

GPC Streamliner

Focus: New Pathways in GPC/SEC



Innovation and development

are the keys of success in a fast changing analytical environment even for well established and worldwide used methods like GPC/SEC. This GPC Streamliner brings an overview of PSS' new developments and opportunities for solutions in GPC/SEC scenario.

- New analytical fields like the area of biopolymers require new separation materials and lead to the development of new methods and to a successful expansion of the analytical portfolio.
- New technical solutions for more stable, robust instruments, detectors and IT approaches, to offer efficient, affordable and precise analytical solutions as well as longer instrument uptime.

- New concepts in the service area to accommodate growing demands and infrastructure changes in the analytical laboratory business and to assist customers with implementation of new methods and to streamline their laboratory workflow.

Dedicated GPC/SEC packages can help to save time and money, when offering flexible and easy-to-use solutions that support the work flow of chemists and lab technicians. Explore the potential of new technologies, new instrument features and software solutions during a visit at the PSS facilities or at several trade shows and conferences. At the ACS meeting in San Francisco offers a workshop „Column and Method Selection for Biopolymers“ free of charge.

New Solutions for GPC

Advanced technologies developed and optimized over the last years, allow today the design and production of more robust and more reliable components with smaller footprints.

Based on excellent single components, PSS has adopted modular approach for GPC/SEC systems which have proven to be powerful solutions with the desired flexibility for changing needs: superior precision, increased sensitivity, increased data quality and confidence in analytical results.

PSS offers modular and compliant GPC specific solutions that are not limited to just one application. These systems can cover analytical, semi-preparative and HighSpeed applications and can integrate advanced detection, like light scattering, viscometry or triple plus, as well as advanced separation like polymer LC, LA-CC or 2D separation. Increased instrument uptime and easy-to-use maintenance tools lead to high productivity and low operation costs.

The software solution that unifies instrument control with data acquisition and evaluation for all GPC/SEC applications is WinGPC Unity, a Macromolecular

» Continues on Page 2

In This Issue

- 1 Focus: New Pathways in GPC/SEC
- 2 New solutions for GPC
- 3 20th Anniversary 2005
- 4 PSS Services
- 5 Characterization of Food Biopolymers by GPC

Feature

Analytical
Service
brochure
available



New solutions for GPC



» From Page 1

Chromatography Data System (MCDS) that integrates all applications for macromolecules into one environment. WinGPC Unity follows the modular design showing flexibility by offering specific software modules that integrate seamlessly into any existing installation. Sophisticated informatics solutions manage lab resources and provide analytical growth opportunity from single workstation to Client/Server setups and company wide solutions. The open approach allows vendor independent data acquisition from instruments and detectors and easy exchange of data with LIM systems or ECM (enterprise content management) systems.

PSS GPC/SEC solutions consist of:

- **sensitive detectors** from UV/DAD to refractive index, ELSD, viscometer and multi angle laser light scattering detectors. Additional detection power can be added as needed.
- **reliable pumps and injection** systems that allow analytical operation as well as semi-preparative GPC/SEC operation with automated fraction collection or HighSpeed operation.

- **PSS GPC/SEC columns** packed with column material perfectly compatible with the investigated samples.
- **WinGPC Unity MCDS** as single workstation or company wide solution, that also integrates already existing instrumentation.
- **New:** Instrument control for Agilent 1100 and 1200 components with the WinGPC Unity **SystemPilot** software module for convenient and traceable control via PC, thus substituting ChemStation.
- **New:** WinGPC Unity **Compliance Pack** for all GPC/SEC methods used in regulated laboratories that require increased traceability and enhanced data security.
- **New:** PSS Universal Data Center **UDC810** for plug&play vendor independent data acquisition with integrated verification tools. On-Demand Computer Based User Training is useful for verification of own data evaluation practice.

Author:

Dr. Daniela Held
Tel.: +49 (0) 6131-96239-41
E-Mail: DHeld@polymer.de



Announcement



New distribution channel in Switzerland and Liechtenstein

The personal relationship with our users is important to us. Effective January 1, 2006, PSS started to serve and to distribute our products to Switzerland and Liechtenstein customers directly. We are pleased to answer your questions about the analysis of polymers and bio-molecules.

Please contact:

Dr. Hans-Ulrich Ehmcke
Tel: +49 (0) 6131-96239-32
E-mail: UEhmcke@polymer.de



New methods for sample analysis

1. April 2006, PSS added new methods and testing areas to the portfolio of sample analysis. The new pricelist includes tests like MALDI-ToF, FTIR, DSC, NMR as well as substance identification such as Additives.

Publication data base on www.polymer.de

PSS Netcommunity Members can access publications, articles, talks, poster, presentations, brochures, newsletter, and product information by registering free of charge. The database is searchable by different options, e.g. methods, products etc

WinGPC applications on www.polymer.de

Registered PSS Netcommunity Members can find applications, tips and tricks as well as the highlight articles from the WinGPC newsletter. The WinGPC newsletter with actual documents is usually delivered to all WinGPC users by e-mail.

German and English documents are available for download: www.polymer.de knowledge bank - WinGPC Software information pool. Registration to Netcommunity is free of charge

To register for WinGPC newsletter send an e-mail to info@polymer.de

20th Anniversary 2005

PSS celebrated its 20th anniversary in 2005 with a series of special events and activities with our business partners and friends. Following are the highlights from two of these outstanding events:

Anniversary Symposium at the University of Bayreuth

The response of this mini-symposium covering the future of molecular characterization was overwhelming:



Dr. Harald Pasch, DKI Darmstadt/German, focused his presentation on "Multidimensional Polymer Analysis-Key Technology in State of the Art Material Research" where he showed the interaction of different analysis methods and their benefits. He believes that intensive cooperation between innovative companies such as PSS and application-oriented research in Universities is needed in the future.



Dr. Konrad Knoll, BASF Ludwigshafen/Germany, reflected in his speech "Pioneers of the HPLC-GPC Coupling: The Two-Dimensional View into Complex Polymer Worlds" the way from university research to a finished industrial product. The partnership and the corporate method development with PSS allowed BASF to finish their product development successfully in a much shorter time than expected.



Prof. Dr. Helmut Ringsdorf (University Mainz) raised the issue "STEPS ACROSS BORDERS!" reviewing the history and current conditions about the socio-political responsibility of Science. He asserted that the best way to predict the future is to invent it and that the financial independence of universities are a particular concern for him.



Another keynote lecture was from **Prof. Dr. Krzysztof Matyjaszewski** (Carnegie Mellon University, Pittsburgh, U.S.A). In his presentation "Nanostructured Materials via Atom Transfer Radical Polymerization" he showed the numerous opportunities and benefits achieved by modern polymer synthesis for controlled texturing on molecular and supra-molecular levels.

PSS wishes to thank all speakers for their enlightening presentations.

PSS Anniversary Lottery 2005

PSS organized an Anniversary Lottery on our homepage. Out of the multitude international participants Miss Fortuna (Dr. Martina Adler) drew three happy winners:



M. Sabine Umek from Bayer Industry Services in Uerdingen, Germany received the first prize: a weekend for 2 in Mainz. Sabine Umek works for Bayer Industry Services in Uerdingen, and has more than 15 years in the polymer analysis field with an emphasis on chromatographic coupling techniques: GPC (-IR, -NMR-coupling and Triple-Detection). Bayer Industry Services is a service company of Bayer AG and Lanxess and offers all customers – also outside the company - the whole range of analytical services - from projects of structure analysis up to standardized test and approval.



Dr. Jesper Wichmann from Danisco A/S in Braband, Denmark, received a Digital-Camera for the second prize. Danisco is one of the world's leading producers of ingredients for food and other consumer products. The broad technology platform and product portfolio include emulsifiers, enzymes, stabilizers, cultures, flavors, sugar and sweeteners.

It was a big surprise for **M. Monika van den Broek** from Coltène/Whaledent AG Altstätten, Switzerland receiving the third prize, an iPod.

The PSS team wants to thank all the participants of the anniversary lottery program held in conjunction with our 20th Anniversary in 2005.

Author:

Bernd Meier
Tel: +49 (0) 6131-96239-31
E-Mail: BMeier@polymer.de



Innovations

PSS Universal Data Acquisition Center UDC810

The UDC810 is a multiple channel chromatography interface that allows reliable and secure data acquisition from multiple instruments simultaneously. It converts the analog signal from analytical instruments to digital data and transmits it to the host via serial, USB and LAN/WAN connections. It employs an independent buffer for methods and data to ensure uninterrupted data transfer even if the computer hangs.

The UDC810 can read data from all GPC related detectors which provide analog output signals. Up to 30 channels (detectors) for up to 4 chromatographs can be acquired and processed.

Offline in-house user training is always possible with training data being integrated into the UDC810. They can be transferred into the host computer and processed like real time data. This helps to train users using standardized training materials and standardized procedures.



PSS Universal Data Acquisition Center UDC810

Pullulan DIN Standards

Because of numerous customer requests PSS offers Din certified Pullulan standards effective 1. April 2006. Individual standards in the molecular range between 300D and 1.6Mil D are sold in 100mg packages.

The DIN certificates show the molar mass average values M_p , M_w , M_n , PDI determined with GPC (a relative method) and the results of an absolute method i.e., light scattering, NMR, or vapour pressure osmometry; also included is the molar mass distribution $w(\log M)$ vs M , all relevant method information and measurement conditions.

DIN Pullulan Standards provide high level of quality assurance and the means of method comparison; single molar masses can be purchased individually; for example, for the normalization and validation of a light scattering detector, where a molar mass between below 200.000 D is recommended. The Pullulan GPC-Kit with the molar mass range between 300 and 800.000 D is delivered with 10 100mg – standards. The newly available high molar mass Pullulan standard (1.6 Mil.) effectively expands the calibration curve two fold.

PSS Services

Solutions on every level

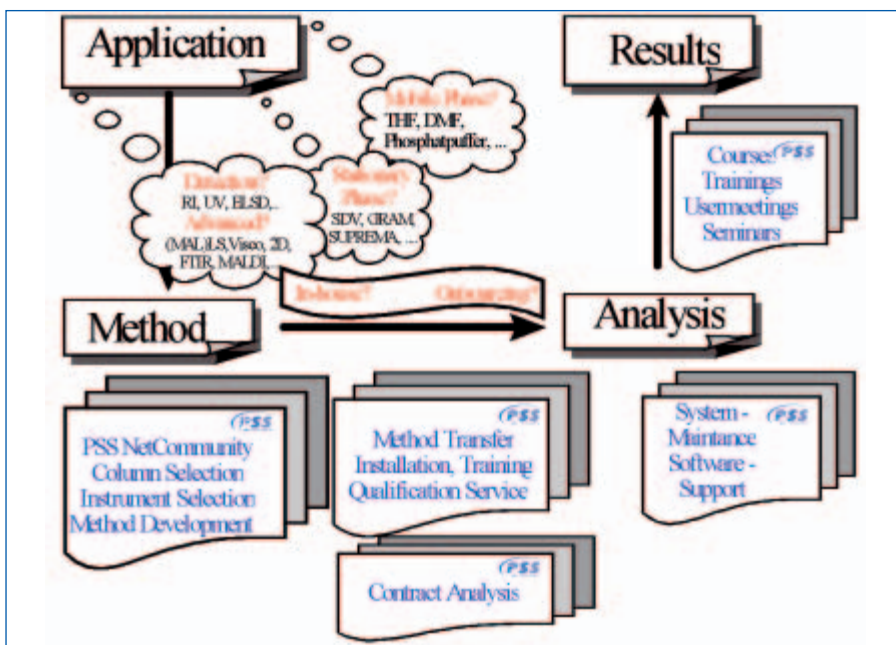
In order to support customers whose laboratories do not have the resources to timely develop and implement their own solutions, PSS offers various services on every level within the field of liquid chromatography of macromolecules.

PSS will ensure that all the conditions for successful GPC/SEC analysis exist:

- The chromatographic system is in good working condition
- The operator knows how to handle information and how to select the appropriate method
- The method is applicable and robust

want to perform the measurements in-house or if they want to use the PSS Contract Analysis Service.

Method Transfer from PSS guarantees an efficient and easy start for the in-house solution. If new detectors or systems are needed, the qualified PSS Installation & Training Service integrates them and familiarizes operators with the new possibilities. Integration into company laboratory informatics solutions as well as into quality management can be included any time: the PSS Instrument and Software Qualification Service ensures qualified solutions and compliant documentation for internal and external audits. PSS offers services for all stages of an instrument's life



Method development

PSS has over 20 years of experience in GPC/SEC and offers application notes for all kinds of macromolecules. PSS NetCommunity members can download detailed descriptions with all parameters needed for successful implementation in their own lab. For special applications, PSS offers a Column Selection Service to find the best column material and the optimum column combination. The Instrument Selection Service can help, if special properties like copolymer distribution, branching, or composition need to be determined. The PSS Method Development Service can be used to ensure the robustness and reproducibility of newly developed or existing methods.

Routine analysis

If the method is ready, customers can decide if they

cycle. Therefore the Maintenance Service for instruments and the Software Service for software solutions help to protect investment and to achieve highest up-times for perfectly working systems.

Operator expertise

PSS offers General Training Courses for GPC/SEC, as well as Seminars on advanced techniques and Software Training Courses. This supports users on all levels to receive qualified results and to use the full potential of the available methods.

Author:

Dr. Martina Adler
Tel.: +49 (0) 6131-96239-42
E-Mail: MAdler@polymer.de



Upcoming events

Shows and exhibits

20.06. – 21.06.2006

GFP Méditerranée, Marseille, France
Talk: 2D chromatography for the analysis of complex polymers; Martina Adler

26.06. – 27.06.2006

5th DPI workshop on 'Combinatorial and high-throughput approaches in polymer science'; Eindhoven, Netherlands
Poster: HighSpeed GPC/SEC Analysis with Optimum Column Design

10.09. – 14.09.2006

ACS-National Meeting /San Francisco (USA)
Booth: 737

Workshop: Column and Method Selection for Biopolymers; Günter Reinhold

19.09. – 21.09.2006

AnalyticaChina 2006, Shanghai, China
Booth (Chance International Group Ltd.)

20.09. – 22.09.2006

8th Austrian Polymer Meeting/ Linz (Austria)
Poster: The Chain of Knowledge – From Catalyst to Application

20.09. – 22.09.2006

Polymeric Materials; Halle, Germany
Poster: The influence of the stationary phase polarity on GPC/SEC separations

16.11. – 18.11.2006

Analytica-Anacon 2006; Bangalore, India
Booth (Chromline Equipment (I) PVT.Ltd.)

Publisher:

PSS Polymer Standards Service GmbH
Postfach 3368 • D-55023 Mainz • Germany
Tel.: +49 (0)6131-96239-0
Fax: +49 (0)6131-96239-11
E-Mail: info@polymer.de
Web: www.polymer.de

PSS Polymer Standards Service-USA, Inc

43 Jefferson Blvd. Ste 3
Warwick, RI 02888 • USA
Tel.: +1-401-780-8884
Fax: +1-401-780-8824
E-Mail: pssusa@polymer.de
Web: www.pssgpcshop.com

Layout und Graphics:

odd gmbh grafische betriebe • www.odd.de

Characterization of Food Biopolymers by GPC

Biopolymers like glycogen, cellulose or starch are well known as building block polymers in fruit and vegetable as well as a source of energy in grain, potatoes and leguminous plants. Their extraordinary properties is the reason why these or macromolecules are produced industrially. Therefore it is very important to have a comprehensive and sophisticated control of production and quality.

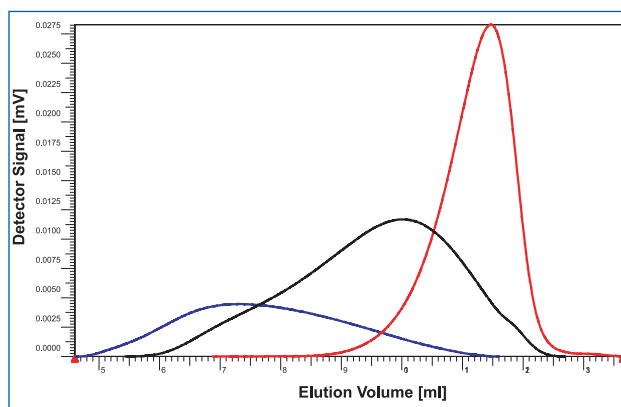


Fig. 1: Chitosan hydrolysate: different states of the degradation of chitosan (blue: early state; black: medium state; red: late state); Conditions: Detector Agilent RI Column: PSS NOVEMA 10 μ m 3000 \AA 8x300mm; Eluent: aqueous, TFAc (0,2 w%), 0,1m NaCl; flow rate: 1ml/min.

The properties of biopolymer macromolecules are defined by various parameters such as composition, structure, topology and molar mass. All these information are available with an appropriate GPC coupling method. For qualitative GPC product comparison it is enough to compare the shape of the GPC chromatograms of different products. This can be easily done by the overlay of the different chromatograms. The individual shape of the chromatogram and the retention time allows distinguishing between different macromolecules. The requirement for a long term reproducibility study by GPC is a chromatographic system free of any kind of interaction. The separation of the molecules has to be due to the size of the molecule and without repulsive or attractive interactions between the substance and stationary phase. This is also true for simple "Good – Bad" overlay comparisons between different products. This fundamental requirement is sometimes hard to fulfill, at least not with standard conditions, especially for macromolecules with many functional groups or even "charged" polymers (polymers containing many charged functional groups). The selection of the best column (proper column polarity) and the method development is therefore very important.

Column selection

The most successful way for a chromatographic system free of interaction is to match the polarity of the stationary phase to the polarity of the solvent and the sample. PSS has developed powerful stationary phases with various surfaces and polarities for aqueous separations:

- SUPREMA column with added salt or buffer is recommended for measurement of neutral polymers and polyanions
- PSS NOVEMA column performs well for polycations, being less polar than the PSS SUPREMA column but still hydrophilic.

PROTEEMA column is especially designed for the requirements of protein separation; the silica based material is dedicated for phosphate buffer systems including salt at a pH < 7. For the successful protein separation, a very high resolution in a small molar mass range is very important. The PSS PROTEEMA column fulfills this constraints or edge condition.

The selection of the right solvent and solvent additive tops the modern method development for the GPC of biopolymers. PSS different materials open a door to study a wide range of biopolymers by GPC under optimized conditions.

Example:

Chitosans are used in many industries like the waste water treatment, the biotechnology, the medicine and pharmaceutical industry and the cosmetics industry. Chitosans are linear Polyaminosaccharide copolymers which are built heterogeneous from 2-Acetoamido-2-deoxy- β -D-glucopyranose and 2-Amino-2-deoxy- β -D-glucopyranose in β -1,4-glycosidic units. Taking advantage of the fact that Chitosans are polycations in acidic media, these polycations can be measured easily by GPC. Figure 1 shows very nicely how GPC can help to observe a chemical process, the degradation of chitosans in detail. Under the given conditions the chitosan is separated by hydrodynamic volume and therefore by size. The larger elution volume corresponds to the smaller chitosan hydrolysate.

Author:

Dr. Thorsten Hofe
Tel.: +49 (0) 06131-96239-60
E-Mail: THofe@polymer.de



Application

Characterization of Wood Polymer Compounds (WPC)

Wood Polymer Compounds are usually a mixture of waste wood and polyolefins (1:1). North America produces more than 700.000 tons per year of WPC, especially for flake boards. The WPC production requires knowledge of the additive phase agent, antioxidant, expanding agent and others; the insoluble wood components can be filtered at high temperatures. An extraction with chloroform is recommended followed by a GPC determination of polyolefins at high temperature. GPC-FTIR coupling is necessary for further components identification.

Sample preparation:

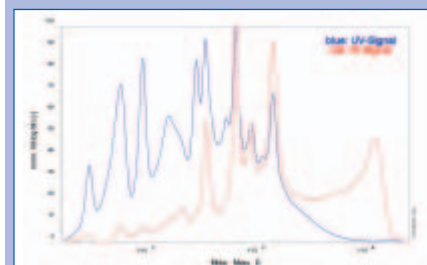
The sample is extracted for 3 days at 50°C with chloroform. The Chloroform is evaporated from the extract and the residue is dissolved in THF for the GPC run.

Analytical conditions:

Eluent: THF with add on
Columns: combination of 3 columns (5 μ m, each 8x300 mm) especially developed for the additive separation,
Calibration: PSS Polyethylene standards
Data acquisition: PSS WinGPC Unity
Detectors: RI-, UV-Detector, (FTIR)
Flow rate: 1 ml/min
Concentration: 3,0 g/l
Inject volume: 100 μ l
Temperature: 25°C

Result:

With the optimized column combination the additives in complex compounds can be separated and their components quantified. The exclusion limit of the column combination is at around 10.000 g/mol, so also oligomer additives (like HALS) or other extracted polymer parts like Polyethylene only visible in the RI-signal (red line) can be separated. Identification is possible with online FTIR coupling.



Conclusion:

Additive GPC columns have a brilliant performance for the separation of a complex, low molecular polymer mixture with the possibility to use a RI detector for quantification. GPC is an alternative to HPLC.