LoGiCal®
produced by LGC

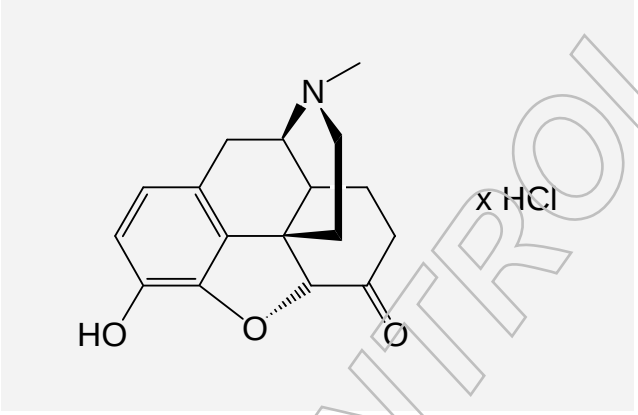
Certificate of Analysis

Reference Substance

Hydromorphone Hydrochloride

Catalogue Number:	LGCFOR0371.00
Lot Number:	15692
Molecular Formula:	$C_{17}H_{19}NO_3$ HCl
Molecular Weight:	321.80
CAS Number:	[71-68-1]

Long-term Storage:	2 to 8 °C, dark
Appearance:	white solid
Melting Point:	> 294 °C (dec.)
Assay 'as is':	99.95 %



Date of shipment: **2016-May-20**

This certificate is valid for two years from the date of shipment provided the substance is stored under the recommended conditions.

Release Date: 2012-07-06

LGC GmbH

Dr. Sabine Schröder
Product Release

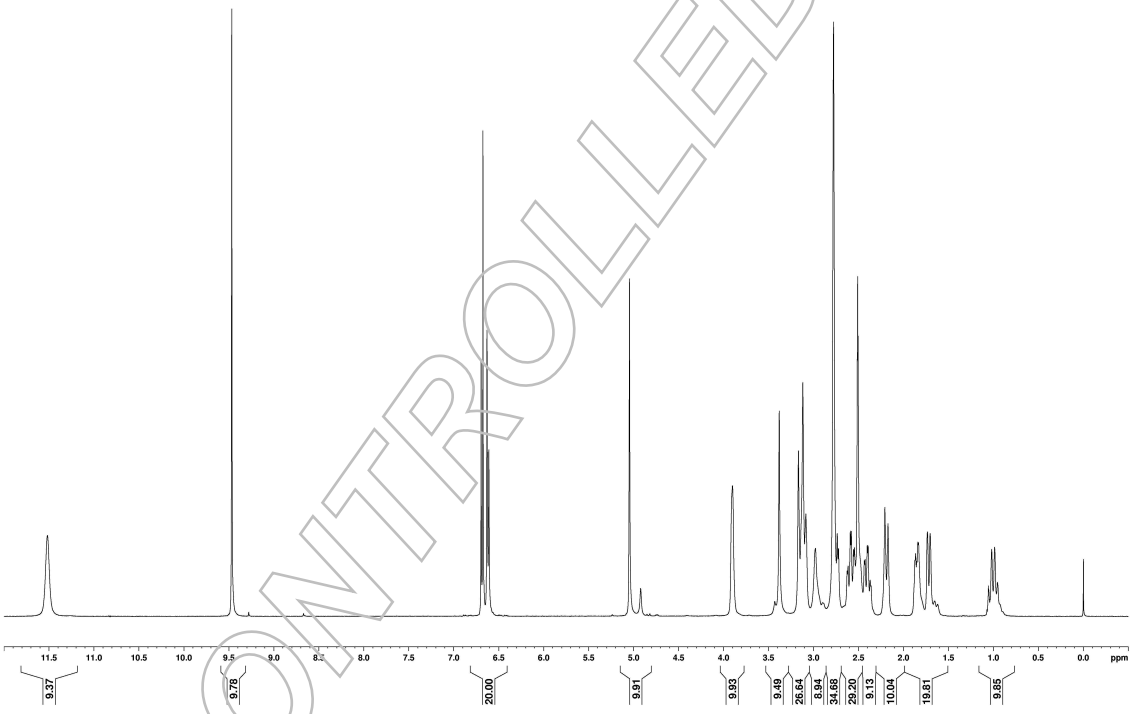
I. Identity

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

Ia. ^{1}H-NMR Spectrum

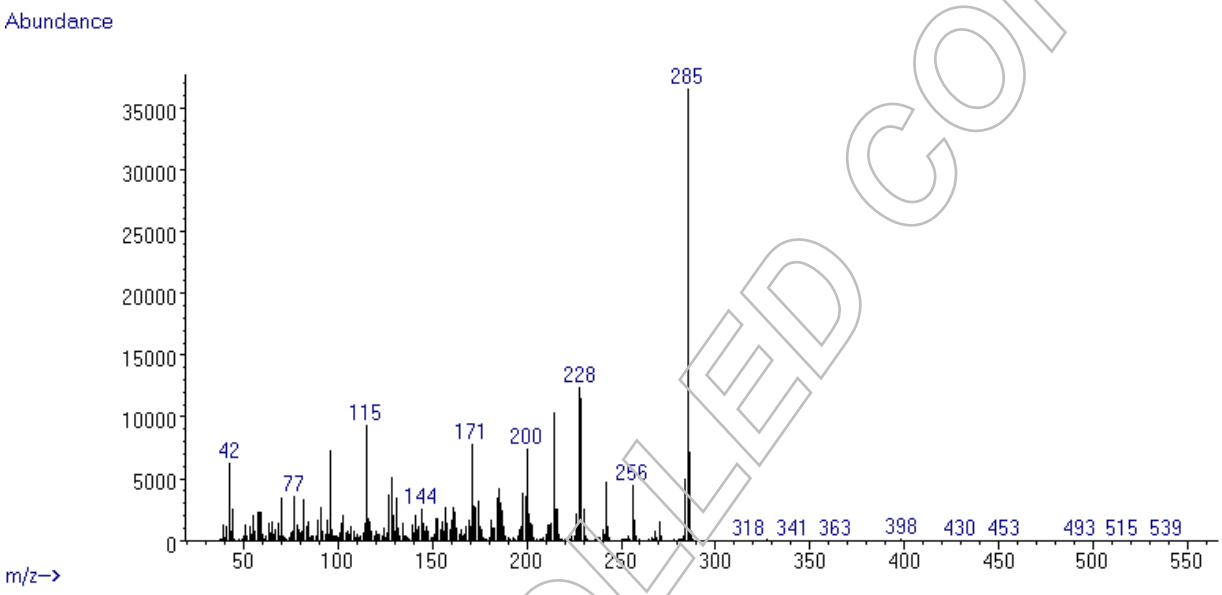
Conditions: 400 MHz, DMSO-d_6

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



Ib. Mass Spectrum

Method: EI, 70eV, detector temperature: 280 °C

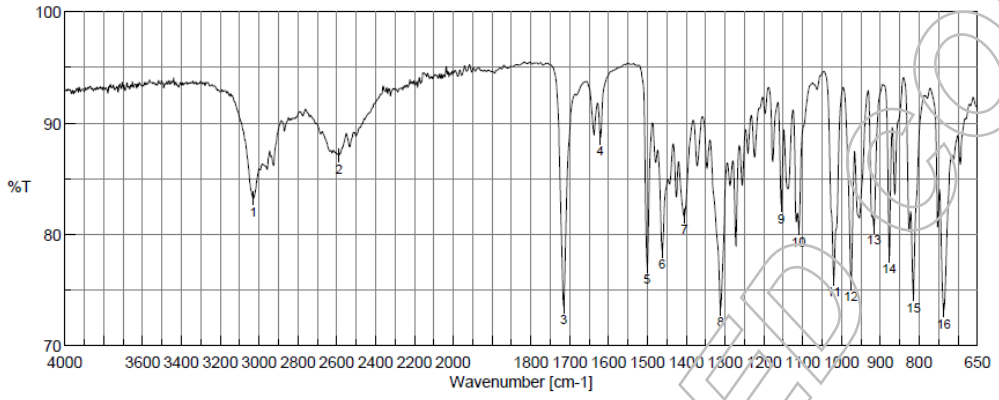


m/z	fragments (M = free base)
285	[M]
228	[M – C_3H_7N]

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



Result of Peak Picking

No.	Position	Intensity
1	3028.66	83.2453
2	2588	87.0942
3	1715.37	73.5523
4	1620.88	88.6521
5	1500.35	77.2136
6	1461.78	78.5508
7	1404.89	81.6374
8	1311.36	73.365
9	1155.15	82.6161
10	1109.83	80.5647
11	1019.19	76.0657
12	975.804	75.6303
13	916.986	80.6769
14	877.452	78.0833
15	814.777	74.6256
16	736.674	73.2273

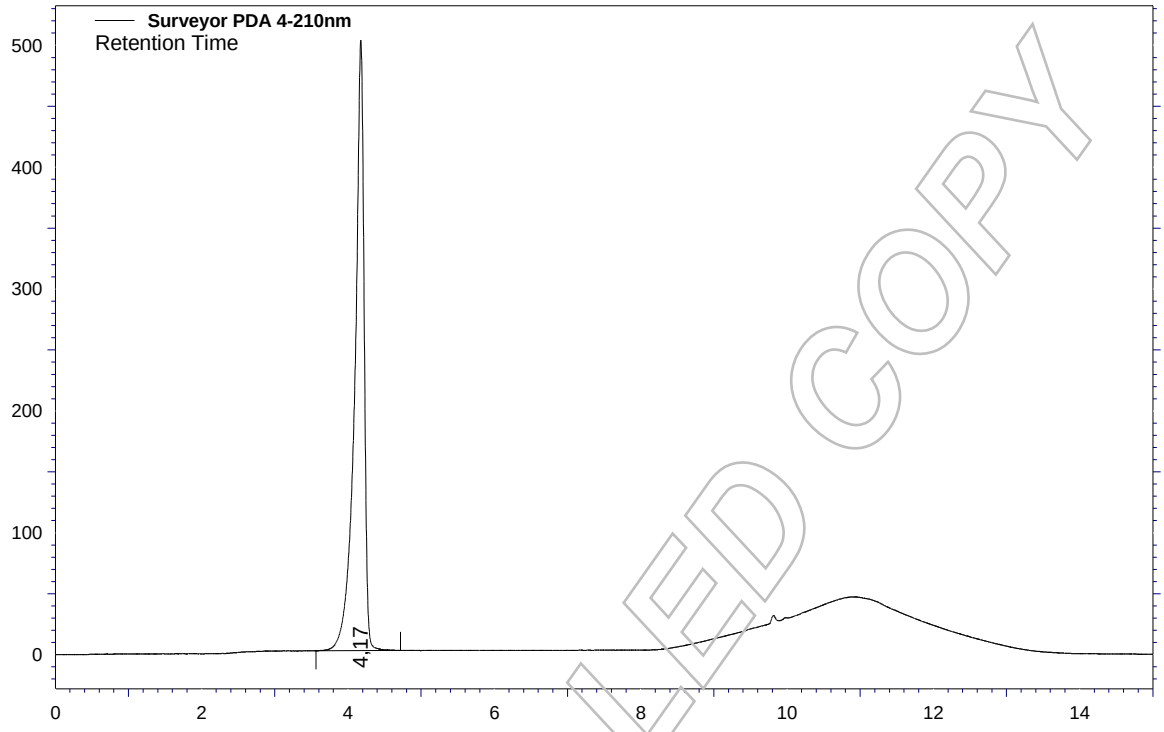
The signals of the IR spectrum and their interpretation are consistent with the structural formula.

II. Purity

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

HPLC Conditions:

Column:	**Conditions:**	**Detector:**	**Injector:**
Hypersil Gold (C18) 5 µm, 150 x 4.6 mm	1.0 ml/min, 40 °C 0-5 min Water/Acetonitrile 95/5 5-8 min Water/Acetonitrile to 50/50 8-10 min Water/Acetonitrile to 98/2 10-15 min Water/Acetonitrile 98/2 (v/v); 0.1 % H_3PO_4	DAD 210 nm	Auto 3 µl; 0.1048 mg/ml in Water



Area Percent Report - Sorted by Signal

Pk #	Retention Time	Area	Area %
1	4.17	4469310	100.00
Totals		4469310	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	100 %
Number of results	n=3
Standard deviation	< 0.01 %

III. Water Content

Method: Karl Fischer titration

Results:

Average	0.05 %
Number of results	n=3
Standard deviation	< 0.01 %

IV. Residual Solvents

Method: ^{1}H-NMR

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

V. Final Result

Total impurities (HPLC)	0.00 %
Water content	0.05 %
Residual solvents	n. d. (not detected)
Assay (100 % method) [1]	99.95 %

The assay is assessed to be 99.95 % 'as is'

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

[1] The calculation of the 100 % method follows the formula:

$$\text{Assay (\%)} = (100\ \% - \text{KF} - \text{RES}) * \frac{\text{Purity HPLC (\%)}}{100\ \%}$$

Water (KF) and Residual solvents (RES) are considered as absolute contributions, HPLC purity is considered as relative contribution.