



Chromatography Media Selection Guide



Achieve targeted performance at every scale

- ▶ **Unique Selectivities.** Pall's versatile line of media includes the powerful HyperCel™ sorbent family of Q and S HyperCel ion exchange sorbents and MEP, HEA, and PPA HyperCel mixed-mode sorbents, offering innovative selectivities for antibody and recombinant protein, plasma derivatives, or other biopharmaceutical protein purifications.
- ▶ **Versatility.** By tailoring attributes such as chemistry and particle size to the specific nature of the purification, Pall sorbents exhibit the highest performance characteristics while ensuring reliable, reproducible separations.
- ▶ **True Scalability.** The ability to scale up is essential for those working in drug discovery, development, and manufacturing. Pall's chromatography products feature direct scale up from process development to pilot or production scale.
- ▶ **High Productivity.** Performance is built into every Pall chromatography product. For example, Q and S HyperCel, and Ceramic HyperD® "Gel-in-a-Shell" sorbents operate 2 to 5 times faster than conventional soft gels and significantly increase the productivity of ion exchange capture and purification steps. Mustang® ion exchange membrane products deliver high volumetric flow rates for increased throughput and reduced buffer consumption, providing efficient contaminant removal and capture of large target molecules (plasmid DNA, viral vectors, etc.).
- ▶ **Trusted Source.** Pall Corporation is the leading global provider of filtration, purification and separation technologies to the biopharmaceutical market. Our capabilities come from a strong blend of biopharmaceutical expertise, leading technology and customer support.

A Comprehensive, Versatile, and Targeted Range of Sorbents and Membranes to Support Your Protein Purifications

Chromatography continues to be an essential technology for the purification of biomolecules. Pall offers an extensive portfolio of chromatography media for:

- ▶ Ion exchange
- ▶ Mixed-mode
- ▶ Solvent detergent removal
- ▶ Hydroxyapatite
- ▶ Size exclusion
- ▶ Affinity
- ▶ Hydrophobic interaction

Pall's chromatography sorbents are available in pack sizes from 5 mL bottles to 20 L drums for use with appropriately-sized columns and packing stations. Larger volumes are available on request. Sorbents are also available prepacked into disposable, small-scale 1 mL and 5 mL devices. These formats facilitate applications ranging from research, to process development and scale up, to full-scale process manufacturing.

Fully scalable Mustang membrane devices are available as either single- or multiple-use products in easy-to-use, compact designs from < 1 mL to 5 L.

Proper Selection Optimizes Protein Purification*

Ion Exchange Chromatography

Sorbent	Chemical Group	Average Particle Size (µm)	Working / Cleaning pH	Applications
Q, S HyperCel Sorbents	Quaternary amine (Q) Sulfonic acid (S)	75	1 – 13 / 1 – 14	<ul style="list-style-type: none"> • High productivity separation • Recombinant proteins • Monoclonal antibodies (MAbs) • Plasma derivatives • Biosimilars • Vaccines
Q, S, DEAE, CM Ceramic HyperD F Sorbents	Quaternary amine (Q) Sulfopropyl (S) Diethylaminoethyl (DEAE) Carboxymethyl (CM)	50	2 – 12 / 1 – 14	<ul style="list-style-type: none"> • Recombinant proteins • Plasmid purification • Proteins, vaccines • MAbs • Capture step • Immunoglobulin purification

Membrane	Chemical Group	Typical DBC	Available Format	Applications
Mustang Q Membrane	Quaternary amine (Q)	70 mg/mL BSA 30 mg/mL DNA	Single-use capsules, reusable XT capsules, Acroprep™ membrane filter plates, Acrodisc® syringe filters	<ul style="list-style-type: none"> • Contaminant removal in polishing applications (DNA, HCP, viruses, endotoxins) • Plasmid, virus, high molecular weight protein capture and oligonucleotide purification • Column guard to enhance selectivity of subsequent chromatography steps
Mustang S Membrane	Sulfonic acid (S)	60 mg/mL human IgG	Single-use capsules, Acroprep membrane filter plates, Acrodisc syringe filters	<ul style="list-style-type: none"> • Specific capture (baculoviruses) • Aggregate polishing from MAb feedstream

*In addition to the sorbents listed in this chart, Pall offers custom made products upon request. Contact your Pall representative for more information.

Mixed-Mode Chromatography

Sorbent	Ligand	Average Particle Size (µm)	Working / Cleaning pH	Applications
MEP HyperCel Sorbent	4-Mercapto-ethyl-pyridine	90	2 – 12 / 2 – 14	<ul style="list-style-type: none"> Direct capture of polyclonal and monoclonal antibodies of most classes, sub-classes and species
HEA HyperCel Sorbent	Hexylamine	90	2 – 12 / 1 – 14	<ul style="list-style-type: none"> Enzymes and recombinant proteins Capture of recombinant antibody fragments
PPA HyperCel Sorbent	Phenylpropylamine	90	2 – 12 / 1 – 14	<ul style="list-style-type: none"> Separation of monomeric IgG from aggregates Direct capture of proteins in low salt concentration

Membrane	Nature	Typical DBC	Available Format	Applications
Mustang E Membrane	Positively-charged modified hydrophilic polyethersulfone (200 nm pore size) (E)	4 x 10 ⁶ EU/mL	Single-use capsules, Acrodisc syringe filters	<ul style="list-style-type: none"> Endotoxin removal from buffers, water, saline, and process streams

Solvent Detergent Removal Chromatography

Sorbent	Chemistry	Average Particle Size (µm)	Working / Cleaning pH	Applications
SDR HyperD Sorbent	Hydrophobic polymer moiety	70	2 – 12 / 2 – 12	<ul style="list-style-type: none"> Elimination of solvent and detergent from biological fluids

Hydroxyapatite Chromatography

Sorbent	Nature	Average Particle Size (µm)	Working / Cleaning pH	Applications
HA Ultrogel® Sorbent	Hydroxyapatite crystals	120	5 – 13 / 5 – 14	<ul style="list-style-type: none"> Immunoglobulin separation Glycoproteins, vaccines

Size Exclusion Chromatography

Sorbent	Fractionation Range/ Exclusion Limit (Da)	Average Particle Size (µm)	Working / Cleaning pH	Applications
Trisacryl GF05 M Sorbent**	200 – 2,500/3,000	60	1 – 11 / 1 – 11	<ul style="list-style-type: none"> Separation of small molecules Desalting
Ultrogel AcA202 Sorbent	1,000 – 15,000/22,000	100	3 – 10 / 3 – 10	<ul style="list-style-type: none"> Desalting Fractionation
Ultrogel AcA54 Ultrogel AcA44 Ultrogel AcA34 Sorbents	5,000 – 70,000/90,000 10,000 – 130,000/200,000 20,000 – 350,000/750,000	100	3 – 10 / 3 – 10	<ul style="list-style-type: none"> Fractionation, purification Molecular weight determination

Affinity and Metal Chelate Chromatography

Sorbent	Ligand	Average Particle Size (µm)	Working / Cleaning pH	Applications
Protein A Ceramic HyperD F Sorbent	Recombinant protein A	50	2 – 11 / 2 – 13	<ul style="list-style-type: none"> Immunoglobulins MABs
Blue Trisacryl M Sorbent	Blue dye	60	1 – 10 / 1 – 10	<ul style="list-style-type: none"> Albumin, enzymes Growth hormones
Blue Trisacryl Plus LS Sorbent	Blue dye	120	1 – 10 / 1 – 14	<ul style="list-style-type: none"> Growth factors Interferon Coagulation factors Lipoproteins
Heparin HyperD M Sorbent	Porcine heparin	80	3 – 13 / 3 – 13	<ul style="list-style-type: none"> Coagulation factors Growth hormones Enzymes Lipoproteins
Lysine HyperD Sorbent	L-lysine	70	3 – 13 / 3 – 13	<ul style="list-style-type: none"> Plasminogen Glycoproteins
IMAC HyperCel Sorbent**	Imino-diacetic acid (IDA)	90	3 – 12 / 3 – 14	<ul style="list-style-type: none"> Immobilized metal affinity chromatography (IMAC)

**Available only in small lab packs.

Versatile Configurations and Formats

Prepacked Columns



AcroSep™ 1 mL Columns

Disposable, laboratory-scale columns prepacked with Pall chromatography media for fast, convenient protein separations. The versatile luer lock inlet and outlet allows convenient use with a syringe, pump, or automated chromatography system.



PRC 1 mL and 5 mL Columns

Rapid screening and condition optimization in 1 mL and 5 mL PRC columns enable rapid selection of the appropriate chemistry. PRC columns are easy to use with direct connection to commonly-used laboratory chromatography systems, and can be connected in series to increase column bed heights up to 20 cm.

Packable Columns



LRC Empty Glass Laboratory Columns

Four internal diameters from 10 to 50 mm and four lengths provide a range of column volumes up to 900 mL and bed heights up to 750 mm. Columns have a borosilicate glass tube and are equipped with one adjustable and one fixed piston, and a screw-lock system to allow a rapid adjustment of the piston.



Resolute® FM Chromatography Columns

Resolute FM columns are ideal for chromatographic purification from process development through to manufacturing scale with a wide range of commonly used media. These glass columns, for development and manufacturing applications, are robust and incorporate new features to improve the outcome of column packing events.

Chromatography Capsules



Mustang Membrane Chromatography Capsules – Single Use

Combining high capacity ion exchange Mustang membranes with a unique 16-layer open-pleat design results in a high flow rate, high capacity, single-use, versatile range of pleated products that can be used for a wide range of applications. This 16-layer construction is held constant from the laboratory-scale Mustang Coin Unit to the largest industrial process-scale capsule, ensuring constant chromatography bed depth in all formats.



Mustang Q XT Membrane Chromatography Capsules – Multiple Use

XT-style Mustang products are designed with a robust polypropylene housing that withstands long-term storage and reuse. A full range of capsule sizes accommodates capacities from process development to full-scale manufacturing. In addition, the use of Pall's patented Ultipleat® technology combined with a complete re-engineering of the capsule design permits the effective use of Mustang membrane chromatography for bind and elute chromatography as well as polishing steps. This is a significant advantage in cases where a target molecule needs to be rapidly captured from large volumes of dilute feedstock and eluted in a minimal volume.



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