Ion-Exchange Phases

- Silica and polymer based anion and cation exchange materials
- Range of pore sizes
- Porous and non-porous materials

Tosoh Bioscience offers a range of silica and methacrylate based high efficiency columns for analysis and isolation of biomolecules by anion and cation exchange chromatography. The BioAssist materials were created to provide higher capacity for larger proteins and have biocompatible PEEK hardware.

TSKgel® Ion-Exchange Phases

TSKgel Phase	Type	Functional Group	pH Range	Particle Size (µm)	Pore Size (Å)	Exclusion Limit (Da) for PEG
Silica-based (SW)						
DEAE-2SW	WAX	DEAE	2 - 7.5	5	125	10,000
DEAE-3SW	WAX	DEAE	2 - 7.5	10	250	30,000
CM-2SW	WCX	Carboxymethyl	2 - 7.5	5	125	10,000
CM-3SW	WCX	Carboxymethyl	2 - 7.5	10	250	30,000
SP-2SW	SCX	Sulphopropyl	2 - 7.5	5	125	10,000
Polymer-based (PW)						
SuperQ-5PW	SAX	Trimethylamino	2 - 12	10, 13	1000	1,000,000
DEAE-5PW	WAX	DEAE	2 - 12	10, 13, 20	1000	1,000,000
BioAssist Q	SAX	Polyamine	2 - 12	10, 13	~4000	>5,000,000
SP-5PW	SCX	Sulphopropyl	2 - 12	10, 13, 20	1000	1,000,000
CM-5PW	WCX	Carboxymethyl	2 - 12	10, 13	1000	1,000,000
BioAssist S	SCX	Sulphopropyl	2 - 12	7, 13	~1300	~4,000,000
Non-porous (NPR)						
DEAE-NPR	WAX	DEAE	2 - 12	2.5	~0	500
SP-NPR	SCX	Sulphopropyl	2 - 12	2.5	~0	500
Q-STAT	SAX	Trimethylamino	3 - 10	7, 10	~0	500
DNA-STAT	SAX	Trimethylamino	3 - 10	5	~0	500
CM-STAT	WCX	Carboxymethyl	3 - 10	7, 10	~0	500
SP-STAT	SCX	Sulphopropyl	3 - 10	7, 10	~0	500

Silica-based Phases (SW)

Silica-based ion-exchange materials have a smaller pore size compared to the polymer-based phases, and are most suitable for analysing smaller molecular weight samples such as nucleotides, pharmaceuticals, catecholamines and small peptides.

Polymer-based Phases (PW)

The porous methacrylate based phases are derived from G5000PW (10µm, 1000Å) spherical particles, derivatised with DEAE, SP or CM functionalities. The SuperQ-5PW is a higher capacity strong anion-exchanger, as a result of the polyamine functional groups. All PW phases show excellent stability from pH 2–12 and offer good mass and activity recovery for enzymes, proteins, DNA, nucleic acids and polypeptides.

Each PW phase has an equivalent in 20 and 30µm particle size TSKgel 5PW resins and even larger particle TOYOPEARL process media. This means that a method developed on an analytical column can be reliably scaled up to preparative and process scale dimensions, using the same backbone chemistry.

Particles in the TSKgel BioAssist Q columns contain very large pores (~4000Å) that are functionalised with polyamine groups to form a network structure. The dynamic binding capacity of BioAssist Q columns is high over a wide molecular weight range. TSKgel BioAssist S columns are packed with polymethacrylate particles possessing 1300Å pores functionalised with sulphopropyl groups. Columns are supplied in biocompatible PEEK hardware for analysis by HPLC or FPLC. TSKgel BioAssist phases are particularly suitable for the analysis of monoclonal antibodies, plasmids and other large proteins.

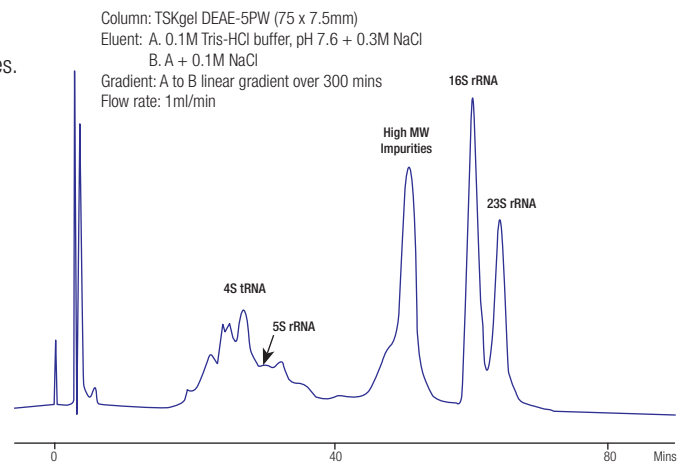


Figure 12. Separation of *E. coli* RNA

Ion-Exchange Phases (continued)

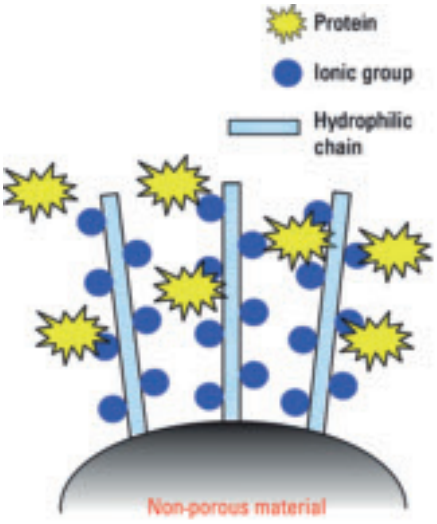
Non-Porous Resin (NPR) Materials

The NPR ion-exchange materials such as DEAE-NPR, DNA-NPR and SP-NPR are based on methacrylate polymer of 2.5µm particle size. High efficiency, coupled with low sample capacity, makes these columns suitable for fast analysis and micro-scale preparative isolation of DNA digests, and haemoglobin variants.

TSKgel STAT Series

TSKgel STAT columns, the newest series of non-porous ion-exchange columns, enable high performance separations with short analysis times. These phases consist of monodisperse, non-porous polymethacrylate resin particles, the surface of which consists of an open access network of multi-layered anion- or cation-exchange groups. The innovative bonding chemistry, combined with a relatively large particle size, results in a high loading capacity and a low operating pressure, compared with traditional non-porous resins.

Table 1 illustrates that despite the fact that surface area decreases with increasing particle size, the larger TSKgel Q-STAT and DNA-STAT particles have higher binding capacities than the smaller particles used in TSKgel NPR columns. The novel bonding chemistry results in a significant increase in static binding capacity, more than compensating for the loss in external surface area of the larger particles.



Schematic diagram of TSKgel STAT series

Table 1

Property	TSKgel DEAE-NPR	TSKgel DNA-STAT	TSKgel Q-STAT	
Particle Size	2.5µm	5µm	7µm	10µm
Capacity*	9.1	38.6	27.0	20.9

* Static binding capacity in mg BSA/mg dry gel

TSKgel STAT 10µm particle size columns in 35 x 3.0mm column dimensions are ideally suited for rapid candidate screening or process monitoring. The smaller 7µm particle size columns (100 x 4.6mm) are designed for high resolution separations of nucleic acids, mAb variants, PEGylated protein or protein aggregates.

Figure 13 shows the reaction monitoring for the PEGylation of lysozyme at 4 minute intervals on a TSKgel SP-STAT column. As demonstrated in the chromatogram, peak areas of mono-, di- and tri-PEGylated lysozyme increased with reaction time, whilst the area of unreacted lysozyme decreased. Figure 14 illustrates the utility of TSKgel DNA-STAT for the separation of mono-, di- and tri-nucleotides.

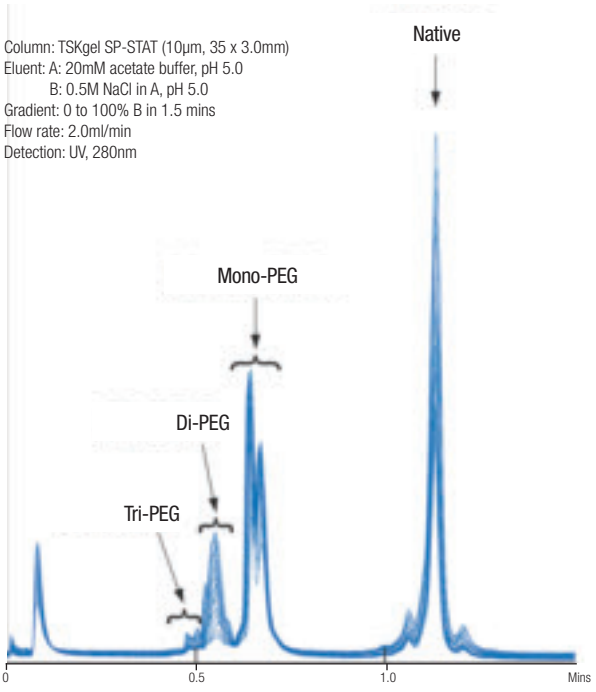


Figure 13. Monitoring PEGylation reaction of lysozyme

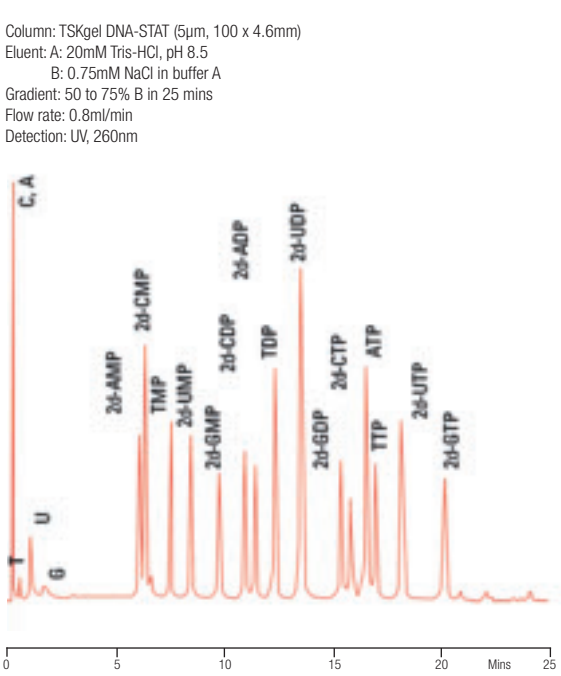


Figure 14. Separation of nucleotides on TSKgel DNA-STAT

Ion-Exchange Phases (continued)

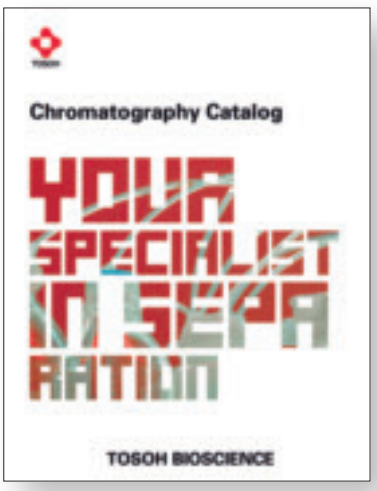
Ordering Information – Ion-Exchange Phases

TSKgel Phase	Column Dimensions (mm)			Guardgel Kit[1] (For 4.6 and 7.5mm i.d. Columns)
	250 x 2.0	250 x 4.6	75 x 7.5	
DEAE-2SW	18761	7168	-	7648[2]
DEAE-3SW	-	-	7163	7648[2]
CM-2SW	-	7167	-	7650[2]
CM-3SW	-	-	7162	7650[2]
SP-2SW	-	7165	-	-

TSKgel Phase	Column Dimensions (mm)					Guardgel Kit[1]	
	75 x 2.0	35 x 4.6	50 x 4.6	75 x 7.5	150 x 21.5	For 4.6 and 7.5mm i.d. Columns	For 21.5mm i.d. Columns
SuperQ-5PW	-	-	-	18257[3]	18387[5]	18388	18390[2]
DEAE-5PW	18757[3]	-	-	7164[3]	7574[5]	7210	16092[2]
BioAssist Q	-	-	19685[4]	-	-	-	-
SP-5PW	18758[3]	-	-	7161[3]	7575[5]	7211	16093[2]
CM-5PW	-	-	-	13068[3]	-	13069	-
BioAssist S	-	-	19686[4]	-	-	-	-
DEAE-NPR	-	13075	-	-	-	-	-
SP-NPR	-	13076	-	-	-	-	-

[1] Kit contains guard, holder and connector [2] 20µm material [3] 10µm material [4] PEEK hardware [5] 13µm material

TSKgel Phase	Particle Size (µm)	Column Dimensions (mm)	Cat. Number	Price
Q-STAT	10	35 x 3.0	21960	
	7	100 x 4.6	21961	
DNA-STAT	5	100 x 4.6	21962	
CM-STAT	10	35 x 3.0	21965	
	7	100 x 4.6	21966	
SP-STAT	10	35 x 3.0	21963	
	7	100 x 4.6	21964	



Please contact Hichrom to request a copy of the Tosoh Bioscience Chromatography catalogue or any product brochure.