SkillPak™ Pre-Packed Columns
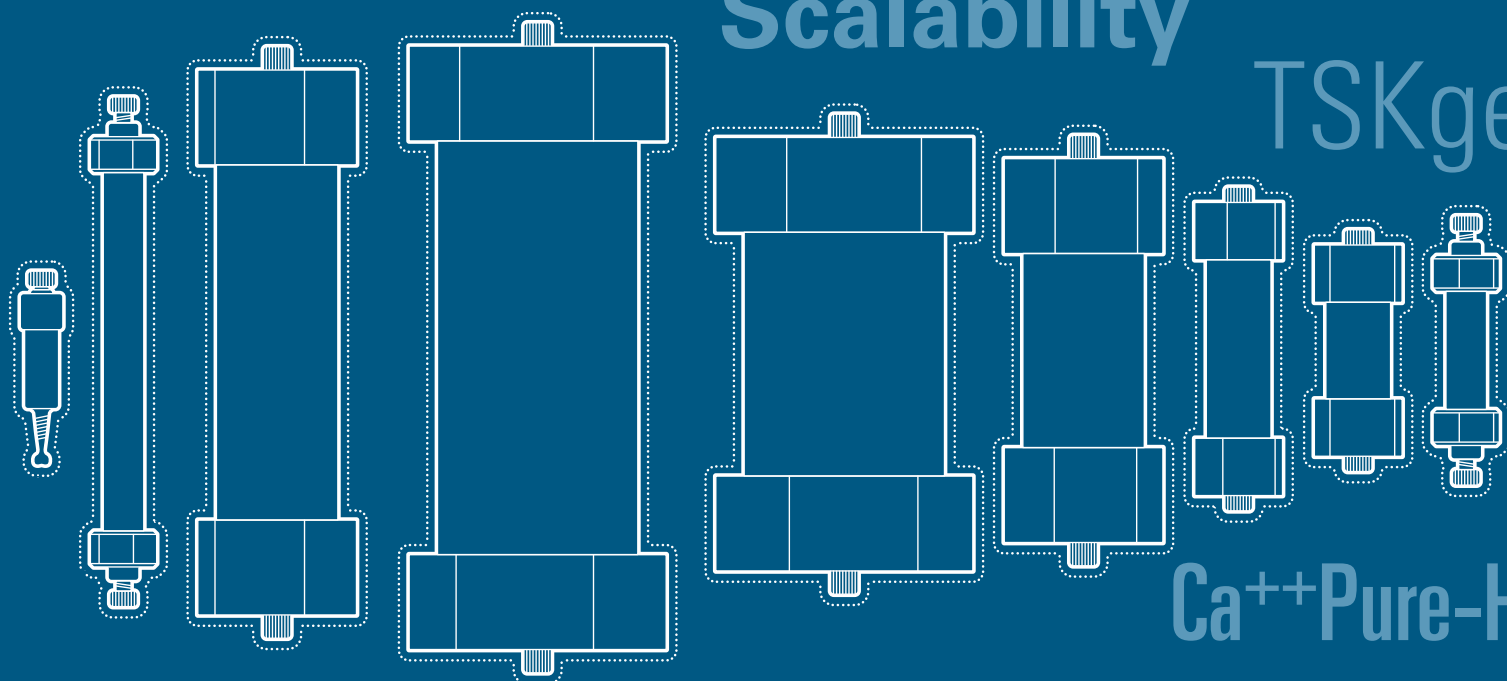
High Performance

SkillPak

Convenience

Multi-Column Chromatography

Scalability

TSKgel

Ca⁺⁺Pure-HA

Method Development

SkillPak BIO

TOYOPEARL

MCC

Experts in Chromatography
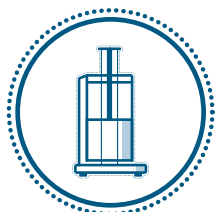
TOSOH BIOSCIENCE

TOSOH BIOSCIENCE

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.
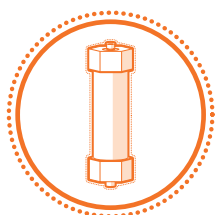
SkillPak™ Pre-packed Columns

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 LenS$_3$ 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.
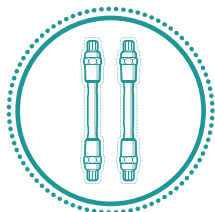
TSKgel U/HPLC Columns

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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SkillPak BIO Pre-packed Columns - Simplify Your MCC Process Development

Simplify Your Batch Method Development

SkillPak Pre-packed Columns

TOSOH BIOSCIENCE

- **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 × 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	• ≤ 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 × 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	• ≤ 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
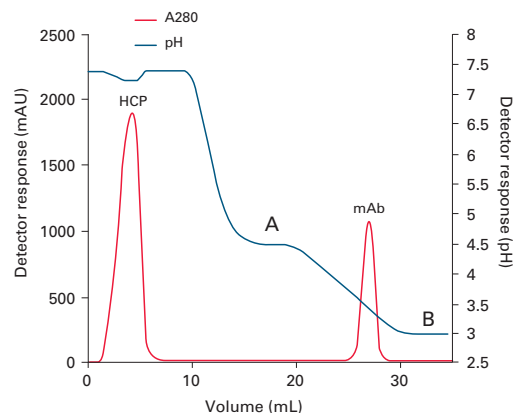
B: SkillPak TOYOPEARL AF-rProtein A HC-650F column

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.

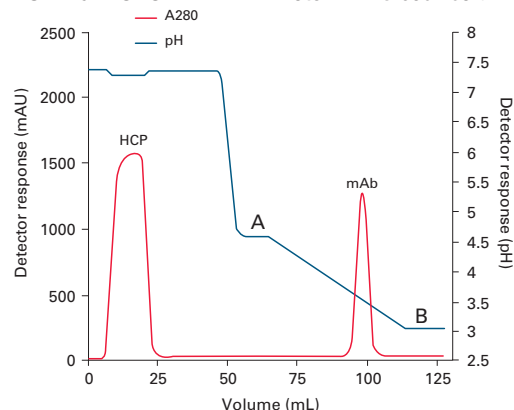### Experimental Conditions

Column:	SkillPak 5 TOYOPEARL AF-rProtein A HC-650F (5 mL)
Equilibration buffer:	0.1 mol/L Na_2HPO_4/NaH_2PO_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
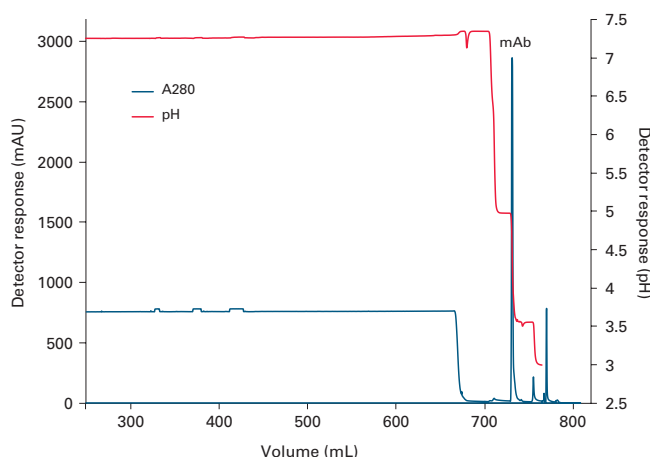
Column reproducibility: capture of intact mAb using a 5 mL SkillPak column

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 NH_2-750F 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 NH_2-750F in different scales
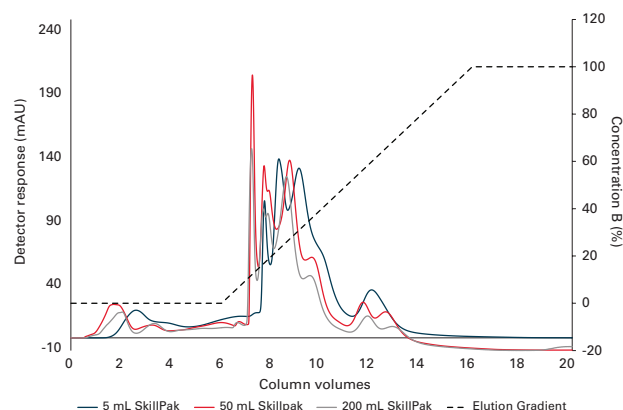
➤ Table 6. Composition of CEX protein standard

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
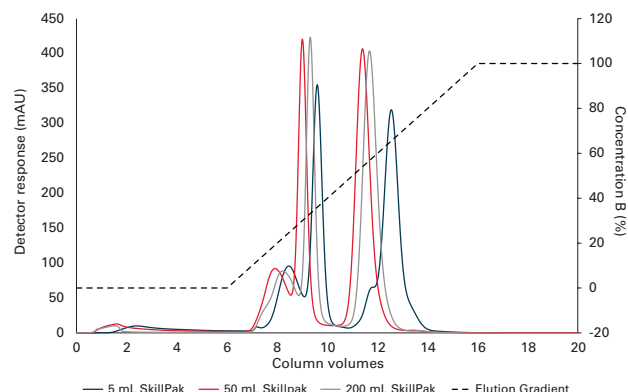
The separation of the protein standards on AEX and CEX leads to similar elution profiles on the different column scales. The proteins eluted with increasing net surface charge during the linear salt gradient. In both cases, a shift to the right in retention volume can be observed with decreasing column 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 NH_2-750F 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 NH_2-750F

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 NH₂ (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 μm for TSKgel Super Q-5PW (20), 45 μm for TOYOPEARL AF-rProtein L-650F, and 65 μm 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
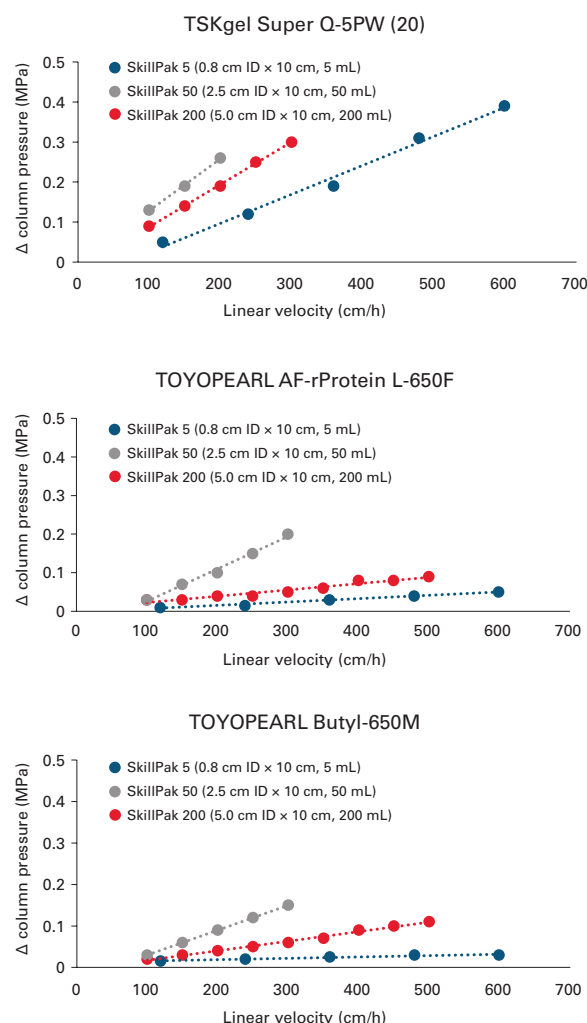
Ordering Information: SkillPak 1 columns

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

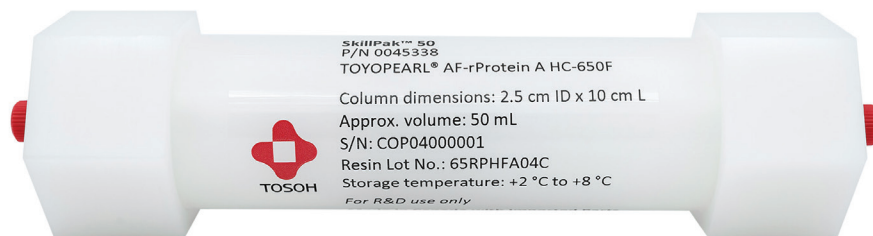## Ordering Information: SkillPak 5 columns, continued

Part #	Description	Resin volume (ea.)	Column dimensions
Mixed-Mode Chromatography			
0045261	SkillPak 5 TOYOPEARL MX-Trp-650M	5 mL	0.8 cm ID × 10 cm
Size Exclusion Chromatography			
0045292	SkillPak 5 TOYOPEARL HW-40C	5 mL	0.8 cm ID × 10 cm
0045260	SkillPak 5 TOYOPEARL HW-40F	5 mL	0.8 cm ID × 10 cm
HA Chromatography			
0045262	SkillPak 5 Ca^{++}Pure-HA	5 mL	0.8 cm ID × 10 cm
Column Libraries			
0045263	SkillPak 5 mAb Platform column library, (TOYOPEARL AF-rProtein A HC-650F, Sulfate-650F, NH$_2$-750F)	5 mL × 1 ea	0.8 cm ID × 10 cm
0045264	SkillPak 5 Salt Tolerant column library, (TOYOPEARL Sulfate-650F, NH$_2$-750F)	5 mL × 1 ea	0.8 cm ID × 10 cm
0045265	SkillPak 5 Mixed Mode column library, (Ca^{++}Pure-HA, TOYOPEARL MX-Trp-650M)	5 mL × 1 ea	0.8 cm ID × 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 × 1 ea	0.8 cm ID × 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 × 10 cm
Ion Exchange Chromatography			
0045302	SkillPak 50 TSKgel SuperQ-5PW (20)	50 mL	2.5 cm ID × 10 cm
0045304	SkillPak 50 TOYOPEARL SuperQ-650S	50 mL	2.5 cm ID × 10 cm
0045306	SkillPak 50 TOYOPEARL GigaCap Q-650M	50 mL	2.5 cm ID × 10 cm
0045308	SkillPak 50 TOYOPEARL GigaCap DEAE-650M	50 mL	2.5 cm ID × 10 cm
0045310	SkillPak 50 TOYOPEARL NH_2-750F	50 mL	2.5 cm ID × 10 cm
0045312	SkillPak 50 TOYOPEARL QAE-550C	50 mL	2.5 cm ID × 10 cm
0045314	SkillPak 50 TOYOPEARL GigaCap S-650S	50 mL	2.5 cm ID × 10 cm
0045316	SkillPak 50 TSKgel SP-5PW (20)	50 mL	2.5 cm ID × 10 cm
0045318	SkillPak 50 TOYOPEARL Sulfate-650F	50 mL	2.5 cm ID × 10 cm
0045320	SkillPak 50 TOYOPEARL GigaCap CM-650M	50 mL	2.5 cm ID × 10 cm
0045322	SkillPak 50 TOYOPEARL SP-550C	50 mL	2.5 cm ID × 10 cm
Hydrophobic Interaction Chromatography			
0045324	SkillPak 50 TOYOPEARL PPG-600M	50 mL	2.5 cm ID × 10 cm
0045326	SkillPak 50 TOYOPEARL Butyl-600M	50 mL	2.5 cm ID × 10 cm
0045328	SkillPak 50 TOYOPEARL Butyl-650M	50 mL	2.5 cm ID × 10 cm
0045330	SkillPak 50 TOYOPEARL Hexyl-650C	50 mL	2.5 cm ID × 10 cm
0045332	SkillPak 50 TOYOPEARL Phenyl-600M	50 mL	2.5 cm ID × 10 cm
0045334	SkillPak 50 TOYOPEARL Phenyl-650M	50 mL	2.5 cm ID × 10 cm
0045336	SkillPak 50 TOYOPEARL Ether-650M	50 mL	2.5 cm ID × 10 cm
Affinity Chromatography			
0045338	SkillPak 50 TOYOPEARL AF-rProtein A HC-650F	50 mL	2.5 cm ID × 10 cm
0045340	SkillPak 50 TOYOPEARL AF-rProtein L-650F	50 mL	2.5 cm ID × 10 cm
0045342	SkillPak 50 TOYOPEARL AF-Chelate-650M	50 mL	2.5 cm ID × 10 cm
Mixed-Mode Chromatography			
0045344	SkillPak 50 TOYOPEARL MX-Trp-650M	50 mL	2.5 cm ID × 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 × 10 cm
Ion Exchange Chromatography			
0045303	SkillPak 200 TSKgel SuperQ-5PW (20)	200 mL	5.0 cm ID × 10 cm
0045305	SkillPak 200 TOYOPEARL SuperQ-650S	200 mL	5.0 cm ID × 10 cm
0045307	SkillPak 200 TOYOPEARL GigaCap Q-650M	200 mL	5.0 cm ID × 10 cm
0045309	SkillPak 200 TOYOPEARL GigaCap DEAE-650M	200 mL	5.0 cm ID × 10 cm
0045311	SkillPak 200 TOYOPEARL NH$_2$-750F	200 mL	5.0 cm ID × 10 cm
0045313	SkillPak 200 TOYOPEARL QAE-550C	200 mL	5.0 cm ID × 10 cm
0045315	SkillPak 200 TOYOPEARL GigaCap S-650S	200 mL	5.0 cm ID × 10 cm
0045317	SkillPak 200 TSKgel SP-5PW (20)	200 mL	5.0 cm ID × 10 cm
0045319	SkillPak 200 TOYOPEARL Sulfate-650F	200 mL	5.0 cm ID × 10 cm
0045321	SkillPak 200 TOYOPEARL GigaCap CM-650M	200 mL	5.0 cm ID × 10 cm
0045323	SkillPak 200 TOYOPEARL SP-550C	200 mL	5.0 cm ID × 10 cm
Hydrophobic Interaction Chromatography			
0045325	SkillPak 200 TOYOPEARL PPG-600M	200 mL	5.0 cm ID × 10 cm
0045327	SkillPak 200 TOYOPEARL Butyl-600M	200 mL	5.0 cm ID × 10 cm
0045329	SkillPak 200 TOYOPEARL Butyl-650M	200 mL	5.0 cm ID × 10 cm
0045331	SkillPak 200 TOYOPEARL Hexyl-650C	200 mL	5.0 cm ID × 10 cm
0045333	SkillPak 200 TOYOPEARL Phenyl-600M	200 mL	5.0 cm ID × 10 cm
0045335	SkillPak 200 TOYOPEARL Phenyl-650M	200 mL	5.0 cm ID × 10 cm
0045337	SkillPak 200 TOYOPEARL Ether-650M	200 mL	5.0 cm ID × 10 cm
Affinity Chromatography			
0045339	SkillPak 200 TOYOPEARL AF-rProtein A HC-650F	200 mL	5.0 cm ID × 10 cm
0045341	SkillPak 200 TOYOPEARL AF-rProtein L-650F	200 mL	5.0 cm ID × 10 cm
0045343	SkillPak 200 TOYOPEARL AF-Chelate-650M	200 mL	5.0 cm ID × 10 cm
Mixed-Mode Chromatography			
0045345	SkillPak 200 TOYOPEARL MX-Trp-650M	200 mL	5.0 cm ID × 10 cm
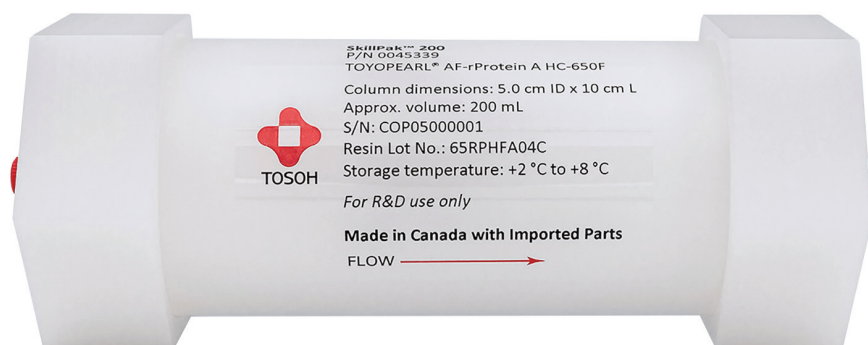
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Simplify Your MCC Process Development

- **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	• 6 columns for standard processes • 10 columns for high-titer processes	• 1, 6, and 10 columns to adapt to any process setup
IEC	• 4 columns to cover all IEC MCC processes	• 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 NH2-750F, x4	1 mL	0.8 cm ID × 2.0 cm
0045385	SkillPak 5 BIO NH2-750F, x4	5 mL	1.6 cm ID × 2.5 cm
0045386	SkillPak 10 BIO NH2-750F, x4	10 mL	1.6 cm ID × 5.1 cm
0045387	SkillPak 25 BIO NH2-750F, x1	25 mL	2.5 cm ID × 5.1 cm
0045388	SkillPak 25 BIO NH2-750F, x4	50 mL	2.5 cm ID × 10 cm
0045389	SkillPak 100 BIO NH2-750F, x1	100 mL	5.0 cm ID × 5.1 cm
0045390	SkillPak 100 BIO NH2-750F, 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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