Electronic Supplementary Material (ESI) for Organic Chemistry Frontiers.

Supplementary Information

Visible-light-promoted radical amidoarylation of arylacrylamides towards amidated oxindoles

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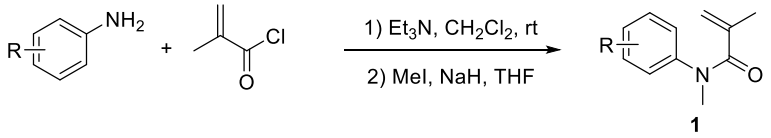
Contents

General information

The NMR spectra were recorded on a Bruker AVANCE III-400 MHz or an INOVA600 MHz spectrometer in $CDCl_3$, D_2O and $(CD_3)_2CO$. The chemical shifts of ^1H NMR spectra in $CDCl_3$ were determined with $Si(CH_3)_4$ as the internal standard (δ = 0.00 ppm); the chemical shifts of ^1H NMR spectra were determined with the solvent peak as the standard in $(CD_3)_2CO$ and D_2O (δ = 2.05 ppm for $(CD_3)_2CO$, δ = 4.79 ppm for D_2O). The chemical shifts in ^{13}C NMR spectra were determined based on the chemical shift of $CDCl_3$ (δ = 77.0 ppm) and $(CD_3)_2CO$ (δ = 29.0 ppm). Multiplicities are given as: s (singlet), d (doublet), t (triplet), dd (doublet of doublets), q (quartet) or m (multiplet). HR-MS was performed on a Bruker APEXII FT-ICR mass instrument (ESI). Data collections for crystal structure were performed at room temperature (296 K) using MoKα radiation on a Bruker Smart APEXII diffractometer. Flash column chromatography was carried out on silica gel (200–300 mesh). Commercially available reagents were used without further purification. A 40 W Kessil blue LED lamp (440 nm) was used as the light source. All solvents were dried following the standard procedures before use.

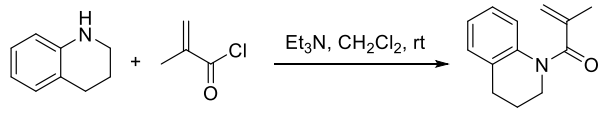
2. General procedure for the synthesis of 1[1,2]



1

(1) Methacryloyl chloride (1.2 mL, 12 mmol, 1.2 equiv.) was added dropwise to a mixture of aniline (1.0 equiv.), Et_3N (2.8 mL, 2.0 mmol, 2.0 equiv.) in CH_2Cl_2 (2.0 mL) at 0 ^oC. After stirring at 0 ^oC for 30 min and room temperature overnight, the mixture was quenched with saturated $NaHCO_3$ solution. The mixture was extract with CH_2Cl_2 (3×25 mL), washed with brine, and dried over Na_2SO_4. After filtration and concentration, the crude amide was used in next step without further purification.

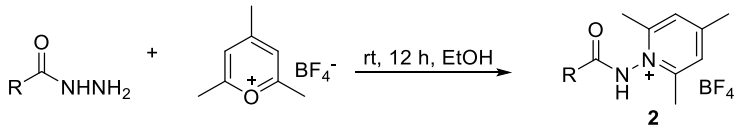
(2) NaH (0.8 g, 60% in mineral oil, 20 mmol, 2.0 equiv.) was added to a solution of the above crude amide in THF (50 mL) at 0 ^oC in portions. After stirring for 20 min at 0 ^oC, MeI (1.9 mL, 3.0 mmol, 3.0 equiv.) was added dropwise and the mixture was stirred overnight. The resulting mixture was quenched with water, extracted with ethyl acetate (2 × 30 mL). The combined organic layers were washed with brine, dried over Na_2SO_4, and concentrated under reduced pressure. The crude material was purified by column chromatography on silica gel using petroleum ether (PE)/ethyl acetate (EA) to give the pure products **1a**–**1p**, **1t-1u**.



1q

Methacryloyl chloride (1.2 mL, 12 mmol, 1.2 equiv.) was added to a mixture of tetrahydroquinoline (1.25 mL, 10 mmol, 1.0 equiv.), Et_3N (2.8 mL, 2.0 mmol, 2.0 equiv.) in CH_2Cl_2 (2.0 mL) at 0 ^oC dropwise. After stirring at 0 ^oC for 30 min and room temperature overnight, the mixture was quenched with saturated $NaHCO_3$ solution. The mixture was extract with CH_2Cl_2 (3×25 mL), and the combined organic phases were washed with brine, and dried over Na_2SO_4. After filtration and concentration, the crude material was purified by column chromatography on silica gel using PE/EA to give the pure product **1q**. Compounds **1q**–**1s** and **1v** were prepared in the same way.

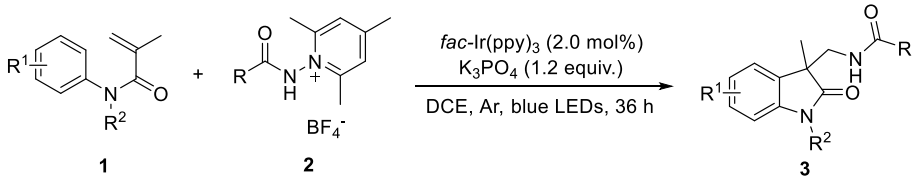
3. Synthesis of *N*-pyridinium tetrafluoroborates 2[3]



2

To a solution of pyrylium salt (1.0 equiv.) in ethanol was added hydrazine (1.0 equiv.) at room temperature. The reaction mixture was stirred at room temperature for 12 h. The mixture was cooled to 0 ^oC and petroleum ether was added. The precipitate was collected, washed with Et_2O and dried to give products **2**.

4. General procedure for the preparation of 3



1 **2** **3**

1 (0.3 mmol, 1.5 equiv.), **2** (0.2 mmol, 1.0 equiv.), K_3PO_4 (0.24 mmol, 1.2 equiv.) and *fac*-Ir(ppy)$_3$ (2.0 mol%, 0.02 equiv.) were added into an 15 mL oven-dried glass tube, and the tube was evacuated and backfilled with argon (repeated three times). Dichloroethane (DCE) (2.0 mL) was added to the tube and the reaction mixture was irradiated with a 40 W Kessil blue LED lamp (50% intensity) at ambient temperature for 36 h. After completion of the reaction (monitored by TLC), the solvent was removed under vacuum. The residue was purified by column chromatography on silica gel (eluting with PE /EA) to afford products **3**.

Gram-scale preparation

1a (1.05 g, 6.0 mmol, 1.5 equiv.), **2a** (1.3 g, 4.0 mmol, 1.0 equiv.), K_3PO_4 (1.02 g,

4.8 mmol, 1.2 equiv.) and *fac*-Ir(ppy)$_3$ (52 mg, 2.0 mol%, 0.02 equiv.) were added into an 100 mL oven-dried glass tube, the tube was evacuated and backfilled with argon (repeated three times). DCE (30 mL) was then added to the tube and the reaction mixture was irradiated with a 40 W Kessil blue LED lamp (100% intensity) for 42 h. After completion of the reaction (monitored by TLC), the solvent was removed under vacuum. The residual was purified by column chromatography on silica gel (eluting with PE /EA) to afford 0.71 g of **3a** (61% yield).

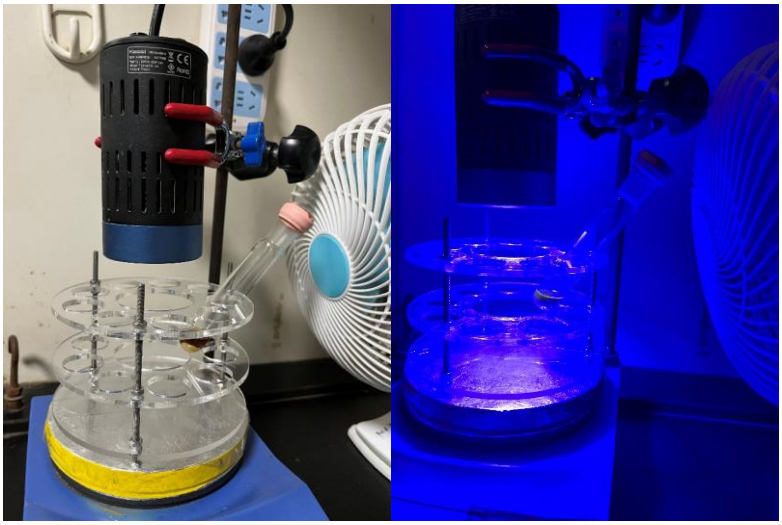
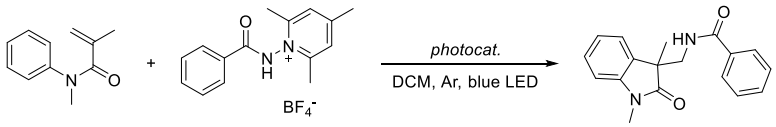


Figure S1. Experiment setup

5. Optimization of the reaction conditions

Table S1. Screening of the photocatalyst

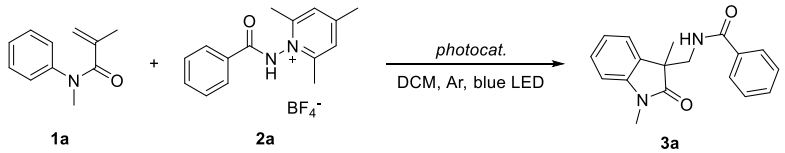


1a 2a 3a

Entry	Photocatalyst	Yield (%)[a]
1	*fac*-Ir(ppy)$_3$	65
2	Ir(dtbpy)(ppy)$_2$PF$_6$	23
3	Ru(bpy)$_3$Cl$_2$	N.R.
4	Cu(dap)$_2$Cl	N.R.
5	Ru(phen)$_3$Cl$_2$	trace[b]
6	Eosin Y	trace[b]
7	4-CzIPN	trace[b]

Reaction conditions: **1a** (0.1 mmol, 1.0 equiv.), **2a** (0.12 mmol, 1.2 equiv.), photocatalyst (2.0 mol%), DCM (dichloromethane) (1.0 mL), 40 W blue LED (50 % intensity), ambient temperature, 24 h, under argon atmosphere. [a]Isolated yields. [b]Most of S.M. was recovered.

Table S2. Screening of the solvent

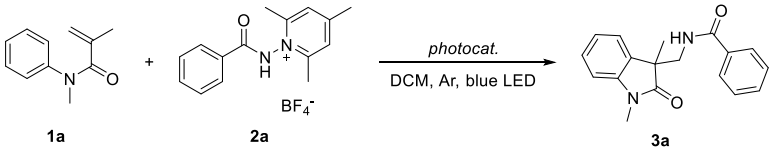


1a 2a 3a

Entry	Solvent	Yield (%)[a]
1	DCM	65
2	MeCN	58
3	DCE	68
4	$CHCl_3$	54
5	THF	N.R.
6	HFIP	N.R.
7	DMF	trace[d]
8	DMSO	41
9	toluene	32
10	MeOH	10
11	Acetone	58

Reaction conditions: **1a** (0.1 mmol, 1.0 equiv.), **2 a** (0.12 mmol, 1.2 equiv.), *fac*-Ir(ppy)$_3$ (2.0 mol%), solvent (1.0 mL), 40 W blue LEDs (50 % intensity), room temperature, 24 h, under argon atmosphere. [a]Isolated yields. [b]Most of S.M. was recovered. HFIP = hexafluoroisopropanol.

Table S3. Screening of the additive



1a 2a 3a

Entry	Photocatalyst	Solvent	Additive (equiv.)	Yield (%)[a]
1	*fac*-Ir(ppy)$_3$	DCM	$InCl_3$ (0.2)	54
2	*fac*-Ir(ppy)$_3$	DCM	$FeCl_3$ (0.2)	56
3	*fac*-Ir(ppy)$_3$	DCM	K_3PO_4 (1.0)	61
4	*fac*-Ir(ppy)$_3$	DCE	K_3PO_4 (1.0)	73
5	*fac*-Ir(ppy)$_3$	$CHCl_3$	K_3PO_4 (1.0)	65
6	*fac*-Ir(ppy)$_3$	DMSO	K_3PO_4 (1.0)	20
7	Ir(dtbpy)(ppy)$_2$PF$_6$	DCM	K_3PO_4 (1.0)	71
8	Ir(dtbpy)(ppy)$_2$PF$_6$	MeCN	NaOAc (1.0)	65
9	Ir(dtbpy)(ppy)$_2$PF$_6$	DCM	NaOAc (1.0)	68

Reaction conditions: **1a** (0.1 mmol, 1.0 equiv.), **2a** (0.12 mmol, 1.2 equiv.), *fac*-Ir(ppy)$_3$ (2.0 mol%), solvent (1.0 mL), 40 W blue LED (50 % intensity), room temperature, 24 h, under argon atmosphere. [a]Isolated yields.

Table S4. Effect of the ratio of **1a** with **2a**

Entry	**1a**	**2a**	Solvent	Yield of **3a** (%)[b]
1	1.0	1.5	MeCN	69
2	1.0	1.5	DCM	70
3	1.0	1.5	DCE	73
4	1.0	1.5	$CHCl_3$	61
5	1.5	1.0	MeCN	56
6	1.5	1.0	DCM	74
7	**1.5**	**1.0**	**DCE**	**81**
8	1.5	1.0	$CHCl_3$	64
9	1.5	1.0	DCE	58[c]
10	1.5	1.0	DCE	74[d]

Reaction conditions: **1a** (0.1 mmol, 1.0 equiv.), **2a** (0.12 mmol, 1.2 equiv.), *fac*-Ir(ppy)$_3$ (2.0 mol%), solvent (1.0 mL), K_3PO_4 (1.2 equiv.), 40 W blue LED (50 % intensity), room temperature, 36 h, under argon atmosphere. [b]Isolated yields. [c]Reaction time 12 h, [d]Reaction time 24 h.

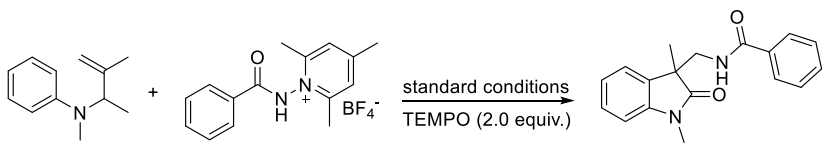
Table S5. Screening of the base

Entry	**1a**	**2a**	Base	Yield of **3a** (%)[a]
1	1.5	1.0	Na_3PO_4	61
2	1.5	1.0	K_2CO_3	64
3	1.5	1.0	NaOAc	60
4	1.5	1.0	Et_3N	41
5	1.5	1.0	no	61
6	1.5	1.0	K_3PO_4	N.R.[b]
7	1.5	1.0	K_3PO_4	N.R.[c]
8	1.5	1.0	DBU	48
9	1.5	1.0	DABCO	23

Reaction conditions: **1a** (0.1 mmol, 1.0 equiv.), **2a** (0.12 mmol, 1.2 equiv.), *fac*-Ir(ppy)$_3$ (2.0 mol%), solvent (1.0 mL), base (1.2 equiv.), 40 W blue LED (50 % intensity), room temperature, 36 h, under argon atmosphere. [a]Isolated yields. [b]In the dark, [c]No photocatalyst.

6. Inhibition experiment

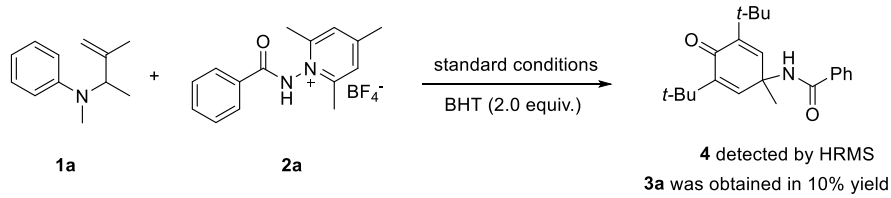
TEMPO trapping experiment.



1a (0.3 mmol, 1.5 equiv.), **2a** (0.2 mmol, 1.0 equiv.), K_3PO_4 (0.24 mmol, 1.2 equiv.), 2,2,6,6-tetramethyl-1-piperidinyloxy (TEMPO) (2.0 equiv.) and *fac*-Ir(ppy)$_3$ (2.0 mol%, 0.02 equiv.) were added sequentially into an oven-dried glass tube, the tube was evacuated and backfilled with argon (repeated three times). DCE (2.0 mL) was then added to the tube and the reaction mixture was irradiated with a 40 W kessil

blue LED lamp (50% intensity) for 36 h. TLC analysis indicates that no reaction took place and **3a** was not generated. **1a** and TEMPO were recovered mostly.

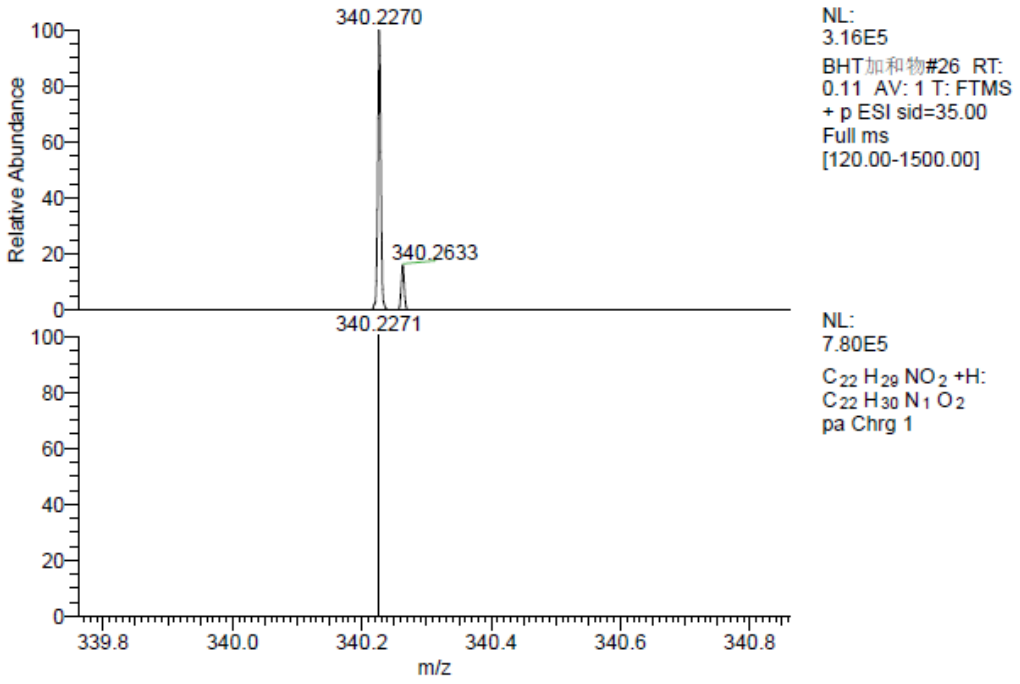
BHT trapping experiment.



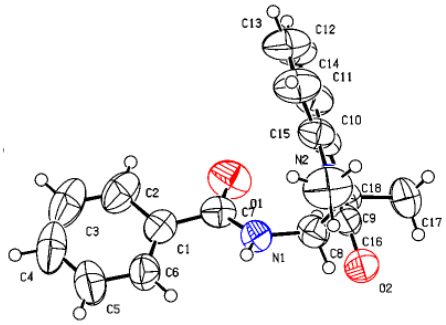
1a **2a** **4** detected by HRMS

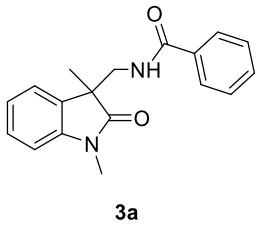
3a was obtained in 10% yield

1a (0.3 mmol, 1.5 equiv.), **2a** (0.2 mmol, 1.0 equiv.), K_3PO_4 (0.24 mmol, 1.2 equiv.), 2,6-di-tert-butyl-4-methylphenol (BHT) (2.0 equiv.) and *fac*-Ir(ppy)$_3$ (2.0 mol%, 0.02 equiv.) were added sequentially into an oven-dried glass tube, the tube was evacuated and backfilled with argon (repeated three times). DCE (2.0 mL) was then added to the tube and the reaction mixture was irradiated with a 40 W kessil blue LED (50% intensity) lamp for 36 h. After completion of the reaction (monitored by TLC), the solvent was removed under vacuum. The crude product was purified by flash chromatography on silica gel directly to give the desired product **3a** with 10% yield. The BHT trapping product **4** was detected by HRMS. HRMS (EI) for **4**: m/z [M + H]$^+$ calcd for $C_{22}H_{29}NO_2$: 340.2271; Found: 340.2272.



7. X-ray Single crystal diffraction data of 3a





3a

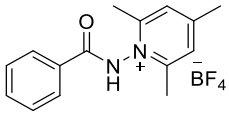
Bond precision:	C-C = 0.0026 A		Wavelength= 1.54184
Cell:	a=9.1402(4)	b=9.4815(4)	c=18.9795(6)
	alpha=96.936(3)	beta=91.503(3)	gamma=101.596(3)
Temperature:	303 K		

	Calculated	Reported
Volume	1597.30(11)	1597.29(11)
Space group	P -1	P -1
Hall group	-P 1	-P 1
Moiety formula	C18 H18 N2 O2	C18H18N2O2
Sum formula	C18 H18 N2 O2	C18H18N2O2
Mr	294.34	294.34
Dx,g cm-3	1.224	1.224
Z	4	4
Mu (mm-1)	0.647	0.647
F000	624.0	624.0
F000’	625.84	
h,k,lmax	11, 11, 23	11, 11, 23
Nref	6707	6407
Tmin,Tmax	0.890,0.950	0.691,1.000
Tmin’	0.862	

Correction method= # Reported T Limits: Tmin=0.691 Tmax=1.000
AbsCorr = MULTI-SCAN

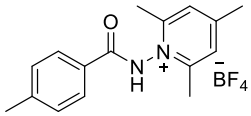
Data completeness= 0.955	Theta(max)= 76.545
R(reflections)= 0.0433(4837)	wR2(reflections)= 0.1308(6407)
S = 1.060	Npar= 402

8. Characterization data of compounds 2



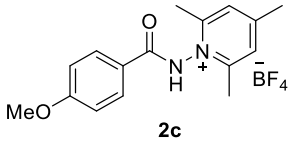
2a

1-Benzamido-2,4,6-trimethylpyridin-1-ium tetrafluoroborate (2a): yellow solid; m.p. = 98–100 ^{o}C; ^{1}H NMR ($CDCl_3$, 400 MHz) δ: 11.25 (s, 1H), 8.09 (d, *J* = 7.7 Hz, 2H), 7.68 (t, *J* = 7.4 Hz, 1H), 7.56–7.55 (m, 4H), 2.69 (s, 6H), 2,60 (s, 3H); ^{13}C NMR ($CDCl_3$, 100 MHz) δ: 164.2, 160.6, 157.7, 134.1, 129.3, 128.5, 128.0, 127.7, 22.0, 19.3; HRMS-ESI (m/z) $[M]^+$ calcd for $C_{15}H_{17}N_2O^+$: 241.1335; Found, 241.1340.



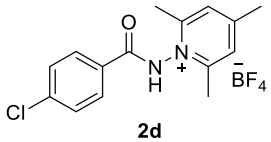
2b

2,4,6-Trimethyl-1-(4-methylbenzamido)pyridin-1-ium tetrafluoroborate (2b): white solid; m.p. = 136–138 ^{o}C; ^{1}H NMR ($CDCl_3$, 400 MHz) δ:11.21 (s, 1H), 7.99 (d, *J* = 8.3 Hz, 2H), 7.56 (s, 2H), 7.37 (d, *J* = 8.0 Hz, 2H), 2.70 (s, 6H), 2.61(s, 3H), 2.46 (s, 3H); ^{13}C NMR ($CDCl_3$, 100 MHz) δ: 164.2, 160.3, 157.9, 145.2, 129.9, 128.0, 127.6, 125.7, 22.0, 21.7, 19.4; HRMS-ESI (m/z) $[M]^+$ calcd for $C_{16}H_{19}N_2O^+$: 255.1492; Found, 255.1494.



2c

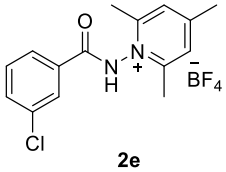
1-(4-Methoxybenzamido)-2,4,6-trimethylpyridin-1-ium tetrafluoroborate (2c): white solid; m.p. = 126–128 ^{o}C; ^{1}H NMR ($CDCl_3$, 400 MHz) δ: 11.16 (s, 1H), 8.09-8.05 (m, 2H), 7.54 (s, 2H), 7.06–7.03 (m, 2H), 3.90 (s, 3H), 2.70 (s, 6H), 2.61 (s, 3H); ^{13}C NMR ($CDCl_3$, 100 MHz) δ: 164.3, 163.8, 160.2, 158.0, 130.2, 127.6, 120.6, 114.5, 55.6, 22.1, 19.4; HRMS-ESI (m/z) $[M]^+$ calcd for $C_{16}H_{19}N_2O_2^+$: 271.1441; Found, 271.1443.



2d

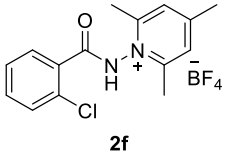
1-(4-Chlorobenzamido)-2,4,6-trimethylpyridin-1-ium tetrafluoroborate (2d): white solid; m.p. = 154–156 ^{o}C; ^{1}H NMR ($CDCl_3$, 400 MHz) δ: 11.22 (s, 1H), 7.98 (d, *J* = 8.3 Hz, 2H), 7.56 (s, 1H), 7.37 (d, *J* = 8.0 Hz), 2.70 (s, 6H), 2.61 (s, 3H), 2.46 (s, 3H); ^{13}C NMR ($CDCl_3$, 100 MHz) δ: 163.3, 160.7, 157.6, 140.7, 129.6, 129.5, 127.8, 126.9, 22.0, 19.3; HRMS-ESI (m/z) $[M]^+$ calcd for $C_{15}H_{16}ClN_2O^+$: 275.0946; Found,

275.0946.



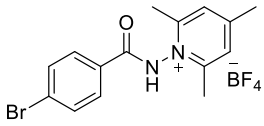
2e

1-(3-Chlorobenzamido)-2,4,6-trimethylpyridin-1-ium tetrafluoroborate (2e): white solid; m.p. = 142–144 °C; ^{1}H NMR ($CDCl_3$, 400 MHz) δ: 11.40 (s, 1H), 8.06 (t, *J* = 1.8 Hz, 1H), 8.01 (d, *J* = 7.8 Hz, 1H), 7.67–7.65 (m, 2H), 7.57–7.52 (m, 3H), 2.71 (s, 6H), 2.63 (s, 3H); ^{13}C NMR ($CDCl_3$, 100 MHz) δ: 163.1, 160.7, 157.7, 135.6, 134.2, 130.8, 130.2, 128.6, 127.7, 125.6, 22.1, 19.4; HRMS-ESI (m/z) $[M]^+$ calcd for $C_{15}H_{16}ClN_2O^+$: 275.0946; Found, 275.0948.



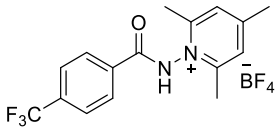
2f

1-(2-Chlorobenzamido)-2,4,6-trimethylpyridin-1-ium tetrafluoroborate (2f): white solid; m.p. = 138–140 °C; ^{1}H NMR ($CDCl_3$, 600 MHz) δ: 11.07 (s, 1H), 7.76 (d, J = 5.0 Hz, 1H), 7.59 (s, 2H), 7.53 (d, *J* = 2.6 Hz, 2H), 7.47–7.43 (m, 1H), 2.78 (s, 6H), 2.60 (s, 3H); ^{13}C NMR ($CDCl_3$, 150 MHz) δ: 163.8, 160.9, 157.8, 133.5, 132.1, 131.1, 129.8, 129.6, 127.8, 127.6, 22.1, 19.6; HRMS-ESI (m/z) $[M]^+$ calcd for $C_{15}H_{16}ClN_2O^+$: 275.0946; Found, 275.0950.



2g

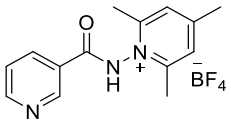
1-(4-Bromobenzamido)-2,4,6-trimethylpyridin-1-ium tetrafluoroborate (2g): white solid; m.p. = 140–142 °C; ^{1}H NMR ($CDCl_3$, 400 MHz) δ: 11.37 (s, 1H), 7.99–7.96 (m, 2H), 7.74–7.70 (m, 2H), 7.57 (s, 2H), 2.70 (s, 6H), 2.63 (s, 3H); ^{13}C NMR ($CDCl_3$, 100 MHz) δ: 163.5, 160.6, 157.7, 132.6, 129.6, 129.5, 127.7, 127.3, 22.1, 19.4; HRMS-ESI (m/z) $[M]^+$ calcd for $C_{15}H_{16}BrN_2O^+$: 319.0441; Found, 319.0444.



2h

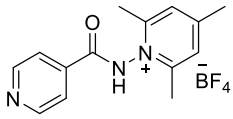
2,4,6-Trimethyl-1-(4-(trifluoromethyl)benzamido)pyridin-1-ium tetrafluoroborate (2h): white solid; m.p. = 198–200 °C; ^{1}H NMR ($(CD_3)_2CO$, 400 MHz) δ: 8.33 (d, *J* = 8.1 Hz, 2H), 8.03 (s, 1H), 8.01 (s, 3H), 2.82 (s, 6H), 2.72 (s, 3H); ^{13}C NMR ($(CD_3)_2CO$, 100 MHz) δ: 163.5, 161.8, 157.4, 134.2 (q, *J* = 32 Hz, 1C),

133.4, 129.1, 128.2, 126.1 (q, J = 5.0 Hz, 1C), 123.8 (q, J = 270 Hz, 1C), 21.2, 18.5; HRMS-ESI (m/z) $[M]^+$ calcd for $C_{16}H_{16}F_3N_2O^+$: 309.1209; Found, 309.1210.



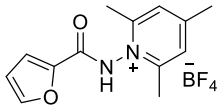
2i

2,4,6-Trimethyl-1-(nicotinamido)pyridin-1-ium tetrafluoroborate (2i): white solid; m.p. = 146–148 ^oC; ^1H NMR (D_2O, 400 MHz) δ: 9.27 (t, J = 0.92 Hz, 1H), 9.06–9.03 (m, 1H), 8.89 (d, J = 5.8 Hz, 1H), 8.16–8.13 (m, 1H), 7.55 (s, 2H), 2.50 (s, 6H), 2.48 (s, 3H); ^{13}C NMR (D_2O, 100 MHz) δ: 165.5, 154.9, 152.4, 145.0, 143.1, 141.3, 134.9, 127.2, 127.0, 20.4, 18.2; HRMS-ESI (m/z) $[M]^+$ calcd for $C_{14}H_{16}N_3O^+$: 242.1288; Found, 242.1291.



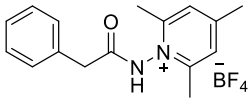
2j

1-(Isonicotinamido)-2,4,6-trimethylpyridin-1-ium tetrafluoroborate (2j): white solid; m.p. = 142–144 ^oC; ^1H NMR (D_2O, 400 MHz) δ: 8.77 (d, J = 6.4 Hz, 2H), 8.36 (d, J = 6.8 Hz, 2H), 7.43 (s, 2H), 2.38 (s, 6H), 2.36 s, 3H); ^{13}C NMR (D_2O, 100 MHz) δ: 166.6, 154.8, 152.6, 152.0, 142.0, 127.0, 125.5, 20.4, 18.1; HRMS-ESI (m/z) $[M]^+$ calcd for $C_{14}H_{16}N_3O^+$: 242.1288; Found, 242.1285.



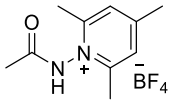
2k

1-(Furan-2-carboxamido)-2,4,6-trimethylpyridin-1-ium tetrafluoroborate (2j): white solid; m.p. = 122–124 ^oC; ^1H NMR ($CDCl_3$, 400 MHz) δ: 11.25 (s, 1H), 7.73 (s, 1H), 7.56 (s, 2H), 7.48 (d, J = 3.5 Hz, 1H), 2.72 (s, 6H), 2.62 (s, 3H); ^{13}C NMR ($CDCl_3$, 100 MHz) δ: 160.7, 158.1, 155.2, 147.5, 143.1, 127.3, 118.8, 112.7, 22.2, 19.5; HRMS-ESI (m/z) $[M]^+$ calcd for $C_{13}H_{15}N_2O_2^+$: 231.1128; Found, 231.1130.



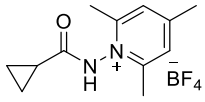
2l

2,4,6-Trimethyl-1-(2-phenylacetamido)pyridin-1-ium tetrafluoroborate (2l) : white solid; m.p. = 102–104 ^oC; ^1H NMR ($(CD_3)_2CO$, 400 MHz) δ: 7.87 (s, 2H), 7.48 (d, J = 7.2 Hz, 2H), 7.41–7.37 (m, 2H), 7.34–7.31 (m, 1H), 3.98 (s, 2H), 3.04 (s, 1H), 2.63 (s, 3H), 2.61 (s, 6H); ^{13}C NMR ($(CD_3)_2CO$, 100 MHz) δ: 168.5, 161.3, 157.2, 133.7, 129.5, 128.7, 127.9, 127.4, 40.1, 20.1, 18.3; HRMS-ESI (m/z) $[M]^+$ calcd for $C_{16}H_{19}N_2O^+$: 255.1492; Found, 255.1488.



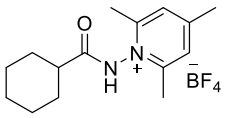
2m

1-Acetamido-2,4,6-trimethylpyridin-1-ium tetrafluoroborate (2m): white solid; m.p. = 103–105 ^{o}C; ^{1}H NMR ($(CD_3)_2CO$, 400 MHz) δ: 7.91 (s, 2H), 2.72 (s, 6H), 2.65 (s, 3H), 2.32 (s, 3H); ^{13}C NMR ($(CD_3)_2CO$, 100 MHz) δ: 167.7, 161.2, 157.2, 127.9, 21.0, 19.6, 18.4; HRMS-ESI (m/z) $[M]^+$ calcd for $C_{10}H_{15}N_2O^+$: 179.1179; Found, 179.1182.



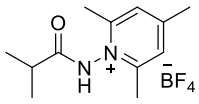
2n

1-(Cyclopropanecarboxamido)-2,4,6-trimethylpyridin-1-ium tetrafluoroborate (2n): white solid; m.p. = 99–101 ^{o}C; ^{1}H NMR ($CDCl_3$, 400 MHz) δ: 10.74, (s, 1H), 7.58 (s, 2H), 2.64 (s, 6H), 2.58 (s, 3H), 1.97-1.94 (m, 1H), 1.10–1.06 (m, 4H); ^{13}C NMR ($CDCl_3$, 100 MHz) δ: 171.9, 160.8, 157.4, 127.8, 21.9, 19.2, 12.3, 9.0; HRMS-ESI (m/z) $[M]^+$ calcd for $C_{12}H_{17}N_2O^+$: 205.1335; Found, 205.1339.



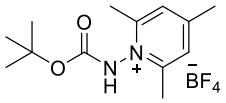
2o

1-(Cyclohexanecarboxamido)-2,4,6-trimethylpyridin-1-ium tetrafluoroborate (2n): white solid; m.p. = 122–124 ^{o}C; ^{1}H NMR ($(CD_3)_2CO$, 400 MHz) δ: 7.91 (s, 2H), 3.07 (s, 1H), 2.75–2.68 (m, 7H), 2.65 (s, 3H), 2.02 (m, 1H), 1.84–1.80 (m, 2H), 1.73–1.68 (m, 1H), 1.57 (dq, *J* = 3.0, 12.2 Hz, 2H), 1.40 (td, *J* = 3.2, 12.4 Hz, 2H), 1.29 (tt, *J* = 2.8, 12.0 Hz, 1H) 1.14–1.09 (m, 1H); ^{13}C NMR ($(CD_3)_2CO$, 100 MHz) δ: 173.1, 161.1, 157.1, 127.9, 42.4, 25.4, 25.1, 21.1, 18.4; HRMS-ESI (m/z) $[M]^+$ calcd for $C_{15}H_{23}N_2O^+$: 247.1805; Found, 247.1807.



2p

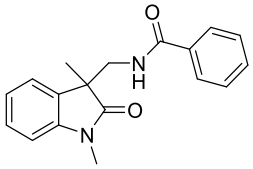
1-Isobutyramido-2,4,6-trimethylpyridin-1-ium tetrafluoroborate (2p): white solid; m.p. = 108–110 ^{o}C; ^{1}H NMR ($(CD_3)_2CO$, 400 MHz) δ: 7.92 (s, 2H), 2.69 (s, 6H), 2.64 (s, 3H), 1.30 (s, 3H), 1.29 (s, 3H); ^{13}C NMR ($(CD_3)_2CO$, 100 MHz) δ: 174.2, 161.2, 157.1, 128.0, 33.0, 21.1, 18.4; HRMS-ESI (m/z) $[M]^+$ calcd for $C_{12}H_{19}N_2O^+$: 207.1492; Found, 207.1489.



2q

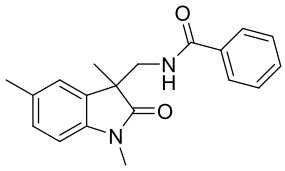
1-((Tert-butoxycarbonyl)amino)-2,4,6-trimethylpyridin-1-ium tetrafluoroborate (2q): white solid; m.p. = 92–94 ^{o}C; ^{1}H NMR ($CDCl_3$, 400 MHz) δ: 9.54 (s, 1H), 7.61 (s, 2H), 2.67, (s, 6H), 2.57 (s, 3H), 1.53 (s, 9H); ^{13}C NMR ($CDCl_3$, 100 MHz) δ: 160.9, 158.0, 152.0, 127.8, 84.7, 27.9, 22.0, 19.1; HRMS-ESI (m/z) $[M]^+$ calcd for $C_{13}H_{21}N_2O_2^+$: 237.1598; Found, 237.1599.

9. Characterization data of compounds 3



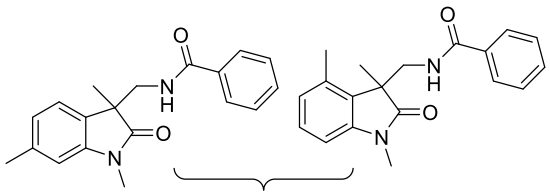
3a

***N*-((1,3-Dimethyl-2-oxoindolin-3-yl)methyl)benzamide (3a):** The resultant residue was purified by flash silica gel column chromatography to afford **3a** as colorless solid (46 mg, 78%); m.p. = 112–114 ^{o}C; ^{1}H NMR ($CDCl_3$, 400 MHz) δ: 7.82–7.80 (m, 2H), 7.52–7.48 (m, 1H), 7.45–7.38 (m, 3H), 7.34–7.30 (m, 2H), 7.12 (m, 1H), 6.89 (m, 1H), 4.24 (dd, *J* = 8.4, 13.6, 1H), 3.27–3.23 (m, 4H), 1.47 (s, 3H); ^{13}C NMR ($CDCl_3$, 100 MHz) δ: 180.3, 167.5, 142.8, 134.3, 132.0, 131.5, 128.6, 128.5, 127.0, 123.2, 123.1, 108.4, 47.2, 45.1, 26.3, 20.2; HRMS-ESI (m/z) $[M + H]^+$ calcd for $C_{18}H_{18}N_2O_2$: 295.1441; Found, 295.1445.



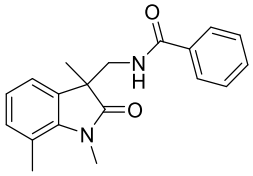
3b

***N*-((1,3,6-Trimethyl-2-oxoindolin-3-yl)methyl)benzamide (3b):** The resultant residue was purified by flash silica gel column chromatography to afford **3b** as white solid (39 mg, 68%); m.p. = 81–83 ^{o}C; ^{1}H NMR ($CDCl_3$, 400 MHz) δ: 7.84–7.82 (m, 2H), 7.52–7.39 (m, 4H), 7.14–7.10 (m, 2H), 6.78 (d, *J* = 7.8 Hz, 1H), 4.26 (dd, *J* = 8.6, 13.6 Hz, 1H), 3.23 (s, 3H), 3.18 (dd, *J* = 2.5, 13.6 Hz, 1H), 2.36 (s, 3H), 1.46 (s, 3H); ^{13}C NMR ($CDCl_3$, 100 MHz) δ: 180.2, 167.4, 140.3, 134.3, 132.8, 132.1, 131.4, 128.7, 128.5, 126.9, 123.8, 108.1, 47.0, 45.1, 26.2, 21.1, 20.2; HRMS-ESI (m/z) $[M + H]^+$ calcd for $C_{19}H_{20}N_2O_2$: 309.1598; Found, 309.1601.



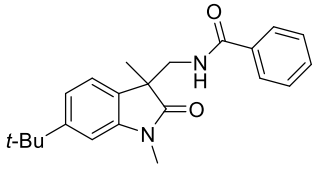
3c (3 : 5)

***N*-((1,3,4-Trimethyl-2-oxoindolin-3-yl)methyl)benzamide or *N*-((1,3,6-Trimethyl-2-oxoindolin-3-yl)methyl)benzamide (3c):** The resultant residue was purified by flash silica gel column chromatography to afford **3c** as yellow solid (37 mg, 61%); m.p. = 116–118 ^{o}C; ^{1}H NMR ($CDCl_3$, 400 MHz) δ: 7.83–7.77 (m, 3.3H), 7.52–7.38 (m, 7H), 7.23–7.18 (m, 1.7H), 6.94–6.88 (m, 1.6H), 6.73 (d, *J* = 7.6 Hz, 1.6H), 4.48 (dd, *J* = 8.2, 13.6 Hz, 1H), 4.23 (dd, *J* = 8.2, 13.6 Hz, 0.6H), 3.33 (dd, *J* = 3.0, 13.6 Hz, 1H), 3.24–3.19 (m, 5.5H), 2.50 (s, 3H), 2.40 (s, 1.8H), 1.55 (s, 3H), 1.45 (s, 1.8H); ^{13}C NMR ($CDCl_3$, 100 MHz) δ: 180.5, 180.2, 167.4, 143.1, 142.8, 138.7, 135.0, 134.2, 131.4, 129.0, 128.8, 128.5, 128.3, 126.9, 126.9, 125.8, 123.6, 122.7, 109.3, 106.1, 48.0, 46.9, 45.1, 26.3, 26.1, 21.7, 20.2, 18.4, 18.1; HRMS-ESI (m/z) $[M + H]^+$ calcd for $C_{19}H_{20}N_2O_2$: 309.1598; Found, 309.1601.



3d

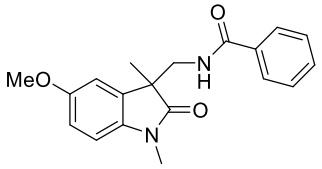
***N*-((1,3,7-Trimethyl-2-oxoindolin-3-yl)methyl)benzamide (3d):** The resultant residue was purified by flash silica gel column chromatography to afford **3d** as yellow oil (17 mg, 28%); ^{1}H NMR ($CDCl_3$, 400 MHz) δ: 7.86–7.83 (m, 2H), 7.53–7.43 (m, 4H), 7.15 (dd, *J* = 1.3, 6.9 Hz, 1H), 7.06–6.99 (m, 2H), 4.24 (dd, *J* = 8.6, 13.6 Hz, 1H), 3.53 (s, 3H), 3.15 (dd, *J* = 2.5, 13.6 Hz, 1H), 2.60 (s, 3H), 1.44 (s, 3H); ^{13}C NMR ($CDCl_3$, 100 MHz) δ: 181.1, 167.5, 140.5, 134.3, 132.7, 132.3, 131.5, 128.6, 127.0, 123.1, 120.9, 120.1, 46.3, 45.3, 29.6, 20.6, 19.0; HRMS-ESI (m/z) $[M + H]^+$ calcd for $C_{19}H_{20}N_2O_2$: 309.1598; Found, 309.1600.



3e

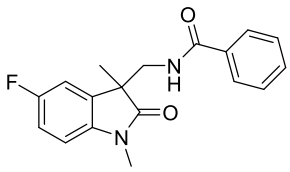
***N*-((6-(*tert*-Butyl)-1,3-dimethyl-2-oxoindolin-3-yl)methyl)benzamide (3e):** The resultant residue was purified by flash silica gel column chromatography to afford **3e** as yellow oil (43 mg, 62%); ^{1}H NMR ($CDCl_3$, 400 MHz) δ: 7.87–7.85 (m, 2H),

7.53–7.43 (m, 4H), 7.36–7.34 (m, 2H), 6.83 (dd, *J* = 0.8, 8.0 Hz, 1H), 4.31 (dd, *J* = 8.7, 13.6 Hz, 1H), 3.24 (s, 3H), 3.16 (dd, *J* = 2.3, 13.6 Hz, 1H), 1.48, (s, 3H), 1.33 (s, 9H); ^{13}C NMR ($CDCl_3$, 100 MHz) δ: 180.6, 167.6, 146.6, 140.4, 134.4, 131.8, 131.5, 128.6, 127.0, 125.1, 120.2, 107.9, 47.2, 45.2, 34.7, 31.6, 26.3, 20.3; HRMS-ESI (m/z) $[M + H]^+$ calcd for $C_{22}H_{26}N_2O_2$: 351.2067; Found, 351.2069.



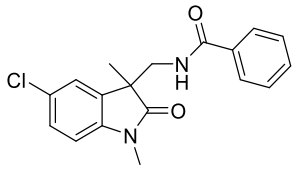
3f

***N*-((5-Methoxy-1,3-dimethyl-2-oxoindolin-3-yl)methyl)benzamide (3f) :** The resultant residue was purified by flash silica gel column chromatography to afford **3f** as yellow oil (38 mg, 59%); ^{1}H NMR ($CDCl_3$, 600 MHz) δ: 7.84–7.82 (m, 2H), 7.50 (t, *J* = 7.3 Hz, 1H), 7.45–7.40 (m, 3H), 6.94 (d, *J* = 2.4 Hz, 1H), 6.85-6.83 (m, 1H), 6.81-6.79 (m, 1H), 4.26 (dd, *J* = 8.6, 13.6 Hz, 1H), 3.81 (s, 3H), 3.23 (s, 3H), 3.20 (dd, *J* = 2.4, 13.6 Hz, 1H), 1.46 (s, 3H); ^{13}C NMR ($CDCl_3$, 150 MHz) δ: 180.0, 167.5, 156.5, 136.2, 134.3, 133.4, 131.5, 128.6, 127.0, 113.1, 110.2, 108.9, 55.9, 47.5, 45.1, 26.3, 20.3; HRMS-ESI (m/z) $[M + H]^+$ calcd for $C_{19}H_{20}N_2O_3$: 325.1547; Found, 325.1550.



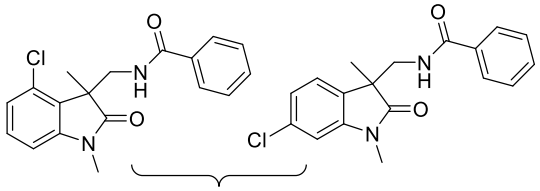
3g

***N*-((5-Fluoro-1,3-dimethyl-2-oxoindolin-3-yl)methyl)benzamide (3g):** The resultant residue was purified by flash silica gel column chromatography to afford **3g** as white solid (45 mg, 72%); m.p. = 118–120 ^{o}C; ^{1}H NMR ($CDCl_3$, 400 MHz) δ: 7.80–7.78 (m, 2H), 7.51–7.47 (m, 1H), 7.45–7.41 (m, 2H), 7.28 (d, *J* = 6.0 Hz, 1H), 7.08 (dd, *J* = 2.5, 7.8 Hz, 1H), 7.01 (dt, *J* = 2.6, 8.6 Hz, 1H) 6.80 (q, *J* = 4.2 Hz, 1H), 4.19 (dd, *J* = 8.2, 13.6 Hz, 1H), 3.29 (dd, *J* = 3.2, 13.6 Hz, 1H), 3.24 (s, 3H); ^{19}F NMR ($CDCl_3$, 376 MHz) δ: 119.3; ^{13}C NMR ($CDCl_3$, 100 MHz) δ: 179.8, 167.4, 159.5 (d, *J* = 240 Hz, 1C), 138.7 (d, *J* = 1.8 Hz, 1C), 134.1, 133.6 (d, *J* = 8.0 Hz, 1C), 131.5, 128.5, 126.9, 114.7 (d, *J* = 23.4 Hz, 1C), 111.4, (d, J = 24.7 Hz, 1C), 108.8 (d, J = 8.1 Hz, 1C), 47.8 (d, J = 1.4 Hz, 1C), 44.9, 26.3, 20.1; HRMS-ESI (m/z) $[M + H]^+$ calcd for $C_{18}H_{17}FN_2O_2$: 313.1347;Found, 313.1349.



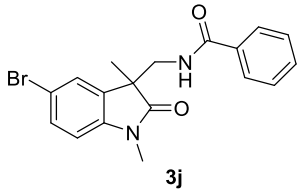
3h

***N*-((5-Chloro-1,3-dimethyl-2-oxoindolin-3-yl)methyl)benzamide (3h):** The resultant residue was purified by flash silica gel column chromatography to afford **3h** as colorless oil (44 mg, 67%); ^{1}H NMR ($CDCl_3$, 400 MHz) δ: 7.80, (d, *J* = 7.2 Hz, 2H), 7.50 (t, *J* = 7.6 Hz, 1H), 7.44 (t, *J* = 7.6 Hz, 2H), 7.31–7.24 (m, 3H), 6.81 (d, *J* = 8.0 Hz, 1H), 4.22 (dd, *J* = 8.4, 13.6 Hz, 1H), 3.27-3.23 (m, 4H), 1.46 (s, 3H); ^{13}C NMR ($CDCl_3$, 100 MHz) δ: 179.7, 167.5, 141.4, 134.1, 133.6, 131.6, 128.6, 128.5, 126.9, 123.7, 109.3, 47.6, 44.9, 26.3, 20.1; HRMS-ESI (m/z) $[M + H]^+$ calcd for $C_{18}H_{17}ClN_2O_2$: 329.1051; Found, 329.1054.



3i (2 : 1)

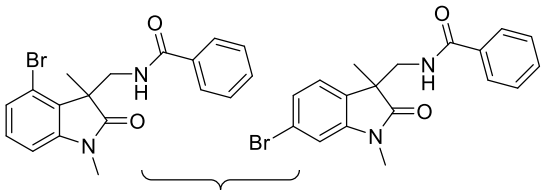
***N*-((4-Chloro-1,3-dimethyl-2-oxoindolin-3-yl)methyl)benzamide or *N*-((6-Chloro-1,3-dimethyl-2-oxoindolin-3-yl)methyl)benzamide (3i):** The resultant residue was purified by flash silica gel column chromatography to afford **3i** as yellow solid (36 mg, 55%); m.p. = 113–115 ^{o}C; ^{1}H NMR ($CDCl_3$, 400 MHz) δ: 7.80–7.76 (m, 3H), 7.53–7.41 (m, 4.5H),7.28–7.21 (m, 3H), 7.11–7.05 (m, 1.5H), 6.89 (dd, *J* = 1.8 Hz, 0.5H), 6.79 (dd, *J* = 0.8, 7.8 Hz, 1H), 4.65 (dd, *J* = 8.3, 13.6 Hz, 1H), 4.19 (dd, *J* = 8.2, 13.6 Hz, 0.5H), 3.41 (dd, *J* = 3.0, 13.6 Hz, 1H), 3.29 (dd, *J* = 3.3, 13.6 Hz, 0.5H), 3.25 (s, 3H), 3.24 (s, 1.5H), 1.62 (s, 3H), 1.45 (s, 1.5H); ^{13}C NMR ($CDCl_3$, 100 MHz) δ: 180.2, 180.0, 167.5, 167.4, 144.7. 144.1, 134.4, 134.3, 134.2, 131.6, 131.5, 131.2, 131.0, 129.8, 128.6, 128.6, 128.1, 127.0, 124.3, 124.1, 123.0, 109.2, 106.9, 48.9, 47.3, 44.9, 42.7, 26.5, 26.4, 20.3, 17.6; HRMS-ESI (m/z) $[M + H]^+$ calcd for $C_{18}H_{17}ClN_2O_2$: 329.1051; Found, 329.1054.



3j

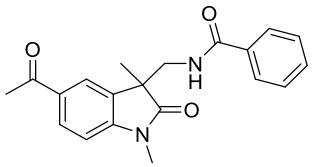
***N*-((5-Bromo-1,3-dimethyl-2-oxoindolin-3-yl)methyl)benzamide (3j):** The resultant residue was purified by flash silica gel column chromatography to afford **3j** as brown solid (43 mg, 58%); m.p. = 120–122 ^{o}C; ^{1}H NMR ($CDCl_3$, 400 MHz) δ: 7.82–7.80 (m,

2H), 7.53–7.49 (m, 1H), 7.46–7.43 (m, 4H), 7.27 (d, *J* = 10.3 Hz, 1H), 6.78 (d, *J* = 6.4 Hz, 1H), 4.24 (dd, *J* = 8.4, 13.6 Hz, 1H), 3.25–3.21 (m, 4H), 1.47 (s, 3H); ^{13}C NMR ($CDCl_3$, 100 MHz) δ: 179.6, 167.5, 141.8, 134.1, 134.0, 131.5, 131.4, 128.5, 126.9, 126.4, 115.8, 109.8, 47.5, 44.9, 26.3, 20.1; HRMS-ESI (m/z) $[M + H]^+$ calcd for $C_{18}H_{17}BrN_2O_2$: 373.0546; Found, 373.0550.



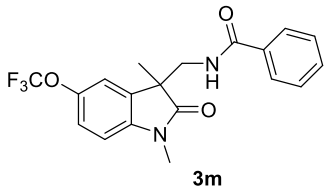
3k (3 : 1)

***N*-((4-Bromo-1,3-dimethyl-2-oxoindolin-3-yl)methyl)benzamide or *N*-((6-Bromo-1,3-dimethyl-2-oxoindolin-3-yl)methyl)benzamide (3k):** The resultant residue was purified by flash silica gel column chromatography to afford **3k** as yellow oil (42 mg, 57%); ^{1}H NMR ($CDCl_3$, 600 MHz) δ: 7.79–7.75 (m, 2.7H), 7.50–7.47 (m, 1.4H), 7.42 (q, *J* = 8.8 Hz, 2.7H), 7.26–7.16 (m, 4H), 7.03 (d, *J* = 1.6 Hz, 0.3H), 6.82 (dd, *J* = 0.6, 7.6 Hz, 1H), 4.70 (dd, *J* = 8.4, 13,6 Hz, 1H), 4.17 (dd, *J* = 8.2, 13.6 Hz, 0.3H), 3.42 (dd, *J* = 3.0, 13.6, Hz, 1H), 3.31 (dd, *J* = 3.0, 13.6 Hz, 0.3H), 3.23 (s, 3H), 3.22 (s, 1H), 1.63 (s, 3H), 1.45 (s, 1H); ^{13}C NMR ($CDCl_3$, 150 MHz) δ: 180.0, 179.6, 167.5, 167.3, 145.0, 144.2, 134.3, 134.2, 131.6, 131.5, 130.9, 130.0, 129.8, 128.6, 128.6, 127.4, 127.0, 127.0, 125.9, 124.5, 122.1, 119.2, 111.9, 107.4, 49.6, 47.4, 44.8, 42.5, 26.5, 26.4, 20.2, 17.5; HRMS-ESI (m/z) $[M + H]^+$ calcd for $C_{18}H_{17}BrN_2O_2$: 373.0546; Found, 373.0549.



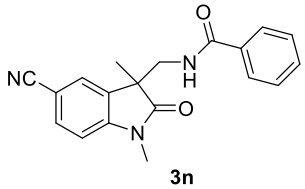
3l

***N*-((5-acetyl-1,3-dimethyl-2-oxoindolin-3-yl)methyl)benzamide (3l):** The resultant residue was purified by flash silica gel column chromatography to afford **3l** as yellow oil (48 mg, 71%); ^{1}H NMR ($CDCl_3$, 600 MHz) δ: 8.00 (dd, *J* = 1.7 8.2 Hz, 1H), 7.95 (d, *J* = 1.6 Hz, 1H), 7.79–7.77 (m, 2H), 7.51–7.48 (m, 1H), 7.44–7.42 (m, 2H), 7.19 (d, *J* = 5.6 Hz, 1H), 6.95 (d, *J* = 8.2 Hz, 1H), 4.27 (dd, *J* = 8.4, 13.6 Hz, 1H), 3.32 (dd, *J* = 3.2, 13.6 Hz, 1H), 3.29 (s, 3H), 2.60 (s, 3H), 1.51 (s, 3H); ^{13}C NMR ($CDCl_3$, 150 MHz) δ: 196.7, 180.5, 167.6, 147.1, 134.2, 132.6, 132.2, 131.6, 130.3, 128.6, 127.0, 123.3, 108.0, 47.4, 45.0, 26.6, 26.5, 20.2; HRMS-ESI (m/z) $[M + H]^+$ calcd for $C_{20}H_{20}N_2O_3$: 337.1547; Found, 337.1551.



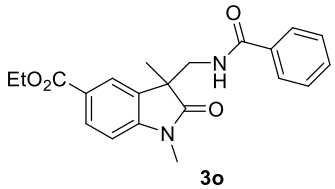
3m

***N*-((1,3-Ddimethyl-2-oxo-5-(trifluoromethoxy)indolin-3-yl)methyl)benzamide (3m):** The resultant residue was purified by flash silica gel column chromatography to afford **3m** as yellow solid (50 mg, 66%); m.p. = 105–107 ^{o}C; ^{1}H NMR ($CDCl_3$, 400 MHz) δ: 7.80–7.78 (m, 2H), 7.52–7.48 (m, 1H), 7.45–7.41 (m, 2H), 7.28–7.23 (m, 2H), 7.21–7.18 (m, 1H), 6.87 (d, *J* = 8.4 Hz, 1H), 4.21 (dd, *J* = 8.3, 13.6 Hz, 1H), 3.31 (dd, *J* = 3.2, 13.6 Hz, 1H), 3.25 (s, 3H), 1.48 (s, 3H); ^{19}F NMR ($CDCl_3$, 376 MHz) δ: 58.3; ^{13}C NMR ($CDCl_3$, 100 MHz) δ: 179.9, 167.5, 145.0 (q, *J* = 1.6 Hz, 1C),141.4, 134.1, 133.5, 131.6, 128.6. 126.9, 121.6, 120.5 (q, *J* = 255 Hz, 1C), 117.2, 108.8, 47.8, 44.8, 26.4, 20.1; HRMS-ESI (m/z) $[M + H]^+$ calcd for $C_{19}H_{17}F_3N_2O_3$: 379.1264; Found, 379.1266.



3n

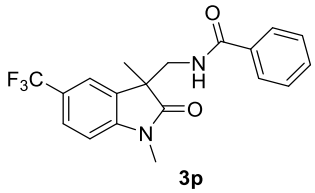
***N*-((5-Cyano-1,3-dimethyl-2-oxoindolin-3-yl)methyl)benzamide (3n):** The resultant residue was purified by flash silica gel column chromatography to afford **3n** as white solid (50 mg, 79%); m.p. = 108–110 ^{o}C; ^{1}H NMR ($CDCl_3$, 400 MHz) δ: 7.75 (d, *J* = 7.2 Hz, 2H), 7.64 (d, *J* = 8.1 Hz, 1H), 7.60 (s, 1H), 7.51 (t, *J* = 7.2 Hz, 1H), 7.43 (t, *J* = 7.6 Hz, 2H), 7.08 (d, *J* = 4.0 Hz, 1H), 6.95 (d, *J* = 8.2 Hz, 1H), 4.16 (dd, *J* = 8.0, 13.6 Hz, 1H), 3.42 (dd, *J* = 4.0, 13.6 Hz, 1H), 3.28 (s, 3H), 1.49 (s, 3H); ^{13}C NMR ($CDCl_3$, 100 MHz) δ: 179.8, 167.5, 146.7, 133.9, 133.8, 133.0, 131.7, 128.6, 126.9, 126.6, 118.8, 108.8, 106.2, 47.7, 44.7, 26.5, 20.1; HRMS-ESI (m/z) $[M + H]^+$ calcd for $C_{19}H_{17}N_3O_2$: 320.1394; Found, 320.1395.



3o

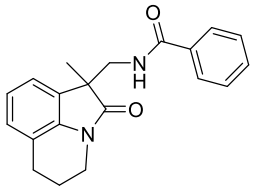
ethyl-3-(Benzamidomethyl)-1,3-dimethyl-2-oxoindoline-5-carboxylate (3o): The resultant residue was purified by flash silica gel column chromatography to afford **3o** as white solid (53 mg, 72%); m.p. = 164–166 ^{o}C; ^{1}H NMR ($CDCl_3$, 400 MHz) δ: 8.09 (dd, *J* = 1.6, 8.2 Hz, 1H), 8.01 (d, *J* = 1.2 Hz, 1H), 7.82-7.80 (m, 2H), 7.53–7.49 (m, 1H), 7.46–7.42 (m, 2H), 7.28–7.25 (m, 1H), 6.94 (d, *J* = 8.2 Hz, 1H), 4.41–4.28 (m, 3H), 3.28 (s, 3H), 3.24 (dd, *J* = 2.8, 13.6 Hz, 1H), 1.51 (s, 3H), 1.42 (t, *J* = 7.2 Hz,

3H); ^{13}C NMR ($CDCl_3$, 100 MHz) δ: 180.4, 167.4, 166.0, 146.7, 134.1, 131.8, 131.5, 131.2, 128.5, 126.9, 125.3, 124.2, 107.9, 60.9, 47.1, 44.8, 26.4, 19.9, 14.3; HRMS-ESI (m/z) $[M + H]^+$ calcd for $C_{21}H_{22}N_2O_4$: 367.1652; Found, 367.1656.



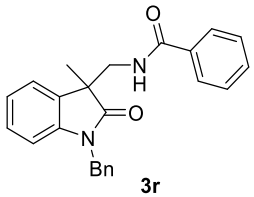
3p

***N*-((1,3-Dimethyl-2-oxo-5-(trifluoromethyl)indolin-3-yl)methyl)benzamide (3p):** The resultant residue was purified by flash silica gel column chromatography to afford **3p** as colorless solid (40 mg, 56%); m.p. = 126–128 ^{o}C; ^{1}H NMR ($CDCl_3$, 600 MHz) δ: 7.80–7.79 (m, 2H), 7.61–7.58 (m, 2H), 7.52–7.49 (m, 1H), 7.45–7.42 (m, 2H), 7.21 (d, *J* = 6.2 Hz, 1H), 6.96, (d, *J* = 8.2 Hz, 1H), 4.25 (dd, *J* = 8.4, 13.6 Hz, 1H), 3.30-2.74 (m, 4H), 1.50 (s, 3H); ^{19}F NMR ($CDCl_3$, 376 MHz) δ: 61.5; ^{13}C NMR ($CDCl_3$, 150 MHz) δ: 180.1, 167.5, 145.8, 134.2, 132.6, 131.6, 128.6, 127.2, 126.9, 126.3 (q, *J* = 4.4 Hz, 1C), 125.4, (q, *J* = 32 Hz, 1C), 124.2 (q, *J* = 270 Hz, 1C), 120.2 (q, *J* = 3.4 Hz, 1C), 108.2, 47.4, 44.8, 26.4, 20.0; HRMS-ESI (m/z) $[M + H]^+$ calcd for $C_{19}H_{17}F_3N_2O_2$: 363.1315; Found, 363.1317.



3q

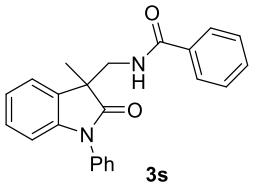
***N*-((1-Methyl-2-oxo-1,2,5,6-tetrahydro-4H-pyrrolo[3,2,1-ij]quinolin-1 yl)methyl)benzamide (3q):** The resultant residue was purified by flash silica gel column chromatography to afford **3q** as yellow oil (35 mg, 55%); ^{1}H NMR ($CDCl_3$, 400 MHz) δ: 7.83–7.81 (m, 2H), 7.51–7.39 (m, 4H), 7.14 (d, *J* = 7.2 Hz, 1H), 7.07 (d, *J* = 7.0 Hz, 1H), 7.00 (t, *J* = 7.4 Hz, 1H), 7.25 (dd, *J* = 8.4, 13.6 Hz, 1H), 3.74 (t, *J* = 5.8 Hz, 2H), 3.25 (dd, *J* = 2.7, 13,6 Hz, 1H), 2.81 (t, *J* = 6.0 Hz, 2H), 2.04 (p, *J* = 6.2 Hz, 2H), 1.48 (s, 3H); ^{13}C NMR ($CDCl_3$, 100 MHz) δ: 179.1, 167.4, 138.5, 134.3, 131.4, 130.6, 128.5, 127.3, 126.9, 122.6, 120.8, 120.5, 48.4, 45.1, 38.8, 24.4, 21.1, 20.0; HRMS-ESI (m/z) $[M + H]^+$ calcd for $C_{20}H_{20}N_2O_2$: 321.1598; Found, 321.1602.



3r

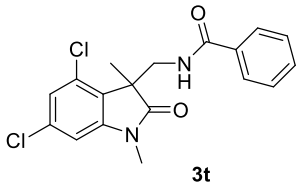
***N*-((1-Benzyl-3-methyl-2-oxoindolin-3-yl)methyl)benzamide (3r):** The resultant residue was purified by flash silica gel column chromatography to afford **3r** as

colorless oil (37 mg, 50%); ^{1}H NMR ($CDCl_3$, 400 MHz) δ: 7.73–7.71 (m, 2H), 7.54–7.47 (m, 2H), 7.38 (t, *J* = 7.2 Hz, 2H), 7.26 (s, 5H), 7.20 (dt, *J* = 1.1, 7.7 Hz, 2H), 7.11-7.07 (m, 1H), 6.79 (d, *J* = 7.7 Hz, 1H), 4.94 (q, *J* = 20.0 Hz, 2H), 4.27 (dd, *J* = 7.8, 13.6 Hz, 1H), 3.46 (dd, *J* = 3.2, 13.6 Hz, 1H), 1.52 (s, 3H); ^{13}C NMR ($CDCl_3$, 100 MHz) δ: 180.4, 167.5, 142.0, 135.6, 134.2, 131.9, 131.5, 128.9, 128.6, 128.5, 127.8, 127.2, 127.0, 123.2, 123.2, 109.4, 47.6, 45.2, 43.7, 20.6; HRMS-ESI (m/z) [M + H]$^+$ calcd for $C_{24}H_{22}N_2O_2$: 371.1754; Found, 371.1757.



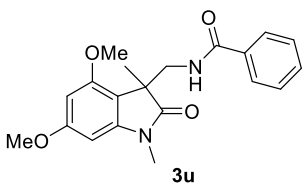
3s

***N*-((3-Methyl-2-oxo-1-phenylindolin-3-yl)methyl)benzamide (3s):** The resultant residue was purified by flash silica gel column chromatography to afford **3s** as yellow oil (41 mg, 58%); ^{1}H NMR ($CDCl_3$, 400 MHz) δ: 7.83 (d, *J* = 7.2 Hz, 2H), 7.55, (t, *J* = 7.8 Hz, 2H), 7.49–7.40 (m, 8H), 7.28–-7.24 (m, 1H), 7.17 (t, *J* = 7.2 Hz, 1H), 6.88 (d, *J* = 7.6 Hz, 1H), 4.37 (dd, *J* = 8.6, 13.6 Hz, 1H), 3.39 (dd, *J* = 2.8, 13.6Hz, 1H), 1.60 (s, 3H); ^{13}C NMR ($CDCl_3$, 100 MHz) δ: 179.9, 167.5, 142.7, 134.2, 134.0, 131.8, 131.5, 129.7, 128.5, 128.4, 128.3, 127.0, 126.4, 123.6, 123.4, 109.7, 47.5, 45.3, 20.5; HRMS-ESI (m/z) [M + H]$^+$ calcd for $C_{23}H_{20}N_2O_2$: 357.1598; Found, 357.1601.



3t

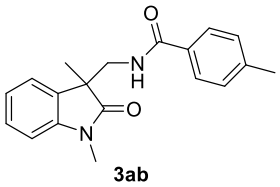
***N*-((4,6-Dichloro-1,3-dimethyl-2-oxoindolin-3-yl)methyl)benzamide (3t):** The resultant residue was purified by flash silica gel column chromatography to afford **3t** as colorless oil (30 mg, 42%); ^{1}H NMR ($CDCl_3$, 400 MHz) δ: 7.74–7.72 (m, 2H), 7.51–7.48 (m, 1H), 7.42 (t, *J* = 7.7 Hz, 1H), 7.17 (d, *J* = 4.6 Hz, 1H), 7.07 (d, *J* = 1.6 Hz, 1H), 6.79 (d, *J* = 1.6 Hz, 1H), 4.53 (dd, *J* = 8.0, 13.6 Hz, 1H), 3.50 (dd, *J* = 3.5, 13.6 Hz, 1H), 3.22 (s, 3H), 1.59 (s, 3H); ^{13}C NMR ($CDCl_3$, 100 MHz) δ: 179.6, 167.8, 145.5, 135.2, 131.8, 131.7, 128.6, 127.0, 126.5, 123.8, 107.9, 49.0, 42.8, 26.7, 17.6; HRMS-ESI (m/z) [M + H]$^+$ calcd for $C_{18}H_{16}Cl_2N_2O_2$: 363.0662; Found, 363.0664.



3u

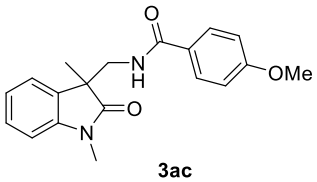
***N*-((4,6-Dimethoxy-1,3-dimethyl-2-oxoindolin-3-yl)methyl)benzamide (3u):** The resultant residue was purified by flash silica gel column chromatography to afford **3u**

as yellow oil (32 mg, 45%); ^{1}H NMR ($CDCl_3$, 600 MHz) δ: 7.81 (d, *J* = 5.0 Hz, 2H), 7.49 (t, *J* = 4.8 Hz, 1H), 7.43 (t, *J* = 5.2 Hz, 3H), 6.21 (d, *J* = 1.1 Hz, 1H), 6.13 (d, *J* = 1.1 Hz, 1H), 4.30 (dd, *J* = 5.0, 13.6 Hz, 1H), 3.86 (s, 3H), 3.84 (s, 3H), 3.36 (dd, *J* = 2.0, 13.6 Hz, 1H), 3.21 (s, 3H), 1.50 (s, 3H); ^{13}C NMR ($CDCl_3$, 150 MHz) δ: 180.9, 167.4, 161.9, 157.0, 144.9, 134.7, 131.3, 128.5, 127.0, 109.8, 92.6, 88.7, 55.7, 55.5, 47.2, 44.2, 26.4, 18.3; HRMS-ESI (m/z) $[M + H]^+$ calcd for $C_{20}H_{22}N_2O_4$: 355.1652; Found, 355.1656.



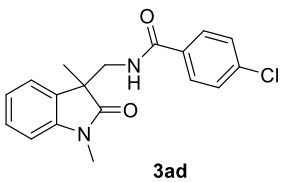
3ab

***N*-((1,3-Dimethyl-2-oxoindolin-3-yl)methyl)-4-methylbenzamide (3ab):** The resultant residue was purified by flash silica gel column chromatography to afford **3ab** as colorless solid (43 mg, 70%); m.p. = 122–124 ^{o}C; ^{1}H NMR ($CDCl_3$, 400 MHz) δ: 7.71 (d, *J* = 8.1 Hz, 2H), 7.34–7.29 (m, 3H), 7.23 (d, *J* = 8.0 Hz, 2H), 7.15–7.11 (m, 1H), 6.89 (d, *J* = 7.7 Hz, 1H), 4.24 (dd, *J* = 8.4, 13.6 Hz, 1H), 3.25-3.21 (m, 4H), 2.39 (s, 3H), 1.46 (s, 3H); ^{13}C NMR ($CDCl_3$, 100 MHz) δ: 180.3, 167.4, 142.7, 141.9, 132.0, 131.4, 129.2, 128.5, 126.9, 123.1, 123.0, 128.3, 47.2, 45.0, 26.2, 21.4, 20.1; HRMS-ESI (m/z) $[M + H]^+$ calcd for $C_{19}H_{20}N_2O_2$: 309.1598; Found, 309.1599.



3ac

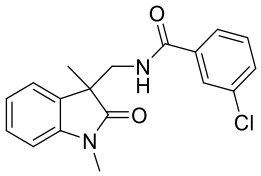
***N*-((1,3-Dimethyl-2-oxoindolin-3-yl)methyl)-4-methoxybenzamide (3ac):** The resultant residue was purified by flash silica gel column chromatography to afford **3ac** as colorless oil (40 mg, 62%); ^{1}H NMR ($CDCl_3$, 400 MHz) δ: 7.80–7.77 (m, 2H), 7.34–7.30 (m, 2H), 7.25 (d, *J* = 10.6 Hz, 1H), 7.14–7.10 (m, 1H), 6.94–6.88 (m, 3H), 4.24 (dd, *J* = 8.4, 13.6 Hz, 1H), 3.84 (s, 3H), 3.25 (s, 3H), 3.22 (dd, *J* = 2.8, 13.6 Hz, 1H), 1.46 (s, 3H); ^{13}C NMR ($CDCl_3$, 100 MHz) δ: 180.3, 167.0, 162.1, 142.8, 132.1, 128.7, 128.4, 126.6, 123.1, 123.0, 113.7, 108.3, 55.3, 47.2, 45.0, 26.2, 20.1; HRMS-ESI (m/z) $[M + H]^+$ calcd for $C_{19}H_{20}N_2O_3$: 325.1547; Found, 325.1548.



3ad

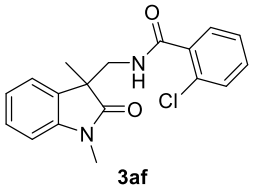
4-Chloro-*N*-((1,3-dimethyl-2-oxoindolin-3-yl)methyl)benzamide (3ad): The resultant residue was purified by flash silica gel column chromatography to afford

3ad as yellow oil (34 mg, 52%); ^{1}H NMR ($CDCl_3$, 400 MHz) δ: 7.76 (d, *J* = 8.5 Hz, 2H), 7.41 (d. *J* = 8.2 Hz, 3H), 7.33 (t, *J* = 7.7 Hz, 2H), 7.13 (t, *J* = 7.6 Hz, 1H), 6.90 (d, *J* = 7.7 Hz, 1H), 4.24 (dd, *J* = 8.5, 13.6 Hz, 1H), 3.26 (s, 3H), 3.21 (dd, *J* = 2.6, 13.6 Hz, 1H), 1.46 (s, 3H); ^{13}C NMR ($CDCl_3$, 100 MHz) δ: 180.3, 166.4, 142.8, 137.8, 132.7, 132.0, 128.9, 128.6, 128.5, 123.3, 123.0, 108.5, 47.1, 45.2, 26.3, 20.3; HRMS-ESI (m/z) $[M + H]^+$ calcd for $C_{18}H_{17}ClN_2O_2$: 329.1051; Found, 329.1055.



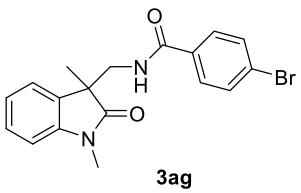
3ae

3-Chloro-*N*-((1,3-dimethyl-2-oxoindolin-3-yl)methyl)benzamide (3ae): The resultant residue was purified by flash silica gel column chromatography to afford **3ae** as white solid (40 mg, 61%); m.p. = 98–100 ^{o}C; ^{1}H NMR ($CDCl_3$, 600 MHz) δ: 7.79 (t, *J* = 0.8 Hz, 1H), 7.66 (d, *J* = 5.2 Hz, 1H), 7.47–7.45 (m, 1H), 7.38–7.35 (m, 2H), 7.34–7.31 (m, 2H), 7.13 (t, *J* = 3.2 Hz, 1H), 6.90 (d, *J* = 3.2 Hz, 1H), 4.22 (dd, *J* = 3.3, 13.6 Hz, 1H), 3.26–3.24 (m, 4H), 1.47 (s, 3H); ^{13}C NMR ($CDCl_3$, 150 MHz) δ: 180.2, 166.2, 142.8, 136.1, 134.8, 131.9, 131.6, 129.9, 128.6, 127.5, 124.9, 123.3, 123.1, 108.5, 47.2, 45.2, 26.3, 20.3; HRMS-ESI (m/z) $[M + H]^+$ calcd for $C_{18}H_{17}ClN_2O_2$: 329.1051; Found, 329.1053.



3af

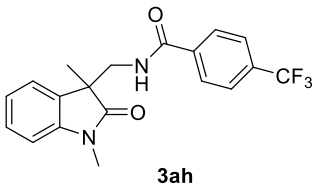
2-Chloro-*N*-((1,3-dimethyl-2-oxoindolin-3-yl)methyl)benzamide (3af): The resultant residue was purified by flash silica gel column chromatography to afford **3af** as yellow oil (42 mg, 64%); ^{1}H NMR ($CDCl_3$, 400 MHz) δ: 7.50 (dd, *J* = 0.6, 8.0 Hz, 1H), 7.36–7.29 (m, 5H), 7.14–7.10 (m, 1H), 6.87 (d, *J* = 7.8 Hz, 1H), 4.10 (dd, *J* = 7.4, 13.6 Hz, 1H), 3.53 (dd, *J* = 4.4, 13.6 Hz, 1H), 3.22 (s, 3H), 1.49 (s, 3H); ^{13}C NMR ($CDCl_3$, 100 MHz) δ: 179.8, 166.7, 143.1, 135.1, 131.7, 131.2, 130.6, 130.2, 129.9, 128.6, 127.0, 123.3, 123.1, 108.3, 47.8, 45.2, 26.3, 20.7; HRMS-ESI (m/z) $[M + H]^+$ calcd for $C_{18}H_{17}ClN_2O_2$: 329.1051; Found, 329.1054.



3ag

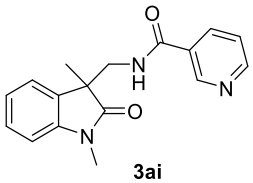
4-Bromo-*N*-((1,3-dimethyl-2-oxoindolin-3-yl)methyl)benzamide (3ag): The resultant residue was purified by flash silica gel column chromatography to afford **3ag**

as colorless oil (37 mg, 50%); ^{1}H NMR ($CDCl_3$, 400 MHz) δ: 7.69 (d, *J* = 8.6 Hz, 2H), 7.57 (d, *J* = 8.6 Hz, 2H), 7.41 (d, *J* = 8.6 Hz, 1H), 7.35–7.31(m, 2H), 7.13 (t, *J* = 7.2 Hz, 1H), 6.90 (d, *J* = 7.7 Hz, 1H), 4.24 (dd, *J* = 8.4, 13.6 Hz, 1H), 3.25 (s, 3H), 3.21 (*J* = 2.6, 13.6 Hz, 1H), 1.46 (s, 3H); ^{13}C NMR ($CDCl_3$, 100 MHz) δ: 180.3, 166.5, 142.8, 133.1, 131.9, 131.8, 128.6, 126.2, 123.3, 123.0, 108.5, 47.1, 45.2, 26.3, 20.3; HRMS-ESI (m/z) $[M + H]^+$ calcd for $C_{18}H_{17}BrN_2O_2$: 373.0546; Found, 373.0548.



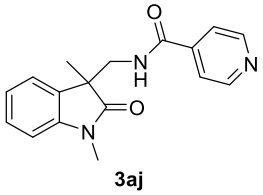
3ah

***N*-((1,3-Dimethyl-2-oxoindolin-3-yl)methyl)-4-(trifluoromethyl)benzamide (3ah):** The resultant residue was purified by flash silica gel column chromatography to afford **3ah** as white solid (46 mg, 63%); m.p. = 61–63 ^{o}C; ^{1}H NMR ($CDCl_3$, 400 MHz) δ: 7.92 (d, *J* = 8.2 Hz, 2H), 7.70 (d, *J* = 8.2 Hz, 2H), 7.51 (d, *J* = 7.0 Hz, 1H), 7.36–7.32 (m, 2H), 7.14 (t, *J* = 7.6 Hz, 1H), 6.91 (d, *J* = 7.6 Hz, 1H), 4.26 (dd, *J* = 8.4, 13.6 Hz, 1H), 3.27–3.23 (m, 4H), 1.48 (s, 3H); ^{19}F NMR ($CDCl_3$, 376 MHz) δ: 62.9; ^{13}C NMR ($CDCl_3$, 100 MHz) δ: 180.2, 166.2, 142.7, 137.5, 133.4, 131.8, 128.7, 127.4, 125.6, (q, *J* = 3.7 Hz, 1C), 122.6 (q, *J* = 270 Hz, 1C), 123.2, 123.0, 108.5, 47.0, 45.2, 26.2, 20.2; HRMS-ESI (m/z) $[M + H]^+$ calcd for $C_{19}H_{17}F_3N_2O_2$: 363.1315; Found, 363.1317.



3ai

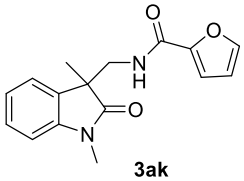
***N*-((1,3-Dimethyl-2-oxoindolin-3-yl)methyl)nicotinamide (3ai):** The resultant residue was purified by flash silica gel column chromatography to afford **3ai** as brown oil (28 mg, 48%); ^{1}H NMR ($CDCl_3$, 400 MHz) δ: 9.00 (s, 1H), 8.73 (d, *J* = 3.9 Hz, 1H), 8.11 (td, *J* = 7.9, 1.9 Hz, 1H), 7.43–7.32 (m, 4H), 7.6–7.12 (m, 1H), 6.92–6.90 (m, 1H), 4.24 (dd, *J* = 8.2, 13.6Hz, 1H), 2.9, 13.6 Hz, 1H), 3.26 (s, 3H), 1.48 (s, 3H); ^{13}C NMR ($CDCl_3$, 100 MHz) δ: 180.2, 165.7, 152.3, 148.3, 142.8. 134.9, 131.8, 129.9, 128.7, 123.4, 123.3, 123.1, 108.5, 47.1, 45.2, 26.3,20.3; HRMS-ESI (m/z) $[M + H]^+$ calcd for $C_{17}H_{17}N_3O_2$: 296.1394; Found, 296.1396.



3aj

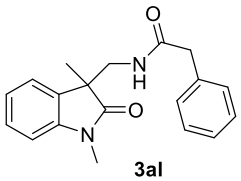
***N*-((1,3-Dimethyl-2-oxoindolin-3-yl)methyl)isonicotinamide (3aj):** The resultant

residue was purified by flash silica gel column chromatography to afford **3aj** as yellow oil (34 mg, 58%); ^{1}H NMR ($CDCl_3$, 400 MHz) δ: 8.74 (dd, *J* = 1.4, 4.5 Hz, 2H), 7.66–7.63 (m, 3H), 7.37–7.32 (m, 2H), 7.4 (dt, *J* = 0.8, 7.6 Hz, 1H), 6.92 (d, *J* = 7.8 Hz, 1H), 4.24 (dd, *J* = 8.4, 13.6 Hz, 1H), 3.26-3.23 (m, 4H), 1.47 (s, 3H); ^{13}C NMR ($CDCl_3$, 100 MHz) δ: 180.2, 165.6, 150.6, 142.7, 141.3, 131.7, 128.7, 123.3, 123.0, 120.9, 108.6, 46.9, 45.2, 26.3, 20.3; HRMS-ESI (m/z) $[M + H]^+$ calcd for $C_{17}H_{17}N_3O_2$: 296.1394; Found, 296.1390.



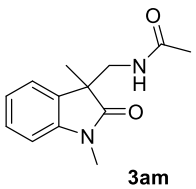
3ak

***N*-((1,3-Dimethyl-2-oxoindolin-3-yl)methyl)furan-2-carboxamide (3ak):** The resultant residue was purified by flash silica gel column chromatography to afford **3ak** as yellow oil (18 mg, 31%); ^{1}H NMR ($CDCl_3$, 400 MHz) δ: 7.46 (t, *J* = 0.9 Hz, 1H), 7.33–7.27 (m, 3H), 7,14–7.09 (m, 2H), 6.88 (d, *J* = 8.2Hz, 1H), 6.48 (q, *J* = 1.7 Hz, 1H), 4.11 (dd, *J* = 8.2, 13.6 Hz, 1H), 3.32 (dd, *J* = 3.6, 13.6 Hz, 1H), 3.25 (s, 3H), 1.45 (s, 3H); ^{13}C NMR ($CDCl_3$, 100 MHz) δ: 179.9, 158.6, 147.8, 144.1, 142.9, 131.9, 128.5, 123.1, 114.3, 112.0, 108.4, 47.4, 44.3, 26.3, 20.2; HRMS-ESI (m/z) $[M + H]^+$ calcd for $C_{16}H_{16}N_2O_3$: 285.1234; Found, 285.1237.



3al

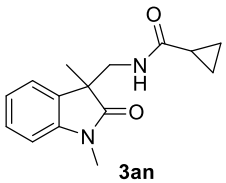
***N*-((1,3-Dimethyl-2-oxoindolin-3-yl)methyl)-2-phenylacetamide (3al)** : The resultant residue was purified by flash silica gel column chromatography to afford **3al** as colorless oil (14 mg, 23%); ^{1}H NMR ($CDCl_3$, 400 MHz) δ: 7.33–7.27 (m, 4H), 7.18 (d, *J* = 7.3 Hz, 1H), 7.08–7.05 (m, 3H), 6.80 (d, *J* = 7.8 Hz, 1H), 5.89 (s, 1H), 3.73 (dd, *J* = 6.8, 13.6 Hz, 1H), 3.47 (d, *J* = 4.6 Hz, 2H), 3.40 (dd, *J* = 5.2, 13.6 Hz, 1H), 3.10 (s, 3H), 1.30 (s, 3H); ^{13}C NMR ($CDCl_3$, 100 MHz) δ: 179.5, 171.0, 142.9, 134.7, 131.6, 129.3, 129.0, 128.4, 127.4, 123.2, 123.0, 108.2, 47.9, 44.7, 43.8, 26.2, 20.2; HRMS-ESI (m/z) $[M + H]^+$ calcd for $C_{19}H_{20}N_2O_2$: 309.1598; Found, 309.1595.



3am

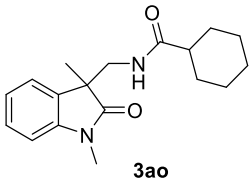
***N*-((1,3-Dimethyl-2-oxoindolin-3-yl)methyl)acetamide (3am):** The resultant residue was purified by flash silica gel column chromatography to afford **3am** as yellow oil

(23 mg, 49%); ^{1}H NMR ($CDCl_3$, 400 MHz) δ: 7.33–7.26 (m, 2H), 7.10 (dt, *J* = 0.8, 7.6 Hz, 1H), 6.88 (d, *J* = 7.8 Hz, 1H), 6.39 (d, *J* = 4.2 Hz, 1H), 3.98 (dd, *J* = 8.1, 13.6 Hz, 1H), 3.23 (s, 3H), 3.12 (dd, *J* = 3.3, 13.6 Hz, 1H), 1.98 (s, 3H), 1.40 (s, 3H); ^{13}C NMR ($CDCl_3$, 100 MHz) δ: 180.1, 170.3, 142.8, 132.0, 128.5, 123.1, 123.1, 108.3, 47.2, 44.7, 26.2, 23.3, 20.2; HRMS-ESI (m/z) $[M + H]^+$ calcd for $C_{13}H_{16}N_2O_2$: 233.1285; Found, 233.1288.



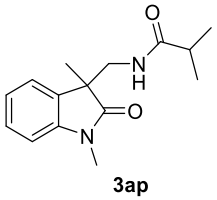
3an

***N*-((1,3-Dimethyl-2-oxoindolin-3-yl)methyl)cyclopropanecarboxamide (3an):** The resultant residue was purified by flash silica gel column chromatography to afford **3an** as white soild (18 mg, 34%); m.p. = 160–162 ^{o}C; ^{1}H NMR ($CDCl_3$, 400 MHz) δ: 7.33–7.25 (m, 2H), 7.09 (dt, *J* = 0.6, 7.6 Hz, 1H), 6.87 (d, *J* = 7.8 Hz, 1H), 6.51 (d, *J* = 5.2 Hz, 1H), 3.99 (dd, *J* = 8.2, 13.6 Hz, 1H), 3.24 (s, 3H), 3.14 (dd, *J* = 3.4, 13.6 Hz, 1H), 1.41–1.34 (m, 4H), 1.00–0.94 (m, 1H), 0.89–0.84 (m, 1H), 0.77–0.66 (m, 2H); ^{13}C NMR ($CDCl_3$, 100 MHz) δ: 180.2, 173.9, 142.9, 132.1, 128.4, 123.1, 123.0, 108.3, 47.4, 44.8,26.3, 20.1, 14.8, 7.2, 7.1; HRMS-ESI (m/z) $[M + H]^+$ calcd for $C_{15}H_{18}N_2O_2$: 259.1441; Found, 259.1444.



3ao

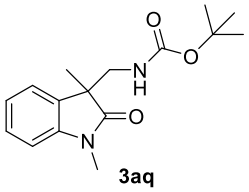
***N*-((1,3-Dimethyl-2-oxoindolin-3-yl)methyl)cyclohexanecarboxamide (3ao):** The resultant residue was purified by flash silica gel column chromatography to afford **3ao** as yellow solid (23 mg, 38%); m.p. = 60–62 ^{o}C; ^{1}H NMR ($CDCl_3$, 400 MHz) δ: 7.32–7.26 (m, 2H), 7.10 (dt, *J* = 0.7, 7.6 Hz, 1H), 6.87 (d, *J* = 7.7 Hz, 1H), 6.37 (d, *J* = 4.4 Hz, 1H), 3.95 (dd, *J* = 8.0, 13.6 Hz, 1H), 3.23 (s, 3H), 3.15 (dd, *J* = 3.6, 13.6 Hz, 1H), 2.07 (tt, *J* = 3.0, 11.3 Hz, 1H), 1.86–1.63 (m, 5H), 1.41–1.20 (m, 8H); ^{13}C NMR ($CDCl_3$, 100 MHz) δ: 180.2, 176.2, 142.8, 132.0, 128.4, 123.1, 123.0, 108.2, 47.5, 45.5, 44.2, 29.6, 29.5, 26.2, 25.7, 25.6, 20.0; HRMS-ESI (m/z) $[M + H]^+$ calcd for $C_{18}H_{24}N_2O_2$: 309.1911; Found, 309.1913.



3ap

***N*-((1,3-Dimethyl-2-oxoindolin-3-yl)methyl)isobutyramide (3ap):** The resultant

residue was purified by flash silica gel column chromatography to afford **3ap** as colorless oil (16 mg, 32%); ^{1}H NMR ($CDCl_3$, 400 MHz) δ: 7.32–7.27 (m, 2H), 7.10 (t, *J* = 7.6 Hz, 1H), 6.86 (d, *J* = 7.7 Hz, 1H), 6.31 (s, 1H), 3.92 (dd, *J* = 7.8, 13.6 Hz, 1H), 3.24–3.20 (m, 4H), 2.33 (p, *J* = 6.9 Hz, 1H), 1.39 (s, 3H), 1.12 (d, *J* = 6.9 Hz, 3H), 1.03 (dd, *J* = 6.9 Hz, 3H); ^{13}C NMR ($CDCl_3$, 100 MHz) δ: 180.2, 177.1, 142.9, 132.0, 128.4, 123.2, 123.1, 108.2, 47.7, 44.3, 35.7, 26.2, 20.1, 19.5, 19.5; HRMS-ESI (m/z) $[M + H]^+$ calcd for $C_{15}H_{20}N_2O_2$: 261.1598; Found, 261.1597.



3aq

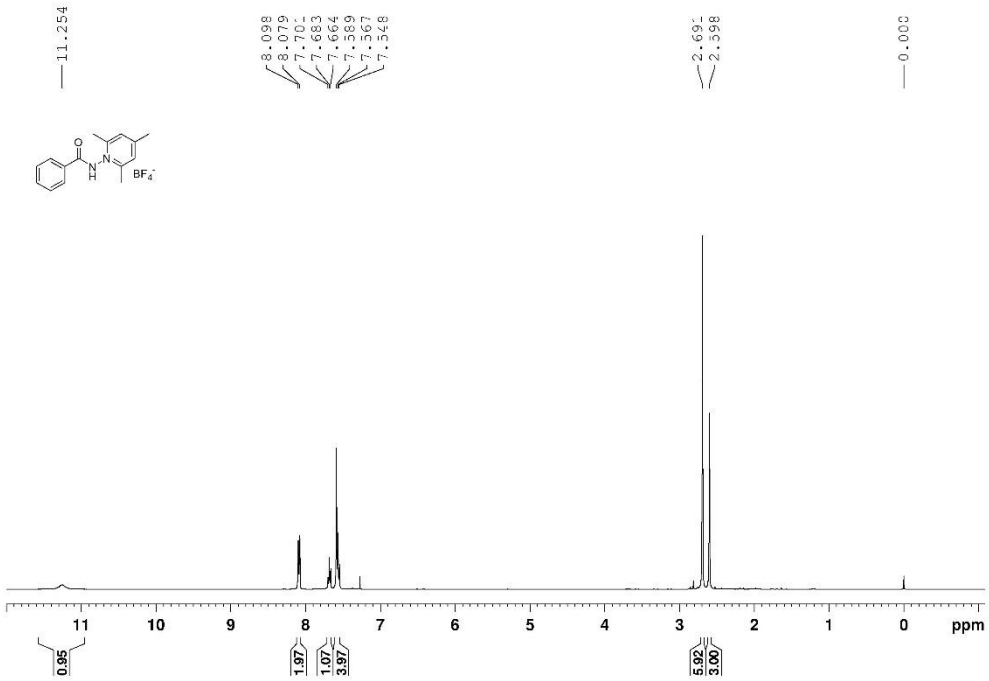
***tert*-Butyl ((1,3-dimethyl-2-oxoindolin-3-yl)methyl)carbamate (3aq):** The resultant residue was purified by flash silica gel column chromatography to afford **3aq** as colorless oil (34 mg, 59%); ^{1}H NMR ($CDCl_3$, 400 MHz) δ: 7.31–7.25 (m, 2H), 7.08 (dt, *J* = 0.8, 7.6 Hz, 1H), 6.85 (d, *J* = 7.8 Hz, 1H), 5.10 (s, 1H), 3.64 (dd, *J* = 7.8, 13.6 Hz, 1H), 3.27–3.22 (m, 4H), 1.38 (d, *J* = 7.6 Hz, 12H); ^{13}C NMR ($CDCl_3$, 100 MHz) δ: 179.7, 155.9, 143.1, 131.9, 128.2, 123.1, 122.7, 108.0, 79.2, 48.1, 46.2, 28.2, 26.2, 19.9; HRMS-ESI (m/z) $[M + H]^+$ calcd for $C_{16}H_{22}N_2O_3$: 291.1703; Found, 291.1705.

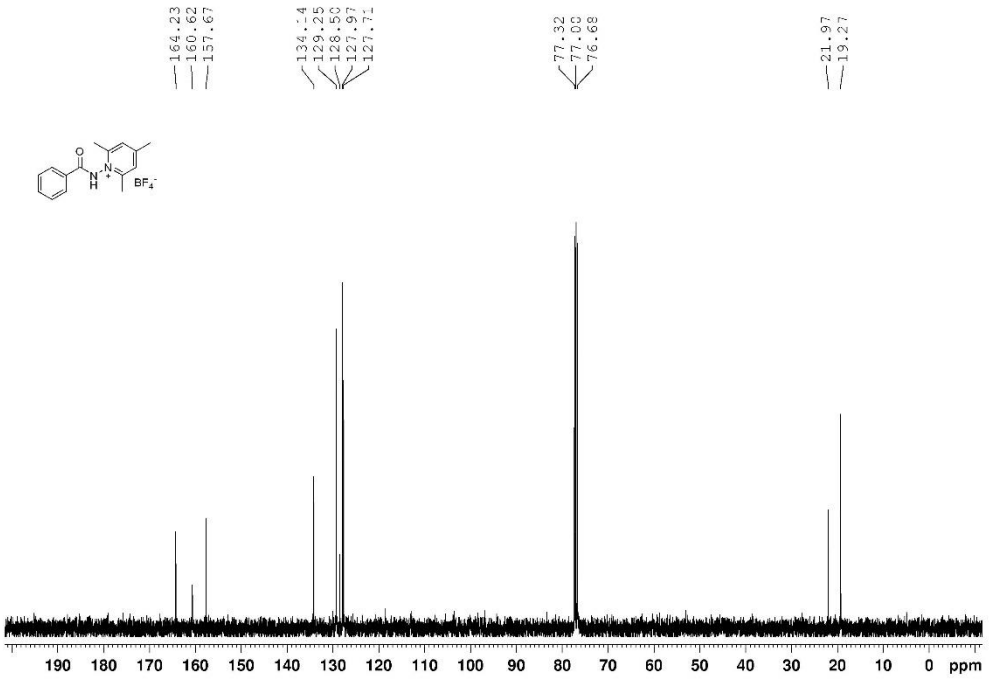
10. References.

1. X. Liu, X. Ma, Y. Huang and Z. Gu, *Org. Lett.*, 2013, **15**, 4814–4817.
2. A. Pinto, Y. Jia, L. Neuville and J. Zhu, *Chem. Eur. J.*, 2007, **13**, 961–967.
3. W. Guo, Q. Wang and J. Zhu, *Angew. Chem. Int. Ed.*, 2021, **60**, 4085–4089.

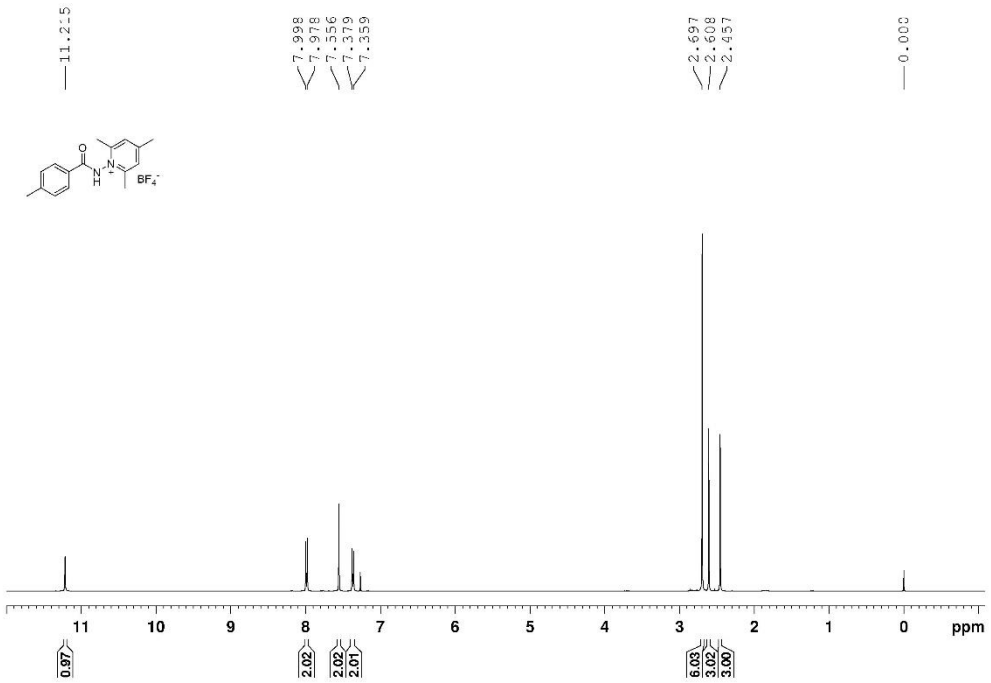
11. Copies of NMR spectra

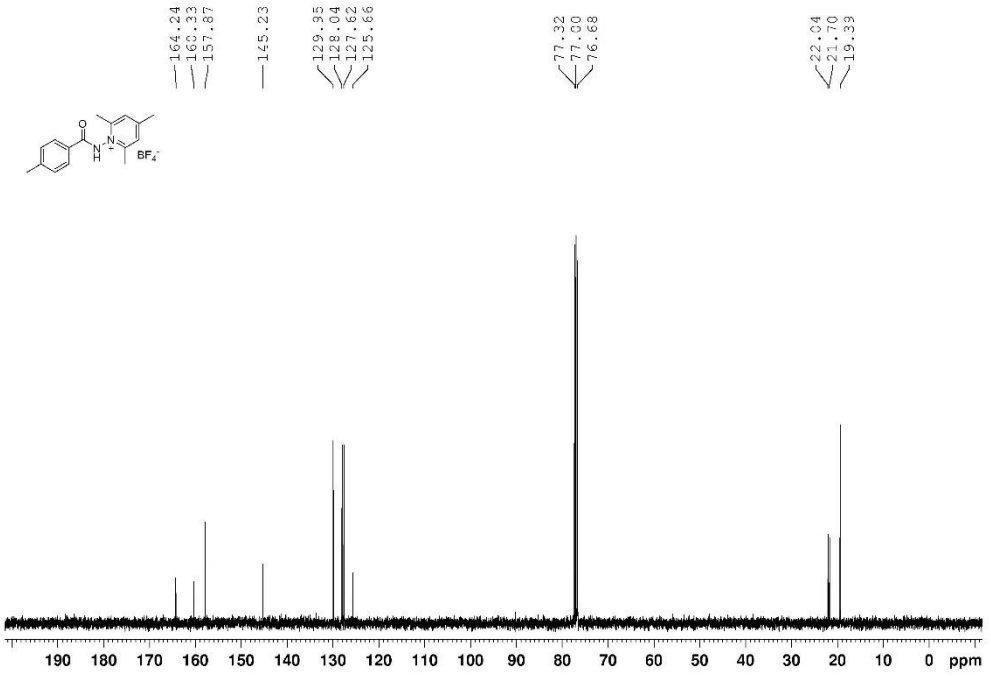
2a; ^{1}H NMR (400 Hz, $CDCl_3$); ^{13}C NMR (100 Hz, $CDCl_3$)



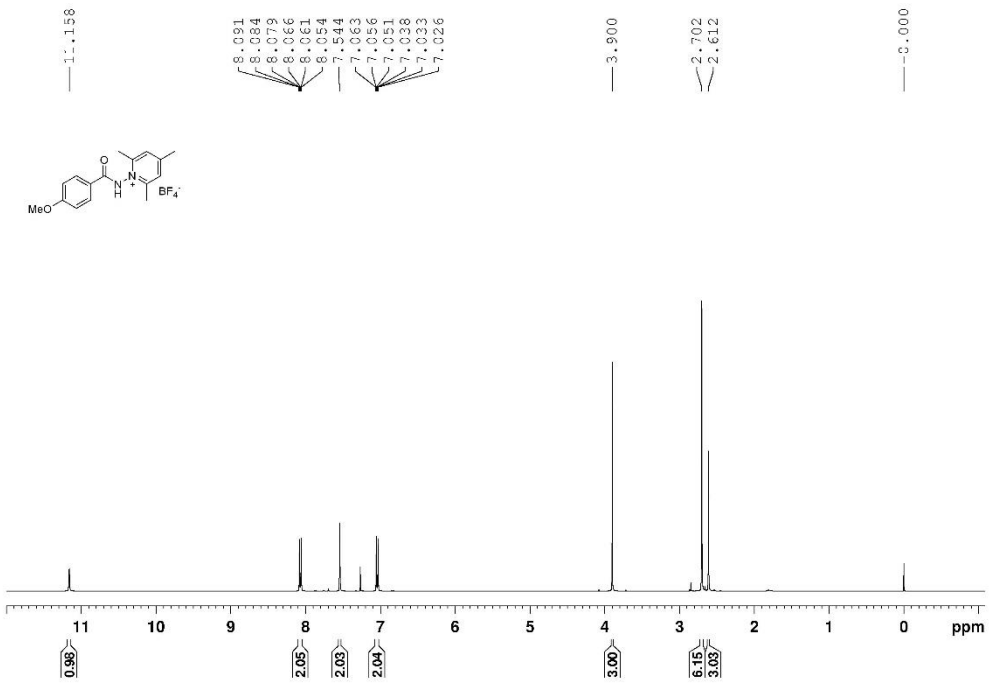


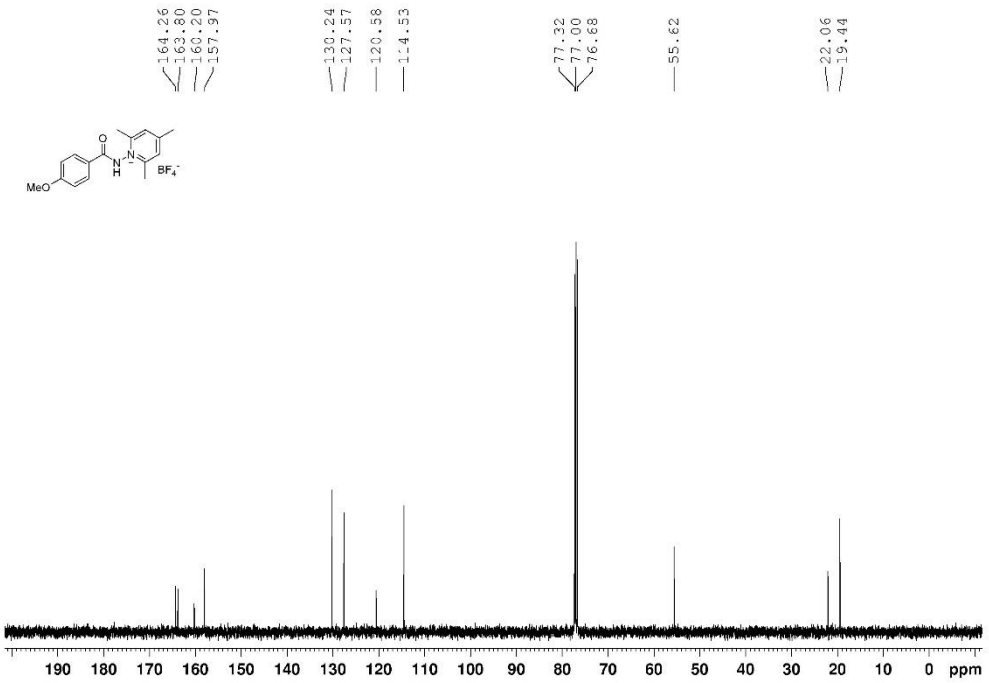
2b; ^{1}H NMR (400 Hz, $CDCl_3$); ^{13}C NMR (100 Hz, $CDCl_3$)



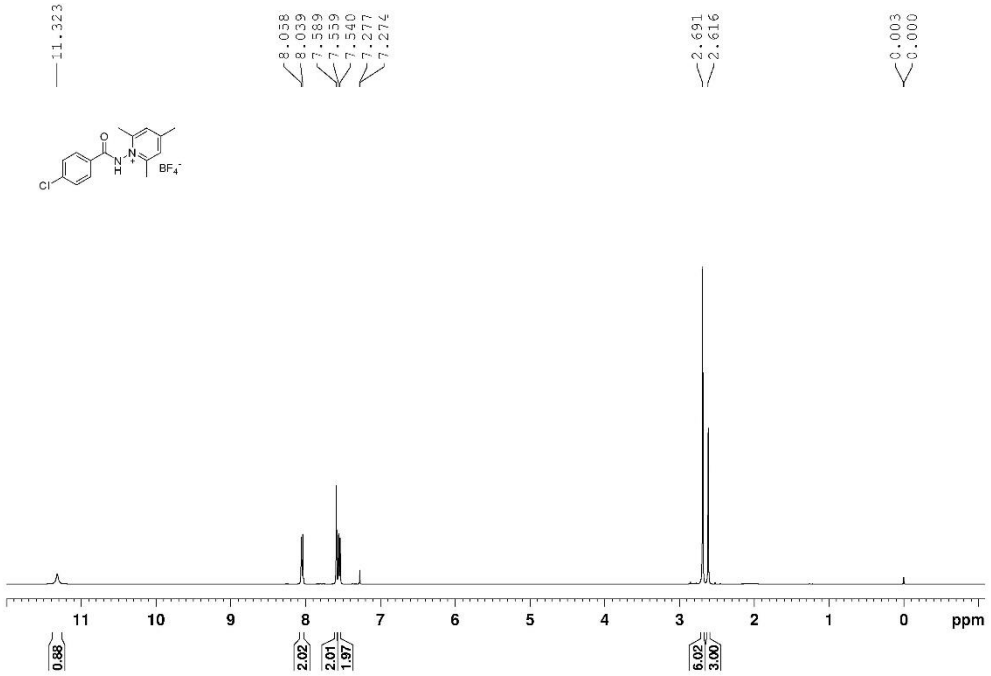


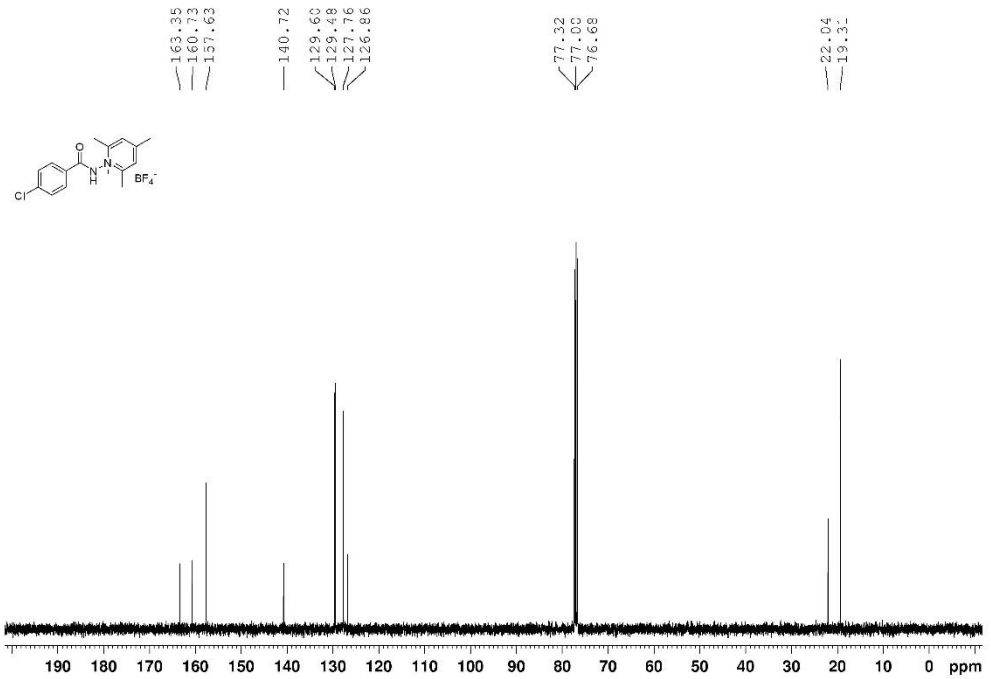
2c; ^{1}H NMR (400 Hz, $CDCl_3$); ^{13}C NMR (100 Hz, $CDCl_3$)



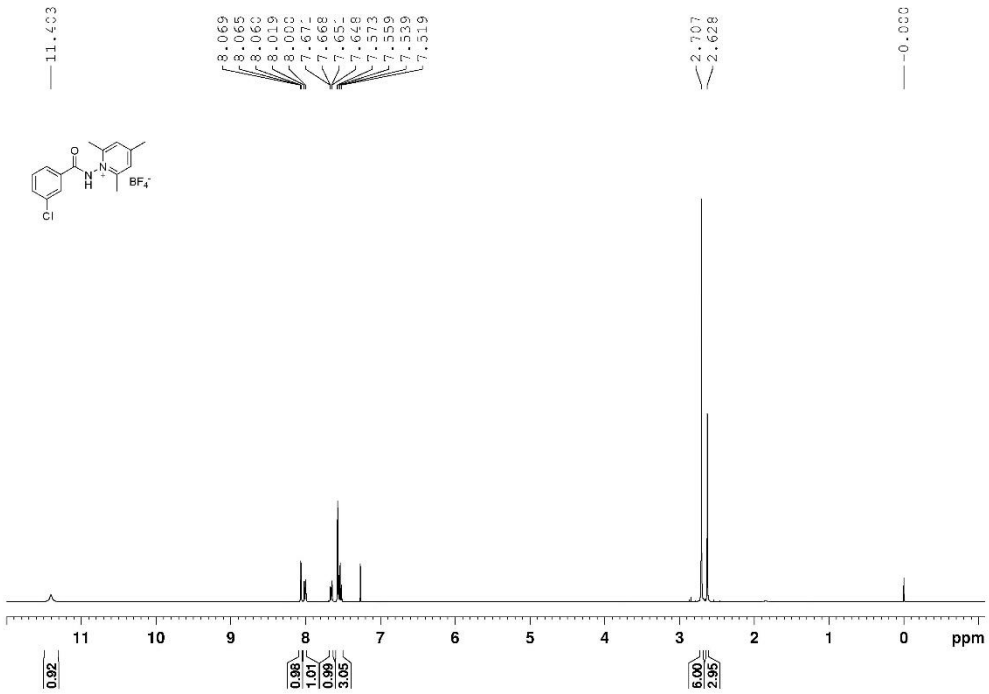


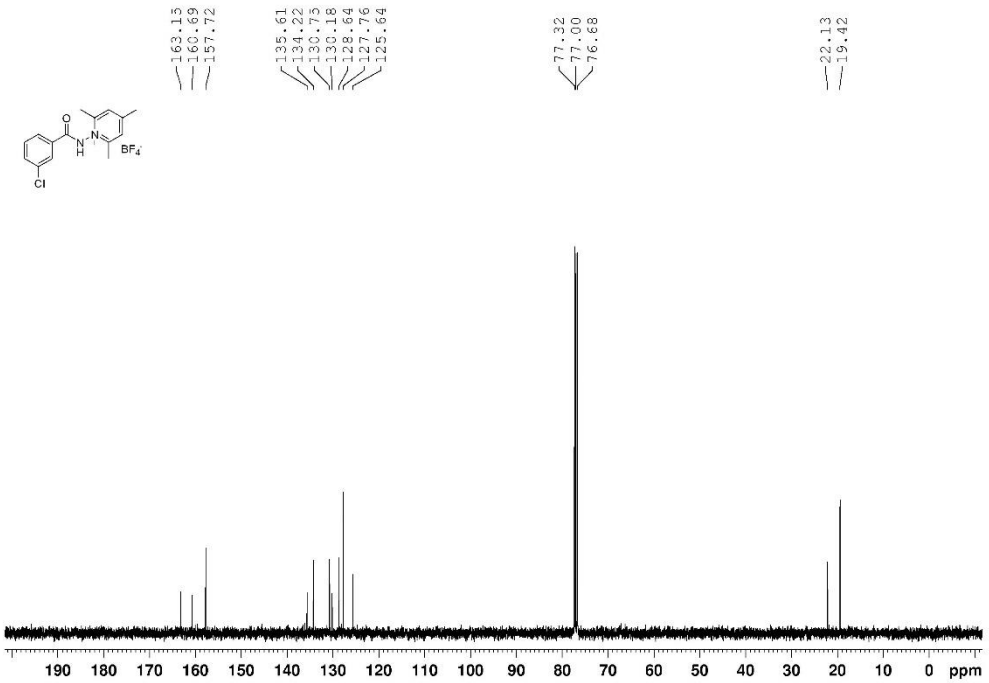
2d; ^{1}H NMR (400 Hz, $CDCl_3$); ^{13}C NMR (100 Hz, $CDCl_3$)



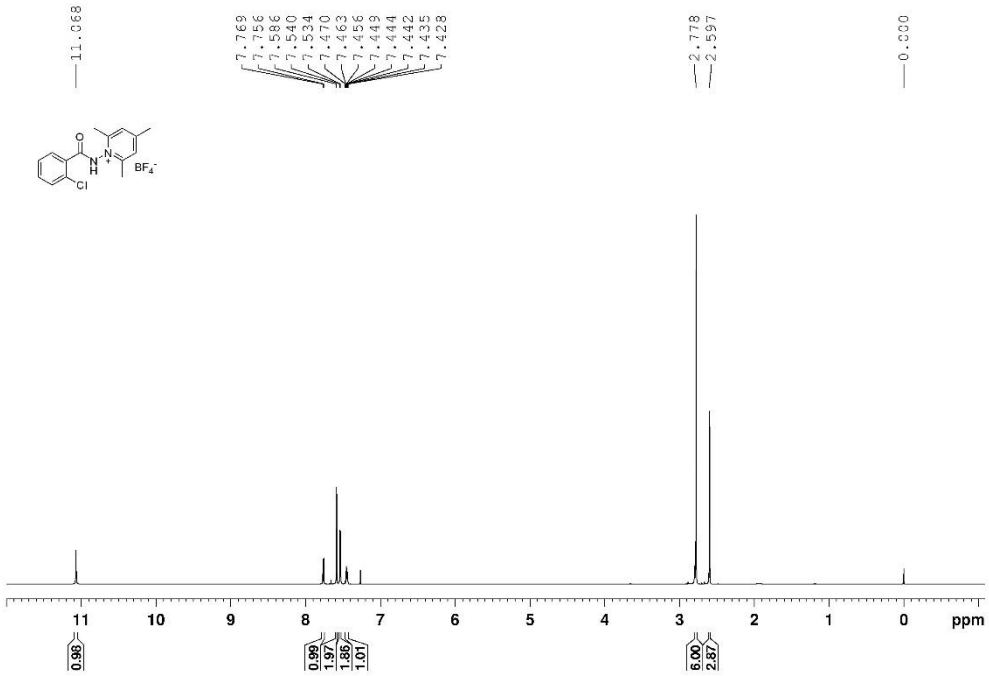


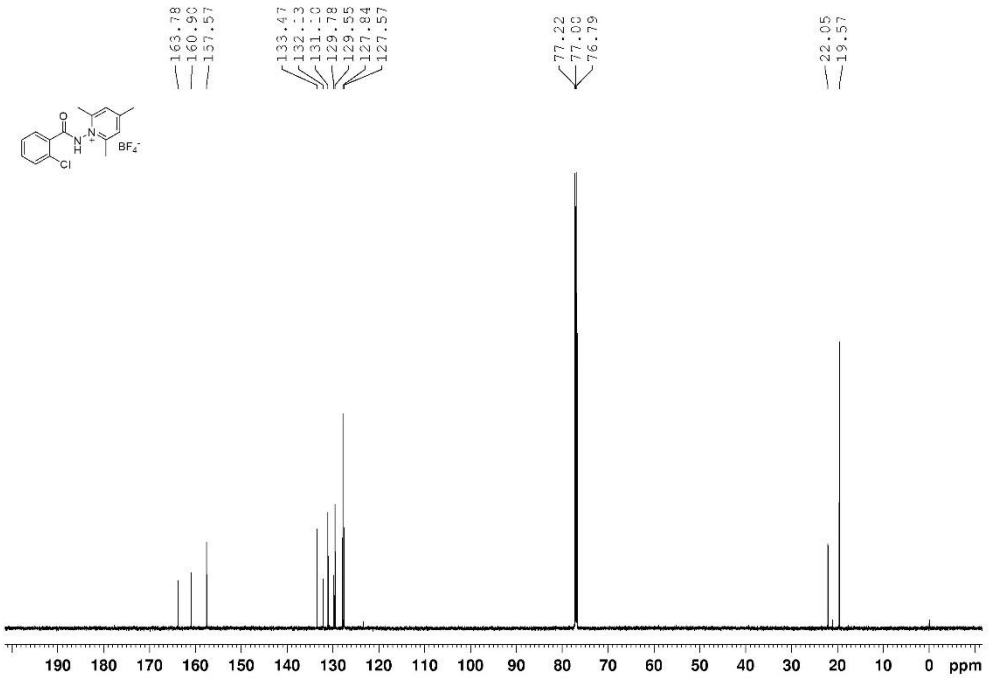
2e; ^{1}H NMR (400 Hz, $CDCl_3$); ^{13}C NMR (100 Hz, $CDCl_3$)



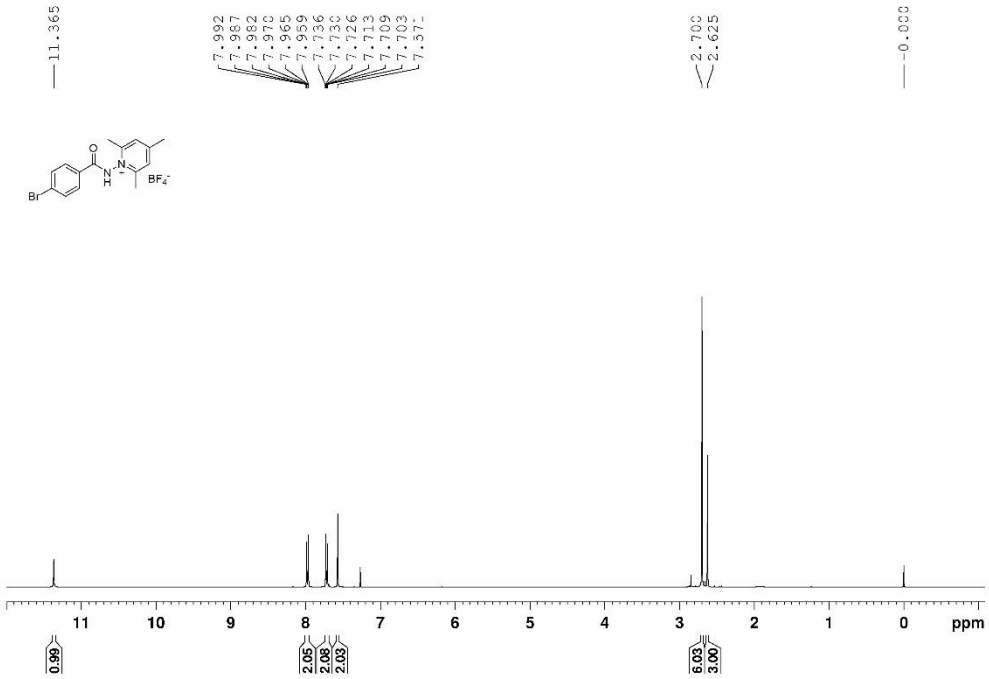


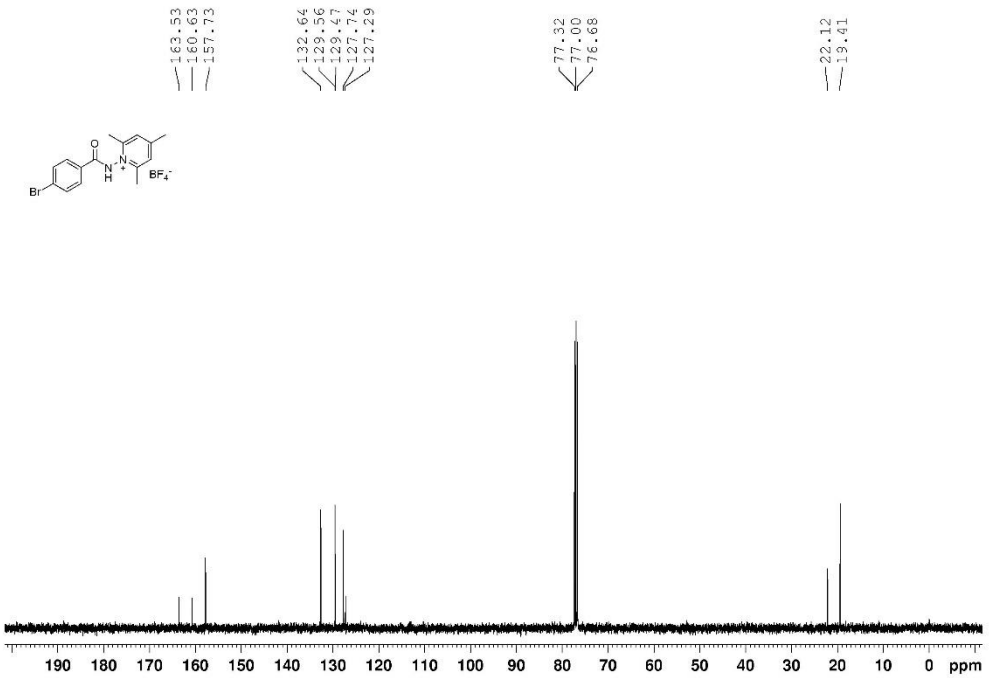
2f; ^{1}H NMR (600 Hz, $CDCl_3$); ^{13}C NMR (150 Hz, $CDCl_3$)



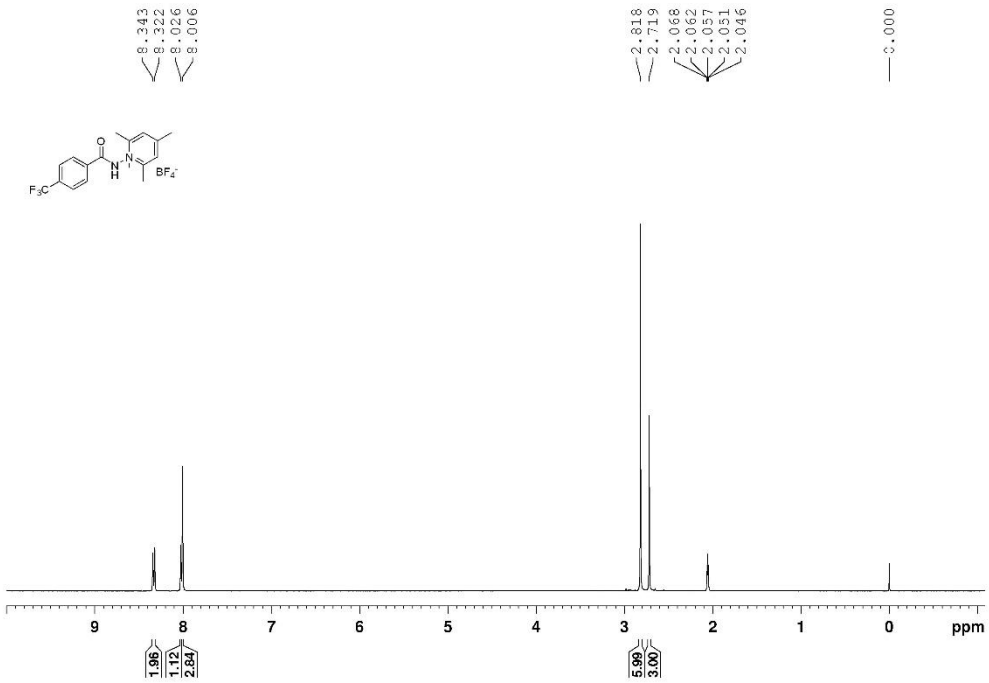


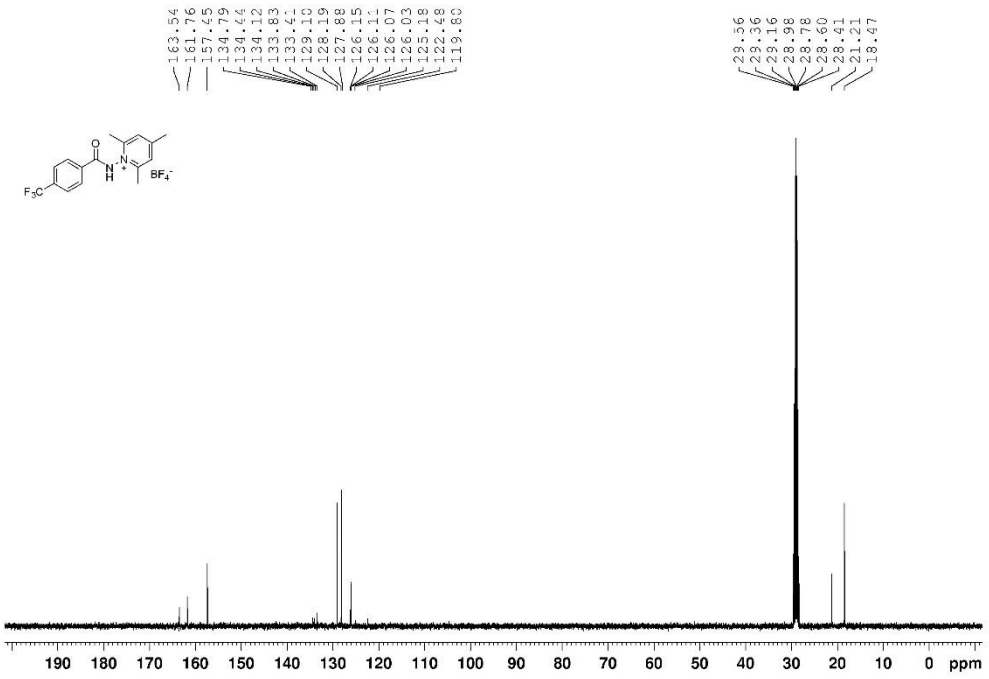
2g; ^{1}H NMR (400 Hz, $CDCl_3$); ^{13}C NMR (100 Hz, $CDCl_3$)



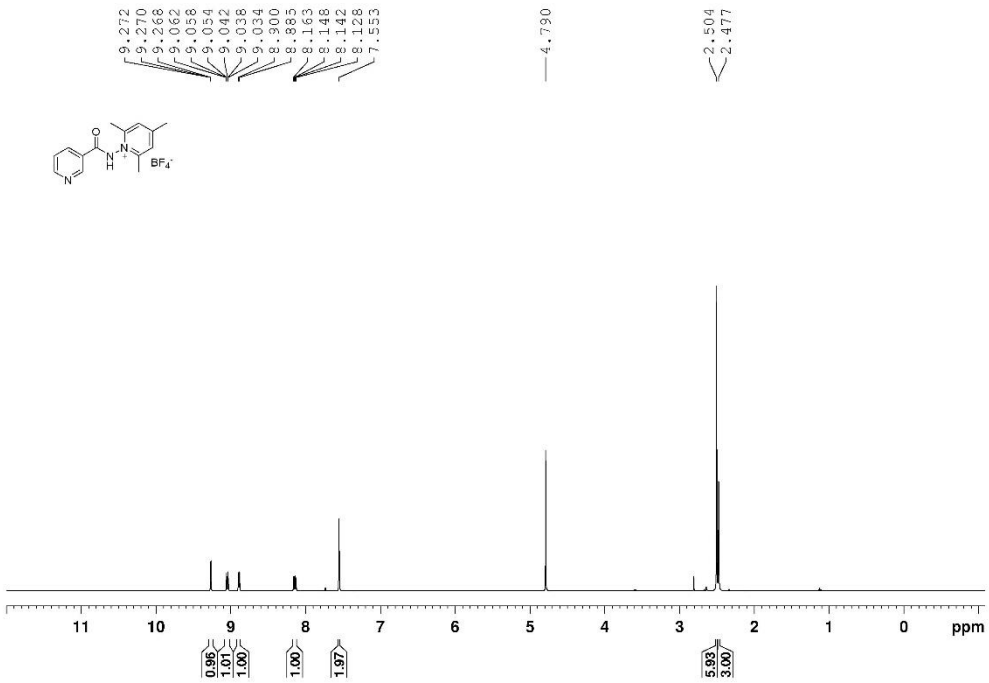


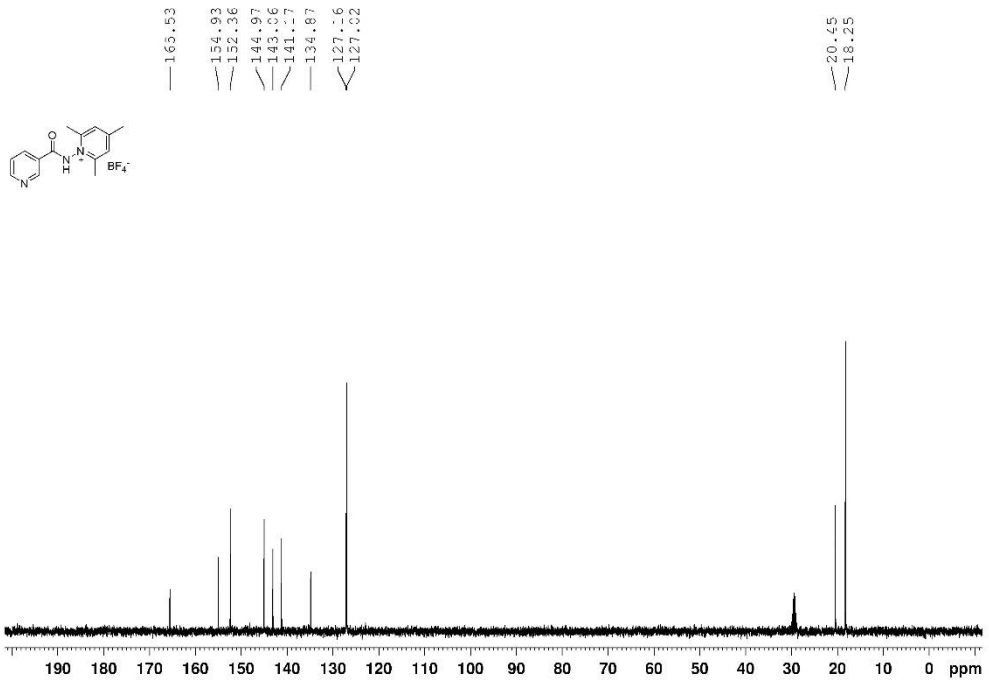
2h; ^{1}H NMR (400 Hz, $CDCl_3$); ^{13}C NMR (100 Hz, $CDCl_3$)



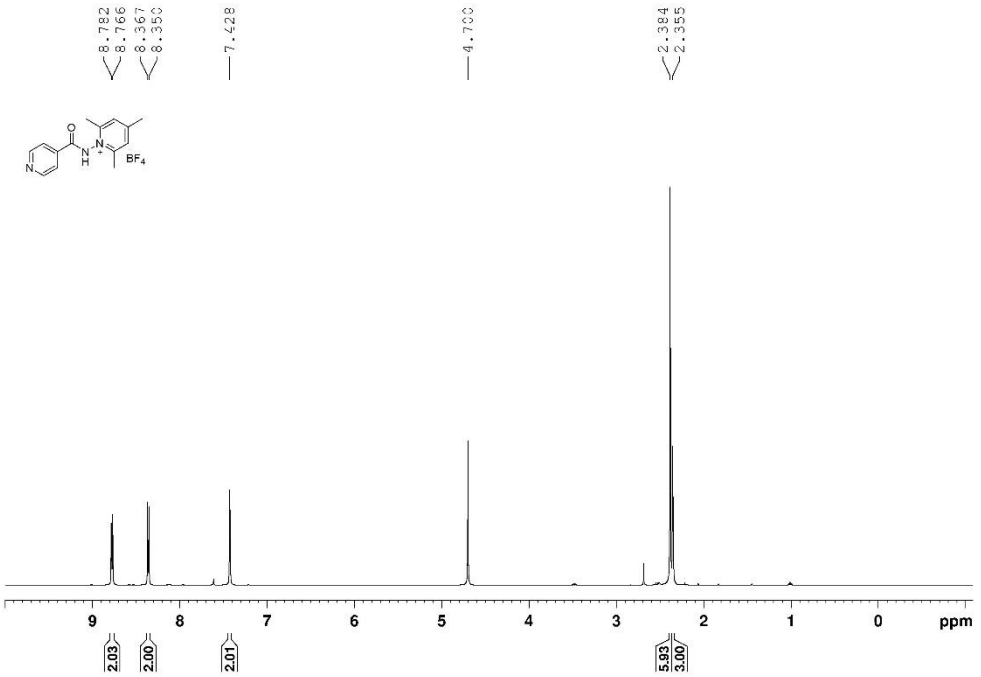


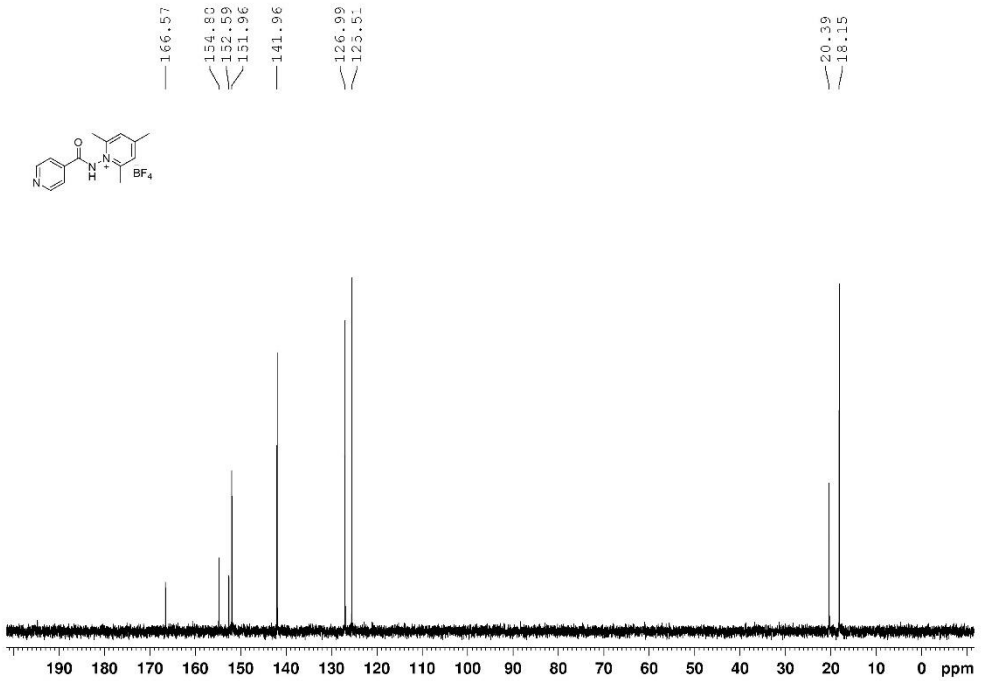
2i; ^{1}H NMR (400 Hz, D_2O); ^{13}C NMR (100 Hz, D_2O)



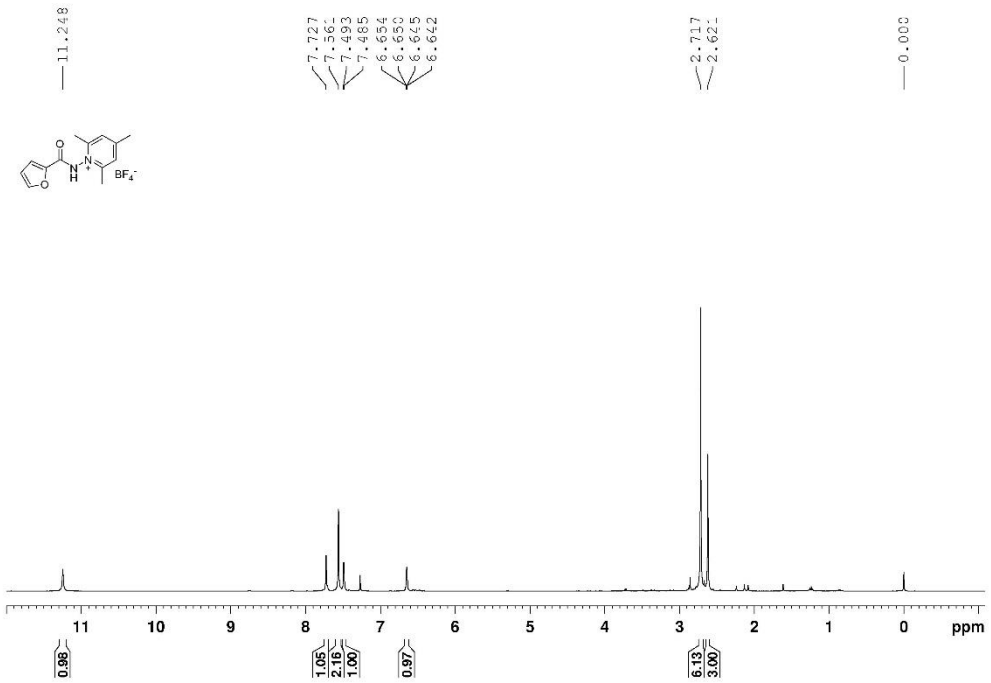


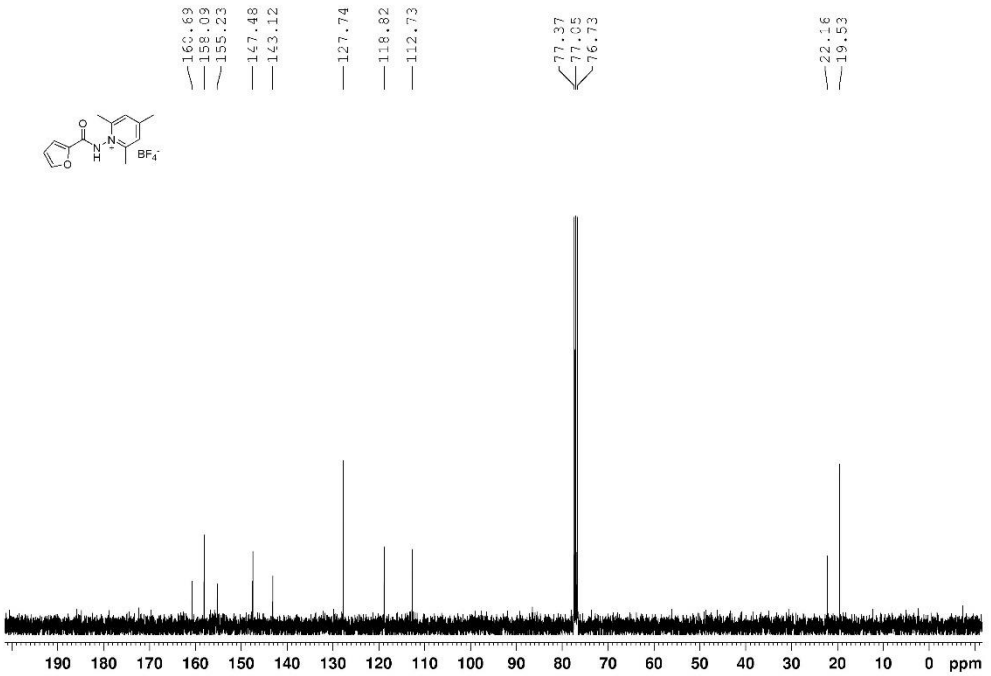
2j; ^{1}H NMR (400 Hz, D_2O); ^{13}C NMR (100 Hz, D_2O)



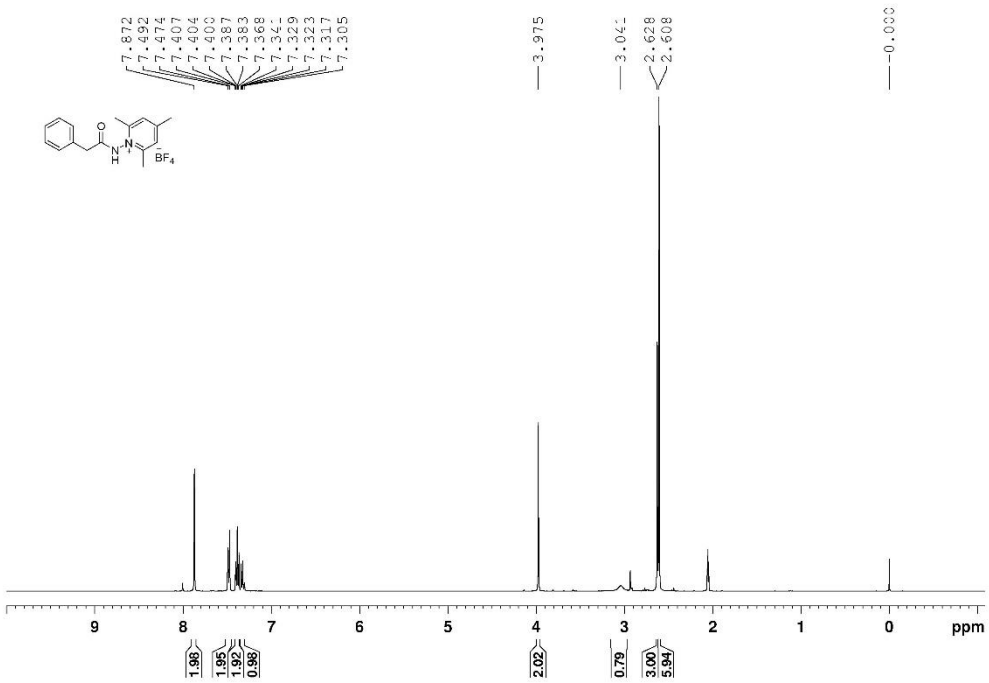


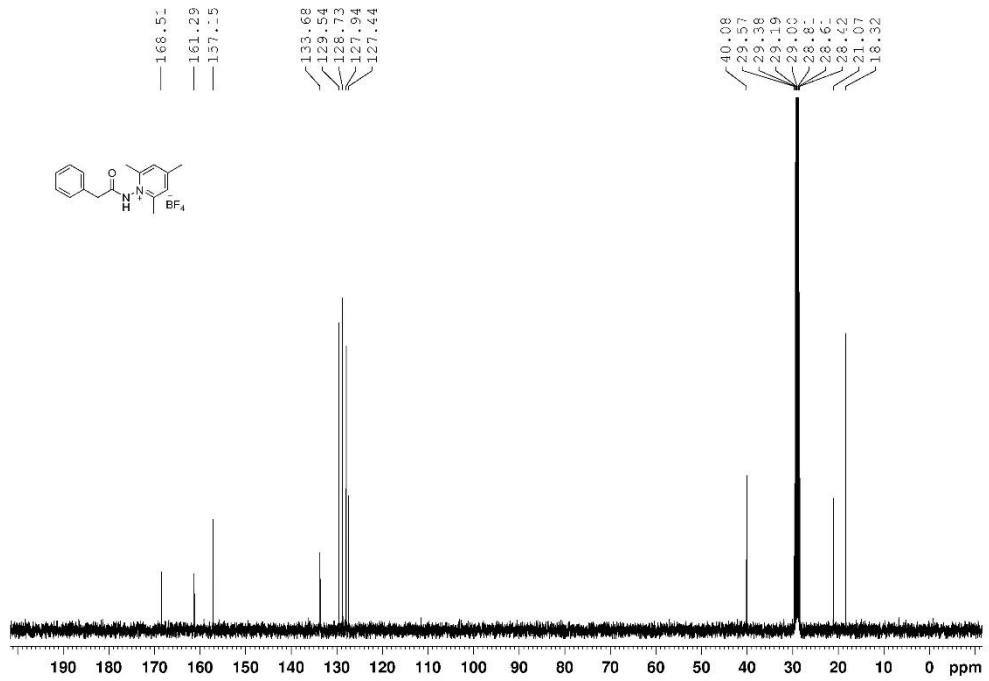
2k; ^{1}H NMR (400 Hz, $CDCl_3$); ^{13}C NMR (100 Hz, $CDCl_3$)



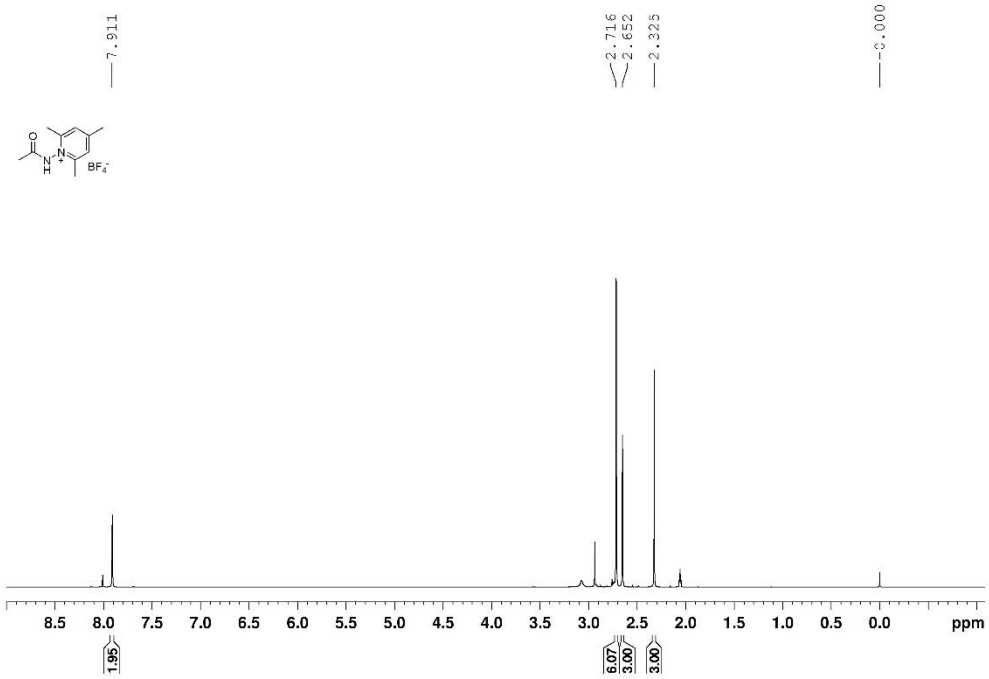


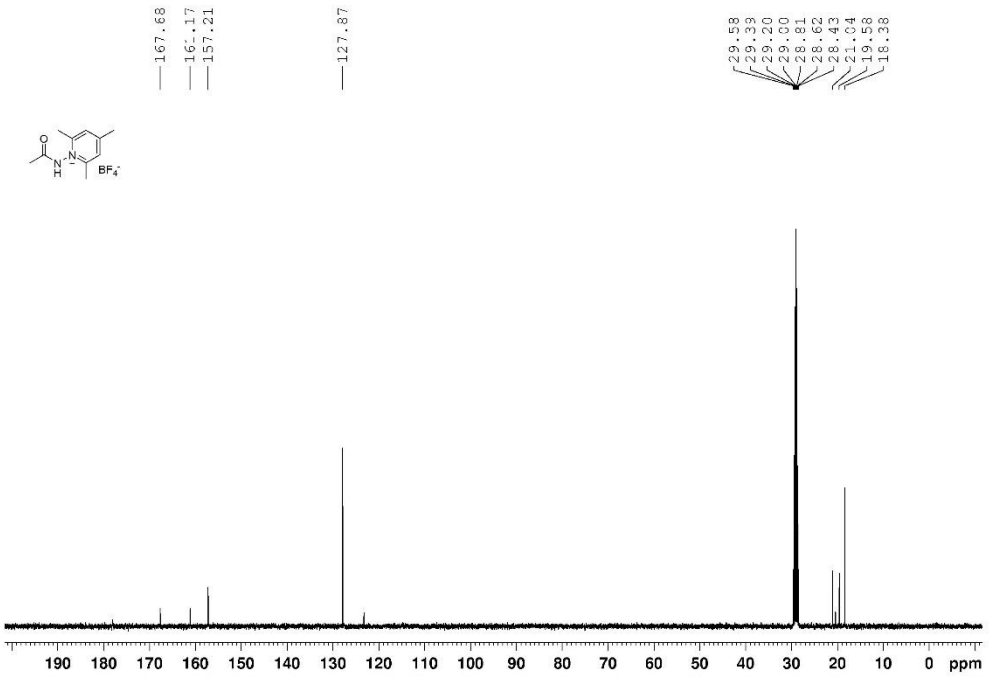
2l; ^{1}H NMR (400 Hz, $(CD_3)_2CO$); ^{13}C NMR (100 Hz, $(CD_3)_2CO$)



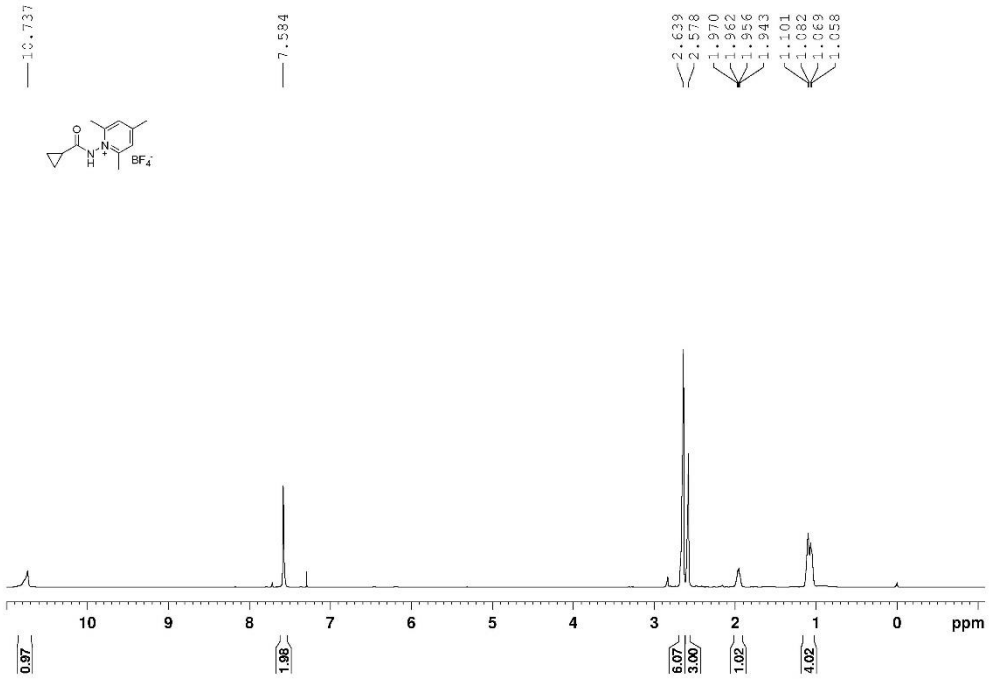


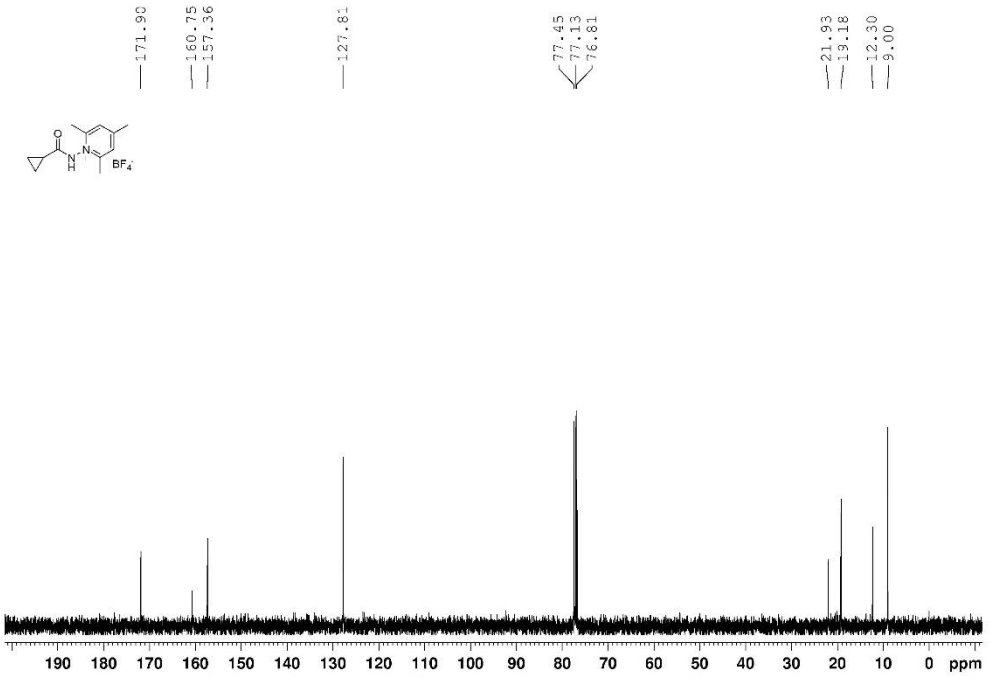
2m; ^{1}H NMR (400 Hz, $(CD_3)_2CO$); ^{13}C NMR (100 Hz, $(CD_3)_2CO$)



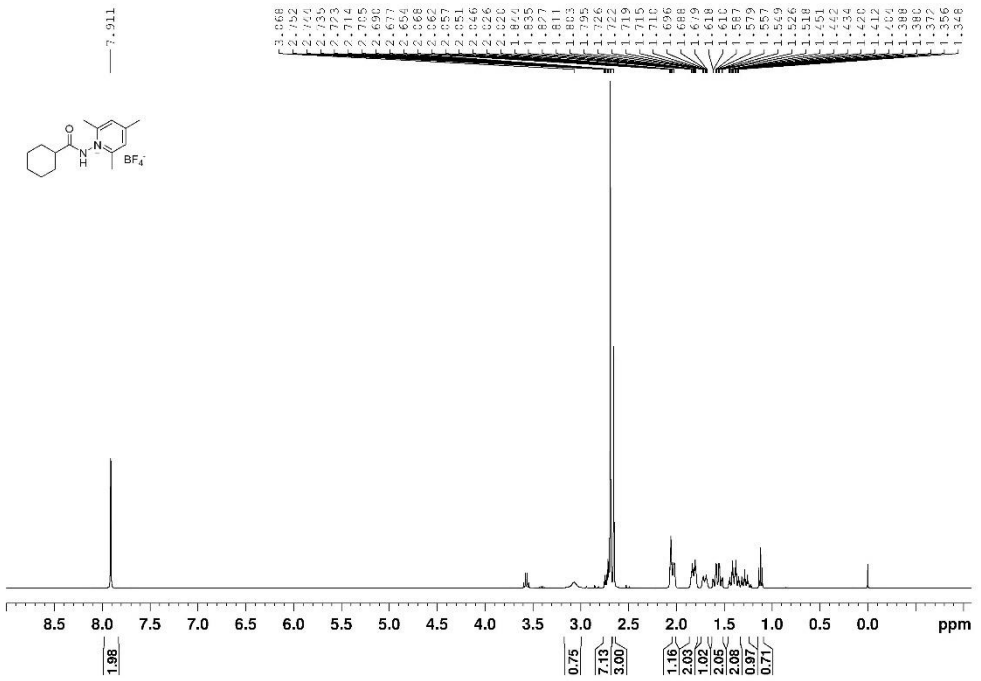


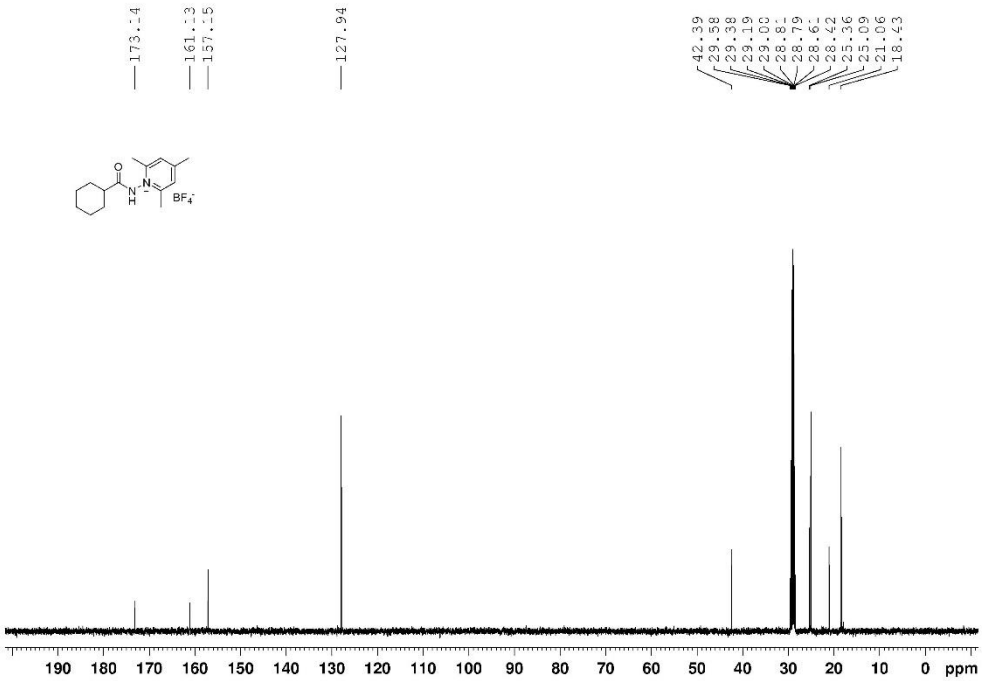
2n; ^{1}H NMR (400 Hz, $CDCl_3$); ^{13}C NMR (100 Hz, $CDCl_3$)



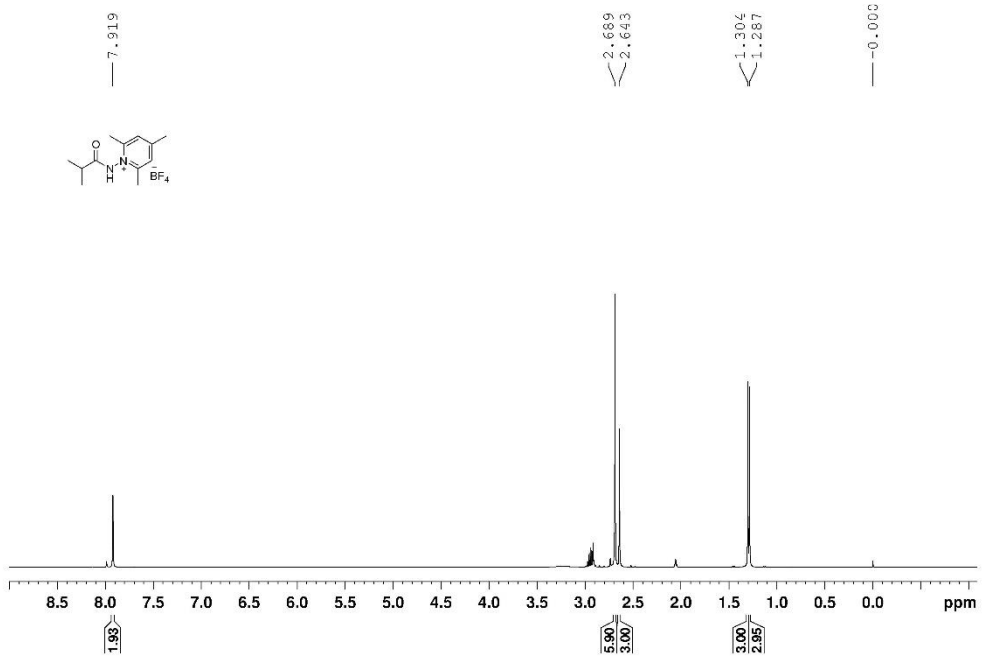


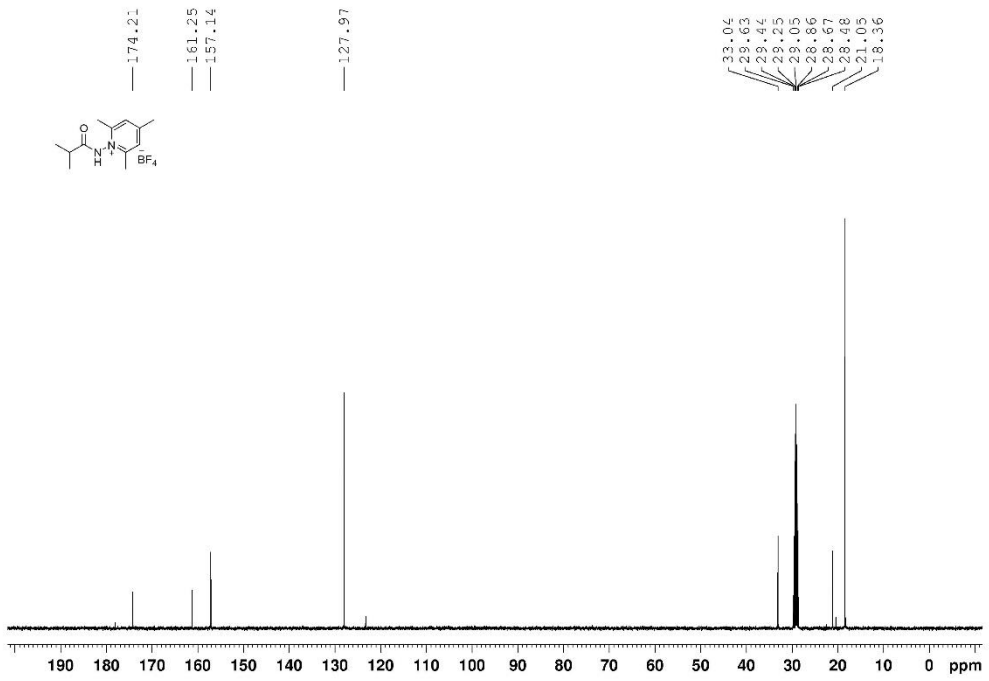
2o; ^{1}H NMR (400 Hz, $(CD_3)_2CO$); ^{13}C NMR (100 Hz, $(CD_3)_2CO$)



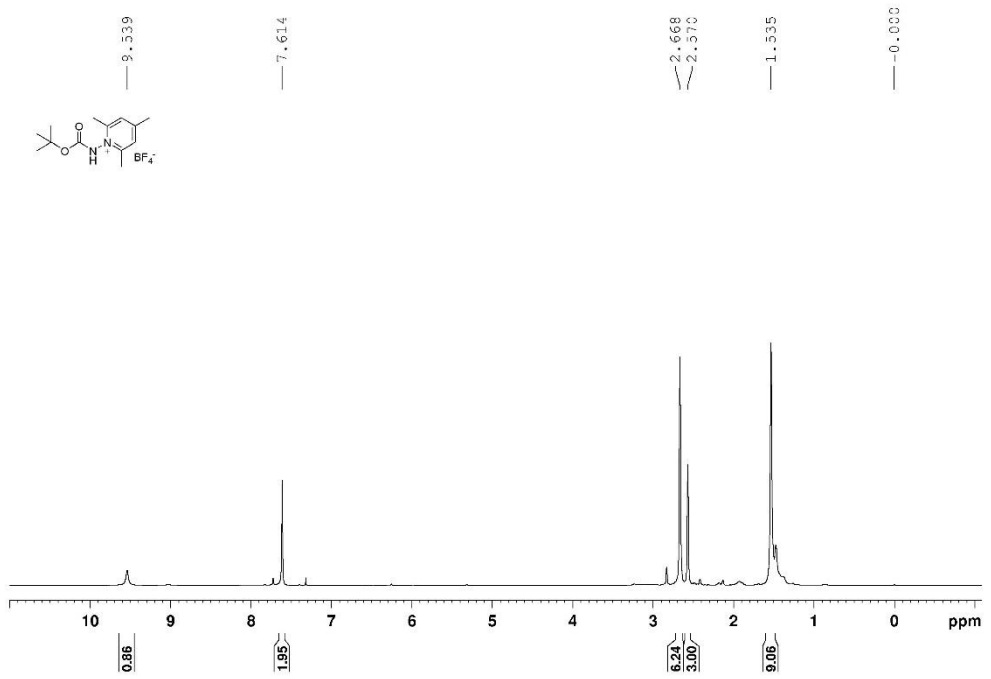


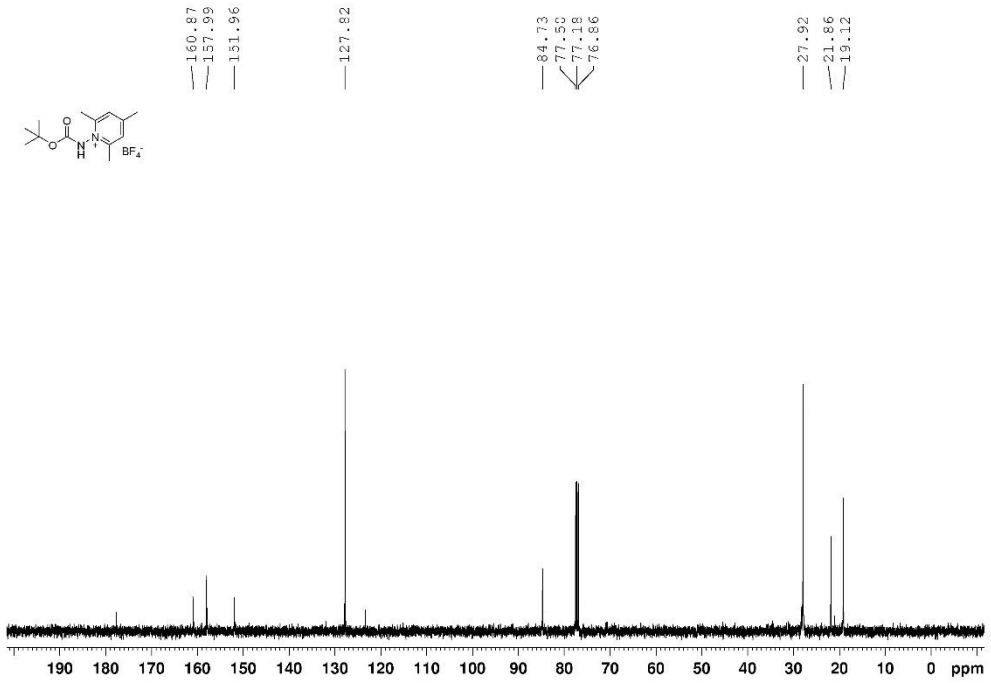
2p; ^{1}H NMR (400 Hz, $(CD_3)_2CO$); ^{13}C NMR (100 Hz, $(CD_3)_2CO$)



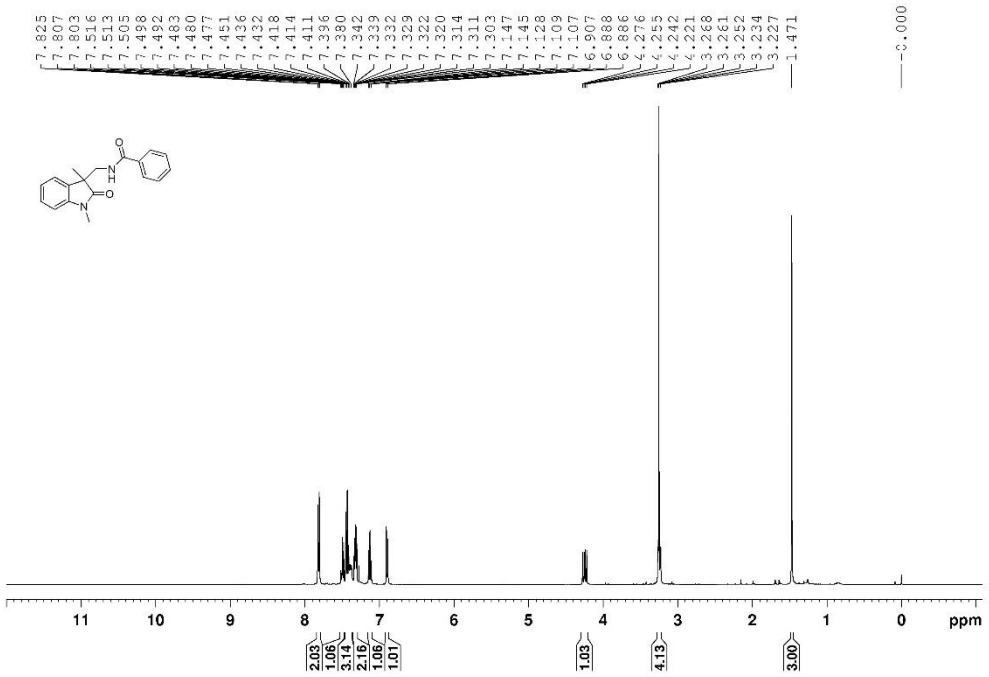


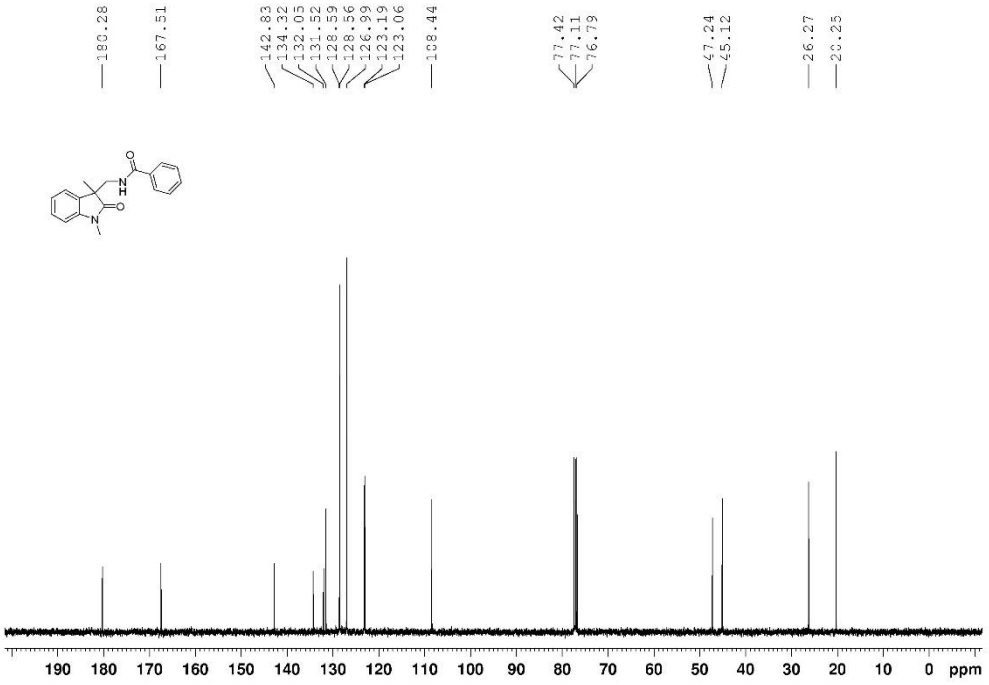
2q; ^{1}H NMR (400 Hz, $CDCl_3$); ^{13}C NMR (100 Hz, $CDCl_3$)



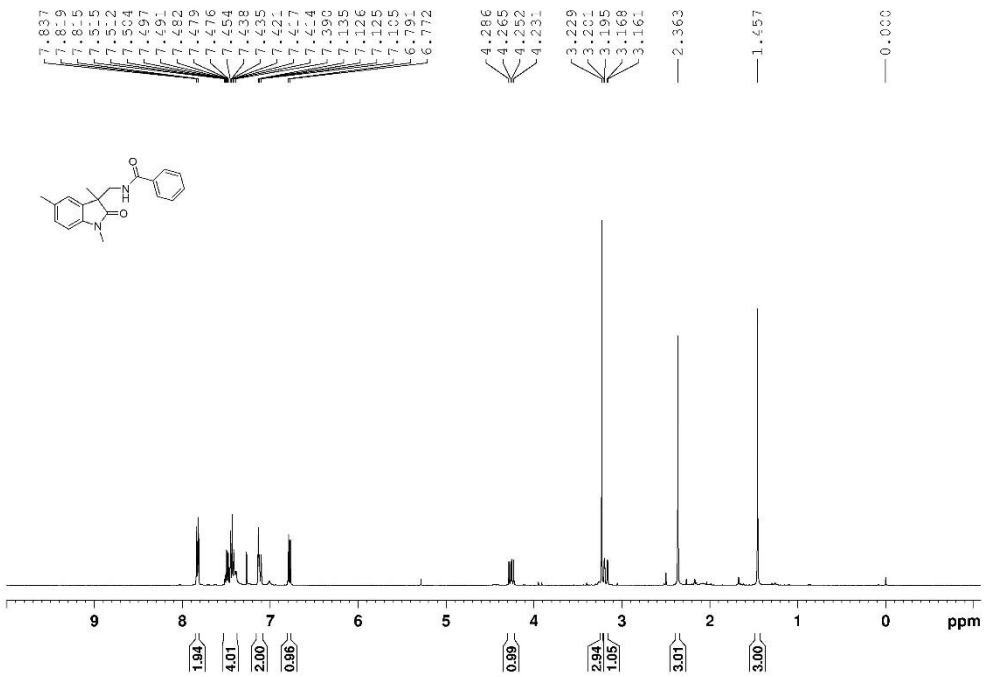


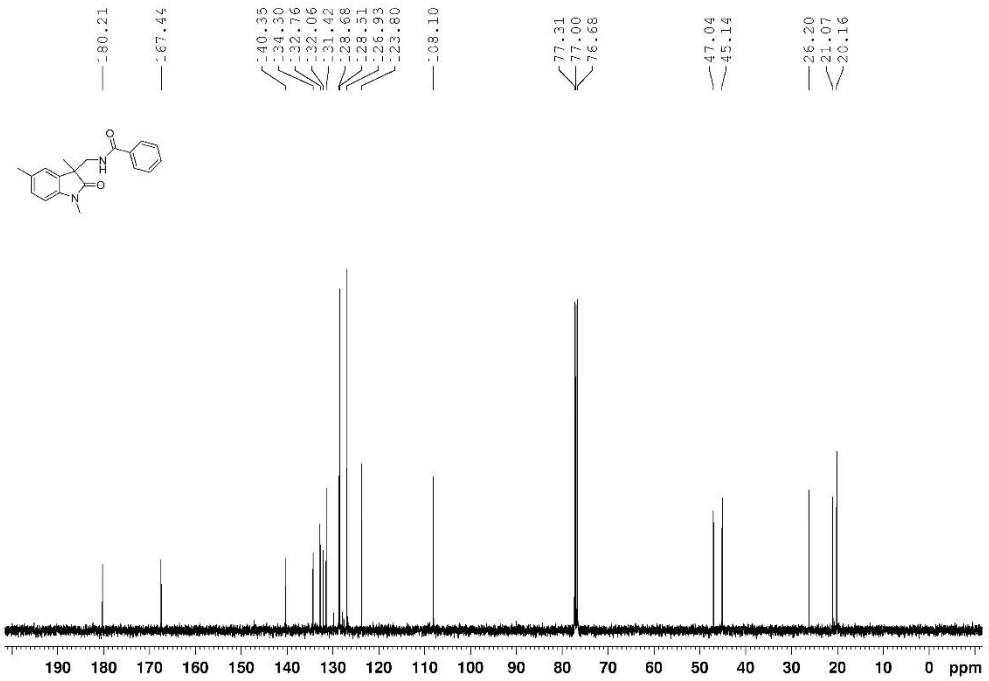
3a; ^{1}H NMR (400 Hz, $CDCl_3$); ^{13}C NMR (100 Hz, $CDCl_3$)



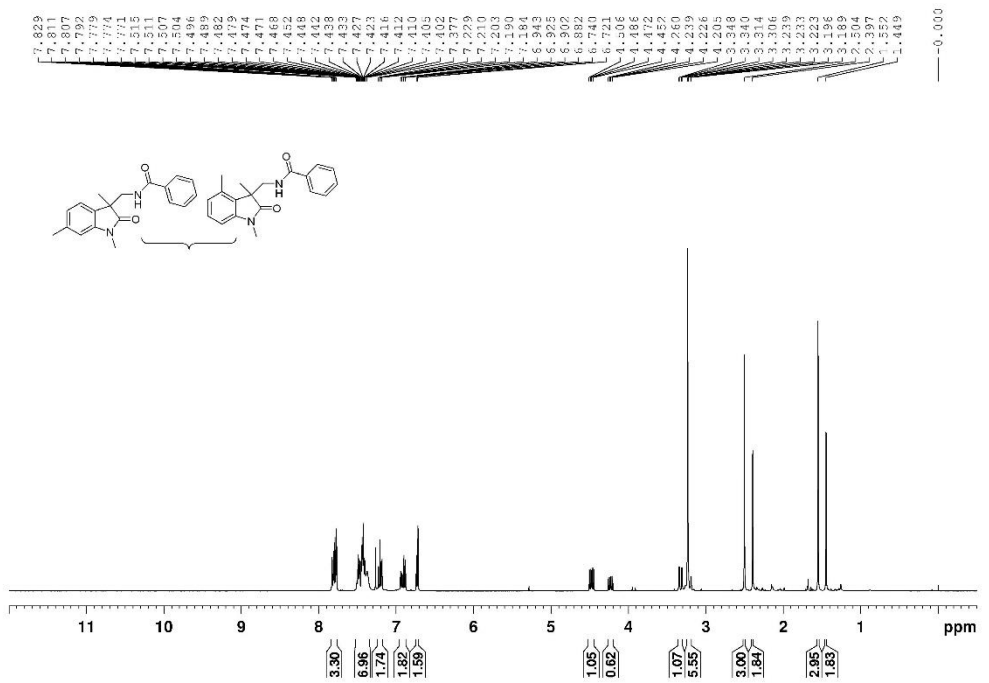


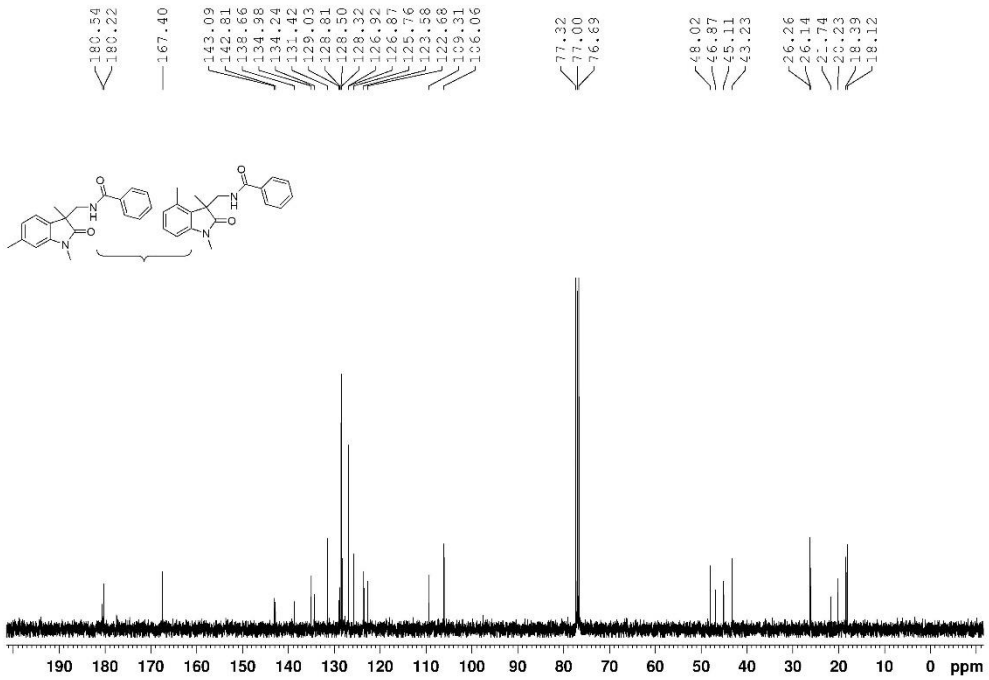
3b; ^{1}H NMR (400 Hz, $CDCl_3$); ^{13}C NMR (100 Hz, $CDCl_3$)



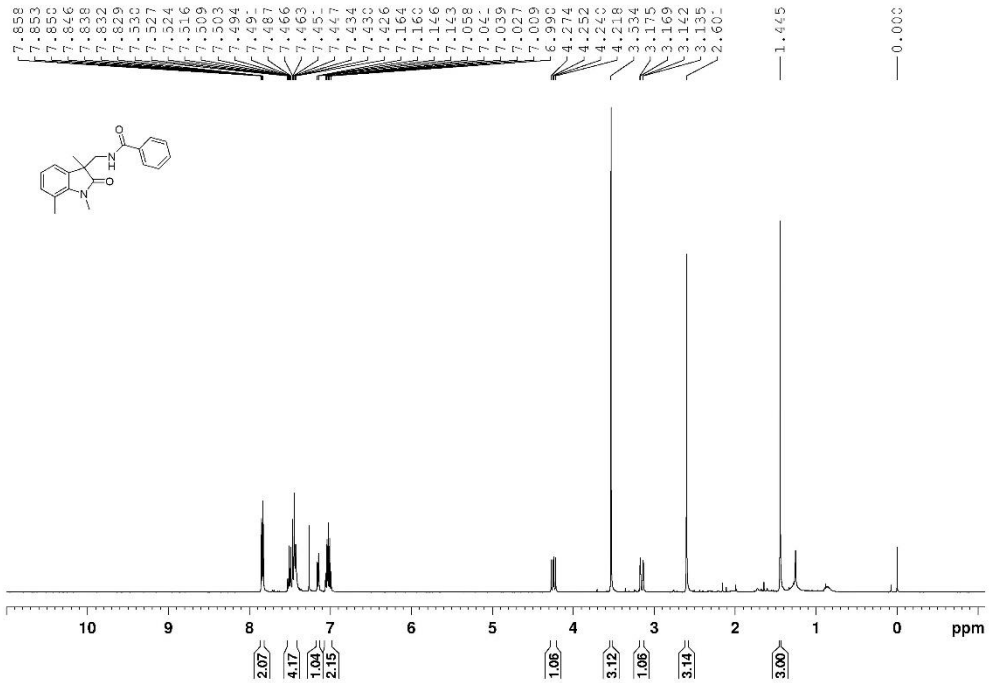


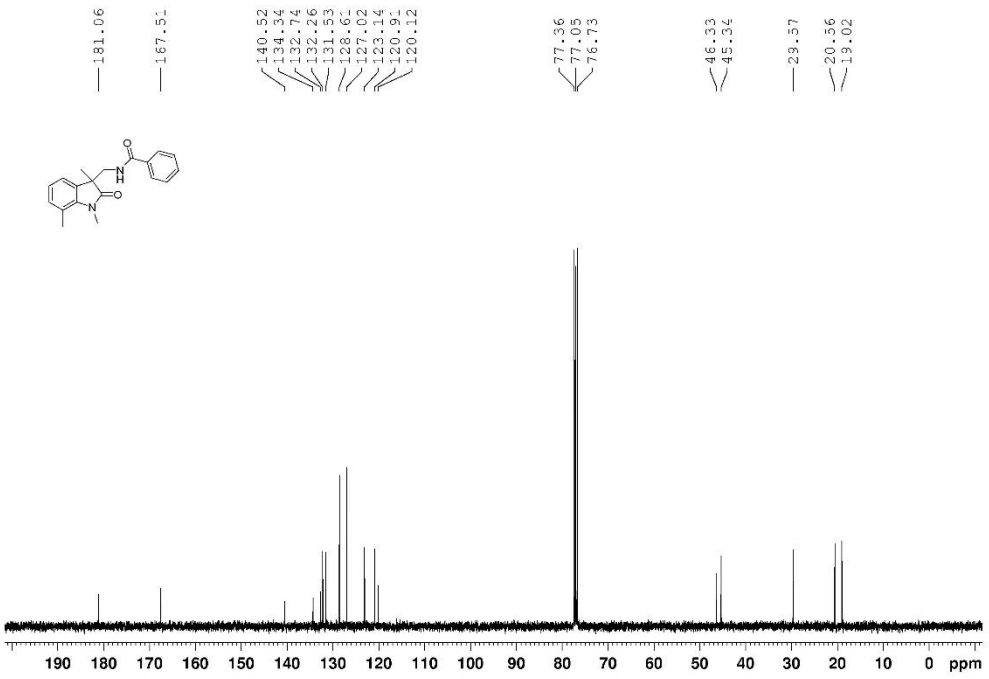
3c; ^{1}H NMR (400 Hz, $CDCl_3$); ^{13}C NMR (100 Hz, $CDCl_3$)



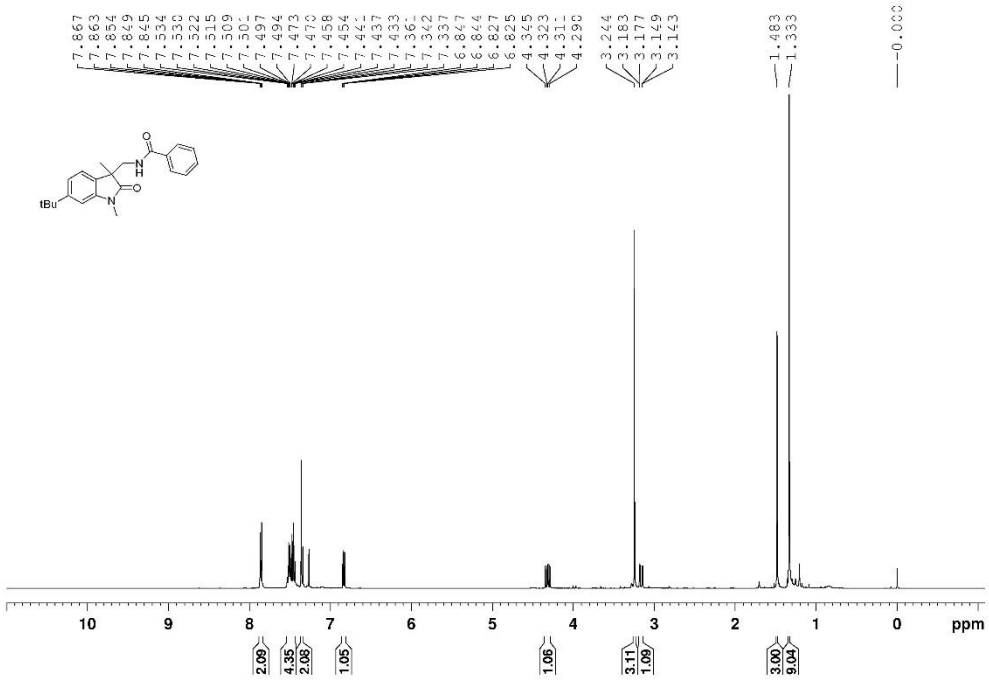


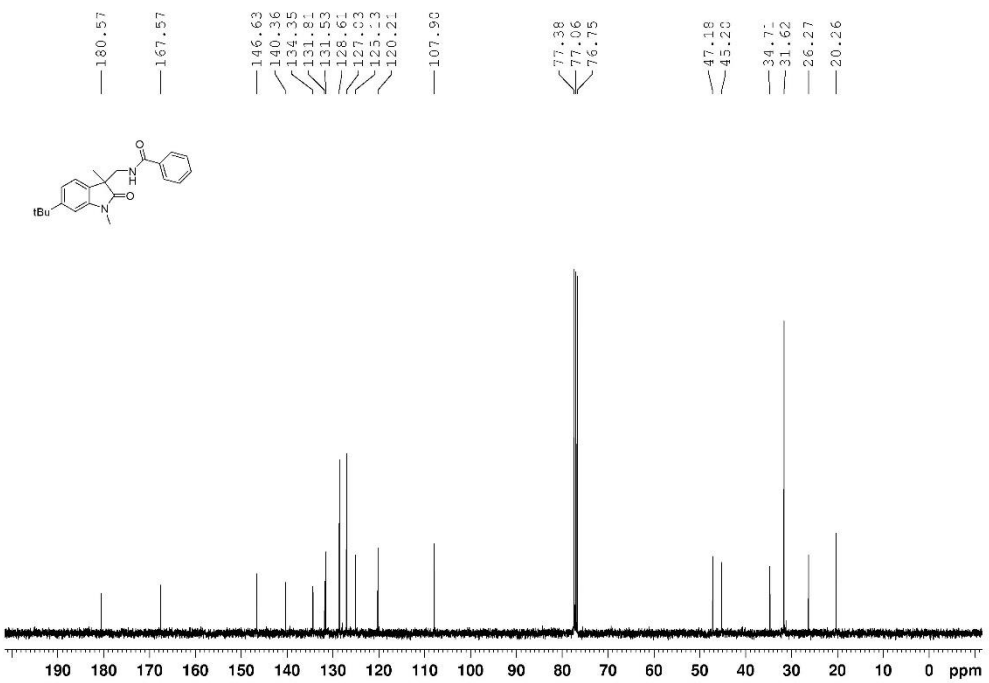
3d; ^{1}H NMR (400 Hz, $CDCl_3$); ^{13}C NMR (100 Hz, $CDCl_3$)



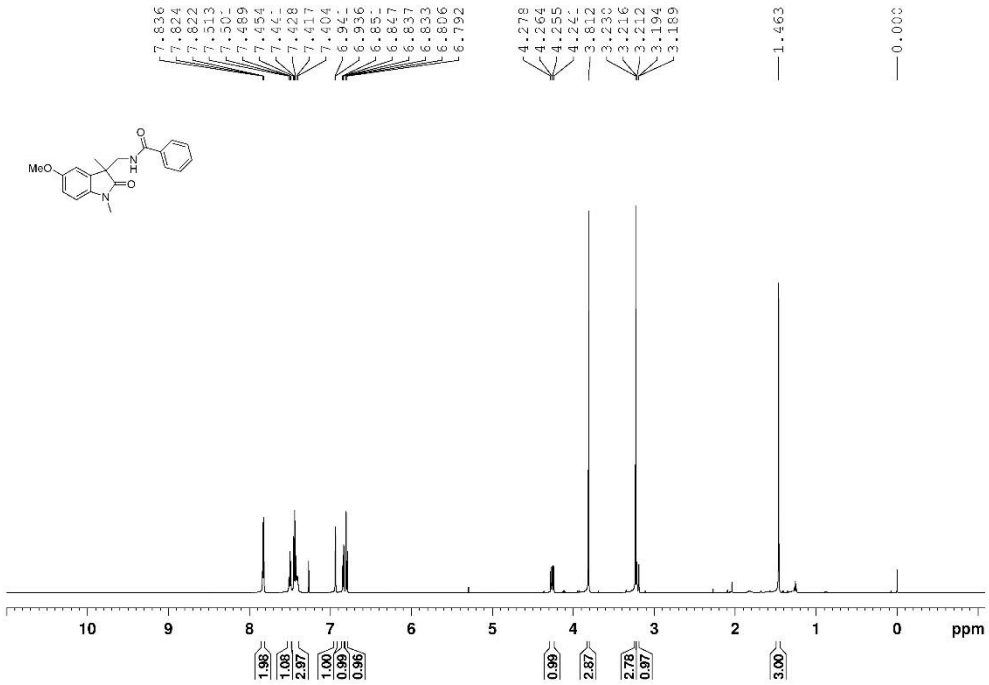


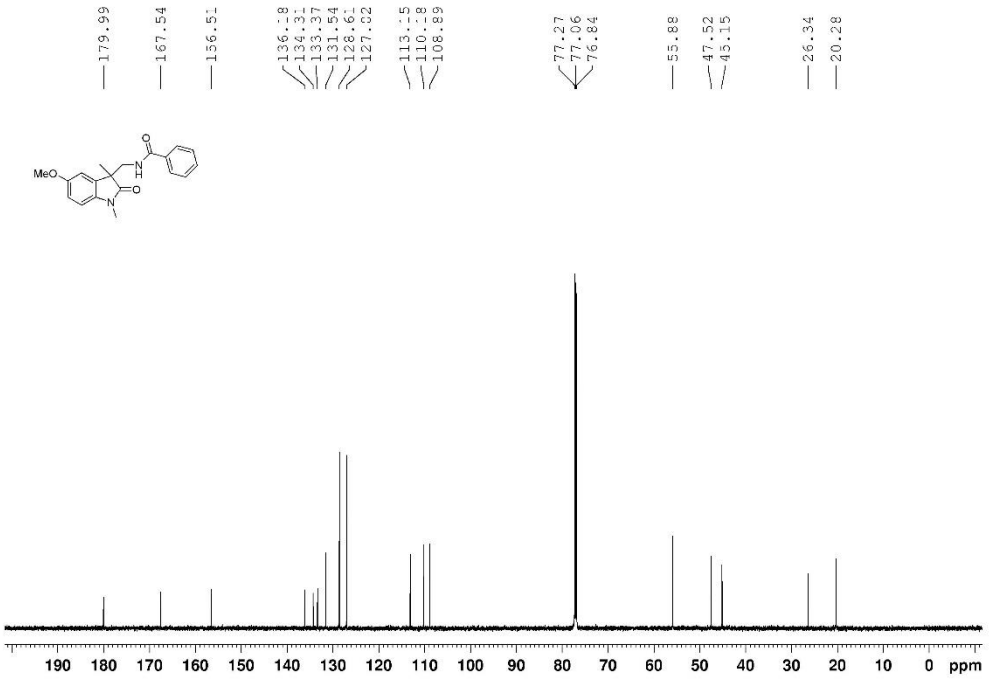
3e; ^{1}H NMR (400 Hz, $CDCl_3$); ^{13}C NMR (100 Hz, $CDCl_3$)



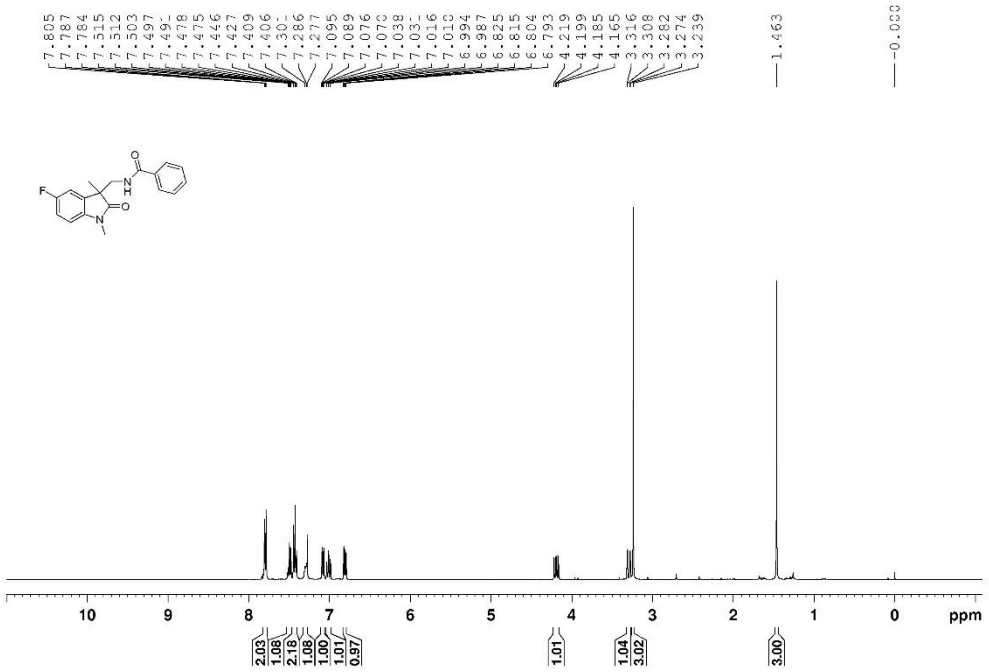


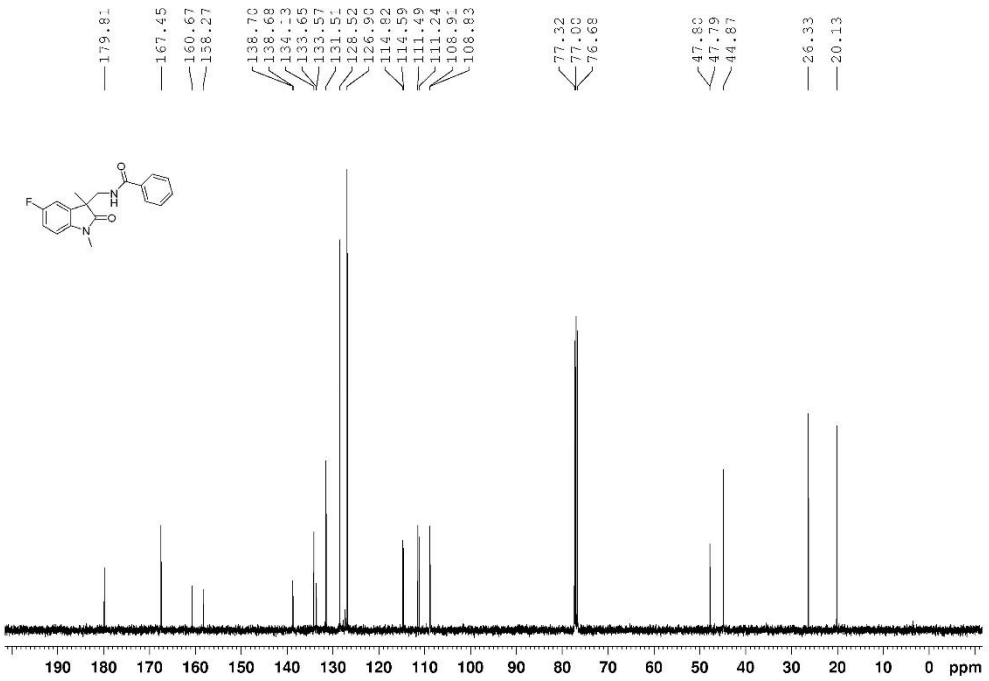
3f; ^{1}H NMR (600 Hz, $CDCl_3$); ^{13}C NMR (150 Hz, $CDCl_3$)

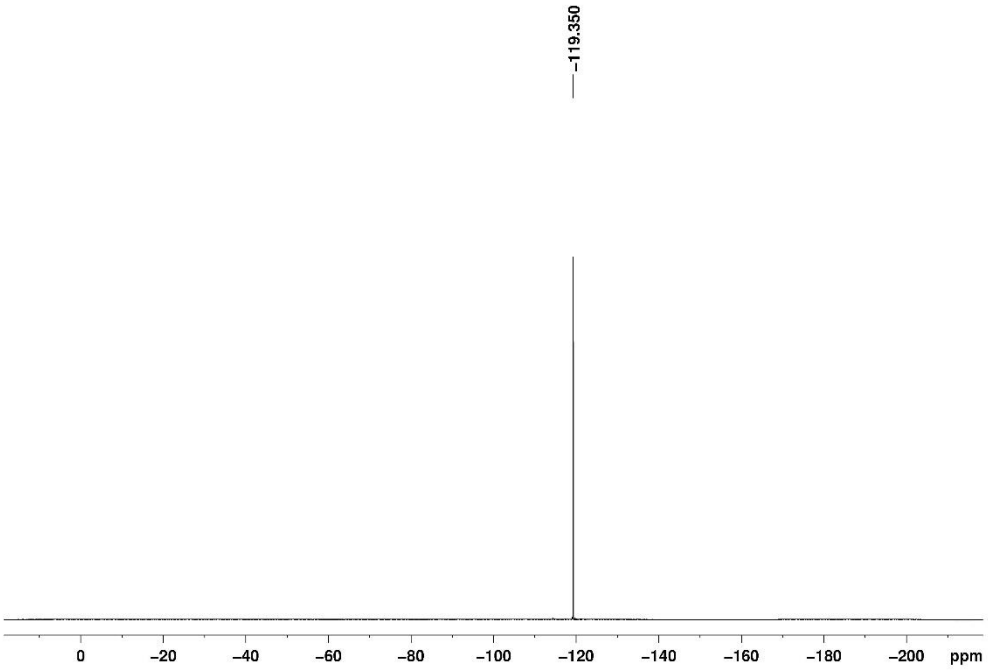




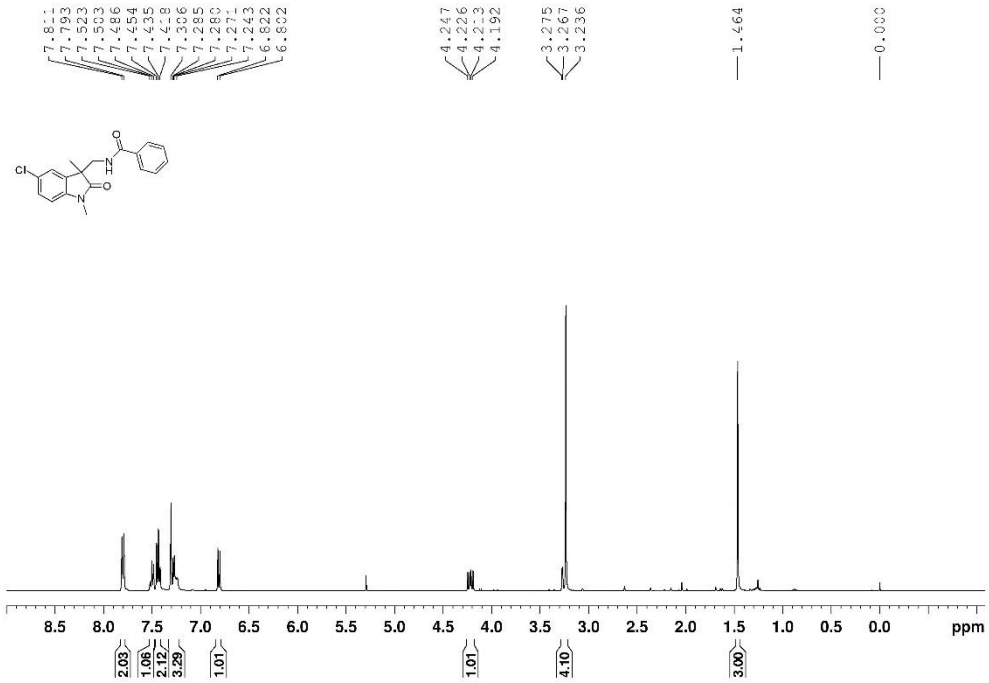
3g; ^{1}H NMR (400 Hz, $CDCl_3$); ^{13}C NMR (100 Hz, $CDCl_3$); ^{19}F NMR (376 Hz, $CDCl_3$)

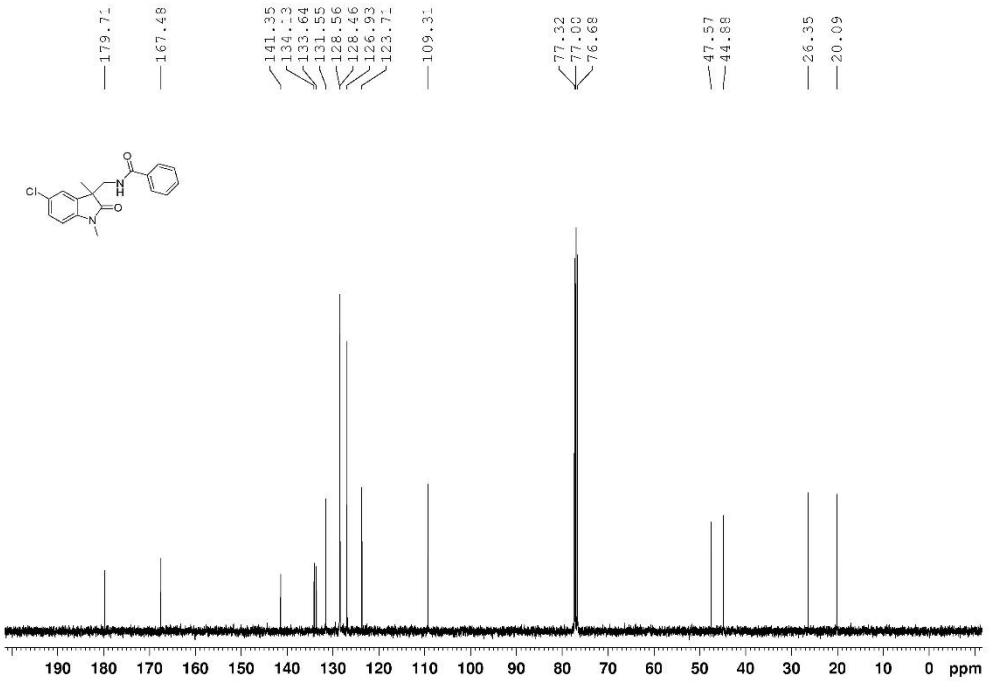




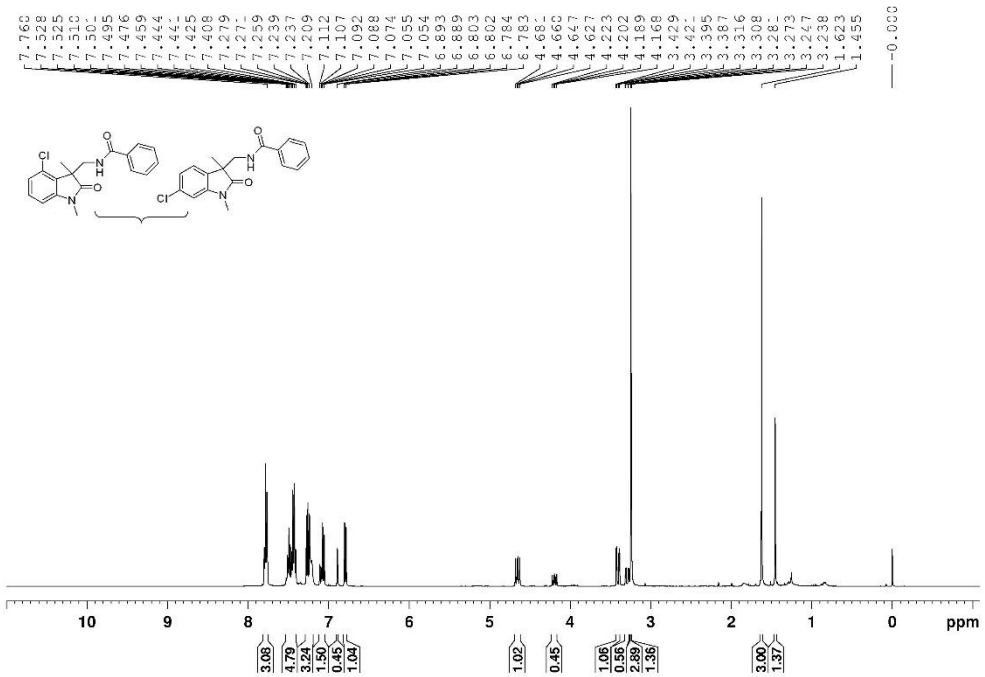

−119.350
0
−20
−40
−60
−80
−100
−120
−140
−160
−180
−200
ppm

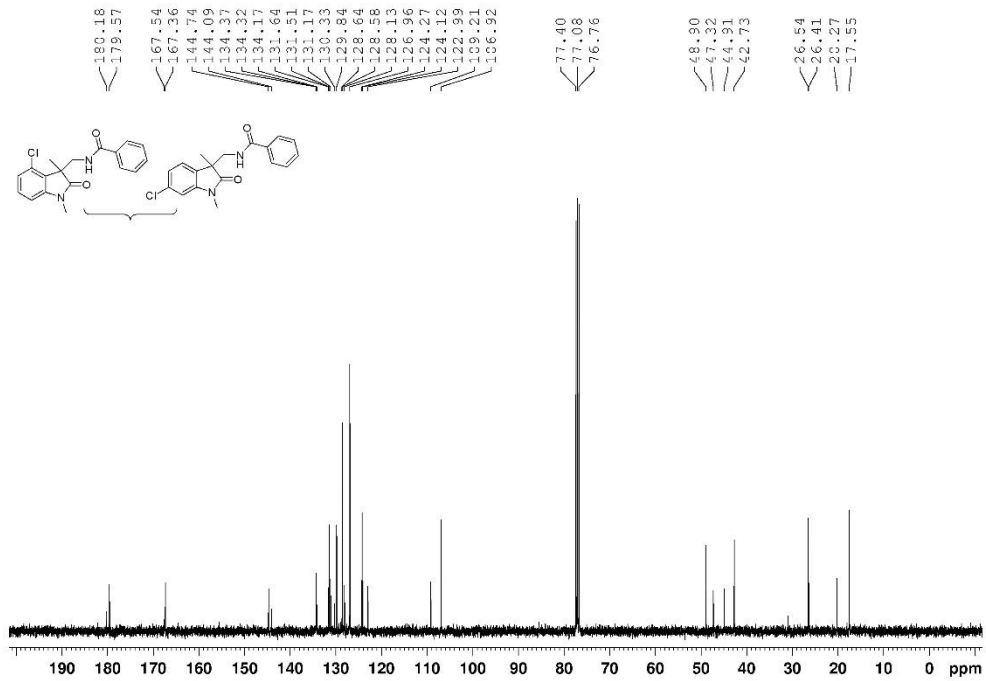
3h; ^{1}H NMR (400 Hz, $CDCl_3$); ^{13}C NMR (100 Hz, $CDCl_3$)



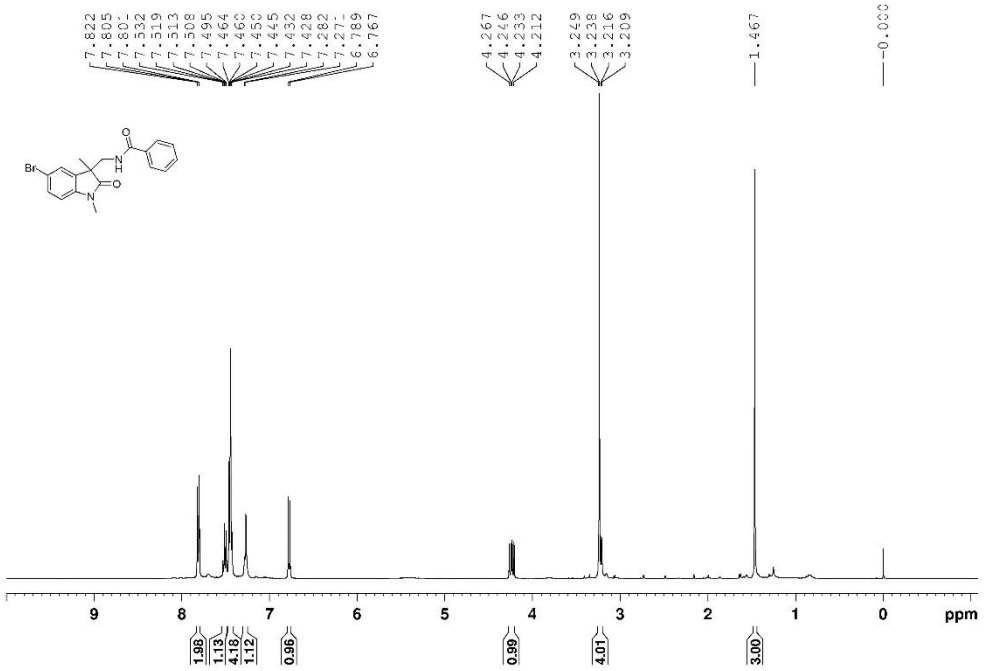


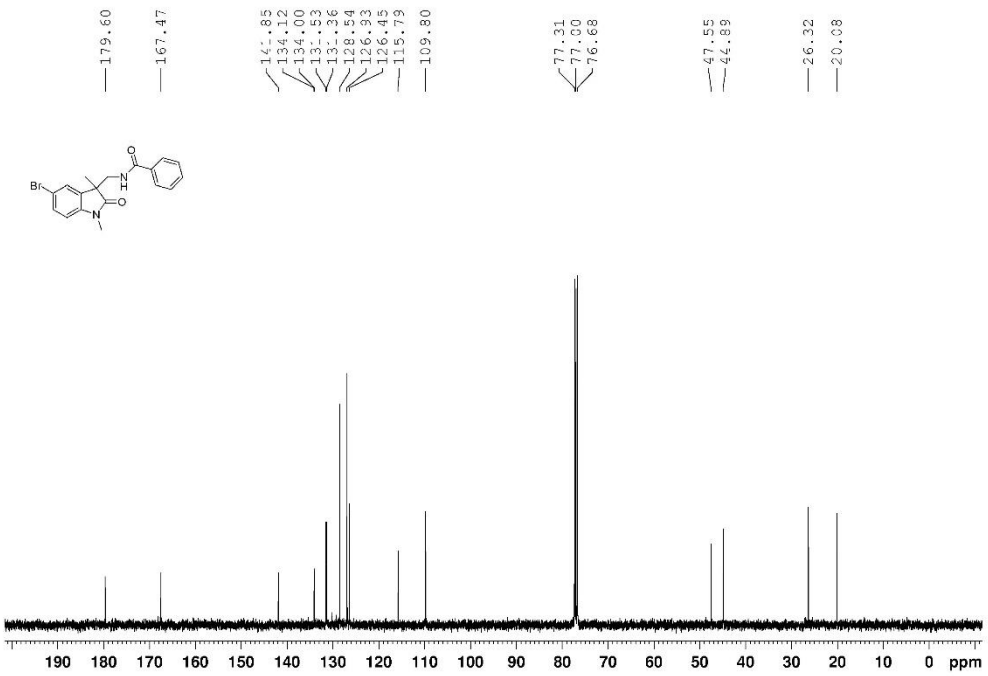
3i; ^{1}H NMR (400 Hz, $CDCl_3$); ^{13}C NMR (100 Hz, $CDCl_3$)



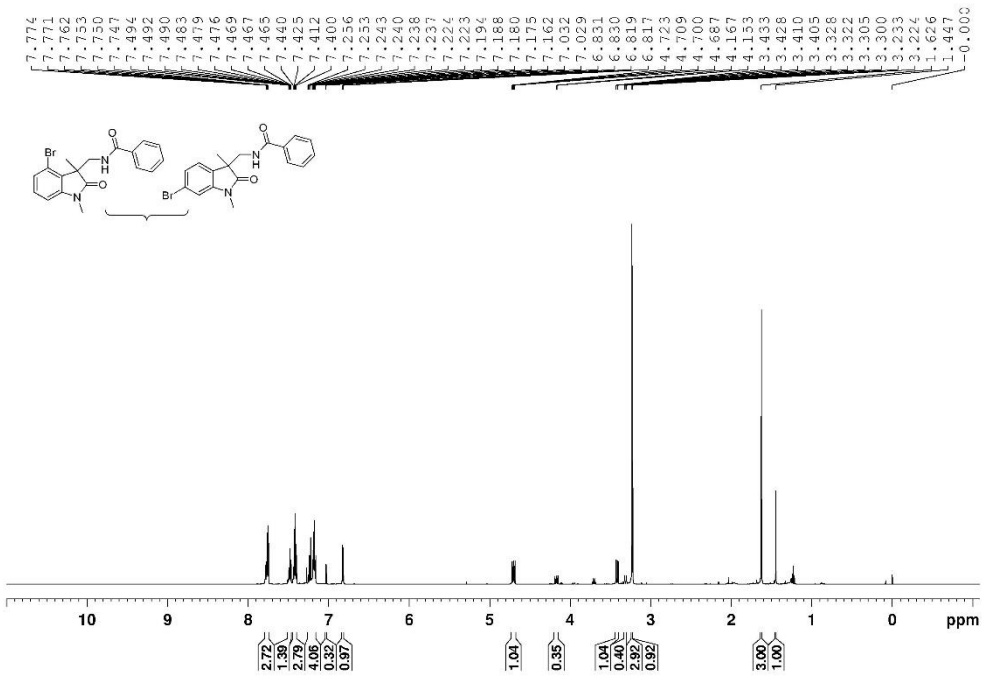


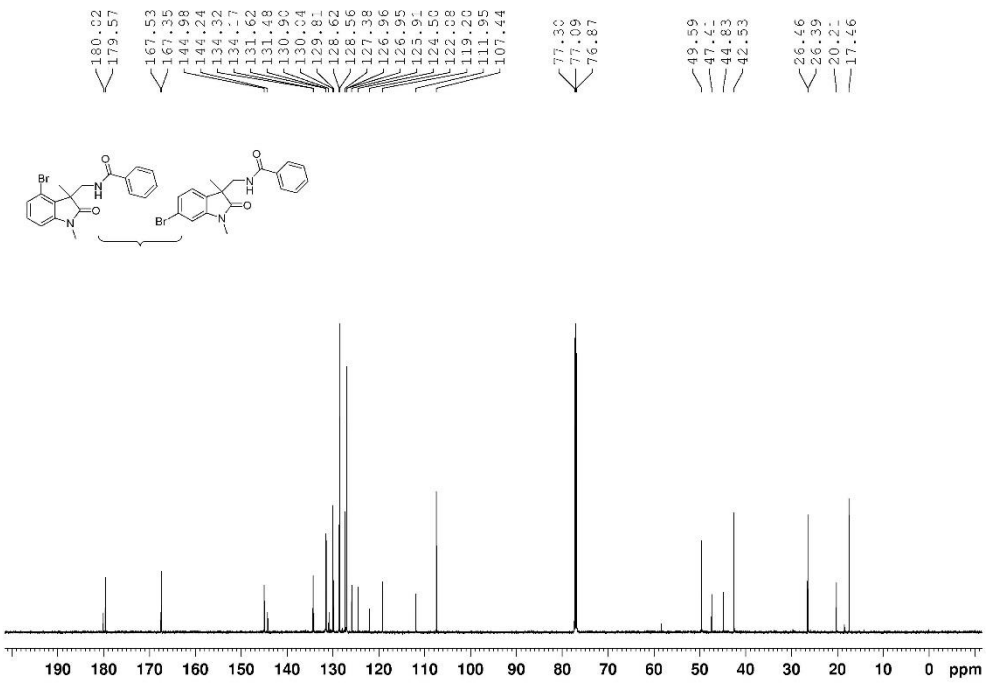
3j; ^{1}H NMR (400 Hz, $CDCl_3$); ^{13}C NMR (100 Hz, $CDCl_3$)



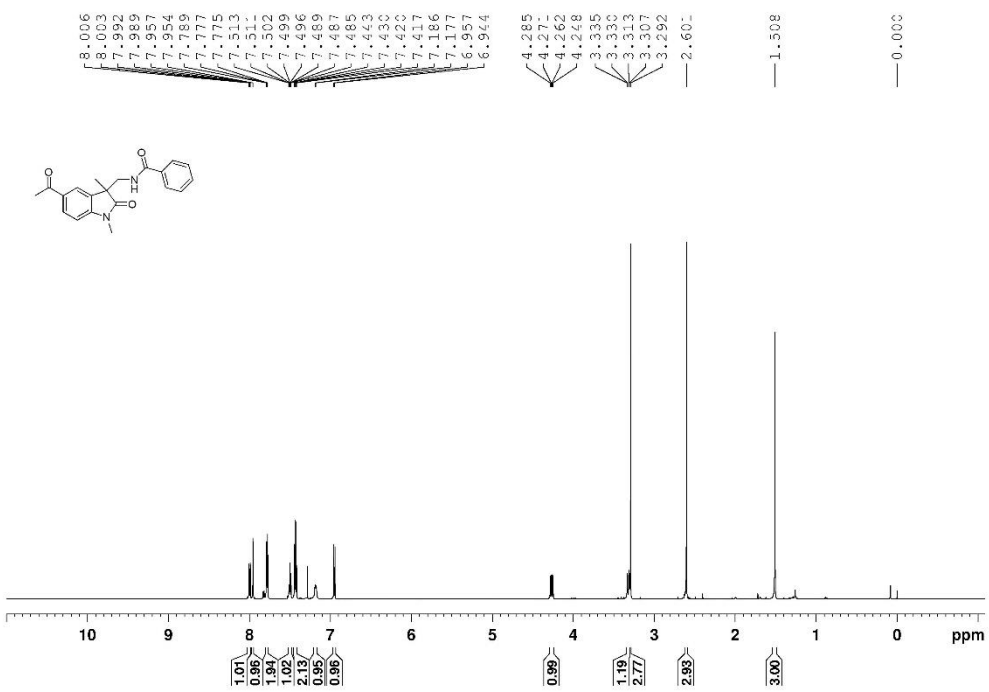


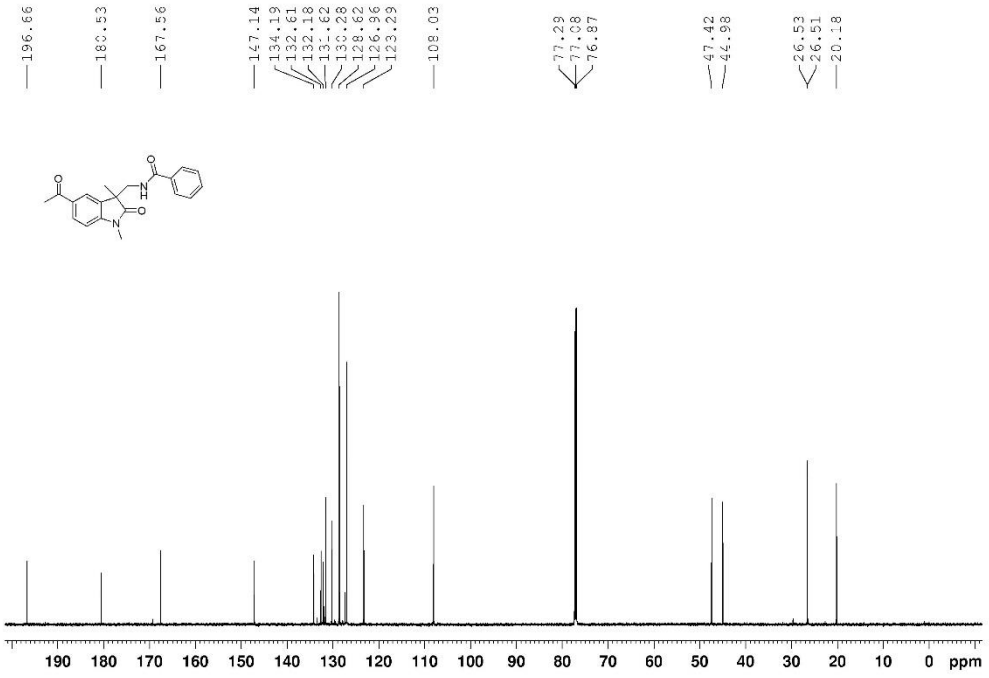
3k; ^{1}H NMR (600 Hz, $CDCl_3$); ^{13}C NMR (150 Hz, $CDCl_3$)



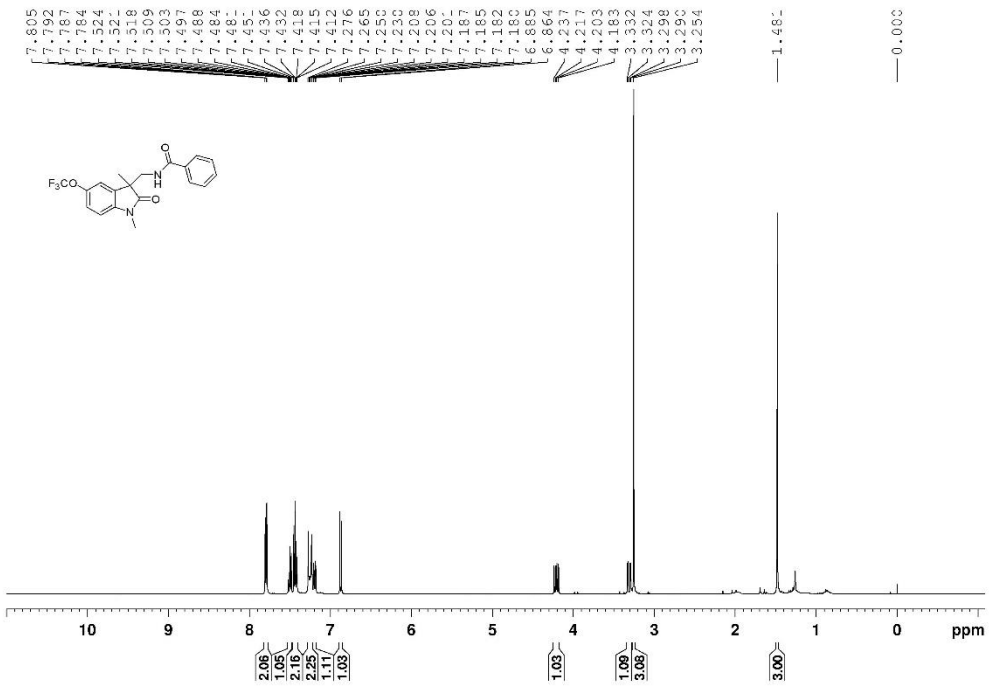


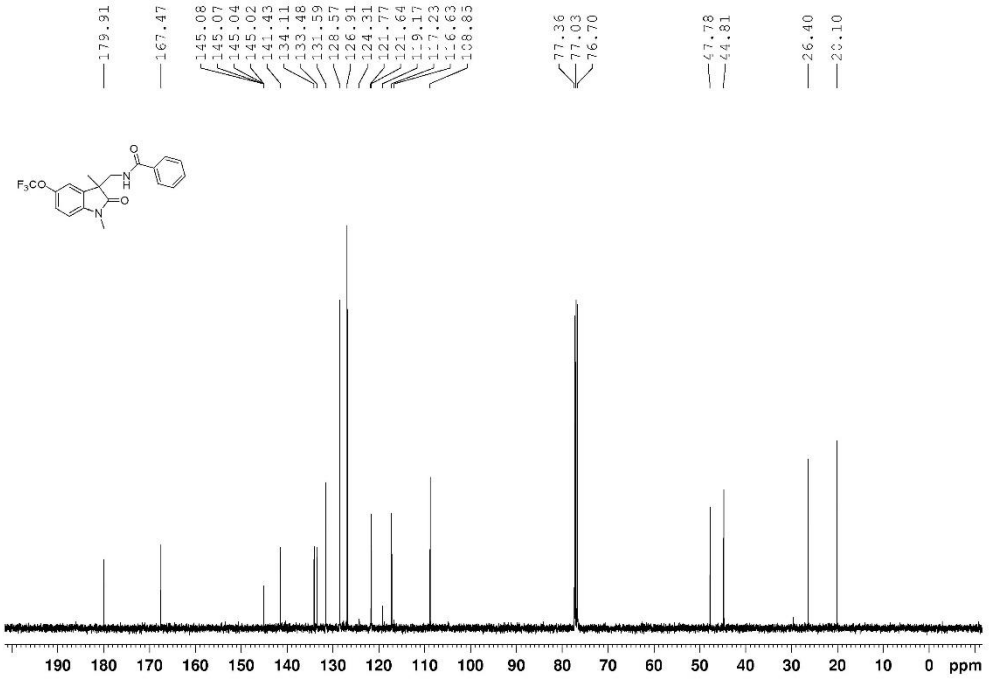
3l; ^{1}H NMR (600 Hz, $CDCl_3$); ^{13}C NMR (150 Hz, $CDCl_3$)

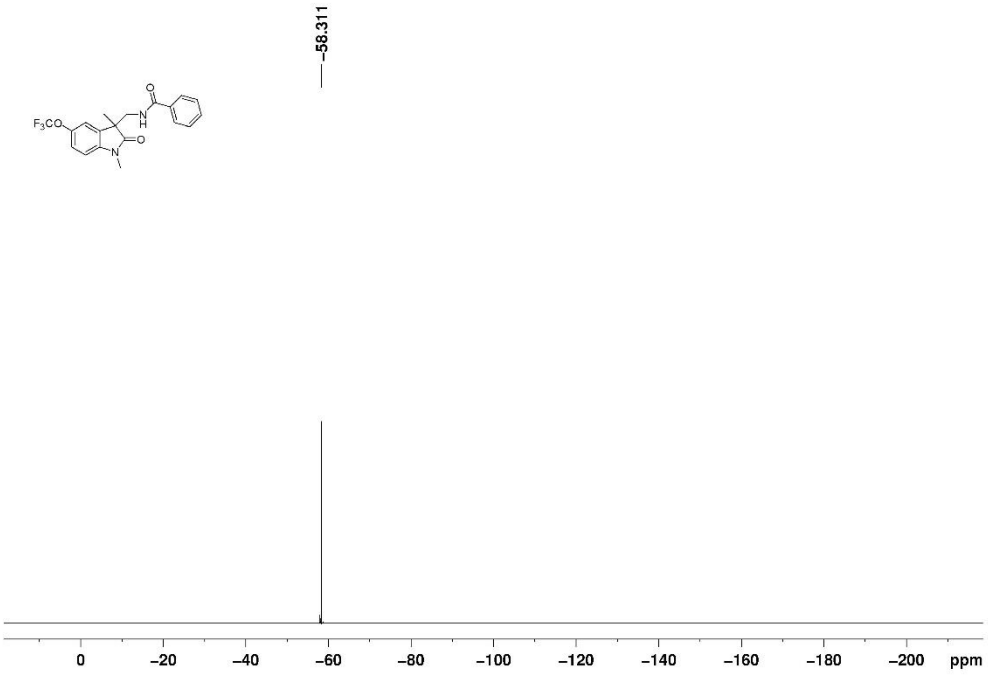




3m; ^{1}H NMR (400 Hz, $CDCl_3$); ^{13}C NMR (100 Hz, $CDCl_3$); ^{19}F NMR (376 Hz, $CDCl_3$)



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F3CO
N
H
O
O
N
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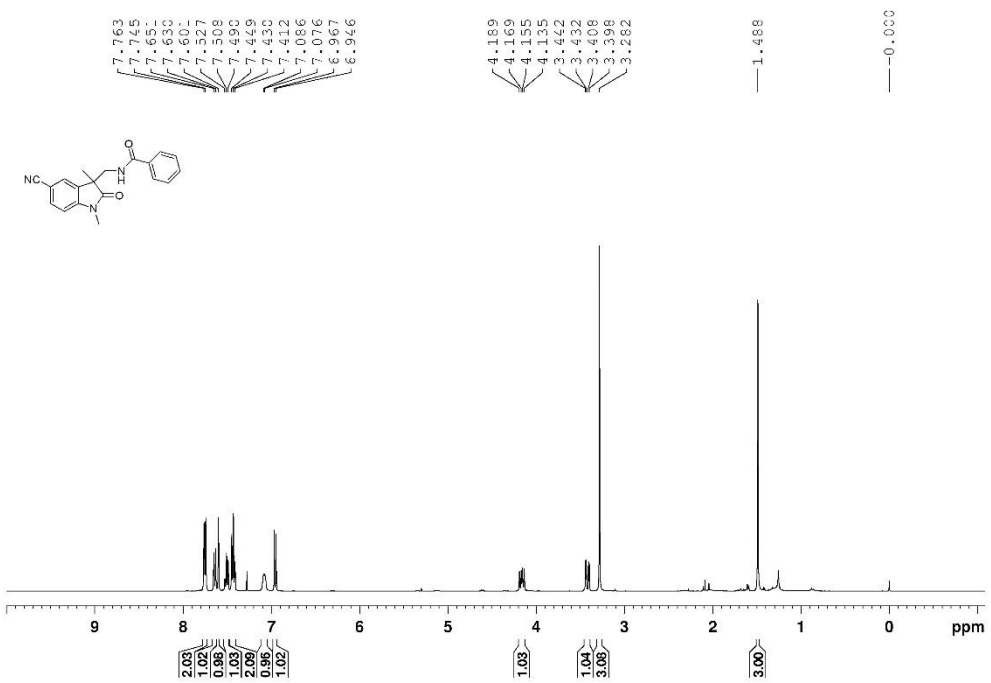
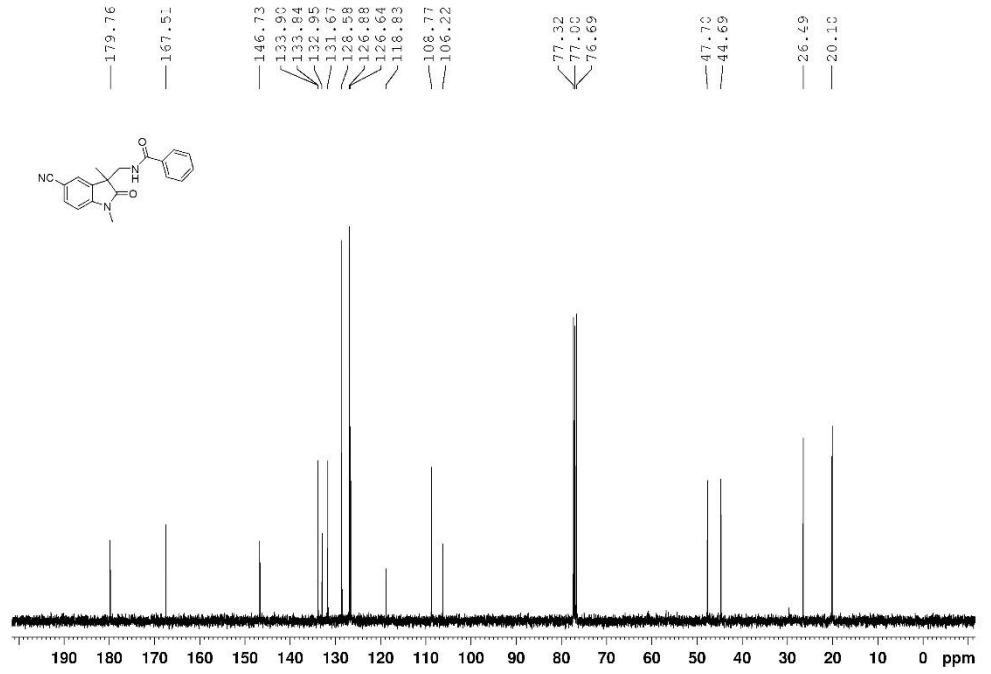
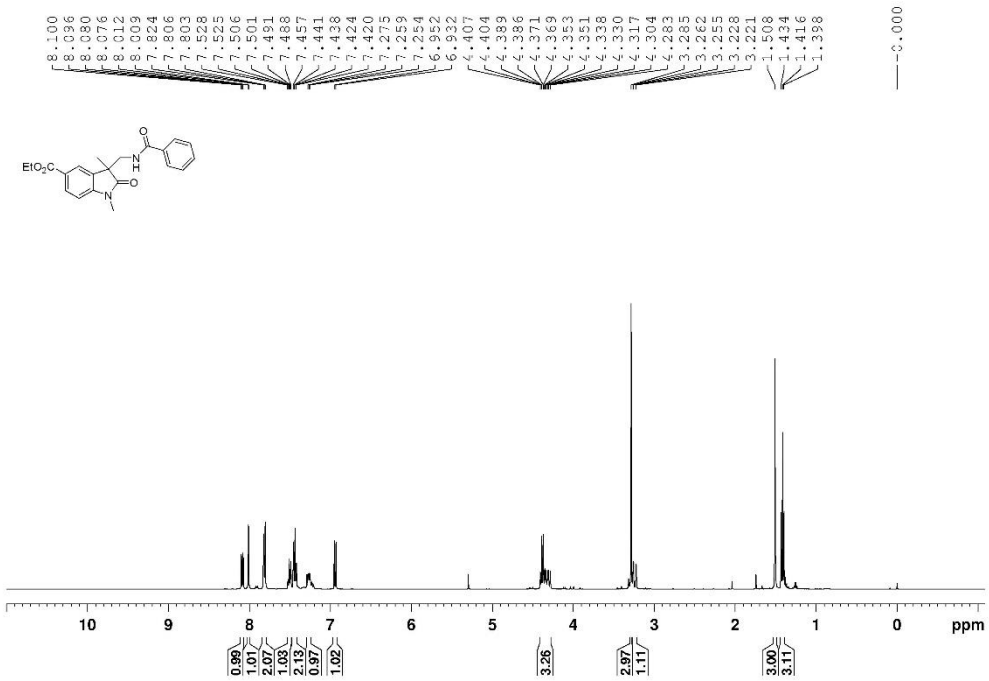
-40
-60
-80
-100
-120
-140
-160
-180
-200
ppm

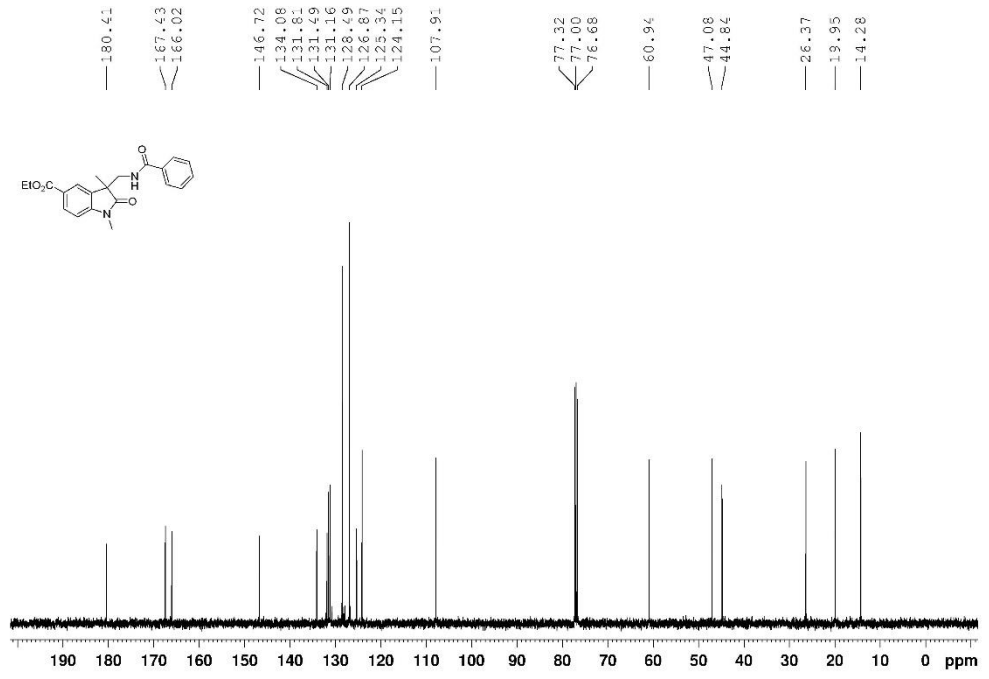
3n; ^{1}H NMR (400 Hz, $CDCl_3$); ^{13}C NMR (100 Hz, $CDCl_3$)



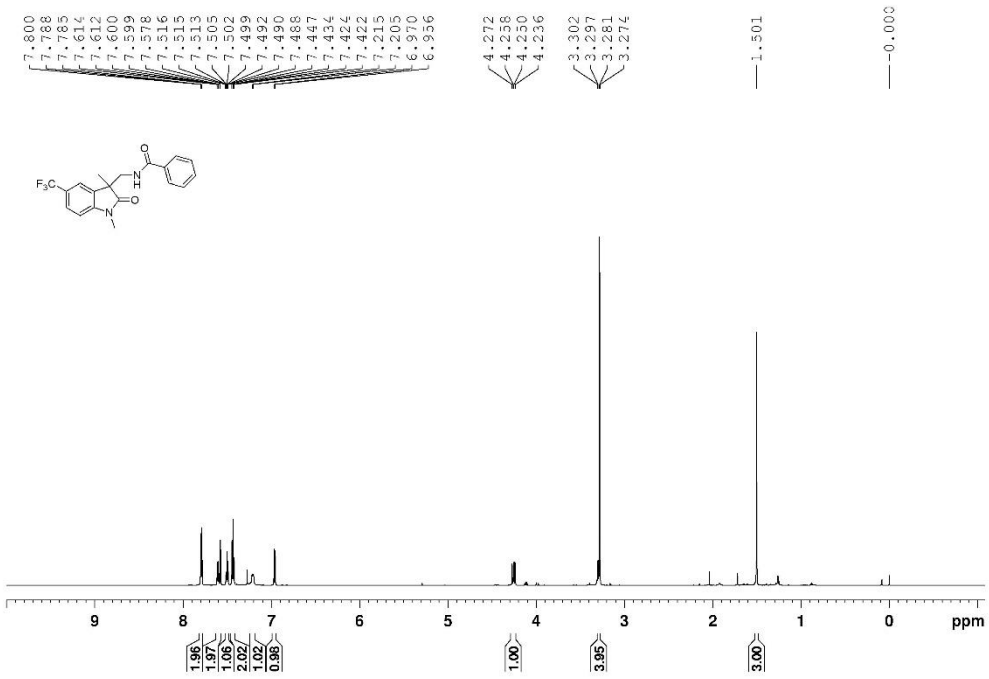


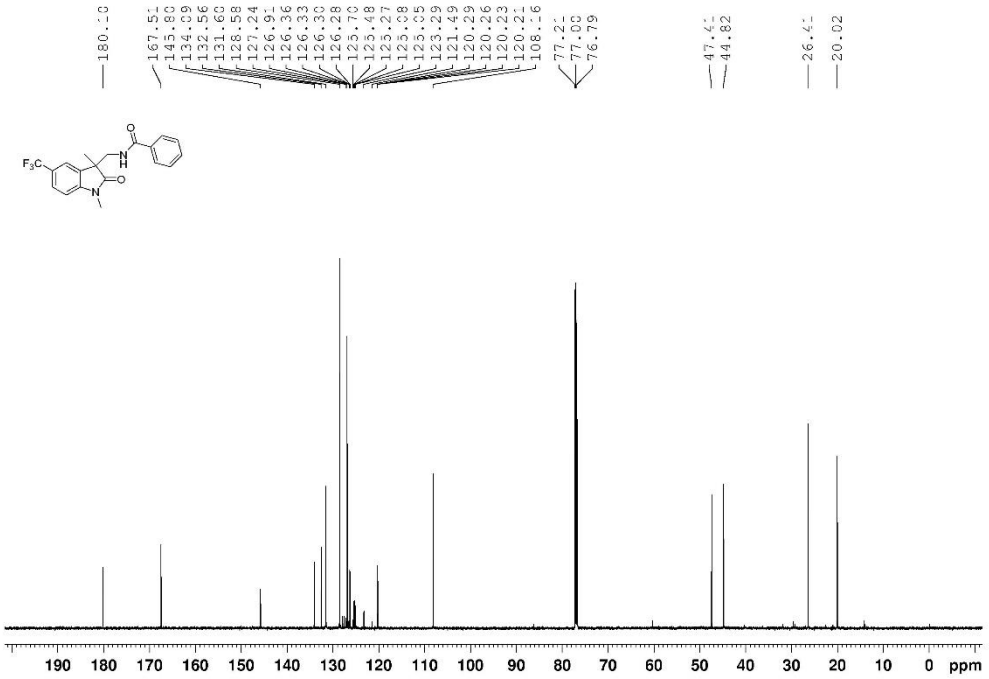
3o; ^{1}H NMR (400 Hz, $CDCl_3$); ^{13}C NMR (100 Hz, $CDCl_3$)

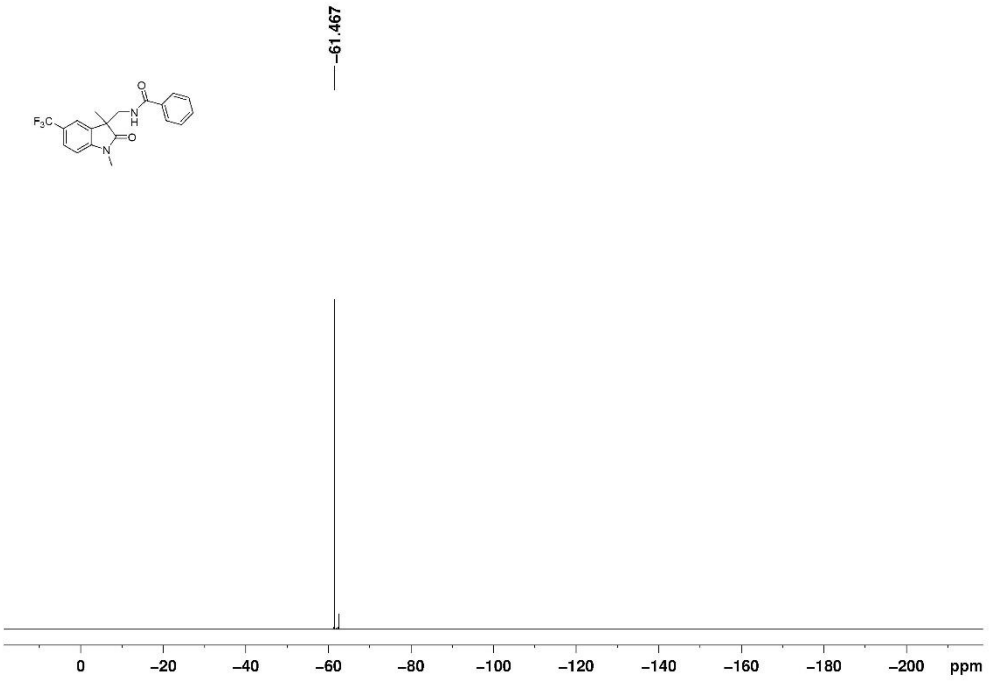




3p; ^{1}H NMR (600 Hz, $CDCl_3$); ^{13}C NMR (150 Hz, $CDCl_3$); ^{19}F NMR (376 Hz, $CDCl_3$)



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O
H
N
O
N
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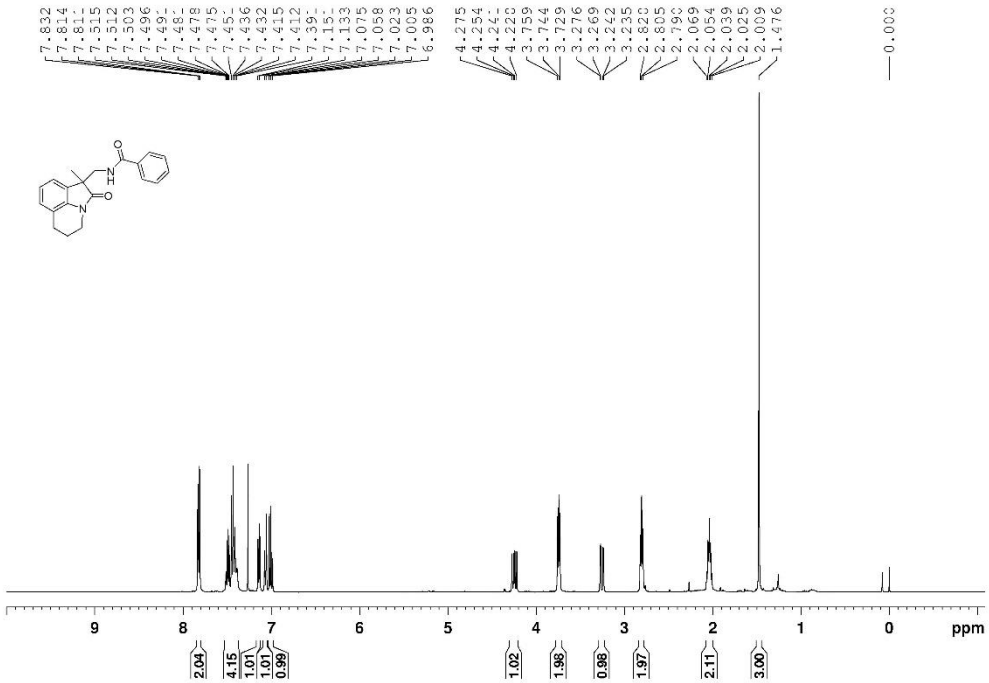
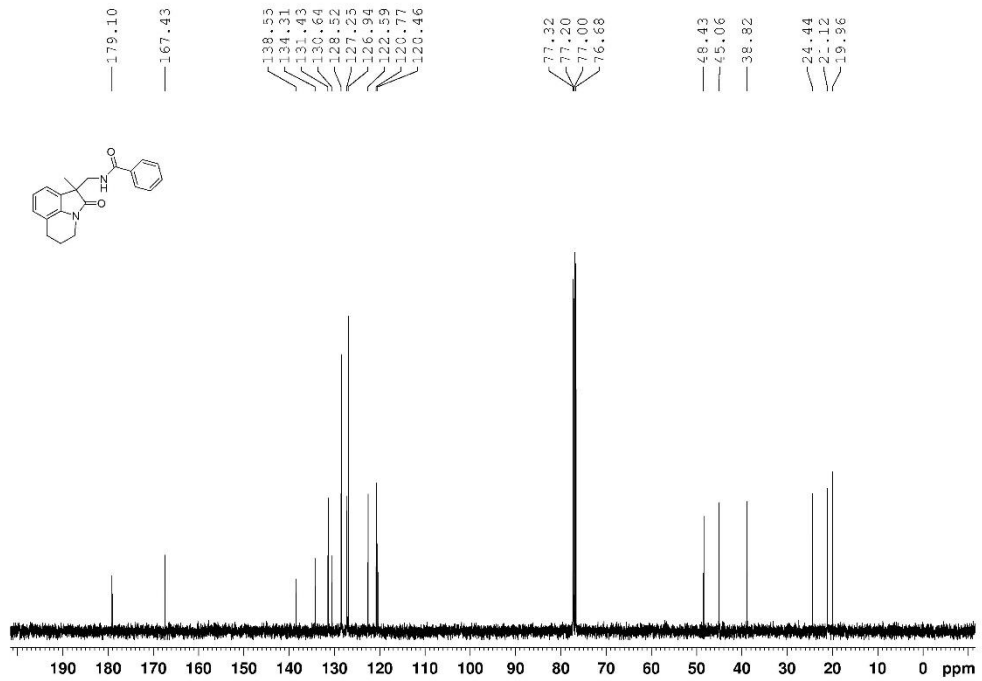
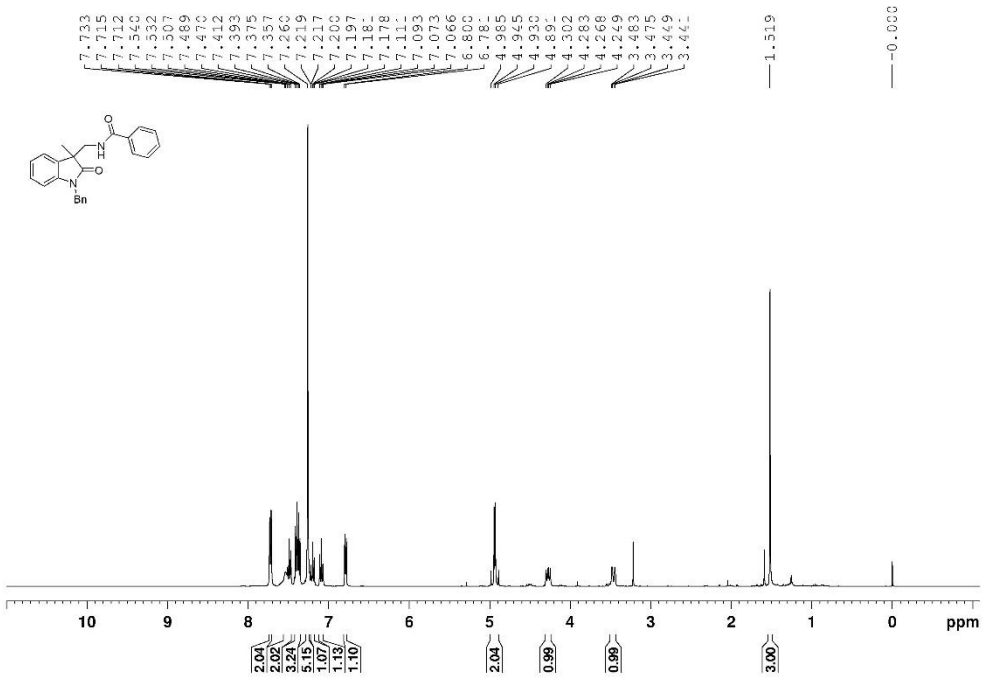
−20
−40
−60
−80
−100
−120
−140
−160
−180
−200
ppm

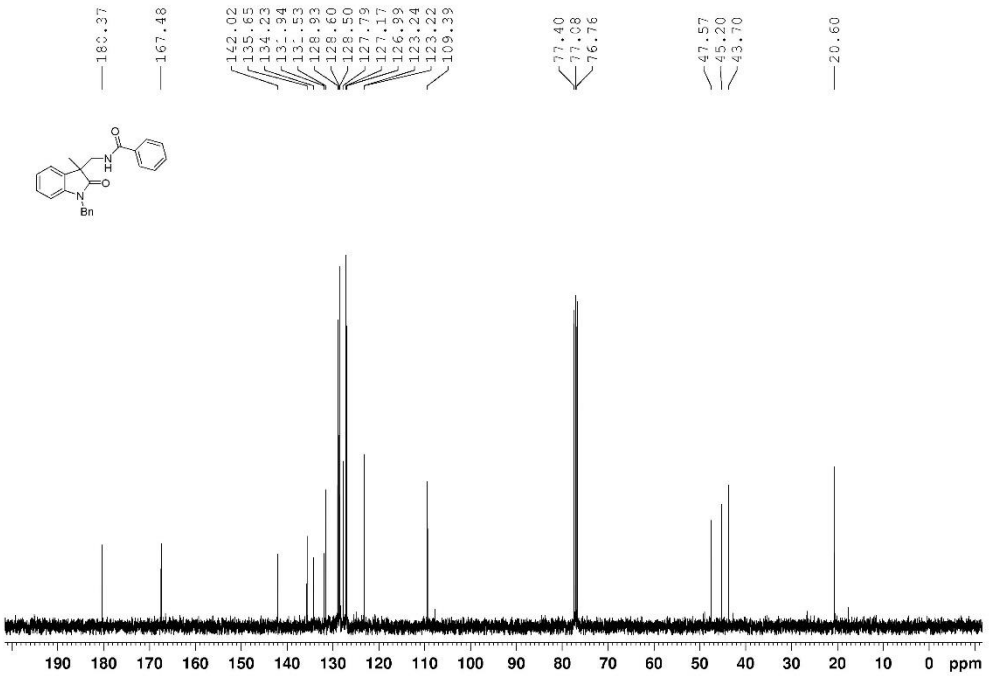
3q; ^{1}H NMR (400 Hz, $CDCl_3$); ^{13}C NMR (100 Hz, $CDCl_3$)



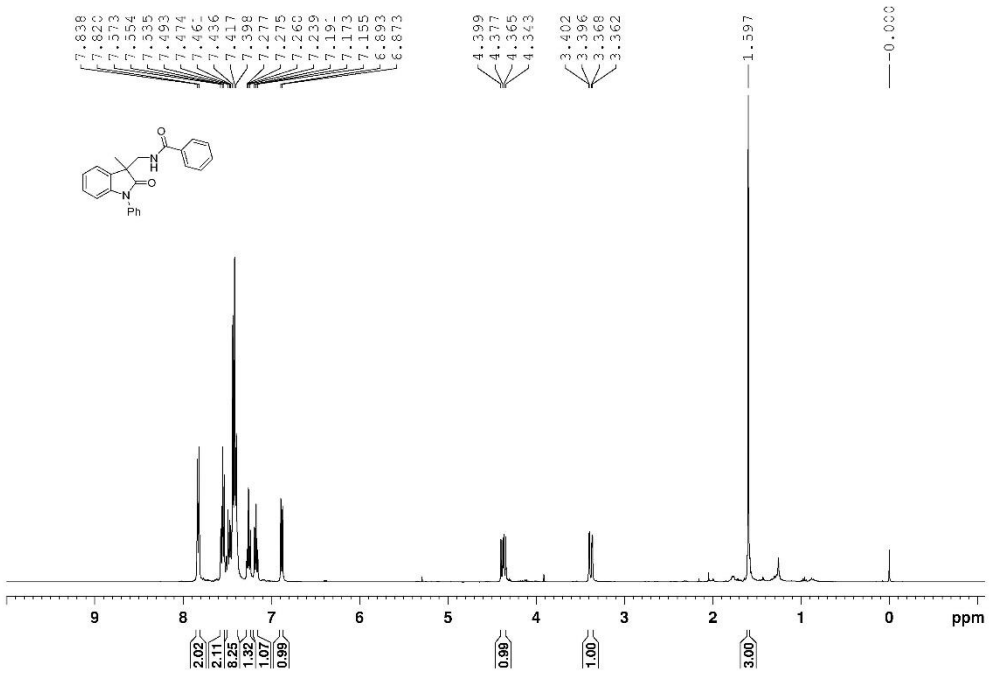


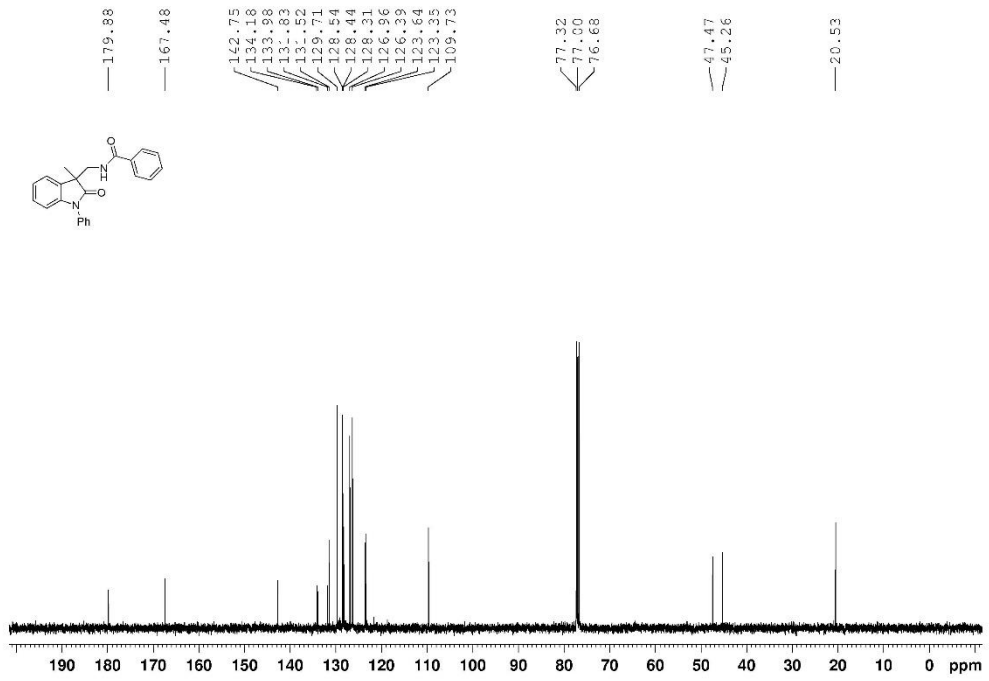
3r; ^{1}H NMR (400 Hz, $CDCl_3$); ^{13}C NMR (100 Hz, $CDCl_3$)



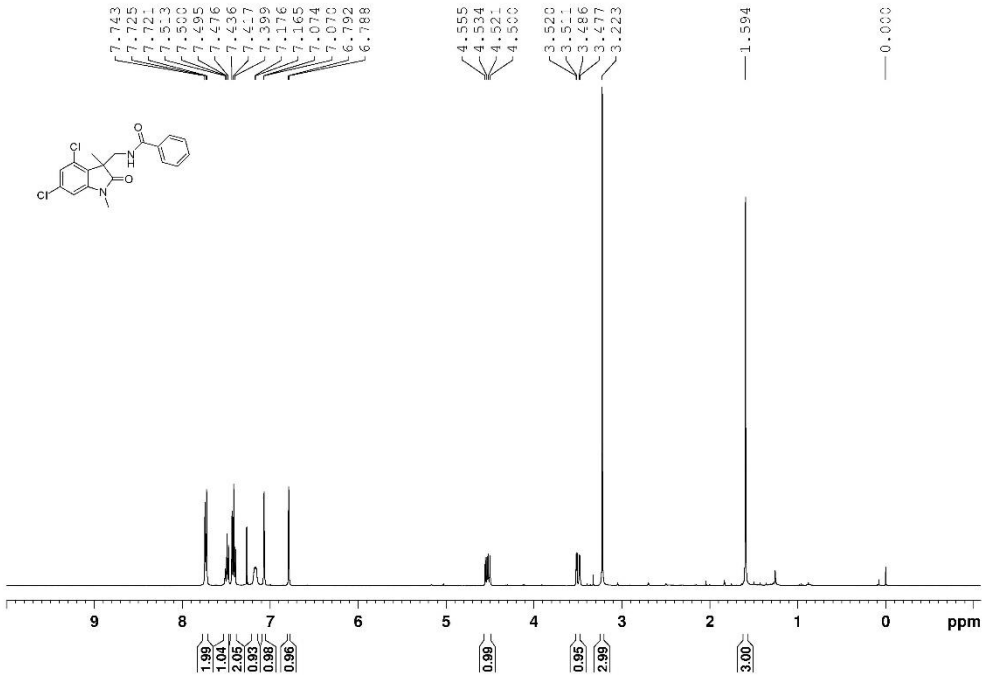


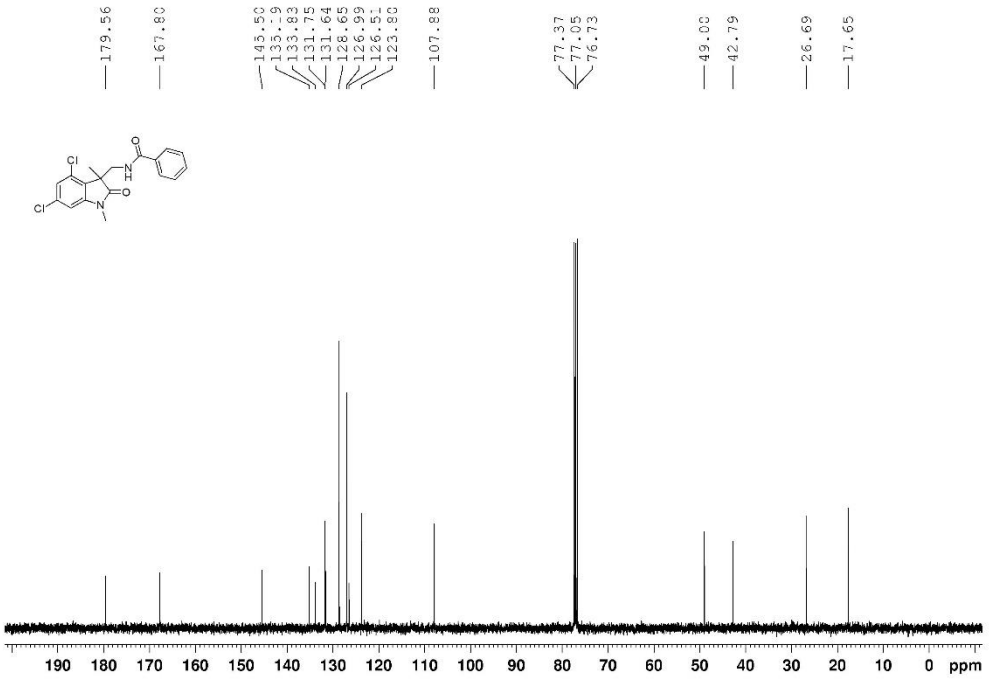
3s; ^{1}H NMR (400 Hz, $CDCl_3$); ^{13}C NMR (100 Hz, $CDCl_3$)



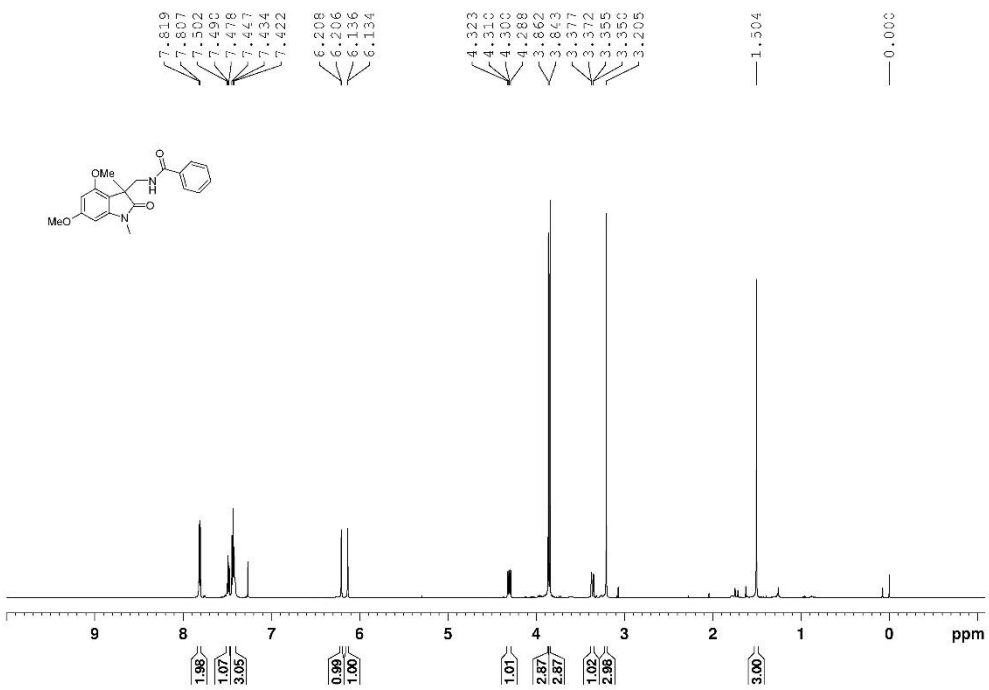


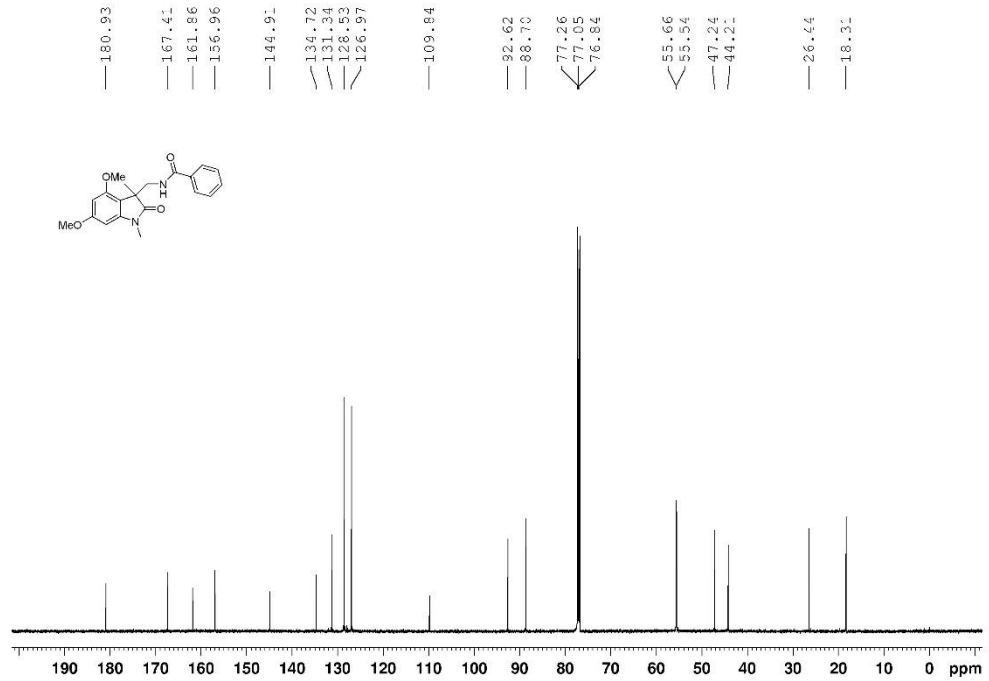
3t; ^{1}H NMR (400 Hz, $CDCl_3$); ^{13}C NMR (100 Hz, $CDCl_3$)



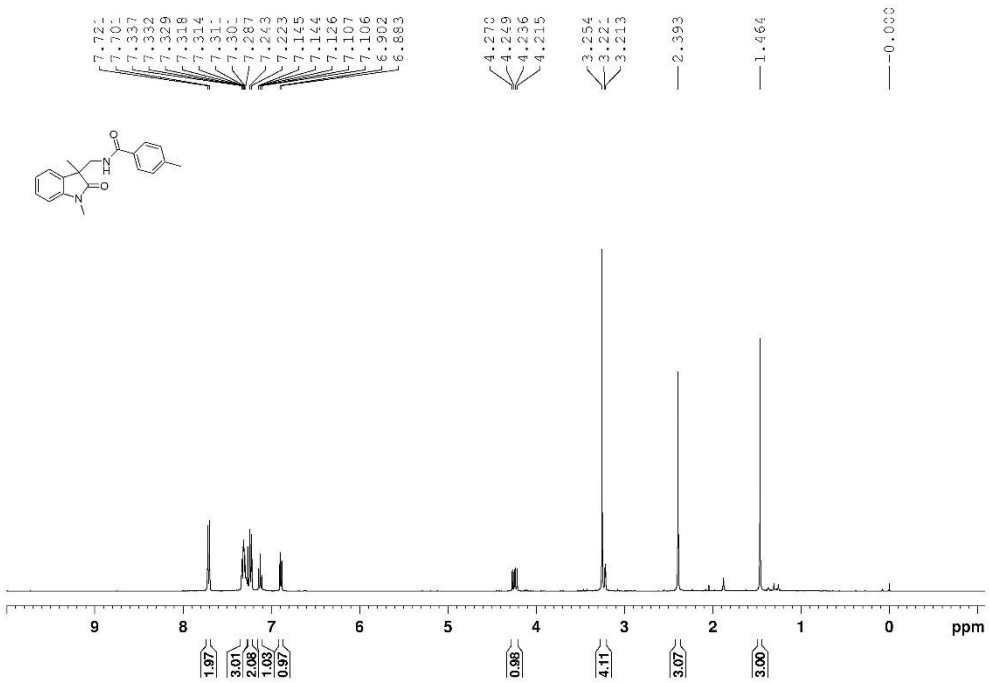


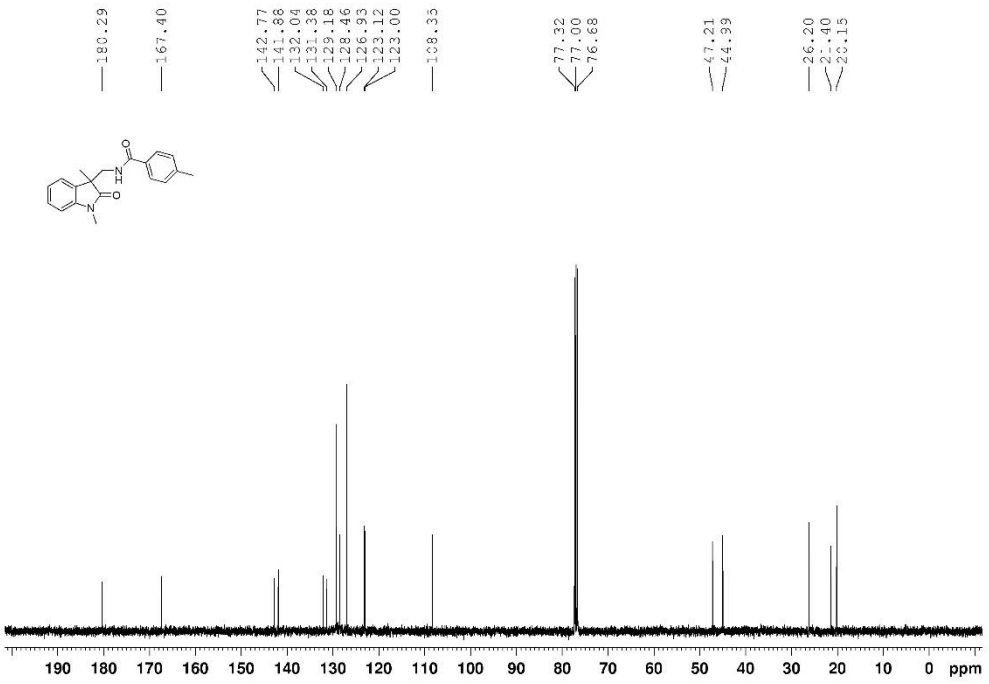
3u; ^{1}H NMR 600 Hz, $CDCl_3$); ^{13}C NMR (150 Hz, $CDCl_3$)



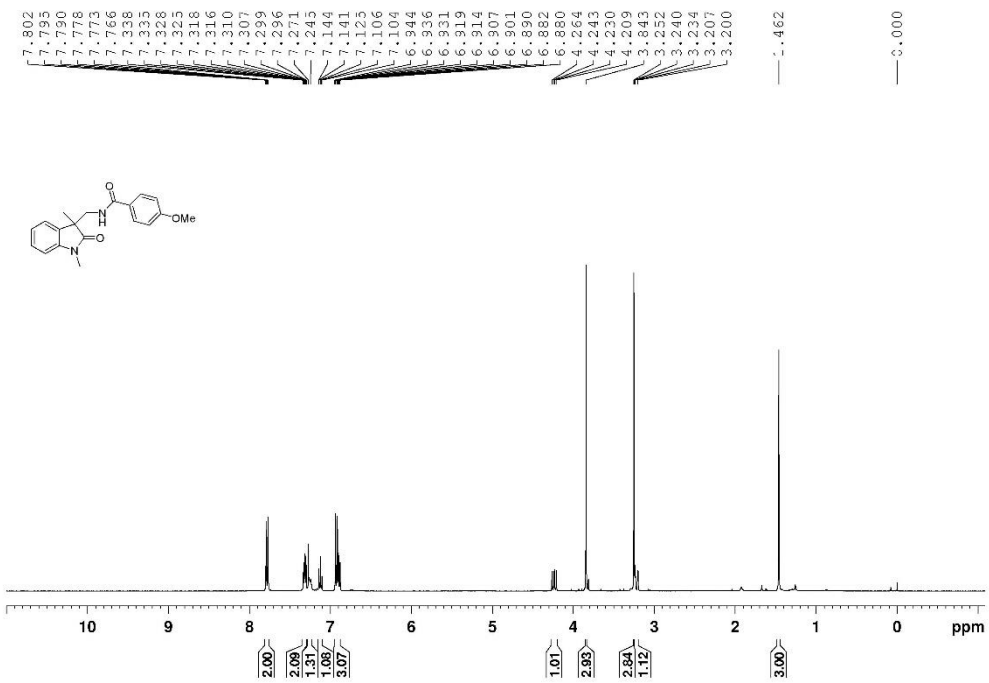


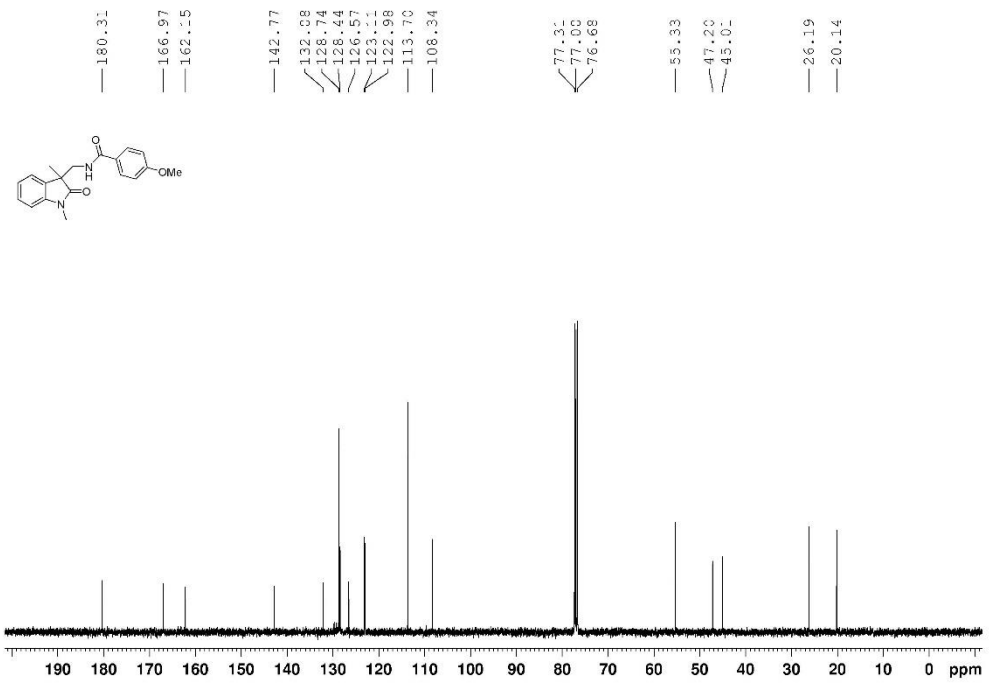
3ab; ^{1}H NMR (400 Hz, $CDCl_3$); ^{13}C NMR (100 Hz, $CDCl_3$)



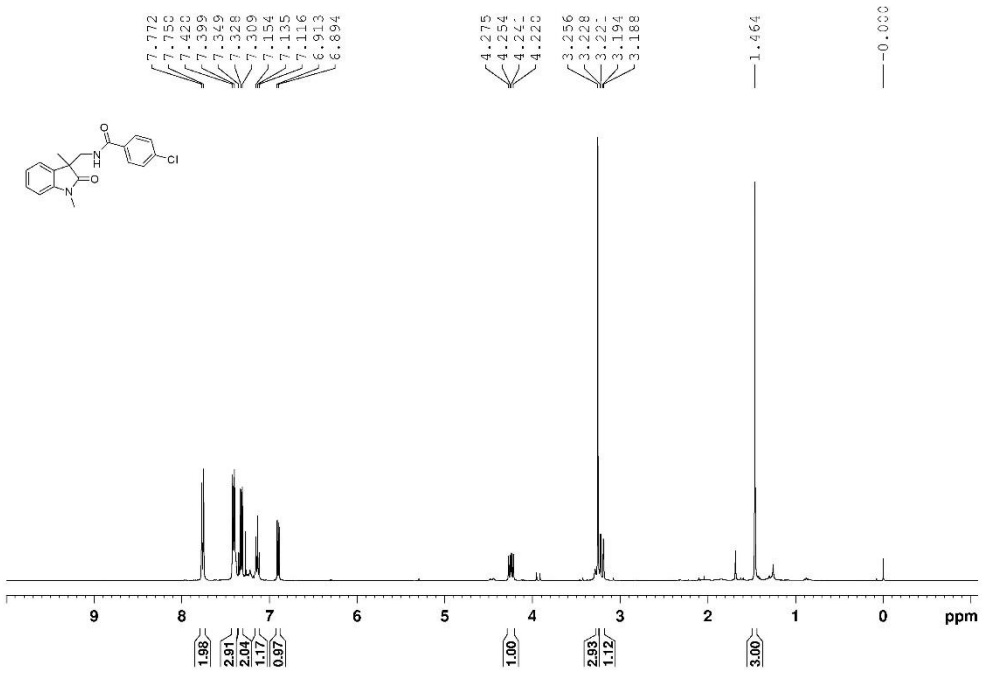


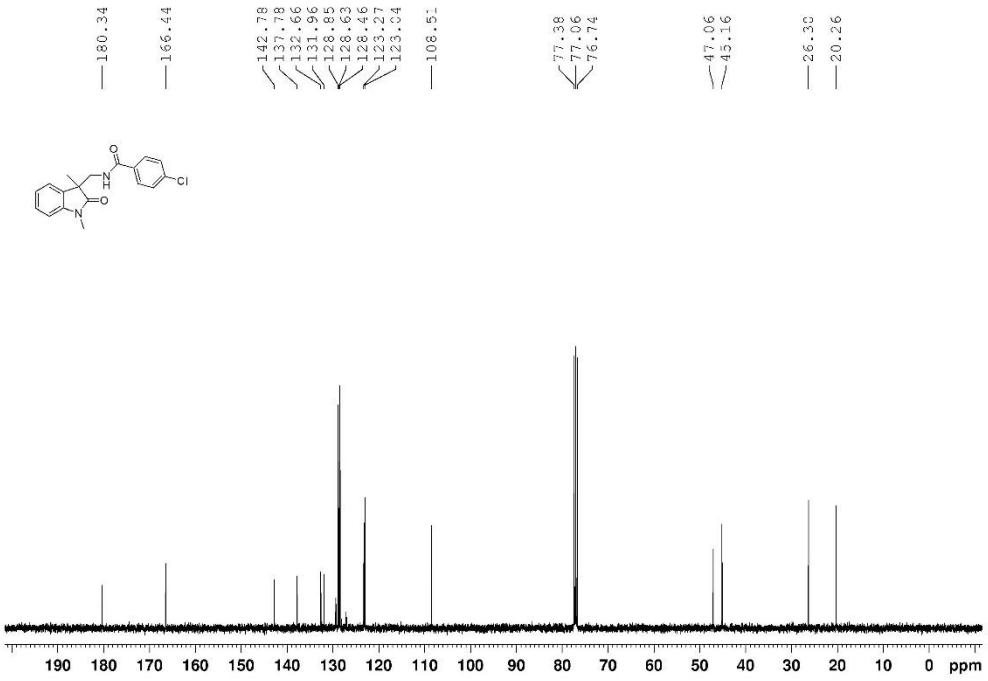
3ac; ^{1}H NMR (400 Hz, $CDCl_3$); ^{13}C NMR (100 Hz, $CDCl_3$)



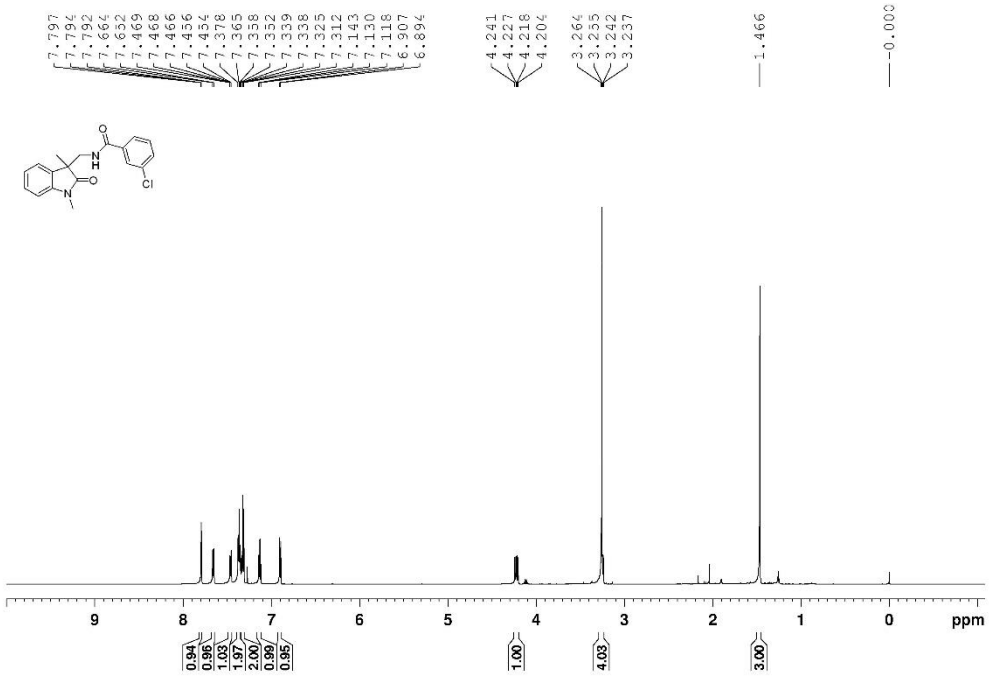


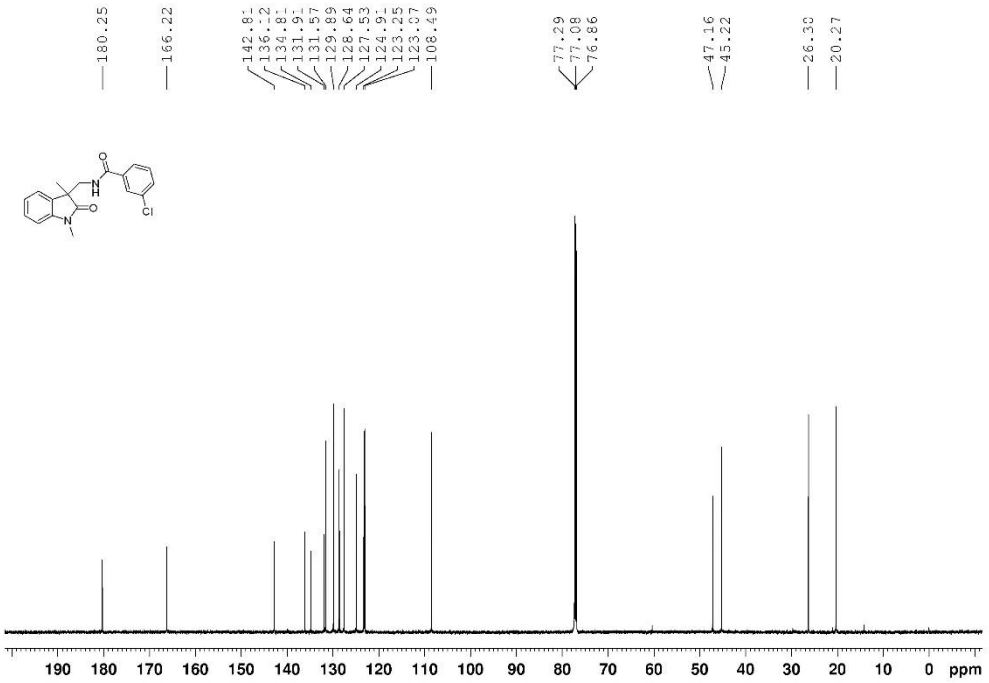
3ad; ^{1}H NMR (400 Hz, $CDCl_3$); ^{13}C NMR (100 Hz, $CDCl_3$)



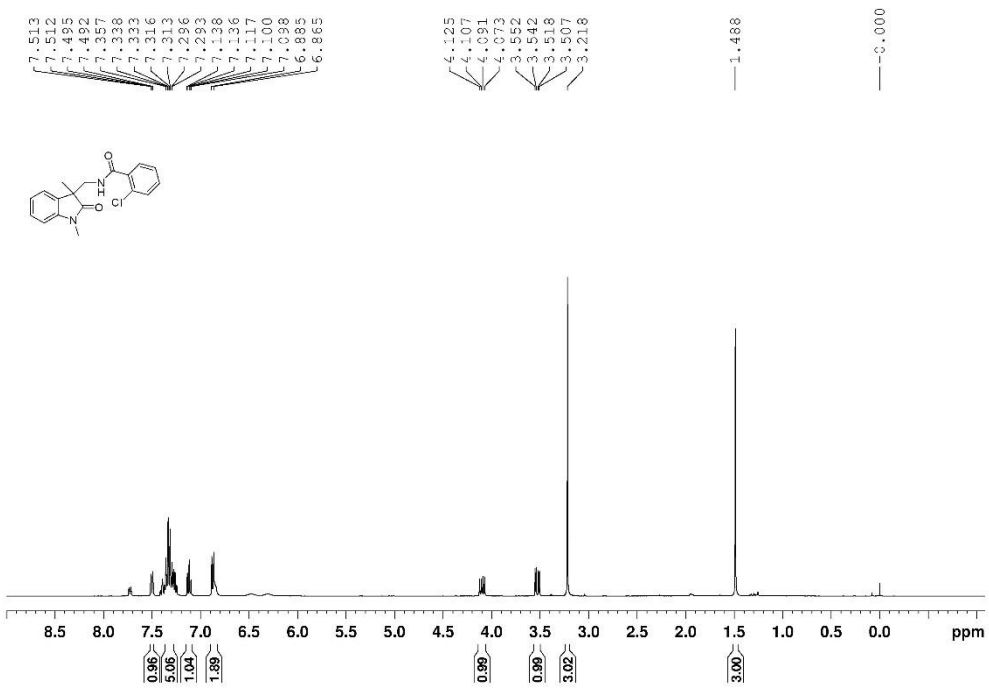


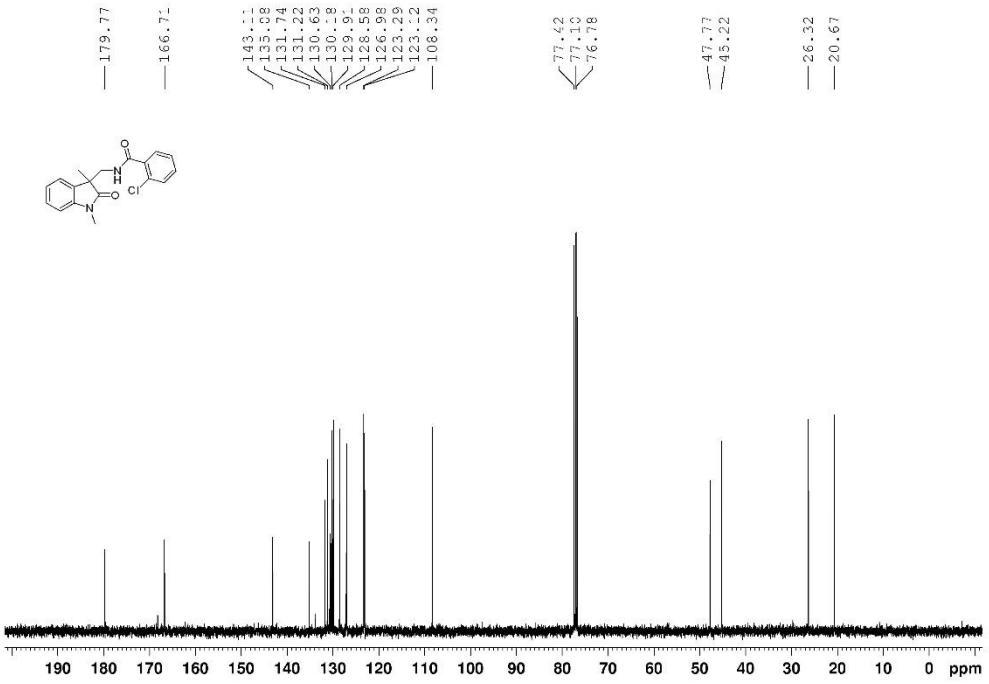
3ae; ^{1}H NMR (600 Hz, $CDCl_3$); ^{13}C NMR (150 Hz, $CDCl_3$)



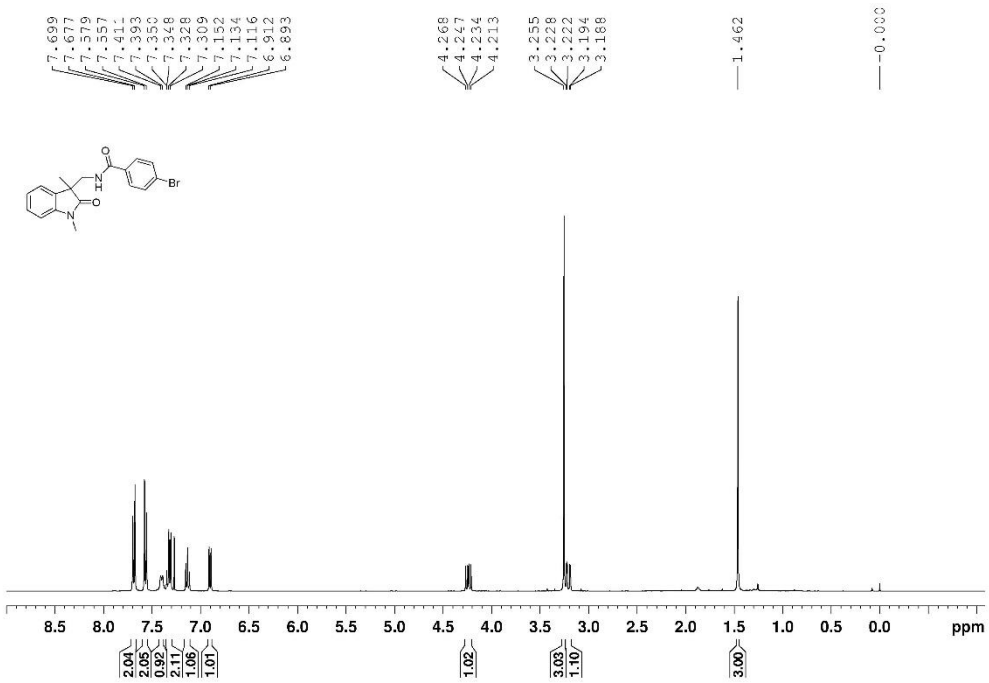


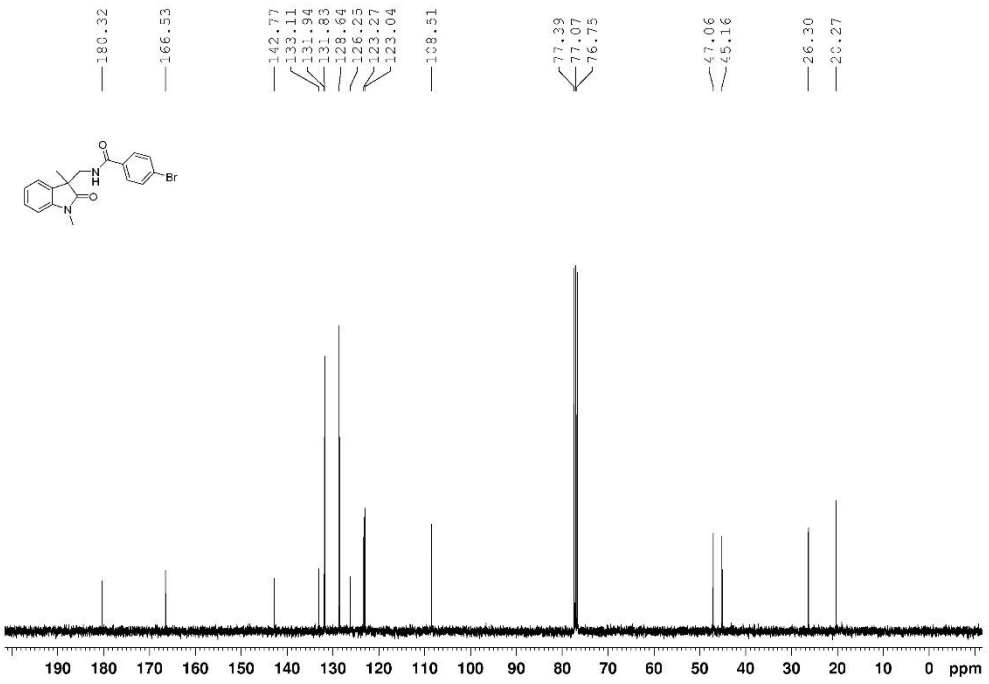
3af; ^{1}H NMR (600 Hz, $CDCl_3$); ^{13}C NMR (150Hz, $CDCl_3$)



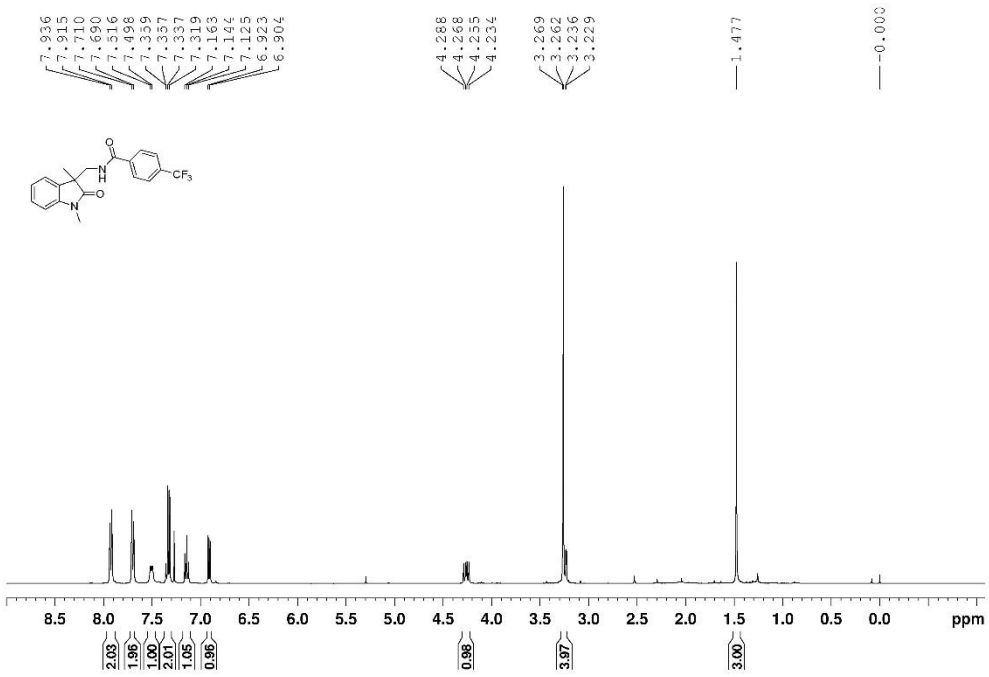


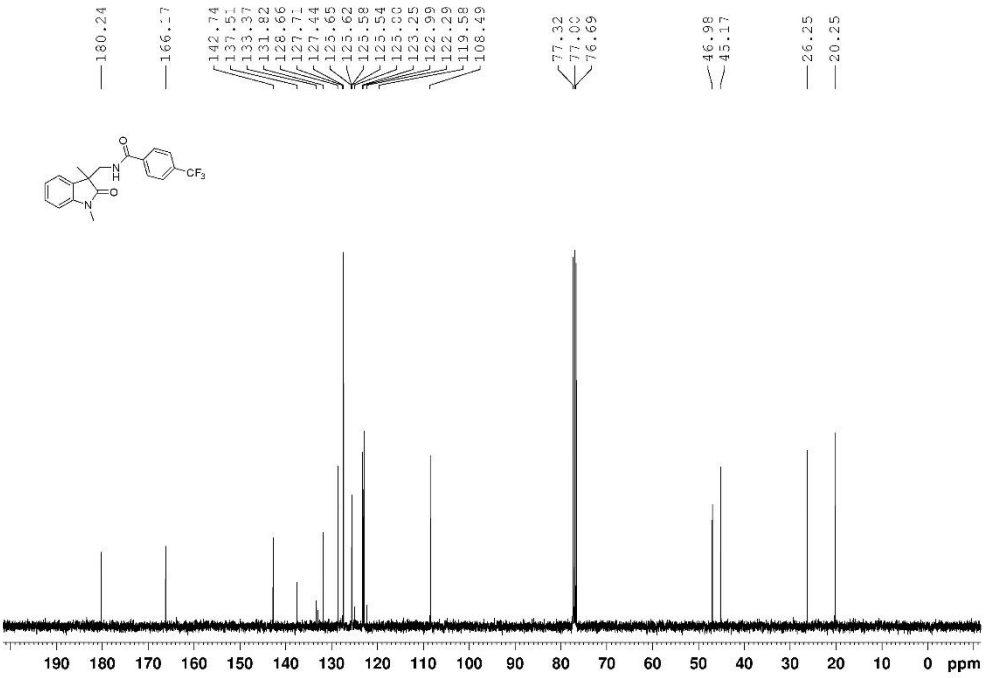
3ag; ^{1}H NMR (400 Hz, $CDCl_3$); ^{13}C NMR (100 Hz, $CDCl_3$)

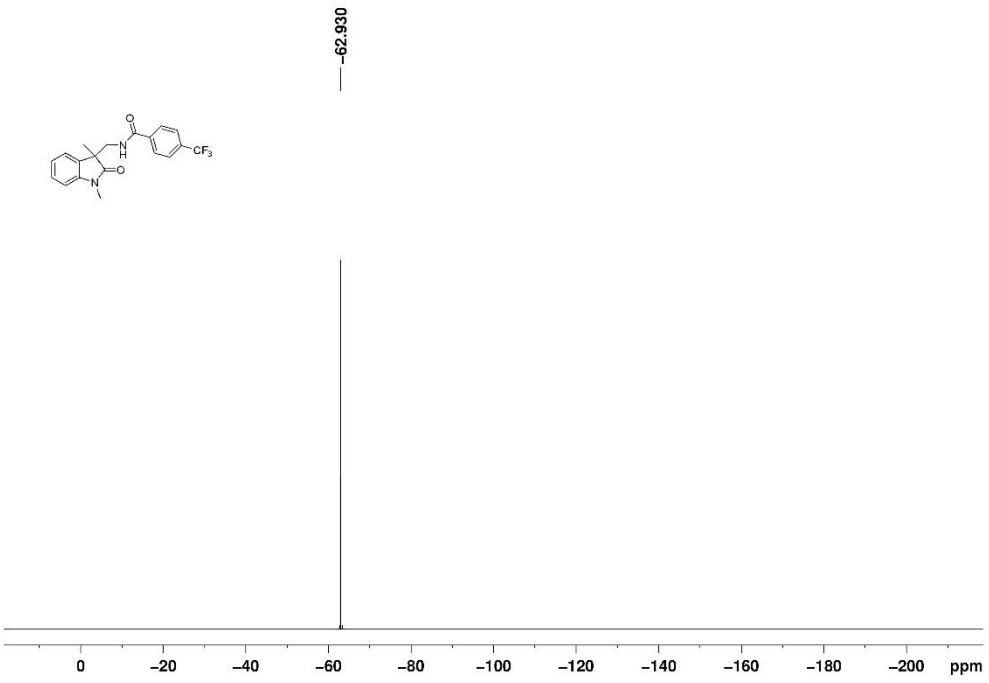




3ah; ^{1}H NMR (400 Hz, $CDCl_3$); ^{13}C NMR (100 Hz, $CDCl_3$); ^{19}F NMR (376 Hz, $CDCl_3$)



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-60
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-120
-140
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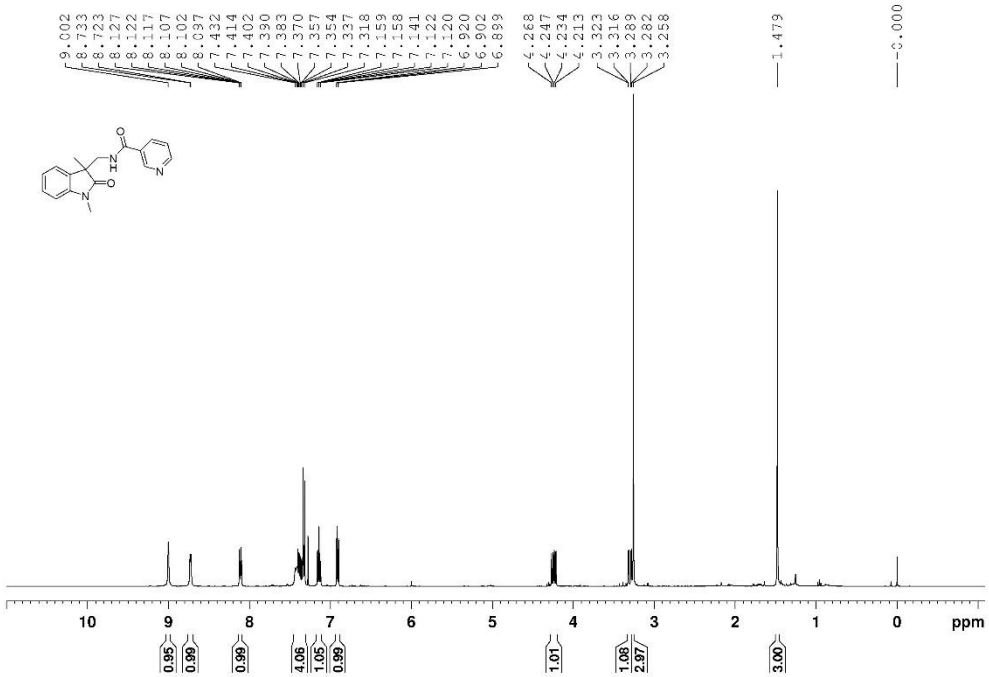
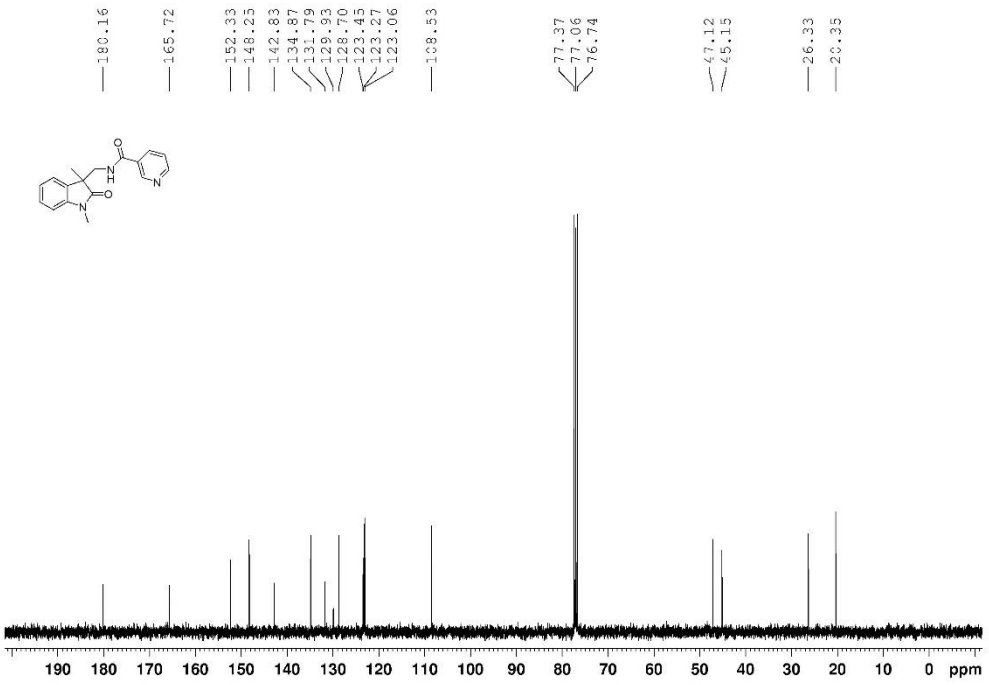
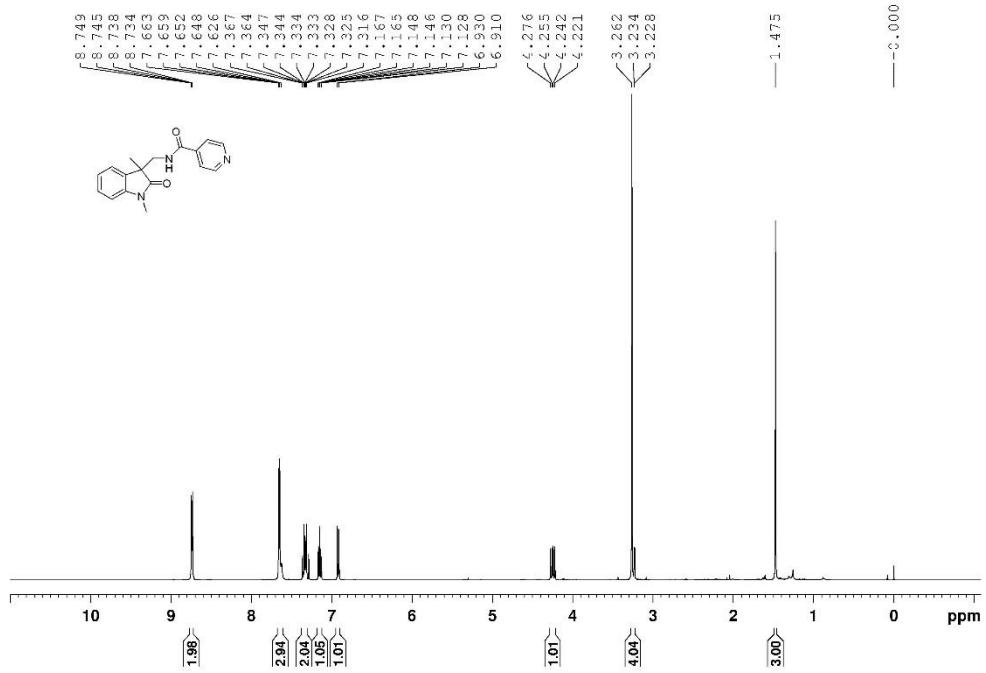
-180
-200
ppm

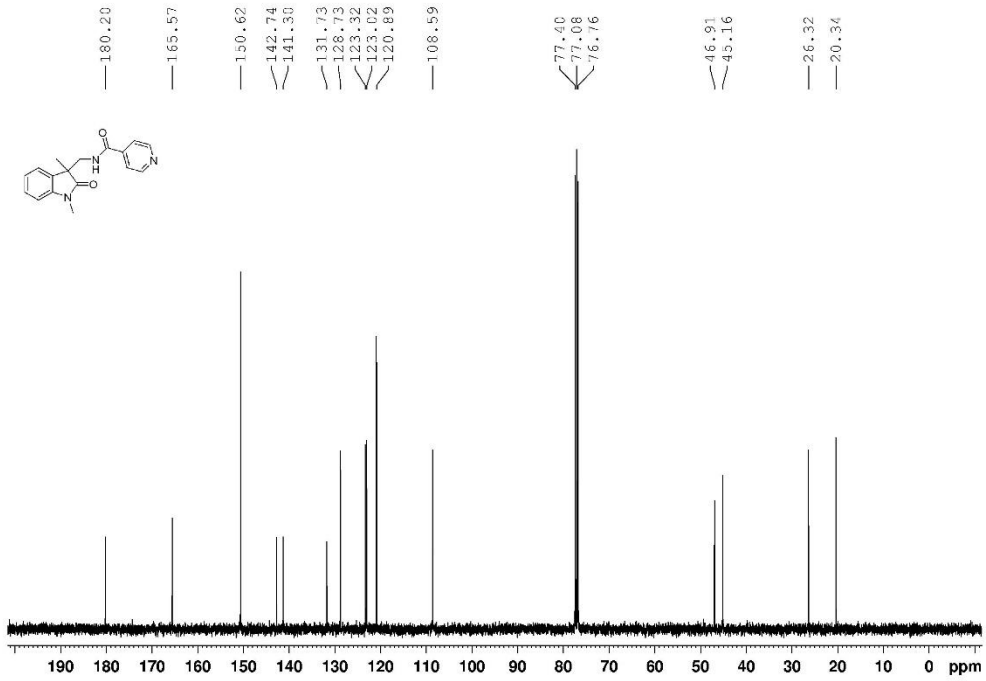
3ai; ^{1}H NMR (400 Hz, $CDCl_3$); ^{13}C NMR (100 Hz, $CDCl_3$)



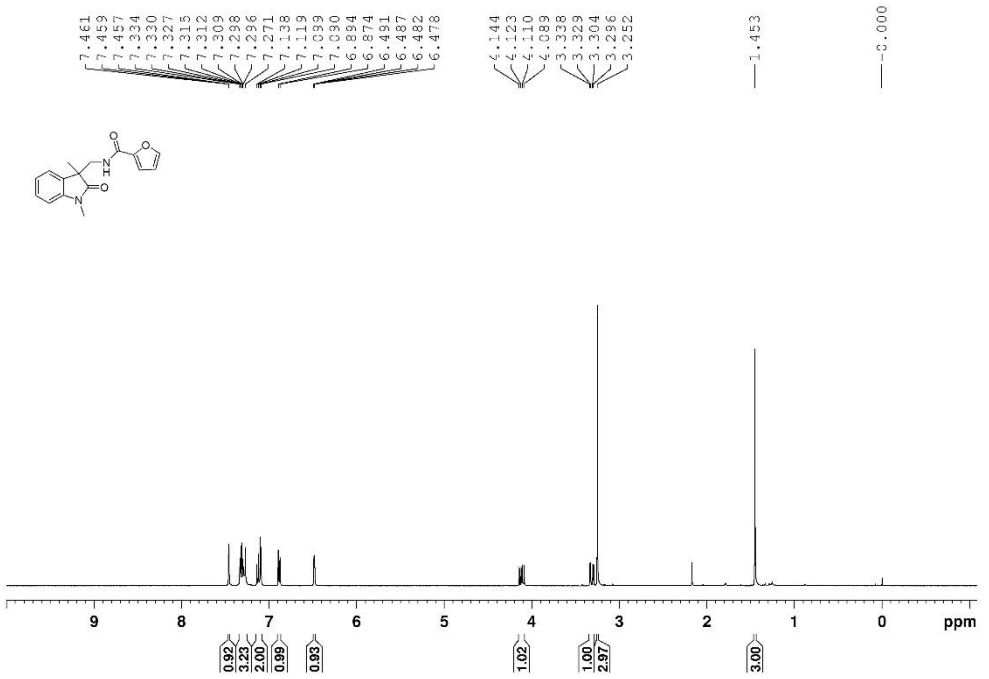


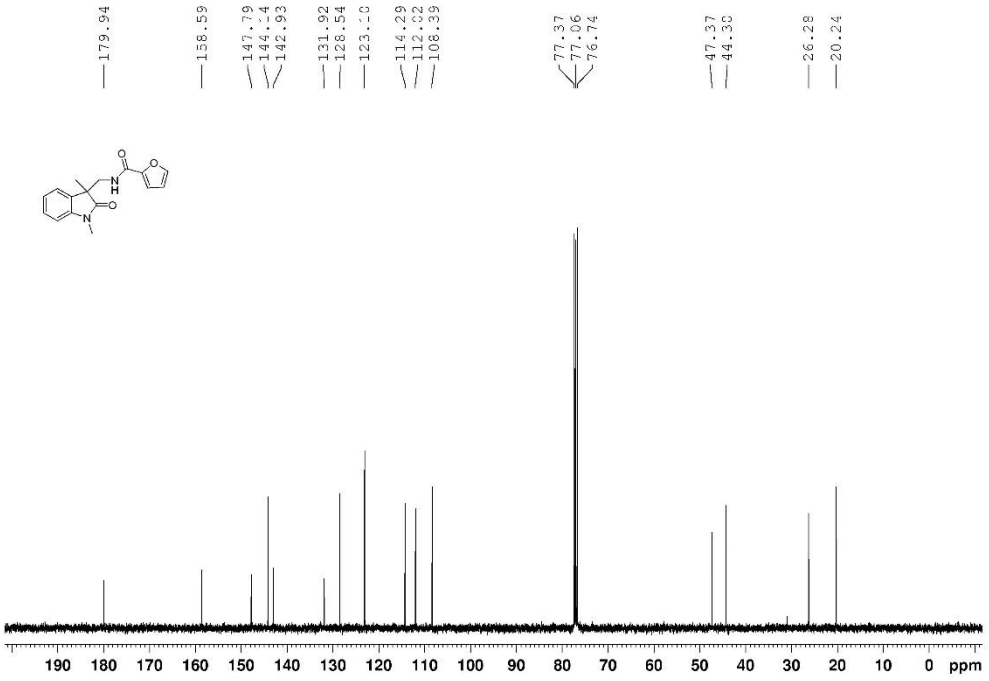
3aj; ^{1}H NMR (400 Hz, $CDCl_3$); ^{13}C NMR (100 Hz, $CDCl_3$)



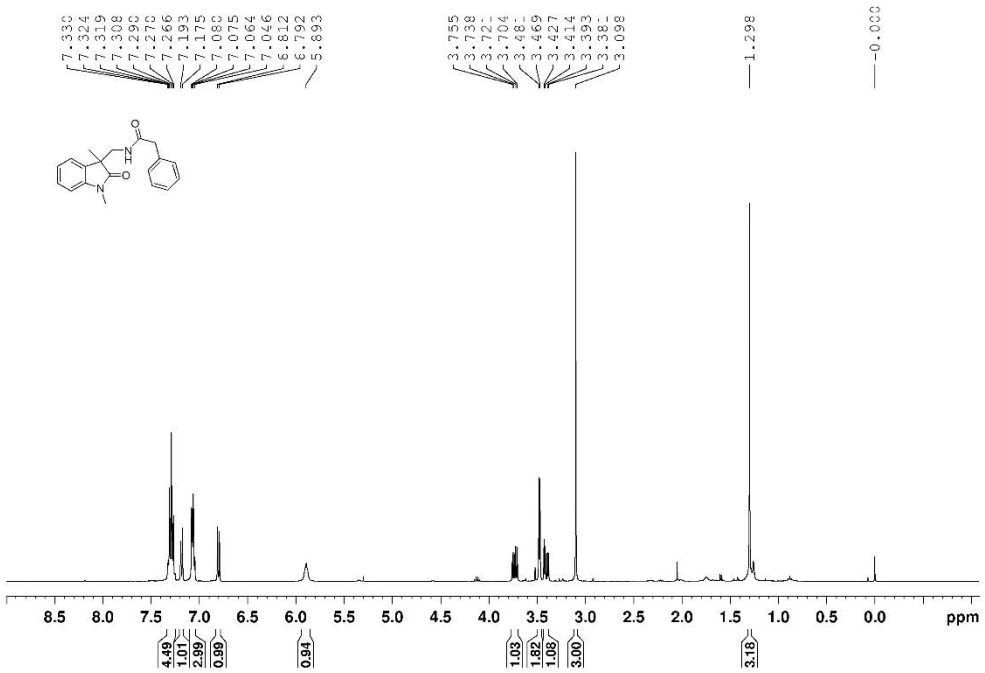


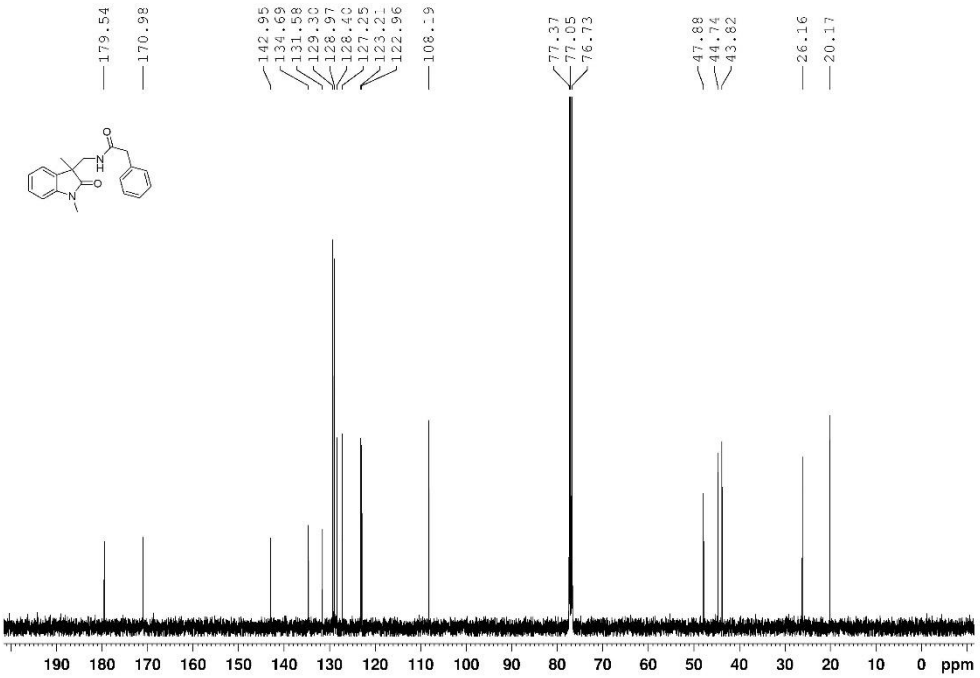
3ak; ^{1}H NMR (400 Hz, $CDCl_3$); ^{13}C NMR (100 Hz, $CDCl_3$)



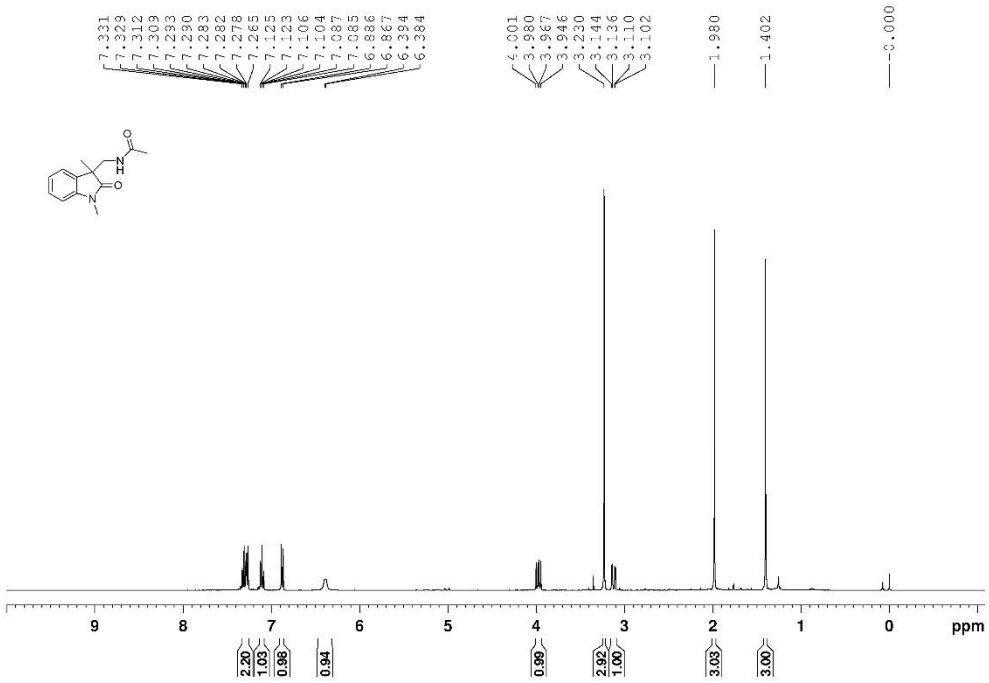


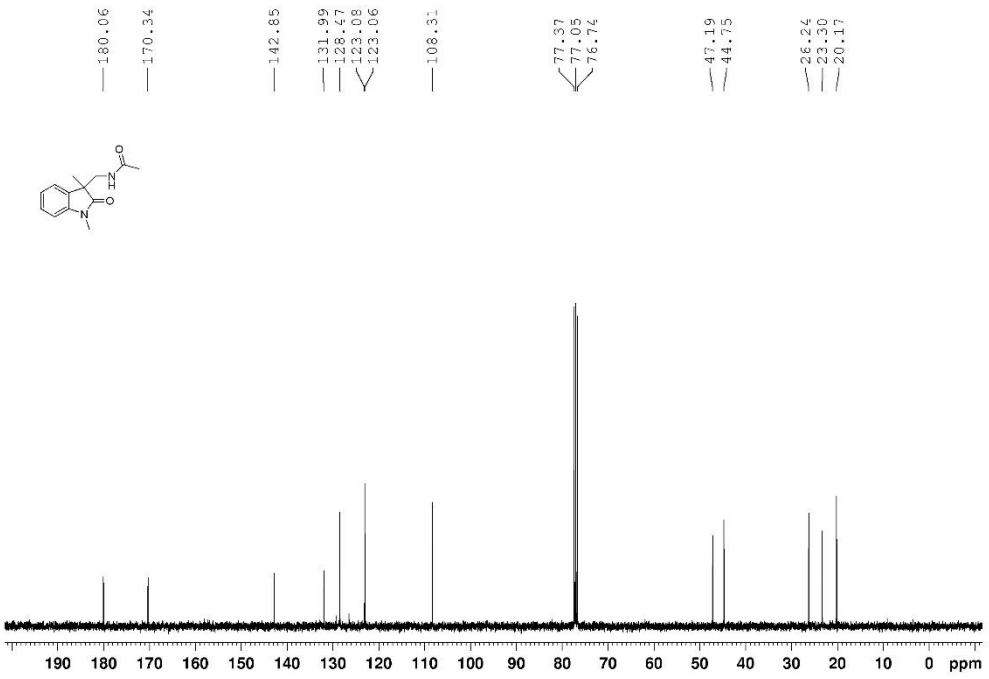
3al; ^{1}H NMR (400 Hz, $CDCl_3$); ^{13}C NMR (100 Hz, $CDCl_3$)



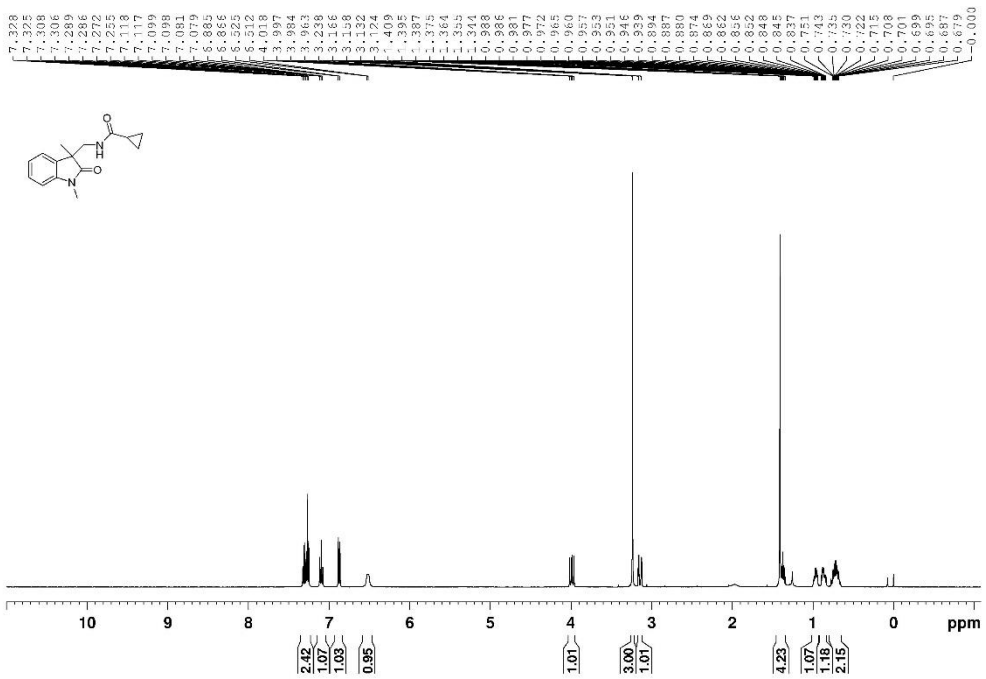


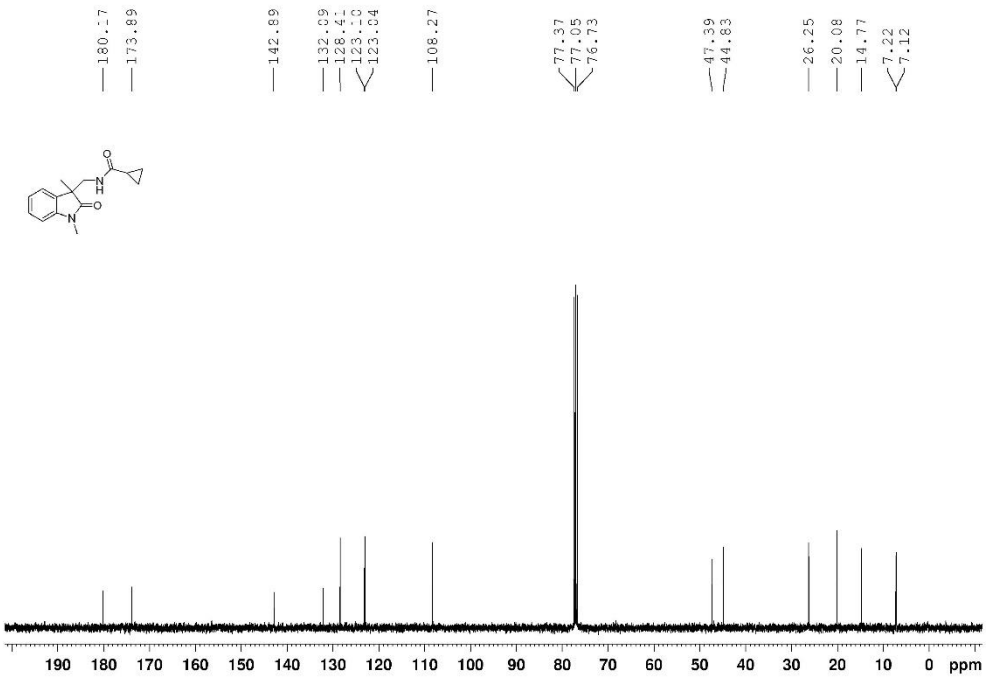
3am; ^{1}H NMR (400 Hz, $CDCl_3$); ^{13}C NMR (100 Hz, $CDCl_3$)



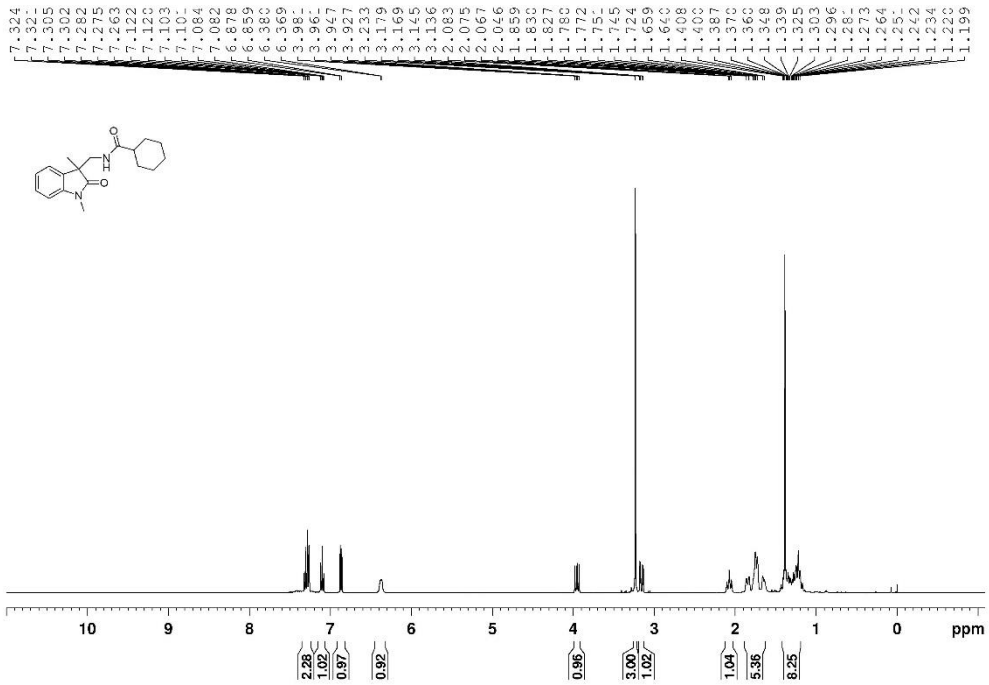


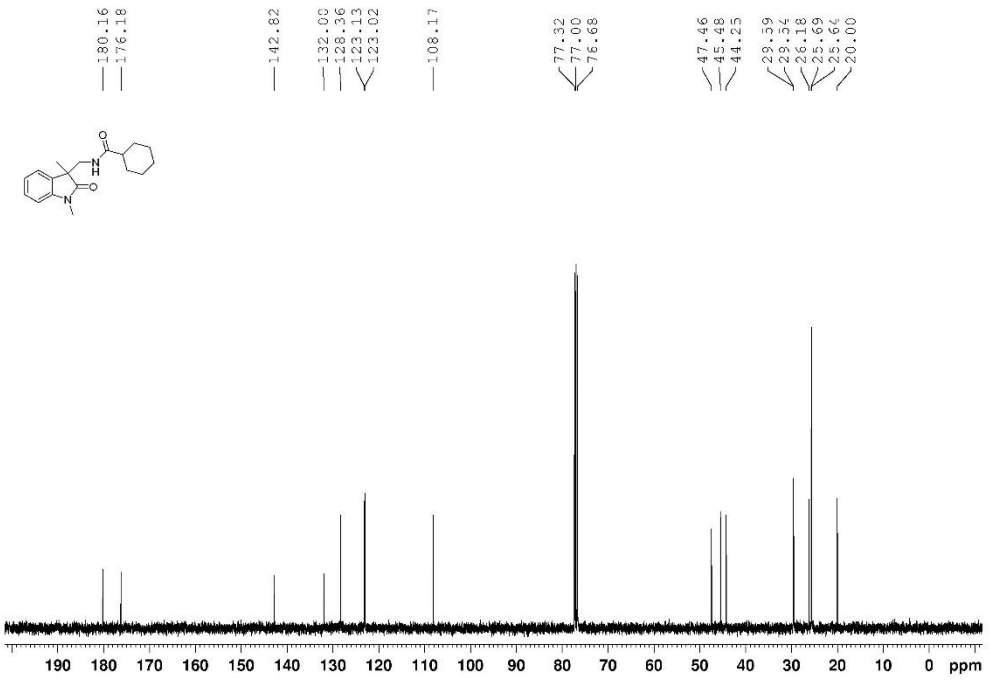
3an; ^{1}H NMR (400 Hz, $CDCl_3$); ^{13}C NMR (100 Hz, $CDCl_3$)



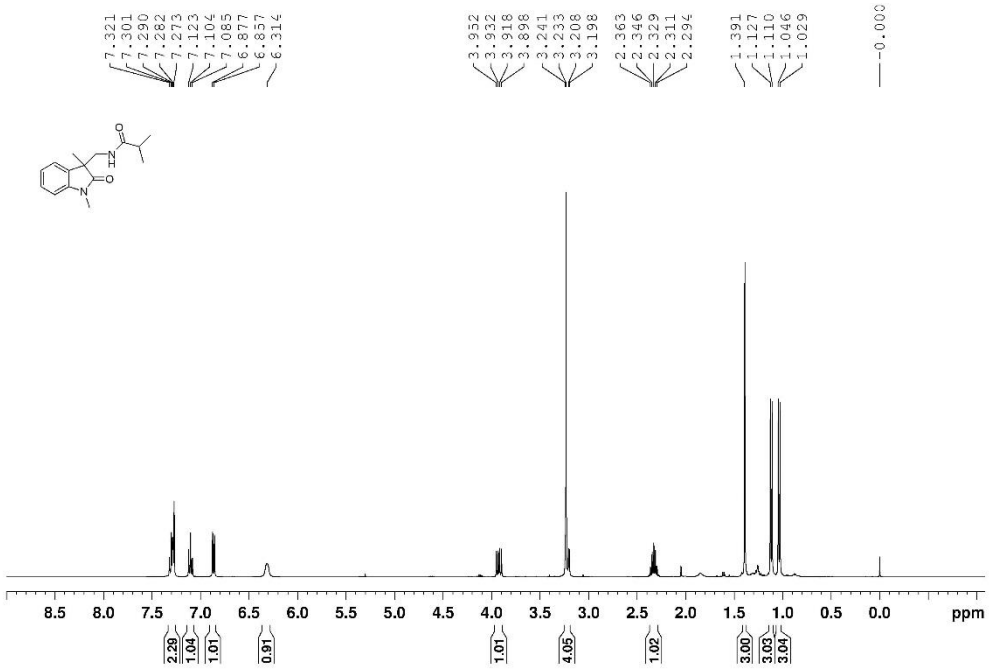


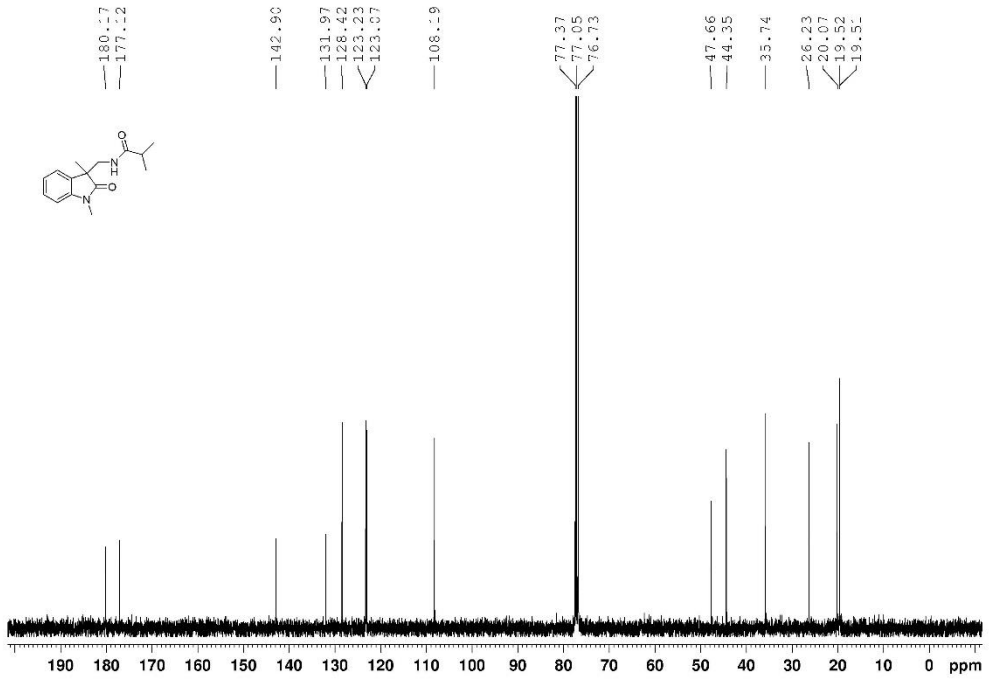
3ao; ^{1}H NMR (400 Hz, $CDCl_3$); ^{13}C NMR (100 Hz, $CDCl_3$)





3ap; ^{1}H NMR (400 Hz, $CDCl_3$); ^{13}C NMR (100 Hz, $CDCl_3$)





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