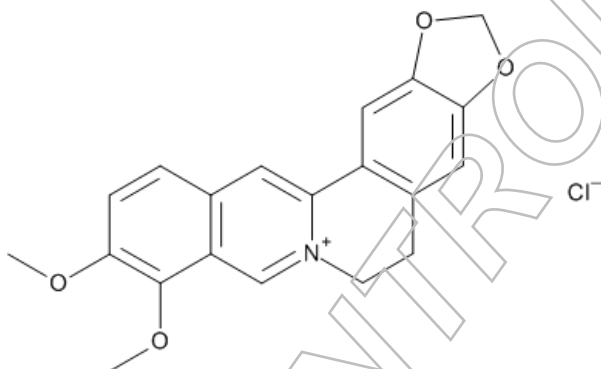




# Certificate of Analysis

## Reference Standard

Berberine Chloride



Molecular Formula: C<sub>20</sub>H<sub>18</sub>NO<sub>4</sub> Cl  
Molecular Weight: 371.81  
CAS Number: 633-65-8

Catalogue Number: MM1632.00  
Lot Number: 988929  
Long-term Storage: 2 to 8 °C, dark  
Appearance: yellow solid  
Melting Point: 190 °C (dec.)  
Assay 'as is': 86.9 %

Date of shipment: **2018-October-29**

This certificate is valid for one year from the date of shipment provided the substance is stored under the recommended conditions unopened in the original container.

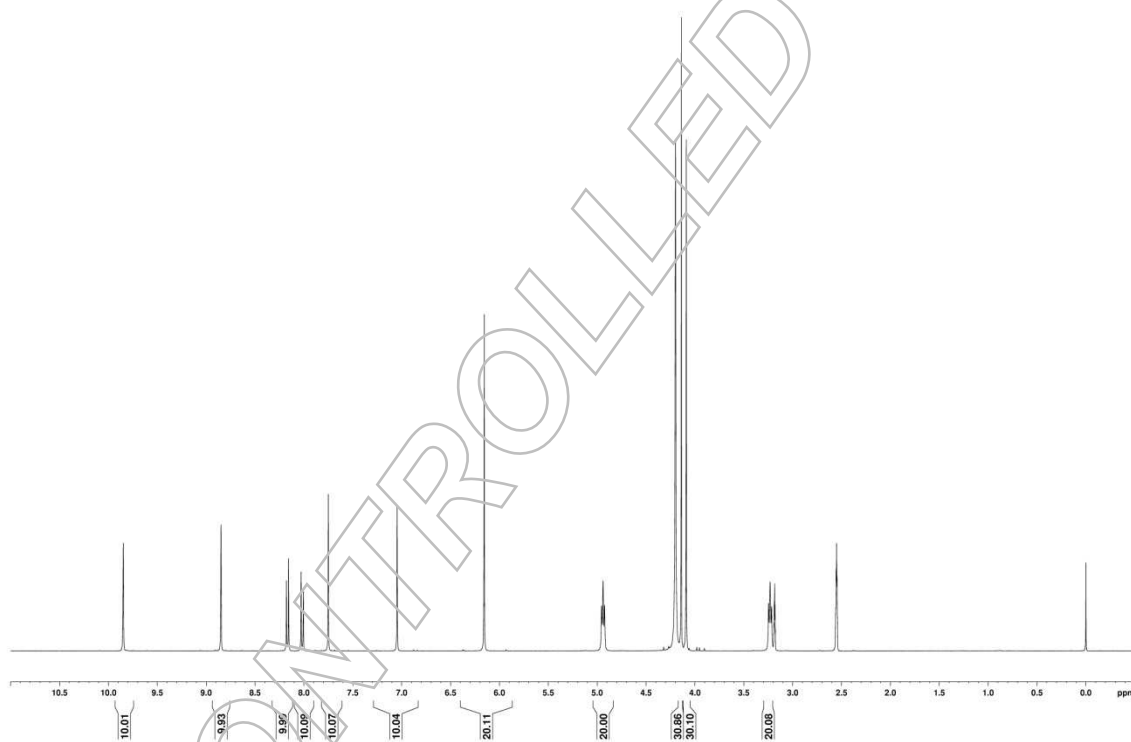


## I. Identity

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

### 1a. <sup>1</sup>H-NMR Spectrum

Conditions: 400 MHz, DMSO-d<sub>6</sub>

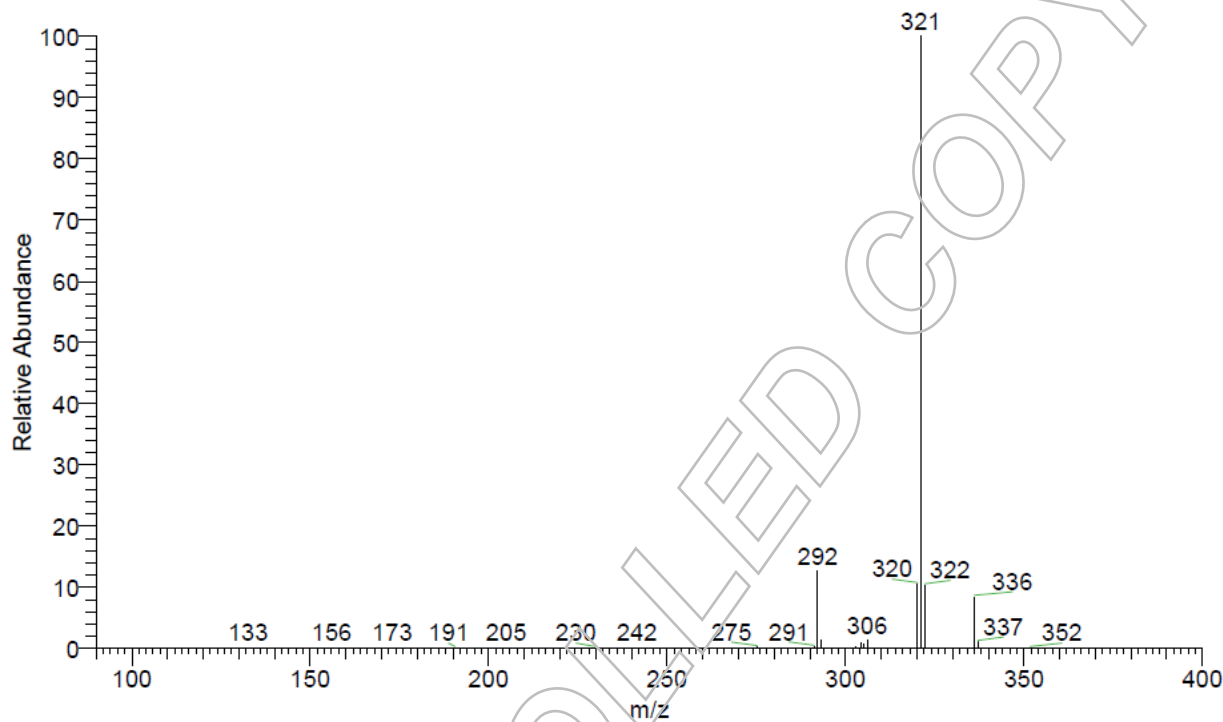


The structure is confirmed by the signals of the spectrum and their interpretation.



### Ib. Mass Spectrum

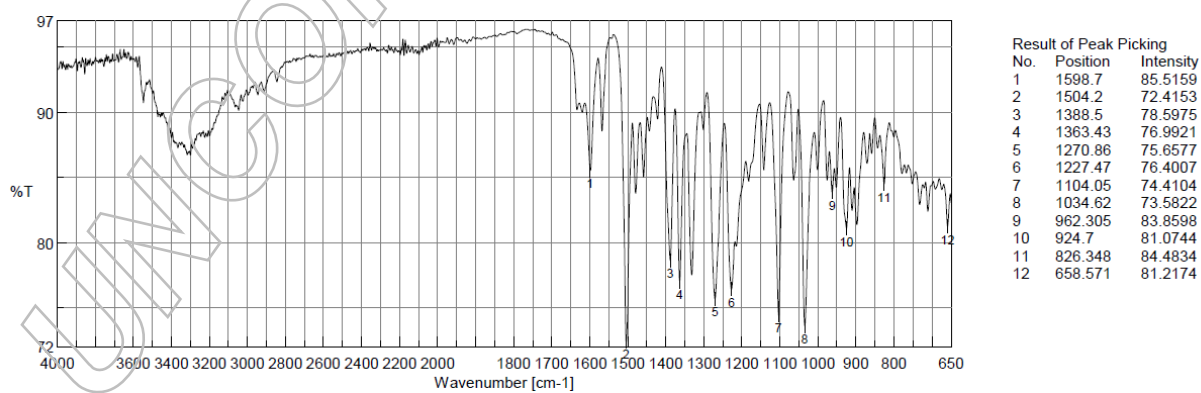
Method: 4.5 kV ESI+; vaporization temperature: 200 °C



The signals of the mass spectrum and their interpretation are consistent with the structural formula.

### Ic. IR Spectrum

Method: Attenuated Total Reflection Fourier Transform Infrared (ATR-FTIR) Spectroscopy



The signals of the IR spectrum and their interpretation are consistent with the structural formula.



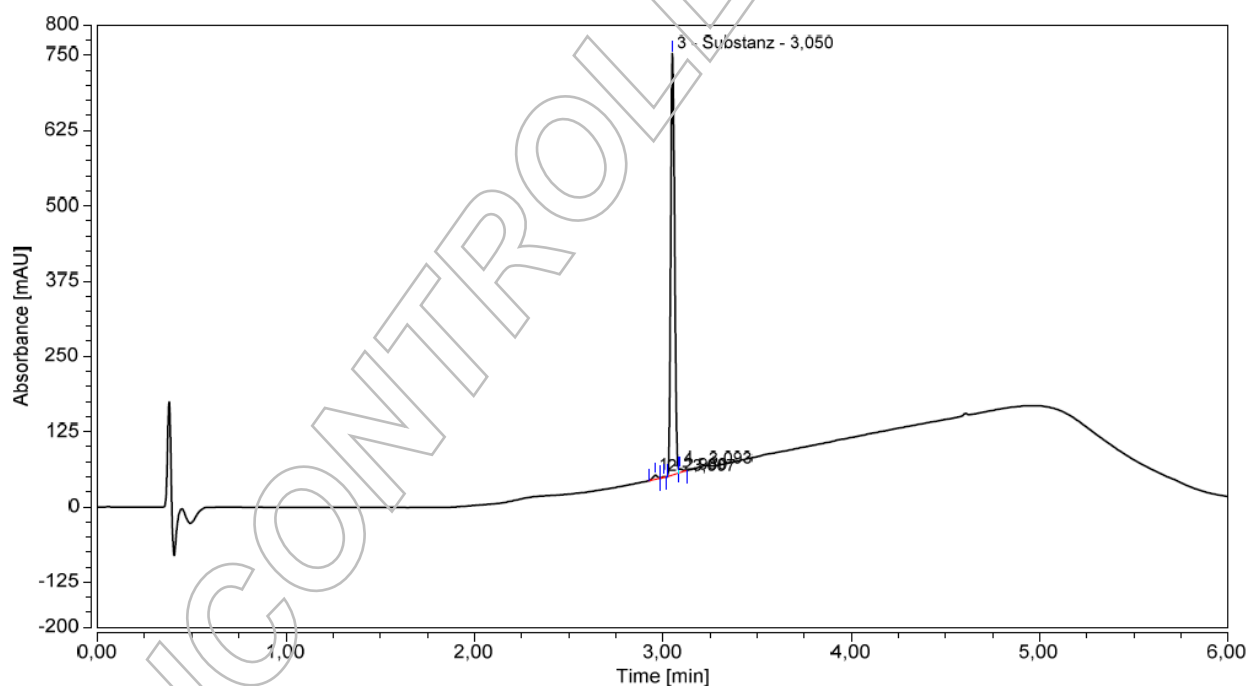
## II. Purity

### IIa. High Performance Liquid Chromatography (HPLC)

The purity of the reference substance was analysed by high performance liquid chromatography (HPLC).

#### HPLC Conditions:

Column:	Conditions:	Detector:	injector:
Cortecs UPLC C18+	0.5 ml/min, 40 °C	DAD	Auto
1.6 µm, 75 x 2.1 mm	0-1 min Water/Acetonitrile 98/2	230 nm	3 µl; 0.048 mg/ml in
	1-4 min Water/Acetonitrile to 98/2		Water/Acetonitrile 50/50 (v/v)
	4-5 min Water/Acetonitrile to 2/98		
	5-6 min Water/Acetonitrile 2/98 (v/v);		
	0.1 % HCOOH		





### Area Percent Report - Sorted by Signal

Pk #	Retention Time	Area	Area %
1	2.960	0.186	1.10
2	3.007	0.029	0.17
3	3.050	16.519	98.02
4	3.093	0.120	0.71
Totals		16.853	100.00

For the calculation the system peaks were ignored. 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 %.

#### Results:

Average 98.04 %  
Number of results n=3  
Standard deviation 0.05 %

#### IIb. Water Content

Method: Karl Fischer titration

#### Results:

Average 11.35 %  
Number of results n=3  
Standard deviation 0.03 %

#### IIc. Residual Solvents

Method: <sup>1</sup>H-NMR

No significant amounts of residual solvents were detected (< 0.05 %).



### III. Final Result

<b>Chromatographic purity (HPLC)</b>	98.04 %
<b>Water content</b>	11.35 %
<b>Residual solvents</b>	No significant amounts of residual solvents were detected (< 0.05 %).
<b>Assay (100 % method)<sup>1</sup></b>	86.91 %

The assay is assessed to be 86.9 % 'as is'

The assay 'as is' is equivalent to the assay based on the not anhydrous and not dried substance respectively.

Release Date:

Luckenwalde, 2018-10-17

Dr. Sabine Schröder  
Product Release

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<sup>1</sup> 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, purity is considered as relative contribution.