

# CHROMATOGRAPHY UNOsphere™ S Cation Exchange Resin

- Efficient capture of biopharmaceutical molecules from crude feedstreams
- Ultrahigh binding capacities at fast linear velocities
- Hydrophilic polymeric resin engineered for high mechanical stability and low backpressures
- Robust polymer designed to withstand repetitive clean-in-place cycles
- Large open pore structure for fast mass transfer
- Compatible with separation of proteins, nucleic acids, viruses, plasmids, and other biomolecules
- Biopharmaceutical manufacturing quantities available
- Fully supported for regulatory submission

## Achieve High Productivity Using UNOsphere S Cation Exchange Resin

### Be Productive

In the bioprocess industry, the isolation of biomolecules from crude feedstock is one of the most demanding chromatographic steps in the downstream process.

Biopharmaceutical manufacturers are under increasing economic pressure to reduce drug production costs.

These factors require the resins used in the capture step to have very high binding capacities at fast linear velocities while maintaining low column backpressure.

UNOsphere is a patented\* next-generation polymeric resin based on a single-step polymerization process that delivers high productivity in the capture step.

### UNOsphere Polymer Technology

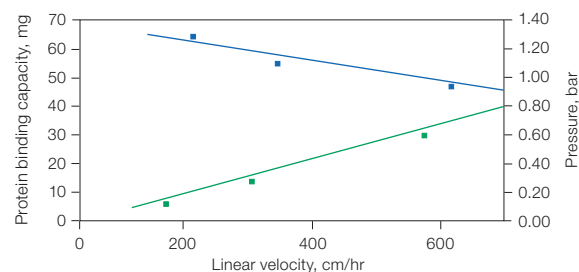
The genesis of UNOsphere Resin is based on the single-step polymerization process used to prepare UNO® Continuous Bed Columns. Incorporation of the sulfonic acid ligand into the matrix during polymerization leads to consistent batch-to-batch reproducibility. UNOsphere Resin is macroporous (>2,000 Å), leading to fast binding kinetics and high binding capacities (Table 1). Careful selection of monomers and crosslinkers provides unrivaled base stability and resin rigidity.

\* U.S. patent 6,423,666 B1.

### Properties of UNOsphere S Resin

Most production chromatography systems have maximum pressure limits of 3 bar. The median particle size of UNOsphere S Resin is 80 µm, which generates a backpressure less than 1.5 bar at 1,200 cm/hr (Figure 1). The highly macroporous nature of UNOsphere S Resin provides high binding capacities that range from 40 to 60 mg IgG/ml resin in the linear velocity range of 150–600 cm/hr (Figure 1).

Harsh conditions, such as clean-in-place and corrosive buffer systems, may affect the long-term stability of chromatographic resins. The robustness of UNOsphere S Resin allows it to survive these conditions with minimal loss of performance (Table 1).



**Fig. 1. Binding and backpressure properties of UNOsphere S Resin.** Column size, 1.1 × 20 cm; sample, 2 mg/ml hlgG; buffer, 50 mM sodium acetate, pH 5.0. Backpressure (—); 10% breakthrough (BT) capacity (—).



**Table 1. Properties of UNOsphere S Resin.**

Property	Description
Type of ion exchanger	Strong cation
Functional group	-SO <sub>3</sub> <sup>-</sup>
Particle size	80 μm
Total ionic capacity	269 ± 50 meq/ml
	60 mg IgG/ml at 150 cm/hr
Dynamic binding capacity	10% BT capacity determined with 4.5 mg/ml hlgG in 1.1 x 10 cm column
Recommended linear flow rate	50–300 cm/hr
Pressure vs. flow performance	Under 2.0 bar at flow rate of 1,200 cm/hr (20 x 20 cm packed bed, 1.17 compression factor)
Compression factor (settled bed volume/packed bed volume)	1.15–1.20
pH stability	1–14
Shipping solution	20% ethanol or 0.1 M NaCl
Regeneration	1–2 M NaCl
Sanitization	0.5–1.0 N NaOH
Storage conditions	20% ethanol or 0.1 N NaOH
Chemical stability	
1.0 M NaOH (20°C)	Up to 2,000 hr
1.0 M HCl (20°C)	Up to 200 hr*
Shelf life	5 years

\* Data derived under accelerated conditions at 60°C.

### Capture Performance

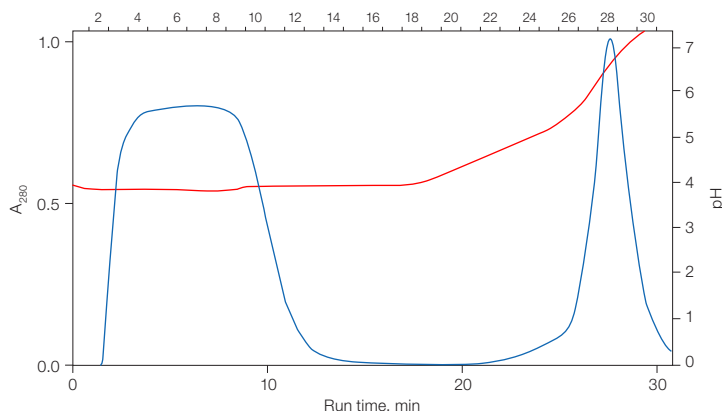
UNOsphere S Resin is designed for high-efficiency capture of monoclonal antibodies from crude feedstreams. Murine IgG<sub>1</sub> (6.6 mg) was captured and eluted from a 2 ml UNOsphere S Column (Figures 2 and 3); assays of the load and eluate demonstrated a recovery of 97%. No antibody was detected in the flowthrough (Figure 3, lane 2). The 10% breakthrough capacity for this murine IgG<sub>1</sub> antibody is 12.8 mg/ml (at 600 cm/hr) from conditioned medium.

### Technical Assistance

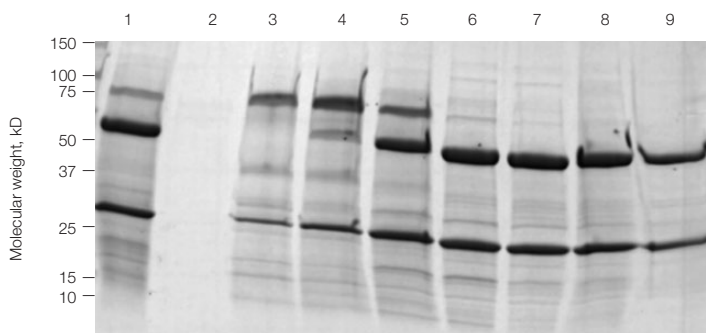
Regulatory support files are available upon request. Bio-Rad Laboratories is an ISO 9001 registered corporation. For additional information and technical assistance, contact your local Bio-Rad office. In the USA and Canada, call 1-800-424-6723.

Visit [bio-rad.com/web/UNOsphereS](http://bio-rad.com/web/UNOsphereS) for more information about Bio-Rad's UNOsphere S Resin and to request a free sample.

For more technical information, request bulletins 2678, 2774, 2780, 2849, and 6713. For more information about the chromatographic performance of UNOsphere Resin, refer to the bibliography (note that the authors refer to UNOsphere Resin as BRX).



**Fig. 2. Purification of murine IgG<sub>1</sub> on UNOsphere S Column.** Column size, 0.5 x 10 cm (2 ml); sample, 15 ml (6.6 mg) of murine IgG<sub>1</sub>-conditioned medium. The sample was loaded onto the column in 20 mM citrate-phosphate buffer, pH 4.0, washed, and eluted in a linear gradient of 0–100% 20 mM citrate-phosphate, pH 8.0, in 10 column volumes at a flow rate of 2.0 ml/min (600 cm/hr). Each fraction was 2.0 ml. A<sub>280</sub> (—); buffer pH (—). A, absorbance.



**Fig. 3. SDS-PAGE gel of UNOsphere-purified murine IgG<sub>1</sub>.** Fractions from the chromatography run shown in Figure 2 were separated on a 4–20% precast gel. On left, reference standards; lane 1, conditioned medium; lane 2, flowthrough; lanes 3–8, fractions 25, 26, 27, 28, 29, and 30; lane 9, Protein A-purified murine IgG<sub>1</sub> from culture medium.

### Bibliography

- Gagnon P et al. (2010). Minibodies and multimodal chromatography methods: A convergence of challenge and opportunity. *Bioprocess Int* 8, 26–35.
- Guo J and Carta G (2015). Unfolding and aggregation of monoclonal antibodies on cation exchange columns: Effects of resin type, load buffer, and protein stability. *J Chromatogr A* 1388, 184–194.
- Hunter AK and Carta G (2000). Protein adsorption on novel acrylamido-based polymeric ion exchangers. I. Morphology and equilibrium adsorption. *J Chromatogr A* 897, 65–80.
- Hunter AK and Carta G (2000). Protein adsorption on novel acrylamido-based polymeric ion exchangers. II. Adsorption rates and column behavior. *J Chromatogr A* 897, 81–97.
- Tao Y et al. (2011). Adsorption of deamidated antibody variants on macroporous and dextran-grafted cation exchangers. II. Adsorption kinetics. *J Chromatogr A* 1218, 1,530–1,537.
- Tugcu N et al. (2008). Maximizing productivity of chromatography steps for purification of monoclonal antibodies. *Biotechnol Bioeng* 99, 599–613.

## Ordering Information

Catalog # Description

### Prepacked Screening Tools

7324710	Foresight™ UNOsphere S Plates, 2 x 96-well, 20 µl
7324813	Foresight UNOsphere S RoboColumn Unit, 200 µl
7324814	Foresight UNOsphere S RoboColumn Unit, 600 µl
7324730	Foresight UNOsphere S Column, 1 x 1 ml
7324750	Foresight UNOsphere S Column, 1 x 5 ml

### Bulk Resin

1560111	UNOsphere S Support, 25 ml
1560113	UNOsphere S Support, 100 ml
1560115	UNOsphere S Support, 500 ml
156-0117	UNOsphere S Support, 10 L



**Bio-Rad  
Laboratories, Inc.**

Life Science  
Group

**Web site** [bio-rad.com](http://bio-rad.com) **USA** 1 800 424 6723 **Australia** 61 2 9914 2800 **Austria** 43 1 877 89 01 177 **Belgium** 32 (0)3 710 53 00 **Brazil** 55 11 3065 7550  
**Canada** 1 905 364 3435 **China** 86 21 6169 8500 **Czech Republic** 420 241 430 532 **Denmark** 45 44 52 10 00 **Finland** 358 09 804 22 00  
**France** 33 01 47 95 69 65 **Germany** 49 89 31 884 0 **Hong Kong** 852 2789 3300 **Hungary** 36 1 459 6100 **India** 91 124 4029300  
**Israel** 972 03 963 6050 **Italy** 39 02 216091 **Japan** 81 3 6361 7000 **Korea** 82 2 3473 4460 **Mexico** 52 555 488 7670 **The Netherlands** 31 (0)318 540 666  
**New Zealand** 64 9 415 2280 **Norway** 47 23 38 41 30 **Poland** 48 22 331 99 99 **Portugal** 351 21 472 7700 **Russia** 7 495 721 14 04  
**Singapore** 65 6415 3188 **South Africa** 27 (0) 861 246 723 **Spain** 34 91 590 5200 **Sweden** 46 08 555 12700 **Switzerland** 41 026674 55 05  
**Taiwan** 886 2 2578 7189 **Thailand** 66 662 651 8311 **United Arab Emirates** 971 4 8187300 **United Kingdom** 44 020 8328 2000

