

Uncompromising Analysis of Polymers and Macromolecules

Expanded portfolio of Agilent
GPC/SEC columns and standards



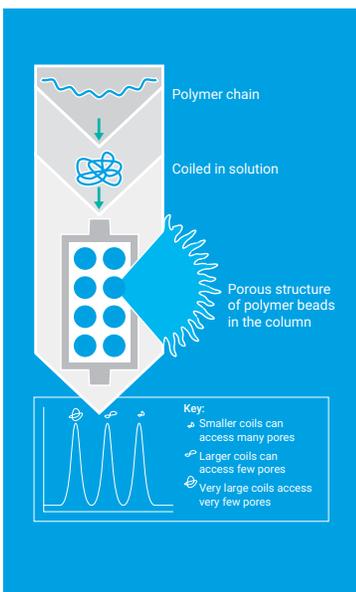


Analyze with Certainty and Ensure Confidence in Your Product Quality

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**—used for bottles, buckets, toys, and other petrochemical-derived products—that dissolve in low-polar organic solvents
- **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. And, 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 17025 and 17034 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:

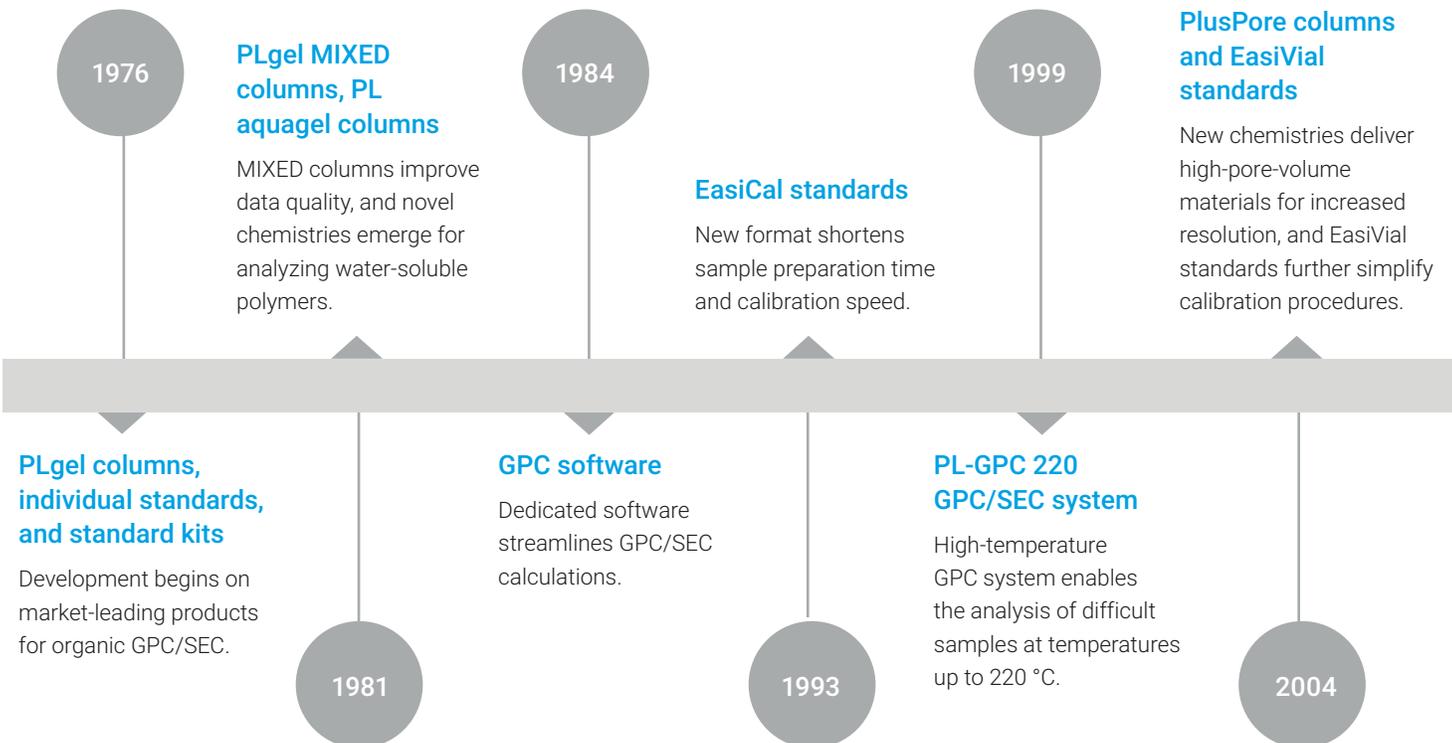
- Polymer standards in powder form
- Prepared InfinityLab EasiVial and EasiCal standards, and the ReadyCal and EasyValid validation kits, save time by eliminating tedious weighing procedures, and can be used for a wide variety of applications
- Ultranarrow molecular weight (MW) standards, available in 1, 5, and 10 g quantities, for use as model polymers in research and analytical development

To access a wide range of application notes for polymer and macromolecule analysis, go to explore.agilent.com/gpc-sec-columns



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 Polymer Standards Service (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>PLgel GPC SDV GPC PLgel MIXED SDV Linear SDV LUX PLgel MIXED-LS</p>	<ul style="list-style-type: none"> – Individual pore sizes and mixed-bed or linear columns – Low-noise columns for light scattering detection
	<p>Polycarbonates, Polyurethanes, Epoxy Resins, Polyester Resins, Siloxanes, Silicone Fluids</p>	<p>InfinityLab PlusPore InfinityLab PolyPore InfinityLab ResiPore InfinityLab OligoPore InfinityLab MesoPore PL Rapide</p>	<ul style="list-style-type: none"> – Next-generation, high-performance GPC columns for superior separations
	<p>Nylons, Polylactides, Polyesters, PET</p>	<p>PL HFIPgel PFG</p>	<ul style="list-style-type: none"> – Compatible with fluorinated solvents – Available in 5 µm particles for higher efficiency
	<p>Food films, PE, PP, Polymers</p>	<p>InfinityLab PLgel Olexis POLEFIN</p>	<ul style="list-style-type: none"> – High-temperature GPC
	<p>Epoxy, Polyurethanes, Polysulfones, Celluloses</p>	<p>PolarGel PolarSil GRAM</p>	<ul style="list-style-type: none"> – Medium-polar organic solvents – PolarSil available in 3 µm particle sizes for higher efficiency

Organic solvent-soluble polymers

Water-soluble polymers



Dextran, Saccharides,
Hyaluronic Acid,
Acrylates, Acrylamides,
Heparin, Gum

PL aquagel-OH
PL Multisolvant
PL Rapide Aqua
SUPREMA GPC/SEC
SUPREMA LUX

- Individual pore sizes and mixed-bed columns
- Low-noise columns for light scattering detection
- SUPREMA compatible with 100% organic modifiers



Sulfonated Polyanions,
Lignins

MCX

- Charged anionic polymers
- Robust at high pH
- Compatible with organic modifiers
- Available at 5 µm particle sizes

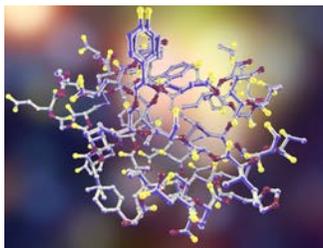


Chitosan, Food Ingredients,
Cationic Polymers

Novema Max

- Charged cationic polymers
- Robust at low pH
- Compatible with organic modifiers
- Available at 5 µm particle sizes

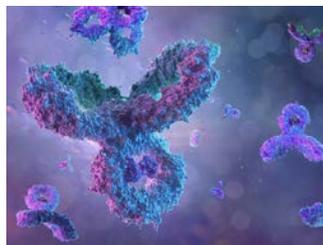
Water-soluble polymers



Proteins, Peptides,
Enzymes

AdvanceBio SEC
Bio SEC-3
Bio SEC-5
PROTEEMA

- Pre-equilibrated for light scattering applications in bio-inert hardware
- Aqueous buffer solutions are also available



Monoclonal Antibodies
(mAbs)

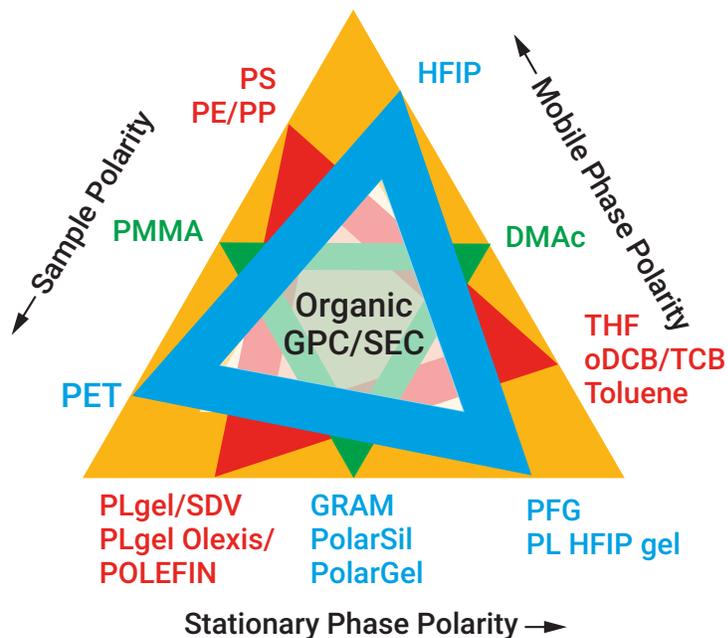
AdvanceBio SEC
Bio SEC-3
Bio SEC-5
mAb

- Pre-equilibrated for light scattering applications in bio-inert hardware
- Aqueous buffer solutions are also available

Biologics

Selection tips

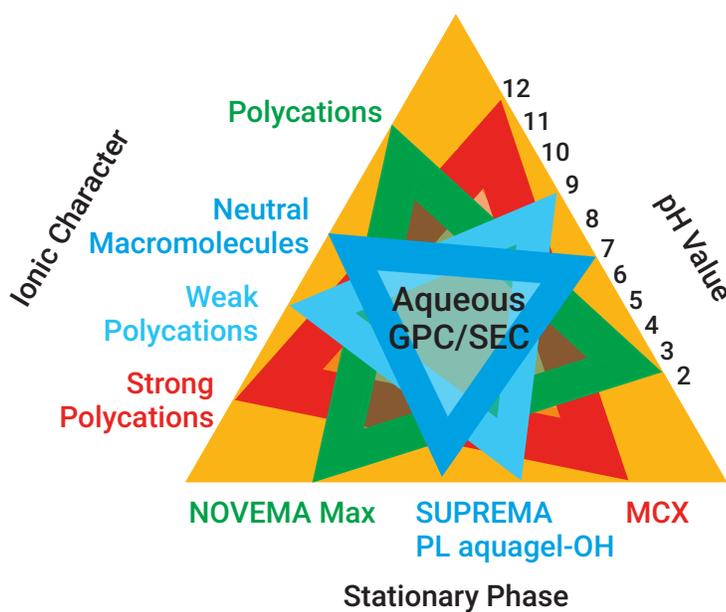
Column selection tips



Organic-soluble polymers

- ▲ **Red 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

Standards selection tips

Which standards should I use?

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 EasiVial and ReadyCal format.
	Naturally occurring macromolecules in water or aqueous buffers	Pullulan or Dextran	These standards perform in aqueous systems and are available in ReadyCal format.
	Cationic macromolecules in water or aqueous buffers	Pullulan or poly (2-vinylpyridine)	Depending on column selection, polycations often require acidic eluent conditions.
	Strong anionic macromolecules in water or aqueous buffers	Pullulan or Poly (styrene sulfonate) sodium salt	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 EasiVial and ReadyCal format.
	Medium polar organic, such as DMF, DMSO, NMP	Polymethyl methacrylate (PMMA), Polyethylene glycol/oxide (PEG/PEO) or Pullulan	Polymethyl methacrylate is soluble in various organic solvents and is available in InfinityLab EasiVial and ReadyCal format.
	Fluorinated solvents, such as HFIP	Polymethyl methacrylate (PMMA)	Polymethyl methacrylate is soluble in various organic solvents and is available in InfinityLab EasiVial and ReadyCal 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 EasiVial, ReadyCal, or InfinityLab EasiCal	InfinityLab EasiVials and ReadyCals 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 EasiVial, ReadyCal, or individual standards	InfinityLab EasiVials and ReadyCals 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>EasyValid validation kit for aqueous applications</p> <p>EasyValid validation kit for organic applications</p>	<p>For checking the system performance after installation—as part of the OQ/PV (Operational Qualification/Performance Verification):</p> <ul style="list-style-type: none"> • For performance review after maintenance • For review after changing system components • For verifying your operations • For interlaboratory consistency checks • For identifying systematic errors • For training new employees

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