Reversed-Phase Materials

- Silica- and polymer-based materials
- Super series ideal for LC-MS
- High recovery for biomolecules

Tosoh Bioscience offers a number of both silica-based and polymer-based columns for reversed-phase applications. The characteristics of these materials are summarised below.

TSKgel® Reversed-phase Materials

TSKgel Phase	Functional Group	Bonding	Particle Size (µm)	Pore Size (Å)	Carbon Load (%)	Endcapped	Exclusion Limit (Da)
Silica-based							
ODS-140HTP	C18	Polymeric	2.3	140	8	Yes	20,000
ODS-100V	C18	Monomeric	3, 5	100	15	Yes	8,000
ODS-100Z	C18	Monomeric	3, 5	100	20	Yes	8,000
ODS-80TM	C18	Monomeric	5, 10	80	15	Yes	6,000
ODS-80TS	C18	Monomeric	5, 10	80	15	Yes	6,000
Octyl-80TS	C8	Monomeric	5	80	11	Yes	6,000
CN-80TS	Cyano	Monomeric	5	80	8	Yes	6,000
ODS-120T	C18	Polymeric	5, 10	120	22	Yes	10,000
ODS-120A	C18	Polymeric	5, 10	120	20	No	10,000
Super-ODS	C18	Polymeric	2.3	110	8	Yes	10,000
Super-Octyl	C8	Polymeric	2.3	110	5	Yes	10,000
Super-Phenyl	Phenyl	Polymeric	2.3	110	3	Yes	10,000
OligoDNA RP	C18	Monomeric	5	250	10	No	165,000
TMS-250	C1	Monomeric	10	250	5	No	200,000
Protein C4-300	C4	Polymeric	3	300	3	Yes	-
Polymer-based							
Octadecyl-2PW	C18	Monomeric	5	125	-	-	8,000
Octadecyl-4PW	C18	Monomeric	7, 13	500	-	-	200,000
Phenyl-5PW RP	Phenyl	Monomeric	10, 13	1000	-	-	1,000,000
Octadecyl-NPR	C18	Monomeric	2.5	Non-porous	-	-	>1,000,000

Silica-based Phases

TSKgel ODS-140HTP

TSKgel® ODS-140HTP columns were developed for use in high throughput applications. They are packed with 2.3µm particles, providing high resolution and short analysis times at moderate pressure. The lower pressure drop enables these columns to be used with either UHPLC (up to 9,000psi) or conventional HPLC systems.

TSKgel ODS-100V and ODS-100Z

- Ultra pure silica
- TSKgel ODS-100V compatible with 100% aqueous eluent
- Good retention of polar analytes

TSKgel ODS-100V and ODS-100Z reversed-phase columns are based on ultra pure silica with a high surface area (450m^2/g). TSKgel ODS-100V provides strong retention for polar compounds due to its lower C18 ligand density (15% carbon content). The phase is prepared by an incomplete first reaction with a difunctional octadecylsilane reagent, followed by endcapping with a mixture of two difunctional dialkylsilane reagents. This enables the phase to provide complete wetting and retention stability in 100% aqueous eluents. Figure 7 shows the separation of 15 organic acids in less than 25 minutes using 0.1% phosphoric acid eluent.

TSKgel ODS-100Z contains a high density (20% carbon content) C18 bonded phase for maximum retention and selectivity of small molecular weight compounds. It is prepared by bonding the surface with a difunctional octadecylsilane, followed by repeated endcapping with monofunctional trimethylsilane reagent.

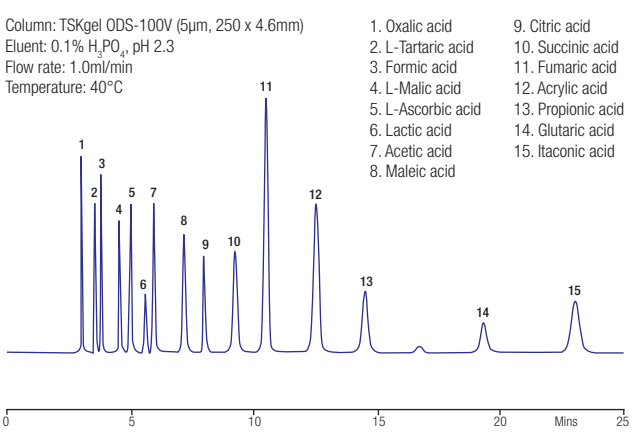


Figure 7. Organic acids on TSKgel ODS-100V

Reversed-Phase Materials (continued)

TSKgel® Super Series

The silica particles used in the Super series columns are monodisperse spherical 2.3µm beads with 110Å pores. The Super-ODS, Super-Octyl and Super-Phenyl phases are polymerically bonded and exhaustively endcapped, to produce low metal-content, low silanol phases. The 2.3µm particle provides superior resolution and speed of analysis as well as improved sensitivity. The columns do not suffer from excessive pressure drops.

TSKgel® Super series columns provide high resolution separations for pharmaceuticals, peptides, nucleotides, amino acids and small proteins. In pharmaceutical stability testing, degradation products as low as 0.1% of the main component can be measured.

The high performance of TSKgel Super-ODS is shown by the rapid analysis of 18 PTC-derivatized amino acids in under 5 minutes (Figure 8).

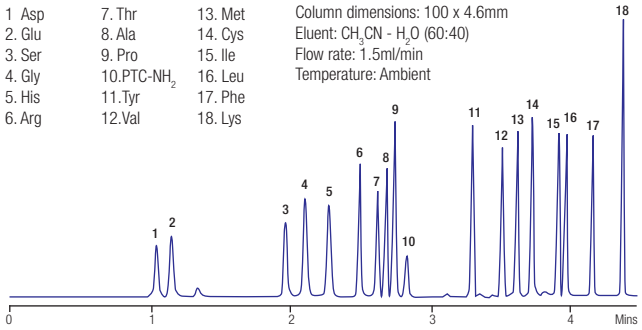


Figure 8. TSKgel Super-ODS for rapid separation of 18 PTC-derivatized amino acids

TSKgel Protein C4-300

TSKgel Protein C4-300 is a 300Å pore size phase, designed for the optimal recovery and resolution of proteins such as recombinant proteins, antibody fragments or PEGylated proteins.

Ordering Information – Silica-based Phases

TSKgel Phase	Column Dimensions (mm)	
	50 x 2.1	100 x 2.1
ODS-140HTP	21927	21928

TSKgel Phase 3µm	Column Dimensions[1] (mm)				Guard Cartridges[2] (3/pk) (For 2.0mm i.d. columns)
	35 x 2.0	50 x 2.0	75 x 2.0	150 x 2.0	
100V	21813	21812	21811	21810	21997
100Z	22728	22729	22730	22732	21996

TSKgel Phase 5µm	Column Dimensions (mm)				Guard Cartridges[3] (3/pk) (For 4.6mm i.d. columns)
	50 x 2.0	150 x 2.0	150 x 4.6	250 x 4.6	
100V	21457	21458	21455	21456	21453
100Z	21460	21459	21461	21462	21454

[1] Other dimensions available [2] Use with holder 19308 [3] Use with holder 19018 Other dimension guards available

TSKgel Phase 5µm	Column Dimensions[5] (mm)								
	50 x 2.0	100 x 2.0	150 x 2.0	250 x 2.0	50 x 4.6	75 x 4.6	100 x 4.6	150 x 4.6	250 x 4.6
	-	-			-		-		
ODS-80TM	-	-	-	-	-	16651	-	8148	8149
ODS-80TS	-	-	18150	18151	-	17200	-	17201	17202
Octyl-80TS	-	-	-	-	-	-	-	17344	17345
CN-80TS	-	-	-	-	-	-	-	17348	17349
	-	-			-	-	-		
ODS-120T	-	-	18152	18153	-	-	-	7637	7125
ODS-120A	-	-	-	-	-	-	-	7636	7124
			-	-		-		-	-
Super-ODS[4]	19541	19542	-	-	18154	-	18197	-	-
			-	-					-
Super-Octyl[4]	20013	20014	-	-	18275	-	18276	-	-
Super-Phenyl[4]	20017	20018	-	-	18277	-	18278	-	-
OligoDNA RP	-	-	-	-	-	-	-	13352	-
TMS-250[6]	-	-	-	-	-	7190	-	-	-
-				-		-			-
Protein C4-300[7]	22830	22831	22832	-	22827	-	22828	22829	-

[4] 2.3µm [5] Preparative dimensions and guard cartridges available [6] 10µm particle size [7] 3µm particle size

Reversed-Phase Materials (continued)

Polymer-based Phases

The polymer-based reversed-phase materials are chemically stable from pH 2 – 12, allowing operation at basic pH where silica-based phases have limited chemical stability. The non-porous Octadecyl-NPR column produces extremely fast kinetics and quantitative recovery of proteins at sub-microgram loads. Figure 9 shows the high resolution, fast separation of peptides on a TSKgel Octadecyl-NPR column.

TSKgel® Octadecyl-4PW is suitable for the analysis of peptides and small proteins, whereas the TSKgel Octadecyl-2PW is used for small pharmaceutical compounds at basic pH. TSKgel Phenyl-5PW has a high loading capacity and is ideal for the separation of high molecular weight proteins.

The specifications of these phases are summarised on page 247.

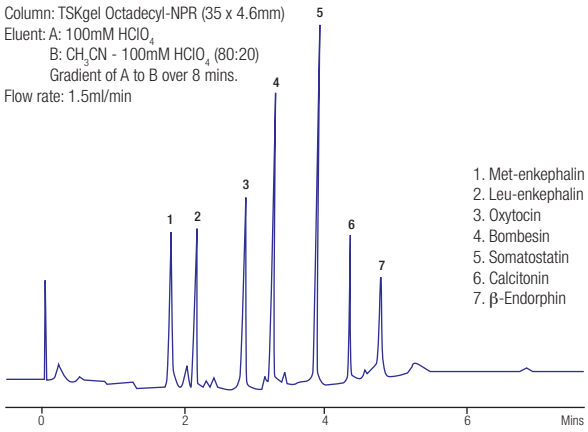


Figure 9. High speed analysis of peptides

Ordering Information – Polymer-based Phases

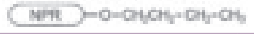
TSKgel Phase	Column Dimensions[1] (mm)						Guard Cartridge (3/pk)	
	75 x 2.0	150 x 2.0	35 x 4.6	75 x 4.6	150 x 4.6	150 x 6.0	For 2.0mm i.d. columns[2]	For 4.6mm i.d. columns[3]
Octadecyl-2PW	-	18754	-	-	17500	17501	42161	-
Octadecyl-4PW	-	18755	-	-	13351	-	42160	19008
Phenyl-5PW RP	18756	-	-	8043	-	-	42159	19007
Octadecyl-NPR	-	-	14005	-	-	-	-	-

[1] Preparative dimensions available [2] Use with holder 19308 [3] Use with holder 19018

Hydrophobic Interaction (HIC) Phases

- Ether, phenyl and butyl functionalities
- Analytical and preparative columns
- Wide pH range (2 – 12)
- Fully scalable from analytical to preparative dimensions

TSKgel HIC Phases

Phase	Structure	Particle Size (µm)	Pore Size (Å)
Ether-5PW		10, 13, 20	1000
Phenyl-5PW		10, 13, 20	1000
Butyl-NPR		2.5	-

The porous HIC packing materials are based on the G5000PW resin and derivatized with phenyl (Phenyl-5PW) or oligoethyleneglycol groups (Ether-5PW). The Ether-5PW is less hydrophobic than Phenyl-5PW and thus exhibits shorter retention times. Butyl-NPR is based on 2.5µm non-porous particles of the same chemical composition as G5000PW, and is useful for high speed applications. It is more hydrophobic than Phenyl-5PW. It also benefits from excellent mass recovery and is the preferred choice for process monitoring and quality control. The TSKgel HIC columns are compatible with water-soluble organic solvents at concentrations below 50% methanol, ethanol, acetonitrile, DMF, DMSO or below 30% chloroform.

Applications of TSKgel HIC Phases

Sample	MW Range (Da)	TSKgel Phase
Peptides	<10,000	Butyl-NPR
Medium to large proteins	>10,000	Phenyl-5PW, Ether-5PW, Butyl-NPR
DNA, RNA and PCR products	>500,000	Phenyl-5PW, Butyl-NPR
Oligonucleotides	>10,000	Phenyl-5PW, Butyl-NPR

Ordering Information – TSKgel HIC Phases

Phase	Column Dimensions (mm)					Guardgel Kit[1]	
	75 x 2.0	35 x 4.6	100 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
Ether-5PW (10µm)	18760	-	-	8641	-	8643[3]	-
Phenyl-5PW (10µm)	18759	-	-	7573	7656[2]	7652[3]	16095[2]
Butyl-NPR	-	14947	42168	-	-	-	-

[1] Kit contains guard, holder and connector [2] 13µm material [3] 20µm material