GE Healthcare
Life Sciences

Instructions 28-9776-55 AE **Ion Exchange Media**

Capto™ SP ImpRes and Capto Q ImpRes

Capto SP ImpRes and Capto Q ImpRes are strong cation and strong anion exchange BioProcess™ chromatography media, respectively, for intermediate purification and polishing of a wide range of biomolecules. The combination of the high flow agarose technique used for all Capto products and the small particle size of Capto ImpRes results in good pressure-flow properties as well as impressive resolution.

Capto SP ImpRes and Capto Q ImpRes provide:

- High-resolution intermediate purification and polishing based on the well-established Capto platform with traditional ligands
- Flexibility of design – large operational window of flow rates and bed heights
- High-throughput purifications easy to optimize and scale up
- Higher manufacturing productivity enables improved process economy
- Security of supply and comprehensive regulatory support

Table of Contents

Please read these instructions carefully before using Capto SP ImpRes and Capto Q ImpRes.

Safety
For use and handling of the product in a safe way, please refer to the Safety Data Sheet.

1 BioProcess media

BioProcess media are developed and supported for production scale chromatography. All BioProcess media are produced with validated methods and are tested to meet manufacturing requirements. Secure ordering and delivery routines give a reliable supply of media for production scale. Regulatory Support Files (RSF) are available to assist process validation and submissions to regulatory authorities. BioProcess media cover all purification steps from capture to polishing.

2 Properties of Capto SP ImpRes and Capto Q ImpRes

The structures of the well established SP (sulfonate group) and Q (quaternary amine group) ligands used for Capto ImpRes are shown in Figure 1.

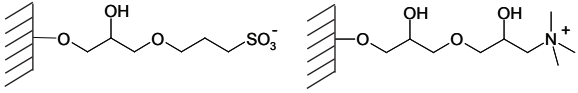

Fig 1. The strong ion exchange group of Capto SP ImpRes (left) and Capto Q ImpRes (right).

The media are designed for intermediate purification or polishing. They are based on the high flow agarose base matrix, which gives good pressure-flow properties (Fig 2).

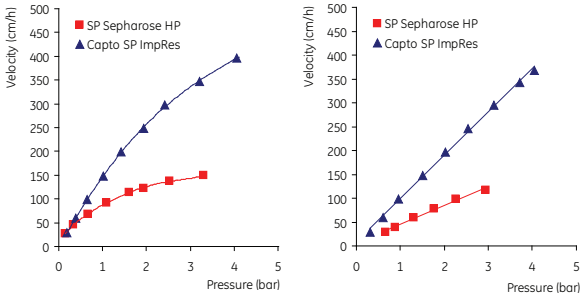

Fig 2. Example of pressure flow curves for Capto SP ImpRes and SP Sepharose HP in open bed (left) and packed bed (right), respectively. Running conditions: AxiChrom™ 300 (30 cm i.d.), 20 cm bed height with Packing factor 1.15 in water at 20°C. Pressure contribution from system, tubings and column is excluded.

The bead size is small, which allows for high resolution. Capto ImpRes thus allows for high resolution purifications at high flow rates. The combination of the well established SP and Q ligands with a small high flow agarose bead makes the media ideal for high throughput intermediate purification and polishing. Further characteristics of the media are found in Table1.

Table 1. Characteristics of Capto SP ImpRes and Capto Q ImpRes

	Capto SP ImpRes	Capto Q ImpRes
Matrix	High flow agarose	High flow agarose
Functional group	$-CH_2CH_2CH_2SO_3^-$	$-CH_2N^+(CH_3)_3$
Total ionic capacity	0.13 to 0.16 mmol (H^+) /ml medium	0.15 to 0.18 mmol (Cl^-) /ml medium
Average particle size (d_{50v}) [1]	40 µm	40 µm
Maximum operational flow velocity [2]	At least 220 cm/h in a 1 m diameter column with bed height 20 cm at 20°C; measured using process buffers with the same viscosity as water at < 3 bar (0.3 MPa)	
Binding capacity [3] **(mg/ml medium)**	> 70 mg lysozyme > 95 mg BSA	> 55 mg BSA > 48 mg ß-Lactoglobulin
pH stability [4]		
Working range	4 to 12	2 to 12
Cleaning-in-place	3 to 14	2 to 14
Working temperature	4°C to 30°C	4°C to 30°C
Chemical stability	All commonly used aqueous buffers, 1 M sodium hydroxide [5], 8 M urea, 6 M guanidine hydrochloride, 30% isopropanol and 70% ethanol	
Avoid	Oxidizing agents, cationic detergents	Oxidizing agents, anionic detergents
Storage	20% ethanol, 0.2 M sodium acetate	20% ethanol

1 d_{50v} is the median particle size of the cumulative volume distribution.

2 Flow velocity stated in the Table is dependent on the column used.

3 Dynamic binding capacity at 10% breakthrough measured at a residence time of 4 minutes (150 cm/h) in a Tricorn™ 5/100 column with 10 cm bed height.
Capto SP ImpRes: 20 mM sodium phosphate, pH 7.2 (lysozyme) and 50 mM Tris, pH 8.0 (BSA)
Capto Q ImpRes: 50 mM sodium acetate, pH 4.75 (BSA and ß-lactoglobulin)

4 Working range: pH interval where the medium can be operated without significant change in function.
Cleaning-in-place: pH stability where the medium can be subjected to cleaning-in-place without significant change in function.

5 No significant change in ionic capacity and carbon content after 1 week storage in 1 M NaOH at 40°C.

3 Method optimization

The aim of designing and optimizing an ion exchange separation process is to identify conditions that promote binding of the highest amount of target molecule, in the shortest possible time with highest possible product recovery and purity. Design the method in laboratory scale.

For certain proteins, dynamic binding capacities increase at increased conductivity and this is pH dependent. Therefore, scouting of both pH and conductivity for optimal dynamic binding conditions on Capto SP ImpRes and Capto Q ImpRes is recommended. Flow velocity can also be included in the scouting, even though the effect of flow should be small for Capto ImpRes.

Elution of protein can either be done by use of salt, pH or a combination of both. For optimization of the elution, sample load, flow velocity and gradient volume should be considered. The three factors are interrelated and best results will be obtained using:

- Maximized sample load with respect to dynamic binding capacity.
- Maximized flow velocity with respect to system constraints and media rigidity.
- The gradient volume that provides the best resolution with maximized sample load and maximized flow velocity.

The use of PreDictor™ plates is preferentially included in the method development. The PreDictor plates are 96-well filter plates pre-filled with chromatography media, which can be used for rapid screening of chromatographic conditions in small scale. The suggested workflow with Predictor plates is shown in Figure 3, where a large design space can be explored prior to further experiments in packed column formats, such as prepacked HiScreen™ columns.

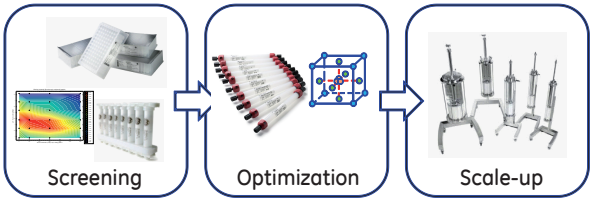

Fig 3. The recommended workflow is described in the figure. It starts with screening of conditions in high throughput formats, followed by optimization, preferably by applying Design of Experiments (DoE), in small columns and finally scale-up to large columns.

Table 2. The experimental conditions to consider when designing and optimizing the process.

Phases	Activity	Conditions to consider
1. Equilibration of column and sample preparation	Equilibration of column and adjustment of sample	• pH • Conductivity • Column volume • Column bed height • Particle content • Temperature
2. Sample application	Manual or automatic application onto the column	• Flow rate • Sample pH • Sample conductivity • Upward/downward flow
3. Wash	Wash out unbound material with clean binding buffer	• Flow rate • Upward/downward flow • Buffer choice (normally same as column equilibration buffer)

Phases	Activity	Conditions to consider
4. Elution	Elute the material from the column either with salt or by change in pH	• Sample load • pH • Conductivity • Flow rate • Upward/downward flow

For more information about method development and optimization, consult the handbooks, *Ion exchange Chromatography & Chromatofocusing: Principles and Methods*, (11-0004-21) and *High throughput process development with PreDictor plates*, (28-9403-08).

4 Scale-up

After optimizing the method at laboratory scale, the process can be scaled up. Scale-up is typically performed by keeping bed height and flow velocity constant while increasing bed diameter and volumetric flow rate. However, since optimization is preferentially performed with small column volumes, in order to save sample and buffer, some parameters such as the dynamic binding capacity may be optimized using shorter bed heights than those being used in the final scale. As long as the residence time is kept constant, the binding capacity for the target molecule remains the same.

Other factors, such as clearance of critical impurities, may change when column bed height is modified and should be validated using the final bed height. The residence time is approximated as the bed height (cm) divided by the linear flow velocity (cm/h) applied during sample loading.

Procedure

Step	Action
1	Select bed volume according to required binding capacity. Keep sample concentration and gradient slope constant.
2	Select column diameter to obtain the bed height (10 to 40 cm) from method optimization. The excellent rigidity of the high flow base matrix allows for flexibility in choice of bed heights.
3	The larger equipment used when scaling up may cause some deviations from the method optimized at small scale. In such cases, check the buffer delivery and monitoring systems for time delays or volume changes. Different lengths and diameters of outlet tubing can cause zone spreading on larger systems. Check also the compatibility of the hardware and chromatography media pressure limits with expected pressure during packing and operation.

5 Column packing

Packing Tricorn columns

The following instructions are for packing Tricorn 5/100 and Tricorn 10/100 columns with a 10 cm bed height.

For more details about packing Tricorn columns, see the instructions *Tricorn Empty High Performance Columns* (28-4094-88).

Packing preparations

Materials

- Capto SP ImpRes or Capto Q ImpRes
- Plastic spoon or spatula
- Glass filter G4
- Vacuum suction equipment
- Filter flask
- Measuring cylinder
- Thin capillary
- 10 mM NaCl
- Tricorn 5/100 column, Tricorn Glass Tube 5/100 (to be used as packing tube), and Tricorn Packing Connector 5-5, *or*
- Tricorn 10/100 column, Tricorn Packing Equipment 10/100, which includes the 10-mm packing connector, 100-mm glass tube (to be used as packing tube).
- Bottom unit with filter holder, cap, and stop plug.

Equipment

Chromatography system, such as ÄKTA™ system, or a stand-alone pump such as Pump P-900, depending on the flow rate required, can be used for packing.

Equilibrate all materials to room temperature.

Washing the chromatography medium

Mount the glass filter funnel onto the filtering flask. Suspend the medium by shaking and pour into the funnel and wash according to the following instructions:

Step	Action
1	Wash 5 times with 5 ml 10 mM NaCl/ml chromatography medium.
2	Gently stir with a spatula between additions.
3	Move the washed medium from the funnel into a beaker and add 10 mM NaCl to obtain a 50% slurry concentration.

Preparing the packing slurry

Check the slurry concentration after settling overnight in a measuring cylinder or use the method for slurry concentration measurement described in application note 28-9259-32. Tricorn columns can be packed with an excess of medium to be removed after packing.

Packing procedure

Main features

Table 3. Main features of the packing method.

	Tricorn 5/100	Tricorn 10/100
Slurry packing solution	10 mM NaCl	10 mM NaCl
Slurry concentration	50%	50%
Phase 1		
Packing velocity	2250 cm/h	2250 cm/h
Packing flow	7.4 ml/min	29.4 ml/min
Packing time	3 min	3 min
Phase 2		
Packing velocity	2250 cm/h	2250 cm/h
Packing flow	7.4 ml/min	29.4 ml/min
Packing time	20 min	20 min

Procedure

Step	Action
	Preparing packing
1	Assemble the column according to the column instructions *Tricorn Empty High Performance Columns*, code no 28-4094-88). For additional information, please visit Technical support at www.gelifesciences.com/tricorn.
2	Put a stop plug in the bottom of the column tube and pour the suspended media slurry (50%) into the top of the packing tube, filling both column tube and packing tube. Avoid formation of air bubbles in the medium by pouring it along a thin capillary.
3	Attach an extra bottom unit or an adapter unit to the top of the packing tube. Place a beaker beneath the column tube and connect a pump to the top of the packing unit. Remove the stop plug from the bottom of the column tube.

Step	Action
	Phase 1
4	Pack the media at 7.4 ml/min (Tricorn 5/100) or 29.4 ml/min (Tricorn 10/100) for 3 minutes.
5	When the medium is packed, switch off the pump, attach the stop plug into bottom of the column tube, disconnect the pump and remove the packing tube and packing connector. If necessary, remove excess medium by re-suspending the top of the packed bed and remove with a Pasteur pipette or spatula.
6	Fill up the column with the same solution that was used for packing the column.
7	Place a pre-wetted filter on top of the solution in the column and gently push it into the column tube with the filter tool. ***Note:*** *Coarse filter should not be used with Capto SP ImpRes or Capto Q ImpRes.*
8	Prepare the adapter unit by screwing the guiding ring inside the adapter unit out to its outer rim and then turn it back 1.5 turns.
9	Wet the O-ring on the adapter unit by dipping it into water or buffer.
10	Screw the adapter unit onto the column tube, ensuring the inner part of the guiding ring fits into the slot on the column tube threads. Ensure that there are no trapped air bubbles.
11	Screw the adapter down to approximately 1 mm above the surface of the bed.
12	Connect the pump to the adapter unit. Remove the stop plug in the bottom of the column.
	Phase 2
13	Pack the media at 7.4 ml/min (Tricorn 5/100) or 29.4 ml/min (Tricorn 10/100) for 20 minutes.
14	Turn the adapter down to the bed surface (make sure not to compress the bed).

Step	Action
15	Switch off the pump, attach the stop plug into bottom of the column tube and disconnect the pump slowly.
16	Press the adapter lock down into the locked position.
17	Screw a stop plug into the adapter unit. The column is now ready to be used.

Testing the packed column

See section *Evaluation of column packing*.

Packing HiScale™ columns

Introduction

The following instructions are for packing HiScale 16/20, 16/40 and HiScale 26/20, 26/40, 50/20 and 50/40 with 10, 20 and 35 cm bed heights.

For more details about packing HiScale columns, see instructions *HiScale columns (16, 26, 50) and accessories* (28-9674-70).

Materials needed

- Capto SP ImpRes or Capto Q ImpRes
- HiScale column
- HiScale packing tube (depending on bed height)
- Plastic spoon or spatula
- Glass filter G4
- Vacuum suction equipment
- Filter flask
- Measuring cylinder
- 10 mM NaCl

Equipment

Chromatography system, such as ÄKTA system, or a stand-alone pump such as Pump P-900, depending on the flow rate required, can be used for packing.

Equilibrate all materials to room temperature.

Definitions

The bed height of a gravity settled bed differs from the bed height of a bed settled at a given flow (consolidated). Therefore, the compression factor (CF) has to be separated from the packing factor (PF).

$L_{settled}$	Bed height measured after settling by gravity.
L_{cons}	Consolidated bed height Bed height measured after settling the medium at a given flow velocity.
L_{packed}	Packed bed height
CF	Compression factor CF = $L_{settled}/L_{packed}$
PF	Packing factor PF = L_{cons}/L_{packed}
A_C	Cross sectional area of the column
V_C	Column volume $V_C = L_{packed} \times A_C$
C_{slurry}	Concentration of the slurry

Preparation of the slurry

To measure the slurry concentration, let the medium settle in 20% ethanol at least overnight in a measuring cylinder or use the method for slurry concentration measurement described in application note 28-9259-32. This method can also be used for HiScale columns.

Washing the medium

Mount a glass filter funnel onto a filtering flask. Suspend the medium by shaking and pour into the funnel and wash according to the following instructions:

Step	Action
1	Wash 5 times with 5 ml 10 mM NaCl/ml medium.
2	Gently stir with a spatula between additions.
3	Move the washed medium from the funnel into a beaker and add 10 mM NaCl to obtain a 50% slurry concentration.

Packing parameters

Table 4. Main features of the packing method for HiScale 16/20 and HiScale 16/40

Product	HiScale 16/20	HiScale 16/40	
Bed height (cm)	10	20	35
Slurry/ packing solution	10 mM NaCl	10 mM NaCl	10 mM NaCl
Slurry concentration (%)	50	50	50
Packing factor (PF)	1.12	1.12	1.09
Packing velocity (cm/h)	1200	1000	700
Packing flow rate (ml/min)	40	33	23
Flow condition (cm/h)	1200	1000	700
Flow condition (ml/min)	40	33	23

Table 5. Main features of the packing method for HiScale 26/20 and HiScale 26/40

Product	HiScale 26/20	HiScale 26/40	
Bed height (cm)	10	20	35
Slurry/ packing solution	10 mM NaCl	10 mM NaCl	10 mM NaCl
Slurry concentration (%)	50	50	50
Packing factor (PF)	1.12	1.12	1.09
Packing velocity (cm/h)	1200	1000	700
Packing flow rate (ml/min)	106	88	62

Table 6. Main features of the packing method for HiScale 50/20 and HiScale 50/40

Product	HiScale 50/20	HiScale 50/40	
Bed height (cm)	10	20	35
Slurry/ packing solution	10 mM NaCl	10 mM NaCl	10 mM NaCl
Slurry concentration (%)	50	50	50
Packing factor (PF)	1.12	1.12	1.09
Packing velocity (cm/h)	1200	1000	700
Packing flow rate (ml/min)	393	327	229

Packing procedure

Step	Action
1	Assemble the column according to the column instructions (*HiScale columns (16, 26, 50) and accessories*, code no 28-9674-70).
2	Mount the column tube in a stand.
3	Connect the bottom adapter unit to the pump or a syringe and prime the bottom net with a slow flow of packing solution. This is easiest done if the nets are dry, but if air is trapped under the net it can be removed by a light suction with a syringe.
4	Mount the bottom adapter unit in the bottom of the column tube and tighten the O-ring.
5	Fill the column with approximately 1 cm packing liquid using the pump/syringe. Disconnect the pump/syringe and put a stop plug on the outlet.
6	Mount the packing tube on top of the column tube.
7	Connect the top adapter to the pump and prime it with a slow downward flow. The net needs to be facing the roof as this is done. If air is trapped under the net it can be removed by a light suction with a syringe

Step	Action
8	Fill the column with slurry suspended in packing solution. If needed, top up the slurry with extra packing solution so the top adapter dips into the slurry to avoid air under the net.
9	Mount the top adapter unit on top of the packing tube. Tighten the O-ring firmly and remove the bottom stop plug.
10	Start a downward flow with packing flow velocity according to Tables in Section *Packing parameters*.
11	Let the flow run until the bed has consolidated.
12	Use the scale on the column to measure the bed height. There might be a build up of media at the column wall after the bed is consolidated and to easier see where the top of the bed is, a light source can be used.
13	Calculate the final bed height by dividing the consolidated bed height with the desired packing factor. $L_{packed} = L_{cons}/PF$. See Tables in Section *Packing parameters*.
14	Turn off the flow and put a stop plug in the bottom.
15	Dismount the top adapter from the packing tube.
16	Over a beaker or a sink, detach the packing tube from the column.
17	Remount the top adapter in the column tube. Make sure no air is trapped under the net and lower the adapter down to 1 to 2 cm above the bed, making sure the surface is not disturbed.
18	Tighten the O-ring on the adapter. Remove the bottom stop plug and carefully start turning the end cap down. While spilling out liquid through the bottom, proceed turning until the calculated final bed height is reached.
19	Make sure that the pressure peaks that occur during turning the end knob down do not exceed the pressure specifications of the media.

Step	Action
20	HiScale 26 or HiScale 50 columns are now ready to be tested. For HiScale 16 flow conditioning needs to be performed. Start a downward flow to flow condition the bed. The flow rate is shown in the first table in Section *Packing parameters*. Let the flow run for about 30 minutes. The HiScale 16 column is now ready to be tested.

Note: *For packing Axichrom, BPG™ and Chromaflow™ columns, please refer to the application note "Packing Capto SP ImpRes and Capto Q ImpRes in production-scale columns" (29-0306-98).*

Testing the packed column

See Section *Evaluation of column packing*.

6 Evaluation of column packing

Intervals

Test the column efficiency to check the quality of packing. Testing should be done immediately after packing and at regular intervals during the working life of the column and also when separation performance is seen to deteriorate.

Column efficiency testing

The best method of expressing the efficiency of a packed column is 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 sample such as 1% acetone solution to the column. Sodium chloride can also be used as a test substance. Use a concentration of 0.8 M NaCl in water as sample and 0.4 M NaCl in water as eluent.

For more information about column efficiency testing, consult the application note *Column efficiency testing* (28-9372-07).

Note: *The calculated plate number will vary according to the test conditions and it should only be used as a reference value. It is important that test conditions and equipment are kept constant so that results are comparable. Changes of solute, solvent, eluent, sample volume, flow velocity, liquid pathway, temperature, etc. will influence the results.*

Sample volume and flow velocity

For optimal results, the sample volume should be approximately 1% of the column volume and the flow velocity 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 follows:

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

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

L = bed height (cm)

N = number of theoretical plates

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 units

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

The reduced plate height, h, is calculated as follows:

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

d_{50v} = mean diameter of the beads (cm)

As a guideline, a value of < 3 is very good.

The peak should be symmetrical, and the asymmetry factor 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.

Peak asymmetry factor calculation:

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

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

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

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

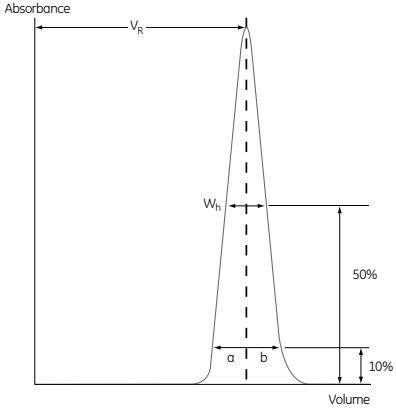

Fig 4. A typical test chromatogram showing the parameters used for HETP and A_s calculations.

7 Maintenance

For best performance from Capto SP ImpRes and Capto Q ImpRes and to maximize the life time of the media, follow the procedures described below.

Equilibration

After packing, and before a chromatographic run, equilibrate with start buffer by washing with five bed volumes or until the column effluent shows stable conductivity and pH values. The equilibration step can be shortened by first washing with a high concentration buffer to obtain approximately the desired pH value and then washing with start buffer until the conductivity and pH values are stable.

Regeneration

After each separation, elute any reversibly bound material with a high ionic strength solution (e.g., 1 to 2 M NaCl in elution buffer). Regenerate the medium by washing with five bed volumes of start buffer or until the column effluent shows stable conductivity and pH values.

Cleaning-in-place (CIP)

Regular CIP prevents the build-up of contaminants in the packed bed and helps to maintain capacity, flow properties and general performance.

A specific CIP protocol should be designed for each process according to the type of contaminants present.

Precipitated, hydrophobically bound proteins or lipoproteins	Wash with 1 M NaOH solution with reversed flow direction. Contact time 15 to 30 min (sample dependent). Use 1 M NaOH with 1 M NaCl if the results are not satisfactory with only NaOH.
Ionically bound proteins	Wash with 0.5 to 2 column volumes of 2 M NaCl with reversed flow direction. Contact time 10 to 15 minutes.
Lipids and very hydrophobic proteins	Wash with 2 to 4 column volumes of up to 70% ethanol[1] or 30% isopropanol with reversed flow direction. Contact time 1 to 2 h. Alternatively, wash with 2 to 4 column volumes of 0.1 to 0.5% non-ionic detergent with reversed flow direction. Contact time 1 to 2 h.

[1] Specific regulations may apply when using 70% ethanol since the use of explosion-proof areas and equipment may be required.

Sanitization

To reduce microbial contamination in the packed column, sanitization using 0.5 to 1 M NaOH with a contact time of 1 h is recommended. The CIP protocol for precipitated, hydrophobically bound proteins or lipoproteins sanitizes the medium effectively.

Storage

Capto Q ImpRes: 20% ethanol
Capto SP ImpRes: 20% ethanol, 0.2 M sodium acetate.
Storage temperature: 4°C to 30°C.

Store unused medium in the container at a temperature of 4°C to 30°C. After storage, equilibrate with at least five column volumes of start buffer.

8 Ordering information

Product	Quantity	Code No
Capto SP ImpRes	25 ml	17-5468-10
	100 ml	17-5468-02
	1 l	17-5468-03
	5 l	17-5468-04
	10 l	17-5468-05
Capto Q ImpRes	25 ml	17-5470-10
	100 ml	17-5470-02
	1 l	17-5470-03
	5 l	17-5470-04
	10 l	17-5470-05

Capto SP ImpRes is supplied in suspension in 20% ethanol containing 0.2 M sodium acetate. Capto Q ImpRes is supplied in suspension in 20% ethanol. For additional information, please contact your local GE Healthcare representative.

Related products

Product	Quantity	Code No
PreDictor Capto SP ImpRes, 6 µl	4 × 96-well filter plates	17-5468-16
PreDictor Capto SP ImpRes, 20 µl	4 × 96-well filter plates	17-5468-17
PreDictor RoboColumn™ Capto SP ImpRes, 200 µl	8 columns in row	28-9974-49
PreDictor RoboColumn Capto SP ImpRes, 600 µl	8 columns in row	28-9974-50
HiTrap™ Capto SP ImpRes	5 × 1 ml	17-5468-51
HiTrap Capto SP ImpRes	5 × 5 ml	17-5468-55
HiScreen Capto SP ImpRes	1 × 4.7 ml	17-5468-15
PreDictor Capto Q ImpRes, 6 µl	4 × 96-well filter plates	17-5470-16
PreDictor Capto Q ImpRes, 20 µl	4 × 96-well filter plates	17-5470-17
PreDictor RoboColumn Capto Q ImpRes, 200 µl	8 columns in row	28-9969-18
PreDictor RoboColumn Capto Q ImpRes, 600 µl	8 columns in row	28-9973-91
HiTrap Capto Q ImpRes	5 × 1 ml	17-5470-51
HiTrap Capto Q ImpRes	5 × 5 ml	17-5470-55
HiScreen Capto Q ImpRes	1 × 4.7 ml	17-5470-15
Tricorn 5/100 column	1	28-4064-10
Tricorn 10/100 column	1	28-4064-15
HiScale 16/20	1	28-9644-41
HiScale 16/40	1	28-9644-24
HiScale 26/20	1	28-9645-14
HiScale 26/40	1	28-9645-13
HiScale 50/20	1	28-9644-45
HiScale 50/40	1	28-9644-44

Accessories

Product	Quantity	Code No
Tricorn Glass Tube 5/100	1	18-1153-06
Tricorn Packing Connector 5-5	1	18-1153-21
Tricorn Packing Equipment 10/100	1	18-1153-25
Packing tube 20 (HiScale 16)	1	28-9868-16
Packing tube 40 (HiScale 16)	1	28-9868-15
Packing tube 20 (HiScale 26)	1	28-9803-83
Packing tube 40 (HiScale 26)	1	28-9645-05
Packing tube 20 (HiScale 50)	1	28-9802-51
Packing tube 40 (HiScale 50)	1	28-9645-06

Literature

Product	Code No
Data File: Capto SP ImpRes and Capto Q ImpRes	28-9837-63
Handbook: Ion Exchange Chromatography & Chromatofocusing: Principles and Methods	11-0004-21
Handbook: High throughput process development with PreDictor plates	28-9403-58
Instructions: Tricorn Empty High Performance Columns	28-4094-88
Instructions: HiScale columns (16, 26, 50) and accessories	28-9674-70
Application note: Column efficiency testing	28-9372-07
Application note: Packing Capto SP ImpRes and Capto Q ImpRes in production-scale columns	29-0306-98

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