

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.

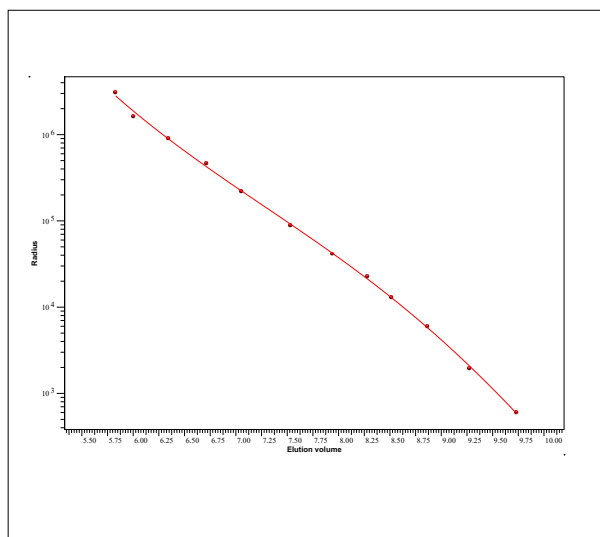
Patrick Kunzweiler

Quality Manager
Liquid Phase Separation Division

Certificate of Analysis

Product: Kit Poly(methyl methacrylate) high
 Part No: PSS-MMKITH
 Lot No: MMKITH-13

GPC/SEC - Calibration Curve



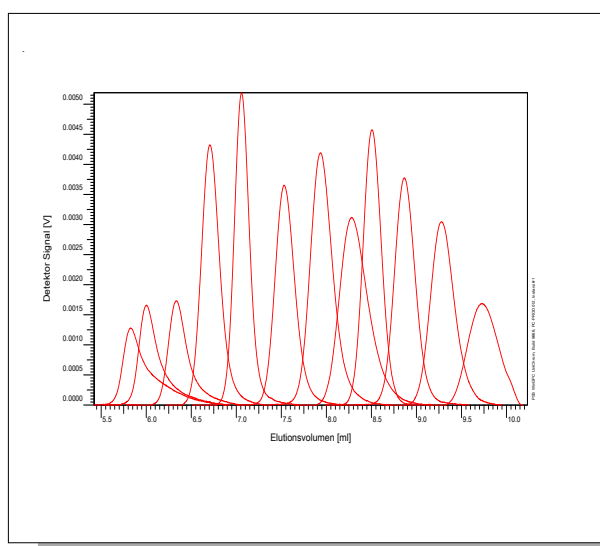
GPC/SEC - Calibration Table

Elution volume [ml]	Mp [Da]	Polymer Lot No:	Polymer Part No:
5,83	3060000	MM271016	PSS-MM2M
6,00	1640000	MM250403	PSS-MM1.5M
6,34	914000	MM260319	PSS-MM850K
6,71	459000	MMG161209	PSS-MM470K
7,06	217000	MMG230118	PSS-MM210K
7,53	88500	MMG060808	PSS-MM85K
7,94	41400	MMG1079	PSS-MM40K
8,28	22800	MMG290415	PSS-MM21K
8,51	12900	MMG280106	PSS-MM12.5K
8,86	5980	MMG110913	PSS-MM6.5K
9,28	1930	MMG221121	PSS-MM2.1K
9,73	602	MMG131020	PSS-MM600

Note:

Mp = Molar mass at the peak maximum

GPC/SEC - Polymer Overlay



GPC/SEC - Calibration Conditions


Solvent: Tetrahydrofuran
 Flow rate: 0,17 ml/min
 Precolumn [4.6 x 30 mm]: PSS SDV 10µm
 Columns [4,6 x 250 mm]: PSS SDV 10µm 10e3Å / 10e5Å / 10e7Å
 Temperature: 23 °C
 Inject volume: 5 µl
 Internal standard: Toluene at 10,82 ml
 Data Acquisition Software: PSS WinGPC
 Calibration by: A.Klein

Fit quality

Fit-type: PSS Poly 5
 R: 0,999737

Storage: Store the tightly recapped polymer standards in a dry, dark, cool area; e.g. a refrigerator (4 °C).
 Date of expiry: 2032/11/30 (See also product label.)
 Date of approval: 2023/02/26

Manufacture and control according to PSS method of analysis

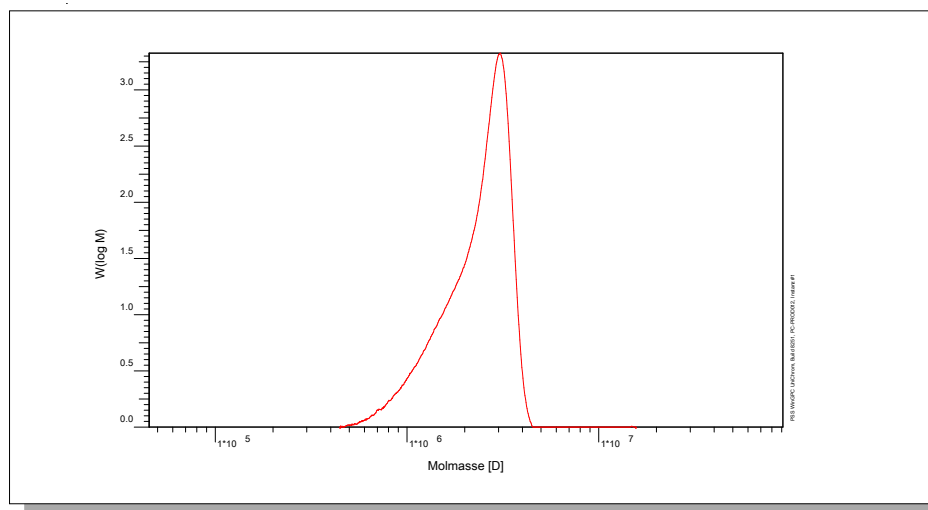

 Dr. J. Preis
 production manager



Certificate of Analysis

Polymer type: Poly(methyl methacrylate)
 Part No: PSS-MM2M
 Lot No: MM271016

Molar Mass Distribution



GPC/SEC - Conditions

Sample concentration	0,50 g/l	Inject volume	20 µl
Solvent	Tetrahydrofuran	Flow rate	0,50 ml/min
Precolumn [8 x 50 mm]	PSS SDV 10µm	Temperature	23 °C
Columns [analytical, each 8 x 300 mm]	PSS SDV 10µm 10e3Å / 10e5Å / 10e7Å	Operator	J.Preis
Data Acquisition Software	PSS WinGPC		

GPC/SEC - Results

Detector	Mw [Da]	Mn [Da]	Mp [Da]	PDI [Mw/Mn]
PSS SECcurity RI	2400000	2030000	3060000	1,19

Additional Methods - Results

Method	Mw [Da]
Light Scattering, on-line (SLD7x00)	2230000

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

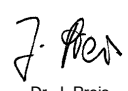
Light Scattering run on-line.

System and instrument validation based on Certified Reference Materials Poly(styrene) Lot No: ERM-FA001.

Sample concentration	0.5043 g/L
Inject volume	100µL
Sample dn/dc	0.087mL/g

Storage: Store the tightly recapped polymer standard in a dry, dark, cool area; e.g. a refrigerator (4 °C).
Date of expiry: 2032/11/30 (See also product label.)
Date of approval: 2023/02/26

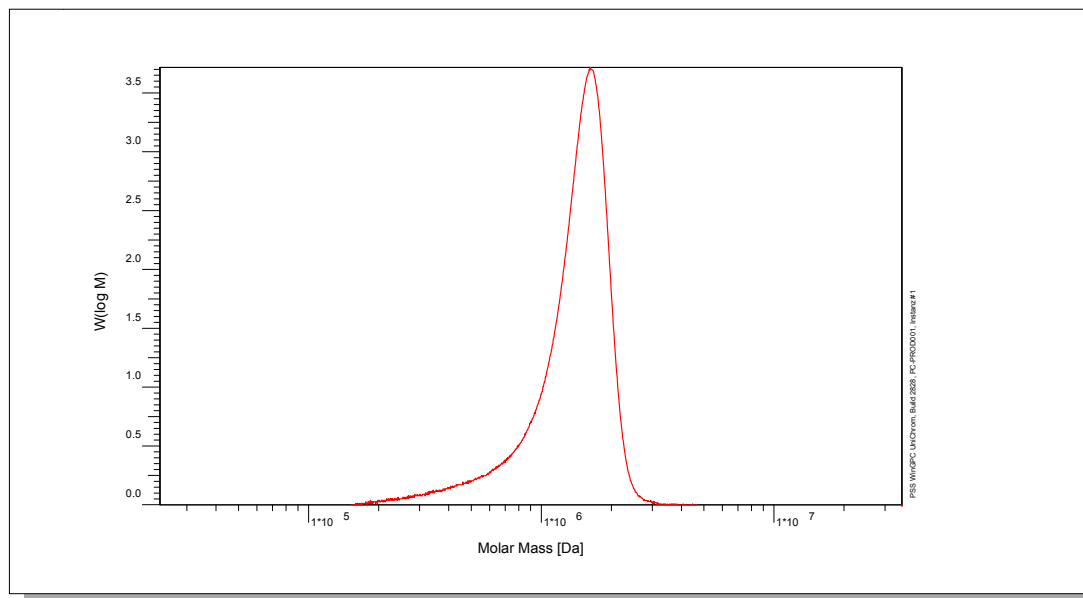
Manufacture and control according to PSS method of analysis


 Dr. J. Preis
 production manager

Certificate of Analysis

Polymer type: Poly(methyl methacrylate)
 Part No: PSS-MM1.5M
 Lot No: MM250403

Molar Mass Distribution



GPC/SEC - Conditions

Sample concentration	1,00 g/l	Inject volume	20 µl
Solvent	Tetrahydrofuran	Flow rate	1,00 ml/min
Precolumn [8 x 50 mm]	PSS SDV 5µm	Temperature	23 °C
Columns [analytical, each 8 x 300 mm]	PSS SDV 5µm 10e3Å / 10e5Å / 10e6Å	Operator	J.Preis
Data Acquisition Software	PSS WinGPC		

GPC/SEC - Results

Detector	Mw [Da]	Mn [Da]	Mp [Da]	PDI [Mw/Mn]
PSS SECcurity RI	1410000	1170000	1640000	1,21

Additional Methods - Results

Method	Mw [Da]
Light Scattering, on-line (SLD7x00)	1500000

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 Certified Reference Materials Poly(styrene) Lot No: ERM-FA001.

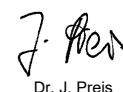
Sample concentration	0.9131 g/L
Inject volume Sample	100µL
dn/dc	0.087mL/g

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

Date of expiry: 2032/11/30 (See also product label.)

Date of approval: 2023/02/26

Manufacture and control according to PSS method of analysis

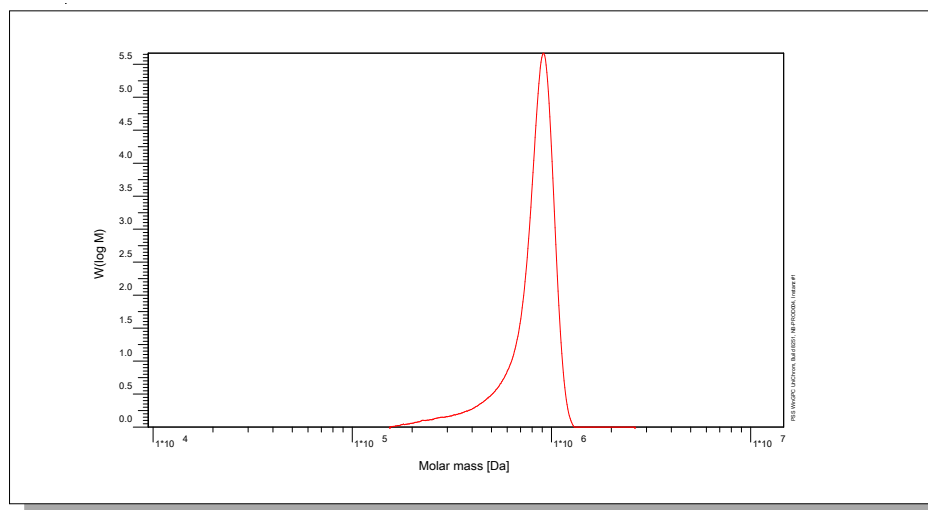


Dr. J. Preis
 production manager

Certificate of Analysis

Polymer type: Poly(methyl methacrylate)
 Part No: PSS-MM850K
 Lot No: MM260319

Molar Mass Distribution



GPC/SEC - Conditions

Sample concentration	1,00 g/l	Inject volume	20 µl
Solvent	Tetrahydrofuran	Flow rate	1,00 ml/min
Precolumn [8 x 50 mm]	PSS SDV 5µm	Temperature	23 °C
Columns [analytical, each 8 x 300 mm]	PSS SDV 5µm 10e3Å / 10e5Å / 10e6Å	Operator	A.Klein
Data Acquisition Software	PSS WinGPC		

GPC/SEC - Results

Detector	Mw [Da]	Mn [Da]	Mp [Da]	PDI [Mw/Mn]
PSS SECcurity RI	828000	758000	914000	1,09

Additional Methods - Results

Method	Mw [Da]
Light Scattering, on-line (SLD7x00)	792000

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 Certified Reference Materials Poly(styrene) Lot No: ERM-FA001.

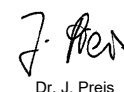
Sample concentration	0.9943 g/L
Inject volume	100µL
Sample dn/dc	0.087mL/g

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

Date of expiry: 2032/11/30 (See also product label.)

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Manufacture and control according to PSS method of analysis

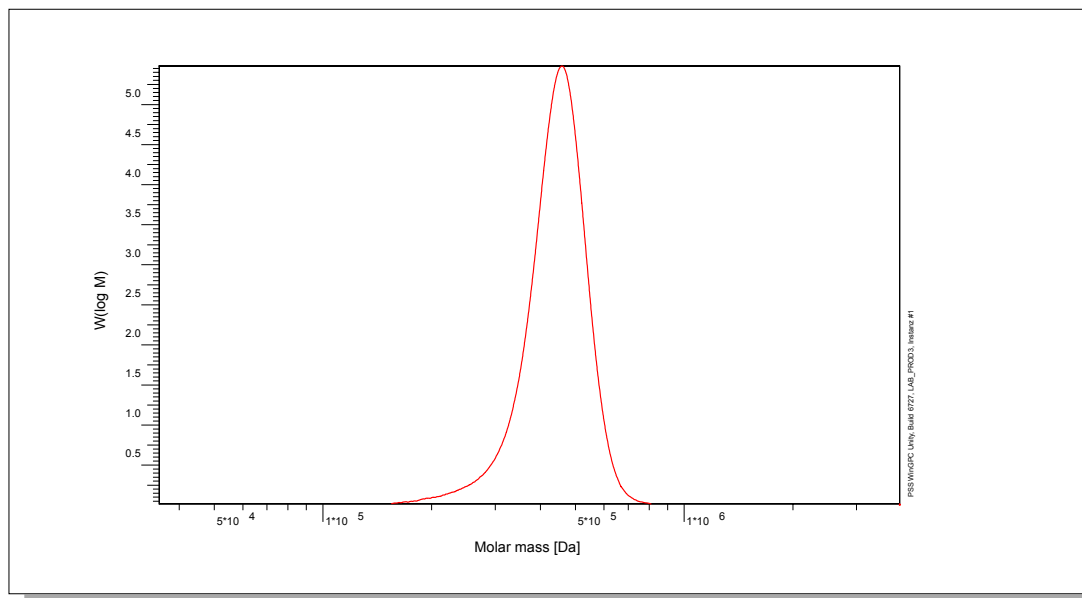


Dr. J. Preis
 production manager

Certificate of Analysis

Polymer type: Poly(methyl methacrylate)
 Part No: PSS-MM470K
 Lot No: MMG161209

Molar Mass Distribution



GPC/SEC - Conditions

Sample concentration	1,00 g/l	Inject volume	20 µl
Solvent	Tetrahydrofuran	Flow rate	1,00 ml/min
Precolumn [8 x 50 mm]	PSS SDV 5µm precolumn	Temperature	23 °C
Columns [analytical, each 8 x 300 mm]	PSS SDV 5µm 10e5Å / 10e5Å / 10e6Å	Operator	S. Fugmann
Data Acquisition Software	PSS WinGPC		

GPC/SEC - Results

Detector	Mw [Da]	Mn [Da]	Mp [Da]	PDI [Mw/Mn]
Agilent RID	444000	424000	459000	1,05

Additional Methods - Results

Method	Mw [Da]
Light Scattering, on-line (SLD7x00)	424000

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 Certified Reference Materials Poly(styrene) Lot No: ERM-FA001.

Sample concentration	1.0058 g/L
Inject volume	100µL
Sample dn/dc	0.087mL/g

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

Date of expiry: 2032/11/30 (See also product label.)

Date of approval: 2023/02/26

Manufacture and control according to PSS method of analysis

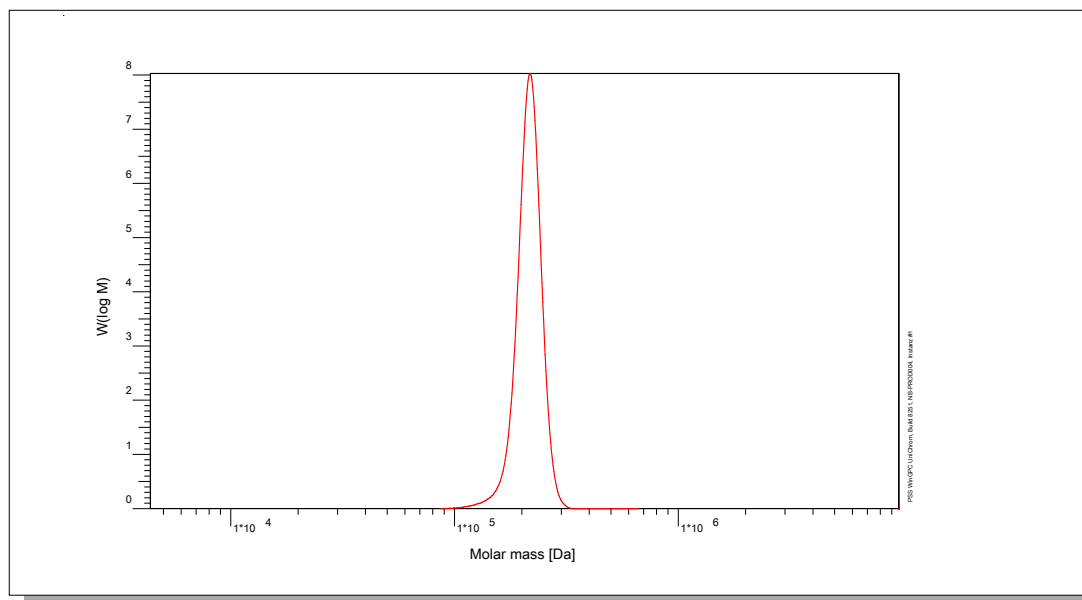


Dr. J. Preis
 production manager

Certificate of Analysis

Polymer type: Poly(methyl methacrylate)
 Part No: PSS-MM210K
 Lot No: MMG230118

Molar Mass Distribution



GPC/SEC - Conditions

Sample concentration	1,00 g/l	Inject volume	20 µl
Solvent	Tetrahydrofuran	Flow rate	1,00 ml/min
Precolumn [8 x 50 mm]	PSS SDV 5µm	Temperature	23 °C
Columns [analytical, each 8 x 300 mm]	PSS SDV 5µm 10e3Å / 10e5Å / 10e6Å		
Data Acquisition Software	PSS WinGPC	Operator	J.Preis

GPC/SEC - Results

Detector	Mw [Da]	Mn [Da]	Mp [Da]	PDI [Mw/Mn]
PSS SECcurity RI	214000	209000	217000	1,02

Additional Methods - Results

Method	Mw [Da]
Light Scattering, on-line (SLD7x00)	212000

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 Certified Reference Materials Poly(styrene) Lot No: ERM-FA001.

Sample concentration 1.0082 g/L
 Inject volume Sample 100µL
 dn/dc 0.087mL/g

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

Date of expiry: 2032/11/30 (See also product label.)

Date of approval: 2023/02/26

Manufacture and control according to PSS method of analysis

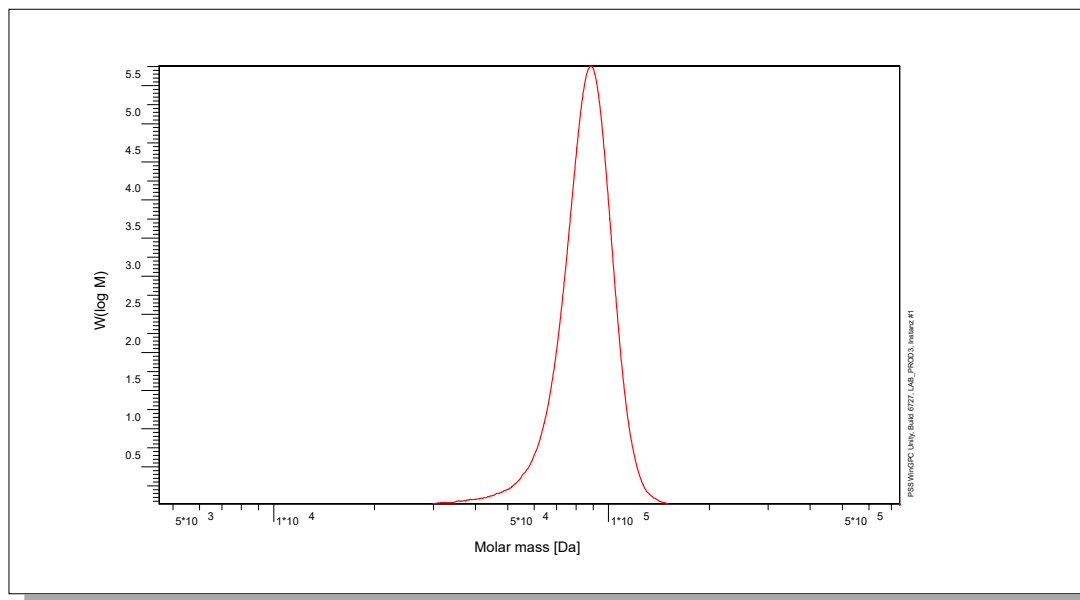


Dr. J. Preis
 production manager

Certificate of Analysis

Polymer type: Poly(methyl methacrylate)
 Part No: PSS-MM85K
 Lot No: MMG060808

Molar Mass Distribution



GPC/SEC - Conditions

Sample concentration	1,00 g/l	Inject volume	20 µl
Solvent	Tetrahydrofuran	Flow rate	1,00 ml/min
Precolumn [8 x 50 mm]	PSS SDV 5µm	Temperature	23 °C
Columns [analytical, each 8 x 300 mm]	PSS SDV 5µm 10e3Å / 10e5Å / 10e6Å	Operator	S. Fugmann
Data Acquisition Software	PSS WinGPC		

GPC/SEC - Results

Detector	Mw [Da]	Mn [Da]	Mp [Da]	PDI [Mw/Mn]
PSS SECcurity RI	86700	83700	88500	1,04

Additional Methods - Results

Method	Mw [Da]
Light Scattering, on-line (SLD7x00)	87600

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 Certified Reference Materials Poly(styrene) Lot No: ERM-FA001.

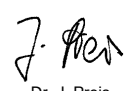
Sample concentration 1.5909 g/L
 Inject volume Sample 100µL
 dn/dc 0.087mL/g

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

Date of expiry: 2032/11/30 (See also product label.)

Date of approval: 2023/02/26

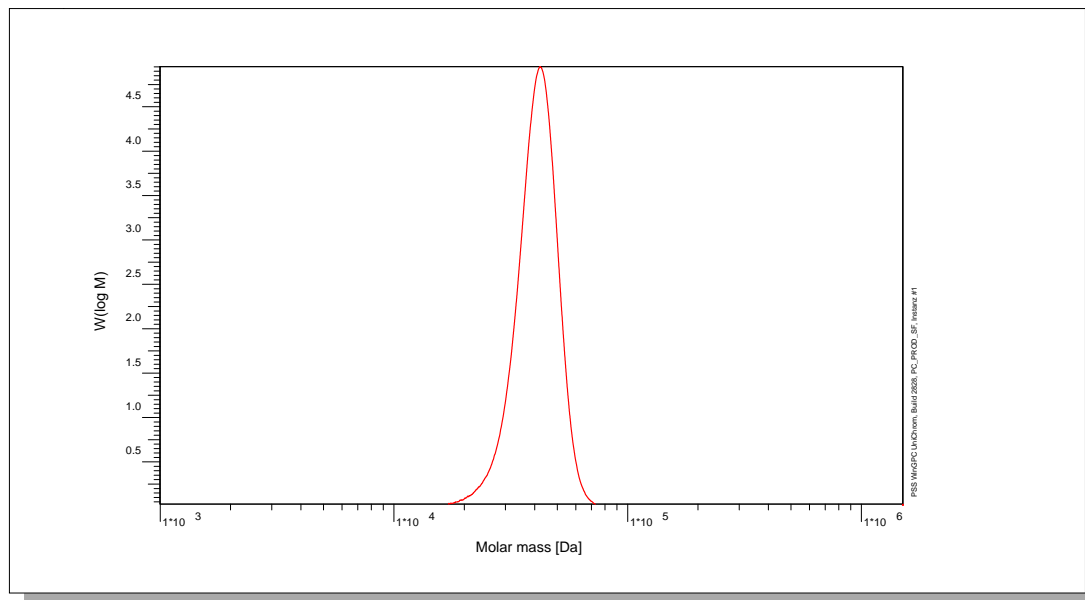
Manufacture and control according to PSS method of analysis


 Dr. J. Preis
 production manager

Certificate of Analysis

Polymer type: Poly(methyl methacrylate)
 Part No: PSS-MM40K
 Lot No: MMG1079

Molar Mass Distribution



GPC/SEC - Conditions

Sample concentration	1,00 g/l	Inject volume	20 µl
Solvent	Tetrahydrofuran	Flow rate	1,00 ml/min
Precolumn [8 x 50 mm]	PSS SDV 5µm	Temperature	23 °C
Columns [analytical, each 8 x 300 mm]	PSS SDV 5µm 10e3Å / 10e5Å / 10e6Å	Operator	S. Fugmann
Data Acquisition Software	PSS WinGPC		

GPC/SEC - Results

Detector	Mw [Da]	Mn [Da]	Mp [Da]	PDI [Mw/Mn]
PSS SECcurity RI	40300	38100	41400	1,06

Additional Methods - Results

Method	Mw [Da]
Light Scattering, on-line (SLD7x00)	42400

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 Certified Reference Materials Poly(styrene) Lot No: ERM-FA001.


Sample concentration 2.4380 g/L
 Inject volume Sample 100µL
 dn/dc 0.087mL/g

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

Date of expiry: 2032/11/30 (See also product label.)

Date of approval: 2023/02/26

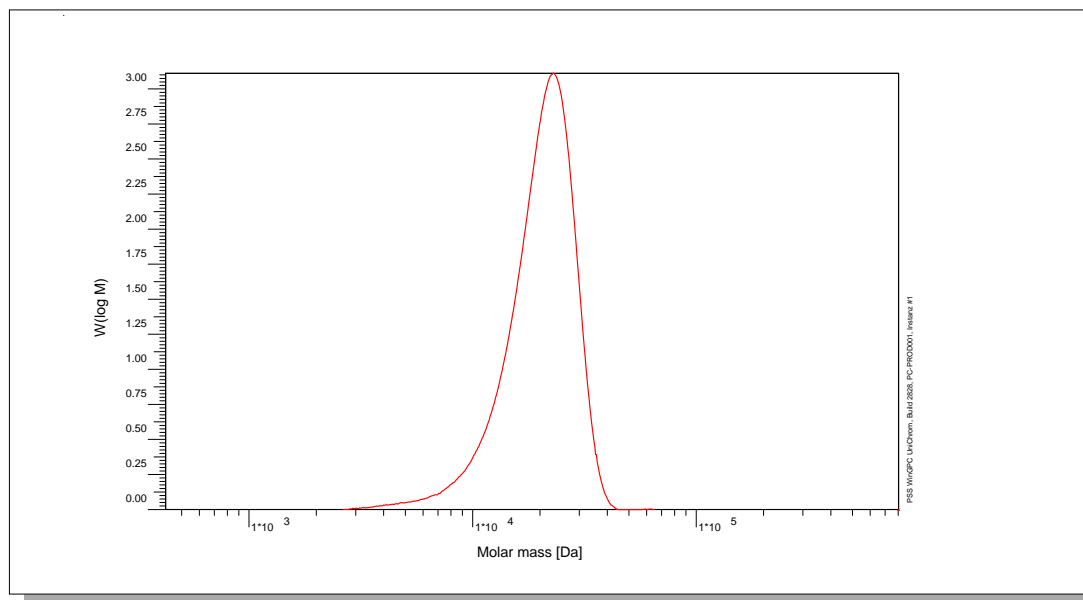
Manufacture and control according to PSS method of analysis


 Dr. J. Preis
 production manager

Certificate of Analysis

Polymer type: Poly(methyl methacrylate)
 Part No: PSS-MM21K
 Lot No: MMG290415

Molar Mass Distribution



GPC/SEC - Conditions

Sample concentration	1,00 g/l	Inject volume	20 µl
Solvent	Tetrahydrofuran	Flow rate	1,00 ml/min
Precolumn [8 x 50 mm]	PSS SDV 5µm	Temperature	23 °C
Columns [analytical, each 8 x 300 mm]	PSS SDV 5µm 10e3Å / 10e5Å / 10e6Å	Operator	J.Preis
Data Acquisition Software	PSS WinGPC		

GPC/SEC - Results

Detector	Mw [Da]	Mn [Da]	Mp [Da]	PDI [Mw/Mn]
PSS SECcurity RI	21200	18700	22800	1,13

Additional Methods - Results

Method	Mw [Da]
Light Scattering, on-line (SLD7x00)	21600

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 Certified Reference Materials Poly(styrene) Lot No: ERM-FA001.

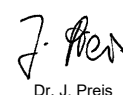
Sample concentration 5.4566 g/L
 Inject volume Sample 100µL
 dn/dc 0.087mL/g

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

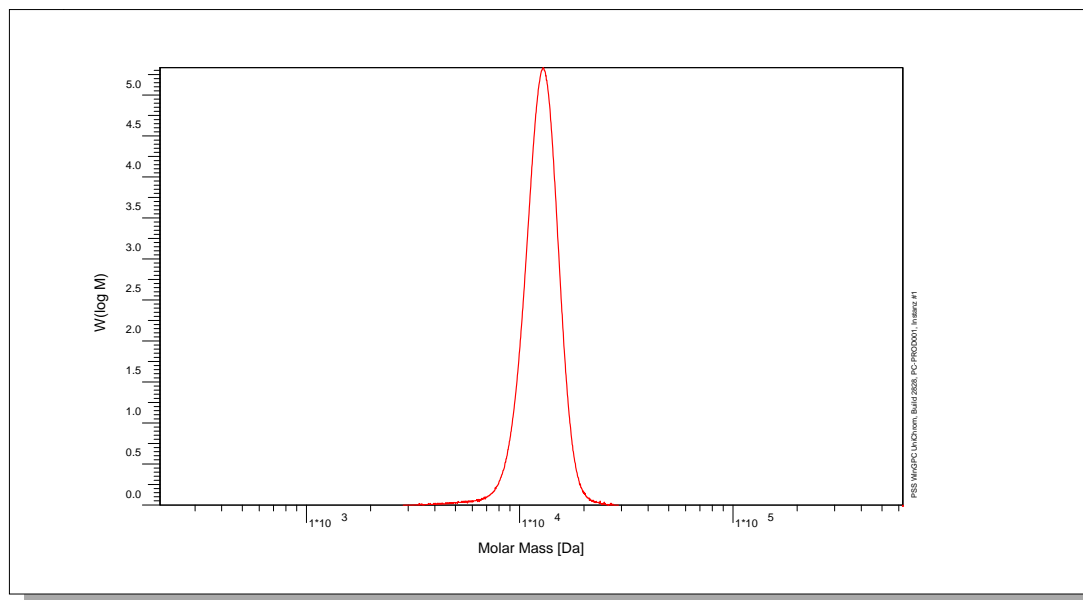


Dr. J. Preis
 production manager

Certificate of Analysis

Polymer type: Poly(methyl methacrylate)
 Part No: PSS-MM12.5K
 Lot No: MMG280106

Molar Mass Distribution



GPC/SEC - Conditions

Sample concentration	1,00 g/l	Inject volume	20 µl
Solvent	Tetrahydrofuran	Flow rate	1,00 ml/min
Precolumn [8 x 50 mm]	PSS SDV 5µm	Temperature	23 °C
Columns [analytical, each 8 x 300 mm]	PSS SDV 5µm 10e3Å / 10e5Å / 10e6Å	Operator	J.Preis
Data Acquisition Software	PSS WinGPC		

GPC/SEC - Results

Detector	Mw [Da]	Mn [Da]	Mp [Da]	PDI [Mw/Mn]
PSS SECcurity RI	12800	12300	12900	1,04

Additional Methods - Results

Method	Mw [Da]
Light Scattering, on-line (SLD7x00)	12100

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 Certified Reference Materials Poly(styrene) Lot No: ERM-FA001.

Sample concentration 6.4384 g/L
 Inject volume Sample 100µL
 dn/dc 0.087mL/g

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

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Date of approval: 2023/02/26

Manufacture and control according to PSS method of analysis

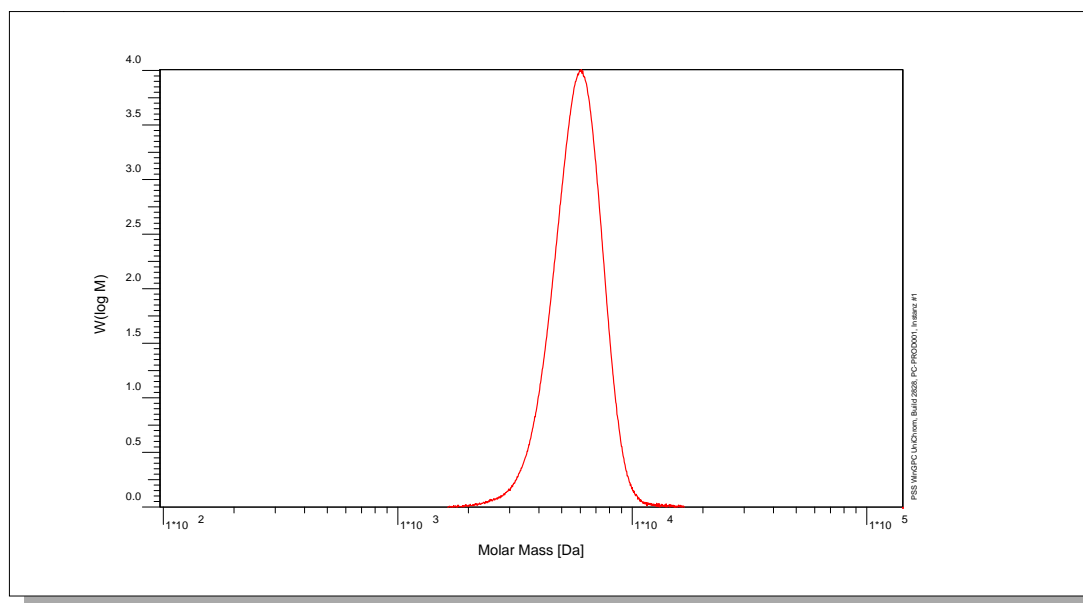


Dr. J. Preis
 production manager

Certificate of Analysis

Polymer type: Poly(methyl methacrylate)
 Part No: PSS-MM6.5K
 Lot No: MMG110913

Molar Mass Distribution



GPC/SEC - Conditions

Sample concentration	1,00 g/l	Inject volume	20 µl
Solvent	Tetrahydrofuran	Flow rate	1,00 ml/min
Precolumn [8 x 50 mm]	PSS SDV 5µm	Temperature	23 °C
Columns [analytical, each 8 x 300 mm]	PSS SDV 5µm 10e3Å / 10e5Å / 10e6Å	Operator	J.Preis
Data Acquisition Software	PSS WinGPC		

GPC/SEC - Results

Detector	Mw [Da]	Mn [Da]	Mp [Da]	PDI [Mw/Mn]
PSS SECcurity RI	5930	5590	5980	1,06

Additional Methods - Results

Method	Mw [Da]
Light Scattering, on-line (SLD7x00)	6070

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 Certified Reference Materials Poly(styrene) Lot No: ERM-FA001.

Sample concentration 8.8693 g/L
 Inject volume Sample 100µL
 dn/dc 0.087mL/g

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

Date of expiry: 2032/11/30 (See also product label.)

Date of approval: 2023/02/26

Manufacture and control according to PSS method of analysis

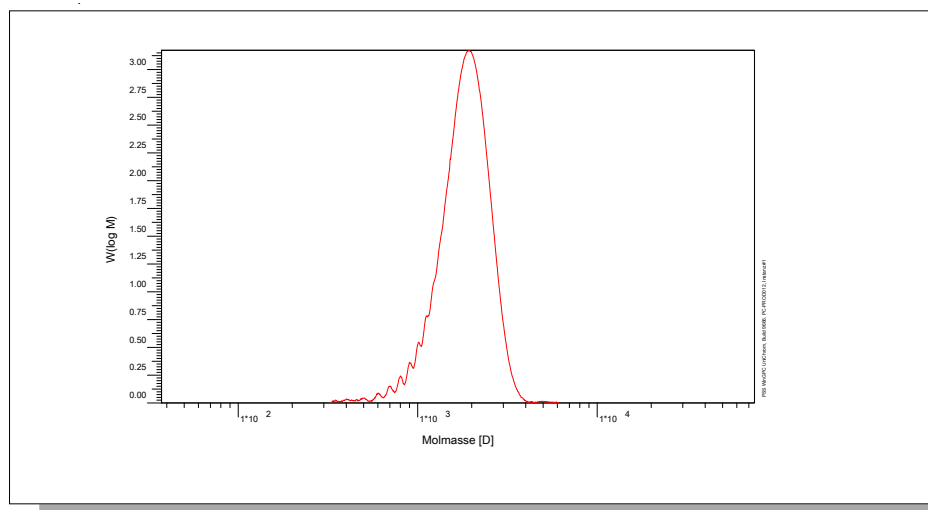


Dr. J. Preis
 production manager

Certificate of Analysis

Polymer type: Poly(methyl methacrylate)
 Part No: PSS-MM2.1K
 Lot No: MMG221121

Molar Mass Distribution



GPC/SEC - Conditions

Sample concentration	1,00 g/l	Inject volume	20 µl
Solvent	THF	Flow rate	1,00 ml/min
Precolumn [8 x 50 mm]	PSS SDV 3µm	Temperature	23 °C
Columns [analytical, each 8 x 300 mm]	PSS SDV 3µm 1 000Å / 1 000Å / 1 000Å		
Data Acquisition Software	PSS WinGPC	Operator	A.Klein

GPC/SEC - Results

Detector	Mw [Da]	Mn [Da]	Mp [Da]	PDI [Mw/Mn]
PSS SECcurity ² RI	1890	1690	1930	1,12

Additional Methods - Results

Method	Mw [Da]
Light Scattering, on-line (SLD7x00)	1960

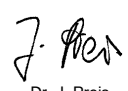
Mw = Weight average molecular weight
 Mn = Number average molecular weight
 Mp = Molar mass at the peak maximum
 PDI = Polydispersity Index

Light Scattering run on-line.
 System and instrument validation based on Poly(styrene) Lot No: ps2088.

Sample concentration	13.3036 g/L
Inject volume	100µL
Sample dn/dc	0.087mL/g

Storage: Store the tightly recapped polymer standard in a dry, dark, cool area; e.g. a refrigerator (4 °C).
Date of expiry: 2032/11/30 (See also product label.)
Date of approval: 2023/02/26

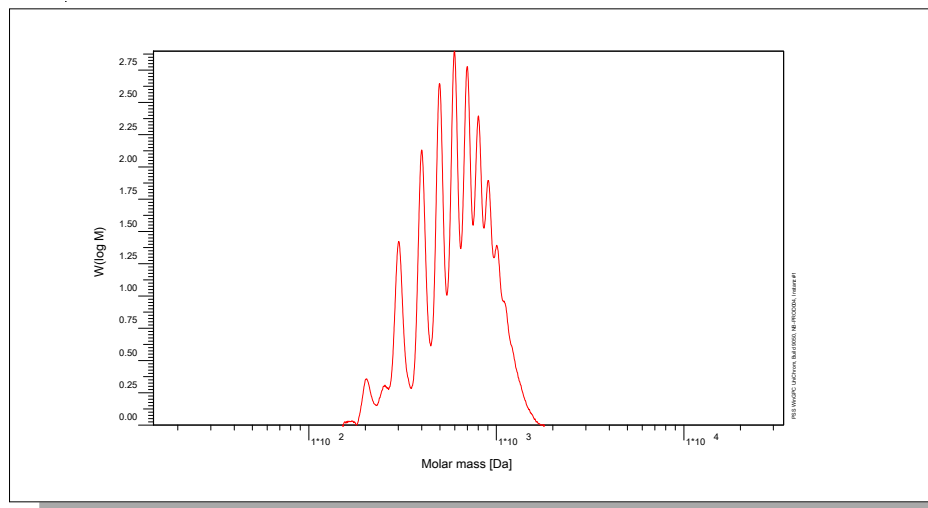
Manufacture and control according to PSS method of analysis


 Dr. J. Preis
 production manager

Certificate of Analysis

Polymer type: Poly(methyl methacrylate)
 Part No: PSS-MM600
 Lot No: MMG131020

Molar Mass Distribution



GPC/SEC - Conditions

Sample concentration	1,00 g/l	Inject volume	20 µl
Solvent	Tetrahydrofuran	Flow rate	1,00 ml/min
Precolumn [8 x 50 mm]	PSS SDV 3µm	Temperature	23 °C
Columns [analytical, each 8 x 300 mm]	PSS SDV 3µm 1000Å / 1000Å / 1000Å		
Data Acquisition Software	PSS WinGPC	Operator	A.Klein

GPC/SEC - Results

Detector	Mw [Da]	Mn [Da]	Mp [Da]	PDI [Mw/Mn]
PSS SECcurity RI	643	510	602	1,26

Additional Methods - Results

Method	Mn [Da]
Nuclear Magnetic Resonance spectroscopy	541

¹H-NMR (400MHz, 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).

Date of expiry: 2032/11/30 (See also product label.)

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Manufacture and control according to PSS method of analysis



Dr. J. Preis
 production manager