

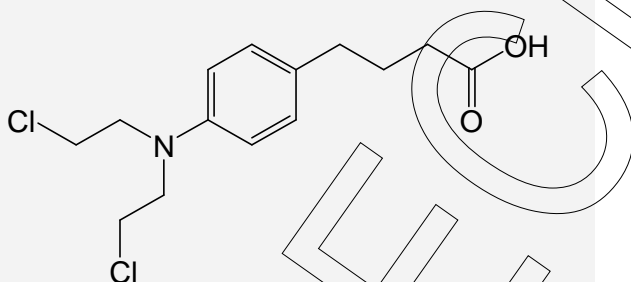
Certificate of Analysis

Reference Substance

Chlorambucil

Catalogue Number: LGCFOR0821.00
Lot Number: 11231
Molecular Formula: C₁₄H₁₉Cl₂NO₂
Molecular Weight: 304.21
CAS Number: [305-03-3]

Long-term Storage: 2 to 8 °C, dark
Appearance: white solid
Melting Point: 67 °C
Assay 'as is': 99.3 %



Date of shipment: **2020-November-30**

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

Release Date: 2012-01-06

LGC GmbH

Dr. Sabine Schröder
Product Release

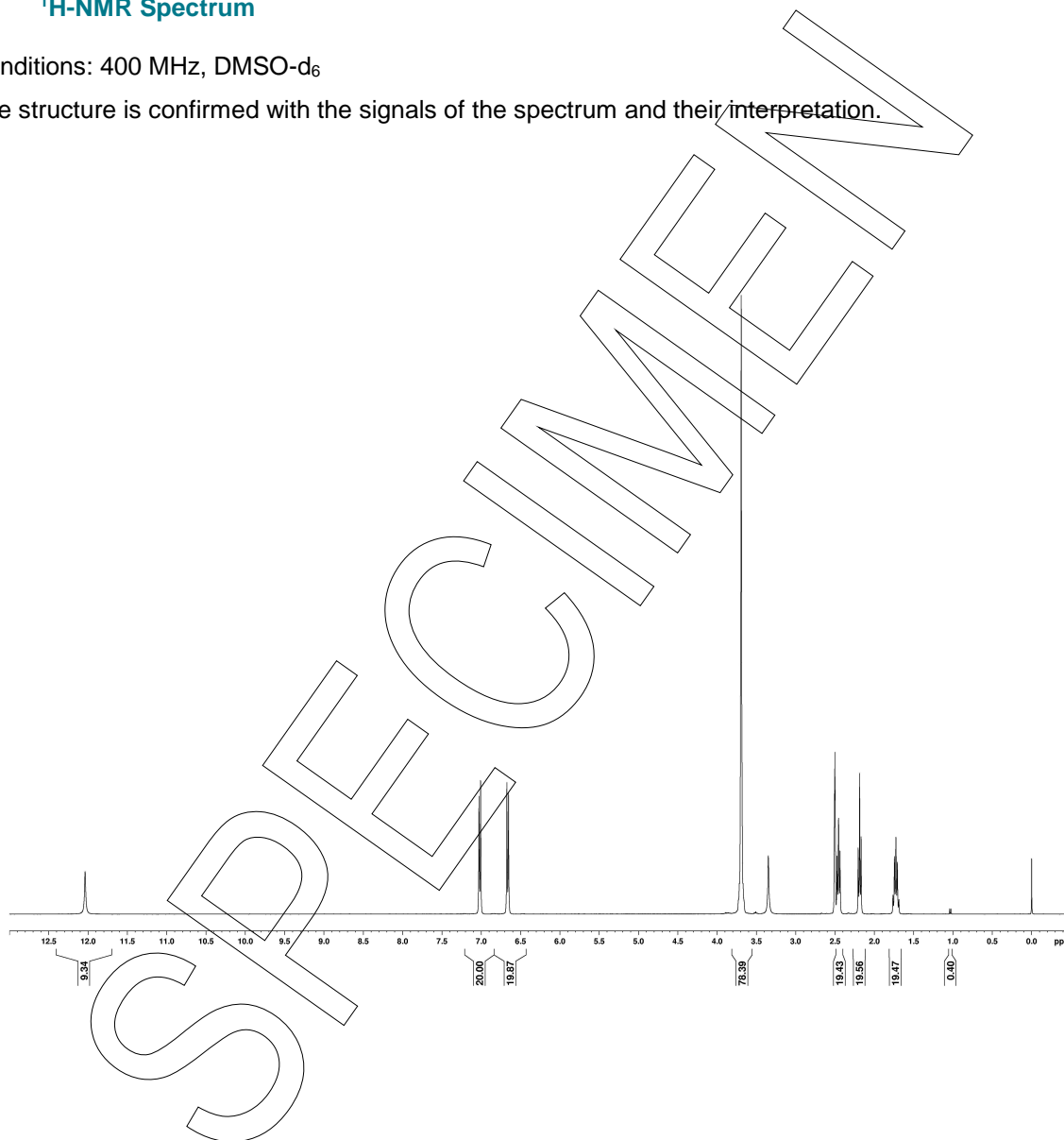
I. Identity

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

Ia. ¹H-NMR Spectrum

Conditions: 400 MHz, DMSO-d₆

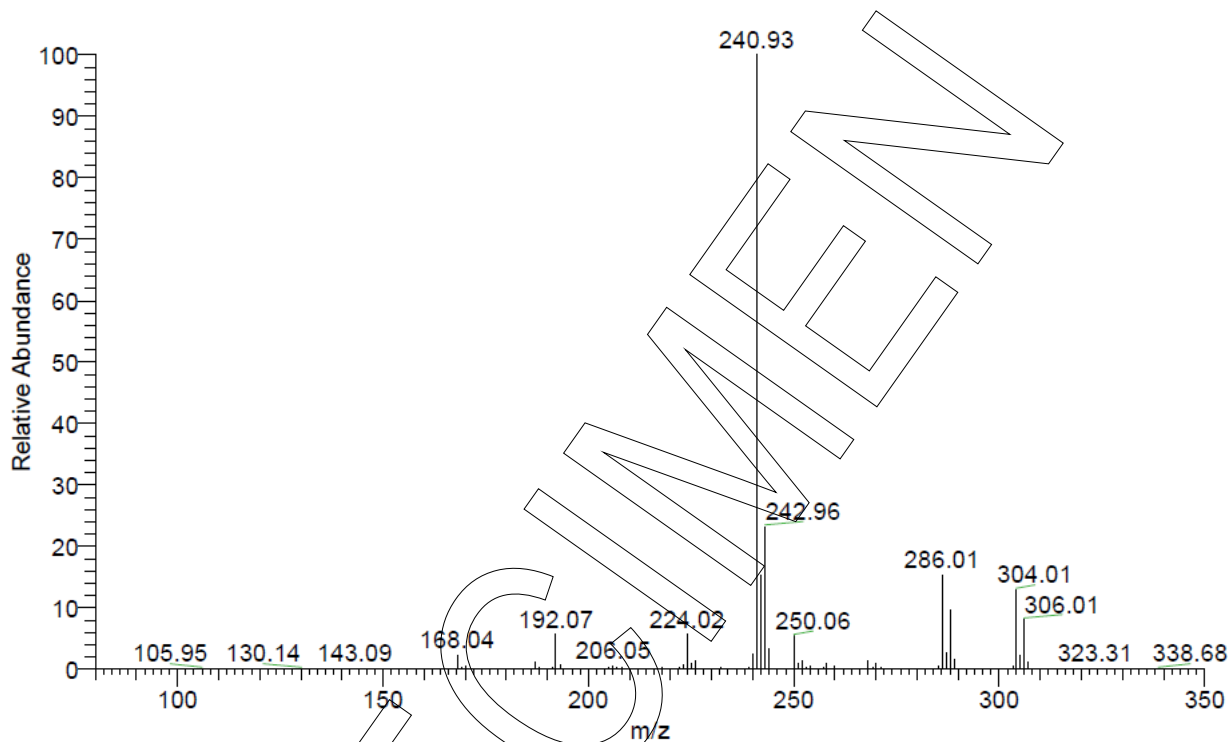
The structure is confirmed with the signals of the spectrum and their interpretation.



LGCFOR0821.00 Lot Number 11231

1b. Mass Spectrum

Method: 4.5 kV ESI; vaporization temperature: 200 °C, direct inlet

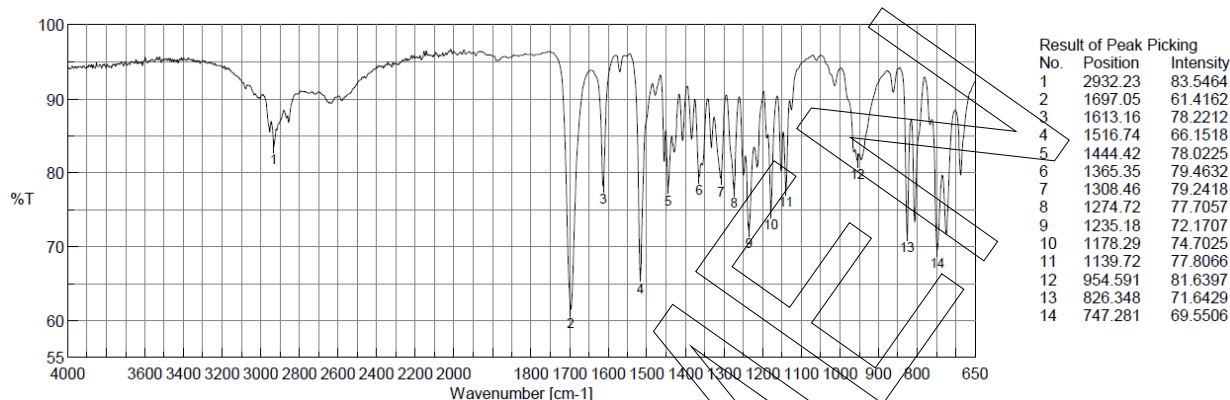


m/z	fragments
304	[MH]
286	[MH - H ₂ O]
241	[MH - C ₂ H ₄ Cl]

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

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

HPLC Conditions:

Column:

RP 60 Select B
5 µm, 125 x 4 mm

Conditions:

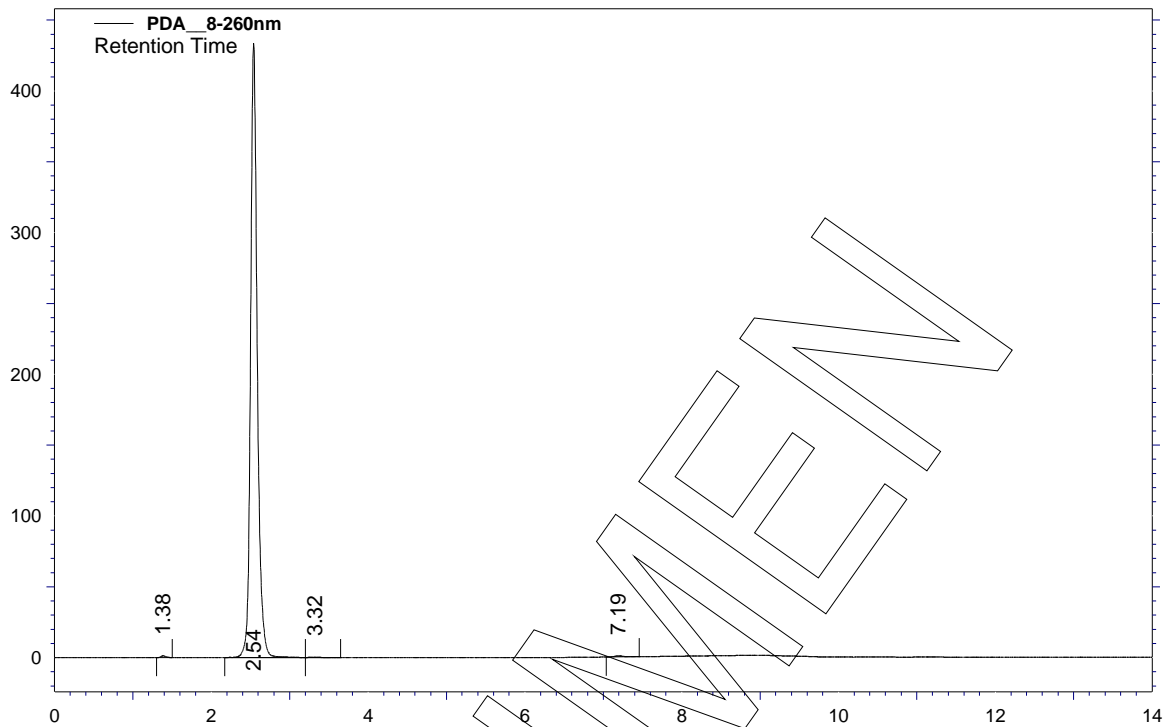
1.0 ml/min, 40 °C
0 – 4 min Water/Acetonitrile 45/55
4 – 7 min Water/Acetonitrile to 20/80
7 – 9 min Water/Acetonitrile to 45/55
9 – 14 min Water/Acetonitrile 45/55 (v/v);
0.1 % H₃PO₄

Detector:

DAD
260 nm

Injector:

Auto
2 µl; 0.0864 mg/ml in
Water/Acetonitrile 50/50 (v/v)



Area Percent Report - Sorted by Signal

Pk #	Retention Time	Area	Area %
1	1.38	4902	0.19
2	2.54	2578334	99.48
3	3.32	2347	0.09
4	7.19	6327	0.24
Totals		2591910	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 99.47 %
Number of results n=3
Standard deviation 0.10 %

III. Water Content

Method: Karl Fischer titration

Results:

Average	0.06 %
Number of results	n=3
Standard deviation	0.02 %

IV. Residual Solvents

Method: ¹H-NMR

Result: 0.13 % 2-Propanol

V. Final Result

Total impurities (HPLC)	0.53 %
Water content	0.06 %
Residual solvents	0.13 %
Assay (100 % method) ¹	99.28 %

The assay is assessed to be 99.3 % '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.

LGCFOR0821.00 Lot Number 11231

LGC GmbH, Im Biotechnologiepark, TGZ II, D-14943 Luckenwalde, Germany