



Preparative columns  
for HPLC and SFC

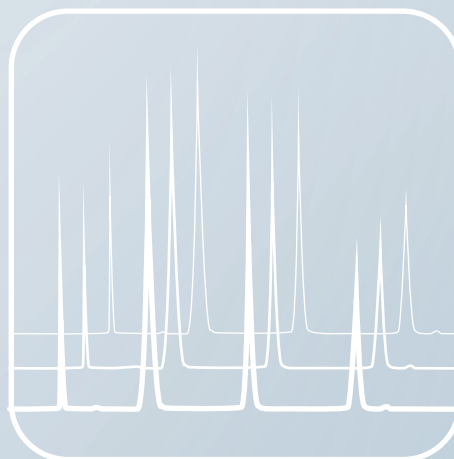
## YMC-ACTUS



Throughput

Yield

Long Lasting



## 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.

YMC-Actus packed with YMC's innovative resins

- Yield
- Throughput
- Long column lifetime

are easily achieved!

*With YMC-Actus,  
time is on your side!*



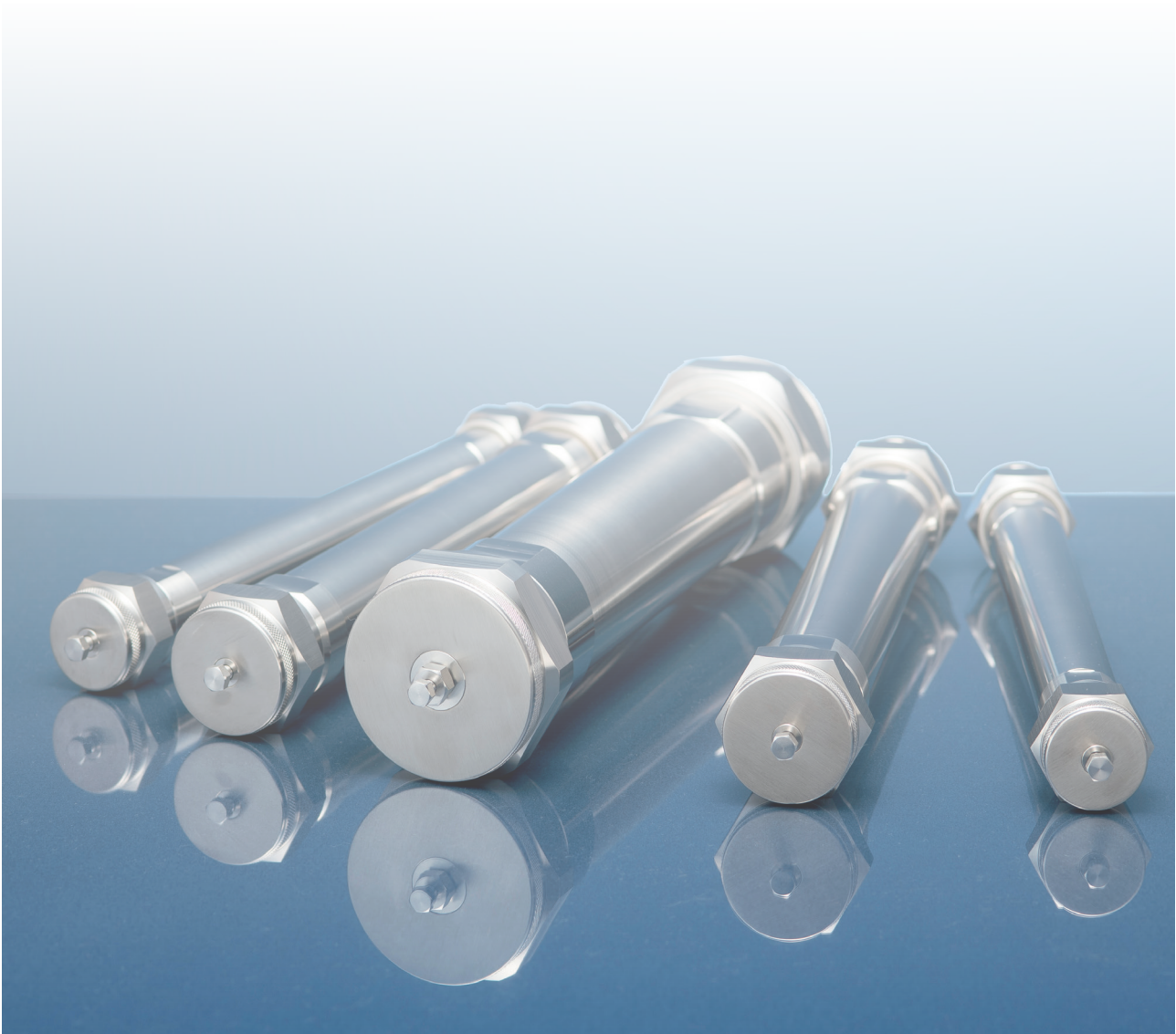
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Specifications

|                               | YMC-Actus                                                       |
|-------------------------------|-----------------------------------------------------------------|
| Stationary phases             | YMC-Triart<br>RP Classics<br>CHIRAL ART                         |
| Particle size / $\mu\text{m}$ | 5, 7*, 10*, 15*, 20*                                            |
| Internal diameter / mm        | 20, 30, 50                                                      |
| Length / mm                   | 50, 75, 100, 150, 250                                           |
| Pressure limit                | 20–30 mm ID: 30 MPa (4,351 psi)<br>50 mm ID: 20 MPa (2,900 psi) |

\*not all combinations of stationary phase and particle size are available

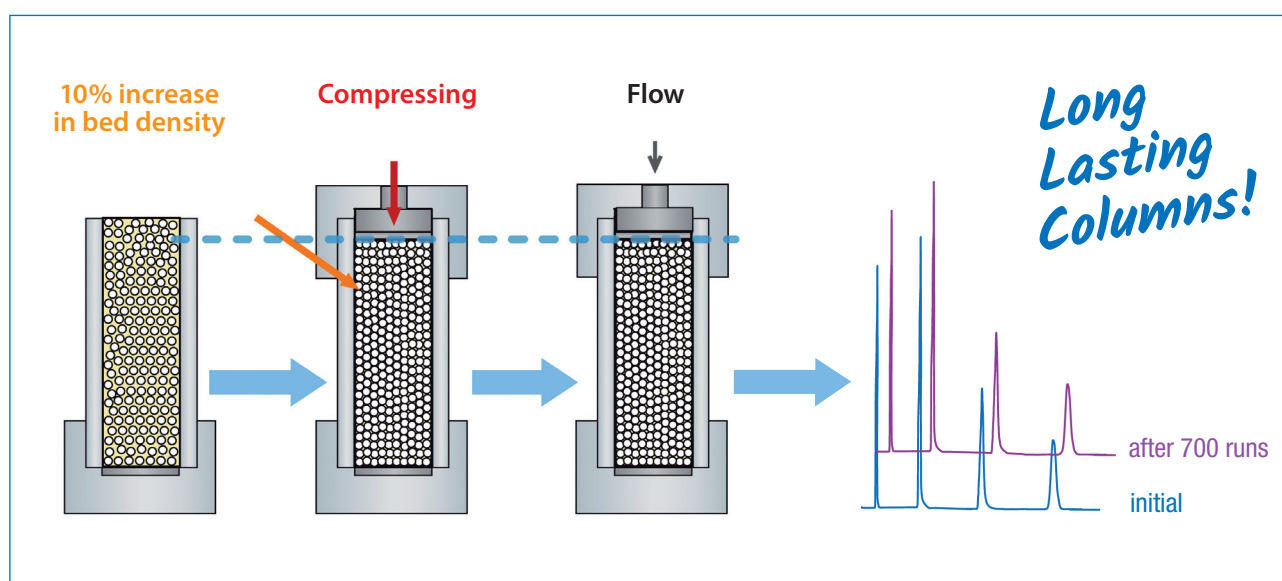


## High performance purifications with YMC-Actus (semi-)preparative columns

### How to obtain long lasting columns!

YMC-Actus series columns are semi-preparative HPLC columns that have excellent column stability and efficiency as a result of applying axial compression technology.

YMC-Actus series columns show high stability under high flow rate or steep gradient conditions which are desirable for milligram scale preparative HPLC of various compounds.



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 semiprep 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.

## YMC-Triart and Actus Technology: A perfect match!

YMC-Triart is a versatile material with exceptional narrow particle and pore size distributions. YMC-Triart allows challenging pH and high temperature conditions in work day-to-day 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.

### Phase overview

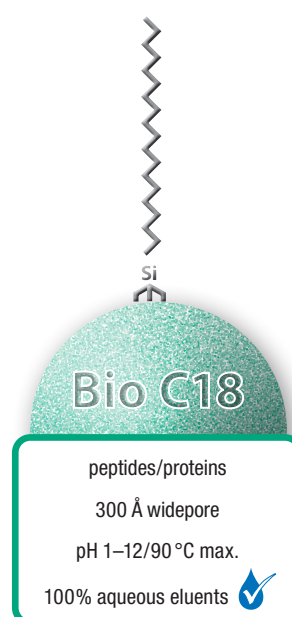
#### YMC-Triart C18



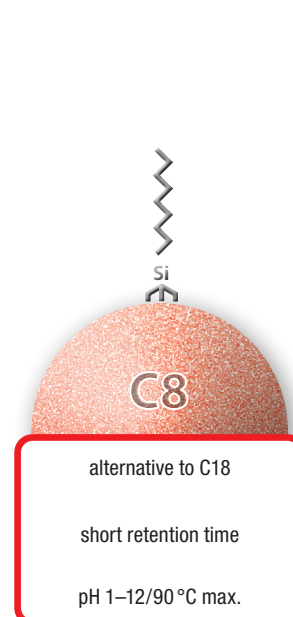
#### YMC-Triart C18 ExRS



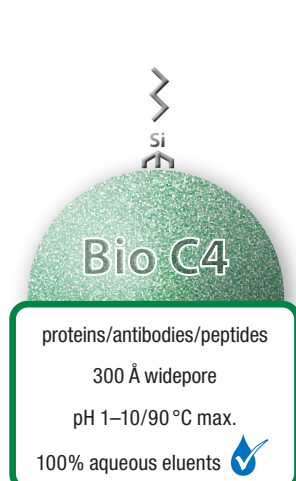
#### YMC-Triart Bio C18



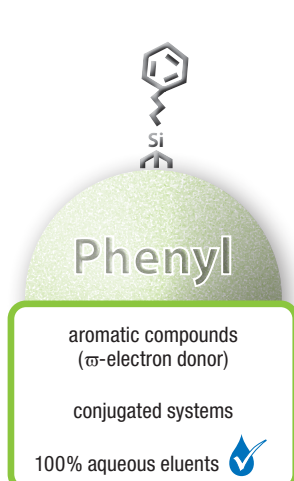
#### YMC-Triart C8



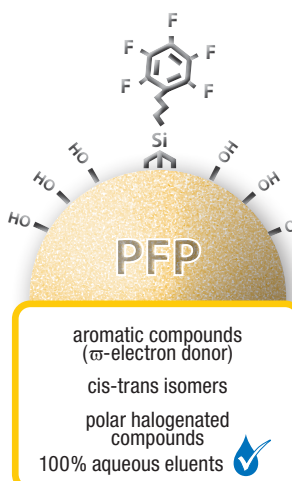
#### YMC-Triart Bio C4



#### YMC-Triart Phenyl



#### YMC-Triart PFP



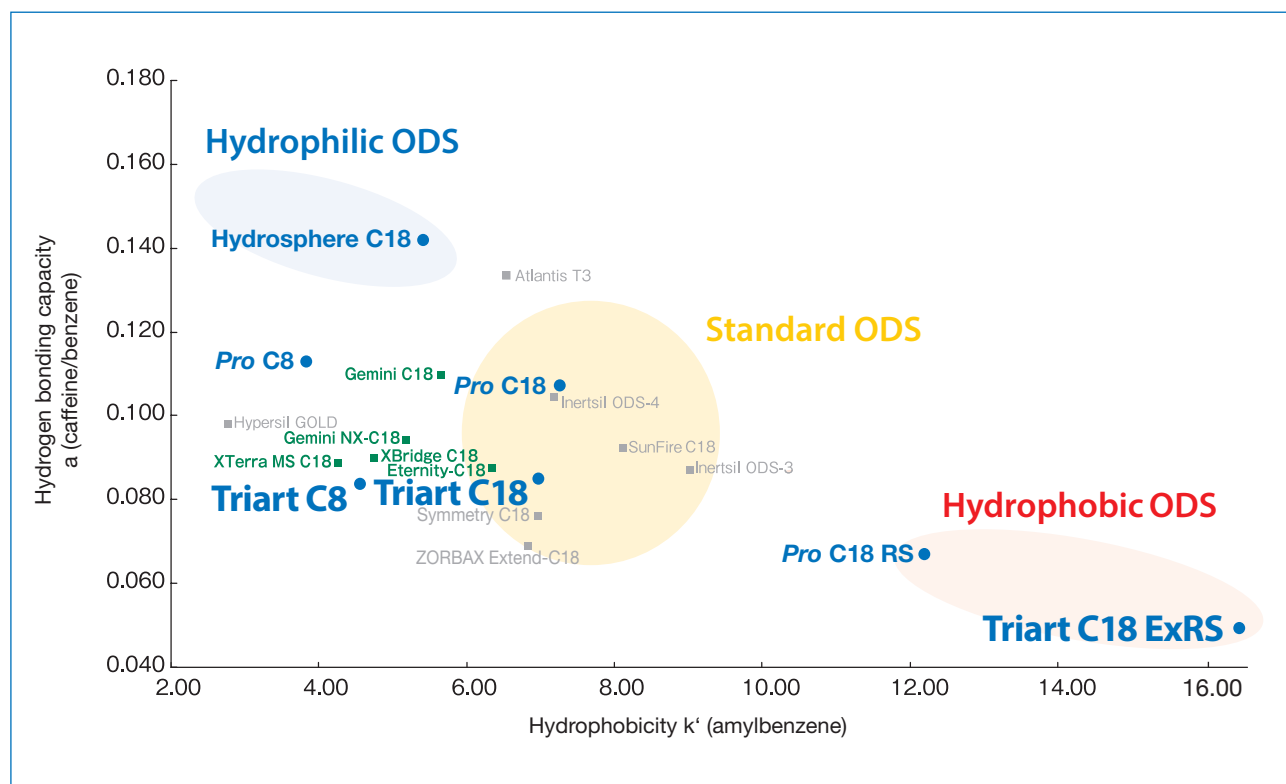
#### YMC-Triart Diol-HILIC



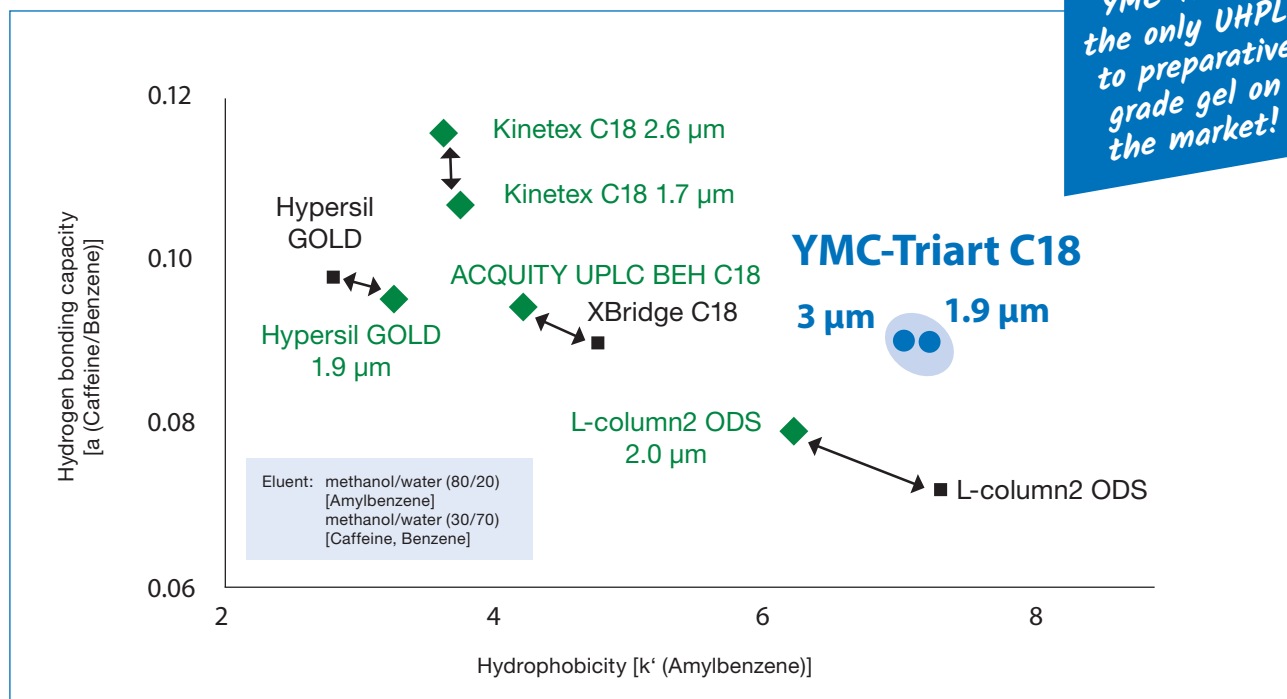
## Specification YMC-Triart

|                      | C18                                                             | C18 ExRS                       | Bio C18                        | C8                             | Bio C4                         | Phenyl                | PFP                          | Diol-HILIC            |
|----------------------|-----------------------------------------------------------------|--------------------------------|--------------------------------|--------------------------------|--------------------------------|-----------------------|------------------------------|-----------------------|
| Base                 | organic/inorganic silica                                        |                                |                                |                                |                                |                       |                              |                       |
| Stationary phase     | C18 (USP L1)                                                    | C18 (USP L1)                   | C18 (USP L1)                   | C8 (USP L7)                    | C4 (USP L26)                   | Phenyl (USP L11)      | Penta-fluorophenyl (USP L43) | Diol (USP L20)        |
| Particle size        | 1.9, 3 and 5 µm                                                 |                                |                                |                                |                                |                       |                              |                       |
| Pore size            | 12 nm                                                           | 8 nm                           | 30 nm                          | 12 nm                          | 30 nm                          | 12 nm                 | 12 nm                        | 12 nm                 |
| Specific surface     | 360 m <sup>2</sup> /g                                           | 430 m <sup>2</sup> /g          | —                              | 360 m <sup>2</sup> /g          | —                              | 360 m <sup>2</sup> /g | 360 m <sup>2</sup> /g        | 360 m <sup>2</sup> /g |
| Carbon content       | 20%                                                             | 25%                            | —                              | 17%                            | —                              | 17%                   | 15%                          | —                     |
| Bonding              | trifunctional                                                   |                                |                                |                                |                                |                       |                              |                       |
| Endcapping           | multi-stage                                                     | multi-stage                    | multi-stage                    | multi-stage                    | multi-stage                    | multi-stage           | none                         | none                  |
| pH range             | 1 ~ 12                                                          | 1 ~ 12                         | 1 ~ 12                         | 1 ~ 12                         | 1 ~ 10                         | 1 ~ 10                | 1 ~ 8                        | 2 ~ 10                |
| Temperature range    | pH < 7: 90 °C<br>pH > 7: 50 °C                                  | pH < 7: 90 °C<br>pH > 7: 50 °C | pH < 7: 90 °C<br>pH > 7: 50 °C | pH < 7: 90 °C<br>pH > 7: 50 °C | pH < 7: 90 °C<br>pH > 7: 50 °C | 50 °C                 | 50 °C                        | 50 °C                 |
| Pressure limit       | 20–30 mm ID: 30 MPa (4,351 psi)<br>50 mm ID: 20 MPa (2,900 psi) |                                |                                |                                |                                |                       |                              |                       |
| 100% aqueous eluents | ✓                                                               | ✗                              | ✓                              | ✗                              | ✓                              | ✓                     | ✓                            | ✓                     |

## "First choice" column for method development

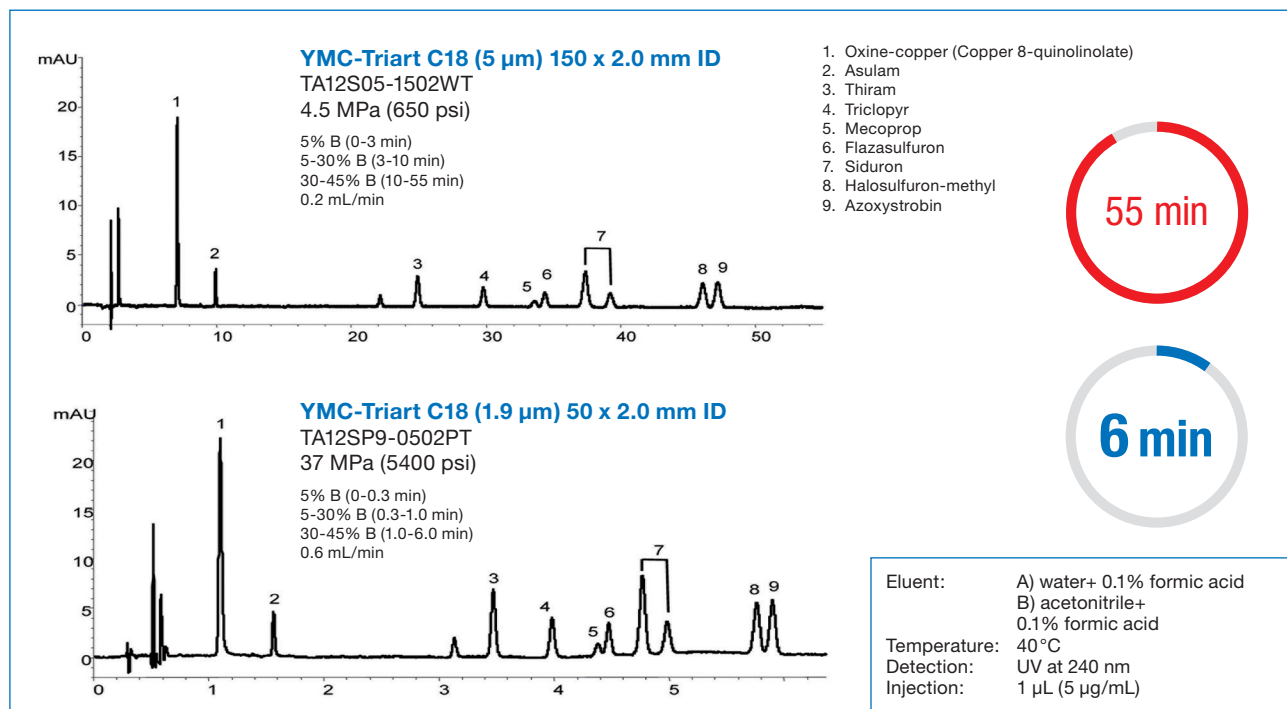


## Evaluation of method transfer performance



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

## Method transfer HPLC ↔ UHPLC

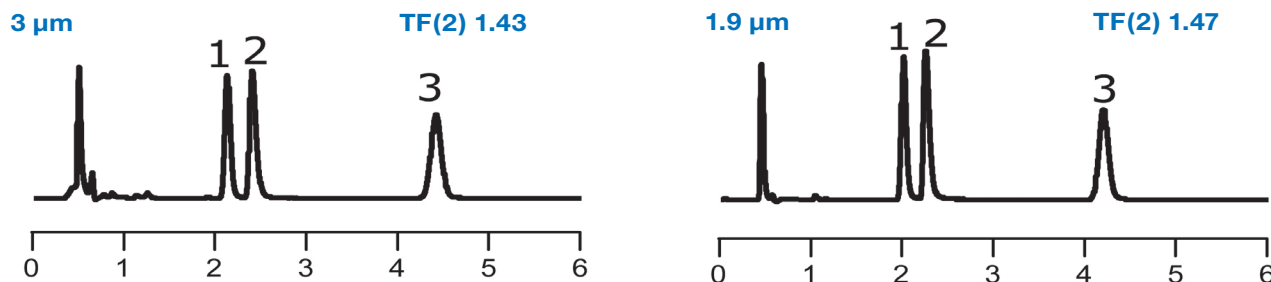


When transferring the 55 min HPLC method to UHPLC scale, the resolution remains the same although the separation time is reduced to only 6 min.

## Secure your method transfer!

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

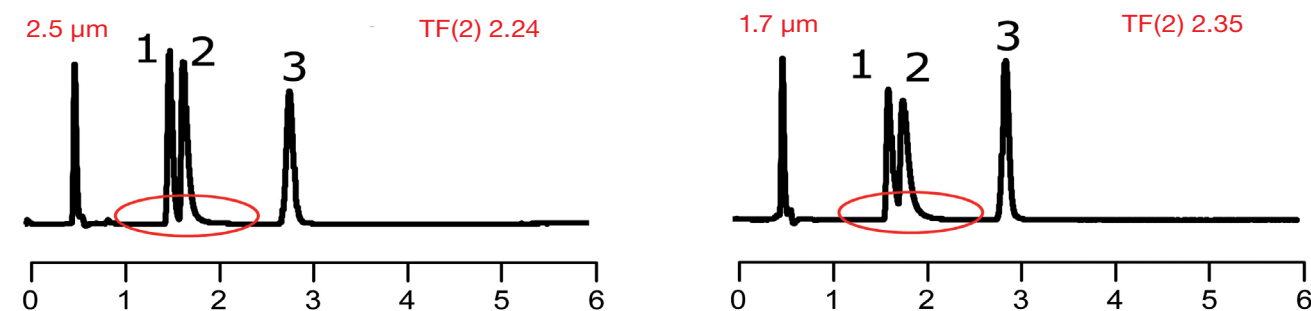
### YMC-Triart C18



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

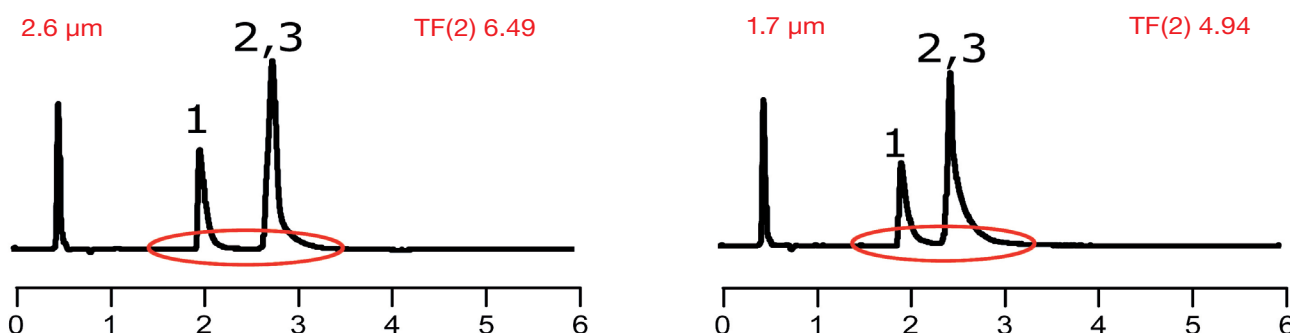
## Case Studies

### X-Bridge BEH C18 and Acquity UPLC BEH C18



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

### Kinetex™ C18

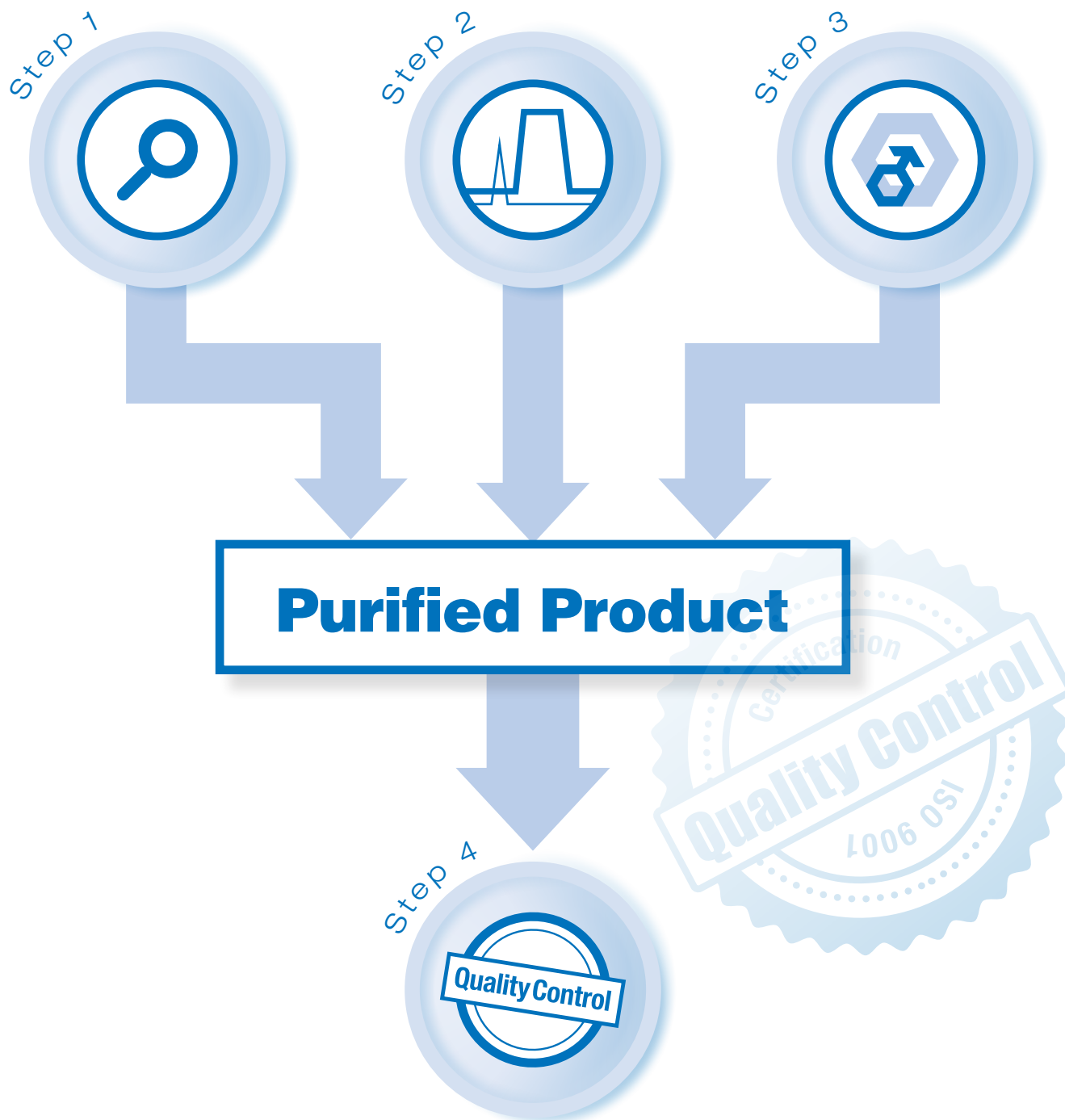


Kinetex™ C18 columns show significant peak tailing and have limited scalability due to lack of larger particle sizes.

Column: 50 x 2.0 mm ID or 2.1 mm ID  
 Eluent: 20 mM KH<sub>2</sub>PO<sub>4</sub>-K<sub>2</sub>HPO<sub>4</sub> (pH 6.9) / acetonitrile (65/35)  
 Temperature: 40 °C  
 Flow rate: 0.2 mL/min  
 Detection: UV at 235 nm

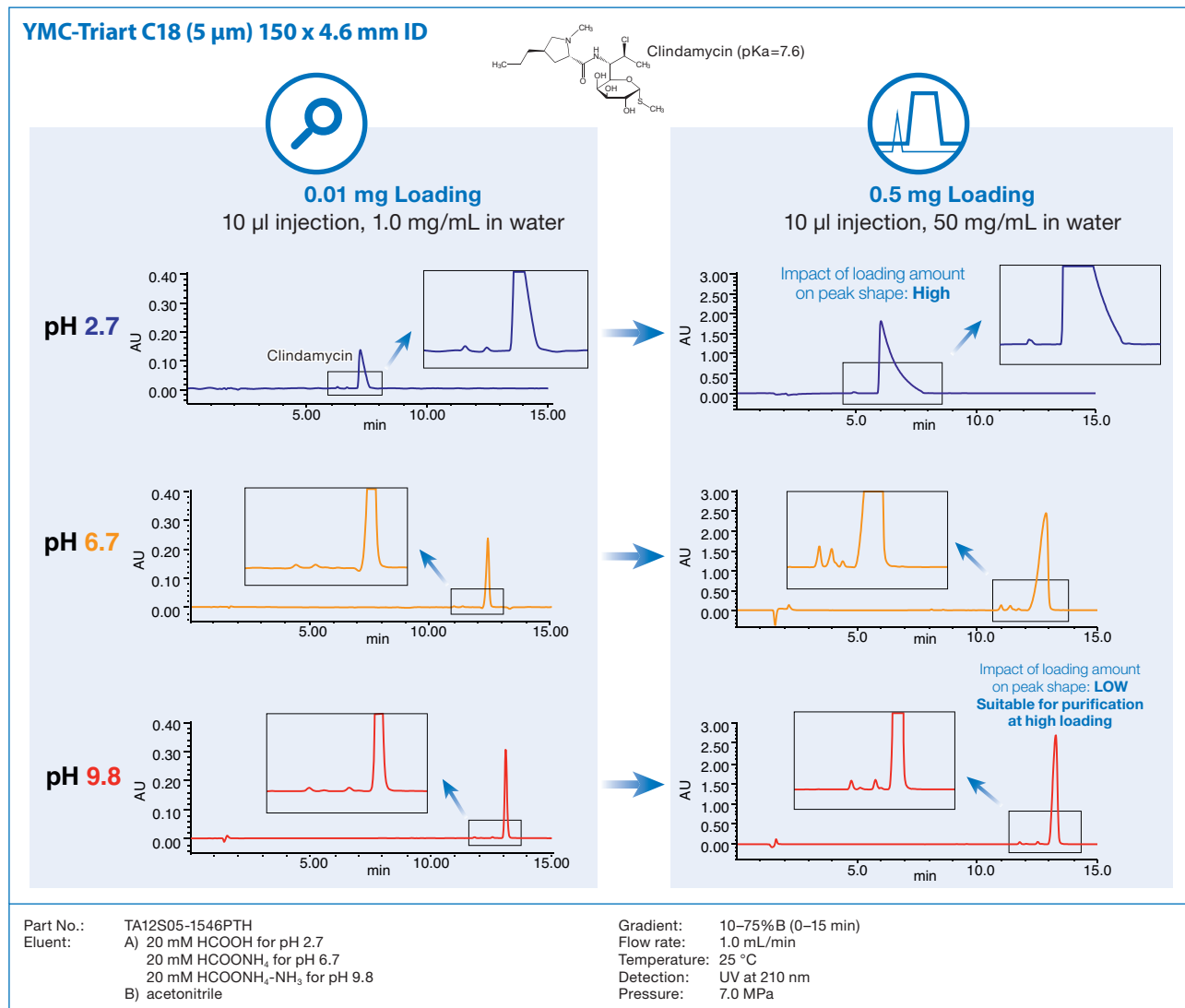
1. Chlorpheniramine (basic)  
 2. Dextromethorphan (basic)  
 3. Propyl paraben (internal standard)

## Effective purification method development!

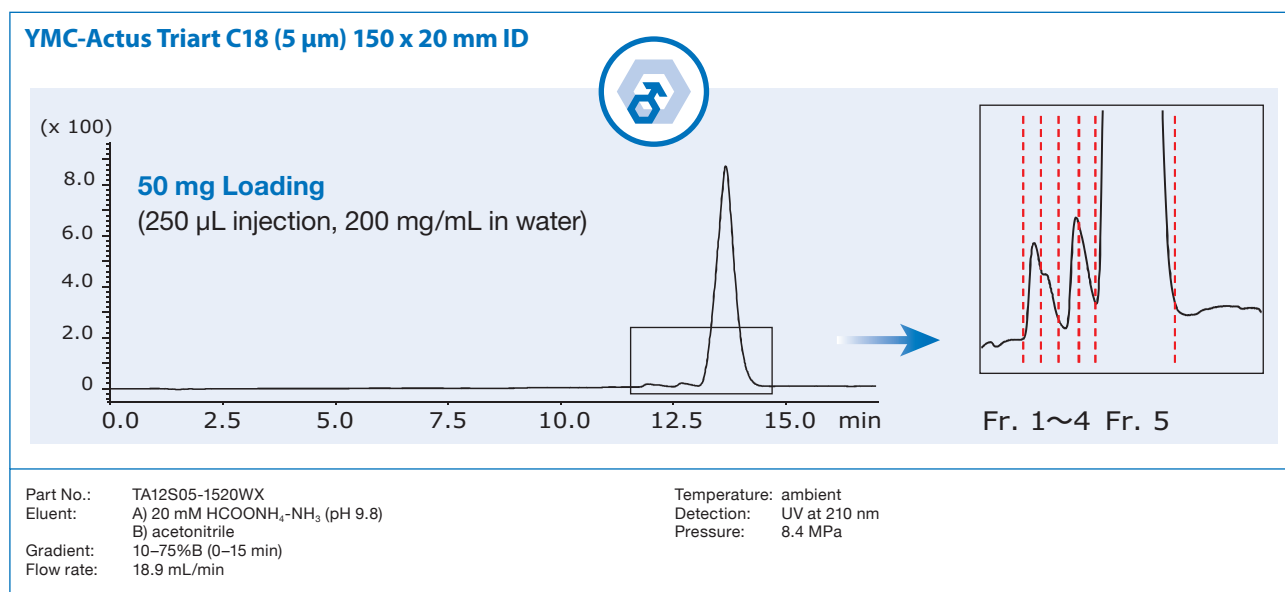


-  **Step 1** Developing a well optimised separation on an analytical scale
-  **Step 2** Loading study on an analytical scale
-  **Step 3** Scale-up to semi-preparative column dimensions
-  **Step 4** Quality control/proof of concept

## Development of the analytical method



## Quality control/proof of concept



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



### Step 1 Developing a well optimised separation on an analytical scale

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



### Step 2 Loading study on an analytical scale

Select the particle size of the packing material and the inner diameter of column appropriate for the sample volume. 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 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 more accurately predict loadability and calculations of the running costs.



### Step 3 Scale-up to semi-preparative column dimensions

Proceed with the preparative separation by scaling up the chromatographic parameters such as flow rate, column ID and sample load by the required factor. Of all the steps in this process, 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 which must be included: 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.



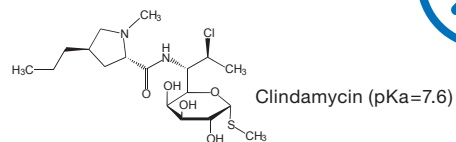
### Step 4 Quality control/proof of concept

Analyse the fractions from your purification.

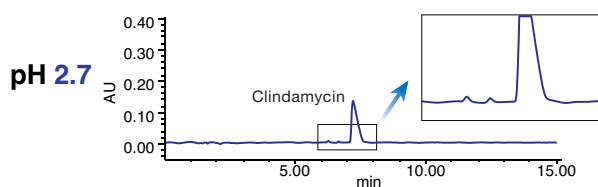
## Example: Separation of Clindamycin as basic drug

### Step 1 Development of the analytical method

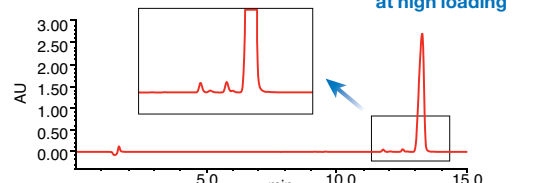
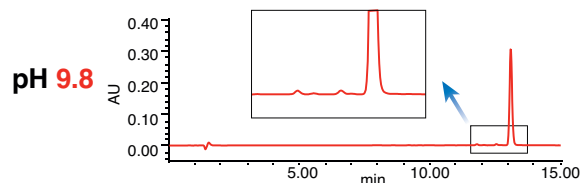
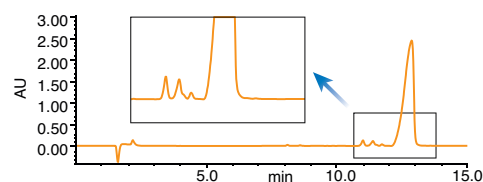
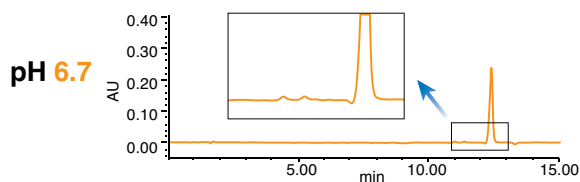
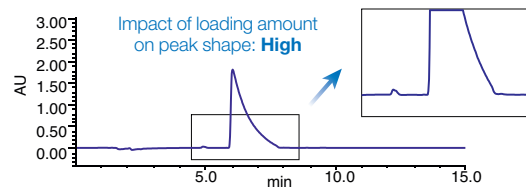
YMC-Triart C18 (5  $\mu$ m) 150 x 4.6 mm ID



**0.01 mg Loading**  
10  $\mu$ l injection, 1.0 mg/mL in water

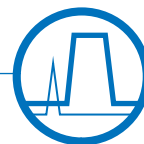


**0.5 mg Loading**  
10  $\mu$ l injection, 50 mg/mL in water

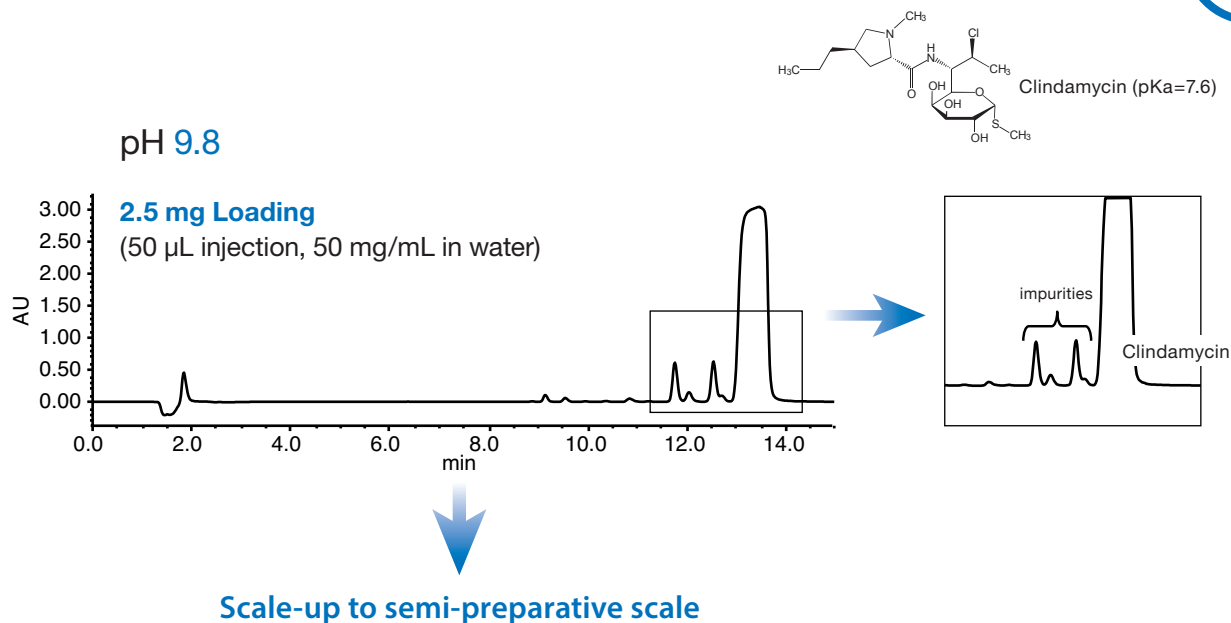


Part No.: TA12S05-1546PTH  
Eluent: A) 20 mM HCOOH for pH 2.7  
20 mM HCOONH<sub>4</sub> for pH 6.7  
20 mM HCOONH<sub>4</sub>-NH<sub>3</sub> for pH 9.8  
B) acetonitrile  
Gradient: 10-75%B (0-15 min)  
Flow rate: 1.0 mL/min  
Temperature: 25°C  
Detection: UV at 210 nm  
Pressure: 7.0 MPa

## Step 2 Loading study on an analytical scale

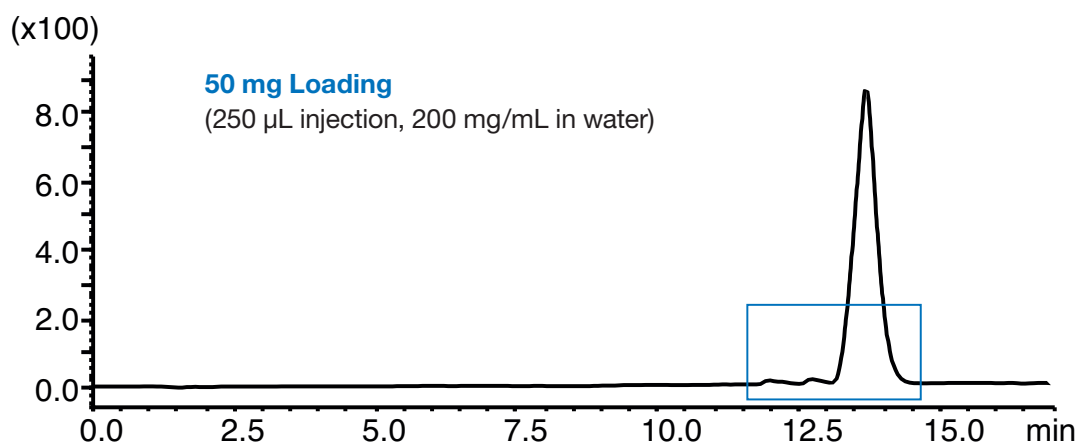


YMC-Triart C18 (5 µm) 150 x 4.6 mm ID



Part No.: TA12S05-1546PTH  
 Eluent: A) 20 mM HCOONH<sub>4</sub>-NH<sub>3</sub> for pH 9.8  
 B) acetonitrile  
 Gradient: 10–75%B (0–15 min)  
 Flow rate: 1.0 mL/min  
 Temperature: 25 °C  
 Detection: UV at 210 nm  
 Pressure: 7.0 MPa

## Step 3 Scale-up

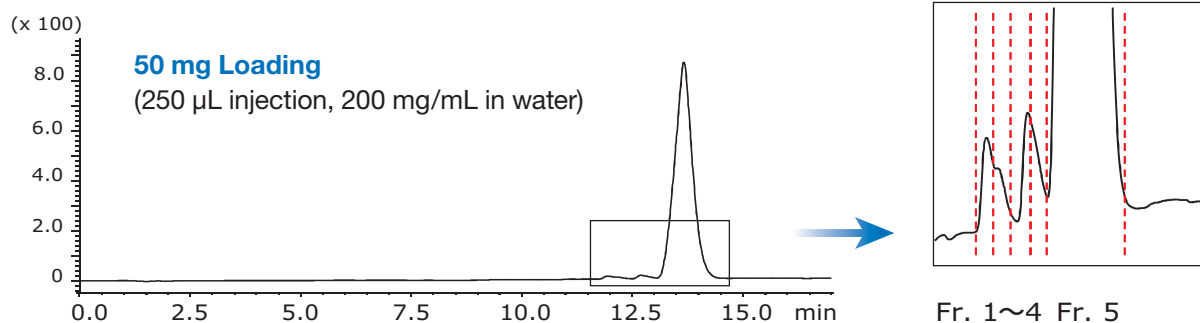


Part No.: TA12S05-1520WX  
 Eluent: A) 20 mM HCOONH<sub>4</sub>-NH<sub>3</sub> (pH 9.8)  
 B) acetonitrile  
 Gradient: 10–75%B (0–15 min)

Flow rate: 18.9 mL/min  
 Temperature: ambient  
 Detection: UV at 210 nm  
 Pressure: 8.4 MPa

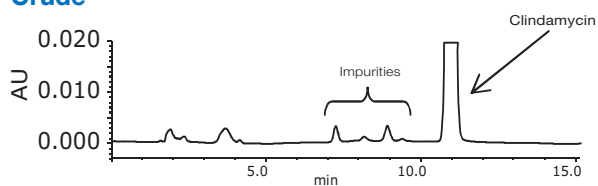
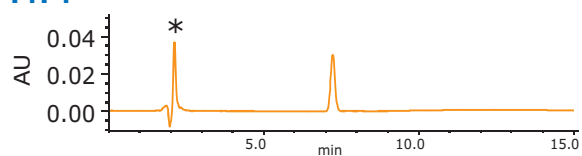
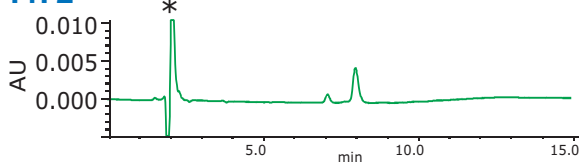
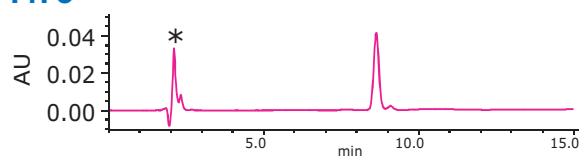
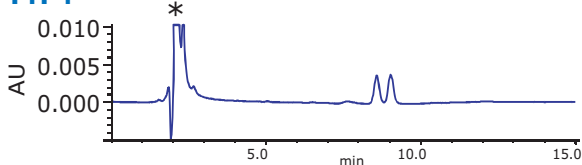
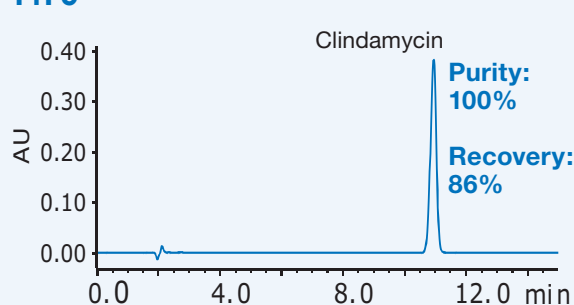
**Step 4** Quality control/proof of concept

Quality Control

**YMC-Actus Triart C18 (5 µm) 150 x 20 mm ID**

Part No.: TA12S05-1520WX  
 Eluent: A) 20 mM HCOONH<sub>4</sub>-NH<sub>3</sub> (pH 9.8)  
 B) acetonitrile  
 Gradient: 10–75%B (0–15 min)  
 Flow rate: 18.9 mL/min  
 Temperature: ambient

Detection: UV at 210 nm  
 Pressure: 8.4 MPa

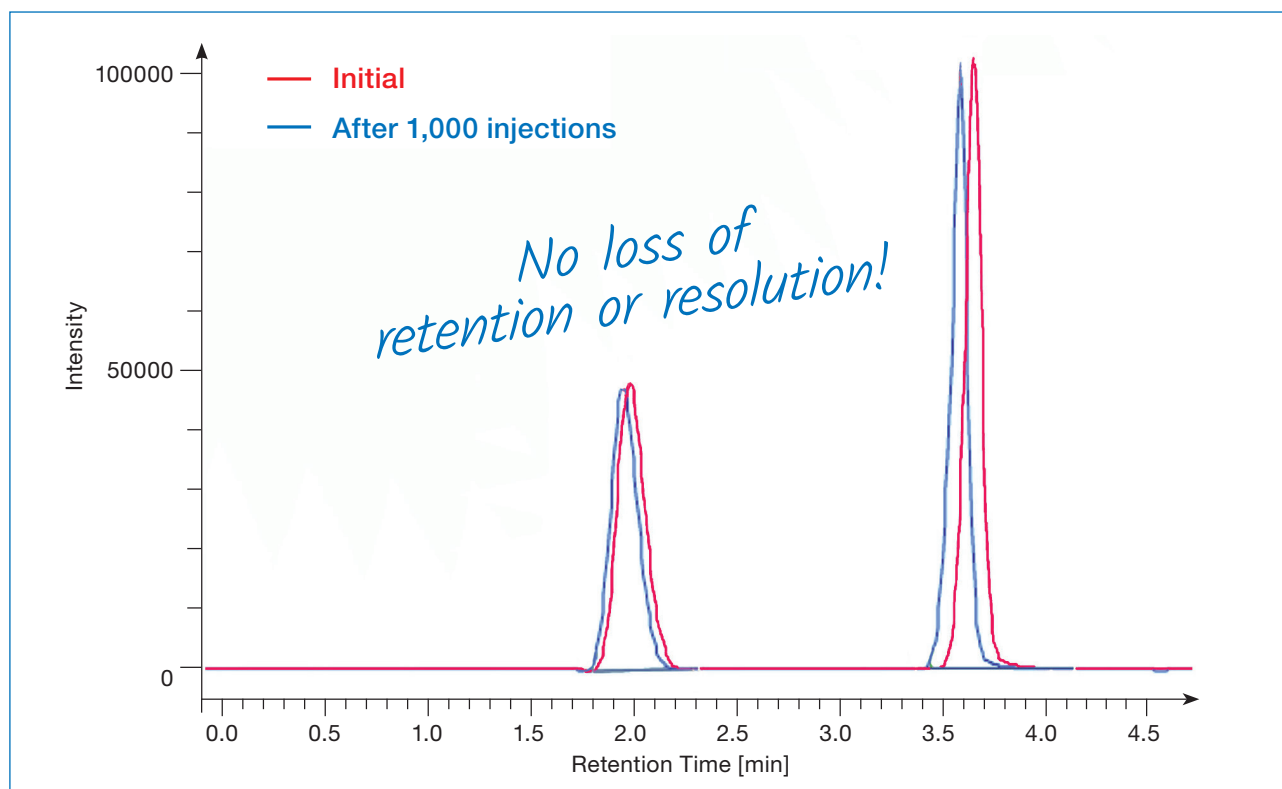
**Analysis of fractions****Crude****Fr. 1****Fr. 2****Fr. 3****Fr. 4****Fr. 5**

Column: YMC-Triart C18 (5 µm) 150 x 4.6 mm ID  
 Part No.: TA12S05-1546PTH  
 Eluent: 50 mM KH<sub>2</sub>PO<sub>4</sub> (pH 7.5 adjusted by 8 M KOH)/acetonitrile (55/45)  
 Flow rate: 1.0 mL/min  
 Temperature: 25 °C  
 Detection: UV at 210 nm  
 Injection: 20 µL

## YMC-Actus delivers SFC stability!

In general, the stability of chiral and achiral 50 mm ID SFC columns can often be reduced. Also, the inlet frit is often distorted after about 500 runs which leads to a silica leakage.

Using YMC-Actus for SFC long life times can be achieved as a result of the robust column packing. The following test shows the stability of YMC-Actus.



|                  | Repeated injections               | Standard test                                    |
|------------------|-----------------------------------|--------------------------------------------------|
| Mobile Phase     | CO <sub>2</sub> /methanol (70/30) | CO <sub>2</sub> /methanol (70/30)                |
| Flow Rate        | 195 mL/min                        | 195 mL/min                                       |
| Pressure         | 120 bar (at column head)          | 120 bar (at column head)                         |
| Detection        | 254 nm                            | 254 nm                                           |
| Temperature      | 30 °C                             | 30 °C                                            |
| Backpressure     | 100 bar                           | 100 bar                                          |
| Sample           | Methanol                          | 1. Toluene (5 µL/mL),<br>2. Caffeine (500 µg/mL) |
| Injection Volume | 1 mL (inject every 1 min)         | 1 mL (inject every 1 min)                        |
| Pressure drop    |                                   | 40 bar                                           |

In order to monitor column stability under a customer's usual SFC working conditions not only was a pressure of 120 bar (at column head) applied but 1 mL injections were also applied every minute with a pressure drop of 40 bar. The column performance was checked after every 100 injections.

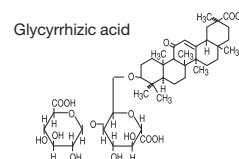
No significant change in performance could be detected after 1,000 repeated injections (corresponding to about 17 h).

Furthermore, no significant changes in retention time, theoretical plate count and tailing factor could be determined over the complete test period.

## YMC-Actus and YMC-Pack ODS-AQ

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

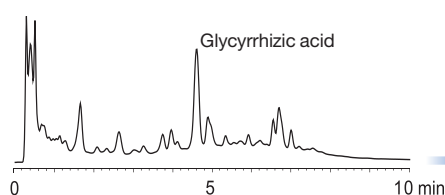
### Glycyrrhizic acid in herb medicine



#### Analysis:

**YMC-Pack ODS-AQ (5 µm) 50 x 4.6 mm ID**

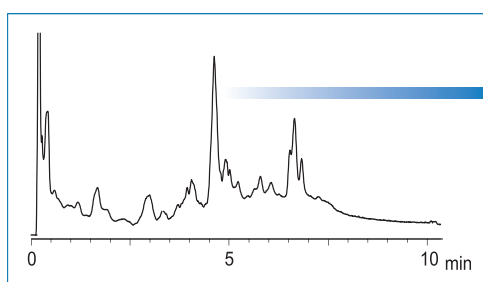
3 mL/min, 10 µl injection



#### Purification:

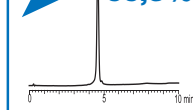
**YMC-Actus ODS-AQ (5 µm) 50 x 20 mm ID**

60 mL/min, 500 µl injection



After purification

**99,5%**



Part No.: AQ12S05-0546WT (analytical column)  
AQ12S05-0520WX (semi prep. column)  
Eluent: A) water/acetic acid (99/1)  
B) methanol/acetic acid (99/1)  
Gradient: 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)

## YMC-Actus and Hydrosphere C18

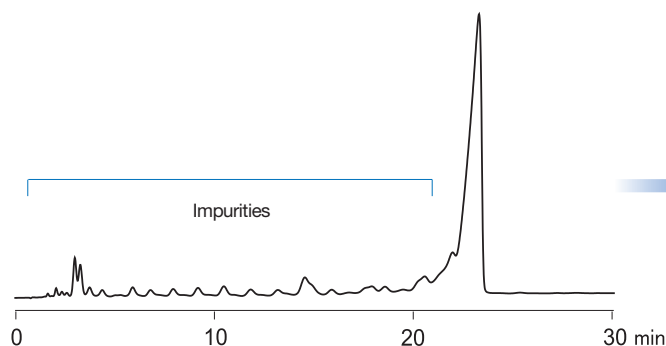
Outstanding separation of highly polar compounds

### Crude synthetic 30mer oligonucleotide

#### Analysis:

**Hydrosphere C18 (5 µm) 50 x 4.6 mm ID**

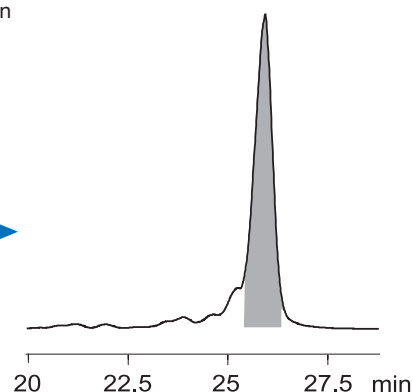
1 mL/min, 5 µl injection



#### Purification:

**YMC-Actus Hydrosphere C18 (5 µm) 50 x 20 mm ID**

60 mL/min, 500 µl injection

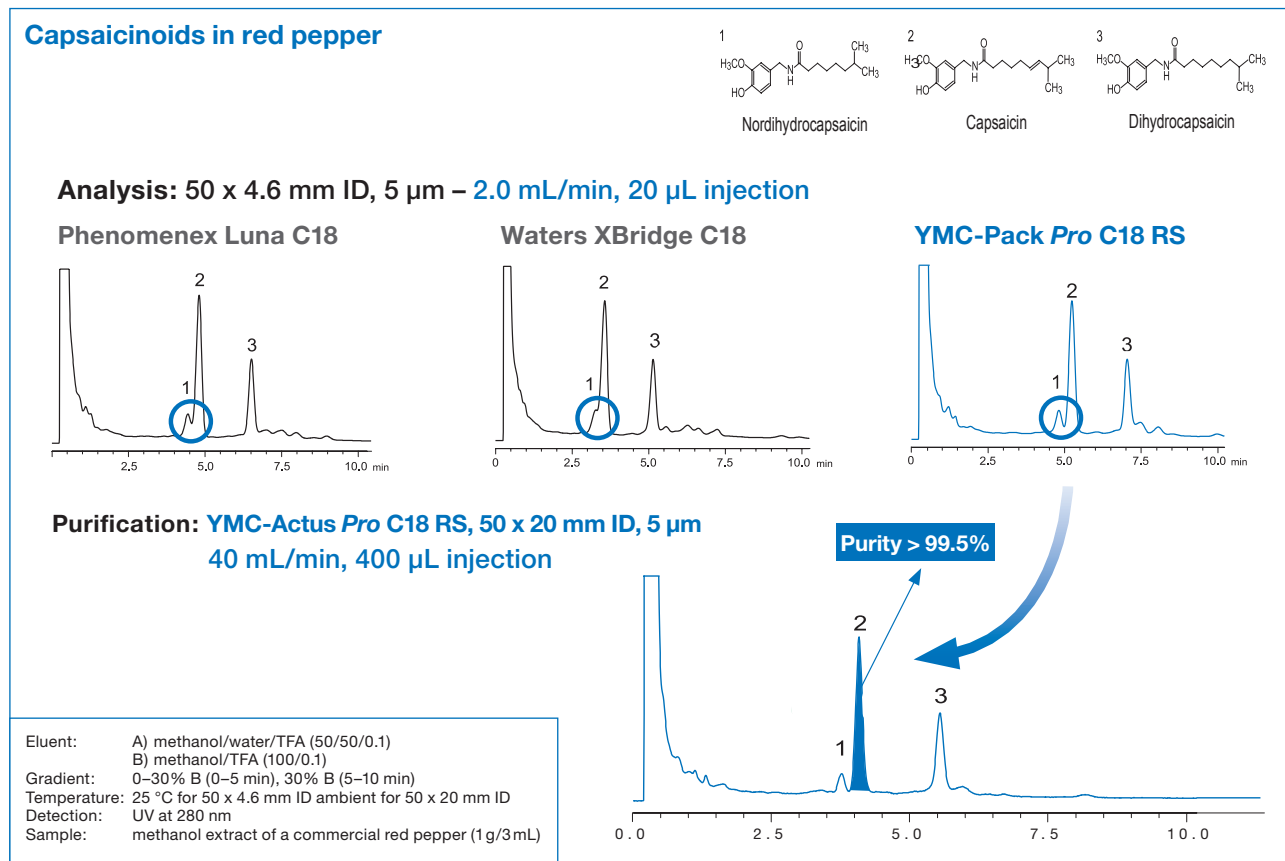


Part No.: HS12S05-0546WT (analytical column)  
HS12S05-0520WX (semi prep. column)  
Eluent: A) 10 mM DBA-acetic acid (pH 6.0)/methanol (60/40)  
B) 10 mM DBA-acetic acid (pH 6.0)/methanol (20/80)  
Gradient: 10–35% B (0–30 min)  
Temperature: ambient  
Detection: UV at 269 nm  
Sample: synthetic oligonucleotide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

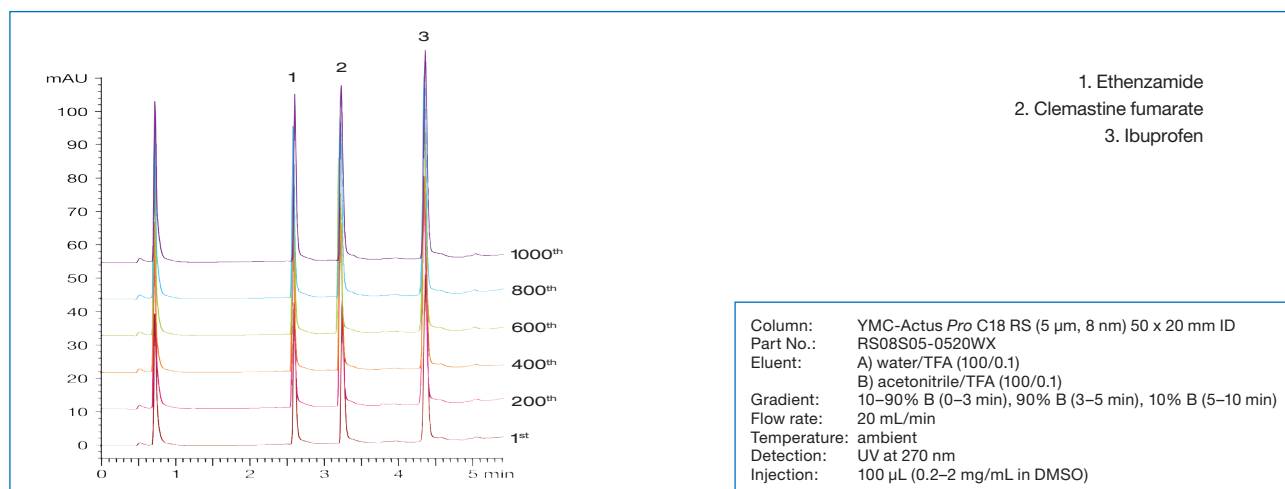
## YMC-Actus and YMC-Pack Pro C18 RS

### Excellent separation of compounds with similar structures

YMC-Actus shows the same excellent separation results as achieved with analytical columns. Even compounds with similar structures can be separated with high purities.



### Available for high-throughput purification: Injection in DMSO



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

## CHIRAL ART Immobilised Polysaccharide Derivatives Series

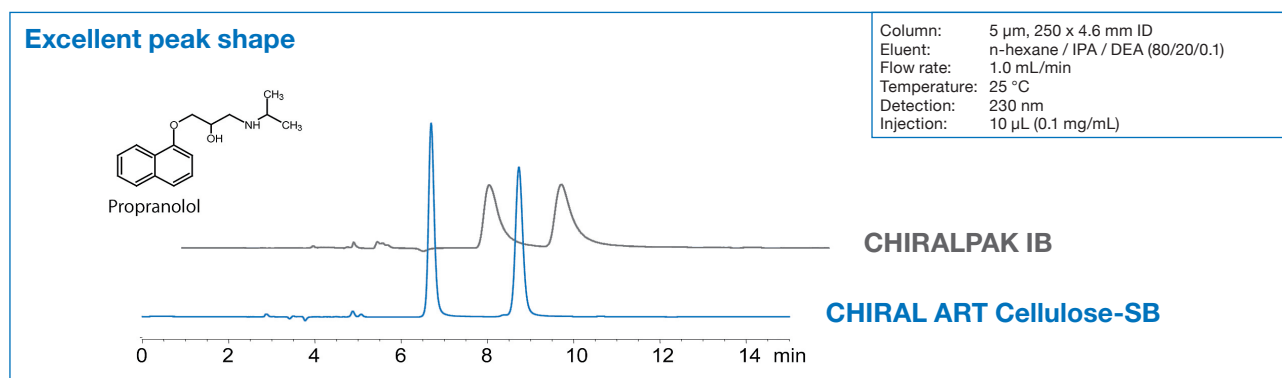
- applicable for normal and reversed phase modes
- unique immobilised chiral selector
- more flexibility due to wide range of usable solvents
- highly robust, also suitable for SFC/SMB
- HPLC columns and preparative grade bulk media with particle sizes of 3, 5, 10 or 20 µm available
- extremely attractive pricing

### Introduction

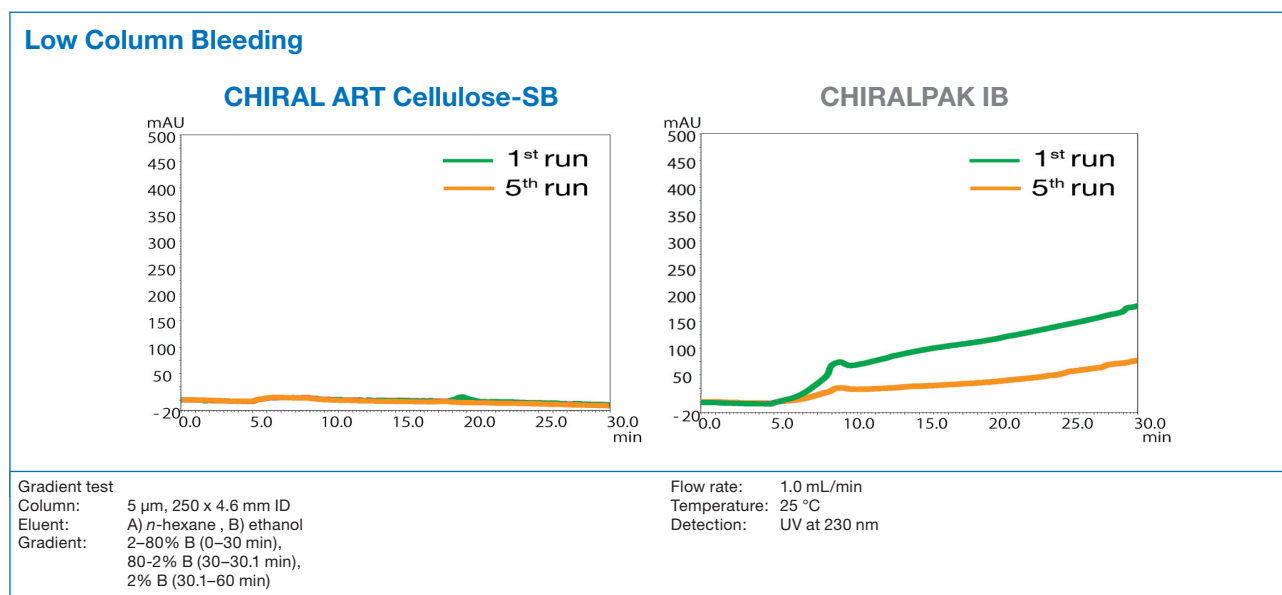
CHIRAL ART polysaccharide derivatives are a series of chiral separation columns/packing materials with high stereo-selectivity. They are suitable for separations of a wide range of chiral compounds, cis-trans isomers and geometric isomers. The range of particle sizes and column dimensions available offer outstanding cost effectiveness for analytical to preparative separations.

### Immobilised Type

CHIRAL ART immobilised polysaccharide derivatives can be used either in normal phase or in reversed phase modes. They are available in HPLC columns and in preparative grades, in large (multi kg) quantities.



CHIRAL ART polysaccharide derivatives provide excellent peak shapes for ionic and metal coordinating compounds.



## Immobilised Polysaccharide Derivatives Series

|                  | CHIRAL ART Amylose-SA                                           | CHIRAL ART Cellulose-SB                       | CHIRAL ART Cellulose-SC                       | CHIRAL ART Cellulose-SJ          |
|------------------|-----------------------------------------------------------------|-----------------------------------------------|-----------------------------------------------|----------------------------------|
| Particle size    | 3, 5, 10, 20 µm                                                 |                                               |                                               |                                  |
| Chiral selector  | Amylose tris (3,5-dimethylphenyl-carbamate)                     | Cellulose tris (3,5-dimethylphenyl-carbamate) | Cellulose tris (3,5-dichlorophenyl-carbamate) | Cellulose tris (4-methylbenzoat) |
| USP              | L99                                                             | —                                             | —                                             | —                                |
| Type             | Immobilised type                                                |                                               |                                               |                                  |
| Separation mode  | Normal Phase / Reversed Phase / SFC                             |                                               |                                               |                                  |
| Shipping solvent | n-hexane / 2-propanol (90/10)                                   |                                               |                                               |                                  |
| Usable pH-range  | 2.0–9.0                                                         |                                               |                                               |                                  |
| Temperature      | 0–40 °C                                                         |                                               |                                               |                                  |
| Pressure limit   | 20–30 mm ID: 30 MPa (4,351 psi)<br>50 mm ID: 20 MPa (2,900 psi) |                                               |                                               |                                  |

## Product Line-up

| Product name            | Particle size | CHIRAL selector                              | Type        | Competitive product                            |
|-------------------------|---------------|----------------------------------------------|-------------|------------------------------------------------|
| CHIRAL ART Amylose-SA   | 3 µm          | Amylose tris (3,5-dimethylphenylcarbamate)   | Immobilised | CHIRALPAK® IA, IA-3                            |
| CHIRAL ART Cellulose-SB | 5 µm          | Cellulose tris (3,5-dimethylphenylcarbamate) |             | CHIRALPAK® IB, IB-3                            |
| CHIRAL ART Cellulose-SC | 10 µm         | Cellulose tris (3,5-dichlorophenylcarbamate) |             | CHIRALPAK® IC, IC-3                            |
| CHIRAL ART Cellulose-SJ | 20 µm         | Cellulose tris (4-methylbenzoat)             |             | same chiral selector as CHIRALPAK® OJ (coated) |

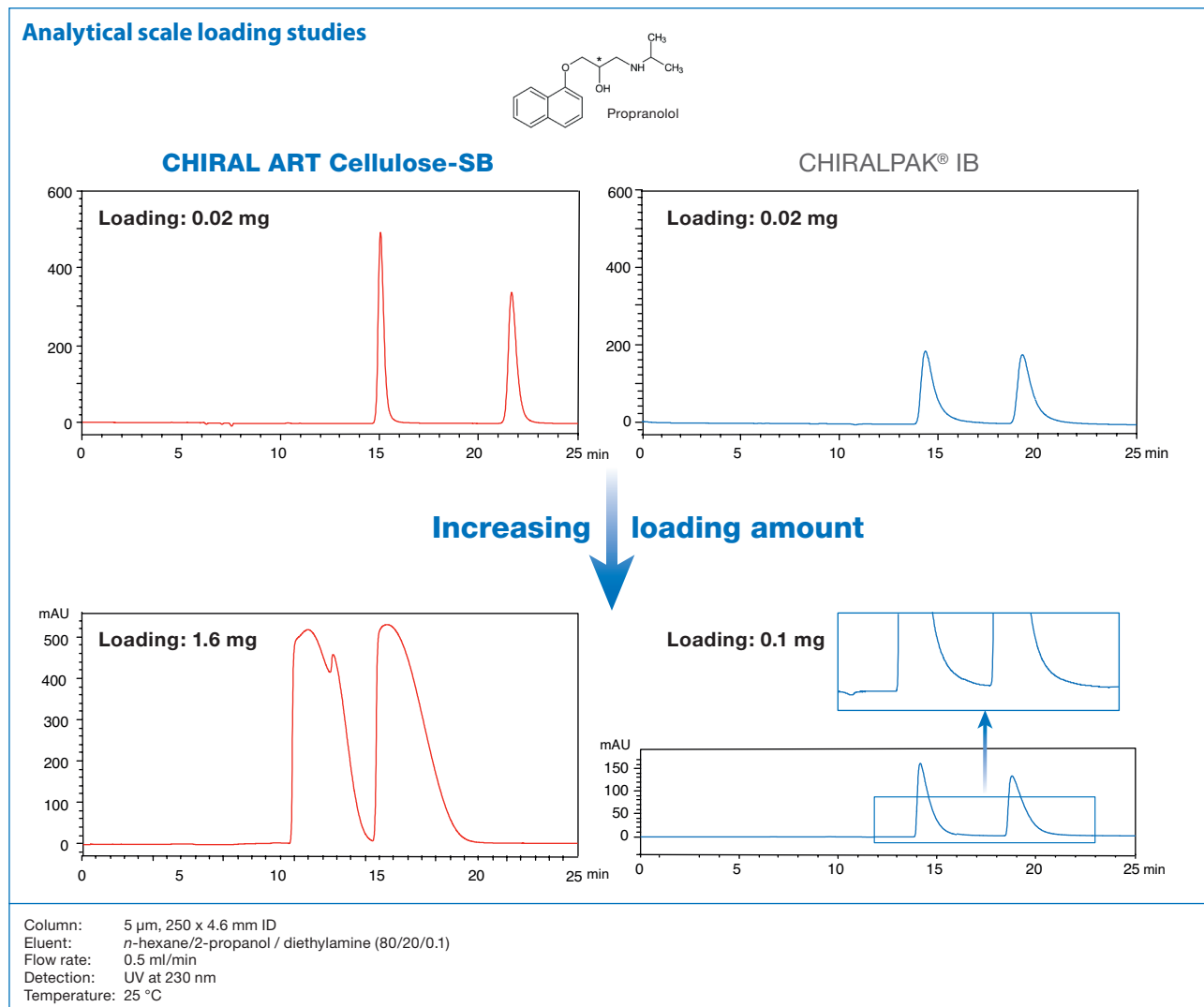
## Column Care

The recommended pH range for using CHIRAL ART immobilised polysaccharide columns is 2.0-9.0. Remove acid and buffer salts before storage. Store the column in n-hexane/2-propanol = 90/10 (NP) or methanol/water = 50/50 (RP).

If columns are affected by undesired contaminants or clogged inlet frits which cause back pressure increases, flush the column (in the reversed direction) with ethanol.

For detailed information please refer to the "Column Care and Use Instructions" which can be downloaded from [www.ymc.de/support-documentation.html](http://www.ymc.de/support-documentation.html).

## Efficient purification using YMC-Actus CHIRAL ART



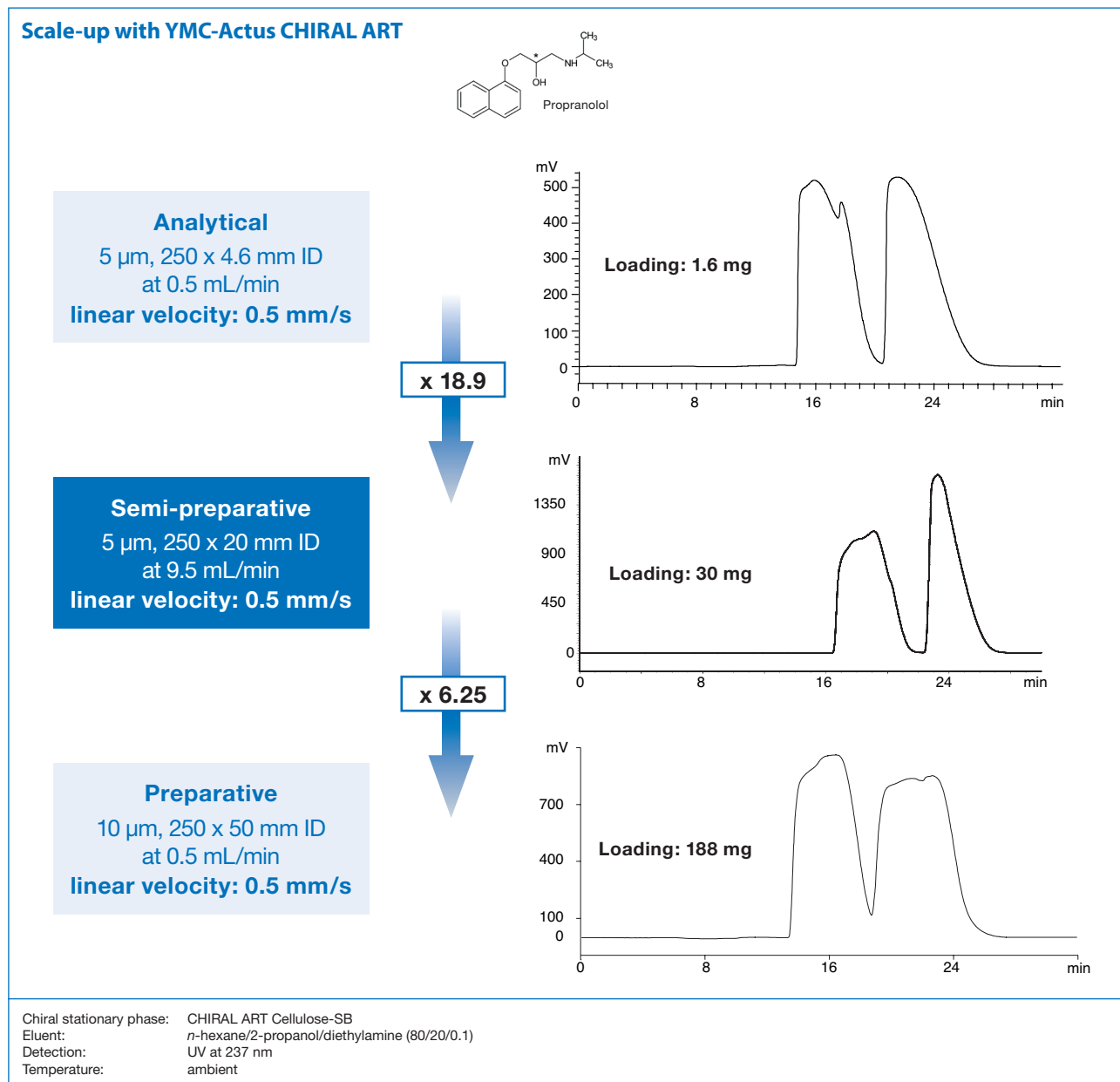
With the competitor's product, loading amounts of more than 0.1 mg was not possible because the enantiomeric excess of the 2nd peak was already less than 98%ee with a loading amount of 0.1 mg.

|                      | CHIRAL ART Cellulose-SB |                      | CHIRALPAK® IB        |                      |
|----------------------|-------------------------|----------------------|----------------------|----------------------|
|                      | 1 <sup>st</sup> peak    | 2 <sup>nd</sup> peak | 1 <sup>st</sup> peak | 2 <sup>nd</sup> peak |
| Enantiomeric excess  | >99.9%ee                | 99.3%ee              | >99.9%ee             | 97.9%ee              |
| Recovery             | 99%                     | 99%                  | 99%                  | 97%                  |
| Productivity (mg/h)* | 3.1                     | 3.3                  | 0.3                  | 0.3                  |

\*Calculated for repeated injections every 15 minutes (CHIRAL ART Cellulose-SB) and every 10 minutes (CHIRALPAK® IB).

The calculated maximum loading amount on CHIRAL ART Cellulose-SB of 1.6 mg was 10 times larger than that obtained for the competitor's product due to the large differences in the peak shapes, even though the interval between repeat injections was longer!

## Efficient purification using YMC-Actus CHIRAL ART



|                     | Analytical<br>250 x 4.6 mm ID |                      | YMC-Actus<br>Semi-preparative<br>250 x 20 mm ID |                      | Self-packed<br>DAC Preparative<br>250 x 50 mm ID |                      |
|---------------------|-------------------------------|----------------------|-------------------------------------------------|----------------------|--------------------------------------------------|----------------------|
|                     | 1 <sup>st</sup> peak          | 2 <sup>nd</sup> peak | 1 <sup>st</sup> peak                            | 2 <sup>nd</sup> peak | 1 <sup>st</sup> peak                             | 2 <sup>nd</sup> peak |
| Enantiomeric excess | >99.9% ee                     | 99.3% ee             | 99.9% ee                                        | 99.8% ee             | 99.1% ee                                         | 99.3% ee             |
| Recovery            | 99%                           | 99%                  | 97%                                             | 99%                  | 99%                                              | 94%                  |
| Productivity (mg/h) | 3.1                           | 3.3                  | 58.6                                            | 62.4                 | 366                                              | 390                  |

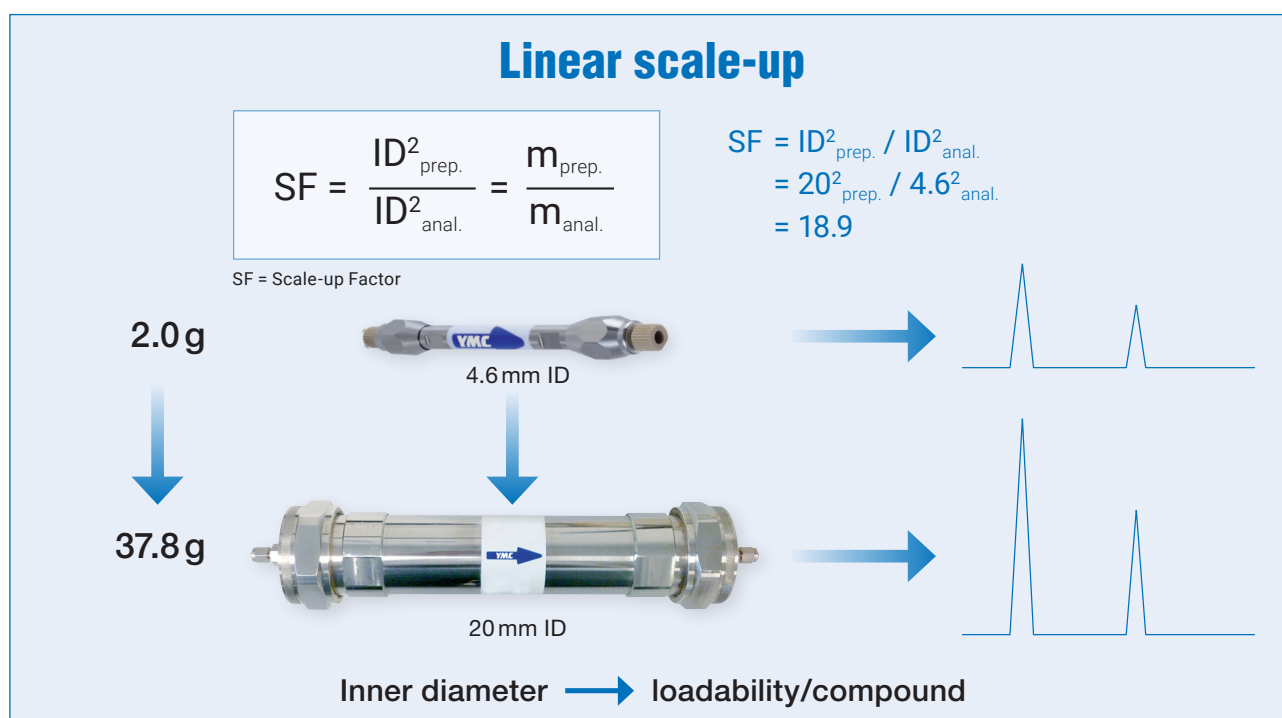
Linear scale-up was performed using the appropriate scaling factors. The Dynamic Axial Compression Column self-packed with CHIRAL ART Cellulose-SB 10  $\mu$ m can be easily and linearly scaled-up for an even greater purification scale. The final productivity is 366 and 390 mg/h respectively for peaks 1 and 2.

## Linear scale-up

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

| Scalable factor SF | ID "Linear scale-up"                     | Column length                                | Column length and ID "Volume"                                              |
|--------------------|------------------------------------------|----------------------------------------------|----------------------------------------------------------------------------|
|                    | $SF = \frac{ID_{prep.}^2}{ID_{anal.}^2}$ | $SF = \frac{L_{prep.}}{L_{anal.}}$           | $SF = \frac{ID_{prep.}^2}{ID_{anal.}^2} / \frac{L_{prep.}^2}{L_{anal.}^2}$ |
| Impact             | Flow rate<br>Eluent composition          | Retention time<br>Cycle time<br>Plate number | Amount of adsorbent                                                        |

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



### Guideline for Sample Load according to column ID

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

## Optimisation of preparative chromatography

The main task for a preparative chromatographer is to find the suitable system. In order to simplify the decisions that have to be made YMC have developed a **“Preparative Column Selection Guide”**.

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

**Flow rate equation** (Use the same equation to calculate the sample load)

$$F' = F \times (Dc'/Dc)^2$$

F': Analytical column flow rate [mL/min]

F: Preparative column flow rate [mL/min]

Dc: Analytical column diameter [mm ID]

Dc': Preparative column diameter [mm ID]

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

The **“Preparative Column Selection Guide”** will help selection of:

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

**Application data mainly by courtesy of YMC Co., Ltd.**

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## Ordering Information

**Product code:** **XXXXXXX-**  
Phase (code)

### Available Phases

| Phase                    | Particle size [μm] | Pore size [nm] | Phase code |
|--------------------------|--------------------|----------------|------------|
| YMC-Triart C18           | 5                  | 12             | TA12S05-   |
| YMC-Triart C18 ExRS      | 5                  | 8              | TAR08S05-  |
| YMC-Triart Bio C18       | 5                  | 30             | TA30S05-   |
| YMC-Triart C8            | 5                  | 12             | TO12S05-   |
| YMC-Triart Bio C4        | 5                  | 30             | TB30S05-   |
| YMC-Triart Phenyl        | 5                  | 12             | TPH12S05-  |
| YMC-Triart PFP           | 5                  | 12             | TPF12S05-  |
| YMC-Pack Pro C18         | 5                  | 12             | AS12S05-   |
| Hydrosphere C18          | 5                  | 12             | HS12S05-   |
| YMC-Pack Pro C18 RS      | 5                  | 8              | RS08S05-   |
| YMC-Pack Pro C8          | 5                  | 12             | OS12S05-   |
| YMC-Pack Pro C4          | 5                  | 12             | BS12S05-   |
| YMC-Pack ODS-A           | 10                 | 12             | AA12S05-   |
| YMC-Pack ODS-AQ          | 15                 | 12             | AQ12S05-   |
| YMCbasic                 | 20                 | 20             | BA99S05-   |
| YMC-Triart Prep C18-S    | 7                  | 12             | TAS12S07-  |
|                          | 10                 | 12             | TAS12S11-  |
|                          | 15                 | 12             | TAS12S16-  |
|                          | 20                 | 12             | TAS12S21-  |
| YMC-Triart Prep C8-S     | 10                 | 20             | TOS20S11-  |
|                          | 15                 | 20             | TOS20S16-  |
|                          | 20                 | 20             | TOS20S21-  |
| YMC Omega                | 10                 | –              | OMG99S11-  |
| CHIRAL ART Amylose-C     | 5                  | –              | KAN99S05-  |
|                          | 10                 | –              | KAN99S11-  |
|                          | 20                 | –              | KAN99S21-  |
| CHIRAL ART Amylose-C Neo | 5                  | –              | KBN99S05-  |
|                          | 10                 | –              | KBN99S11-  |
|                          | 20                 | –              | KBN99S21-  |
| CHIRAL ART Cellulose-C   | 5                  | –              | KCN99S05-  |
|                          | 10                 | –              | KCN99S11-  |
|                          | 20                 | –              | KCN99S21-  |
| CHIRAL ART Amylose-SA    | 5                  | –              | KSA99S05-  |
|                          | 10                 | –              | KSA99S11-  |
|                          | 20                 | –              | KSA99S21-  |
| CHIRAL ART Cellulose-SB  | 5                  | –              | KSB99S05-  |
|                          | 10                 | –              | KSB99S11-  |
|                          | 20                 | –              | KSB99S21-  |
| CHIRAL ART Cellulose-SC  | 5                  | –              | KSC99S05-  |
|                          | 10                 | –              | KSC99S11-  |
|                          | 20                 | –              | KSC99S21-  |
| CHIRAL ART Cellulose-SJ  | 5                  | –              | KSJ99S05-  |
|                          | 10                 | –              | KSJ99S11-  |
|                          | 20                 | –              | KSJ99S21-  |

**-XXXXXX**  
Hardware/Dimensions (code)

Example: YMC-Triart C18 5 µm, 100 x 20 mm ID  
1. Phase code: **TA12S05-**  
2. Hardware code: **-1020WX**  
➔ **Product code: TA12S05-1020WX**

Available Dimensions

| Column ID<br>[mm] | Column length (mm) |         |         |         |         | Guard<br>cartridges*<br>with 10 mm<br>length<br><br>(pack of 2) |
|-------------------|--------------------|---------|---------|---------|---------|-----------------------------------------------------------------|
|                   | 50                 | 75      | 100     | 150     | 250     |                                                                 |
| 20                | -0520WX            | –       | -1020WX | -1520WX | -2520WX | -0120CCN                                                        |
| 30                | -0530WX            | -L530WX | -1030WX | -1530WX | -2530WX | -0130CCN                                                        |
| 50                | –                  | –       | -1053DX | -1553DX | -2553DX | (-0553DXG)**                                                    |

\*holder required: 20 mm guard column ID: XPGHFSP20ID; 30 mm guard column ID: XPGHFSP30ID

\*\*no holder required for 50 x 50 mm ID guard columns (no cartridge)

YMC-Actus CHIRAL ART columns are available with 100 mm, 150 mm and 250 mm length.

50 mm ID columns are also available  
with a 1/16" connection (AX) while the standard is a 1/8" connection (DX).

Adapter for 1/8" Connection: DX



Adapter for 1/16" Connection: AX



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