

Supplementary Material

An efficient total synthesis of vilanterol: an inhaled drug

Kamalaker Reddy Kamireddy,^a Sailam Sri Gogula,^a Venkateswarlu Banoji,^a Sayaji Rao,^a and Balakishan Gorre^{b*}

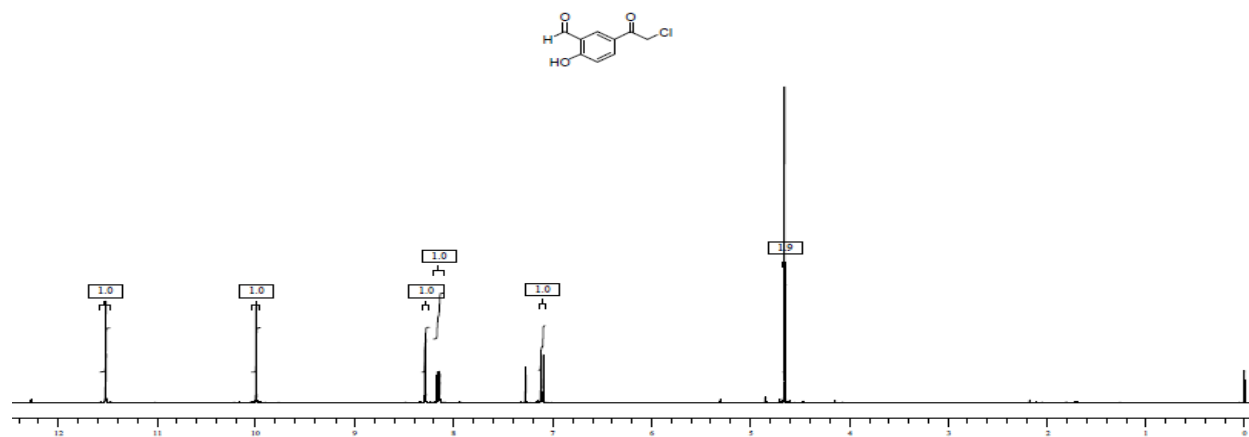
^aUniversity College of Science, Osmania University, Hyderabad, India-500007

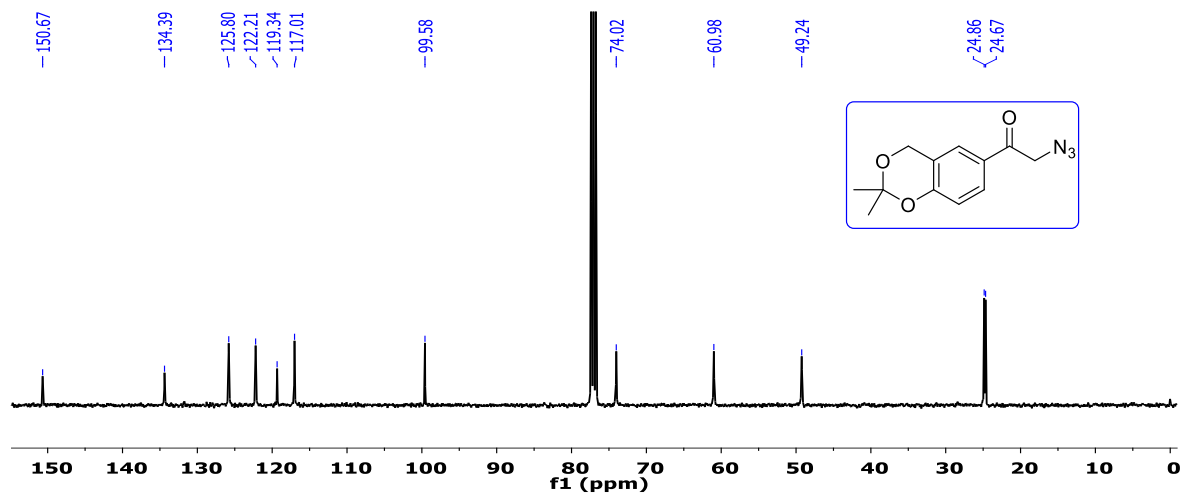
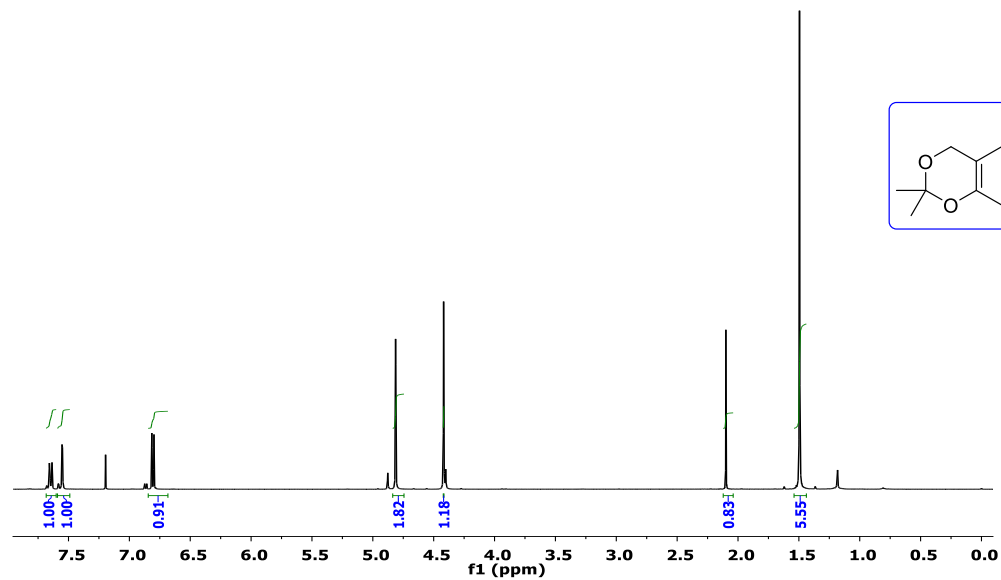
^bDepartment of Chemistry, University College of Science, Telangana University, Telangana, India-503322

Email: gbk@telanganauniversity.ac.in

Table of Contents

¹ H and ¹³ C NMR spectra of compound 5	S2
¹ H and ¹³ C NMR spectra of compound 6	S3
Mass (ESI) spectrum of compound 6	S4
¹ H and ¹³ C NMR spectra of compound 7	S5
Mass (ESI) spectrum of compound 7	S6
HPLC spectrum of compound 7	S7
¹ H and ¹³ C NMR spectra of compound 8	S8
Mass (ESI) spectrum of compound 8	S9
¹ H and ¹³ C NMR spectra of compound 9	S10
Mass (ESI) spectrum of compound 9	S11
¹ H and ¹³ C NMR spectra of compound 10	S12
IR spectrum of Compound 10	S13
Mass and HRMS (ESI) spectra of compound 10	S13
¹ H and ¹³ C NMR spectra of compound 12	S15
IR spectrum of Compound 12	S16
Mass and HRMS (ESI) spectra of compound 12	S16
¹ H and ¹³ C NMR spectra of compound 13	S18
IR spectrum of Compound 13	S19
Mass and HRMS (ESI) spectra of compound 13	S20
¹ H and ¹³ C NMR spectra of compound 1	S22
IR spectrum of Compound 1	S23
Mass and HRMS (ESI) spectra of compound 1	S24

^1H (300 MHz, CDCl_3) and ^{13}C (75 MHz, CDCl_3) NMR spectra of compound 5

^1H (500 MHz, CDCl_3) and ^{13}C (101 MHz, CDCl_3) NMR spectra of compound 6

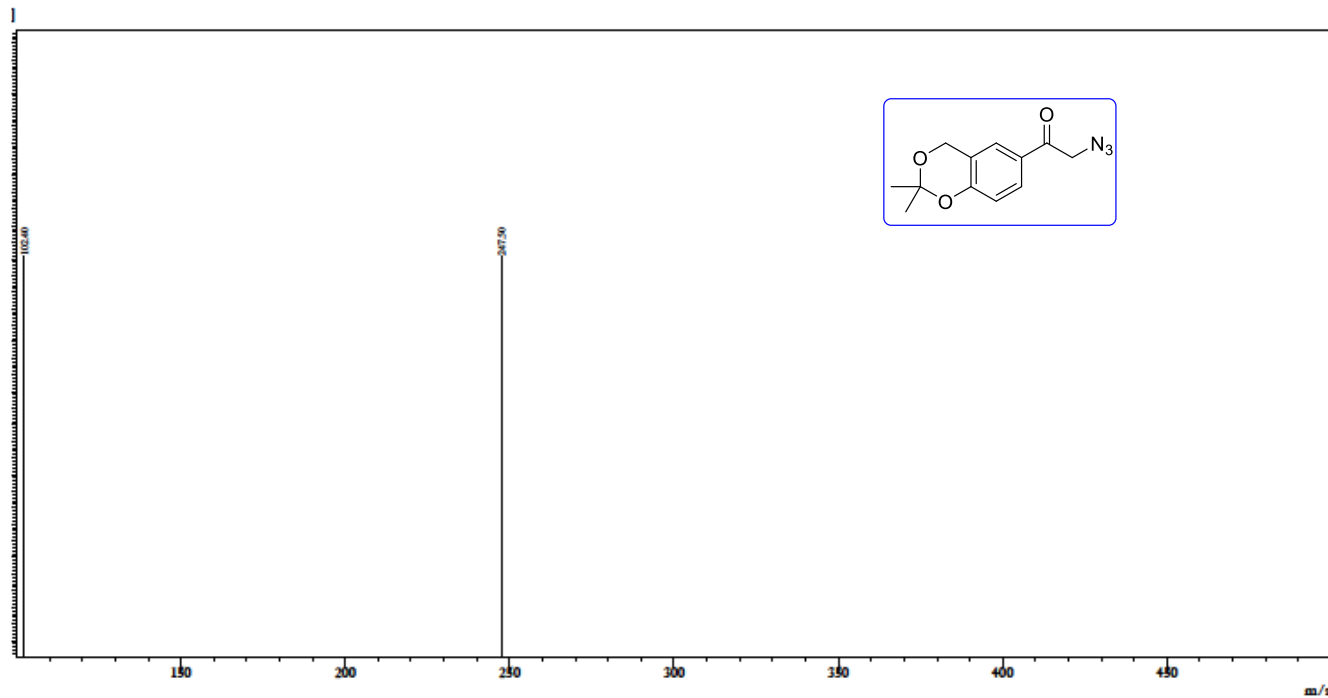
Mass (ESI) of compound 6

OSPC, Dr RATHOD

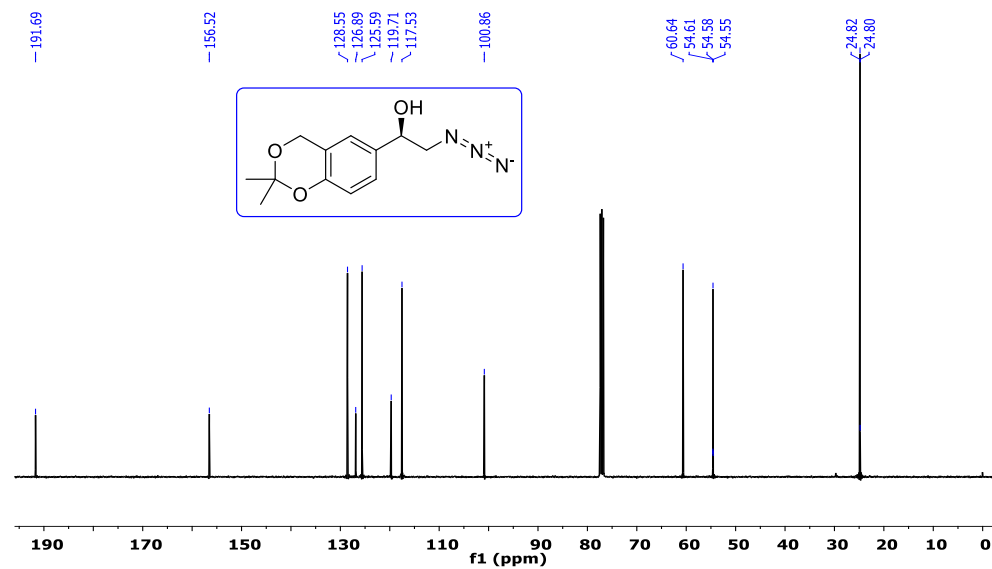
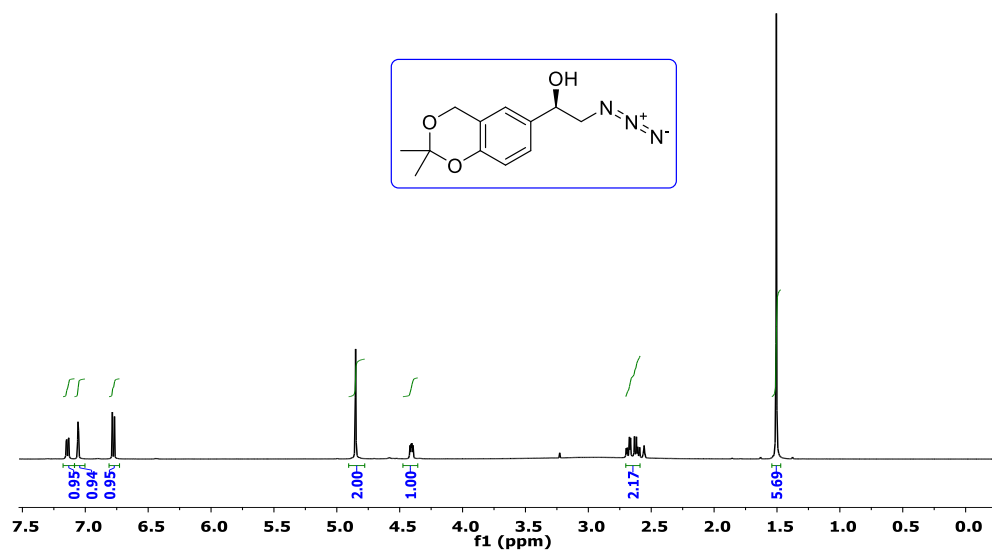
SHIMADZU
LabSolutions

MASS REPORT

Sample Name : PSH-247-6
File : 24052023.28.lcd
Acquired : 5/24/2023 4:21:13 PM
In File : 24052023_532023_1055 AM.lcb

MS Spectrum
D:\DATA\MAY2023\24052023.28.lcdESI Positive
Scan Mode: Single 0.220(S1)

1

^1H (500 MHz, DMSO) and ^{13}C (101 MHz, CDCl_3) NMR spectra of compound 7

Mass (ESI) of compound 7

OSPC, Dr. RATHOD

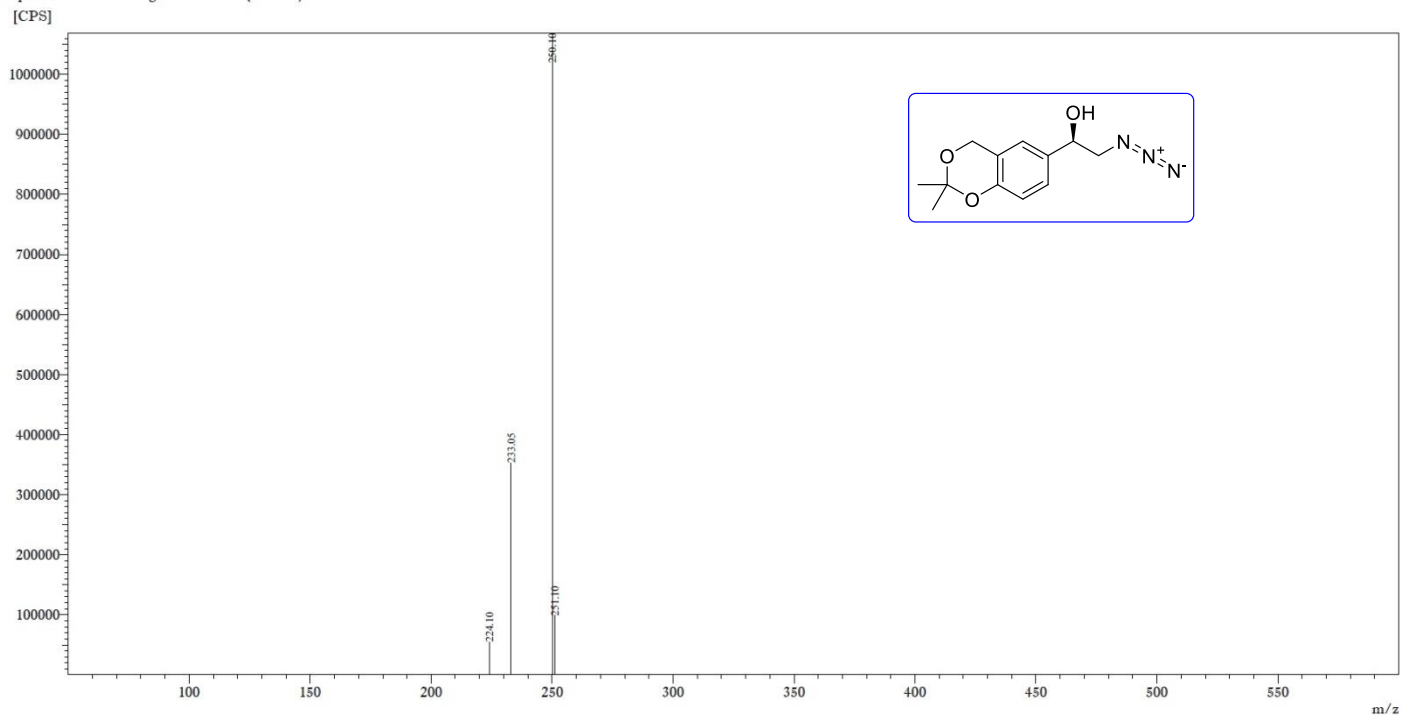


MASS REPORT

Sample Name : HUS-9
Data File : 13032023.32.lcd
Date Acquired : 5/23/2023 11:44:21 AM
Batch File : 12032021-1.lcb

Averaged ESI Positive+
Spectrum Mode: Averaged 0.443-0.859(191-369)

MS Spectrum
D:\DATA\March 2021\12032021.32.lcd

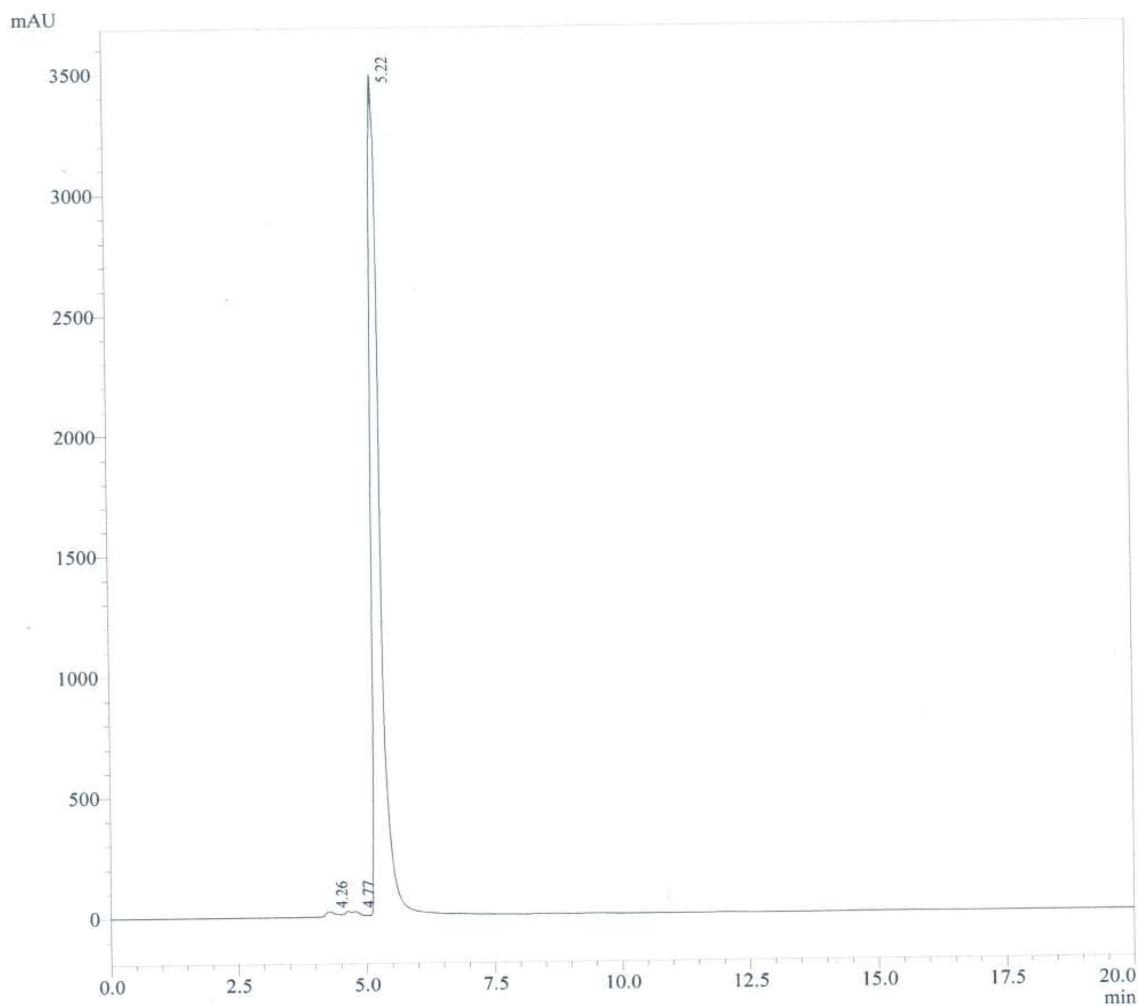


HPLC of compound 7 on IG5 CHIRALPAK column with a Hex/ IPA ratio of 50/50

INDIAN INSTITUTE OF CHEMICAL TECHNOLOGY
CROP PROTECTION CHEMICALS DIVISION

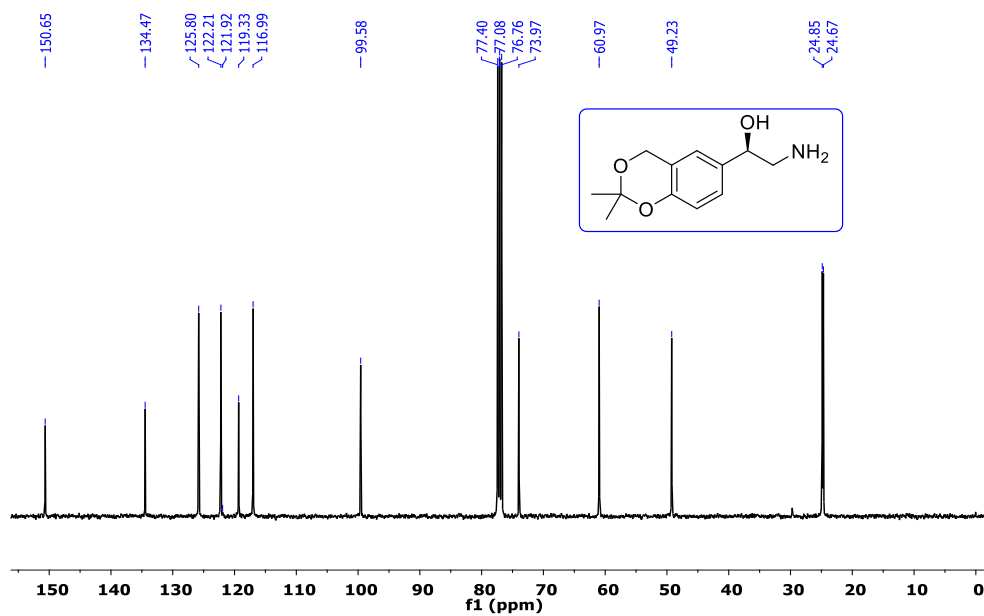
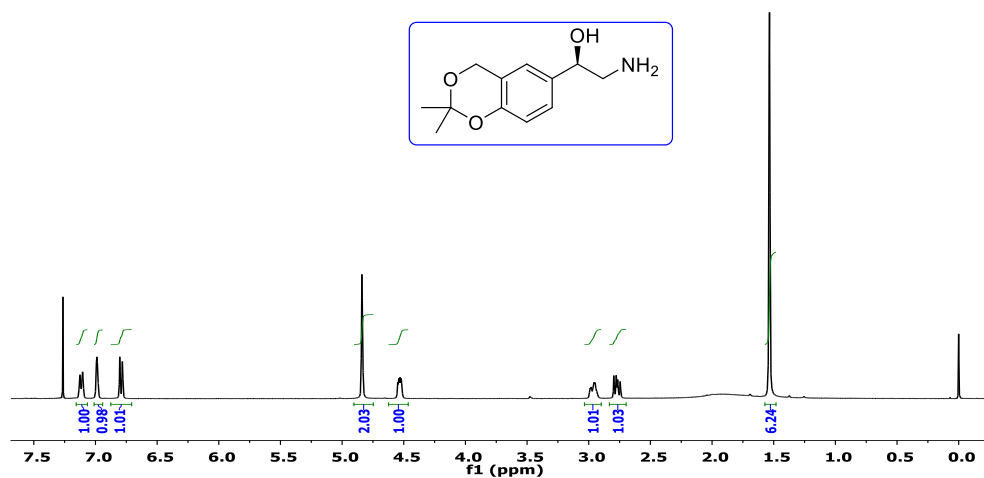
Acquired by : T RAMESH BABU
Sample Name : BVSR
Sample ID : AZIDE
Data Filename : KRED-290.lcd
Method Filename : Deepthi.lcm
Date Acquired : 16/06/2023

D:\BVSR\KRED-290.lcd



PDA Ch1 200nm - 500nm 2nm

Peak#	Ret. Time	Area	Area %
1	4.26	272951	0.67
2	4.77	196199	0.48
3	5.22	40556978	98.86
Total		41026128	100.00

^1H (400 MHz, CDCl_3) and ^{13}C (101 MHz, CDCl_3) NMR spectra of compound 8

Mass (ESI) of compound 8

OSPC, Dr RATHOD

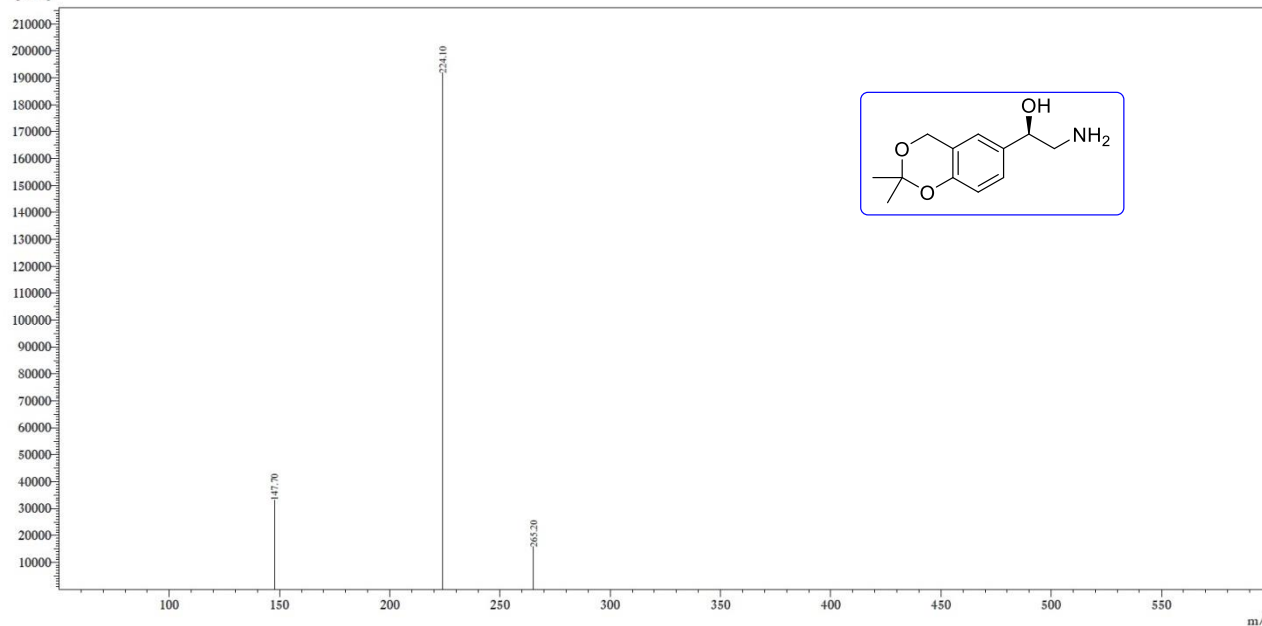
SHIMADZU
LabSolutions

MASS REPORT

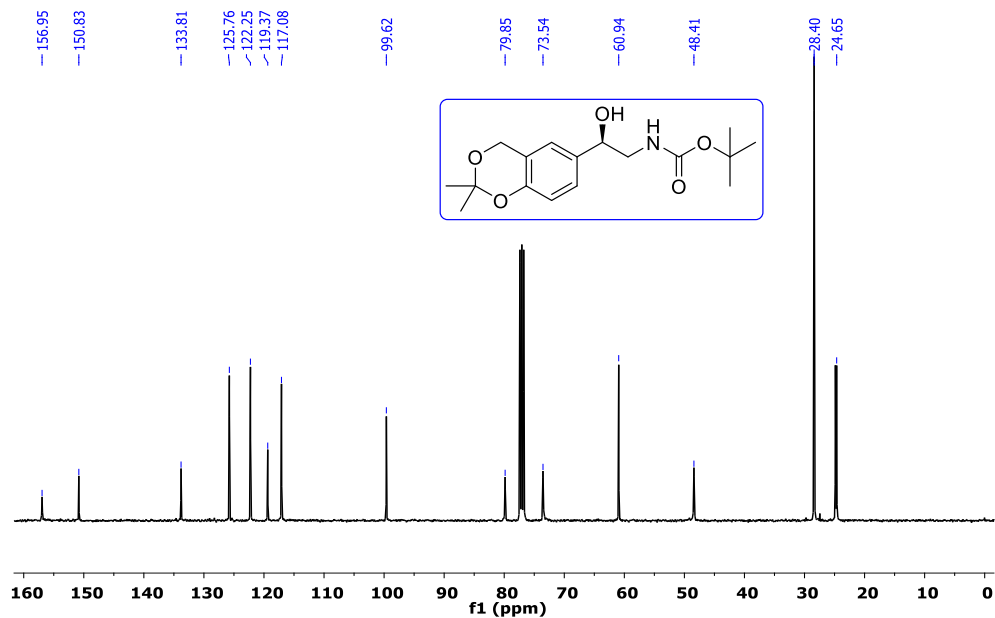
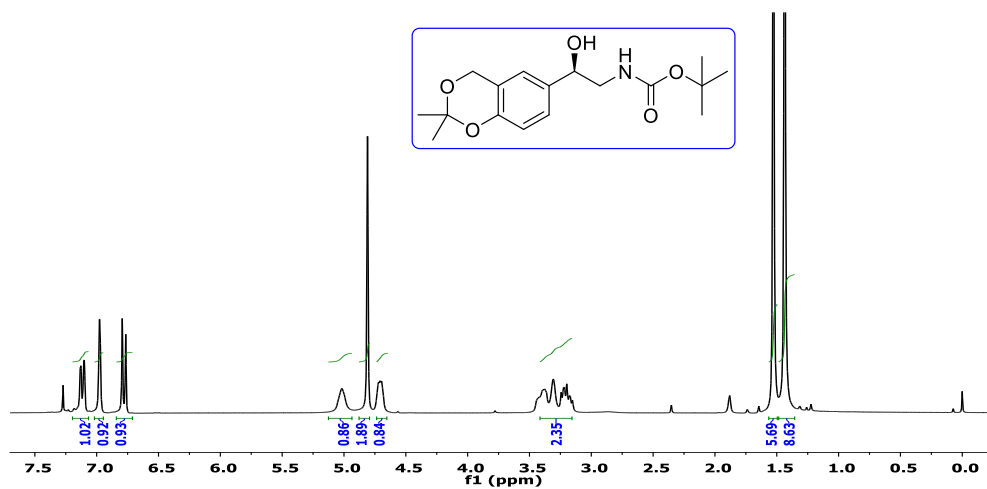
Sample Name : PSH-223-8
Data File : 24052023.30.lcd
Date Acquired : 5/24/2023 4:26:32 PM
Batch File : 24052023 532023 1055 AM.lcb

MS Spectrum
D:\DATA\MAY2023\24052023.30.lcd

SingleESI Positive+
Spectrum Mode:Single 0.330(121)
[CPS]



1

^1H (300 MHz, CDCl_3) and ^{13}C (101 MHz, CDCl_3) NMR spectra of compound 9

Mass (ESI) of compound 9

OSPC, Dr RATHOD

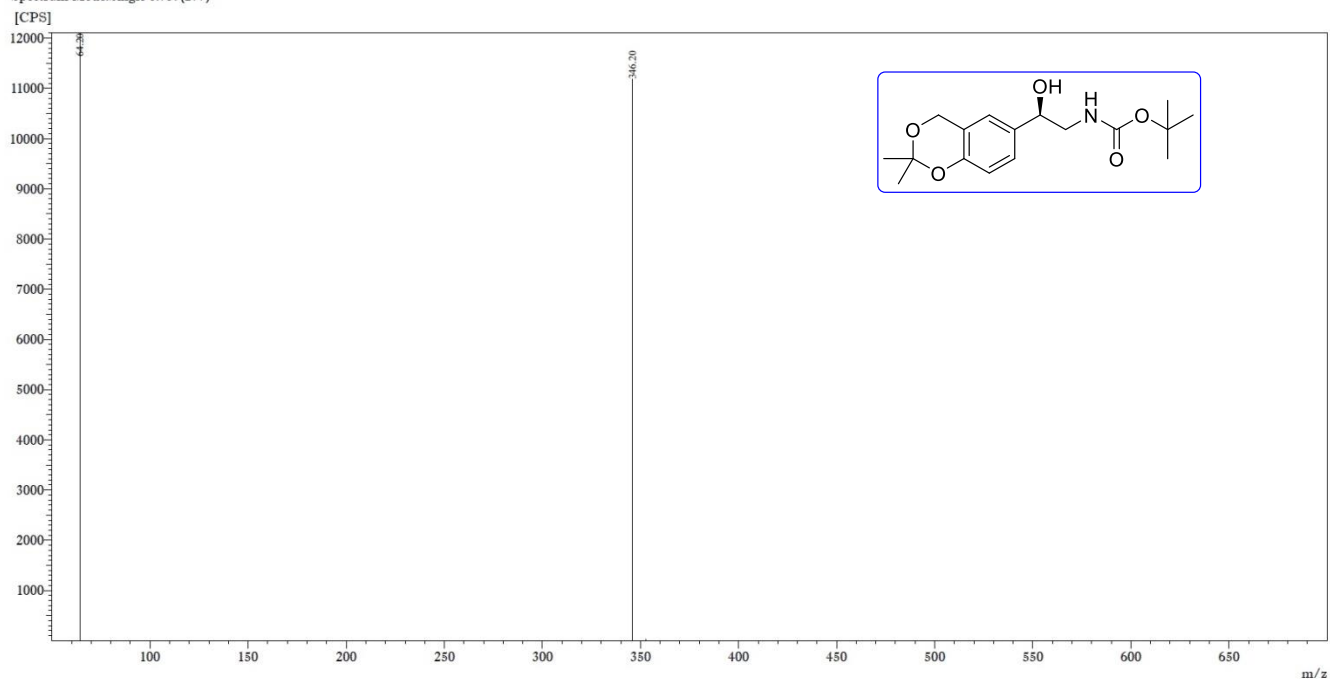


MASS REPORT

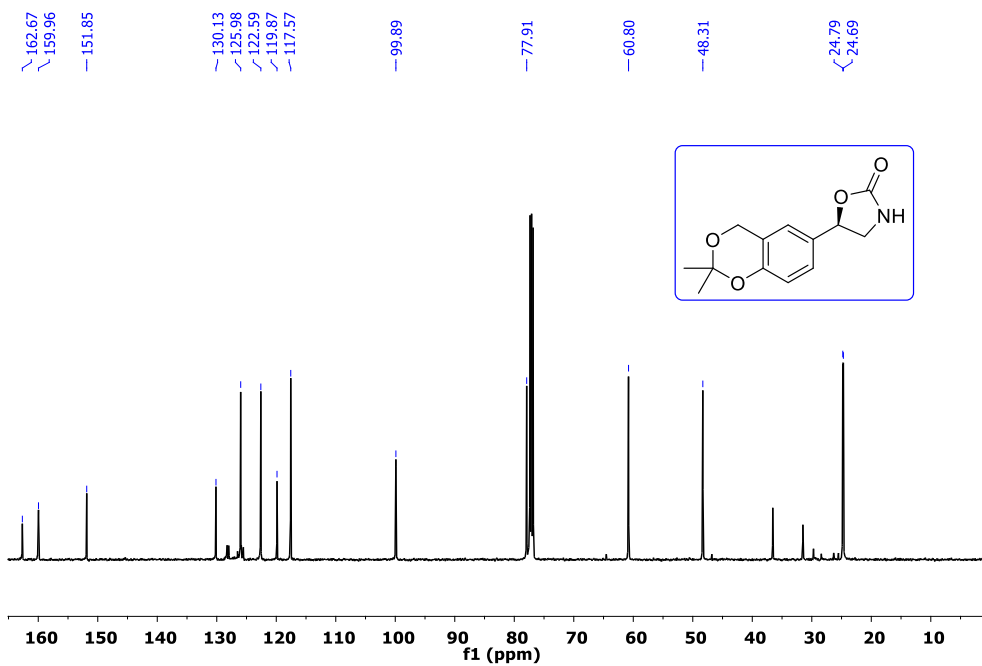
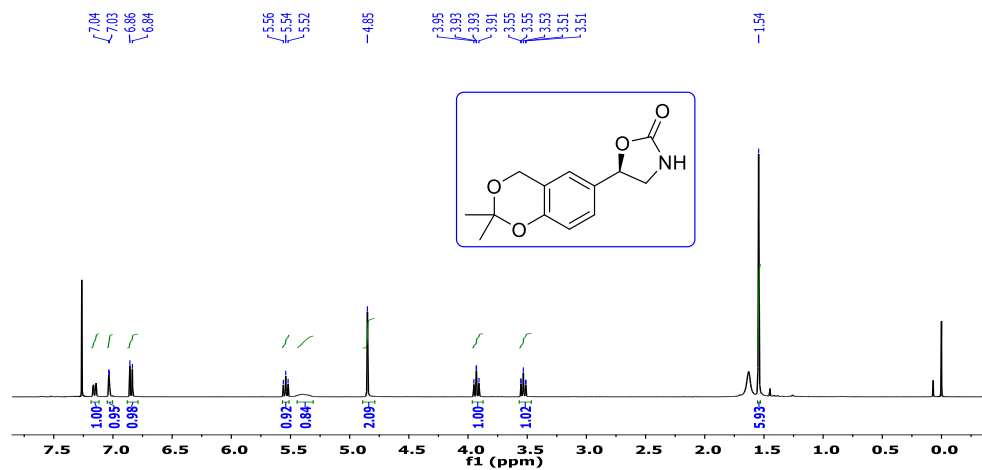
Sample Name : PSH-323-9
Data File : 24052023_29.lcd
Date Acquired : 5/24/2023 4:23:52 PM
Batch File : 24052023_532023_1055 AM.lcb

MS Spectrum
D:\DATA\MAY2023\24052023_29.lcd

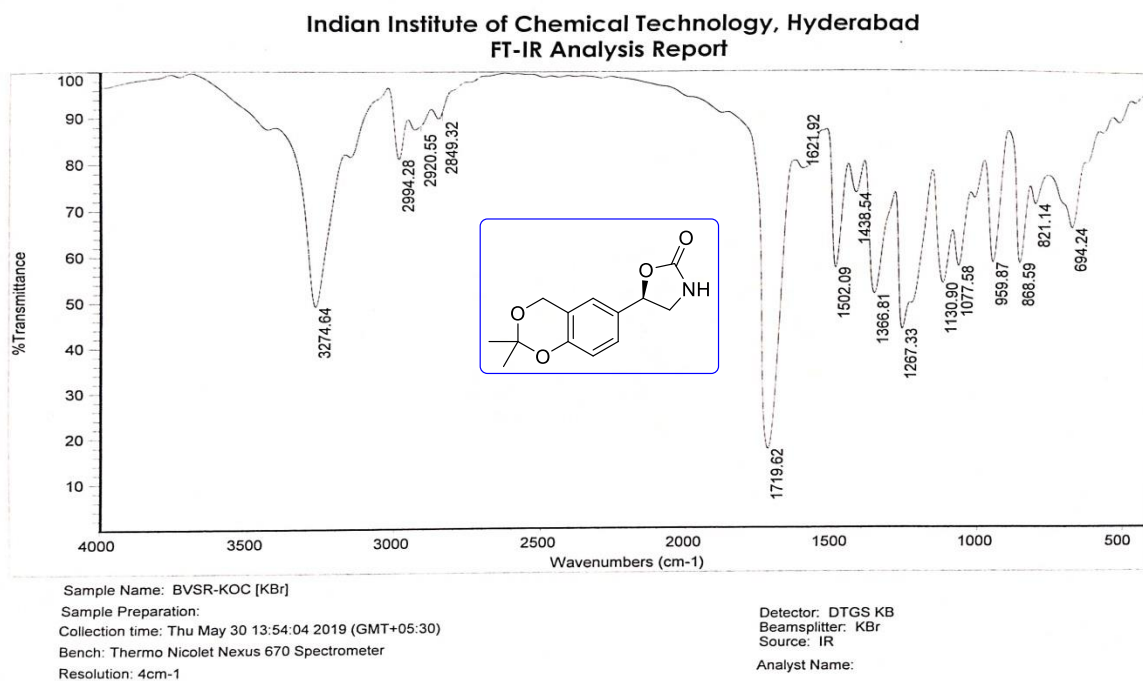
SingleESI Positive+
Spectrum Mode:Single 0.759(277)



1

^1H (400 MHz, CDCl_3) and ^{13}C (126 MHz, CDCl_3) NMR spectra of compound 10

IR spectrum of compound 10



Mass and HRMS (ESI) spectra of compound 10

SHIMADZU
LabSolutions

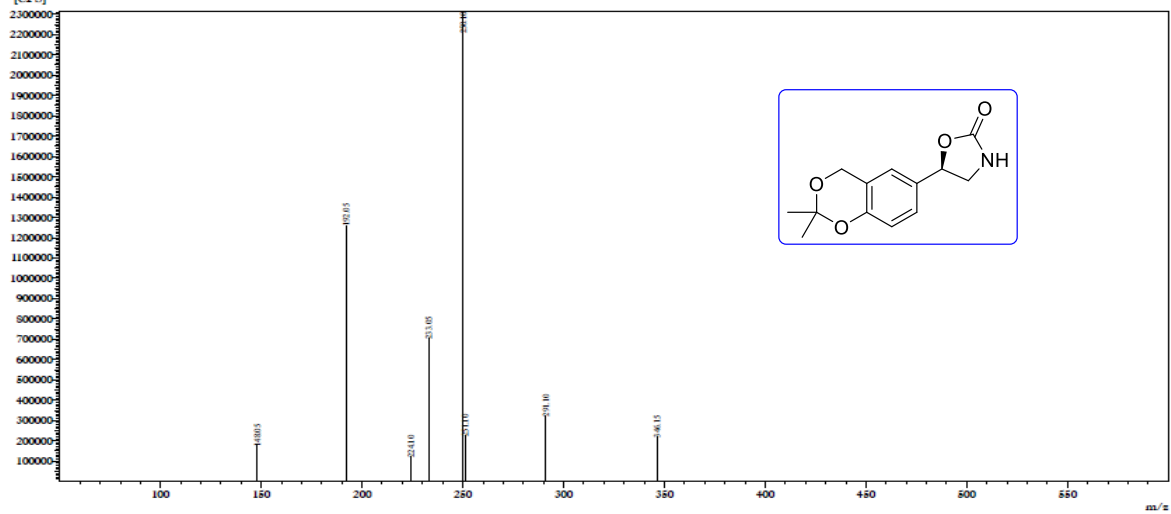
MASS REPORT

OSPC, Dr. RATHOD

Sample Name : HUS-10
 Data File : 12032021.28.1cd
 Date Acquired : 3/15/2021 11:33:58 AM
 Batch File : 12032021-1.1cb

Averaged ESI Positive+
 Spectrum Mode: Averaged 0.499-0.907(215-347)
 [CPS]

MS Spectrum
 D:\DATA\March 2021\12032021.28.1cd



12/03/21 13:30:02

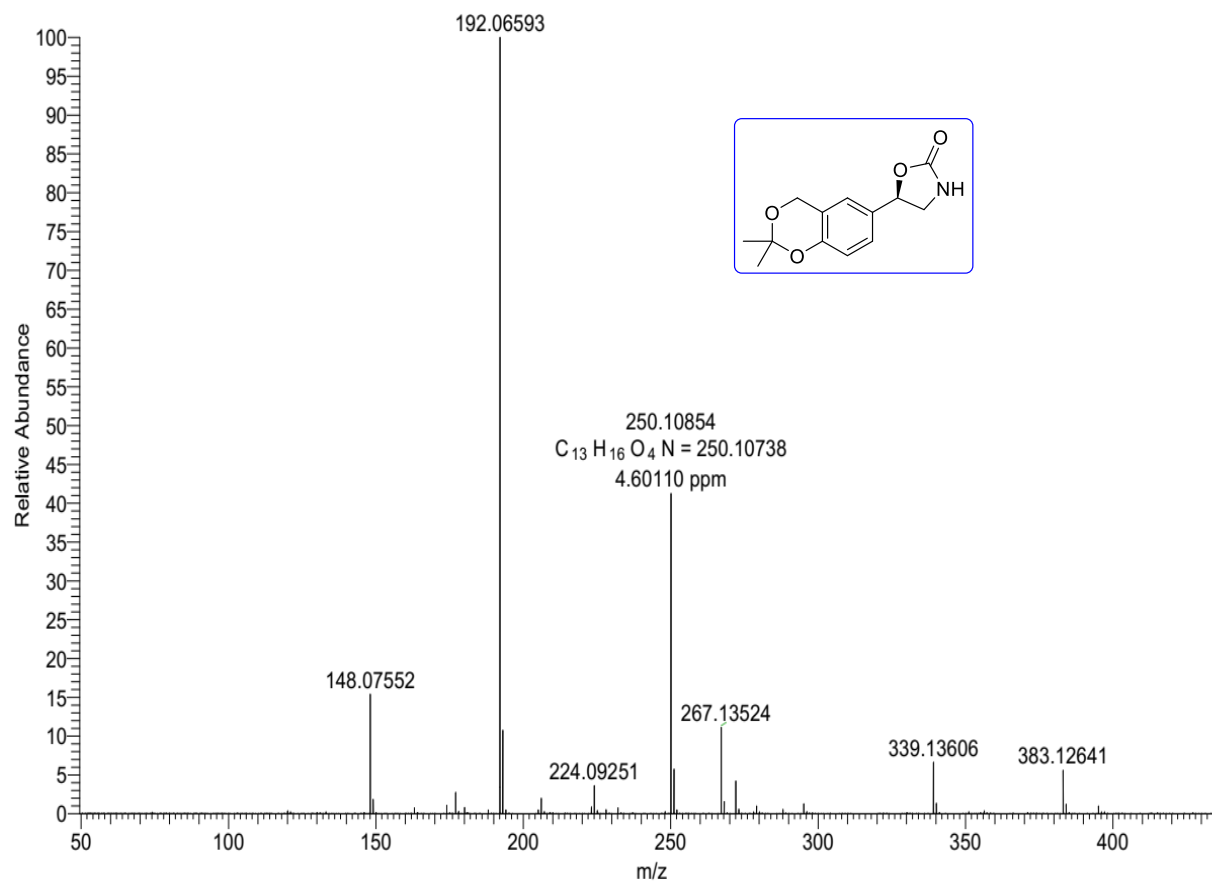
249

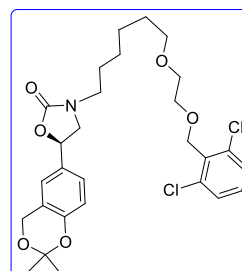
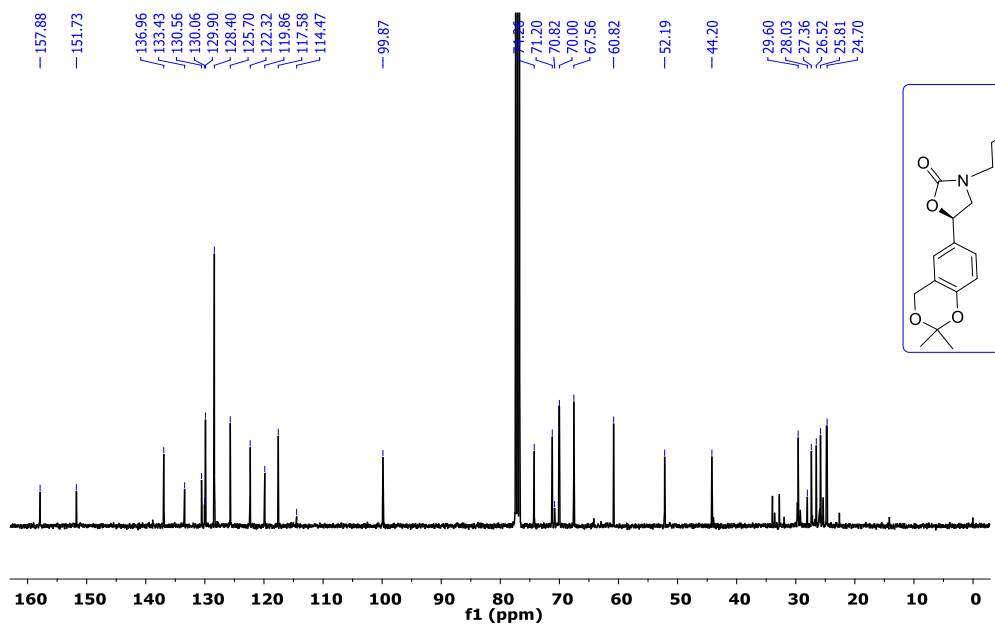
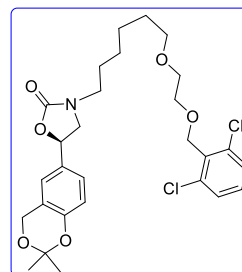
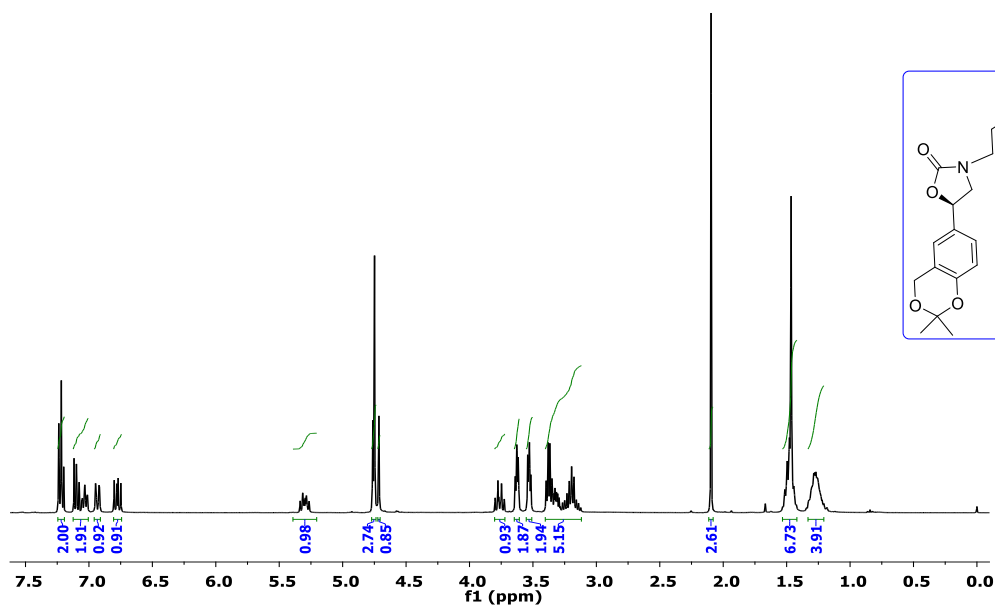
Thermo Scientific Orbitrap Exploris 120

Analysed by G SAIKRISHNA

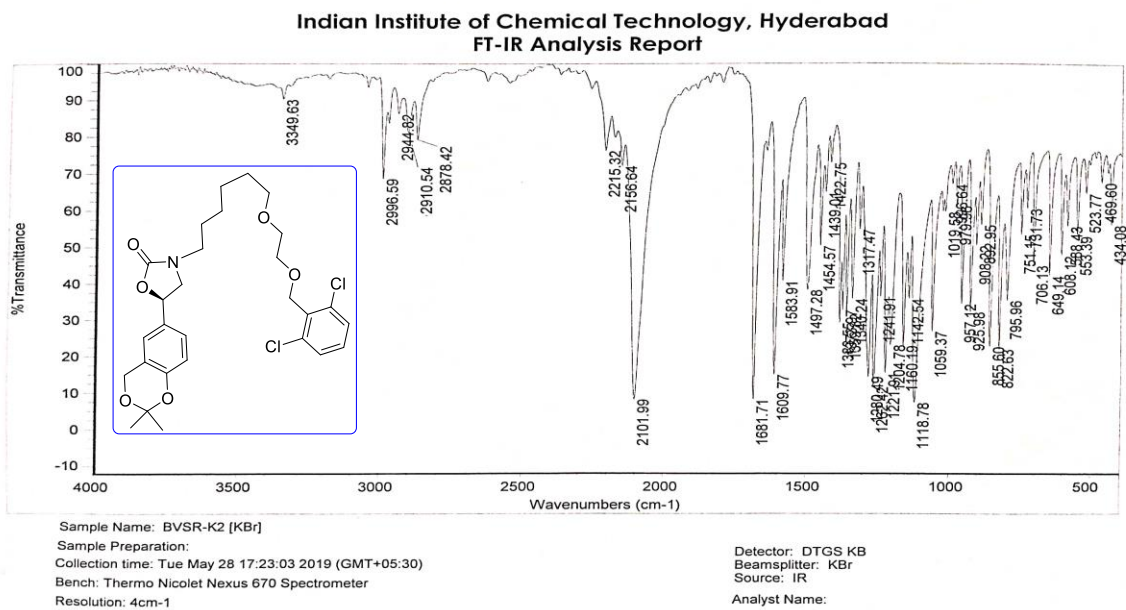
BVSR-02 #11-34 RT: 0.03-0.08 AV: 24 SB: 382 0.32-1.20 NL: 6.14E8

T: FTMS + p ESI Full ms [50.0000-3000.0000]

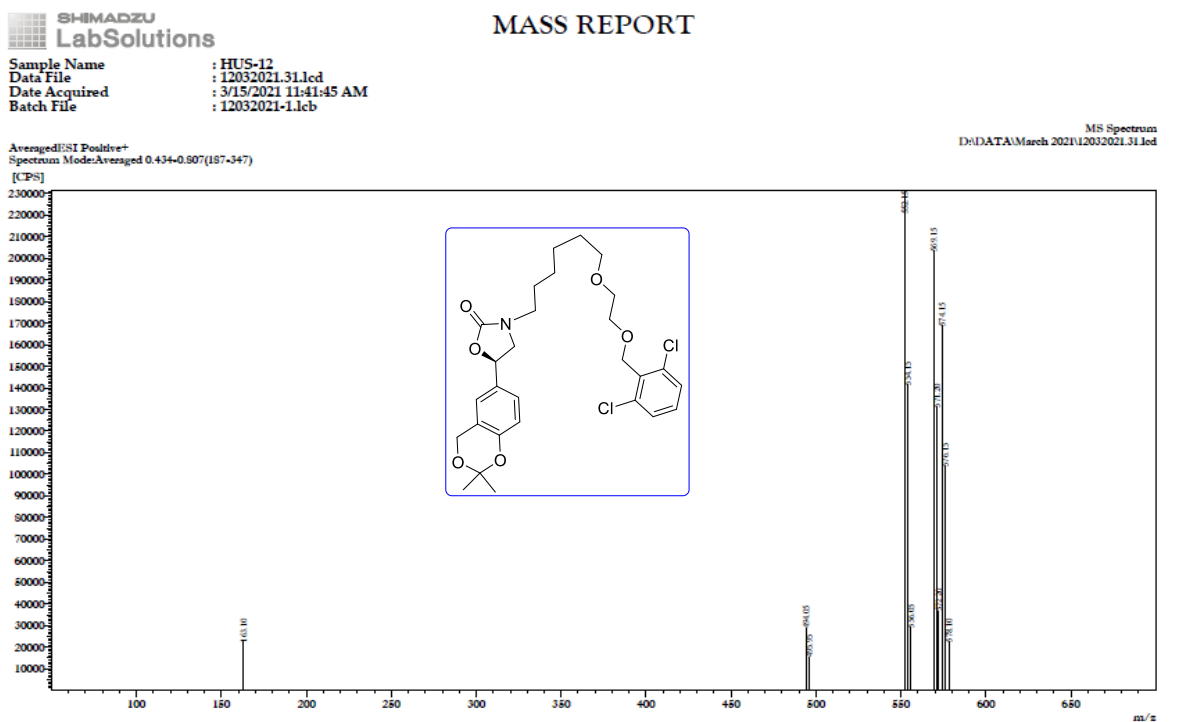


^1H (400 MHz, CDCl_3) and ^{13}C (101 MHz, CDCl_3) NMR spectra of compound 12

IR spectrum of compound 12



Mass and HRMS (ESI) spectra of compound 12

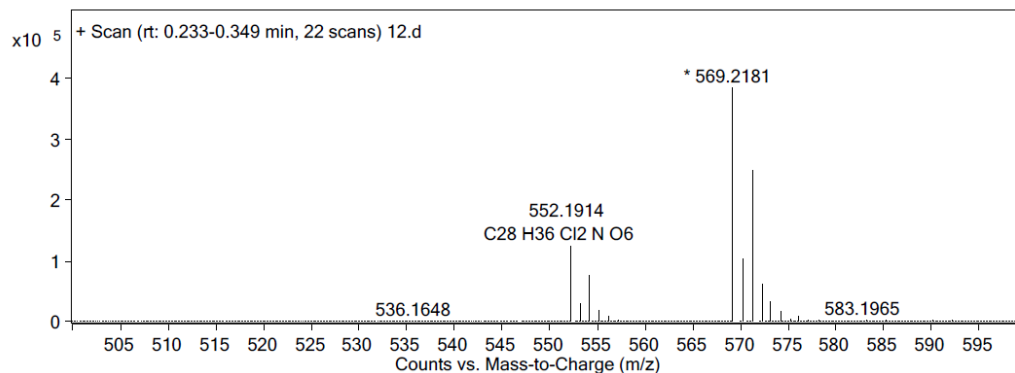


Qualitative Analysis Report

Data File	12.d	Sample Name	
Sample Type	Sample	Position	P1-A1
Instrument Name	Instrument 1	User Name	CSIR-IICT\Analyst
Acq Method	hrms-pos-method.m	Acquired Time	13-09-2021 12:39:47
IRM Calibration Status	Success	DA Method	0.m
Comment		Info.	
Sample Group		Acquisition SW Version	6200 series TOF/6500 series Q-TOF B.06.01 (B6172 SP1)
Stream Name	LC 1		

User Spectra

Fragmentor Voltage Collision Energy Ionization Mode
80 0 ESI

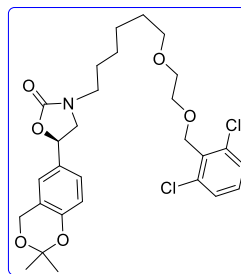


Peak List

m/z	z	Abund
569.2181	1	384313.03

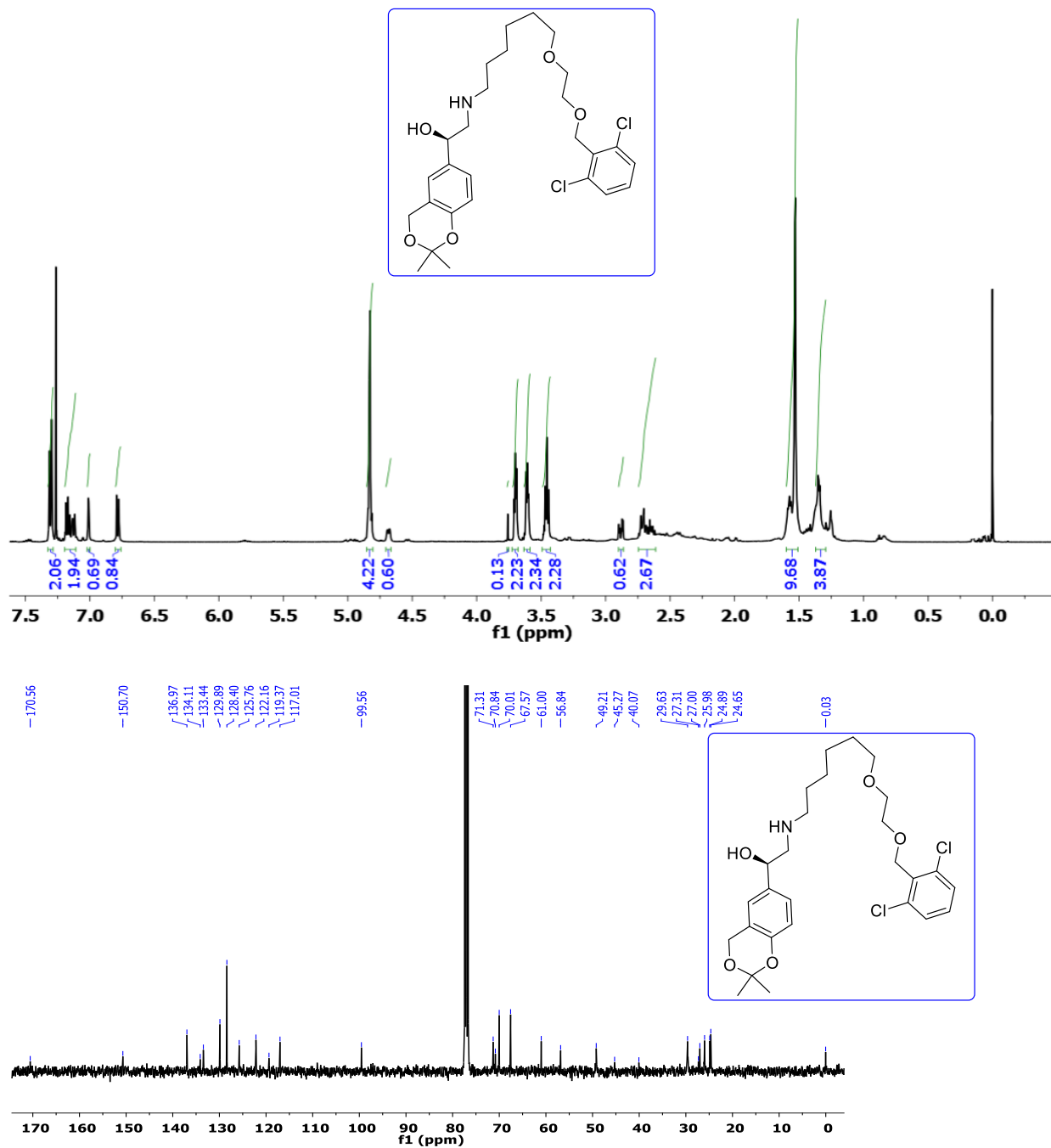
Formula Calculator Element Limits

Element	Min	Max
C	0	30
H	0	60
O	0	6
N	0	1
Cl	0	2

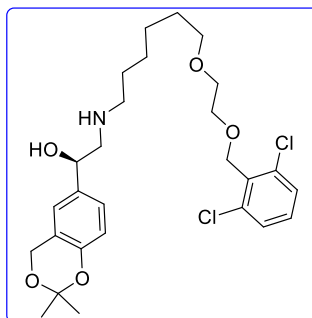
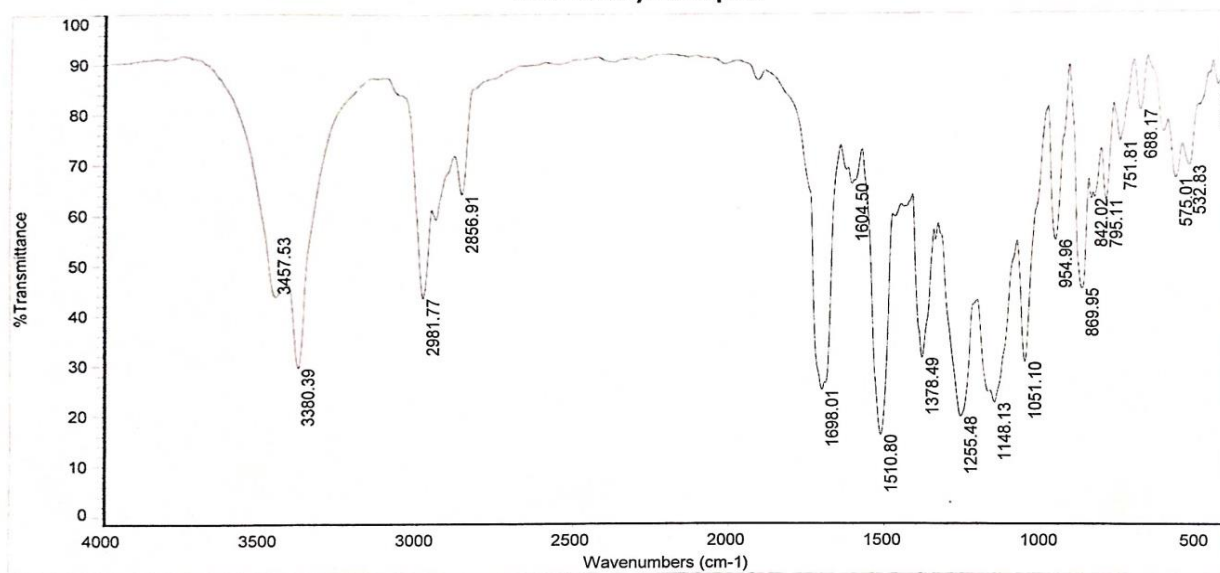


Formula Calculator Results

Formula	Best	Mass	Tgt Mass	Diff (ppm)	Ion Species	Score
C28 H36 Cl2 N O6	True	552.1918	552.19197	0.3	C28 H36 Cl2 N O6	95.69
C28 H35 Cl2 N O6	True	551.18398	551.18414	0.3	C28 H36 Cl2 N O6	95.69

^1H (500 MHz, CDCl_3) and ^{13}C (101 MHz, CDCl_3) NMR spectra of compound 13

IR spectrum of compound 13

Indian Institute of Chemical Technology, Hyderabad
FT-IR Analysis Report

Sample Name: BVSR-KNB [KBr]
Sample Preparation:
Collection time: Thu May 30 13:50:08 2019 (GMT+05:30)
Bench: Thermo Nicolet Nexus 670 Spectrometer
Resolution: 4cm⁻¹

Detector: DTGS KB
Beamsplitter: KBr
Source: IR
Analyst Name:

Mass and HRMS (ESI) spectra of compound 13

OSPC, Dr. RATHOD

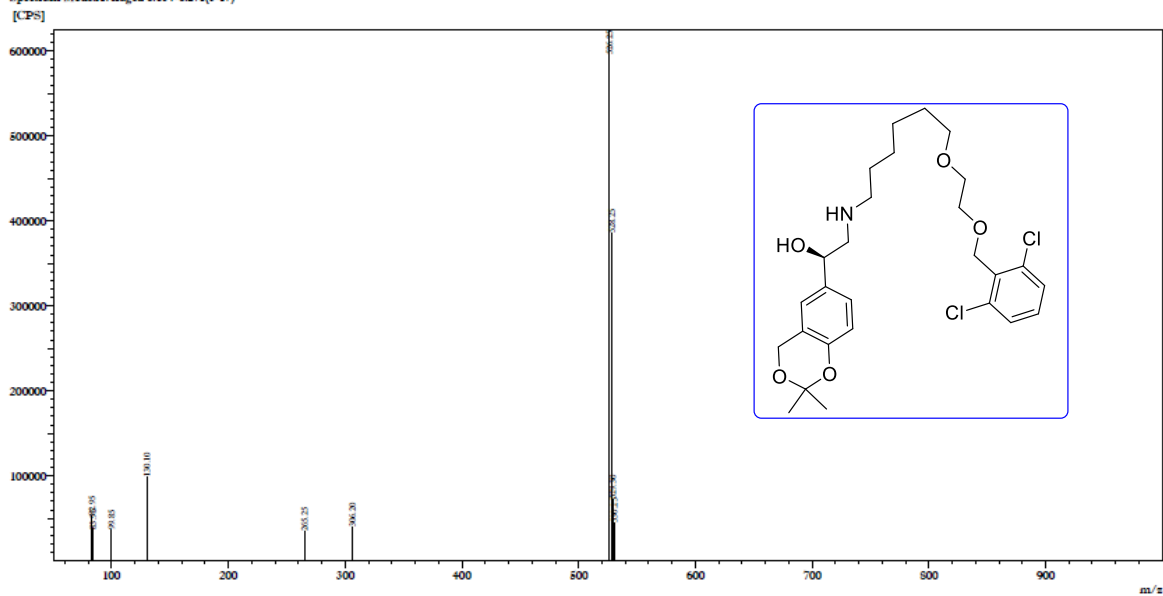
SHIMADZU
LabSolutions

MASS REPORT

Sample Name : HUS-N
Data File : 23082021.15.lcd
Date Acquired : 8/23/2021 11:35:31 AM
Batch File : 23082021-1.lcb

MS Spectrum
D:\DATA\AUG-2021\23082021.15.lcd

Averaged ESI Positive+
Spectrum Mode: Averaged 0.034-0.271 (3-17)



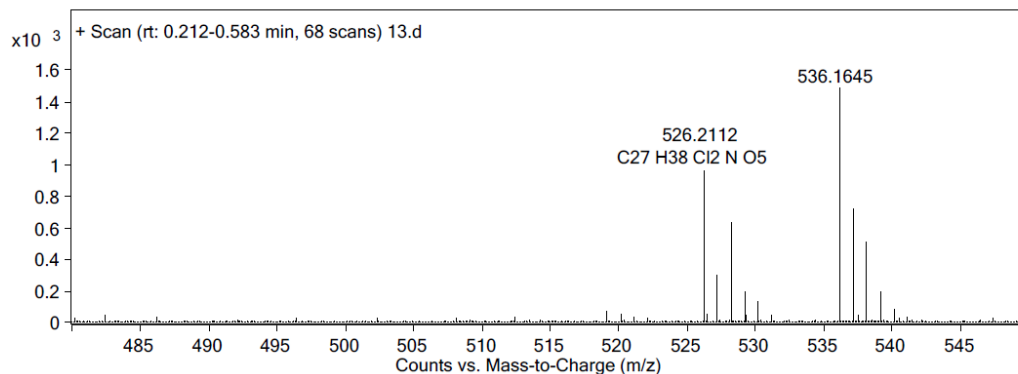
1

Qualitative Analysis Report

Data File	13.d	Sample Name	
Sample Type	Sample	Position	P1-A1
Instrument Name	Instrument 1	User Name	CSIR-IICT\Analyst
Acq Method	hrms-pos-method.m	Acquired Time	13-09-2021 12:41:12
IRM Calibration Status	Success	DA Method	0.m
Comment		Info.	
Sample Group		Acquisition SW Version	6200 series TOF/6500 series Q-TOF B.06.01 (B6172 SP1)
Stream Name	LC 1		

User Spectra

Fragmentor Voltage Collision Energy Ionization Mode
80 0 ESI

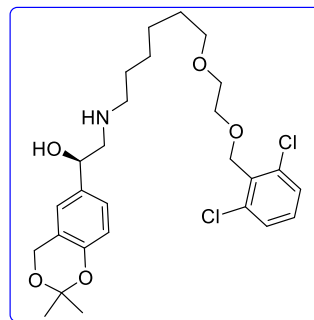


Peak List

m/z	z	Abund
130.1587	1	16312.73

Formula Calculator Element Limits

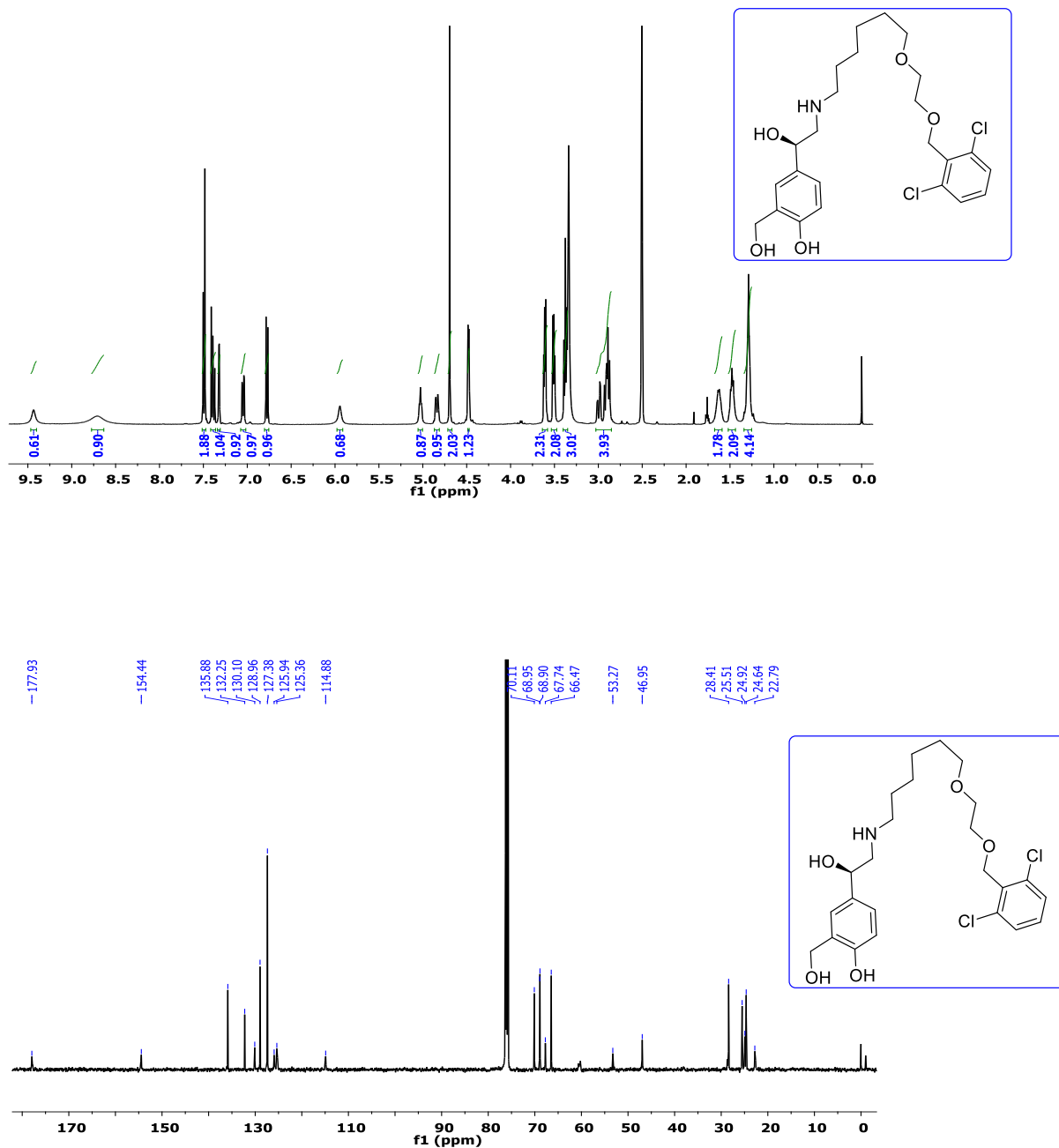
Element	Min	Max
C	0	30
H	0	60
O	0	6
N	0	1
Cl	0	2



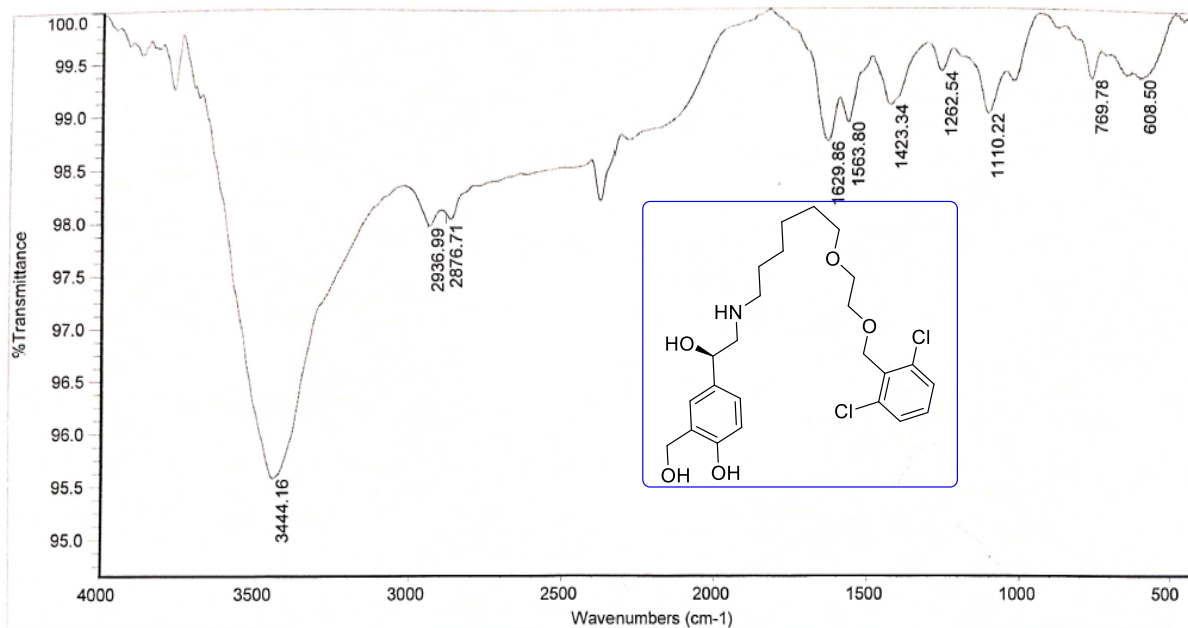
Formula Calculator Results

Formula	Best	Mass	Tgt Mass	Diff (ppm)	Ion Species	Score
C ₂₇ H ₃₈ Cl ₂ N O ₅	True	526.21165	526.2127	2.01	C ₂₇ H ₃₈ Cl ₂ N O ₅	96.37
C ₂₇ H ₃₇ Cl ₂ N O ₅	True	525.20382	525.20488	2.01	C ₂₇ H ₃₈ Cl ₂ N O ₅	96.37
C ₂₅ H ₃₉ Cl ₂ N O ₅	True	503.22192	503.22053	-2.76	C ₂₅ H ₃₉ Cl ₂ N Na O ₅	93.48



^1H (400 MHz, DMSO) and ^{13}C (126 MHz, CDCl_3) NMR spectra of compound 1

IR spectrum of compound 1

Indian Institute of Chemical Technology, Hyderabad
FT-IR Analysis Report

Sample Name: BVSr-KVD [NEAT]

Sample Preparation:

Collection time: Thu May 30 17:09:24 2019 (GMT+05:30)

Bench: Thermo Nicolet Nexus 670 Spectrometer

Resolution: 4cm⁻¹

Detector: DTGS KB

Beamsplitter: KBr

Source: IR

Analyst Name:

Mass and HRMS (ESI) spectra of compound 1

OSPC, Dr. RATHOD

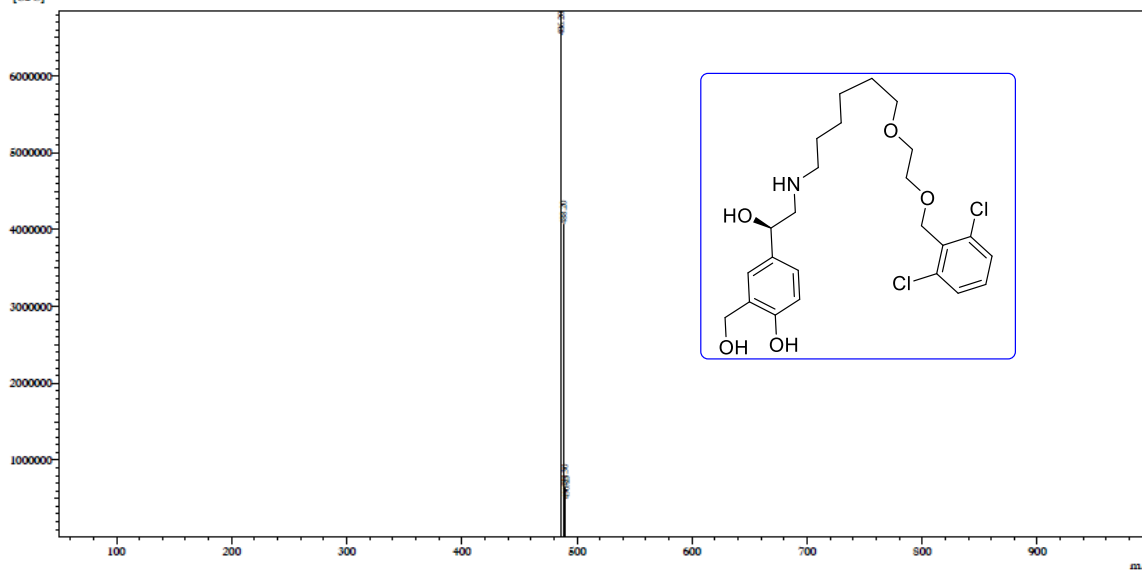
SHIMADZU
LabSolutions

MASS REPORT

Sample Name : HUS-14
Data File : 18082021.40.1cd
Date Acquired : 8/18/2021 5:08:41 PM
Batch File : 18072021-4.1cb

MS Spectrum
Da:DATA\AUG-2021\18082021.40.1cd

Single:ESI Positive+
Spectrum Mode:Single 0.135(9)
[CPS]



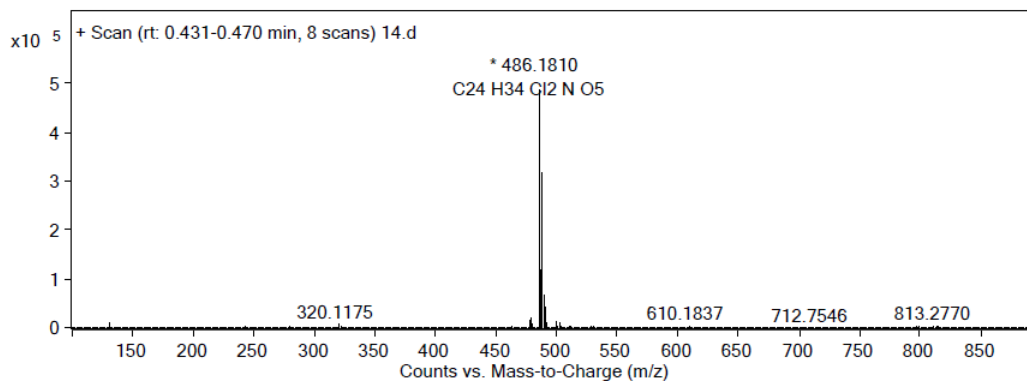
1

Qualitative Analysis Report

Data File	14.d	Sample Name	
Sample Type	Sample	Position	P1-A1
Instrument Name	Instrument 1	User Name	CSIR-IICT\Analyst
Acq Method	hrms-pos-method.m	Acquired Time	13-09-2021 12:42:58
IRM Calibration Status	Success	DA Method	0.m
Comment		Info.	
Sample Group		Acquisition SW Version	6200 series TOF/6500 series Q-TOF B.06.01 (B6172 SP1)
Stream Name	LC 1		

User Spectra

Fragmentor Voltage Collision Energy Ionization Mode
80 0 ESI

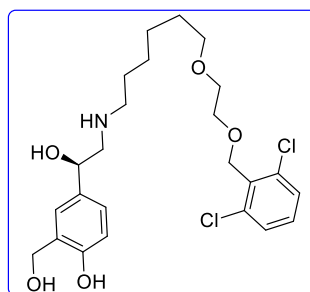


Peak List

m/z	z	Abund	Formula	Ion
486.181	1	486429.88	C24 H34 Cl2 N O5	M+

Formula Calculator Element Limits

Element	Min	Max
C	0	25
H	0	60
O	0	6
N	0	1
Cl	0	2



Formula Calculator Results

Formula	Best	Mass	Tgt Mass	Diff (ppm)	Ion Species	Score
C24 H34 Cl2 N O5	True	486.18137	486.1814	0.07	C24 H34 Cl2 N O5	97.16
C24 H33 Cl2 N O5	True	485.17355	485.17358	0.07	C24 H34 Cl2 N O5	97.16



Agilent Technologies

Page 1 of 2

Printed at 12:45 PM on 13-Sep-2021