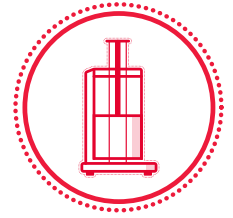




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# TOYOPEARL® SULFATE-650F SALT TOLERANT CATION EXCHANGE RESIN

Ion Exchange Chromatography (IEC) is one of the most frequently used chromatographic modes for the purification of biomolecules. Compared with other chromatographic modes, ion exchange media offer high dynamic binding capacities and a straightforward method development. IEC is used at all stages and scales of purification of therapeutic proteins: from laboratory scale purification to industrial scale downstream processing.

While most modern ion exchange resins are featuring extremely high binding capacities the interest is now shifting towards salt-tolerant ion exchange media that enable capturing out of a biological feedstock at physiological conditions or direct processing of target fractions without dilution.

TOYOPEARL Sulfate-650F is based on the proven polymeric TOYOPEARL bead, which is functionalized with sulfate groups. The resulting cation exchange resin offers a high binding capacity for immunoglobulin G (IgG) across a range of pH values and conductivities. It provides an increased salt tolerance and its selectivity is different than that of most sulfate type cation exchange media currently available.

TOYOPEARL Sulfate-650F is ideal for a range of process scale applications including the capture of proteins from biological feedstock (mammalian cell culture or bacterial feedstock) without dilution and the intermediate or final purification of monoclonal antibodies (mAbs). It is especially suitable for post-Protein A removal of aggregates in bind-elute mode. In addition, it provides a Heparin-like affinity to other target molecules such as blood factors.



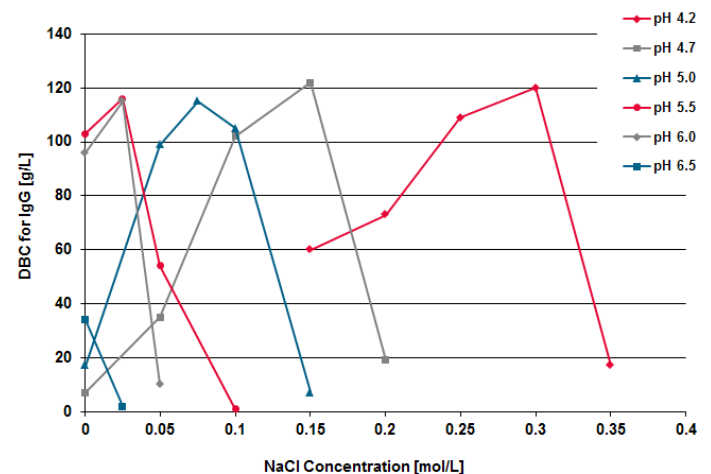
## HIGHLIGHTS

- High protein binding capacity at elevated ion strength
- Unique selectivity, differing from conventional CEX media
- MAb aggregate removal in bind-elute mode
- Affinity capturing of selected targets

## SALT TOLERANCE

TOYOPEARL Sulfate-650F shows a high binding capacity for IgG of typically more than 95 g IgG/L at a broad range of salt concentrations. *Figure 1* shows the effect of buffer pH and sodium chloride concentration on IgG binding capacity. At a pH of 4.2 the highest binding capacity for polyclonal IgG is reached at a sodium chloride concentration of 300 mmol/L.

## EFFECT OF pH AND CONDUCTIVITY ON IgG DBC



**Figure 1**  
 Column: TOYOPEARL Sulfate-650F 6.0 mm ID.x 4 cm  
 Sample: 1 g/L polyclonal hIgG (Kakatsuken) in x mol/L NaCl + 0.054 mol/L acetate (pH 4.2-5.5) or MES buffer (pH 6.0, 6.5)  
 Residence time: 4 min

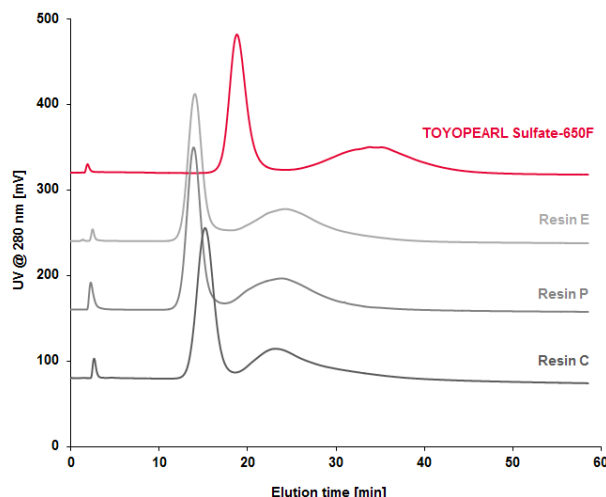
AGGREGATE REMOVAL

Post-Protein A aggregate removal is a demanding step in downstream processing of monoclonal antibodies and cation exchange chromatography is the most popular mode applied for this purpose. TOYOPEARL Sulfate-650F was developed to provide a good resolution between mAb monomers and aggregates. *Figure 2* proves the superior separation power of the new resin compared to other cation exchange media on the market.

SUMMARY

TOYOPEARL Sulfate-650F stands out by its various modes of interaction (affinity & ionic) for a broad range of applications and its high binding capacity for IgG for efficient aggregate removal. All in all, this resin is a highly selective, salt tolerant and high capacity cation exchange resin for the capture and intermediate polishing of biomolecules. It offers chromatographers the ability to use mobile phases at physiological conditions without any loss of capacity or selectivity.

AGGREGATE REMOVAL ON VARIOUS CATION EXCHANGE MEDIA



**Figure 2**  
 Column: Cation exchanger, 7.5 mm ID X 7.5 cm  
 Eluents: A: 0.054 mol/L acetate buffer (pH 5.5), B: 1.0 mol/L NaCl in A  
 Gradient: 58.5 min linear 0% -100% B (NaCl conc. + 0.0167 M/min)  
 Flow rate: 1.0 mL/min  
 Sample: 3 g/L monoclonal humanized IgG acid/heat treatment,  
 Injection vol.: 90 µL (Aggregate content ~1.9%)

Ordering Information

TOYOPEARL Sulfate-650F

| Part-No          | Description            | Resin volume | Pore size | Particle size |
|------------------|------------------------|--------------|-----------|---------------|
| <b>TOYOPEARL</b> |                        |              |           |               |
| 0023467          | TOYOPEARL Sulfate-650F | 100 mL       | 100 nm    | 45 µm         |
| 0023468          | TOYOPEARL Sulfate-650F | 250 mL       | 100 nm    | 45 µm         |
| 0023469          | TOYOPEARL Sulfate-650F | 1 L          | 100 nm    | 45 µm         |
| 0023470          | TOYOPEARL Sulfate-650F | 5 L          | 100 nm    | 45 µm         |
| 0023471          | TOYOPEARL Sulfate-650F | 50 L         | 100 nm    | 45 µm         |

Process Development Columns

|         |   |                        |        |                  |
|---------|---|------------------------|--------|------------------|
| 0045228 | SkillPak Antibody<br>AF-rProtein A HC-650F, AF-rProtein L-650F, NH <sub>2</sub> -750F, Sulfate-650F, GigaCap Q-650M, GigaCap S-650S 1 mL x 1 ea | 1 mL col. Library      |        | 7 mm ID x 2.5 cm |
| 0045229 | SkillPak mAb Platform<br>AF-rProtein A HC-650F, Sulfate-650F, NH <sub>2</sub> -750F 1 mL x 2 ea   | 1 mL col. library      |        | 7 mm ID x 2.5 cm |
| 0045230 | SkillPak Salt Tolerant<br>Sulfate-650F, NH <sub>2</sub> -750F 1 mL x 3 ea   | 1 mL col. library      |        | 7 mm ID x 2.5 cm |
| 0045232 | SkillPak Best in Class<br>AF-rProtein A HC-650F, AF-rProtein L-650F, NH <sub>2</sub> -750F, Sulfate-650F, Ca <sup>++</sup> Pure-HA 1 mL x 1 ea  | 1 mL col. Library      |        | 7 mm ID x 2.5 cm |
| 0045227 | SkillPak CIEX<br>GigaCap S-650S, GigaCap CM-650M, Sulfate-650F 1 mL x 2 ea  | 1 mL col. library      |        | 7 mm ID x 2.5 cm |
| 0045205 | SkillPak Sulfate-650F   | 5 x 1 mL col. SkillPak |        | 7 mm ID x 2.5 cm |
| 0045263 | SkillPak mAb Platform<br>AF-rProtein A HC-650F, Sulfate-650F, NH <sub>2</sub> -750F 5 mL x 1 ea   | 5 mL col. library      |        | 8 mm ID x 10 cm  |
| 0045264 | SkillPak Salt Tolerant<br>Sulfate-650F, NH <sub>2</sub> -750F 5 mL x 1 ea   | 5 mL col. library      |        | 8 mm ID x 10 cm  |
| 0045266 | SkillPak Best in Class<br>AF-rProtein A HC-650F, AF-rProtein L-650F, NH <sub>2</sub> -750F, Sulfate-650F, Ca <sup>++</sup> Pure-HA 5 mL x 1 ea  | 5 mL col. library      |        | 8 mm ID x 10 cm  |
| 0045241 | SkillPak Sulfate-650F   | 5 mL col.              |        |                  |
| 0045027 | RoboColumn Sulfate-650F   | 200 µL x 8             | 100 nm | 45 µm            |
| 0045028 | RoboColumn Sulfate-650F   | 600 µL x 8             | 100 nm | 45 µm            |