

# Certificate of Analysis



Agilent Technologies, Inc. acquired Polymer Standards Service GmbH (PSS) on August 01<sup>st</sup>, 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.

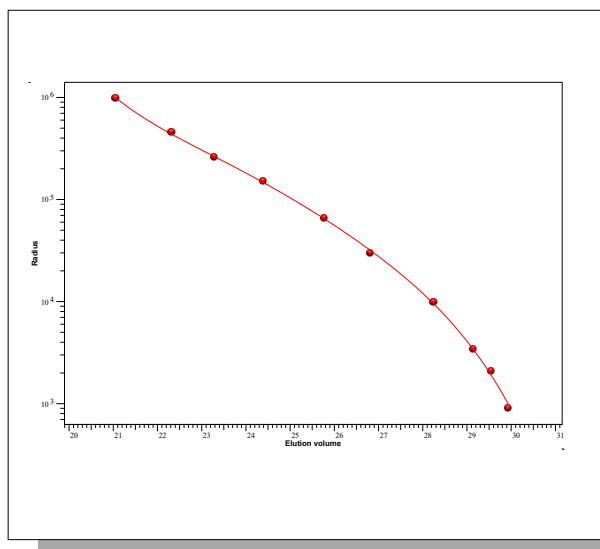
Patrick Kunzweiler

Quality Manager  
Liquid Phase Separation Division

# Certificate of Analysis

Product: Kit Poly(styrene sulfonate) sodium salt  
 Part No: PSS-PSSKIT  
 Lot No: PSSKIT-17

## GPC/SEC - Calibration Curve



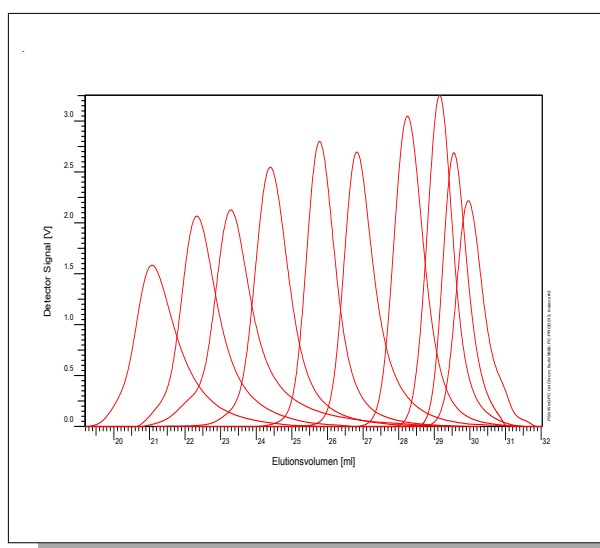
## GPC/SEC - Calibration Table

Elution volume [ml]	Mp [Da]	Polymer Lot No:	Polymer Part No:
21,06	976000	PSS14052-6	PSS-PSS1M
22,33	455000	PSS120219	PSS-PSS450K
23,29	258000	PSS170511-3	PSS-PSS280K
24,39	151000	PSS7065n-3	PSS-PSS140K
25,77	65400	PSS9029n-3	PSS-PSS67K
26,82	29500	PSS1088-4	PSS-PSS30K
28,25	9740	PSS210213-2	PSS-PSS10K
29,15	3420	PSS200504-3	PSS-PSS3.4K
29,56	2060	PSS131218	PSS-PSS2K
29,94	891	PSS130504-3	PSS-PSS1K

**Note:**

Mp = Molar mass at the peak maximum

## GPC/SEC - Polymer Overlay



## GPC/SEC - Calibration Conditions


Solvent: Water, Disodium hydrogen phosphate 0.067M  
 Flow rate: 1,00 ml/min  
 Precolumn [8 x 50 mm]: PSS MCX 10µm  
 Columns [8 x 300 mm]: PSS MCX 10µm 10e3Å / 10e5Å / 10e7Å  
 Temperature: 23 °C  
 Inject volume: 20 µl  
 Internal standard: Ethylene glycol at 37,35 ml  
 Data Acquisition Software: PSS WinGPC  
 Calibration by: A.Klein

**Fit quality**

Fit-type: PSS Poly 5  
 R: 0,999741

Storage: Store the tightly recapped polymer standards in a dry, dark, cool area; e.g. a refrigerator (4 °C).  
 Date of expiry: 2028/02/29 (See also product label.)  
 Date of approval: 2023/02/24

Manufacture and control according to PSS method of analysis

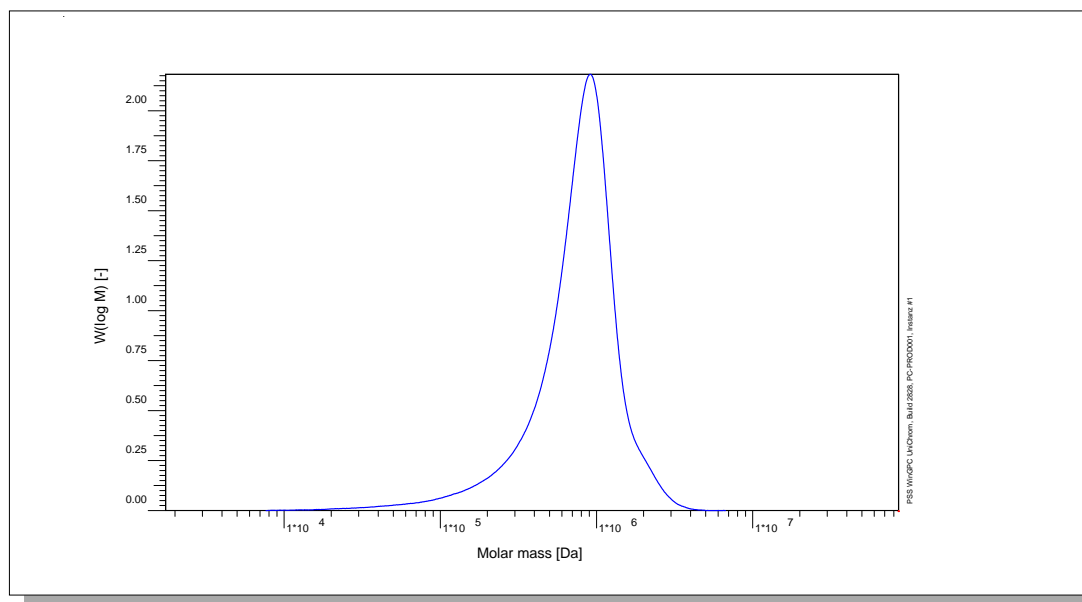
  
 Dr. J. Preis  
 production manager



# Certificate of Analysis

Polymer type: Poly(styrene sulfonate) sodium salt  
 Part No: PSS-PSS1M  
 Lot No: PSS14052-6

## Molar Mass Distribution



## GPC/SEC - Conditions

Sample concentration	0,50 g/l	Inject volume	20 µl
Flow rate	1,00 ml/min	Temperature	23 °C
Solvent	0.067M		
Precolumn [8 x 50 mm]	PSS MCX 10µm		
Columns [analytical, each 8 x 300 mm]	PSS MCX 10µm 10e3Å / 10e5Å / 10e7Å		
Data Acquisition Software	PSS WinGPC	Operator	J.Preis

## GPC/SEC - Results

Detector	Mw [Da]	Mn [Da]	Mp [Da]	PDI [Mw/Mn]
PSS SECcurity UV 254nm	519000	474000	519000	1.20

Parent Poly(styrene) Molecular Weight: Mw [Da] = 519000 Mn [Da] = 474000 Mp [Da] = 519000 PDI = 1.09

**Note:**

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

The molecular weights are calculated with the factor 1.88. Degree of sulfonation > 90%.  
 (For calculation: Assumption: Degree of sulfonation is 90%).

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

**Date of expiry:** 2028/02/29 (See also product label.)

**Date of approval:** 2023/02/24

Manufacture and control according to PSS method of analysis

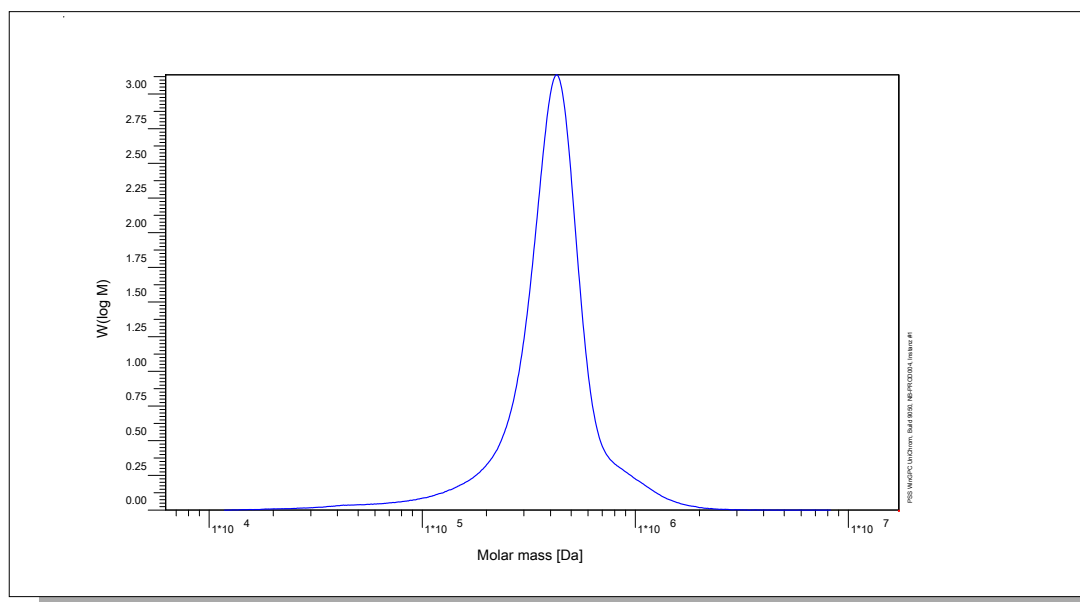


Dr. J. Preis  
production manager

# Certificate of Analysis

Polymer type: Poly(styrene sulfonate) sodium salt  
 Part No: PSS-PSS450K  
 Lot No: PSS120219

## 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	Water, Disodium hydrogen phosphate 0.067M		
Precolumn [8 x 50 mm]	PSS MCX 10µm		
Columns [analytical, each 8 x 300 mm]	PSS MCX 10µm 10e3Å / 10e5Å / 10e7Å		
Data Acquisition Software	PSS WinGPC	Operator	J.Preis

## GPC/SEC - Results

Detector	Mw [Da]	Mn [Da]	Mp [Da]	PDI [Mw/Mn]
PSS SECurity UV 254nm	453000	-	455000	<1.20

Parent Poly(styrene) Molecular Weight: Mw [Da] = 241000 Mn [Da] = 236000 Mp [Da] = 242000 PDI = 1.02

### Note:

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

The molecular weights are calculated with the factor 1.88 . Degree of sulfonation > 90%.

(For calculation: Assumption: Degree of sulfonation is 90%)

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

**Date of expiry:** 2028/02/29 (See also product label.)

**Date of approval:** 2023/02/24

Manufacture and control according to PSS method of analysis

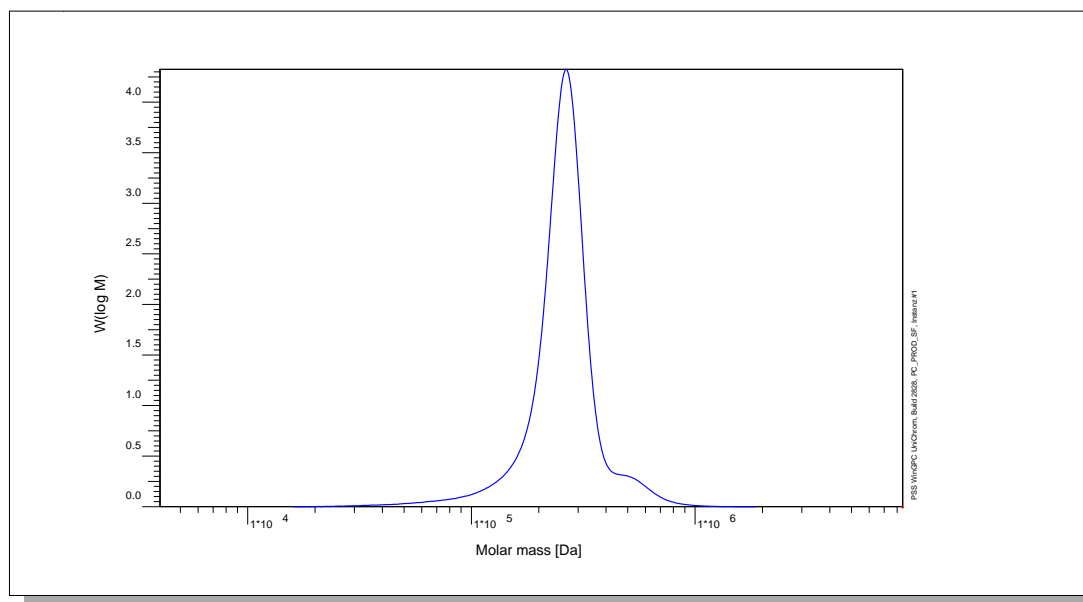


Dr. J. Preis  
production manager

# Certificate of Analysis

Polymer type: Poly(styrene sulfonate) sodium salt  
 Part No: PSS-PSS280K  
 Lot No: PSS170511-3

## Molar Mass Distribution



## GPC/SEC - Conditions

Sample concentration	1,00 g/l	Inject volume	20 µl
Solvent	Water, Disodium hydrogen phosphate 0.067M	Flow rate	1,00 ml/min
Precolumn [8 x 50 mm]	PSS MCX 10µm	Temperature	23 °C
Columns [analytical, each 8 x 300 mm]	PSS MCX 10µm 10e3Å / 10e5Å / 10e7Å	Operator	S.Fugmann
Data Acquisition Software	PSS WinGPC		

## GPC/SEC - Results

Detector	Mw [Da]	Mn [Da]	Mp [Da]	PDI [Mw/Mn]
PSS SECcurity UV 254nm	261000	-	258000	<1.20

Parent Poly(styrene) Molecular Weight: Mw [Da] = 139 000 Mn [Da] = 135 000 Mp [Da] = 137 000 PDI = 1.02

### Note:

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

The molecular weights are calculated with the factor 1.88. Degree of sulfonation > 90%.  
 (For calculation: Assumption: Degree of sulfonation is 90%).

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

**Date of expiry:** 2028/02/29 (See also product label.)

**Date of approval:** 2023/02/24

Manufacture and control according to PSS method of analysis

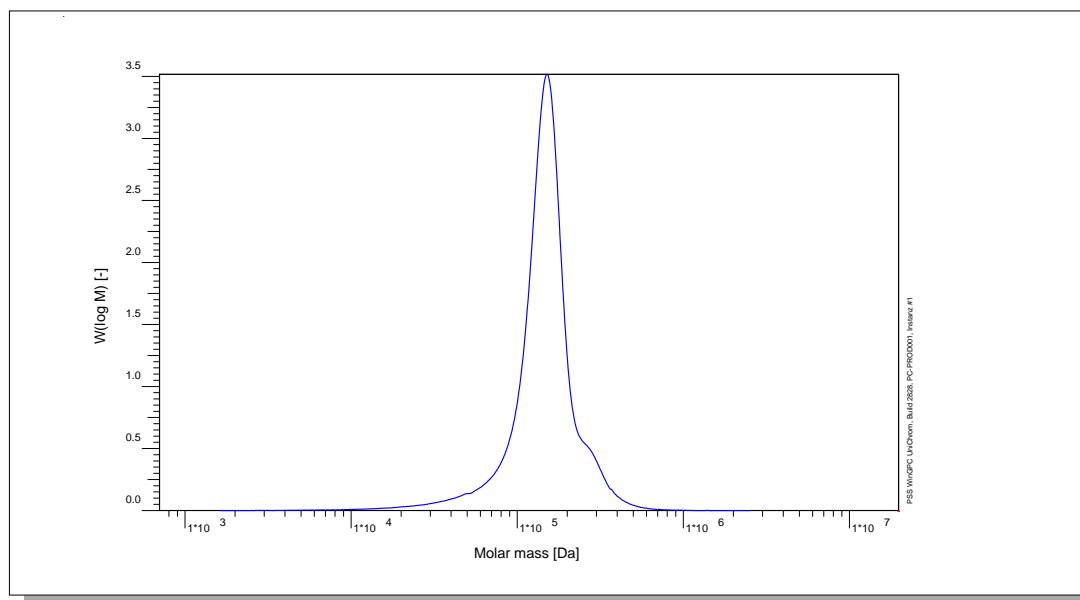


Dr. J. Preis  
 production manager

# Certificate of Analysis

Polymer type: Poly(styrene sulfonate) sodium salt  
 Part No: PSS-PSS140K  
 Lot No: PSS7065N-3

## 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	Water	Concentration	0.067M
Precolumn [8 x 50 mm]	PSS MCX 10µm		
Columns [analytical, each 8 x 300 mm]	PSS MCX 10µm 10e3Å / 10e5Å / 10e7Å		
Data Acquisition Software	PSS WinGPC	Operator	J.Preis

## GPC/SEC - Results

Detector	Mw [Da]	Mn [Da]	Mp [Da]	PDI [Mw/Mn]
PSS SECcurity UV 254nm	77100	-	151000	<1.20

Parent Poly(styrene) Molecular Weight: Mw [Da] = 77100 Mn [Da] = 73800 Mp [Da] = 80200 PDI = 1.04

**Note:**

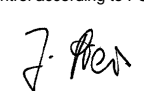
- Mw = Weight average molecular weight
- Mn = Number average molecular weight
- Mp = Molar mass at the peak maximum
- PDI = Polydispersity Index

The molecular weights are calculated with the factor 1.88. Degree of sulfonation > 90%.  
 (For calculation: Assumption: Degree of sulfonation is 90%).

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

**Date of expiry:** 2028/02/29 (See also product label.)  
**Date of approval:** 2023/02/24

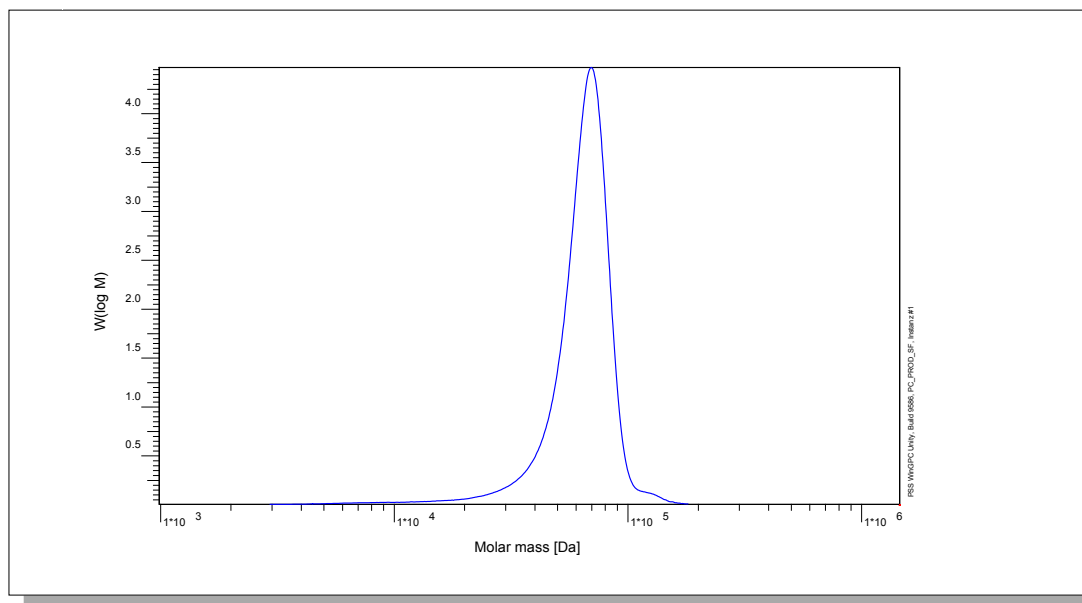
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 Dr. J. Preis  
 production manager

# Certificate of Analysis

Polymer type: Poly(styrene sulfonate) sodium salt  
 Part No: PSS-PSS67K  
 Lot No: PSS9029N-3

## Molar Mass Distribution



## GPC/SEC - Conditions

Sample concentration	1,00 g/l	Inject volume	20 µl
Solvent	Water, Disodium hydrogen phosphate 0.067M	Flow rate	1,00 ml/min
Precolumn [8 x 50 mm]	PSS MCX 10µm	Temperature	23 °C
Columns [analytical, each 8 x 300 mm]	PSS MCX 10µm 10e3A / 10e5A / 10e7A	Operator	J.Preis
Data Acquisition Software	PSS WinGPC		

## GPC/SEC - Results

Detector	Mw [Da]	Mn [Da]	Mp [Da]	PDI [Mw/Mn]
PSS SECcurity UV 254nm	63900	-	65400	<1.20

Parent Poly(styrene) Molecular Weight: Mw [Da] = 34 000 Mn [Da] = 32 700 Mp [Da] = 34 800 PDI = 1.04

### Note:

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

The molecular weights are calculated with the factor 1.88. Degree of sulfonation > 90%.  
 (For calculation: Assumption: Degree of sulfonation is 90%).

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

**Date of expiry:** 2028/02/29 (See also product label.)

**Date of approval:** 2023/02/24

Manufacture and control according to PSS method of analysis

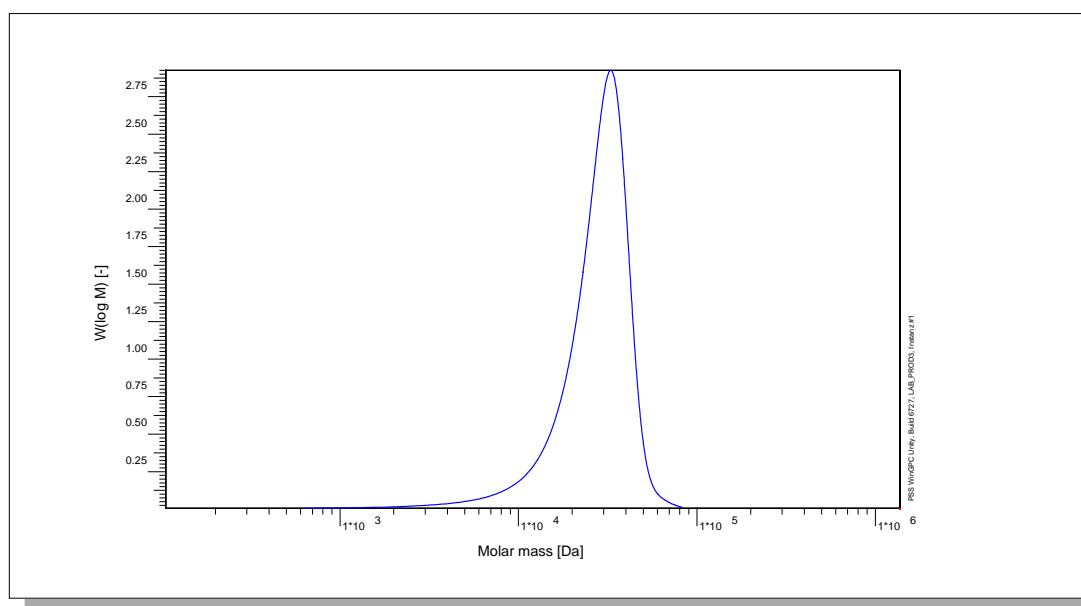


Dr. J. Preis  
 production manager

# Certificate of Analysis

Polymer type: Poly(styrene sulfonate) sodium salt  
 Part No: PSS-PSS30K  
 Lot No: PSS1088-4

## Molar Mass Distribution



## GPC/SEC - Conditions

Sample concentration	1,00 g/l	Inject volume	20 µl
Solvent	Water, Disodium hydrogen phosphate 0.067M	Flow rate	1,00 ml/min
Precolumn [8 x 50 mm]	PSS MCX 10µm	Temperature	25° C
Columns [analytical, each 8 x 300 mm]	PSS MCX 10µm 10e3Å / 10e5Å / 10e7Å		
Data Acquisition Software	PSS WinGPC	Operator	S.Fugmann

## GPC/SEC - Results

Detector	Mw [Da]	Mn [Da]	Mp [Da]	PDI [Mw/Mn]
PSS SECcurity UV 254nm	29100	-	29500	< 1.20

Parent Poly(styrene) Molecular Weight: Mw [Da] = 15 500 Mn [Da] = 14 700 Mp [Da] = 15 700 PDI = 1.06

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

The molecular weights are calculated with the factor 1.88. Degree of sulfonation > 90%.  
 (For calculation: Assumption: Degree of sulfonation is 90%).

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

**Date of expiry:** 2028/02/29 (See also product label.)

**Date of approval:** 2023/02/24

Manufacture and control according to PSS method of analysis



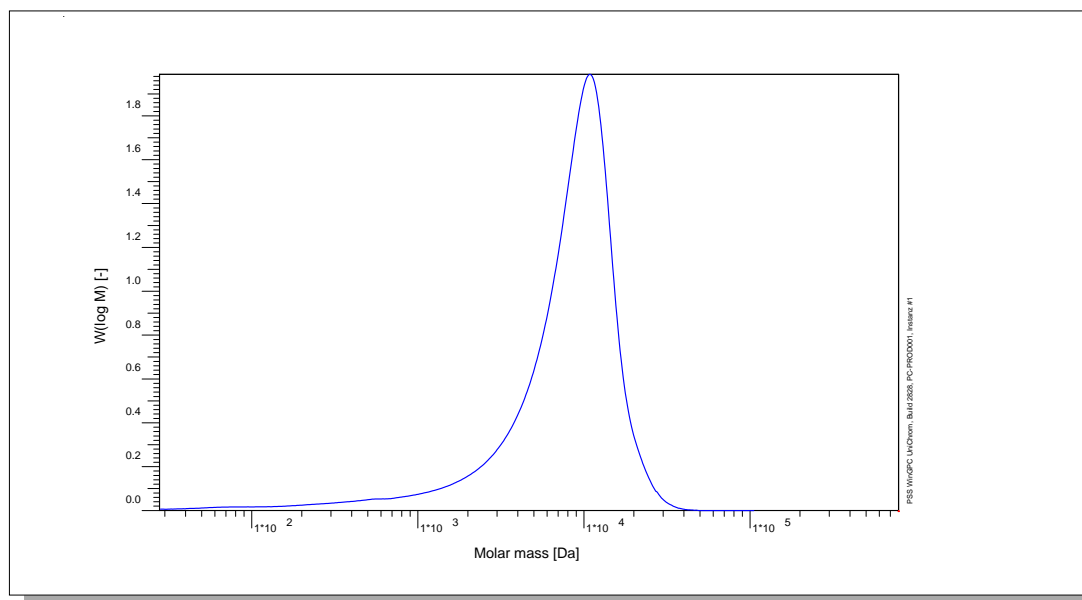
Dr. J. Preis  
 production manager



# Certificate of Analysis

Polymer type: Poly(styrene sulfonate) sodium salt  
 Part No: PSS-PSS10K  
 Lot No: PSS210213-2

## 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	Water, Disodium hydrogen phosphate 0.067M		
Precolumn [8 x 50 mm]	PSS MCX 10µm		
Columns [analytical, each 8 x 300 mm]	PSS MCX 10µm 10e3Å / 10e5Å / 10e7Å		
Data Acquisition Software	PSS WinGPC	Operator	J.Preis

## GPC/SEC - Results

Detector	Mw [Da]	Mn [Da]	Mp [Da]	PDI [Mw/Mn]
PSS SECcurity UV 254nm	5150	4970	5180	<1.20

Parent Poly(styrene) Molecular Weight: Mw [Da] = 5150 Mn [Da] = 4970 Mp [Da] = 5180 PDI = 1.04

**Note:**

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

The molecular weights are calculated with the factor 1.88. Degree of sulfonation > 90%.  
 (For calculation: Assumption: Degree of sulfonation is 90%).

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

**Date of expiry:** 2028/02/29 (See also product label.)

**Date of approval:** 2023/02/24

Manufacture and control according to PSS method of analysis

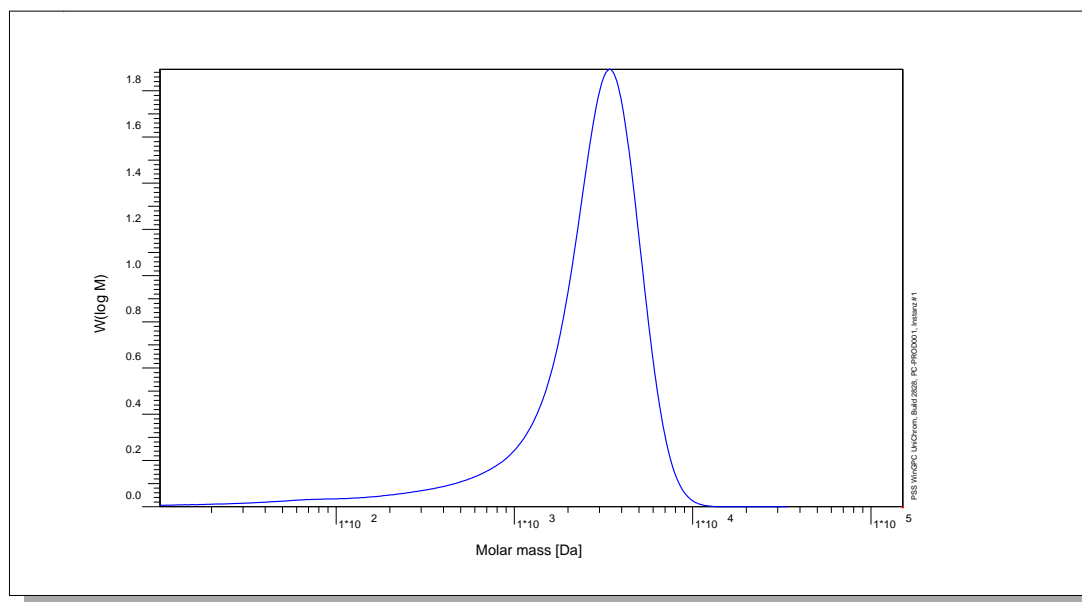


Dr. J. Preis  
production manager

# Certificate of Analysis

Polymer type: Poly(styrene sulfonate) sodium salt  
 Part No: PSS-PSS3.4K  
 Lot No: PSS200504-3

## 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	Water, Disodium hydrogen phosphate 0.067M		
Precolumn [8 x 50 mm]	PSS MCX 10µm		
Columns [analytical, each 8 x 300 mm]	PSS MCX 10µm 10e3Å / 10e5Å / 10e7Å		
Data Acquisition Software	PSS WinGPC	Operator	J.Preis

## GPC/SEC - Results

Detector	Mw [Da]	Mn [Da]	Mp [Da]	PDI [Mw/Mn]
PSS SECcurity UV 254nm	3610	-	3420	<1.20

Parent Poly(styrene) Molecular Weight: Mw [Da] = 1920 Mn [Da] = 1770 Mp [Da] = 1820 PDI = 1.08

**Note:**

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

The molecular weights are calculated with the factor 1.88. Degree of sulfonation > 90%.  
 (For calculation: Assumption: Degree of sulfonation is 90%).

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

**Date of expiry:** 2028/02/29 (See also product label.)

**Date of approval:** 2023/02/24

Manufacture and control according to PSS method of analysis

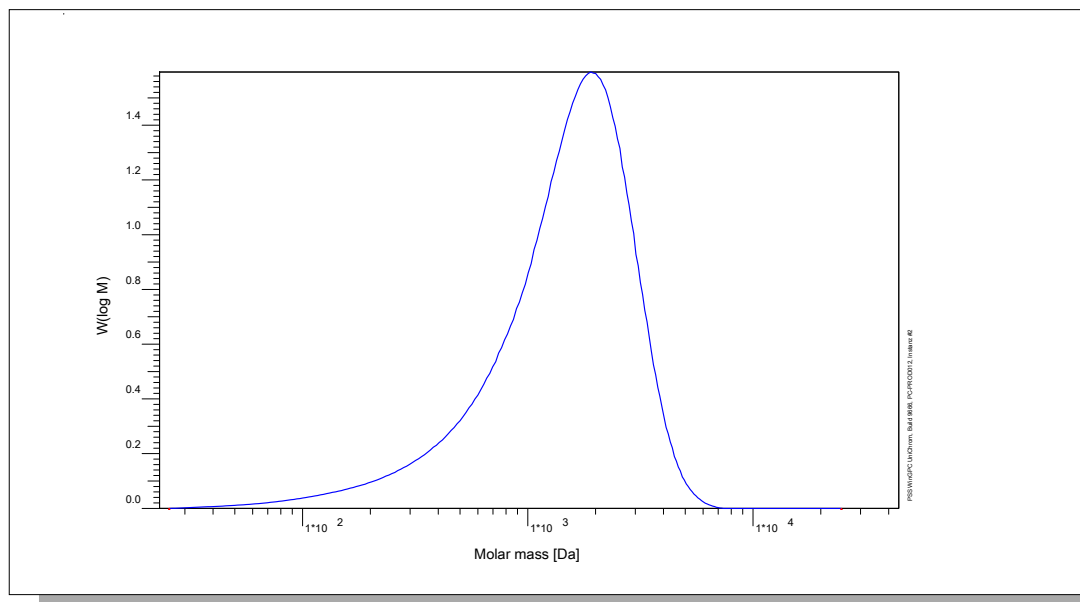


Dr. J. Preis  
production manager

# Certificate of Analysis

Polymer type: Poly(styrene sulfonate) sodium salt  
 Part No: PSS-PSS2K  
 Lot No: PSS131218

## 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	Water, Disodium hydrogen phosphate 0.067M		
Precolumn [8 x 50 mm]	PSS MCX 10µm		
Columns [analytical, each 8 x 300 mm]	PSS MCX 10µm 10e3Å / 10e5Å / 10e7Å		
Data Acquisition Software	PSS WinGPC	Operator	A.Klein

## GPC/SEC - Results

Detector	Mw [Da]	Mn [Da]	Mp [Da]	PDI [Mw/Mn]
PSS SECcurity VW 254nm	1070	968	2060	<1.20

Parent Poly(styrene) Molecular Weight: Mw [Da] = 1070 Mn [Da] = 968 Mp [Da] = 1098 PDI = 1,11

**Note:**

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

The molecular weights are calculated with the factor 1.88. Degree of sulfonation > 90%.  
 (For calculation: Assumption: Degree of sulfonation is 90%).

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

**Date of expiry:** 2028/02/29 (See also product label.)

**Date of approval:** 2023/02/24

Manufacture and control according to PSS method of analysis

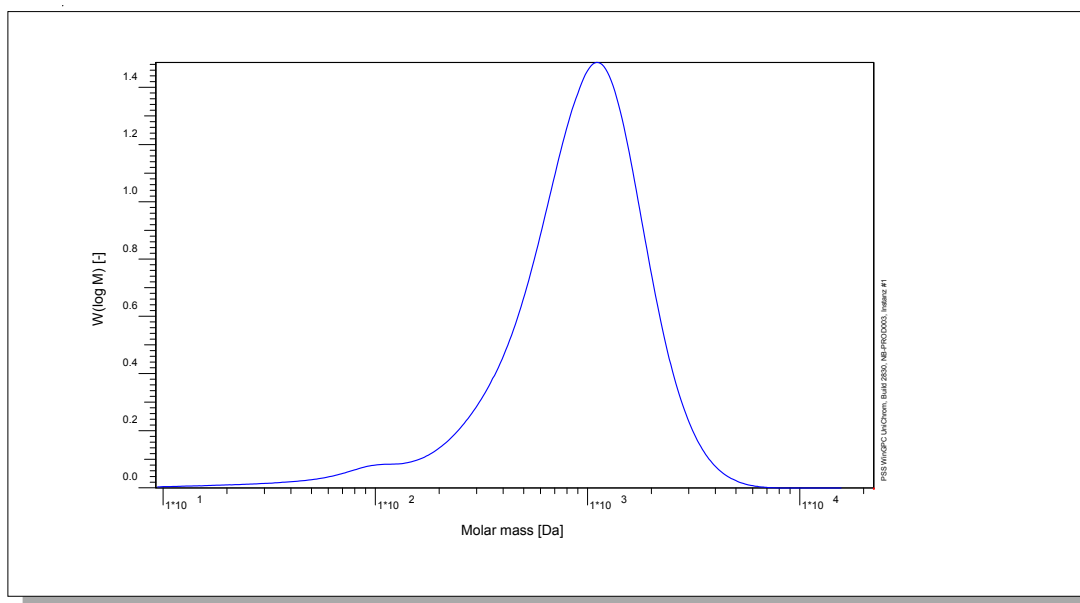


Dr. J. Preis  
production manager

# Certificate of Analysis

Polymer type: Poly(styrene sulfonate) sodium salt  
 Part No: PSS-PSS1K  
 Lot No: PSS130504-3

## 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	Water, Disodium hydrogen phosphate 0.067M		
Precolumn [8 x 50 mm]	PSS MCX 10µm		
Columns [analytical, each 8 x 300 mm]	PSS MCX 10µm 10e3Å / 10e5Å / 10e7Å		
Data Acquisition Software	PSS WinGPC	Operator	J.Preis

## GPC/SEC - Results

Detector	Mw [Da]	Mn [Da]	Mp [Da]	PDI [Mw/Mn]
PSS SECcurity UV 254nm	1100	-	891	<1.20

Parent Poly(styrene) Molecular Weight: Mw [Da] = 588 Mn [Da] = 538 Mp [Da] = 474 PDI = 1.09

**Note:**

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

The molecular weights are calculated with the factor 1.88. Degree of sulfonation > 90%.  
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**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