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SUPELCO®

Product Information

Progel™-TSK H_{HR} Columns for Gel Permeation Chromatography

Progel-TSK H_{HR} columns are the newest products in the Progel-TSK line of styrene-divinylbenzene-based columns. Developed for gel permeation analyses of polymers in organic eluents, these column packings are stable in a wide range of organic solvents, eliminating the need for special sran, they show little swelling when used with toluene, benzene, acetone, or dimethylformamide. However, they should not be used with polar solvents, such as methanol, water, or methanol/water mixtures. Eight distinct separation ranges are available, and mixed bed columns offer linear molecular weight vs. elution volume plots over 4 distinct molecular weight ranges. Progel-TSK H_{HR} columns can be operated at temperatures to 140 °C.

Specifications for Progel-TSK H_{HR} GPC Columns (all columns 30 cm x 7.8 mm I.D.)

Column	Particle Size (µm)	Theoretical Plates per Column	Analyte Molecular Weight Range (Dalton)*
$G1000H_{HR}$	5	16,000a	<1500
$G2000H_{HR}$	5	16,000a	<4000
$G2500H_{HR}$	5	16,000a	<1.2 x 104
$G3000H_{HR}$	5	16,000b	<3.0 x 104
$G4000H_{HR}$	5	16,000b	<5.5 x 105
$G5000H_{HR}$	5	16,000c	<1.5 x 106
$G6000H_{HR}$	5	16,000c	<~1 x 107
$G7000H_{HR}$	5	16,000c	<~5 x 107
GMH_{HR}-H	5	16,000c	<~1 x 107
GMH_{HR}-L	5	16,000b	<1.0 x 104
GMH_{HR}-M	5	16,000c	<1.0 x 106
GMH_{HR}-N	5	16,000c	<1.5 x 105
$G5000H_{HR}$(S)	13	8000c	<1.5 x 106
$G6000H_{HR}$(S)	13	8000c	<~1 x 107
$G7000H_{HR}$(S)	13	8000c	<~5 x 107
GMH_{HR}-H(S)	13	8000c	<~1 x 107
GMH_{HR}-M(S)	13	8000c	<1.0 x 106

Test Analyte: [a]benzene; [b]n-butylbenzene; [c]dicyclohexylphthalate
Eluent: tetrahydrofuran
Flow Rate: 1.0 mL/min.; Detection: UV, 254 nm
*Polystyrene

Ordering Information:

Progel-TSK H_{HR} Column	Cat. No.
$G1000H_{HR}$	**817352**
$G2000H_{HR}$	**817353**
$G2500H_{HR}$	**817354**
$G3000H_{HR}$	**817355**
$G4000H_{HR}$	**817356**
$G5000H_{HR}$	**817357**
Mixed Bed Columns	
GMH_{HR}-L	**817362**
GMH_{HR}-M	**817392**
Guard Columns	
H_{HR}-L (for $G1000H_{HR}$ – $G4000H_{HR}$ columns)	**817368**

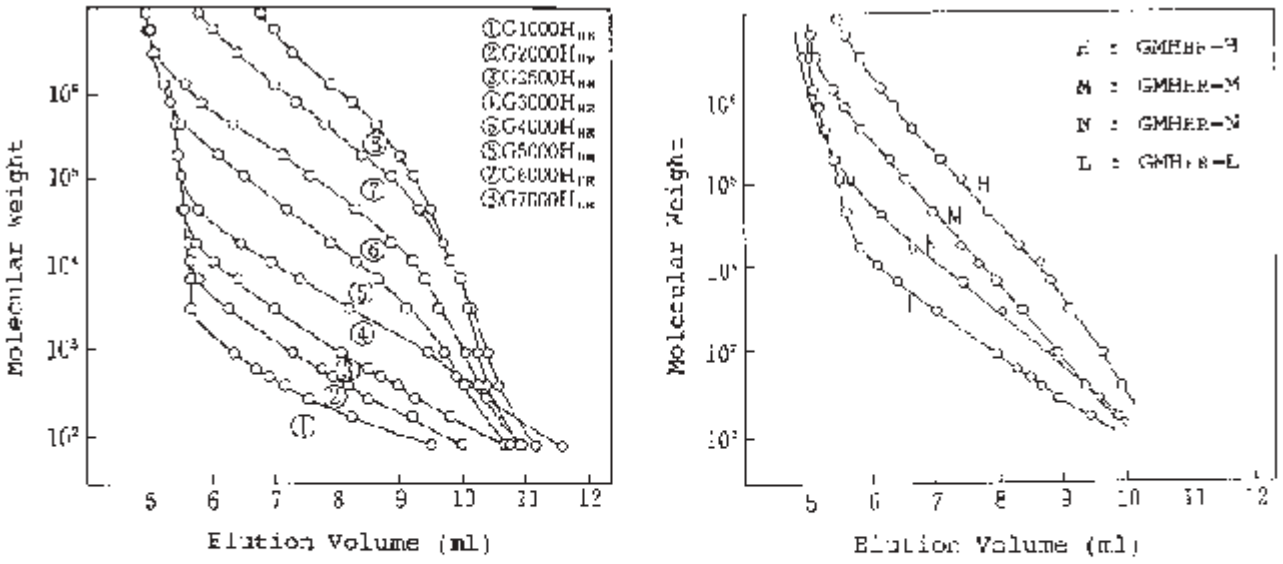
$G5000H_{HR}$, $G6000H_{HR}$, $G7000H_{HR}$, GMH_{HR}-H, and GMH_{HR}-M columns are available with 13 µm preparative grade packings on request.

The following data are from a presentation by K. Komiya, K. Tokunaga, H. Moriyama and Y. Kato, given at PittCon '95 (March 1995, New Orleans, LA USA)

Comparison of Packing Material Swelling in Various Solvents

Solvent	Swelling Ratio *	
	G2000HHR	G2000HXL
Toluene	1.01	1.06
Benzene	1.00	—
THF	1.00	1.00
Acetone	0.99	0.86
DMF	0.99	0.86
Methanol(MeOH)	0.98	
MeOH/H2O(50/50)	0.93	—
H2O	0.86	0.52

*Swelling ratio = (Vol. in Solvent)/(Vol. in THF)



Calibration Curves of TSK-GEL HHR Columns with Std. Polystyrene

Conditions :

Column size : 7.8 mm I.D. X 30 cm

Solvent : THF

Flow rate : 1.0 ml/min

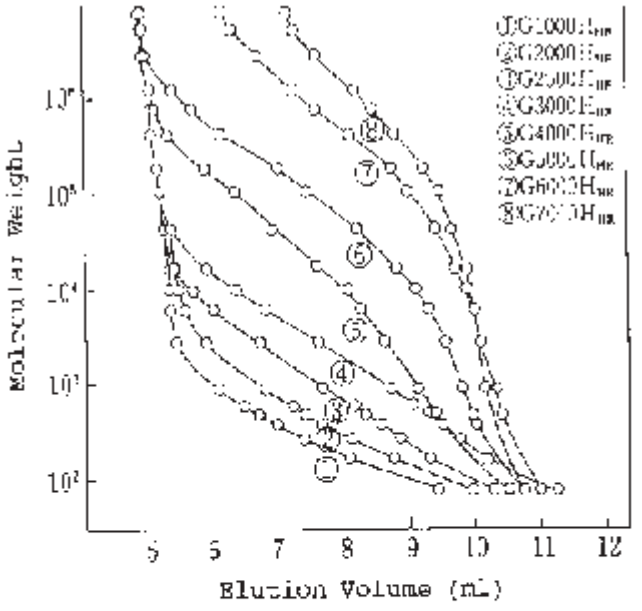
Temperature : 25°C

Detection : UV. at 254 nm

Stability of Column Performance against Solvent exchange

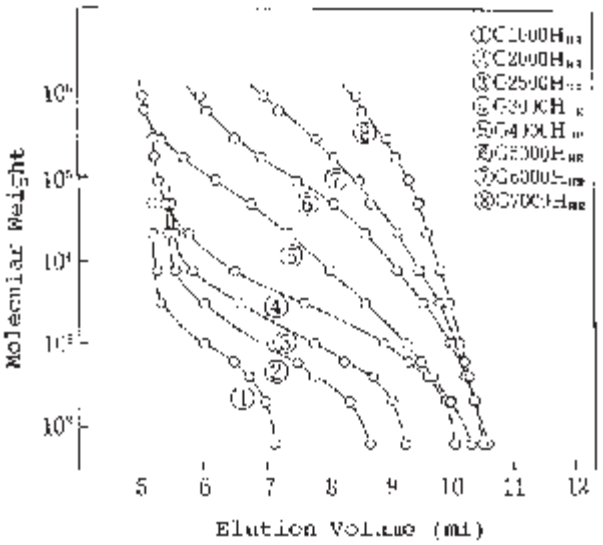
Solvent	Theoretical Plates*(/30 cm)	
	G1000HHR	G1000HXL
1 THF	18,700	20,300
2 Chloroform	19,000	20,400
3 DMF	18,700	17,200
4 HFIP	18,200	void
5 Methylcellosolve	18,500	void
6 DMSO	16,900	–
7 Caebon tetra-chloride	19,500	
8 Ethanol	17,200	

Measuring condition of theoretical plates:
Sample : benzene,0.1%,20 µl
Solvent : THF, Flow rate : 1.0 ml/min
Temperature : 25°C, Detection : UV. at 254 nm



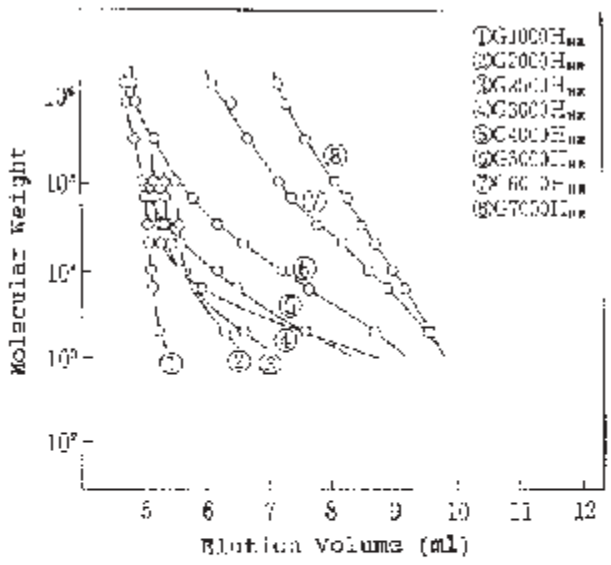
Calibration Curves of TSK-GEL HHR Columns with Std.Polystyrene

Conditions :
Column size : 7.8 mm id. X 30 cm
Solvent : chloroform
Flow rate : 1.0 ml/min
Temperature : 25°C
Detection : UV. at 254 nm



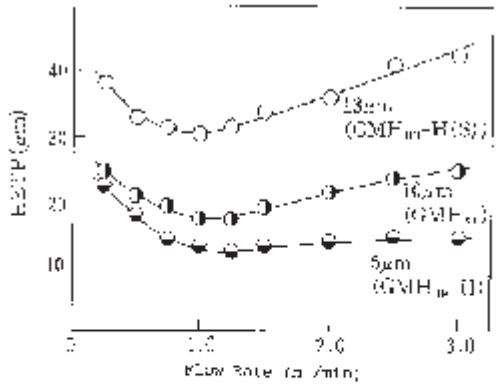
Calibration Curves of TSK-GEL HHR Columns with Std.Polyethyleneoxide

Conditions :
Column size : 7.8 mm id. x 30 cm
Solvent : 10mM lithium bromide in DMF
Flow rate : 1.0 ml/min
Temperature : 25°C
Detection : RI



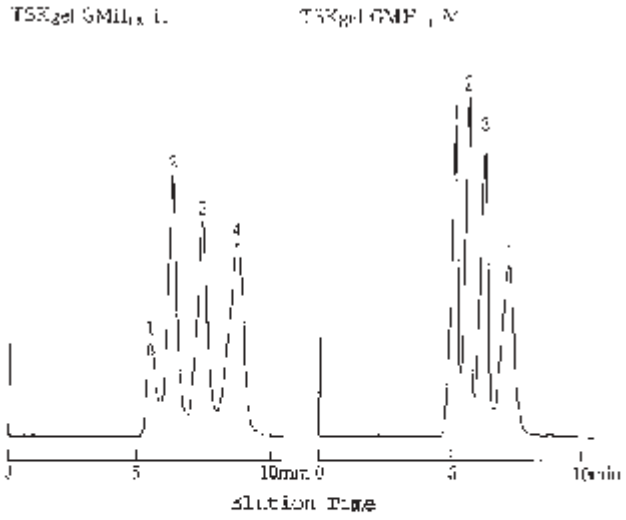
Calibration Curves of TSK-GEL HHR Columns with Std.Polymethylmethacrylate

Conditions :
Column size : 7.8 mm id. x 30 cm
Solvent : 5mM sodium trifluoroacetate in HFIP
Flow rate : 1.0 ml/min
Temperature : 40°C
Detection : UV. at 220 nm



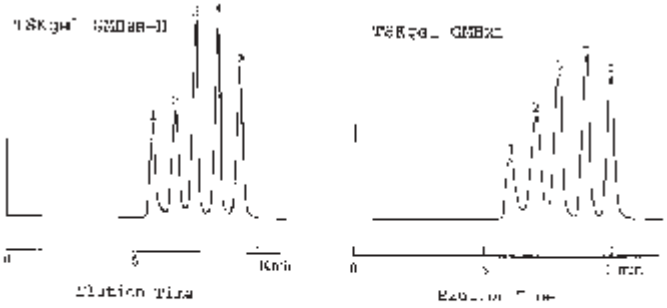
Flow Rate Dependence of HETP on TSKgel H3R and H2L Columns

Conditions :
Column size : 7.8 mm id. x 30 cm
Solvent : THF
Sample : dicyclohexylphthalate, 0.2 mg/ml, 20 μl
Temperature : 25°C Detection : UV. at 254 nm



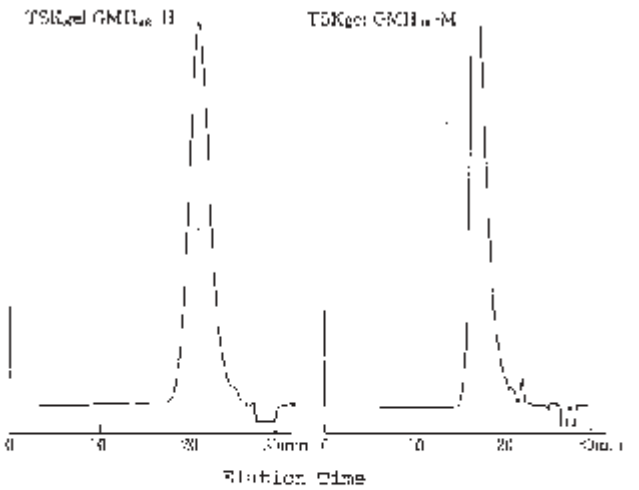
Chromatograms of Std.Polymethylmethacrylate mixture on TSKgel GMEuR-H and GMHR-M Columns

Conditions :
Column size : 7.8 mm id. x 30 cm
Solvent : 5mM sodium trifluoroacetate in THF
Flow rate : 1.0 ml/min Temperature : 40°C
Detection : UV. at 220 nm
Sample : Std.polymethylmethacrylate; 1. MW.820,000, 2. MW.467,000, 3. MW.46,200, 4. MW.1,950



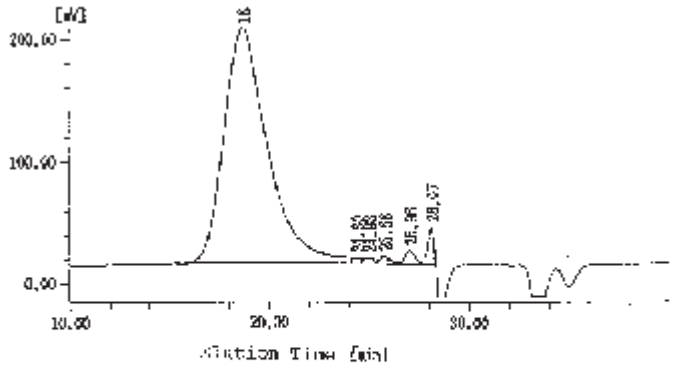
Comparison of Resolution of TSKgel H-R and HXL Columns

Conditions :
Column size : 7.8 mm I.D. x 30 cm
Solvent : THF
Temperature : 25°C Detection : UV. at 254 nm
Sample : Std.polystyrene, 5 μl



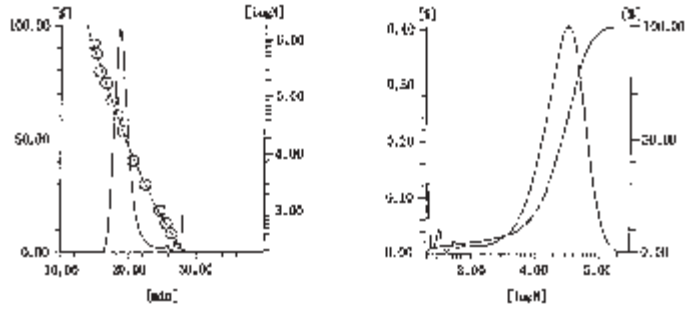
Chromatograms of Polyetherimide on TSKgel GMEuR-H and GMHR-M Columns

Conditions :
Column size : 7.8 mm I.D. x 30 cm
Solvent : 10 mM lithium chloride in N-methylpyrrolidone
Flow rate : 0.75 ml/min
Temperature : 80°C Detection : RI



Chromatogram of Polystyrene on TSKgel GMHHR-M Columns

Conditions :
Column size : 7.8 mm i.d. x 30 cm
Solvent : 10mM lithium bromide in DMF, Flow rate : 1.0 ml/min
Temperature : 40°C Pressure : 60 kgf/cm²
Detection : RI



Molecular Weight Calculation Result

Mn : 1.5875x10⁴ Mw/Mn = 1.01
Mw : 1.6079x10⁴ Mz/Mw = 1.01
Mz : 1.6294x10⁴

Available Solvent List for TSK-GEL HT Columns

THF,Benzene,Toluene,n-Hexane,Decalin
Chloroform,Dichloromethane,Carbon tetra-chloride,
DMF,DMAA,DMSO,N-Methylpyrrolidone
HFIP,TFE,m-Cresol or o-chlorophenol/chloroform
Quinoline,pyridine
1,4-Dioxane,MEK,Acetone,Ethanol
o-Dichlorobenzene,1-Chloronaphthalene,Trichlorobenzene

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