

AGILENT AQUEOUS AND POLAR GPC/SEC COLUMNS



Contents

Agilent GPC/SEC columns.....	3
InfinityLab PL Multisolvent.....	4
PL aquagel-OH SEC columns.....	7
PL Rapide Aqua columns.....	10
PL aquagel-OH preparative SEC columns.....	11
Agilent PolarGel GPC columns.....	12
Agilent Publications.....	14
Agilent GPC/SEC Analysis Systems.....	15

1976

PLgel columns, individual standards, and standard kits

Polymer Laboratories founded to develop market-leading products for organic GPC/SEC



1981

PLgel MIXED columns, PL aquagel columns

MIXED columns improve data quality, and novel chemistries for analysis of water-soluble polymers

1984

GPC software

Dedicated software streamlines GPC/SEC calculations



1993

EasiCal standards

New format shortens sample preparation time and the speed of calibration



1999

PL-GPC 220 instrument

Market-leading high temperature GPC system for even the most difficult samples at temperatures up to 220 °C



AGILENT GPC/SEC COLUMNS

For molecular weight separation in aqueous and polar solvents

Tough

Agilent GPC/SEC columns set the standard for robustness and lifetime across a wide range of solvents and conditions. This uncompromising quality has made it the workhorse of the analytical industry for over 35 years.

Fast

The unmatched chemical and physical stability of Agilent's GPC/SEC media allows for wider pores and larger volumes, which translates to faster separations, higher resolution, and reduced cost-of-analysis.

Inert

The neutral surface and the ability to operate across a wide range of eluent conditions allows for high performance analyses of compounds with neutral, ionic and hydrophobic moieties.



2004

PlusPore columns and EasiVial standards

New chemistries deliver high-pore-volume materials for increased resolution, and EasiVial standards simplify calibration procedures even further



2007

PLgel Olexis columns

Optimized for polyolefin analysis with highest resolution and data quality for even ultrahigh molecular weight samples

2009

1260 Infinity Multi-Detector Suite and PolarGel columns

The 1260 Infinity MDS turns any LC into a powerful multi-detector GPC system, and PolarGel columns analyze polar samples in any solvent system



2015

The 1260 Infinity II Multi-Detector GPC/SEC System

The first choice for accurate, reproducible polymer analysis. Select any combination of light scattering, viscometry and refractive index detection for absolute molecular weights and sizes.



2017

PL MultiSolvent GPC columns

The newest addition to the InfinityLab GPC family, offering solvent flexibility for a variety of GPC analyses all on one column.

INFINITYLAB PL MULTISOLVENT

Part of the
InfinityLab
family

High performance size exclusion chromatography across solvents

- Polymer-coated silica offers excellent resolution without sticking
- Special amphoteric surface chemistry is compatible with aqueous, polar organic, and nonpolar solvents and samples
- Short, efficient, and fast, these columns maximize instrument throughput and minimize labor costs

Characteristics:

pH range: 2 to 8.5

Solvent compatibility: Water, Buffer, Chloroform, Dichloromethane, THF

Typical Pressure: <200 bar (2900 psi) (aqueous buffer)

Maximum Pressure: 400 bar (5800 psi)

Maximum Temperature: 80 °C

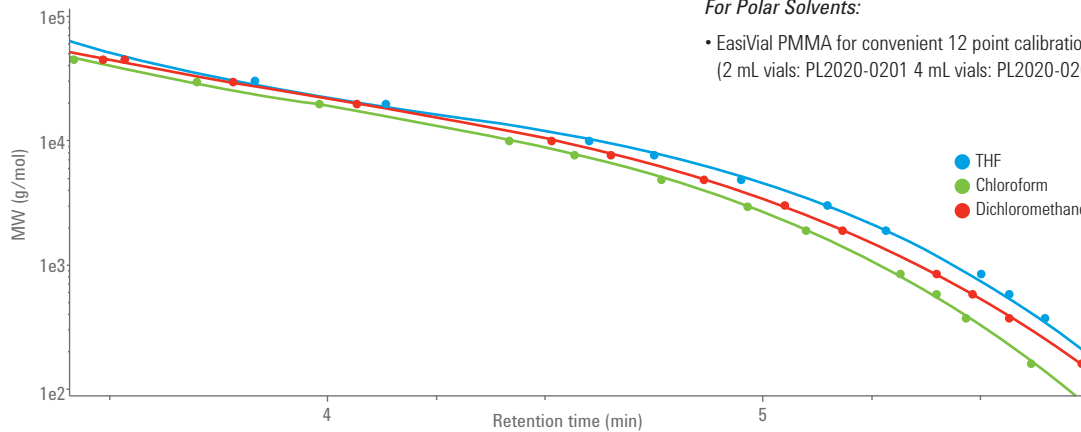
Recommended Calibrants:

For Aqueous Solvents:

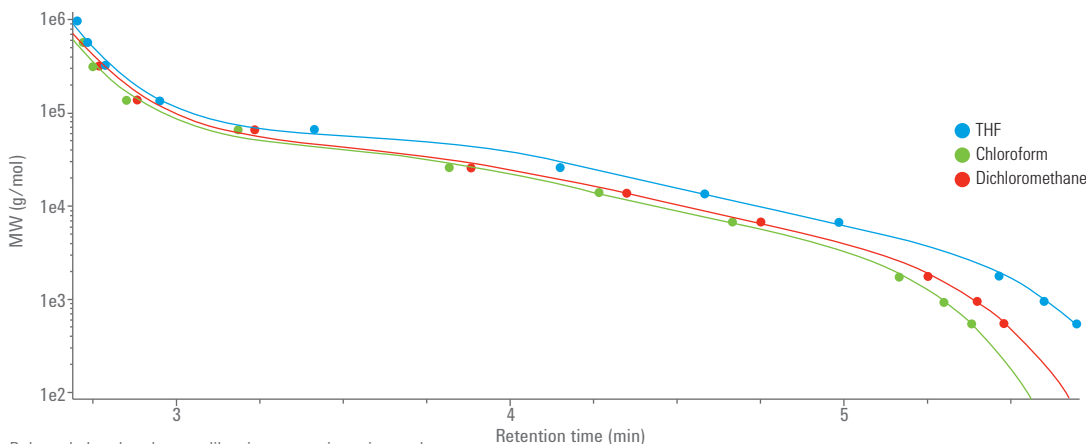
- EasiVial PEG/PEO for convenient 12 point calibration in three preweighed vials (2 mL vials: PL2080-0201 4 mL vials: PL2080-0200)

For Polar Solvents:

- EasiVial PMMA for convenient 12 point calibration in three preweighed vials (2 mL vials: PL2020-0201 4 mL vials: PL2020-0200)



Polystyrene calibration curves in various solvents

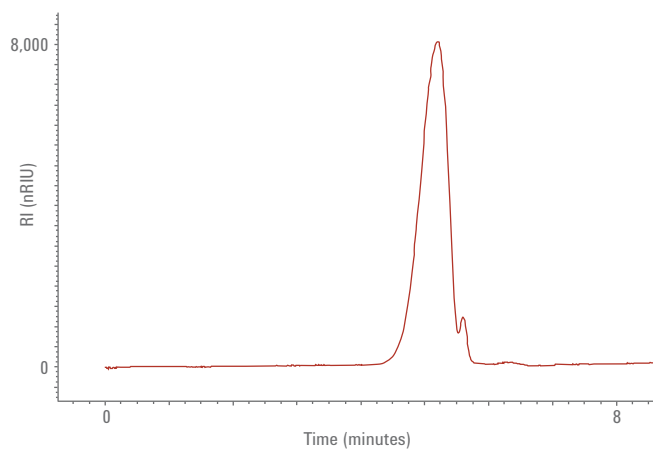


Polymethylmethacrylate calibration curves in various solvents

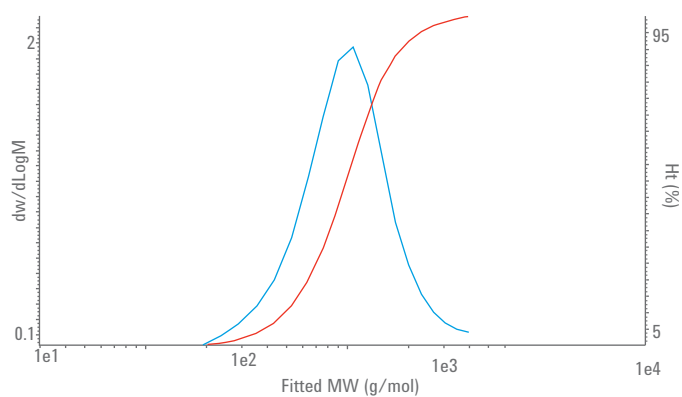
INFINITYLAB PL MULTISOLVENT

Part of the
InfinityLab
family

Column: InfinityLab PL Multisolvant 30 4.6 x 150 mm
Temperature: 25 °C
Solvent: Dichloromethane

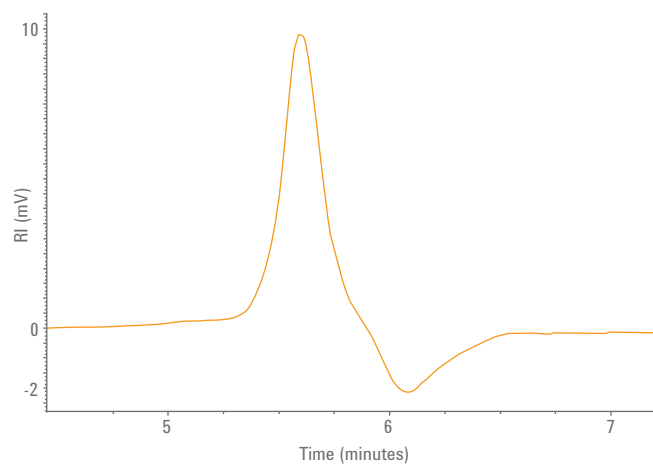


Fast separation of an epoxy sample in dichloromethane

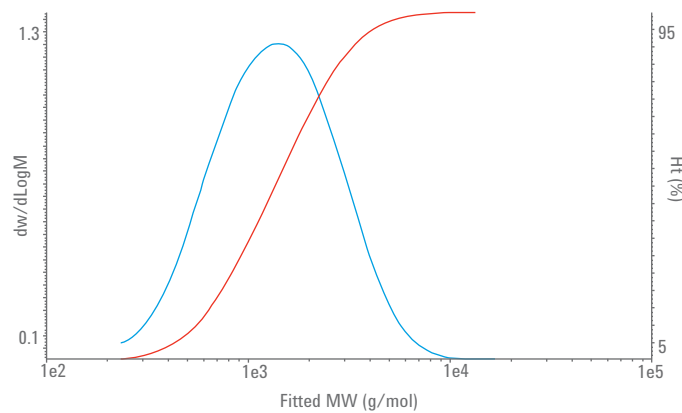


MW distribution of epoxy sample

Column: InfinityLab PL Multisolvant 30 4.6x150 mm
Temperature: 25 °C
Solvent: 10 mM NaH_2PO_4 + 0.2 M NaNO_3 at pH 7



A switch to aqueous buffer and rapid analysis of dextrin



MW distribution of dextrin sample

INFINITYLAB PL MULTISOLVENT

Part of the
InfinityLab
family

Ordering information

InfintyLab PL Multisolvent

Description	MW range (g/mol) (PEG/PEO)	Guaranteed efficiency (p/m)	Part No.
InfintyLab PL Multisolvent 20, 4.6 x 150 mm	up to 30,000	>145,000	PL1515-3321
InfintyLab PL Multisolvent 20, 4.6 x 50 mm			PL1515-1321
InfintyLab PL Multisolvent 20, 7.8 x 150 mm			PL1015-3321
InfintyLab PL Multisolvent 20, 7.8 x 50 mm			PL1015-1321
InfintyLab PL Multisolvent 30, 4.6 x 150 mm	3,000 to 100,000	>145,000	PL1515-3323
InfintyLab PL Multisolvent 30, 4.6 x 50 mm			PL1515-1323
InfintyLab PL Multisolvent 30, 7.8 x 150 mm			PL1015-3323
InfintyLab PL Multisolvent 30, 7.8 x 50 mm			PL1015-1323

Agilent InfinityLab Maximize Your LC Workflow Efficiency

How can you make your LC workflow more efficient, so you can spend more time on your analytical priorities?

Find out—with Agilent InfinityLab—an optimized portfolio of LC instruments, columns, and supplies designed to work together in perfect harmony.

Learn more at:

www.agilent.com/chem/infinitylab



PL AQUAGEL-OH SEC COLUMNS

High performance aqueous size exclusion chromatography

- Highly stable matrix ensures reliable separations, even with modified eluents
- MIXED columns cover a wide spread of molecular weights, eliminating dislocations and inaccurate measurements
- Highly inert towards neutral, polar, anionic, and cationic samples

Characteristics:

pH range: 2-10

Solvent compatibility: Water and buffers containing up to 50% methanol

Typical Pressure: <30 bar (435 psi)

Maximum Pressure: 140 bar (2030 psi)

Maximum Temperature: 90 °C

Recommended Calibrants:

For PL aquagel-OH 5 µm columns:

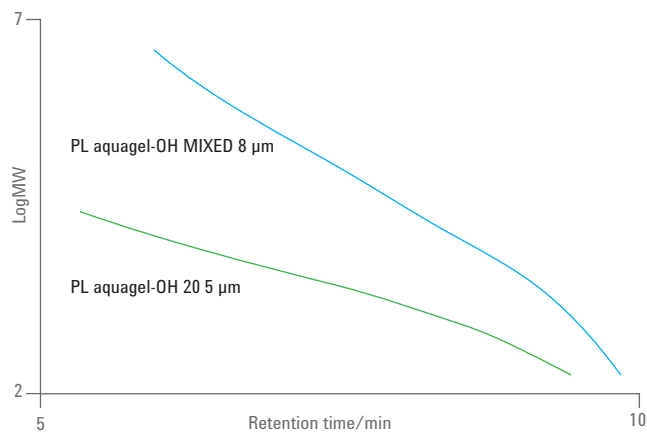
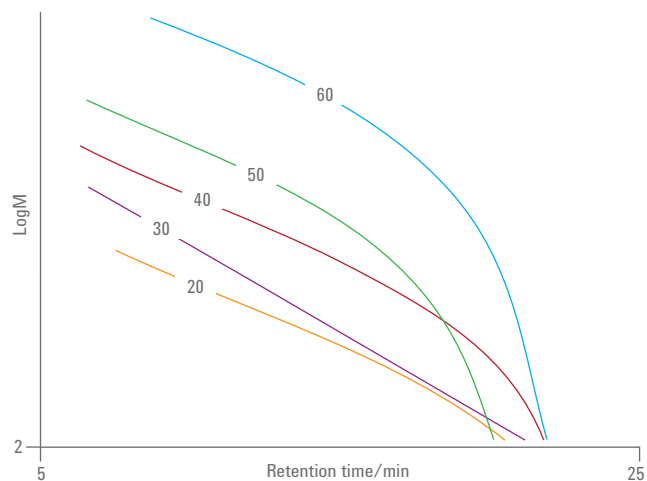
- EasiVial PEG for convenient 12 point calibration in three preweighed vials (2 mL vials: PL2070-0201 4 mL vials: PL2070-0200)

For PL aquagel-OH 8 µm columns:

- EasiVial PEG/PEO for convenient 12 point calibration in three preweighed vials (2 mL vials: PL2080-0201 4 mL vials: PL2080-0200)

For PL aquagel-OH 15 µm columns:

- EasiVial PEG/PEO for convenient 12 point calibration in three preweighed vials (2 mL vials: PL2080-0201 4 mL vials: PL2080-0200)



PL aquagel-OH calibration curves

Tip: Polymers with MW over 2,000,000 are much more likely to suffer from shear degradation. This is largely eliminated by switching from 8 µm to 15 µm particles.

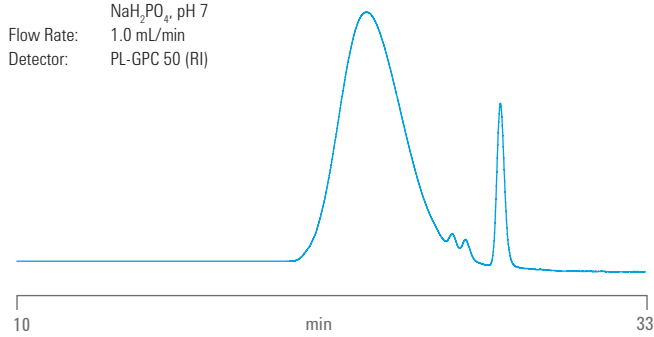
PL AQUAGEL-OH SEC COLUMNS

Typical applications

Heparin, gum, polyacrylic acid, polyacrylamide, pectin, dextran

Conditions

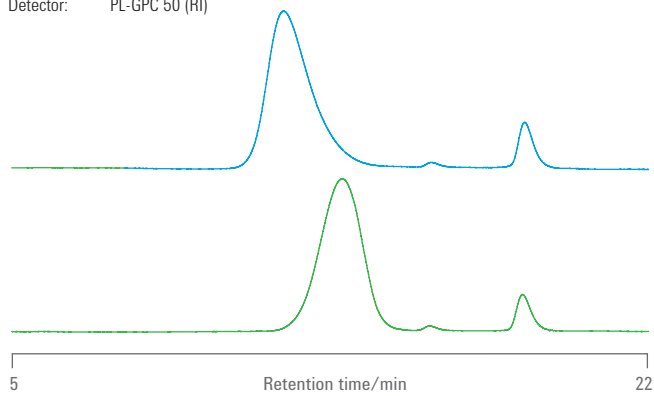
Columns: 3 x PL aquagel-OH MIXED 8 μ m,
7.5 x 300 mm
Eluent: 0.2 M NaNO₃, 0.01 M
NaH₂PO₄, pH 7
Flow Rate: 1.0 mL/min
Detector: PL-GPC 50 (RI)



Polyvinyl alcohol

Conditions

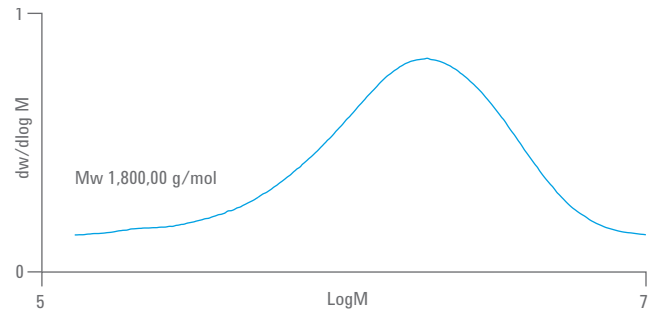
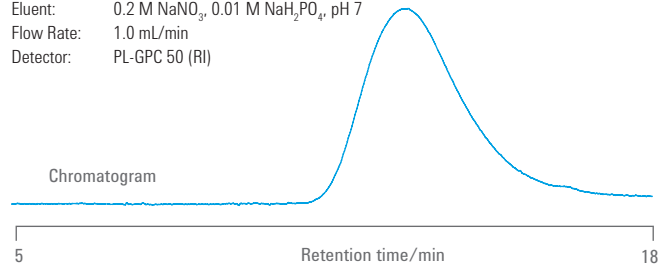
Columns: 2 x PL aquagel-OH 30 8 μ m, 7.5 x 300 mm
Eluent: 0.2 M NaNO₃, 0.01 M NaH₂PO₄, pH 7
Flow Rate: 1.0 mL/min
Detector: PL-GPC 50 (RI)



Heparin

Conditions

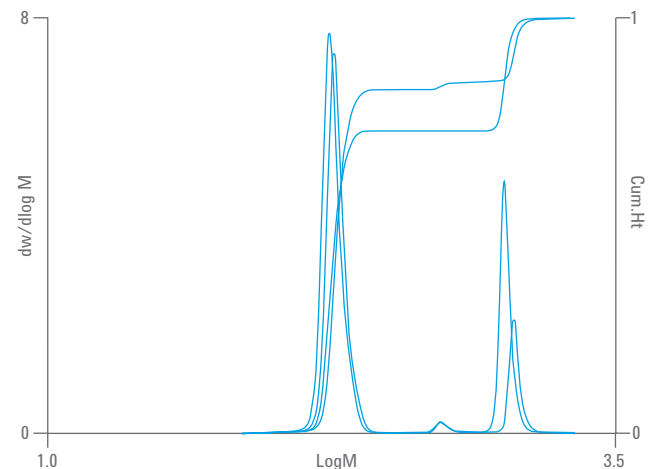
Columns: PL aquagel-OH 60 15 μ m, 7.5 x 300 mm
PL aquagel-OH 40 15 μ m, 7.5 x 300 mm
Eluent: 0.2 M NaNO₃, 0.01 M NaH₂PO₄, pH 7
Flow Rate: 1.0 mL/min
Detector: PL-GPC 50 (RI)



Hyaluronic acid

Conditions

Columns: 2 x PL aquagel-OH 20 5 μ m, 7.5 x 300 mm
Eluent: 0.25 M ammonium formate in water
Flow Rate: 1.0 mL/min
Inj. Vol: 20 μ L
Software: Agilent GPC/SEC software
Detector: Agilent ELS (neb = 30 °C, evap = 30 °C, gas = 1.4 SLM)



Differences in composition of two alkyl naphthalene sulfonates

PL AQUAGEL-OH SEC COLUMNS

Ordering information

PL aquagel-OH columns, 7.5 x 300 mm

Description	Particle size (µm)	MW range (g/mol) (PEG/PEO)	Guaranteed Efficiency (p/m)	Part No.
PL aquagel-OH 20	5	100 to 20,000	>55,000	PL1120-6520
PL aquagel-OH 30	8	100 to 60,000	>35,000	PL1120-6830
PL aquagel-OH 40	8	10,000 to 200,000	>35,000	PL1149-6840
PL aquagel-OH 40	15	10,000 to 200,000	>15,000	PL1149-6240
PL aquagel-OH 50	8	50,000 to 600,000	>35,000	PL1149-6850
PL aquagel-OH 50	15	50,000 to 600,000	>15,000	PL1149-6250
PL aquagel-OH 60	8	200,000 to 10,000,000	>35,000	PL1149-6860
PL aquagel-OH 60	15	200,000 to 10,000,000	>15,000	PL1149-6260
PL aquagel-OH MIXED-H	8	6,000 to 10,000,000	>35,000	PL1149-6800
PL aquagel-OH MIXED-M	8	1,000 to 500,000	>35,000	PL1149-6801

Ordering information

PL aquagel-OH analytical column accessories

Description	Quantity (pk)	Part No.
Frit removal tool for threaded columns only	1	PL1310-0001
Frit (2 µm) kit for threaded columns, 7.5 mm id	5	PL1310-0002
Frit (5 µm) kit for threaded columns, 7.5 mm id	5	PL1310-0012
Column connecting nuts, 1/16 in. tube	5	PL1310-0007
Tubing ferrules, 1/16 in. tube	5	PL1310-0008
LDV intercolumn SS connector	1	PL1310-0005
Connecting tubing, 10 cm length, 0.01 in. id	10	PL1310-0048

Ordering information

PL aquagel-OH Guard columns

Description	Particle size (µm)	id (mm)	Length (mm)	Part No.
PL aquagel-OH Guard	10	25.0	25	PL1249-1120
PL aquagel-OH Guard	5	7.5	50	PL1149-1530
PL aquagel-OH Guard	8	7.5	50	PL1149-1840

See also: *Polymer Calibration Standards, with highly characterized molecular weights, publication 5990-7996EN*

PL RAPIDE AQUA COLUMNS

Fast separations on high dispersion systems

- Maximize throughput when using older systems or multiple detectors
- High sample throughput reduces labor costs per sample
- Net savings of solvents due to reduced analysis time

Characteristics:

pH range: 2-10

Solvent compatibility: Water and buffers containing up to 50% methanol

Typical Pressure: <30 bar (435 psi)

Maximum Pressure: 140 bar (2030 psi)

Maximum Temperature: 90 °C

Recommended Calibrants:

For PL Rapide L columns:

- EasiVial PEG for convenient 12 point calibration in three preweighed vials (2 mL vials: PL2070-0201 4mL vials: PL2070-0200)

For PL Rapide H columns:

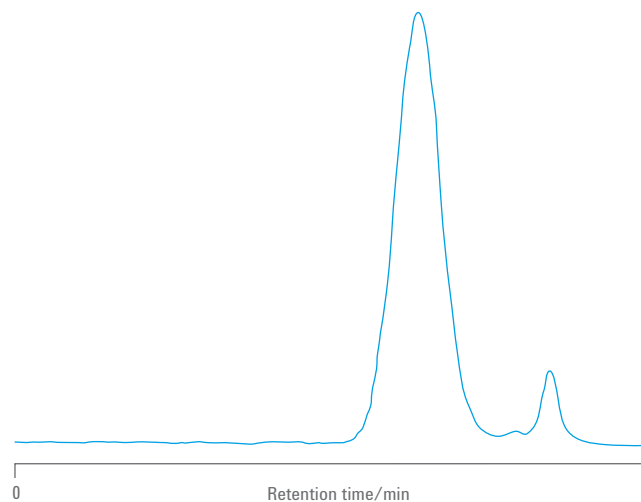
- EasiVial PEG/PEO for convenient 12 point calibration in three preweighed vials (2 mL vials: PL2080-0201 4mL vials: PL2080-0200)

Typical applications

Sodium acrylate

Conditions

Column: PL Rapide Aqua H, 7.5 x 150 mm
 Eluent: Water + 0.2 M NaNO₃, 0.01 M NaH₂PO₄, pH 7
 Flow rate: 1.0 mL/min
 Detector: RI



Sodium acrylate

Ordering information

PL Rapide Aqua columns

Description	MW range (g/mol)	Guaranteed efficiency (p/m)	Part No.
PL Rapide Aqua H, 7.5 x 150 mm	6,000 to 10,000,000	>35,000	PL1149-3800
PL Rapide Aqua H, 10 x 100 mm	6,000 to 10,000,000	>35,000	PL1049-2800
PL Rapide Aqua L, 7.5 x 150 mm	100 to 60,000	>35,000	PL1120-3830
PL Rapide Aqua L, 10 x 100 mm	100 to 60,000	>35,000	PL1020-2830

PL AQUAGEL-OH PREPARATIVE SEC COLUMNS

Rapid and convenient scale-up

- Up to 10 x scale-up for milligram to gram quantities
- Efficient 8 μm particles offer greater speed, purity, and recovery
- High pore volume maximizes loadability

Preparative PL aquagel-OH columns use the same 8 μm particles as standard columns. This enables rapid and reliable scale-up from analytical to preparative separations.

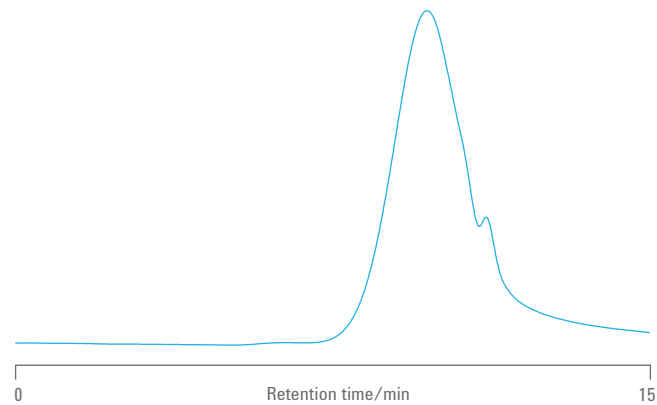
The analytical grade 8 μm media offer much higher efficiency than conventional large particle SEC and GFC columns. This efficiency results in fast separations to maximize throughput, and sharp peak shape to maximize purity and yield from each cut.

Typical applications

Fractionation of disperse polymers, component isolation

Conditions

Column: PL aquagel-OH 40 8 μm , 25 x 300 mm
Eluent: 0.2M NaNO_3 , 0.01M NaH_2PO_4 , pH 7
Flow Rate: 10.0 mL/min
Loading: 10 mg/mL, 2 mL
Detector: RI



Polyvinyl alcohol

Ordering information

PL aquagel-OH preparative columns 8 μm , 25 x 300 mm

Description	MW range (g/mol) (PEG/PEO)	Part No.
PL aquagel-OH 30	100 to 60,000	PL1220-6130
PL aquagel-OH 40	10,000 to 200,000	PL1249-6140
PL aquagel-OH 50	50,000 to 600,000	PL1249-6150
PL aquagel-OH MIXED	6,000 to 10,000,000	PL1249-6100
PL aquagel-OH Guard, 25 x 25 mm		PL1249-1120

AGILENT POLARGEL GPC COLUMNS

For intermediate polarity solvents and polar solvent combinations

- Eliminates the risk of interactions and bad data when using in high polarity solvents such as DMSO, NMP, DMAc, and DMF
- High efficiency and resolution maximizes sample throughput
- Excellent stability and lifetime in challenging polar solvents and at elevated temperatures

Highly polar groups present on some polymers can lead to non-specific interactions and secondary separation mechanisms when using polar solvents. These secondary effects result in distorted chromatograms and inaccurate MW data.

PolarGel “mixed bed” columns have a medium polarity surface and high mechanical stability. They are capable of operating in a wide range of solvents and solvent combinations, greatly enhancing their ability to analyze polar polymers that are not soluble in traditional aqueous or organic solvents.

Characteristics:

pH Range: 2-10

Solvent Range: THF to Water

Particle Size: 8 μm

Efficiency: >35,000 p/m

Typical Pressure: <30 bar (435 psi)

Maximum Pressure: 140 bar (2030 psi)

Maximum Temperature: 80 °C

Recommended Calibrants:

For Polar Solvents:

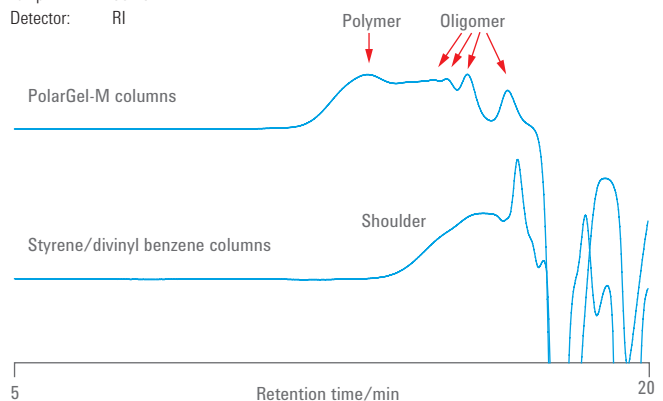
- EasiVial PMMA for convenient 12 point calibration in three preweighed vials (2 mL vials: PL2070-0202 4 mL vials: PL2070-0203)

For Polar/Aqueous Solvents:

- EasiVial PEG/PEO for convenient 12 point calibration in three preweighed vials (2 mL vials: PL2080-0201 4 mL vials: PL2080-0200)

Conditions

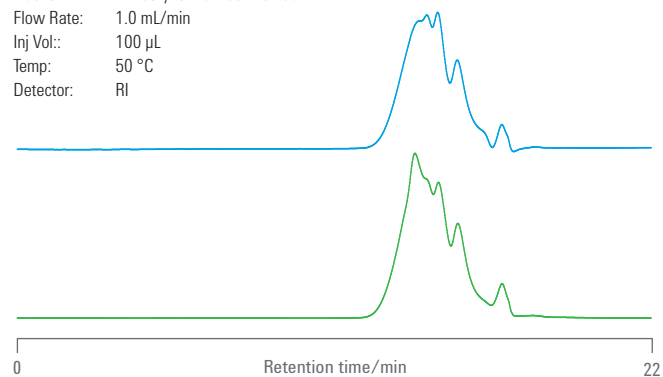
Columns: 2 x PolarGel-M, 7.5 x 300 mm
Sample: Melamine resins
Eluent: Dimethylformamide + 0.1% LiBr
Flow Rate: 1.0 mL/min
Temp: 50 °C
Detector: RI



Superior polar performance from PolarGel columns

Conditions

Columns: 2 x PolarGel-L, 7.5 x 300 mm
Eluent: Dimethylformamide + 0.1% LiBr
Flow Rate: 1.0 mL/min
Inj Vol: 100 μL
Temp: 50 °C
Detector: RI



Two samples of melamine resin analyzed by PolarGel-L

Tip: Buffers in a stored column may crystallize out and cause damage, so flush out the column with water containing a small amount of sodium azide, to prevent biological growth.

AGILENT POLARGEL GPC COLUMNS

Ordering information

PolarGel columns

Description	MW range (g/mol)	Guaranteed efficiency (p/m)	Part No.
PolarGel-L, 7.5 x 300 mm	100 to 60,000	>35,000	PL1117-6830
PolarGel-M, 7.5 x 300 mm	1,000 to 500,000	>35,000	PL1117-6800

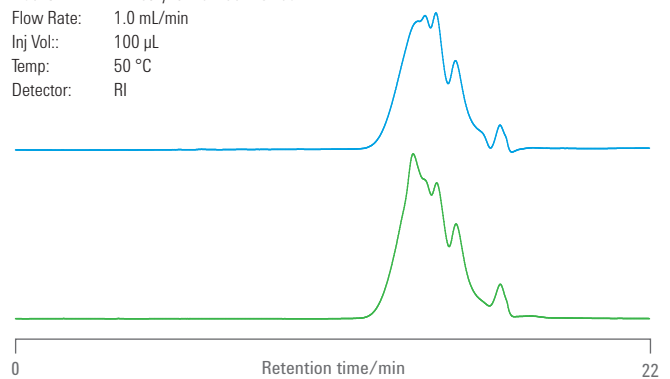
Ordering information

PolarGel Guards 7.5 x 50 mm

Description	Part No.
PolarGel-L Guard column, 7.5 x 50 mm	PL1117-1830
PolarGel-M Guard column, 7.5 x 50 mm	PL1117-1800

Conditions

Columns: 2 x PolarGel-L, 7.5 x 300 mm
 Eluent: Dimethylformamide + 0.1% LiBr
 Flow Rate: 1.0 mL/min
 Inj Vol: 100 µL
 Temp: 50 °C
 Detector: RI



Two samples of melamine resin analyzed by PolarGel-L

Tip: Filter samples through a 0.45 µm filter prior to injection to extend column lifetime.

AGILENT PUBLICATIONS

Further reading

GPC/SEC publication	Publication number
Primers	
An introduction to gel permeation chromatography and size exclusion chromatography	5990-6969EN
Calibrating GPC/SEC columns - a guide to best practice	5991-2720EN
Step-by-step method development in GPC	5991-7272EN
Polymer-to-solvent reference table for GPC/SEC	5991-6802EN
Instrument setup for Fast GPC	5991-7191EN
Application compendia	
Analysis of polymers by GPC/SEC - energy & chemicals applications	5991-2517EN
Analysis of polymers by GPC/SEC - food applications	5991-2029EN
Analysis of polymers by GPC/SEC - pharmaceutical applications	5991-2519EN
Excipient analysis by GPC/SEC and other LC techniques	5990-7771EN
Biodegradable polymers - analysis of biodegradable polymers by GPC/SEC	5990-6920EN
Analysis of engineering polymers by GPC/SEC	5990-6970EN
Analysis of elastomers by GPC/SEC	5990-6866EN
Analysis of polyolefins by GPC/SEC	5990-6971EN
Low molecular weight resins - Analysis of low molecular weight resins and prepolymers by GPC/SEC	5990-6845EN
Product guides	
Aqueous and polar GPC/SEC columns	5990-7995EN
GPC/SEC standards	5990-7996EN



Agilent GPC/SEC calibration standards

Calibrating your GPC/SEC columns with the highest quality polymer standards, Agilent EasiVial and Agilent EasiCal, ensures superior results and boosts productivity through:

- Improved reproducibility
- Improved resolution, leading to better accuracy
- Earlier detection of problems
- Reduced trouble-shooting and system downtime
- Statistically significant analysis of the system

To learn more about calibrating your GPC columns, refer to the primer **Calibrating GPC Columns - A Guide to Best Practice** (5991-2720EN).

Get your copy, and find other useful documents at www.agilent.com/chem/gpcresources

AGILENT GPC/SEC ANALYSIS SYSTEMS

The Agilent 1260 Infinity II GPC/SEC system and 1260 Infinity II Multi-Detector GPC/SEC system are part of Agilent InfinityLab, an optimized portfolio of LC instruments, columns and supplies that work together seamlessly for maximum efficiency and performance.



The Agilent 1260 Infinity II GPC/SEC system has been designed to meet the challenges of today's polymer analyst.

The system features the new Infinity II refractive index detector for exceptional improvements in resolution and speed. The newly developed vialsampler offers higher unattended sample throughput, while the multicolumn thermostat provides accurate temperature control to minimize detector noise and baseline drift. The updated isocratic pump allows for extra flow precision to maximize reproducibility and accuracy in MW measurements.



The Agilent 1260 Infinity II Multi-Detector GPC/SEC system is the first choice for accurate, reproducible polymer analysis. Select any combination of light scattering, viscometry and refractive index detection for absolute molecular weights and sizes.

The system provides a wealth of information regarding polymer structure and it is also possible to identify and quantify properties such as branching which can influence processing and physical properties. Precise temperature control minimizes equilibration time and maximizes sample throughput.



Innovative InfinityLab supplies that simplify your work

- Handle mobile phases with ease using ergonomic, easy-grip solvent bottles
- Prevent harmful solvents from leaching into the air with InfinityLab Stay Safe caps
- Safely control solvent drainage with InfinityLab Anti-Drain Fitting
- Ensure leak-free column connections with InfinityLab Quick Connect Fittings

Calibration is key to generating reliable and accurate GPC data.
To learn more, refer to the primer:

Calibrating GPC Columns—A Guide to Best Practice

Publication 5991-2720EN



Learn more

www.agilent.com/chem/gpcresources

Buy online

www.agilent.com/chem/store

Find a local Agilent customer center
in your country

www.agilent.com/chem/contactus

USA and Canada

1-800-227-9770

agilent_inquiries@agilent.com

Europe

info_agilent@agilent.com

Asia Pacific

inquiry_lsca@agilent.com

India

india-lsca_marketing@agilent.com

This information is subject to change without notice.

© Agilent Technologies, Inc. 2017
Printed in the USA July 1, 2017
5990-7995EN