

Supporting Information
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Supporting Information

Visible Light Induced Photocatalytic Conversion of Enamines into Amides

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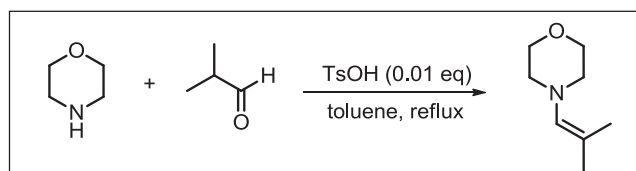
Materials and methods

All reactions were carried out under a nitrogen atmosphere with dry solvents under anhydrous conditions, unless otherwise noted. All the chemicals were purchased commercially, and used without further purification. Anhydrous THF and toluene were distilled from sodium-benzophenone. Dichloromethane and acetonitrile were distilled from calcium hydride. Thin-layer chromatography (TLC) was conducted with 0.25 mm Tsingdao silica gel plates (60F-254) and visualized by exposure to UV light (254 nm) or stained with potassium permanganate. Flash column chromatography was performed using Tsingdao silica gel (60, particle size 0.040–0.063 mm). Reagents were purchased at the highest commercial quality and used without further purification, unless otherwise stated. ^1H NMR spectra were recorded on Bruker spectrometers (at 400 or 500 MHz) and are reported relative to deuterated solvent signals. Data for ^1H NMR spectra are reported as follows: chemical shift (δ ppm), multiplicity, coupling constant (Hz) and integration. ^{13}C NMR spectra were recorded on Bruker Spectrometers (at 100 or 125 MHz). Data for ^{13}C NMR spectra are reported in terms of chemical shift. Mass spectrometric data were obtained using Bruker Apex IV RTMS. The following abbreviations were used to explain the multiplicities: s = singlet, d = doublet, t = triplet, q = quartet, m = multiplet, br = broad.

General procedure for the preparations of enamines

1) Preparations of enamines 7a-7j

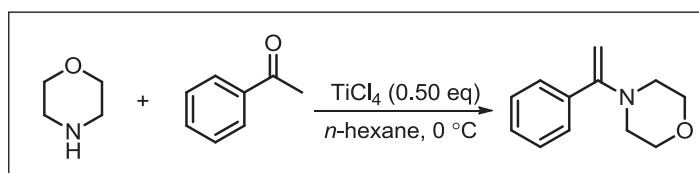
Enamines 7a-7j were prepared from isobutyraldehyde or pentan-3-one and the corresponding amine according to ref: Stork, G.; Brizzolara, A.; Landesman, H.; Szmuszkowicz, J.; Terrell, R. *J. Am. Chem. Soc.* **1963**, *85*, 207-222.



A flame-dried round bottom flask (250 mL) equipped with magnetic stirring bar and a water separator was charged with morpholine (0.10 mol, 8.71 g), isobutyraldehyde (0.11 mol, 7.93 g), TsOH (0.0011 mol, 0.21 g) and toluene (50 mL). The reaction mixture was heated to reflux until no further water was separated. After the solvent was removed in vacuo, the residue was distilled under reduced pressure to afford desired pure product enamines **7a-7j** in 72-88% yield.

2) Preparations of enamines 9a-9d

Enamines 9a-9d were prepared from morpholine and the corresponding acetophenone according to ref: Peng, W. -M; Shreeve, J. M. *J. Org. Chem.* **2005**, *70*, 5760-5763.



A flame-dried round bottom flask (250 mL) equipped with magnetic stirring bar

was charged with acetophenone (0.043 mol, 5.14g), morpholine (0.26 mol, 22.65g) and *n*-hexane (100 mL). Under a nitrogen atmosphere, TiCl₄ (0.022 mol, 0.0042 g) was added by dropwise at 0 °C. Then the reaction mixture was stirred at room temperature for 24 hours. After that the insoluble solid was filtrated, and the filtrate was evaporated in vacuo. Then the residue was distilled under reduced pressure to afford desired pure product enamines **9a-9d** in 65-83% yield.

General procedure for visible-light-promoted ene reaction

1) Synthesis of **8-((tert-butyldimethylsilyl)oxy)-1,4-dioxaspiro[4.5]dec-8-en-7-one (4)** and **1,4-dioxaspiro[4.5]dec-6-en-8-one (5)**

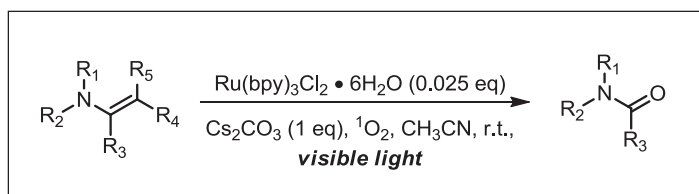
A flame-dried round bottom flask (10 mL) was equipped with magnetic stirring bar and charged with sily enol ether compound (0.4 mmol, 1.0 equiv), tris(2,2'-bipyridyl) ruthenium(II) chloride hexahydrate (0.01 mmol, 0.025 equiv) and MeCN (2.0 mL). The mixture was then added DMAP (0.04 mmol, 0.10 equiv), and irradiated by a household bulb (45 W) under a balloon oxygen atmosphere at room temperature until the starting material disappeared from the TLC. The reaction mixture was filtrated through celite and washed with ether. Then the solvent was removed under reduced pressure, the residue was purified by silica gel column chromatography to afford desired pure products **4** (32% yield) and **5** (43% yield).

2) Synthesis of **1,4-dioxaspiro[4.5]dec-6-en-8-one (5)** and **8-((tert-butyldimethylsilyl)oxy)-1,4-dioxaspiro[4.5]dec-8-en-7-ol (6)**

A flame-dried round bottom flask (10 mL) was equipped with magnetic stirring bar and charged with sily enol ether compound (0.4 mmol, 1.0 equiv), tris(2,2'-bipyridyl) ruthenium(II) chloride hexahydrate (0.01 mmol, 0.025 equiv) and MeCN (2.0 mL). The mixture was irradiated by a household bulb (45 W) under a balloon oxygen atmosphere at room temperature until the starting material disappeared from the TLC. Then P(OEt)₃ was added into the reaction system and continued to stir for 2 hours. The mixture was filtrated through celite and washed with ether. After the solvent was removed under

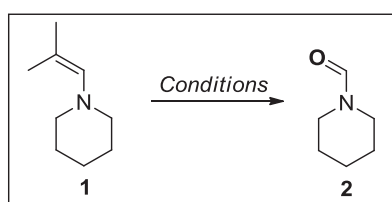
reduced pressure, the residue was purified by silica gel column chromatography to afford desired pure product **5** (41% yield) and **6** (30% yield).

General procedure for visible-light-promoted amide formations



A flame-dried round bottom flask (10 mL) was equipped with magnetic stirring bar and charged with enamine compound (0.4 mmol, 1.0 equiv), tris(2,2'-bipyridyl) ruthenium(II) chloride hexahydrate (0.01 mmol, 0.025 equiv) and MeCN (2.0 mL). The mixture was then added Cs_2CO_3 (0.4 mmol, 1.0 equiv), and irradiated by a household bulb (45 W) under a balloon oxygen atmosphere at room temperature until the starting material disappeared from the TLC. The reaction mixture was filtrated through celite and washed with ether. The solvent was removed under reduced pressure, the residue was purified by silica gel column chromatography to afford desired pure product **8-10** in 40-99% yield.

Table 1. Optimizing the Conditions

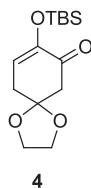


Entry	Catalyst (2.5% mol)	Solvent	Cs_2CO_3 (eq)	Light Source ^a	Gas	Yield (%) ^b
1	$\text{Ru}(\text{bpy})_3\text{Cl}_2$	MeOH	0	+	O_2	62
2	$\text{Ru}(\text{bpy})_3\text{Cl}_2$	CH_2Cl_2	0	+	O_2	36
3	$\text{Ru}(\text{bpy})_3\text{Cl}_2$	CH_3CN	0	+	O_2	70
4	$\text{Ru}(\text{bpy})_3\text{Cl}_2$	DMF	0	+	O_2	51
5	$\text{Ru}(\text{bpy})_3\text{Cl}_2$	CH_3CN	1.0	+	O_2	87
6	$\text{Ru}(\text{bpy})_3\text{Cl}_2$	CH_3CN	1.0	-	O_2	0
7	$\text{Ru}(\text{bpy})_3\text{Cl}_2$	CH_3CN	1.0	+	N_2	0
8	$\text{Ru}(\text{bpy})_3\text{Cl}_2$	CH_3CN	1.0	+	air	40
9	no catalyst	CH_3CN	1.0	+	O_2	0
10	Rose Bengal	CH_3CN	1.0	+	O_2	63

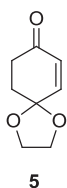
a: "+" means under visible-light irradiation, "-" means without visible-light irradiation.

b: Yield was quantitatively determined by $^1\text{H-NMR}$ using naphthalene as the internal reference.

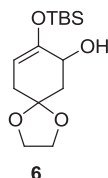
^1H NMR and ^{13}C NMR spectra data of products



8-((tert-butyldimethylsilyl)oxy)-1,4-dioxaspiro[4.5]dec-8-en-7-one (4): ^1H NMR (500 MHz, CDCl_3): δ 6.05 (t, $J = 4.5$ Hz, 1H), 3.97 (s, 4H), 2.75 (s, 2H), 2.66 (d, $J = 4.6$ Hz, 2H), 0.93 (s, 9H), 0.14 (s, 6H); ^{13}C NMR (125 MHz, CDCl_3): δ 192.3, 148.1, 129.5, 122.8, 108.5, 64.7, 48.5, 35.8, 25.6, 18.4, -4.67; HRMS calculated for $\text{C}_{14}\text{H}_{24}\text{NaO}_4\text{Si}$ ($\text{M} + \text{Na}^+$): 307.1336, found: 307.1333.

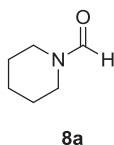


1,4-dioxaspiro[4.5]dec-6-en-8-one (5): ^1H NMR (400 MHz, CDCl_3): δ 6.61 (d, $J = 10.2$ Hz, 1H), 6.00 (d, $J = 10.2$ Hz, 1H), 4.08-4.00 (m, 4H), 2.63 (t, $J = 6.4$ Hz, 2H), 2.20 (t, $J = 6.4$ Hz, 2H); ^{13}C NMR (125 MHz, CDCl_3): δ 198.7, 146.3, 130.5, 103.9, 65.0, 35.22, 32.83; HRMS calculated for $\text{C}_8\text{H}_{10}\text{O}_3\text{Na}$ ($\text{M} + \text{Na}^+$): 177.0522, found: 177.0521.

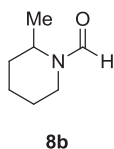


8-((tert-butyldimethylsilyl)oxy)-1,4-dioxaspiro[4.5]dec-8-en-7-ol (6): ^1H NMR (500 MHz, CDCl_3): δ 4.80 (t, $J = 4.5$ Hz, 1H), 4.09-4.03 (m, 1H), 4.03-3.93 (m, 4H), 2.97 (d, $J = 6.3$ Hz, 1H), 2.31 (d, $J = 3.7$ Hz, 2H), 2.11 (dd, $J = 13.4, 5.3$ Hz, 1H), 2.00 (dd, $J =$

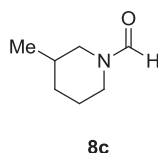
13.4, 4.5 Hz, 1H), 0.94 (s, 9H), 0.17 (s, 6H); ^{13}C NMR (125 MHz, CDCl_3): δ 151.0, 107.9, 101.9, 68.4, 64.4, 38.9, 34.5, 25.7, 18.1, -4.5; HRMS calculated for $\text{C}_{14}\text{H}_{27}\text{O}_4\text{Si}$ ($\text{M} + \text{H}^+$): 287.1673, found: 287.1676.



piperidine-1-carbaldehyde (8a): ^1H NMR (400 MHz, CDCl_3): δ 7.95 (s, 1H), 3.42 (t, $J = 5.7$ Hz, 2H), 3.25 (t, $J = 5.6$ Hz, 2H), 1.66-1.60 (m, 2H), 1.55-1.45 (m, 4H); ^{13}C NMR (100 MHz, CDCl_3): δ 160.7, 46.7, 40.5, 26.5, 25.0, 24.6; HRMS calculated for $\text{C}_6\text{H}_{12}\text{NO}$ ($\text{M} + \text{H}^+$): 114.0913, found: 114.0913.

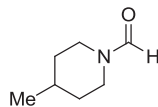


2-methylpiperidine-1-carbaldehyde (8b): ^1H NMR (500 MHz, CDCl_3): δ 8.07 (s, 1H), 7.95 (s, 1H), 4.67 (t, $J = 6.0$ Hz, 1H), 3.93 (dt, $J = 13.4, 4.0$ Hz, 1H), 3.77-3.72 (m, 1H), 3.34 (dd, $J = 13.6, 4.8$ Hz, 1H), 3.21-3.16 (m, 1H), 3.05-2.99 (m, 1H), 1.72-1.62 (m, 8H), 1.57-1.53 (m, 2H), 1.43-1.37 (m, 2H), 1.27 (d, $J = 7.0$ Hz, 3H), 1.16 (d, $J = 7.0$ Hz, 3H); ^{13}C NMR (125 MHz, CDCl_3): δ 161.0, 160.5, 50.5, 42.9, 42.1, 36.7, 31.8, 29.5, 26.5, 25.2, 20.2, 19.3, 17.8, 15.6; HRMS calculated for $\text{C}_7\text{H}_{14}\text{NO}$ ($\text{M} + \text{H}^+$): 128.1070, found: 128.1069.



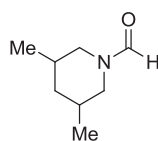
3-methylpiperidine-1-carbaldehyde (8c): ^1H NMR (400 MHz, CDCl_3): δ 7.97 (d, $J = 5.6$ Hz, 1H), 4.20-4.14 (m, 2H), 3.50-3.41 (m, 2H), 3.00-2.95 (m, 1H), 2.68-2.60 (m, 2H), 2.30-2.24 (m, 1H), 1.83-1.81 (m, 2H), 1.73-1.63 (m, 2H), 1.58-1.48 (m, 2H),

1.44-1.37 (m, 2H), 1.21-1.116 (m, 2H), 0.88 (d, $J = 6.6$ Hz, 6H); ^{13}C NMR (100 MHz, CDCl_3): δ 160.7, 160.6, 53.2, 46.9, 46.3, 40.1, 33.1, 33.0, 31.8, 30.5, 25.9, 24.2, 18.7, 18.5; HRMS calculated for $\text{C}_7\text{H}_{14}\text{NO}$ ($\text{M} + \text{H}^+$): 128.1070, found: 128.1069.



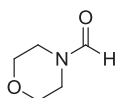
8d

4-methylpiperidine-1-carbaldehyde (8d): ^1H NMR (400 MHz, CDCl_3): δ 7.96 (s, 1H), 4.30 (dt, $J = 13.2, 2.0$ Hz, 1H), 3.54 (dt, $J = 13.2, 2.0$ Hz, 1H), 3.00 (td, $J = 12.7, 2.8$ Hz, 1H), 2.57 (td, $J = 12.7, 2.8$ Hz, 1H), 1.70-1.60 (m, 3H), 1.10-1.00 (m, 2H), 0.92 (d, $J = 6.4$ Hz, 3H); ^{13}C NMR (100 MHz, CDCl_3) δ 160.7, 46.1, 39.8, 34.6, 33.2, 31.2, 21.6; HRMS calculated for $\text{C}_7\text{H}_{14}\text{NO}$ ($\text{M} + \text{H}^+$): 128.1070, found: 128.1068.



8e

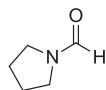
3,5-dimethylpiperidine-1-carbaldehyde (8e): ^1H NMR (400 MHz, CDCl_3): δ 7.98 (s, 1H), 4.33 (dt, $J = 12.8, 2.2$ Hz, 1H), 3.45 (dt, $J = 12.8, 2.2$ Hz, 1H), 2.53 (t, $J = 11.9$ Hz, 1H), 2.04 (t, $J = 12.0$ Hz, 1.5H), 1.83-1.80 (m, 1.5H), 1.60-1.44 (m, 4H), 1.22 (s, 1H), 0.89-0.73 (m, 10H); ^{13}C NMR (100 MHz, CDCl_3): δ 160.6, 53.0, 46.7, 42.6, 32.4, 30.8, 18.9, 18.7; HRMS calculated for $\text{C}_8\text{H}_{16}\text{NO}$ ($\text{M} + \text{H}^+$): 142.1226, found: 142.1225.



8f

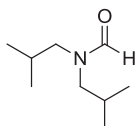
morpholine-4-carbaldehyde (8f): ^1H NMR (400 MHz, CDCl_3): δ 8.01 (s, 1H), 3.65 (t, $J = 4.8$ Hz, 2H), 3.62 (t, $J = 4.6$ Hz, 2H), 3.53 (t, $J = 5.2$ Hz, 2H), 3.36 (t, $J = 5.0$ Hz,

2H); ^{13}C NMR (100 MHz, CDCl_3): δ 160.8, 67.1, 66.3, 45.7, 40.5; HRMS calculated for $\text{C}_5\text{H}_{10}\text{NO}_2$ ($\text{M} + \text{H}^+$): 116.0706, found: 116.0706.



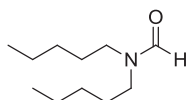
8g

pyrrolidine-1-carbaldehyde (8g): ^1H NMR (400 MHz, CDCl_3): δ 8.24 (s, 1H), 3.48 (t, $J = 6.4$ Hz, 2H), 3.40 (t, $J = 6.0$ Hz, 2H), 1.92-1.86 (m, 4H); ^{13}C NMR (100 MHz, CDCl_3): δ 160.8, 45.9, 43.0, 24.8, 24.1; HRMS calculated for $\text{C}_5\text{H}_{10}\text{NO}_2$ ($\text{M} + \text{H}^+$): 100.0757, found: 100.0757.



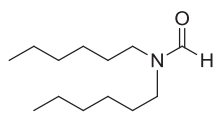
8h

***N,N*-diisobutylformamide (8h):** ^1H NMR (400 MHz, CDCl_3): δ 8.06 (s, 1H), 3.11 (d, $J = 7.6$ Hz, 2H), 2.97 (d, $J = 7.4$ Hz, 2H), 2.00-1.85 (m, 2H), 0.89-0.86 (m, 12H); ^{13}C NMR (100 MHz, CDCl_3): δ 163.2, 55.3, 49.3, 26.3, 26.0, 20.0, 19.7; HRMS calculated for $\text{C}_9\text{H}_{20}\text{NO}$ ($\text{M} + \text{H}^+$): 158.1539, found: 158.1542.



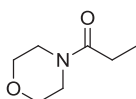
8i

***N,N*-dipentylformamide (8i):** ^1H NMR (500 MHz, CDCl_3): δ 8.02 (s, 1H), 3.26 (t, $J = 7.6$ Hz, 2H), 3.17 (t, $J = 7.1$ Hz, 2H), 1.51-1.50 (m, 4H), 1.34-1.27 (m, 8H), 0.90-0.86 (m, 6H); ^{13}C NMR (125 MHz, CDCl_3): δ 162.6, 47.4, 42.1, 29.1, 28.6, 28.4, 27.0, 22.4, 22.2, 13.9, 13.8; HRMS calculated for $\text{C}_{11}\text{H}_{24}\text{NO}$ ($\text{M} + \text{H}^+$): 186.1852, found: 186.1854.



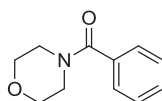
8j

***N,N*-dihexylformamide (8j):** ^1H NMR (500 MHz, CDCl_3): δ 8.01 (s, 1H), 3.26 (t, J = 7.6 Hz, 2H), 3.16 (t, J = 7.1 Hz, 2H), 1.53-1.42(m, 4H), 1.27 (m, 12H), 0.88-0.85 (m, 6H); ^{13}C NMR (125 MHz, CDCl_3): δ 162.6, 47.4, 42.2, 31.5, 31.4, 28.7, 27.3, 26.6, 26.1, 22.5, 22.4, 13.9, 13.8; HRMS calculated for $\text{C}_{13}\text{H}_{28}\text{NO}$ ($\text{M} + \text{H}^+$): 214.2165, found: 214.2166.



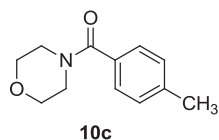
10a

1-morpholinopropan-1-one (10a): ^1H NMR (400 MHz, CDCl_3): δ 3.65 (t, J = 4.6 Hz, 4H), 3.59 (t, J = 4.9 Hz, 2H), 3.43 (t, J = 5.0 Hz, 2H), 2.31 (q, J = 7.5 Hz, 2H), 1.13 (t, J = 7.4 Hz, 3H); ^{13}C NMR (100 MHz, CDCl_3): δ 172.4, 66.8, 66.5, 45.7, 41.8, 26.2, 9.3; HRMS calculated for $\text{C}_7\text{H}_{14}\text{NO}_2$ ($\text{M} + \text{H}^+$): 144.1019, found: 144.1020.

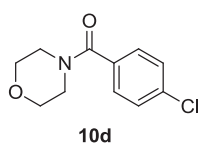


10b

morpholino(phenyl)methanone (10b): ^1H NMR (500 MHz, CDCl_3): δ 7.39-7.36 (m, 5H), 3.84-3.37 (m, 8H); ^{13}C NMR (125 MHz, CDCl_3): δ 170.4, 135.4, 129.8, 128.5, 127.1, 66.9, 48.3, 42.7; HRMS calculated for $\text{C}_{11}\text{H}_{14}\text{NO}_2$ ($\text{M} + \text{H}^+$): 192.1019, found: 192.1018.

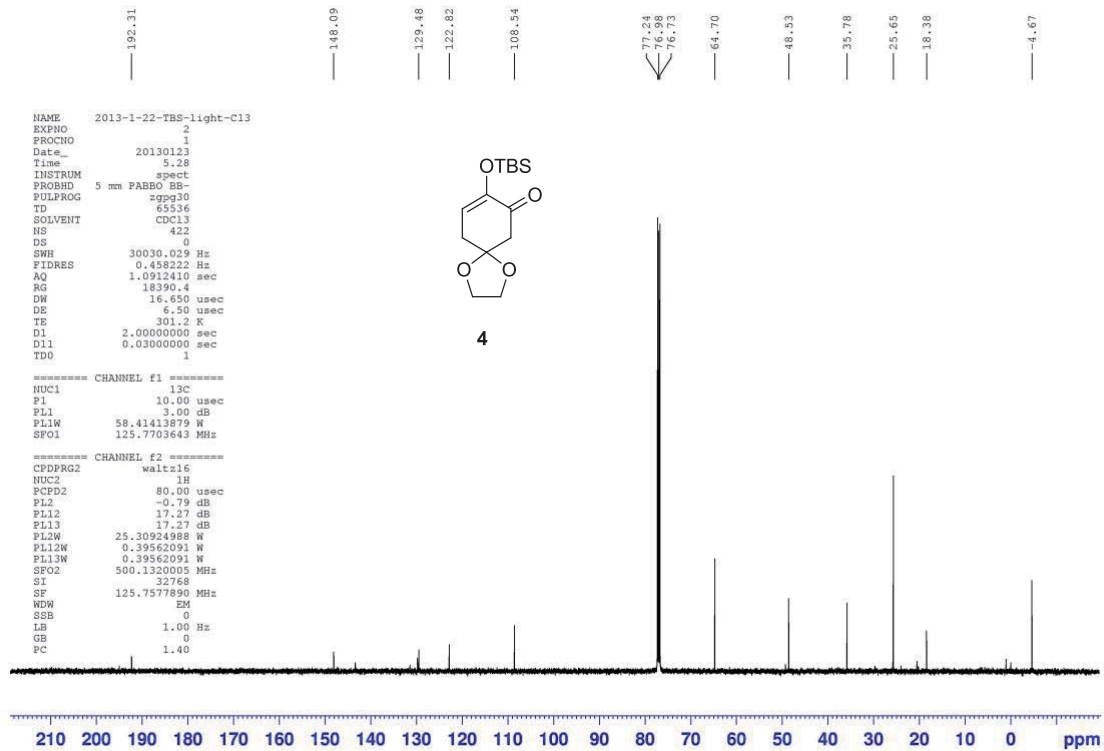
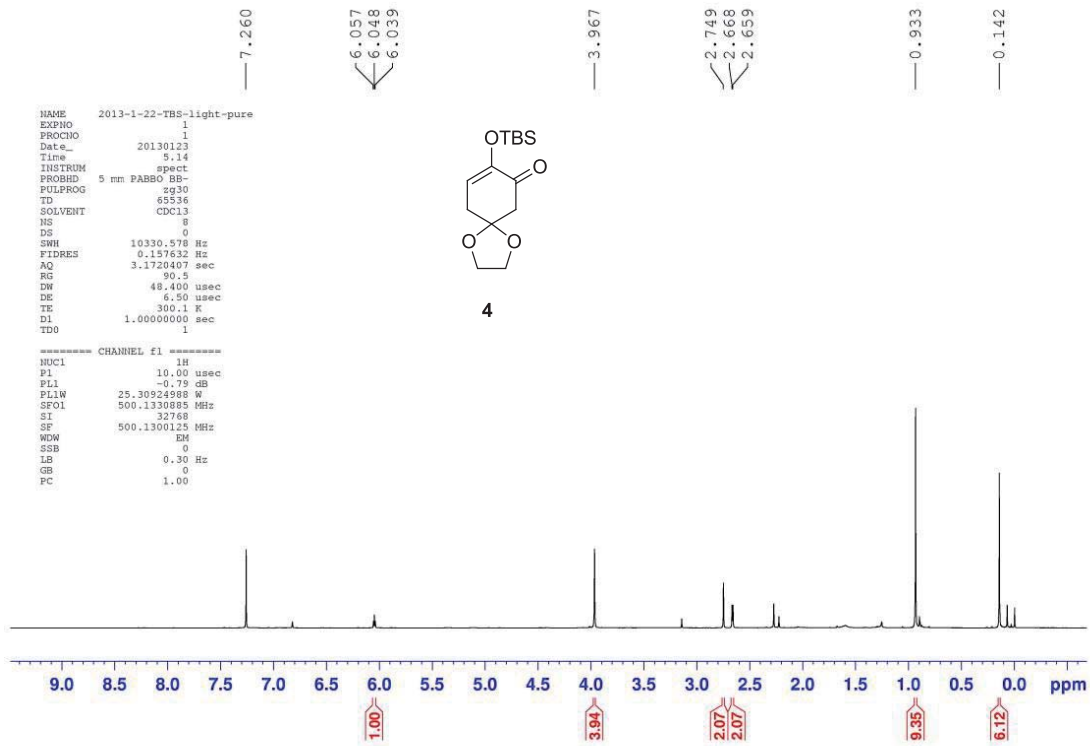


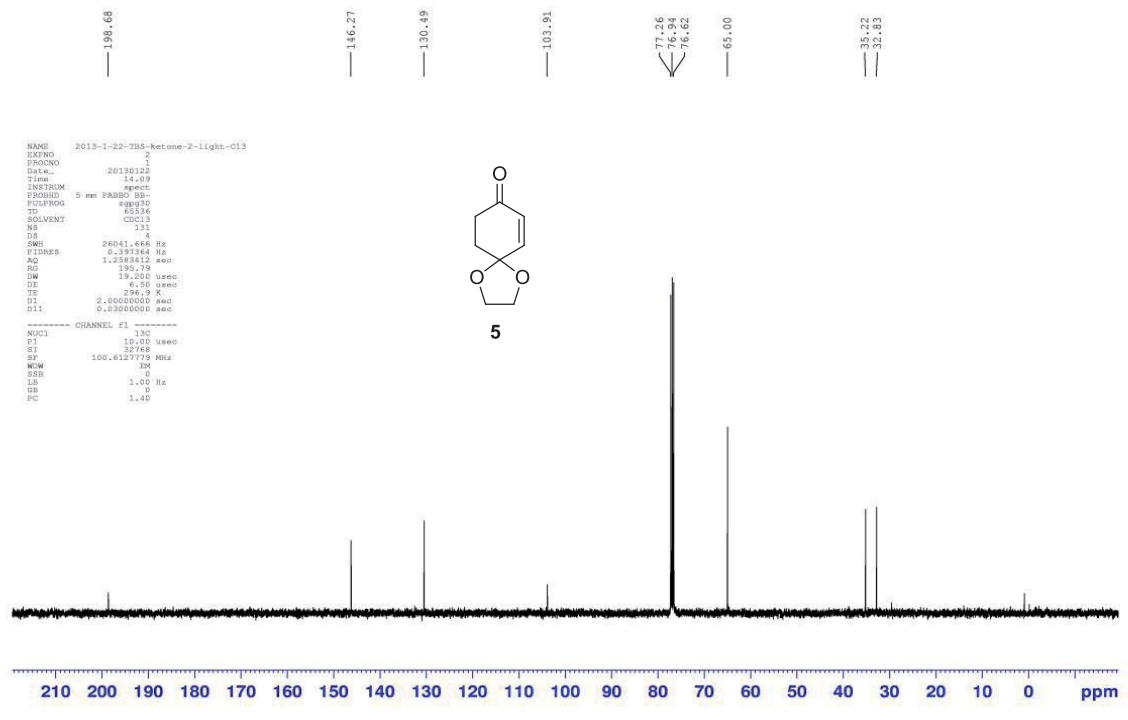
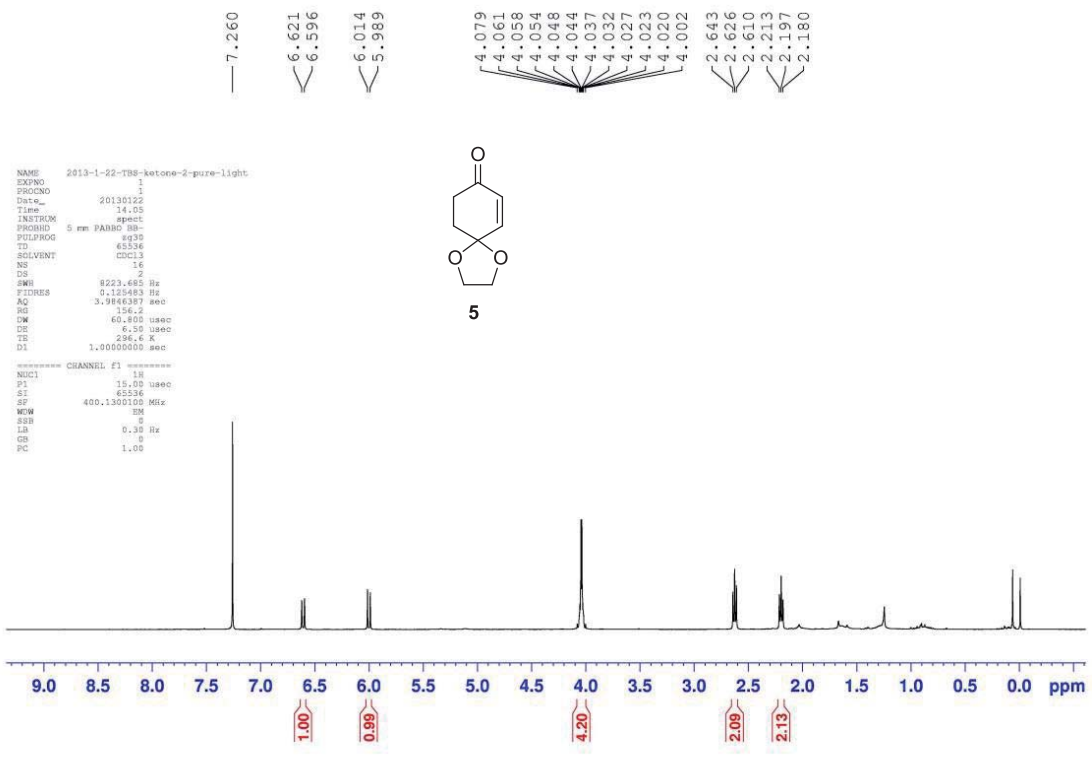
morpholino(*p*-tolyl)methanone (10c): ^1H NMR (500 MHz, CDCl_3): δ 7.29 (d, $J = 8.0$ Hz, 2H), 7.19 (d, $J = 8.0$ Hz, 2H), 3.67 (br, 8H), 2.36 (s, 3H); ^{13}C NMR (125 MHz, CDCl_3): δ 170.6, 140.0, 132.4, 129.1, 127.1, 66.9, 48.2, 43.3; HRMS calculated for $\text{C}_{12}\text{H}_{16}\text{NO}_2$ ($\text{M} + \text{H}^+$): 206.1176, found: 206.1176.

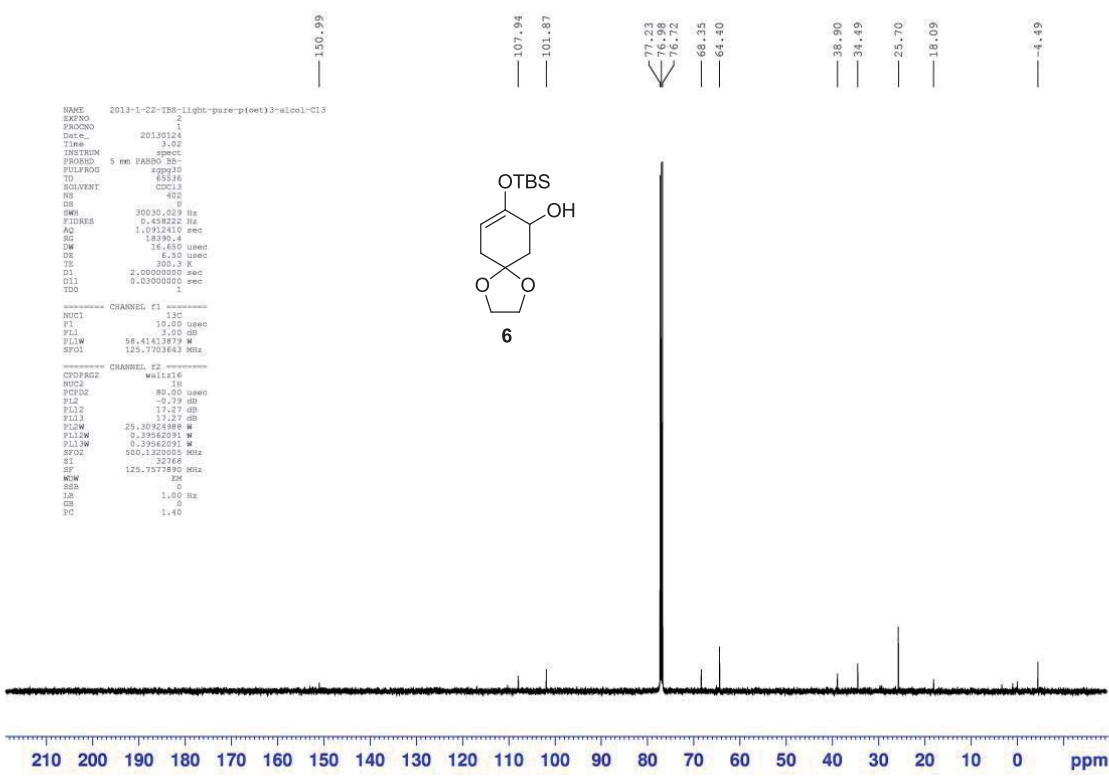
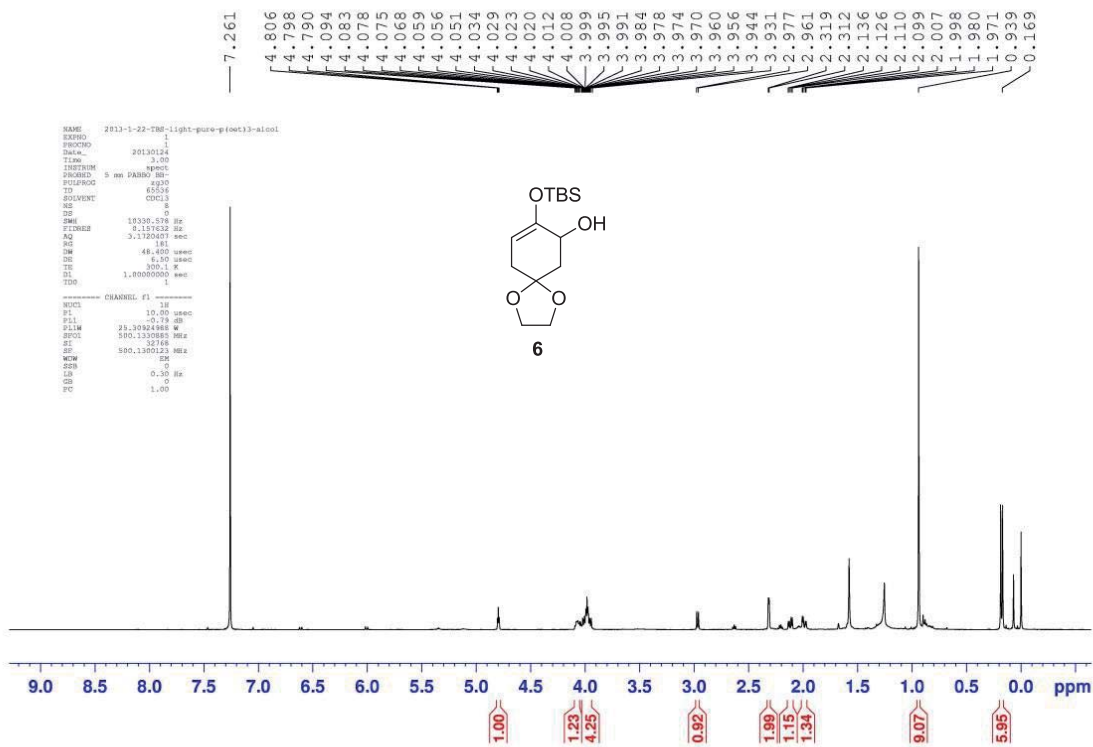


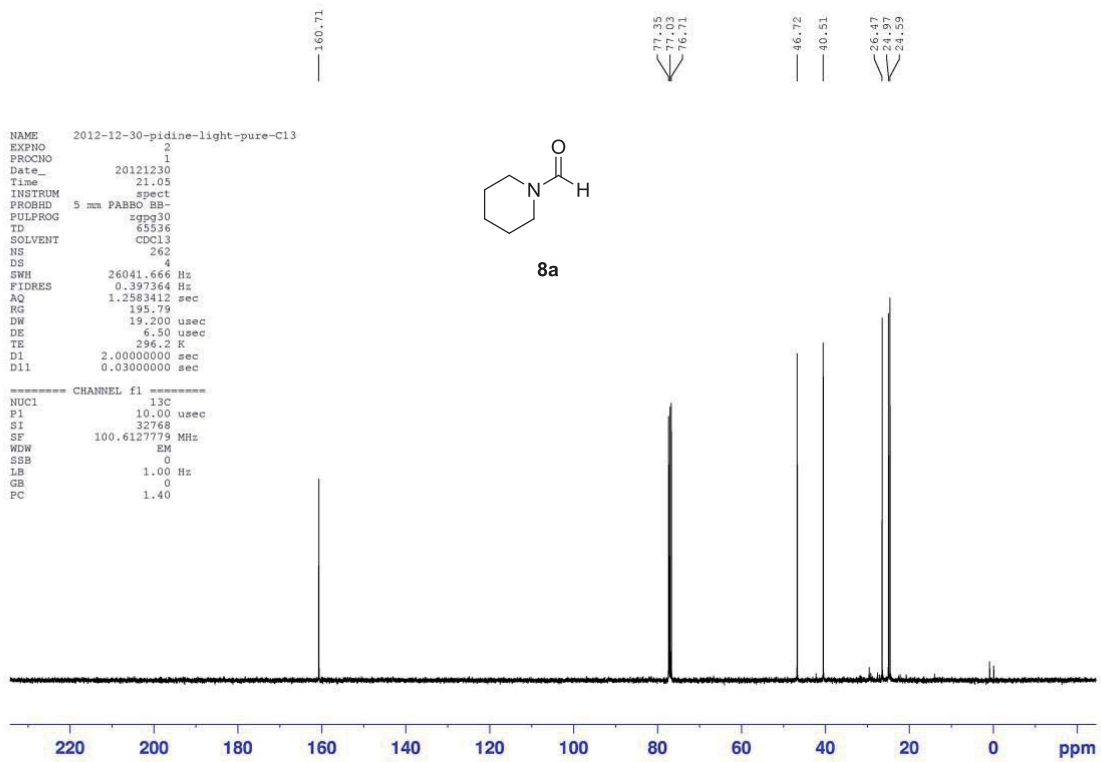
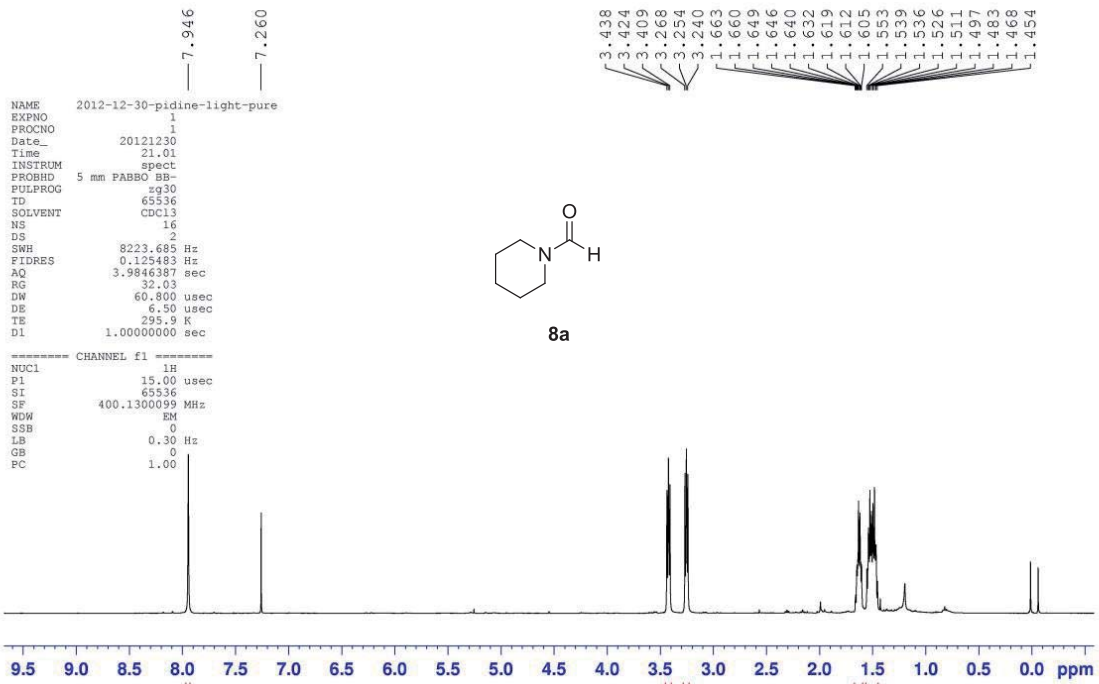
(4-chlorophenyl)(morpholino)methanone (10d): ^1H NMR (400 MHz, CDCl_3): δ 7.39-7.32 (m, 4H), 3.71-3.43 (br, 8H); ^{13}C NMR (100 MHz, CDCl_3): δ 169.3, 135.9, 135.5, 128.8, 128.6, 66.7, 48.2, 42.6; HRMS calculated for $\text{C}_{11}\text{H}_{13}\text{ClNO}_2$ ($\text{M} + \text{H}^+$): 226.0629, found: 206.0630.

Copies of ^1H NMR and ^{13}C NMR spectra



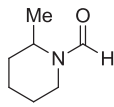






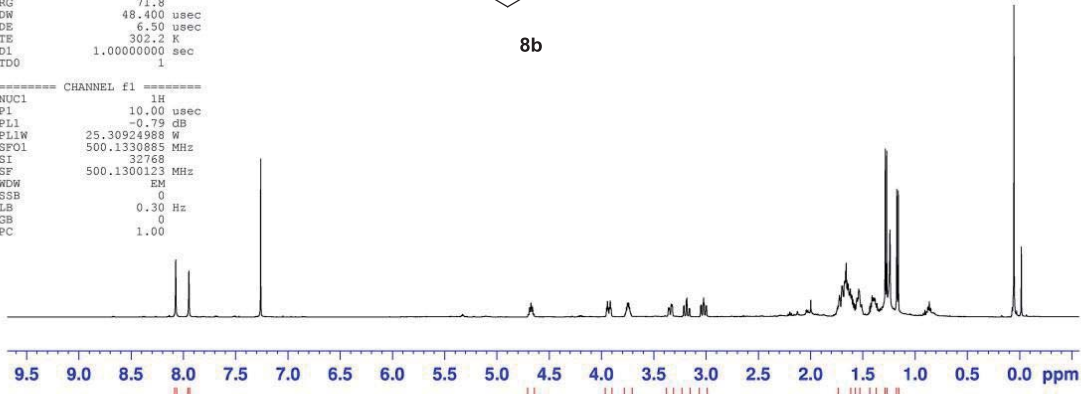
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3.187
3.182
3.050
3.043
3.027
3.022
3.017
3.000
2.994
1.722
1.715
1.700
1.693
1.684
1.675
1.671
1.664
1.657
1.650
1.639
1.627
1.618
1.592
1.581
1.569
1.556
1.545
1.538
1.535
1.532
1.510
1.510
1.432
1.423
1.410
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1.373
1.363
1.284
1.270
1.173
1.159

NAME 2012-12-28-2-Me-light-pure
EXPNO 1
PROCNO 1
Date_ 20121229
Time 14.51
INSTRUM spect
PROBHD 5 mm PABBO BB-
PULPROG zg30
TD 65536
SOLVENT CDC13
NS 8
DS 0
SWH 10330.578 Hz
FIDRES 0.157632 Hz
AQ 3.1720407 sec
RG 71.8
DW 48.400 usec
DE 6.50 usec
TE 302.2 K
D1 1.00000000 sec
TD0 1



8b

===== CHANNEL f1 =====
NUC1 1H
P1 10.00 usec
PL1 -0.79 dB
PL1W 25.30924988 W
SF01 500.1330885 MHz
SI 32768
SF 500.1300123 MHz
WDW EM
SSB 0
LB 0.30 Hz
GB 0
PC 1.00



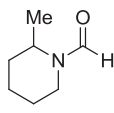
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160.52

77.25
77.00
76.75

50.53
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42.10
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31.81
29.54
26.50
20.25
19.36
17.86
15.63

0.95

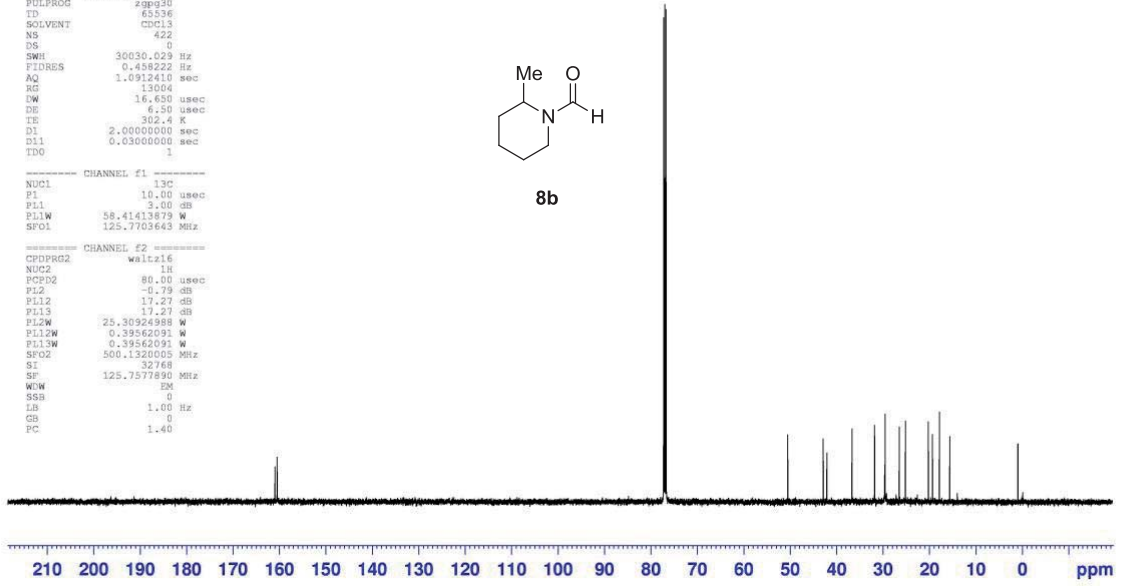
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PROCNO 1
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Time 14.56
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PULPROG zgpg30
TD 65536
SOLVENT CDC13
NS 422
DS 0
SWH 30030.029 Hz
FIDRES 0.498222 Hz
AQ 1.0912410 sec
RG 13004
DW 16.650 usec
DE 6.50 usec
TE 302.4 K
D1 2.00000000 sec
D11 0.03000000 sec
TD0 1

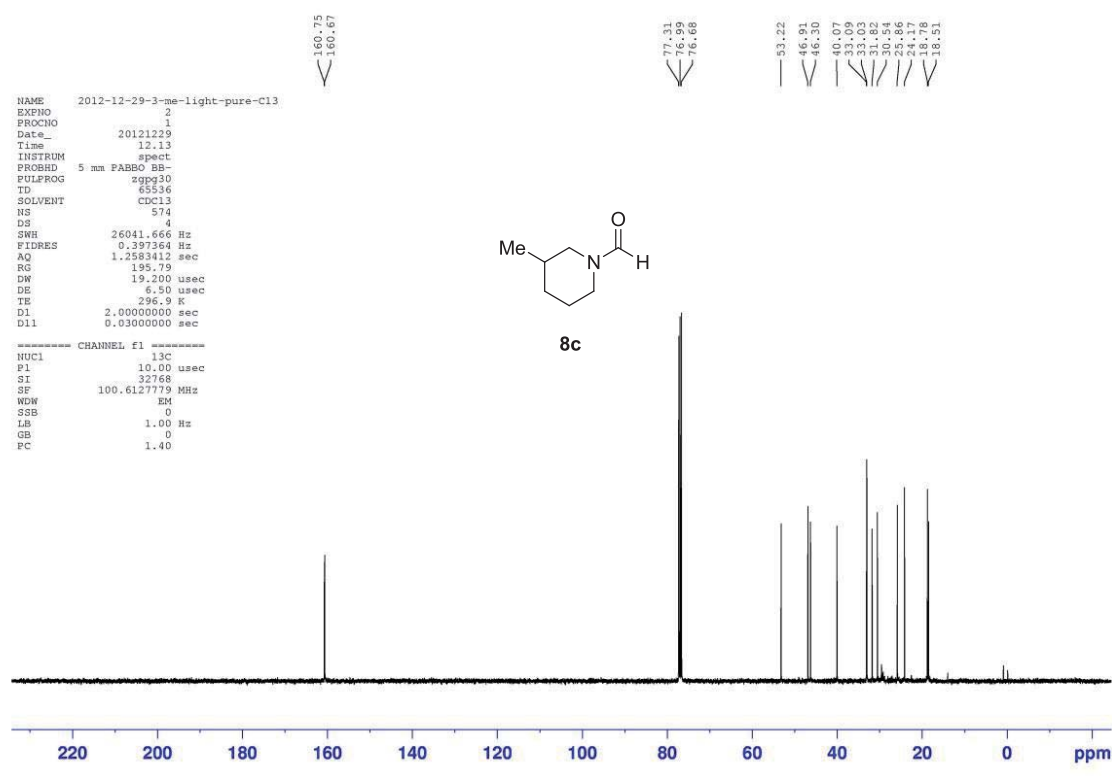
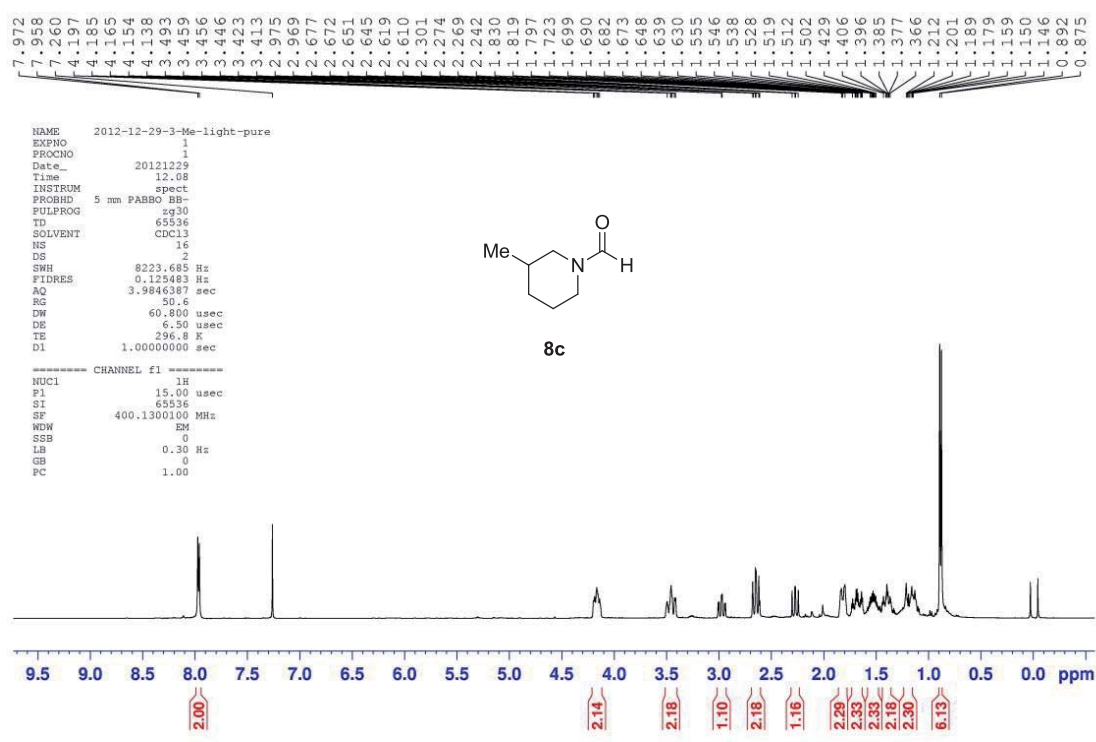


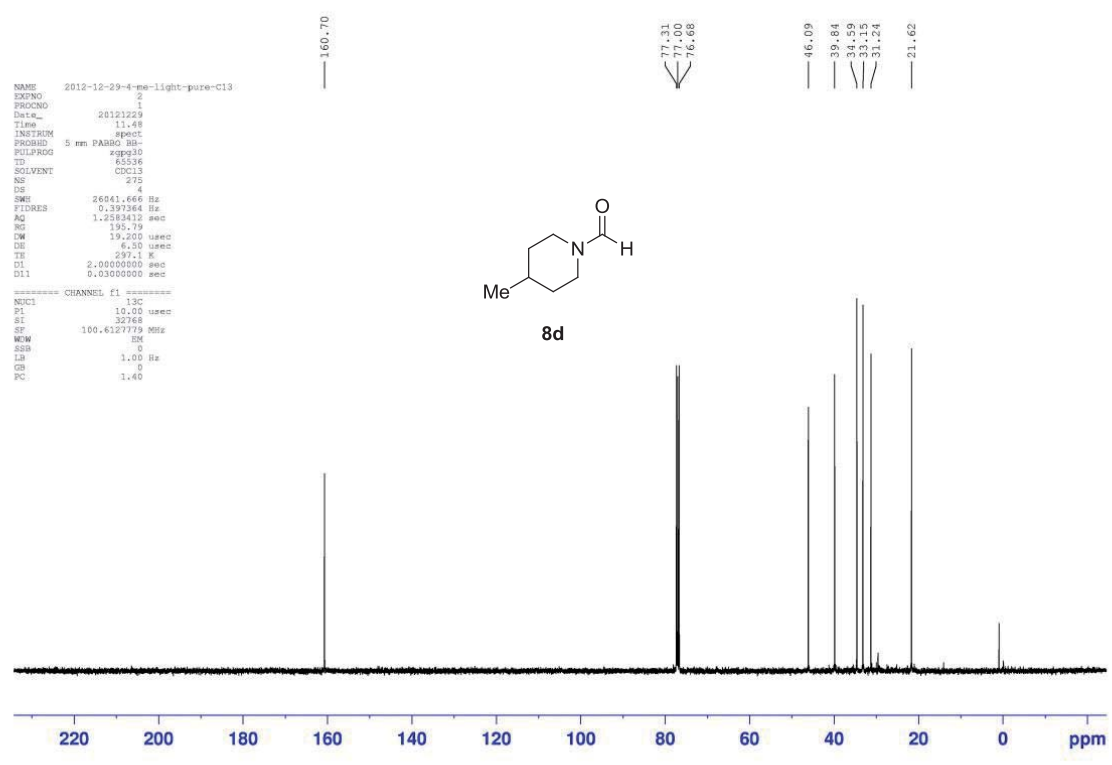
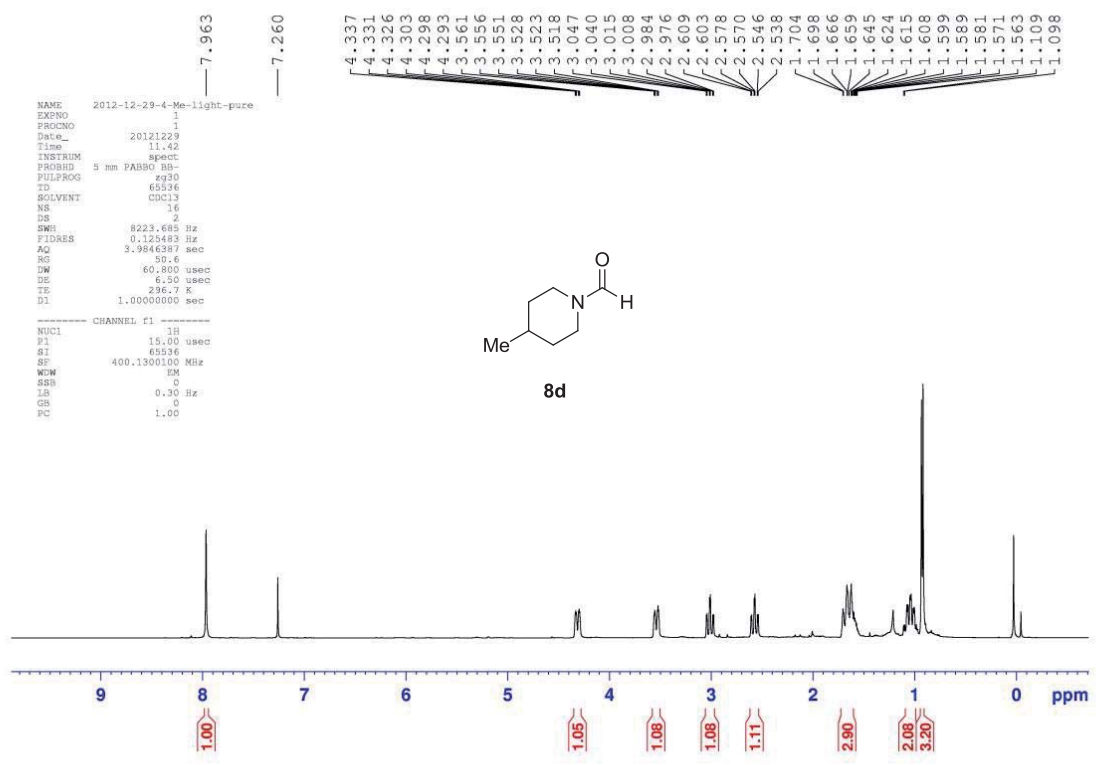
8b

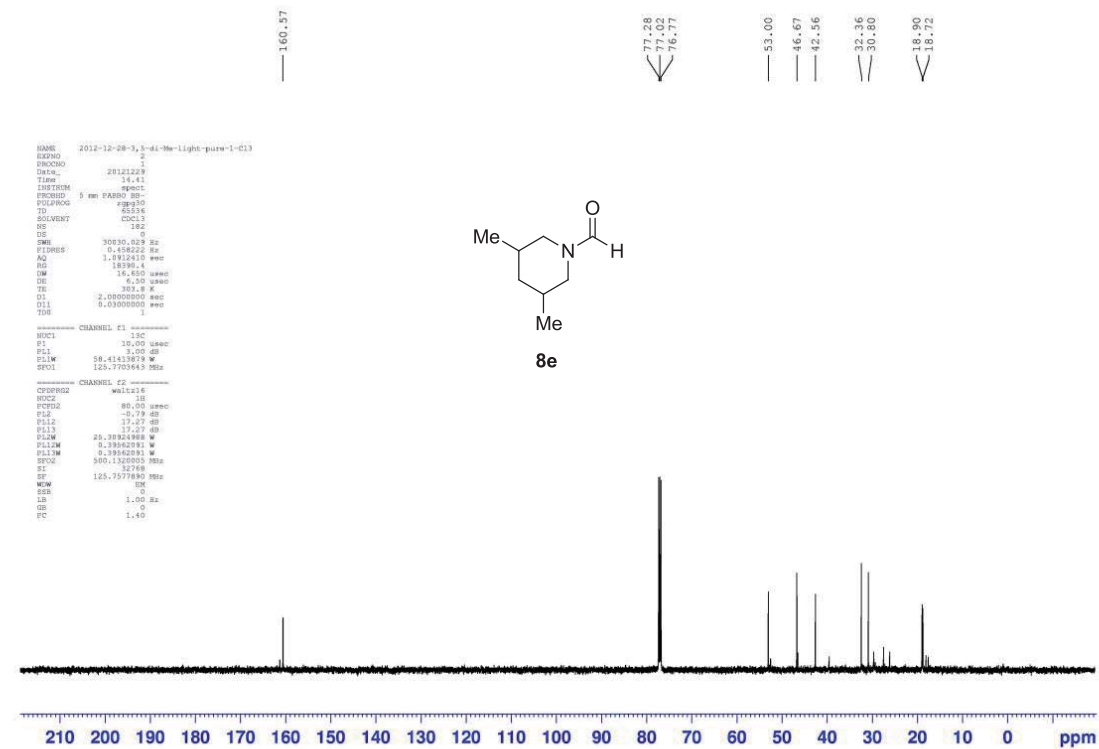
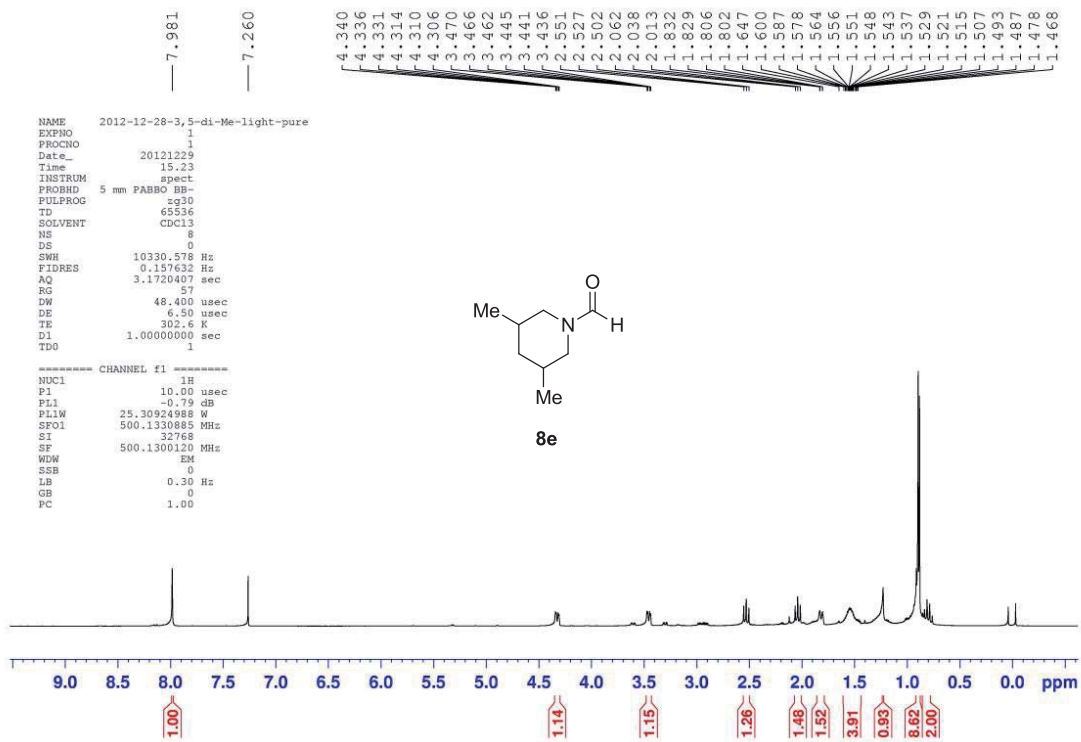
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SF01 125.7703643 MHz

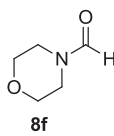
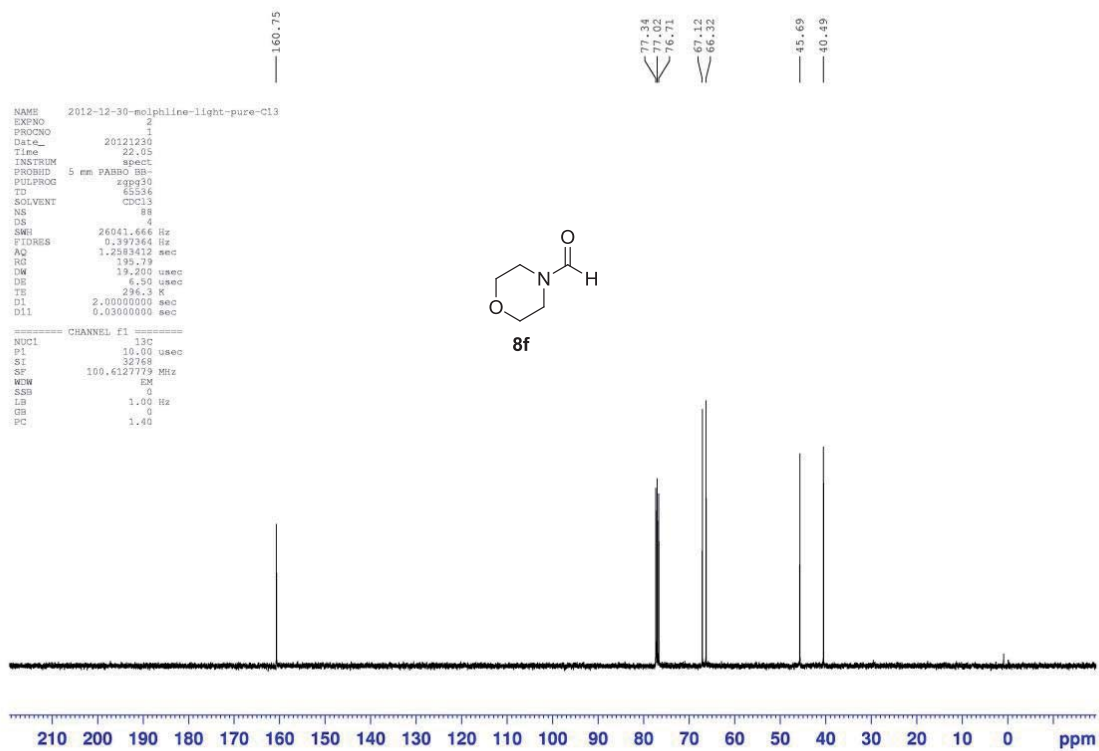
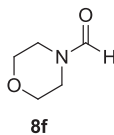
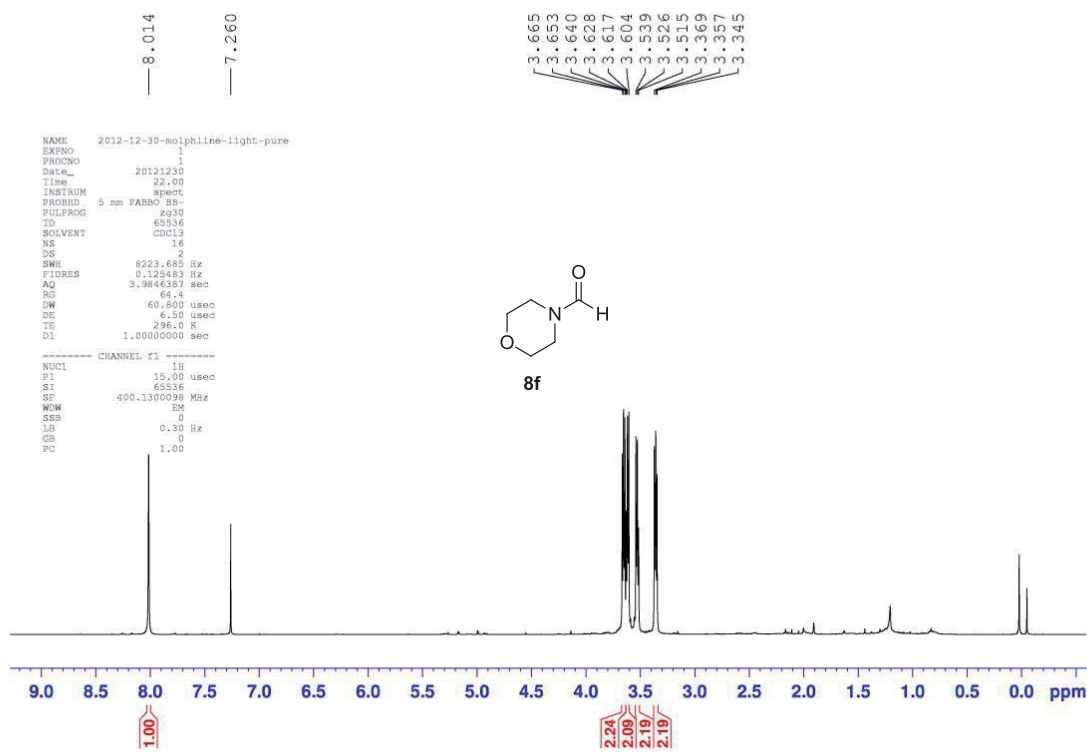
===== CHANNEL f2 =====
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NUC2 1H
PCPD2 80.00 usec
PL2 -0.79 dB
PL12 17.27 dB
PL13 17.27 dB
PL2W 25.30924988 W
PL12W 0.39562091 W
PL13W 0.39562091 W
SF02 500.1320005 MHz
SI 32768
SF 125.7577890 MHz
WDW EM
SSB 0
LB 1.00 Hz
GB 0
PC 1.40

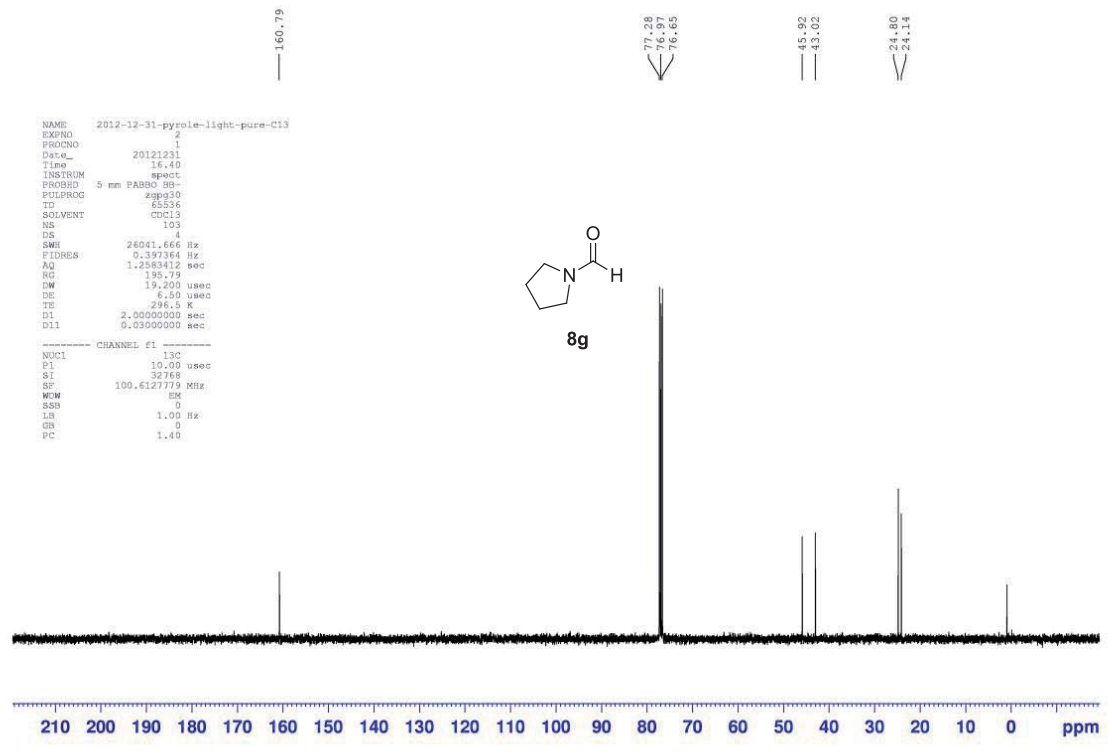
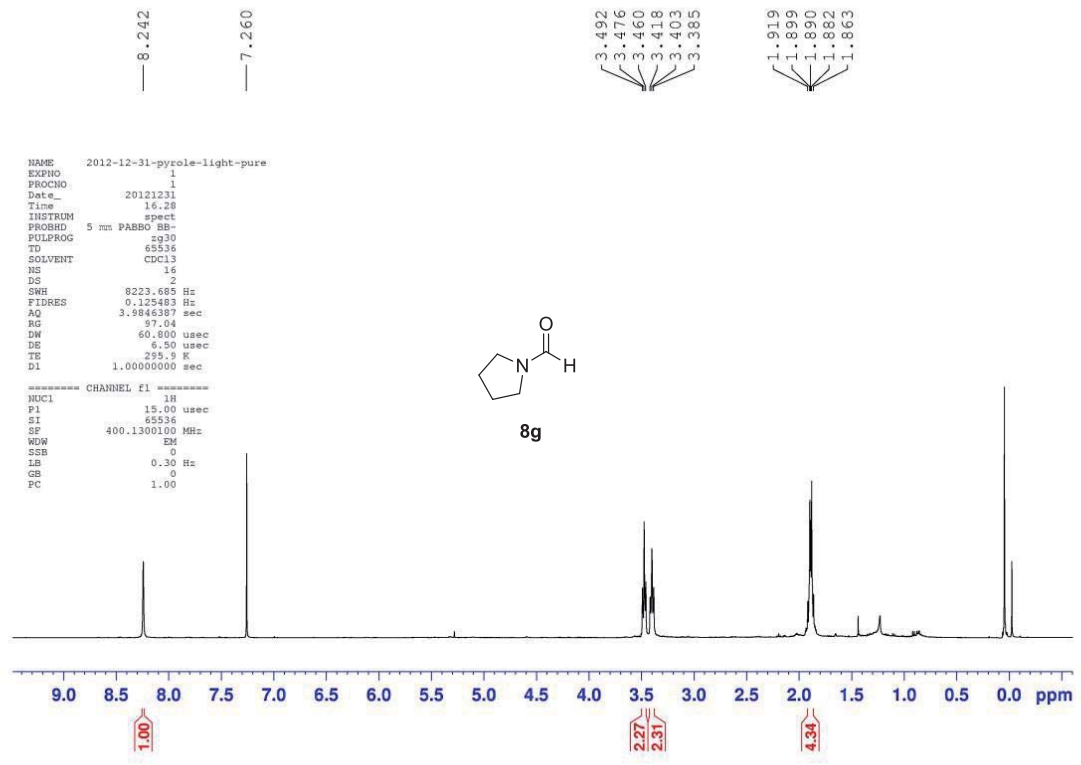


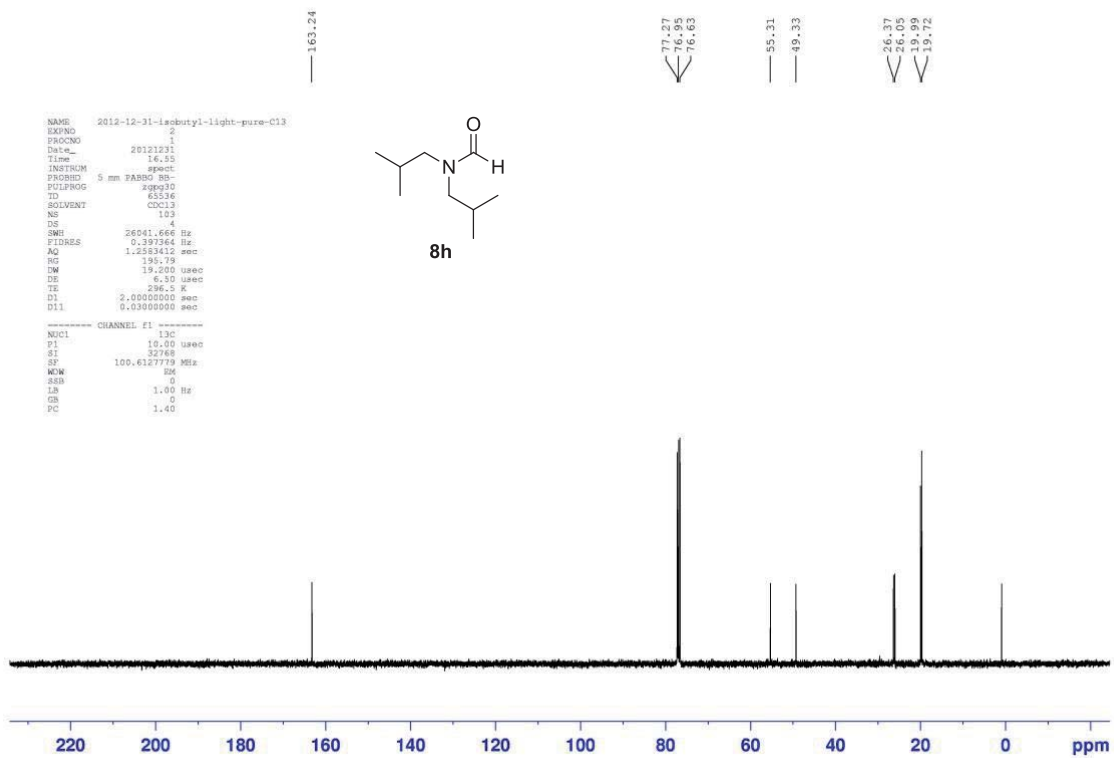
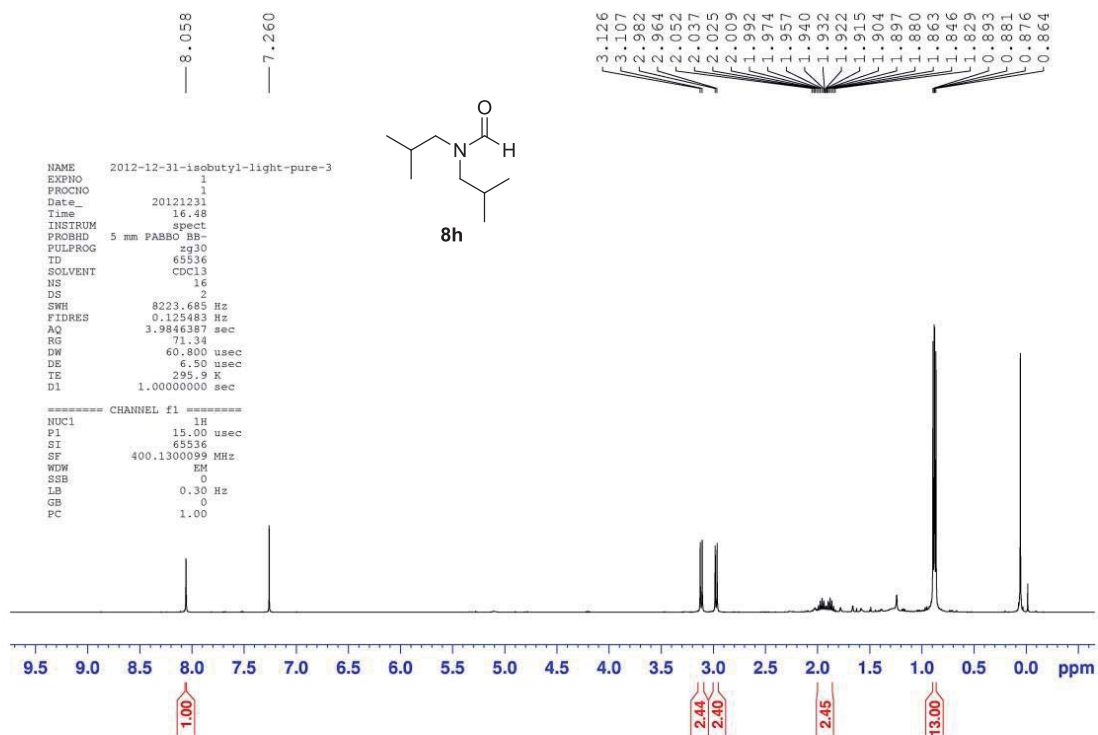


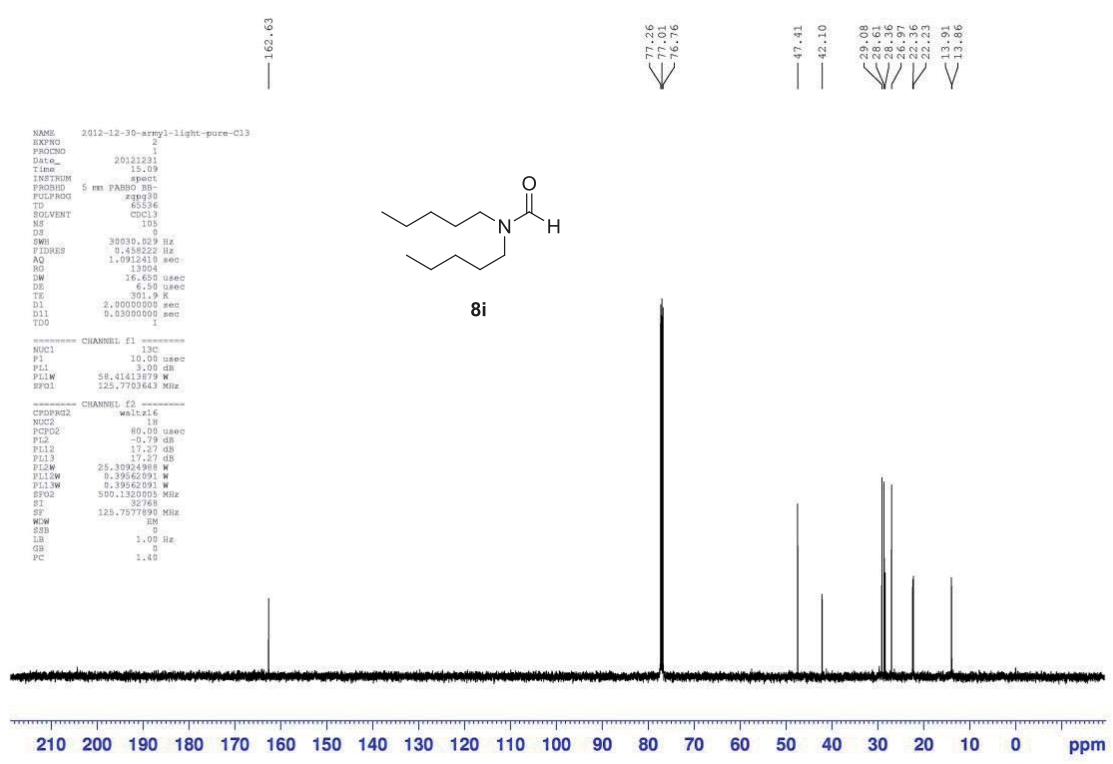
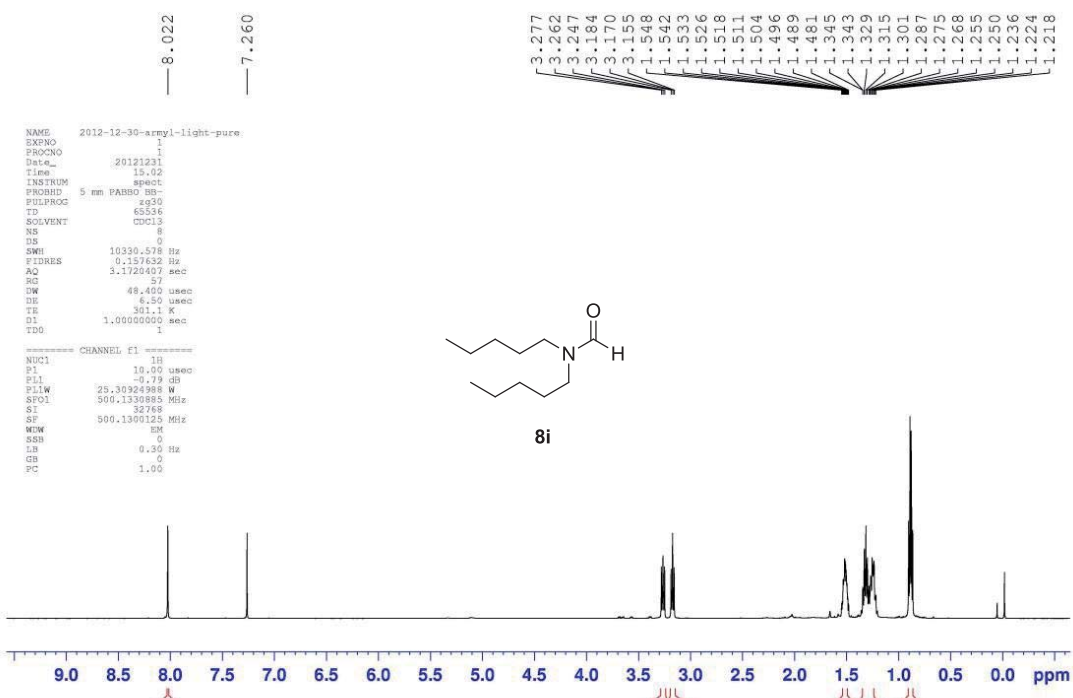


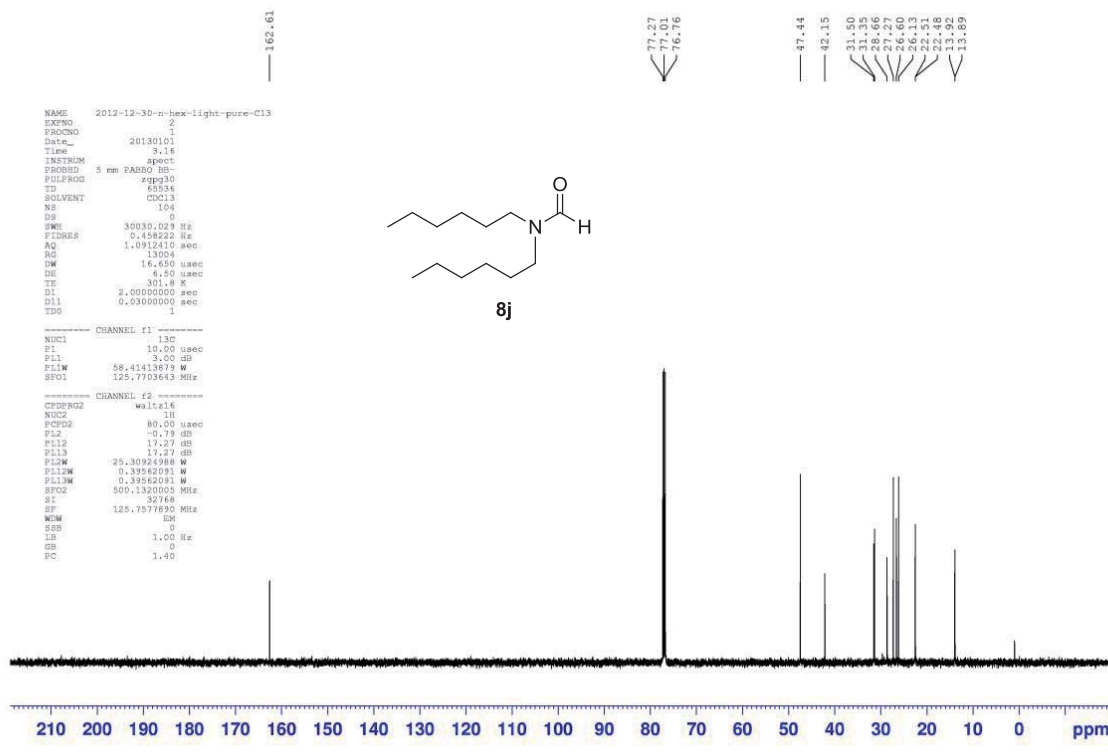
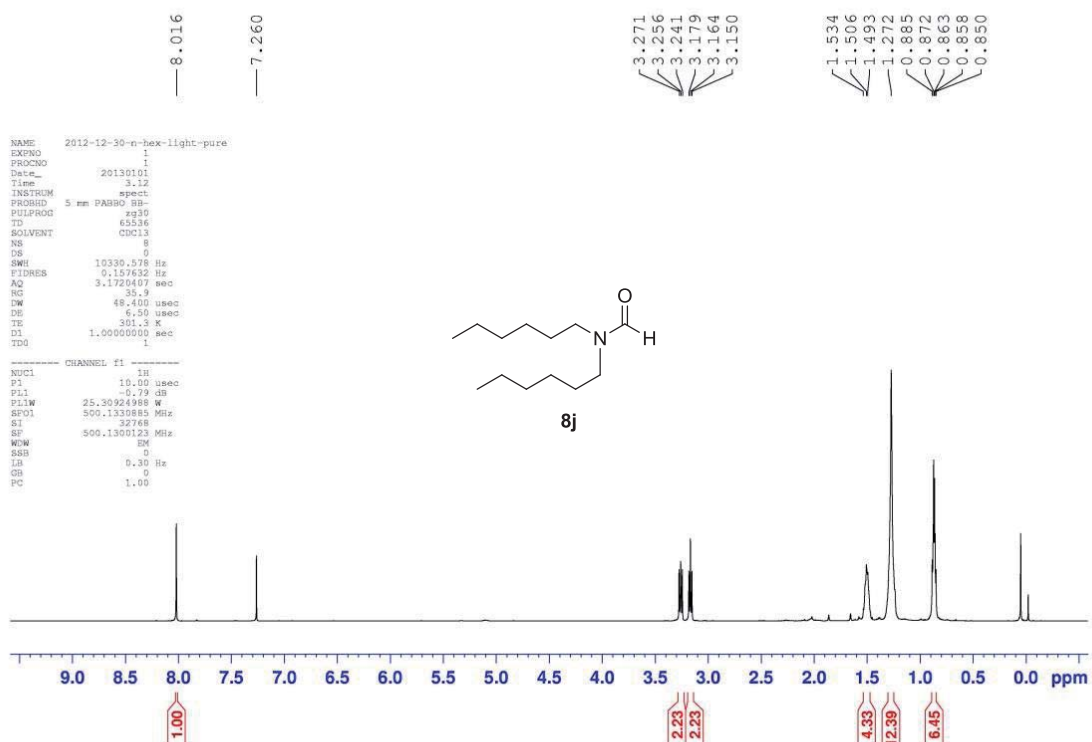


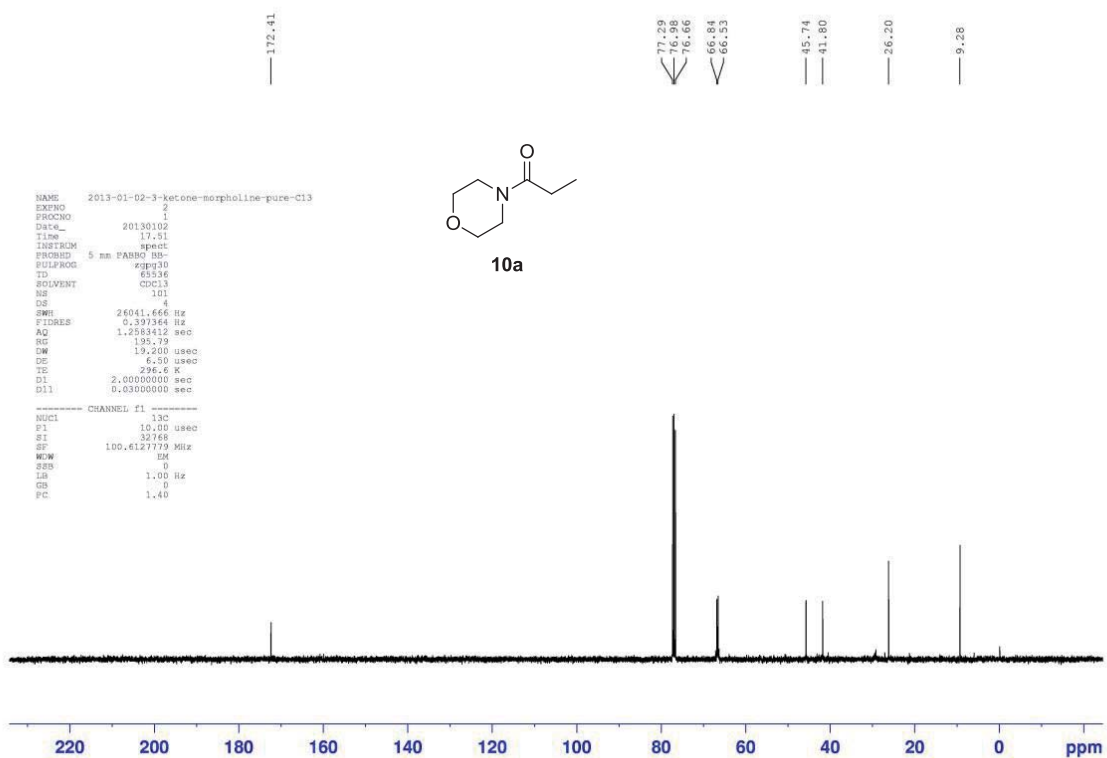
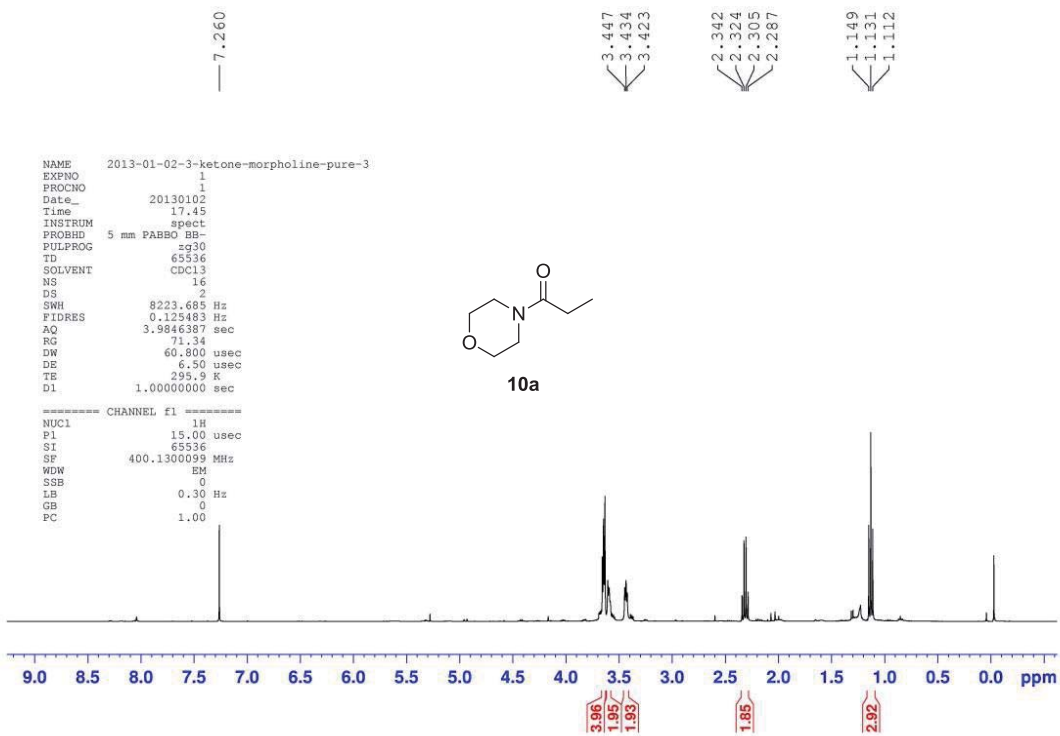


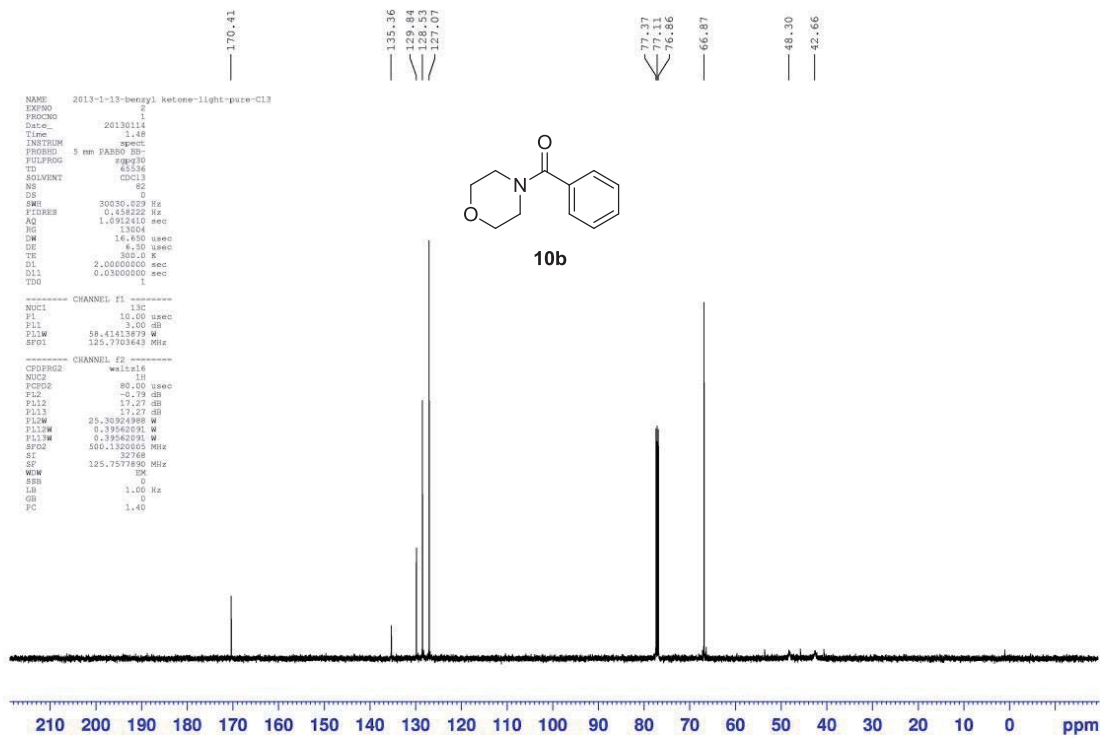
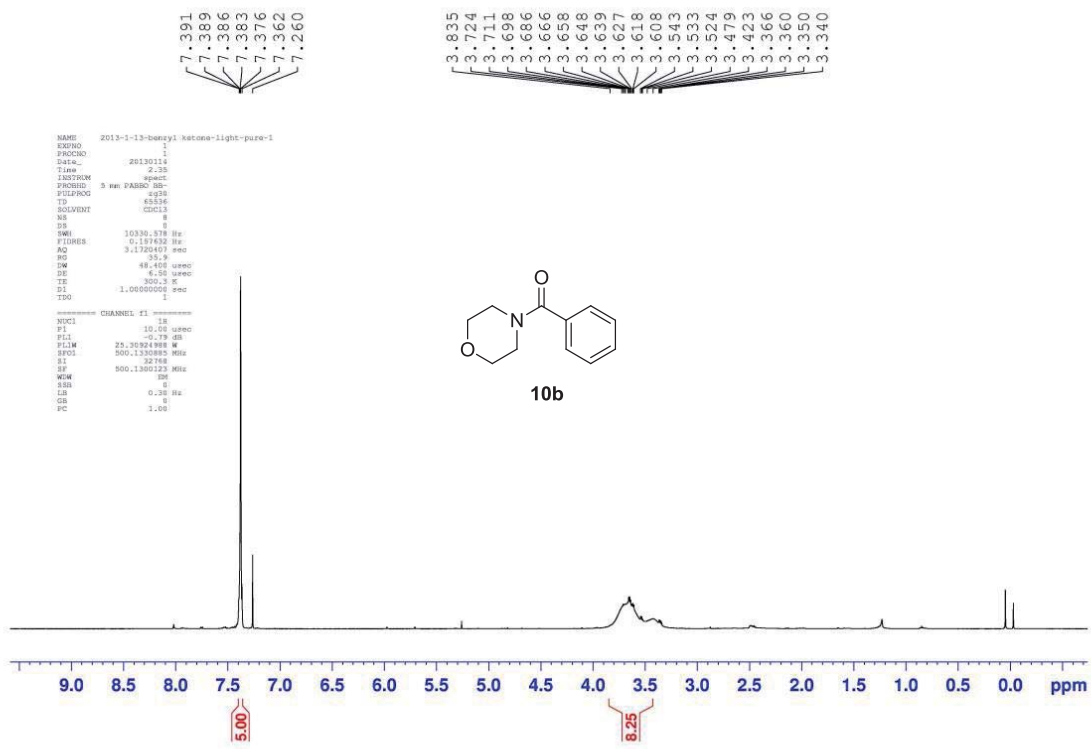


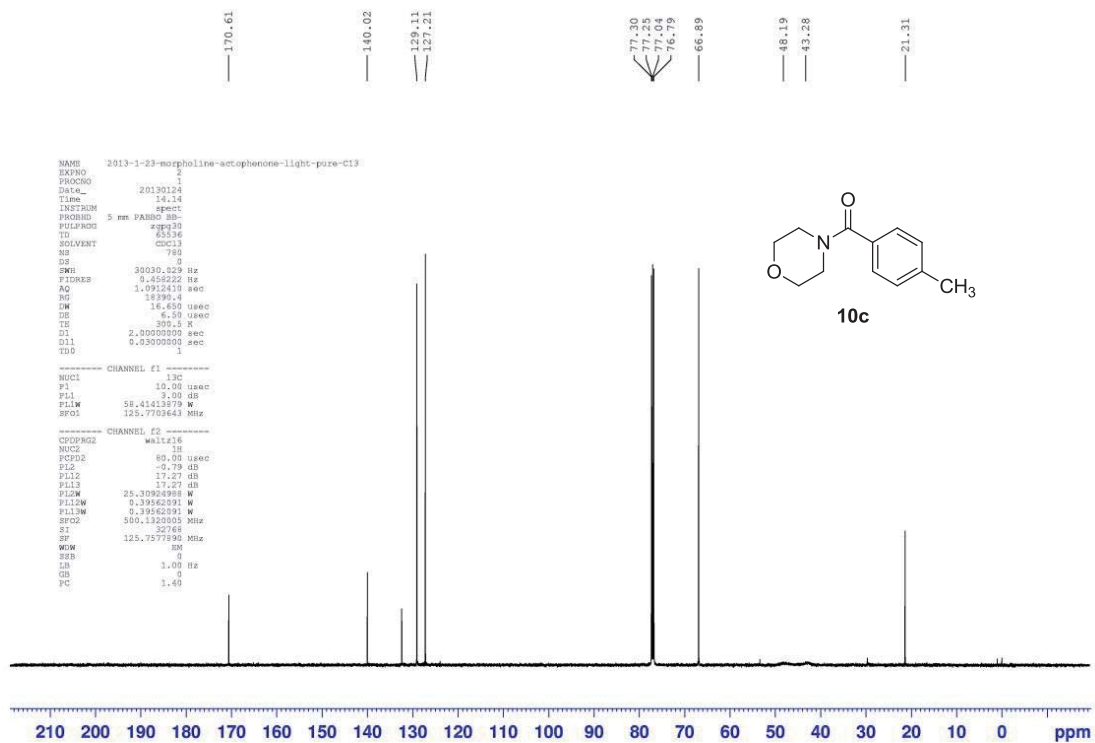
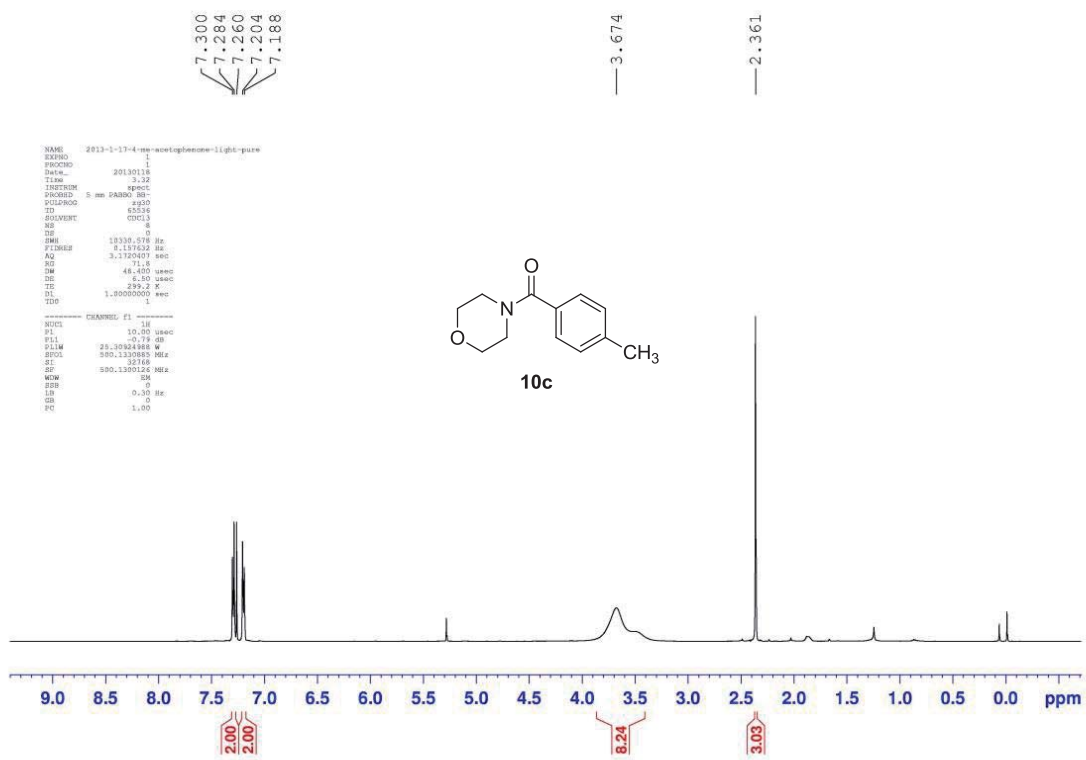










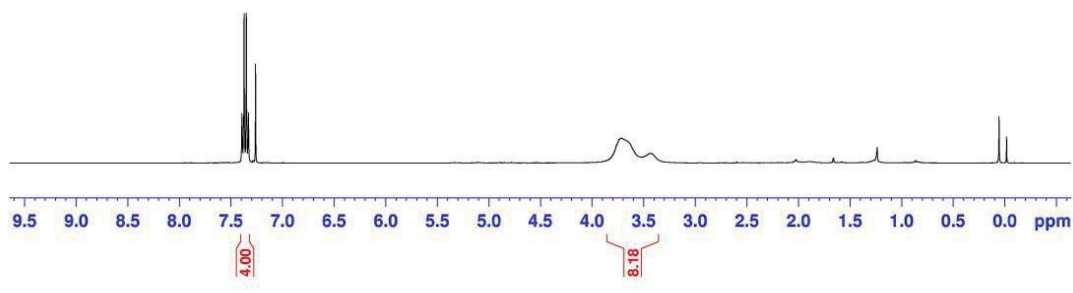
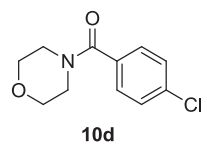


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7.371
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7.333
7.328
7.260

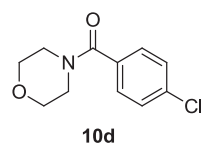
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PROCNO 1
Date_ 20130119
Time 10.05
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FIDRES 0.125467 Hz
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RG 78.0
DM 60.800 usec
DE 6.50 usec
TE 295.1 K
D1 1.0000000 sec
----- CHANNEL f1 -----
NUC1 1H
P1 15.00 usec
SFO 400.1300099 MHz
WDM EM
SFO 400.1300099 MHz
LB 0.30 Hz
GB 0
PC 1.00
  
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76.67
66.74
48.20
42.62



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NAME 2013-1-19-4-Cl-pure-light-Cl3
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PROCNO 1
Date_ 20130119
Time 10.11
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PULPROG zgpg30
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SOLVENT CDCl3
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TE 295.4 K
D1 2.0000000 sec
D11 0.0300000 sec
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PC 1.40
  
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