




  
**Malvern** | Material relationships



-  MOLECULAR WEIGHT
-  MOLECULAR SIZE
-  MOLECULAR STRUCTURE

# MALVERN ADVANCED GPC/SEC DETECTORS

SETTING THE STANDARD

# WHAT CAN ADVANCED GPC/SEC DETECTION OFFER YOU?

A modern research environment demands a complete understanding of a sample's molecular properties including accurate and reliable measurements of molecular weight.

Single detector GPC/SEC systems have been used for many years but cannot keep up with evermore demanding applications. The addition of advanced detection brings the greater understanding needed for today's samples.

- A **light scattering** detector: the heart of an advanced GPC/SEC system. Light scattering enables absolute molecular weight independent of structure and sample retention time
- A **viscometer**: probes the very structure of a molecule to give a sample's intrinsic viscosity. No other detector can match its sensitivity to structural changes such as branching
- A **refractive index or ultraviolet** detector: concentration measurement is the first step in any advanced GPC/SEC measurement and the Viscotek detectors' range includes various options.

The ultimate in advanced detection is the combination all of these detectors to get a complete understanding of the molecule being investigated.

## Malvern's Advanced GPC/SEC Detectors



Advanced GPC/SEC detectors can be used to upgrade existing GPC/SEC systems to more advanced setups offering the full range of applications but without the expense of a complete new system.

Choice and versatility drive our GPC/SEC range and our goal is to provide an advanced detection solution tailored to your specific needs.

Through the innovative use of different measurement technologies, our detectors cover the full spectrum of GPC/SEC applications in the protein, polymer and polysaccharide characterization fields. The Malvern detector range can measure:

- **Absolute molecular weight, distribution and polydispersity**
- **Intrinsic viscosity and molecular structure**
- **Mark-Houwink parameters**
- **Molecular size (Rh & Rg)**
- **Branching number and frequency**
- **Composition**
- **2nd virial coefficient  $A_2$  ( $B_{22}$ ).**

All of the detectors in this brochure are available as individual modules to enhance your existing chromatography system, or as part of a complete GPC/SEC system. For more information about complete GPC/SEC systems, please refer to the separate brochure.

# SYNTHETIC AND NATURAL POLYMER APPLICATIONS

The physical properties of a synthetic polymer like polystyrene, or a natural polymer like hyaluronic acid are strongly dependent on its molecular properties. Molecular weight, polydispersity, structure and (for copolymers) composition all contribute to determining the final product's properties and processability.

With more and more novel polymers entering the market, conventional measurements of molecular weight using a single detector are no longer sufficient. Our detectors make absolute measurements of these properties to cover a wide range of synthetic and natural polymer applications including:

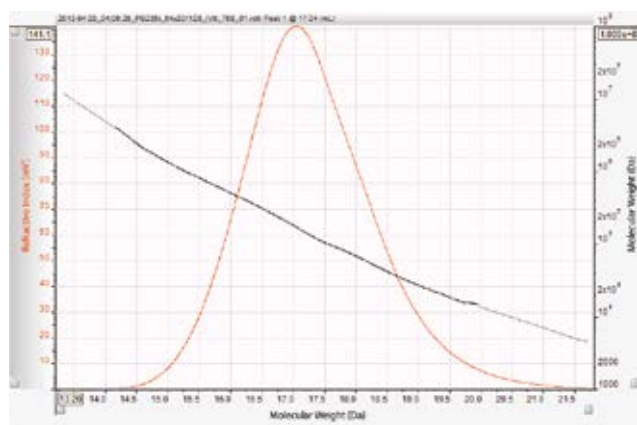
- Polymer research
- Paints and coatings
- Food ingredients
- Drug excipients
- Tablet coatings
- Cosmetic and cosmeceuticals.

Molecular weight and molecular weight distribution can affect a polymer's **strength, durability, flexibility, toughness** and **degradation** rates. The different molecular weight moments also provide information on **flow properties** or **reactivity**.

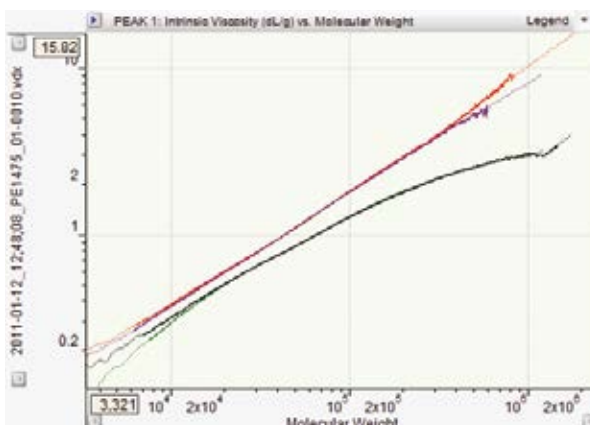
Intrinsic viscosity is a direct measure of molecular structure and can be used to assess **branching**, which also affects **processability** and **flow viscosity**.

Copolymers combine the properties of their components. Measuring their **composition** will therefore help to understand the contribution of the individual components.

If you are interested in understanding these polymer properties better, take a look at the OMNISEC REVEAL or the Viscotek TDA.



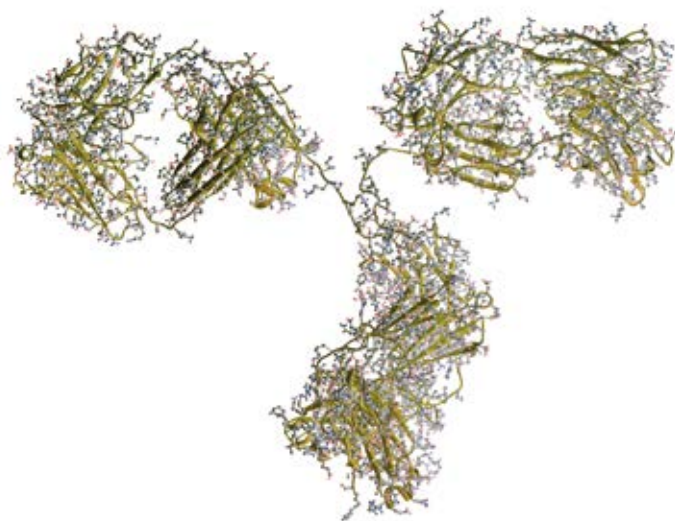
Absolute molecular weight measured by light scattering overlaid on the RI chromatogram



Mark-Houwink plot of molecular weight vs intrinsic viscosity for polymer structural elucidation.

# PROTEIN APPLICATIONS

A protein's activity is strongly dependent on it being in the correct conformation and oligomeric state. Biopharmaceutical drugs must be aggregate-free and protein conjugates must be well controlled during research and as manufactured drugs. Single-detector GPC/SEC cannot meet the growing demands in this field but advanced GPC/SEC detection can help the protein scientist with all of these parameters, helping them to better understand the behavior of their protein of interest.



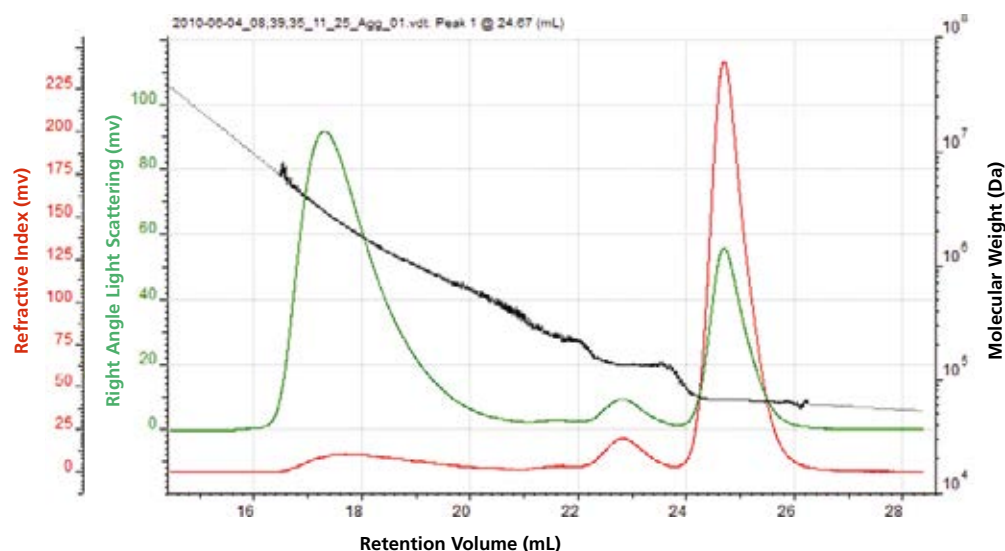
The molecular weight and size of a protein directly identifies its oligomeric state while polydispersity gives an indication of the purity of a sample peak.

**Aggregates** can be identified and their molecular weight, polydispersity and quantity all measured.

**Conjugates** such as PEGylated, glycosylated and membrane proteins can be characterized for their composition and molecular weight.

Intrinsic viscosity can be used to give an idea of **broad conformational changes** that relate, for example, to ligand binding.

If you are interested in understanding these protein properties better, take a look at the Viscotek SEC-MALS 20, OMNISEC REVEAL or the Zetasizer  $\mu$ V.



Protein oligomers and aggregates shown by Right Angle Light Scattering (RALs) (green) and Refractive Index (RI) (red) chromatograms overlaid with the absolute molecular weight (black).

# OMNISEC REVEAL

Absolute Molecular Weight, Intrinsic Viscosity, Molecular Size, Concentration

OMNISEC REVEAL is Malvern's latest and most advanced integrated multi-detector system for superior GPC/SEC analysis. It includes refractive index (RI), UV/Vis absorbance, light scattering and intrinsic viscosity detectors for the characterization of synthetic polymers, natural polymers and polysaccharides, and proteins.

In combination, these detectors can measure:

- Sample concentration
- Absolute molecular weight and molecular weight distribution
- Polydispersity
- Intrinsic viscosity
- Molecular size ( $R_h$  &  $R_g$ )
- Molecular structure
- Mark-Houwink parameters
- Refractive Index increment,  $dn/dc$ .

An integrated design keeps all of the detectors in one compartment, affording multiple advantages:

- Inter-detector tubing is minimized reducing band broadening to improve data quality and result accuracy
- The detectors and the inter-detector tubing are all maintained at the same temperature to further improve data quality by maintaining baseline stability.

The result is unparalleled multi-detector data quality.





# OMNISEC REVEAL TECHNOLOGY

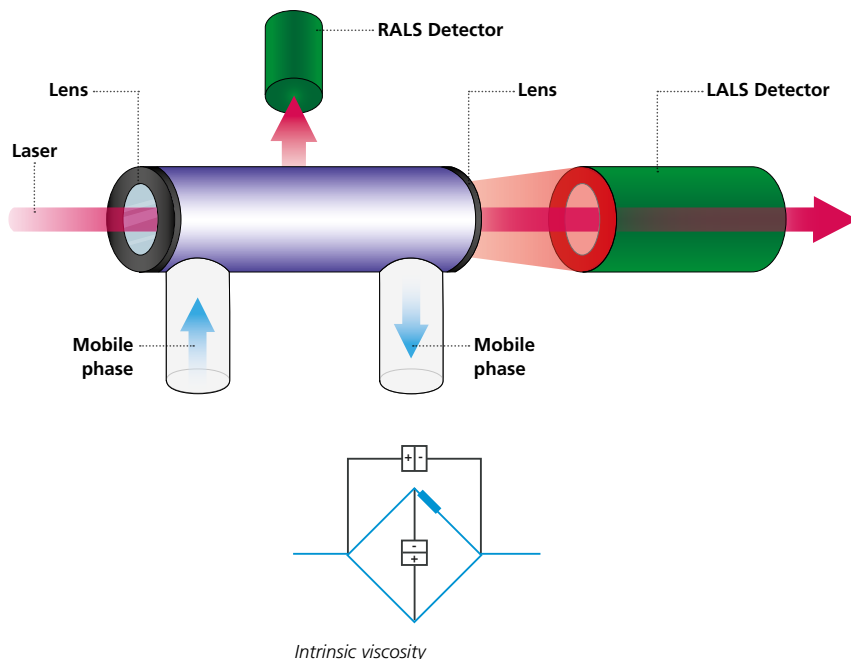
Absolute Molecular Weight, Intrinsic Viscosity, Molecular Size, Concentration

OMNISEC REVEAL's **refractive index detector** measures sample concentration. Its robust flow cell is kept in series with the other detectors for maximum sensitivity.

The **UV/Vis photodiode array** (200-900 nm) opens up absorbance measurements to a wider application range.

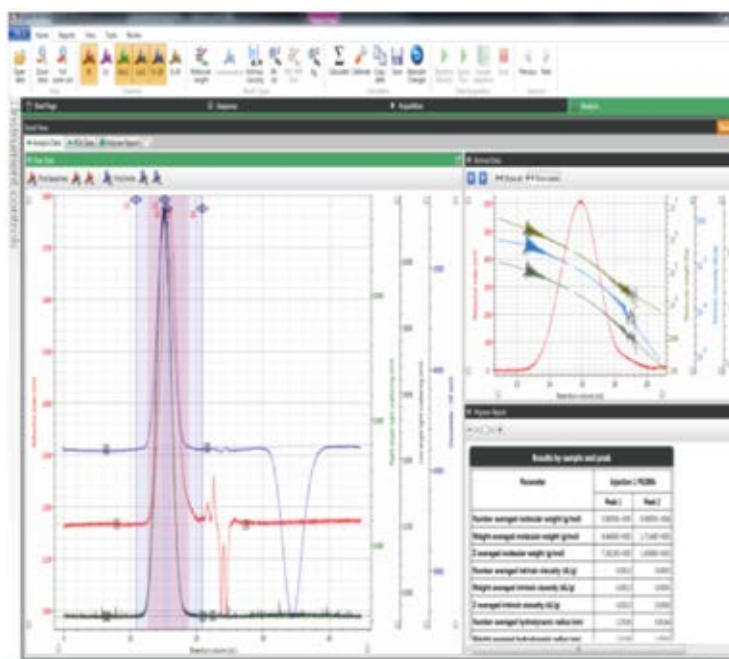
The **light scattering detector** combines the sensitivity of 90° Right Angle Light Scattering (RALS) with the accuracy of 7° Low-Angle Light Scattering (LALS). Its superior sensitivity makes it ideal for measuring low molecular weight, low concentration or low dn/dc samples, while its 18 µL flow cell minimizes band broadening.

OMNISEC REVEAL's **digital differential viscometer** includes a unique self-balancing bridge which can be easily replaced by the user. Its new 316 stainless steel pressure transducers improve baseline stability, sensitivity and robustness and means few limitations with salts or pH.



# OMNISEC SOFTWARE v10

Absolute Molecular Weight, Intrinsic Viscosity, Molecular Size



OMNISEC software v10, for OMNISEC REVEAL has been designed with you and your priorities in mind. The software is laid out to guide the user through setup, data acquisition and analysis in an intuitive workflow and its advanced user interface reduces training requirements for new users.

Key benefits of OMNISEC software v10 include:

- Intuitive look and feel
- Simple and customizable reporting to present only the data that is most important to you
- Overlay multiple injections and results quickly and easily
- Easy exporting of data
- 1-click from data to results
- Compliance with 21 CFR Part 11.

# VISCOTEK SEC-MALS 20

Absolute Molecular Weight, Molecular Size

The SEC-MALS 20 is a modular multi-angle light scattering detector that can easily be combined with any existing GPC/SEC system, for direct measurements of absolute molecular weight and size.

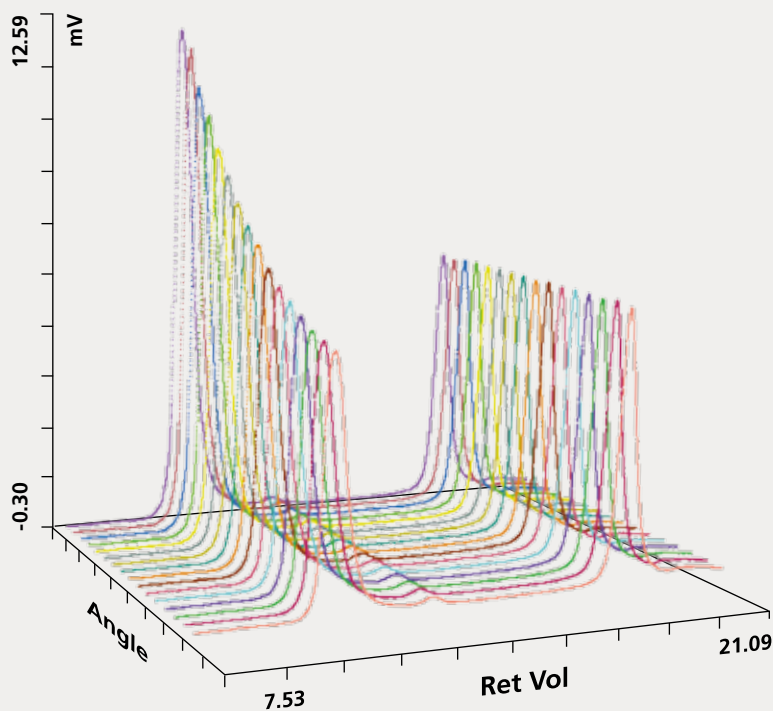


For proteins, the SEC-MALS 20 offers:

- Absolute molecular weight and oligomeric state
- Aggregate quantity, molecular weight and size (where applicable)
- Conjugation in samples such as PEGylated or membrane proteins (with two concentration detectors)
- 2nd virial coefficient  $A_2$  ( $B_{22}$ ).

For natural and synthetic polymers, the SEC-MALS 20 offers:

- Absolute molecular weight and molecular weight distribution
- Molecular size ( $R_g$ ) for structural comparisons through conformation plots
- 2nd virial coefficient  $A_2$  ( $B_{22}$ ).



The key to the performance of the SEC-MALS 20 is the vertical flow cell with radial optics:

- Reduced detector noise at low angles
- Reduced need to clean the detector
- Fixed, constant and known measurement angles, regardless of solvent type
- One cell for all solvents means never having to switch or remove the cell
- Reduced band broadening and tailing compared with other MALS detectors, thanks to the low volume cell.

The overall result is minimized noise and the most accurate MALS data available.

MALS signals from an aggregated protein and monomer

# ZETASIZER $\mu$ V

Absolute Molecular Weight, Molecular Size



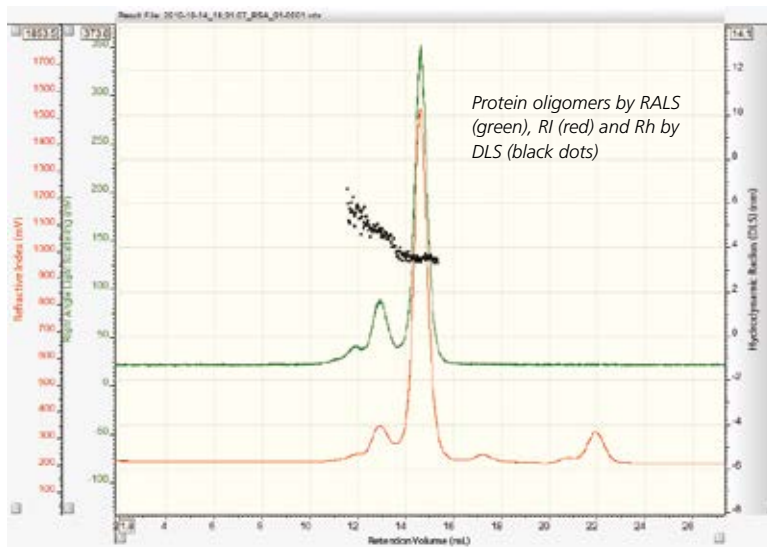
The dual capability Zetasizer  $\mu$ V offers unmatched versatility for protein analysis. It combines measurements of molecular weight by Static Light Scattering (SLS) with measurements of molecular size (Rh) by Dynamic Light Scattering (DLS). It can also perform both of these measurements in batch and GPC/SEC flow modes.

The detector is optimized for the measurement of smaller molecules that scatter less light, making it ideal for protein measurements.

## SEC Mode

In flow mode, as a modular SEC-DLS detector, the Zetasizer  $\mu$ V measures the intensity of scattered light from which is calculated the absolute molecular weight of small macromolecules like proteins. It can also continually collect correlation functions to make measurements of Rh by DLS at the same time. As a GPC/SEC detector, the Zetasizer  $\mu$ V can measure:

- Absolute molecular weight and oligomeric state
- Aggregation levels
- Molecular size (Rh)
- Conjugate composition and molecular weight (with RI & PDA)
- 2nd virial coefficient  $A_2$  ( $B_{22}$ ).



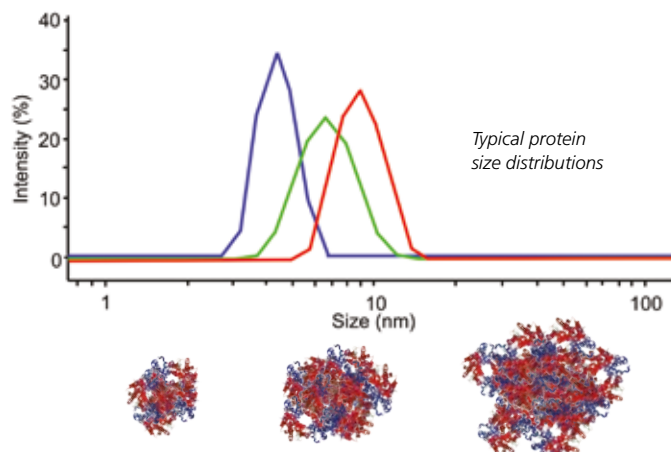
Chromatographic data from the Zetasizer  $\mu$ V in SEC mode

## Batch Mode

In batch mode, using a cuvette, the Zetasizer  $\mu$ V can perform all of the DLS-based measurements you would expect from a Zetasizer instrument. Its temperature control allows you to perform the common temperature ramp, aggregation point, and stability experiments - all controlled using Malvern's Zetasizer software. In batch mode, the Zetasizer  $\mu$ V can measure:

- Hydrodynamic radius
- Aggregate detection
- Aggregation temperature studies.

DLS data from the Zetasizer  $\mu$ V in batch mode



Typical protein size distributions



# VISCOTEK TDA

Absolute Molecular Weight, Intrinsic Viscosity, Molecular Size, Concentration

The Viscotek TDA is a multi-detector platform for advanced GPC/SEC measurements. It uses refractive index, light scattering and viscometer detectors to measure:

- Sample concentration
- Absolute molecular weight and molecular weight distribution
- Polydispersity
- Intrinsic viscosity
- Molecular size ( $R_h$  &  $R_g$ )
- Molecular structure/branching
- Mark-Houwink parameters
- Refractive Index increment,  $dn/dc$
- 2nd virial coefficient,  $A_2$  ( $B_{22}$ )
- Copolymer and conjugate composition (with the PDA).

The integrated platform has these advantages:

- All columns and detector cells are housed in a single temperature-controlled compartment (up to 80 °C) for maximum baseline stability and solvent range
- Inter-detector tubing is minimized reducing band broadening and tailing.

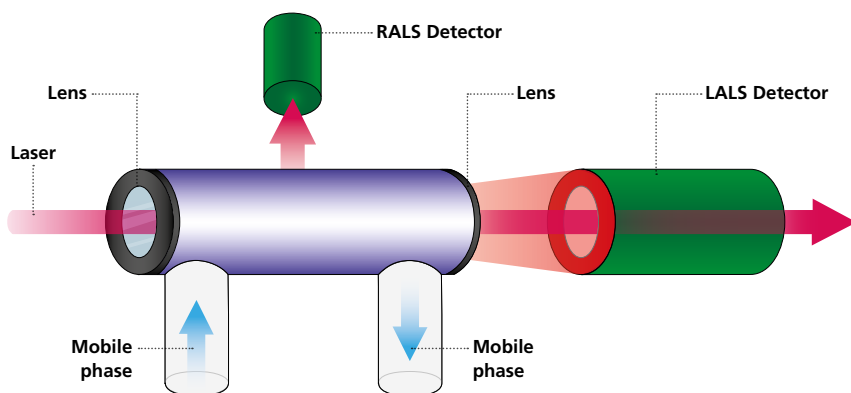


*The TDA as part of a complete system*

# VISCOTEK TDA TECHNOLOGY

Absolute Molecular Weight, Intrinsic Viscosity, Molecular Size, Concentration

The TDA's **refractive index (RI) detector** measures the concentration of almost any solute. The proprietary RI detector in the TDA has a robust flow cell keeping all detectors in series and maximizing their sensitivity.



A RALS/LALS detector

The **light scattering detector** inside the TDA combines the sensitivity of 90° Right Angle Light Scattering (RALS) with the accuracy of 7° Low-Angle Light Scattering (LALS). The software automatically chooses the best angle for the sample at every data slice. Its flow cell is just 18 µL minimizing band broadening.

Viscotek invented and patented the first **differential viscometer**. The TDA's digital transducers give a fast, sensitive response to viscosity changes, and 316 stainless steel construction means few sample limitations with salts or pH.

# VISCOTEK RI AND PDA DETECTORS

Concentration

A modular differential refractive index detector for measuring sample concentration, which can be temperature controlled from ambient up to 55°C for improved baseline stability and is also compatible with sub-ambient measurements in a cold room or refrigerated cabinet. A 9 µl cell minimizes band-broadening.



The Viscotek PDA is a photodiode array detector for measuring the absorbance of UV light, covering the full UV spectrum from 190 nm – 510 nm. A visible spectrum option is also available to measure 430 nm – 710 nm. Fibre optic or stand-alone versions are available to allow integration into any system.

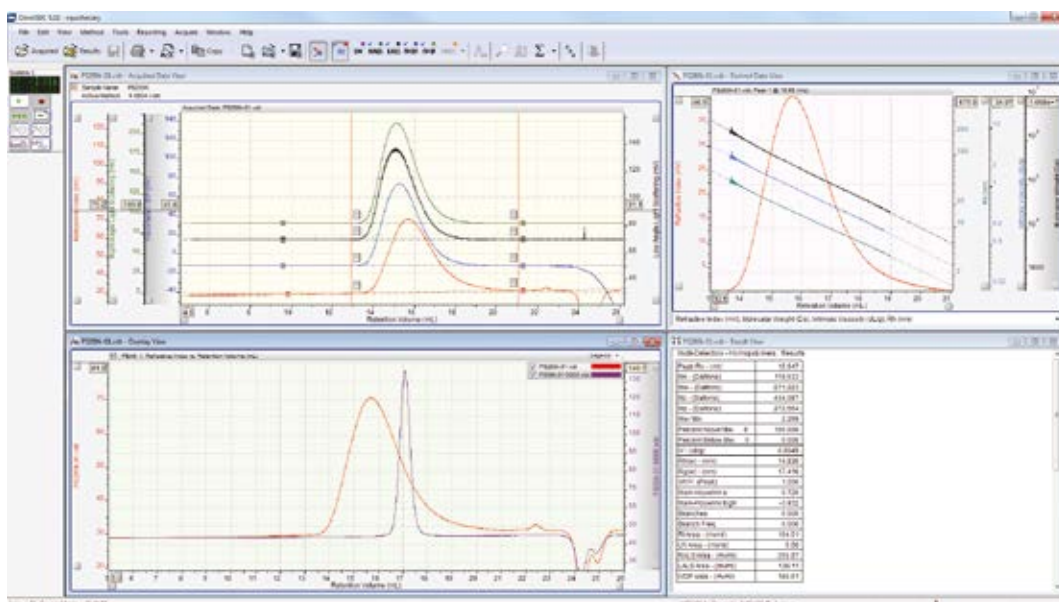


# OMNISEC SOFTWARE v5

Control and analysis in a single package

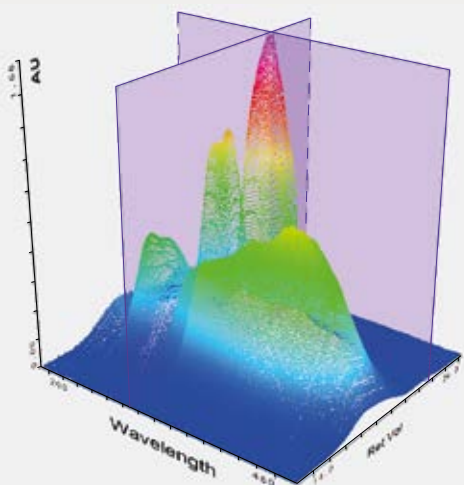
OmniSEC software v5 is the GPC/SEC software package available for the Viscotek products.

With its clear user interface, OmniSEC software v5 is used to control Viscotek systems, acquire data from all Viscotek detectors and perform GPC/SEC data analysis.



With OmniSEC software v5 you can:

- Measure molecular weight and molecular weight distribution by light scattering or column calibration techniques
- Measure intrinsic viscosity and hydrodynamic radius. Mark-Houwink parameters and branching
- Be sure of the most accurate results thanks to proven band-broadening corrections
- Perform copolymer and conjugate calculations
- Overlay multiple chromatograms or results
- Reanalyze entire datasets in a few clicks using the Trend View
- Calculate  $dn/dc$ ,  $dA/dc$  (extinction coefficient) and  $A_2(B_{22})$
- View all the angular data from a MALS measurement in a single plot with just one click of the mouse.



By combining RI and UV signals from a copolymer or conjugated sample, the software can calculate the concentration of each component and then measure the complex molecular weight and composition.

In this way, these samples can be fully characterized. Such samples include:

- Styrene/butadiene copolymers
- Conjugated protein samples such as PEGylated or membrane proteins.

*Explore relationship of UV absorbance with wavelength and retention volume (or molecular weight) via powerful interactive 3D plot.*



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| Material relationships



MOLECULAR WEIGHT



MOLECULAR SIZE



MOLECULAR STRUCTURE

# MALVERN GPC/SEC SYSTEMS

SETTING THE STANDARD





# WHAT CAN ADVANCED GPC/SEC OFFER YOU?

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- A **light scattering** detector: the heart of an advanced GPC/SEC system. Light scattering enables absolute molecular weight independent of structure and sample retention time
- A **viscometer**: probes the very structure of a molecule to give a sample's intrinsic viscosity. No other detector can match its sensitivity to structural changes such as branching
- A **refractive index** or ultraviolet detector: concentration measurement is the first step in any advanced GPC/SEC measurement and the Viscotek detectors include a range of options.

## VISCOTEK SYSTEMS



A Viscotek system is a complete out-of-the-box solution for the characterization of synthetic and natural polymers as well as proteins.

In a single run they are capable of making the most accurate measurements of molecular weight and size, intrinsic viscosity and structure as well as characterize copolymers, conjugates and branching.

They are designed to work together under a single software package and form a complete solution to guarantee the return on your investment into a new GPC/SEC system.

All of the detectors that make up the GPC/SEC systems in this brochure are also available as individual modules to enhance your existing chromatography system. For more information about individual GPC/SEC detectors, please refer to the separate 'Malvern GPC/SEC Detectors' brochure

# WHY BUY THE COMPLETE SOLUTION FROM MALVERN?

At Malvern, we not only provide you what is inside the box, we also like to think outside the box with our Technical and Application support, to get you up and running in the least amount of time possible.

When you purchase a complete solution from Malvern, we like to ensure the system will be a perfect match for your application needs; that's why we offer to run your samples through our highly experienced applications lab to fully understand your requirements before purchase and ensure minimum start-up time after installation.

The installation comes with entry-level training to get you up and running with the basics as soon as possible along with an invitation to one of our advanced training courses. But the support doesn't end there!

With Malvern technical staff and application personnel to assist with training and method development, and Global Technical Support at the end of the phone, we'll be with you every step of the way. You'll also have access to our on-line webinars and e-learning as well as other training courses.

Consumables and maintenance of your system are both critical to your sample analysis. Malvern offers a full range of columns, standards and other consumables, as well as a complete range of support plan options to suit your needs.

In short, at Malvern we pride ourselves on providing you with a complete solution.



# SYNTHETIC AND NATURAL POLYMER APPLICATIONS

The physical properties of a synthetic polymer like polystyrene, or a natural polymer like hyaluronic acid are strongly dependent on its molecular properties. Molecular weight, polydispersity, structure and (for copolymers) composition all contribute to determining the final product's properties and processability.

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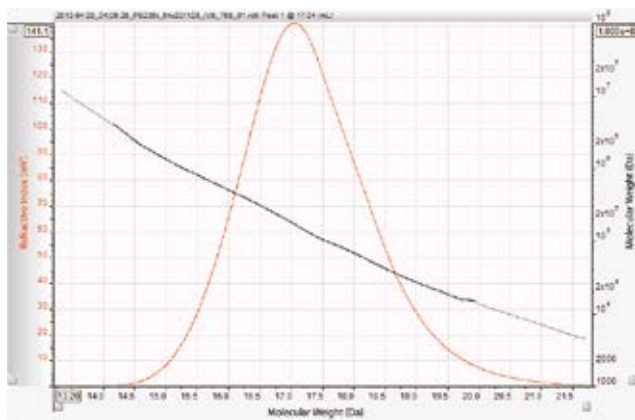
- Polymer research
- Paints and coatings
- Bulk polymers & polyolefins
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Molecular weight and molecular weight distribution can affect a polymer's **strength, durability, flexibility, toughness** and **degradation** rates. The different molecular weight moments also provide information on **flow properties** or **reactivity**.

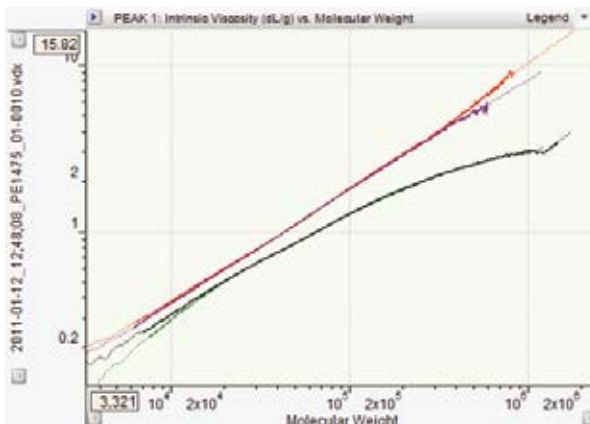
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Copolymers combine the properties of their components. Measuring their **composition** will therefore help to understand the contribution of the individual components.

If you are interested in understanding these polymer properties better, take a look at the OMNISEC or the Viscotek TDAmix systems.



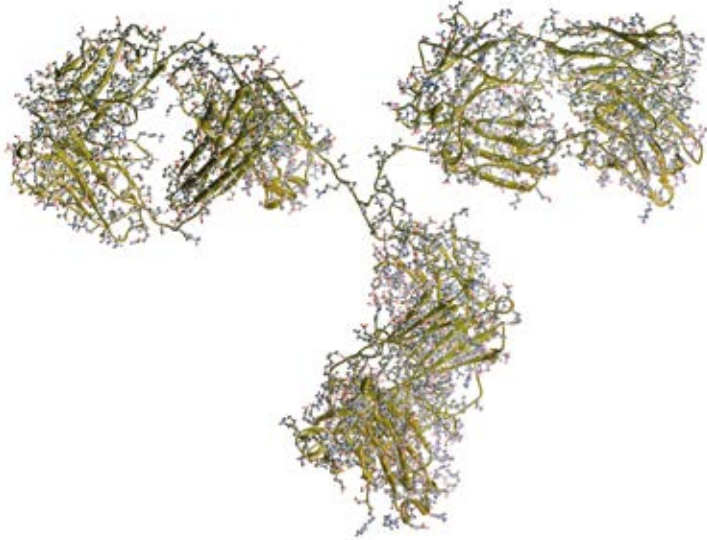
Absolute molecular weight measured by light scattering overlaid on the RI chromatogram



Mark-Houwink plot of intrinsic viscosity vs molecular weight for polymer structural elucidation.

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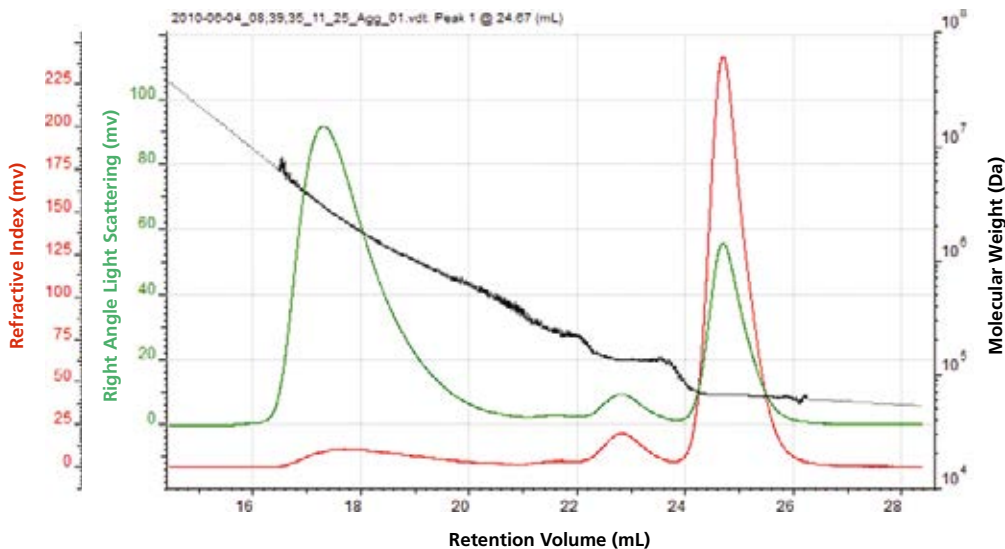
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Protein oligomers and aggregates shown by Right Angle Light Scattering (RALS) (green) and Refractive Index (RI) (red) chromatograms overlaid with the absolute molecular weight (black).

# OMNISEC SYSTEM

Absolute Molecular Weight, Intrinsic Viscosity, Molecular Size, Concentration

Malvern's expertise and experience with GPC/SEC has enabled the development of the most sensitive and accurate multi-detector system available for the characterization of any polymer or protein. The system includes:

**OMNISEC RESOLVE** has been designed using our 30 years of experience in GPC/SEC instrument development to achieve the highest possible standard in chromatographic performance.

**OMNISEC REVEAL** is the integrated multi-detector platform. It is available with refractive index, UV/Vis absorbance, light scattering and viscosity detectors to make a wide range of measurements that meet the needs of a many applications.

The low volume degasser allows rapid solvent and buffer changeover. Improved degassing efficiency combined with a low pulsation isocratic pump provides excellent flow rate stability and reduced baseline noise on all detectors.

The temperature controlled (4-65°C) autosampler can make injections from vials or 96-well microtiter plates with zero overhead to prevent wastage of your most precious samples, and the integrated column oven maintains a stable separation temperature up to 65°C.



For detailed information about the OMNISEC system, and a full list of specifications, please refer to the separate brochure.



# OMNISEC REVEAL TECHNOLOGY

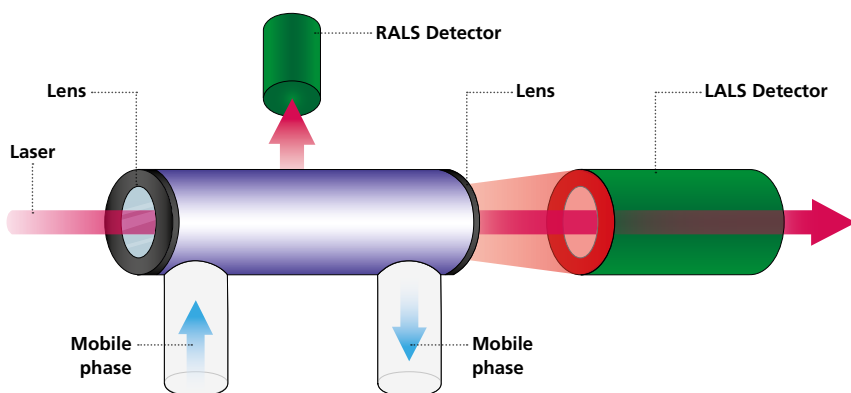
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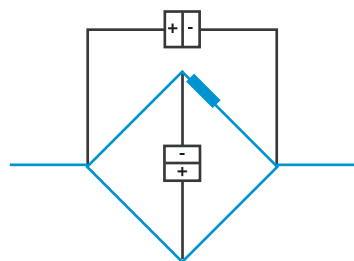
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A RALS/LALS detector



Intrinsic viscosity

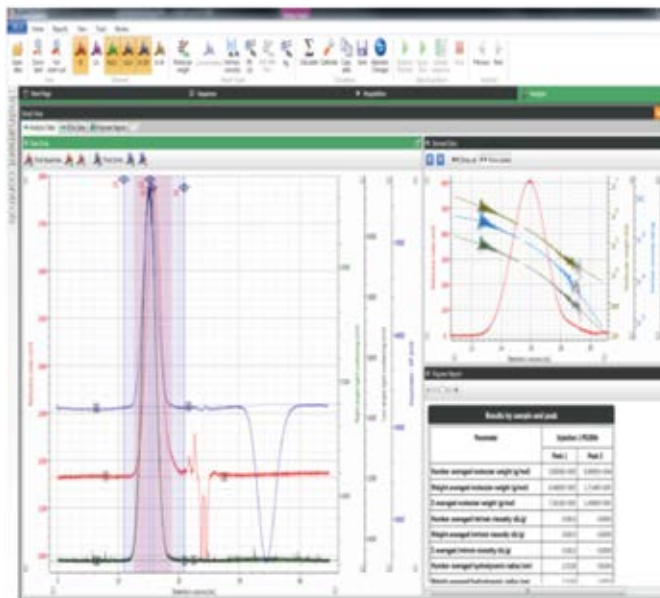
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- Simple and customizable reporting to present only the data that is most important to you
- Overlay multiple injections and results quickly and easily
- Easy exporting of data
- 1-click from data to results!
- Compliance with 21 CFR Part 11.



# VISCOTEK SEC-MALS 20 SYSTEM

Absolute Molecular Weight, Molecular Size

The SEC-MALS 20 is a modular multi-angle light scattering detector for direct measurements of absolute molecular weight and size. It can easily be combined with a column oven, modular RI detector and GPCmax to form a complete SEC-MALS 20 system, offering a turnkey solution with control of data acquisition and analysis using a single software package. The SEC-MALS 20 can also be added to the TDAmx or 270max if MALS is required.

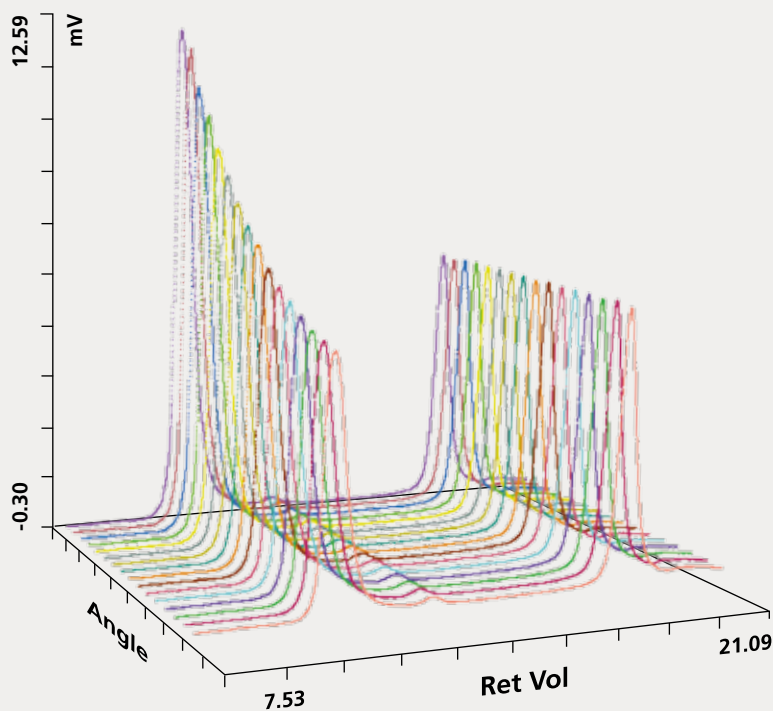


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- Second virial coefficient  $A_2$  ( $B_{22}$ ).

For natural and synthetic polymers, the SEC-MALS 20 offers:

- Absolute molecular weight and molecular weight distribution
- Molecular size ( $R_g$ ) for structural comparisons through conformation plots
- Second virial coefficient  $A_2$  ( $B_{22}$ ).



OmniSEC software v5 simplifies MALS data:

- To view the slice-by-slice data, simply open the fit view and move the slider across the chromatogram peak to see the MALS data from any point on the chromatogram
- Switching between models (Zimm, Berry, Debye) and fit orders (1-5) is performed easily using the fit view. The results are updated immediately making it possible to compare results in seconds
- The 3 dimensional MALS view (left) makes visualizing isotropic and anisotropic scattering easy.

MALS signals from an aggregated protein and monomer

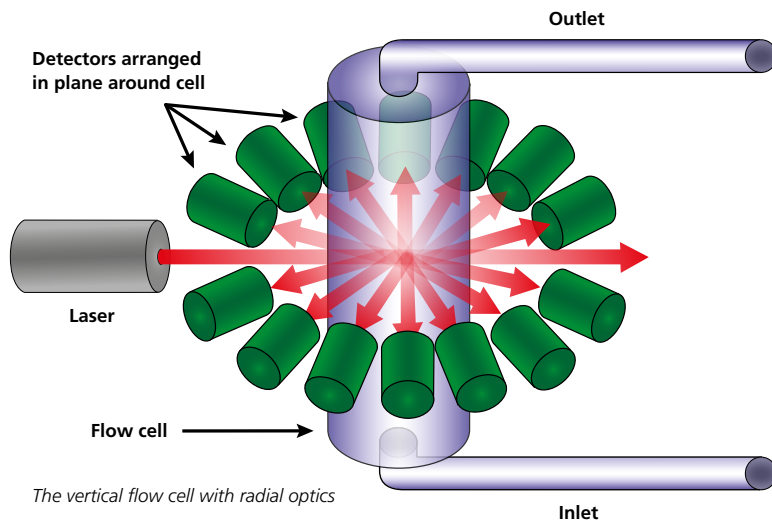
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- Reduced detector noise at low angles
- Reduced need to clean the detector
- Fixed, constant and known measurement angles, regardless of solvent type
- One cell for all solvents means never having to switch or remove the cell
- Reduced band broadening and tailing compared with other MALS detectors, thanks to the low volume cell.

The overall result is minimized noise and the most accurate MALS data available.



# VISCOTEK TDAm<sub>ax</sub> SYSTEM

Absolute Molecular Weight, Intrinsic Viscosity, Molecular Size, Concentration

The Viscotek TDAm<sub>ax</sub> is a complete stand-alone, temperature controlled, multi-detector GPC/SEC system. The detector module, the Triple Detector Array (TDA), is paired with the GPCmax to form a complete solution for macromolecular characterization. The detector can contain any combination of refractive index, light scattering and viscometer detectors to measure:

- Sample concentration
- Absolute molecular weight and molecular weight distribution
- Polydispersity
- Intrinsic viscosity
- Molecular size (R<sub>h</sub> & R<sub>g</sub>)
- Molecular structure/branching
- Mark-Houwink parameters
- Refractive Index increment, dn/dc
- Second virial coefficient, A<sub>2</sub> (B<sub>22</sub>)
- Copolymer and conjugate composition (with the additional PDA detector).

The TDAm<sub>ax</sub> system offers the following benefits:

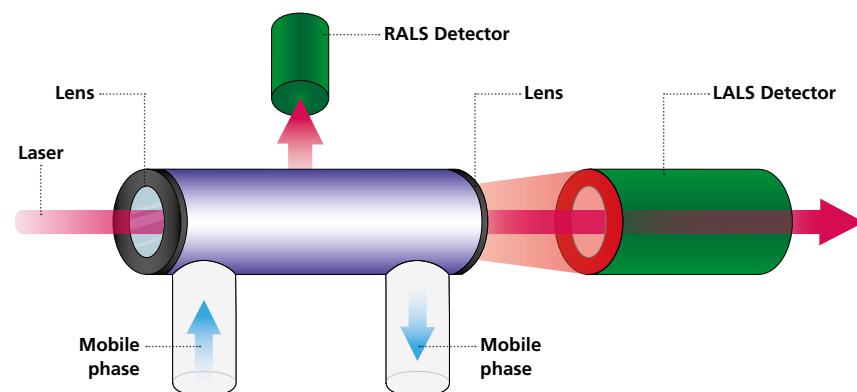
- An all-in-one chromatography solution for separation, acquisition and analysis
- All columns and detectors are housed in a single temperature-controlled compartment (up to 80°C) for improved baseline stability and solvent range
- Inter-detector tubing is minimized reducing band broadening and tailing.



# VISCOTEK TDA TECHNOLOGY

Absolute Molecular Weight, Intrinsic Viscosity, Molecular Size, Concentration

The TDA's **refractive index (RI) detector** measures the concentration of almost any solute. The proprietary RI detector in the TDA has a robust flow cell keeping all detectors in series and maximizing their sensitivity.



A RALS/LALS detector

The **light scattering detector** inside the TDA combines the sensitivity of 90° Right Angle Light Scattering (RALS) with the accuracy of 7° Low Angle Light Scattering (LALS). The software automatically chooses the best angle for the sample at every data slice. Its flow cell is just 18 µL minimizing band broadening.

Viscotek invented and patented the first **differential viscometer**. The TDA's digital transducers give a fast, sensitive response to viscosity changes, and the 316 stainless steel construction means few sample limitations with salts or pH.

The Viscotek PDA is a **photodiode array detector** for measuring the absorbance of UV light from 190 nm – 510 nm. A visible spectrum option is also available to measure 400 nm – 690 nm.

## GPCmax

Integrated Pump, Degasser & Autosampler

The separation side of the Viscotek systems is best supported by the GPCmax: a combined pump, degasser and autosampler.

The isocratic pump has exceptional flow rate accuracy and minimal pulsation for improved baseline stability. The integrated degasser baseline stability improves and the autosampler allows for the unattended measurement of up to 120 samples.

The GPCmax, like the detectors, is controlled using the OmniSEC software v5, meaning only a single software suite is required for data collection and analysis.





# VISCOTEK RImax SYSTEM

## Conventional Calibration

The RImax is a conventional calibration system for the measurement of relative molecular weight based on sample retention volume compared with molecular weight standards. The RImax system can be upgraded later with any of the Viscotek modular detectors.

The system comprises:

- A GPCmax to combine the pump, degasser, and autosampler
- A column oven to improve separation efficiency and quality
- A sensitive and stable modular RI detector for the measurement of sample retention time. The detector cell temperature can be controlled from ambient up to 55°C for improved baseline stability and is also compatible with sub-ambient measurements in a cold room or refrigerated cabinet. A 9  $\mu$ L cell minimizes band-broadening
- OmniSEC software v5 includes advanced conventional calibration and analysis.



# VISCOTEK HT-GPC SYSTEM

Multi-detection of Polyolefins

The Viscotek HT-GPC system is a complete multi-detector system for the characterization of synthetic polymers that are only soluble at elevated temperatures (up to 160°C) such as the polyolefins polyethylene and polypropylene. It can be customized for conventional or universal calibration or triple-detection. The system comprises:

- The HT-GPC module containing column and detector oven, including refractive index (RI), light scattering (LS), and viscometer (IV)
- The Vortex heated autosampler
- A main pump for solvent delivery
- An auxiliary pump for the RI reference cell and filter back-flush
- Solvent degasser.

The combination of all detectors enables measurements of:

- Sample concentration
- Absolute molecular weight and molecular weight distribution
- Polydispersity
- Intrinsic viscosity
- Molecular size (Rh & Rg)
- Mark-Houwink parameters
- Refractive Index increment,  $dn/dc$
- Second virial coefficient,  $A_2$  ( $B_{22}$ )
- Copolymer and conjugate composition (with the additional PDA).



# VISCOTEK HT-GPC VORTEX AUTOSAMPLER

Multi-detection of Polyolefins

The Vortex heated autosampler is the ideal solution for safe dissolution and injection of high-temperature GPC samples.

Sample and cold solvent are placed into the vial and loaded into the autosampler. The autosampler heats and individual magnetic stirrers mix the sample to aid dissolution. The sample is then injected via the heated transfer line minimizing any chance of precipitation.

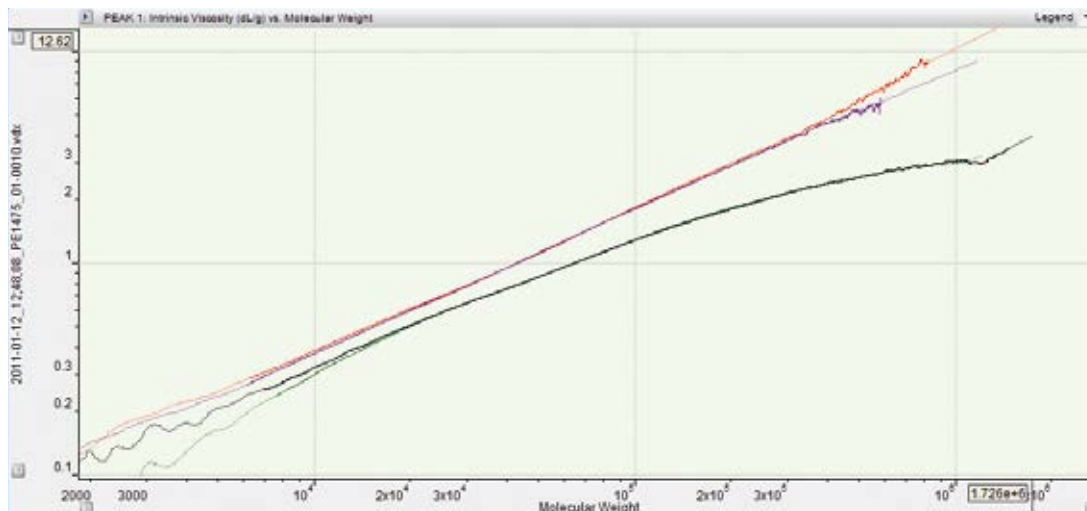
The HT-GPC automatically filters samples during injection eliminating the need to manually filter hot samples. The auxiliary pump is used to back-flush the filter so that it can be re-used removing the need for regular replacement and system downtime.



# VISCOTEK HT-GPC DETECTOR MODULE

The HT-GPC's proprietary **refractive index detector** has a robust flow cell to keep all detectors in series and maximize their sensitivity. The dual flow design improves baseline stability. Its **light scattering detector** is a RALS/LALS design and its **viscometer** combines robustness with excellent sensitivity.

The combination gives accurate and reproducible measurements of molecular weight, intrinsic viscosity and branching.



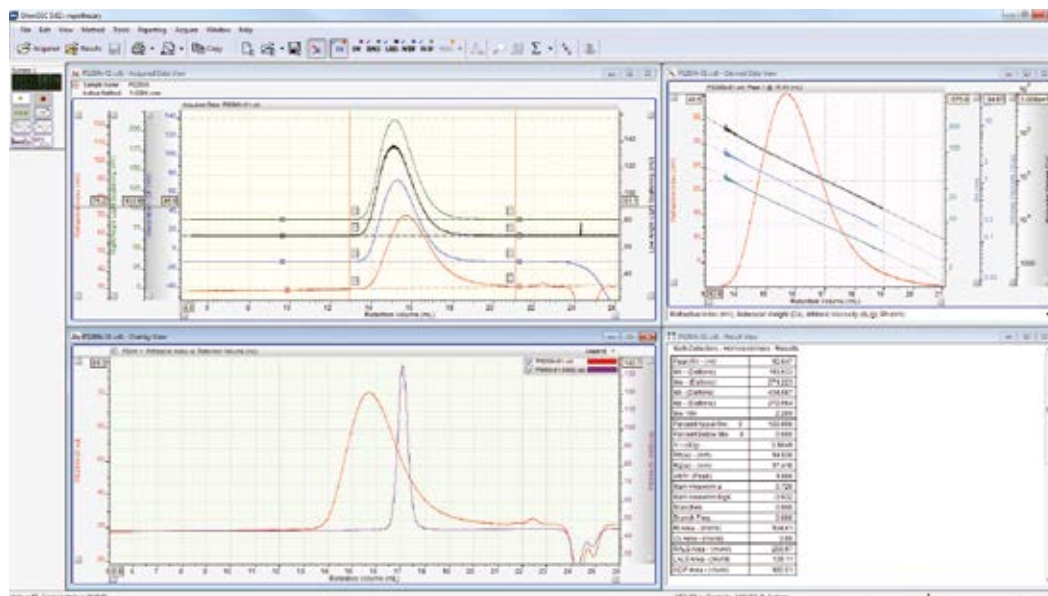
A Mark-Houwink plot of linear and branched polyethylene measured by the HT-GPC

# OMNISEC SOFTWARE v5

Control and analysis in a single package

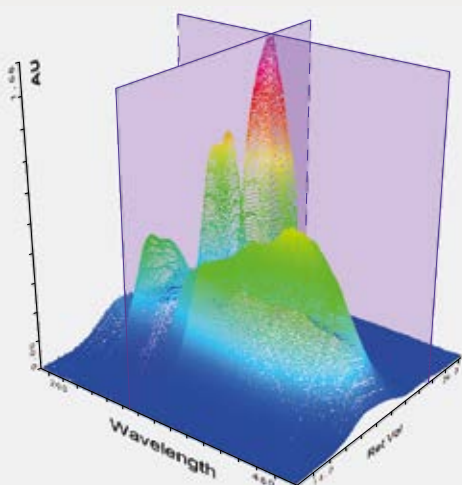
OmniSEC software v5 is the GPC/SEC software package required for the Viscotek products.

With its clear user interface, OmniSEC software v5 is used to control Viscotek systems, acquire data from all Viscotek detectors and perform GPC/SEC data analysis.



With OmniSEC software v5 you can:

- Determine molecular weight and molecular weight distribution by light scattering or column calibration techniques
- Calculate intrinsic viscosity and hydrodynamic radius, Mark-Houwink parameters and branching
- Be sure of the most accurate results thanks to proven band-broadening corrections
- Perform copolymer and conjugate calculations
- Overlay multiple chromatograms or results
- Reanalyze entire datasets in a few clicks using the Trend View
- Calculate  $dn/dc$ ,  $dA/dc$  (extinction coefficient) and  $A_2$  ( $B_{22}$ )
- View all the angular data from a MALS measurement in a single plot with just one click of the mouse
- Select from a polymer- or protein-focused user interface to suit your application requirements.



By combining RI and UV signals from a copolymer or conjugated sample, the software can calculate the concentration of each component and then measure the complex molecular weight and composition.

In this way, these samples can be fully characterized. Such samples include:

- Styrene/butadiene copolymers
- Conjugated protein samples such as PEGylated or membrane proteins.

*Explore relationship of UV absorbance with wavelength and retention volume (or molecular weight) via powerful interactive 3D plot.*



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