Supporting Information

Palladium-catalyzed reductive coupling of phenols with anilines and amines: efficient conversion of phenolic lignin model monomers and analogues to cyclohexylamines

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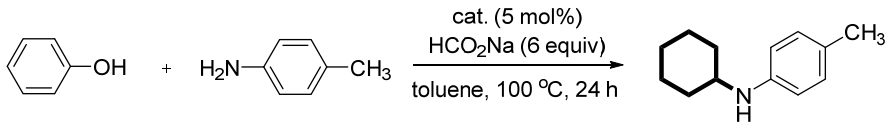
A. General method

^{1}H and ^{13}C NMR spectra were obtained on a 500 MHz NMR spectrometer. The chemical shifts are referenced to signals at 7.26 and 77.0 ppm, respectively, using chloroform as solvent with TMS as the internal standard unless otherwise noted. Mass spectra were recorded on a GC-MS spectrometer at an ionization voltage of 70 eV equipped with a DB-WAX capillary column (internal diameter: 0.25 mm, length: 30 m). Silica gel (300-400 mesh) was used for flash column chromatograph, eluting (unless otherwise stated) with an ethyl acetate/petroleum ether (PE) (60-90 ^{o}C) mixture.

B. Optimization of the reaction conditions

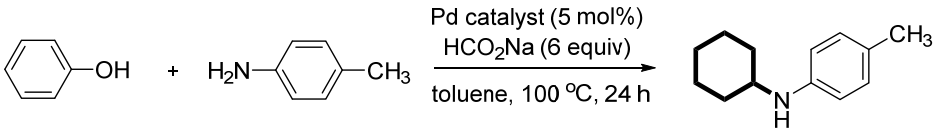
1) Study of catalysts



Entry	Catalyst	Yield[a]/%	Entry	Catalyst	Yield[a]/%
1	$Cu(CO_2CF_3)\cdot H_2O$	N.P.	7	AuCN	N.P.
2	[RuCp*Cl_2]n	N.P.	8	$CoCl_2$	N.P.
3	AgOTf	N.P.	9	$FeCl_3$	N.P.
4	$NiCl_2(PPh_3)_2$	N.P.	10	$Ga(acac)_3$	N.P.
5	$In(OAc)_3$	N.P.	11	$(CO)(PPh_3)_2RhCl$	N.P.
6	$Pt(COD)Cl_2$	N.P.	12	Ph_3Bi	N.P.

Conditions: phenol (0.20 mmol), *p*-toluidine (0.20 mmol), catalyst (5 mol%), sodium formate (6 equiv) and toluene (0.8 mL) at 100°C for 24 h under an argon atmosphere. [a] Yields were determined by GC analysis with mesitylene as internal standard.

2) Study of palladium catalysts



Entry	Catalyst	Yield[a]/%	Entry	Catalyst	Yield[a]/%
1	$Pd/CaCO_3$ (5% content)	trace	10	$Pd(CH_3CN)_2Cl_2$	N.P.
2	$PdCl_2$	N.P.	11	$Pd(OH)_2$	24
3	$[PdCl(C_3H_5)]_2$	N.P.	12	$PdCl_2$(binap)	N.P.
4	$Pd(dba)_2$	34	13	$Pd(CH_3CN)_4(BF_4)_2$	N.P.
5	$Pd(OAc)_2$	N.P.	14	$Pd/BaSO_4$ (5% content)	N.P.
6	$PdCl_2$(dtbpf)	N.P.	15	Pd/C (10 % content)	83
7	$Pd(acac)_2$	N.P.	16	-	N.P.

8	$Pd(NO_3)_2{\cdot}2H_2O$	N.P.	17[b]	Pd/C[b]	94
9	$Pd(PPh_3)_4$	N.P.	18[c]	Pd/C[c]	95 (92)

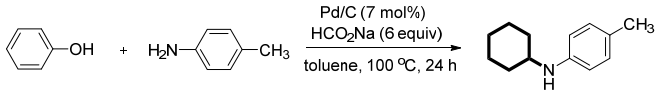
Conditions: phenol (0.20 mmol), *p*-toluidine (0.20 mmol), Pd catalyst (5 mol%), sodium formate (6 equiv) and toluene (0.8 mL) at 100°C for 24 h under an argon atmosphere. [a]Yields were determined by GC analysis with mesitylene as internal standard; isolated yields in brackets. [b]Pd/C (10 mol%) was used. [c]Pd/C (7 mol%) was used.

3) Study of the amount of sodium formate

Entry	Sodium formate	Yield[a]/%
1	10%	trace
2	30%	trace
3	60%	23
4	1 equiv	37
5	2 equiv	58
6	4 equiv	65
7	6 equiv	83

Conditions: phenol (0.20 mmol), *p*-toluidine (0.20 mmol), Pd/C (5 mol%), and toluene (0.8 mL) at 100°C for 24 h under an argon atmosphere. [a] Yields were determined by GC analysis with mesitylene as internal standard.

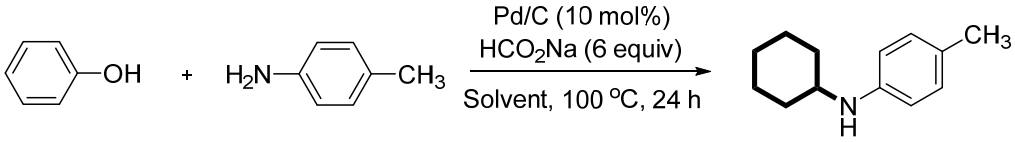
4) Study of ligands



Entry	Ligand	Yield[a]/%
1	1,4-bis(diphenylphosphino)butane	N.P.
2	1,1′-bis(dicyclohexylphosphino)ferrocene	N.P.
3	Bianp	12
4	2-picolinic acid	88
5	1,10-phen	64
6	tri(4-methoxy phenyl) phosphine	N.P.
7	DPPF	N.P.
8	1,3-bis(diphenylphosphino)propane	N.P.

Conditions: phenol (0.20 mmol), *p*-toluidine (0.20 mmol), Pd/C (7 mol%), ligand (15 mol%), sodium formate (6 equiv) and toluene (0.8 mL) at 100°C for 24 h under an argon atmosphere. [a] Yields were determined by GC analysis with mesitylene as internal standard.

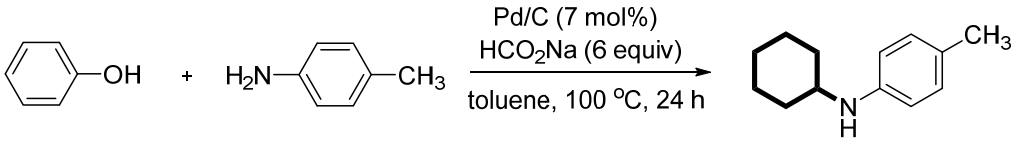
5) Study of solvents



Entry	Solvent	Yield[a]/%	Entry	Solvent	Yield[a]/%
1	THF	89	5	1,4-dioxane	86
2	EtOH	47	6	DMF	N.P.
3	MeCN	N.P.	7	DMSO	N.P.
4	H_2O	80	8	PhCl	N.P.

Conditions: phenol (0.20 mmol), *p*-toluidine (0.20 mmol), Pd/C (10 mol%), sodium formate (6 equiv) and solvent (0.8 mL) at 100°C for 24 h under an argon atmosphere. [a] Yields were determined by GC analysis with mesitylene as internal standard.

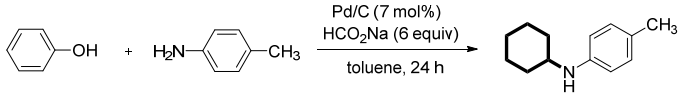
6) Study of acids and bases



Entry	Acid	Yield[a]/%	Entry	Base	Yield[a]/%
1	$FeCl_3$	N.P.	9	K_3PO_4	57
2	LiF	89	10	Cs_2CO_3	N.P.
3	$SnCl_2$	69	11	NaOMe	90
4	$ScOOCCF_3$	71	12	DMAP	95
5	$ZnOSO_2CF_3$	88	13	NaO^tBu	89
6	$CuCl_2$	N.P.	14	DBU	trace
7	CH_3COOH	80	15	DABCO	91
8	CF_3COOH	84	16	TEA	54

Conditions: phenol (0.20 mmol), *p*-toluidine (0.20 mmol), Pd/C (7 mol%), sodium formate (6 equiv), additive (0.5 equiv) and toluene (0.8 mL) at 100°C for 24 h under an argon atmosphere. [a] Yields were determined by GC analysis with mesitylene as internal standard.

7) Study of temperature



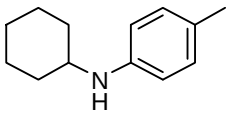
Entry	temperature	Yield[a]/%
1	70	60
2	80	73
4	120	86

Conditions: phenol (0.20 mmol), *p*-toluidine (0.20 mmol), Pd/C (7 mol%), sodium formate (6 equiv), and toluene (0.8 mL) for 24 h under an argon atmosphere. [a] Yields were determined by GC analysis with mesitylene as internal standard.

C. General procedure for the reductive coupling of phenol with amine

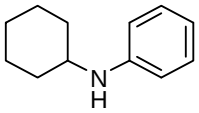
In a 5 mL microwave vial were combined phenol (0.20 mmol), amine (0.20 mmol), Pd/C (10 wt%, 14.84 mg, 7 mol% based on Pd contents) and sodium formate (1.2 mmol) in toluene (0.8 mL). The mixture was then stirred at 100 °C for 24 h under an argon atmosphere. The mixture was then diluted with ethyl acetate (3 mL), filtered and eluted through a short silica gel plug with more ethyl acetate (2 x 3 mL). Solvent was removed, and the residue was separated by column chromatography to give the pure sample.

D. Analytical data



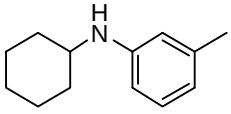
***N*-cyclohexyl-4-methylaniline (3a)**

^{1}H NMR (500 MHz, $CDCl_3$): δ = 6.97 (d, J = 7.5 Hz, 2H), 6.53 (d, J = 7.5 Hz, 2H), 3.22 (t, J = 10.0 Hz, 1H), 2.23 (s, 3H), 2.05 (d, J = 12.0 Hz, 2H), 1.75 (d, J = 13.5 Hz, 2H), 1.65 (d, J = 12.5 Hz, 1H), 1.39-1.32 (m, 2H), 1.23 (t, J = 12.5 Hz, 1H), 1.69-1.09 (m, 2H). ^{13}C NMR (125 MHz, $CDCl_3$): δ = 145.0, 129.7, 126.1, 113.5, 52.1, 33.5, 25.9, 25.0, 20.3. MS (EI) m/z: 189, 160, 146, 131, 106, 91, 77, 55.



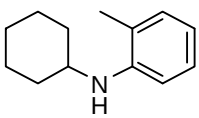
***N*-cyclohexylaniline (3b)**

^{1}H NMR (500 MHz, $CDCl_3$): δ = 7.17-7.14 (m, 2H), 6.66 (t, J = 7.5 Hz, 1H), 6.60 (d, J = 7.5 Hz, 2H), 3.28-3.22 (m, 1H), 2.07-2.04 (m, 2H), 1.78-1.74 (m, 2H), 1.67-1.63 (m, 1H), 1.41-1.33 (m, 2H), 1.27-1.16 (m, 1H), 1.19-1.11 (m, 2H). ^{13}C NMR (125 MHz, $CDCl_3$): δ = 147.3, 129.2, 116.8, 113.1, 51.7, 33.5, 25.9, 25.0. MS (EI) m/z: 175, 146, 132, 118, 106, 93, 77, 65, 58, 51.



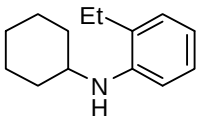
***N*-cyclohexyl-3-methylaniline (3c)**

^{1}H NMR (500 MHz, $CDCl_3$): δ = 7.05 (t, J = 8.0 Hz, 1H), 6.49 (d, J = 7.5 Hz, 1H), 6.41 (d, J = 7.0 Hz, 2H), 3.28-3.22 (m, 1H), 2.27 (s, 3H), 2.07-2.04 (m, 2H), 1.78-1.74 (m, 2H), 1.67-1.63 (m, 1H), 1.42-1.33 (m, 2H), 1.26-1.20 (m, 1H), 1.19-1.11 (m, 2H). ^{13}C NMR (125 MHz, $CDCl_3$): δ = 147.3, 139.0, 129.1, 117.8, 113.9, 110.3, 51.7, 33.5, 25.9, 25.0, 21.6. MS (EI) m/z: 189, 160, 146, 132, 120, 107, 91, 77, 65, 55.



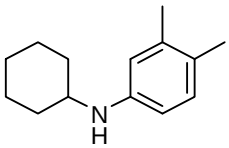
***N*-cyclohexyl-2-methylaniline (3d)**

^{1}H NMR (500 MHz, $CDCl_3$): δ = 7.13-7.10 (m, 1H), 7.06 (d, J = 7.0 Hz, 1H), 6.66-6.61 (m, 2H), 3.36-3.30 (m, 1H), 2.14 (s, 3H), 2.12-2.09 (m, 2H), 1.81-1.77 (m, 2H), 1.70-1.66 (m, 1H), 1.46-1.37 (m, 2H), 1.31-1.18 (m, 3H). ^{13}C NMR (125 MHz, $CDCl_3$): δ = 145.2, 130.2, 127.0, 121.6, 116.2, 110.2, 51.5, 33.6, 26.0, 25.0, 17.5. MS (EI) m/z: 189, 160, 146, 132, 120, 107, 91, 77, 65, 55.



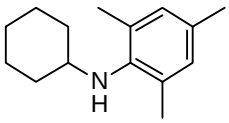
_N_-cyclohexyl-2-ethylaniline (3e)

^{1}H NMR (500 MHz, $CDCl_3$): δ = 7.14-7.07 (m, 2H), 6.68 (t, J = 7.0 Hz, 2H), 3.37-3.32 (m, 1H), 2.51-2.47 (q, J = 7.5 Hz, 2H), 2.12-2.09 (m, 2H), 1.81-1.77 (m, 2H), 1.70-1.66 (m, 1H), 1.32-1.19 (m, 3H), 1.27 (t, J = 7.5 Hz, 3H). ^{13}C NMR (125 MHz, $CDCl_3$): δ = 144.6, 128.0, 127.2, 126.9, 116.4, 110.5, 51.5, 33.6, 26.0, 25.0, 23.9, 12.8. MS (EI) m/z: 203, 188, 174, 160, 147, 132, 118, 106, 91, 77, 55.



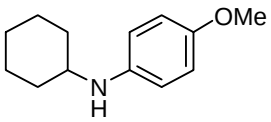
_N_-cyclohexyl-4-methylaniline (3f)

^{1}H NMR (500 MHz, $CDCl_3$): δ = 6.93 (d, J = 8.0 Hz, 1H), 6.44 (d, J = 2.5 Hz, 1H), 6.39 (dd, J = 8.0, 2.5 Hz, 1H), 3.26-3.20 (m, 1H), 2.20 (s, 3H), 2.16 (s, 3H), 2.07-2.04 (m, 2H), 1.78-1.74 (m, 2H), 1.67-1.64 (m, 1H), 1.42-1.33 (m, 2H), 1.27-1.21 (m, 1H), 1.20-1.10 (m, 2H). ^{13}C NMR (125 MHz, $CDCl_3$): δ = 145.5, 137.2, 130.3, 124.9, 115.2, 110.7, 52.0, 33.6, 26.0, 25.0, 20.0, 18.6. MS (EI) m/z: 203, 160, 145, 120, 106, 91, 77, 55.



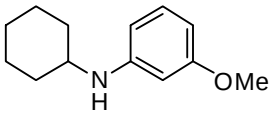
_N_-cyclohexyl-2,4,6-trimethylaniline (3g)

^{1}H NMR (500 MHz, $CDCl_3$): δ = 6.80 (s, 2H), 2.91-2.85 (m, 1H), 2.23 (s, 3H), 2.22 (s, 3H), 1.97-1.94 (m, 2H), 1.75-1.72 (m, 2H), 1.63-1.60 (m, 1H), 1.29-1.20 (m, 3H), 1.15-1.07 (m, 2H). ^{13}C NMR (125 MHz, $CDCl_3$): δ = 142.4, 130.4, 129.3, 129.2, 56.5, 34.9, 26.0, 25.6, 20.5, 18.9. MS (EI) m/z: 217, 174, 158, 146, 134, 120, 91, 77, 65, 55.



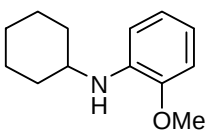
_N_-cyclohexyl-4-methoxyaniline (3h)

^{1}H NMR (500 MHz, $CDCl_3$): δ = 6.78-6.76 (m, 2H), 6.59-6.57 (m, 2H), 3.74 (s, 3H), 3.19-3.14 (m, 1H), 3.10 (s, 1H), 2.06-2.03 (m, 2H), 1.77-1.73 (m, 2H), 1.66-1.63 (m, 1H), 1.40-1.31 (m, 2H), 1.25-1.20 (m, 1H), 1.16-1.08 (m, 2H). ^{13}C NMR (125 MHz, $CDCl_3$): δ = 151.9, 141.5, 114.9, 114.8, 55.8, 52.8, 33.6, 26.0, 25.0. MS (EI) m/z: 205, 162, 134, 108, 92, 77, 55.



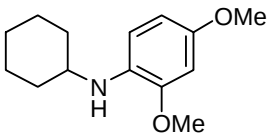
_N_-cyclohexyl-3-methoxyaniline (3i)

^{1}H NMR (500 MHz, $CDCl_3$): δ = 7.06 (t, J = 8.0 Hz, 1H), 6.25-6.20 (m, 2H), 6.16-6.15 (m, 1H), 3.77 (s, 3H), 3.26-3.21 (m, 1H), 2.08-2.05 (m, 2H), 1.78-1.74 (m, 2H), 1.67-1.63 (m, 1H), 1.41-1.32 (m, 2H), 1.27-1.11 (m, 3H). ^{13}C NMR (125 MHz, $CDCl_3$): δ = 160.8, 148.7, 129.9, 106.4, 101.8, 99.1, 55.0, 51.7, 33.4, 25.9, 25.0. MS (EI) m/z: 205, 162, 148, 123, 107, 92, 77, 55.



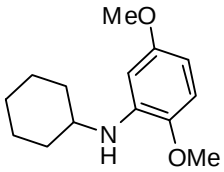
_N_-cyclohexyl-2-methoxyaniline (3j)

^{1}H NMR (500 MHz, $CDCl_3$): δ = 6.85 (t, J = 7.5 Hz, 1H), 6.77 (d, J = 8.0 Hz, 1H), 6.63 (t, J = 7.5 Hz, 2H), 4.16 (s, 1H), 3.84 (s, 3H), 3.29-3.23 (m, 1H), 2.09-2.06 (m, 2H), 1.80-1.76 (m, 2H), 1.67-1.64 (m, 1H), 1.43-1.34 (m, 2H), 1.29-1.18 (m, 3H). ^{13}C NMR (125 MHz, $CDCl_3$): δ = 146.7, 137.2, 121.2, 115.7, 110.2, 109.5, 55.3, 51.3, 33.4, 26.0, 25.1. MS (EI) m/z: 205, 190, 176, 162, 134, 120, 108, 80, 55.



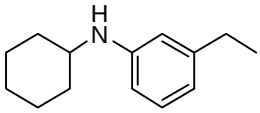
***N*-cyclohexyl-2,4-dimethoxyaniline (3k)**

^{1}H NMR **(**500 MHz, $CDCl_3$): δ = 6.55 (d, J = 8.5 Hz, 1H), 6.45 (d, J = 3.0 Hz, 1H), 6.40 (dd, J = 8.5, 3.0 Hz, 1H), 3.81 (s, 3H), 3.75 (s, 3H), 3.20-3.15 (m, 1H), 2.07-2.04 (m, 2H), 1.78-1.74 (m, 2H), 1.66-1.62 (m, 1H), 1.40-1.31 (m, 2H), 1.26-1.13 (m, 3H). ^{13}C NMR (125 MHz, $CDCl_3$): δ = 151.5, 148.0, 131.5, 111.0, 103.9, 99.2, 55.8, 55.4, 52.2, 33.5, 26.0, 25.1. MS (EI) m/z: 235, 220, 192, 164, 138, 110, 95, 79, 55.



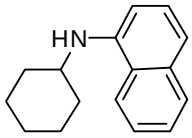
***N*-cyclohexyl-2,5-dimethoxyaniline (3l)**

^{1}H NMR **(**500 MHz, $CDCl_3$): δ = 6.65 (d, J = 8.5 Hz, 1H), 6.23 (d, J = 2.5 Hz, 1H), 6.12-6.10 (m, 1H), 4.20 (s, 1H), 3.79 (s, 3H), 3.75 (s, 3H), 3.24-3.18 (m, 1H), 2.08-2.05 (m, 2H), 1.78-1.74 (m, 2H), 1.67-1.63 (m, 1H), 1.41-1.32 (m, 2H), 1.27-1.16 (m, 3H). ^{13}C NMR (125 MHz, $CDCl_3$): δ = 154.8, 141.5, 138.3, 109.9, 98.4, 97.8, 55.9, 55.5, 51.3, 33.3, 25.9, 25.0. MS (EI) m/z: 235, 220, 192, 164, 138, 110, 79, 55.



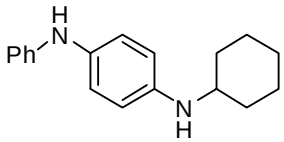
***N*-cyclohexyl-3-ethylaniline (3m)**

H NMR **(**500 MHz, $CDCl_3$): δ = 7.08 (t, J = 7.5 Hz, 1H), 6.53 (d, J = 7.5 Hz, 1H), 6.41 (d, J = 8.0 Hz, 2H), 3.28-3.23 (m, 1H), 2.57 (q, J = 7.5 Hz, 2H), 2.07-2.04 (m, 2H), 1.78-1.74 (m, 2H), 1.67-1.63 (m, 1H), 1.42-1.33 (m, 2H), 1.27-1.12 (m, 3H), 1.22 (t, J = 7.5 Hz, 3H). ^{13}C NMR (125 MHz, $CDCl_3$): δ = 147.3, 145.4, 129.1, 116.6, 112.9, 110.4, 51.7, 33.5, 29.0, 25.9, 25.0, 15.5. MS (EI) m/z: 203, 174, 160, 147, 130, 118, 106, 147, 130, 118, 106, 91, 77, 65, 55.



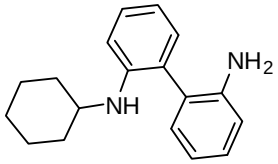
***N*-cyclohexylnaphthalen-1-amine (3n)**

^{1}H NMR **(**500 MHz, $CDCl_3$): δ = 7.81-7.78 (m, 2H), 7.47-7.41 (m, 2H), 7.35 (t, J = 8.0 Hz, 1H), 7.21 (d, J = 8.0 Hz, 1H), 6.66 (d, J = 8.0 Hz, 1H), 4.28 (s, 1H), 3.52-3.46 (m, 1H), 2.22-2.19 (m, 2H), 1.86-1.82 (m, 2H), 1.74-1.70 (m, 1H), 1.51-1.42 (m, 2H), 1.37-1.28 (m, 3H). ^{13}C NMR (125 MHz, $CDCl_3$): δ = 142.3, 134.5, 128.7, 126.6, 125.5, 124.4, 123.4, 119.8, 116.6, 104.7, 51.8, 33.3, 26.0, 25.0. MS (EI) m/z: 225, 182, 168, 143, 127, 115, 77, 55.



***N*^{1}-cyclohexyl-*N*^{4}-phenylbenzene-1,4-diamine (3o)**

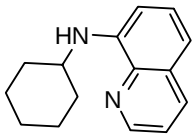
^{1}H NMR **(**500 MHz, $CDCl_3$): δ = 7.18 (t, J = 7.0 Hz, 2H), 6.99 (s, 2H), 6.84-6.77 (m, 3H), 6.59 (s, 2H), 5.36 (s, 1H), 3.23 (s, 2H, 2.08 (d, J = 10.0 Hz, 2H), 1.79-1.76 (m, 2H), 1.68-1.65 (m, 1H), 1.42-1.34 (m, 2H), 1.27-1.23 (m, 1H), 1.20-1.13 (m, 2H). ^{13}C NMR (125 MHz, $CDCl_3$): δ = 146.4, 143.6, 132.2, 129.2, 124.0, 118.6, 114.7, 114.2, 52.3, 33.6, 25.9, 25.0. MS (EI) m/z: 266, 253, 223, 183, 167, 147, 133, 96, 73, 55.



***N*^{2}-cyclohexyl-[1,1'-biphenyl]-2,2'-diamine (3p)**

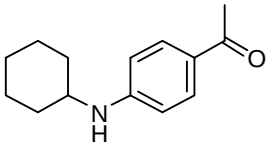
^{1}H NMR **(**500 MHz, $CDCl_3$): δ = 7.25-7.22 (m, 1H), 7.20-7.17 (m, 1H), 7.11-7.08 (m, 2H), 6.85-6.82 (m, 1H), 6.79-6.73 (m, 3H), 3.70 (s, 2H), 3.31-3.26 (m, 1H), 2.02 (d, J = 12.0 Hz, 1H), 1.96 (d, J = 12.0

Hz, 1H), 1.71-1.66 (m, 2H), 1.62-1.58 (m, 1H), 1.38-1.30 (m, 2H), 1.21-1.02 (m, 3H). ^{13}C NMR (125 MHz, $CDCl_3$): δ = 144.6, 144.3, 131.2, 131.0, 128.8, 128.7, 124.5, 124.3, 118.7, 116.7, 115.5, 111.4, 51.7, 33.2, 25.9, 24.9. MS (EI) m/z: 266, 223, 208, 195, 183, 167, 111, 98, 83,67, 55.



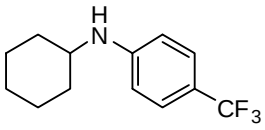
_N_-cyclohexylquinolin-8-amine (3q)

^{1}H NMR (500 MHz, $CDCl_3$): δ = 8.70-8.69 (m, 1H), 8.04 (d, J = 8.0 Hz, 1H), 7.37-7.33 (m, 2H), 7.00 (d, J = 8.0 Hz, 1H), 6.69 (d, J = 7.5 Hz, 1H), 6.14 (s, 1H), 3.48-3.45 (m, 1H), 2.18-2.16 (m, 2H), 1.85-1.82 (m, 2H), 1.70-1.67 (m, 1H), 1.48-1.26 (m, 6H). ^{13}C NMR (125 MHz, $CDCl_3$): δ = 146.5, 143.7, 136.0, 132.2, 128.9, 127.8, 121.2, 113.0, 104.8, 51.2, 33.0, 26.0, 25.1. MS (EI) m/z: 226, 197, 183, 169, 156, 144, 129, 117, 102, 89, 77, 55.



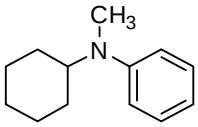
1-(4-(cyclohexylamino)phenyl)ethanone (3r)

^{1}H NMR (500 MHz, $CDCl_3$): δ = 7.80 (d, J = 9.0 Hz, 2H), 6.53 (d, J = 9.0 Hz, 2H), 4.16 (s, 1H), 3.37-3.31 (m, 1H), 2.48 (s, 3H), 2.06-2.03 (m, 2H), 1.79-1.75 (m, 2H), 1.68-1.64 (s, 1H), 1.42-1.34 (m, 2H), 1.27-1.15 (m, 3H). ^{13}C NMR (125 MHz, $CDCl_3$): δ = 196.1, 151.0, 130.8, 126.3, 111.7, 51.4, 33.0, 25.9, 25.7, 24.8. MS (EI) m/z: 217, 202, 174, 146, 132, 120, 106, 91, 77, 65, 55.



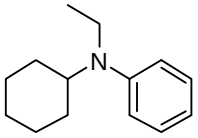
***N*-cyclohexyl-4-(trifluoromethyl)aniline (3s)**

^{1}H NMR (500 MHz, $CDCl_3$): δ = 7.37 (d, J = 8.5 Hz, 2H), 6.56 (d, J = 8.5 Hz, 2H), 3.88 (s, 1H), 3.31-3.27 (m, 1H), 2.06-2.03 (m, 2H), 1.79-1.75 (m, 2H), 1.68-1.64 (m, 1H), 1.43-1.34 (m, 2H), 1.27-1.16 (m, 3H). ^{13}C NMR (125 MHz, $CDCl_3$): δ = 149.7, 144.8, 126.6, 126.6, 126.6, 126.5, 126.1, 123.9, 121.8, 118.2, 117.9, 111.9, 51.3, 33.1, 25.7, 24.8. MS (EI) m/z: 243, 224, 214, 220, 186, 174, 161, 145, 130, 118, 91, 55.



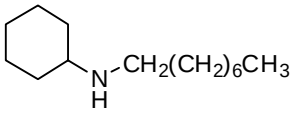
***N*-cyclohexyl-*N*-methylaniline (3t)**

^{1}H NMR (500 MHz, $CDCl_3$): δ = 7.22 (t, J = 7.5 Hz, 2H), 6.78 (d, J = 8.0 Hz, 2H), 6.68 (t, J = 7.5 Hz, 1H), 3.59 -3.54 (m, 1H), 2.78 (s, 3H), 1.86-1.78 (m, 4H), 1.69 (t, J = 6.5 Hz, 1H), 1.50-1.42 (m, 2H), 1.40-1.32 (m, 2H), 1.18-1.09 (m, 1H). ^{13}C NMR (125 MHz, $CDCl_3$): 150.1, 129.1, 116.2, 113.1, 58.1, 31.1, 30.0, 26.2, 25.9. MS (EI) m/z: 189, 146, 132, 120, 106, 91, 77, 55.



***N*-cyclohexyl-*N*-ethylaniline (3u)**

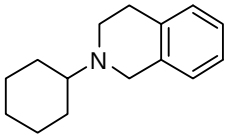
^{1}H NMR (500 MHz, $CDCl_3$): δ = 7.20 (t, J = 7.0 Hz, 2H), 6.73 (d, J = 7.5 Hz, 2H), 6.63 (t, J = 7.0 Hz, 1H), 3.54 (t, J = 10.0 Hz, 1H), 3.28 (q, J = 7.0 Hz, 2H), 1.85 (d, J = 8.0 Hz, 3H), 1.69 (d, J = 7.5 Hz, 1H), 1.55 (s, 2H), 1.45-1.31 (m, 3H), 1.25 (s, 1H), 1.15 (t, J = 7.0 Hz, 3H). ^{13}C NMR (125 MHz, $CDCl_3$): δ = 148.4, 129.1, 115.5, 112.5, 57.1, 38.9, 30.7, 26.3, 26.0, 15.2. MS (EI) m/z: 203, 188, 174, 160, 146, 132, 119, 104, 91, 77, 55.



***N*-octylcyclohexanamine (3v)**

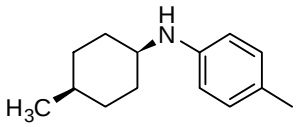
^{1}H NMR (500 MHz, $CDCl_3$): δ = 2.61 (t, J = 7.5 Hz, 2H), 2.44-2.40

(m, 1H), 1.89 (d, J = 10.5 Hz, 2H), 1.73-1.71 (m, 2H), 1.61 (d, J = 9.0 Hz, 1H), 1.47 (d, J = 7.0 Hz, 2H), 1.28-1.21 (m, 12H), 1.19-1.06 (m, 4H), 0.87 (t, J = 7.0 Hz, 3H). ^{13}C NMR (125 MHz, $CDCl_3$): δ = 56.9, 46.9, 33.4, 31.8, 30.2, 29.5, 29.2, 27.4, 26.1, 25.1, 22.6, 14.1. MS (EI) m/z: 211, 182, 168, 140, 112, 98, 83, 70, 55.



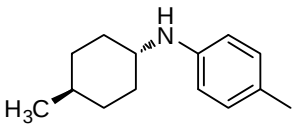
2-cyclohexyl-1,2,3,4-tetrahydroisoquinoline (3w)

^{1}H NMR (500 MHz, $CDCl_3$): δ = 7.11-7.07 (m, 3H), 7.02-7.01 (m, 1H), 3.80 (s, 2H), 2.89 (t, J = 5.0 Hz, 2H), 2.85 (t, J = 5.0 Hz, 2H), 2.51-2.46 (m, 1H), 1.97 (d, J = 11.0 Hz, 2H), 1.84 (d, J = 12.5 Hz, 2H), 1.66 (d, J = 12.5 Hz, 1H), 1.38-1.24 (m, 4H), 1.19-1.11 (m, 1H). ^{13}C NMR (125 MHz, $CDCl_3$): δ = 135.3, 134.6, 128.6, 126.7, 125.9, 125.4, 63.1, 51.7, 46.7, 29.6, 288, 26.3, 25.9. MS (EI) m/z: 215, 172, 158, 146, 132, 117, 104, 91, 77, 65, 55.



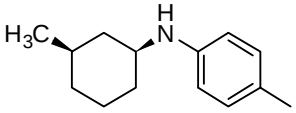
4-methyl-*N*-(4-methylcyclohexyl)aniline (4a)

^{1}H NMR (500 MHz, $CDCl_3$): δ =^{1}H NMR (500 MHz, $CDCl_3$): δ = 6.99 (d, *J* = 8.0 Hz, 2H), 6.55 (d, *J* = 8.5 Hz, 2H), 3.53 (t, *J* = 4.0 Hz, 1H), 2.24 (s, 3H), 1.77-1.74 (m, 2H), 1.67-1.61 (m, 2H), 1.57-1.53 (m, 3H), 1.30-1.22 (m, 2H), 0.95 (d, *J* = 6.5 Hz, 3H). ^{13}C NMR (125 MHz, $CDCl_3$): δ = 145.1, 129.7, 125.9, 113.4, 48.4, 30.9, 29.8, 29.3, 21.3, 20.3. MS (EI) m/z: 203, 146, 133, 120, 107, 91, 77, 55.

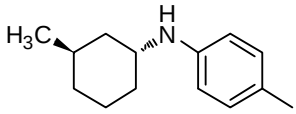


^{1}H NMR (500 MHz, $CDCl_3$): δ = 6.96 (d, *J* = 8.5 Hz, 2H), 6.51 (d, *J* = 8.5 Hz, 2H), 3.16-3.11 (m, 1H), 2.22 (s, 3H), 2.10 (d, *J* = 5.5 Hz, 2H), 1.74 (t, *J* = 6.0 Hz, 2H), 1.41-1.35 (m, 1H), 1.13-1.01 (m, 4H), 0.91 (d, *J* = 6.5 Hz, 3H). ^{13}C NMR (125 MHz, $CDCl_3$): δ = 145.2, 129.7, 126.1, 113.5, 52.4, 34.1, 33.6, 32.3, 22.2, 20.3. MS (EI) m/z: 203, 146, 133, 120, 107, 91, 77, 55.

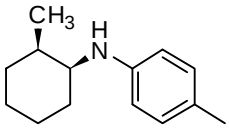
4-methyl-*N*-(3-methylcyclohexyl)aniline (4b)



^{1}H NMR (500 MHz, $CDCl_3$): δ = 6.98 (d, *J* = 8.5 Hz, 2H), 6.54 (d, *J* = 8.5 Hz, 2H), 3.65 (t, *J* = 4.0 Hz, 1H), 2.23 (s, 3H), 1.75-1.72 (m, 2H), 1.66-1.64 (m, 2H), 1.58-1.52 (m, 3H), 1.37-1.32 (m, 1H), 1.08-1.01 (m, 1H), 0.92 (d, *J* = 6.5 Hz, 3H). ^{13}C NMR (125 MHz, $CDCl_3$): δ = 145.0, 129.7, 126.0, 113.3, 47.9, 38.8, 34.0, 30.4, 27.1, 21.7, 20.5, 20.3. MS (EI) m/z: 203, 188, 160, 146, 133, 120, 107, 91, 77, 55.

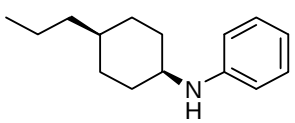


^{1}H NMR (500 MHz, $CDCl_3$): δ = 6.97 (d, *J* = 8.5 Hz, 2H), 6.54 (d, *J* = 8.5 Hz, 2H), 3.22-3.18 (m, 1H), 2.23 (s, 3H), 2.11-2.07 (m, 2H), 1.80-1.75 (m, 1H), 1.68 (d, *J* = 13.0 Hz, 1H), 1.53-1.46 (m, 1H), 1.40-1.31 (m, 1H), 1.00-0.95 (m, 1H), 0.92 (d, J = 6.5 Hz, 3H), 0.89-0.80 (m, 1H), 0.76-0.69 (m, 1H). ^{13}C NMR (125 MHz, $CDCl_3$): δ = 144.9, 129.7, 126.3, 113.7, 52.6, 42.5, 34.6, 33.3, 32.0, 25.0, 22.5, 20.3. MS (EI) m/z: 203, 188, 160, 146, 133, 120, 107, 91, 77, 55.



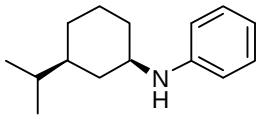
4-methyl-*N*-(2-methylcyclohexyl)aniline (4c)

^{1}H NMR (500 MHz, $CDCl_3$): δ = 6.97 (d, J = 8.5 Hz, 2H), 6.54 (d, J = 8.5 Hz, 2H), 3.47-3.44 (m, 1H), 2.22 (s, 3H), 2.03-1.99 (m, 1H), 1.67-1.63 (m, 1H), 1.57-1.52 (m, 4H), 1.42-1.34 (m, 3H), 0.91 (d, J = 7.0 Hz, 3H). ^{13}C NMR (125 MHz, $CDCl_3$): δ = 145.4, 129.7, 125.8, 113.4, 53.5, 33.1, 30.4, 28.6, 22.9, 20.3, 15.4. MS (EI) m/z: 203, 160, 146, 133, 120, 107, 91, 77, 65, 53.



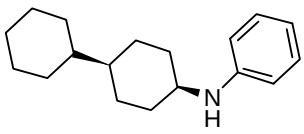
***N*-(4-propylcyclohexyl)aniline (4d)**

^{1}H NMR (500 MHz, $CDCl_3$): δ = 7.18-7.15 (m, 2H), 6.67 (t, J = 7.5 Hz, 1H), 6.61 (d, J = 8.0 Hz, 2H), 3.58-3.55 (m, 1H), 1.76-1.73 (m, 2H), 1.67-1.55 (m, 4H), 1.42-1.38 (m, 1H), 1.35-1.22 (m, 6H), 0.91 (t, J = 7.5 Hz, 3H). ^{13}C NMR (125 MHz, $CDCl_3$): δ = 147.3, 129.2, 116.8, 113.2, 48.5, 37.9, 35.6, 29.3, 27.8, 20.1, 14.3. MS (EI) m/z: 217, 132, 118, 106, 93, 77, 67, 55.



***N*-(3-isopropylcyclohexyl)aniline (4e)**

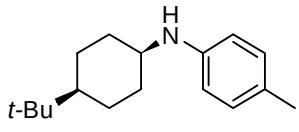
^{1}H NMR (500 MHz, $CDCl_3$): δ = 7.16 (t, J = 8.0 Hz, 2H), 6.67 (t, J = 7.5 Hz, 1H), 6.62 (d, J = 8.0 Hz, 2H), 3.73 (t, J = 3.5 Hz, 1H), 1.77 (d, J = 11.5 Hz, 2H), 1.68-1.65 (m, 1H), 1.60-1.41 (m, 5H), 1.37-1.31 (m, 1H), 1.15-1.08 (m, 1H), 0.88-0.85 (m, 6H). ^{13}C NMR (125 MHz, $CDCl_3$): δ = 147.3, 129.2, 116.8, 113.20, 47.8, 38.3, 34.1, 31.8, 30.2, 28.8, 20.8, 20.1, 19.6. MS (EI) m/z: 217, 174, 132, 118, 106, 93, 77, 67, 55.



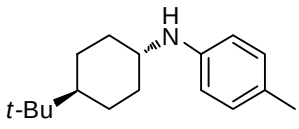
***N*-phenyl-[1,1'-bi(cyclohexan)]-4-amine (4f)**

^{1}H NMR (500 MHz, $CDCl_3$): δ = 7.17-7.14 (m, 2H), 6.66 (t, J = 7.5 Hz, 1H), 6.61 (d, J = 8.0 Hz, 2H), 3.60 (t, J = 4.0 Hz, 1H), 1.83-1.79 (m, 2H), 1.73 (d, J = 10.5 Hz, 4H), 1.66-1.51 (m, 5H), 1.36-1.29 (m, 2H), 1.26-1.11 (m, 5H), 0.97-0.90 (m, 2H). ^{13}C NMR (125 MHz, $CDCl_3$): δ = 147.0, 129.2, 116.8, 113.2, 48.1, 42.1, 41.7, 30.3, 29.7, 26.7, 26.7, 24.6. MS (EI) m/z: 257, 186, 132, 118, 106, 93, 81, 67, 55.

***N*-(4-(*tert*-butyl)cyclohexyl)-4-methylaniline (4g)**

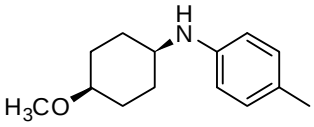


^{1}H NMR (500 MHz, $CDCl_3$): δ = 6.90 (d, J = 8.5 Hz, 2H), 6.56 (d, J = 8.5 Hz, 2H), 3.65 (t, J = 3.0 Hz, 1H), 2.25 (s, 3H), 1.99 (d, J = 14.0 Hz, 2H), 1.61-1.55 (m, 2H), 1.53-1.49 (m, 2H), 1.25-1.17 (m, 2H), 1.08-1.05 (m, 1H), 0.88 (s, 9H). ^{13}C NMR (125 MHz, $CDCl_3$): δ = 145.1, 129.7, 125.9, 113.4, 47.9, 47.0, 32.5, 30.3, 27.5, 21.5, 20.3. MS (EI) m/z: 245, 188, 172, 146, 131, 107, 91, 72, 57.

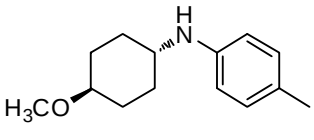


^{1}H NMR (500 MHz, $CDCl_3$): δ = 6.97 (d, J = 8.5 Hz, 2H), 6.53 (d, J = 8.5 Hz, 2H), 3.15 (m, 1H), 2.23 (s, 3H), 2.17 (d, J = 11.5 Hz, 2H), 1.83 (d, J = 12.5 Hz, 2H), 1.14-1.02 (m, 5H), 0.88 (s, 9H). ^{13}C NMR (125 MHz, $CDCl_3$): δ = 145.1, 129.7, 126.1, 113.5, 52.8, 47.7, 34.0, 32.4, 27.6, 26.3, 20.3. MS (EI) m/z: 245, 188, 172, 146, 131, 107, 91, 72, 57.

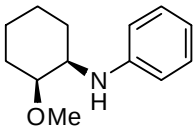
***N*-(4-methoxycyclohexyl)-4-methylaniline (4h)**



^{1}H NMR (500 MHz, $CDCl_3$): δ = 6.97 (d, J = 8.5 Hz, 2H), 6.53 (d, J = 8.5 Hz, 2H), 3.38-3.36 (m, 1H),3.34 (s, 1H), 3.32 (s, 3H), 2.23 (s, 3H), 1.86-1.75 (m, 4H), 1.59 (t, J = 9.5 Hz, 4H). ^{13}C NMR (125 MHz, $CDCl_3$): δ = 144.8, 129.7, 126.3, 113.6, 75.3, 55.6, 50.5, 27.9, 27.7, 20.3. MS (EI) m/z: 219, 146, 131, 106, 91, 77, 65, 53.



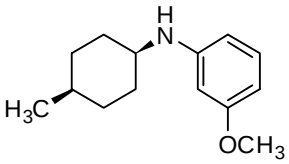
^{1}H NMR (500 MHz, $CDCl_3$): δ = 6.97 (d, J = 8.5 Hz, 2H), 6.52 (d, J = 8.5 Hz, 2H), 3.36 (s, 3H), 3.26-3.20 (m, 1H), 3.20-3.15 (m, 1H), 2.24 (s, 3H), 2.15 (d, J = 12.0 Hz, 2H), 2.08 (t, J = 6.5 Hz, 2H), 1.38-1.30 (m, 2H), 1.19-1.11 (m, 2H). ^{13}C NMR (125 MHz, $CDCl_3$): δ = 145.0, 129.7, 126.4, 113.5, 78.7, 55.9, 51.6, 31.0, 30.3, 20.3. MS (EI) m/z: 219, 146, 131, 106, 91, 77, 65, 53.



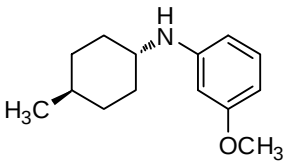
***N*-(2-methoxycyclohexyl)aniline (4i)**

^{1}H NMR (500 MHz, $CDCl_3$): δ = 7.17-7.14 (m, 2H), 6.67 (t, J = 7.5 Hz, 1H), 6.62 (d, J = 8.0 Hz, 2H), 4.17 (s, 1H), 3.51 (t, J = 2.0 Hz, 1H), 3.41-3.38 (m, 1H), 3.33 (s, 3H), 2.06-2.02 (m, 1H), 1.77-1.68 (m, 2H), 1.59-1.46 (m, 2H), 1.44-1.26 (m, 3H). ^{13}C NMR (125 MHz, $CDCl_3$): δ = 147.3, 129.2, 117.1, 113.6, 77.6, 56.3, 53.7, 27.4, 27.2, 24.1, 20.1. MS (EI) m/z: 205, 190, 174, 162, 144, 132, 118, 106, 93, 77, 65, 51.

3-methoxy-*N*-(4-methylcyclohexyl)aniline (4j)

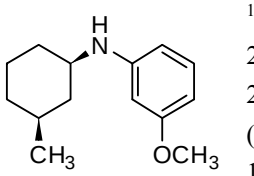


^{1}H NMR (500 MHz, $CDCl_3$): δ = 7.06 (t, J = 8.0 Hz, 1H), 6.24-6.22 (m, 2H), 6.16 (s, 1H), 3.77 (s, 3H), 3.54-3.51 (m, 1H), 1.77-1.73 (m, 2H), 1.66-1.63(m, 2H), 1.56-1.53 (m, 3H), 1.28-1.20 (m, 2H), 0.93 (d, J = 6.5 Hz, 3H). ^{13}C NMR (125 MHz, $CDCl_3$): δ = 160.9, 148.6, 129.9, 106.4, 101.8, 99.0, 55.0, 48.3, 30.8, 29.8, 29.2, 21.3. MS (EI) m/z: 219, 207, 176, 162, 148, 136, 123, 77, 67, 55.

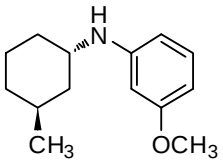


^{1}H NMR (500 MHz, $CDCl_3$): δ = 7.05 (t, J = 8.0 Hz, 1H), 6.25-6.21 (m, 2H), 6.16 (s, 1H), 3.76 (s, 3H), 3.18-3.12 (m, 1H), 2.11 (d, J = 12.5 Hz, 2H), 1.74 (d, J = 12.5 Hz, 2H), 1.41-1.34 (m, 1H), 1.16-1.09 (m, 2H), 1.07-1.00 (m, 2H), 0.91 (d, J = 6.5 Hz, 3H). ^{13}C NMR (125 MHz, $CDCl_3$): δ = 160.8, 132.7, 129.9, 106.6, 102.1, 99.4, 55.0, 52.4, 34.0, 33.4, 32.3, 22.2. MS (EI) m/z: 219, 207, 176, 162, 148, 136, 123, 77, 67, 55.

3-methoxy-*N*-(3-methylcyclohexyl)aniline (4k)

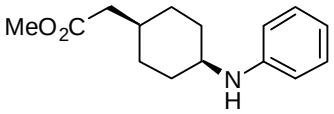


^{1}H NMR (500 MHz, $CDCl_3$): δ = 7.06 (t, J = 8.0 Hz, 1H), 6.24-6.21 (m, 2H), 6.16 (t, J = 2.0 Hz, 1H), 3.77 (s, 3H), 3.66-3.65 (m, 1H), 1.75-1.73 (m, 2H), 1.70-1.66 (m, 2H), 1.64-1.50 (m, 3H), 1.37-1.32 (m, 1H), 1.08-1.02 (m, 1H), 0.92 (d, J = 6.5 Hz, 3H). ^{13}C NMR (125 MHz, $CDCl_3$): δ =160.9, 148.7, 129.9, 106.3, 101.8, 98.9, 55.0, 47.6, 38.8, 33.9, 30.4, 27.1, 21.7, 20.5. MS (EI) m/z: 219, 204, 176, 162, 149, 136, 123, 107, 92, 77, 55.

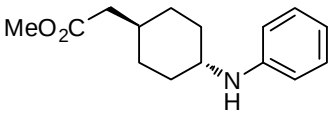


^{1}H NMR (500 MHz, $CDCl_3$): δ = 7.05 (t, J = 8.0 Hz, 1H), 6.23 (t, J = 9.0 Hz, 2H), 6.16 (s, 1H), 3.76 (s, 3H), 3.24-3.18 (m, 1H), 2.10-2.08 (m, 2H), 1.80-1.76 (m, 1H), 1.68 (d, J = 12.5 Hz, 1H), 1.50-1.48 (m, 1H), 1.39-1.31 (m, 1H), 1.02-0.96 (m, 1H), 0.91 (d, J = 6.5 Hz, 3H), 0.86-0.80 (m, 1H), 0.78-0.71 (m, 1H). ^{13}C NMR (125 MHz, $CDCl_3$): δ = 160.8, 148.4, 129.9, 106.6, 102.0, 99.4, 55.1, 52.3, 42.3, 34.6, 33.2, 32.0, 25.0, 22.4. MS (EI) m/z: 219, 204, 176, 162, 149, 136, 123, 107, 92, 77, 55.

methyl 2-(4-(phenylamino)cyclohexyl)acetate (4l)

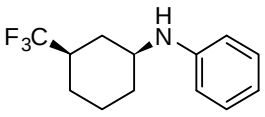


^{1}H NMR (500 MHz, $CDCl_3$): δ = 7.16 (t, J = 7.5 Hz, 2H), 6.67 (t, J = 7.5 Hz, 1H), 6.60 (d, J = 8.0 Hz, 2H), 3.67 (s, 3H, 3.57 (t, J = 4.0 Hz, 1H), 2.29 (d, J = 7.5 Hz, 2H), 1.98-1.95 (m, 1H), 1.77-1.66 (m, 4H), 1.64-1.59 (m, 2H), 1.39-1.31 (m, 2H). ^{13}C NMR (125 MHz, $CDCl_3$): δ = 173.3, 147.1, 129.2, 117.0, 113.2, 51.4, 48.0, 40.2, 33.1, 29.1, 27.5. MS (EI) m/z: 247, 216, 191, 174, 158, 132, 117, 93, 77, 55.

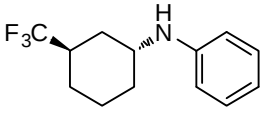


^{1}H NMR (500 MHz, $CDCl_3$): δ = 7.17-7.13 (m, 2H), 6.67 (t, J = 7.5 Hz, 1H), 6.59 (d, J = 8.0 Hz, 2H), 3.67 (s, 3H), 3.21-3.16 (m, 1H), 2.24 (d, J = 6.5 Hz, 2H), 2.14 (t, J = 5.0 Hz, 2H), 1.84-1.81 (m, 3H), 1.18-1.11 (m, 4H). ^{13}C NMR (125 MHz, $CDCl_3$): δ = 173.3, 147.0, 129.2, 117.2, 113.3, 52.0, 51.4, 41.3, 34.3, 33.1, 31.7. MS (EI) m/z: 247, 216, 191, 174, 158, 132, 117, 93, 77, 55.

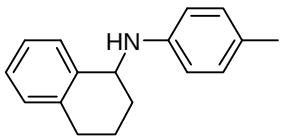
***N*-(3-(trifluoromethyl)cyclohexyl)aniline (4m)**



^{1}H NMR (500 MHz, $CDCl_3$): δ = 7.20-7.17 (m, 2H), 6.71 (t, J = 7.5 Hz, 1H), 6.61 (d, J = 7.5 Hz, 2H), 3.81-3.80 (m, 1H), 2.40-2.32 (m, 1H), 2.07-2.03 (m, 1H), 1.93-1.89 (m, 1H), 1.82-1.80 (m, 1H), 1.74-1.69 (m, 1H), 1.67-1.54 (m, 3H), 1.45-1.37 (m, 1H). ^{13}C NMR (125 MHz, $CDCl_3$): δ = 146.7, 129.4, 117.5, 113.1, 46.7, 37.0, 36.8, 29.9, 28.8, 24.4, 24.4, 19.4. MS (EI) m/z: 243, 200, 175, 146, 132, 118, 106, 93, 77, 65, 51.



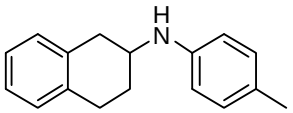
^{1}H NMR (500 MHz, $CDCl_3$): δ = 7.17 (t, J = 7.5 Hz, 2H), 6.71 (t, J = 8.0 Hz, 1H), 6.60 (d, J = 7.5 Hz, 2H), 3.32-3.26 (m, 1H), 2.37 (d, J = 12.5 Hz, 1H), 2.19-2.15 (m, 2H), 1.96-1.93 (m, 2H), 1.45-1.36 (m, 1H), 1.30-1.27 (m, 1H), 1.15-1.05 (m, 2H). ^{13}C NMR (125 MHz, $CDCl_3$): δ = 146.3, 129.4, 117.7, 113.4, 51.2, 41.4, 41.2, 32.9, 31.9, 29.7, 24.5, 23.7. MS (EI) m/z: 243, 200, 175, 146, 132, 118, 106, 93, 77, 65, 51.



***N*-(*p*-tolyl)-1,2,3,4-tetrahydronaphthalen-1-amine (4n)**

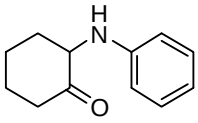
^{1}H NMR (500 MHz, $CDCl_3$): δ = 7.42-7.40 (m, 1H), 7.21-7.15 (m, 2H), 7.13-7.12 (m, 1H), 7.02 (d, J = 8.4 Hz, 2H), 4.60 (t, J = 5.0 Hz, 1H), 3.76 (s, 1H), 2.88-2.74 (m, 2H), 2.27 (s, 3H), 1.99-1.96 (m, 2H), 1.94-1.87 (m, 1H), 1.82-1.78 (m, 1H). ^{13}C NMR (125 MHz, $CDCl_3$): δ = 145.2, 138.4, 137.6, 129.8, 129.2, 129.0, 127.0, 126.3, 126.0, 113.0, 51.3, 29.3, 28.7, 20.4, 19.4. MS (EI) m/z: 237, 131,

107, 91, 65, 50.



_N_-(_p_-tolyl)-1,2,3,4-tetrahydronaphthalen-2-amine (4o)

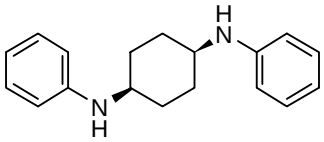
^{1}H NMR (500 MHz, $CDCl_3$): δ = 7.15-7.11 (m, 3H), 7.09-7.07 (m, 1H), 7.01 (d, J = 8.0 Hz, 2H), 6.59 (d, J = 8.0 Hz, 2H), 3.81-3.76 (m, 1H), 3.24-3.19 (m, 1H), 2.92-2.89 (m, 2H), 2.71-2.66 (m, 1H), 2.25 (s, 3H), 2.20-2.17 (m, 1H), 1.81-1.73 (m, 1H). ^{13}C NMR (125 MHz, $CDCl_3$): δ = 144.6, 135.9, 134.7, 129.8, 129.5, 128.8, 126.0, 125.8, 119.3, 113.7, 48.9, 36.5, 28.8, 27.5, 20.4. MS (EI) m/z: 237, 209, 194, 180, 167, 131, 115, 91, 77, 65.



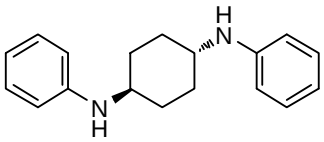
2-(phenylamino)cyclohexanone (4p)

^{1}H NMR (500 MHz, $CDCl_3$): δ = 7.19-7.16 (m, 2H), 6.70 (t, J = 7.5 Hz, 1H), 6.61 (d, J = 7.5 Hz, 2H), 4.88 (s, 1H), 4.02-3.98 (m, 1H), 2.70-2.65 (m, 1H), 2.60-2.57 (m, 1H), 2.46-2.39 (m, 1H), 2.19-2.13 (m, 1H), 1.96-1.91 (m, 1H), 1.87-1.78 (m, 1H), 1.76-1.67 (m, 1H), 1.48-1.40 (m, 1H). ^{13}C NMR (125 MHz, $CDCl_3$): δ = 208.4, 146.5, 129.3, 117.5, 113.0, 61.8, 41.2, 35.7, 28.1, 24.0. MS (EI) m/z: 189, 161, 132, 119, 104, 93, 77, 65, 51.

N^1,N^4-diphenylcyclohexane-1,4-diamine (4q)



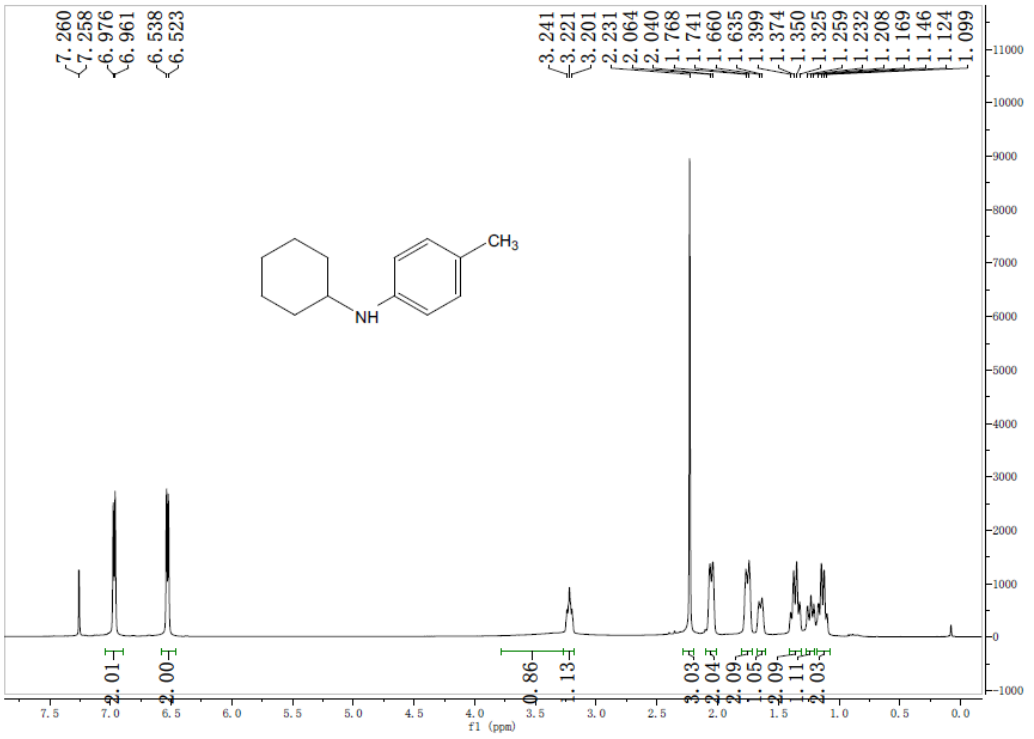
^{1}H NMR (500 MHz, $CDCl_3$): δ = 7.18-7.15 (m, 2H), 6.68 (t, J = 7.5 Hz, 1H), 6.62 (d, J = 7.5 Hz, 2H), 3.50 (s, 1H), 1.86-1.82 (m, 2H), 1.72-1.66 (m, 2H). ^{13}C NMR (125 MHz, $CDCl_3$): δ = 147.0, 129.3, 117.2, 113.2, 49.1, 28.4. MS (EI) m/z: 266, 207, 174, 158, 144, 134, 118, 104, 91, 77, 65, 51.

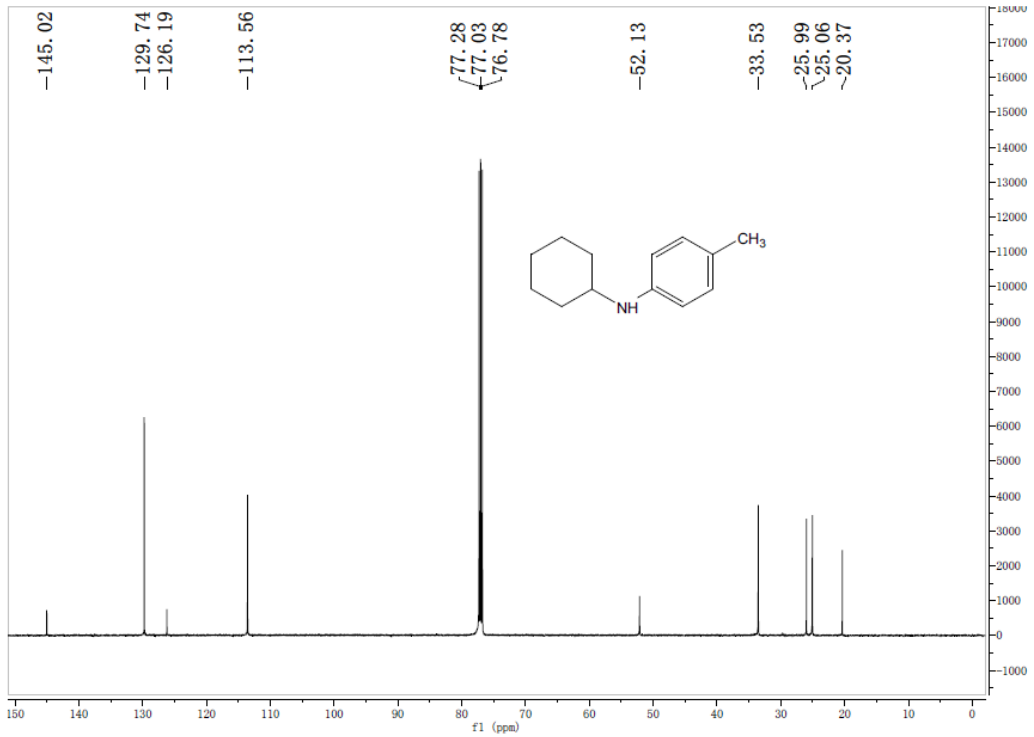


^{1}H NMR (500 MHz, $CDCl_3$): δ = 7.18-7.15 (m, 2H), 6.68 (t, J = 7.5 Hz, 1H), 6.60 (d, J = 7.5 Hz, 2H), 3.31-3.28 (m, 1H), 2.21 (d, J = 6.5 Hz, 2H), 1.30-1.26 (m, 2H). ^{13}C NMR (125 MHz, $CDCl_3$): δ =147.1, 129.3, 117.2, 113.2, 51.7, 32.2. MS (EI) m/z: 266, 207, 173, 158, 134, 118, 93, 77, 51.

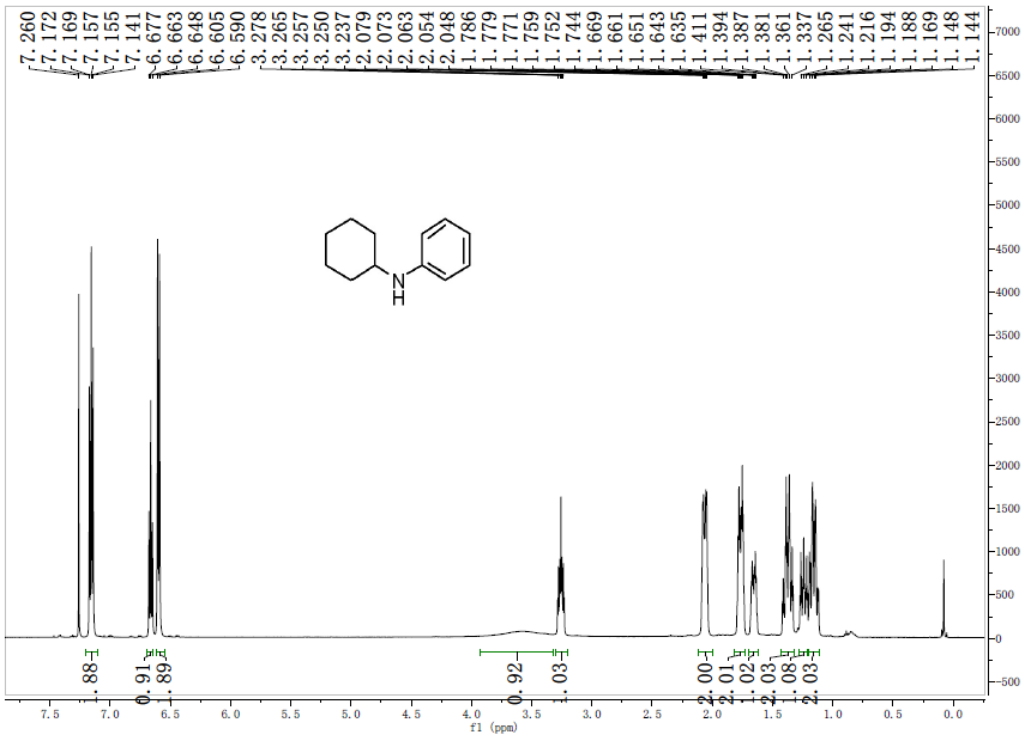
E. NMR Spectra

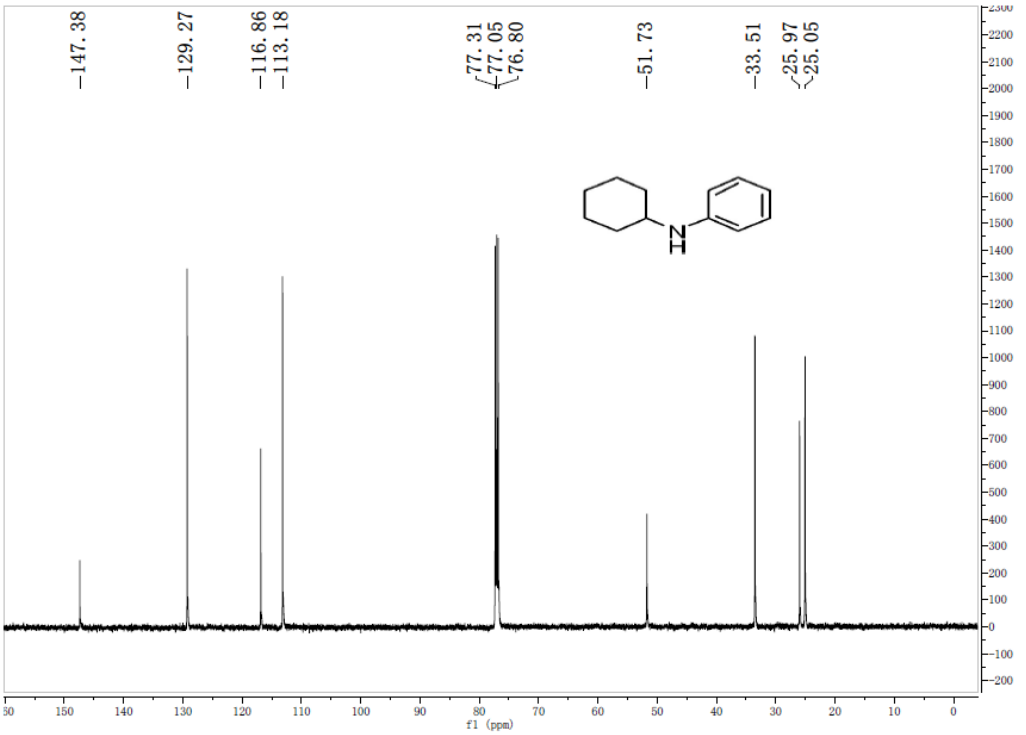
^{1}H NMR and ^{13}C NMR of *N*-cyclohexyl-4-methylaniline (3a)



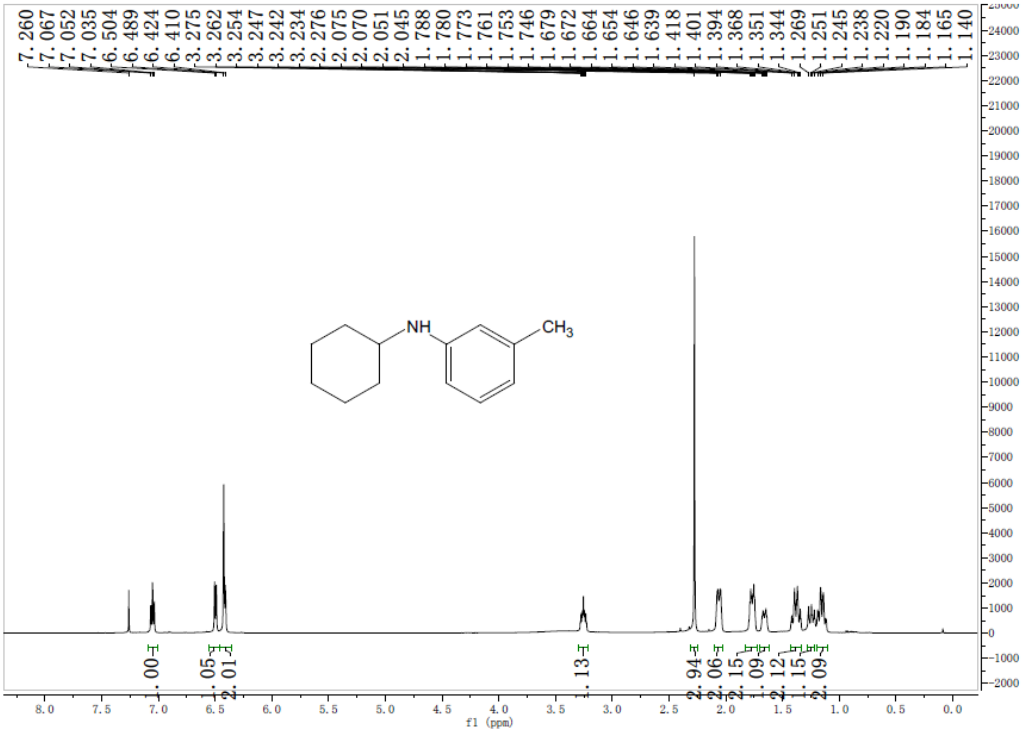


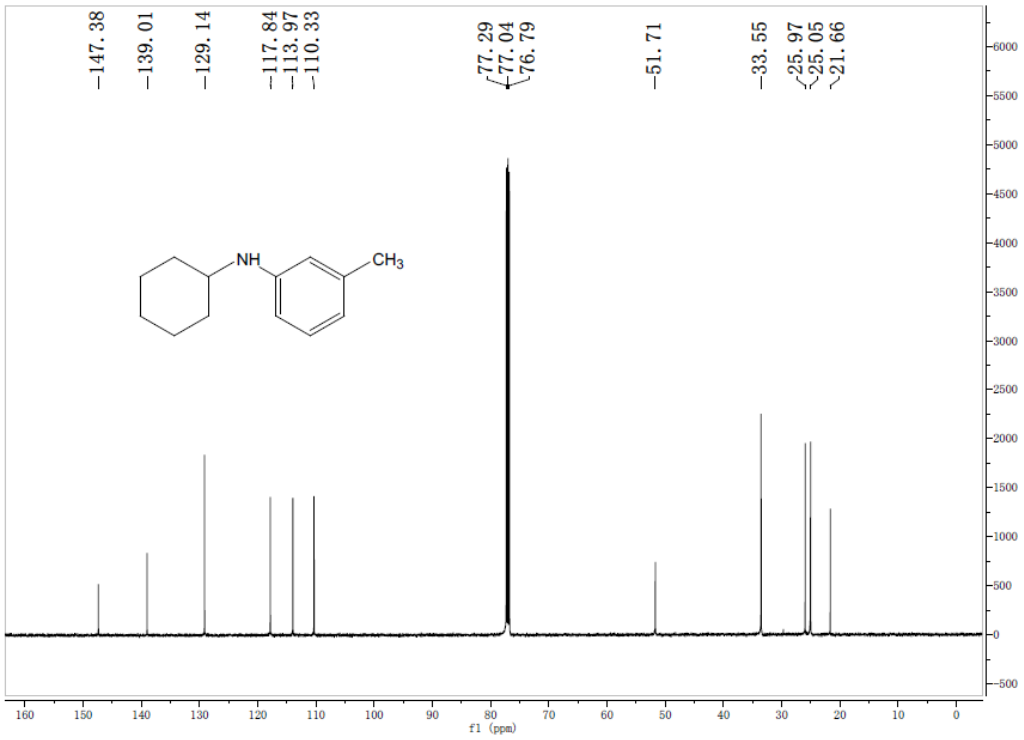
^{1}H NMR and ^{13}C NMR of *N*-cyclohexylaniline (3b)



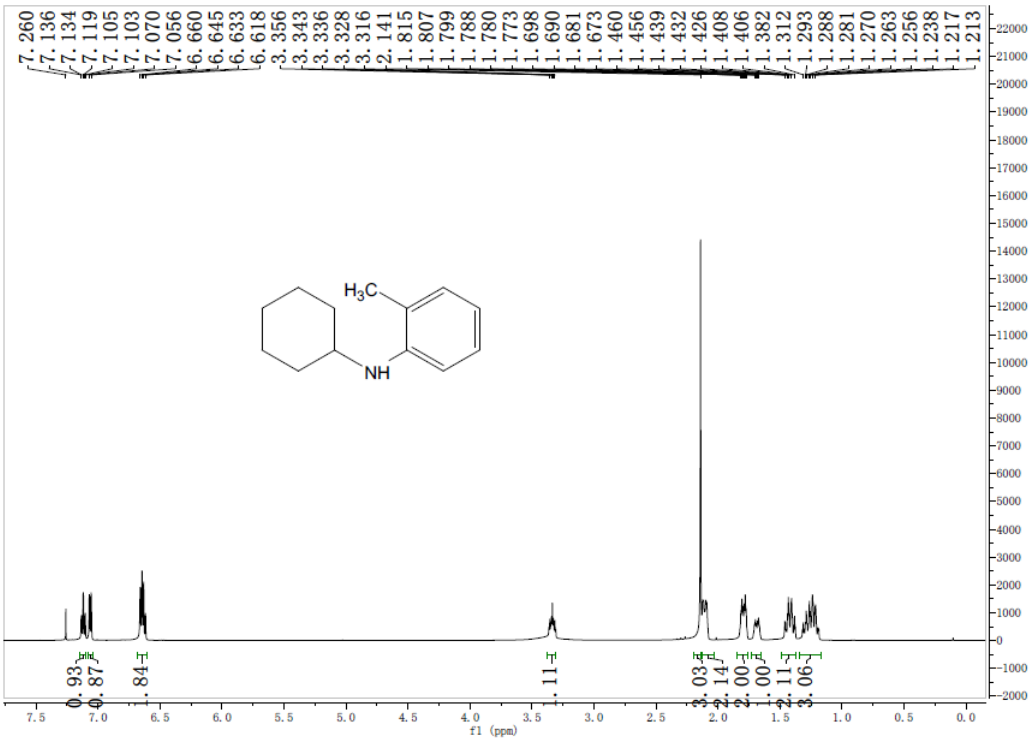


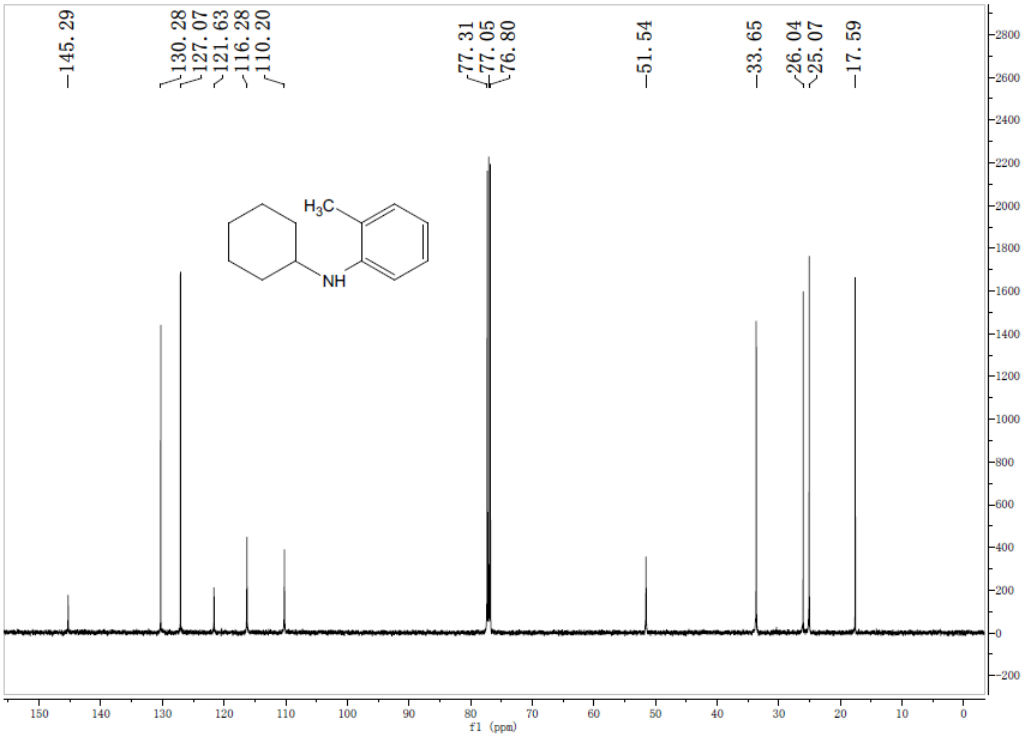
^{1}H NMR and ^{13}C NMR of *N*-cyclohexyl-3-methylaniline (3c)



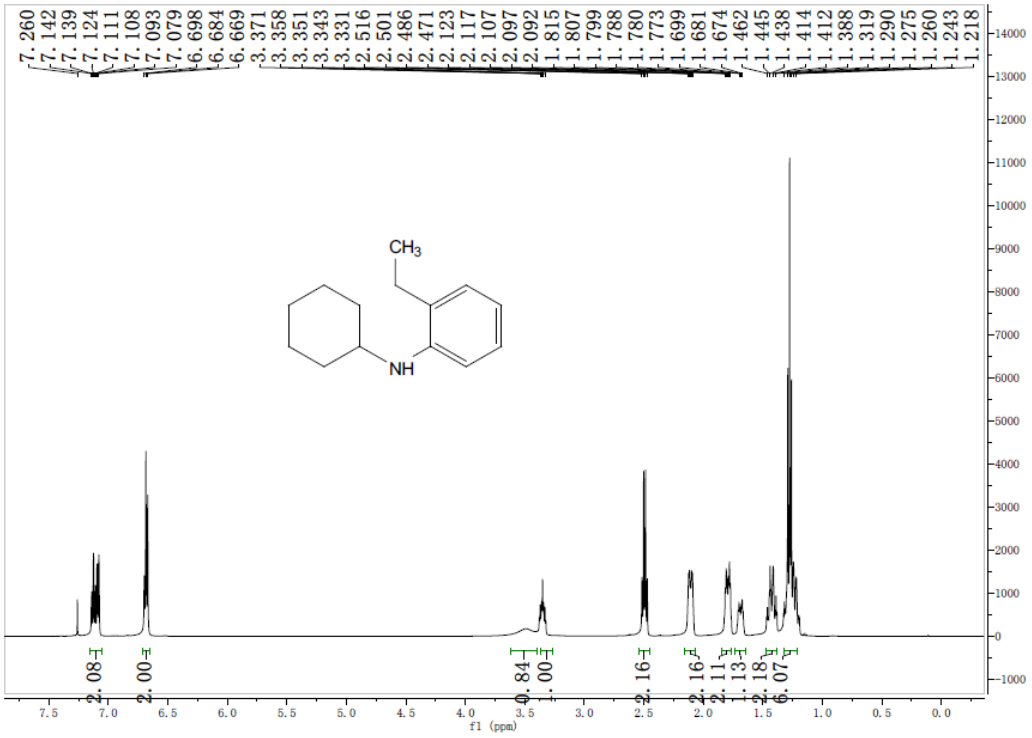


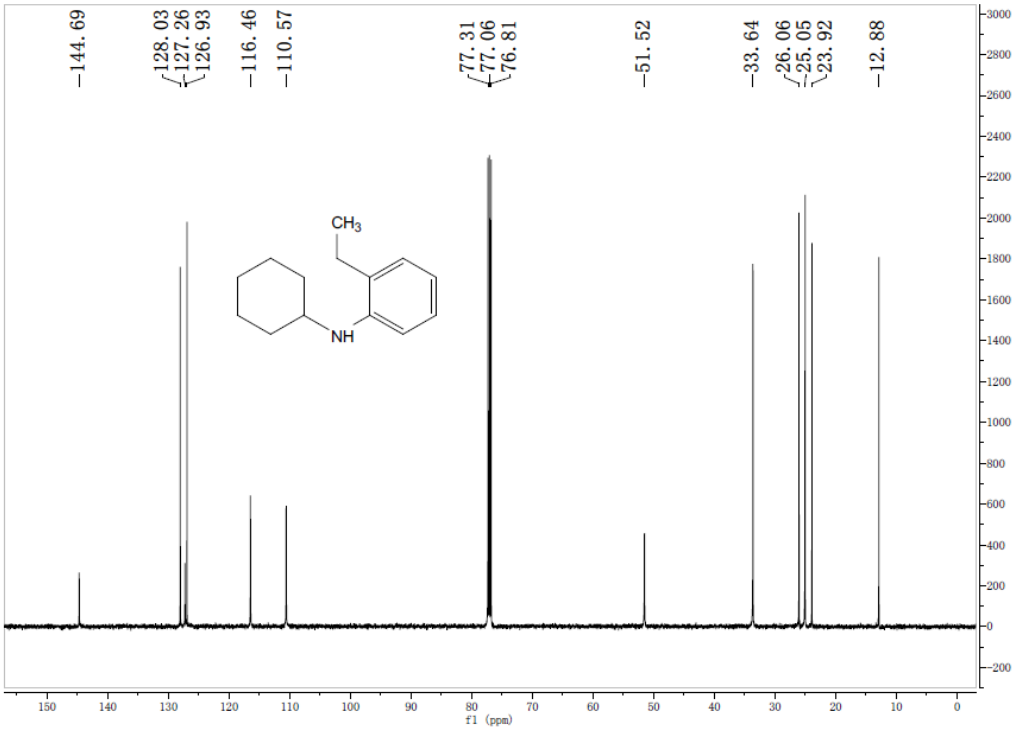
^{1}H NMR and ^{13}C NMR of *N*-cyclohexyl-2-methylaniline (3d)



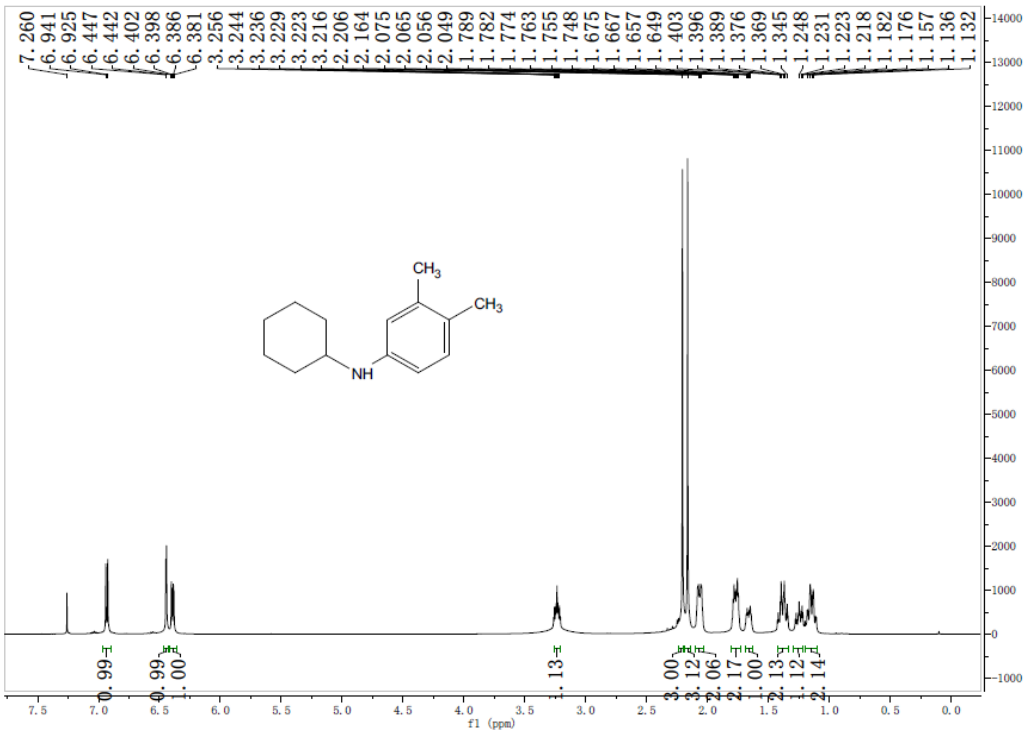


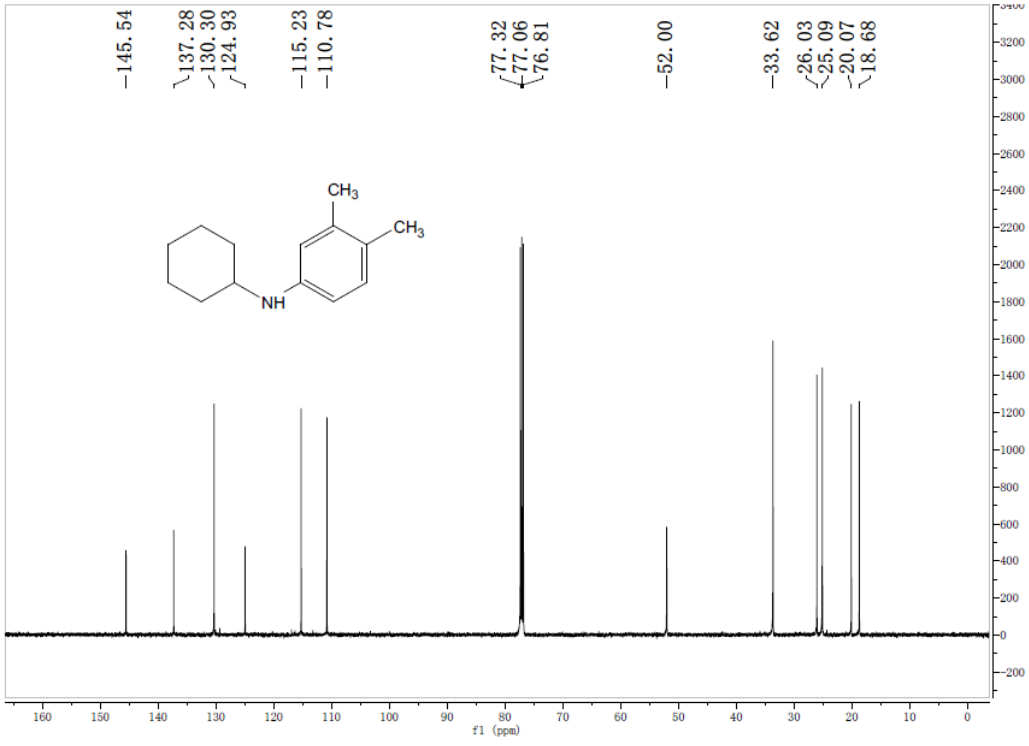
^{1}H NMR and ^{13}C NMR of *N*-cyclohexyl-2-ethylaniline (3e)



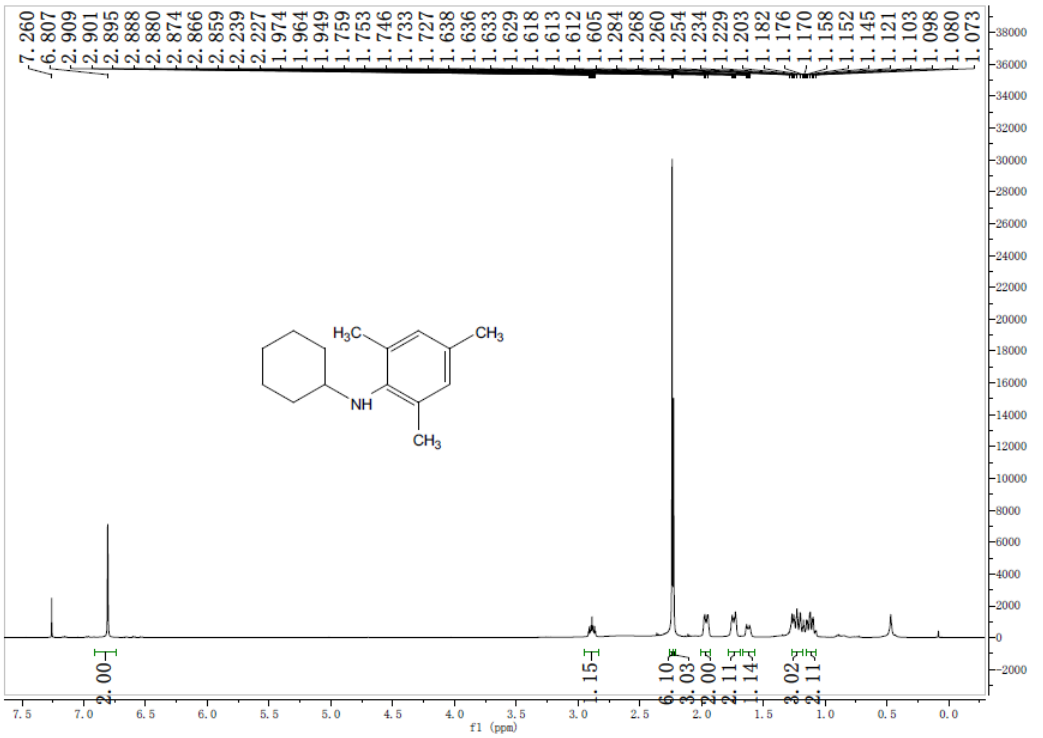


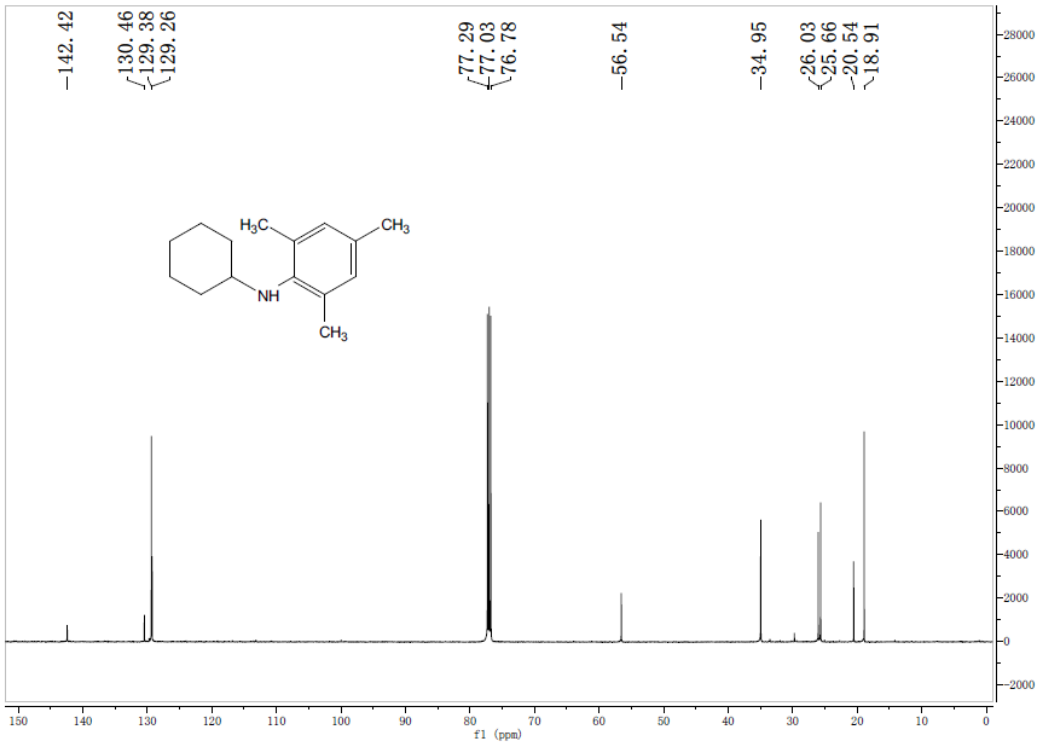
^{1}H NMR and ^{13}C NMR of *N*-cyclohexyl-4-methylaniline (3f)



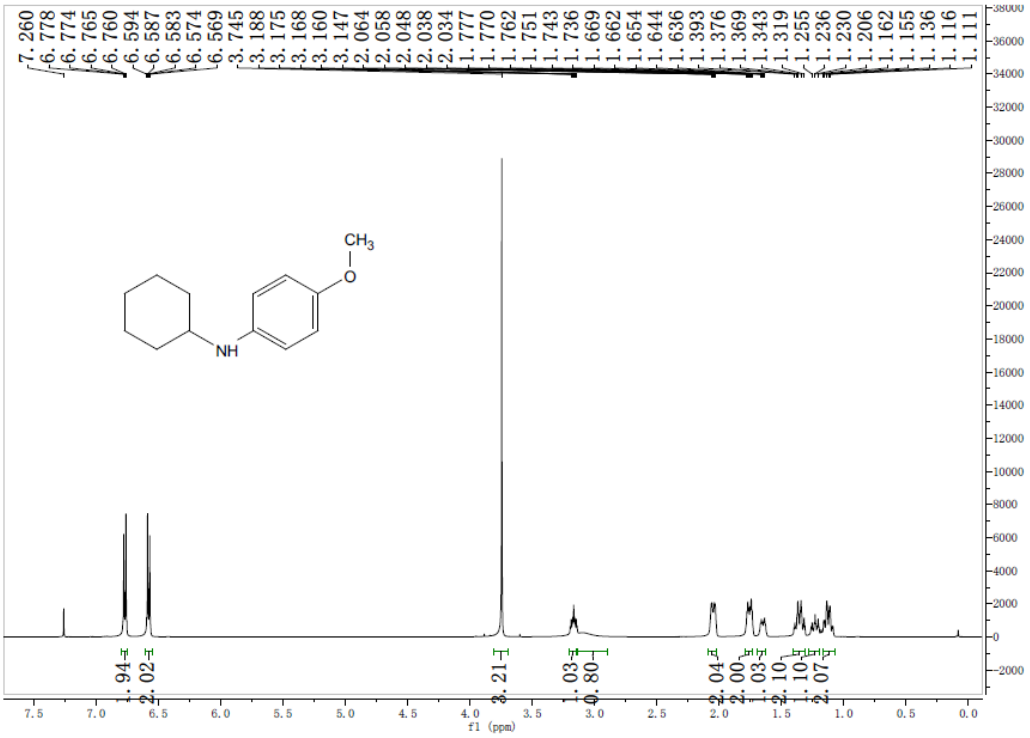


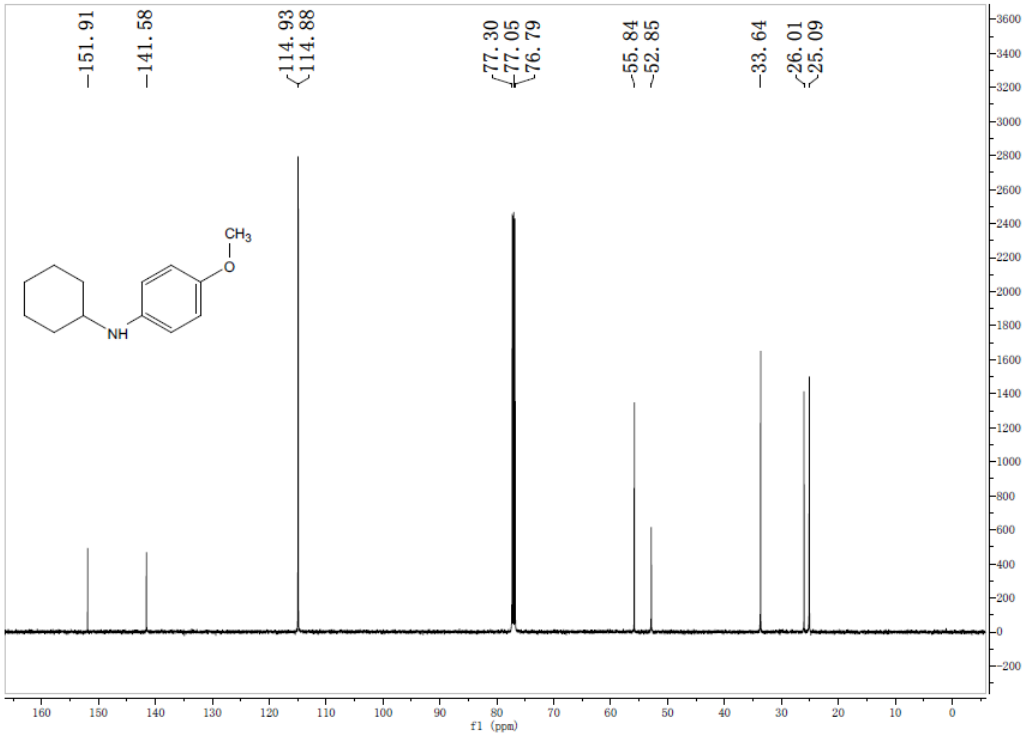
^{1}H NMR and ^{13}C NMR of *N*-cyclohexyl-2,4,6-trimethylaniline (3g)



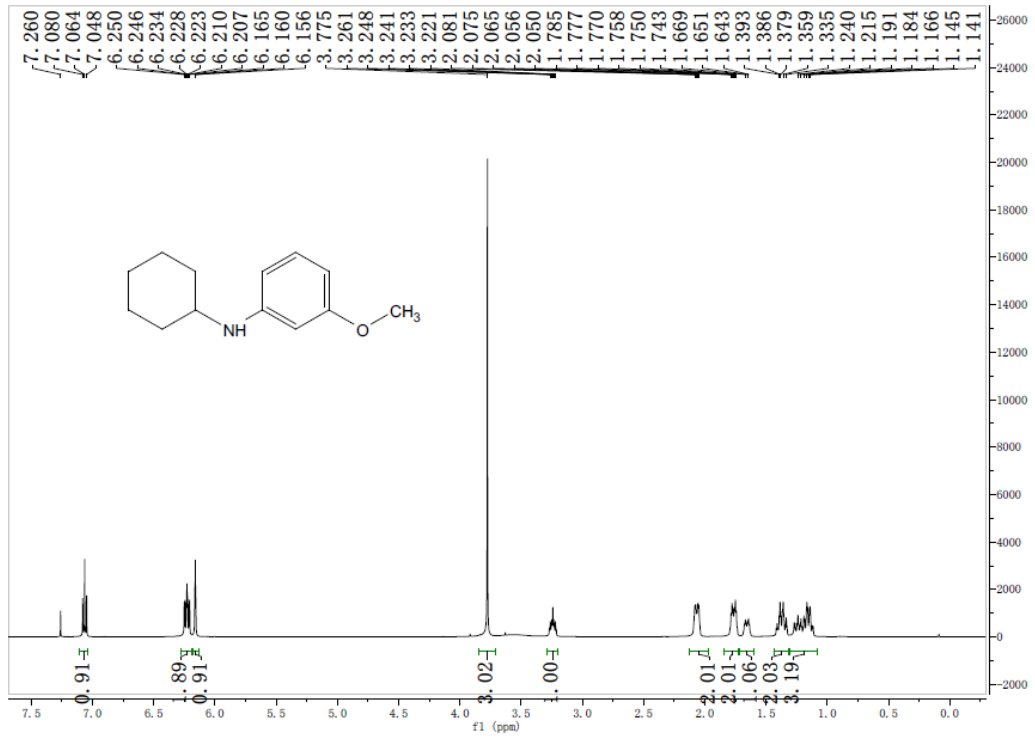


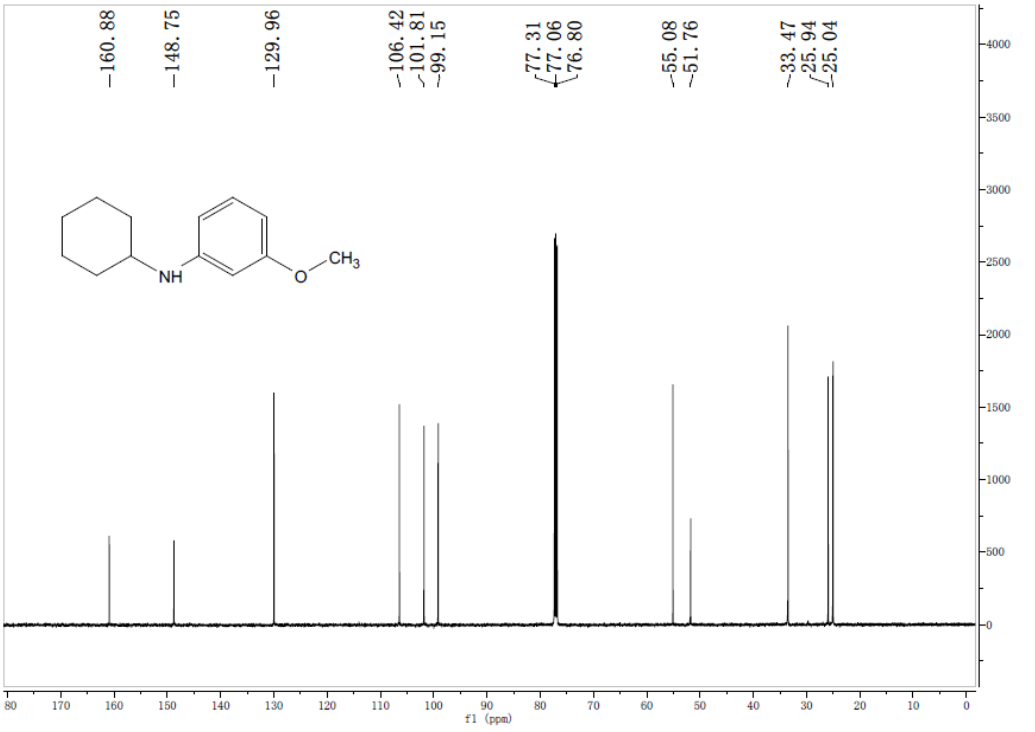
^{1}H NMR and ^{13}C NMR of *N*-cyclohexyl-4-methoxyaniline (3h)



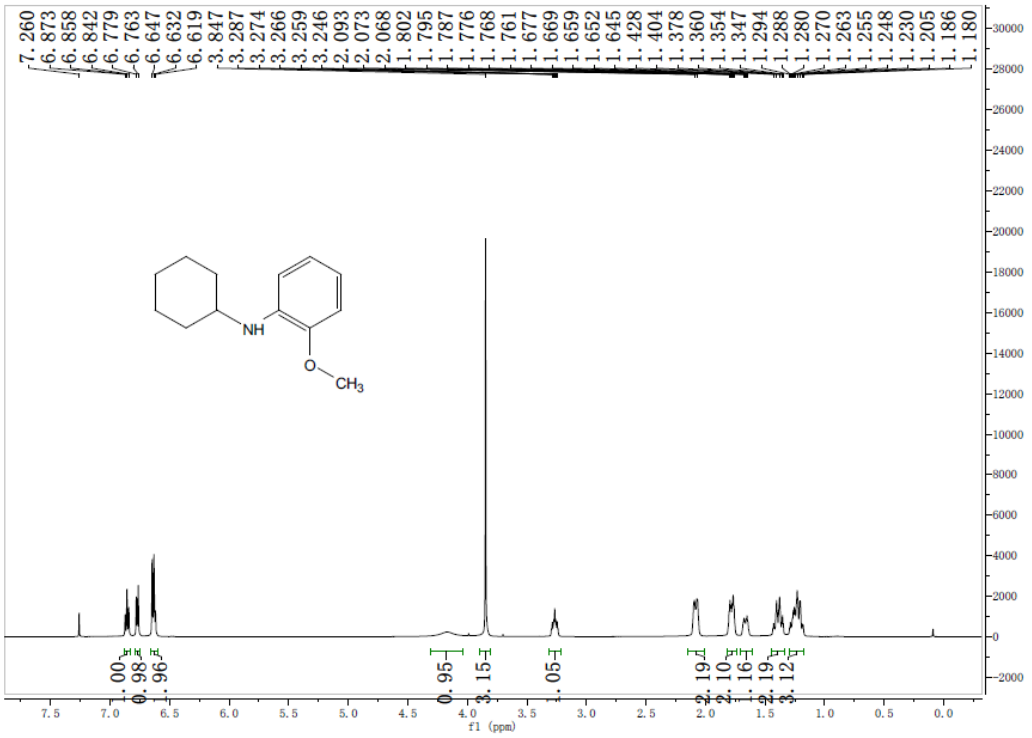


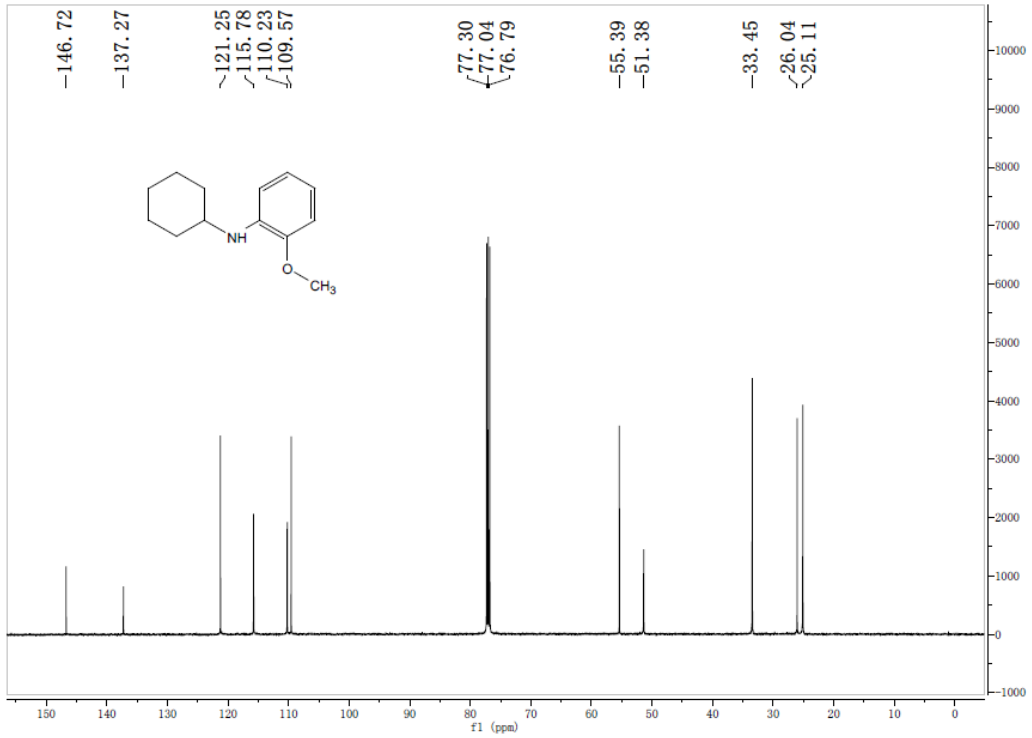
^{1}H NMR and ^{13}C NMR of *N*-cyclohexyl-3-methoxyaniline (3i)



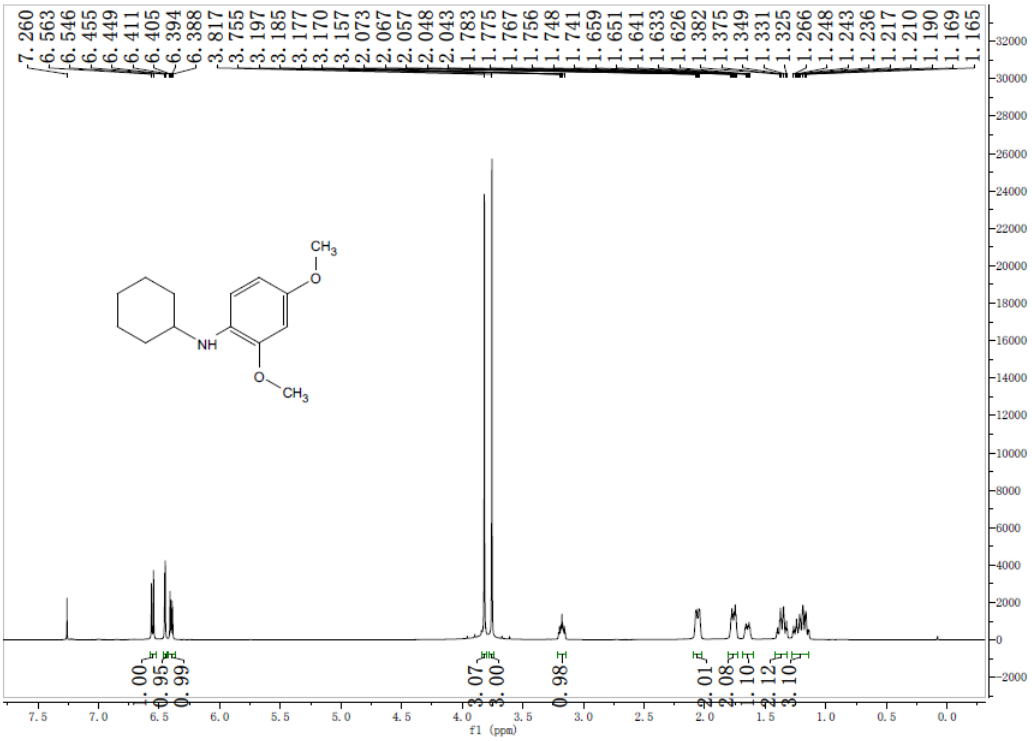


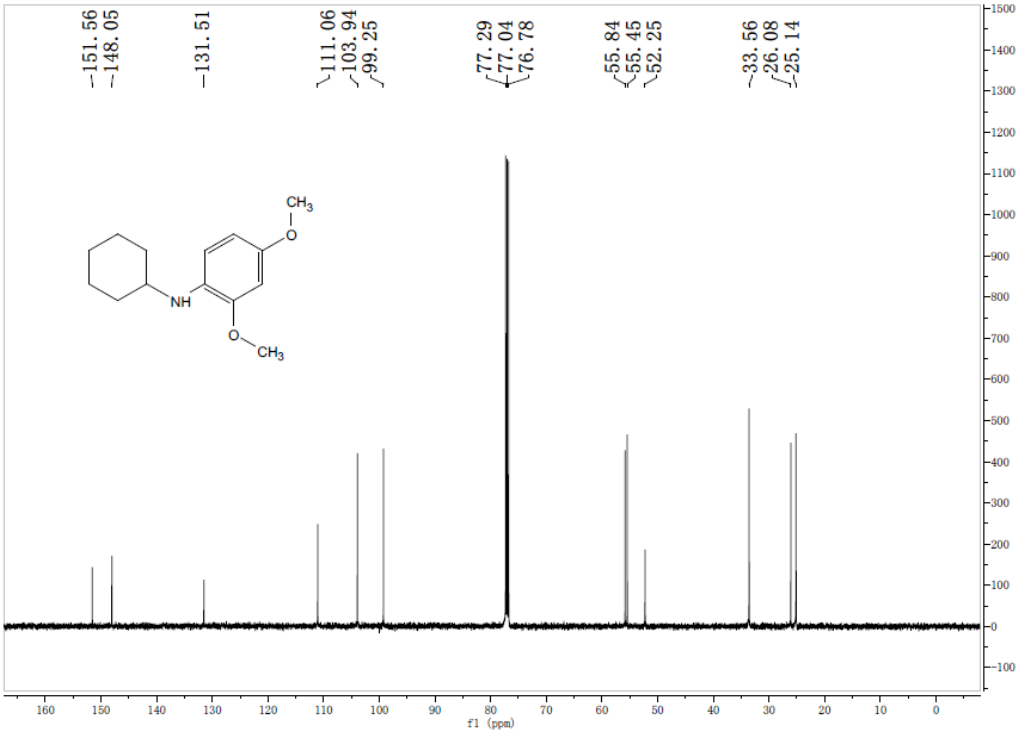
^{1}H NMR and ^{13}C NMR of *N*-cyclohexyl-2-methoxyaniline (3j)



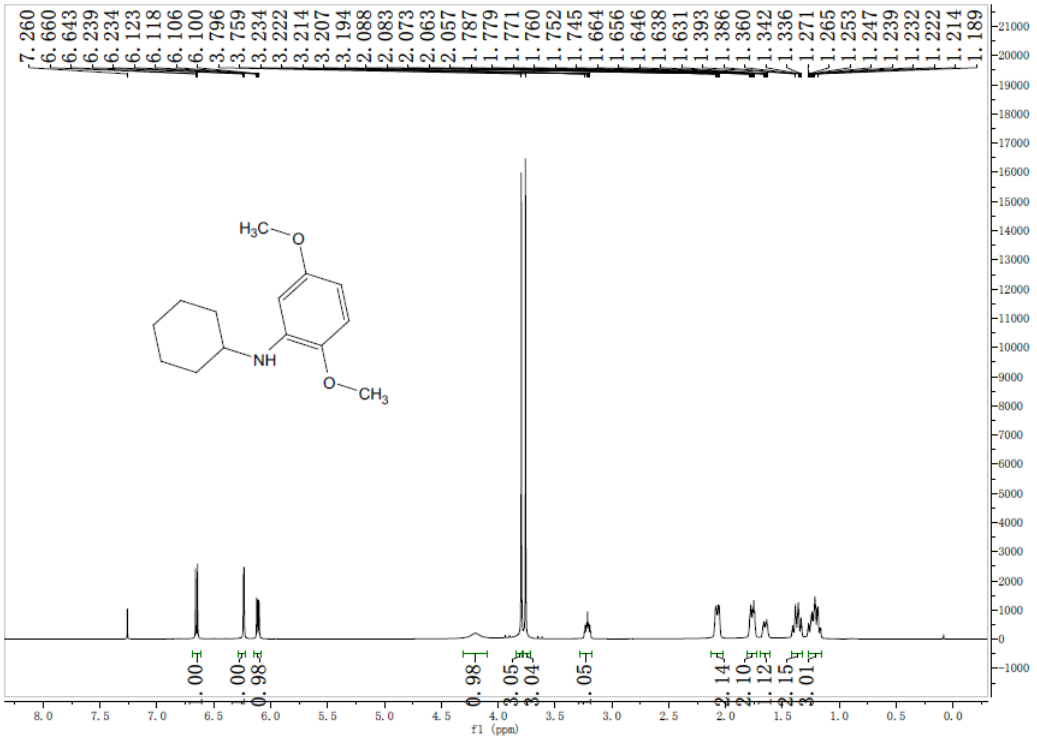


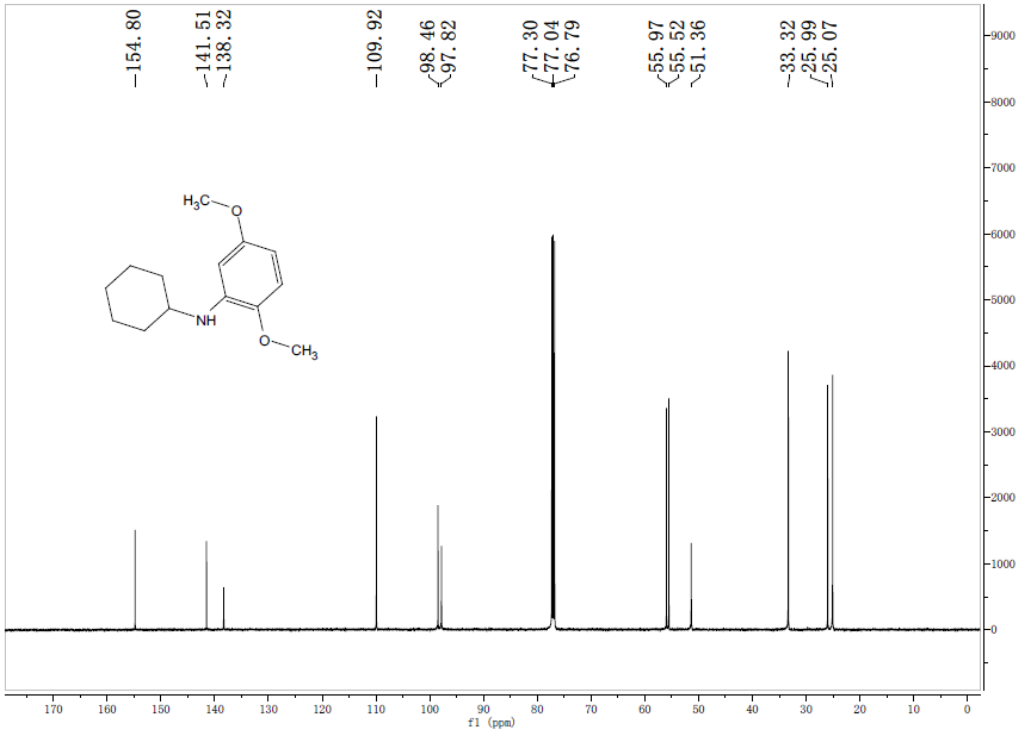
^{1}H NMR and ^{13}C NMR of *N*-cyclohexyl-2,4-dimethoxyaniline (3k)



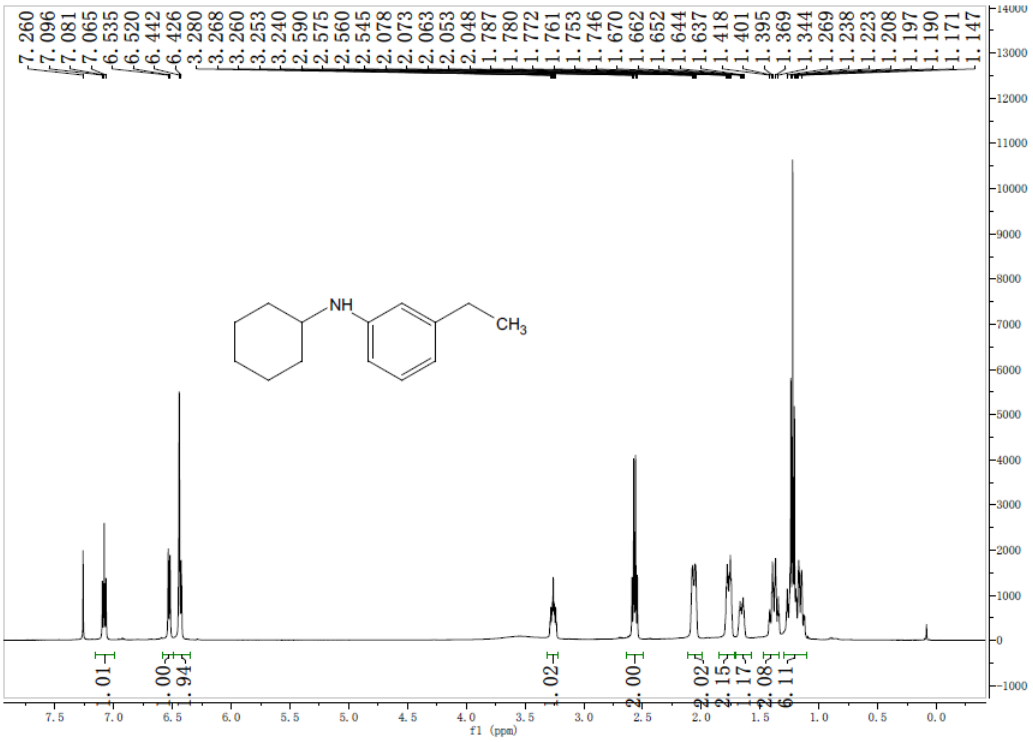


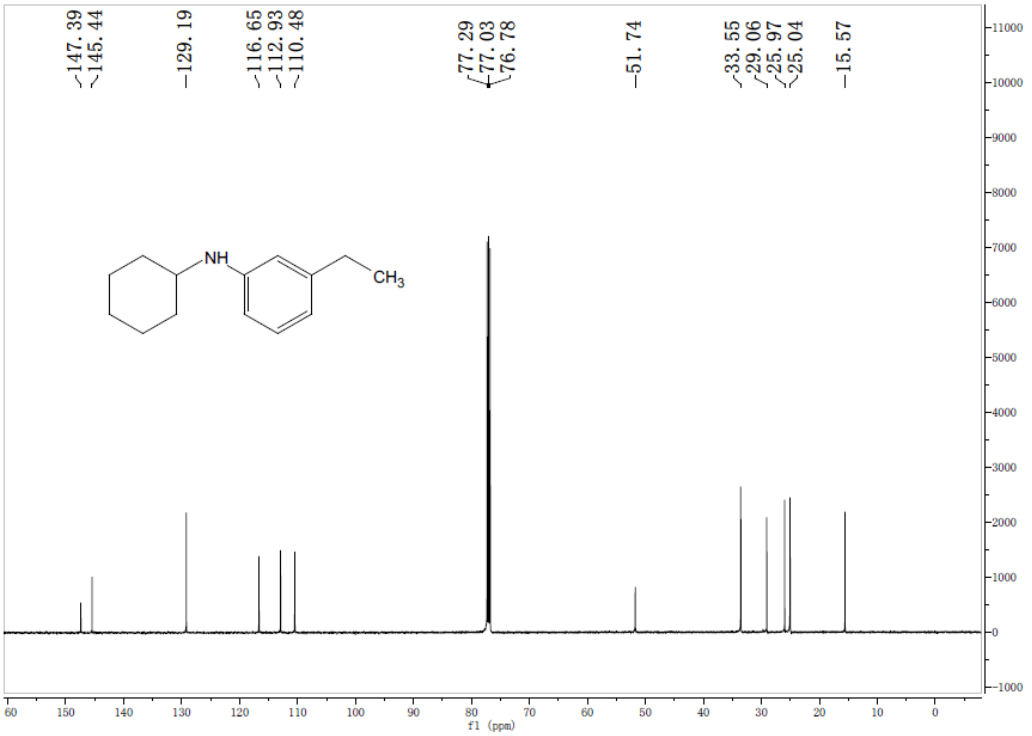
^{1}H NMR and ^{13}C NMR of *N*-cyclohexyl-2,5-dimethoxyaniline (3l)



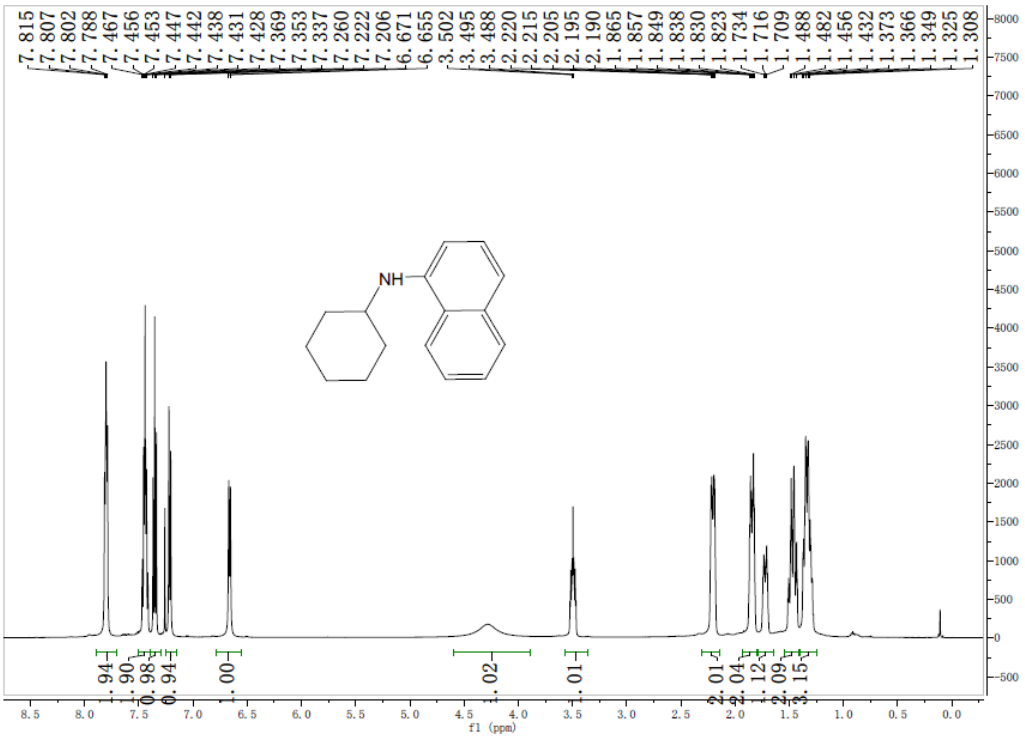


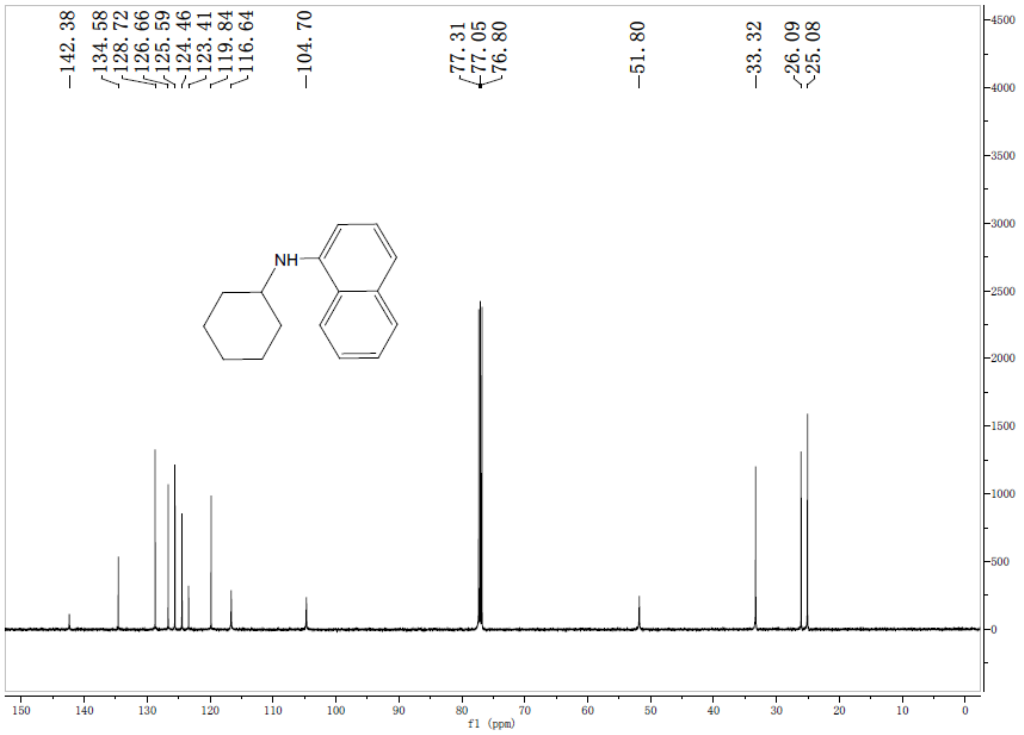
^{1}H NMR and ^{13}C NMR of *N*-cyclohexyl-3-ethylaniline (3m)



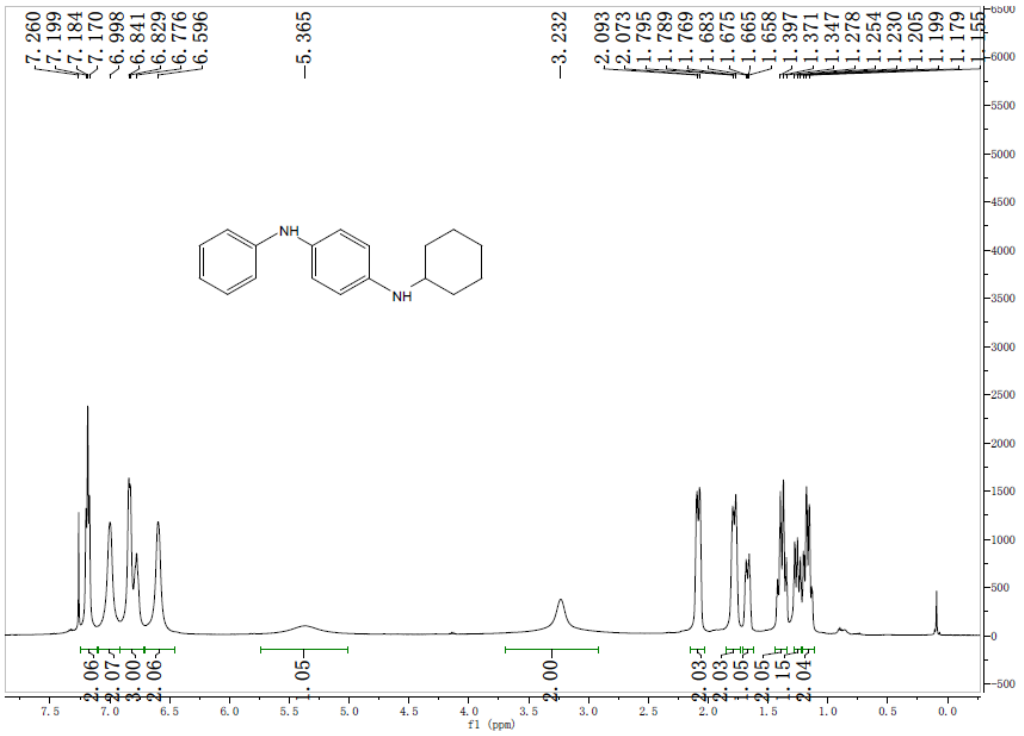


^{1}H NMR and ^{13}C NMR of *N*-cyclohexylnaphthalen-1-amine (3n)

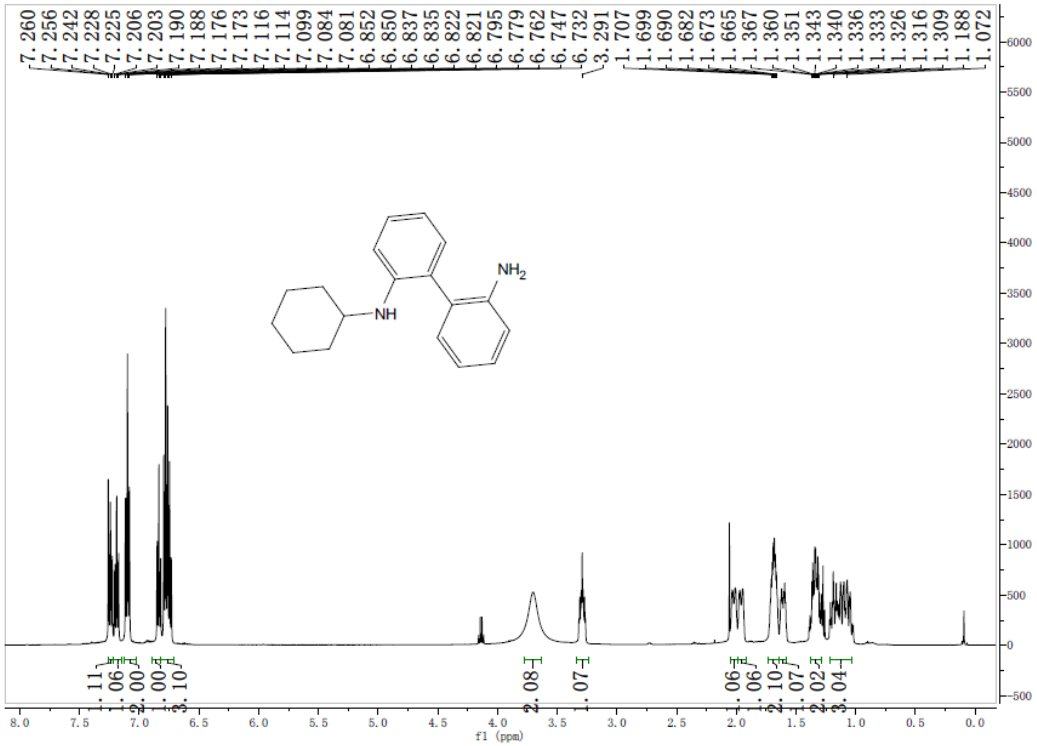


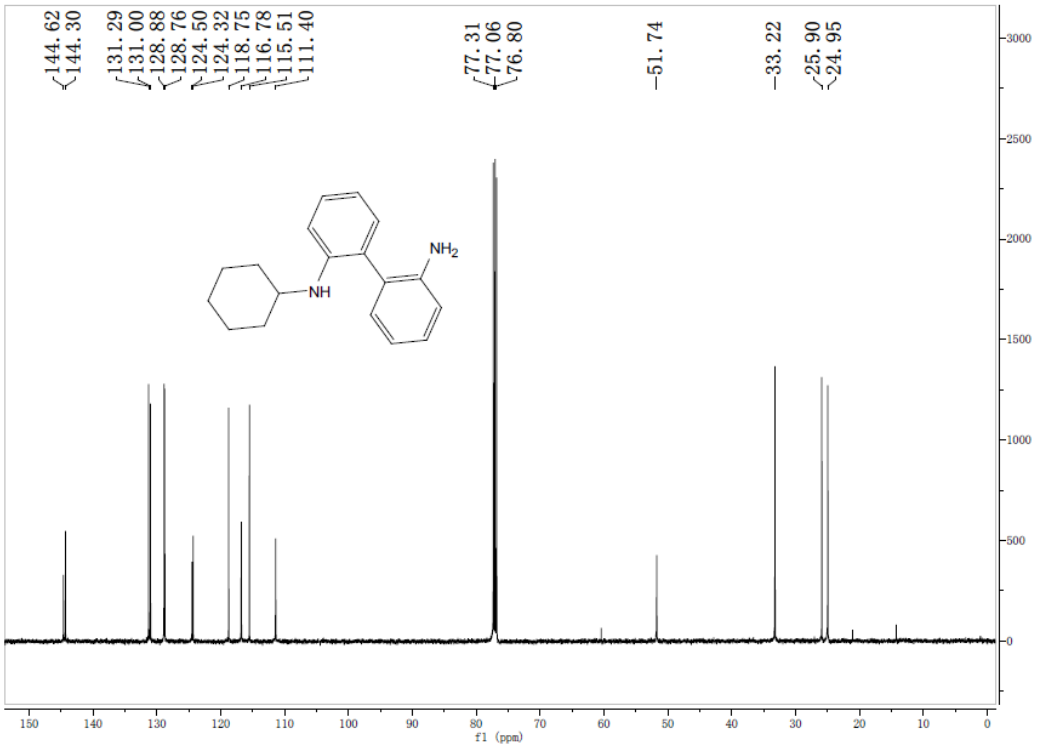


^{1}H NMR and ^{13}C NMR of N^{1}-cyclohexyl-N^{4}-phenylbenzene-1,4-diamine (3o)

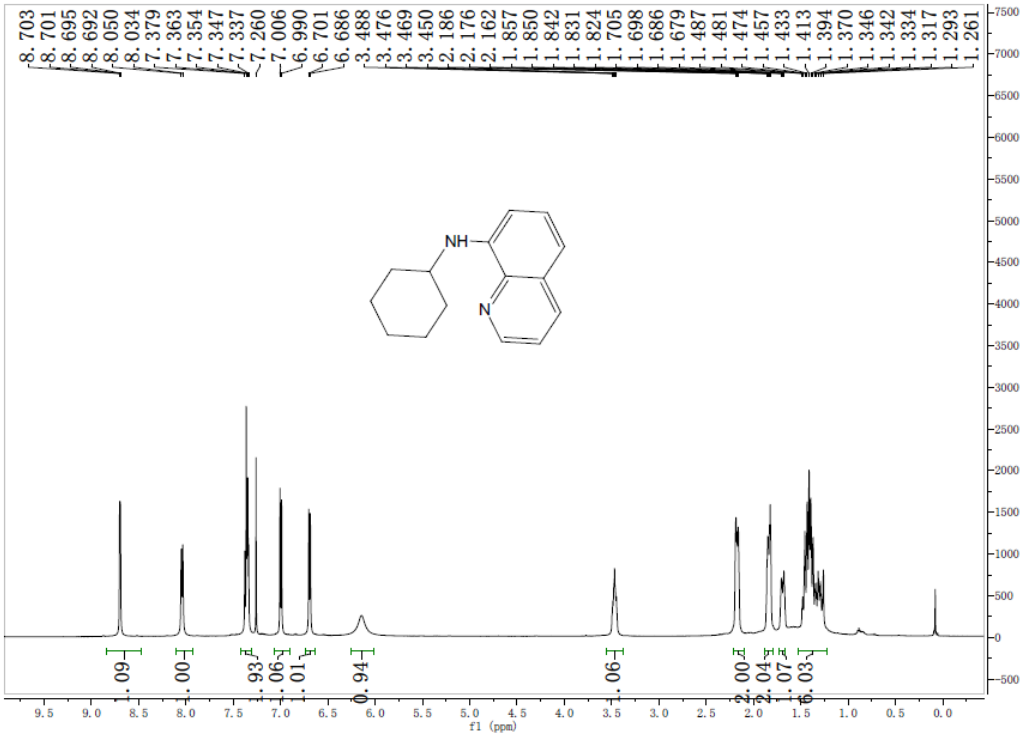


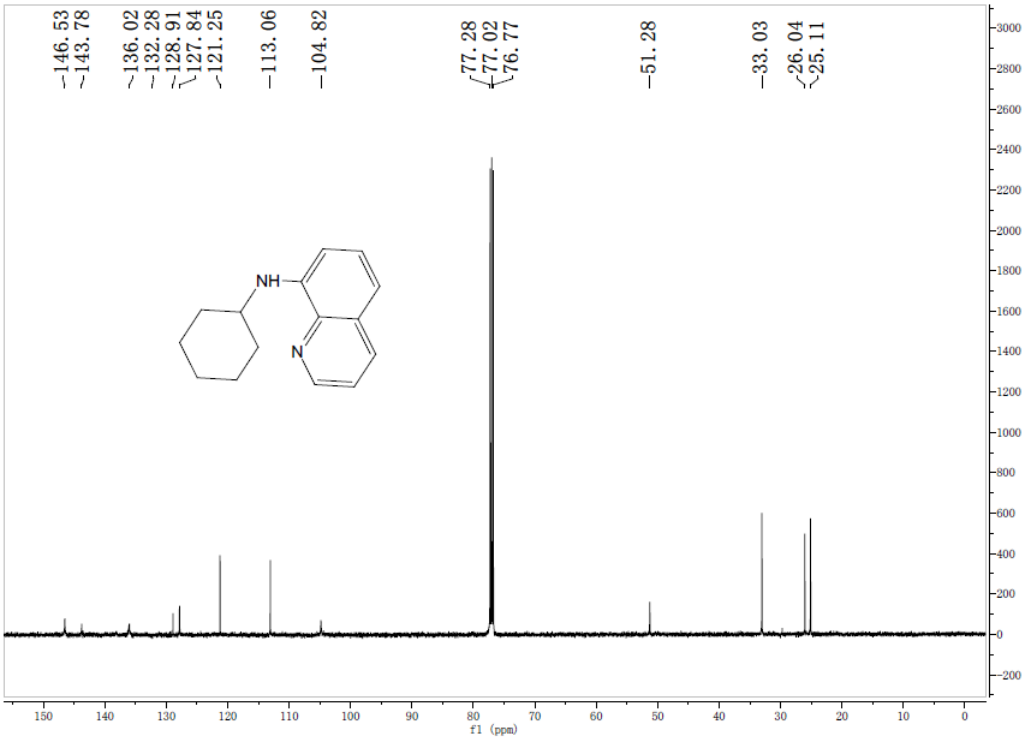
^{1}H NMR and ^{13}C NMR of N^{2}-cyclohexyl-[1,1'-biphenyl]-2,2'-diamine (3p)



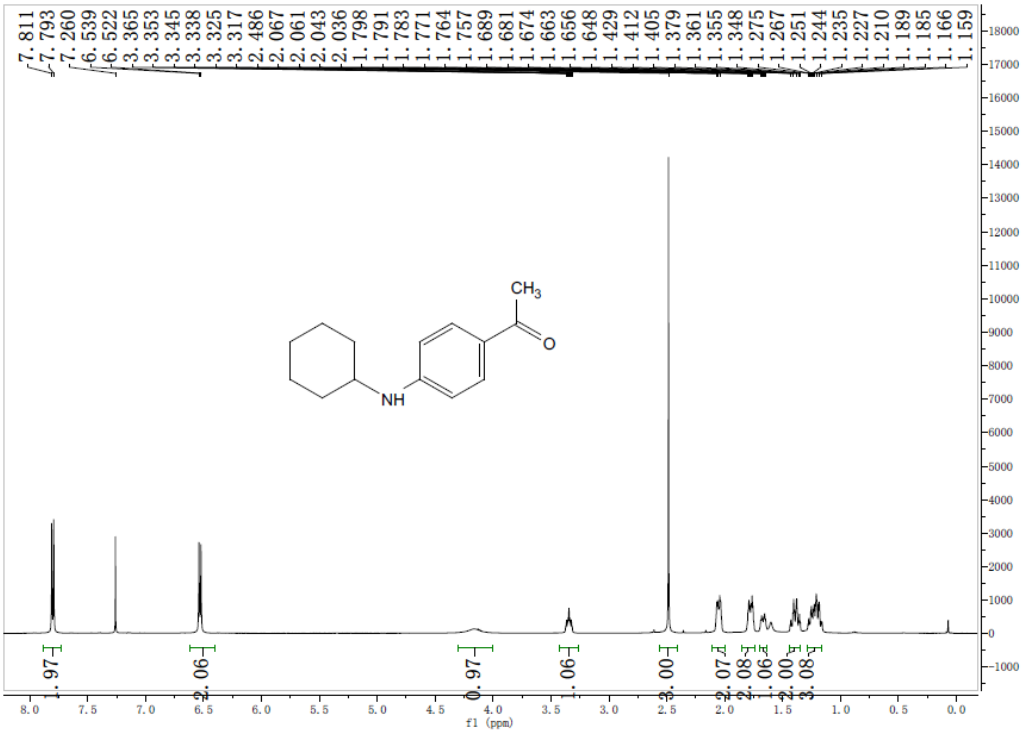


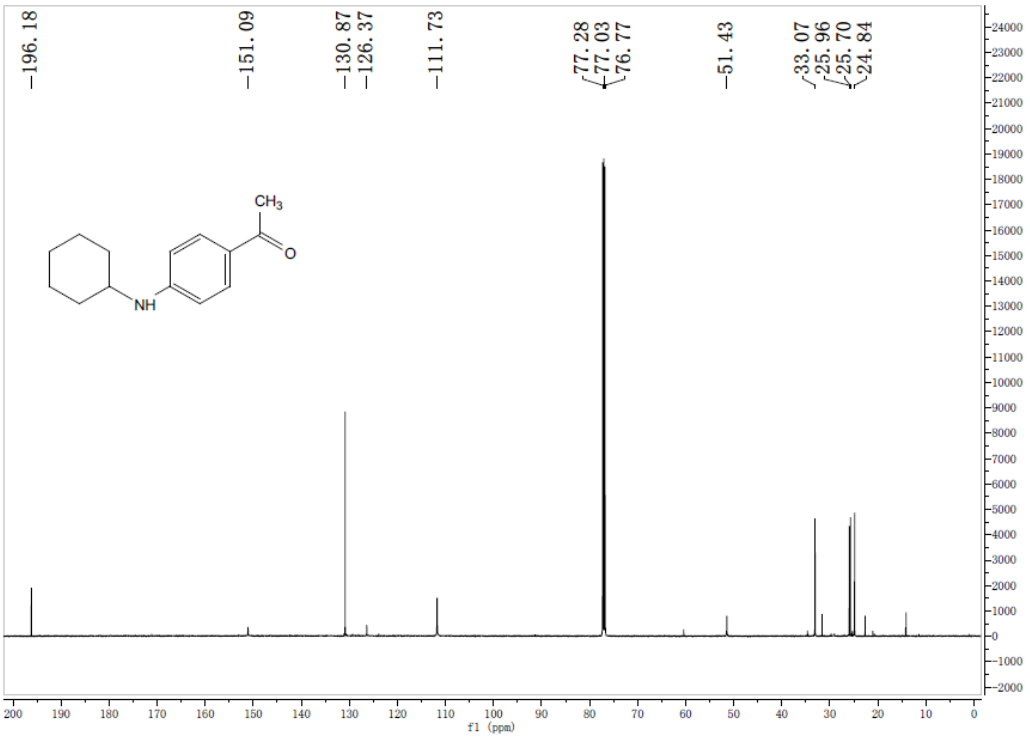
^{1}H NMR and ^{13}C NMR of *N*-cyclohexylquinolin-8-amine (3q)



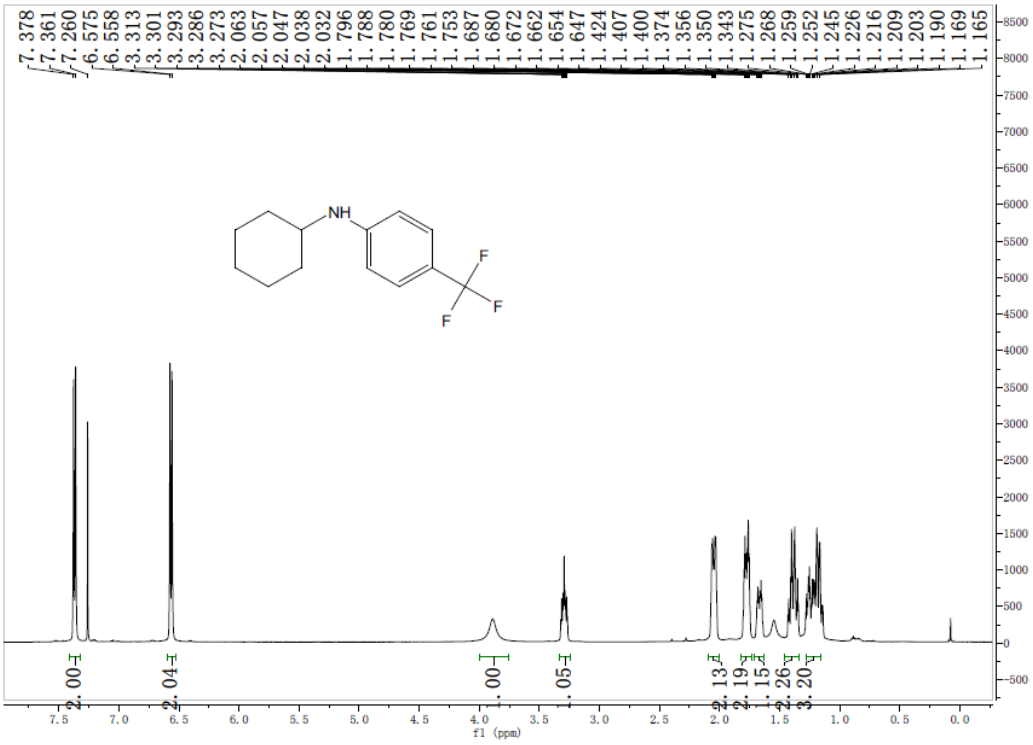


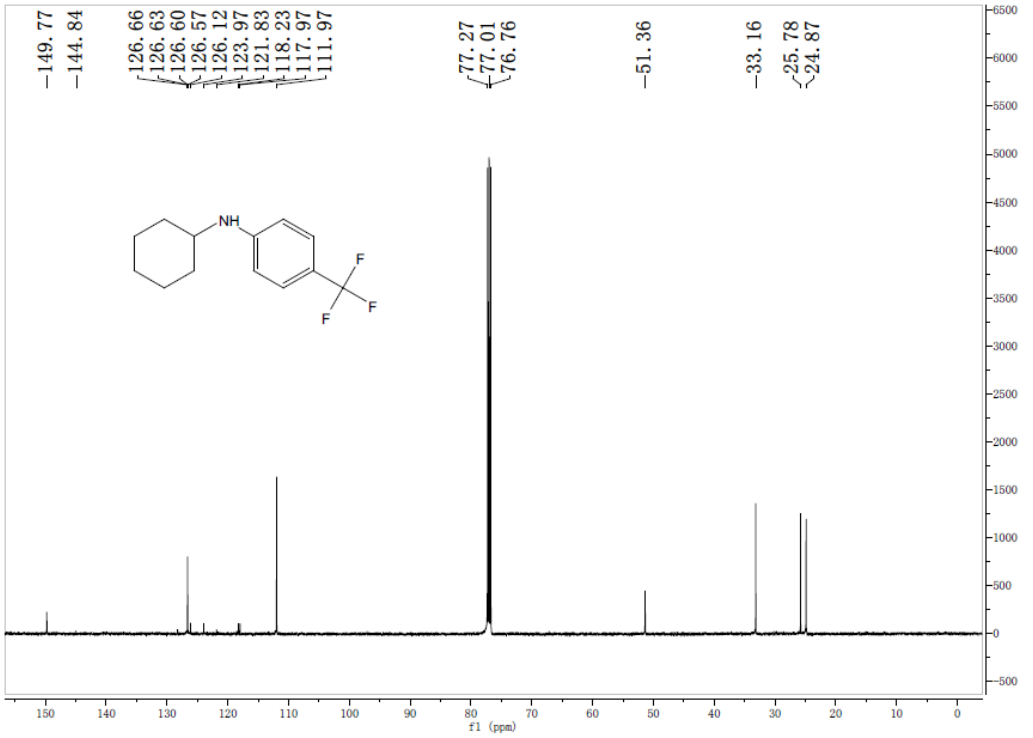
^{1}H NMR and ^{13}C NMR of 1-(4-(cyclohexylamino)phenyl)ethanone (3r)



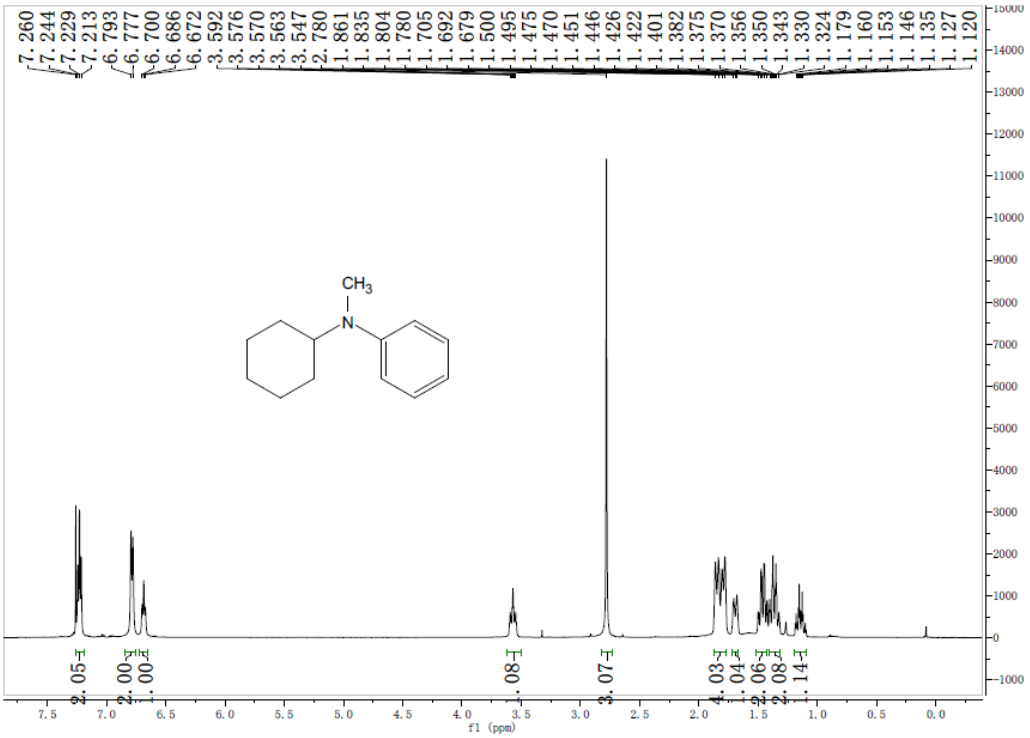


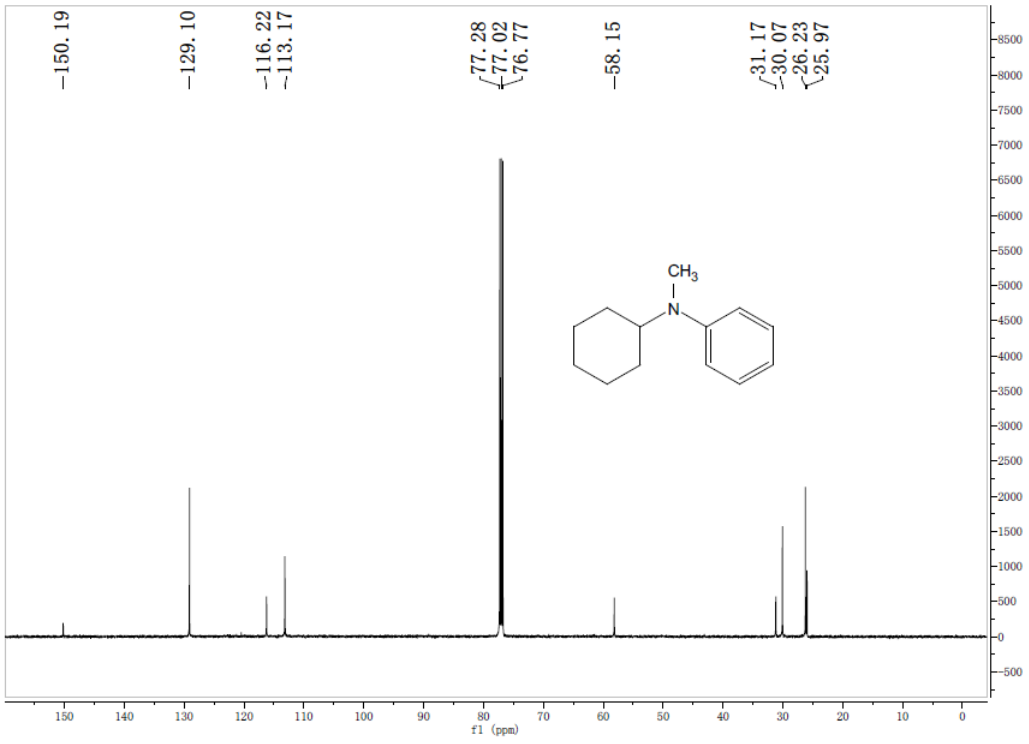
^{1}H NMR and ^{13}C NMR of *N*-cyclohexyl-4-(trifluoromethyl)aniline (3s)



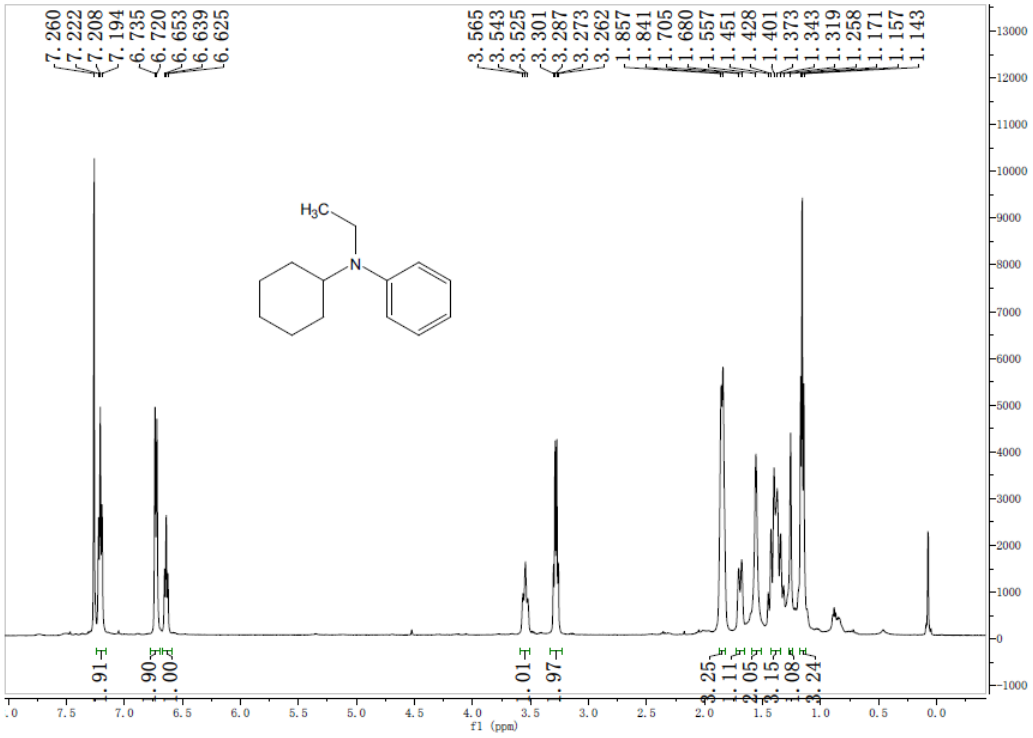


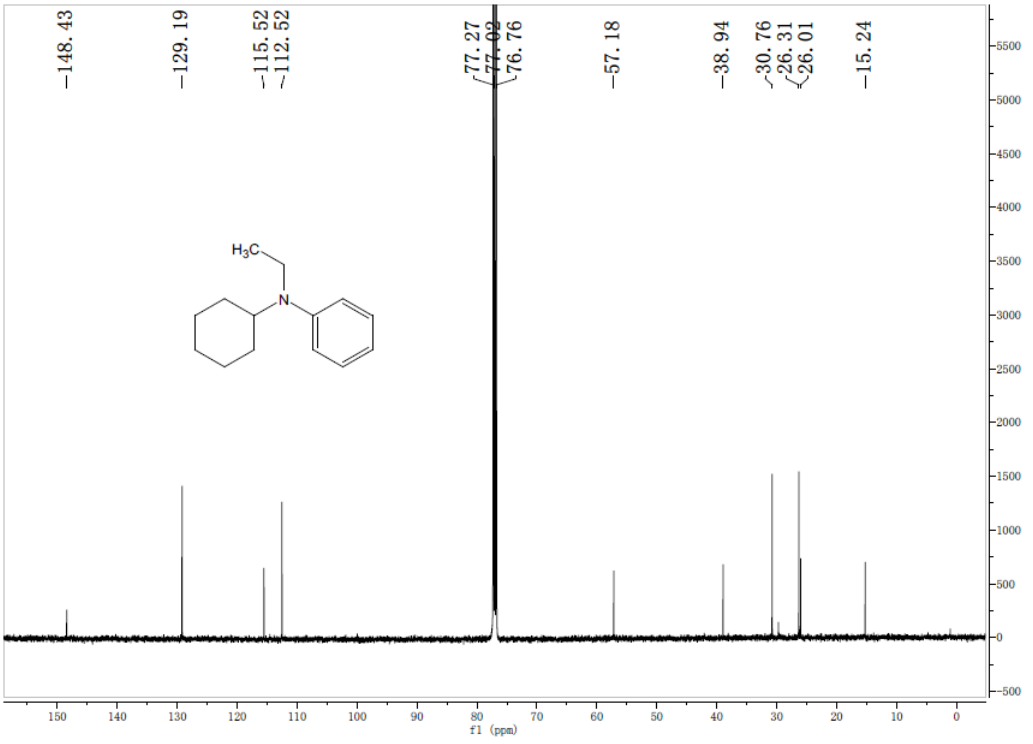
^{1}H NMR and ^{13}C NMR of *N*-cyclohexyl-*N*-methylaniline (3t)



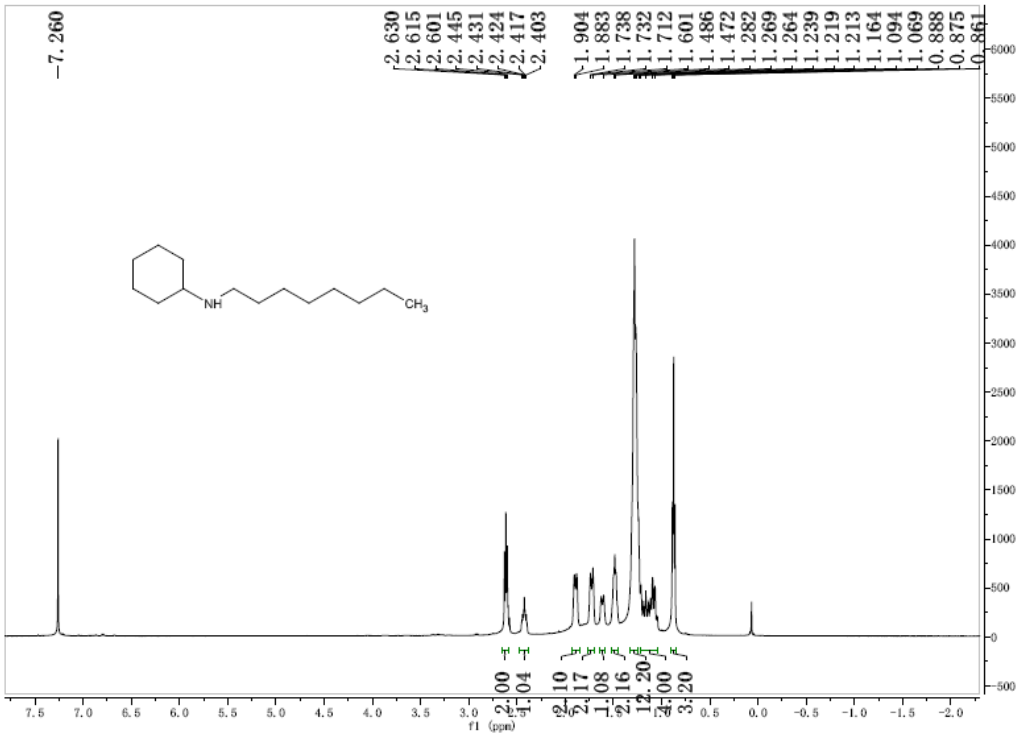


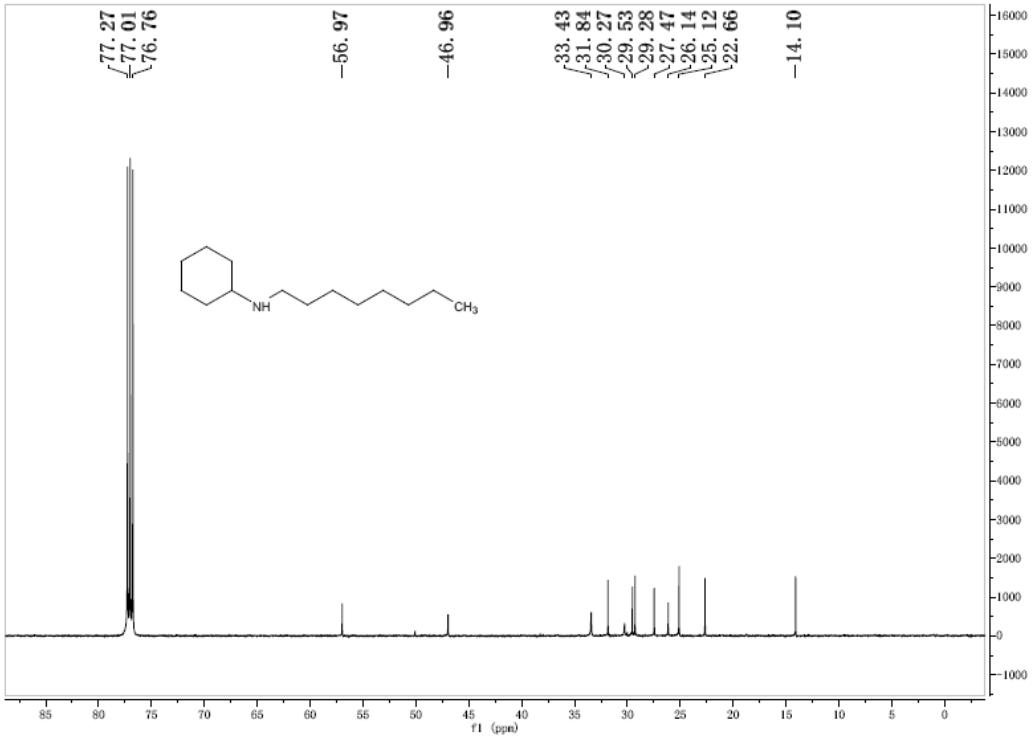
^{1}H NMR and ^{13}C NMR of *N*-cyclohexyl-*N*-ethylaniline (3u)



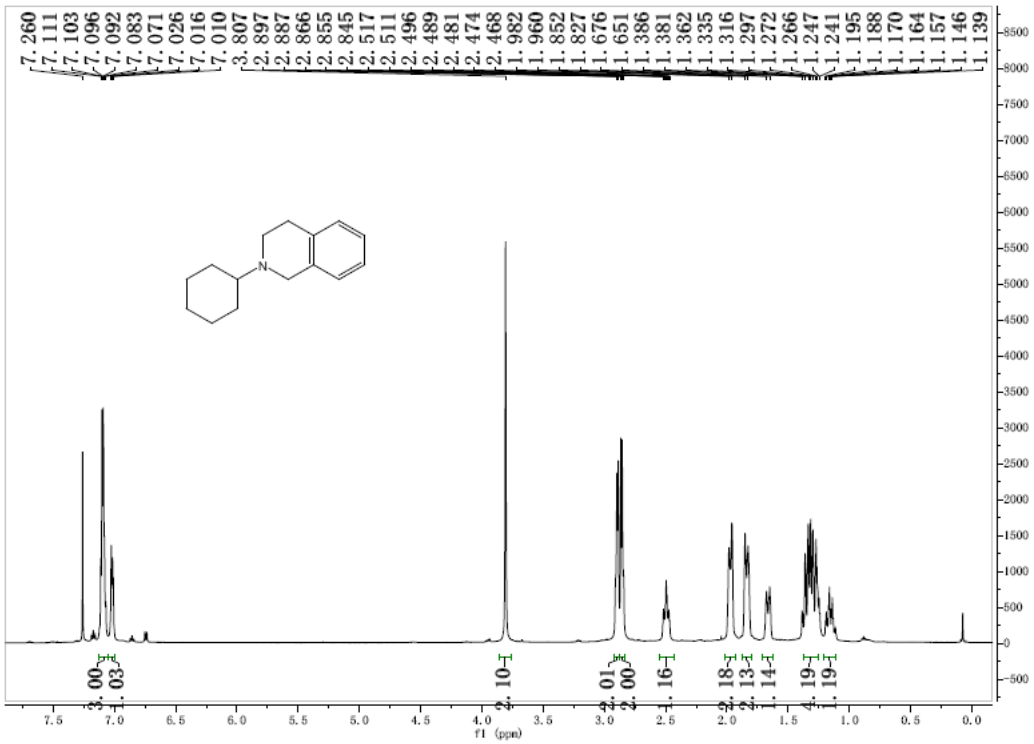


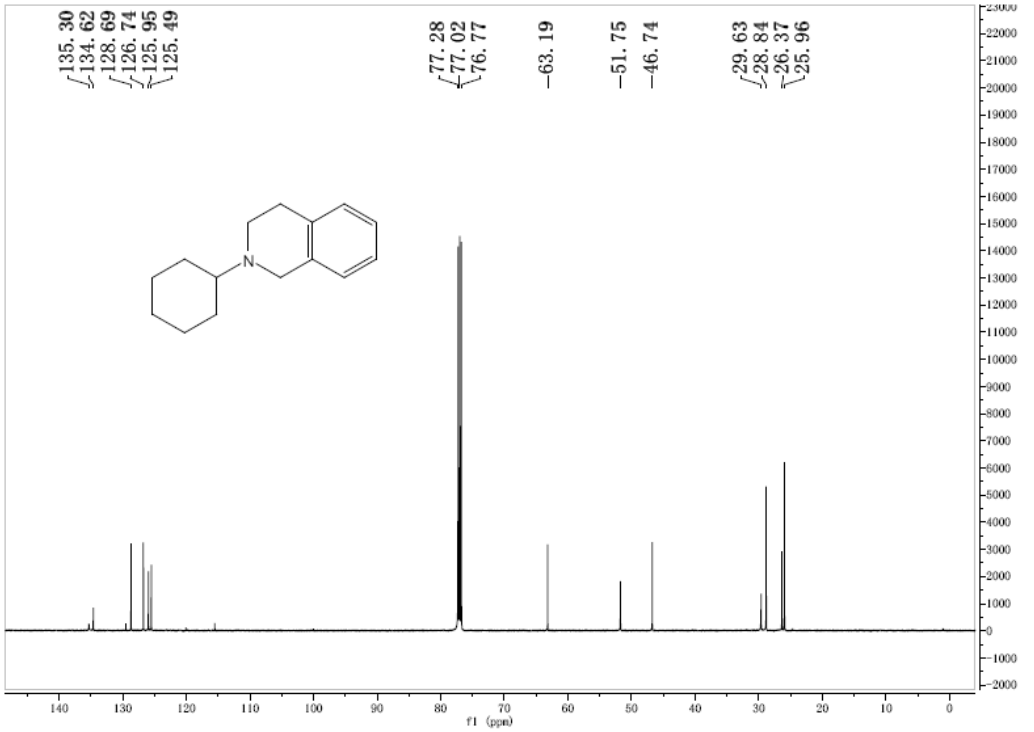
^{1}H NMR and ^{13}C NMR of *N*-octylcyclohexanamine (3v)



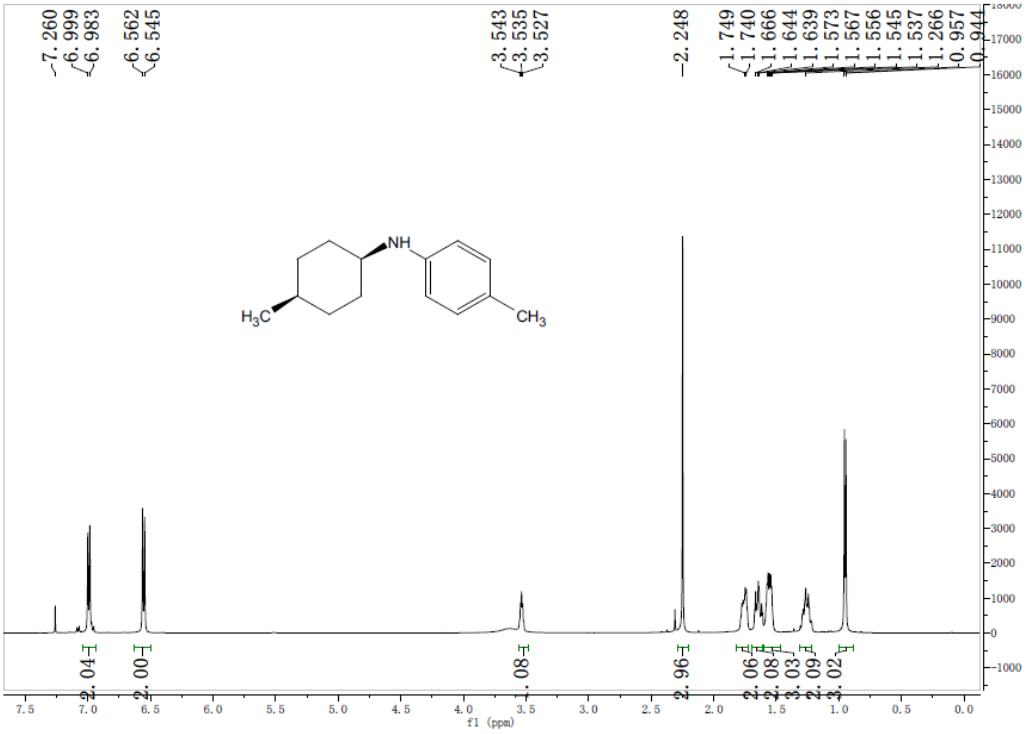


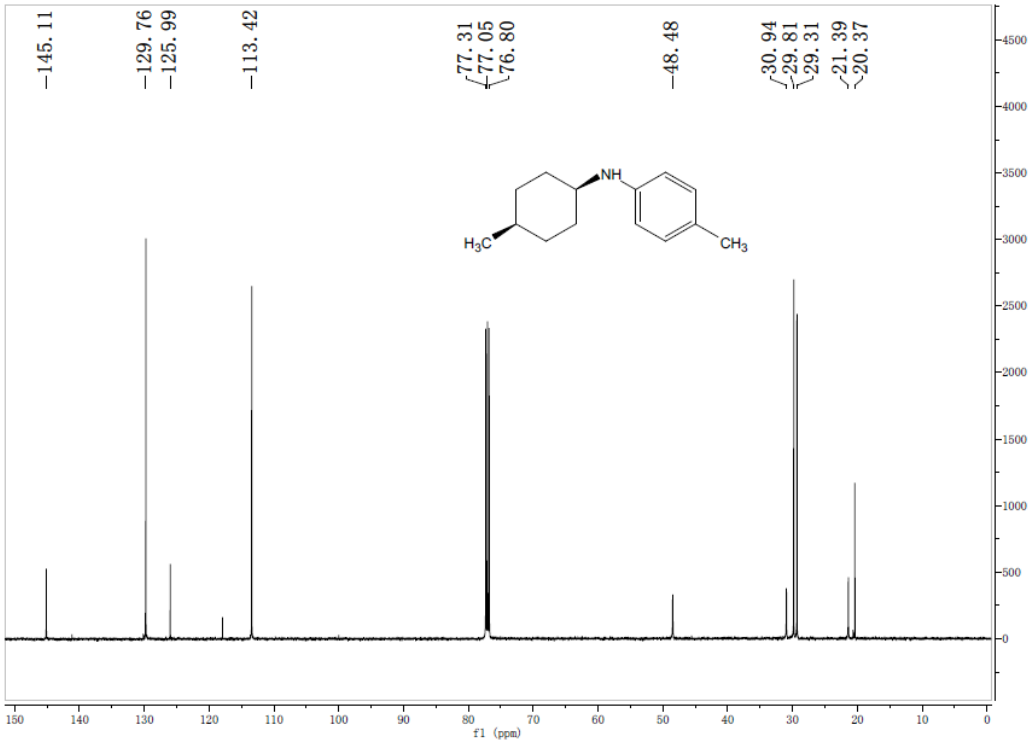
^{1}H NMR and ^{13}C NMR of 2-cyclohexyl-1,2,3,4-tetrahydroisoquinoline (3w)



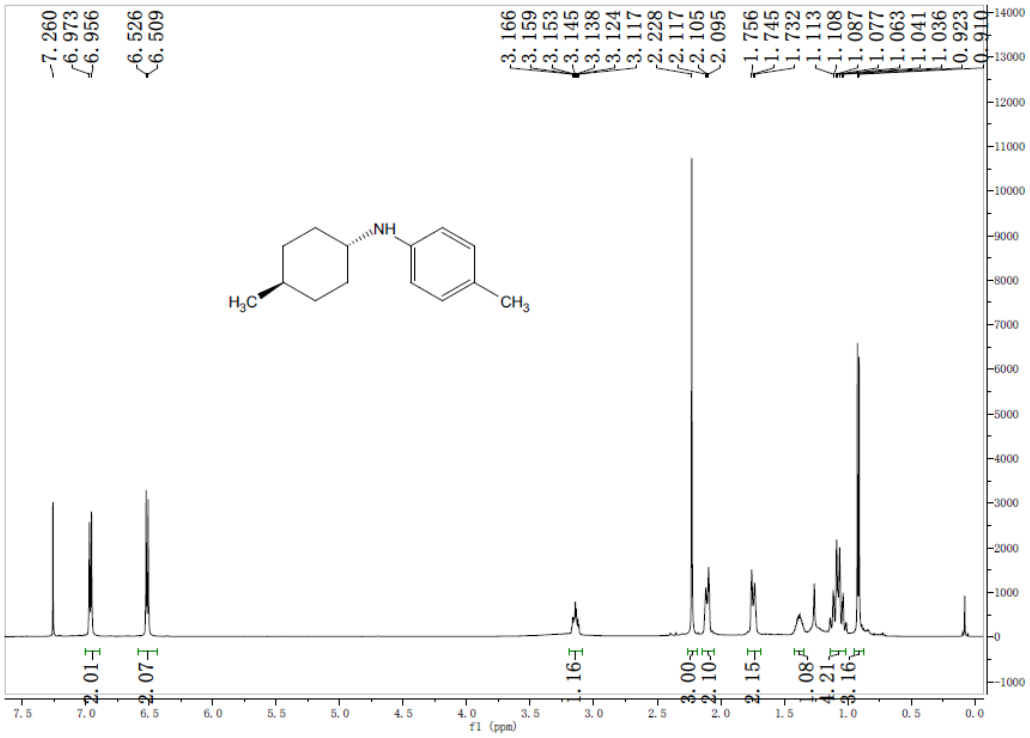


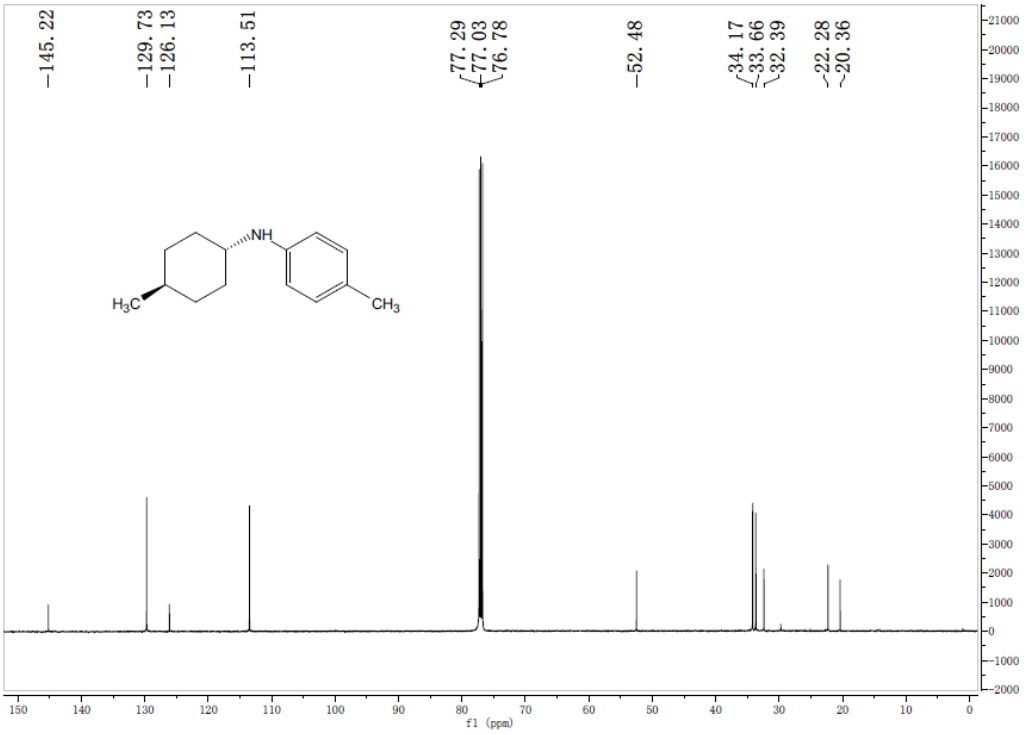
^{1}H NMR and ^{13}C NMR of *cis*-4-methyl-*N*-(4-methylcyclohexyl)aniline (4a)



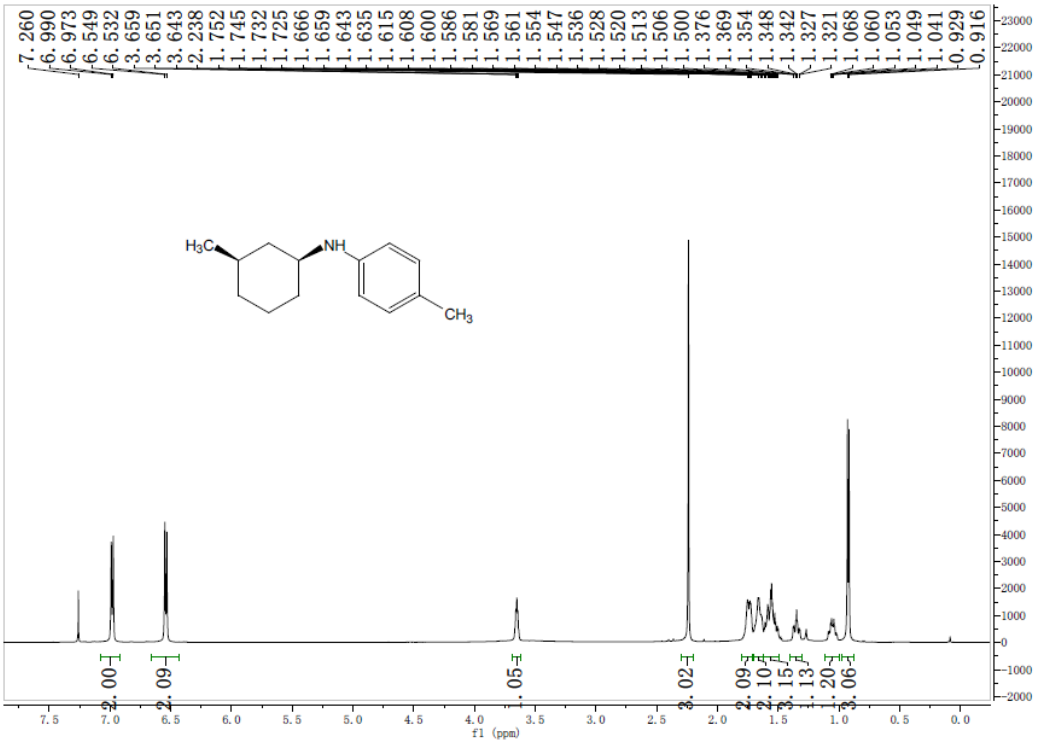


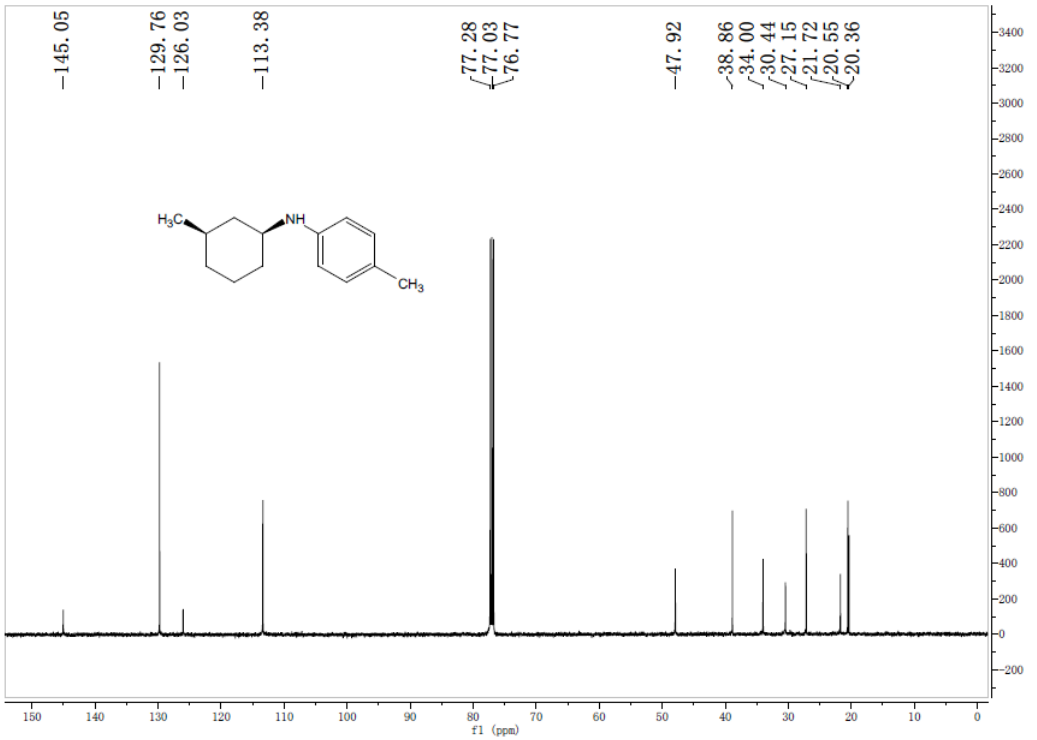
^{1}H NMR and ^{13}C NMR of *trans*-4-methyl-*N*-(4-methylcyclohexyl)aniline (4a)



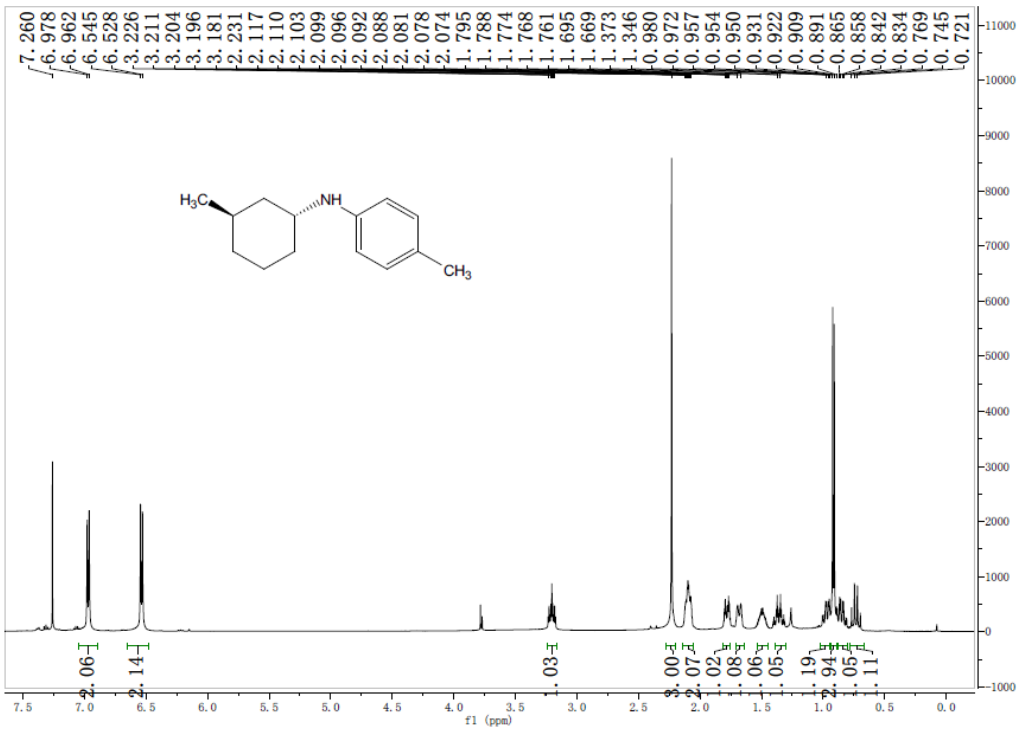


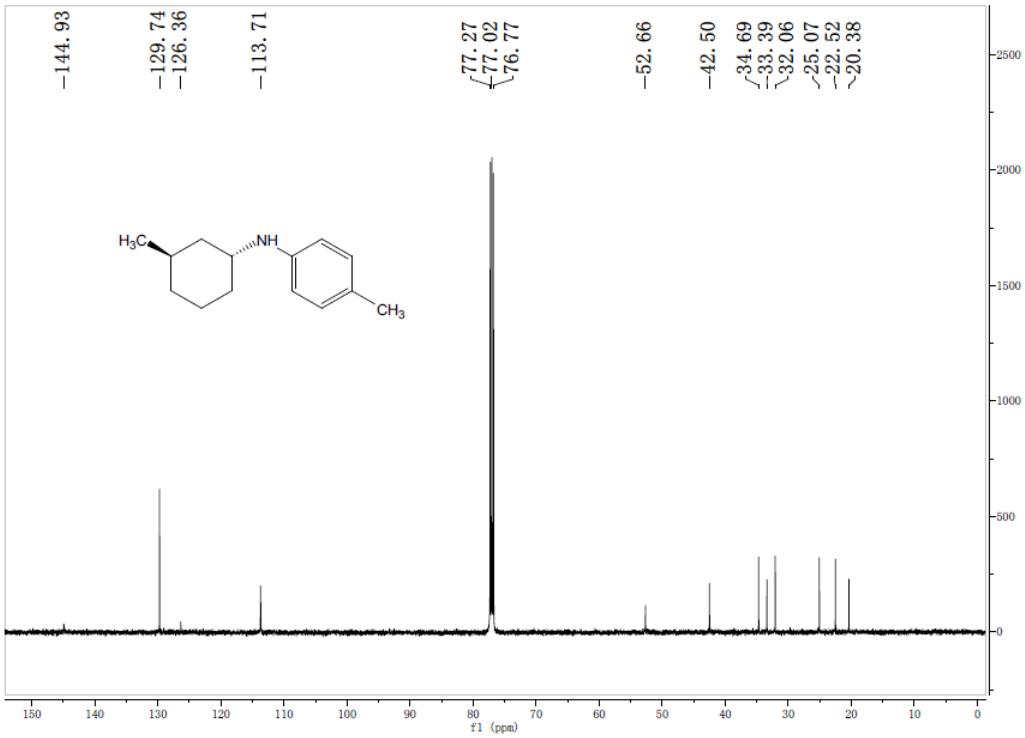
^{1}H NMR and ^{13}C NMR of *cis*-4-methyl-*N*-(3-methylcyclohexyl)aniline (4b)



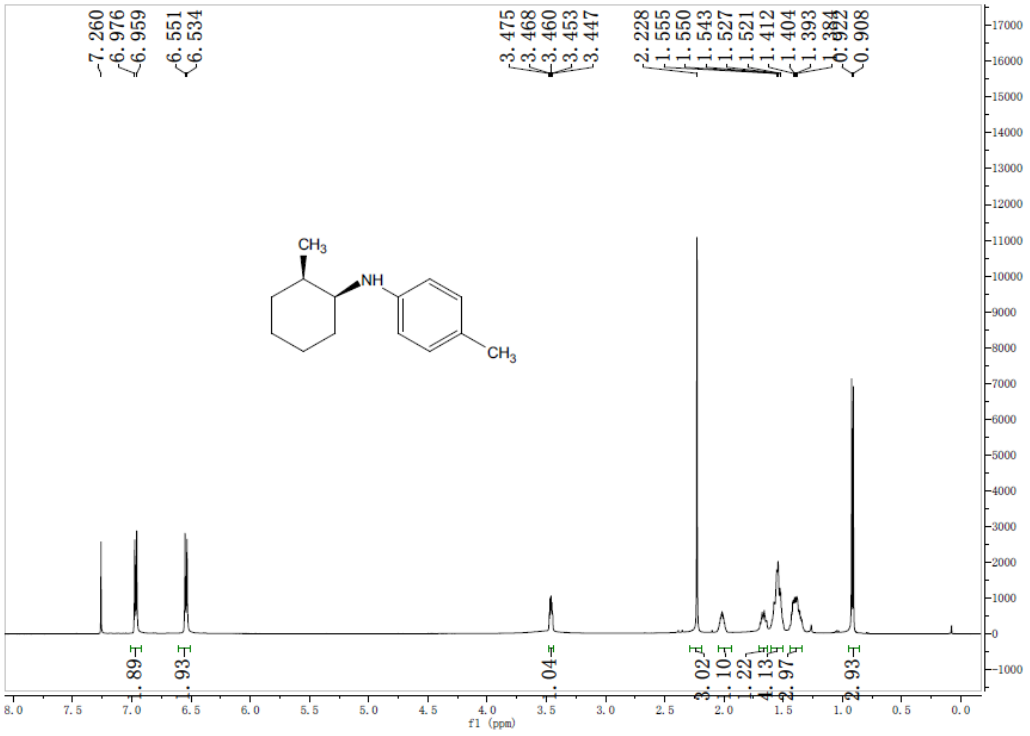


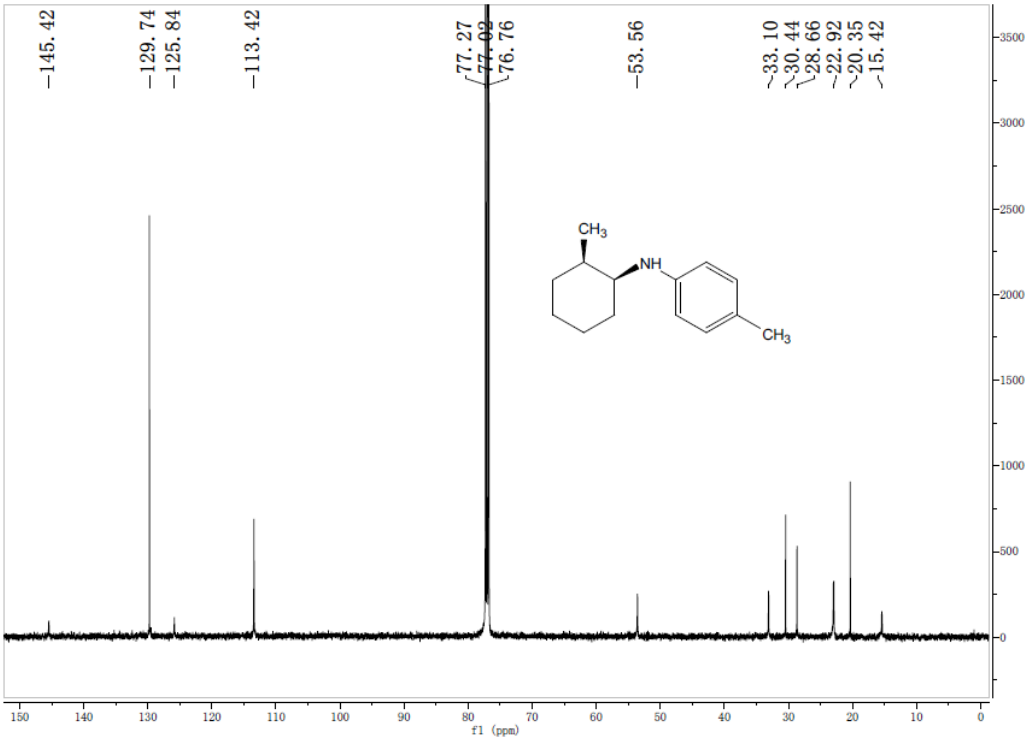
^{1}H NMR and ^{13}C NMR of *trans*-4-methyl-*N*-(3-methylcyclohexyl)aniline (4b)



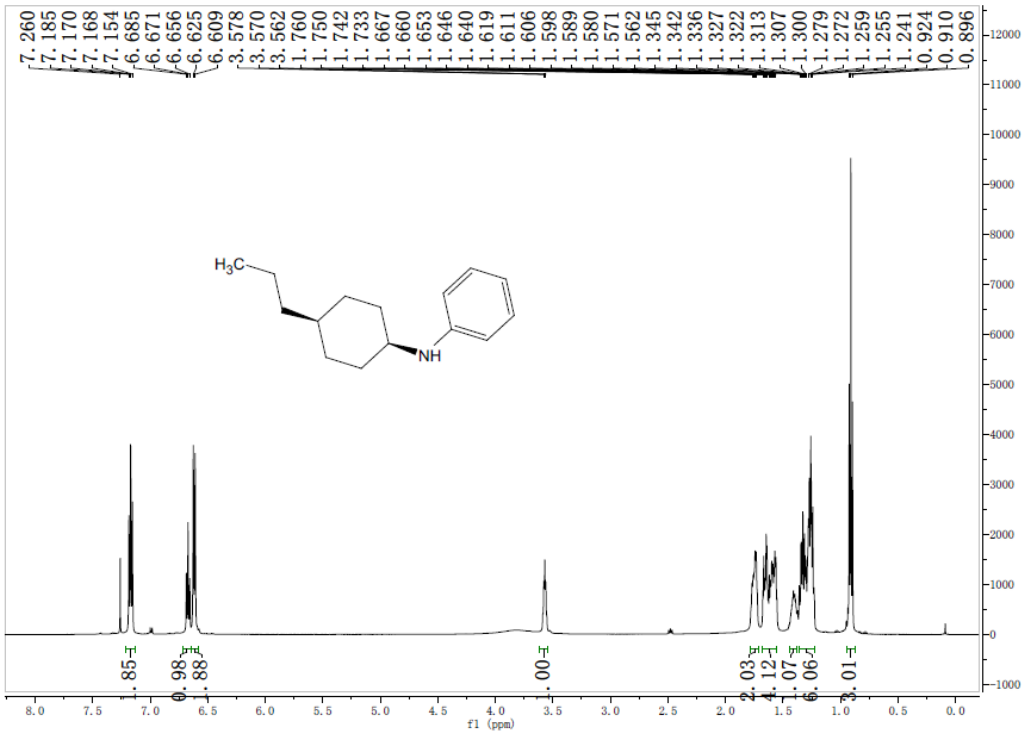


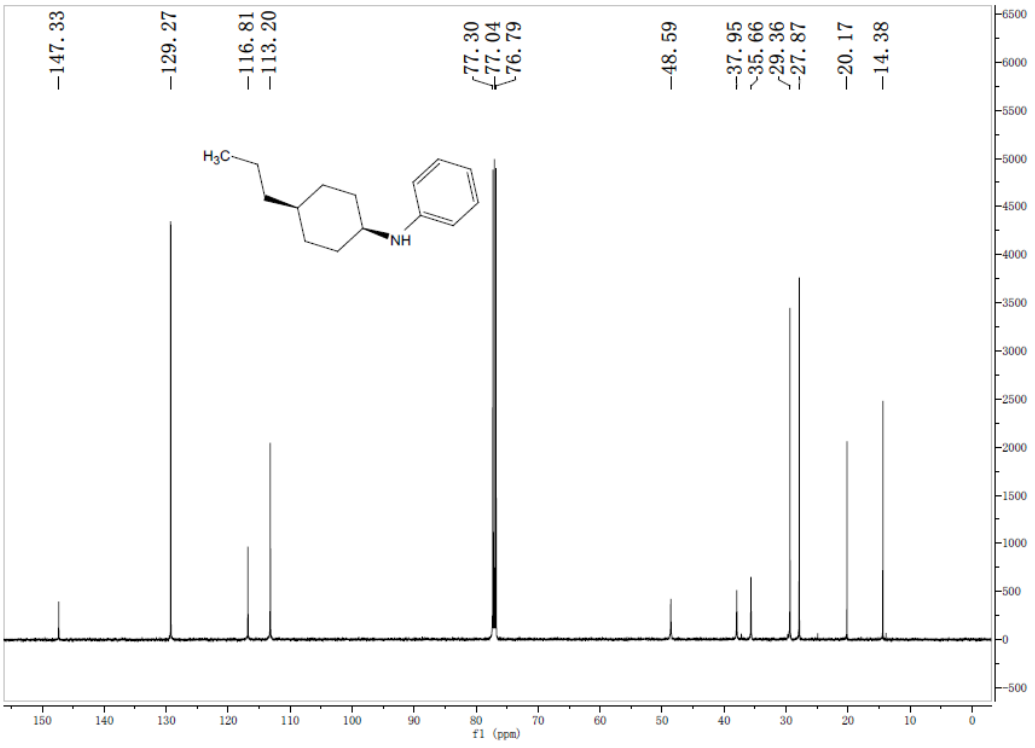
^{1}H NMR and ^{13}C NMR of *cis*-4-methyl-*N*-(2-methylcyclohexyl)aniline (4c)



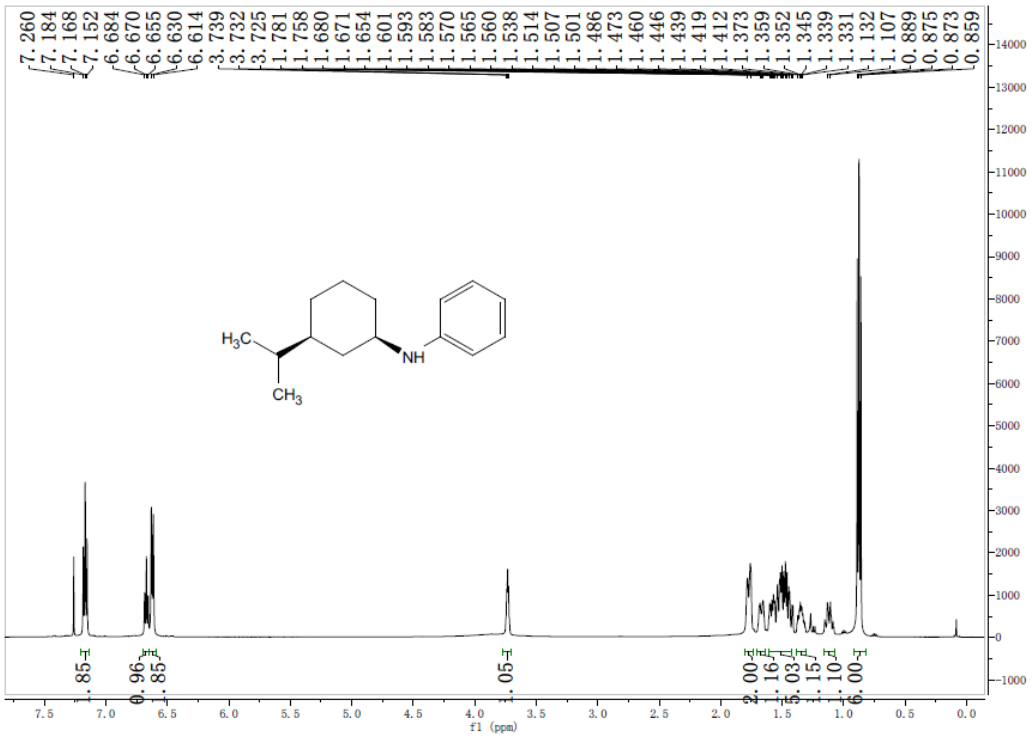


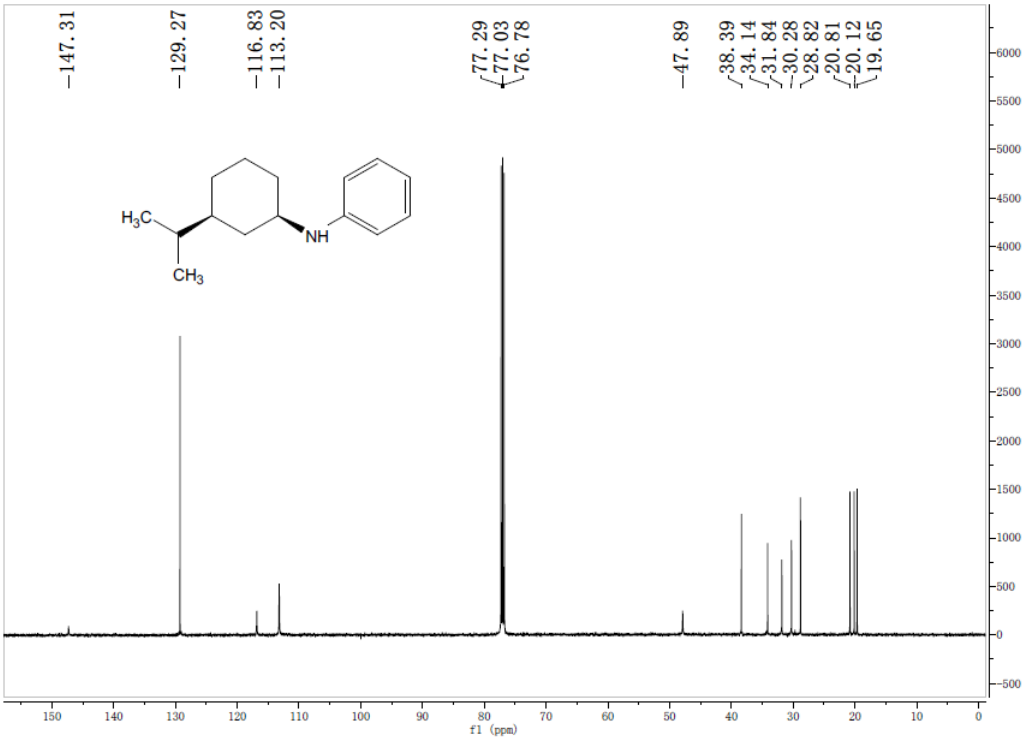
^{1}H NMR and ^{13}C NMR of *cis*-*N*-(4-propylcyclohexyl)aniline (4d)



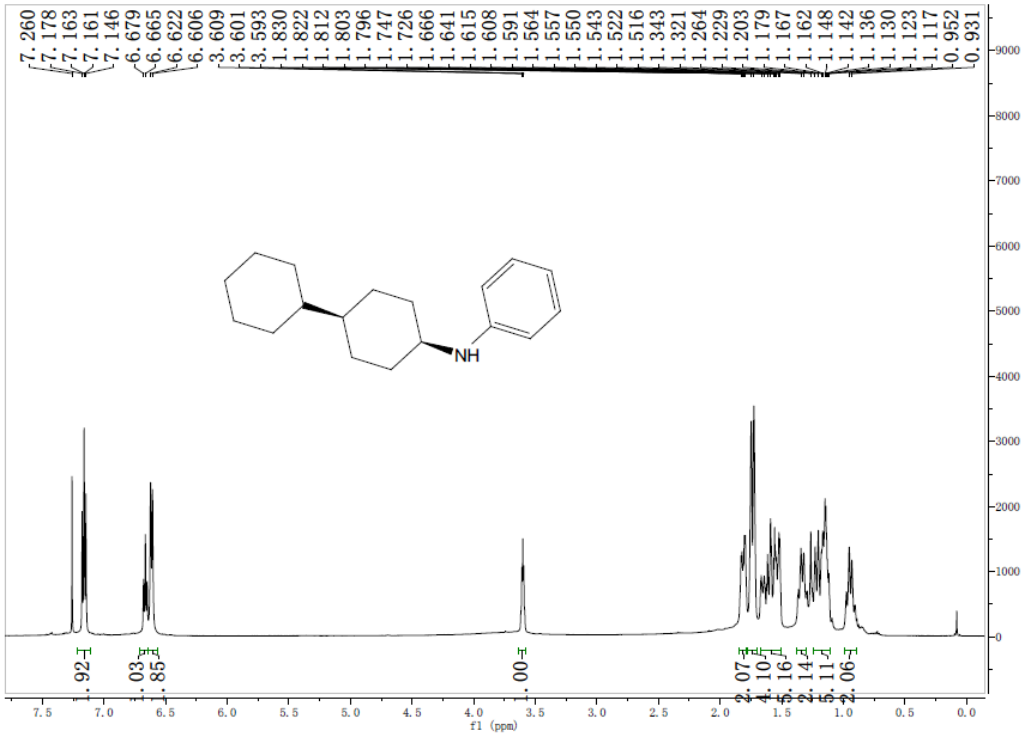


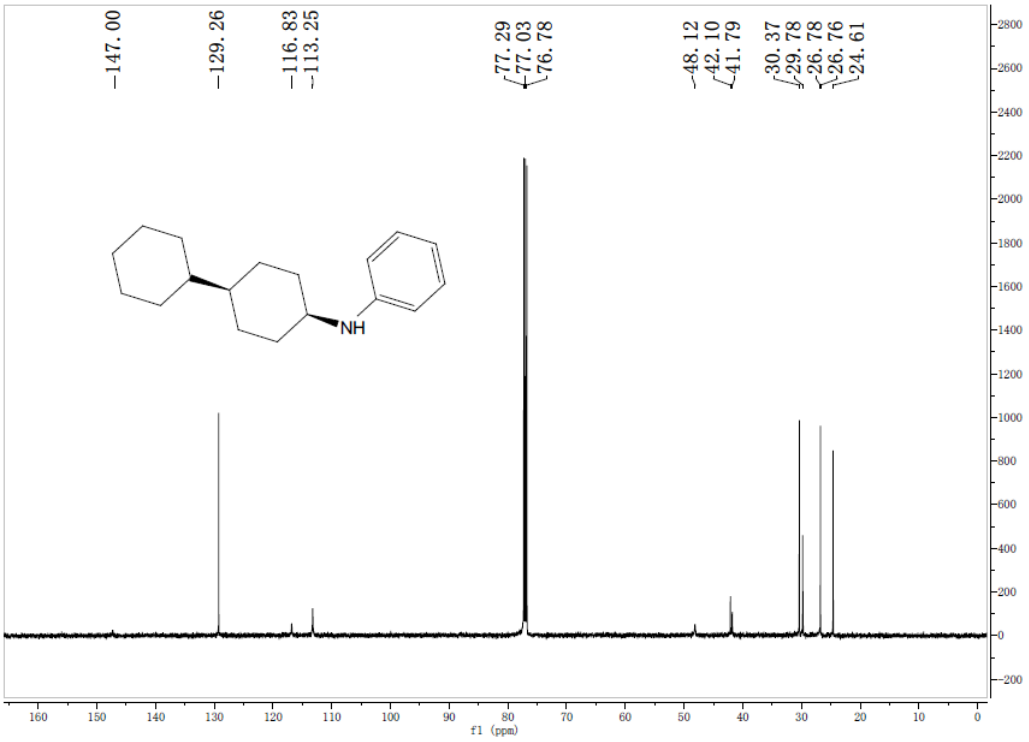
^{1}H NMR and ^{13}C NMR of *cis*-*N*-(3-isopropylcyclohexyl)aniline (4e)



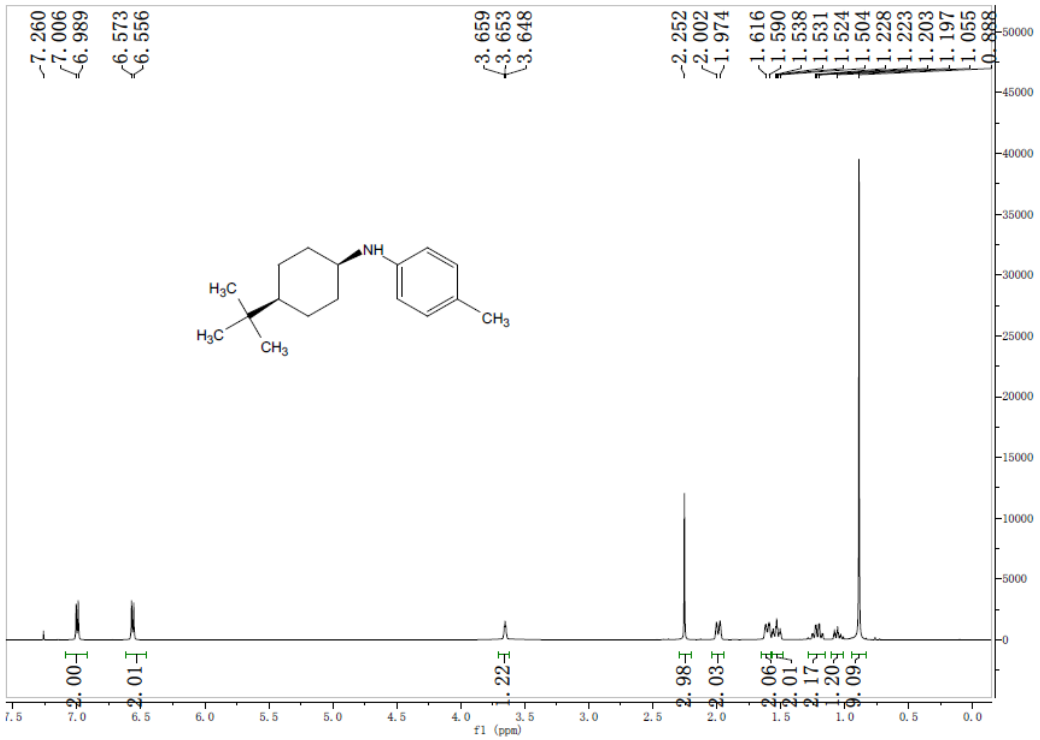


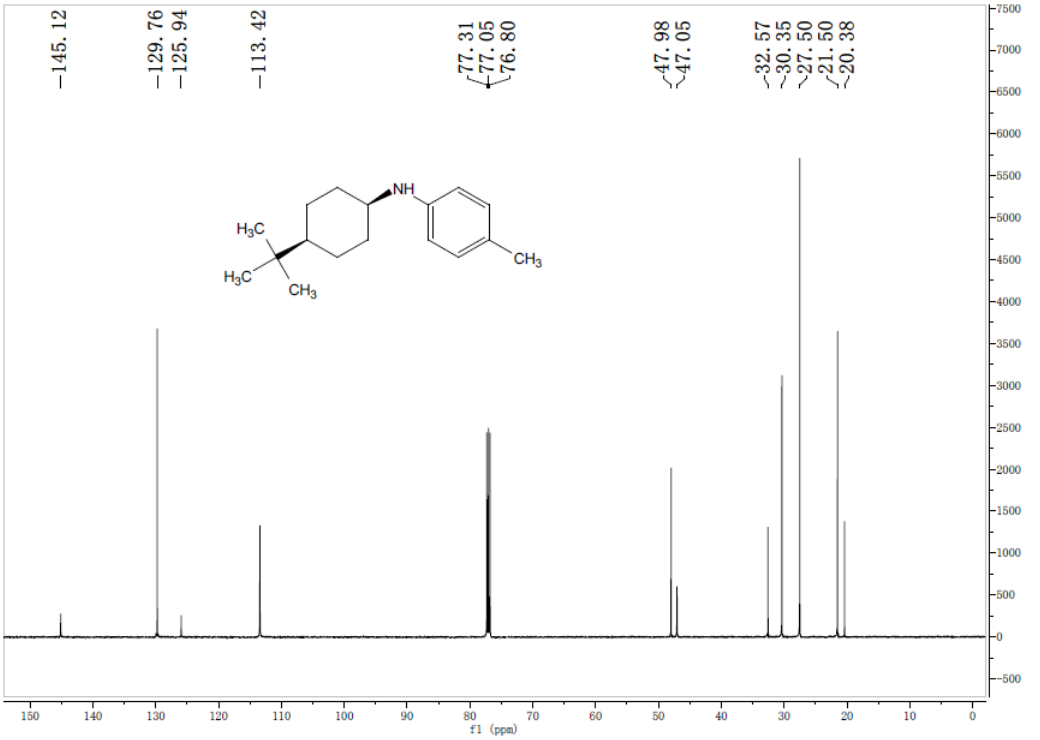
^{1}H NMR and ^{13}C NMR of *cis*-*N*-phenyl-[1,1'-bi(cyclohexan)]-4-amine (4f)



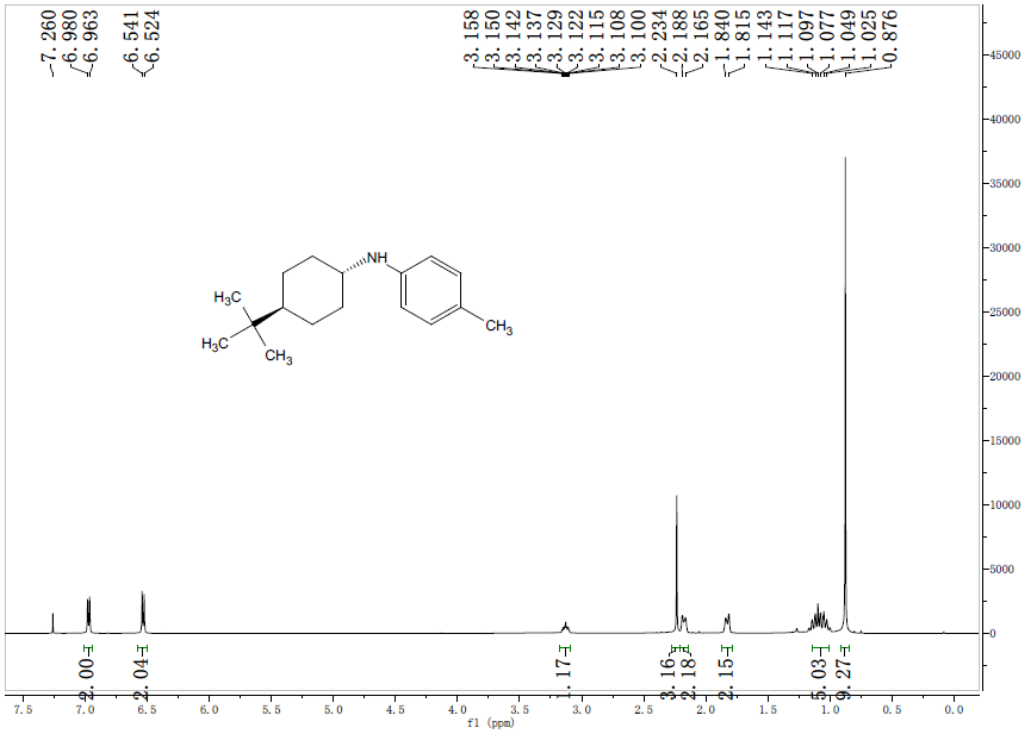


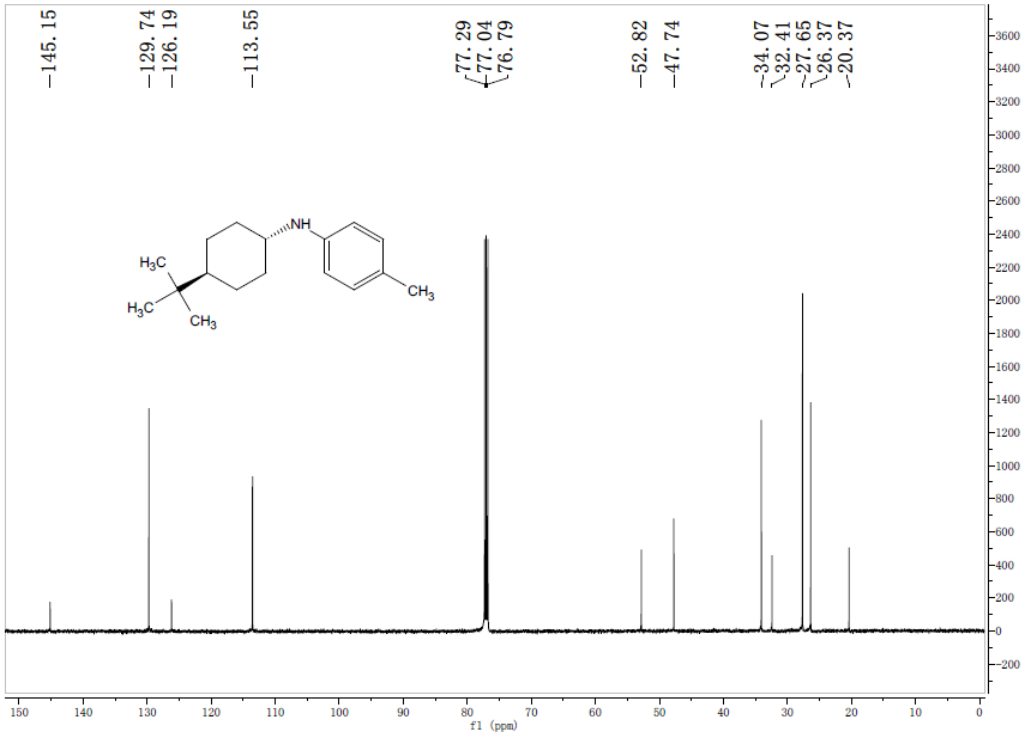
^{1}H NMR and ^{13}C NMR of *cis*-*N*-(4-(*tert*-butyl)cyclohexyl)-4-methylaniline (4g)



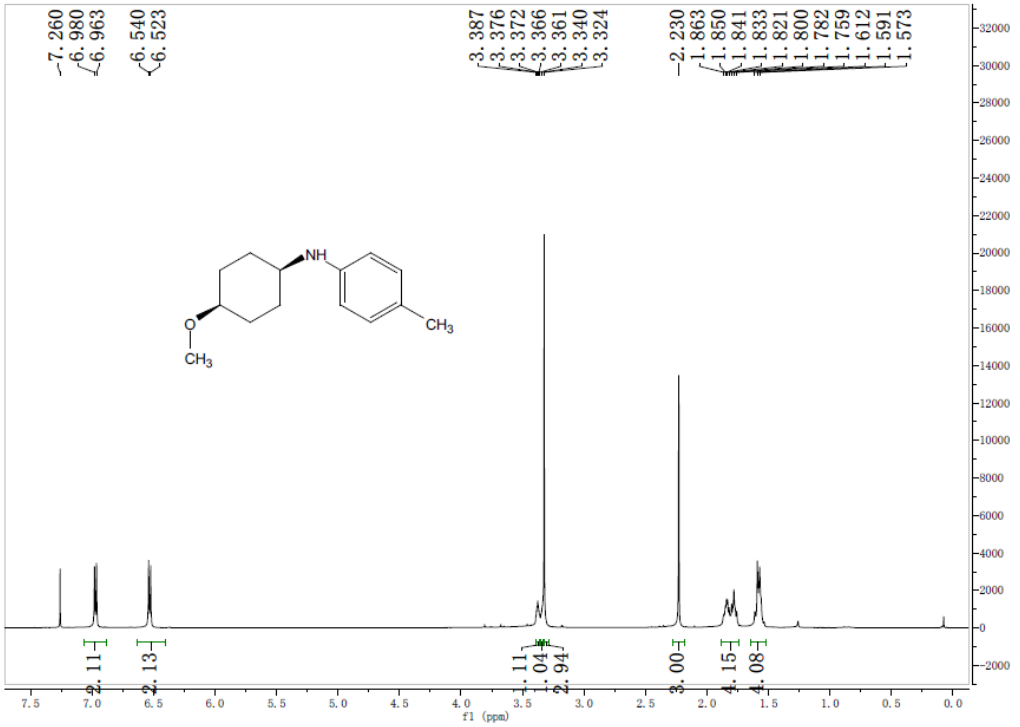


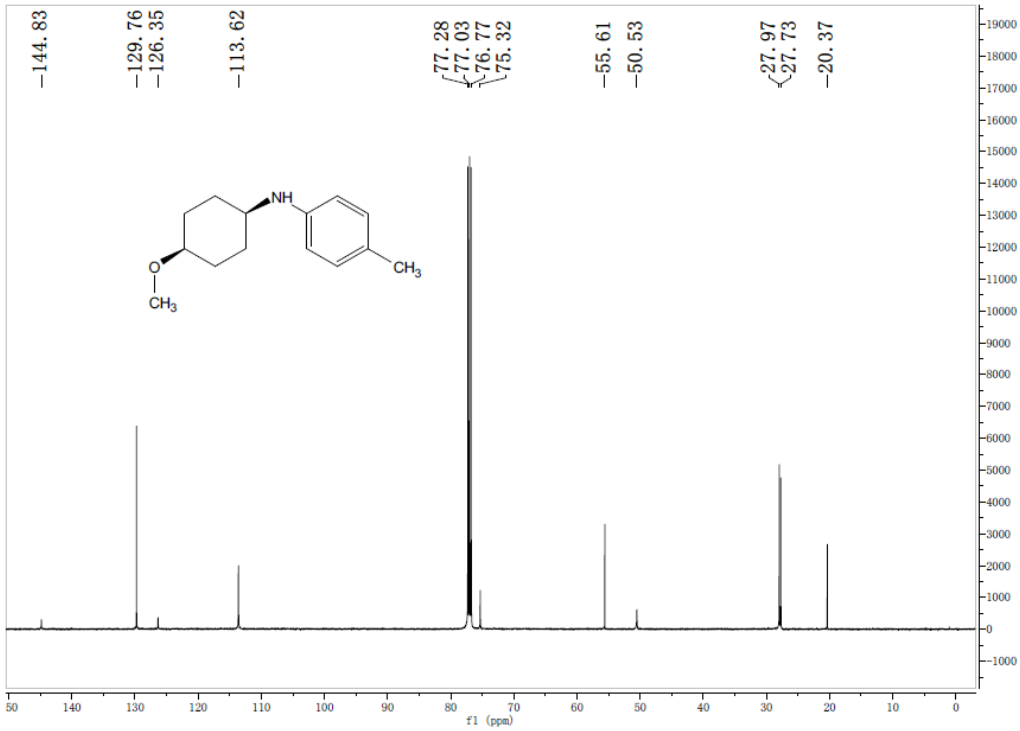
^{1}H NMR and ^{13}C NMR of *trans*-*N*-(4-(*tert*-butyl)cyclohexyl)-4-methylaniline (4g)



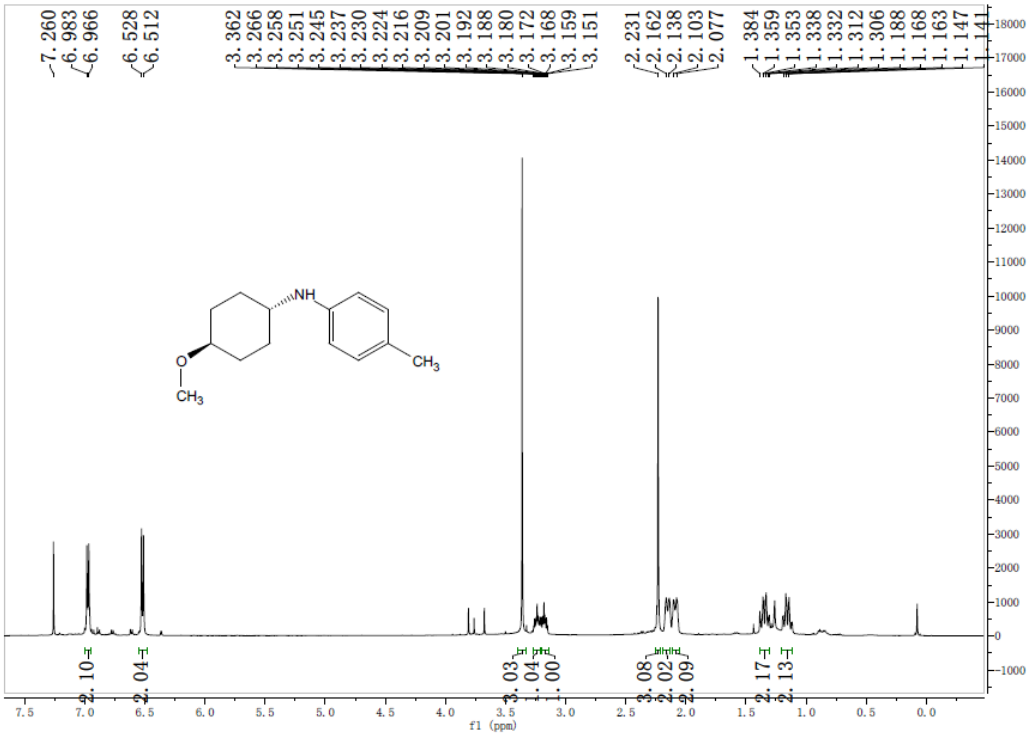


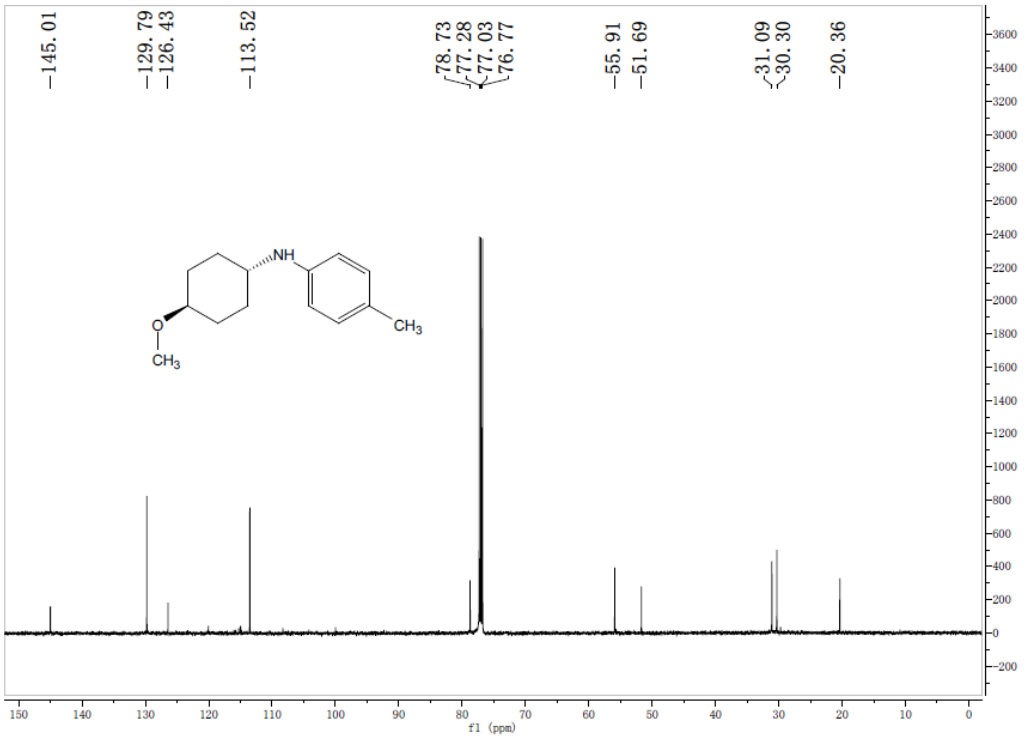
^{1}H NMR and ^{13}C NMR of *cis*-*N*-(4-methoxycyclohexyl)-4-methylaniline (4h)



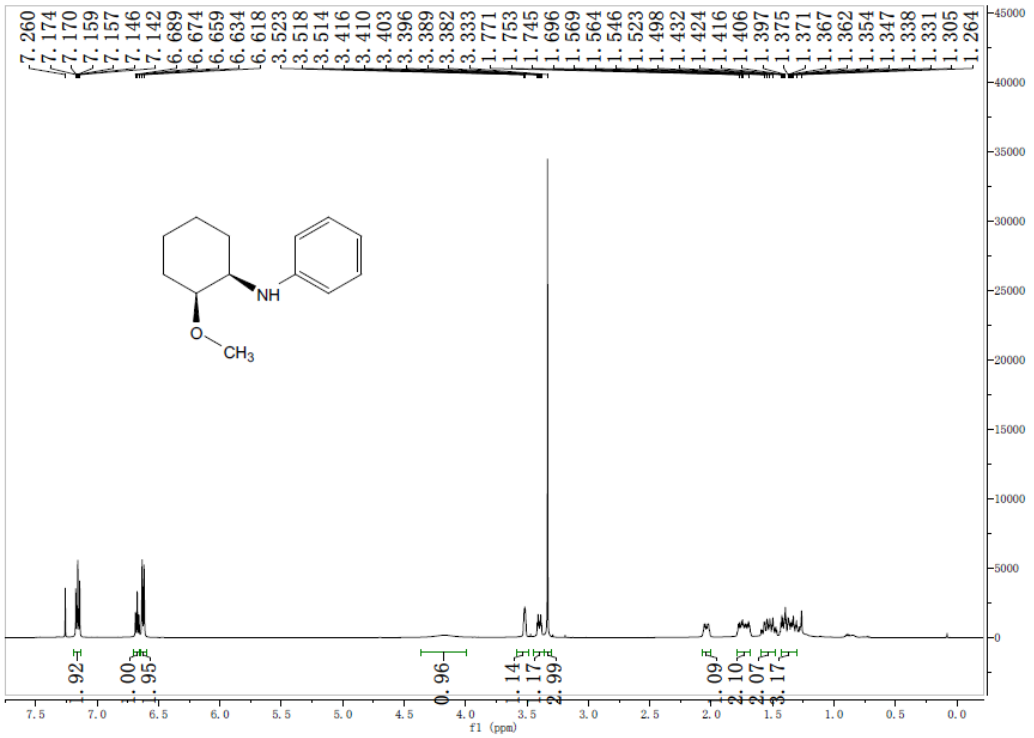


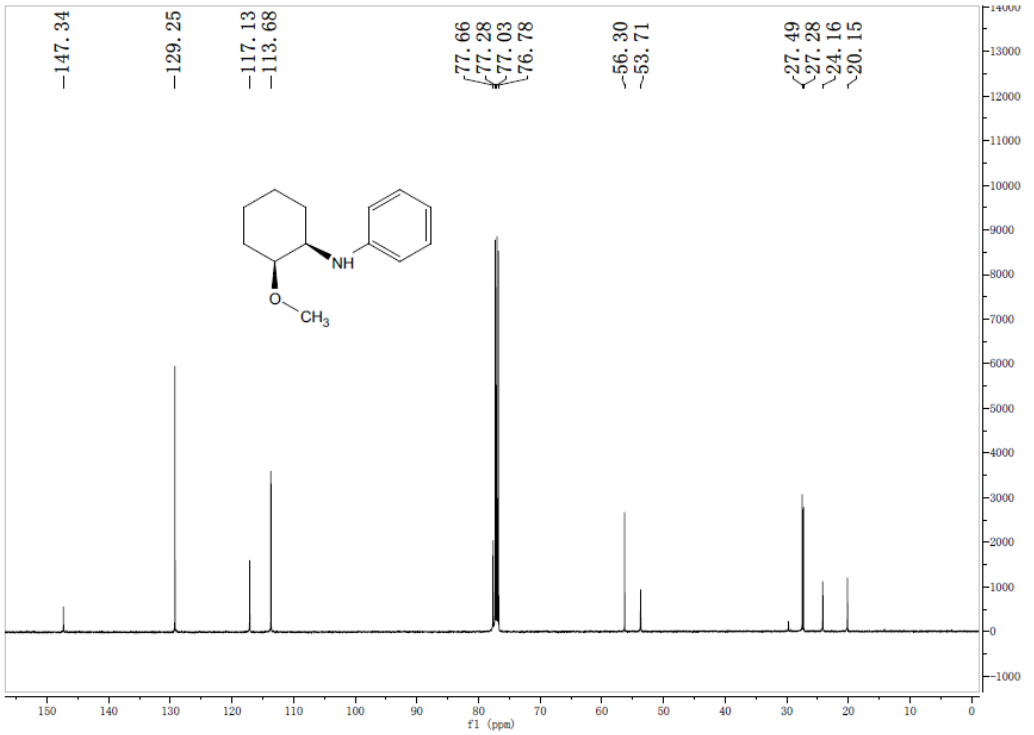
^{1}H NMR and ^{13}C NMR of *trans*-*N*-(4-methoxycyclohexyl)-4-methylaniline (4h)



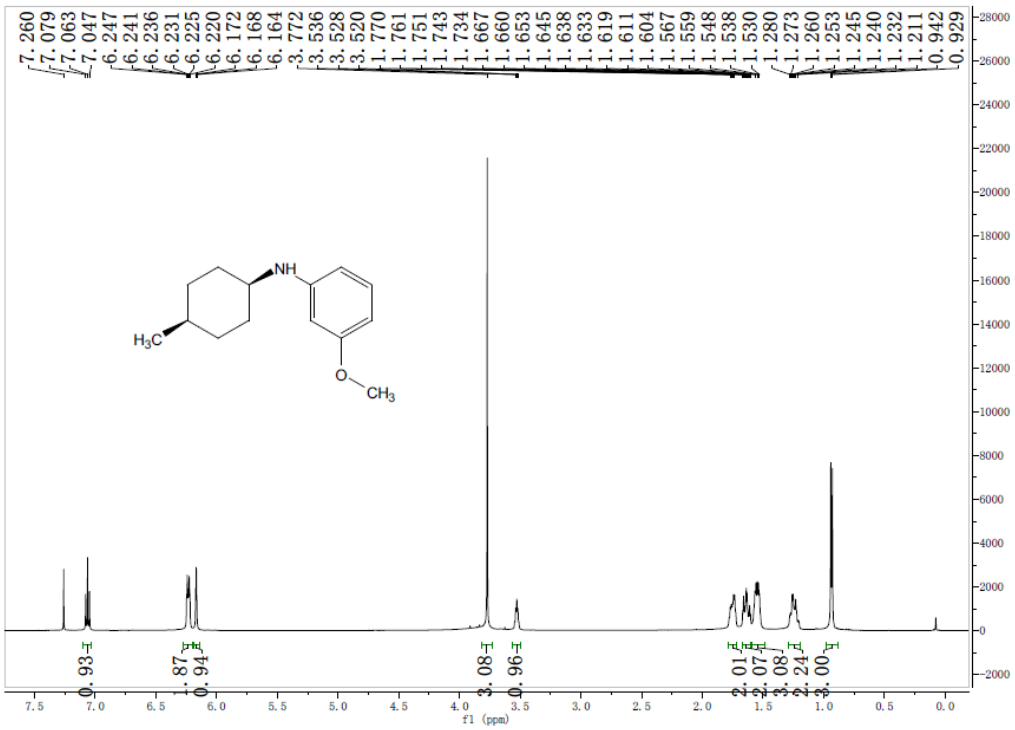


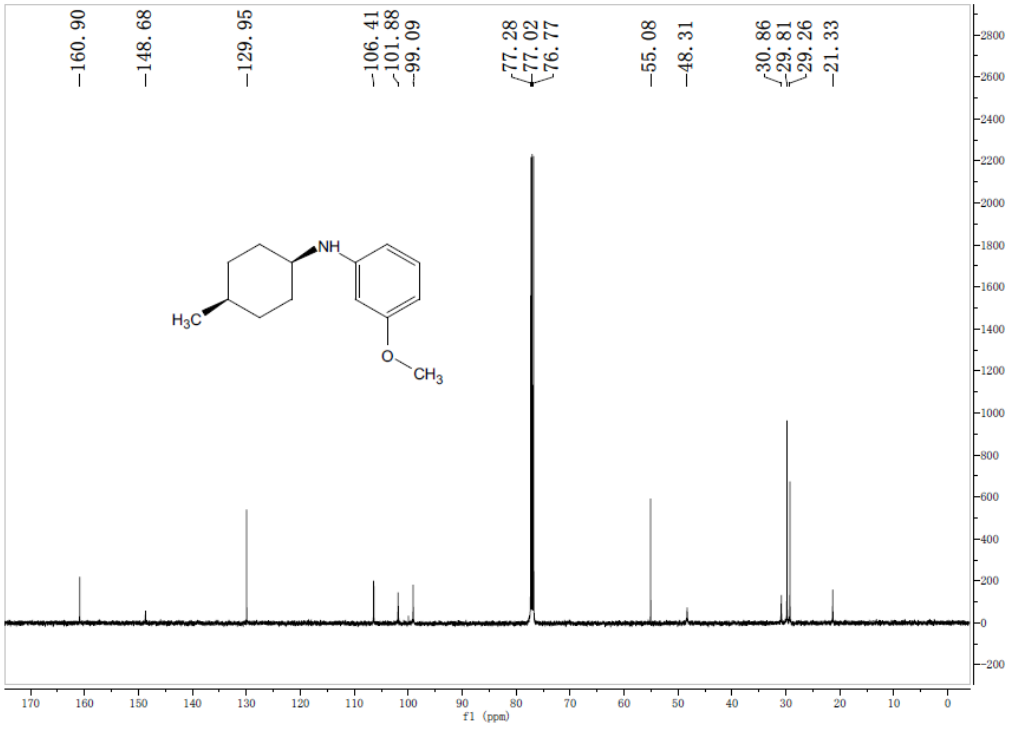
^{1}H NMR and ^{13}C NMR of *cis*-*N*-(2-methoxycyclohexyl)aniline (4i)



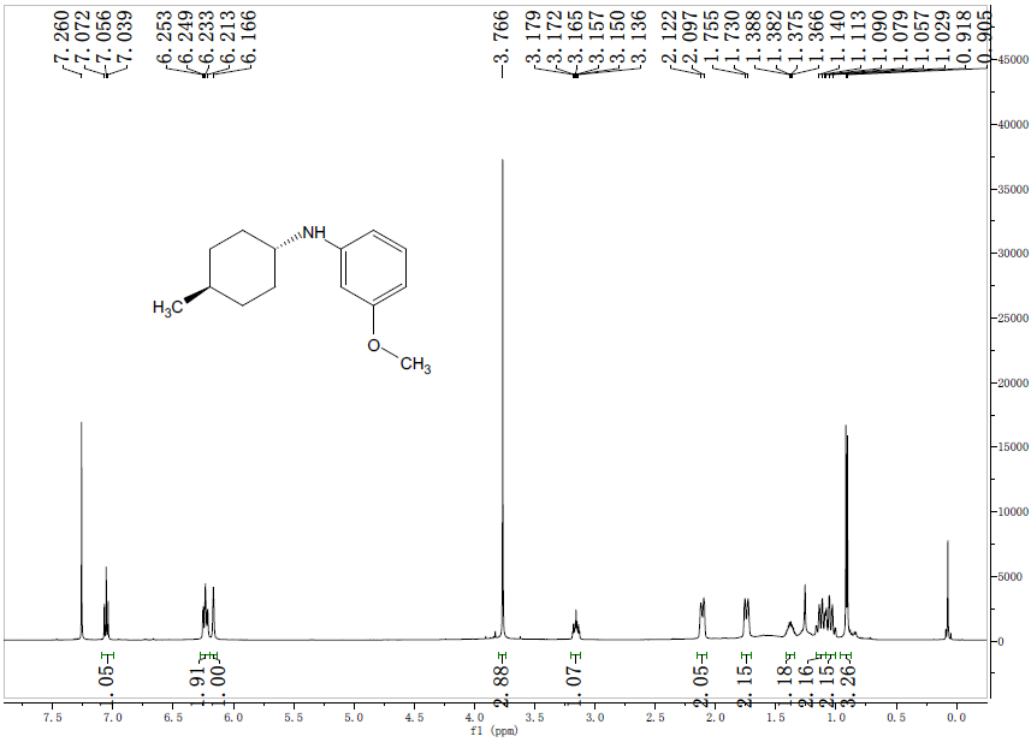


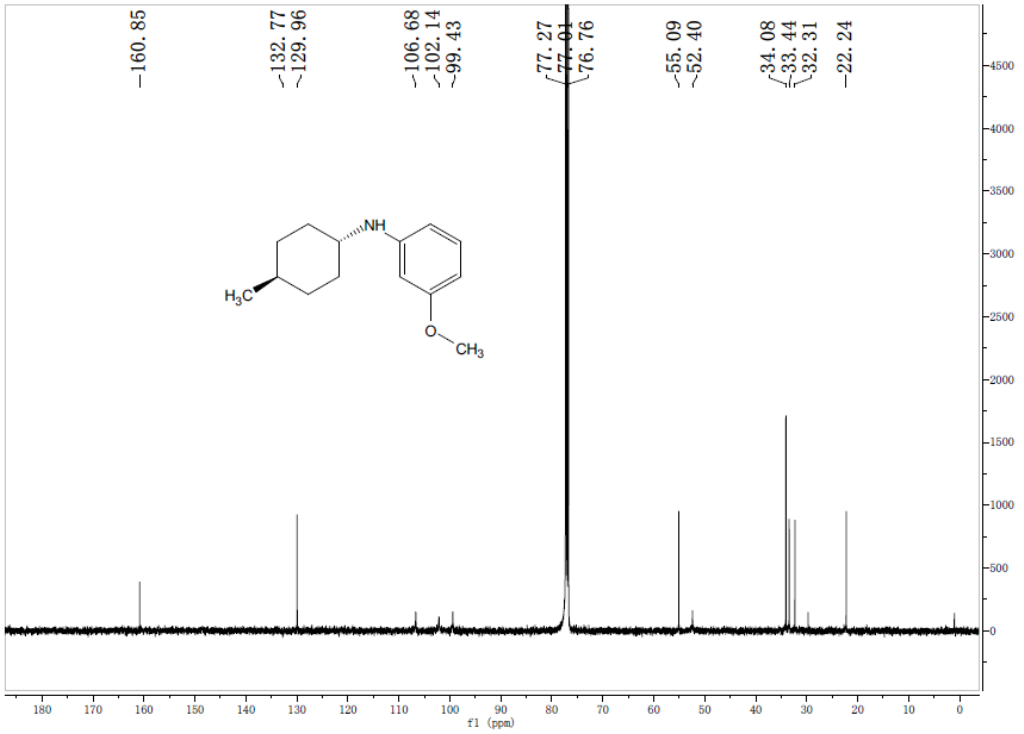
^{1}H NMR and ^{13}C NMR of *cis*-3-methoxy-*N*-(4-methylcyclohexyl)aniline (4j)



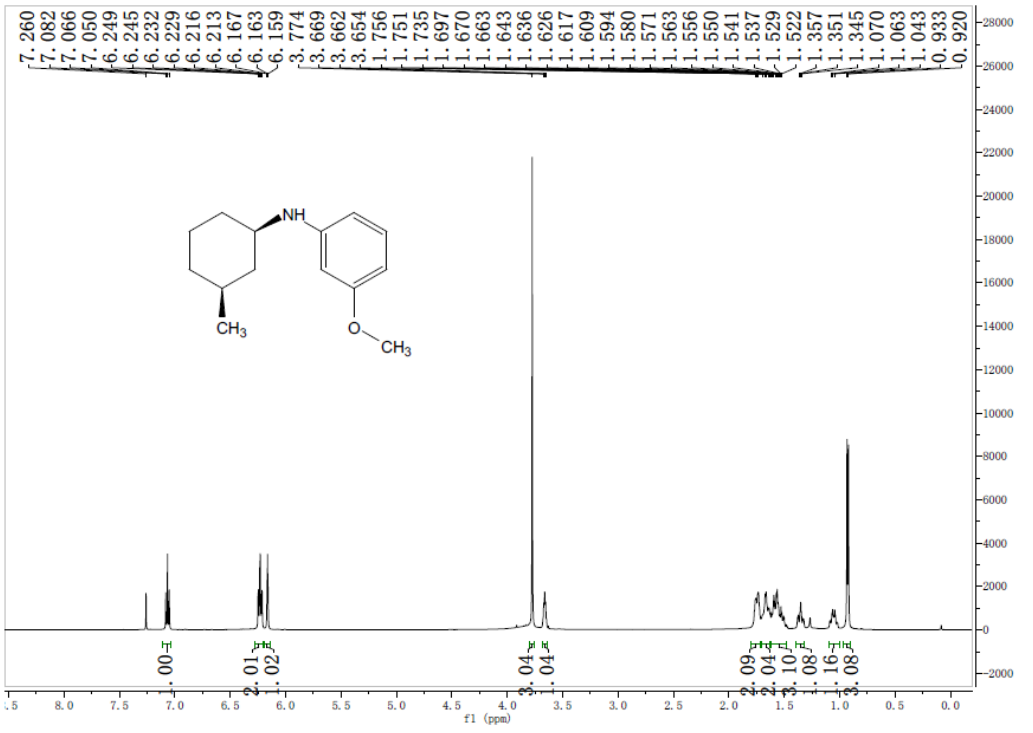


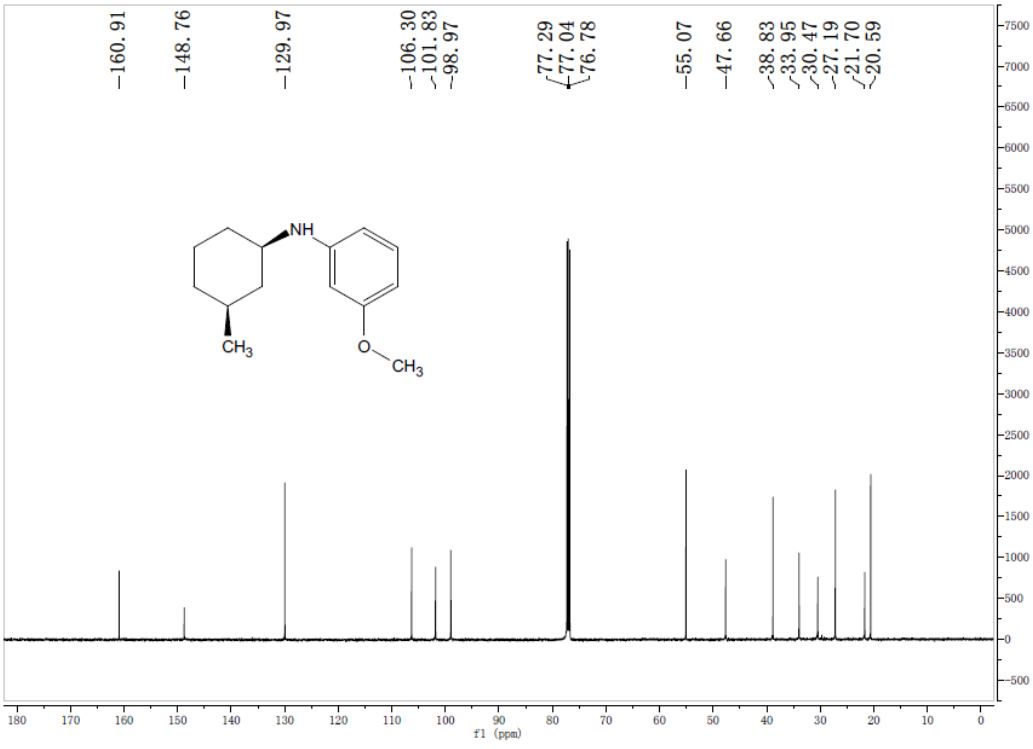
^{1}H NMR and ^{13}C NMR of *trans*-3-methoxy-*N*-(4-methylcyclohexyl)aniline (4j)



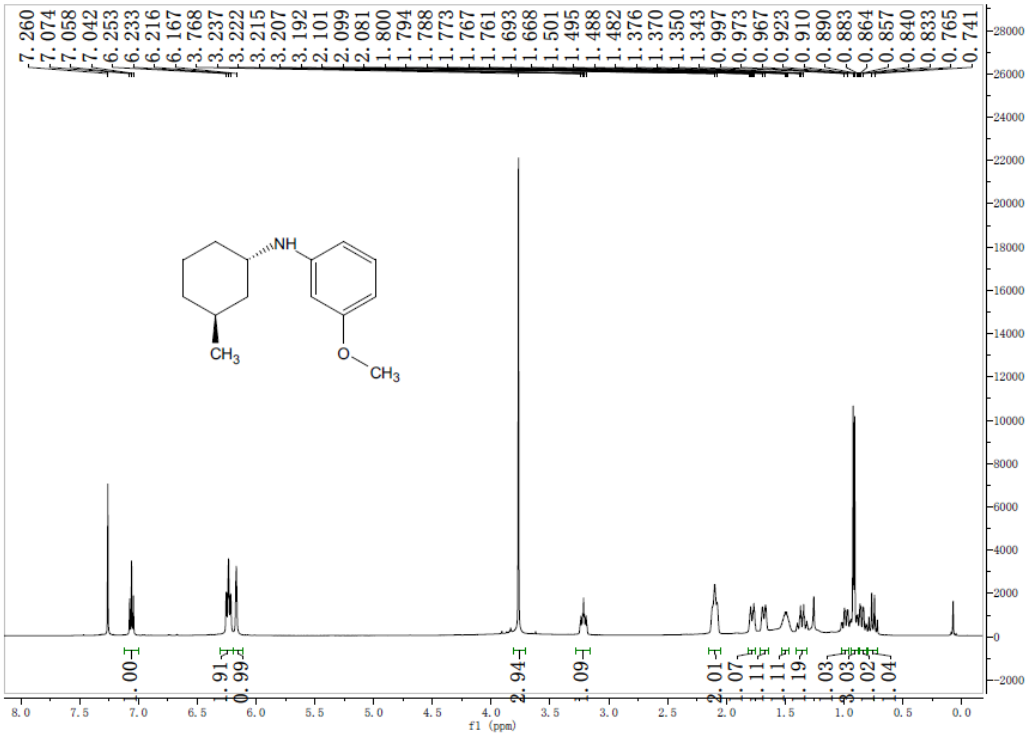


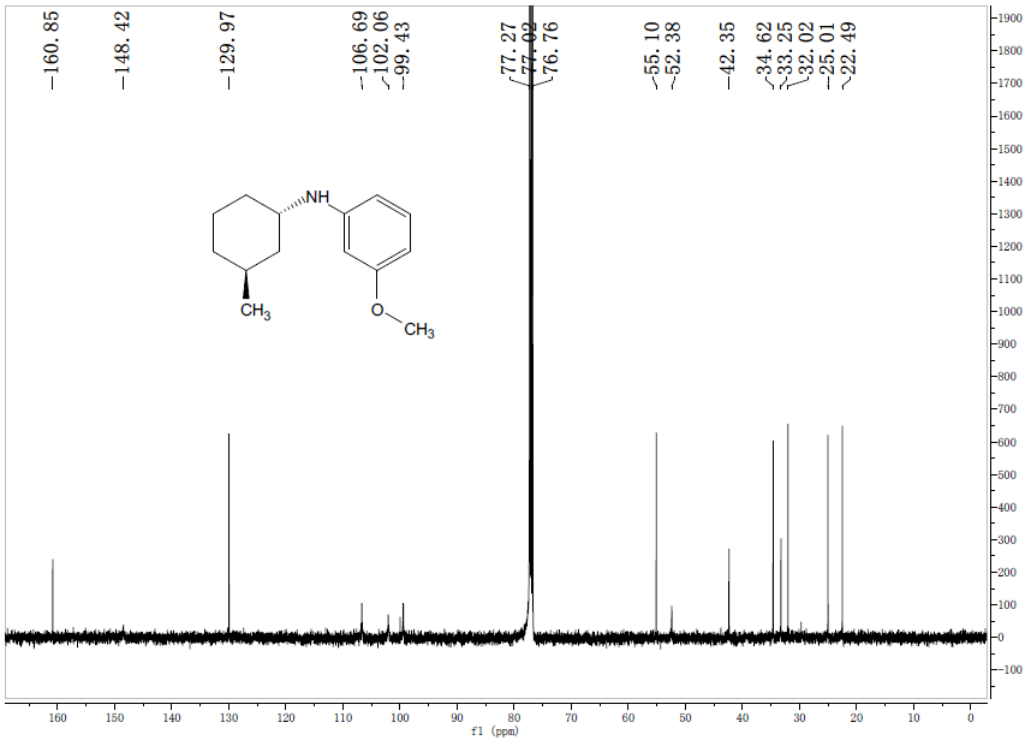
^{1}H NMR and ^{13}C NMR of *cis*-3-methoxy-*N*-(3-methylcyclohexyl)aniline (4k)



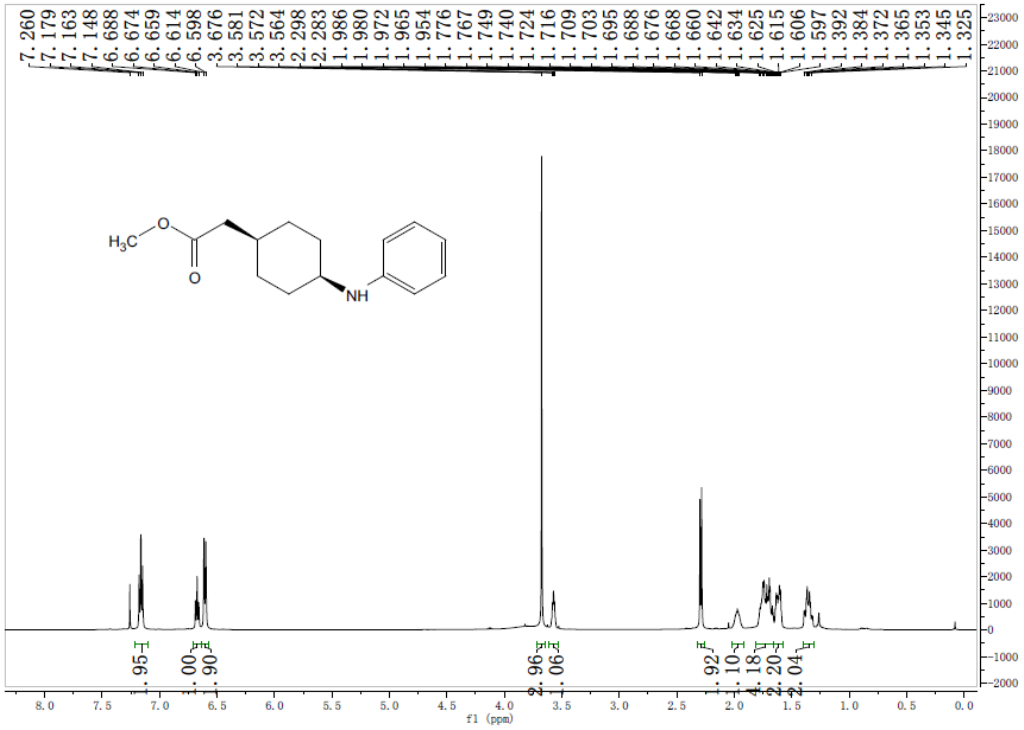


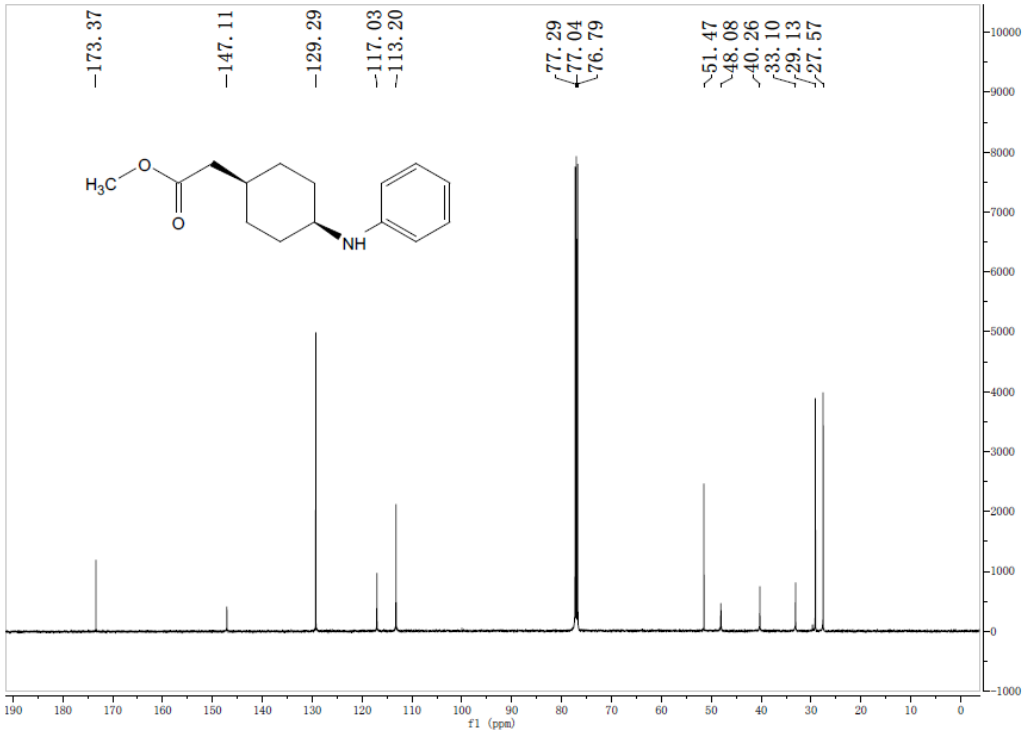
^{1}H NMR and ^{13}C NMR of *trans*-3-methoxy-*N*-(3-methylcyclohexyl)aniline (4k)



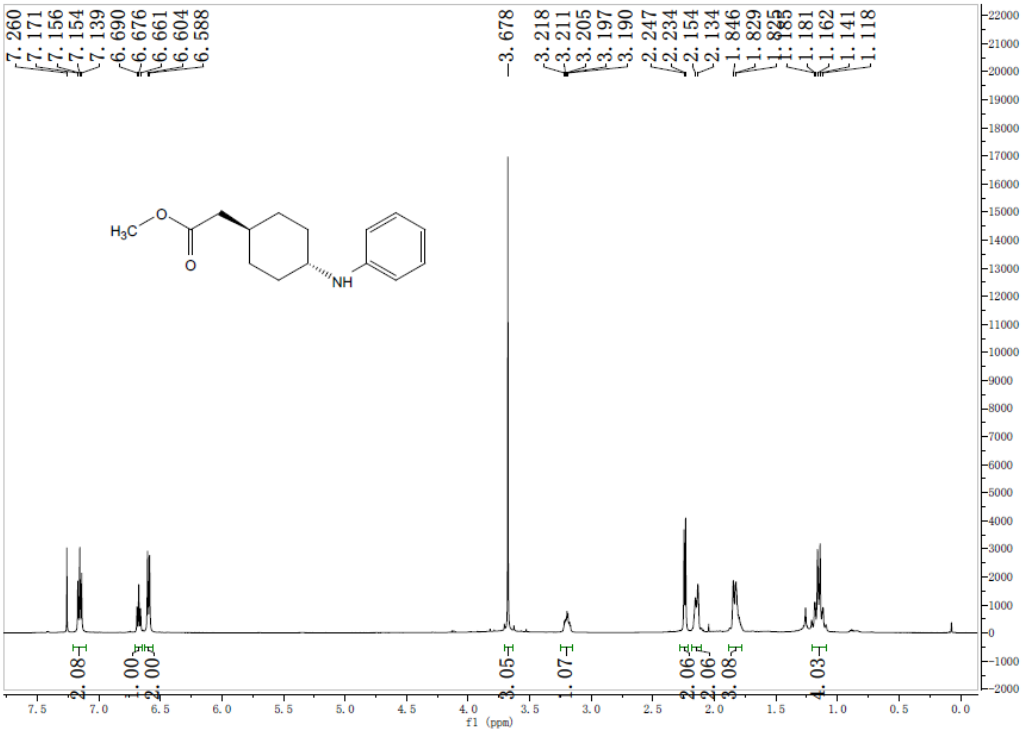


^{1}H NMR and ^{13}C NMR of *cis*-methyl 2-(4-(phenylamino)cyclohexyl)acetate (4l)

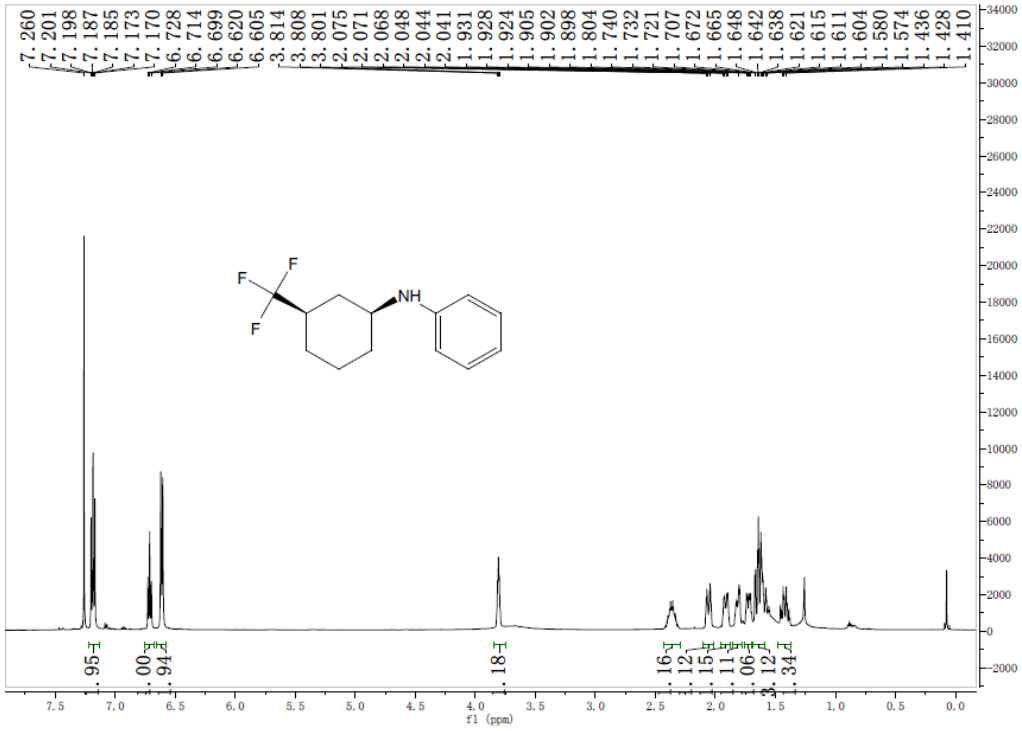


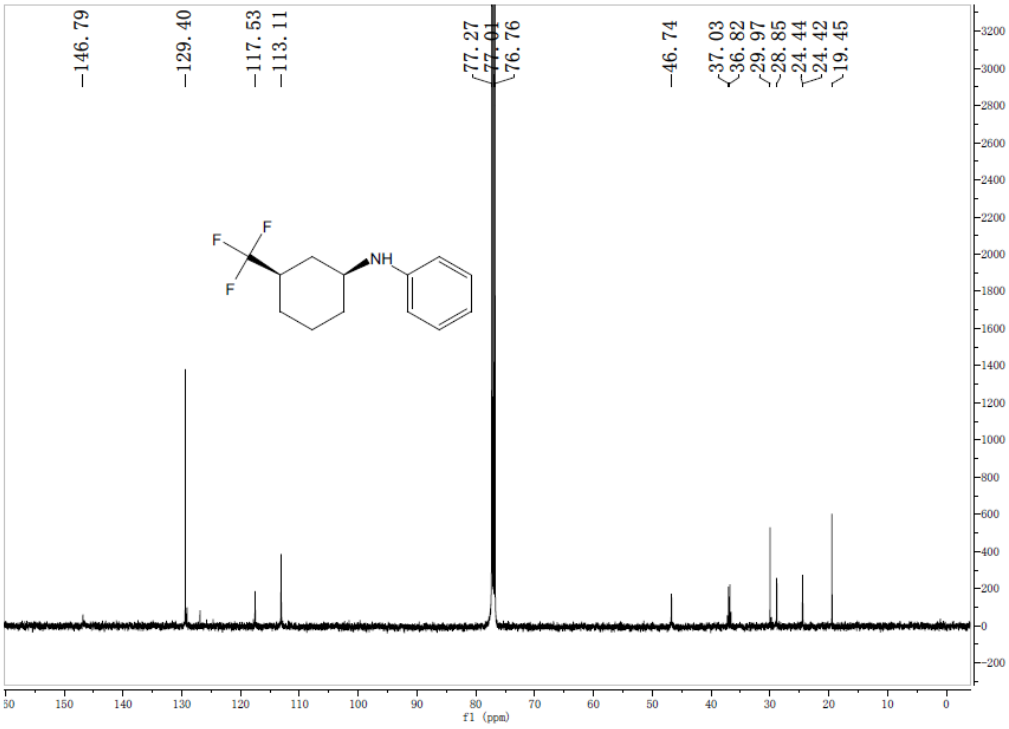


^{1}H NMR and ^{13}C NMR of *trans*-methyl 2-(4-(phenylamino)cyclohexyl)acetate (4l)

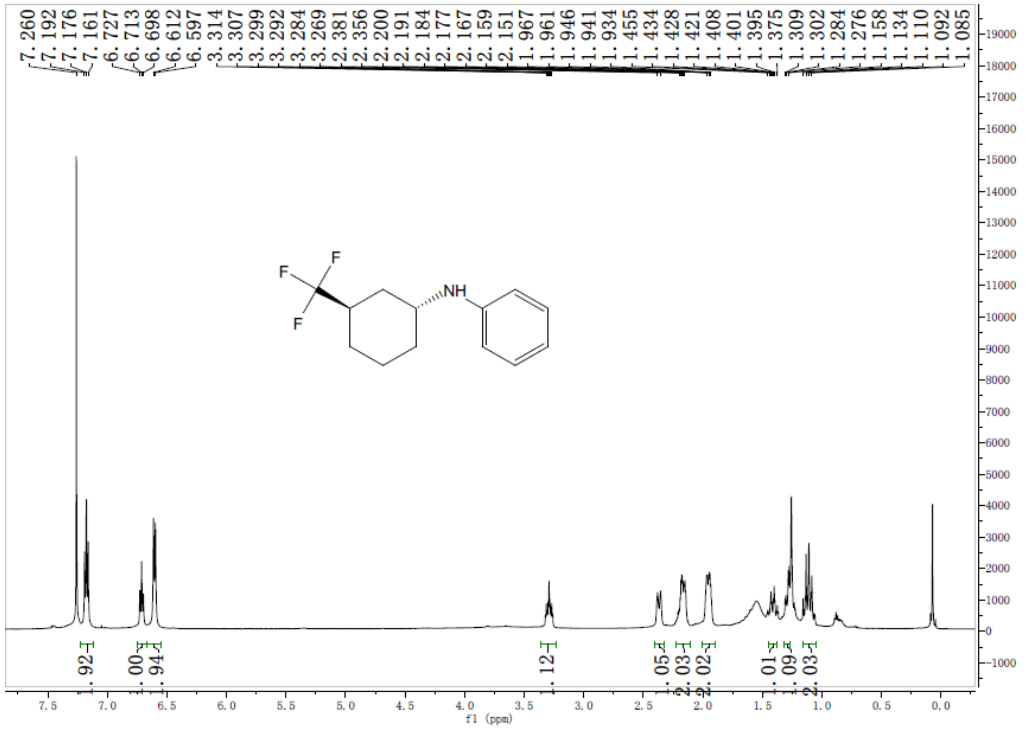


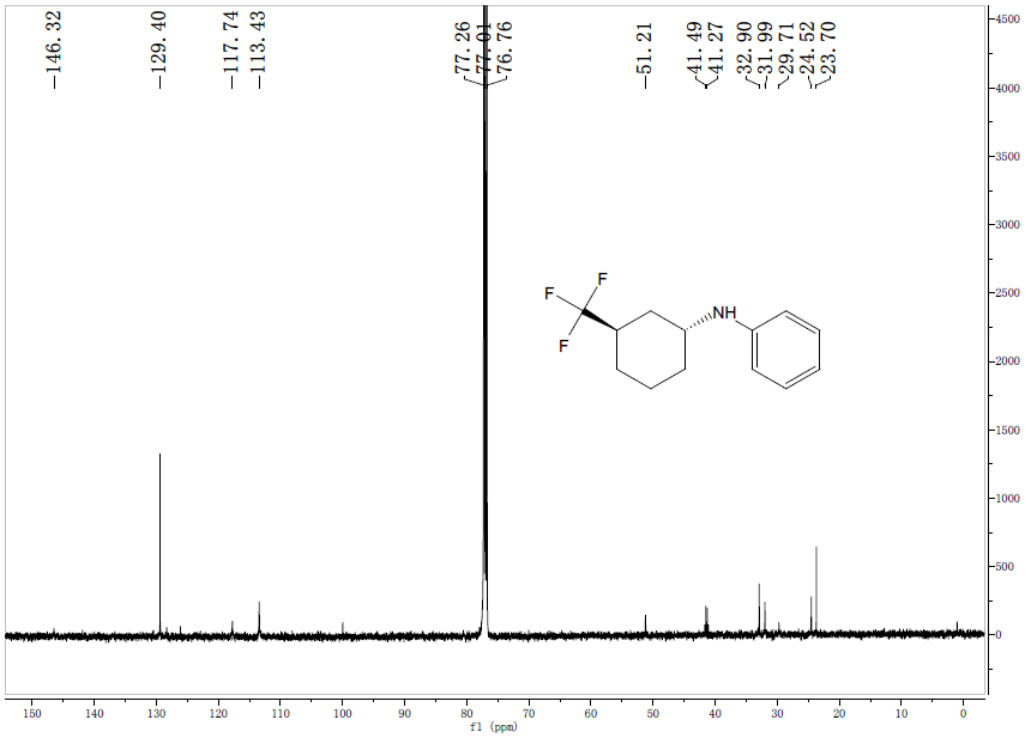
^{1}H NMR and ^{13}C NMR of *cis*-*N*-(3-(trifluoromethyl)cyclohexyl)aniline (4m)



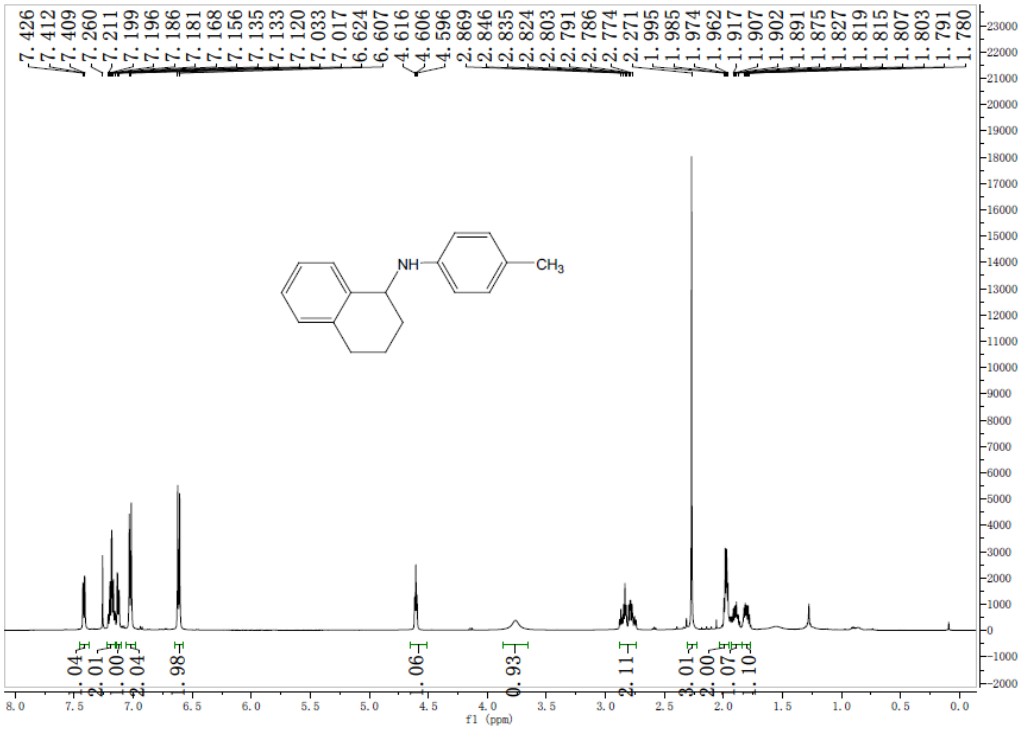


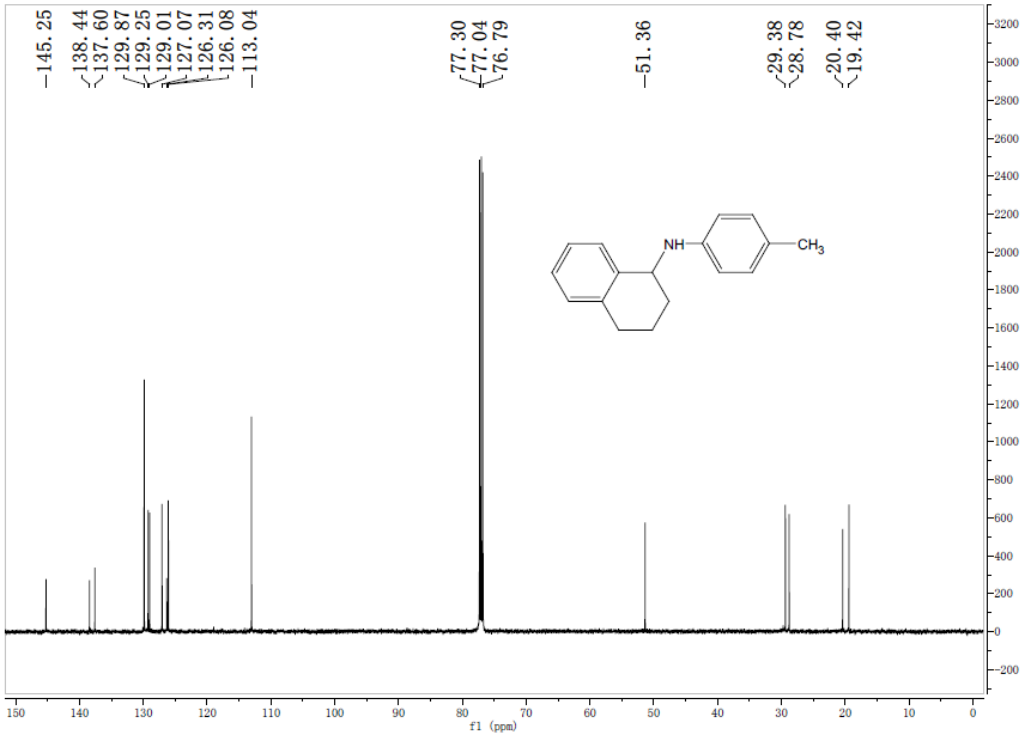
^{1}H NMR and ^{13}C NMR of *trans*-*N*-(3-(trifluoromethyl)cyclohexyl)aniline (4m)



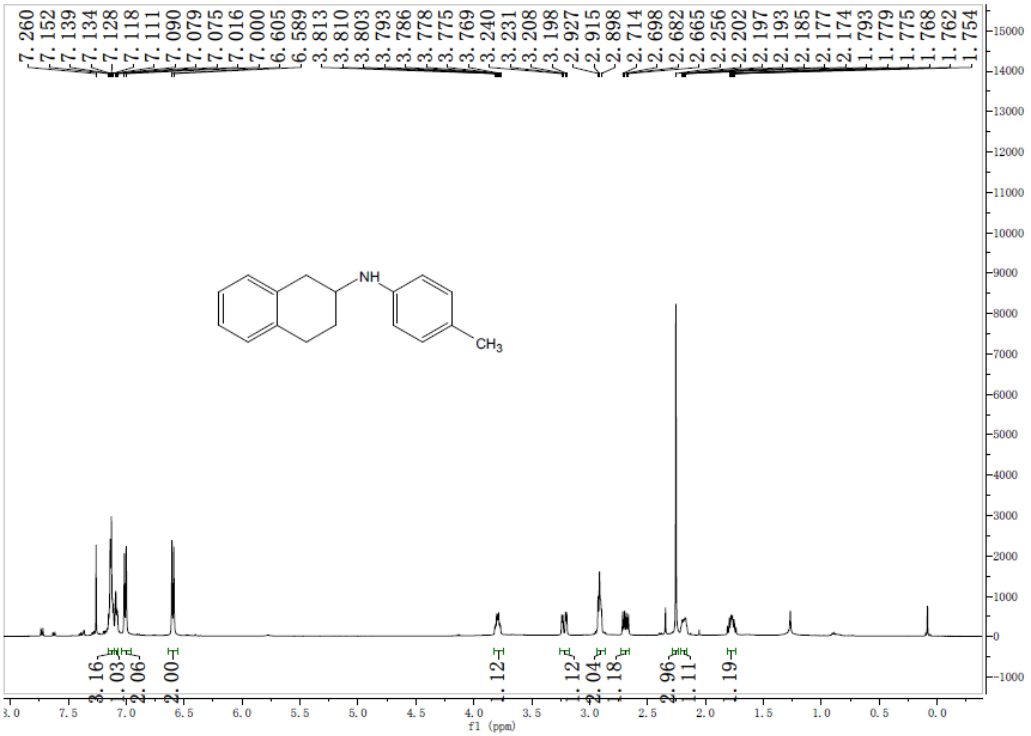


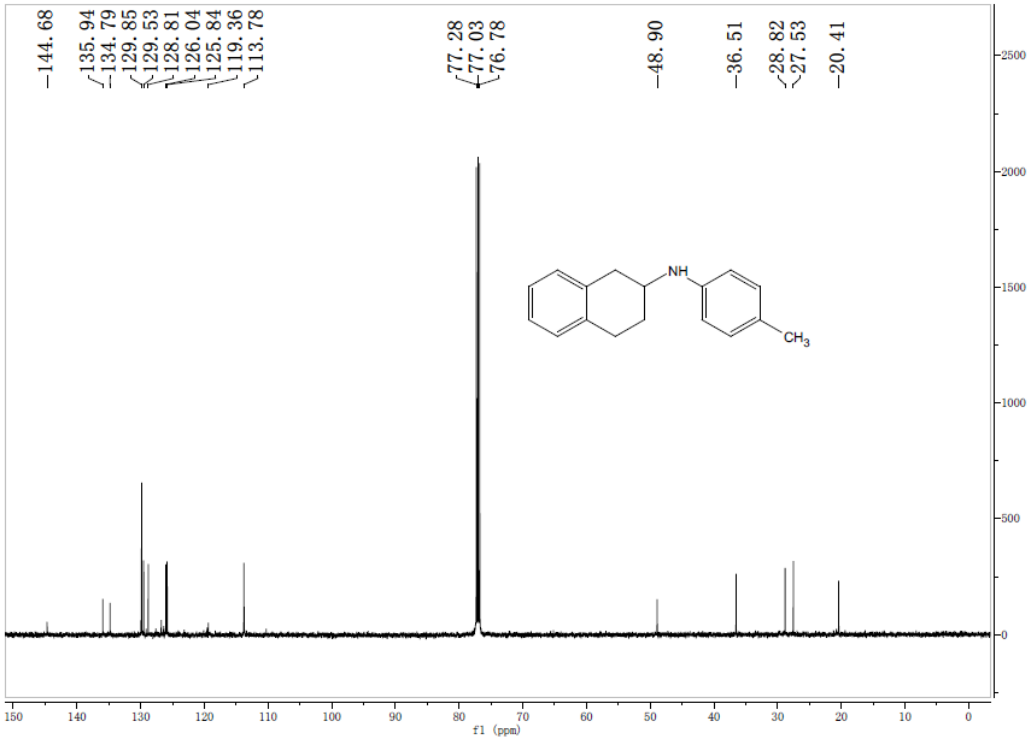
^{1}H NMR and ^{13}C NMR of *N*-(*p*-tolyl)-1,2,3,4-tetrahydronaphthalen-1-amine (4n)



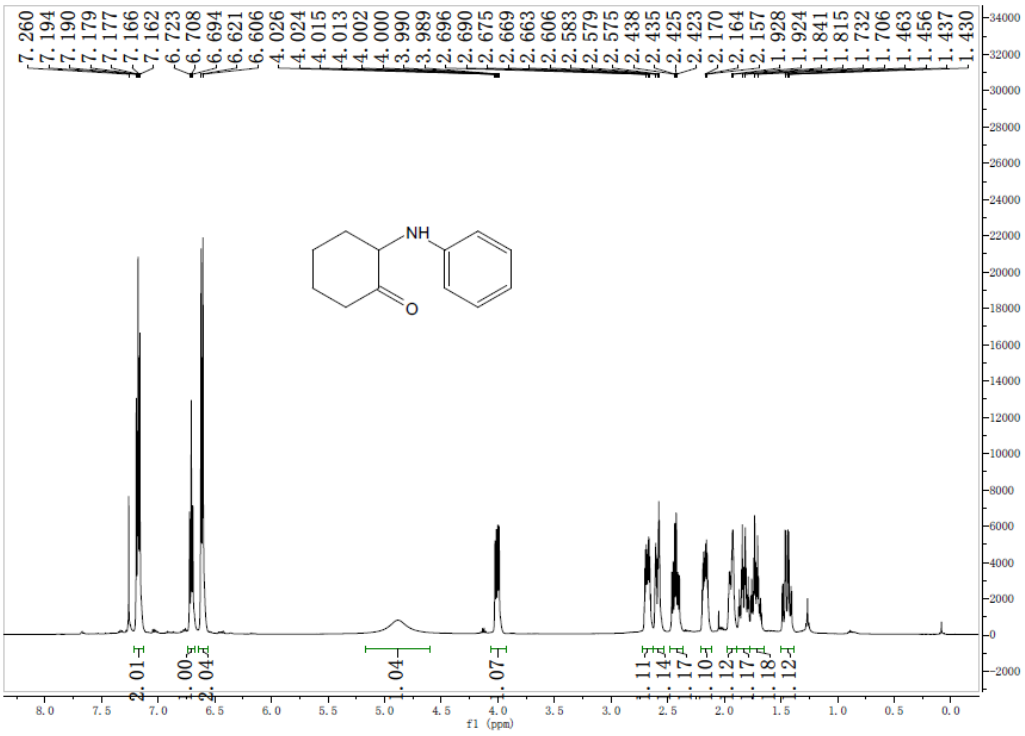


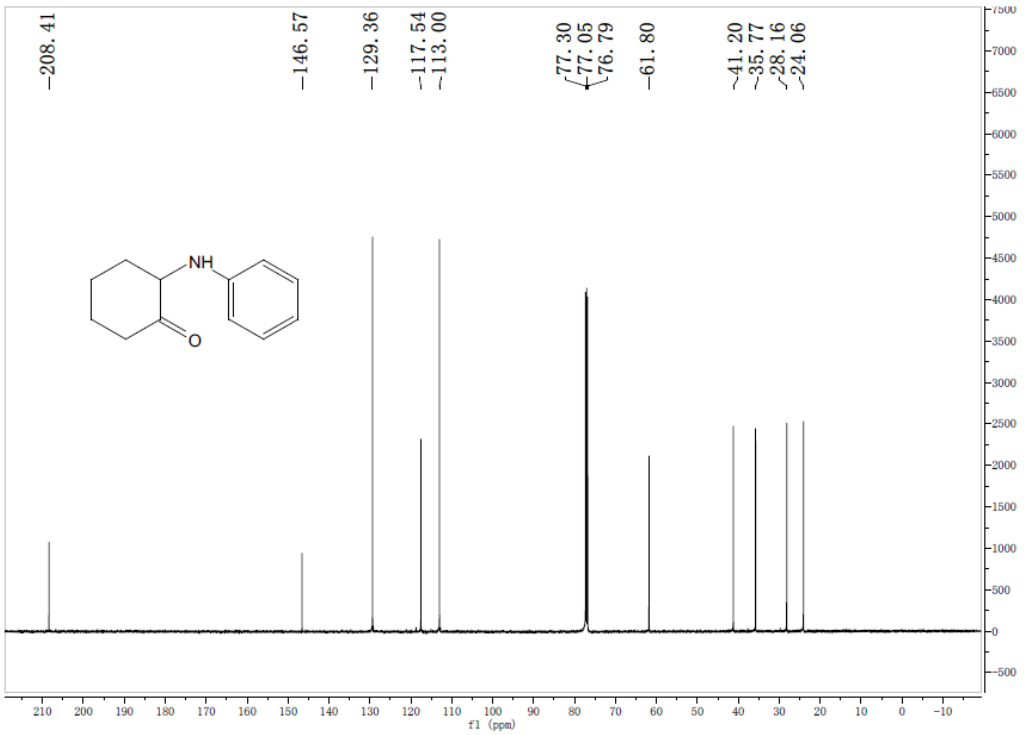
^{1}H NMR and ^{13}C NMR of *N*-(*p*-tolyl)-1,2,3,4-tetrahydronaphthalen-2-amine (4o)



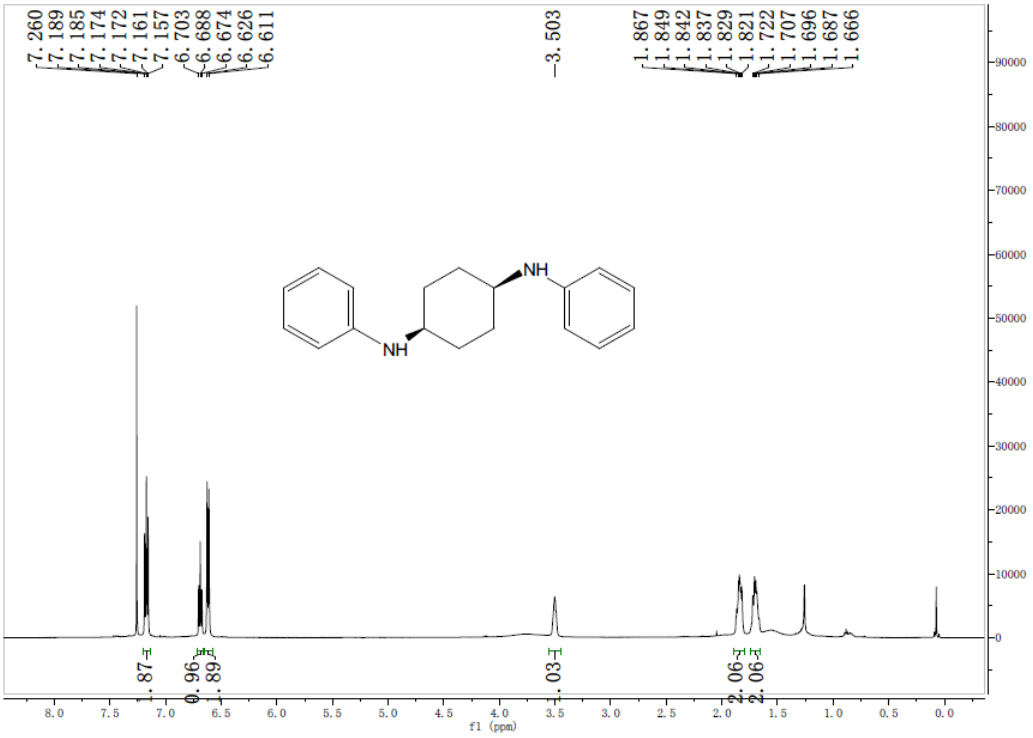


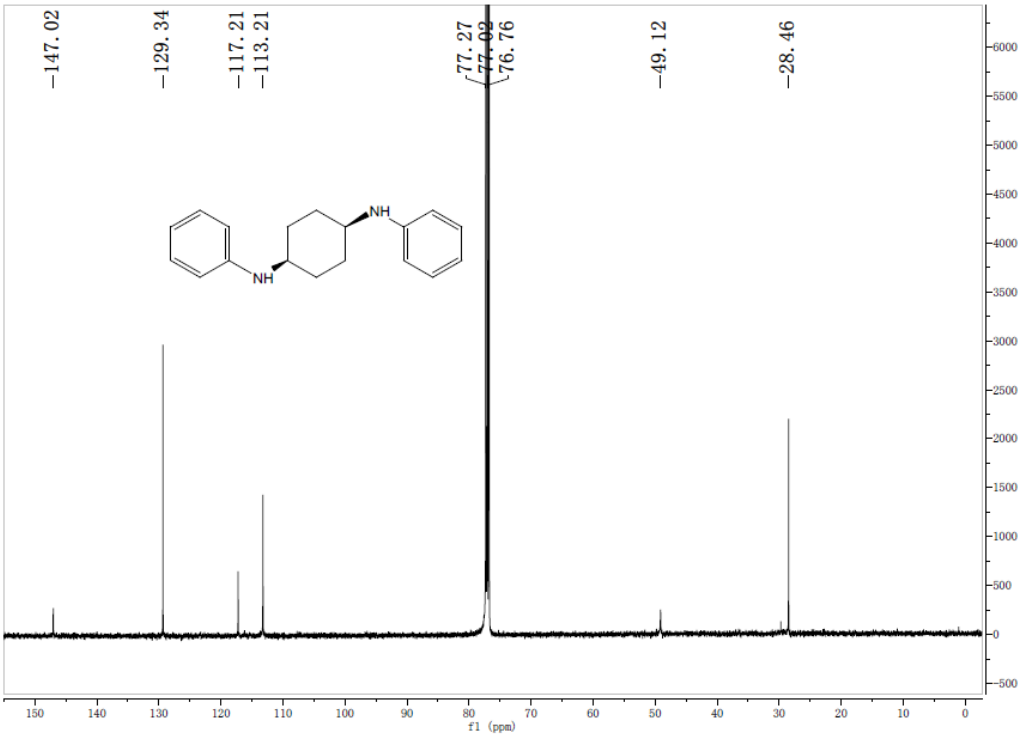
^{1}H NMR and ^{13}C NMR of 2-(phenylamino)cyclohexanone (4p)





^{1}H NMR and ^{13}C NMR of *cis*-N^{1},N^{4}-diphenylcyclohexane-1,4-diamine (4q)





^{1}H NMR and ^{13}C NMR of *trans*-N^{1},N^{4}-diphenylcyclohexane-1,4-diamine (4q)