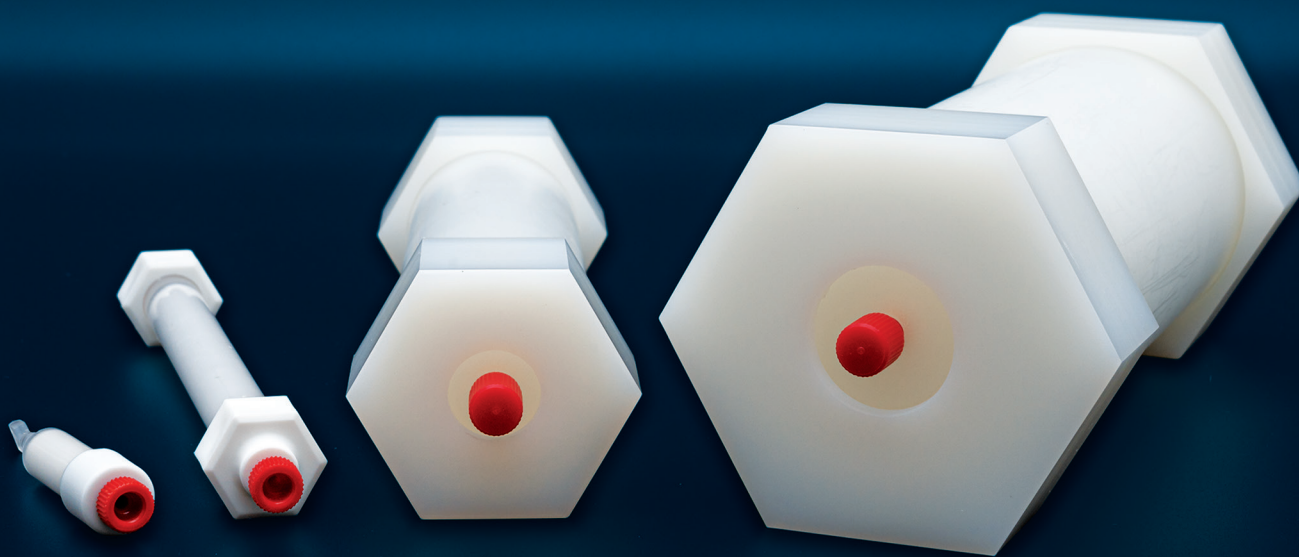




SkillPak[®] Pre-Packed Columns



High Performance • Convenience • Scalability
Short Delivery Times

Experts in Chromatography

TOSOH BIOSCIENCE

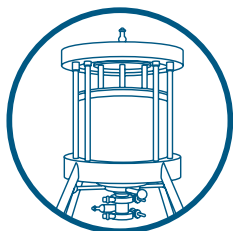


TOSOH BIOSCIENCE

TOSOH

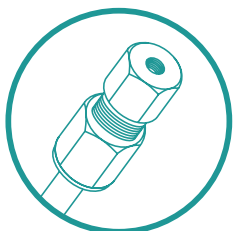
Solutions for Your Purification and Separation Tasks from Lab to Production

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.



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.

SkillPak are chromatography columns pre-packed with TOYOPEARL, TSKgel, or Ca⁺⁺Pure-HA process chromatography media. These columns have been designed to develop and scale-up purification processes for biomolecules, such as monoclonal antibodies, proteins and oligonucleotides.

SkillPak pre-packed columns are designed for your purification and separation tasks from platform design to pilot scale. These columns are ready to use upon receipt and show excellent physical strength and ideal flow characteristics for industrial downstream processing.

Table 1. 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. 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

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 3. 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. 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

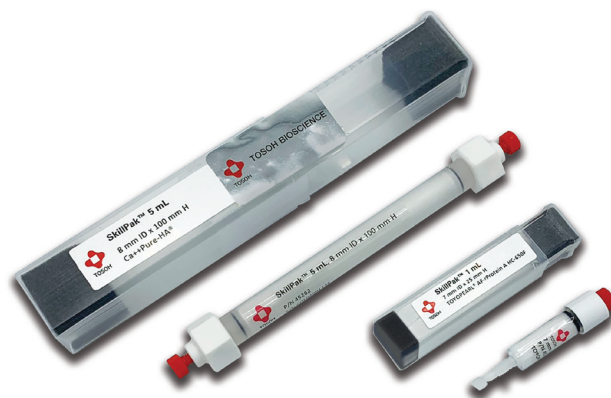
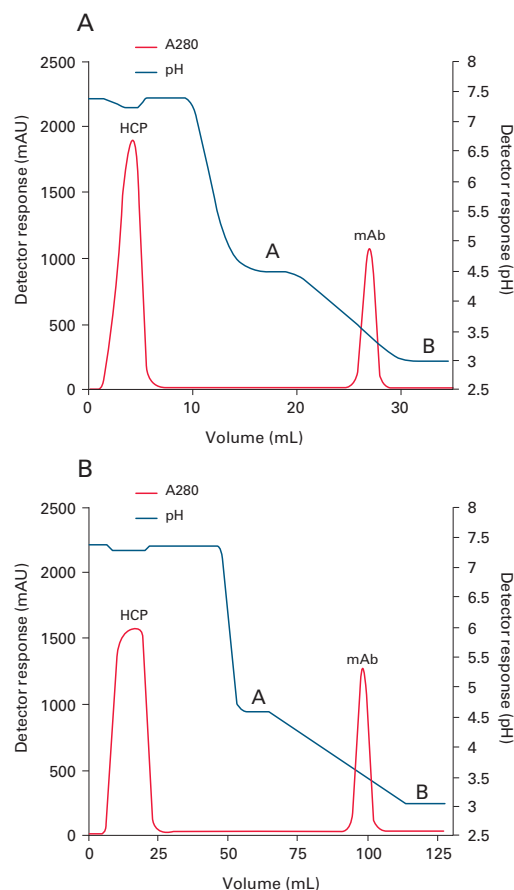
Finding the appropriate buffer and pH for mAb elution reduces the risk of increasing aggregation in the mAb sample. To identify optimized conditions for mAb binding and elution, a buffer-adjusted mAb containing Chinese Hamster Ovary (CHO) cell line supernatant was loaded onto a 5 mL SkillPak column pre-packed with TOYOPEARL AF-rProtein A HC-650F media.

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 TOYOPEARL AF-rProtein A HC-650F column (Panel A); SkillPak 5 TOYOPEARL AF-rProtein A HC-650F column (Panel B)



Method development for Fab purification: capture of Fab antibodies using a 1 mL SkillPak column

Humanized IgG₁ was digested using a papain enzyme to obtain Fab. See procedure below. 100 µL of the papain-digested IgG₁ which contains Fab material was loaded onto a 1 mL SkillPak column pre-packed with TOYOPEARL AF-rProtein L-650F resin.

3.5 g/L human IgG₁
50 mmol/L sodium phosphate buffer, pH 7.0
150 mmol/L sodium chloride
10 mmol/L L-cystein
10 mmol/L EDTA

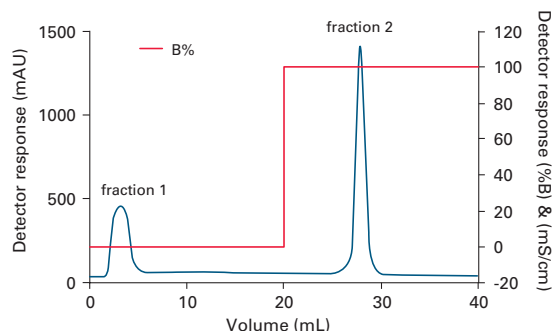
25 °C 5h incubation

Add 1/10 volume of 0.3 mol/L N-Ethylmaleimide

Fab to be loaded onto the SkillPak 1 TOYOPEARL AF-rProtein L-650F column

Figure 2 shows that Fab from the digested humanized IgG₁ was successfully captured by the SkillPak 1 TOYOPEARL AF-rProtein L-650F column. Fab was eluted at approximately 28 minutes.

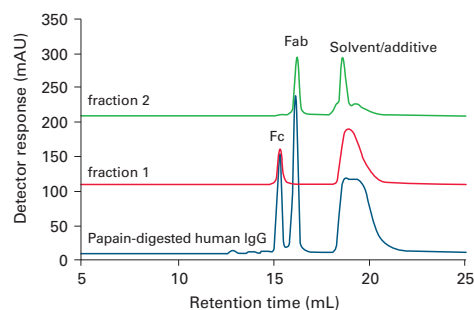
Figure 2. Capture of Fab using the SkillPak 1 TOYOPEARL AF-rProtein L-650F column



Column: SkillPak 1 TOYOPEARL AF-rProtein L-650F
Flow rate: 0.5 mL/min
Mobile phase: A: 0.1 mol/L citrate buffer, pH 6.5
B: 0.1 mol/L citrate buffer, pH 2.2
Detection: UV @ 280 nm
Sample: papain-digested human IgG₁

The unbound peak (fraction 1) and the Fab peak (fraction 2) were captured and then analyzed using a 2 µm size exclusion chromatography column, TSKgel UP-SW3000. **Figure 3** shows that only fraction 2 contained Fab material, as compared to the papain-digested IgG (reference material).

Figure 3. Analysis of captured Fab from the digested IgG₁ using TSKgel UP-SW3000



Column: TSKgel UP-SW3000, 2 µm, 4.6 mm ID x 30 cm
Flow rate: 0.5 mL/min
Mobile phase: 50 mmol/L phosphate buffer + 0.2 mol/L NaCl, pH 6.8
Detection: UV @ 280 nm
Samples: fractions of protein L chromatography
papain-digest of human IgG



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

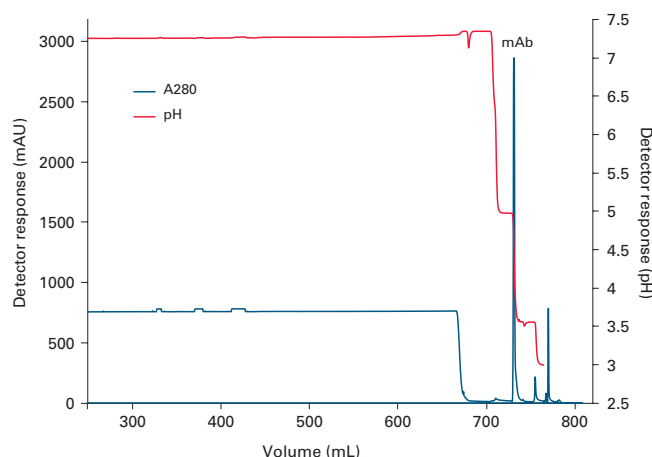
340 mL of hybridoma cell line supernatant (titer ~0.03 g/L) was loaded on a 5 mL SkillPak column packed with TOYOPEARL AF-rProtein A HC 650F resin.

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

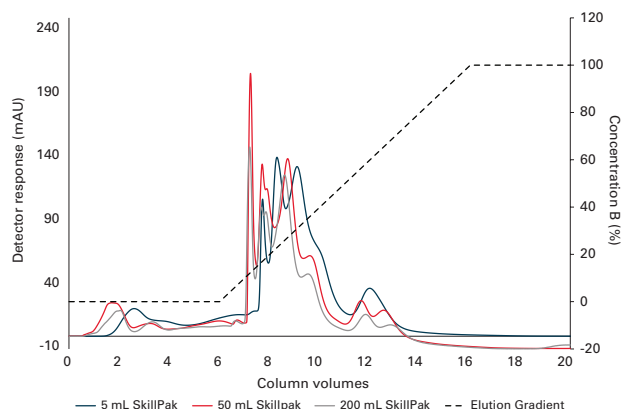
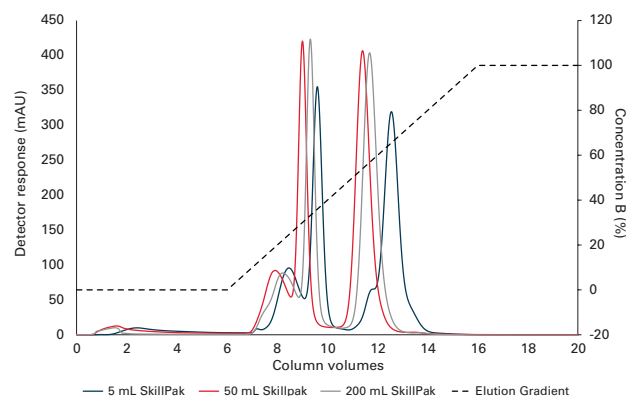


Table 6. Composition of CEX protein standard

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)

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

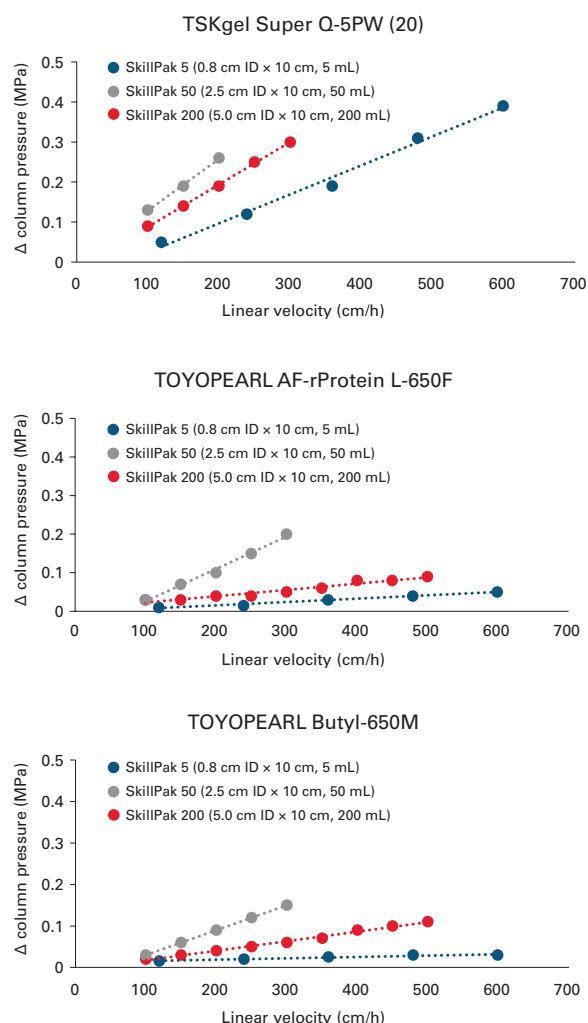
Overall recoveries of around 90 % and a high monomer purity of over 99.9 % were achieved. Using the SkillPak column platform, we could effortlessly develop and the scale-up the process without adjusting the process parameters between the different scales. This seamless scale-up using SkillPak pre-packed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

(Full application note available)

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			
45200	SkillPak 1 TOYOPEARL AF-rProtein L-650F	1 mL	0.7 cm ID × 2.5 cm
45221	SkillPak 1 TOYOPEARL AF-rProtein L-650F (qty. 5)	1 mL	0.7 cm ID × 2.5 cm
45201	SkillPak 1 TOYOPEARL AF-rProtein A HC-650F	1 mL	0.7 cm ID × 2.5 cm
45222	SkillPak 1 TOYOPEARL AF-rProtein A HC-650F (qty. 5)	1 mL	0.7 cm ID × 2.5 cm
45202	SkillPak 1 TOYOPEARL AF-Chelate-650M	1 mL	0.7 cm ID × 2.5 cm
Ion Exchange Chromatography			
45274	SkillPak 1 TOYOPEARL GigaCap Q-650S (qty. 5)	1 mL	0.7 cm ID × 2.5 cm
45203	SkillPak 1 TOYOPEARL GigaCap Q-650M (qty. 5)	1 mL	0.7 cm ID × 2.5 cm
45204	SkillPak 1 TOYOPEARL GigaCap S-650S (qty. 5)	1 mL	0.7 cm ID × 2.5 cm
45275	SkillPak 1 TOYOPEARL GigaCap S-650M (qty. 5)	1 mL	0.7 cm ID × 2.5 cm
45205	SkillPak 1 TOYOPEARL Sulfate-650F (qty. 5)	1 mL	0.7 cm ID × 2.5 cm
45206	SkillPak 1 TOYOPEARL SuperQ-650Ss (qty. 5)	1 mL	0.7 cm ID × 2.5 cm
45282	SkillPak 1 TOYOPEARL SuperQ-650M (qty. 5)	1 mL	0.7 cm ID × 2.5 cm
45207	SkillPak 1 TSKgel SP-5PW (20) (qty. 5)	1 mL	0.7 cm ID × 2.5 cm
45208	SkillPak 1 TSKgel SuperQ-5PW (20) (qty. 5)	1 mL	0.7 cm ID × 2.5 cm
45209	SkillPak 1 TOYOPEARL NH ₂ -750F (qty. 5)	1 mL	0.7 cm ID × 2.5 cm
45210	SkillPak 1 TOYOPEARL GigaCap DEAE-650M (qty. 5)	1 mL	0.7 cm ID × 2.5 cm
45211	SkillPak 1 TOYOPEARL GigaCap CM-650M (qty. 5)	1 mL	0.7 cm ID × 2.5 cm
45212	SkillPak 1 TOYOPEARL QAE-550C (qty. 5)	1 mL	0.7 cm ID × 2.5 cm
45213	SkillPak 1 TOYOPEARL SP-550C (qty. 5)	1 mL	0.7 cm ID × 2.5 cm
45280	SkillPak 1 TOYOPEARL SP-650C (qty. 5)	1 mL	0.7 cm ID × 2.5 cm
45281	SkillPak 1 TOYOPEARL SP-650M (qty. 5)	1 mL	0.7 cm ID × 2.5 cm
45268	SkillPak 1 TOYOPEARL CM-650C (qty. 5)	1 mL	0.7 cm ID × 2.5 cm
45269	SkillPak 1 TOYOPEARL CM-650M (qty. 5)	1 mL	0.7 cm ID × 2.5 cm
45270	SkillPak 1 TOYOPEARL CM-650S (qty. 5)	1 mL	0.7 cm ID × 2.5 cm
45271	SkillPak 1 TOYOPEARL DEAE-650C (qty. 5)	1 mL	0.7 cm ID × 2.5 cm
45272	SkillPak 1 TOYOPEARL DEAE-650M (qty. 5)	1 mL	0.7 cm ID × 2.5 cm
45273	SkillPak 1 TOYOPEARL DEAE-650Sn (qty. 5)	1 mL	0.7 cm ID × 2.5 cm
45277	SkillPak 1 TOYOPEARL MegaCap II SP-550EC (qty. 5)	1 mL	0.7 cm ID × 2.5 cm
Hydrophobic Interaction Chromatography			
45214	SkillPak 1 TOYOPEARL Butyl-600M (qty. 5)	1 mL	0.7 cm ID × 2.5 cm
45215	SkillPak 1 TOYOPEARL Butyl-650M (qty. 5)	1 mL	0.7 cm ID × 2.5 cm
45267	SkillPak 1 TOYOPEARL Butyl-650C (qty. 5)	1 mL	0.7 cm ID × 2.5 cm
45216	SkillPak 1 TOYOPEARL Phenyl-600M (qty. 5)	1 mL	0.7 cm ID × 2.5 cm
45279	SkillPak 1 TOYOPEARL Phenyl-650S (qty. 5)	1 mL	0.7 cm ID × 2.5 cm
45217	SkillPak 1 TOYOPEARL Phenyl-650M (qty. 5)	1 mL	0.7 cm ID × 2.5 cm
45278	SkillPak 1 TOYOPEARL Phenyl-650C (qty. 5)	1 mL	0.7 cm ID × 2.5 cm
45218	SkillPak 1 TOYOPEARL PPG-600M (qty. 5)	1 mL	0.7 cm ID × 2.5 cm
45219	SkillPak 1 TOYOPEARL Hexyl-650C (qty. 5)	1 mL	0.7 cm ID × 2.5 cm
45220	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			
45224	SkillPak 1 TOYOPEARL MX-Trp-650M (qty. 5)	1 mL	0.7 cm ID × 2.5 cm
Size Exclusion Chromatography			
45276	SkillPak 1 TOYOPEARL HW-40C (qty. 5)	1 mL	0.7 cm ID × 2.5 cm
45223	SkillPak 1 TOYOPEARL HW-40F (qty. 5)	1 mL	0.7 cm ID × 2.5 cm
HA Chromatography			
45225	SkillPak 1 Ca ⁺⁺ Pure-HA	1 mL	0.7 cm ID × 2.5 cm
Column Libraries			
45226	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
45227	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
45228	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 × 2 ea	0.7 cm ID × 2.5 cm
45229	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
45230	SkillPak 1 Salt Tolerant column library, (TOYOPEARL Sulfate-650F, NH ₂ -750F)	1 mL × 2 ea	0.7 cm ID × 2.5 cm
45231	SkillPak 1 Mixed Mode column library, (Ca ⁺⁺ Pure-HA, TOYOPEARL MX-Trp-650M)	1 mL × 2 ea	0.7 cm ID × 2.5 cm
45232	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 × 2 ea	0.7 cm ID × 2.5 cm
45233	SkillPak 1 HIC column library, (TOYOPEARL Butyl-650M, Phenyl-650M, PPG-600M, Hexyl-650C, Ether-650M)	1 mL × 2 ea	0.7 cm ID × 2.5 cm
45234	SkillPak 1 HIC column library, (TOYOPEARL Butyl-600M, Phenyl-600M, PPG-600M, Hexyl-650C, Ether-650M)	1 mL × 2 ea	0.7 cm ID × 2.5 cm
45235	SkillPak 1 HIC column library, (TOYOPEARL Butyl-650M, Phenyl-650M, PPG-600M)	1 mL × 2 ea	0.7 cm ID × 2.5 cm
45236	SkillPak 1 HIC column library, (TOYOPEARL Butyl-600M, Phenyl-600M, PPG-600M)	1 mL × 2 ea	0.7 cm ID × 2.5 cm
45237	SkillPak 1 HIC column library, (TOYOPEARL Phenyl-650M, PPG-600M, Hexyl-650C)	1 mL × 2 ea	0.7 cm ID × 2.5 cm
45238	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			
45257	SkillPak 5 TOYOPEARL AF-rProtein L-650F	5 mL	0.8 cm ID × 10 cm
45258	SkillPak 5 TOYOPEARL AF-rProtein A HC-650F	5 mL	0.8 cm ID × 10 cm
45259	SkillPak 5 TOYOPEARL AF-Chelate-650M	5 mL	0.8 cm ID × 10 cm
Ion Exchange Chromatography			
45290	SkillPak 5 TOYOPEARL GigaCap Q-650S	5 mL	0.8 cm ID × 10 cm
45239	SkillPak 5 TOYOPEARL GigaCap Q-650M	5 mL	0.8 cm ID × 10 cm
45240	SkillPak 5 TOYOPEARL GigaCap S-650S	5 mL	0.8 cm ID × 10 cm
45291	SkillPak 5 TOYOPEARL GigaCap S-650M	5 mL	0.8 cm ID × 10 cm
45241	SkillPak 5 TOYOPEARL Sulfate-650F	5 mL	0.8 cm ID × 10 cm
45242	SkillPak 5 TOYOPEARL SuperQ-650S	5 mL	0.8 cm ID × 10 cm
45298	SkillPak 5 TOYOPEARL SuperQ-650M	5 mL	0.8 cm ID × 10 cm
45243	SkillPak 5 TSKgel SP-5PW (20)	5 mL	0.8 cm ID × 10 cm
45244	SkillPak 5 TSKgel SuperQ-5PW (20)	5 mL	0.8 cm ID × 10 cm
45245	SkillPak 5 TOYOPEARL NH ₂ -750F	5 mL	0.8 cm ID × 10 cm
45246	SkillPak 5 TOYOPEARL GigaCap DEAE-650M	5 mL	0.8 cm ID × 10 cm
45247	SkillPak 5 TOYOPEARL GigaCap CM-650M	5 mL	0.8 cm ID × 10 cm
45248	SkillPak 5 TOYOPEARL QAE-550C	5 mL	0.8 cm ID × 10 cm
45249	SkillPak 5 TOYOPEARL SP-550C	5 mL	0.8 cm ID × 10 cm
45296	SkillPak 5 TOYOPEARL SP-650C	5 mL	0.8 cm ID × 10 cm
45297	SkillPak 5 TOYOPEARL SP-650M	5 mL	0.8 cm ID × 10 cm
45284	SkillPak 5 TOYOPEARL CM-650C	5 mL	0.8 cm ID × 10 cm
45285	SkillPak 5 TOYOPEARL CM-650M	5 mL	0.8 cm ID × 10 cm
45286	SkillPak 5 TOYOPEARL CM-650S	5 mL	0.8 cm ID × 10 cm
45287	SkillPak 5 TOYOPEARL DEAE-650C	5 mL	0.8 cm ID × 10 cm
45288	SkillPak 5 TOYOPEARL DEAE-650M	5 mL	0.8 cm ID × 10 cm
45289	SkillPak 5 TOYOPEARL DEAE-650S	5 mL	0.8 cm ID × 10 cm
45293	SkillPak 5 TOYOPEARL MegaCap II SP-550EC	5 mL	0.8 cm ID × 10 cm
Hydrophobic Interaction Chromatography			
45250	SkillPak 5 TOYOPEARL Butyl-600M	5 mL	0.8 cm ID × 10 cm
45251	SkillPak 5 TOYOPEARL Butyl-650M	5 mL	0.8 cm ID × 10 cm
45283	SkillPak 5 TOYOPEARL Butyl-650C	5 mL	0.8 cm ID × 10 cm
45252	SkillPak 5 TOYOPEARL Phenyl-600M	5 mL	0.8 cm ID × 10 cm
45294	SkillPak 5 TOYOPEARL Phenyl-650C	5 mL	0.8 cm ID × 10 cm
45253	SkillPak 5 TOYOPEARL Phenyl-650M	5 mL	0.8 cm ID × 10 cm
45295	SkillPak 5 TOYOPEARL Phenyl-650S	5 mL	0.8 cm ID × 10 cm
45254	SkillPak 5 TOYOPEARL PPG-600M	5 mL	0.8 cm ID × 10 cm
45255	SkillPak 5 TOYOPEARL Hexyl-650C	5 mL	0.8 cm ID × 10 cm
45256	SkillPak 5 TOYOPEARL Ether-650M	5 mL	0.8 cm ID × 10 cm
45296	SkillPak 5 TOYOPEARL SP-650C	5 mL	0.8 cm ID × 10 cm
45297	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			
45261	SkillPak 5 TOYOPEARL MX-Trp-650M	5 mL	0.8 cm ID × 10 cm
Size Exclusion Chromatography			
45292	SkillPak 5 TOYOPEARL HW-40C	5 mL	0.8 cm ID × 10 cm
45260	SkillPak 5 TOYOPEARL HW-40F	5 mL	0.8 cm ID × 10 cm
HA Chromatography			
45262	SkillPak 5 Ca ⁺⁺ Pure-HA	5 mL	0.8 cm ID × 10 cm
Column Libraries			
45263	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
45264	SkillPak 5 Salt Tolerant column library, (TOYOPEARL Sulfate-650F, NH ₂ -750F)	5 mL × 1 ea	0.8 cm ID × 10 cm
45265	SkillPak 5 Mixed Mode column library, (Ca ⁺⁺ Pure-HA, TOYOPEARL MX-Trp-650M)	5 mL × 1 ea	0.8 cm ID × 10 cm
45266	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			
45300	SkillPak 50 TOYOPEARL HW-40F	50 mL	2.5 cm ID × 10 cm
Ion Exchange Chromatography			
45302	SkillPak 50 TSKgel SuperQ-5PW (20)	50 mL	2.5 cm ID × 10 cm
45304	SkillPak 50 TOYOPEARL SuperQ-650S	50 mL	2.5 cm ID × 10 cm
45306	SkillPak 50 TOYOPEARL GigaCap Q-650M	50 mL	2.5 cm ID × 10 cm
45308	SkillPak 50 TOYOPEARL GigaCap DEAE-650M	50 mL	2.5 cm ID × 10 cm
45310	SkillPak 50 TOYOPEARL NH ₂ -750F	50 mL	2.5 cm ID × 10 cm
45312	SkillPak 50 TOYOPEARL QAE-550C	50 mL	2.5 cm ID × 10 cm
45314	SkillPak 50 TOYOPEARL GigaCap S-650S	50 mL	2.5 cm ID × 10 cm
45316	SkillPak 50 TSKgel SP-5PW (20)	50 mL	2.5 cm ID × 10 cm
45318	SkillPak 50 TOYOPEARL Sulfate-650F	50 mL	2.5 cm ID × 10 cm
45320	SkillPak 50 TOYOPEARL GigaCap CM-650M	50 mL	2.5 cm ID × 10 cm
45322	SkillPak 50 TOYOPEARL SP-550C	50 mL	2.5 cm ID × 10 cm
Hydrophobic Interaction Chromatography			
45324	SkillPak 50 TOYOPEARL PPG-600M	50 mL	2.5 cm ID × 10 cm
45326	SkillPak 50 TOYOPEARL Butyl-600M	50 mL	2.5 cm ID × 10 cm
45328	SkillPak 50 TOYOPEARL Butyl-650M	50 mL	2.5 cm ID × 10 cm
45330	SkillPak 50 TOYOPEARL Hexyl-650C	50 mL	2.5 cm ID × 10 cm
45332	SkillPak 50 TOYOPEARL Phenyl-600M	50 mL	2.5 cm ID × 10 cm
45334	SkillPak 50 TOYOPEARL Phenyl-650M	50 mL	2.5 cm ID × 10 cm
45336	SkillPak 50 TOYOPEARL Ether-650M	50 mL	2.5 cm ID × 10 cm
Affinity Chromatography			
45338	SkillPak 50 TOYOPEARL AF-rProtein A HC-650F	50 mL	2.5 cm ID × 10 cm
45340	SkillPak 50 TOYOPEARL AF-rProtein L-650F	50 mL	2.5 cm ID × 10 cm
45342	SkillPak 50 TOYOPEARL AF-Chelate-650M	50 mL	2.5 cm ID × 10 cm
Mixed-Mode Chromatography			
45344	SkillPak 50 TOYOPEARL MX-Trp-650M	50 mL	2.5 cm ID × 10 cm

Ordering Information: SkillPak 200 columns

Part #	Description	Resin volume (ea.)	Column dimensions
Size Exclusion Chromatography			
45301	SkillPak 200 TOYOPEARL HW-40F	200 mL	5.0 cm ID x 10 cm
Ion Exchange Chromatography			
45303	SkillPak 200 TSKgel SuperQ-5PW (20)	200 mL	5.0 cm ID x 10 cm
45305	SkillPak 200 TOYOPEARL SuperQ-650S	200 mL	5.0 cm ID x 10 cm
45307	SkillPak 200 TOYOPEARL GigaCap Q-650M	200 mL	5.0 cm ID x 10 cm
45309	SkillPak 200 TOYOPEARL GigaCap DEAE-650M	200 mL	5.0 cm ID x 10 cm
45311	SkillPak 200 TOYOPEARL NH ₂ -750F	200 mL	5.0 cm ID x 10 cm
45313	SkillPak 200 TOYOPEARL QAE-550C	200 mL	5.0 cm ID x 10 cm
45315	SkillPak 200 TOYOPEARL GigaCap S-650S	200 mL	5.0 cm ID x 10 cm
45317	SkillPak 200 TSKgel SP-5PW (20)	200 mL	5.0 cm ID x 10 cm
45319	SkillPak 200 TOYOPEARL Sulfate-650F	200 mL	5.0 cm ID x 10 cm
45321	SkillPak 200 TOYOPEARL GigaCap CM-650M	200 mL	5.0 cm ID x 10 cm
45323	SkillPak 200 TOYOPEARL SP-550C	200 mL	5.0 cm ID x 10 cm
Hydrophobic Interaction Chromatography			
45325	SkillPak 200 TOYOPEARL PPG-600M	200 mL	5.0 cm ID x 10 cm
45327	SkillPak 200 TOYOPEARL Butyl-600M	200 mL	5.0 cm ID x 10 cm
45329	SkillPak 200 TOYOPEARL Butyl-650M	200 mL	5.0 cm ID x 10 cm
45331	SkillPak 200 TOYOPEARL Hexyl-650C	200 mL	5.0 cm ID x 10 cm
45333	SkillPak 200 TOYOPEARL Phenyl-600M	200 mL	5.0 cm ID x 10 cm
45335	SkillPak 200 TOYOPEARL Phenyl-650M	200 mL	5.0 cm ID x 10 cm
45337	SkillPak 200 TOYOPEARL Ether-650M	200 mL	5.0 cm ID x 10 cm
Affinity Chromatography			
45339	SkillPak 200 TOYOPEARL AF-rProtein A HC-650F	200 mL	5.0 cm ID x 10 cm
45341	SkillPak 200 TOYOPEARL AF-rProtein L-650F	200 mL	5.0 cm ID x 10 cm
45343	SkillPak 200 TOYOPEARL AF-Chelate-650M	200 mL	5.0 cm ID x 10 cm
Mixed-Mode Chromatography			
45345	SkillPak 200 TOYOPEARL MX-Trp-650M	200 mL	5.0 cm ID x 10 cm

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TOSOH BIOSCIENCE

Tosoh Bioscience LLC
3604 Horizon Drive, Suite 100
King of Prussia, PA 19406
Orders & Service: (800) 366-4875
Fax: (484) 805-1277
www.tosohbioscience.com
email: info.tbl@tosoh.com

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