

Certificate of Analysis



Agilent Technologies, Inc. acquired Polymer Standards Service GmbH (PSS) on August 01st, 2022.

The Quality Certificate / Certificate of Analysis generated by PSS attached to this Letter is valid for the Product stated in the Certificate sold to You by Agilent Technologies, Inc or its subsidiaries.

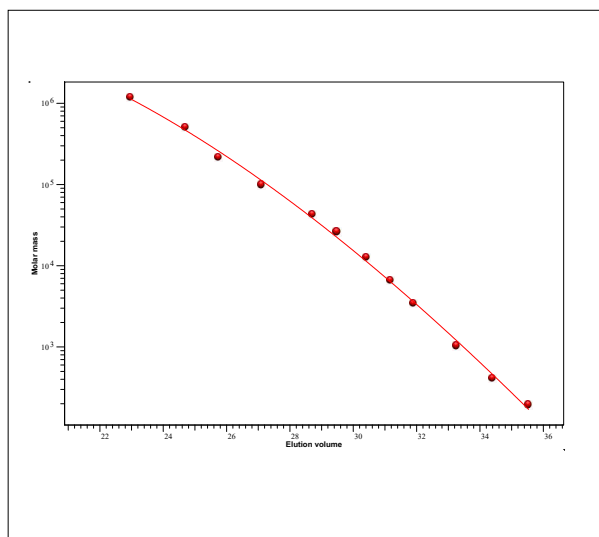
Patrick Kunzweiler

Quality Manager
Liquid Phase Separation Division

Certificate of Analysis

Product: Kit Poly(ethylene oxide) / Poly(ethylene glycol)
 Part No: PSS-PEOKIT
 Lot No: PEOKIT-16

GPC/SEC - Calibration Curve



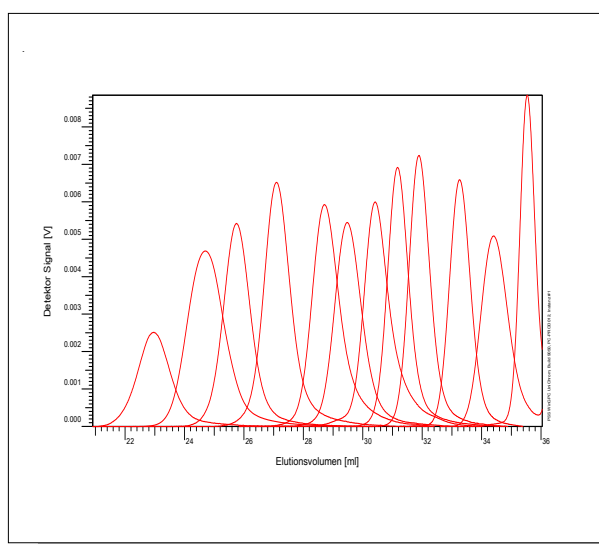
GPC/SEC - Calibration Table

Elution volume [ml]	Mp [Da]	Polymer Lot No:	Polymer Part No:
22,97	1180000	PEO120520	PSS-PEO1.2M
24,70	504000	PEO270417	PSS-PEO500K
25,74	217000	PEO120515	PSS-PEO220K
27,11	99000	PEO061212	PSSPEO90K
28,70	42700	PEO130810	PSS-PEO42K
29,48	26100	PEO131103	PSS-PEO25K
30,42	12600	PEG1128	PSS-PEG12K
31,17	6530	PEG2128	PSS-PEG6K
31,90	3450	PEG040416	PSS-PEG3K
33,25	1030	PEG231113	PSS-PEG1K
34,40	414	PEG181113	PSS-PEG400
35,53	194	PEGP4-3	PSS-PEG194

Note:

Mp = Molar mass at the peak maximum

GPC/SEC - Polymer Overlay



GPC/SEC - Calibration Conditions

Solvent	Water, Sodium azide 0.2g/L
Flow rate	1,00 ml/min
Precolumn [8 x 50 mm]	PSS SUPREMA 10µm
Columns [8 x 300 mm]	PSS SUPREMA 10µm ultrahigh / ultrahigh / ultrahigh
Temperature	23 °C
Inject volume	20 µl
Internal standard	Ethylene glycol at 36,68 ml
Data Acquisition Software	PSS WinGPC
Calibration by	A.Klein

Fit quality

Fit-type	Polynomial 3
R	0,999100

Storage: Store the tightly recapped polymer standards in a dry, dark, cool area; e.g. a refrigerator (4 °C).

Date of expiry: 2028/01/31 (See also product label.)

Date of approval: 2023/02/14

Manufacture and control according to PSS method of analysis

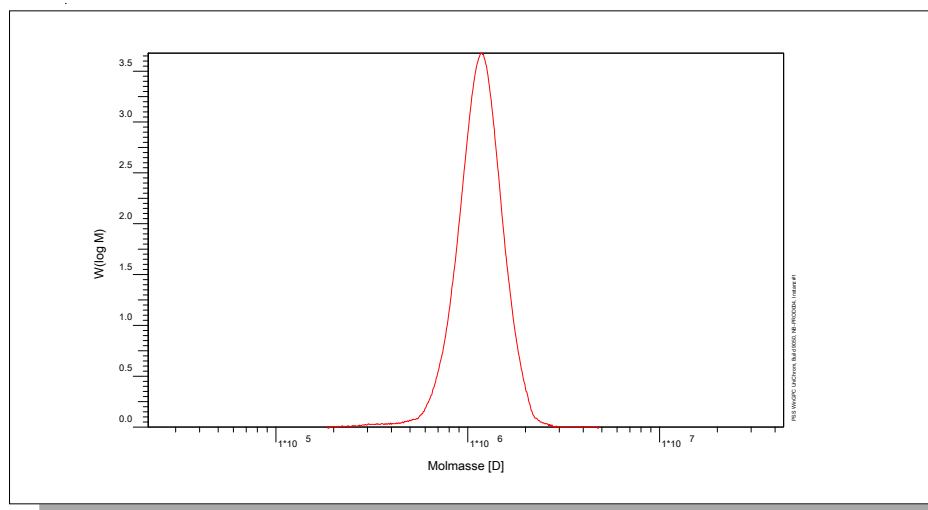


Dr. J. Preis
production manager

Certificate of Analysis

Polymer type: Poly(ethylene oxide)
 Part No: PSS-PEO1.2M
 Lot No: PEO120520

Molar Mass Distribution



GPC/SEC - Conditions

Sample concentration	0,50 g/l	Inject volume	20 µl
Solvent	Water, Sodium azide 0.2g/L	Flow rate	1,00 ml/min
Precolumn [8 x 50 mm]	PSS SUPREMA 10µm	Temperature	23 °C
Columns [analytical, each 8 x 300 mm]	PSS SUPREMA 10µm ultrahigh / ultrahigh / ultrahigh		
Data Acquisition Software	PSS WinGPC	Operator	A.Klein

GPC/SEC - Results

Detector	Mw [Da]	Mn [Da]	Mp [Da]	PDI [Mw/Mn]
PSS SECcurity RI	1200000	1110000	1180000	1,08

Additional Methods - Results

Method	Mw [Da]
Light Scattering, on-line (SLD7x00)	1200000

Mw = Weight average molecular weight
 Mn = Number average molecular weight
 Mp = Molar mass at the peak maximum
 PDI = Polydispersity Index

Light Scattering run on-line.

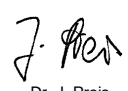
System and instrument validation based on Pullulan Lot No: p-100-4.

Sample concentration 0,5993 g/L
 Inject volume 100µL

Polymer stabilized with 500 ppm Irganox® 1076.

Storage: Store the tightly recapped polymer standard in a dry, dark, cool area; e.g. a refrigerator (4 °C).
Date of expiry: 2028/01/31 (See also product label.)
Date of approval: 2023/02/14

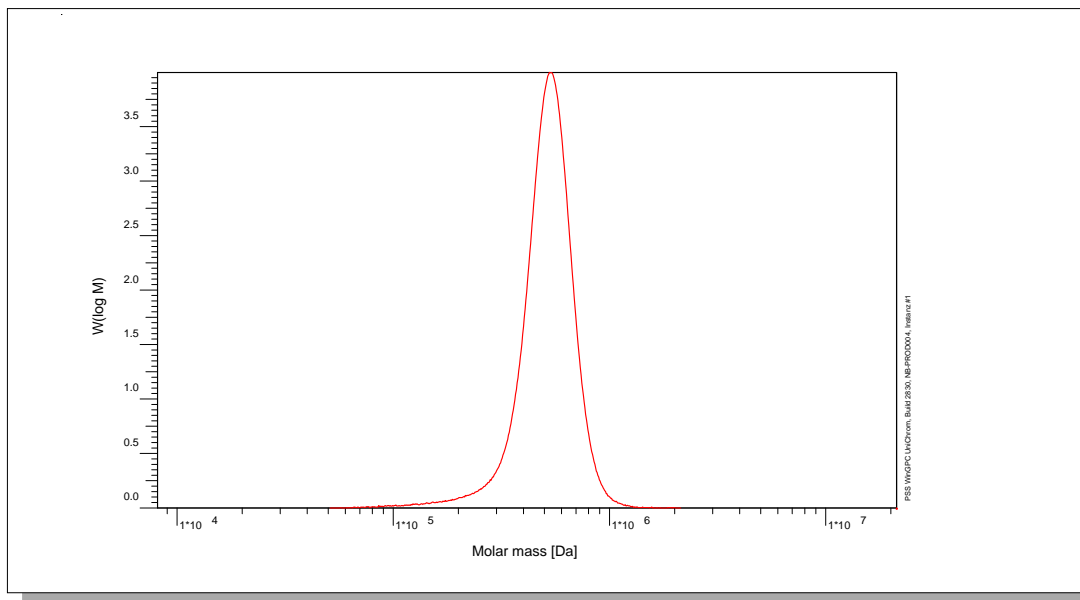
Manufacture and control according to PSS method of analysis


 Dr. J. Preis
 production manager

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Polymer type: Poly(ethylene oxide)
 Part No: PSS-PEO500K
 Lot No: PEO270417

Molar Mass Distribution



GPC/SEC - Conditions

Sample concentration	1,00 g/l	Inject volume	20 µl
Flow rate	1,00 ml/min	Temperature	23 °C
Solvent	H2O, 0,5 g/L NaN3		
Precolumn [8 x 50 mm]	PSS SUPREMA 10µm		
Columns [analytical, each 8 x 300 mm]	PSS SUPREMA 10µm 100Å / 100Å / 10 000Å / 10 000Å		
Data Acquisition Software	PSS WinGPC	Operator	J.Preis

GPC/SEC - Results

Detector	Mw [Da]	Mn [Da]	Mp [Da]	PDI [Mw/Mn]
PSS SECcurity µRI	504000	461000	504000	1,09

Additional Methods - Results

Method	Mw [Da]
Light Scattering, on-line (SLD7x00)	457000

Mw = Weight average molecular weight
 Mn = Number average molecular weight
 Mp = Molar mass at the peak maximum
 PDI = Polydispersity Index

Light Scattering run on-line.

System and instrument validation based on DIN-Pullulan Lot No: p-100di.

Sample concentration	0.9920 g/L
Inject volume Sample	100µL
dn/dc	0.132mL/g

Polymer stabilized with 500 ppm Irganox® 1076.

Storage: Store the tightly recapped polymer standard in a dry, dark, cool area; e.g. a refrigerator (4 °C).

Date of expiry: 2028/01/31 (See also product label.)

Date of approval: 2023/02/14

Manufacture and control according to PSS method of analysis

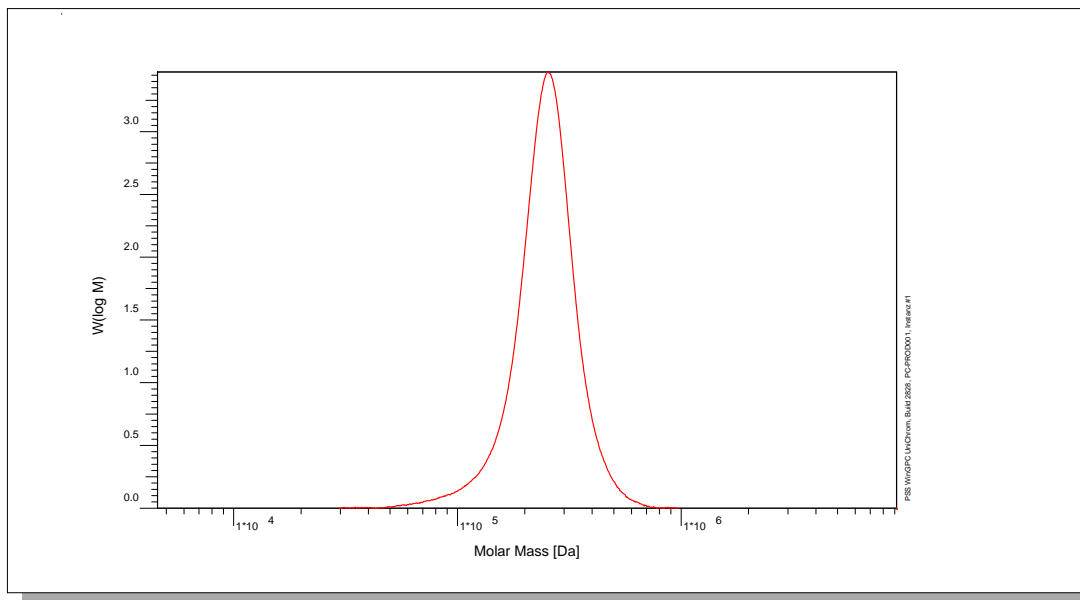


Dr. J. Preis
production manager

Certificate of Analysis

Polymer type: Poly(ethylene oxide)
 Part No: PSS-PEO220K
 Lot No: PEO120515

Molar Mass Distribution



GPC/SEC - Conditions

Sample concentration	1,00 g/l	Inject volume	20 µl
Flow rate	1,00 ml/min	Temperature	30 °C
Solvent	Water, Sodium azide 0.2g/L		
Precolumn [8 x 50 mm]	PSS SUPREMA 10µm		
Columns [analytical, each 8 x 300 mm]	PSS SUPREMA 10µm 100Å / 100Å / 10 000Å / 10 000Å		
Data Acquisition Software	PSS WinGPC	Operator	J.Preis

GPC/SEC - Results

Detector	Mw [Da]	Mn [Da]	Mp [Da]	PDI [Mw/Mn]
PSS SECcurity RI	220000	196000	217000	1,12

Additional Methods - Results

Method	Mw [Da]
Light Scattering, on-line (SLD7x00)	203000

Mw = Weight average molecular weight
 Mn = Number average molecular weight
 Mp = Molar mass at the peak maximum
 PDI = Polydispersity Index

Light Scattering run on-line.

System and instrument validation based on DIN-Pullulan Lot No: p-100di.

Sample concentration	0.9900 g/L
Inject volume Sample	100µL
dn/dc	0.132mL/g

Polymer stabilized with 500 ppm Irganox® 1076.

Storage: Store the tightly recapped polymer standard in a dry, dark, cool area; e.g. a refrigerator (4 °C).

Date of expiry: 2028/01/31 (See also product label.)

Date of approval: 2023/02/14

Manufacture and control according to PSS method of analysis

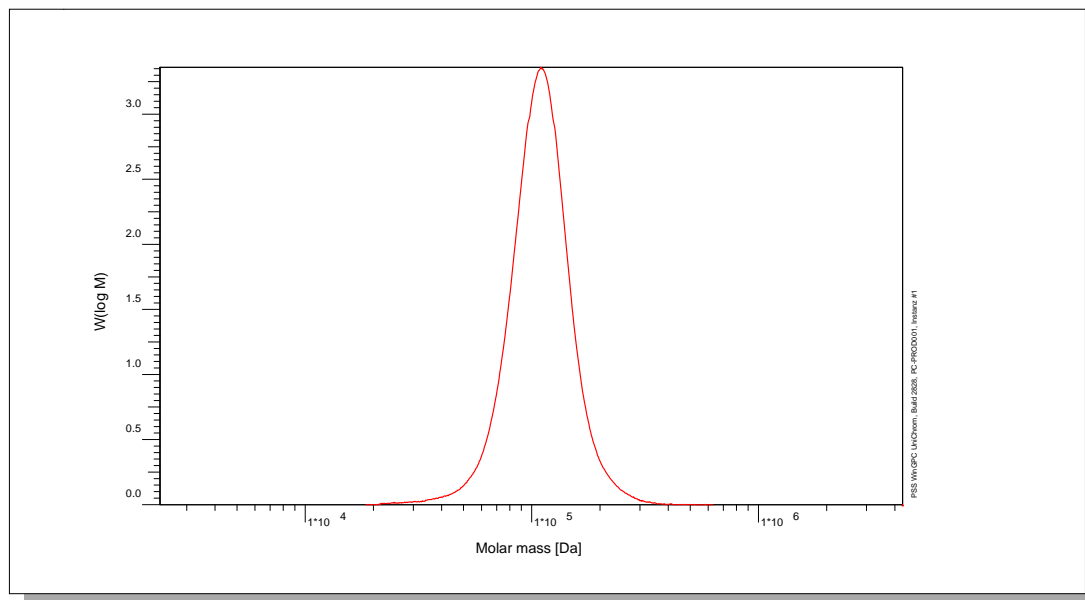


Dr. J. Preis
production manager

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Polymer type: Poly(ethylene oxide)
 Part No: PSS-PEO90K
 Lot No: PEO061212

Molar Mass Distribution



GPC/SEC - Conditions

Sample concentration	1,00 g/l	Inject volume	20 µl
Flow rate	1,00 ml/min	Temperature	30 °C
Solvent	Water, Sodium azide 0.2g/L		
Precolumn [8 x 50 mm]	PSS SUPREMA 10µm		
Columns [analytical, each 8 x 300 mm]	PSS SUPREMA 10µm 100Å / 100Å / 10 000Å / 10 000Å		
Data Acquisition Software	PSS WinGPC	Operator	J.Preis

GPC/SEC - Results

Detector	Mw [Da]	Mn [Da]	Mp [Da]	PDI [Mw/Mn]
PSS SECcurity RI	103000	91800	99000	1,12

Additional Methods - Results

Method	Mw [Da]
Light Scattering, on-line (SLD7x00)	93200

Mw = Weight average molecular weight
 Mn = Number average molecular weight
 Mp = Molar mass at the peak maximum
 PDI= Polydispersity Index

Light Scattering run on-line.

System and instrument validation based on DIN-Pullulan Lot No: p-100di.

Sample concentration 1.3688 g/L
 Inject volume Sample 100µL
 dn/dc 0.132mL/g

Storage: Store the tightly recapped polymer standard in a dry, dark, cool area; e.g. a refrigerator (4 °C).

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Manufacture and control according to PSS method of analysis

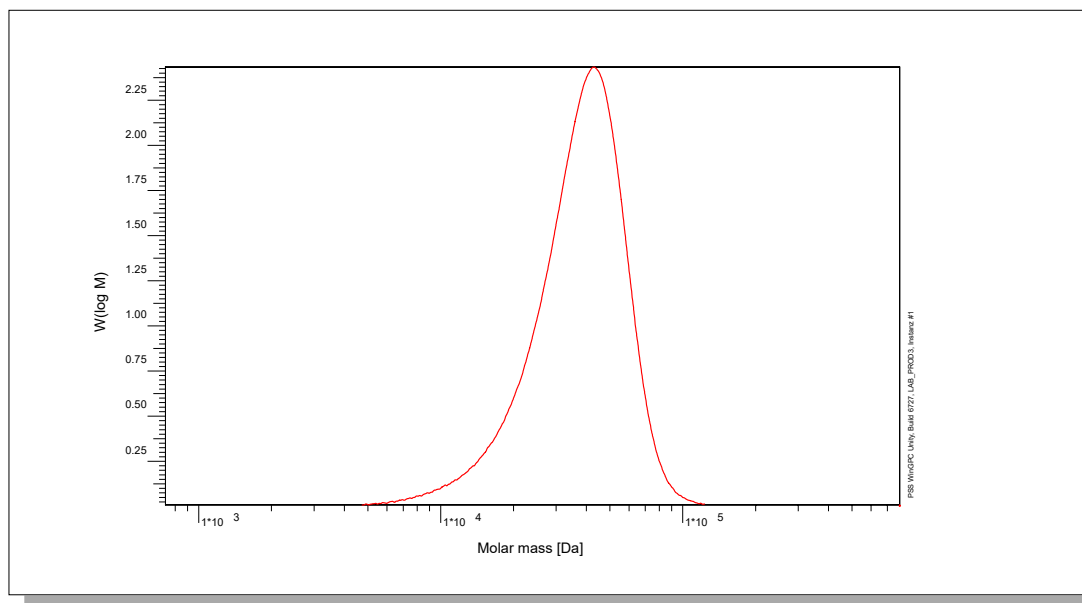


Dr. J. Preis
 production manager

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Polymer type: Poly(ethylene oxide)
 Part No: PSS-PEO42K
 Lot No: PEO130810

Molar Mass Distribution



GPC/SEC - Conditions

Sample concentration	1,00 g/l	Inject volume	20 µl
Solvent	Water, Sodium azide 0.02%	Flow rate	1,00 ml/min
Precolumn [8 x 50 mm]	PSS SUPREMA 10µm	Temperature	35 °C
Columns [analytical, each 8 x 300 mm]	PSS SUPREMA 10µm 100Å / 10 000Å	Operator	S. Fugmann
Data Acquisition Software	PSS WinGPC		

GPC/SEC - Results

Detector	Mw [Da]	Mn [Da]	Mp [Da]	PDI [Mw/Mn]
PSS SECcurity RI	40100	30700	42700	1,23

Additional Methods - Results

Method	Mw [Da]
Light Scattering, on-line (SLD7x00)	36500

Mw = Weight average molecular weight
 Mn = Number average molecular weight
 Mp = Molar mass at the peak maximum
 PDI = Polydispersity Index

Light Scattering run on-line.

System and instrument validation based on DIN-Pullulan Lot No: p-100di.

Sample concentration 3.8797 g/L
 Inject volume Sample 100µL
 dn/dc 0.132mL/g

Storage: Store the tightly recapped polymer standard in a dry, dark, cool area; e.g. a refrigerator (4 °C).

Date of expiry: 2028/01/31 (See also product label.)

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Manufacture and control according to PSS method of analysis

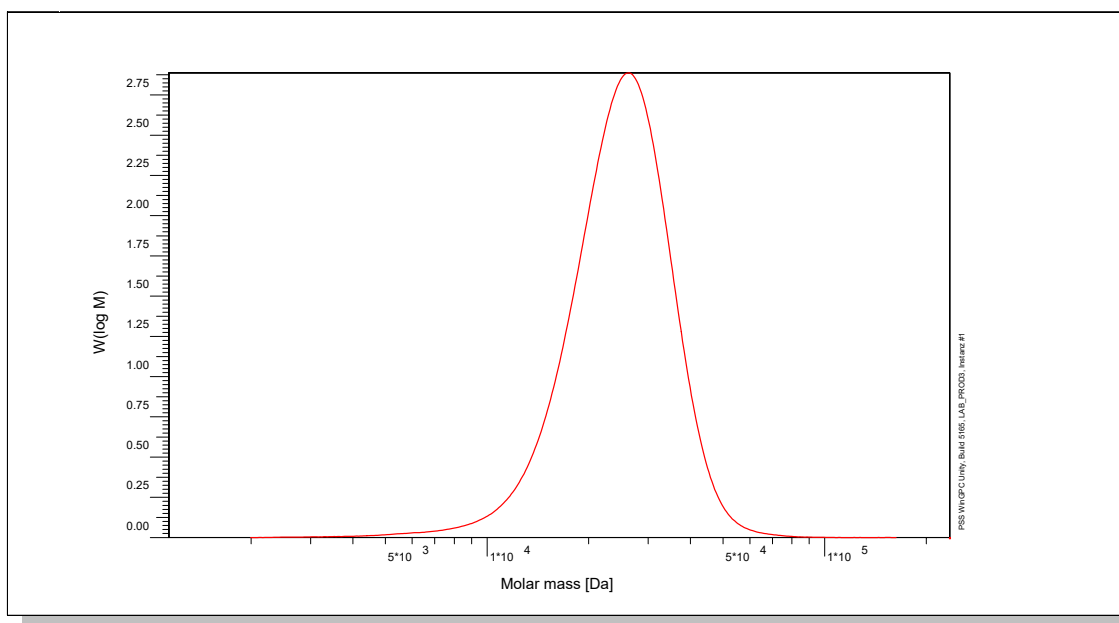


Dr. J. Preis
 production manager

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Polymer type: Poly(ethylene oxide)
 Part No: PSS-PEO25K
 Lot No: PEO131103

Molar Mass Distribution



GPC/SEC - Conditions

Sample concentration	1,00 g/l	Inject volume	20 µl
Solvent	Water, Sodium azide 0.05%	Flow rate	1,00 ml/min
Precolumn [8 x 50 mm]	PSS SUPREMA 10µm	Temperature	25,0° C
Columns [analytical, each 8 x 300 mm]	PSS SUPREMA 10µm 30Å / 1 000Å	Operator	S. Fugmann
Data Acquisition Software	PSS WinGPC		

GPC/SEC - Results

Detector	Mw [Da]	Mn [Da]	Mp [Da]	PDI [Mw/Mn]
PSS SECcurity RI	25800	22100	26100	1,17

Additional Methods - Results

Method	Mw [Da]
Light Scattering, on-line (SLD7x00)	23700

Mw = Weight average molecular weight
 Mn = Number average molecular weight
 Mp = Molar mass at the peak maximum
 PDI = Polydispersity Index

Light Scattering run on-line.

System and instrument validation based on DIN-Pullulan Lot No: p-100di.


Sample concentration 5.6447 g/L
 Inject volume 100µL
 Sample dn/dc 0.132mL/g

Storage: Store the tightly recapped polymer standard in a dry, dark, cool area; e.g. a refrigerator (4 °C).

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Manufacture and control according to PSS method of analysis

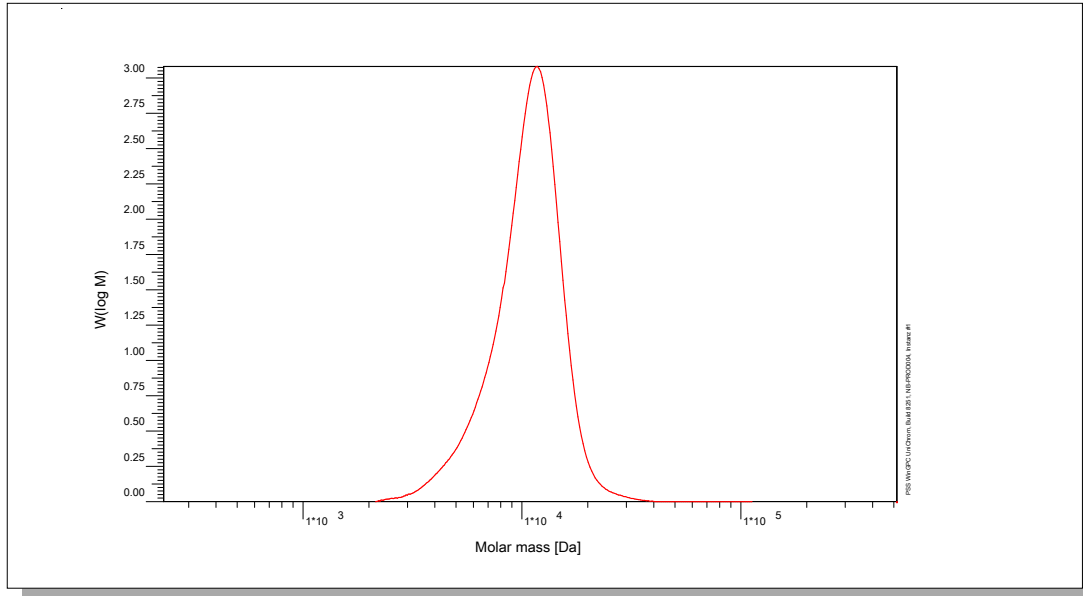

 Dr. J. Preis
 production manager



Certificate of Analysis

Polymer type: Poly(ethylene glycol)
 Part No: PSS-PEG12K
 Lot No: PEG1128

Molar Mass Distribution



GPC/SEC - Conditions

Sample concentration	1,00 g/l	Inject volume	20 µl
Flow rate	1,00 ml/min	Temperature	30 °C
Solvent	Water, Sodium azide 0.2g/l		
Precolumn [8 x 50 mm]	PSS SUPREMA 5µm		
Columns [analytical, each 8 x 300 mm]	PSS SUPREMA 5µm 100Å / 100Å / 100Å		
Data Acquisition Software	PSS WinGPC	Operator	J.Preis

GPC/SEC - Results

Detector	Mw [Da]	Mn [Da]	Mp [Da]	PDI [Mw/Mn]
PSS SECcurity RI	11400	10300	12600	1,11

Additional Methods - Results

Method	Mw [Da]
Light Scattering, on-line (SLD7x00)	10200

Mw = Weight average molecular weight
 Mn = Number average molecular weight
 Mp = Molar mass at the peak maximum
 PDI = Polydispersity Index

Light Scattering run on-line.

System and instrument validation based on DIN-Pullulan Lot No: p-100di.


Sample concentration	7.5308 g/L
Inject volume Sample	100µL
dn/dc	0.132mL/g

Storage: Store the tightly recapped polymer standard in a dry, dark, cool area; e.g. a refrigerator (4 °C).

Date of expiry: 2028/01/31 (See also product label.)

Date of approval: 2023/02/14

Manufacture control according to PSS method of analysis

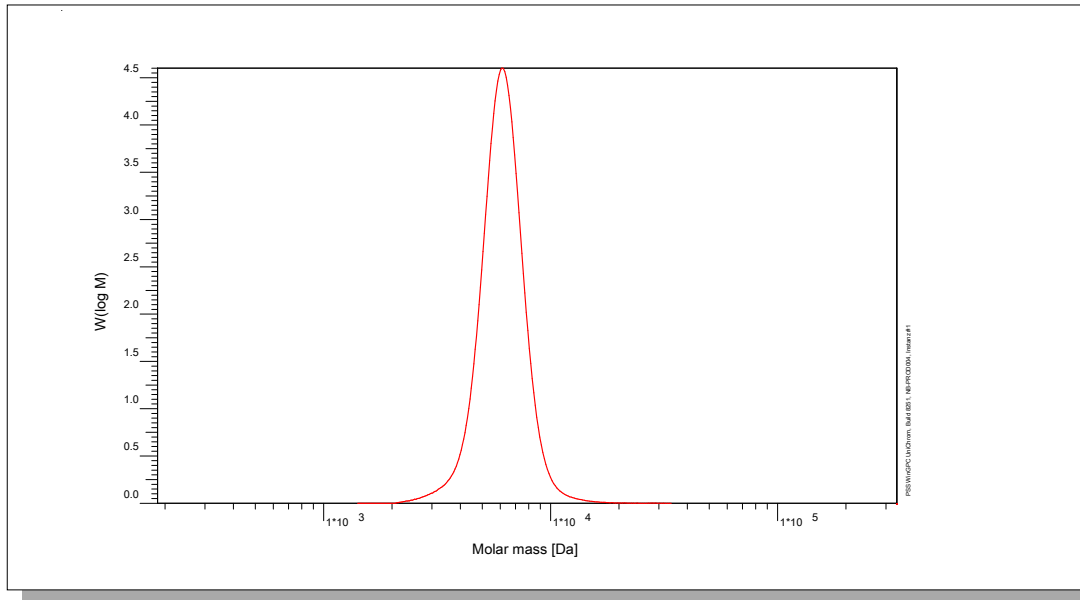

 Dr. J. Preis
 production manager



Certificate of Analysis

Polymer type: Poly(ethylene glycol)
 Part No: PSS-PEG6K
 Lot No: PEG2128

Molar Mass Distribution



GPC/SEC - Conditions

Sample concentration	1,00 g/l	Inject volume	20 µl
Flow rate	1,00 ml/min	Temperature	30 °C
Solvent	Water, Sodium azide 0.2g/l		
Precolumn [8 x 50 mm]	PSS SUPREMA 5µm		
Columns [analytical, each 8 x 300 mm]	PSS SUPREMA 5µm 100Å / 100Å / 100Å		
Data Acquisition Software	PSS WinGPC	Operator	J.Preis

GPC/SEC - Results

Detector	Mw [Da]	Mn [Da]	Mp [Da]	PDI [Mw/Mn]
PSS SECcurity RI	6200	5860	6530	1,06

Additional Methods - Results

Method	Mw [Da]
Light Scattering, on-line (SLD7x00)	6250

Mw = Weight average molecular weight
 Mn = Number average molecular weight
 Mp = Molar mass at the peak maximum
 PDI = Polydispersity Index

Light Scattering run on-line.

System and instrument validation based on DIN-Pullulan Lot No: p-100di.


Sample concentration	9.1428 g/L
Inject volume Sample	100µL
dn/dc	0.132mL/g

Storage: Store the tightly recapped polymer standard in a dry, dark, cool area; e.g. a refrigerator (4 °C).

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Manufacture control according to PSS method of analysis

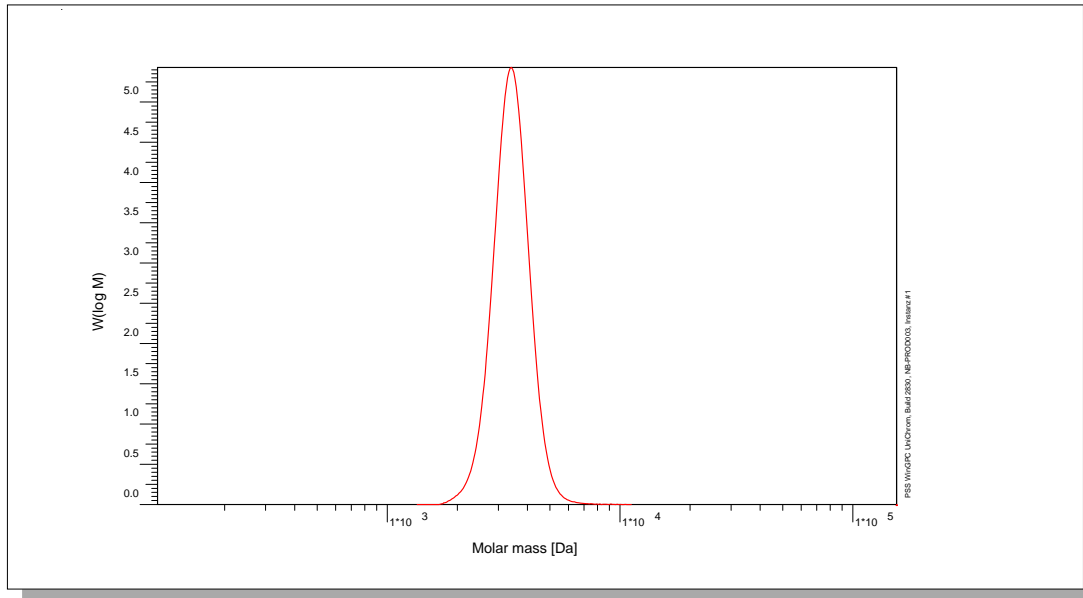

 Dr. J. Preis
 production manager



Certificate of Analysis

Polymer type: Poly(ethylene glycol)
 Part No: PSS-PEG3k
 Lot No: PEG040416

Molar Mass Distribution



GPC/SEC - Conditions

Sample concentration	1,00 g/l	Inject volume	20 µl
Solvent	Water, Sodium azide 0.2g/l	Flow rate	1,00 ml/min
Precolumn [8 x 50 mm]	PSS SUPREMA 5µm	Temperature	30 °C
Columns [analytical, each 8 x 300 mm]	PSS SUPREMA 5µm 100Å / 100Å / 100Å		
Data Acquisition Software	PSS WinGPC	Operator	J.Preis

GPC/SEC - Results

Detector	Mw [Da]	Mn [Da]	Mp [Da]	PDI [Mw/Mn]
PSS SECcurity RI	3450	3340	3450	1,03

Additional Methods - Results

Method	Mw [Da]
Light Scattering, on-line (SLD7x00)	3570

Mw = Weight average molecular weight
 Mn = Number average molecular weight
 Mp = Molar mass at the peak maximum
 PDI = Polydispersity Index

Light Scattering run on-line.

System and instrument validation based on DIN-Pullulan Lot No: p-100di.

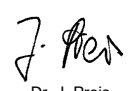
Sample concentration 9.9661 g/L
 Inject volume Sample 100µL
 dn/dc 0.132mL/g

Storage: Store the tightly recapped polymer standard in a dry, dark, cool area; e.g. a refrigerator (4 °C).

Date of expiry: 2028/01/31 (See also product label.)

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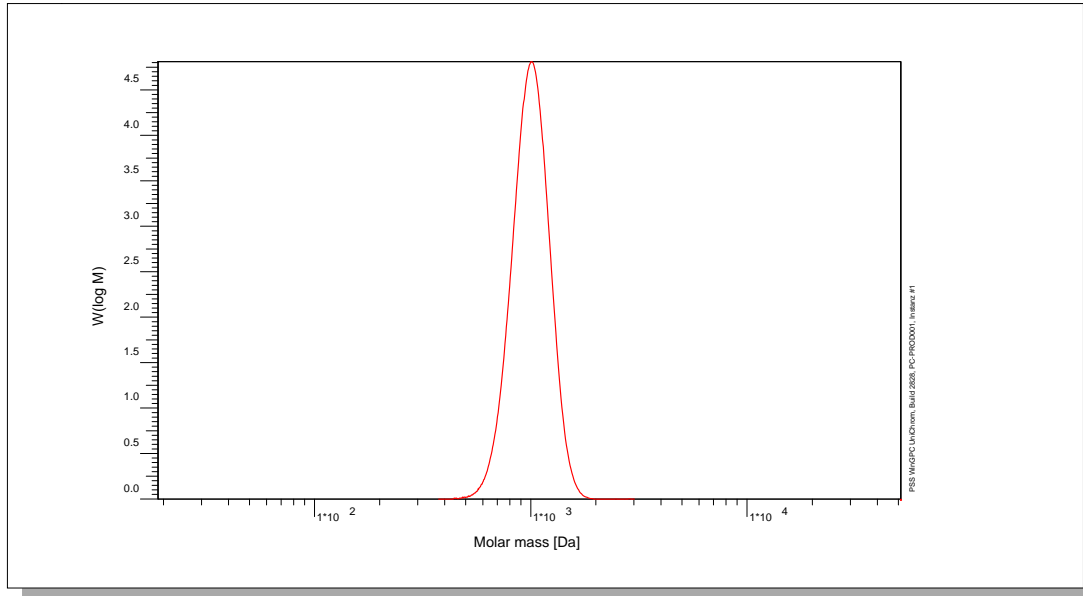
Manufacture control according to PSS method of analysis


 Dr. J. Preis
 production manager

Certificate of Analysis

Polymer type: Poly(ethylene glycol)
 Part No: PSS-PEG1K
 Lot No: PEG231113

Molar Mass Distribution



GPC/SEC - Conditions

Sample concentration	1,00 g/l	Inject volume	20 µl
Solvent	Water, Sodium azide 0.2g/l	Flow rate	1,00 ml/min
Precolumn [8 x 50 mm]	PSS SUPREMA 5µm	Temperature	30 °C
Columns [analytical, each 8 x 300 mm]	PSS SUPREMA 5µm 100Å / 100Å / 100Å		
Data Acquisition Software	PSS WinGPC	Operator	J.Preis

GPC/SEC - Results

Detector	Mw [Da]	Mn [Da]	Mp [Da]	PDI [mw/Mn]
PSS SECcurity RI	1020	978	1030	1,04

Additional Methods - Results

Method	Mn [Da]
Nuclear Magnetic Resonance spectroscopy	837

¹H-NMR (300MHz, CDCl₃)

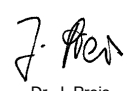
Mw = Weight average molecular weight
 Mn = Number average molecular weight
 Mp = Molar mass at the peak maximum
 PDI = Polydispersity Index

Storage: Store the tightly recapped polymer standard in a dry, dark, cool area; e.g. a refrigerator (4 °C).

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Manufacture control according to PSS method of analysis

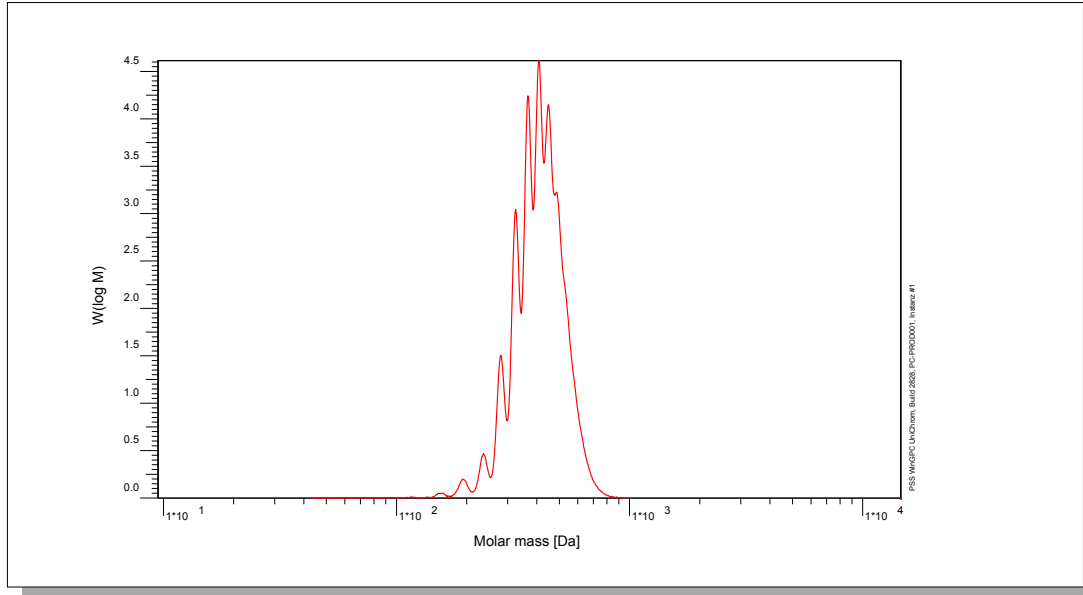

 Dr. J. Preis
 production manager



Certificate of Analysis

Polymer type: Poly(ethylene glycol)
 Part No: PSS-PEG400
 Lot No: PEG181113

Molar Mass Distribution



GPC/SEC - Conditions

Sample concentration	1,00 g/l	Inject volume	20 µl
Solvent	Water, Sodium azide 0.2g/l	Flow rate	1,00 ml/min
Precolumn [8 x 50 mm]	PSS SUPREMA 5µm	Temperature	30 °C
Columns [analytical, each 8 x 300 mm]	PSS SUPREMA 5µm 100Å / 100Å / 100Å		
Data Acquisition Software	PSS WinGPC	Operator	J.Preis

GPC/SEC - Results

Detector	Mw [Da]	Mn [Da]	Mp [Da]	PDI [mw/Mn]
PSS SECcurity RI	415	390	414	1,06

Additional Methods - Results

Method	Mn [Da]
Nuclear Magnetic Resonance spectroscopy	378

¹H-NMR (300MHz, CDCl₃)

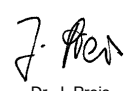
Mw = Weight average molecular weight
 Mn = Number average molecular weight
 Mp = Molar mass at the peak maximum
 PDI = Polydispersity Index

Storage: Store the tightly recapped polymer standard in a dry, dark, cool area; e.g. a refrigerator (4 °C).

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Manufacture control according to PSS method of analysis

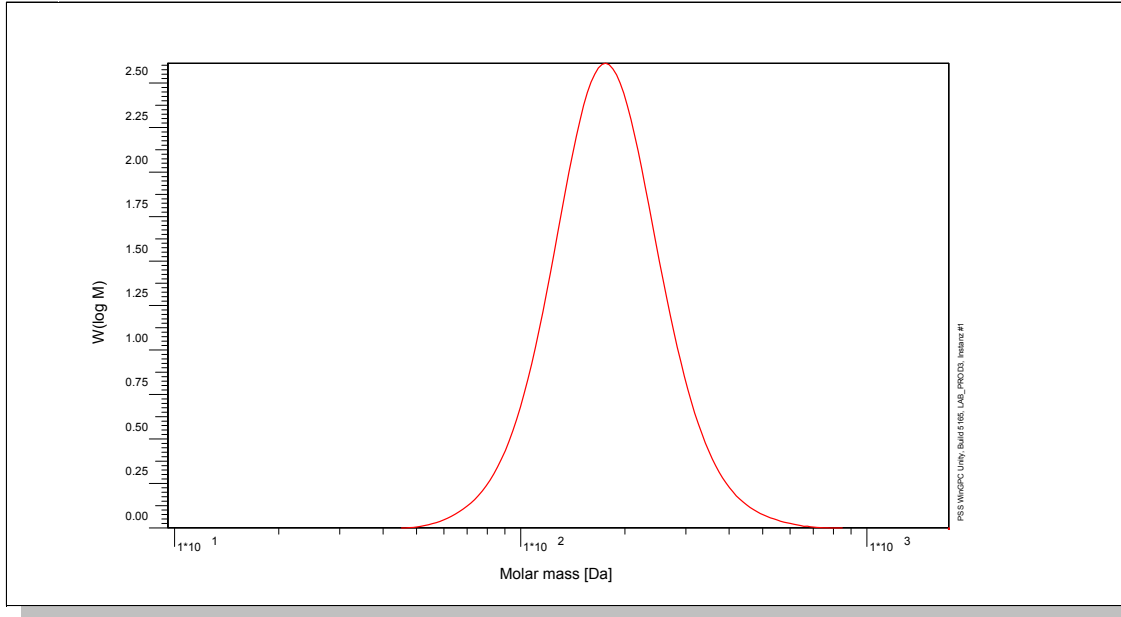

 Dr. J. Preis
 production manager



Certificate of Analysis

Polymer type: Poly(ethylene glycol)
 Part No: PSS-PEG194
 Lot No: PEGP-43

Molar Mass Distribution



GPC/SEC - Conditions

Sample concentration	1,00 g/l	Inject volume	20 µl
Solvent	Water, Sodium azide 0.05%	Flow rate	1,00 ml/min
Precolumn [8 x 50 mm]	PSS SUPREMA 10µm	Temperature	25,0° C
Columns [analytical, each 8 x 300 mm]	PSS SUPREMA 10µm 30 Å / 1 000 Å		
Data Acquisition Software	PSS WinGPC	Operator	S. Fugmann

GPC/SEC - Results

Detector	Mw [Da]	Mn [Da]	Mp [Da]	PDI [Mw/Mn]
PSS SECcurity RI	194	194	194	1,00

Additional Methods - Results

Method	Mn [Da]
Nuclear Magnetic Resonance spectroscopy	194

¹H-NMR (300MHz, CDCl₃)

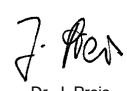
Mw = Weight average molecular weight
 Mn = Number average molecular weight
 Mp = Molar mass at the peak maximum
 PDI = Polydispersity Index

Storage: Store the tightly recapped polymer standard in a dry, dark, cool area; e.g. a refrigerator (4 °C).

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Manufacture control according to PSS method of analysis


 Dr. J. Preis
 production manager

