

## PROTEIN PURIFICATION CHROMATOGRAPHY

# ENrich™ High-Resolution Protein Purification Columns

- High resolution
- 10- $\mu$ m bead size
- Fast purification
- High capacity
- Highly reproducible separation
- Stability from pH 2–12

## Achieve High-Resolution Protein Purification with Short Separation Times

ENrich Columns are designed for rapid, high-resolution protein separations and purification. Their 10- $\mu$ m bead size and unique polymeric stationary phase provide high-resolution separations at fast flow rates, resulting in short separation times. ENrich Columns have high capacity and reproducibility, making them ideal for the intermediate and polishing steps of the laboratory-scale protein purification workflow. ENrich Ion Exchange Columns are available in strong anion and cation exchange stationary phases and ENrich Size Exclusion Chromatography (SEC) Columns are available in two different separation ranges.

### ENrich Ion Exchange Columns

- ENrich Q: Strong anion exchange column
- ENrich S: Strong cation exchange column

### ENrich Size Exclusion Columns

- ENrich SEC 650 with a separation range from 5–650 kD
- ENrich SEC 70 with a separation range from 0.5–70 kD

### Media Characteristics

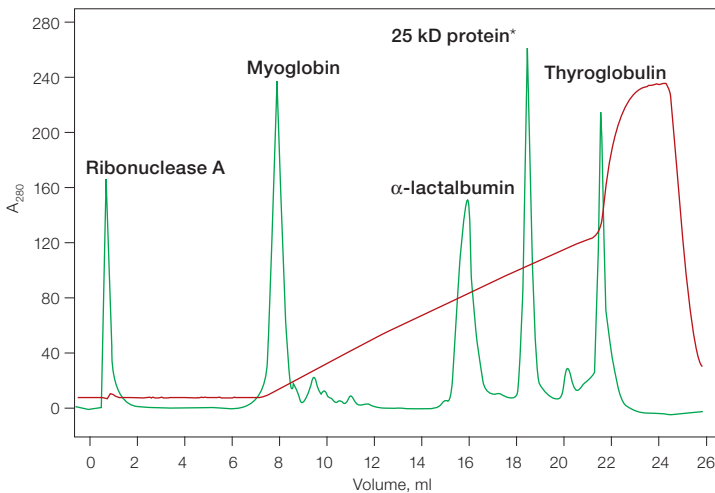
ENrich Columns are composed of a unique hydrophilic polymethacrylate stationary phase that delivers beneficial chromatographic properties and performance. The 10- $\mu$ m spherical beads provide high efficiency and resolution for protein separations. The resin is both highly porous and rigid, which provides high permeability and low backpressures. This gives ENrich Columns the ability to run at high flow rates with low pressure, which results in short separation times. The robust polymethacrylate stationary phase provides consistent reproducible results and compatibility with buffers and solvents used in biochemical separations. The wide pH stability range of the ENrich stationary phase offers flexibility of run conditions for protein separation method development.



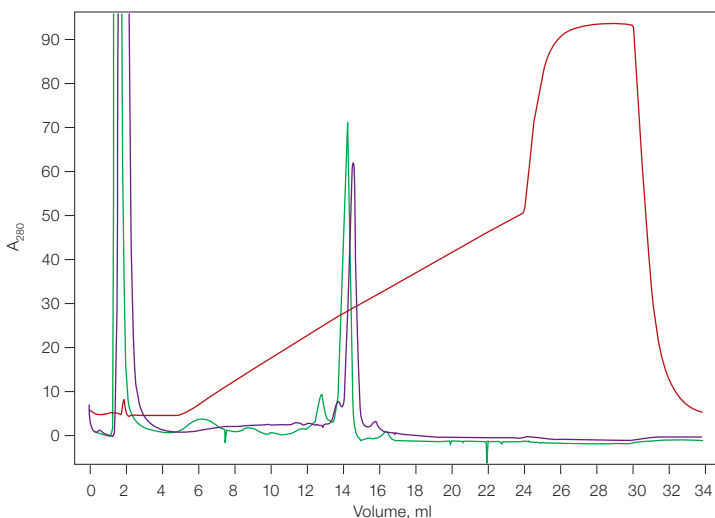
**BIO-RAD**

## ENrich Ion Exchange Columns

ENrich Ion Exchange Columns, available in both 1 ml and 8 ml sizes, allow exceptionally high-resolution protein separations and purification. Their 10- $\mu\text{m}$  bead size and unique polymeric stationary phase provide extremely high peak efficiency and resolution. Figure 1 illustrates the separation of a complex protein sample, highlighting the high-resolution performance (degree of separation between peaks) and efficiency (sharpness of peaks) of the ENrich Q Ion Exchange Column. Figure 2 demonstrates the higher peak efficiency and resolution of the ENrich S Ion Exchange Column compared to a common competitor's column.



**Fig. 1. The 1 ml ENrich Q Column provides high-resolution separation of a complex sample of protein standards.** Conductivity, mS/cm (→).  
\* Precision Plus Protein™ 25 kD Standard

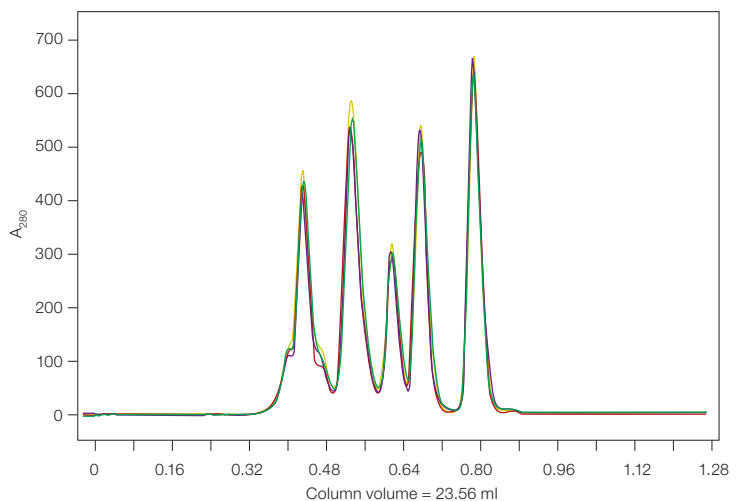


**Fig. 2. The 1 ml ENrich S Column shows higher peak efficiency and resolution compared to a competitor's column.** Sample: egg white proteins. ENrich S (—); competitor's column (—); conductivity, mS/cm (→).

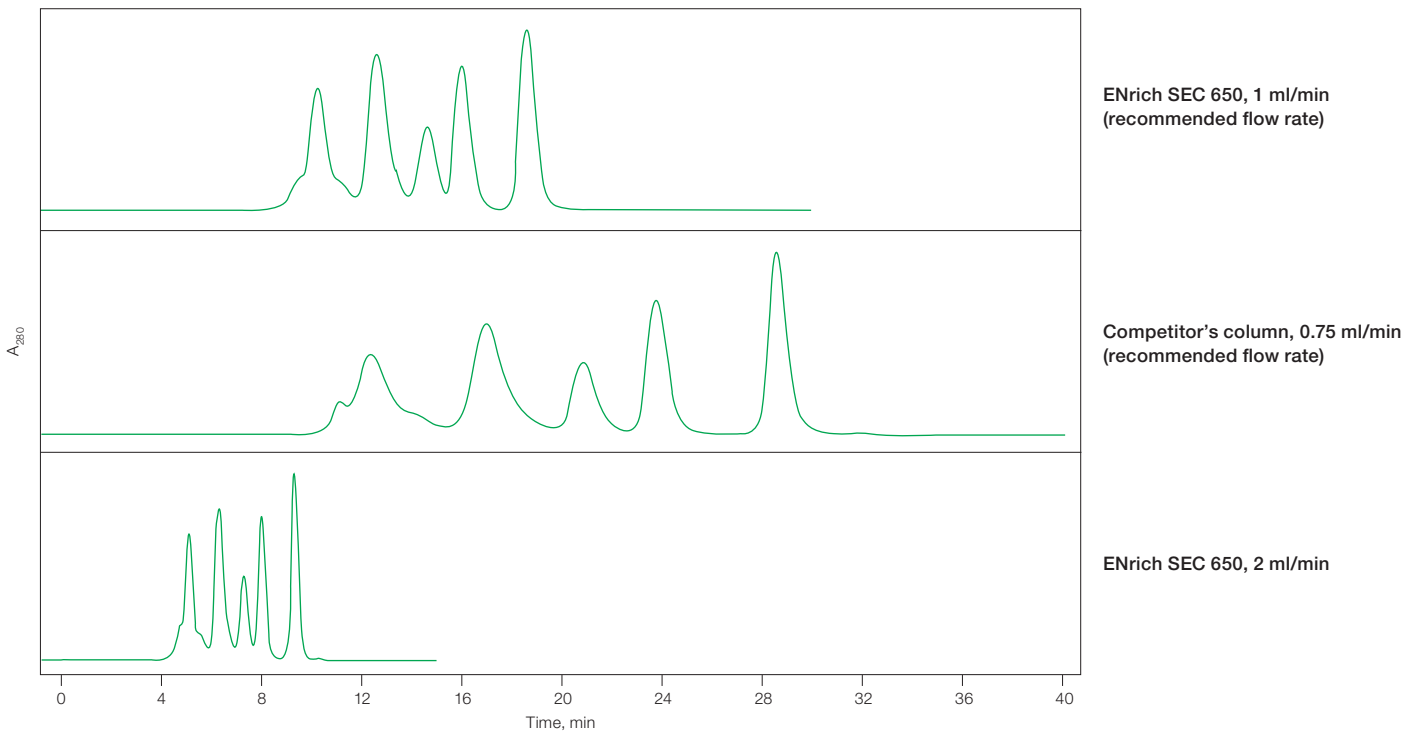
ENrich Ion Exchange Columns have spherical, rigid, and highly porous polymeric resin derivatized with quaternary ammonium or sulfonic acid functional groups. The high density of these functional groups provides ENrich Q and S Columns with a high binding capacity of up to 120 mg protein/ml of resin. The highly porous and stable 10- $\mu\text{m}$  beads of the column's stationary phase provide excellent resolution of proteins at high flow rates with low backpressures, resulting in short separation times. The hydrophilic ENrich Ion Exchange Resin demonstrates extremely low nonspecific binding of biomolecules accompanied by high recovery of biological activity. The ENrich Ion Exchange Columns are stable over a pH range of 2–12, offering flexible pH scouting capabilities and allowing for easy cleaning and regeneration.

## ENrich Size Exclusion Columns

ENrich SEC Columns are designed for quick, reproducible high-resolution protein separations and purification based on size. They can run at high flow rates with acceptable pressure, which results in short separation times. A 24 ml ENrich SEC Column can complete a high-resolution separation in less than 15 minutes. Figure 3 shows the high-resolution separation of a complex protein sample, run from 0.5 to 2 ml/min on an ENrich SEC 650 Column without loss of efficiency and resolution. Also, ENrich SEC Columns, while having similar resolution to a common competitor's size exclusion column, can provide separations in significantly shorter time. Figure 4 shows similar resolution for a protein sample run on the ENrich SEC 650 and competitor's columns. However, the higher flow rate separation run on the ENrich SEC 650 Column is completed in a significantly shorter period of time. The 1 and 2 ml/min protein separation runs of the ENrich SEC 650 Column shown in Figure 4 demonstrate similar high resolution to that in Figure 3.



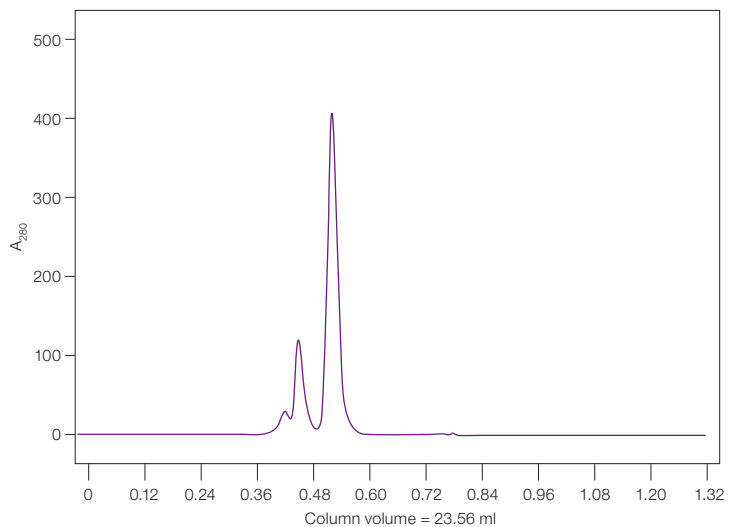
**Fig. 3. The ENrich SEC 650 Column provides the same high resolution for a complex sample of protein standards run at different flow rates including 1.5 and 2 ml/min.** ENrich 650 at 2 ml/min (—); ENrich 650 at 1.5 ml/min (—); ENrich 650 at 1 ml/min (—); ENrich 650 at 0.5 ml/min (—).



**Fig. 4. The ENrich SEC 650 Column completes the same high-resolution protein separation in a significantly shorter time than a common competitor's column.** (See also Figure 3.)

The ENrich SEC Columns can be used for a variety of protein applications, including high-resolution separation and purification of monoclonal antibodies and associated aggregates (Figure 5).

Prepacked ENrich SEC Columns with a 10 x 30 mm format and 24 ml column volume are ideal for laboratory-scale high-resolution protein separations and commonly required loading volumes. The resin particles of the ENrich SEC 650 and 70 Columns have different pore structures, which provide them with different separation ranges. The ENrich SEC 650 Column has a separation range of 5–650 kD and the ENrich SEC 70 Column has a separation range of 0.5–70 kD. The inert, hydrophilic stationary phase of ENrich SEC Columns provides extremely low nonspecific binding of proteins accompanied by high recovery of biological activity. The highly stable stationary phase of the ENrich SEC Column also allows the use of a variety of run conditions for high-resolution protein separations.



**Fig. 5. The ENrich SEC 650 Column provides high-resolution separation of a monoclonal antibody and aggregates.**

## Specifications

	ENrich SEC 70	ENrich SEC 650	ENrich Q		ENrich S	
			5 x 50	10 x 100	5 x 50	10 x 100
Mode of separation	Size	Size	Strong anion exchanger	Strong anion exchanger	Strong cation exchanger	Strong cation exchanger
Functional group	—	—	Quaternary ammonium	Quaternary ammonium	Sulfonic acid	Sulfonic acid
Linear separation range	0.5–70 kD	5–650 kD	—	—	—	—
Column dimensions (diameter x height, mm)	10 x 300	10 x 300	5 x 50	10 x 100	5 x 50	10 x 100
Column volume	24 ml	24 ml	1 ml	8 ml	1 ml	8 ml
Average particle size	10 µm	10 µm	10 µm	10 µm	10 µm	10 µm
Recommended flow rates	0.5–1 ml/min	0.75–1.25 ml/min	1 ml/min	4 ml/min	1 ml/min	4 ml/min
Maximum recommended flow rate	1.5 ml/min	2 ml/min	2 ml/min	6 ml/min	2 ml/min	6 ml/min
Maximum operating pressure	600 psi	600 psi	500 psi	500 psi	500 psi	500 psi
Recommended sample volume	<250 µl	<250 µl	N/A	N/A	N/A	N/A
Maximum protein capacity, mg/ml	N/A	N/A	130 bovine albumin	130 bovine albumin	120 human IgG	120 human IgG
Working pH range	2–12	2–12	2–12	2–12	2–12	2–12
Operating temperatures	4–40°C	4–40°C	4–40°C	4–40°C	4–40°C	4–40°C

## Ordering Information

Catalog # Description

### ENrich Columns

780-1070 **ENrich SEC 70 10 x 300 Column**  
 780-1650 **ENrich SEC 650 10 x 300 Column**  
 780-0093 **ENrich 10 Frit Kit**, includes 2 frits, 1 frit remover, 2 O-rings  
 151-1901 **Gel Filtration Standard**, 6 vials  
 780-0001 **ENrich Q 5 x 50 Column**  
 780-0003 **ENrich Q 10 x 100 Column**  
 780-0021 **ENrich S 5 x 50 Column**  
 780-0023 **ENrich S 10 x 100 Column**  
 780-0091 **ENrich 5 Frit Kit**, includes 2 frits, 1 frit remover, 2 O-rings

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