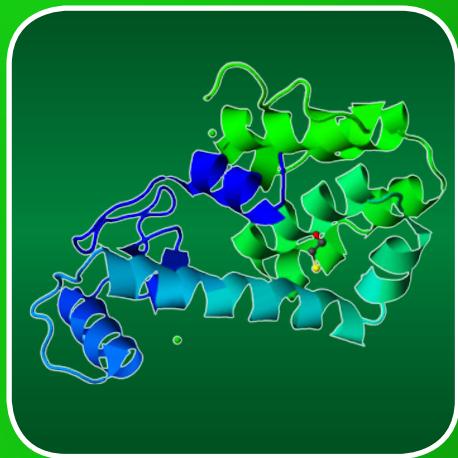
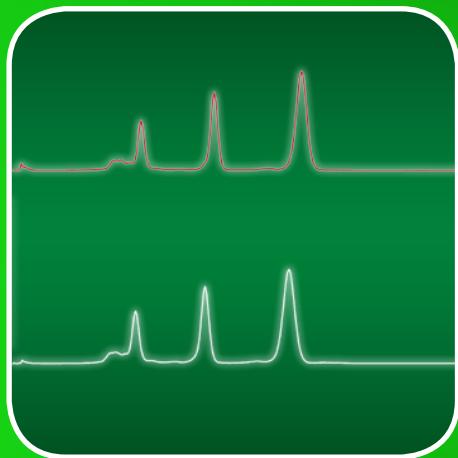


# BioPro IEX Resins



Resin  
Downstream  
Purification

**BioPro IEX:**  
Designed for  
bioseparations



## Contents

Introduction .....	4
Guide to IEX Media Selection.....	5
Specifications.....	7
Solutions for Capture Processes.....	9
Solutions for Intermediate Purification and Polishing.....	15
Purification of Monoclonal Antibodies .....	23
Ordering Information.....	28

# 4

## Introduction

Ion exchange (IEX) media is widely used in the analysis and purification of biomolecules. For instance, in industrial-scale protein production processes, IEX media are often used for initial product capture and intermediate purification stages as well as the final polishing steps. Using reversible charge-charge interactions offers several advantages over in comparison to other chromatographic methods, e.g. high capacity and fast throughput.

BioPro IEX and BioPro IEX SmartSep form a series of ion exchange resins specifically designed for biochromatography. It is available as a strong anion exchanger (BioPro IEX Q) and a strong cation exchanger (BioPro IEX S). The media is based on a hydrophilic polymer matrix, with a particle size of 10 µm, 20 µm, 30 µm and 75 µm. BioPro IEX resins with a 75 µm particle size are especially suited for the initial capture step while the BioPro IEX SmartSep 10 µm, 20 µm, 30 µm are the ideal choices for the intermediate purification and polishing processes. BioPro IEX is manufactured in lot sizes up to 450 L.

BioPro IEX	
<b>Ion Exchange Type</b>	Strong anion exchanger, strong cation exchanger
<b>Particle Size</b>	75 µm
BioPro IEX SmartSep	
<b>Ion Exchange Type</b>	Strong anion exchanger, strong cation exchanger
<b>Particle Size</b>	10 µm, 20 µm, 30 µm

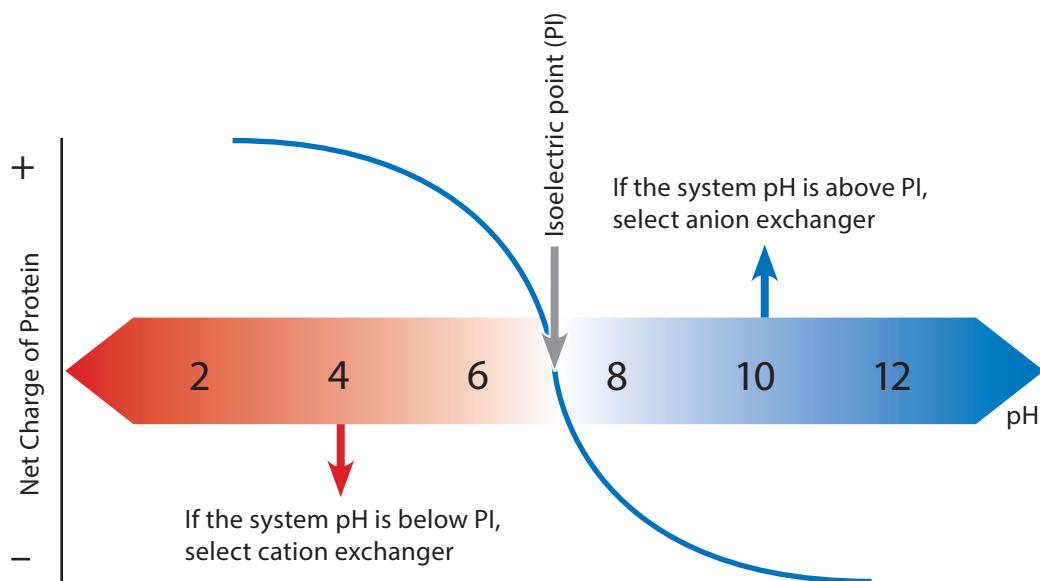
### **BioPro IEX series media provide:**

- Solutions for challenging separations
- Increased productivity
- Reduced processing costs
- Worldwide availability, even for large quantities
- Full compliance with FDA regulations

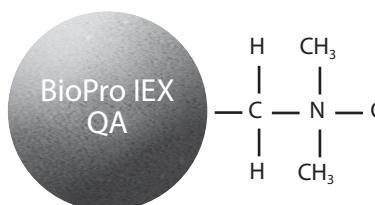
## Guide to IEX Media Selection

### Selection of the media chemistry

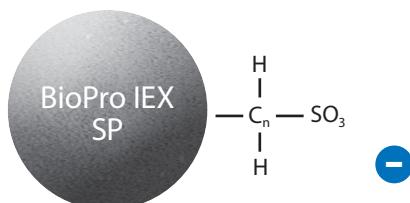
The separation with IEX Media is based on the net surface charge of the analytes in relation to the pH of the surroundings. The theory for selection of an anion exchanger or a cation exchanger is shown in the figure below.



BioPro IEX series products are polymeric ion exchange media for the purification of biological molecules. They are available in Q and S chemistries.



**Strong anion exchanger**



**Strong cation exchanger**

N.B.: Fully porous particles

# 6

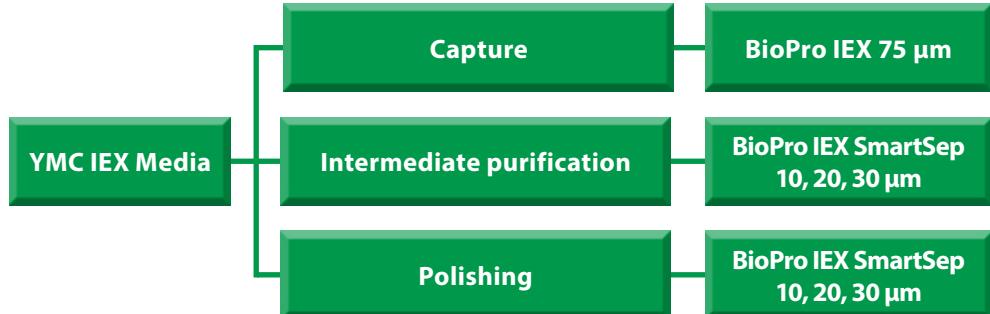
## Guide to IEX Media Selection

The selection of the particle size of the media depends on the purification purpose. A purification strategy usually includes three parts:

- initial product capture
- intermediate purification stages
- the final polishing step

Each step has correspondingly different targets and requirements for the chromatography media. The capture step aims at isolating and concentrating the targets. It requires that the media have high binding capacity even at high flow rate and easy scale-up steps. The intermediate purification is for removing the bulk impurities while the polishing step is for removing all trace impurities. The corresponding media should exhibit high resolution and low non-specific adsorption.

IEX resins are used during the whole process from the capture to the final polishing. BioPro IEX media are designed for capture step of biopharmaceuticals and BioPro IEX SmartSep media are for intermediate purification and polishing steps of biopharmaceuticals.



## Specifications

### BioPro IEX for Capture

BioPro IEX Series	BioPro IEX Q75	BioPro IEX S75
Ion exchange type	strong anion exchanger	strong cation exchanger
Charged group	-R-N <sup>+</sup> (CH <sub>3</sub> ) <sub>3</sub>	-R-SO <sub>3</sub> <sup>-</sup>
Matrix	Hydrophilic polymer beads	
Pore size	Porous	
Compression factor	1.05 - 1.15	
Particle size	75 µm	
Pressure resistance	0.3 MPa	
Typical flow rate	200-1000 cm/hr Max. 2000 cm/hr	
Ion-exchange capacity	min. 0.10 meq/ml-resin	
Dynamic binding capacity	min. 160 mg/ml-resin (BSA)	

Regulatory support file available under non-disclosure agreement.

Used in validated cGMP-manufacturing processes.

Customised material available on request.

DMF registered with FDA.

### BioPro IEX SmartSep for intermediate purifications and polishing

BioPro IEX Series	BioPro IEX SmartSep Q10	BioPro IEX SmartSep Q20	BioPro IEX SmartSep Q30	BioPro IEX SmartSep S10	BioPro IEX SmartSep S20	BioPro IEX SmartSep S30
Ion exchange type	strong anion exchanger		strong cation exchanger			
Charged group	-R-N <sup>+</sup> (CH <sub>3</sub> ) <sub>3</sub>		-R-SO <sub>3</sub> <sup>-</sup>			
Matrix	Hydrophilic polymer beads					
Pore size	Porous					
Compression factor	1.05 - 1.15					
Particle size	10 µm	20 µm	30 µm	10 µm	20 µm	30 µm
Pressure resistance	Regular use: 3 MPa Max.: 4 MPa	Regular use: 2 MPa Max.: 3 MPa	Regular use: 3 MPa Max.: 4 MPa	Regular use: 2 MPa Max.: 3 MPa		
Typical flow rate	200-1000 cm/hr Max. 2000 cm/hr					
Ion-exchange capacity	min. 0.08 meq/ml-resin		min. 0.08 meq/ml-resin			
Dynamic binding capacity	min. 100 mg/ml-resin (BSA)		min. 100 mg/ml-resin (lysozyme)			



Solution for your capture process:  
BioPro IEX 75 µm

## BioPro IEX Ion Exchange Resin

BioPro IEX ion exchange resins are designed for the capture step of peptides, proteins and nucleotides on the laboratory and industrial scales. The materials offer high dynamic binding capacity, together with low non-specific adsorption and excellent recovery. The narrow particle size distribution and the low operating pressure enable the materials to work even at high flow rates.

- Excellent dynamic binding capacity (DBC)
- Low non-specific adsorption and high recovery
- High capacity with low operating pressure even at high flow rates
- Full compliances with GMP requirements
- Short delivery for industrial-scale quantities
- Reduced processing costs

### Scale up and availability

The BioPro IEX series includes prepacked columns with 5 µm porous and non-porous resins for fast analysis, and bulk materials up to 75 µm porous beads for purification and capture. The 5 µm porous type and bulk media have similar retention selectivity which allows for predictable scale-up process. The bulk media are available in quantities up to several thousand litres.

#### Mission Statement

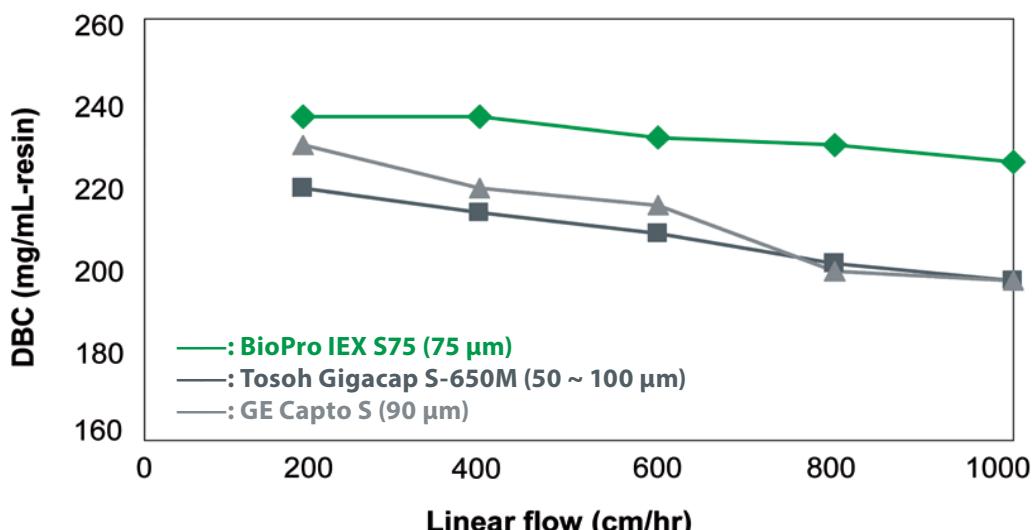
YMC will never knowingly change any product that is being used in a validated production process or validated analytical method.

# 10

## High Dynamic Binding Capacity (DBC)

### High binding capacity and high recovery

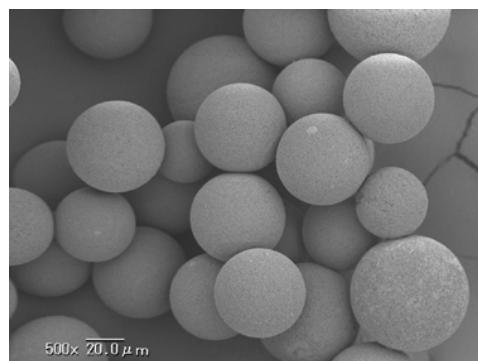
The porous versions of BioPro IEX show high dynamic binding capacity and excellent recovery, making them useful for preparative separations of proteins and antibodies.



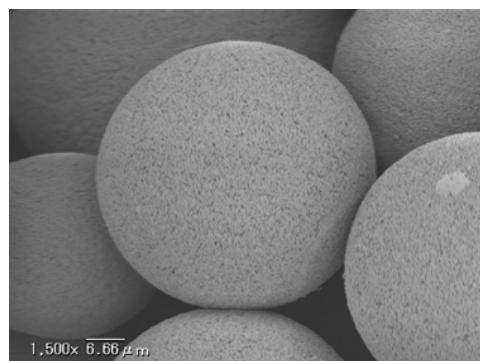
Column:	BioPro IEX S75, 50 x 5.0 mm ID
Sample:	1.0 mg/ml Lysozyme in equilibration buffer
Eluent:	A) 20 mM Glycine-NaOH (pH 9.0) B) 20 mM Glycine-NaOH (pH 9.0) containing 0.5 M NaCl
Detection:	UV at 300 nm

High sample loading at high flow rates has been determined by the dynamic binding capacity of an ion exchange resin.

The dynamic binding capacity of BioPro IEX is excellent even at high flow rates. When compared to similar competitor products it consistently exhibits a higher dynamic binding capacity. This results in higher sample loading in your preparative processes.



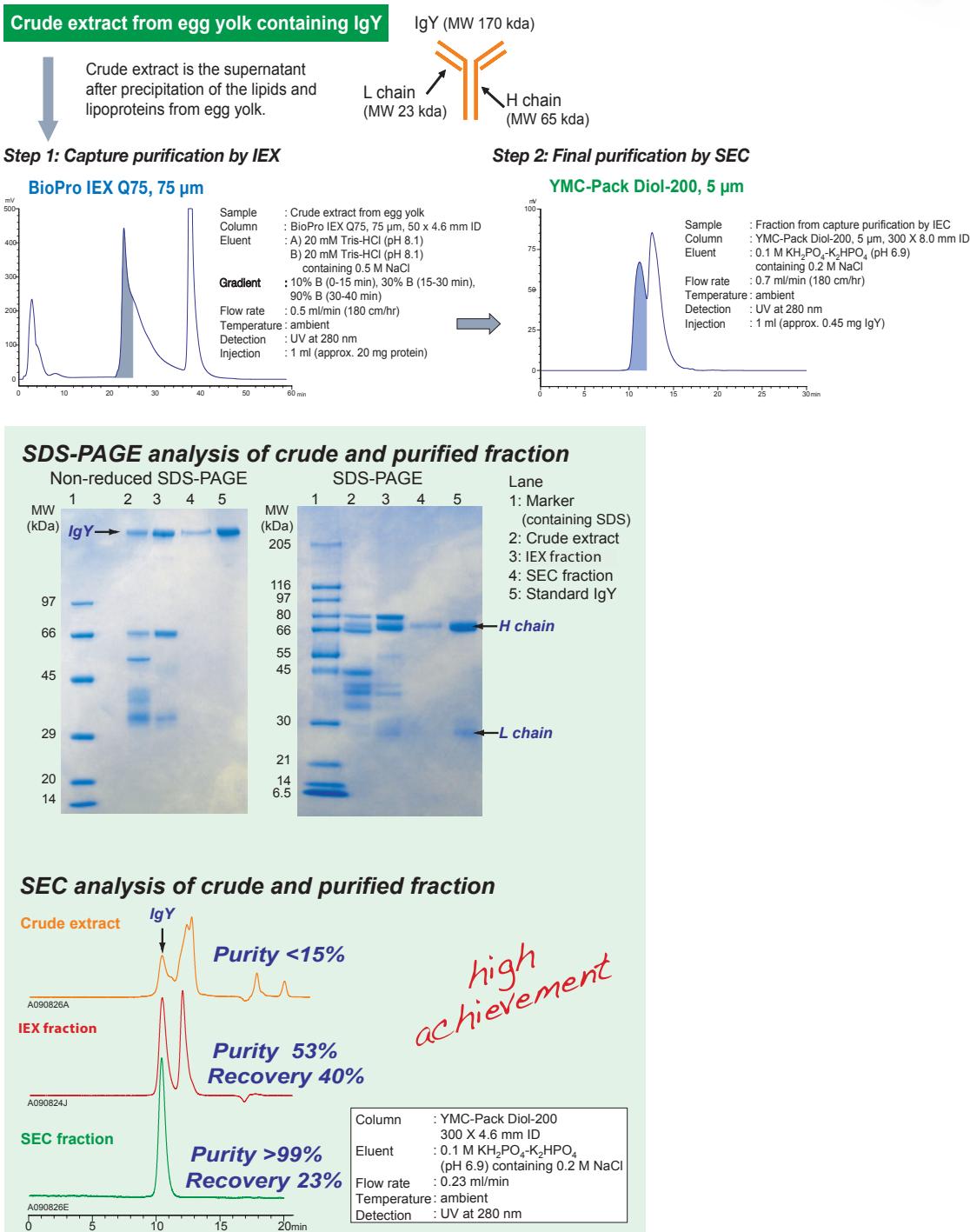
BioPro IEX S75 Particle



BioPro IEX S75 Particle

## Excellent Performance – Applications

**Two step purification of IgY to produce reference standard material from crude egg yolk extract\***

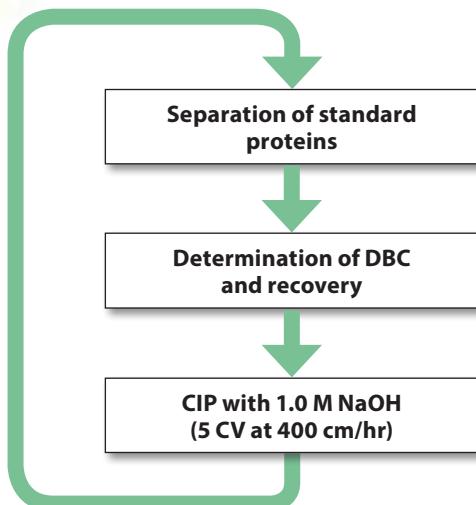


\* Application data by courtesy YMC Co., Ltd.

# 12

## Cleaning-In-Place (CIP) Performance

### Test protocol



Column: BioPro IEX S75, 50 x 5.0 mm ID

#### Conditions for standard protein separation

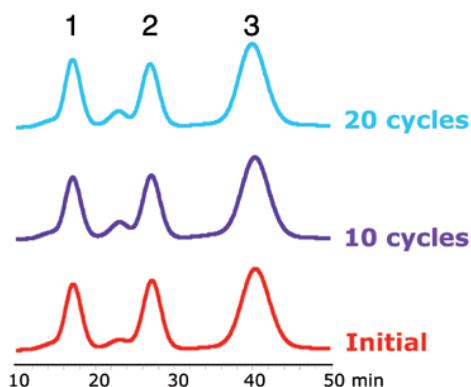
Eluent: A) 20 mM  $\text{Na}_2\text{HPO}_4\text{-Na}_2\text{HPO}_4$  (pH 6.8)  
B) 20 mM  $\text{Na}_2\text{HPO}_4\text{-Na}_2\text{HPO}_4$  (pH 6.8)  
containing 0.5 M NaCl  
Gradient: 0-100% B (0-60 min, Linear)  
Flow rate: 0.59 ml/min (180 cm/hr)  
Temperature: 25 °C  
Detection: UV at 220 nm  
Injection: 24 µl

#### Conditions of DBC determination

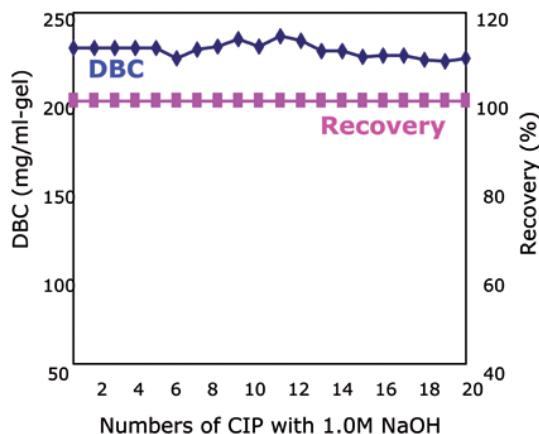
Eluent: A) 20 mM Glycine-NaOH(pH 9.0)  
B) 20 mM Glycine-NaOH(pH 9.0)  
containing 0.5 M NaCl  
Flow rate: 2.62 ml/min (800 cm/hr)  
Sample: 1.0 mg/ml Lysozyme in  
equilibration buffer  
Temperature: ambient (25 °C)  
Detection: UV at 300 nm  
DBC determined at 10% breakthrough.

## CIP Performance

### Separation of standard proteins\*



### DBC and recovery\*

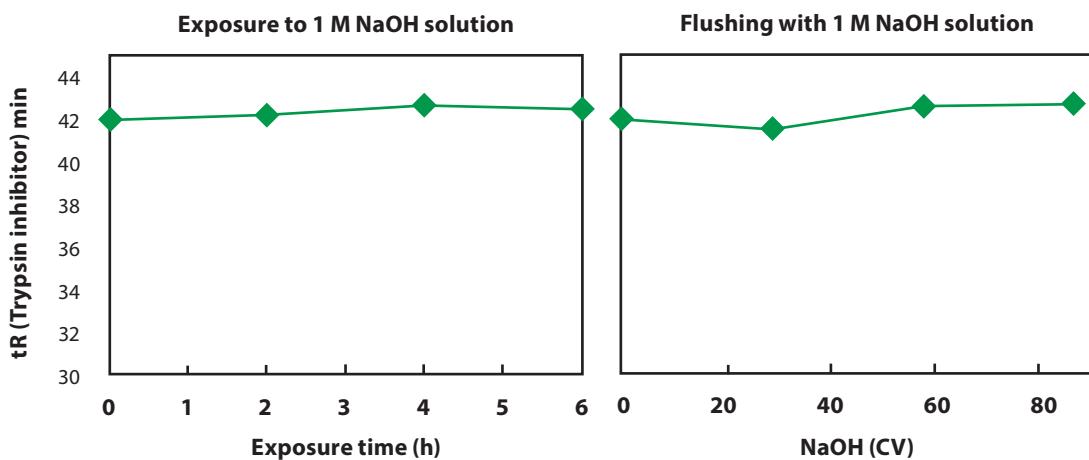
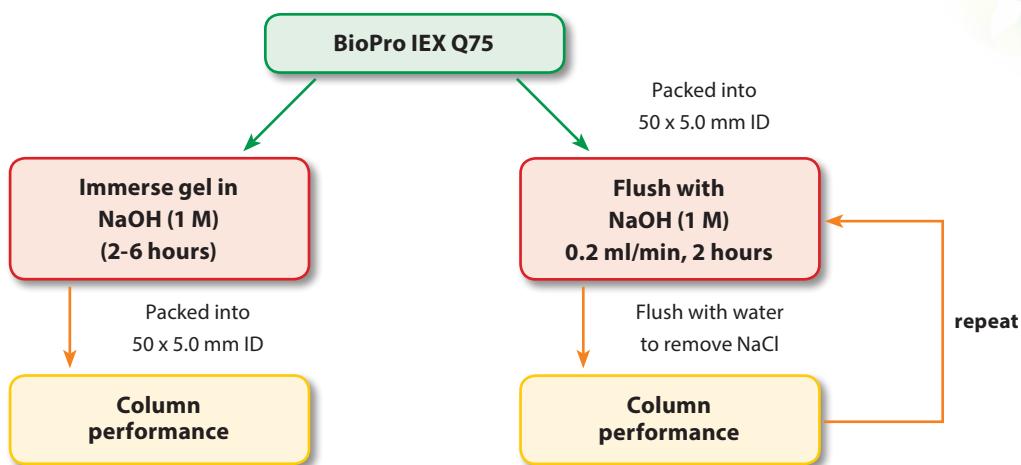


BioPro IEX is well suited for alkaline CIP procedures.

The dynamic binding capacity (DBC) and the selectivity are unaffected by 20 cycles of CIP with 1.0 M NaOH. The recovery of proteins is maintained at 100%, which demonstrates the absence of nonspecific adsorption of proteins by this hydrophilic resin.

\* Application data by courtesy YMC Co., Ltd.

## Stability in Alkaline Conditions\*



### Column performance test conditions

Eluent: A) 20 mM Tris-HCl (pH 8.1)  
B) 20 mM Tris-HCl (pH 8.1) containing 0.5 M NaCl  
Gradient: 10 - 80% B (0-60 min)  
Flow rate: 0.5 ml/min

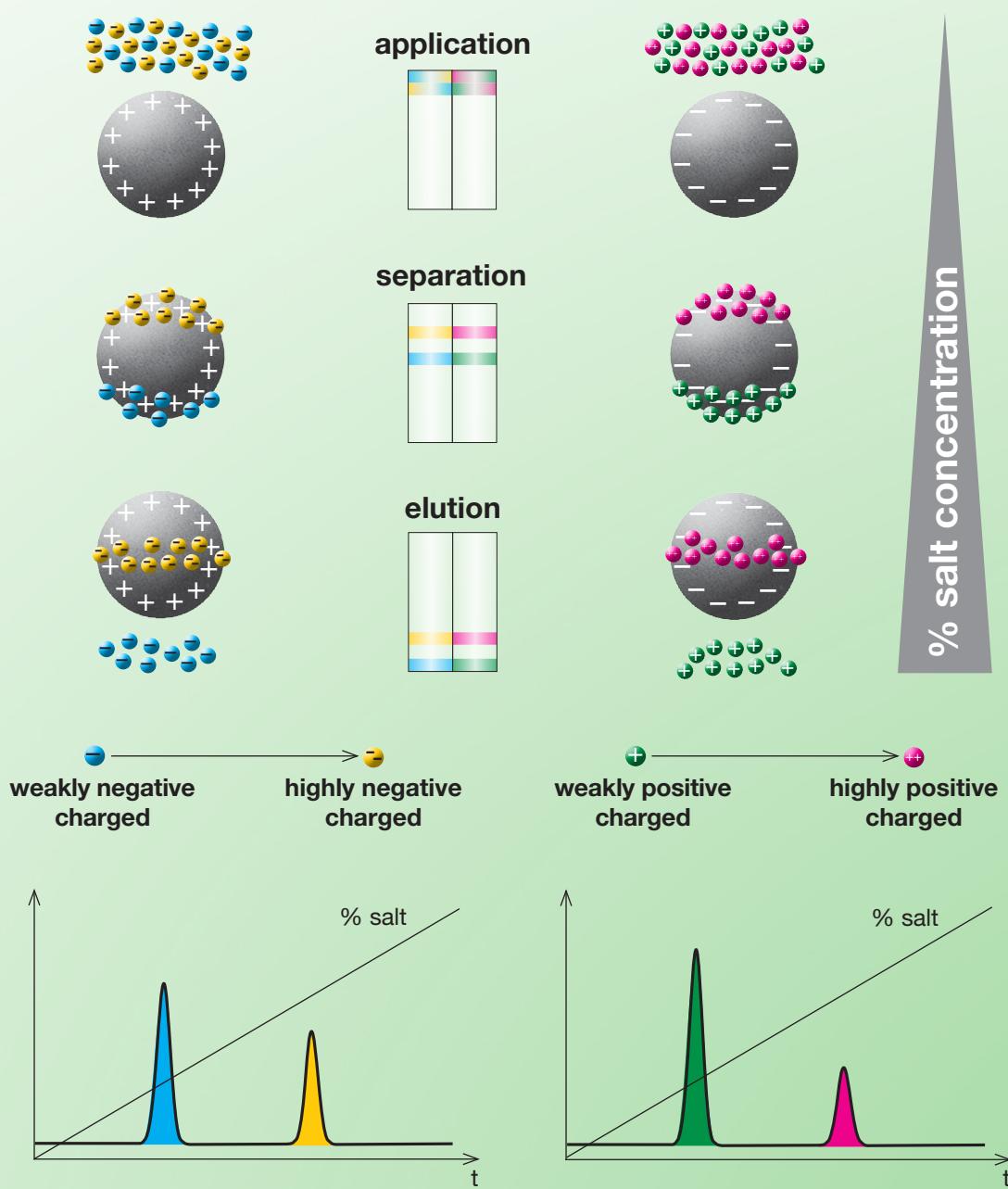
Temperature: 25 °C  
Detection: UV at 220 nm  
Sample: Trypsin inhibitor, Transferrin  
Injection: 40 µl

Stability towards alkaline conditions is essential for efficient sanitizing procedures in a highly regulated environment.

BioPro IEX media show excellent tolerance towards challenging alkaline conditions. Stability testing demonstrates that 0.01M NaOH is suitable for long term storage of BioPro IEX. The high chemical stability of BioPro IEX resins allows effective cleaning with alkaline solution and the longevity this material ensures efficient and economic purifications.

\* Application data by courtesy YMC Co., Ltd.

# Solution for intermediate purification and polishing: BioPro IEX SmartSep



## BioPro IEX SmartSep Ion Exchange Resin

BioPro IEX SmartSep 10 µm, 20 µm and 30 µm resins are the ideal choices for the intermediate purification and polishing processes. With its small particle size, BioPro IEX SmartSep 10 µm provides extraordinary high resolution. BioPro IEX SmartSep 20 µm and 30 µm have been widely used in industrial production process.

- Solution for challenging separations
- Increase productivity
- Reduced processing costs
- Short delivery time for industrial-scale quantities
- Full compliance with GMP regulations

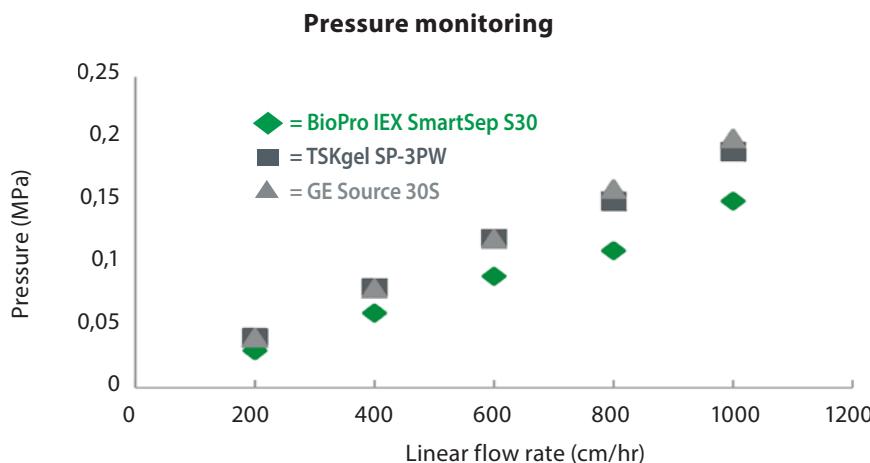
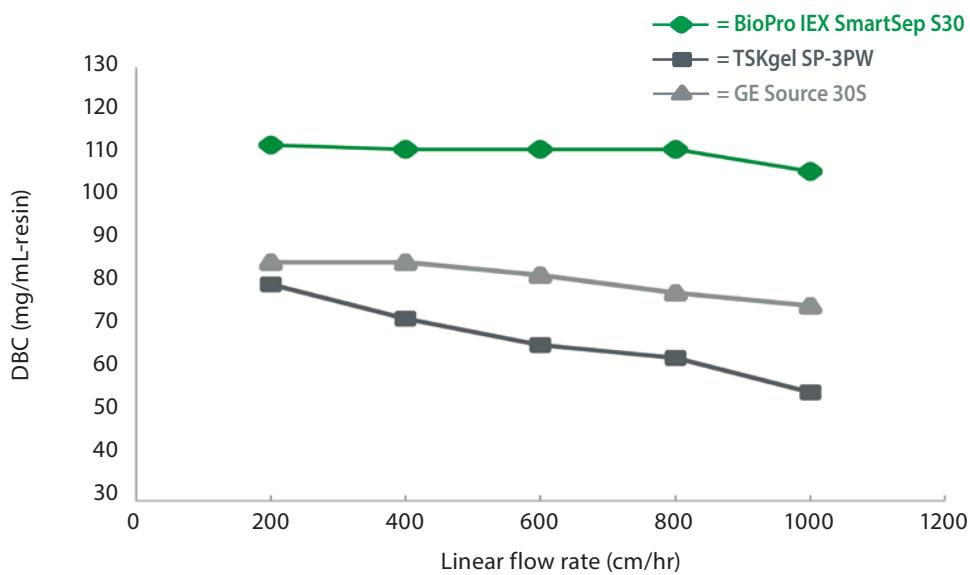
Examples of possible preparative applications of BioPro IEX SmartSep resins are:

- **Antibody purification**
- **Protein purification**
- **Peptide purification**
- **Oligonucleotide purification**



## High Dynamic Binding Capacity (DBC)

**Comparison of the Performance of BioPro IEX SmartSep and Competitors' Products in the Purification of Lysozyme , Insulin and Polyclonal IgG**

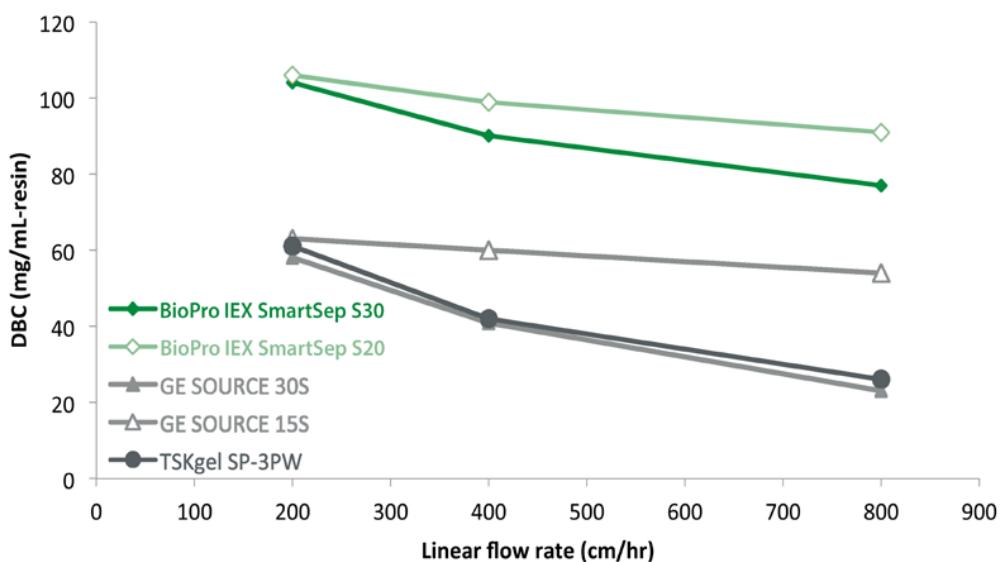


Column: 50 x 5.0 mm ID  
Equilibration buffer: 20 mM Glycine-NaOH (pH 9.0)  
Linear velocity: 200-1,000 cm/hr (0.66 mL/min-3.27 mL/min)

Comparison of DBC for lysozyme (left) and column pressure (right) at different flow rate.

BioPro IEX SmartSep shows considerably higher DBC across a wide range of linear velocity. A high DBC at flow rates of up to 1,000 cm/hr can reduce process time and increase productivity.

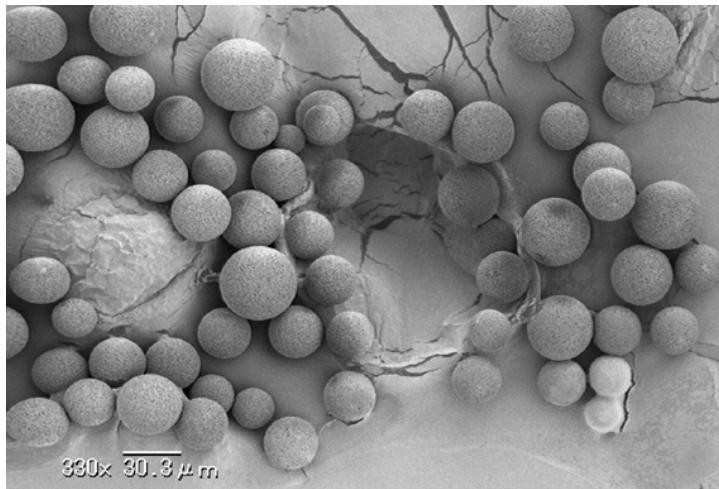
## High Dynamic Binding Capacity (DBC)



Column: 50 x 5.0 mm ID  
Equilibration buffer: 20 mM Glycine-NaOH (pH 9.0)  
Linear velocity: 200-1,000 cm/hr (0.66 mL/min-3.27 mL/min)

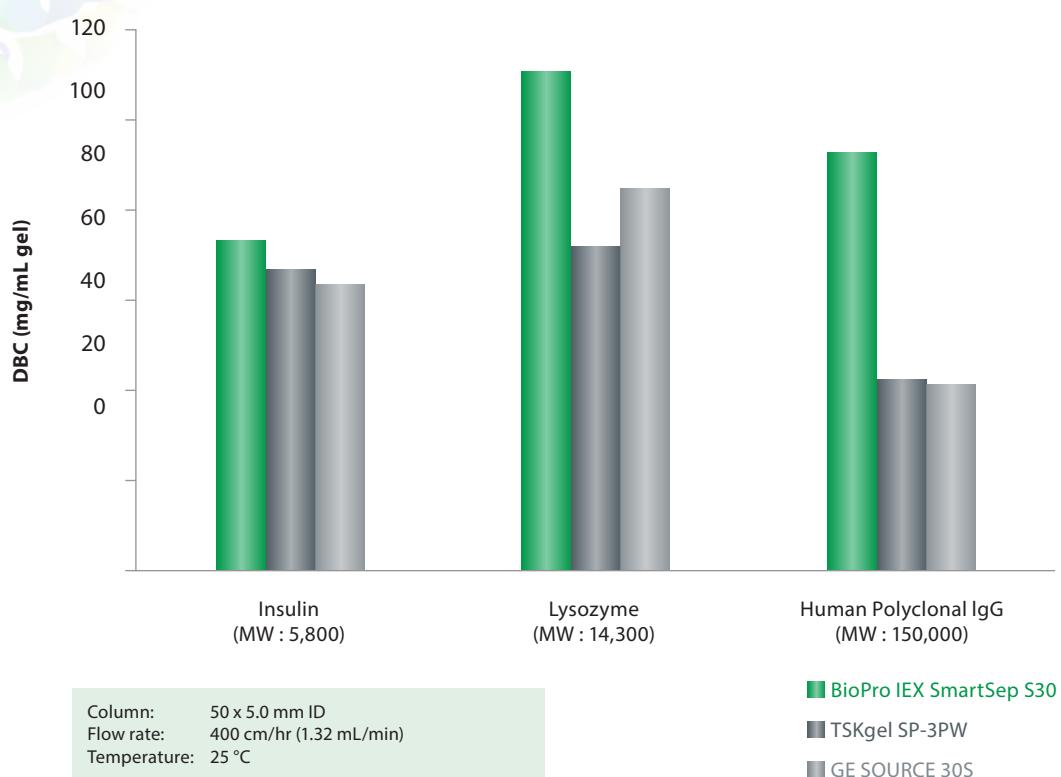
Comparison of BioPro IEX SmartSep S30 and competitor's DBC for human polyclonal IgG at different flow rates.

BioPro IEX SmartSep shows considerably higher DBC across a wide range of linear velocity. A high DBC at flow rates of up to 1,000 cm/hr can reduce process time and increase productivity.



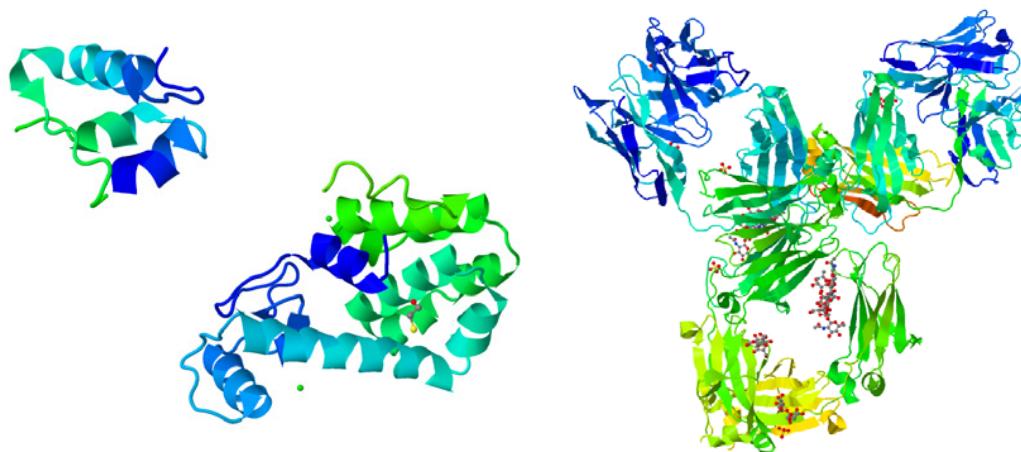
BioPro IEX SmartSep S30 particles

## High Dynamic Binding Capacity (DBC)



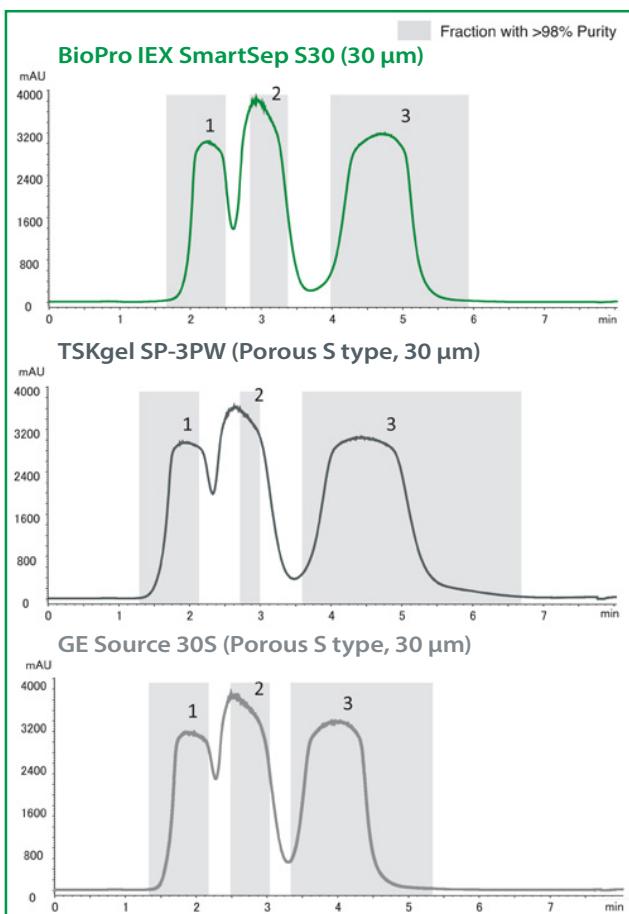
Comparison of BioPro IEX SmartSep S30 and competitor's DBC for lysozyme, insulin and polyclonal IgG.

BioPro IEX SmartSep shows higher dynamic binding capacity for both small peptides and large proteins.



## High Resolution and Recovery

BioPro IEX SmartSep bulk media offer a perfect solution for challenging separations. With the high binding capacity and recovery, the media allow high-throughput purifications and increased productivity. Easy elution of target compounds improves the whole process.



	Recovery (> 98% Purity)			
	Ribonuclease A	Cytochrome c	Lysozyme	Total
<b>BioPro IEX SmartSep S30</b>	<b>90.5%</b>	<b>81.5%</b>	<b>99.3%</b>	<b>90.7%</b>
TSKgel SP-3PW	74.2 %	54.4 %	99.5 %	76.9 %
GE Source 30S	87.2 %	76.0 %	99.5 %	87.8 %

*up to  
50% higher  
recovery*

Comparison of resolution with competitors' materials.

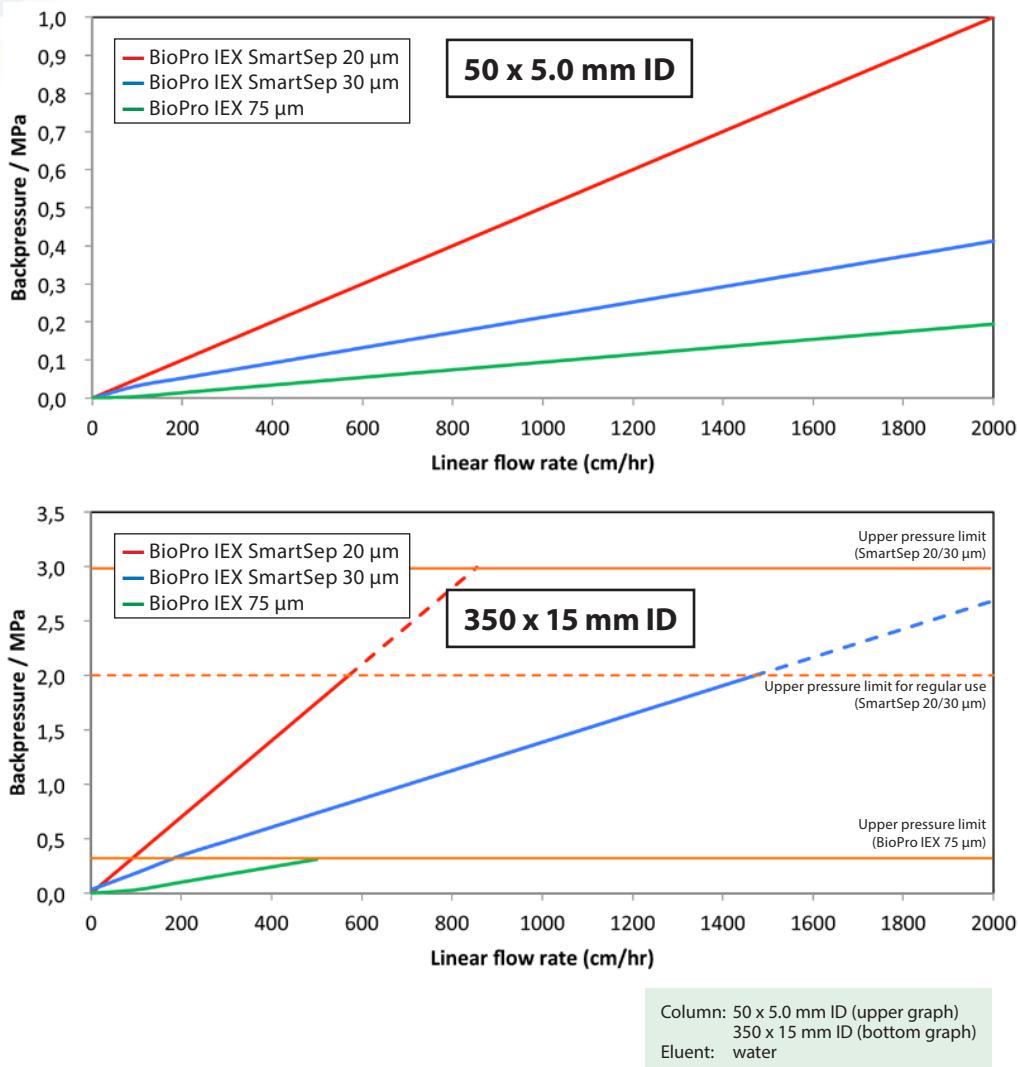
Column: 50 x 5.0 mm ID  
 Eluent: A) 20 mM NaH<sub>2</sub>PO<sub>4</sub>-Na<sub>2</sub>HPO<sub>4</sub> (pH 6.8)  
           B) 20 mM NaH<sub>2</sub>PO<sub>4</sub>-Na<sub>2</sub>HPO<sub>4</sub> (pH 6.8) containing 0.5 M NaCl  
 Gradient: 0-100% B, 30 column volumes  
 Flow rate: 1600 cm/hr (5.23 mL/min)  
 Temperature: 25°C

Detection: UV at 220 nm  
 Injection: 20 mL (30 mg Proteins)  
 Sample: 1. Ribonuclease A (0.5 mg/mL)  
           2. Cytochrome c (0.5 mg/mL)  
           3. Lysozyme (0.5 mg/mL)

BioPro IEX SmartSep S30 maintains its high resolution and high sample loading ability even at 1600 cm/hr and under high loading condition (30 mg/mL). It shows up to 50% higher recovery for specific target compounds compared to the competitor's materials. These features of the BioPro IEX SmartSep material indicate the possibility of cost savings for your purification.

# 20

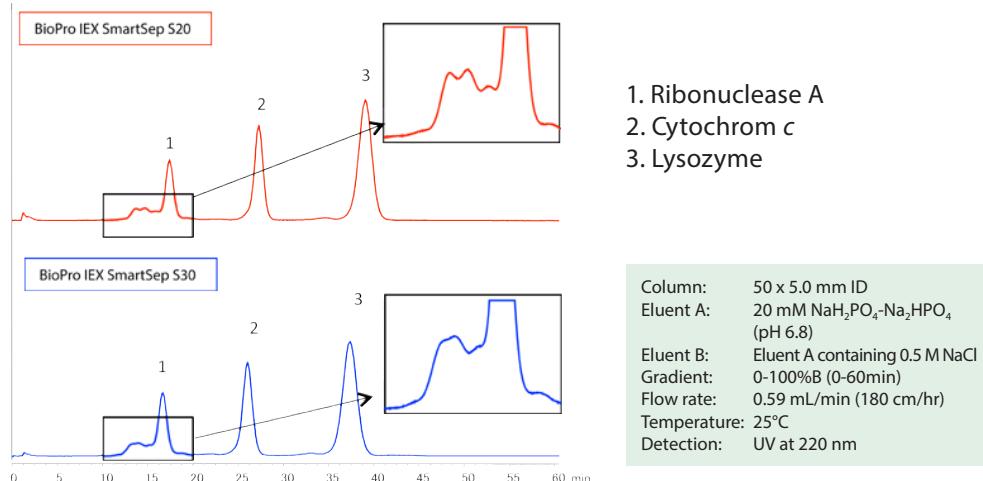
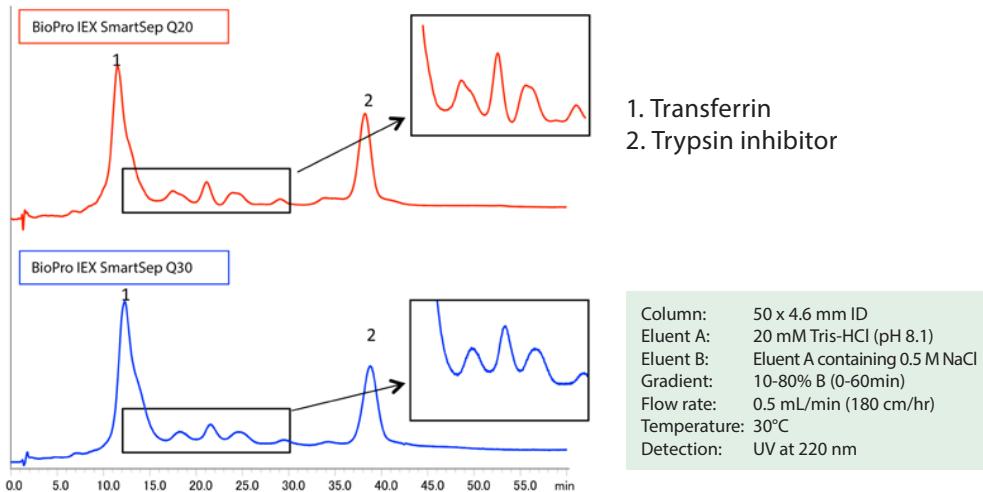
## Low Backpressure



BioPro IEX series media demonstrate low backpressures over a wide range of flow rates. Less than 1.0 MPa backpressure is generated at a flow rate of 2000 cm/hr with bed length of 50 mm. The pressure-flow curve is shown in the figure above. The resins with particle size of 30 µm allow high flow rates even with low pressure equipment.

## Scalability across All Particle Sizes

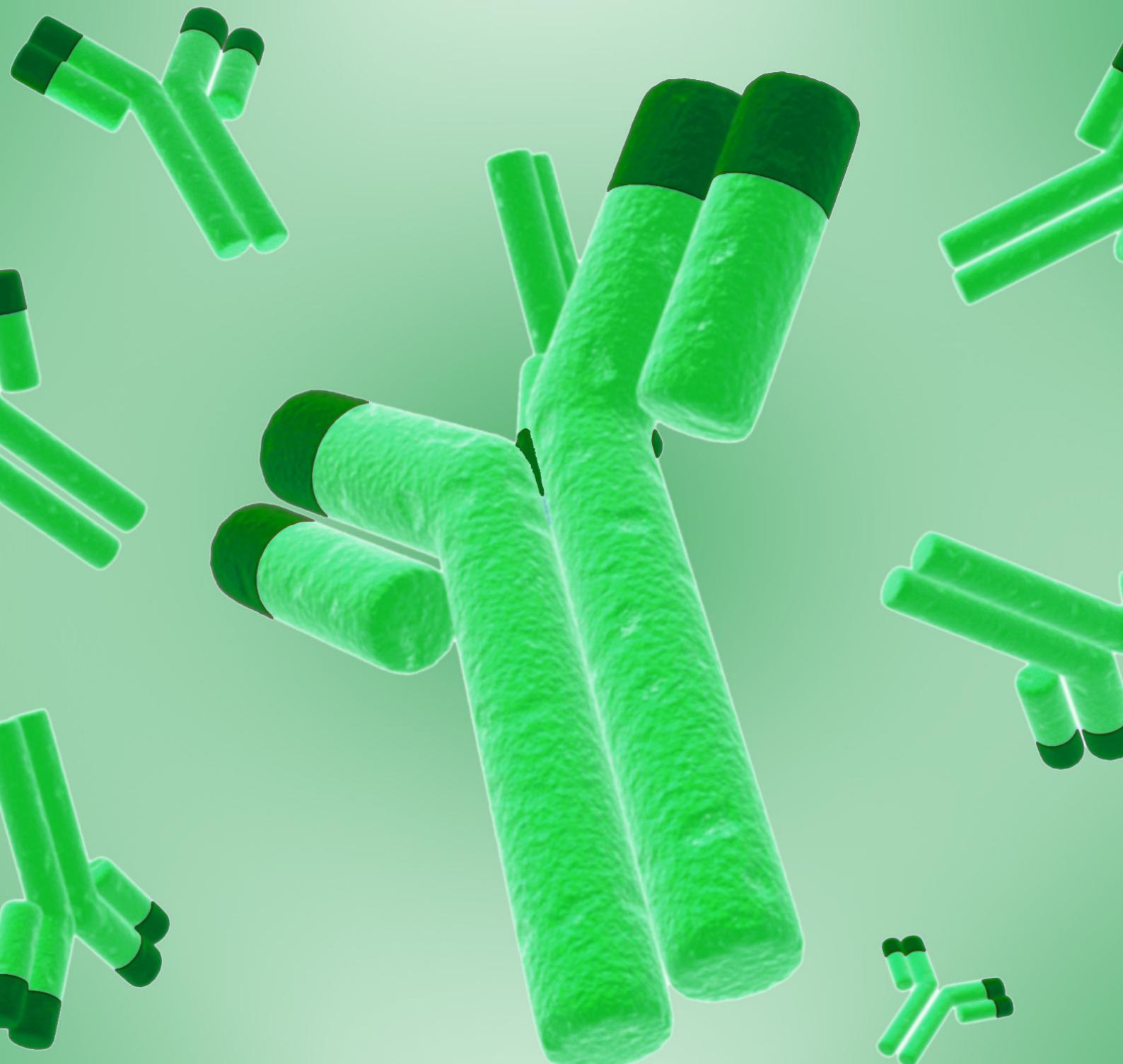
BioPro IEX SmartSep materials have the same separation characteristics across the different particle sizes.



The consistent performance across all particle sizes is advantageous for seamless method transfer between particle sizes.



# Purification of Monoclonal Antibodies

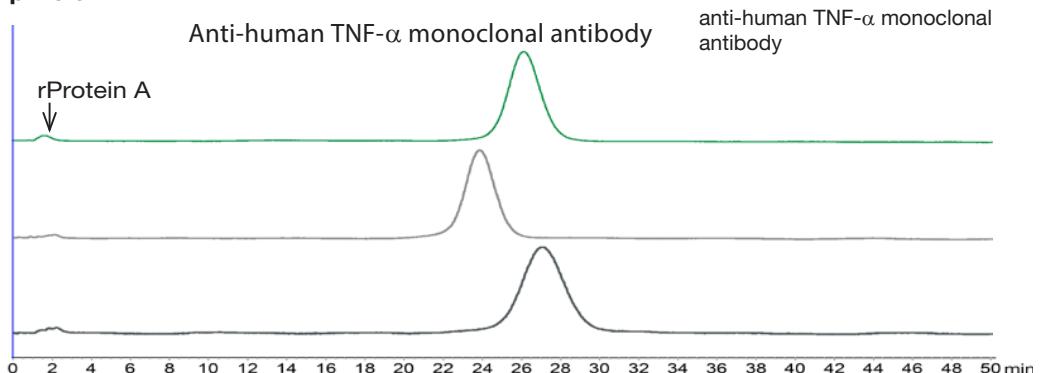


## Purification of Monoclonal Antibodies

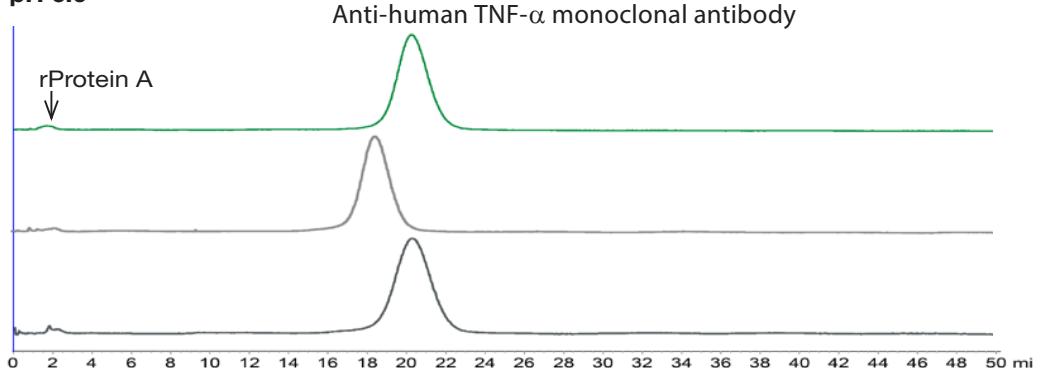
For purification of monoclonal antibodies, high demands are required from the separating medium. Factors influencing the binding characteristics of IgG are pH, linear velocity and salt concentration (conductivity) at the time when the sample is loaded onto the column. A purification of anti-human TNF- $\alpha$  monoclonal antibody was performed using BioPro IEX SmartSep and the influence of factors such as pH, linear velocity and salt concentration were studied. The BioPro IEX SmartSep material shows good performance in all the tests.

### Comparison of the Performance of BioPro IEX SmartSep and Competitors' Products in the Purification of anti-human TNF- $\alpha$ monoclonal antibody

#### pH 5.3



#### pH 6.0



Column:	50 x 5.0 mm ID
Eluent:	A) 20 mM citric acid-NaOH (pH 5.3) B) Eluent A containing 0.5 M NaCl
Gradient:	0-100% B (0-30 CV)
Flow rate:	180 cm/hr (0.59 mL/min)
Temperature:	ambient
Detection:	UV at 280 nm
Sample:	Anti-human TNF- $\alpha$ monoclonal antibody (after affinity chromatography)
IgG Load:	0.1 mg
Injection:	0.25 mL

BioPro IEX SmartSep S30

GE Source 30S

Tosoh TSKgel SP-3PW

## Purification of Monoclonal Antibodies

**Influence of pH, linear velocity and salt concentration on the purification of IgG using BioPro IEX SmartSep**

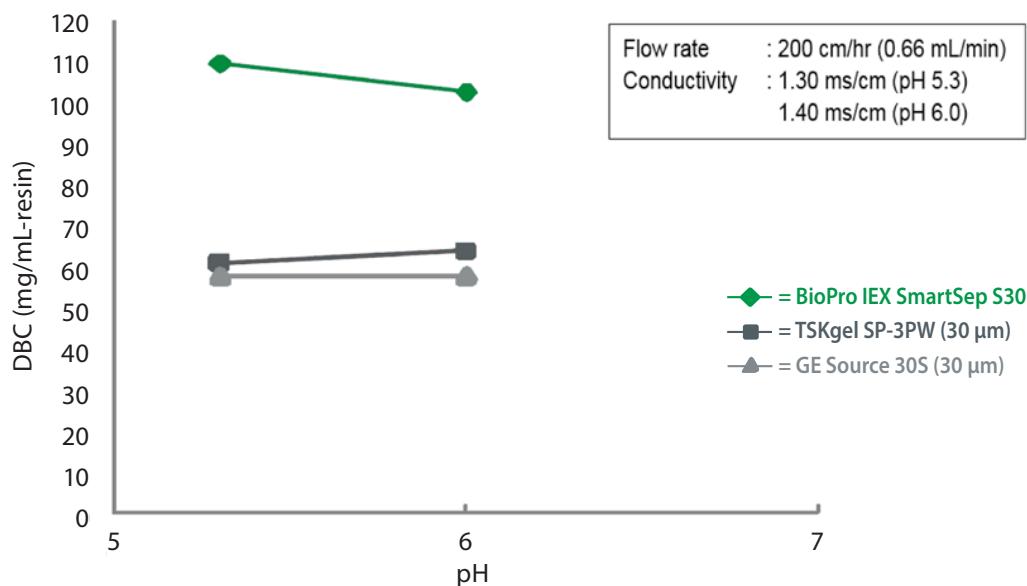
### Experimental conditions

pH: 6.0 vs. 5.3  
 Linear velocity: 200 - 800 cm/hr  
 Salt concentration: 0 - 50 mM NaCl

Column: 50 x 5.0 mm ID  
 Eluent:  
 A) 20 mM citric acid-NaOH buffer (pH 5.3 or 6.0)  
 B) Eluent A containing 0.5 M NaCl  
 Flow rate: 200 - 800 cm/hr (0.66-2.62 mL/min)  
 Temperature: ambient (25°C)  
 Detection: UV at 280nm  
 Sample: 1.5 mg/mL human polyclonal IgG in equilibration buffer

### Influence of pH

pH	DBC (mg/mL-resin, 10% breakthrough)	
	pH 5.3	pH 6.0
BioPro IEX SmartSep S30	110	103
Tosoh TSKgel SP-3PW (30 µm)	61	64
GE Source 30S (30 µm)	58	58

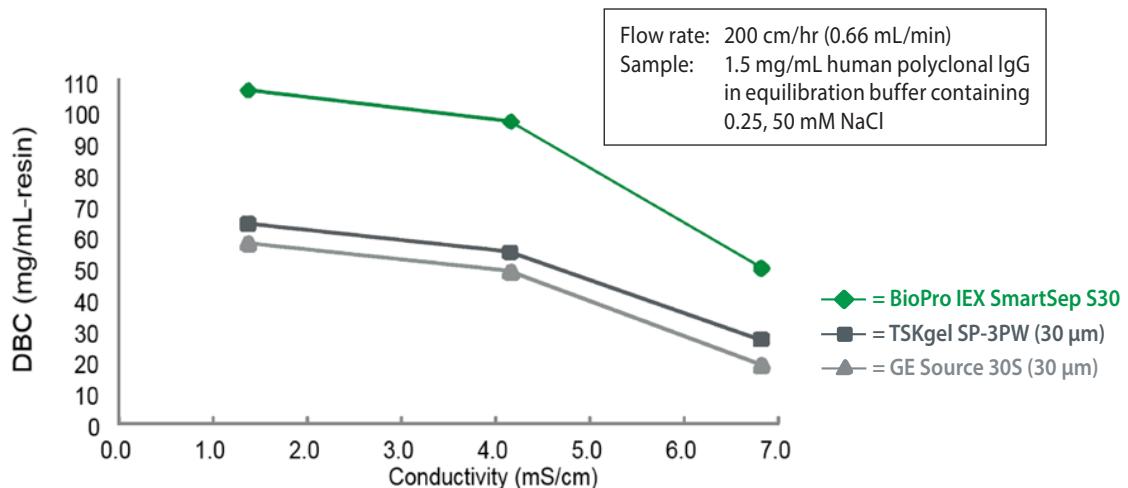


High binding capacities are achieved regardless of elution of pH. Therefore, milder eluting conditions for IgG can be selected to protect the product purity.

## Purification of Monoclonal Antibodies

### Influence of salt concentration

	DBC (mg/mL-resin, 10% breakthrough)		
pH	5.3		
NaCl concentration	0 mM	25 mM	50 mM
Conductivity	1.36 mS/cm	4.14 mS/cm	6.8 mS/cm
BioPro IEX SmartSep S30	107	97	50
Tosoh TSKgel SP-3PW (30 µm)	64	55	27
GE Source 30S (30 µm)	58	49	19

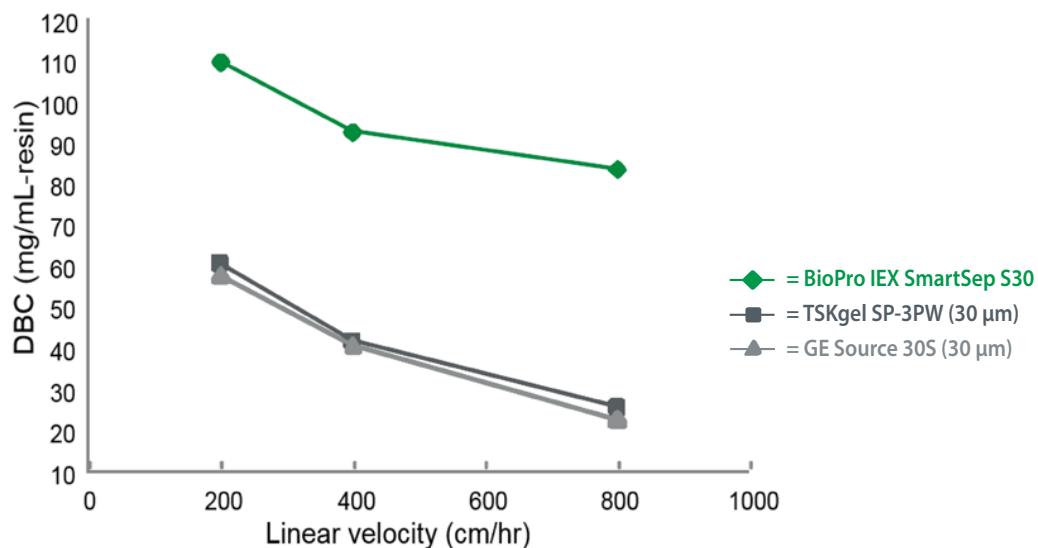


BioPro IEX SmartSep has a higher salt concentration tolerance. This simplifies the desalting process after Protein A chromatography and will help to shorten the production process.

## Purification of Monoclonal Antibodies

### Influence of linear velocity

Linear velocity	DBC (mg/mL-resin, 10% breakthrough)		
	200 cm/hr	400 cm/hr	800 cm/hr
BioPro IEX SmartSep S30	110	93	84
Tosoh TSKgel SP-3PW (30 µm)	61	42	26
GE Source 30S (30 µm)	58	41	23



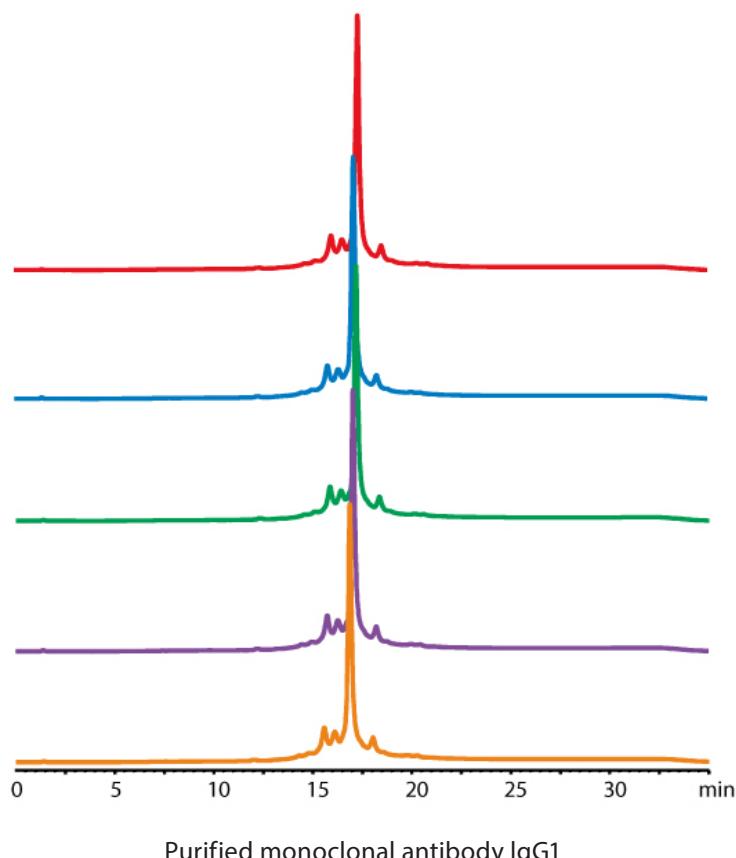
BioPro IEX SmartSep maintains higher binding capacity values over a wider range of linear velocities. This will increase product throughput for the purification process without any loss of efficiency.

## Purification of Monoclonal Antibodies

### Conclusions

BioPro IEX SmartSep materials meet the highest demands for the purification of monoclonal antibodies. High binding capacity is achieved regardless of elution of pH, linear velocity or salt concentration. This allows purification processes to be carried out more efficiently.

- **Higher throughput with no loss of efficiency**
- **Simplification of desalting processes**
- **Reduced processing costs**
- **Short delivery time for industrial-scale quantities**
- **Full compliance with GMP regulations**



Purified monoclonal antibody IgG1

## Screening Kits and Test Samples

### Screening kits and bulk samples for media selection and method development

YMC offers a number of ion exchange screening kits based on 1 mL or 5 mL columns and also free bulk media samples for testing. This provides a significant advantage and efficiency in media screening and purification method development.

#### 1 mL Type (26 x 7.0 mm ID)



- Resin screening
- Purification method development

#### 5 mL Type (26 x 15.6 mm ID)



- Purification method development
- Loadability studies

Please contact us to order your free bulk media samples for testing.



## Ordering Information for BioPro IEX Resin

### Availability

- Large production capacity for YMC's IEX resin.
- Short delivery time even for large quantities.
- Full compliance with GMP requirements.

### Strong anion exchanger: BioPro IEX Q

Product	Particle Size	Code	Pack Sizes*					
			50 ml	250 ml	1 L	5 L	10 L	20 L
BioPro IEX SmartSep Q10	10 µm	QSA0S10	✓	✓	✓	✓	✓	✓
BioPro IEX SmartSep Q20	20 µm	QSA0S20	✓	✓	✓	✓	✓	✓
BioPro IEX SmartSep Q30	30 µm	QSA0S30	✓	✓	✓	✓	✓	✓
BioPro IEX Q75	75 µm	QAA0S75	✓	✓	✓	✓	✓	✓

### Strong cation exchanger: BioPro IEX S

Product	Particle Size	Code	Pack Sizes*					
			50 ml	250 ml	1 L	5 L	10 L	20 L
BioPro IEX SmartSep S10	10 µm	SSA0S10	✓	✓	✓	✓	✓	✓
BioPro IEX SmartSep S20	20 µm	SSA0S20	✓	✓	✓	✓	✓	✓
BioPro IEX SmartSep S30	30 µm	SSA0S30	✓	✓	✓	✓	✓	✓
BioPro IEX S75	75 µm	SPA0S75	✓	✓	✓	✓	✓	✓

\* Larger or customised pack sizes are available on request.

Regulatory support file available under non-disclosure agreement. Used in validated cGMP-manufacturing processes. Customised material available on request. DMF registered with FDA.

## Ordering Information for Preparative Screening Kits

### Preparative screening kits

Product name*	Particle Size	Specification	Column volume	Product number
BioPro IEX Q75	75 µm	5 / pack	1 mL	BPQAA0S75-01PK
		5 / pack	5 mL	BPQAA0S75-05PK
BioPro IEX SmartSep Q30	30 µm	5 / pack	1 mL	BPQSA0S30-01PK
		5 / pack	5 mL	BPQSA0S30-05PK
BioPro IEX S75	75 µm	5 / pack	1 mL	BPSPA0S75-01PK
		5 / pack	5 mL	BPSPA0S75-05PK
BioPro IEX SmartSep S30	30 µm	5 / pack	1 mL	BPSSA0S30-01PK
		5 / pack	5 mL	BPSSA0S30-05PK

\* Other screening kits are available on request

# 30

## YMC Glass Columns

Ideally suited for use with BioPro IEX stationary phases:  
Glass columns made by YMC for biochromatography

### YMC ECO columns

- Pressure resistance: 5 – 30 bar
- Inner diameter: 10 – 80 mm
- Column length: 120 – 1000 mm
- Variable bed length
- Column volumes: 0 – 4.7 L
- Available as AB (aqueous buffer versions) SR (solvent resistant versions)



### YMC ECO<sup>PLUS</sup> column

- Pressure resistance: 15 – 80 bar
- Inner diameter: 5 – 50 mm
- Column length: 125 – 500 mm
- Variable bed length
- Column volumes: 0 – 1 L
- Available as AB (aqueous buffer versions) SR (solvent resistant versions)

### YMC Pilot<sup>PLUS</sup>

- Inner diameter 70 mm, 100 mm, 140 mm and 200 mm
- Two glass lengths 500 or 850 mm
- Unique Sealing Principle
- Easy Piston Adjustment
- Removable Column Body
- Safe and Easy Handling



The New Standard

## YMC Solutions for Preparative Chromatography

YMC has more than 30 years experience in the manufacture of stationary phases for preparative liquid chromatography.

BioPro IEX series products are polymeric ion exchange resins for the purification of biological molecules. They represent one part of the three part YMC-Prep portfolio: silica, hybrid silica and polymer media.

Further information on YMC\*Gel silica and YMC-Triart Prep products can be found in the following brochures:



### YMC\*Gel HG-series brochure

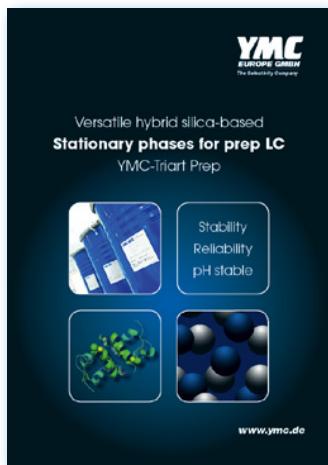
General purpose preparative phases based on a high grade silica base.

Available as silica or with C18, C8, C4, C1, phenyl, cyano, amino or diol bonding.

Particle size: 10 µm, 15 µm, 20 µm or 50 µm

Pore size: 12 nm, 20 nm or 30 nm

(Other particle and pore sizes on request)



### YMC-Triart Prep

Hybrid silica phase, stable between pH 2.0 - 10.0.

Available with C18 and C8 bonding.

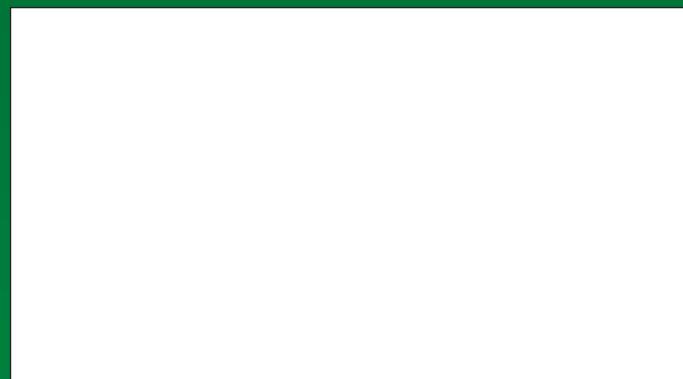
Particle size: 10 µm, 15 µm or 20 µm

Pore size: 12 nm or 20 nm

(Other particle and pore sizes on request)

GE is a trademark of General Electric Company.  
Tosoh is a trademark of Tosoh Bioscience LLC.

Your local distributor:



**YMC Europe GmbH**

Schöttmannshof 19  
D-46539 Dinslaken  
Germany  
Phone +49(0)2064/427-0, FAX +49(0)2064/427-222  
[www.ymc.de](http://www.ymc.de)

**YMC Schweiz GmbH**

Im Wasenboden 8  
4056 Basel  
Switzerland  
Phone + 41 61 561 80 50, Fax + 41 61 561 80 59  
[www.ymc-schweiz.ch](http://www.ymc-schweiz.ch)

**YMC CO., LTD.**

YMC Karasuma-Gojo Bld. 284 Daigo-cho,  
Karasuma Nishiiru Gojo-dori Shimogyo-ku,  
Kyoto 600-8106 Japan  
Phone +81(0)75-342-4515, FAX +81(0)75-342-4550  
[www.ymc.co.jp](http://www.ymc.co.jp)