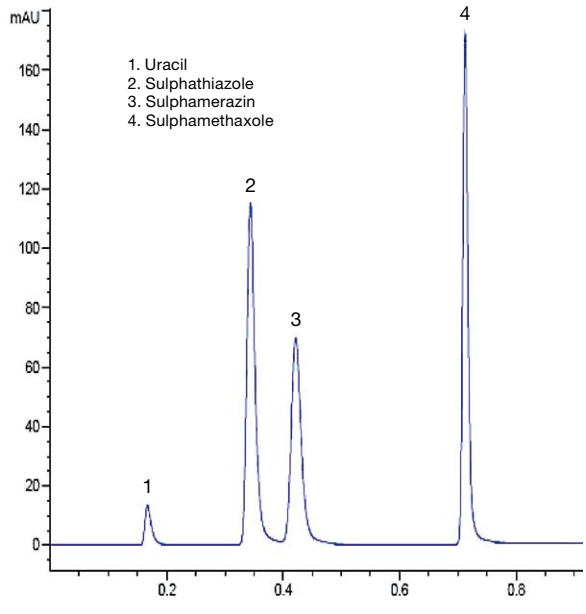
Column:	YMC-Trairt C18, 12 nm, 1.9 µm, 50 x 2.0 mm ID
Part No.:	TA12SP9-0502PT
Eluent:	A) H_2O + 0.1% TFA B) acetonitrile + 0.1% TFA
Gradient:	30% B (0 min); 30-32% B (0-5 min); 32% B (55 min)
Flow rate:	0.6 ml/min
Detection:	UV at 220 nm
Pressure:	611 bar
Injection:	0.5 µl
Temperature:	30 °C

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

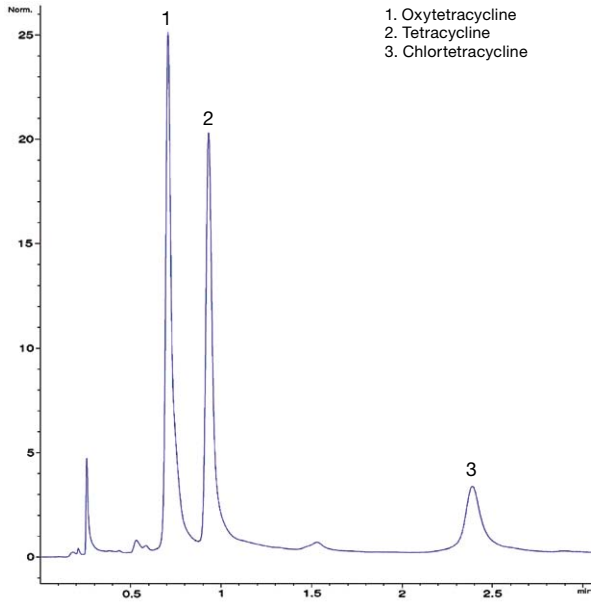
Sulpha drugs*



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

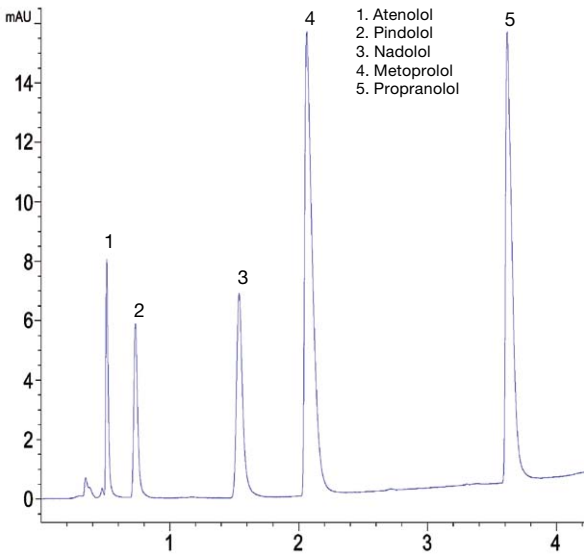
UHPLC

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

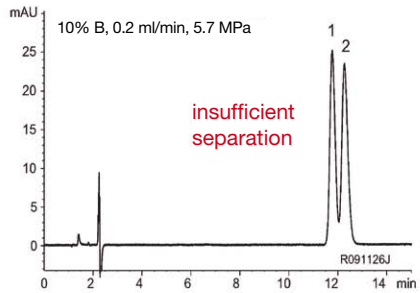
Betablockers*



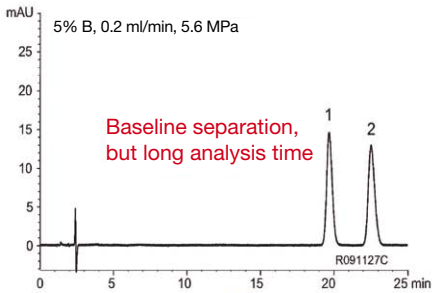
Column:	YMC-Trairt C18, 12 nm, 1.9 µm, 50 x 2.0 mm ID
Part No.:	TA12SP9-0502PT
Eluent:	A) 20 mM CH_3COONH_4 + ammonia (pH 9.0) B) acetonitrile
Gradient:	25% B (1.0 min); 75% B (1-6 min)
Flow rate:	0.35 ml/min
Detection:	UV at 254 nm
Pressure:	450 bar
Injection:	1 µl
Temperature:	40 °C

Fast LC for conventional HPLC*

YMC-Triart C18, 5 µm, 150 x 2.0 mm ID

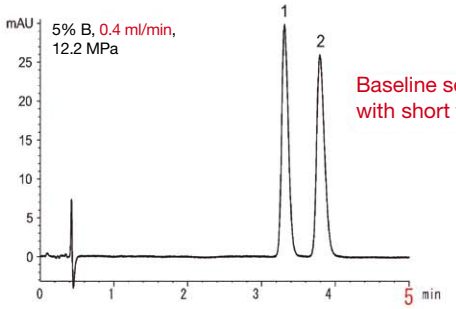


optimisation

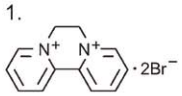


Down scaling

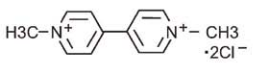
YMC-Triart C18, 3 µm, 50 x 2.0 mm ID



1. Diquat



2. Paraquat



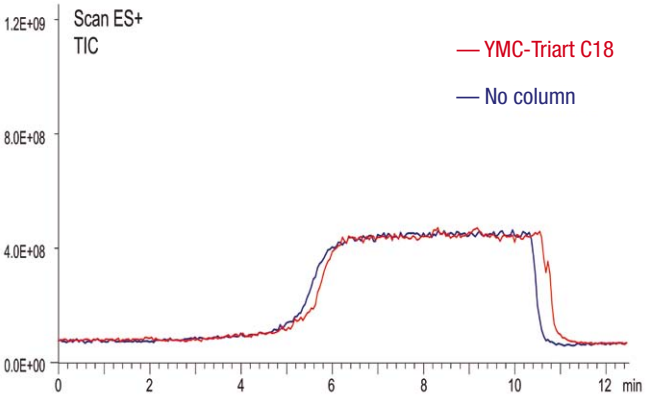
Eluent:	A) water / HFBA* (100/0.1) B) acetonitrile / HFBA* (100/0.1)
Temperature:	37 °C
Detection:	UV at 290 nm
Injection:	1 µl (0.1 mg/ml)

*heptafluorobutyric acid

* Application data by courtesy YMC Co., Ltd.

LC/MS

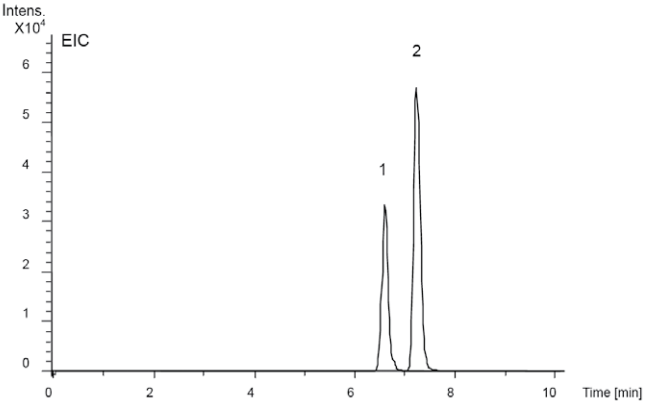
LC/MS compatibility*



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)

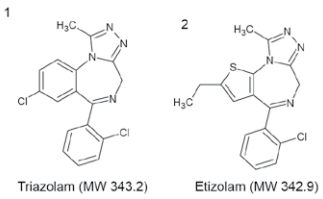
Column bleeding, caused by the fragments of stationary phase, is the main reason for background noise and restrictions on detection limits. No bleed is observed in the test of total ion current (TIC) measured by LC/MS with blank or with YMC-Triart C18. So in terms of the signal/noise ratio (S/N ratio), 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

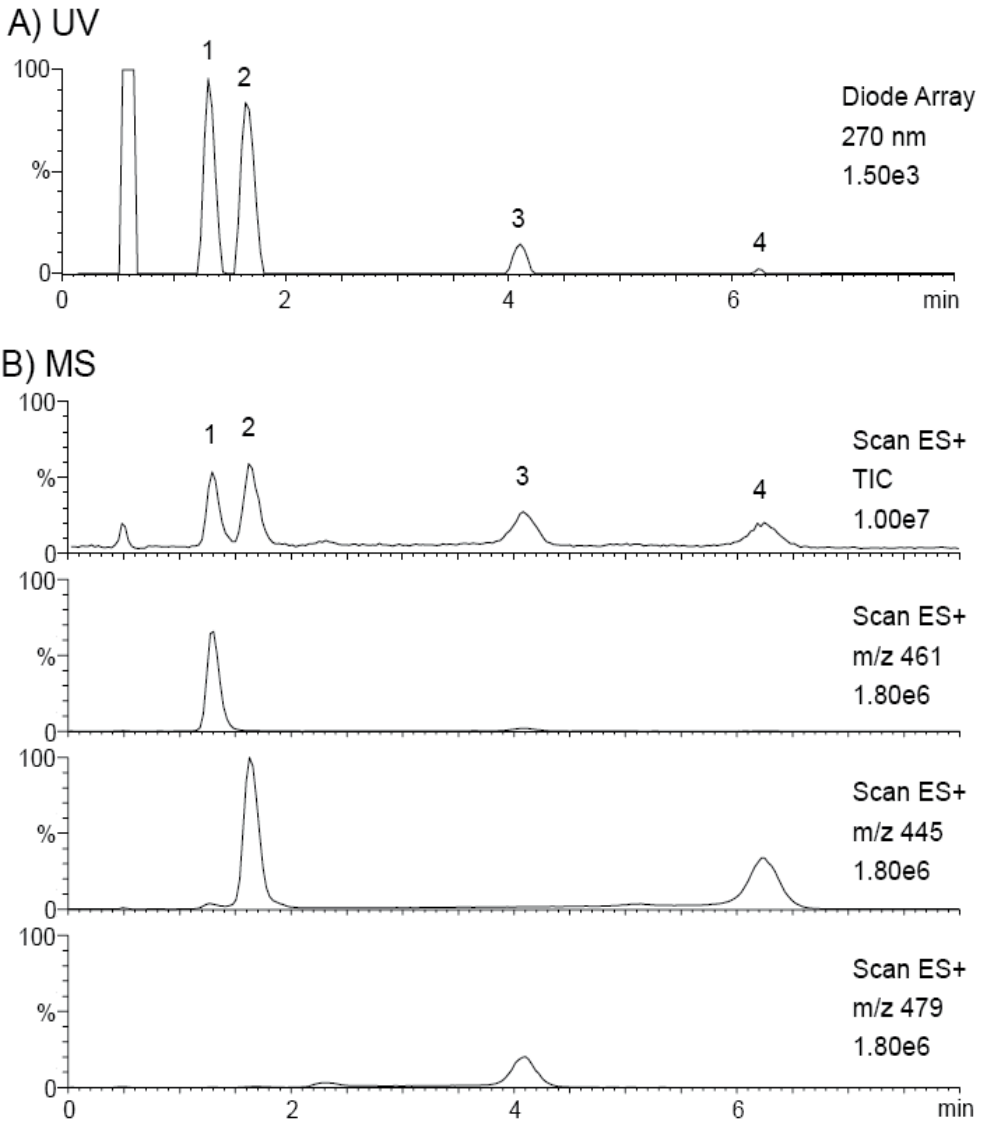
Courtesy of J. Watanabe, Bruker Daltonics K. K.

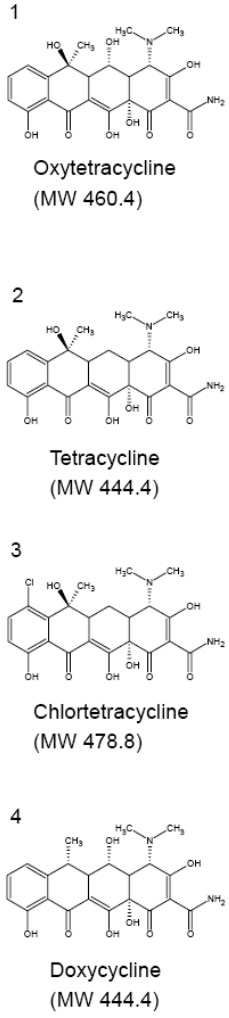


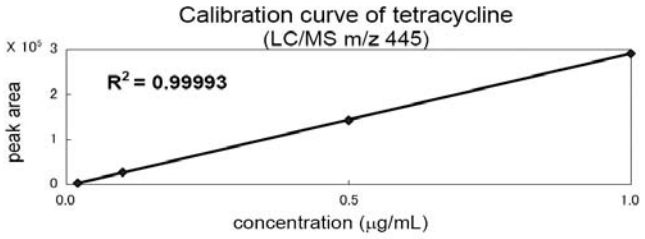
Column:	YMC-Triart C18 (5 µm, 12 nm) 50 x 2.0 mm ID
Part No.:	TA12S05-0502WT
Eluent:	A) 10 mM formic acid B) acetonitrile
Gradient:	25-50% B (0-10 min)
Flow rate:	0.2 ml/min
Temperature:	40 °C
Detection:	Bruker Daltonics micrOTOF, ESI, positive mode
Injection:	5 µl (100 ng/ml)

LC/MS

LC/MS analysis of tetracycline antibiotics*





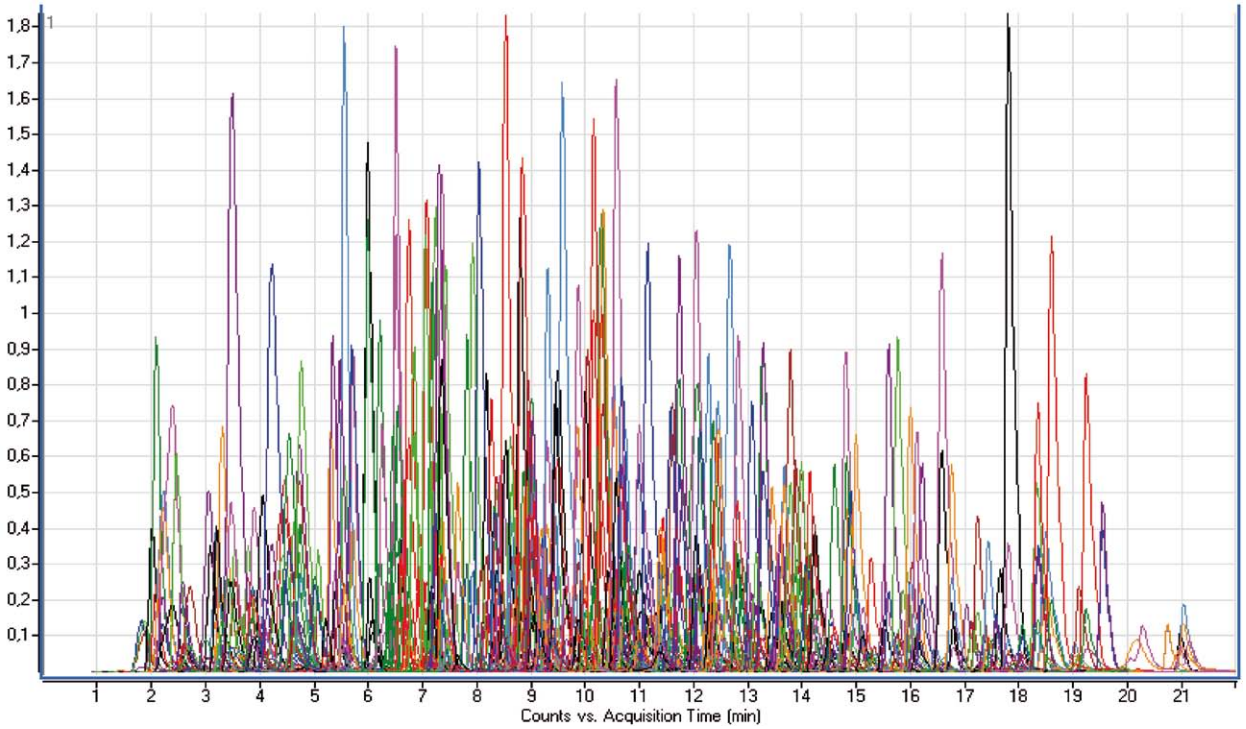


Column:	YMC-Triart C18 (5 µm, 12 nm) 50 x 2.0 mm ID
Part No.:	TA12S05-0502WT
Eluent:	acetonitrile / water / formic acid (15/85/0.1)
Flow rate:	0.4 ml/min
Temperature:	40 °C
Detection:	A) UV at 270 nm B) ESI positive-mode
Injection:	10 µl (1 µg/ml)

* Application data by courtesy YMC Co., Ltd.

LC/MS

Analysis of 360 pesticides in a single run

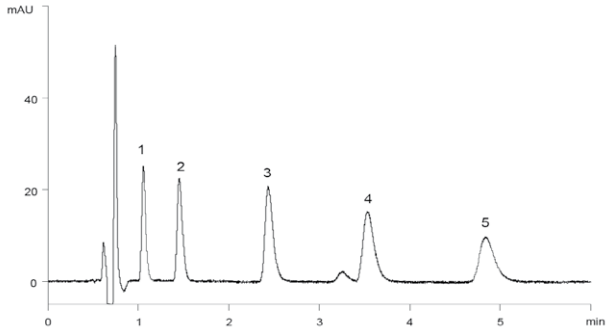


Column:	YMC-Triart C18 (3 µm, 100 x 2.0 mm ID)	Injection:	5 µl
Part No.:	TA12S03-1002WT	Gradient:	0 min: 30% B, 0.1 min: 50% B, 18 min: 100% B, 21 min: 100% B, 21.01 min: 30% B, 29 min: 30% B
Eluent:	A) 5 mM ammonium formate / water B) 5 mM ammonium formate / methanol	Total run time:	30 min
Flow rate:	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)

Pharmaceuticals

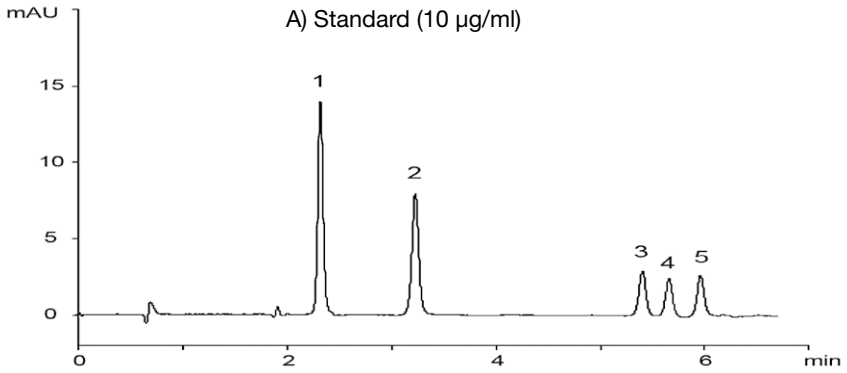
Separation of alkaloids*

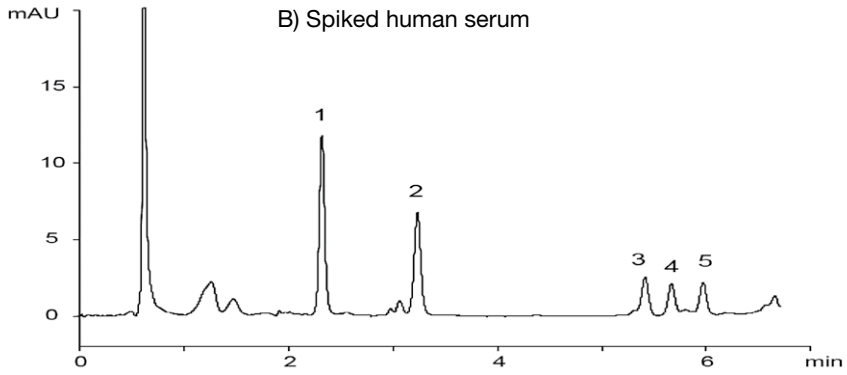


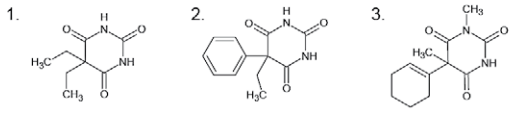
1. Scopolamine
2. Atropine
3. Cinchonine
4. Quinine
5. Dihydroquinine

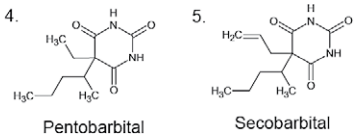
Column:	YMC-Triart C18 (5 µm, 12 nm) 50 x 2.0 mm ID
Part No.:	TA12S05-0502WT
Eluent:	20 mM CH_3COOH-CH_3COONH_4 (pH 4.9) / acetonitrile (80/20)
Flow rate:	0.2 ml/min
Temperature:	40 °C
Detection:	UV at 220 nm
Injection:	1 µl (0.02-0.1 mg/ml)

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)

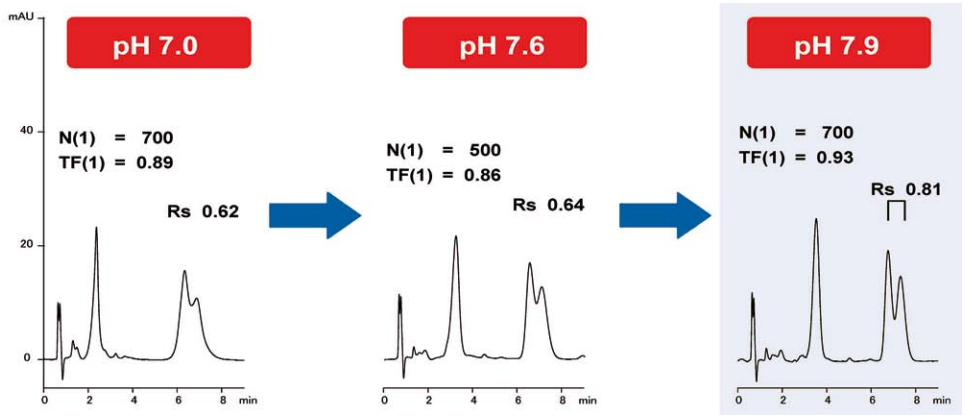
Column:	YMC-Triart C18 (5 µm, 12 nm) 50 x 2.0 mm ID
Part No.:	TA12S05-0502WT
Eluent:	A) 20 mM $HCOONH_4$-NH_3 (pH 9.5)
	B) methanol
Gradient:	0-90% B (0-7 min)
Flow rate:	0.2 ml/min
Temperature:	25 °C
Detection:	UV at 240 nm
Injection:	1 µl

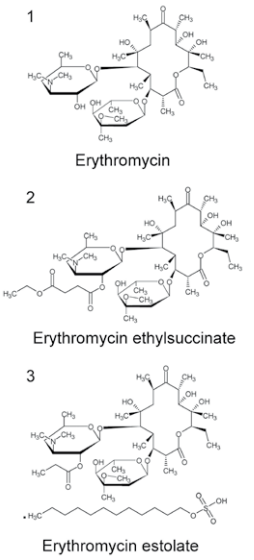
* Application data by courtesy YMC Co., Ltd.

Pharmaceuticals

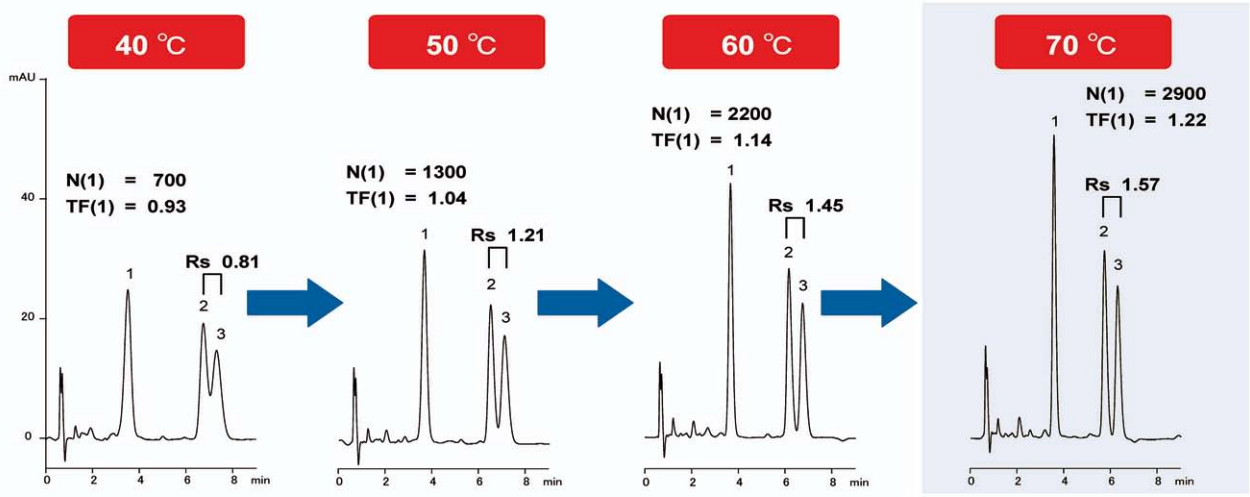
Erythromycin at elevated pH and temperature*

1. Optimisation of pH

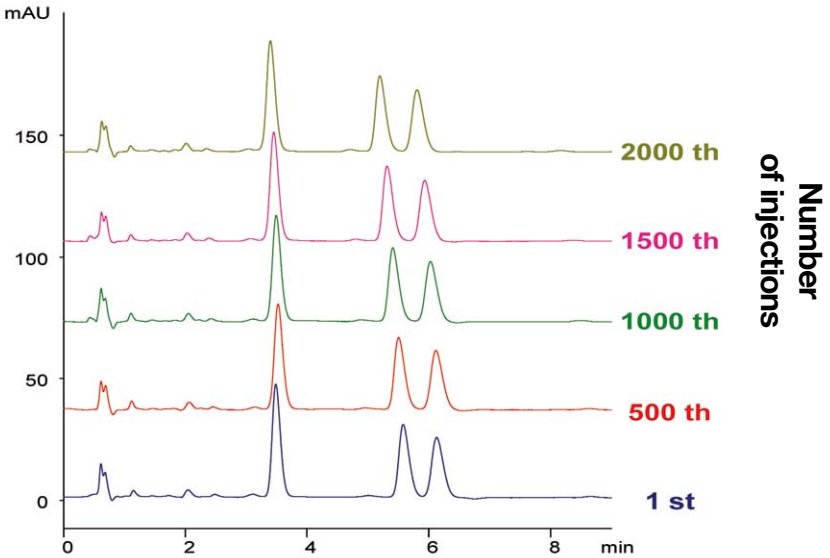




2. Optimisation of temperature (pH 7.9)



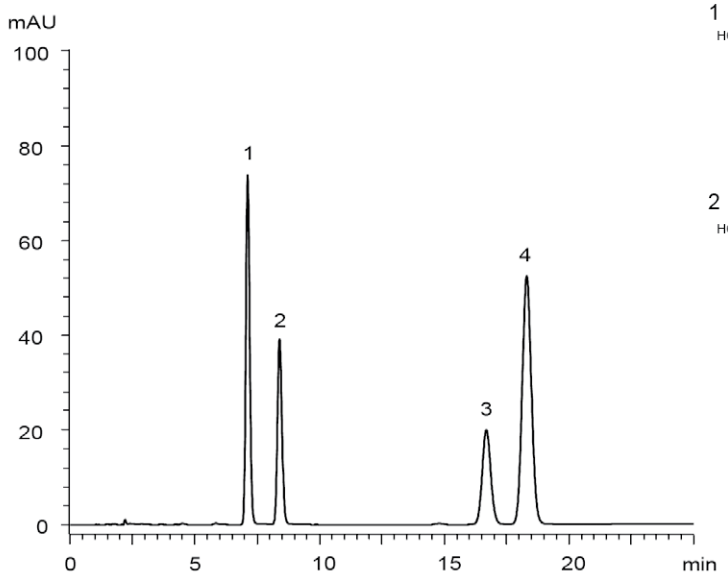
3. Stability test: pH 7.9, 70 °C



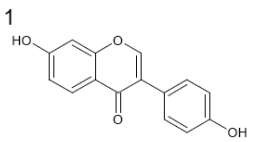
Column:	YMC-Triart C18 (3 µm, 12 nm)
Dimension:	50 x 2.0 mm ID
Part No.:	TA12S03-0502WT
Eluent:	20 mM KH_2PO_4-K_2HPO_4 / acetonitrile / methanol (40/45/15)
Flow rate:	0.2 ml/min
Detection:	UV at 210 nm

Pharmaceuticals

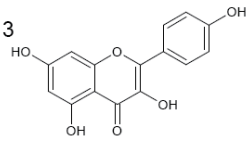
Separation of flavonoids*



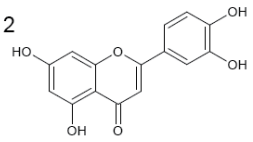
1 Daidzein



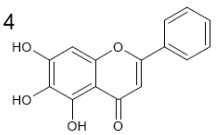
3 Kaempferol



2 Luteolin

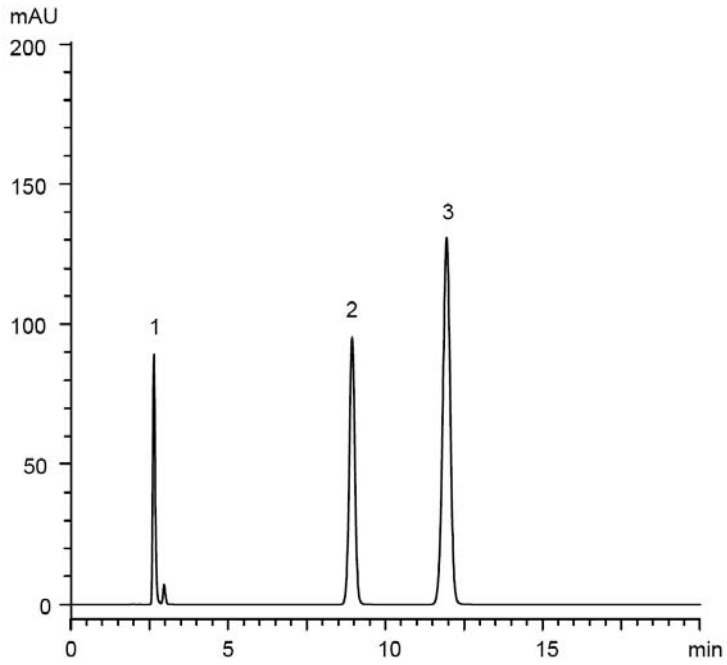


4 Baicalein

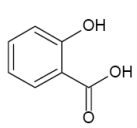


Column:	YMC-Triart C18 (5 µm, 12 nm)
Dimension:	150 x 3.0 mm ID
Part No.:	TA12S05-1503WT
Eluent:	acetonitrile / 10 mM H_3PO_4 (30/70)
Flow rate:	0.425 ml/min
Temperature:	37 °C
Detection:	UV at 280 nm
Injection:	2 µl (50 µg/ml)

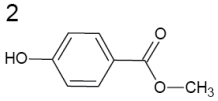
Separation of aromatic carboxylic acids*



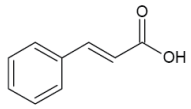
1 Salicylic acid



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



3 *trans*-Cinnamic acid

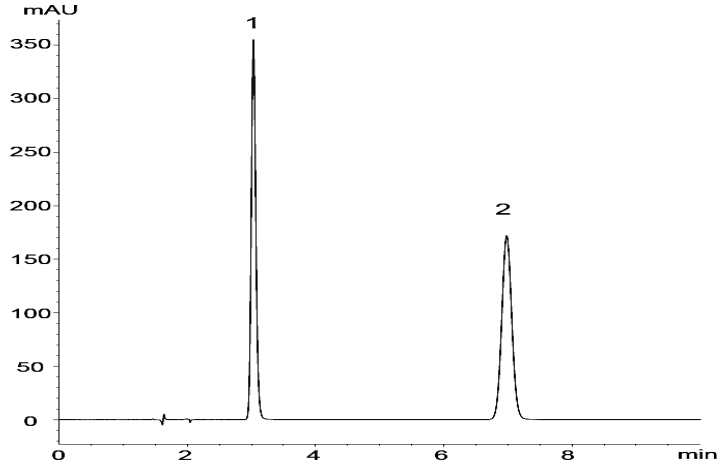


Column:	YMC-Triart C18 (5 µm, 12 nm)
Dimension:	150 x 3.0 mm ID
Part No.:	TA12S05-1503WT
Eluent:	10 mM CH_3COOH-CH_3COONH_4 (pH 4.2) / acetonitrile (75/25)
Flow rate:	0.425 ml/min
Temperature:	40 °C
Detection:	UV at 254 nm
Injection:	4 µl (0.02 ~ 0.3 mg/ml)

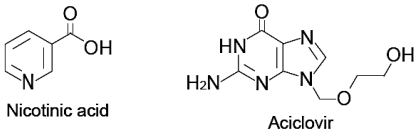
* Application data by courtesy YMC Co., Ltd.

Pharmaceuticals

Aciclovir syrup and injection*



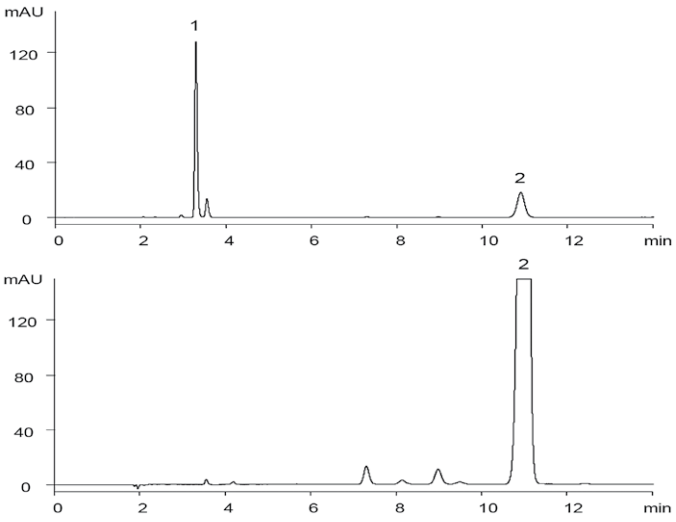
1. Nicotinic acid



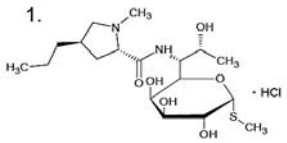
2. Aciclovir

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)

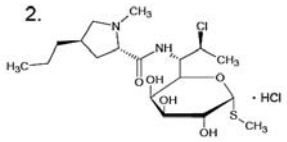
Clindamycin hydrochloride*



1. Lincomycin hydrochloride

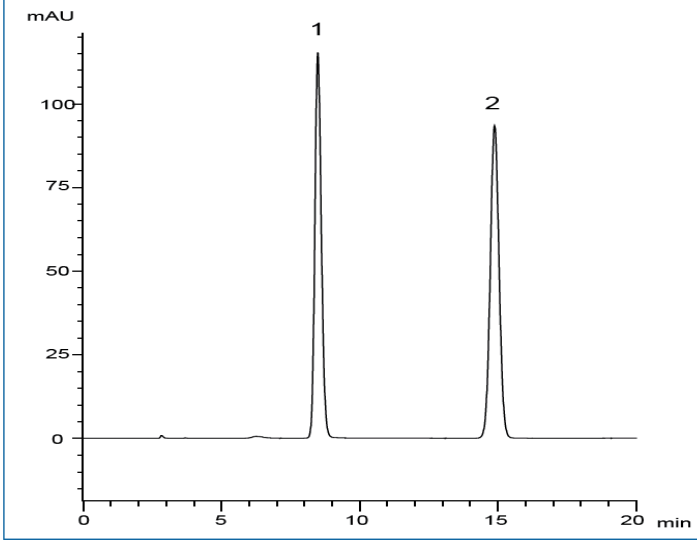


2. Clindamycin hydrochloride

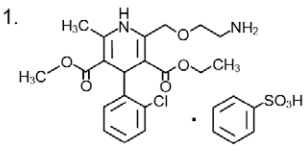


Column:	YMC-Triart C18 (5 µm, 12 nm) 250 x 4.6 mm ID
Part No.:	TA12S05-2546WT
Eluent:	50 mM KH_2PO_4 (pH 7.5 adjusted by 8 M KOH) / acetonitrile (55/45)
Flow rate:	1.0 ml/min
Temperature:	25 °C
Detection:	UV at 210 nm
Injection:	10 µl

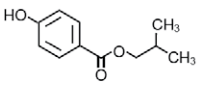
Analysis of amlodipine besilate*



1. Amlodipine besilate



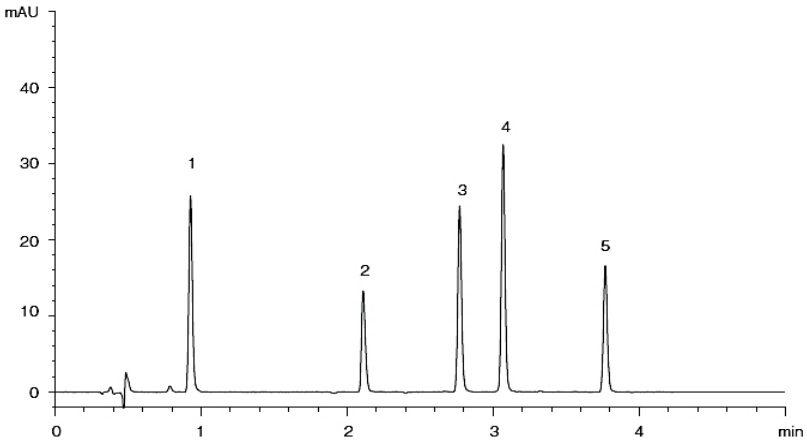
2. Isobutyl *p*-hydroxybenzoate



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)

Pharmaceuticals

Basic drugs*

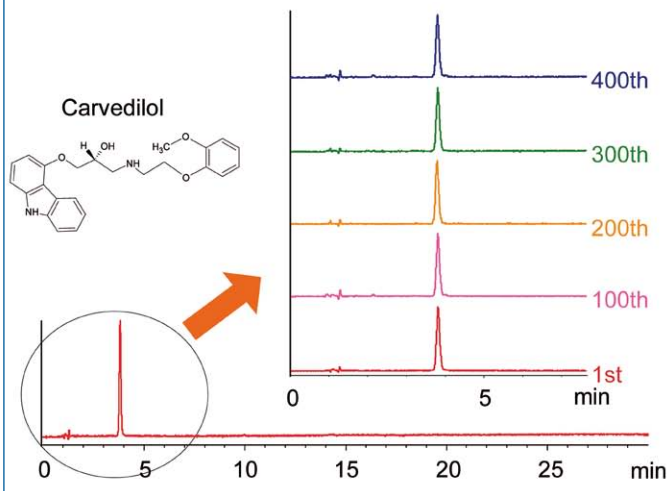


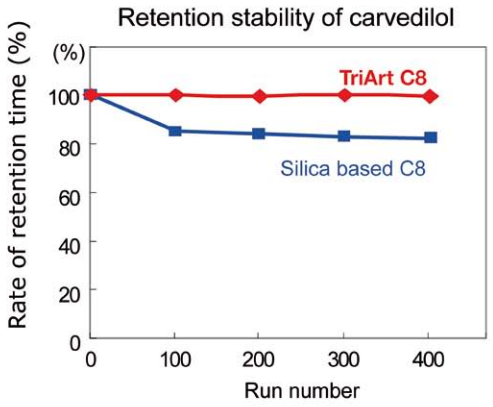
1. Hydrochlorothiazide
2. Amlodipine besilate
3. Valsartan
4. Atorvastatin calcium hydrate
5. Candesartan cilexetil

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

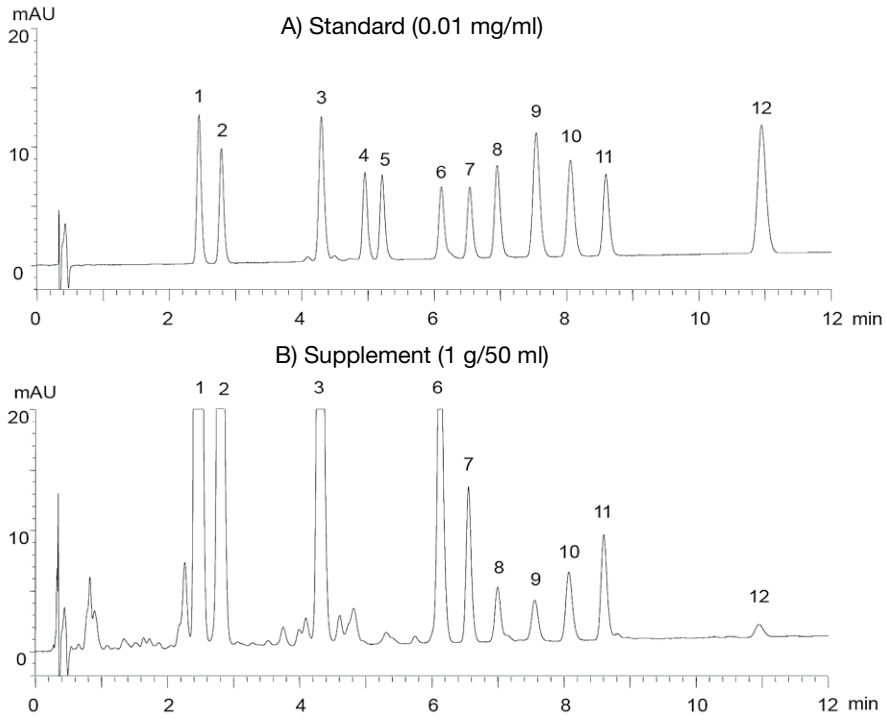
Column:	YMC-Triart C8 (5 µm, 150 x 2.0 mm ID)
Part No.:	TO12S05-1502WT
Eluent:	phosphate buffer (pH 2.0)* / acetonitrile (65/35)
	*Dissolve 2.72 g of KH_2PO_4 in 900 ml water, adjust pH 2.0 with H_3PO_4 and add water to make 1000 ml
Flow rate:	0.28 ml/min (adjust the flow rate so that the retention time 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 a elevated temperature.

* Application data by courtesy YMC Co., Ltd.

Food

Soy isoflavones in supplement*



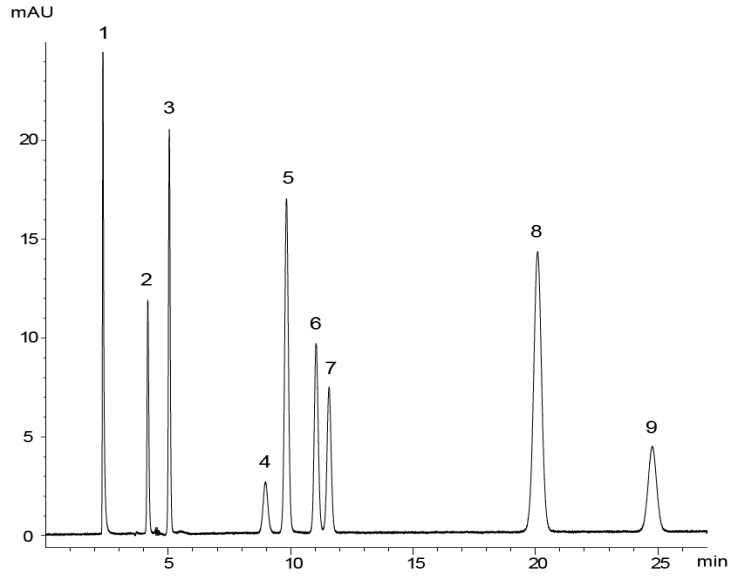
1. Daidzin
2. Glycitin
3. Genistin
4. 6"-*O*-Malonyldaidzin
5. 6"-*O*-Malonylglycitin
6. 6"-*O*-Acetyldaidzin
7. 6"-*O*-Acetylglycitin
8. 6"-*O*-Malonylgenistin
9. Daidzein
10. Glycitein
11. 6"-*O*-Acetylgenistin
12. Genistein

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*

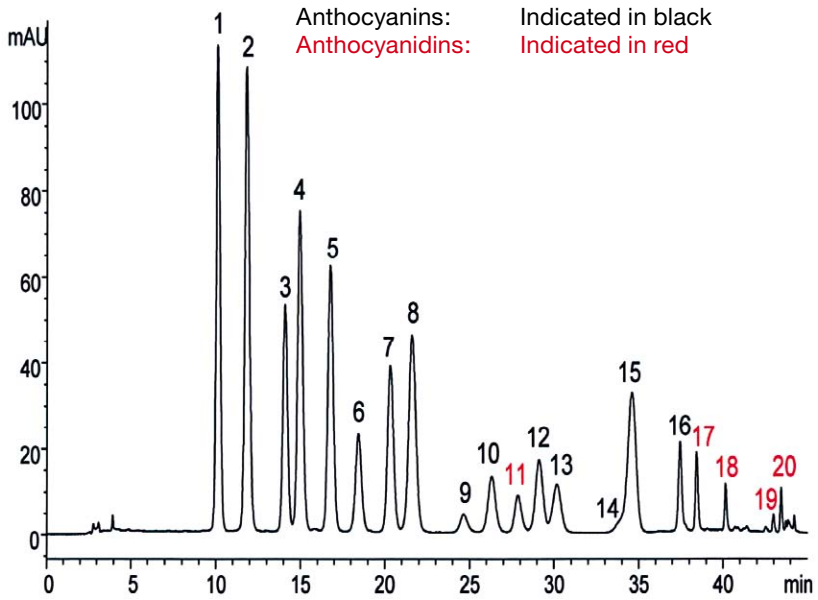


1. Thiamine HCl (Vitamin B_1)
2. Pyridoxine HCl (Vitamin B_6)
3. Nicotinamide
4. Cyanocobalamin (Vitamin B_{12})
5. L-Ascorbic acid 2-glucoside
6. L-Ascorbic acid (Vitamin C)
7. Erythorbic acid
8. Riboflavin (Vitamin B_2)
9. Nicotinic acid

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*

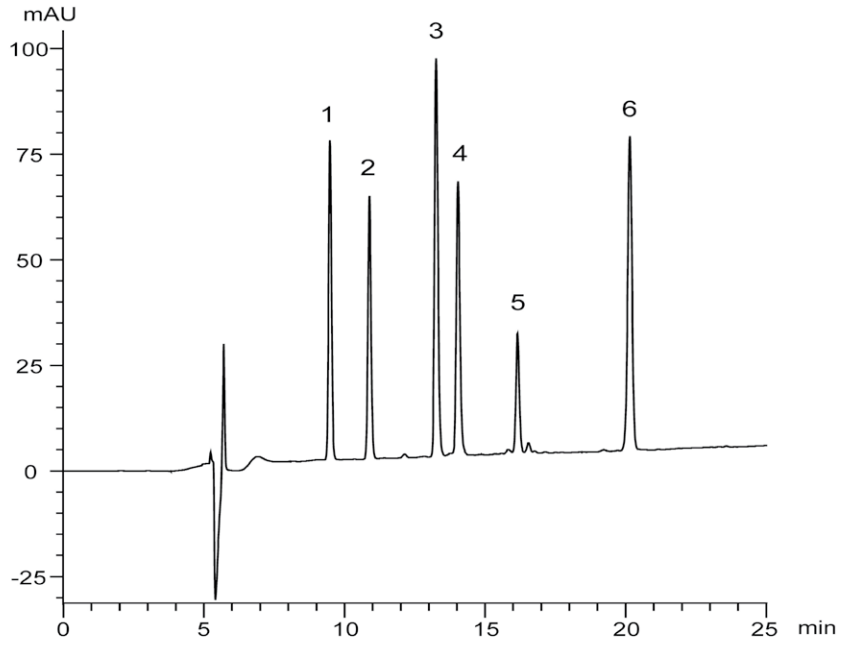


1. Delphinidin-3-*O*-galactoside
2. Delphinidin-3-*O*-glucoside
3. Cyanidin-3-*O*-galactoside
4. Delphinidin-3-*O*-arabinoside
5. Cyanidin-3-*O*-glucoside
6. Petunidin-3-*O*-galactoside
7. Cyanidin-3-*O*-arabinoside
8. Petunidin-3-*O*-glucoside
9. Peonidin-3-*O*-galactoside
10. Petunidin-3-*O*-arabinoside
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)
Dimension:	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)

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)

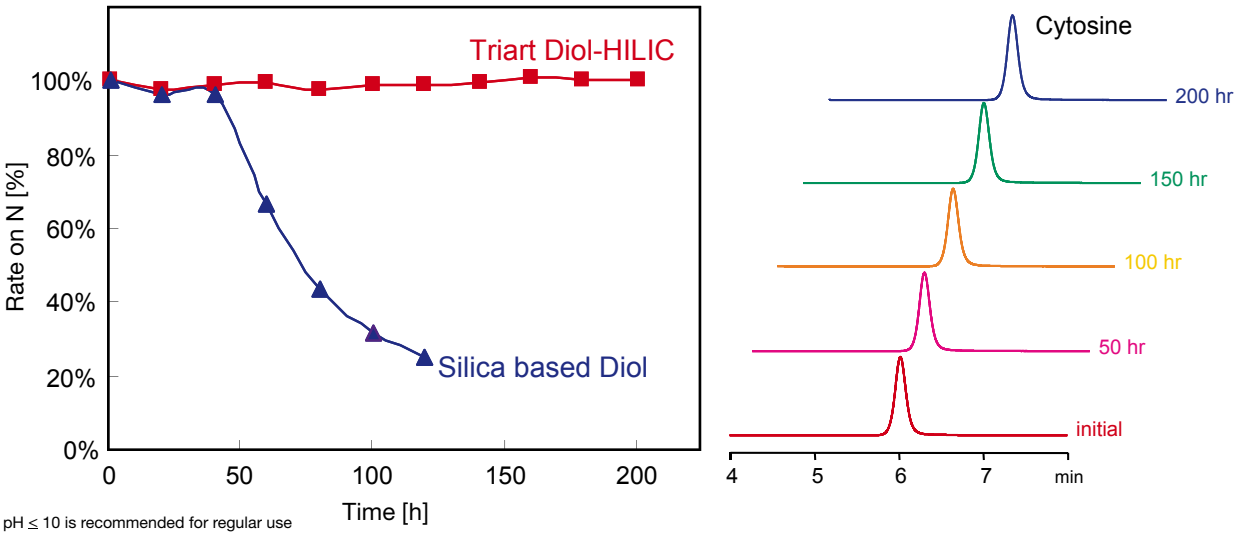
Column:	YMC-Triart C18 (5 µm, 12 nm)
Dimension:	150 x 2.0 mm ID
Part No.:	TA12S05-1502WT
Eluent:	A) water / TFA (100/0.1) B) acetonitrile / TFA (100/0.1) 20-45% B (0-25 min)
Flow rate:	0.2 ml/min
Temperature:	37 °C
Detection:	UV at 220 nm
Injection:	2 ml (0.075 ~ 0.25 mg/ml)

* Application data by courtesy YMC Co., Ltd.

HILIC

Great stability and reproducibility at high pH*

Stability in high pH (pH 11, 50 °C)**

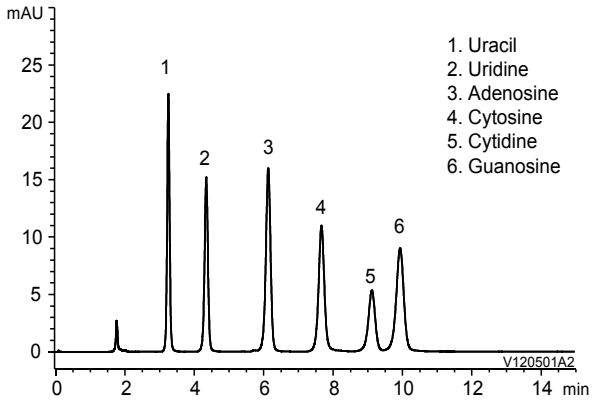


** pH ≤ 10 is recommended for regular use

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

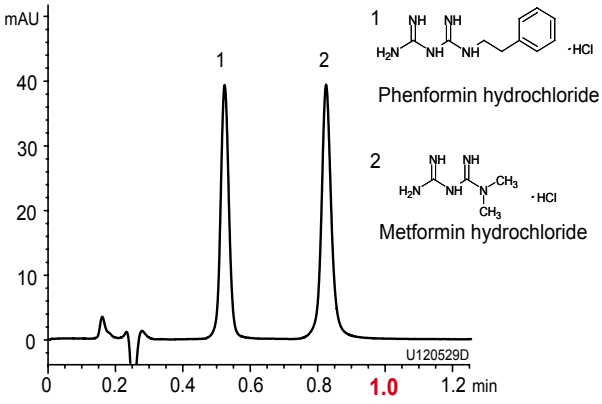
YMC-Triart Diol-HILC offers highly reproducible separations even at high pH and high temperature. The lifetime of YMC-Triart Diol-HILIC is much longer than that of conventional silica-based Diol columns.

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)

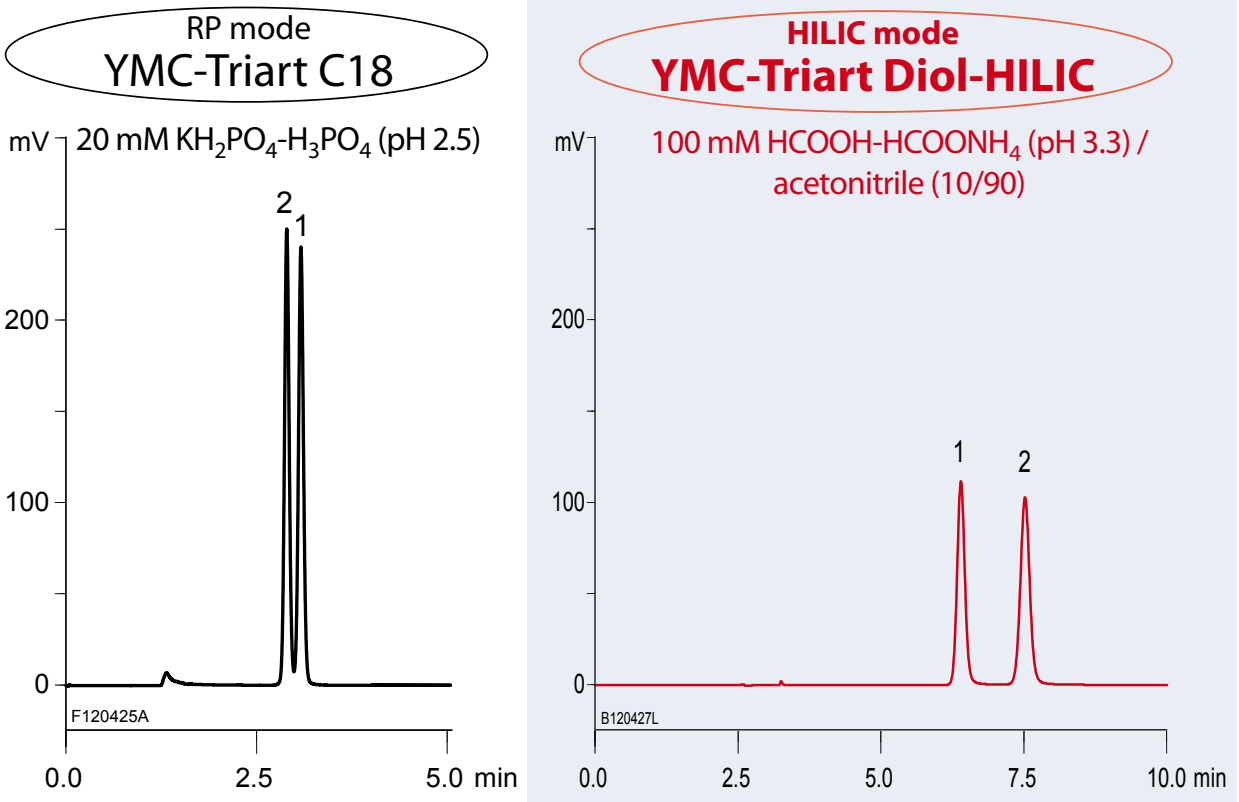
Diabetes drugs*

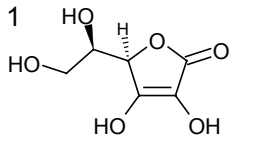


Column:	YMC-Triart Diol-HILIC (1.9 µm, 12 nm) 50 x 2.0 mm ID
Part No.:	TDH12SP9-0502PT
Eluent:	100 mM HCOOH-$HCOONH_4$ (pH 3.7) / acetonitrile (10/90)
Flow rate:	0.8 ml/min
Temperature:	25 °C
Detection:	UV at 235 nm
Injection:	2 µl (10 µg/ml)

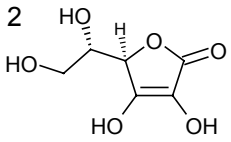
HILIC

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.

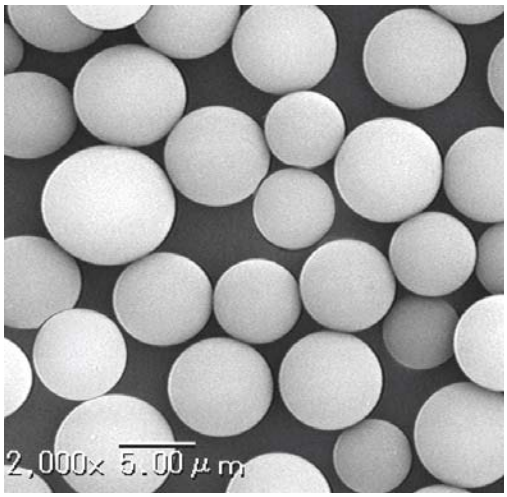
* Application data by courtesy YMC Co., Ltd.

QC Data

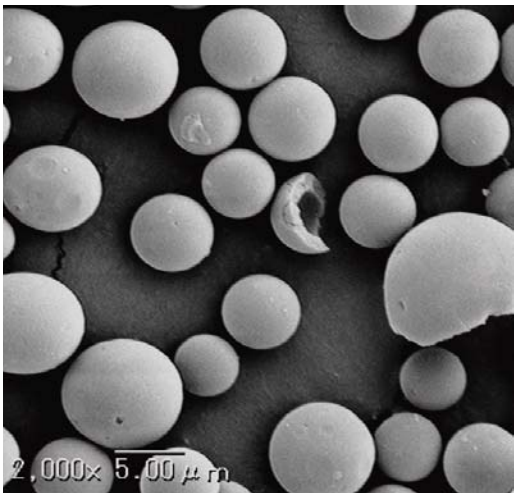
YMC-Triart: Improved quality of particles

Uniform spherical particles

YMC-Triart

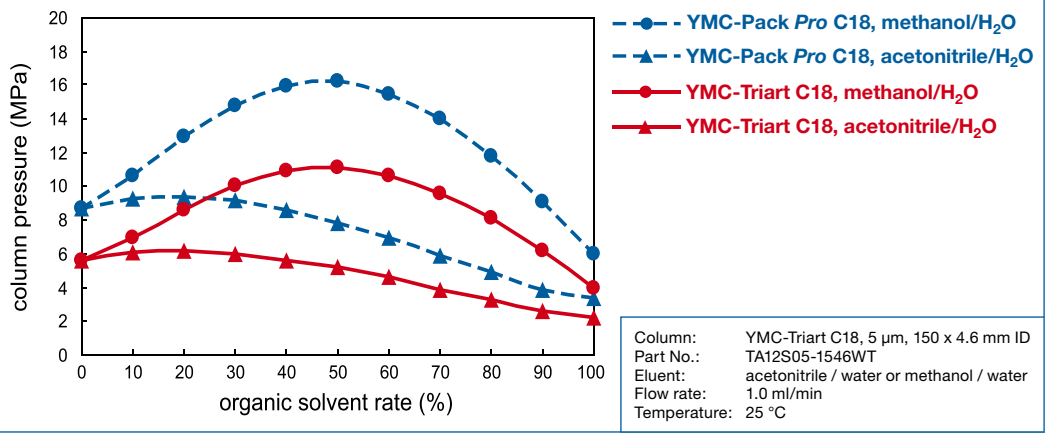


X-Bridge HILIC



The new uniform spherical particle support is used for YMC-Triart C18 and C8. The particle is 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 multi-layered 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).

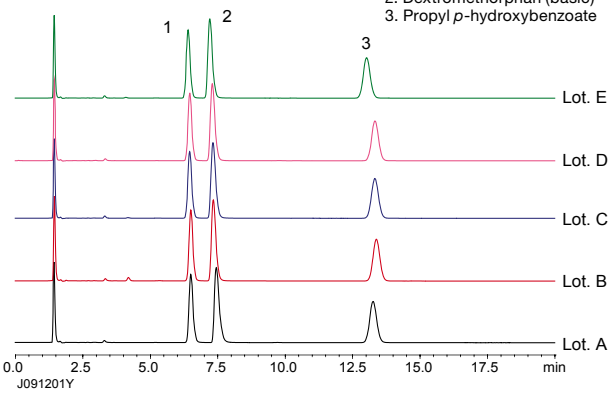
QC Data

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

Batch-to-Batch reproducibility

Basic compounds*

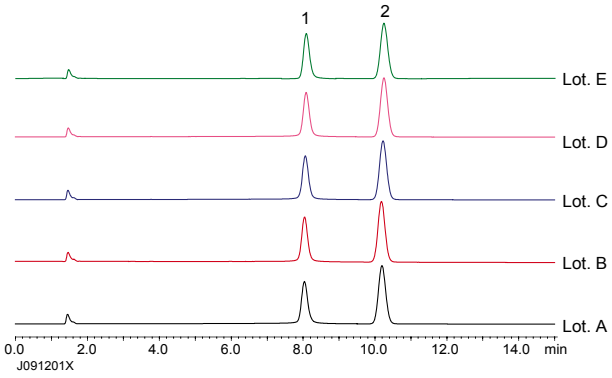
1. Chlorpheniramine (basic)
2. Dextromethorphan (basic)
3. Propyl *p*-hydroxybenzoate



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

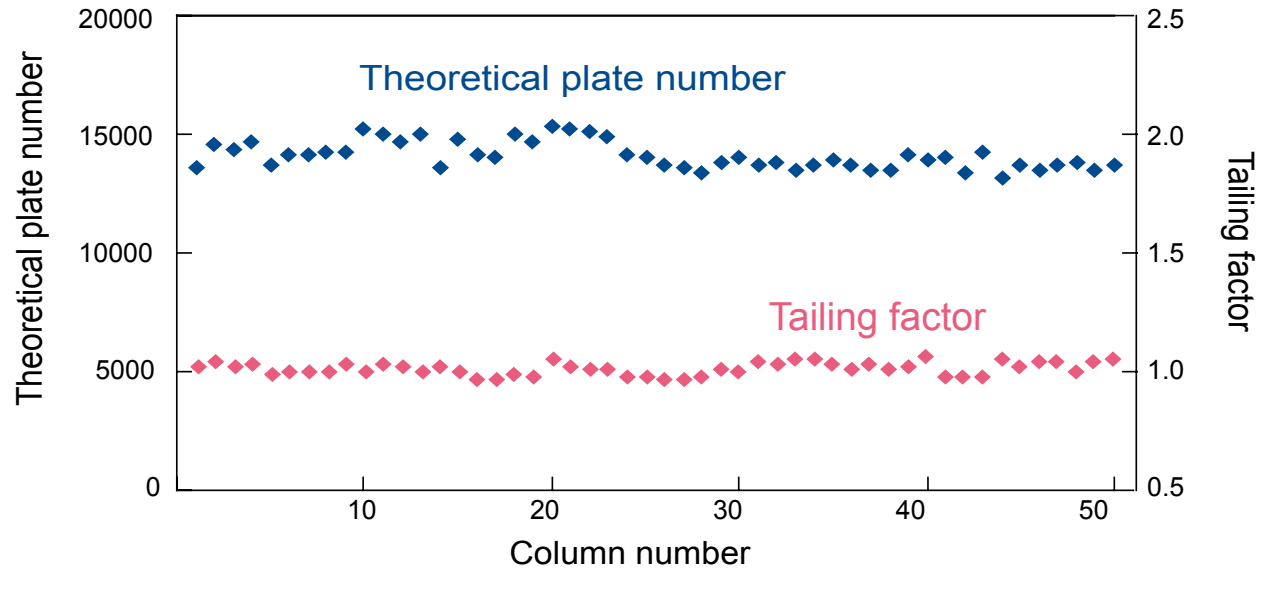
Coordination compounds*

1. Hinokitiol (coordination)
2. Methyl benzoate



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.

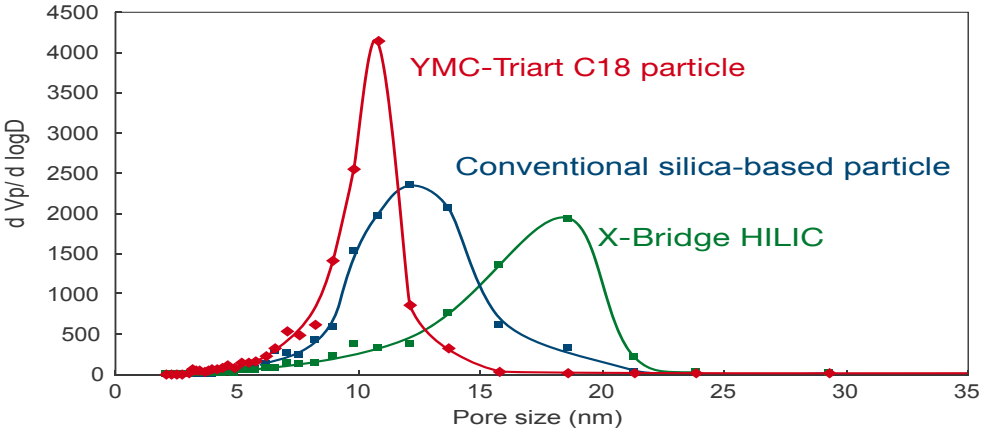


Column:	YMC-Triart C18, 5 µm, 150 x 4.6 mm ID	Flow rate:	1.0 ml/min
Part No.:	TA12S05-1546WT	Temperature:	ambient
Eluent:	acetonitrile / water (40/60)	Sample:	butyl benzoate

* Application data by courtesy YMC Co., Ltd.

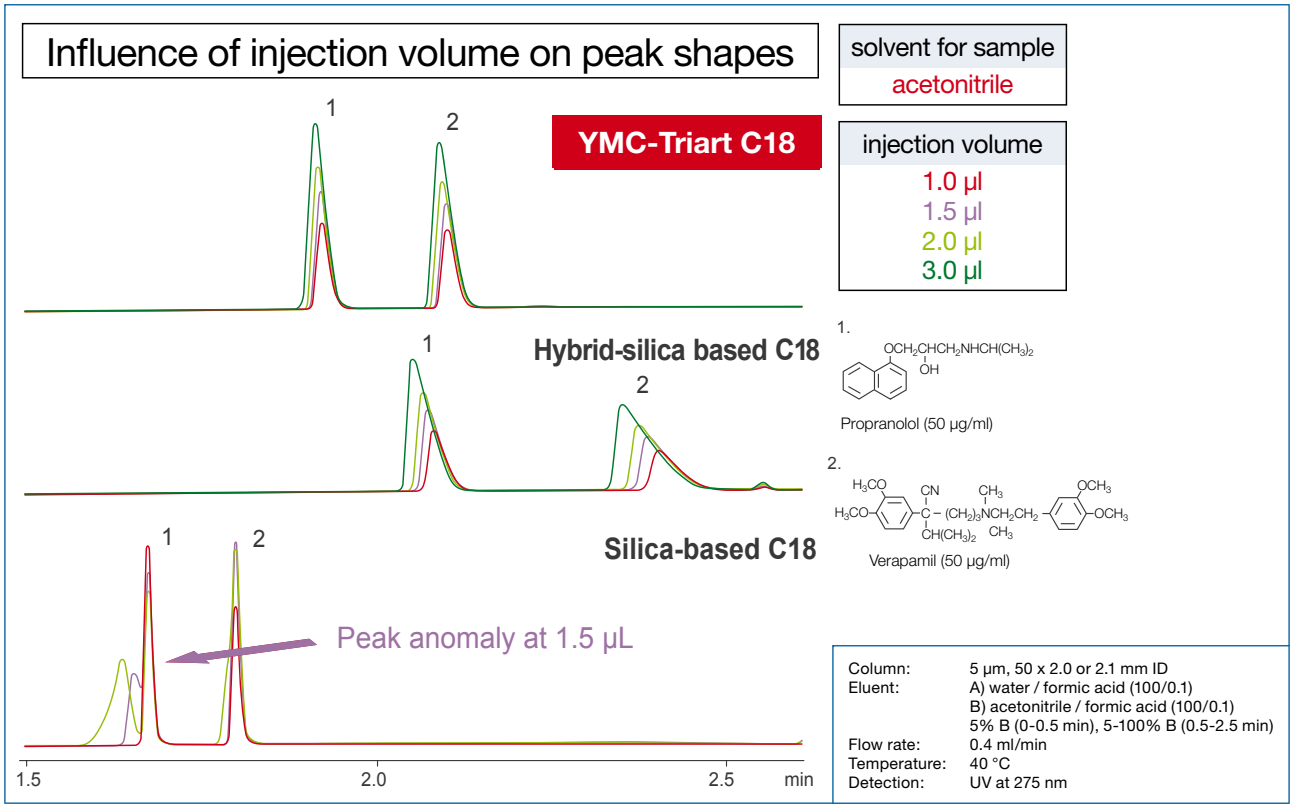
QC Data

Narrow pore distribution



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

Improved loadability



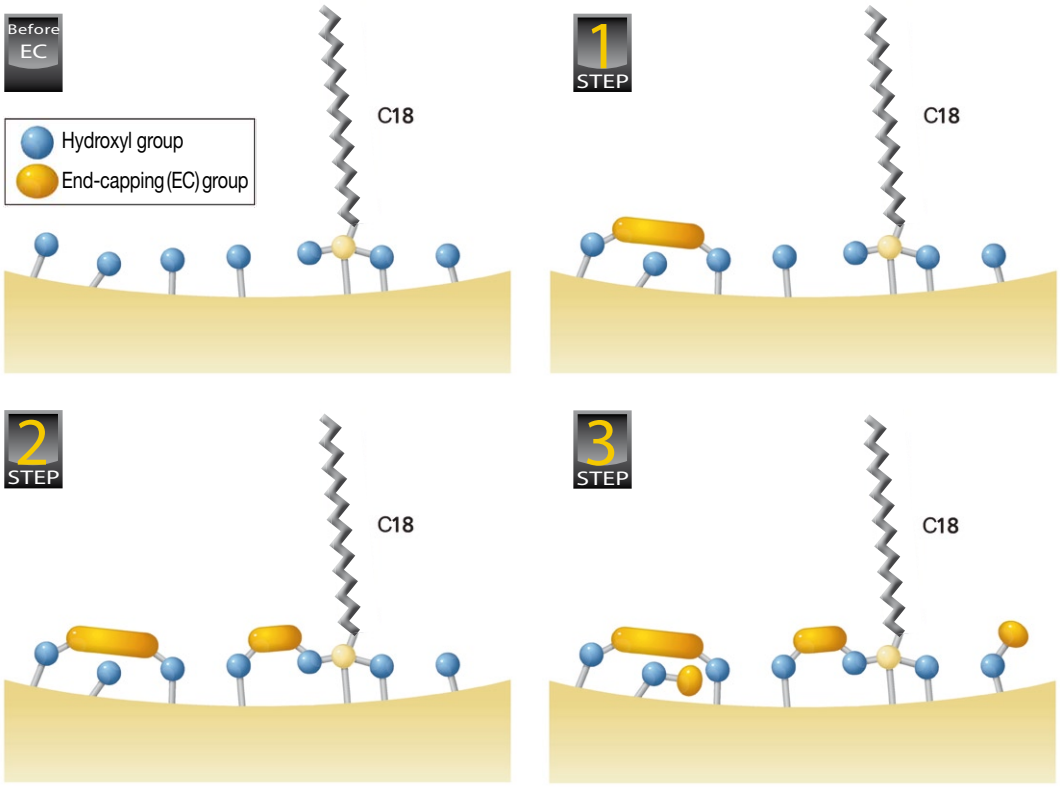
In order to prevent peak errors, there is the limit to the injection volume when the sample is injected in high elution solvents (such as 100% acetonitrile). Compared with traditional columns, more than double the injection volume can injected into YMC-Triart columns as a result of the extremely narrow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

QC Data

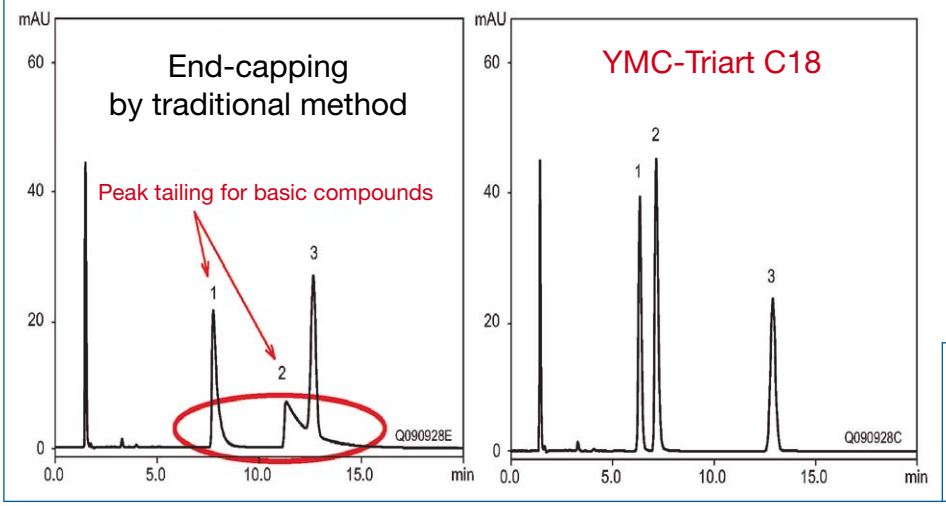
Multi-stage endcapping

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 capping-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 C18 and C8 use a new innovation in end capping called “multistage end-capping” 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“ end-capping is demonstrated:



Ingredients in cough/cold medication:

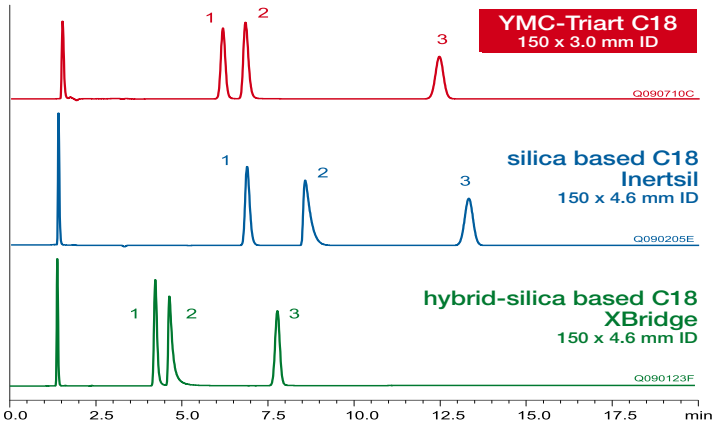
1. Chlorpheniramine
2. Dextromethorphan
3. Propyl *p*-hydroxybenzoate

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

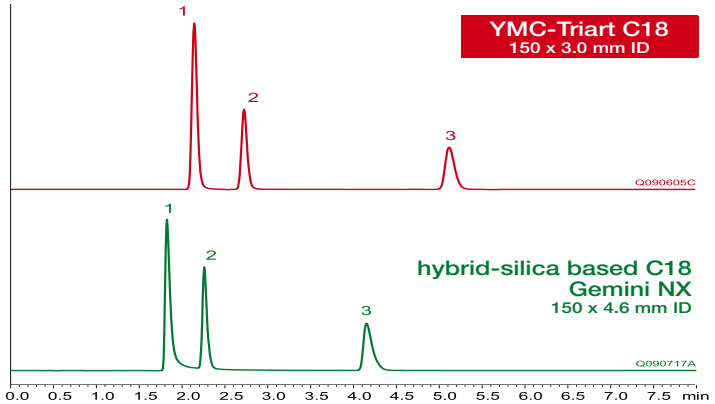
1. Chlorpheniramine
2. Dextromethorphan
3. Propyl *p*-hydroxybenzoate

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*



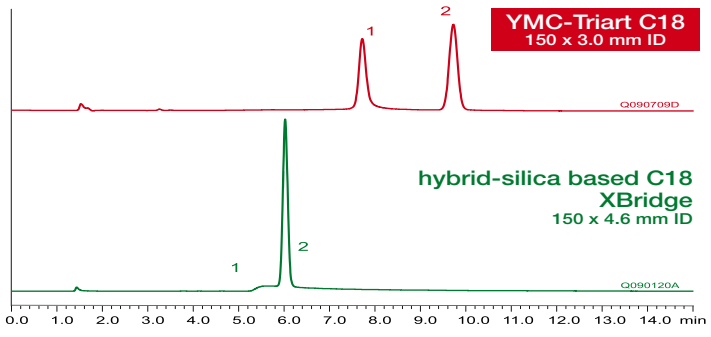
Organic acid

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 / 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 is 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

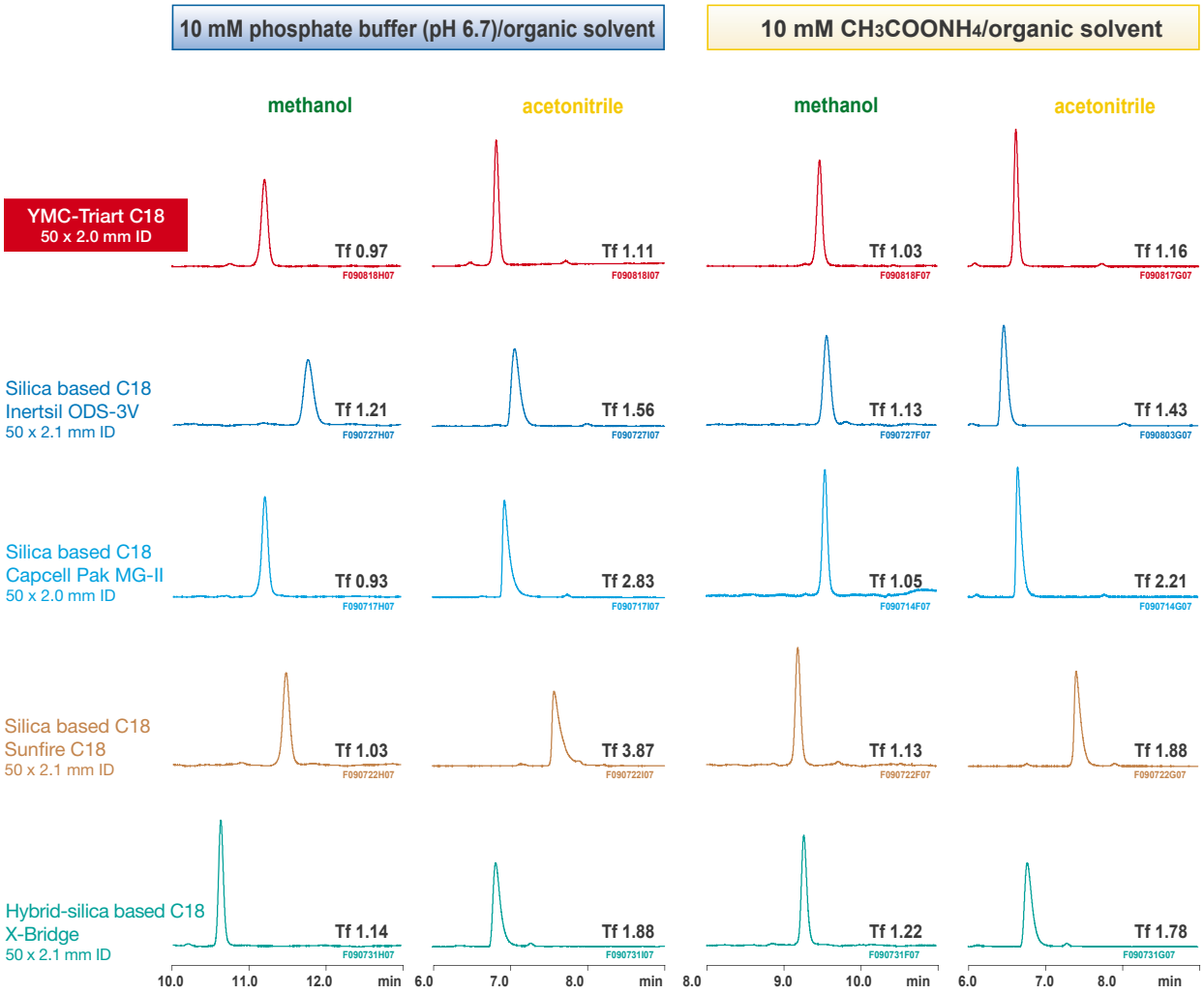
low metal impurities

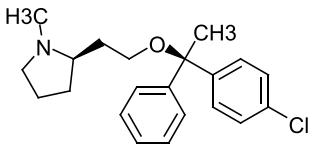
Column:	5 µm, 150 x 3.0 or 150 x 4.6 mm ID
Eluent:	acetonitrile / 0.1% H_3PO_4 (40/60)
Flow rate:	0.425 ml/min for 3.0 mm ID 1.0 ml/min for 4.6 mm ID
Temperature:	40 °C
Detection:	UV at 254 nm

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

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**
	3.0	—	TA12SP9-0303PT	TA12SP9-0503PT	TA12SP9-L503PT	TA12SP9-1003PT	TA12SP9-1503PT	TA12SP9-E503CC
C8	2.0	T012SP9-0202PT	T012SP9-0302PT	T012SP9-0502PT	T012SP9-L502PT	T012SP9-1002PT	T012SP9-1502PT	T012SP9-E5Q1CC**
	3.0	—	T012SP9-0303PT	T012SP9-0503PT	T012SP9-L503PT	T012SP9-1003PT	T012SP9-1503PT	T012SP9-E503CC
HILIC	2.0	TDH12SP9-0202PT	TDH12SP9-0302PT	TDH12SP9-0502PT	TDH12SP9-L502PT	TDH12SP9-1002PT	TDH12SP9-1502PT	TDH12SP9-E5Q1CC**
	3.0	—	TDH12SP9-0303PT	TDH12SP9-0503PT	TDH12SP9-L503PT	TDH12SP9-1003PT	TDH12SP9-1503PT	TDH12SP9-E503CC

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

YMC-Triart 3 µm analytical columns

Phase	Column ID (mm)	Column length (mm)					Guard cartridges* with 10 mm length
		50	75	100	150	250	(pack of 5)
C18	2.0	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	T012S03-0502WT	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
HILIC	2.0	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

Phase	Column ID (mm)	Column length (mm)					Guard cartridges* with 10 mm length
		50	75	100	150	250	(pack of 5)
C18	2.0	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
C8	2.0	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
HILIC	2.0	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

For other dimensions please refer to page 247

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

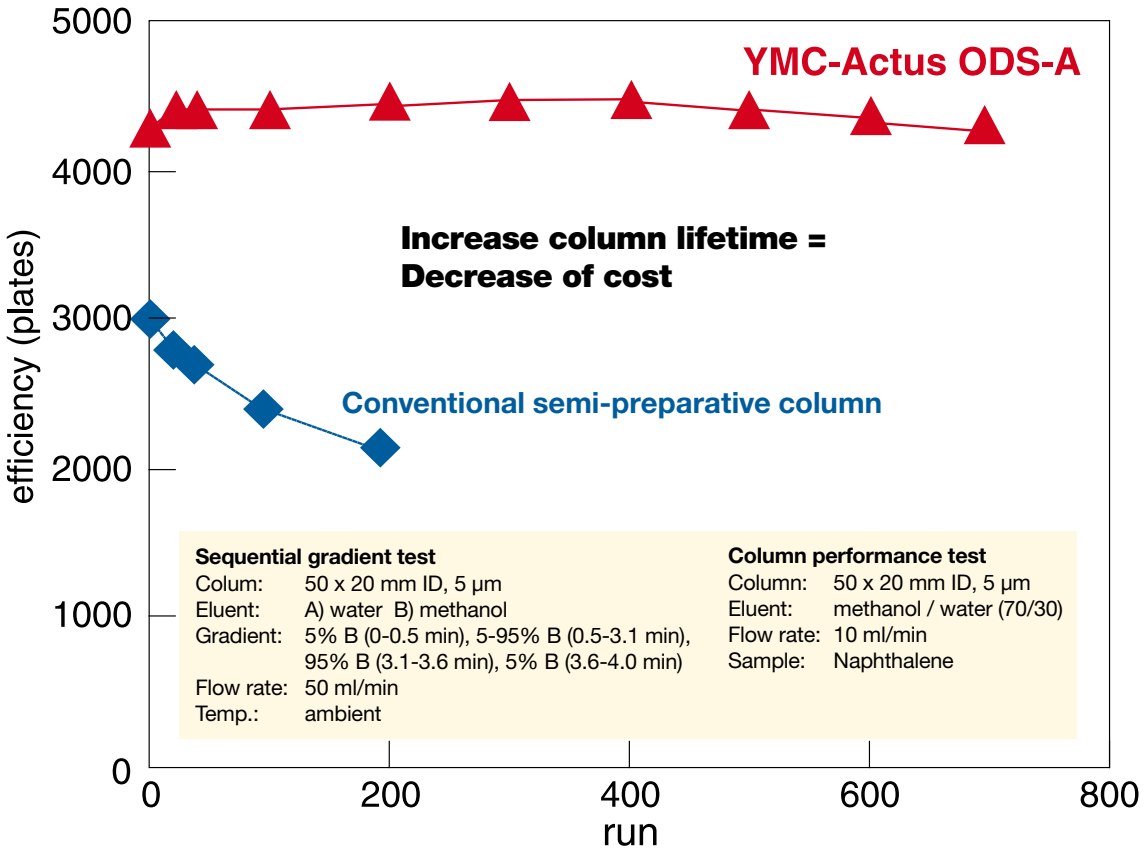
Stability

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

With YMC-Actus, a new 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.

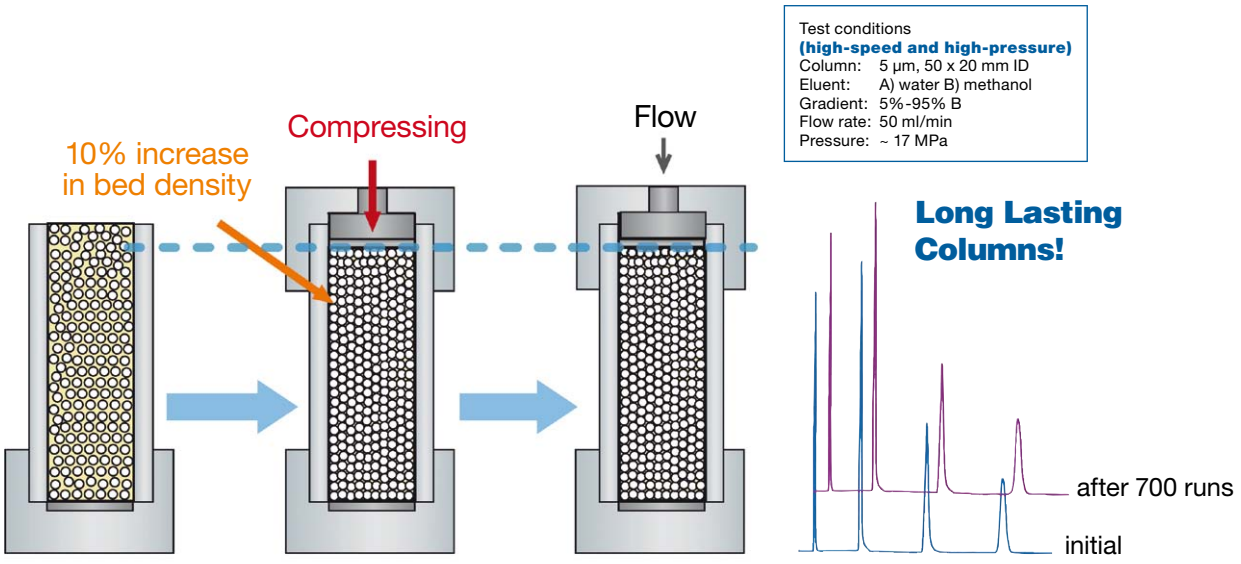
YMC-Actus columns offer outstanding efficiency without compromising resolution. Furthermore, YMC-Actus columns provide reliable results, even after exposure to severe, rapid gradient conditions and multiple injections.



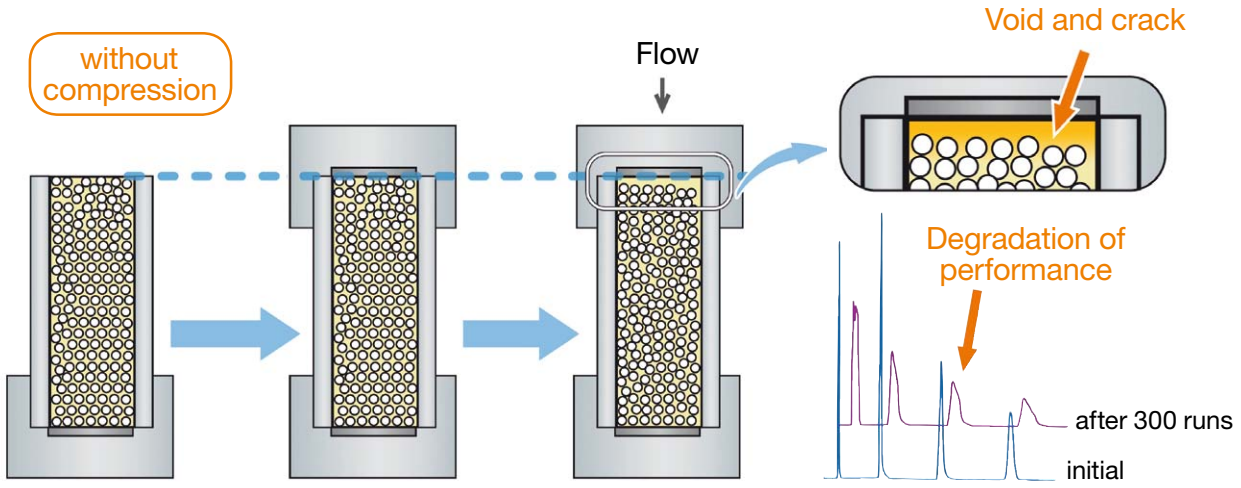
YMC-Actus

Axial Compression Technology for Ultimate Separation

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.



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.

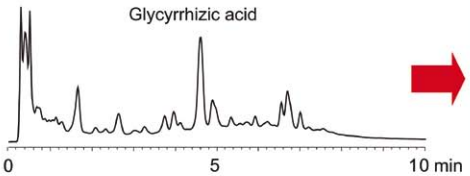
YMC-Actus

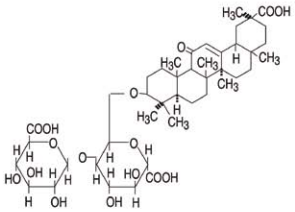
Excellent stability and efficiency under fast gradient conditions at high flow rate

Glycyrrhizic acid in herb medicine*

Analysis

YMC-Pack ODS-AQ, 50 x 4.6 mm ID, 5 µm
3 ml/min, 10 µl injection

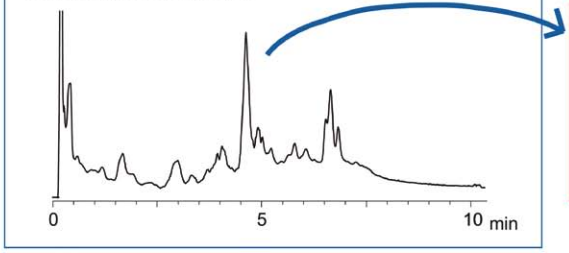


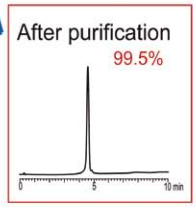


Glycyrrhizic acid

Purification

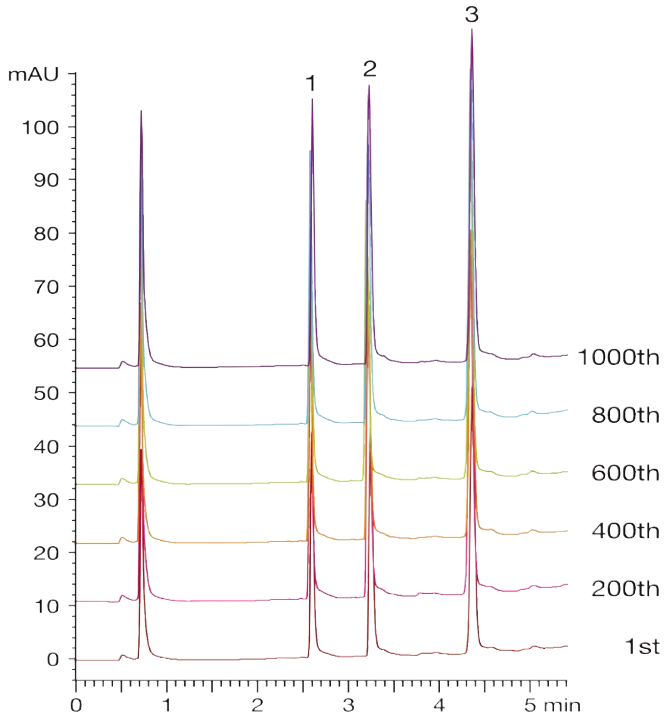
YMC-Actus ODS-AQ, 50 x 20 mm ID, 5 µm
60 ml/min, 500 µl injection





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

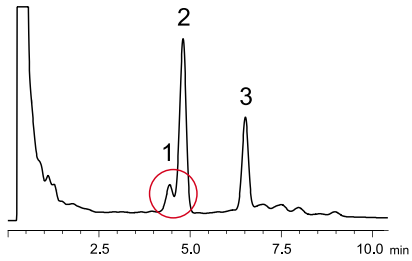
YMC Actus

Excellent separation of compounds with similar structure

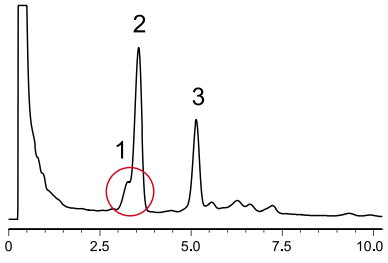
Capsaicinoids in red pepper*

Analysis 50 x 4.6 mm ID, 5 µm
2.0 ml/min, 20 µl injection

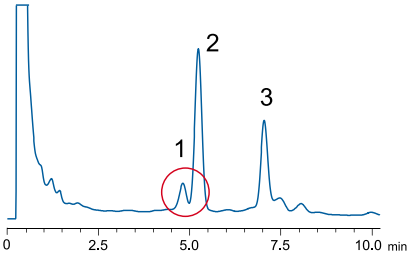
Phenomenex Luna C18

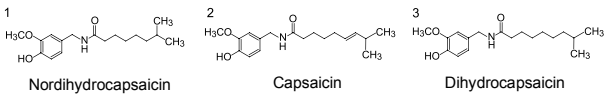


Waters XBridge C18



YMC-Pack *Pro* C18 RS

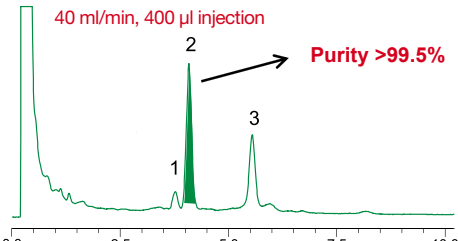




Nordihydrocapsaicin | Capsaicin | Dihydrocapsaicin

Purification

YMC-Actus *Pro* C18 RS, 50 x 20 mm ID 5 µm
40 ml/min, 400 µl injection
Purity >99.5%



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)

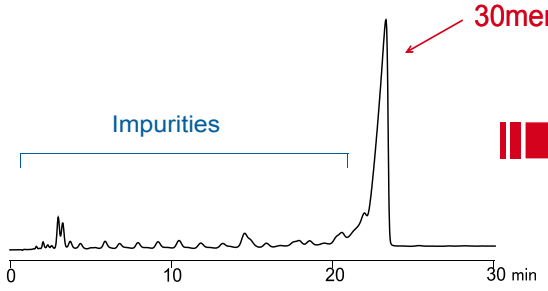
Outstanding separation of highly polar compounds

Crude synthetic 30mer oligonucleotide*

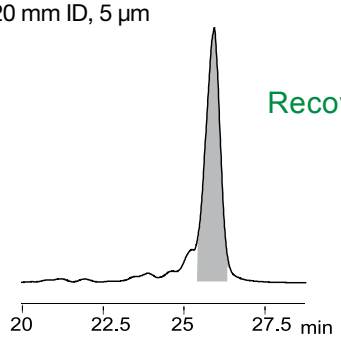
Analysis 1.0 ml/min, 5 µl injection

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%

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.

Ordering Information

High durability semi-preparative columns

Packing material	Particle size [µm]	Pore size [nm]	Column size length x ID [mm]	Product Code
Triart C18	S-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 TA12S05-1053DX TA12S05-1553DX TA12S05-2553DX
Pro C18	S-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 AS12S05-1053DX AS12S05-1553DX AS12S05-2553DX
Hydrosphere C18	S-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 HS12S05-1053DX HS12S05-1553DX HS12S05-2553DX
Pro C18 RS	S-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 RS08S05-1053DX RS08S05-1553DX RS08S05-2553DX
Triart C8	S-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 TO12S05-1053DX TO12S05-1553DX TO12S05-2553DX
Pro C8	S-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 OS12S05-1053DX OS12S05-1553DX OS12S05-2553DX

Ordering Information

High durability semi-preparative columns

Packing material	Particle size [µm]	Pore size [nm]	Column size length x ID [mm]	Product Code
ODS-A	S-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 AA12S05-1053DX AA12S05-1553DX AA12S05-2553DX
ODS-AQ	S-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 AQ12S05-1053DX AQ12S05-1553DX AQ12S05-2553DX
YMCbasic	S-5	—	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 BA99S05-1053DX BA99S05-1553DX BA99S05-2553DX

Guard cartridges

Packing material	Particle size [µm]	Pore size [nm]	Column size length x ID [mm]	Product Code
Triart C18	S-5	12	10 x 20 10 x 30	TA12S05-0120CC TA12S05-0130CC
Pro C18	S-5	12	10 x 20 10 x 30	AS12S05-0120CC AS12S05-0130CC
Hydrosphere C18	S-5	12	10 x 20 10 x 30	HS12S05-0120CC HS12S05-0130CC
Pro C18 RS	S-5	8	10 x 20 10 x 30	RS08S05-0120CC RS08S05-0130CC
Pro C8	S-5	12	10 x 20 10 x 30	OS12S05-0120CC OS12S05-0130CC
ODS-A	S-5	12	10 x 20 10 x 30	AA12S05-0120CC AA12S05-0130CC
ODS-AQ	S-5	12	10 x 20 10 x 30	AQ12S05-0120CC AQ12S05-0130CC
Triart Prep C18-S	S-10	12	10 x 20 10 x 30	TAS12S11-0120CC TAS12S11-0130CC
	S-15	12	10 x 20 10 x 30	TAS12S16-0120CC TAS12S16-0130CC
Triart Prep C8-S	S-10	20	10 x 20 10 x 30	TOS20S11-0120CC TOS20S11-0130CC
Omega	S-10	—	10 x 20 10 x 30	OMG99S11-0120CC OMG99S11-0130CC
YMCbasic	S-5	—	10 x 20 10 x 30	BA99S05-0120CC BA99S05-0130CC

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

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.

To satisfy the demand for these Ultra Fast LC methods, YMC introduced YMC-UltraHT columns, which ideally match the latest instrumentation technology for “extra” high pressure application e.g. with Agilent 1200™ series or Waters Acquity UPLC™.

As a column and bulk media supplier with many years of practical chromatographic experience, YMC found unacceptable that the use of novel separation media is often restricted to dedicated equipment and not applicable to the large installed base of “conventional” HPLC systems with a standard pressure rating of 5800 psi (400 bar, 40 MPa). For this reason, specifications for YMC-UltraHT columns have been designed to provide powerful chromatographic improvements, in terms of velocity and resolution, even with conventional operating conditions. 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 (see page 54 for details).

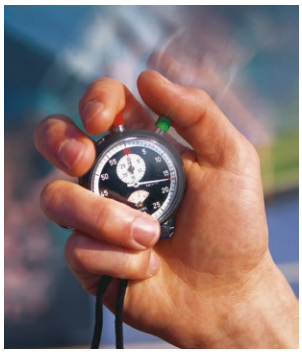
For effective high throughput separations, YMC offer a wide range of high performance HPLC columns which allow Ultra Fast analytical HPLC with conventional equipment. Due to the down-scalability of the majority of YMC’s stationary phases, the time needed for a single analysis can be reduced to less than 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-phase: 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

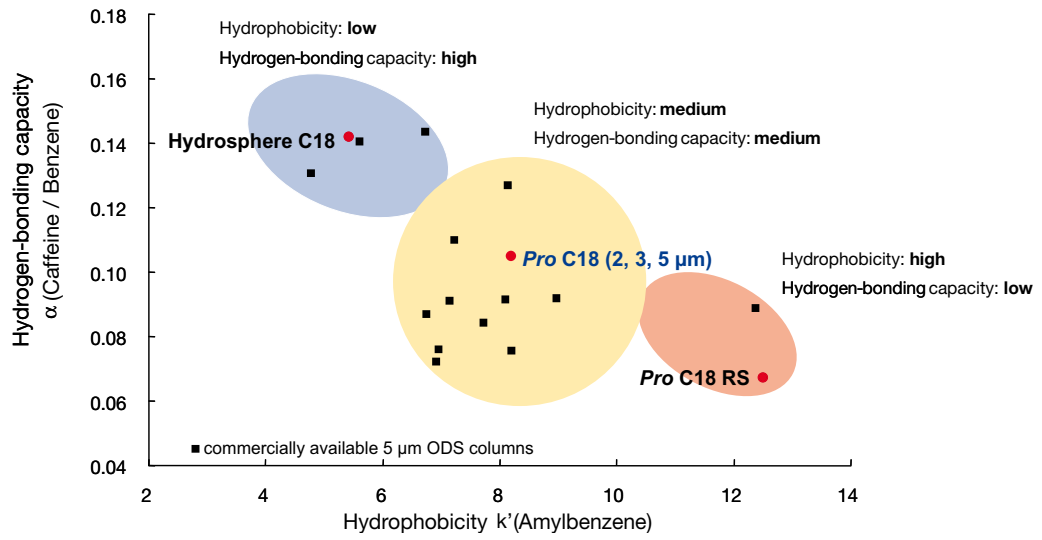
Since the introduction of the *Pro*Family series of phases, YMC-Pack *Pro* C18 has proved to be one of the first choices for a wide range of HPLC applications in pharmaceutical and biotechnological research and production, where efficiency and reliability are a major demand.

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 did developed Hydrosphere C18 in order of 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

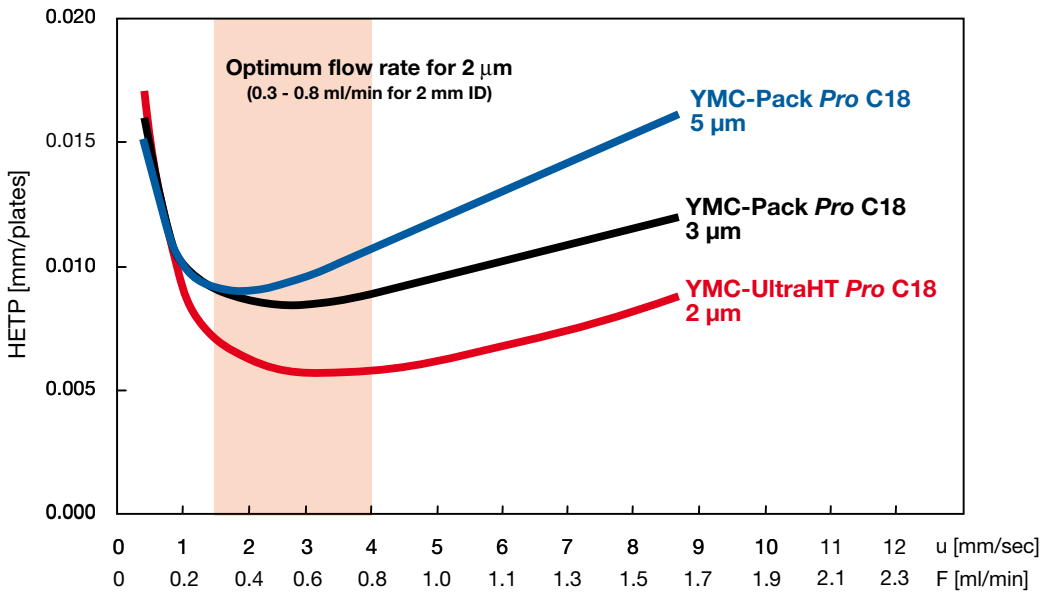
Selectivity-Chart*



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.

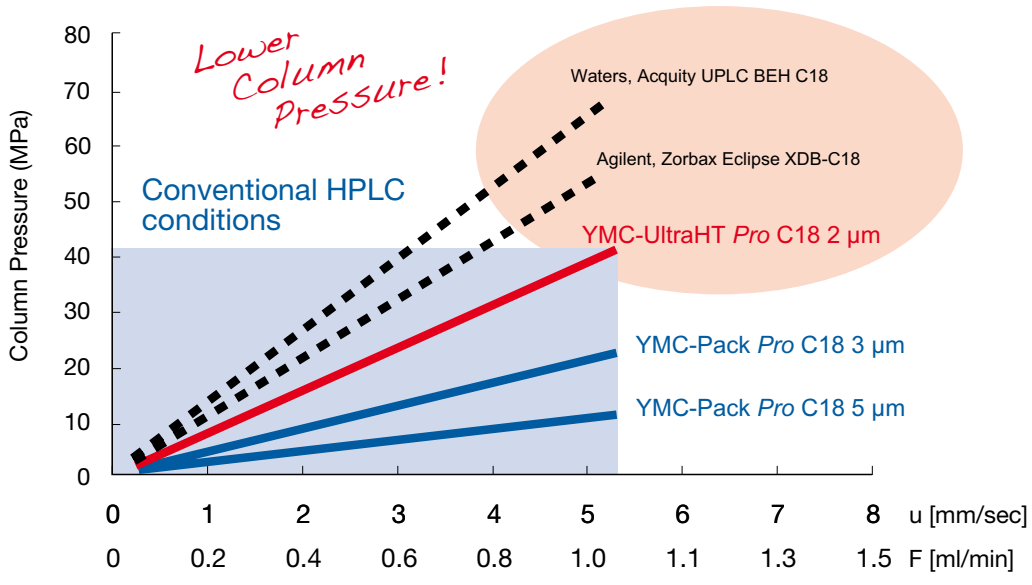
* Application data by courtesy YMC Co., Ltd.

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.

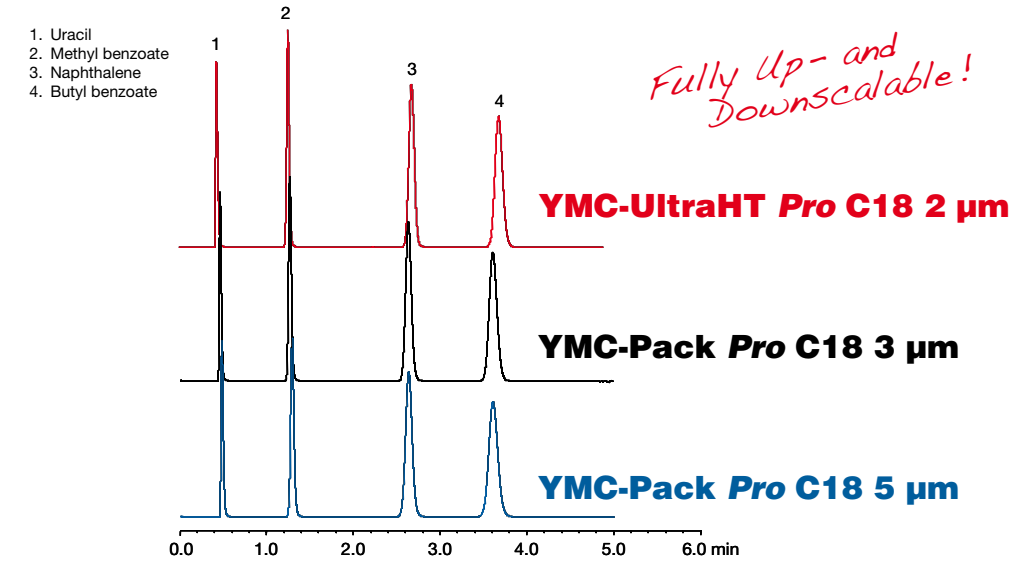
Column Pressure*



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

Reproducibility Comparison*



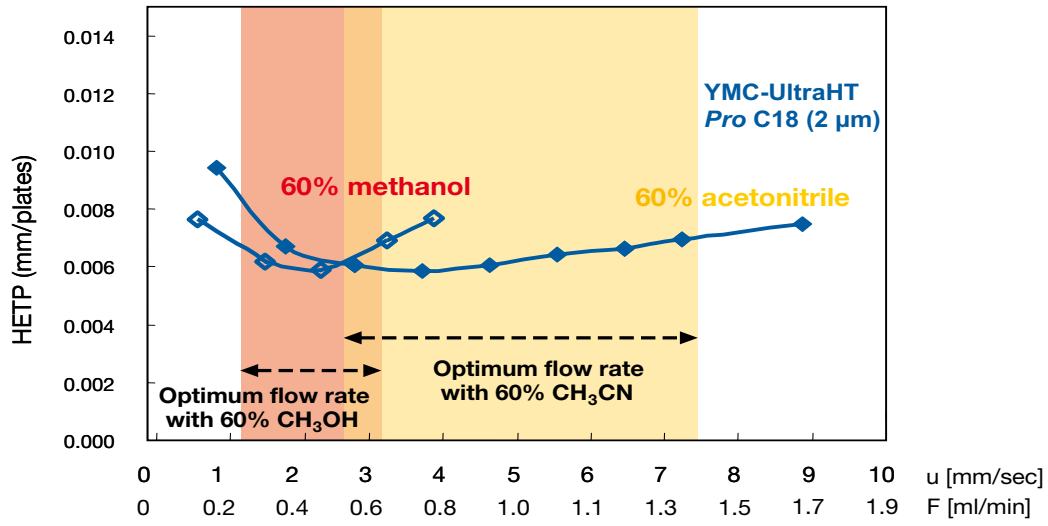
Column: 50 x 2.0 or 2.1 mm ID
Eluent: acetonitrile / water (60/40)
Temperature: 25 °C
Detection: UV at 270 nm

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*



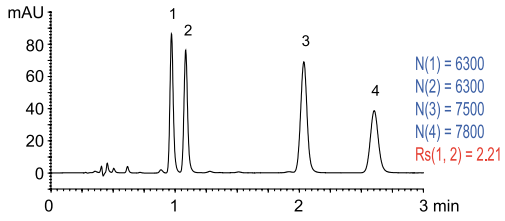
Column: YMC-UltraHT *Pro* C18, 2 µm, 50 x 2.0 mm ID
Temperature: 25 °C
Sample: Butyl benzoate

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.

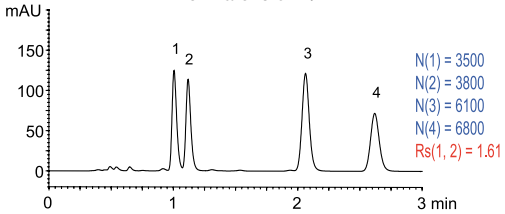
Fast LC analysis with conventional LC equipment*

50 x 3 mm ID

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

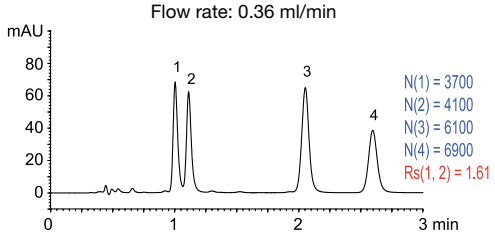


Standard Cell (8 µl, Cell length 10 mm)
Flow rate: 0.8 ml/min

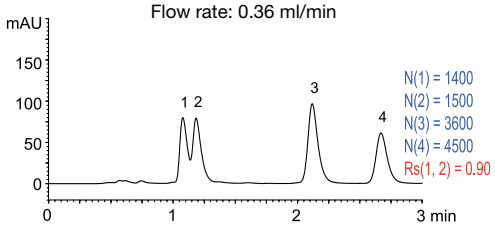


50 x 2 mm ID

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



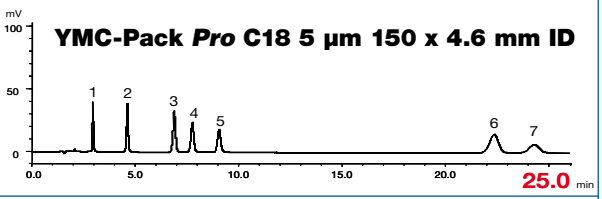
Column: YMC-UltraHT *Pro* C18
Eluent: acetonitrile / 20 mM KH_2PO_4 (10/90)
Temperature: 37 °C
Detection: UV at 260 nm

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

* Application data by courtesy YMC Co., Ltd.

Downscale of Methods

Conventional LC Method*

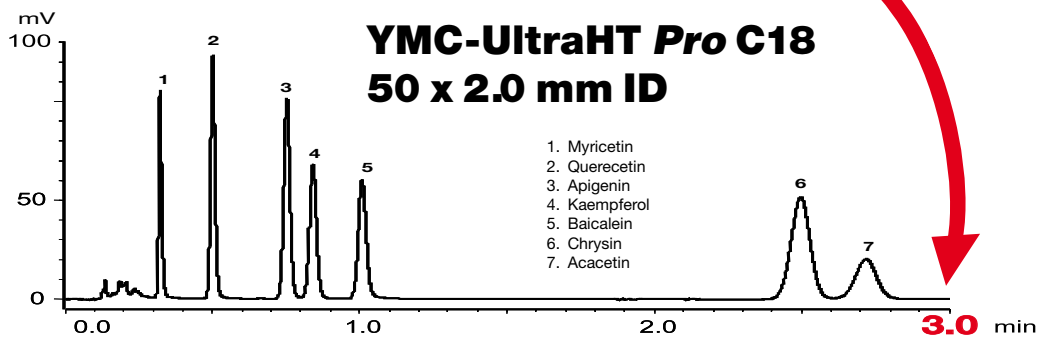


Eluent: acetonitrile / water / formic acid (35/65/0.1)
Flow rate: 1.0 ml/min (1.00 mm/sec)
Temperature: 40 °C
Detection: UV at 260 nm
Pressure: 1230 psi (83 bar, 8.3 MPa)

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.

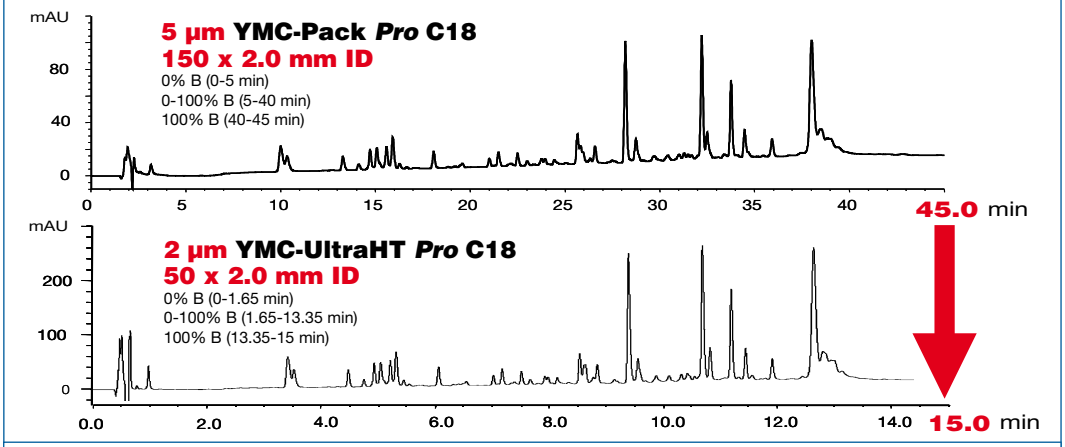
Ultra Fast LC Method*



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.

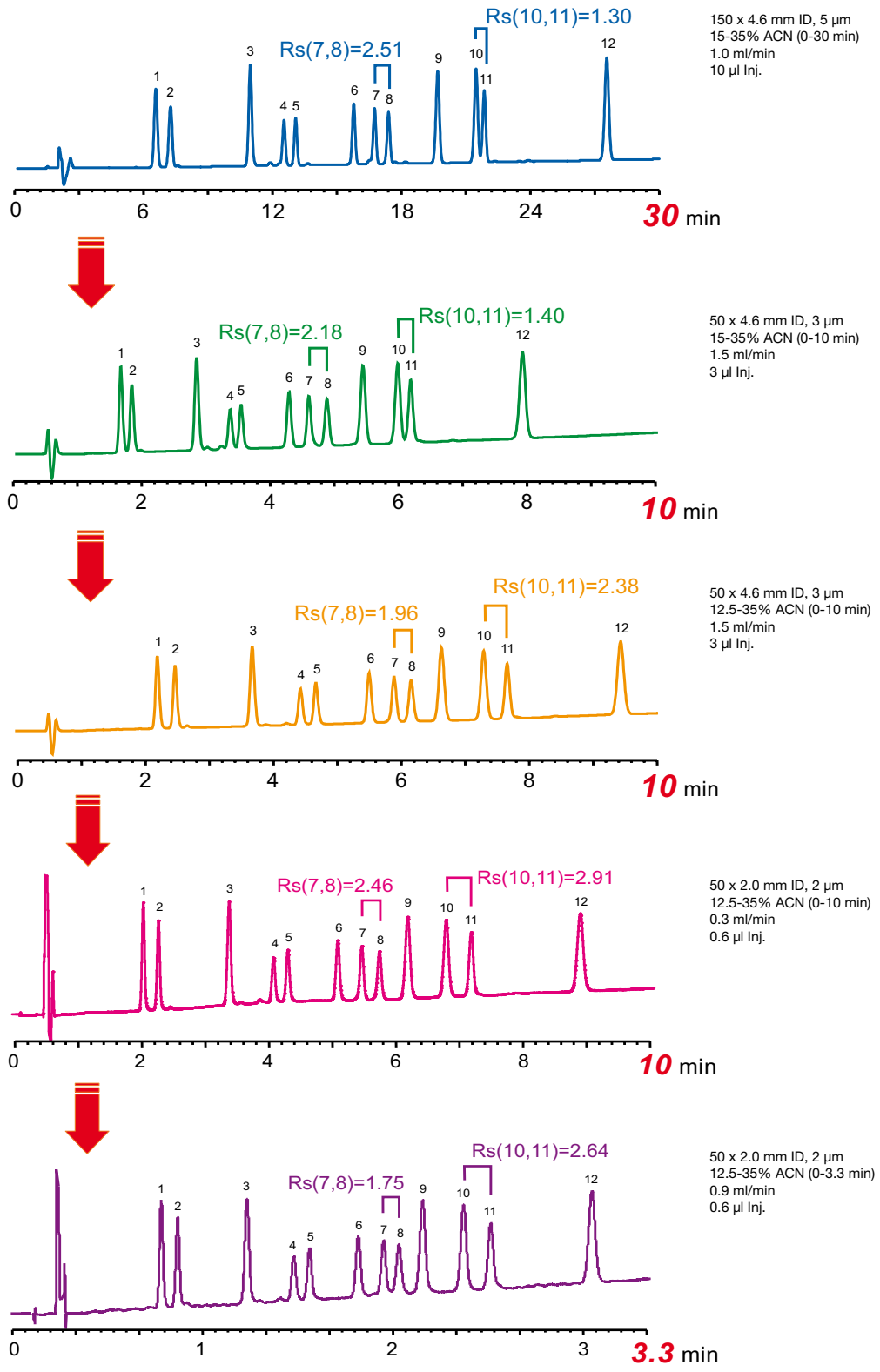
Peptide mapping*



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

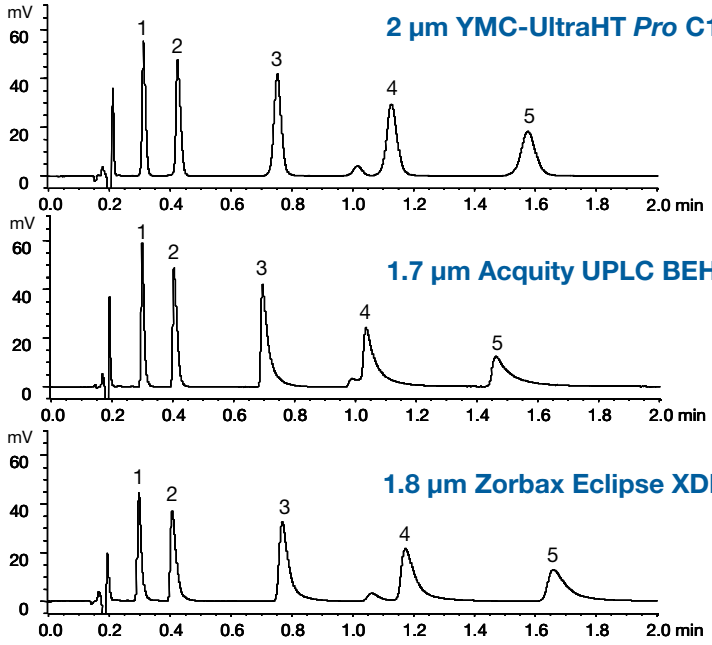
* Application data by courtesy YMC Co., Ltd.

Downscale of Methods

Why not take the pressure out of Fast LC!

Peak performance*

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



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

N 5 = 106,000 /m
Tf 5 = 1.07
4470 psi (300 bar, 30 MPa)

1.7 µm Acquity UPLC BEH C18, 50 x 2.1 mm ID

N 5 = 89,000 /m
Tf 5 = 3.99
7450 psi (500 bar, 50 MPa)

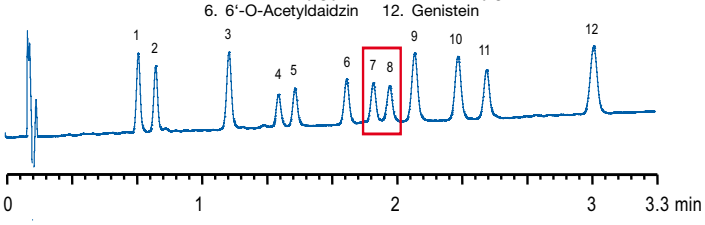
1.8 µm Zorbax Eclipse XDB-C18, 50 x 2.1 mm ID

N 5 = 78,000 /m
Tf 5 = 2.35
5960 psi (400 bar, 40 MPa)

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

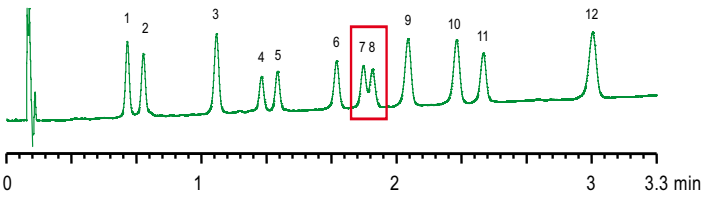
Peak performance*

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



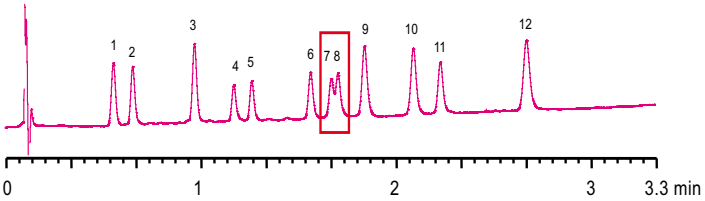
2 µm YMC-UltraHT Hydrosphere C18, 50 x 2.0 mm ID

7449 psi (500 bar, 50 MPa)



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

8044 psi (540 bar, 54 MPa)

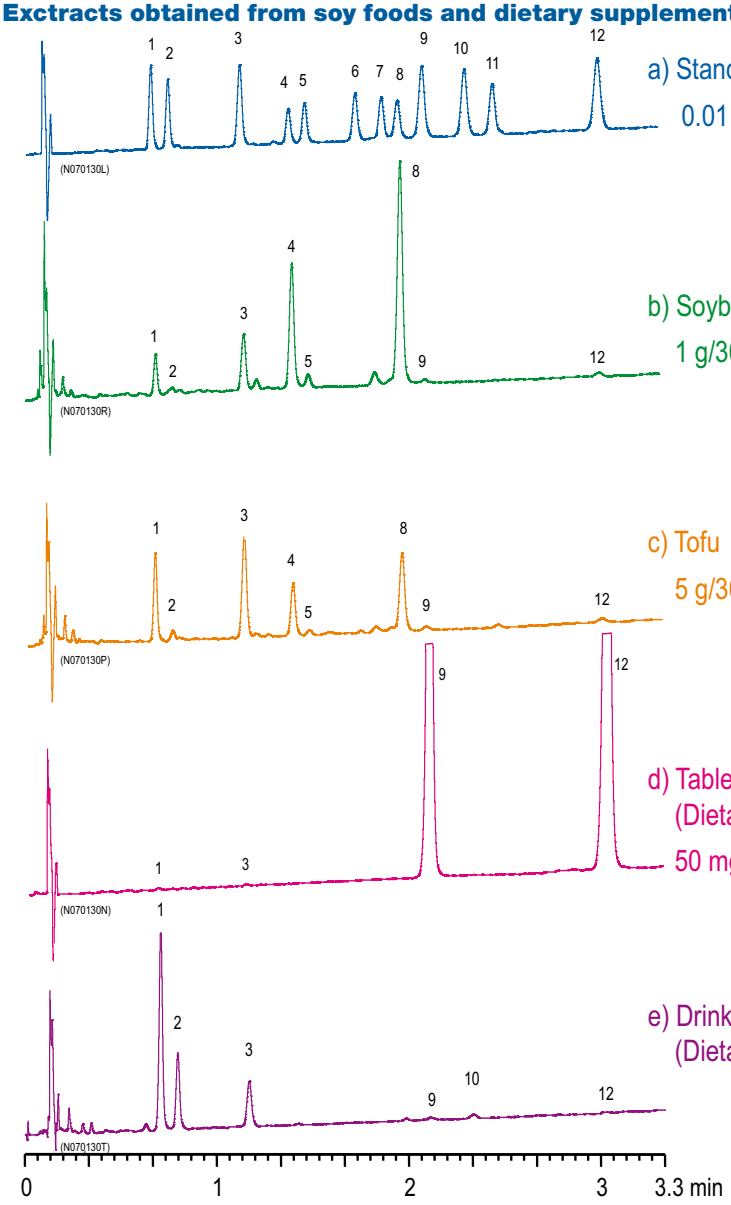


1.8 µm Zorbax SB-C18, 50 x 2.1 mm ID

11,470 psi (770 bar, 77 MPa)

Downscale of Methods

Exctracts 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)

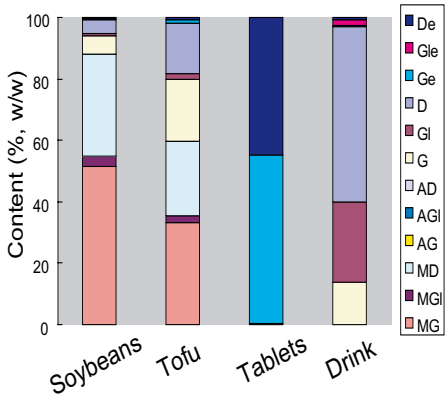
Sample preparation method

Sample b-d
← 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)

Sample e

Column	: YMC-UltraHT Hydrosphere C18 (2 µm) 50 x 2.0 mm ID
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

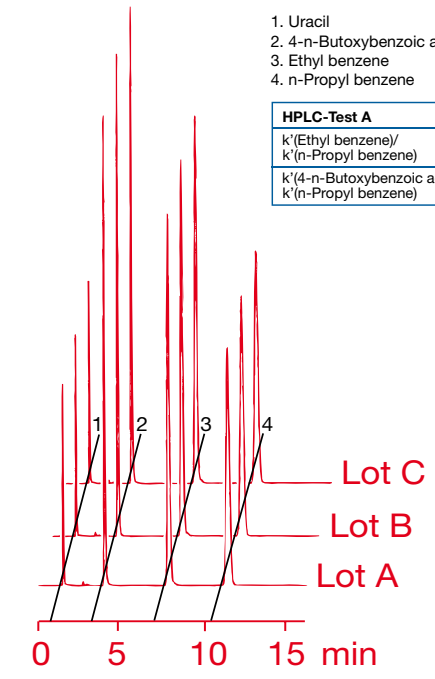
- **YMC-Pack *Pro*Family based on ultra high purity silica**
- **Hydrosphere C18 for stability in aqueous mobile phases**
- **every packed column supplied with:**
  - **lot certificate**
  - **test chromatogram**

	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
	see pages 68-69	see pages 70-71	see pages 72-73	see pages 74-77	see pages 78-79

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



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

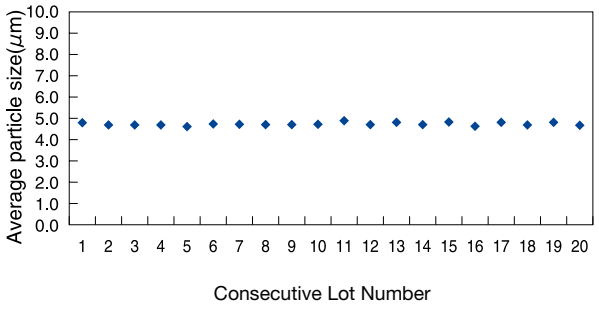
YMC *Pro*Family

Underlying silica gel support

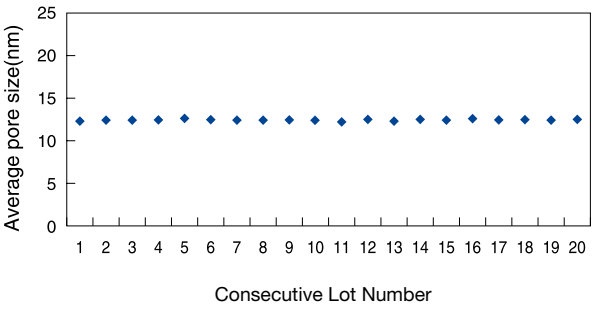
The physical properties of silica gel have a great effect on the selectivity and performance of the bonded packing. For the purpose of supplying columns of stable quality, the physical properties of silica gel used for packing such as particle size, pore size, specific surface area, pore volume and amount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

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

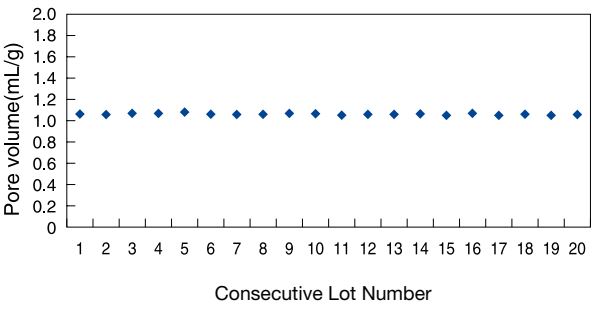
Particle size*



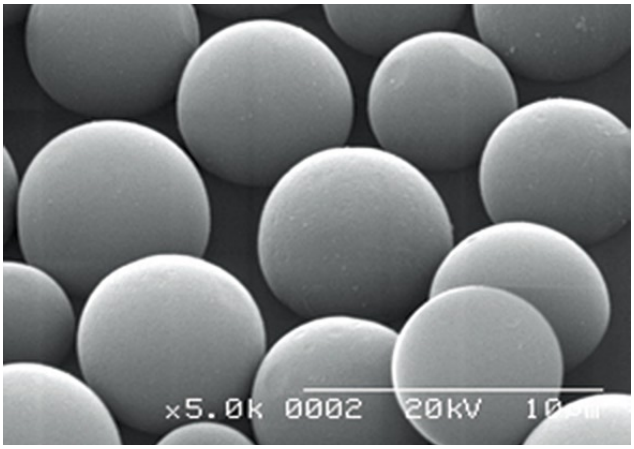
Pore size*



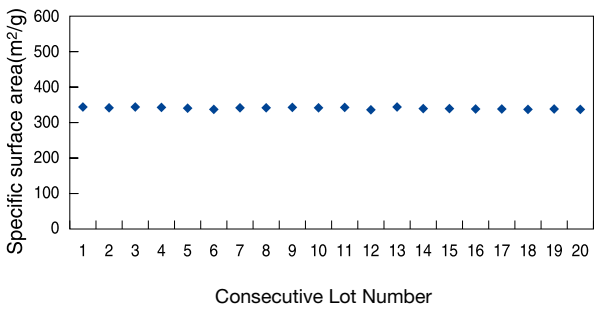
Pore volume*



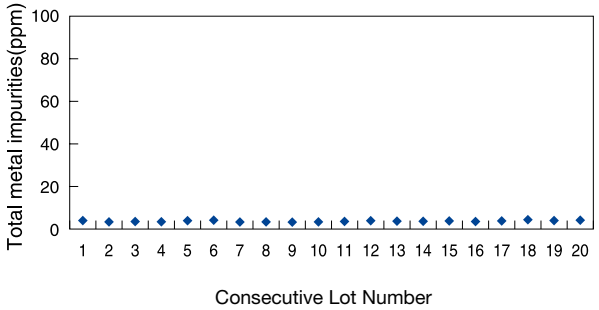
Silica Support Material (5 µm, 12 nm)



Specific surface area*



Amount of metal content*



* Application data by courtesy YMC Co., Ltd.

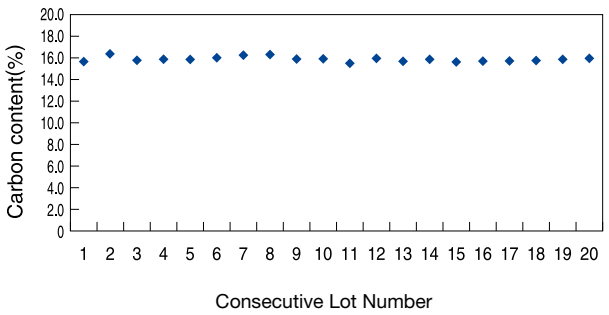
YMC *Pro*Family

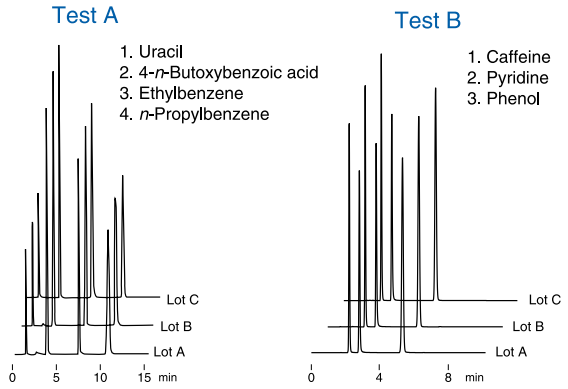
Packing material

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.

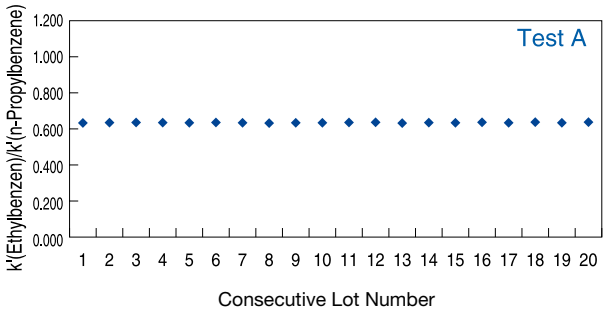
Pro C18 5 µm, Reproducibility between batches

Percent Carbon Content*

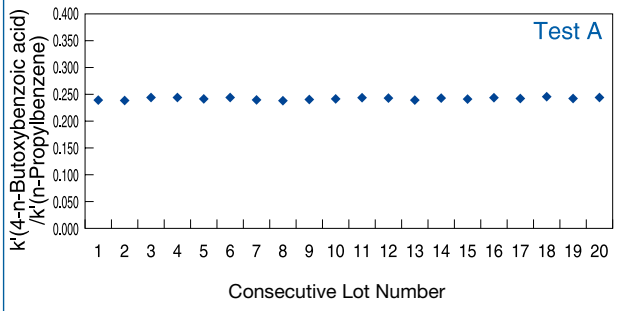




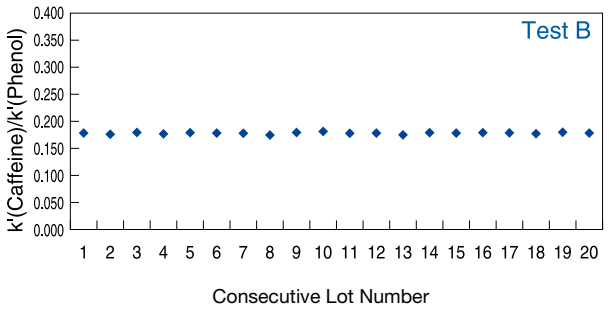
Hydrophobicity*



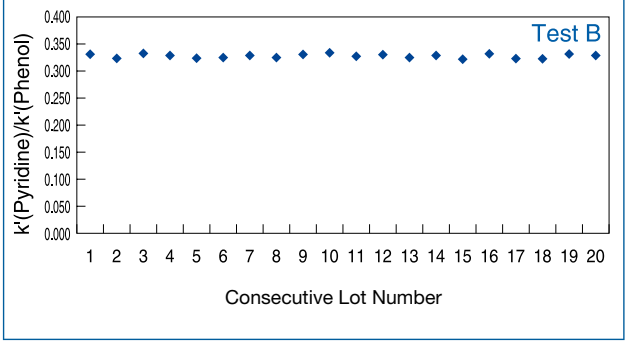
Acidic compounds*



Hydrogen bonding ability*



Basic compounds*



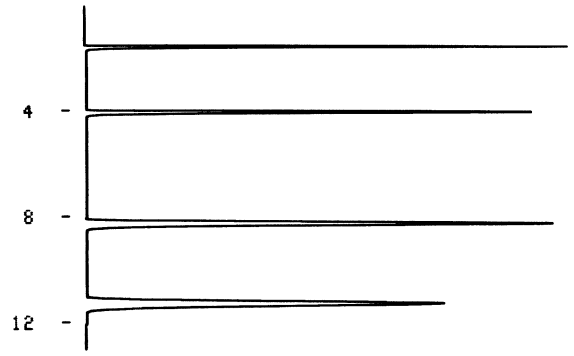
Individual Column Test

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 an asymmetry of 0.90 to 1.15 (at 10% peak height for 5 µm particle size).

//
// YMC HPLC COLUMN INSPECTION REPORT //
//

NAME, PARTICLE : YMC-Pack Pro C18, S-5 µm,12nm GEL LOT,7602
PRODUCT CODE : AS12S05-1546WT, AS-302
SIZE, SER.NO. : 150 x 4.6 mmI.D., No.0415125458(W)

ELUENT : ACETONITRILE/WATER (60/40)
FLOW RATE : 1 mL/min
PRESSURE : 6.86 MPa
TEMPERATURE : AMBIENT
DETECTION : UV at 270 nm, 0.32 AUFS
INJECTION VOLUME : 5 uL
CHART SPEED : 5 mm/min



in order of elution;

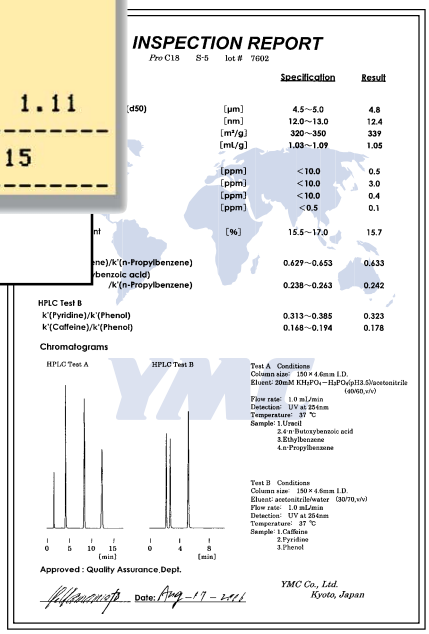
No(n)	SAMPLE		k'	AlPha	N	As
1	URACIL	0.05 mg/mL				
2	METHYL BENZOATE	0.5 uL/mL	1.6			
3	NAPHTHALENE	0.18 mg/mL	4.34	2.71		
4	BUTYL BENZOATE	1.5 uL/mL	6.31	1.45	17000	1.11

Guarantee 15000 - N - 19000 , 0.90 - As - 1.15

As, asymmetry factor at 10% Peak height
[SYSTEM No. 102] [INSPECTED BY M.BANDO] YMC Co.,Ltd., JAPAN

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

Individual Lot Test


INSPECTION REPORT

Pro C18 S-5 lot # 7602

		Specification	Result
d50)	[µm]	4.5~5.0	4.8
	[nm]	12.0~13.0	12.4
	[m²/g]	320~350	339
	[mL/g]	1.03~1.09	1.05
	[ppm]	<10.0	0.5
	[ppm]	<10.0	3.0
	[ppm]	<10.0	0.4
	[ppm]	<0.5	0.1
nt	[%]	15.5~17.0	15.7
ne)/k'(n-Propylbenzene)		0.629~0.653	0.633
benzoic acid) /k'(n-Propylbenzene)		0.238~0.263	0.242
HPLC Test B			
k'(Pyridine)/k'(Phenol)		0.313~0.385	0.323
k'(Caffeine)/k'(Phenol)		0.168~0.194	0.178

Chromatograms

HPLC Test A HPLC Test B

Test A Conditions
Column size: 150×4.6mm I.D.
Eluent: 20mM 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
Sample: 1.Uracil
2.4-n-Butoxybenzoic acid
3.Ethylbenzene
4.n-Propylbenzene

Test B Conditions
Column size: 150×4.6mm I.D.
Eluent: acetonitrile/water (30/70,v/v)
Flow rate: 1.0 mL/min
Detection: UV at 254nm
Temperature: 37 °C
Sample: 1.Caffeine
2.Pyridine
3.Phenol

Approved : Quality Assurance Dept.

Date: Aug-17-2011

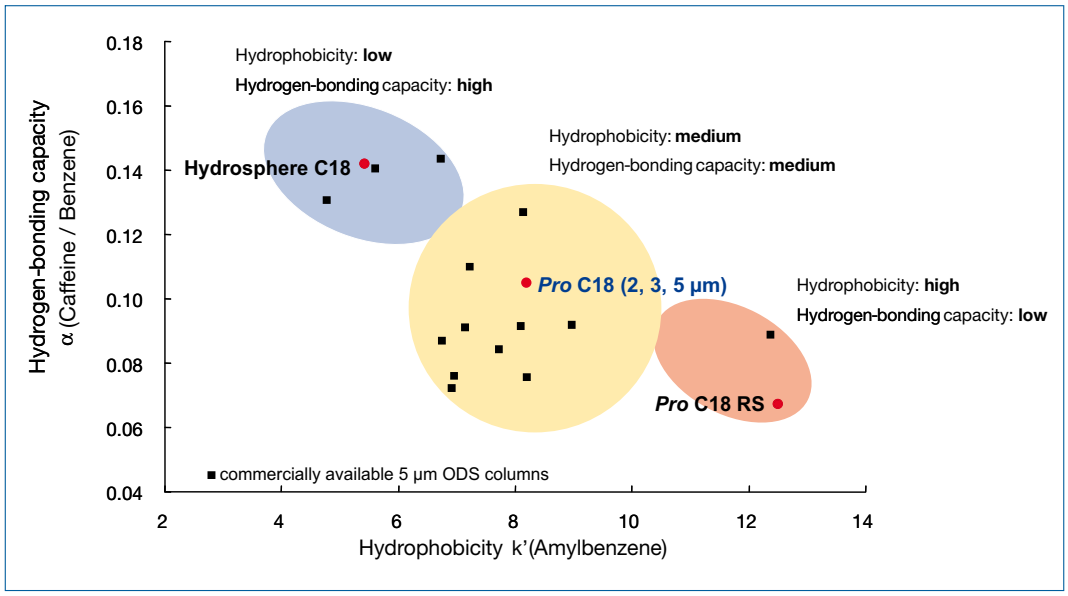
YMC Co., Ltd. Kyoto, Japan

* Application data by courtesy YMC Co., Ltd.

YMC *Pro*Family

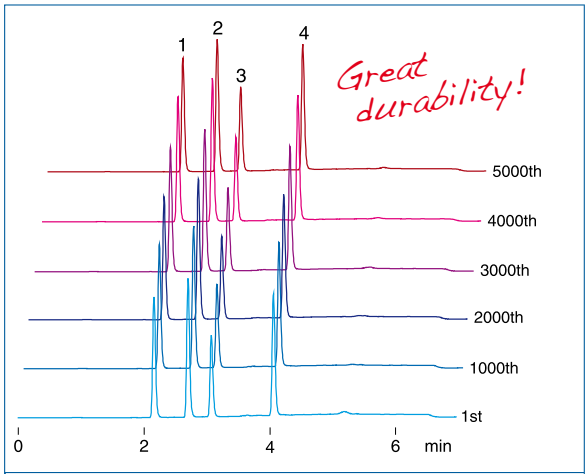
Comparison of separative selectivity

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 *Pro* C18 RS have contrasting separation characteristics, with standard *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.



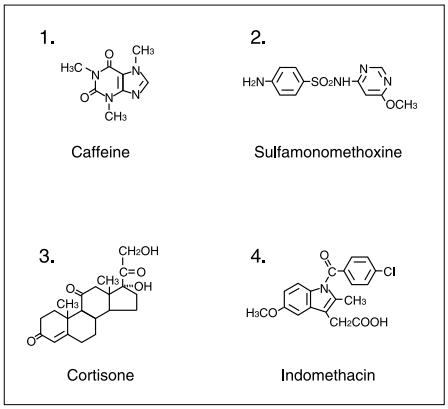
Durability for repetitive analysis

The long-term stability of a *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 month) 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



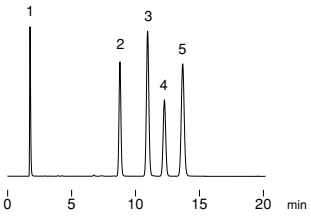
YMC *Pro*Family

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.

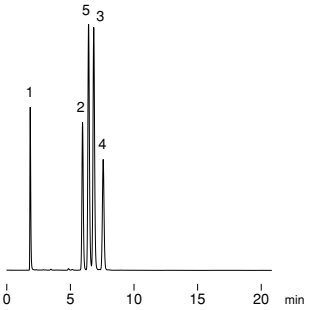
The compounds 1. uracil (dead volume marker) 2. n-butylbenzene 3. o-terphenyl 4. n-amylbenzene and 5. triphenylene are used to determine the hydrophobicity (2. and 4.) and the steric selectivity (3. and. 5.) of each *Pro*Family member under unbuffered chromatographic conditions.

YMC-Pack *Pro* C18



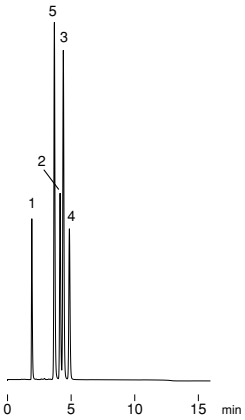
balanced hydrogen bonding, capacity and hydrophobicity

YMC-Pack *Pro* C8



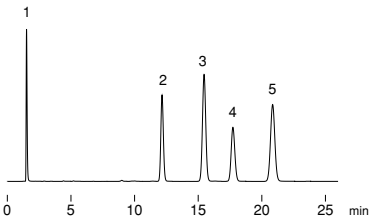
lower hydrophobicity

YMC-Pack *Pro* C4



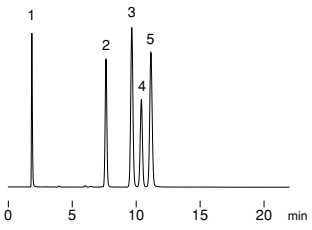
lowest hydrophobicity

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.

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

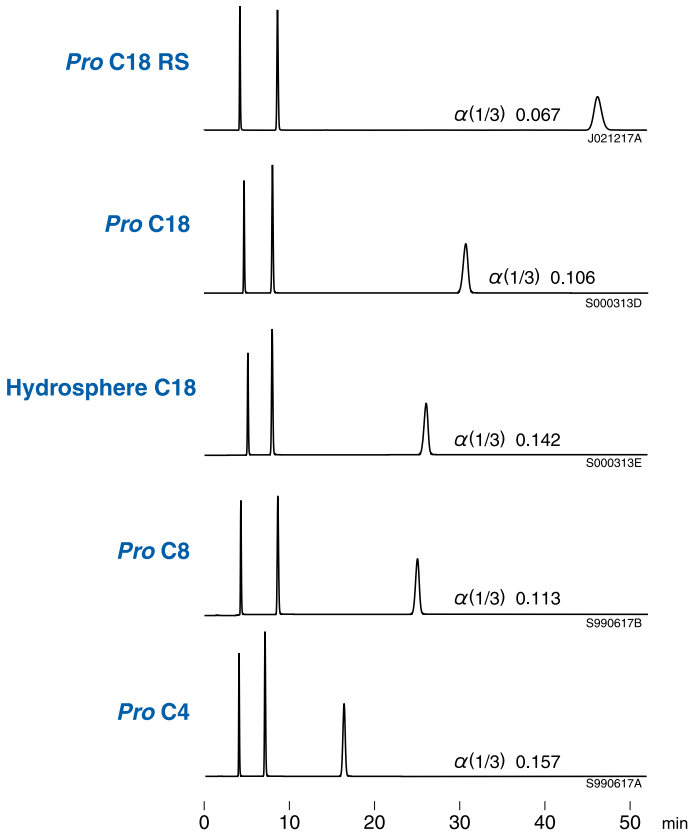
* Application data by courtesy YMC Co., Ltd.

YMC *Pro*Family

Hydrogen bonding capacity

Hydrogen bonding capacity is evaluated by examining the relative retention coefficient as α (caffeine/benzene). Among the *Pro* series both Hydrosphere C18 with low density of C18, and *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 packing have similar retention time, but show different selectivity.

Hydrogen bonding capacity*



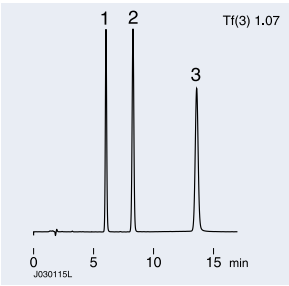
Column: 150 x 4.6 mm ID
Eluent: methanol / water (30/70)
Flow rate: 1.0 ml/min
Temperature: 37° C
Detection: UV at 254 nm

YMC *Pro*Family

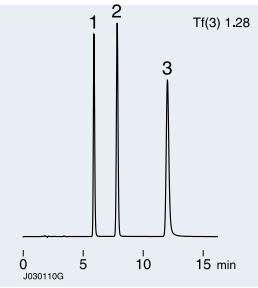
Acidic and basic compounds

Acidic compounds*

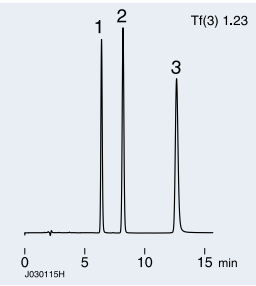
***Pro* C18 RS**



***Pro* C18**



Hydrosphere C18

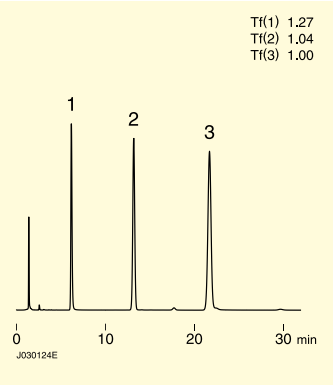


Column: 150 x 4.6 mm ID
Eluent: 20 mM CH_3COONa-CH_3COOH (pH 4.4) / acetonitrile (80/20)
Flow rate: 1.0 ml/min
Temperature: 37° C
Detection: UV at 230 nm

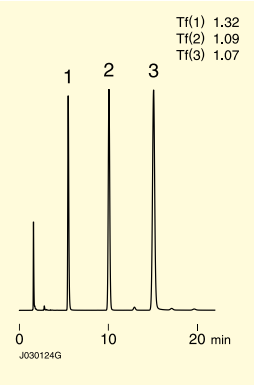
1. *p*-Hydroxyacetophenone (I.S.)
2. Sorbic acid
3. Dehydroacetic acid

Basic compounds*

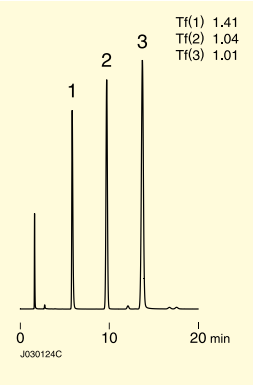
***Pro* C18 RS**

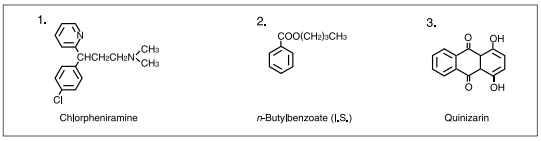


***Pro* C18**



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**

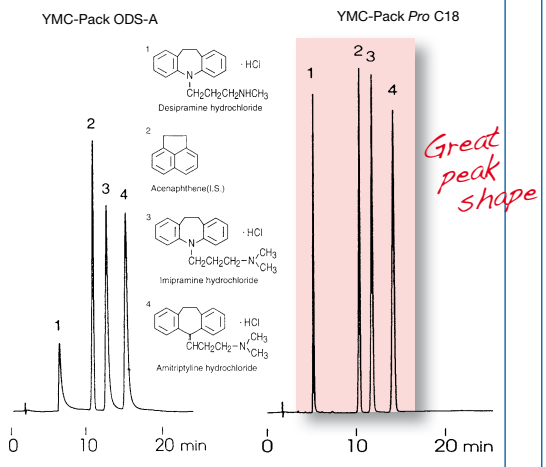
YMC-Pack *Pro* C18	Specification
Particle size / µm	2*; 3*; 5
Pore size / nm	12
Surface area / m^2g^{-1}	330
Carbon content / %	16
Recommended pH range	2.0 - 8.0

*** please be referred to page 52 ff for YMC-UltraHT columns**

Properties

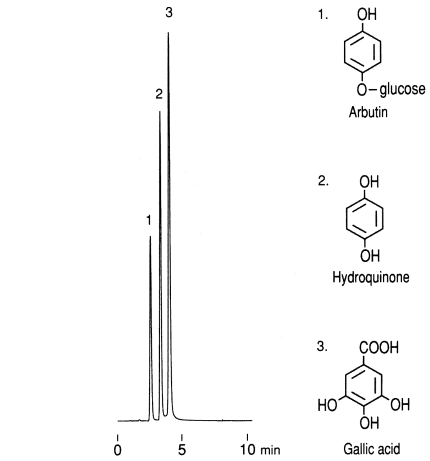
YMC-Pack *Pro* C18 is based on an ultra pure silica support, which is used for the whole *Pro*Family. Due to a proprietary endcapping process especially designed for this type of silica, YMC-Pack *Pro* C18 is perfectly suitable for the separation of acidic and basic molecules. The inertness of the silica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



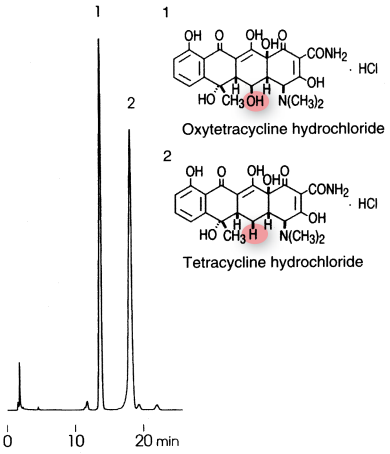
Column: YMC-Pack *Pro* C18 (3 µm, 12 nm) 50 x 2.0 mm ID
Eluent: 10 mM CH_3COONH_4 / methanol (45/55)
Flow rate: 0.2 ml/min
Temperature: 37° C
Detection: UV at 254 nm

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

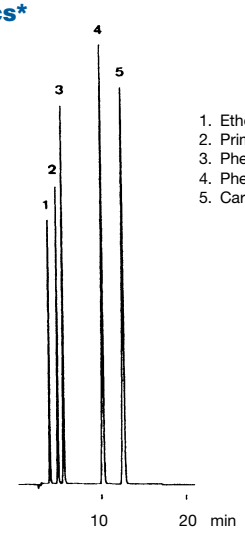
Oxytetracycline hydrochloride

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)

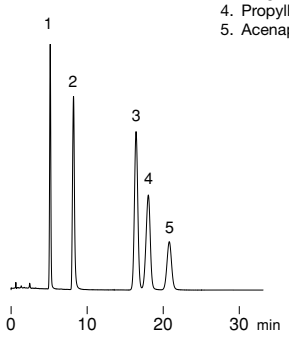
Antiepileptics*



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)

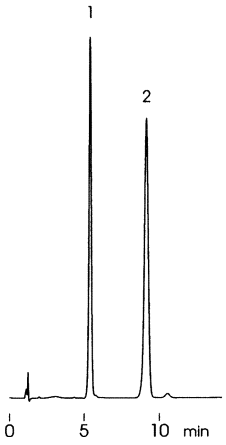
Baseline separation of compounds with different polarity*

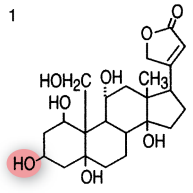


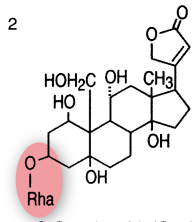
1. Toluene
2. Amitriptyline HCl
3. Progesterone
4. Propylbenzene
5. Acenaphthene

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 are shipped with each analytical column.

* Application data by courtesy YMC Co., Ltd.

YMC-Pack *Pro* C8

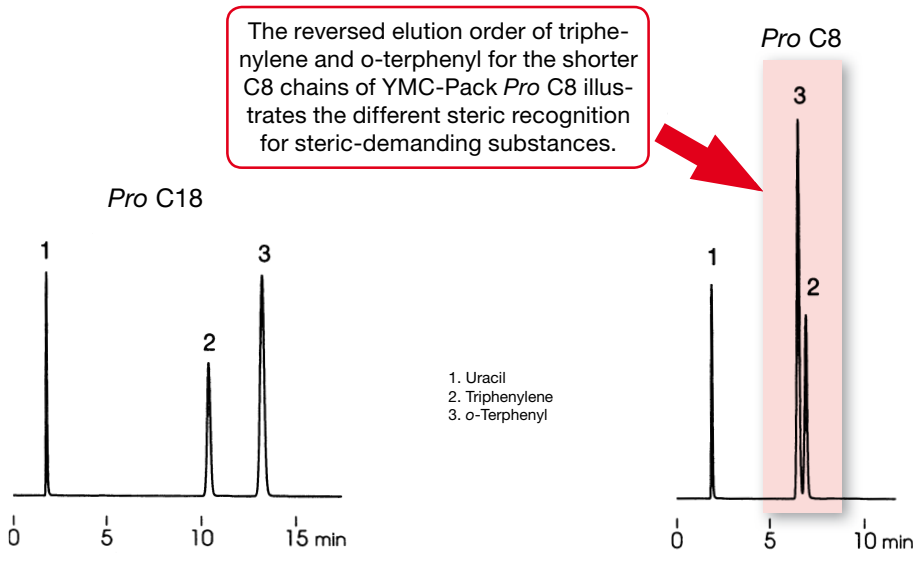
- **extremely broad selectivity pattern**
- **good alternative to C18-phases**
- **suitable for all types of organic molecules, especially basic pharmaceuticals**

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*



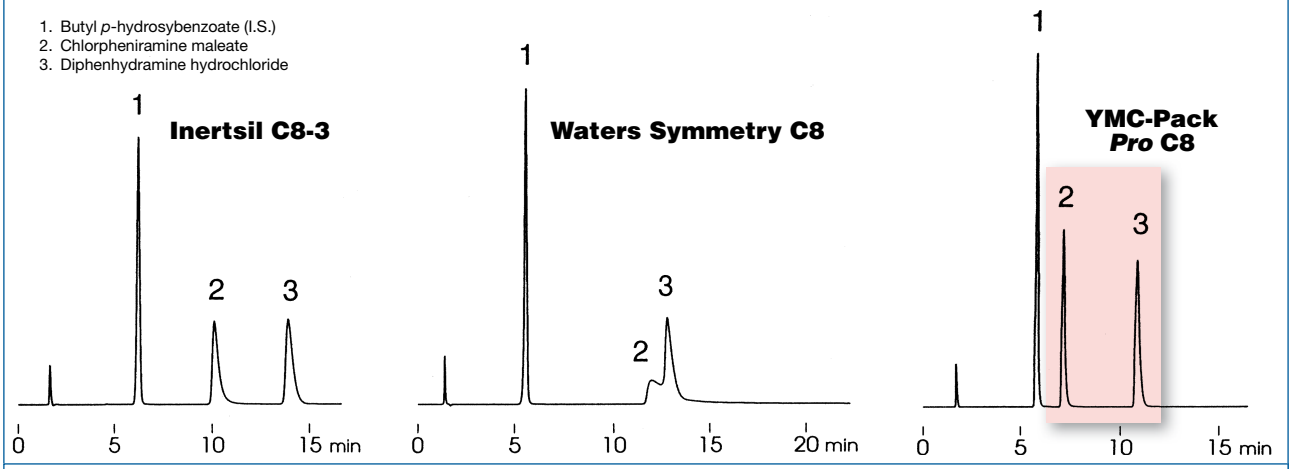
Column: 150 x 4.6 mm ID
Eluent: methanol / water (80/20)
Flow rate: 1.0 ml/min
Temperature: 37° C
Detection: UV at 254 nm

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

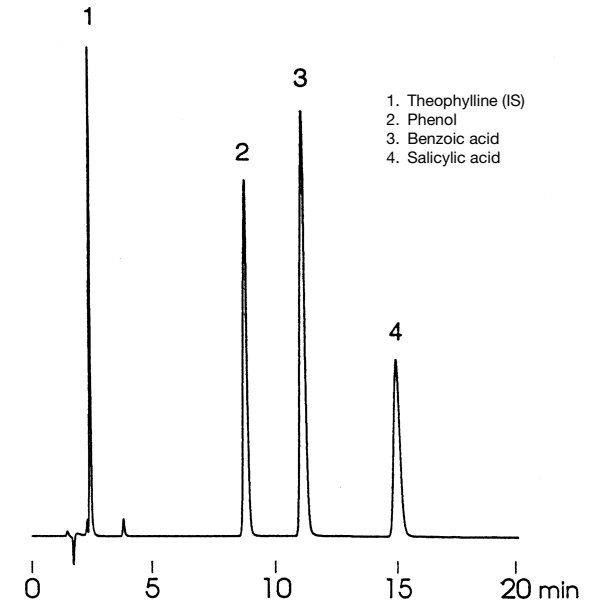


Histamine antagonists

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*

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

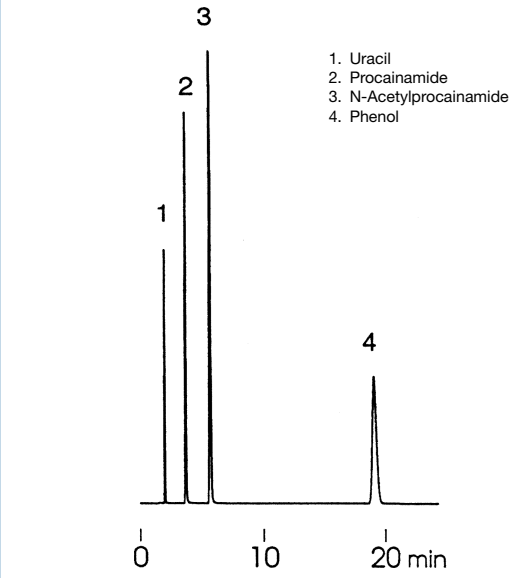


Disinfectants

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*

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



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.

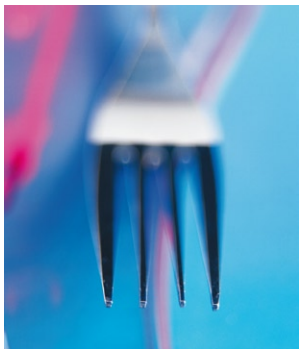
For detailed information please refer to the "Column Care and Use Instructions" which are shipped with each analytical column.

* Application data by courtesy YMC Co., Ltd.

YMC-Pack *Pro* C4

L26

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



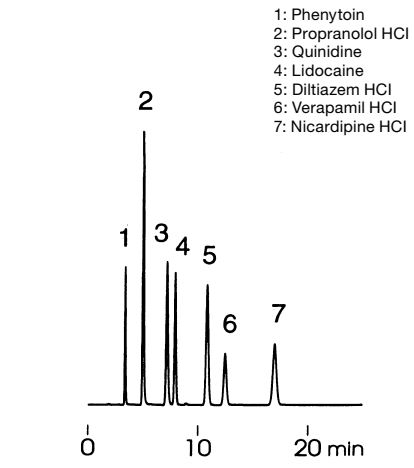
YMC-Pack *Pro* C4	Specification
Particle size / µm	3; 5
Pore size / nm	12
Surface area / m^2g^{-1}	330
Carbon content / %	7
Recommended pH range	2.0 - 7.5

General

More than 80% of the RP-HPLC 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.

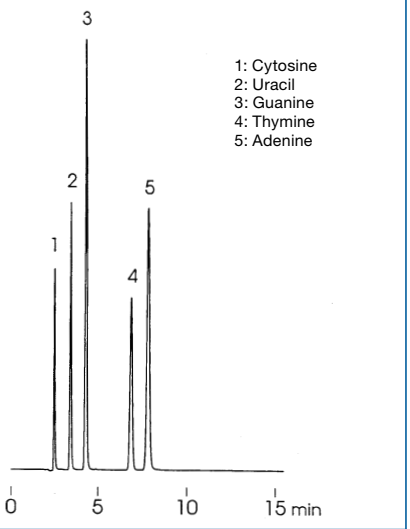
Within the *Pro*Family, YMC-Pack *Pro* C4 is the selectivity of choice to reduce time of analysis in combination with the given advantages of the *Pro*Family, namely the high purity silica support and the low metal content, which result in excellent peak performance as below.

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*

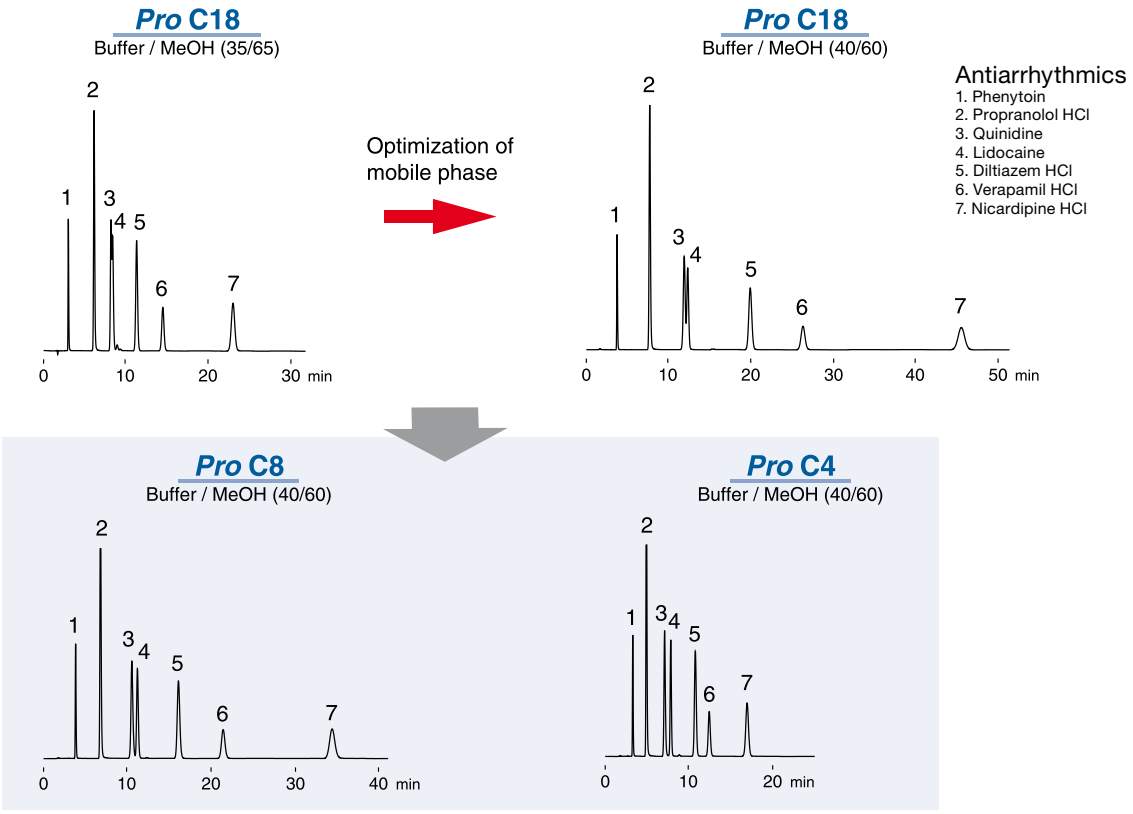


Nucleic acid bases
Column: YMC-Pack *Pro* C4 (5 µm, 12 nm) 150 x 4.6 mm ID
Part No.: BS12S05-1546WT
Eluent: 20 mM KH_2PO_4
Flow rate: 1.0 ml/min
Temperature: 37° C
Detection: UV at 254 nm

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 are shipped with each analytical column.

* 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**

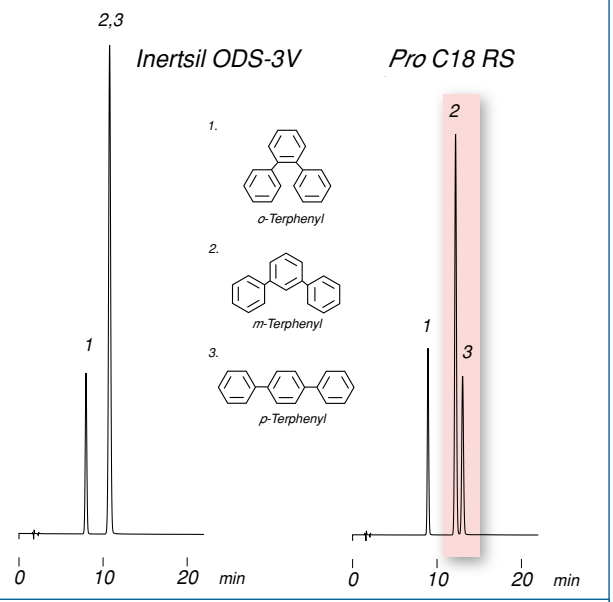
YMC-Pack *Pro* C18 RS	Specification
Particle size / µm	3; 5
Pore size / nm	8
Surface area / m^2g^{-1}	510
Carbon content / %	22
Recommended pH range	1.0 - 10.0*

* 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*



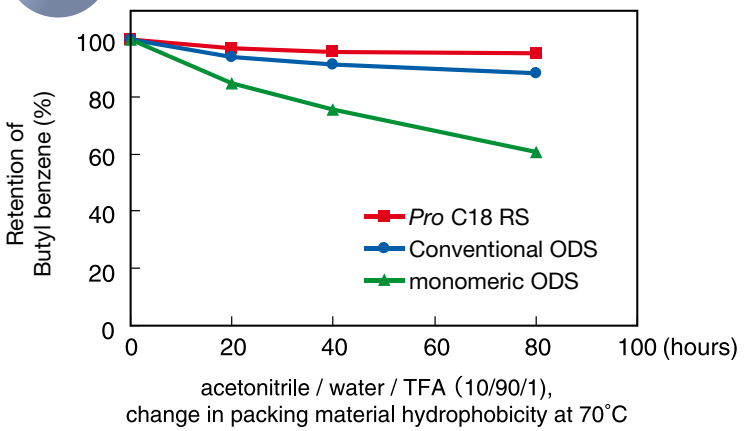
Column: 150 x 4.6 mm ID
Eluent: methanol / water (85/15)
Flow rate: 1.0 ml/min
Temperature: 37° C
Detection: UV at 254 nm

YMC-Pack *Pro* C18 RS

Stability under acidic conditions*

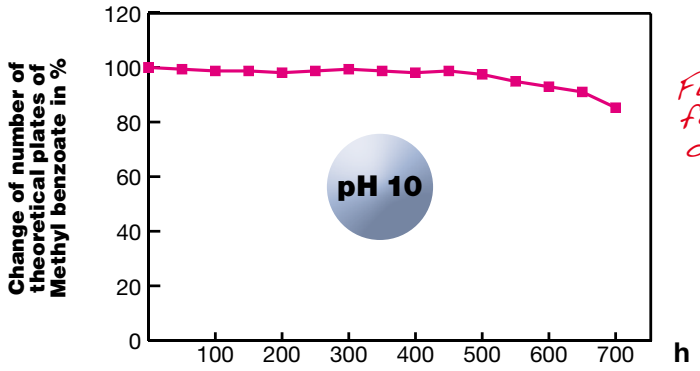
pH 1

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.

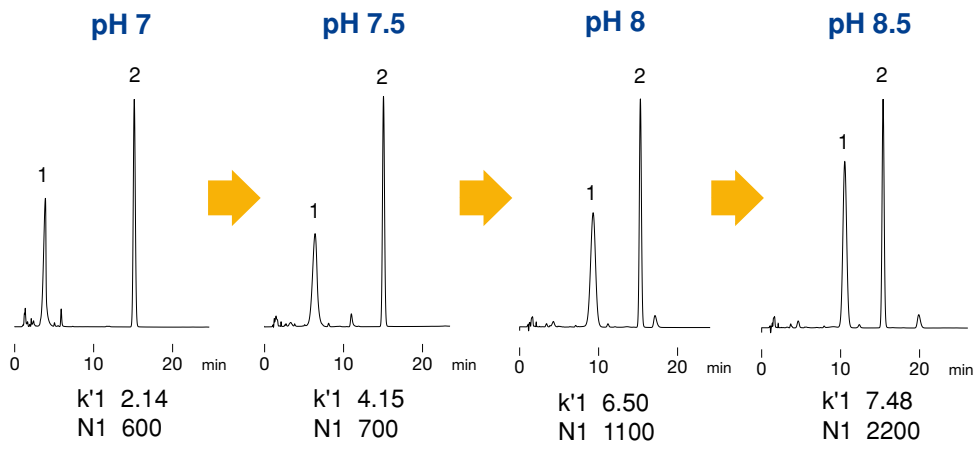
Basic eluents may significantly affect silicas and traditional bonding chemistries. Therefore, stability data should be considered only after verifying that the buffer system used maintains the selected pH during preparation and use. Furthermore, it must be verified that the eluent is not recycled, since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

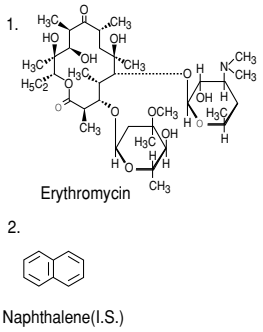
* Application data by courtesy YMC Co., Ltd.

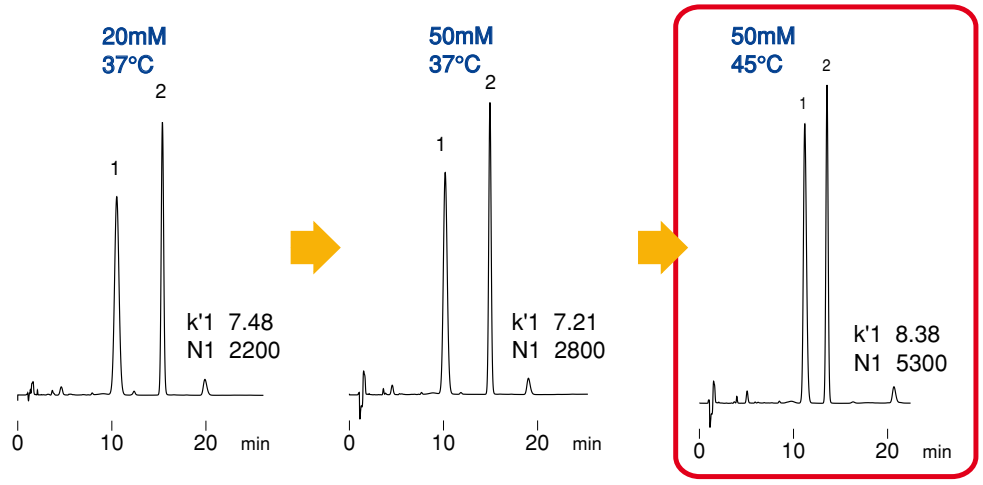
YMC-Pack *Pro* C18 RS

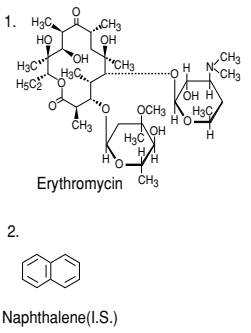
YMC-Pack *Pro* C18 RS: Ideal for the separation of steric demanding compounds and/or for use under broader pH conditions!

Method optimization*









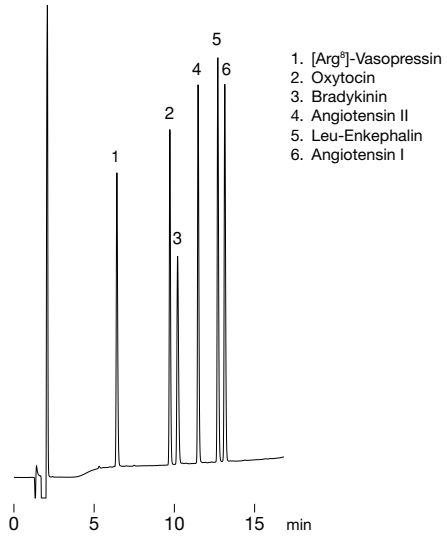
Column:	YMC-Pack *Pro* C18 RS (5 µm, 8 nm) 150 x 4.6 mm ID
Eluent:	potassium phosphate buffer (pH 8.5) / acetronitrile (50/50)
Flow rate:	1.0 ml/min
Temperature:	37° C
Detection:	UV at 210 nm

YMC-Pack *Pro* C18 RS

Applications

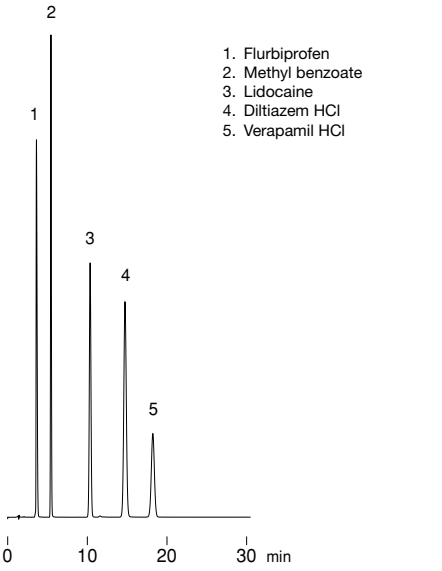
The specific properties of YMC-Pack *Pro* C18 RS make it an excellent choice for the separation of non-polar structurally related analytes. The extended resistance towards acidic and basic conditions not only widens the possibilities in method development but also provides further selectivities for demanding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

Peptides: LC-MS conditions*



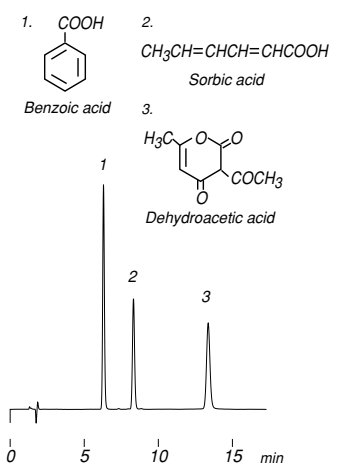
Column:	YMC-Pack *Pro* C18 RS (5 µm, 8 nm) 150 x 4.6 mm ID
Part No.:	RS08S05-1546WT
Eluent:	A: water / TFA (100/0.1) B: acetonitrile / TFA (100/0.1)
Gradient:	15-35% B (0-15 min)
Flow:	1.0 ml/min
Detection:	UV, 220 nm, 0.32 AUFS
Temperature:	37 °C
Injection:	20 µl (0.05 mg/ml)

Drugs: LC-MS conditions*



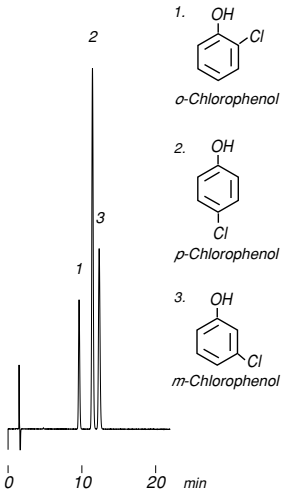
Column:	YMC-Pack *Pro* C18 RS (5 µm, 8 nm) 150 x 4.6 mm ID
Part No:	RS08S05-1546WT
Eluent:	20 mM CH_3COONH_4-NH_3 (pH 8.9) / methanol (35/65)
Flow:	1.0 ml/min
Detection:	UV, 220 nm, 0.64 AUFS
Temperature:	30 °C
Injection:	10 µl (0.1 mg/ml, 0.036 µl/ml)

Food preservatives*



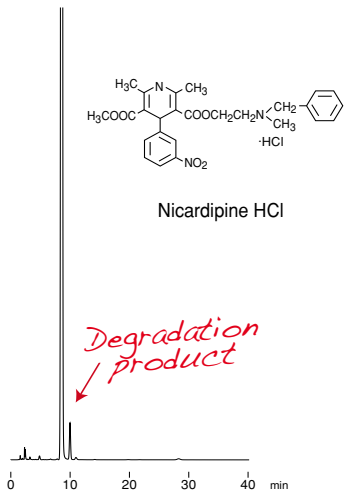
Column:	YMC-Pack *Pro* C18 RS (5 µm, 8 nm) 150 x 4.6 mm ID
Part No.:	RS08S05-1546WT
Eluent:	20 mM CH_3COONa - CH_3COOH (pH 4.3) / acetonitrile (80/20)
Flow:	1.0 ml/min
Detection:	UV at 230 nm, 0.26 AUFS
Temperature:	37 °C
Injection:	10 µl (0.02 mg/ml)

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

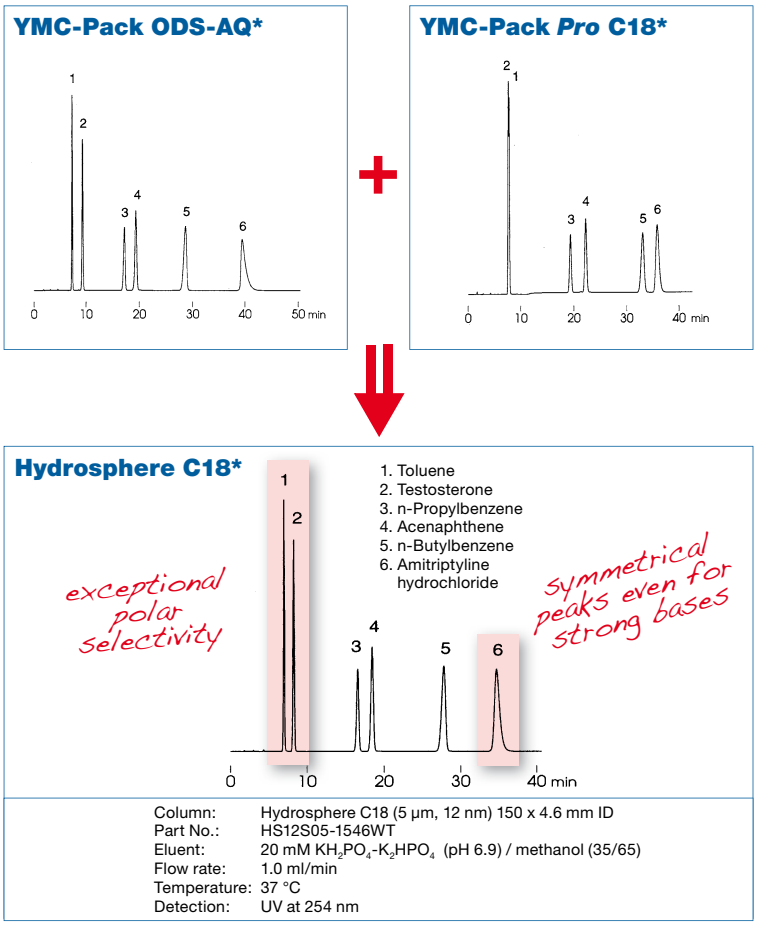
- **stable under the use of 100% aqueous eluent**
- **"hydrophilic" C18 surface for enhanced polar recognition**
- **no need for ion pair reagents**
- **based on highly inert, ultrapure, pH neutral silica**
- **specifically designed for pharmaceutical and biotechnology R&D**

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

*** please be referred to page 52 ff for YMC-UltraHT columns**

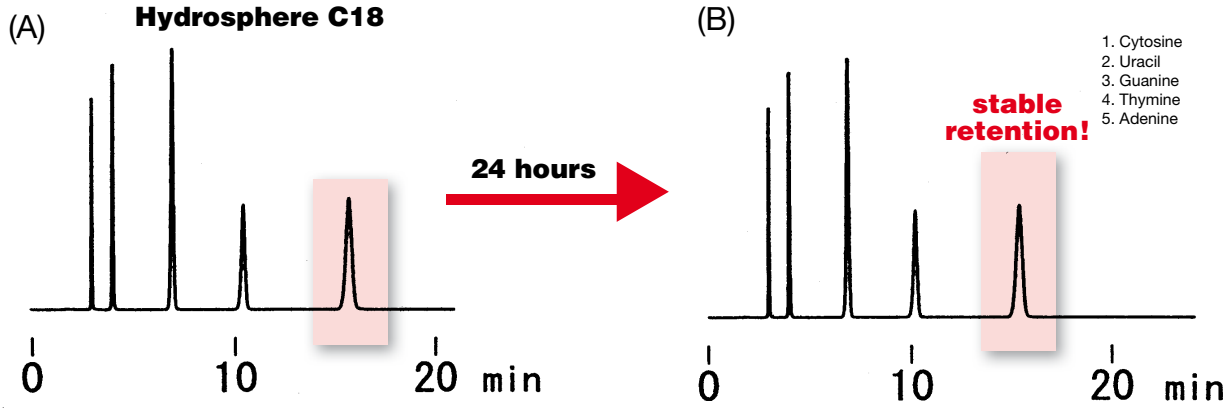
General

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*

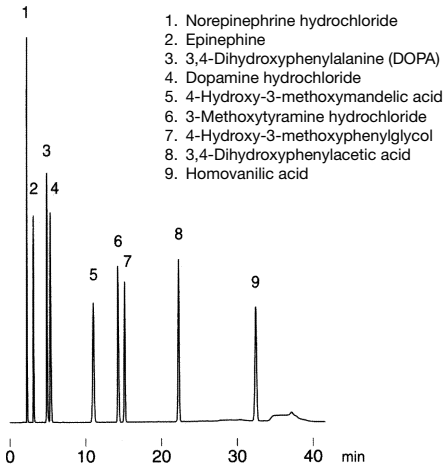


Column:	Hydrosphere C18 (5 µm, 12 nm) 150 x 4.6 mm ID
Part No.:	HS12S05-1546WT
Eluent:	20 mM KH_2PO_4-K_2HPO_2 (pH 6.9)
Flow rate:	1.0 ml/min
Temperature:	37 °C
Detection:	UV at 254 nm

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.

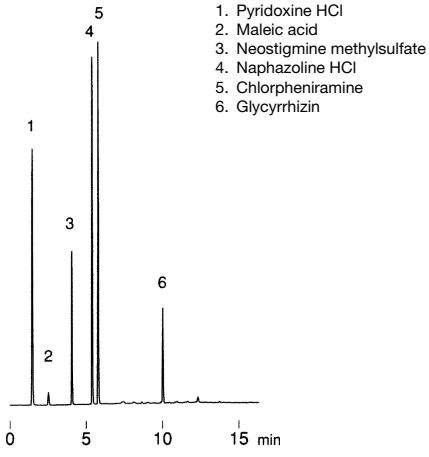
No ion pair reagent required*



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 are shipped with each analytical column.

* 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 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

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

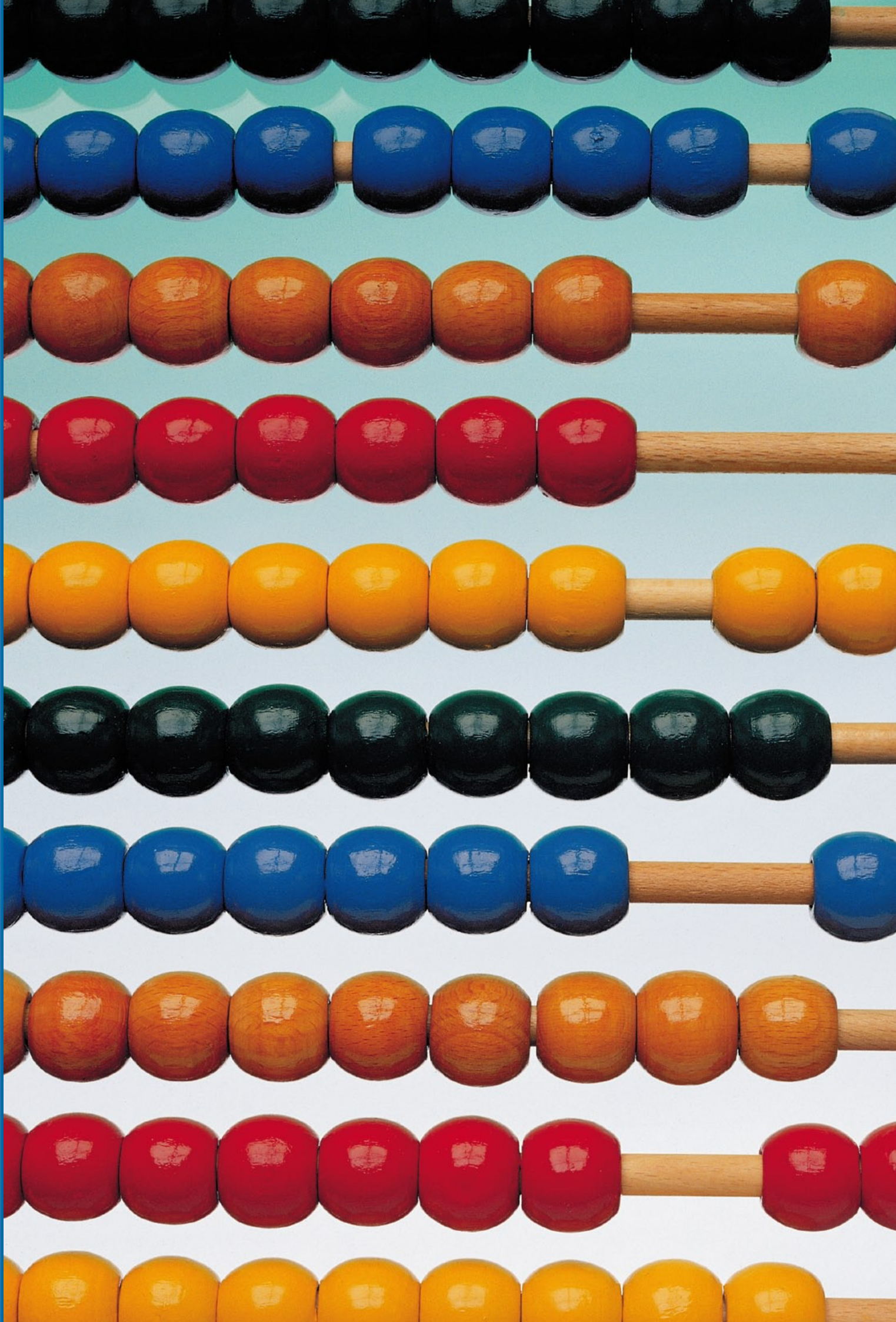
Ordering Information

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 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 247



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 catalogue 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.

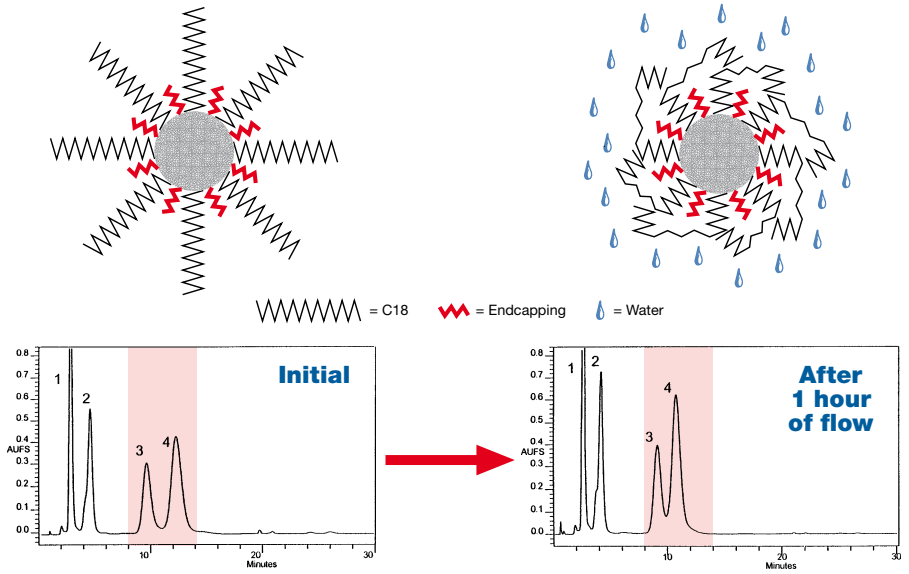
Genuine linear scale-up from analytical to large scale separations is easily achievable with YMC products such as YMC-Pack ODS-AQ, where particle sizes from 3 to 150 µm are available in large lot sizes up to several hundred kilograms, if needed. This, together with the outstanding selectivity of YMC-Pack ODS-AQ, make it an essential tool to enhance the productivity of large scale chromatographic processes.

YMC-Pack ODS-AQ is also available in preparative particle sizes.

YMC-Pack ODS-AQ

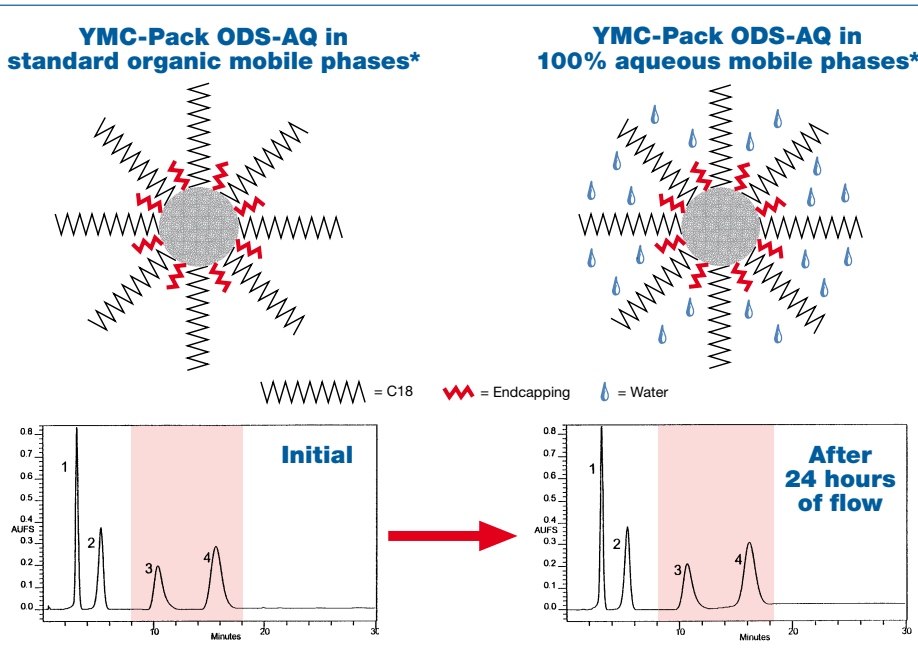
Comparison of ODS-AQ vs. Conventional ODS

Conventional ODS-Column



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 ODS-AQ

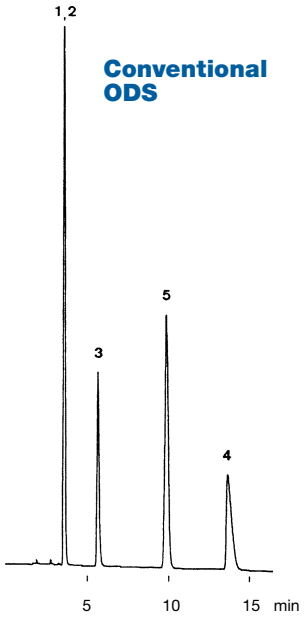


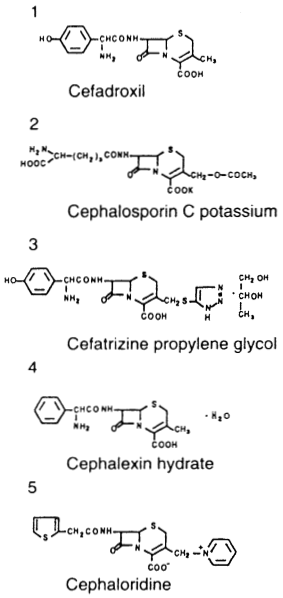
Column: YMC-Pack ODS-AQ (25 µm, 12 nm) 250 x 10 mm ID
Mobile Phase: 100% water
Compounds: Highly polar and very water soluble

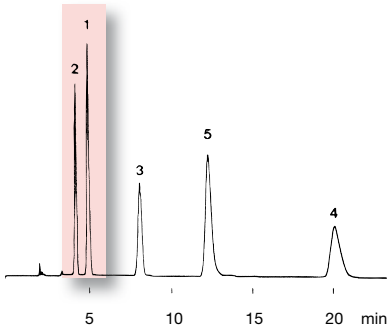
* Application data by courtesy YMC Co., Ltd.

YMC-Pack ODS-AQ

Exceptional performance for the separation of polar compounds*



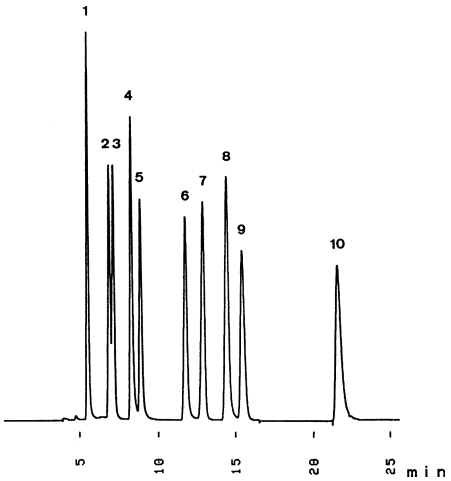




Cephalosporin antibiotics
Column: YMC-Pack ODS-AM (5 µm, 12 nm) 150 x 4.6 mm ID
Part No.: AM12S05-1546WT
Eluent: methanol / water / acetic acid (10/85/5)
Flow: 1.0 ml/min
Detection: UV at 260 nm, 0.16 AUFS
Temperature: 37 °C

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

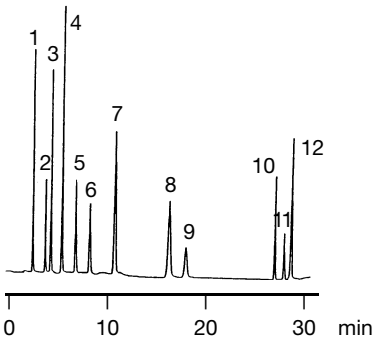
Strong retention in aqueous eluents*



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*

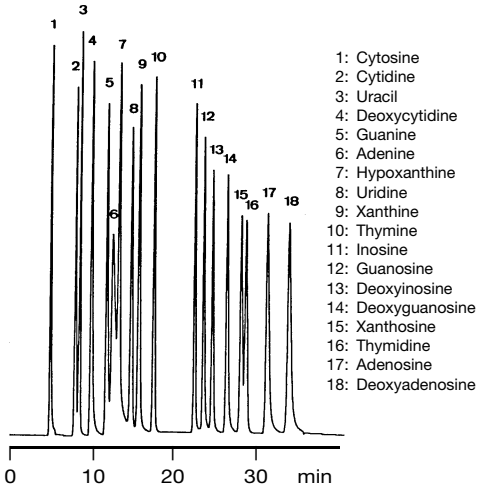


1: Noradrenaline
2: Adrenaline
3: DL-3,4-Dihydroxymandelic Acid
4: 3,4-Dihydroxyphenylalanine (DOPA)
5: Dopamine Hydrochloride
6: Tyrosine
7: DL-3-Methoxy-4-Hydroxymandelic Acid
8: Phenylalanine
9: 4-Hydroxy-3-Methoxy Phenylglycol
10: 5-Hydroxyindole-3-Acetic Acid
11: Vanillic Acid
12: Homovanillic Acid

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*

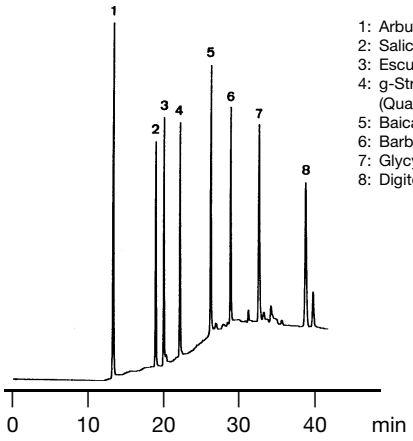


1: Cytosine
2: Cytidine
3: Uracil
4: Deoxycytidine
5: Guanine
6: Adenine
7: Hypoxanthine
8: Uridine
9: Xanthine
10: Thymine
11: Inosine
12: Guanosine
13: Deoxyinosine
14: Deoxyguanosine
15: Xanthosine
16: Thymidine
17: Adenosine
18: Deoxyadenosine

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 appli-cation range*



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

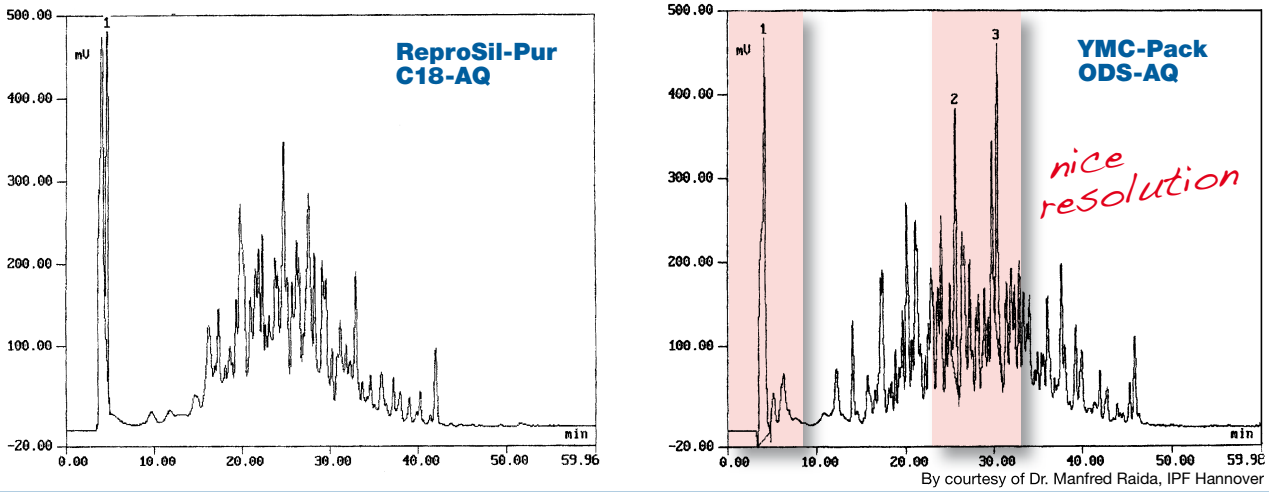
Crude drugs

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 1987, 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 25 (!) years later, many new analytical and preparative methods are still being developed on YMC-Pack ODS-AQ chemistry despite of various AQ-type products recently 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 innovation, namely new generation Hydrosphere C18, described on pages 78-79, as a potential in-house competitor.

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.

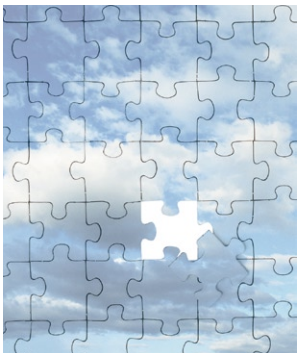
For detailed information please refer to the “Column Care and Use Instructions”, which are shipped with each analytical column.

* Application data by courtesy YMC Co., Ltd.

YMC-Pack ODS-A

L1

- **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	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.

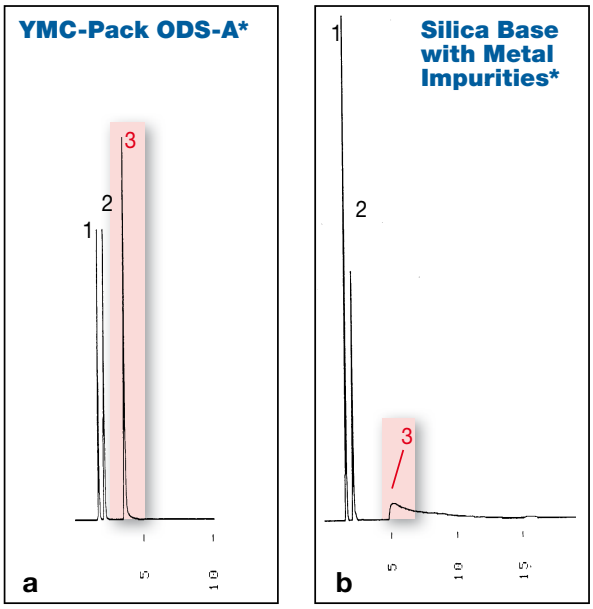
Properties

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 retention.

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 coordination 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

Coordination compounds
a: High purity packing material YMC-Pack ODS-A
b: Competitive product

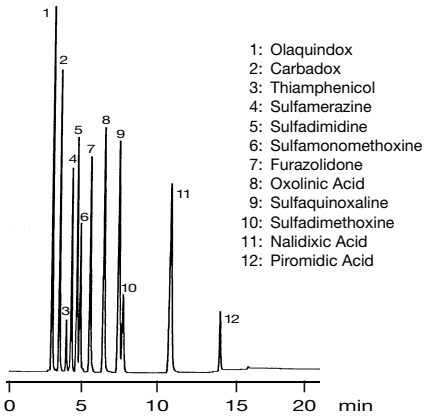
YMC-Pack ODS-A

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.

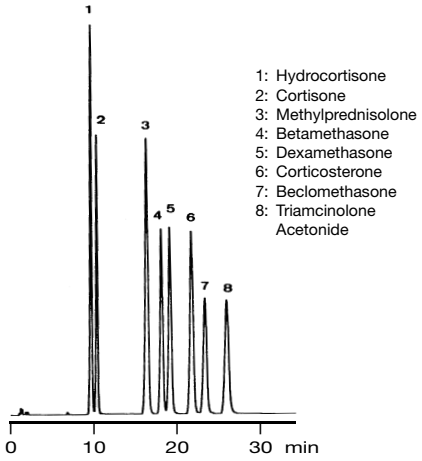
YMC-Pack ODS-A is available in particle sizes from 3 to 50 µm. As the selectivity is identical throughout the whole range, these phases are ideal for scale-up from analytical to preparative process scale.

Antibacterial agents*



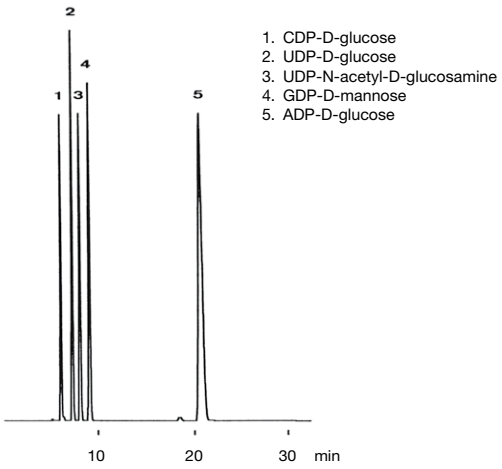
Column:	YMC-Pack ODS-A (5 µm, 12 nm) 250 x 4.6 mm ID
Part No.:	AA12S05-2546WT
Eluent:	A: ACN / $NH_4H_2PO_4$ (50 mM) = 10/90 B: ACN / $NH_4H_2PO_4$ (50 mM) = 80/20
Gradient:	25% B (0-5 min), 25-100% B (5-15 min), 100% B (15-20 min)
Flow:	1.0 ml/min
Detection:	UV, 240 nm
Temperature:	37 °C

Adrenocorticosteroids*



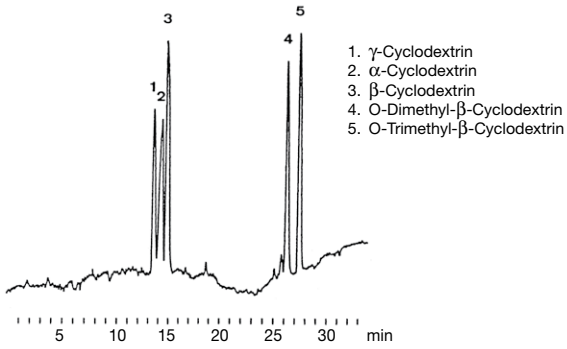
Column:	YMC-Pack ODS-A (5 µm, 12 nm) 150 x 4.6 mm ID
Part No.:	AA12S05-1546WT
Eluent:	ACN / H_2O = 27/73
Flow:	1.0 ml/min
Detection:	UV, 260 nm
Temperature:	37 °C

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 are shipped with each analytical column.

* Application data by courtesy YMC Co., Ltd.

YMC-Pack ODS-AM

L1

- **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 requires 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.

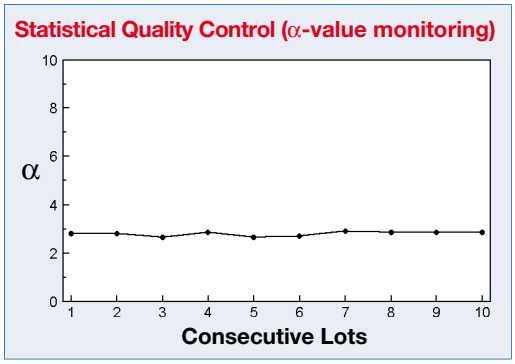
Properties

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.

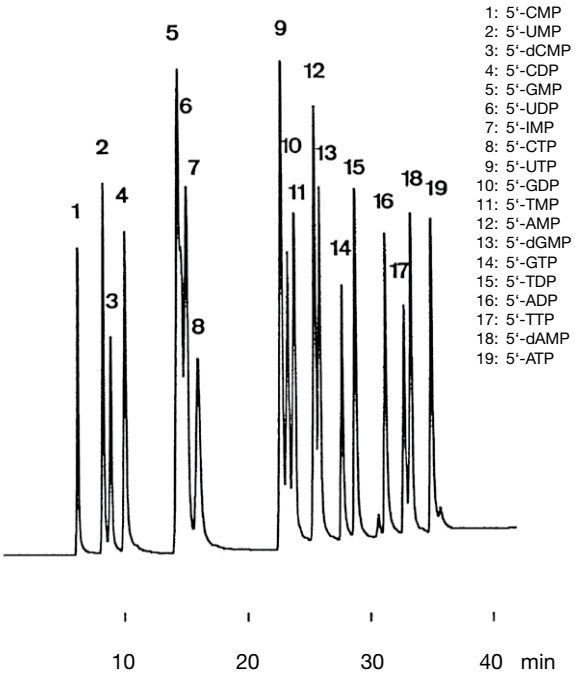
Due to the guaranteed long term reproducibility, YMC-Pack ODS-AM columns often are the final choice for establishing validated HPLC analysis.

YMC-Pack ODS-AM

Applications

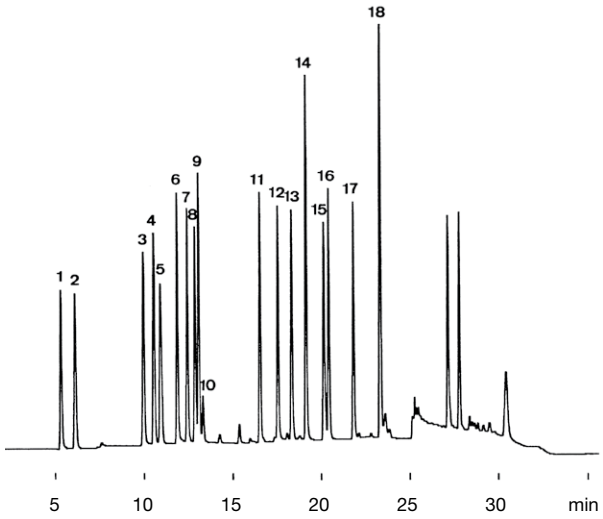
ODS-AM has an appropriate selectivity for polar to moderately nonpolar pharmaceuticals, organic intermediates, biological and natural products found in the chemical and pharmaceutical industry.

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.

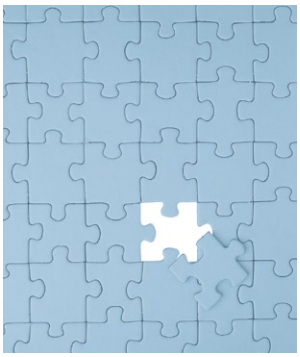
For detailed information please refer to the “Column Care and Use Instructions” which are shipped with each analytical column.

* Application data by courtesy YMC Co., Ltd.

YMC-Pack ODS-AL

L1

- **residual silanols for mixed-mode separations**
- **same high ligand density as other YMC ODS phases**
- **unique selectivity for polar compounds**

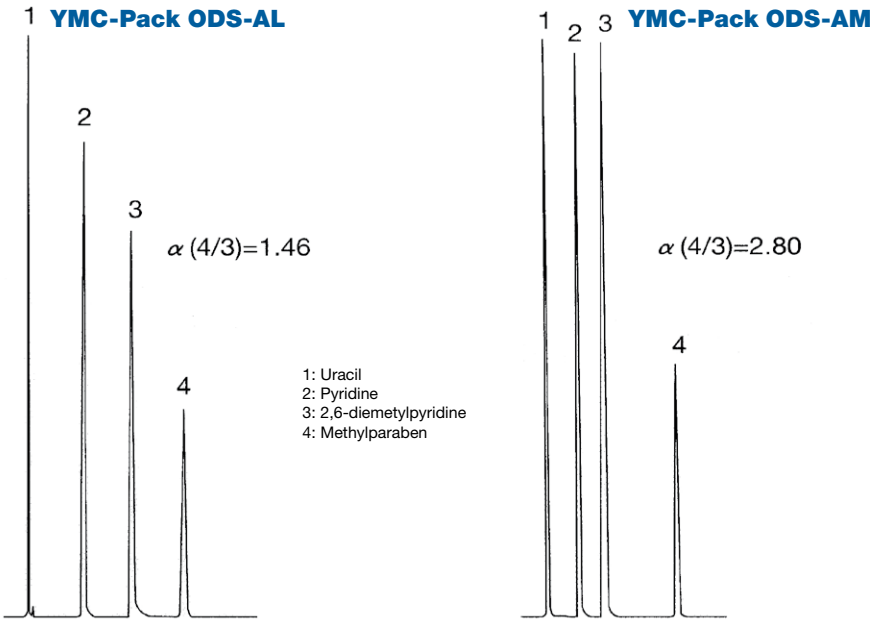


YMC-Pack ODS-AL	Specification
Particle Size / µm	3; 5
Pore Size / nm	12
Surface area / m^2g^{-1}	330
Carbon content / %	17
Recommended pH range	2.0 - 7.5

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*

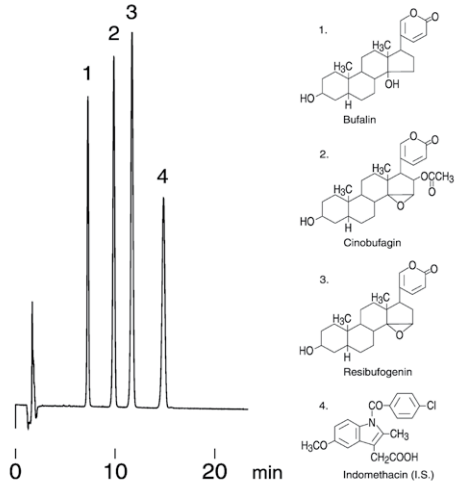


The separation factor (α) of internal standards methylparaben / 2,6-dimethylpyridine for YMC-Pack ODS-AL, which is not endcapped is different to that of YMC-Pack ODS-AM. Due to the residual silanol groups,YMC-Pack ODS-AL shows relatively great retention of pyridines.

YMC-Pack ODS-AL

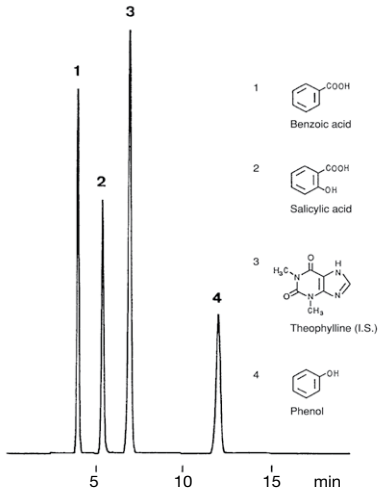
Applications

Steroids from toad venom*



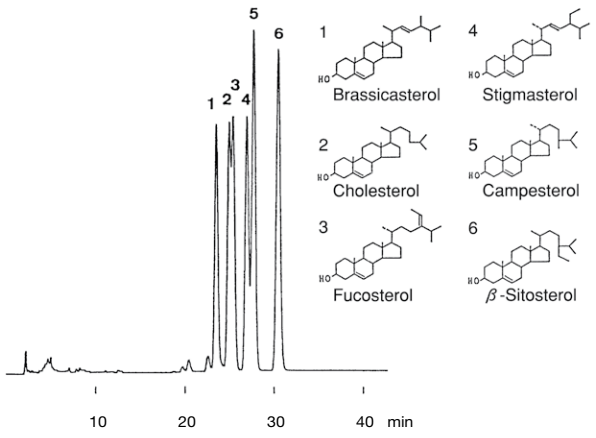
Column:	YMC-Pack ODS-AL (5 µm, 12 nm) 150 x 4.6 mm ID
Part No.:	AL12S05-1546WT
Eluent:	ACN / 0.1% phosphoric acid (45/55)
Flow:	1.0 ml/min
Detection:	UV at 300 nm, 0.08 AUFS
Temperature:	40 °C
Injection:	10 µl (0.04 ~ 0.08 mg/ml)

Disinfectants*



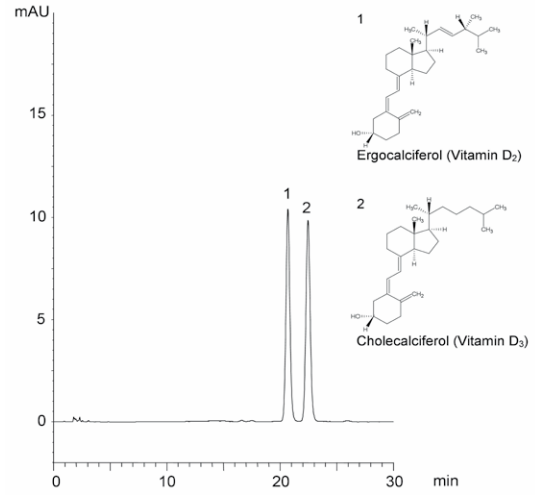
Column:	YMC-Pack ODS-AL (5 µm, 12 nm) 150 x 4.6 mm ID
Part No.:	AL12S05-1546WT
Eluent:	100 mM KH_2PO_4-Na_2HPO_4 (pH 7.0) / methanol (75/25)
Flow:	0.8 ml/min
Detection:	UV at 270 nm, 0.13 AUFS
Temperature:	30 °C
Injection:	3 µl (0.1 ~ 0.8 mg/ml)

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

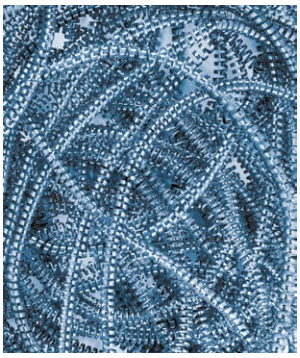
The recommended pH range for using YMC-Pack ODS-AL columns is 2.0-7.5. Remove acid and buffer salts before storage. Store the column in methanol/water = 50/50. If columns are affected by undesired contaminants or clogged inlet frits which cause back pressure increases, flush the column with THF in the opposite flow direction.

For detailed information please refer to the “Column Care and Use Instructions” which are shipped with each analytical column.

* 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.

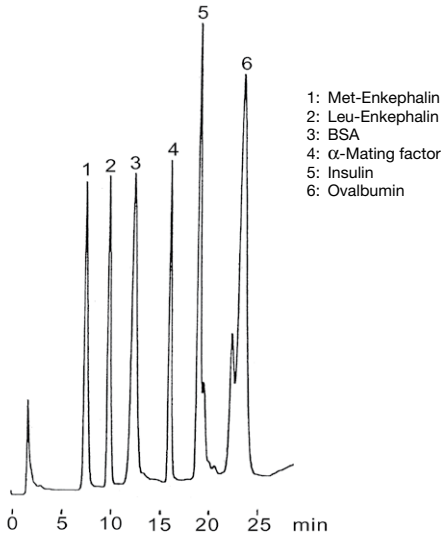
It should be noted that interactions between aromatic or conjugated systems and the methacrylate backbone provides slightly greater retention when compared to silica-based ODS columns, whereas highly aliphatic compounds show greater retention on silica-based ODS supports.

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

YMC-Pack PolymerC18

Applications

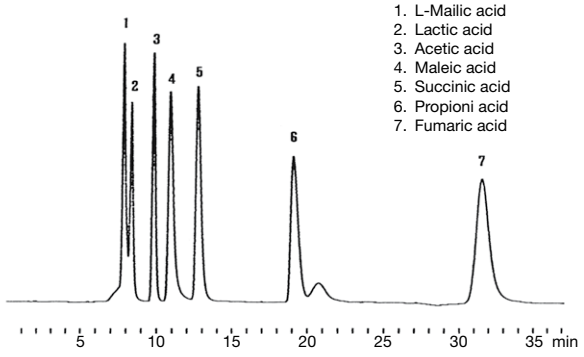
Peptides and proteins*



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

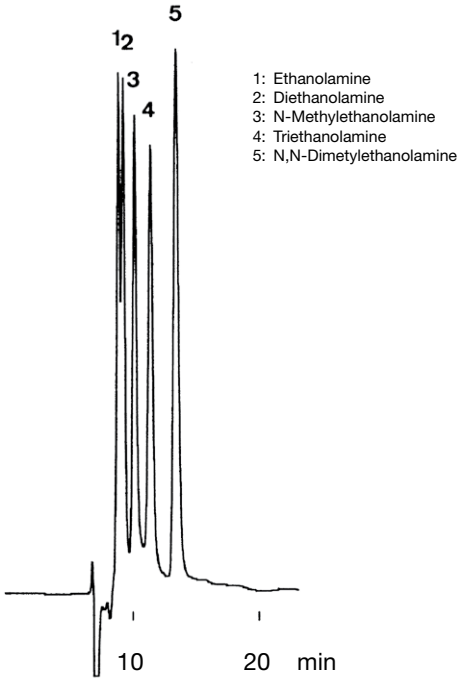
Organic acids*



1. L-Mailic acid
2. Lactic acid
3. Acetic acid
4. Maleic acid
5. Succinic acid
6. Propioni 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

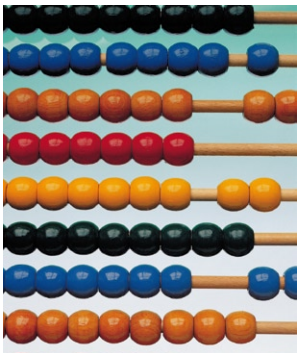
YMC-Pack PolymerC18 is stable towards hydrolysis between pH 2.0-13.0. Remove acid and buffer salts before storage. Store the column in methanol / water = 70/30. If columns are affected by undesired contaminants or clogged inlet frits which cause back pressure increases, flush the column with THF in the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

For detailed information please refer to the “Column Care and Use Instructions” which are shipped with each analytical column.

* 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**



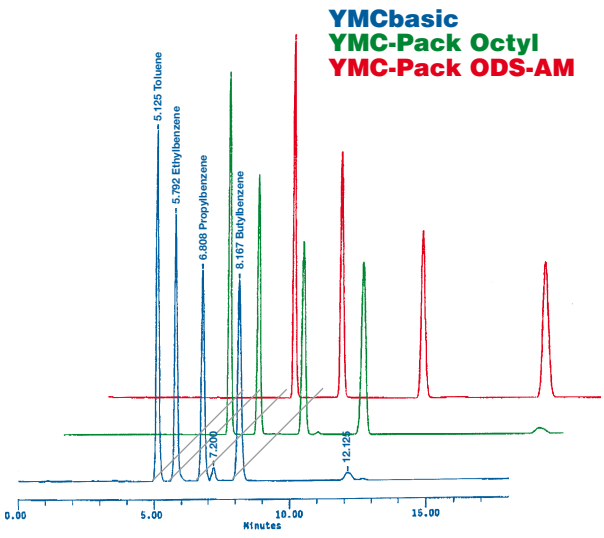
YMCbasic	Specification
Particle size / µm	3; 5
Pore size / nm	proprietary
Surface area / m^2g^{-1}	proprietary
Carbon content / %	7.5
Recommended pH range	2.0 - 7.5

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

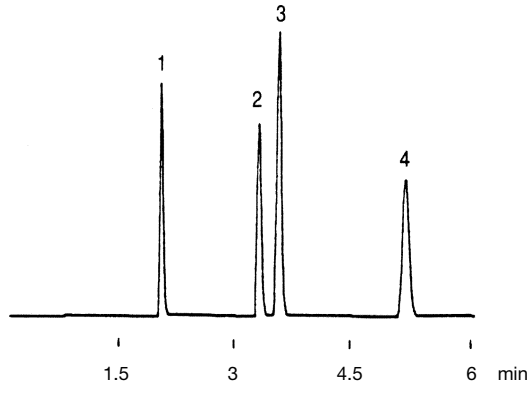
Applications

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

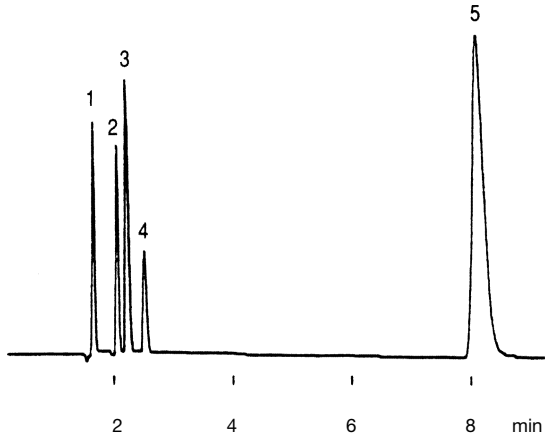
Anilines and aromatic compounds*



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

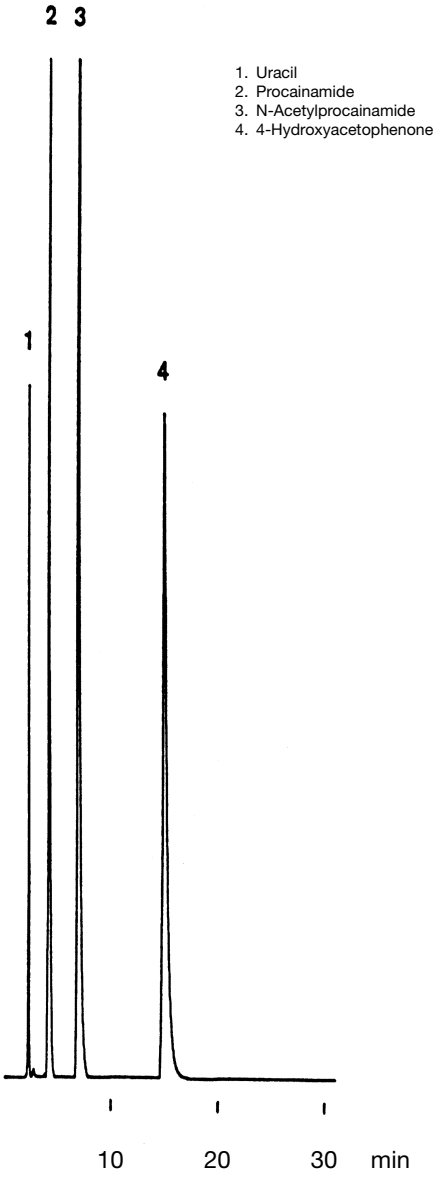
Cough/cold medicine*



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.

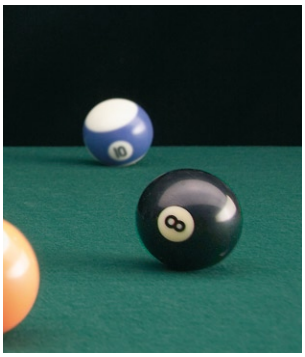
For detailed information please refer to the “Column Care and Use Instructions”, which are shipped with each analytical column.

* Application data by courtesy YMC Co., Ltd.

YMC-Pack C_8 (Octyl)

L7

- **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.

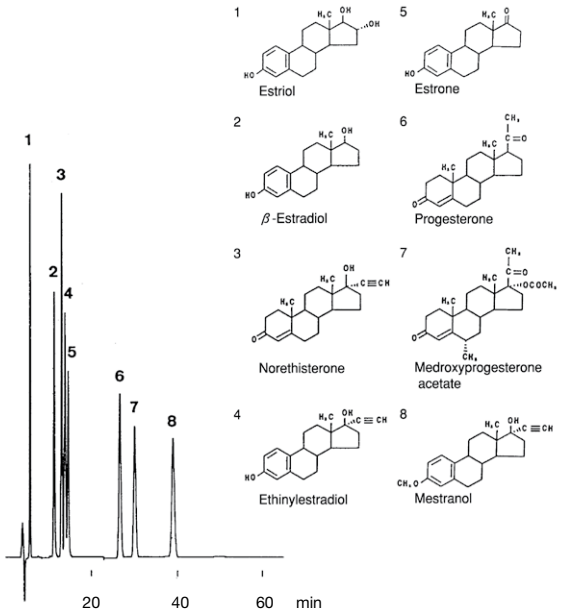
Column care

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 are shipped with each analytical column.

YMC-Pack C_8 (Octyl)

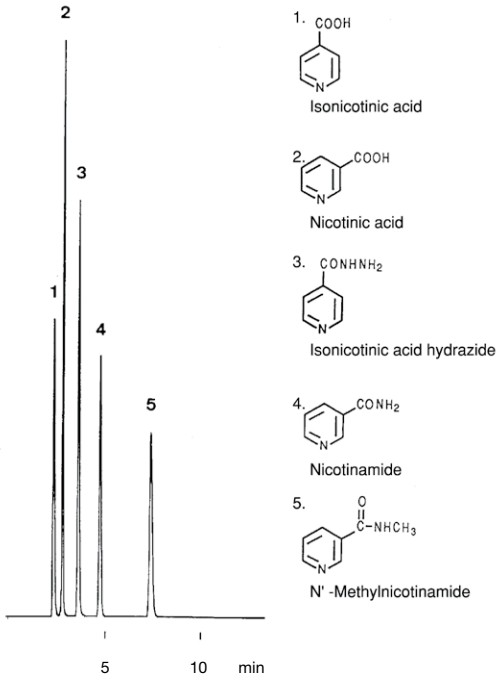
Applications

Estrogens and progestins*



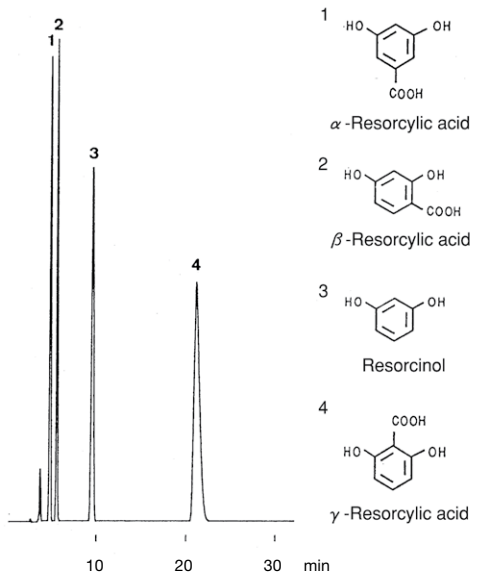
Column:	YMC-Pack C_8 (Octyl) (5 µm, 12 nm) 250 x 4.6 mm ID
Part No.:	OC12S05-2546WT
Eluent:	acetonitrile / THF / water (46/4/50)
Flow:	0.7 ml/min
Detection:	UV at 230 nm, 0.16 AUFS
Temperature:	30 °C
Injection:	7 µl (0.1 mg/ml)

Nicotinic acid analogues*



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

Resorcylic acid isomers*



Column:	YMC-Pack C_8 (Octyl) (5 µm, 12 nm) 150 x 4.6 mm ID
Part No.:	OC12S05-1546WT
Eluent:	methanol / 100 mM KH_2PO_4 (10/90)
Flow:	0.8 ml/min
Detection:	UV at 285 nm, 0.16 AUFS
Temperature:	37 °C
Injection:	10 µl (0.05 ~ 0.4 mg/ml)

* Application data by courtesy YMC Co., Ltd.

YMC-Pack Ph (Phenyl)

L11

- **fully endcapped, monomeric phenyl phase**
- **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

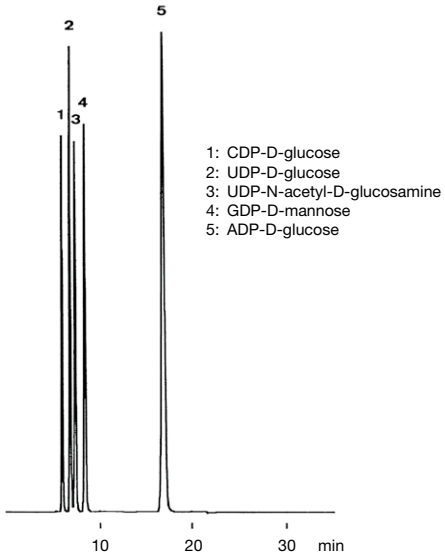
YMC-Pack Ph (Phenyl) provides a unique selectivity when compared to aliphatic straight chain reversed phases such as C18, C8 or C4. The π-electrons of the phenyl groups can interact with aromatic residues of an analyte molecule in addition to hydrophobic interactions to increase retention relative to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

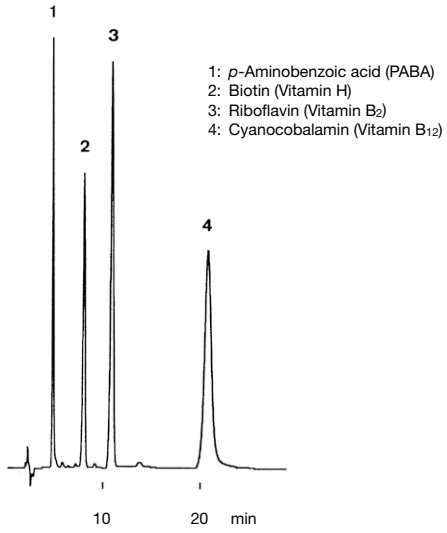
YMC-Pack Ph (Phenyl)

Sugar nucleotides*



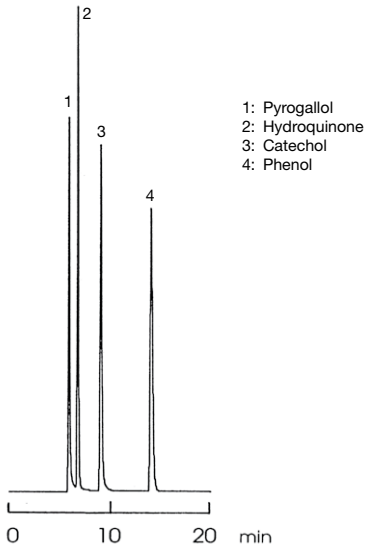
Column:	YMC-Pack Ph (5 µm, 12 nm) 250 x 4.6 mm ID
Part No.:	PH12S05-2546WT
Eluent:	100 mM triethylamine-acetic acid (pH 6.0)
Flow:	1.0 ml/min
Detection:	UV at 260 nm, 0.16 AUFS
Temperature:	37 °C
Injection:	5 µl (0.27 ~ 0.71 mg/ml)

Water-soluble vitamins*



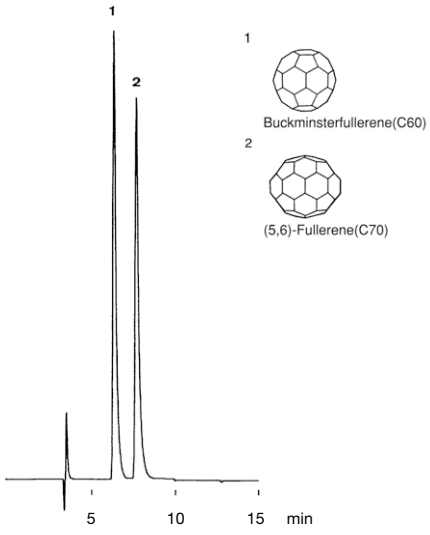
Column:	YMC-Pack Ph (5 µm, 12 nm) 150 x 4.6 mm ID
Part No.:	PH12S05-1546WT
Eluent:	acetonitrile / 50 mM $NH_4H_2PO_4$ (10/90)
Flow:	1.0 ml/min
Detection:	UV at 210 nm, 0.16 AUFS
Temperature:	37 °C
Injection:	10 µl (0.02 ~ 0.30 mg/ml)

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 are shipped with each analytical column.

* Application data by courtesy YMC Co., Ltd.

YMC-Pack C_4 (Butyl)

L26

- **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	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

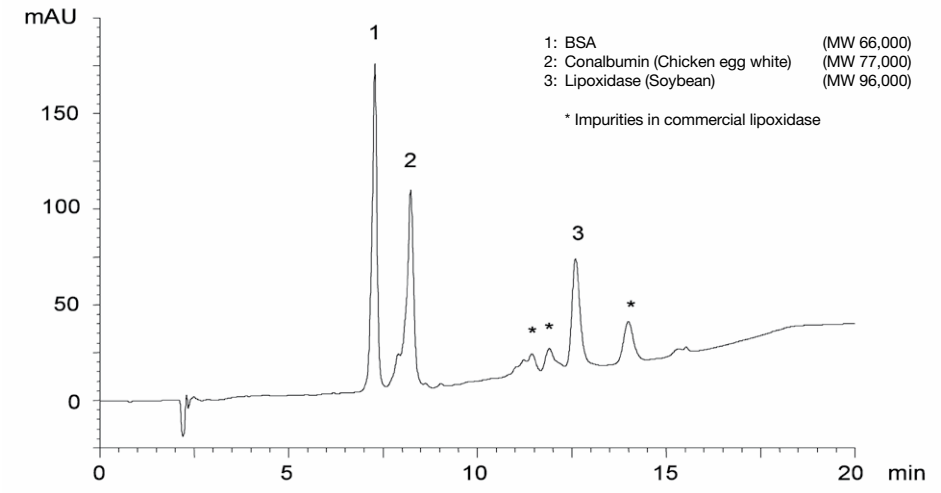
General

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.

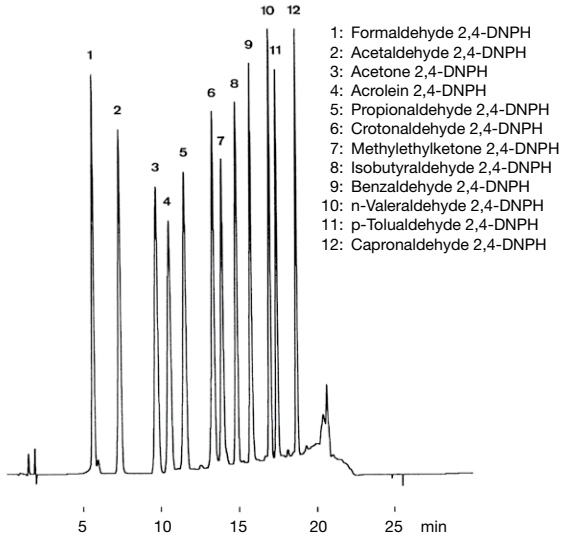
Proteins (MW 66,000 – 96,000)*



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)

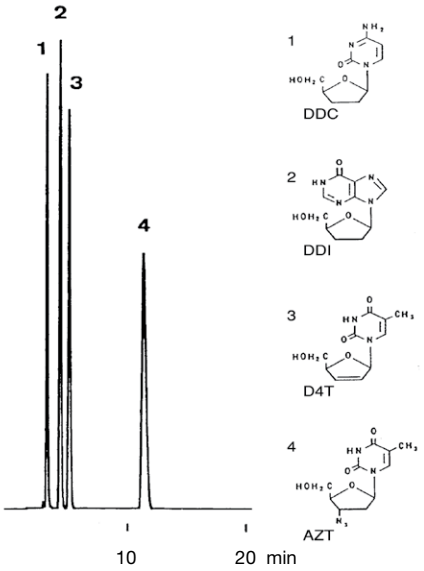
2,4-Dinitrophenylhydrazones of aldehydes and ketones*



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

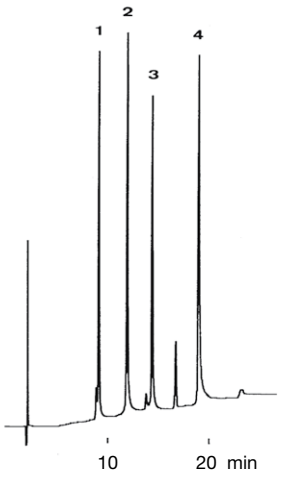
Column:	YMC-Pack C_4 (5 µm ,12 nm) 150 x 4.6 mm ID
Part No.:	BU12S05-1546WT
Eluent:	A = tetrahydrofuran / water (10/90) B = acetonitrile; 35% B (0-7 min), 35-65% B (7-18 min, linear), 100% B (18-19 min), 35% B (19-35 min)
Flow:	1.5 ml/min
Detection:	UV at 360 nm, 0.01 AUFS
Temperature:	30 °C
Injection: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

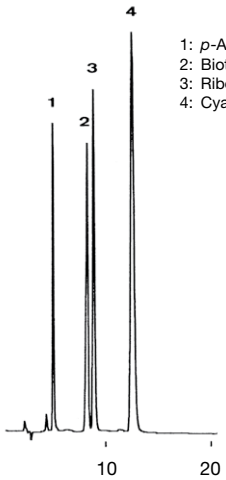
Proteins*



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 are shipped with each analytical column.

* Application data by courtesy YMC Co., Ltd.

YMC-Pack TMS (C1)

L13

- **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	5
Pore Size / nm	12	30
Surface area / m^2g^{-1}	330	100
Carbon content / %	4	3
Recommended pH range	2.0 - 7.5	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

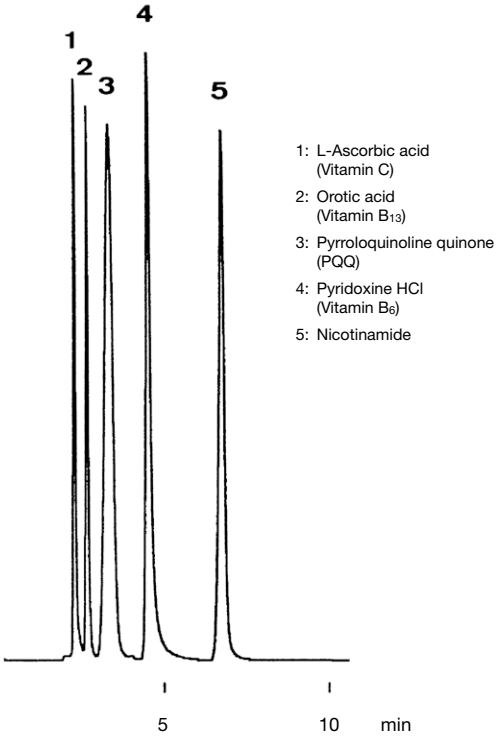
YMC-Pack TMS (C1) is bonded with trimethylmonochlorosilane to create a phase with intermediate polarity for separation of extremely hydrophobic compounds using conventional reversed phase solvents and of highly polar compounds using normal phase solvents.

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)

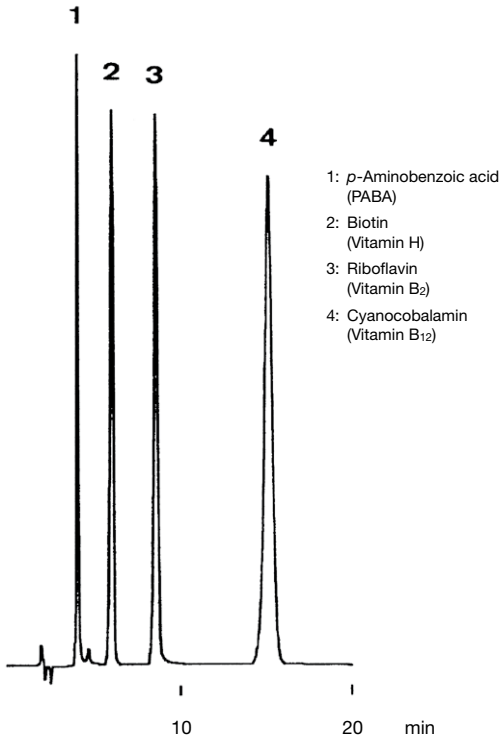
Water-soluble vitamins*



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 are shipped with each analytical column.

* Application data by courtesy YMC Co., Ltd.

YMC-Pack CN (Cyano)

L10

- **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.

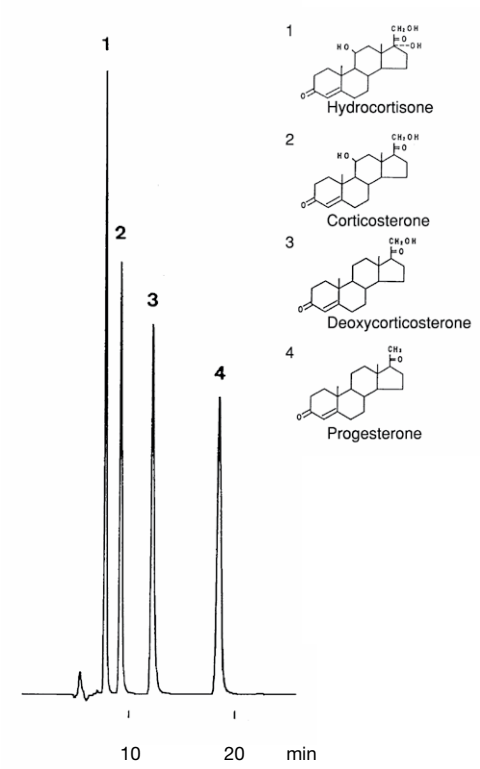
Cyano packings also provide an alternative to silica material in normal phase chromatography, where bonded normal phase packings have the advantage of faster equilibration, more uniform surface activity and increased resistance to dissolution.

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.

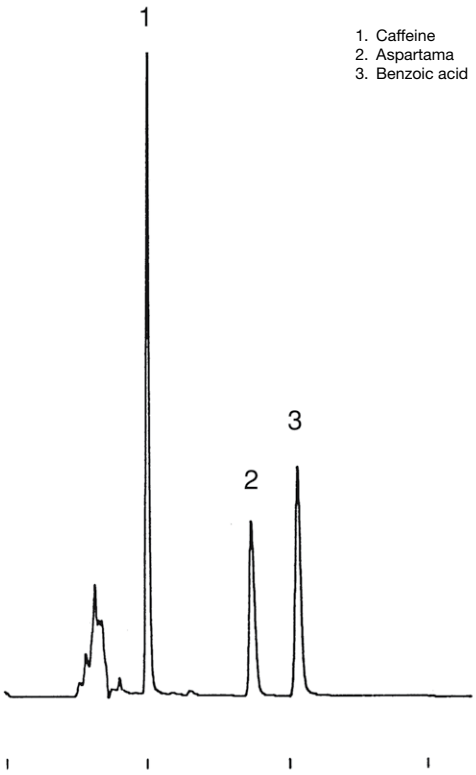
YMC-Pack CN (Cyano)

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 are shipped with each analytical column.

* 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

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

Ordering Information

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
30 nm 5 µm	2.1	TM30S05-H3Q1QT	TM30S05-05Q1QT	TM30S05-10Q1QT	TM30S05-15Q1QT	TM30S05-25Q1QT	TM30S05-01Q1GC
	3.0	TM30S05-H303QT	TM30S05-0503QT	TM30S05-1003QT	TM30S05-1503QT	TM30S05-2503QT	TM30S05-0103GC
	4.0	TM30S05-H304QT	TM30S05-0504QT	TM30S05-1004QT	TM30S05-1504QT	TM30S05-2504QT	TM30S05-0104GC
	4.6	TM30S05-0346WT	TM30S05-0546WT	TM30S05-1046WT	TM30S05-1546WT	TM30S05-2546WT	TM30S05-0104GC

*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

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 247

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

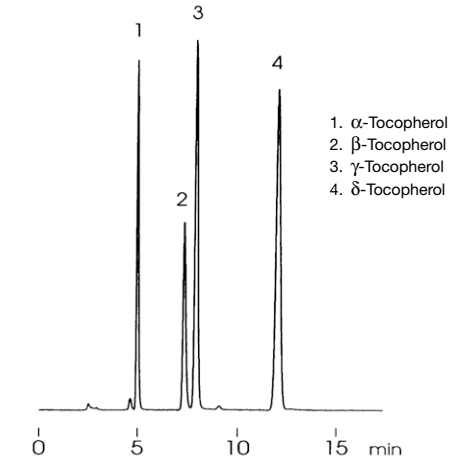
The high purity YMC-Pack SIL (Silica) allows almost total sample recovery because the low content of impurities such as residual metals reduces non-specific sample adsorption. This also prevents unusual peak-shapes thereby encouraging higher sample loading. In addition, the porous structure of the spheres 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 every YMC bonded phase, 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.

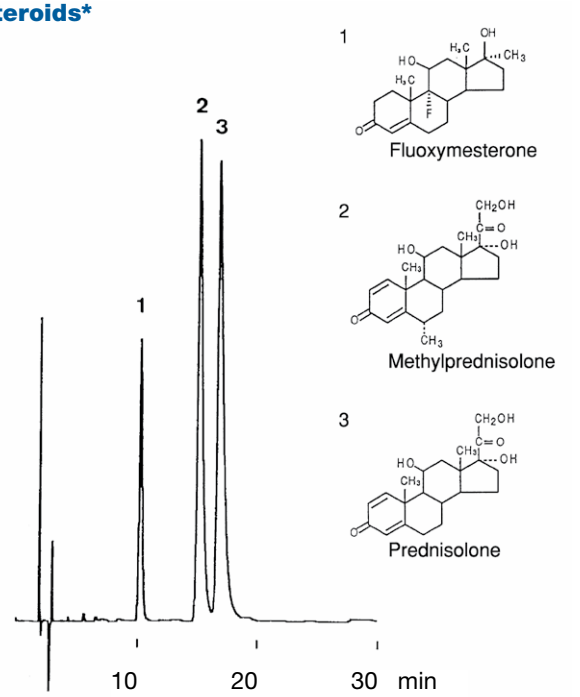
Ultra High Purity Silica*



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)

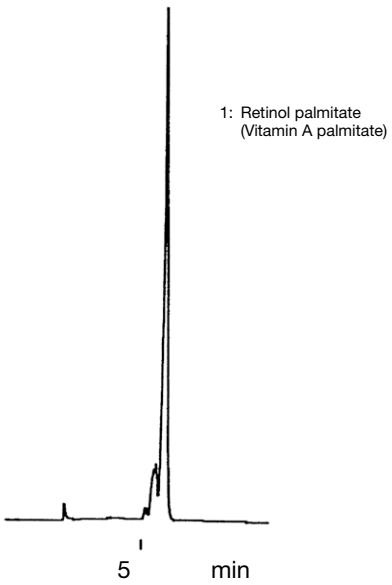
YMC-Pack SIL (Silica)

Steroids*



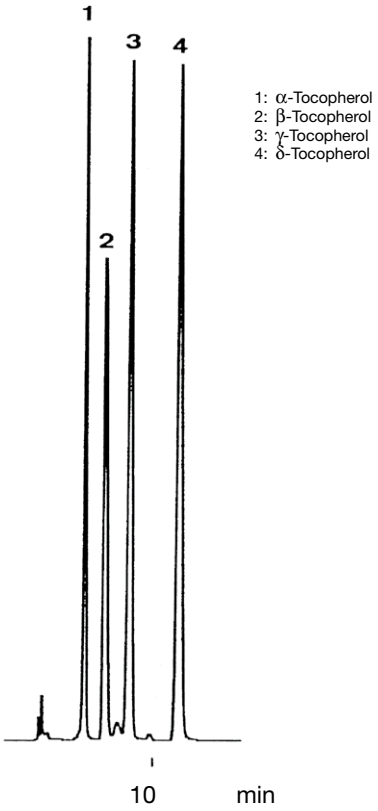
Column:	YMC-Pack SIL (5 µm, 6 nm) 250 x 4.6 mm ID
Part No.:	SL06S05-2546WT
Eluent:	hexane / THF / acetic acid (60/40/1)
Flow:	1.5 ml/min
Detection:	UV at 250 nm, 0.16 AUFS
Temperature:	30 °C
Injection:	10 µl (0.25 mg/ml)

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)

Tocopherols*



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

Column care

YMC-Pack SIL is stable towards hydrolysis between pH 2.0-7.5. Remove acid and buffer salts before storage. For detailed information please refer to the “Column Care and Use Instructions” which are shipped with each analytical column.

* Application data by courtesy YMC Co., Ltd.

YMC-Pack PVA-Sil

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- **bonded phase alternative to silica for normal phase applications**
- **vinyl alcohol polymerised silica support**
- **consistent surface activity, unaffected by water**
- **excellent for packed column supercritical fluid chromatography**

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

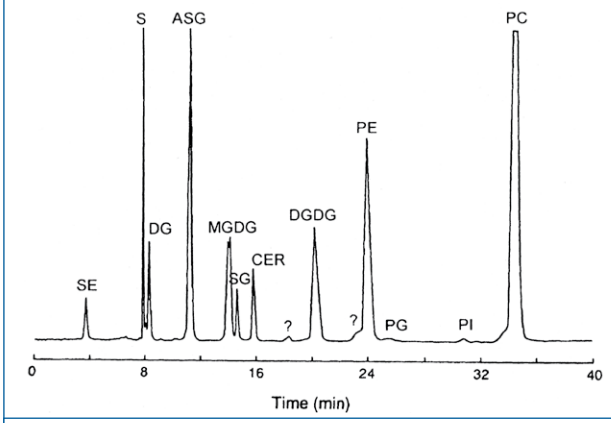
The PVA polymer shell on PVA-Sil deactivates the silica support while providing a hydrophilic surface. This, coupled with available column dimension of 1.0 mm and 2.0 mm ID means that PVA-Sil columns are well suited for SFC separations.

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 are shipped with each analytical column.

YMC-Pack PVA-Sil

Analysis of Potato Lipids*



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

Gradient:

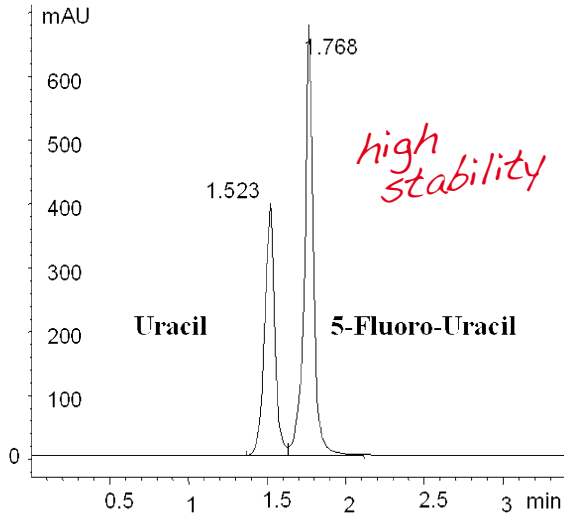
Tmin:	0	5	15	40	40.1	45	50
B%:	0	20	52	52	70	0	0
C%:	0	0	4	14	0	0	0
Flow (ml/mn):	1	1	1	1.4	1.4	2	2

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

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

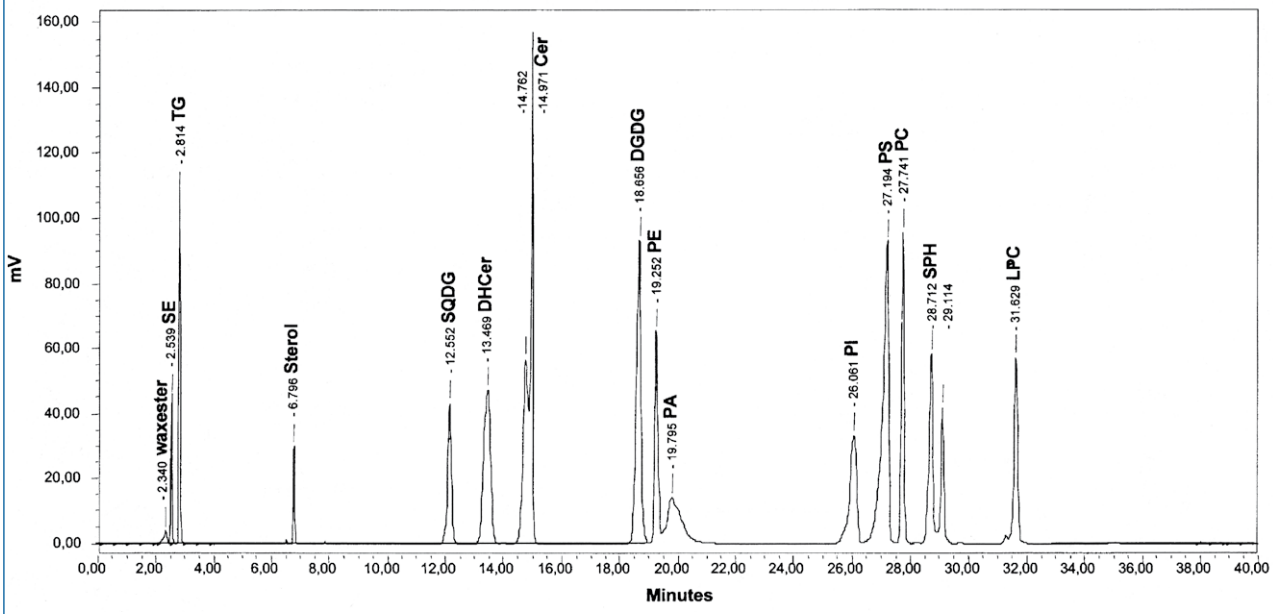
Literature: W.W. Christie; R.A. Urwin, J. high Resol. Chromatogr., Vol. 18 (1995) p.97 - 100

Uracil (in HILIC-mode)*



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

Analysis of Lipids



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

SE: steryl oleate
TG: TAG/tripentadecanoin
Sterol: stigmasterol/sitosterol
SQDG: sulfoquinovosyldiacylglycerol
DHCer: dehydroxycerebroside
Cer: cerebroside
DGDG: digalactosyldiacylglycerol

PE: PE-dipalmitoyl
PA: PA-diheptadecanoyl
PI: PI-diheptadecanoyl
PS: PS-diheptadecanoyl
PC: PC-diheptadecanoyl
SPH: sphingomyelin
LPC: lysophosphatidylcholine

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

* Application data by courtesy YMC Co., Ltd.

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	175
Carbon content / %	7	2.5
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.

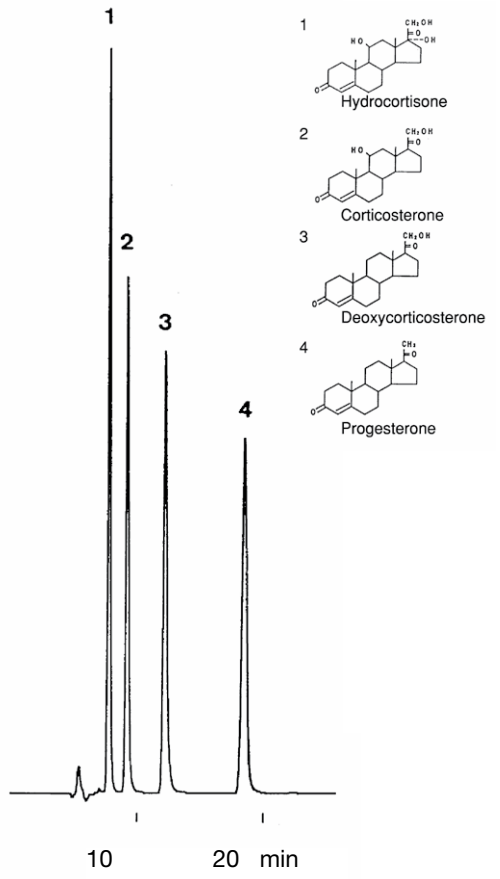
YMC-Pack CN (Cyano) is also available in preparative particle sizes.

YMC-Pack CN (Cyano)

YMC-Pack CN Separation Modes

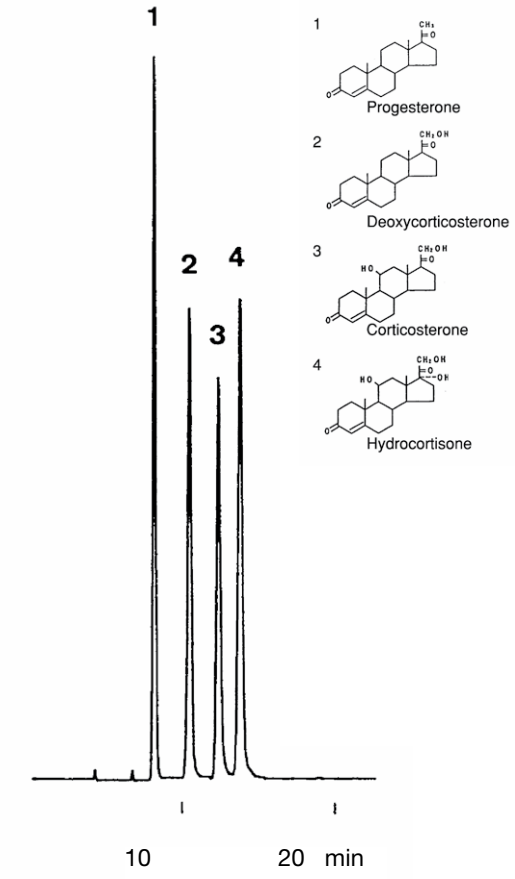
YMC-Pack CN can be used either in reversed-phase and normal-phase modes since it provides cyanopropyl groups of medium polarity. It can be employed in reversed-phase mode with an aqueous mobile phase of higher polarity and in normal-phase mode with a lower polarity than the stationary phase. This results 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 are shipped with each analytical column.

* Application data by courtesy YMC Co., Ltd.

YMC-Pack Diol-NP

L20

- **good selectivity without excessive retention**
- **high product recovery rate**
- **high prep loading**
- **bonded phase 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 (DN) (DL)	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.

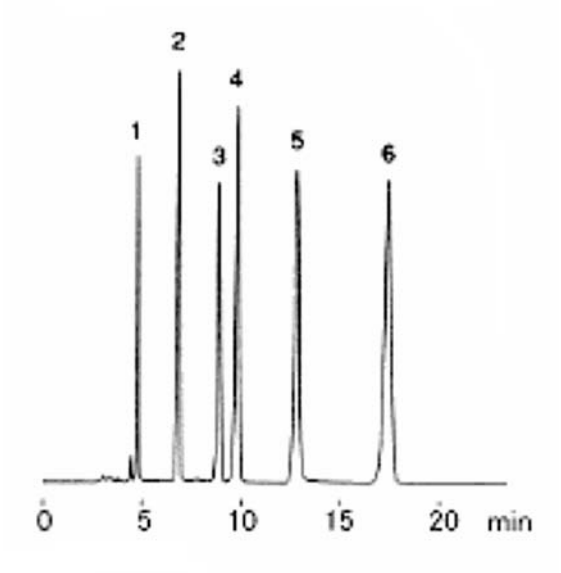
YMC-Pack Diol GPC columns exhibit better performance characteristics than underivatised silica for size separations as the non-specific adsorptive sites have been eliminated. Diol is available in four porosities: 6, 12, 20 and 30 nm and thus it is suitable for separation or molecular weight determination of proteins with molecular weights of 10,000 to several hundred thousands.

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 are shipped with each analytical column.

* Application data by courtesy YMC Co., Ltd.

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.

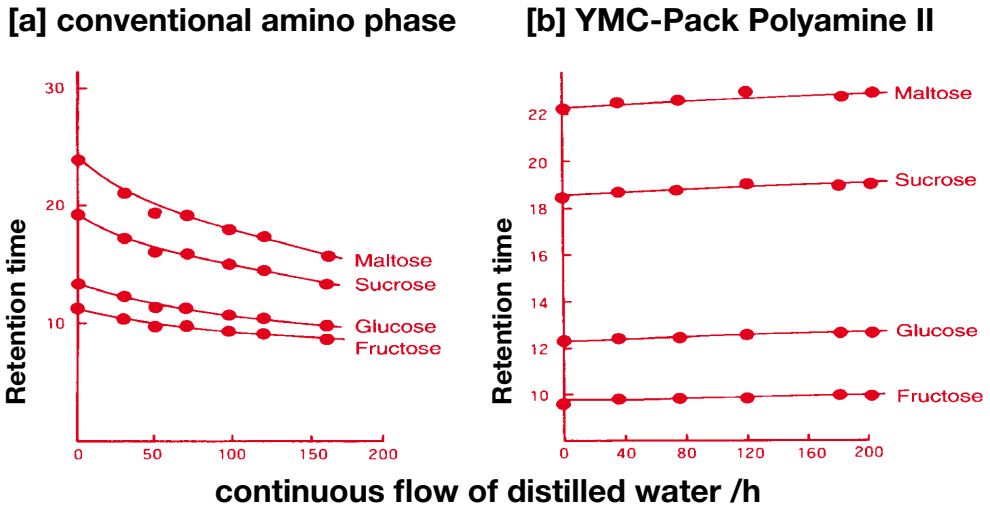
Reducing sugars are often adsorbed irreversibly to conventional amino phases, which causes problems in their recovery and quantitation. In YMC-Pack Polyamine II columns however, the adsorption of reducing sugars plays only a minor role. As a result a high recovery of these compounds can be obtained which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

Column care

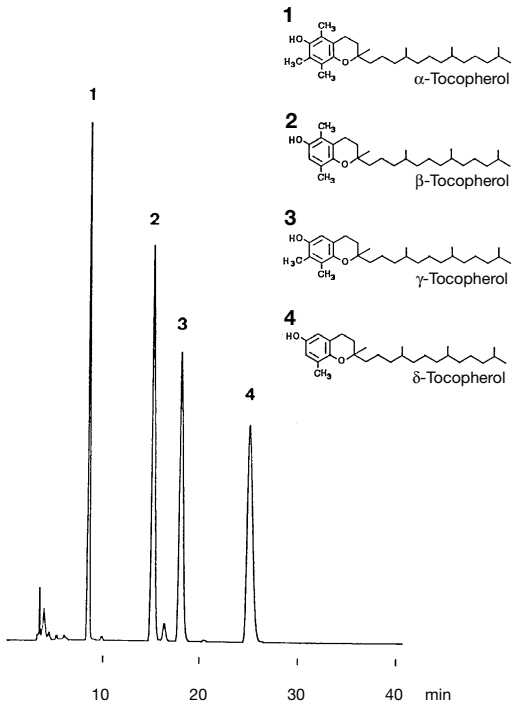
YMC-Pack Polyamine II is stable towards hydrolysis between pH 2.0-9.0. Remove acid and buffer salts before storage. For detailed information please refer to the "Column Care and Use Instructions" which are shipped with each analytical column.

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

* Application data by courtesy YMC Co., Ltd.

YMC-Pack NH_2 (Amino)

L8

- **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 NH2 (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 NH2 (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 NH2 packings operate under normal phase / HILIC elution conditions, water, which is more polar than acetonitrile, is the stronger solvent.) YMC-Pack NH2 (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.

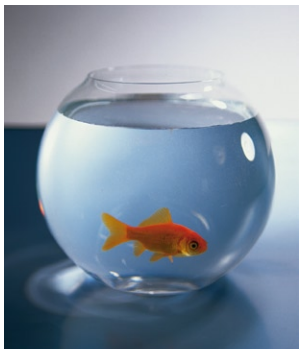
YMC-Pack NH_2 (Amino) is also available in preparative particle sizes.

Column care

YMC-Pack NH2 (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 are shipped with each analytical column.

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**

L13

YMC-Pack TMS	Specification	
Particle Size / µm	3; 5	5
Pore Size / nm	12	30
Surface area / m^2g^{-1}	330	175
Carbon content / %	4	3
Recommended pH range	2.0 - 7.5	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 are shipped with each analytical column.

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
12 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
30 nm 5 µm	2.1	TM30S05-H3Q1QT	TM30S05-05Q1QT	TM30S05-10Q1QT	TM30S05-15Q1QT	TM30S05-25Q1QT	TM30S05-01Q1GC
	3.0	TM30S05-H303QT	TM30S05-0503QT	TM30S05-1003QT	TM30S05-1503QT	TM30S05-2503QT	TM30S05-0103GC
	4.0	TM30S05-H304QT	TM30S05-0504QT	TM30S05-1004QT	TM30S05-1504QT	TM30S05-2504QT	TM30S05-0104GC
	4.6	TM30S05-0346WT	TM30S05-0546WT	TM30S05-1046WT	TM30S05-1546WT	TM30S05-2546WT	TM30S05-0104GC

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

For other dimensions please refer to page 247

* Application data by courtesy YMC Co., Ltd.

YMC Phases for Biochromatography

Contents

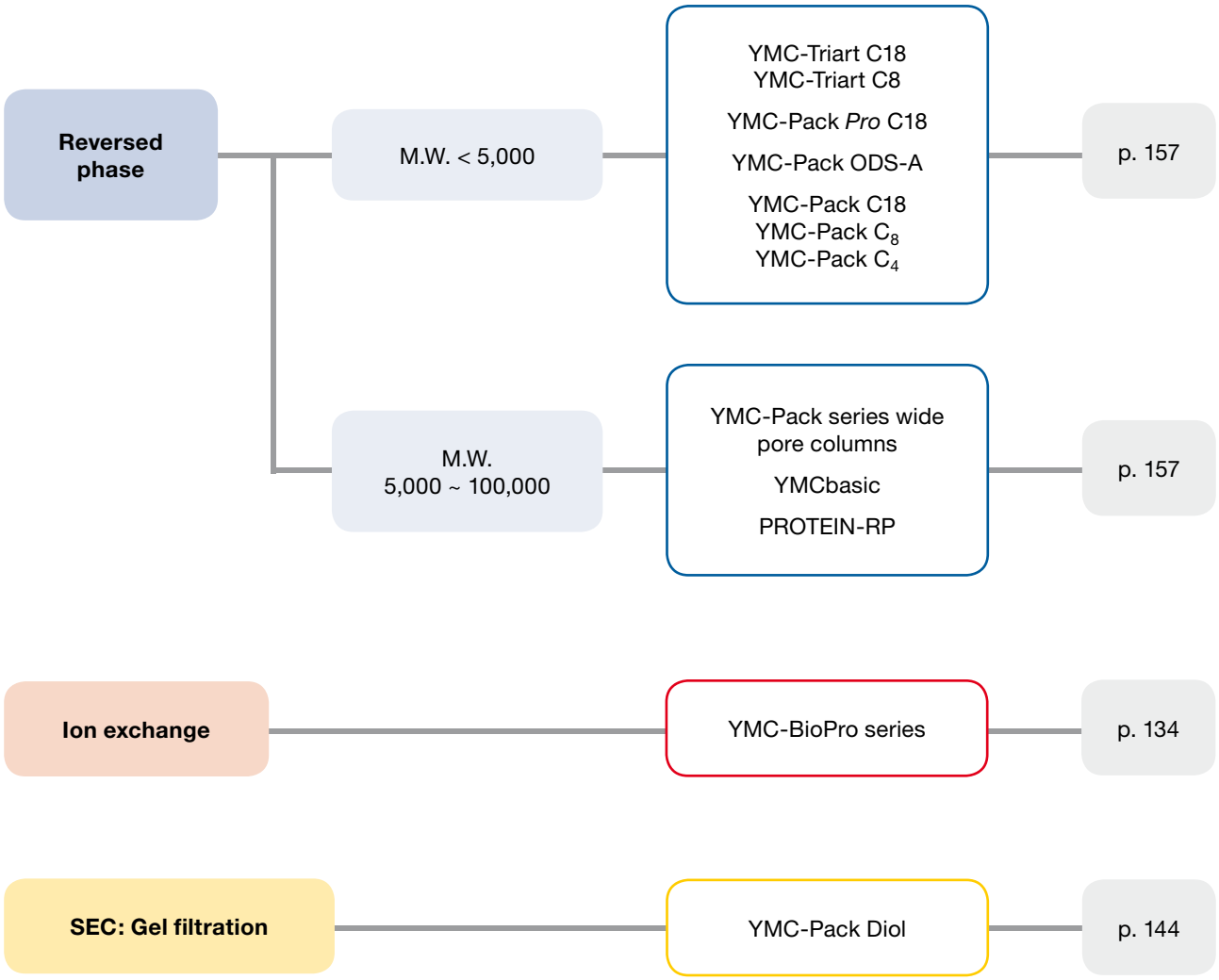
Introduction

HPLC Columns for Biochromatography

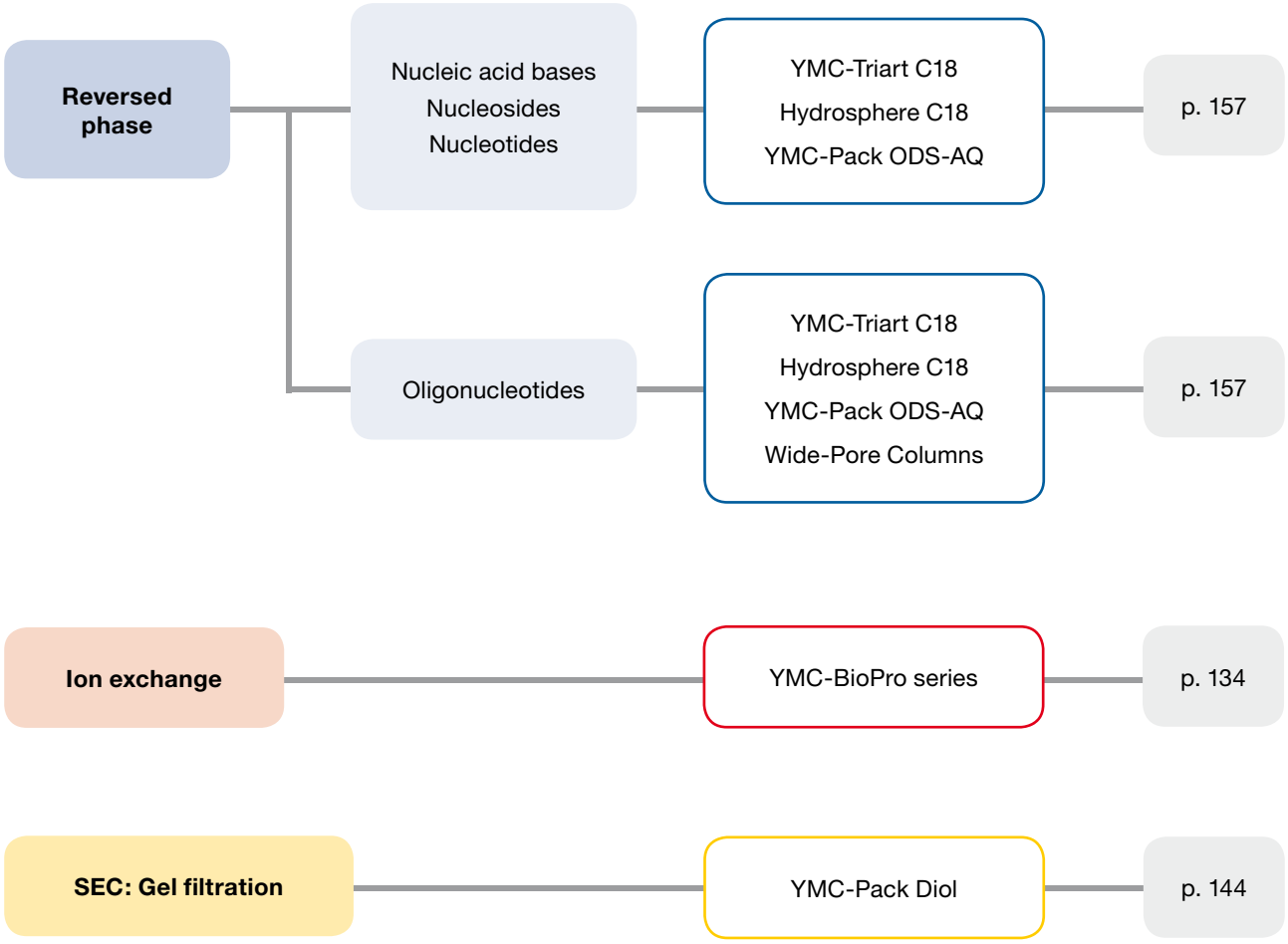
Historically, small molecules have played the major role in diagnosis and therapy. However with the recent developments in the fields of genomics, proteomics and metabolomics, biological molecules have become an important tool for the treatment of diseases or help understanding biological processes.

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.

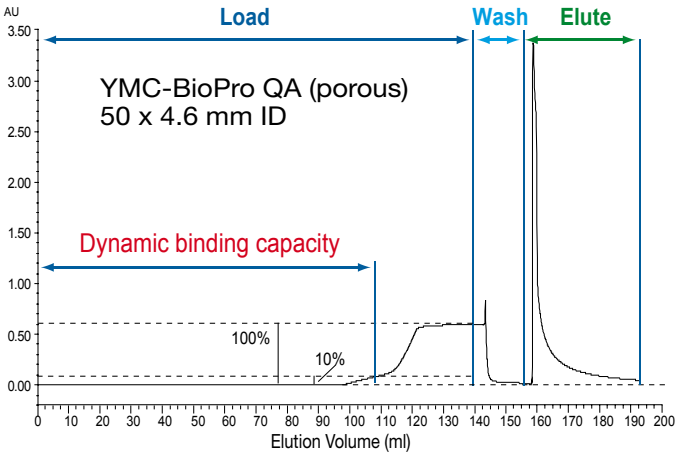
Proteins, Peptides



Nucleic acids



Determination of DBC*



* Application data by courtesy YMC Co., Ltd.

Before determination, equilibrate the column with equilibration buffer.

Step 1: Load

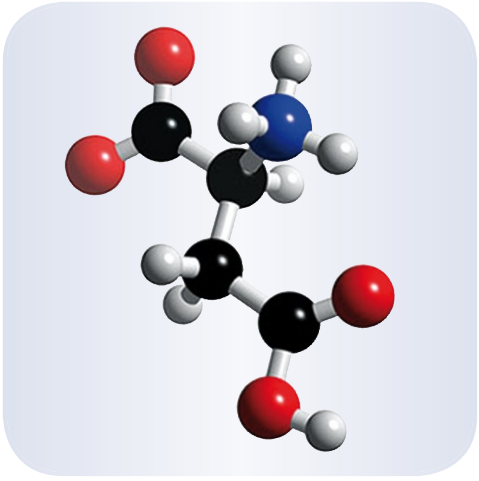
A protein solution of known concentration is continuously loaded at the desired flow rate and the absorbance of the eluate is monitored until full saturation is achieved (100% UV absorbance of the pure sample solutions).

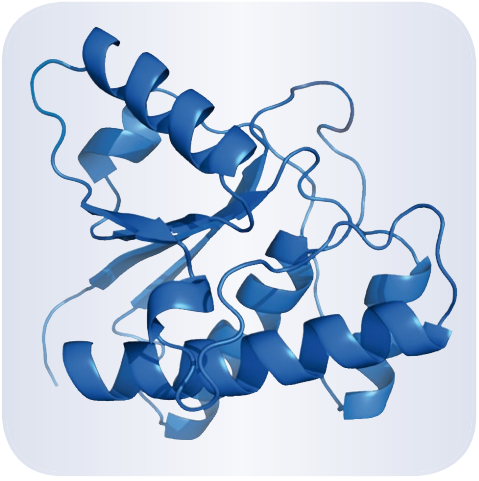
Step 2: Wash

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

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%).



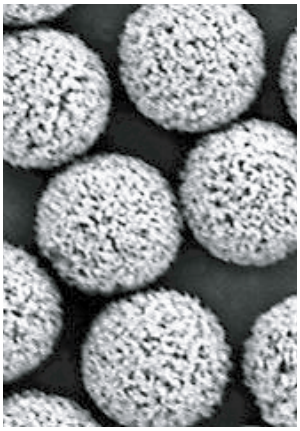


IEX

YMC-BioPro series

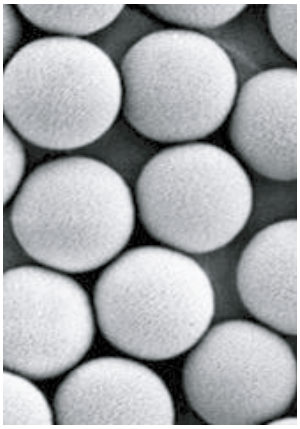
- **newly developed porous hydrophilic polymer with low nonspecific adsorption**
- **excellent binding capacity and recovery of biomolecules**
- **very high resolution**

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	$-CH_2N^+(CH_3)_3$	$-CH_2CH_2CH_2SO_3$
Dynamic binding capacity	> 110 (BSA)	> 70 (IgG)
Available pH range	2.0 - 12.0	2.0 - 12.0



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	5	5
Charged group	$-CH_2N^+(CH_3)_3$	$-CH_2CH_2CH_2SO_3$
Dynamic binding capacity	> 12 (BSA)	> 10 (IgG)
Available pH range	2.0 - 12.0	2.0 - 12.0



Nonporous polymer beads

General

YMC-BioPro series ion exchange columns are available in QA and SP chemistries and are based on 5 micron porous (QA or SP columns) or nonporous (QA-F and SP-F columns) hydrophilic polymer beads. The porous materials offer excellent binding capacity with unusually high efficiency, and low operating pressure when packed in 50 x 4.6 mm columns. The non porous particles offer high efficiency, exceptional resolution, and low operating pressures in 30 x 4.6 mm and 100 x 4.6 mm columns.

YMC-BioPro series

High binding capacity and high recovery for porous type

The porous version 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

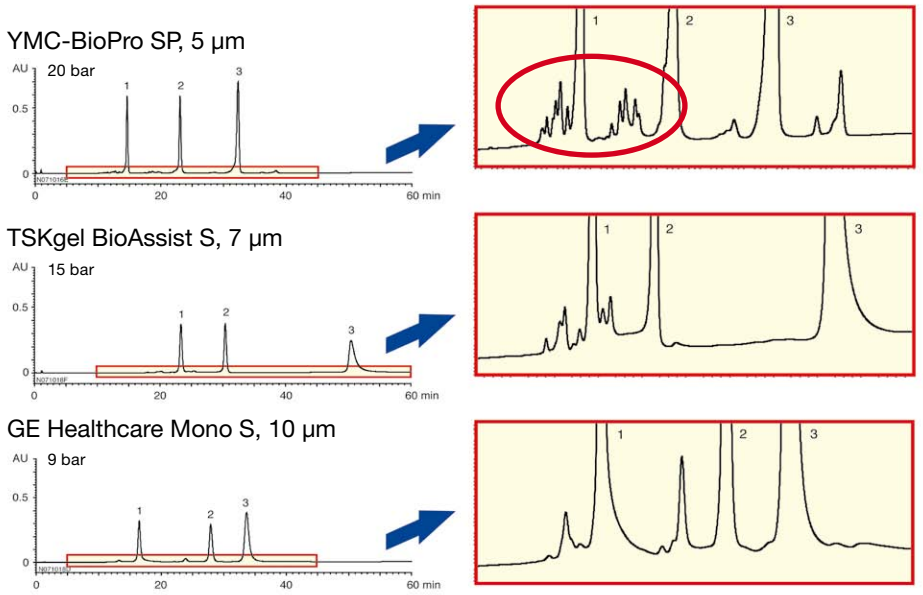
* Recovery: (Eluted amount/Dynamic binding capacity) x 100

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

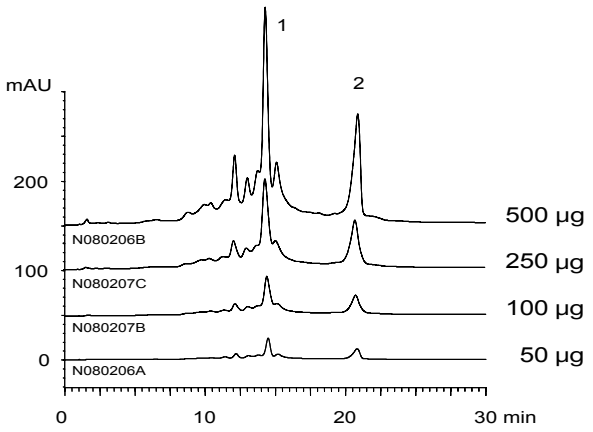
* Application data by courtesy YMC Co., Ltd.

YMC-BioPro QA/SP

Applications for porous YMC-BioPro

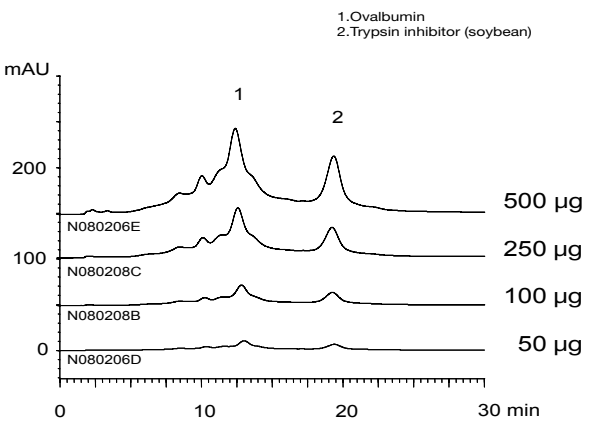
Loading study for YMC-BioPro QA (porous) – Proteins*

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



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

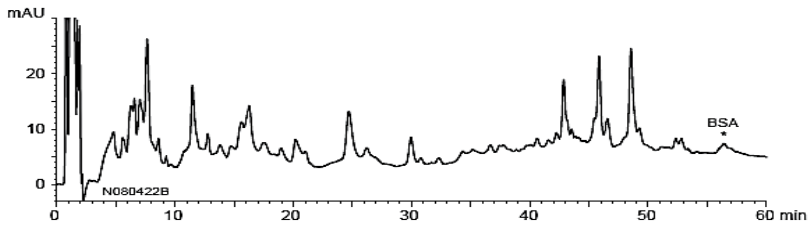
GE Healthcare (Mono Q)
10 µm (50 x 5.0 mm ID)



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

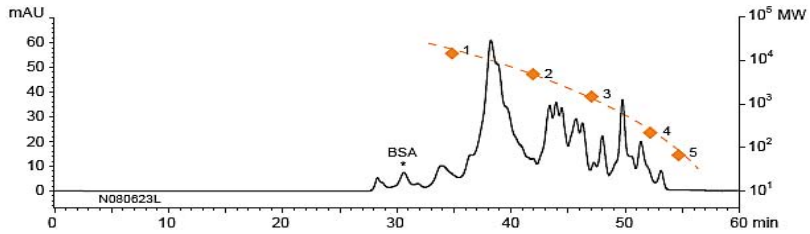
Peptide mapping*

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



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

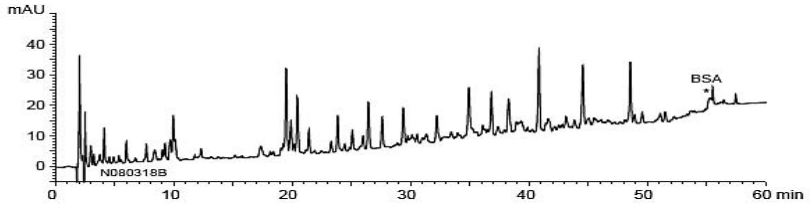


Calibration curve of proteins and peptides

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

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



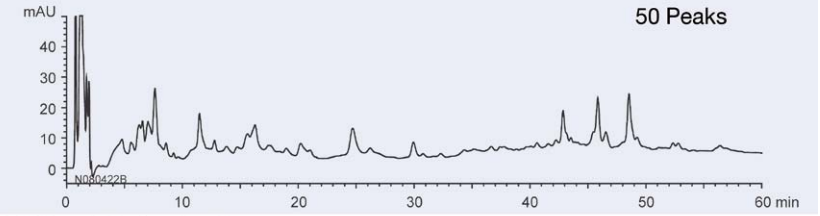
Tryptic digest of BSA (MW: 66,000)

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

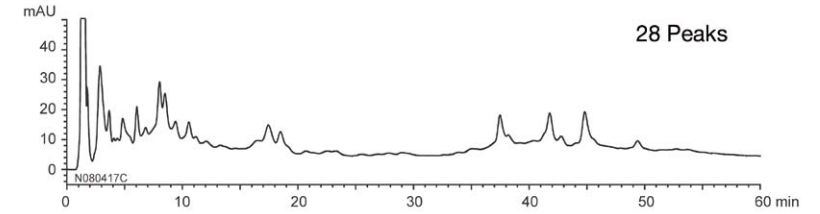
YMC-BioPro QA/SP

Peptide mapping of tryptic digest of BSA*

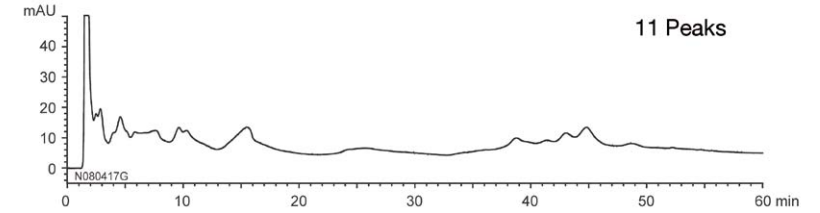
YMC-BioPro QA
5 µm, 50 x 4.6 mm ID



TSKgel BioAssist Q
10 µm, 50 x 4.6 mm ID



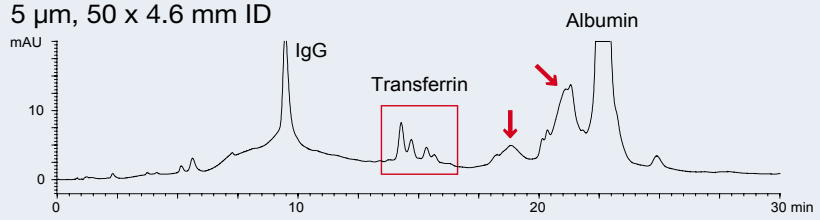
Mono Q
10 µm, 50 x 5.0 mm ID



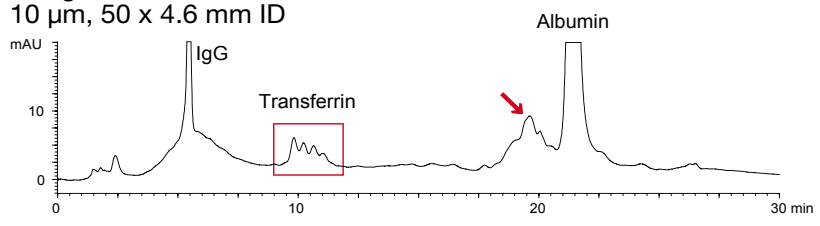
Eluent:	A) 20 mM Tris-HCl (pH 8.6) B) 20 mM Tris-HCl (pH 8.6) containing 0.5 M NaCl
Gradient:	0-15%B (0-30 min), 15-60%B (30-60 min)
Flow rate:	0.5 ml/min
Temperature:	25°C
Detection:	UV at 220 nm
Injection:	20 µl
Sample:	Tryptic digest of BSA

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

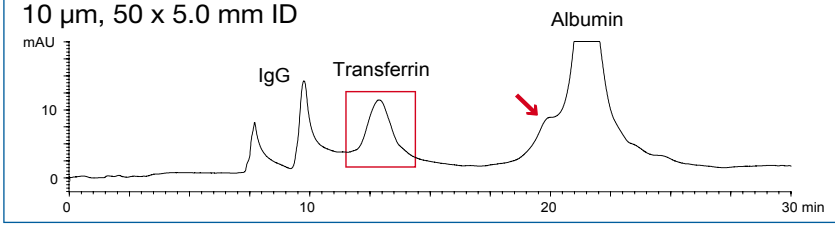
YMC-BioPro QA
5 µm, 50 x 4.6 mm ID



TSKgel BioAssist Q
10 µm, 50 x 4.6 mm ID



GE Healthcare Mono Q
10 µm, 50 x 5.0 mm ID



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 ml/ml)

* Application data by courtesy YMC Co., Ltd.

YMC-BioPro Q75/S75, Q30/S30

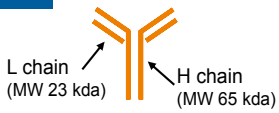
Capture purification by ion-exchange chromatography (IEX)

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

Crude extract from egg yolk containing IgY

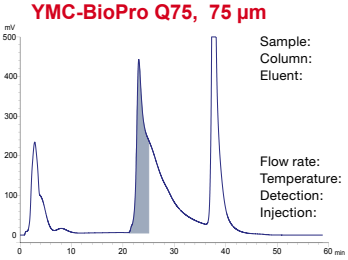
Crude extract is the supernatant after precipitation of the lipids and lipoproteins from egg yolk.

IgY (MW 170 kda)



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

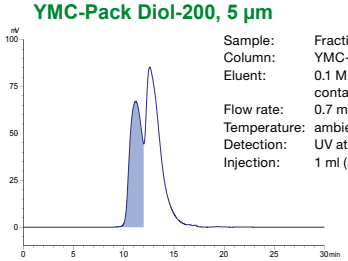
YMC-BioPro Q75, 75 µm



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)

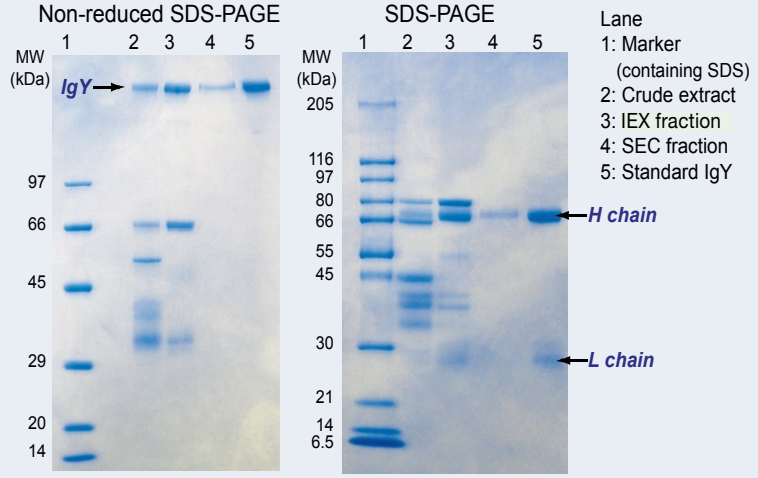
Step 2: Final purification by size-exclusion chromatography (SEC)

YMC-Pack Diol-200, 5 µm

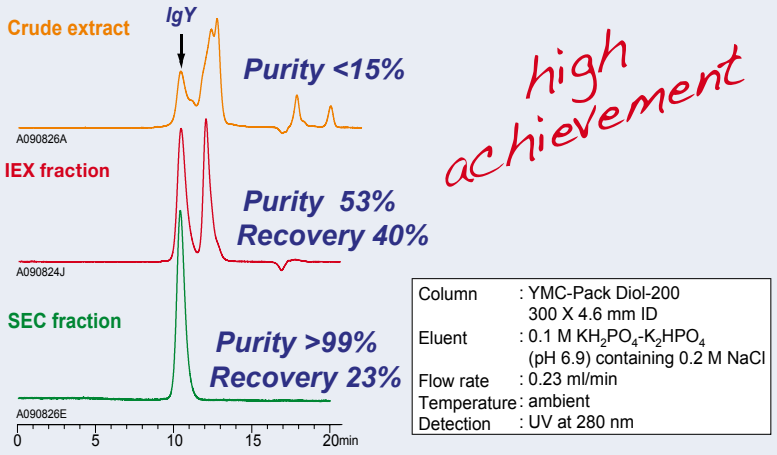


Sample:	Fraction from capture purification by IEC
Column:	YMC-Pack Diol-200, 5 µm, 300 x 8.0 mm ID
Eluent:	0.1 M KH_2PO_4-K_2HPO_4 (pH 6.9) containing 0.2 M NaCl
Flow rate:	0.7 ml/min (84 cm/hr)
Temperature:	ambient
Detection:	UV at 280 nm
Injection:	1 ml (approx. 0.45 mg IgY)

SDS-PAGE analysis of crude and purified fraction



SEC analysis of crude and purified fraction

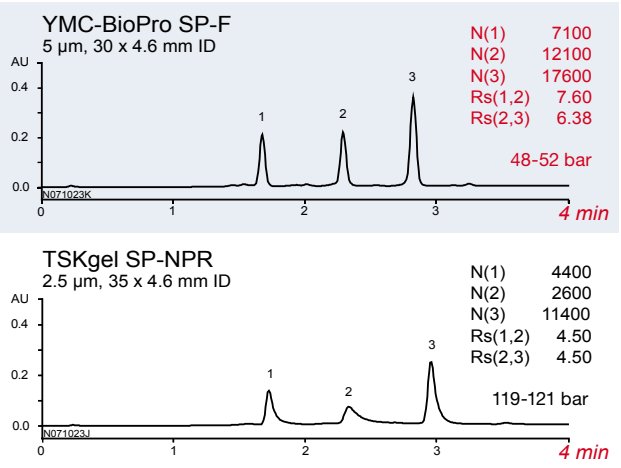


Column	: YMC-Pack Diol-200 300 X 4.6 mm ID
Eluent	: 0.1 M KH_2PO_4-K_2HPO_4 (pH 6.9) containing 0.2 M NaCl
Flow rate	: 0.23 ml/min
Temperature	: ambient
Detection	: UV at 280 nm

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*



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

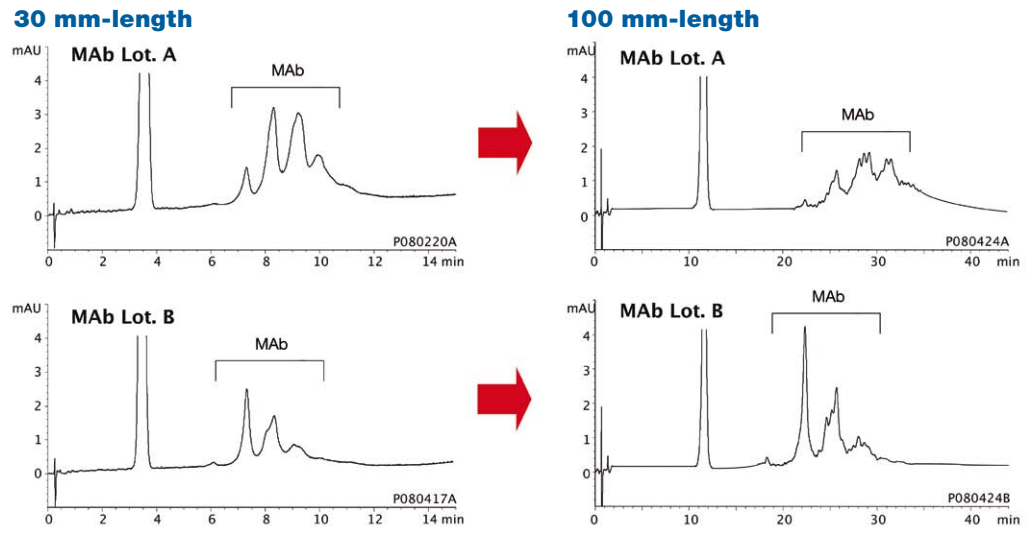
Despite the larger particle size, the theoretical plate count for YMC-BioPro SP-F is higher than that for TSKgel SP-NPR.

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 competitors' columns, YMC-BioPro QA-F and SP-F show higher theoretical plate counts, excellent peak shapes, and lower backpressure. This makes YMC-BioPro QA-F and 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
Part No.:	QF00S05-0346WP QF00S05-1046WP
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
Flow rate:	1.0 ml/min
Temperature:	25 °C
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)

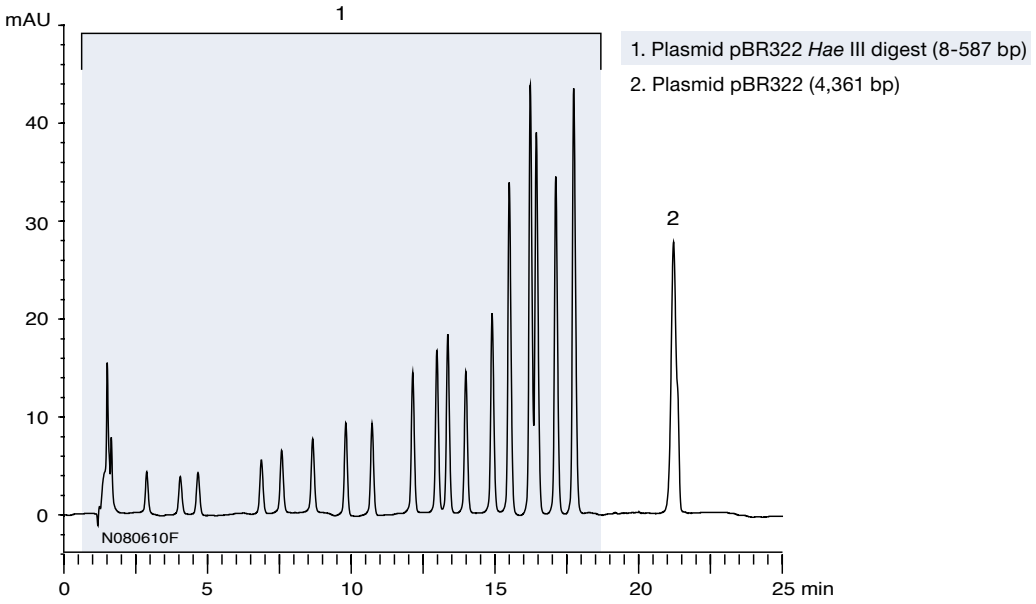
Two different lots of commercially available MAb, purified by DEAE chromatography, are separated on 30 mm and 100 mm lentgh of YMC-BioPro QA-F columns. The lot-to-lot variability of MAb is observed and the resolution is increased on 100 mm-length column.

* Application data by courtesy YMC Co., Ltd.

YMC-BioPro QA-F/SP-F

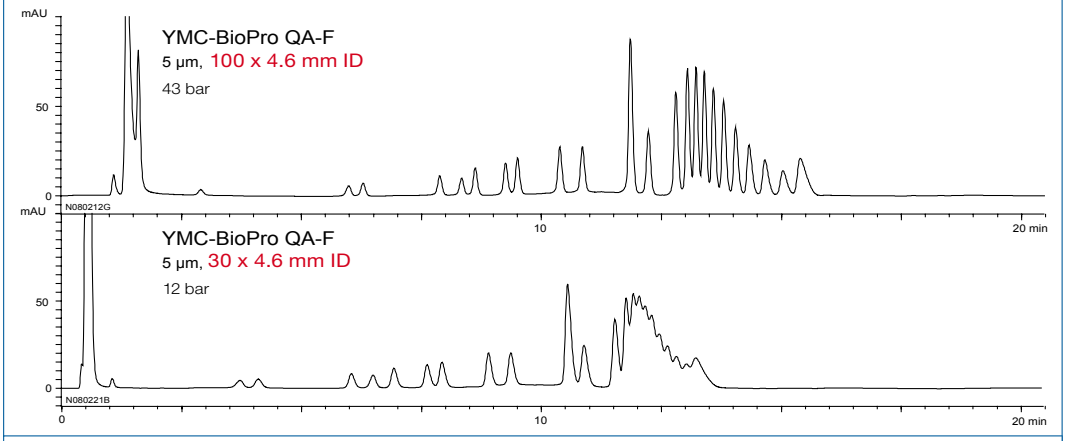
Applications for non-porous YMC-BioPro: High Resolution IEX

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*



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)

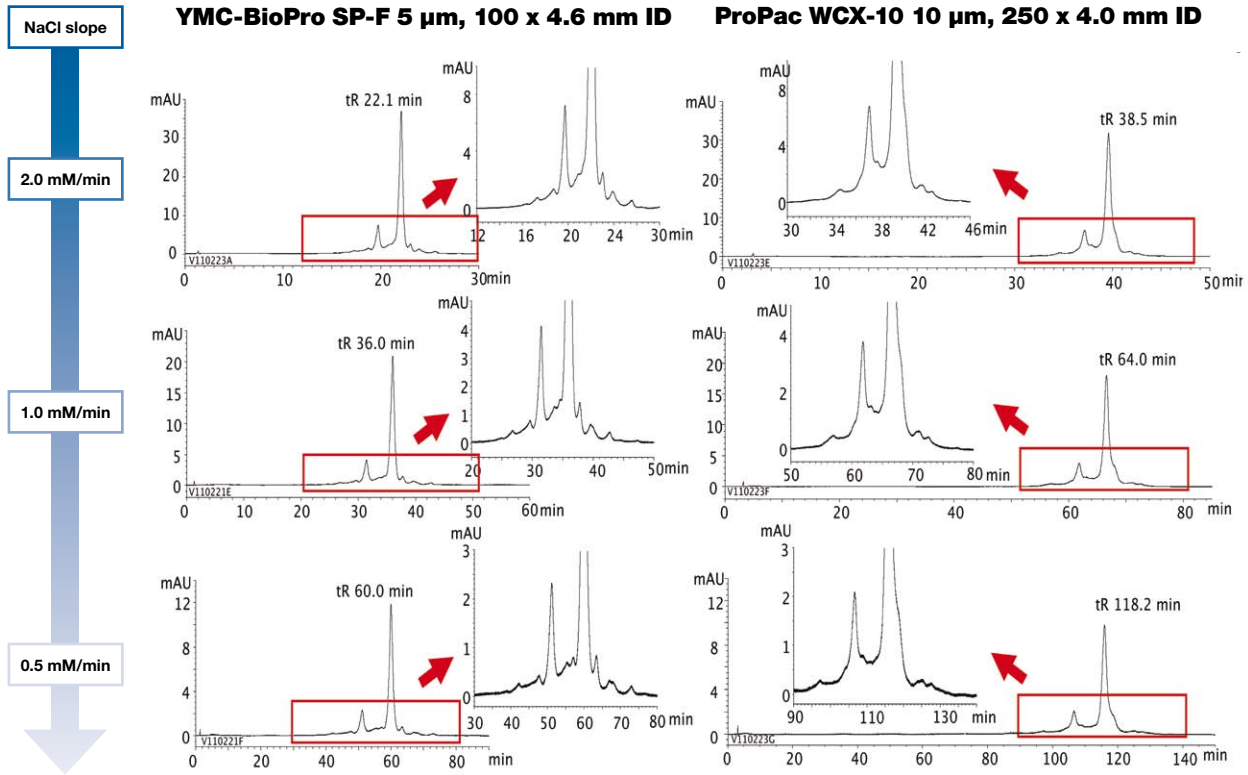
Comparison of DNA fragment separation on 100 mm and 30 mm length YMC-BioPro QA-F columns.

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: Humanized 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 monoklonal 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 results in 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.

Ordering information

5 µm analytical columns

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

Olther dimensions on demand

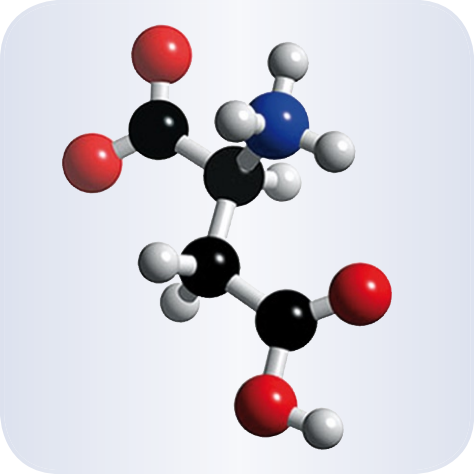
Preparative grade YMC-BioPro also available as bulk media! (See next page!)

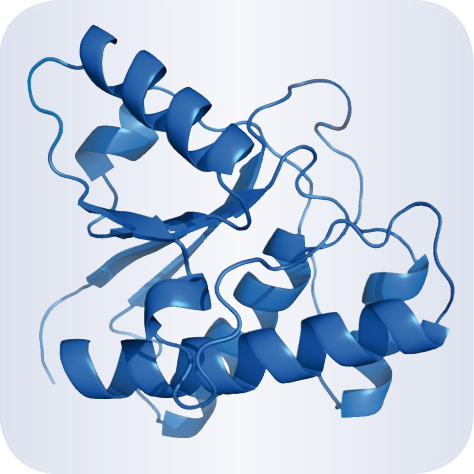
* Application data by courtesy YMC Co., Ltd.

Ordering information

Bulk media

Phase	Particle Size	Part-No.
YMC-BioPro Q30	30 µm	QAA0S30
YMC-BioPro S30	30 µm	SPA0S30
YMC-BioPro Q75	75 µm	QAA0S75
YMC-BioPro S75	75 µm	SPA0S75





SEC

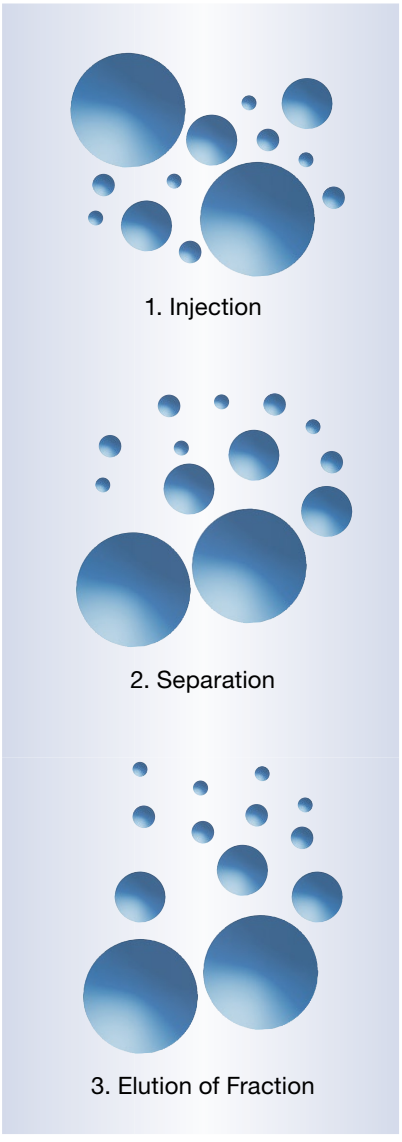
YMC-Pack Diol

L20

What is special about YMC SEC columns?

- **method development**
- **scalability**
- **reproducibility**
- **cost-efficiency**

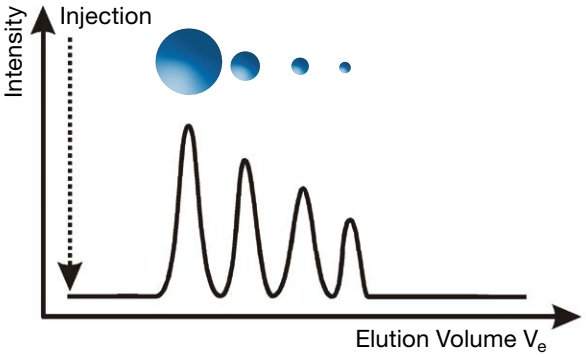
YMC-Pack Diol	Diol-60 for peptides and small proteins	Diol-120 for intermediate proteins	Diol-200 for large proteins	Diol-300 for very large proteins
Particle Size / µm	5	5	5	5
Pore Size / nm	6	12	20	30
Surface area / m^2g^{-1}	450	330	175	100
Recommended pH range	5.0 - 7.5	5.0 - 7.5	5.0 - 7.5	5.0 -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



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.



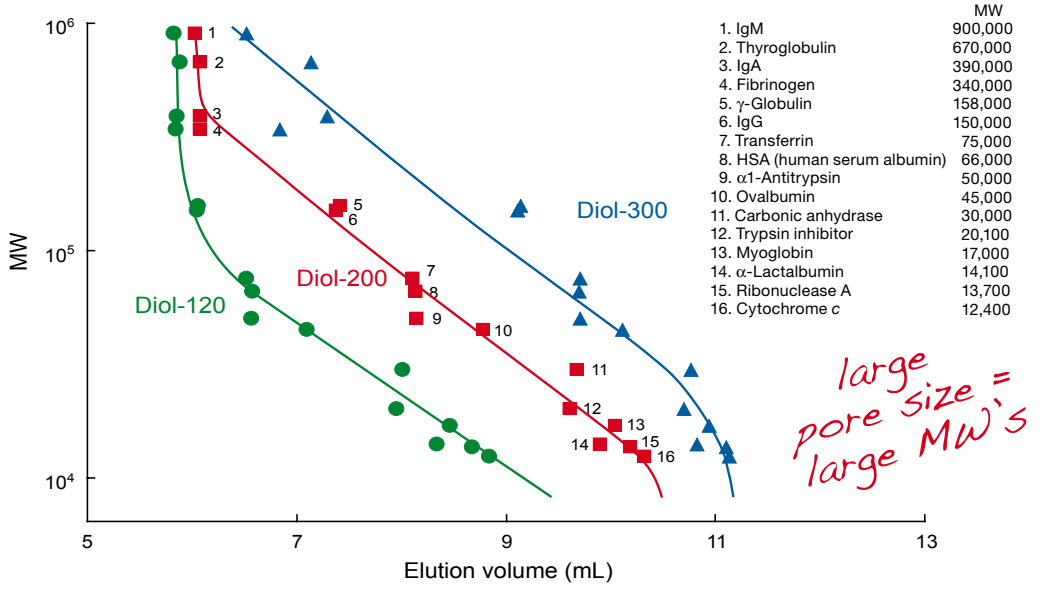
small molecules = long retention time
bigger molecules = short retention time

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

SEC Applications for YMC-Pack Diol*

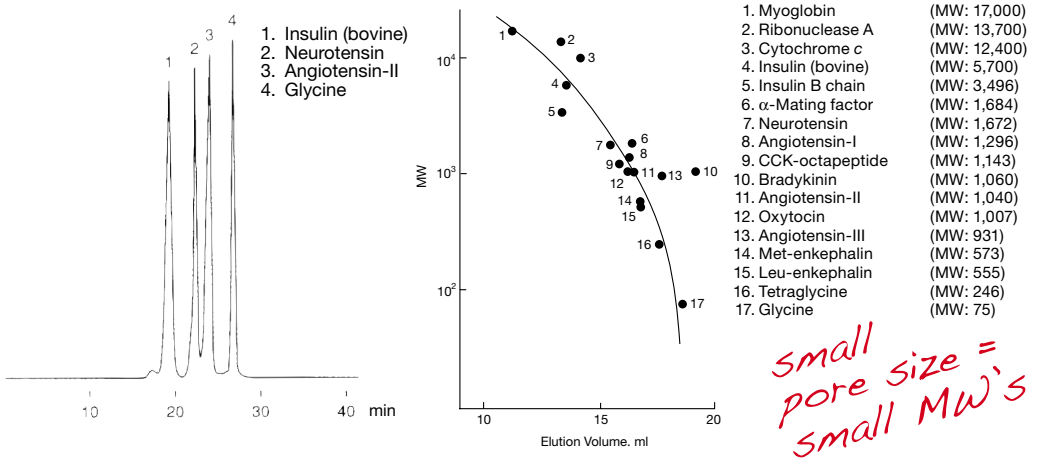
For separation of proteins with molecular weights from 10.000 to several 100.000



	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

Column: YMC-Pack Diol, 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: 25 °C
Detection: UV at 280 nm

For separation of proteins with molecular weights below 10.000



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)

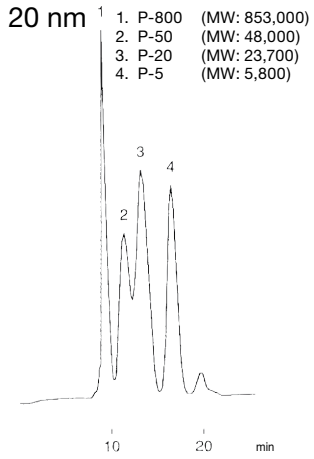
Column: YMC-Pack Diol (6 nm) 500 x 8.0 mm ID
Part No.: DL06S05-5008WT
Eluent: 0.1 M KH_2PO_4-K_2HPO_4 (pH 7) containing 0.2 M NaCl / acetonitrile (70/30)
Flow rate: 0.7 ml/min
Temperature: ambient
Detection: UV at 215 nm

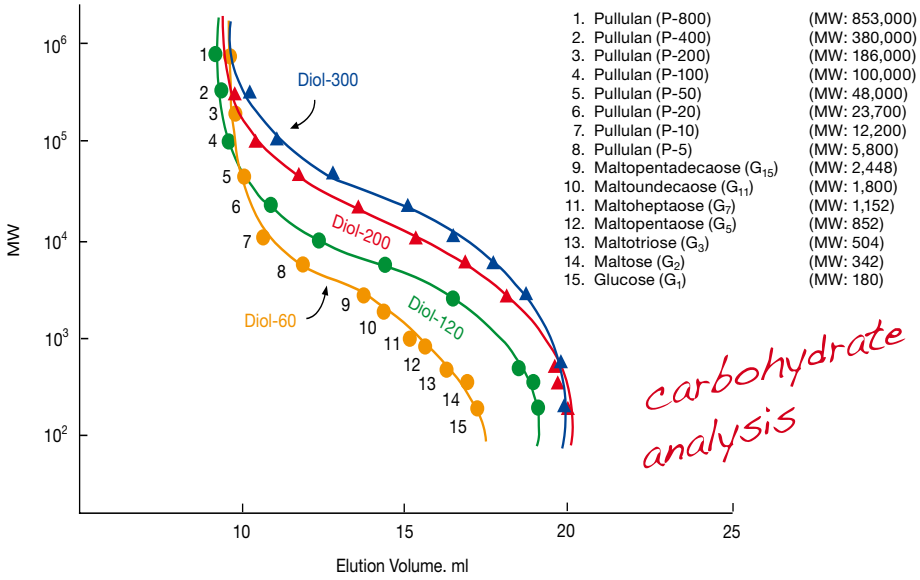
* Application data by courtesy YMC Co., Ltd.

YMC-Pack Diol

SEC Applications for YMC-Pack Diol*

For molecular weight determination of oligosaccharides and polysaccharides





carbohydrate analysis

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

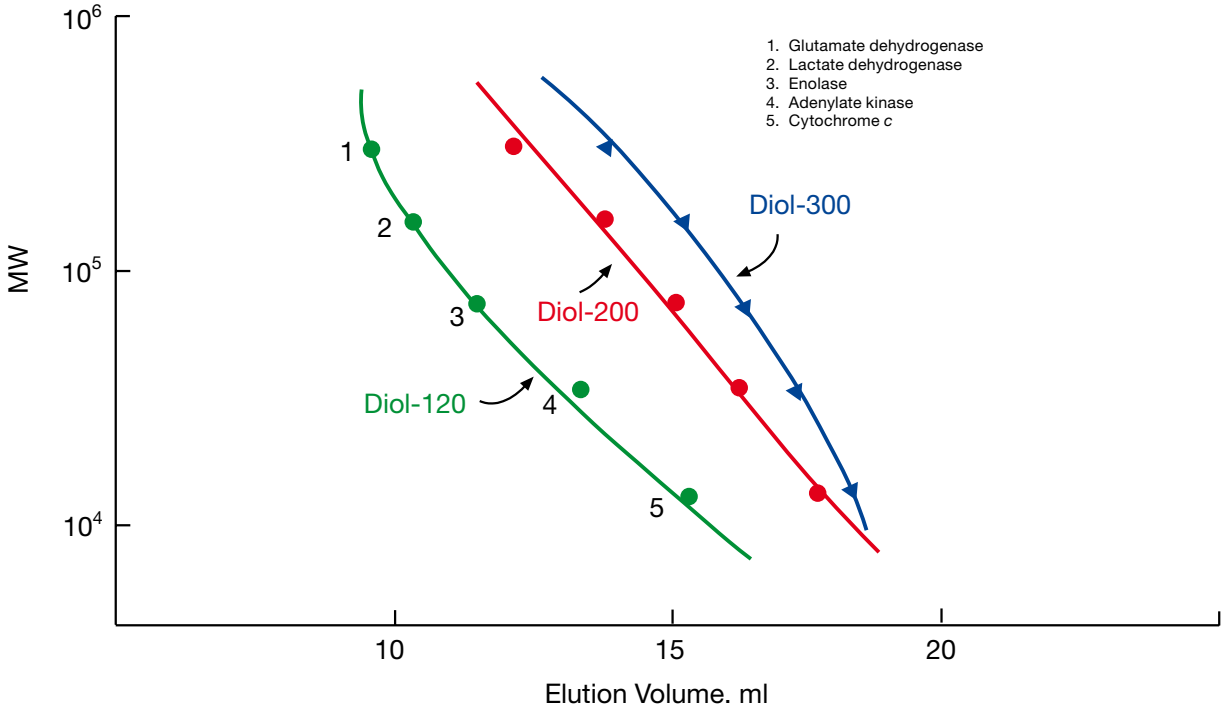
Column Selection Tool

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 10.000 to several 100.000
YMC-Pack Diol-300	for MW several 10.000 to 1.000.000

YMC-Pack Diol

High flexibility

Proteins and Peptides*



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

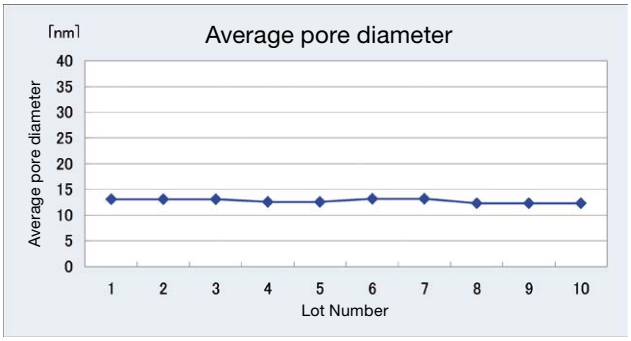
* Application data by courtesy YMC Co., Ltd.

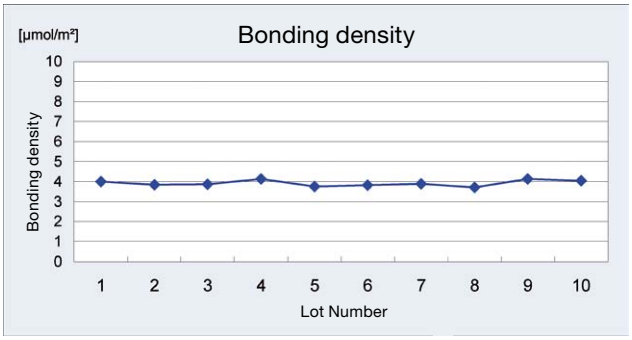
YMC-Pack Diol

Reproducibility

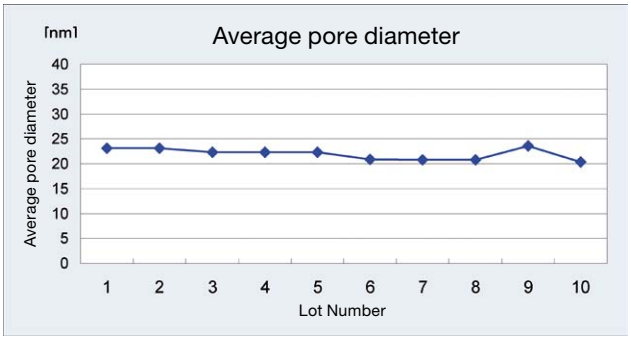
YMC-Pack Diol columns have the reputation, not only for their high versatility and excellent cost/performance ratio, but also for their high degree of lot-to-lot reproducibility.

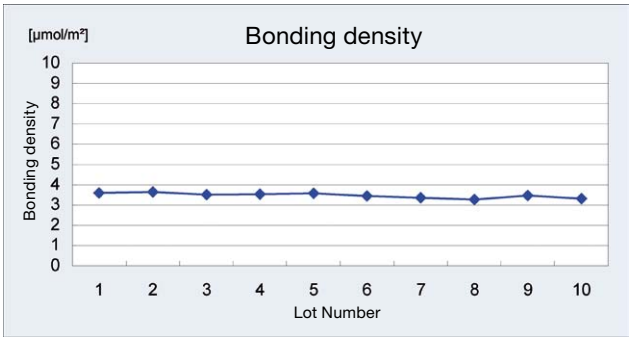
YMC-Pack Diol-120*



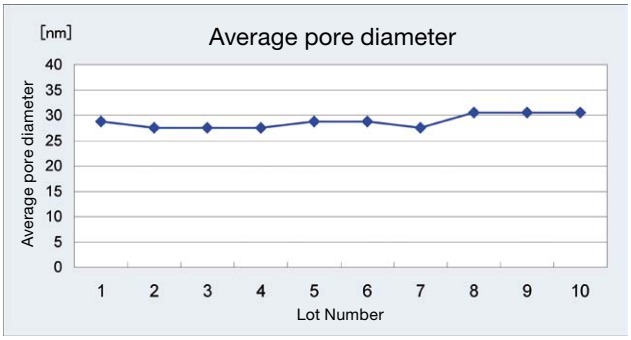


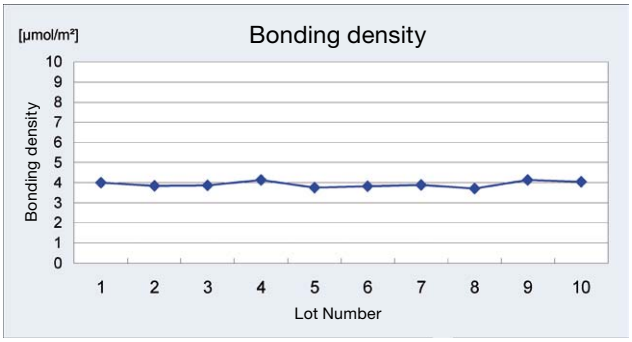
YMC-Pack Diol-200*





YMC-Pack Diol-300*

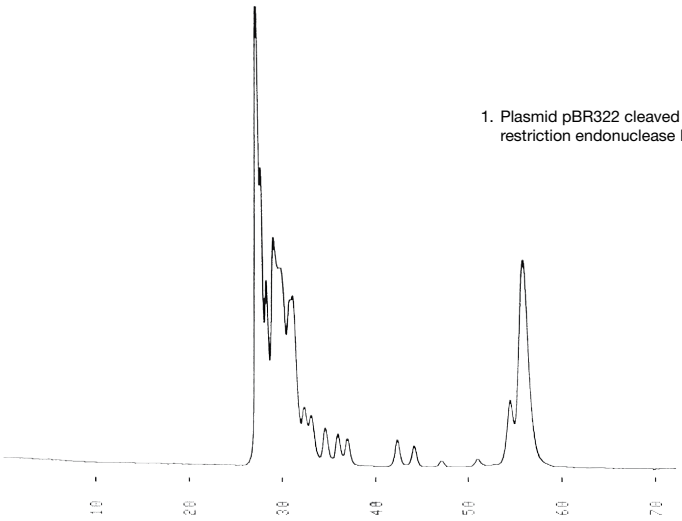




YMC-Pack Diol

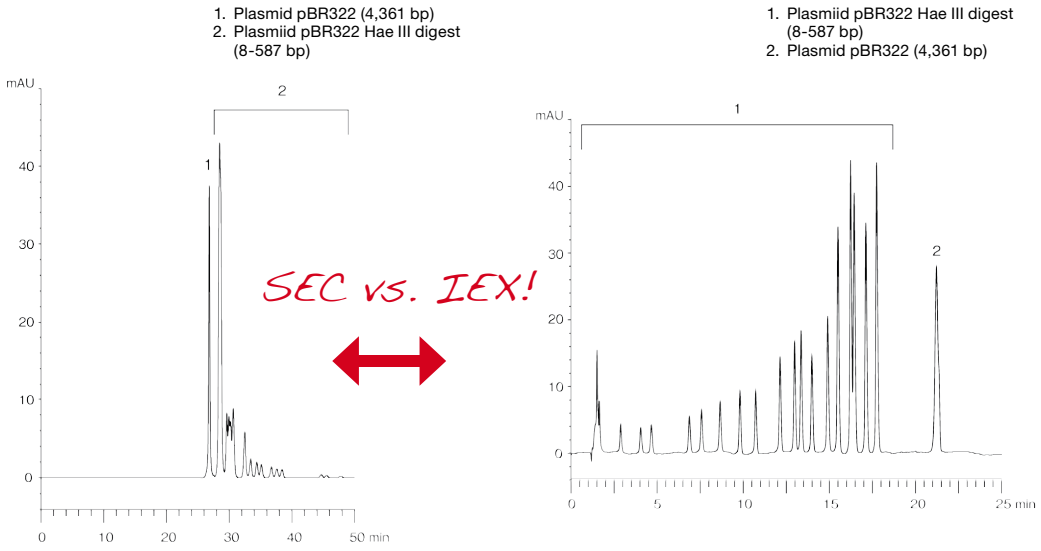
SEC Applications for YMC-Pack Diol*

Plasmid pBR322 restriction fragment



Column:	YMC-Pack Diol-300 + Diol-200, 500 x 8.0 mm ID x 2	Temperature:	ambient (26 °C)
Part No.:	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



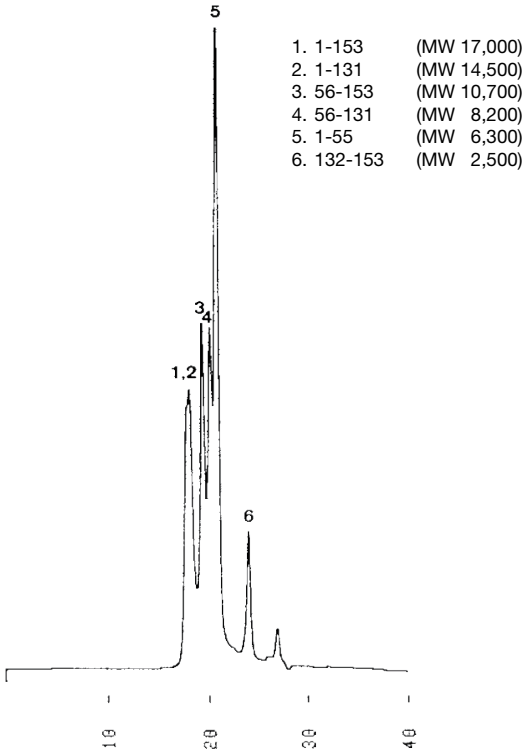
Column:	YMC-Pack Diol-300 + Diol-200, 500 x 8.0 mm ID x 2	Column:	YMC-BioPro QA-F (5 µm), 100 x 4.6 mm ID
Part No.:	DL30S05-5008WT DL20S05-5008WT	Part No.:	QF00S05-1046WP
Eluent:	0.1 M KH_2PO_4-K_2HPO_4 (pH 7.0) containing 0.2 M NaCl	Eluent:	A) 20 mM Tris-HCl (pH 8.1) B) 20 mM Tris-HCl (pH 8.1) containing 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*

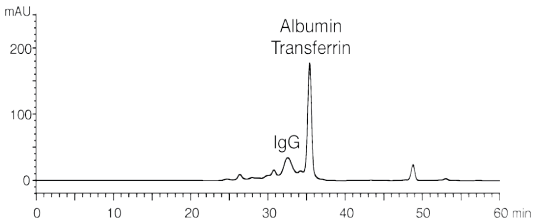
Peptide fragments from myoglobin



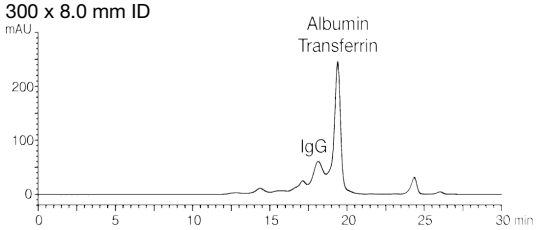
Column:	YMC-Pack Diol-120, 500 x 8.0 mm ID
Part No.:	DL12S05-5008WT
Eluent:	0.1 M KH_2PO_4-K_2HPO_4 (pH 7.0) containing 0.2 M NaCl/acetonitrile (70/30)
Flow rate:	0.7 ml/min
Temperature:	ambient (25 °C)
Detection:	UV at 215 nm, 0.32 AUFS
Injection:	20 µl (2.0 mg/ml)
Sample:	Cyanogen bromide cleavages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

Proteins in human serum

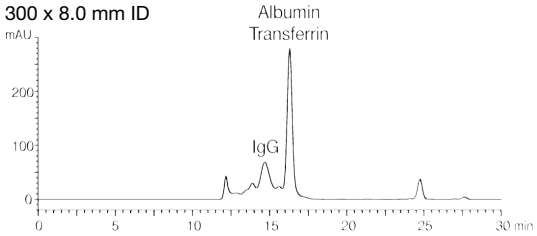
YMC-Pack Diol-300 + Diol-200
300 x 8.0 mm ID x 2



YMC-Pack Diol-300
300 x 8.0 mm ID

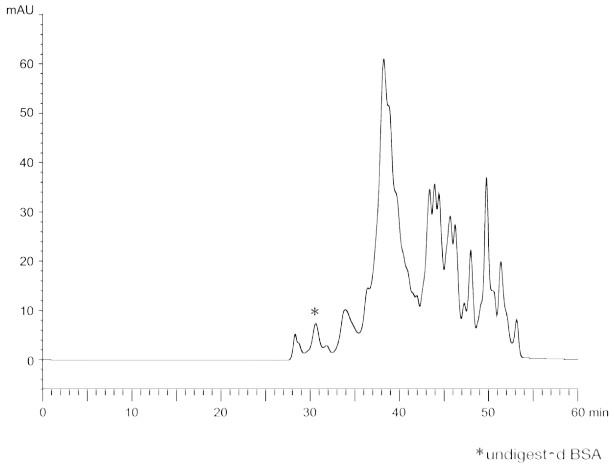


YMC-Pack Diol-200
300 x 8.0 mm ID



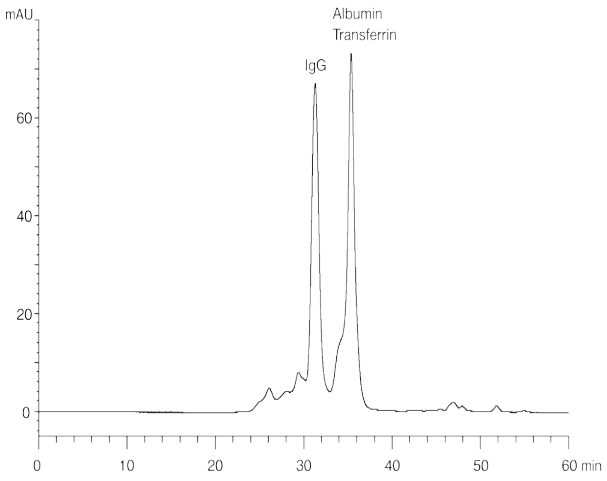
Eluent:	0.1 M KH_2PO_4-K_2HPO_4 (pH 7.0) containing 0.2 M NaCl
Flow rate:	0.5 ml/min
Temperature:	ambient (25 °C)
Detection:	UV at 280 nm
Injection:	20 µl
Sample:	Human serum (100 µl/ml)

Peptide mapping



Column:	YMC-Pack Diol-120 + Diol-60, 500 x 8.0 mm ID x 2
Part No.:	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

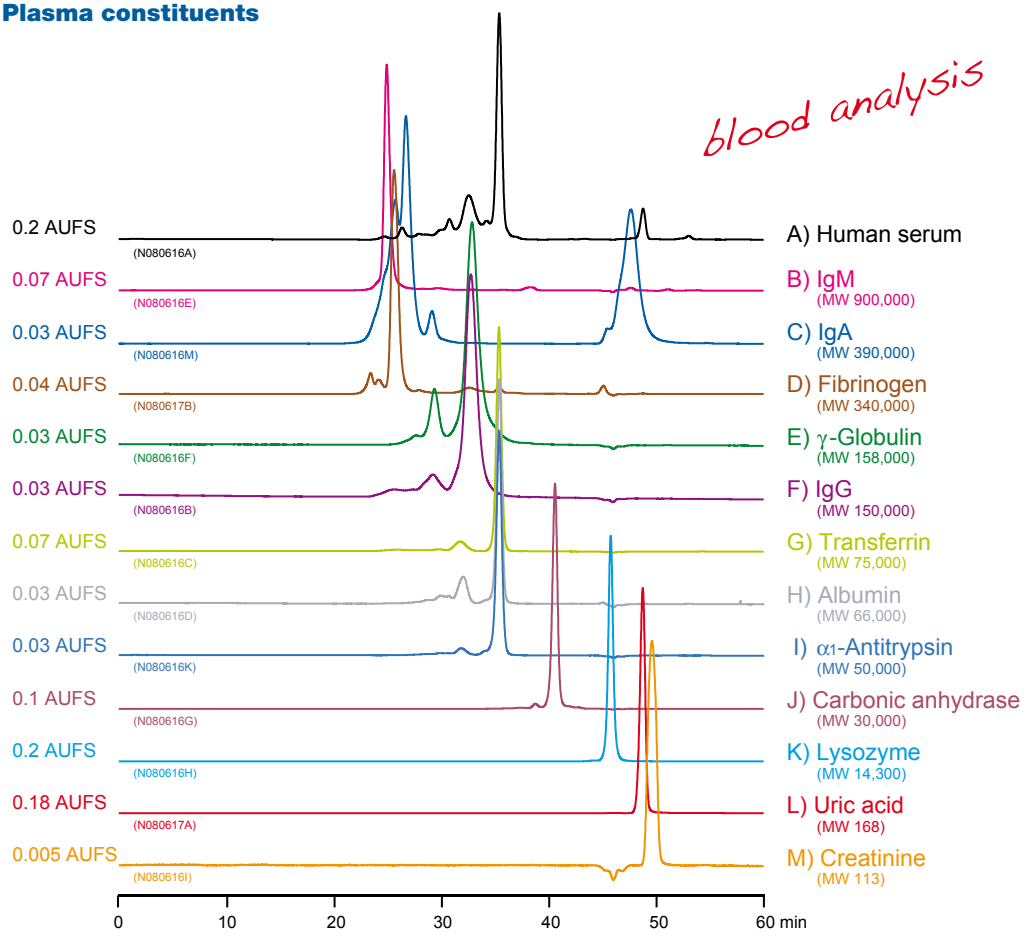


Column:	YMC-Pack Diol-300 + Diol-200, 300 x 4.6 mm ID x 2
Part No.:	DL30S05-3046WT + DL20S05-3046WT
Eluent:	0.1 M KH_2PO_4-K_2HPO_4 (pH 7.0)
Flow rate:	0.17 ml/min
Temperature:	ambient (25 °C)
Detection:	UV at 220 nm
Injection:	10 µl (60 times dilution with water)

YMC-Pack Diol

SEC Applications for YMC-Pack Diol*

Plasma constituents



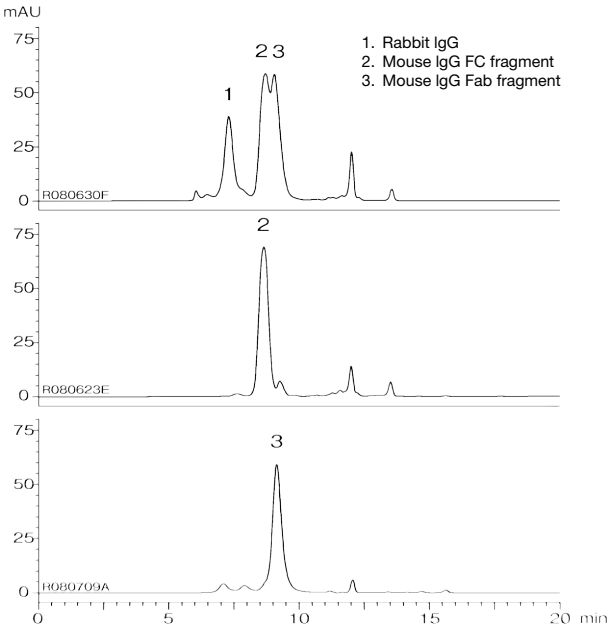
Column:	YMC-Pack Diol-300 + Diol-200, 300 x 8.0 mm ID x 2	Temperature:	ambient (25 °C)
Part No.:	DL30S05-3008WT + DL20S05-3008WT	Detection:	UV at 280 nm
Eluent:	0.1 M $KH_2PO_4K_2HPO_4$ (pH 7.0) containing 0.2 M NaCl	Injection:	20 µl (L: 1 µl)
Flow rate:	0.5 ml/min	Sample:	A) 100 µl/ml; B-M) 1.0 mg/ml

* Application data by courtesy YMC Co., Ltd.

YMC-Pack Diol

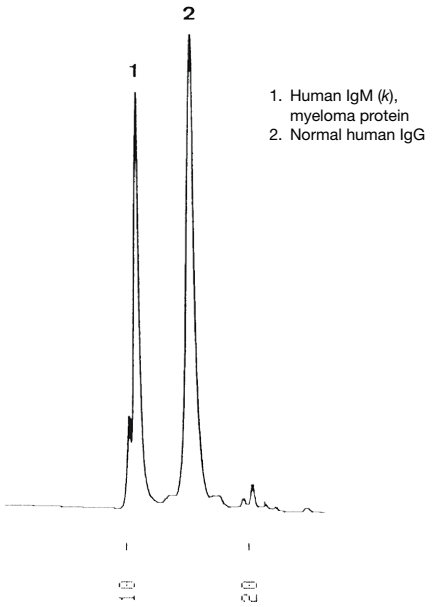
SEC Applications for YMC-Pack Diol*

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)

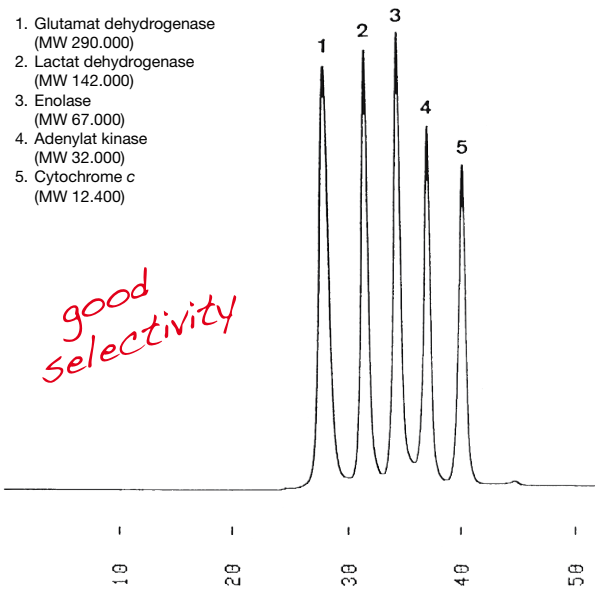
Human Immunglobulin



Column:	YMC-Pack Diol-300, 500 x 8.0 mm ID
Part No.:	DL30S05-5008WT
Eluent:	0.1M NaH_2PO_4-Na_2HPO_4 (pH 6.8) containing 0.1M 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)

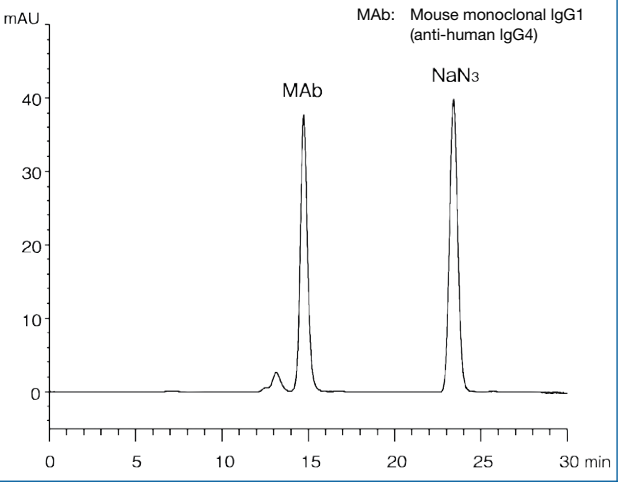
Proteins for molecular weight markers

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)



Column:	YMC-Pack Diol-200, 500 x 8.0 mm ID + 300 x 8.0 mm ID
Part No.:	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.

Monoclonal antibody (MAb)

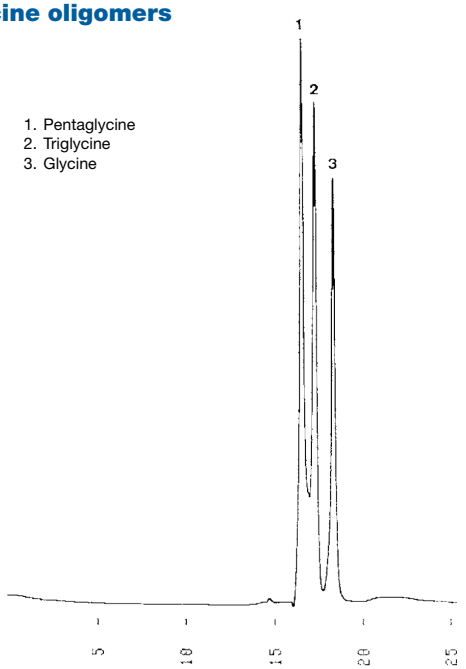


Column:	YMC-Pack Diol-200, 300 x 4.6 mm ID
Part No.:	DL20S05-3046WT
Eluent:	0.1 M KH_2PO_4-K_2HPO_4 (pH 7.0)
Flow rate:	0.17 ml/min
Temperature:	ambient (25 °C)
Detection:	UV at 220 nm
Injection:	10 µl
Sample:	a commercially available mouse monoclonal IgG1 (0.05 mg/ml) (purified by DEAE chromatography,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

YMC-Pack Diol

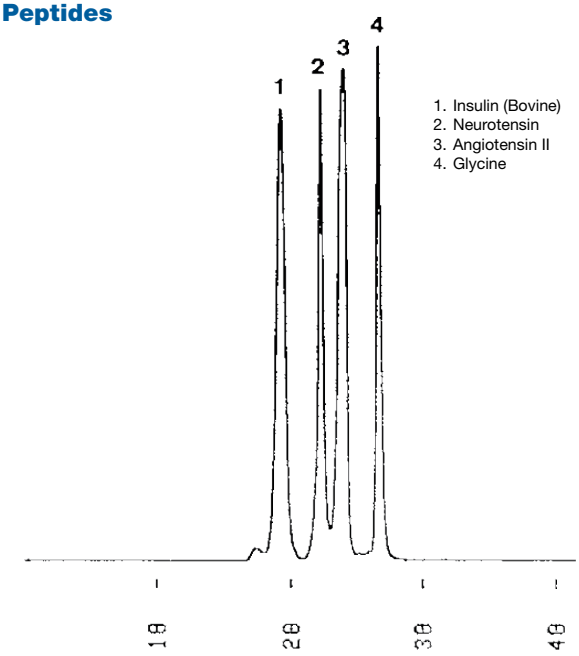
SEC Applications for YMC-Pack Diol*

Glycine oligomers



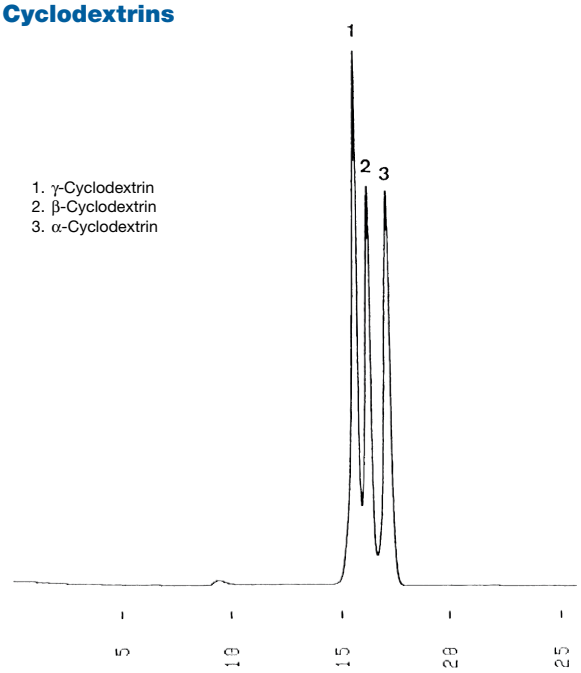
Column:	YMC-Pack Diol-60, 500 x 8.0 mm ID
Part No.:	DL06S05-5008WT
Eluent:	0.1M KH_2PO_4-K_2HPO_4 (pH 7.0) / acetonitrile (70/30)
Flow rate:	1.0 ml/min
Temperature:	ambient (24 °C)
Detection:	UV at 215 nm, 0.08 AUFS
Injection:	20 µl (0.25 ~ 2.5 mg/ml)

Peptides



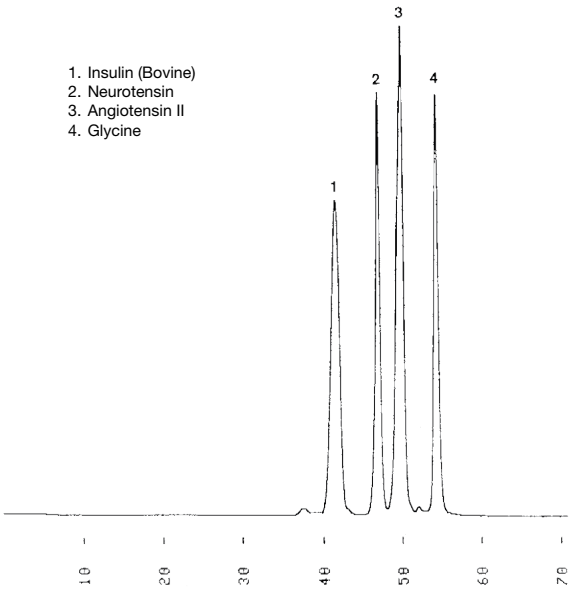
Column:	YMC-Pack Diol-60, 500 x 8.0 mm ID
Part No.:	DL06S05-5008WT
Eluent:	0.1M KH_2PO_4-K_2HPO_4 (pH 7.0) / containing 0.2 M NaCl / acetonitrile (70/30)
Flow rate:	0.7 ml/min
Temperature:	ambient (25 °C)
Detection:	UV at 215 nm, 0.16 AUFS
Injection:	25 µl (0.07 ~ 5.3 mg/ml)

Cyclodextrins



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)

Peptides



Column:	YMC-Pack Diol-120 + 60, 500 x 8.0 mm ID x 2
Part No.:	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)

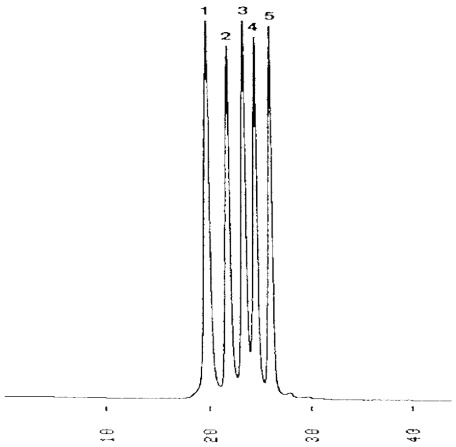
* Application data by courtesy YMC Co., Ltd.

YMC-Pack Diol

SEC Applications for YMC-Pack Diol*

Proteins for molecular weight markers

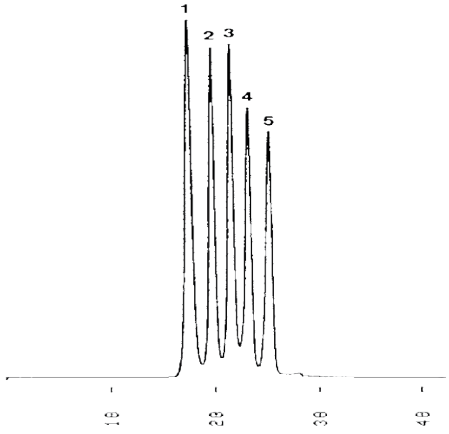
1. Glutamate dehydrogenase (MW 290,000)
2. Lactate dehydrogenase (MW 142,000)
3. Enolase (MW 67,000)
4. Adenylate kinase (MW 32,000)
5. Cytochrome c (MW 12,400)



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)
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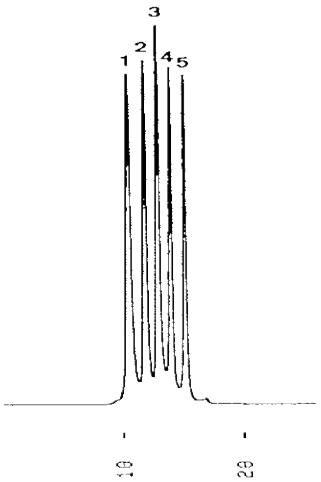

Column: YMC-Pack Diol-200, 300 x 8.0 mm ID
Part No.: DL20S05-3008WT
Eluent: 0.1 M KH_2PO_4-K_2HPO_4 (pH 7.0) containing 0.2 M NaCl
Flow rate: 0.7 ml/min
Temperature: ambient (26 °C)
Detection: UV at 280 nm, 0.08 AUFS
Injection: 15 µl (100 µl / 1 vial)
Sample: MW-Marker (HPLC), manufactured by ORIENTAL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

Proteins for molecular weight markers

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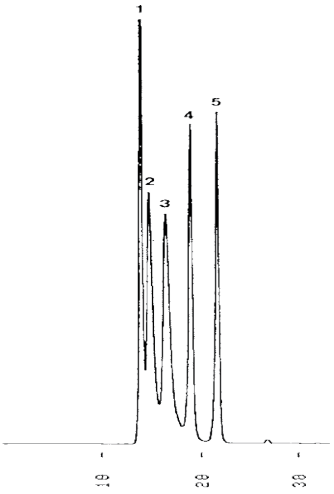


Column: YMC-Pack Diol-120, 500 x 8.0 mm ID
Part No.: DL12S05-5008WT
Eluent: 0.1 M KH_2PO_4-K_2HPO_4 (pH 7.0) containing 0.2 M NaCl
Flow rate: 0.7 ml/min
Temperature: ambient (26 °C)
Detection: UV at 280 nm, 0.08 AUFS
Injection: 15 µl (100 µl / 1 vial)
Sample: MW-Marker (HPLC), manufactured by ORIENTAL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

Ordering Information

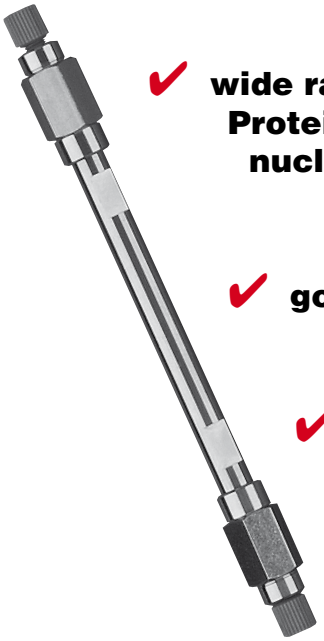
YMC-Pack Diol

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

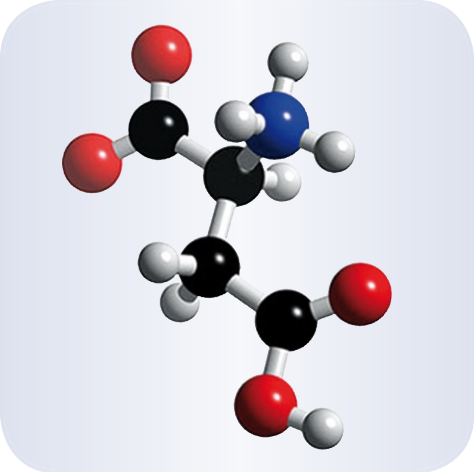
Guard Columns are available for the different column dimensions.
For more details please contact us: Phone 02064-427-0 or email info@ymc.de.

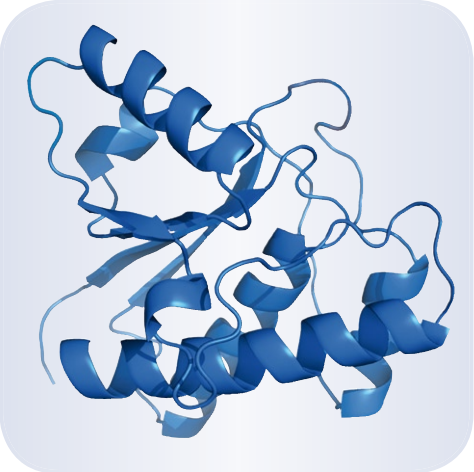
* Application data by courtesy YMC Co., Ltd.

YMC SEC columns provide:



- ✔ **wide range of applications: Proteins, peptides, carbohydrates and nucleic acid components**
- ✔ **good cost/performance ratio**
- ✔ **scalability: from 5 µm to 15 µm**
- ✔ **minimal secondary interactions**





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	YMC-Pack ODS-AQ	Hydrosphere C18
Particle size / µm	1.9; 3; 5	2; 3; 5	3; 5	3; 5	2; 3; 5
Pore size / nm	12	12	12; 20; 30	12; 20	12
Carbon content / %	20	16	17; 12; 7	14; 10	12
pH range	1.0 - 12.0	2.0 - 8.0	2.0 - 7.5	2.0 - 7.5	2.0 - 8.0

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

For further information about our preparative bulk materials please refer to the following dedicated brochures: ”YMC*Gel HG-series“, ”YMC preparative phases for biochromatography“, and ”YMC-Triart Prep“.

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's "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.

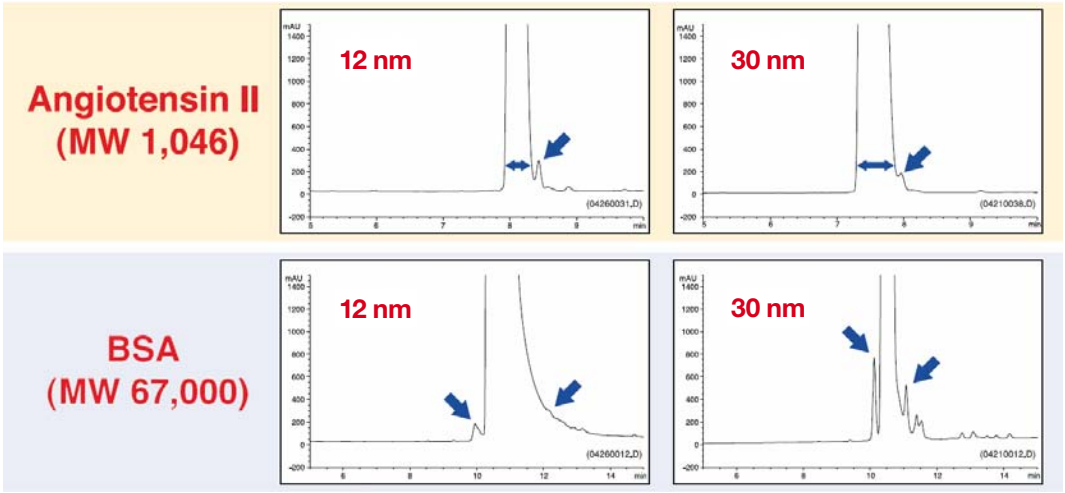
However, the separation may also be influenced by the hydrophobicity of the peptide/protein and the nature of the column's bonded phase. Therefore, for initial method development, it might be useful, in the first instance, to follow the arrow shown in the table for method optimisation.

Column Selection Tool*

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

◎: excellent, ○: good, △: moderate

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



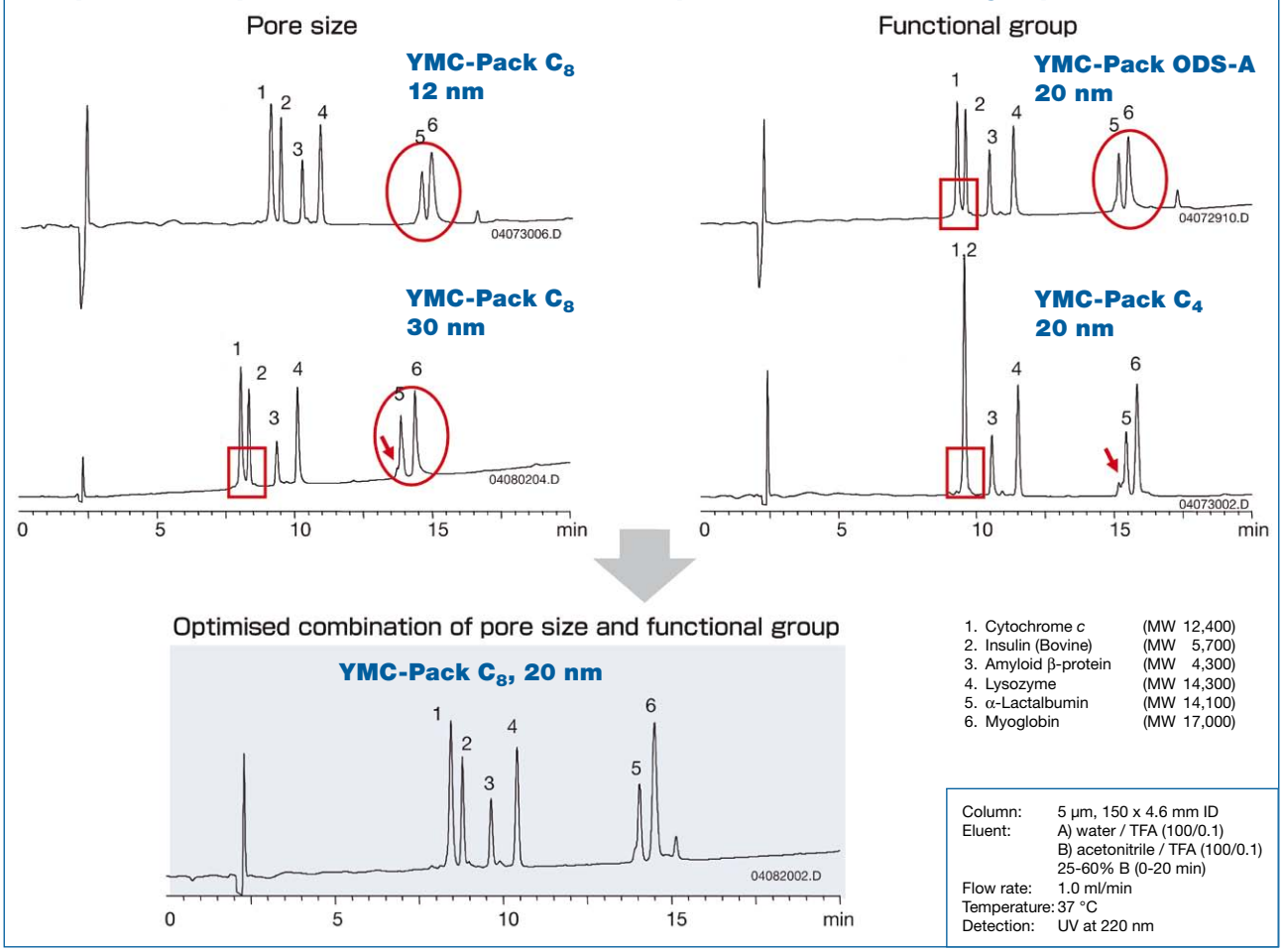
For smaller peptides a small pore size is more successful. Larger molecules are separated much better with larger pore sizes!

* Application data by courtesy YMC Co., Ltd.

Bioseparation Columns

Separation of peptides and proteins (MW 4,300 - 17,000)*

Comparison of separation on columns with different pore size and functional group



Optimised combination of pore size and functional group

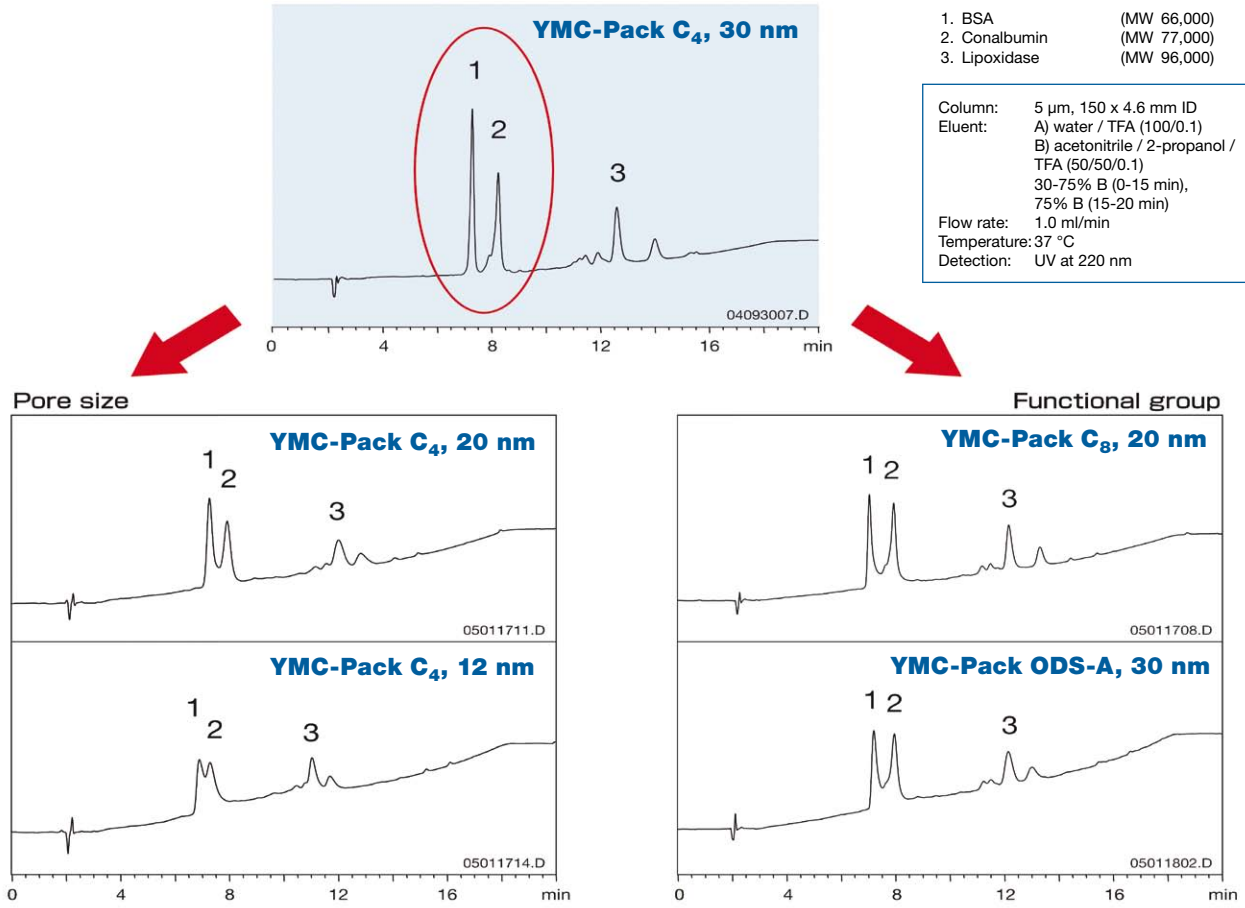
1. Cytochrome *c* (MW 12,400)
2. Insulin (Bovine) (MW 5,700)
3. Amyloid β-protein (MW 4,300)
4. Lysozyme (MW 14,300)
5. α-Lactalbumin (MW 14,100)
6. Myoglobin (MW 17,000)

Column:	5 µm, 150 x 4.6 mm ID
Eluent:	A) water / TFA (100/0.1)
	B) acetonitrile / TFA (100/0.1)
	25-60% B (0-20 min)
Flow rate:	1.0 ml/min
Temperature:	37 °C
Detection:	UV at 220 nm

For proteins and peptides with molecular weighs in the range 4,300 to 17,000, separation characteristics are compared using columns with different pore sizes and functional groups. As predicted by the table on the previous page, the most suitable column is C8, 20 nm for proteins and peptides with molecular weights in this range. If either the pore size or the functional group of the packing material is not optimised, peak broadening and poor resolution are observed. By using the most suitable column (C8, 20 nm) for the target compounds, sharp peak shapes and excellent separation are achieved.

Bioseparation Columns

Comparison of separation on columns with different pore size and functional group*



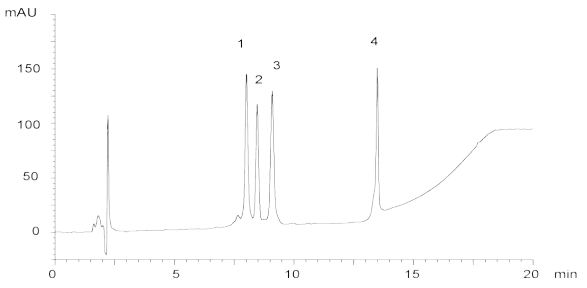
1. BSA (MW 66,000)
2. Conalbumin (MW 77,000)
3. Lipoxidase (MW 96,000)

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

It is important to optimise the pore size and functional group of the packing material for each target protein as these depend on molecular weight of the protein in order to obtain better peak shape and resolution. Proteins with molecular weights within the range 20,000 to 100,000 are separated most effectively by a C4 column with 30 nm pore size.

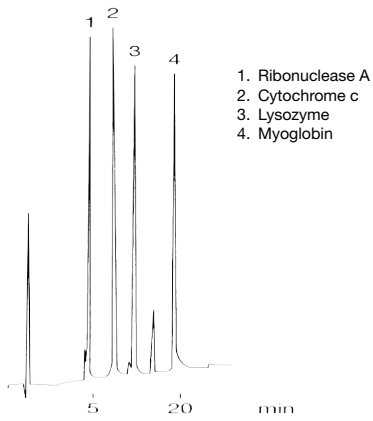
Proteins*

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 C_4 (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

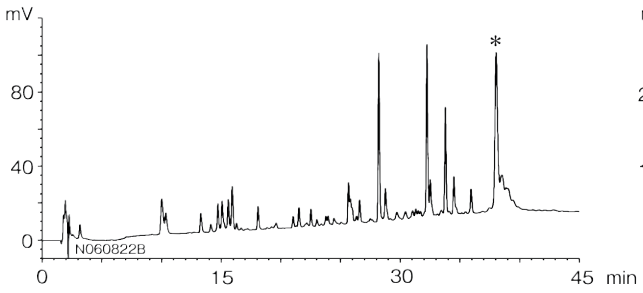
Column:	YMC-Pack C_4 (5 µm, 30 nm) 150 x 4.6 mm ID
Part No.:	BU30S05-1546WT
Eluent:	A) acetonitrile / water / TFA (5/95/0.1) B) acetonitrile / water / TFA (60/40/0.1)
Gradient:	30%-90% B (0-20 min., linear), 90% B (20-50 min)
Flow rate:	1.0 ml/min
Temperature:	37 °C
Detection:	UV at 220 nm

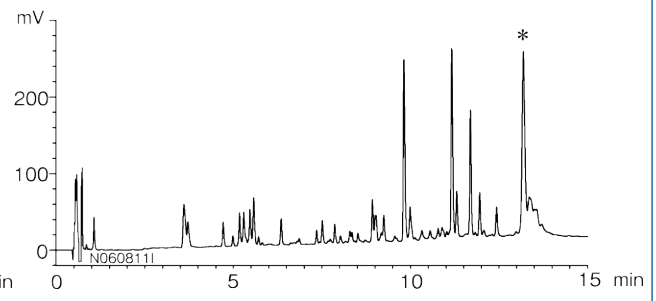
* Application data by courtesy YMC Co., Ltd.

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

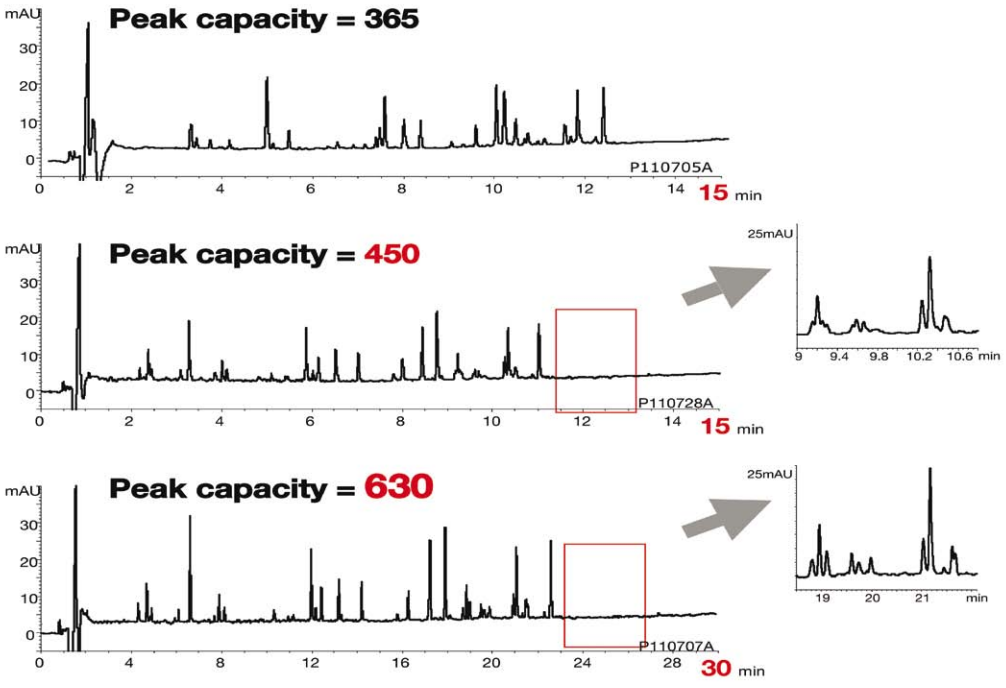
Column:	YMC-UltraHT *Pro* C18 (2 µm, 12 nm) 50 × 2.0 mm ID
Part No.:	AS12S02-0502WT
Eluent:	A) acetonitrile/water/trifluoroacetic acid (10/90/0.1) B) acetonitrile/water/trifluoroacetic acid (35/65/0.1)
Gradient:	Time A (in %) B (in %) 0 100 0 1.65 100 0 13.35 0 100 15.00 0 100
Flow rate:	0.2 ml/min
Temperature: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

Peptide mapping

40 °C
1.9 µm, 100 x 2.0 mm ID
15 min gradient
46.5-48.5 MPa (6,740-7,030 psi)

70 °C
1.9 µm, 100 x 2.0 mm ID
15 min gradient
27.6-28.6 MPa (4,000-4,150 psi)

Two coupled
1.9 µm, 100 x 2.0 mm ID
30 min gradient
58.1-61.6 MPa (8,430-8,930 psi)



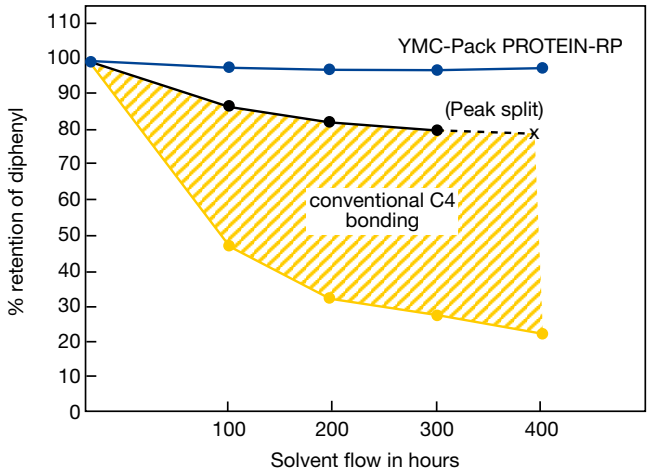
Column:	YMC-Triart C18 (1.9 µm, 12 nm)
Part No.:	TA12SP9-1002PT
Eluent:	A) water / TFA (100/0.1), B) acetonitrile / TFA (100/0.08) 5-40%B (0-15 min) for a single column, 5-40%B (0-30min) for two coupled columns
Flow rate:	0.4 ml/min
Detection:	UV at 220 nm
Injection:	10 µl for a single column, 20 µL for two coupled columns
Sample:	Tryptic digest of Bovine Hemoglobin
System:	Agilent 1290

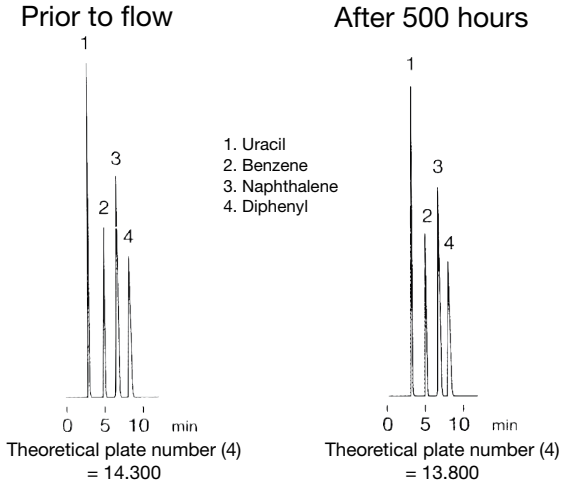
23% more peaks can be resolved by increasing the column temperature to 70°C in the separation of tryptic digest of Hemoglobin.
The outstanding efficiency obtained by a coupling of two 100 mm length of Triart 1.9 µm columns reduces co-elution peaks and allows the precise separation in an analysis of complicated samples, such as peptide mapping.

Bioseparation Columns

Peptide and Protein Applications*

Improved durability 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

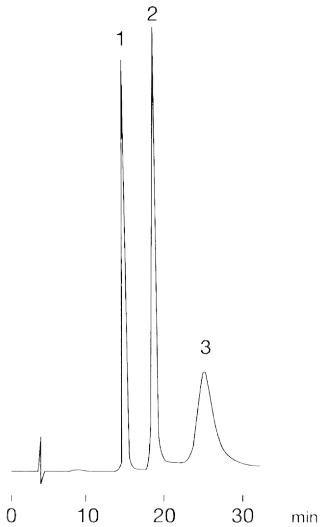
Measurement conditions
Column: YMC-Pack PROTEIN-RP (5 µm) 250 x 4.6 mm ID
Part No.: PR99S05-2546WT
Eluent: acetonitrile / water (40/60)
Flow rate: 1.0 ml/min
Temperature: 30° C
Detection: UV at 254 nm, 0.32 AUFS

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 below it effectively separates both low molecular weight compounds and high molecular weight proteins, with equally good peak shapes being obtained.

Proteins

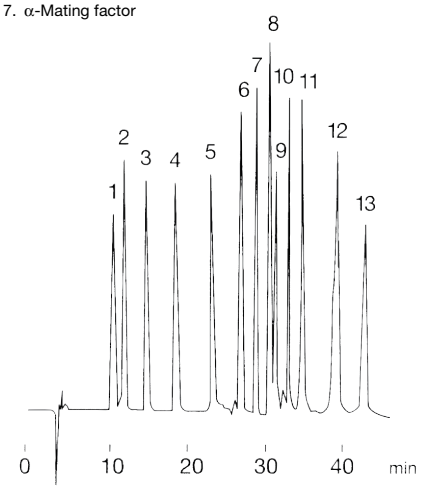
1. Cytochrome c (MW: 12.400, 5 µg)
2. BSA (MW: 66.000, 25 µg)
3. Ferritin (MW: 440.000,10 µg)



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



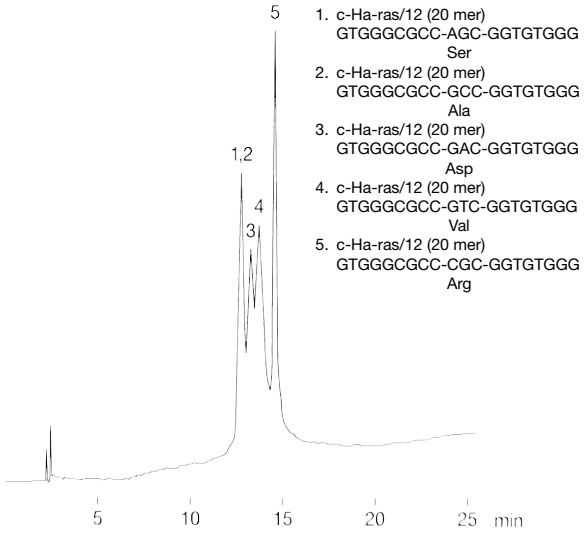
Column: YMC-Pack PROTEIN-RP (5 µm) 250 x 4.6 mm ID
Part No.: PR99S05-2546WT
Eluent: A) water / TFA (100/0.1)
B) acetonitrile / TFA (100/0.1)
Gradient: 10%-90% B (0-60 min., linear)
Flow rate: 1.0 ml/min
Temperature: ambient
Detection: UV at 220 nm, 0.32 AUFS

* Application data by courtesy YMC Co., Ltd.

Bioseparation Columns

Oligonucleotide Applications*

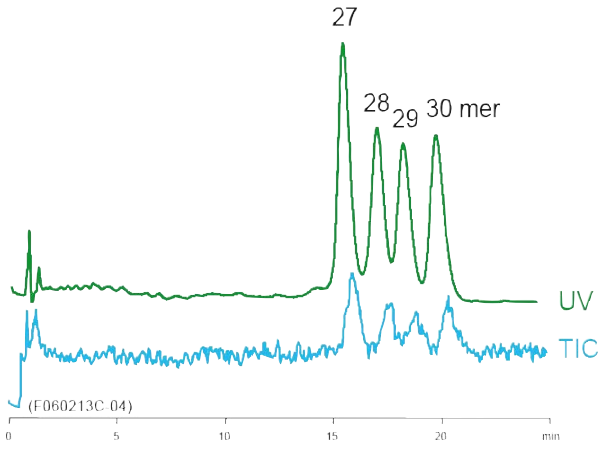
Oligonucleotides



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, 50 x 2.0 mm ID, 3 µm
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)

Outstanding separation of highly polar compounds*

Crude synthetic 30mer oligonucleotide

Analysis 1.0 ml/min, 5 µl injection

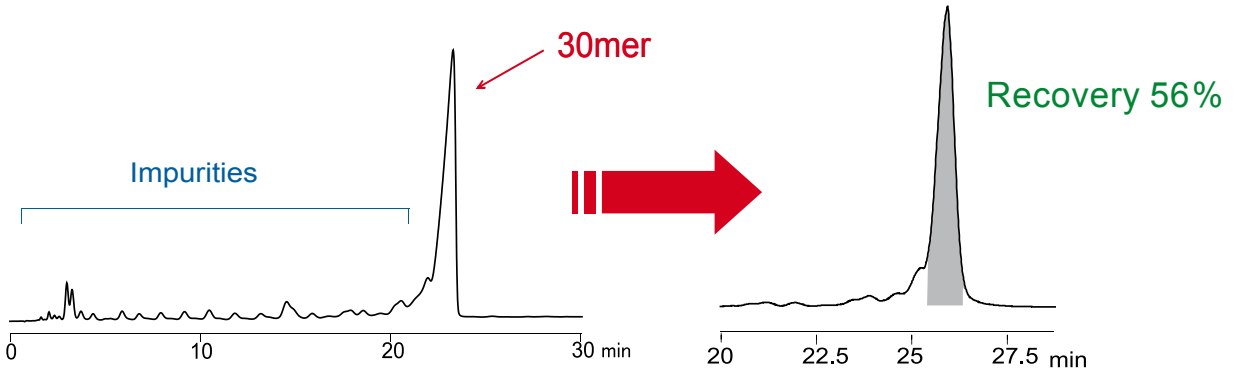
Hydrosphere C18

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



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)

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 —
YMC-Triart C8	2.0 3.0	T012SP9-0302PT —	T012SP9-0502PT T012SP9-0503PT	T012SP9-1002PT T012SP9-1003PT	T012SP9-1502PT —

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 —	AS12S02-0502WT AS12S02-0503WT	AS12S02-1002WT AS12S02-1003WT	AS12S02-1502WT AS12S02-1503WT
YMC-UltraHT Hydrosphere C18	2.0 3.0	HS12S02-0302WT —	HS12S02-0502WT HS12S02-0503WT	HS12S02-1002WT HS12S02-1003WT	HS12S02-1502WT HS12S02-1503WT

12 nm, 3 µm analytical columns

Phase	Column length [mm]	Column ID [mm]		
		2.0	3.0	4.6
YMC-Pack ODS-A (C18)	150 250	AA12S03-1502WT —	AA12S03-1503WT AA12S03-2503WT	AA12S03-1546WT AA12S03-2546WT
YMC-Pack ODS-AQ (C18)	150 250	AQ12S03-1502WT —	AQ12S03-1503WT AQ12S03-2503WT	AQ12S03-1546WT AQ12S03-2546WT
YMC-Pack *Pro* C18	150 250	AS12S03-1502WT —	AS12S03-1503WT AS12S03-2503WT	AS12S03-1546WT AS12S03-2546WT
Hydrosphere C18	150 250	HS12S03-1502WT —	HS12S03-1503WT HS12S03-2503WT	HS12S03-1546WT HS12S03-2546WT
YMC-Triart C18	150 250	TA12S03-1502WT —	TA12S03-1503WT TA12S03-2503WT	TA12S03-1546WT TA12S03-2546WT
YMC-Triart C8	150 250	T012S03-1502WT —	T012S03-1503WT T012S03-2503WT	T012S03-1546WT T012S03-2546WT
YMC-Pack C_8	150 250	OC12S03-1502WT —	OC12S03-1503WT OC12S03-2503WT	OC12S03-1546WT OC12S03-2546WT
YMCbasic (eq. C8)	150 250	BA99S03-1502WT —	BA99S03-1503WT BA99S03-2503WT	BA99S03-1546WT BA99S03-2546WT
YMC-Pack C_4	150 250	BU12S03-1502WT —	BU12S03-1503WT BU12S03-2503WT	BU12S03-1546WT 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.

* Application data by courtesy YMC Co., Ltd.

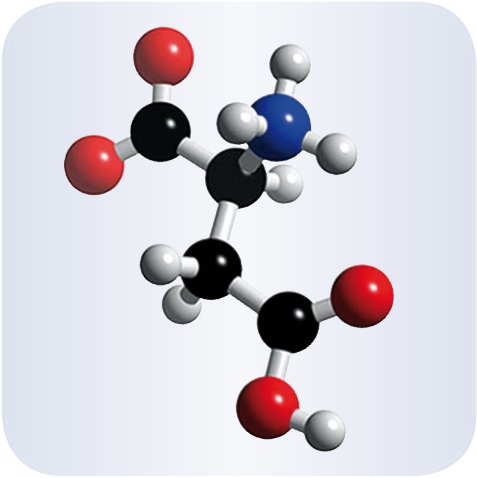
Ordering Information

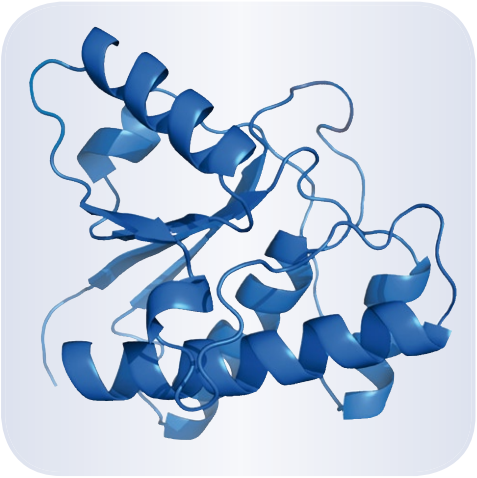
12 nm, 5 µm analytical columns

Phase	Column length [mm]	Column ID [mm]		
		2.0	3.0	4.6
YMC-Pack ODS-A (C18)	150 250	AA12S05-1502WT AA12S05-2502WT	AA12S05-1503WT AA12S05-2503WT	AA12S05-1546WT AA12S05-2546WT
YMC-Pack ODS-AQ (C18)	150 250	AQ12S05-1502WT AQ12S05-2502WT	AQ12S05-1503WT AQ12S05-2503WT	AQ12S05-1546WT AQ12S05-2546WT
YMC-Pack *Pro* C18	150 250	AS12S05-1502WT AS12S05-2502WT	AS12S05-1503WT AS12S05-2503WT	AS12S05-1546WT AS12S05-2546WT
Hydrosphere C18	150 250	HS12S05-1502WT HS12S05-2502WT	HS12S05-1503WT HS12S05-2503WT	HS12S05-1546WT HS12S05-2546WT
YMC-Triart C18	150 250	TA12S05-1502WT TA12S05-2502WT	TA12S05-1503WT TA12S05-2503WT	TA12S05-1546WT TA12S05-2546WT
YMC-Triart C8	150 250	T012S05-1502WT T012S05-2502WT	T012S05-1503WT T012S05-2503WT	T012S05-1546WT T012S05-2546WT
YMC-Pack C_8	150 250	OC12S05-1502WT OC12S05-2502WT	OC12S05-1503WT OC12S05-2503WT	OC12S05-1546WT OC12S05-2546WT
YMCbasic (eq. C8)	150 250	BA99S05-1502WT BA99S05-2502WT	BA99S05-1503WT BA99S05-2503WT	BA99S05-1546WT BA99S05-2546WT
YMC-Pack C_4	150 250	BU12S05-1502WT BU12S05-2502WT	BU12S05-1503WT BU12S05-2503WT	BU12S05-1546WT BU12S05-2546WT
YMC-Pack PROTEIN-RP (eq. C4)	150 250	PR99S05-1502WT PR99S05-2502WT	PR99S05-1503WT PR99S05-2503WT	PR99S05-1546WT PR99S05-2546WT

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

For further information about our preparative bulk materials please refer to the following dedicated brochures: ”YMC*Gel HG-series“, ”YMC preparative phases for biochromatography“, and ”YMC-Triart Prep“.

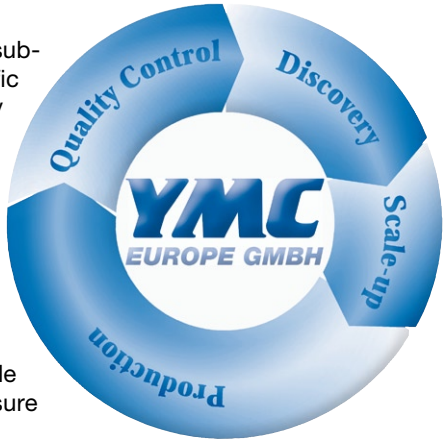




GLASS
COLUMNS

Glass Columns

Introduction



When taking high value target compounds into discovery and subsequent scale-up, efficient tools are required to match specific requirements. It is one of the YMC mission statements to fully support purification steps along from discovery/screening to production scale. YMC laboratory glass columns are specifically designed to comply with the latest media technology and corresponding operating conditions: high capacity sorbents, high flow velocities and a high number of operational cycles - all to increase process economy.

The demands in biochromatography are subject to consistent growth and the demands of higher resolution media which become available with increased requirements regarding mobile phase variation, temperature control, column bed backpressure and, last but not least, validation regulations.

Application

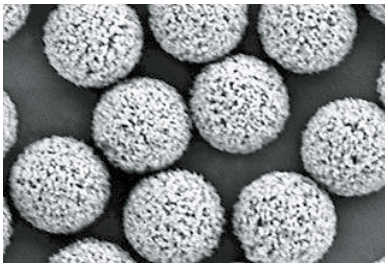
YMC glass columns are suitable for a variety of separation modes, including ion exchange, affinity, normal or reversed phase, chiral, hydrophobic interaction, size exclusion, etc. for product capture, sample cleaning, monoclonal antibody purification, etc.

Within certified operating conditions, there are virtually are no restrictions with regard to the brand or make of the LC-system to which these columns can be attached. All YMC glass columns come equipped with a selection of connectors and adapters for both metric and imperial (inch) system components making them immediately ready to go.

YMC laboratory glass columns are designed for the purification of small sample quantities in column bed volumes between 0 and approx. 5 litres. In addition to typical applications using aqueous buffer systems, solvent resistant versions also are available. Also available are columns with heating/cooling jackets whilst column couplers and packing tubes are available to assist column packing.
YMC Pilot columns are available with bed volumes ranging from 500 ml up to several hundred litres.

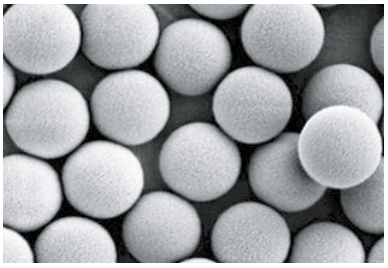
All YMC glass columns are made from high quality glass and precision-machined parts. They are easy to use, without special tools or specially trained personnel - providing consistent reproducible and robust chromatography.

YMC-BioPro QA / YMC-BioPro SP



Porous polymer beads

YMC-BioPro QA-F / YMC-BioPro SP-F



Nonporous polymer beads

Columns are available with FDA-conformity certificates for the materials of production (on request) as well as a factory acceptance test (FAT) certificate. Qualification and validation support are provided by qualified engineers, chemists and dedicated support staff.

Such regulatory support measures will optimise your valuable time and allow you to focus on your core duties, especially when aiming at pilot or production scale operations. Using modern media with modern columns, right from the start, can positively affect your development times, maximise your uptimes and your overall process economy.

Glass Columns

YMC ECO-series

are designed for soft gel and low pressure applications within the range of max 5-30 bar (depending on internal diameter which ranges from 10 to 80 mm ID) with column volumes ranging from 0 up to approx 5 litres. With a choice of one or two adjustable length plungers, these columns 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 allowing easy exchange of parts should damage occur. 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.

YMC ECO columns with compressible O-rings

YMC ECO^{PLUS} with enhanced pressure rating

YMC ECO^{PLUS}-series

represents an advanced family of columns with extended pressure ratings up to 80 bar. This allows the use of media which provide more sophisticated chromatography and, therefore require more sophisticated features. In addition to the enhanced sealing mechanism, another highlight of ECO^{PLUS} columns is the CNC precision machined Quick-Lock bayonet concept: no more than a 1/4-turn is required to completely close and seal the column ends! ECO^{PLUS} columns come in a range of bed volumes from 0.4 and 982 ml. Both the O-ring seal for aqueous buffers (AB) and the chevron seals for solvent resistant (SR) versions provide low dead volume sealing to the glass body and the column bed.

Glass Columns

YMC Pilot columns

are routinely available ex-stock in dimensions of 100, 140, 200 and 300 mm ID as they are the most commonly used sizes for column volumes of 0.78 up to 52 litres for aqueous buffers. In addition, YMC has decades of experience in customising Pilot columns to specific needs: “baby brothers and sisters” with 60 or 90 mm ID, and larger acrylic or stainless versions up to 600 mm ID with higher pressure ratings, bubble traps, solvent resistant execution, tiltable column bodies or tailored racks to address limited space being among the impressive options which have been installed throughout the world. If a standard product will not fully satisfy your requirements, YMC will happily work closely with you to get you the column you require.

Another feature of YMC Pilot columns is the flow distributor, which was modelled by computational simulation for ideal dynamic flow properties. All flow distributors are precision CNC machined from solid blocks for a maximum consistency of mobile phase velocity and thorough eluent distribution along the entire cross-section of the column. As a result, YMC Pilot columns will deliver the best that can be obtained from the packing material, reproducibly and economically.

Pilot column Ø 200 mm x 300 mm with cooling jacket, swivelling, with drip tray for column packing.

In order to identify a product or to request a customised column, kindly refer to the following questionnaires. You will find that our engineers, chemists or machining experts are highly responsive to your specific needs.

Ordering Information

ECO series glass columns, type „Vario" (1 adjustable length plunger)

	Length [mm]	Pressure limit [bar]	Bed length [mm]		Volume [ml]		Frit porosity* [µm]	Part-No. AB-Version	Part-No. SR-Version
			min.	max.	min.	max.			
10 mm ID	120	30	0	120	0	9.4	10 - 16	ECO10/120V0V	ECO10/120V0K
	200		80	200	6,3	16	10 - 16	ECO10/200V0V	ECO10/200V0K
	450		330	450	26	35	10 - 16	ECO10/450V0V	ECO10/450V0K
	750		630	750	50	59	10 - 16	ECO10/750V0V	ECO10/750V0K
	1000		880	1000	69	79	10 - 16	ECO10/999V0V	ECO10/999V0K
15 mm ID	120	25	0	120	0	21	10 - 16	ECO15/120V0V	ECO15/120V0K
	200		80	200	14	35	10 - 16	ECO15/200V0V	ECO15/200V0K
	450		330	450	58	80	10 - 16	ECO15/450V0V	ECO15/450V0K
	750		630	750	111	133	10 - 16	ECO15/750V0V	ECO15/750V0K
	1000		880	1000	156	177	10 - 16	ECO15/999V0V	ECO15/999V0K
20 mm ID	120	20	0	120	0	38	10 - 16	ECO20/120V0V	ECO20/120V0K
	200		80	200	25	63	10 - 16	ECO20/200V0V	ECO20/200V0K
	450		330	450	104	141	10 - 16	ECO20/450V0V	ECO20/450V0K
	750		630	750	198	236	10 - 16	ECO20/750V0V	ECO20/750V0K
	1000		880	1000	277	314	10 - 16	ECO20/999V0V	ECO20/999V0K
25 mm ID	120	15	0	120	0	59	10 - 16	ECO25/120V0V	ECO25/120V0K
	200		80	200	39	98	10 - 16	ECO25/200V0V	ECO25/200V0K
	450		330	450	162	221	10 - 16	ECO25/450V0V	ECO25/450V0K
	750		630	750	309	368	10 - 16	ECO25/750V0V	ECO25/750V0K
	1000		880	1000	432	491	10 - 16	ECO25/999V0V	ECO25/999V0K
32 mm ID	120	10	0	120	0	95	10 - 16	ECO32/120V0V	ECO32/120V0K
	200		80	200	64	161	10 - 16	ECO32/200V0V	ECO32/200V0K
	450		330	450	265	362	10 - 16	ECO32/450V0V	ECO32/450V0K
	750		630	750	507	603	10 - 16	ECO32/750V0V	ECO32/750V0K
	1000		880	1000	708	804	10 - 16	ECO32/999V0V	ECO32/999V0K
50 mm ID	120	10	0	120	0	236	10 - 16	ECO50/120V0V	ECO50/120V0K
	200		80	200	157	393	10 - 16	ECO50/200V0V	ECO50/200V0K
	450		330	450	648	884	10 - 16	ECO50/450V0V	ECO50/450V0K
	750		630	750	1237	1473	10 - 16	ECO50/750V0V	ECO50/750V0K
	1000		880	1000	1728	1964	10 - 16	ECO50/999V0V	ECO50/999V0K

Accessories supplied

All columns: 1x frit removal tool
2x plugs, PTFE (1/4"-28G)
1x protective netted tubing

and for all diameters fitting tubing, nuts and ferrules:

ID 10–15mm: 1x 1m FEP-tubing (0.8 x 1.6mm)
4x 1/4"-28G nut and ferrule (collapsable), for 1/16" tubing
2x M6 nut and ferrule for 1/16" tubing
2x 10-32 nut/ferrule for 1/16" tubing

ID 25–80mm: 1x 1m FEP-tubing (1.6 or 2.4 x 3.2mm)
4x 1/4"-28G nut and ferrule (collapsable), for 1/8" tubing
2x M6 nut and ferrule for 1/8" tubing

* for frit porosity 16-40 the part no.ends V3V or V3K

for frit porosity 40-100 the part no. ends V4V or V4K

for the water-jacket option add -K to the part no.

Ordering Information

ECO series glass columns, type „Multivario" (2 adjustable length plungers)

	Length [mm]	Pressure limit [bar]	Bed length [mm]		Volume [ml]		Frit porosity* [µm]	Part-No. AB-Version	Part-No. SR-Version
			min.	max.	min.	max.			
10 mm ID	120	30	0	120	0	9.4	10 - 16	ECO10/120M0V	ECO10/120M0K
	200		0	200	0	16	10 - 16	ECO10/200M0V	ECO10/200M0K
	450		210	450	16	35	10 - 16	ECO10/450M0V	ECO10/450M0K
	750		510	750	40	59	10 - 16	ECO10/750M0V	ECO10/750M0K
	1000		760	1000	60	79	10 - 16	ECO10/999M0V	ECO10/999M0K
15 mm ID	120	25	0	120	0	21	10 - 16	ECO15/120M0V	ECO15/120M0K
	200		0	200	0	35	10 - 16	ECO15/200M0V	ECO15/200M0K
	450		210	450	37	80	10 - 16	ECO15/450M0V	ECO15/450M0K
	750		510	750	90	133	10 - 16	ECO15/750M0V	ECO15/750M0K
	1000		760	1000	134	177	10 - 16	ECO15/999M0V	ECO15/999M0K
20 mm ID	120	20	0	120	0	38	10 - 16	ECO20/120M0V	ECO20/120M0K
	200		0	200	0	63	10 - 16	ECO20/200M0V	ECO20/200M0K
	450		210	450	66	141	10 - 16	ECO20/450M0V	ECO20/450M0K
	750		510	750	160	236	10 - 16	ECO20/750M0V	ECO20/750M0K
	1000		760	1000	239	314	10 - 16	ECO20/999M0V	ECO20/999M0K
25 mm ID	120	15	0	120	0	59	10 - 16	ECO25/120M0V	ECO25/120M0K
	200		0	200	0	98	10 - 16	ECO25/200M0V	ECO25/200M0K
	450		210	450	103	221	10 - 16	ECO25/450M0V	ECO25/450M0K
	750		510	750	250	368	10 - 16	ECO25/750M0V	ECO25/750M0K
	1000		760	1000	373	491	10 - 16	ECO25/999M0V	ECO25/999M0K
32 mm ID	120	10	0	120	0	95	10 - 16	ECO32/120M0V	ECO32/120M0K
	200		0	200	0	161	10 - 16	ECO32/200M0V	ECO32/200M0K
	450		210	450	169	362	10 - 16	ECO32/450M0V	ECO32/450M0K
	750		510	750	410	603	10 - 16	ECO32/750M0V	ECO32/750M0K
	1000		760	1000	611	804	10 - 16	ECO32/999M0V	ECO32/999M0K
50 mm ID	120	10	0	120	0	236	10 - 16	ECO50/120M0V	ECO50/120M0K
	200		0	200	0	393	10 - 16	ECO50/200M0V	ECO50/200M0K
	450		210	450	412	884	10 - 16	ECO50/450M0V	ECO50/450M0K
	750		510	750	1001	1473	10 - 16	ECO50/750M0V	ECO50/750M0K
	1000		760	1000	1492	1964	10 - 16	ECO50/999M0V	ECO50/999M0K

Accessories supplied

All columns: 1x frit removal tool
2x plugs, PTFE (1/4"-28G)
1x protective netted tubing

and for all diameters fitting tubing, nuts and ferrules:

ID 10–15mm: 1x 1m FEP-tubing (0.8 x 1.6mm)
4x 1/4"-28G nut and ferrule (collapsable), for 1/16" tubing
2x M6 nut and ferrule for 1/16" tubing
2x 10-32 nut/ferrule for 1/16" tubing

ID 25–80mm: 1x 1m FEP-tubing (1.6 or 2.4 x 3.2mm)
4x 1/4"-28G nut and ferrule (collapsable), for 1/8" tubing
2x M6 nut and ferrule for 1/8" tubing

* for frit porosity 16-40 the part no.ends V3V or V3K

for frit porosity 40-100 the part no. ends V4V or V4K

for the water-jacket option add -K to the part no.

Ordering Information

ECO^{PLUS} series glass columns, short plungers

	Length [mm]	Pressure limit [bar]	Bed length [mm] min.	Bed length [mm] max.	Volume [ml] min.	Volume [ml] max.	Frit porosity [µm]	Part-No. AB-Version	Part-No. SR-Version
5 mm ID	125	80 (AB) 80 (SR)	22	125	0.4	2.5	10	TAC05/125PE0-AB-2	TAC05/125G0-SR-2
	250		147	250	2.9	4.9	10	TAC05/250PE0-AB-2	TAC05/250G0-SR-2
	500		397	500	7.8	9.8	10	TAC05/500PE0-AB-2	TAC05/500G0-SR-2
	125		22	125	0.4	2.5	5	TAC05/125PE5-AB-2	—
	250		147	250	2.9	4.9	5	TAC05/250PE5-AB-2	—
	500		397	500	7.8	4.9	5	TAC05/500PE5-AB-2	—
	125		22	125	0.4	2.5	2	—	TAC05/125G2-SR-2
	250		147	250	2.9	4.9	2	—	TAC05/250G2-SR-2
	500		397	500	7.8	9.8	2	—	TAC05/500G2-SR-2
10 mm ID	125	80 (AB) 50 (SR)	32	125	2.5	9.8	10	TAC10/125PE0-AB-2	TAC10/125G0-SR-2
	250		157	250	12	20	10	TAC10/250PE0-AB-2	TAC10/250G0-SR-2
	500		407	500	32	39	10	TAC10/500PE0-AB-2	TAC10/500G0-SR-2
	125		32	125	2.5	9.8	5	TAC10/125PE5-AB-2	—
	250		157	250	12	20	5	TAC10/250PE5-AB-2	—
	500		407	500	32	39	5	TAC10/500PE5-AB-2	—
	125		32	125	2.5	4.9	2	—	TAC10/125G2-SR-2
	250		157	250	12	20	2	—	TAC10/250G2-SR-2
	500		407	500	32	39	2	—	TAC10/500G2-SR-2
15 mm ID	125	70 (AB) 50 (SR)	24	125	4.2	22	10	TAC15/125PE0-AB-2	TAC15/125G0-SR-2
	250		149	250	26	44	10	TAC15/250PE0-AB-2	TAC15/250G0-SR-2
	500		399	500	71	88	10	TAC15/500PE0-AB-2	TAC15/500G0-SR-2
	125		24	125	4.2	22	5	TAC15/125PE5-AB-2	—
	250		149	250	26	44	5	TAC15/250PE5-AB-2	—
	500		399	500	71	88	5	TAC15/500PE5-AB-2	—
	125		24	125	4.2	22	2	—	TAC15/125G2-SR-2
	250		149	250	26	44	2	—	TAC15/250G2-SR-2
	500		399	500	71	88	2	—	TAC15/500G2-SR-2
25 mm ID	125	50 (AB) 50 (SR)	28	125	14	61	10	TAC25/125PE0-AB-2	TAC25/125G0-SR-2
	250		153	250	75	123	10	TAC25/250PE0-AB-2	TAC25/250G0-SR-2
	500		403	500	198	245	10	TAC25/500PE0-AB-2	TAC25/500G0-SR-2
	125		28	125	14	61	5	TAC25/125PE5-AB-2	—
	250		153	250	75	123	5	TAC25/250PE5-AB-2	—
	500		403	500	198	245	5	TAC25/500PE5-AB-2	—
	125		28	125	14	61	2	—	TAC25/125G2-SR-2
	250		153	250	75	123	2	—	TAC25/250G2-SR-2
	500		403	500	198	245	2	—	TAC25/500G2-SR-2
35 mm ID	125	40 (AB) 40 (SR)	30	125	29	120	10	TAC35/125PE0-AB-2	TAC35/125G0-SR-2
	250		155	250	149	241	10	TAC35/250PE0-AB-2	TAC35/250G0-SR-2
	500		405	500	390	481	10	TAC35/500PE0-AB-2	TAC35/500G0-SR-2
	125		30	125	29	120	5	TAC35/125PE5-AB-2	—
	250		155	250	149	241	5	TAC35/250PE5-AB-2	—
	500		405	500	390	481	5	TAC35/500PE5-AB-2	—
	125		30	125	29	120	2	—	TAC35/125G2-SR-2
	250		155	250	149	241	2	—	TAC35/250G2-SR-2
	500		405	500	390	481	2	—	TAC35/500G2-SR-2
50 mm ID	125	30 (AB) 25 (SR)	36	125	71	245	10	TAC50/125PE0-AB-2	TAC50/125G0-SR-2
	250		161	250	316	491	10	TAC50/250PE0-AB-2	TAC50/250G0-SR-2
	500		410	500	805	982	10	TAC50/500PE0-AB-2	TAC50/500G0-SR-2
	125		36	125	71	245	5	TAC50/125PE5-AB-2	—
	250		161	250	316	491	5	TAC50/250PE5-AB-2	—
	500		410	500	805	982	5	TAC50/500PE5-AB-2	—
	125		36	125	71	245	2	—	TAC50/125G2-SR-2
	250		161	250	316	491	2	—	TAC50/250G2-SR-2
	500		410	500	805	982	2	—	TAC50/500G2-SR-2

frit material: Polyethylene (AB-version)
Sintered glass (SR-version)

Accessories supplied

for ID 5 mm:
1x 1 m Tefzel tubing 1/16“. pre-attached
4x 1/4“-28G nut and ferrule for 1/16“ tubing
2x M6 nut and ferrule for 1/16“ tubing
2x 10-32 nut/ferrule for 1/16“ tubing
2x plugs, PTFE (1/4“-28G)

for ID 10 - 15 mm:
1x 1 m 1/16“ FEP tubing (0.8 x 1.6 mm)
4x 1/4“-28G nut and ferrule for 1/16“ tubing
2x M6 nut and ferrule for 1/16“ tubing
2x 10-32 nut/ferrule for 1/16“ tubing
1x frit removal tool
2 x plugs, PTFE (1/4“-28G)

for ID 25 - 50 mm:
1x 1 m 1/8“ FEP tubing (1.6 x 3.2 mm)
4x 1/4“-28G nut and 4x ferrule for 1/8“ tubing
2x M6 nut and ferrule for 1/8“ tubing
1x frit removal tool
2x plugs, PTFE (1/4“-28G)

Ordering Information

ECO^{PLUS} series glass columns, short/long plungers

	Length [mm]	Pressure limit [bar]	Bed length [mm] min.	Bed length [mm] max.	Volume [ml] min.	Volume [ml] max.	Frit porosity [µm]	Part-No. AB-Version	Part-No. SR-Version
5 mm ID	125	80 (AB) 50 (SR)	0	125	0	2.5	10	TAC05/125SLPE0-AB-2	TAC05/125SLG0-SR-2
	250		67	250	1.3	4.9	10	TAC05/250SLPE0-AB-2	TAC05/250SLG0-SR-2
	500		317	500	6.2	9.8	10	TAC05/500SLPE0-AB-2	TAC05/500SLG0-SR-2
	125		0	125	0	2.5	5	TAC05/125SLPE5-AB-2	—
	250		67	250	1.3	4.9	5	TAC05/250SLPE5-AB-2	—
	500		317	500	6.2	4.9	5	TAC05/500SLPE5-AB-2	—
	125		0	125	0	2.5	2	—	TAC05/125SLG2-SR-2
	250		67	250	1.3	4.9	2	—	TAC05/250SLG2-SR-2
	500		317	500	6.2	9.8	2	—	TAC05/500SLG2-SR-2
10 mm ID	125	80 (AB) 50 (SR)	0	125	0	9.8	10	TAC10/125SLPE0-AB-2	TAC10/125SLG0-SR-2
	250		77	250	6	20	10	TAC10/250SLPE0-AB-2	TAC10/250SLG0-SR-2
	500		327	500	26	39	10	TAC10/500SLPE0-AB-2	TAC10/500SLG0-SR-2
	125		0	125	0	9.8	5	TAC10/125SLPE5-AB-2	—
	250		77	250	6	20	5	TAC10/250SLPE5-AB-2	—
	500		327	500	26	39	5	TAC10/500SLPE5-AB-2	—
	125		0	125	0	4.9	2	—	TAC10/125SLG2-SR-2
	250		77	250	6	20	2	—	TAC10/250SLG2-SR-2
	500		327	500	26	39	2	—	TAC10/500SLG2-SR-2
15 mm ID	125	70 (AB) 50 (SR)	0	125	0	22	10	TAC15/125SLPE0-AB-2	TAC15/125SLG0-SR-2
	250		69	250	12	44	10	TAC15/250SLPE0-AB-2	TAC15/250SLG0-SR-2
	500		319	500	56	88	10	TAC15/500SLPE0-AB-2	TAC15/500SLG0-SR-2
	125		0	125	0	22	5	TAC15/125SLPE5-AB-2	—
	250		69	250	12	44	5	TAC15/250SLPE5-AB-2	—
	500		319	500	56	88	5	TAC15/500SLPE5-AB-2	—
	125		0	125	0	22	2	—	TAC15/125SLG2-SR-2
	250		69	250	12	44	2	—	TAC15/250SLG2-SR-2
	500		319	500	56	88	2	—	TAC15/500SLG2-SR-2
25 mm ID	125	50 (AB) 50 (SR)	0	125	0	61	10	TAC25/125SLPE0-AB-2	TAC25/125SLG0-SR-2
	250		73	250	36	123	10	TAC25/250SLPE0-AB-2	TAC25/250SLG0-SR-2
	500		323	500	159	245	10	TAC25/500SLPE0-AB-2	TAC25/500SLG0-SR-2
	125		0	125	0	61	5	TAC25/125SLPE5-AB-2	—
	250		73	250	36	123	5	TAC25/250SLPE5-AB-2	—
	500		323	500	159	245	5	TAC25/500SLPE5-AB-2	—
	125		0	125	0	61	2	—	TAC25/125SLG2-SR-2
	250		73	250	36	123	2	—	TAC25/250SLG2-SR-2
	500		323	500	159	245	2	—	TAC25/500SLG2-SR-2
35 mm ID	125	40 (AB) 40 (SR)	0	125	0	120	10	TAC35/125SLPE0-AB-2	TAC35/125SLG0-SR-2
	250		75	250	72	241	10	TAC35/250SLPE0-AB-2	TAC35/250SLG0-SR-2
	500		325	500	313	481	10	TAC35/500SLPE0-AB-2	TAC35/500SLG0-SR-2
	125		0	125	0	120	5	TAC35/125SLPE5-AB-2	—
	250		75	250	72	241	5	TAC35/250SLPE5-AB-2	—
	500		325	500	313	481	5	TAC35/500SLPE5-AB-2	—
	125		0	125	0	120	2	—	TAC35/125SLG2-SR-2
	250		75	250	72	241	2	—	TAC35/250SLG2-SR-2
	500		325	500	313	481	2	—	TAC35/500SLG2-SR-2
50 mm ID	125	30 (AB) 25 (SR)	0	125	0	245	10	TAC50/125SLPE0-AB-2	TAC50/125SLG0-SR-2
	250		81	250	159	491	10	TAC50/250SLPE0-AB-2	TAC50/250SLG0-SR-2
	500		331	500	650	982	10	TAC50/500SLPE0-AB-2	TAC50/500SLG0-SR-2
	125		0	125	0	245	5	TAC50/125SLPE5-AB-2	—
	250		81	250	159	491	5	TAC50/250SLPE5-AB-2	—
	500		331	500	650	982	5	TAC50/500SLPE5-AB-2	—
	125		0	125	0	245	2	—	TAC50/125SLG2-SR-2
	250		81	250	159	491	2	—	TAC50/250SLG2-SR-2
	500		331	500	650	982	2	—	TAC50/500SLG2-SR-2

frit material: Polyethylene (AB-version)
Sintered glass (SR-version)

Accessories supplied

for ID 5 mm:
1x 1 m Tefzel tubing 1/16“. pre-attached
4x 1/4“-28G nut and ferrule for 1/16“ tubing
2x M6 nut and ferrule for 1/16“ tubing
2x 10-32 nut/ferrule for 1/16“ tubing
2x plugs, PTFE (1/4“-28G)

for ID 10 - 15 mm:
1x 1 m 1/16“ FEP tubing (0.8 x 1.6 mm)
4x 1/4“-28G nut and ferrule for 1/16“ tubing
2x M6 nut and ferrule for 1/16“ tubing
2x 10-32 nut/ferrule for 1/16“ tubing
1x frit removal tool
2 x plugs, PTFE (1/4“-28G)

for ID 25 - 50 mm:
1x 1 m 1/8“ FEP tubing (1.6 x 3.2 mm)
4x 1/4“-28G nut and 4x ferrule for 1/8“ tubing
2x M6 nut and ferrule for 1/8“ tubing
1x frit removal tool
2x plugs, PTFE (1/4“-28G)

Ordering Information

ECO^{PLUS} series glass columns, long plungers

	Length [mm]	Pressure limit [bar]	Bed length [mm] min.	Bed length [mm] max.	Volume [ml] min.	Volume [ml] max.	Frit porosity [µm]	Part-No. AB-Version	Part-No. SR-Version
5 mm ID	125	80 (AB) 50 (SR)	0	125	0	2.5	10	TAC05/125LPE0-AB-2	TAC05/125LG0-SR-2
	250		0	250	0	4.9	10	TAC05/250LPE0-AB-2	TAC05/250LG0-SR-2
	500		237	500	4.7	9.8	10	TAC05/500LPE0-AB-2	TAC05/500LG0-SR-2
	125		0	125	0	2.5	5	TAC05/125LPE5-AB-2	—
	250		0	250	0	4.9	5	TAC05/250LPE5-AB-2	—
	500		237	500	4.7	4.9	5	TAC05/500LPE5-AB-2	—
	125		0	125	0	2.5	2	—	TAC05/125LG2-SR-2
	250		0	250	0	4.9	2	—	TAC05/250LG2-SR-2
	500		237	500	4.7	9.8	2	—	TAC05/500LG2-SR-2
10 mm ID	125	80 (AB) 50 (SR)	0	125	0	9.8	10	TAC10/125LPE0-AB-2	TAC10/125LG0-SR-2
	250		0	250	0	20	10	TAC10/250LPE0-AB-2	TAC10/250LG0-SR-2
	500		247	500	19	39	10	TAC10/500LPE0-AB-2	TAC10/500LG0-SR-2
	125		0	125	0	9.8	5	TAC10/125LPE5-AB-2	—
	250		0	250	0	20	5	TAC10/250LPE5-AB-2	—
	500		247	500	19	39	5	TAC10/500LPE5-AB-2	—
	125		0	125	0	4.9	2	—	TAC10/125LG2-SR-2
	250		0	250	0	20	2	—	TAC10/250LG2-SR-2
	500		247	500	19	39	2	—	TAC10/500LG2-SR-2
15 mm ID	125	70 (AB) 50 (SR)	0	125	0	22	10	TAC15/125LPE0-AB-2	TAC15/125LG0-SR-2
	250		0	250	0	44	10	TAC15/250LPE0-AB-2	TAC15/250LG0-SR-2
	500		239	500	42	88	10	TAC15/500LPE0-AB-2	TAC15/500LG0-SR-2
	125		0	125	0	22	5	TAC15/125LPE5-AB-2	—
	250		0	250	0	44	5	TAC15/250LPE5-AB-2	—
	500		239	500	42	88	5	TAC15/500LPE5-AB-2	—
	125		0	125	0	22	2	—	TAC15/125LG2-SR-2
	250		0	250	0	44	2	—	TAC15/250LG2-SR-2
	500		239	500	42	88	2	—	TAC15/500LG2-SR-2
25 mm ID	125	50 (AB) 50 (SR)	0	125	0	61	10	TAC25/125LPE0-AB-2	TAC25/125LG0-SR-2
	250		0	250	0	123	10	TAC25/250LPE0-AB-2	TAC25/250LG0-SR-2
	500		243	500	119	245	10	TAC25/500LPE0-AB-2	TAC25/500LG0-SR-2
	125		0	125	0	61	5	TAC25/125LPE5-AB-2	—
	250		0	250	0	123	5	TAC25/250LPE5-AB-2	—
	500		243	500	119	245	5	TAC25/500LPE5-AB-2	—
	125		0	125	0	61	2	—	TAC25/125LG2-SR-2
	250		0	250	0	123	2	—	TAC25/250LG2-SR-2
	500		243	500	119	245	2	—	TAC25/500LG2-SR-2
35 mm ID	125	40 (AB) 40 (SR)	0	125	0	120	10	TAC35/125LPE0-AB-2	TAC35/125LG0-SR-2
	250		0	250	0	241	10	TAC35/250LPE0-AB-2	TAC35/250LG0-SR-2
	500		245	500	236	481	10	TAC35/500LPE0-AB-2	TAC35/500LG0-SR-2
	125		0	125	0	120	5	TAC35/125LPE5-AB-2	—
	250		0	250	0	241	5	TAC35/250LPE5-AB-2	—
	500		245	500	236	481	5	TAC35/500LPE5-AB-2	—
	125		0	125	0	120	2	—	TAC35/125LG2-SR-2
	250		0	250	0	241	2	—	TAC35/250LG2-SR-2
	500		245	500	236	481	2	—	TAC35/500LG2-SR-2
50 mm ID	125	30 (AB) 25 (SR)	0	125	0	245	10	TAC50/125LPE0-AB-2	TAC50/125LG0-SR-2
	250		0	250	0	491	10	TAC50/250LPE0-AB-2	TAC50/250LG0-SR-2
	500		250	500	491	982	10	TAC50/500LPE0-AB-2	TAC50/500LG0-SR-2
	125		0	125	0	245	5	TAC50/125LPE5-AB-2	—
	250		0	250	0	491	5	TAC50/250LPE5-AB-2	—
	500		250	500	491	982	5	TAC50/500LPE5-AB-2	—
	125		0	125	0	245	2	—	TAC50/125LG2-SR-2
	250		0	250	0	491	2	—	TAC50/250LG2-SR-2
	500		250	500	491	982	2	—	TAC50/500LG2-SR-2

frit material: Polyethylene (AB-version)
Sintered glass (SR-version)

Accessories supplied

for ID 5 mm:
1x 1 m Tefzel tubing 1/16“. pre-attached
4x 1/4“-28G nut and ferrule for 1/16“ tubing
2x M6 nut and ferrule for 1/16“ tubing
2x 10-32 nut/ferrule for 1/16“ tubing
2x plugs, PTFE (1/4“-28G)

for ID 10 - 15 mm:
1x 1 m 1/16“ FEP tubing (0.8 x 1.6 mm)
4x 1/4“-28G nut and ferrule for 1/16“ tubing
2x M6 nut and ferrule for 1/16“ tubing
2x 10-32 nut/ferrule for 1/16“ tubing
1x frit removal tool
2 x plugs, PTFE (1/4“-28G)

for ID 25 - 50 mm:
1x 1 m 1/8“ FEP tubing (1.6 x 3.2 mm)
4x 1/4“-28G nut and 4x ferrule for 1/8“ tubing
2x M6 nut and ferrule for 1/8“ tubing
1x frit removal tool
2x plugs, PTFE (1/4“-28G)

Chiral Columns

Content

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 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.

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)

General

Normal Phase

YMC Chiral NEA consists of polymeric 1-naphthylethylamine bonded to a wide pore spherical silica. The R and S columns differ in the optical rotation of the CSP; the R column being formed from R-(+)1-naphthylethylamine and the S column from S-(-)1-naphthylethylamine. This results in the two column types having the effect of reversing the elution order of enantiomeric pairs of compounds.

Reversed Phase

YMC-Chiral NEA columns are as well suitable for reversed phase separation of polar, water soluble compounds particularly pharmaceutical compounds.
Recommended eluents include aqueous eluents containing organic modifiers in the range 0-100% or aqueous buffers with pH 2.0-6.5. At the pH limits the minimum organic modifier concentration should be not less than 10%. Typical organic modifiers include acetonitrile, methanol and ethanol. Buffer concentrations should be less than 1 mol/l and must be rinsed from the column with water/modifier solutions (80-100% water) before storage of the column. The columns should be stored in salt-free water/modifier solutions with a minimum 40% modifier. Used under these conditions excellent column stability will be achieved.

Properties

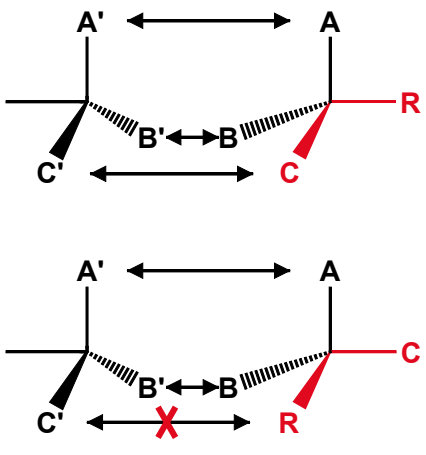
Although separation modes are chosen according to the purpose of separation, it is recommended to use one column dedicated for one separation mode in order to maximise the lifetime of the column into account.

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:

- f-f interactions
- hydrogen bonding
- dipole interactions
- steric effects

and 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 f-donating groups such as dinitobenzoyl, dinitrophenylurea or dinitrophenylcarbamate groups. In some cases, the increase in detectability can offset the disadvantages of derivatisation.

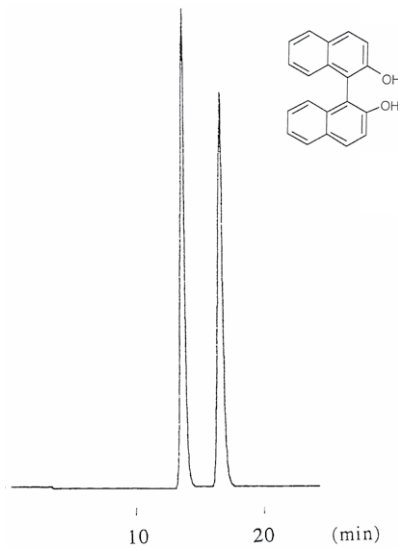
Chiral Separation Mechanism*



YMC Chiral NEA(R)(S)

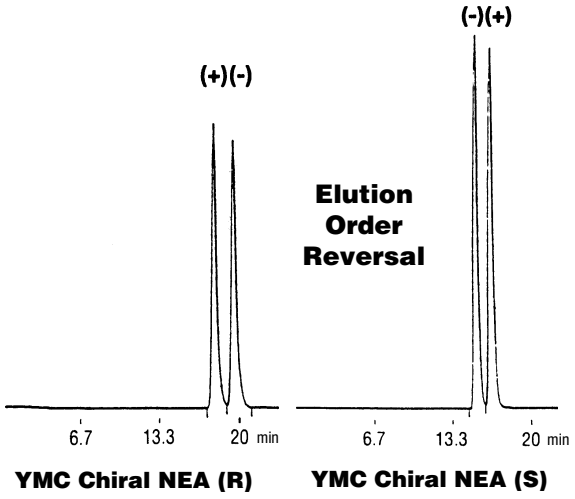
Applications used in normal-phase mode

1,1'-Bi-2-Naphthol*



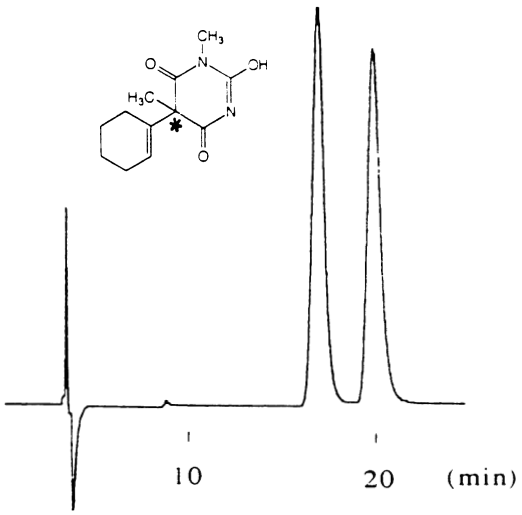
Column:	YMC Chiral NEA (R) 250 x 4.6 mm ID
Part No.:	CR30S05-2546WT
Eluent:	hexane / dichloromethane / ethanol (70/30/2)
Flow rate:	1.0 ml/min
Temperature:	25°C
Detection:	UV at 254 nm

2,2,2-Trifluoro-1-(9-anthryl) ethanol*



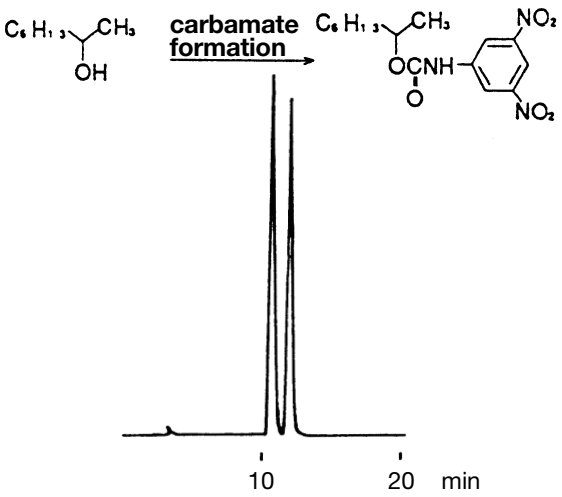
Column:	YMC Chiral NEA (R) and YMC Chiral NEA (S) 250 x 4.6 mm ID
Part No.:	CR30S05-2546WT and CS30S05-2546WT
Eluent:	hexane / dichloromethane / ethanol (70/30/1)
Flow rate:	0.5 ml/min
Temperature:	25°C
Detection:	UV at 254 nm

Hexobarbital*



Column:	YMC Chiral NEA (R) 250 x 4.6 mm ID
Part No.:	CR30S05-2546WT
Eluent:	hexane / CH_2Cl_2 / ethanol (90/10/2)
Flow rate:	1.0 ml/min
Temperature:	ambient
Detection:	UV at 220 nm

1-Phenylethanol*



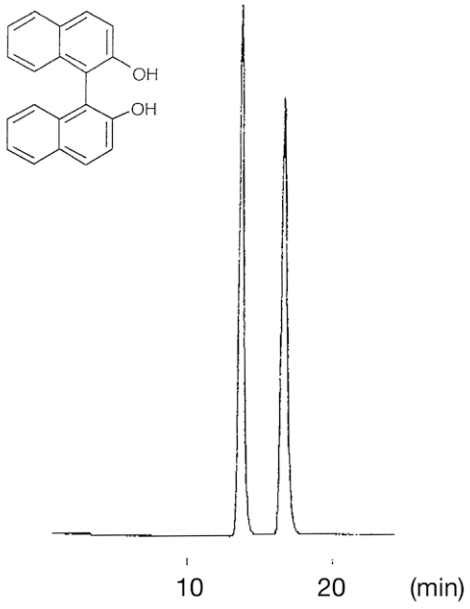
Column:	YMC Chiral NEA (R) 250 x 4.6 mm ID
Part No.:	CR30S05-2546WT
Eluent:	hexane / CH_2Cl_2 / ethanol (90/10/5)
Flow rate:	1.0 ml/min
Temperature:	35°C
Detection:	UV at 254 nm

* Application data by courtesy YMC Co., Ltd.

YMC Chiral NEA(R)(S)

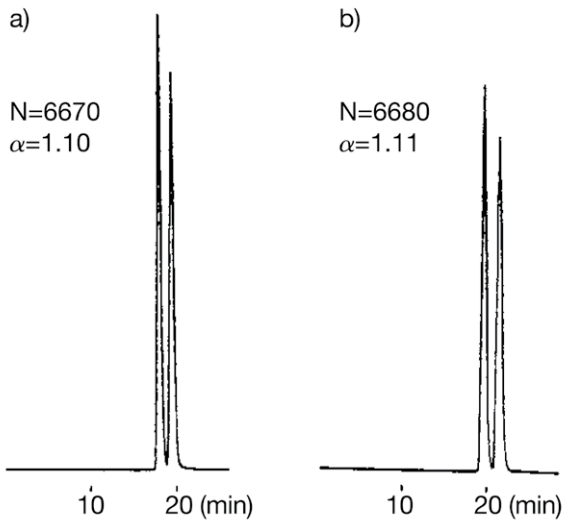
Applications used in reversed-phase mode

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*



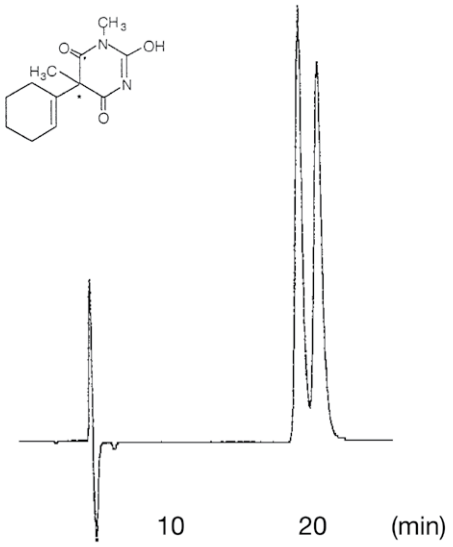
a)

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)

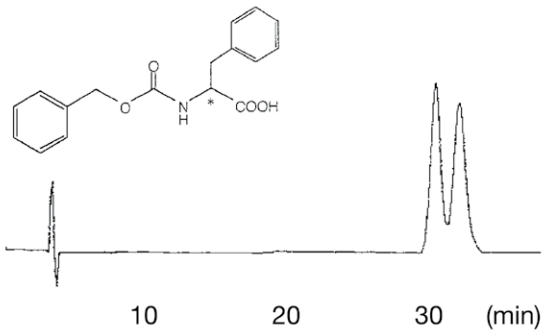
Eluent:	acetonitrile / 0.5M $NaClO_4$ (40/60)
Flow:	1.0 ml/min
Temperature:	ambient
Detection:	UV at 254 nm

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

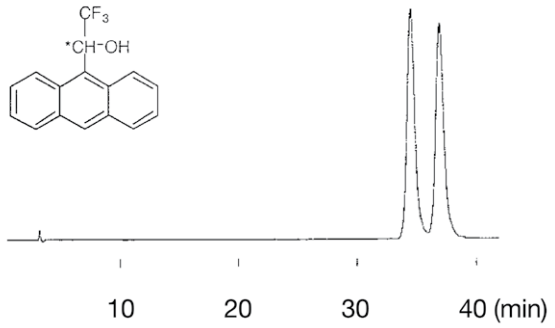
CBZ-Phenylalanine (Z-Phe-OH)*



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

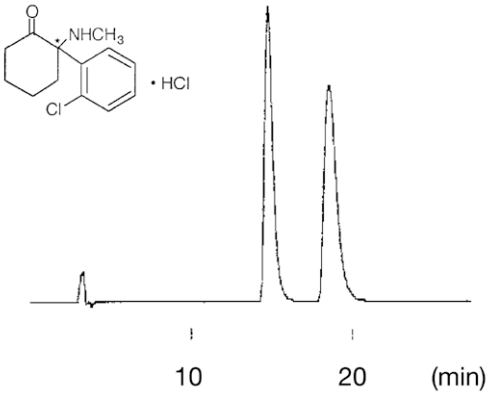
YMC Chiral NEA(R)(S)

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

Ketamin · 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 are shipped with each analytical column.

* Application data by courtesy YMC Co., Ltd.

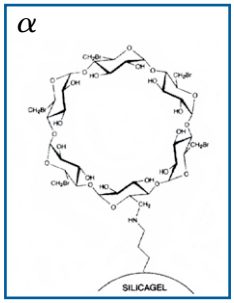
YMC Chiral CD BR

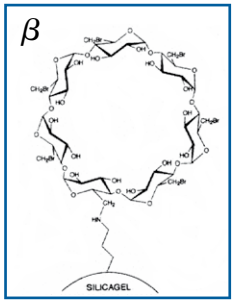
- **reversed phase**
- **polar pharmaceuticals**
- **positional isomers**
- **water-soluble compounds**

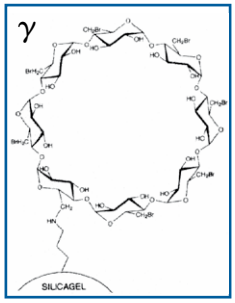
YMC Chiral CD BR	Specification
Particle Size / µm	5
Pore Size / nm	12
Surface area / m^2g^{-1}	proprietary
Carbon content / %	proprietary
Recommended pH range	3.5 - 6.5

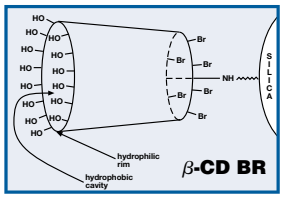
General

The family of commercially available cyclic malto-ogliosaccharides known as cyclodextrins consist of three members; α-cyclodextrin consists of six (1—>4)-linked α-D-glucopyranose residues in a ring, whereas β-, and γ-cyclodextrins consist of seven and eight residues in the ring. The resulting cone-shaped cylindrical molecules have a hydrophobic cavity and a hydrophilic rim. The latter is due to the hydroxyl groups of the carbohydrate; the secondary hydroxyl groups on carbon atoms 2 and 3 of the glucose residues being on the larger diameter rim whilst the primary hydroxyl groups on carbon atom 6 are on the smaller diameter rim. The diameters of the cavities are such that a single phenyl ring can be accommodated within α-cyclodextrin, whilst the cavities of α-cyclodextrin and α-cyclodextrin can accommodate substituted single phenyl rings and multiple ring systems.









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.

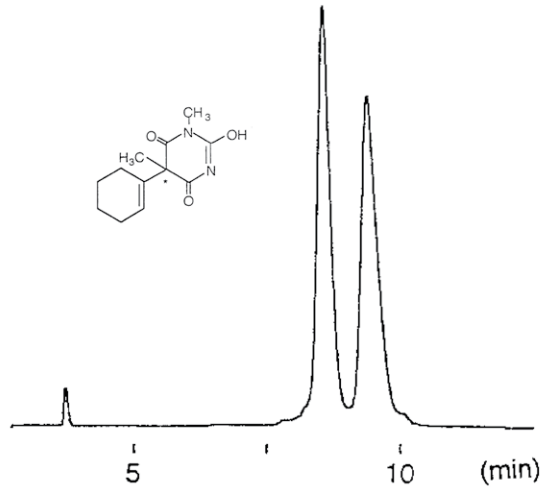
Column Care

YMC-Chiral CD BR columns have a pH range of pH 3.5-6.5 and can be used with the common buffer systems. However all salts and buffer components must be rinsed from the column with water/methanol solutions (80-100% water) before storage of the column. The columns should be stored in salt-free water/methanol solutions (50% methanol). It is possible to regenerate the column by removal of contamination with THF solution.

YMC Chiral CD BR

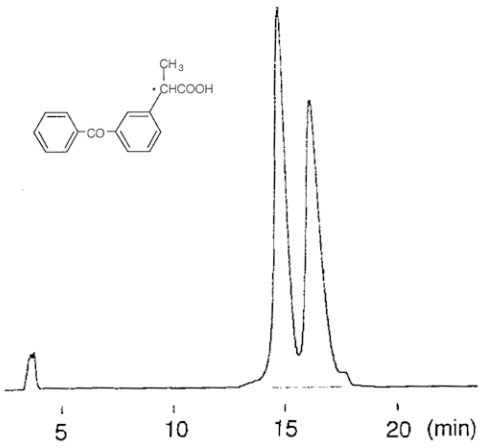
Applications

Hexobarbital*



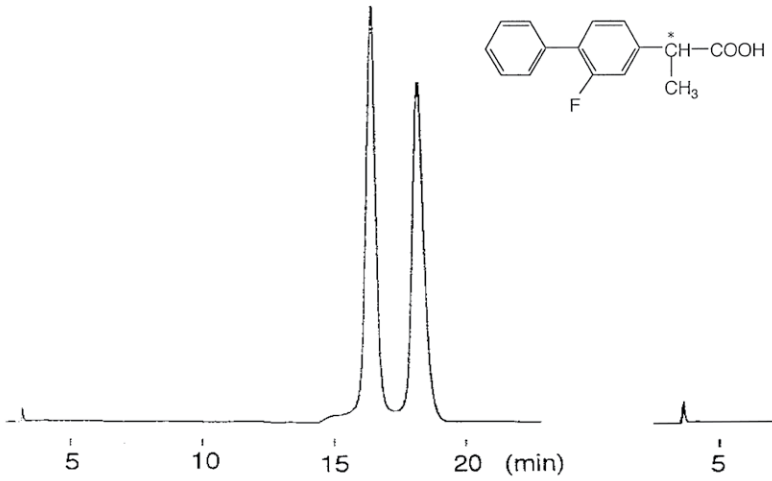
Column:	YMC-Chiral β-CD BR 250 x 4.6 mm ID
Part No.:	DB12S05-2546WT
Eluent:	0.1M acetic acid-triethylamine in water (pH5.6) / methanol (30/70)
Flow:	1.0 ml/min
Temperature:	30°C
Detection:	UV at 254 nm
Injection:	5 µl (1 mg/ml)

Ketoprofen*

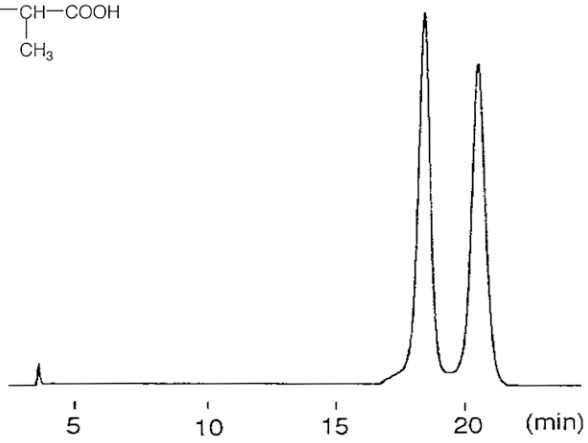


Column:	YMC-Chiral β-CD BR 250 x 4.6 mm ID
Part No.:	DB12S05-2546WT
Eluent:	0.1M acetic acid-triethylamine in water (pH5.6) / methanol (30/70)
Flow:	1.0 ml/min
Temperature:	25°C
Detection:	UV at 254 nm
Injection:	10 µl (1 mg/ml)

Fluorbiprofen*



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)

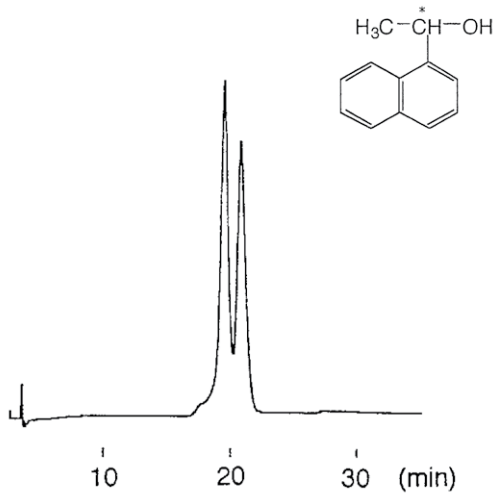


Column:	YMC-Chiral γ-CD BR 250 x 4.6 mm ID
Part No.:	DG12S05-2546WT
Eluent:	0.1M acetic acid-triethylaminein water (pH4.0) / methanol (30/70)
Flow:	1.0 ml/min
Temperature:	25°C
Detection:	UV at 254 nm
Injection:	2 µl (1 mg/ml)

* Application data by courtesy YMC Co., Ltd.

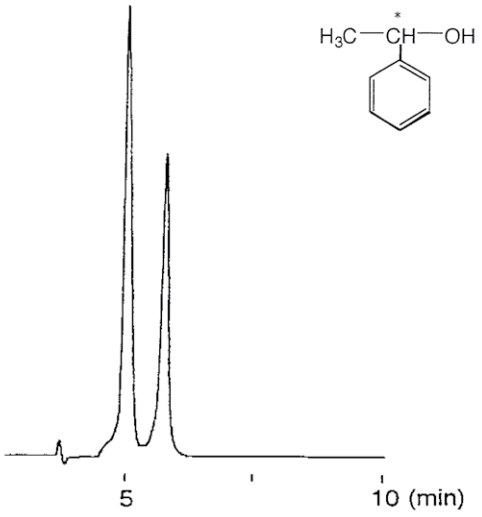
YMC Chiral CD BR

1-(1-naphthyl)-ethylalcohol*



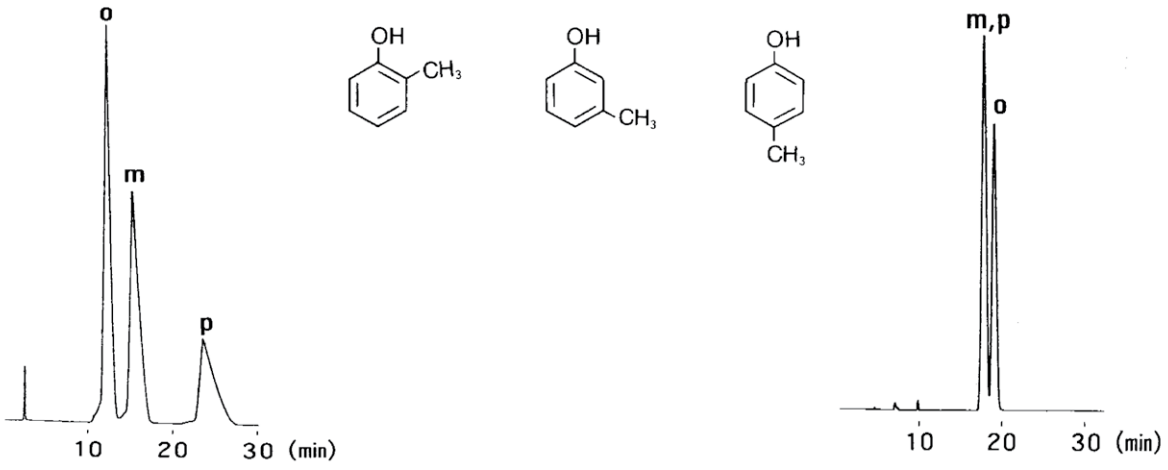
Column:	YMC-Chiral γ-CD BR 250 x 4.6 mm ID
Part No.:	DG12S05-2546WT
Eluent:	0.1M $AcOH_{aq}$-TEA (Triethylamine)$_{aq}$ (pH5.6) / methanol (90/10)
Flow:	1.0 ml/min
Temperature:	30°C
Detection:	UV at 254 nm
Injection:	5 µl (1 mg/ml)

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*

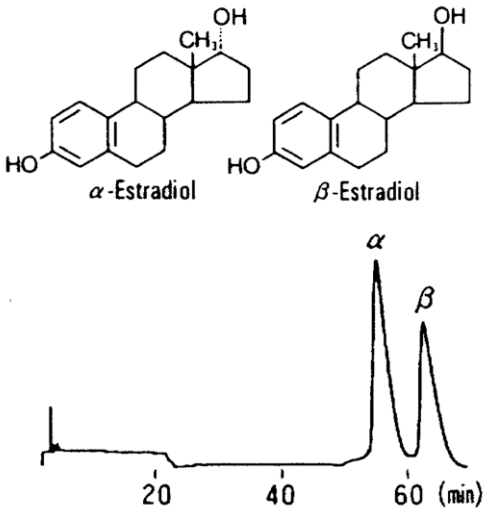


Column:	YMC-Chiral β-CD BR 250 x 4.6 mm ID
Part No.:	DB12S05-2546WT
Eluent:	methanol / water (20/80)
Flow:	1.0 ml/min
Temperature:	ambient
Detection:	UV at 254 nm

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

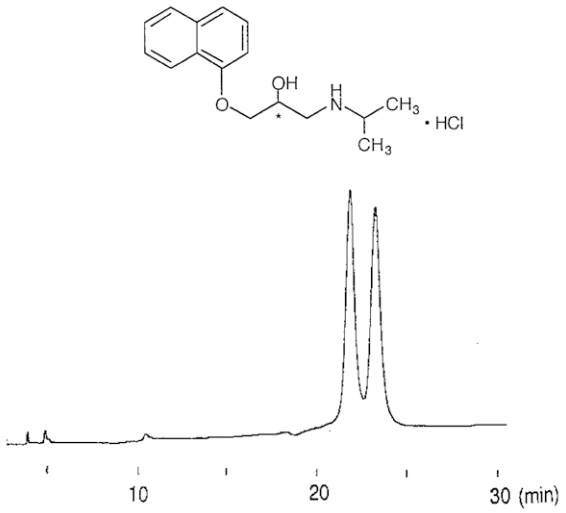
YMC Chiral CD BR

Estradiols*



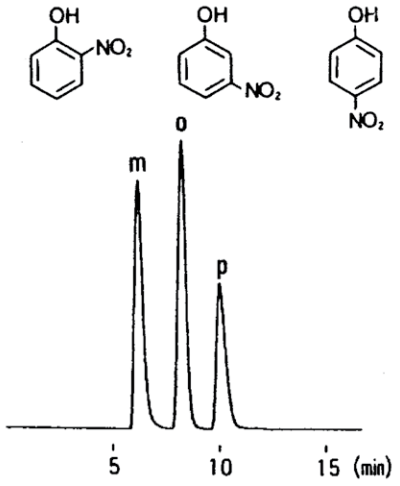
Column:	YMC-Chiral γ-CD BR 250 x 4.6 mm ID
Part No.:	DG12S05-2546WT
Eluent:	methanol / water (50/50)
Flow:	1.0 ml/min
Temperature:	30°C
Detection:	UV at 230 nm

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 are shipped with each analytical column.

* Application data by courtesy YMC Co., Ltd.

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

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 method for specific applications. For this reason, YMC introduce YMC30 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 then alternative process of C18 chain density.

YMC30 / 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**

YMC30 / 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

* Please inquire for bulk packing material.

General

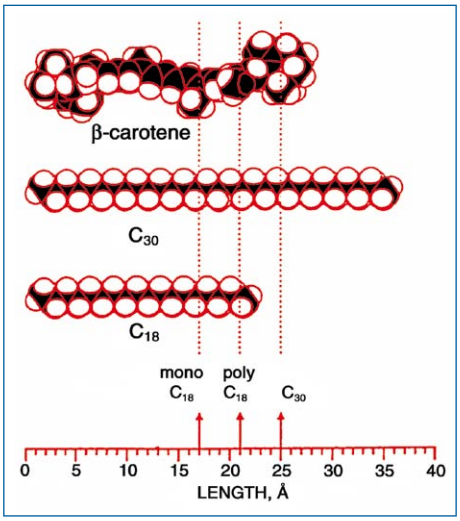
The separation of geometric and positional isomers is a challenging task in reversed phase chromatography. Subtle molecular differences have to be recognized and resolved by this particular stationary phase. Sander et al. have conclusively shown that polymeric C30 HPLC stationary phases are able to discriminate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

Properties

Compared to classical C18 stationary phases, YMC30 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 YMC30 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 YMC30 phase.

The resolving power of YMC30 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 YMC30 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)).

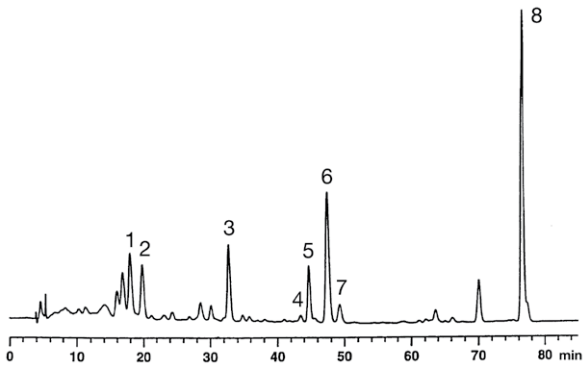
Applications

YMC30 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.

YMC30 / YMC Carotenoid

Separation of natural compounds*

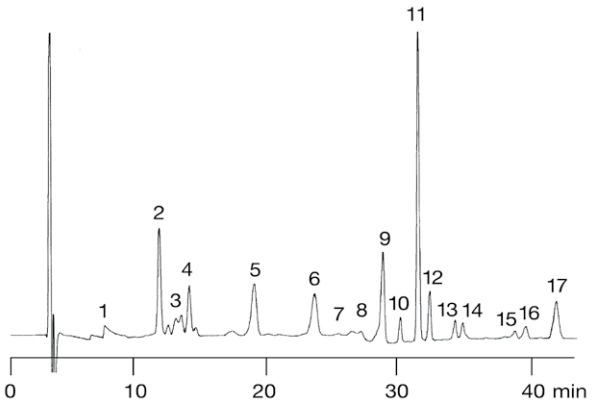
Extract of SRM 2383, NIST food standard[a]



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:	YMC30 (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]



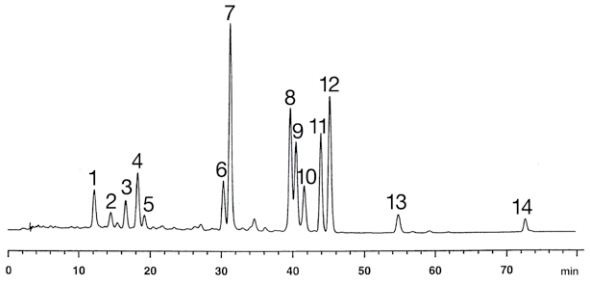
1: Chlorophyll c_1+c_2
2: Fucoxanthin
3: Neoxanthin
4: Violaxanthin
5: Diadinoxanthin
6: Lutein
7: Zeaxanthin
8: Diatoxanthin
9: Chlorophyll b_x
10: Chlorophyll b_y
11: Chlorophyll a_x
12: Chlorophyll a_y
13: β-Cryptoxanthin
14: Echinenone
15: Phaephorbid b
16: α-Carotene
17: β-Carotene

Column:	YMC30 (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

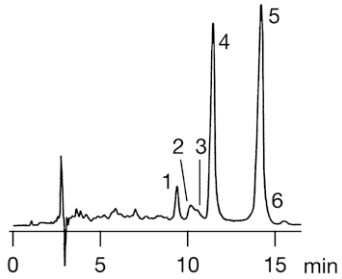
Carotene and Xanthophyll standard[a]



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:	YMC30 (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

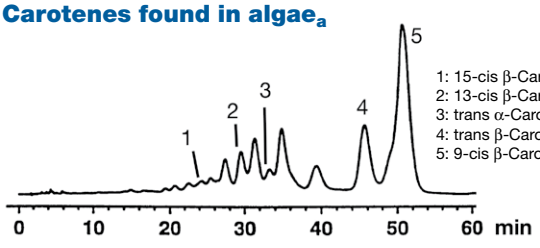
Carotene isomers from commercially available capsules[a]



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:	YMC30 (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

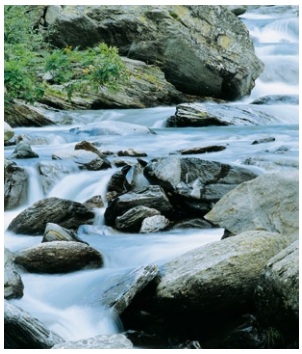
Column:	YMC30 (5 µm) 250 x 4.6 mm ID
Part No.:	CT99S05-2546WT
Eluent:	MeOH / MTBE = 80/20
Flow:	2.0 ml/min
Detection:	UV at 450 nm
Temperature:	3 °C

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**
- **provide 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

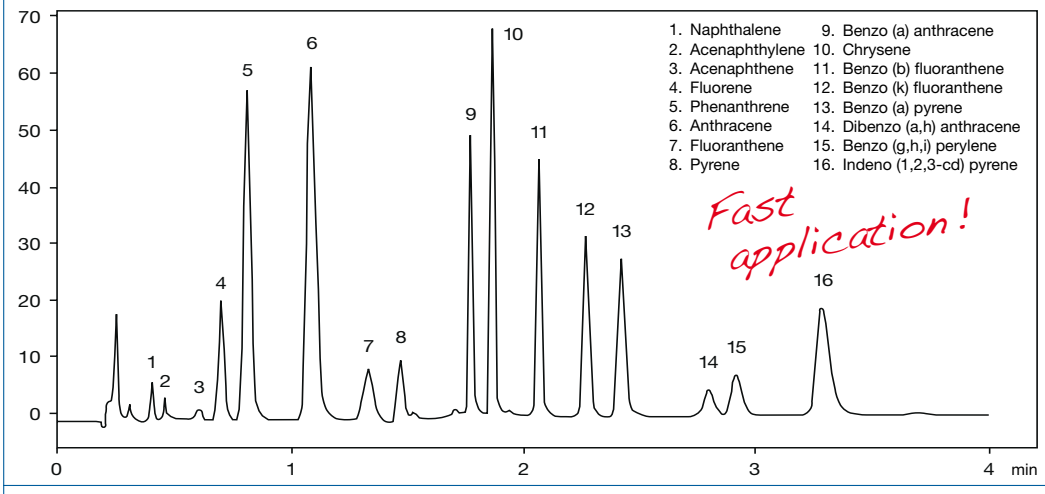
Polynuclear Aromatic Hydrocarbons (PAHs) are among the most frequently monitored environmental contaminants. YMC PAH columns have been specifically developed for the highly demanding analysis of Polynuclear Aromatic Hydrocarbons.

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*



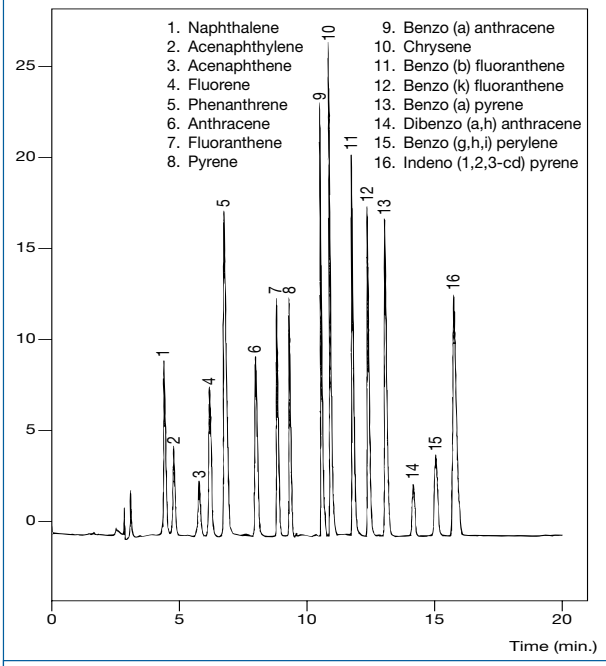
Column:	YMC PAH (3 µm) 50 x 4.0 mm ID
Part No.:	YP99S03-0504QT
Eluent:	A) methanol / water (80/20) B) acetonitrile
Flow rate:	2.0 ml/min
Temperature:	24 °C
Detection:	UV at 254 nm

Gradient

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

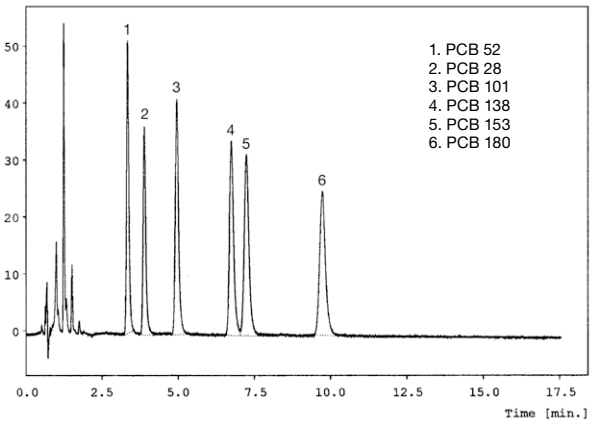
YMC PAH

16 PAH according to EPA 610*



Column:	YMC PAH (5 µm) 250 x 3.0 mm ID
Part No.:	YP99S05-2503QT
Eluent:	A) MeOH / water (80/20) / B) acetonitrile
Flow rate:	0.43 ml/min
Temperature:	30 °C
Detection:	UV at 254 nm

PCB separation according EPA*

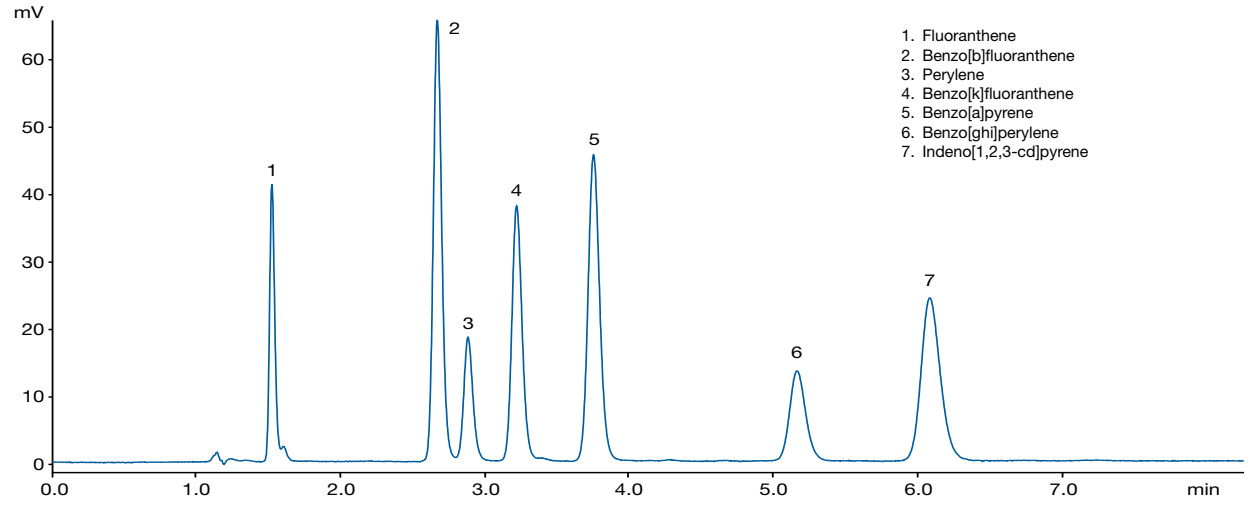


Column:	YMC PAH (3 µm) 100 x 3.0 mm ID
Part No.:	YP99S05-1003QT
Eluent:	CH_3CN / water (75/25)
Flow rate:	0.6 ml/min
Temperature:	30 °C
Detection:	UV at 220 nm

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*



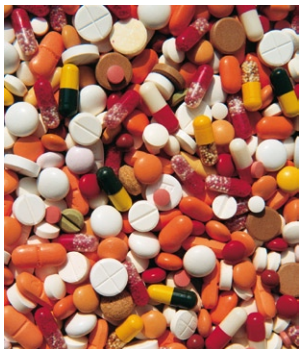
Column:	YMC PAH (5 µm) 125 x 4.0 mm ID
Part No.:	YP99S05-R504QT
Eluent:	acetonitrile / methanol (95/5)
Flow rate:	1.0 ml/min
Temp.:	25 °C
Detection:	UV at 254 nm
Inj.-vol.:	5 µl

* Application data by courtesy YMC Co., Ltd.

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

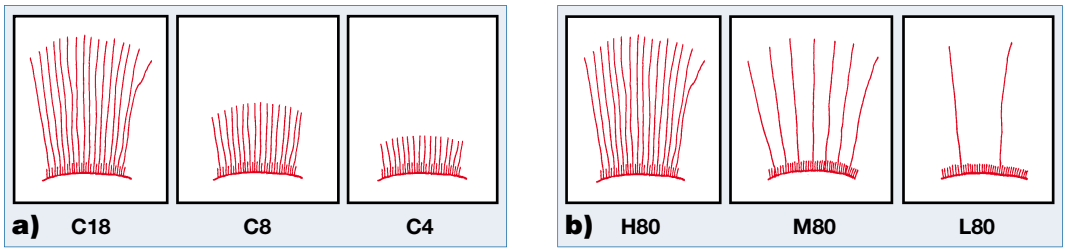
a selectivity concept designed for
- quality control
- pharmaceuticals
- organic intermediates
- hormones, steroids



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.

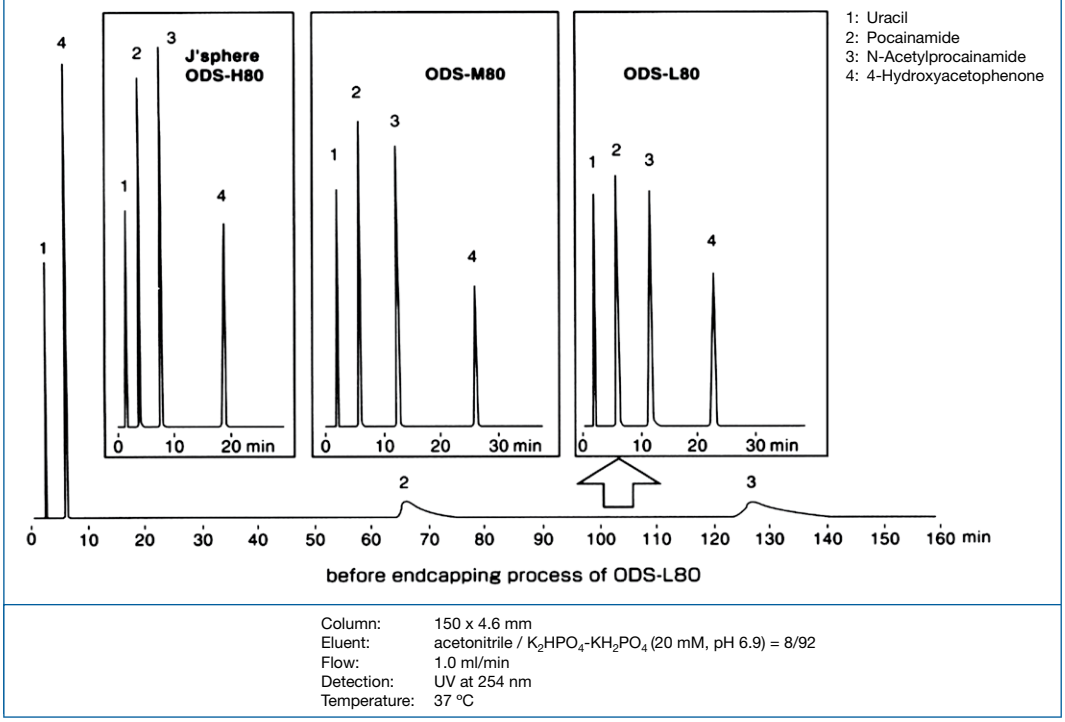
Physico-Chemical Properties

J'sphere ODS packings are based on a spherical, ultra pure, high surface area silica with a mean pore diameter of 80 Å 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.

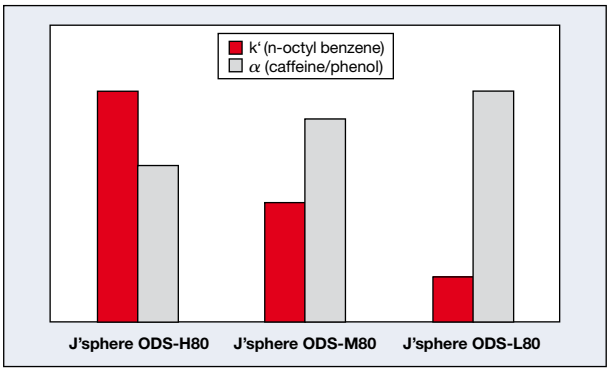
J'sphere ODS

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



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

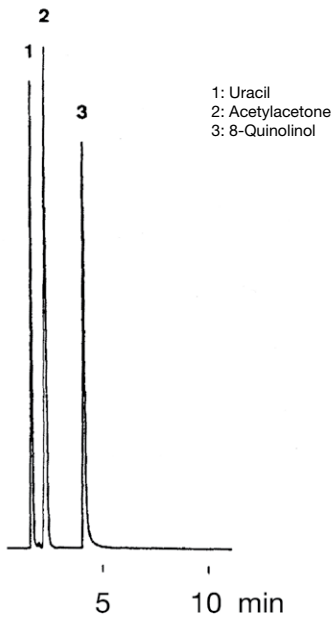
By using the graduated properties of J'sphere ODS columns, a great variety of chemical and pharmaceutical applications can be achieved. YMC J'sphere ODS analytical columns are a good choice for the analysis of pharmaceuticals, organic intermediates, metabolites etc., due to their concept of fine-tuned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

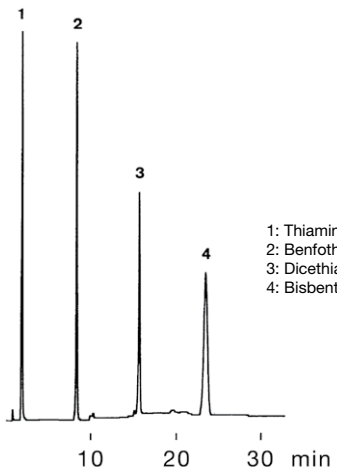
Elution profile of complexing agents*



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

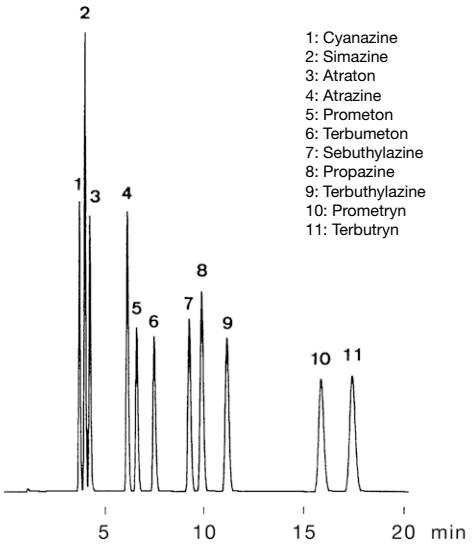
Thiamine and derivatives*



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

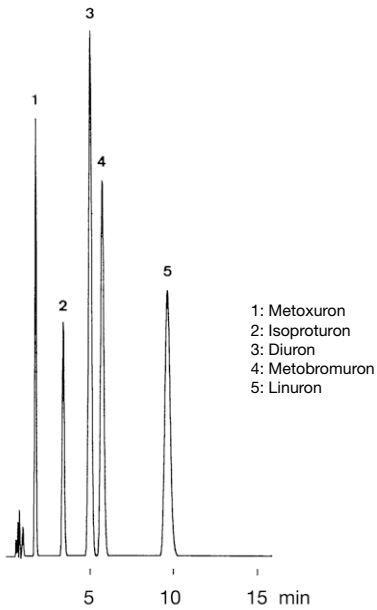
Triazine herbicides*



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*



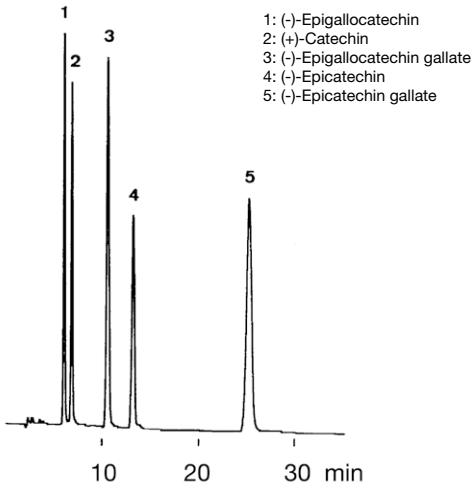
1: Metoxuron
2: Isoproturon
3: Diuron
4: Metobromuron
5: Linuron

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

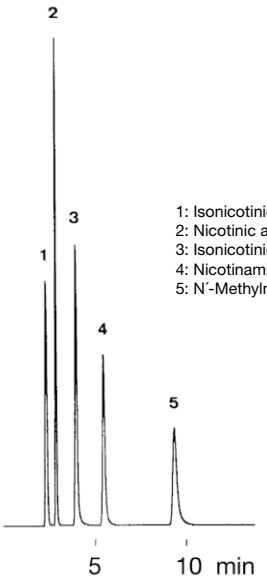
Catechins*



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

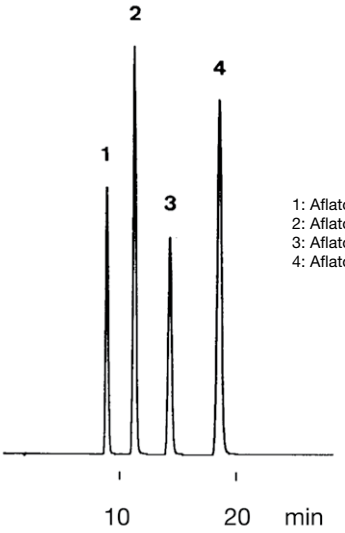
Nicotinic acid analogues*



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

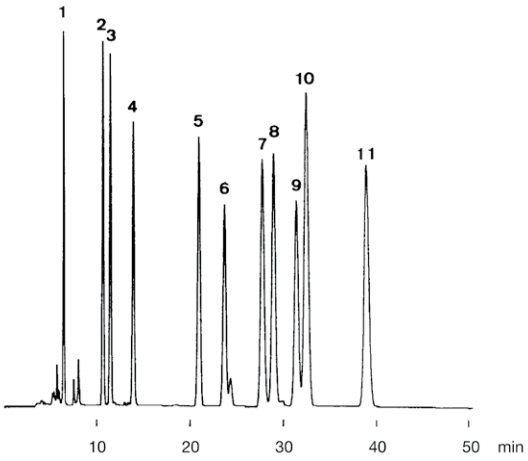
Aflatoxins*



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*

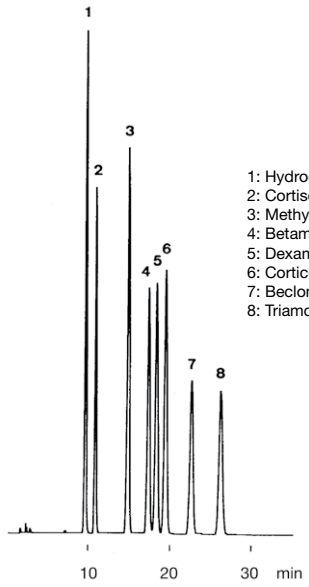


1: Cefsulodin sodium
2: Cephalexin hydrate
3: Cefaclor
4: Cephradine
5: Cephaloglycin
6: Cephapirin sodium
7: Cefotaxime sodium
8: Cephaloridine
9: Cefazolin sodium
10: Cefuroxime sodium
11: Cefoxitin sodium

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

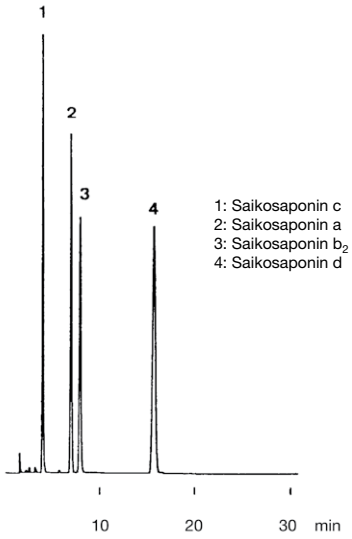
Adrenocorticosteroids*



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

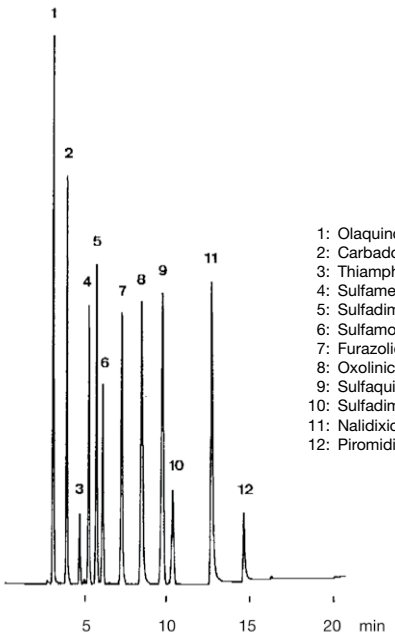
Saikosaponins*



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

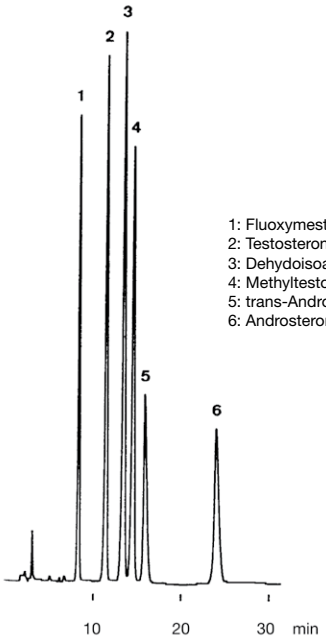
Antibacterial agents*



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

YMC30

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	YP99S03-0346WT	YP99S03-0546WT	YP99S03-1046WT	YP99S03-1546WT	YP99S03-2546WT	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	YP99S05-0346WT	YP99S05-0546WT	YP99S05-1046WT	YP99S05-1546WT	YP99S05-2546WT	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 247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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. The example below with a reference sample shows a.m. effects in less half of the time.

Flash Cartridges

YMC-DispoPackAT Flash Cartridges - high quality products for your purification success

YMC-DisoPackAT cartridges are available in different volumes taking from 12 g to 800 g of packing material. The selection chart provides indicative data 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).

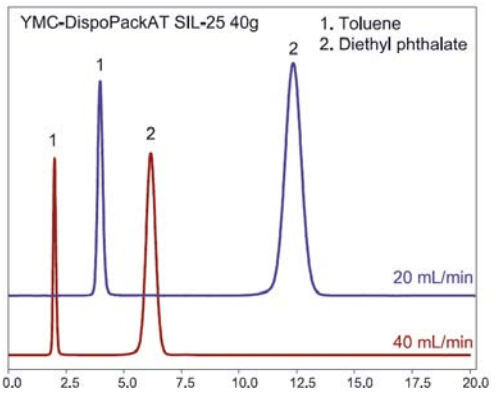
In order to verify the efficiency or to compare the differences, please inquire evaluation samples from YMC or Authorized YMC Distributors.

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**

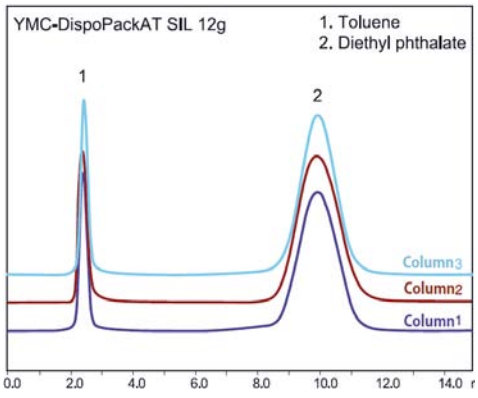
Flash Cartridges	Traditional	Premium
Shape	irregular	spherical
Base	silica	silica
Particle size / µm	40-63	25
Pore size / nm	SIL 6; NH_2, Diol, ODS 15	8
Column connection	Luer / Luer lock	Luer / Luer lock
Pressure tolerance	13.8 bar (300 g & 800 g 12.4 bar)	13.8 bar (300 g & 800 g 12.4 bar)
Available 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

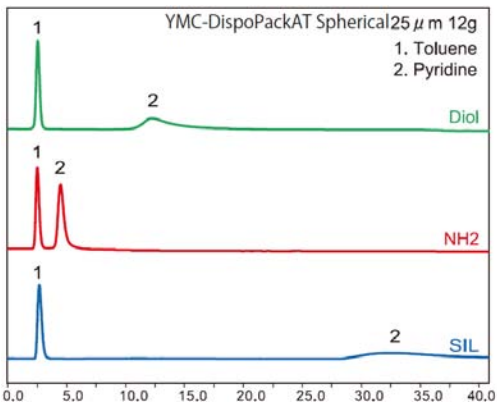
High reproducibility*



Eluent: n-hexane / ethyl acetate (90/10)
Flow rate: 10 ml/min
Detection: UV at 254 nm

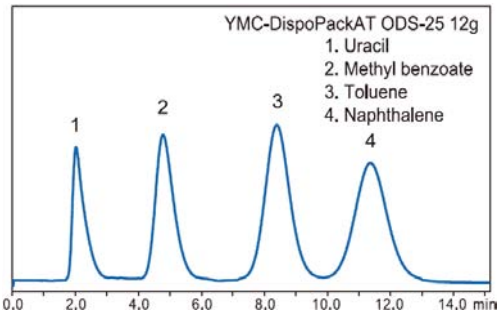
Flash Cartridges

Normal Phase*



Eluent: n-hexane / ethyl acetate (80/20)
Flow rate: 10 ml/min
Detection: UV at 254 nm

Reversed Phase*



Eluent: methanol / water (70/30)
Flow rate: 10 ml/min
Detection: UV at 254 nm

Application Examples Normal Phase:

e.g. carotenoids, phthalates, phenones, steroids ...

Application Examples Reversed Phase:

e.g. polar organic compounds, polar heterocyclic compounds, peptides

Product Finder

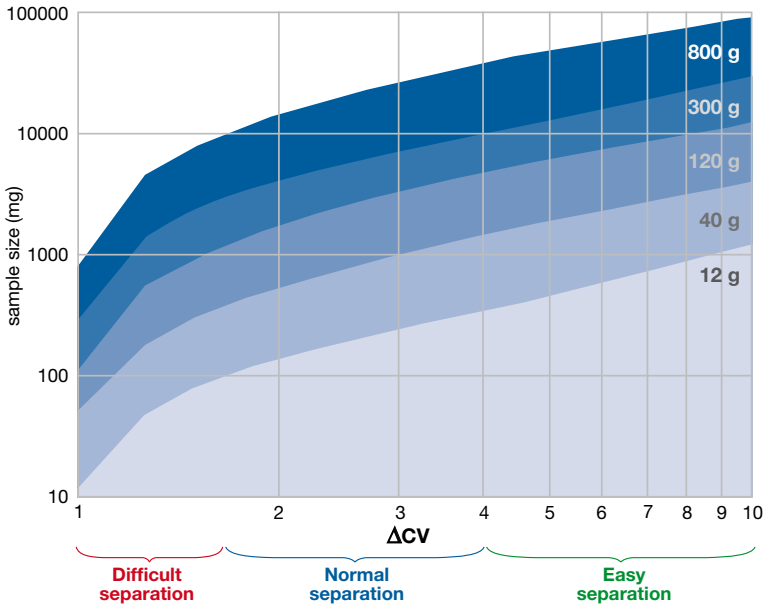
YMC-DispoPackAT

High Quality Flash Cartridges

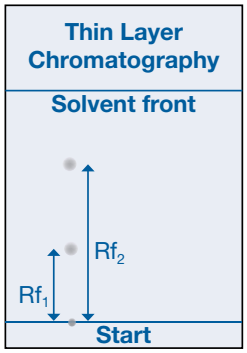
YMC EUROPE GMBH
The Selectivity Company

Product finder

The table below 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.



	YMC DispoPackAT			
	size (g)	Pack Qty	irregular 40-63 µm	spherical 25 µm
Silica	12	24	DPA12SLK06I5224	DPA12SLK08S2524
	40	12	DPA40SLK06I5212	DPA40SLK08S2512
	120	6	DPAA2SLK06I5206	DPAA2SLK08S2506
	300	1	DPAC0SLK06I5201	DPAC0SLK08S2501
	800	1	DPAH0SLK06I5201	DPAH0SLK08S2501
Diol	12	24	DPA12DLK15I5224	DPA12DLK08S2524
	40	12	DPA40DLK15I5212	DPA40DLK08S2512
	120	6	DPAA2DLK15I5206	DPAA2DLK08S2506
	300	1	DPAC0DLK15I5201	DPAC0DLK08S2501
	800	1	DPAH0DLK15I5201	DPAH0DLK08S2501
NH_2	12	24	DPA12NHK15I5224	DPA12NHK08S2524
	40	12	DPA40NHK15I5212	DPA40NHK08S2512
	120	6	DPAA2NHK15I5206	DPAA2NHK08S2506
	300	1	DPAC0NHK15I5201	DPAC0NHK08S2501
	800	1	DPAH0NHK15I5201	DPAH0NHK08S2501
C18	12	24	DPA12ABK15I5224	DPA12ABK08S2524
	40	12	DPA40ABK15I5212	DPA40ABK08S2512
	120	6	DPAA2ABK15I5206	DPAA2ABK08S2506
	300	1	DPAC0ABK15I5201	DPAC0ABK08S2501
	800	1	DPAH0ABK15I5201	DPAH0ABK08S2501



RF: Retention Factor

CV: Column Volume

CV = 1/RF

ΔCV = 1/RF1-1/RF2

* Application data by courtesy YMC Co., Ltd.

Ordering Information

Irregular (Particle Size 40 – 63 µm)

Product	Size [g]	Pack Qty	Part number
YMC-DispoPackAT **SIL**	12	24	DPA12SLK06I5224
	40	12	DPA40SLK06I5212
	120	6	DPAA2SLK06I5206
	300	1	DPAC0SLK06I5201
	800	1	DPAH0SLK06I5201
YMC-DispoPackAT **NH_2**	12	24	DPA12NHK15I5224
	40	12	DPA40NHK15I5212
	120	6	DPAA2NHK15I5206
	300	1	DPAC0NHK15I5201
	800	1	DPAH0NHK15I5201
YMC-DispoPackAT **Diol**	12	24	DPA12DLK15I5224
	40	12	DPA40DLK15I5212
	120	6	DPAA2DLK15I5206
	300	1	DPAC0DLK15I5201
	800	1	DPAH0DLK15I5201
YMC-DispoPackAT **ODS**	12	24	DPA12ABK15I5224
	40	12	DPA40ABK15I5212
	120	6	DPAA2ABK15I5206
	300	1	DPAC0ABK15I5201
	800	1	DPAH0ABK15I5201

Spherical (Particle Size 25 µm)

Product	Size [g]	Pack Qty	Part number
YMC-DispoPackAT **SIL-25**	12	24	DPA12SLK08S2524
	40	12	DPA40SLK08S2512
	120	6	DPAA2SLK08S2506
	300	1	DPAC0SLK08S2501
	800	1	DPAH0SLK08S2501
YMC-DispoPackAT **NH_2-25**	12	24	DPA12NHK08S2524
	40	12	DPA40NHK08S2512
	120	6	DPAA2NHK08S2506
	300	1	DPAC0NHK08S2501
	800	1	DPAH0NHK08S2501
YMC-DispoPackAT **Diol-25**	12	24	DPA12DLK08S2524
	40	12	DPA40DLK08S2512
	120	6	DPAA2DLK08S2506
	300	1	DPAC0DLK08S2501
	800	1	DPAH0DLK08S2501
YMC-DispoPackAT **ODS-25**	12	24	DPA12ABK08S2524
	40	12	DPA40ABK08S2512
	120	6	DPAA2ABK08S2506
	300	1	DPAC0ABK08S2501
	800	1	DPAH0ABK08S2501

Preparative & Process LC

Contents

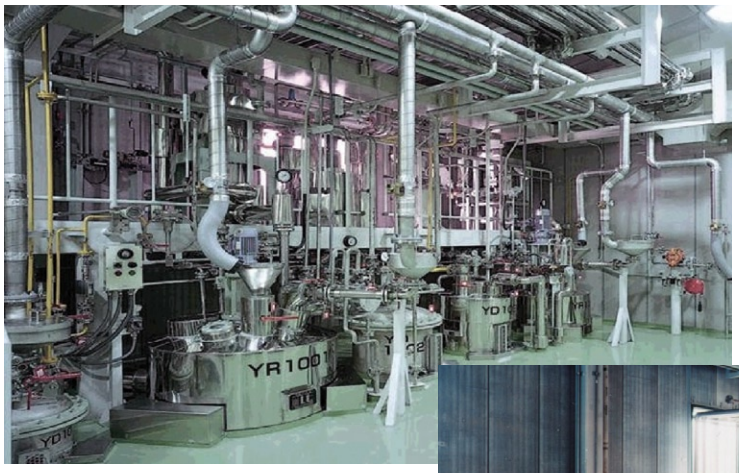
Introduction

Since 1980, YMC has consistently developed to become one of the leading specialist vendors dedicated to providing chromatographic media solutions from R&D to industrial scale purification of high value compounds. The “Worlds of YMC” consist of both laboratory and academic environments as well as straightforward production conditions in pharmaceutical, biotech, chemical and other industries. Since 1986, YMC silica resins have been successfully adopted and validated in industrial processes and used reproducibly day after day, year after year.

These products are complemented by the newly developed hybrid phase, YMC-Triart, and the resin-based, strong ion-exchangers, YMC-BioPro.

Preparative & Process LC

Traditionally, the core focus was to provide ultrapure silica supports with highly selective surface chemistries in terms of bonding type and endcapping. YMC were first to set a milestone with the “legendary” YMC-Pack ODS-AQ, a C18 phase stable in aqueous conditions, for the reversed phase separation of polar compounds. YMC were first to set another milestone for a product dedicated specifically to the separation of basic compounds: YMCbasic. By nature of the overall vision, both these two products (and others) are available in preparative grades that made their way from the lab into various large-scale processes worldwide.



YMC of today maintains three technology platforms:

- **traditional, yet consistently improved silica supports**
- **hydrophilic polymer beads for IEX / biochromatography**
- **YMC-Triart; an organic/inorganic hybrid-style support with outstanding stability**

Preparative & Process LC

All the above platforms are available not only as preparative grades by definition of the specification, but also by availability in multi-ton per year capacities, and large lot sizes.

With YMC-Triart, YMC has again set a milestone by being the first in presenting the benefits of hybrid-style media to the preparative community: enhanced pH-stability from pH1 to pH12, highly defined particle properties and excellent mechanical stability for long-term separation methods.

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, India and the USA in addition to Germany which provides support for the EMEA countries together with a network of Authorised Distributors who provide additional local support.

YMC*Gel HG-Series 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**

*For more information about high grade silica phases for preparative HPLC please see our brochure: "YMC*Gel HG-series"*

"YMC will never knowingly change or modify an existing product that has any customer base." This statement ensures that YMC maintains the constant production of traditional products that are subject to validated processes. It is also this statement that proves the level of control that YMC can guarantee for reproducing any product that it manufactured in the past. Continuity and consistency are live and routinely applied values with YMC.

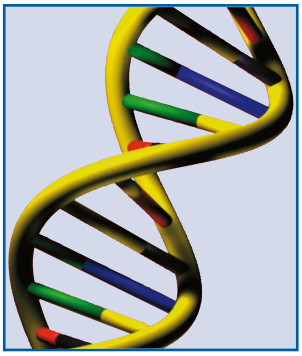
As time passes, YMC nevertheless continues to seek opportunities to improve existing products further. The latest generation, HG-series silica, provides improved mechanical and chemical stability and represents the product of choice for new methods. The unbounded silica support is available in lots of up to 500 kgs whilst bonded products are routinely produced in lots of up to 200 kgs.

YMC*Gel HG-Series Product Range

PRODUCT	BONDING	PHASE DESCRIPTION	PORE SIZE* (nm)	PARTICLE SIZE* (µm spherical)	CARBON LOAD** (%C)	pH
ODS-A-HG	C18	high performance C18 silica	12; 20; 30	10; 15; 20; 50	17; 12; 7	2.0-7.5
ODS-AQ-HG	C18	"hydrophilic" endcapping, for 100% aqueous eluent systems, substantially increased retention of polar compounds	12; 20; (30)	10; 15; 20; 50	14; 10	2.0-7.5
C8-HG (Octyl)	C8	C8 phase, high coverage monomeric bonding chemistry	12; 20; 30	10; 15; 20; 50	10; 7; 4	2.0-7.5
C4-HG (Butyl)	C4	C4 phase, less hydrophobic surface structure than C8 packing material	12; 20; 30	10; 15; 20; 50	7; 5; 3	2.0-7.5
TMS-HG (C1)	C1	trimethylsilane bonding	12; (20; 30)	10; 15; 20; 50	4	2.0-7.5
Ph-HG (Phenyl)	Phenyl	monomeric bonded phenyl, the p electron interaction gives a separation selectivity different from ODS	12; (20; 30)	10; 15; 20; 50	9	2.0-7.5
NH_2-HG (Amino)	Aminopropyl	primary amino derivative, high coverage monomeric bonding chemistry, suitable for HILIC	12; (20; 30)	10; 15; 20; 50	3	2.0-7.5
CN-HG (Cyano)	Cyanopropyl	for RP and NP applications, useful also for SFC and HILIC	12; (20; 30)	10; 15; 20; 50	7	2.0-7.5
Diol-HG	Diol	for normal phase applications, high recovery for biological material, suitable for HILIC and SFC	12; 20; 30	10; 15; 20; 50	–	2.0-7.5
SIL-HG (Silica)	—	ultra high purity, high mechanical stability, suitable for HILIC and SFC	12; 20; 30	10; 15; 20; 50	–	–

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 of pore size and particle size are available.
**With respect to pore size.

YMC-BioPro - IEX Ion Exchange Media



- **hydrophilic methacrylate polymer beads**
- **high dynamic binding capacity**
- **low non-specific adsorption**
- **excellent recovery**
- **stable to cleaning in place**

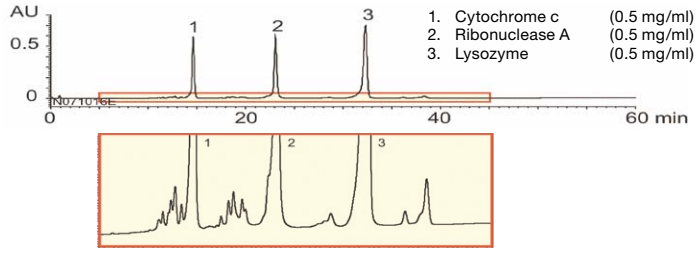
YMC BioPro is specifically designed for the cost-effective separation of proteins, antibodies, peptides and oligonucleotides.

It is available at analytical scale in porous or non-porous versions of a 5 µm bead, whilst preparative grade media is available in 10 µm, 30 µm and 75 µm porous beads for polishing, purification or capture. Based on a hydrophilic polymer, these strong ion exchange materials frequently demonstrate impressive recoveries and high dynamic binding capacities, even at higher than normal linear flow rates.

Excellent resolution

Standard protein separation on porous YMC-BioPro SP

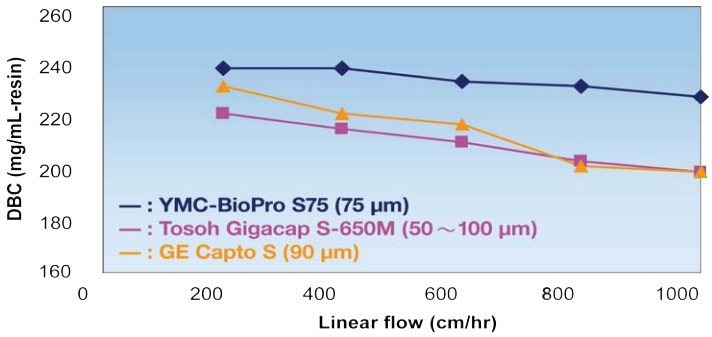
YMC-BioPro SP
5 µm, 50 x 4.6 mm ID



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 0.5M NaCl 0-100% B (0-60 min., linear)
Flow rate:	0.5 ml/min (4.6 mm ID column)
Temperature:	25 °C
Detection:	UV at 220 nm
Injection:	20 µl (4.6 mm ID column)

Further details about YMC-BioPro can be found in our brochure: "YMC preparative phases for biochromatography"

Excellent Binding Capacity



Column:	50 x 50 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

YMC-BioPro 75 µm higher DBC at every flow

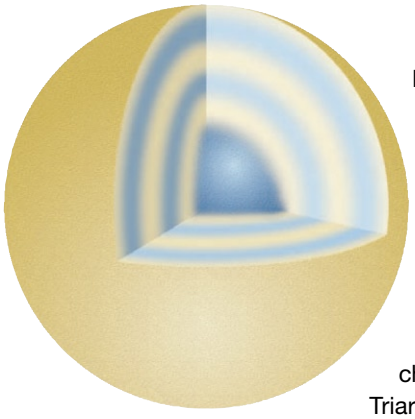
YMC-BioPro Product Range

Product	Chemistry	Phase Description	Pore Size [nm]	Particle Size [µm]	pH Stability
YMC-BioPro Q	Quaternary amine	Strong anion exchanger	100	10; 30; 75	2.0 - 12.0
YCM-BioPro S	Sulfobutyl	Strong cation exchanger	100	10; 30; 75	2.0 - 12.0

* Application data by courtesy YMC Co., Ltd.

YMC-Triart Prep

- **organic/inorganic hybrid-style support**
- **universal applicability for acidic, basic & neutral compounds**
- **extremely stable: pH 1-12 & temperature up to 70° C**



Flow chemistry using micro-reactor technology is key to the production of YMC-Triart. The droplet formation process in microstructured synthesis reactors is highly controllable, resulting in the tight specification for particle size distribution and pore size distribution. Consequently, YMC-Triart generates low backpressure so that small particles can be applied at higher flow rates with high resolution.

The organic/inorganic "multi-layered" hybrid particle in conjunction with proprietary endcapping delivers unrivalled mechanical and chemical strength. From real life process development work, YMC-Triart has been shown to outperform traditional silica-based materials 2- to 4-fold in terms of long-term stability. This data relates to reaching "end-of-life"-criteria after repeated purification, equilibration and CIP-cleaning cycles, where the column packing needs to be replaced either because the purity of the target compound is decreasing or due to an increase of backpressure. As a result, the economy of the purification process is favourably affected when looking at the amount of target compound achieved per kg of sorbent or cost per kg/kg of target compound.

The pH-range for the optimum stability of YMC-Triart is from pH1 to pH 12 at temperatures up to 70°C. This enables a high level of freedom of choice in selecting the most efficient method conditions with regard to efficiency and robustness in method development. Therefore, YMC-Triart is recommended as one of the first choices for method development.

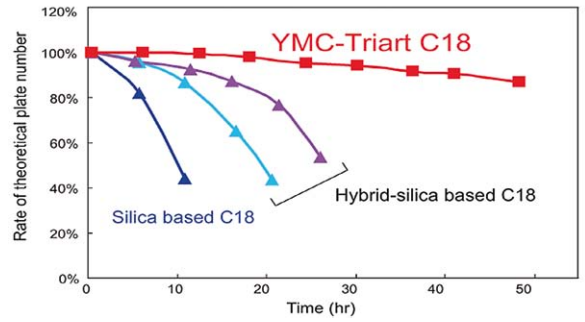
Product-related documentation such as a Regulatory Support File and column packing recommendations are readily available. YMC will happily provide scouting columns and technical assistance in method development, scale-up and actual production – worldwide, day after day, year after year.

Detailed information about our innovative Triart technology is availabe in the dedicated brochure: "YMC-Triart Prep"

YMC-Triart Prep

High pH Stability*

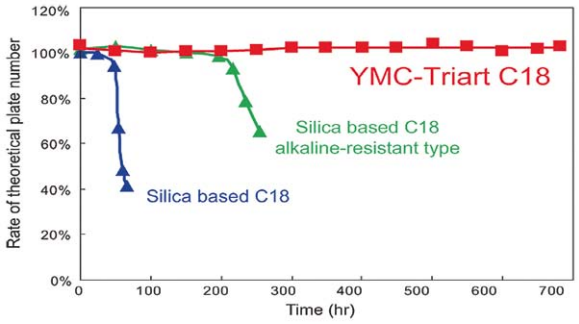
Phosphate buffer (pH 11.5, 40 °C)



Column: 5 µm, 150 x 4.6 mm ID
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

Temperature Stability*

pH 6.9, 70 °C



Column: 5 µm, 50 x 2.0 mm ID
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

YMC-Triart Prep Product Range

Product	Bonding	Phase Description	Pore Size [nm]	Particle Size [µm]	pH Stability
YMC-Triart Prep C18-S	C18	multilayered hybrid particle, polymeric bonding	12; 20	10; 15; 20; 50	1.0 - 12.0
YCM-Triart Prep C8-S	C8	multilayered hybrid particle, polymeric bonding	12; 20	10; 15; 20	1.0 - 12.0

* Application data by courtesy YMC Co., Ltd.

Technical Information

Contents

Introduction

Technical Information

YMC produces chromatography packing materials and HPLC columns under very strict quality control procedures and delivers to customers only those products that 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 leaflet which is included with each column. Please determine the miscibility of this solvent with the mobile phase to 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 (ie both 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 the instruction manual included with each column. Should this instruction manual be available, please contact YMC or your local distributor. A general overview of the characteristics of each phase is shown on the inside of the envelope.

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 to 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 is used, 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, call us.

Silica-based particles

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

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

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

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

Polymer-based particles: Polymer C18™

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

4. Guard columns

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

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

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

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

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

Column ID (mm)	Recommended Guard Cartridge ID (mm)
1.0	1.0
2.1	2.1
3.0	3.0
4.0	4.0
4.6	4.0* (4.6*)
10	10
20	20
30	30

* Formerly, external guard columns of 4.6 mm ID exhibit dead volume resulting in poor performance of the column system. Additionally, these guards were rather expensive.
In the course 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.
Thus, we recommend to use 4.0 mm ID guards with a 4.6 mm ID main 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 UltraHT 2.0 µm	50	500	7500

Column ID (mm)	Maximum Operating Pressure		
	(MPa)	(bar)	(psi)
1.0	20/25[1]	200/250[1]	3000/3750[1]
2.1	20/25	200/250	3000/3750
3.0	20/25	200/250	3000/3750
4.0	20/25	200/250	3000/3750
4.6	20/25	200/250	3000/3750
6.0	20/25	200/250	3000/3750
8.0	20/25	200/250	3000/3750
10	10	100	1500
20	10	100	1500
30	10	100	1500
50 and above	7.0/10	70/100[2]	1000/1500[2]
YMC-Actus 20/30	30	300	4500
YMC-Actus 50	10	100	1500

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

[2] depending on certification of the column; >10 µm packings should be kept below 3 MPa (30 bar, 450 psi)

Note: PolymerC18 has a pressure limit of 14.5 MPa (145 bar, 2000 psi)

6. Temperature

The upper temperature limit for silica and bonded phases is 50°C (70°C for YMC-Triart 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 variables 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 tot 50 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 perchloric acid 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 the miscibility with the mobile phase existing in the column and a separate wash stage 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.

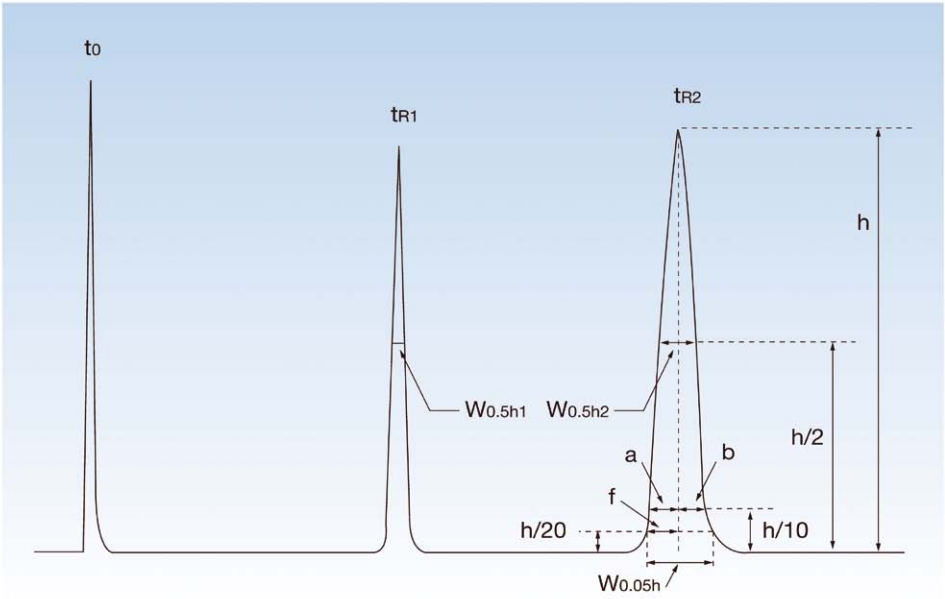
Column efficiency, an important characteristic for evaluation of column performance, is generally measured in terms of theoretical plate number. This is calculated using peak width at half-height. Narrower peak widths result in higher theoretical plate numbers. Longer columns and smaller packing material 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.

Theses 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.



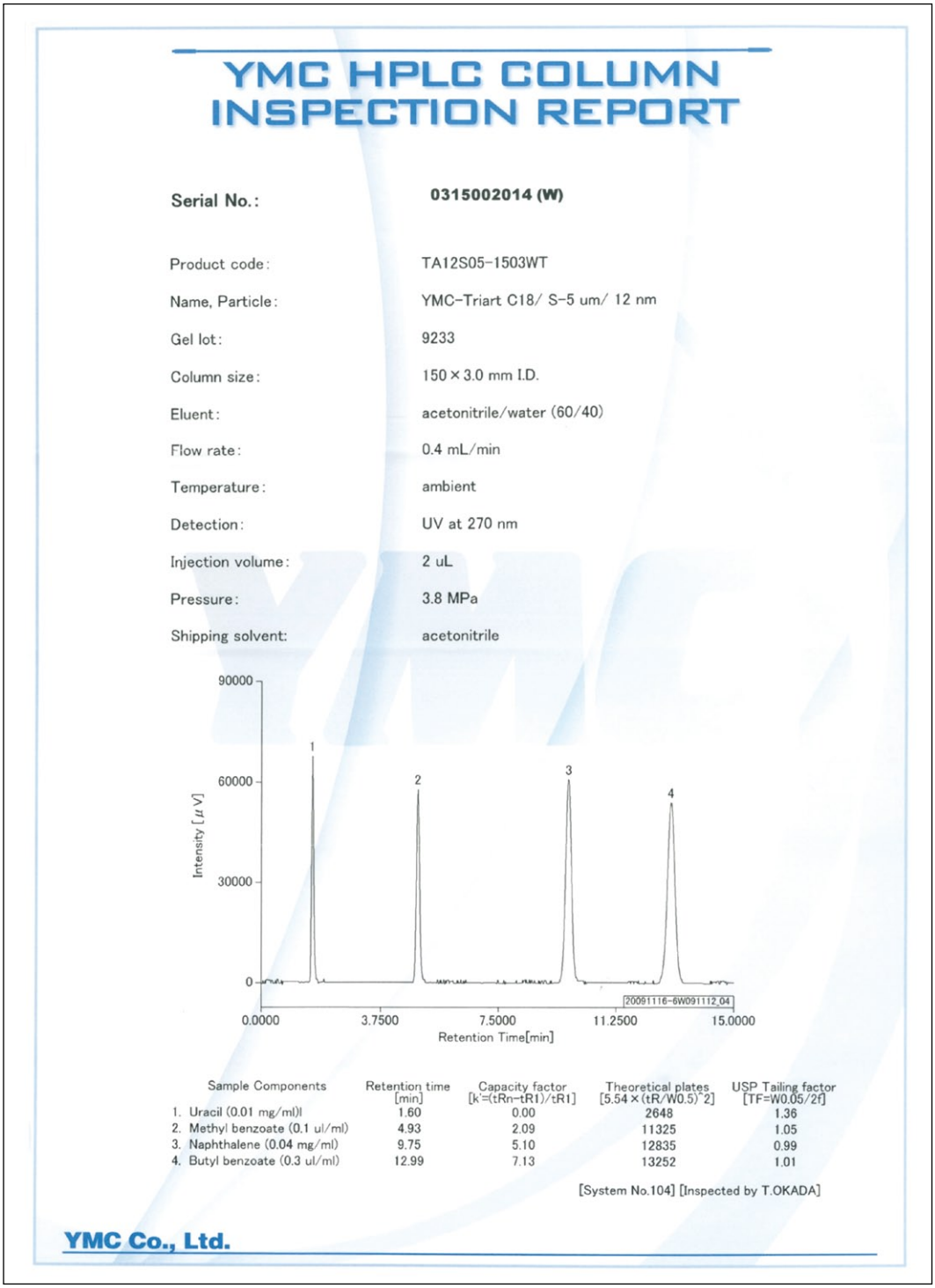
t_0	Void volume, Column dead-time	
t_R	Retention time	
h	Peak height	
$W_{0.5h}$	Peak width at half-height	
N	Theoretical plate number	$N=5.54\times (t_R/W_{0.5h})^2$
k'	Capacity factor	$k'=(t_R-t_0)/t_0$
α	Separation factor	$\alpha=k'_2/k'_1$
R_s	Resolution	$Rs=1.18\times (t_{R2}-t_{R1})/(W_{0.5h1}+W_{0.5h2})$
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.: 0315002014 (W)

Product code:	TA12S05-1503WT
Name, Particle:	YMC-Triart C18/ S-5 um/ 12 nm
Gel lot:	9233
Column size:	150 × 3.0 mm I.D.
Eluent:	acetonitrile/water (60/40)
Flow rate:	0.4 mL/min
Temperature:	ambient
Detection:	UV at 270 nm
Injection volume:	2 uL
Pressure:	3.8 MPa
Shipping solvent:	acetonitrile

Sample Components	Retention time [min]	Capacity factor [k'=(tRn-tR1)/tR1]	Theoretical plates [5.54×(tR/W0.5)^2]	USP Tailing factor [TF=W0.05/2f]
1. Uracil (0.01 mg/ml)l	1.60	0.00	2648	1.36
2. Methyl benzoate (0.1 ul/ml)	4.93	2.09	11325	1.05
3. Naphthalene (0.04 mg/ml)	9.75	5.10	12835	0.99
4. Butyl benzoate (0.3 ul/ml)	12.99	7.13	13252	1.01

[System No.104] [Inspected by T.OKADA]

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?

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 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 derivatisation 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, 3000 psi)

Column length of 250 mm or greater and diameters less than 10 mm:
25 MPa, (250 bar, 3750 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 of gel surface condition caused as a 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 mixedsolvent 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 materials 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 rises up?

Depending on the reasons for increased pressure, the following procedures are recommended:-

Blocked frits: Flush the column in reverse flow as described on page 342-343. 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 218-219.

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 225. 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 to be 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 Hydrosphere C18 or 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.

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 quantity of impurities UV absorbing 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 trace, many failures are 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.

Figures right show chromatograms from two identical operations except that the acetonitrile used was of different grades. One was HPLC grade (Figure 1); the other was 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 dependant 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

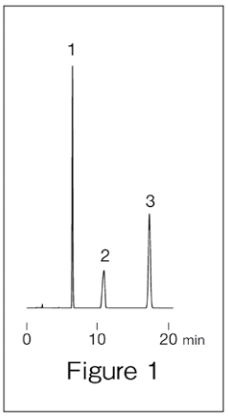


Figure 1

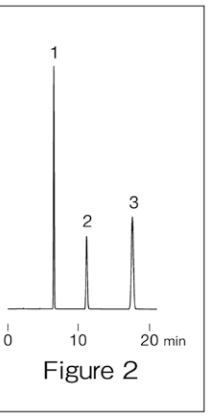


Figure 2

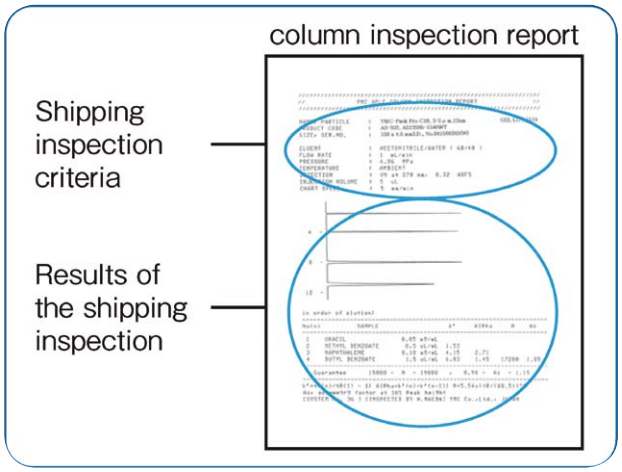
the chromatogram shown in Figure 2 irrespective of the grade of solvent. To avoid the influence of different grades, solvents specifically made for HPLC must be used. Even compounds which have groups which can dissociate can be analysed with eluent containing no acid or salt, although eluents with additives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

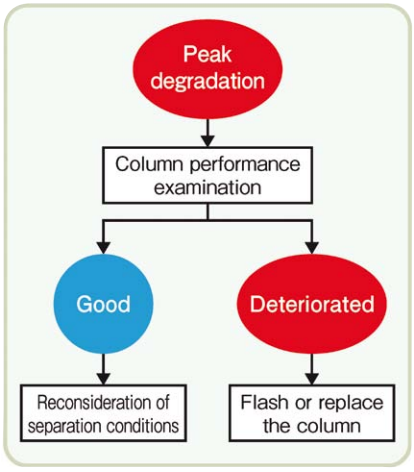
Troubleshooting

3. Peak shape anomaly

A common problem encountered during HPLC operations is peak shape anomalies such as peak tailing and double 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

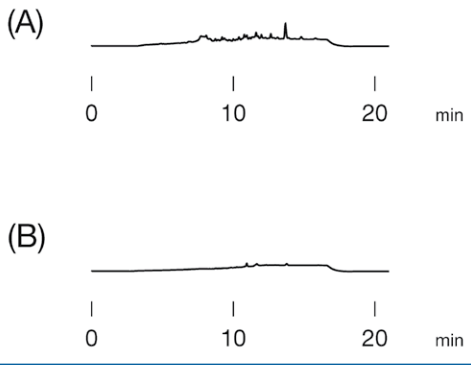
5. The Cause of the Ghost Peaks

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).

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 shown in the figure below. 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.

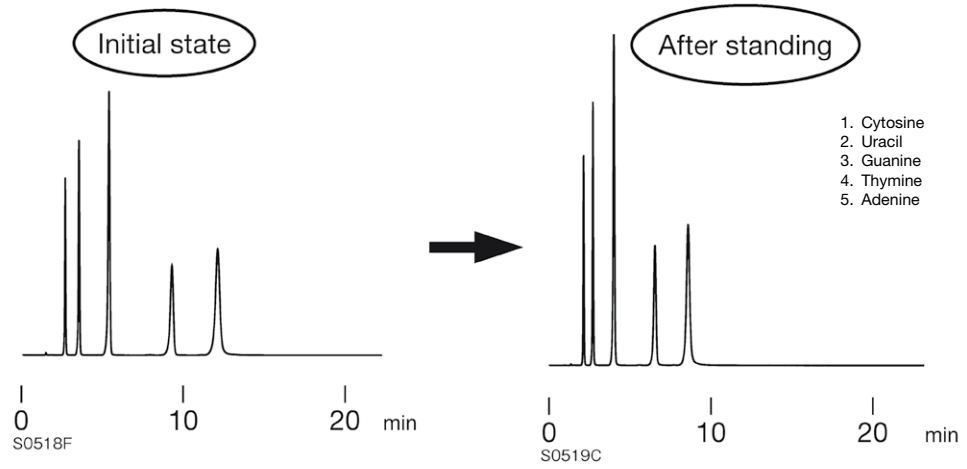
Troubleshooting

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.

Basic 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

Column Area Ratio

Inner Diameter	1.0	2.0	3.0	4.6	10.0	20.0	30.0	50.0
Ratio	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	X	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔			
Methanol	X	X	X	✔	X	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔		
Water	X	X	X	X	X	X	X	X	✔	X	✔	X	✔	✔	✔	✔	✔	✔	✔	✔	

Column Selection Guide

Pharmaceutical products / Agricultrual chemicals / Antibiotics / Antimicrobial agent / Metabolites / Steroids / Food additives / Natural products / Others

Reversed Phase

Neutral compounds / Acidic compounds

YMC-Triart C18, C8	Multi-layer hybrid particle
Pro Series ODS	High performance ODS column processed with advanced endcapping technology
Pro Series C8, C4	High performance reversed phase column processed with advanced endcapping technology
YMC-Pack ODS series	Conventional ODS column
YMC-Pack C_8, C_4	Useful for cases in which retention is too strong using ODS
J'sphere ODS series	Three kinds of ODS with different carbon contents
YMC-Pack Ph	Reversed-phase column utilizing π-π interaction
YMC-Pack CN	Can be used in both normal-phase and reversed-phase modes
YMC-Pack TMS	Reversed-phase column with the lowest hydrophobicity
YMC-Pack PolymerC18	Polymer type reversed-phase column without effect from silanol
YMCbasic	Useful for separation of basic compounds

Basic compounds

YMC-Triart C18, C8	Multi-layer hybrid particle
Pro Series ODS	Provides good peak shapes for basic compounds
Pro Series C8, C4	Useful for cases where retention is too strong using ODS

Hydrophilic compounds

Hydrosphere C18	Can be used with 100% water mobile phase
YMC-Pack ODS-AQ	Stronger retention of hydrophilic compounds than conventional ODS
YMC-Pack CN	Can be used in both normal-phase and reversed-phase modes
YMC-Pack TMS	Reversed-phase column with the lowest hydrophobicity

HILIC/ Normal Phase

YMC-Triart Diol-HILIC	Versatile HILIC column
YMC-Pack SIL	Standard normal-phase column
YMC-Pack CN	Can be equilibrated faster than bare silica gel
YMC-Pack Diol-NP	Normal-phase column providing separation characteristics different from bare silica gel
YMC-Pack Polyamine II	Amino column with utilising the polarity of amino groups
YMC-Pack NH_2	Normal-phase column utilising the polarity of amino groups

Vitamins

Reversed Phase

Water-soluble vitamins

YMC-Triart C18	Multi-layer hybrid particle
YMC-Pack *Pro* C18	Provides good peak shapes due to advanced endcapping technology
Hydrosphere C18	Can be used with 100% water mobile phase

Fat-soluble vitamins

YMC-Triart C18	Multi-layer hybrid particle
YMC-Pack *Pro* C18	Provides good peak shapes due to advanced endcapping technology
YMC-Pack ODS-A	Conventional ODS column
YMC-Pack ODS-AM	ODS column with outstanding lot-to-lot reproducibility

HILIC/ Normal Phase

Water-soluble vitamins

YMC-Triart Diol-HILIC	Versatile HILIC column
YMC-Pack Polyamine II	Amino column with improved durability
YMC-Pack NH_2	Normal-phase column utilising the polarity of amino groups

Fat-soluble vitamins

YMC-Pack SIL	Standard normal-phase column
YMC-Pack Polyamine II	Amino column with improved durability

Sugars

Reversed Phase

Oligosaccharides

Hydrosphere C18	Can be used with 100% water mobile phase
YMC-Pack ODS-AQ	Stronger retention of hydrophilic compounds than conventional ODS

HILIC/ Normal Phase

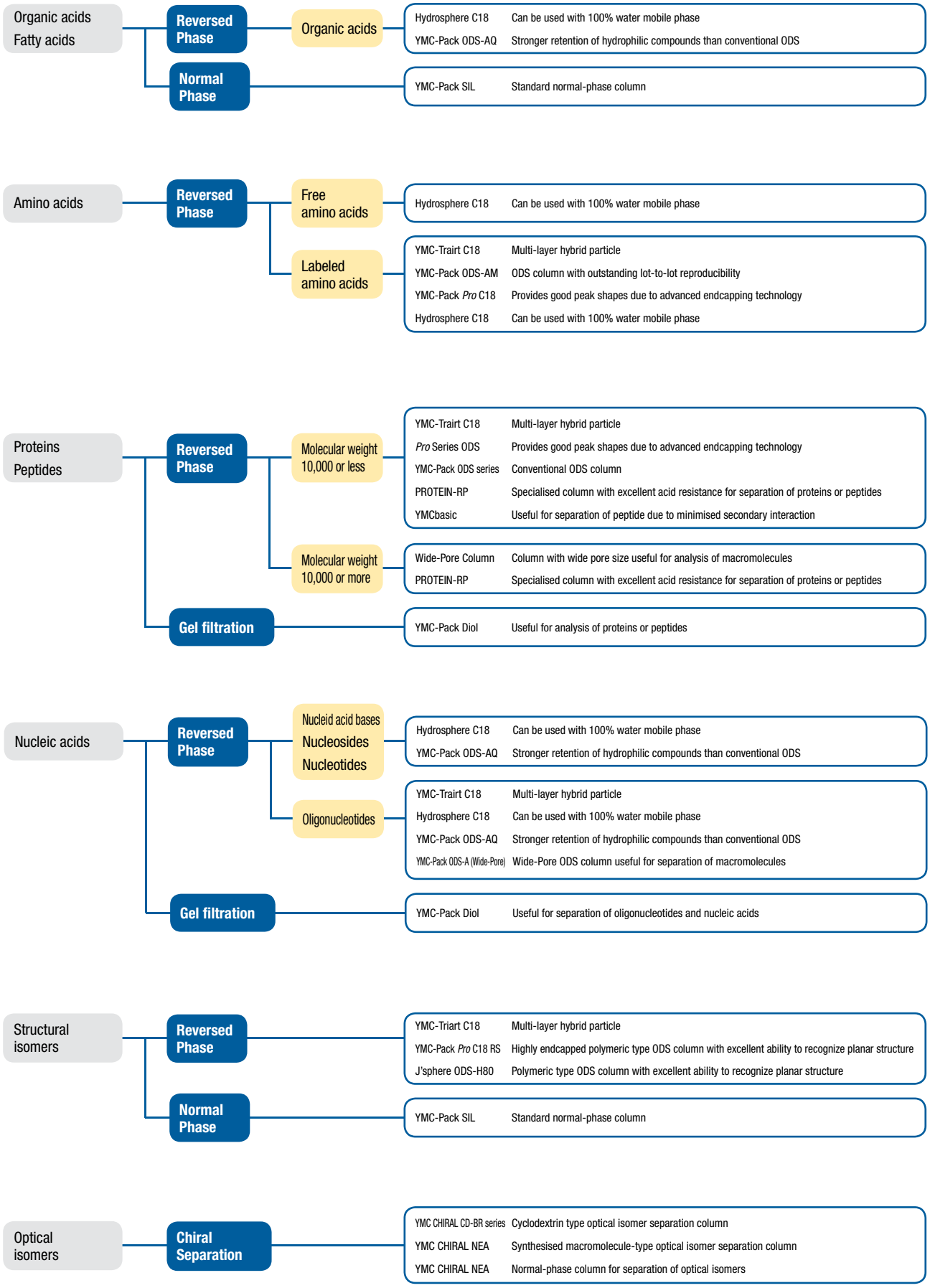
Monosaccharides / Oligosaccharides

YMC-Pack Polyamine II	Amino column with improved durability
YMC-Pack NH_2	Normal-phase column utilising the polarity of amino groups
YMC-Pack Polyamine	Column chemically bonded with polyamine

Gel filtration

YMC-Pack Diol	Useful for molecular weight determination of sugars

Column Selection Guide



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:

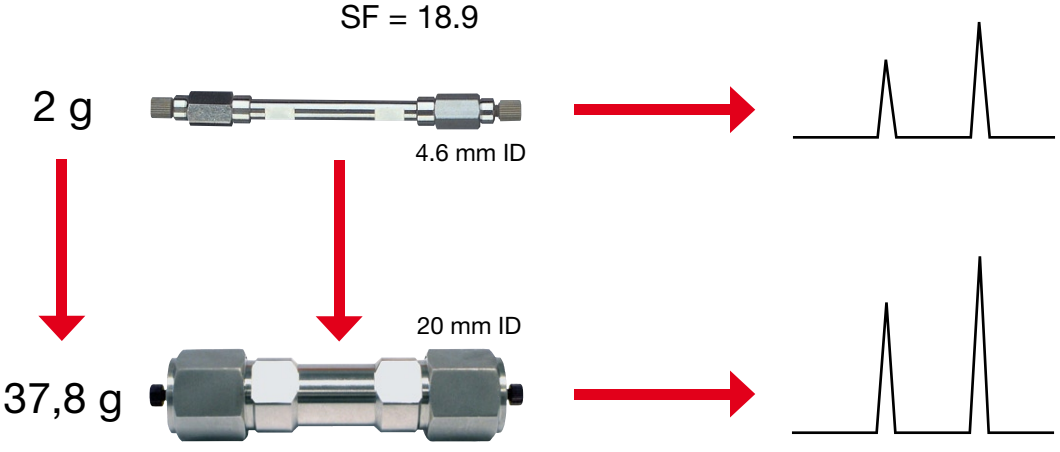
Linear Scale-Up

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

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

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

$$SF = 18.9$$



Inner diameter → loadability / compound

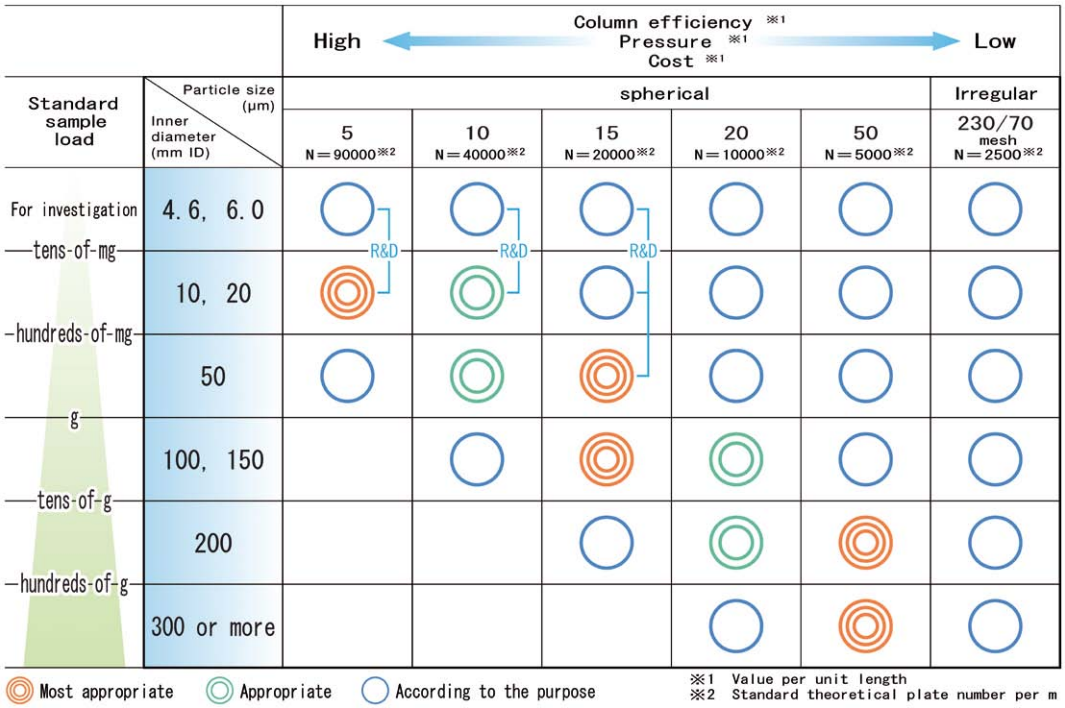
Guideline for Sample Load according to column ID

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

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Ordering Information

The previous product listing represents commonly used standard column dimension. In order to identify any specific product version and order 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	
YMC30	CT	6	06	spherical	S	3	03	10	01	0.05	E5	Quick Seal	QT
Triart C18	TA	8	08			4	04	20	02	0.075	E8	Cartridge	QC
Pro C18	AS	12	12			5	05	33	03	0.1	F0	Waters type	WT
Pro C18 RS	RS	20	20			6	06	50	05	0.2	G0		
Hydrosphere C18	HS	30	30					75	L5	0.3	H0		
ODS-A	AA	100	A0			10	11	100	10	0.5	J0		
ODS-AM	AM	proprietary	99			15	16	125	R5	0.8	M0		
ODS-AQ	AQ	non-porous	00			20	21	150	15	1.0	01		
J'sphere ODS-H80	JH					50	50	250	25	2.1	02		
J'sphere ODS-M80	JM					75	75			3.0	03		
J'sphere ODS-L80	JL							300	30	4.0	04		
ODS-AL	AL					63/210	A4	500	50				
PAH	YP					150	A5	1000	A0	4.6	46		
PolymerC18	PC									6.0	06		
Triart C8	TO									8.0	08		
Pro C8	OS									10	10		
C8 (Octyl)	OC									20	20		
YMCbasic	BA									30	30		
Ph (Phenyl)	PH												
Pro C4	BS									50 (2000 psi)	52		
C4 (Butyl)	BU									70 (2000 psi)	72		
Protein-RP	PR									100 (2000 psi)	A2		
TMS (C1)	TM									150 (2000 psi)	B2		
PVA-Sil	PV									200 (2000 psi)	C2		
Polyamine II	PB												
NH_2 (Amino)	NH												
CN (Cyano)	CN												
Triart Diol-HILIC	TDH												
Diol	DL												
SIL (Silica)	SL												
BioPro-QA	QA												
BioPro-SP	SP												
BioPro-QA-F	QF												
BioPro-SP-F	SF												
Chiral NEA (R)	NR												
Chiral NEA (S)	NS												
Chiral CD BR α	DA												
Chiral CD BR β	DB												
Chiral CD BR γ	DG												
Chiral Prep CD ST	ST												
Chiral Prep CD PM	PM												

Example

Choose your column and fill in the "Gel and Hardware Code" or detailed description (The part number consists of the "Gel Code" and the "Hardware Code").

YMC-Pack ODS-A		12 nm		spherical		3 µm		250 mm		1.0 mm		Quick Seal	
	AA		**12**		**S**		**03**		**25**		**01**		**QT**

Your column part number: AA12S03-2501QT (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.

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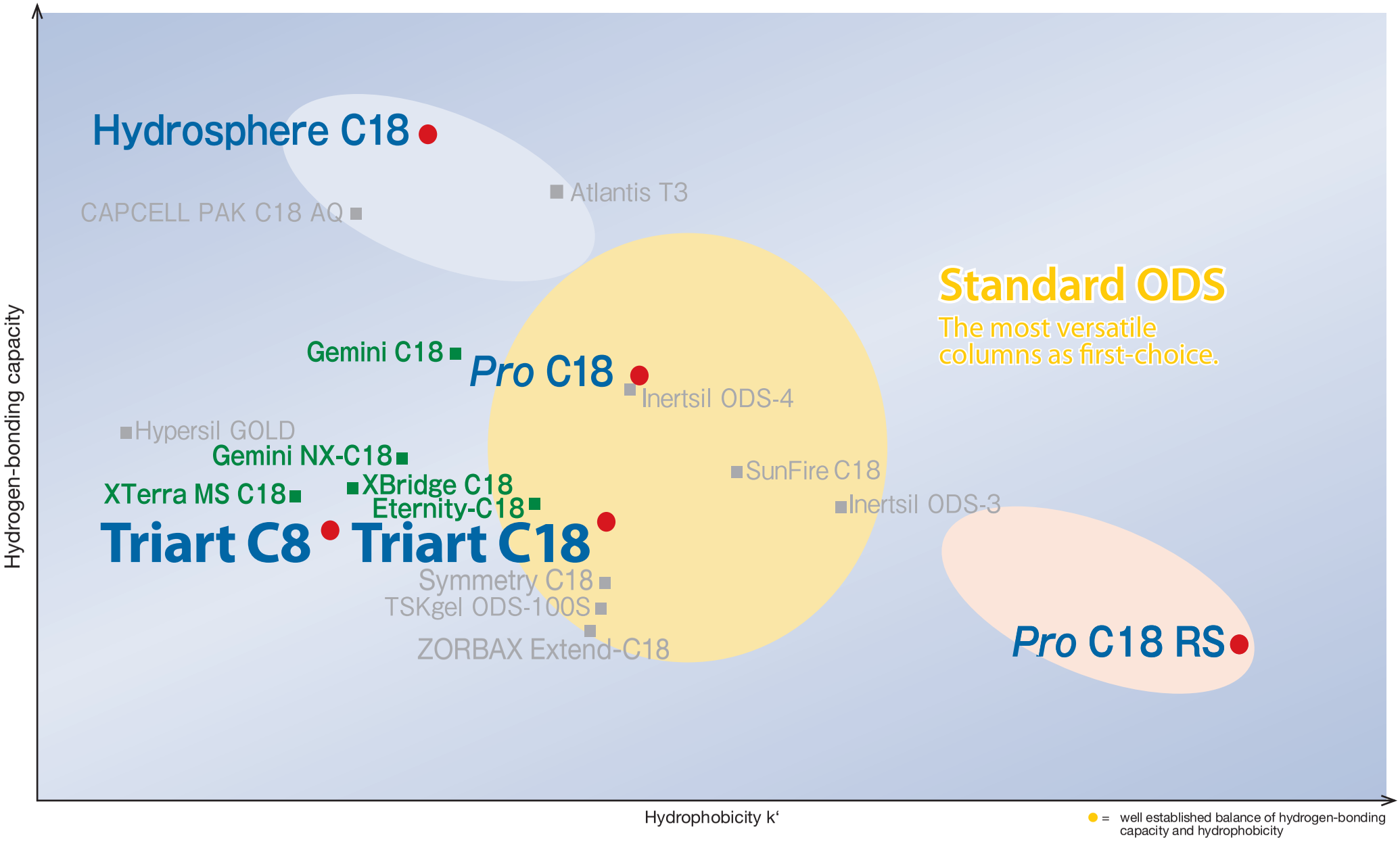
Analytical stationary phases routinely available from YMC

		PRODUCT	PAGE	PHASE (silica-based unless stated)	END-CAPPED	USP CLASS NO.	PARTICLE SIZE (µm spherical)	PORE SIZE (nm)	CARBON LOAD (%C)	pH	TYPICAL APPLICATIONS	PAGE	PRODUCT
Reversed Phase	C30	C30	192	proprietary polymeric bonding chemistry	—	—	3, 5	proprietary	—	2.0-7.5	isomeric carotenes, retinols, steroids, fat-soluble vitamins	192	C30
	C18	Triart C18	13-40 216	multi-layer hybrid particle	yes	L1	1.9, 3, 5	12	20	1.0-12.0	acid, neutral, basic and chelating compounds, metabolites, "versatile" stationary phase	13 216	Triart C18
		Pro C18	70	very low residual non-specific interactions	yes	L1	3, 5	12	17	2.0-8.0	fat-soluble vitamins, antioxidants, metabolites, acidic, neutral, basic and chelating compounds	70	*Pro* C18
		UltraHT	54	2 µm *Pro* C18 for fast and ultra fast separations			2					54	UltraHT
		Pro C18 RS	76	high carbon load with polymeric bonding C18	yes	L1	3, 5	8	22	1.0-10.0	acidic and basic compounds	76	*Pro* C18 RS
		Hydrosphere C18	80	can be used in 100% aqueous eluent	yes	L1	3, 5	12	12	2.0-8.0	strong polar compounds, antibiotics, nucleic acids, water-soluble vitamins, acidic, neutral, basic and chelating compounds	80	Hydrosphere C18
		UltraHT	54	2 µm Hydrosphere C18 for fast and ultra fast separations			2					54	UltraHT
		ODS-A	90	one of the YMC's international bestsellers	yes	L1	3, 5	12, 20, 30	17, 12, 7	2.0-7.5	general purpose phase	90	ODS-A
		ODS-AM	92	high performance C18 column for validated methods operation	yes	L1	3, 5	12	17	2.0-7.5	purines, phenols, PTC-amino acids, angiotensins, alkaloids	92	ODS-AM
		ODS-AQ	86	"hydrophilic" endcapping, for 100% aqueous eluent systems	yes	L1	3, 5	12, 20	14, 10	2.0-7.5	strong polar compounds	86	ODS-AQ
		J'sphere	196	C18-family with differently controlled hydrophobicity for method development	yes	L1	4	8	22, 14, 9 (JH, JM, JL)	1.0-9.0 (JH) 2.0-7.5 (JM+JL)	positional isomers, complexing agents, pharmaceuticals	196	J'sphere
		ODS-AL	94	traditional C18 for "mixed mode" separations	no	L1	3, 5	12	17	2.0-7.5	tocopherols, fat-soluble vitamins, disinfectants	94	ODS-AL
		Polymer C18	96	polymethacrylate matrix, wide pH applicability	—	—	6	proprietary	C18 equivalent 10%	2.0-13.0	phenols, anilines, peptides in high pH, pharmaceuticals, quaternary amines	96	Polymer C18
	C8	Triart C8	13-40 216	multi-layer hybrid particle	yes	L1	1.9, 3, 5	12	17	1.0-12.0	acid, neutral, basic and chelating compounds, metabolites, "versatile" stationary phase	13 216	Triart C8
		Pro C8	72	C8, with very low residual non-specific interactions	yes	L7	3, 5	12	10	2.0-7.5	acidic, neutral, basic and chelating compounds, drugs and metabolites	72	*Pro* C8
		C8 (Octyl)	100	traditional C8	yes	L7	3, 5	12, 20, 30	10, 7, 4	2.0-7.5	proteins and peptides, estrogens, general purpose phase	100	C8 (Octyl)
		YMCbasic	98	monomeric bonded chains of C8 and smaller	—	L7	3, 5	proprietary	8	2.0-7.5	basic molecules w/o modifiers, anilines, alkaloids, antidepressants	98	YMCbasic
		Ph (Phenyl)	102	monomeric bonded phenyl	yes	L11	3, 5	12, 30	9, 3	2.0-7.5	phenols, fullerenes, sweeteners	102	Ph (Phenyl)
	C4	*Pro* C4	74	C4, with very low residual non-specific interactions	yes	L26	3, 5	12	8	2.0-7.5	polar acidic, neutral, basic and chelating compounds, polar peptides	74	*Pro* C4
		C4 (Butyl)	104	traditional C4	yes	L26	3, 5	12, 20, 30	7, 5, 3	2.0-7.5	biological separations, polar compounds	104	C4 (Butyl)
		PROTEIN-RP	158	high stability, good recovery rates	yes	L26	5	proprietary	—	1.5-7.5	proteins, peptides	158	PROTEIN-RP
		YMC-PAH	194	proprietary bonding chemistry	—	—	3, 5	—	—	2.0-8.0	polyaromatic hydrocarbons	194	YMC-PAH
Normal Phase / HILIC		TMS (C1)	106	trimethyl silane	—	L13	3, 5	12, 30	4, 3	2.0-7.5	water-soluble vitamins	106	TMS (C1)
		PVA-SIL	118	polyvinyl alcohol bonded on silica support	—	L24	5	12	—	2.0-9.5	proteins, phospholipids, retinoids, lipids	118	PVA-SIL
		Polyamine II (PBMN)	124	mixed secondary and tertiary amino derivative	—	—	5	12	—	2.0-7.5	malto-oligosaccharides, tocopherols, nucleotides, sugars	124	Polyamine II (PBMN)
		NH_2 (Amino)	126	primary amino derivate	—	L8	3, 5	12	3	2.0-7.5	sugars, nucleotides, water-soluble vitamins	126	NH_2 (Amino)
		CN (Cyano)	120	useful for SFC applications	yes	L10	3, 5	12, 30	7, 3	2.0-7.5	proteins, steroids, catechols	120	CN (Cyano)
		Triart Diol-HILIC	32	versatile HILIC column	—	L20	1.9; 3; 5	12	—	2.0-10.0	peptides, proteins, malto-oligosaccharides	32	Triart Diol-HILIC
		Diol	122 146	versatile alternative to silica for normal phase separations	—	L20	5	6, 12	—	2.0-7.5	peptides, proteins, malto-oligosaccharides	122 146	Diol
		SIL (Silica)	116 214	ultra high purity, high mechanical stability	—	L3	3, 5	6, 12, 20, 30	—	2.0-7.5	small oganic molecules, fat-soluble vitamins, tocopherols	116 214	SIL (Silica)
IEX		BioPro QA / SP	136	high ion exchange capacity, porous hydrophilic polymer	—	—	5	100	—	2.0-12.0	proteins, peptides, nucleotides	136	BioPro QA / SP
		BioPro QA-F / SP-F	141	high ion exchange capacity, non-porous hydrophilic polymer	—	—	5	—	—	2.0-12.0	proteins, peptides, nucleotides	141	BioPro QA-F / SP-F
SEC		Diol-60, -120, -200, -300	122 146	versatile phase for gel filtration separations	—	L20	5	6, 12, 20, 30	—	5.0-7.5	peptides, proteins, malto-oligosaccharides	122 146	Diol-60, -120, -200, -300

YMC – The Selectivity Company



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