

# Uncompromising Analysis of Polymers and Macromolecules

Expanded portfolio of Agilent  
GPC/SEC columns and standards



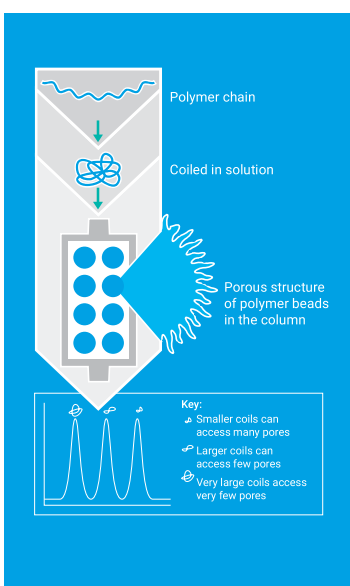


# Analyze with Certainty and Ensure Confidence in Your Product Quality

Polymers and macromolecules have become so ubiquitous that almost every industry now demands some level of characterization and analysis. The different types of polymers and macromolecules include:

- **Polymers** that dissolve in low-polar organic solvents. They're used for bottles, buckets, toys, and other petrochemical-derived products.
- **Water-soluble polymers and macromolecules** that are common in food and medical products.
- **Protein-based macromolecules** (such as monoclonal antibodies) that are soluble in aqueous buffers.

Gel permeation chromatography (GPC) or size exclusion chromatography (SEC) are the methods of choice for separating macromolecules based on their size in solution.



## How does GPC/SEC work?

1. GPC/SEC separates macromolecules according to their size (hydrodynamic volume) in solution. The size of a macromolecule of a given chemistry and structure in solution depends on its molecular weight and the solvent in which it is dissolved.
2. Dissolved macromolecules mostly form coils in solution, which are introduced to the eluent flowing through a column packed with insoluble porous beads that have a well-defined pore structure. The pore size is similar to that of the macromolecule coils, allowing the coils to diffuse in and out of the pores.
3. Compounds elute based on size. Large coils elute first, as they cannot fit in as many pores, and smaller coils elute last.
4. This size separation lets you calculate molecular weight by referring to a calibration curve constructed using chemical standards.

# The complete analytical solution from the polymer/macromolecule analysis experts

If you're seeking to improve your GPC/SEC analysis of macromolecules—or develop new applications for challenging polar and/or charged macromolecules—Agilent can help. Thanks to our acquisition of Polymer Standards Service (PSS)—a leading provider of GPC/SEC columns, calibration standards, instrumentation, software, and services—our GPC/SEC portfolio has expanded to include new columns and chemical standards for macromolecule applications. Plus, they're all backed by decades of characterization knowledge and expertise.



## High-quality columns

Agilent offers a comprehensive range of GPC/SEC columns that cover diverse applications and can be used with organic, aqueous, and polar solvents. These columns include high-quality PLgel, PL aquagel-OH, PolarGel, SUPREMA, NOVEMA Max, and GRAM, along with specialty columns for specific applications.



## Quality reference materials essential to successful calibration

Agilent standards are tested and manufactured using ISO 9001 certifications. Each standard is fully traceable with a unique batch number and a certificate of analysis (CoA) that details the exact method and characterization results.

Options include:

- Polymers that dissolve in low-polar organic solvents and are used for bottles, buckets, toys, and other petrochemical-derived products.
- Prepared InfinityLab EasiVial and EasiCal standards, and the ReadyCal and EasyValid validation kits. They save time by eliminating tedious weighing procedures, and can be used for a wide variety of applications.

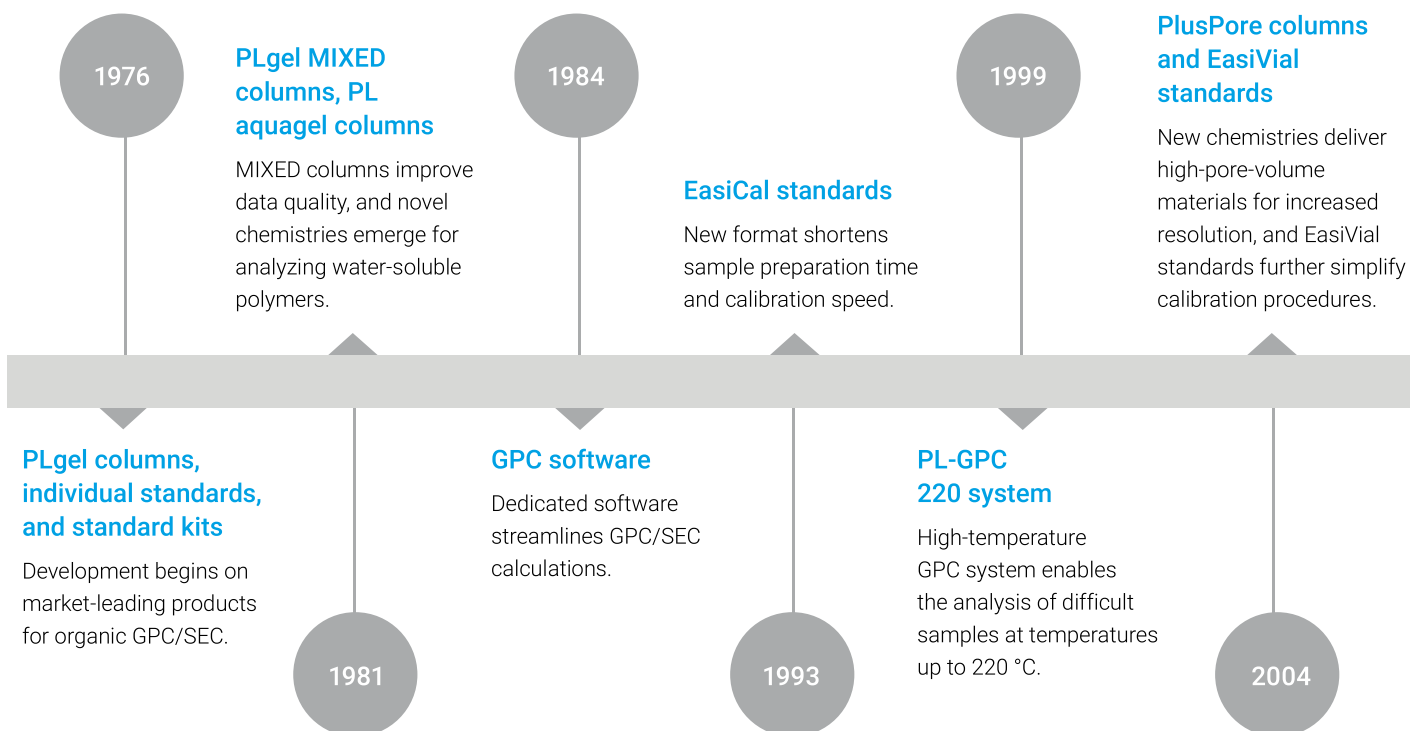


To access a wide range of application notes for polymer and macromolecule analysis, go to [explore.agilent.com/gpc-sec-column](https://explore.agilent.com/gpc-sec-column)



## More than 40 years of industry leadership

From research and development to final product testing, Agilent can help you be certain that your products meet expectations.





2007

### 1260 Infinity multidetector GPC/SEC system and PolarGel columns

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

2015

### PL Multisolvant GPC columns

These newest additions to our InfinityLab GPC family offer solvent flexibility for many types of GPC analyses, all on one column.

2022

### PLgel Olexis columns

Optimized for polyolefin analysis, these columns provide the highest resolution and data quality—even for ultrahigh molecular weight samples.

2009

### 1260 Infinity II multidetector GPC/SEC system

Your 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

### Polymer Standards Service (PSS)

Agilent acquires PSS, expanding the portfolio of columns, standards, services, and detection capabilities for macromolecules.

# Easy reference guide: Expanded portfolio of Agilent GPC/SEC columns and standards

The expanded Agilent portfolio for polymer analysis delivers a complete solution that supports your unique analytical needs and ensures robust, reliable outcomes.

## Organic solvent-soluble polymers

	<p>Neutral Polymers Polycarbonate PVC</p>	<p><a href="#">PLgel</a> <a href="#">PLgel MIXED</a> <a href="#">PLgel MIXED-LS*</a> <a href="#">PL Rapide</a> <a href="#">SDV</a> <a href="#">SDV Linear</a> <a href="#">SDV Lux*</a></p>	<ul style="list-style-type: none"> <li>– Individual pore sizes and mixed-bed or linear columns</li> </ul>
	<p>Polycarbonates Polyurethanes Epoxy Resins Polyester Resins Siloxanes Silicone Fluids</p>	<p><a href="#">InfinityLab MesoPore</a> <a href="#">InfinityLab OligoPore</a> <a href="#">InfinityLab PolyPore</a> <a href="#">InfinityLab ResiPore</a></p>	<ul style="list-style-type: none"> <li>– Next generation of InfinityLab GPC/SEC columns available in smaller internal diameters</li> <li>– New high-efficiency media with improved pore volumes</li> <li>– Maximizes overall separation performance in shorter run times with less solvent consumption</li> </ul>
	<p>Nylons Poly lactides Polyesters PET</p>	<p><a href="#">PFG</a> <a href="#">PFG Lux*</a> <a href="#">PL HFIPgel</a></p>	<ul style="list-style-type: none"> <li>– Compatible with fluorinated solvents</li> <li>– Available in 5 µm particles for higher efficiency</li> </ul>
	<p>Food Films PE PP Polymers</p>	<p><a href="#">PLgel Olexis</a> <a href="#">POLEFIN</a></p>	<ul style="list-style-type: none"> <li>– High-temperature GPC</li> <li>– Particle and pore sizes optimized for analysis of large molecules in viscous eluents under demanding analysis conditions</li> </ul>
	<p>Epoxy Polyurethanes Polysulfones Celluloses</p>	<p><a href="#">GRAM</a> <a href="#">GRAM Lux*</a> <a href="#">PolarGel</a> <a href="#">PolarSil</a></p>	<ul style="list-style-type: none"> <li>– Medium-polar organic solvents</li> <li>– PolarSil available in 3 µm particle sizes for higher efficiency</li> </ul>

\* Light scattering ready. Low noise columns suitable for immediate use with laser light scattering detection.

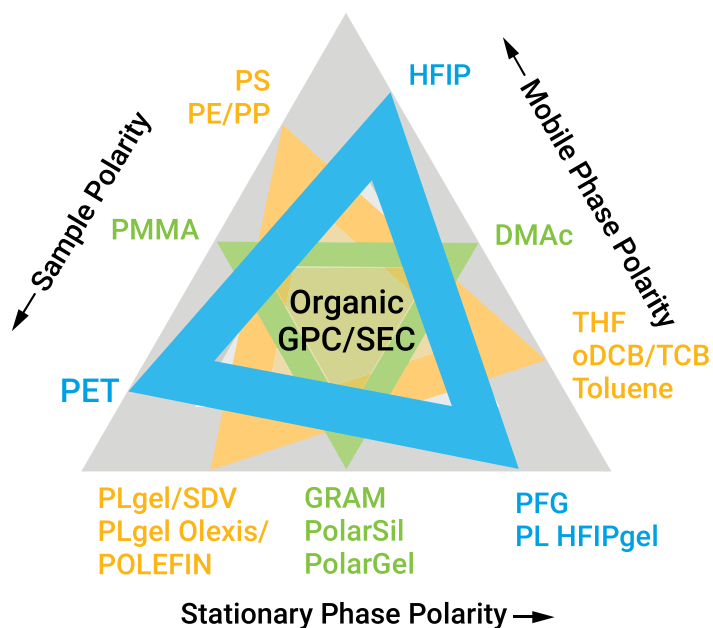
## Water-soluble polymers

	<p>Dextran Saccharides Hyaluronic Acid Acrylates Acrylamides Heparin Gum</p>	<p><a href="#">PL aquagel-OH</a> <a href="#">PL Multisolvant</a> <a href="#">PL Rapide Aqua</a> <a href="#">SUPREMA</a> <a href="#">SUPREMA Lux*</a></p>	<ul style="list-style-type: none"> <li>- Individual pore sizes and mixed-bed columns</li> <li>- SUPREMA compatible with 100% organic modifiers</li> </ul>
	<p>Sulfonated Polyanions Lignins</p>	<p><a href="#">MCX</a></p>	<ul style="list-style-type: none"> <li>- Charged anionic polymers</li> <li>- Robust at high pH</li> <li>- Compatible with organic modifiers</li> <li>- Available in 5 µm particle sizes</li> </ul>
	<p>Chitosan Food Ingredients Cationic Polymers</p>	<p><a href="#">NOVEMA Max</a> <a href="#">NOVEMA Max Lux*</a></p>	<ul style="list-style-type: none"> <li>- Charged cationic polymers</li> <li>- Robust at low pH</li> <li>- Compatible with organic modifiers</li> <li>- Available in 5 µm particle sizes</li> </ul>
	<p>Proteins Peptides Enzymes</p>	<p><a href="#">AdvanceBio SEC 1.9 µm*</a> <a href="#">AdvanceBio SEC 2.7 µm*</a> <a href="#">Bio SEC-3</a> <a href="#">Bio SEC-5</a> <a href="#">PROTEEMA</a></p>	<ul style="list-style-type: none"> <li>- Pore size options from 100 to 2,000 Å</li> <li>- Options for UV, light scattering, and MS detection</li> <li>- AdvanceBio SEC has a hydrophilic coating for low secondary interactions</li> <li>- PROTEEMA is a diol SEC phase available in bio-inert hardware</li> </ul>
	<p>Monoclonal Antibodies (mAbs)</p>	<p><a href="#">AdvanceBio SEC*</a> <a href="#">Bio SEC-3</a> <a href="#">Bio SEC-5</a> <a href="#">MAB*</a></p>	<ul style="list-style-type: none"> <li>- Options for UV, light scattering, and MS detection</li> <li>- AdvanceBio SEC has a hydrophilic coating for low secondary interactions</li> <li>- MAB is a mixed-bed, diol SEC phase available in bio-inert hardware</li> </ul>

\* Light scattering ready. Low noise columns suitable for immediate use with laser light scattering detection.

# Selection tips

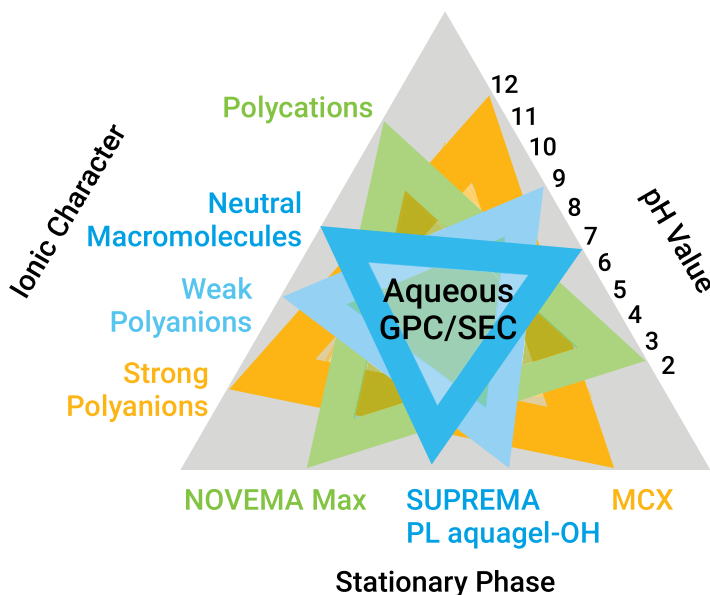
## Column selection tips



### Organic-soluble polymers

- ▲ **Yellow triangle:** Compounds only soluble in strong solvents, like THF
- ▲ **Green triangle:** Compounds soluble in medium-polar solvents, like DMAc
- ▲ **Blue triangle:** Compounds soluble in higher-polar fluorinated solvents, like HFIP.

**Note:** For organic applications, a system of balanced polarities is recommended.



### Water-soluble polymers

The main solvent is water, but your column choice should be made in correlation to the pH ranges at which the columns will be used.

To learn more and to access ordering information for the GPC/SEC columns and standards, go to [www.agilent.com/chem/gpc-sec-columns](http://www.agilent.com/chem/gpc-sec-columns)



## Standards selection tips

Which standards should I use? For additional detail and ordering information, please see

[www.agilent.com/en/product/gpc-sec-columns-standards/gpc-sec-standards](http://www.agilent.com/en/product/gpc-sec-columns-standards/gpc-sec-standards)

Question	Answer	Recommendation	Comments
<p>What is the sample and recommended eluent?</p> <p>Standards are macromolecules, so the choice of standard mainly reflects solubility in the chosen eluents and the type of sample to be measured.</p>	Synthetic polymers in water or aqueous buffers	> Polyethyleneglycol/oxide (PEG/PEO)	> These standards perform in aqueous systems and are available in InfinityLab <a href="#">EasiVial</a> and <a href="#">ReadyCal</a> format.
	Naturally occurring macromolecules in water or aqueous buffers	> Pullulan or dextran	> These standards perform in aqueous systems and are available in <a href="#">ReadyCal</a> format.
	Cationic macromolecules in water or aqueous buffers	> Poly(2-vinylpyridine) or pullulan	> Depending on column selection, polycations often require acidic eluent conditions.
	Strong anionic macromolecules in water or aqueous buffers	> Poly(styrene sulfonate) sodium salt or pullulan	> Depending on column selection, polyanions often require basic eluent conditions.
	Typical non-polar organic solvents, such as THF, chloroform, toluene	> Polystyrene (PS) or polymethyl methacrylate (PMMA)	> Polystyrene is the most commonly used standard and is available in InfinityLab <a href="#">EasiVial</a> and <a href="#">ReadyCal</a> format.
	Medium polar organic, such as DMF, DMSO, NMP	> Polymethyl methacrylate (PMMA), polyethylene glycol/oxide (PEG/PEO) or pullulan	> PMMA is soluble in various organic solvents and is available in InfinityLab <a href="#">EasiVial</a> and <a href="#">ReadyCal</a> format.
	Fluorinated solvents, such as HFIP	> Polymethyl methacrylate (PMMA)	> PMMA is soluble in various organic solvents and is available in InfinityLab <a href="#">EasiVial</a> and <a href="#">ReadyCal</a> format.
<p>Which standard format is best?</p> <p>Different formats are available depending on your needs.</p>	To save time and labor when generating a general calibration curve	> InfinityLab <a href="#">EasiVial</a> , <a href="#">ReadyCal</a> , or <a href="#">EasiCal</a>	> InfinityLab EasiVial standards and ReadyCal kits offer a wide range of polymer types, while InfinityLab EasiCal can be used in any type of vial or container.
	If accurate concentrations are required	> InfinityLab <a href="#">EasiVial</a> , <a href="#">ReadyCal</a> , or individual standards	> InfinityLab EasiVial standards and ReadyCal kits offer an easy pre-weighed option, while individual standards are available in larger quantities for concentrated solutions and custom combinations.
<p>I want to validate my GPC/SEC system. Are there special standards available?</p>	<p>For use in aqueous systems</p> <p>For use in THF</p>	<p>&gt; <a href="#">EasyValid</a> validation kit for aqueous applications</p> <p>&gt; <a href="#">EasyValid</a> validation kit for organic applications</p>	<p>&gt; For checking the system performance after installation—as part of the OQ/PV (Operational Qualification/Performance Verification):</p> <ul style="list-style-type: none"> <li>• For performance review after maintenance</li> <li>• For review after changing system components</li> <li>• For verifying your operations</li> <li>• For interlaboratory consistency checks</li> <li>• For identifying systematic errors</li> <li>• For training new employees</li> </ul>

For more information about GPC/SEC calibration kits,

visit [www.agilent.com/en/product/gpc-sec-columns-standards/gpc-sec-standards/calibration-kits](http://www.agilent.com/en/product/gpc-sec-columns-standards/gpc-sec-standards/calibration-kits)

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Learn more about GPC/SEC columns and standards:

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