Electronic Supplementary Material (ESI) for RSC Advances.

Supporting Information

Novel one-pot pseudo four component reaction: expeditious synthesis of functionalized imidazo[1,2-*a*]pyridines

Haleh Sanaeishoar [a,*], Roya Nazarpour [a], Fouad Mohave [b]

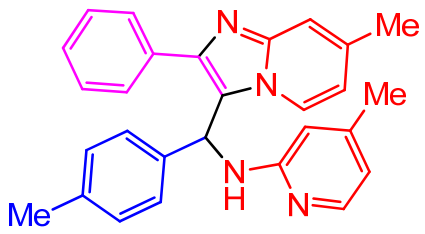
[a] Department of Chemistry, College of Science, Ahvaz Branch, Islamic Azad University, Ahvaz, Iran

[b] Young Researchers and Elite Club, Ahvaz Branch, Islamic Azad University, Ahvaz, Iran

*Corresponding author, E-mail address: hsanaei@iauahvaz.ac.ir

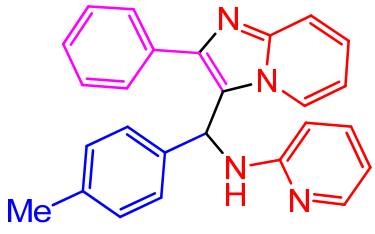
Tel: +98-613-4457612 Fax: +98-613-4435288

Table of Contents



4a

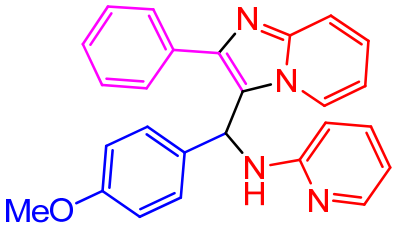
4-Methyl-*N*-((7-methyl-2-phenyl*H*-imidazo[1,2-*a*]pyridin-3-yl)(*p*-tolyl)methyl)pyridin-2-amine (4a). Colorless crystal, mp 174-175 °C, 0.35 g, 85% yield, IR (KBr, cm^{-1}): 3250 (NH), 3053 (CH), 2908 (CH), 1438 & 1607 (CC of Ar). ^{1}H NMR ($CDCl_3$, 300 MHz): 1.97 (3 H, s, CH_3), 2.33 (3 H, s, CH_3), 2.36 (3 H, s, CH_3), 5.77 (1 H, s, NH), 6.04 (1 H, d, J = 5.9 Hz, CH of Ar), 6.21 (1 H, d, J = 6.8 Hz, CH of Ar), 6.31 (1 H, d, J = 5 Hz, CH of Ar), 6.45 (1 H, d, J = 5.9 Hz , CH of Ar), 7.14-7.67 (12 H, m, *CH*NH, CH of Ar). ^{13}C NMR ($CDCl_3$, 100 MHz): δ = 22.2, 22.4, 52.6, 107.6, 115.50, 116.3, 117.2, 119.2, 125.4, 128.0, 129.1, 129.74, 130.0, 130.9, 135.7, 136.8, 138.8, 146.9, 148.7, 159.3. Anal. Calcd for $C_{28}H_{26}N_4$: C, 80.35; H, 6.26; N, 13.39. Found: C, 80.38; H, 6.23; N, 13.42.



4b

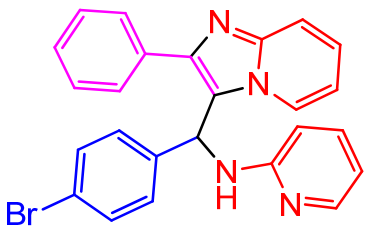
***N*-((2-phenyl*H*-imidazo[1,2-*a*]pyridin-3-yl)(*p*-tolyl)methyl)pyridin-2-amine (4b).** White powder, mp 181-182 °C, 0.28 g, 73% yield, IR (KBr, cm^{-1}): 3254 (NH), 3025 (CH), 1602 and 1441 (CC of Ar). ^{1}H NMR ($CDCl_3$, 300 MHz): 2.33 (3 H, s, CH_3), 6.03 (1 H, d, J = 8

Hz, CH), 6.35-6.45 (3 H, m, CH of Ar, *CH*NH), 6.55 (1 H, d, *J* = 4.3 Hz, CH of Ar), 7.07-7.09 (14 H, m, CH of Ar). ^{13}C NMR ($CDCl_3$, 75 MHz): δ = 20.6, 51.1, 105.8, 111.4, 113.2, 117.1, 118.4, 124.08, 124.4, 126.4, 127.6, 128.1, 128.4, 129.3, 133.8, 135.0, 137.2, 137.2, 144.8, 147.5, 157.4. Anal. Calcd for $C_{26}H_{22}N_4$: C, 79.97; H, 5.68; N, 14.35. Found: C, 79.95; H, 5.67; N, 14.37.



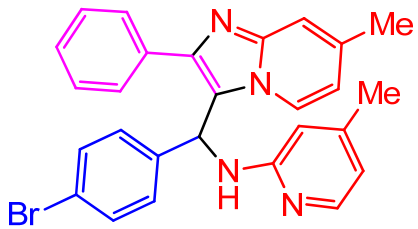
4c

***N*-((4-methoxyphenyl)(2-phenyl*H*-imidazo[1,2-*a*]pyridin-3-yl)methyl)pyridin-2-amine(4c).** White powder, mp 188-189 °C, 0.30 g, 75% yield, IR (KBr): 3243 (NH), 3053 (CH), 2832 (CH), 1603 and 1441 (CC of Ar). ^{1}H NMR (Aceton-d_6, 300 MHz): δ = 3.80 (3H, s, CH_3), 6.56-8.14 (19 H, m, NH, *CH*NH, CH of Ar). ^{13}C NMR (Aceton-d_6, 75 MHz): δ = 50.3, 55.4, 109.3, 112.3, 113.8, 114.8, 114.9, 118.1, 121.1, 124.9, 126.4, 128.3, 128.4, 128.6, 129.0, 129.7, 130.5, 132.4, 136.1, 137.7, 148.6, 159.8. Anal. Calcd for $C_{26}H_{22}N_4O$: C, 76.83; H, 5.46; N, 13.78. Found: C, 76.85; H, 5.45; N, 13.79.



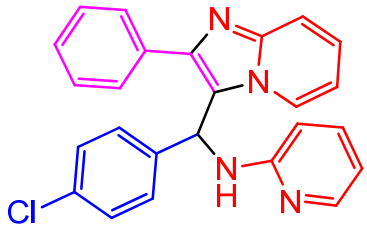
4d

***N*-((4-bromophenyl)(2-phenyl*H*-imidazo[1,2-*a*]pyridin-3-yl)methyl)pyridin-2-amine(4d).** White powder, mp 190-191 °C, 0.31 g, 70% yield, IR (KBr): 3257(NH), 3049(CH), 1600 and 1441(CC of Ar). ^{1}H NMR ($CDCl_3$, 300 MHz): δ = 5.7 (1 H, s, NH), 6.16 (1H, s, *CH*NH), 6.59-6.65 (3 H, m, CH of Ar), 7.18-7.90 (14 H, m, CH of Ar). ^{13}C NMR ($CDCl_3$, 75 MHz): δ = 51, 107.1, 112.4, 114.2, 117.9, 118.7, 121.7, 124.4, 124.8, 128.1, 128.5, 128.6, 128.8, 132.0, 134.0, 137.74, 137.9, 145.3, 145.4, 148.1, 157.4. Anal. Calcd for $C_{25}H_{19}BrN_4$: C, 65.94; H, 4.21; N, 12.30. Found: C, 65.95; H, 4.19; N, 12.32.



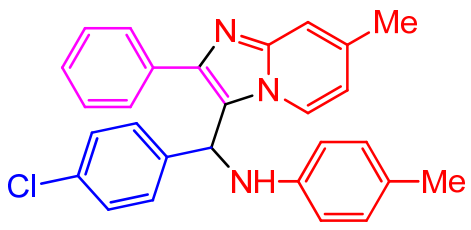
4e

***N*-((2-(4-bromophenyl)-7-methyl*H*-imidazo[1,2-*a*]pyridin-3-yl)(phenyl)methyl)-4-methylpyridin-2-amine(4e).** White powder, mp170-171 °C, 0.37 g, 77% yield, IR (KBr): 3212(NH), 3086(CH), 2964(CH), 2910(CH), 1611 and 1448 (CC of Ar).^{1}H NMR ($CDCl_3$, 300 MHz): δ = 2.00 (3 H, s, CH_3), 2.31 (3 H, s, CH_3), 5.83(1 H, s, NH), 6.13(1 H, s, *CH*NH), 6.33-6.49 (3 H, m, CH of Ar), 7.18-7.62(12 H, m, CH of Ar). ^{13}C NMR ($CDCl_3$, 75 MHz): δ = 21.2, 51.0, 106.7, 114.3, 114.4, 115.4, 116.0, 117.5, 117.5, 123.7, 123.8, 128.7, 132.0, 132.0, 134.3, 134.3, 135.7, 135.7, 137.9, 144.6, 145.7, 147.4, 157.87. Anal. Calcd for $C_{27}H_{23}BrN_4$: C, 73.88; H, 5.28; N, 12.76. Found: C, 73.89; H, 5.25; N, 12.78.



4f

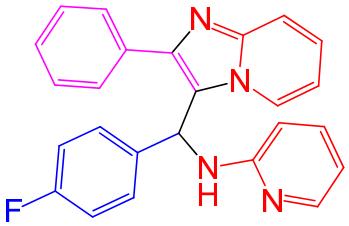
***N*-((4-chlorophenyl)(2-phenyl*H*-imidazo[1,2-*a*]pyridin-3-yl)methyl)pyridin-2-amine(4f).** white powder, mp 199-200 °C, 0.32 g, 80 % yield, IR (KBr): 3255 (NH), 3114 (CH), 3050 (CH), 1601 and 1441 (CC of Ar). ^{1}H NMR ($CDCl_3$, 300 MHz): δ = 5.76 (1 H, s, NH), 6.15(1 H, d, *J* = 7.8 Hz, CH of Ar), 6.57-6.68 (3 H, m, *CH*NH, CH of Ar), 7.15-7.86(14 H, m, CH of Ar). ^{13}C NMR ($CDCl_3$, 75 MHz): δ = 50.9, 107, 112.3, 114.2, 117.0, 118.7, 119.0, 124.4, 124.7, 128.1, 128.2, 128.6, 128.8, 129.1, 133.6, 134.0, 137.3, 137.7, 145.3, 148.1, 157.4. Anal. Calcd for $C_{25}H_{19}ClN_4$: C, 73.08; H, 4.66; N, 13.64. Found: C, 73.06; H, 4.68; N, 13.65.



4g

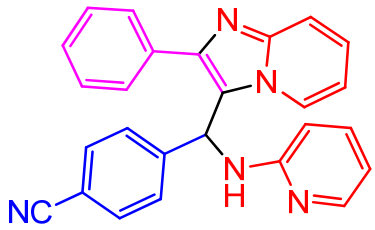
***N*-((4-chlorophenyl)(7-methyl-2-phenylimidazo[1,2-*a*]pyridin-3-yl)methyl)-5-methylpyridin-2-amine (4g).** White powder, mp 202-203 °C, 0.36 g, 83% yield, IR (KBr):

3212 (NH), 2965 (CH), 2910 (CH), 1610 and 1434 (CC of Ar). ^{1}H NMR ($CDCl_3$, 300 MHz): δ = 2.04 (3 H, s, CH_3), 2.34 (3 H, s, CH_3), 5.85 (2 H, s, NH, *CH*NH), 6.30 (1 H, d, *J* = 6.7 Hz, CH of Ar), 6.39 (1 H, d, *J* = 4.7 Hz, CH of Ar), 6.54 (1 H, d, *J* = 5.8 Hz, CH of Ar), 7.27-7.68 (12 H, m, CH of Ar). ^{13}C NMR ($CDCl_3$, 75 MHz): δ = 21.1, 21.3, 107.0, 114.8, 115.6, 116.2, 117.8, 123.7, 128.0, 128.3, 128.6, 128.8, 129.1, 133.6, 134.3, 135.8, 137.4, 145.2, 145.8, 147.6, 149.0, 157.7. Anal. Calcd for $C_{27}H_{23}ClN_4$: C, 73.88; H, 5.28; N, 12.76.Found: C, 73.85; H, 5.26; N, 12.78.



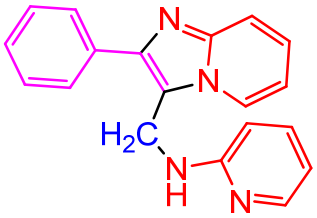
4h

***N*-((4-fluorophenyl)(2-phenyl*H*-imidazo[1,2-*a*]pyridin-3-yl)methyl)pyridin-2-amine (4h).** White powder, mp 198-199 °C, 0.29 g, 75% yield, IR (KBr): 3251 (NH), 1602 and 1442 (CC of Ar). ^{1}H NMR ($CDCl_3$, 300 MHz): δ = 5.59 (1 H, s, NH), 6.15 (1 H, d, *J* = 8.1 Hz, , CH of Ar), 6.62-6.69 (3 H, m, *CH*NH, CH of Ar), 7.00-7.96 (14 H, m, CH of Ar). ^{13}C NMR ($CDCl_3$, 75 MHz): δ = 51.0, 76.6, 107.7, 112.3, 114.2, 115.7, 116.0, 117.9, 118.9, 119.0, 124.5, 124.7, 128.3 (d, $^{2}J_{CF}$ = 26.5 Hz), 128.6, 128.9, 134.2, 134.5, 137.8, 145.3, 148.1, 157.4, 162.6 (d, $^{1}J_{CF}$ = 257.0). Anal. Calcd for $C_{25}H_{19}FN_4$: C, 76.12; H, 4.86; N, 14.20. Found: C, 76.14; H, 4.85; N, 14.21.



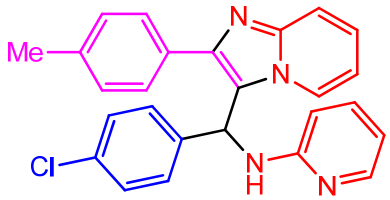
4i

4-((2-phenyl*H*-imidazo[1,2-*a*]pyridin-3-yl)(pyridin-2-ylamino)methyl)benzonitrile (4i). Yellow powder, mp 199-200 °C, 0.39 g, 97% yield, IR (KBr): 3242 (NH), 3061 (CH), 3014 (CH), 1604 and 1474 (CC of Ar). ^{1}H NMR ($CDCl_3$, 300 MHz): δ = 5.55 (1 H, s, NH), 6.35 (1 H, s, *CH*NH), 6.66 (2 H, s, CH of Ar), 6.89 (1 H, s, CH of Ar), 7.18-8.01 (14 H, m, CH of Ar). ^{13}C NMR ($CDCl_3$, 75 MHz): δ = 50.7, 107.9, 111.31, 112.7, 114.6, 118.0, 118.5, 124.0, 125.0, 127.6, 128.3, 128.5, 128.8, 132.5, 133.7, 137.7, 144.7, 145.2, 145.4, 148.2, 157.0. Anal. Calcd for $C_{26}H_{19}N_5$: C, 77.79; H, 4.77; N, 17.44. Found: C, 77.77; H, 4.75; N, 17.41.



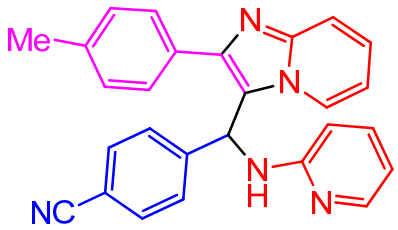
4j

***N*-((2-phenyl*H*-imidazo[1,2-*a*]pyridin-3-yl)methyl)pyridin-2-amine(4j).** White powder, mp 178-179 °C, 0.23 g, 78% yield, IR(KBr): 3248(NH), 3020(CH). ^{1}H NMR ($CDCl_3$, 400 MHz): δ =4.62 (1 H, s, NH), 5.03 (2 H, s, CH_2NH), 6.35 (1H, d, J = 3.6 Hz, CH of Ar), 6.46 (1 H, s, CH), 6.67 (1 H, s, CH of Ar), 6.82 (1 H, s, CH of Ar), 6.95-8.42 (9 H, m, CH of Ar). ^{13}C NMR ($CDCl_3$, 75 MHz): 35.5, 108.3, 112.4, 113.6, 117.0, 117.4, 124.3, 124.8, 127.9, 128.4, 128.7, 134.0, 137.4, 144.6, 145.1, 148.0, 158.1. Anal. Calcd for $C_{19}H_{16}N_4$: C, 75.98; H, 5.37; N, 18.65. Found: C, 75.96; H, 5.38; N, 18.63.



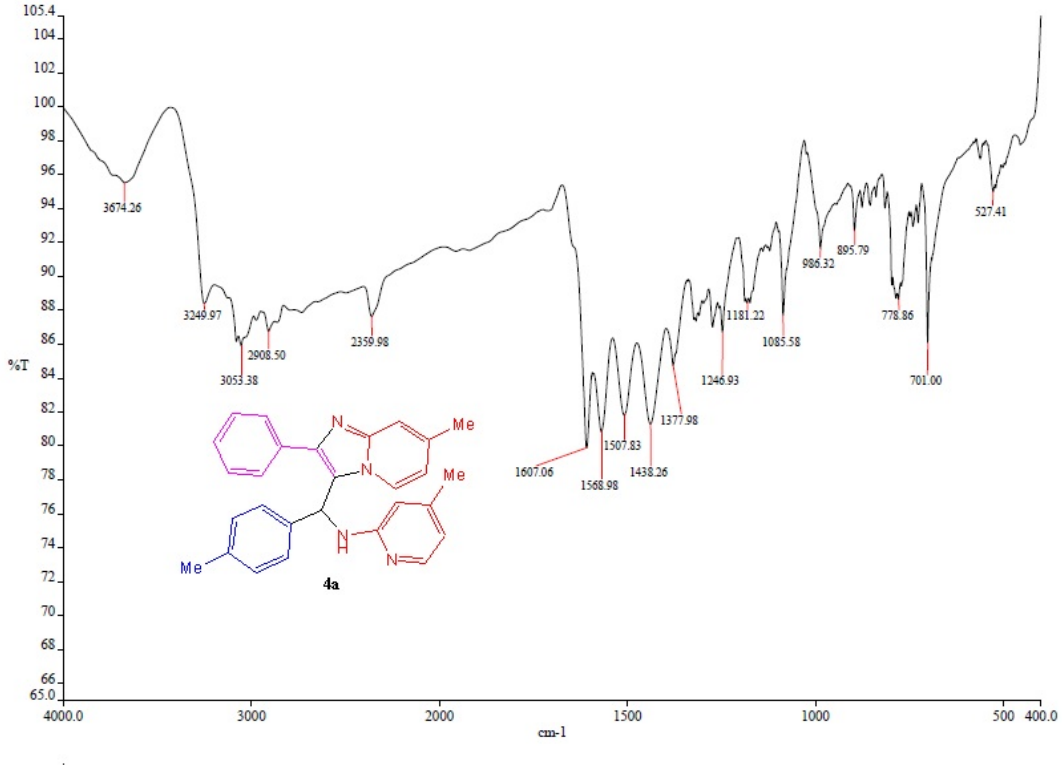
4k

***N*-((4-chlorophenyl)(2-(*p*-tolyl)imidazo[1,2-a]pyridin-3-yl)methyl)pyridin-2-amine (4k).** White powder, mp170-171 °C, 0.35 g, 84 % yield, IR(KBr): 3244(NH), 3095(CH), 3029(CH), 1600 and 1478(CC of Ar).^{1}H NMR ($CDCl_3$, 300 MHz): δ = 2.42 (3H, s, CH_3), 5.37 (1H, s, NH), 6.23(1H, s, *CH*NH), 6.68(2H, s, CH of Ar), 7.3-8.0 (14H, m, CH of Ar). ^{13}C NMR ($CDCl_3$, 75 MHz): δ = 21.3, 51.0, 107.7, 112.7, 114.1, 117.7, 124.7, 125.2, 128.2, 128.7, 128.8, 129.3, 129.5, 130.7, 134.0, 137.3, 139.7, 143.0, 145.3, 148.8, 145.2, 148.0. Anal.Calcd for $C_{26}H_{21}ClN_4$: C, 73.49; H, 4.98; N, 13.19. Found: C, 73.47; H, 4.97; N, 13.17.

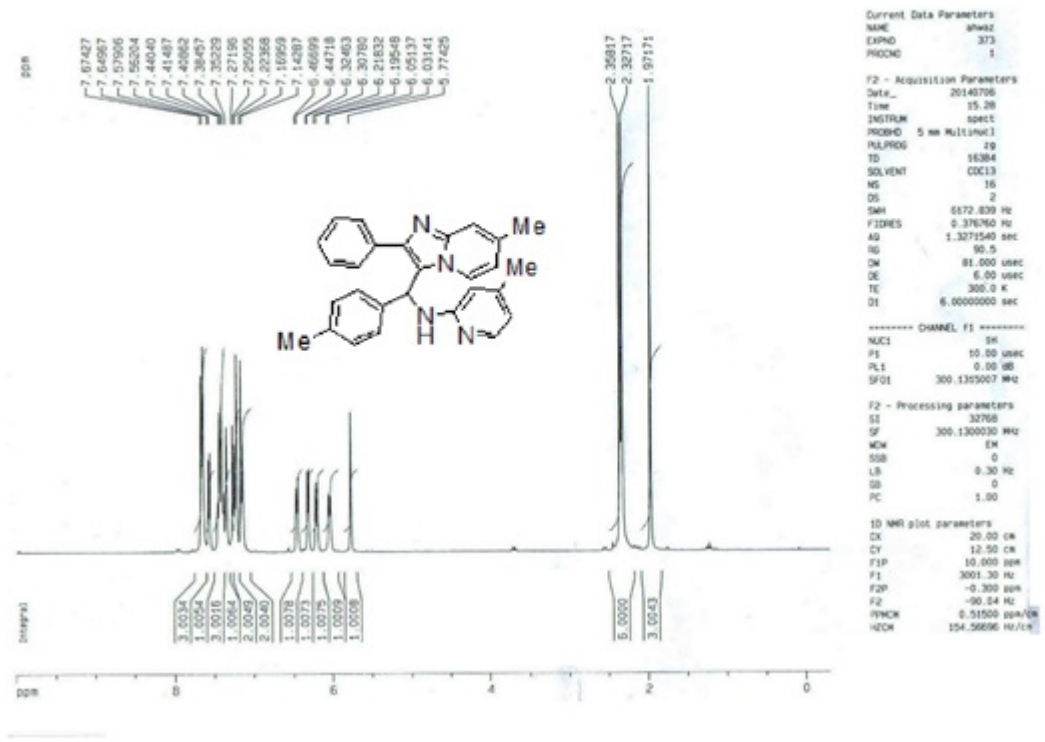


4l

4-((pyridin-2-ylamino)(2-(*p*-tolyl)imidazo[1,2-a]pyridin-3-yl)methyl)benzonitrile (4l). Withe powder, mp187-188 °C, 0.41 g, 96% yield, IR (KBr): 3237(NH), 3088(CH), 3028(CH), 2225(CN), 1598 and 1474(CC of Ar).^{1}H NMR ($CDCl_3$, 300 MHz): δ = 2.39 (3H, s, CH_3), 6.28 (2H, s, NH, *CH*NH), 6.44-8.05 (16H, m, CH of Ar). ^{13}C NMR ($CDCl_3$, 75 MHz): δ = 21.3, 57.0, 114.1, 115.7, 119.8, 119.9, 122.0, 123.8, 124.4, 125.0, 126.4, 126.3, 126.6, 126.7, 133.4, 134.7, 136.6, 140.6, 141.7, 142.1, 143.7, 143.7, 153.0. Anal. Calcd for $C_{27}H_{21}N_5$: C, 78.05; H, 5.09; N, 16.86. Found: C, 78.06; H, 5.07; N, 16.84.

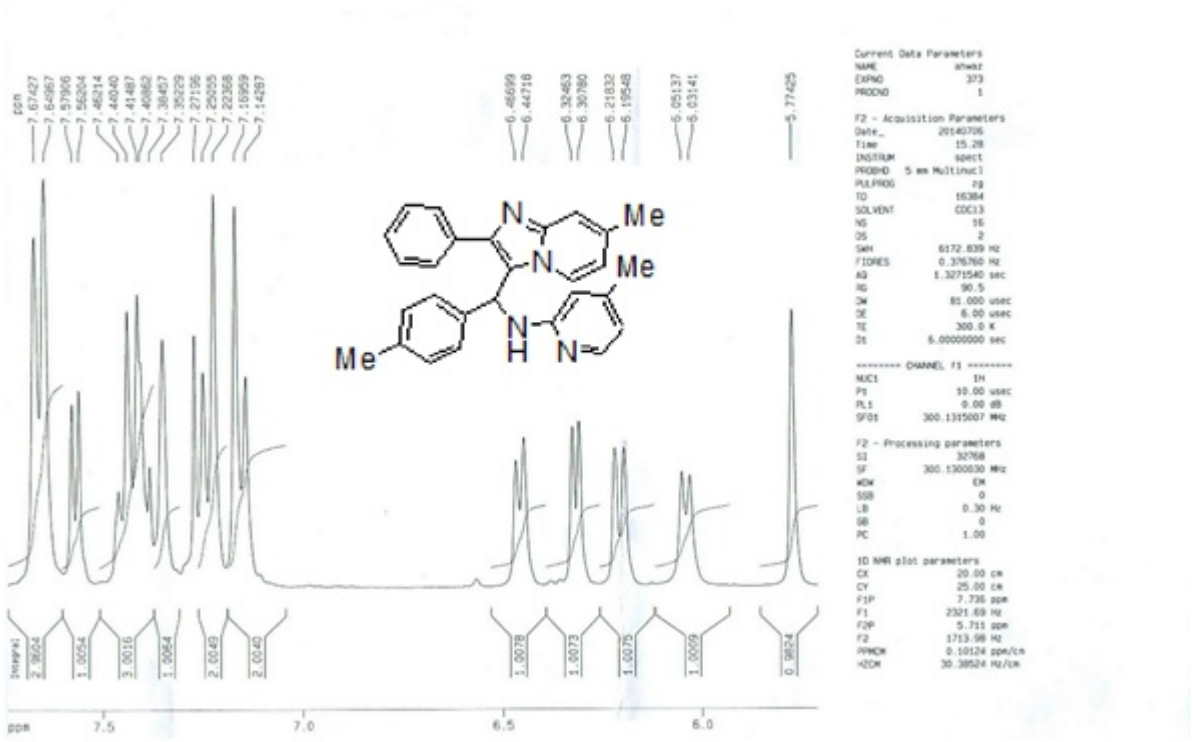

%T
cm-1
3674.26
3249.97
3053.38
2908.50
2359.98
1607.06
1568.98
1507.83
1438.26
1377.98
1246.93
1181.22
1085.58
986.32
895.79
778.86
701.00
527.41
Me
Me
Me
N
N
H
N
4a

IR of 4a

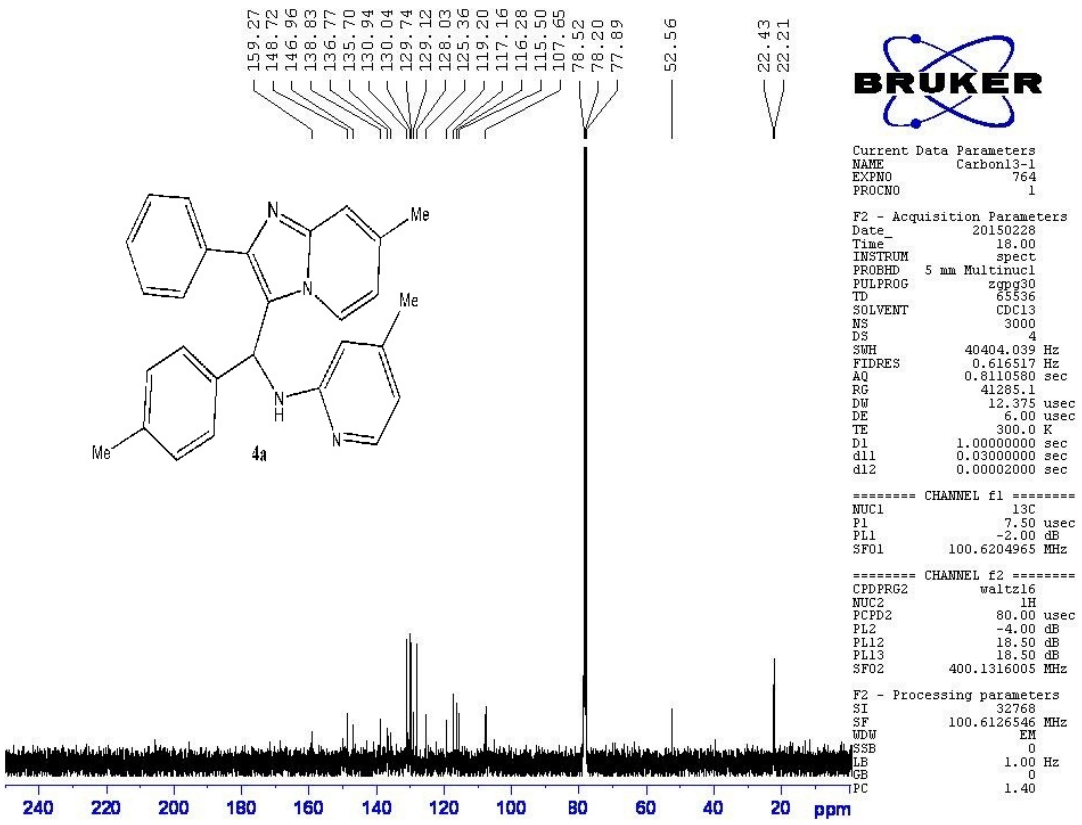



```
Current Data Parameters
NAME                  ahwaz
EXPNO                   373
PROCNO                    1

F2 - Acquisition Parameters
Date_              20140706
Time                  15.28
INSTRUM                spect
PROBHD     5 mm Multinucl
PULPROG                zg
TD                    16384
SOLVENT               CDCl3
NS                       16
DS                        2
SWH                6172.839 Hz
FIDRES             0.376760 Hz
AQ                 1.3271540 sec
RG                     90.5
DW                   81.000 usec
DE                    6.00 usec
TE                   300.0 K
D1                 6.00000000 sec

--------- CHANNEL f1 ---------
NUC1                     1H
P1                    10.00 usec
PL1                    0.00 dB
SFO1              300.1305007 MHz

F2 - Processing parameters
SI                       32768
SF                300.1300030 MHz
WDW                      EM
SSB                       0
LB                     0.30 Hz
GB                        0
PC                     1.00

1D NMR plot parameters
CX                    20.00 cm
CY                    12.50 cm
F1P                   10.000 ppm
F1                  3001.30 Hz
F2P                   -0.300 ppm
F2                   -90.04 Hz
PPMCM                 0.51500 ppm/cm
HZCM                154.56696 Hz/cm
```

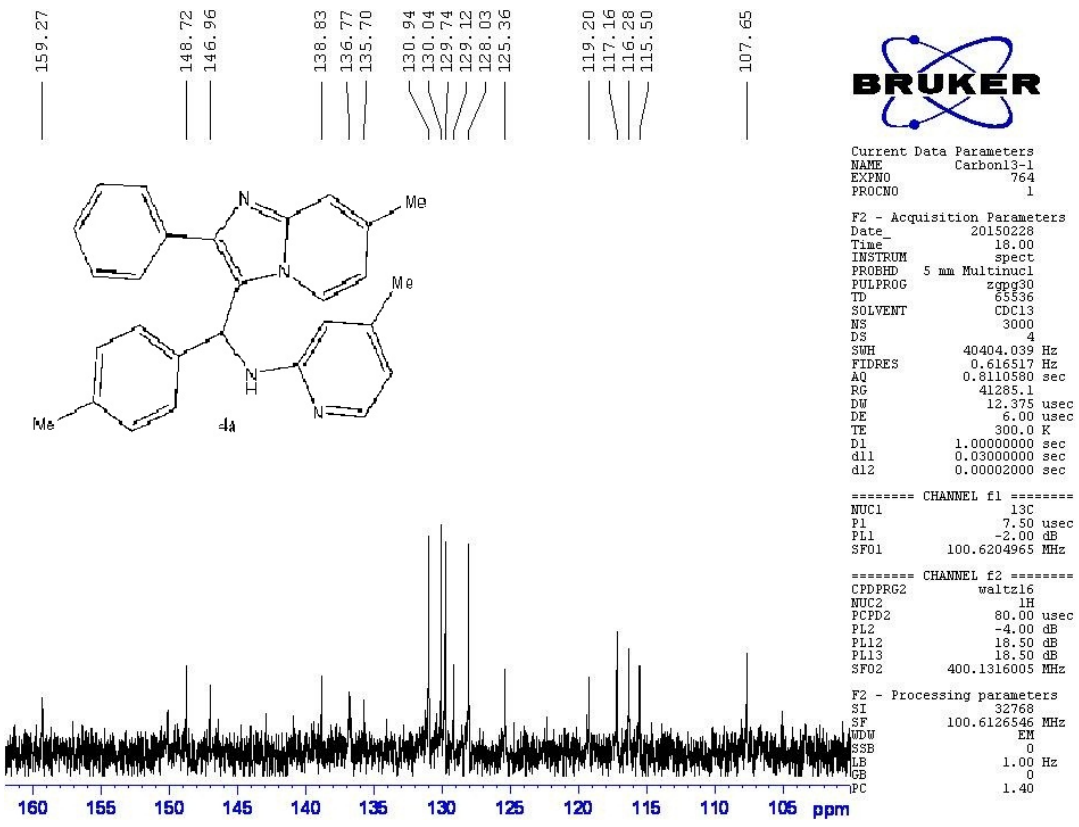
^{1}H-NMR of 4a


ppm
7.67427
7.64867
7.57906
7.56204
7.48214
7.44040
7.41487
7.40862
7.38457
7.35229
7.27196
7.25055
7.22368
7.16959
7.14287
6.46699
6.44718
6.32463
6.30780
6.21832
6.19548
6.05137
6.03141
5.77425
Me
Me
Me
N
N
H
N
Integral
2.9664
1.0054
3.0016
1.0064
2.0049
2.0040
1.0078
1.0073
1.0075
1.0009
0.9824
ppm
7.5
7.0
6.5
6.0
Current Data Parameters
NAME ahwaz
EXPNO 373
PROCNO 1
F2 - Acquisition Parameters
Date_ 20140706
Time 15.28
INSTRUM spect
PROBHD 5 mm Multinucl
PULPROG zg
TD 16384
SOLVENT CDCl3
NS 16
DS 2
SWH 6172.839 Hz
FIDRES 0.376760 Hz
AQ 1.3271540 sec
RG 90.5
DW 81.000 usec
DE 6.00 usec
TE 300.0 K
D1 6.00000000 sec
-------- CHANNEL f1 --------
NUC1 1H
P1 10.00 usec
PL1 0.00 dB
SFO1 300.1315007 MHz
F2 - Processing parameters
SI 32768
SF 300.1300030 MHz
WDW EM
SSB 0
LB 0.30 Hz
GB 0
PC 1.00
1D NMR plot parameters
CX 20.00 cm
CY 25.00 cm
F1P 7.736 ppm
F1 2321.69 Hz
F2P 5.711 ppm
F2 1713.98 Hz
PPMCM 0.10124 ppm/cm
HZCM 30.38524 Hz/cm

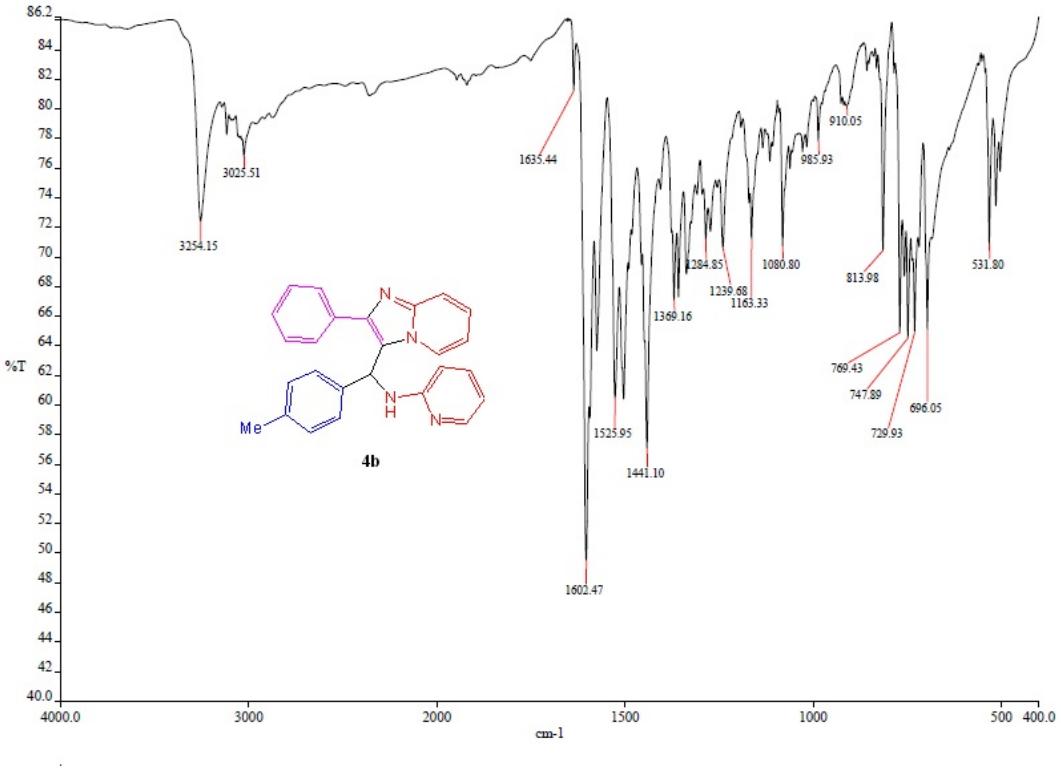
^{1}H-NMR of 4a


159.27
148.72
146.96
138.83
136.77
135.70
130.94
130.04
129.74
129.12
128.03
125.36
119.20
117.16
116.28
115.50
107.65
78.52
78.20
77.89
52.56
22.43
22.21
BRUKER
Current Data Parameters
NAME Carbon13-1
EXPNO 764
PROCNO 1
F2 - Acquisition Parameters
Date_ 20150228
Time 18.00
INSTRUM spect
PROBHD 5 mm Multinucl
PULPROG zgpg30
TD 65536
SOLVENT CDCl3
NS 3000
DS 4
SWH 40404.039 Hz
FIDRES 0.616517 Hz
AQ 0.8110580 sec
RG 41285.1
DW 12.375 usec
DE 6.00 usec
TE 300.0 K
D1 1.00000000 sec
d11 0.03000000 sec
d12 0.00002000 sec
======== CHANNEL f1 ========
NUC1 13C
P1 7.50 usec
PL1 -2.00 dB
SFO1 100.6204965 MHz
======== CHANNEL f2 ========
CPDPRG2 waltz16
NUC2 1H
PCPD2 80.00 usec
PL2 -4.00 dB
PL12 18.50 dB
PL13 18.50 dB
SFO2 400.1316005 MHz
F2 - Processing parameters
SI 32768
SF 100.6126546 MHz
WDW EM
SSB 0
LB 1.00 Hz
GB 0
PC 1.40
Me
Me
Me
N
N
N
H
4a
240
220
200
180
160
140
120
100
80
60
40
20
ppm

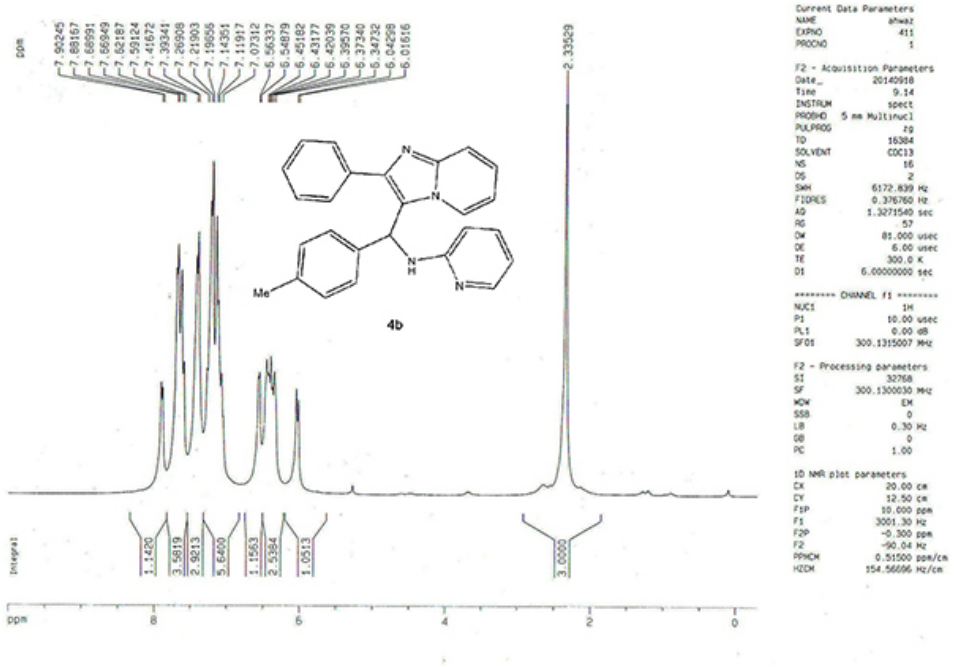
^{13}C-NMR of 4a


159.27
148.72
146.96
138.83
136.77
135.70
130.94
130.04
129.74
129.12
128.03
125.36
119.20
117.16
116.28
115.50
107.65
Me
Me
Me
N
N
NH
N
4a
BRUKER
Current Data Parameters
NAME Carbon13-1
EXPNO 764
PROCNO 1
F2 - Acquisition Parameters
Date_ 20150228
Time 18.00
INSTRUM spect
PROBHD 5 mm Multinuc1
PULPROG zgpg30
TD 65536
SOLVENT CDC13
NS 3000
DS 4
SWH 40404.039 Hz
FIDRES 0.616517 Hz
AQ 0.8110580 sec
RG 41285.1
DW 12.375 usec
DE 6.00 usec
TE 300.0 K
D1 1.00000000 sec
d11 0.03000000 sec
d12 0.00002000 sec
======== CHANNEL f1 ========
NUC1 13C
P1 7.50 usec
PL1 -2.00 dB
SF01 100.6204965 MHz
======== CHANNEL f2 ========
CPDPRG2 waltz16
NUC2 1H
PCPD2 80.00 usec
PL2 -4.00 dB
PL12 18.50 dB
PL13 18.50 dB
SF02 400.1316005 MHz
F2 - Processing parameters
SI 32768
SF 100.6126546 MHz
WDW EM
SSB 0
LB 1.00 Hz
GB 0
PC 1.40
160
155
150
145
140
135
130
125
120
115
110
105
ppm

^{13}C-NMR of 4a


%T
cm-1
4000.0
3000
2000
1500
1000
500
400.0
3254.15
3025.51
1635.44
1602.47
1525.95
1441.10
1369.16
1284.85
1239.68
1163.33
1080.80
985.93
910.05
813.98
769.43
747.89
729.93
696.05
531.80
Me
N
H
N
N
4b

IR of 4b



Current Data Parameters
NAME ahwaz
EXPNO 411
PROCNO 1

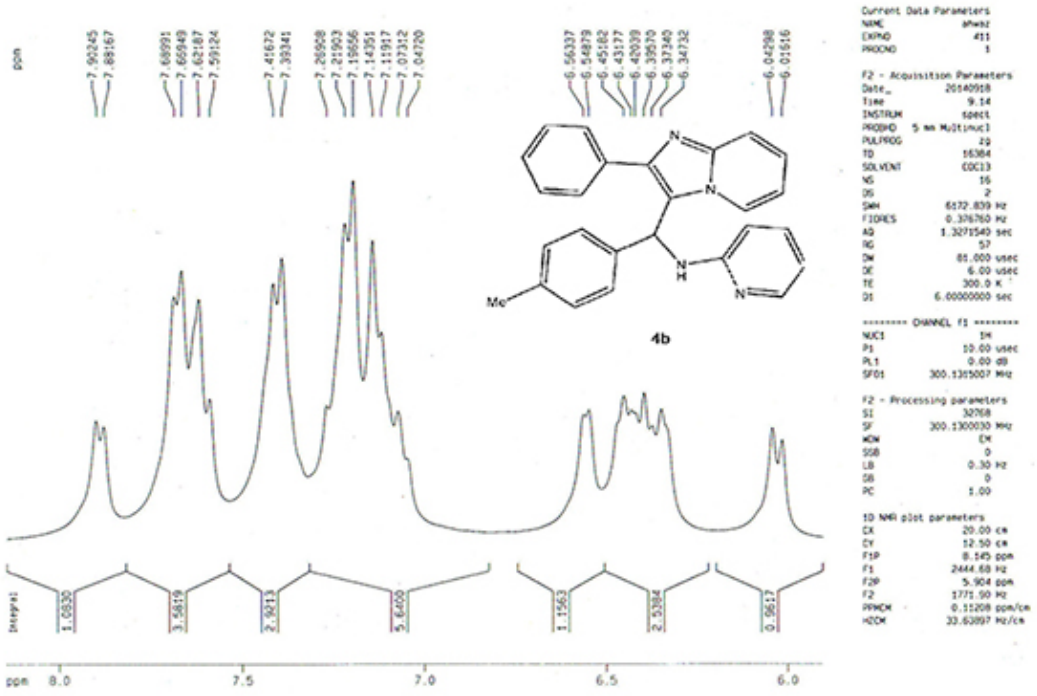
F2 - Acquisition Parameters
Date_ 20140918
Time 9.14
INSTRUM spect
PROBHD 5 mm Multinucl
PULPROG zg
TD 16384
SOLVENT CDCl3
NS 16
DS 2
SWH 6172.839 Hz
FIDRES 0.376760 Hz
AQ 1.3271540 sec
RG 57
DW 81.000 usec
DE 6.00 usec
TE 300.0 K
D1 6.00000000 sec

======== CHANNEL f1 ========
NUC1 1H
P1 10.00 usec
PL1 0.00 dB
SFO1 300.1315007 MHz

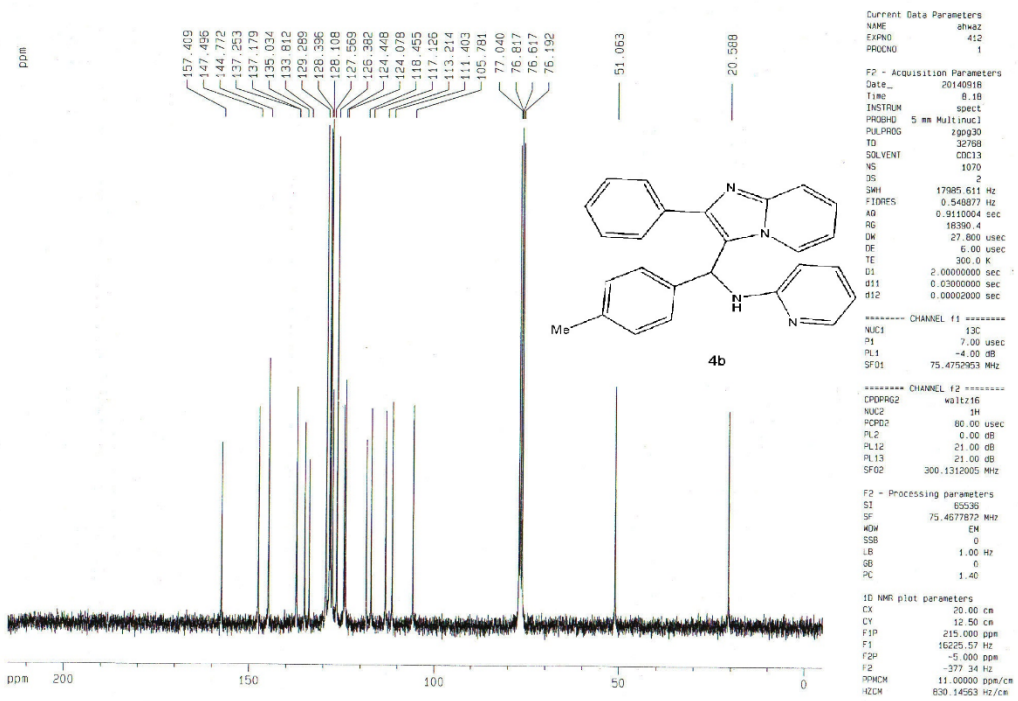
F2 - Processing parameters
SI 32768
SF 300.1300030 MHz
WDW EM
SSB 0
LB 0.30 Hz
GB 0
PC 1.00

1D NMR plot parameters
CX 20.00 cm
CY 12.50 cm
F1P 10.000 ppm
F1 3001.30 Hz
F2P -0.300 ppm
F2 -90.04 Hz
PPMCM 0.51500 ppm/cm
HZCM 154.56696 Hz/cm

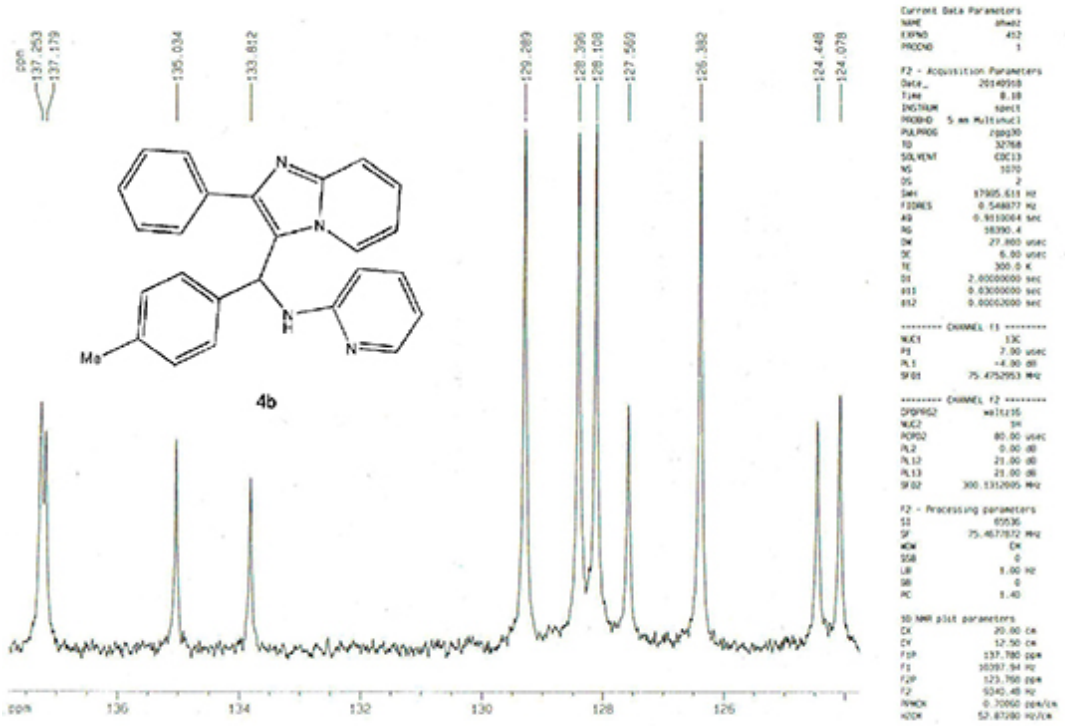
^{1}H-NMR of 4b


ppm
7.90245
7.88167
7.66991
7.65949
7.62187
7.59124
7.41672
7.39341
7.26968
7.21903
7.19656
7.14351
7.11917
7.07312
7.04720
6.56337
6.54879
6.45182
6.43177
6.42039
6.39570
6.37340
6.34732
6.04298
6.01616
Me
N
H
4b
Integral
1.0830
3.5619
2.9013
5.6400
1.1563
2.5384
0.9617
ppm 8.0
7.5
7.0
6.5
6.0
Current Data Parameters
NAME ahwaz
EXPNO 411
PROCNO 1
F2 - Acquisition Parameters
Date_ 20140918
Time 9.14
INSTRUM spect
PROBHD 5 mm Multinucl
PULPROG zg
TD 16384
SOLVENT CDCl3
NS 16
DS 2
SWH 6172.839 Hz
FIDRES 0.376760 Hz
AQ 1.3271540 sec
RG 57
DW 81.000 usec
DE 6.00 usec
TE 300.0 K
D1 6.00000000 sec
-------- CHANNEL f1 --------
NUC1 1H
P1 10.00 usec
PL1 0.00 dB
SFO1 300.1305007 MHz
F2 - Processing parameters
SI 32768
SF 300.1300030 MHz
WDW EM
SSB 0
LB 0.30 Hz
GB 0
PC 1.00
1D NMR plot parameters
CX 20.00 cm
CY 12.50 cm
F1P 8.545 ppm
F1 2444.68 Hz
F2P 5.904 ppm
F2 1771.90 Hz
PPMCM 0.11208 ppm/cm
HZCM 33.63897 Hz/cm

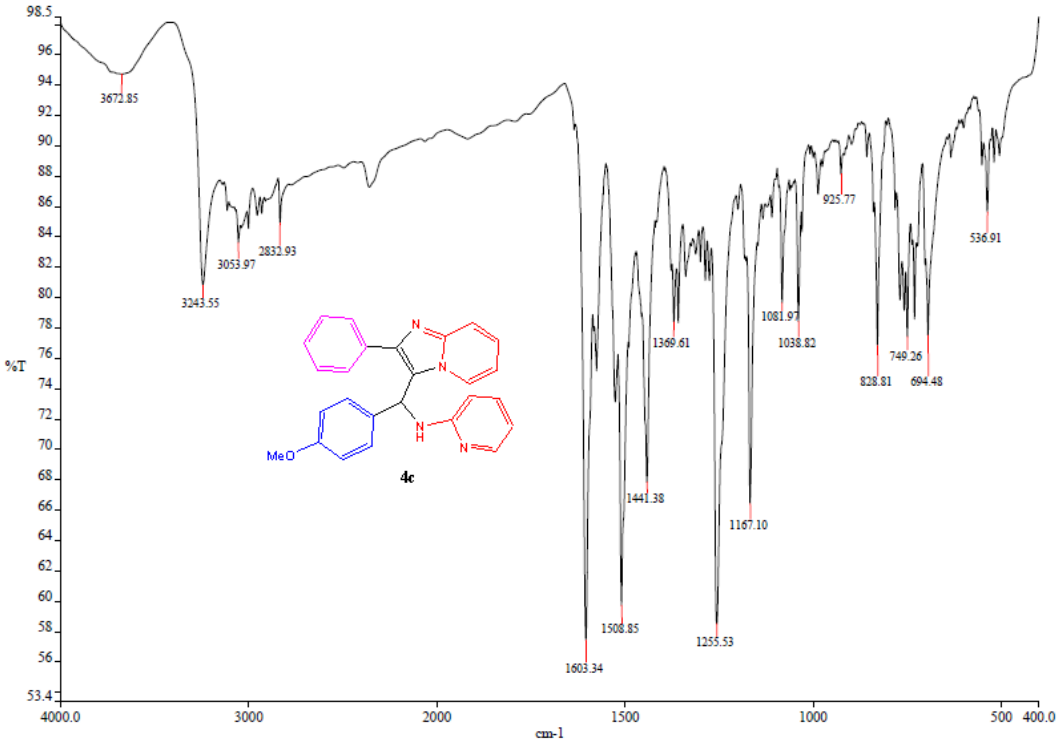
^{1}H-NMR of 4b


ppm
157.409
147.496
144.772
137.253
137.179
135.034
133.812
129.289
128.396
128.108
127.569
126.382
124.448
124.078
118.455
117.126
113.214
111.403
105.791
77.040
76.817
76.617
76.192
51.063
20.588
Me
4b
ppm 200 150 100 50 0
Current Data Parameters
NAME ahwz
EXPNO 412
PROCNO 1
F2 - Acquisition Parameters
Date_ 20140918
Time 8.18
INSTRUM spect
PROBHD 5 mm Multinucl
PULPROG zgpg30
TD 32768
SOLVENT CDCl3
NS 1070
DS 2
SWH 17985.611 Hz
FIDRES 0.548877 Hz
AQ 0.9110004 sec
RG 18390.4
DW 27.800 usec
DE 6.00 usec
TE 300.0 K
D1 2.00000000 sec
d11 0.03000000 sec
d12 0.00002000 sec
======== CHANNEL f1 ========
NUC1 13C
P1 7.00 usec
PL1 -4.00 dB
SFO1 75.4752953 MHz
======== CHANNEL f2 ========
CPDPRG2 waltz16
NUC2 1H
PCPD2 80.00 usec
PL2 0.00 dB
PL12 21.00 dB
PL13 21.00 dB
SFO2 300.1312005 MHz
F2 - Processing parameters
SI 65536
SF 75.4677872 MHz
WDW EM
SSB 0
LB 1.00 Hz
GB 0
PC 1.40
1D NMR plot parameters
CX 20.00 cm
CY 12.50 cm
F1P 215.000 ppm
F1 16225.57 Hz
F2P -5.000 ppm
F2 -377.34 Hz
PPMCM 11.00000 ppm/cm
HZCM 830.14563 Hz/cm

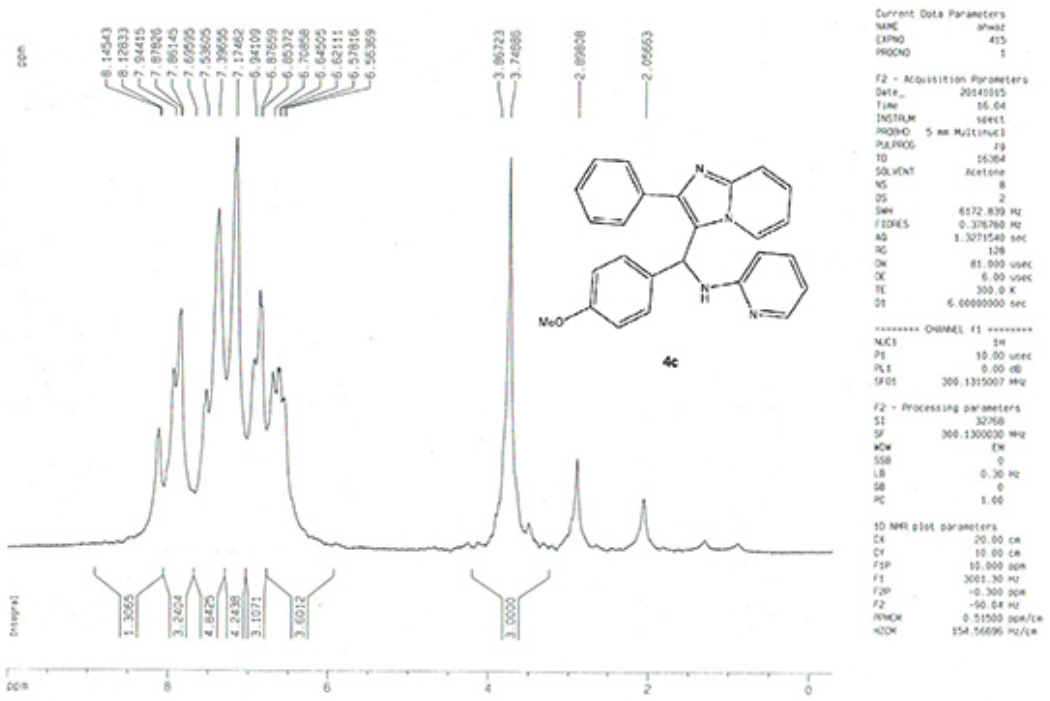
^{13}C-NMR of 4b


ppm
137.253
137.179
135.034
133.812
129.289
128.396
128.108
127.569
126.382
124.448
124.078
Me
4b
ppm
136
134
132
130
128
126

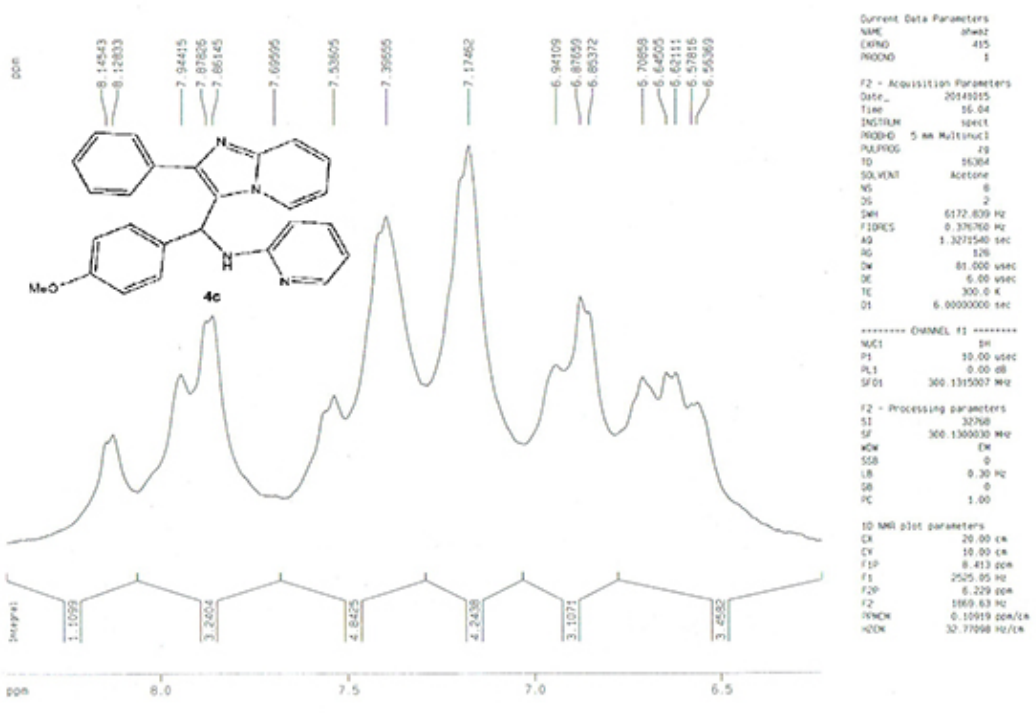
^{13}C-NMR of 4b


98.5
96
94
92
90
88
86
84
82
80
78
76
74
72
70
68
66
64
62
60
58
56
53.4
%T
4000.0
3000
2000
1500
1000
500
400.0
cm-1
3672.85
3243.55
3053.97
2832.93
1603.34
1508.85
1441.38
1369.61
1255.53
1167.10
1081.97
1038.82
925.77
828.81
749.26
694.48
536.91
MeO
N
H
4c

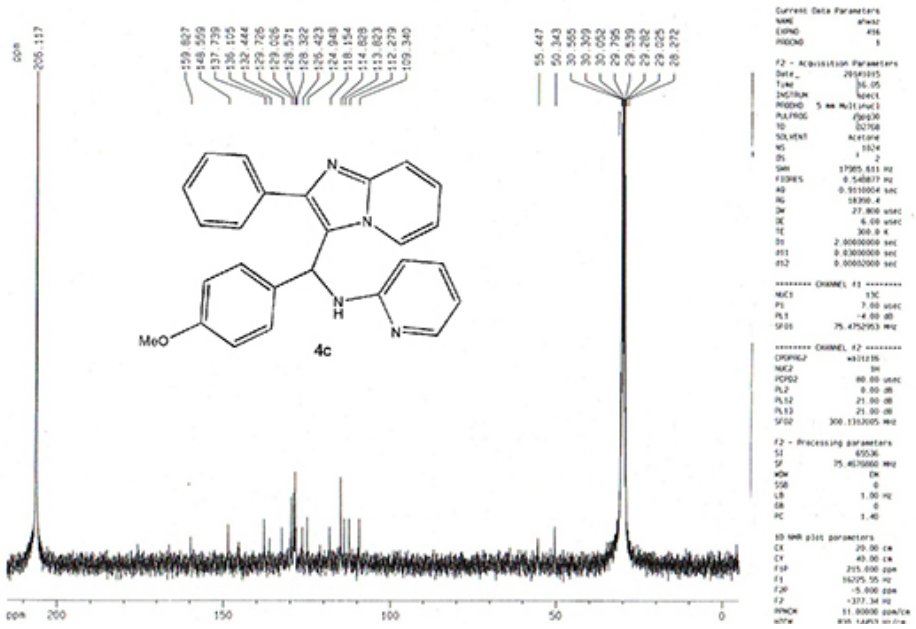
IR of 4c


8.14543
8.12833
7.94415
7.87826
7.86145
7.60595
7.53605
7.39656
7.17462
6.84109
6.87659
6.85372
6.70858
6.64505
6.62111
6.57816
6.56369
3.86723
3.74686
2.89858
2.05653
MeO
4c
Integral
1.3065
3.2404
4.8425
4.2438
3.1071
3.6012
3.0000
ppm
8
6
4
2
0
Current Data Parameters
NAME ahwaz
EXPNO 405
PROCNO 1
F2 - Acquisition Parameters
Date_ 20140305
Time 16.04
INSTRUM spect
PROBHD 5 mm Multinucl
PULPROG zg
TD 16384
SOLVENT Acetone
NS 8
DS 2
SWH 6172.839 Hz
FIDRES 0.376760 Hz
AQ 1.3271540 sec
RG 128
DW 81.000 usec
DE 6.00 usec
TE 300.0 K
D1 6.00000000 sec
======== CHANNEL f1 ========
NUC1 1H
P1 10.00 usec
PL1 0.00 dB
SF01 300.1315007 MHz
F2 - Processing parameters
SI 32768
SF 300.1300030 MHz
WDW EM
SSB 0
LB 0.30 Hz
GB 0
PC 1.00
1D NMR plot parameters
CX 20.00 cm
CY 10.00 cm
F1P 10.000 ppm
F1 3001.30 Hz
F2P -0.300 ppm
F2 -90.04 Hz
PPMCM 0.51500 ppm/cm
HZCM 154.56696 Hz/cm

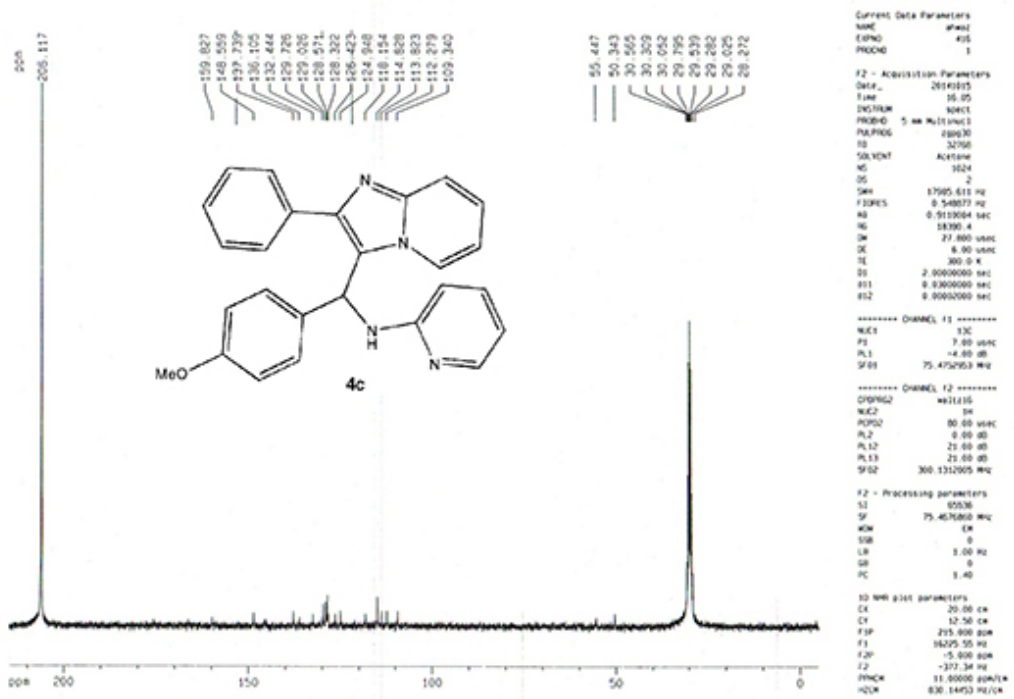
^{1}H-NMR of 4c


8.14543
8.12833
7.94415
7.87826
7.86145
7.69999
7.53605
7.39695
7.17462
6.94109
6.87659
6.86372
6.70858
6.64505
6.62111
6.57816
6.55369
MeO
4c
1.1099
3.2604
4.8425
4.2438
3.1071
3.4582
8.0
7.5
7.0
6.5
ppm

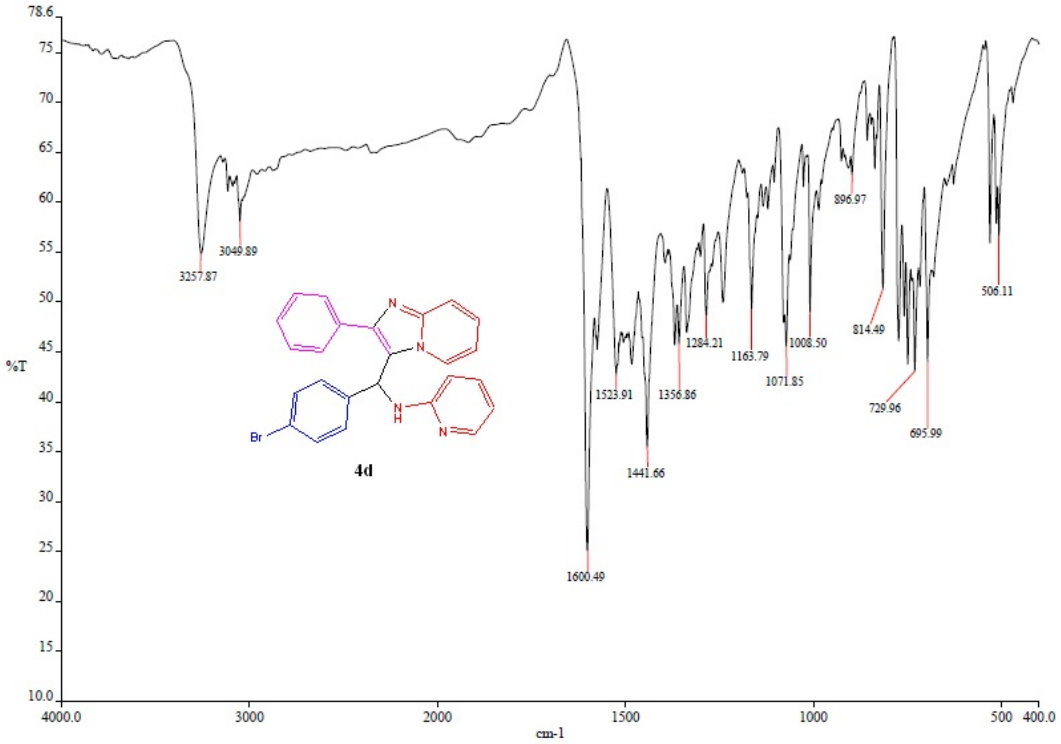
^{1}H-NMR of 4c



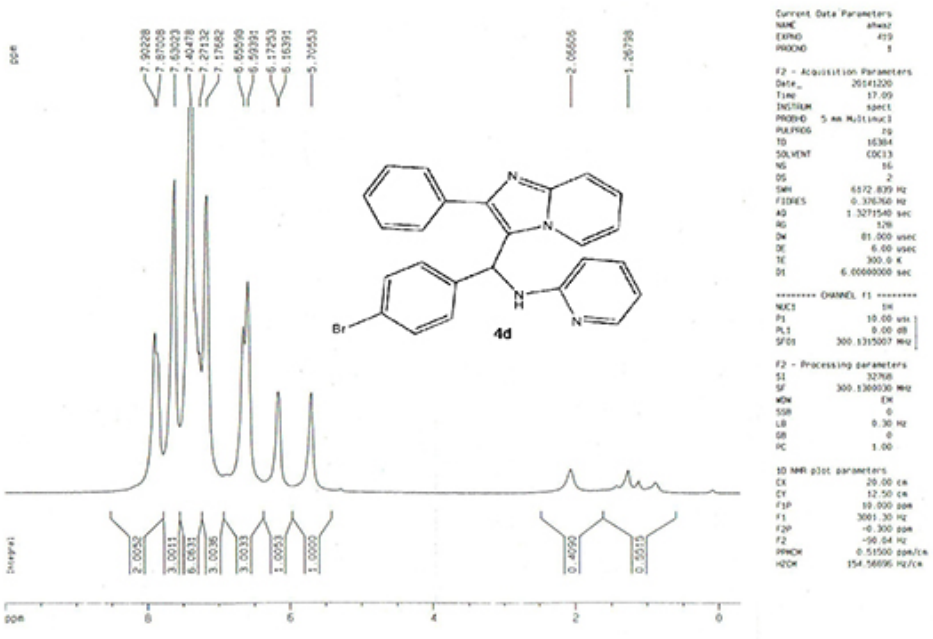
^{13}C-NMR of 4c


ppm
206.117
159.827
148.559
137.739
136.105
132.444
129.726
129.026
128.571
128.322
126.423
124.948
118.154
114.828
113.823
112.279
109.340
55.447
50.343
30.565
30.369
30.052
29.795
29.539
29.282
29.025
28.272
MeO
N
N
H
N
4c
ppm
200
150
100
50
0

^{13}C-NMR of 4c


78.6
75
70
65
60
55
50
45
40
35
30
25
20
15
10.0
%T
4000.0
3000
2000
1500
1000
500
400.0
cm-1
3257.87
3049.89
1600.49
1523.91
1441.66
1356.86
1284.21
1163.79
1071.85
1008.50
896.97
814.49
729.96
695.99
506.11
Br
N
N
N
H
4d

IR of 4d



Current Data Parameters
NAME ahwaz
EXPNO 419
PROCNO 1

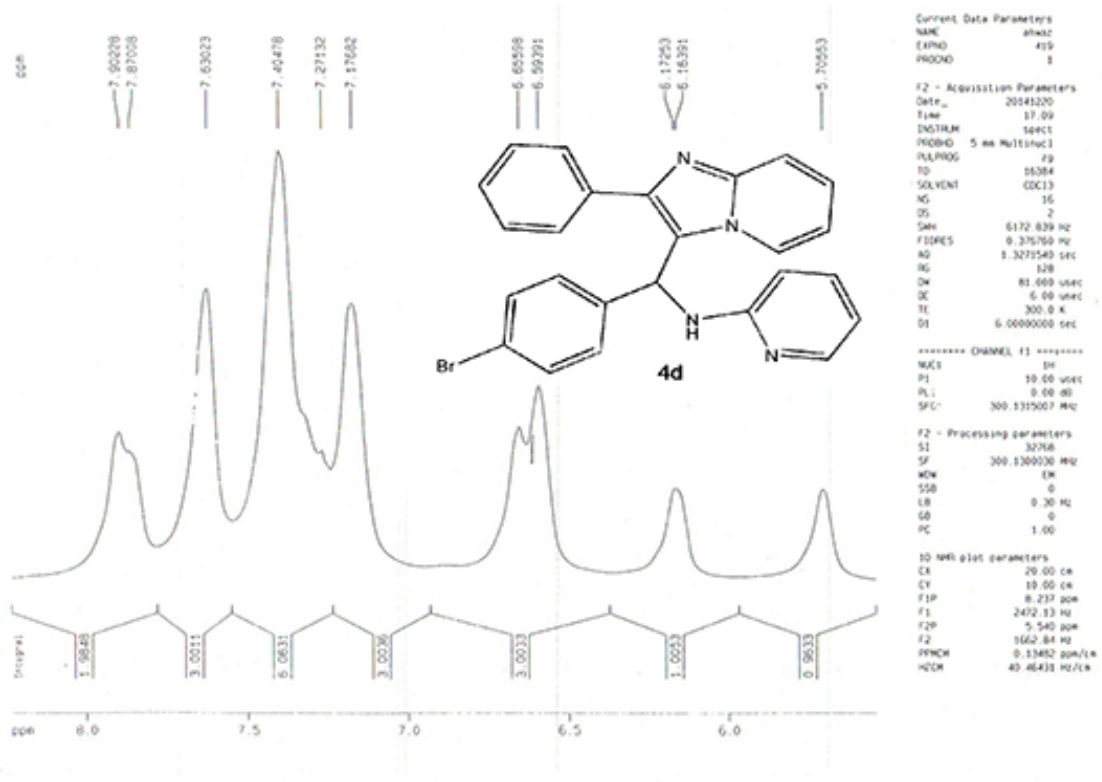
F2 - Acquisition Parameters
Date_ 20141220
Time 17.09
INSTRUM spect
PROBHD 5 mm Multinucl
PULPROG zg
TD 16384
SOLVENT CDCl3
NS 16
DS 2
SWH 6172.839 Hz
FIDRES 0.376760 Hz
AQ 1.3271540 sec
RG 128
DW 81.000 usec
DE 6.00 usec
TE 300.0 K
D1 6.00000000 sec

======== CHANNEL f1 ========
NUC1 1H
P1 10.00 usec
PL1 0.00 dB
SFO1 300.1315007 MHz

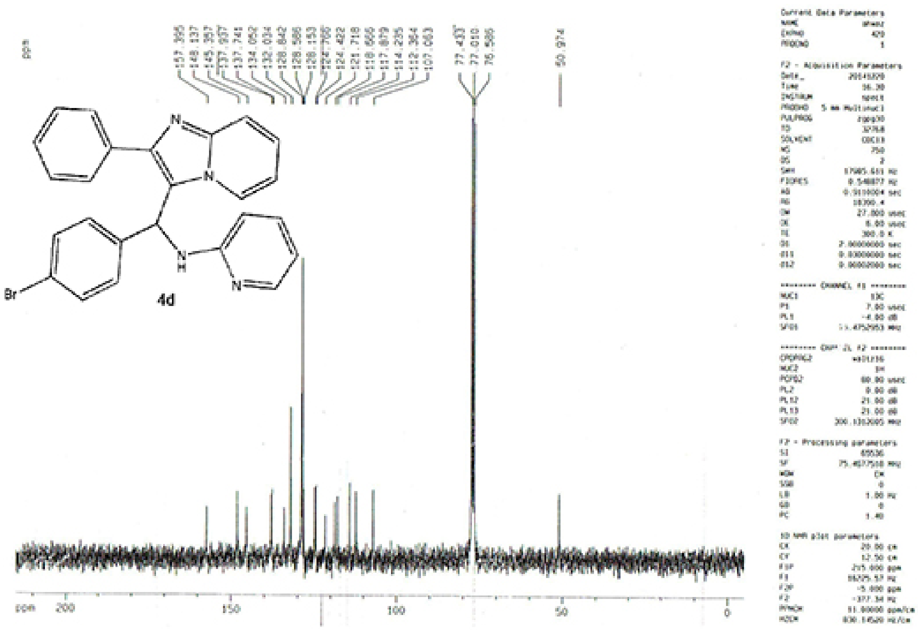
F2 - Processing parameters
SI 32768
SF 300.1300000 MHz
WDW EM
SSB 0
LB 0.30 Hz
GB 0
PC 1.00

1D NMR plot parameters
CX 20.00 cm
CY 12.50 cm
F1P 10.000 ppm
F1 3001.30 Hz
F2P -0.300 ppm
F2 -90.04 Hz
PPMCM 0.51500 ppm/cm
HZCM 154.56696 Hz/cm

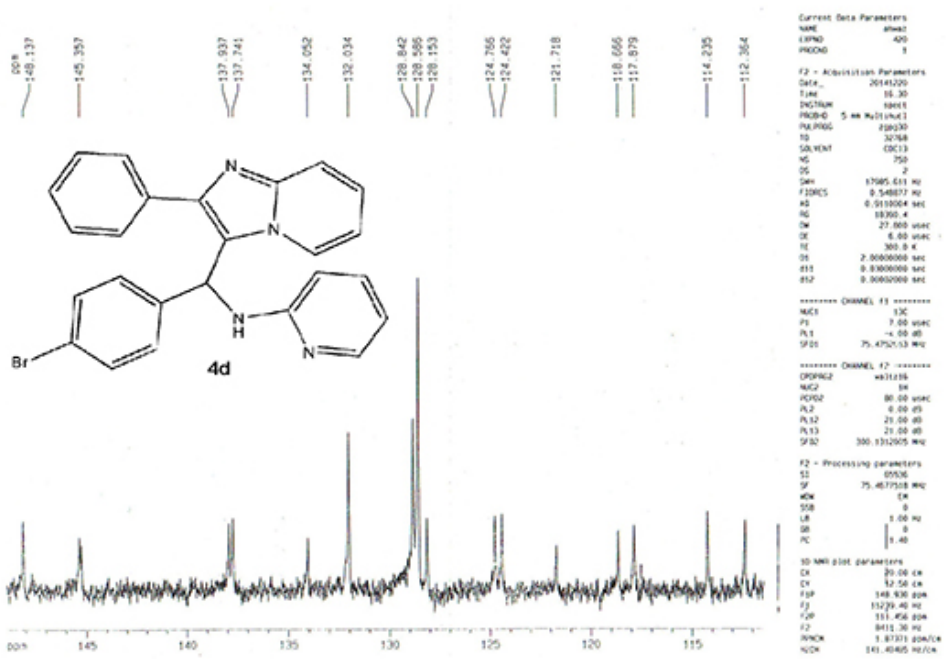
^{1}H-NMR of 4d


7.90209
7.87008
7.63023
7.40478
7.27132
7.17682
6.65598
6.59291
6.17253
6.16391
5.70553
Br
N
N
N
H
4d
1.9849
3.0011
6.0631
3.0036
3.0033
1.0053
0.9633
8.0
7.5
7.0
6.5
6.0
ppm

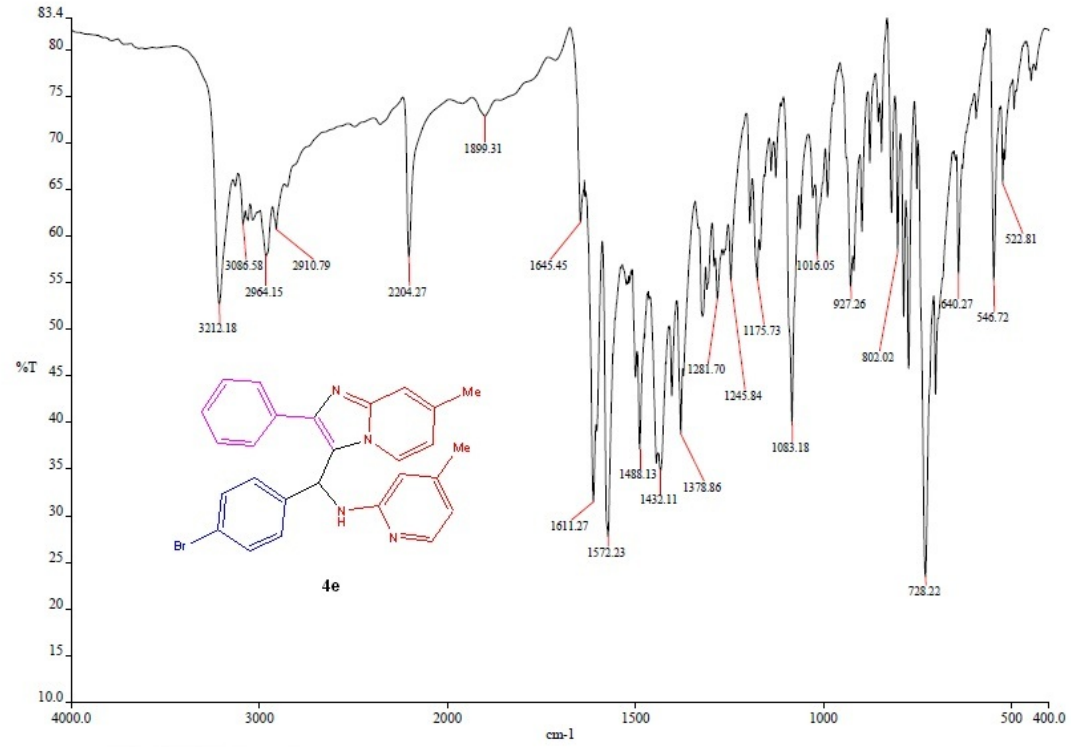
^{1}H-NMR of 4d



^{13}C-NMR of 4d

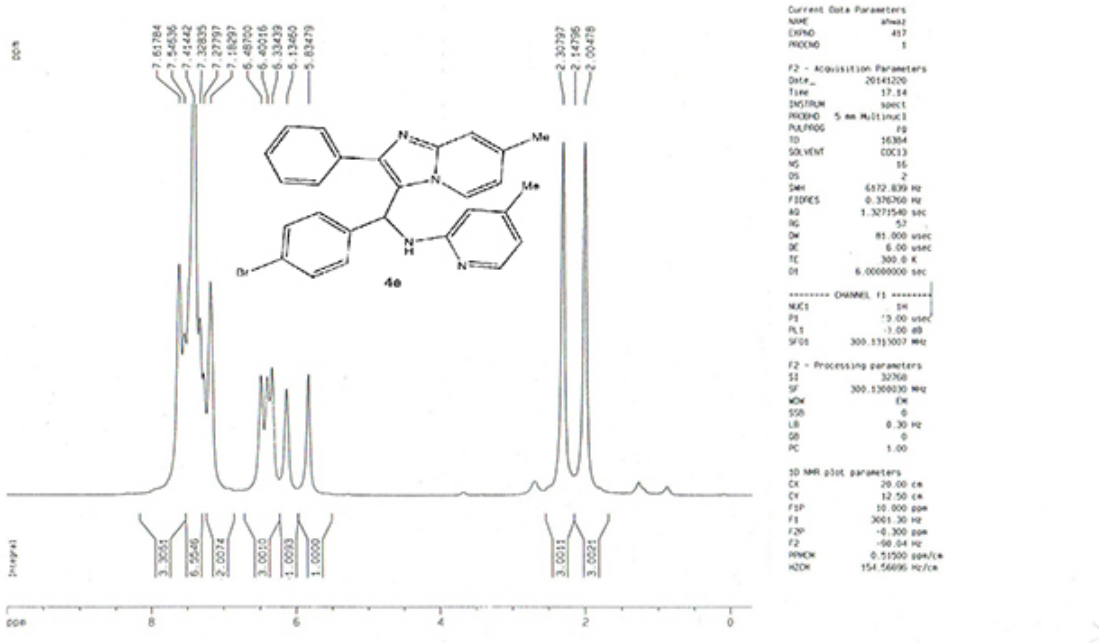

ppm
148.137
145.357
137.937
137.741
134.052
132.034
128.842
128.565
128.153
124.766
124.422
121.718
118.066
117.879
114.235
112.364
Br
N
N
H
N
4d
ppm
145
140
135
130
125
120
115

^{13}C-NMR of 4d

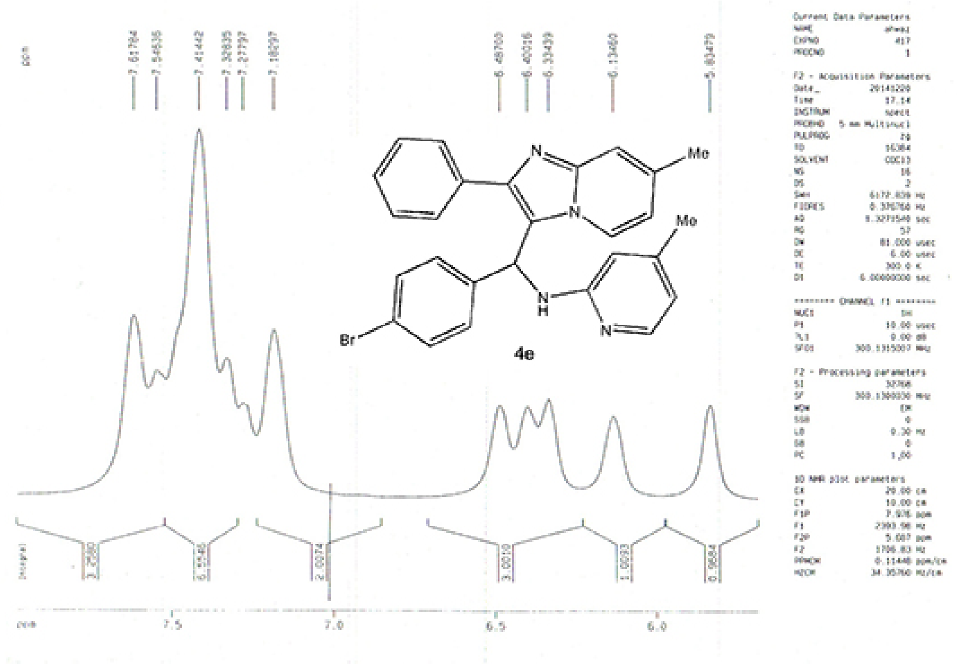

83.4
80
75
70
65
60
55
50
45
40
35
30
25
20
15
10.0
%T
4000.0
3000
2000
1500
1000
500
400.0
cm-1
3212.18
3086.58
2964.15
2910.79
2204.27
1899.31
1645.45
1611.27
1572.23
1488.13
1432.11
1378.86
1281.70
1245.84
1175.73
1083.18
1016.05
927.26
802.02
738.22
640.27
546.72
522.81
Me
Me
N
N
H
N
Br

4e

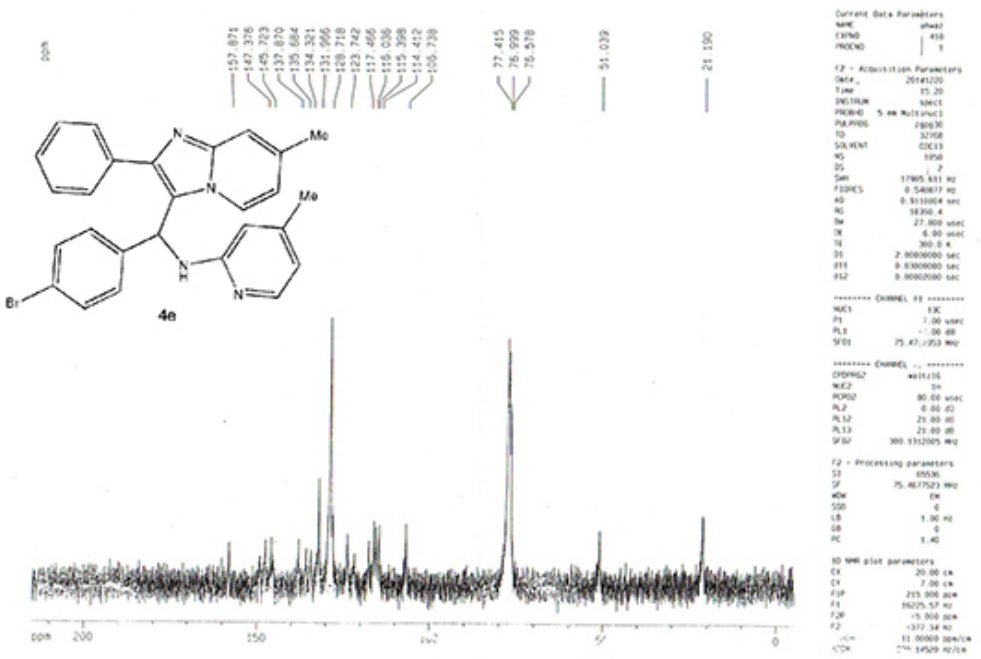
IR of 4e


7.61784
7.54536
7.41442
7.32835
7.27797
7.18297
6.48700
6.40016
6.33439
6.13460
5.83479
2.30797
2.14796
2.00478
Me
Me
Br
N
H
4e
3.3051
6.9546
2.0074
3.0010
1.0093
1.0000
3.0011
3.0021
ppm
8
6
4
2
0

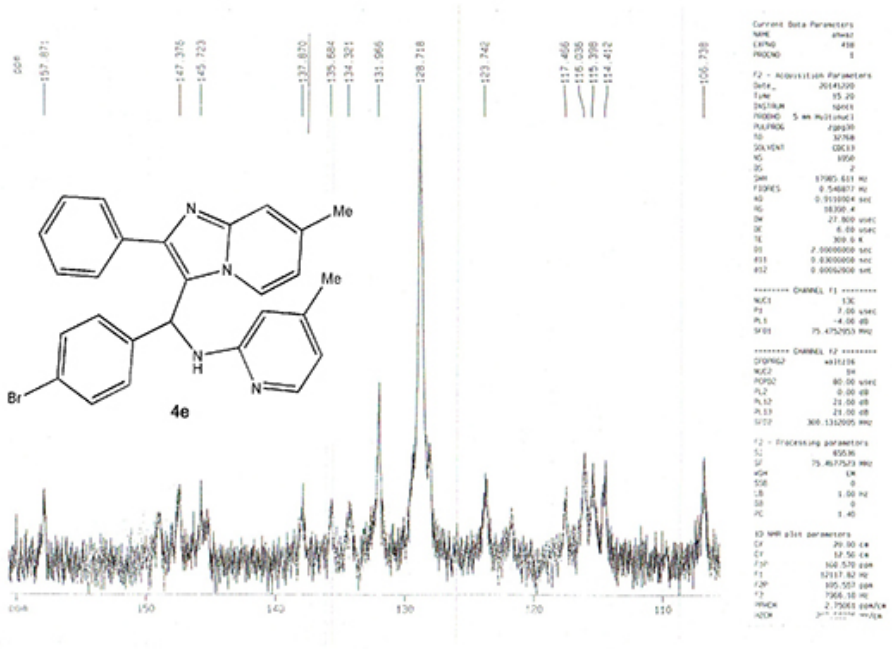
^{1}H-NMR of 4e



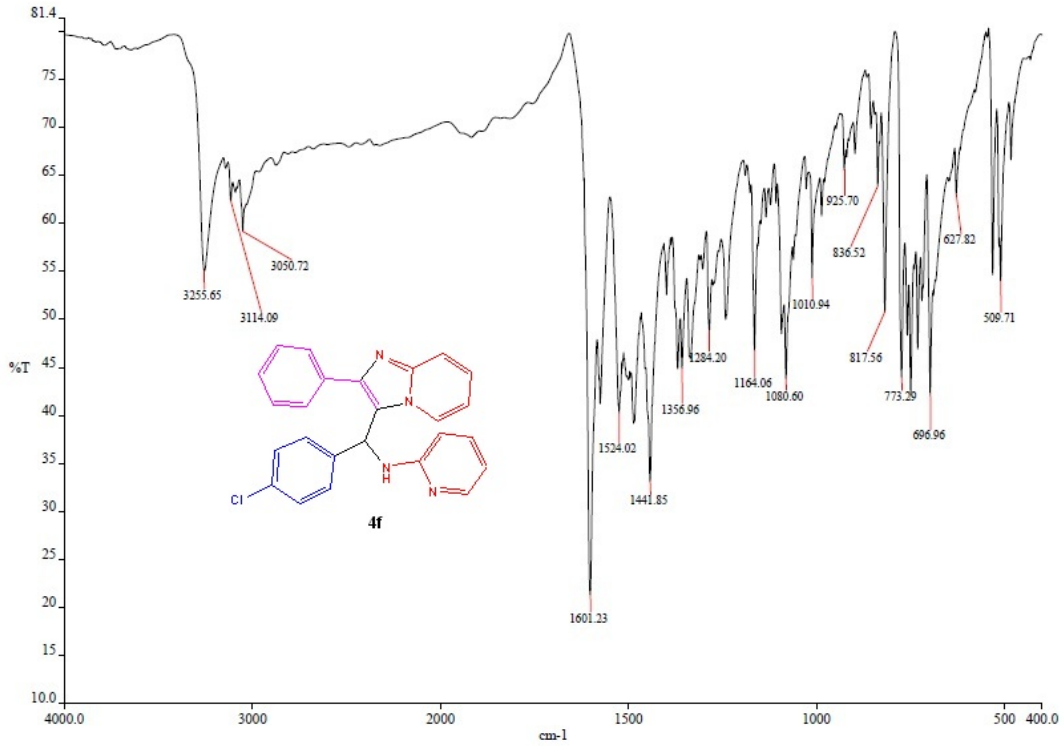
[1]H-NMR of 4e



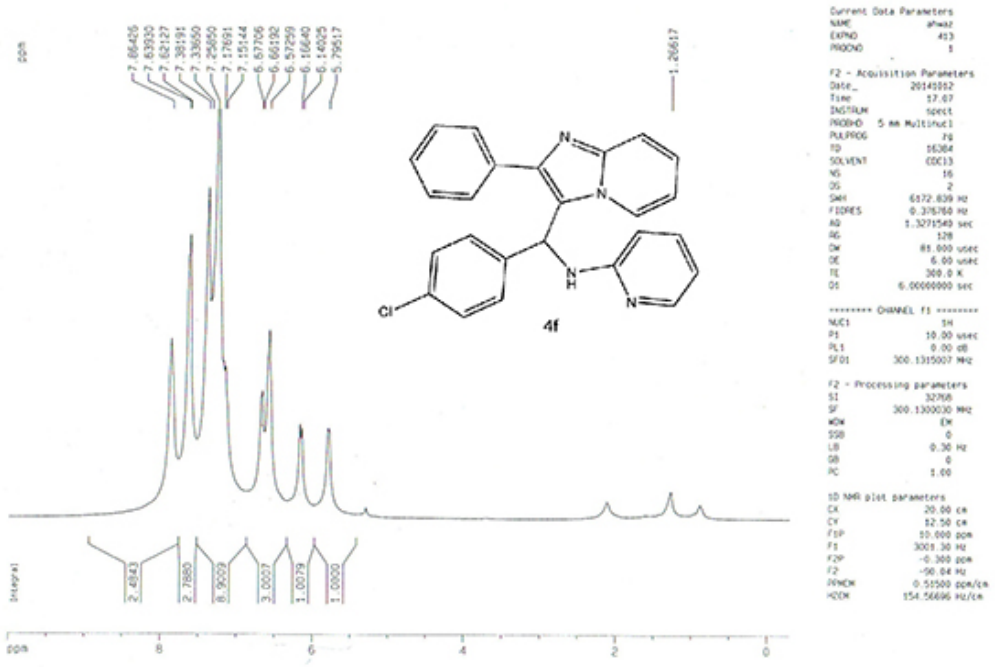
^{13}C-NMR of 4e



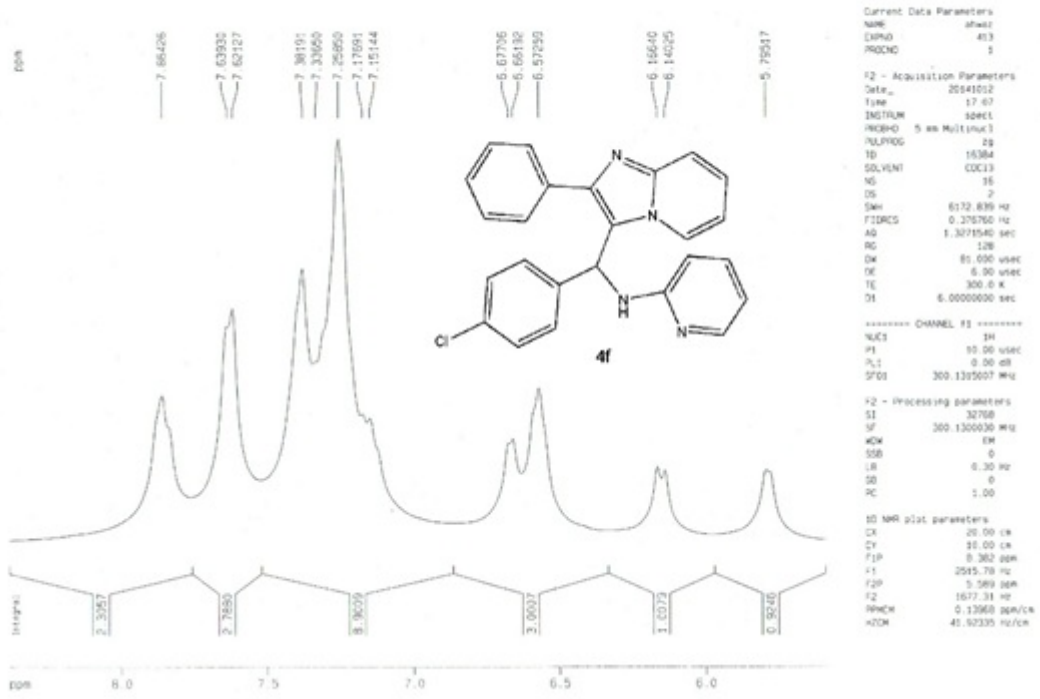
^{13}C-NMR of 4e


81.4
75
70
65
60
55
50
45
40
35
30
25
20
15
10.0
%T
4000.0
3000
2000
1500
1000
500
400.0
cm-1
3255.65
3114.09
3050.72
1601.23
1524.02
1441.85
1356.96
1284.20
1164.06
1080.60
1010.94
925.70
836.52
817.56
773.29
696.96
627.82
509.71
N
N
H
N
Cl
4f

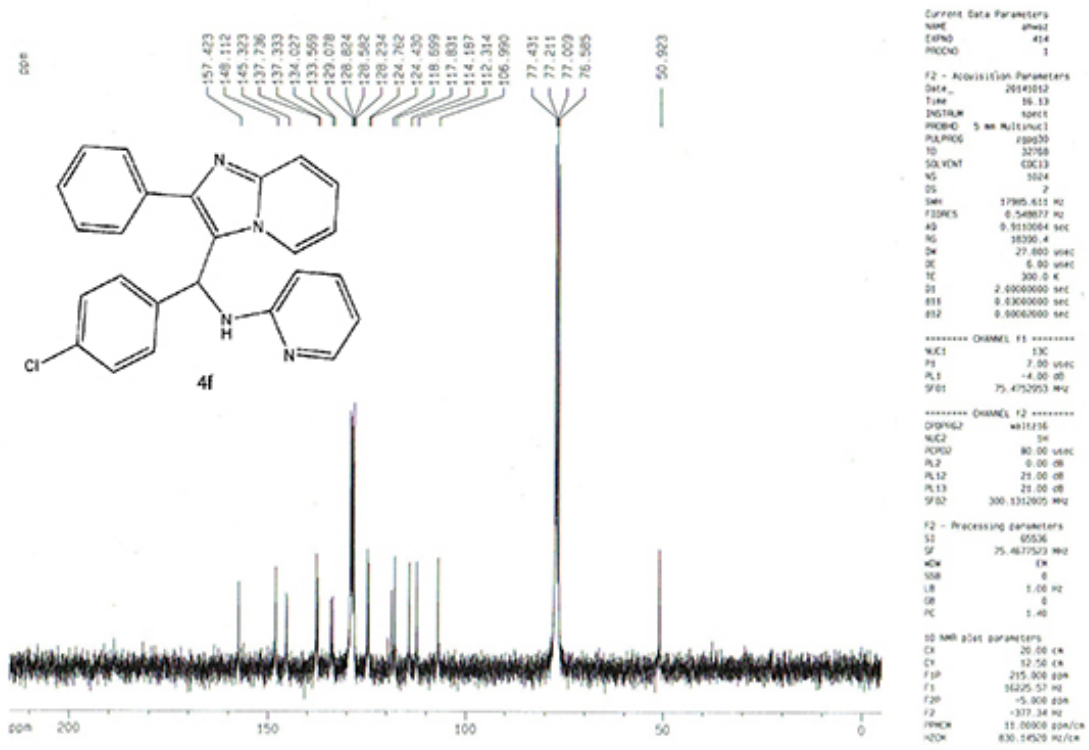
IR of 4f


7.86426
7.83930
7.82127
7.38191
7.33650
7.29850
7.17691
7.15144
6.67706
6.66192
6.57259
6.16640
6.14025
5.79617
1.26617
4f
2.4843
2.7880
8.9009
3.0007
1.0079
1.0000
Current Data Parameters
NAME ahwaz
EXPNO 413
PROCNO 1
F2 - Acquisition Parameters
Date_ 20141012
Time 17.07
INSTRUM spect
PROBHD 5 mm Multinucl
PULPROG zg
TD 16384
SOLVENT CDCl3
NS 16
DS 2
SWH 6172.839 Hz
FIDRES 0.376768 Hz
AQ 1.3271549 sec
RG 128
DW 81.000 usec
DE 6.00 usec
TE 300.0 K
D1 6.00000000 sec
======== CHANNEL f1 ========
NUC1 1H
P1 10.00 usec
PL1 0.00 dB
SF01 300.1315007 MHz
F2 - Processing parameters
SI 32768
SF 300.1300030 MHz
WDW EM
SSB 0
LB 0.30 Hz
GB 0
PC 1.00
1D NMR plot parameters
CX 20.00 cm
CY 12.50 cm
F1P 10.000 ppm
F1 3003.30 Hz
F2P -0.300 ppm
F2 -90.04 Hz
PPMCM 0.51500 ppm/cm
HZCM 154.56696 Hz/cm

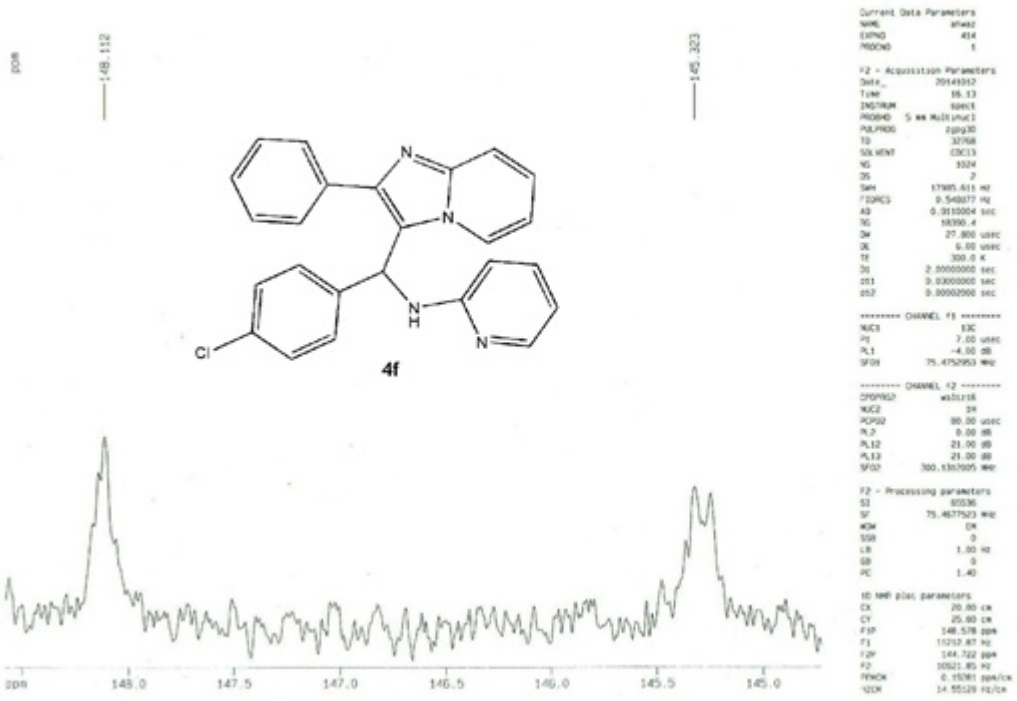
^{1}H-NMR of 4f


7.86426
7.63933
7.62127
7.38191
7.33669
7.25850
7.17691
7.15144
6.67706
6.66182
6.57259
6.16640
6.14025
5.79517
4f
2.3357
2.7880
8.0000
3.0607
1.0073
0.9240
ppm
8.0
7.5
7.0
6.5
6.0

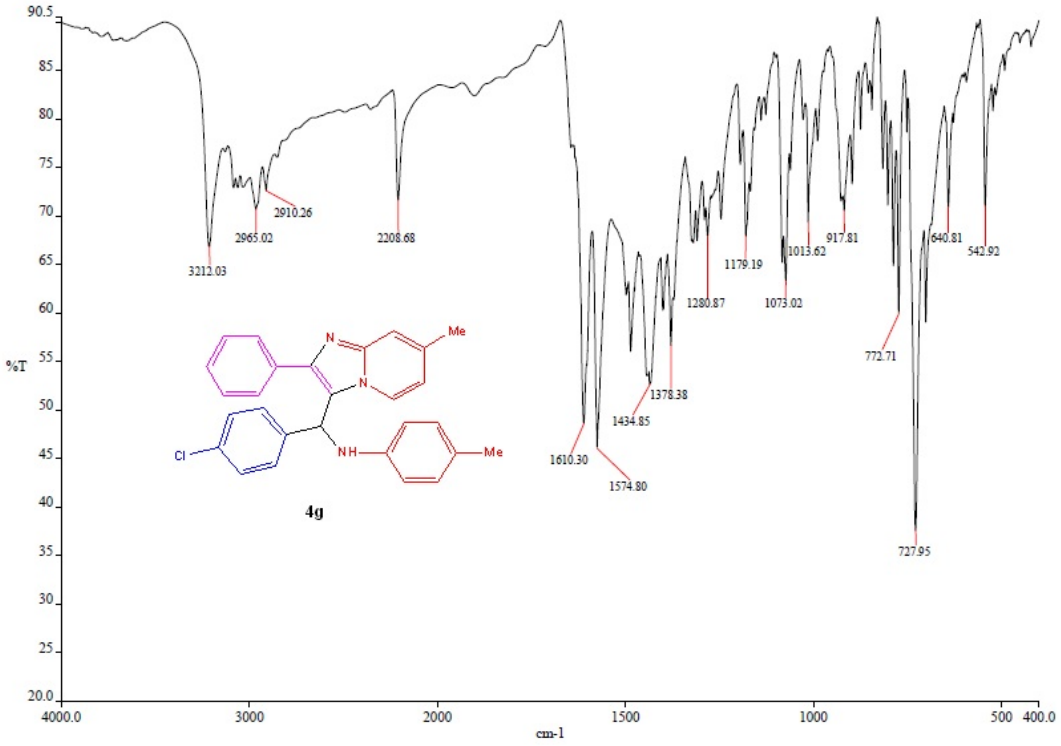
^{1}H-NMR of 4f


157.423
148.112
145.323
137.736
137.333
134.027
133.569
129.078
128.824
128.582
128.234
124.762
124.430
118.699
117.891
114.187
112.314
106.990
77.431
77.211
77.009
76.585
50.923
ppm
200
150
100
50
0
N
N
N
H
Cl
4f

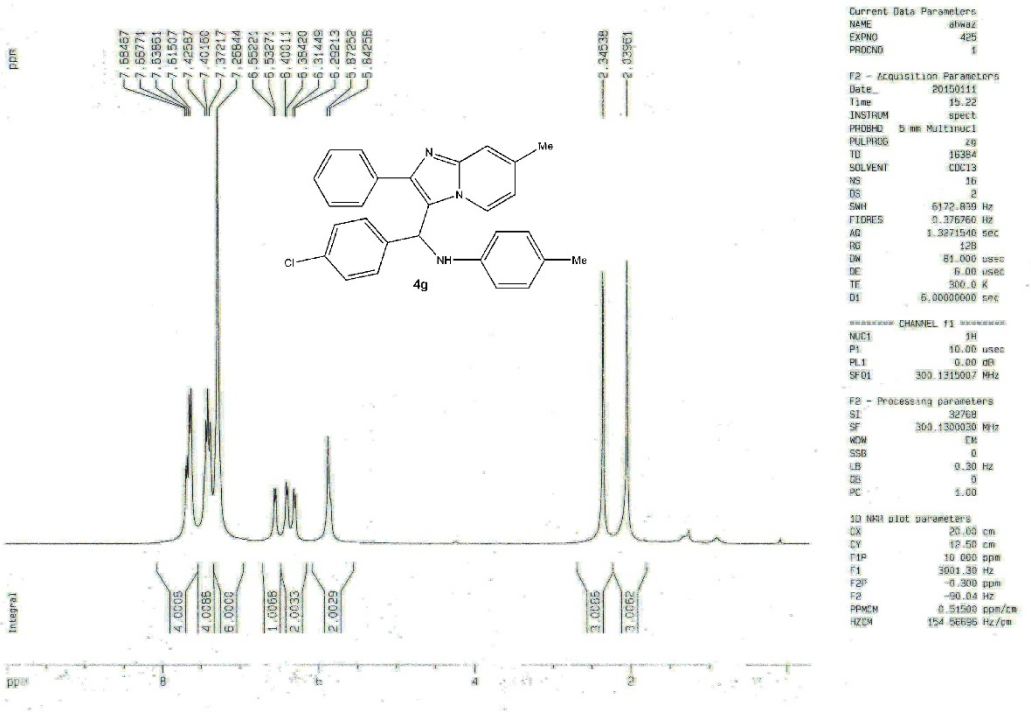
^{13}C-NMR of 4f


ppm
148.112
145.323
N
N
N
H
Cl
4f
148.0
147.5
147.0
146.5
146.0
145.5
145.0

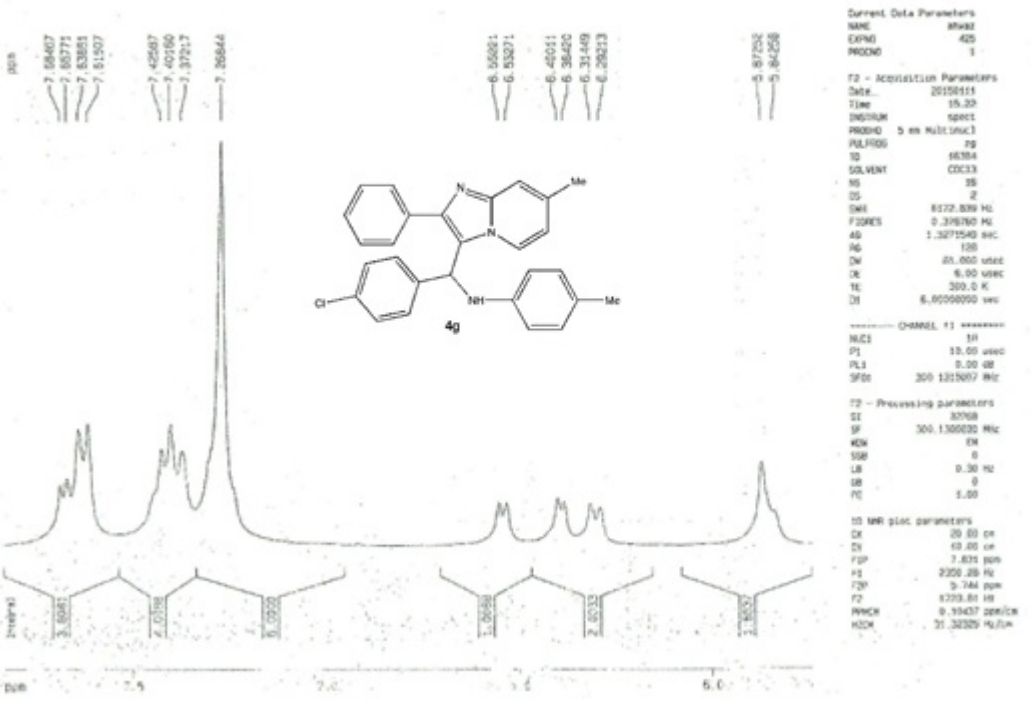
^{13}C-NMR of 4f


90.5
85
80
75
70
65
60
55
50
45
40
35
30
25
20.0
%T
4000.0
3000
2000
1500
1000
500
400.0
cm-1
3212.03
2965.02
2910.26
2208.68
1610.30
1574.80
1434.85
1378.38
1280.87
1179.19
1073.02
1013.62
917.81
772.71
727.95
640.81
542.92
N
N
Me
Cl
NH
Me
4g

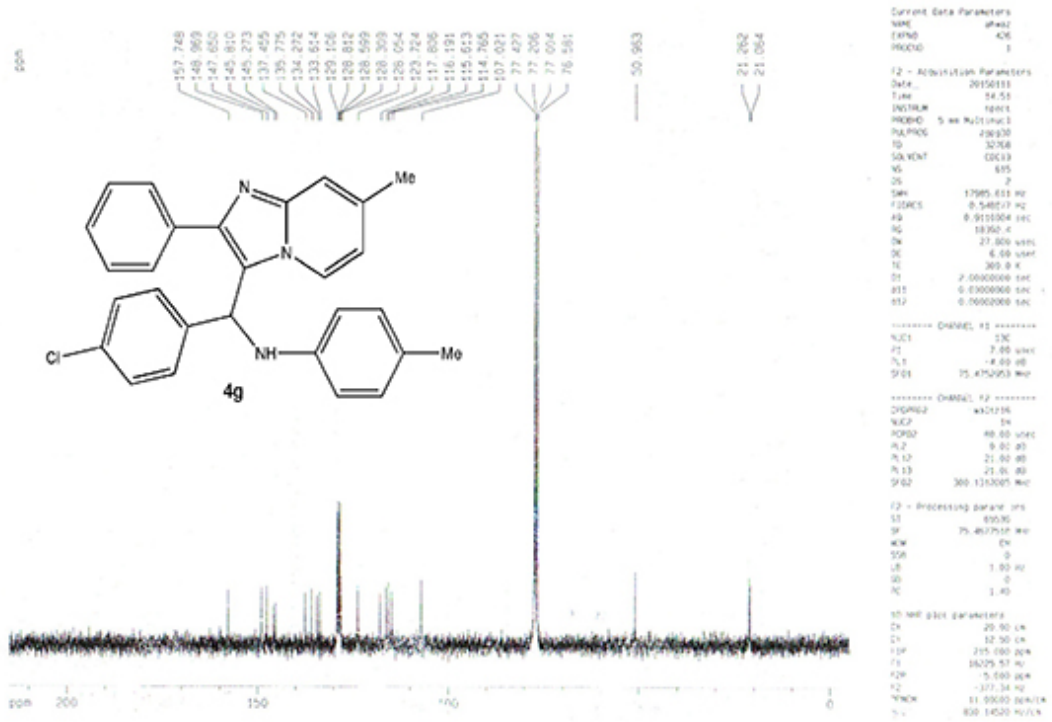
IR of 4g


ppm
7.68457
7.65771
7.53861
7.51507
7.42567
7.40166
7.37217
7.26844
6.55821
6.53271
6.40011
6.36420
6.31449
6.20213
5.87252
5.84256
2.34538
2.03961
Me
N
N
Cl
NH
Me
4g
Integral
4.0005
4.0085
6.0000
1.0068
2.0033
2.0029
3.0065
3.0062
ppm
8
6
4
2
Current Data Parameters
NAME ahwaz
EXPNO 425
PROCNO 1
F2 - Acquisition Parameters
Date_ 20150111
Time 15.22
INSTRUM spect
PROBHD 5 mm Multinucl
PULPROG zg
TD 16384
SOLVENT CDCl3
NS 16
DS 2
SWH 6172.839 Hz
FIDRES 0.376760 Hz
AQ 1.3271540 sec
RG 128
DW 81.000 usec
DE 6.00 usec
TE 300.0 K
D1 5.00000000 sec
======== CHANNEL f1 ========
NUC1 1H
P1 10.00 usec
PL1 0.00 dB
SFO1 300.1315007 MHz
F2 - Processing parameters
SI 32768
SF 300.1300030 MHz
WDW EM
SSB 0
LB 0.30 Hz
GB 0
PC 1.00
1D NMR plot parameters
CX 20.00 cm
CY 12.50 cm
F1P 10.000 ppm
F1 3001.30 Hz
F2P -0.300 ppm
F2 -90.04 Hz
PPMCM 0.51500 ppm/cm
HZCM 154.56895 Hz/cm

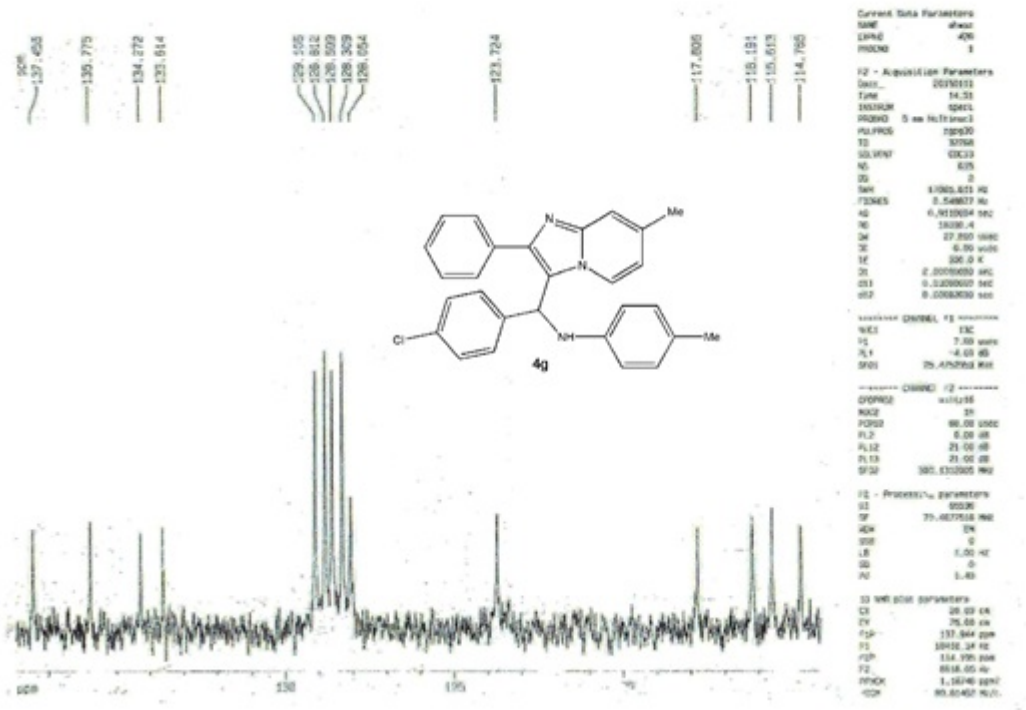
^{1}H-NMR of 4g


7.68407
7.65771
7.63881
7.61507
7.42587
7.40160
7.37917
7.26844
6.55081
6.53271
6.40411
6.38420
6.31449
6.28213
5.87758
5.84258
Me
N
N
Cl
NH
Me
4g
Current Data Parameters
NAME anwaz
EXPNO 425
PROCNO 1
F2 - Acquisition Parameters
Date_ 20150115
Time 15.20
INSTRUM spect
PROBHD 5 mm Multinuc1
PULPROG zg
TD 65384
SOLVENT CDCl3
NS 16
DS 2
SWH 6172.839 Hz
FIDRES 0.376760 Hz
AQ 1.3271540 sec
RG 128
DW 81.000 usec
DE 6.00 usec
TE 300.0 K
D1 6.00000000 sec
CHANNEL f1
NUC1 1H
P1 10.00 usec
PL1 0.00 dB
SFO1 300.1315007 MHz
F2 - Processing parameters
SI 32768
SF 300.1300000 MHz
WDW EM
SSB 0
LB 0.30 Hz
GB 0
PC 1.00
1D NMR plot parameters
CX 20.00 cm
CY 10.00 cm
F1P 7.835 ppm
F1 2350.28 Hz
F2P 5.744 ppm
F2 1723.81 Hz
PPMCM 0.19437 ppm/cm
HZCM 31.32329 Hz/cm

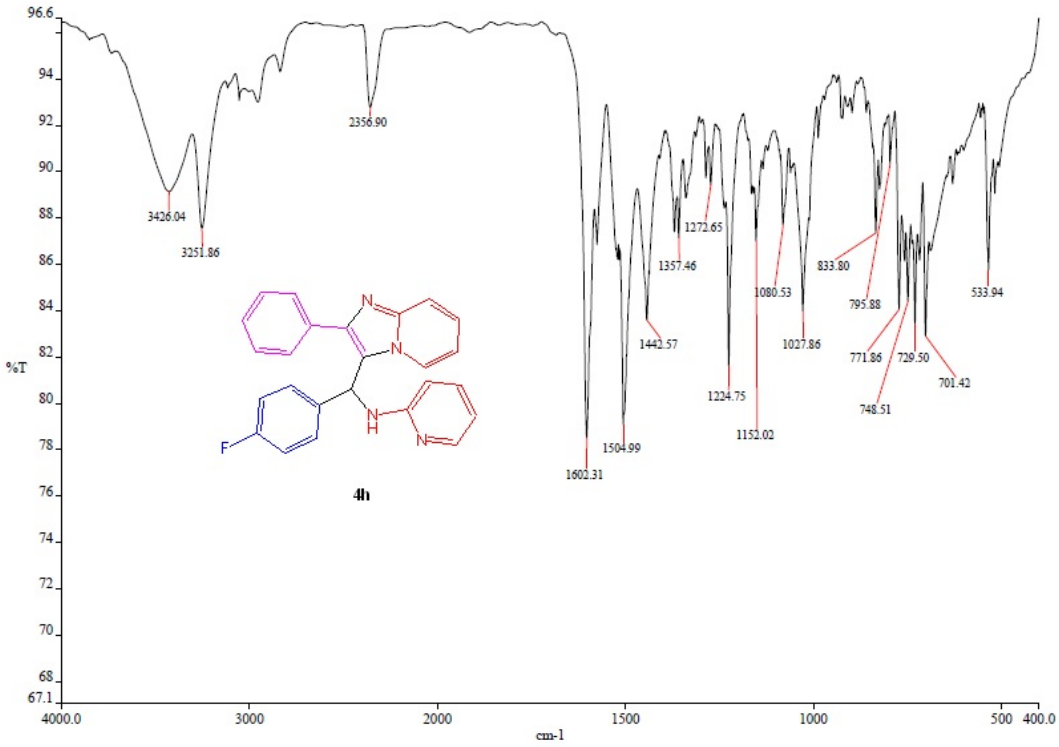
^{1}H-NMR of 4g



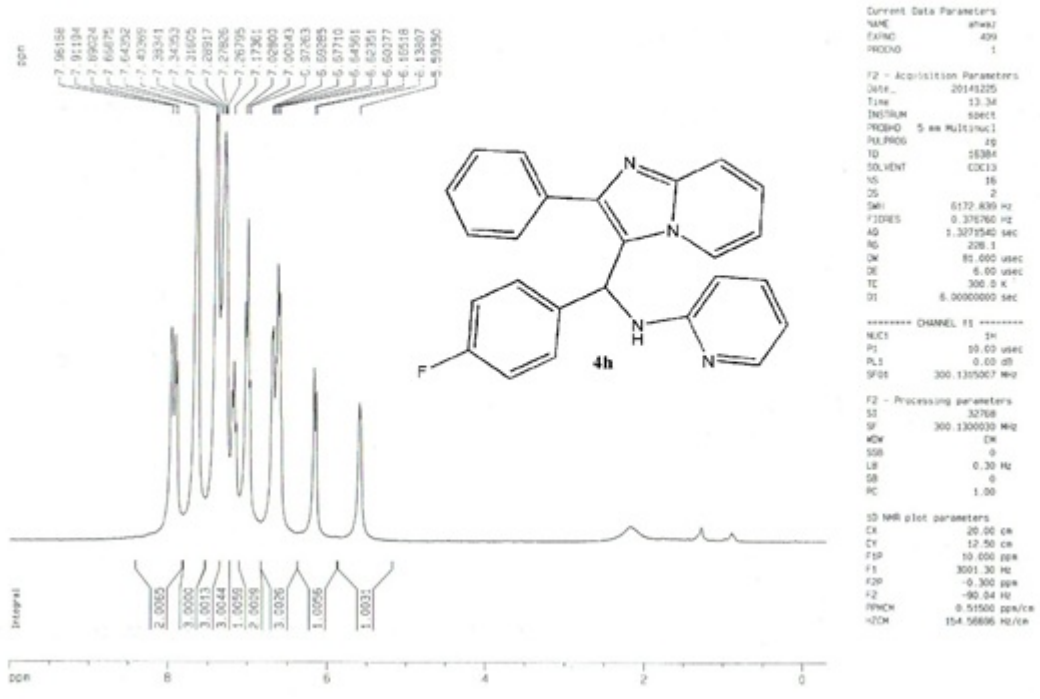
^{13}C-NMR of 4g


137.468
135.779
134.272
131.614
129.155
128.812
128.509
128.369
126.054
123.724
117.806
115.191
115.013
114.765
Me
N
N
Cl
NH
Me
4g

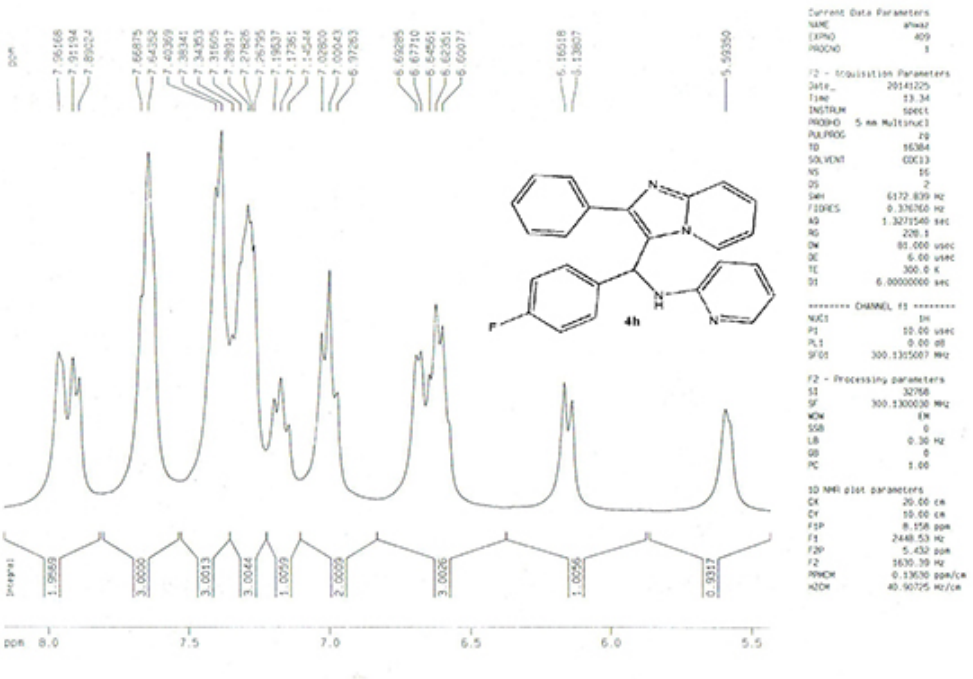
^{13}C-NMR of 4g


96.6
94
92
90
88
86
84
82
80
78
76
74
72
70
68
67.1
%T
4000.0
3000
2000
1500
1000
500
400.0
cm-1
3426.04
3251.86
2356.90
1602.31
1504.99
1442.57
1357.46
1272.65
1224.75
1152.02
1080.53
1027.86
833.80
795.88
771.86
748.51
729.50
701.42
533.94
F
N
N
H
N
4h

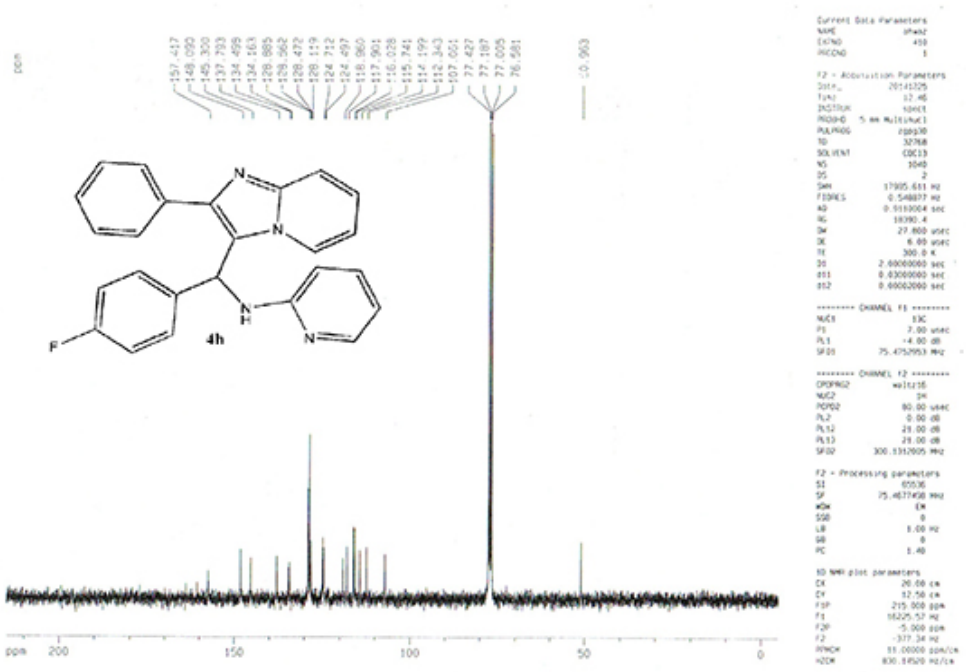
IR of 4h



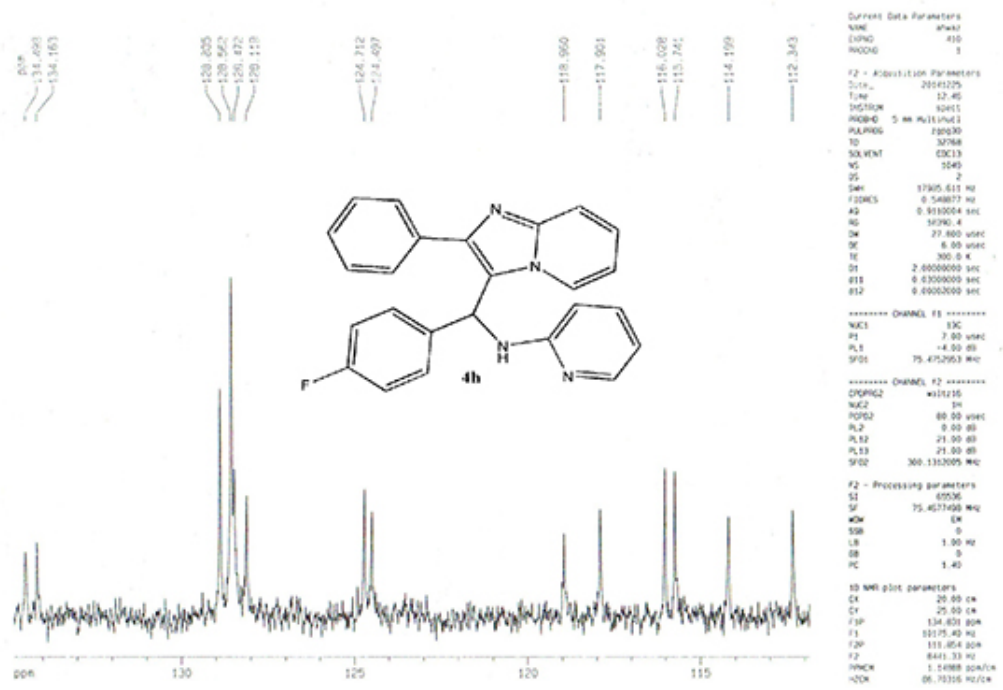
^{1}H-NMR of 4h



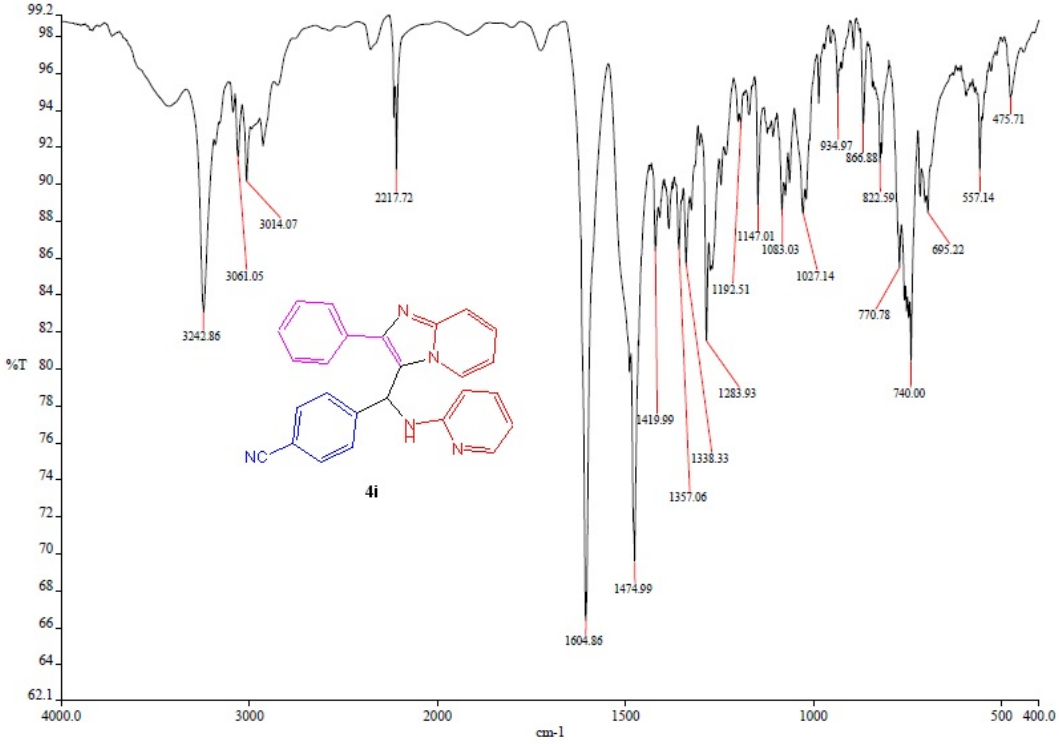
^{1}H-NMR of 4h



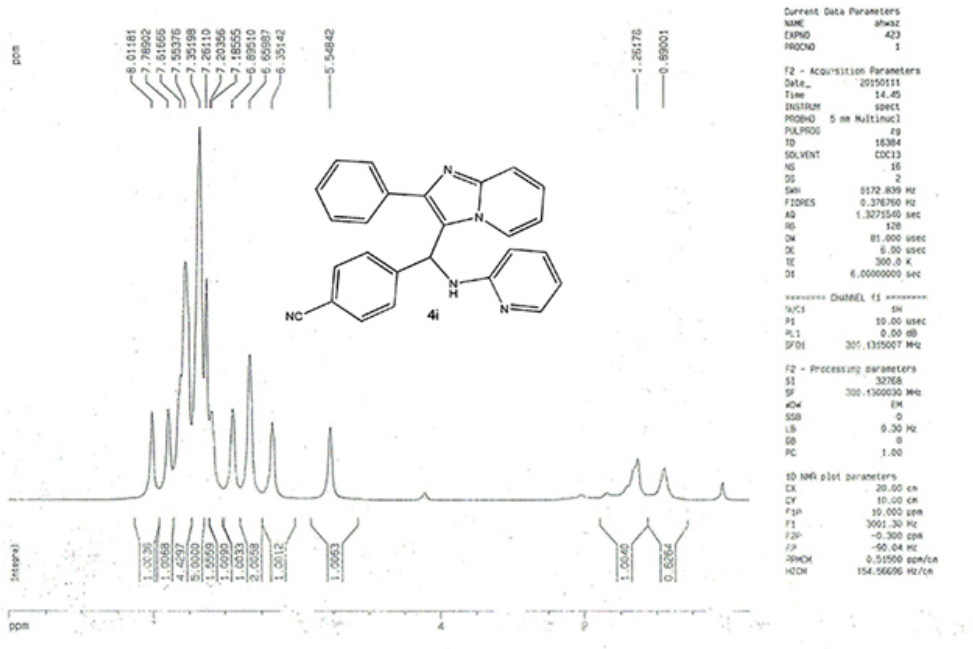
^{13}C-NMR of 4h



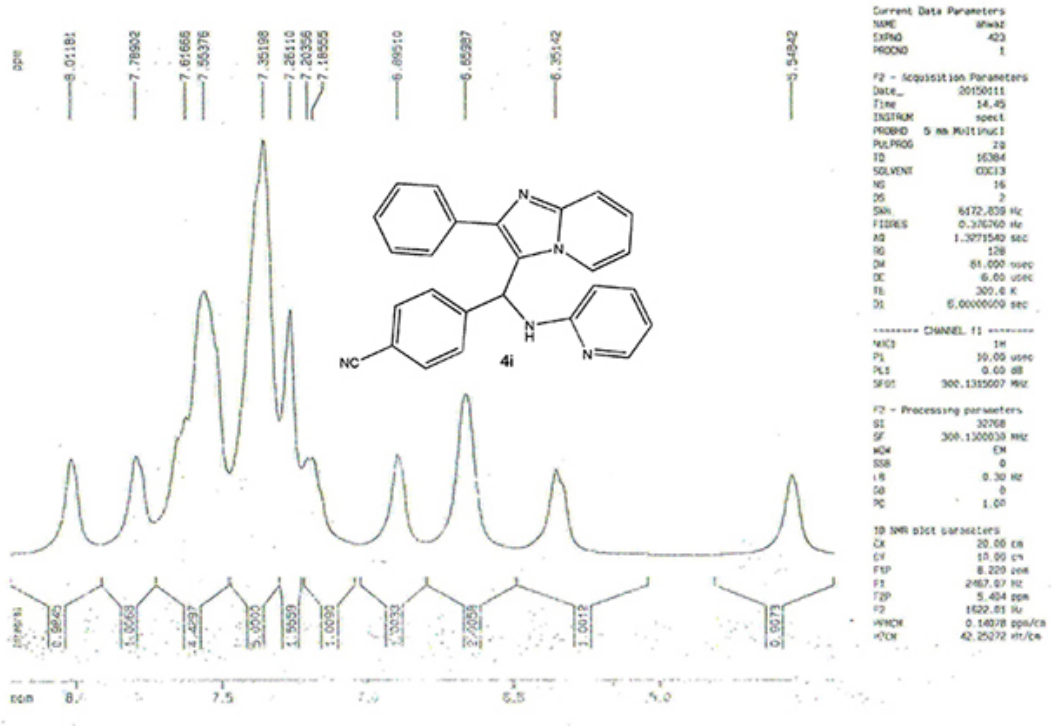
^{13}C-NMR of 4h


%T
cm-1
3242.86
3061.05
3014.07
2217.72
1604.86
1474.99
1419.99
1357.06
1338.33
1283.93
1192.51
1147.01
1083.03
1027.14
934.97
866.88
822.59
770.78
740.00
695.22
557.14
475.71
4i

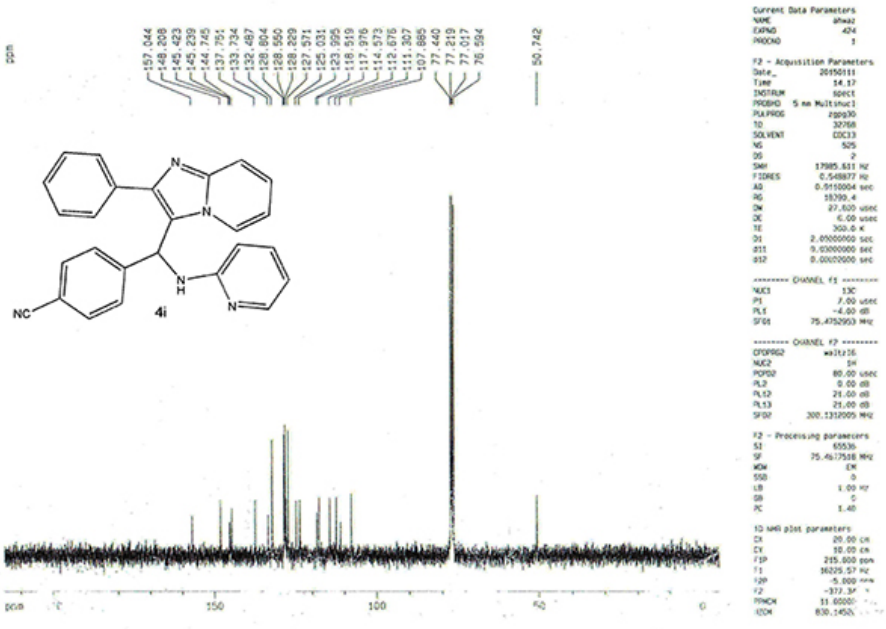
IR of 4i


ppm
8.01181
7.78902
7.61666
7.55376
7.35198
7.26610
7.20356
7.18555
6.89510
6.65587
6.35142
5.54842
1.26176
0.89001
NC
4i
Integral
1.0036
1.0048
4.4297
1.0000
1.0599
1.0000
1.0833
2.0658
1.0612
1.0663
1.0640
0.6264
ppm
Current Data Parameters
NAME ahwaz
EXPNO 423
PROCNO 1
F2 - Acquisition Parameters
Date_ 20150111
Time 14.45
INSTRUM spect
PROBHD 5 mm Multinucl
PULPROG zg
TD 16384
SOLVENT CDCl3
NS 16
DS 2
SWH 6172.839 Hz
FIDRES 0.376760 Hz
AQ 1.3271540 sec
RG 128
DW 81.000 usec
DE 6.00 usec
TE 300.0 K
D1 6.00000000 sec
======== CHANNEL f1 ========
NUC1 1H
P1 10.00 usec
PL1 0.00 dB
SFO1 300.1315007 MHz
F2 - Processing parameters
SI 32768
SF 300.1300030 MHz
WDW EM
SSB 0
LB 0.30 Hz
GB 0
PC 1.00
1D NMR plot parameters
CX 20.00 cm
CY 10.00 cm
F1P 10.000 ppm
F1 3001.30 Hz
F2P -0.300 ppm
F2 -90.04 Hz
PPMCM 0.51500 ppm/cm
HZCM 154.56606 Hz/cm

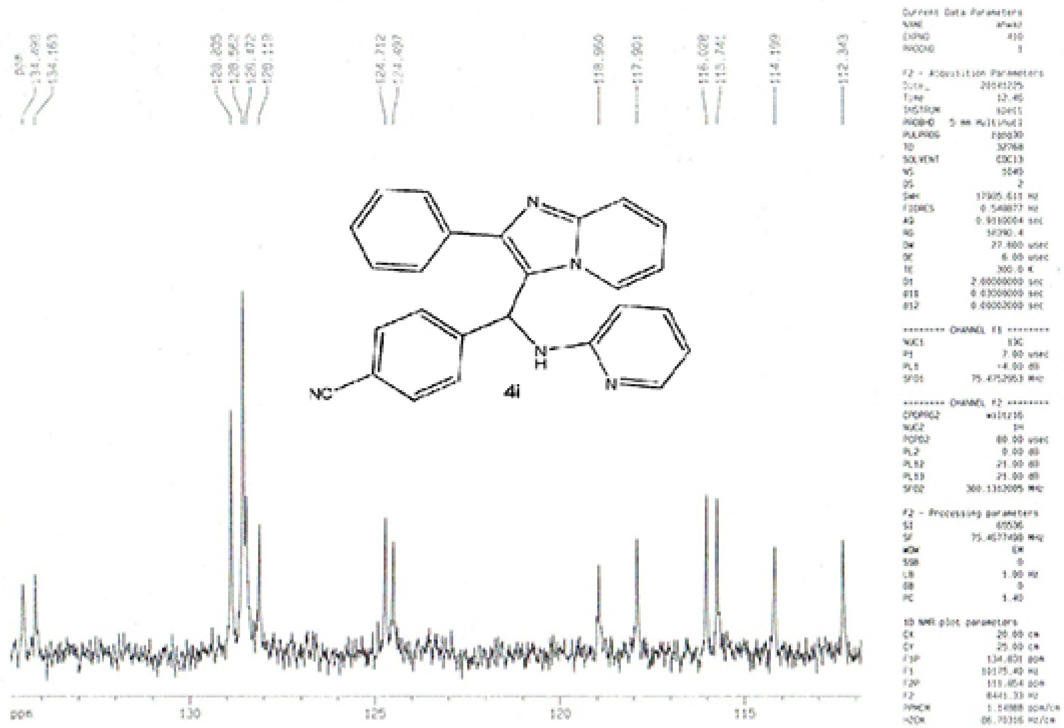
^{1}H-NMR of 4i


8.01181
7.78902
7.61666
7.56376
7.35198
7.26110
7.20356
7.18055
6.89510
6.65987
6.35142
5.54842
4i
NC
N
H
Current Data Parameters
NAME mhwaz
EXPNO 423
PROCNO 1
F2 - Acquisition Parameters
Date_ 20150111
Time 14.45
INSTRUM spect
PROBHD 5 mm Multinucl
PULPROG zg
TD 16384
SOLVENT CDCl3
NS 16
DS 2
SWH 6172.839 Hz
FIDRES 0.376760 Hz
AQ 1.3271540 sec
RG 128
DW 81.000 usec
DE 6.00 usec
TE 300.6 K
D1 6.00000009 sec
CHANNEL f1
NUC1 1H
P1 10.00 usec
PL1 0.00 dB
SFO1 300.1315007 MHz
F2 - Processing parameters
SI 32768
SF 300.1300030 MHz
WDW EM
SSB 0
LB 0.30 Hz
GB 0
PC 1.00
1D NMR plot parameters
CX 20.00 cm
CY 10.00 cm
F1P 8.220 ppm
F1 2467.07 Hz
F2P 5.404 ppm
F2 1622.01 Hz
PPMCM 0.14078 ppm/cm
HZCM 42.25272 Hz/cm
integral
0.8845
1.0468
4.4297
5.0000
1.9659
1.0000
1.3033
2.7086
1.0012
0.9073
ppm
8.0
7.5
7.0
6.5
5.0

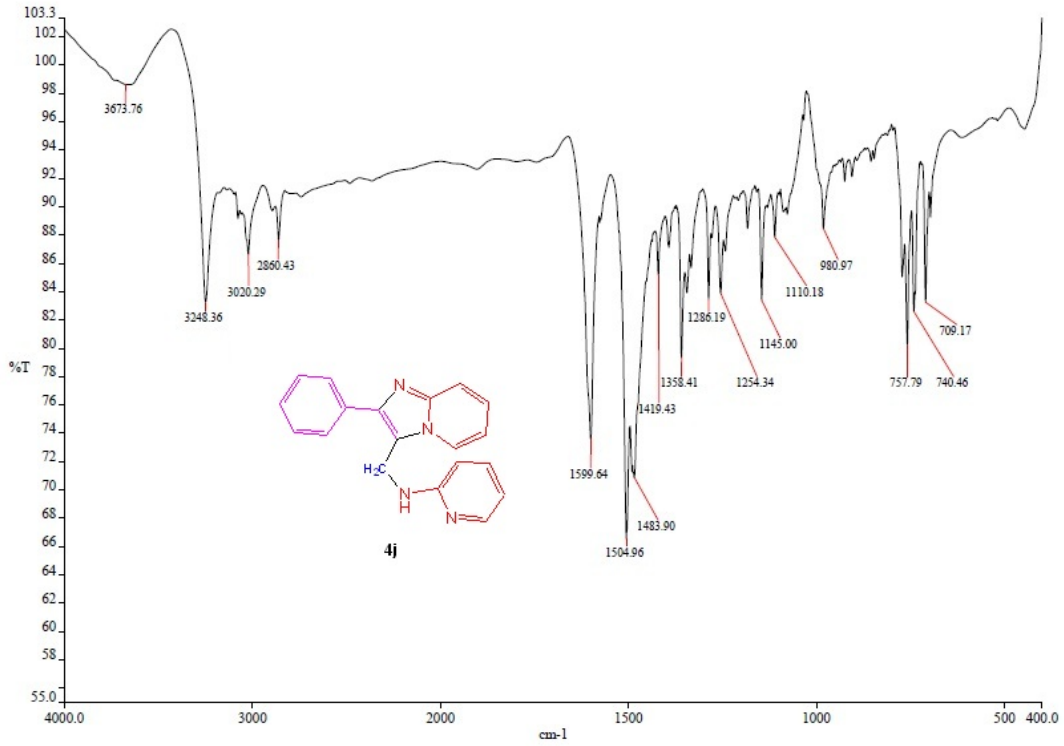
^{1}H-NMR of 4i


157.044
148.208
145.423
145.239
144.746
137.751
133.734
132.487
128.804
128.580
128.289
127.571
125.031
123.995
118.519
117.976
114.573
112.676
111.307
107.885
77.440
77.219
77.017
76.594
50.742
NC
4i
N
N
N
H

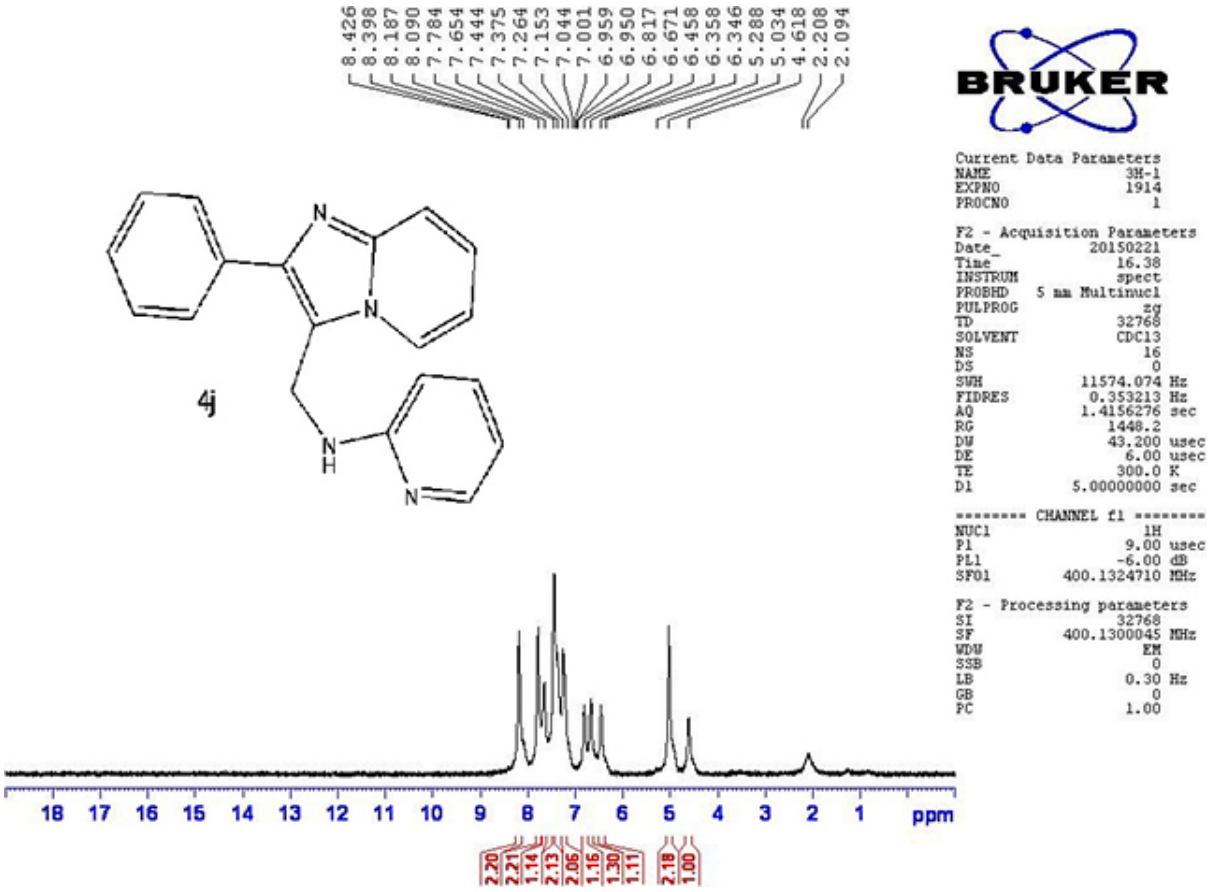
^{13}C-NMR of 4i



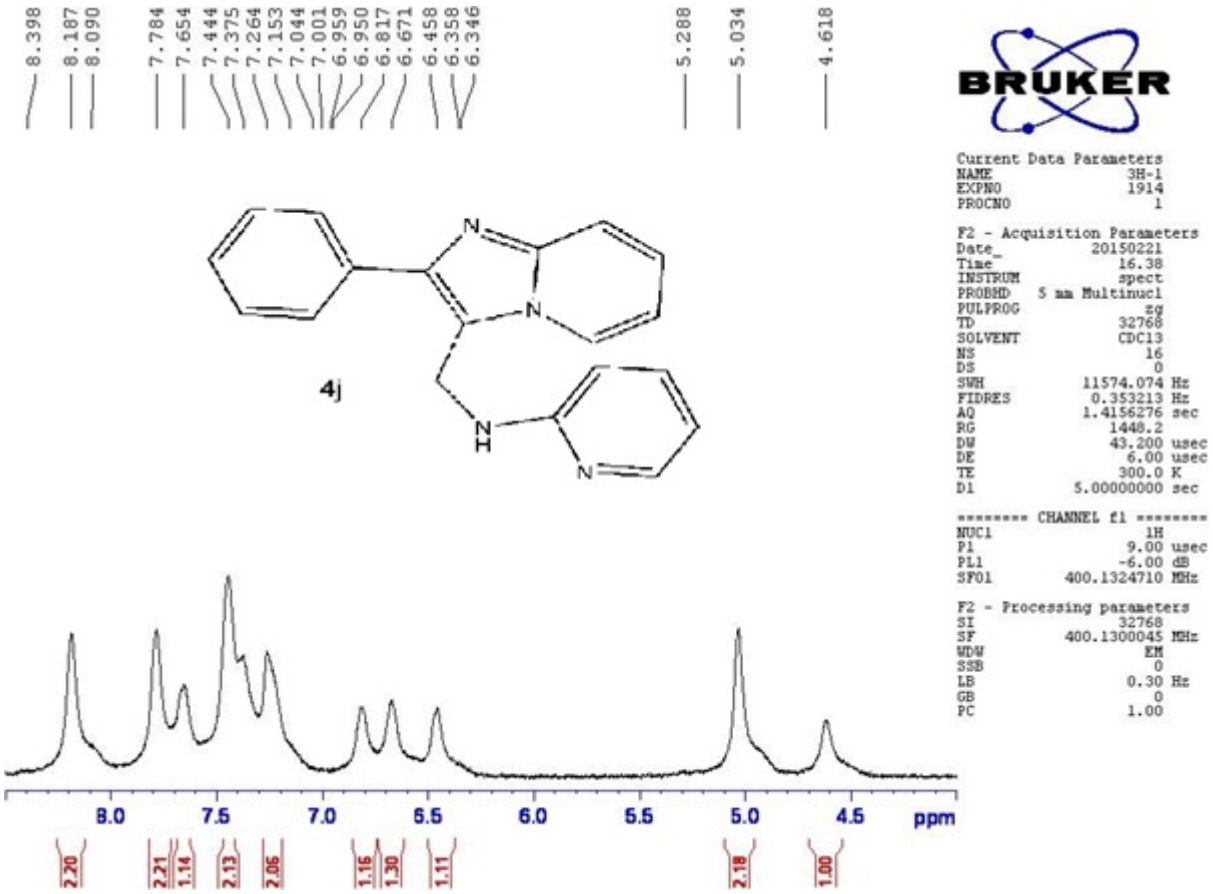
^{13}C-NMR of 4i


103.3
102
100
98
96
94
92
90
88
86
84
82
80
78
76
74
72
70
68
66
64
62
60
58
55.0
%T
3673.76
3248.36
3020.29
2860.43
1599.64
1504.96
1483.90
1419.43
1358.41
1286.19
1254.34
1145.00
1110.18
980.97
757.79
740.46
709.17
4j
4000.0
3000
2000
1500
1000
500
400.0
cm-1

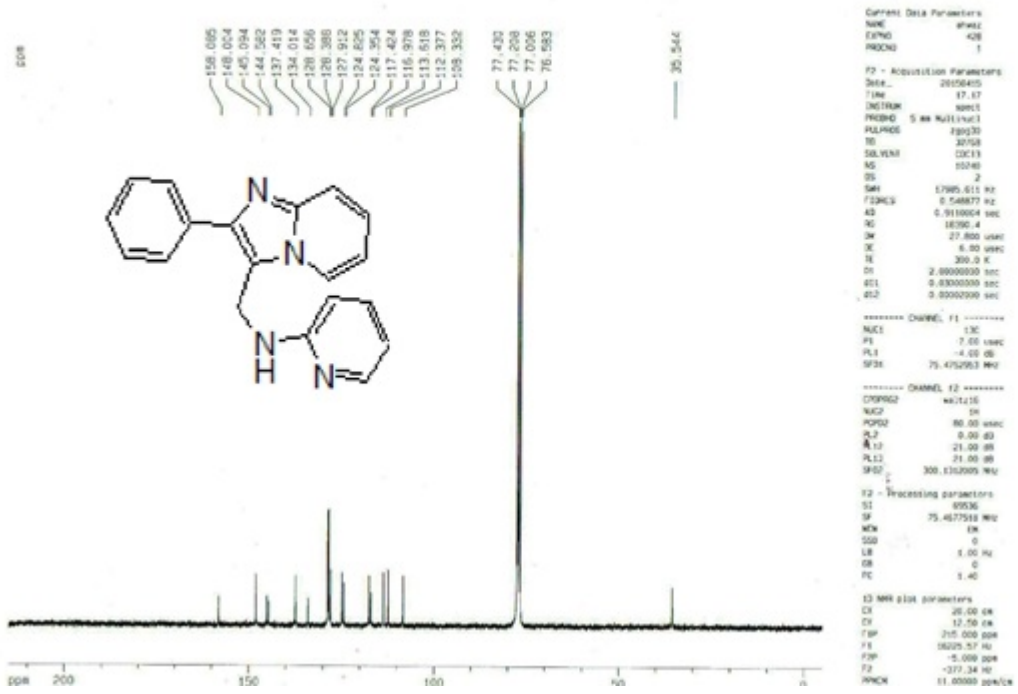
IR of 4j


8.426
8.398
8.187
8.090
7.784
7.654
7.444
7.375
7.264
7.153
7.044
7.001
6.959
6.950
6.817
6.671
6.458
6.358
6.346
5.288
5.034
4.618
2.208
2.094
4j
N
N
N
H
N
BRUKER
Current Data Parameters
NAME 3H-1
EXPNO 1914
PROCNO 1
F2 - Acquisition Parameters
Date_ 20150221
Time 16.38
INSTRUM spect
PROBHD 5 mm Multinucl
PULPROG zg
TD 32768
SOLVENT CDCl3
NS 16
DS 0
SWH 11574.074 Hz
FIDRES 0.353213 Hz
AQ 1.4156276 sec
RG 1448.2
DW 43.200 usec
DE 6.00 usec
TE 300.0 K
D1 5.00000000 sec
======== CHANNEL f1 ========
NUC1 1H
P1 9.00 usec
PL1 -6.00 dB
SF01 400.1324710 MHz
F2 - Processing parameters
SI 32768
SF 400.1300045 MHz
WDW EM
SSB 0
LB 0.30 Hz
GB 0
PC 1.00
18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 ppm
2.20
2.21
1.14
2.13
2.06
1.16
1.30
1.11
2.18
1.00

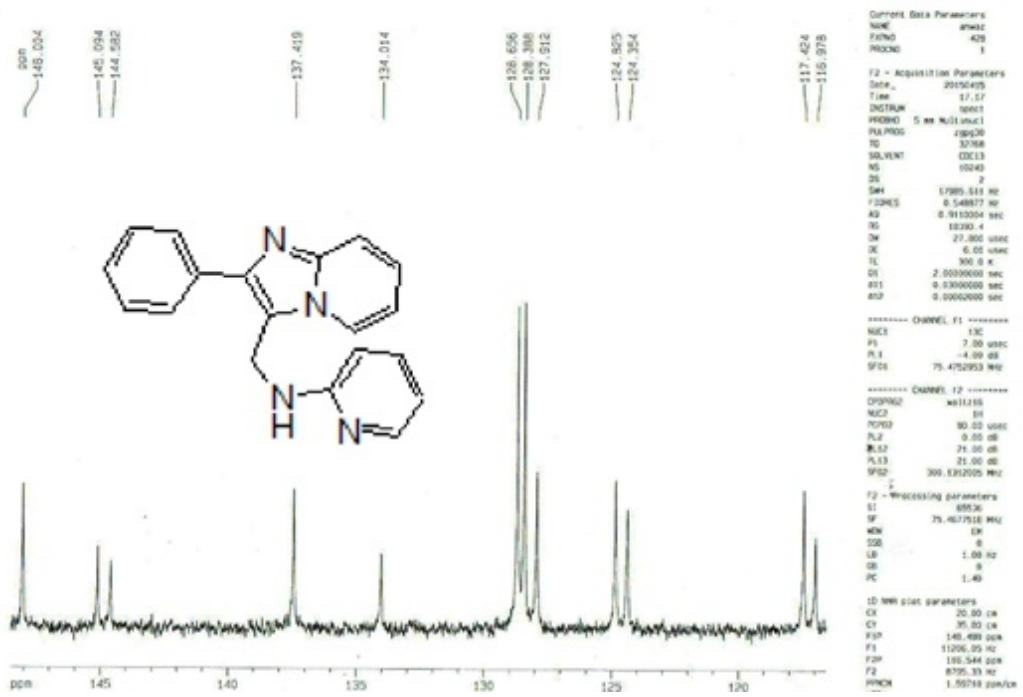
^{1}H-NMR of 4j


8.398
8.187
8.090
7.784
7.654
7.444
7.375
7.264
7.153
7.044
7.001
6.959
6.950
6.817
6.671
6.458
6.358
6.346
5.288
5.034
4.618
BRUKER
Current Data Parameters
NAME 3H-1
EXPNO 1914
PROCNO 1
F2 - Acquisition Parameters
Date_ 20150221
Time 16.38
INSTRUM spect
PROBHD 5 mm Multinucl
PULPROG zg
TD 32768
SOLVENT CDCl3
NS 16
DS 0
SWH 11574.074 Hz
FIDRES 0.353213 Hz
AQ 1.4156276 sec
RG 1448.2
DW 43.200 usec
DE 6.00 usec
TE 300.0 K
D1 5.00000000 sec
======== CHANNEL f1 ========
NUC1 1H
P1 9.00 usec
PL1 -6.00 dB
SF01 400.1324710 MHz
F2 - Processing parameters
SI 32768
SF 400.1300045 MHz
WDW EM
SSB 0
LB 0.30 Hz
GB 0
PC 1.00
4j
N
N
N
H
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
ppm
2.20
2.21
1.14
2.13
2.06
1.16
1.30
1.11
2.18
1.00

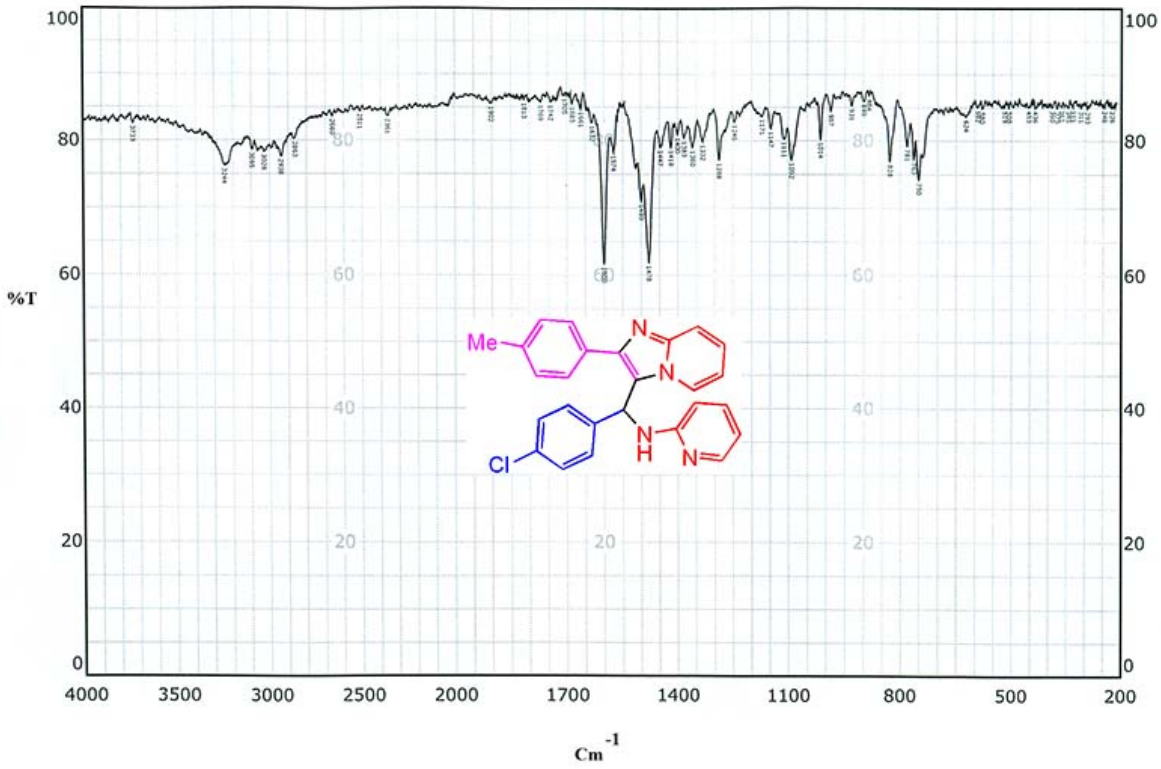
^{1}H-NMR of 4j



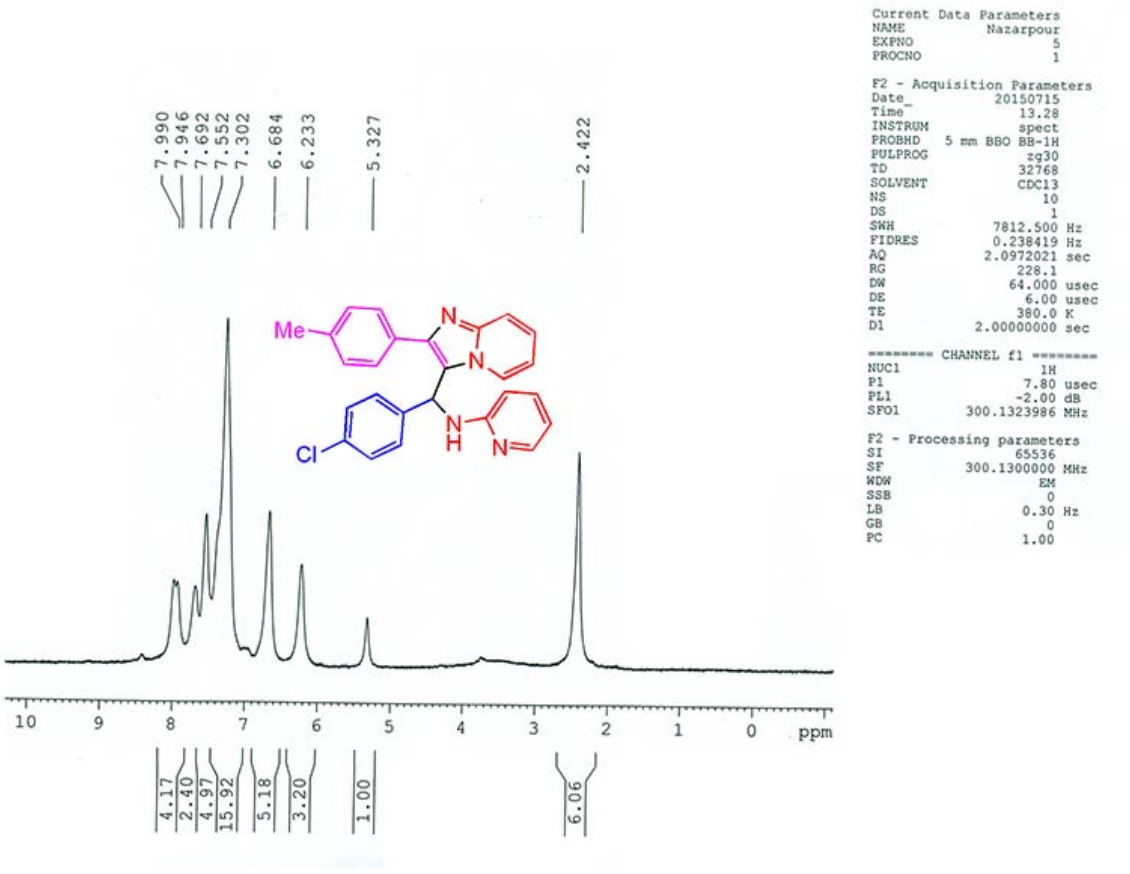
^{13}C-NMR of 4j


ppm
146.004
145.094
144.582
137.419
134.014
128.636
128.398
127.912
124.505
124.354
117.424
116.978
N
N
N
H
N
ppm
145
140
135
130
125
120

^{13}C-NMR of 4j


100
80
60
40
20
0
%T
4000
3500
3000
2500
2000
1700
1400
1100
800
500
200
Cm -1
Me
N
N
N
H
Cl

IR of 4k



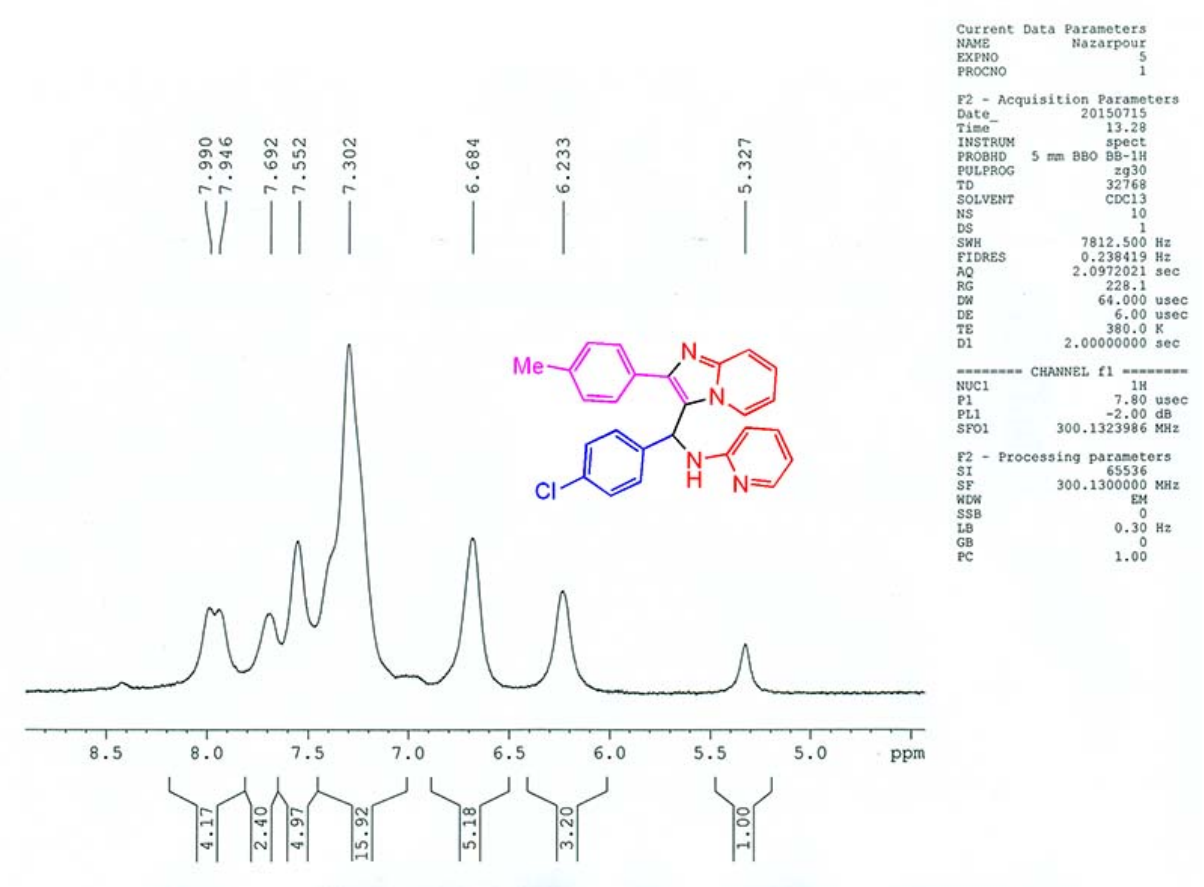
Current Data Parameters
NAME Nazarpour
EXPNO 5
PROCNO 1

F2 - Acquisition Parameters
Date_ 20150715
Time 13.28
INSTRUM spect
PROBHD 5 mm BBO BB-1H
PULPROG zg30
TD 32768
SOLVENT CDC13
NS 10
DS 1
SWH 7812.500 Hz
FIDRES 0.238419 Hz
AQ 2.0972021 sec
RG 228.1
DW 64.000 usec
DE 6.00 usec
TE 380.0 K
D1 2.00000000 sec

======== CHANNEL f1 ========
NUC1 1H
P1 7.80 usec
PL1 -2.00 dB
SFO1 300.1323986 MHz

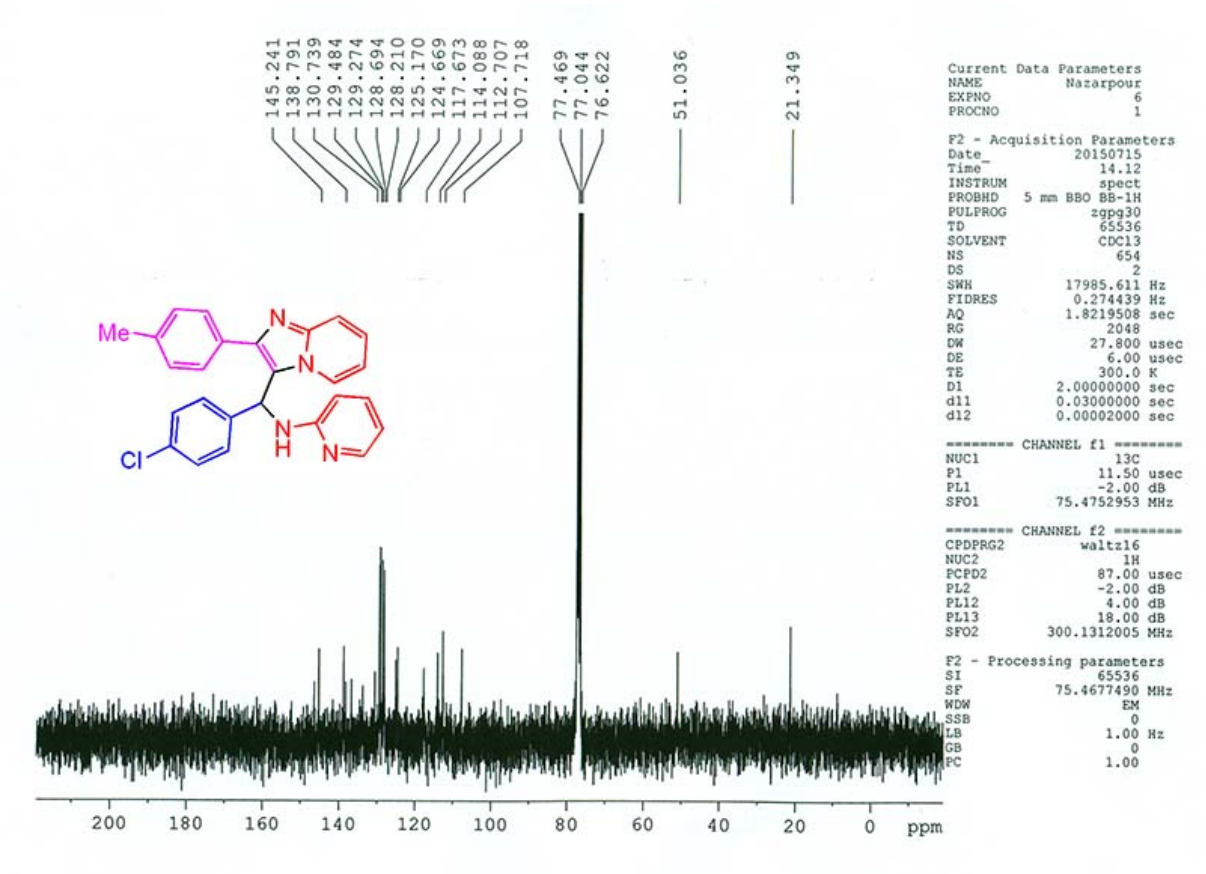
F2 - Processing parameters
SI 65536
SF 300.1300000 MHz
WDW EM
SSB 0
LB 0.30 Hz
GB 0
PC 1.00

^{1}H-NMR of 4k

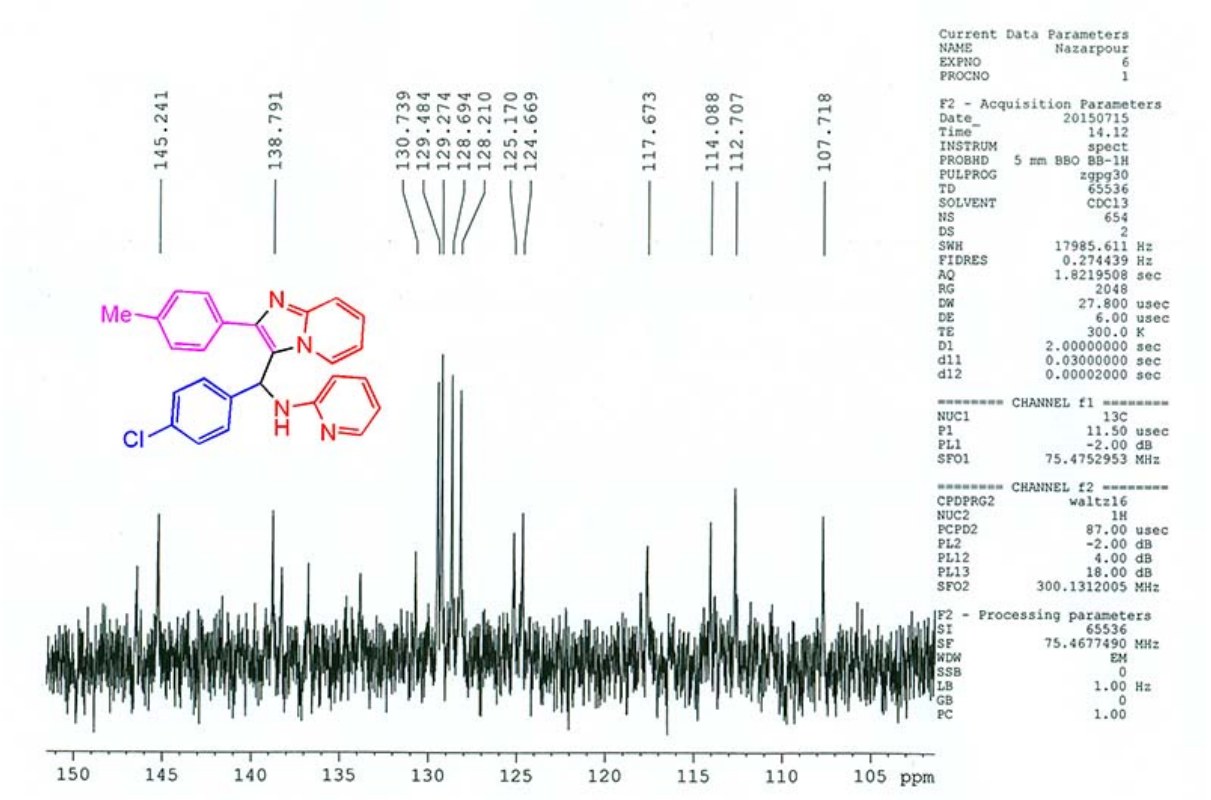



```
Current Data Parameters
NAME                 Nazarpour
EXPNO                        5
PROCNO                       1

F2 - Acquisition Parameters
Date_               20150715
Time                   13.28
INSTRUM                spect
PROBHD     5 mm BBO BB-1H
PULPROG                 zg30
TD                     32768
SOLVENT                CDCl3
NS                        10
DS                         1
SWH                7812.500 Hz
FIDRES             0.238419 Hz
AQ                 2.0972021 sec
RG                     228.1
DW                    64.000 usec
DE                     6.00 usec
TE                    380.0 K
D1                 2.00000000 sec

======== CHANNEL f1 ========
NUC1                       1H
P1                      7.80 usec
PL1                     -2.00 dB
SFO1             300.1323986 MHz

F2 - Processing parameters
SI                         65536
SF               300.1300000 MHz
WDW                        EM
SSB                         0
LB                       0.30 Hz
GB                          0
PC                       1.00
```

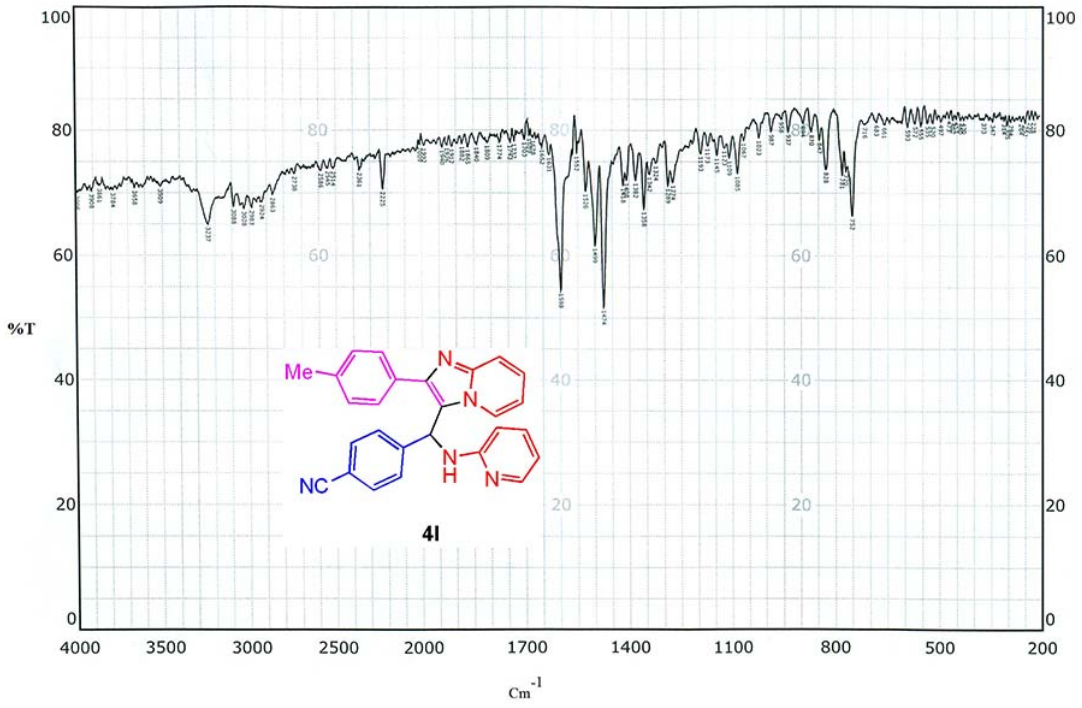
^{1}H-NMR of 4k


145.241
138.791
130.739
129.484
129.274
128.694
128.210
125.170
124.669
117.673
114.088
112.707
107.718
77.469
77.044
76.622
51.036
21.349
Me
Cl
N
N
H
N
200
180
160
140
120
100
80
60
40
20
0
ppm
Current Data Parameters
NAME Nazarpour
EXPNO 6
PROCNO 1
F2 - Acquisition Parameters
Date_ 20150715
Time 14.12
INSTRUM spect
PROBHD 5 mm BBO BB-1H
PULPROG zgpg30
TD 65536
SOLVENT CDC13
NS 654
DS 2
SWH 17985.611 Hz
FIDRES 0.274439 Hz
AQ 1.8219508 sec
RG 2048
DW 27.800 usec
DE 6.00 usec
TE 300.0 K
D1 2.00000000 sec
d11 0.03000000 sec
d12 0.00002000 sec
======== CHANNEL f1 ========
NUC1 13C
P1 11.50 usec
PL1 -2.00 dB
SFO1 75.4752953 MHz
======== CHANNEL f2 ========
CPDPRG2 waltz16
NUC2 1H
PCPD2 87.00 usec
PL2 -2.00 dB
PL12 4.00 dB
PL13 18.00 dB
SFO2 300.1312005 MHz
F2 - Processing parameters
SI 65536
SF 75.4677490 MHz
WDW EM
SSB 0
LB 1.00 Hz
GB 0
PC 1.00

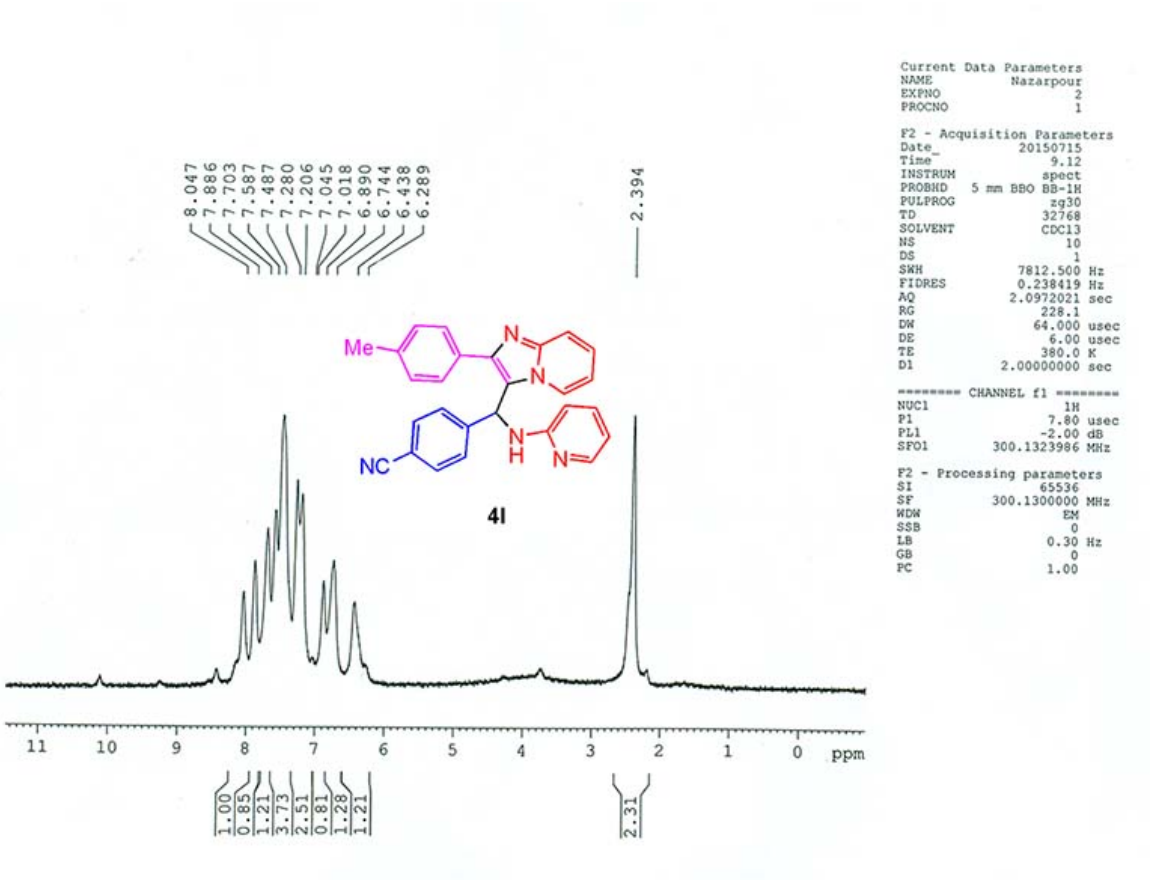
^{13}C-NMR of 4k


145.241
138.791
130.739
129.484
129.274
128.694
128.210
125.170
124.669
117.673
114.088
112.707
107.718
Me
Cl
N
N
H
N
150
145
140
135
130
125
120
115
110
105 ppm
Current Data Parameters
NAME Nazarpour
EXPNO 6
PROCNO 1
F2 - Acquisition Parameters
Date_ 20150715
Time 14.12
INSTRUM spect
PROBHD 5 mm BBO BB-1H
PULPROG zgpg30
TD 65536
SOLVENT CDCl3
NS 654
DS 2
SWH 17985.611 Hz
FIDRES 0.274439 Hz
AQ 1.8219508 sec
RG 2048
DW 27.800 usec
DE 6.00 usec
TE 300.0 K
D1 2.00000000 sec
d11 0.03000000 sec
d12 0.00002000 sec
======== CHANNEL f1 ========
NUC1 13C
P1 11.50 usec
PL1 -2.00 dB
SFO1 75.4752953 MHz
======== CHANNEL f2 ========
CPDPRG2 waltz16
NUC2 1H
PCPD2 87.00 usec
PL2 -2.00 dB
PL12 4.00 dB
PL13 18.00 dB
SFO2 300.1312005 MHz
F2 - Processing parameters
SI 65536
SF 75.4677490 MHz
WDW EM
SSB 0
LB 1.00 Hz
GB 0
PC 1.00

^{13}C-NMR of 4k

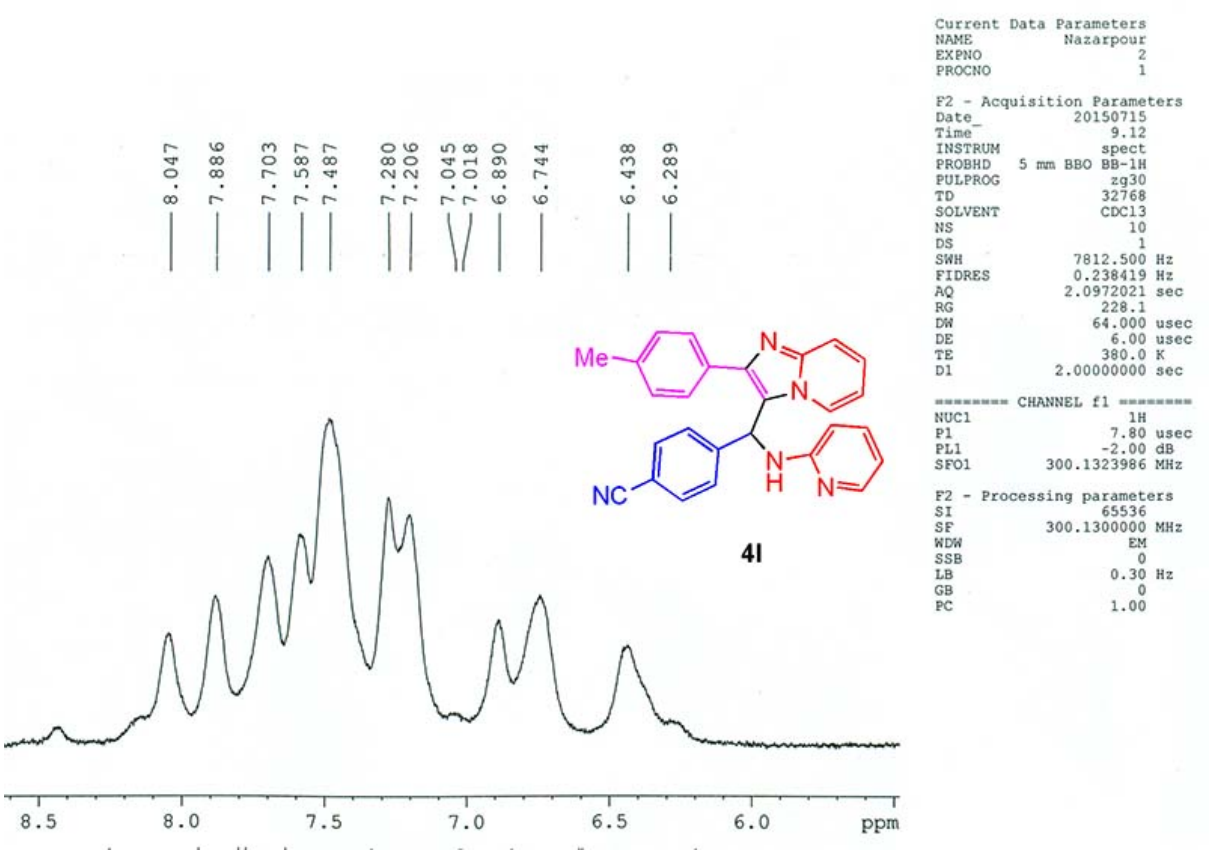

%T
100
80
60
40
20
0
4000
3500
3000
2500
2000
1700
1400
1100
800
500
200
Cm-1
Me
N
N
N
H
NC
4l

IR of 4l

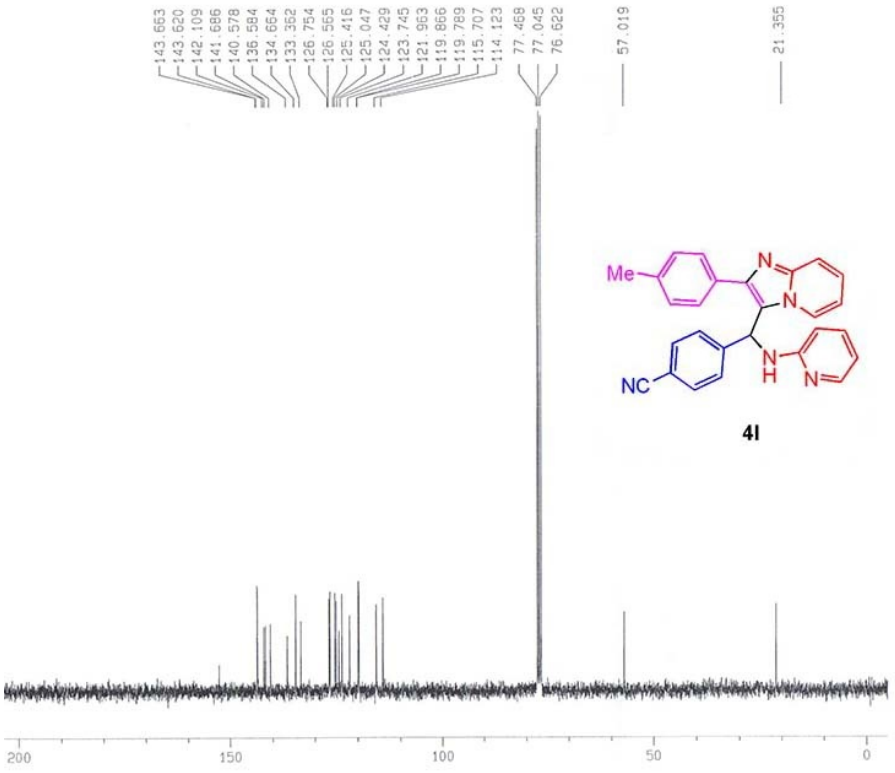



```
Current Data Parameters
NAME                  Nazarpour
EXPNO                         2
PROCNO                        1

F2 - Acquisition Parameters
Date_                  20150715
Time                       9.12
INSTRUM                   spect
PROBHD     5 mm BBO BB-1H
PULPROG                   zg30
TD                       32768
SOLVENT                  CDCl3
NS                           10
DS                            1
SWH                  7812.500 Hz
FIDRES               0.238419 Hz
AQ                   2.0972021 sec
RG                       228.1
DW                      64.000 usec
DE                       6.00 usec
TE                      380.0 K
D1                   2.00000000 sec

======== CHANNEL f1 ========
NUC1                         1H
P1                        7.80 usec
PL1                      -2.00 dB
SFO1           300.1323986 MHz

F2 - Processing parameters
SI                       65536
SF             300.1300000 MHz
WDW                         EM
SSB                          0
LB                        0.30 Hz
GB                           0
PC                        1.00
```

^{1}H-NMR of 4l

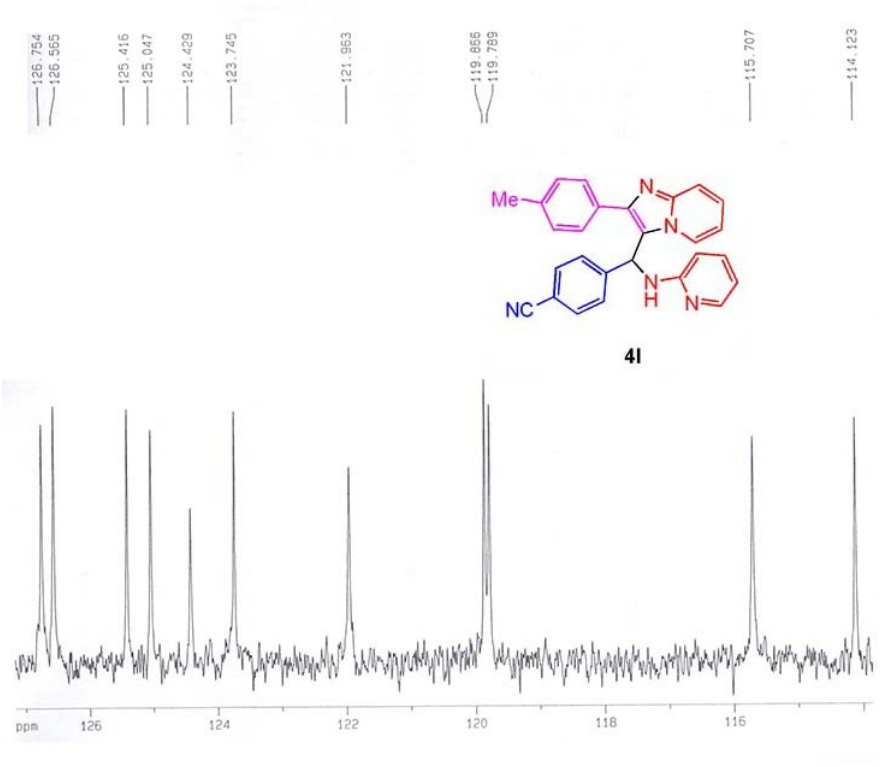

8.047
7.886
7.703
7.587
7.487
7.280
7.206
7.045
7.018
6.890
6.744
6.438
6.289
Me
N
N
N
H
NC
4l
8.5
8.0
7.5
7.0
6.5
6.0
ppm
Current Data Parameters
NAME Nazarpour
EXPNO 2
PROCNO 1
F2 - Acquisition Parameters
Date_ 20150715
Time 9.12
INSTRUM spect
PROBHD 5 mm BBO BB-1H
PULPROG zg30
TD 32768
SOLVENT CDCl3
NS 10
DS 1
SWH 7812.500 Hz
FIDRES 0.238419 Hz
AQ 2.0972021 sec
RG 228.1
DW 64.000 usec
DE 6.00 usec
TE 380.0 K
D1 2.00000000 sec
======== CHANNEL f1 ========
NUC1 1H
P1 7.80 usec
PL1 -2.00 dB
SFO1 300.1323986 MHz
F2 - Processing parameters
SI 65536
SF 300.1300000 MHz
WDW EM
SSB 0
LB 0.30 Hz
GB 0
PC 1.00

^{1}H-NMR of 4l



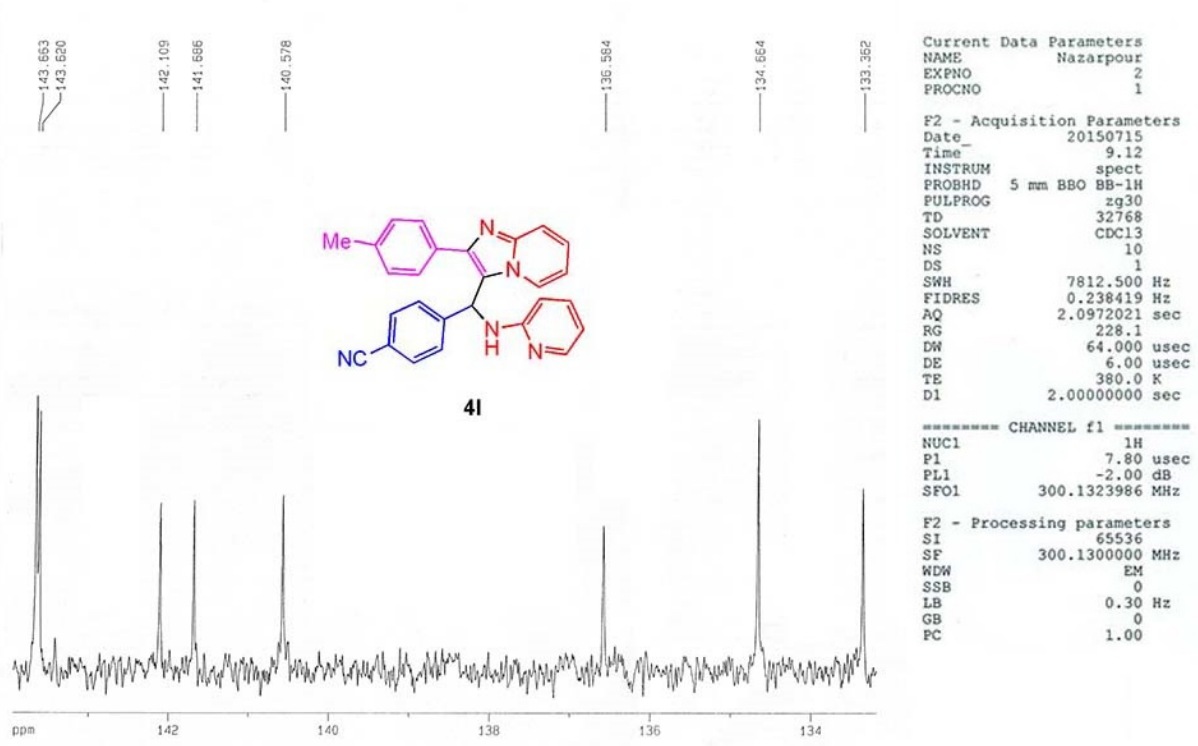

```
Current Data Parameters
NAME                 Nazarpour
EXPNO                        2
PROCNO                       1

F2 - Acquisition Parameters
Date_                 20150715
Time                      9.12
INSTRUM                  spect
PROBHD     5 mm BBO BB-1H
PULPROG                  zg30
TD                      32768
SOLVENT                 CDCl3
NS                         10
DS                          1
SWH                  7812.500 Hz
FIDRES               0.238419 Hz
AQ                   2.0972021 sec
RG                       228.1
DW                      64.000 usec
DE                       6.00 usec
TE                      380.0 K
D1                   2.00000000 sec

======== CHANNEL f1 ========
NUC1                        1H
P1                       7.80 usec
PL1                     -2.00 dB
SFO1           300.1323986 MHz

F2 - Processing parameters
SI                       65536
SF             300.1300000 MHz
WDW                         EM
SSB                          0
LB                        0.30 Hz
GB                           0
PC                        1.00
```

^{13}C-NMR of 4l




```
Current Data Parameters
NAME                 Nazarpour
EXPNO                        2
PROCNO                       1

F2 - Acquisition Parameters
Date_               20150715
Time                    9.12
INSTRUM                spect
PROBHD    5 mm BBO BB-1H
PULPROG                 zg30
TD                     32768
SOLVENT                CDCl3
NS                        10
DS                         1
SWH                 7812.500 Hz
FIDRES              0.238419 Hz
AQ                  2.0972021 sec
RG                      228.1
DW                     64.000 usec
DE                      6.00 usec
TE                     380.0 K
D1                  2.00000000 sec

======== CHANNEL f1 ========
NUC1                       1H
P1                      7.80 usec
PL1                    -2.00 dB
SFO1             300.1323986 MHz

F2 - Processing parameters
SI                     65536
SF               300.1300000 MHz
WDW                       EM
SSB                        0
LB                      0.30 Hz
GB                         0
PC                      1.00
```

^{13}C-NMR of 4l


143.653
143.620
142.109
141.686
140.578
136.564
134.664
133.352
Me
N
N
NC
N
H
N
41
ppm
142
140
138
136
134
Current Data Parameters
NAME Nazarpour
EXPNO 2
PROCNO 1
F2 - Acquisition Parameters
Date_ 20150715
Time 9.12
INSTRUM spect
PROBHD 5 mm BBO BB-1H
PULPROG zg30
TD 32768
SOLVENT CDCl3
NS 10
DS 1
SWH 7812.500 Hz
FIDRES 0.238419 Hz
AQ 2.0972021 sec
RG 228.1
DW 64.000 usec
DE 6.00 usec
TE 380.0 K
D1 2.00000000 sec
======== CHANNEL f1 ========
NUC1 1H
P1 7.80 usec
PL1 -2.00 dB
SFO1 300.1323986 MHz
F2 - Processing parameters
SI 65536
SF 300.1300000 MHz
WDW EM
SSB 0
LB 0.30 Hz
GB 0
PC 1.00

^{13}C-NMR of 4l