



TOSOH

SkillPak™ Pre-Packed Columns

High Performance

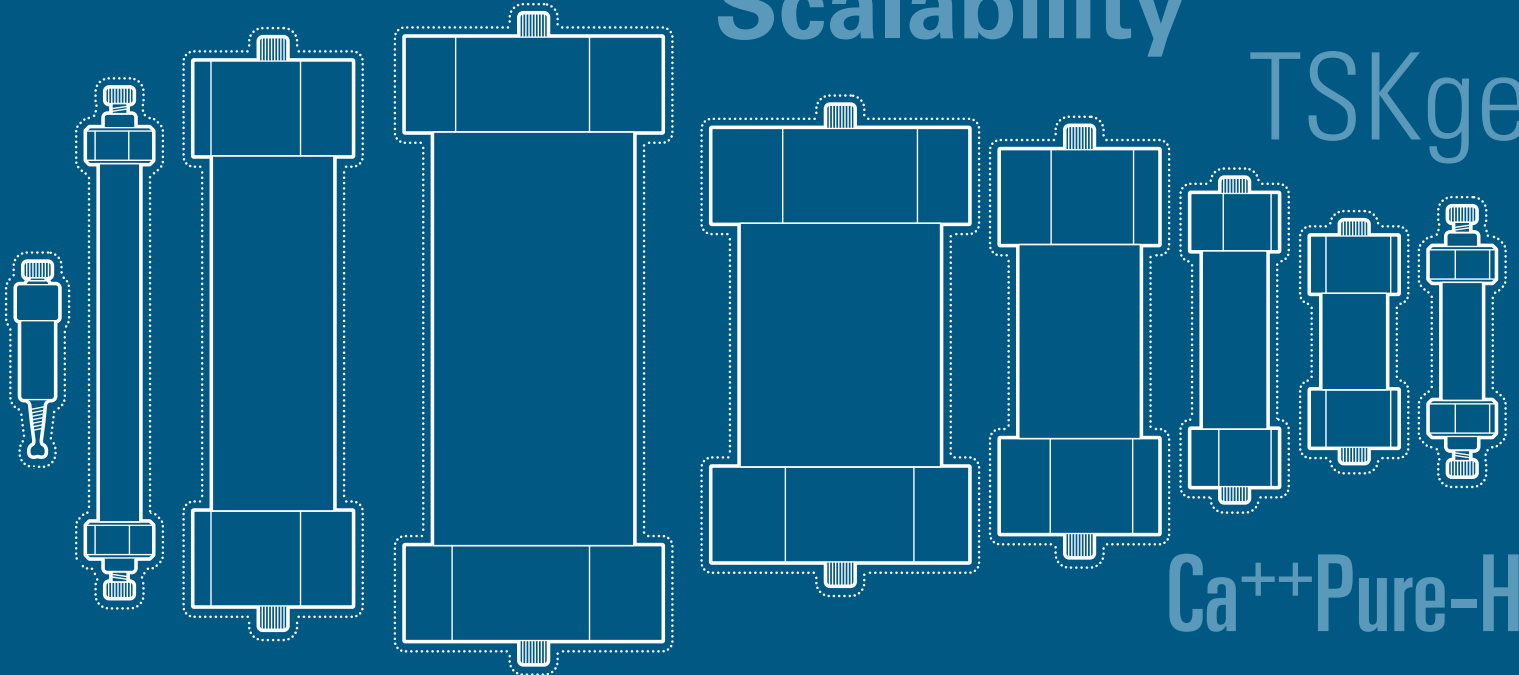
Convenience

SkillPak

Multi-Column Chromatography

Scalability

TSKgel



Ca⁺⁺Pure-HA

Method Development

SkillPak BIO

TOYOPEARL

MCC



Experts in Chromatography

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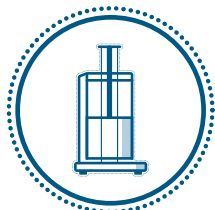


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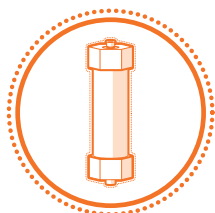
Solutions for Your Purification and Separation Tasks from Lab to Production

Tosoh Bioscience is a leading supplier of chromatographic media, columns and gel permeation chromatography (GPC) instruments with over 500 specialty products to meet your analysis and purification needs.



TOYOPEARL[®], TSKgel[®] & Ca⁺⁺Pure-HA[™] Resins

TOYOPEARL and TSKgel chromatography resins are specifically designed for the purification of biomolecules. Ca⁺⁺Pure-HA is a hydroxyapatite resin and has unique separation properties for biomolecules. These resins show excellent physical strength and ideal flow characteristics for industrial downstream processing.



SkillPak[™] Pre-packed Columns

SkillPak columns are designed to simplify preparative LC. These columns are pre-packed with our best-in-class resins and are available in various dimensions to address all method development, scale-up, and process purification needs.



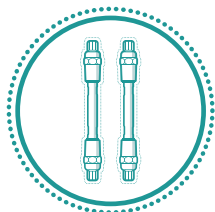
Octave[™] Multi-Column Chromatography Systems

The Octave MCC instruments are comprehensive and versatile multi-column chromatography systems with a modular design and added functionalities that support a range of process scales, implementations, and applications, including continuous purification.



LenS[™]₃ Multi-Angle Light Scattering Detectors

The LenS₃ MALS detector offers a revolutionary approach for the measurement of molecular weight (MW) and radius of gyration (Rg) of delivery vectors, biomolecules, synthetic polymers, polysaccharides, and biopolymers.



TSKgel U/HPLC Columns

Extensively used in laboratories all over the world, our TSKgel columns are designed for researchers seeking the highest level of performance. Covering the total range of U/HPLC, these columns offer high resolution, excellent reproducibility and long column life. Scaling up from analytical to preparative columns is made simple and easy.



EcoSEC[™] GPC Systems

The EcoSEC series of fully automated liquid chromatography systems for gel permeation chromatography is designed for robust polymer analysis. Both solutions, for ambient and for high temperature GPC, combine dual pump solvent systems, sophisticated heating and a highly efficient detection system to deliver the highest reproducibility.

This brochure will introduce you to SkillPak pre-packed columns for the purification of biomolecules.

Introduction

SkillPak pre-packed columns offer a comprehensive solution for your batch and multi-column chromatography development from platform design to pilot scale. Ready to use upon receipt, SkillPak pre-packed columns show excellent physical strength and ideal flow characteristics for downstream processing. Furthermore, customers benefit from short lead times for all dimensions and resins.

SkillPak 1, 5, 50, and 200 have been specifically developed for batch chromatography applications. Pre-packed with TOYOPEARL, TSKgel, or Ca⁺⁺Pure-HA process chromatography media, these columns offer superior performance for the purification of biomolecules, such as monoclonal antibodies, proteins, and oligonucleotides. SkillPak 1 and SkillPak 5 columns are designed for fast method development, resin screening, or sample concentration, while SkillPak 50 and SkillPak 200 columns allow seamless scale-up of chromatography processes after method development on SkillPak 1 and SkillPak 5 columns. All SkillPak columns guarantee optimal performance and can be operated with standard low- or medium-pressure liquid chromatography systems. They are reproducibly packed and take into account the varying compressibility of each resin, providing an accurate representation of conditions found in full-scale columns.

In addition to SkillPak columns for batch process development, Tosoh Bioscience also offers SkillPak BIO pre-packed columns designed explicitly for multi-column chromatography (MCC) process development. SkillPak BIO pre-packed columns, combined with Tosoh Bioscience's Octave™ BIO MCC system and TOYOPEARL resins, offer a unique and comprehensive solution for developing MCC processes. With dedicated dimensions and TOYOPEARL resins chosen carefully for MCC applications, SkillPak BIO columns are designed to unlock the best MCC experience. Moreover, SkillPak BIO columns are provided as kits containing a single resin lot with minimal column-to-column variability, ensuring optimal MCC performance.

Whether you aim for fast batch method development or look for a unique pre-packed column offering for the development of MCC processes, SkillPak pre-packed columns are the solution for your purification and separation needs.



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Simplify Your Batch Method Development



SkillPak Pre-packed Columns

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- A go-to solution for DSP method development.
- A technology that facilitates seamless scale-up.
- Optimal performance on standard low- or medium-pressure LC systems.
- Available in 1, 5, 50, and 200 mL column volumes of TOYOPEARL, TSKgel and Ca⁺⁺Pure-HA resins.
- Ready to use on receipt, with short delivery times.

SkillPak pre-packed columns are an essential component of Tosoh Bioscience's comprehensive solution for developing and scaling up purification processes for biomolecules, such as monoclonal antibodies, proteins, and oligonucleotides. SkillPak pre-packed columns are designed for purification and separation tasks from platform design to pilot scale. The columns are available off the shelf and ready to use, showing excellent physical strength and ideal flow characteristics for industrial downstream processing.

Based on Tosoh Bioscience's decades of expertise in packing chromatography media, SkillPak column design and packing procedures employ tightly controlled methods to pack TOYOPEARL, TSKgel, and Ca⁺⁺Pure-HA into the columns. This ensures that each column is consistently packed to the same level of performance, providing reproducible results for the batch process development work of biopharma experts. Additionally, customers benefit from short lead times thanks to Tosoh Bioscience's complete control of the media and hardware supply chain.

SkillPak 1 and SkillPak 5 columns are designed for fast method development, resin screening, or sample concentration. SkillPak 50 and SkillPak 200 columns allow seamless scale-up of chromatography processes after method development on SkillPak 1 and SkillPak 5 columns. Each column is reproducibly packed and takes into account the varying compressibility of each resin, providing an accurate representation of conditions found in full-scale columns.

In the following pages, we will explore the specifications, benefits, and features of SkillPak pre-packed columns and how they can enhance the productivity and efficiency of purification process development efforts.

Short lead times

Tosoh Bioscience recognizes the importance of prompt delivery for process development products and has implemented a vertically integrated supply chain to ensure quick turnaround times for our SkillPak pre-packed columns. With most screening/method development dimensions available off the shelf, customers can initiate their process development work in a matter of days. For SkillPak pre-packed columns not available off the shelf, we have a lead time of 4-6 weeks, as we established a stock of resin at our production facility.

By utilizing our vertically integrated supply chain, customers can focus on their process development without delay or concern over the availability and consistency of SkillPak pre-packed columns.

Tables 1 to 4 list the properties and operation specifications of the SkillPak 1, 5, 50, and 200 columns. These columns guarantee optimal performance and can be operated with commonly used low or medium pressure liquid chromatography systems. They are reproducibly packed and take into account the varying compressibility of each resin. This provides an accurate representation of conditions found in production scale columns.

Table 1. Properties and operation specifications of SkillPak 1 columns

| | |
|----------------------------|---|
| Column dimension | 0.7 cm ID × 2.5 cm bed height |
| Volume | 1 mL |
| Maximum flow rate | 4 mL/min (600 cm/h) |
| Maximum operating pressure | 0.3 MPa |
| Connections | Standard fittings (10-32 for 1/16 inch capillary) |
| Shipping buffer | 20% ethanol for TOYOPEARL and TSKgel [with the exception of 0.5 mol/L sodium citrate with 20% ethanol for TSKgel SP-5PW (20) and SuperQ-5PW (20)], 20 mmol/L sodium phosphate with 20% ethanol for Ca ⁺⁺ Pure-HA |

Table 2. Properties and operation specifications of SkillPak 5 columns

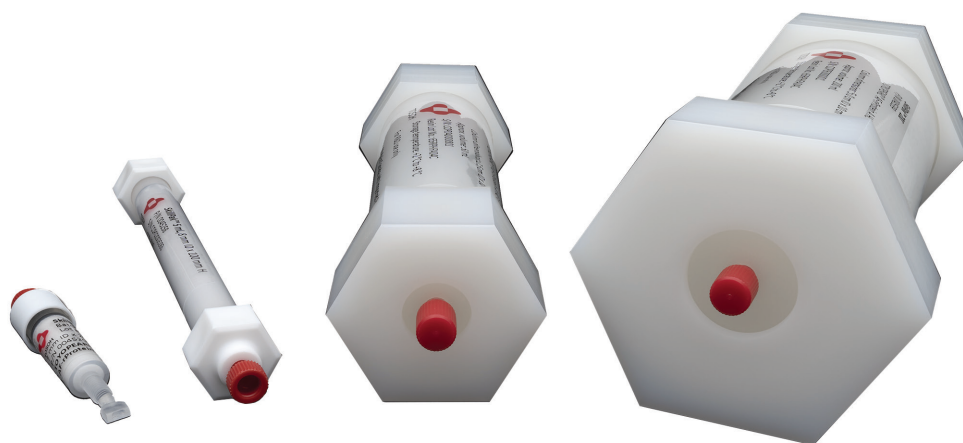
| | |
|--------------------------------------|---|
| Column dimension | 0.8 cm ID × 10 cm bed height |
| Volume | 5 mL |
| Standard flow rate | 1.3 mL/min (150 cm/h) |
| Maximum flow rate | 5 mL/min (600 cm/h) for TOYOPEARL M and C grade resins; 2.5 mL/min (300 cm/h) for TSKgel, Ca ⁺⁺ Pure-HA and TOYOPEARL S- and F-grade resins, including TOYOPEARL AF-rProtein A HC-650F and TOYOPEARL AF-rProtein L-650F; 1.6 mL/min (200 cm/h) for TOYOPEARL Phenyl-650S |
| Maximum operating pressure | 0.3 MPa for TOYOPEARL resins, ≤ 0.4 MPa for TSKgel resins and Ca ⁺⁺ Pure-HA |
| Connections | Standard fittings (10-32 for 1/16 inch capillary) |
| Shipping buffer | 20% ethanol for TOYOPEARL and TSKgel, 20 mmol/L sodium phosphate with 20% ethanol for Ca ⁺⁺ Pure-HA |
| Asymmetry factor (As) specifications | 0.8-1.4 for TOYOPEARL and TSKgel, 0.8-2.6 for Ca ⁺⁺ Pure-HA |

Table 3. Properties and operation specifications of SkillPak 50 columns

| | |
|---|---|
| Column dimension | 2.5 cm ID x 10 cm bed height |
| Volume | approx. 50 mL (see labels and CoA) |
| Maximum recommended flow rate - in 2 mol/L NaCl for HIC media - in 1 mol/L NaCl for all other media | <ul style="list-style-type: none"> • ≤ 500 cm/h for most TOYOPEARL S, M, F, and C grade resins • ≤ 450 cm/h for TSKgel SP-5PW (20) • ≤ 400 cm/h for TOYOPEARL SuperQ-650S, NH₂-750F, Sulfate-650F, and AF-rProtein A HC-650F • ≤ 300 cm/h for TSKgel SuperQ-5PW (20) and TOYOPEARL Phenyl-600 and HW-40F |
| Connections | 1/4-28 Standard fittings with flat-bottom geometry for 1/8" OD or 1/16" OD capillary |
| Shipping buffer | 20% ethanol for TOYOPEARL and TSKgel resins |
| Asymmetry factor (As) | 0.8 - 1.4 for TOYOPEARL and TSKgel resins |
| Plate count | See resin-related specifications on the Certificate of Analysis |

Table 4. Properties and operation specifications of SkillPak 200 columns

| | |
|---|--|
| Column dimension | 5.0 cm ID x 10 cm bed height |
| Volume | approx. 200 mL (see labels and CoA) |
| Maximum recommended flow rate - in 2 mol/L NaCl for HIC media - in 1 mol/L NaCl for all other media | <ul style="list-style-type: none"> • ≤ 300 cm/h for most TOYOPEARL S, M, F, and C grade resins and TOYOPEARL GigaCap Q-650M • ≤ 250 cm/h for TOYOPEARL SuperQ-650S, NH₂-750F, GigaCap series, and Phenyl 600M, • ≤ 200 cm/h TSKgel SuperQ-5PW (20), TSKgel SP-5PW (20), and TOYOPEARL HW-40F |
| Connections | 1/4-28 Standard fittings with flat-bottom geometry for 1/8" OD or 1/16" OD capillary |
| Shipping buffer | 20% ethanol for TOYOPEARL and TSKgel resins |
| Asymmetry factor (As) | 0.8 - 1.4 for TOYOPEARL and TSKgel resins |
| Plate count | See resin-related specifications on the Certificate of Analysis |



Applications

The SkillPak 1 and SkillPak 5 (1 and 5 mL) columns are ideal to use for parameter and method optimization and for robustness testing for the development of a new or replacement purification process. The SkillPak 50 and SkillPak 200 (50 and 200 mL) columns are ideal for scaling-up the previously developed purification process in a controlled manner.

Method development for mAb purification: determine elution pH for a mAb using 1 mL and 5 mL SkillPak columns

Finding the appropriate buffer and pH for mAb elution reduces the risk of increasing aggregation in the mAb sample. To identify optimized conditions for mAb binding and elution, a buffer-adjusted mAb containing Chinese Hamster Ovary (CHO) cell line supernatant was loaded onto SkillPak columns pre-packed with TOYOPEARL AF-rProtein A HC-650F media.

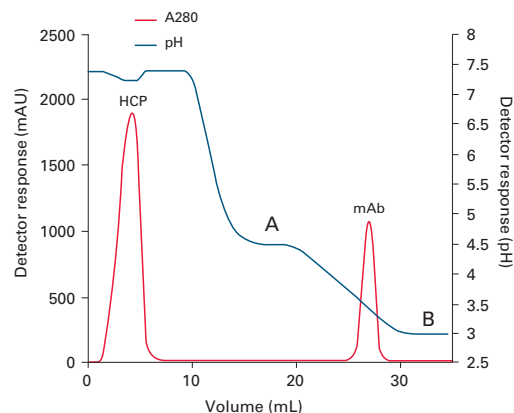
Experimental Conditions

| | |
|----------------------------|---|
| Columns: | SkillPak 1 TOYOPEARL AF-rProtein A HC-650F (1 mL) and SkillPak 5 TOYOPEARL AF-rProtein A HC-650F (5 mL) |
| Equilibration buffer: | 0.1 mol/L sodium phosphate, 0.15 mol/L NaCl, pH 7.3 |
| Mobile phase A (gradient): | 25 mmol/L citrate (NaOH), pH 4.5 |
| Mobile phase B (gradient): | 25 mmol/L citrate (NaOH), pH 3.0 |
| Elution gradient: | Linear from gradient buffer A to 100% B over 10 CV |
| Flow (load): | 0.25 mL/min (1 mL column); 1.5 mL/min (5 mL column) |
| Flow (wash, gradient): | 1.0 mL/min (1 mL column); 2.0 mL/min (5 mL column) using AKTA™ avant 25 |
| Samples: | 2 mL of buffer-adjusted CHO cell culture supernatant containing 4 mg mAb (1 mL column); 14 mL of buffer-adjusted CHO cell culture supernatant containing 20 mg mAb (5 mL column) |

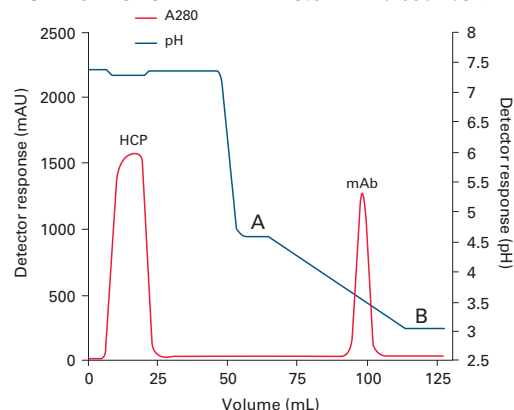
Figure 1, Panels A & B, demonstrate that a sharp mAb peak with elution max at pH 3.5 was obtained using a linear pH gradient. To maximize recovery, pH 3.3-3.5 can be selected for step elution.

Figure 1. Determination of elution pH for mAb using SkillPak 1 (Panel A); and SkillPak 5 (Panel B) columns

A: SkillPak TOYOPEARL AF-rProtein A HC-650F column



B: SkillPak TOYOPEARL AF-rProtein A HC-650F column



Method development for mAb purification: capture of intact antibodies using a 5 mL SkillPak column

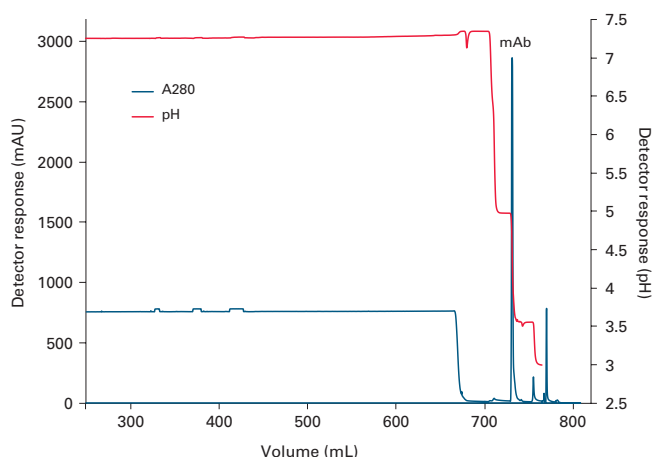
340 mL of hybridoma cell line supernatant (titer ~0.03 g/L) was loaded on a 5 mL SkillPak column packed with TOYOPEARL AF-rProtein A HC 650F resin.

Experimental Conditions

| | |
|------------------------|---|
| Column: | SkillPak 5 TOYOPEARL AF-rProtein A HC-650F (5 mL) |
| Equilibration buffer: | 0.1 mol/L Na ₂ HPO ₄ /NaH ₂ PO ₄ , 0.15 mol/L NaCl, pH 7.3 |
| Post-loading 1st wash: | equilibration buffer (5 CV) |
| Post-loading 2nd wash: | 0.1 mol/L acetate (NaOH), pH 5.0 (5 CV) |
| Elution: | 0.1 mol/L acetate (NaOH), pH 3.5 (5 CV) |
| Column strip: | 0.1 mol/L acetic acid, pH 2.9 (3 CV) |
| Column cleaning: | 0.2 mol/L NaOH (3 CV), 15 min hold |
| Flow (load): | 150 cm/h (1.25 mL/min), 4 min residence time |
| Flow (wash/elution): | 240 cm/h (2.0 mL/min) (AKTA avant 25) |
| Temperature: | ambient (room temperature) |
| Sample: | 340 mL hybridoma cell culture supernatant (buffer-adjusted) |

After a short wash at pH 5.0, a sharp and efficient elution peak was obtained at the start of the pH 3.5 elution (Figure 4). Total mAb recovery was 9.8 mg in the elution peak (4.8 mL).

➤ **Figure 4.** Capture of intact mAb using SkillPak 5 TOYOPEARL AF-rProtein A HC-650F column



Column reproducibility: capture of intact mAb using a 5 mL SkillPak column

A 5 mL SkillPak column pre-packed with TOYOPEARL AF-rProtein A HC-650F resin was loaded with 23.5 mg of mAb feedstock. After 10 cycles the average recovery was 91% (average yield was 21.3 mg) as shown in the table below. Both pH max for elution and yield were highly consistent throughout the 10 cycles.

| Reproducibility of a 5 mL SkillPak column for capture of intact mAb | | | | | | | |
|---|---------------------------|--------------------|-------------------|---------------|-------------------------|-------------|------------|
| Run # | Retention @ peak max (mL) | Peak area (mL*mAU) | Peak height (mAU) | pH @ peak max | Eluate A280 (1:10 dil.) | Eluate (mL) | Yield (mg) |
| 1 | 102.1 | 6327 | 1599 | 3.57 | 0.309 | 9.62 | 21.9 |
| 2 | 102.1 | 6335 | 1587 | 3.57 | 0.299 | 9.79 | 21.5 |
| 3 | 102.2 | 6351 | 1577 | 3.56 | 0.312 | 9.34 | 21.4 |
| 4 | 102.1 | 6358 | 1620 | 3.57 | 0.296 | 9.60 | 20.9 |
| 5 | 102.3 | 6308 | 1572 | 3.56 | 0.290 | 9.86 | 21.0 |
| 6 | 102.0 | 6310 | 1619 | 3.57 | 0.298 | 9.56 | 20.9 |
| 7 | 102.0 | 6300 | 1630 | 3.55 | 0.300 | 9.45 | 20.8 |
| 8 | 102.0 | 6294 | 1622 | 3.54 | 0.298 | 9.51 | 20.8 |
| 9 | 102.1 | 6309 | 1605 | 3.53 | 0.312 | 9.65 | 22.1 |
| 10 | 102.2 | 6291 | 1596 | 3.57 | 0.307 | 9.71 | 21.9 |
| Ave. | 102.1 | 6318 | 1603 | 3.56 | | | 21.3 |
| St.Dev. | 0.1 | 23 | 20 | 0.01 | | | 0.5 |

ext. coefficient=1.36

Seamless scale-up of downstream processes

To demonstrate the excellent scale-up capabilities of SkillPak pre-packed columns, we separated two different protein standards on different column dimensions packed with the anion exchange (AEX) resin TOYOPEARL NH₂-750F and cation exchange (CEX) resin TOYOPEARL Sulfate-650F.

Table 5. Composition of AEX protein standard

| Protein | C (g/L) | pI |
|------------------------------|---------|------------|
| Papain | 0.5 | ~8.8 |
| Trypsin inhibitor (soy bean) | 0.5 | ~4.1 - 4.5 |
| BSA | 1 | ~4.7 |
| Pepsin | 1 | ~ 2.7 |

Figure 5. Separation of a protein standard on TOYOPEARL NH₂-750F in different scales

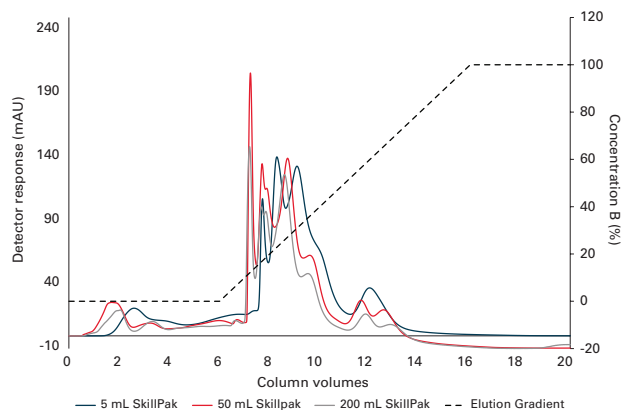
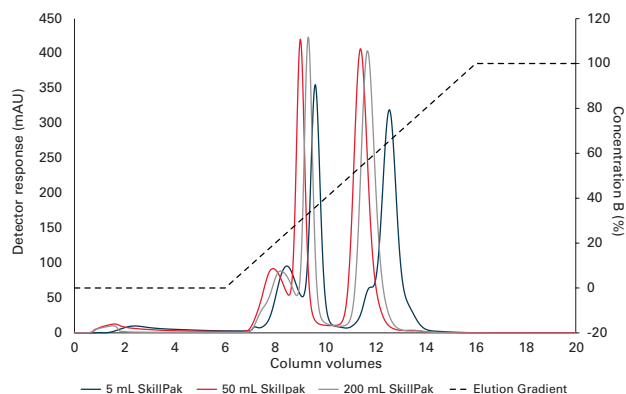


Table 6. Composition of CEX protein standard

| Protein | C (g/L) | pI |
|--------------------------------|---------|-------|
| γ-Globulins (from human blood) | 0.5 | ~ 7.2 |
| Ribonuclease A | 0.5 | ~ 8.5 |
| α-Chymotrypsinogen | 0.5 | ~ 9.6 |
| Lysozyme | 0.5 | ~ 11 |

Figure 6. Separation of a protein standard on TOYOPEARL Sulfate-650F in different scales



The separation of the protein standards on AEX and CEX leads to similar elution profiles on the different column scales. The proteins eluted with increasing net surface charge during the linear salt gradient. In both cases, a shift to the right in retention volume can be observed with decreasing column volume. This can be attributed to the different influences of the system dead volume.

We also determined the dynamic binding capacity (DBC) of Bovine Serum Albumin (BSA) on the AEX resin on SkillPak 5, SkillPak 50, and SkillPak 200 columns to demonstrate scale equivalence. The values for Dynamic Binding Capacity (DBC) of BSA on the different scales of TOYOPEARL NH₂-750F are very close, with a maximum deviation of 4% (see Table 7). This shows the independence of binding capacity from column scale, which can be very important with regard to loading mass in scaled-up processes. With the given independence, binding capacity can be determined on a small scale to conserve both product and buffers. Later the determined capacity and thus maximum loading masses can be confidently assumed for larger-scale columns.

Table 7. DBC of BSA on different scales of TOYOPEARL NH₂-750F

| Column Volume | DBC 10% |
|---------------|---------|
| 5 | 67.10 |
| 50 | 64.89 |
| 200 | 64.58 |

(Full application note available: AN0074_AN130)

Development and scale-up of an antibody platform

We developed and scaled up a 2-step platform to purify a specific mAb, Pertuzumab, using SkillPak pre-packed columns up to 200 mL. The 2-step platform consists of a Protein A capture and a single polishing step on a salt-tolerant anion exchange resin (AEX).

➤ **Table 8.** Summary of 2-step scale-up from 5 mL to 50 mL to 200 mL using TOYOPEARL AF-rProtein A HC-650F and TOYOPEARL NH₂-750F in SkillPak pre-packed columns

| CV (mL) | Loaded mAb (mg) | Recovery Pro A (%) | Recovery NH ₂ (FT) (%) | Overall recovery (%) | Monomer purity (%) |
|---------|-----------------|--------------------|-----------------------------------|----------------------|--------------------|
| 5 | 176 | 98.14 | 87.76 | 86.13 | 99.92 |
| 50 | 1932 | 98.58 | 94.97 | 93.62 | 99.69 |
| 200 | 7728 | 97.58 | 92.63 | 90.38 | 99.75 |

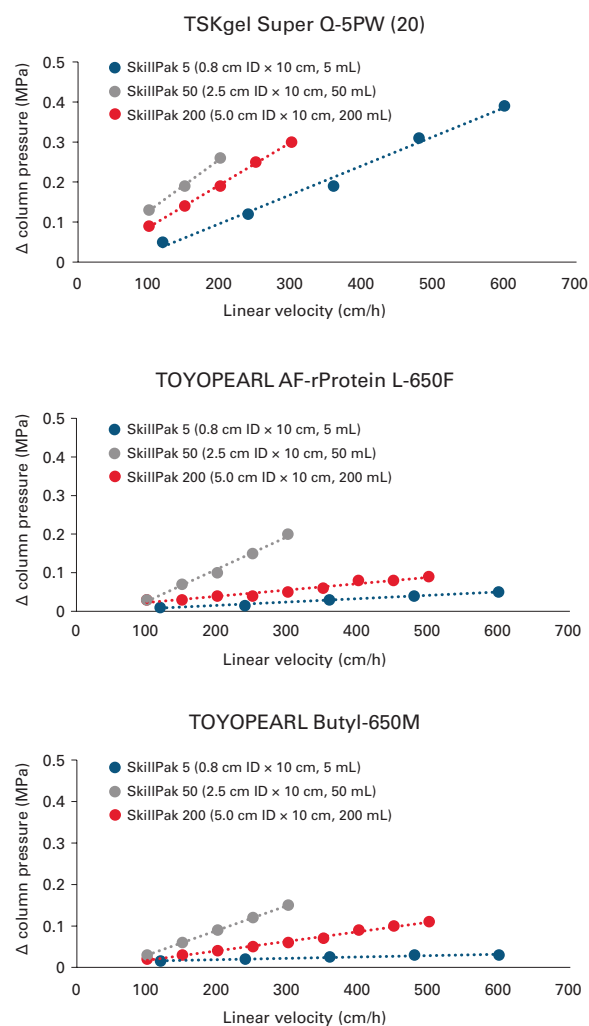
Overall recoveries of around 90 % and a high monomer purity of over 99.9 % were achieved. Using the SkillPak column platform, we could effortlessly develop and the scale-up the process without adjusting the process parameters between the different scales. This seamless scale-up using SkillPak pre-packed columns allows scientists to move from process development to pilot scale quickly, safely, and efficiently.

(Full application note available: AN0075_AN131)

Packing Performance

SkillPak columns exhibit excellent flow characteristics packed with specified process resins and are compatible with low to medium pressure chromatography systems. The figures below demonstrate the superior packing performance for SkillPak columns pre-packed with several TOYOPEARL and TSKgel resins. Representative results are shown here with different bead diameters (20 μ m for TSKgel Super Q-5PW (20), 45 μ m for TOYOPEARL AF-rProtein L-650F, and 65 μ m for TOYOPEARL Butyl-650M). During development of the SkillPak columns, the pressure/flow characteristics have been evaluated for all resin grades to ensure the best performances during the use of the columns.

➤ **Figure 7.** Packing performance data for SkillPak columns



Ordering Information: SkillPak 1 columns

| Part # | Description | Resin volume (ea.) | Column dimensions |
|---|---|--------------------|--------------------|
| Affinity Chromatography | | | |
| 0045200 | SkillPak 1 TOYOPEARL AF-rProtein L-650F | 1 mL | 0.7 cm ID × 2.5 cm |
| 0045221 | SkillPak 1 TOYOPEARL AF-rProtein L-650F (qty. 5) | 1 mL | 0.7 cm ID × 2.5 cm |
| 0045201 | SkillPak 1 TOYOPEARL AF-rProtein A HC-650F | 1 mL | 0.7 cm ID × 2.5 cm |
| 0045222 | SkillPak 1 TOYOPEARL AF-rProtein A HC-650F (qty. 5) | 1 mL | 0.7 cm ID × 2.5 cm |
| 0045202 | SkillPak 1 TOYOPEARL AF-Chelate-650M | 1 mL | 0.7 cm ID × 2.5 cm |
| Ion Exchange Chromatography | | | |
| 0045274 | SkillPak 1 TOYOPEARL GigaCap Q-650S (qty. 5) | 1 mL | 0.7 cm ID × 2.5 cm |
| 0045203 | SkillPak 1 TOYOPEARL GigaCap Q-650M (qty. 5) | 1 mL | 0.7 cm ID × 2.5 cm |
| 0045204 | SkillPak 1 TOYOPEARL GigaCap S-650S (qty. 5) | 1 mL | 0.7 cm ID × 2.5 cm |
| 0045275 | SkillPak 1 TOYOPEARL GigaCap S-650M (qty. 5) | 1 mL | 0.7 cm ID × 2.5 cm |
| 0045205 | SkillPak 1 TOYOPEARL Sulfate-650F (qty. 5) | 1 mL | 0.7 cm ID × 2.5 cm |
| 0045206 | SkillPak 1 TOYOPEARL SuperQ-650Ss (qty. 5) | 1 mL | 0.7 cm ID × 2.5 cm |
| 0045282 | SkillPak 1 TOYOPEARL SuperQ-650M (qty. 5) | 1 mL | 0.7 cm ID × 2.5 cm |
| 0045207 | SkillPak 1 TSKgel SP-5PW (20) (qty. 5) | 1 mL | 0.7 cm ID × 2.5 cm |
| 0045208 | SkillPak 1 TSKgel SuperQ-5PW (20) (qty. 5) | 1 mL | 0.7 cm ID × 2.5 cm |
| 0045209 | SkillPak 1 TOYOPEARL NH ₂ -750F (qty. 5) | 1 mL | 0.7 cm ID × 2.5 cm |
| 0045210 | SkillPak 1 TOYOPEARL GigaCap DEAE-650M (qty. 5) | 1 mL | 0.7 cm ID × 2.5 cm |
| 0045211 | SkillPak 1 TOYOPEARL GigaCap CM-650M (qty. 5) | 1 mL | 0.7 cm ID × 2.5 cm |
| 0045212 | SkillPak 1 TOYOPEARL QAE-550C (qty. 5) | 1 mL | 0.7 cm ID × 2.5 cm |
| 0045213 | SkillPak 1 TOYOPEARL SP-550C (qty. 5) | 1 mL | 0.7 cm ID × 2.5 cm |
| 0045280 | SkillPak 1 TOYOPEARL SP-650C (qty. 5) | 1 mL | 0.7 cm ID × 2.5 cm |
| 0045281 | SkillPak 1 TOYOPEARL SP-650M (qty. 5) | 1 mL | 0.7 cm ID × 2.5 cm |
| 0045268 | SkillPak 1 TOYOPEARL CM-650C (qty. 5) | 1 mL | 0.7 cm ID × 2.5 cm |
| 0045269 | SkillPak 1 TOYOPEARL CM-650M (qty. 5) | 1 mL | 0.7 cm ID × 2.5 cm |
| 0045270 | SkillPak 1 TOYOPEARL CM-650S (qty. 5) | 1 mL | 0.7 cm ID × 2.5 cm |
| 0045271 | SkillPak 1 TOYOPEARL DEAE-650C (qty. 5) | 1 mL | 0.7 cm ID × 2.5 cm |
| 0045272 | SkillPak 1 TOYOPEARL DEAE-650M (qty. 5) | 1 mL | 0.7 cm ID × 2.5 cm |
| 0045273 | SkillPak 1 TOYOPEARL DEAE-650Sn (qty. 5) | 1 mL | 0.7 cm ID × 2.5 cm |
| 0045277 | SkillPak 1 TOYOPEARL MegaCap II SP-550EC (qty. 5) | 1 mL | 0.7 cm ID × 2.5 cm |
| Hydrophobic Interaction Chromatography | | | |
| 0045214 | SkillPak 1 TOYOPEARL Butyl-600M (qty. 5) | 1 mL | 0.7 cm ID × 2.5 cm |
| 0045215 | SkillPak 1 TOYOPEARL Butyl-650M (qty. 5) | 1 mL | 0.7 cm ID × 2.5 cm |
| 0045267 | SkillPak 1 TOYOPEARL Butyl-650C (qty. 5) | 1 mL | 0.7 cm ID × 2.5 cm |
| 0045216 | SkillPak 1 TOYOPEARL Phenyl-600M (qty. 5) | 1 mL | 0.7 cm ID × 2.5 cm |
| 0045279 | SkillPak 1 TOYOPEARL Phenyl-650S (qty. 5) | 1 mL | 0.7 cm ID × 2.5 cm |
| 0045217 | SkillPak 1 TOYOPEARL Phenyl-650M (qty. 5) | 1 mL | 0.7 cm ID × 2.5 cm |
| 0045278 | SkillPak 1 TOYOPEARL Phenyl-650C (qty. 5) | 1 mL | 0.7 cm ID × 2.5 cm |
| 0045218 | SkillPak 1 TOYOPEARL PPG-600M (qty. 5) | 1 mL | 0.7 cm ID × 2.5 cm |
| 0045219 | SkillPak 1 TOYOPEARL Hexyl-650C (qty. 5) | 1 mL | 0.7 cm ID × 2.5 cm |
| 0045220 | SkillPak 1 TOYOPEARL Ether-650M (qty. 5) | 1 mL | 0.7 cm ID × 2.5 cm |

Ordering Information: SkillPak 1 columns, continued

| Part # | Description | Resin volume (ea.) | Column dimensions |
|--------------------------------------|---|--------------------|--------------------|
| Mixed-Mode Chromatography | | | |
| 0045224 | SkillPak 1 TOYOPEARL MX-Trp-650M (qty. 5) | 1 mL | 0.7 cm ID × 2.5 cm |
| Size Exclusion Chromatography | | | |
| 0045276 | SkillPak 1 TOYOPEARL HW-40C (qty. 5) | 1 mL | 0.7 cm ID × 2.5 cm |
| 0045223 | SkillPak 1 TOYOPEARL HW-40F (qty. 5) | 1 mL | 0.7 cm ID × 2.5 cm |
| HA Chromatography | | | |
| 0045225 | SkillPak 1 Ca ⁺⁺ Pure-HA | 1 mL | 0.7 cm ID × 2.5 cm |
| Column Libraries | | | |
| 0045226 | SkillPak 1 Anion Exchange column library, (TOYOPEARL GigaCap Q-650M, GigaCap DEAE-650M, NH ₂ -750F) | 1 mL × 2 ea | 0.7 cm ID × 2.5 cm |
| 0045227 | SkillPak 1 Cation Exchange column library, (TOYOPEARL GigaCap S-650S, GigaCap CM-650M, Sulfate-650F) | 1 mL × 2 ea | 0.7 cm ID × 2.5 cm |
| 0045228 | SkillPak 1 Antibody column library, (TOYOPEARL AF-rProtein A HC-650F, AF-rProtein L-650F, NH ₂ -750F, Sulfate-650F, GigaCap Q-650M, GigaCap S-650S) | 1 mL ea | 0.7 cm ID × 2.5 cm |
| 0045229 | SkillPak 1 mAb Platform column library, (TOYOPEARL AF-rProtein A HC-650F, Sulfate-650F, NH ₂ -750F) | 1 mL × 2 ea | 0.7 cm ID × 2.5 cm |
| 0045230 | SkillPak 1 Salt Tolerant column library, (TOYOPEARL Sulfate-650F, NH ₂ -750F) | 1 mL × 3 ea | 0.7 cm ID × 2.5 cm |
| 0045231 | SkillPak 1 Mixed Mode column library, (Ca ⁺⁺ Pure-HA, TOYOPEARL MX-Trp-650M) | 1 mL × 3 ea | 0.7 cm ID × 2.5 cm |
| 0045232 | SkillPak 1 Best-in-Class column library, (Ca ⁺⁺ Pure-HA, TOYOPEARL AF-rProtein A HC-650F, AF-rProtein L-650F, NH ₂ -750F, Sulfate-650F) | 1 mL ea | 0.7 cm ID × 2.5 cm |
| 0045233 | SkillPak 1 HIC column library, (TOYOPEARL Butyl-650M, Phenyl-650M, PPG-600M, Hexyl-650C, Ether-650M) | 1 mL ea | 0.7 cm ID × 2.5 cm |
| 0045234 | SkillPak 1 HIC column library, (TOYOPEARL Butyl-600M, Phenyl-600M, PPG-600M, Hexyl-650C, Ether-650M) | 1 mL ea | 0.7 cm ID × 2.5 cm |
| 0045235 | SkillPak 1 HIC column library, (TOYOPEARL Butyl-650M, Phenyl-650M, PPG-600M) | 1 mL × 2 ea | 0.7 cm ID × 2.5 cm |
| 0045236 | SkillPak 1 HIC column library, (TOYOPEARL Butyl-600M, Phenyl-600M, PPG-600M) | 1 mL × 2 ea | 0.7 cm ID × 2.5 cm |
| 0045237 | SkillPak 1 HIC column library, (TOYOPEARL Phenyl-650M, PPG-600M, Hexyl-650C) | 1 mL × 2 ea | 0.7 cm ID × 2.5 cm |
| 0045238 | SkillPak 1 HIC column library, (TOYOPEARL Phenyl-600M, PPG-600M, Hexyl-650C) | 1 mL × 2 ea | 0.7 cm ID × 2.5 cm |

Ordering Information: SkillPak 5 columns

| Part # | Description | Resin volume (ea.) | Column dimensions |
|---|--|--------------------|-------------------|
| Affinity Chromatography | | | |
| 0045257 | SkillPak 5 TOYOPEARL AF-rProtein L-650F | 5 mL | 0.8 cm ID × 10 cm |
| 0045258 | SkillPak 5 TOYOPEARL AF-rProtein A HC-650F | 5 mL | 0.8 cm ID × 10 cm |
| 0045259 | SkillPak 5 TOYOPEARL AF-Chelate-650M | 5 mL | 0.8 cm ID × 10 cm |
| Ion Exchange Chromatography | | | |
| 0045290 | SkillPak 5 TOYOPEARL GigaCap Q-650S | 5 mL | 0.8 cm ID × 10 cm |
| 0045239 | SkillPak 5 TOYOPEARL GigaCap Q-650M | 5 mL | 0.8 cm ID × 10 cm |
| 0045240 | SkillPak 5 TOYOPEARL GigaCap S-650S | 5 mL | 0.8 cm ID × 10 cm |
| 0045291 | SkillPak 5 TOYOPEARL GigaCap S-650M | 5 mL | 0.8 cm ID × 10 cm |
| 0045241 | SkillPak 5 TOYOPEARL Sulfate-650F | 5 mL | 0.8 cm ID × 10 cm |
| 0045242 | SkillPak 5 TOYOPEARL SuperQ-650S | 5 mL | 0.8 cm ID × 10 cm |
| 0045298 | SkillPak 5 TOYOPEARL SuperQ-650M | 5 mL | 0.8 cm ID × 10 cm |
| 0045243 | SkillPak 5 TSKgel SP-5PW (20) | 5 mL | 0.8 cm ID × 10 cm |
| 0045244 | SkillPak 5 TSKgel SuperQ-5PW (20) | 5 mL | 0.8 cm ID × 10 cm |
| 0045245 | SkillPak 5 TOYOPEARL NH ₂ -750F | 5 mL | 0.8 cm ID × 10 cm |
| 0045246 | SkillPak 5 TOYOPEARL GigaCap DEAE-650M | 5 mL | 0.8 cm ID × 10 cm |
| 0045247 | SkillPak 5 TOYOPEARL GigaCap CM-650M | 5 mL | 0.8 cm ID × 10 cm |
| 0045248 | SkillPak 5 TOYOPEARL QAE-550C | 5 mL | 0.8 cm ID × 10 cm |
| 0045249 | SkillPak 5 TOYOPEARL SP-550C | 5 mL | 0.8 cm ID × 10 cm |
| 0045296 | SkillPak 5 TOYOPEARL SP-650C | 5 mL | 0.8 cm ID × 10 cm |
| 0045297 | SkillPak 5 TOYOPEARL SP-650M | 5 mL | 0.8 cm ID × 10 cm |
| 0045284 | SkillPak 5 TOYOPEARL CM-650C | 5 mL | 0.8 cm ID × 10 cm |
| 0045285 | SkillPak 5 TOYOPEARL CM-650M | 5 mL | 0.8 cm ID × 10 cm |
| 0045286 | SkillPak 5 TOYOPEARL CM-650S | 5 mL | 0.8 cm ID × 10 cm |
| 0045287 | SkillPak 5 TOYOPEARL DEAE-650C | 5 mL | 0.8 cm ID × 10 cm |
| 0045288 | SkillPak 5 TOYOPEARL DEAE-650M | 5 mL | 0.8 cm ID × 10 cm |
| 0045289 | SkillPak 5 TOYOPEARL DEAE-650S | 5 mL | 0.8 cm ID × 10 cm |
| 0045293 | SkillPak 5 TOYOPEARL MegaCap II SP-550EC | 5 mL | 0.8 cm ID × 10 cm |
| Hydrophobic Interaction Chromatography | | | |
| 0045250 | SkillPak 5 TOYOPEARL Butyl-600M | 5 mL | 0.8 cm ID × 10 cm |
| 0045251 | SkillPak 5 TOYOPEARL Butyl-650M | 5 mL | 0.8 cm ID × 10 cm |
| 0045283 | SkillPak 5 TOYOPEARL Butyl-650C | 5 mL | 0.8 cm ID × 10 cm |
| 0045252 | SkillPak 5 TOYOPEARL Phenyl-600M | 5 mL | 0.8 cm ID × 10 cm |
| 0045294 | SkillPak 5 TOYOPEARL Phenyl-650C | 5 mL | 0.8 cm ID × 10 cm |
| 0045253 | SkillPak 5 TOYOPEARL Phenyl-650M | 5 mL | 0.8 cm ID × 10 cm |
| 0045295 | SkillPak 5 TOYOPEARL Phenyl-650S | 5 mL | 0.8 cm ID × 10 cm |
| 0045254 | SkillPak 5 TOYOPEARL PPG-600M | 5 mL | 0.8 cm ID × 10 cm |
| 0045255 | SkillPak 5 TOYOPEARL Hexyl-650C | 5 mL | 0.8 cm ID × 10 cm |
| 0045256 | SkillPak 5 TOYOPEARL Ether-650M | 5 mL | 0.8 cm ID × 10 cm |
| 0045296 | SkillPak 5 TOYOPEARL SP-650C | 5 mL | 0.8 cm ID × 10 cm |
| 0045297 | SkillPak 5 TOYOPEARL SP-650M | 5 mL | 0.8 cm ID × 10 cm |

Ordering Information: SkillPak 5 columns, continued

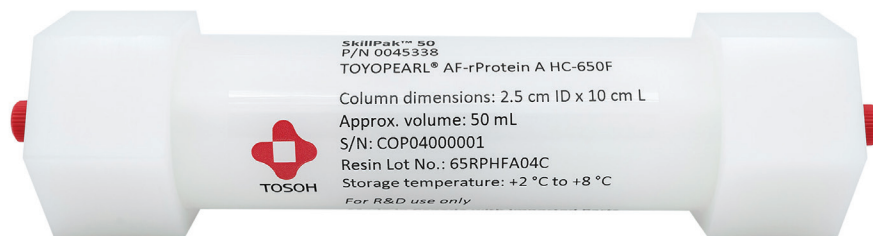
| Part # | Description | Resin volume (ea.) | Column dimensions |
|--------------------------------------|--|--------------------|-------------------|
| Mixed-Mode Chromatography | | | |
| 0045261 | SkillPak 5 TOYOPEARL MX-Trp-650M | 5 mL | 0.8 cm ID x 10 cm |
| Size Exclusion Chromatography | | | |
| 0045292 | SkillPak 5 TOYOPEARL HW-40C | 5 mL | 0.8 cm ID x 10 cm |
| 0045260 | SkillPak 5 TOYOPEARL HW-40F | 5 mL | 0.8 cm ID x 10 cm |
| HA Chromatography | | | |
| 0045262 | SkillPak 5 Ca ⁺⁺ Pure-HA | 5 mL | 0.8 cm ID x 10 cm |
| Column Libraries | | | |
| 0045263 | SkillPak 5 mAb Platform column library, (TOYOPEARL AF-rProtein A HC-650F, Sulfate-650F, NH ₂ -750F) | 5 mL x 1 ea | 0.8 cm ID x 10 cm |
| 0045264 | SkillPak 5 Salt Tolerant column library, (TOYOPEARL Sulfate-650F, NH ₂ -750F) | 5 mL x 1 ea | 0.8 cm ID x 10 cm |
| 0045265 | SkillPak 5 Mixed Mode column library, (Ca ⁺⁺ Pure-HA, TOYOPEARL MX-Trp-650M) | 5 mL x 1 ea | 0.8 cm ID x 10 cm |
| 0045266 | SkillPak 5 Best-in-Class column library, (Ca ⁺⁺ Pure-HA, TOYOPEARL AF-rProtein A HC-650F, AF-rProtein L-650F, NH ₂ -750F, Sulfate-650F) | 5 mL x 1 ea | 0.8 cm ID x 10 cm |



Product shown at actual size.

Ordering Information: SkillPak 50 columns

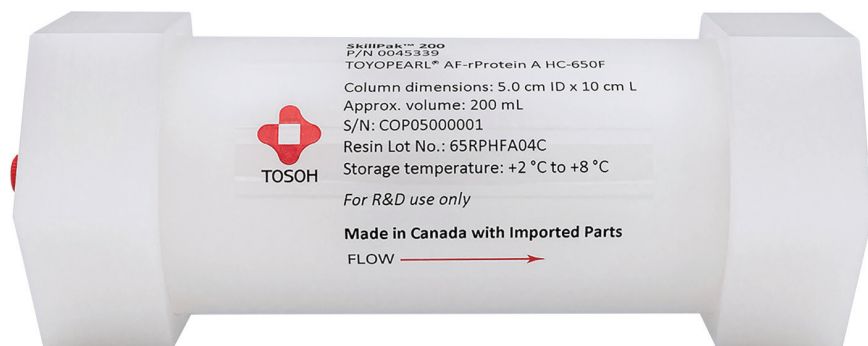
| Part # | Description | Resin volume (ea.) | Column dimensions |
|---|---|--------------------|-------------------|
| Size Exclusion Chromatography | | | |
| 0045300 | SkillPak 50 TOYOPEARL HW-40F | 50 mL | 2.5 cm ID x 10 cm |
| Ion Exchange Chromatography | | | |
| 0045302 | SkillPak 50 TSKgel SuperQ-5PW (20) | 50 mL | 2.5 cm ID x 10 cm |
| 0045304 | SkillPak 50 TOYOPEARL SuperQ-650S | 50 mL | 2.5 cm ID x 10 cm |
| 0045306 | SkillPak 50 TOYOPEARL GigaCap Q-650M | 50 mL | 2.5 cm ID x 10 cm |
| 0045308 | SkillPak 50 TOYOPEARL GigaCap DEAE-650M | 50 mL | 2.5 cm ID x 10 cm |
| 0045310 | SkillPak 50 TOYOPEARL NH ₂ -750F | 50 mL | 2.5 cm ID x 10 cm |
| 0045312 | SkillPak 50 TOYOPEARL QAE-550C | 50 mL | 2.5 cm ID x 10 cm |
| 0045314 | SkillPak 50 TOYOPEARL GigaCap S-650S | 50 mL | 2.5 cm ID x 10 cm |
| 0045316 | SkillPak 50 TSKgel SP-5PW (20) | 50 mL | 2.5 cm ID x 10 cm |
| 0045318 | SkillPak 50 TOYOPEARL Sulfate-650F | 50 mL | 2.5 cm ID x 10 cm |
| 0045320 | SkillPak 50 TOYOPEARL GigaCap CM-650M | 50 mL | 2.5 cm ID x 10 cm |
| 0045322 | SkillPak 50 TOYOPEARL SP-550C | 50 mL | 2.5 cm ID x 10 cm |
| Hydrophobic Interaction Chromatography | | | |
| 0045324 | SkillPak 50 TOYOPEARL PPG-600M | 50 mL | 2.5 cm ID x 10 cm |
| 0045326 | SkillPak 50 TOYOPEARL Butyl-600M | 50 mL | 2.5 cm ID x 10 cm |
| 0045328 | SkillPak 50 TOYOPEARL Butyl-650M | 50 mL | 2.5 cm ID x 10 cm |
| 0045330 | SkillPak 50 TOYOPEARL Hexyl-650C | 50 mL | 2.5 cm ID x 10 cm |
| 0045332 | SkillPak 50 TOYOPEARL Phenyl-600M | 50 mL | 2.5 cm ID x 10 cm |
| 0045334 | SkillPak 50 TOYOPEARL Phenyl-650M | 50 mL | 2.5 cm ID x 10 cm |
| 0045336 | SkillPak 50 TOYOPEARL Ether-650M | 50 mL | 2.5 cm ID x 10 cm |
| Affinity Chromatography | | | |
| 0045338 | SkillPak 50 TOYOPEARL AF-rProtein A HC-650F | 50 mL | 2.5 cm ID x 10 cm |
| 0045340 | SkillPak 50 TOYOPEARL AF-rProtein L-650F | 50 mL | 2.5 cm ID x 10 cm |
| 0045342 | SkillPak 50 TOYOPEARL AF-Chelate-650M | 50 mL | 2.5 cm ID x 10 cm |
| Mixed-Mode Chromatography | | | |
| 0045344 | SkillPak 50 TOYOPEARL MX-Trp-650M | 50 mL | 2.5 cm ID x 10 cm |



Not actual size.

Ordering Information: SkillPak 200 columns

| Part # | Description | Resin volume (ea.) | Column dimensions |
|---|--|--------------------|-------------------|
| Size Exclusion Chromatography | | | |
| 0045301 | SkillPak 200 TOYOPEARL HW-40F | 200 mL | 5.0 cm ID x 10 cm |
| Ion Exchange Chromatography | | | |
| 0045303 | SkillPak 200 TSKgel SuperQ-5PW (20) | 200 mL | 5.0 cm ID x 10 cm |
| 0045305 | SkillPak 200 TOYOPEARL SuperQ-650S | 200 mL | 5.0 cm ID x 10 cm |
| 0045307 | SkillPak 200 TOYOPEARL GigaCap Q-650M | 200 mL | 5.0 cm ID x 10 cm |
| 0045309 | SkillPak 200 TOYOPEARL GigaCap DEAE-650M | 200 mL | 5.0 cm ID x 10 cm |
| 0045311 | SkillPak 200 TOYOPEARL NH ₂ -750F | 200 mL | 5.0 cm ID x 10 cm |
| 0045313 | SkillPak 200 TOYOPEARL QAE-550C | 200 mL | 5.0 cm ID x 10 cm |
| 0045315 | SkillPak 200 TOYOPEARL GigaCap S-650S | 200 mL | 5.0 cm ID x 10 cm |
| 0045317 | SkillPak 200 TSKgel SP-5PW (20) | 200 mL | 5.0 cm ID x 10 cm |
| 0045319 | SkillPak 200 TOYOPEARL Sulfate-650F | 200 mL | 5.0 cm ID x 10 cm |
| 0045321 | SkillPak 200 TOYOPEARL GigaCap CM-650M | 200 mL | 5.0 cm ID x 10 cm |
| 0045323 | SkillPak 200 TOYOPEARL SP-550C | 200 mL | 5.0 cm ID x 10 cm |
| Hydrophobic Interaction Chromatography | | | |
| 0045325 | SkillPak 200 TOYOPEARL PPG-600M | 200 mL | 5.0 cm ID x 10 cm |
| 0045327 | SkillPak 200 TOYOPEARL Butyl-600M | 200 mL | 5.0 cm ID x 10 cm |
| 0045329 | SkillPak 200 TOYOPEARL Butyl-650M | 200 mL | 5.0 cm ID x 10 cm |
| 0045331 | SkillPak 200 TOYOPEARL Hexyl-650C | 200 mL | 5.0 cm ID x 10 cm |
| 0045333 | SkillPak 200 TOYOPEARL Phenyl-600M | 200 mL | 5.0 cm ID x 10 cm |
| 0045335 | SkillPak 200 TOYOPEARL Phenyl-650M | 200 mL | 5.0 cm ID x 10 cm |
| 0045337 | SkillPak 200 TOYOPEARL Ether-650M | 200 mL | 5.0 cm ID x 10 cm |
| Affinity Chromatography | | | |
| 0045339 | SkillPak 200 TOYOPEARL AF-rProtein A HC-650F | 200 mL | 5.0 cm ID x 10 cm |
| 0045341 | SkillPak 200 TOYOPEARL AF-rProtein L-650F | 200 mL | 5.0 cm ID x 10 cm |
| 0045343 | SkillPak 200 TOYOPEARL AF-Chelate-650M | 200 mL | 5.0 cm ID x 10 cm |
| Mixed-Mode Chromatography | | | |
| 0045345 | SkillPak 200 TOYOPEARL MX-Trp-650M | 200 mL | 5.0 cm ID x 10 cm |



Not actual size.





Simplify Your MCC Process Development



- Dedicated pre-packed columns designed for multi-column chromatography.
- Optimal performance on all MCC systems.
- Convenient for process development and scale-up of MCC processes.
- Available in 1, 5, 10, 25, and 100 mL columns of comprehensive TOYOPEARL resins for MCC applications.
- Provided in kits containing single resin lot with minimal column-to-column variability.

SkillPak BIO Pre-packed Columns

TOSOH BIOSCIENCE

SkillPak BIO pre-packed columns are part of Tosoh Bioscience’s holistic solution for the development of multi-column chromatography (MCC) processes. SkillPak BIO pre-packed columns are the perfect complement to the Octave BIO MCC system and TOYOPEARL resins, offering a unique and comprehensive solution for developing MCC processes. Designed with dedicated dimensions and comprehensive TOYOPEARL resins for MCC applications, SkillPak BIO is designed to unlock the best MCC performance.

SkillPak BIO column design and packing procedures are based on Tosoh Bioscience’s decades of expertise in packing chromatography media. We employ tightly controlled methods to pack the TOYOPEARL resins into the MCC-dedicated columns, which take into account the varying compressibility of each resin. This ensures that each column is consistently packed to the same level of performance, providing reproducible results for the batch process development work of biopharma experts. Available in kits that cover different MCC use cases, each kit contains a single resin lot with low column-to-column variability, ensuring optimal MCC performance. Additionally, customers benefit from short lead times thanks to Tosoh Bioscience’s complete control of the media and hardware supply chain.

In **Tables 1-4**, we will explore the specifications, benefits, and features of SkillPak BIO pre-packed columns and how they can enhance the productivity and efficiency of your MCC process development work.

➤ **Table 2.** Dedicated dimensions for MCC applications

| Step | Dimensions | Volume | Flow rate at 0.5 min residence time |
|--------------------------------|--------------------|--------|-------------------------------------|
| Screening / Method development | 0.8 cm ID x 2.0 cm | 1 mL | 2 mL/min |
| | 1.6 cm ID x 2.5 cm | 5 mL | 10 mL/min |
| | 1.6 cm ID x 5.1 cm | 10 mL | 20 mL/min |
| Technique adaptation/ Scale-up | 2.5 cm ID x 5.1 cm | 25 mL | 50 mL/min |
| | 5.0 cm ID x 5.1 cm | 100 mL | 200 mL/min |

➤ **Table 1.** Specifications of SkillPak BIO columns

| | SkillPak 1 BIO | SkillPak 5 BIO | SkillPak 10 BIO | SkillPak 25 BIO | SkillPak 100 BIO |
|--|---|----------------|-----------------|--|------------------|
| Approx. volume | 1 mL | 5 mL | 10 mL | 25 mL | 100 mL |
| Maximum recommended flow rate in 1 mol/L NaCl (mL/min) | 2 | 10 | 20 | 50 | 200 |
| Storage temperature | see labels and Certificate of Analysis | | | | |
| Frit porosity | 10 µm | | | | |
| Connections | 10-32 Standard fitting | | | 1/4-28 Standard fittings with flat-bottom geometry for 1/8" OD or 1/16" OD capillary | |
| Shipping buffer | 20% ethanol for TOYOPEARL and TSKgel resins | | | | |
| Asymmetry factor (As) | 0.8 - 1.4 for TOYOPEARL and TSKgel resins | | | | |
| Plate count | See resin-related specifications on the Certificate of Analysis | | | | |
| Estimated shelf life | 12 months | | | | |
| Hardware pressure stability | 10 bar | | | | |
| Resin pressure stability | see resin documentation | | | | |

➤ **Table 3.** Comprehensive resins for MCC applications

| Resin name | Application mode | Recommended for purifying... |
|---------------------------------|---|--|
| TOYOPEARL AF-rProtein A HC-650F | Capture with Protein A | Monoclonal Antibodies |
| TOYOPEARL AF-rProtein L-650F | Capture with Protein L | Antibody Fragments |
| TOYOPEARL NH ₂ -750F | Polish with Anion exchange | Antibodies, antibody fragments, and other biomolecules |
| TOYOPEARL Sulfate-650F | Polish with Anion exchange | Antibodies, antibody fragments, and other biomolecules |
| TOYOPEARL GigaCap S-650S | Polish with (strong) Anion exchange | Viruses, vaccines, and other biomolecules |
| TOYOPEARL SuperQ-650S | high throughput capture, intermediate purification, and polishing | Therapeutic nucleic acids |

➤ **Table 4.** Kits with single resin lot and low column-to-column variability for optimal MCC performance

| | Screening/ Method development (1, 5, 10 mL) | Technique adaptation / Scale-up (25, 100 mL) |
|------------|---|--|
| AFC | <ul style="list-style-type: none"> • 6 columns for standard processes • 10 columns for high-titer processes | <ul style="list-style-type: none"> • 1, 6, and 10 columns to adapt to any process setup |
| IEC | <ul style="list-style-type: none"> • 4 columns to cover all IEC MCC processes | <ul style="list-style-type: none"> • 1 and 4 columns to adapt to any process setup |

Short lead times

Tosoh recognizes the importance of prompt delivery for process development products and has implemented a vertically integrated supply chain to ensure quick turnaround times for our SkillPak BIO pre-packed columns. With most screening/method development dimensions available off the shelf, customers can initiate their process development work in a matter of days. For SkillPak BIO pre-packed columns not available off the shelf, we have a lead time of 4-6 weeks, as we established a stock of resin at our production facility. By utilizing our vertically integrated supply chain, customers can focus on their process development without delay or concern over the availability and consistency of SkillPak BIO pre-packed columns.



Ordering Information:

| Part # | Description | Resin volume (ea.) | Column dimensions |
|--|---|--------------------|--------------------|
| TOYOPEARL AF-rProtein A HC-650F | | | |
| 0045346 | SkillPak 1 BIO AF-rProtein A HC-650F, x6 | 1 mL | 0.8 cm ID × 2.0 cm |
| 0045347 | SkillPak 1 BIO AF-rProtein A HC-650F, x10 | 1 mL | 0.8 cm ID × 2.0 cm |
| 0045348 | SkillPak 5 BIO AF-rProtein A HC-650F, x6 | 5 mL | 1.6 cm ID × 2.5 cm |
| 0045349 | SkillPak 5 BIO AF-rProtein A HC-650F, x10 | 5 mL | 1.6 cm ID × 2.5 cm |
| 0045350 | SkillPak 10 BIO AF-rProtein A HC-650F, x6 | 10 mL | 1.6 cm ID × 5.1 cm |
| 0045351 | SkillPak 10 BIO AF-rProtein A HC-650F, x10 | 10 mL | 1.6 cm ID × 5.1 cm |
| 0045352 | SkillPak 25 BIO AF-rProtein A HC-650F, x1 | 25 mL | 2.5 cm ID × 5.1 cm |
| 0045353 | SkillPak 25 BIO AF-rProtein A HC-650F, x6 | 25 mL | 2.5 cm ID × 5.1 cm |
| 0045354 | SkillPak 25 BIO AF-rProtein A HC-650F, x10 | 25 mL | 2.5 cm ID × 5.1 cm |
| 0045355 | SkillPak 100 BIO AF-rProtein A HC-650F, x1 | 100 mL | 5.0 cm ID × 5.1 cm |
| 0045356 | SkillPak 100 BIO AF-rProtein A HC-650F, x6 | 100 mL | 5.0 cm ID × 5.1 cm |
| 0045357 | SkillPak 100 BIO AF-rProtein A HC-650F, x10 | 100 mL | 5.0 cm ID × 5.1 cm |
| TOYOPEARL AF-rProtein L-650F | | | |
| 0045358 | SkillPak 1 BIO AF-rProtein L-650F, x6 | 1 mL | 0.8 cm ID × 2.0 cm |
| 0045359 | SkillPak 1 BIO AF-rProtein L-650F, x10 | 1 mL | 0.8 cm ID × 2.0 cm |
| 0045360 | SkillPak 5 BIO AF-rProtein L-650F, x6 | 5 mL | 1.6 cm ID × 2.5 cm |
| 0045361 | SkillPak 5 BIO AF-rProtein L-650F, x10 | 5 mL | 1.6 cm ID × 2.5 cm |
| 0045362 | SkillPak 10 BIO AF-rProtein L-650F, x6 | 10 mL | 1.6 cm ID × 5.1 cm |
| 0045363 | SkillPak 10 BIO AF-rProtein L-650F, x10 | 10 mL | 1.6 cm ID × 5.1 cm |
| 0045364 | SkillPak 25 BIO AF-rProtein L-650F, x1 | 25 mL | 2.5 cm ID × 5.1 cm |
| 0045365 | SkillPak 25 BIO AF-rProtein L-650F, x6 | 25 mL | 2.5 cm ID × 5.1 cm |
| 0045366 | SkillPak 25 BIO AF-rProtein L-650F, x10 | 25 mL | 2.5 cm ID × 5.1 cm |
| 0045367 | SkillPak 100 BIO AF-rProtein L-650F, x1 | 100 mL | 5.0 cm ID × 5.1 cm |
| 0045368 | SkillPak 100 BIO AF-rProtein L-650F, x6 | 100 mL | 5.0 cm ID × 5.1 cm |
| 0045369 | SkillPak 100 BIO AF-rProtein L-650F, x10 | 100 mL | 5.0 cm ID × 5.1 cm |
| TOYOPEARL Sulfate-650F | | | |
| 0045370 | SkillPak 1 BIO Sulfate-650F, x4 | 1 mL | 0.8 cm ID × 2.0 cm |
| 0045371 | SkillPak 5 BIO Sulfate-650F, x4 | 5 mL | 1.6 cm ID × 2.5 cm |
| 0045372 | SkillPak 10 BIO Sulfate-650F, x4 | 10 mL | 1.6 cm ID × 5.1 cm |
| 0045373 | SkillPak 25 BIO Sulfate-650F, x1 | 25 mL | 2.5 cm ID × 5.1 cm |
| 0045374 | SkillPak 25 BIO Sulfate-650F, x4 | 25 mL | 2.5 cm ID × 5.1 cm |
| 0045375 | SkillPak 100 BIO Sulfate-650F, x1 | 100 mL | 5.0 cm ID × 5.1 cm |
| 0045376 | SkillPak 100 BIO Sulfate-650F, x4 | 100 mL | 5.0 cm ID × 5.1 cm |

Ordering Information:

| Part # | Description | Resin volume (ea.) | Column dimensions |
|--------------------------------------|--|--------------------|--------------------|
| TOYOPEARL GigaCap S-650M | | | |
| 0045377 | SkillPak 1 BIO GigaCap S-650M, x6 | 1 mL | 0.8 cm ID × 2.0 cm |
| 0045378 | SkillPak 1 BIO GigaCap S-650M, x10 | 1 mL | 0.8 cm ID × 2.0 cm |
| 0045379 | SkillPak 5 BIO GigaCap S-650M, x6 | 5 mL | 1.6 cm ID × 2.5 cm |
| 0045380 | SkillPak 5 BIO GigaCap S-650M, x10 | 5 mL | 1.6 cm ID × 2.5 cm |
| 0045381 | SkillPak 10 BIO GigaCap S-650M, x6 | 10 mL | 1.6 cm ID × 5.1 cm |
| 0045382 | SkillPak 10 BIO GigaCap S-650M, x10 | 10 mL | 1.6 cm ID × 5.1 cm |
| 0045383 | SkillPak 25 BIO GigaCap S-650M, x1 | 25 mL | 2.5 cm ID × 5.1 cm |
| TOYOPEARL NH₂-750F | | | |
| 0045384 | SkillPak 1 BIO NH ₂ -750F, x4 | 1 mL | 0.8 cm ID × 2.0 cm |
| 0045385 | SkillPak 5 BIO NH ₂ -750F, x4 | 5 mL | 1.6 cm ID × 2.5 cm |
| 0045386 | SkillPak 10 BIO NH ₂ -750F, x4 | 10 mL | 1.6 cm ID × 5.1 cm |
| 0045387 | SkillPak 25 BIO NH ₂ -750F, x1 | 25 mL | 2.5 cm ID × 5.1 cm |
| 0045388 | SkillPak 25 BIO NH ₂ -750F, x4 | 50 mL | 2.5 cm ID × 10 cm |
| 0045389 | SkillPak 100 BIO NH ₂ -750F, x1 | 100 mL | 5.0 cm ID × 5.1 cm |
| 0045390 | SkillPak 100 BIO NH ₂ -750F, x4 | 100 mL | 5.0 cm ID × 5.1 cm |
| TOYOPEARL SuperQ-650S | | | |
| 0045391 | SkillPak 1 BIO SuperQ-650S, x4 | 1 mL | 0.8 cm ID × 2.0 cm |
| 0045392 | SkillPak 5 BIO SuperQ-650S, x4 | 5 mL | 1.6 cm ID × 2.5 cm |
| 0045393 | SkillPak 10 BIO SuperQ-650S, x4 | 10 mL | 1.6 cm ID × 5.1 cm |
| 0045394 | SkillPak 25 BIO SuperQ-650S, x1 | 25 mL | 2.5 cm ID × 5.1 cm |
| 0045395 | SkillPak 25 BIO SuperQ-650S, x4 | 50 mL | 2.5 cm ID × 10 cm |
| 0045396 | SkillPak 100 BIO SuperQ-650S, x1 | 100 mL | 5.0 cm ID × 5.1 cm |
| 0045397 | SkillPak 100 BIO SuperQ-650S, x4 | 100 mL | 5.0 cm ID × 5.1 cm |



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