



Butyl-S Sepharose™ 6 Fast Flow

Hydrophobic interaction chromatography

Instructions for Use

Butyl-S Sepharose™ 6 Fast Flow is a separation resin for hydrophobic interaction chromatography (HIC). Substances are separated on the basis of differences in hydrophobicity. Butyl-S Sepharose 6 Fast Flow belongs to the Cytiva range of BioProcess™ resins.

This instruction contains information about resin characteristics as well as column packing, testing, and maintenance.

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Read these instructions carefully before using the products.

Safety

For use and handling of the products in a safe way, refer to the Safety Data Sheets.

1 Introduction

BioProcess resin

BioProcess chromatography resins are developed and supported for production-scale chromatography. BioProcess resins cover all purification steps from capture to polishing.

All BioProcess resins are produced with validated methods and are tested to meet manufacturing requirements. Secure ordering and delivery routines give a reliable supply of resins for production scale. Regulatory Support Files (RSF) are available for BioProcess resins to assist in process validation and submissions to regulatory authorities.

Resin description

The base matrix, Sepharose 6 Fast Flow, is a cross-linked, 6% agarose derivative with excellent flow characteristics, making it ideal for process-scale applications, particularly the initial capture and intermediate purification stages of a separation when high flow rates are required.

The high physical and chemical stability of the matrix prevents bed compression and the formation of fines, and allows for efficient maintenance procedures for increased lifespan.

Figure 1 shows a typical pressure-flow curve for Butyl-S Sepharose 6 Fast Flow. Table 1 lists its main characteristics.

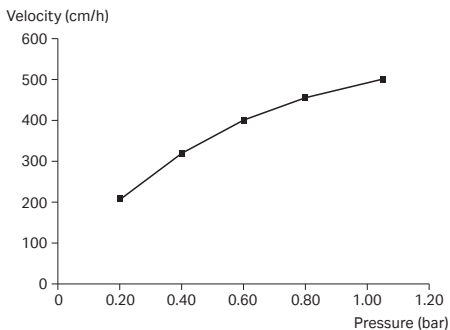


Fig 1. Typical pressure-flow curve for Butyl-S Sepharose 6 Fast Flow in an XK 50/30 column, bed height 15 cm; mobile phase 0.1 M NaCl

Resin properties

The following table lists the characteristics of the resins.

Table 1. Characteristics of Butyl-S Sepharose 6 Fast Flow

Matrix	Cross-linked agarose, 6%, spherical
Type of ligand	Butyl-S: -S-(CH ₂) ₃ -CH ₃ attached via a 12-atom spacer
Ligand concentration	~ 10 µmol ligand/mL resin
Particle size, d_{50v}¹	~ 90 µm
Pressure-flow characteristics^{2,3}	250–400 cm/h at < 0.1 MPa in an XK 50/60 column with 5 cm diameter and 25 cm bed height (at 20°C using buffers with the same viscosity as water)
pH stability, operational⁴	3 to 13
pH stability, CIP⁵	2 to 14
Operating temperature	4°C to 40°C
Chemical stability⁶	Stable in commonly used aqueous buffers, 1 mM HCl, 1.0 M NaOH, 30% isopropanol ⁷ , 6 M guanidine hydrochloride, 8 M urea
Autoclavability	20 min at 121°C in 0.05 M sodium phosphate, pH 7, 1 cycle
Delivery conditions	20% ethanol

¹ Median particle size of the cumulative volume distribution.

² The pressure-flow characteristics describe the relationship between pressure and flow under the set circumstances. The pressure given is not the maximum pressure of the resin.

³ Pressure-flow test performed on the base matrix.

⁴ pH range where resin can be operated without significant change in function.

⁵ pH range where resin can be subjected to cleaning- or sanitization-in-place without significant change in function.

⁶ 1.0 M NaOH should only be used for cleaning purposes.

⁷ Consult local safety regulations to verify if safety precautions are required for the use of 30% isopropanol.

Method design and optimization

The main purpose of optimizing a chromatographic step is to reach the predefined purity level with the highest possible product recovery by choosing the most suitable combination of critical chromatographic parameters. In process chromatography, in contrast to analytical or small-scale preparative chromatography, this has to be accomplished as quickly and economically as possible. That means finding the conditions that give the highest possible productivity and process economy.

Recommendations for optimizing the critical operational parameters that maximize the use of a HIC step can be found in *handbook (CY11248)*, or in related literature available at cytiva.com.

2 Binding

The binding of proteins to hydrophobic resins is influenced by:

- the structure of the ligand (e.g., carbon chain or an aromatic ligand)
- the ligand concentration
- the ionic strength of the buffer
- the salting-out effect (see The Hofmeister series in the next chapter)
- the temperature

Those salts which cause salting-out (e.g., ammonium sulfate), also promote binding to hydrophobic ligands. The column is equilibrated and the sample is applied in a solution of high ionic strength. A typical starting buffer is 1.7 M $(\text{NH}_4)_2\text{SO}_4$, which is just below the concentration employed for salting-out proteins.

Hydrophobic interactions are weaker at lower temperatures. This must be taken into account if chromatography is done in a cold room.

3 Elution

Bound proteins are eluted by reducing the strength of the hydrophobic interaction. This can be done by:

- reducing the concentration of salting-out ions in the buffer with a decreasing salt gradient (linear or step)
- increasing the concentration of salting-in ions in the buffer with an increasing gradient (linear or step)
- eluting with a polarity-reducing organic solvent (e.g., ethylene glycol) added to the buffer
- eluting with detergent added to the buffer

The Hofmeister series

← Increasing salting-out (precipitation) effect

Anions: $\text{PO}_4^{3-} < \text{SO}_4^{2-} < \text{CH}_3\text{COO}^- < \text{Cl}^- < \text{Br}^- < \text{NO}_3^- < \text{ClO}_4^- < \text{I}^- < \text{SCN}^-$

Cations: $\text{NH}_4^+ > \text{Rb}^+ > \text{K}^+ > \text{Na}^+ > \text{Cs}^+ > \text{Li}^+ > \text{Mg}^{2+} > \text{Ba}^{2+}$

Increasing salting-in (chaotropic) effect →

Increasing the salting-out (precipitation) effect strengthens the hydrophobic interactions; whereas increasing the salting-in (chaotropic) effect weakens them. It is recommended to start with a linear gradient from 0% to 100% B with:

Buffer A: 50 mM phosphate buffer, pH 7.0 + 1.7 M $(\text{NH}_4)_2\text{SO}_4$

Note: *When working with proteins that tend to aggregate, start with a lower $(\text{NH}_4)_2\text{SO}_4$ concentration to avoid protein precipitation.*

Buffer B: 50 mM phosphate buffer, pH 7.0

4 General column packing guidelines

Recommended columns

Laboratory-scale columns	• Tricorn™, i.d. 5-10 mm, bed volumes up to 24 mL, bed heights up to 30 cm • HiScale™, i.d. 10-50 mm, bed volumes up to 785 mL, bed heights up to 40 cm • XK, i.d. 16-50 mm, bed volumes up to 559 mL, bed heights up to 28 cm
Large-scale columns	• BPG, i.d. 100-450 mm, bed volumes up to 130 L, bed heights up to 58 cm • Chromaflow™, i.d. 280-2000 mm, bed volumes up to 1570 L, bed heights up to 50 cm • AxiChrom™, i.d. 50-200 mm, bed volumes up to 16.7 L, bed heights up to 50 cm • AxiChrom, i.d. 300-1600 mm, bed volumes up to 1005 L, bed heights up to 50 cm

General considerations

Purifying biological macromolecules by HIC is a typical high-selectivity technique where the difference in retention for the molecules to be separated can be substantial at any specific ionic strength.

Therefore, relatively short columns can be used if the selectivity of the adsorbent is exploited in an optimal way. Typical bed heights range from 3 to 15 cm, which also minimizes back pressure and allows for high throughput.

Columns can be packed in different ways depending on the type of column and equipment used. Always read and follow the column instruction manual carefully. Sepharose 6 Fast Flow based resins are easy to pack since their rigidity allows the use of high flow rates (see [Fig. 1, on page 4](#)).

Two types of packing methods are described:

- pressure packing (for columns with adapters)
- Chromaflow packing

The following parameters refer to large-scale packing:

General packing procedures	
Preferred packing solution	10% to 20% ethanol
Resin slurry concentration	50%
Packing pressure	0.16 to 0.20 MPa (1.6 to 2.0 bar)
Packing flow velocity	400 to 600 cm/h

The packing quality of the column greatly affects the separation results. It is very important to pack and test the column according to the following recommendations.

Always start by determining the optimal packing flow velocity. Guidelines for determining optimal packing flow velocities for columns with adapters and fixed bed heights are given in the next section.

Determine optimal packing flow velocity

The optimal packing flow velocity depends on column size and type, resin volume, packing solution, and temperature. The optimal packing flow velocity must therefore be determined empirically for each individual system.

To determine the optimal packing flow velocity, follow these steps:

Step	Action
-------------	---------------

- | | |
|----------|---|
| 1 | Calculate the amount of resin needed for the slurry (this is especially important for columns with fixed bed heights). The quantity of resin required per liter packed volume is approximately 1.15 L sedimented resin. |
| 2 | Prepare the column exactly as for column packing. |
| 3 | Start packing the resin at a low flow velocity (30 cm/h). |
| 4 | Increase the pressure in increments and record the flow velocity when the pressure has stabilized. Do not exceed the maximum pressure of the column, or the maximum flow velocity for the resin. |

Step	Action
------	--------

- | | |
|---|--|
| 5 | The maximum flow velocity is reached when the pressure-flow curve levels off or the maximum pressure of the column is reached. Stop packing and do not exceed this flow velocity. The optimal packing flow velocity/pressure is 70% to 100% of the maximum flow velocity/pressure. |
| 6 | Plot the pressure-flow rate curve as in Figure 1 and determine the optimal packing flow velocity. |

The operational flow velocity/pressure must be no greater than 70% of the packing flow velocity/pressure.

5 Packing laboratory-scale columns

HiScale and XK columns

The following instructions are for packing HiScale and XK columns with a 10 cm bed height, but the instructions can be modified for columns of different dimensions by maintaining the packing pressure at 0.2 MPa (2 bar).

Materials and equipment needed

Material / equipment needed	Specification
Resin	Butyl-S Sepharose 6 Fast Flow
Column	HiScale column or XK column
Equipment	• Chromatography system, such as ÄKTA™ system, or a stand-alone pump such as Pump P-900, depending on the required flow rate • Pressure monitor • Vacuum suction equipment
Other materials	• Measuring cylinder • Filter flask • Distilled water • Glass filter G4 • Plastic spoon or spatula

Prepare the slurry

To prepare the slurry, follow the steps below. If you only want to measure the slurry concentration, follow the first three steps of the instructions below or use the method for slurry concentration measurement described in the Applications content *How to determine resin slurry concentration*. The method can also be used for HiScale and XK columns.

Step	Action
------	--------

- | | |
|---|---|
| 1 | Let the resin settle in 20% ethanol at least overnight in a measuring cylinder. |
| 2 | Measure the sedimented resin in the measuring cylinder. |
| 3 | Calculate the slurry concentration. |
| 4 | Attach a glass filter funnel onto a filter flask. |
| 5 | Shake the resin to suspend it into a homogenous slurry. |
| 6 | Pour the resin into the glass filter funnel. |
| 7 | Wash the slurry five times with 1 to 2 mL distilled water/mL resin. |
| | Note:
<i>Gently stir with a spatula between each wash step.</i> |
| 8 | Transfer the washed slurry from the glass filter funnel into a beaker. |
| 9 | Add enough distilled water to obtain a 50% slurry concentration. |

Wash the resin

Step	Action
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- | | |
|---|---|
| 1 | Wash five times with 1 to 2 mL distilled water/mL resin. |
| 2 | Gently stir with a spatula between additions. |
| 3 | Move the washed resin from the funnel into a beaker and add distilled water to obtain a 50% slurry concentration. |

Prepare the column for packing

Step	Action
------	--------

- | | |
|---|--|
| 1 | Attach the packing tube to the top of the column and rinse with distilled water. |
| 2 | Attach the filter and the bottom piece to the column. |
| 3 | Wet the bottom filter by injecting 20% ethanol through the effluent tubing. |
| 4 | Assemble the column and the packing tube vertically on a laboratory stand and rinse them with distilled water. |
| 5 | Add distilled water, up to 2 cm over the column endpiece, and attach a tubing clamp to the effluent tubing. |
| 6 | Pour all the slurry into the column and packing tube. |
| 7 | Top up the column with distilled water. |

Pack the column

Step	Action
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- | | |
|---|---|
| 1 | Connect the pump outlet to the inlet on the packing tube and open the column outlet. |
| 2 | Pack the column with distilled water at a constant flow rate (see table below) until the resin bed is stable. |
| 3 | Adjust the flow rate to twice the final flow rate (see table below) and decrease the flow rate stepwise until the pressure signal is 0.18 ± 0.02 MPa. |
| 4 | Pack the column at the flow rate which gives 0.18 ± 0.02 MPa for 45 minutes. |
| 5 | Disconnect the packing tube. |
| 6 | Carefully fill the rest of the column with distilled water to form an upward meniscus at the top and insert the flow adapter. |
| Note:
<i>Lower the adapter down to the bed surface.</i> | |
| 7 | Continue packing the column at 0.18 ± 0.02 MPa for 6 minutes. |
| 8 | Mark the position of the bed surface on the column and stop the pump. |
| 9 | Close the column outlet and lower the adapter down to the bed surface. |
| 10 | Lower the adapter a further 3 mm into the resin bed. |

Note: It is recommended to perform CIP after packing, as column packing involves open handling of the resin.

Packing parameters

Parameter	Column inner diameter			
	10 mm ¹	16 mm	26 mm	50 mm
Sedimented resin (mL)²	9.2	23	61	230
Slurry (mL)	18.4	46	122	460
Bed height (mm)	100	100	100	100
Flow rate (mL/min)³	0.8	2.0	5.0	20
Pressure (MPa)⁴	0.18 ± 0.02	0.18 ± 0.02	0.18 ± 0.02	0.18 ± 0.02
Final flow rate (mL/min)	~ 4	~ 10	~ 25	~ 93

¹ Only applies to HiScale.

² Sedimented resin volume = 1.15 × packed resin volume.

³ Recommended flow rate at first packing step.

⁴ Pressure limit at second packing step.

Equilibration

To equilibrate, pump approximately 100 mL of start buffer through the column at a linear flow velocity of 60 cm/h. The column is fully equilibrated when the pH and/or conductivity of the effluent is the same as the start buffer.

Sample preparation

The amount of sample that can be applied to the column differs considerably, depending on the degree of substitution of the resin, the nature of the sample, and the start buffer conditions.

High ligand density does not necessarily correspond to high capacity for adsorption of protein, but a high ligand density can encourage multi-point attachment of proteins which otherwise might have difficulty adsorbing to lower ligand densities. A moderate ligand density allows selective binding of the target protein by adjustment of the binding buffer concentration.

The sample should be dissolved in start buffer. Alternatively the sample may be transferred to start buffer by dialysis or by buffer exchange using a HiTrap™ Desalting or a PD-10 Desalting columns. The viscosity of the sample should not exceed that of the buffer. For normal aqueous buffer systems, this corresponds to a protein concentration of approximately 50 mg/mL.

Before application, centrifuge or filter the sample through a 0.45 µm filter to remove particulate matter.

Operating flow velocity

The flow velocity used for sample binding and subsequent elution depends on the degree of resolution required, but is normally within the range of 60 to 100 cm/h for Sepharose 6 Fast Flow resins. The lower the flow velocity, the better the resolution and the capacity.

6 Packing methods for process-scale columns

Packing AxiChrom columns

AxiChrom columns are packed using mechanical axial compression packing. For more information regarding the AxiChrom columns and packing procedures, refer to:

- *AxiChrom columns, Data file (CY10003)*
- *AxiChrom 50–200 columns, Operating Instructions (29379190)*
- *AxiChrom 300–1600 columns, Operating Instructions (29065430)*
- *AxiChrom 300–2000 columns, User Manual (29388247)*
- *AxiChrom Column and AxiChrom Column Controller, User Manual (29720910)*

Note: *It is recommended to perform CIP after packing, as column packing involves open handling of the resin.*

Intelligent Packing in AxiChrom columns

When packing AxiChrom 50 to 200 columns with an ÄKTA™ system, Intelligent Packing control is managed by the UNICORN™ system control software. For AxiChrom 300 to 1600 columns, Intelligent Packing is performed by the AxiChrom column control unit, a separate unit that comprises a touchscreen-operated user interface, or from the UNICORN software on the ÄKTA process™ system.

In the Intelligent Packing wizard, packing methods are created by entering values for the following packing variables:

- column
- resin
- packing factor
- slurry concentration
- target bed height

Pack BPG columns

BPG columns are supplied with a movable adapter. They are packed by conventional pressure-packing by pumping the packing solution through the chromatographic bed at a constant flow rate (or back pressure).

Step	Action
1	Pour some water (or packing solution) into the column. Make sure that no air is trapped under the bottom net. Leave approximately 2 cm of liquid in the column.
2	Mix the packing buffer with the resin to form a 50% to 70% slurry. (Sedimented bed volume/slurry volume = 0.5 to 0.7). Pour the slurry into the column. Insert the adapter and lower it to the surface of the slurry, making sure that no air is trapped under the adapter. Secure the adapter in place.
3	Seal the adapter O-ring and lower the adapter a little further into the slurry to fill the adapter inlet with packing solution.
4	Connect a pump and a pressure gauge and start packing at the predetermined packing flow rate (or pressure). Keep the flow rate (or pressure) constant during packing and check the pressure at the column inlet. Never exceed the pressure limit for column or resin (0.18 ± 0.02 MPa (1.8 ± 0.2 bar)).

Step	Action
------	--------

- | | |
|---|---|
| 5 | When the bed has stabilized, mark the bed height on the column tube, close the bottom valve and stop the pump. The bed starts rising in the column. Loosen the O-ring and lower the adapter to 0.5 to 1 cm above the bed surface. |
| 6 | Seal the O-ring, start the pump and continue packing. Repeat steps 5 and 6 until there is a maximum of 1 cm between bed surface and adapter when the bed has stabilized. |
| 7 | Close the bottom valve, stop the pump, disconnect the column inlet and push the adapter down to approximately 3 mm below the mark on the column tube without loosening the adapter O-ring. The packing solution will flush the adapter inlet. Remove any trapped air by pumping liquid from the bottom (after the inlet tubing and the bottom valve have been properly filled). |

Note: *It is recommended to perform CIP after packing, as column packing involves open handling of the resin.*

Packing Chromaflow columns

Prepare the column for packing as described in the *Operating instructions (28962232)*, refer to the *Data file (CY13377)*, and pack the column appropriately for the resin type.

Note: *It is recommended to perform CIP after packing, as column packing involves open handling of the resin.*

The column is now ready for equilibration and testing.

7 Evaluation of column packing

Introduction

The quality of the packed bed and the column performance must be evaluated initially and monitored throughout the lifetime. The method for measuring the efficiency of a packed column is in terms of the height equivalent to a theoretical plate (HETP) and the asymmetry factor (A_s).

Frequency

Test the column efficiency to evaluate the packing quality:

- after completion of a packing procedure
- at regular intervals during the working life of the column
- when a decrease in separation performance is observed

Column efficiency testing

Packed column efficiency is best expressed in terms of the height equivalent to a theoretical plate (HETP) and the asymmetry factor (A_s). These values are easily determined by applying a test sample such as 1% acetone solution or sodium chloride to the column.

Note: Use a concentration of 0.8 M NaCl in water as sample and 0.4 M NaCl in water as eluent.

The calculated plate number depends on the test conditions and must only be used as a reference value. It is important that the test conditions and the equipment used remain the same so that the results are comparable.

Test results are affected by changes in:

- solute
- solvent
- eluent
- sample volume
- flow velocity
- liquid pathway
- temperature
- chromatography system

For more information about column efficiency testing, refer to the application note *Column efficiency testing* available on cytiva.com.

Sample volume and flow velocity

For optimal column efficiency testing results, the sample volume must be approximately 1% of the CV and the flow velocity must be 30 cm/h. If an acceptance limit is defined in relation to column performance, the column plate number can be used as one of the acceptance criteria for column use.

Method for measuring HETP and A_s

Calculate HETP and A_s from the UV curve (or conductivity curve) as stated below:

$$\text{HETP} = \frac{L}{N}$$

L = bed height (cm)
 N = number of theoretical plates

$$N = 5.54 \times \left(\frac{V_R}{W_h} \right)^2$$

V_R = volume eluted from the start of sample application to the peak maximum
 W_h = peak width measured as the width of the recorded peak at half of the peak height
 V_R and W_h are in the same unit

The concept of reduced plate height is often used for comparing column performance.

The reduced plate height (h) is calculated as follows:

$$h = \frac{\text{HETP}}{d_{50v}}$$

d_{50v} = median particle size of the cumulative volume distribution (cm)

As a guideline, an acceptance value of < 3 for (h) can be used.

The peak must be symmetrical, and the asymmetry factor must be as close to 1 as possible. A typical acceptable range could be $0.8 < A_s < 1.8$.

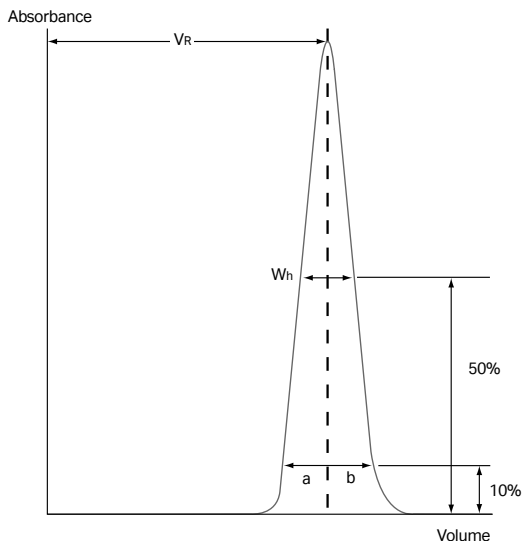
A change in the shape of the peak is usually the first indication of bed deterioration due to excessive use.

The peak asymmetry factor is calculated as follows:

$$A_s = \frac{b}{a}$$

b = descending part of the peak width at 10% of the peak height
 a = ascending part of the peak width at 10% of the peak height

The figure below shows a UV trace for acetone in a typical test chromatogram from which the HETP and A_5 values are calculated.



8 Maintenance

Regeneration

For best performance from the resin, bound substances must be washed from the column after each chromatographic cycle.

Wash with 2 bed volumes of water, followed by 2 to 3 bed volumes of starting buffer.

To prevent a buildup of impurities or contaminants on the column over time, you might need to apply more rigorous cleaning protocols on a regular basis.

Cleaning-in-place (CIP)

CIP is a procedure that removes impurities or contaminants such as lipids, endotoxins, nucleic acids, and precipitated or denatured proteins that remain in the packed column after regeneration. Regular CIP prevents the buildup of impurities or contaminants in the packed bed and helps to maintain capacity, flow properties, and general performance. A specific CIP protocol must be designed for each process according to the type of impurities or contaminants present.

It is recommended to perform a CIP:

- before first-time use – especially after packing the column – or after long-term storage
- between cycles
- when an increase in back pressure or a reduction in column performance is observed
- to prevent potential cross-contamination or carry-over, when the same column is used for purification of different proteins or protein lots and batches

Recommended protocols for removing specific contaminants or impurities are listed below. Depending on the type of contaminants or impurities, a combination of protocols might be required.

Precipitated proteins	Wash the column with 4 bed volumes of 0.5 to 1.0 M NaOH at 40 cm/h with reversed flow direction, followed by 2 to 3 bed volumes of water.
Strongly bound hydrophobic proteins, lipoproteins, and lipids	Wash the column with 4 to 10 bed volumes of up to 70% ethanol or 30% isopropanol¹ with reversed flow direction, followed by 3 to 4 bed volumes of water. Apply gradients to avoid air bubble formation when using high concentrations of organic solvents. Alternatively, wash the column with 1 to 2 bed volumes of 0.5% nonionic detergent at 40 cm/h followed by 5 bed volumes of 70% ethanol to remove the detergent, and 3 to 4 bed volumes of water.

¹ Consult local safety regulations to verify if safety precautions are required for the use of 70% ethanol or 30% isopropanol.

Sanitization

For inactivation of microbial contaminants, equilibrate the column with 0.5 to 1.0 M NaOH at a flow velocity of approximately 40 cm/h, contact time 30 to 60 minutes. For more details, refer to Application note *Use of sodium hydroxide for cleaning and sanitization of chromatography resins and systems (CY13951)*.

Wash the column thoroughly with running buffer after sanitization.

Storage

Store columns, unused resin and packed columns at 4°C to 30°C in 20% ethanol.

9 Reference information

Ordering information

Resin and prepacked columns

Product	Pack size	Product code
Butyl-S Sepharose 6 Fast Flow	200 mL	17097802
	1 L ¹	17097803
	5 L ¹	17097804
HiScreen™ Butyl-S FF	1 × 4.7 mL	28926985
HiTrap Butyl-S FF	5 × 1 mL	17097813
HiTrap Capto™ HIC Selection Kit	7 × 1 mL	29321087
HiTrap HIC Selection Kit	7 × 1 mL	28411007
PreDicator™ Butyl-S Sepharose 6 Fast Flow, 6 µL	4 × 96-well filter plates	17097816
PreDicator Butyl-S Sepharose 6 Fast Flow, 50 µL	4 × 96-well filter plates	17097817
PreDicator Capto HIC Screening Kit, 6 µL	4 × 96-well filter plates	29711438
PreDicator Capto HIC Screening Kit, 20 µL	4 × 96-well filter plates	29711439
PreDicator HIC screening, 20 µL	4 × 96-well filter plates	28949401
PreDicator HIC Screening Low Hydrophobicity, 6 µL	4 × 96-well filter plates	28992395
PreDicator HIC Screening Low Hydrophobicity, 50 µL	4 × 96-well filter plates	28992398

¹ Pack sizes available upon request.

Empty laboratory-scale columns

Product	Pack size	Product code
HiScale 10/40	1	29360550
HiScale 16/20	1	28964441

Product	Pack size	Product code
HiScale 16/40	1	28964424
HiScale 26/20	1	28964514
HiScale 26/40	1	28964513
HiScale 50/20	1	28964445
HiScale 50/40	1	28964444
Tricorn 5/20	1	28406408
Tricorn 5/50	1	28406409
Tricorn 5/100	1	28406410
Tricorn 5/150	1	28406411
Tricorn 5/200	1	28406412
Tricorn 10/20	1	28406413
Tricorn 10/50	1	28406414
Tricorn 10/100	1	28406415
Tricorn 10/150	1	28406416
Tricorn 10/200	1	28406417
Tricorn 10/300	1	28406418
Tricorn 10/600	1	28406419
XK 16/20	1	28988937
XK 16/40	1	28988938
XK 16/70	1	28988946
XK 16/100	1	28988947
XK 26/20	1	28988948
XK 26/40	1	28988949
XK 26/70	1	28988950
XK 26/100	1	28988951
XK 50/20	1	28988952
XK 50/30	1	28988953
XK 50/60	1	28988964
XK 50/100	1	28988965

Related documentation

All items below are available at [cytiva.com](https://www.cytiva.com).

Description	Reference
Application notes	
Use of sodium hydroxide for cleaning and sanitization of chromatography resins and systems	CY13951
Predictable scale-up through column design and robust packing methodology	CY13211
Data files	
BPG columns	CY978
Chromaflow columns	CY13377
AxiChrom columns	CY10003
Butyl-S Sepharose 6 Fast Flow	CY17153
Handbook	
Hydrophobic interaction chromatography and reversed phase chromatography: Principles and methods	CY11248
Instructions	
AxiChrom 50–200 columns, Operating Instructions	29379190
AxiChrom 300–1600 columns, Operating Instructions	29065430
AxiChrom 300–2000 columns, User Manual	29388247
AxiChrom Column and AxiChrom Column Controller, User Manual	29720910
BPG columns, Operating Instructions	29193223
Chromaflow column 400–1000, Operating Instructions	28962232
HiTrap HIC columns	11003453
Selection guide	
Hydrophobic Interaction Chromatography (HIC)	CY14016



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