

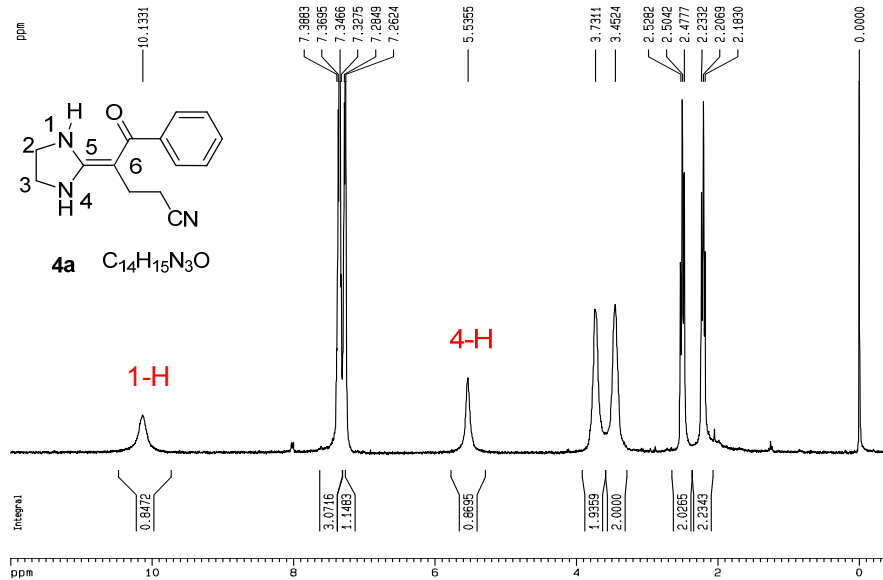
**REACTIONS OF HETEROCYCLIC KETENE
AMINALS WITH ACRYLONITRILE: AN EFFICIENT
SYNTHESIS OF DIHYDROPYRIDINE-FUSED
1,3-DIAZAHETEROCYCLES**

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Li-Ben Wang,¹ Zhi-Tang Huang,^{* 1} Chu-Yi Yu,^{*1}**

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Spectra of compound 4a:

¹H-NMR



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Current Data Parameters
NAME      zaq-053a
EXPNO    5
PROCNO   1

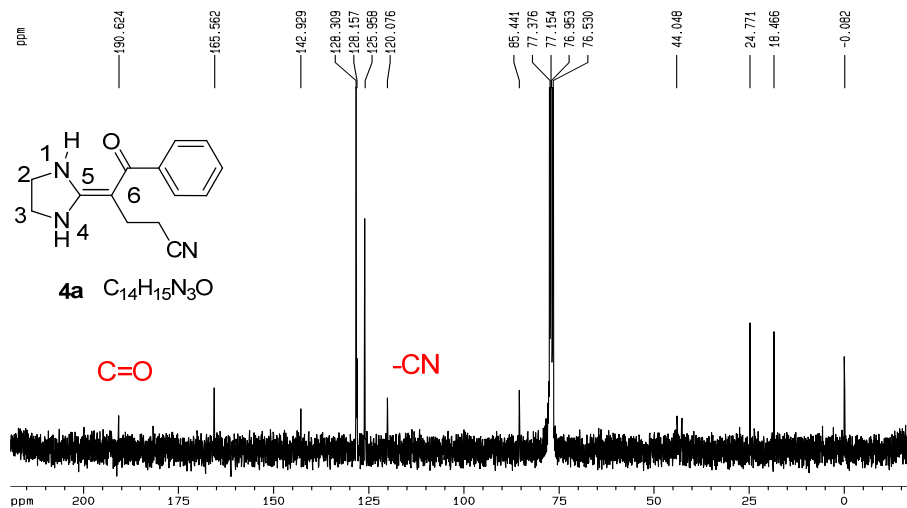
F2 - Acquisition Parameters
Date_    20080402
Time     23.48
INSTRUM  av300
PROBHD   5 mm DUL 13C-1
PULPROG  zg30
TD        65536
SOLVENT  CDCl3
NS        16
DS        0
SWH       8992.806 Hz
FIDRES    0.137219 Hz
AQ        3.6438515 sec
RG        322.5
DW        55.600 usec
DE        6.00 usec
TE        298.4 K
D1        2.00000000 sec
MCREST    0.00000000 sec
MCWRK     0.01500000 sec

===== CHANNEL f1 =====
NUC1      1H
P1        7.00 usec
PL1       -1.00 dB
SFO1      300.1319534 MHz

F2 - Processing Parameters
SI        32768
SF        300.1300053 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       12.000 ppm
F1        3601.55 Hz
F2P       -0.500 ppm
F2        -150.05 Hz
PPMCM     0.62500 ppm/cm
HZCM      187.58125 Hz/cm
    
```

¹³C-NMR



```

Current Data Parameters
NAME      zaq-053a
EXPNO    8
PROCNO   1

F2 - Acquisition Parameters
Date_    20080622
Time     9.22
INSTRUM  spect
PROBHD   5 mm DUL 13C-1
PULPROG  zgpg30
TD        20930
SOLVENT  DMSO-d6
NS        4
DS        4
SWH       17965.611 Hz
FIDRES    0.274439 Hz
AQ        1.8219508 sec
RG        652
DW        27.800 usec
DE        6.00 usec
TE        303.1 K
D1        2.00000000 sec
d11       0.03000000 sec
DELTA     1.89999996 sec
MCREST    0.00000000 sec
MCWRK     0.01500000 sec

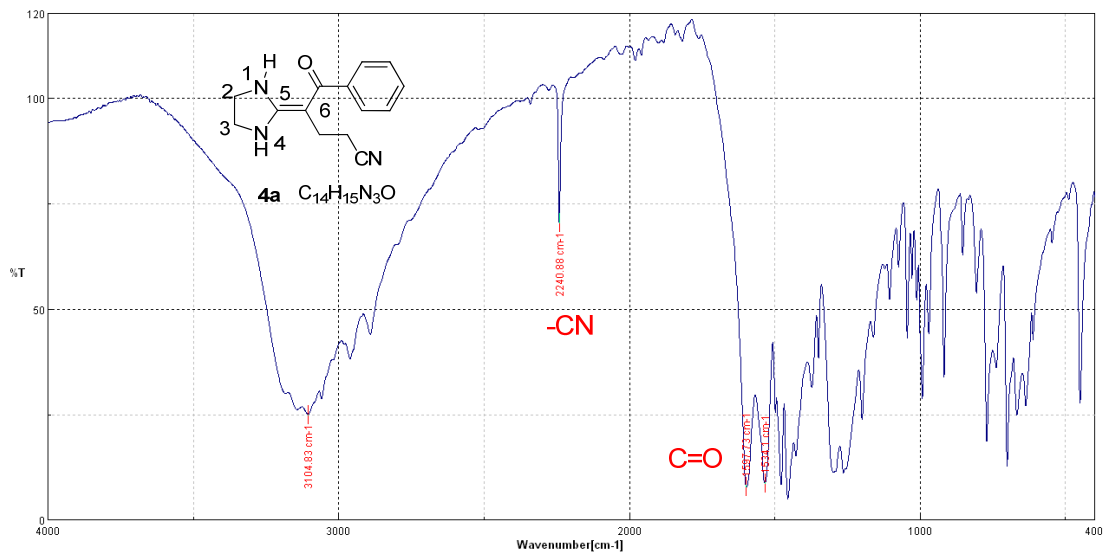
===== CHANNEL f1 =====
NUC1      13C
P1        12.50 usec
PL1       -1.00 dB
SFO1      75.4755953 MHz

===== CHANNEL f2 =====
CPDPRG2  waltz16
NUC2      1H
P2P2     80.00 usec
PL2       -1.00 dB
PL12     20.16 dB
PL13     15.96 dB
SFO2     300.1312005 MHz

F2 - Processing Parameters
SI        32768
SF        75.4677490 MHz
WDW       EM
SSB       0
LB        1.00 Hz
GB        0
PC        1.40

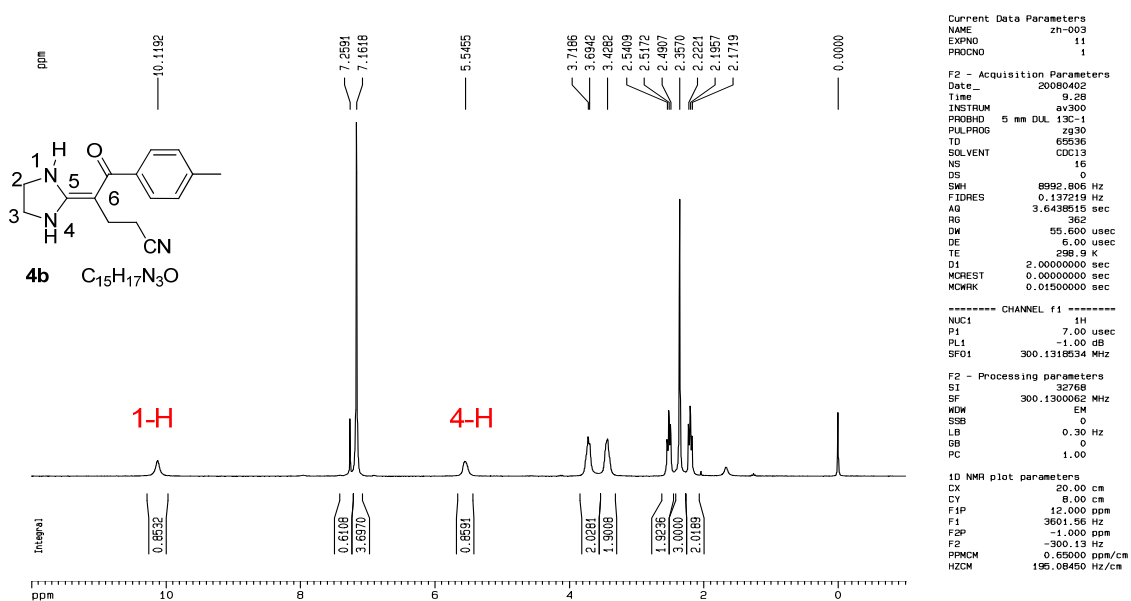
1D NMR plot parameters
CX        20.00 cm
CY        12.50 cm
F1P       219.155 ppm
F1        16539.11 Hz
F2P       -19.167 ppm
F2        -1446.51 Hz
PPMCM     11.91609 ppm/cm
HZCM      899.28058 Hz/cm
    
```

IR

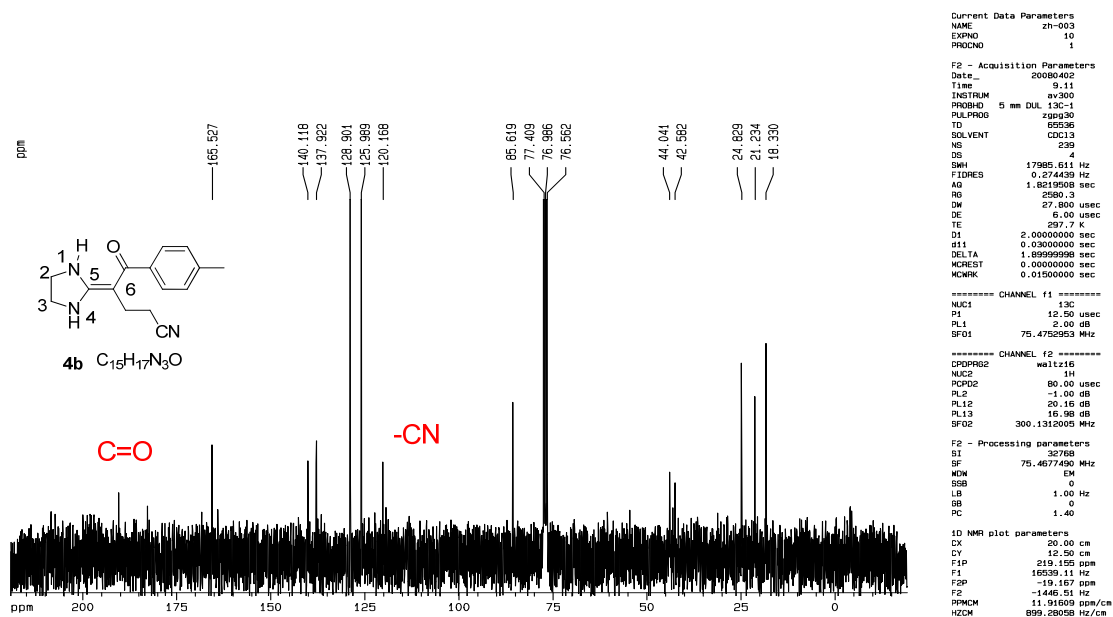


Spectra of compound **4b**:

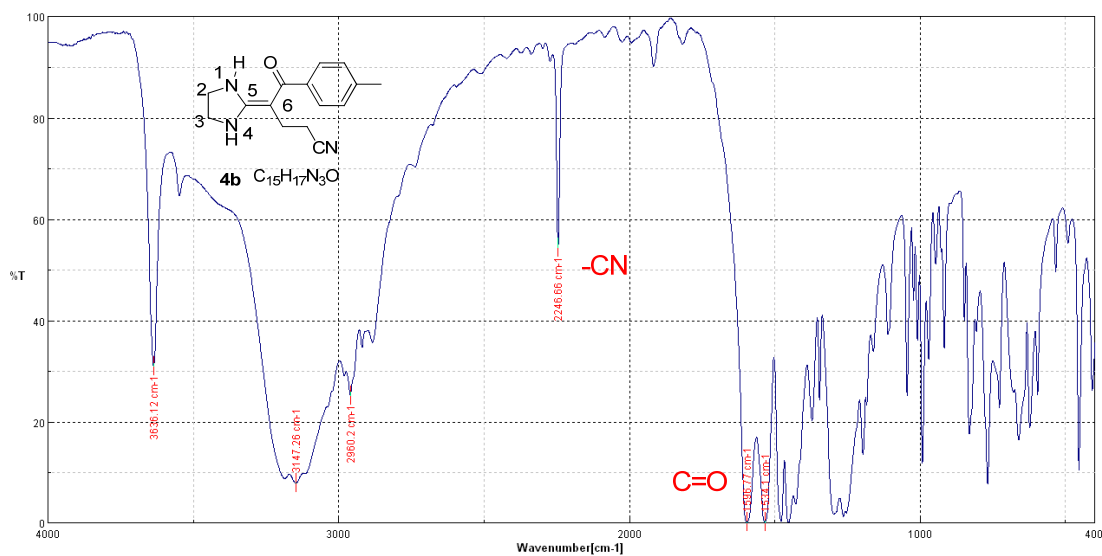
¹H-NMR



¹³C-NMR

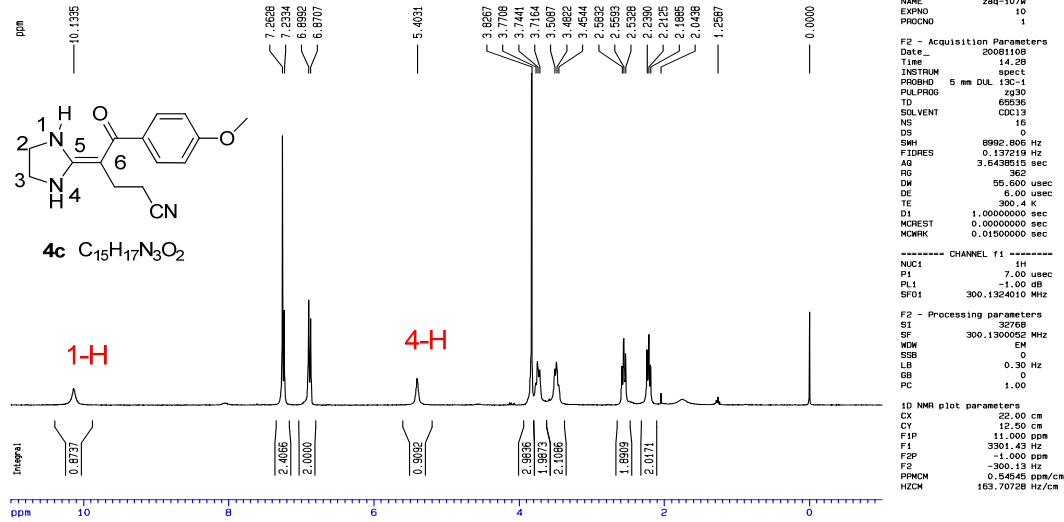


IR:

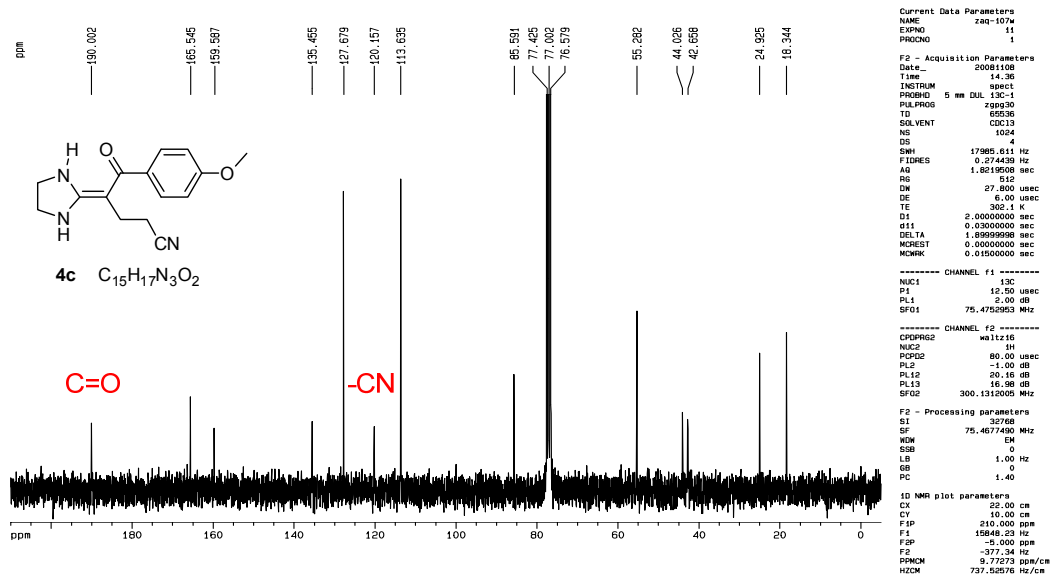


Spectra of compound 4c

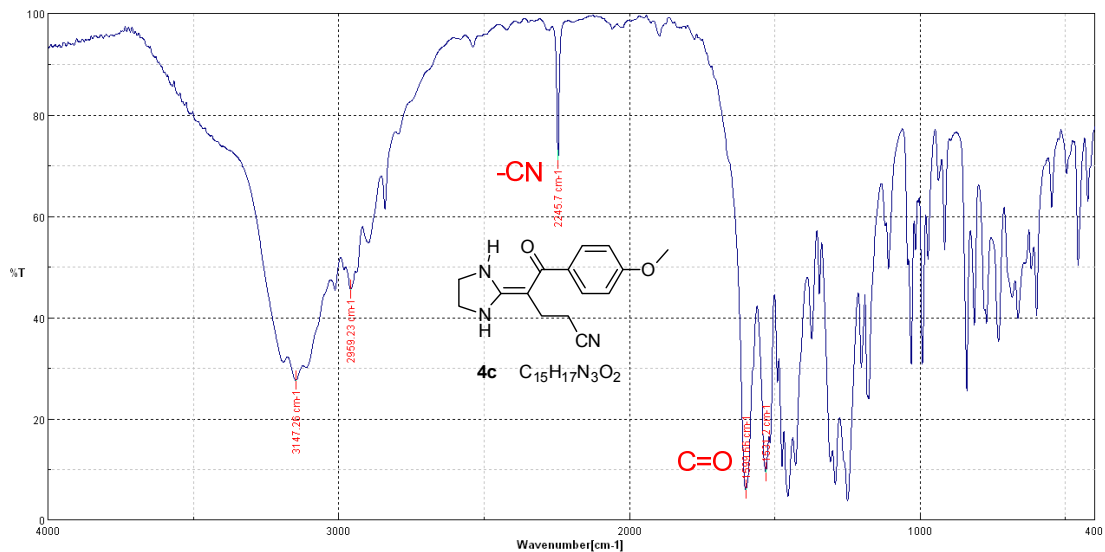
¹H-NMR



¹³C-NMR

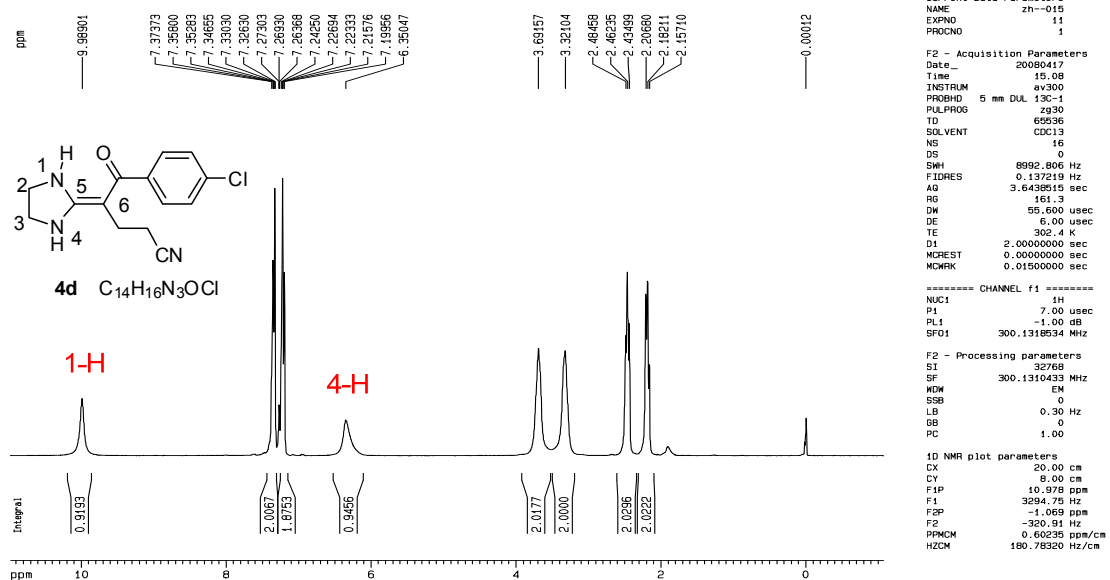


IR:

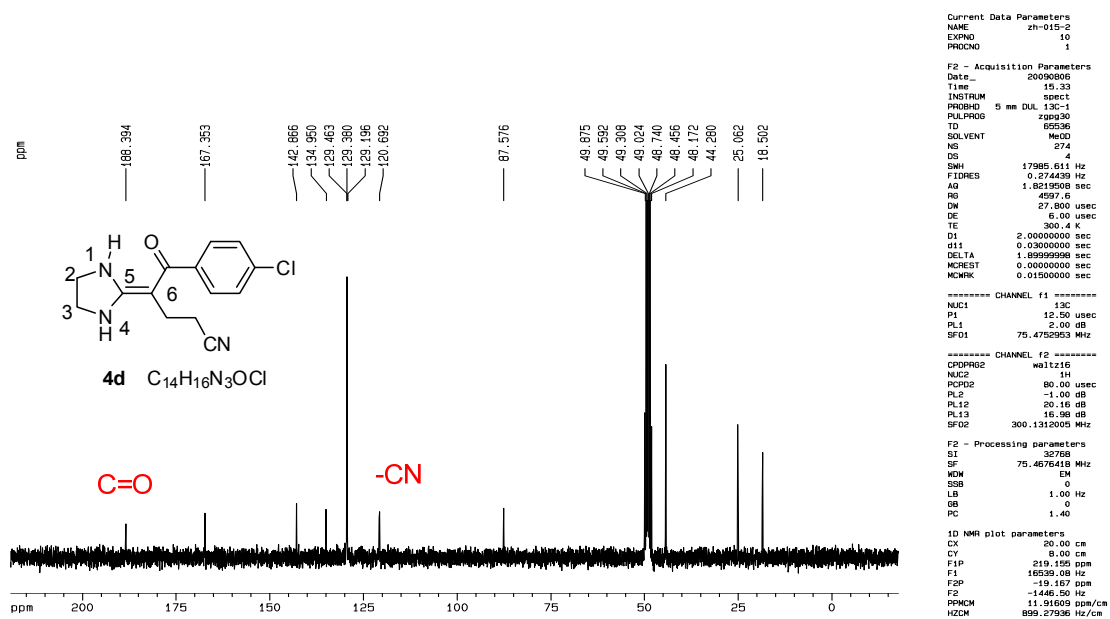


Spectra of compound **4d**:

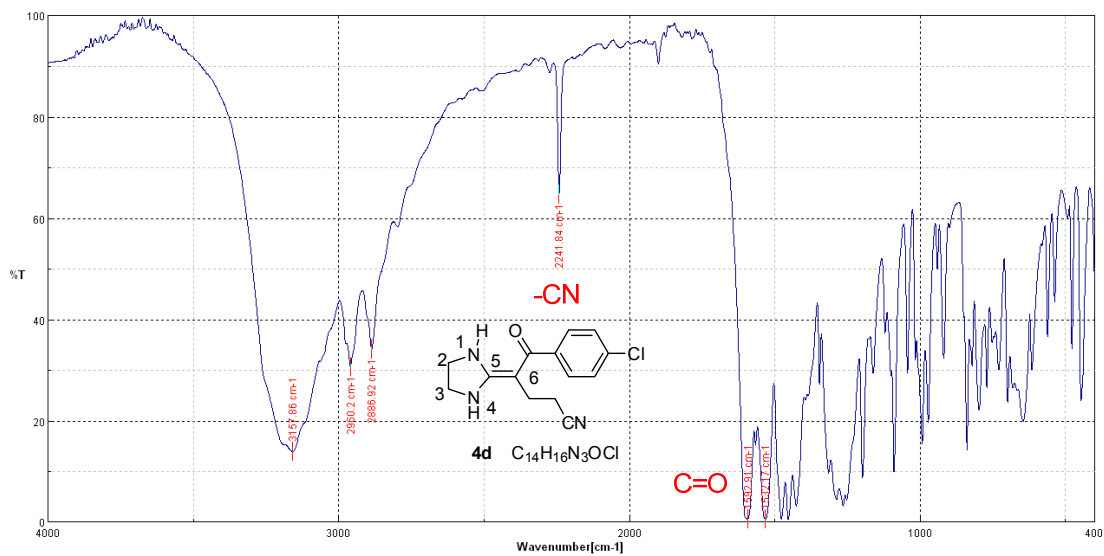
$^1\text{H-NMR}$



¹³C-NMR

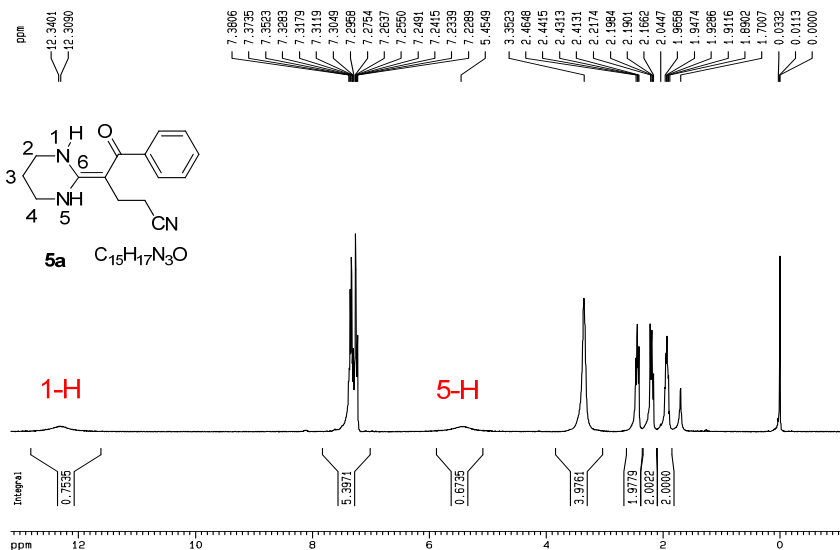


IR:

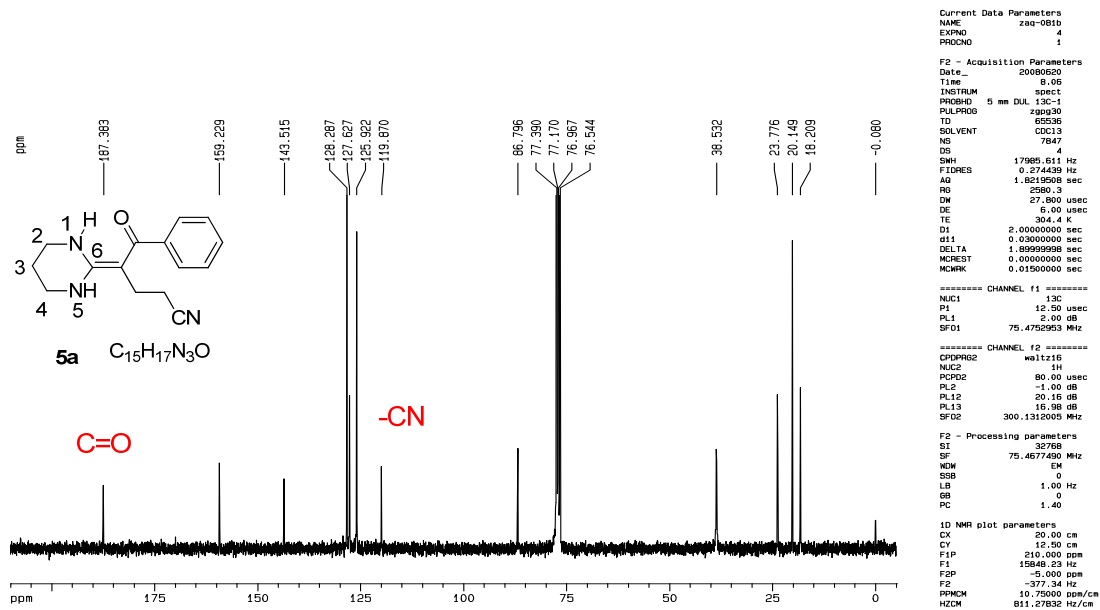


Spectra of compound 5a:

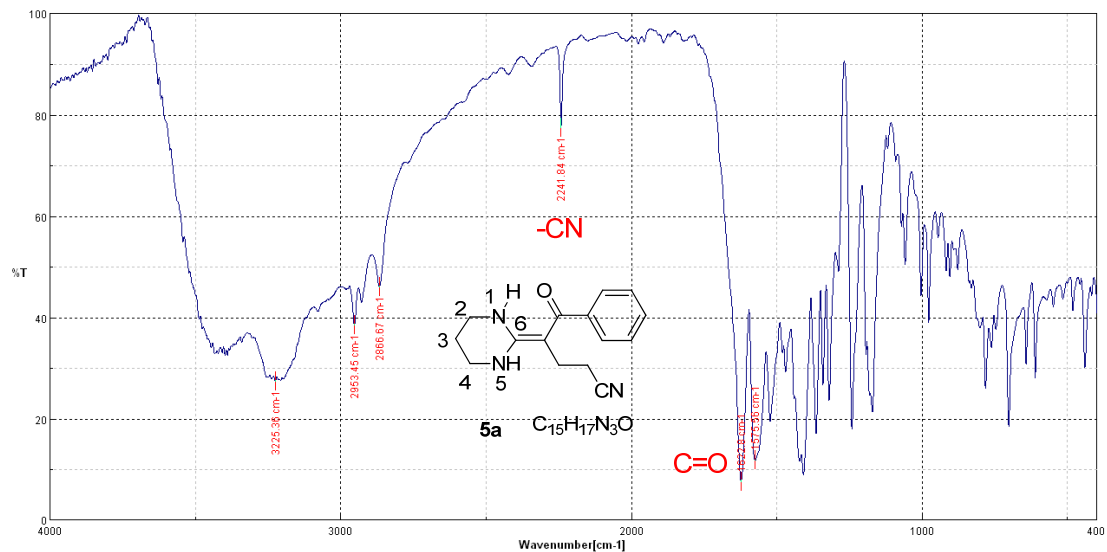
¹H-NMR



¹³C-NMR

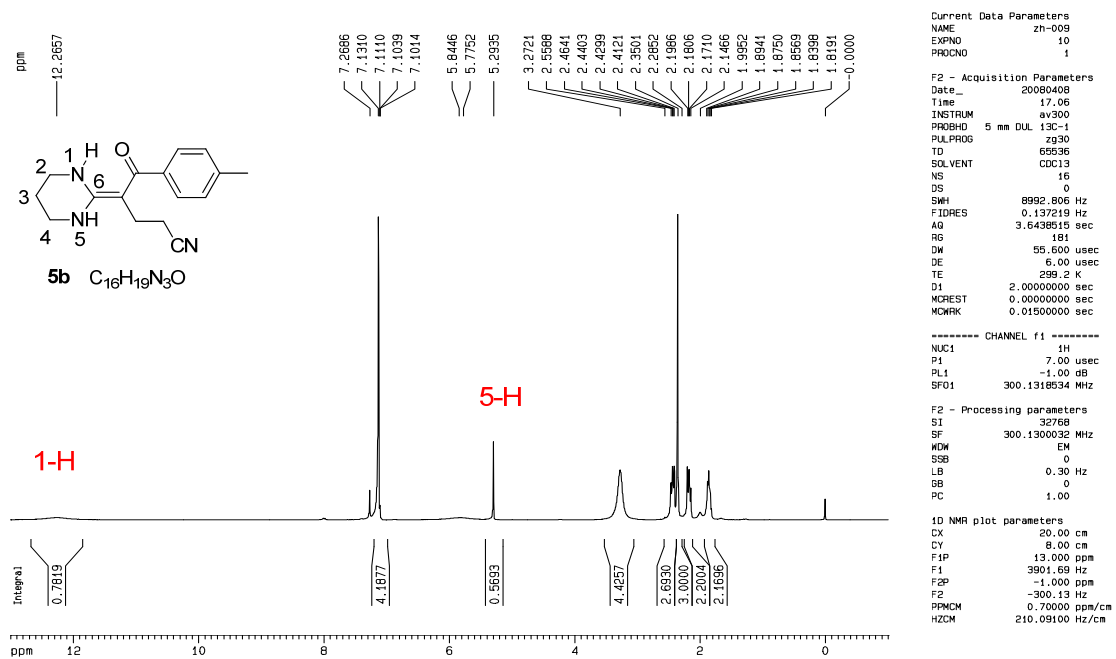


IR:

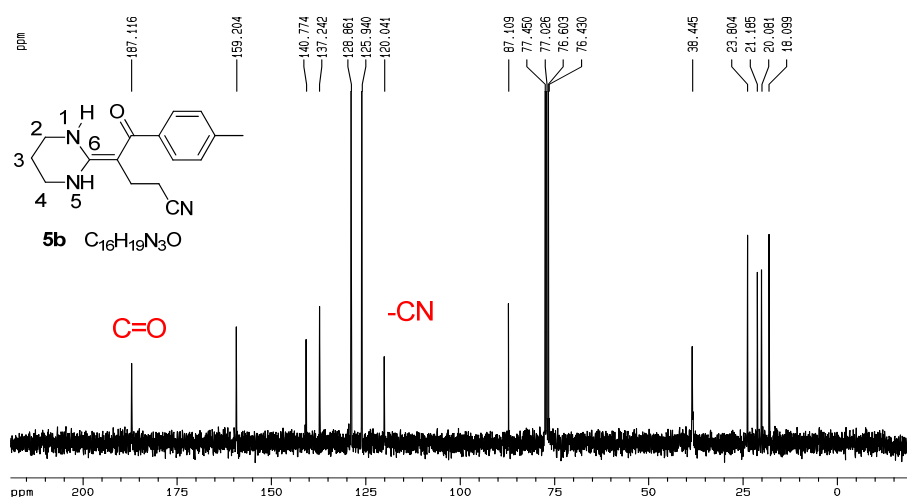


Spectra of compound **5b**:

$^1\text{H-NMR}$



¹³C-NMR



```

Current Data Parameters
NAME          zh-009
EXPNO        1
PROCNO       1

F2 - Acquisition Parameters
Date_        20090408
Time         17.11
INSTRUM      av300
PROBHD       5 mm DUA 13C-1
PULPROG      zgpg30
TD           65536
SOLVENT      CDCl3
NS           222
DS           4
SWH          17985.611 Hz
FIDRES       0.274439 Hz
AQ           1.8219508 sec
RG           14596.5
DW           27.800 usec
DE           6.00 usec
TE           300.5 K
D1           2.00000000 sec
d11          0.03000000 sec
DELTA        1.89999998 sec
MCREST       0.00000000 sec
MCWRK        0.01500000 sec

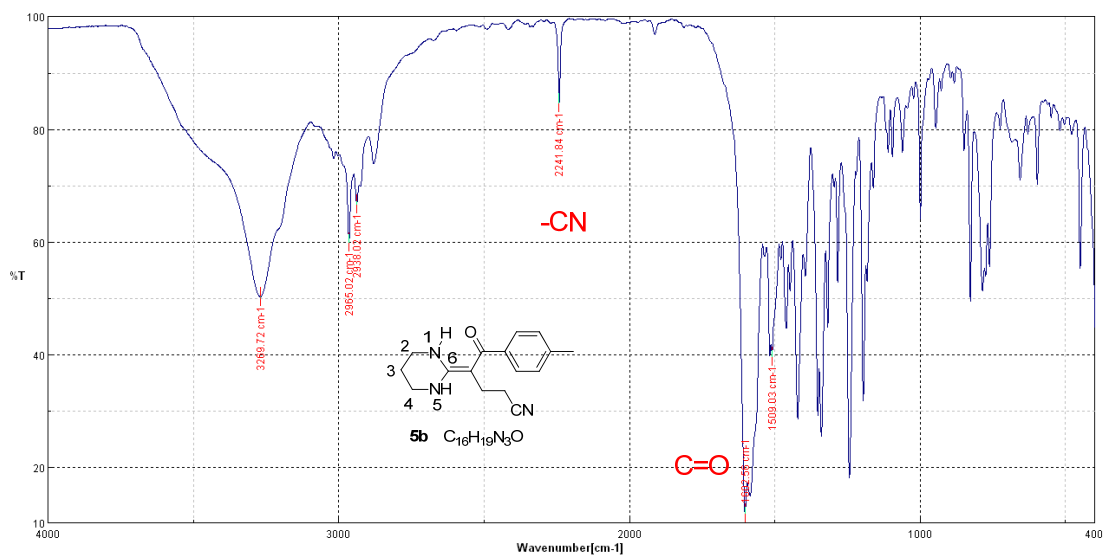
===== CHANNEL f1 =====
NUC1          13C
P1           12.50 usec
PL1           2.00 dB
SFO1         75.4752953 MHz

===== CHANNEL f2 =====
CPDPRG2      waltz16
NUC2          1H
PCPD2        98.00 usec
PL2           -1.00 dB
PL12         20.16 dB
PL13         15.58 dB
SFO2         300.1312005 MHz

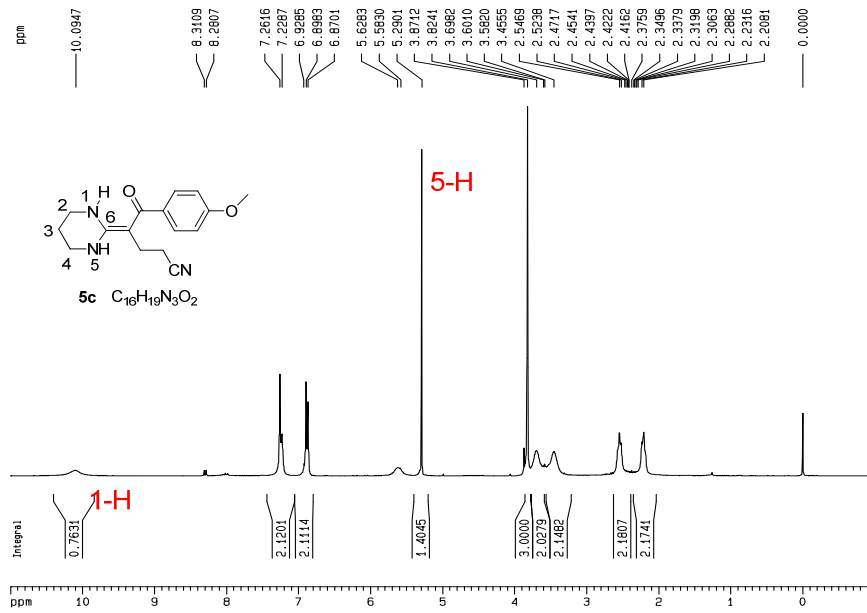
F2 - Processing parameters
SI           32768
SF           75.4677499 MHz
WDW          EM
SSB          0
LB           1.00 Hz
GB           0
PC           1.40

1D NMR plot parameters
CX           20.00 cm
CY           12.50 cm
F1P          219.350 ppm
F1           16593.11 Hz
F2P          -19.167 ppm
F2           -1445.51 Hz
PPMCM        11.91600 ppm/cm
HZCM         899.28058 Hz/cm
    
```

IR:



Spectra of compound **5c**:
¹H-NMR



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Current Data Parameters
NAME          zh--013
EXPNO         13
PROCNO        1

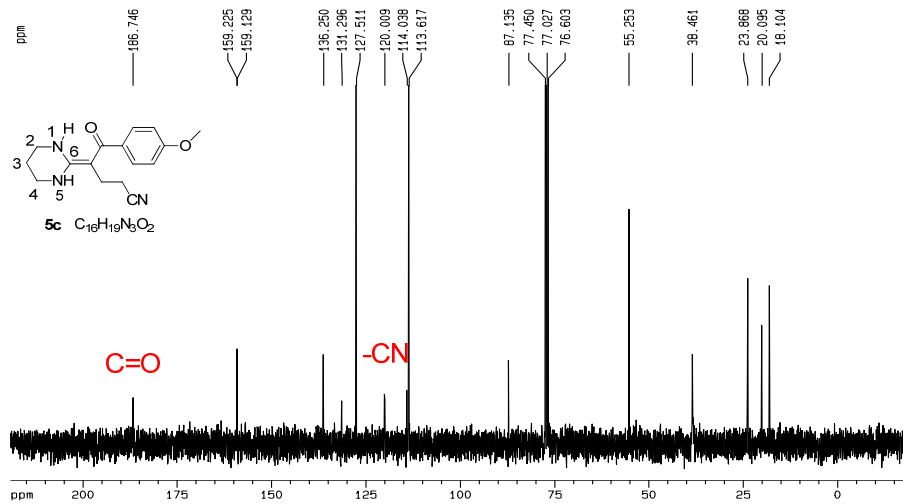
F2 - Acquisition Parameters
Date_         20080415
Time          17.32
INSTRUM       av300
PROBHD        5 mm DUL 13C-1
PULPROG       zgpg30
TD            65536
SOLVENT       CDCl3
NS            16
DS            0
SWH           8992.806 Hz
FIDRES        0.137219 Hz
AQ            3.6438915 sec
RG            287.4
DM            55.600 usec
DE            6.00 usec
TE            303.9 K
D1            2.0000000 sec
MCREST        0.0000000 sec
MCWRK         0.0150000 sec

----- CHANNEL f1 -----
NUC1           1H
P1             7.00 usec
PL1            -1.00 dB
SFO1          300.1318534 MHz

F2 - Processing parameters
SI            32768
SF            300.1300053 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           11.000 ppm
F1            3301.43 Hz
F2P           -1.000 ppm
F2            -300.13 Hz
PPMCM         0.60000 ppm/cm
HZCM          180.07800 Hz/cm
    
```

¹³C-NMR



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Current Data Parameters
NAME          zh--013
EXPNO         22
PROCNO        1

F2 - Acquisition Parameters
Date_         20080415
Time          17.43
INSTRUM       av300
PROBHD        5 mm DUL 13C-1
PULPROG       zgpg30
TD            65536
SOLVENT       CDCl3
NS            91
DS            4
SWH           17985.611 Hz
FIDRES        0.274439 Hz
AQ            1.8218508 sec
RG            5160.8
DM            27.800 usec
DE            6.00 usec
TE            301.7 K
D1            2.0000000 sec
D11           0.0300000 sec
DELTA         1.89999998 sec
MCREST        0.0000000 sec
MCWRK         0.0150000 sec

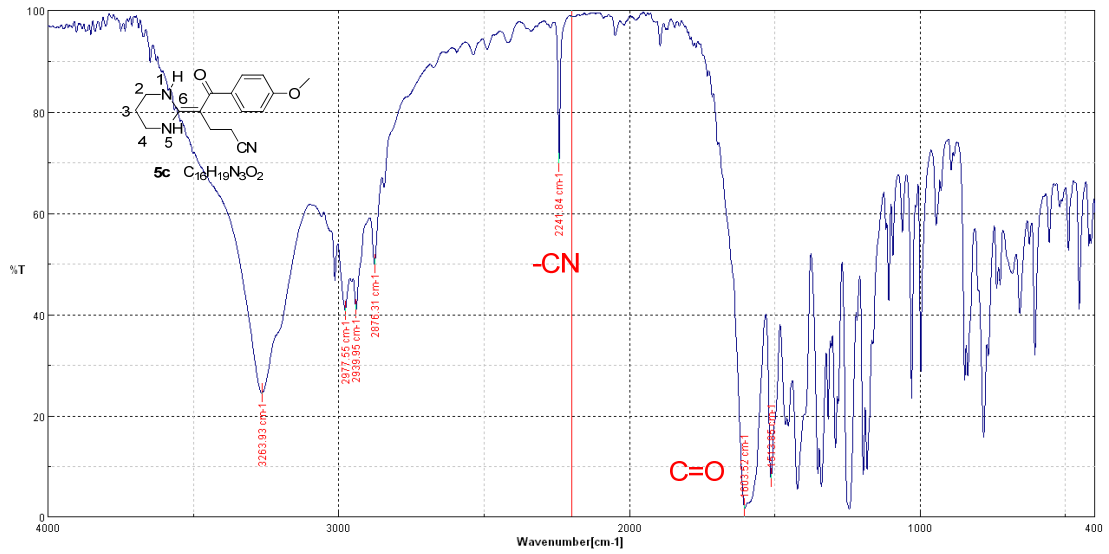
----- CHANNEL f1 -----
NUC1           13C
P1            12.50 usec
PL1            2.00 dB
SFO1          75.4752953 MHz

----- CHANNEL f2 -----
CPDPRG2       waltz16
NUC2           1H
PCPD2         80.00 usec
PL2            -1.00 dB
PL12          20.15 dB
PL13          16.98 dB
SFO2          300.1312005 MHz

F2 - Processing parameters
SI            32768
SF            75.4677490 MHz
WDW           EM
SSB           0
LB            1.00 Hz
GB            0
PC            1.40

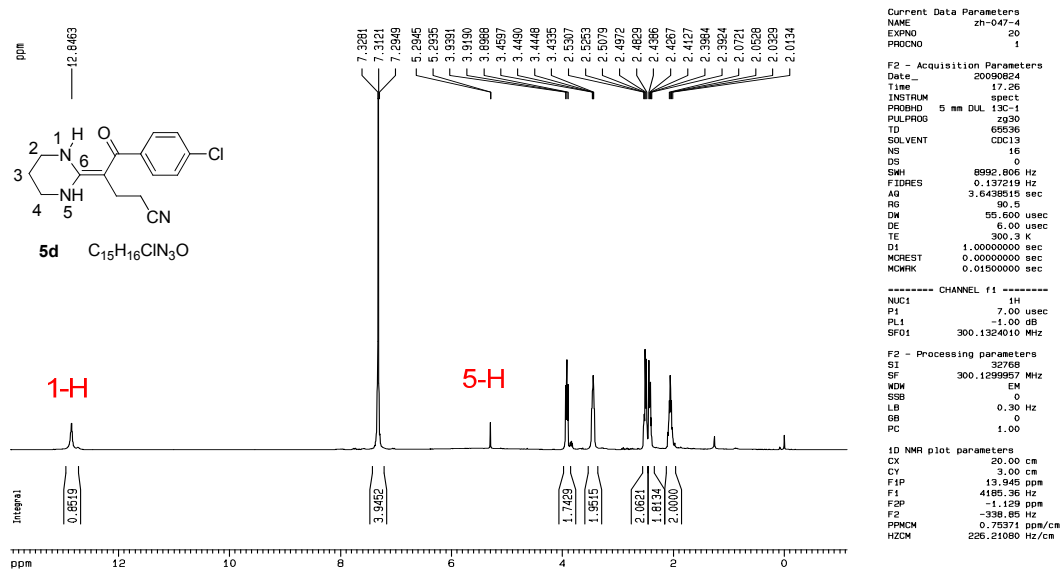
1D NMR plot parameters
CX            20.00 cm
CY            12.50 cm
F1P           219.150 ppm
F1            16539.11 Hz
F2P           -19.167 ppm
F2            -1446.51 Hz
PPMCM         11.91600 ppm/cm
HZCM          899.08000 Hz/cm
    
```

IR:

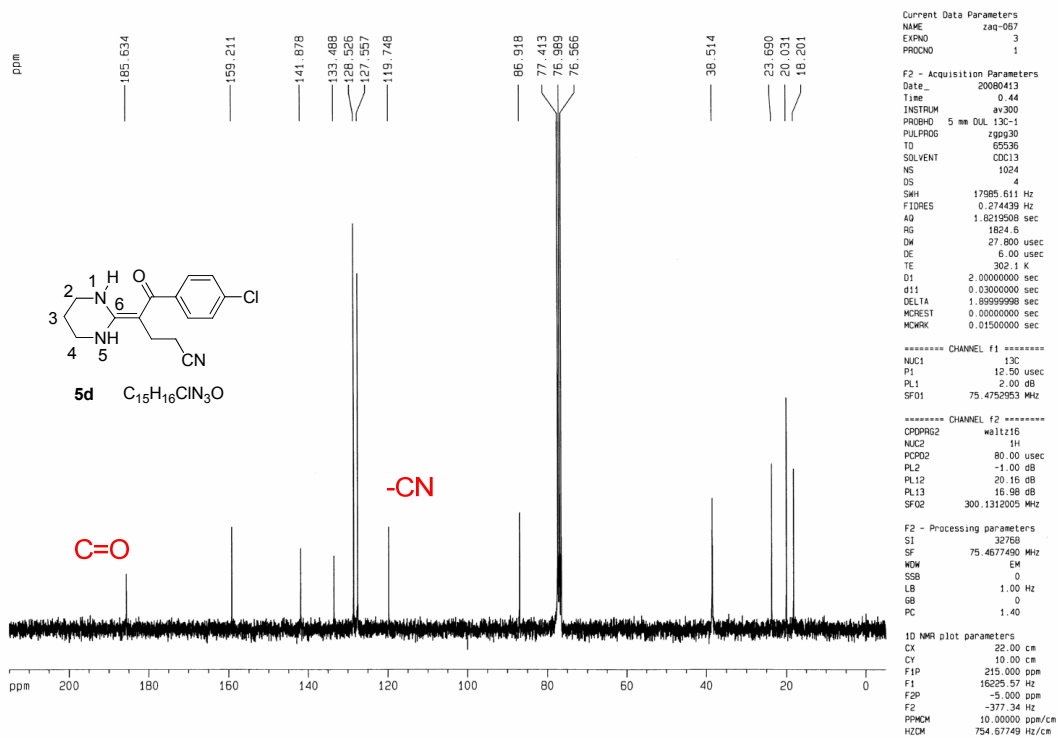


Spectra of compound **5d**:

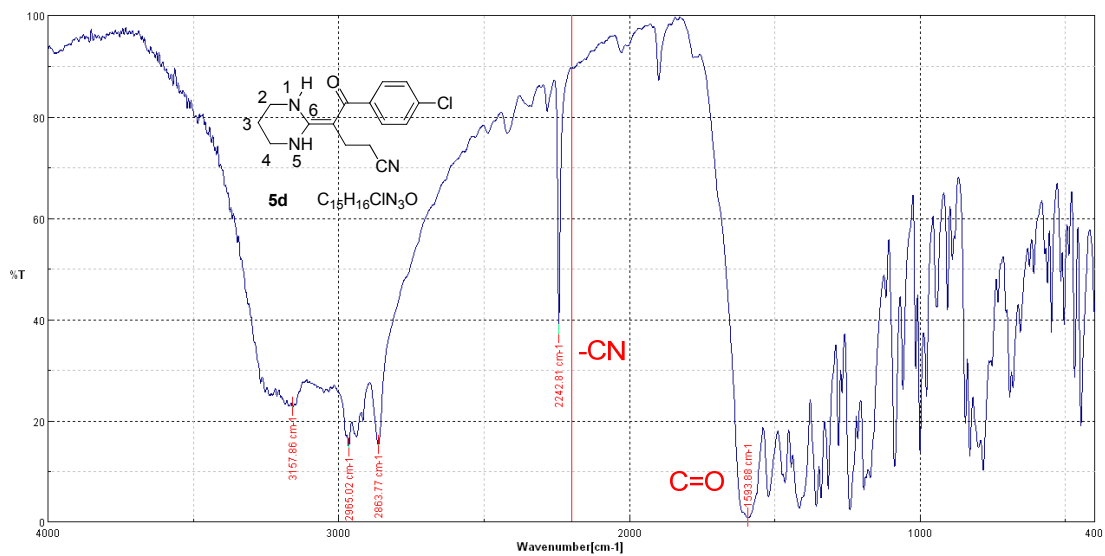
¹H-NMR:



¹³C-NMR

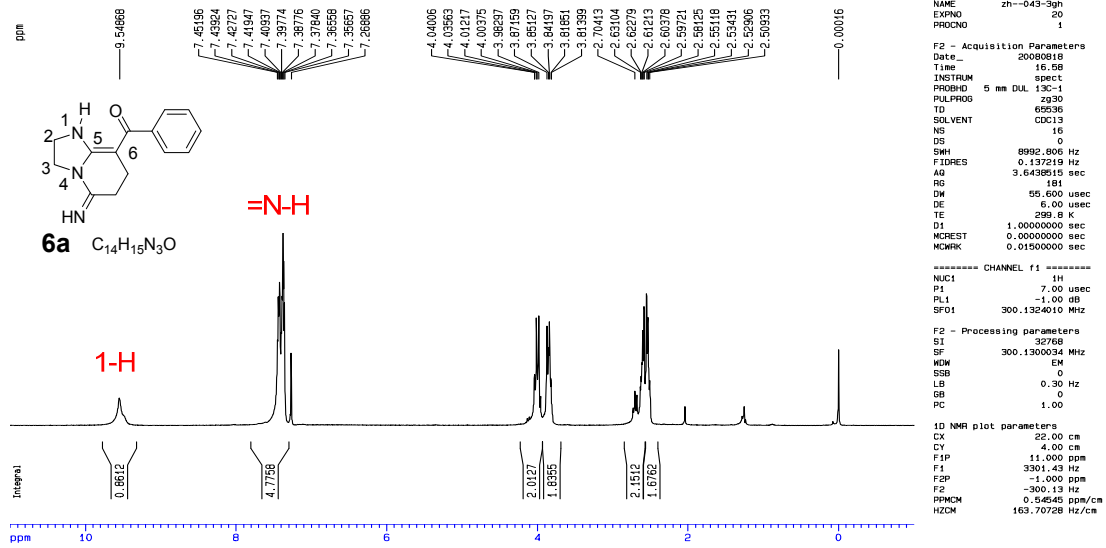


IR:

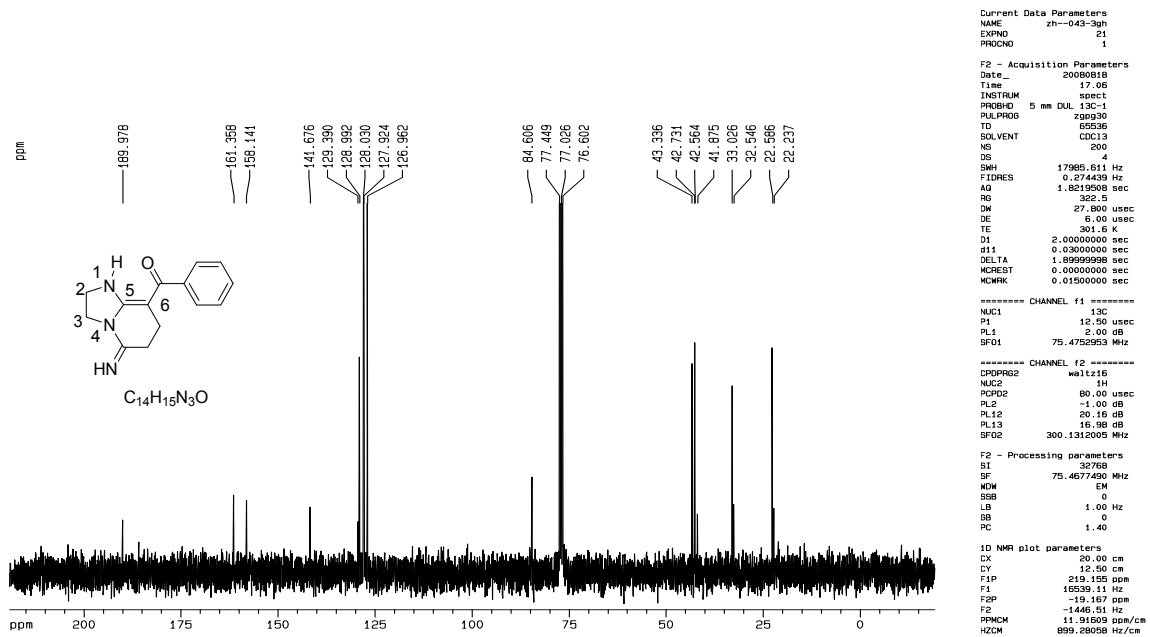


Spectra of compound **6a**:

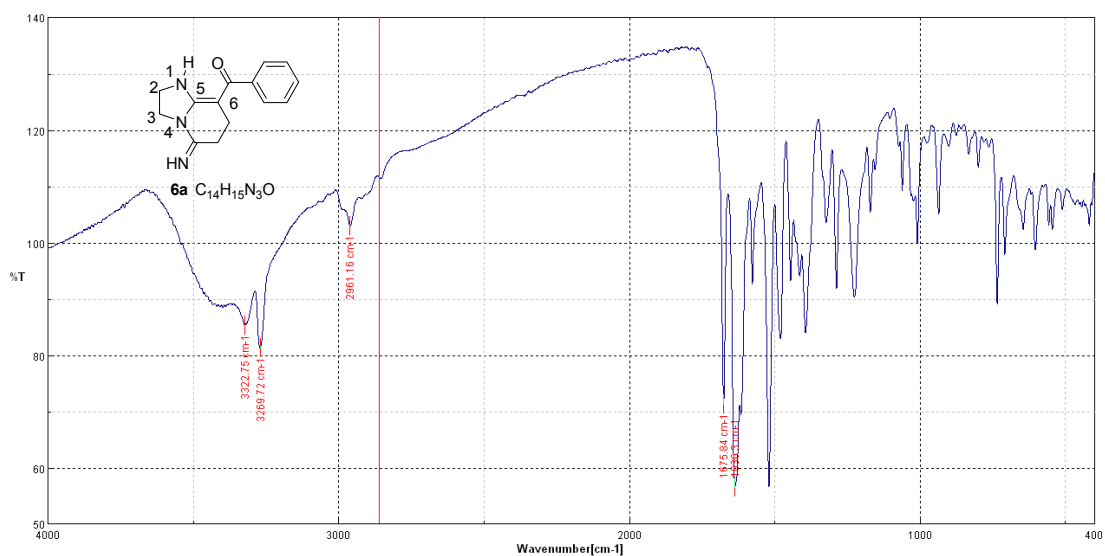
¹H-NMR:



¹³C-NMR:

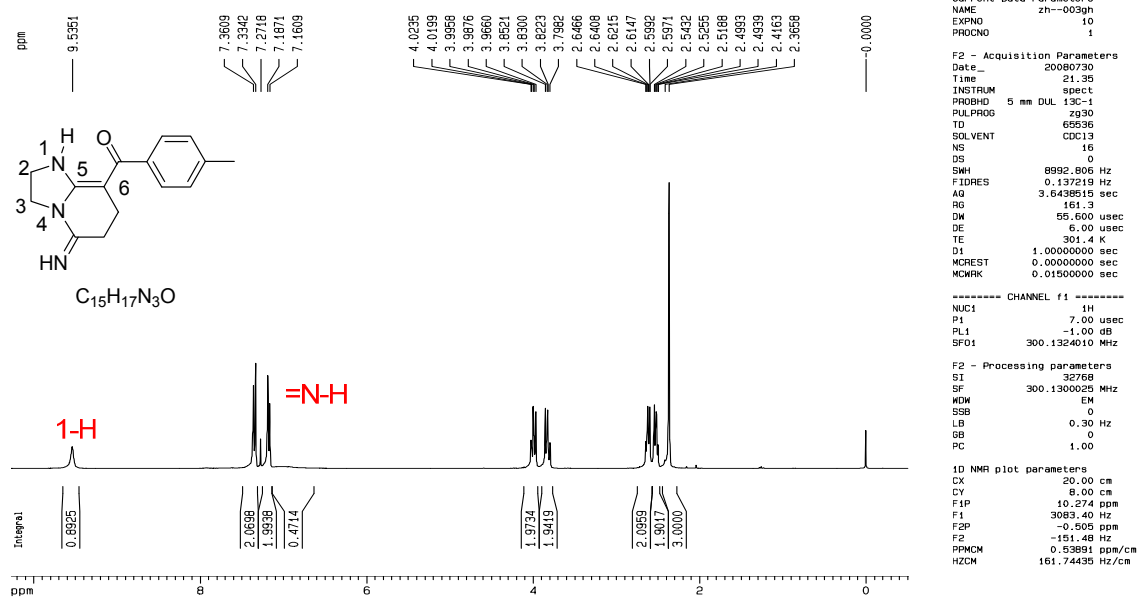


IR:

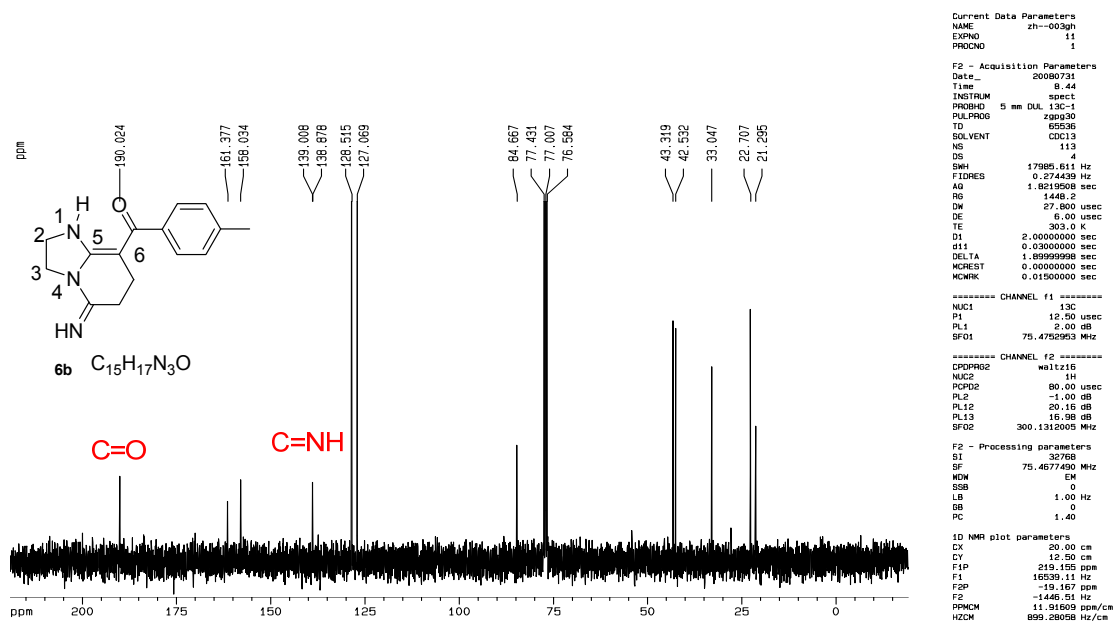


Spectra of compound **6b**:

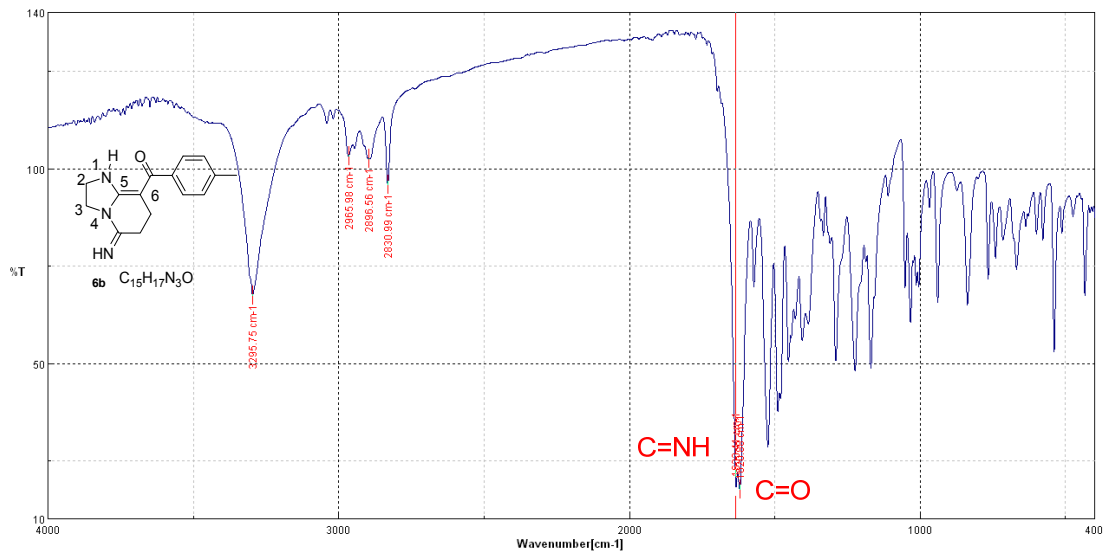
¹H-NMR:



¹³C-NMR:

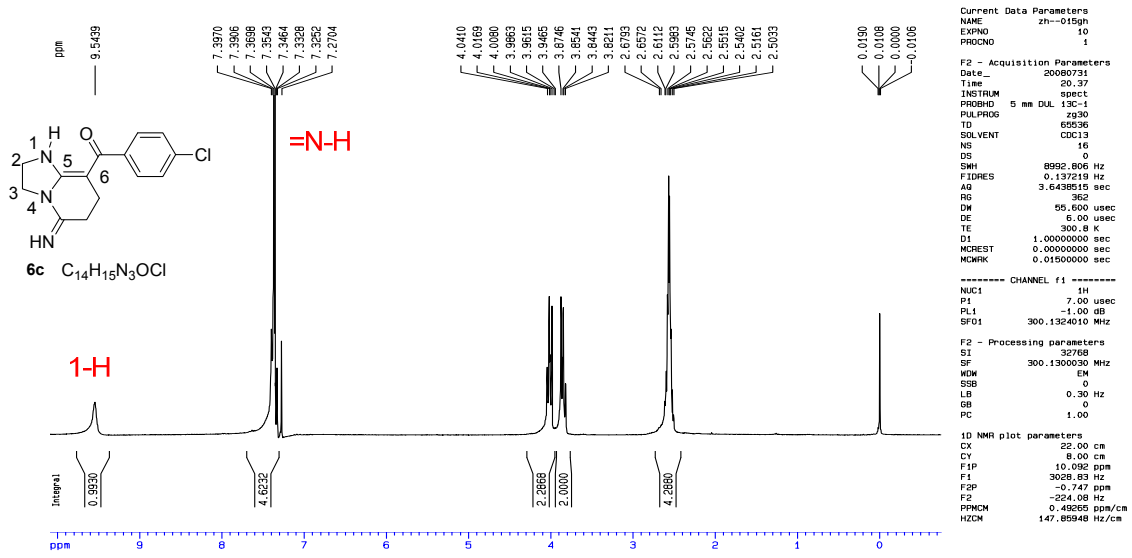


IR:

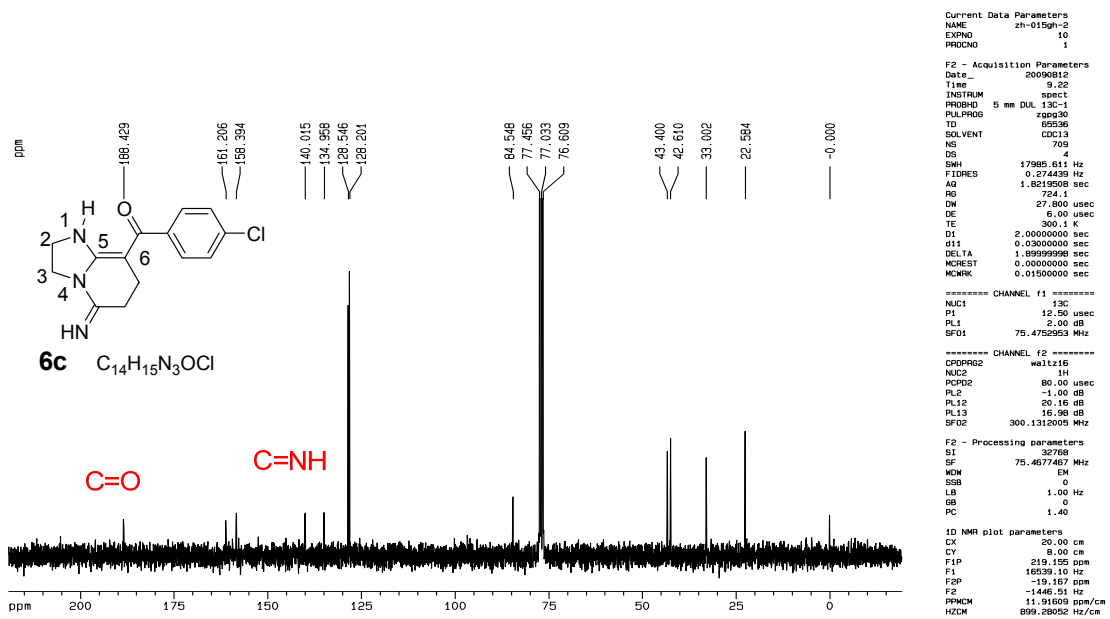


Spectra of compound 6c:

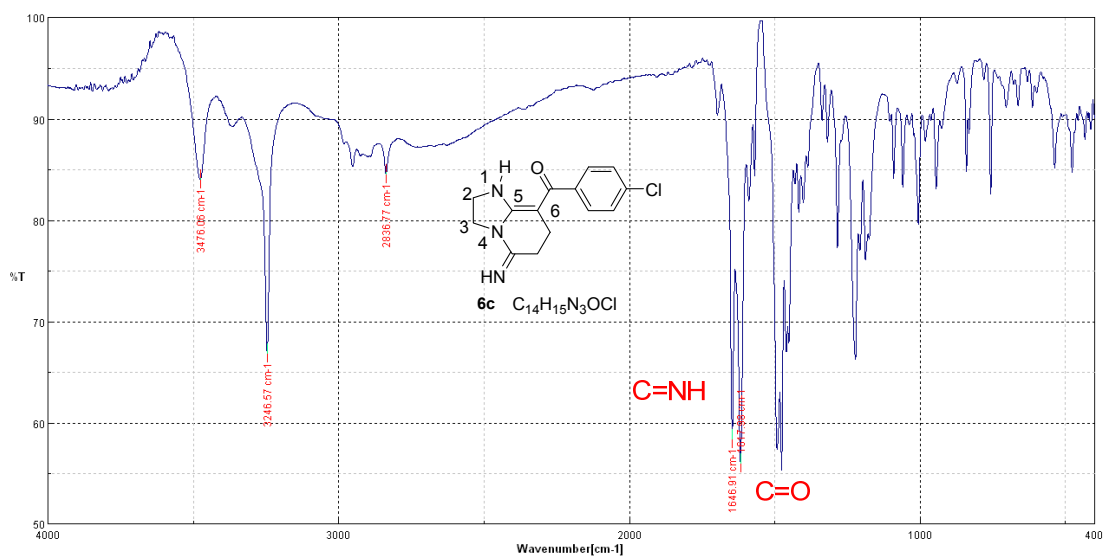
¹H-NMR:



¹³C-NMR:

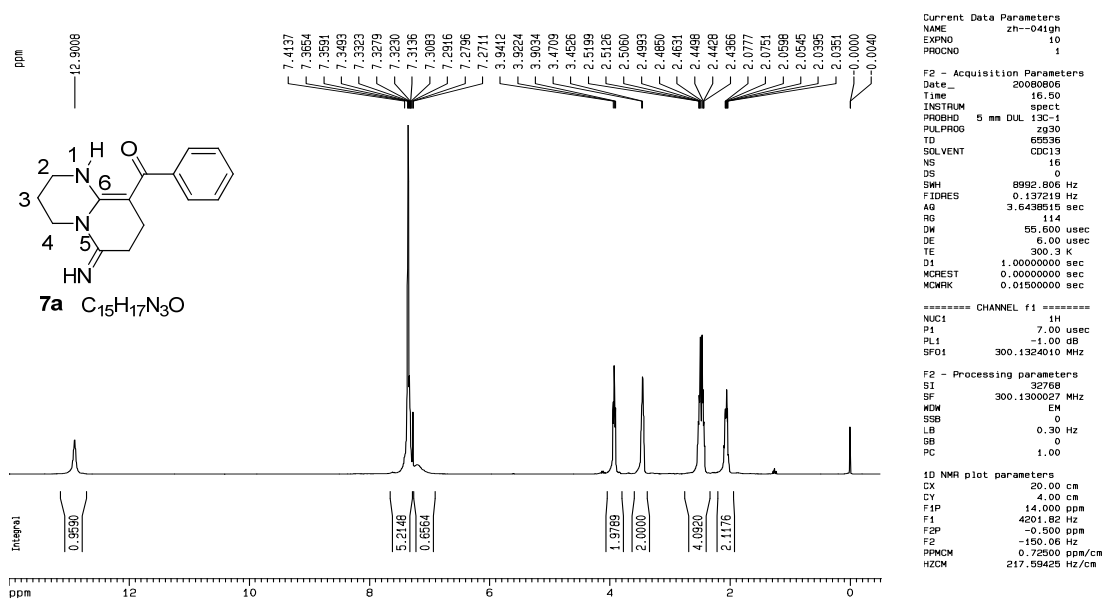


IR:

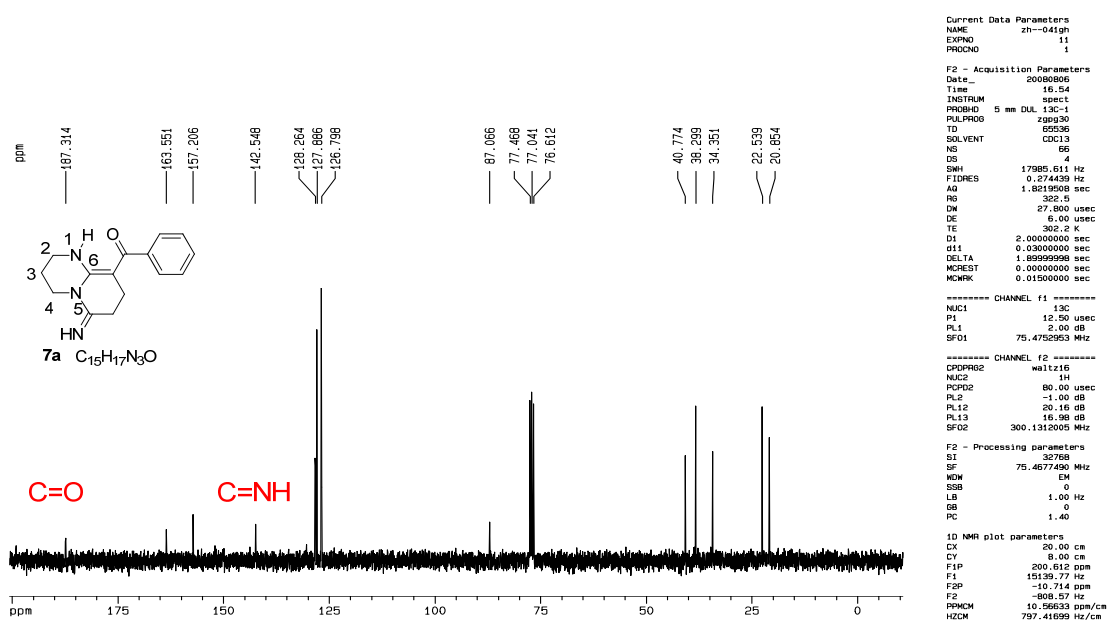


Spectra of compound **7a**:

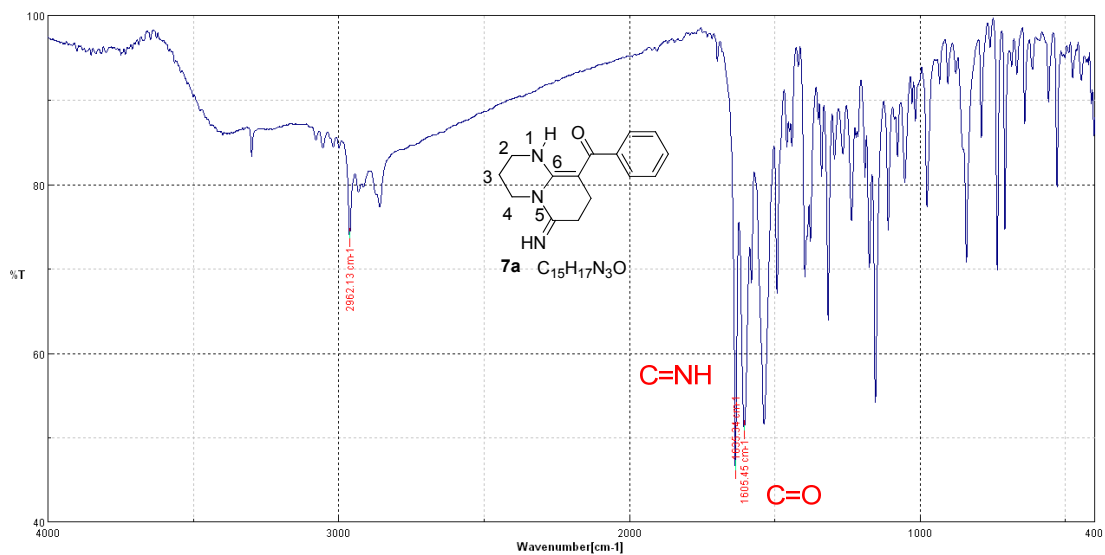
¹H-NMR:



¹³C-NMR:

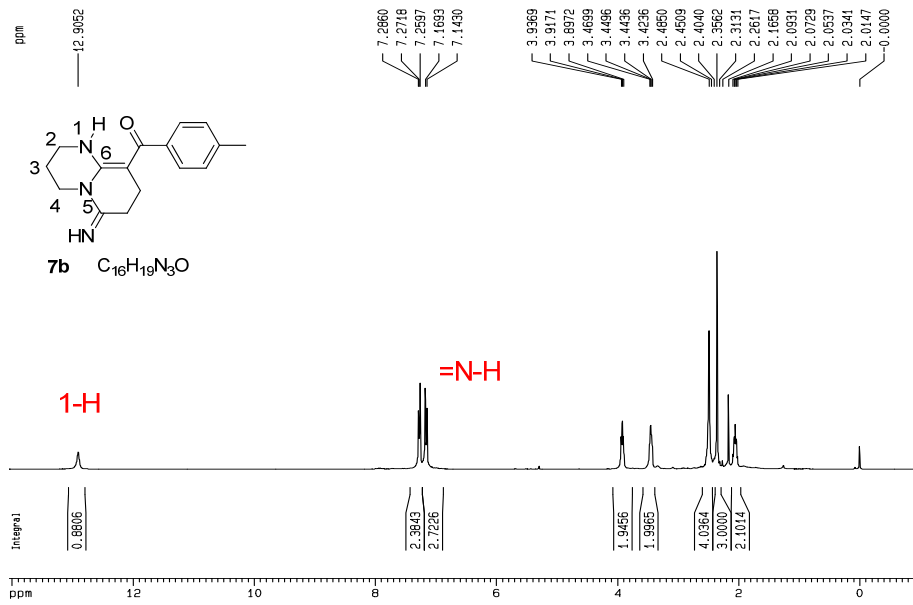


IR:



Spectra of compound **7b**:

¹H-NMR:



Current Data Parameters
 NAME zh-009-3gh
 EXPNO 10
 PROCNO 1

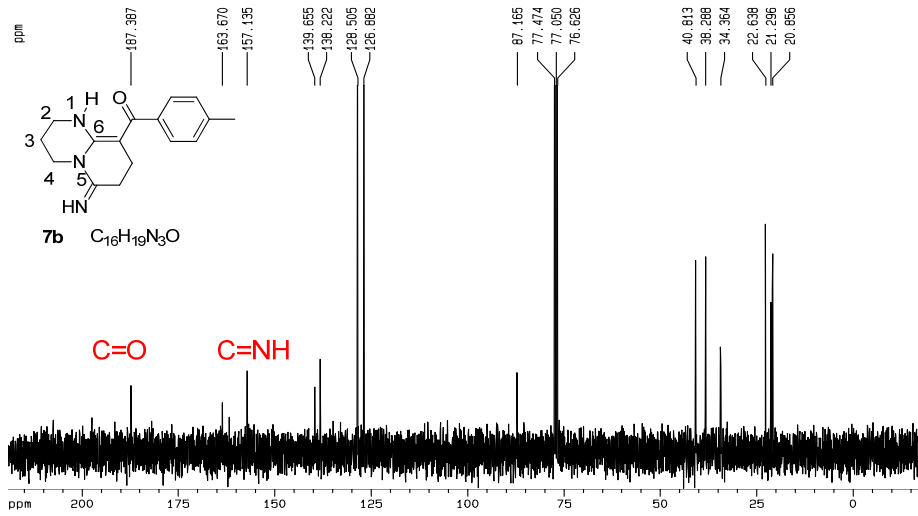
F2 - Acquisition Parameters
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 Time 17.30
 INSTRUM spect
 PROBHD 5 mm DUL 13C-1
 PULPROG zg30
 TD 65536
 SOLVENT CDC13
 NS 16
 DS 0
 SWH 8992.806 Hz
 FIDRES 0.137219 Hz
 AQ 3.6438515 sec
 RG 143.7
 DW 55.600 usec
 DE 6.00 usec
 TE 300.2 K
 D1 1.0000000 sec
 MCREST 0.0000000 sec
 MCWRK 0.0150000 sec

----- CHANNEL f1 -----
 NUC1 1H
 P1 7.00 usec
 PL1 -1.00 dB
 SFO1 300.1324010 MHz

F2 - Processing parameters
 SI 32768
 SF 300.1300024 MHz
 MDW EM
 SSB 0
 LB 0.30 Hz
 GB 0
 PC 1.00

1D NMR plot parameters
 CX 20.00 cm
 CY 6.00 cm
 F1P 14.044 ppm
 F1 4215.11 Hz
 F2P -1.036 ppm
 F2 -311.07 Hz
 PRMCM 0.75404 ppm/cm
 HZCM 226.30902 Hz/cm

¹³C-NMR:



Current Data Parameters
 NAME zh-009-3gh
 EXPNO 11
 PROCNO 1

F2 - Acquisition Parameters
 Date_ 20080812
 Time 17.38
 INSTRUM spect
 PROBHD 5 mm DUL 13C-1
 PULPROG zgpg30
 TD 65536
 SOLVENT CDCl3
 NS 45
 DS 4
 SWH 17985.811 Hz
 FIDRES 0.274439 Hz
 AQ 1.6219508 sec
 RG 456.1
 DW 27.800 usec
 DE 6.00 usec
 TE 300.4 K
 D1 2.0000000 sec
 H11 0.0300000 sec
 DELTA 1.8999998 sec
 MCREST 0.0000000 sec
 MCWRK 0.0150000 sec

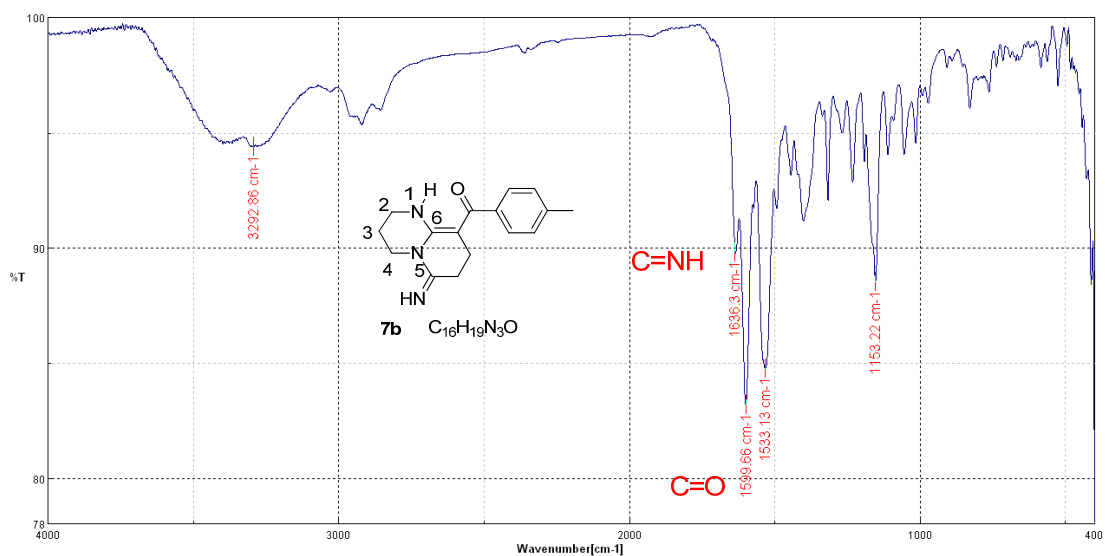
----- CHANNEL f1 -----
 NUC1 13C
 P1 12.50 usec
 PL1 2.00 dB
 SFO1 75.4752953 MHz

----- CHANNEL f2 -----
 CPDPRG2 waltz16
 NUC2 1H
 PCPD2 80.00 usec
 PL2 -1.00 dB
 PL12 20.16 dB
 PL13 16.98 dB
 SFO2 300.1312005 MHz

F2 - Processing parameters
 SI 32768
 SF 75.4677490 MHz
 MDW EM
 SSB 0
 LB 1.00 Hz
 GB 0
 PC 1.40

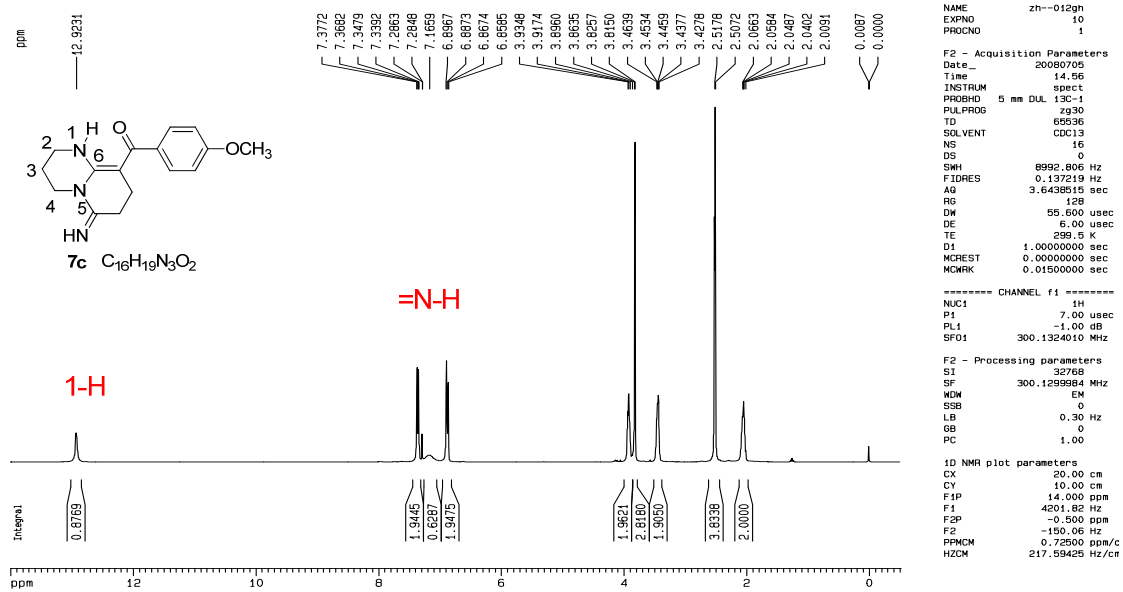
1D NMR plot parameters
 CX 20.00 cm
 CY 12.50 cm
 F1P 219.195 ppm
 F1 16559.11 Hz
 F2P -19.167 ppm
 F2 -1446.51 Hz
 PRMCM 11.91608 ppm/cm
 HZCM 899.28808 Hz/cm

IR:

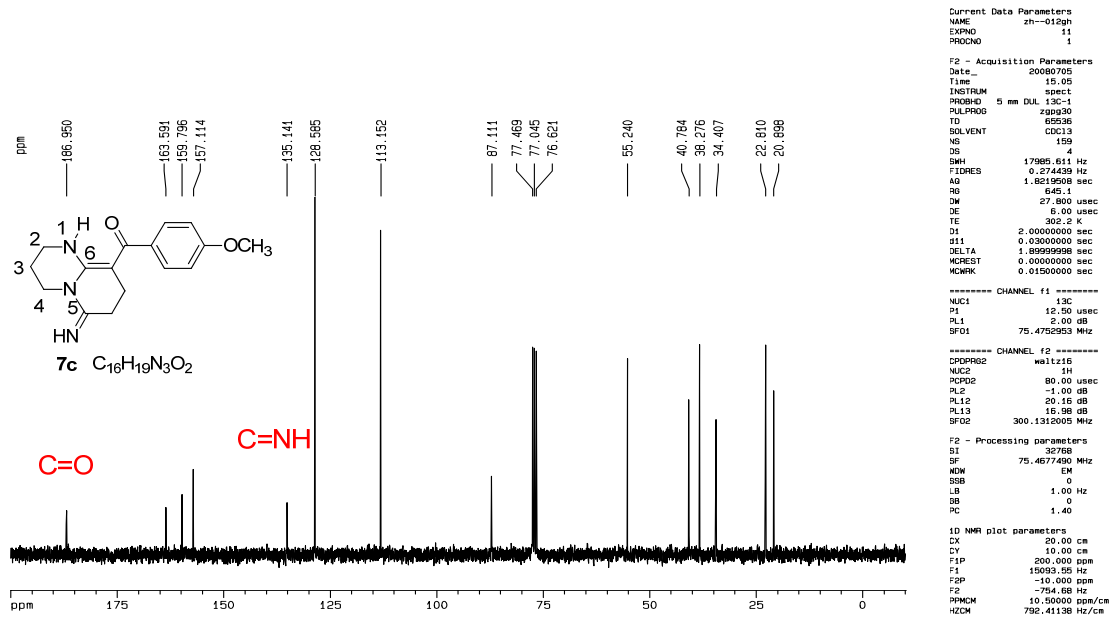


Spectra of compound **7c**:

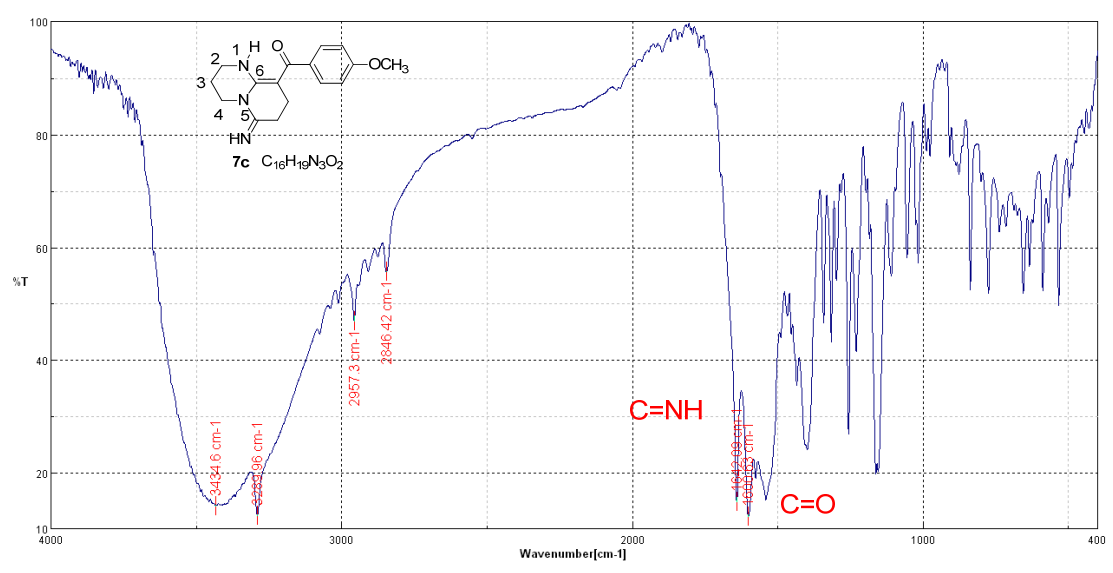
$^1\text{H-NMR}$:



$^{13}\text{C-NMR}$:

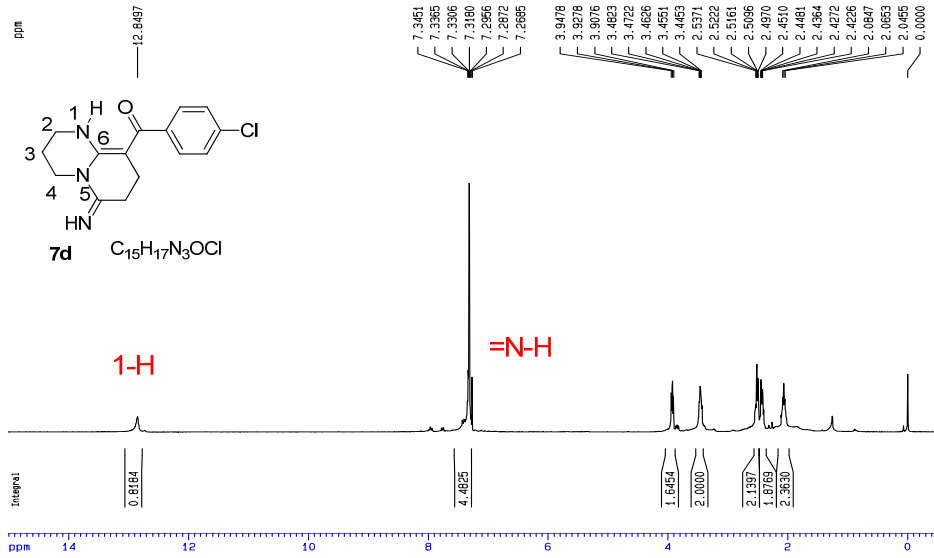


IR:



Spectra of compound 7d:

¹H-NMR:



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Current Data Parameters
NAME      zh--042-2gh
EXPNO    1
PROCNO   1

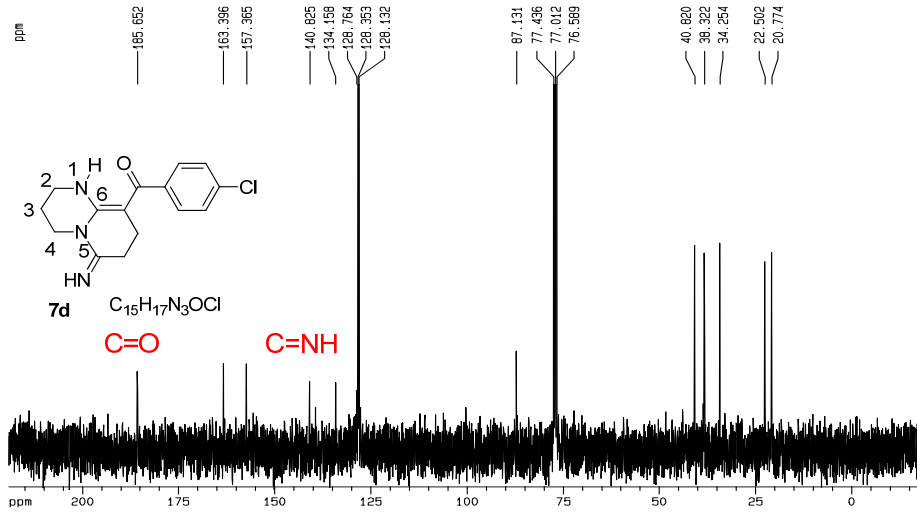
F2 - Acquisition Parameters
Date_    20080814
Time     12.20
INSTRUM  spect
PROBHD   5 mm DUL 13C-1
PULPROG  zg30
TD        65536
SOLVENT  CDCl3
NS        16
DS        0
SWH       8992.806 Hz
FIDRES   0.137219 Hz
AQ        3.6438915 sec
RG         362
DM        55.500 usec
DE        6.00 usec
TE        300.5 K
D1        1.00000000 sec
MCREST   0.00000000 sec
MCWRK    0.01500000 sec

===== CHANNEL f1 =====
NUC1      1H
P1        7.00 usec
PL1       -1.00 dB
SFO1      300.1324010 MHz

F2 - Processing parameters
SI        32768
SF        300.1300034 MHz
WDW       0
SSB       0
LB        0.30 Hz
GB        0
PC        1.00

ID NMR plot parameters
CX        22.00 cm
CY        2.00 cm
F1P       15.000 ppm
F1        4501.95 Hz
F2P       -0.500 ppm
F2        -150.06 Hz
PQCM      0.70455 ppm/cm
HZCM      211.45523 Hz/cm
    
```

¹³C-NMR:



```

Current Data Parameters
NAME      zh--042-2gh
EXPNO    1
PROCNO   1

F2 - Acquisition Parameters
Date_    20080814
Time     12.25
INSTRUM  spect
PROBHD   5 mm DUL 13C-1
PULPROG  zgpg30
TD        65536
SOLVENT  CDCl3
NS        256
DS        4
SWH       17985.611 Hz
FIDRES   0.274459 Hz
AQ        1.8219508 sec
RG         512
DM        27.800 usec
DE        6.00 usec
TE        301.8 K
D1        2.00000000 sec
d11       0.03000000 sec
DELTA    1.89999998 sec
MCREST   0.00000000 sec
MCWRK    0.01500000 sec

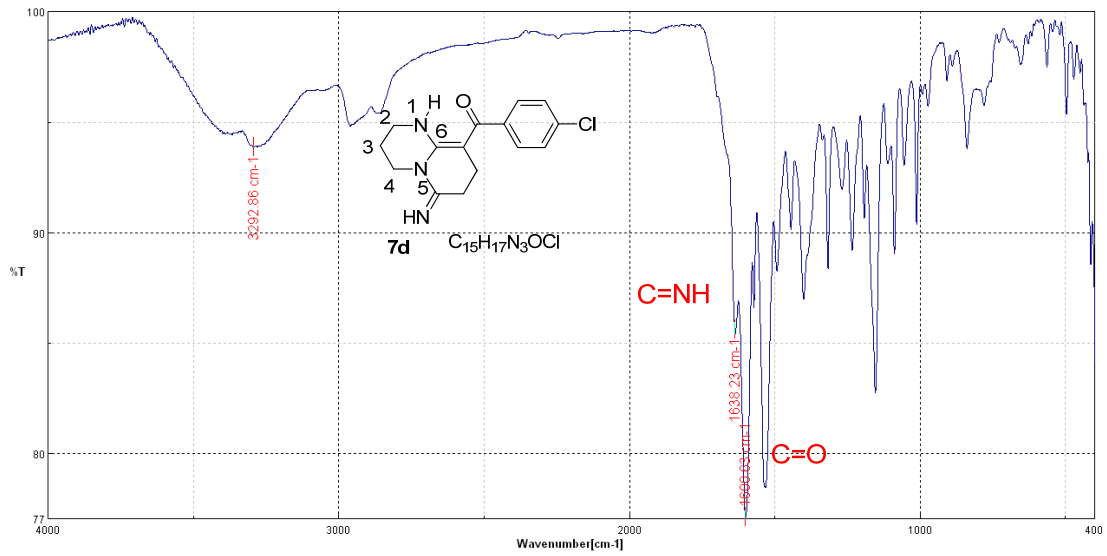
===== CHANNEL f1 =====
NUC1      13C
P1        12.00 usec
PL1       2.00 dB
SFO1      75.4752953 MHz

===== CHANNEL f2 =====
CPDPRG2  waltz16
NUC2      1H
PCPD2    80.00 usec
PL2       -1.00 dB
PL12     20.15 dB
PL13     16.98 dB
SFO2     300.1315005 MHz

F2 - Processing parameters
SI        32768
SF        75.4677490 MHz
WDW       0
SSB       0
LB        1.00 Hz
GB        0
PC        1.40

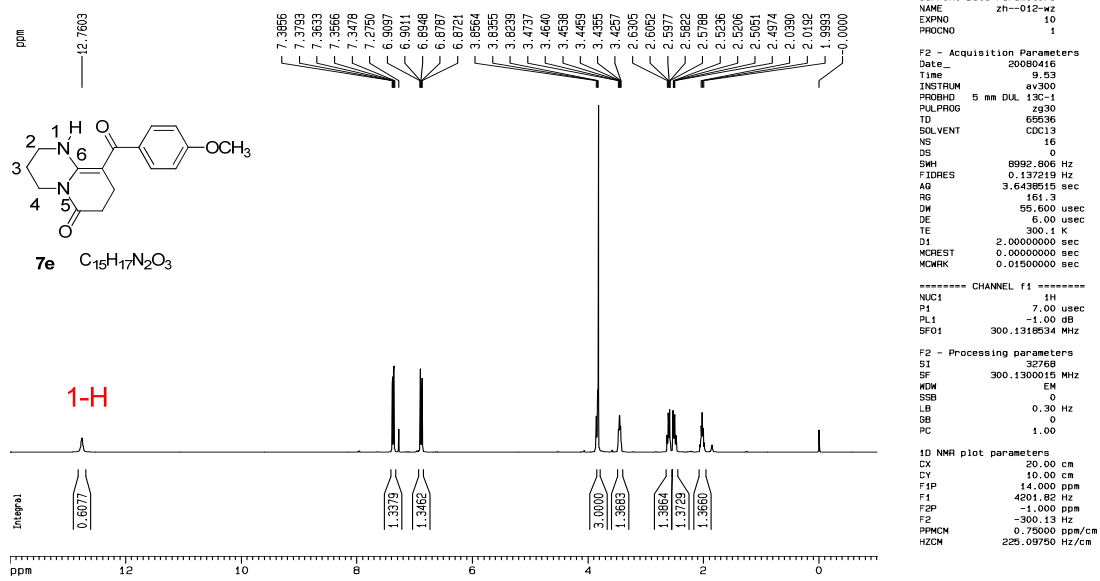
ID NMR plot parameters
CX        20.00 cm
CY        12.50 cm
F1P       219.195 ppm
F1        16539.11 Hz
F2P       -19.167 ppm
F2        -1446.51 Hz
PQCM      11.91609 ppm/cm
HZCM      899.28058 Hz/cm
    
```

IR

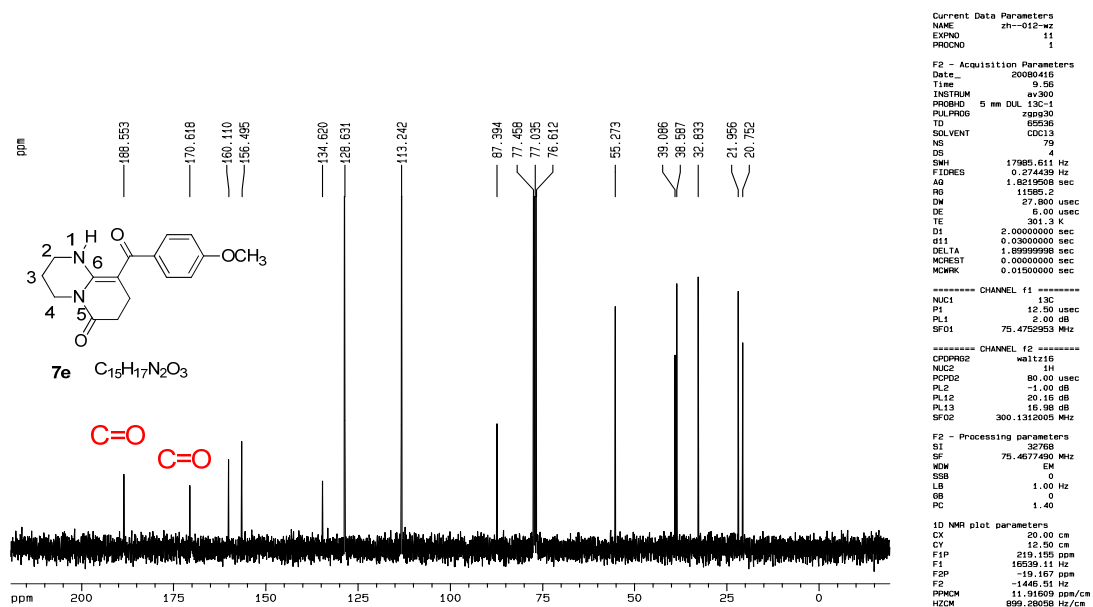


Spectra of compound 7e:

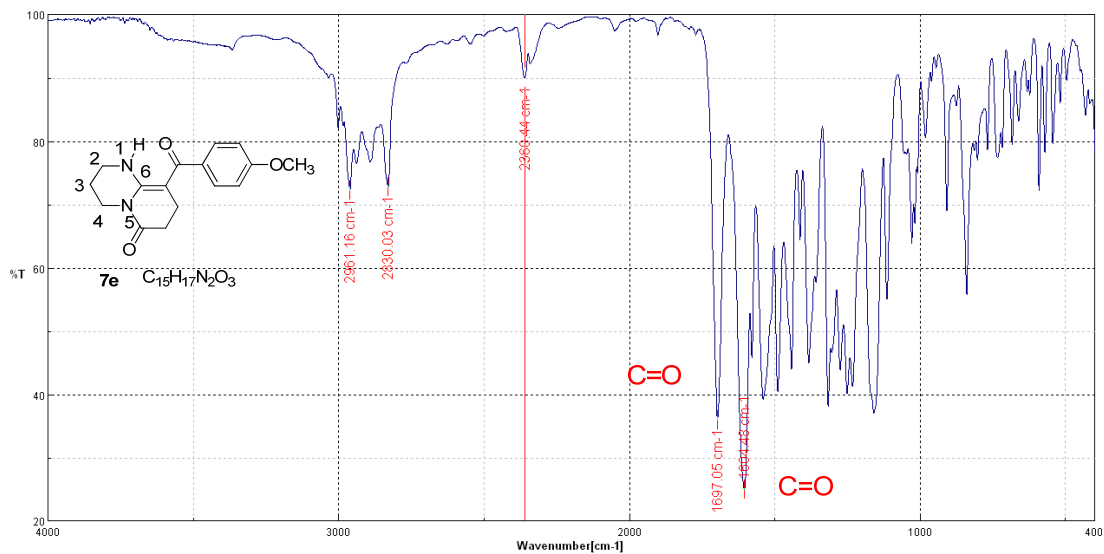
¹H-NMR:



¹³C-NMR

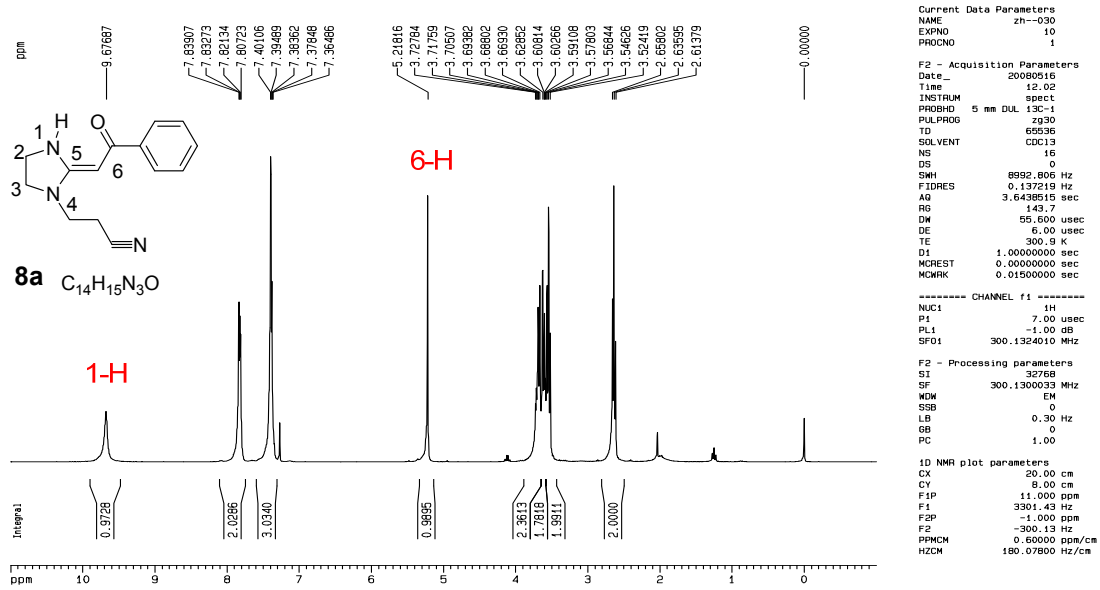


IR:



Spectra of compound **8a**:

¹H-NMR:



```

Current Data Parameters
NAME          zh-030
EXPNO        10
PROCNO       1

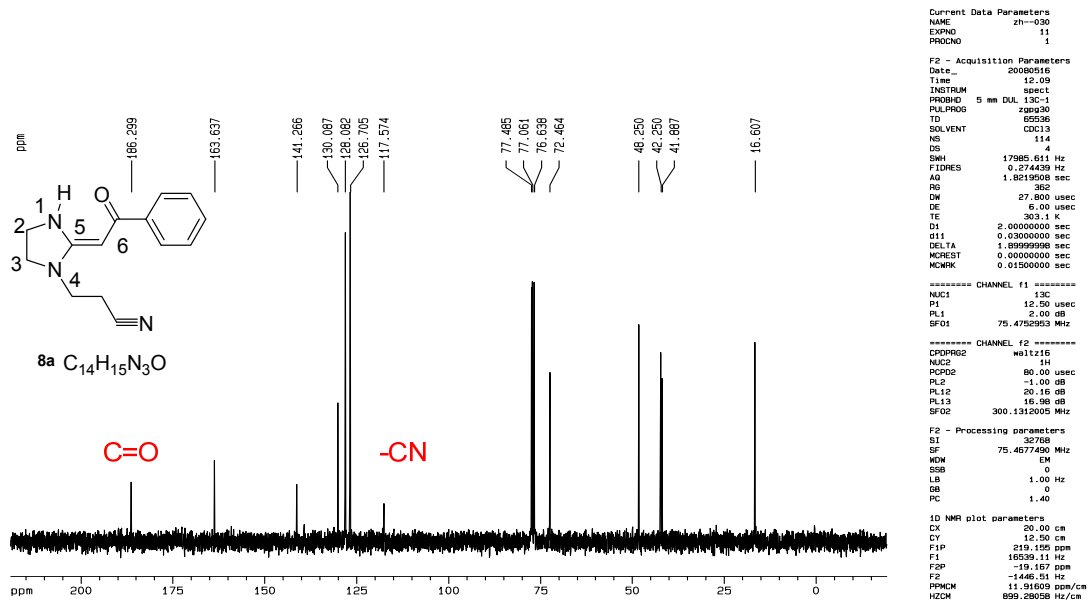
F2 - Acquisition Parameters
Date_        20080516
Time         12.02
INSTRUM     spect
PROBHD      5 mm DUL 13C-1
PULPROG     zg30
TD           65536
SOLVENT     CDCl3
NS           16
DS           0
SMH         8992.806 Hz
FIDRES      0.137219 Hz
AQ          3.6438515 sec
RG           143.7
DM          55.600 usec
DE           6.00 usec
TE           300.2 K
D1           1.0000000 sec
MCREST      0.0000000 sec
MCWRRK      0.0150000 sec

===== CHANNEL f1 =====
NUC1         1H
P1           7.00 usec
PL1          -1.00 dB
SFO1        300.1324010 MHz

F2 - Processing parameters
SI           32768
SF          300.1300033 MHz
WDW          EM
SSB          0
LB           0.30 Hz
GB           0
PC           1.00

1D NMR plot parameters
CX           20.00 cm
CY           8.00 cm
F1P         11.000 ppm
F1          3301.43 Hz
F2P         -1.000 ppm
F2          -300.13 Hz
PPMCM       0.60000 ppm/cm
HZCM        180.07800 Hz/cm
    
```

¹³C-NMR:



```

Current Data Parameters
NAME          zh-030
EXPNO        11
PROCNO       1

F2 - Acquisition Parameters
Date_        20080516
Time         12.09
INSTRUM     spect
PROBHD      5 mm DUL 13C-1
PULPROG     zgpg30
TD           65536
SOLVENT     CDCl3
NS           114
DS           4
SMH         17985.611 Hz
FIDRES      0.274439 Hz
AQ          1.8219508 sec
RG           382
DM          27.800 usec
DE           6.00 usec
TE           303.1 K
D1           2.0000000 sec
d11          0.0300000 sec
DELTA       1.8999998 sec
MCREST      0.0000000 sec
MCWRRK      0.0150000 sec

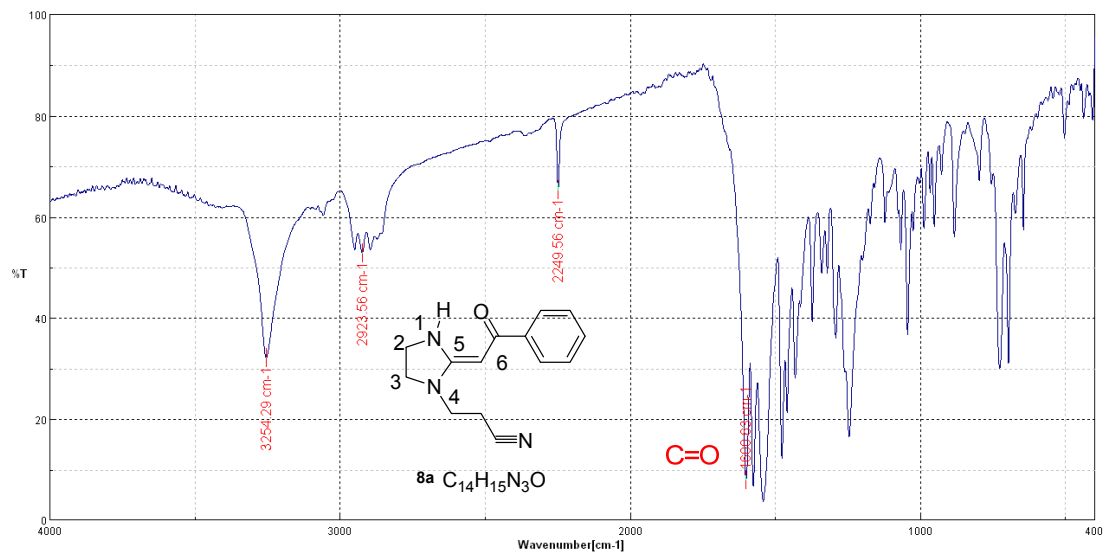
===== CHANNEL f1 =====
NUC1         13C
P1          12.50 usec
PL1          2.00 dB
SFO1        75.4782853 MHz

===== CHANNEL f2 =====
CPDPRG2     waltz16
NUC2         1H
PCPD2       80.00 usec
PL2          -1.00 dB
PL12        20.16 dB
PL13        16.38 dB
SFO2        300.1312005 MHz

F2 - Processing parameters
SI           32768
SF          75.4677450 MHz
WDW          EM
SSB          0
LB           1.00 Hz
GB           0
PC           1.40

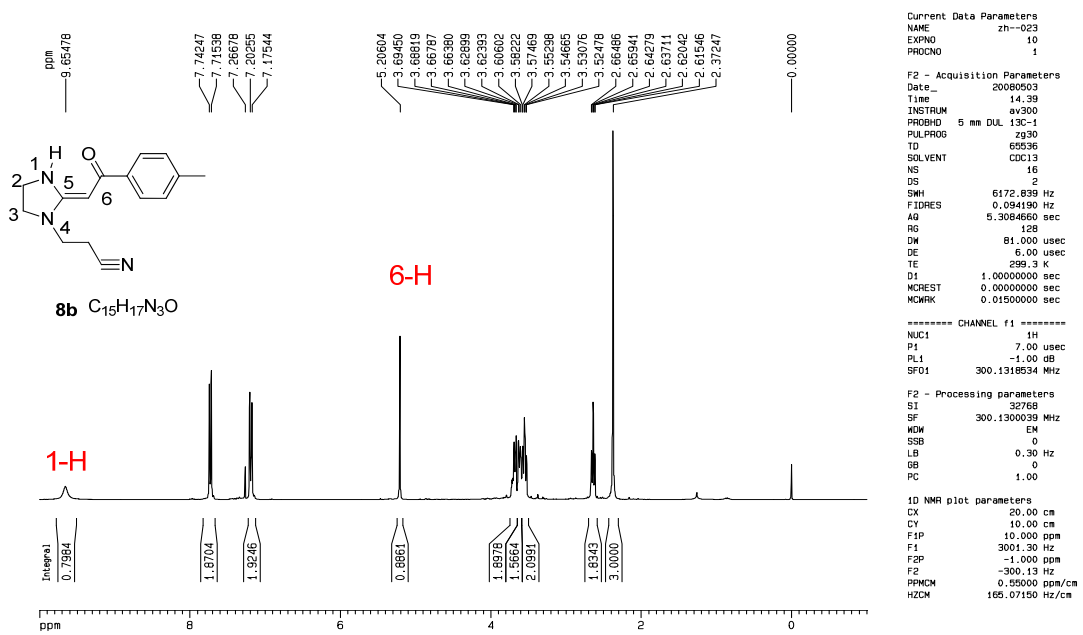
1D NMR plot parameters
CX           20.00 cm
CY           12.50 cm
F1P         215.150 ppm
F1          18539.11 Hz
F2P         -19.167 ppm
F2          -1446.51 Hz
PPMCM       11.91609 ppm/cm
HZCM        899.28038 Hz/cm
    
```

IR:

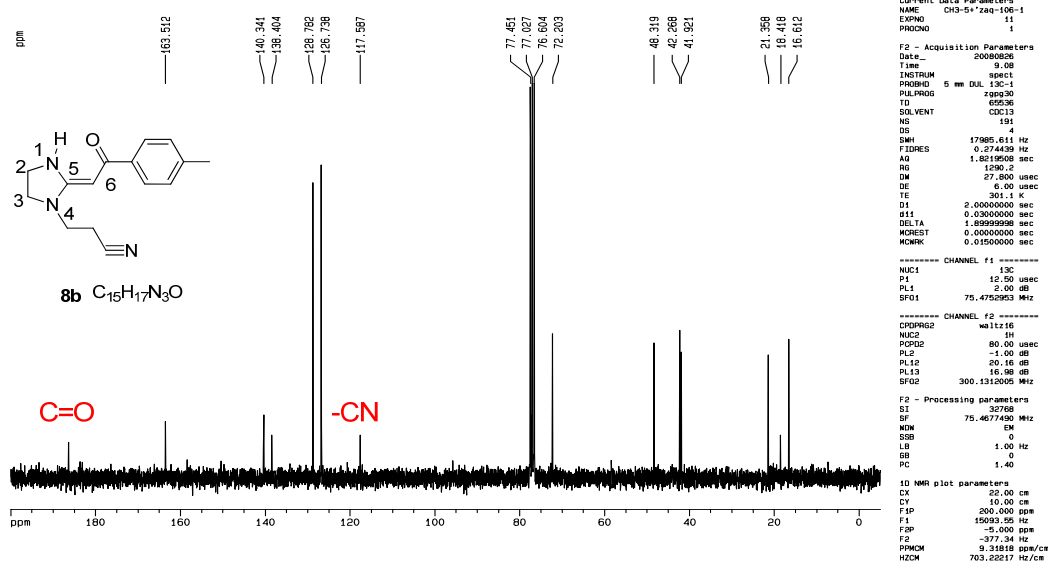


Spectra of compound 8b:

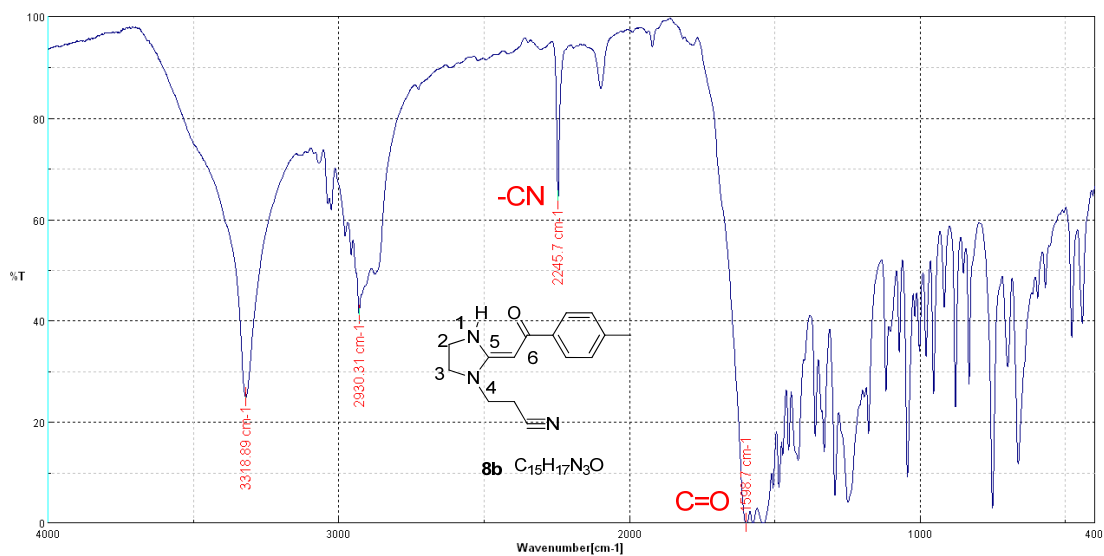
¹H-NMR:



¹³C-NMR:

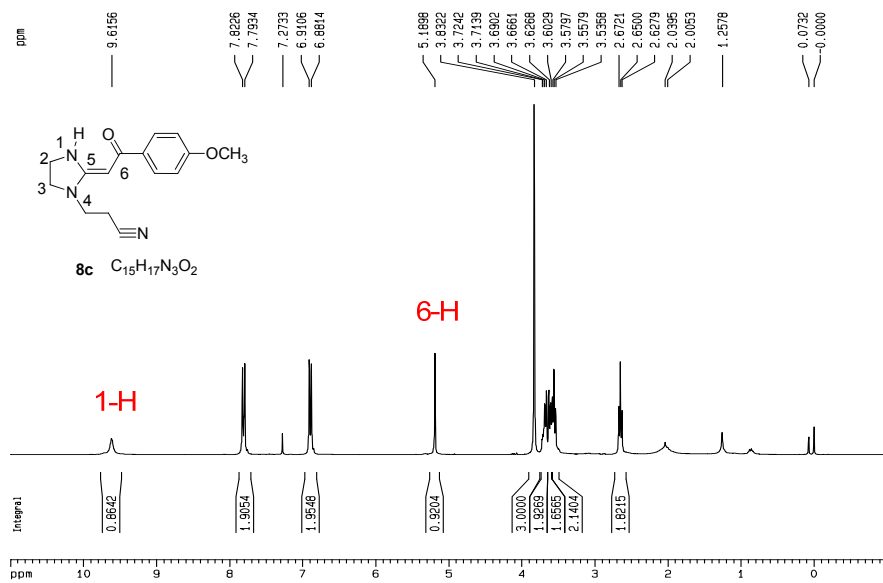


IR:



Spectra of compound **8c**:

¹H-NMR:



```

Current Data Parameters
NAME          zh--029
EXPNO        10
PROCNO       1

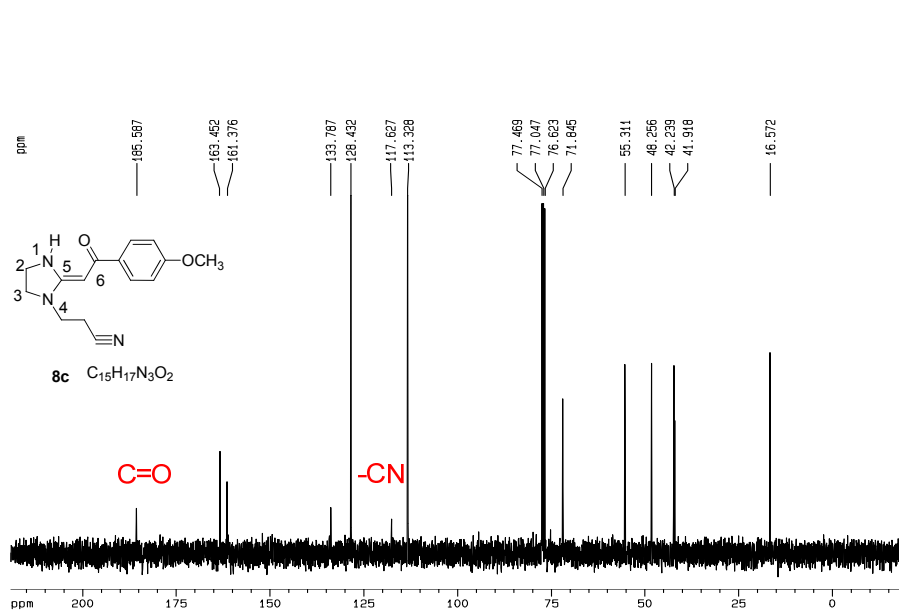
F2 - Acquisition Parameters
Date_        20080510
Time         15.05
INSTRUM      spect
PROBHD       5 mm DUL 13C-1
PULPROG      zg30
TD            69536
SOLVENT      CDCl3
NS            16
DS            0
SWH           8992.806 Hz
FIDRES       0.137219 Hz
AQ            3.6438915 sec
RG            101.3
DW            55.600 usec
DE            6.00 usec
TE            299.6 K
D1            1.00000000 sec
MCREST       0.00000000 sec
MCWRK        0.01500000 sec

===== CHANNEL f1 =====
NUC1          1H
P1            7.00 usec
PL1           -1.00 dB
SFO1          300.1324010 MHz

F2 - Processing parameters
SI            32768
SF            300.1300019 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           11.000 ppm
F1            3301.43 Hz
F2P           -1.000 ppm
F2            -900.13 Hz
PRMCM         0.60000 ppm/cm
HZCM          180.07800 Hz/cm
    
```

¹³C-NMR:



```

Current Data Parameters
NAME          zh--029
EXPNO        11
PROCNO       1

F2 - Acquisition Parameters
Date_        20080510
Time         15.08
INSTRUM      spect
PROBHD       5 mm DUL 13C-1
PULPROG      zgpg30
TD            65536
SOLVENT      CDCl3
NS            91
DS            4
SWH           17985.811 Hz
FIDRES       0.274459 Hz
AQ            1.8219908 sec
RG            6502
DW            27.800 usec
DE            6.00 usec
TE            301.5 K
D1            2.00000000 sec
d11           0.03000000 sec
DELTA        1.89999998 sec
MCREST       0.00000000 sec
MCWRK        0.01500000 sec

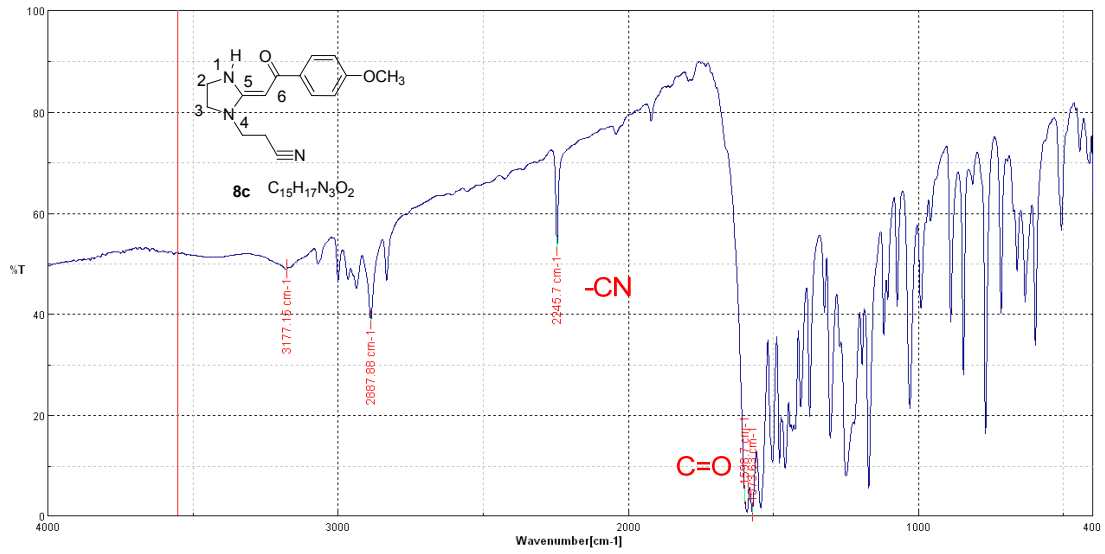
===== CHANNEL f1 =====
NUC1          13C
P1            12.50 usec
PL1            2.00 dB
SFO1          75.4752953 MHz

===== CHANNEL f2 =====
PRPGR2       waltz16
NUC2          1H
PCPR2        80.00 usec
PL2           -1.00 dB
PL12         20.15 dB
PL13         16.98 dB
SFO2          300.1312005 MHz

F2 - Processing parameters
SI            32768
SF            75.4677490 MHz
WDW           EM
SSB           0
LB            1.00 Hz
GB            0
PC            1.40

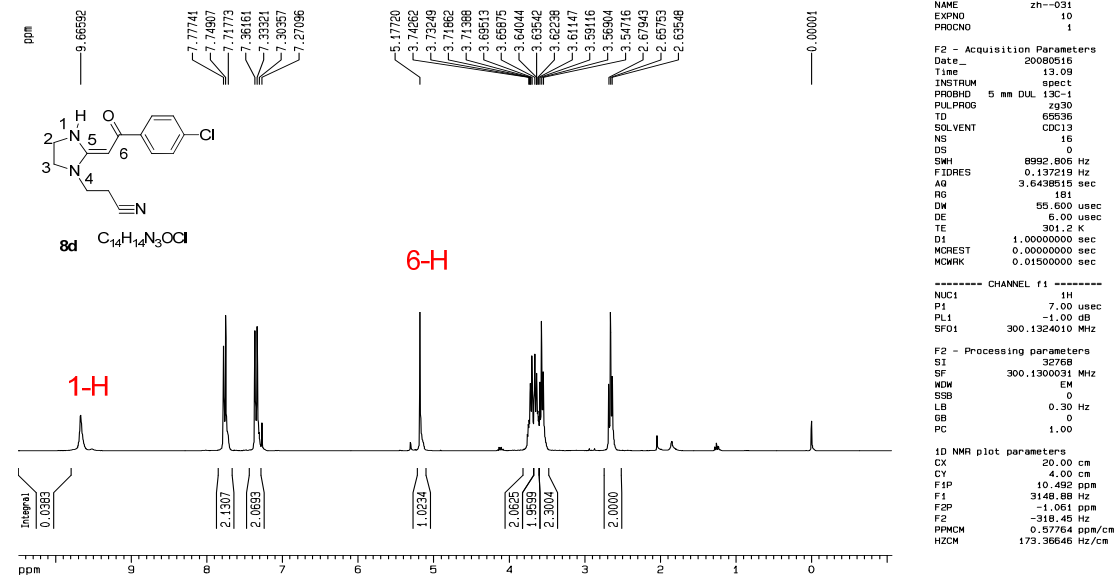
1D NMR plot parameters
CX            20.00 cm
CY            12.50 cm
F1P           219.125 ppm
F1            16539.11 Hz
F2P           -13.167 ppm
F2            -1446.51 Hz
PRMCM         11.91609 ppm/cm
HZCM          899.28058 Hz/cm
    
```

IR:

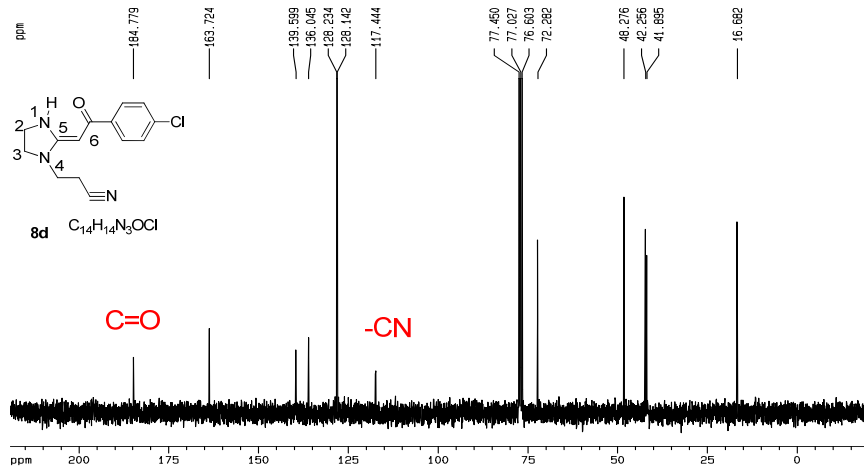


Spectra of compound 8d:

1H -NMR:



¹³C-NMR:



```

Current Data Parameters
NAME      zh--031
EXPNO    1
PROCNO   1

F2 - Acquisition Parameters
Date_    20090916
Time     13.15
INSTRUM spect
PROBHD   5 mm DUL 13C-1
PULPROG zgpg30
TD        65536
SOLVENT  CDCl3
NS        141
DS        4
SWH       17985.611 Hz
FIDRES    0.274439 Hz
AQ        1.3215908 sec
RG         362
DM        27.800 umt
DE         6.00 umt
TE        303.4 K
D1        2.0000000 sec
d11       0.0300000 sec
DELTA    1.8999996 sec
MCREST    0.0000000 sec
MCHWK     0.0150000 sec

===== CHANNEL f1 =====
NUC1      13C
P1        12.50 umt
PL1       2.00 dB
SFO1      75.4752953 MHz

===== CHANNEL f2 =====
CPDPRG2  waltz16
NUC2      1H
PCPD2     80.00 umt
PL2       -1.00 dB
PL12      20.16 dB
PL13      16.98 dB
SFO2      300.1310000 MHz

F2 - Processing parameters
SI         32768
SF         75.467408 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        219.105 ppm
F1         16539.11 Hz
F2P        -18.107 Hz
F2         -1446.51 Hz
PRMCHN     11.91609 ppm
HCHN       899.28058 Hz
    
```

IR:

