TOSOH

Toyopearl GigaCap® Ion Exchange Resins

“Get MORE throughput!”

- Toyopearl GigaCap S-650M
- Toyopearl GigaCap CM-650M
- Toyopearl GigaCap Q-650M

TOSOH BIOSCIENCE

Toyopearl GigaCap Ion Exchange Resins

Money is tight. Will you get the results you want?
Can you reduce your elution pool volumes by 60-70%?

Overview

Recently developed high capacity resins allow more protein to be loaded without the need to replace existing column hardware. However, more elution pool volume and tankage may be required.

*Specifically designed for packed bed use.

Reduce Elution Pool Volumes

As improvements have been made to upstream protein expression systems, downstream chromatographic unit operations have become the rate determining step to increased process throughput. The new Toyopearl GigaCap® resins* have both high capacity and improved elution kinetics. When these parameters are combined together and depending on your existing chromatography resins, these benefits may significantly reduce elution pool volumes by as much as 75%.

Toyopearl GigaCap Ion Exchange Resins

Tosoh Bioscience has introduced three new ion exchange products, which together form the next generation series of high capacity, polymeric ion exchange resins for the purification of mAbs and other proteins.

The Toyopearl GigaCap series consists of three high capacity resins:

- Toyopearl GigaCap S-650M
- Toyopearl GigaCap CM-650M
- Toyopearl GigaCap Q-650M

Each of the above resins exhibit high individual dynamic binding capacities (Table 1) and each can be used at high linear flow velocities up to a pressure of 3 bar for improved process throughput. In addition, data in Figures 1, 2, and 3** shows that proteins are eluted in significantly lower elution pool volume, and thus, a target can be collected in higher concentration when compared with other high capacity resins.

**Please note that, as of this writing, no comparable high capacity weak cation exchange resins were available to compare breakthrough curves.

Table 1.

Resin	Ligand	pKa	Loading conductivity (mS/cm) (up to*)	DBC (g/L) 212 cm/hr, 6mm ID x 4cm
Toyopearl GigaCap S-650M	$-R-SO_3^-$	2.3	6	145[1] (polyclonal hIgG)
Toyopearl GigaCap CM-650M	$-R-COO^-$	4.7	10	100[2] (polyclonal hIgG)
Toyopearl GigaCap Q-650M	$-R-N(CH_3)_3^+$	12.2	6	173[3] (BSA)

* suggested guideline only

[1] 0.1mol/L acetate buffer pH 4.7
[2] 50mmol/L acetate buffer pH 4.7
[3] 50mmol/L Tris-HCl

Figure 1. Toyopearl GigaCap S-650M vs. Capto™ S elution pool volume comparison

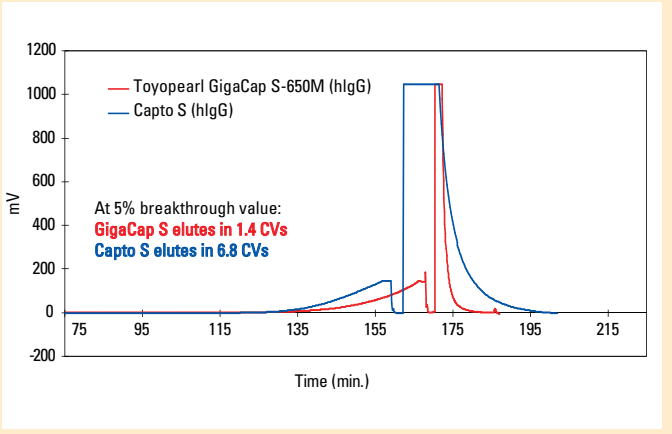
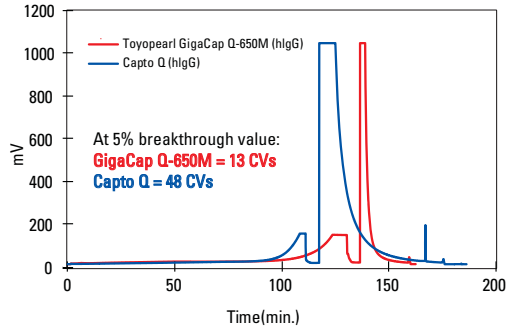


Figure 2. Toyopearl GigaCap Q-650M (hIgG) vs. Capto™ Q elution pool volume comparison



Toyopearl GigaCap Base Beads

Unmodified Toyopearl® HW-65C resin is utilized as the base bead for the new Toyopearl GigaCap resins. Its average particle size of 75µm provides for enhanced efficiency and higher resolution than other larger particle size materials, while improved pressure-flow properties are obtained over smaller particle size materials.

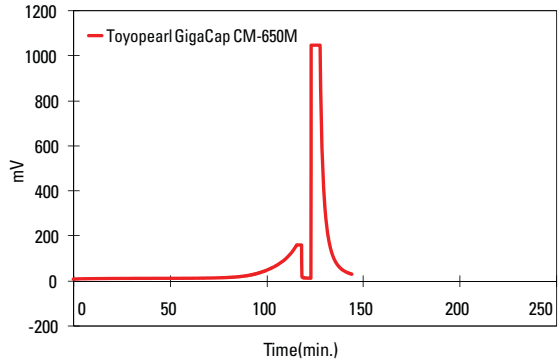
(Toyopearl GigaCap product names ending in "M" utilize a 50-100µm bead.)

Toyopearl GigaCap Ligand Attachment Chemistry

A polymer bead contains a distribution of small to large pores. The new Toyopearl GigaCap ligand attachment chemistry results in preferential placement of the functional groups into the larger more protein-accessible pores promoting both higher protein dynamic binding capacities and improved resin binding and desorption. The actual chemistry to obtain these high capacity ion exchange resins is considered proprietary to Tosoh Corporation.

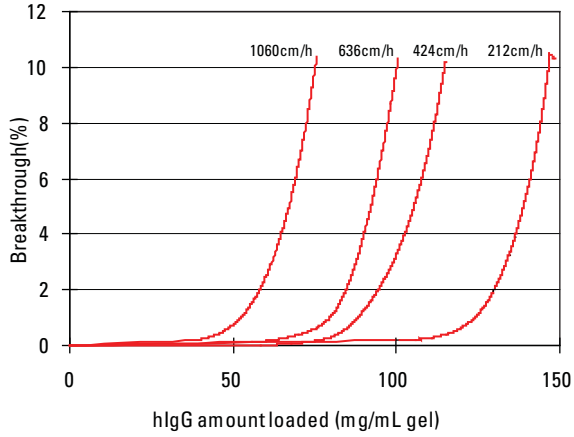
The basic properties of the Toyopearl GigaCap resins are listed in Table I.

Figure 3. Toyopearl GigaCap CM-650M elution pool volume



Column size: 6mm ID x 40mm height
Sample: polyclonal human IgG (1mg/mL)

Figure 4. Toyopearl GigaCap S-650M hIgG breakthrough curves at various linear velocities

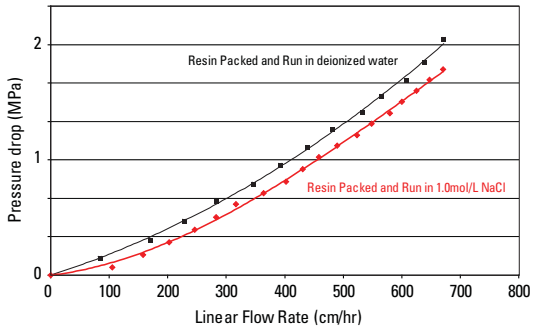


Column size: 6mm ID × 4cm bed height.
Sample: polyclonal human IgG (1mg/mL)
Buffer: 0.1mol/L acetate buffer (pH 4.7)
Linear velocity: 212, 424, 636, 1060 cm/hr
Detection: UV @ 280nm

Toyopearl GigaCap S-650M (strong cation exchange resin)

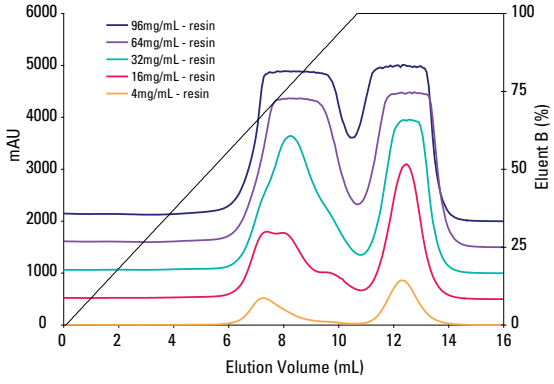
Toyopearl GigaCap S-650M resin was specifically developed for the purification of monoclonal antibodies. It has excellent elution kinetics (Figure 1) and maintains reasonably high capacities at higher linear velocities (Figure 4). The slightly larger particle size (50-100µm) has been optimized to give a unique combination of improved pressure-flow characteristics (Figure 5) with excellent resolution at high loads (Figure 6). In separate studies it was established that DBC-values for smaller proteins such as insulin and lysozyme were also notably improved with typical values of 133mg/mL and 167mg/mL, respectively.

Figure 5. Pressure-Flow data for Toyopearl GigaCap S-650M



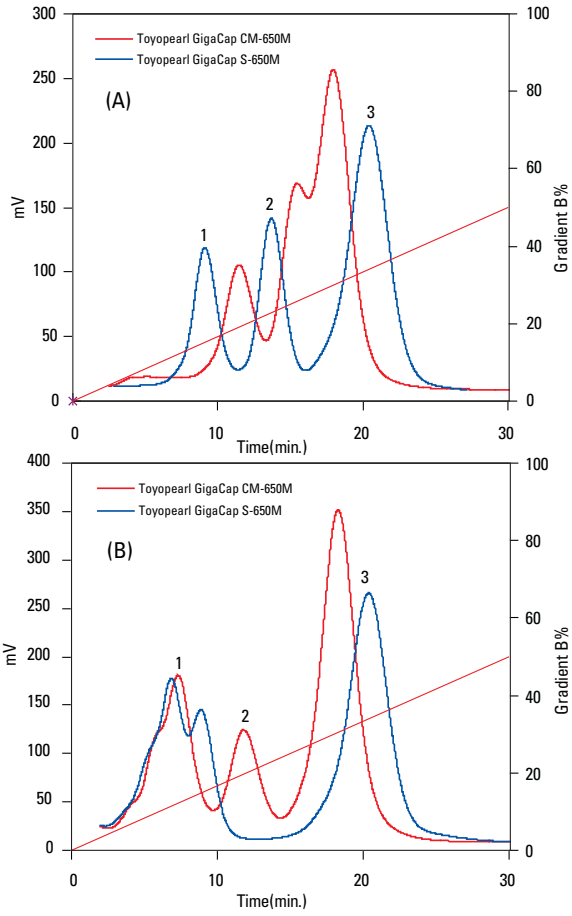
Toyopearl GigaCap S-650M was packed into a 36cm ID x 25cm bed height Eastern Rivers BioStream column to measure the pressure-flow characteristics. The resin had similar profiles when packed and run in both water and 1.0mol/L NaCl.

Figure 6. Resolution of proteins at high loading on Toyopearl GigaCap S-650M



Columns:	3mmID x 15cm
Linear velocity:	300cm/h
Sample:	α-chymotrypsin (2mg/mL) lysozyme (2mg/mL) (total of 4mg proteins/mL)
Eluent:	A: 20mmol/L phosphate buffer (pH 6.0) B: 20mmol/L phosphate buffer + 500mmol/L NaCl (pH 6.0)
Gradient:	10 CV linear gradient from 0 to 100%B (0-500mmol/L NaCl)
Detection:	UV @(280nm)

Figure 7. Toyopearl GigaCap CM-650M has unique selectivity



Column size:	6mm ID x 4cm,
Flow rate:	1.0mL/min
Sample:	(A) 1. ribonuclease A (5.0mg/mL), 2. cytochrome C (1.9mg/mL) 3. lysozyme (3.8mg/mL) (B) 1. trypsinogen (3.8mg/mL), 2. ribonuclease A (5.0mg/mL) 3. lysozyme (3.8mg/mL)
Injection volume:	25µL
Buffer A:	20mmol/L Phosphate (pH 7.0)
Buffer B:	20mmol/L Phosphate + 1.0mol/L NaCl (pH 7.0)
Gradient:	60min linear gradient from buffer A to buffer B
Detection:	UV @280nm

Toyopearl GigaCap CM-650M (weak cation exchange resin)

Toyopearl GigaCap CM-650M resin was designed for the purification of monoclonal antibodies that require a different chromatographic selectivity than is available with Toyopearl GigaCap S-650M resin (Figure 7). Excellent kinetic properties and high capacity are maintained at high linear flow velocities.

Since Toyopearl GigaCap CM-650M resin is based on the same particle size base-beads as the other members of the Toyopearl GigaCap series, very good pressure-flow properties are obtained for this resin as well (Figure 8).

Figure 8. Toyopearl GigaCap CM-650M pressure flow properties

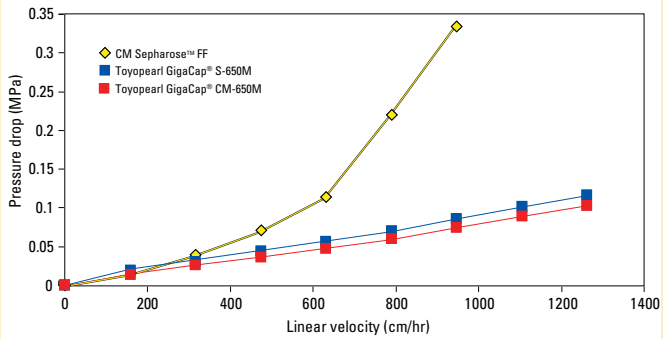
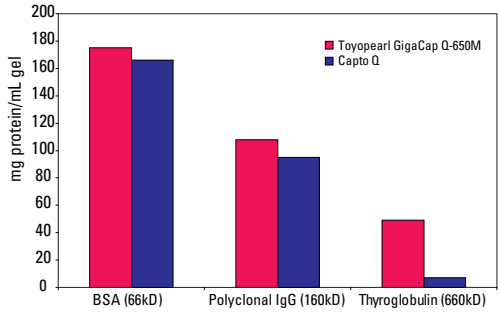


Figure 9. Dynamic binding capacity of proteins with different molecular weights @ 212cm/hr



Toyopearl GigaCap Q-650M (strong anion exchange resin)

Toyopearl GigaCap Q-650M resin is the high capacity anion exchange resin in the Toyopearl GigaCap line of process chromatography resins. It was primarily designed for the capture and purification of proteins, although it can also be used for polishing in negative or flow-through chromatography. Of particular note is the excellent capacity of Toyopearl GigaCap Q-650M for such large proteins as thyroglobulin (Figure 9) when compared to other high capacity resins.

Toyopearl GigaCap Series Caustic Stability

All Toyopearl GigaCap resins are polymeric and have excellent alkaline stability (Table 2).

Table 2.

Resin	Storage Solution	Test Molecule	Capacity	Starting Capacity	Week 1	Week 2	Week 3
Toyopearl GigaCap S-650M	1.0mol/L NaOH	hIgG	Dynamic	143 (mg/mL-gel)	144	140	135
Toyopearl GigaCap CM-650M	0.5mol/L NaOH	hIgG	Dynamic	99 (mg/mL-gel)	88	90	91
Toyopearl GigaCap Q-650M	0.5mol/L NaOH	BSA	Static	166 (mg/mL-gel)	NA	153*	136

* 12 days

Summary

Tosoh Bioscience has introduced three Toyopearl GigaCap ion exchange resins, each offering high capacity at high linear velocities and a substantial reduction of elution pool volumes. These new products have the potential to improve process throughput even at manufacturing sites that have limited options for increased tankage.

Toyopearl GigaCap Ordering Information

Toyopearl GigaCap S-650M

Part #	*Product description*
21833	Toyopearl GigaCap S-650M, 100mL
21834	Toyopearl GigaCap S-650M, 250mL
21835	Toyopearl GigaCap S-650M, 1L
21836	Toyopearl GigaCap S-650M, 5L
21837	Toyopearl GigaCap S-650M, 50L
21868	ToyoScreen GigaCap S-650M, 1mL x 6 ea.
21869	ToyoScreen GigaCap S-650M, 5mL x 6 ea.

Toyopearl GigaCap Q-650M

21854	Toyopearl GigaCap Q-650M, 100mL
21855	Toyopearl GigaCap Q-650M, 250mL
21856	Toyopearl GigaCap Q-650M, 1L
21857	Toyopearl GigaCap Q-650M, 5L
21858	Toyopearl GigaCap Q-650M, 50L
21859	ToyoScreen GigaCap Q-650M, 1mL x 6 ea.
21860	ToyoScreen GigaCap Q-650M, 5mL x 6 ea.

Toyopearl GigaCap CM-650M

21946	Toyopearl GigaCap CM-650M, 100mL
21947	Toyopearl GigaCap CM-650M, 250mL
21948	Toyopearl GigaCap CM-650M, 1L
21949	Toyopearl GigaCap CM-650M, 5L
21950	Toyopearl GigaCap CM-650M, 50L
21951	ToyoScreen GigaCap CM-650M, 1mL x 6 ea.
21952	ToyoScreen GigaCap CM-650M, 5mL x 6 ea.

So many resin choices. But which one will significantly increase process throughput?

TOSOH BIOSCIENCE

TOSOH Bioscience LLC
3604 Horizon Drive, Suite 100
King of Prussia, PA 19406
Orders & Service: (800) 366-4875
Fax: (610) 272-3028
www.tosohbioscience.com
email: info.tbl@tosoh.com

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