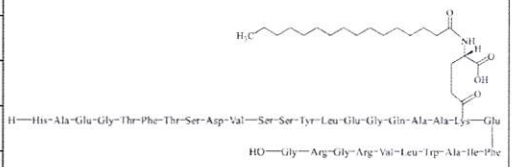
Certificate of Analysis

Certificate No.: **20220210011**

Date: February 10, 2022 Retest date: January 24, 2025

Compound Name:	**Liraglutide**
Synonyms:	L-Histidyl-L-alanyl-L-α-glutamylglycyl-L-threonyl-L-phenylalanyl-L-threonyl-L-seryl-L-α-aspartyl-L-valyl-L-seryl-L-seryl-L-tyrosyl-L-leucyl-L-α-glutamylglycyl-L-glutaminyl-L-alanyl-L-alanyl-*N*6-[*N*-(1-oxohexadecyl)-L-γ-glutamyl]-L-lysyl-L-α-glutamyl-L-phenylalanyl-L-isoleucyl-L-alanyl-L-tryptophyl-L-leucyl-L-valyl-L-arginylglycyl-L-arginylglycine
TLC Catalogue Number:	PL-105001
CAS Number:	204656-20-2
Molecular Weight:	3751.26
Molecular Formula:	$C_{172}H_{265}N_{43}O_{51}$
Source:	TLC Pharmaceutical Standards
Source Lot No.:	4620-087A1
Storage Conditions:	Store at 2-8 °C
Solubility:	Phosphate buffer solution, DMF, DMSO, Water



Test Description	**Specifications**	**Results**
Visual Description	White to off-white solid	**Conforms**
Identification **IR** **MS** **^{1}H NMR**	 Conforms to structure Conforms to structure Conforms to structure	 **Conforms** **Conforms** **Conforms**
Purity (HPLC)	Not less than 95.0%	**97.3%**
Impurity (HPLC)	RT 5.51, 0.20%; RT 17.64, 0.18%; RT 20.49, 0.90%	
Water Content (KF)	N/A	**6.7%**
Optical Rotation	N/A	$[\alpha]_D^{20.0}$(c=0.42, phosphate buffer saline (pH=7.4)): **-11.3°**
Residual Solvents (NMR)	0.8% acetic acid	
Assay (%)	Not less than 90.0%	**90.0%**
Recommendation:	**Release.**	

Name	**Department**	**Signature**	**Date**
Reviewed and approved by:	Quality Control		02 / 11 / 2022
Approved by:	Quality Assurance		02 / 11 / 2022

Attachments: HPLC, IR, MS and NMR spectra.

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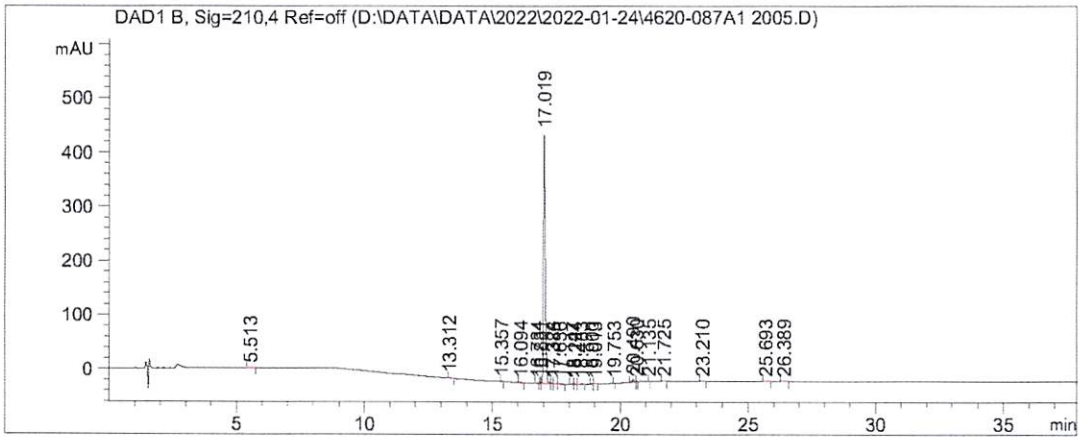
research@tlcstandards.com
130 Pony Drive
Newmarket, Ontario L3Y 7B6 Canada
Phone: (905)-898-3645
Fax: (905)-898-0595

Data File D:\DATA\DATA\2022\2022-01-24\4620-087A1 2005.D
Sample Name: 4620-087A1

```
======================================================================
Acq. Operator   : Xiaocui Zhu
Sample Operator : Xiaocui Zhu
Acq. Instrument : LC-1290-1                    Location :   P1-A-03
Injection Date  : 1/24/2022 3:22:28 PM              Inj :   1
                                              Inj Volume : 1.000 µl
Acq. Method     : D:\DATA\1\Methods\3.M
Last changed    : 1/24/2022 3:14:22 PM by Xiaocui Zhu
                  (modified after loading)
Analysis Method : D:\DATA\1\Methods\3.M
Last changed    : 1/24/2022 4:05:59 PM by Xiaocui Zhu
                  (modified after loading)
Sample Info     : Poroshell 120 EC-C18 (3.0*150mm,2.7um); F=0.4mL/min; T=30 degree;
                  CH3OH/0.05% TFA=60/40(0-6min),60/40-95/5(6-18min),95/5(after 18min)
                  ~1.0mg in 0.5mL H2O and 1d 0.01% NH3.H2O (aq)

Additional Info : Peak(s) manually integrated
```




```
======================================================================
                        Area Percent Report
======================================================================

Sorted By             :      Signal
Multiplier            :      1.0000
Dilution              :      1.0000
Do not use Multiplier & Dilution Factor with ISTDs


Signal 1: DAD1 B, Sig=210,4 Ref=off
```

Peak #	RetTime [min]	Type	Width [min]	Area [mAU*s]	Height [mAU]	Area %
1	5.513	BBA	0.1148	4.48454	5.64039e-1	0.2000
2	13.312	BB	0.0735	1.57257	2.98540e-1	0.0701
3	15.357	MM R	0.0635	7.31175e-1	1.92018e-1	0.0326
4	16.094	BB	0.0624	2.39480	5.77003e-1	0.1068
5	16.734	MM R	0.0524	5.11382e-1	1.62778e-1	0.0228
6	16.881	MF R	0.0350	1.01978	4.85364e-1	0.0455
7	17.019	MF R	0.0787	2181.92041	462.04663	97.2905
8	17.324	MF R	0.0405	2.79673	8.38340e-1	0.1247
9	17.386	MF R	0.1182	2.02256	2.85092e-1	0.0902
10	17.636	FM R	0.1080	4.01400	6.19310e-1	0.1790

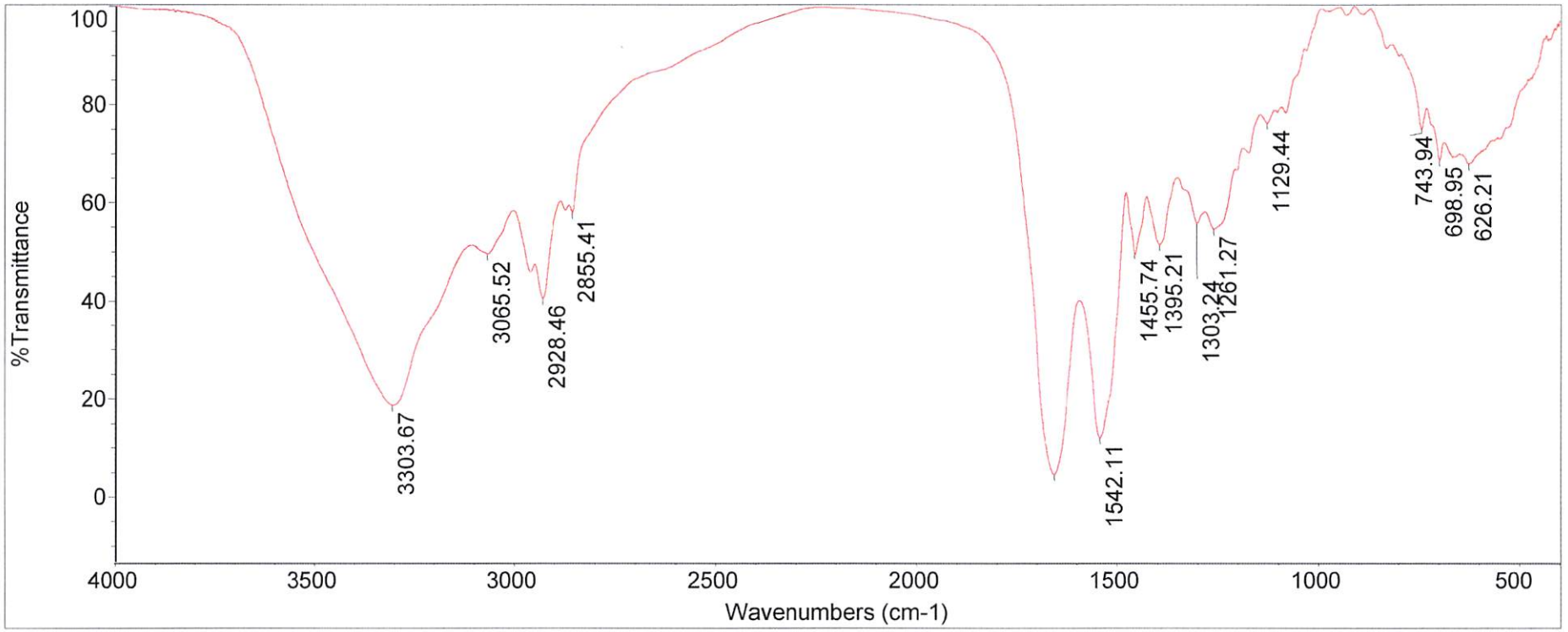
TLC REVIEWED AND APPROVED
021 1/12022

Data File D:\DATA\DATA\2022\2022-01-24\4620-087A1 2005.D
Sample Name: 4620-087A1

Peak #	RetTime [min]	Type	Width [min]	Area [mAU*s]	Height [mAU]	Area %
11	18.147	BV	0.0849	3.30270	5.14673e-1	0.1473
12	18.224	VB	0.0587	1.52239	3.97056e-1	0.0679
13	18.483	BB	0.0598	3.59988	8.78524e-1	0.1605
14	18.900	BV	0.0524	2.47397	7.51587e-1	0.1103
15	19.013	VB	0.0635	3.12577	7.67368e-1	0.1394
16	19.753	BB	0.0415	6.78031e-1	2.51310e-1	0.0302
17	20.490	BV	0.0533	20.15742	5.68802	0.8988
18	20.630	VBAS	0.0548	1.46999	4.00654e-1	0.0655
19	21.135	BBA	0.0509	9.42849e-1	2.97859e-1	0.0420
20	21.725	MM R	0.0867	7.82433e-1	1.74718e-1	0.0349
21	23.210	MM R	0.1027	1.20937	1.96318e-1	0.0539
22	25.693	MM R	0.1009	8.00876e-1	1.32349e-1	0.0357
23	26.389	MM R	0.1415	1.15193	1.35650e-1	0.0514
Totals :				2242.68552	476.65520	

*** End of Report ***

4620-087A1



Collection time: Tue Jan 25 14:50:27 2022 (GMT+08:00)

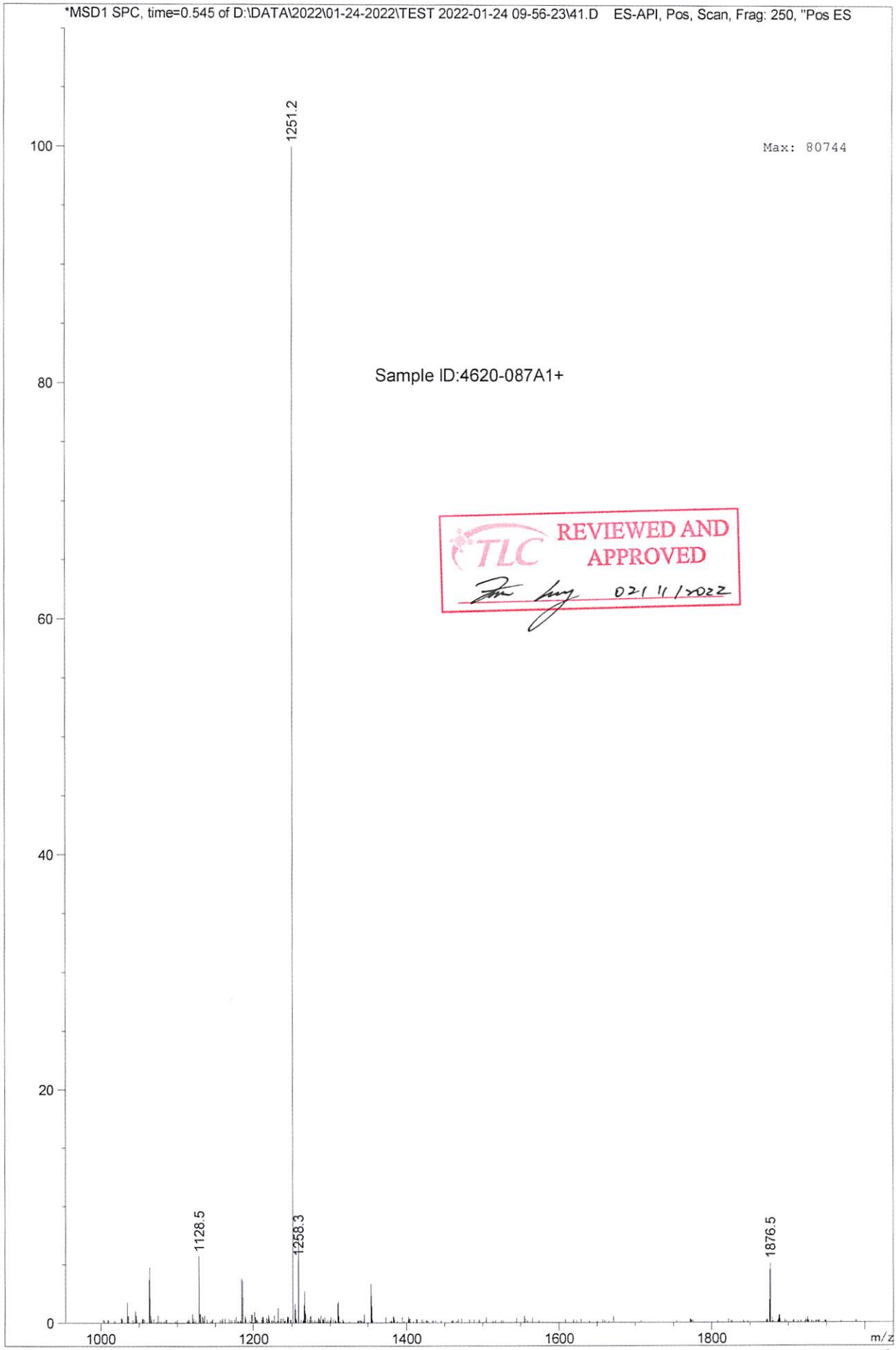
TLC REVIEWED AND APPROVED
02/11/2022

Tue Jan 25 14:52:59 2022 (GMT+08:00)
FIND PEAKS:
Spectrum: *4620-087A1
Region: 4000.00 400.00
Absolute threshold: 80.668
Sensitivity: 63
Peak list:

Position:	626.21	Intensity:	67.840
Position:	698.95	Intensity:	68.630
Position:	743.94	Intensity:	74.896
Position:	1129.44	Intensity:	76.110
Position:	1261.27	Intensity:	54.522
Position:	1303.24	Intensity:	55.669
Position:	1395.21	Intensity:	51.299
Position:	1455.74	Intensity:	49.258
Position:	1542.11	Intensity:	11.981
Position:	1656.66	Intensity:	4.449
Position:	2855.41	Intensity:	57.878
Position:	2928.46	Intensity:	40.436
Position:	3065.52	Intensity:	49.406
Position:	3303.67	Intensity:	18.592

Signature: Jie Sun, 01-25-2022 14:53:11 (GMT+08:00), Authorship - signifies ownership
4620-087A1

MS Spectrum



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TLC
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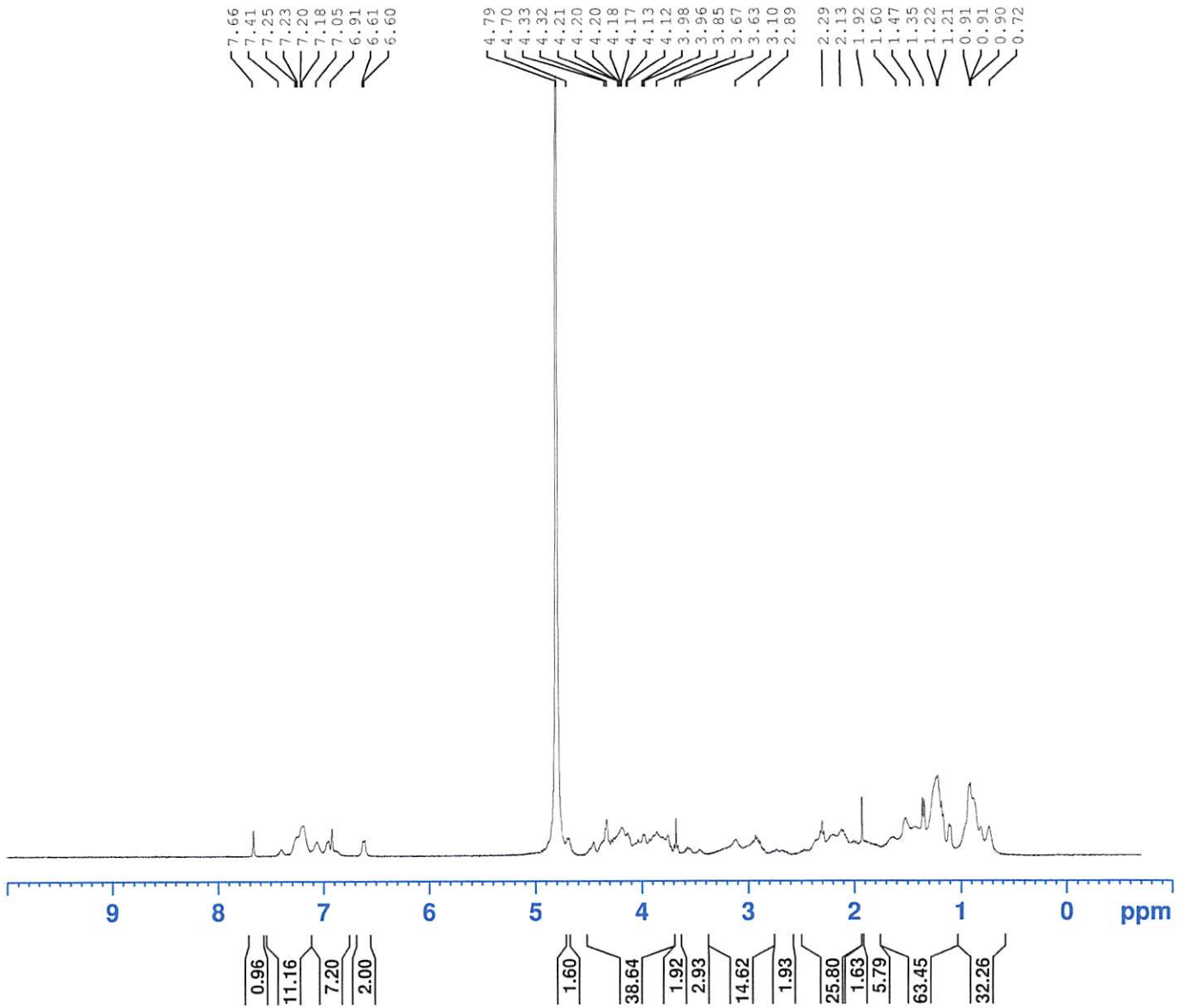
4620-087A1 1H NMR in D2O



BRUKER

Current Data Parameters
NAME 2022-01-24(NMR-400_2)
EXPNO 18
PROCNO 1

F2 - Acquisition Parameters
Date_ 20220124
Time 10.23 h
INSTRUM spect
PROBHD Z116098_0656 (
PULPROG zg30
TD 65536
SOLVENT D2O
NS 4
DS 0
SWH 9615.385 Hz
FIDRES 0.293438 Hz
AQ 3.4078720 sec
RG 71.77
DW 52.000 usec
DE 6.50 usec
TE 298.0 K
D1 1.00000000 sec
TD0 1
SFO1 400.1836016 MHz
NUC1 1H
P1 9.40 usec
PLW1 19.54100037 W

F2 - Processing parameters
SI 65536
SF 400.1790802 MHz
WDW EM
SSB 0
LB 0.30 Hz
GB 0
PC 0.50

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02/11/2022