INSTRUCTION

GoBio Prep 16x100 Butyl SH
GoBio Prep 26x100 Butyl SH

GoBio™ Prep 16x100 Butyl SH and GoBio 26x100 Butyl SH are columns prepacked with WorkBeads™ 40 Butyl SH resin. The functional ligand of WorkBeads 40 Butyl SH is *n*-butyl thioether. Since butyl is a very hydrophobic linear chain, minimal mixed-mode interactions are expected. The resin provides high purity and binding capacity and the possibility to use high flow rates for minimized process time.

- Prepacked, ready-to-use columns for fast and reproducible purifications
- High throughput, binding capacity, and purity
- Reliable and reproducible results
- High chemical stability for easy cleaning-in-place

Intended use

WorkBeads resins are developed and supported for both research and production-scale chromatography. WorkBeads resins are produced according to ISO 9001:2015, and Regulatory Support Files (RSF) are available to assist in the process validation and submissions to regulatory authorities.

The GoBio prepacked column family has been developed for convenient, reproducible, and rapid results and can be used for small-scale purification, extending all the way to process development and full-scale manufacturing.

Safety

Please read the associated Safety Data Sheet (SDS) for WorkBeads 40 Butyl SH and the safety instructions for any equipment to be used.

Unpacking and inspection

Unpack the shipment as soon as it arrives and inspect it for damage. Promptly report any damage or discrepancies to complaints@bio-works.com

Principle

Hydrophobic interaction chromatography (HIC) separates molecules according to differences in their surface hydrophobicity through a reversible interaction between the molecules and the hydrophobic surface of the HIC resin. A high salt concentration enhances the interaction, and a low salt concentration weakens the interaction. The extent of the reversible interaction between the molecule and the hydrophobic surface of a HIC resin depends on the properties of the HIC resin and target molecule, and the running conditions, such as the salt concentration. The principle for molecule adsorption to HIC resins is orthogonal to ion exchange and size exclusion chromatography.

In HIC, the molecules to be separated are usually loaded onto the column under conditions of a high salt concentration, which promotes the exposure of hydrophobic regions and increased hydrophobic interactions. The more hydrophobic the molecule, the less salt is needed to promote binding. As the sample is applied, molecules with higher hydrophobicity tend to bind more strongly to the hydrophobic ligands. In contrast, less hydrophobic molecules will bind less strongly, and molecules with minor hydrophobicity will even pass through the column (or elute in the flow through).

To elute the bound molecules, a decreased salt gradient is typically applied, which reduces the hydrophobicity of the molecules and the hydrophobic ligands, allowing them to be eluted in order of decreasing hydrophobicity. Elution can also be achieved by a stepwise decrease of salt in the elution buffer.

Anti-chaotropic salts, like ammonium sulfate, enhance molecule binding to hydrophobic surfaces. Sample elution can be facilitated by adding mild organic modifiers or detergents to the elution buffer. Commonly, ammonium sulfate at a neutral pH (1-2 M) is used for binding, while sodium chloride may require higher molarity (up to 3 M). However, process optimization is crucial, considering factors from resin to running conditions, to achieve the desired purity and yield of the target molecule.

Binding conditions play a crucial role in HIC separation, impacting selectivity, resolution, and capacity. Samples should be in the same salt conditions as the binding buffer. Buffer exchange may be unnecessary, as the influence of buffer ions and pH tends to be less prominent in many cases. Adjust pH directly if needed. Given that increased salt concentrations can lead to the precipitation of many molecules, it is crucial to assess the stability range of the target molecule at various salt concentrations before optimizing binding conditions. A practical method for determining the stability range is to observe the sample in a test tube at different salt concentrations and monitor the activity of the target molecule left in the supernatant.

Variations in ionic strength, organic solvents, temperature, and pH (especially at the isoelectric point, pI) can influence the structure and solubility of the molecule, impacting its interaction with HIC resins.

The functional ligand of WorkBeads 40 Butyl SH is n-butyl thioether, shown in Figure 1.

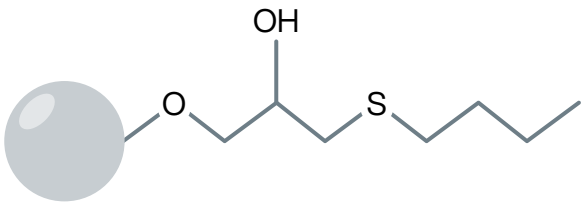

Figure 1. Structure of the ligand used in WorkBeads 40 Butyl SH.

GoBio Prep column characteristics

When using GoBio Prep columns, make sure that the connectors are tightened to prevent leakage. The pressure over the packed bed varies depending on different parameters such as the resin characteristics, sample/buffer viscosities, and the tubings used. Make sure that the flow through the column is according to the arrow on the column label.

These columns should not be opened and refilled.

Note: GoBio Prep column hardware is compatible with most aqueous chemicals, but NOT with concentrated alcohol. Maximal alcohol concentration is 20%.

Table 1. GoBio Prep 16x100 Butyl SH and GoBio 26x100 Butyl SH columns characteristics

Column characteristics	
Column hardware	Acrylic
Top and bottom plugs	Polypropylene
Top and bottom filters	Polyamid
Connections	1/16” female thread in both ends
Column volumes	20 mL (GoBio Prep 16x100) 53 mL (GoBio Prep 26x100)
Column dimensions	16 × 100 mm (GoBio Prep 16x100) 26 × 100 mm (GoBio Prep 26x100)
Maximal column hardware pressure[1]	5 bar, 0.5 MPa, 70 psi

[1] The maximum pressure the packed bed can withstand depends on the sample/liquid viscosity and chromatography resin characteristics. The pressure also depends on the tubing used to connect the column and the system restrictions after the column outlet.

Resins characteristics

WorkBeads 40 Butyl SH is a resin deisgned for hydrophobic interaction chromatography aimed at research and industrial scale purification of proteins, peptides, plasmids, and oligonucleotides by utilizing the difference in their surface hydrophobicity. HIC is a frequently used chromatography technique that can be optimized to achieve excellent separation of different molecules. It is often used as a complement to other techniques that separate according to either charge or size.

The functional ligand of WorkBeads 40 Butyl SH is *n*-butyl thioether. Since butyl is a very hydrophobic linear chain, minimal mixed-mode interactions are expected. The resin is optimized to offer reliable binding performance.

The property of high-resolution separation, in combination with low backpressure, allows both capture and polishing purification applications in standard bioprocess columns.

The characteristics of GoBio Prep 16x100 Butyl SH and GoBio Prep 16x100 Butyl SH are listed in section “Product Description”.

Purification planning

Unpacking and connecting GoBio Prep 16x100 and GoBio Prep 26x100 columns to a chromatography system

*Each packed column is sealed with a pressure syringe in the **bottom** end of the column. It is then placed in a sealed plastic bag.*

1. Cut the plastic bag and remove the column with care.
2. Follow the flow direction (indicated by an arrow on the column label) to clamp the column onto the chromatography system or to a vertical stand.
3. Prepare the chromatography system for connecting the column. The GoBio Prep 16x100 and GoBio Prep 26x100 columns are compatible with 1/16” male connectors with narrow heads. The length of the connector thread must be at least 7 mm to avoid leakage.

Note: It is recommended to use the two red connectors attached to the transport syringe when connecting the column to a chromatography system. One red connector should be used in each end of the column.

4. Gently unhook the springs from the shaft top of the transport syringe using even force.
5. Remove the syringe and keep it for further use during storage.
6. Unscrew the top plug, some liquid may come out. Connect the column to the chromatography system using one of the red connectors "drop-to-drop" avoiding introducing air into the packed column.
7. Connect the bottom of the column to the chromatography system using the second red connector.

Buffer preparation

The buffer species and buffer concentration are important for robust and reproducible methods. Choose a suitable pH and buffer for the binding of the target molecule.

The binding conditions should be optimized to achieve binding of the target molecule, while minimizing the binding of impurities. See examples of buffers to use for samples with unknown charge properties in Table 2.

Note: To avoid bacterial growth and poor column performance, use only freshly prepared and filtered buffers.

Table 2. Typical buffer compositions for purifications using GoBio Prep 16x100 Butyl SH and GoBio Prep 26x100 Butyl SH columns

Target molecule	Binding buffer	Elution buffer
Proteins	50 mM phosphate, 1.2 – 2 M ammonium sulphate, pH 7.0	50 mM phosphate, pH 7.0
Plasmids	50 mM phosphate, 1.5 – 2 M ammonium sulphate, pH 7.0	50 mM phosphate, pH 7.0
PO ON[1] (DMT-on[2])	50 mM Tris-HCl, 0.7 – 1.3 M ammonium sulphate, pH 8.5	50 mM Tris-HCl, 0 – 20 mM ammonium sulphate, pH 8.5

[1] PO ON: phosphorothioate oligonucleotides
[2] DMT-on: Dimethoxytrityl is a 5' protective group used in oligonucleotide synthesis. "on" means that the group is left on the oligonucleotide

Sample preparation

After cell disruption or extraction, clarify the sample by centrifugation at 10 000 – 20 000 × g for 15 – 30 minutes. It is generally also recommended to pass the sample through a 0.22 – 0.45 µm filter, e.g., a syringe filter, to avoid transferring any remaining contaminating particles onto the column. Application of a sample that has not been properly clarified may reduce the performance and lifetime of the column.

Adjust the sample to the salt concentration of the binding buffer to promote hydrophobic interaction. To avoid precipitation caused by the high salt concentrations that can occur locally when adding salt as a solid, salt can be added from a high-concentration stock solution. Adjust the pH of the sample directly to pH 5.0 – 8.5, depending on the sample. Performing a buffer exchange might not be necessary, as the influence of buffer ions and pH tends to be less prominent in certain cases.

Purification

As temperature is a parameter that can affect separations using HIC, keep sample, binding and elution buffers, columns, and chromatographic equipment at the same, constant temperature throughout the purification to ensure consistent and reproducible results.

Note: Do not exceed the maximum recommended flow rate back pressure for the column, see "Product descriptions".

1. Wash out the storage solution with 1 – 2 column volumes (CV) low-salt elution buffer as it may be a risk that the binding buffer salts can precipitate upon exposure to ethanol. Use a reduced flow rate, 50% of the maximum flow rate when washing out the storage solution.

2. Equilibrate with 5 – 10 CV high-salt binding buffer.
3. Apply the sample.
4. Wash with 5 – 20 CV high-salt binding buffer until the UV trace of the effluent returns to near baseline.
5. Elute with low-salt elution buffer using preferably a linear gradient, for example, 10 – 20 CV.
6. If required perform a cleaning-in-place (CIP), see page 7. To prevent precipitation wash the column with 5 CV low-salt elution buffer before starting the CIP procedure.
7. For storage, wash the column with at least 5 CV 20% ethanol.
   Use a reduced flow rate, 50% of the maximum flow rate when equilibration with the storage solution.
8. Make sure that the stop plugs are tight to prevent leakage.
   For prolonged storage, connect the included syringe filled with storage solution to the bottom end of the column.

Optimization

The goal when optimizing a purification is to identify the parameters that promote the binding of the highest amount of the target molecule in the shortest possible time with the greatest possible recovery of the target at the lowest cost.

Conditions should be selected to achieve the binding of the target, while avoiding the binding of impurities, to maximize the purity and yield of the target molecule. If the target molecule is a protein, conditions must also be selected that preserve its native state.

Optimization of salt and salt concentration

In HIC, the binding process is more selective than the elution process and it is essential to optimize the conditions of the binding buffer. The correct salt and salt concentration are the most important parameters that influence capacity and final selectivity.

Sulphate salts, in the order of ammonium, potassium, and sodium sulphates effectively promote ligand-protein interactions in HIC and have a stabilizing influence on protein structure. These so-called kosmotropic (anti-chaotropic) salt ions have higher polarity and bind water strongly and therefore exhibit a higher 'salting-out' effect on the molecules, see Hofmeister series in Figure 2. Commonly used salts are $(NH_4)_2SO_4$, Na_2SO_4, NaCl, KCl, and CH_3COONH_4. The salts that increase surface tension in aqueous solutions tend to promote hydrophobic interactions. The choice of salt for a HIC separation is a matter of trial and error since each salt differs in its ability to promote hydrophobic interactions. As the salt concentration increases, the bond between the target and the resin will become stronger leading to more target being bound to the resin..

Ammonium sulphate often gives a good resolution compared to other salts, and it can be used in concentrations up to 2 M. Sodium chloride can be used up to concentrations of 3 M. Sodium sulphate is a good salting-out agent but can cause problems with sample solubility at high concentrations.

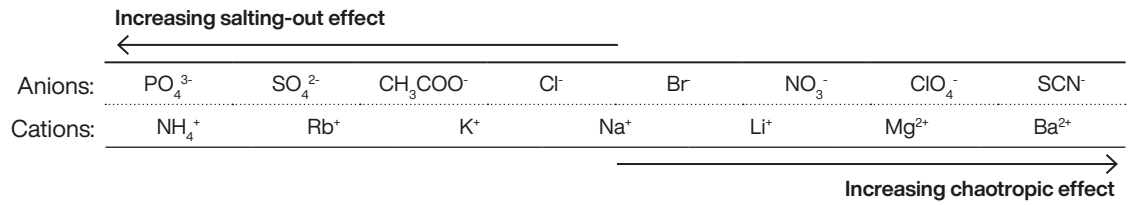

Figure 2. The Hofmeister series.

Optimization of buffer ions and pH

The choice of buffering ions is not critical to hydrophobic interaction. Phosphate buffers and tris buffers are most commonly used. The pH should be compatible with the target's stability and activity. A neutral pH is recommended as a starting point, but it ultimately depends on the properties of the target molecule.

Use a buffer concentration of 20 to 100 mM to maintain buffering capacity pH during sample loading and changes in salt concentration.

Optimization of flow rate

The flow rate during sample loading affects the binding capacity and resolution during the elution.

A low flow rate during sample application promotes binding capacity since more time is allowed for the mass transport of the target substance into the pores of the resin. A small substance, e.g., a peptide, that has a high diffusion rate will have rapid mass transport into the resin and can thus be adsorbed efficiently at higher flow rates as it has fast binding kinetics. A large target substance has a lower diffusion rate and is more hindered by the walls in the pores, resulting in slower mass transport. Achieving a high binding capacity of this substance may require lowering the flow rate. If only a part of the binding capacity of the column is used, sample application can be done at a higher flow rate without loss of the target substance.

Typical linear flow rates are 150 – 300 cm/h. Figure 3 shows how the resolution is affected by the flow velocity for three different protein pairs.

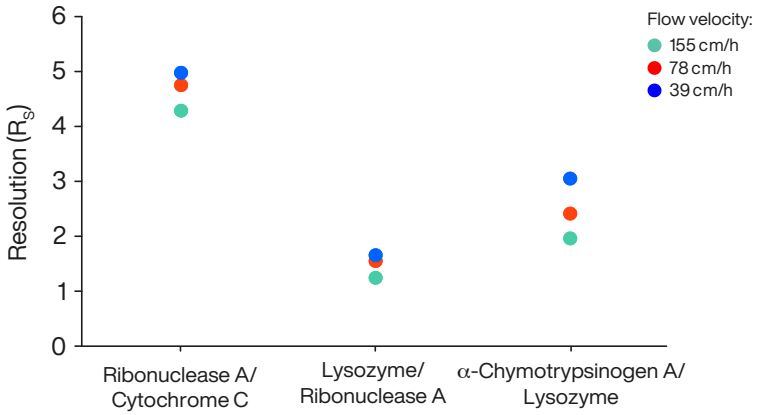

Figure 3. Relationship between resolution and flow velocity acheived using a GoBio Mini Butyl SH 1 mL column. The flow velocities used: 39 cm/h (blue), 78 cm/h (red), and 155 cm/h (green).

Optimization of washing

A continuously decreasing UV signal is an indication that unbound material is still being washed out.

The washing should continue until the UV signal is stable and is the same as in the buffer used for washing, or at least not more than 20 mAU. The washing buffer can be the same as the binding buffer, but in some cases, it may be useful to add an additional step, such as one or two intermediate wash steps, to improve purification.

Optimization of elution conditions

For optimizing the elution condition, it is recommended to use a linear gradient to decrease the ionic strength, see Figure 4.

The results will then be used for the optimal elution buffer when moving to a step elution method, which is often the preferred method in process scale as the target substance is eluted in a more concentrated form. Buffer consumption can be reduced, and the purification cycle times can be shortened.

Elution is, in most cases, carried out using zero or low salt concentration. The optimal salt concentration is dependent on the purity and recovery requirements, as well as the properties of the target substance.

Applying gradient elution gives higher purity than step elution in most cases, but step elution may be preferred if the target needs to be more concentrated in the eluate. To optimize the salt concentration for step elution an initial linear gradient test run should be carried out to determine suitable step elution conditions.

Note: Remember to take the system dead volume into account when comparing the printout of the gradient and the trace.

Other elution possibilities are:

- Increasing the concentration of chaotropic 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
- Isocratic elution is an option for some feeds due to a partial retention
- Changing the temperature to alter the elution pattern

Increasing the salting-out effect strengthens hydrophobic interactions; increasing the chaotropic effect weakens hydrophobic interactions, see Figure 2.

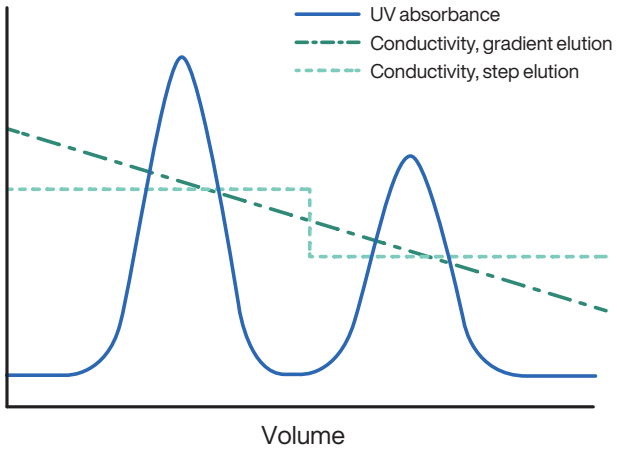

Figure 4. Optimization of step elution with low-salt buffer. A test run with linear gradient elution gives information about suitable salt concentrations to be used in step elution.

Scale-up

After laboratory scale purifications using GoBio Prep 16x100 or GoBio Prep 26x100 columns, the column volume can easily be scaled-up by using larger prepacked columns, such as GoBio Prod columns. The GoBio Prod prepacked column family has column sizes starting from 1 liter. Bulk packages of WorkBeads resins can also be packed into other column formats of choice.

Large-scale purification is often carried out using columns with bed heights ranging from 200 to 300 mm and diameters tailored to the required column volume.

Scale-up principles

During scale-up, the ratio between sample volume and column volume should be kept constant. The column volume is scaled up by increasing the column diameter while keeping the bed height the same (e.g., 200 mm). The linear flow rate should remain the same while the volumetric flow rate increases. The volumetric flow rate for each column can be calculated according to:

$$\text{Volumetric flow rate (mL/min)} = \frac{\text{Linear flow rate (cm/h)} \times \text{Column cross sectional area (cm}^2\text{)}}{60}$$

Flow

The concepts of volumetric flow, linear flow rate and residence time are important when scaling-up in chromatography. Volumetric flow is measured in mL/min or L/min, linear flow in cm/h and residence time in minutes. The relationship between these metrics is:

$$\text{Linear flow rate (cm/h)} = \frac{\text{Volumetric flow (mL/min)} \times 60}{\text{Column cross sectional area (cm}^2\text{)}}$$

$$\text{Residence time (minutes)} = \frac{\text{Column bed height (cm)} \times 60}{\text{Linear flow rate (cm/h)}}$$

In the initial process development work, it is common to use a small column, e.g., 7 × 100 mm, to save samples, buffers and time. This column has a shorter bed height than the final column, which may have a bed height of 200 mm or more. The flow rate for the larger column can be calculated from the flow that was established on the small column using the equation above by keeping the residence time of the small column the same for the larger column. This will allow an increase of the linear flow in proportion to the increase in bed height between the columns, see Table 3 for examples. If the column bed heights are kept constant during scale-up the linear flow rate should be kept constant (as well as the residence time).

Table 3. Example of scale-up parameters

Column dimension	Residence time (minutes)	Linear flow rate (cm/h)	Volumetric flow rate (mL/min)
16x100	4	150	5.0
26x100	4	150	13.3
80x200	8	150	126
130x200	8	150	332
200x200	8	150	785
240x200	8	150	1131
330x250	10	150	2138

Additional purification

Optimization of the purification process by tuning the binding, washing and/or elution conditions of the HIC purification step may not be enough to obtain the required purity. Combining two or more purification steps based on additional chromatography techniques is then recommended.

For example, before a HIC step, an ion exchange chromatography step can be added. If you include an IEX step before the HIC, rather than after, it reduces the required sample handling. Another technique, such as size exclusion chromatography (gel filtration) is a commonly used alternative and often used as a polishing step. Each purification step should be thoroughly optimized, and preferably in the context of the other steps applied in the overall process.

Desalting and buffer exchange

Buffer exchange or desalting of a sample can be performed before analysis and/or after purification by hydrophobic interaction chromatography. This can be carried out quickly and easily in lab-scale using GoBio Mini Dsalt 1 mL, GoBio Mini Dsalt 5 mL, GoBio Prep 16x100 Dsalt (20 mL), and GoBio Prep 26x100 Dsalt (53 mL) prepacked columns depending on sample volumes. GoBio Prod prepacked columns starting from 1 L are available for larger sample volumes, see “Related products”.

These columns are very useful alternatives to dialysis for larger sample volumes or when samples need to be processed rapidly to avoid degradation.

To find out more about Bio-Works’ chromatography products, visit www.bio-works.com

Maintenance

Cleaning and sanitization

During purification, impurities such as cell debris, lipids, nucleic acids, and protein precipitates from the samples may gradually build up in the resin. The severity of this process depends on the type of sample applied to the column and the pre-treatment of the sample. The impurities covering the resin may reduce the performance of the column over time. Regular cleaning (Cleaning-in-place, CIP) keeps the resin clean, reduces the rate of further fouling, and prolongs the capacity, resolution and flow properties of the column.

CIP of the column can be carried out as follows:

1. Wash the column with 5 CV 0.02 M NaCl..
2. Apply 3 – 10 CV of 0.5 – 1 M NaOH for 15 – 30 minutes.

   Note: The contact time is the important factor. Treatment with NaOH overnight can be necessary if severely fouled.
3. Wash the column with 5 – 10 CV 0.02 M NaCl (until the pH is neutral after CIP).
4. Equilibrate the column with 10 CV 20% ethanol (for storage).

Sanitization (reduction of microorganisms) can be carried out using combinations of NaOH and ethanol. The sanitization procedure and its effectiveness will depend on the microorganisms to be removed and needs to be evaluated for each case.

Storage

Store at 2 to 25°C in 20% ethanol.

For prolonged storage, connect the included transport syringe filled with storage solution to the bottom end of the column.

Note: Use a reduced flow rate during equilibration with 20% ethanol, a maximum of 50% of the maximum flow rate.

Product descriptions

	GoBio Prep 16x100 Butyl SH **GoBio Prep 26x100 Butyl SH**
Target substance	Proteins, peptides, plasmids, oligonucleotides
Resin	WorkBeads 40 Butyl SH
Matrix	Rigid, highly cross-linked agarose
Average particle size (D_{V50})[1]	45 µm
Ligand	*n*-butyl thioether (CH_3 - CH_3 - CH_3 - CH_3 - S -)
Ligand density	46 – 62 µmol/mL resin
Dynamic binding capacity (DBC)[2]	43 mg β-lactoglobulin/mL resin
Column volumes	20 mL (16x100) 53 mL (26x100)
Column dimensions	16 × 100 mm 26 × 100 mm
Recommended flow rates[3] 16x100 26x100	 4 – 6 mL/min (120 – 180 cm/h) 10 – 15 mL/min (115 – 170 cm/h)
Maximum flow rate[4] 16x100 26x100	 8 mL/min (240 cm/h) 20 mL/min (230 cm/h)
Maximum back pressure[5]	5 bar, 0.5 MPa, 70 psi
Chemical stability	Compatible with all standard aqueous buffers exhibiting some conductivity, 1 M NaOH, 30% isopropanol, 20% ethanol. Note: Sensitive to oxidants, e.g., H_2O_2.
pH stability	2 – 13
Storage	2 to 25 °C in 20% ethanol

1 The median particle size of the cumulative volume distribution.
2 Dynamic binding capacity at 10% breakthrough determined at a residence time of 4 min (150 cm/h) in a 6.6x100 mm column. Buffer conditions: 0.1 M sodium phosphate, 2 M ammonium sulfate, pH 7.
3 Optimal flow rate during binding is depending on the sample.
4 Maximum flow rate for aqueous buffers at 20 °C. Decrease the maximum flow rate if the liquid has a higher viscosity. Higher viscosities can be caused by low temperature (use half of the maximum flow rate for 20% ethanol).
5 The maximum pressure the packed bed can withstand depends on the sample/liquid viscosity and chromatography resin characteristics. The pressure also depends on the tubing used to connect the column and the system restrictions after the column outlet.

GoBio prepacked column family

GoBio prepacked column family is developed for convenient, reproducible, and fast results and includes columns with different sizes and formats.

GoBio Mini 1 mL and GoBio Mini 5 mL are used for small scale purification and screening using a shorter packed bed.

GoBio Screen 7x100 (3.8 mL) is used for reproducible process development including fast and easy optimization of methods and parameters.

GoBio Prep 16x100 (20 mL) and GoBio Prep 26x100 (53 mL) are used for lab-scale purifications and scaling up.

GoBio Prep 16x600 (120 mL) and GoBio Prep 26x600 (320 mL) are used for preparative lab-scale size exclusion chromatography.

GoBio Prod 80x200 (1 L), GoBio Prod 130x200 (2.7 L), GoBio Prod 200x200 (6 L), GoBio Prod 240x200 (9 L) and GoBio Prod 330x250 (21.4 L) are used for production-scale purifications.

Related products

Product name	Pack size[1]	Article number
Prepacked columns		
GoBio Mini Butyl SH 1 mL	1 mL × 1 1 mL × 5 1 mL × 10	45 500 101 45 500 103 45 500 104
GoBio Mini Butyl SH 5 mL	5 mL × 1 5 mL × 5 5 mL × 10	45 500 105 45 500 107 45 500 108
GoBio Screen 7x100 Butyl SH	3.8 mL × 1	55 500 001
GoBio Prod 80x200 Butyl SH[2]	1 L × 1	55 500 042
GoBio Prod 130x200 Butyl SH[2]	2.7 L × 1	55 500 062
GoBio Prod 200x200 Butyl SH[2]	6 L × 1	55 500 072
GoBio Prod 240x200 Butyl SH[2]	9 L × 1	55 500 082
GoBio Prod 330x250 Butyl SH[2]	21.4 L × 1	55 500 093
GoBio Mini IEX Screening Kit 1 mL[3]	1 mL × 4	45 900 001
GoBio Mini Dsalt 1 mL	1 mL × 5	45 360 103
GoBio Mini Dsalt 5 mL	5 mL × 5	45 360 107
GoBio Prep 16x100 Dsalt[2]	20 mL × 1	55 700 021
GoBio Prep 26x100 Dsalt	53 mL × 1	55 700 031
Bulk resins		
WorkBeads 40 Butyl SH	25 mL 200 mL 1 L 5 L 10 L	40 500 001 40 500 003 40 500 010 40 500 050 40 500 060
WorkBeads Dsalt	300 mL 1 L	40 360 003 40 360 010

[1] All different pack sizes are available on www.bio-works.com
[2] Packed on request.
[3] GoBio Mini IEX Screening Kit includes one of each: GoBio Mini S 1 mL, GoBio Mini Q 1 mL, GoBio Mini DEAE 1 mL and GoBio Mini TREN 1 mL.

Ordering information

Product name	Pack size	Article number
GoBio Prep 16x100 Butyl SH	20 mL × 1	55 500 021
GoBio Prep 26x100 Butyl SH[1]	53 mL × 1	55 500 031

[1] Packed on request.

Orders: sales@bio-works.com or contact your local distributor.

For more information about local distributor and products, visit www.bio-works.com or contact us at info@bio-works.com

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