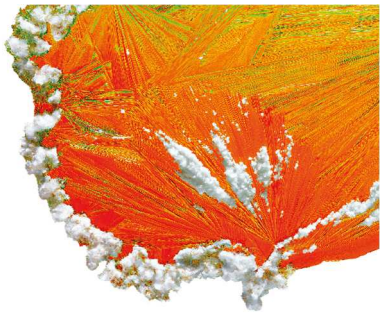


Certificate of Analysis ISO 9001

Reference Material

Product name

(2S,5R,6R)-6-[[(2R)-2-[[(2R)-2-Amino-2-(4-hydroxyphenyl)acetyl]amino]-2-(4-hydroxyphenyl)acetyl]amino]-3,3-dimethyl-7-oxo-4-thia-1-azabicyclo[3.2.0]heptane-2-carboxylic Acid

Product code	**Lot number**
MM0232.07	1094651
CAS number	**Appearance**
188112-75-6	white solid
Molecular weight	**Melting point**
514.55	204 °C (dec.)
Molecular formula	**Long-term storage**
$C_{24}H_{26}N_4O_7S$	- 18 °C, dark

Assay "as is"
94.7 %

Date of shipment: **01 Sep 2020**

Producer confirms that this reference material (RM) meets the specification detailed on this Certificate of Analysis for **one year** from the date of shipment, provided the substance is stored under the recommended conditions unopened in the original container.

Release by:	**Date of Release:**		
Dr. Sabine Schröder	Luckenwalde, 14 Aug 2020		Product Release

Product information

For laboratory use only. Not suitable for human or animal consumption.

Before usage of the RM, it should be allowed to warm to room temperature. No drying required, as the certified value is already corrected for the content of water and other volatile materials.

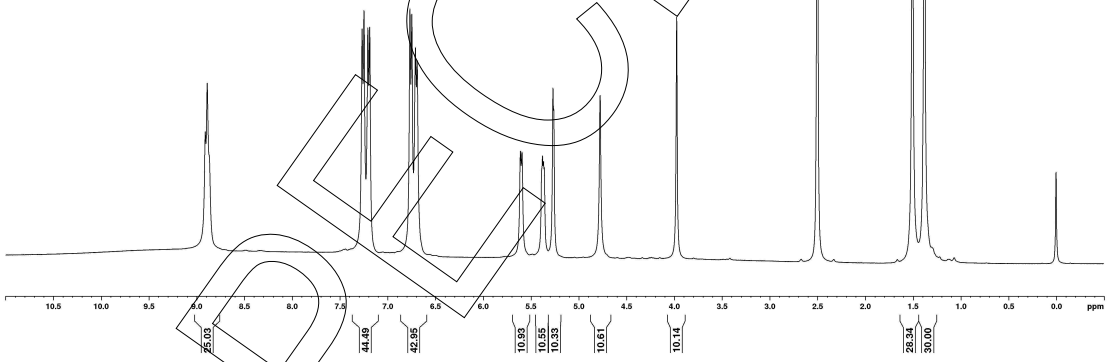
The product quality is controlled by regularly performed quality control tests (retests).

Further content

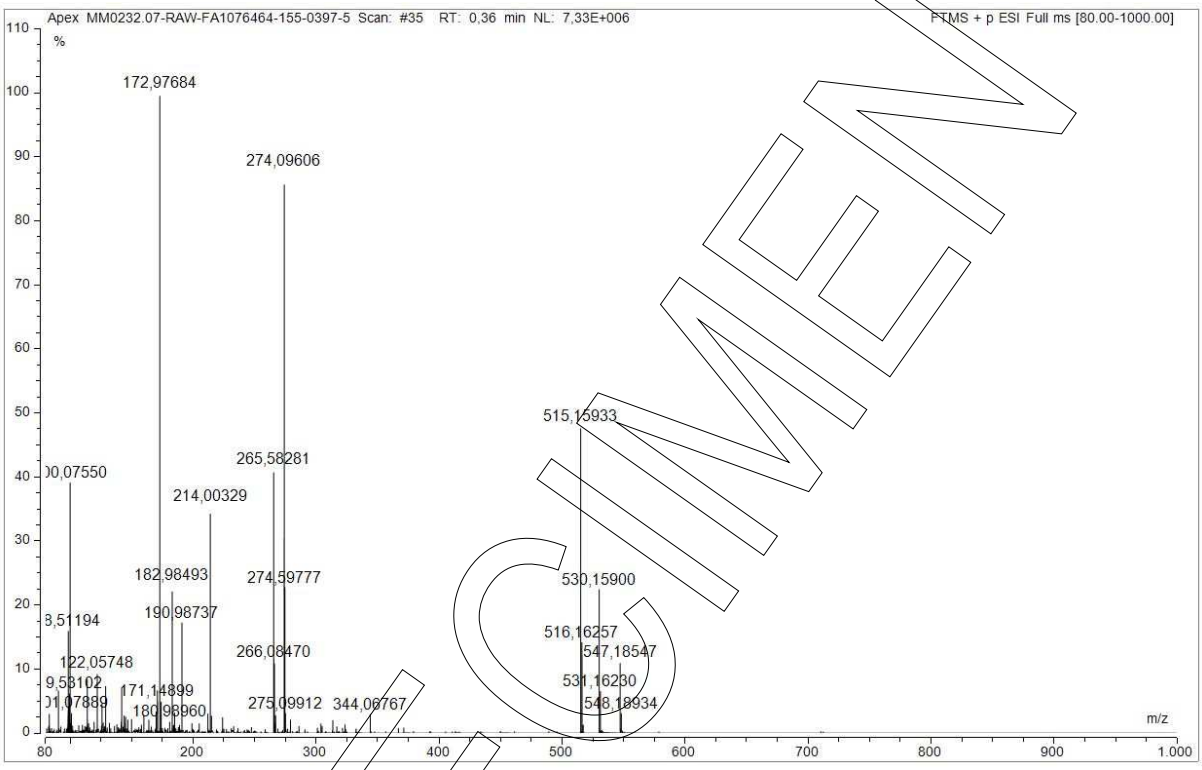
Identity

The identity of the reference material was established by following analyses.

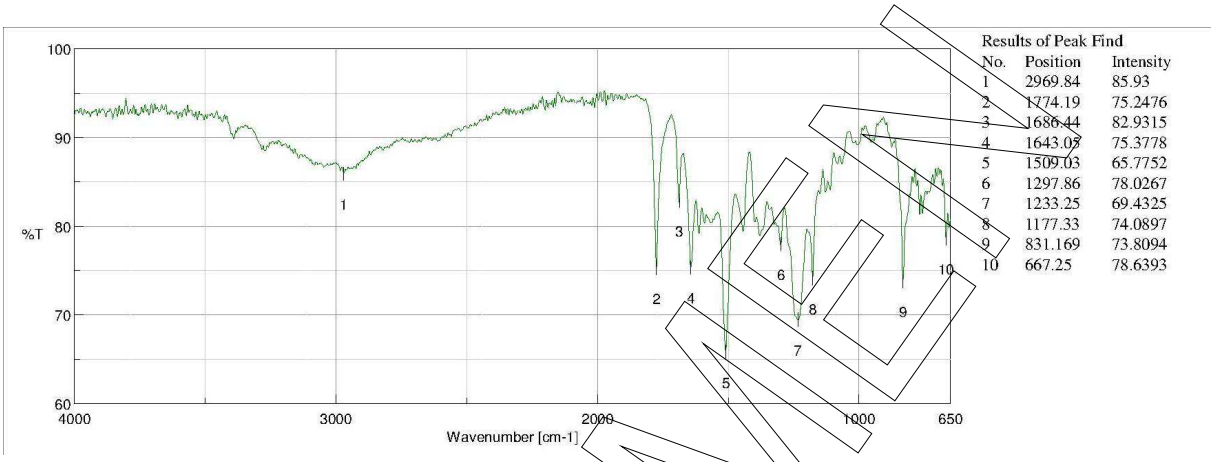
Method	Conditions	Result
^{1}H-NMR	400 MHz, DMSO-d_6	Structure confirmed



Method	Conditions	Result
MS	3.5 kV ESI+; capillary temperature: 269 °C Theoretical value: 515.15950	Structure confirmed



Method	Conditions	Result
IR	Attenuated Total Reflection Fourier Transform Infrared (ATR-FTIR) Spectroscopy	Structure confirmed



Results of Peak Find

No.	Position	Intensity
1	2969.84	85.93
2	1774.19	75.2476
3	1686.44	82.9315
4	1643.03	75.3778
5	1509.03	65.7752
6	1297.86	78.0267
7	1233.25	69.4325
8	1177.33	74.0897
9	831.169	73.8094
10	667.25	78.6393

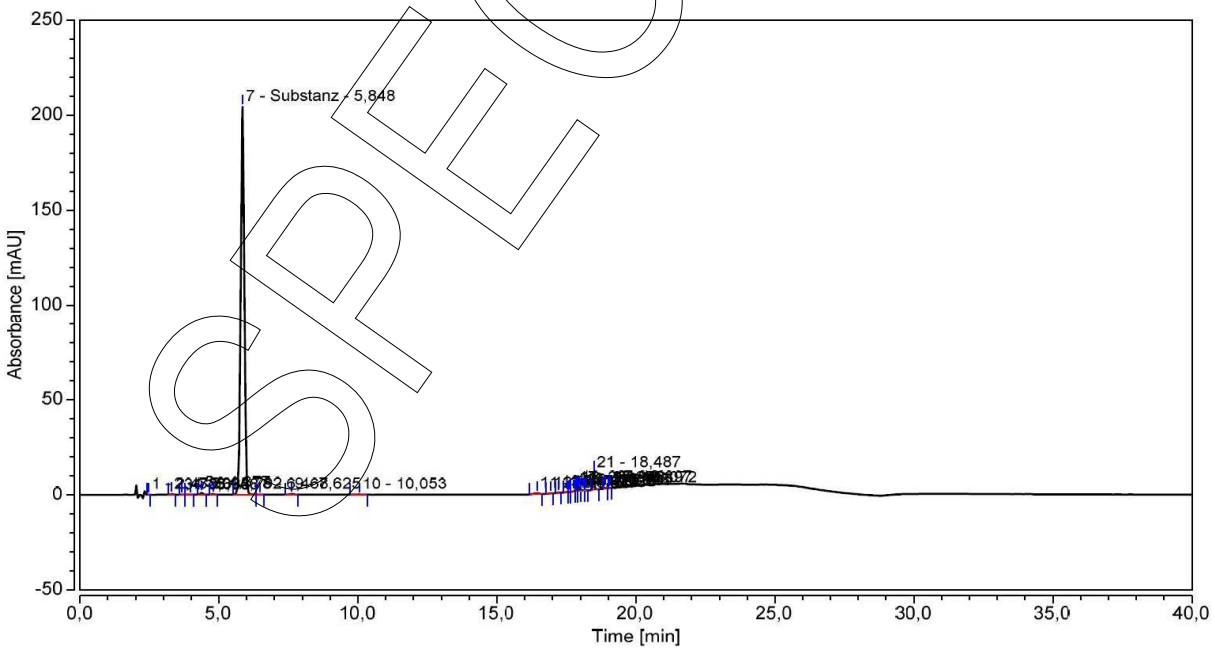
Assay

The assay of the reference material was assessed by following analyses.

Purity by High Performance Liquid Chromatography (HPLC)

HPLC conditions:	
Column	Hypersil Gold C18; 5 µm, 150 x 4.6 mm
Column temperature	40 °C
Detector	DAD, 230 nm
Injector	Auto 1 µl; 0.157 mg/ml in Methanol
Flow rate	1.0 ml/min
Phase A	Water, 0.1 % H_3PO_4
Phase B	Acetonitrile, 0.1 % H_3PO_4
Gradient program	0-13 min A/B 90/10 13-18 min A/B to 60/40 18-23 min A/B 60/40 23-26 min A/B to 90/10 26-40 min A/B 90/10 (v/v)

HPLC chromatogram and peak table



Area percent report - sorted by signal				
Pk #	**Retention time**	**Area**	**Area %**	
1	2.475	0.008	0.03	
2	3.300	0.036	0.11	
3	3.663	0.008	0.03	
4	3.958	0.009	0.03	
5	4.377	0.120	0.38	
6	4.792	0.056	0.18	
7	5.848	30.206	95.80	
8	6.468	0.016	0.05	
9	7.625	0.065	0.21	
10	10.053	0.048	0.15	
11	16.440	0.120	0.38	
12	16.947	0.013	0.04	
13	17.223	0.028	0.09	
14	17.528	0.011	0.03	
15	17.610	0.003	0.01	
16	17.767	0.020	0.06	
17	17.855	0.086	0.27	
18	17.948	0.099	0.31	
19	18.093	0.055	0.17	
20	18.185	0.020	0.06	
21	18.487	0.454	1.44	
22	18.897	0.036	0.11	
23	19.072	0.014	0.04	
Totals		**31.531**	**100.00**	

The content of the analyte was determined as ratio of the peak area of the analyte and the cumulative areas of the purities, added up to 100 %. System peaks were ignored in calculation.

Result (n = 6)	95.81 %; SD = 0.03 %

Volatile content

Water content	
Method	Karl Fischer titration
Result (n = 3)	1.16 %; SD = 0.04 %

Residual solvents	
Method	^{1}H-NMR
Result (n = 1)	No significant amounts of residual solvents were detected (< 0.05 %).

Final result

Assay "as is": **94.70 %**

The assay "as is" is assessed by 100% method (mass balance) and is equivalent to the assay based on the not anhydrous and not dried substance respectively.

The calculation of the 100% method follows the formula:

$$\text{Assay (\%)} = (100\ \% - \text{volatile contents (\%)}) * \frac{\text{Purity (\%)}}{100\ \%}$$

Volatile contents are considered as absolute contributions and purity is considered as relative contribution. Inorganic residues are excluded by additional tests.

Revision table

Revision	Date	Reason for revision
00	14 Aug 2020	Release of the Certificate of Analysis – initial version

Product warranties for the RM are set out in the terms and conditions of purchase.