

Supporting Information

Hydrothermal Preparation and Characterization of ZnFe₂O₄ Magnetic Nanoparticles as an Efficient Heterogeneous Catalyst for the Synthesis of Multi-Substituted Imidazoles (MSI) and Study of their Anti-inflammatory Activity

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^cDepartment of Chemistry, Faculty of Science, Sohag University, 82524 Sohag, Egypt.

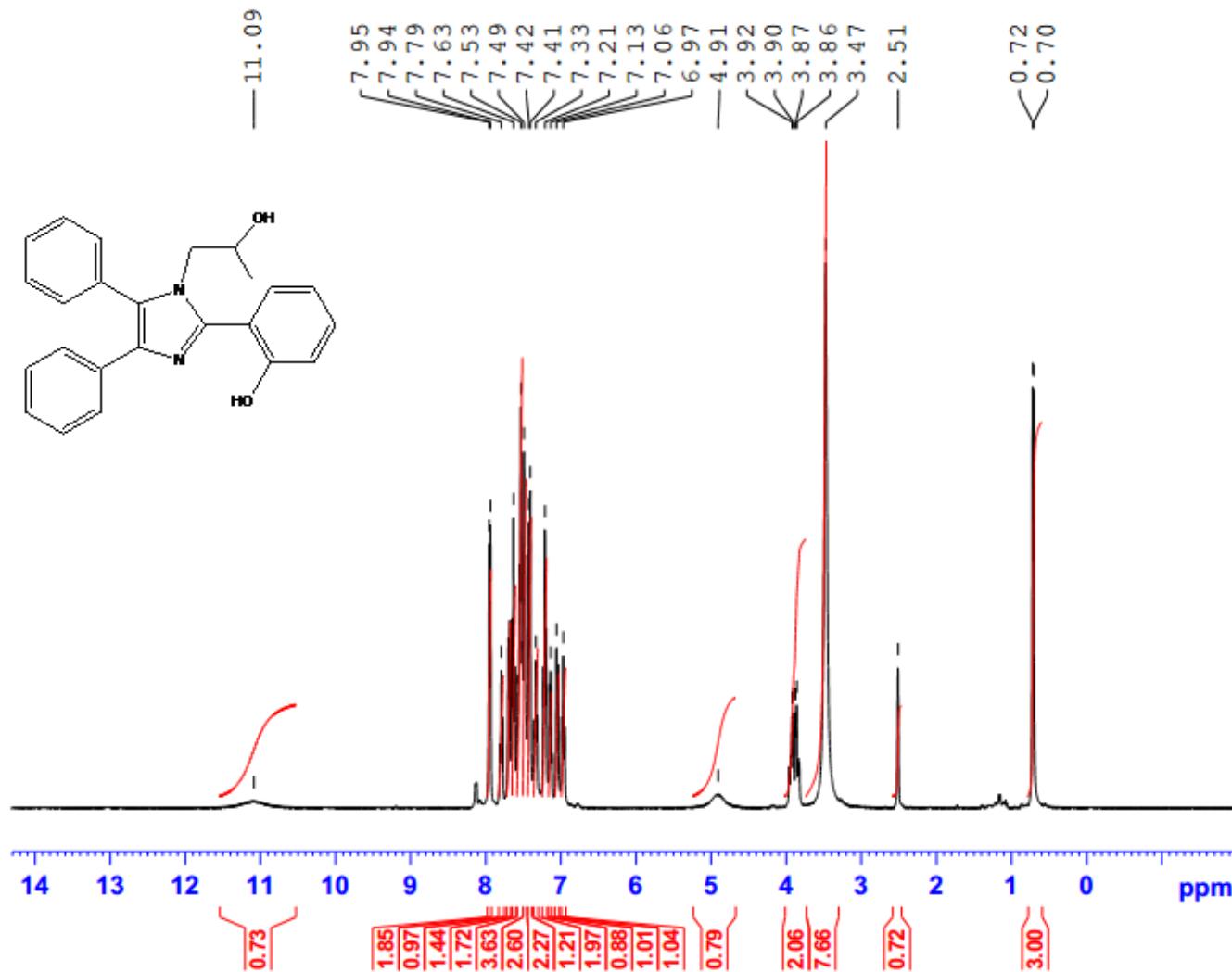
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drantar25@yahoo.com (Antar A. Abdelhamid)

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Fig. S1 : ^1H , ^{13}C NMR and dept-135 spectra of 5a

I-1
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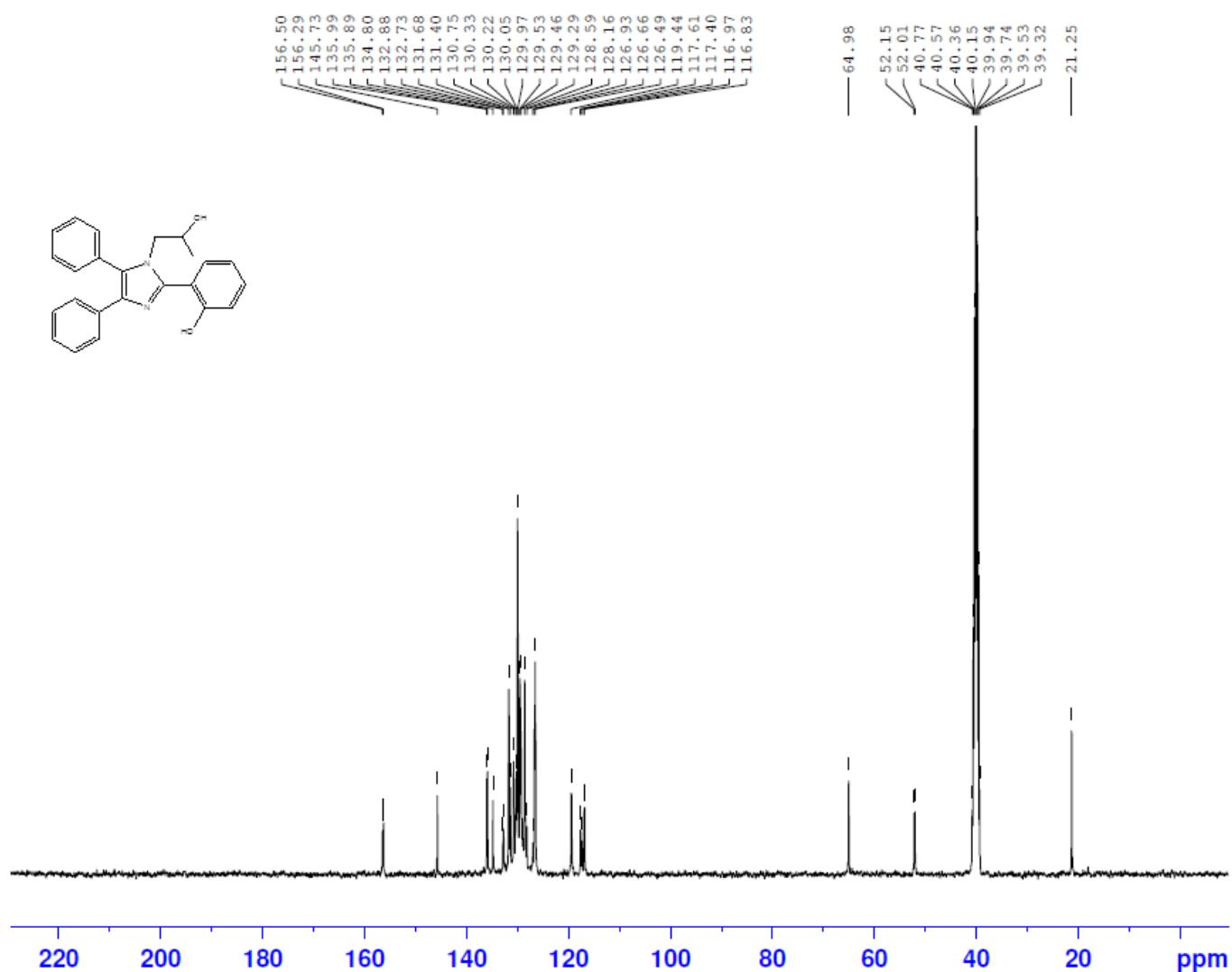
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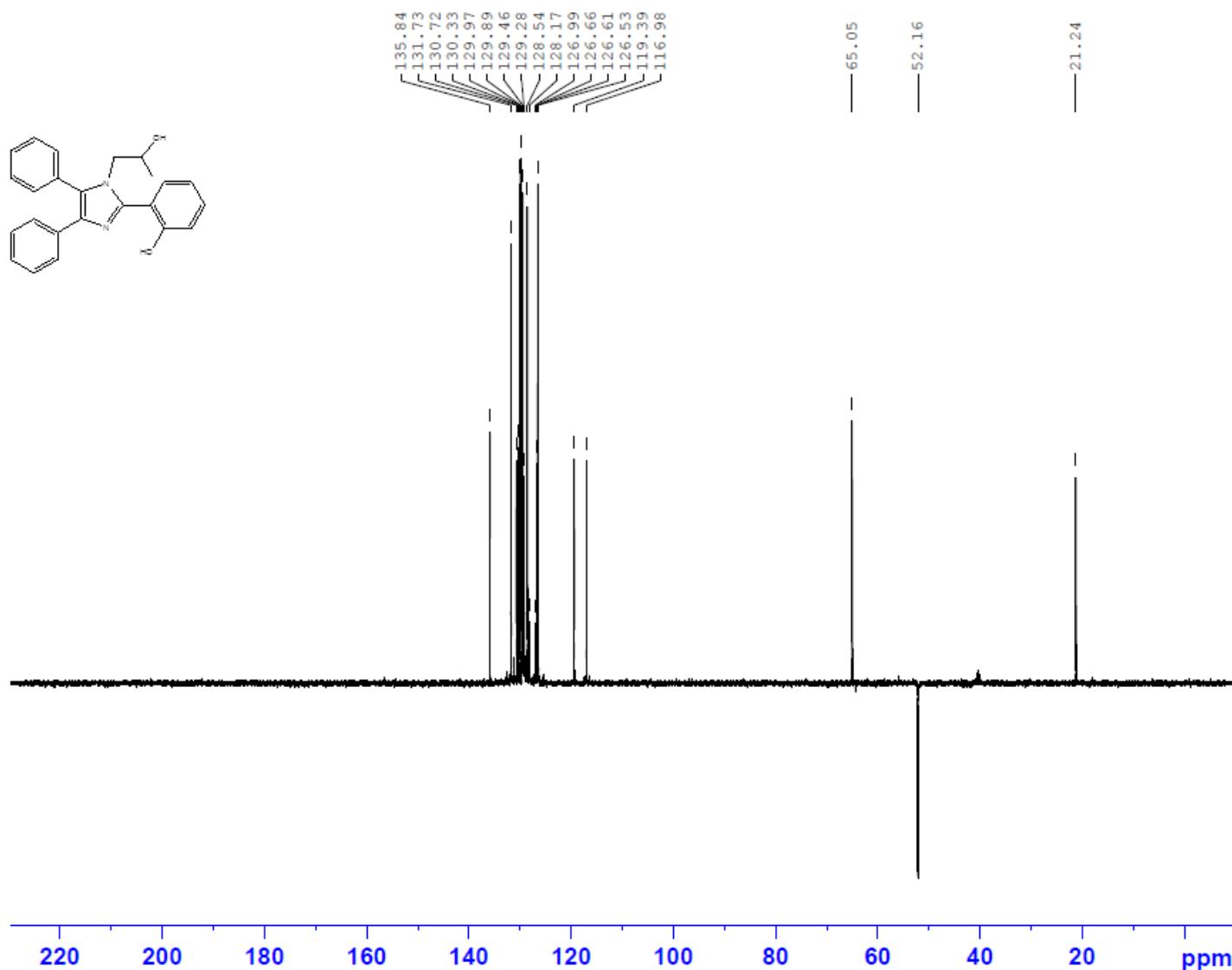
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PLW1 56.00000000 V

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PLW13 0.33284000 V

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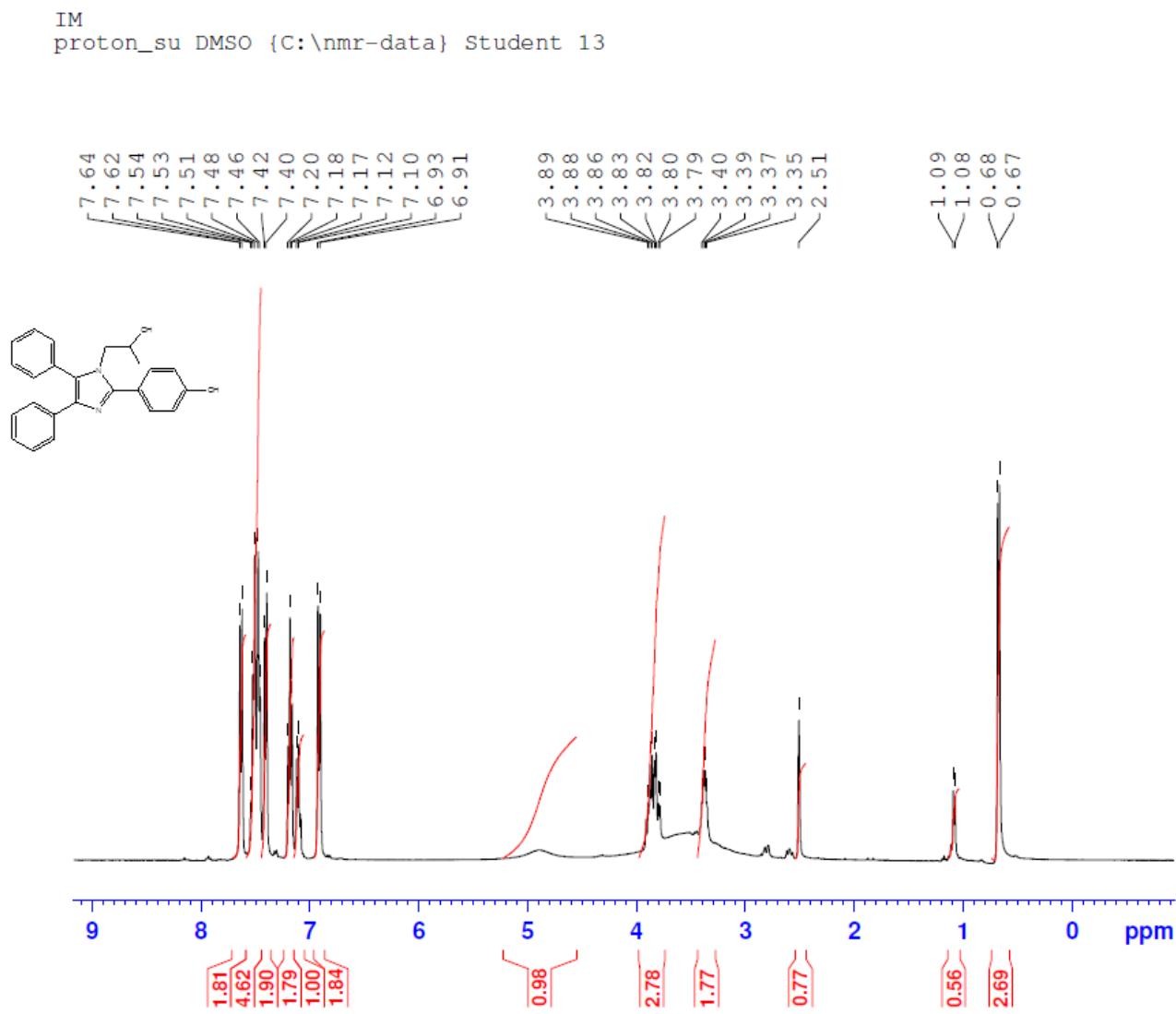
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Fig. S2 : ^1H , ^{13}C NMR and dept-135 spectra of 5b



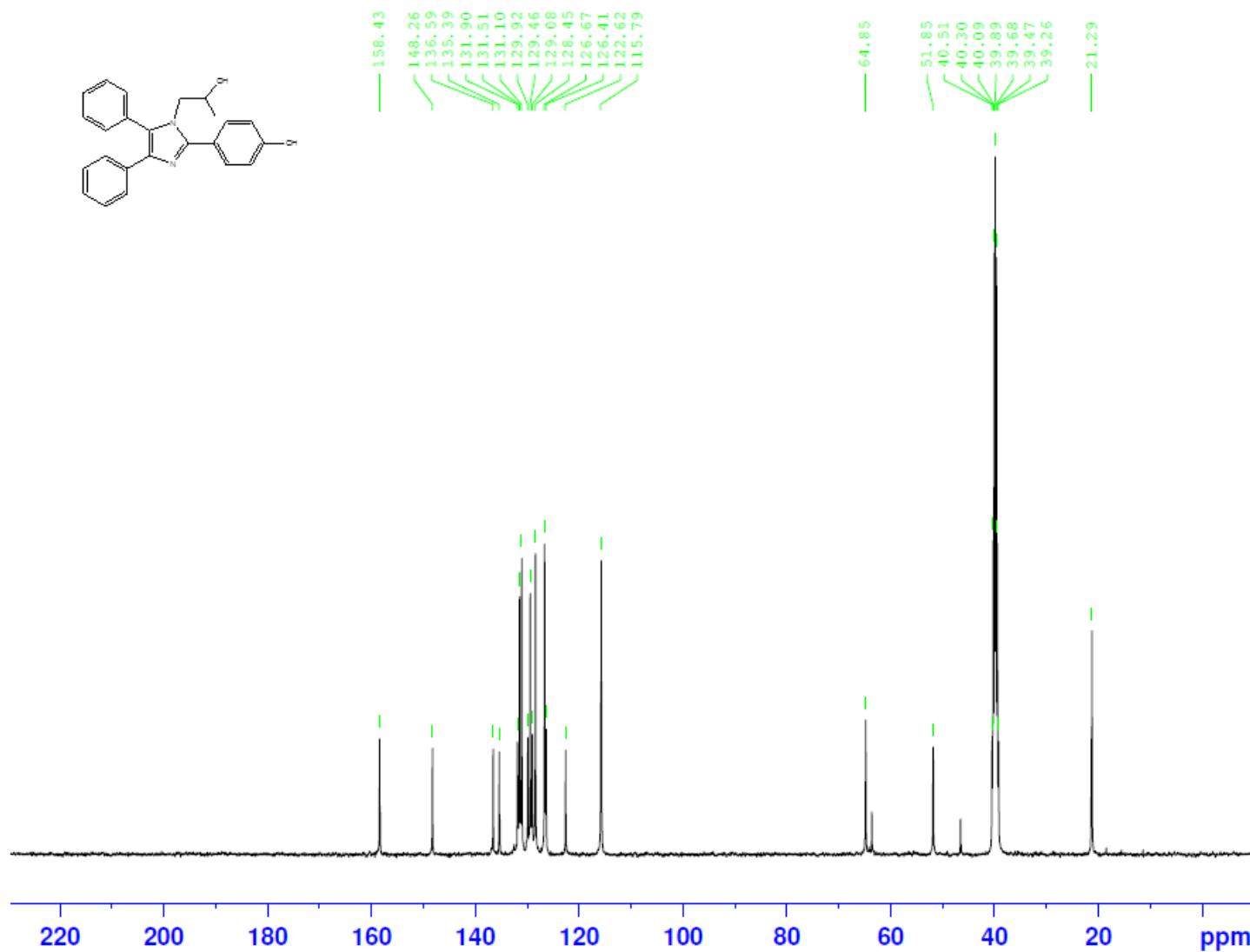
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FIDRES 0.122266 Hz
AQ 4.0894465 sec
RG 68.22
DW 62.400 usec
DE 6.50 usec
TE 298.2 K
D1 1.0000000 sec
TDO 1

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NUC1 1H
P1 12.00 usec
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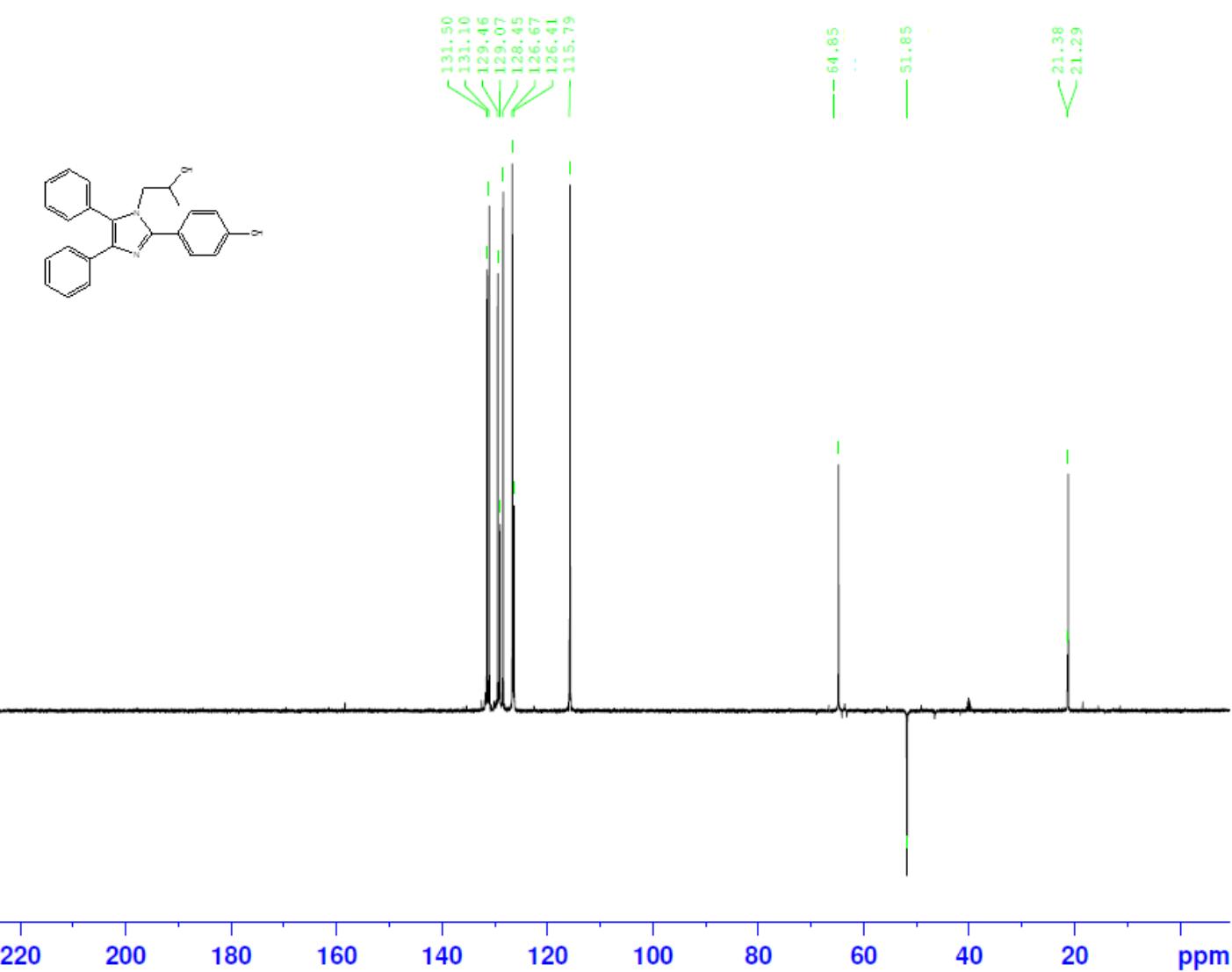
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TE 298.2 I
D1 2.0000000 :
D11 0.03000000 :
TDO 1

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NUC1 13C
P1 9.50 :
PLW1 56.00000000 V

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NUC2 1H
CPDPRG[2] waltz16
PCPD2 90.00 :
PLW2 22.00000000 V
PLW12 0.41091001 V
PLW13 0.33284000 V

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SF 100.6127690 I
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IM
dept135_su DMSO {C:\nmr-data} Student 13



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EXPNO 51
PROCNO 1

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Time 16.00
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PULPROG deptsp135
TD 65536
SOLVENT DMSO
NS 256
DS 4
SWH 24038.461 Hz
FIDRES 0.366598 Hz
AQ 1.3631488 sec
RG 199.04
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TE 298.1 K
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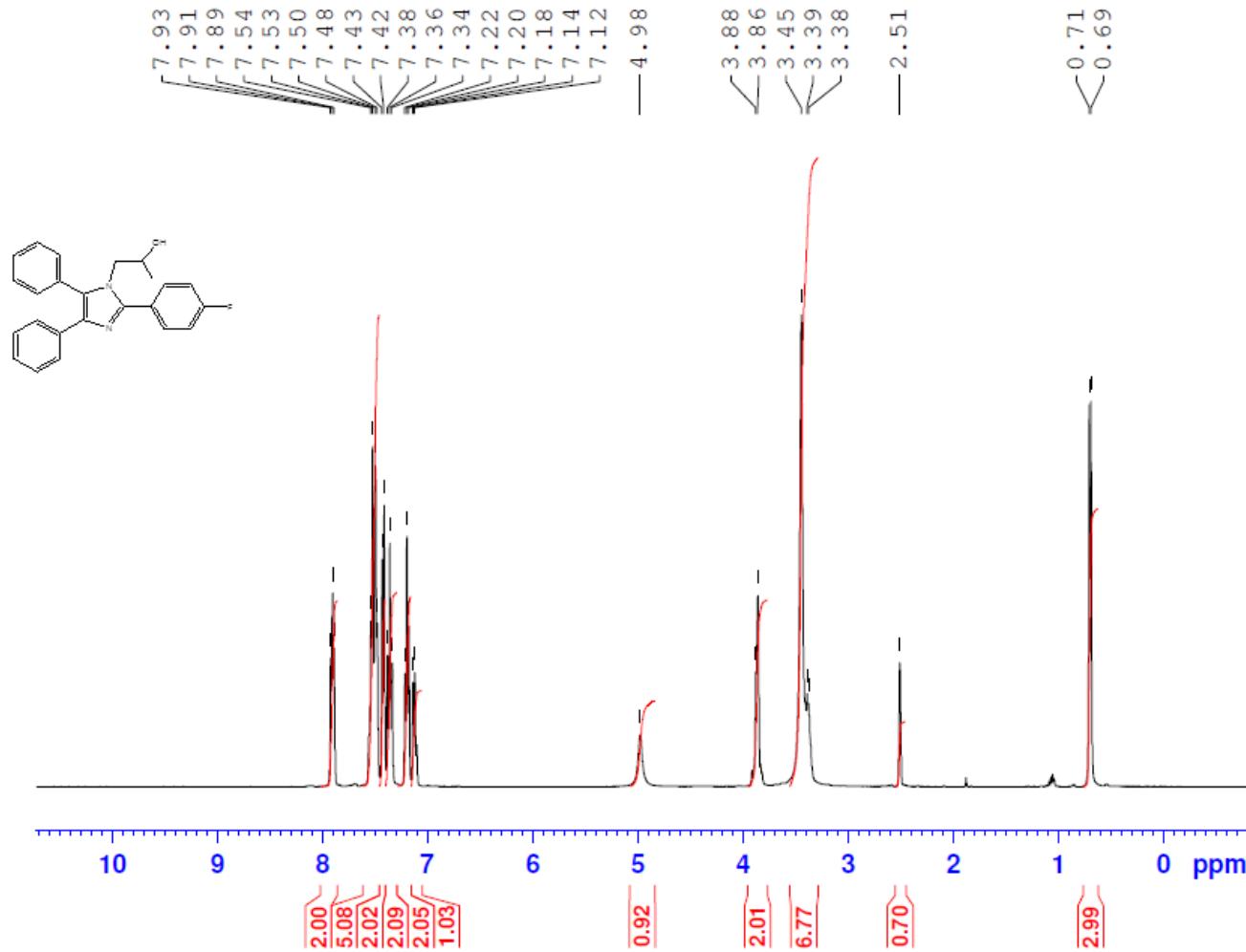
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SPOFFS5 0 Hz
SPW5 7.72189999 W

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NUC2 1H
CPDPRG[2] waltz16
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P4 24.60 usec
PCPD2 90.00 usec
PLW2 22.00000000 W
PLW12 0.41091001 W

F2 - Processing parameters
SI 32768
SF 100.6127690 MHz
WDW EM
SSB 0
LB 1.00 Hz
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PC 1.40

Fig. S3 : ^1H , ^{13}C NMR and dept-135 spectra of 5c

IO
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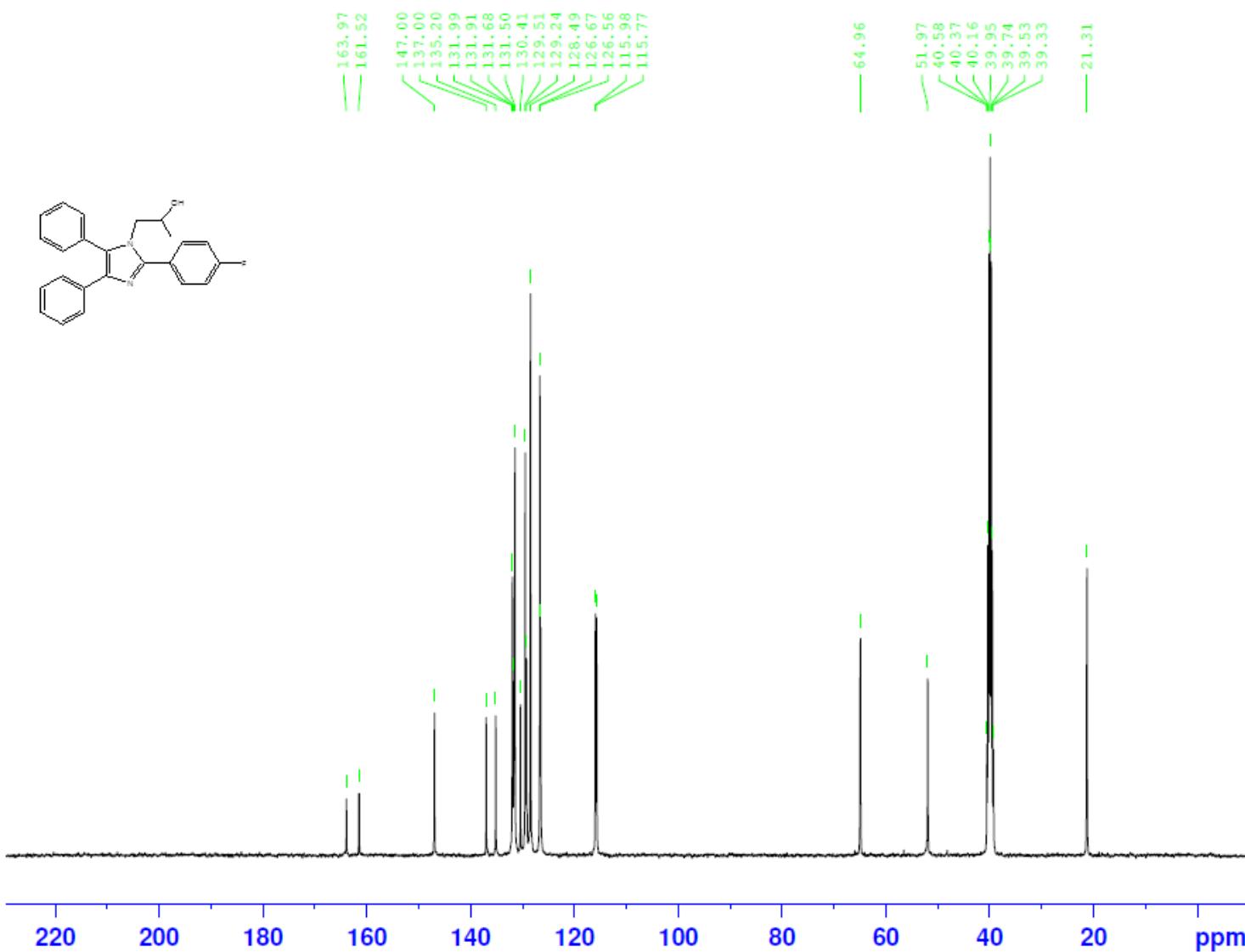
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SOLVENT DMSO
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FIDRES 0.122266 Hz
AQ 4.0894465 sec
RG 36.71
DW 62.400 usec
DE 6.50 usec
TE 298.2 K
D1 1.0000000 sec
TDO 1

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NUC1 1H
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PLW1 22.00000000 W

F2 - Processing parameters
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IO
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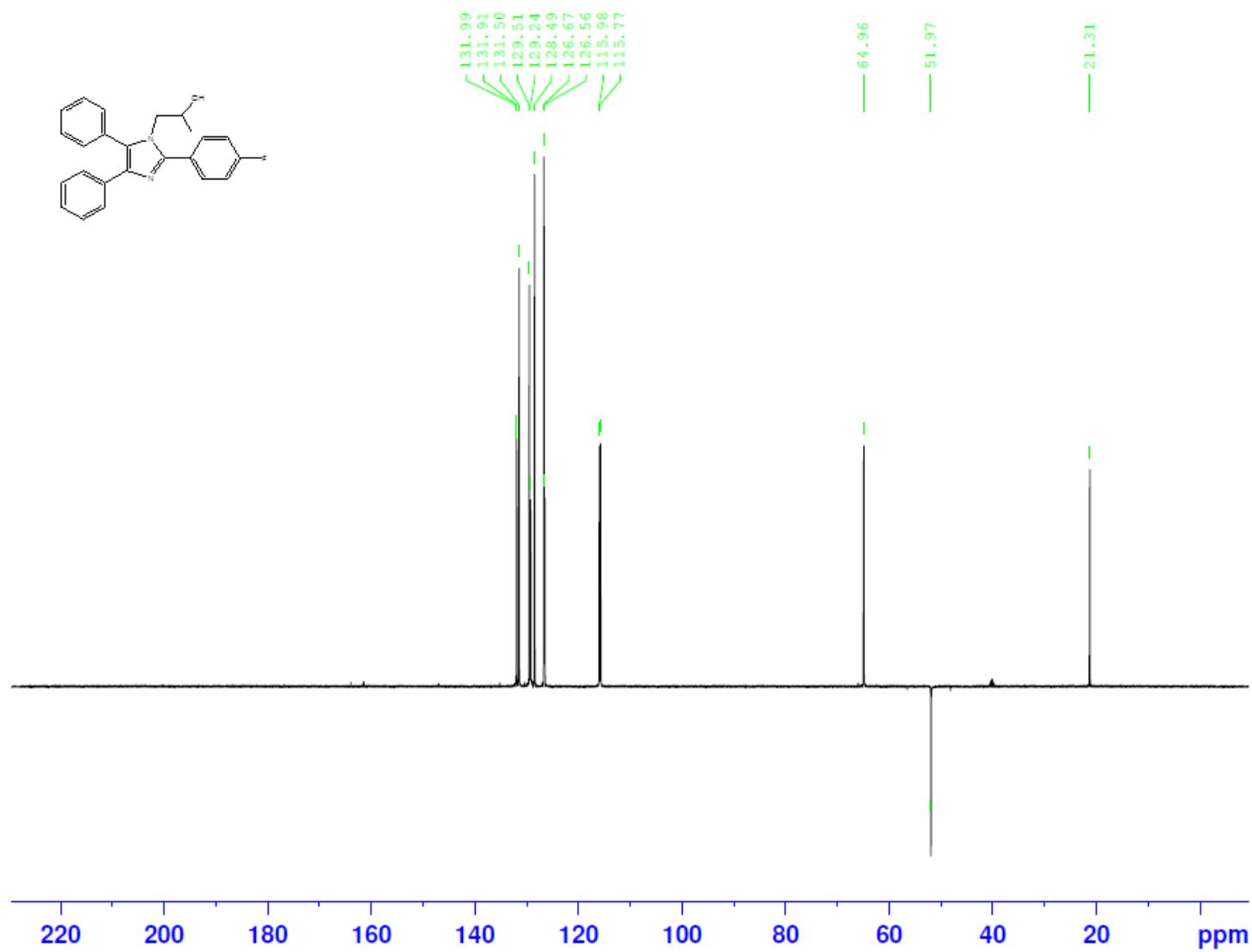
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PULPROG zpgg30
TD 65536
SOLVENT DMSO
NS 512
DS 4
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FIDRES 0.366798 F
AQ 1.3631488 s
RG 100.43
DW 20.800 t
DE 6.50 t
TE 298.1 F
D1 2.0000000 s
D11 0.03000000 s
TD0 1

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NUC1 13C
P1 9.50 t
PLW1 56.00000000 W

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NUC2 1H
CPDPRG[2] waltz16
PCPD2 90.00 t
PLW2 22.00000000 W
PLW12 0.41091001 W
PLW13 0.33284000 W

F2 - Processing parameters
SI 32768
SF 100.6127690 M
WDW EM
SSB 0
LB 6.00 I
GB 0
PC 1.40

IO
dept135_su DMSO {C:\nmr-data} Student 14



Current Data Parameters
NAME Sep30-2014
EXPNO 61
PROCNO 1

F2 - Acquisition Parameters
Date 20140930
Time 16.48
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PULPROG deptsp135
TD 65536
SOLVENT DMSO
NS 256
DS 4
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FIDRES 0.3665798 Hz
AQ 1.3631488 sec
RG 199.04
DW 20.800 usec
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CNST2 145.0000000
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D2 0.00344828 sec
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TDO 1

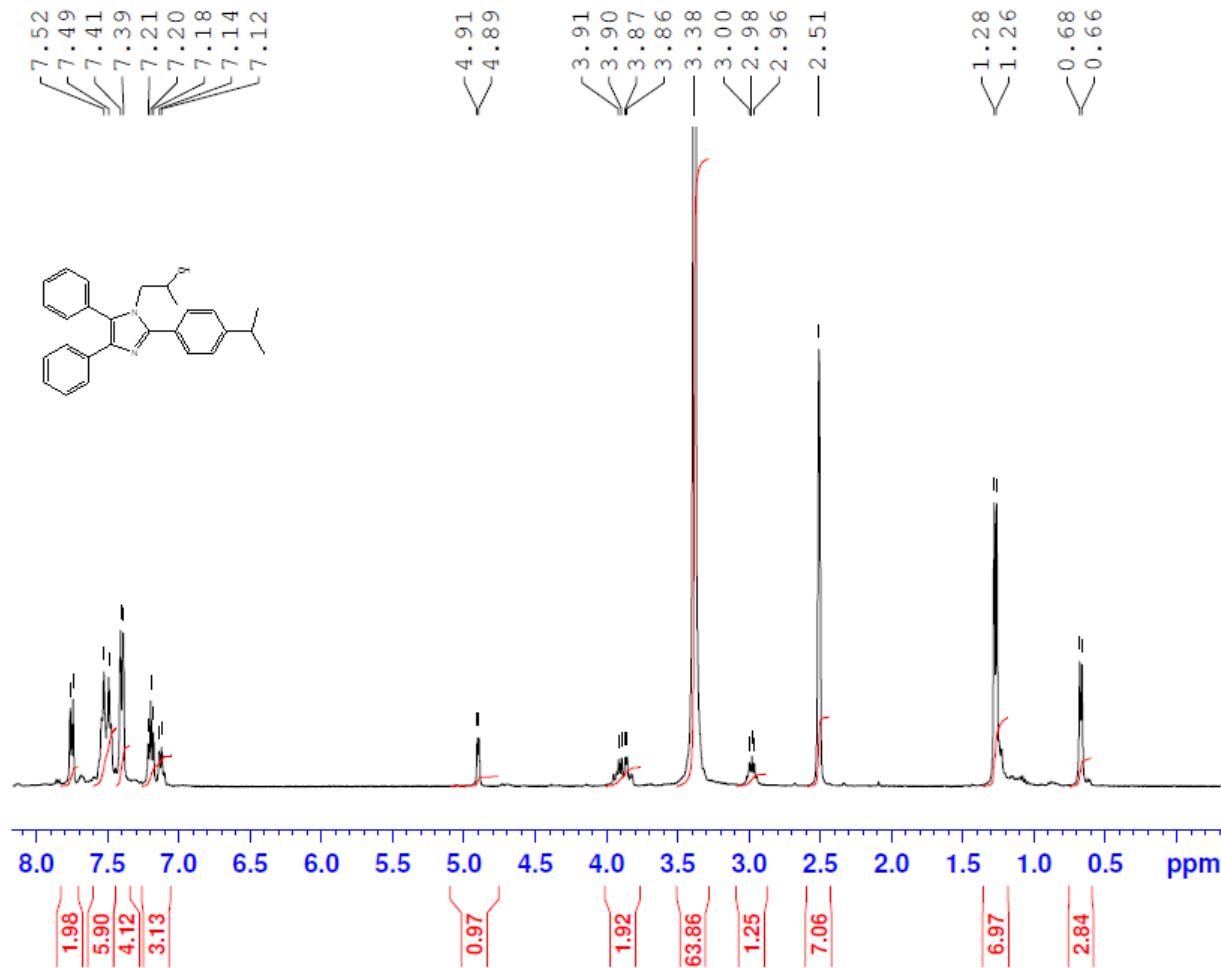
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SPOFFS5 0 Hz
SPW5 7.72189999 W

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CPDPRG[2] waltz16
P3 12.30 usec
P4 24.60 usec
PCPD2 90.00 usec
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PLW12 0.41091001 W

F2 - Processing parameters
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SF 100.6127690 MHz
WDW EM
SSB 0
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Fig. S4 : ^1H , ^{13}C NMR and dept-135 spectra of 5d

IP
proton_su DMSO {C:\nmr-data} Student 12



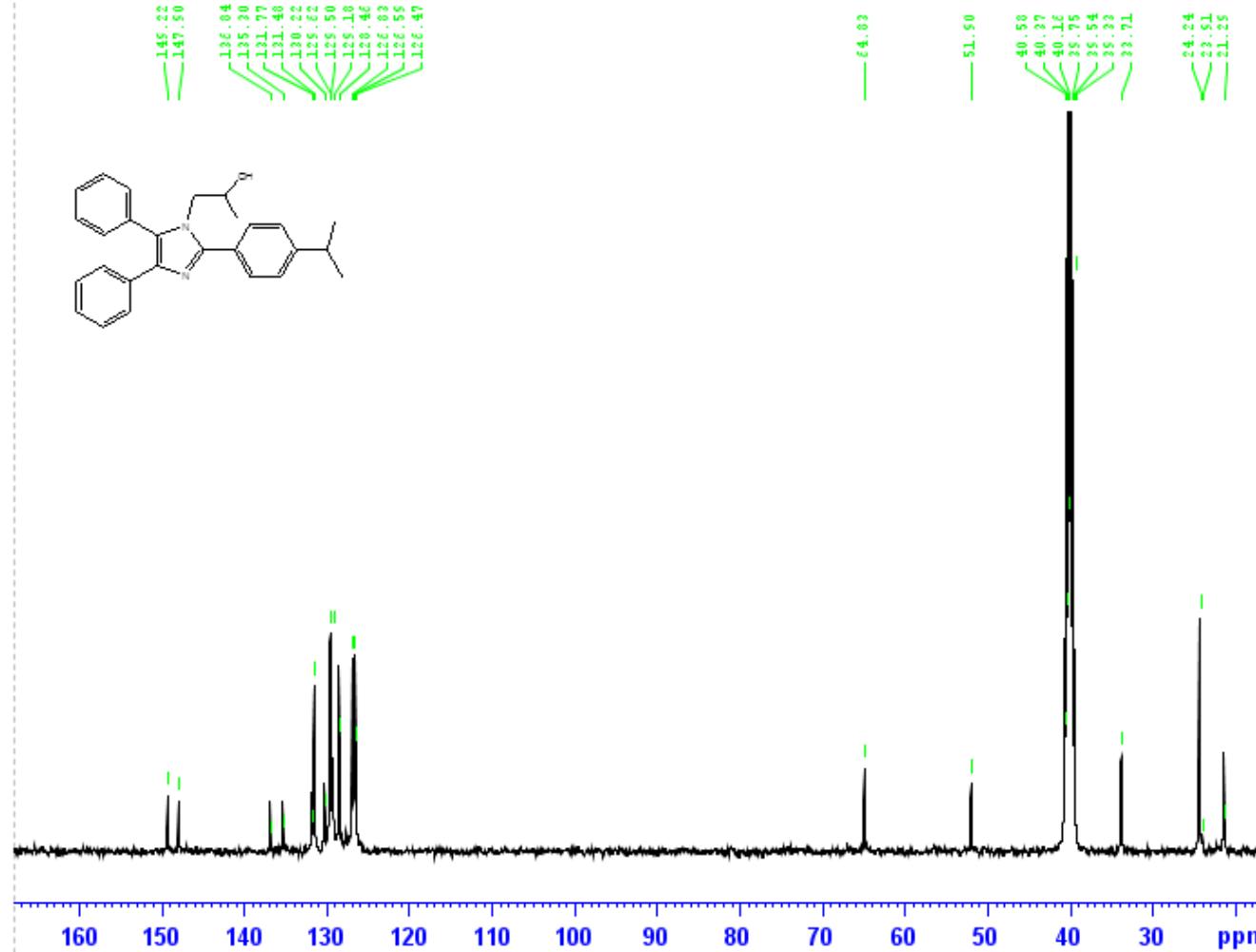
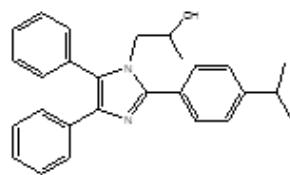
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FIDRES 0.122266 Hz
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RG 120.97
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DE 6.50 usec
TE 298.1 K
D1 1.0000000 sec
TDO 1

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NUC1 1H
P1 12.00 usec
PLW1 22.00000000 W

F2 - Processing parameters
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SF 400.1300000 MHz
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SSB 0
LB 0.30 Hz
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IP
c13_su DMSO {C:\nmr-data} Student 12



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PROCNO 1

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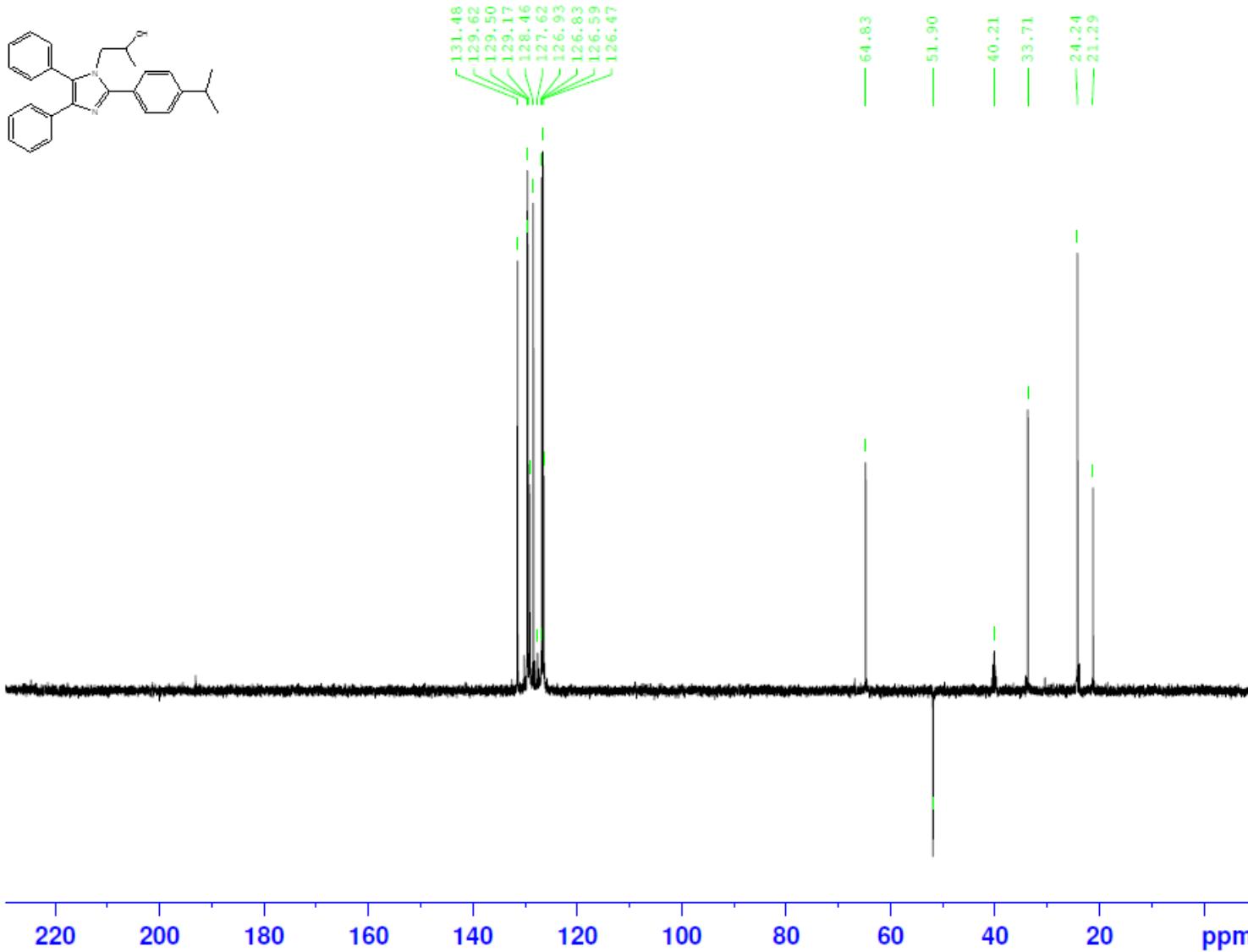
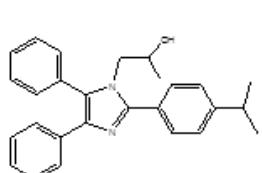
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RG 199.04
DW 20.000 usec
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TE 298.1 K
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D1L 0.03000000 sec
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PLW13 0.33284000 W

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IP
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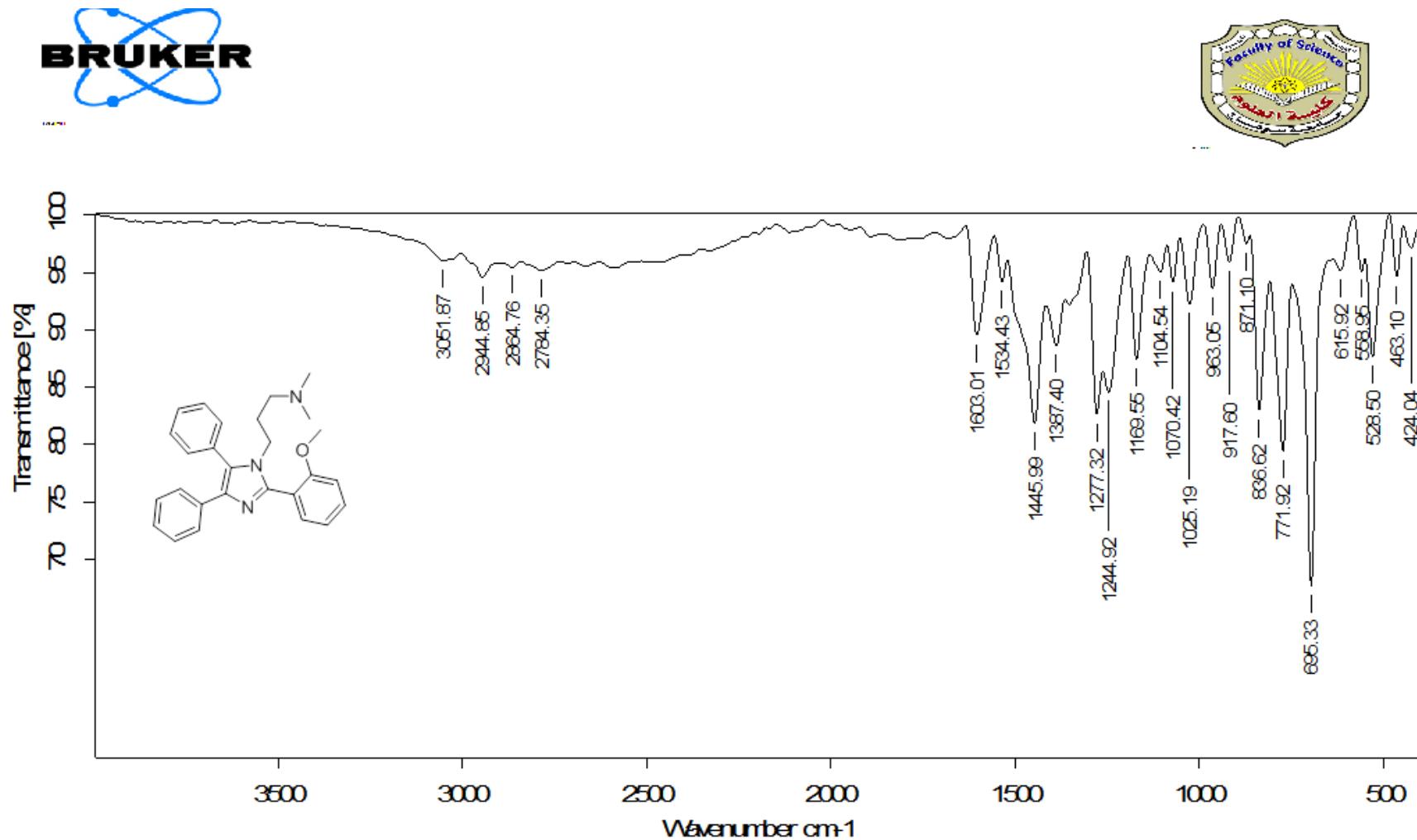
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AQ 1.3631488 sec
RG 199.04
DW 20.800 usec
DE 6.50 usec
TE 298.2 K
CNST2 145.000000
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D12 0.00002000 sec
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NUC1 13C
P1 9.50 usec
P13 2000.00 usec
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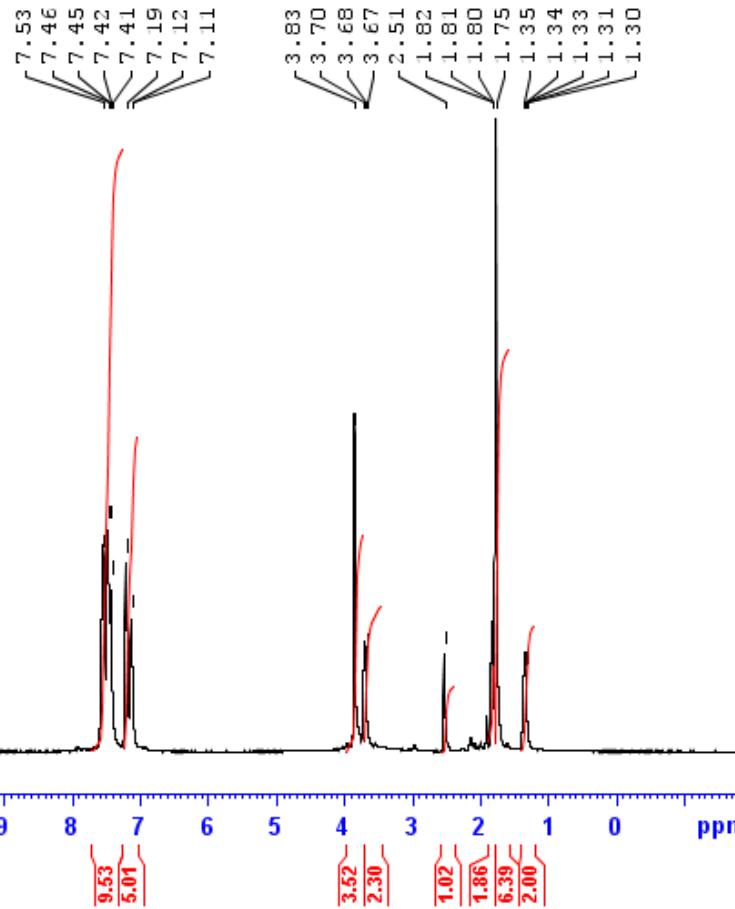
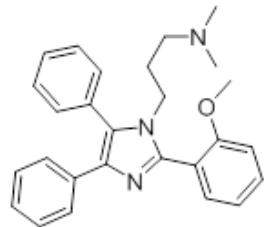
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PLW12 0.41091001 W

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Fig. S5 : IR, ^1H and ^{13}C NMR spectra of 5e



T-2
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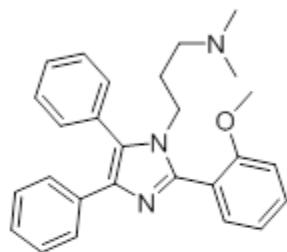


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FIDRES 0.122266 Hz
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RG 68.22
DW 62.400 usec
DE 6.50 usec
TE 300.2 K
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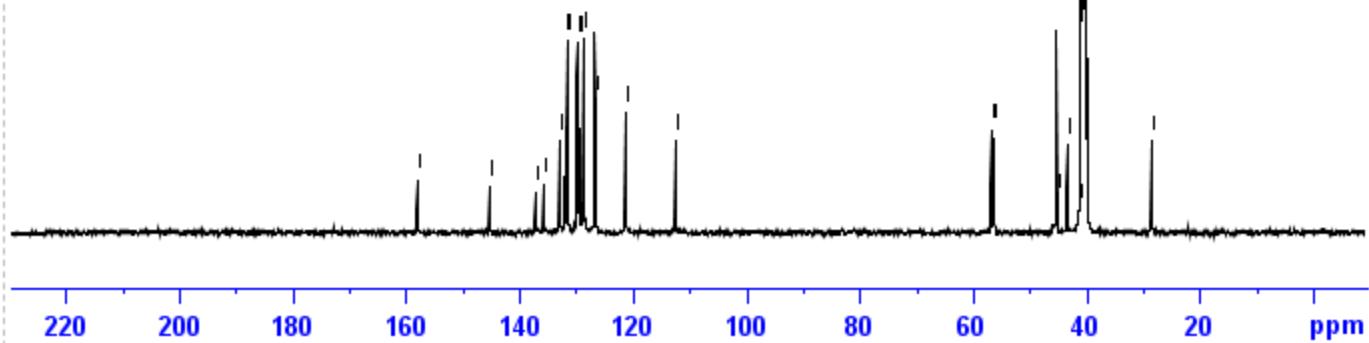
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T-2
c13_su DMSO {C:\nmr-data} Student 18



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126.44
126.32
121.01
112.14

56.45
50.02
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43.06
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28.17



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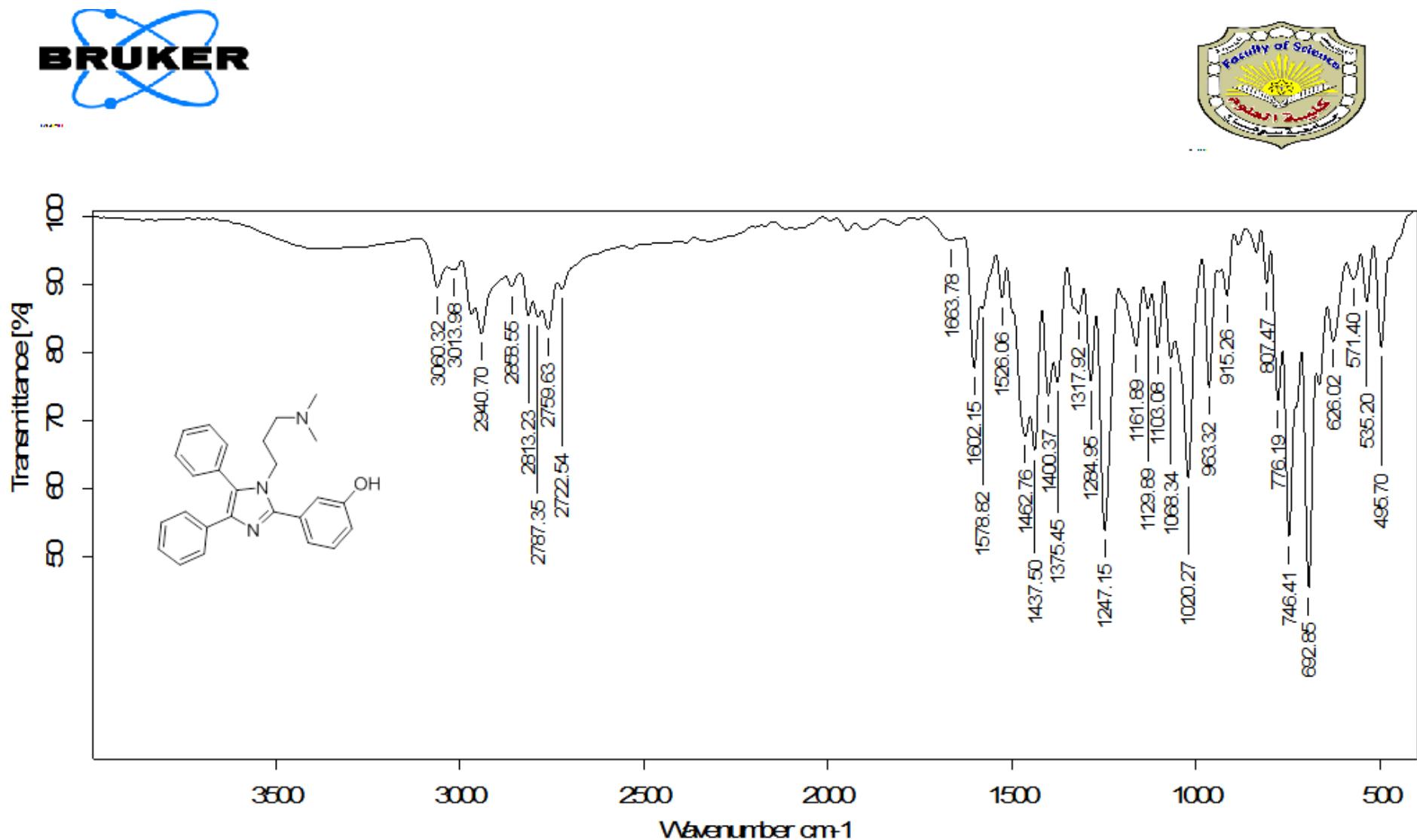
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P1 9.50 usec
PLW1 56.00000000 W

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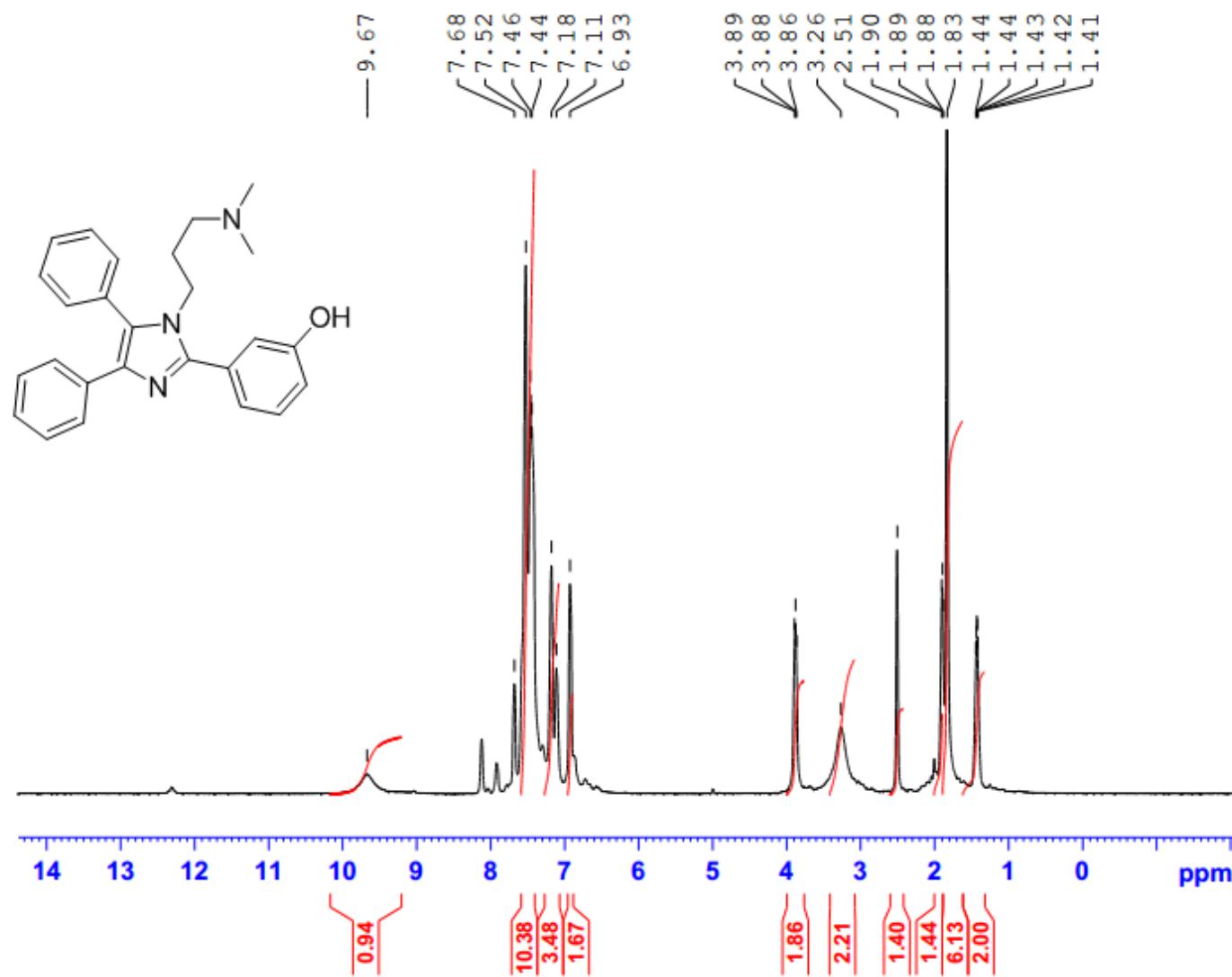
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Fig. S6 : IR, ^1H and ^{13}C NMR spectra of 5f



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T-9
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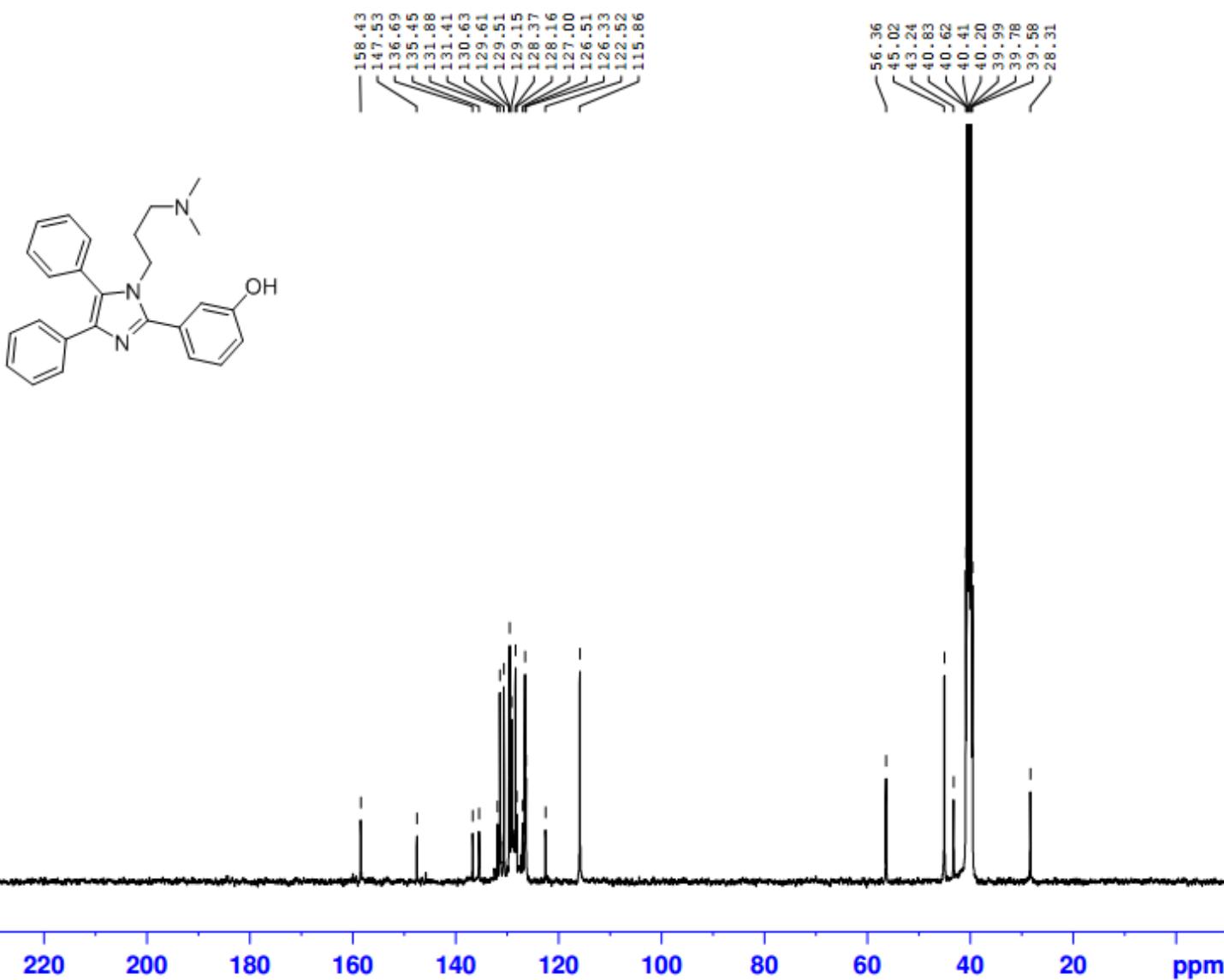
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FIDRES 0.122266 Hz
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RG 120.97
DW 62.400 usec
DE 6.50 usec
TE 323.2 K
D1 1.0000000 sec
TDO 1

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NUC1 1H
P1 12.00 usec
PLW1 22.00000000 W

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T-9
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EXPNO 240
PROCNO 1

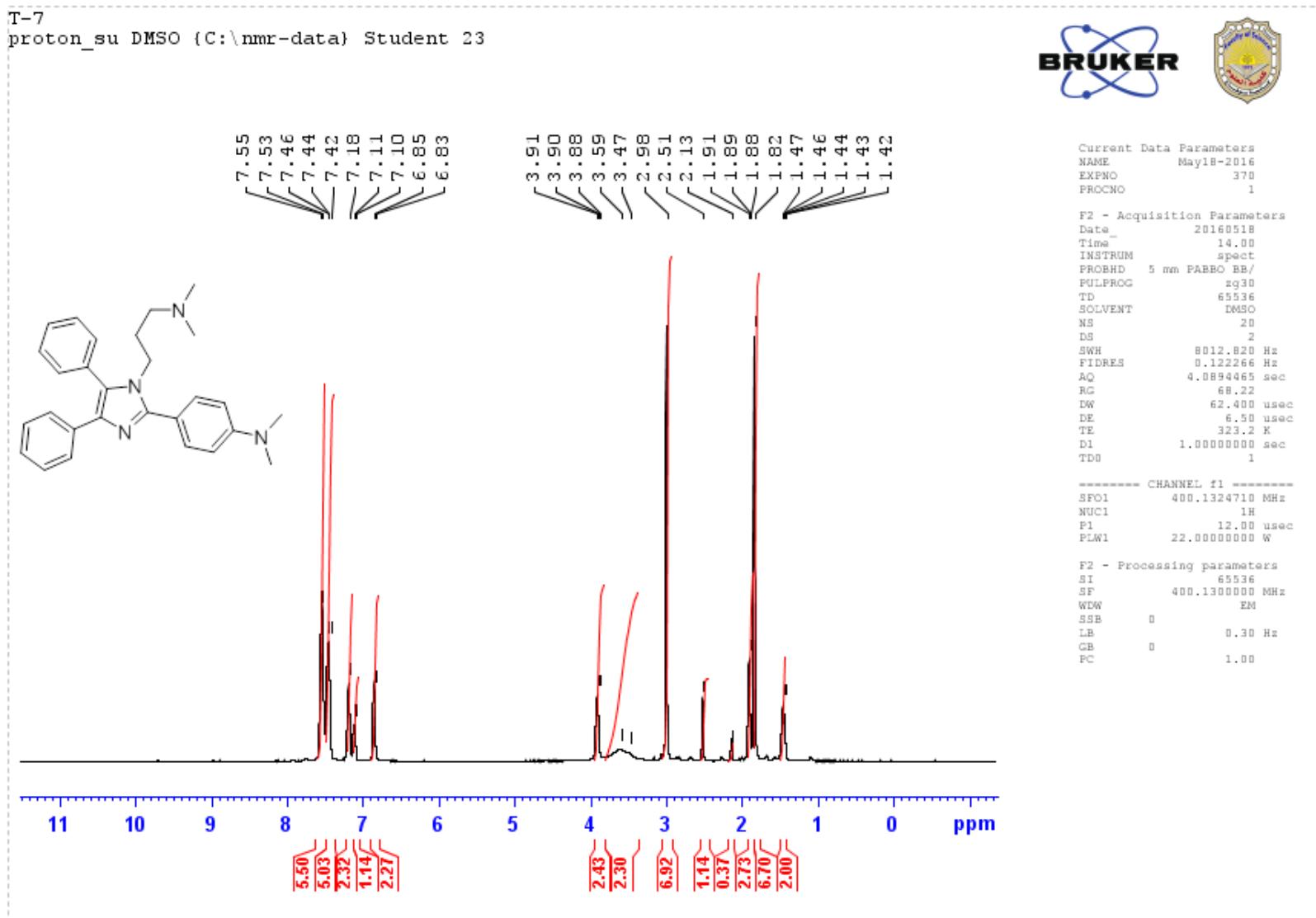
F2 - Acquisition Parameters
Date_ 20160523
Time 21.02
INSTRUM spect
PROBHD 5 mm PABBO BB/
PULPROG zgpg30
TD 65536
SOLVENT DMSO
NS 2200
DS 4
SWH 24038.461 F
FIDRES 0.366798 F
AQ 1.3631488 s
RG 175.84
DW 20.800 t
DE 6.50 t
TE 323.2 F
D1 2.00000000 s
D11 0.03000000 s
TDO 1

----- CHANNEL f1 -----
SFO1 100.6238364 M
NUC1 13C
P1 9.50 t
PLW1 56.00000000 V

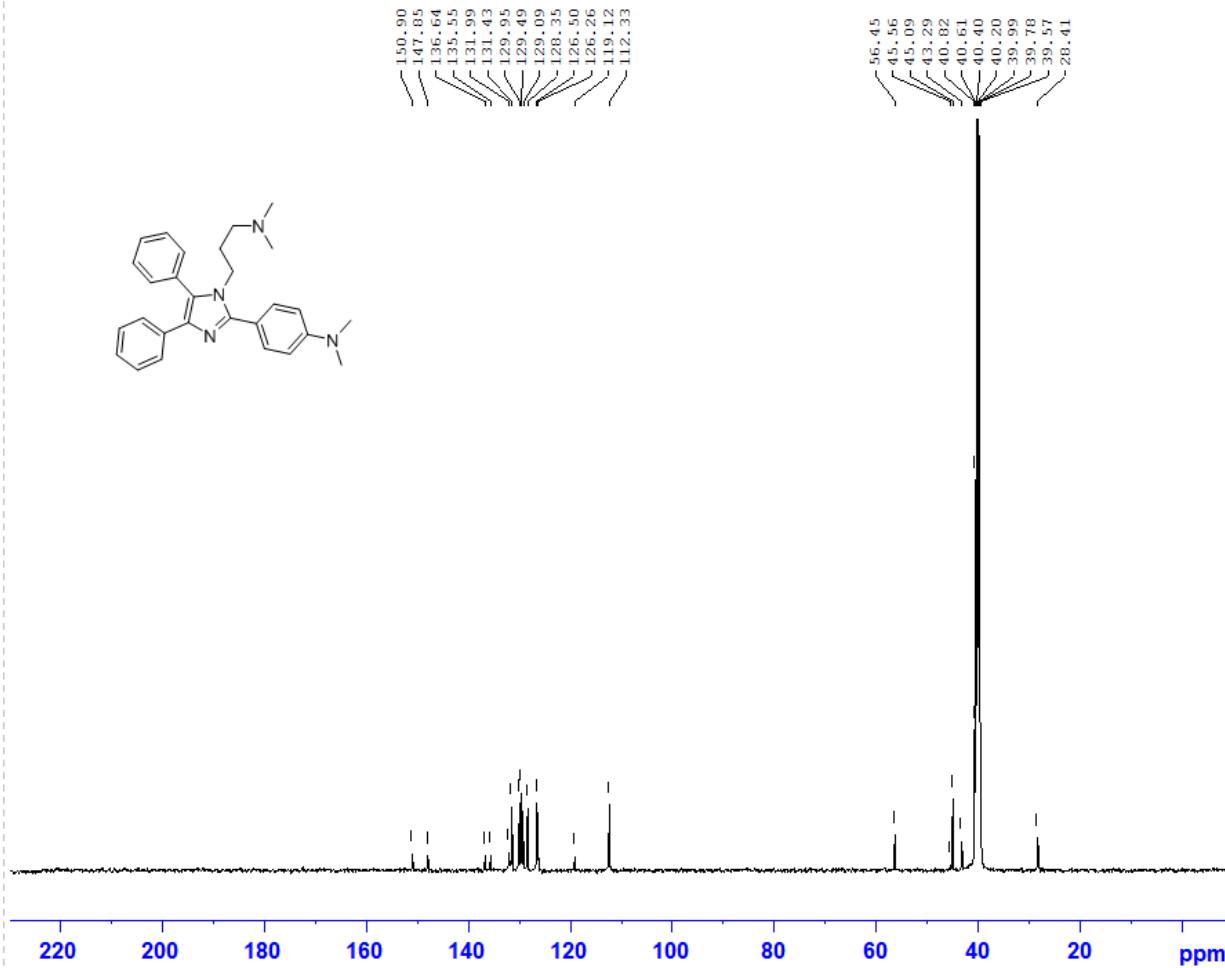
----- CHANNEL f2 -----
SFO2 400.1316005 M
NUC2 1H
CPDPGR[2] waltz16
PCPD2 90.00 t
PLW2 22.00000000 V
PLW12 0.41091001 V
PLW13 0.33284000 V

F2 - Processing parameters:
SI 32768
SF 100.6127690 M
WDW EM
SSB 0
LB 6.00 F
GB 0
PC 1.40

Fig. S7 : ^1H and ^{13}C NMR spectra of 5g



T-7
c13_su DMSO {C:\nmr-data} Student 22



Current Data Parameters
NAME May22-2016
EXPNO 210
PROCNO 1

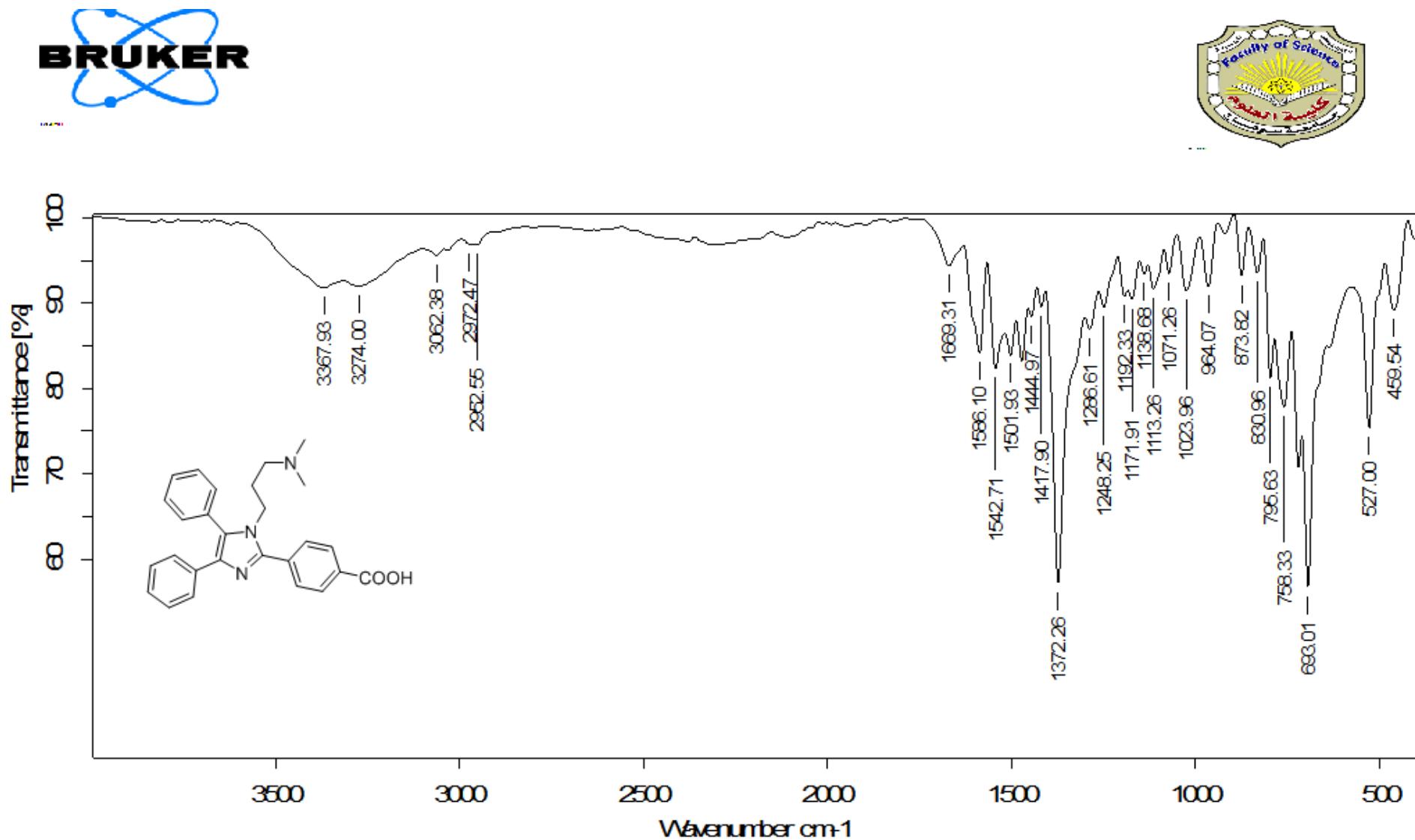
F2 - Acquisition Parameters
Date_ 20160523
Time 16.41
INSTRUM spect
PROBHD 5 mm PABBO BB/
PULPROG zgppg30
TD 65536
SOLVENT DMSO
NS 2200
DS 4
SWH 24038.461 Hz
FIDRES 0.366798 Hz
AQ 1.3631488 sec
RG 100.43
DW 20.800 usec
DE 6.50 usec
TE 323.2 K
D1 2.0000000 sec
D11 0.03000000 sec
TDO 1

===== CHANNEL f1 =====
SFO1 100.6238364 MHz
NUC1 ¹³C
P1 9.50 usec
PLW1 56.0000000 W

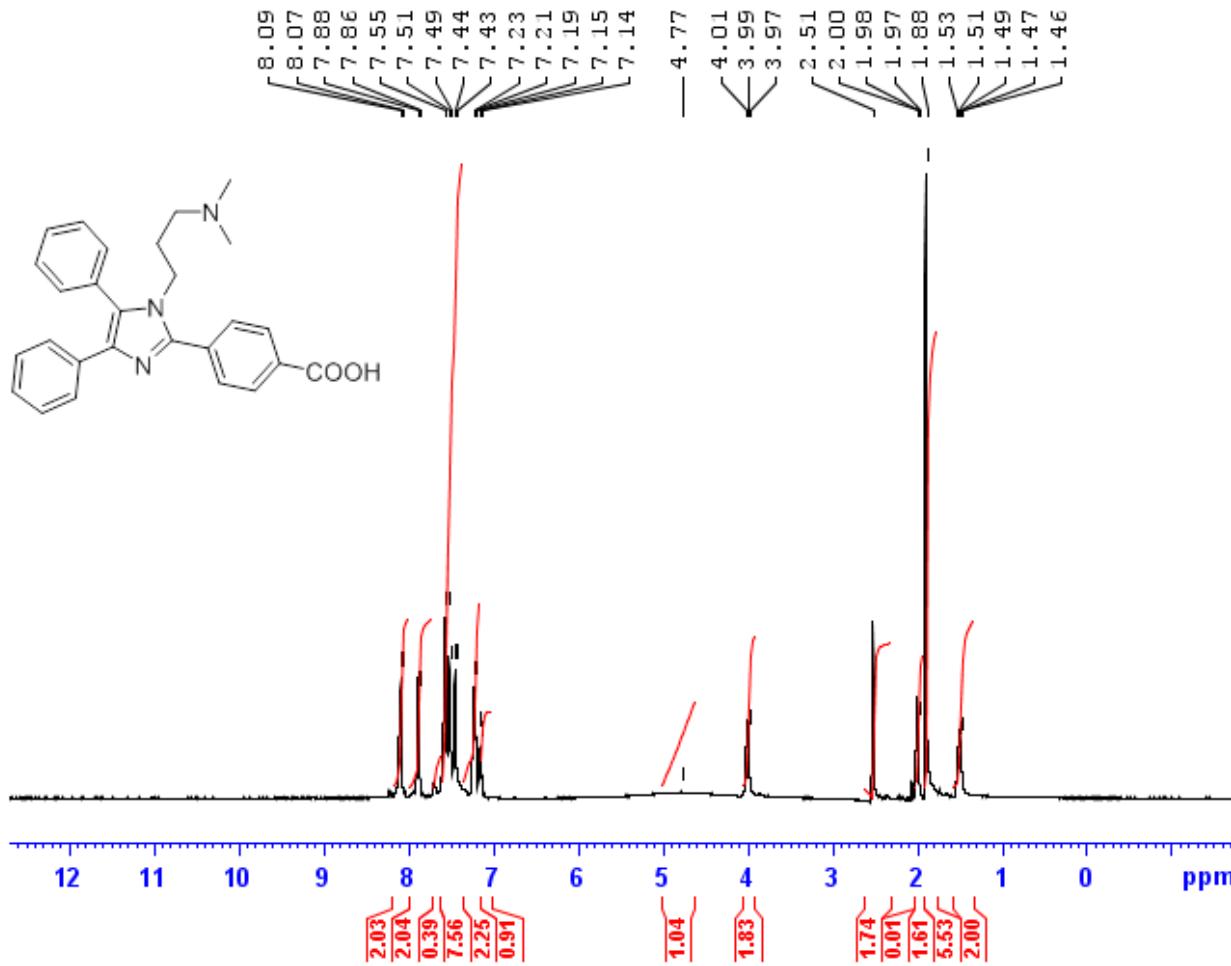
===== CHANNEL f2 =====
SFO2 400.1316005 MHz
NUC2 ¹H
CPDPG[2 waltz16
PCPD2 90.00 usec
PLW2 22.00000000 W
PLW12 0.41091001 W
PLW13 0.33284000 W

F2 - Processing parameters
SI 32768
SF 100.6127690 MHz
WDW EM
SSB 0
LB 6.00 Hz
GB 0
PC 1.40

Fig. S8 : IR, ^1H and ^{13}C NMR spectra of 5h



T-10
proton_su DMSO {C:\nmr-data} Student 11



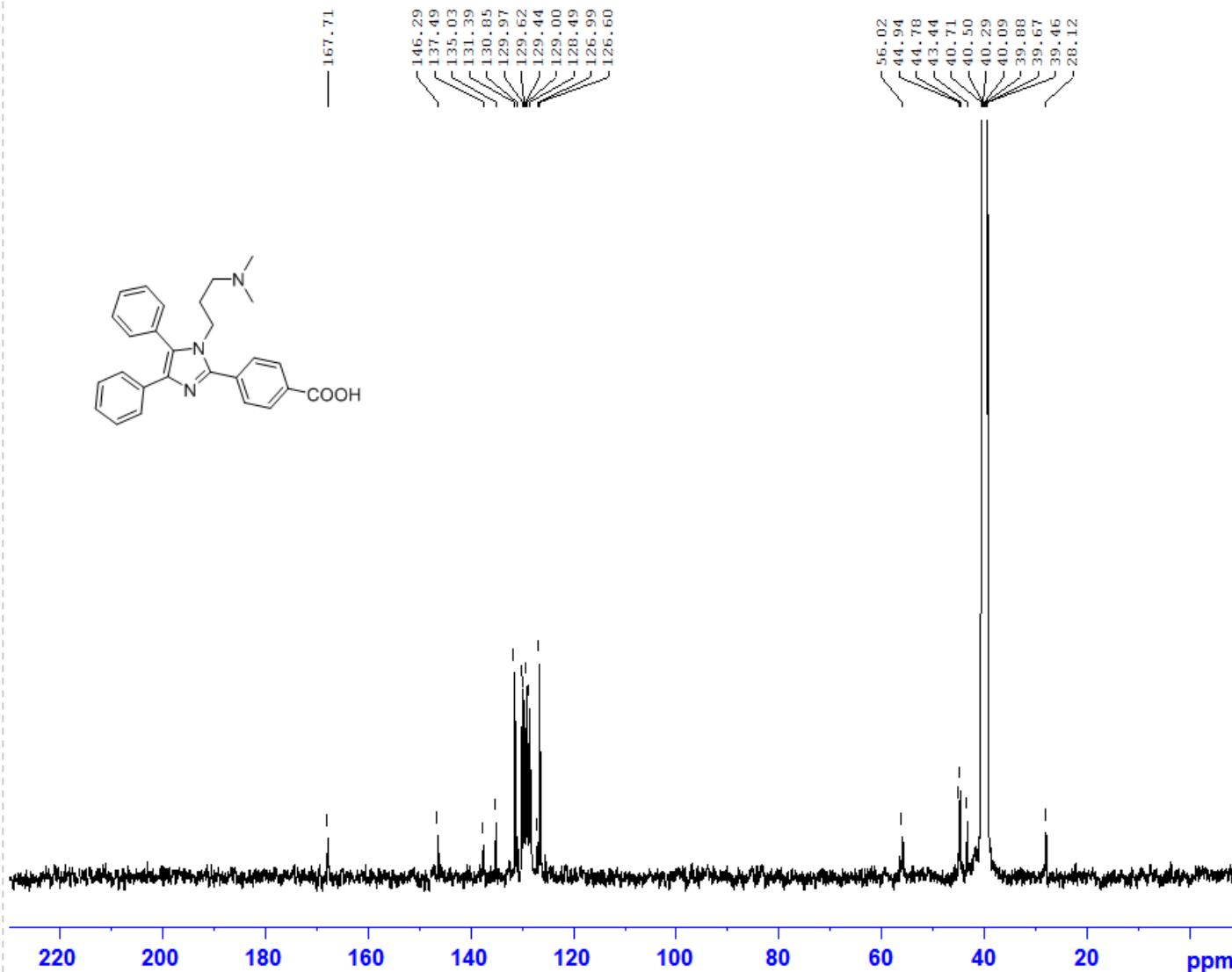
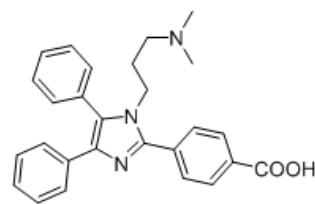
Current Data Parameters
NAME Jun01-2016
EXPNO 110
PROCNO 1

F2 - Acquisition Parameters
Date 20160601
Time 12.43
INSTRUM spect
PROBHD 5 mm PABBO BB/
PULPROG zg30
TD 65536
SOLVENT DMSO
NS 20
DS 2
SWH 8012.820 Hz
FIDRES 0.122266 Hz
AQ 4.0894465 sec
RG 158.76
DW 62.400 usec
DE 6.50 usec
TE 308.1 K
D1 1.0000000 sec
TD0 1

----- CHANNEL f1 -----
SFO1 400.1324710 MHz
NUC1 1H
P1 12.00 usec
PLW1 22.0000000 W

F2 - Processing parameters
SI 65536
SF 400.1300000 MHz
WDW EM
SSB 0
LB 0.30 Hz
GB 0
PC 1.00

T-10
c13_su DMSO {C:\nmr-data} Student 17



Current Data Parameters
NAME Jun20-2016
EXPNO 150
PROCNO 1

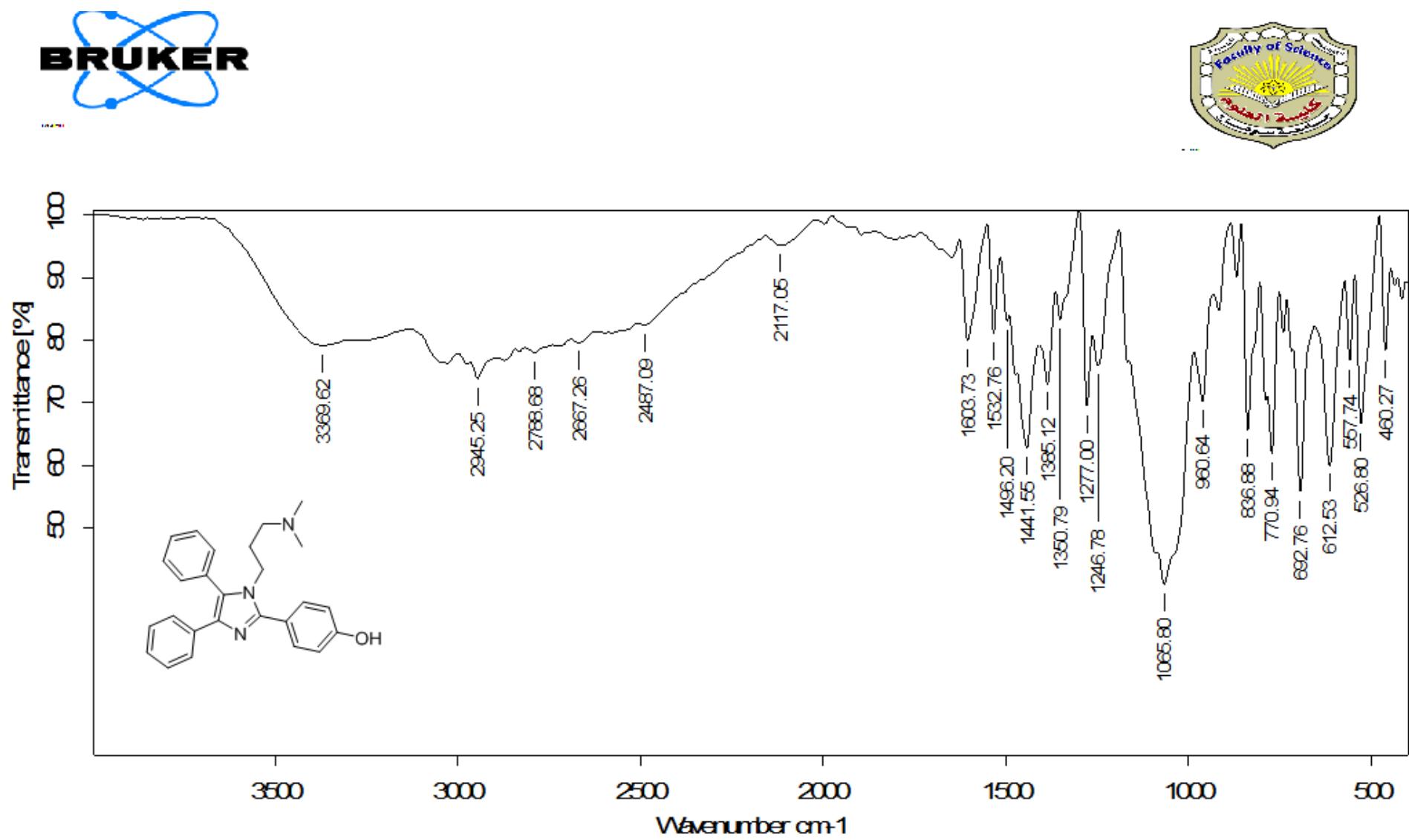
F2 - Acquisition Parameters
Date 20160620
Time 15.31
INSTRUM spect
PROBHD 5 mm PABBO BB/
PULPROG zgpg30
TD 65536
SOLVENT DMSO
NS 2200
DS 4
SWH 24038.461 Hz
FIDRES 0.366798 Hz
AQ 1.3631488 sec
RG 175.84
DW 20.800 usec
DE 6.50 usec
TE 313.1 K
D1 2.0000000 sec
D11 0.03000000 sec
TDO 1

===== CHANNEL f1 =====
SFO1 100.6238364 MHz
NUC1 13C
P1 9.50 usec
PLW1 56.00000000 W

===== CHANNEL f2 =====
SFO2 400.1316005 MHz
NUC2 1H
CPDPRG[2] waltz16
PCPD2 90.00 usec
PLW2 22.00000000 W
PLW12 0.41091001 W
PLW13 0.33284000 W

F2 - Processing parameters
SI 32768
SF 100.6127690 MHz
WDW EM
SSB 0
LB 6.00 Hz
GB 0
PC 1.40

Fig. S9 : IR, ^1H and ^{13}C NMR spectra of 5i



T-12
proton_su DMSO (C:\nmr-data) Student 4

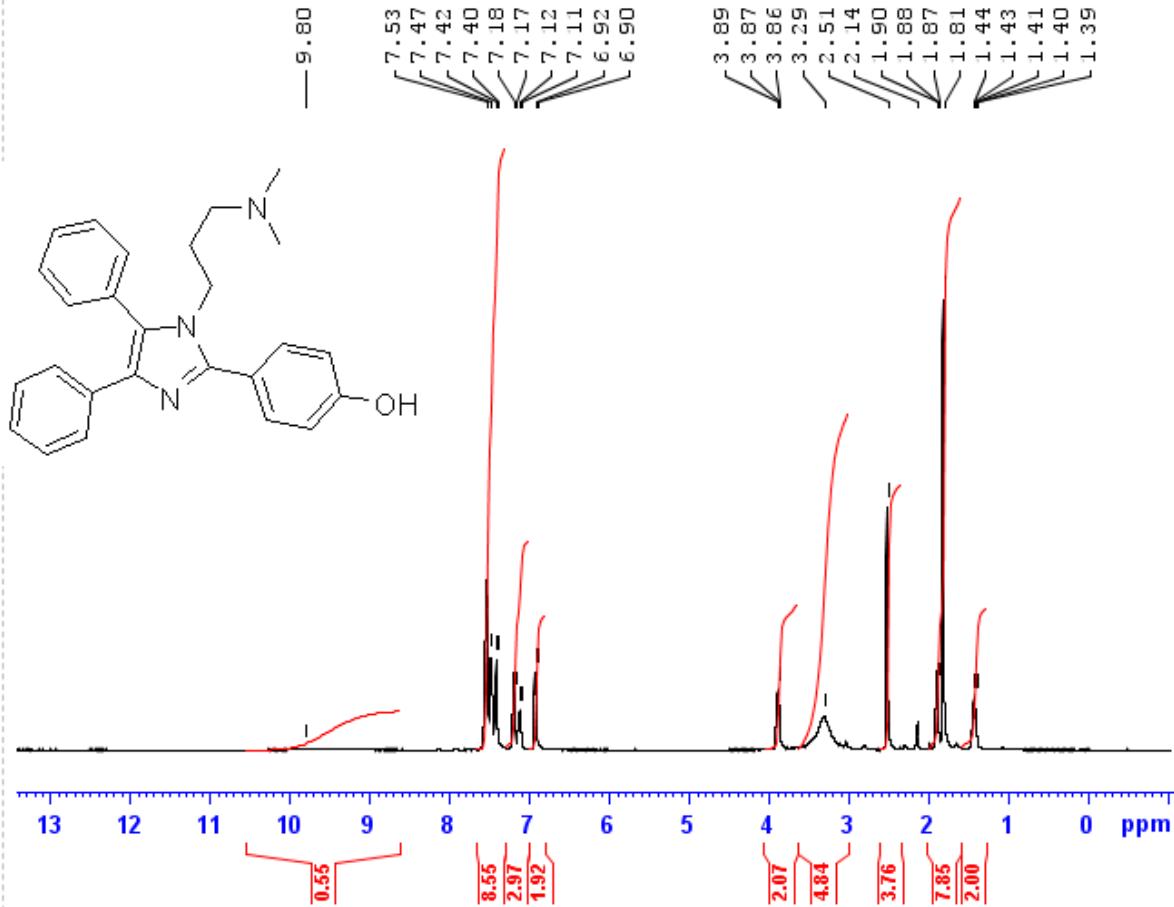


Current Data Parameters
NAME Jun01-2016
EXPNO 40
PROCNO 1

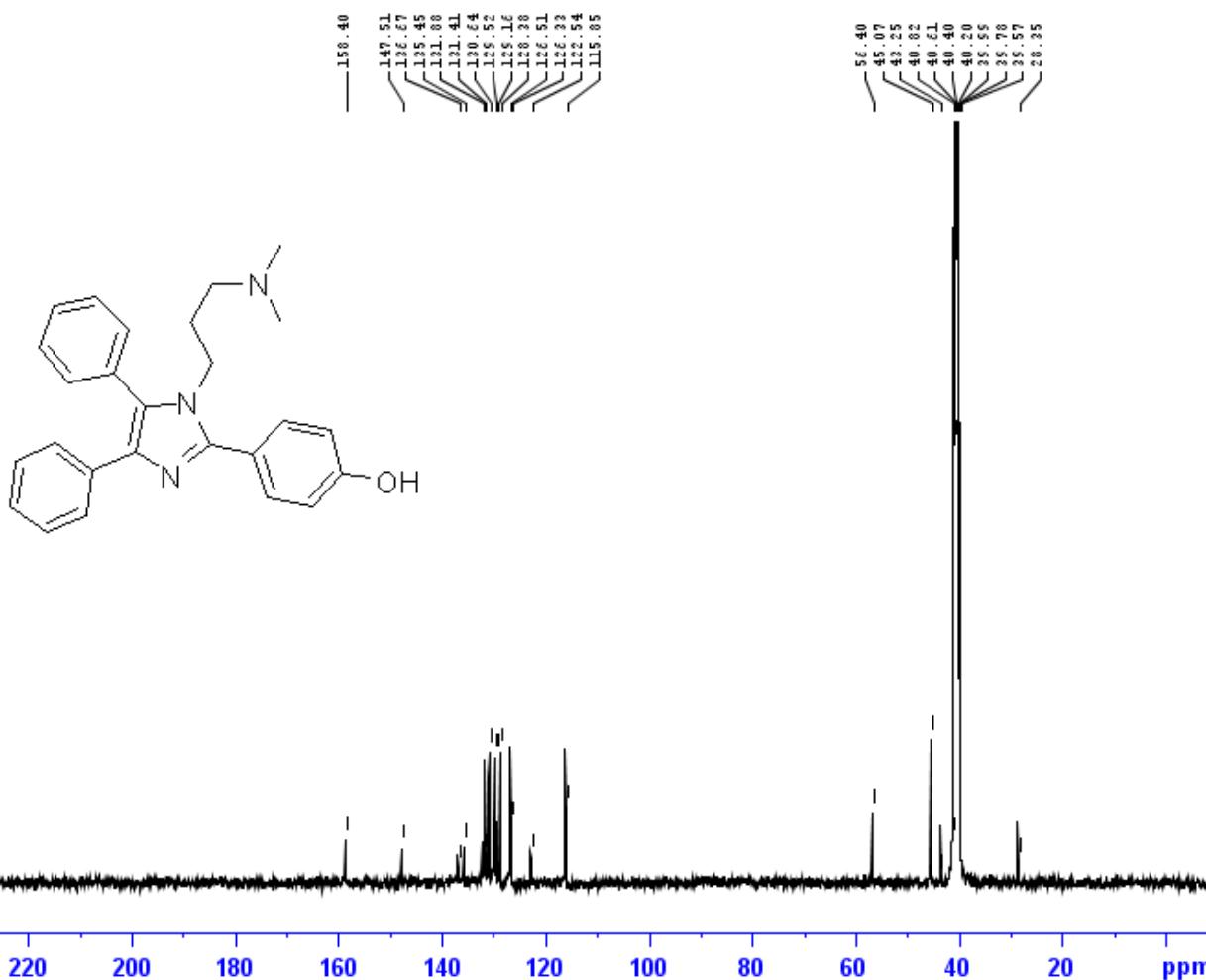
F2 - Acquisition Parameters
Date 20160601
Time 11.35
INSTRUM spect
PROBHD 5 mm PABBO BB/
PULPROG zg3D
TD 65536
SOLVENT DMSO
NS 100
DS 2
SWH 8012.820 Hz
FIDRES 0.122266 Hz
AQ 4.0894465 sec
RG 199.04
DW 62.400 usec
DE 6.50 usec
TE 308.1 K
D1 1.0000000 sec
TDO 1

----- CHANNEL f1 -----
SFO1 400.1324710 MHz
NUC1 1H
PI 12.00 usec
PLW1 22.0000000 W

F2 - Processing parameters
SI 65536
SF 400.1300000 MHz
WDW EM
SSB 0
LB 0.30 Hz
GB 0
PC 1.00



T-12
c13_su DMSO {C:\nmr-data} Student 20



Current Data Parameters
NAME Jurl3-2016
EXPNO 130
PROCNO 1

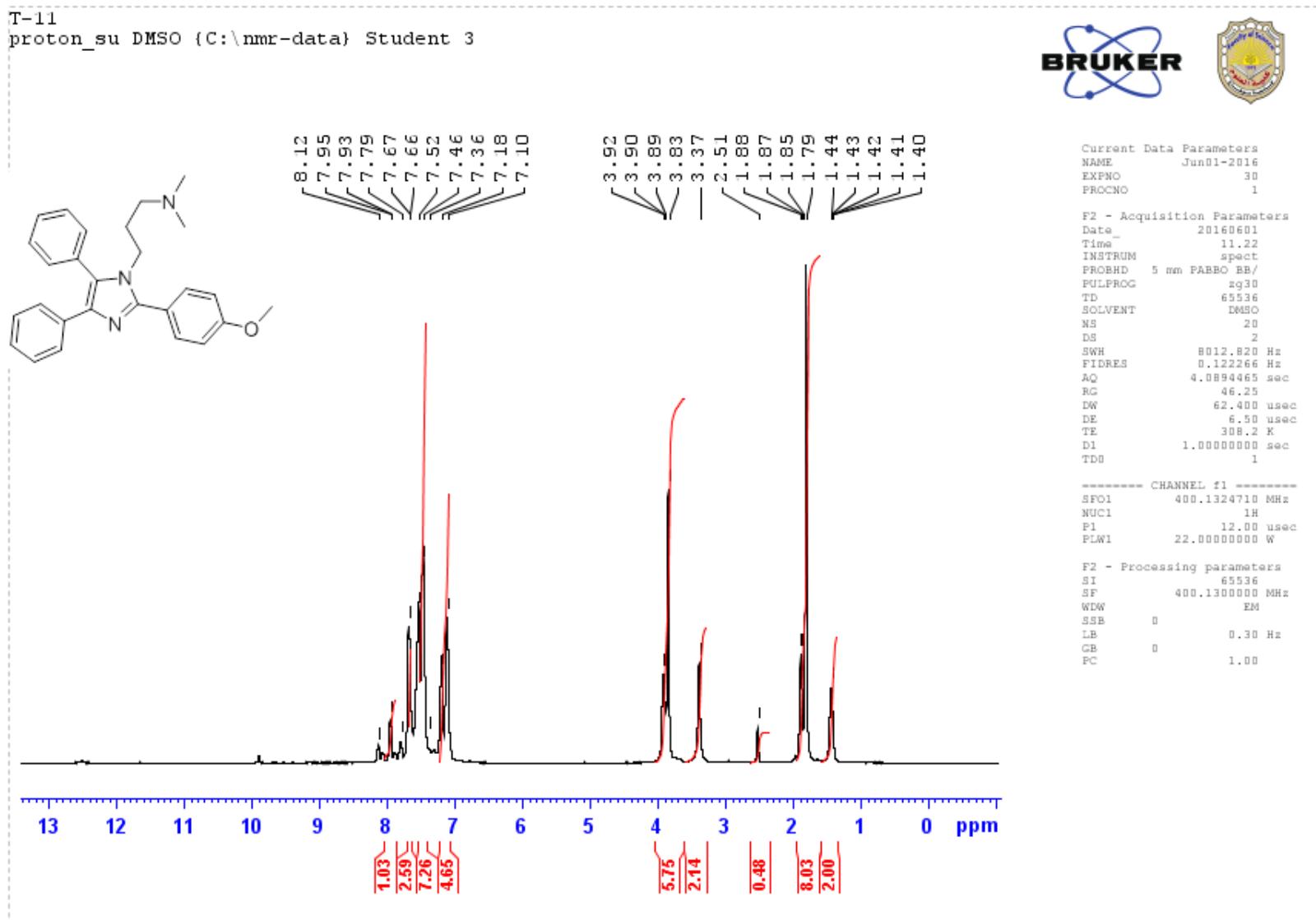
F2 - Acquisition Parameters
Date_ 20160613
Time 21.29
INSTRUM spect
PROBHD 5 mm PABBO BB/
PULPROG zgppg30
TD 65536
SOLVENT DMSO
NS 2200
DS 4
SWH 24038.461 Hz
FIDRES 0.3867938 Hz
AQ 1.3631488 sec
RG 159.04
DW 20.800 usec
DE 6.50 usec
TE 323.2 K
D1 2.00000000 sec
D11 0.03000000 sec
TDO 1

===== CHANNEL f1 =====
SF01 100.6220324 MHz
NUC1 13C
PL 9.50 usec
PLW1 56.00000000 W

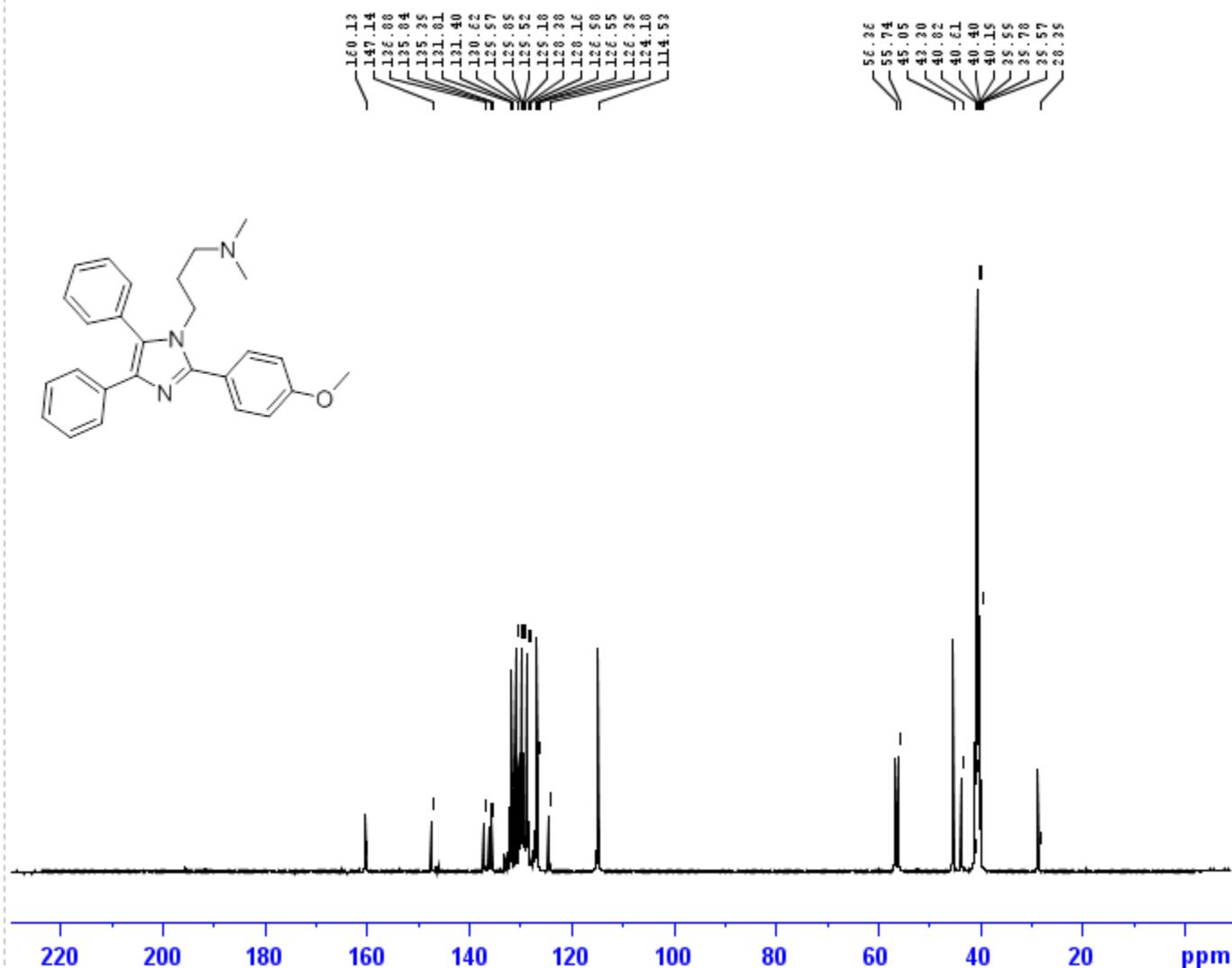
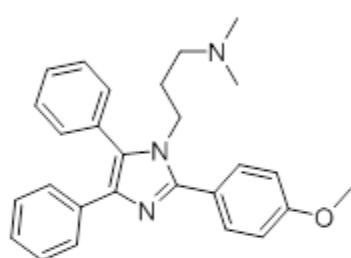
===== CHANNEL f2 =====
SF02 400.1316005 MHz
NUC2 1H
CPDPG[2] waltz16
PCPD2 90.00 usec
PLW2 22.00000000 W
PLW12 0.41051001 W
PLW13 0.23284000 W

F2 - Processing parameters
SI 32768
SF 100.6127650 MHz
WDW DM
SSB 0
LB 6.00 Hz
GB 0
PC 1.40

Fig. S10 : ^1H and ^{13}C NMR spectra of 5j



T-11
c13_su DMSO {C:\nmr-data} Student 19



Current Data Parameters
NAME Jun13-2016
EXPNO 120
PROCNO 1

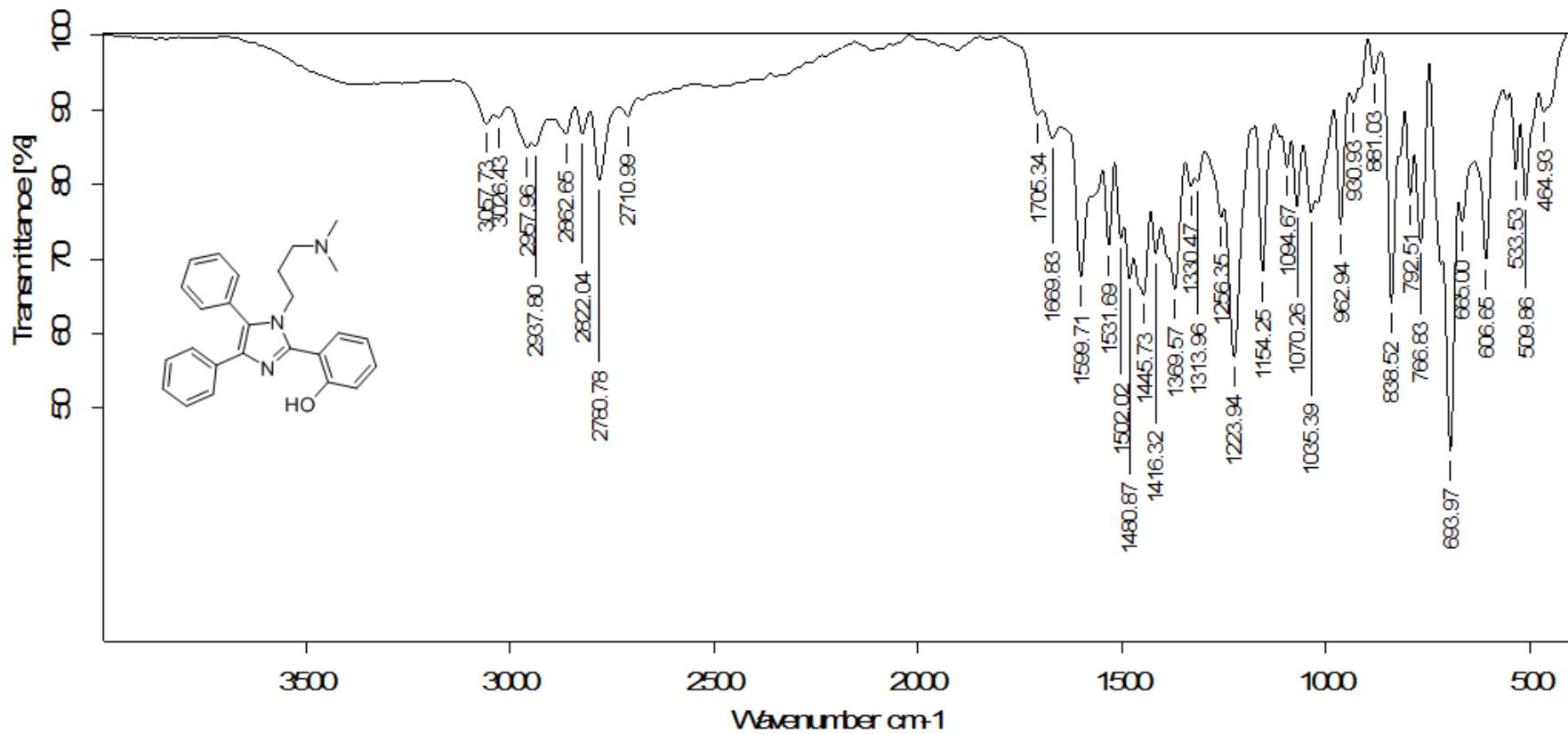
F2 - Acquisition Parameters
Date_ 20160613
Time 19.29
INSTRUM spect
PROBHD 5 mm PABBO BB/
PULPROG wpg30
TD 65536
SOLVENT DMSO
NS 2200
DS 4
SWH 24028.461 Hz
FIDRES 0.366758 Hz
AQ 1.3631480 sec
RG 175.84
DW 20.800 usec
DE 6.50 usec
TE 323.2 K
D1 2.0000000 sec
D11 0.03000000 sec
TD0 1

===== CHANNEL f1 =====
SF01 100.6238364 MHz
NUC1 13C
PL 9.50 usec
PLW1 56.00000000 W

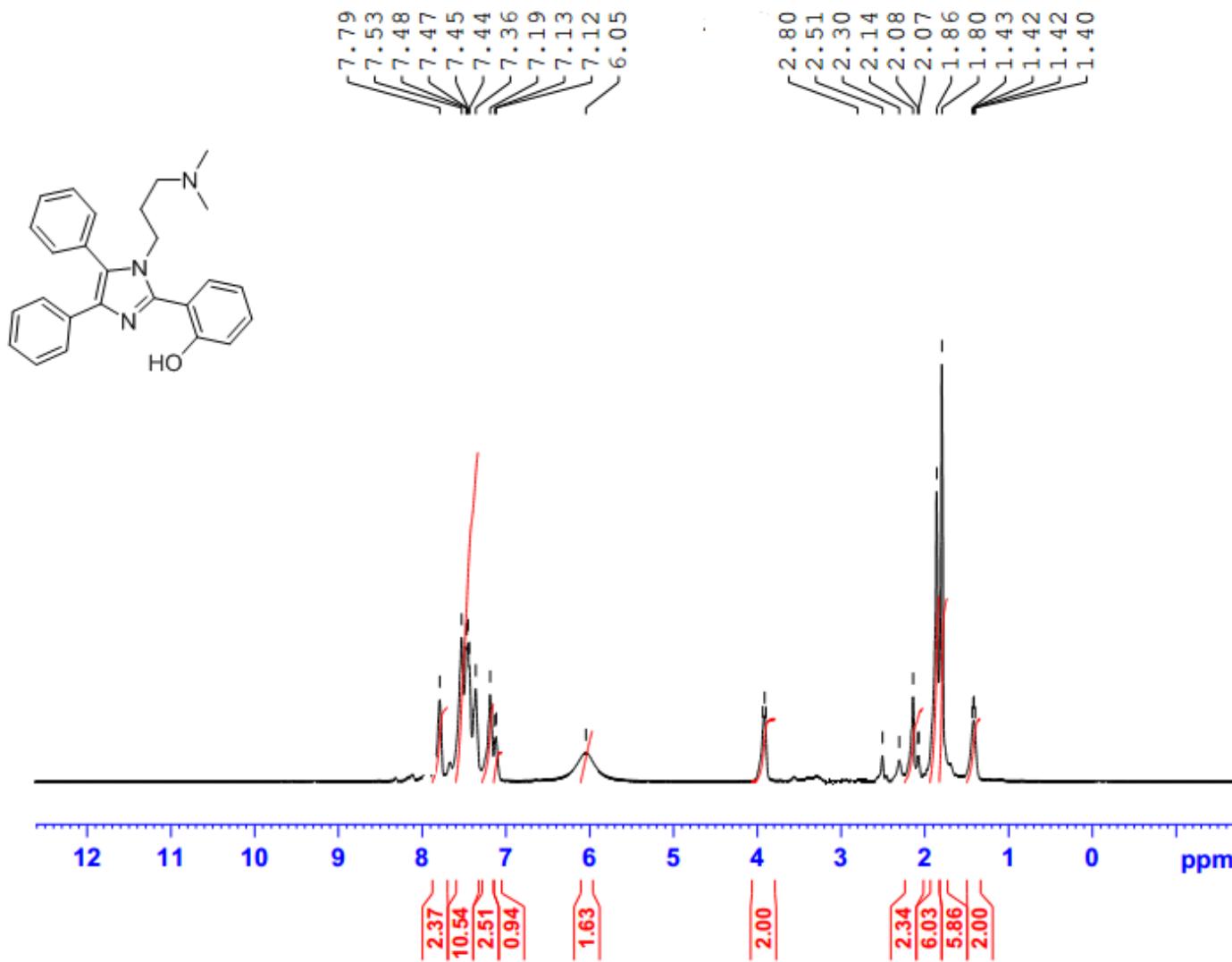
===== CHANNEL f2 =====
SF02 400.1316005 MHz
NUC2 1H
CPDPFG[2] waltz16
PCPD2 90.00 usec
PLW2 22.00000000 W
PLW12 0.41051001 W
PLW13 0.33284000 W

F2 - Processing parameters
SI 32768
SF 100.6127650 MHz
WDW EM
SSB 0
LB 6.00 Hz
GB 0
PC 1.40

Fig. S11 : IR, ^1H , and ^{13}C NMR spectra of 5k



T-1
proton_su DMSO {C:\nmr-data} Student 9



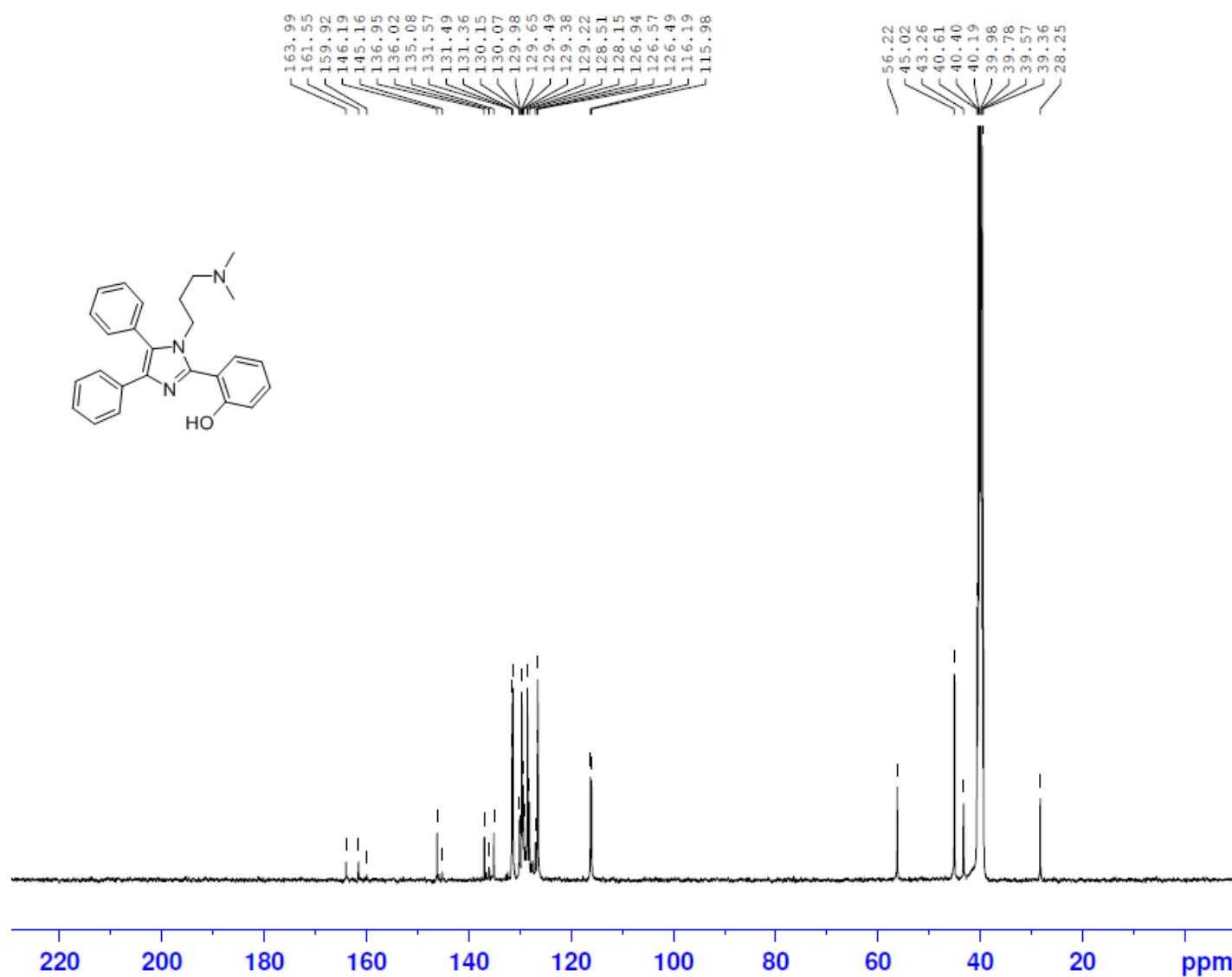
Current Data Parameters
NAME Jun01-2016
EXPNO 90
PROCNO 1

F2 - Acquisition Parameters
Date 20160601
Time 12.18
INSTRUM spect
PROBHD 5 mm PABBO BB/
PULPROG zg30
TD 65536
SOLVENT DMSO
NS 20
DS 2
SWH 8012.820 Hz
FIDRES 0.122266 Hz
AQ 4.0894465 sec
RG 24.76
DW 62.400 usec
DE 6.50 usec
TE 308.2 K
D1 1.0000000 sec
TDO 1

===== CHANNEL f1 =====
SPO1 400.1324710 MHz
NUC1 1H
P1 12.00 usec
PLW1 22.00000000 W

F2 - Processing parameters
SI 65536
SF 400.1300000 MHz
WDW EM
SSB 0 0.30 Hz
LB 0
GB 0 1.00
PC

T-1
c13_su DMSO {C:\nmr-data} Student 13



Current Data Parameters
NAME Aug24-2016
EXPNO 120
PROCNO 1

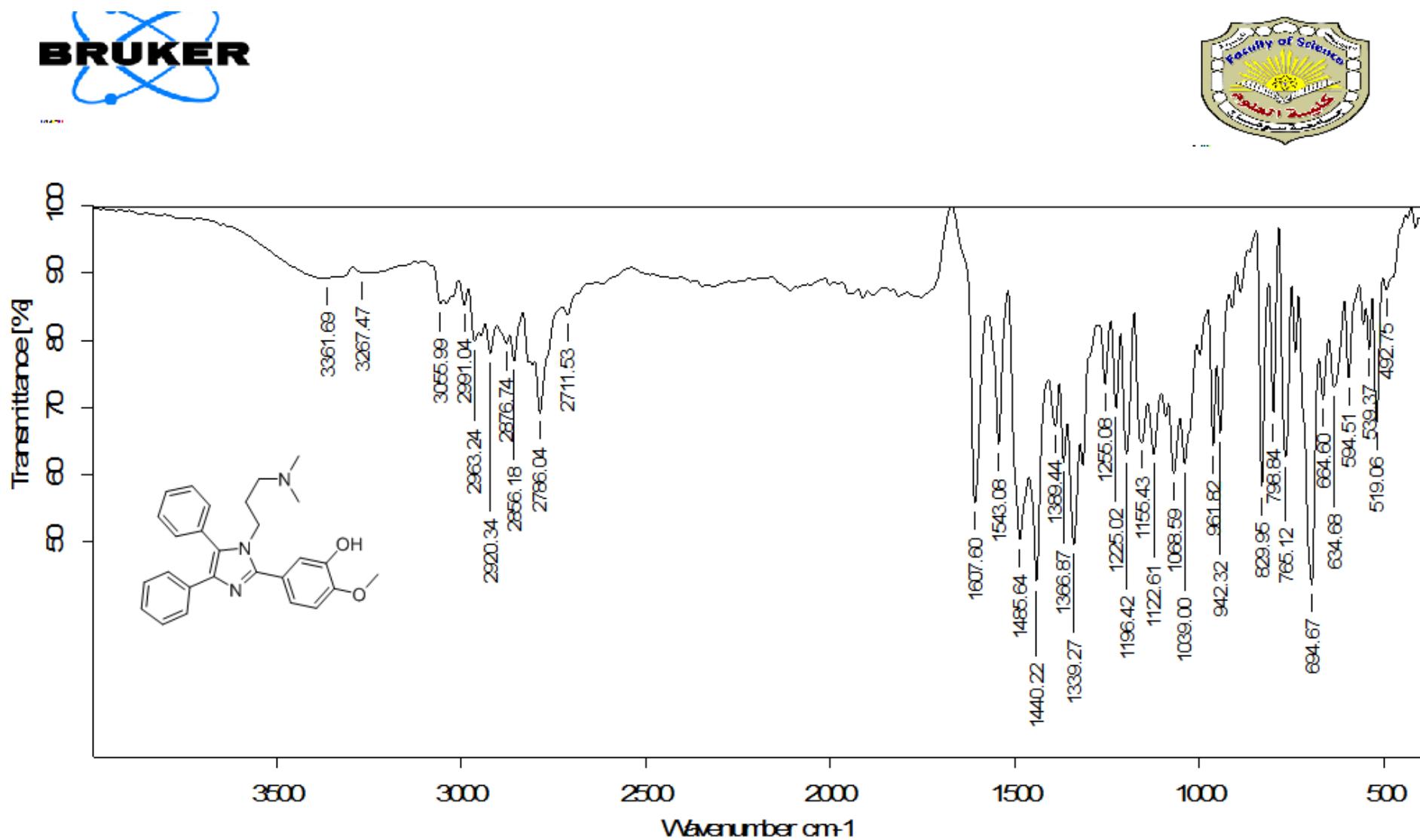
F2 - Acquisition Parameters
Date_ 20160824
Time 20.51
INSTRUM spect
PROBHD 5 mm PABBO BB/
PULPROG zpg30
TD 65536
SOLVENT DMSO
NS 2200
DS 4
SWH 24038.461 I
FIDRES 0.366798 I
AQ 1.3631488 s
RG 100.43
DW 20.800 t
DE 6.50 t
TE 295.9 I
D1 2.00000000 s
D11 0.03000000 s
TDO 1

===== CHANNEL f1 =====
SFO1 100.6238364 M
NUC1 13C
P1 9.50 t
PLW1 56.00000000 V

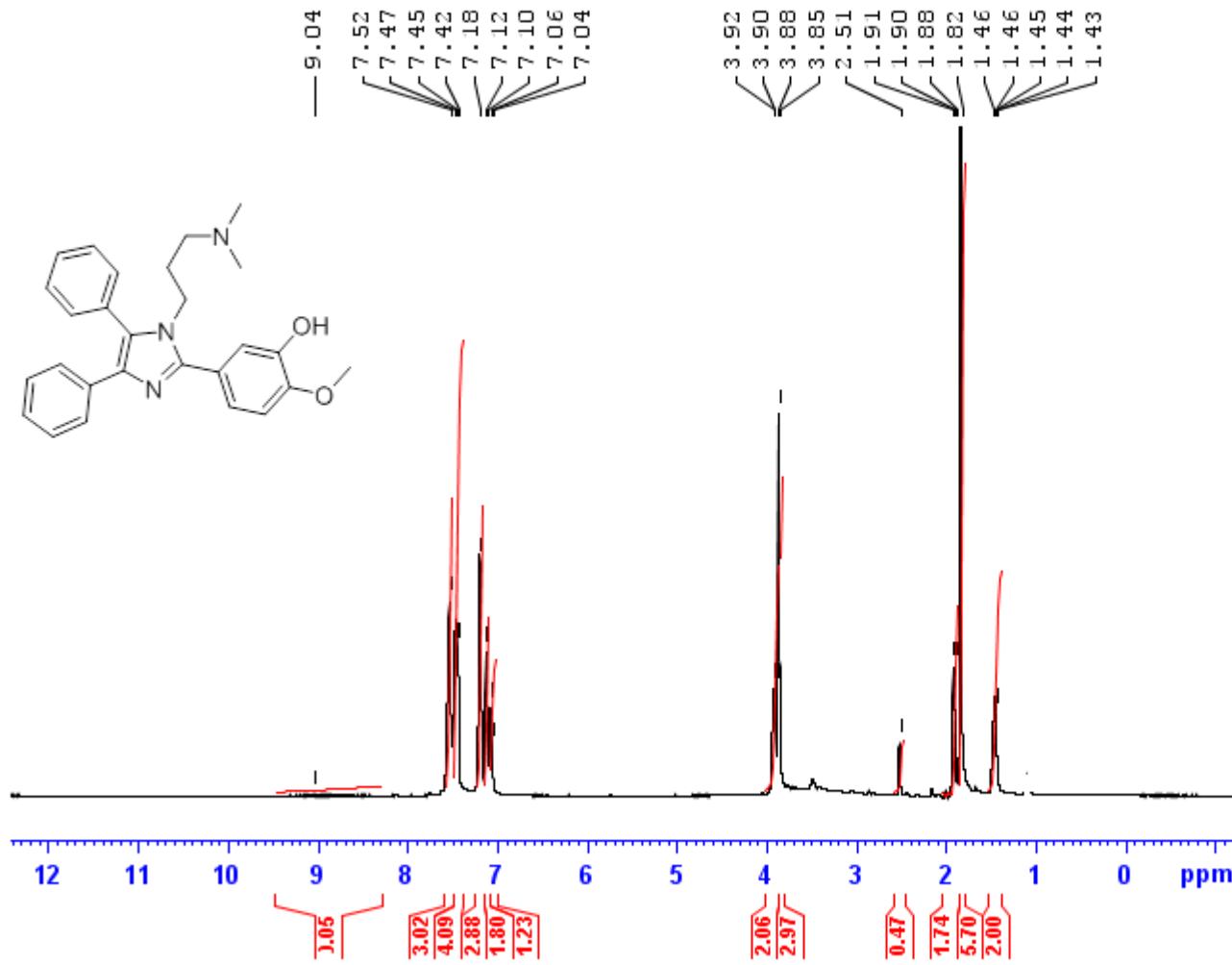
===== CHANNEL f2 =====
SFO2 400.1316005 M
NUC2 1H
CPDPGRG[2] waltz16
PCPD2 90.00 t
PLW2 22.00000000 V
PLW12 0.41091001 V
PLW13 0.33284000 V

F2 - Processing parameters
SI 32768
SF 100.6127690 M
WDW EM
SSB 0
LB 6.00 I
GB 0
PC 1.40

Fig. S12 : IR, ^1H , ^{13}C NMR and dept-135 spectra of 5l



T-5
proton_su DMSO (C:\nmr-data) Student 22



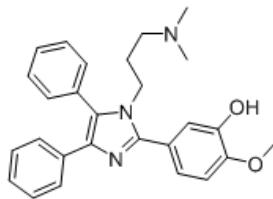
Current Data Parameters
NAME May18-2016
EXPNO 360
PROCNO 1

F2 - Acquisition Parameters
Date 20160518
Time 13.55
INSTRUM spect
PROBHD 5 mm PABBO BB/
PULPROG zg30
TD 65536
SOLVENT DMSO
NS 20
DS 2
SWH 8012.820 Hz
FIDRES 0.122266 Hz
AQ 4.0894465 sec
RG 68.22
DW 62.400 used
DE 6.50 used
TE 323.2 K
D1 1.0000000 sec
TDO 1

----- CHANNEL f1 -----
SF01 400.1324710 MHz
NUC1 1H
P1 12.00 used
PLW1 22.0000000 W

F2 - Processing parameters
SI 65536
SF 400.1300000 MHz
WDW EM
SSB 0
LB 0.30 Hz
GB 0
PC 1.00

T-5
c13_su DMSO {C:\nmr-data} Student 21



148.77
147.23
147.03
136.67
135.36
131.78
131.42
129.75
129.54
129.20
128.42
125.49
126.39
124.41
120.26
116.66
112.69

56.39
56.20
45.05
43.27
40.72
40.52
40.31
40.10
39.89
39.68
39.47
28.38

220 200 180 160 140 120 100 80 60 40 20 ppm



Current Data Parameters
NAME May22-2016
EXPNO 200
PROCNO 1

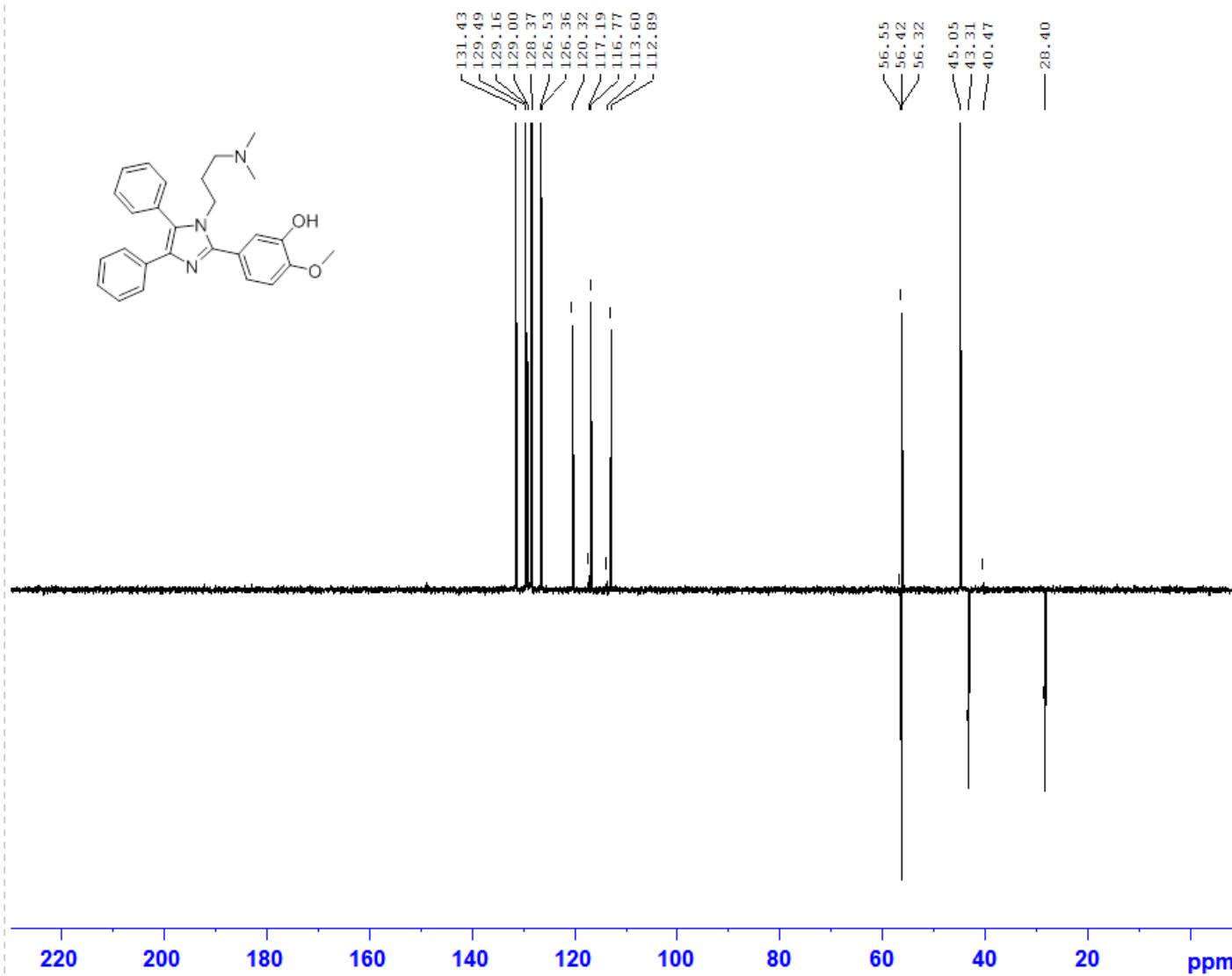
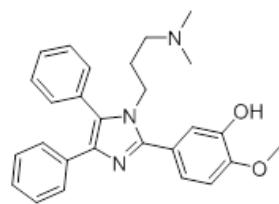
F2 - Acquisition Parameters
Date_ 20160523
Time_ 14.32
INSTRUM spect
PROBHD 5 mm PABBO BB/
PULPROG zpg30
TD 65536
SOLVENT DMSO
NS 2200
DS 4
SWH 24038.461 Hz
FIDRES 0.366798 Hz
AQ 1.3631488 sec
RG 100.43
DW 20.800 usec
DE 6.50 usec
TE 313.1 K
D1 2.00000000 sec
D11 0.03000000 sec
TD0 1

===== CHANNEL f1 =====
SFO1 100.6238364 MHz
NUC1 13C
P1 9.50 usec
PLW1 56.00000000 W

===== CHANNEL f2 =====
SFO2 400.1316005 MHz
NUC2 1H
CPDPRG[2] waltz16
PCPD2 90.00 usec
PLW2 22.00000000 W
PLW12 0.41091001 W
PLW13 0.33284000 W

F2 - Processing parameters
SI 32768
SF 100.6127690 MHz
WDW EM
SSB 0
LB 6.00 Hz
GB 0
PC 1.40

T-5
dept135_su DMSO {C:\nmr-data} Student 19



Current Data Parameters
NAME May29-2016
EXPNO 390
PROCNO 1

F2 - Acquisition Parameters
Date 20160529
Time 23.53
INSTRUM spect
PROBHD 5 mm PABBO BB/
PULPROG deptspl35
TD 65536
SOLVENT DMSO
NS 256
DS 4
SWH 24038.461 Hz
FIDRES 0.366798 Hz
AQ 1.3631488 sec
RG 199.04
DW 20.800 usec
DE 6.50 usec
TE 328.2 K
CNST2 145.0000000
D1 2.0000000 sec
D2 0.00344828 sec
D12 0.00002000 sec
TDO 1

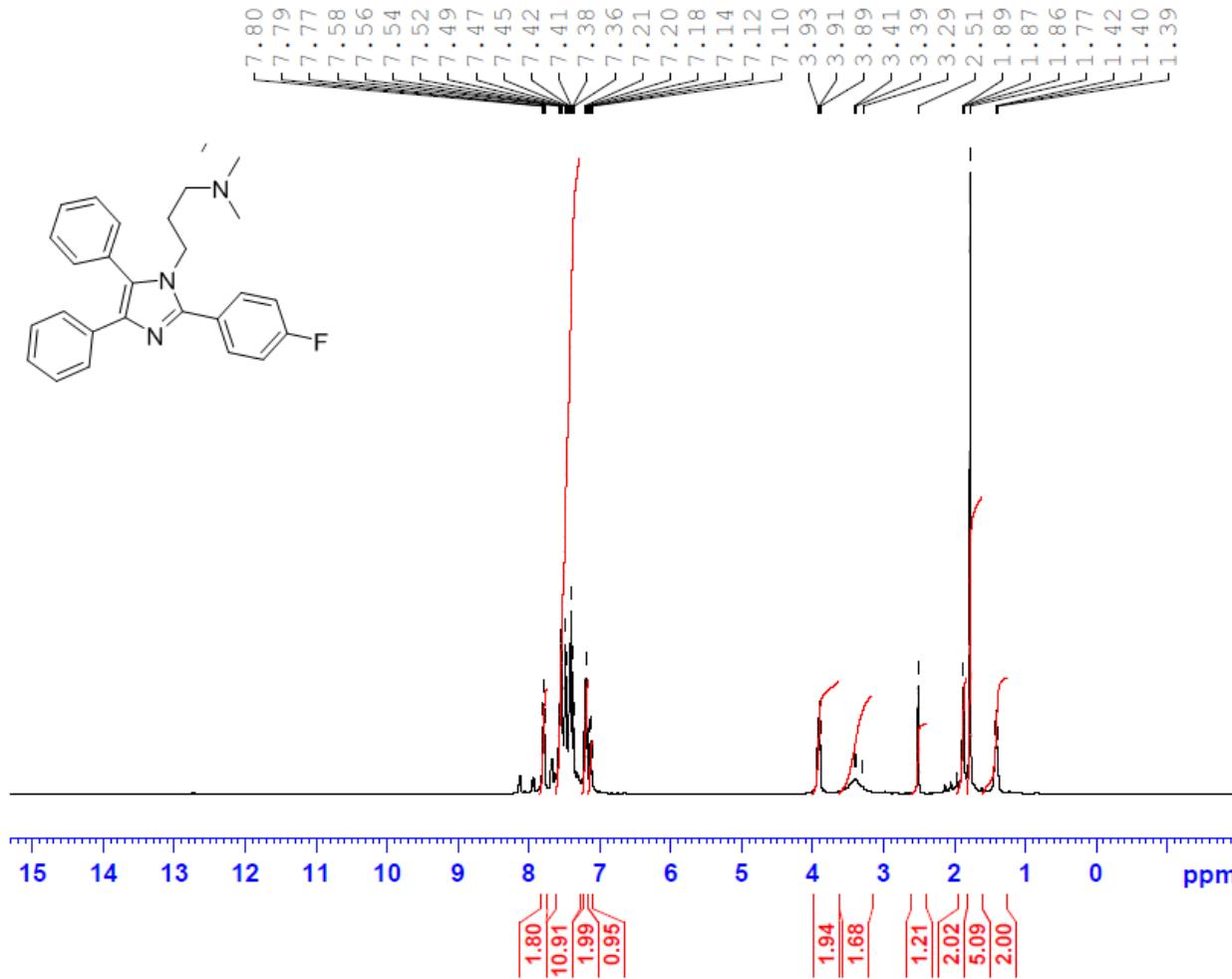
===== CHANNEL f1 =====
SFO1 100.6238364 MHz
NUC1 ¹³C
P1 9.50 usec
P13 2000.00 usec
PLW0 0 W
PLW1 56.00000000 W
SPNAM[5] Crp60comp.4
SPOAL5 0.500
SPOFF55 0 Hz
SPW5 7.72189999 W

===== CHANNEL f2 =====
SFO2 400.1312797 MHz
NUC2 ¹H
CPDPRG[2] waltz16
P3 12.30 usec
P4 24.60 usec
PCPD2 90.00 usec
PLW2 22.00000000 W
PLW12 0.41091001 W

F2 - Processing parameters
SI 32768
SF 100.6127690 MHz
WDW EM
SSB 0
LB 1.00 Hz
GB 0
PC 1.40

Fig. S13 : ^1H and ^{13}C NMR spectra of 5m

T-1
proton_su DMSO {C:\nmr-data} Student 5



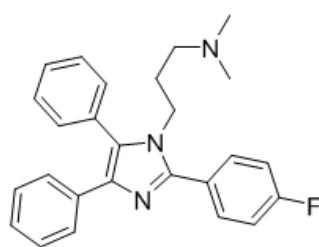
Current Data Parameters
NAME Aug07-2016
EXPNO 192
PROCNO 1

F2 - Acquisition Parameters
Date_ 20160810
Time_ 9.38
INSTRUM spect
PROBHD 5 mm PABBO BB/
PULPROG sg30
TD 65536
SOLVENT DMSO
NS 50
DS 2
SWH 8012.820 Hz
FIDRES 0.122266 Hz
AQ 4.0894465 sec
RG 60.22
DW 62.400 usec
DE 6.50 usec
TE 294.5 K
D1 1.0000000 sec
TD0 1

===== CHANNEL f1 =====
SF01 400.1324710 MHz
NUC1 1H
PI 12.00 usec
PLW1 22.00000000 W

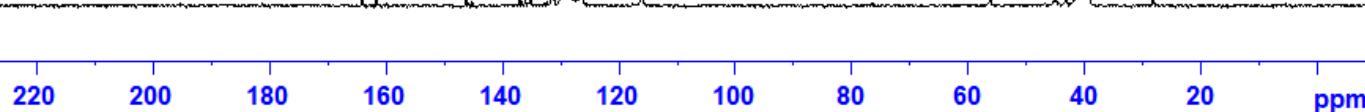
F2 - Processing parameters
SI 65536
SF 400.1300000 MHz
WDW EM
SSB 0
LB 0.30 Hz
GB 0
PC 1.00

T-1
c13_su DMSO {C:\nmr-data} Student 13



163.99
161.55
146.19
136.95
135.08
131.57
131.49
131.36
130.15
130.07
129.98
129.65
129.49
129.38
129.22
128.51
128.15
126.57
126.49
116.19
115.98

56.22
45.02
43.26
40.61
40.40
40.19
39.98
39.78
39.57
39.36
28.25



Current Data Parameters
NAME Aug24-2016
EXPNO 120
PROCNO 1

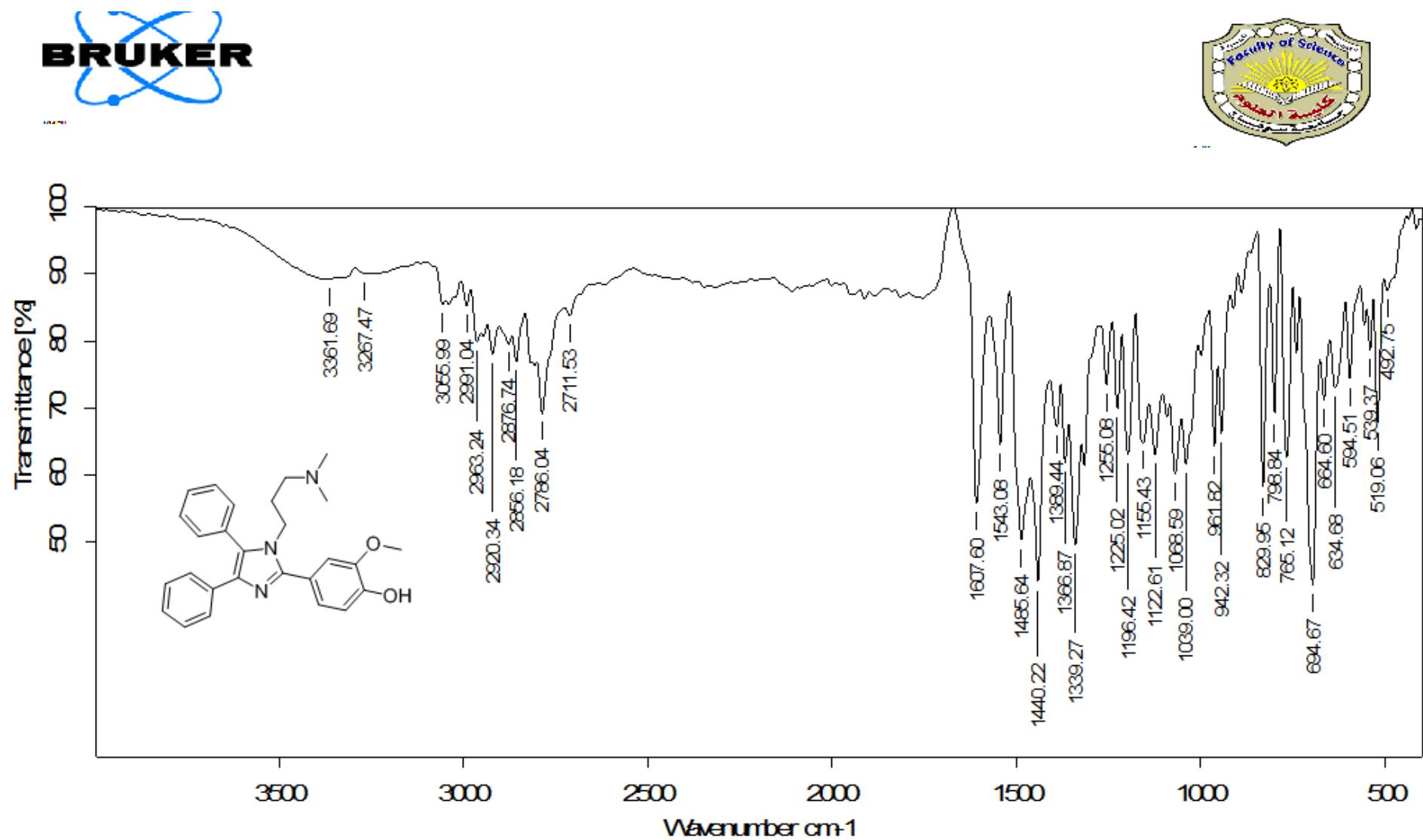
F2 - Acquisition Parameters
Date_ 20160824
Time_ 20.51
INSTRUM spect
PROBHD 5 mm PABBO BB/
PULPROG zgpg30
TD 65536
SOLVENT DMSO
NS 2200
DS 4
SWH 24038.461 Hz
FIDRES 0.3666798 Hz
AQ 1.3631488 sec
RG 100.43
DW 20.800 usec
DE 6.50 usec
TE 295.9 K
D1 2.00000000 sec
D11 0.03000000 sec
TDO 1

===== CHANNEL f1 =====
SFO1 100.6238364 MHz
NUC1 13C
P1 9.50 usec
PLW1 56.00000000 W

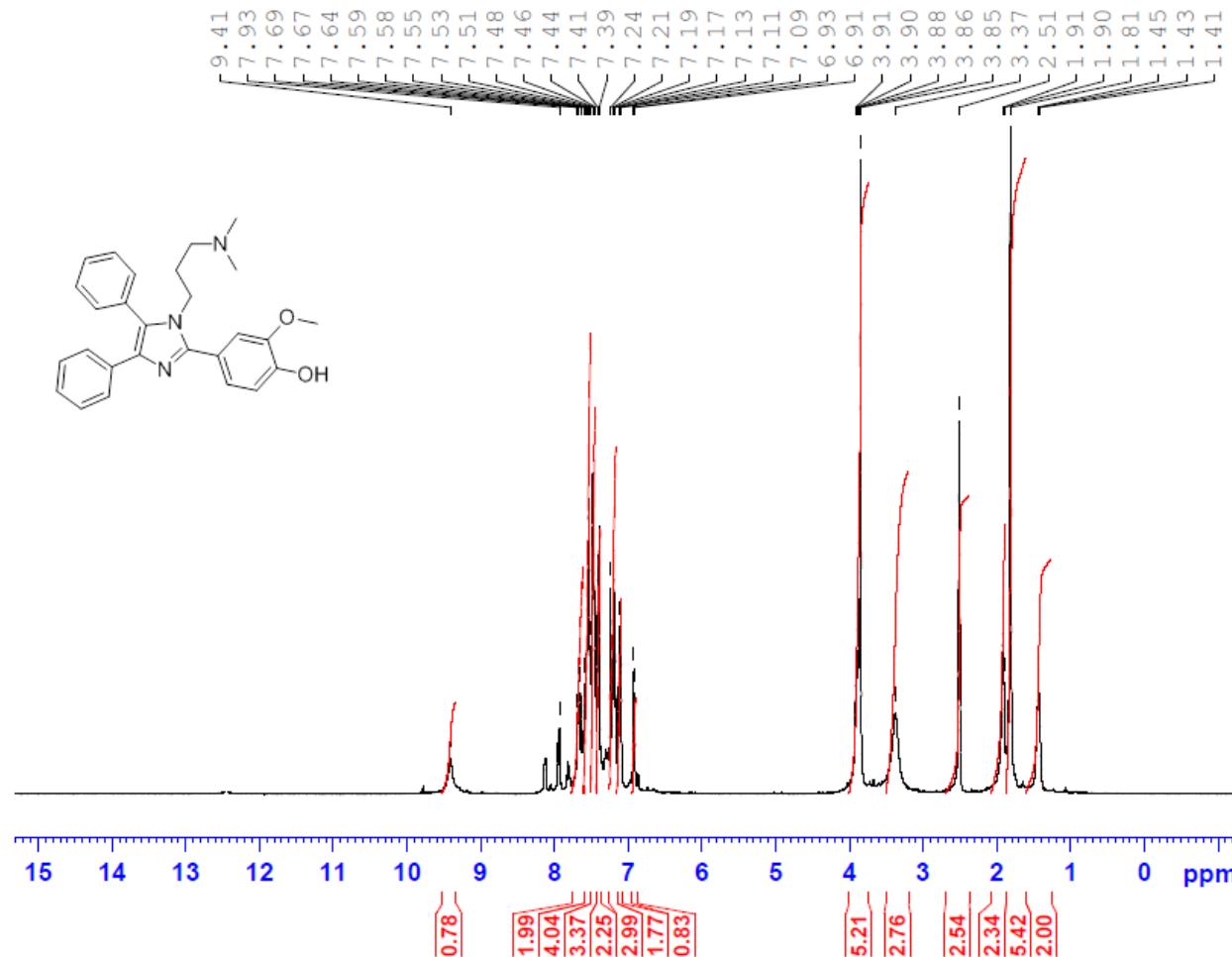
===== CHANNEL f2 =====
SFO2 400.1316005 MHz
NUC2 1H
CPDPRG[2] waltz16
PCPD2 90.00 usec
PLW2 22.00000000 W
PLW12 0.41091001 W
PLW13 0.33284000 W

F2 - Processing parameters
SI 32768
SF 100.6127690 MHz
WDW EM
SSB 0
LB 6.00 Hz
GB 0
PC 1.40

Fig. S14 : IR, ^1H and ^{13}C NMR spectra of 5n



T-13
proton_su DMSO {C:\nmr-data} Student 6



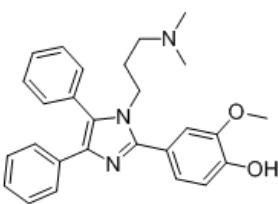
Current Data Parameters
NAME Aug07-2016
EXPNO 200
PROCNO 1

F2 - Acquisition Parameters
Date_ 20160810
Time_ 10.05
INSTRUM spect
PROBHD 5 mm PABBO BB/
PULPROG sg30
TD 65536
SOLVENT DMSO
NS 20
DS 2
SWH 8012.820 Hz
FIDRES 0.122266 Hz
AQ 4.0894465 sec
RG 138
DW 62.400 usec
DE 6.50 usec
TE 294.6 K
D1 1.0000000 sec
TDO 1

===== CHANNEL f1 =====
SFO1 400.1324710 MHz
NUC1 1H
PL 12.00 usec
PLW1 22.0000000 W

F2 - Processing parameters
SI 65536
SF 400.1300000 MHz
WDW EM
SSB 0
LB 0.30 Hz
GB 0
PC 1.00

T-13
c13_su DMSO {C:\nmr-data} Student 16



148.09
147.90
147.53
136.67
135.98
135.41
131.84
131.41
129.98
129.64
129.52
129.18
128.39
128.17
127.01
126.57
126.37
122.88
122.22
116.04
113.89

220 200 180 160 140 120 100 80 60 40 20 ppm

56.40
45.01
43.29
40.80
40.60
40.39
40.18
39.97
39.76
39.55
28.33



Current Data Parameters
NAME Aug25-2016
EXPNO 20
PROCNO 1

F2 - Acquisition Parameters
Date_ 20160825
Time_ 14.15
INSTRUM spect
PROBHD 5 mm PABBO BB/
PULPROG zgpg30
TD 65536
SOLVENT DMSO
NS 2200
DS 4
SWH 24038.461 Hz
FIDRES 0.366798 Hz
AQ 1.3631488 sec
RG 100.43
DW 20.800 usec
DE 6.50 usec
TE 323.2 K
D1 2.0000000 sec
D11 0.0300000 sec
TD0 1

===== CHANNEL f1 =====
SFO1 100.6238364 MHz
NUC1 13C
P1 9.50 usec
PLW1 56.00000000 W

===== CHANNEL f2 =====
SFO2 400.1316005 MHz
NUC2 1H
CPDPRG[2] waltz16
PCPD2 90.00 usec
PLW2 22.00000000 W
PLW12 0.41091001 W
PLW13 0.33284000 W

F2 - Processing parameters
SI 32768
SF 100.6127690 MHz
WDW EM
SSB 0
LB 6.00 Hz
GB 0
PC 1.40

Figure S15: FT-IR spectra for as prepared Zn Fe₂O₄ nanoparticles

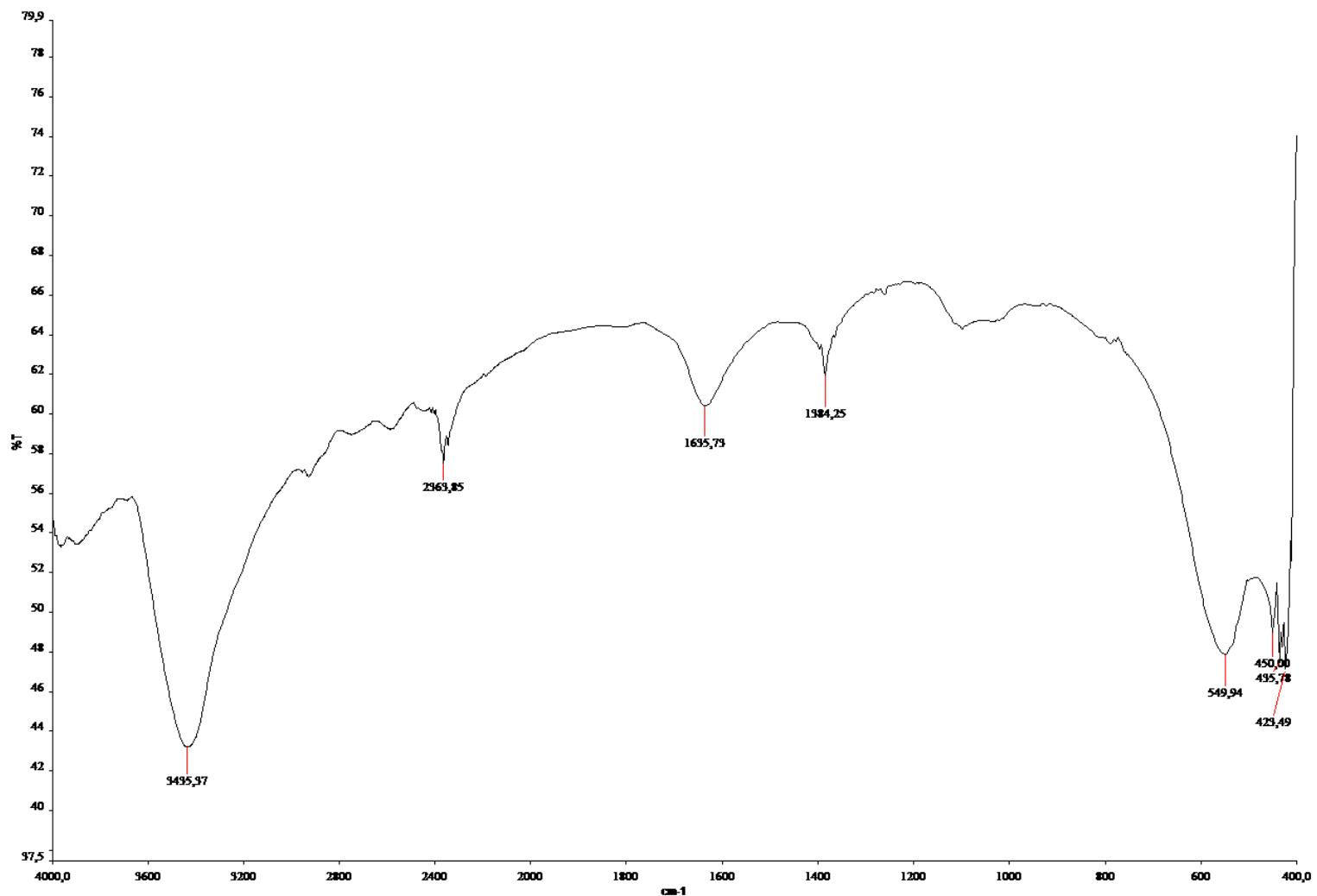


Figure S16: TGA/DTG curves of as prepared Zn Fe₂O₄ nanoparticles

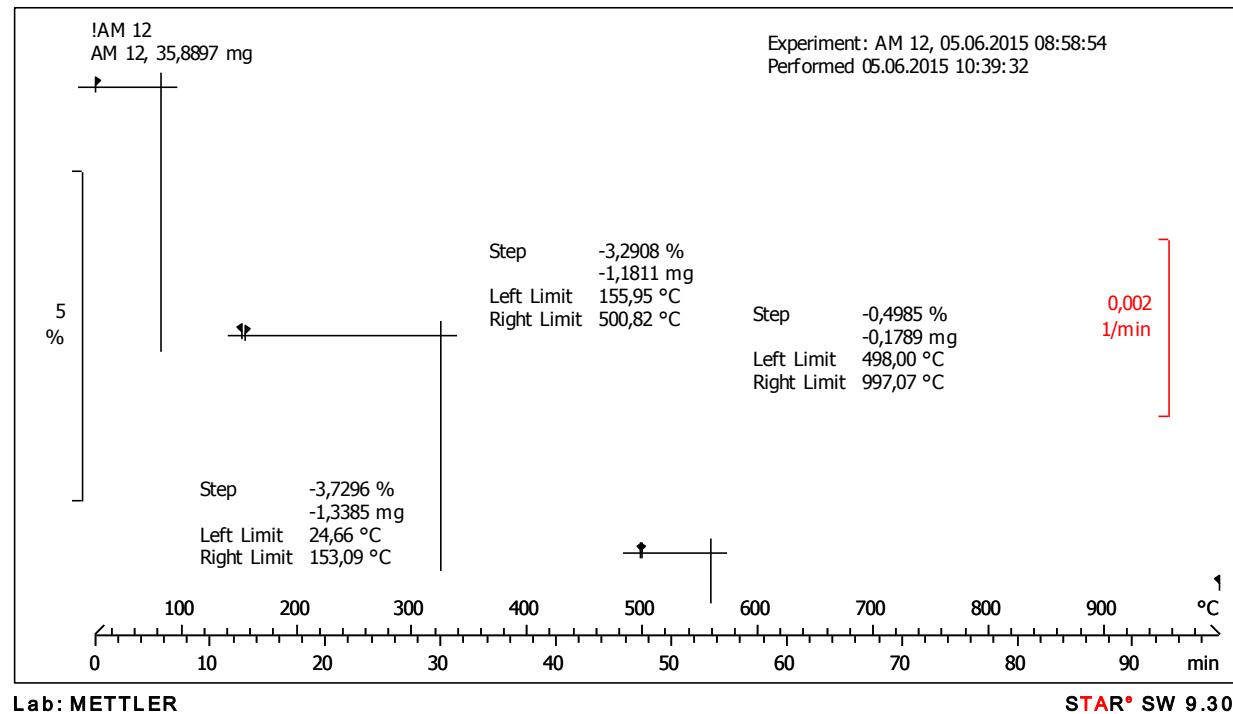


Figure S17: SEM image for the recyclable catalyst after 5 cycles

