# AGILENT ORGANIC GPC/SEC COLUMNS


Agilent Technologies

# Contents



**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

# PLGEL GPC COLUMNS

## For molecular weight separation using organic solvents

**Robust**

PLgel media is a highly cross-linked Polystyrene-Divinylbenzene (PS-DVB) gel, which offers unequalled stability for a broad range of solvents and temperatures.

**Innovative**

As polymer analysis has evolved, so have we. Modern HPLC users can now benefit from Agilent's newest innovations in GPC columns, enabling drastically improved speed and resolution in a wide range of applications.

**Reliable**

For over 40 years, Agilent has continuously manufactured reliable, reproducible PLgel columns for critical industry applications.

**Agilent Innovations**

- **InfinityLab PlusPore** - for next generation fast GPC of a wide range of compounds
- **InfinityLab PLgel Olexis** - for optimized performance during high temperature analysis
- **PLgel MIXED LS** - for noise-free light scattering analysis
- **PLgel Preparative** - for fast sample preparation fractionation, and offline analysis.

**Not sure where to start? Learn more:**

- Step-by-Step Method Development for GPC/SEC (5991-7272EN)
- Polymer-to-Solvent Reference Table for GPC/SEC (5991-6802EN)
- Instrument Setup for Fast GPC (5991-7191EN)

**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.

# PLGEL GPC COLUMNS

## Solvent compatibility

The choice of solvent in GPC is critical to ensure the prevention of secondary interactions leading to incorrect MW measurements. Analytes must have similar polarity to the solvent to prevent these interactions.

To find the best solvent for your samples, refer to the Polymer-to-Solvent Reference Table for GPC/SEC, publication 5991-6802EN.

### Compatible solvents

| Solvent polarity | Solvent |
|---|---|
| 6.0 | Perfluoroalkane |
| 7.3 | Hexane |
| 8.2 | Cyclohexane |
| 8.9 | Toluene |
| 9.1 | Ethyl acetate |
| 9.1 | Tetrahydrofuran (THF) (Stabilized only) |
| 9.3 | Chloroform (Stabilized only) |
| 9.3 | Methyl ethyl ketone (MEK) |
| 9.7 | Dichloromethane |
| 9.8 | Dichloroethene |
| 9.9 | Acetone |
| 10.0 | o-Dichlorobenzene (o-DCB) |
| 10.0 | Trichlorobenzene (TCB) |
| 10.2 | m-Cresol |
| 10.2 | o-Chlorophenol (o-CP) |
| 10.7 | Pyridine |
| 10.8 | Dimethyl acetamide (DMAc) |
| 11.3 | n-Methyl pyrrolidone (NMP) |
| 12.0 | Dimethyl sulfoxide (DMSO) |
| 12.1 | Dimethyl formamide (DMF ) |

## PLgel column conditions

- Can be run at temperatures up to 220 °C, and at pressures up to 150 bar
- Tolerate organic solvents at pH 1-14 and up to 10% water can be used in miscible organic solvents
- Are supplied in ethyl benzene and can be transferred between solvents for different polymer analyses without risk of degradation

### PLgel frit porosity

| Media Type | Porosity (µm) |
|---|---|
| PLgel 3 µm | 2 |
| PLgel 5 µm | 2 |
| PLgel 10 µm | 5 |
| PLgel 20 µm | 10 |

### Ordering information

PLgel 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 |
| Frit (10 µm) kit for threaded columns, 7.5 mm id | 5 | PL1310-0036 |
| PLgel 10 µm column repair gel | 1 | PL1410-0101 |
| PLgel 5 µm column repair gel | 1 | PL1410-0501 |
| Column connecting nuts, 1/16 inch tube | 5 | PL1310-0007 |
| Tubing ferrules, 1/16 inch tube | 5 | PL1310-0008 |
| Connecting tubing, 10 cm length, 0.01 inch id | 10 | PL1310-0048 |

For full instructions on solvent use, refer to the GPC/SEC Column User Guide, publication 5991-3792EN

# INFINITYLAB PLUSPORE COLUMNS

Part of the **InfinityLab** family

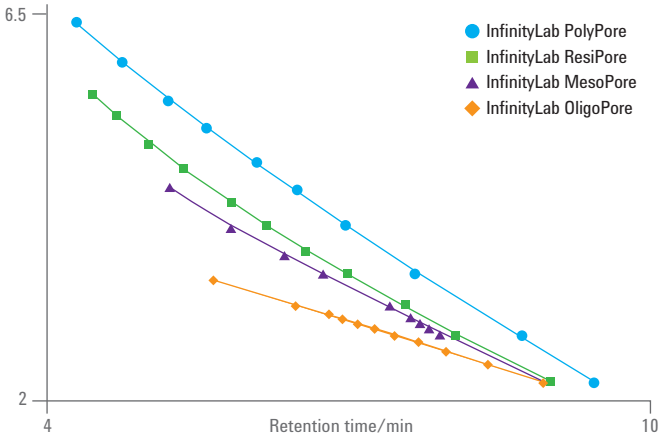
## Next generation GPC particles

- Separate many common samples in under 10 minutes
- High efficiencies and large pore volumes give very high resolution
- Optimized separation over 4 common MW ranges

The InfinityLab PlusPore family of GPC columns uses small, high efficiency media with improved pore volumes to maximize the overall separation.

Multiple pore sizes are present on each PS-DVB particle to further increase efficiency, while still offering a wide MW range with no dislocations.

These columns offer a substantial improvement in both speed and resolution over existing GPC technologies, without sacrificing key factors like reliability and stability.



InfinityLab PlusPore calibration curves

### PlusPore selection guide

| Column | MW Range (g/mol) (PS) | Nominal Particle Size (µm) | Typical efficiency (p/m) | Recommended calibrants | Frit porosity (µm) |
|---|---|---|---|---|---|
| InfinityLab PolyPore | 200 to 2,000,000 | 5 | >60,000 | EasiCal PS-1or EasiVial PS-H | 2 |
| InfinityLab ResiPore | up to 500,000 | 3 | >80,000 | EasiCal PS-2 or EasiVial PS-M | 2 |
| InfinityLab MesoPore | up to 25,000 | 3 | >80,000 | Polystyrene S-L-10 Kit | 2 |
| InfinityLab OligoPore | up to 3,300 | 6 | >55,000 | Polystyrene S-L2-10 Kit | 2 |

# INFINITYLAB POLYPORE

Part of the **InfinityLab** family

## Unrivalled resolution of general polymers

- Optimized for the separation of large polymers and broad MW distributions
- High efficiency particles result in shorter runs and superior resolution
- High performance over the widest range of MWs

**Characteristics**

| | |
|---|---|
| Nominal particle size: | 5 µm |
| Linear MW operating range: | 200 to 2,000,000 g/mol (PS equivalent) |
| Guaranteed column efficiency: | >60,000 p/m |
| Typical pressure: | 1 mL/min (7.5 mm id): ≈ 30 bar (145 psi) per 300 mm (THF @ 25 °C, TCB @ 140 °C) |
| Maximum flow rate: | 7.5 mm id: 1.5 mL/min |
| Maximum pressure: | 150 bar (2175 psi) |
| Maximum temperature: | 150 °C |
| Recommended number of columns/set: | 2x 300 mm |

Recommended calibrants:

- EasiVial PS-H for convenient 12 point calibration in three preweighed vials (2 mL vials: PL2010-0201, 4 mL vials: PL2010-0200)
- EasiCal PS-1 for a 10 point calibration in an easy, stir-in format

See publication 5990-7996EN, GPC/SEC Standards Product Guide

### Ordering Information

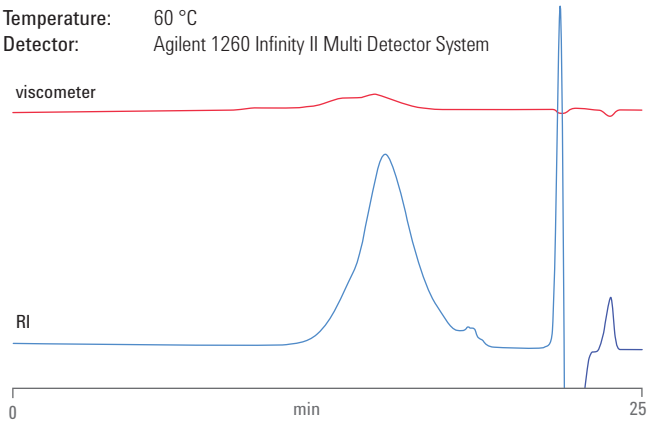
| Description | Part No. |
|---|---|
| InfinityLab PolyPore, 2.1 x 250 mm | PL1913-5500 |
| InfinityLab PolyPore, 4.6 x 250 mm | PL1513-5500 |
| InfinityLab PolyPore, 7.5 x 300 mm | PL1113-6500 |
| InfinityLab PolyPore Guard, 4.6 x 50 mm | PL1513-1500 |
| InfinityLab PolyPore Guard, 7.5 x 50 mm | PL1113-1500 |

### Typical applications

Polystyrenes, polycarbonates, polyurethanes, polysiloxanes

**Conditions**

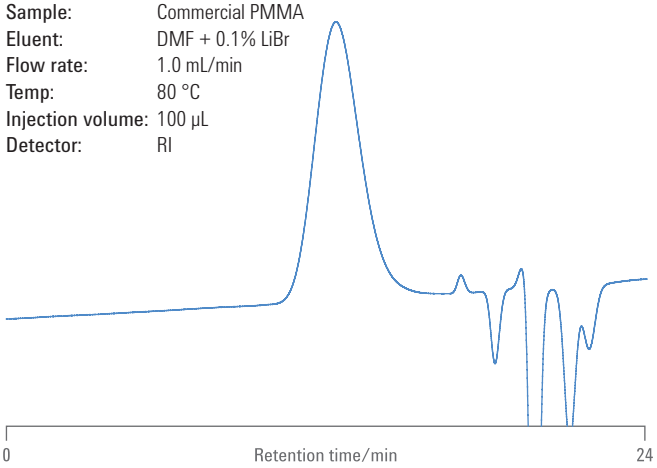
| | |
|---|---|
| Columns: | 2x InfinityLab PolyPore, 7.5 x 300 mm |
| Eluent: | Toluene |
| Flow rate: | 1.0 mL/min |
| Temperature: | 60 °C |
| Detector: | Agilent 1260 Infinity II Multi Detector System |




Analysis of polydimethylsiloxane (PDMS)

**Conditions**

| | |
|---|---|
| Columns: | 2x InfinityLab PolyPore, 7.5 x 300 mm |
| Sample: | Commercial PMMA |
| Eluent: | DMF + 0.1% LiBr |
| Flow rate: | 1.0 mL/min |
| Temp: | 80 °C |
| Injection volume: | 100 µL |
| Detector: | RI |




Polymethylmethacrylate in DMF

# INFINITYLAB RESIPORE

Part of the **InfinityLab** family

## High resolution of resins and condensation polymers

- Optimized for the separation of medium MW polymers
- 3 µm particles offer the highest efficiency and resolution
- Excellent performance over a broad MW range

InfinityLab ResiPore columns are the ideal choice for the analysis of resins and condensation polymers with complex molecular weight distributions that include oligomer content. By combining a low 3 µm particle size and high pore volume, high efficiency InfinityLab ResiPore columns offer maximum resolution of these intermediate molecular weight polymers.

**Characteristics**

| | |
|---|---|
| Nominal particle size: | 3 µm |
| Linear MW operating range: | up to 500,000 g/mol (PS equivalent) |
| Guaranteed column efficiency: | >80,000 p/m |
| Typical pressure: | 1 mL/min (7.5 mm id): ≈ 50 bar (145 psi) per 300 mm (THF @ 25 °C, TCB @ 140 °C) |
| Maximum flow rate: | 7.5 mm id: 1.5 mL/min |
| Maximum pressure: | 150 bar (2175 psi) |
| Maximum temperature: | 110 °C |
| Recommended number of columns/set: | 2x 300 mm |

Recommended calibrants:

- EasiVial PS-M for convenient 12 point calibration in three pre-weighed vials (2 mL vials: PL2010-0301, 4 mL vials: PL2010-0300)
- EasiCal PS-2 for a 10 point calibration in an easy, stir-in format

See publication 5990-7996EN, GPC/SEC Standards Product Guide

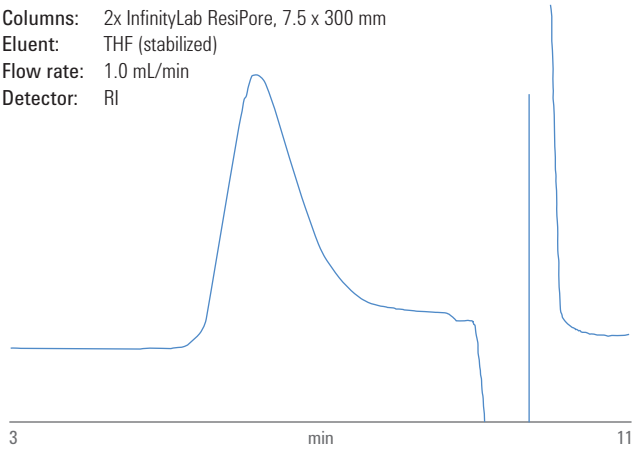
### Ordering Information

| Description | Part No. |
|---|---|
| InfinityLab ResiPore, 2.1 x 250 mm | PL1913-5300 |
| InfinityLab ResiPore, 4.6 x 250 mm | PL1513-5300 |
| InfinityLab ResiPore, 7.5 x 300 mm | PL1113-6300 |
| InfinityLab ResiPore Guard, 4.6 x 50 mm | PL1513-1300 |
| InfinityLab ResiPore Guard, 7.5 x 50 mm | PL1113-1300 |

### Typical applications

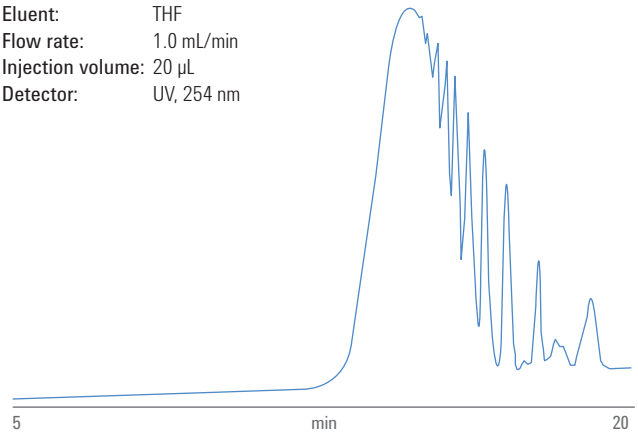
Epoxy resins, polyester resins, silicone fluids, polyolefin waxes

**Conditions**
Columns: 2x InfinityLab ResiPore, 7.5 x 300 mm
Eluent: THF (stabilized)
Flow rate: 1.0 mL/min
Detector: RI




Rapid analysis of commercial paint resin

**Conditions**
Columns: 2x InfinityLab ResiPore, 7.5 x 300 mm
Eluent: THF
Flow rate: 1.0 mL/min
Injection volume: 20 µL
Detector: UV, 254 nm




High resolution analysis of a commercial polyester and its oligomers

# INFINITYLAB MESOPORE

Part of the **InfinityLab** family

## Unsurpassed separation of prepolymers and low MW resins

- Optimized for the separation of low MW polymers, prepolymers, and additives
- 3 µm particles offer the highest efficiency and resolution
- Best for identifying higher oligomers, plasticizers, and residues

InfinityLab MesoPore columns have been designed to give optimum results in the analysis of polymeric materials with a large oligomeric content. By combining a 3 µm particle size with high pore volume, InfinityLab MesoPore columns give the highest resolution separations for the analysis of low molecular weight polymers, such as prepolymers, resins, polyols, and siloxanes.

**Characteristics**

| | |
|---|---|
| Nominal particle size: | 3 µm |
| Linear MW operating range: | up to 25,000 g/mol (PS equivalent) |
| Guaranteed column efficiency: | >80,000 p/m |
| Typical pressure: | 1 mL/min (7.5 mm id): ≈ 50 bar (145 psi) per 300 mm (THF @ 25 °C, TCB @ 140 °C) |
| Maximum flow rate: | 7.5 mm id: 1.5 mL/min |
| Maximum pressure: | 150 bar (2175 psi) |
| Maximum temperature: | 110 °C |
| Recommended number of columns/set: | 1x 300 mm (optimized system), 2x 300 (other systems) |

Recommended calibrants:

- EasiVial PS-L for convenient 12 point calibration in three pre-weighed vials (2 mL vials: PL2010-0401, 4 mL vials: PL2010-0400)
- For polar solvents and alternative calibrations, EasiVial PEG offers the same 12 point calibration in three pre-weighed vials (2 mL vials: PL2070-0201, 4 mL vials: PL2070-0200)

See publication 5990-7996EN, GPC/SEC Standards Product Guide

### Ordering Information

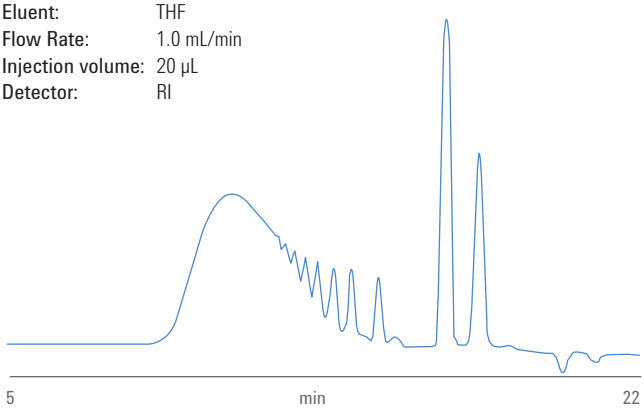
| Description | Part No. |
|---|---|
| InfinityLab MesoPore, 2.1 x 250 mm | PL1913-5325 |
| InfinityLab MesoPore, 4.6 x 250 mm | PL1513-5325 |
| InfinityLab MesoPore, 7.5 x 300 mm | PL1113-6325 |
| InfinityLab MesoPore Guard, 4.6 x 50 mm | PL1513-1325 |
| InfinityLab MesoPore Guard, 7.5 x 50 mm | PL1113-1325 |

### Typical applications

Prepolymers, resins, polyols, siloxanes

**Conditions**

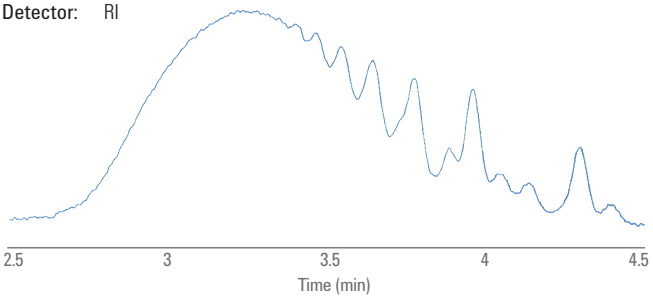
| | |
|---|---|
| Columns: | 2x InfinityLab MesoPore, 7.5 x 300 mm |
| Eluent: | THF |
| Flow Rate: | 1.0 mL/min |
| Injection volume: | 20 µL |
| Detector: | RI |




Polyurethanes

**Conditions**

| | |
|---|---|
| Columns: | InfinityLab MesoPore, 4.6 x 250 mm |
| Eluent: | THF (stabilized) |
| Flow Rate: | 1.2 mL/min |
| Detector: | RI |




Fast epoxy analysis

# INFINITYLAB OLIGOPORE

Part of the **InfinityLab** family

## Excellent resolution of oligomeric samples with analytical and preparative columns

- Optimized particles for separation of individual compounds by MW
- Unique ultrahigh pore volume particles provide maximum separation of small molecules
- Individual identification of oligomers, additives, and impurities

InfinityLab OligoPore columns use a unique, high pore volume polymeric particle to achieve extremely high levels of resolution for small molecules and oligomers. The highly reproducible and predictable separation allows for easy batch identification ('fingerprinting') as well as quantitation of residues, impurities, and additives.

**Characteristics**

| | |
|---|---|
| Nominal particle size: | 6 µm |
| Linear MW operating range: | up to 3,300 g/mol (PS equivalent) |
| Guaranteed column efficiency: | >55,000 p/m |
| Typical pressure: | 1 mL/min (7.5 mm id): ≈ 30 bar (145 psi) per 300 mm (THF @ 25 °C, TCB @ 140 °C) |
| Maximum flow rate: | 7.5 mm id: 1.5 mL/min |
| Maximum pressure: | 150 bar (2175 psi) |
| Maximum temperature: | 110 °C |
| Recommended number of columns/set: | 1x 300 mm (optimized system), 2x 300 (other systems) |

Recommended calibrants:

- EasiVial PS-L for convenient 12 point calibration in three pre-weighed vials (2 mL vials: PL2010-0401, 4 mL vials: PL2010-0400)
- For polar solvents and alternative calibrations, EasiVial PEG offers the same 12 point calibration in three pre-weighed vials (2 mL vials: PL2070-0201, 4 mL vials: PL2070-0200)

See publication 5990-7996EN, GPC/SEC Standards Product Guide

### Ordering Information

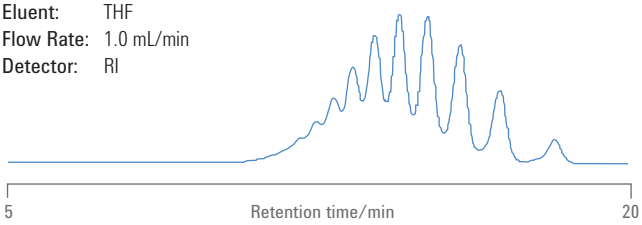
| Description | Part No. |
|---|---|
| InfinityLab OligoPore, 2.1 x 250 mm | PL1913-5520 |
| InfinityLab OligoPore, 4.6 x 250 mm | PL1513-5520 |
| InfinityLab OligoPore, 7.5 x 300 mm | PL1113-6520 |
| InfinityLab OligoPore, 25 x 300 mm | PL1213-6520 |
| InfinityLab OligoPore Guard, 4.6 x 50 mm | PL1513-1320 |
| InfinityLab OligoPore Guard, 7.5 x 50 mm | PL1113-1320 |

### Typical applications

Polyurethanes, epoxy resins, polystyrenes

**Conditions**

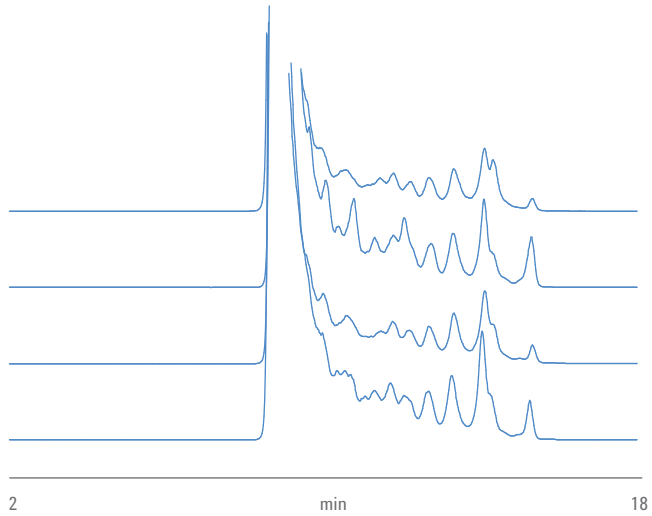
Columns: 2x InfinityLab OligoPore, 7.5 x 300 mm
Eluent: THF
Flow Rate: 1.0 mL/min
Detector: RI




Rapid isolation of individual oligomers in polystyrene sample

**Conditions**

Columns: 2x InfinityLab OligoPore, 7.5 x 300 mm
Eluent: THF (stabilized)
Flow Rate: 1.0 mL/min
Detector: 1260 Infinity II ELSD (neb = 40 °C, evap = 60 °C, gas = 1.5 SLM)




Ultrahigh resolution of oligomers and additives in epoxy batches

# PL RAPIDE COLUMNS

## Maximizing speed and resolution on high dispersion systems

- High-speed analysis even when used with older systems or high dispersion detectors
- Maximizes sample throughput on existing systems with minimal investment
- Simple, drop-in replacement for older technologies

The PL Rapide column offers high speed and resolution on high dispersion systems by combining high efficiency PLgel media with high flow rates.

High flow rates minimize the efficiency loss caused by the high dead volumes found in older instruments and large flowcell detectors. Despite the increase in flowrate, the reduction in runtime means that total solvent consumption is also reduced.

For more information, refer to Instrument Setup for Fast GPC (5991-7191EN)

**Characteristics**

| | |
|---|---|
| Typical pressure: | <30 bar per column |
| Maximum flow rate: | 10 mm id: 3.0 mL/min<br>7.5 mm id: 1.5 mL/min |
| Maximum pressure: | 150 bar (2175 psi)<br>100 bar (1450 psi) |
| Maximum temperature: | 220 °C (Rapide H), 150 °C (Rapide M),<br>110 °C (Rapide L and F) |
| Recommended number of columns/set: | 3x 100 mm or 2x 150 mm |

Recommended calibrants:

- EasiVial PS-H for convenient 12 point calibration in three preweighed vials (2 mL vials: PL2010-0201, 4 mL vials: PL2010-0200)
- EasiCal PS-1 for a 10 point calibration in an easy, stir-in format

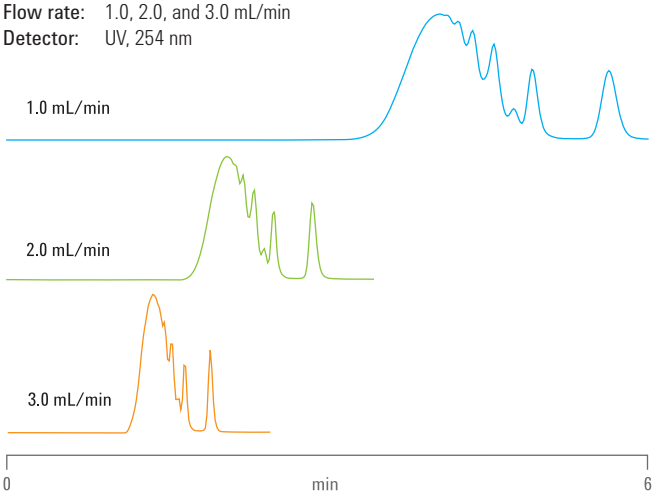
See publication 5990-7996EN, GPC/SEC Standards Product Guide

### Typical applications

Epoxy resins, process monitoring, flow injection analysis

**Conditions**

| | |
|---|---|
| Columns: | PL Rapide L, 10 x 100 mm |
| Sample: | Epoxy resin |
| Eluent: | THF |
| Flow rate: | 1.0, 2.0, and 3.0 mL/min |
| Detector: | UV, 254 nm |




PL Rapide columns show minimal resolution loss at high flow rates

### Ordering information

| Description | MW range (g/mol) | Guaranteed efficiency (p/m) | Part No. |
|---|---|---|---|
| PL Rapide H, 7.5 x 150 mm | 500 to 10,000,000 | >40,000 | PL1113-3100 |
| PL Rapide H, 10 x 100 mm | 500 to 10,000,000 | >40,000 | PL1013-2100 |
| PL Rapide M, 7.5 x 150 mm | 200 to 2,000,000 | >60,000 | PL1113-3500 |
| PL Rapide M, 10 x 100 mm | 200 to 2,000,000 | >60,000 | PL1013-2500 |
| PL Rapide L, 7.5 x 150 mm | 200 to 500,000 | >80,000 | PL1113-3300 |
| PL Rapide L, 10 x 100 mm | 200 to 500,000 | >80,000 | PL1013-2300 |
| PL Rapide F, 7.5 x 150 mm | up to 3,300 | >55,000 | PL1113-3120 |
| PL Rapide F, 10 x 100 mm | up to 3,300 | >55,000 | PL1013-2120 |

# NARROW BORE COLUMNS

## Reduced solvent use

- Reduce solvent use by 70 % (4.6 mm) to 93 % (2.1 mm).
- Store less solvent and increase operator safety.
- Reduce environmental impact and disposal costs of chlorinated and VOC solvents.

To help customers improve their safety and reduce their environmental impact, Agilent offers columns in 4.6 and 2.1 mm diameters for reduced solvent consumption.

These narrow bore columns reduce flow rates while still meeting the same standards for performance, stability, and solvent compatibility.

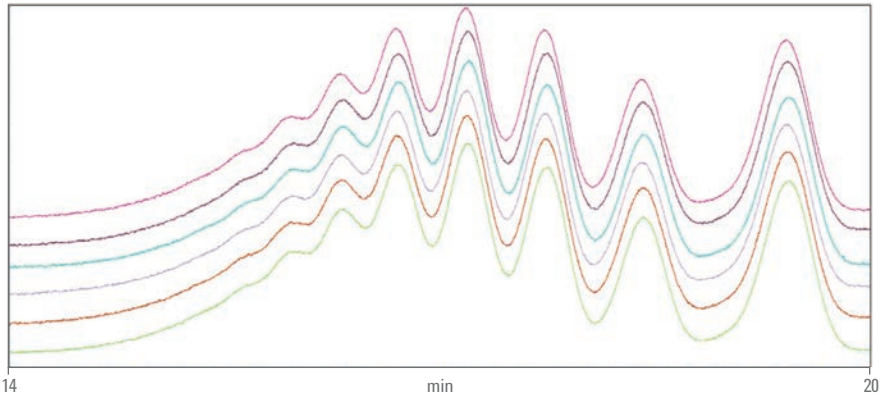
### Tips

Narrow bore columns are much more sensitive to instrument dispersion than wider diameters. Before installation, be sure to review Instrument Setup for Fast GPC (5991-7191EN)

For low flow GPC, achieve high resolution and sensitivity with the Agilent 1290 Infinity II Refractive Index Detector (G7162B)

**Conditions**

| | |
|---|---|
| Columns: | 2x InfinityLab Oligopore, 2.1 x 250 mm |
| Sample: | Polystyrene |
| Eluent: | THF |
| Flow rate: | 0.06 mL/min |
| Detector: | 1290 Infinity II Refractive Index Detector |




Combining a 2.1 mm diameter column with the low dispersion 1290 Infinity II Refractive Index Detector allows for a 94% solvent reduction from a 7.5 mm diameter column

### Ordering information

| Description | Linear MW operating range (g/mol) (PS) | Guaranteed efficiency (p/m) | Part No. |
|---|---|---|---|
| InfinityLab PolyPore, 2.1 x 250 mm | 200 to 2,000,000 | >60,000 | PL1913-5500 |
| InfinityLab PolyPore, 4.6 x 250 mm | 200 to 2,000,000 | >60,000 | PL1513-5500 |
| InfinityLab ResiPore, 2.1 x 250 mm | up to 500,000 | >80,000 | PL1913-5300 |
| InfinityLab ResiPore, 4.6 x 250 mm | up to 500,000 | >80,000 | PL1513-5300 |
| InfinityLab MesoPore, 2.1 x 250 mm | up to 25,000 | >80,000 | PL1913-5325 |
| InfinityLab MesoPore, 4.6 x 250 mm | up to 25,000 | >80,000 | PL1513-5325 |
| InfinityLab OligoPore, 2.1 x 250 mm | up to 3,300 | >55,000 | PL1913-5520 |
| InfinityLab OligoPore, 4.6 x 250 mm | up to 3,300 | >55,500 | PL1513-5520 |

# INFINITYLAB PLGEL OLEXIS

Part of the **InfinityLab** family

## Optimal performance and lifetime for high molecular weight polymers

- Optimized design for the analysis of polyolefins and performance polymers
- 13 µm particles provide stability and resolution, with no shear degradation
- Extended lifetime at very high temperatures

**Characteristics**

| | |
|---|---|
| Nominal particle size: | 13 µm |
| Linear MW operating range: | 2,000 to 10,000,000 g/mol (PS equivalent) |
| Guaranteed column efficiency: | >30,000 p/m |
| Typical pressure: | 1 mL/min (7.5 mm id): ≈ 8 bar (116 psi) per 300 mm (THF @ 20 °C, TCB @ 140 °C) |
| Maximum flow rate: | 7.5 mm id: 1.5 mL/min |
| Maximum pressure: | 150 bar (2175 psi) |
| Maximum temperature: | 220 °C |
| Recommended number of columns/set: | 3x 300 mm |
| Recommended calibrants: | |

- EasiVial PS-H for convenient 12 point calibration in three preweighed vials (2 mL vials: PL2010-0201, 4 mL vials: PL2010-0200)
- EasiCal PS-1 for a 10 point calibration in an easy, stir-in format

See publication 5990-7996EN, GPC/SEC Standards Product Guide

### Ordering information

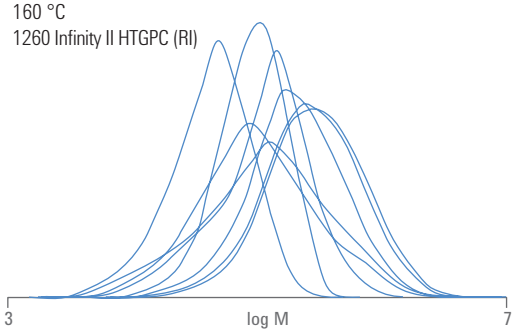
| Description | Part No. |
|---|---|
| InfinityLab PLgel Olexis, 7.5 x 300 mm | PL1110-6400 |
| InfinityLab PLgel Olexis Guard, 7.5 x 50 mm | PL1110-1400 |

### Typical applications

Polyolefins

**Conditions**

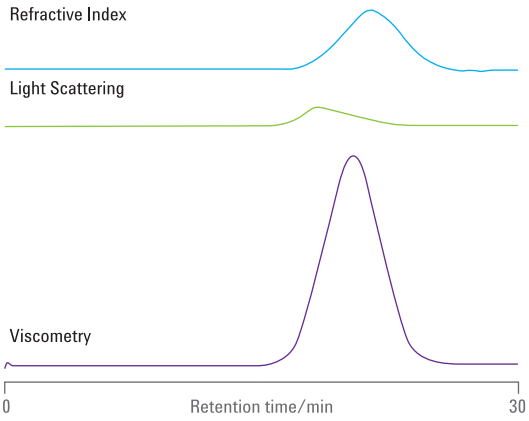
| | |
|---|---|
| Columns: | 3x InfinityLab PLgel Olexis, 7.5 x 300 mm |
| Sample: | Polyolefins |
| Eluent: | Trichlorobenzene + 0.0125% BHT |
| Flow rate: | 1.0 mL/min |
| Injection volume: | 200 µL |
| Temperature: | 160 °C |
| Detector: | 1260 Infinity II HTGPC (RI) |




Reliably predict a polymer's performance with accurate MW distributions

**Conditions**

| | |
|---|---|
| Columns: | 3x InfinityLab PLgel Olexis, 7.5 x 300 mm |
| Eluent: | Trichlorobenzene + 0.0125% BHT |
| Injection volume: | 200 µL |
| Temperature: | 160 °C |
| Detector: | 1260 Infinity II HTGPC (RI) + dual angle LS + viscometry |




Accurate molecular weight and branching information for polyethylene is gathered using triple detector data

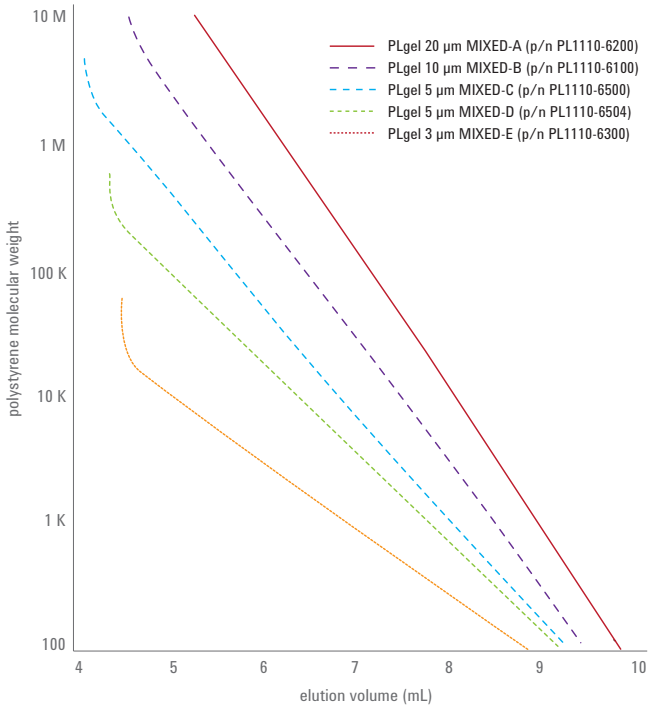
# PLGEL MIXED COLUMNS

## Simplified analysis of a wide variety of samples

- The easiest solution for a GPC analysis, since the chromatogram directly reflects the molecular weight distribution
- MIXED columns are made with individual pore size media precisely blended to create a linear calibration curve over the stated molecular weight range
- Offers a superior alternative to stacking individual pore size columns to extend range, which often leads to mismatched calibration curves and warped molecular weight distributions
- Linear calibration curves offer quick visual identification of peaks, and simplified data processing
- Resolution is easily improved by stacking the same MIXED columns to create the desired level of precision, all while keeping the benefits of a linear calibration curve
- Tight production control of calibration curves means that reproducible chromatograms can be generated with every new column

### Tip

Retention changes as columns age, so regular calibration is crucial for obtaining accurate results.




PLgel MIXED calibration curves

***Reference***

*Meehan, E. (1998) Size exclusion chromatography columns from Polymer Laboratories. In: Chi-San Wu (Ed.) Column Handbook for Size Exclusion Chromatography. Academic Press, New York, USA.*

# PLGEL 20 µm MIXED-A

## For very high MW materials

- Extremely high exclusion limit tailored to the MW of the application
- Large particle size matched to the MW range for optimum performance
- Wide frit and large particles minimize shear degradation of samples

**Characteristics**

| | |
|---|---|
| Linear MW operating range: | 2,000 to 40,000,000 g/mol (PS equivalent) |
| Guaranteed column efficiency: | >18,000 p/m |
| Typical pressure: | 1 mL/min (7.5 mm id): ≈ 3 bar (44 psi) per 300 mm<br>0.3 mL/min (4.6 mm id): ≈ 2.4 bar (35 psi) per 250 mm (THF @ 20 °C, TCB @ 140 °C) |
| Maximum flow rate: | 7.5 mm id: 1.5 mL/min<br>4.6 mm id: 0.5 mL/min |
| Maximum pressure: | 150 bar (2175 psi) |
| Maximum temperature: | 220 °C |
| Recommended number of columns/set: | 4x 250 mm or 4x 300 mm |

Recommended calibrants:

- EasiVial PS-H for convenient 12 point calibration in three preweighed vials (2 mL vials: PL2010-0201, 4 mL vials: PL2010-0200)
- EasiCal PS-1 for a 10 point calibration in an easy, stir-in format

See publication 5990-7996EN, GPC/SEC Standards Product Guide

### Ordering information

| Description | Part No. |
|---|---|
| PLgel 20 µm MIXED-A, 7.5 x 300 mm | PL1110-6200 |
| PLgel 20 µm MiniMIX-A, 4.6 x 250 mm | PL1510-5200 |
| PLgel 20 µm Guard, 7.5 x 50 mm | PL1110-1220 |
| PLgel 20 µm MiniMIX-A Guard, 4.6 x 50 mm | PL1510-1200 |

### Tip

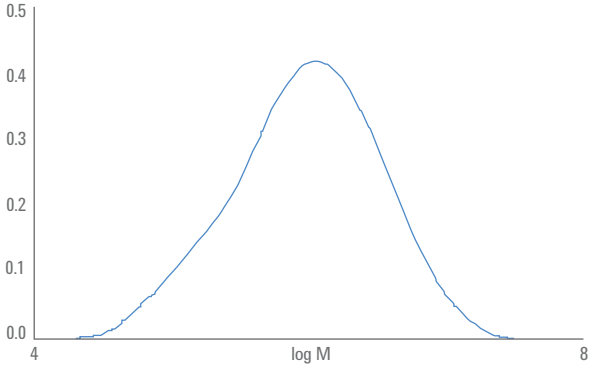
High temperatures mean accelerated degradation. Keep your results accurate with regular calibration.

### Typical applications

Polyolefins, polybutadienes, starches, polyisoprenes

**Conditions**

| | |
|---|---|
| Columns: | 4x PLgel 20 µm MIXED-A, 7.5 x 300 mm |
| Eluent: | TCB + 0.015% BHT |
| Flow rate: | 1.0 mL/min |
| Temperature: | 160 °C |
| Detector: | 1260 Infinity II HTGPC (RI) |



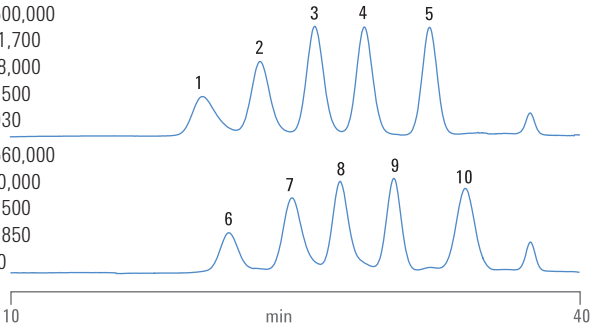

Complete molecular weight distribution of ultrahigh molecular weight polyethylene (UHMWPE) is captured using Agilent PLgel 20 µm MIXED-A columns

**Conditions**

| | |
|---|---|
| Columns: | 4x PLgel 20 µm MIXED-A, 7.5 x 300 mm |
| Sample: | EasiCal PS-1 |
| Eluent: | THF |
| Flow Rate: | 1.0 mL/min |
| Detector: | UV, 254 nm |

**Peak Identification**

1. 7,500,000
2. 841,700
3. 148,000
4. 28,500
5. 2,930
6. 2,560,000
7. 320,000
8. 59,500
9. 10,850
10. 580




Polystyrene standards separation demonstrates the ultrahigh range of the Mixed-A

# PLGEL 10 µm MIXED-B

## Maximum resolution for high temperature, high MW applications

- Wide MW operating range maximizes column usefulness
- 10 µm particles offer improved resolution while maintaining high thermal stability
- Wide range of applications simplifies column choice

**Characteristics**

| | |
|---|---|
| Linear MW operating range: | 500 to 10,000,000 g/mol (PS equivalent) |
| Guaranteed column efficiency: | >35,000 p/m |
| Typical pressure: | 1 mL/min (7.5 mm id): ≈ 10 bar (145 psi) per 300 mm<br>0.3 mL/min (4.6 mm id): ≈ 8 bar (116 psi) per 250 mm (THF @ 20 °C, TCB @ 140 °C) |
| Maximum flow rate: | 7.5 mm id: 1.5 mL/min<br>4.6 mm id: 0.5 mL/min |
| Maximum pressure: | 150 bar (2175 psi) |
| Maximum temperature: | 220 °C |
| Recommended number of columns/set: | 3x 250 mm or 3x 300 mm |

Recommended calibrants:

- EasiVial PS-H for convenient 12 point calibration in three preweighed vials (2 mL vials: PL2010-0201, 4 mL vials: PL2010-0200)
- EasiCal PS-1 for a 10 point calibration in an easy, stir-in format

See publication 5990-7996EN, GPC/SEC Standards Product Guide

### Ordering information

| Description | Part No. |
|---|---|
| PLgel 10 µm MIXED-B, 7.5 x 300 mm | PL1110-6100 |
| PLgel 10 µm MiniMIX-B, 4.6 x 250 mm | PL1510-5100 |
| PLgel 10 µm Guard, 7.5 x 50 mm | PL1110-1120 |
| PLgel 10 µm MiniMIX-B Guard, 4.6 x 50 mm | PL1510-1100 |

### Tip

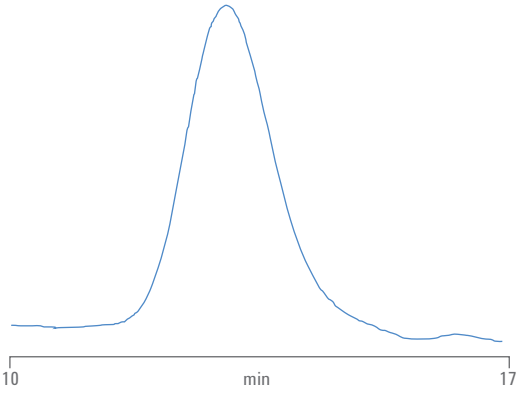
High temperatures mean accelerated degradation. Keep your results accurate with regular calibration.

### Typical applications

Polyolefins, polybutadienes, starches, polyisoprenes

**Conditions**

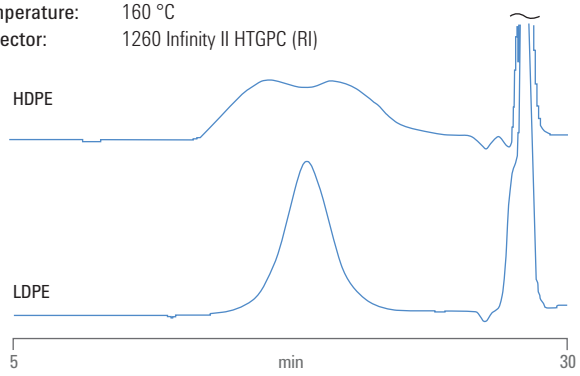
| | |
|---|---|
| Columns: | 2x PLgel 10 µm MIXED-B, 7.5 x 300 mm |
| Eluent: | o-Chlorophenol |
| Flow rate: | 1.0 mL/min |
| Temperature | 100 °C |
| Detector: | 1260 Infinity II HTGPC (RI) |




Analysis for challenging Polyethylene Terephthalate (PET) samples on Agilent PLgel MIXED-B columns

**Conditions**

| | |
|---|---|
| Columns: | 3x PLgel 10 µm MIXED-B, 7.5 x 300 mm |
| Eluent: | TCB |
| Flow rate: | 1.0 mL/min |
| Temperature: | 160 °C |
| Detector: | 1260 Infinity II HTGPC (RI) |




Polyethylenes

# PLGEL 5 µm MIXED-C

## For simple analysis across a wide MW range

- Excellent reproducibility of chromatograms between columns for easy comparison and overlay
- Optimized MW range for general polymer analysis
- Linear calibration curve ensures consistent resolution across the MW range

**Characteristics**

| | |
|---|---|
| Linear MW operating range: | 200 to 2,000,000 g/mol (PS equivalent) |
| Guaranteed column efficiency: | >50,000 p/m |
| Typical pressure: | 1 mL/min (7.5 mm id): ≈ 30 bar (435 psi) per 300 mm<br>0.3 mL/min (4.6 mm id): ≈ 24 bar (348 psi) per 250 mm (THF @ 20 °C, TCB @ 140 °C) |
| Maximum flow rate: | 7.5 mm id: 1.5 mL/min<br>4.6 mm id: 0.5 mL/min |
| Maximum pressure: | 150 bar (2175 psi) |
| Maximum temperature: | 150 °C |
| Recommended number of columns/set: | 2x 250 mm or 2x 300 mm |

Recommended calibrants:

- EasiVial PS-H for convenient 12 point calibration in three preweighed vials (2 mL vials: PL2010-0201, 4 mL vials: PL2010-0200)
- EasiCal PS-1 for a 10 point calibration in an easy, stir-in format

See publication 5990-7996EN, GPC/SEC Standards Product Guide

### Ordering information

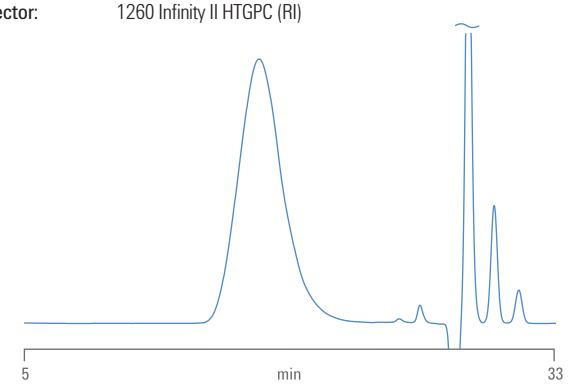
| Description | Part No. |
|---|---|
| PLgel 5 µm MIXED-C, 7.5 x 300 mm | PL1110-6500 |
| PLgel 5 µm MiniMIX-C, 4.6 x 250 mm | PL1510-5500 |
| PLgel 5 µm Guard, 7.5 x 50 mm | PL1110-1520 |
| PLgel 5 µm MiniMIX-C Guard, 4.6 x 50 mm | PL1510-1500 |

### Typical applications

Polystyrenes, polyurethanes, polycarbonates, polysiloxanes

**Conditions**

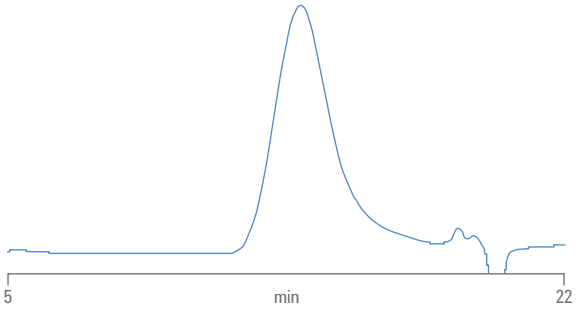
| | |
|---|---|
| Columns: | 2x PLgel 5 µm MIXED-C, 7.5 x 300 mm |
| Eluent: | THF |
| Flow rate: | 1.0 mL/min |
| Detector: | 1260 Infinity II HTGPC (RI) |




GPC measures additive content in PVC

**Conditions**

| | |
|---|---|
| Columns: | 2x PLgel 5 µm MIXED-C, 7.5 x 300 mm |
| Eluent: | DMF + 0.1% LiBr |
| Flow rate: | 1.0 mL/min |
| Temperature: | 80 °C |
| Detector: | 1260 Infinity II HTGPC (RI) |




Polyurethane

# PLGEL 5 µm MIXED-D

## For straightforward analysis of midsized polymers

- Easy visual identification of low MW polymers, plasticizers, and oligomers
- Offers excellent low MW resolution while retaining high temperature stability
- Optimum MW range for many free radical and condensation polymers

**Characteristics**

| | |
|---|---|
| Linear MW operating range: | 200 to 400,000 g/mol (PS equivalent) |
| Guaranteed column efficiency: | >50,000 p/m |
| Typical pressure: | 1 mL/min (7.5 mm id): ≈ 30 bar (435 psi) per 300 mm<br>0.3 mL/min (4.6 mm id): ≈ 24 bar (348 psi) per 250 mm (THF @ 20 °C, TCB @ 140 °C) |
| Maximum flow rate: | 7.5 mm id: 1.5 mL/min<br>4.6 mm id: 0.5 mL/min |
| Maximum pressure: | 150 bar (2175 psi) |
| Maximum temperature: | 150 °C |
| Recommended number of columns/set: | 2x 250 mm or 2x 300 mm |

Recommended calibrants:

- EasiVial PS-M for convenient 12 point calibration in three preweighed vials (2 mL vials: PL2010-0301, 4 mL vials: PL2010-0300)
- EasiCal PS-2 for a 10 point calibration in an easy, stir-in format

See publication 5990-7996EN, GPC/SEC Standards Product Guide

### Ordering information

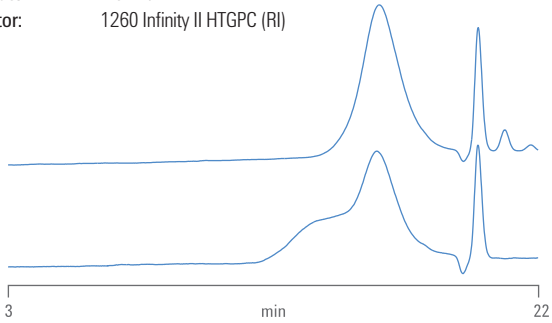
| Description | Part No. |
|---|---|
| PLgel 5 µm MIXED-D, 7.5 x 300 mm | PL1110-6504 |
| PLgel 5 µm MiniMIX-D, 4.6 x 250 mm | PL1510-5504 |
| PLgel 5 µm Guard, 7.5 x 50 mm | PL1110-1520 |
| PLgel 5 µm MiniMIX-D Guard, 4.6 x 50 mm | PL1510-1504 |

### Typical applications

Epoxy resins, silicone fluids, polyester resins, polyolefins

**Conditions**

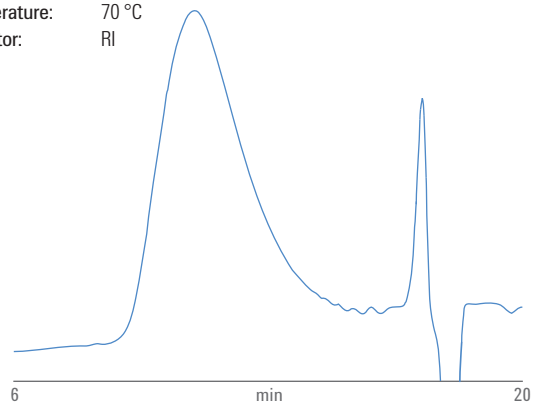
| | |
|---|---|
| Columns: | 2x PLgel 5 µm MIXED-D, 7.5 x 300 mm |
| Eluent: | THF |
| Flow rate: | 1.0 mL/min |
| Detector: | 1260 Infinity II HTGPC (RI) |




Asphalts

**Conditions**

| | |
|---|---|
| Columns: | 2x PLgel 5 µm MIXED-D, 7.5 x 300 mm |
| Eluent: | DMF + 0.1% LiBr |
| Flow rate: | 1.0 mL/min |
| Temperature: | 70 °C |
| Detector: | RI |




Polyetherimide

# PLGEL 3 µm MIXED-E

## Oligomers and polymers up to 25,000 MW

- Highest efficiency MIXED bed column
- Fast analysis improves productivity
- Optimized particle size for low MW polymers, oligomers, and additives

**Characteristics**

| | |
|---|---|
| Linear MW operating range: | up to 25,000 g/mol (PS equivalent) |
| Guaranteed column efficiency: | 7.5 x 300 mm: >80,000 p/m<br>4.6 x 250 mm: >70,000 p/m<br>Highest efficiency/resolution achieved only on high performance, low dead volume equipment. |
| Typical pressure: | 1 mL/min (7.5 mm id): ≈ 50 bar (725 psi) per 300 mm<br>0.3 mL/min (4.6 mm id): ≈ 42 bar (609 psi) per 250 mm (THF @ 20 °C) |
| Maximum flow rate: | 7.5 mm id: 1.5 mL/min<br>4.6 mm id: 0.5 mL/min |
| Maximum pressure: | 180 bar (2611 psi) |
| Maximum temperature: | 110 °C |
| Recommended number of columns/set: | 1-3x 250 mm or 1-3x 300 mm |

Recommended calibrants:

- EasiVial PS-L for convenient 12 point calibration in three pre-weighed vials (2 mL vials: PL2010-0401, 4 mL vials: PL2010-0400)
- For polar solvents and alternative calibrations, EasiVial PEG offers the same 12 point calibration in three pre-weighed vials (2 mL vials: PL2070-0201, 4 mL vials: PL2070-0200)

See publication 5990-7996EN, GPC/SEC Standards Product Guide

### Ordering information

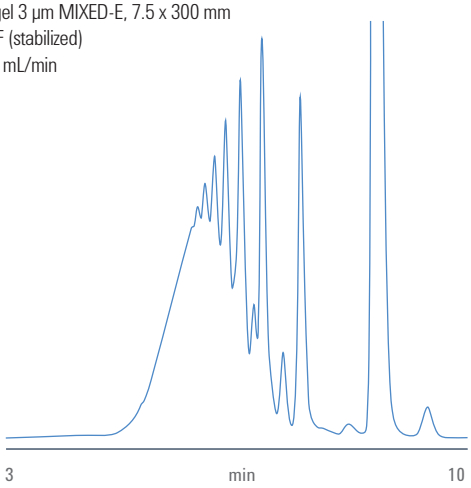
| Description | Part No. |
|---|---|
| PLgel 3 µm MIXED-E, 7.5 x 300 mm | PL1110-6300 |
| PLgel 3 µm MiniMIX-E, 4.6 x 250 mm | PL1510-5300 |
| PLgel 3 µm Guard, 7.5 x 50 mm | PL1110-1320 |
| PLgel 3 µm MiniMIX-E Guard, 4.6 x 50 mm | PL1510-1300 |

### Typical applications

Prepolymers, polyols, resins, siloxanes

**Conditions**

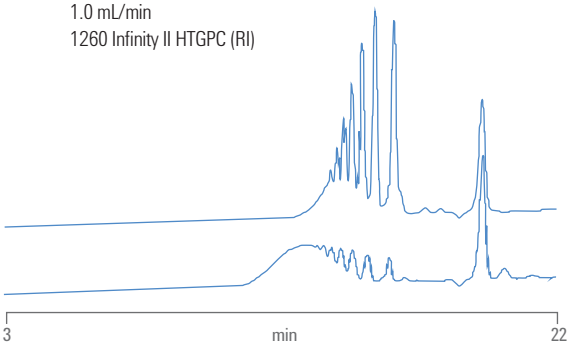
Columns: PLgel 3 µm MIXED-E, 7.5 x 300 mm
Eluent: THF (stabilized)
Flow rate: 1.0 mL/min
Detector: RI




Epoxy resin

**Conditions**

Columns: 2x PLgel 3 µm MIXED-E, 7.5 x 300 mm
Eluent: THF
Flow rate: 1.0 mL/min
Detector: 1260 Infinity II HTGPC (RI)




Polyester resins

# PLGEL MIXED-LS

## Eliminates particle leakage to improve data quality with light scattering detection

- Instant improvement in data quality
- No need for conditioning, therefore saving time and solvent costs
- Maximize the potential of light scattering detectors

PLgel MIXED-LS uses a proprietary polymerization technique to eliminate the LS noise caused by nanoparticle leakage from GPC columns. Columns can be used straight from the box, without wasting hours washing the column.

### Tip

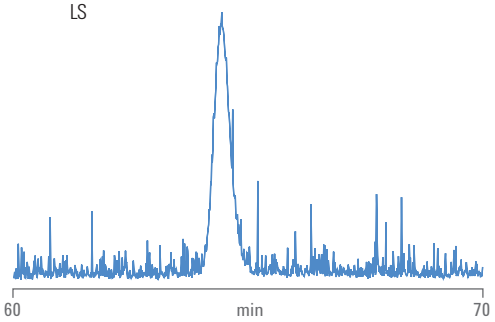
Even a light scattering detector needs calibration.

Agilent offers a complete line of narrow polymer standards, found in the GPC/SEC Standards Product Guide, publication 5990-7996EN

### Typical applications

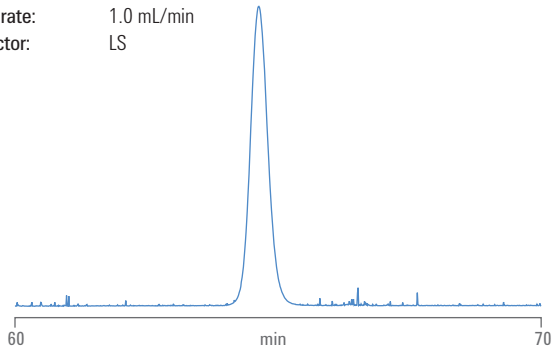
Polyethylenes, polyolefins

**Conditions**
**Columns:** Conventional GPC column
**Eluent:** THF
**Flow rate:** 1.0 mL/min
**Detector:** LS




Analysis of a polystyrene sample showing nanoparticle noise from a conventional GPC column

**Conditions**
**Columns:** PLgel 10 µm MIXED-B LS, 7.5 x 300 mm
**Eluent:** THF
**Flow rate:** 1.0 mL/min
**Detector:** LS




Same sample on the PLgel MIXED-B LS, nanoparticle noise is eliminated

### Ordering information

| Description | Linear MW operating range (g/mol) (PS) | Guaranteed efficiency (p/m) | Part No. |
|---|---|---|---|
| PLgel 10 µm MIXED-B LS, 7.5 x 300 mm | 500 to 10,000,000 | >35,000 | PL1110-6100LS |
| PLgel 20 µm MIXED-A LS, 7.5 x 300 mm | 2,000 to 10,000,000 | >18,000 | PL1110-6200LS |
| PLgel 10 µm Guard, 7.5 x 50 mm | | | PL1110-1120 |
| PLgel 20 µm Guard, 7.5 x 50 mm | | | PL1110-1220 |

# PL HFIPGEL

## Improved performance when using HFIP

- Optimized separation range delivers high performance with no artifacts
- Highly durable packing prolongs column lifetime during HFIP exposure
- Avoid warped calibration curves, dislocations, shoulders, and poor resolution caused by HFIP and similar solvents

Hexafluoroisopropanol (HFIP) is a unique solvent that allows near ambient temperature GPC of challenging polyesters, polyamides (Nylon), polyethylene terephthalate (PET), and poly(lactic-co-glycolic acid) (PLGA).

Agilent developed PL HFIPgel to handle HFIP, and related polar fluorinated solvents, such as trifluoroethanol, while offering the high performance of Agilent's PLgel line.

**Characteristics**

| | |
|---|---|
| Nominal particle size: | 9 µm |
| Linear MW operating range: | 200 to 2,000,000 g/mol (PS equivalent) |
| Guaranteed column efficiency: | >30,000 p/m |
| Typical pressure: | 1 mL/min (7.5 mm id): ≈ 10 bar (145 psi) per 300 mm (HFIP @ 40 °C) |
| Maximum flow rate: | 7.5 mm id: 1.5 mL/min |
| Maximum pressure: | 150 bar (2175 psi) |
| Maximum temperature: | 50 °C (HFIP) |
| Recommended number of columns/set: | 2x 300 mm |

Recommended calibrants:

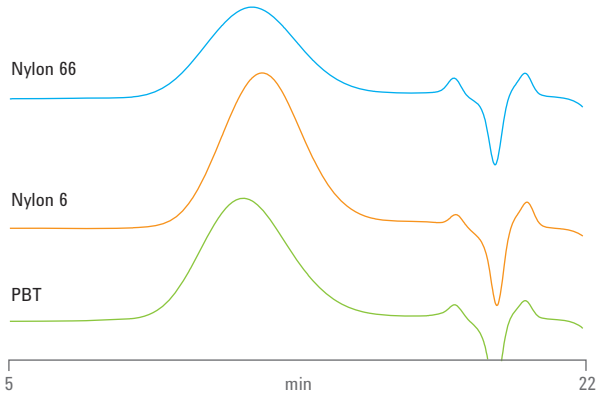
- EasiVial PM for convenient 12 point calibration in three preweighed vials (2 mL vials: PL2020-0201, 4 mL vials: PL2020-0200)
- Polymethylmethacrylate (PMMA) kit M-M-10 (PL2020-0101)

### Typical applications

Polyesters, polyamides, polylactide/glycolide copolymers

**Conditions**

| | |
|---|---|
| Columns: | 2x PL HFIPgel, 7.5 x 300 mm |
| Eluent: | HFIP + 20 mM NaTFAc |
| Flow rate: | 1.0 mL/min |
| Temperature: | 40 °C |
| Detector: | RI |




Low temperature analysis challenging polyamides and polyesters

### Tip

Save on expensive HFIP solvent by recycling solvent and using the smaller diameter 4.6 mm columns.

See publication 5990-7996EN, GPC/SEC Standards Product Guide

### Ordering information

| Description | Part No. |
|---|---|
| PL HFIPgel, 4.6 x 250 mm | PL1514-5900HFIP |
| PL HFIPgel, 7.5 x 300 mm | PL1114-6900HFIP |
| PL HFIPgel Guard, 7.5 x 50 mm | PL1114-1900HFIP |
| PL HFIPgel Guard, 4.6 x 50 mm | PL1514-1900HFIP |

# ENVIROPREP COLUMNS

## Environmental cleanup with EPA methods

- High sample loading capacity ensures effective concentration of trace compounds
- Enables automation of sample cleanup procedures
- Narrow peaks give both high purity and high recovery

Agilent EnviroPrep columns offer an easy, automated sample cleanup solution for customers performing cleanup of extracts from soil, food, and biological samples.

Interference from large molecules, oils, humic acids, and terpenoids are easily removed from samples with virtually zero loss of target molecules.

Prepacked, stainless steel EnviroPrep columns offer substantial improvements in speed and reproducibility over manually packed glass columns for methods such as EPA Method 3640A.

**Characteristics**

| | |
|---|---|
| Nominal particle size: | 10 µm |
| Pore size: | 100 Å |
| Exclusion limit: | 4,000 g/mol (PS equivalent) |
| Guaranteed column efficiency: | >25,000 p/m |
| Typical pressure: | 10 mL/min (25 mm id): ≈ 8 bar (116 psi) per 300 mm (THF @ 20 °C) |
| Maximum flow rate: | 25 mm id: 16.5 mL/min |
| Maximum pressure: | 150 bar (2175 psi) |
| Maximum temperature: | 220 °C |
| Recommended number of columns/set: | 1-2x 300 mm; 1x 300mm + 1x 150mm |

Recommended calibrants:

- EasiVial PS-L for convenient 12 point calibration in three preweighed vials (2 mL vials: PL2010-0401, 4 mL vials: PL2010-0400)
- EPA Test Mix (refer to publication 5991-1588EN)

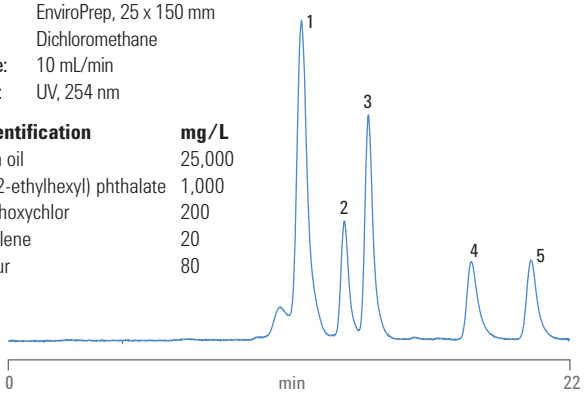
See publication 5990-7996EN, GPC/SEC Standards Product Guide

**Case Study:** An Automated System for the Routine Cleanup of Environmental Samples Prior to Instrument Analysis (Publication 5991-5321EN).

**Conditions**

| | |
|---|---|
| Columns: | EnviroPrep, 25 x 300 mm<br>EnviroPrep, 25 x 150 mm |
| Eluent: | Dichloromethane |
| Flow rate: | 10 mL/min |
| Detector: | UV, 254 nm |

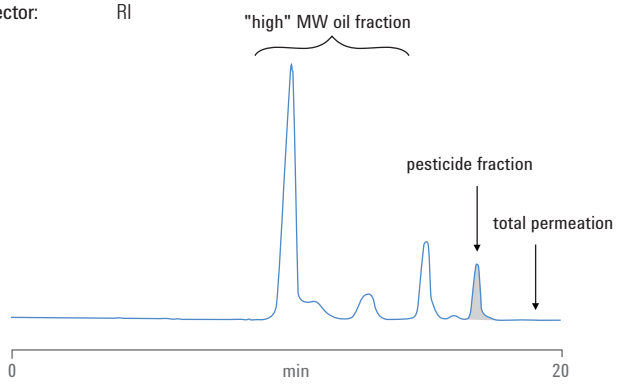
| Peak Identification | mg/L |
|---|---|
| 1. Corn oil | 25,000 |
| 2. Bis(2-ethylhexyl) phthalate | 1,000 |
| 3. Methoxychlor | 200 |
| 4. Perylene | 20 |
| 5. Sulfur | 80 |




Rapid separation of test mix for EPA Method 3640A

**Conditions**

| | |
|---|---|
| Columns: | 2x EnviroPrep, 25 x 300 mm |
| Eluent: | THF (stabilized) |
| Flow rate: | 10 mL/min |
| Detector: | RI |




Fast, complete recovery of Hexachlorocyclohexane spike in mackerel extract

### Ordering information

| Description | Part No. |
|---|---|
| EnviroPrep, 25 x 150 mm | PL1210-3120EPA |
| EnviroPrep, 25 x 300 mm | PL1210-6120EPA |

# PLGEL INDIVIDUAL PORE SIZE COLUMNS

## High resolution over a specific molecular weight range

- Highest resolution over a narrow MW range
- High efficiency improves data quality
- Fast analysis with fewer columns enables users to save time and money

Individual pore size GPC columns offer high resolution over a narrow molecular weight range. The linear portion of the calibration curve, where the slope is at its shallowest, defines the MW region over which optimum resolution is achieved.

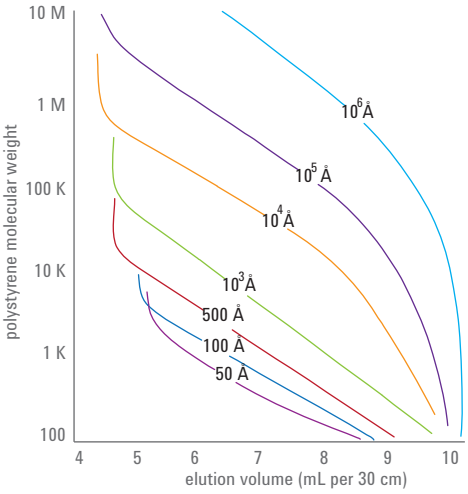
### Tip

Individual pore columns have nonlinear retention times, and raw chromatograms may not reflect the MW distribution. A calibration curve is critical to obtaining correct MW data.

Agilent offers a complete line of narrow polymer standards, found in the GPC/SEC Standards Product Guide, Publication 5990-7996EN

**Conditions**

Calibrant: Polystyrene
Eluent: THF
Flow rate: 1.0 mL/min



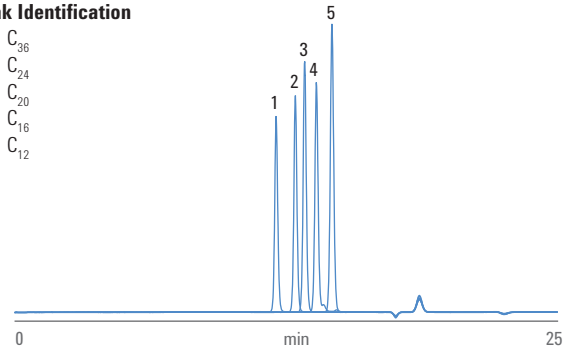

Calibration curves

**Conditions**

Columns: 2x PLgel 3 µm 100 Å, 7.5 x 300 mm
Eluent: TCB + 0.015% BHT
Flow rate: 0.8 mL/min
Temperature: 145 °C
Detector: 1260 Infinity II HTGPC (RI)

**Peak Identification**

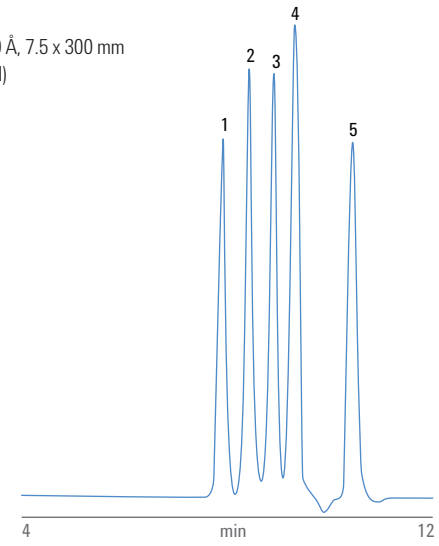
1. $C_{36}$
2. $C_{24}$
3. $C_{20}$
4. $C_{16}$
5. $C_{12}$




Baseline separation of linear aliphatic hydrocarbons

**Conditions**

Columns: PLgel 5 µm 50 Å, 7.5 x 300 mm
Eluent: THF (stabilized)
Flow rate: 1 mL/min
Detector: RI




Analysis of four dialkyl phthalates

# PLGEL INDIVIDUAL PORE SIZE COLUMNS

## Ordering information

PLgel Individual Pore Size Columns, 7.5 x 300 mm

| Description | Pore size (Å) | MW range (g/mol) (PS) | Guaranteed efficiency (p/m) | Part No. | Maximum temperature |
|---|---|---|---|---|---|
| PLgel 3 µm | 100 | up to 5,000 | >100,000 | PL1110-6320 | |
| PLgel 5 µm | 50 | up to 1,500 | >65,000 | PL1110-6515 | |
| PLgel 5 µm | 100 | up to 5,000 | >65,000 | PL1110-6520 | |
| PLgel 5 µm | 500 | 500 to 25,000 | >65,000 | PL1110-6525 | 150 °C |
| PLgel 5 µm | $10^3$ | 500 to 60,000 | >50,000 | PL1110-6530 | |
| PLgel 5 µm | $10^4$ | 10,000 to 450,000 | >50,000 | PL1110-6540 | |
| PLgel 5 µm | $10^5$ | 60,000 to 1,700,000 | >50,000 | PL1110-6550 | |
| PLgel 10 µm | 50 | up to 1,500 | >35,000 | PL1110-6115 | |
| PLgel 10 µm | 100 | up to 5,000 | >35,000 | PL1110-6120 | |
| PLgel 10 µm | 500 | 500 to 25,000 | >35,000 | PL1110-6125 | |
| PLgel 10 µm | $10^3$ | 500 to 60,000 | >35,000 | PL1110-6130 | 220 °C |
| PLgel 10 µm | $10^4$ | 10,000 to 450,000 | >35,000 | PL1110-6140 | |
| PLgel 10 µm | $10^5$ | 60,000 to 1,700,000 | >35,000 | PL1110-6150 | |
| PLgel 10 µm | $10^6$ | 600,000 to 10,000,000 | >35,000 | PL1110-6160 | |

PLgel Guard Columns, 7.5 x 50 mm

| Description | Part No. |
|---|---|
| PLgel 3 µm Guard | PL1110-1320 |
| PLgel 5 µm Guard | PL1110-1520 |
| PLgel 10 µm Guard | PL1110-1120 |
| PLgel 20 µm Guard | PL1110-1220 |

# PLGEL PREPARATIVE COLUMNS

## Fractionation of samples based on their molecular size in solution

- Isolate MW fractions for chromatography, IR, X-ray, chemical, and physical analysis
- 10 µm particles offer greater speed, purity, and recovery
- High pore volumes can isolate milligram to gram quantities

Preparative GPC allows users to isolate fractions of a specific MW from various samples for further analysis. PLgel Preparative 10 µm particles offer very high loadability and efficiency, while keeping the backpressure low.

**For sample preparation:**

GPC easily automates the cleanup and concentration of food, biological, and environmental samples after solvent extraction.

Modern 25 x 300 mm stainless steel columns replace manually packed glass columns for methods such as:

- EPA Method 3640A sample preparation for pesticides.
- Chinese Pharmacopoeia (CHP) sample preparation for pesticides.
- European Pharmacopoeia (Ph. Eur.) determination of mono-, di-, triglycerides, and glycerol.

**For polymer analysis:**

Polymer samples can be fractionated to isolate additives, residues, or MW cuts for offline spectroscopic, chemical, electrical, and physical analysis.

Conversely, a polymer's properties may be tested after specific MWs or compounds are cut out of the formulation.

# PLGEL PREPARATIVE COLUMNS

## Typical applications

Polymer fractionation, component isolation, mixture simplification

**Characteristics**

| | |
|---|---|
| Nominal particle size: | 10 µm (PLgel), 6 µm (Oligopore) |
| Guaranteed column efficiency: | >30,000 p/m , >55,000 (Oligopore) |
| Typical pressure: | 10 mL/min (25 mm id): ≈ 8 bar (116 psi) per 300 mm (THF @ 20 °C) |
| Maximum flow rate: | 25 mm id: 16.5 mL/min |
| Maximum pressure: | 150 bar (2175 psi) |
| Maximum temperature: | 220 °C, 110 °C (Oligopore) |
| Recommended number of columns/set: | 1-2x 300 mm |

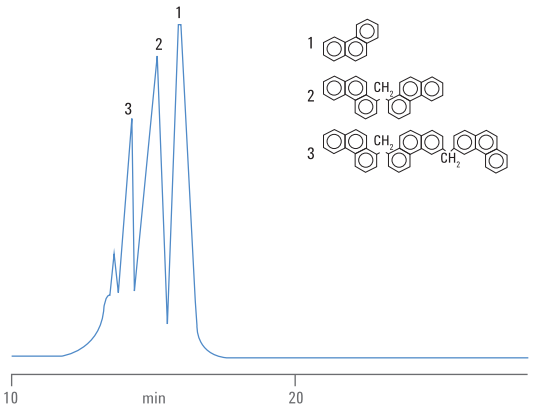
Recommended calibrants:

- EasiVial for convenient 12 point calibration in three preweighed vials
- EasiCal for a simple stir-in 10 point calibration

See publication 5990-7996EN, GPC/SEC Standards Product Guide

**Conditions**

| | |
|---|---|
| Columns: | PLgel 10 µm 500 Å, 25 x 300 mm |
| Sample concentration: | 100 mg/mL, 2 mL |
| Eluent: | Dichloromethane |
| Flow rate: | 9.0 mL/min |
| Loading: | 200 mg on-column |
| Detector: | UV, 254 nm |




Fractionation of an oil distillate

## Ordering information

PLgel Preparative Columns

| Description | MW range (g/mol) (PS) | Part No. |
|---|---|---|
| InfinityLab OligoPore, 6 µm, 25 x 300 mm | up to 3,300 | PL1213-6520 |
| EnviroPrep, 25 x 150 mm | up to 5,000 | PL1210-3120EPA |
| EnviroPrep, 25 x 300 mm | up to 5,000 | PL1210-6120EPA |
| PLgel 10 µm 50Å, 25 x 300 mm | up to 1,500 | PL1210-6115 |
| PLgel 10 µm 100Å, 25 x 300 mm | up to 5,000 | PL1210-6120 |
| PLgel 10 µm 500Å, 25 x 300 mm | 500 to 25,000 | PL1210-6125 |
| PLgel 10 µm 103Å, 25 x 300 mm | 500 to 60,000 | PL1210-6130 |
| PLgel 10 µm 104Å, 25 x 300 mm | 10,000 to 550,000 | PL1210-6140 |
| PLgel 10 µm 105Å, 25 x 300 mm | 60,000 to 1,700,000 | PL1210-6150 |
| PLgel 10 µm 106Å, 25 x 300 mm | 600,000 to 10,000,000 | PL1210-6160 |
| PLgel 10 µm MIXED-B, 25 x 300 mm | 500 to 10,000,000 | PL1210-6100 |
| PLgel 10 µm MIXED-D, 25 x 300 mm | 200 to 400,000 | PL1210-6104 |
| PLgel Prep Guard, 25 x 25 mm | | PL1210-1120 |

# 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 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.

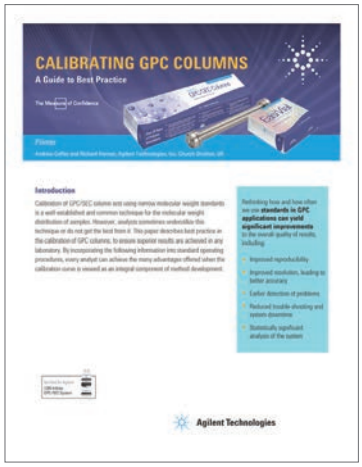
The system features the new Infinity II refractive index detector for exceptional improvements in resolution and speed. The newly developed vialsampler offers higher unattended sample throughput, while the multicolumn thermostat provides accurate temperature control to minimize detector noise and baseline 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

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