Supporting Information

Selective photochemical synthesis of primary arylamines and symmetric diarylamines via amination of aryl bromides using $Ni(NH_3)_6Cl_2$ as a nitrogen source and catalyst

Zhehui Xu,[a] Jianyang Dong,[a] Geyang Song,[a] Fuqiang Kong,[a] Gang Li,[a] Dong Xue*[a]

[a]Key Laboratory of Applied Surface and Colloid Chemistry, Ministry of Education and School of Chemistry and Chemical Engineering, Shaanxi Normal University, Xi'an, 710062 (China).

E-mail: xuedong_welcome@snnu.edu.cn

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1. General information

Unless otherwise specified, the chemicals were obtained commercially and used without further purification. All reactions were carried out under argon atmosphere with dry solvents under anhydrous conditions. Analytical thin-layer chromatography (TLC) was conducted with TLC plates (Silica gel 60 F254, Qingdao Haiyang) and visualization on TLC was achieved by UV light and the use of ninhydrin and iodine color developer to assist. Flash column chromatography was performed on silica gel 200-300 mesh.

^{1}H NMR spectra, $^{13}C\{^{1}H\}$ NMR spectra and ^{19}F NMR spectra were recorded on a Bruker Advance 400 MHz spectrometer. ^{1}H NMR spectra was reported in units of parts per million (ppm) relative to tetramethylsilane (δ 0 ppm), $CDCl_3$ (δ 7.26 ppm) or DMSO-d_6 (δ 2.50 ppm). Multiplicities are given as: br (broad), s (singlet), d (doublet), t (triplet), q (quartet), dd (doublets of doublet), dt (doublets of triplet) or m (multiplet). $^{13}C\{^{1}H\}$ NMR spectra was reported in ppm relative to tetramethylsilane (δ 0 ppm), $CDCl_3$ (δ 77.16 ppm) or DMSO-d_6 (δ 39.52 ppm). HRMS (ESI) were performed on fourier transform ion cyclotron resonance mass spectrometer.

The purple LED lamp used in the experiments was assembled by ourselves (Figure S1). Each of lamp include: 9 W purple LED (390-395 nm, 3 LED lamp beads in series), aluminium radiator with fan, electric driver (XC-8W600-OS). The optical power up to 200 ± 10 mw at 1 cm axis distance detected by Thorlabs' Optical Power Meter (PM100D, S120VC). The LED beads were purchased from Zhuhai UV Optoelectronics Co., Ltd. (THUV395T3WL-3535-60).

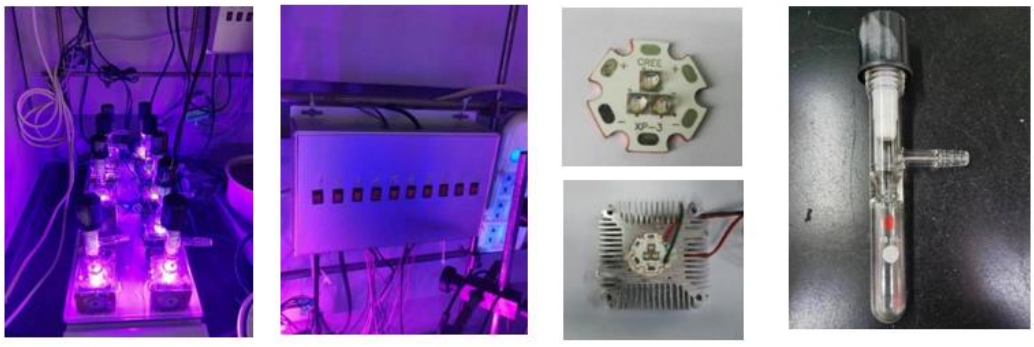
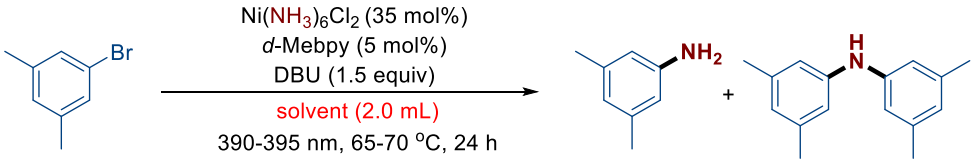


Figure S1. Pictures of photo device and reaction tube

2. Optimization of reaction conditions

2.1 The reaction conditions for preparation of primary arylamines

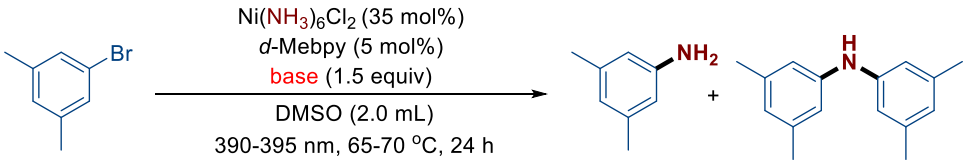
Table S1. The screening of solvents



entry	solvent (2.0 mL)	diarylamine	arylamine
1	DMSO	13%	59%
2	DMF	16%	51%
3	DMAc	13%	42%
4	THF	N.D.	trace
5	1,4-Dioxane	N.D.	N.D.
6	CH_3CN	N.D.	7%
7	2-MeTHF	N.D.	N.D.
8	DMSO:THF=5:1	5%	35%
9	DMAC:THF=9:1	5%	16%

Reaction conditions: aryl bromide (0.2 mmol), $Ni(NH_3)_6Cl_2$ (35 mol%), *d*-Mebpy (5 mol%), DBU (1.5 equiv), solvent (2.0 mL), purple LEDs (390-395 nm), 65-70 °C, Ar, 24 h. Yields determined by ^1H NMR using 1,3-benzodioxole as an internal standard.

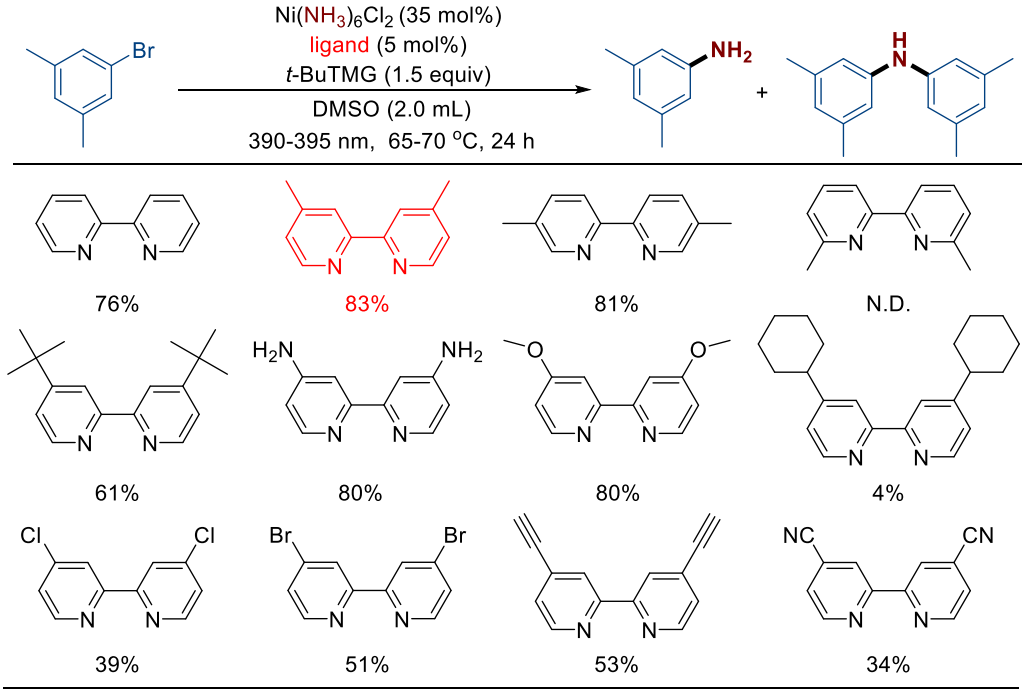
Table S2. The screening of bases



entry	base (1.5 equiv)	diarylamine	arylamine
1	DBU	13%	59%
2	DBN	7%	31%
3	TBD	23%	40%
4	MTBD	trace	98%
5	DMTHPM	18%	61%
6	DABCO	5%	trace
7	TMG	6%	41%
8	*t*-BuTMG	trace	86%
9	DIPEA	trace	N.D.
10	Et_3N	5%	trace

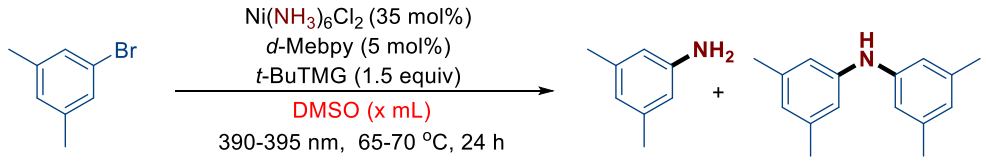
Reaction conditions: aryl bromide (0.2 mmol), $Ni(NH_3)_6Cl_2$ (35 mol%), *d*-Mebpy (5 mol%), base (1.5 equiv), DMSO (2.0 mL), purple LEDs (390-395 nm), 65-70 °C, Ar, 24 h. Yields determined by ^1H NMR using 1,3-benzodioxole as an internal standard.

Table S3. The screening of ligands



Reaction conditions: aryl bromide (0.2 mmol), $Ni(NH_3)_6Cl_2$ (35 mol%), ligand (5 mol%), *t*-BuTMG (1.5 equiv), DMSO (2.0 mL), purple LEDs (390-395 nm), 65-70 °C, Ar, 24 h. The yields of arylamines were determined by ^{1}H NMR using 1,3-benzodioxole as an internal standard.

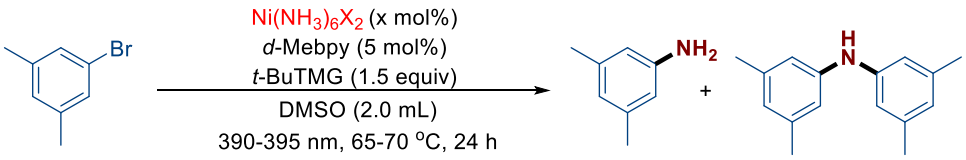
Table S4. The screening of the amount of DMSO



entry	DMSO (x mL)	diarylamine	arylamine
1	1.0 mL	5%	70%
2	1.5 mL	trace	77%
3	2.0 mL	trace	80%
4	2.5 mL	trace	76%
5	3.0 mL	trace	65%

Reaction conditions: aryl bromide (0.2 mmol), $Ni(NH_3)_6Cl_2$ (35 mol%), *d*-Mebpy (5 mol%), *t*-BuTMG (1.5 equiv), DMSO (x mL), purple LEDs (390-395 nm), 65-70 °C, Ar, 24 h. Yields determined by ^{1}H NMR using 1,3-benzodioxole as an internal standard.

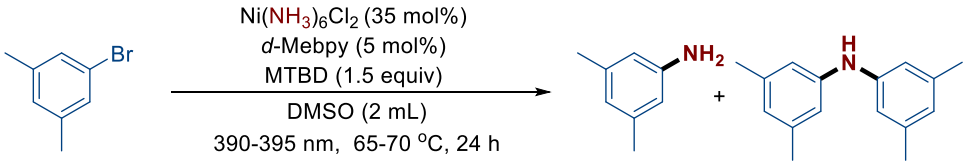
Table S5. The screening of $Ni(NH_3)_6X_2$ (x mol%)



entry	[Ni]-NH_3 (x mol%)	diarylamine	arylamine
1	$Ni(NH_3)_6Br_2$ (35 mol%)	5%	62%
2	$Ni(NH_3)_6I_2$ (35 mol%)	trace	40%
3	$Ni(NH_3)_6Cl_2$ (17 mol%)	trace	75%
4	$Ni(NH_3)_6Cl_2$ (20 mol%)	trace	74%
5	$Ni(NH_3)_6Cl_2$ (25 mol%)	trace	79%
6	$Ni(NH_3)_6Cl_2$ (30 mol%)	trace	79%
7	$Ni(NH_3)_6Cl_2$ (35 mol%)	trace	83%
8	$Ni(NH_3)_6Cl_2$ (40 mol%)	trace	80%

Reaction conditions: aryl bromide (0.2 mmol), $Ni(NH_3)_6X_2$ (x mol%), *d*-Mebpy (5 mol%), *t*-BuTMG (1.5 equiv), DMSO (x mL), purple LEDs (390-395 nm), 65-70 °C, Ar, 24 h. Yields determined by ^{1}H NMR using 1,3-benzodioxole as an internal standard.

Table S6. Control experiments

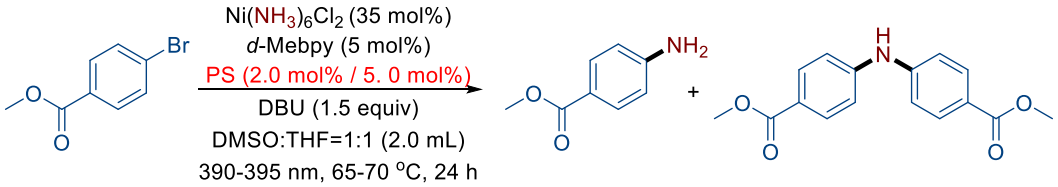


entry	reaction conditions	diarylamine	arylamine
1	Standard conditions	trace	98%
2	No $Ni(NH_3)_6Cl_2$	N.D.	N.D.
3	No ligand	N.D.	11%
4	No base	N.D.	N.D.
5	No light, 70 °C	N.D.	N.D.
6	Air instead of Ar	N.D.	31%

Reaction conditions: aryl bromide (0.2 mmol), $Ni(NH_3)_6Cl_2$ (35 mol%), *d*-Mebpy (5 mol%), MTBD (1.5 equiv), DMSO (2.0 mL), purple LEDs (390-395 nm), 65-70 °C, Ar, 24 h. Yields determined by ^{1}H NMR using 1,3-benzodioxole as an internal standard.

2.2 The reaction conditions for preparation of symmetric diarylamines

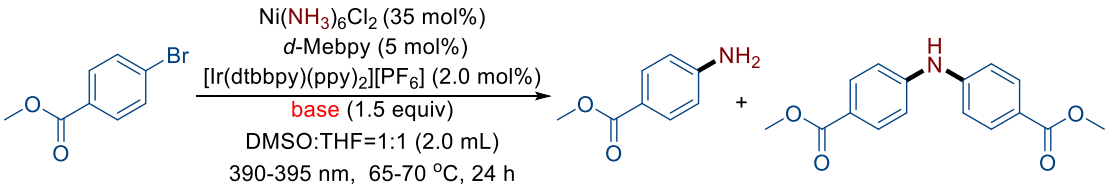
Table S7. The screening of photosensitizers



entry	PS (2.0 mol%)	diarylamine	arylamine
1	—	10%	48%
2	BP (5.0 mol%)	23%	49%
3	[Ir(dtbbpy)(ppy)$_2$][PF$_6$] (2.0 mol%)	45%	45%
4	[Ir(dF(CF$_3$)$_2$ppy)$_2$(dtbbpy)][PF$_6$] (2.0 mol%)	22%	8%
5	Ru(2,2'-bpy)$_3$Cl$_2$·6H$_2$O (2.0 mol%)	10%	36%

Reaction conditions: aryl bromide (0.2 mmol), Ni(NH$_3$)$_6$Cl$_2$ (35 mol%), *d*-Mebpy (5 mol%), PS (2.0 mol% / 5.0 mol%), DBU (1.5 equiv), DMSO:THF=1:1 (2.0 mL), purple LEDs (390-395 nm), 65-70 ℃, Ar, 24 h. Yields determined by ^{1}H NMR using 1,3,5-trimethoxybenzene as an internal standard.

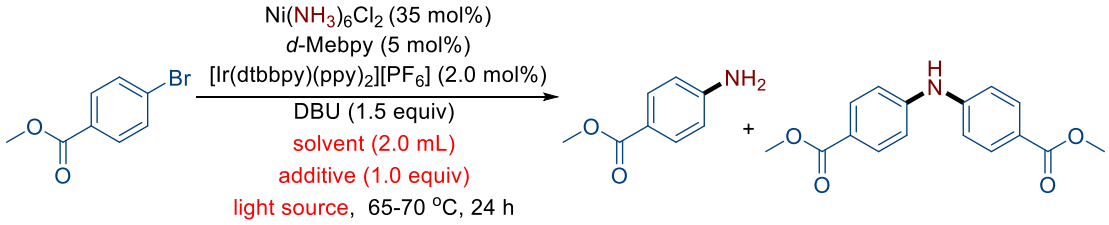
Table S8. The screening of bases



entry	base (1.5 equiv)	diarylamine	arylamine
1	DBU	46%	45%
2	DBN	42%	24%
3	TBD	trace	14%
4	MTBD	5%	6%
5	DMTHPM	31%	46%
6	DABCO	trace	6%
7	TMG	29%	30%
8	*t*-BuTMG	38%	58%
9	DIPEA	trace	trace
10	DIPA	31%	12%
11	Et$_3$N	trace	7%

Reaction conditions: aryl bromide (0.2 mmol), Ni(NH$_3$)$_6$Cl$_2$ (35 mol%), *d*-Mebpy (5 mol%), [Ir(dtbbpy)(ppy)$_2$][PF$_6$] (2.0 mol%), base (1.5 equiv), DMSO:THF=1:1 (2.0 mL), purple LEDs (390-395 nm), 65-70 ℃, Ar, 24 h. Yields determined by ^{1}H NMR using 1,3,5-trimethoxybenzene as an internal standard.

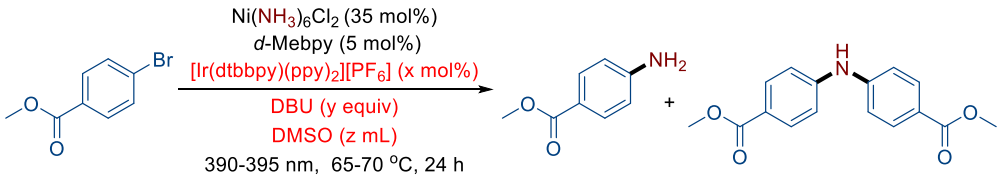
Table S9. The screening of solvents, light sources and additives



entry	solvent (2.0 mL)	light source	additive (1.0 equiv)	diarylamine	arylamine
1	DMSO:THF=1:1	390-395 nm	—	45%	45%
2	THF	390-395 nm	—	20%	trace
3	1,4-Dioxane	390-395 nm	—	23%	trace
4	CH_3CN	390-395 nm	—	21%	60%
5	2-MeTHF	390-395 nm	—	17%	8%
6	Toulene	390-395 nm	—	15%	trace
7	DMSO	390-395 nm	—	46%	46%
8	DMAc	390-395 nm	—	45%	18%
9	DMF	390-395 nm	—	50%	17%
10	DMF	365-370 nm	—	21%	35%
11	DMF	460-465 nm	—	35%	45%
12	DMF	490-495 nm	—	32%	57%
13	DMF	520-530 nm	—	26%	54%
14	DMF	390-395 nm	TBAC	32%	29%
15	DMF	390-395 nm	TBAB	39%	18%
16	DMF	390-395 nm	TBAI	9%	63%
17	DMF	390-395 nm	NaCl	44%	24%
18	DMF	390-395 nm	NaBr	38%	27%
19	DMF	390-395 nm	KBr	45%	27%
20	DMF	390-395 nm	KI	8%	74%

Reaction conditions: aryl bromide (0.2 mmol), $Ni(NH_3)_6Cl_2$ (35 mol%), *d*-Mebpy (5 mol%), $[Ir(dtbbpy)(ppy)_2][PF_6]$ (2.0 mol%), DBU (1.5 equiv), additive (1.0 equiv), solvent (2.0 mL), light source, 65-70 °C, Ar, 24 h. Yields determined by ^1H NMR using 1,3,5-trimethoxybenzene as an internal standard.

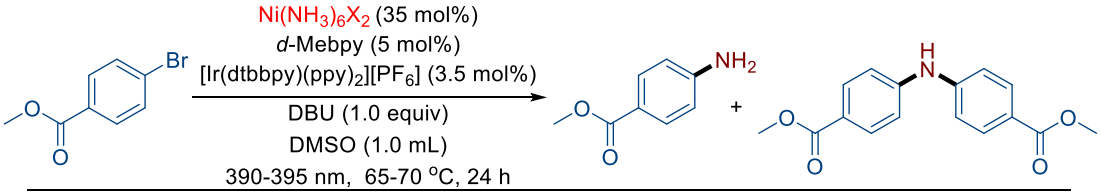
Table S10. The screening of the amount of DBU, DMSO and [Ir(dtbbpy)(ppy)$_2$][PF$_6$]



entry	DBU (y equiv)	DMSO (z mL)	[Ir] (x mol%)	diarylamine	arylamine
1	0.5	2.0 mL	2.0 mol%	32%	11%
2	1.0	2.0 mL	2.0 mol%	61%	21%
3	1.5	2.0 mL	2.0 mol%	47%	38%
4	2.0	2.0 mL	2.0 mol%	48%	39%
5	2.5	2.0 mL	2.0 mol%	42%	46%
6	3.0	2.0 mL	2.0 mol%	39%	48%
7	3.5	2.0 mL	2.0 mol%	36%	51%
8	1.0	1.0 mL	2.0 mol%	63%	11%
9	1.0	1.5 mL	2.0 mol%	59%	17%
10	1.0	2.5 mL	2.0 mol%	55%	17%
11	1.0	3.0 mL	2.0 mol%	54%	20%
12	1.0	1.0 mL	0.5 mol%	36%	39%
13	1.0	1.0 mL	1.0 mol%	50%	32%
14	1.0	1.0 mL	1.5 mol%	61%	17%
15	1.0	1.0 mL	2.5 mol%	65%	24%
16	1.0	1.0 mL	3.0 mol%	65%	25%
17	1.0	1.0 mL	3.5 mol%	72%	15%
18	1.0	1.0 mL	4.0 mol%	69%	15%

Reaction conditions: aryl bromide (0.2 mmol), Ni(NH$_3$)$_6$Cl$_2$ (35 mol%), *d*-Mebpy (5 mol%), [Ir(dtbbpy)(ppy)$_2$][PF$_6$] (x mol%), DBU (y equiv), DMSO (z mL), purple LEDs (390-395 nm), 65-70 ℃, Ar, 24 h. Yields determined by ^{1}H NMR using 1,3,5-trimethoxybenzene as an internal standard.

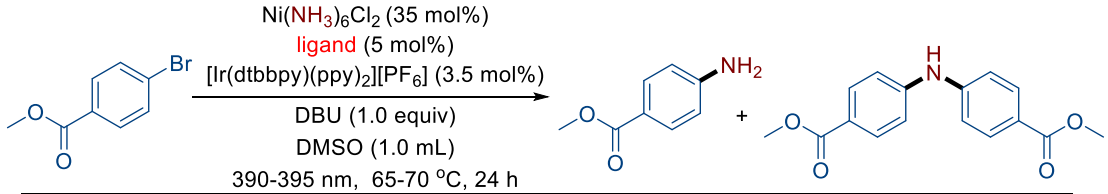
Table S11. The screening of Ni(NH$_3$)$_6$X$_2$

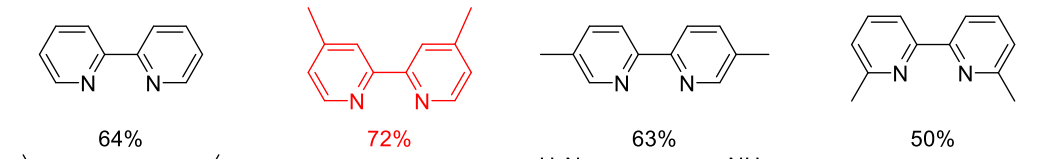


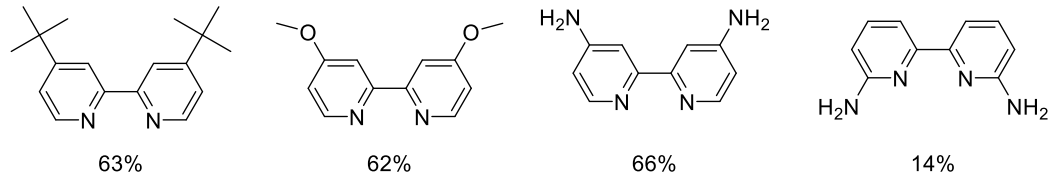
entry	[Ni]-NH$_3$ (35 mol%)	diarylamine	arylamine
1	Ni(NH$_3$)$_6$Cl$_2$	73%	15%
2	Ni(NH$_3$)$_6$Br$_2$	61%	8%
3	Ni(NH$_3$)$_6$I$_2$	8%	79%

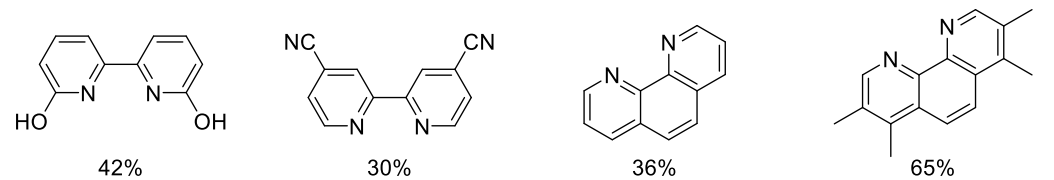
Reaction conditions: aryl bromide (0.2 mmol), Ni(NH$_3$)$_6$X$_2$ (35 mol%), *d*-Mebpy (5 mol%), [Ir(dtbbpy)(ppy)$_2$][PF$_6$] (3.5 mol%), DBU (1.0 equiv), DMSO (1.0 mL), purple LEDs (390-395 nm), 65-70 ℃, Ar, 24 h. Yields determined by ^{1}H NMR using 1,3,5-trimethoxybenzene as an internal standard.

Table S12. The screening of ligands



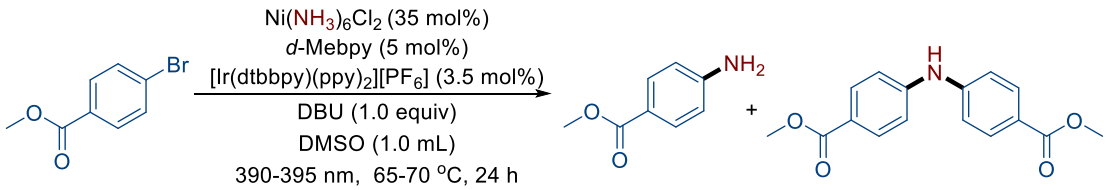






Reaction conditions: aryl bromide (0.2 mmol), $Ni(NH_3)_6Cl_2$ (35 mol%), ligand (5 mol%), $[Ir(dtbbpy)(ppy)_2][PF_6]$ (3.5 mol%), DBU (1.0 equiv), DMSO (1.0 mL), purple LEDs (390-395 nm), 65-70 °C, Ar, 24 h. The yields of diarylamines were determined by ^1H NMR using 1,3,5-trimethoxybenzene as an internal standard.

Table S13. Control experiments

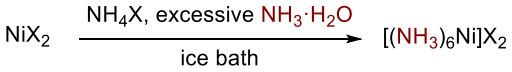


entry	reaction conditions	diarylamine	arylamine
1	Standard conditions	72%	15%
2	No $Ni(NH_3)_6Cl_2$	N.D.	N.D.
3	No dmebpy	58%	25%
4	No [Ir]	11%	47%
5	No DBU	N.D.	trace
6	No light, 70 °C	N.D.	N.D.
7	Air instead of Ar	33%	33%
8	390-395 nm, R.T.	19%	4%

Reaction conditions: aryl bromide (0.2 mmol), $Ni(NH_3)_6Cl_2$ (35 mol%), *d*-Mebpy (5 mol%), $[Ir(dtbbpy)(ppy)_2][PF_6]$ (3.5 mol%), DBU (1.0 equiv), DMSO (1.0 mL), purple LEDs (390-395 nm), 65-70 °C, Ar, 24 h. Yields determined by ^1H NMR using 1,3,5-trimethoxybenzene as an internal standard.

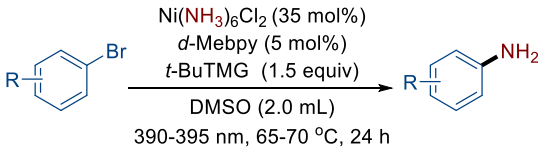
3. General procedure for reactions

3.1 Synthesis of $[(NH_3)_6Ni]X_2$[2]



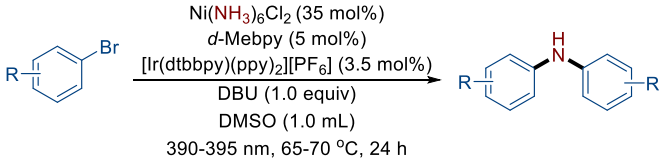
In an ice bath, a magnetic stir bar, NiX_2, NH_4X and excessive ammonia water, were placed into an oven-dried 25 mL dried round-bottomed flask. The reaction mixture for 2-12 h when the reaction is completed. The resulting purplish solution was rinsed with ammonia water and ethanol. The precipitate was filter collected on a frit, rinsed with ethanol and residual solvent was removed under vacuum to give the compound. The compound was used without further purification.

3.2 Standard procedure for exploration of the scope of arylamines



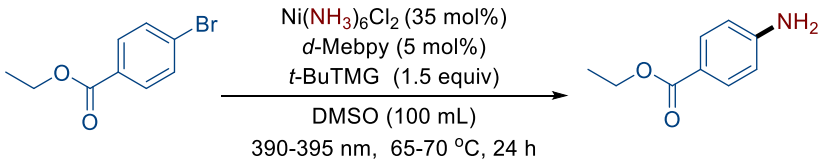
To an oven-dried 10 mL of storage tube were added solid aryl bromides (0.2 mmol) (liquid aryl bromides were added via syringe after purged and evacuated), $Ni(NH_3)_6Cl_2$ (35 mol%), *d*-Mebpy (4,4'-dimethyl-2,2'-bipyridine) (5 mol%) and a magnetic stir bar under argon atmosphere. The mixture was evacuated and backfilled with argon for at least three times. Then *t*-BuTMG (1.5 equiv) or MTBD (1.5 equiv) and DMSO (2.0 mL) were added. The tube was sealed with a Teflon screw valve. The reaction mixture was then irradiated with 9 W purple LEDs (390-395 nm, 1 cm away from the tube, optical power: 200 ± 10 mw/cm^2) at 65-70 °C for 24 hours. After the reaction was completed, the mixture was diluted with ethyl acetate after cooling to room temperature. The organic phases were washed with saturated brine or saturated NH_4Cl (3×10 mL), dried over anhydrous sodium sulfate, and concentrated under reduced pressure. The crude product was then purified by column chromatography on silica gel to give the desired product.

3.3 Standard procedure for exploration of the scope of symmetric diarylamines



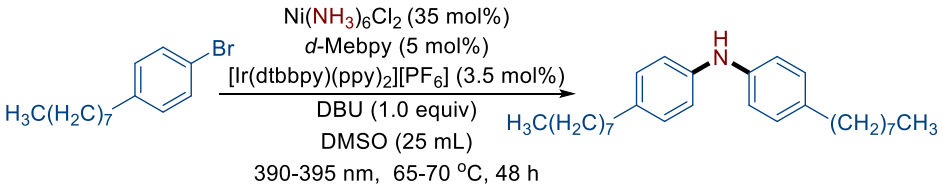
To an oven-dried 10 mL of storage tube were added solid aryl bromides (0.2 mmol) (liquid aryl bromides were added via syringe after purged and evacuated), $Ni(NH_3)_6Cl_2$ (35 mol%), *d*-Mebpy (4,4'-dimethyl-2,2'-bipyridine) (5 mol%), $[Ir(dtbbpy)(ppy)_2][PF_6]$ (3.5 mol%) and a magnetic stir bar under argon atmosphere. The mixture was evacuated and backfilled with argon for at least three times. Then DBU (1.0 equiv) and DMSO (1.0 mL) were added. The tube was sealed with a Teflon screw valve. The reaction mixture was then irradiated with 9 W purple LEDs (390-395 nm, 1 cm away from the tube, optical power: 200 ± 10 mw/cm^2) at 65-70 ^{o}C for 24 hours. After the reaction was completed, the mixture was diluted with ethyl acetate after cooling to room temperature. The organic phases were washed with saturated brine or saturated NH_4Cl (3×10 mL), dried over anhydrous sodium sulfate, and concentrated under reduced pressure. The crude product was then purified by column chromatography on silica gel to give the desired product.

3.4 Preparation of benzocaine at gram scale



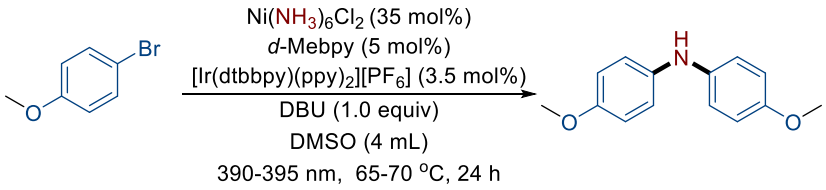
To an oven-dried 200 mL of storage tube were added $Ni(NH_3)_6Cl_2$ (35 mol%), *d*-Mebpy (4,4'-dimethyl-2,2'-bipyridine) (5 mol%) and a magnetic stir bar under argon atmosphere. The mixture was evacuated and backfilled with argon for at least three times. Then ethyl 4-bromobenzoate (10 mmol), *t*-BuTMG (1.5 equiv) and DMSO (100 mL) were added. The tube was sealed with a Teflon screw valve. The reaction mixture was then irradiated with purple LEDs (390-395 nm, 1 cm away from the tube) at 65-70 ^{o}C for 24 hours. After the reaction was completed, the mixture was diluted with ethyl acetate after cooling to room temperature. The organic phases were washed with saturated brine or saturated NH_4Cl, dried over anhydrous sodium sulfate, and concentrated under reduced pressure. The crude product was then purified by column chromatography on silica gel to give the desired product.

3.5 Preparation of antioxidant at gram scale



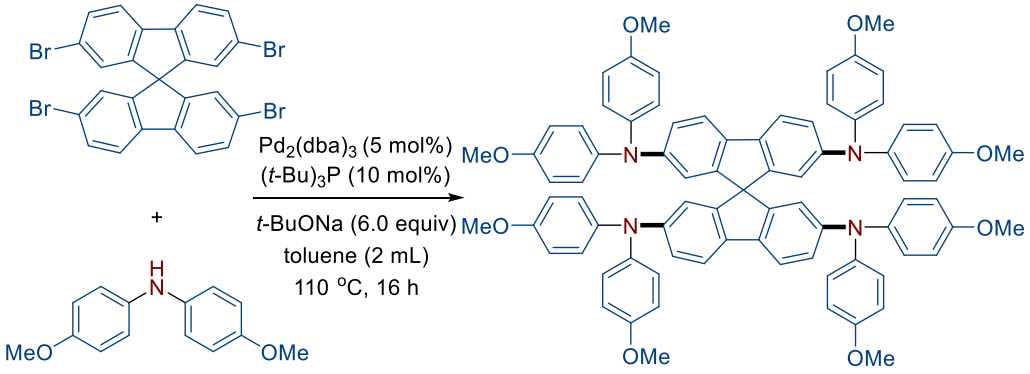
To an oven-dried 100 mL of storage tube were added $Ni(NH_3)_6Cl_2$ (35 mol%), *d*-Mebpy (4,4'-dimethyl-2,2'-bipyridine) (5 mol%), $[Ir(dtbbpy)(ppy)_2][PF_6]$ (3.5 mol%) and a magnetic stir bar under argon atmosphere. The mixture was evacuated and backfilled with argon for at least three times. Then 1-bromo-4-octylbenzene (5 mmol), DBU (1.0 equiv) and DMSO (25 mL) were added. The tube was sealed with a Teflon screw valve. The reaction mixture was then irradiated with purple LEDs (390-395 nm, 1 cm away from the tube) at 65-70 °C for 48 hours. After the reaction was completed, the mixture was diluted with ethyl acetate after cooling to room temperature. The organic phases were washed with saturated brine or saturated NH_4Cl, dried over anhydrous sodium sulfate, and concentrated under reduced pressure. The crude product was then purified by column chromatography on silica gel to give the desired product.

3.6 Preparation of bis(4-methoxyphenyl)amine



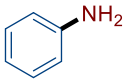
To an oven-dried 10 mL of storage tube were added $Ni(NH_3)_6Cl_2$ (35 mol%), *d*-Mebpy (4,4'-dimethyl-2,2'-bipyridine) (5 mol%), $[Ir(dtbbpy)(ppy)_2][PF_6]$ (3.5 mol%) and a magnetic stir bar under argon atmosphere. The mixture was evacuated and backfilled with argon for at least three times. Then 4-bromoanisole (2 mmol), DBU (1.0 equiv) and DMSO (4 mL) were added. The tube was sealed with a Teflon screw valve. The reaction mixture was then irradiated with purple LEDs (390-395 nm, 1 cm away from the tube) at 65-70 °C for 24 hours. After the reaction was completed, the mixture was diluted with ethyl acetate after cooling to room temperature. The organic phases were washed with saturated brine or saturated NH_4Cl, dried over anhydrous sodium sulfate, and concentrated under reduced pressure. The crude product was then purified by column chromatography on silica gel to give the desired product.

3.7 Preparation of organic hole-transporting material Spiro-OMeTAD

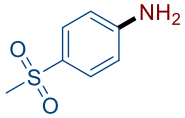


According to literature, Spiro-OMeTAD was synthesized.[22] To an oven-dried 10 mL of storage tube were added 2,2',7,7'-tetrabromo-9,9'-spirobi[9H-fluorene] (0.2 mmol), 4,4'-dimethoxydiphenylamine (0.9 mmol), sodium tert-butoxide (6.0 equiv), tris(dibenzylideneacetone)dipalladium(0) (5 mol%), tri-tert-butylphosphine (10 mol%) and a magnetic stir bar under argon atmosphere. The mixture was evacuated and backfilled with argon for at least three times. Then toluene (2 mL) was added. The tube was sealed with a Teflon screw valve. The reaction mixture was heated at 110 °C for 16 h. After the reaction was completed, the mixture was diluted with ethyl acetate after cooling to room temperature. The organic phases were washed with saturated brine, dried over anhydrous sodium sulfate, and concentrated under reduced pressure. The crude product was then purified by column chromatography on silica gel to give the desired product.

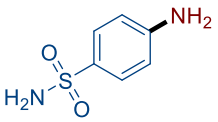
4. Analytical data of products



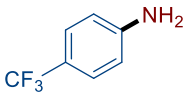
Aniline (4): light yellow oil; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.19 (t, *J* = 7.6 Hz, 2H), 6.79 (t, *J* = 7.6 Hz, 1H), 6.71 (d, *J* = 8.0 Hz, 2H), 3.61 (br, 2H). ^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$) δ 146.5, 129.4, 118.6, 115.2. Spectral datas obtained for the compound are in good agreement with the reported datas.[1]



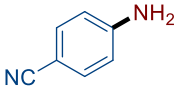
4-(Methylsulfonyl)aniline (5): yellow solid; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.67 (d, *J* = 8.7 Hz, 2H), 6.70 (d, *J* = 8.7 Hz, 2H), 4.24 (br, 2H), 2.99 (s, 3H). ^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$) δ 151.5, 129.6, 128.9, 114.2, 45.1. Spectral datas obtained for the compound are in good agreement with the reported datas.[2]



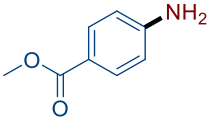
4-Aminobenzenesulfonamide (6): yellow solid; ^{1}H NMR (400 MHz, DMSO-d_6) δ 7.50 (d, *J* = 8.7 Hz, 2H), 6.93 (s, 2H), 6.64 (d, *J* = 8.7 Hz, 2H), 5.82 (s, 2H). ^{13}C{^{1}H} NMR (100 MHz, DMSO-d_6) δ 151.9, 130.1, 127.5, 112.5. Spectral datas obtained for the compound are in good agreement with the reported datas.[3]



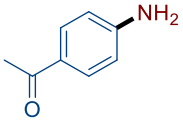
4-(Trifluoromethyl)aniline (7): light yellow solid; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.40 (d, *J* = 8.3 Hz, 1H), 6.69 (d, *J* = 8.3 Hz, 1H), 3.94 (br, 1H). ^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$) δ 149.5, 126.8 (q, *J* = 4.0 Hz), 125.0 (q, *J* = 269.0 Hz), 120.3 (q, *J* = 32.0 Hz), 114.3. ^{19}F NMR (376 MHz, $CDCl_3$) δ -61.25. Spectral datas obtained for the compound are in good agreement with the reported datas.[2]



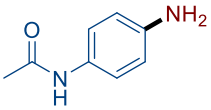
4-Aminobenzonitrile (8): white solid; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.40 (d, *J* = 8.4 Hz, 2H), 6.64 (d, *J* = 8.4 Hz, 2H), 4.17 (br, 2H). ^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$) δ 150.6, 133.9, 120.3, 114.5, 100.2. Spectral datas obtained for the compound are in good agreement with the reported datas.[2]



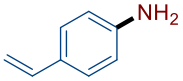
Methyl 4-aminobenzoate (9): white solid; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.85 (d, *J* = 8.7 Hz, 2H), 6.63 (d, *J* = 8.7 Hz, 2H), 4.08 (br, 2H), 3.85 (s, 3H). ^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$) δ 167.3, 150.9, 131.7, 119.9, 113.9, 51.7. Spectral datas obtained for the compound are in good agreement with the reported datas.[2]



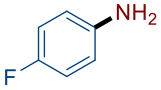
1-(4-Aminophenyl)ethan-1-one (10): light yellow solid; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.81 (d, *J* = 8.6 Hz, 2H), 6.64 (d, *J* = 8.6 Hz, 2H), 4.13 (br, 2H), 2.50 (s, 3H). ^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$) δ 196.6, 151.2, 130.9, 128.1, 113.9, 26.2. Spectral datas obtained for the compound are in good agreement with the reported datas.[2]



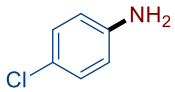
***N*-(4-Aminophenyl)acetamide (11) :** yellow solid; ^{1}H NMR (400 MHz, DMSO-d_6) δ 9.60 (s, 1H), 7.23 (d, *J* = 8.6 Hz, 2H), 6.52 (d, *J* = 8.6 Hz, 2H), 4.84 (br, 2H), 1.99 (s, 3H). ^{13}C{^{1}H} NMR (100 MHz, DMSO-d_6) δ 167.8, 145.0, 129.1, 121.3, 114.3, 24.1. Spectral datas obtained for the compound are in good agreement with the reported datas.[2]



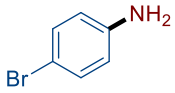
4-Vinylaniline (12): yellow solid; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.20 (d, *J* = 8.3 Hz, 2H), 6.60 (d, *J* = 8.3 Hz, 2H), 6.58 – 6.56 (m, 1H), 5.52 (d, *J* = 17.6 Hz, 1H), 5.01 (d, *J* = 10.9 Hz, 1H), 3.66 (br, 2H). ^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$) δ 146.3, 136.7, 128.5, 127.5, 115.1, 110.1. ^{19}F NMR (376 MHz, Chloroform-*d*) δ -126.85. Spectral datas obtained for the compound are in good agreement with the reported datas.[2]



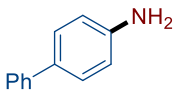
4-Fluoroaniline (13): light yellow oil; ^{1}H NMR (400 MHz, $CDCl_3$) δ 6.86 (t, *J* = 8.7 Hz, 1H), 6.63 – 6.60 (m, 1H), 3.53 (br, 1H). ^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$) δ 156.6 (d, *J* = 235.0 Hz) 142.5, 116.2 (d, *J* = 7.0 Hz), 115.8 (d, *J* = 23.0 Hz). ^{19}F NMR (376 MHz, $CDCl_3$) δ -126.85. Spectral datas obtained for the compound are in good agreement with the reported datas.[2]



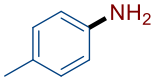
4-Chloroaniline (14): light yellow solid; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.10 (d, *J* = 8.5 Hz, 2H), 6.60 (d, *J* = 8.5 Hz, 2H), 3.63 (br, 2H). ^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$) δ 145.1, 129.2, 123.2, 116.3. Spectral datas obtained for the compound are in good agreement with the reported datas.[2]



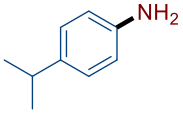
4-Bromoaniline (15): yellow solid; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.23 (d, *J* = 8.8 Hz, 2H), 6.56 (d, *J* = 8.8 Hz, 2H), 3.66 (br, 2H). ^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$) δ 145.5, 132.1, 116.8, 110.3. Spectral datas obtained for the compound are in good agreement with the reported datas.[2]



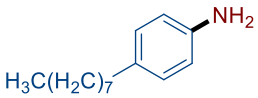
[1,1'-Biphenyl]-4-amine (16): white solid; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.55 (d, *J* = 7.3 Hz, 2H), 7.44 – 7.39 (m, 4H), 7.30 – 7.26 (m, 1H), 6.77 (d, *J* = 8.5 Hz, 2H), 3.72 (br, 2H). ^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$) δ 146.0, 141.3, 131.7, 128.8, 128.2, 126.5, 126.4, 115.5. Spectral datas obtained for the compound are in good agreement with the reported datas.[2]



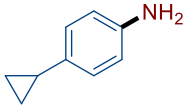
***p*-Toluidine (17):** white solid; ^{1}H NMR (400 MHz, $CDCl_3$) δ 6.98 (d, *J* = 7.7 Hz, 2H), 6.62 (d, *J* = 7.7 Hz, 2H), 3.44 (br, 2H), 2.25 (s, 3H). ^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$) δ 143.8, 129.9, 128.0, 115.4, 20.6. Spectral datas obtained for the compound are in good agreement with the reported datas.[7]



4-Isopropylaniline (18): light yellow oil; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.06 (d, *J* = 8.2 Hz, 2H), 6.66 (d, *J* = 8.2 Hz, 2H), 3.47 (br, 2H), 2.85 (hept, *J* = 6.9 Hz, 1H), 1.24 (d, J = 6.9 Hz, 6H). ^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$) δ 144.3, 139.3, 127.2, 115.3, 33.3, 24.3. Spectral datas obtained for the compound are in good agreement with the reported datas.[2]

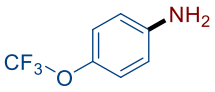


4-Octylaniline (19): yellow oil; ^{1}H NMR (400 MHz, $CDCl_3$) δ 6.9 (d, J = 8.3 Hz, 2H), 6.63 (d, J = 8.3 Hz, 2H), 3.48 (br, 2H), 2.50 (t, *J* = 7.6 Hz, 2H), 1.56 (p, *J* = 7.2 Hz, 2H), 1.31 – 1.27 (m, 10H), 0.89 (t, *J* = 6.7 Hz, 3H). ^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$) δ 144.1, 133.3, 129.3, 115.4, 35.2, 32.0, 32.0, 29.6, 29.4, 29.4, 22.8, 14.2. Spectral datas obtained for the compound are in good agreement with the reported datas.[4]

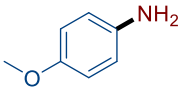


4-Cyclopropylaniline (20): yellow oil; **^{1}**H NMR (400 MHz, $CDCl_3$) δ 6.91 (d, *J* = 8.1 Hz, 2H), 6.62 (d, *J* = 8.1 Hz, 2H), 3.27 (br, 2H), 1.85 – 1.78 (m, 1H), 0.86 (q, *J* =5.1 Hz, 2H), 0.59 (q, *J* = 5.1 Hz, 2H). ^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$) δ 144.1, 134.0, 126.9, 115.4, 14.7, 8.4.Spectral datas obtained for the compound are in good agreement

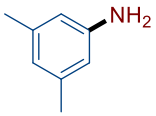
with the reported datas.[5]



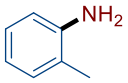
4-(Trifluoromethoxy)aniline (21): yellow oil; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.01 (d, *J* = 8.8 Hz, 2H), 6.64 (d, *J* = 8.8 Hz, 2H), 3.68 (br, 2H). $^{13}C\{^{1}H\}$ NMR (100 MHz, $CDCl_3$) δ 145.4, 141.5, 122.5, 120.8 (d, *J* = 256.5 Hz), 115.6. ^{19}F NMR (376 MHz, $CDCl_3$) δ -58.48. Spectral datas obtained for the compound are in good agreement with the reported datas.[2]



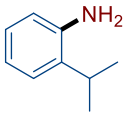
4-Methoxyaniline (22): black solid; ^{1}H NMR (400 MHz, $CDCl_3$) δ 6.75 (d, *J* = 8.8 Hz, 2H), 6.65 (d, *J* = 8.8 Hz, 2H), 3.75 (s, 3H), 3.32 (br, 2H). $^{13}C\{^{1}H\}$ NMR (100 MHz, $CDCl_3$) δ 153.3, 140.5, 116.9, 115.3, 56.3. Spectral datas obtained for the compound are in good agreement with the reported datas.[2]



3,5-Dimethylaniline (2): yellow oil; ^{1}H NMR (400 MHz, $CDCl_3$) δ 6.43 (s, 1H), 6.35 (s, 2H), 3.45 (br, 2H), 2.23 (s, 6H). $^{13}C\{^{1}H\}$ NMR (100 MHz, $CDCl_3$) δ 146.3, 139.1, 120.7, 113.2, 21.4. Spectral datas obtained for the compound are in good agreement with the reported datas.[2]

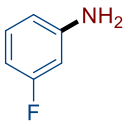


***o*-Toluidine (23):** light yellow oil; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.11 – 7.07 (m, 2H), 6.76 (t, *J* = 7.3 Hz, 1H), 6.71 (d, *J* = 7.8 Hz, 1H), 3.59 (s, 2H), 2.21 (s, 3H). $^{13}C\{^{1}H\}$ NMR (100 MHz, $CDCl_3$) δ 144.7, 130.5, 127.0, 122.4, 118.7, 115.0, 17.4. Spectral datas obtained for the compound are in good agreement with the reported datas.[6]

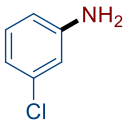


2-Isopropylaniline (24): yellow oil; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.16 (dd, *J* = 7.7, 1.5 Hz, 1H), 7.04 (td, *J* = 7.7, 1.5 Hz, 1H), 6.80 (td, *J* = 7.9, 1.1 Hz, 1H), 6.69 (dd, *J* = 7.9, 1.1 Hz, 1H), 3.65 (s, 2H), 2.92 (hept, *J* = 6.8 Hz, 1H), 1.28 (d, *J* = 6.8 Hz, 6H). $^{13}C\{^{1}H\}$ NMR (100 MHz, $CDCl_3$) δ 143.4, 132.8, 126.6, 125.5, 119.2, 116.0, 27.8, 22.4. Spectral datas obtained for the compound are in good agreement with the reported

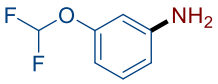
datas.[2]



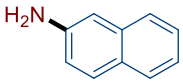
3-Fluoroaniline (25): yellow oil; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.12 – 7.06 (m, 1H), 6.47 – 6.36 (m, 3H), 3.71 (br, 2H). $^{13}C\{^{1}H\}$ NMR (100 MHz, $CDCl_3$) δ 164.0 (d, *J* = 244.4 Hz), 148.4 (d, *J* = 11.1 Hz), 130.6 (d, *J* = 10.1 Hz), 110.8 (d, *J* = 2.0 Hz), 105.2 (d, *J* = 21.2 Hz), 102.1 (d, *J* = 25.3 Hz).^{19}F NMR (376 MHz,$CDCl_3$) δ -113.20. Spectral datas obtained for the compound are in good agreement with the reported datas.[10]



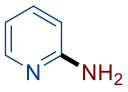
3-Chloroaniline (26): yellow oil; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.07 (t, *J* = 8.0 Hz, 1H), 6.73 (dd, *J* = 8.0, 1.0 Hz, 1H), 6.67 (t, *J* = 2.0 Hz, 1H), 6.54 (dd, *J* = 8.0, 1.5 Hz, 1H), 3.67 (br, 2H). $^{13}C\{^{1}H\}$ NMR (100 MHz, $CDCl_3$) δ 147.8, 134.9, 130.4, 118.5, 115.0, 113.3. Spectral datas obtained for the compound are in good agreement with the reported datas.[6]



3-(Difluoromethoxy)aniline (27): yellow oil; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.12 (t, *J* = 8.0 Hz, 1H), 6.66 – 6.29 (m, 4H), 3.63 (br, 2H). $^{13}C\{^{1}H\}$ NMR (100 MHz, $CDCl_3$) δ 151.7, 147.2, 129.6, 115.2 (t, *J* = 259.6 Hz), 111.1, 107.8, 105.0. ^{19}F NMR (376 MHz, $CDCl_3$) δ -80.24 (d, *J* = 71.4 Hz). Spectral datas obtained for the compound are in good agreement with the reported datas.[12]

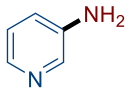


Naphthalen-2-amine (28): white solid; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.74 – 7.68 (m, 2H), 7.63 (d, *J* = 8.5 Hz, 1H), 7.41 (t, *J* = 7.1 Hz, 1H), 7.27 (t, *J* = 9.1 Hz, 1H), 7.00 – 6.96 (m, 2H), 3.86 (br, 2H). $^{13}C\{^{1}H\}$ NMR (100 MHz, $CDCl_3$) δ 144.2, 135.1, 129.3, 128.1, 127.8, 126.5, 125.9, 122.6, 118.4, 108.7. Spectral datas obtained for the compound are in good agreement with the reported datas.[8]

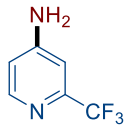


Pyridin-2-amine (29): light yellow oil; ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.02 (d, *J* = 4.9

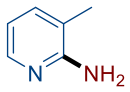
Hz, 1H), 7.36 (td, *J* = 8.3, 1.8 Hz, 1H), 6.58 (td, *J* = 4.9, 1.8 Hz, 1H), 6.44 (d, *J* = 8.3 Hz, 1H), 4.57 (br, 2H). $^{13}C\{^{1}H\}$ NMR (100 MHz, $CDCl_3$) δ 158.6, 148.1, 137.7, 113.9, 108.6. Spectral datas obtained for the compound are in good agreement with the reported datas.[3]



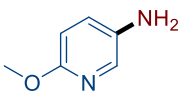
Pyridin-3-amine (30): light yellow oil; ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.04 (d, *J* = 2.7 Hz, 1H), 7.95 (d, *J* = 4.7 Hz, 1H), 7.00 (dd, *J* = 8.1, 4.7 Hz, 1H), 6.91 (dd, *J* = 8.1, 2.7 Hz, 1H), 3.82 (br, 2H). $^{13}C\{^{1}H\}$ NMR (100 MHz, $CDCl_3$) δ 142.8, 139.8, 137.4, 123.7, 121.4. Spectral datas obtained for the compound are in good agreement with the reported datas.[3]



4-(Trifluoromethyl)pyridin-2-amine (31): brown oil; ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.25 (d, *J* = 5.5 Hz, 1H), 6.86 (d, *J* = 1.8 Hz, 1H), 6.62 (dd, *J* = 5.5, 1.8 Hz, 1H), 4.65 (br, 2H). $^{13}C\{^{1}H\}$ NMR (100 MHz, $CDCl_3$) δ 154.0, 150.4, 149.0 (q, *J* = 34.0 Hz), 121.8 (q, *J* = 272.0 Hz), 111.2, 106.4 (q, *J* = 2.0 Hz). ^{19}F NMR (376 MHz, $CDCl_3$) δ -68.54. Spectral datas obtained for the compound are in good agreement with the reported datas.[2]

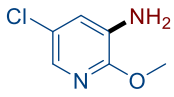


3-Methylpyridin-2-amine (32): yellow oil; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.89 (d, *J* = 6.0 Hz, 1H), 7.19 (d, *J* = 8.0 Hz, 1H), 6.54 (dd, *J* = 8.0, 6.0 Hz, 1H), 4.56 (br, 2H), 2.05 (s, 3H). $^{13}C\{^{1}H\}$ NMR (100 MHz, $CDCl_3$) δ 157.3, 145.6, 137.6, 116.5, 114.2, 17.1. Spectral datas obtained for the compound are in good agreement with the reported datas.[9]

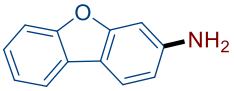


6-Methoxypyridin-3-amine (33): brown oil; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.65 (d, *J* = 2.9 Hz, 1H), 7.01 (dd, *J* = 8.7, 2.9 Hz, 1H), 6.59 (d, *J* = 8.7 Hz, 1H), 3.85 (s, 3H), 3.16 (br, 2H). $^{13}C\{^{1}H\}$ NMR (100 MHz, $CDCl_3$) δ 158.2, 136.8, 133.0, 127.8, 110.8, 53.4. Spectral datas obtained for the compound are in good agreement with the reported

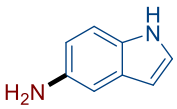
datas.[9]



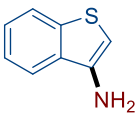
5-Chloro-2-methoxypyridin-3-amine (34): yellow solid; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.48 (d, *J* = 2.2 Hz, 1H), 6.84 (d, *J* = 2.2 Hz, 1H), 3.95 (s, 3H), 3.60 (br, 2H). $^{13}C\{^{1}H\}$ NMR (100 MHz, $CDCl_3$) δ 151.5, 132.7, 131.8, 124.4, 119.6, 53.7. Spectral datas obtained for the compound are in good agreement with the reported datas.[9]



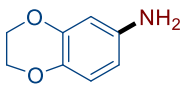
Dibenzo[b,d]furan-3-amine (35): light yellow solid; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.78 (d, *J* = 7.3 Hz, 1H), 7.68 (d, *J* = 8.2 Hz, 1H), 7.47 (d, *J* = 7.9 Hz, 1H), 7.33 – 7.25 (m, 2H), 6.84 (s, 1H), 6.68 (d, *J* = 8.0 Hz, 1H), 3.36 (br, 2H). $^{13}C\{^{1}H\}$ NMR (100 MHz, $CDCl_3$) δ 158.1, 156.1, 146.9, 125.3, 125.0, 122.7, 121.4, 119.5, 115.8, 111.4, 111.3, 97.6. Spectral datas obtained for the compound are in good agreement with the reported datas.[11]



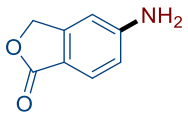
1H-Indol-5-amine (36): yellow oil; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.96 (br, 1H), 7.19 (d, *J* = 8.5 Hz, 1H), 7.12 (s, 1H), 6.95 (s, 1H), 6.67 (d, *J* = 8.5 Hz, 1H), 6.38 (s, 1H), 3.50 (br, 2H). $^{13}C\{^{1}H\}$ NMR (100 MHz, $CDCl_3$) δ 139.7, 130.9, 129.0, 124.8, 113.1, 111.6, 105.7, 101.7. Spectral datas obtained for the compound are in good agreement with the reported datas.[2]



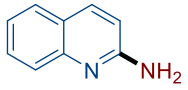
Benzo[b]thiophen-3-amine (37): yellow solid; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.64 (d, *J* = 8.5 Hz, 1H), 7.38 (d, *J* = 5.4 Hz, 1H), 7.15 (d, *J* = 5.4 Hz, 1H), 7.10 (d, *J* = 1.8 Hz, 1H), 6.78 (dd, *J* = 8.5, 1.8 Hz, 1H), 3.58 (br, 2H). $^{13}C\{^{1}H\}$ NMR (100 MHz, $CDCl_3$) δ 143.7, 141.0, 130.6, 127.2, 123.2, 123.1, 115.0, 108.4. Spectral datas obtained for the compound are in good agreement with the reported datas.[2]



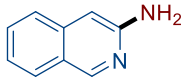
2,3-Dihydrobenzo[b][1,4]dioxin-6-amine (38): yellow oil; ^{1}H NMR (400 MHz, $CDCl_3$) δ 6.67 (d, *J* = 8.5 Hz, 1H), 6.24 (d, *J* = 2.6 Hz, 1H), 6.20 (dd, *J* = 8.5, 2.6 Hz, 1H), 4.22 – 4.20 (m, 2H), 4.18 – 4.16 (m, 2H), 3.28 (br, 2H). ^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$) δ 144.0, 140.9, 136.5, 117.7, 108.8, 104.3, 64.8, 64.3. Spectral datas obtained for the compound are in good agreement with the reported datas.[2]



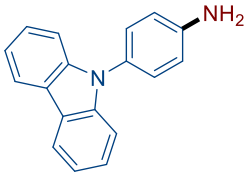
5-Aminoisobenzofuran-1(3H)-one (39): yellow solid; ^{1}H NMR (400 MHz, DMSO-d_6) δ 7.48 (d, *J* = 8.4 Hz, 1H), 6.70 (d, *J* = 8.4 Hz, 1H), 6.62 (s, 1H), 6.28 (s, 2H), 5.19 (s, 2H). ^{13}C{^{1}H} NMR (100 MHz, DMSO-d_6) δ 170.8, 154.7, 150.2, 126.2, 114.8, 111.1, 104.5, 68.7. Spectral datas obtained for the compound are in good agreement with the reported datas.[2]



Quinolin-2-amine (40): brown solid; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.86 (d, *J* = 8.8 Hz, 1H), 7.66 (d, *J* = 8.4 Hz, 1H), 7.61 (d, *J* = 8.0 Hz, 1H), 7.55 (td, *J* = 7.0, 1.3 Hz, 1H), 7.25 (t, *J* = 7.0 Hz, 1H), 6.71 (d, *J* = 8.8 Hz, 1H), 4.96 (br, 2H). ^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$) δ 157.2, 147.8, 138.2, 129.9, 127.6, 126.1, 123.7, 122.8, 111.8. Spectral datas obtained for the compound are in good agreement with the reported datas.[9]

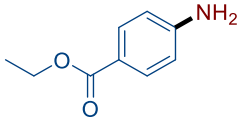


Isoquinolin-3-amine (41): brown solid; ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.93 (s, 1H), 7.79 (d, *J* = 8.2 Hz, 1H), 7.55 – 7.49 (m, 2H), 7.26 (t, *J* = 8.2 Hz, 1H), 6.77 (s, 1H), 4.52 (br, 2H). ^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$) δ 154.7, 151.8, 139.0, 130.5, 127.9, 124.8, 124.2, 123.2, 99.7. Spectral datas obtained for the compound are in good agreement with the reported datas.[9]

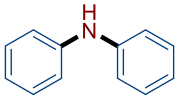


4-(9H-Carbazol-9-yl)aniline (42): yellow solid; ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.18 (d, *J* = 7.7 Hz, 2H), 7.45 – 7.42 (m, 2H), 7.37 (d, *J* = 7.9 Hz, 2H), 7.33 – 7.28 (m, 4H), 6.86 (d, *J* = 8.5 Hz, 2H), 3.80 (br, 2H). ^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$) δ 146.1,

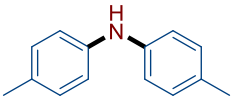
141.7, 128.6, 128.3, 125.9, 123.1, 120.3, 119.6, 116.0, 109.9. Spectral datas obtained for the compound are in good agreement with the reported datas.[2]



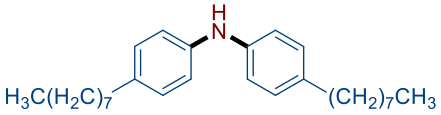
Ethyl 4-aminobenzoate (76): yellow solid; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.86 (d, *J* = 8.7 Hz, 2H), 6.63 (d, *J* = 8.7 Hz, 2H), 4.31 (q, *J* = 7.1 Hz, 2H), 4.05 (br, 2H), 1.36 (t, *J* = 7.1 Hz, 3H). ^{13}C{^{1}H} NMR (100 MHz, Chloroform-*d*) δ 166.83, 150.84, 131.69, 120.31, 113.92, 76.84, 60.43, 14.56. Spectral datas obtained for the compound are in good agreement with the reported datas.[2]



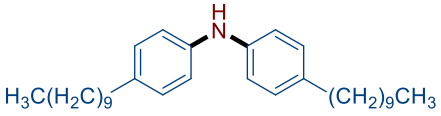
Diphenylamine (45): brown solid; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.32 (t, *J* = 7.7 Hz, 4H), 7.12 (d, *J* = 8.1 Hz, 4H), 6.99 (t, *J* = 7.3 Hz, 2H), 5.72 (br, 1H). ^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$) δ 143.3, 129.5, 121.2, 118.0. Spectral datas obtained for the compound are in good agreement with the reported datas.[13]



Di-*p*-tolylamine (46): white solid; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.07 (d, *J* = 8.2 Hz, 4H), 6.95 (d, *J* = 8.2 Hz, 4H), 5.51 (br, 1H), 2.30 (s, 6H). ^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$) δ 141.3, 130.3, 130.0, 118.1, 20.8. Spectral datas obtained for the compound are in good agreement with the reported datas.[13]

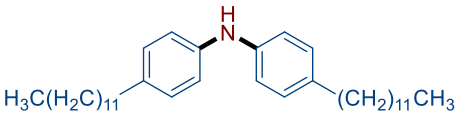


Bis(4-octylphenyl)amine (47): brown oil; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.06 (d, *J* = 8.4 Hz, 4H), 6.97 (d, *J* = 8.4 Hz, 4H), 2.54 (t, *J* =7.6 Hz, 4H), 1.59 (p, *J* = 7.4 Hz, 4H), 1.34 – 1.26 (m, 20H), 0.88 (t, *J* = 6.8 Hz, 6H). ^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$) δ 141.4, 135.6, 129.3, 118.0, 35.4, 32.1, 31.9, 29.7, 29.5, 29.4, 22.8, 14.3. Spectral datas obtained for the compound are in good agreement with the reported datas.[15]

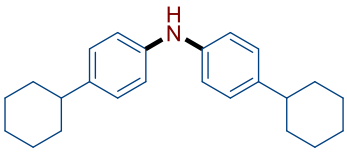


Bis(4-decylphenyl)amine (48): black solid; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.07 (d, *J* = 8.4 Hz, 4H), 6.98 (d, *J* = 8.4 Hz, 4H), 2.55 (t, *J* =7.6 Hz, 4H), 1.60 (p, *J* = 7.2 Hz,

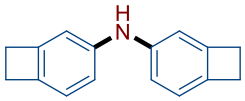
4H), 1.32 – 1.28 (m, 28H), 0.90 (t, *J* = 6.8 Hz, 6H). $^{13}C\{^{1}H\}$ NMR (100 MHz, $CDCl_3$) δ 141.4, 135.6, 129.3, 118.0, 35.4, 32.1, 31.9, 29.9, 29.8, 29.8, 29.7, 29.5, 22.8, 14.3. HRMS (ESI) m/z calc. for $C_{32}H_{52}N$ $[M+H]^+$: 450.4094, found: 450.4089.



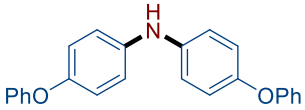
Bis(4-dodecylphenyl)amine (49): brown solid; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.06 (d, *J* = 8.3 Hz, 4H), 6.97 (d, *J* = 8.3 Hz, 4H), 5.56 (br, 1H), 2.62 – 2.47 (m, 4H), 1.65 – 1.53 (m, 6H), 1.27 (s, 34H), 0.89 (t, *J* = 6.7 Hz, 6H). $^{13}C\{^{1}H\}$ NMR (100 MHz, $CDCl_3$) δ 141.4, 135.6, 129.3, 118.0, 35.4, 32.1, 31.9, 29.8, 29.8, 29.8, 29.7, 29.7, 29.5, 29.5, 22.9, 14.3. HRMS (ESI) m/z calc. for $C_{36}H_{60}N$ $[M+H]^+$: 506.4720, found: 506.4716.



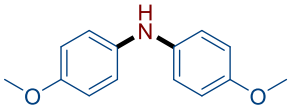
Bis(4-cyclohexylphenyl)amine (50): brown solid; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.10 (d, *J* = 8.4 Hz, 4H), 6.98 (d, *J* = 8.4 Hz, 4H), 2.52 – 2.39 (m, 2H), 1.94 – 1.67 (m, 11H), 1.39 (p, *J* = 12.0 Hz, 9H). $^{13}C\{^{1}H\}$ NMR (100 MHz, $CDCl_3$) δ 141.4, 140.7, 127.5, 43.82, 34.8 27.0, 26.21. HRMS (ESI) m/z calc. for $C_{24}H_{32}N$ $[M+H]^+$: 334.2529, found: 334.2529.



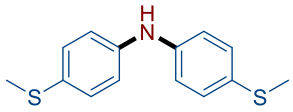
***N*-(Bicyclo[4.2.0]octa-1,3,5-trien-3-yl)bicyclo[4.2.0]octa-1(6),2,4-trien-3-amine (51):** brown solid; ^{1}H NMR (400 MHz, $CDCl_3$) δ 6.92 (d, *J* = 7.8 Hz, 2H), 6.84 (d, *J* = 7.8 Hz, 2H), 6.81 (s, 2H), 3.12 (s, 8H). $^{13}C\{^{1}H\}$ NMR (100 MHz, $CDCl_3$) δ 146.6, 143.3, 138.2, 123.5, 117.6, 113.2, 29.3, 29.1. HRMS (ESI) m/z calc. for $C_{16}H_{16}N$ $[M+H]^+$: 222.1277, found: 222.1275.



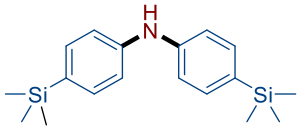
Bis(4-phenoxyphenyl)amine (52): gray solid; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.36 – 7.29 (m, 4H), 7.11 – 6.92 (m, 14H), 5.55 (br, 1H). $^{13}C\{^{1}H\}$ NMR (100 MHz, $CDCl_3$) δ 158.4, 150.9, 139.8, 129.8, 122.7, 120.8, 119.5, 118.0. HRMS (ESI) m/z calc. for $C_{24}H_{20}NO_2$ $[M+H]^+$: 354.1489, found: 354.1488.



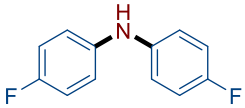
Bis(4-methoxyphenyl)amine (53): black solid; ^{1}H NMR (400 MHz, $CDCl_3$) δ 6.94 (d, *J* = 8.7 Hz, 4H), 6.83 (d, *J* = 8.7 Hz, 4H), 5.30 (br, 1H), 3.78 (s, 6H). $^{13}C\{^{1}H\}$ NMR (100 MHz, $CDCl_3$) δ 154.4, 138.1, 119.7, 114.8, 55.8. Spectral datas obtained for the compound are in good agreement with the reported datas.[15]



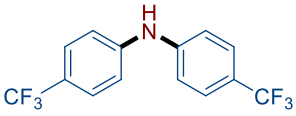
Bis(4-(methylthio)phenyl)amine (54): black solid; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.14 (d, *J* = 7.0 Hz, 4H), 6.89 (d, *J* = 7.4 Hz, 4H), 5.56 (br, 1H), 2.36 (s, 6H). $^{13}C\{^{1}H\}$ NMR (100 MHz, $CDCl_3$) δ 141.4, 130.0, 129.4, 118.7, 18.0. Spectral datas obtained for the compound are in good agreement with the reported datas.[16]



Bis(4-(trimethylsilyl)phenyl)amine (55): brown oil; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.45 (d, *J* = 8.4 Hz, 4H), 7.11 (d, *J* = 8.4 Hz, 4H), 5.80 (br, 1H). 0.28 (s, 18H). $^{13}C\{^{1}H\}$ NMR (100 MHz, $CDCl_3$) δ 143.5, 134.7, 131.9, 117.2, -0.3. HRMS (ESI) m/z calc. for $C_{18}H_{28}NSi_2$ $[M+H]^+$: 314.1760, found: 314.1757.

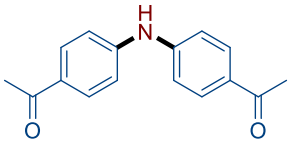


Bis(4-fluorophenyl)amine (56): brown oil; ^{1}H NMR (400 MHz, $CDCl_3$) δ 6.96 (m, 8H), 5.48 (br, 1H). $^{13}C\{^{1}H\}$ NMR (100 MHz, $CDCl_3$) δ 157.8 (d, *J* = 240.4 Hz), 139.8 (d, *J* = 2.0 Hz), 119.4 (d, *J* = 8.1 Hz), 116.0 (d, *J* = 22.2 Hz) ^{19}F NMR (376 MHz, $CDCl_3$) δ -122.63. Spectral datas obtained for the compound are in good agreement with the reported datas.[13]

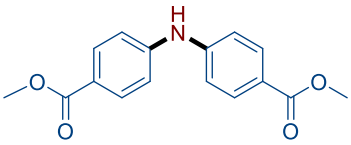


Bis(4-(trifluoromethyl)phenyl)amine (57): brown oil; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.55 (d, *J* = 8.5 Hz, 4H), 7.16 (d, *J* = 8.5 Hz, 4H), 6.11 (br, 1H). $^{13}C\{^{1}H\}$ NMR (100 MHz, $CDCl_3$) δ 145.1, 124.6 (d, *J* = 271.7 Hz), 127.1 (d, *J* = 3.0 Hz) , 123.9 (d, *J* = 32.3

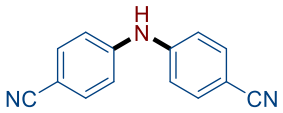
Hz), 117.7. ^{19}F NMR (376 MHz, $CDCl_3$) δ -61.78. Spectral datas obtained for the compound are in good agreement with the reported datas.[13]



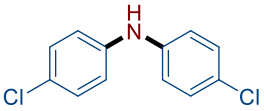
1,1'-(Azanediylbis(4,1-phenylene))bis(ethan-1-one) (58): black solid; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.92 (d, *J* = 8.8 Hz, 4H), 7.15 (d, *J* = 8.8 Hz, 4H), 2.56 (s, 6H). ^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$) δ 196.6, 146.1, 131.0, 130.6, 117.1, 26.4. Spectral datas obtained for the compound are in good agreement with the reported datas.[18]



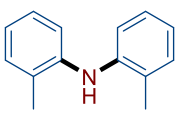
Dimethyl 4,4'-azanediyldibenzoate (44): yellow solid; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.96 (d, *J* = 8.6 Hz, 4H), 7.12 (d, *J* = 8.6 Hz, 4H), 6.61 (br, 1H), 3.88 (s, 6H). ^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$) δ 166.8, 146.0, 131.6, 123.3, 117.1, 52.0. Spectral datas obtained for the compound are in good agreement with the reported datas.[18]



4,4'-Azanediyldibenzonitrile (59): brown solid; ^{1}H NMR (400 MHz, DMSO-d_6) δ 9.51 (br, 1H), 7.74 (d, *J* = 7.4 Hz, 4H), 7.30 (d, *J* = 7.4 Hz, 4H). ^{13}C{^{1}H} NMR (100 MHz, DMSO-d_6) δ 145.7, 133.7, 119.4, 117.3, 102.1. Spectral datas obtained for the compound are in good agreement with the reported datas.[19]

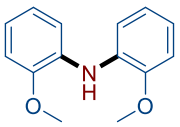


Bis(4-chlorophenyl)amine (60): brown oil; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.22 (d, *J* = 8.7 Hz, 4H), 6.96 (d, *J* = 8.7 Hz, 4H), 5.64 (br, 1H). ^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$) δ 141.4, 129.4, 126.1, 112.0. Spectral datas obtained for the compound are in good agreement with the reported datas.[13]

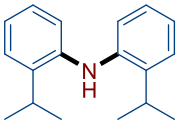


Di-*o*-tolylamine (61): white solid; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.21 (d, *J* = 7.4 Hz, 2H), 7.13 (t, *J* = 7.6 Hz, 2H), 7.00 (d, *J* = 7.9 Hz, 2H), 6.92 (t, *J* = 7.4 Hz, 2H), 5.16 (br, 1H), 2.28 (s, 6H). ^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$) δ 142.1, 131.0, 127.1, 126.9, 121.5,

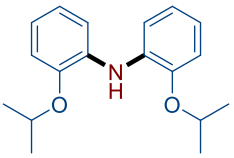
118.4, 17.9. Spectral datas obtained for the compound are in good agreement with the reported datas.[14]



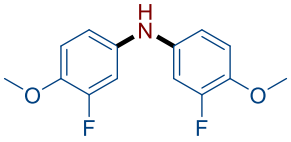
Bis(2-methoxyphenyl)amine (62): brown solid; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.39 (d, *J* = 7.6 Hz, 2H), 6.95 – 6.84 (m, 6H), 6.52 (br, 1H), 3.91 (s, 6H). $^{13}C\{^{1}H\}$ NMR (100 MHz, $CDCl_3$) δ 149.2, 132.7, 120.9, 120.3, 115.7, 110.8, 55.8. HRMS (ESI) m/z calc. for $C_{14}H_{15}NNaO_2$ $[M+Na]^+$: 252.1000, found: 252.0990.



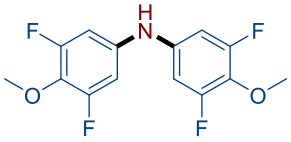
Bis(2-isopropylphenyl)amine (63): colorless oil; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.30 (d, *J* = 7.6 Hz, 2H), 7.10 (t, *J* = 7.6 Hz, 2H), 7.02 – 6.94 (m, 4H), 5.33 (br, 1H), 3.12 (hept, *J* = 6.8 Hz, 2H), 1.30 (d, *J* = 6.8 Hz, 12H). $^{13}C\{^{1}H\}$ NMR (100 MHz, $CDCl_3$) δ 141.4, 138.2, 126.5, 125.8, 121.8, 119.4, 27.8, 22.8. Spectral datas obtained for the compound are in good agreement with the reported datas.[14]



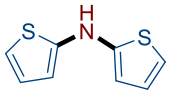
Bis(2-isopropoxyphenyl)amine (64): brown solid; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.43 (d, *J* = 7.8 Hz, 2H), 6.90 (t, *J* = 7.7 Hz, 4H), 6.81 (m, 2H), 4.55 (hept, *J* = 5.7 Hz, 2H), 1.39 (d, *J* = 6.0 Hz, 12H). $^{13}C\{^{1}H\}$ NMR (100 MHz, $CDCl_3$) δ 146.9, 134.1, 121.1, 119.7, 115.0, 114.3, 71.4, 22.5. HRMS (ESI) m/z calc. for $C_{18}H_{23}NNaO_2$ $[M+Na]^+$: 308.1626, found: 308.1621.



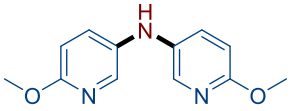
Bis(3-fluoro-4-methoxyphenyl)amine (65): black solid; ^{1}H NMR (400 MHz, $CDCl_3$) δ 6.88 (t, *J* = 9.0 Hz, 2H), 6.79 (dd, *J* = 12.8, 2.7 Hz, 2H), 6.68 – 6.71 (m, 2H), 3.86 (s, 6H). $^{13}C\{^{1}H\}$ NMR (100 MHz, $CDCl_3$) δ 153.2 (d, *J* = 246.4 Hz), 142.5 (d, *J* = 11.11 Hz), 137.9 (d, *J* = 9.1 Hz), 115.3 (d, *J* = 3.0 Hz), 113.9 (d, *J* = 4.0 Hz), 107.3 (d, *J* = 21.2 Hz), 57.2. ^{19}F NMR (376 MHz, $CDCl_3$) δ -132.92. HRMS (ESI) m/z calc. for $C_{14}H_{13}F_2NNaO_2$ $[M+Na]^+$: 288.0807, found: 288.0807.



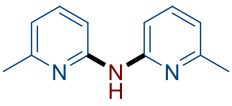
Bis(3,5-difluoro-4-methoxyphenyl)amine (66): brown solid; ^{1}H NMR (400 MHz, $CDCl_3$) δ 6.65 – 6.49 (m, 4H), 5.58 (br, 1H), 3.93 (s, 6H). $^{13}C\{^{1}H\}$ NMR (100 MHz, $CDCl_3$) δ 156.8 (dd, *J* = 248.5, 8.1 Hz), 138.0 (t, *J* = 12.1 Hz), 131.3 (t, *J* = 15.2 Hz), (102.5, 102.4, 102.3, 102.2), 62.3 (t, *J* = 3.0 Hz). ^{19}F NMR (376 MHz, $CDCl_3$) δ -127.30. HRMS (ESI) m/z calc. for $C_{14}H_{11}F_4NNaO_2$ $[M+Na]^+$: 324.0618, found: 324.0622.



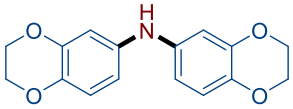
Di(thiophen-2-yl)amine (67): brown solid; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.39 – 7.30 (m, 2H), 7.21 (dd, *J* = 3.5, 1.2 Hz, 2H), 7.00 – 6.92 (m, 2H). $^{13}C\{^{1}H\}$ NMR (100 MHz, $CDCl_3$) δ 135.7, 132.9, 129.8, 127.6. Spectral datas obtained for the compound are in good agreement with the reported datas.[20]



Bis(6-methoxypyridin-3-yl)amine (68): brown oil; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.86 (d, *J* = 2.9 Hz, 2H), 7.27 (dd, *J* = 8.8, 2.9 Hz, 2H), 6.67 (d, *J* = 8.8 Hz, 2H), 5.21 (br, 1H), 3.89 (s, 6H). $^{13}C\{^{1}H\}$ NMR (100 MHz, $CDCl_3$) δ 159.8, 137.0, 134.7, 130.5, 111.2, 53.6. HRMS (ESI) m/z calc. for $C_{12}H_{14}N_3O_2$ $[M+H]^+$: 232.1081, found: 232.1078.

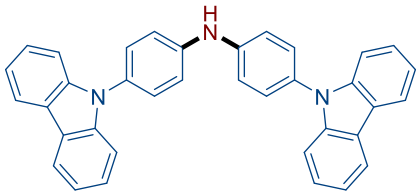


Bis(6-methylpyridin-2-yl)amine (69): yellow oil; ^{1}H NMR (400 MHz, $CDCl_3$ δ 7.47 (t, *J* = 7.8 Hz, 2H), 7.36 (d, *J* = 8.2 Hz, 2H), 7.28 (br, 1H), 6.69 (d, *J* = 7.3 Hz, 2H), 2.46 (s, 6H). $^{13}C\{^{1}H\}$ NMR (100 MHz, $CDCl_3$) δ 156.8, 153.6, 138.1, 115.6, 108.4, 24.4. Spectral datas obtained for the compound are in good agreement with the reported datas.[17]

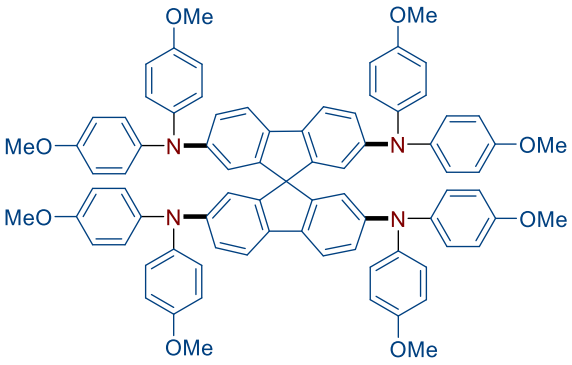


Bis(2,3-dihydrobenzo[b][1,4]dioxin-6-yl)amine (70): black solid; ^{1}H NMR (400 MHz, $CDCl_3$) δ 6.75 (d, *J* = 8.6 Hz, 2H), 6.56 (s, 2H), 6.50 (s, 2H), 4.30 – 4.14 (m, 8H).

$^{13}C\{^{1}H\}$ NMR (100 MHz, $CDCl_3$) δ 144.0, 138.5, 138.2, 117.7, 111.9, 107.3, 64.7, 64.4. HRMS (ESI) m/z calc. for $C_{16}H_{16}NO_4$ $[M+H]^+$: 286.1074, found: 286.1074.



Bis(4-(9H-carbazol-9-yl)phenyl)amine (71): black oil; ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.22 (d, *J* = 7.8 Hz, 4H), 7.63 – 7.45 (m, 13H), 7.37 – 7.34 (m, *J* = 7.9, 4.0 Hz, 7H). $^{13}C\{^{1}H\}$ NMR (100 MHz, $CDCl_3$) δ 142.6, 141.4, 130.9, 128.5, 126.0, 123.3, 120.4, 119.9, 118.9, 109.9. Spectral datas obtained for the compound are in good agreement with the reported datas.[21]



N2,N2,N2',N2',N7,N7,N7',N7'-Octakis(4-methoxyphenyl)-9,9'-spirobi[fluorene]-2,2',7,7'-tetraamine (74): yellow solid; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.36 (d, *J* = 8.2 Hz, 4H), 6.92 (d, *J* = 8.9 Hz, 16H), 6.81 – 6.75 (m, 20H), 6.56 (d, *J* = 1.7 Hz, 4H), 3.77 (s, 24H). $^{13}C\{^{1}H\}$ NMR (100 MHz, $CDCl_3$) δ 155.2, 150.2, 147.3, 141.7, 135.7, 125.2, 122.9, 119.9, 118.3, 114.6, 65.7, 55.6. Spectral datas obtained for the compound are in good agreement with the reported datas.[22]

5. References

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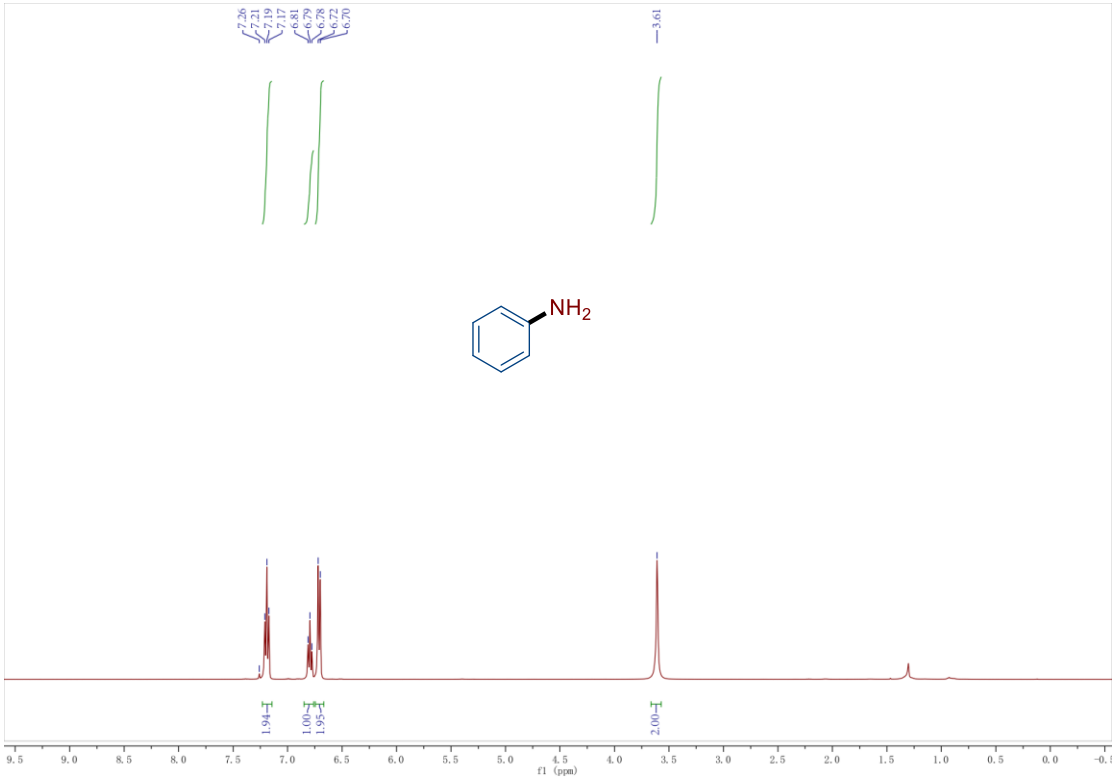
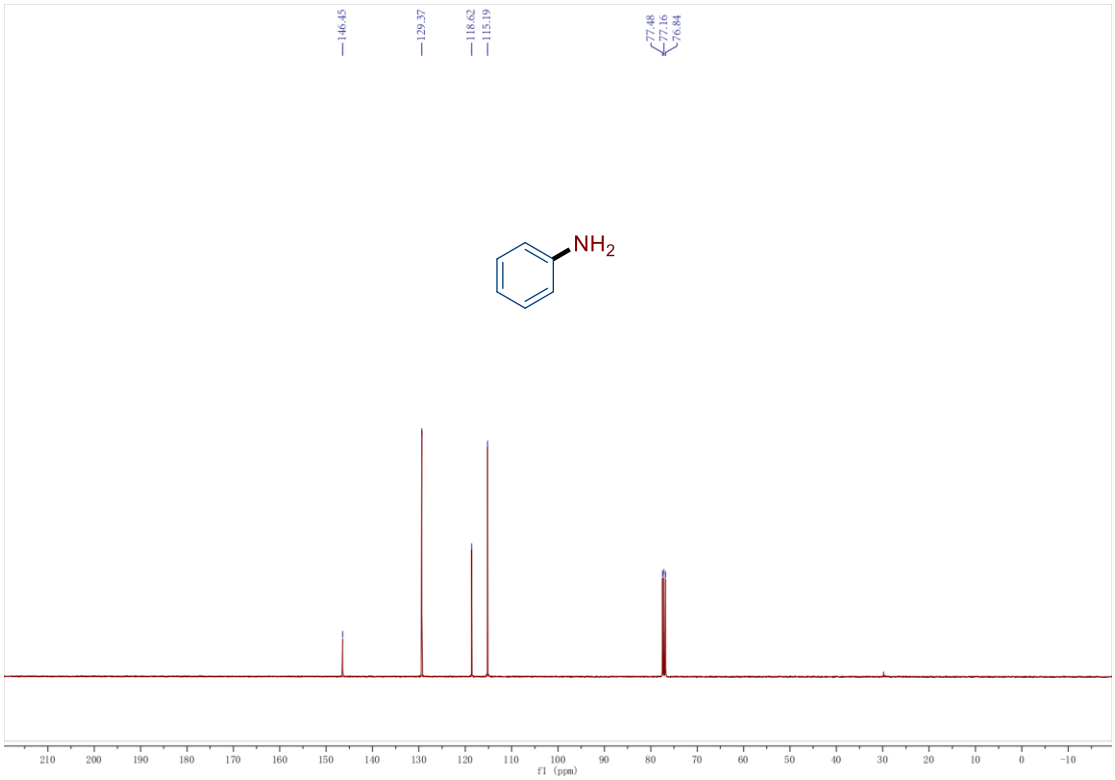
6. Copies of ^{1}H NMR, ^{13}C NMR and ^{19}F NMR spectra of products

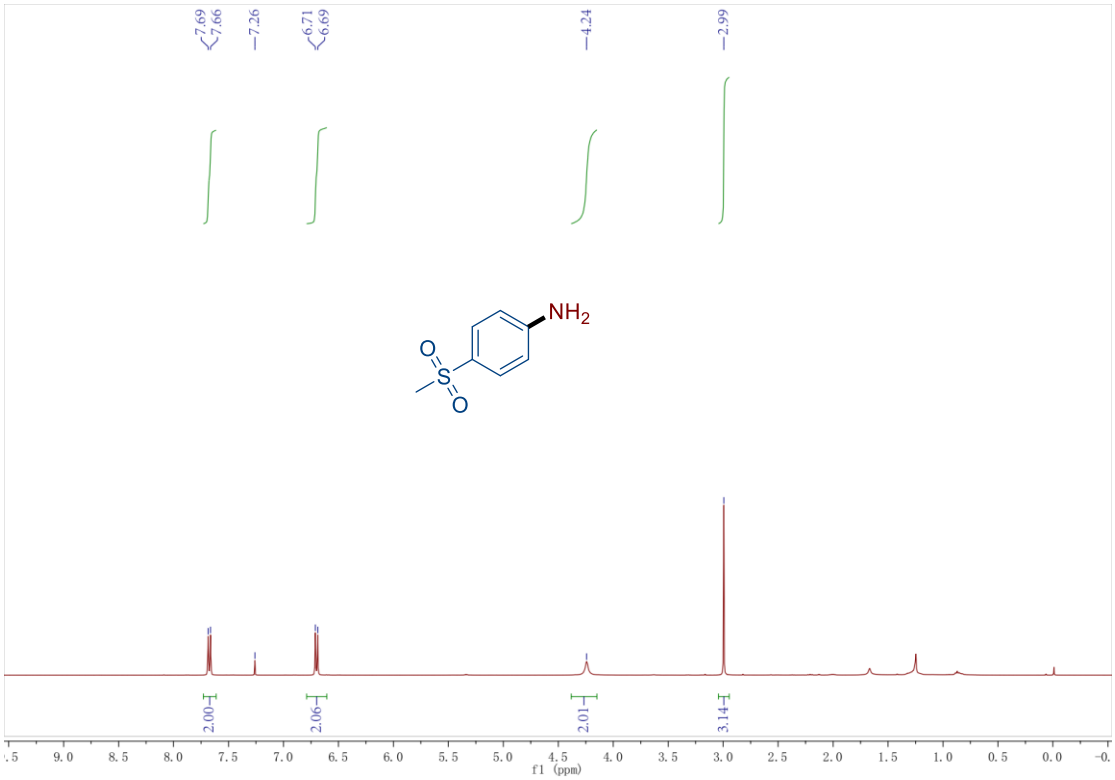
^{1}H NMR (400 MHz, $CDCl_3$) spectrum of compound **4**



^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$) spectrum of compound **4**



^{1}H NMR (400 MHz, $CDCl_3$) spectrum of compound **5**



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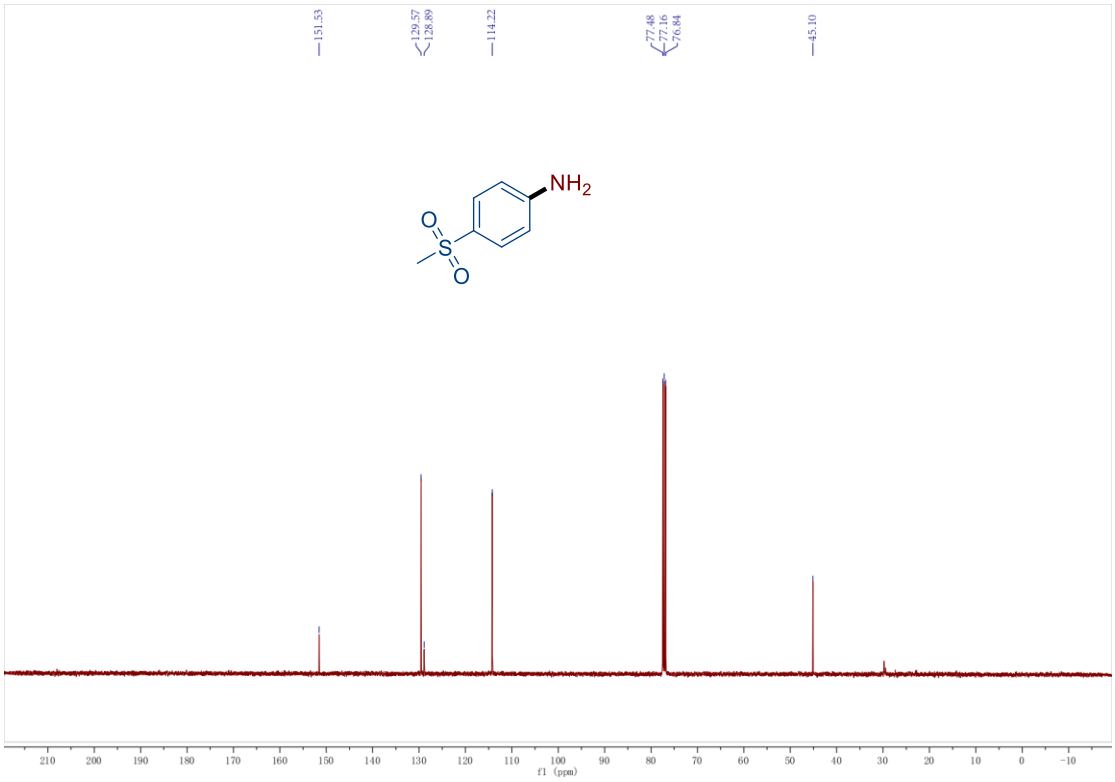
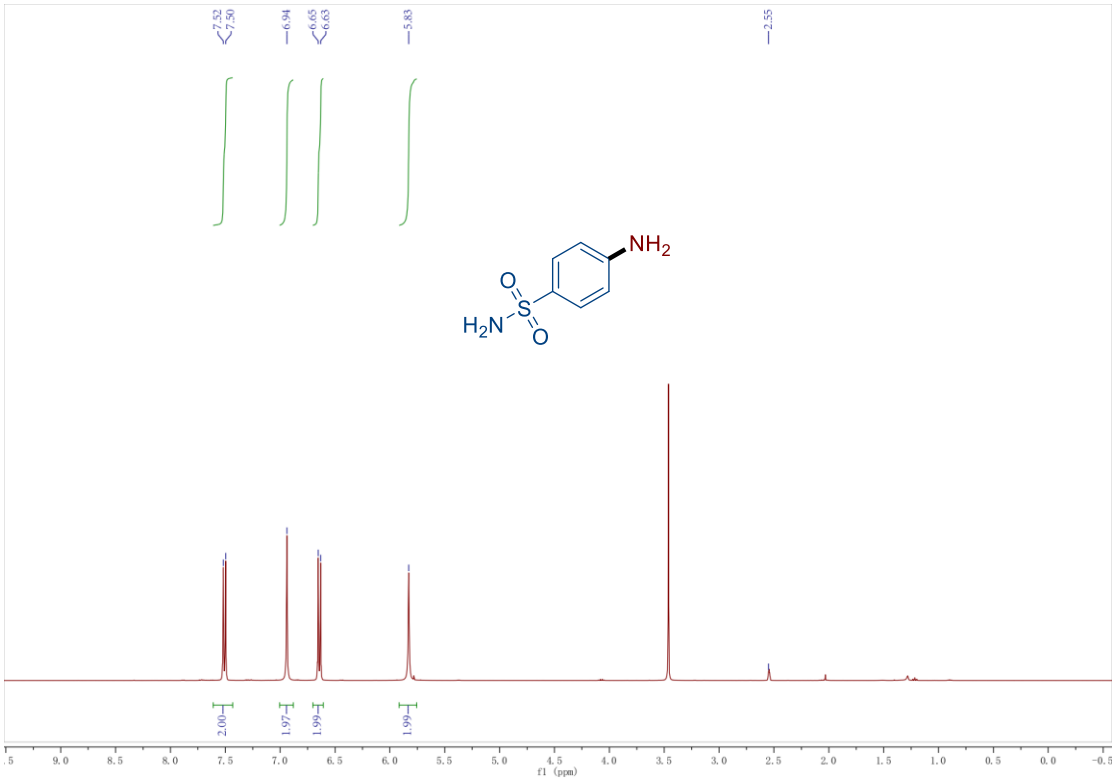


^{1}H NMR (400 MHz, DMSO-d_6) spectrum of compound **6**



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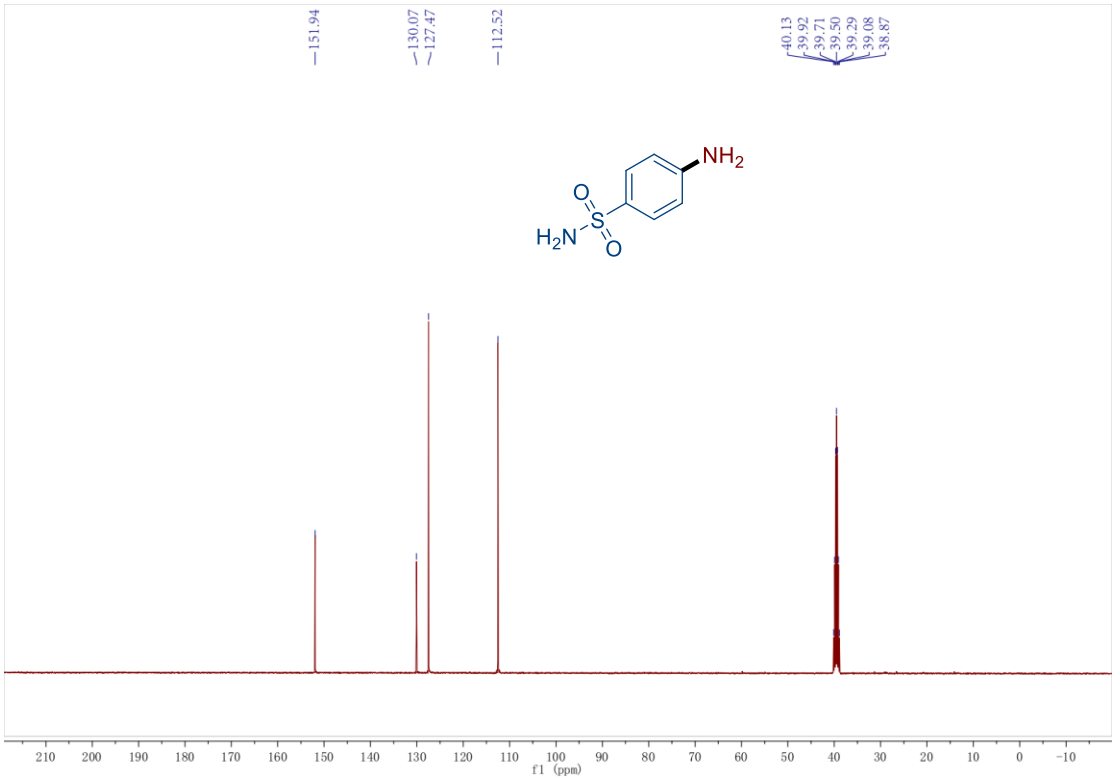
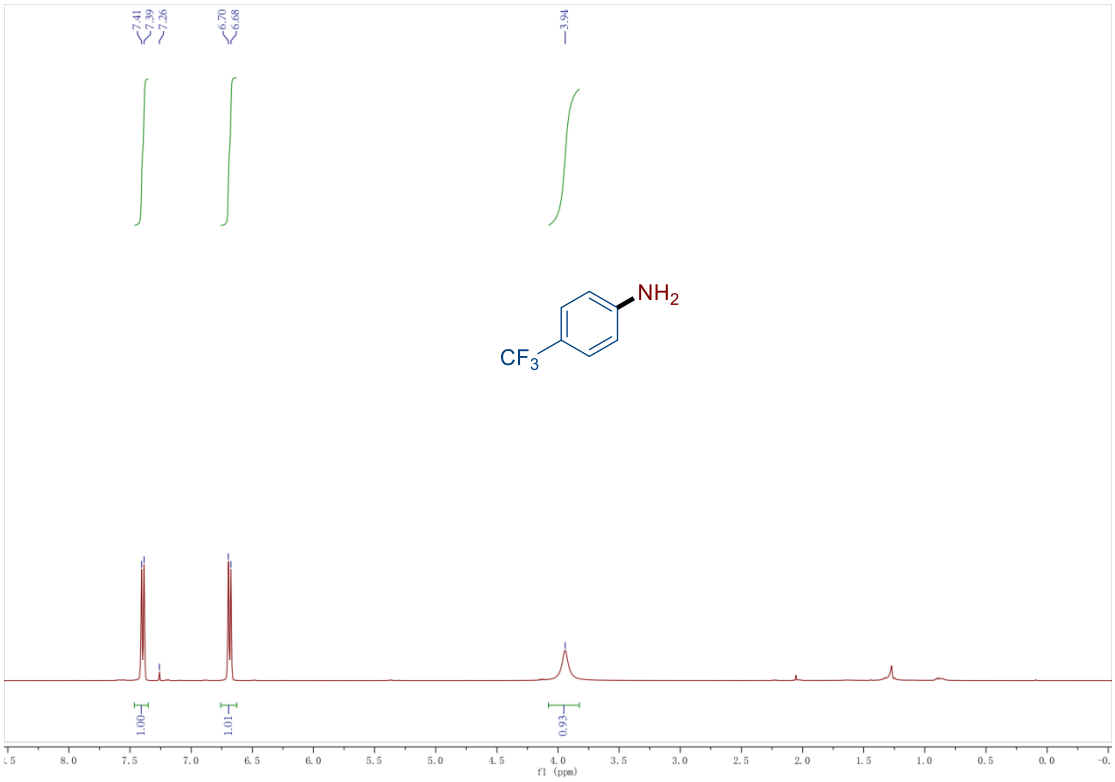


^{1}H NMR (400 MHz, $CDCl_3$) spectrum of compound **7**



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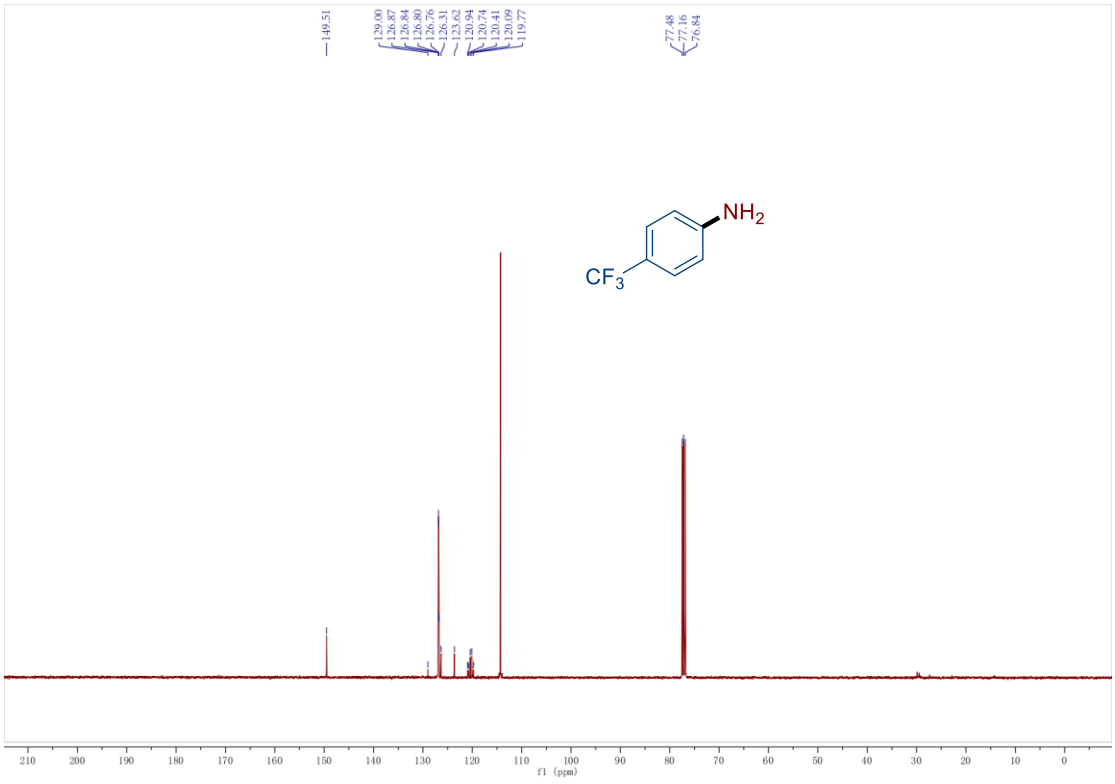
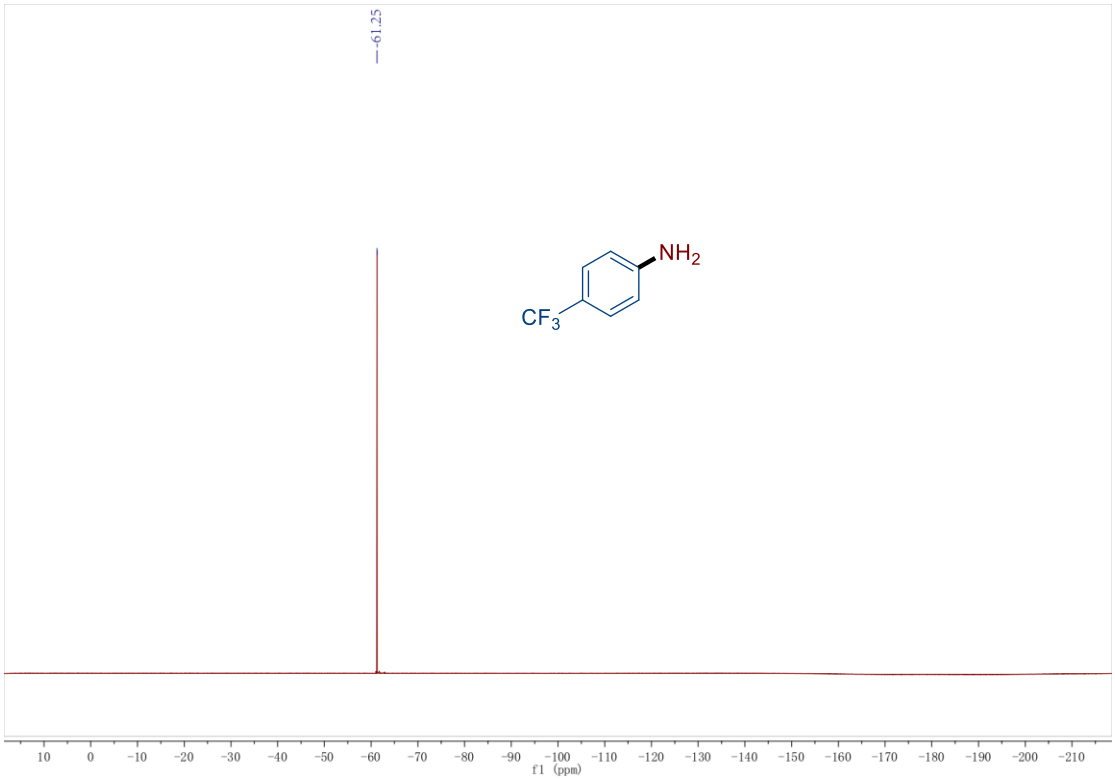
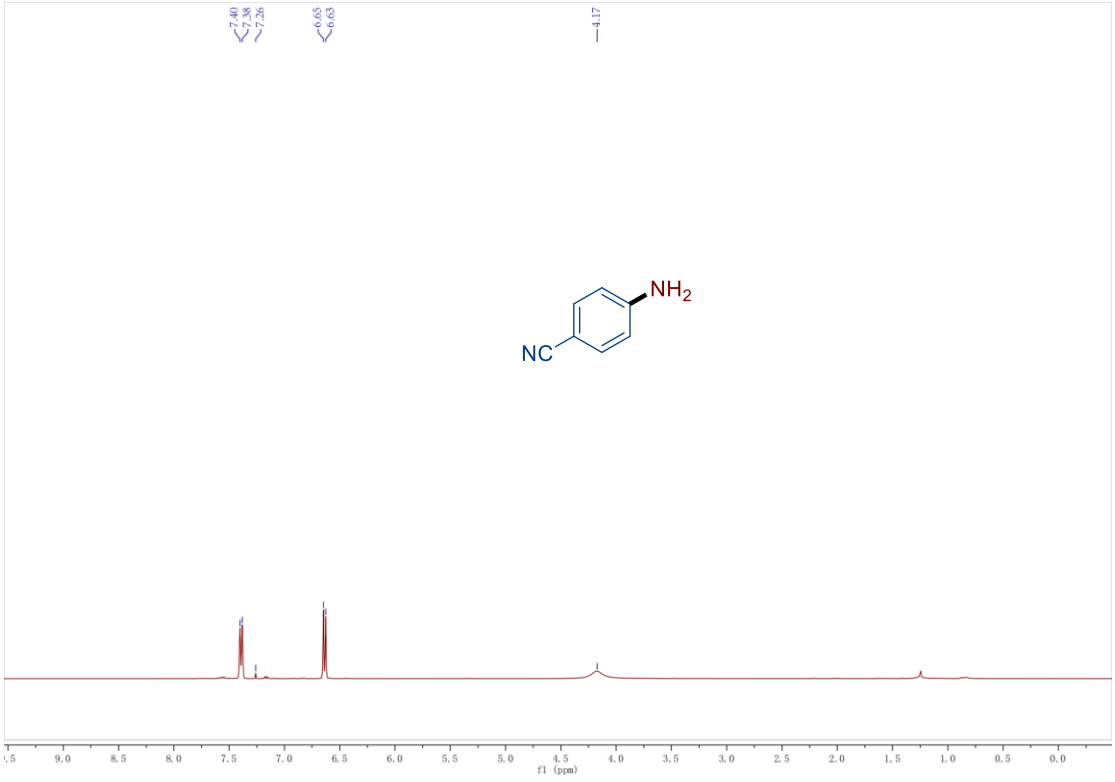


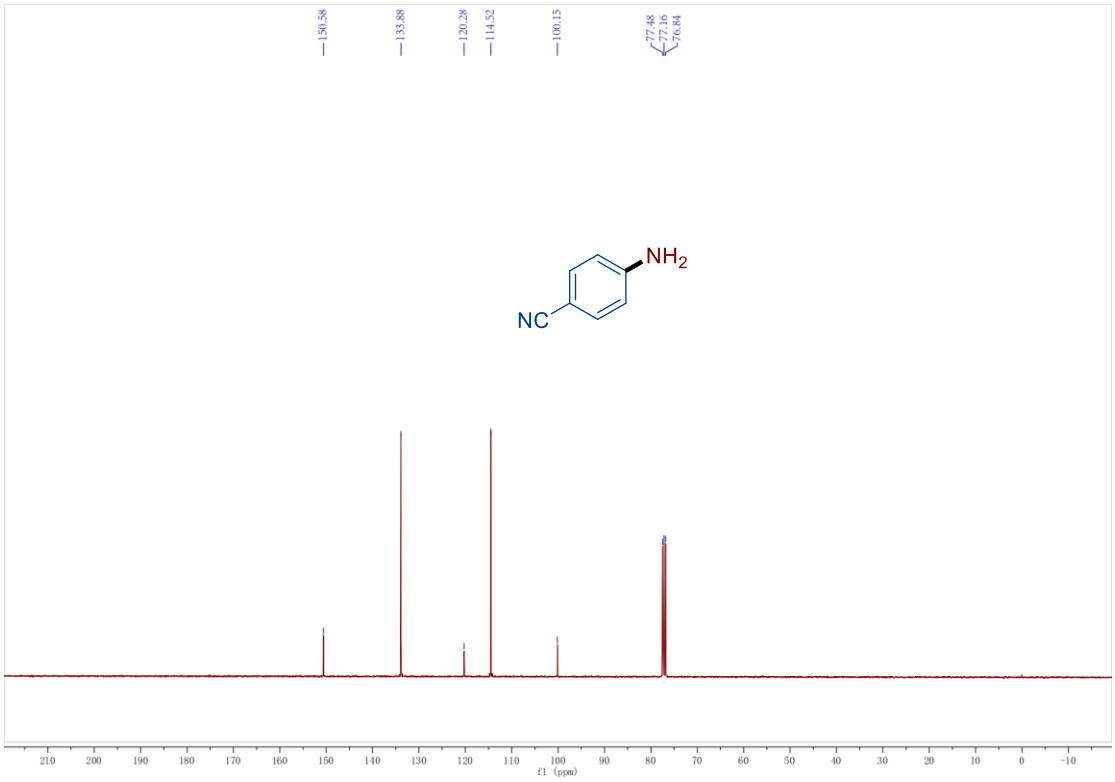
^{19}F NMR (376 MHz, $CDCl_3$) spectrum of compound **7**



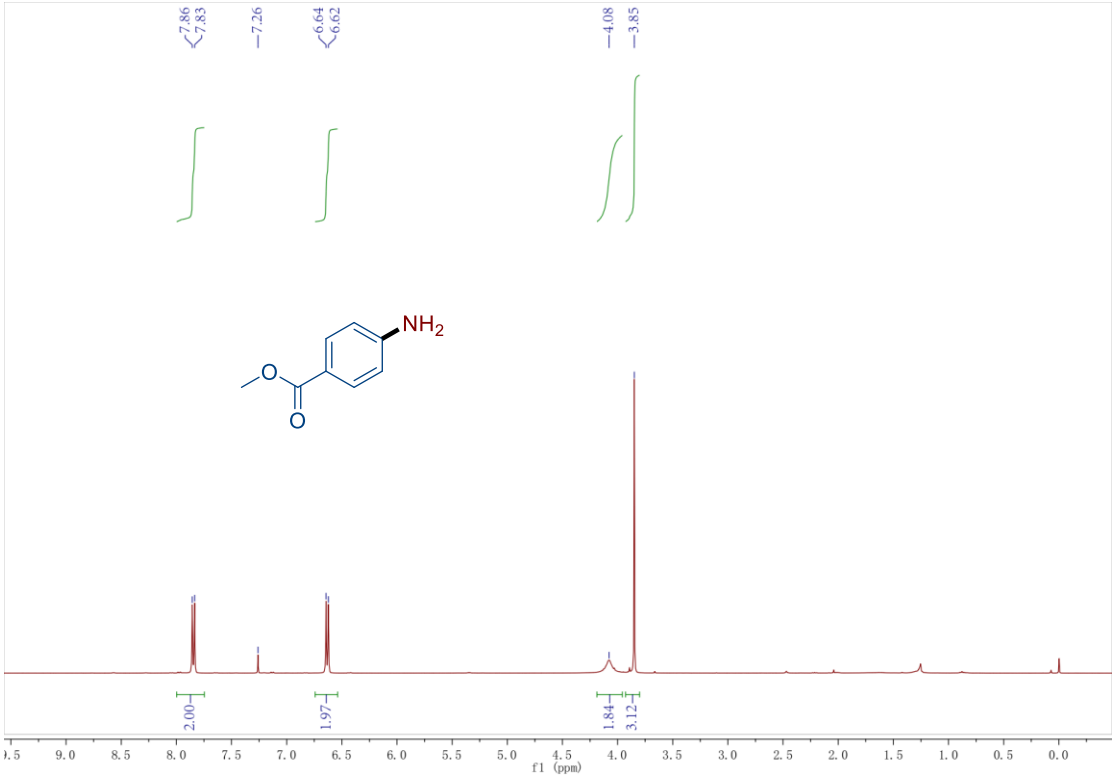
^{1}H NMR (400 MHz, $CDCl_3$) spectrum of compound **8**



$^{13}C\{^{1}H\}$ NMR (100 MHz, $CDCl_3$) spectrum of compound **8**



^{1}H NMR (400 MHz, $CDCl_3$) spectrum of compound **9**



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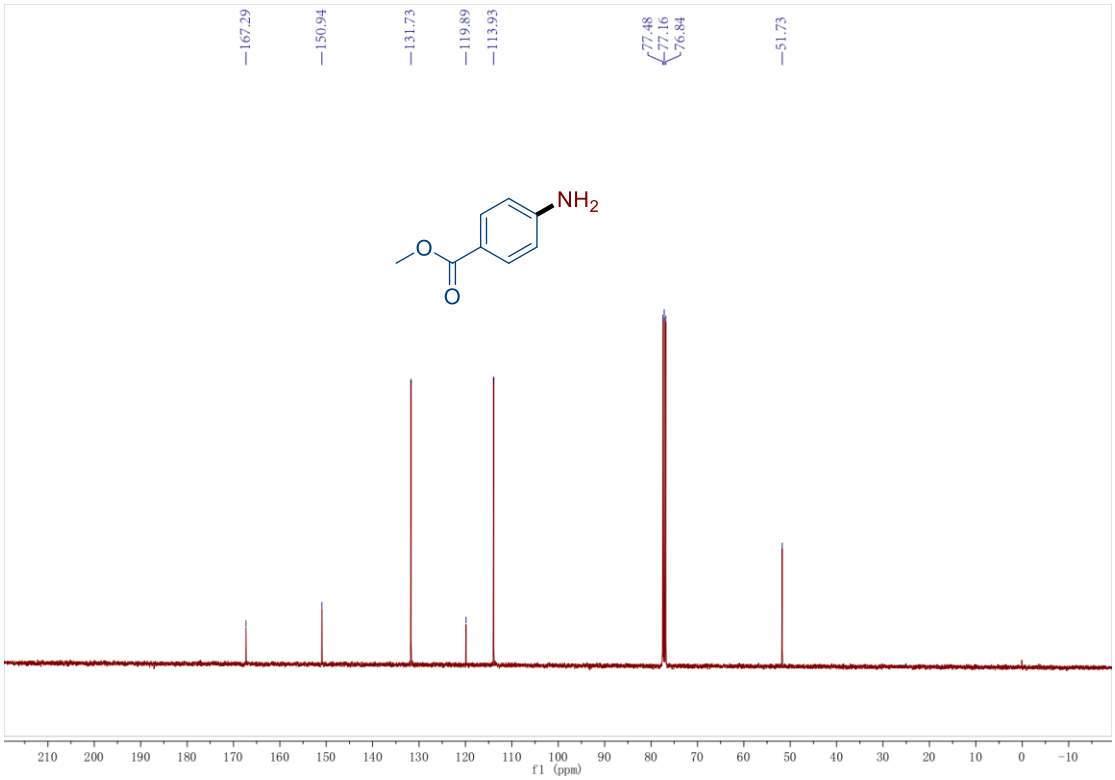

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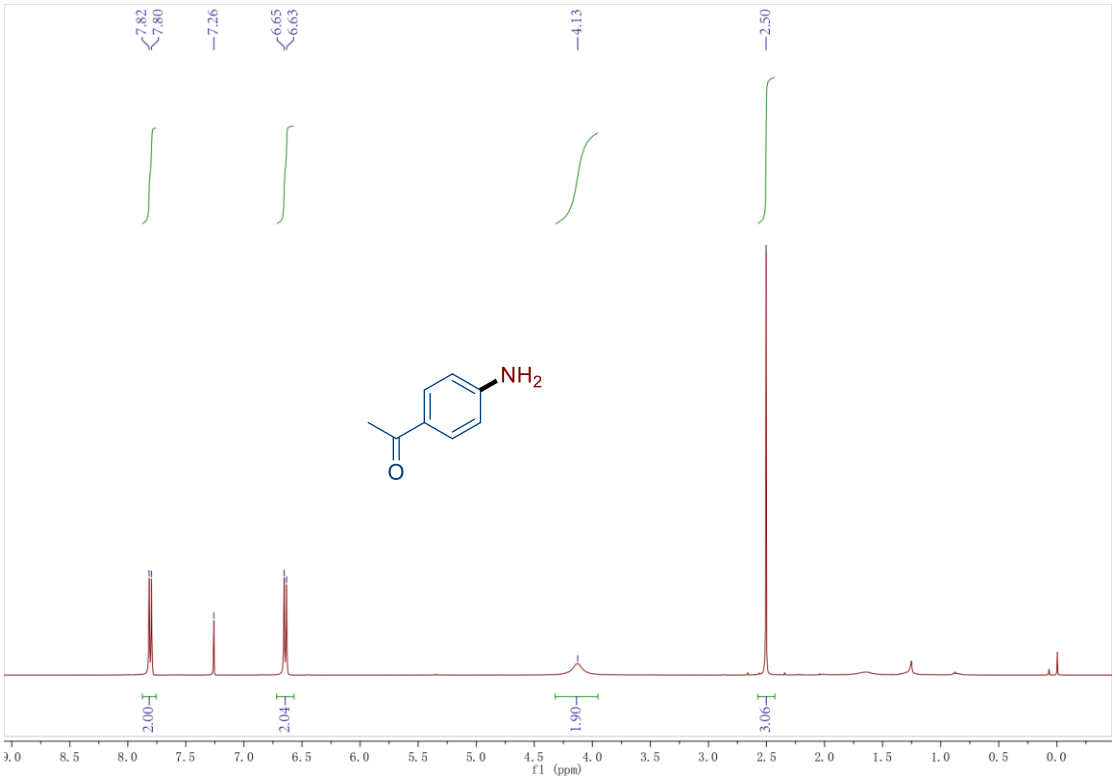

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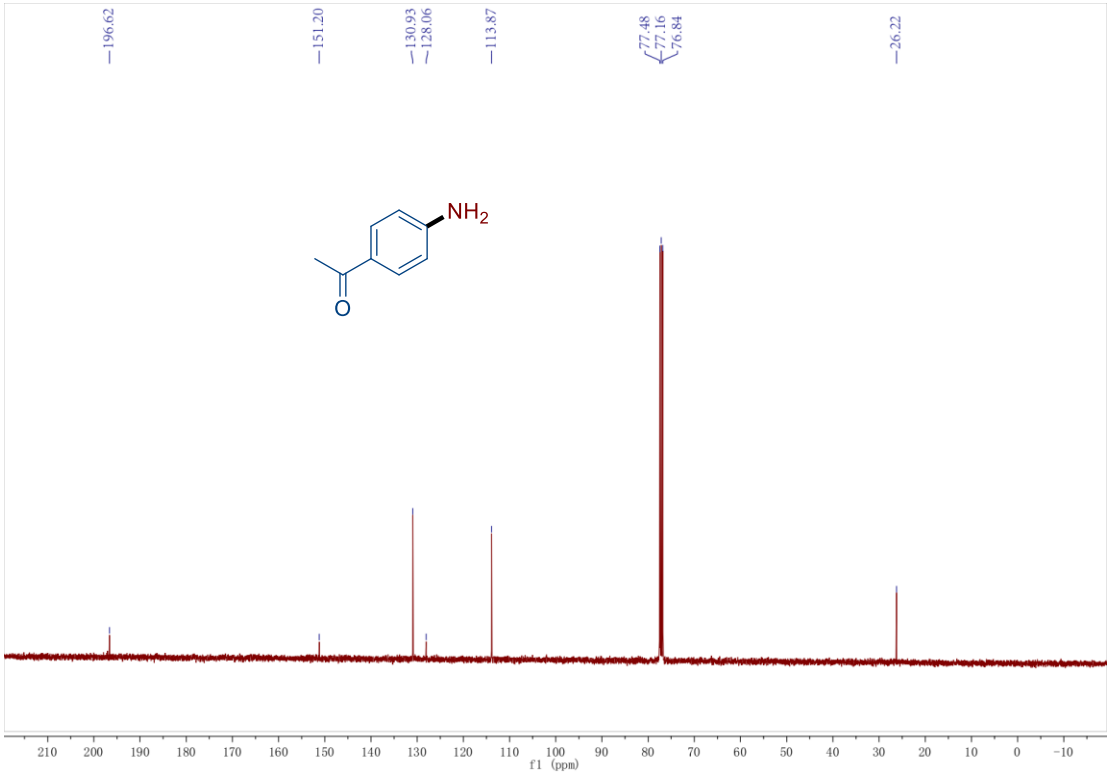

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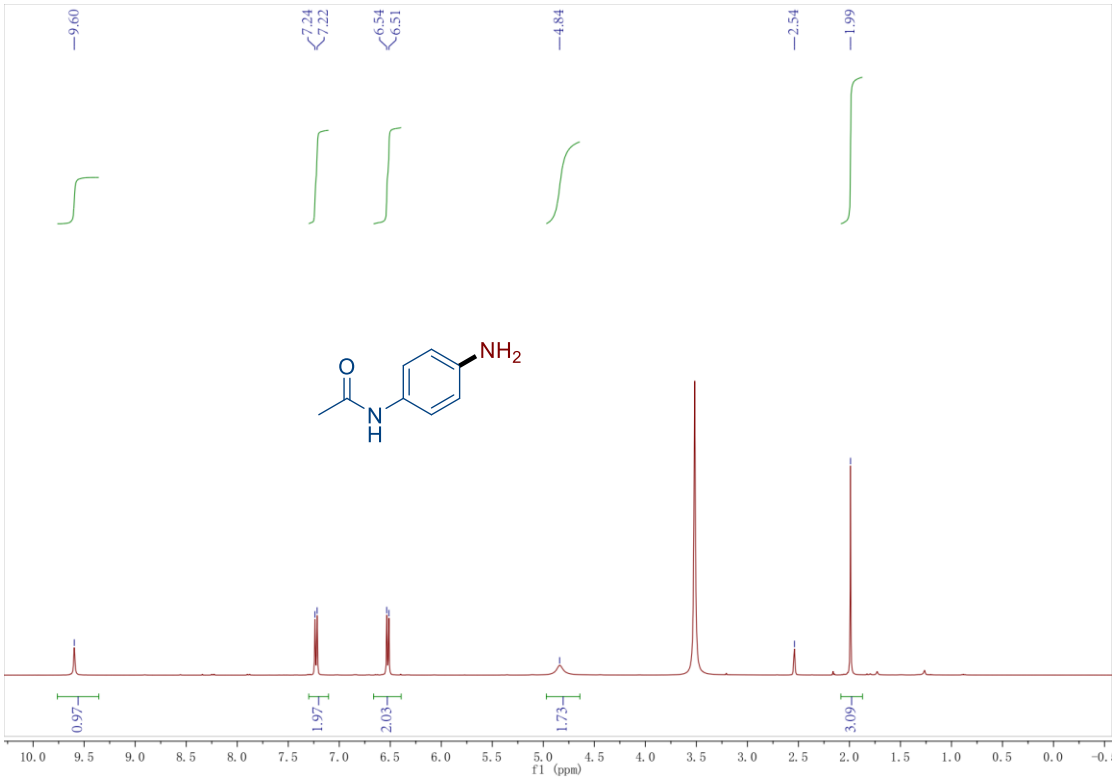
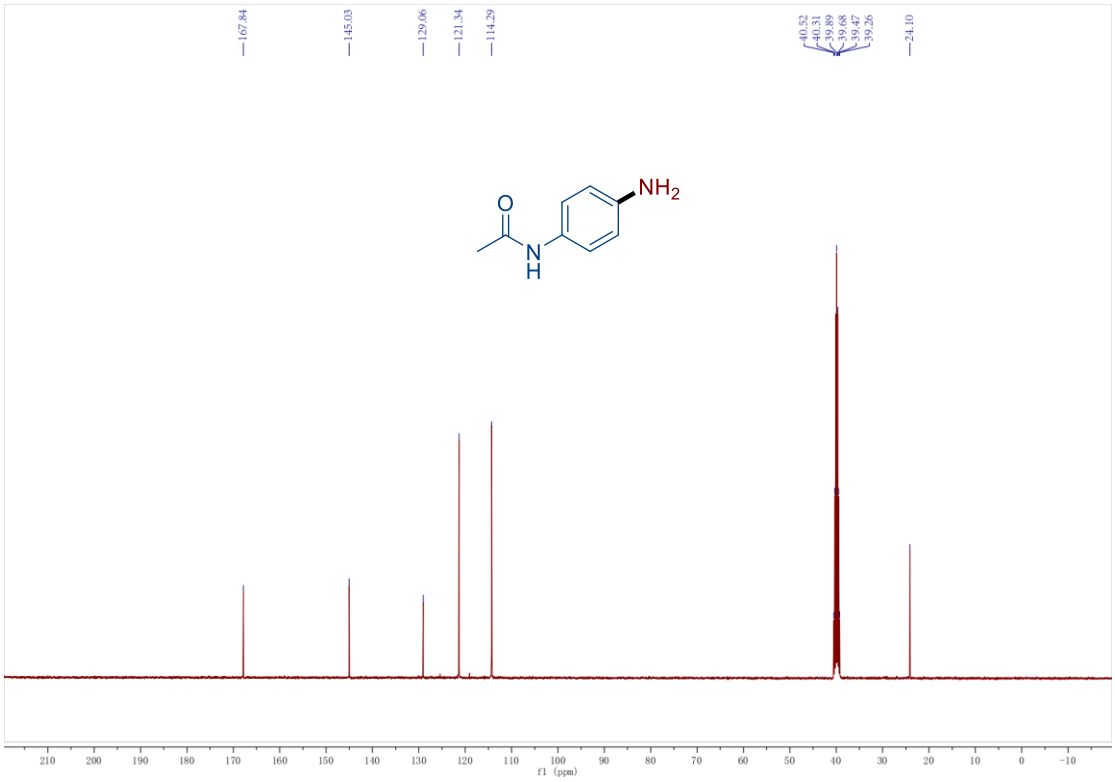


$^{13}C\{^{1}H\}$ NMR (100 MHz, DMSO-d_6) spectrum of compound **11**



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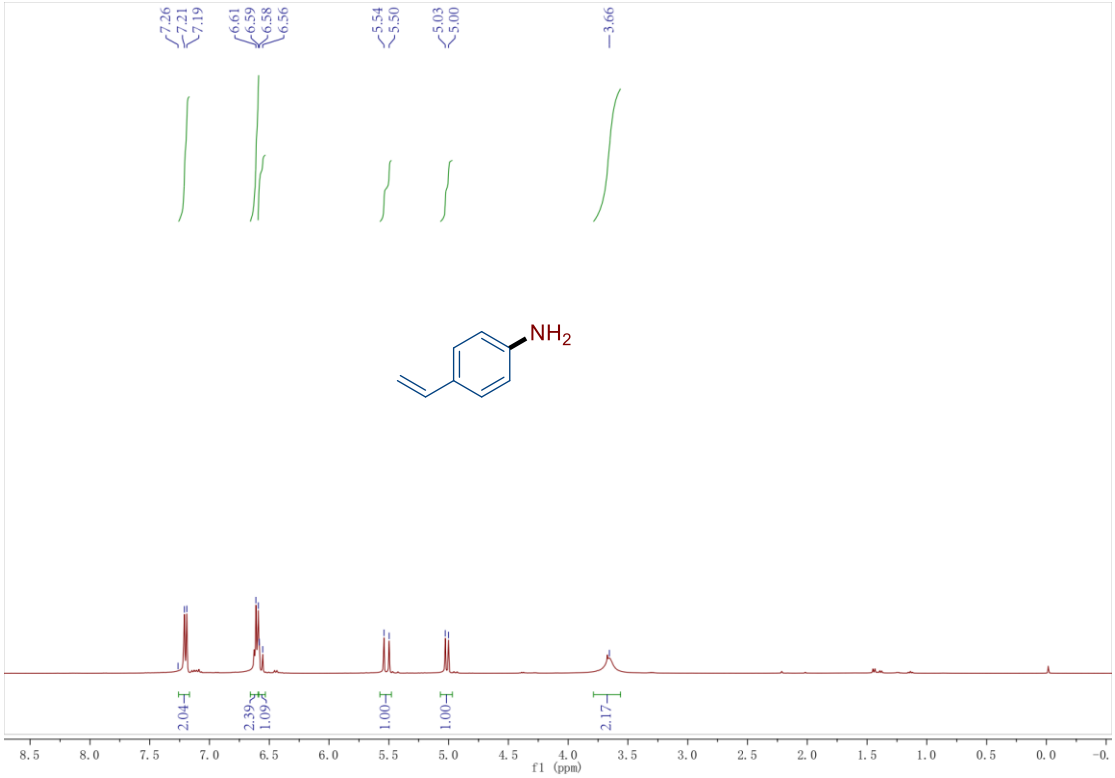

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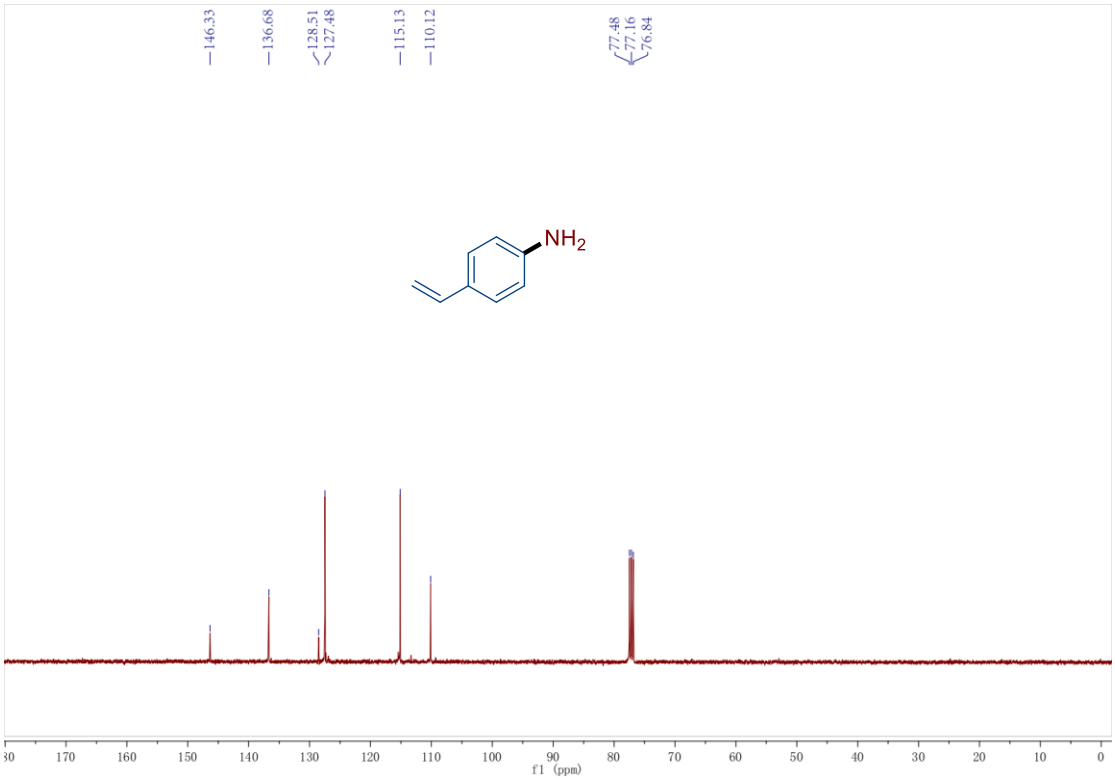

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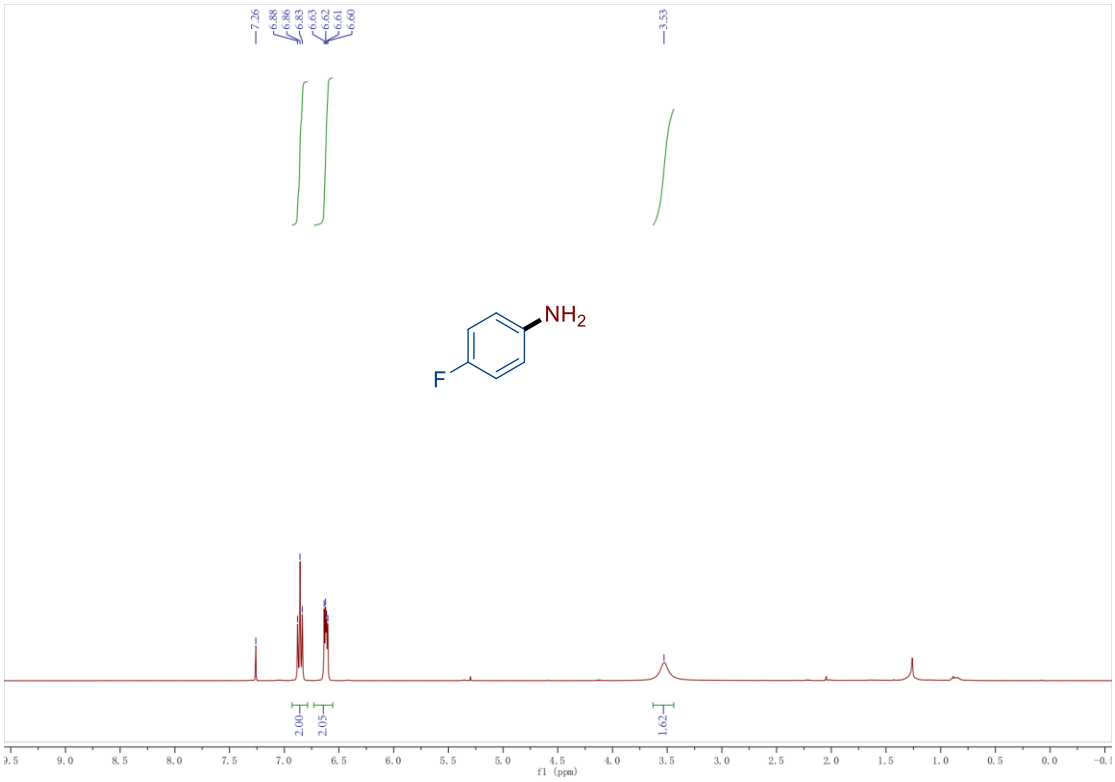

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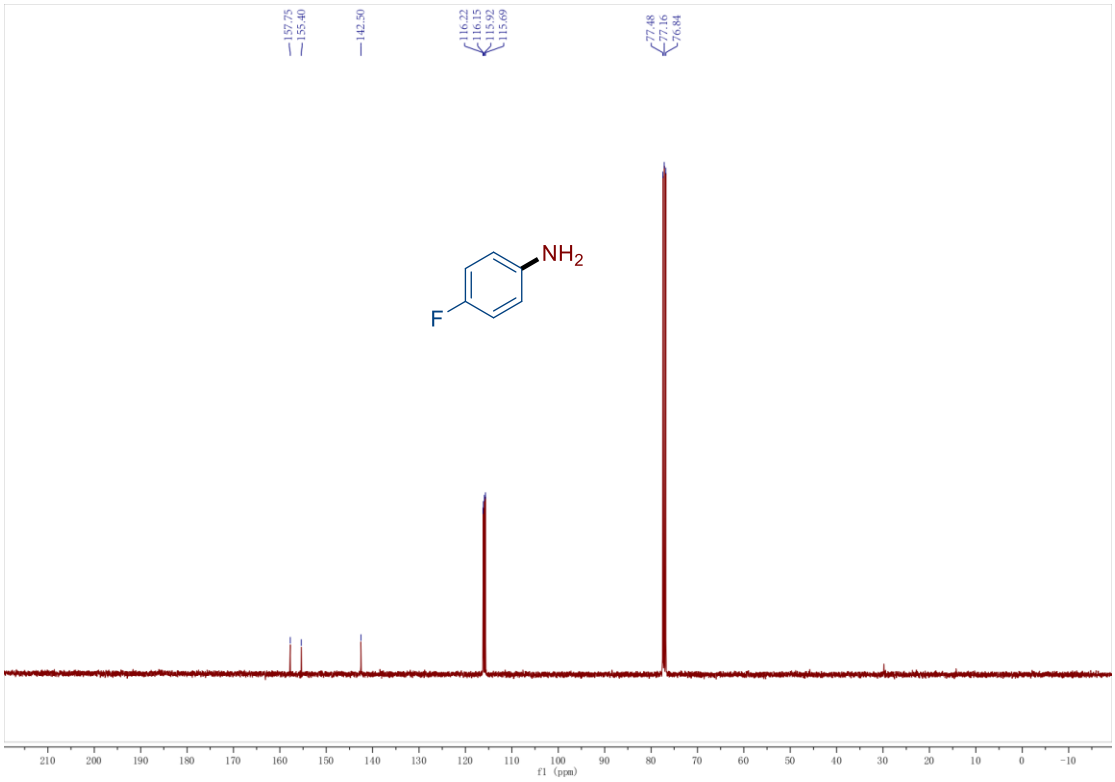
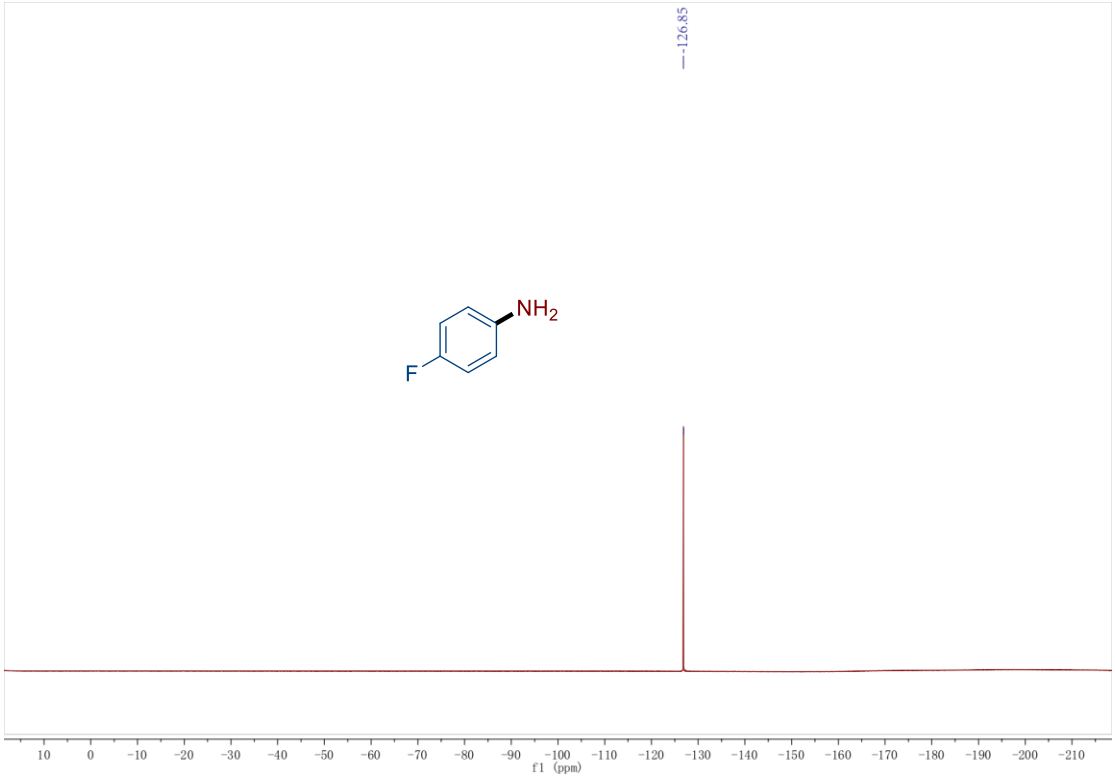


^{19}F NMR (376 MHz, $CDCl_3$) spectrum of compound **13**



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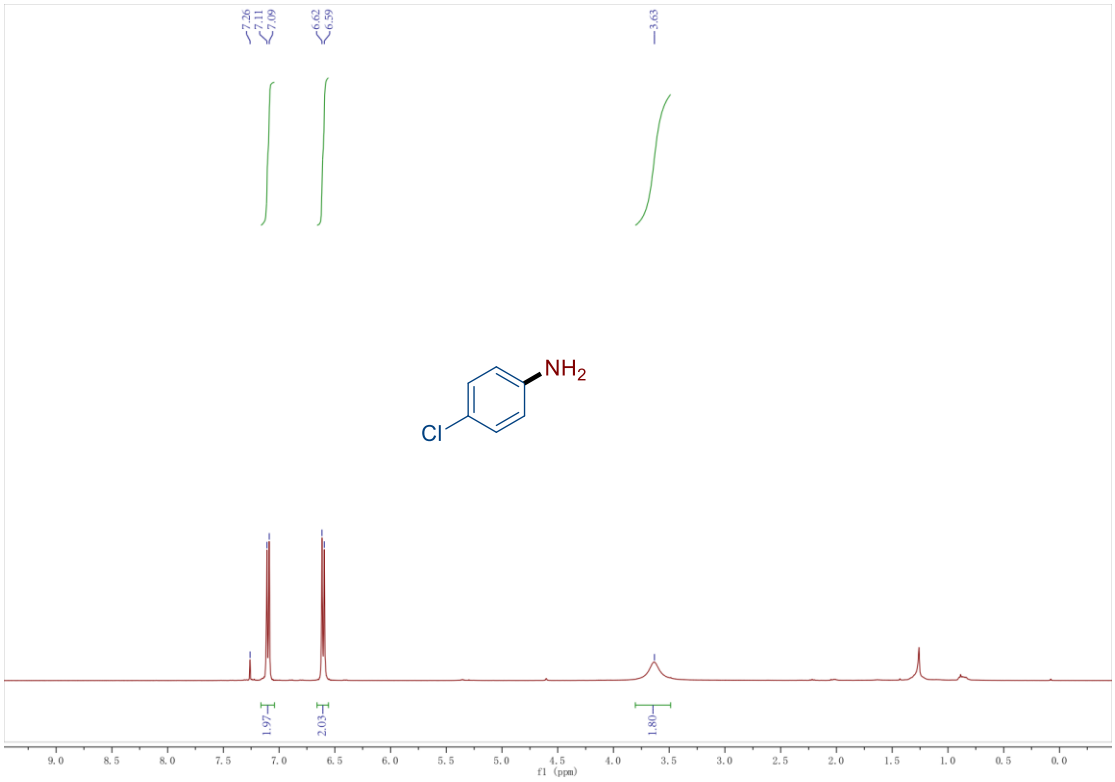

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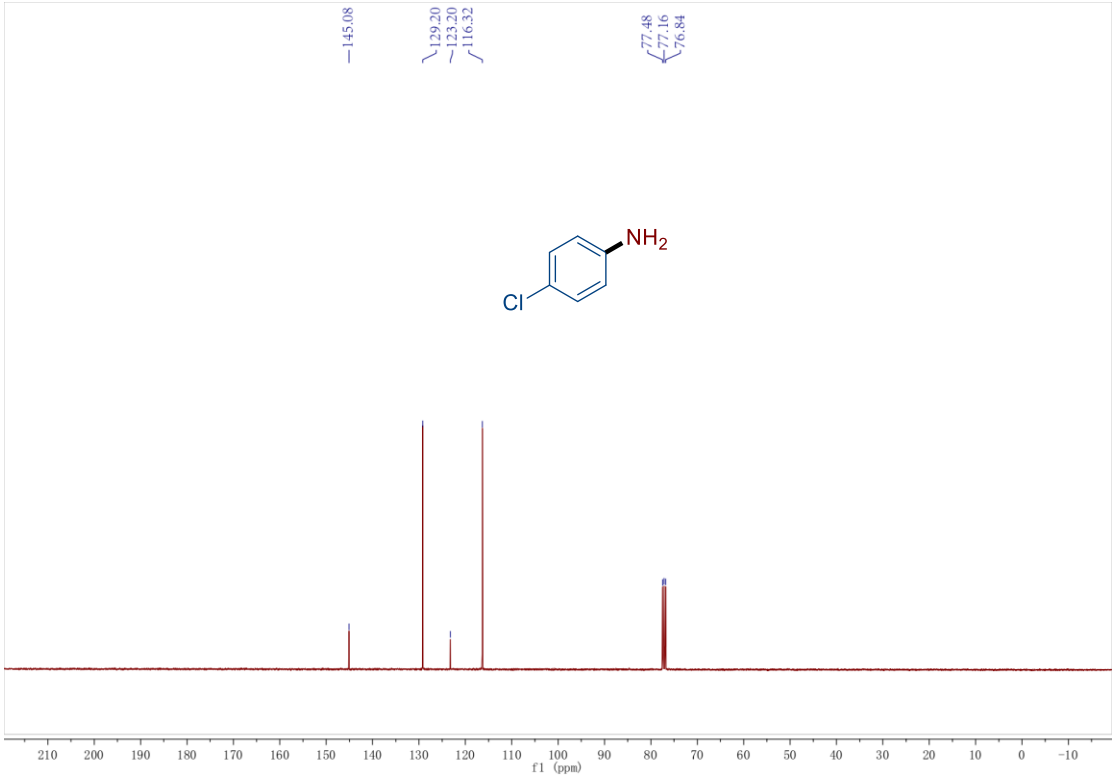

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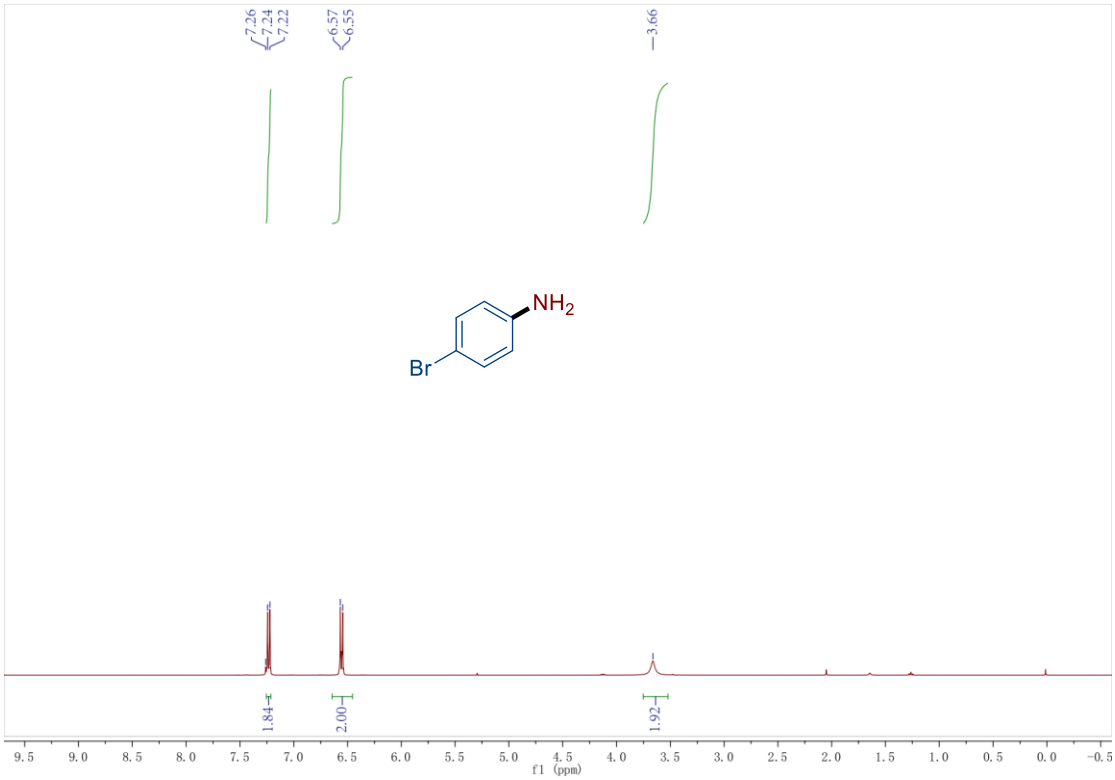

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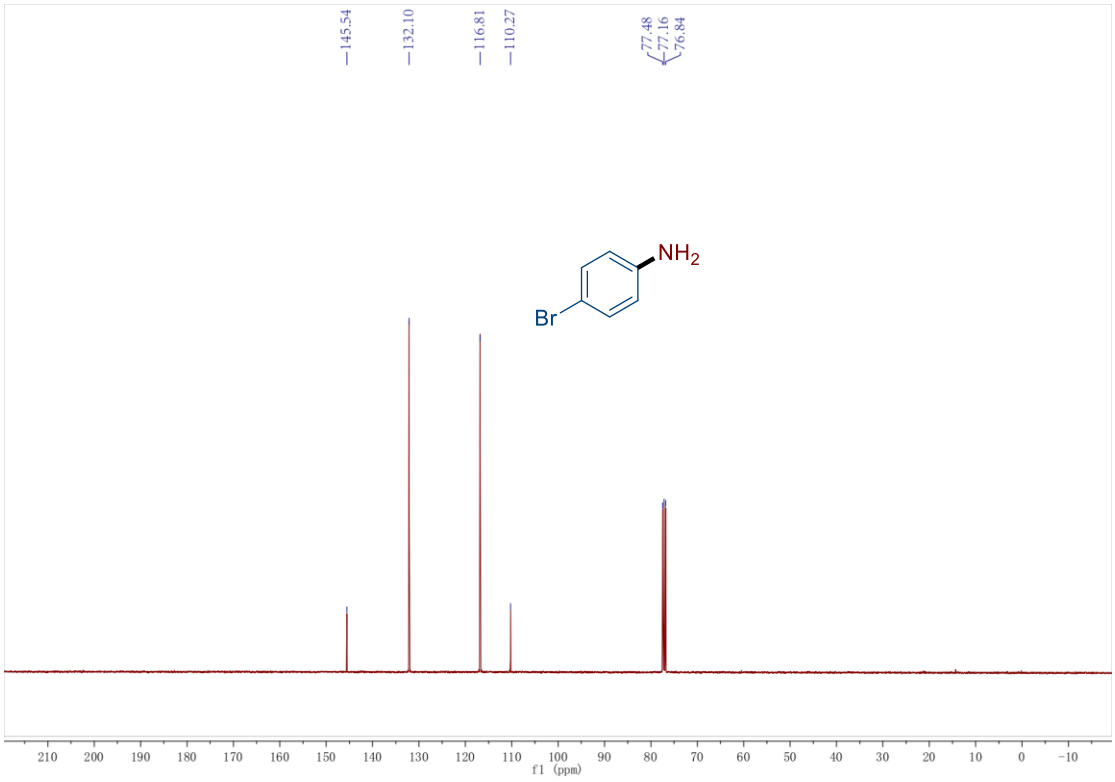

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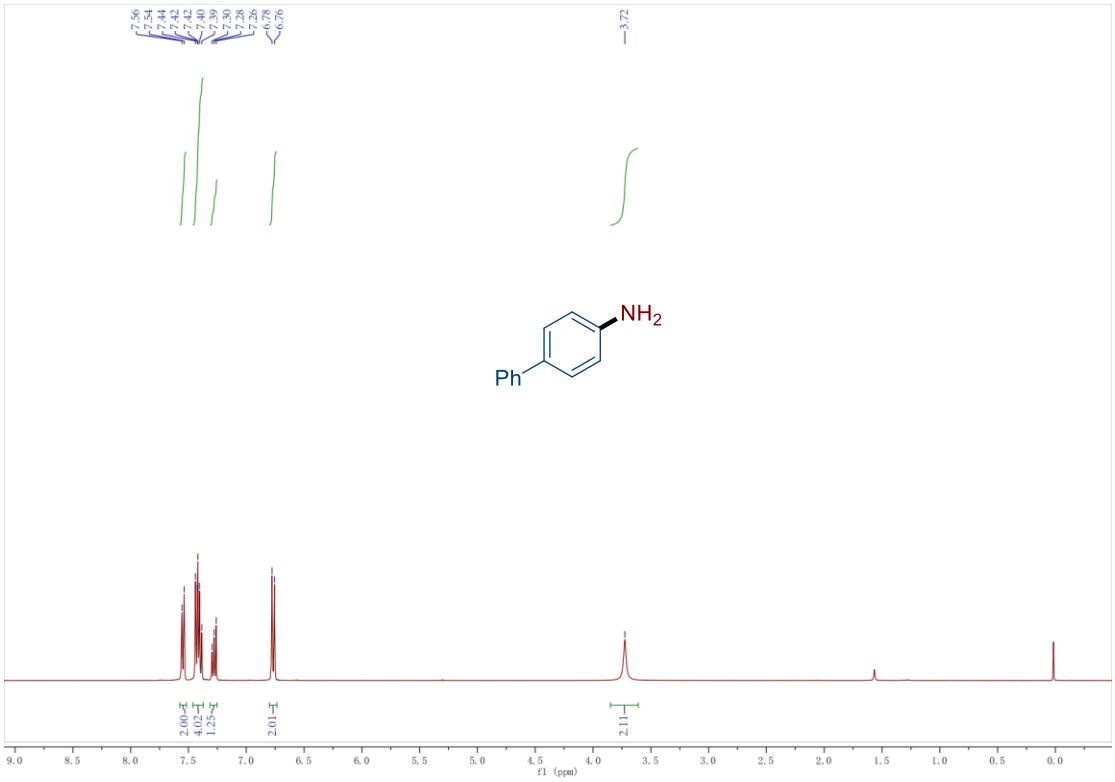

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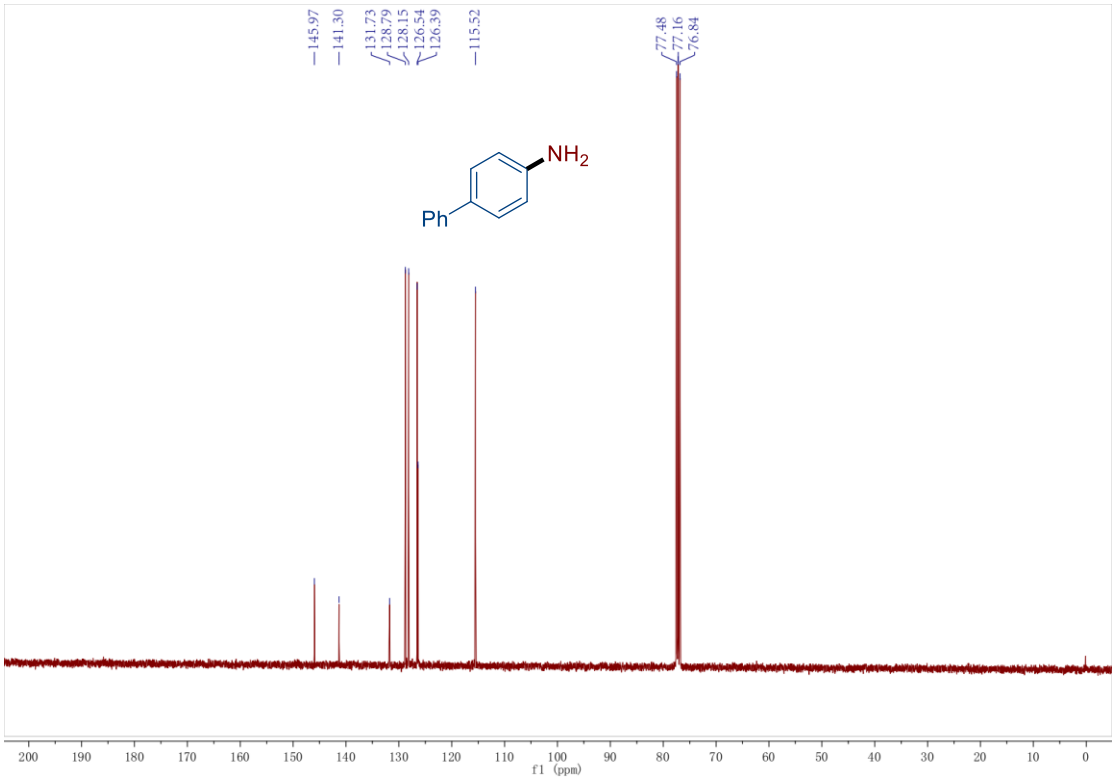

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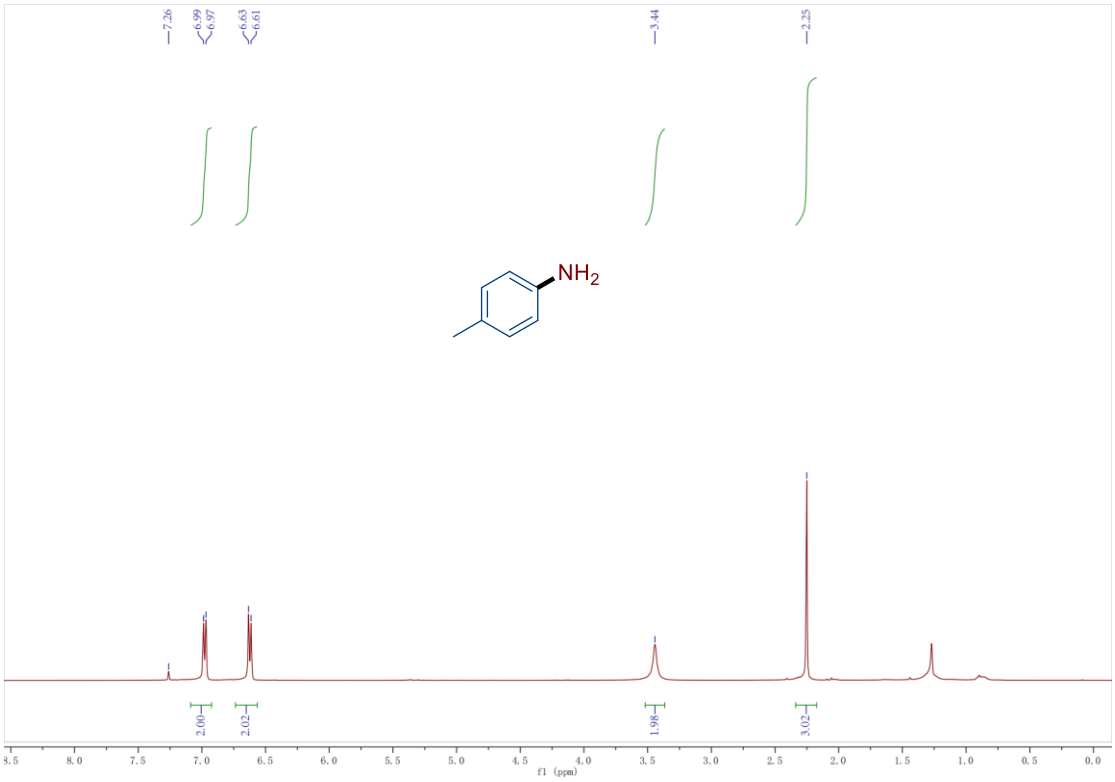

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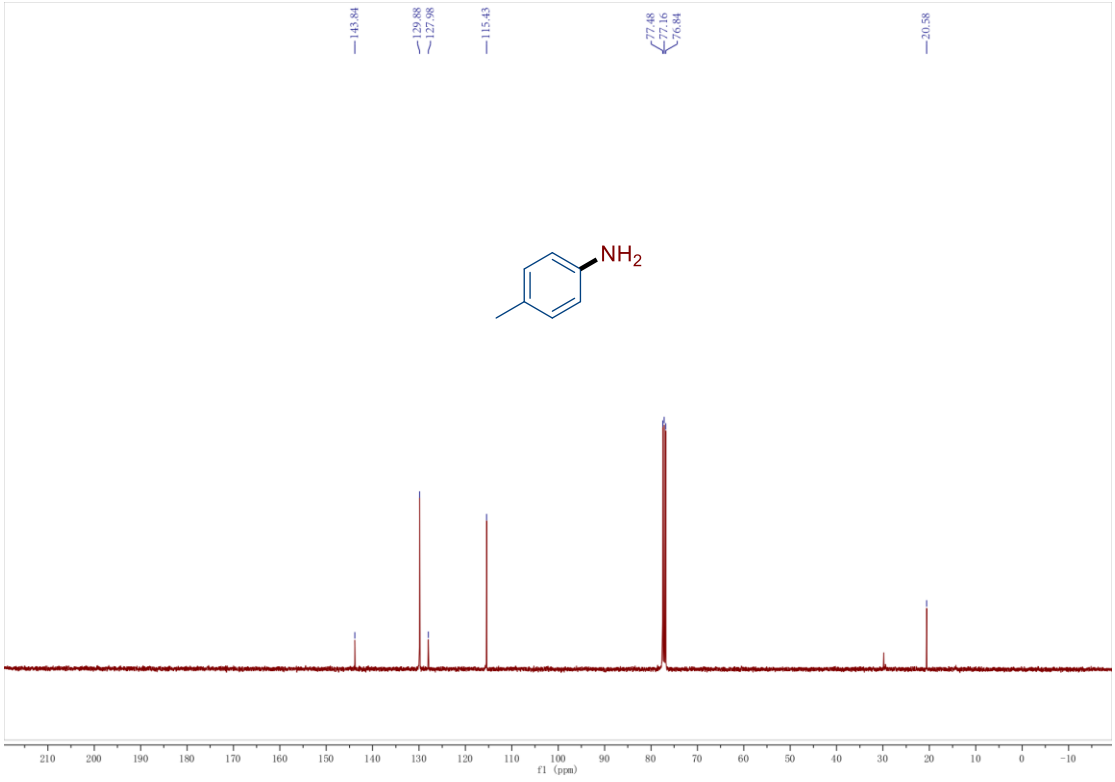

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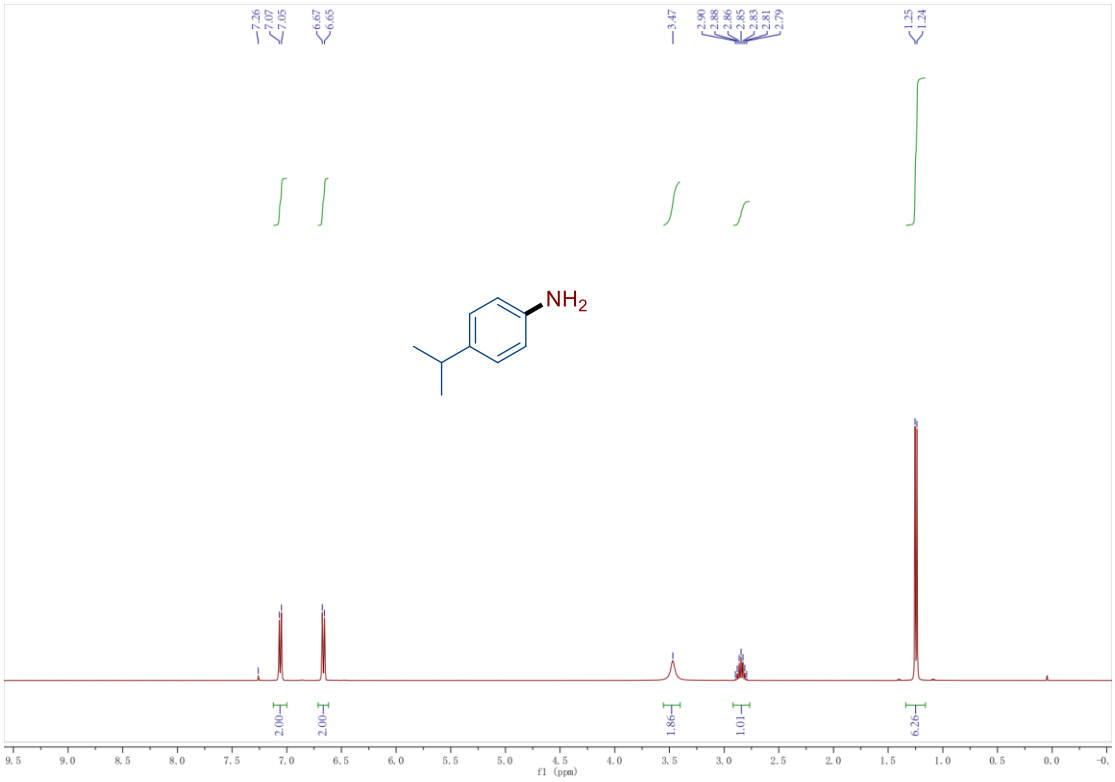

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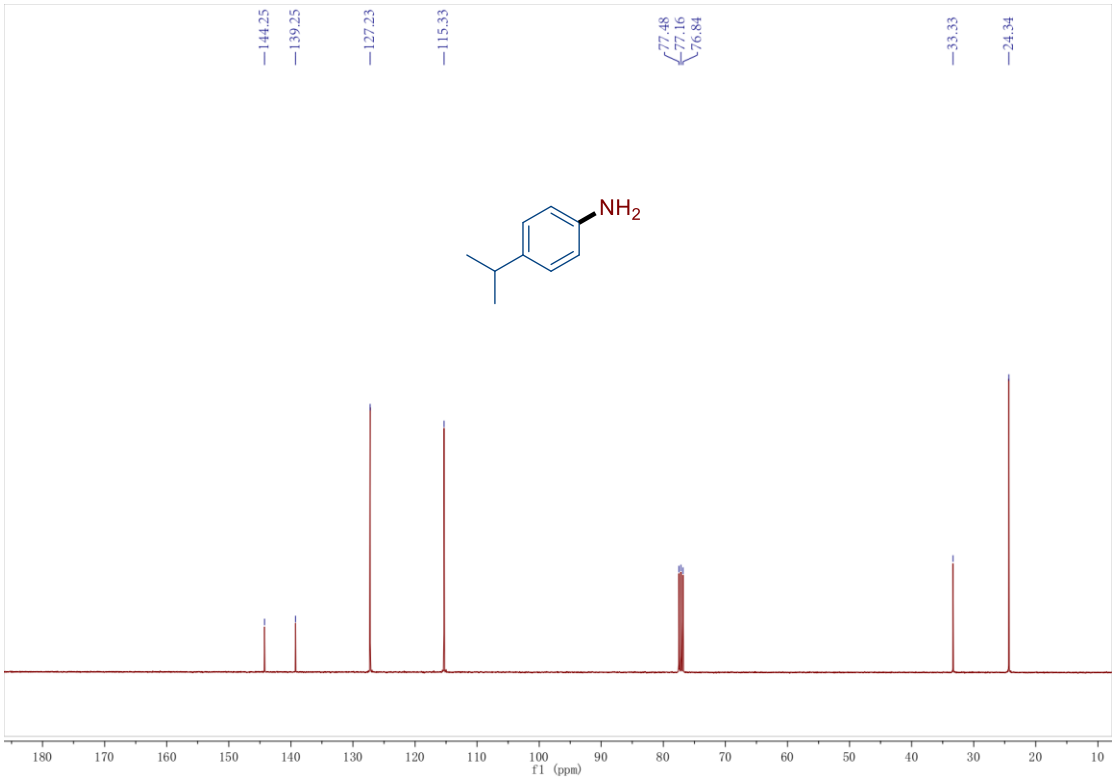

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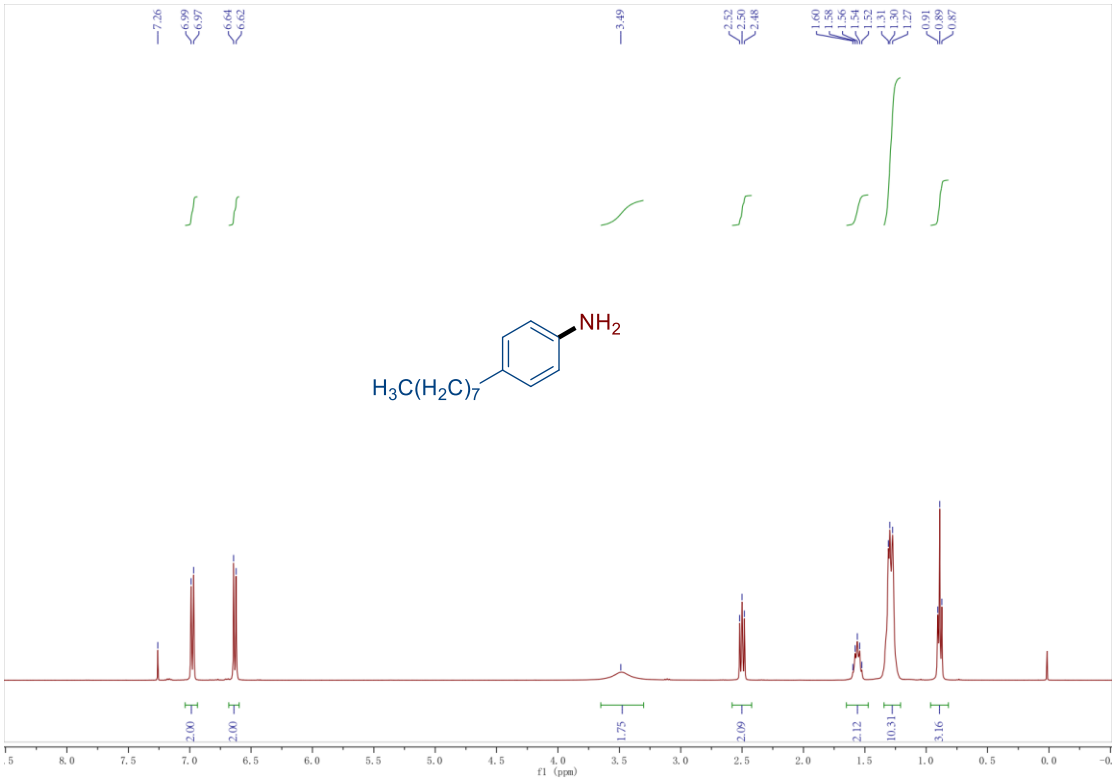

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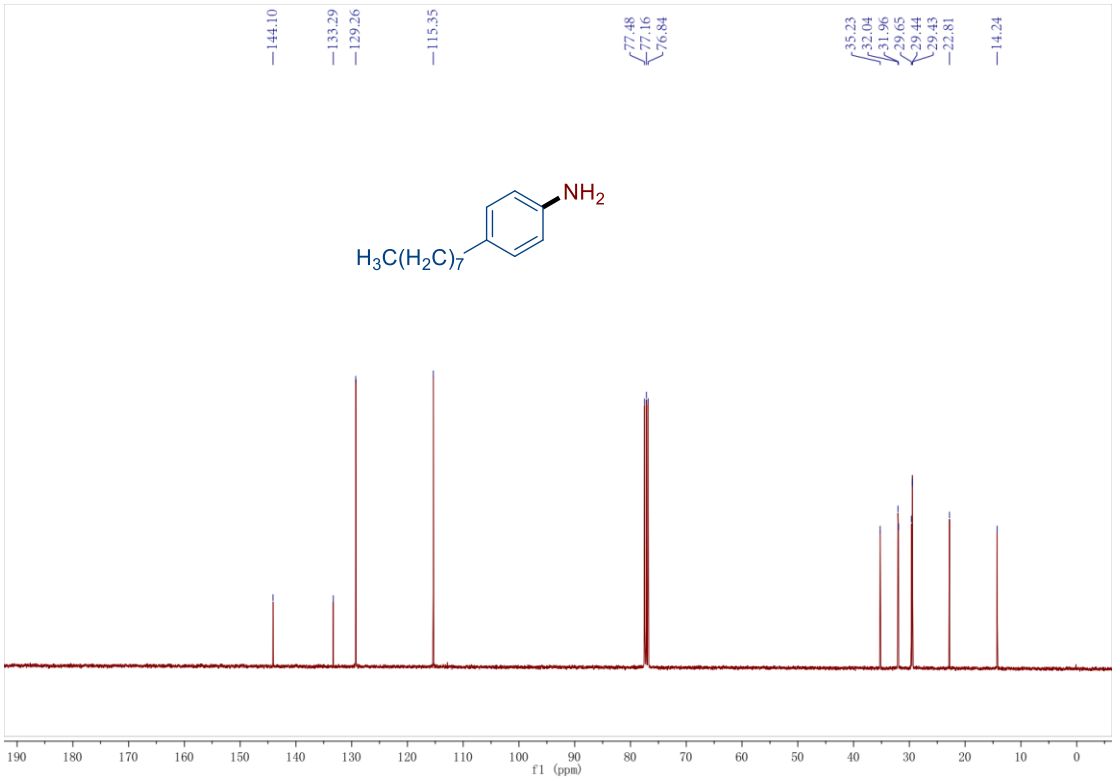

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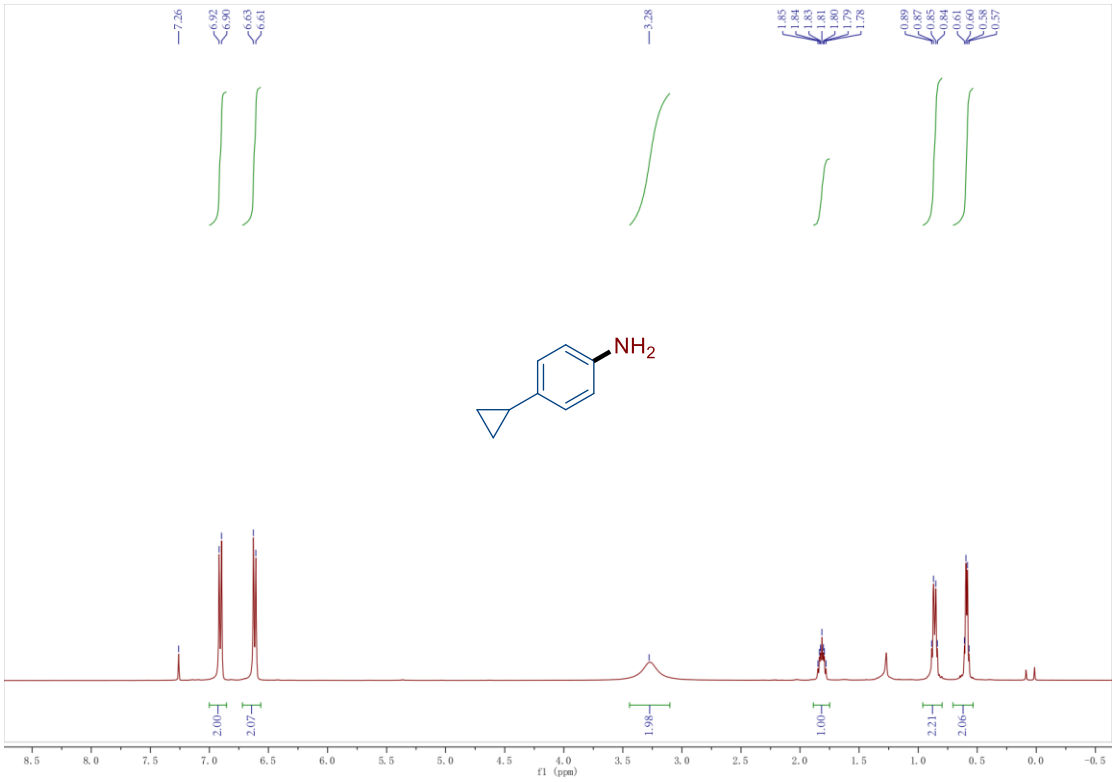

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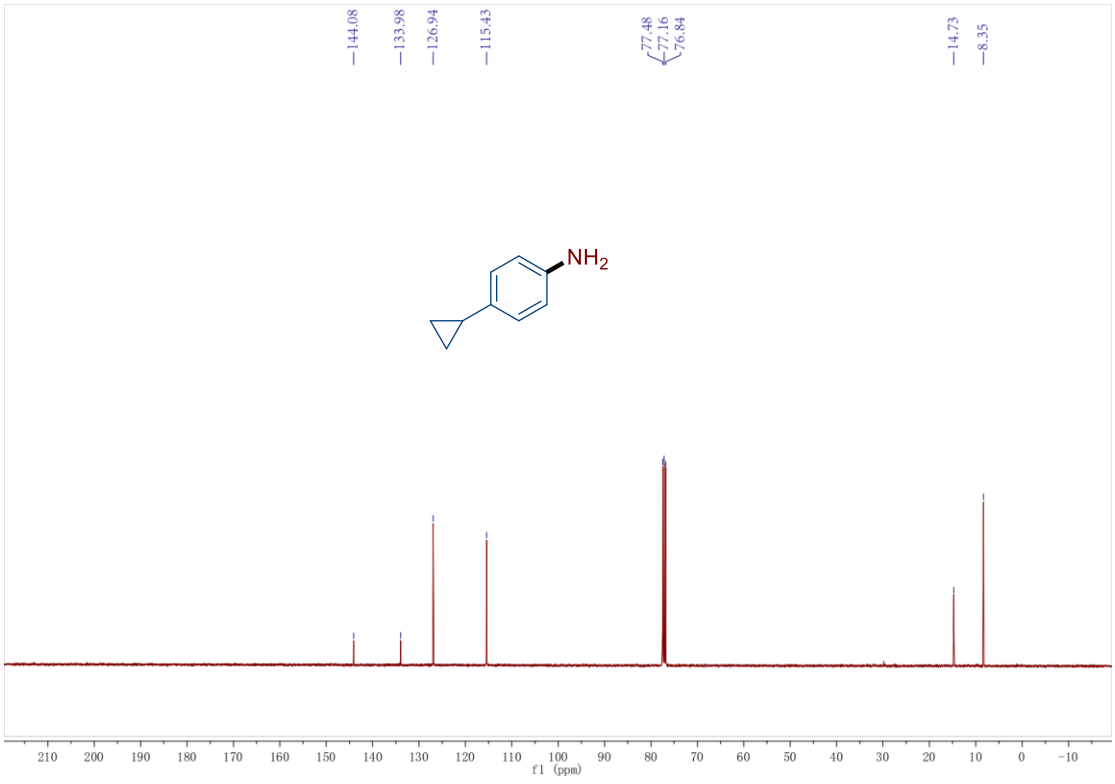

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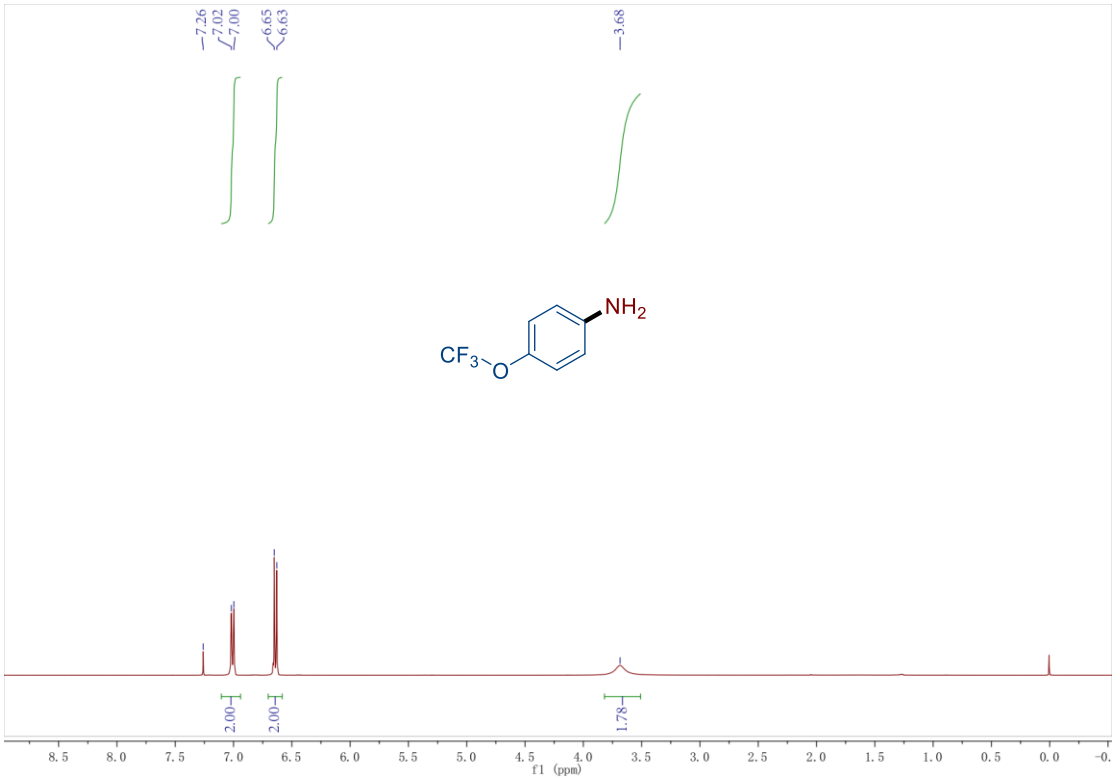

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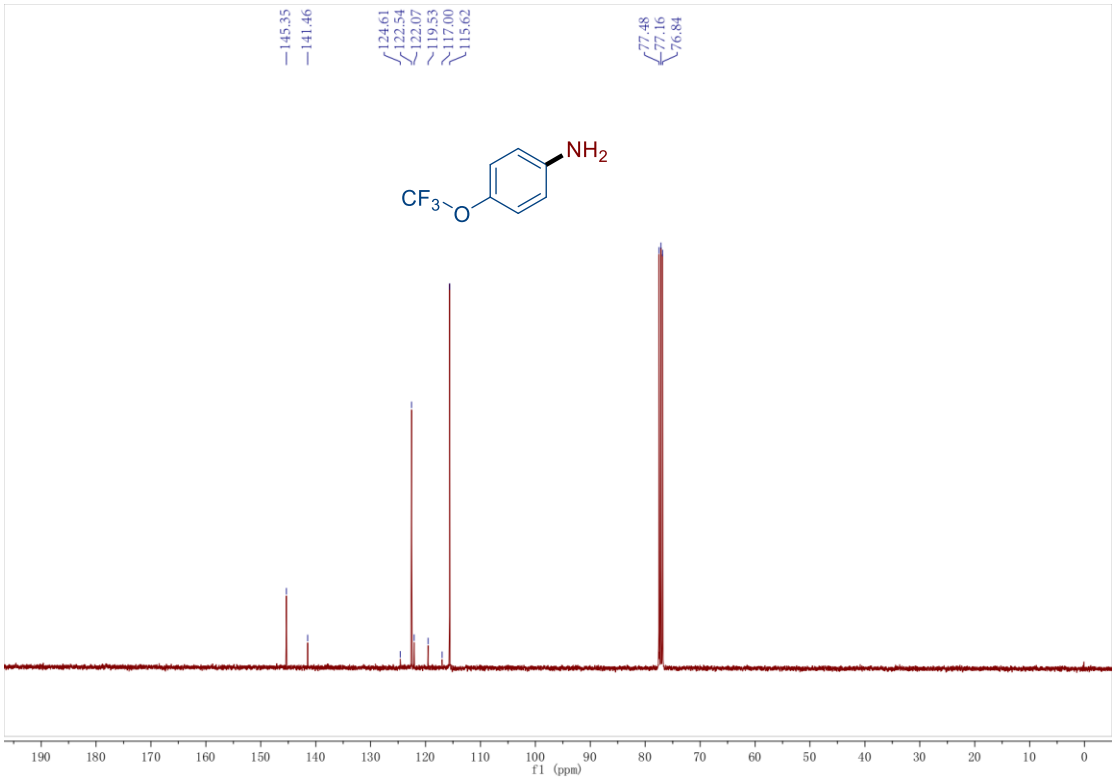

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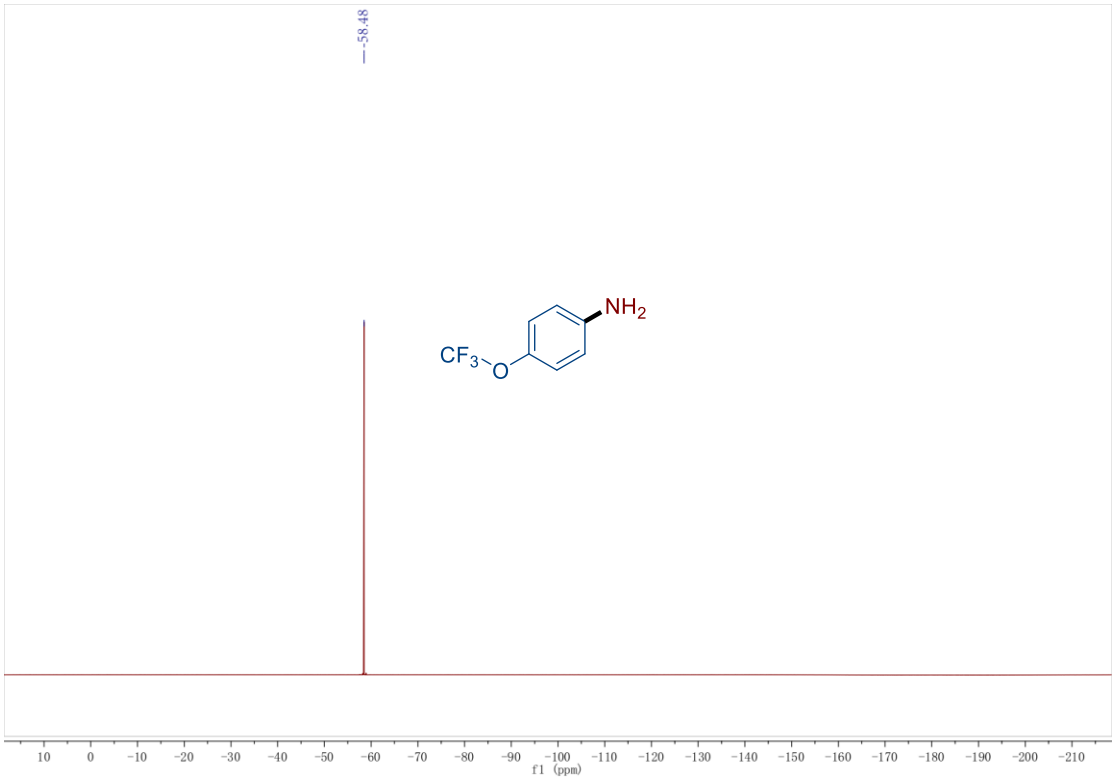

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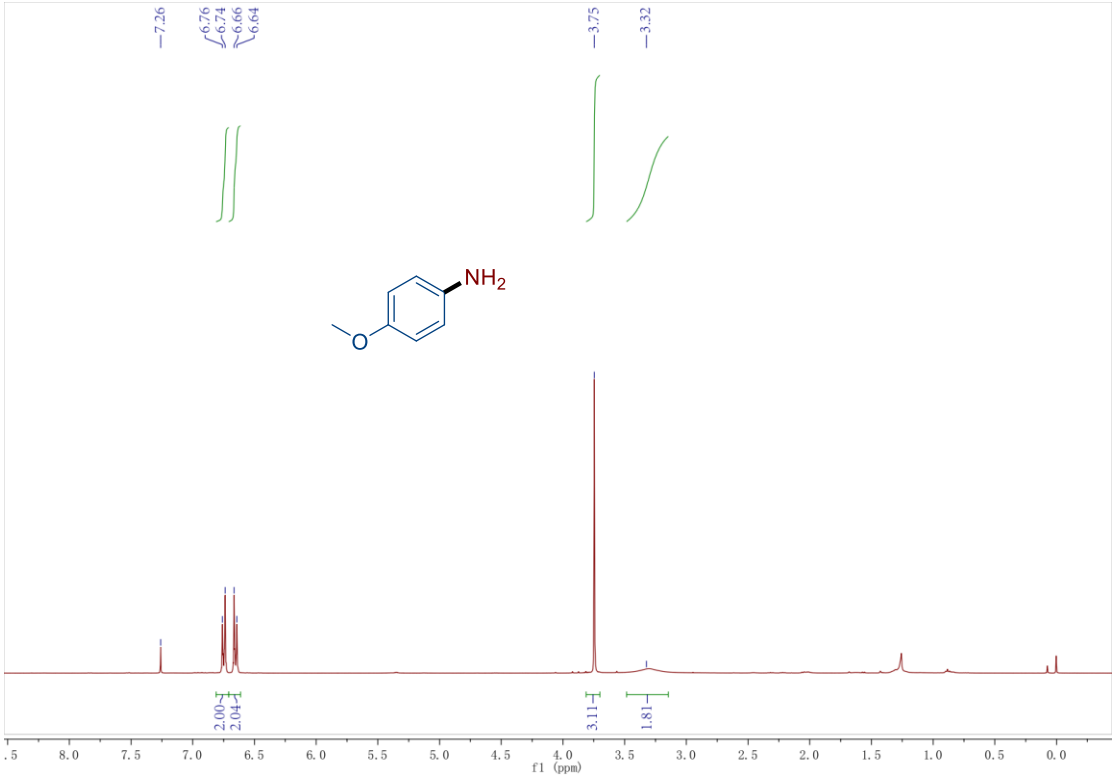

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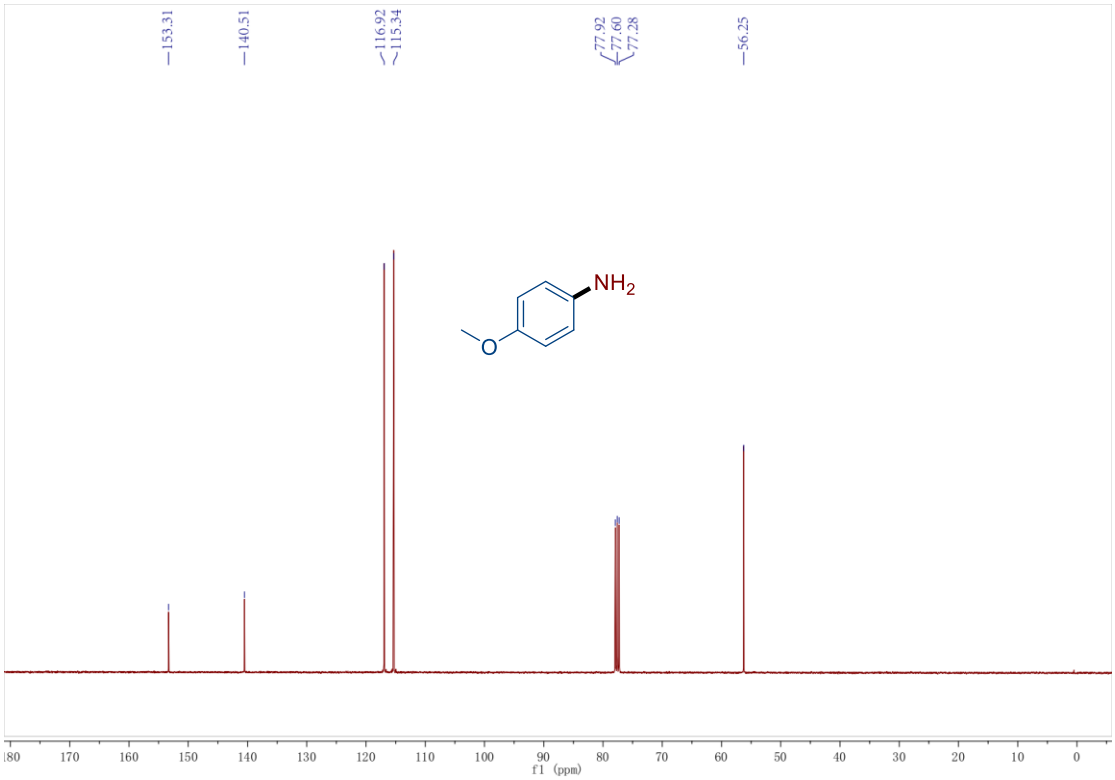

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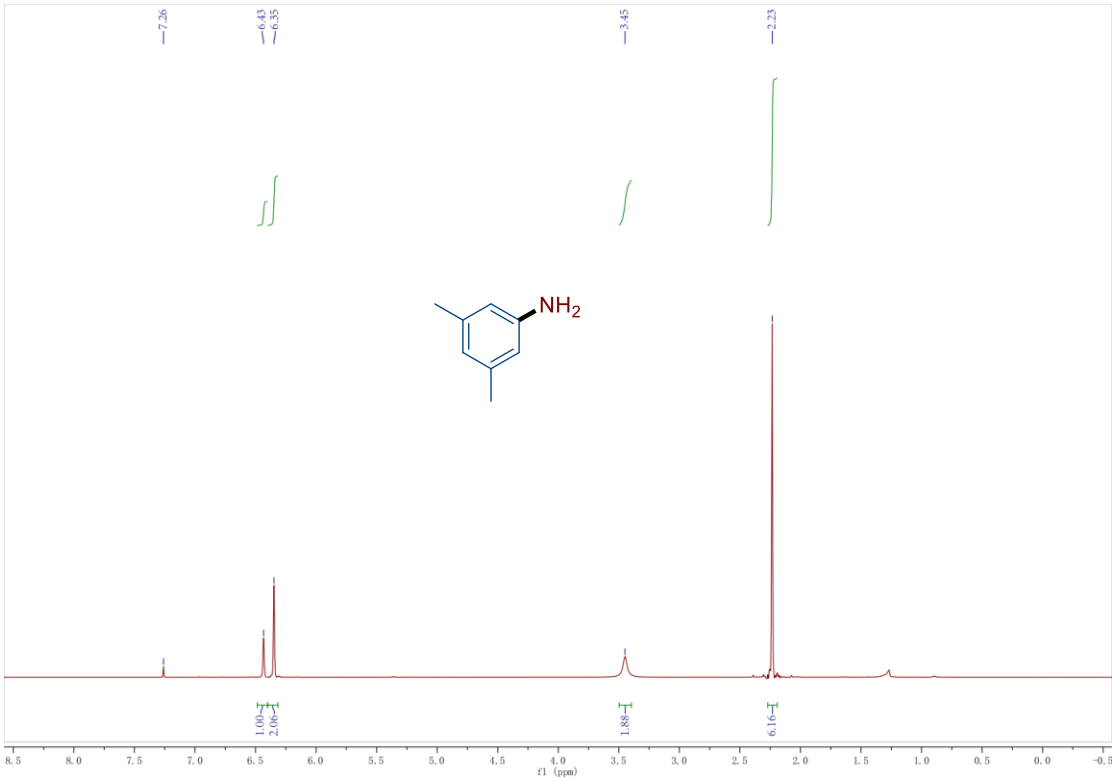

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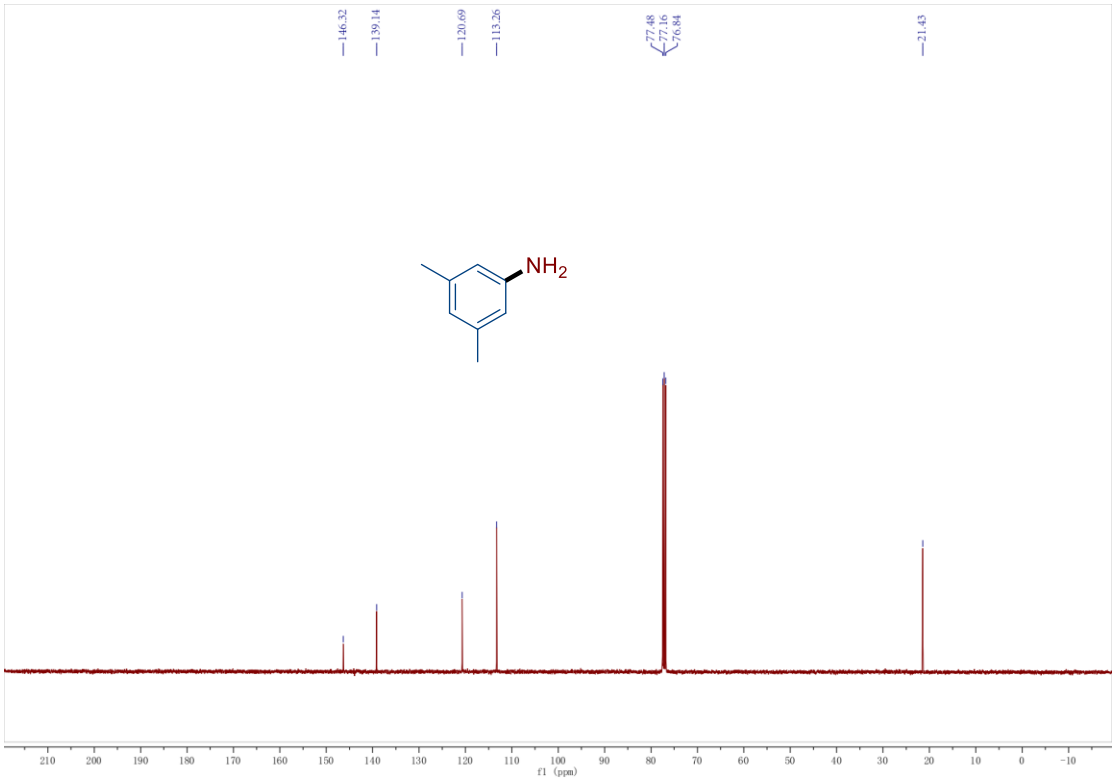

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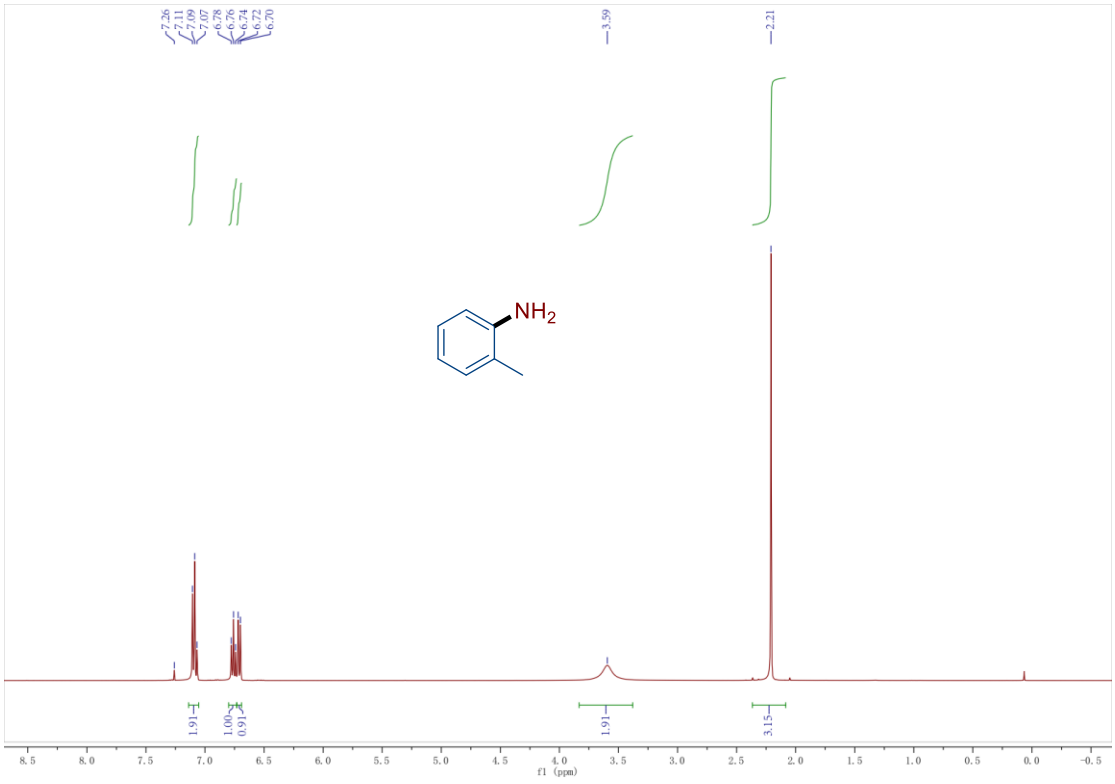
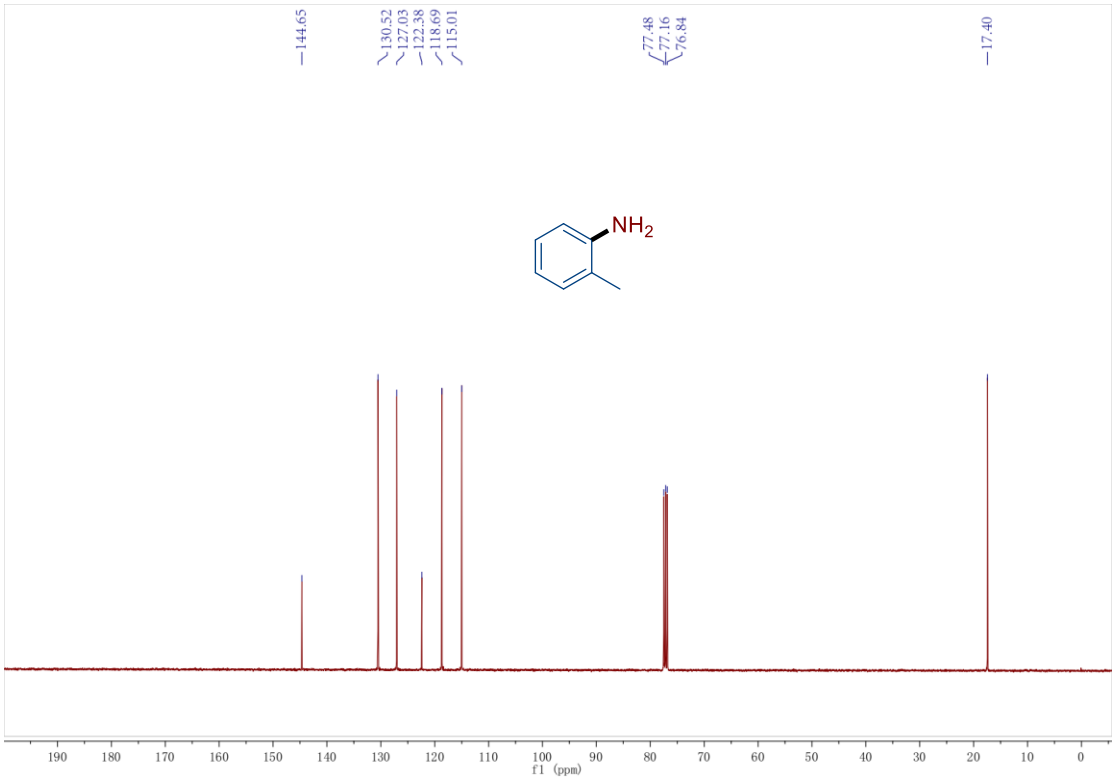
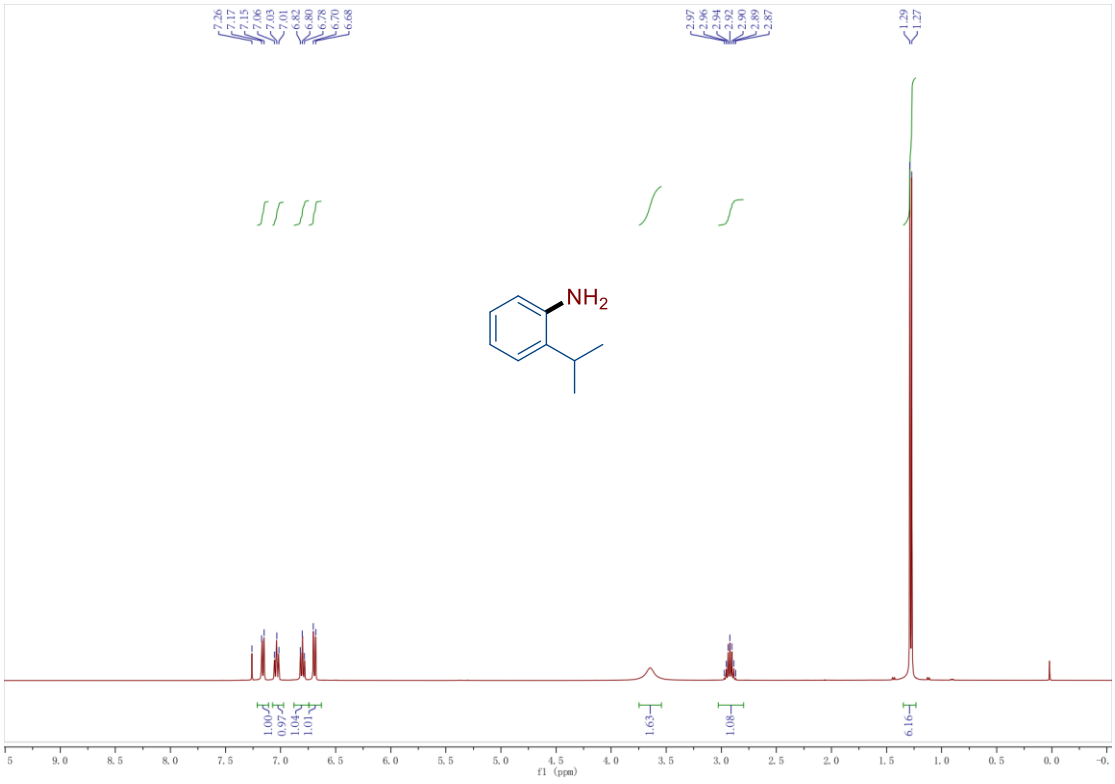


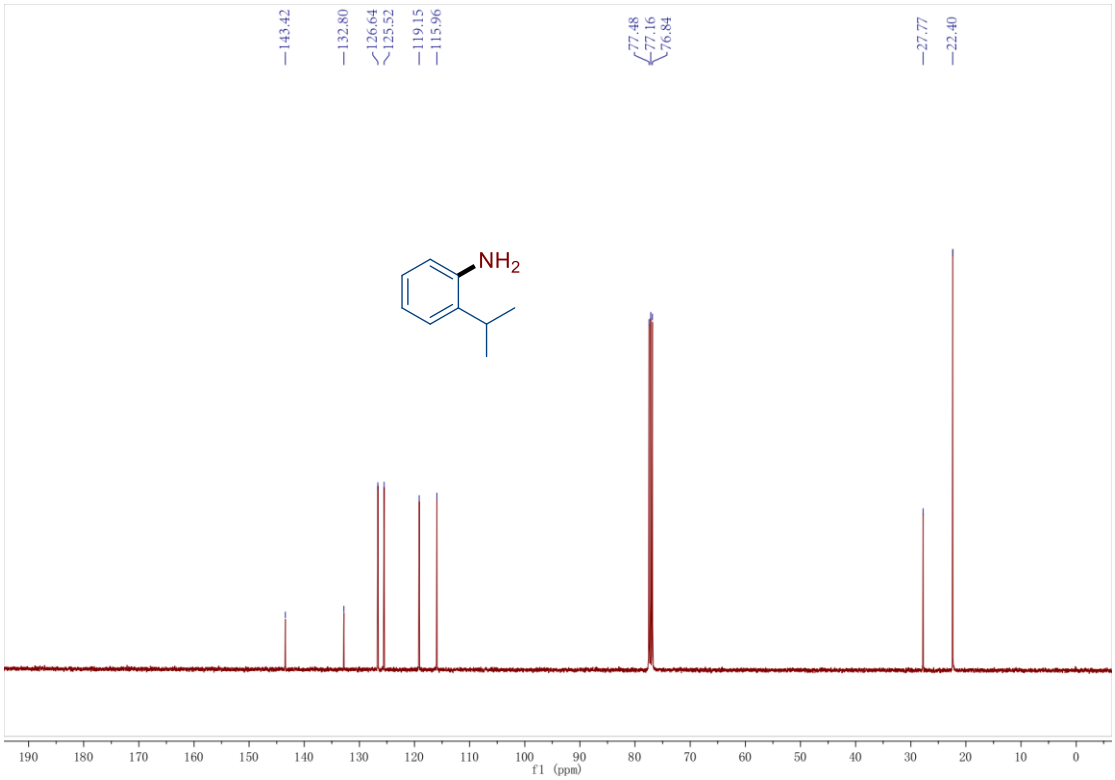
$^{13}C\{^{1}H\}$ NMR (100 MHz, $CDCl_3$) spectrum of compound **23**



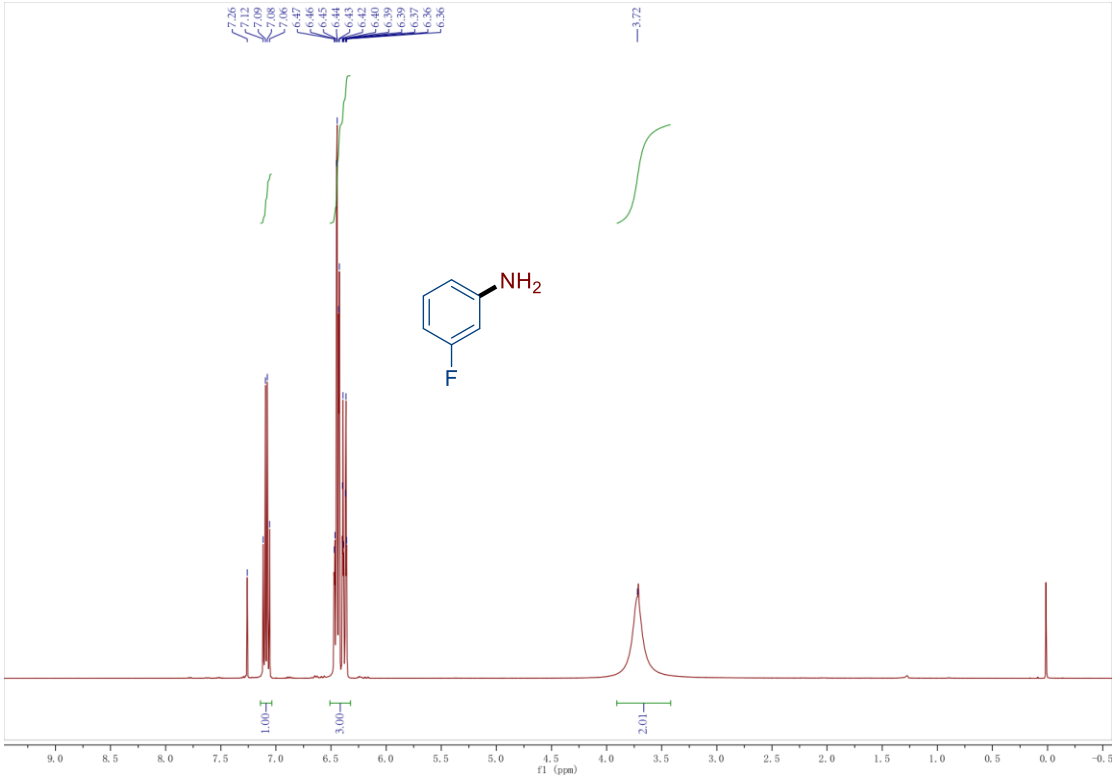
^{1}H NMR (400 MHz, $CDCl_3$) spectrum of compound **24**



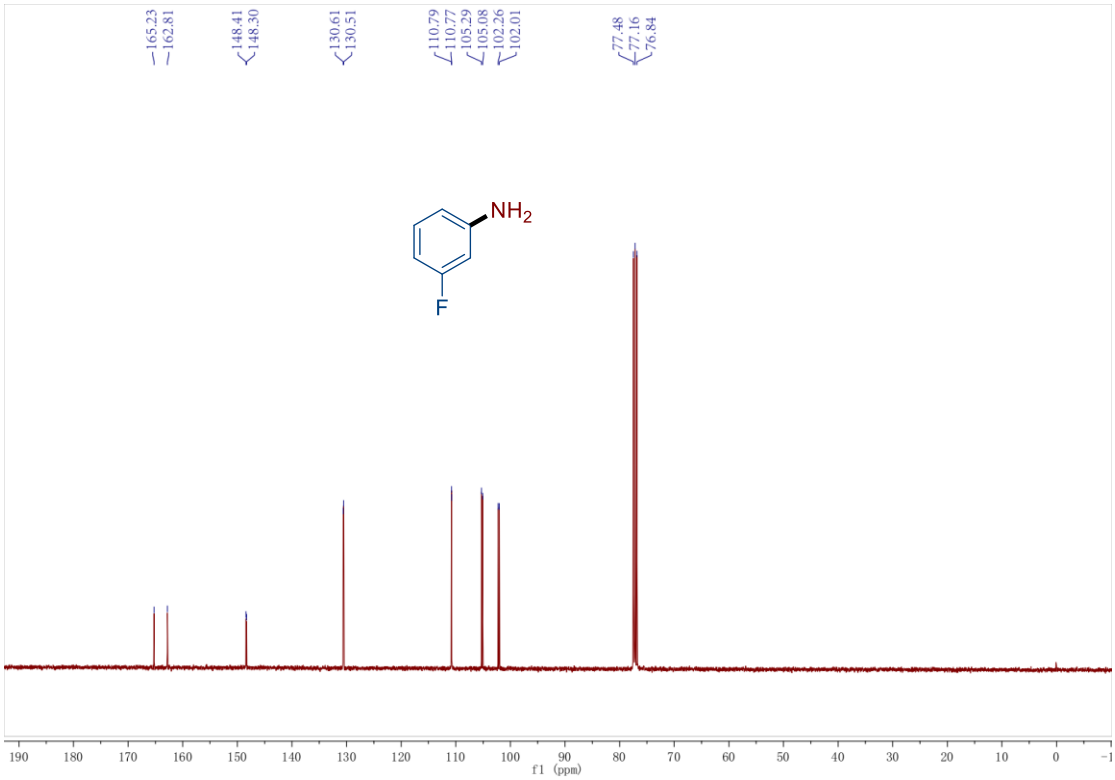
$^{13}C\{^{1}H\}$ NMR (100 MHz, $CDCl_3$) spectrum of compound **24**



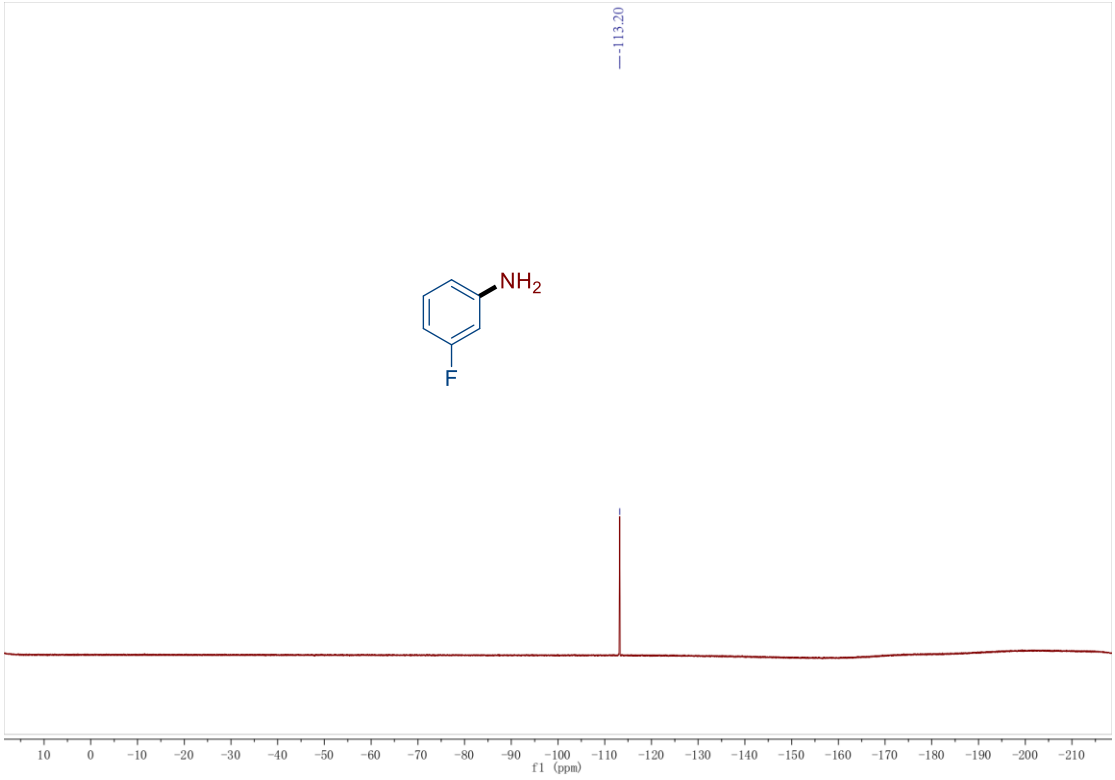
^{1}H NMR (400 MHz, $CDCl_3$) spectrum of compound **25**



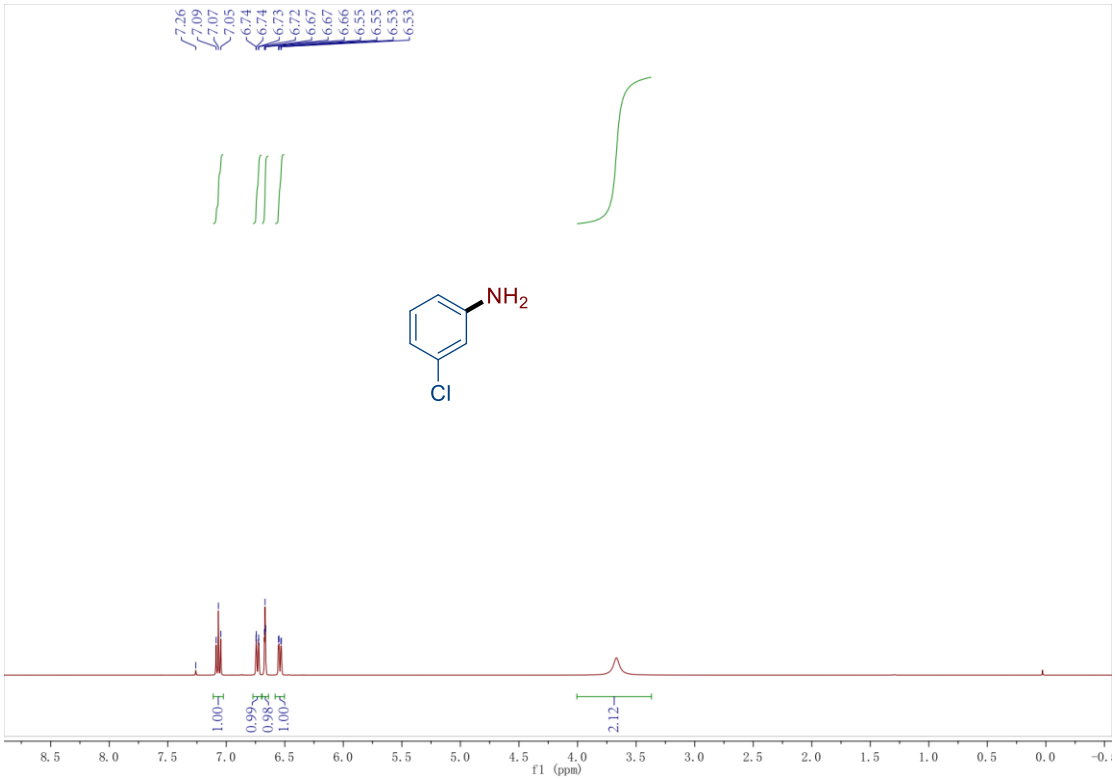
$^{13}C\{^{1}H\}$ NMR (100 MHz, $CDCl_3$) spectrum of compound **25**



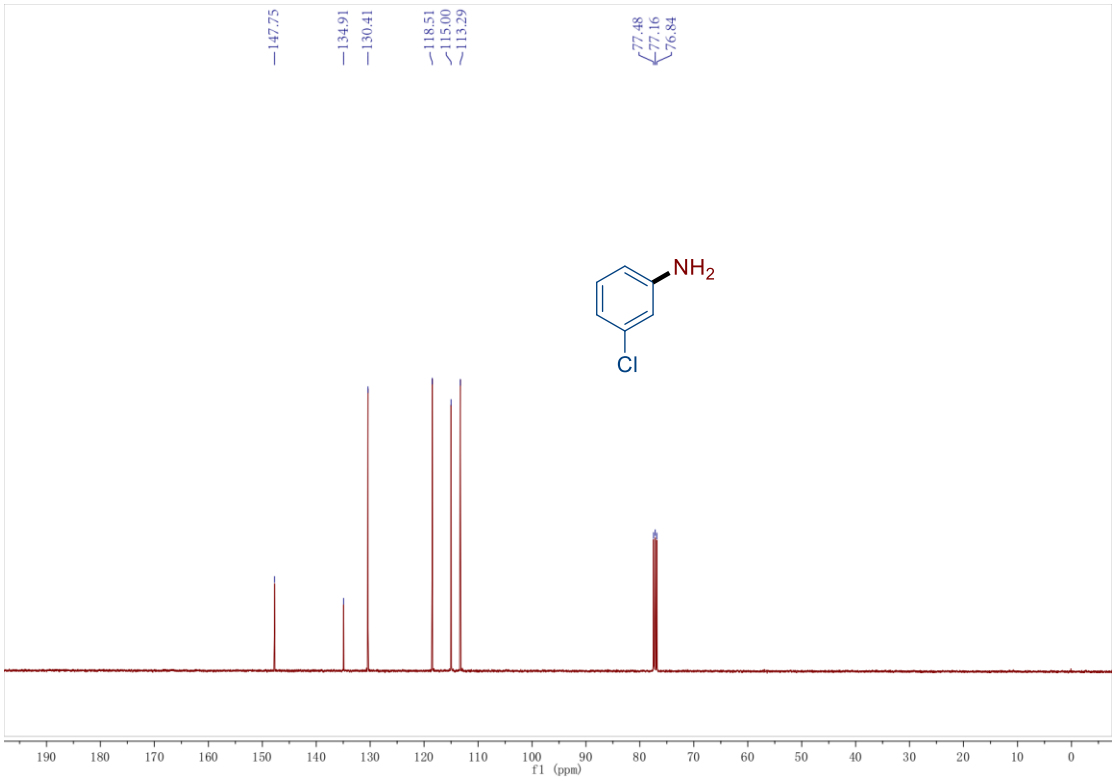
^{19}F NMR (376 MHz, $CDCl_3$) spectrum of compound **25**



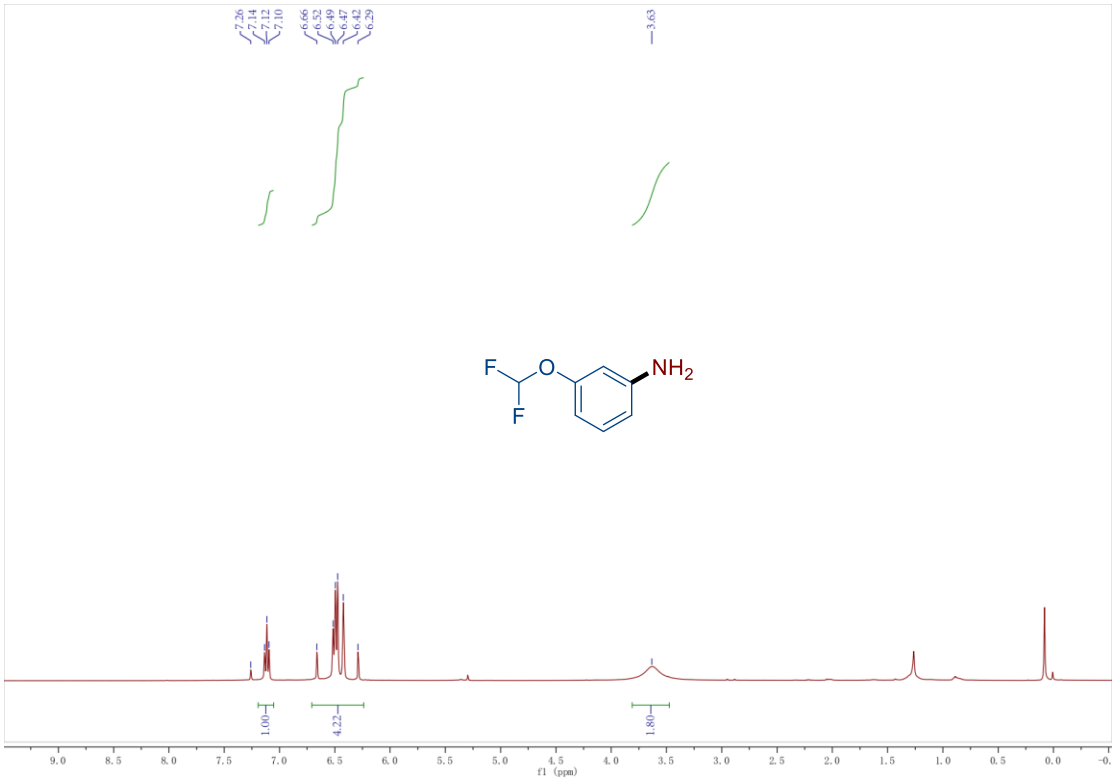
^{1}H NMR (400 MHz, $CDCl_3$) spectrum of compound **26**



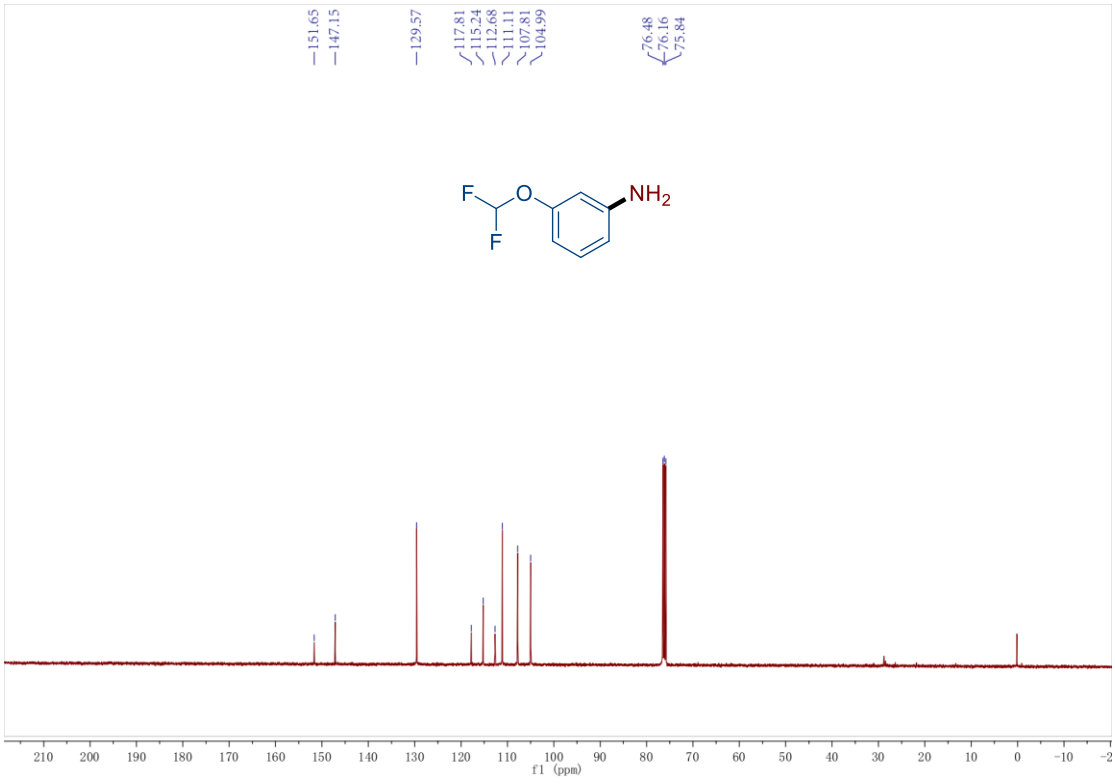
^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$) spectrum of compound **26**



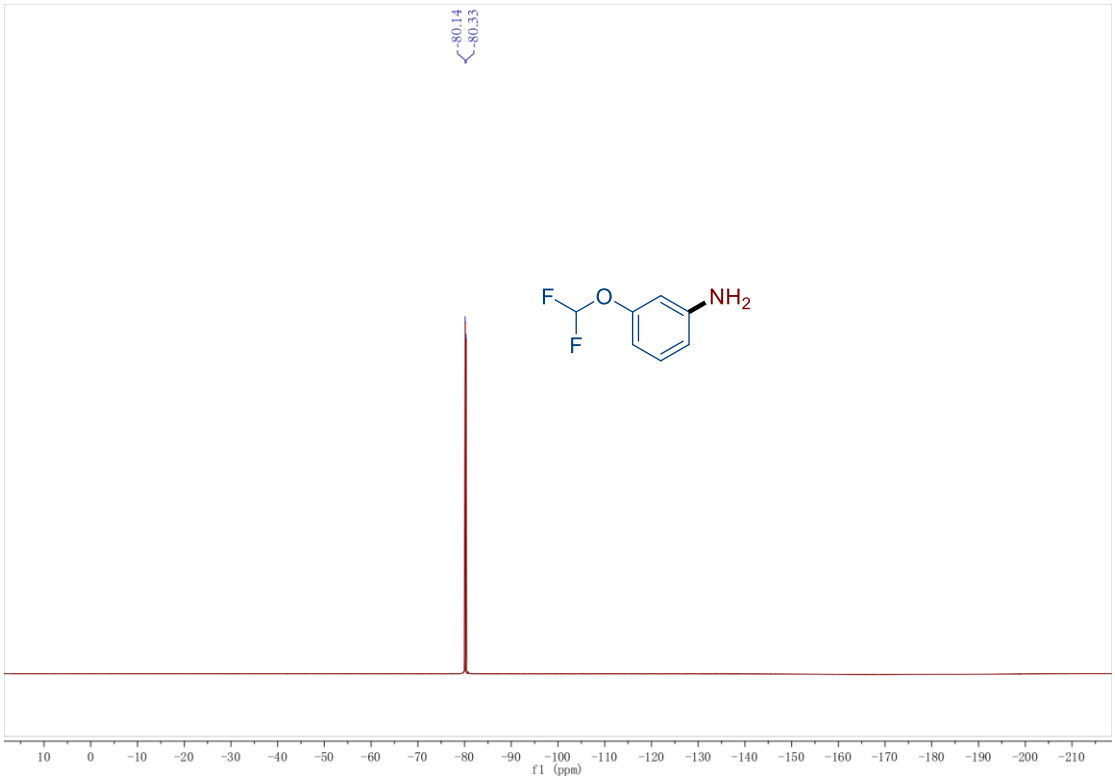
^{1}H NMR (400 MHz, $CDCl_3$) spectrum of compound **27**



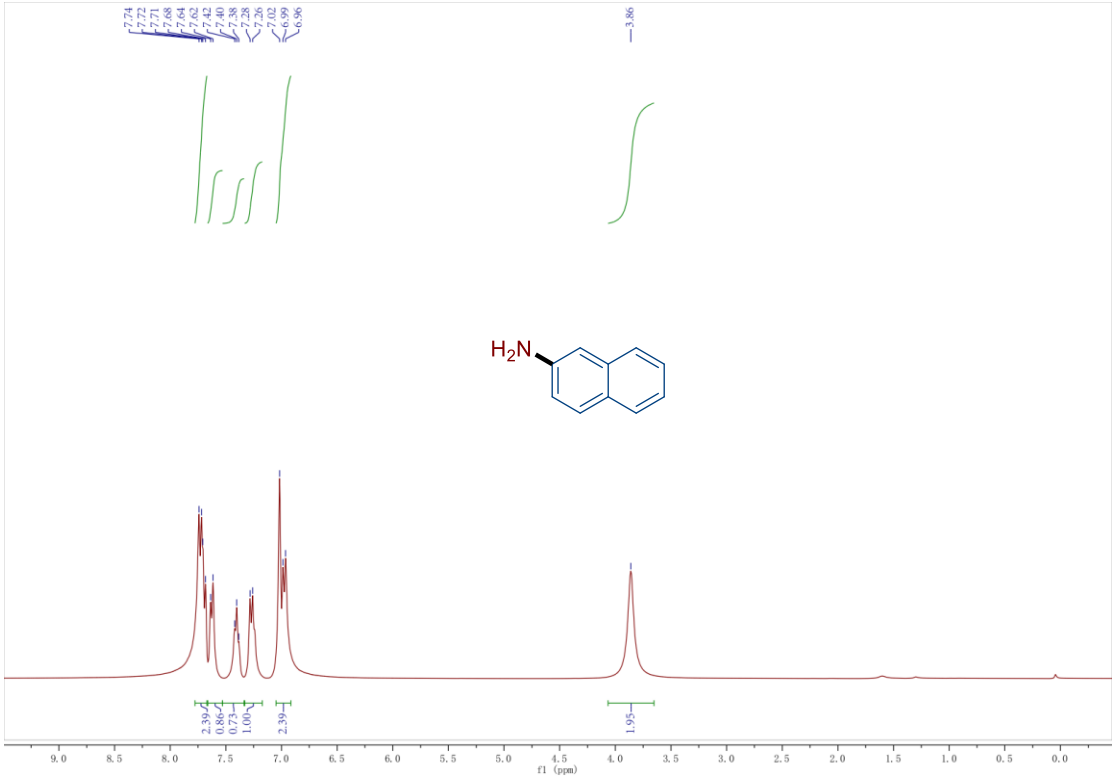
^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$) spectrum of compound **27**



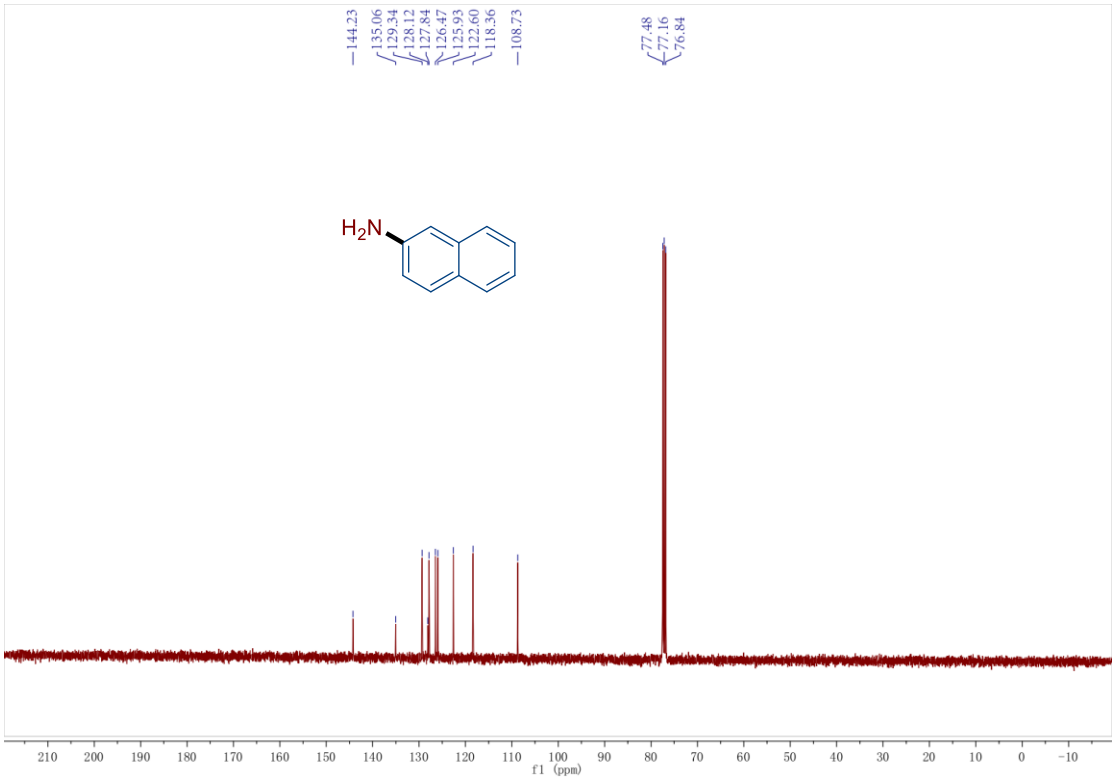
^{19}F NMR (376 MHz, $CDCl_3$) spectrum of compound **27**



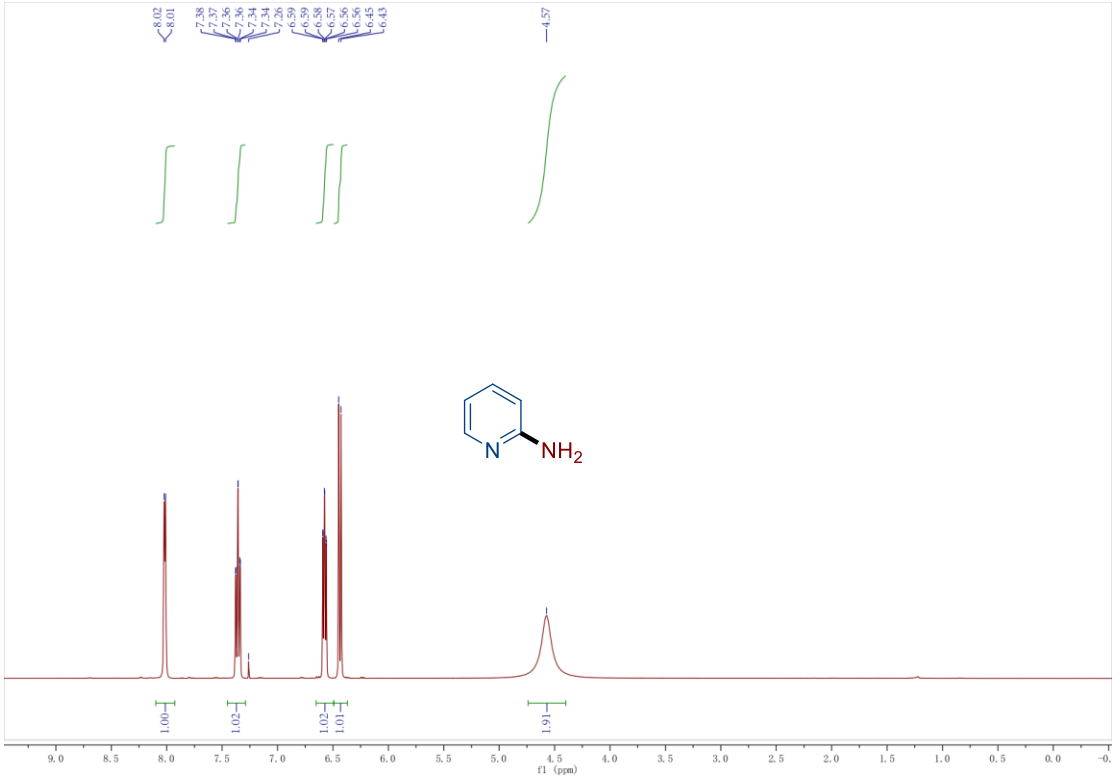
^{1}H NMR (400 MHz, $CDCl_3$) spectrum of compound **28**



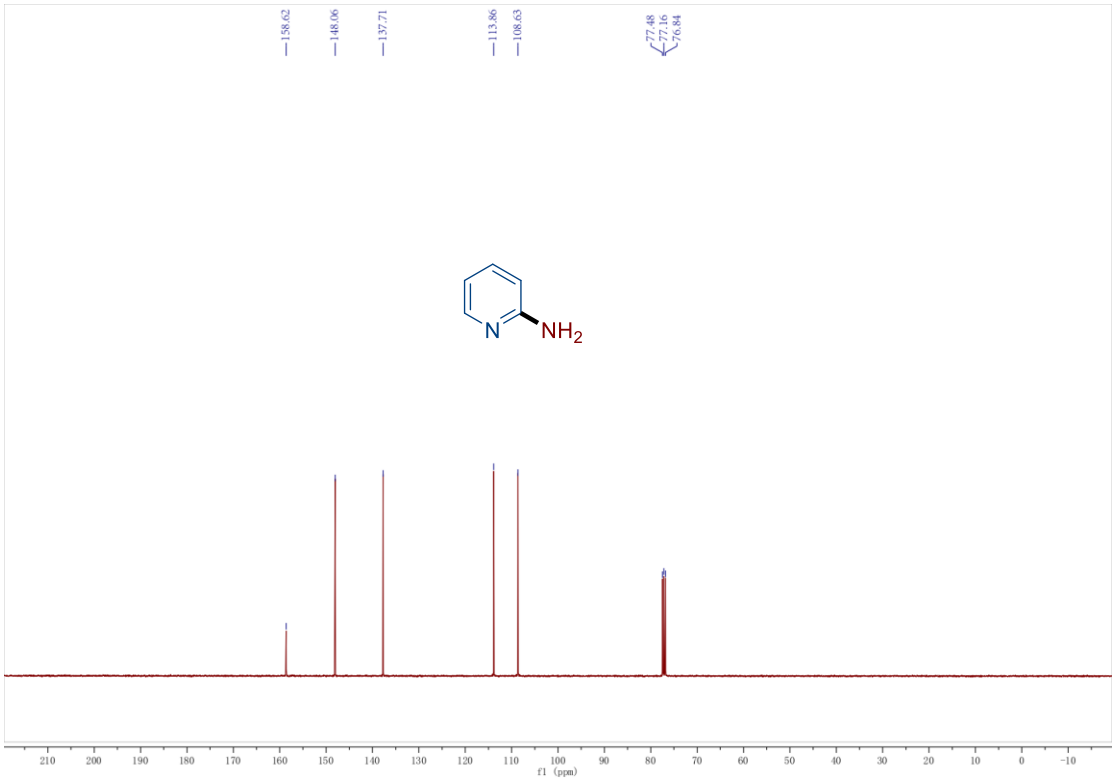
$^{13}C\{^{1}H\}$ NMR (100 MHz, $CDCl_3$) spectrum of compound **28**



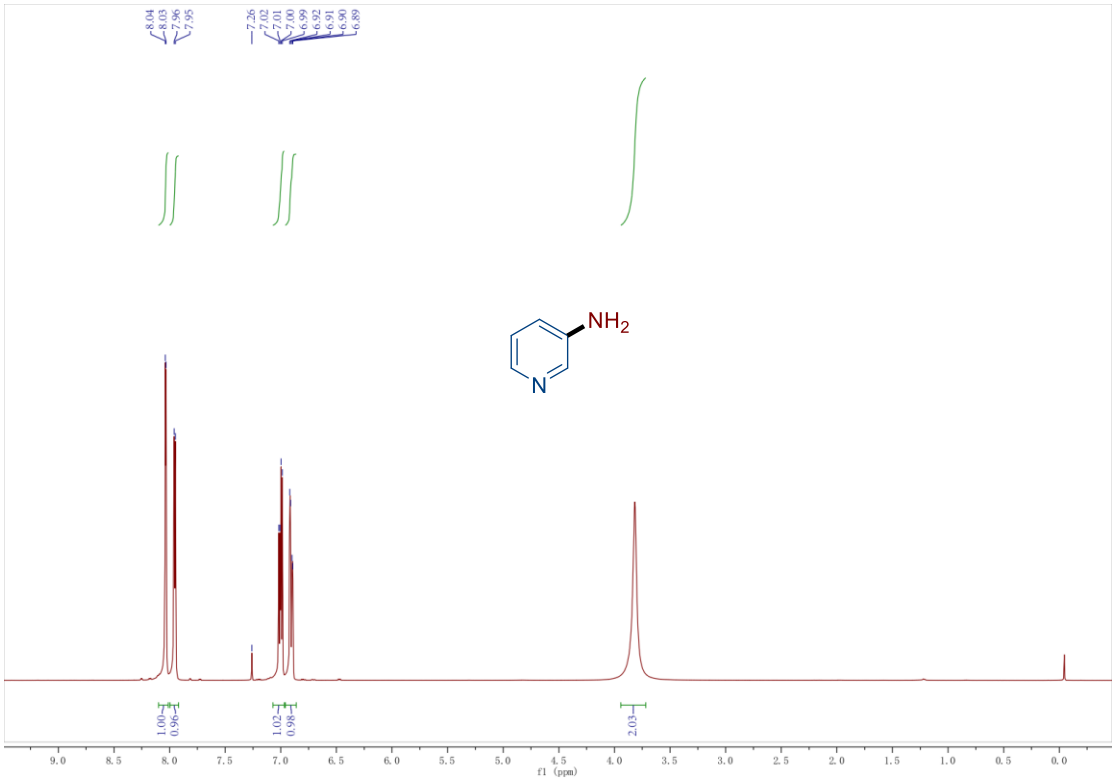
^{1}H NMR (400 MHz, $CDCl_3$) spectrum of compound **29**



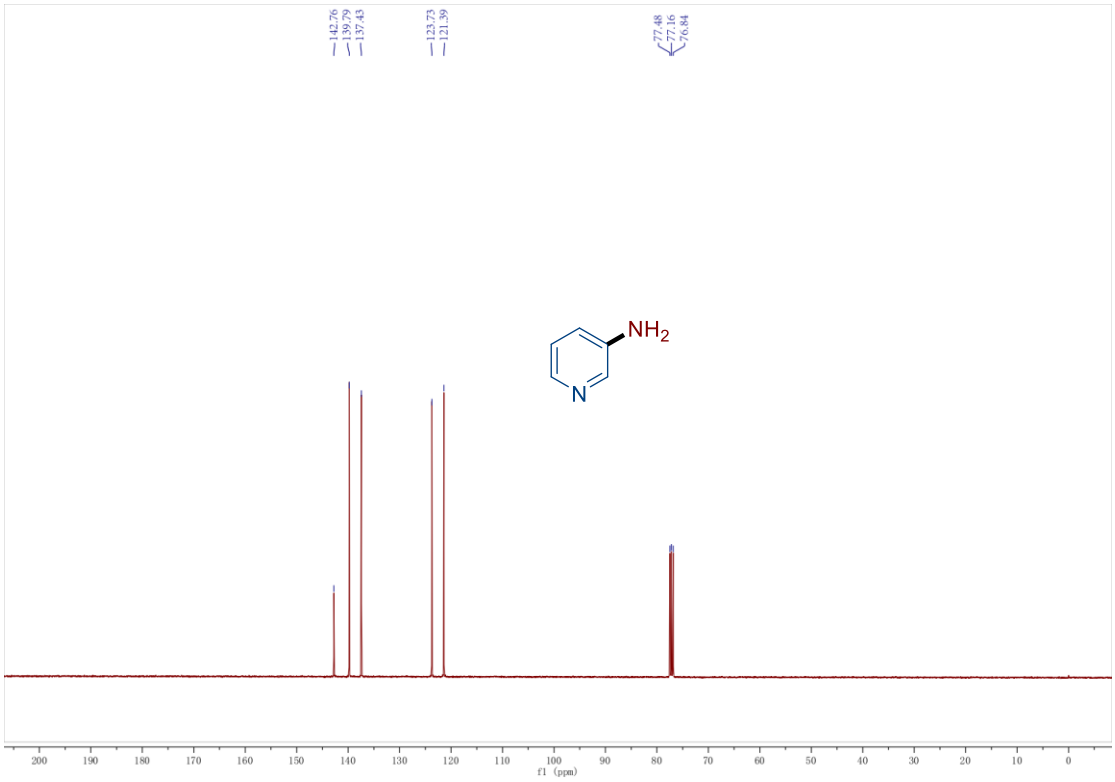
$^{13}C\{^{1}H\}$ NMR (100 MHz, $CDCl_3$) spectrum of compound **29**



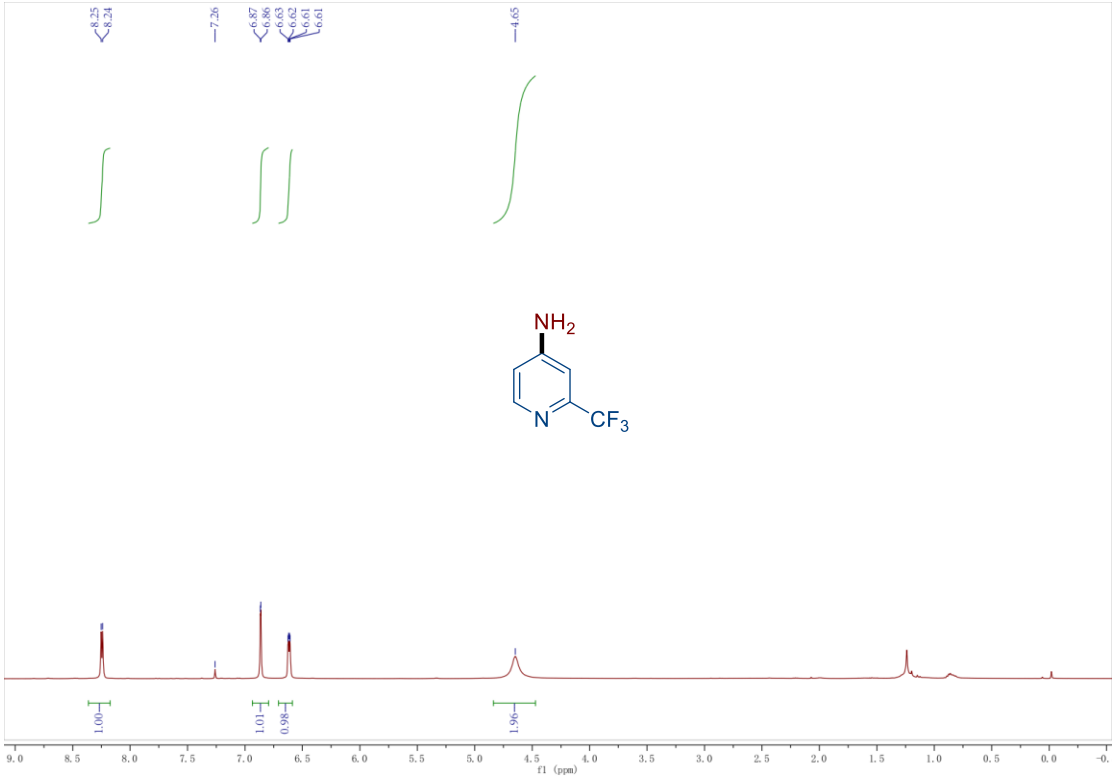
^{1}H NMR (400 MHz, $CDCl_3$) spectrum of compound **30**



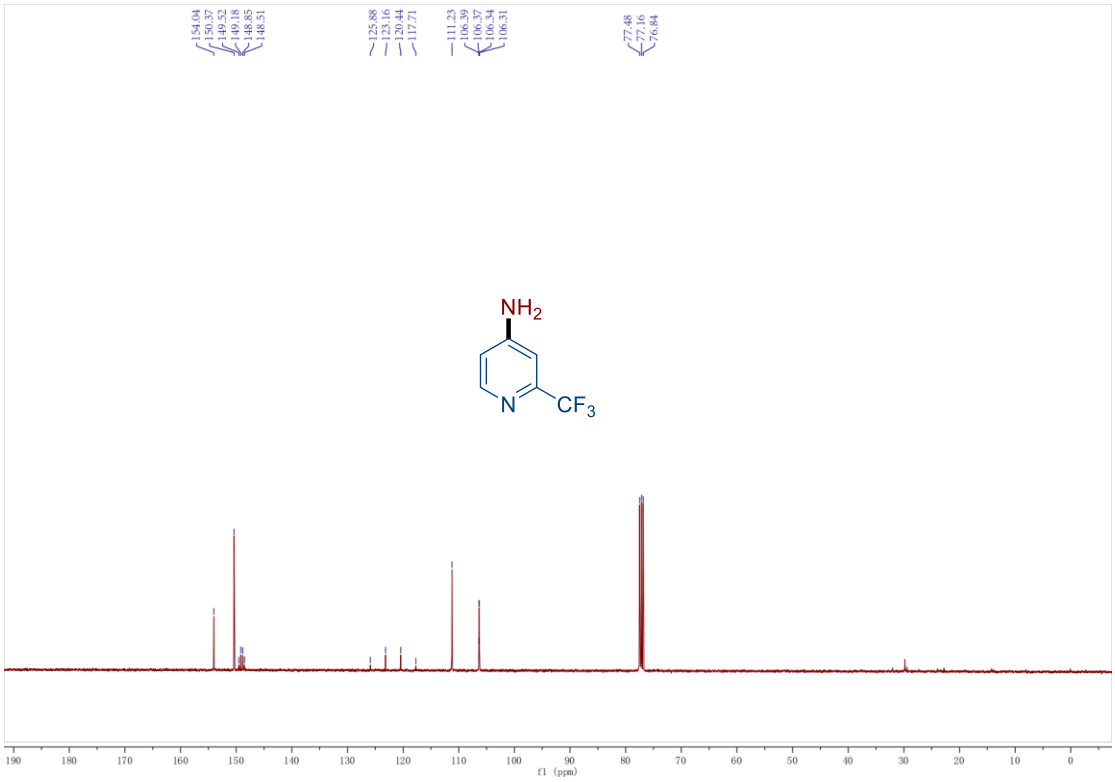
$^{13}C\{^{1}H\}$ NMR (100 MHz, $CDCl_3$) spectrum of compound **30**



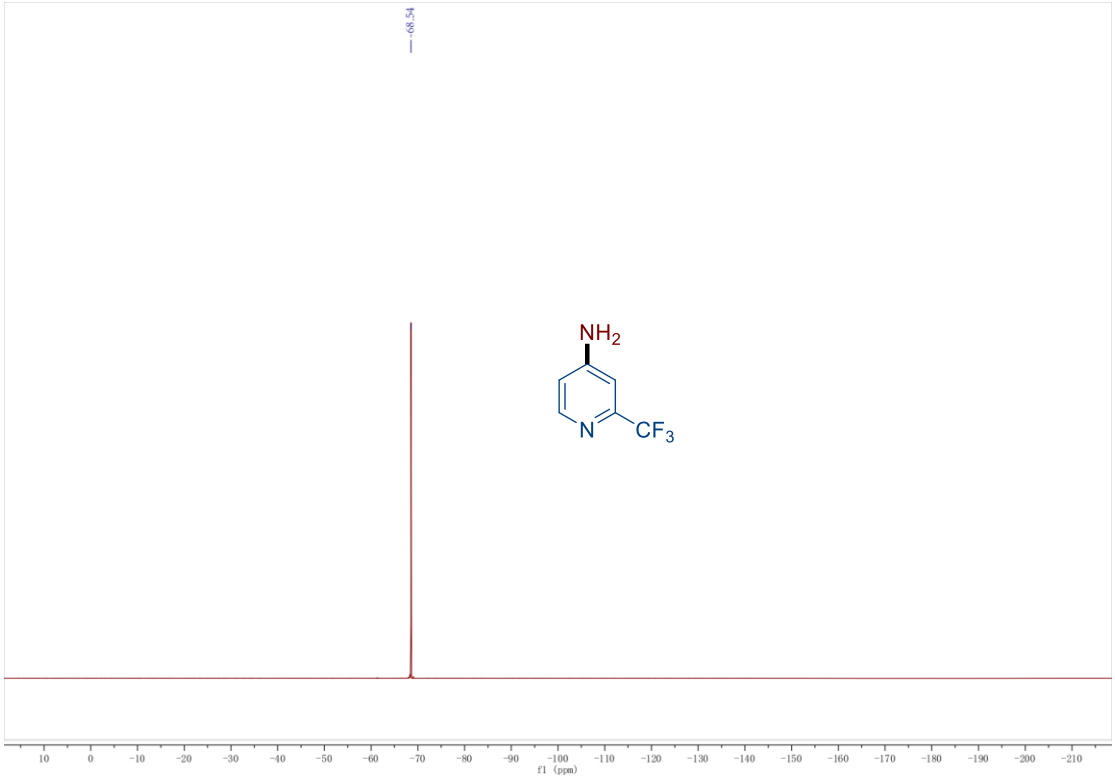
^{1}H NMR (400 MHz, $CDCl_3$) spectrum of compound **31**



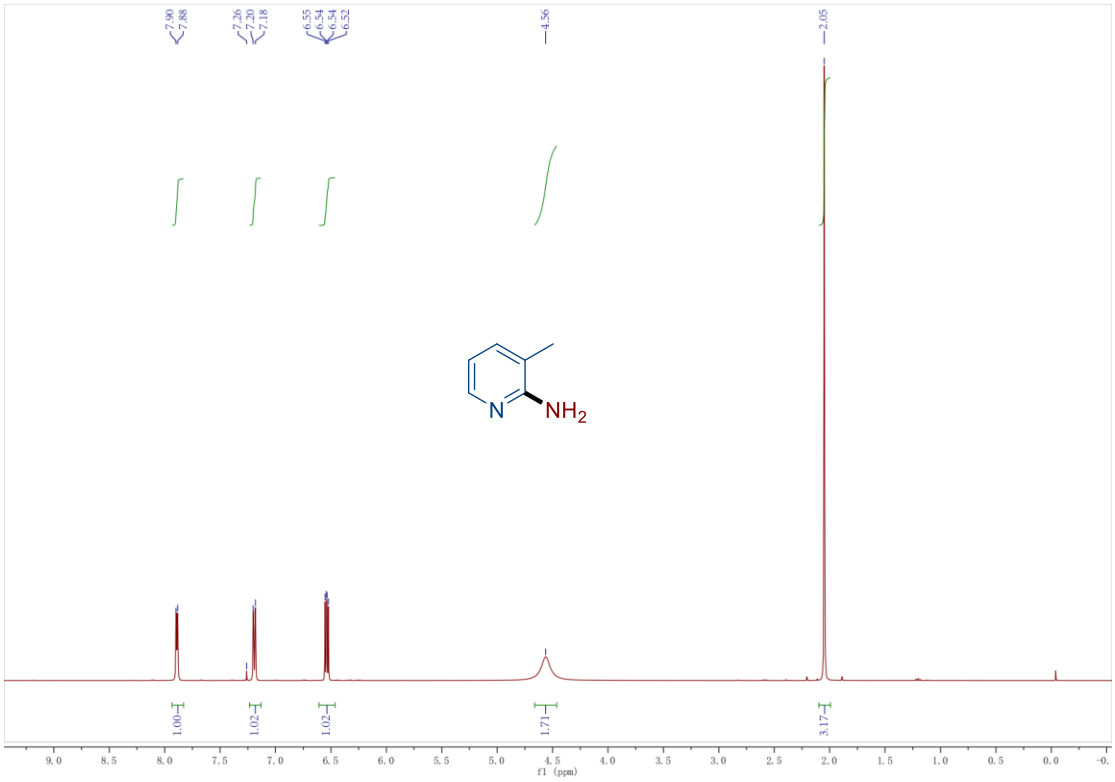
$^{13}C\{^{1}H\}$ NMR (100 MHz, $CDCl_3$) spectrum of compound **31**



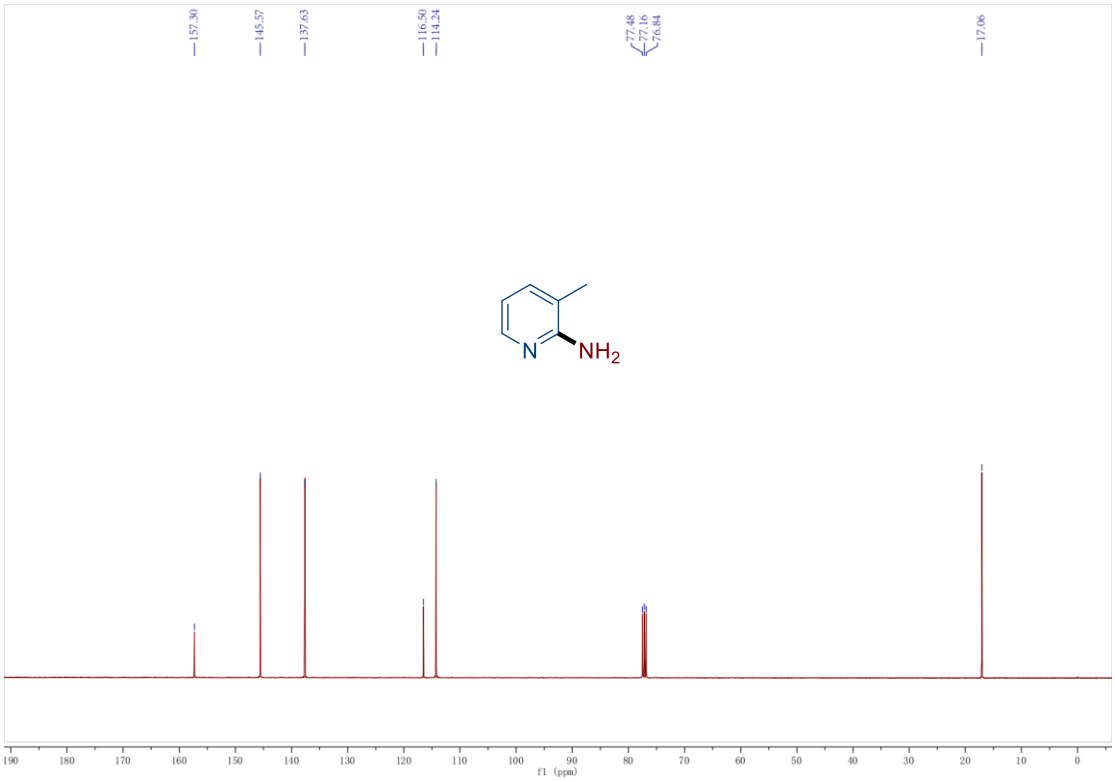
^{19}F NMR (376 MHz, $CDCl_3$) spectrum of compound **31**



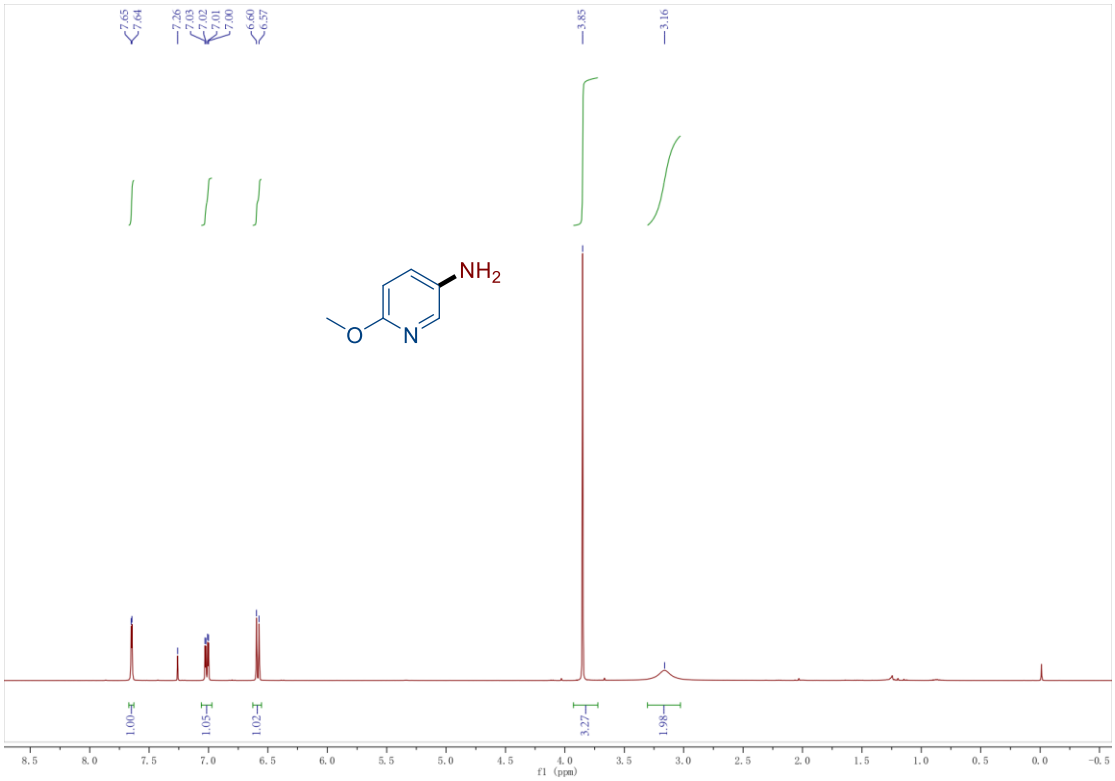
^{1}H NMR (400 MHz, $CDCl_3$) spectrum of compound **32**



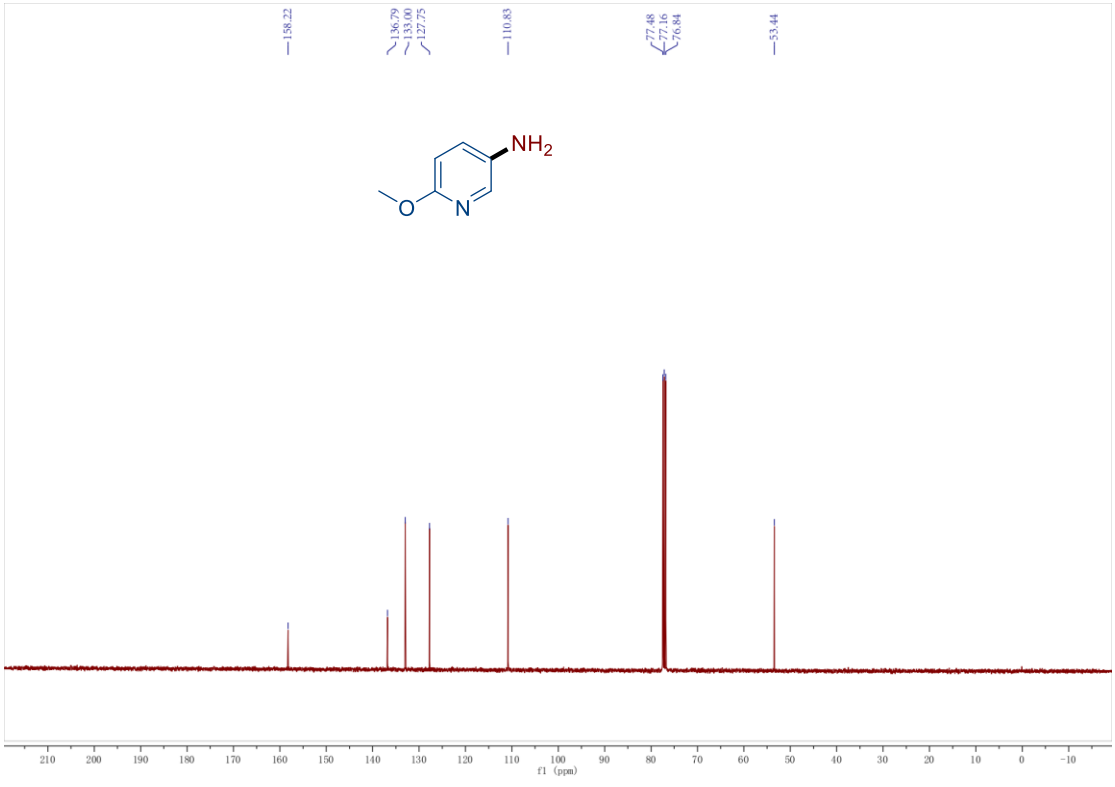
^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$) spectrum of compound **32**



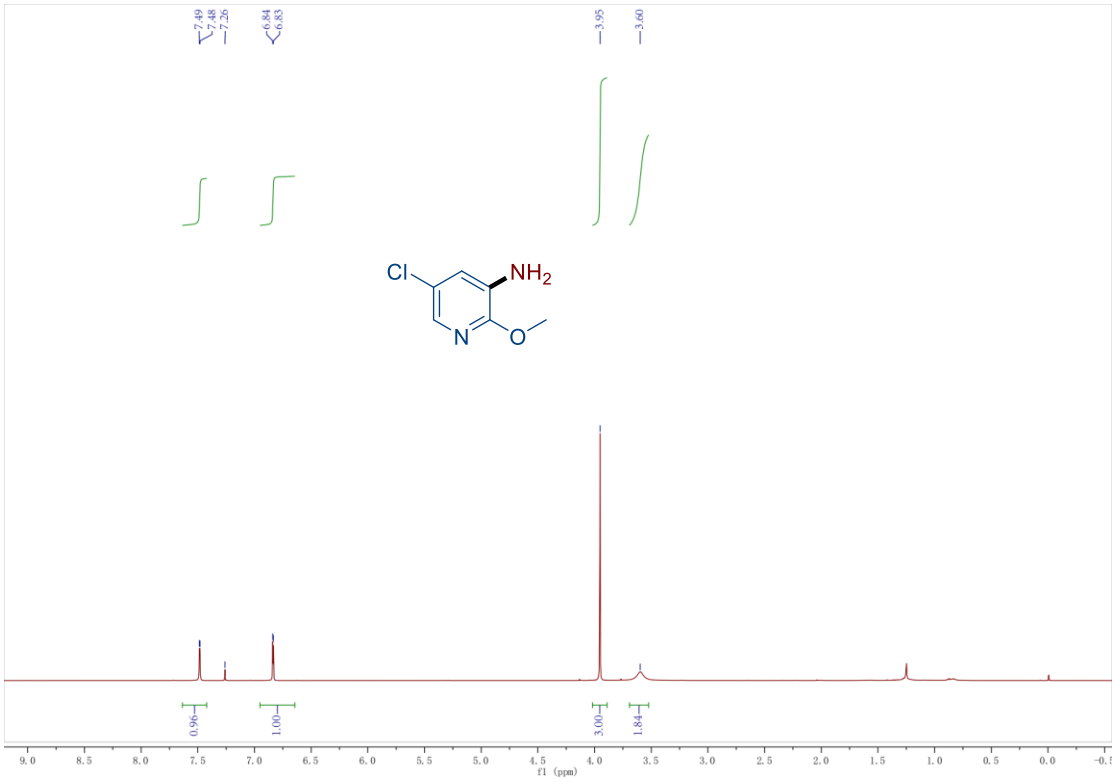
^{1}H NMR (400 MHz, $CDCl_3$) spectrum of compound **33**



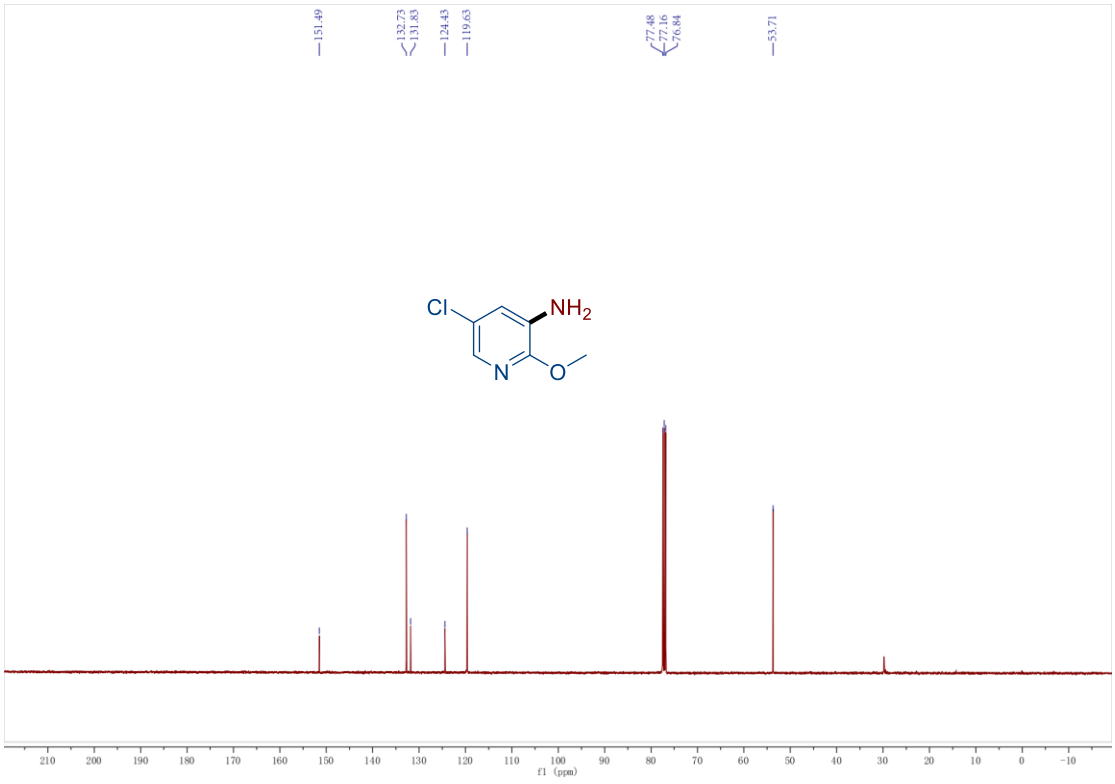
^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$) spectrum of compound **33**



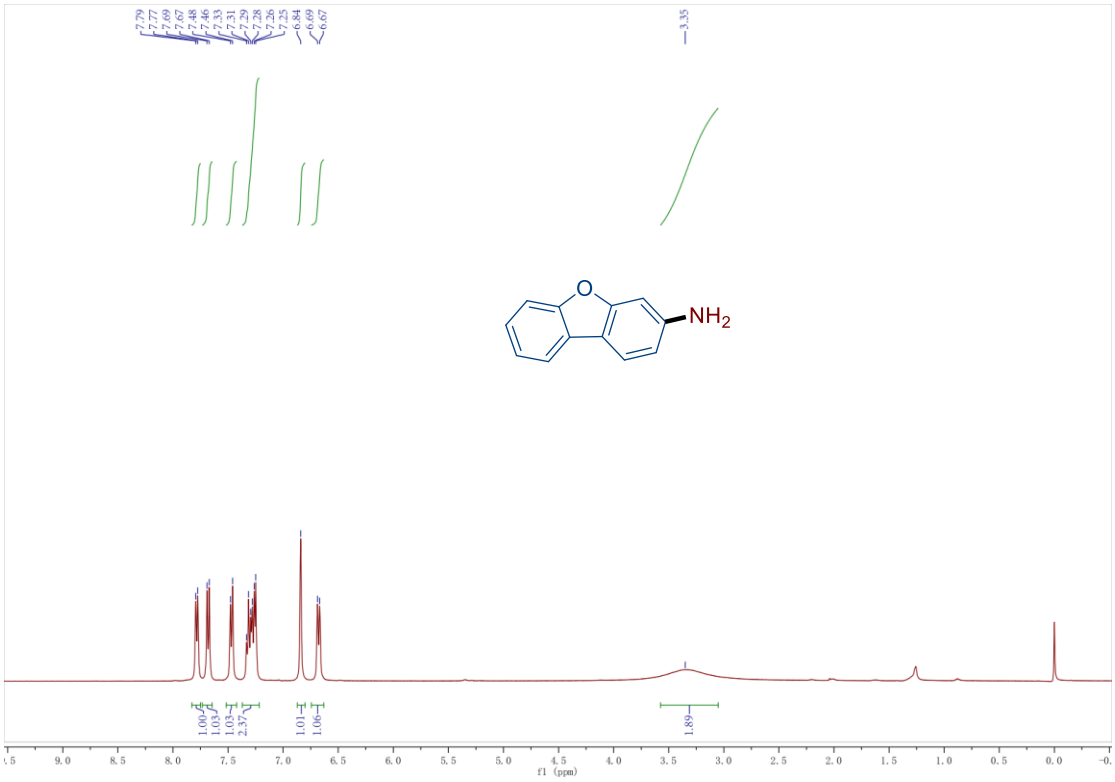
^{1}H NMR (400 MHz, $CDCl_3$) spectrum of compound **34**



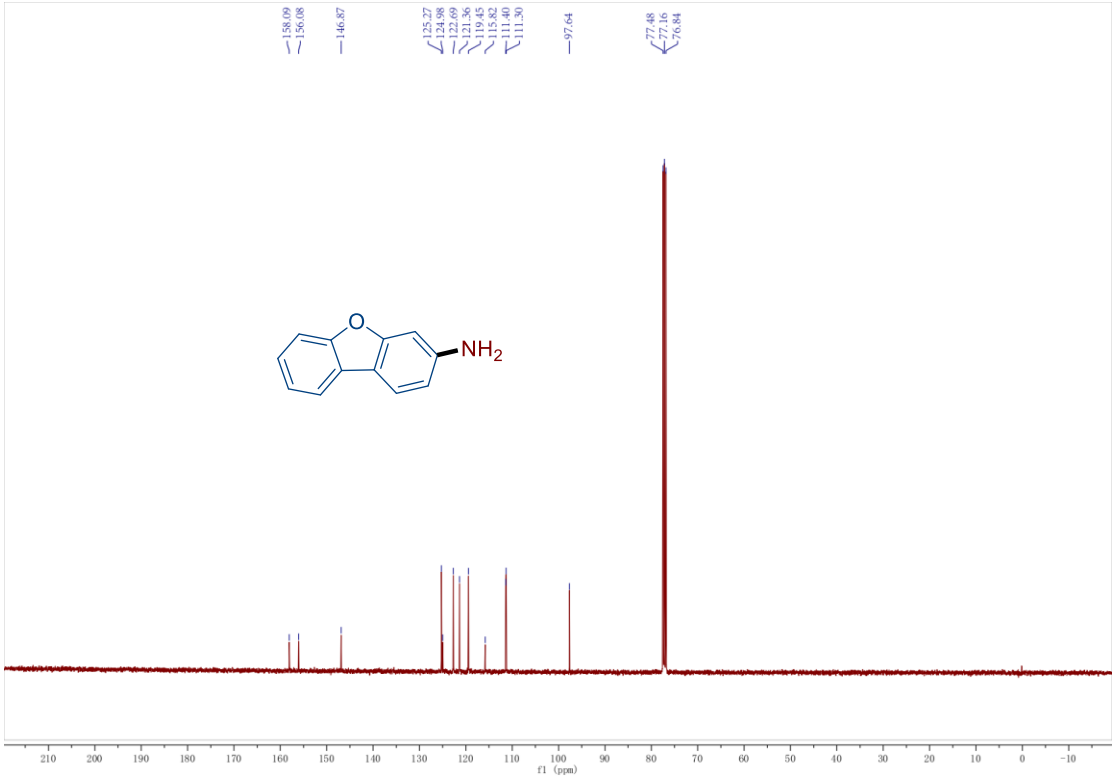
^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$) spectrum of compound **34**



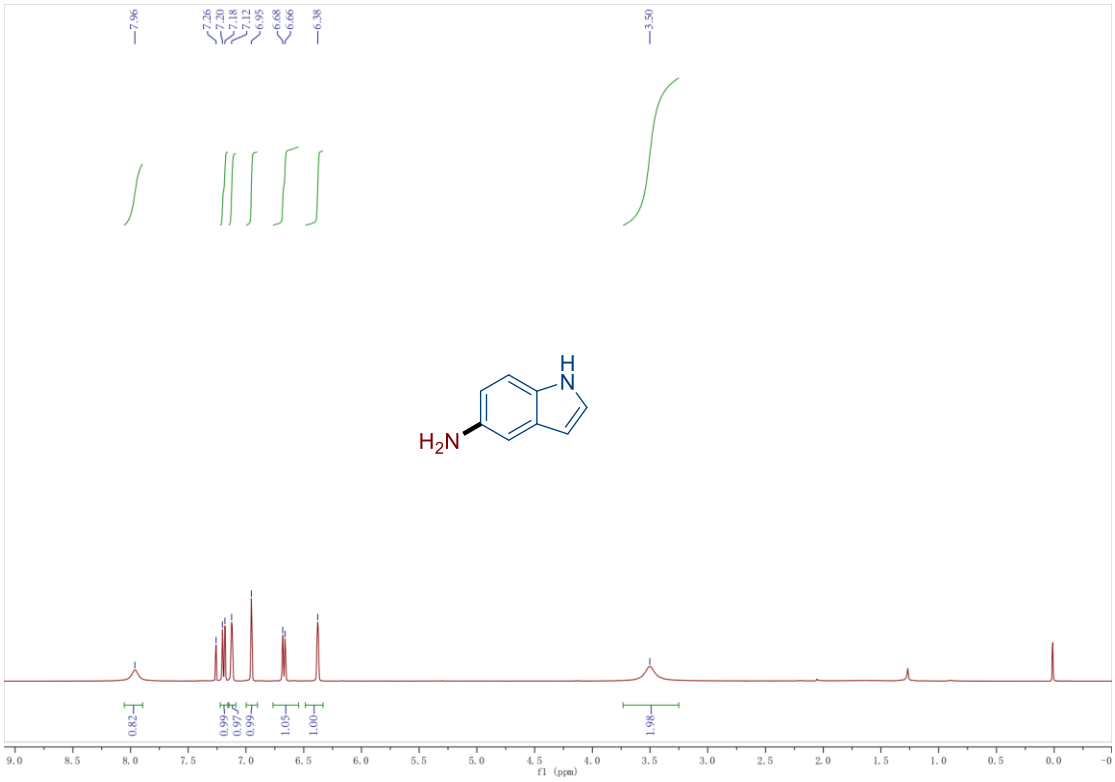
^{1}H NMR (400 MHz, $CDCl_3$) spectrum of compound **35**



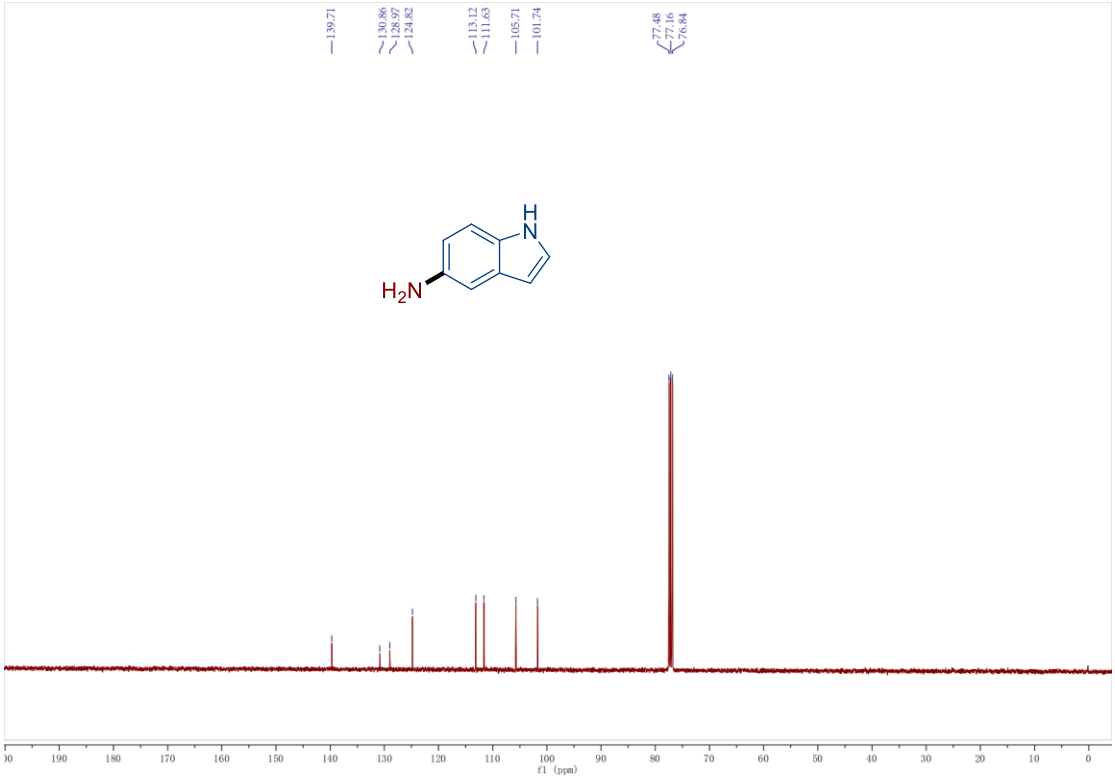
^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$) spectrum of compound **35**



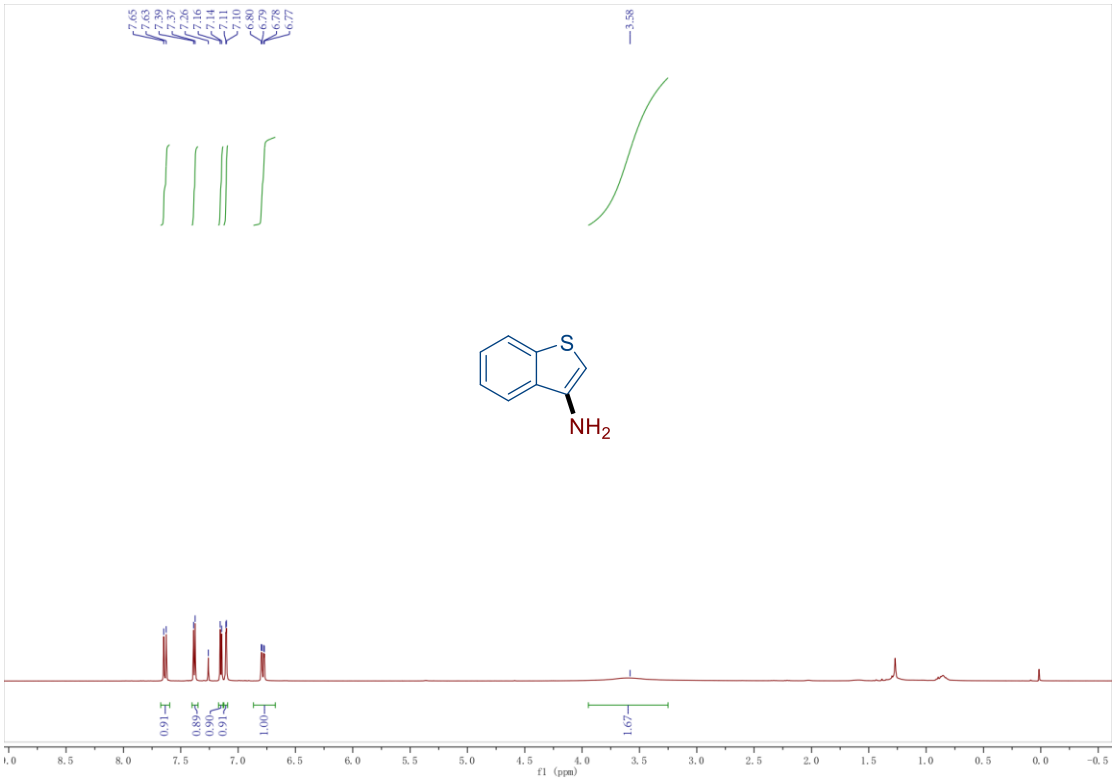
^{1}H NMR (400 MHz, $CDCl_3$) spectrum of compound **36**



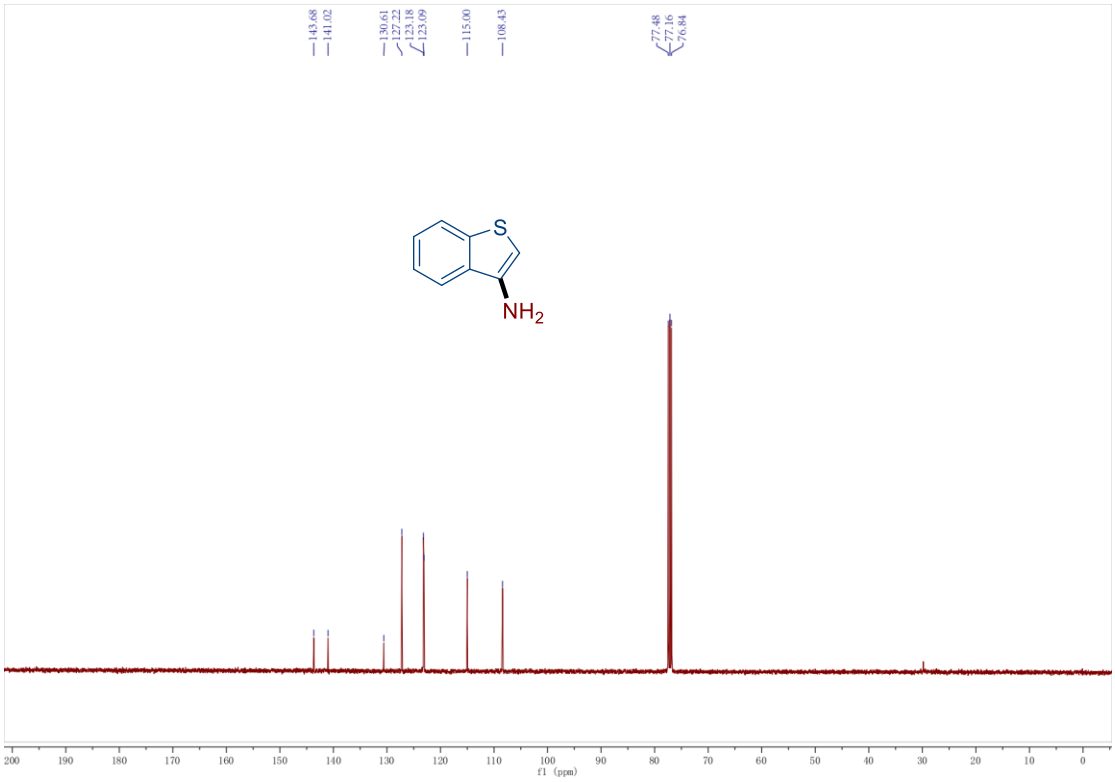
^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$) spectrum of compound **36**



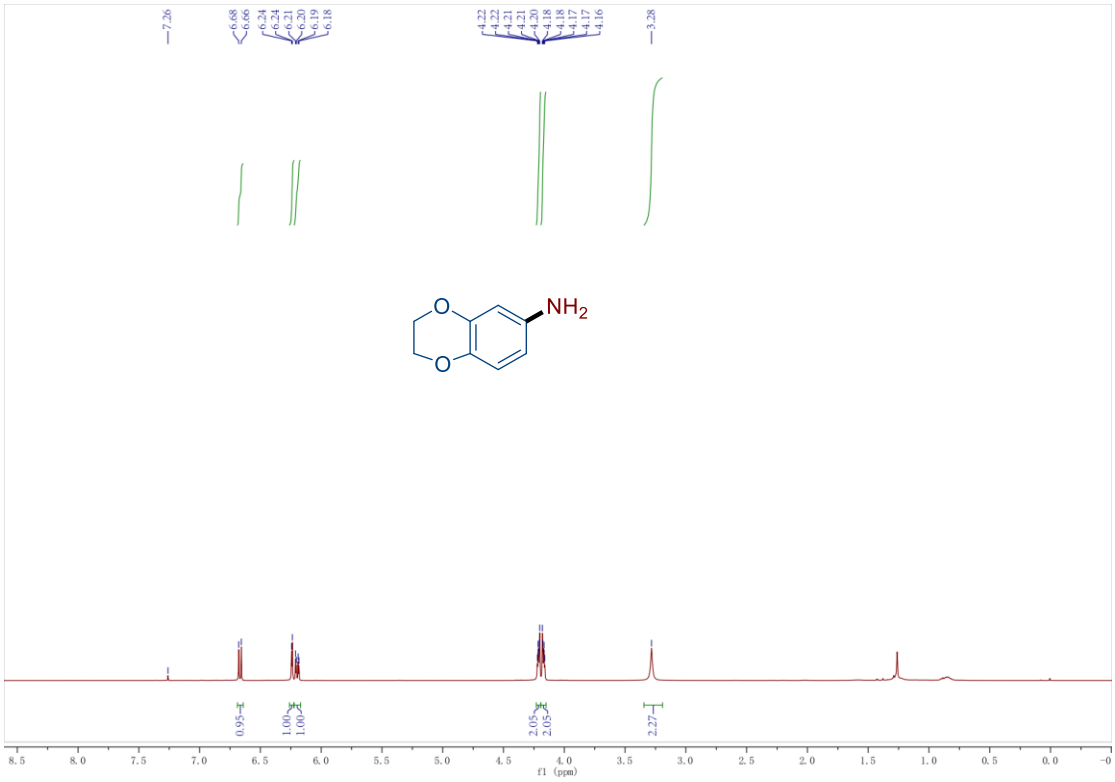
^{1}H NMR (400 MHz, $CDCl_3$) spectrum of compound **37**



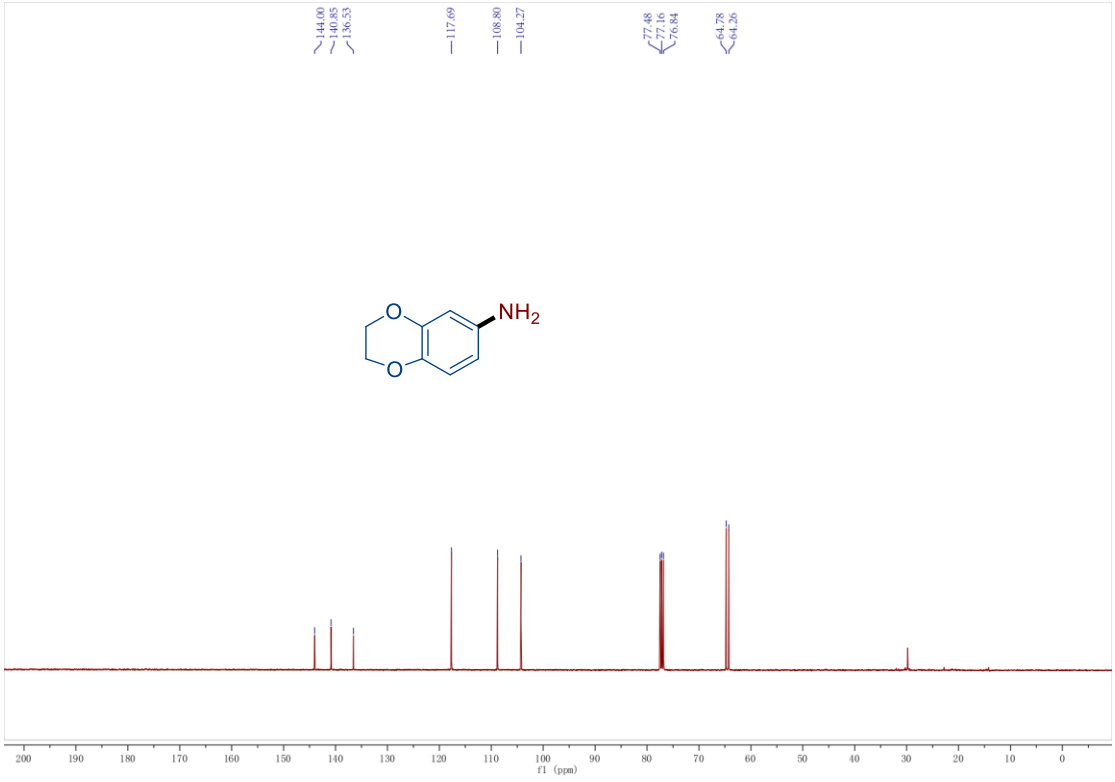
^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$) spectrum of compound **37**



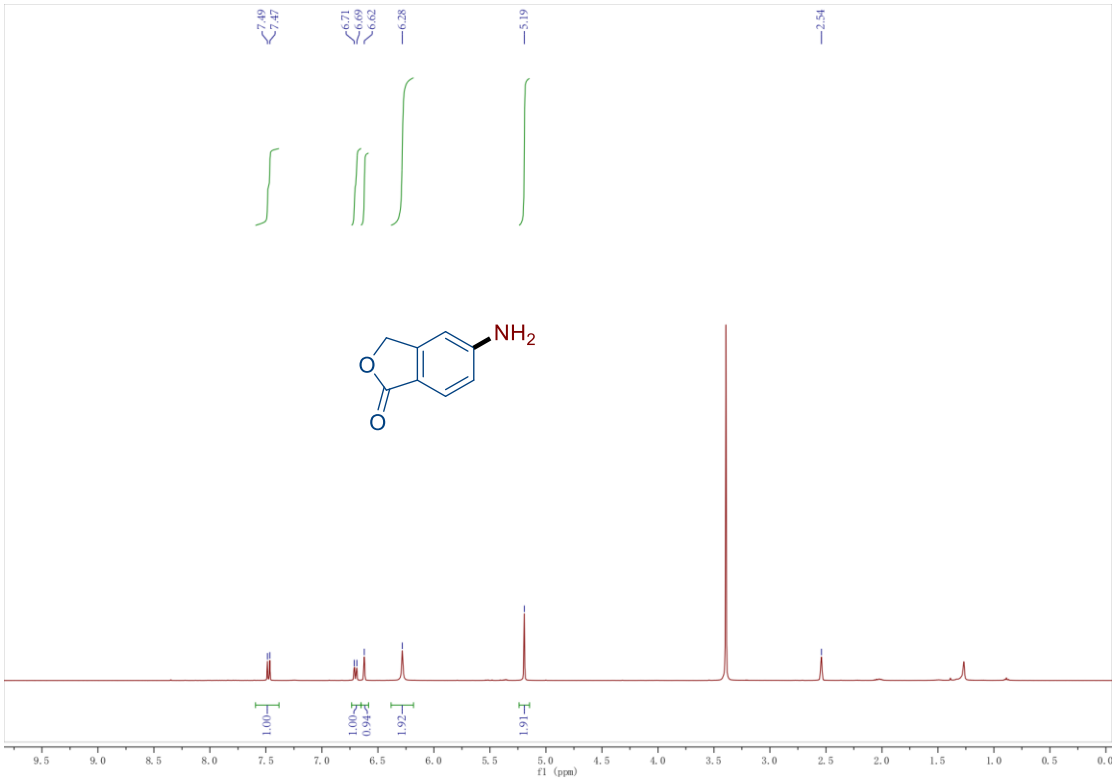
^{1}H NMR (400 MHz, $CDCl_3$) spectrum of compound **38**



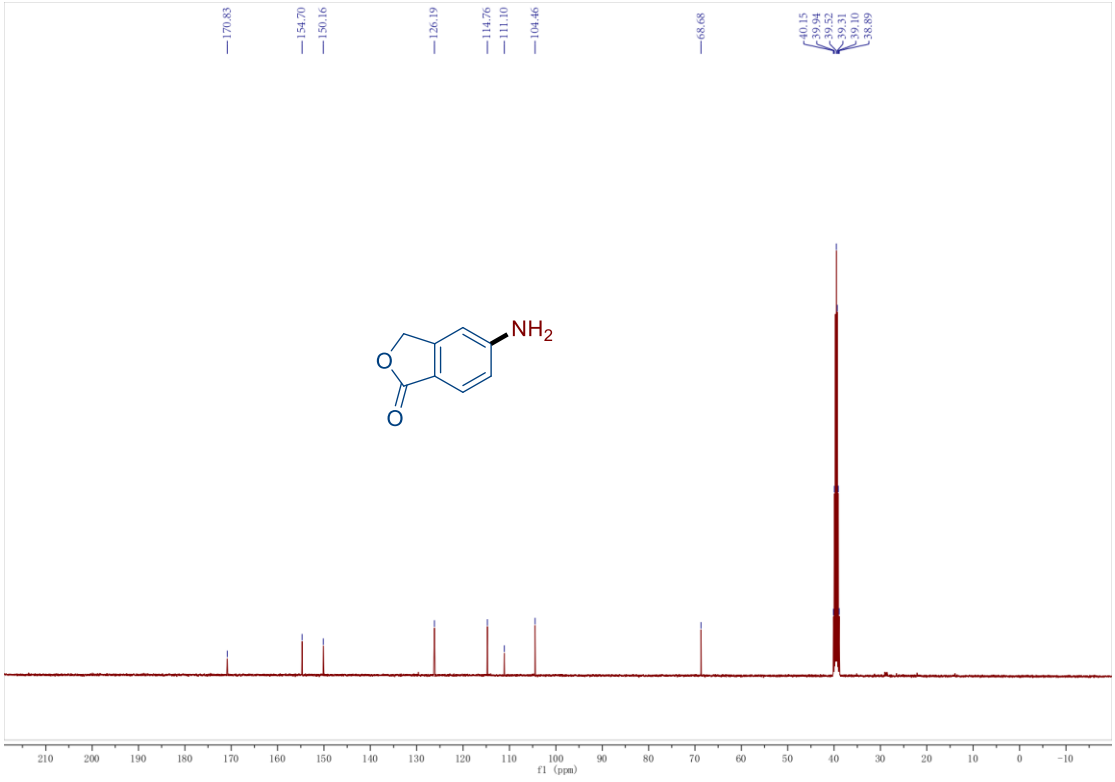
^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$) spectrum of compound **38**



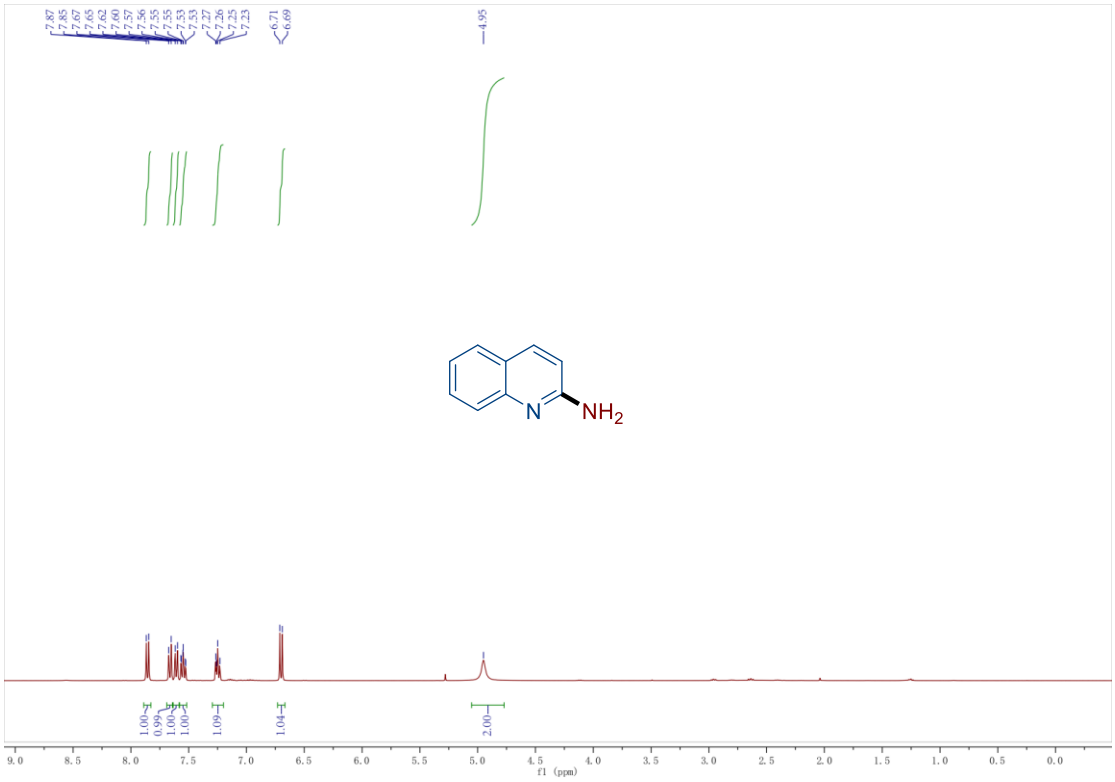
^{1}H NMR (400 MHz, DMSO-d_6) spectrum of compound **39**



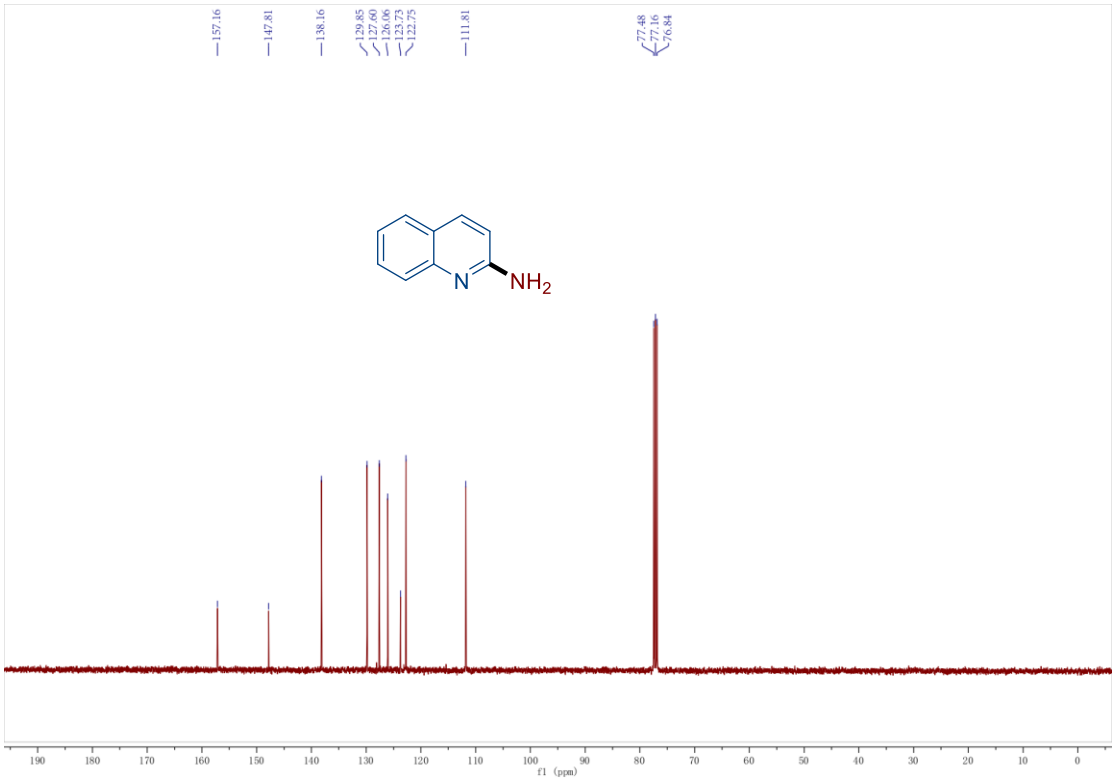
^{13}C{^{1}H} NMR (100 MHz, DMSO-d_6) spectrum of compound **39**



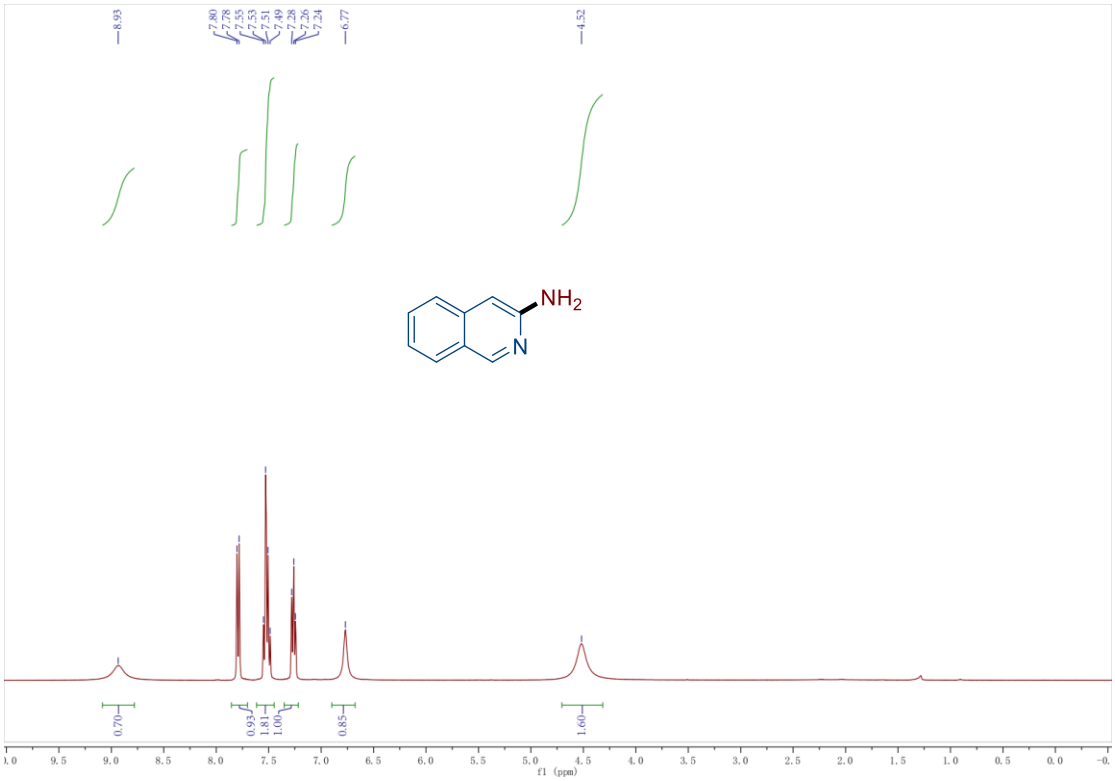
^{1}H NMR (400 MHz, $CDCl_3$) spectrum of compound **40**



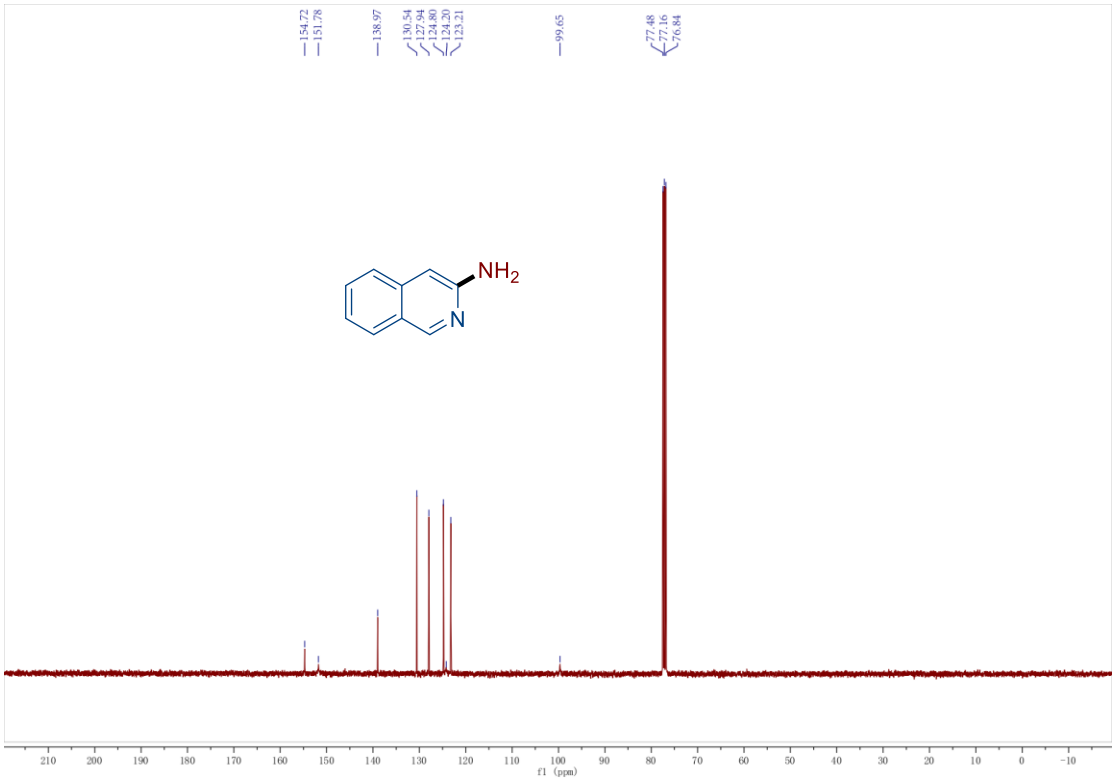
^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$) spectrum of compound **40**



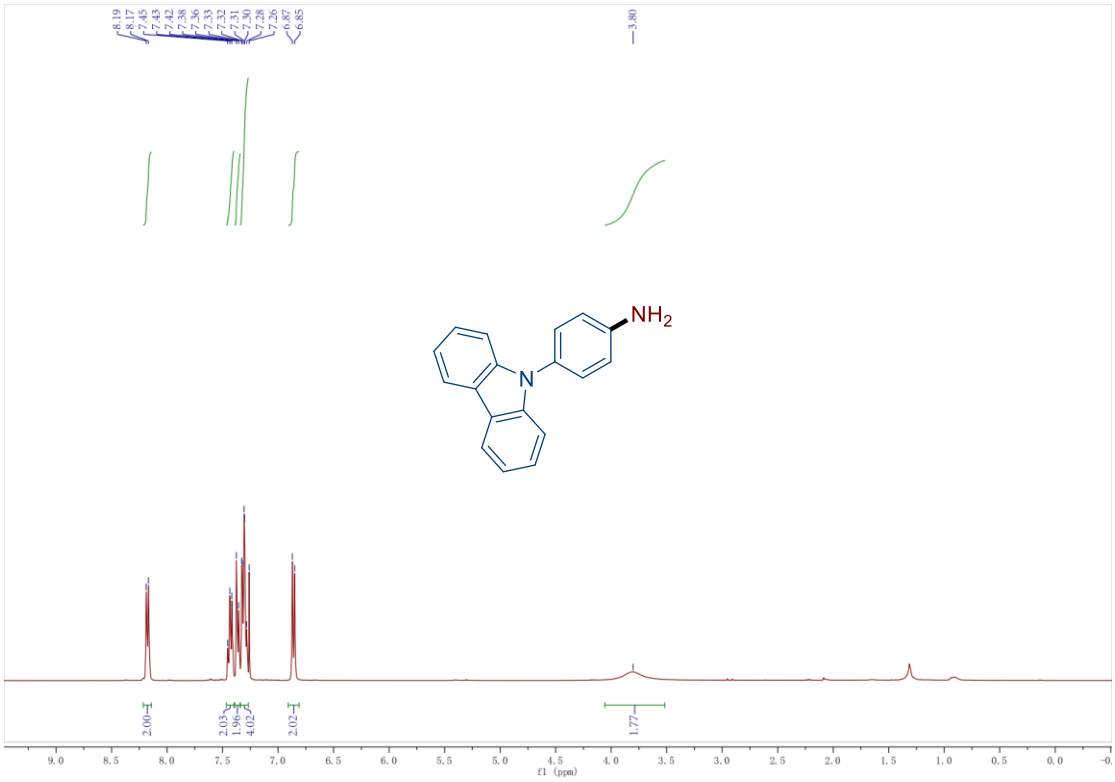
^{1}H NMR (400 MHz, $CDCl_3$) spectrum of compound **41**



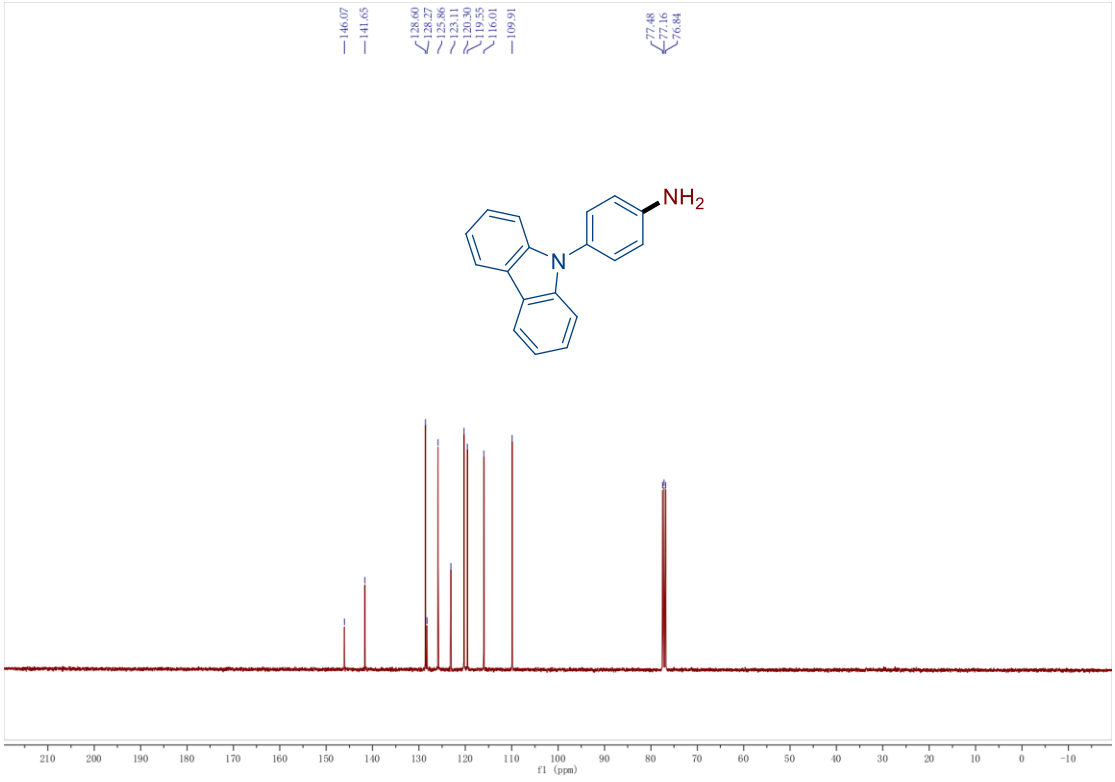
^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$) spectrum of compound **41**



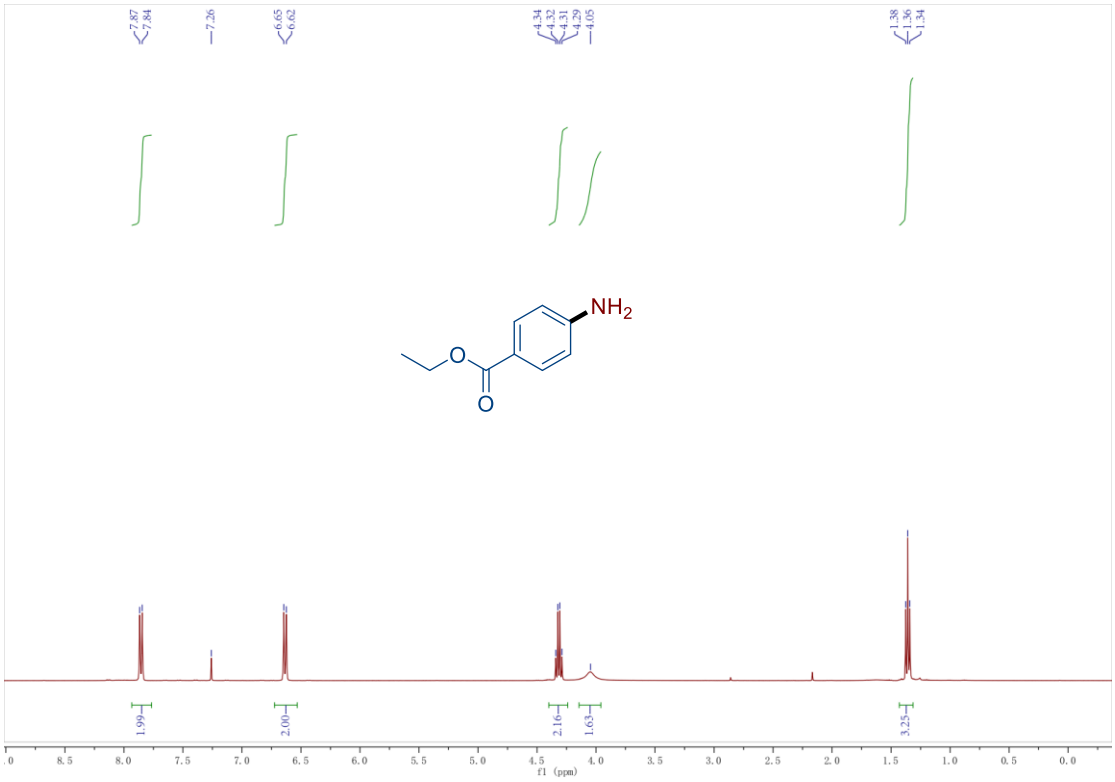
^{1}H NMR (400 MHz, $CDCl_3$) spectrum of compound **42**



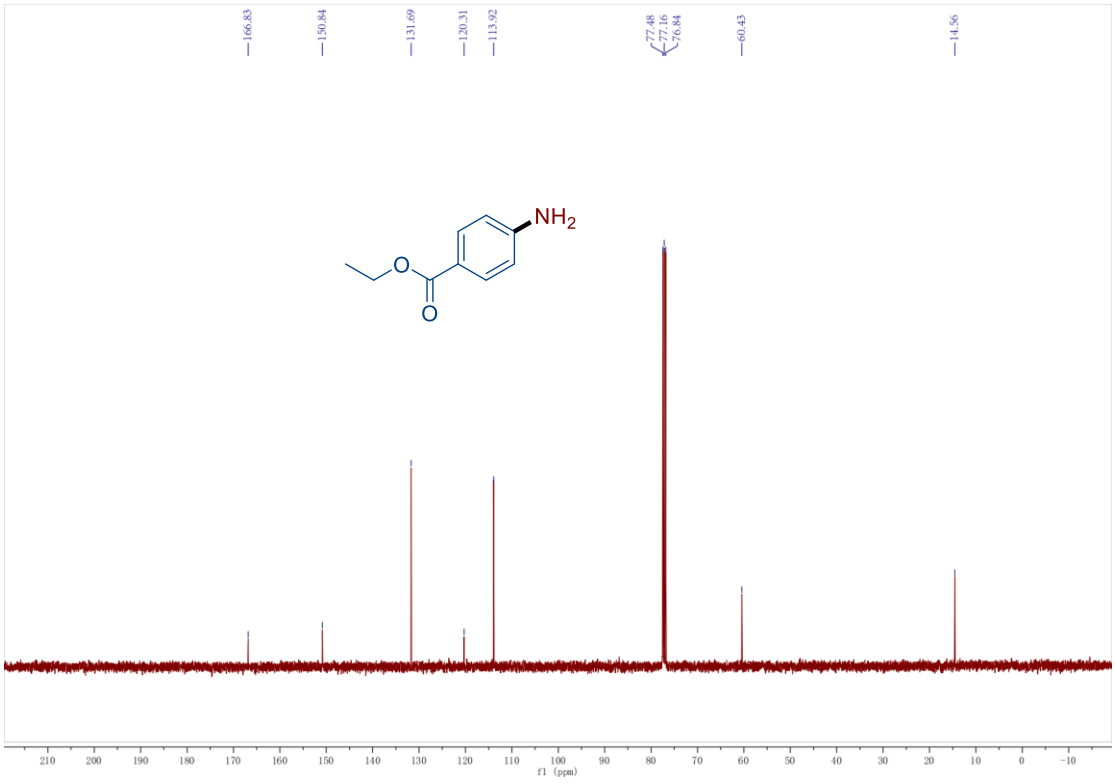
^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$) spectrum of compound **42**



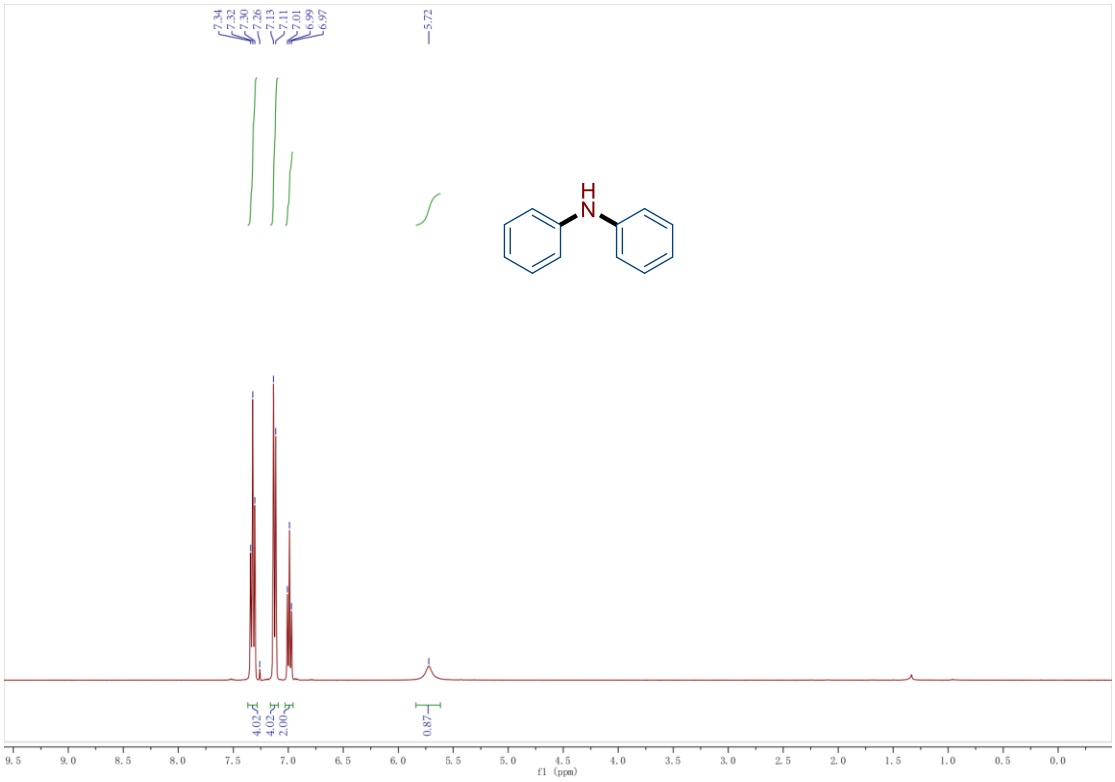
^{1}H NMR (400 MHz, $CDCl_3$) spectrum of compound **76**



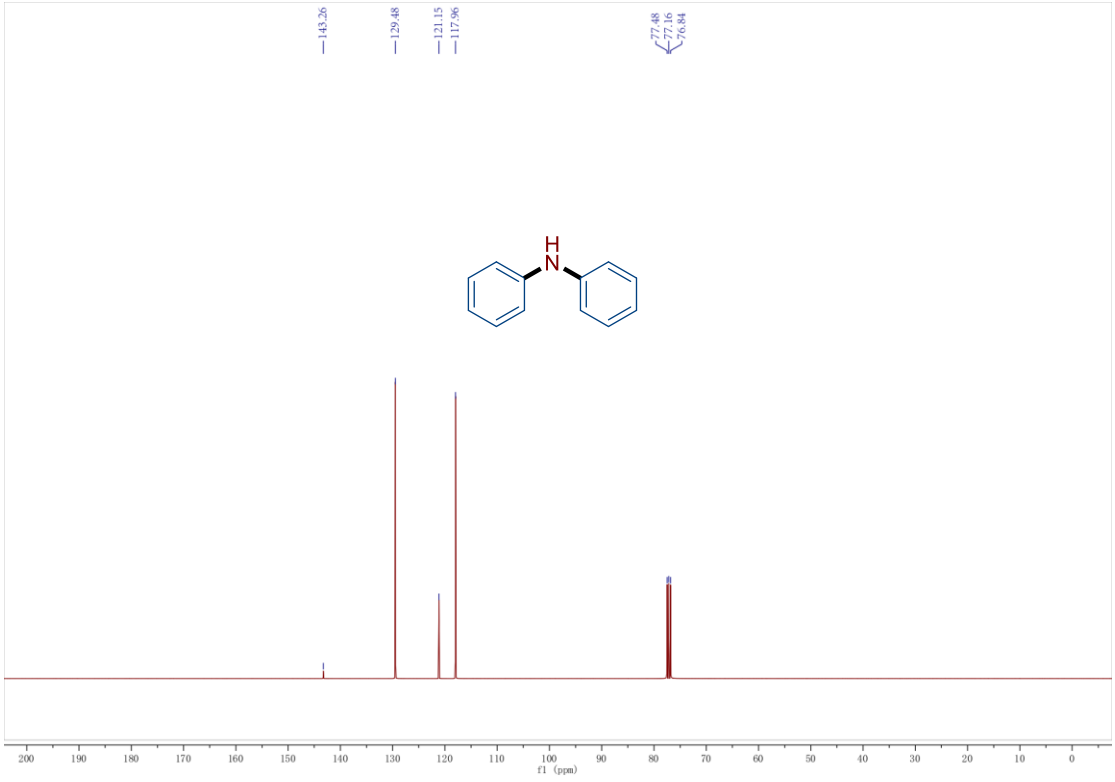
^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$) spectrum of compound **76**



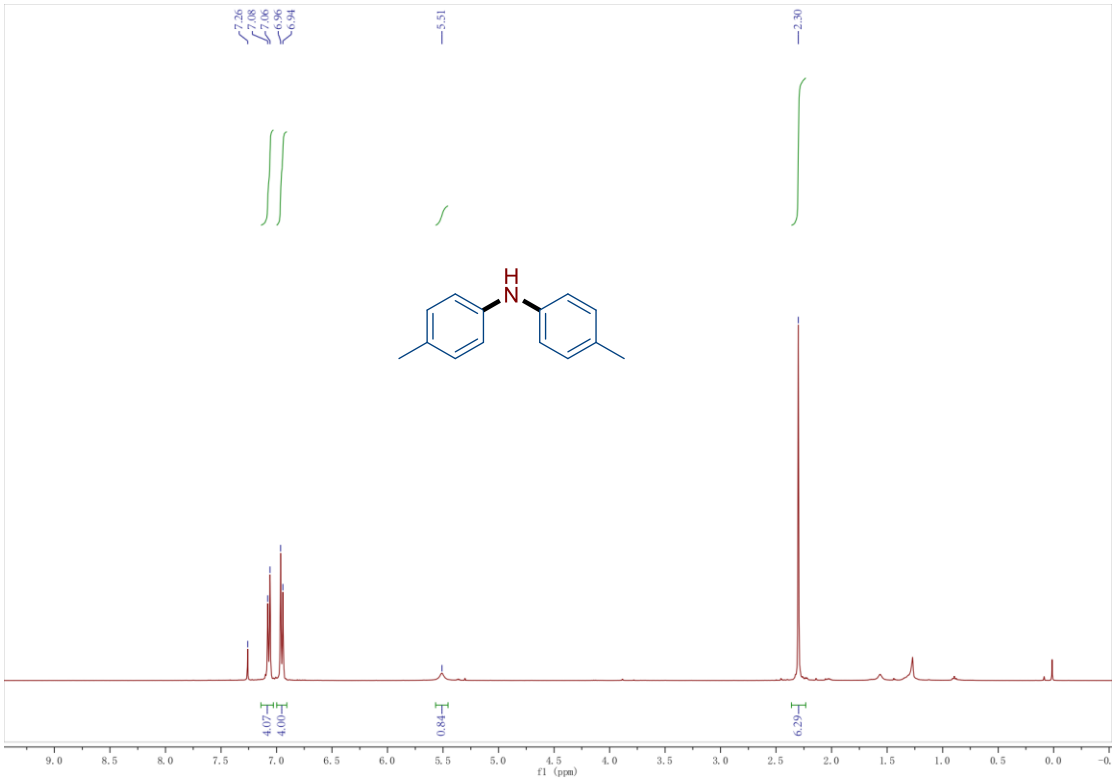
^{1}H NMR (400 MHz, $CDCl_3$) spectrum of compound **45**



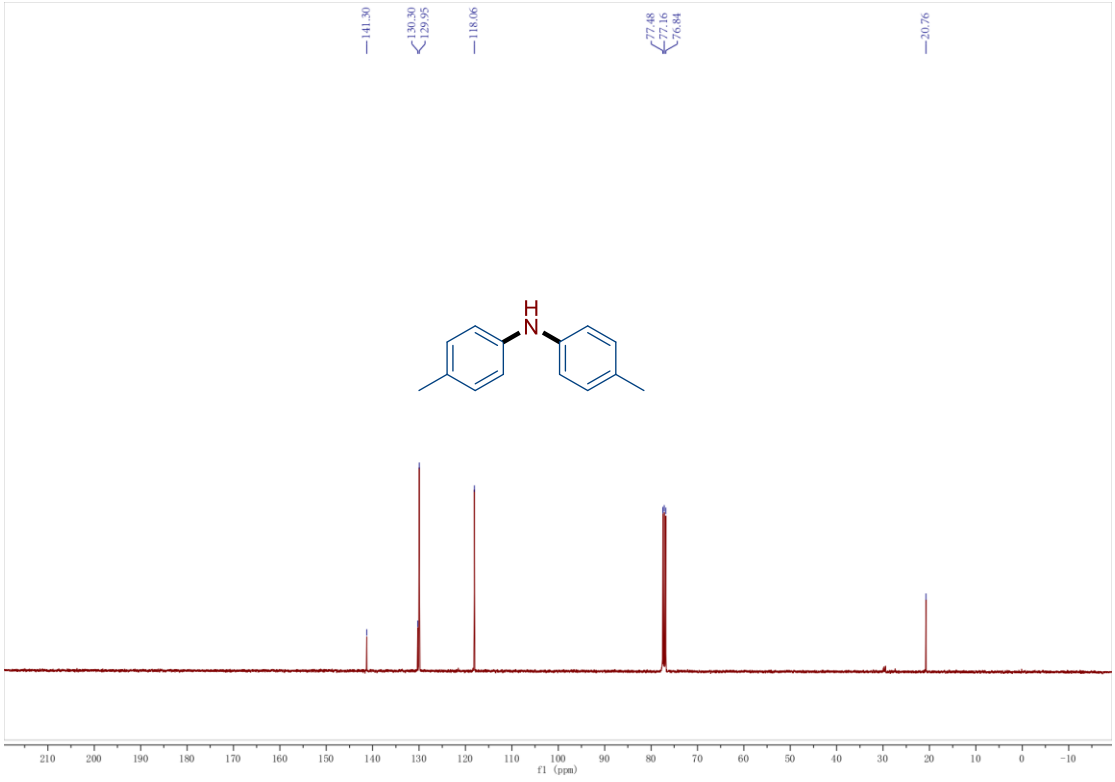
^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$) spectrum of compound **45**



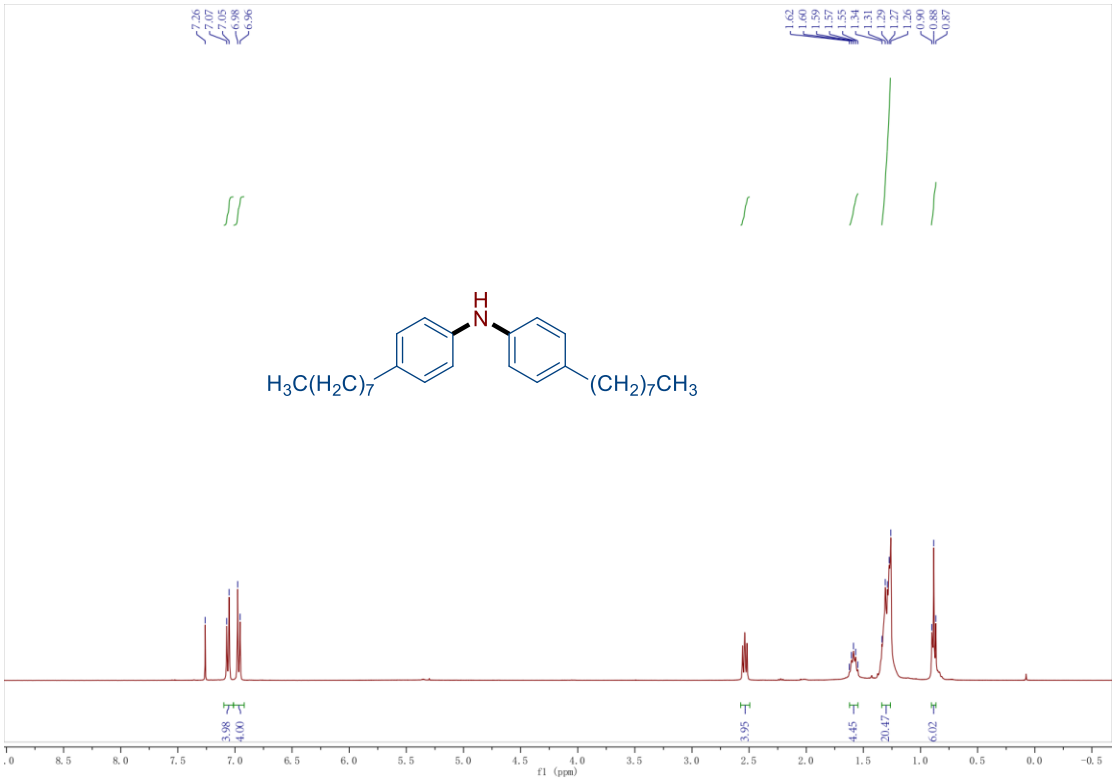
^{1}H NMR (400 MHz, $CDCl_3$) spectrum of compound **46**



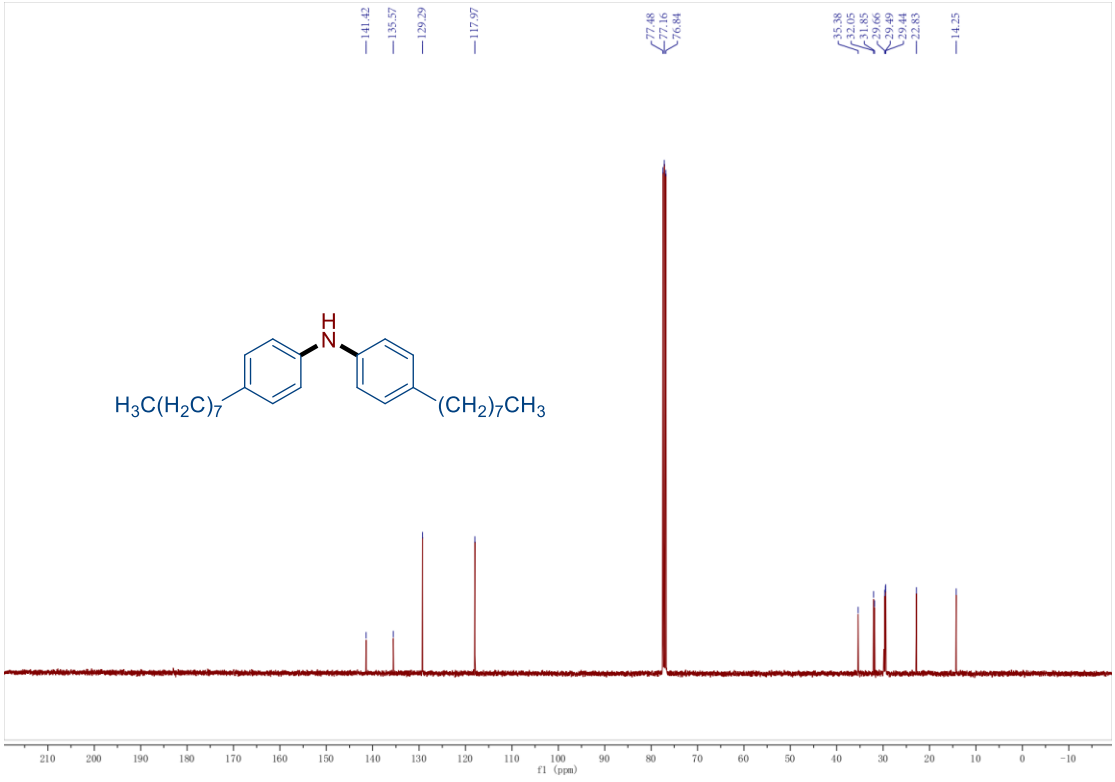
^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$) spectrum of compound **46**



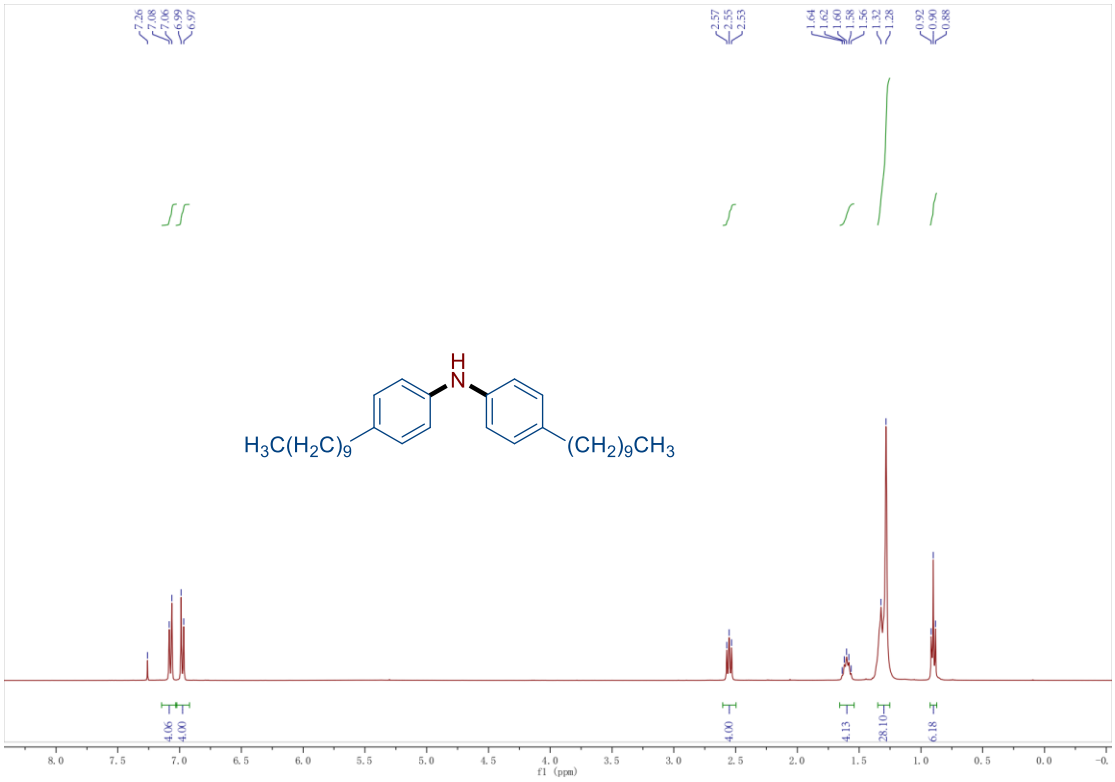
^{1}H NMR (400 MHz, $CDCl_3$) spectrum of compound **47**



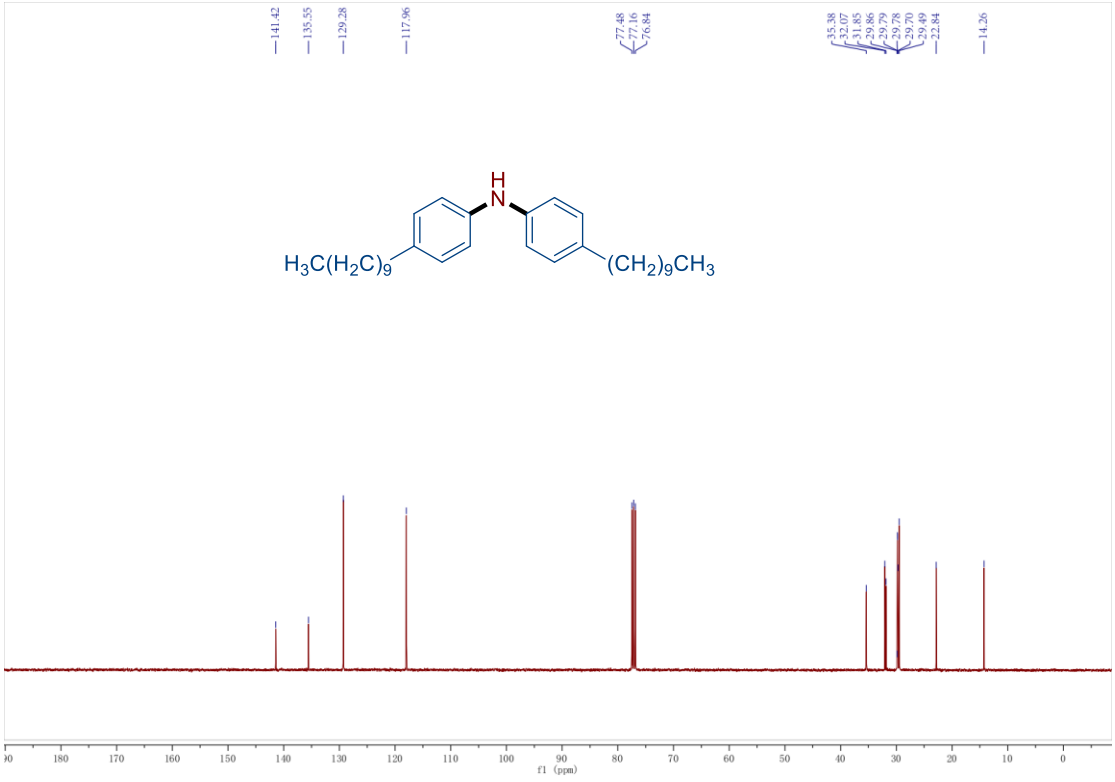
^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$) spectrum of compound **47**



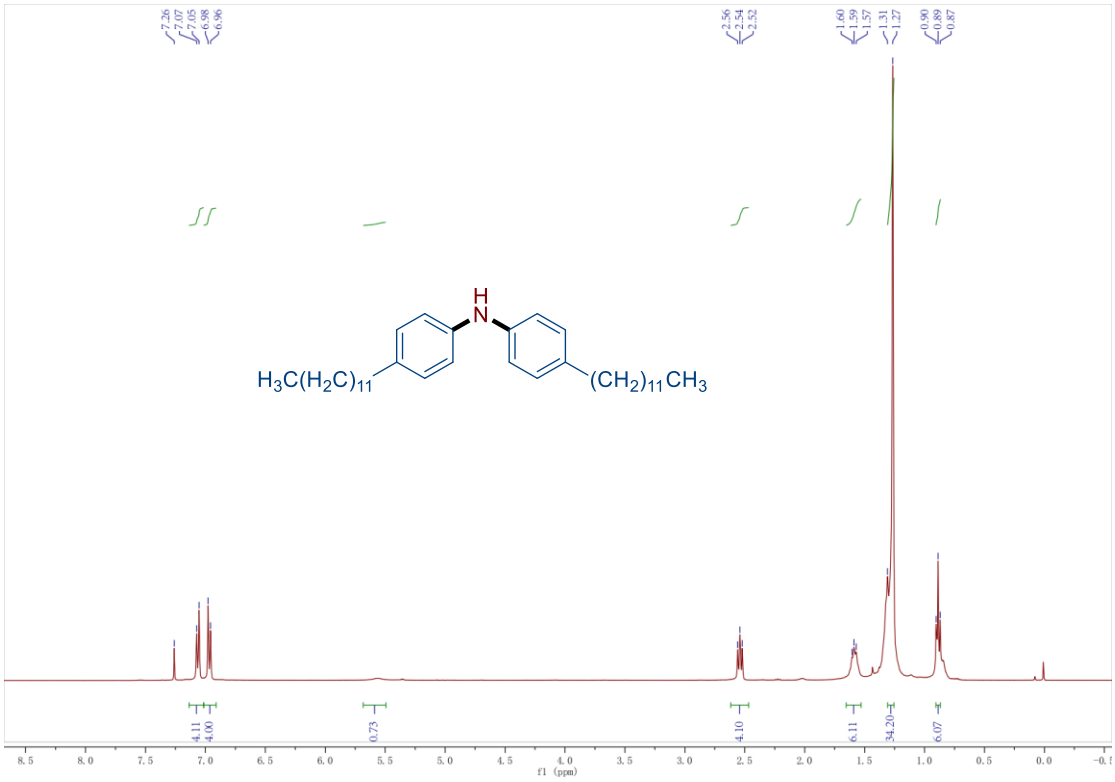
^{1}H NMR (400 MHz, $CDCl_3$) spectrum of compound **48**



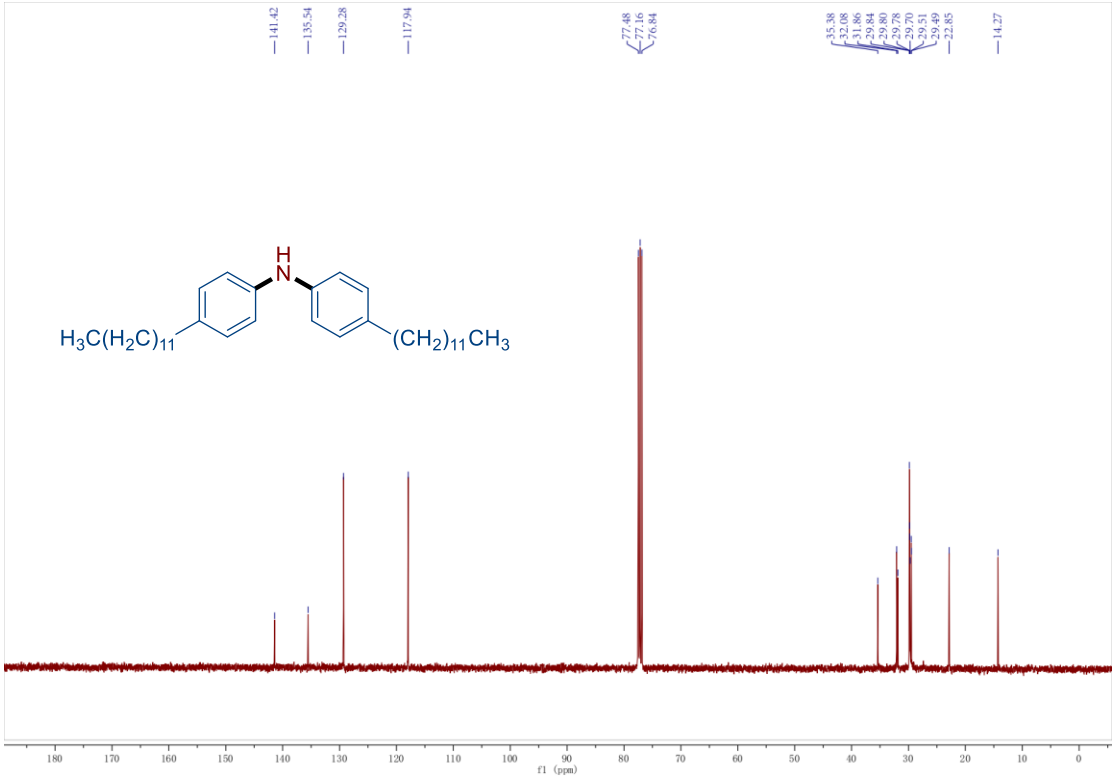
^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$) spectrum of compound **48**



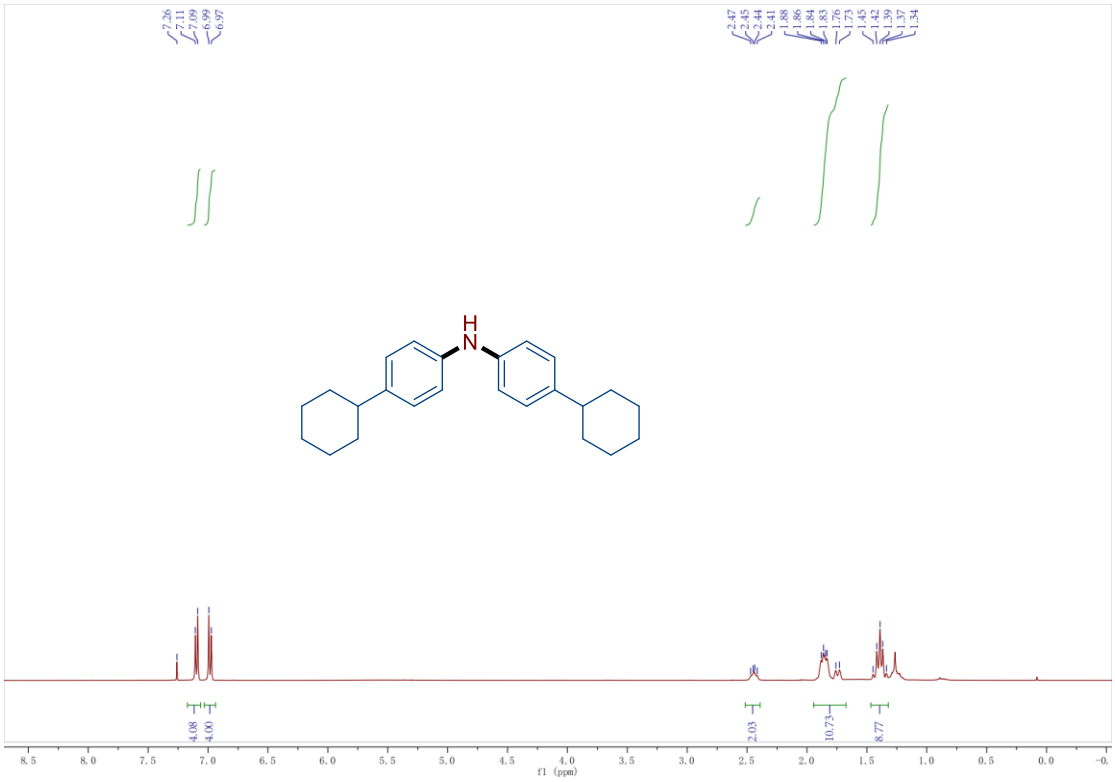
^{1}H NMR (400 MHz, $CDCl_3$) spectrum of compound **49**



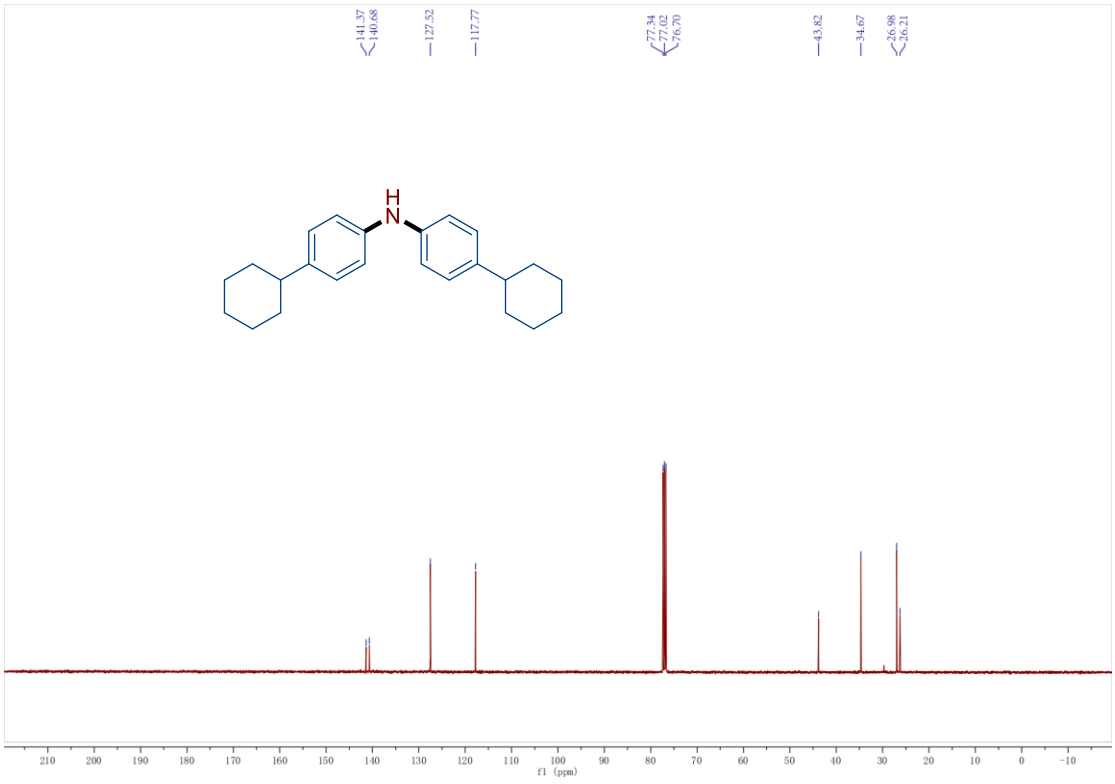
^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$) spectrum of compound **49**



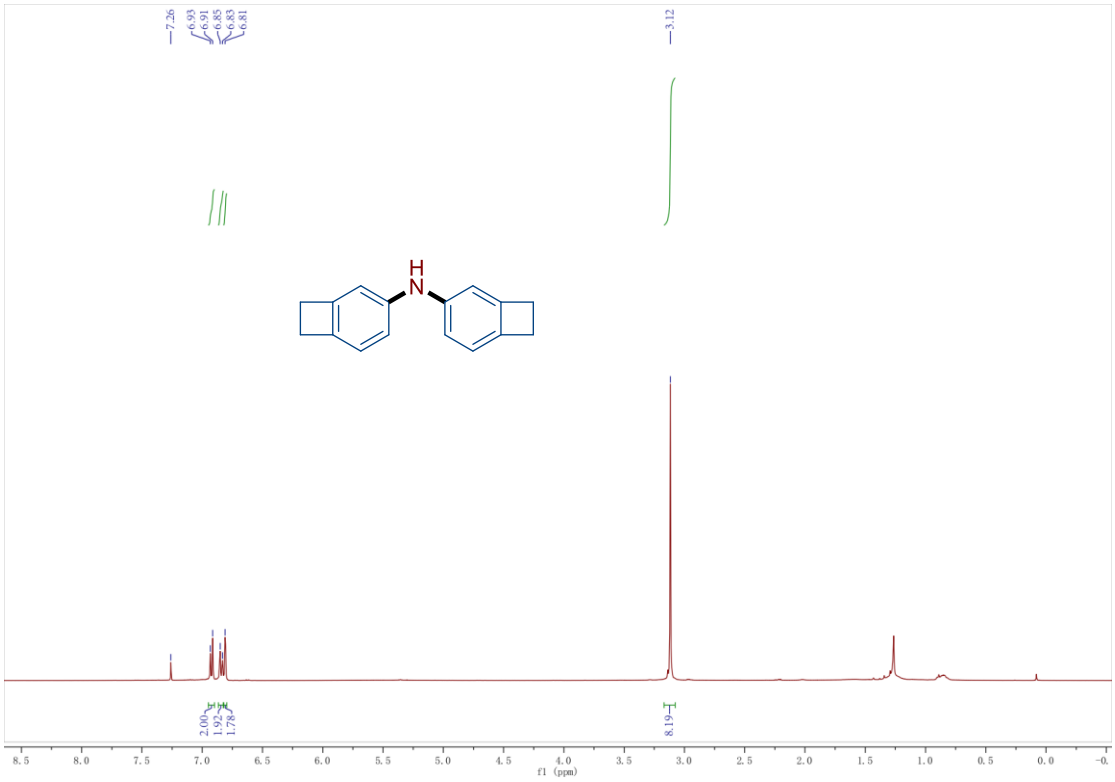
^{1}H NMR (400 MHz, $CDCl_3$) spectrum of compound **50**



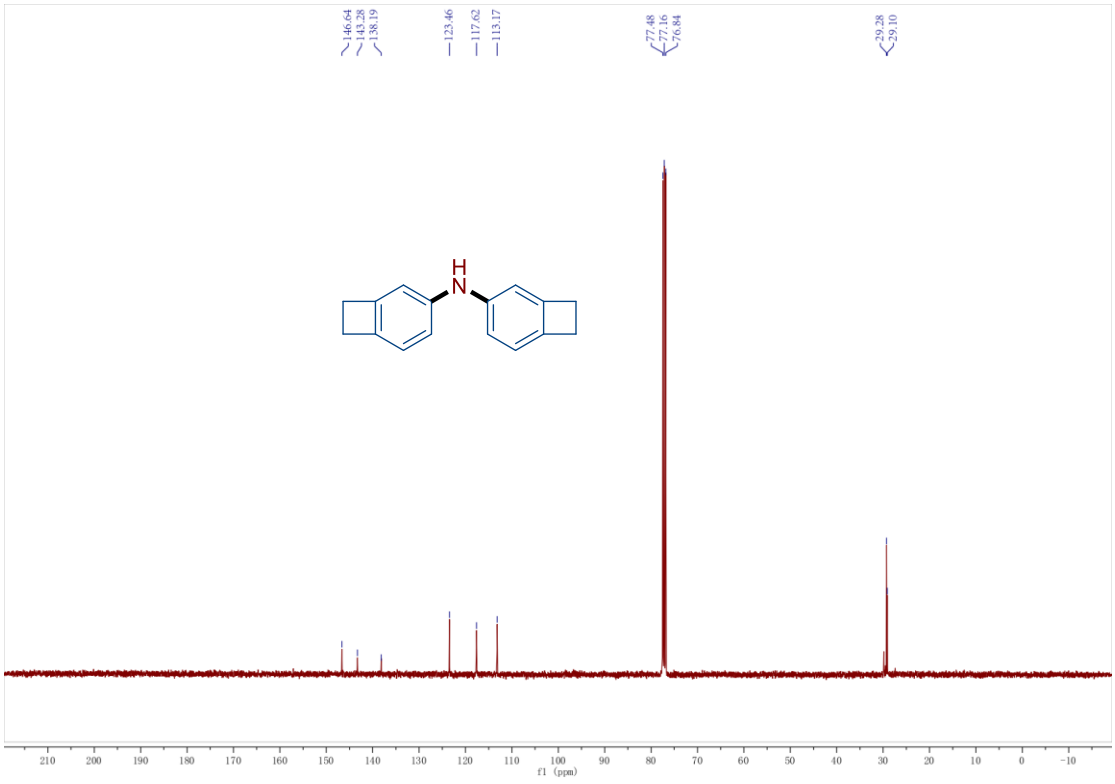
^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$) spectrum of compound **50**



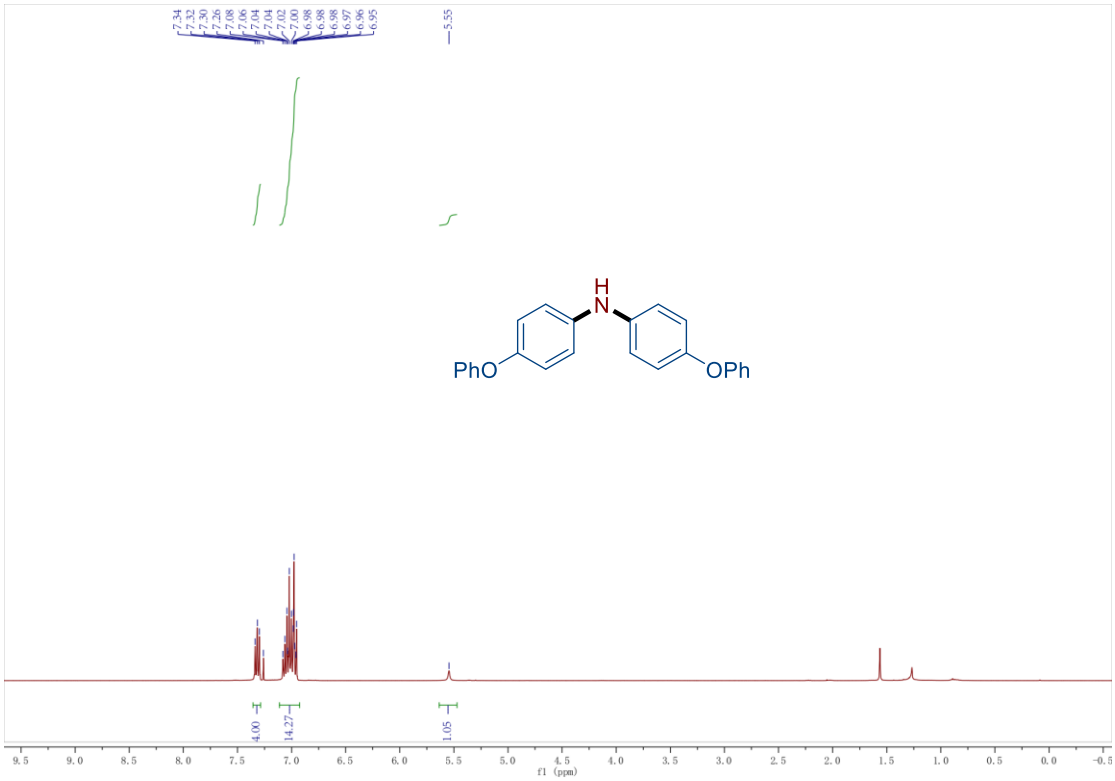
^{1}H NMR (400 MHz, $CDCl_3$) spectrum of compound **51**



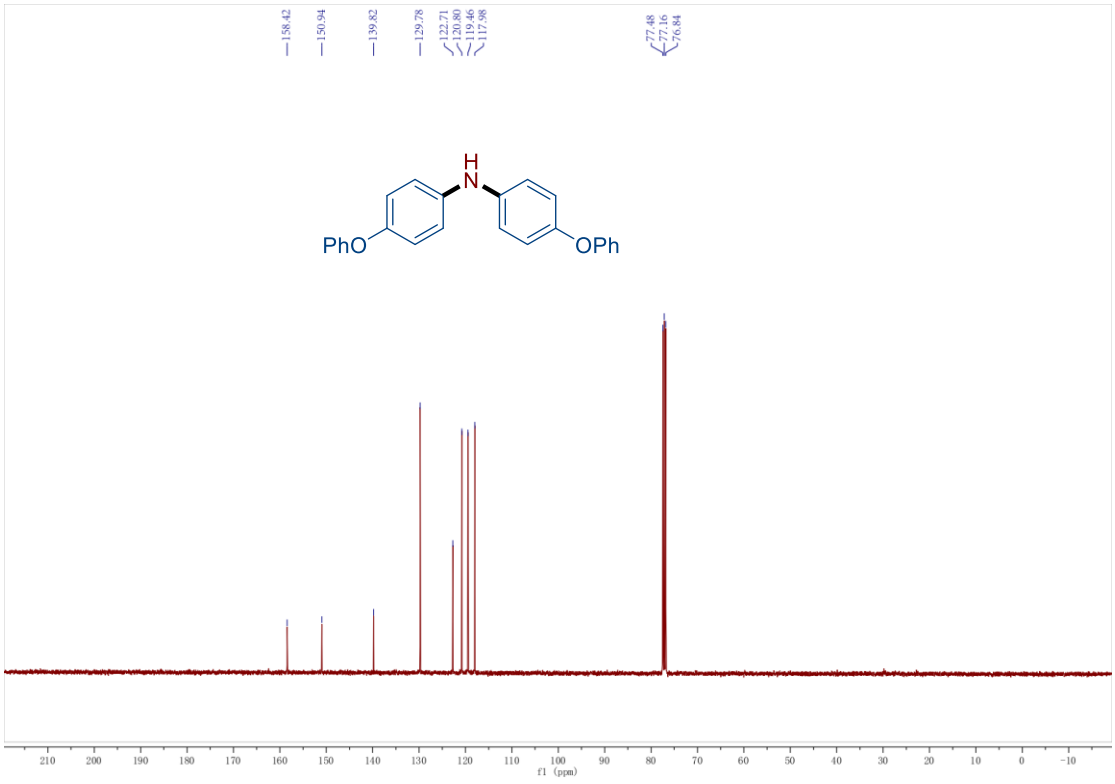
^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$) spectrum of compound **51**



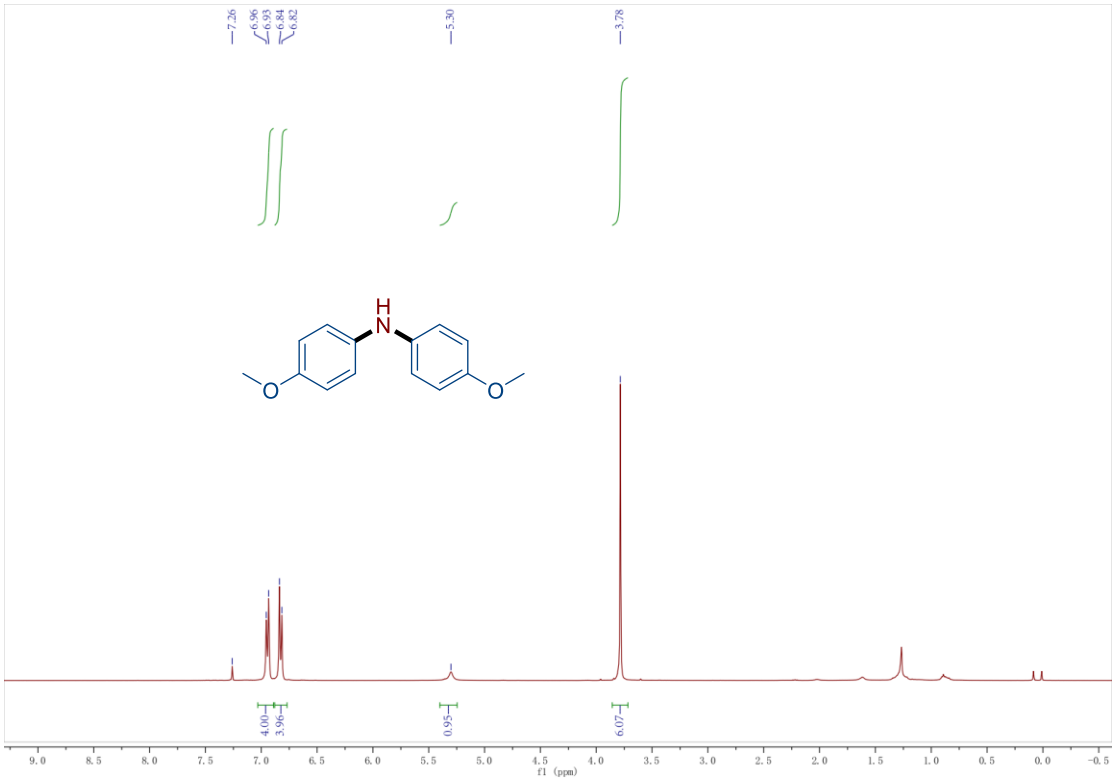
^{1}H NMR (400 MHz, $CDCl_3$) spectrum of compound **52**



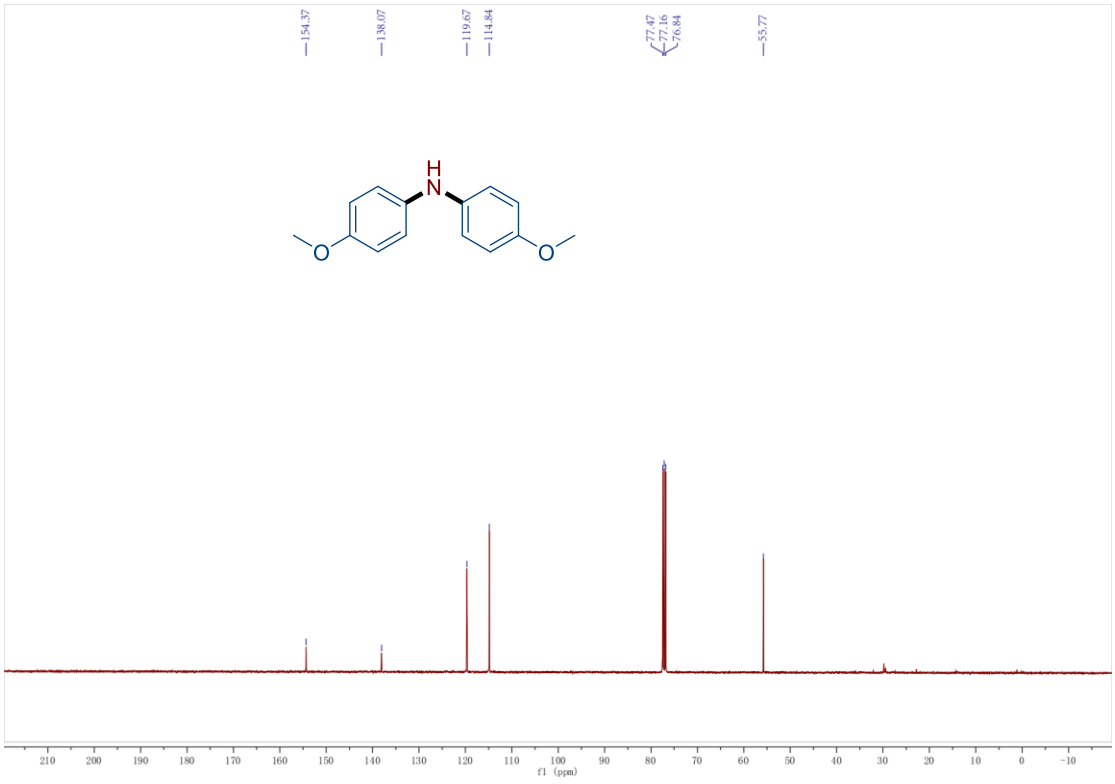
^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$) spectrum of compound **52**



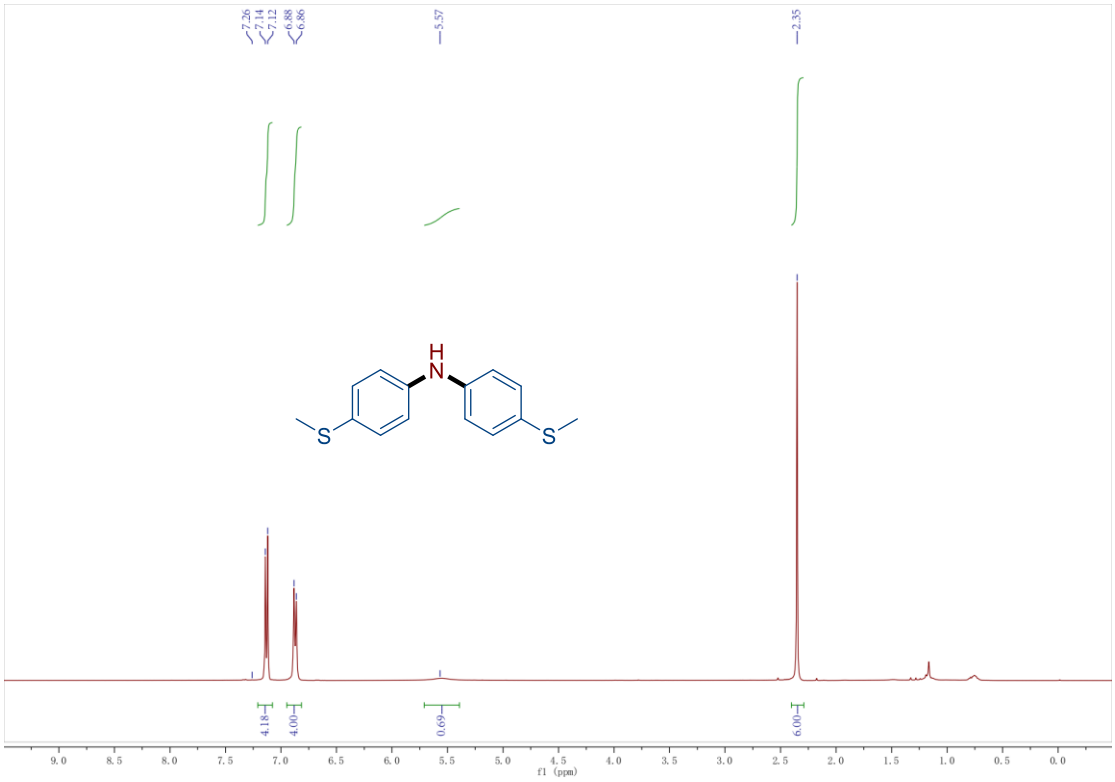
^{1}H NMR (400 MHz, $CDCl_3$) spectrum of compound **53**



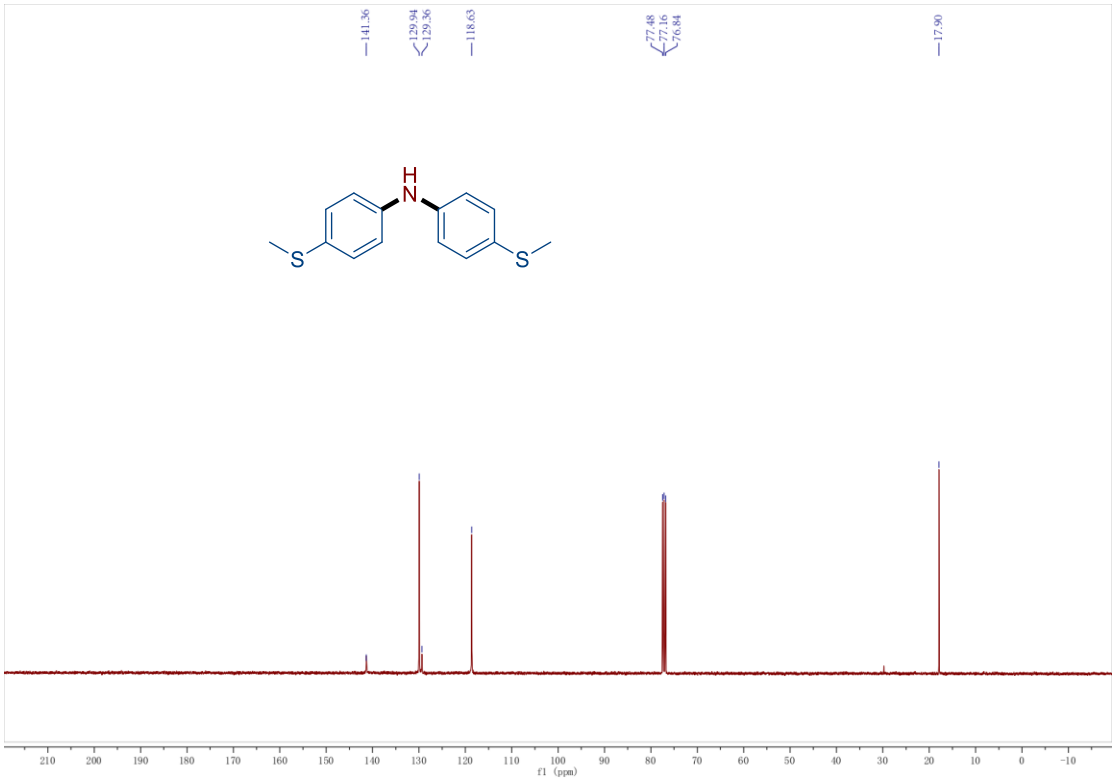
^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$) spectrum of compound **53**



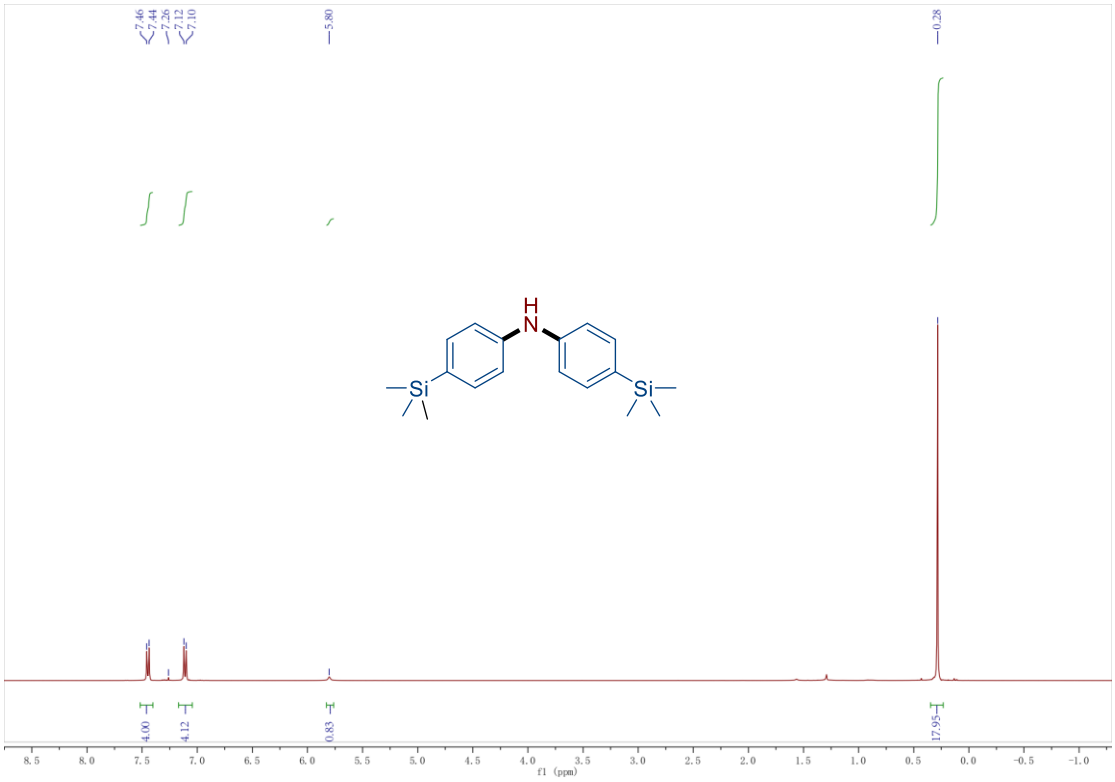
^{1}H NMR (400 MHz, $CDCl_3$) spectrum of compound **54**



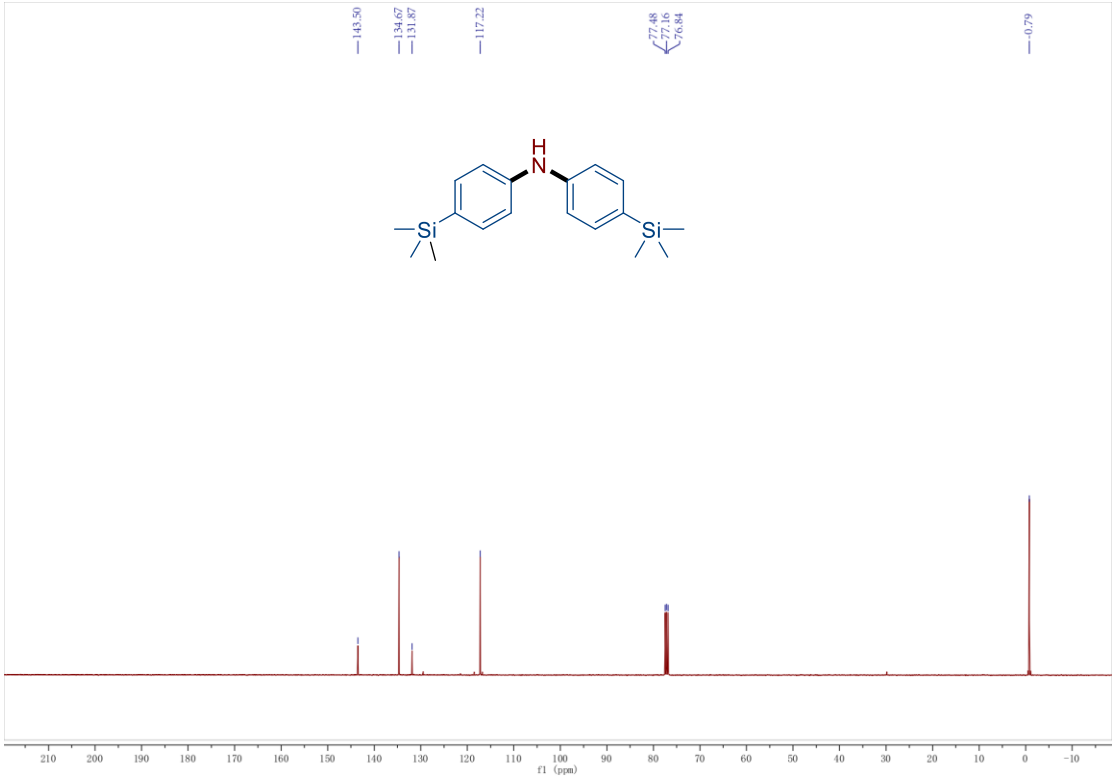
^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$) spectrum of compound **54**



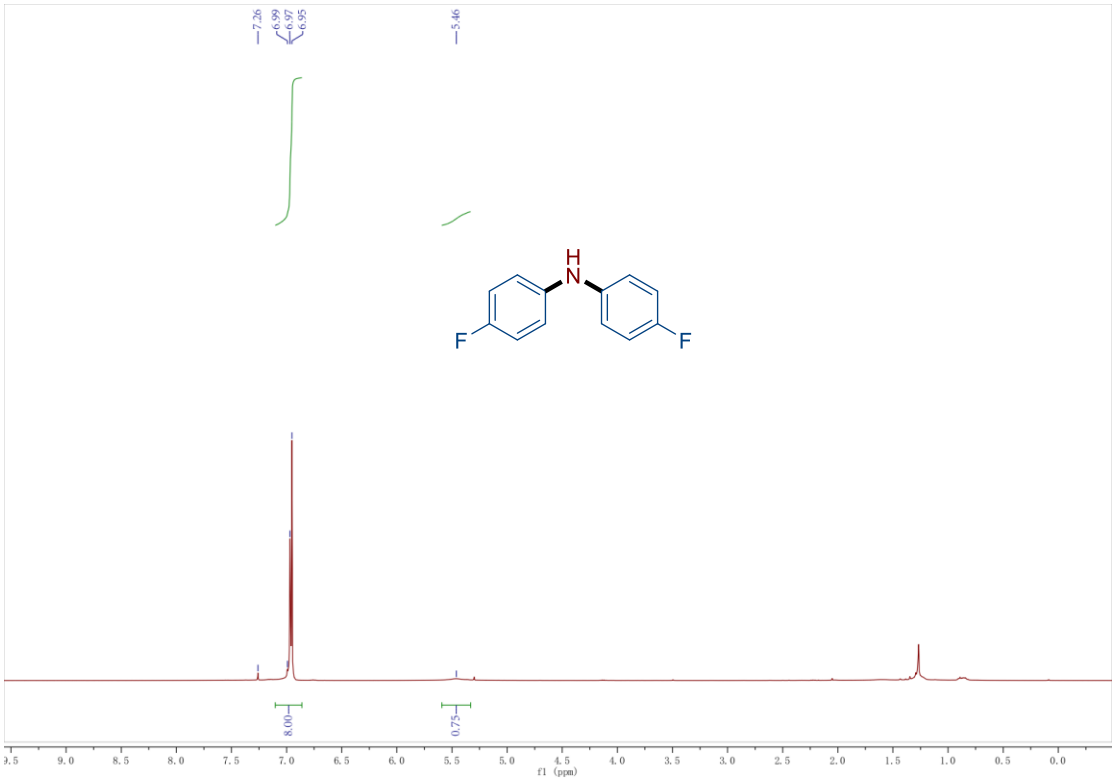
^{1}H NMR (400 MHz, $CDCl_3$) spectrum of compound **55**



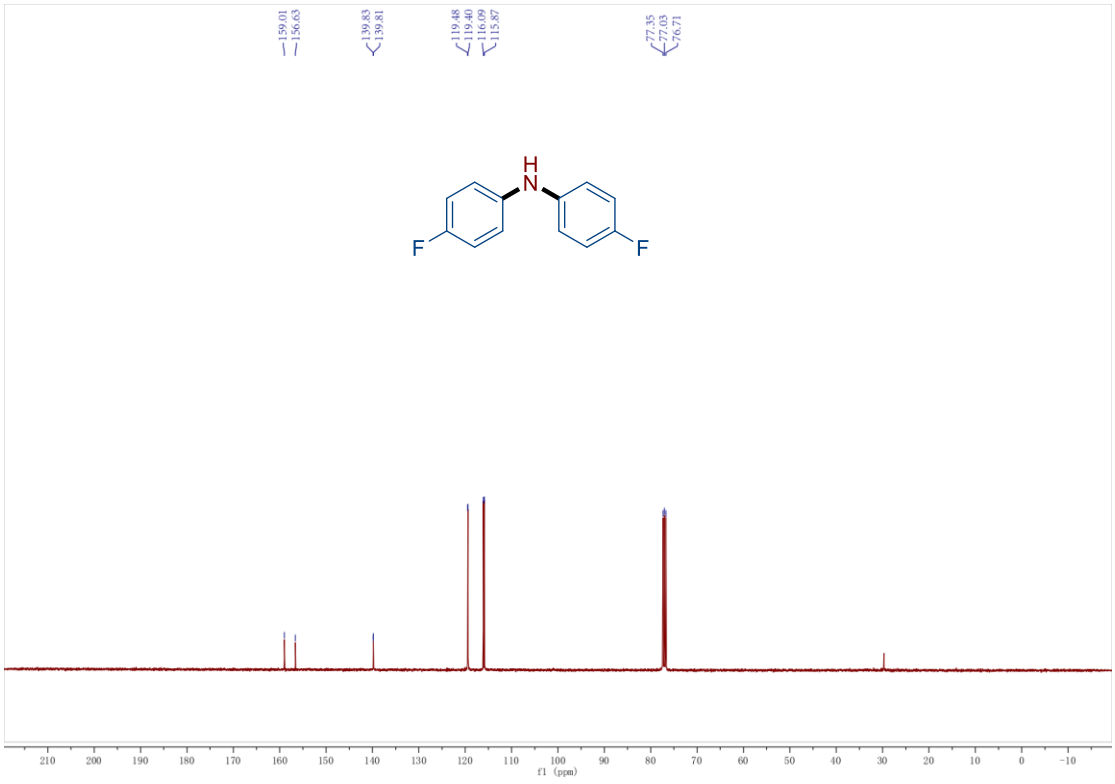
^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$) spectrum of compound **55**



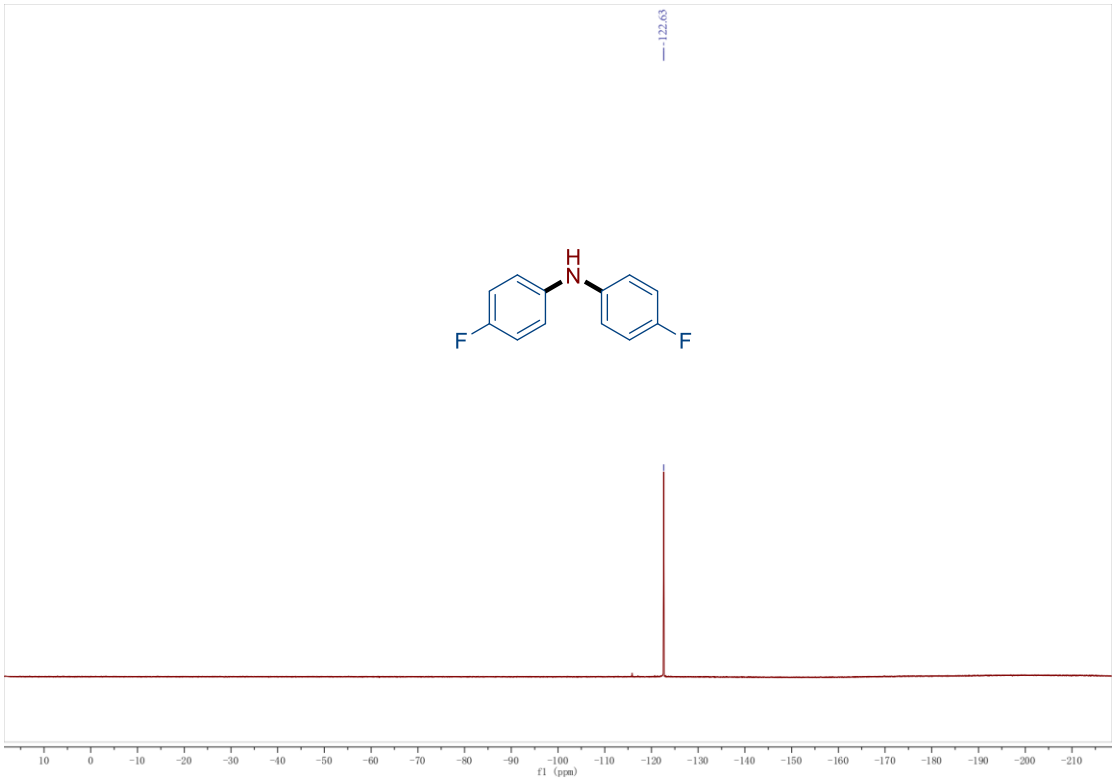
^{1}H NMR (400 MHz, $CDCl_3$) spectrum of compound **56**



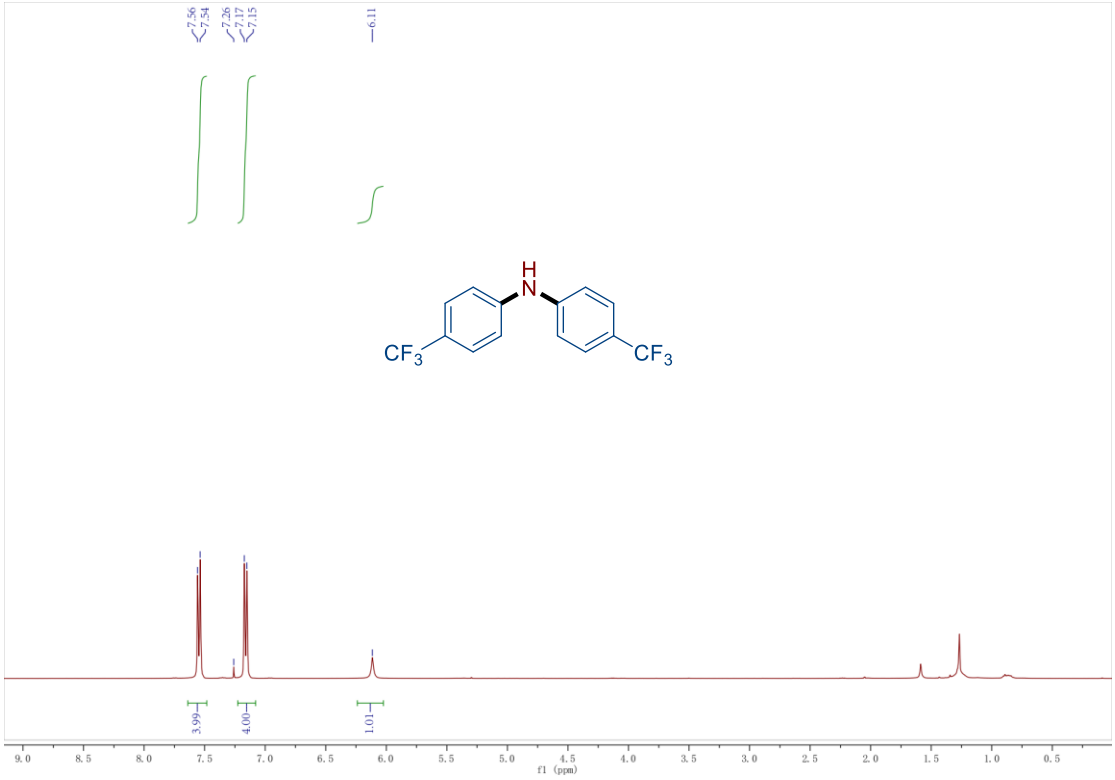
^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$) spectrum of compound **56**



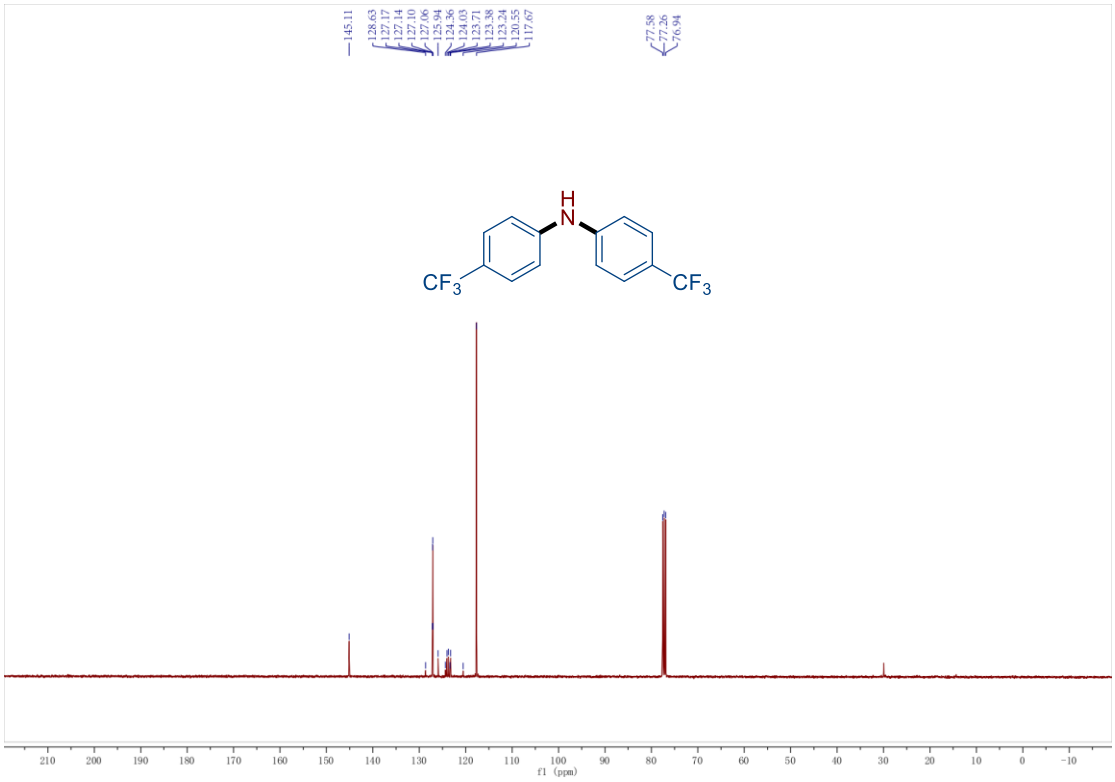
^{19}F NMR (376 MHz, $CDCl_3$) spectrum of compound **56**



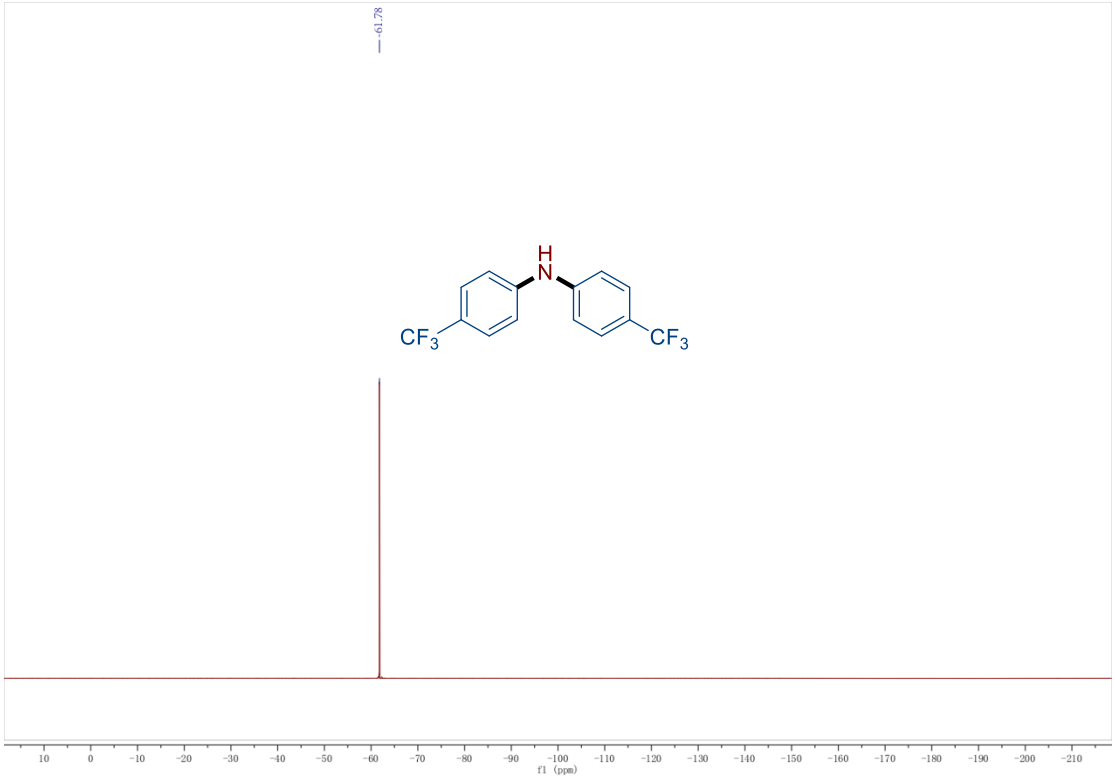
^{1}H NMR (400 MHz, $CDCl_3$) spectrum of compound **57**



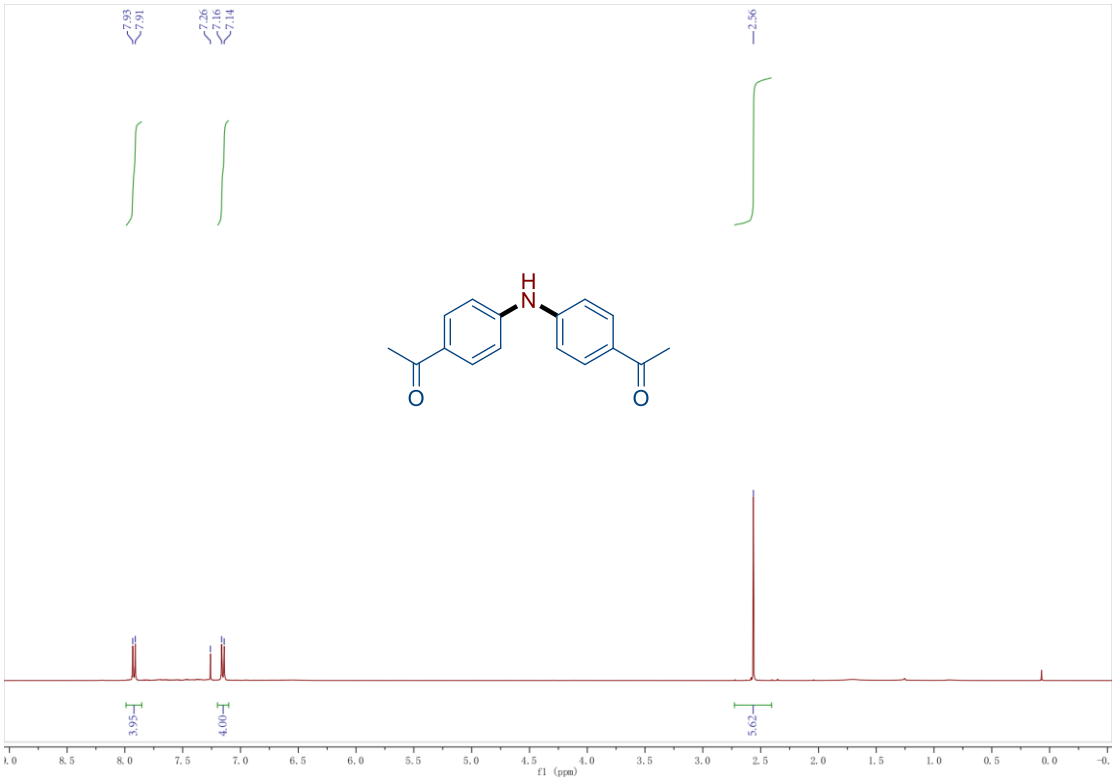
$^{13}C\{^{1}H\}$ NMR (100 MHz, $CDCl_3$) spectrum of compound **57**



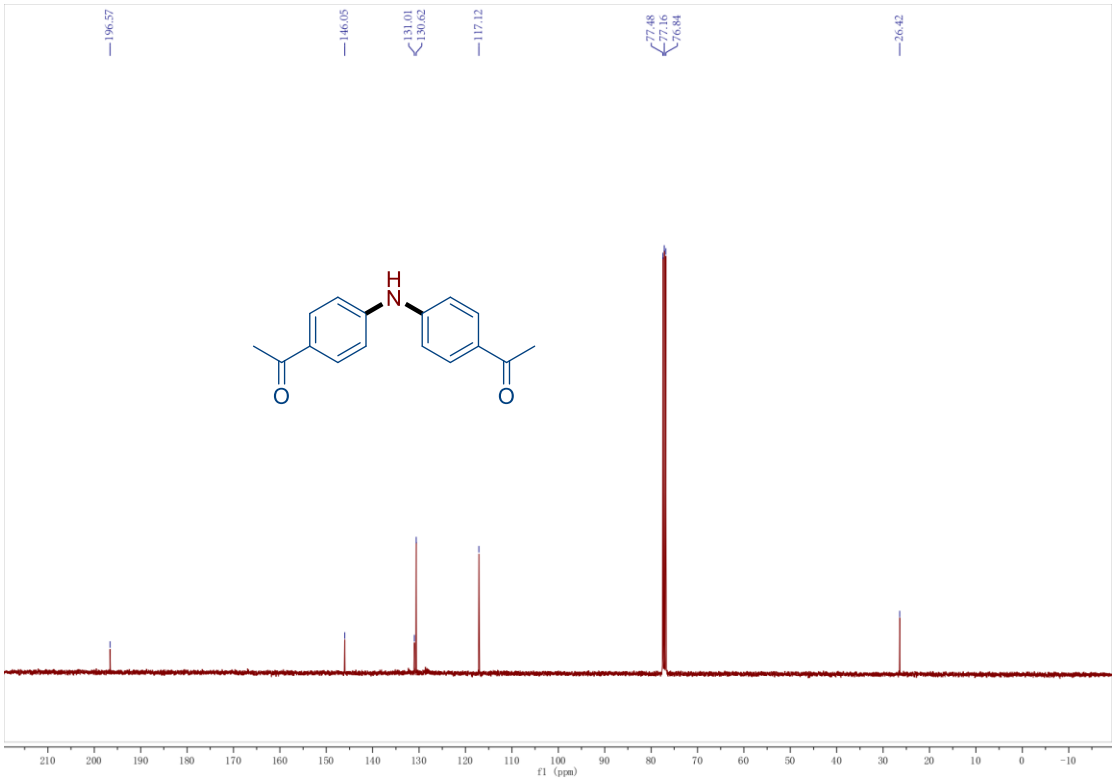
^{19}F NMR (376 MHz, $CDCl_3$) spectrum of compound **57**



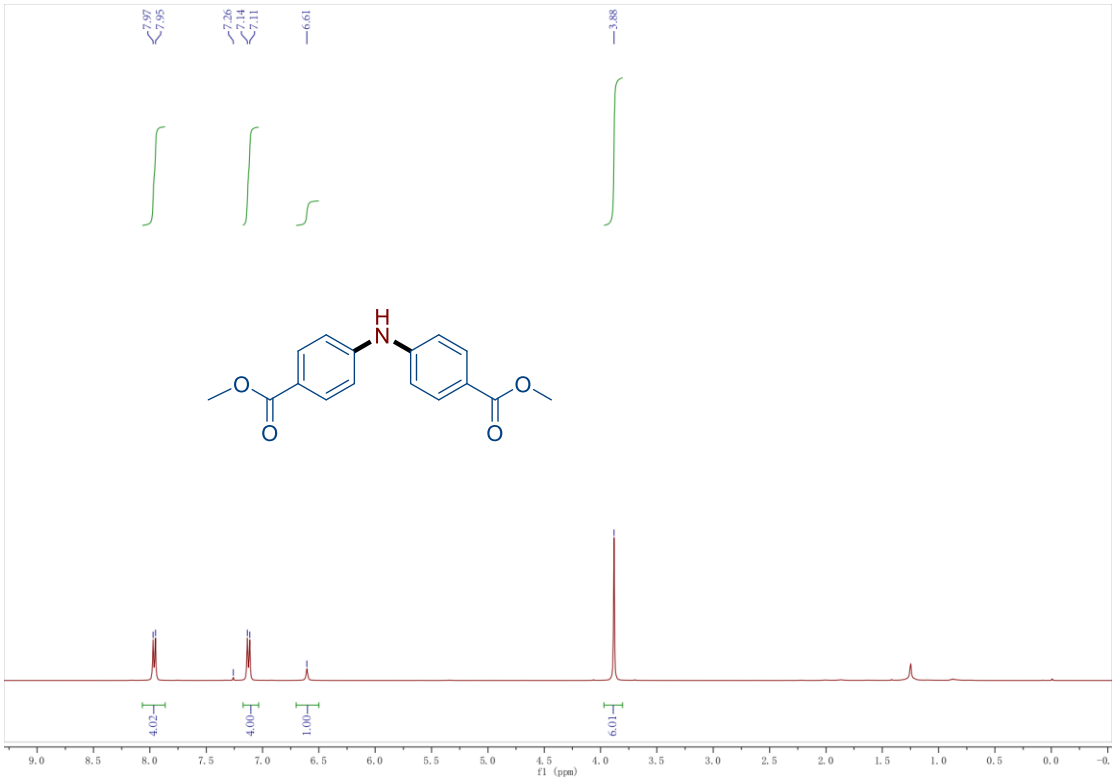
^{1}H NMR (400 MHz, $CDCl_3$) spectrum of compound **58**



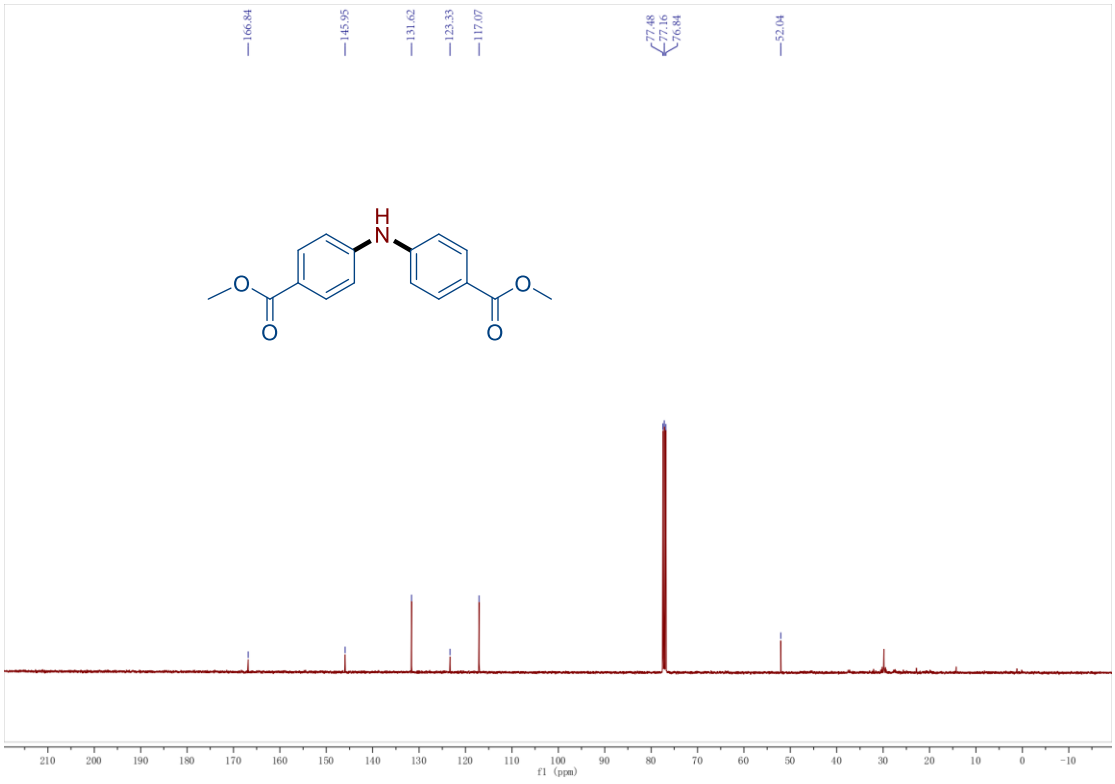
^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$) spectrum of compound **58**



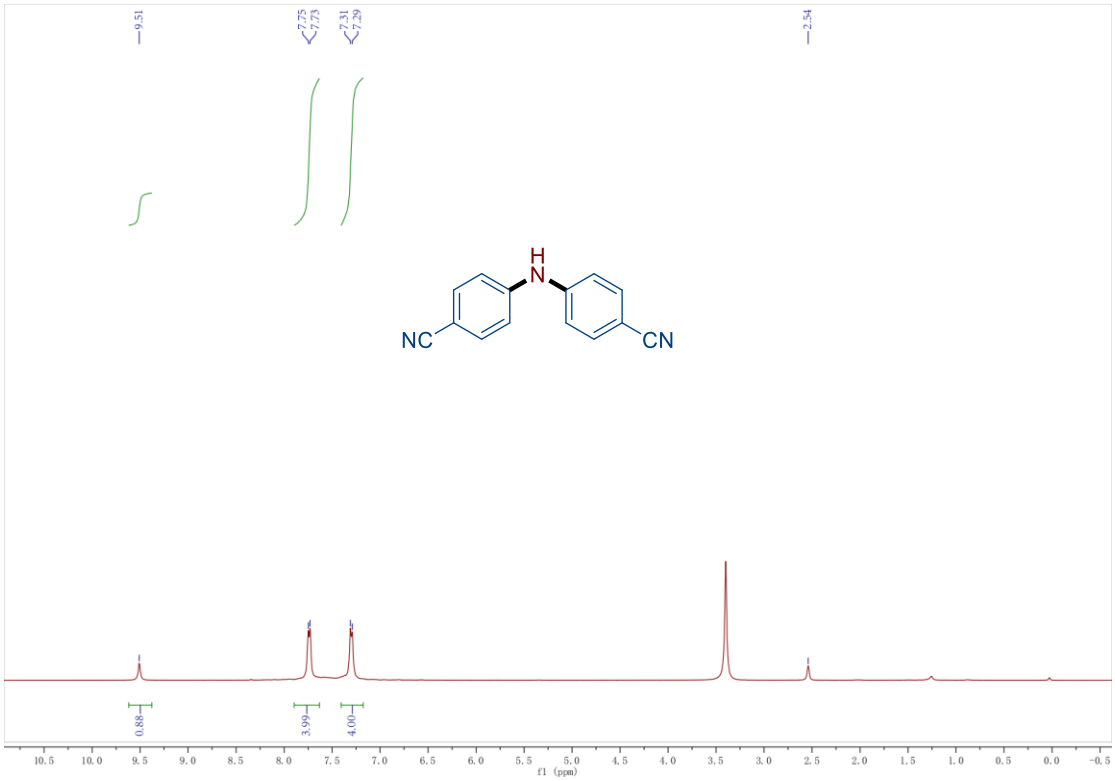
^{1}H NMR (400 MHz, $CDCl_3$) spectrum of compound **44**



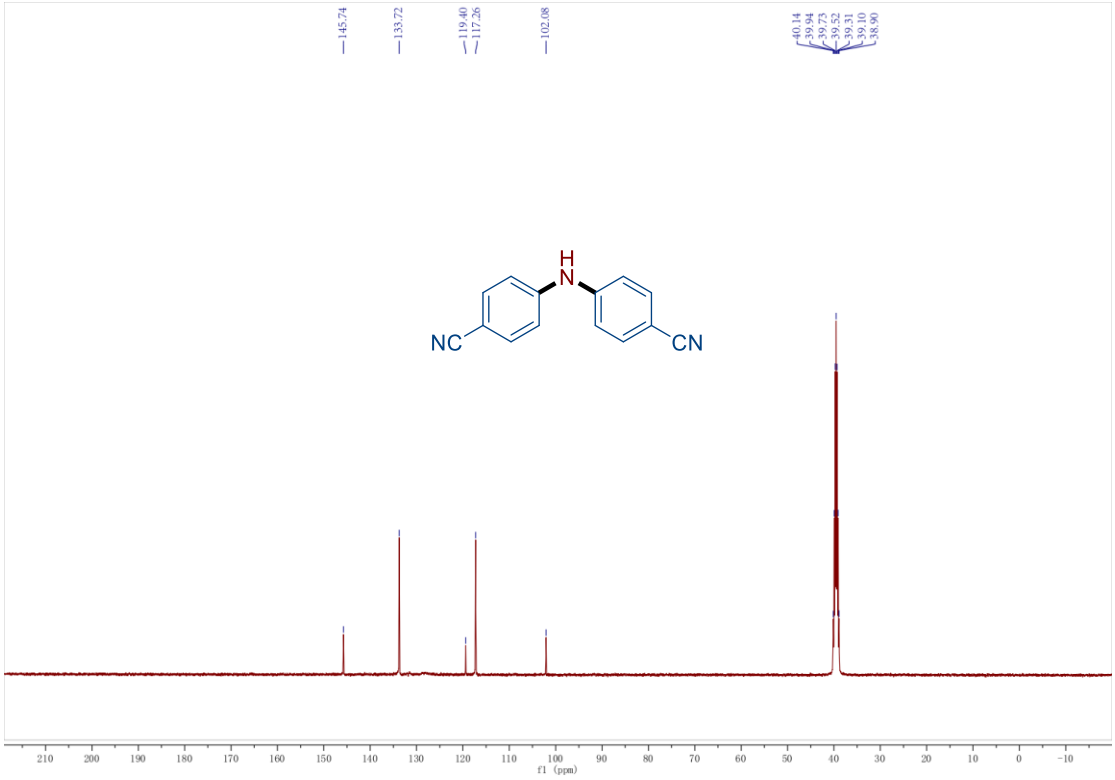
^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$) spectrum of compound **44**



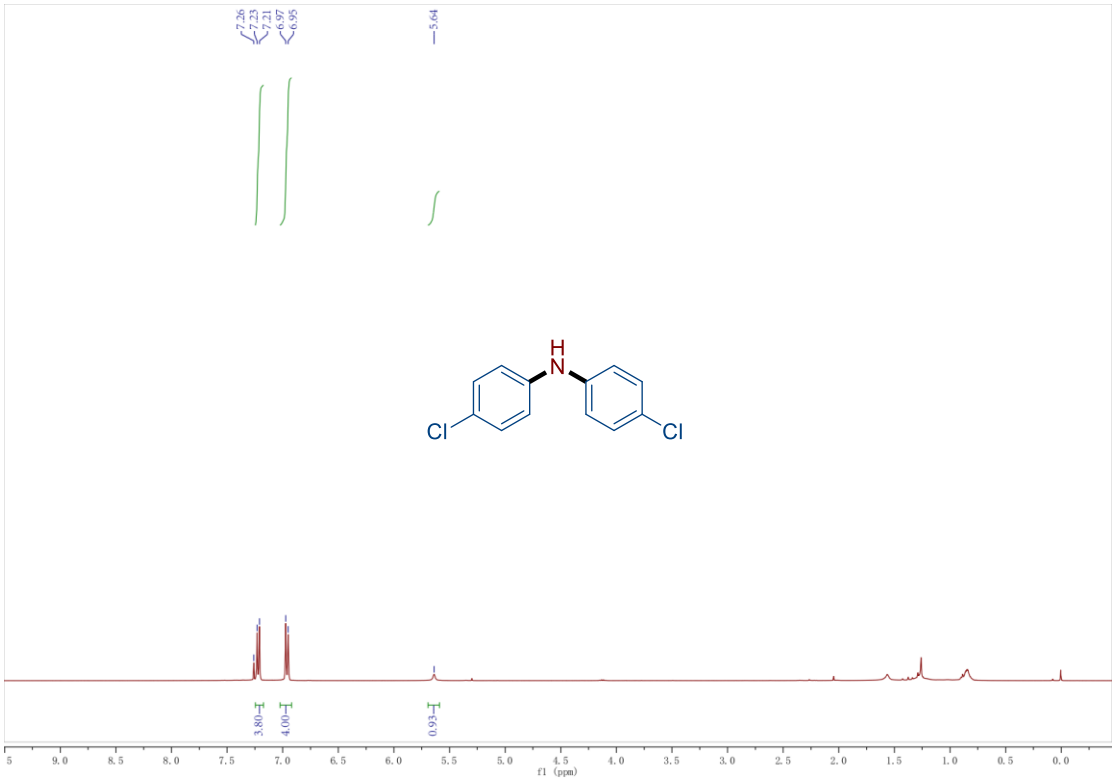
^{1}H NMR (400 MHz, DMSO-d_6) spectrum of compound **59**



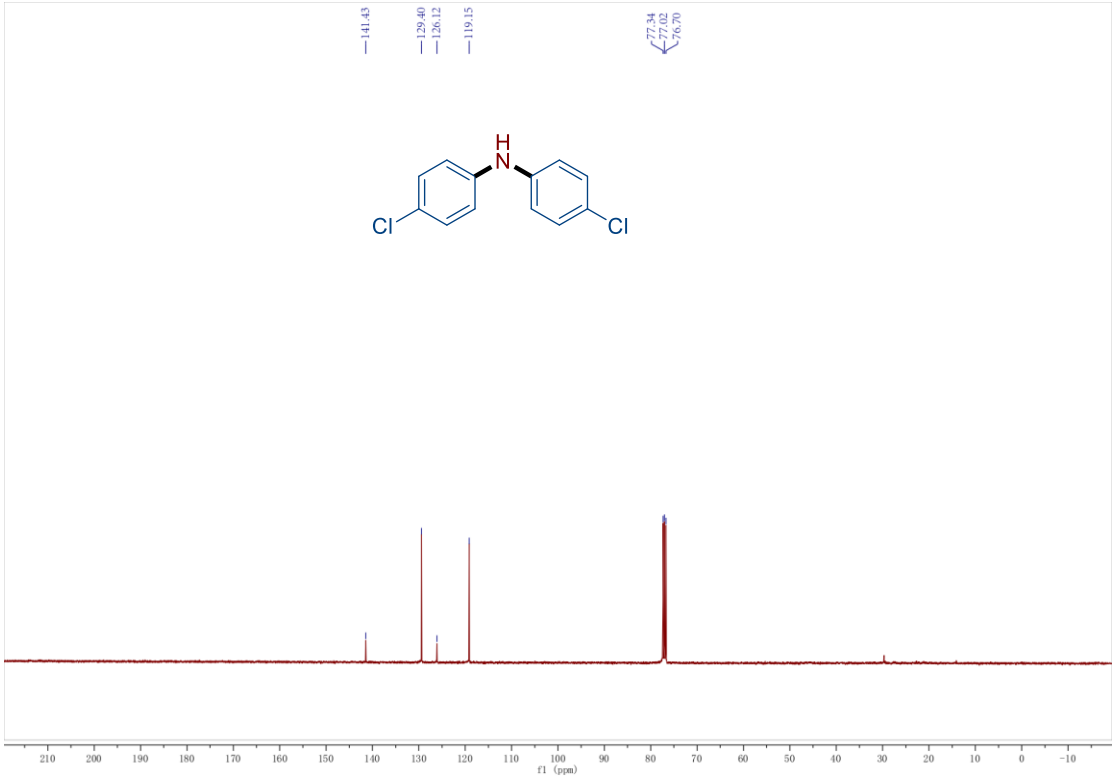
^{13}C{^{1}H} NMR (100 MHz, DMSO-d_6) spectrum of compound **59**



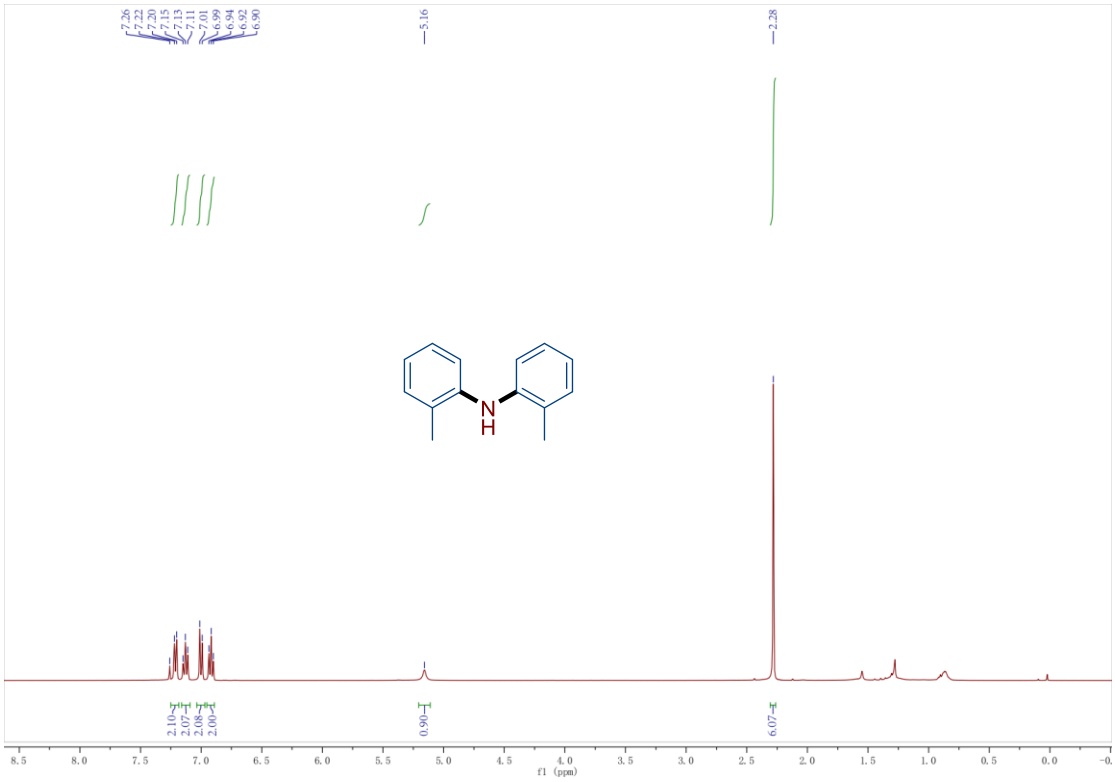
^{1}H NMR (400 MHz, $CDCl_3$) spectrum of compound **60**



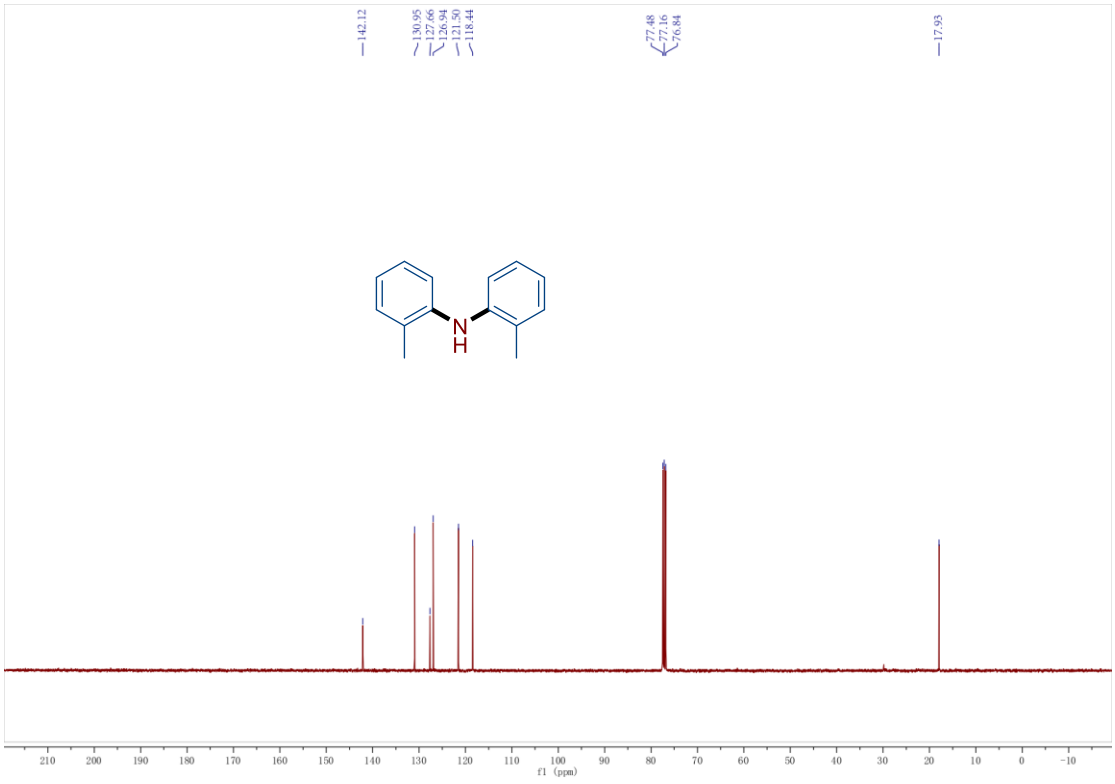
^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$) spectrum of compound **60**



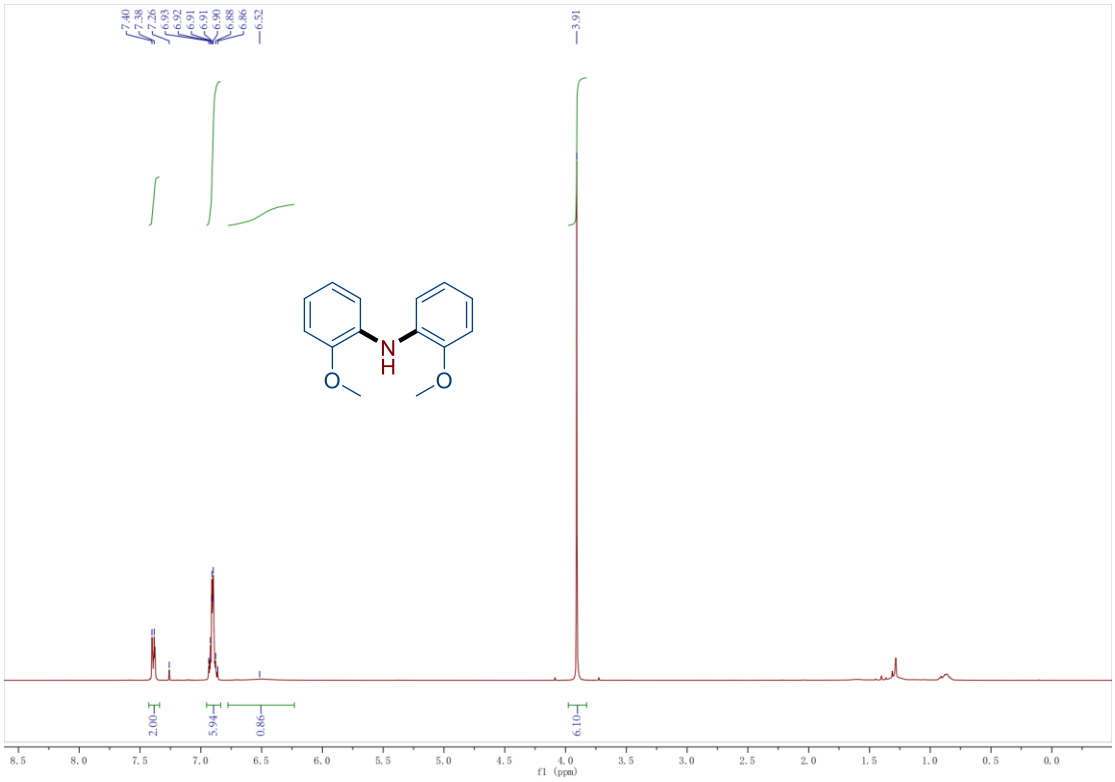
^{1}H NMR (400 MHz, $CDCl_3$) spectrum of compound **61**



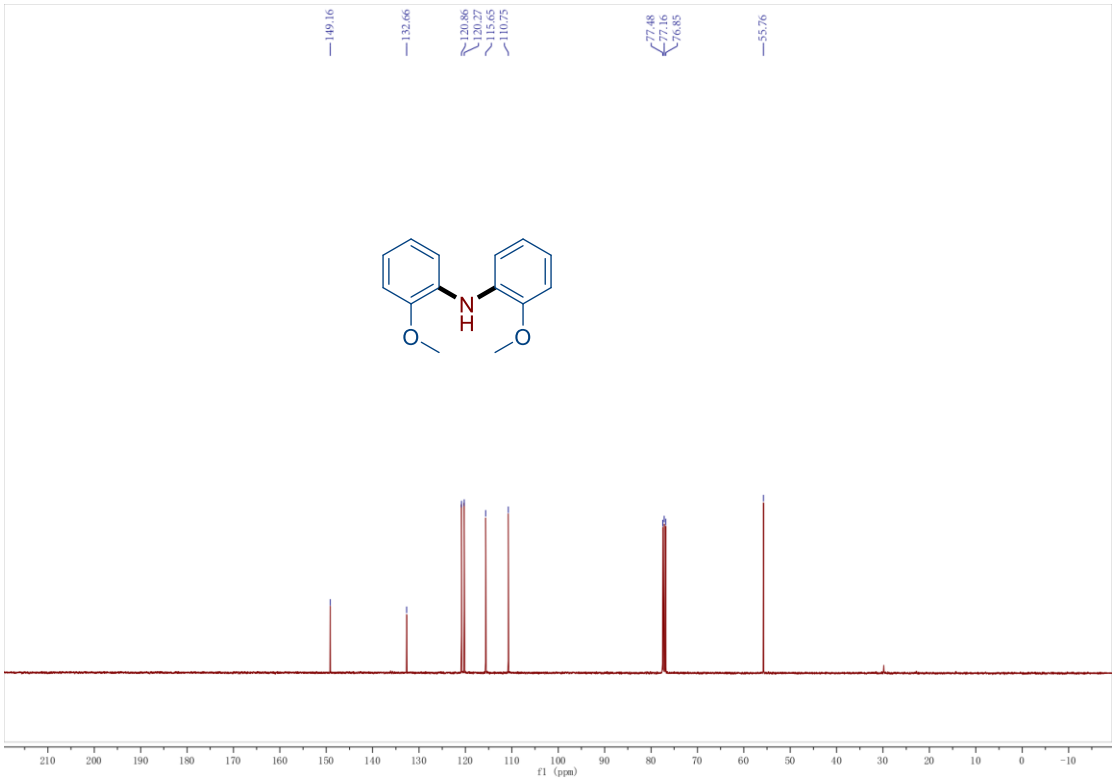
^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$) spectrum of compound **61**



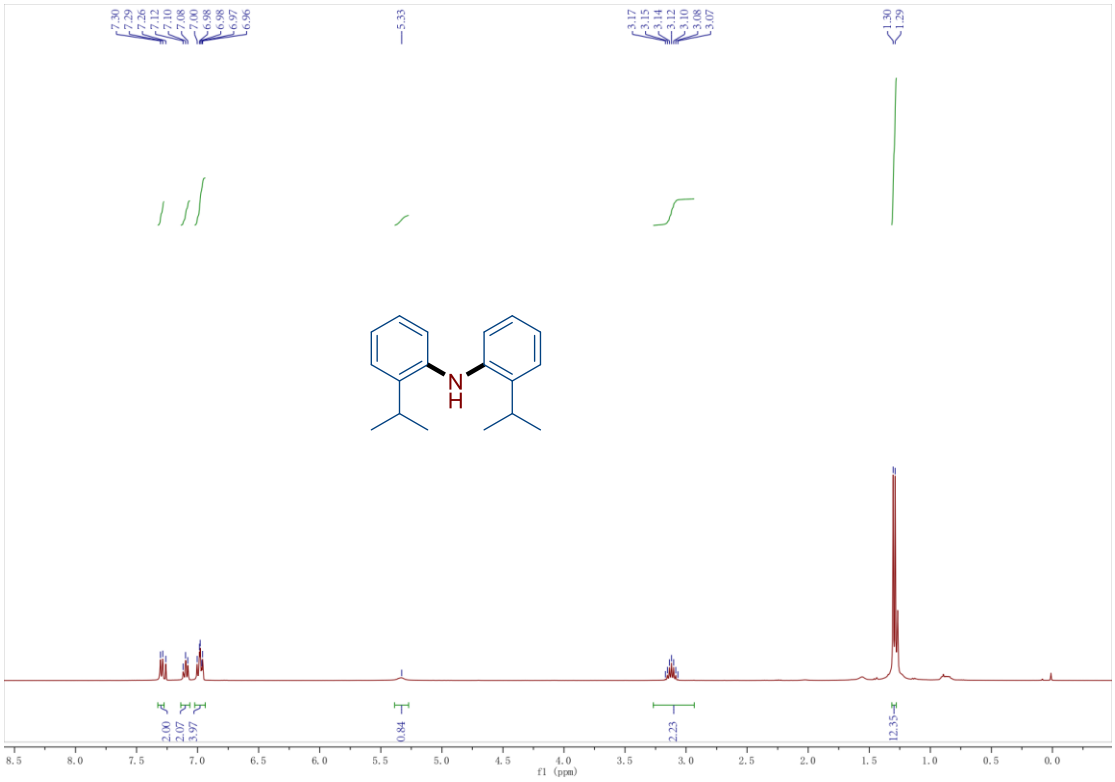
^{1}H NMR (400 MHz, $CDCl_3$) spectrum of compound **62**



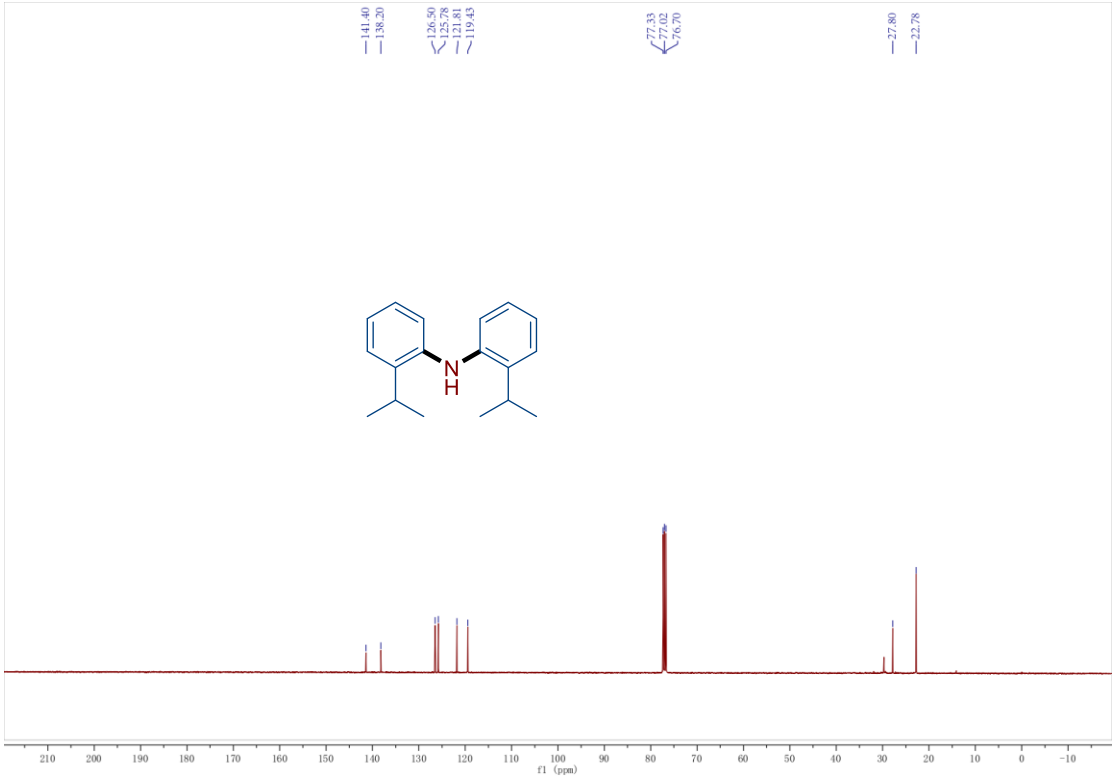
^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$) spectrum of compound **62**



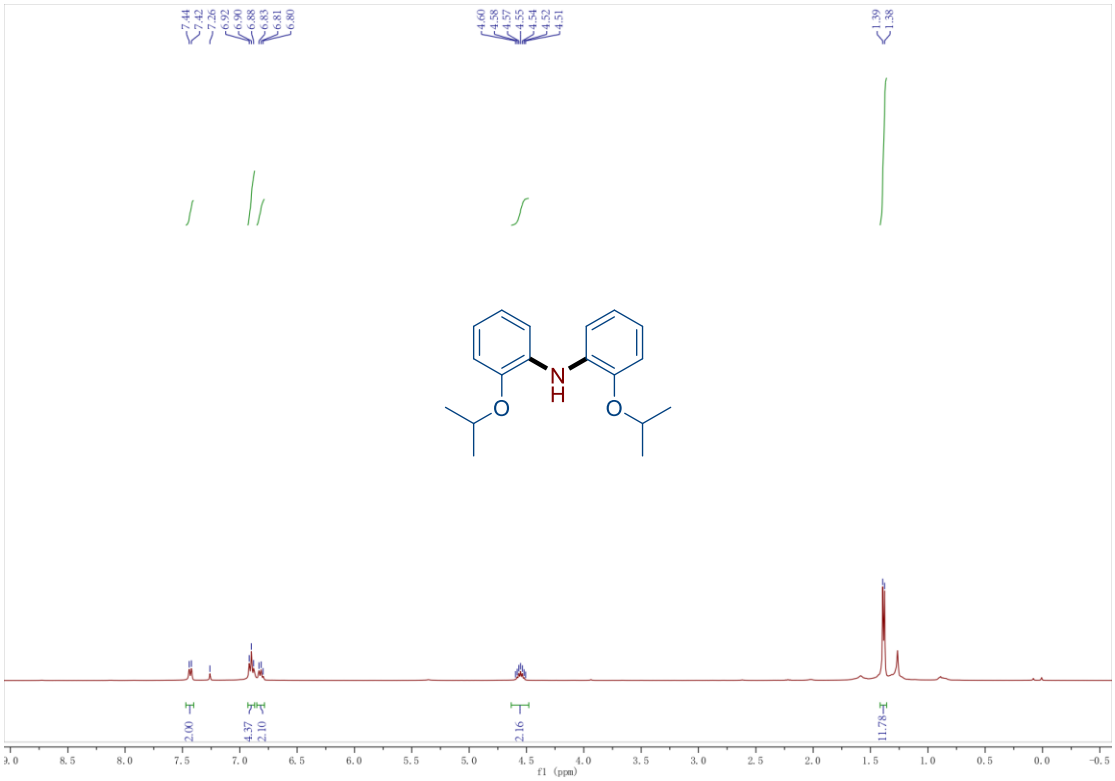
^{1}H NMR (400 MHz, $CDCl_3$) spectrum of compound **63**



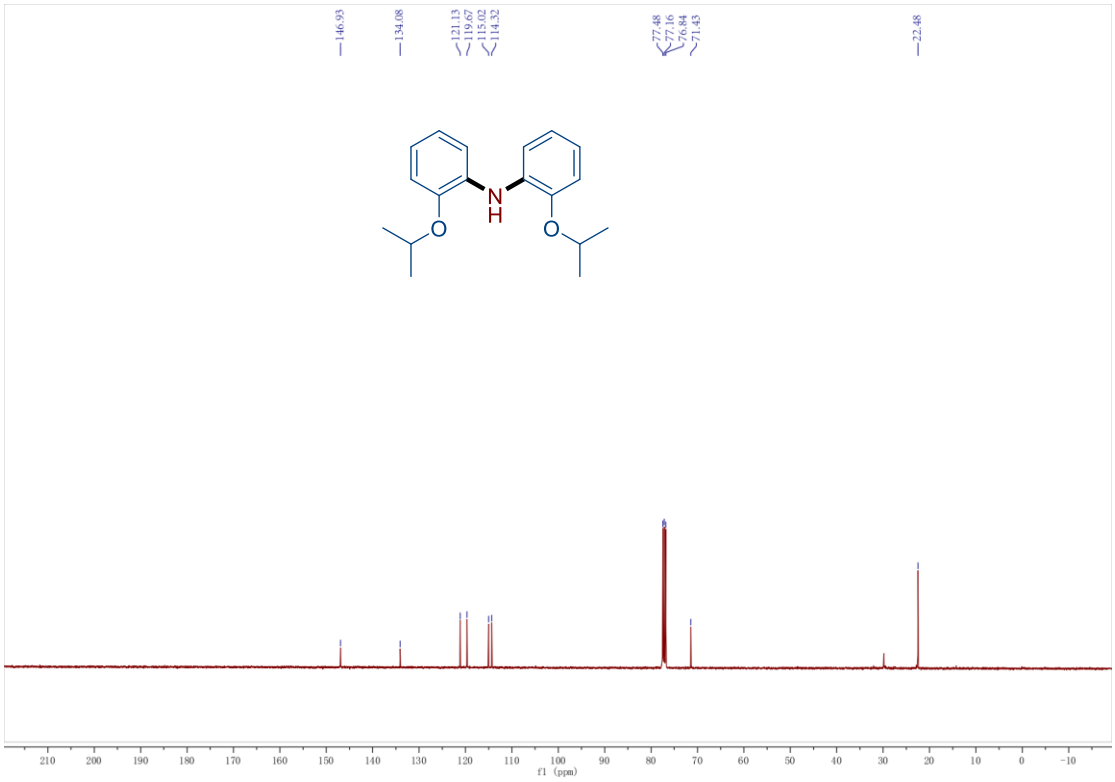
^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$) spectrum of compound **63**



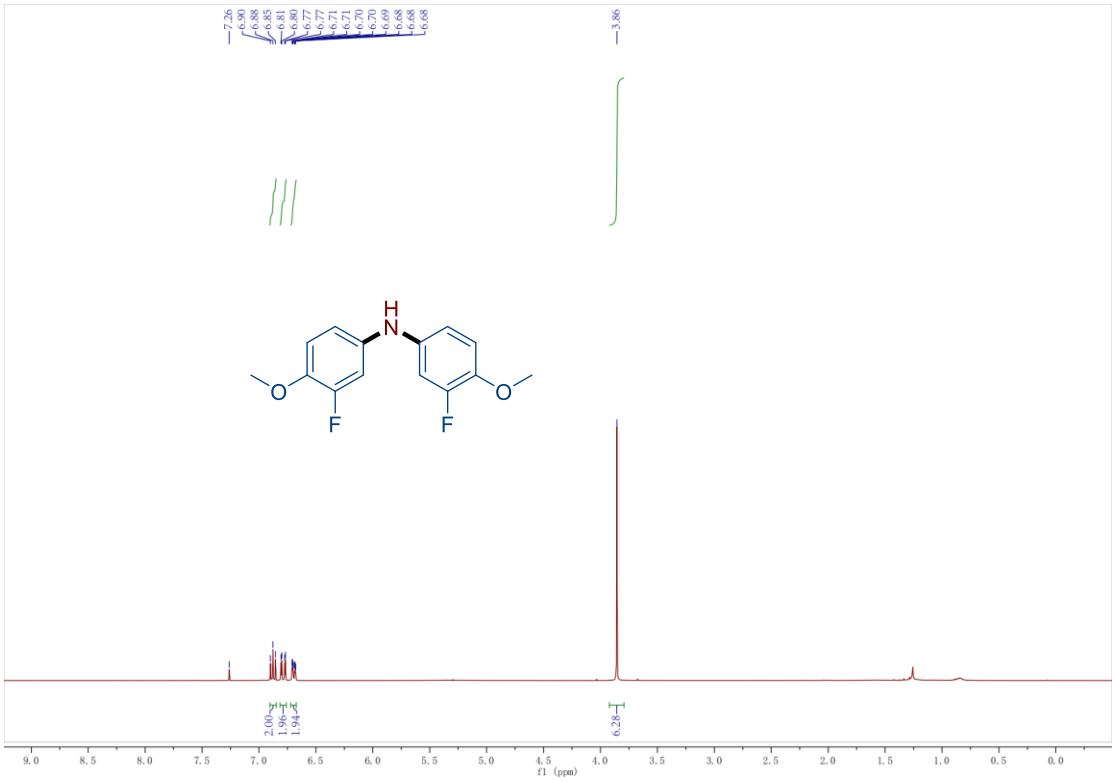
^{1}H NMR (400 MHz, $CDCl_3$) spectrum of compound **64**



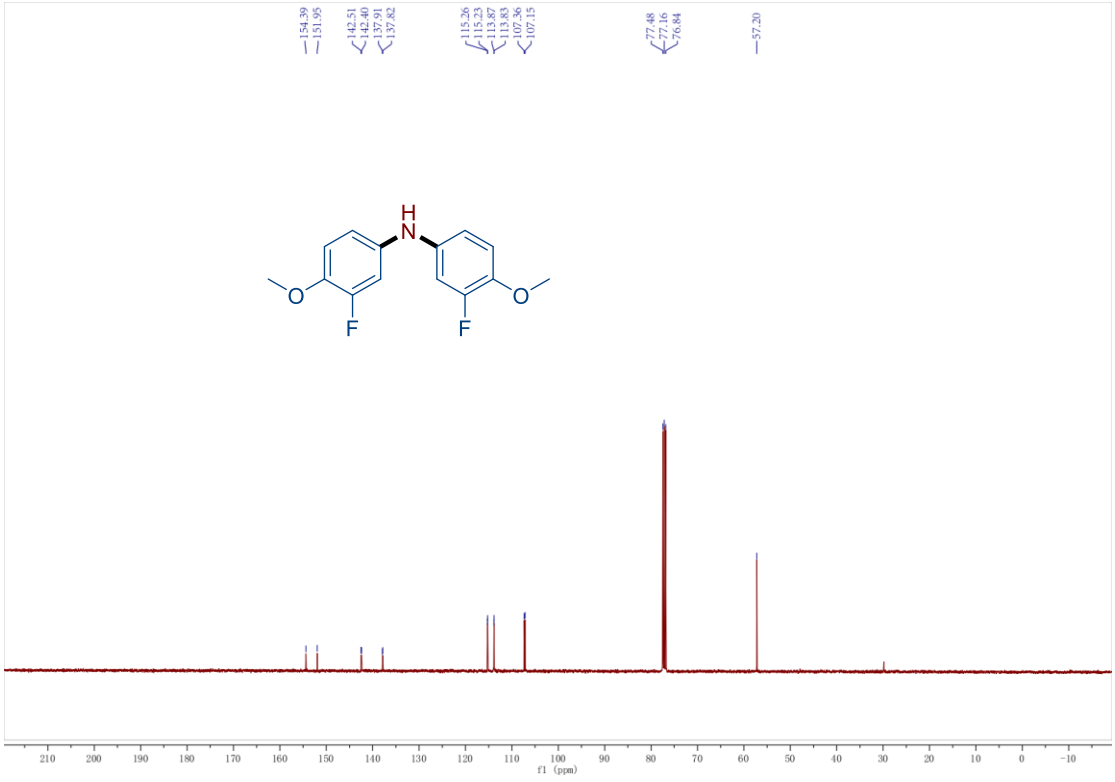
^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$) spectrum of compound **64**



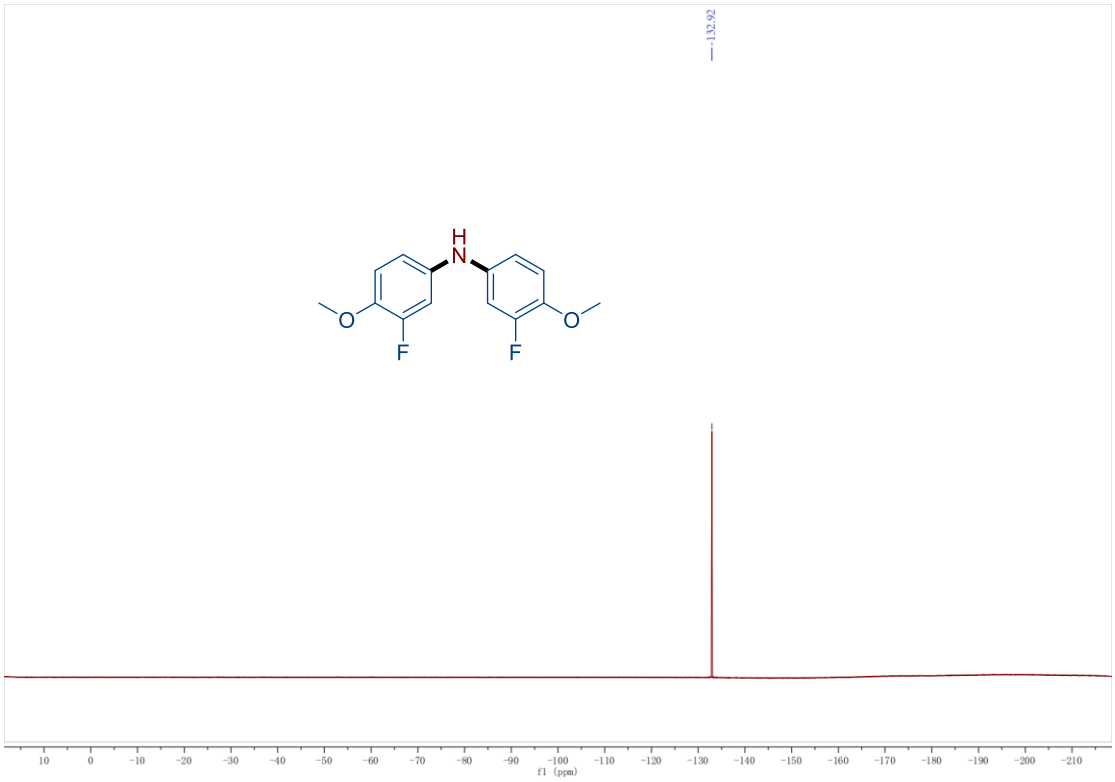
^{1}H NMR (400 MHz, $CDCl_3$) spectrum of compound **65**



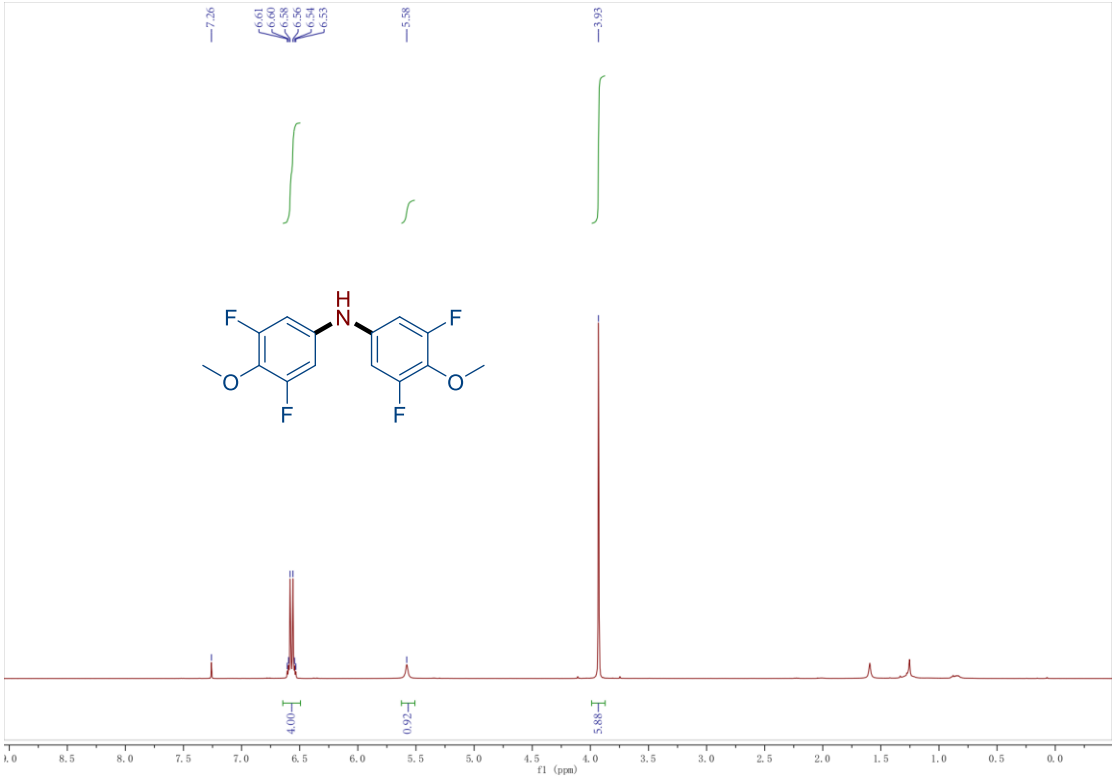
^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$) spectrum of compound **65**



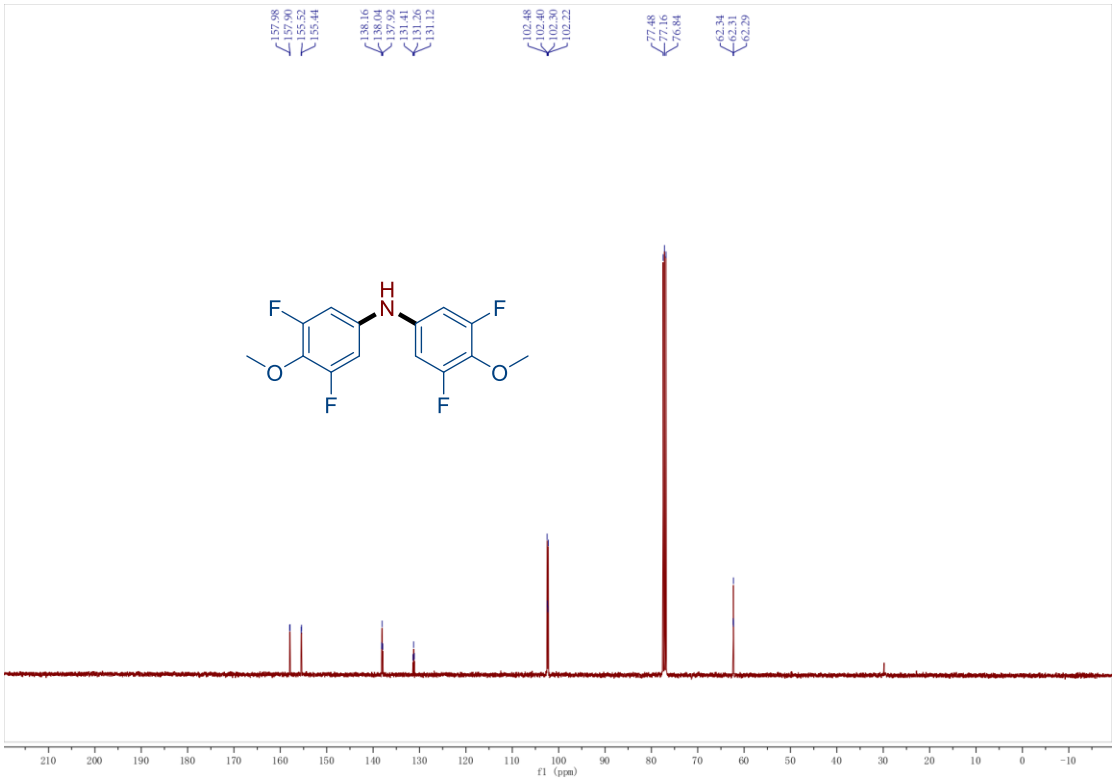
^{19}F NMR (376MHz, $CDCl_3$) spectrum of compound **65**



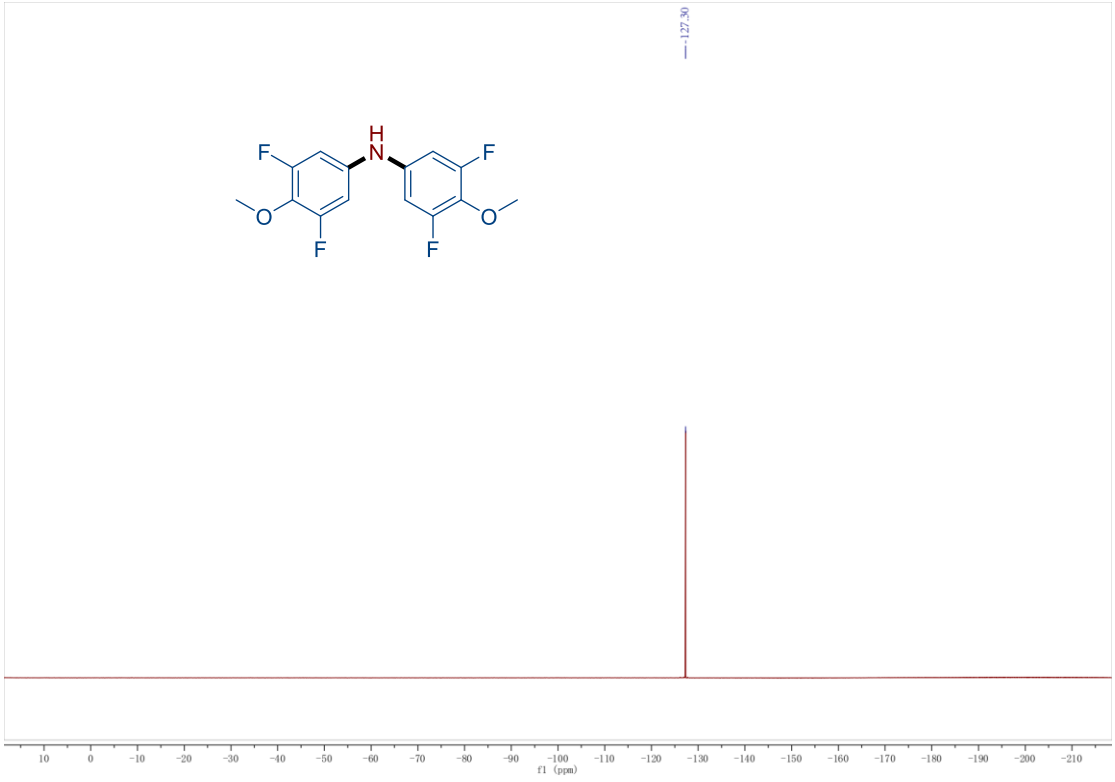
^{1}H NMR (400 MHz, $CDCl_3$) spectrum of compound **66**



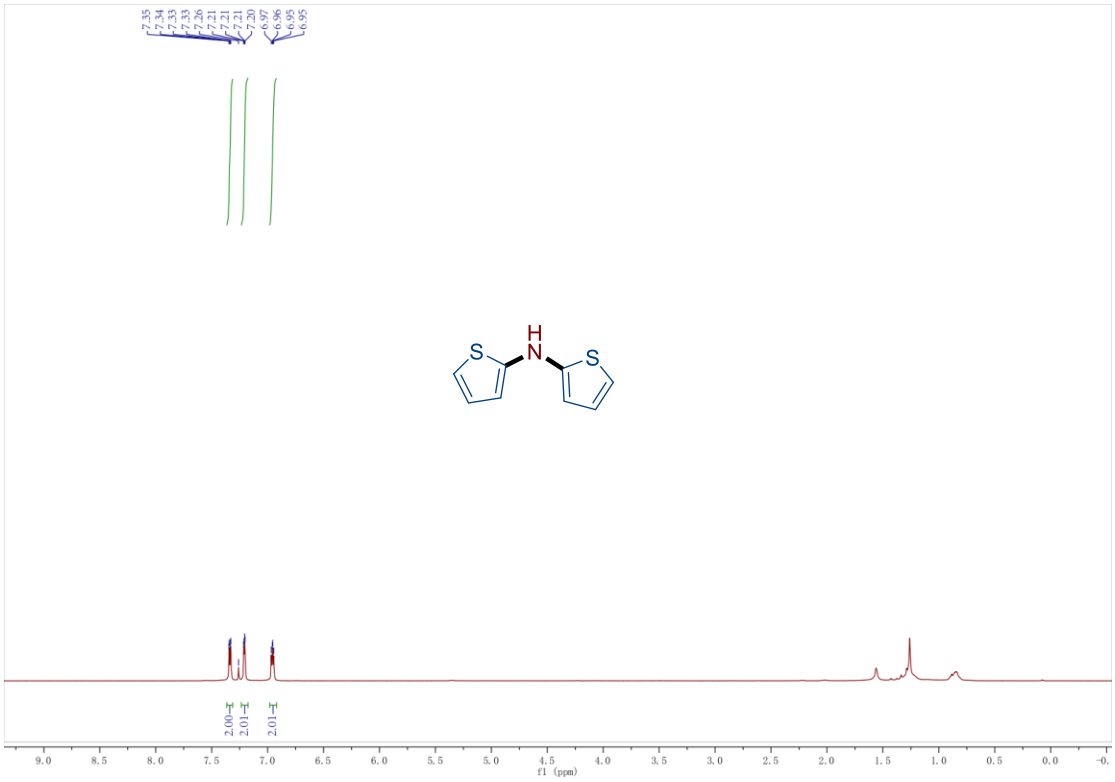
$^{13}C\{^{1}H\}$ NMR (100 MHz, $CDCl_3$) spectrum of compound **66**



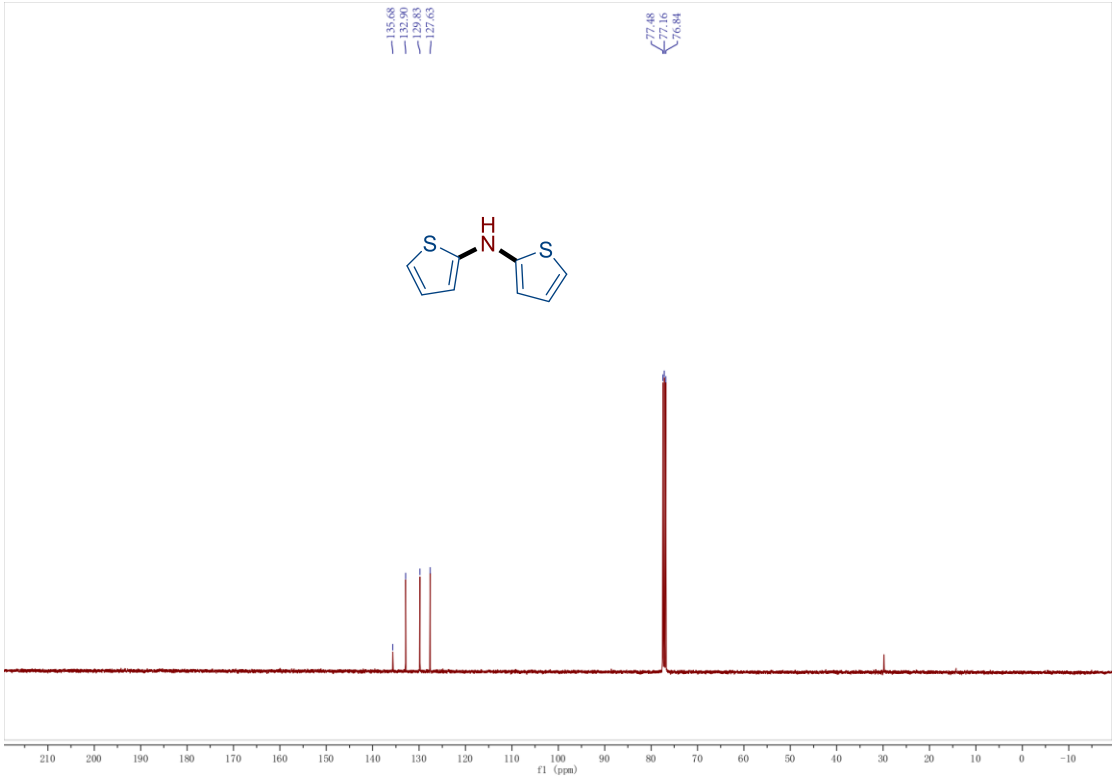
^{19}F NMR (376 MHz, $CDCl_3$) spectrum of compound **66**



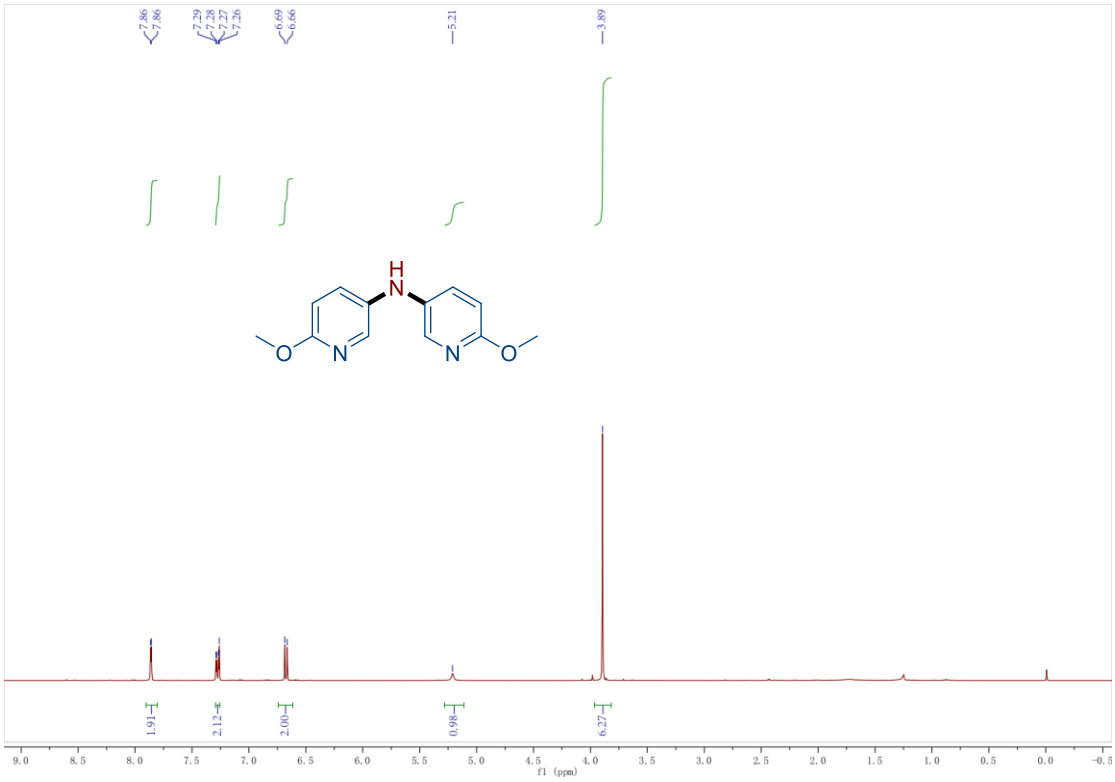
^{1}H NMR (400 MHz, $CDCl_3$) spectrum of compound **67**



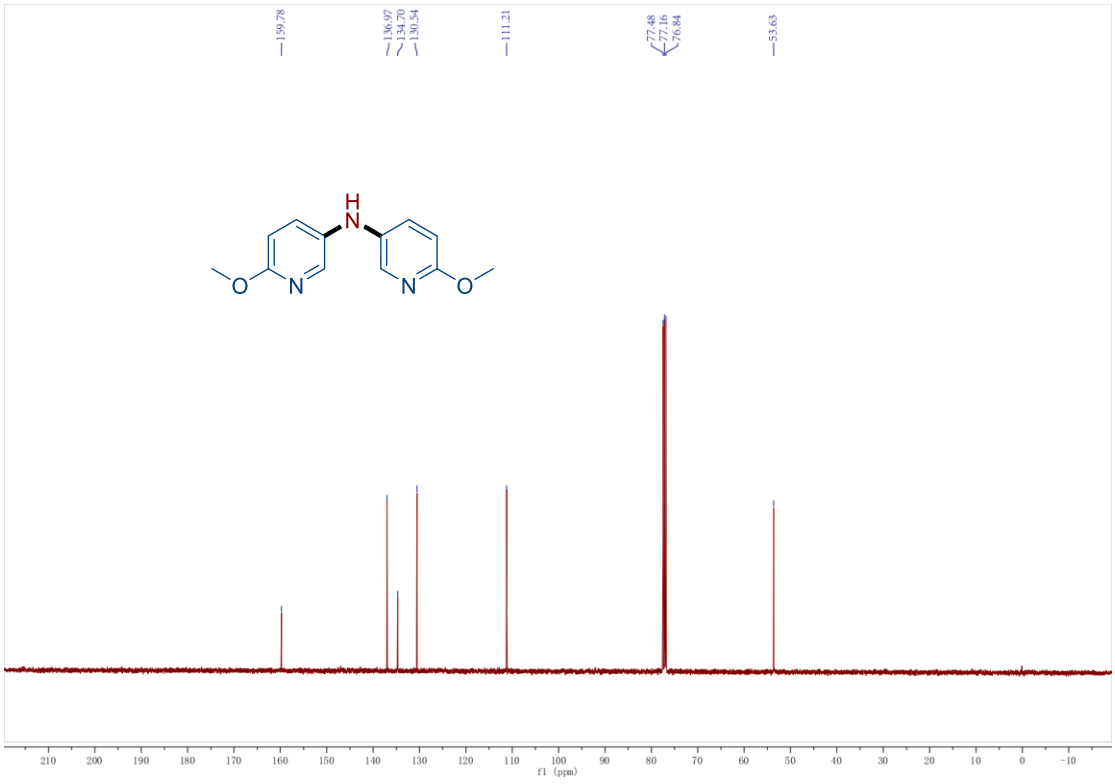
^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$) spectrum of compound **67**



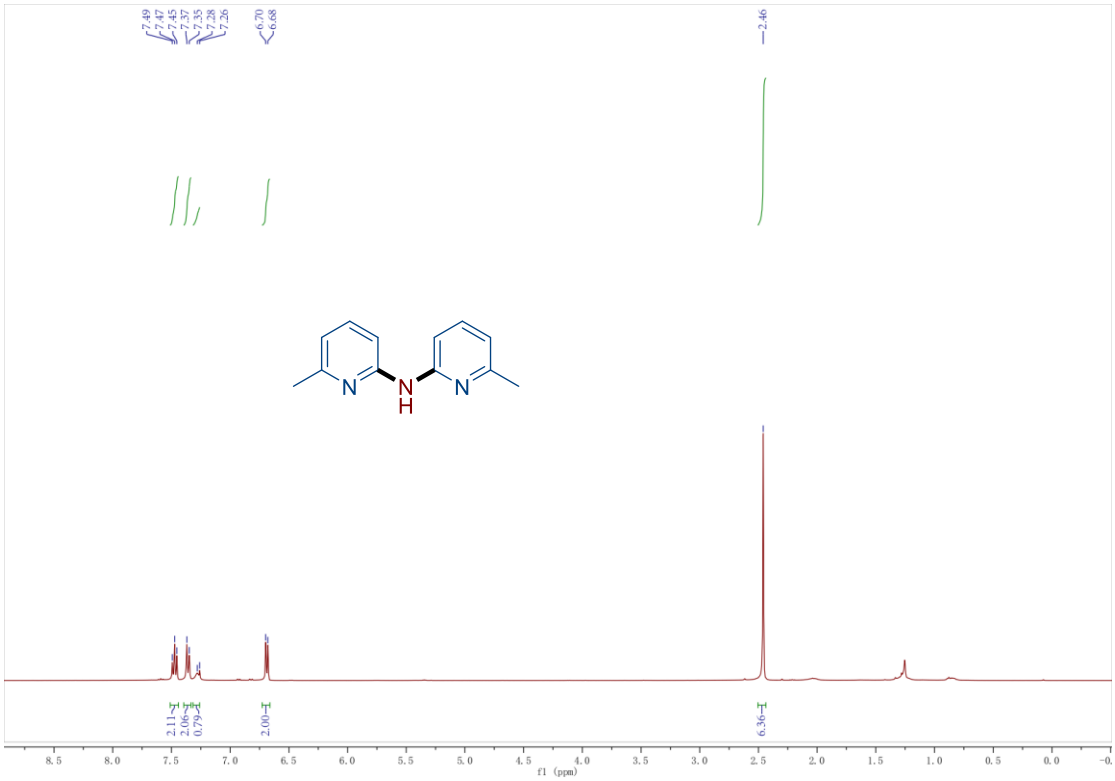
^{1}H NMR (400 MHz, $CDCl_3$) spectrum of compound **68**



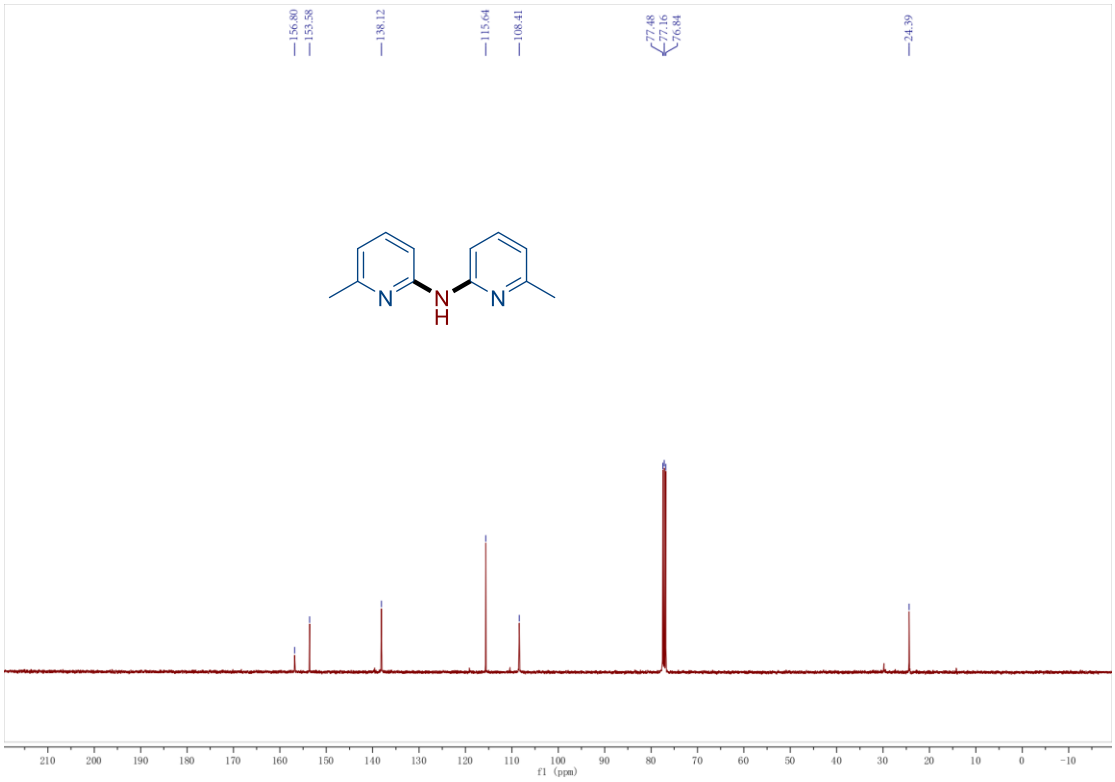
^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$) spectrum of compound **68**



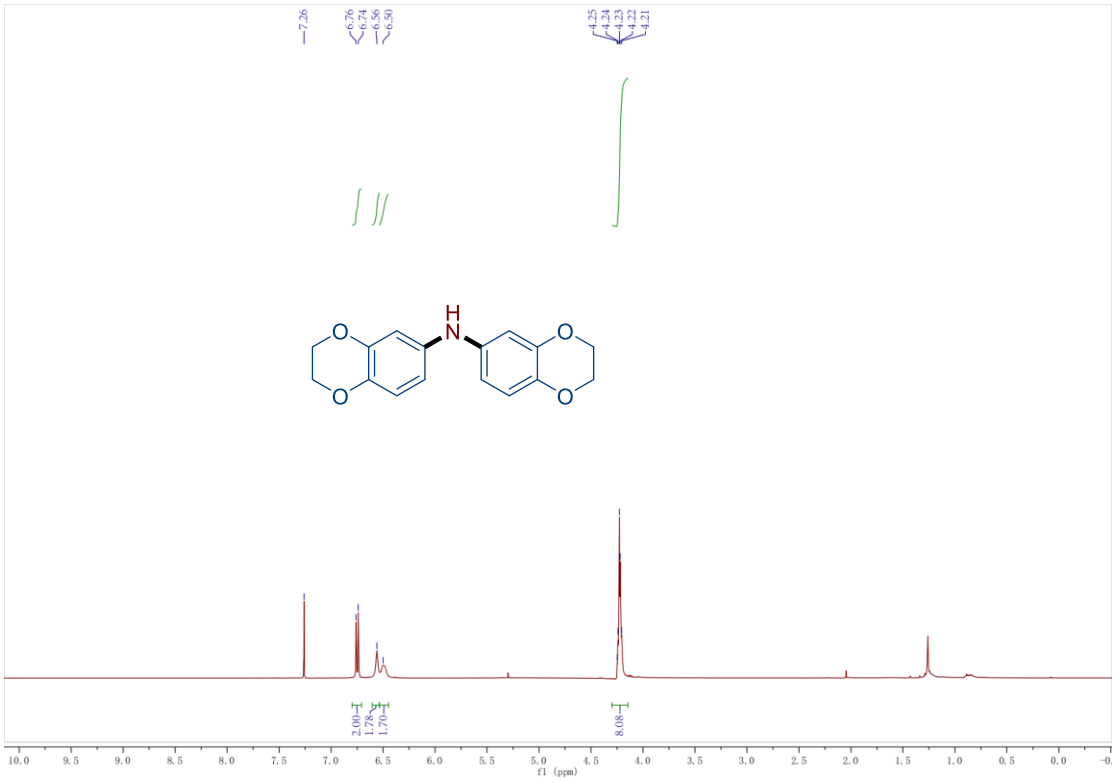
^{1}H NMR (400 MHz, $CDCl_3$) spectrum of compound **69**



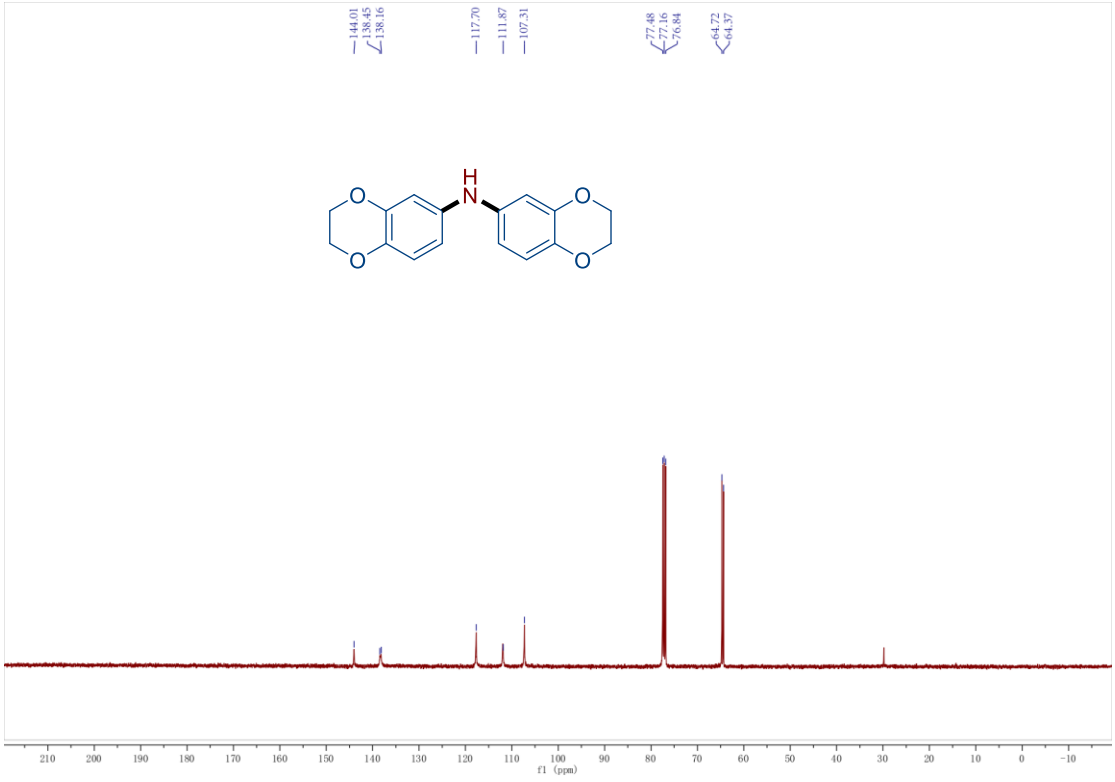
^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$) spectrum of compound **69**



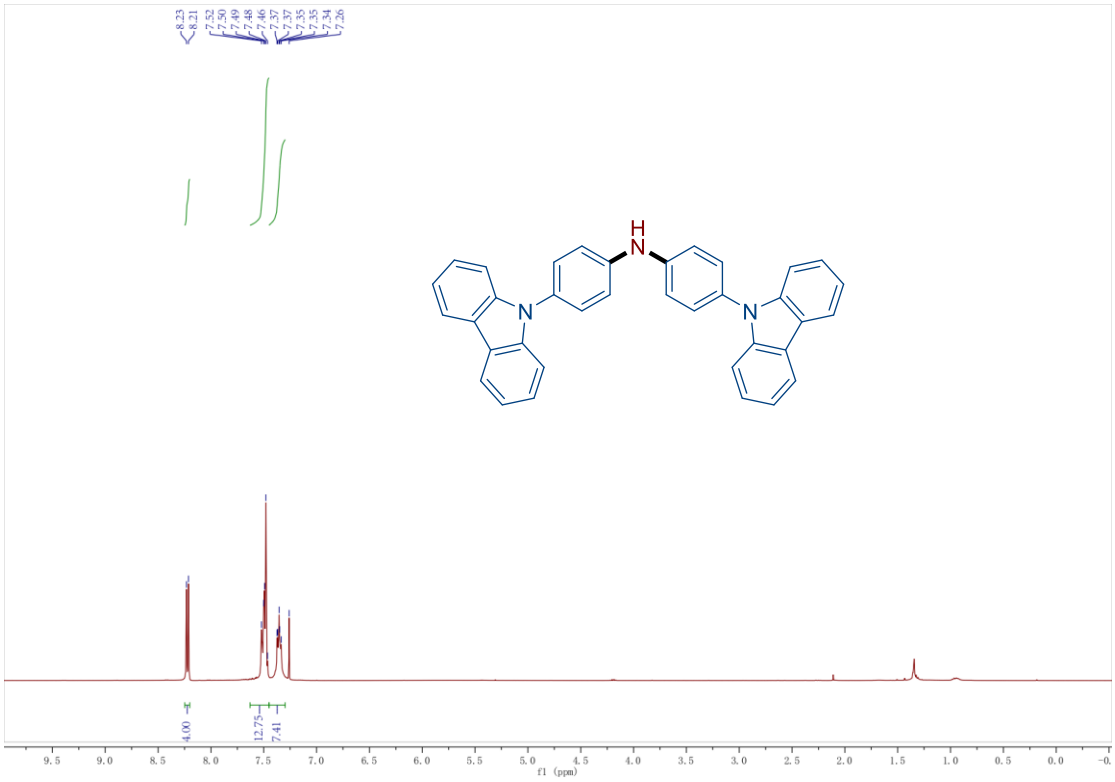
^{1}H NMR (400 MHz, $CDCl_3$) spectrum of compound **70**



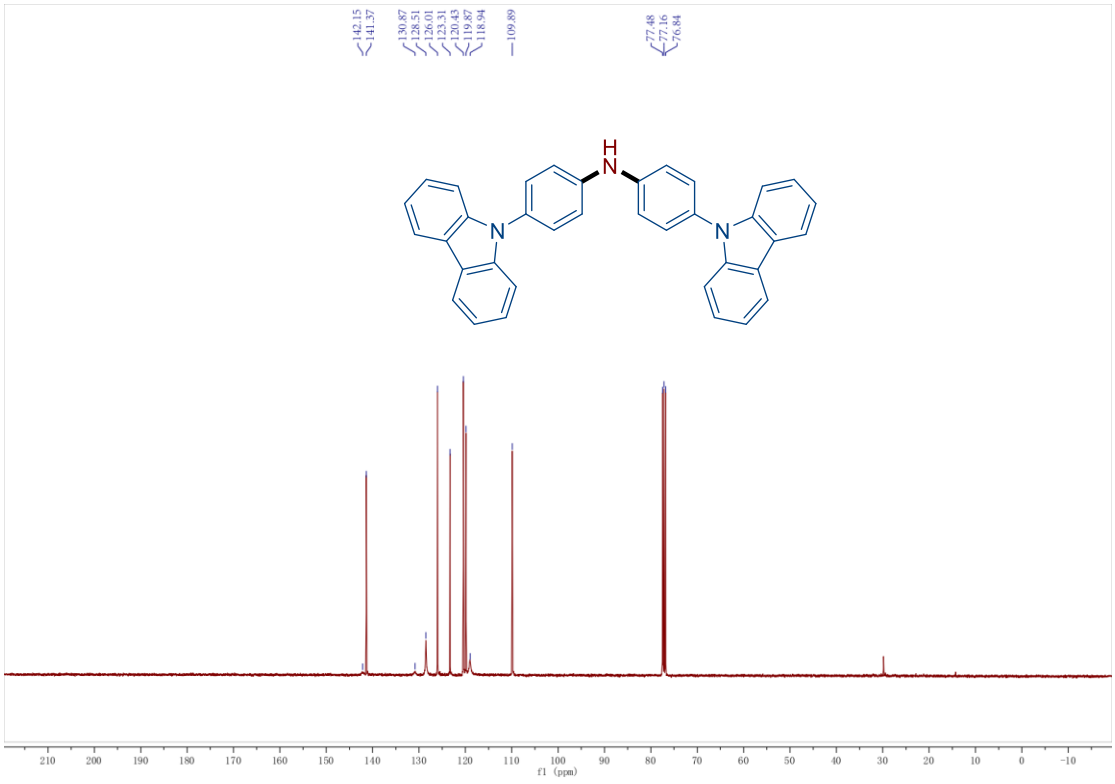
^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$) spectrum of compound **70**



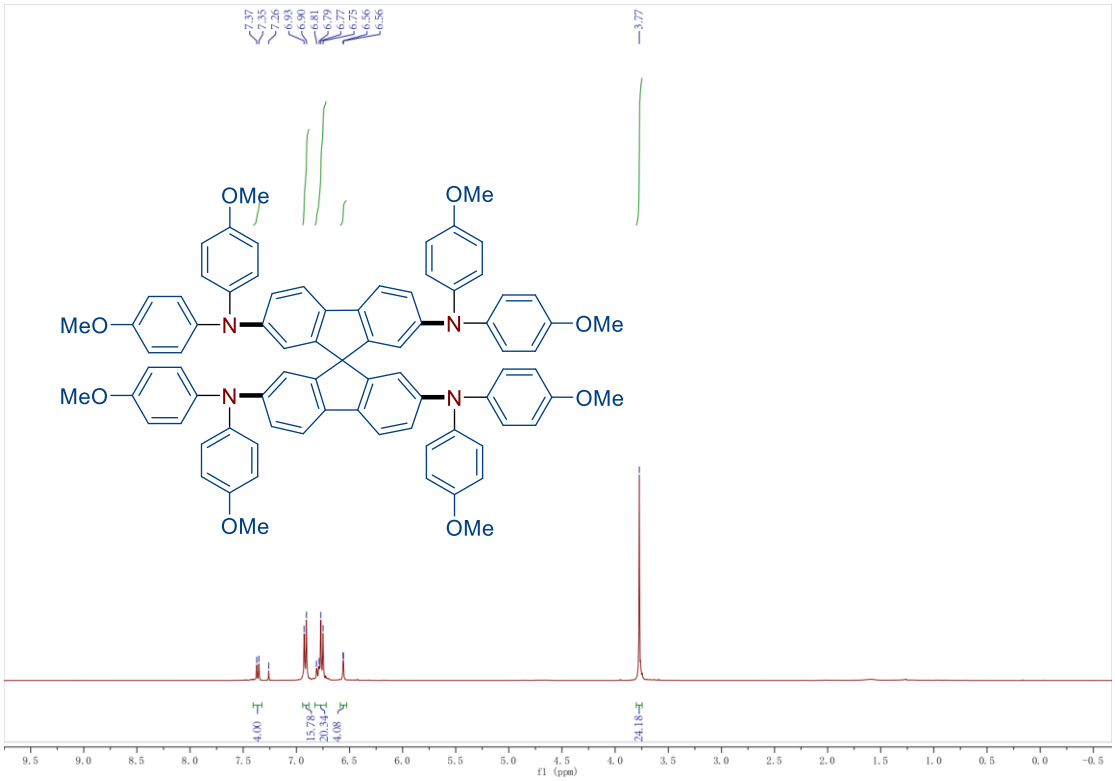
^{1}H NMR (400 MHz, $CDCl_3$) spectrum of compound **71**



^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$) spectrum of compound **71**



^{1}H NMR (400 MHz, $CDCl_3$) spectrum of compound **74**



^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$) spectrum of compound **74**