

Organic-acid catalysed Minisci-type arylation of heterocycles with aryl acyl peroxides

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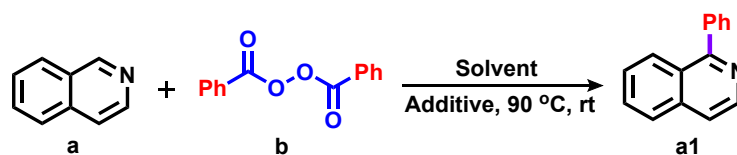
Supporting Information

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1. Optimization of reaction conditions

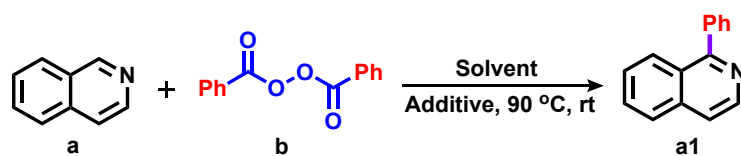
1.1 Optimization of additives^{a,b}



Entry	Temperature	Additive	Solvent	Time	Yield[%] ^b
1 ^a	90	TFA	EtOAc	12	80
2 ^c	90	-	EtOAc	12	trace
3	90	H ₂ SO ₄	EtOAc	12	0
4	90	HCl	EtOAc	12	0
5	90	CH ₃ COOH	EtOAc	12	39
6	90	methanesulfonic acid	EtOAc	12	0
7	90	trifluoromethanesulfonic acid	EtOAc	12	22
8	90	pivalic acid	EtOAc	12	trace
9	90	IRC ^d	EtOAc	12	trace
10	90	2-naphthalenesulfonic acid	EtOAc	12	50
11	90	<i>p</i> -aminobenzene sulfonic acid	EtOAc	12	40
12	90	methylbenzoic acid	EtOAc	12	30
13	90	phenylboronic acid	EtOAc	12	56
14	90	Taurine	EtOAc	12	55
15	90	2-naphthalene formic acid	EtOAc	12	28
16	90	malic acid	EtOAc	12	67
17	90	fluorin boric acid	EtOAc	12	43
18	90	hydroiodic acid	EtOAc	12	24

^a Reaction condition: **a** (0.2 mmol), **b** (2.0 equiv), TFA (1 mol%), EtOAc (3 mL), 90 °C, rt, 12 h. ^b Isolated yields. ^c Without additive. ^d IRC = Cation exchange resin.

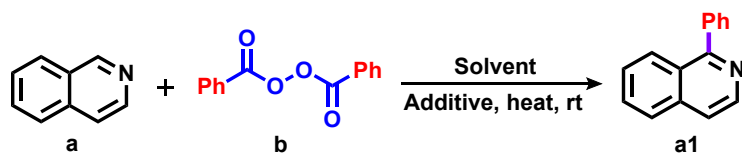
1.2 Optimization of solvents^{a,b}



Entry	Temperature	Additive	Solvent	Time	Yield[%] ^b
1	90	TFA	CH ₃ CN	12	40
2	90	TFA	C ₆ H ₁₂ ^c	12	45
3	90	TFA	Toluene	12	55
4	90	TFA	Acetone	12	78
5	90	TFA	DCE	12	52
6	90	TFA	EtOAc	12	80
7	90	TFA	DMF ^d	12	0
8	90	TFA	CCl ₄	12	0
9	90	TFA	THF	12	0
10	90	TFA	DMSO	12	0
11	90	TFA	H ₂ O	12	0
12	90	TFA	1,4-Dioxane	12	0
13	90	TFA	DCM	12	20
14	90	TFA	DMAC ^e	12	0
15	90	TFA	<i>n</i> -Hexane	12	0
16	90	TFA	Pyridine	12	28

^a Reaction condition: **a** (0.2 mmol), **b** (2.0 equiv), TFA (1 mol%), EtOAc (3 mL), 90 °C, rt, 12 h. ^b Isolated yields. ^c C₆H₁₂ = Cyclohexane. ^d DMF = *N,N*-dimethylformamide. ^e DMAC = *N,N*-dimethylacetamide.

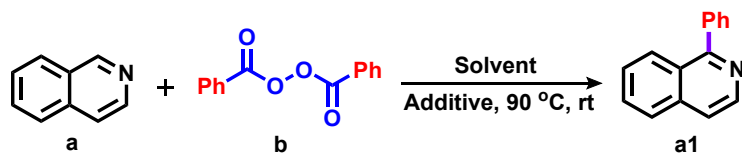
1.3 Optimization of temperature^{a,b}



Entry	Temperature	Additive	Solvent	Time	Yield[%] ^b
1 ^c	-	TFA	EtOAc	12	0
2	20	TFA	EtOAc	12	0
3	40	TFA	EtOAc	12	0
4	60	TFA	EtOAc	12	20
5	70	TFA	EtOAc	12	75
6	80	TFA	EtOAc	12	72
7	90	TFA	EtOAc	12	80
8	100	TFA	EtOAc	12	68
9	120	TFA	EtOAc	12	60

^a Reaction condition: **a** (0.2 mmol), **b** (2.0 equiv), TFA (1 mol%), EtOAc (3 mL), rt, 12 h. ^b Isolated yields. ^c Under room temperature.

1.4 Optimization of time^{a,b}

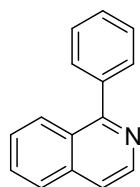


Entry	Temperature	Additive	Solvent	Time	Yield[%] ^b
1	90	TFA	EtOAc	2	30
2	90	TFA	EtOAc	6	50
3	90	TFA	EtOAc	10	70
4	90	TFA	EtOAc	12	80
5	90	TFA	EtOAc	24	80

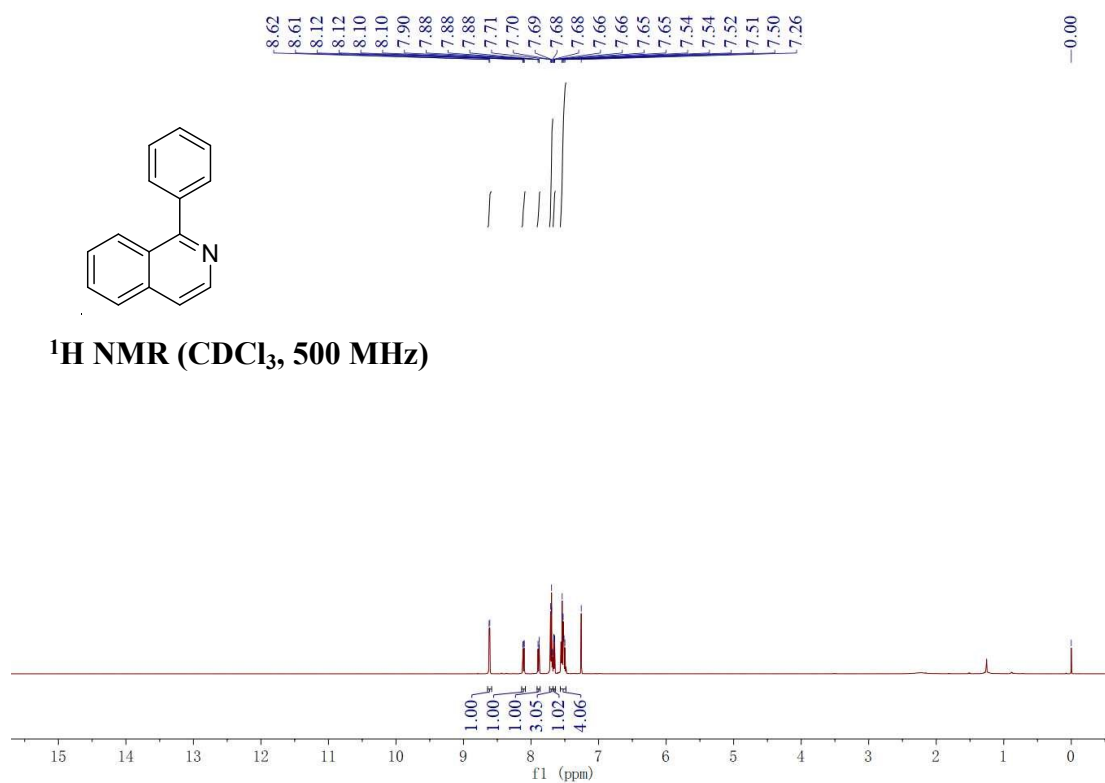
^a Reaction condition: **a** (0.2 mmol), **b** (2.0 equiv), TFA (1 mol%), EtOAc (3 mL), 90 °C, rt. ^b Isolated yields.

2. Copies of NMR spectra

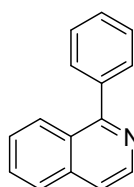
^1H NMR Spectrum of Compound a1



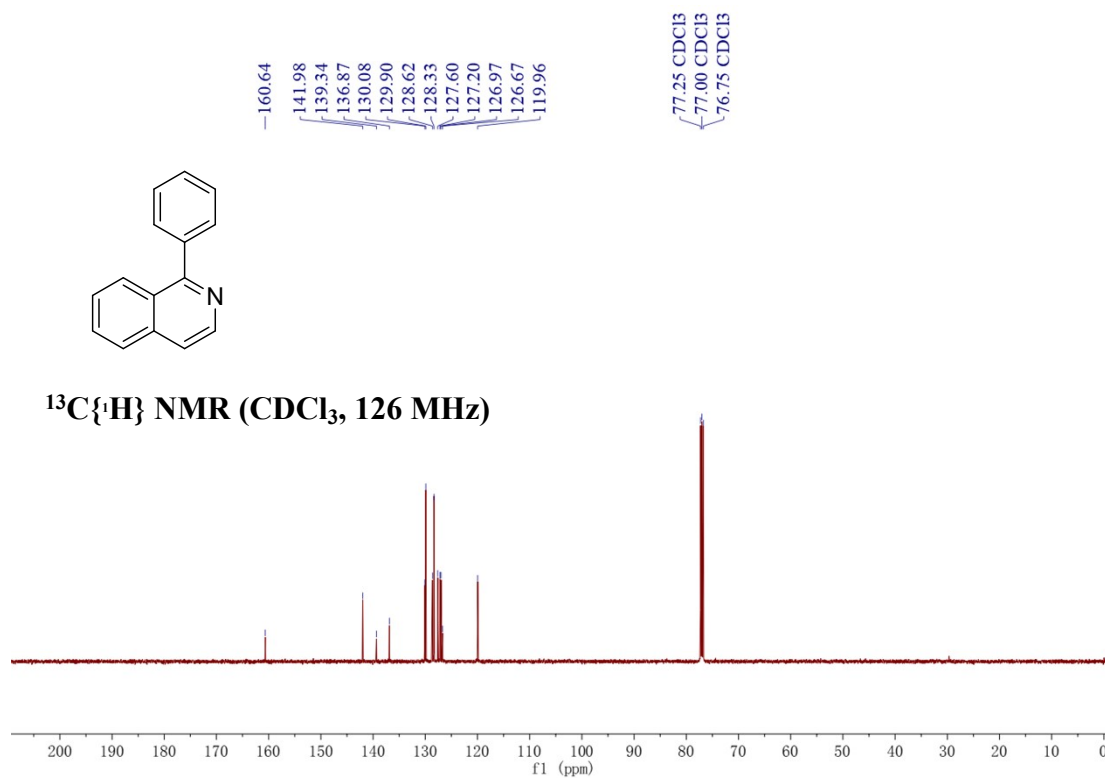
^1H NMR (CDCl_3 , 500 MHz)



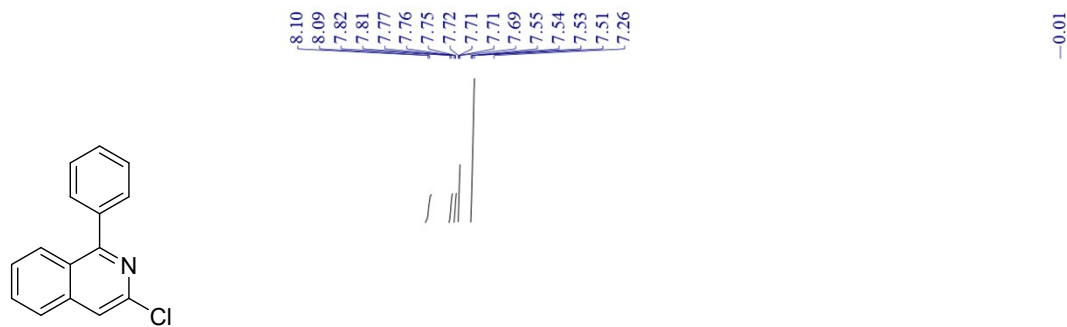
$^{13}\text{C}\{^1\text{H}\}$ NMR Spectrum of Compound a1



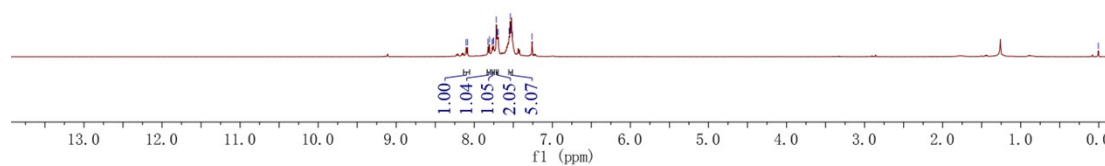
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^1H NMR Spectrum of Compound a2



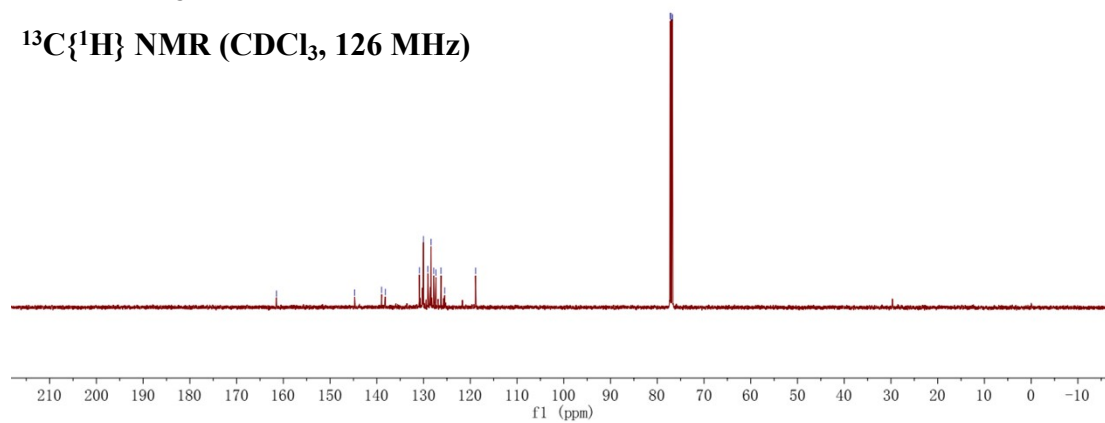
^1H NMR (CDCl₃, 500 MHz)



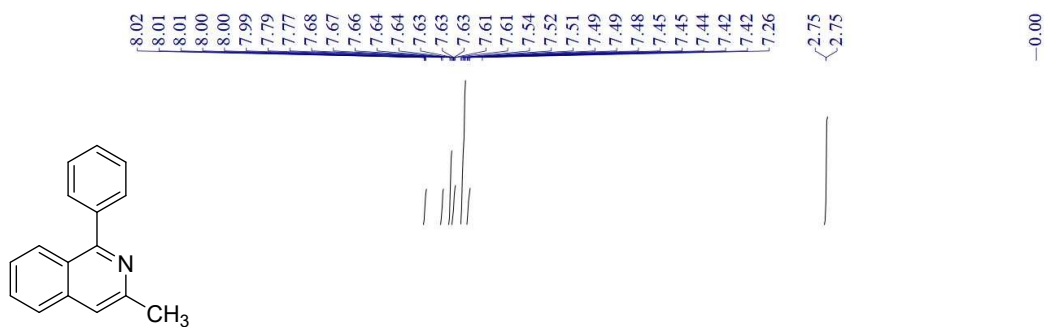
$^{13}\text{C}\{^1\text{H}\}$ NMR Spectrum of Compound a2



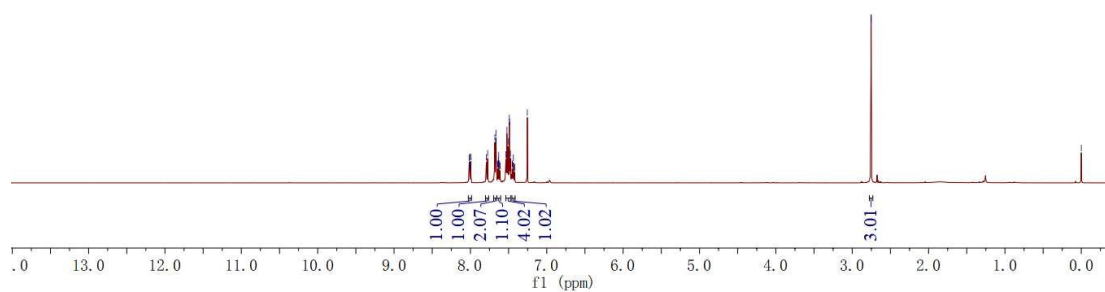
$^{13}\text{C}\{^1\text{H}\}$ NMR (CDCl₃, 126 MHz)



¹H NMR Spectrum of Compound a3



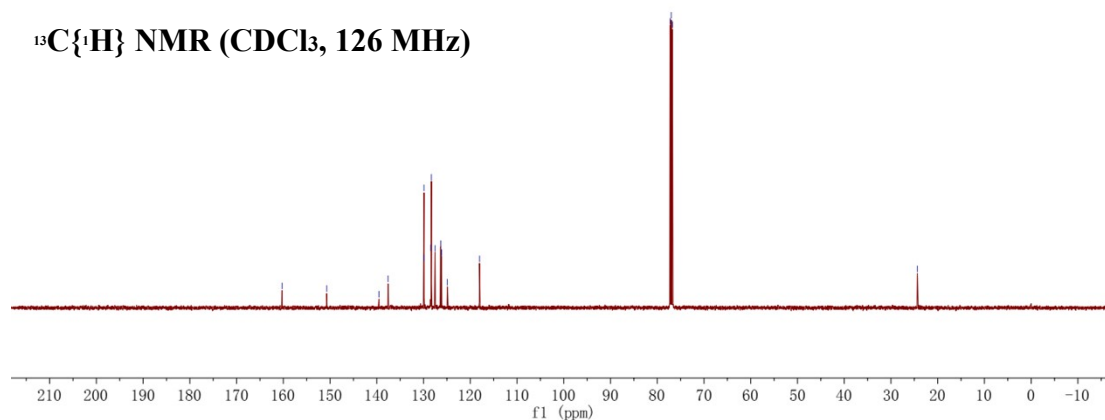
¹H NMR (CDCl₃, 500 MHz)



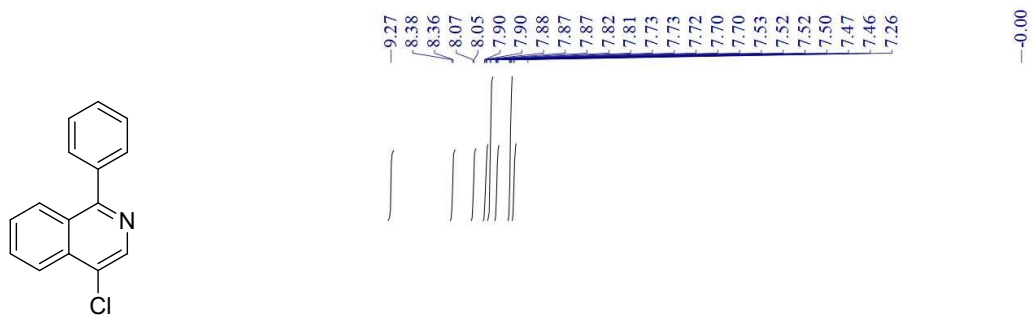
¹³C{¹H} NMR Spectrum of Compound a3



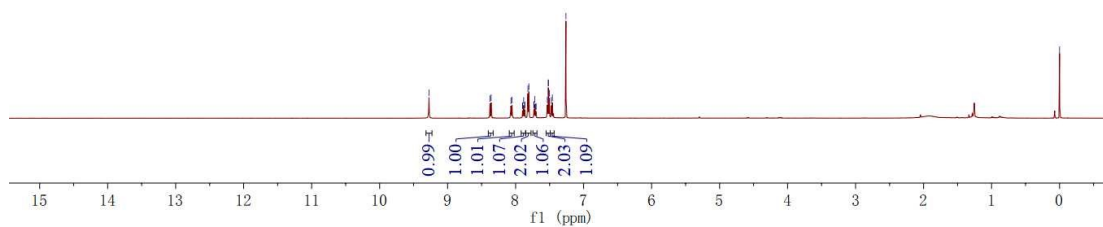
¹³C{¹H} NMR (CDCl₃, 126 MHz)



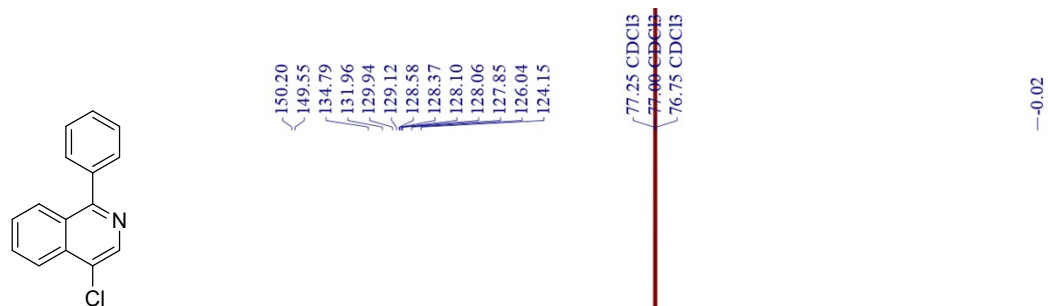
^1H NMR Spectrum of Compound a4



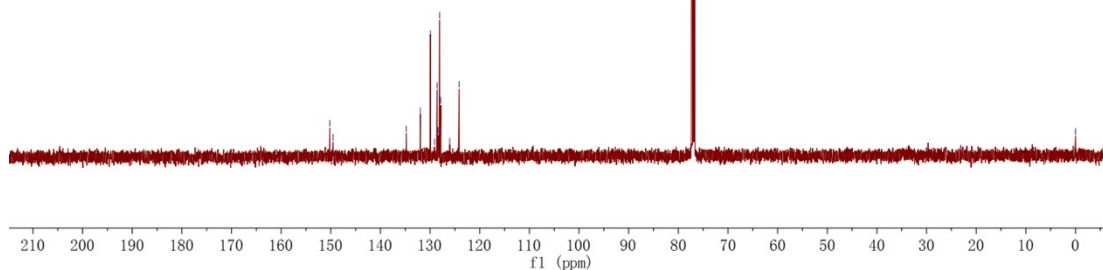
^1H NMR (CDCl₃, 500 MHz)



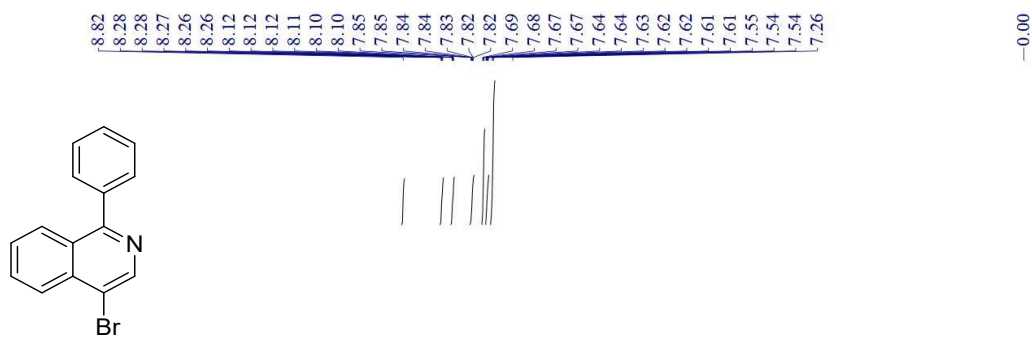
$^{13}\text{C}\{^1\text{H}\}$ NMR Spectrum of Compound a4



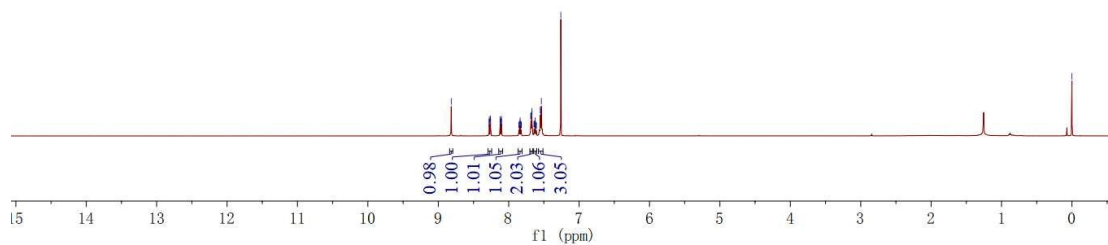
$^{13}\text{C}\{^1\text{H}\}$ NMR (CDCl₃, 126 MHz)



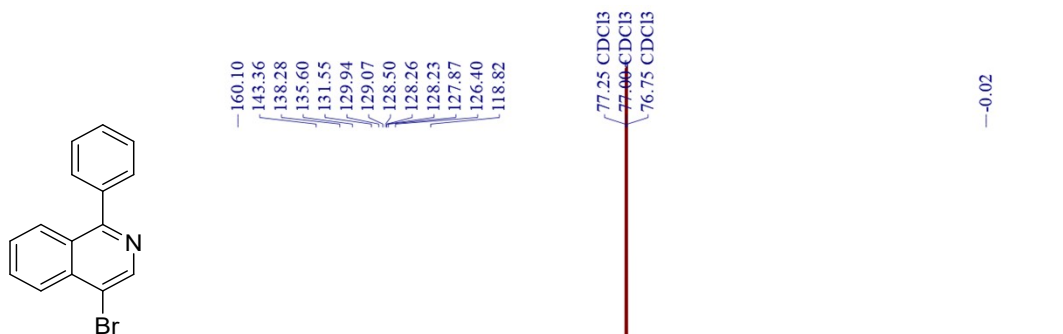
^1H NMR Spectrum of Compound a5



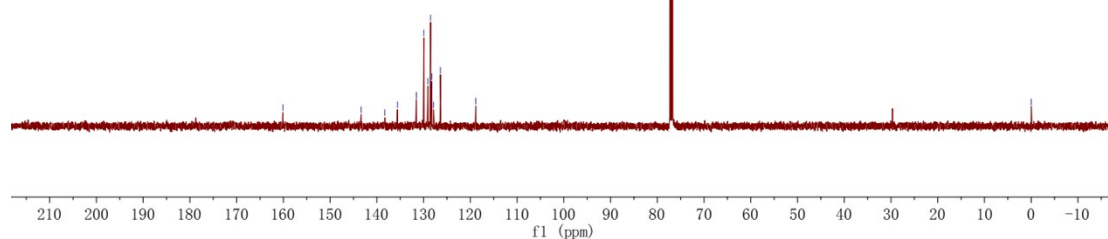
^1H NMR (CDCl_3 , 500 MHz)



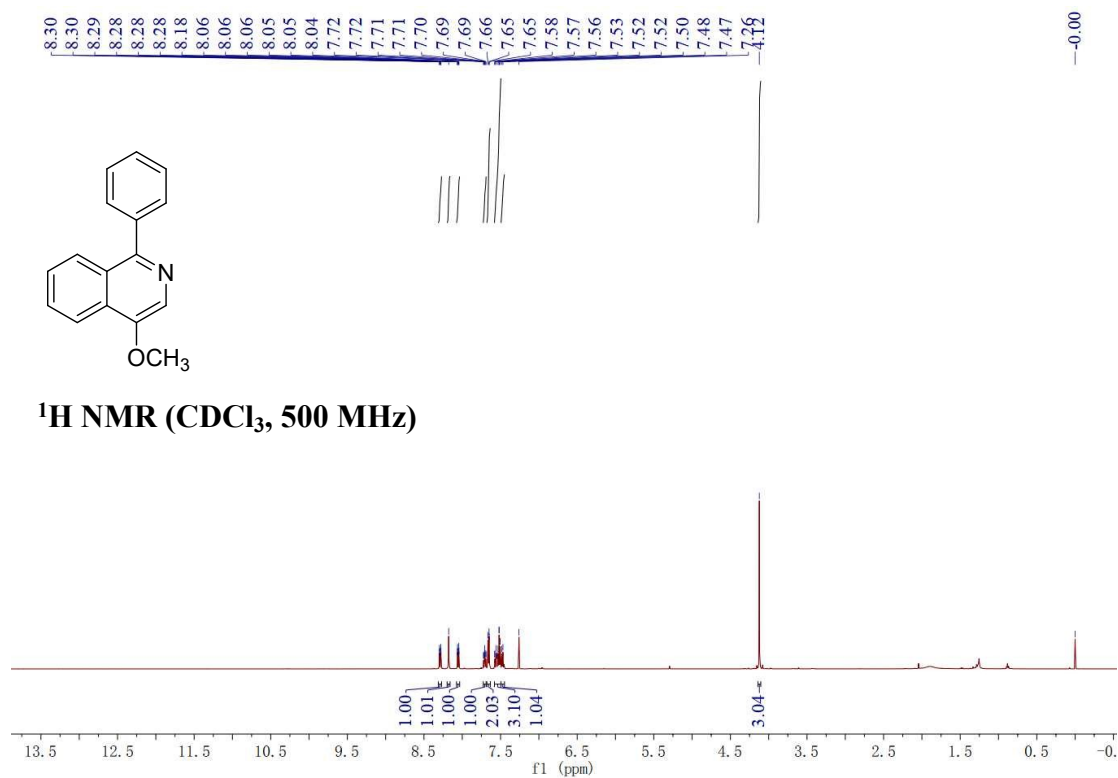
$^{13}\text{C}\{^1\text{H}\}$ NMR Spectrum of Compound a5



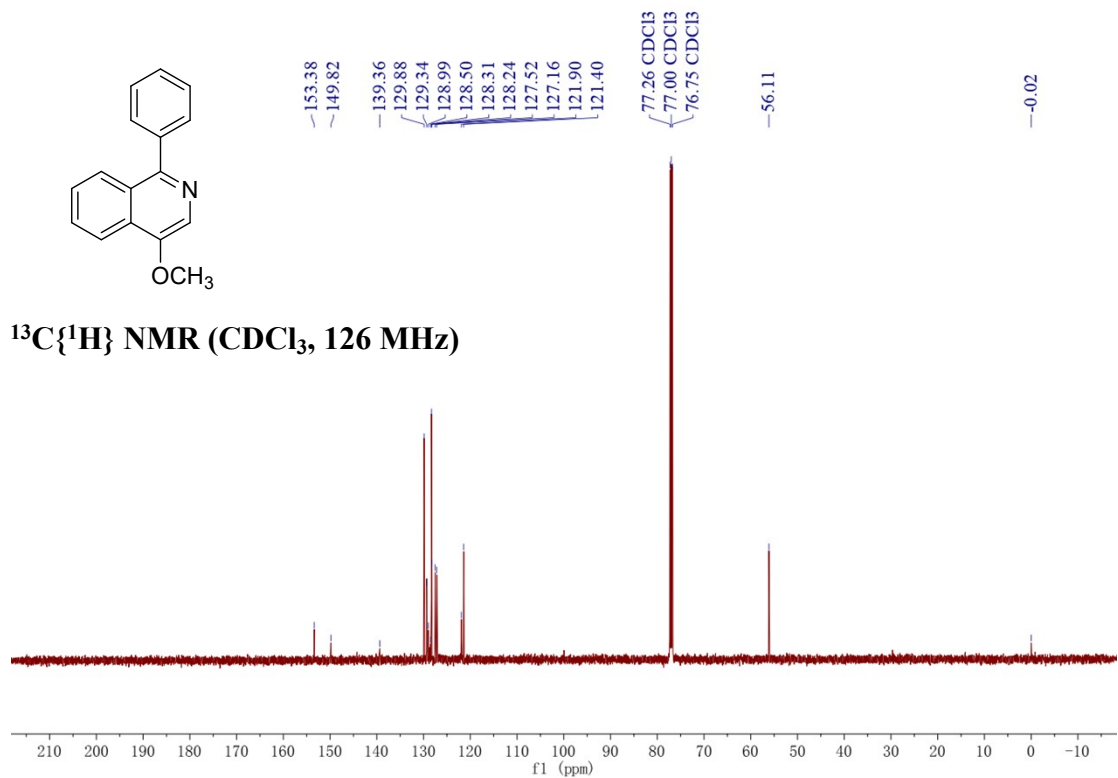
$^{13}\text{C}\{^1\text{H}\}$ NMR (CDCl_3 , 126 MHz)



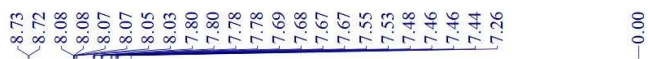
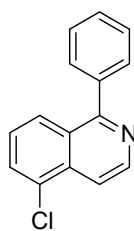
^1H NMR Spectrum of Compound a6



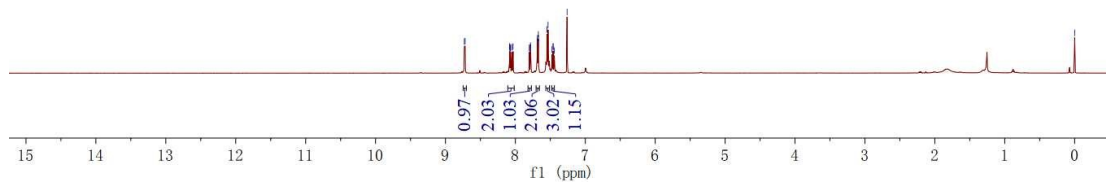
$^{13}\text{C}\{^1\text{H}\}$ NMR Spectrum of Compound a6



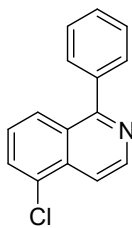
^1H NMR Spectrum of Compound a7



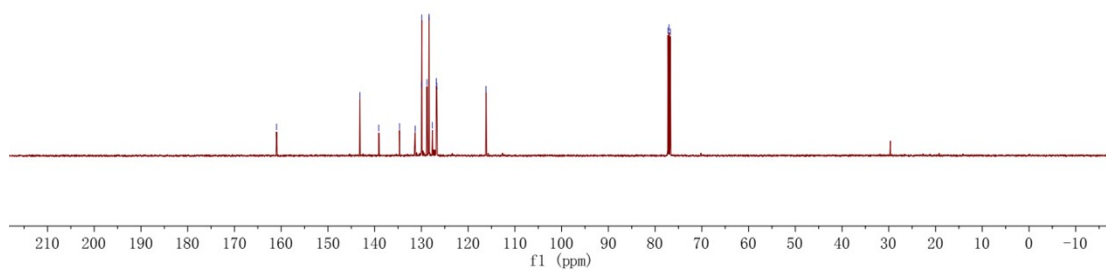
^1H NMR (CDCl_3 , 500 MHz)



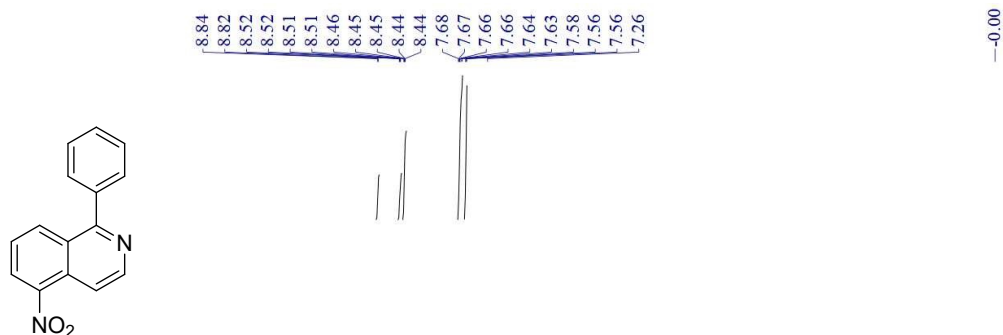
$^{13}\text{C}\{^1\text{H}\}$ NMR Spectrum of Compound a7



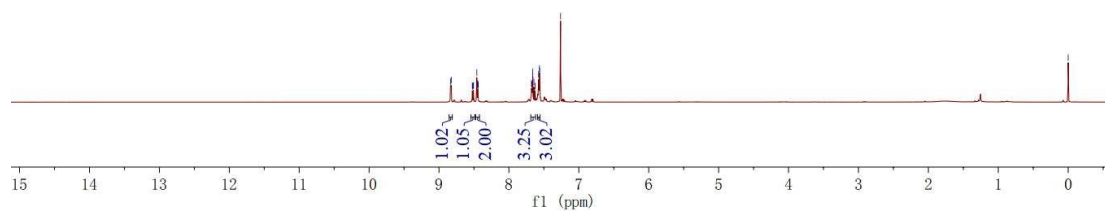
$^{13}\text{C}\{^1\text{H}\}$ NMR (CDCl_3 , 126 MHz)



¹H NMR Spectrum of Compound a8



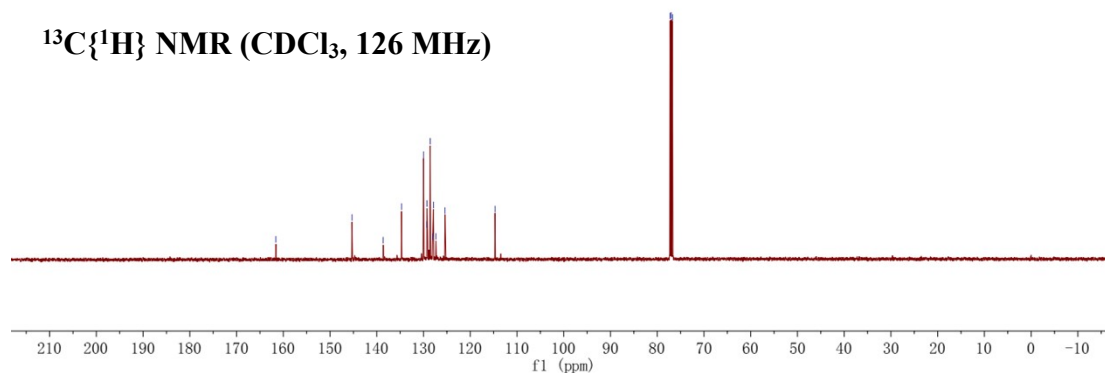
¹H NMR (CDCl₃, 500 MHz)



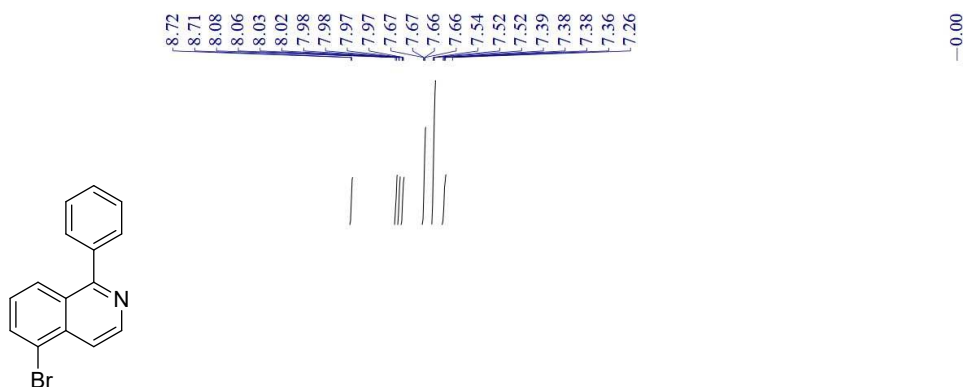
¹³C{¹H} NMR Spectrum of Compound a8



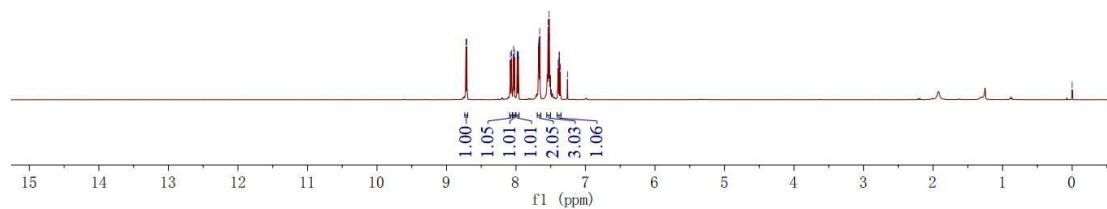
¹³C{¹H} NMR (CDCl₃, 126 MHz)



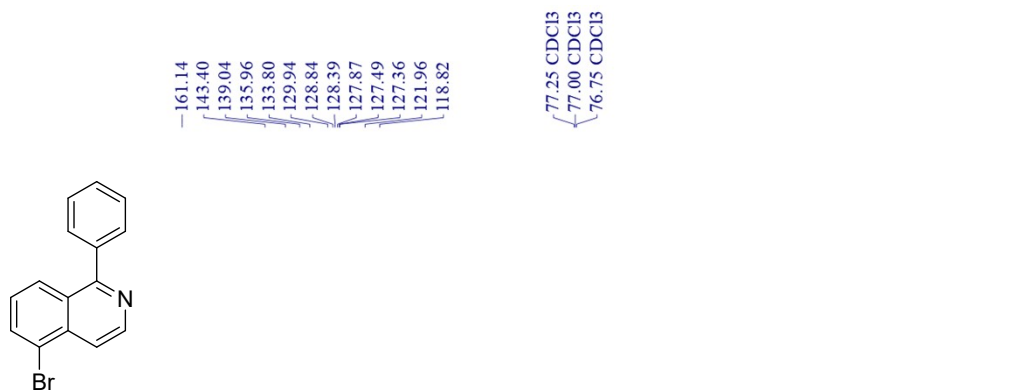
¹H NMR Spectrum of Compound a9



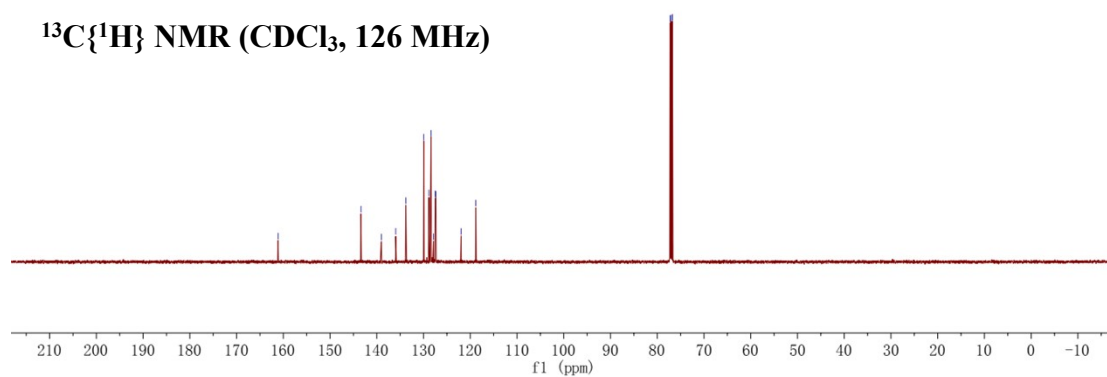
¹H NMR (CDCl₃, 500 MHz)



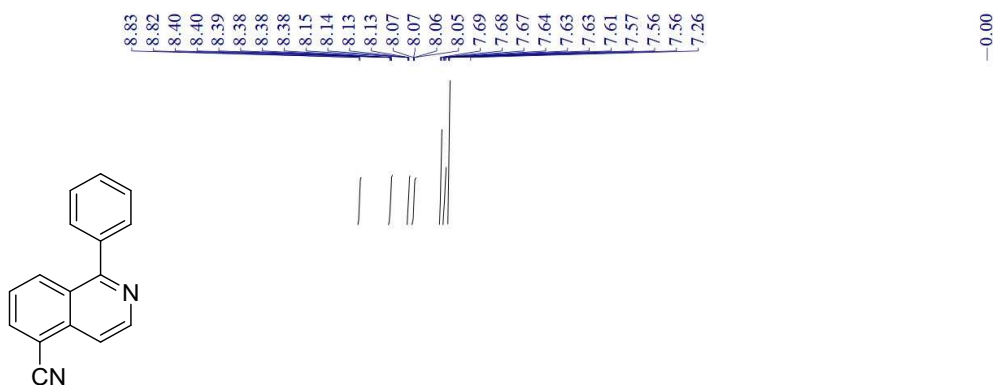
¹³C{¹H} NMR Spectrum of Compound a9



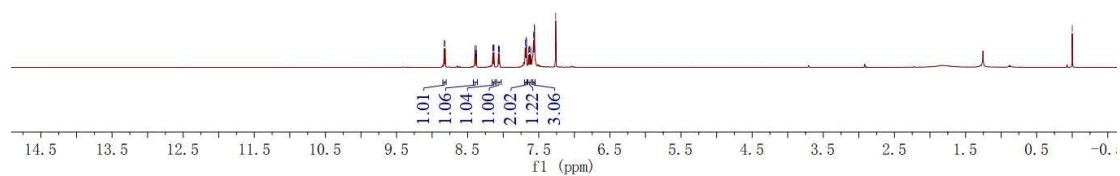
¹³C{¹H} NMR (CDCl₃, 126 MHz)



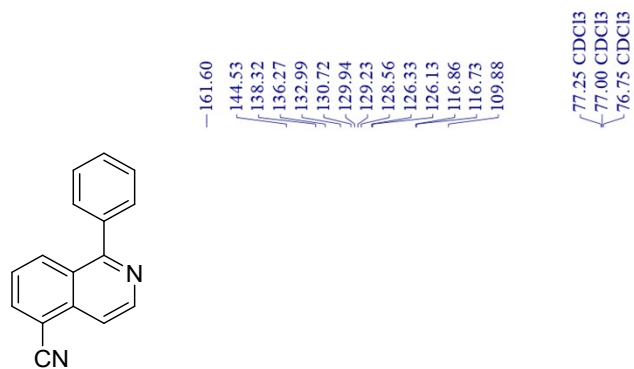
¹H NMR Spectrum of Compound a10



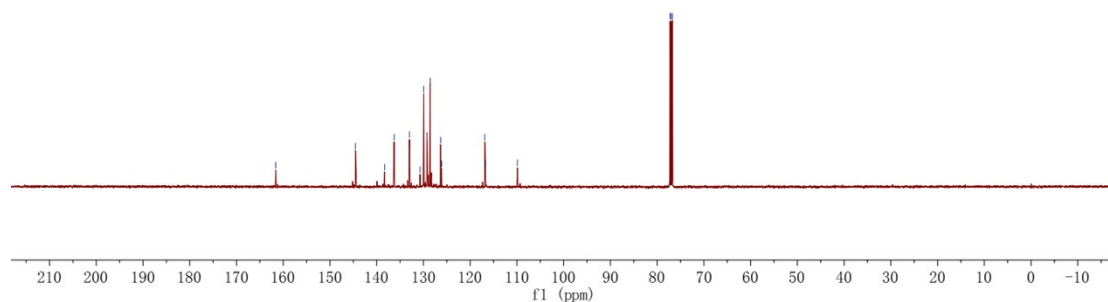
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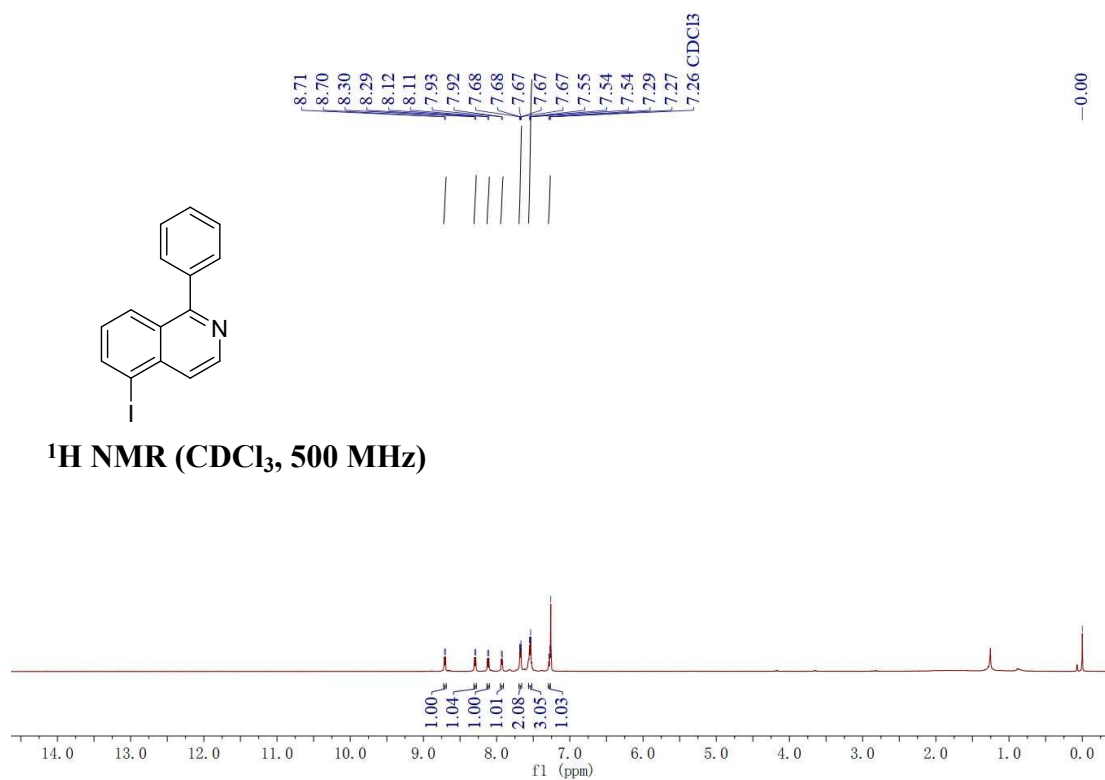
¹³C{¹H} NMR Spectrum of Compound a10



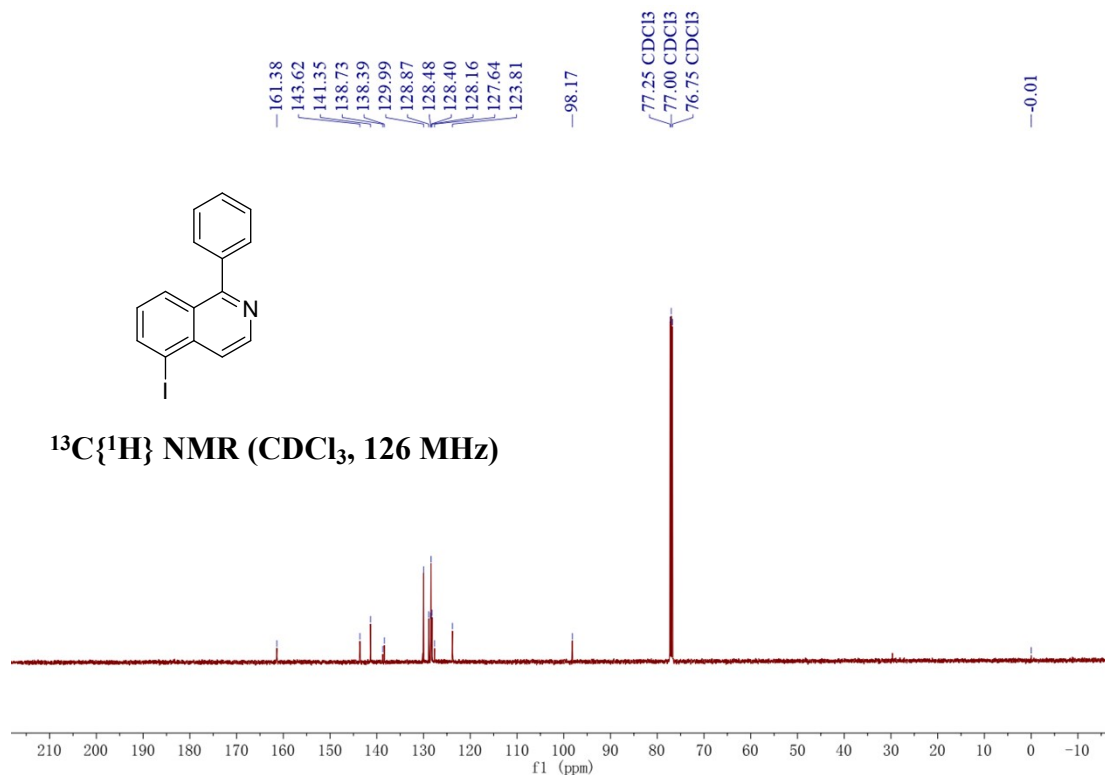
¹³C{¹H} NMR (CDCl₃, 126 MHz)



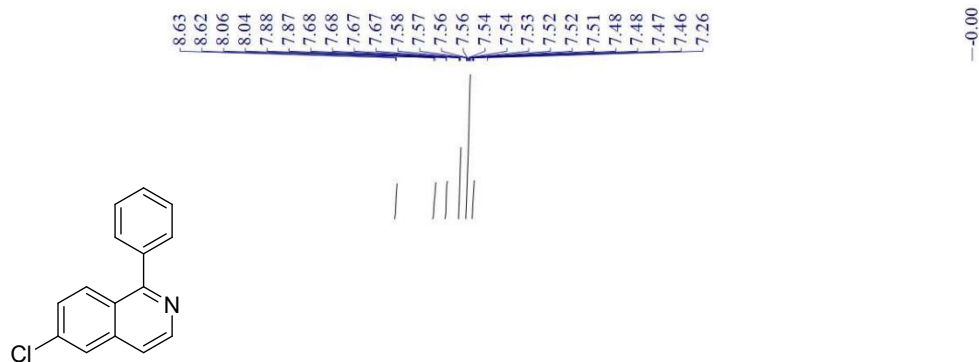
¹H NMR Spectrum of Compound a11



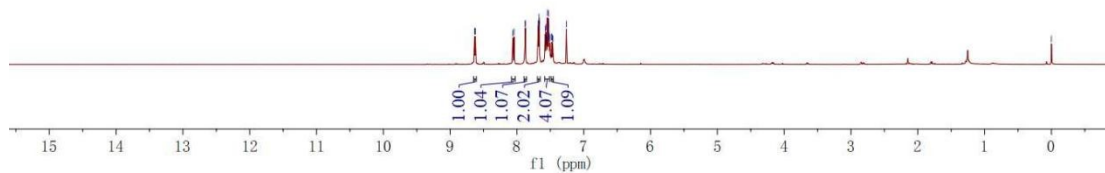
¹³C{¹H} NMR Spectrum of Compound a11



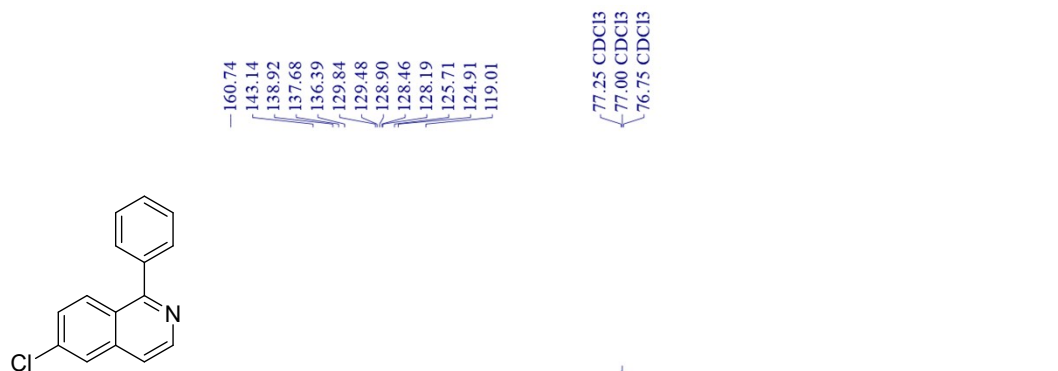
^1H NMR Spectrum of Compound a12



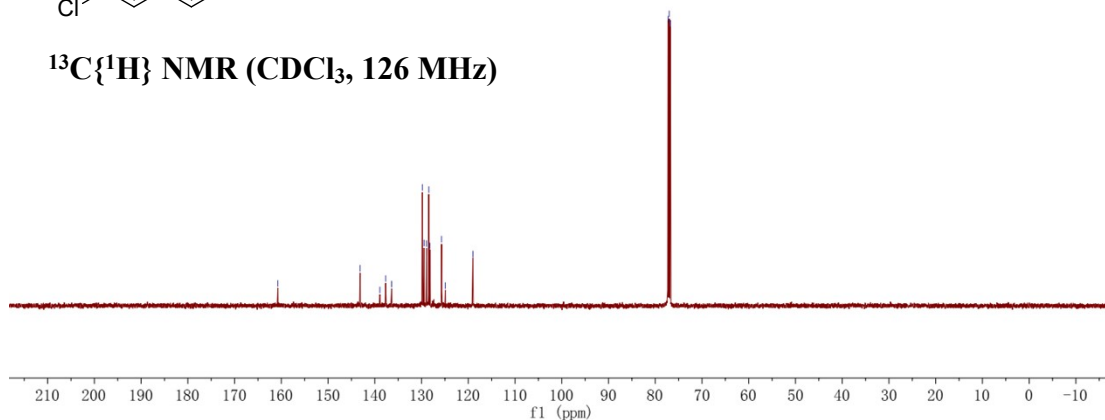
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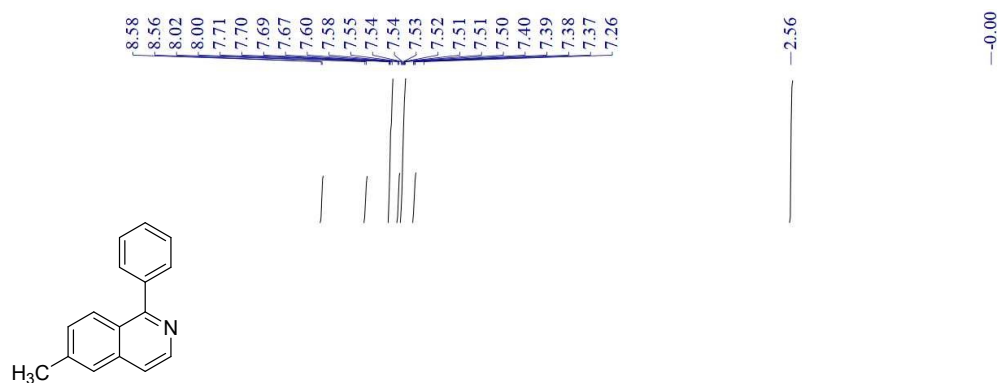
$^{13}\text{C}\{^1\text{H}\}$ NMR Spectrum of Compound a12



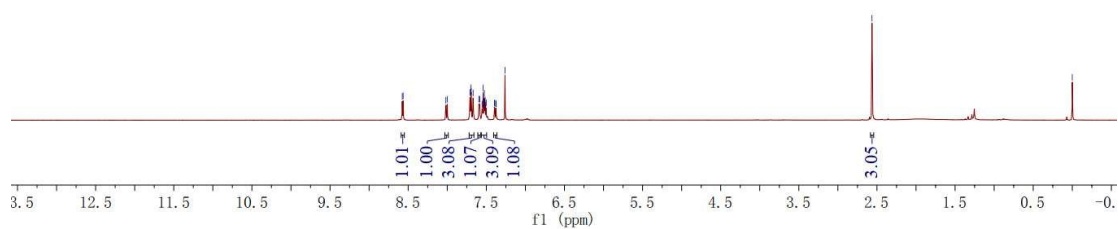
$^{13}\text{C}\{^1\text{H}\}$ NMR (CDCl₃, 126 MHz)



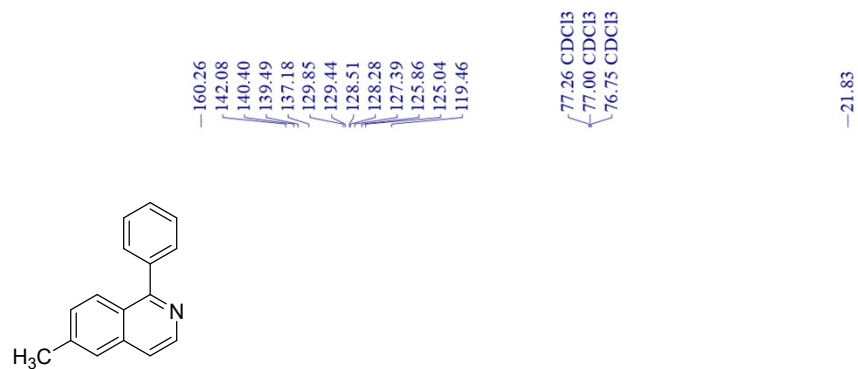
¹H NMR Spectrum of Compound a13



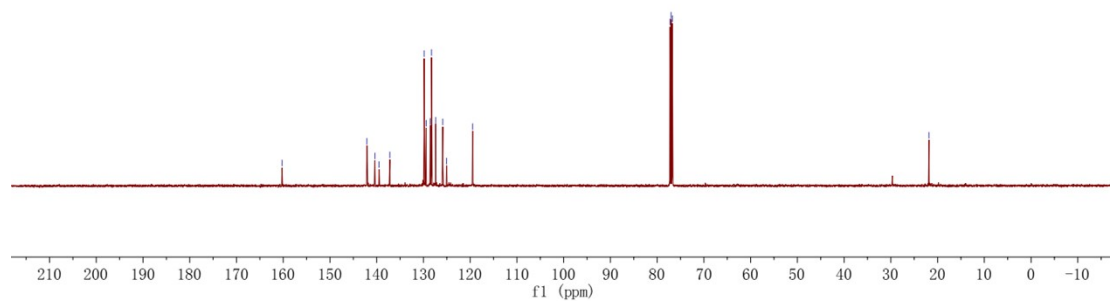
¹H NMR (CDCl₃, 500 MHz)



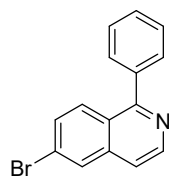
¹³C{¹H} NMR Spectrum of Compound a13



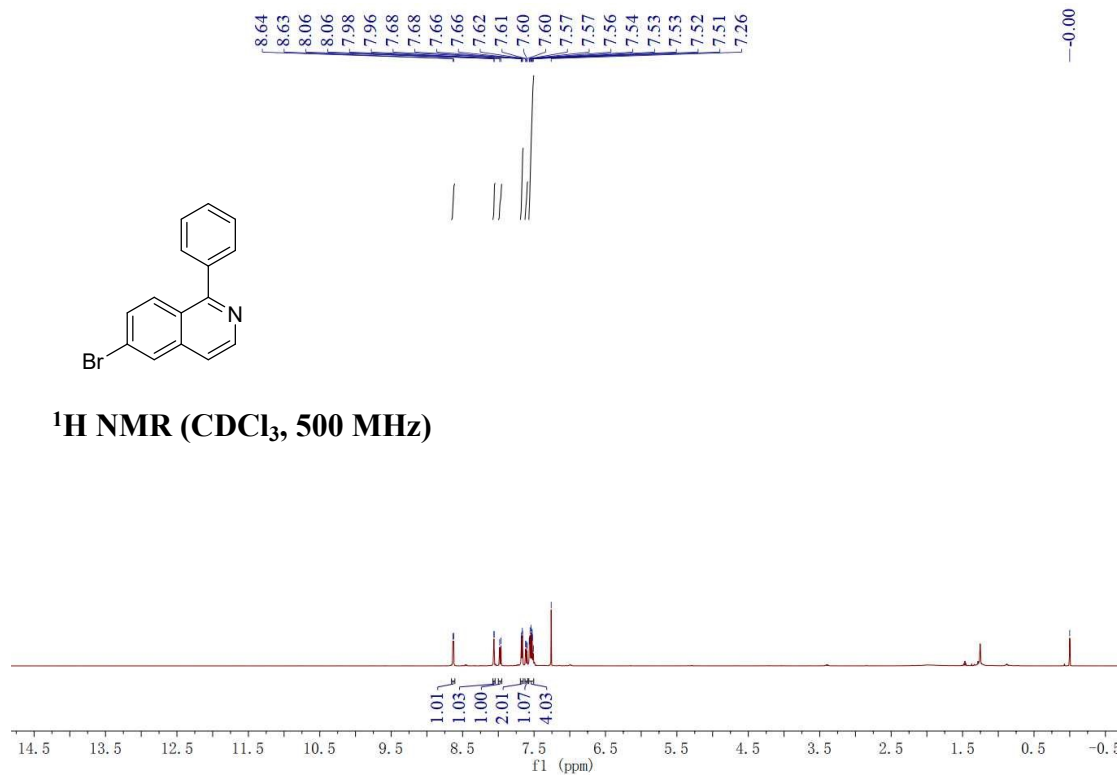
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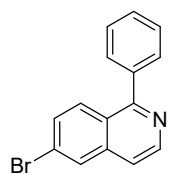
¹H NMR Spectrum of Compound a14



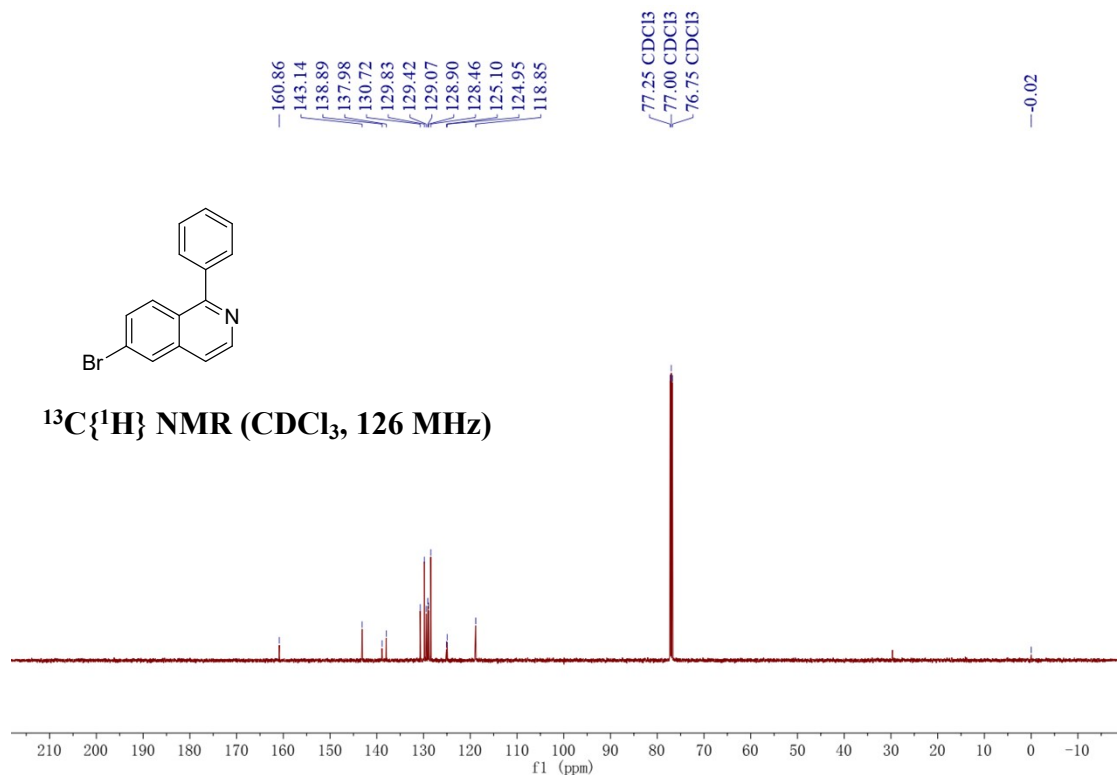
¹H NMR (CDCl₃, 500 MHz)



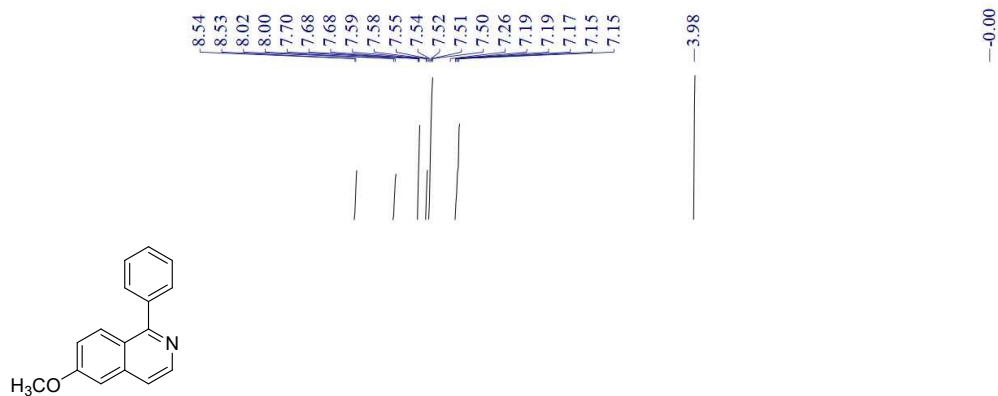
¹³C{¹H} NMR Spectrum of Compound a14



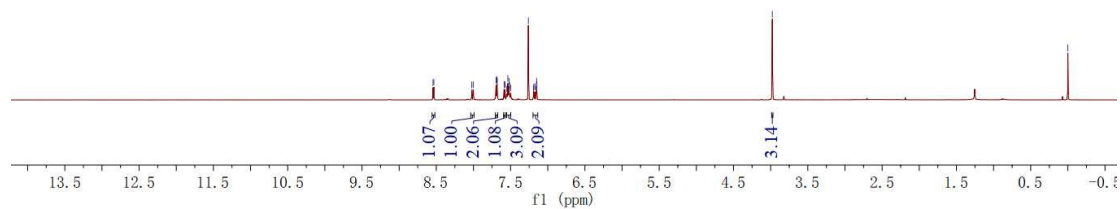
¹³C{¹H} NMR (CDCl₃, 126 MHz)



^1H NMR Spectrum of Compound a15



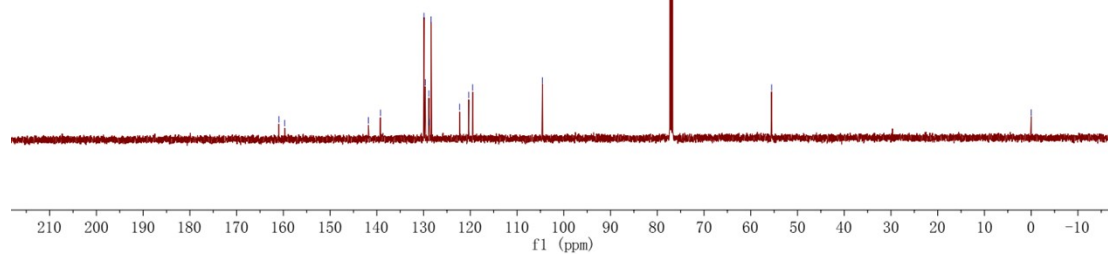
^1H NMR (CDCl₃, 500 MHz)



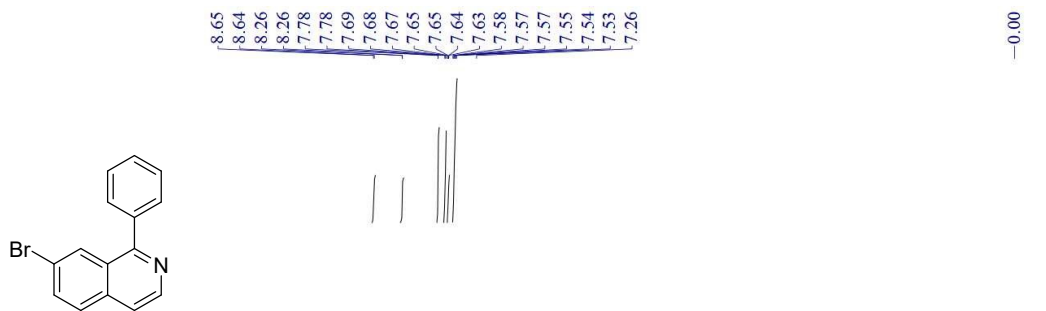
$^{13}\text{C}\{^1\text{H}\}$ NMR Spectrum of Compound a15



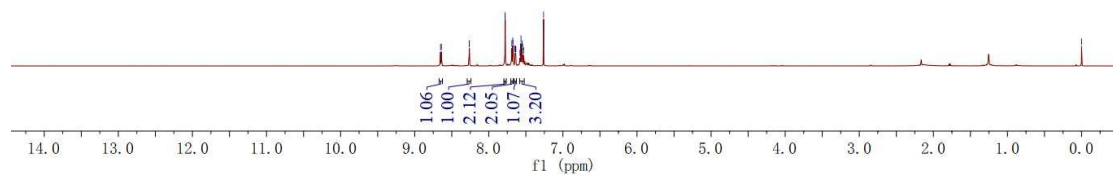
$^{13}\text{C}\{^1\text{H}\}$ NMR (CDCl₃, 126 MHz)



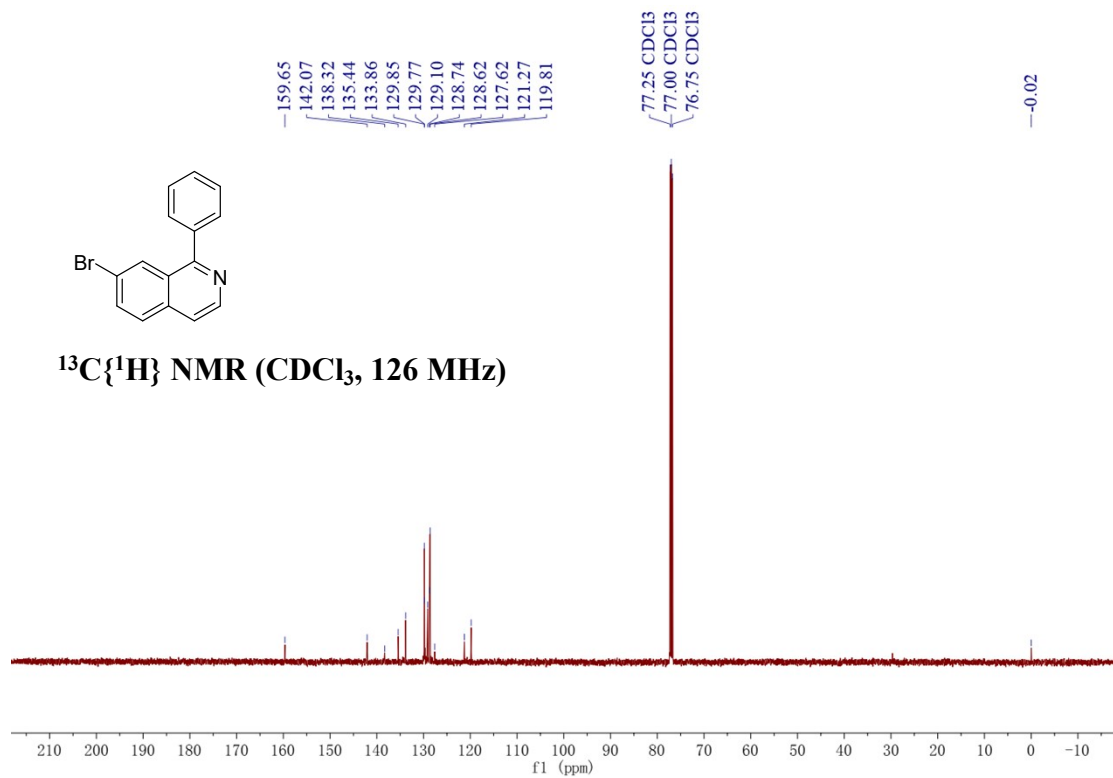
^1H NMR Spectrum of Compound a16



^1H NMR (CDCl_3 , 500 MHz)

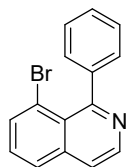


$^{13}\text{C}\{^1\text{H}\}$ NMR Spectrum of Compound a16

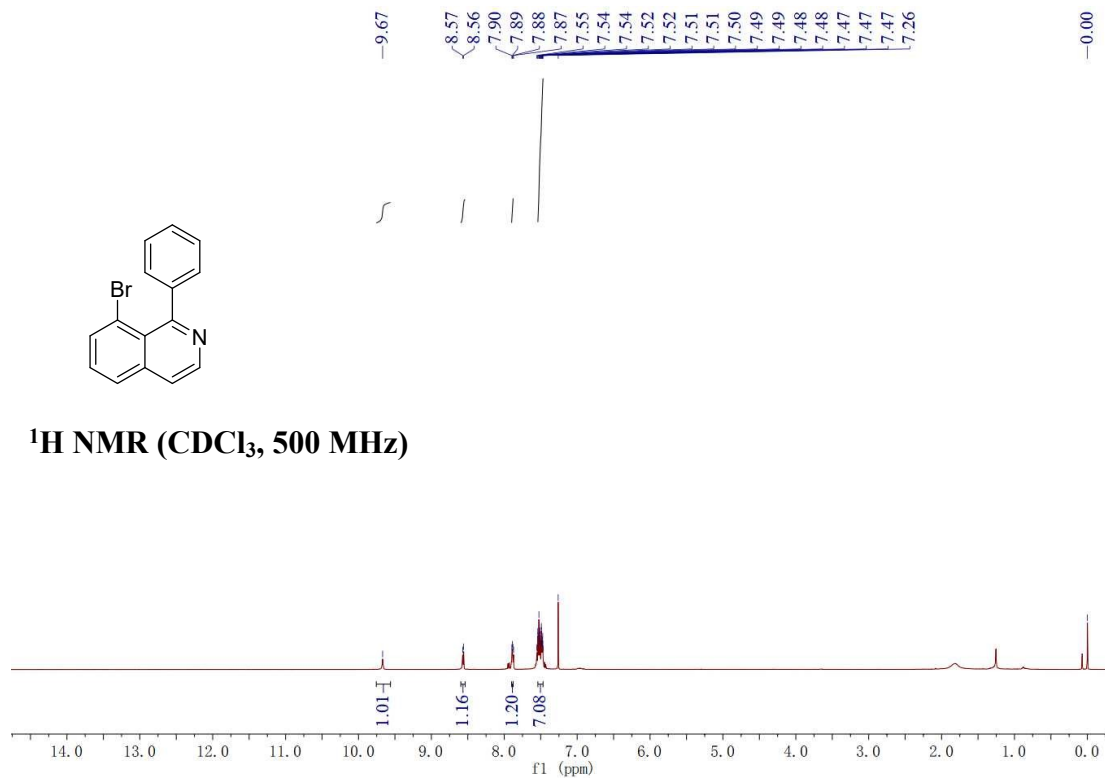


$^{13}\text{C}\{^1\text{H}\}$ NMR (CDCl_3 , 126 MHz)

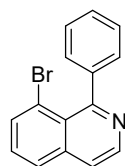
¹H NMR Spectrum of Compound a17



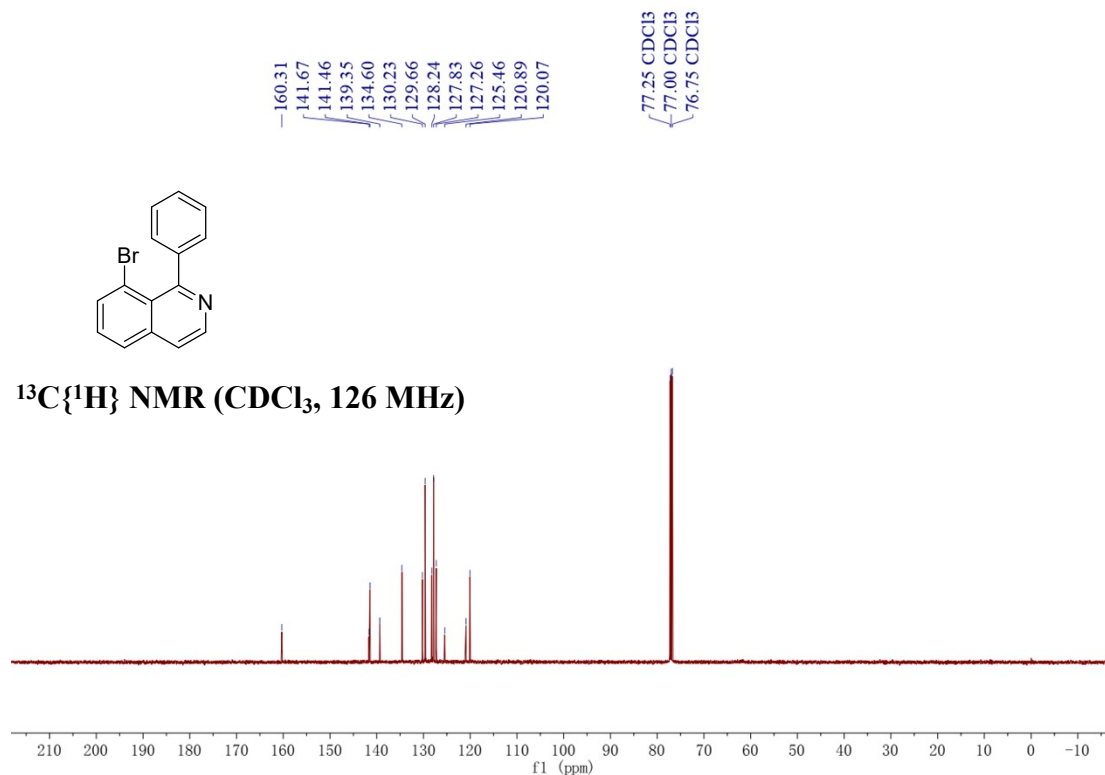
¹H NMR (CDCl₃, 500 MHz)



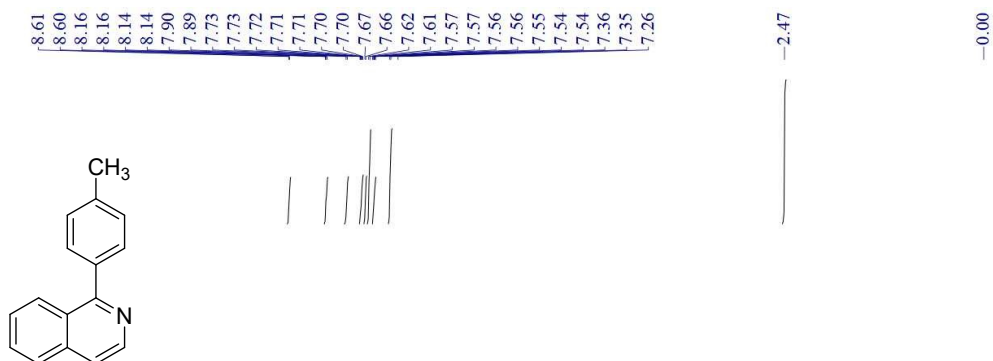
¹³C{¹H} NMR Spectrum of Compound a17



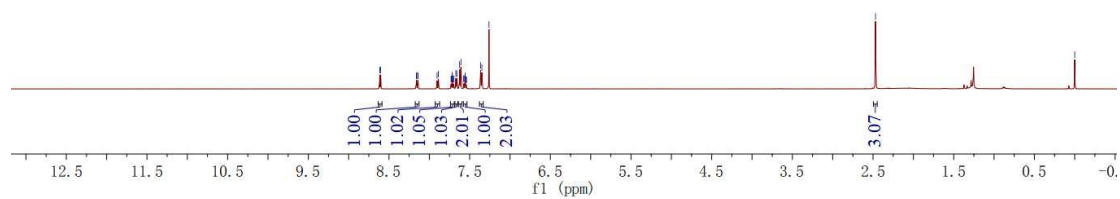
¹³C{¹H} NMR (CDCl₃, 126 MHz)



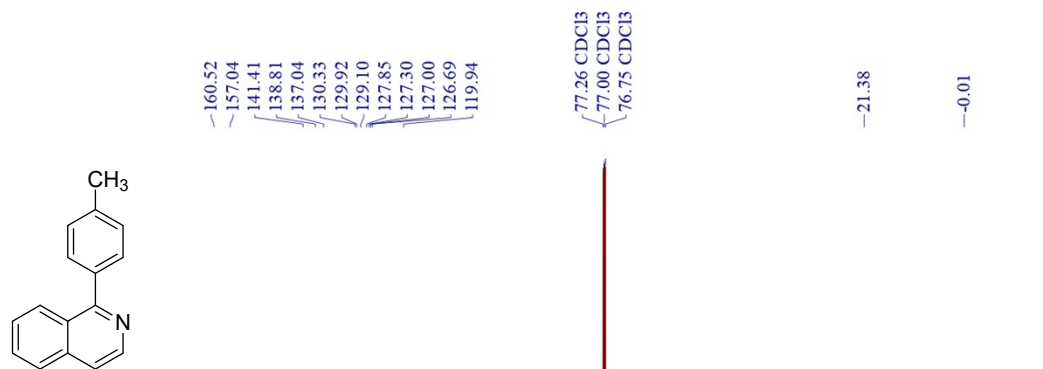
^1H NMR Spectrum of Compound b1



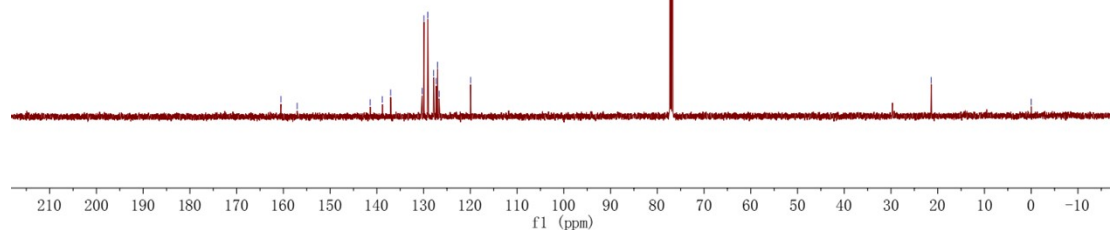
^1H NMR (CDCl₃, 500 MHz)



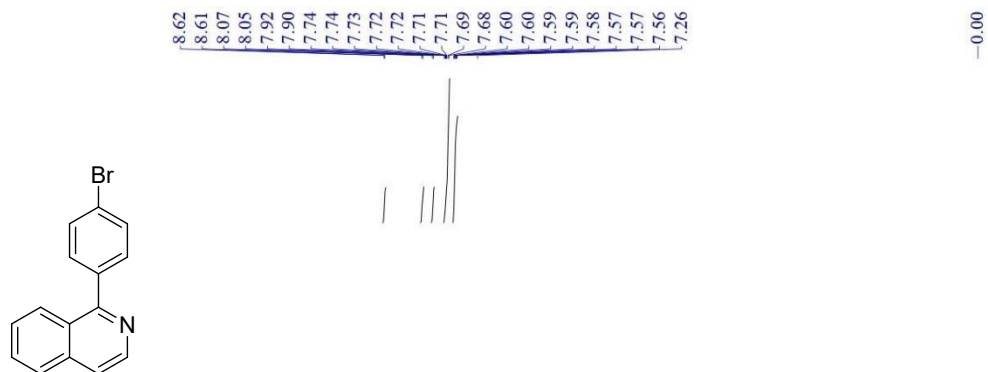
$^{13}\text{C}\{^1\text{H}\}$ NMR Spectrum of Compound b1



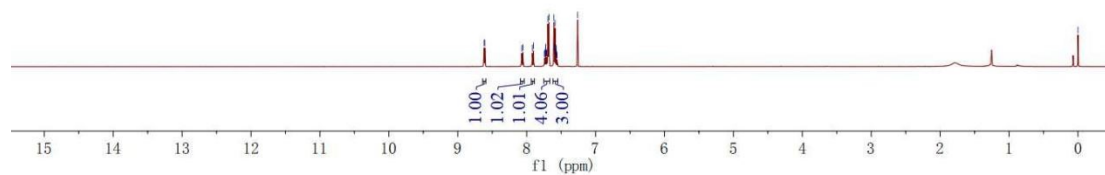
$^{13}\text{C}\{^1\text{H}\}$ NMR (CDCl₃, 126 MHz)



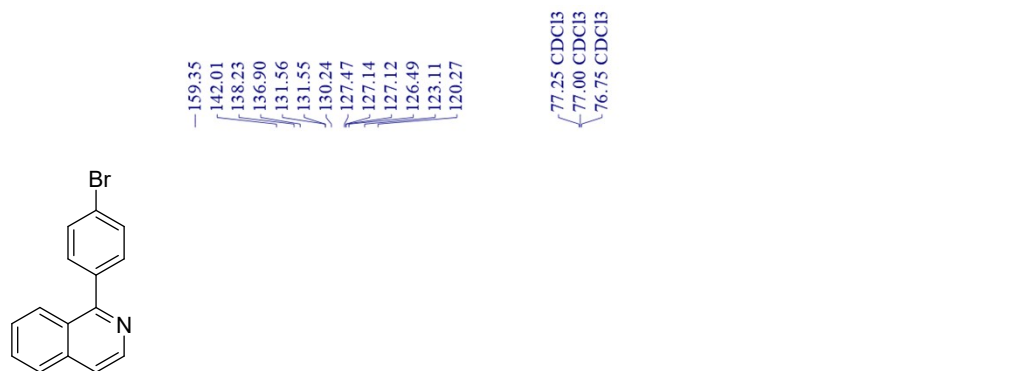
^1H NMR Spectrum of Compound b2



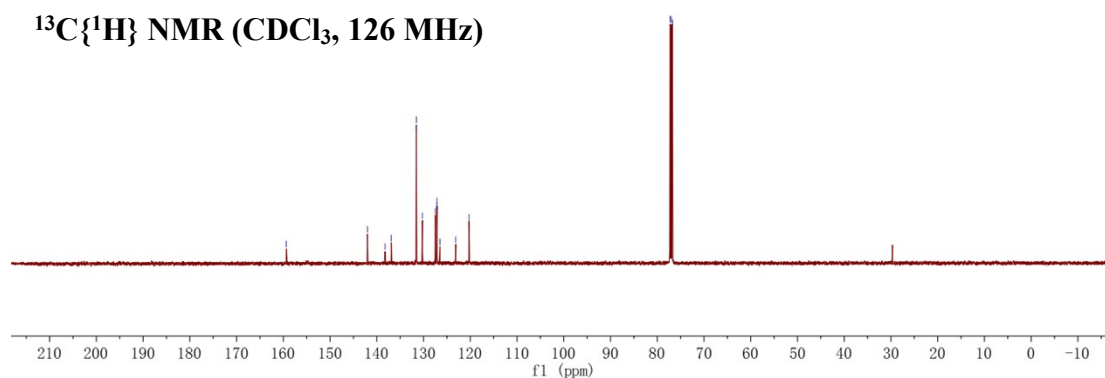
^1H NMR (CDCl₃, 500 MHz)



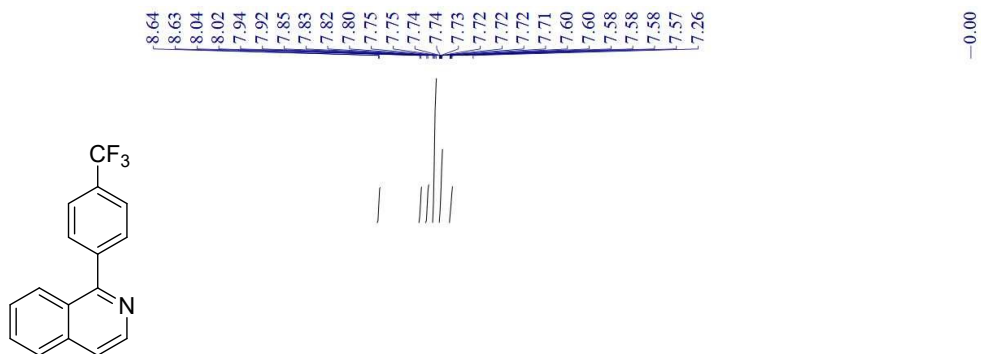
$^{13}\text{C}\{^1\text{H}\}$ NMR Spectrum of Compound b2



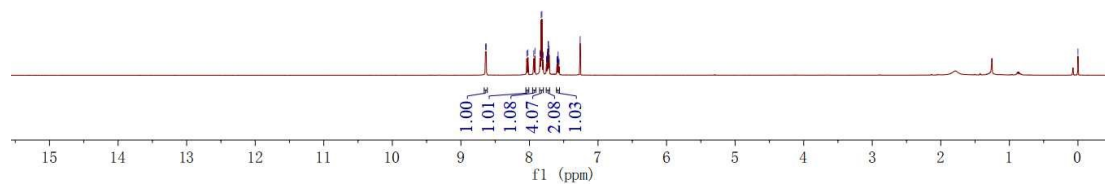
$^{13}\text{C}\{^1\text{H}\}$ NMR (CDCl₃, 126 MHz)



^1H NMR Spectrum of Compound b3



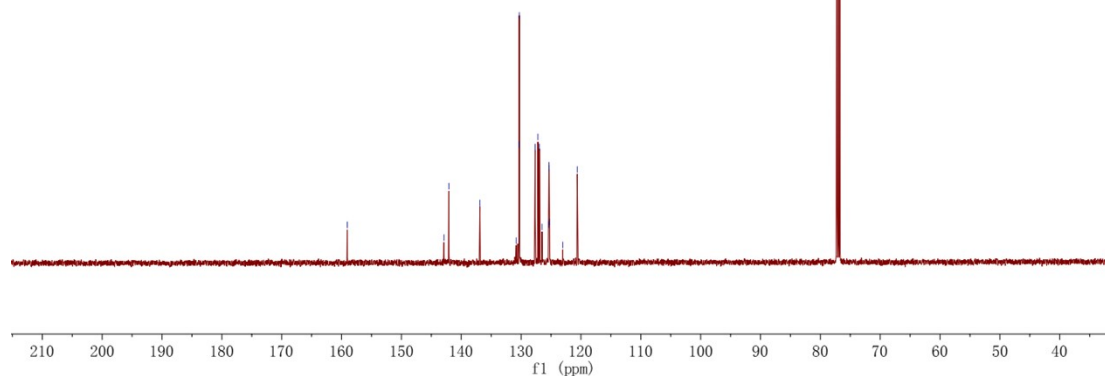
^1H NMR (CDCl₃, 500 MHz)



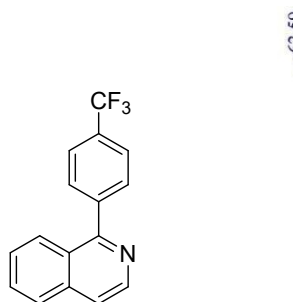
$^{13}\text{C}\{^1\text{H}\}$ NMR Spectrum of Compound b3



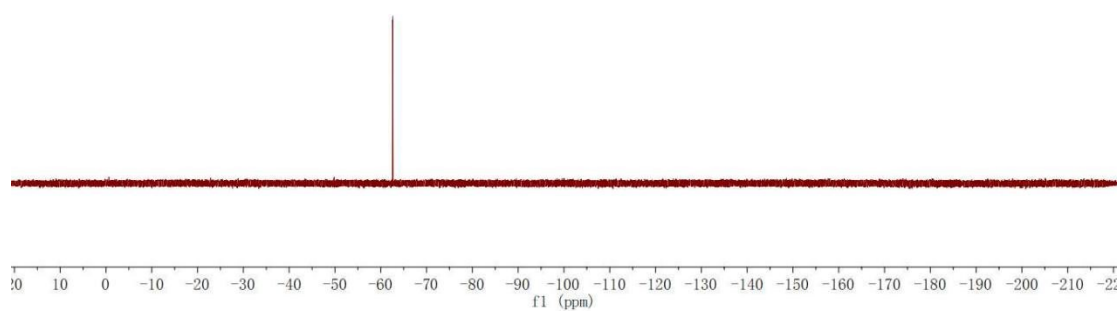
$^{13}\text{C}\{^1\text{H}\}$ NMR (CDCl₃, 126 MHz)



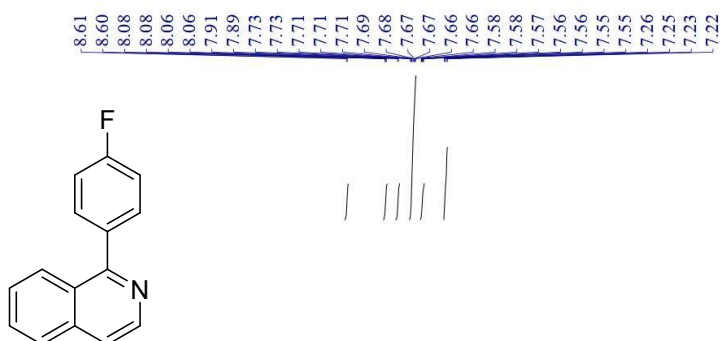
$^{19}\text{F}\{^1\text{H}\}$ NMR Spectrum of Compound b3



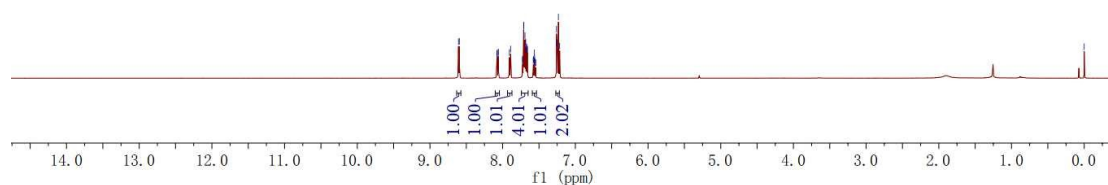
$^{19}\text{F}\{^1\text{H}\}$ NMR (CDCl_3 , 471 MHz)



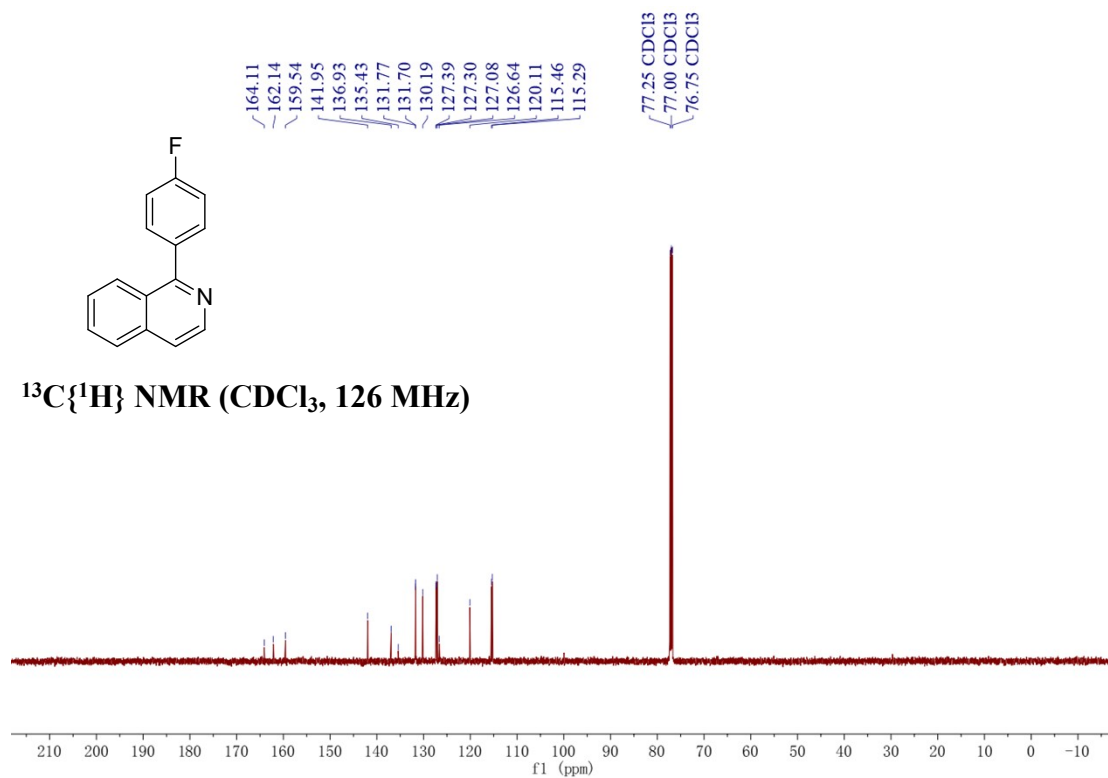
^1H NMR Spectrum of Compound b4



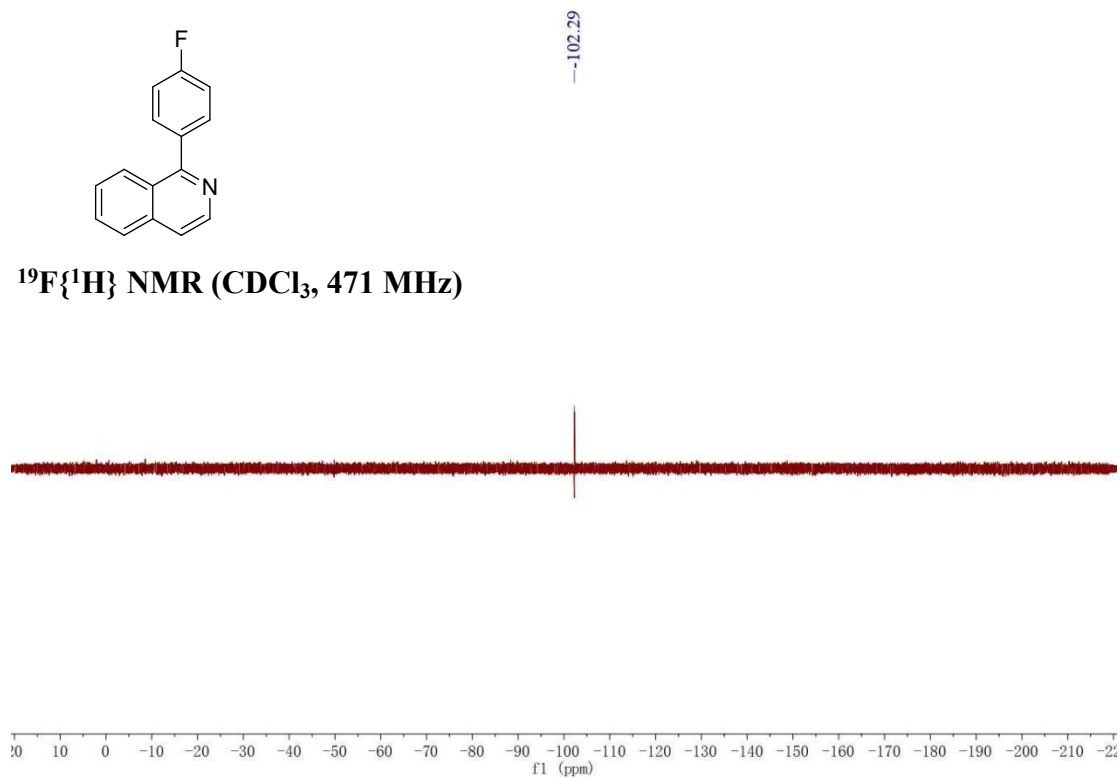
^1H NMR (CDCl_3 , 500 MHz)



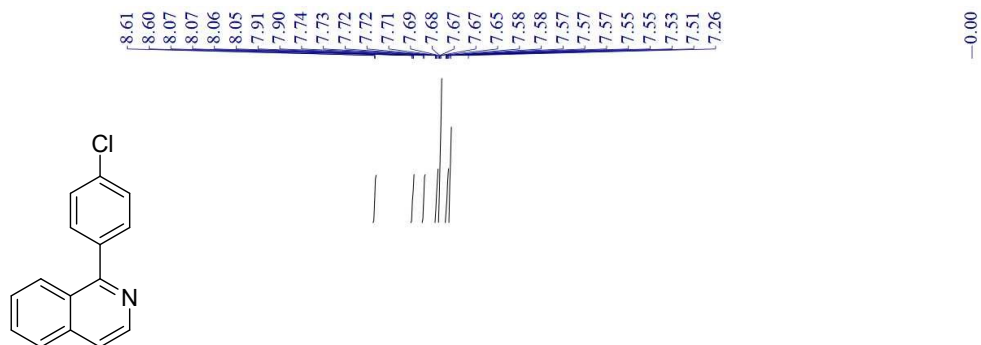
$^{13}\text{C}\{^1\text{H}\}$ NMR Spectrum of Compound b4



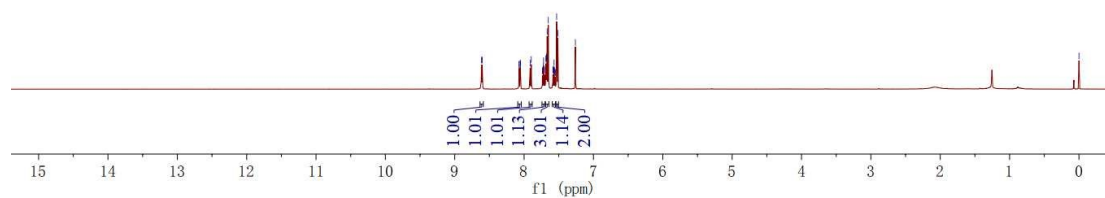
$^{19}\text{F}\{^1\text{H}\}$ NMR Spectrum of Compound b4



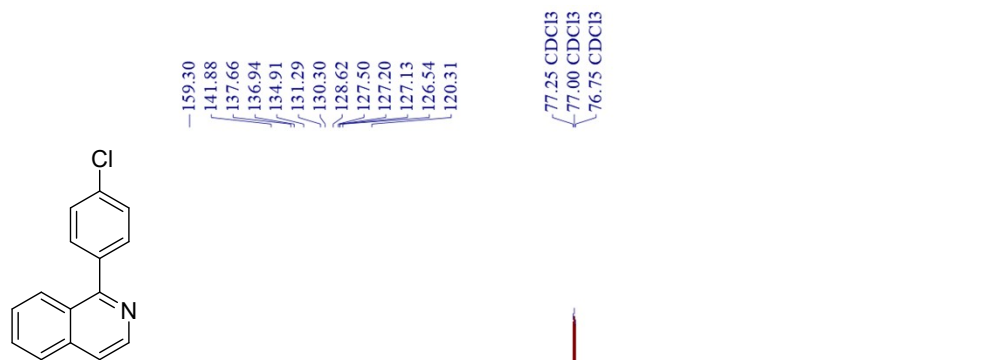
^1H NMR Spectrum of Compound b5



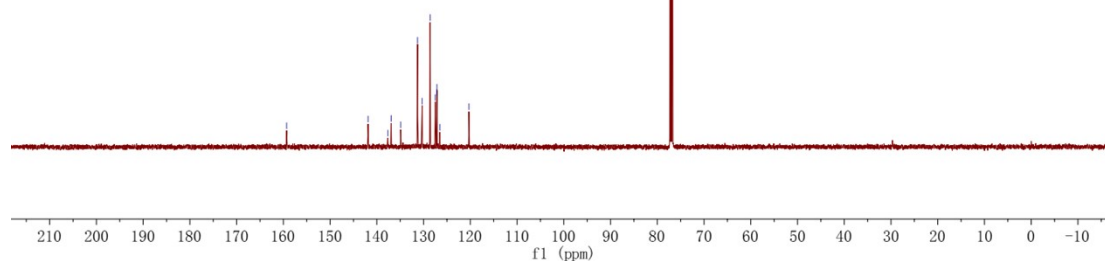
^1H NMR (CDCl_3 , 500 MHz)



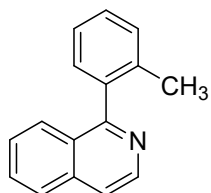
$^{13}\text{C}\{^1\text{H}\}$ NMR Spectrum of Compound b5



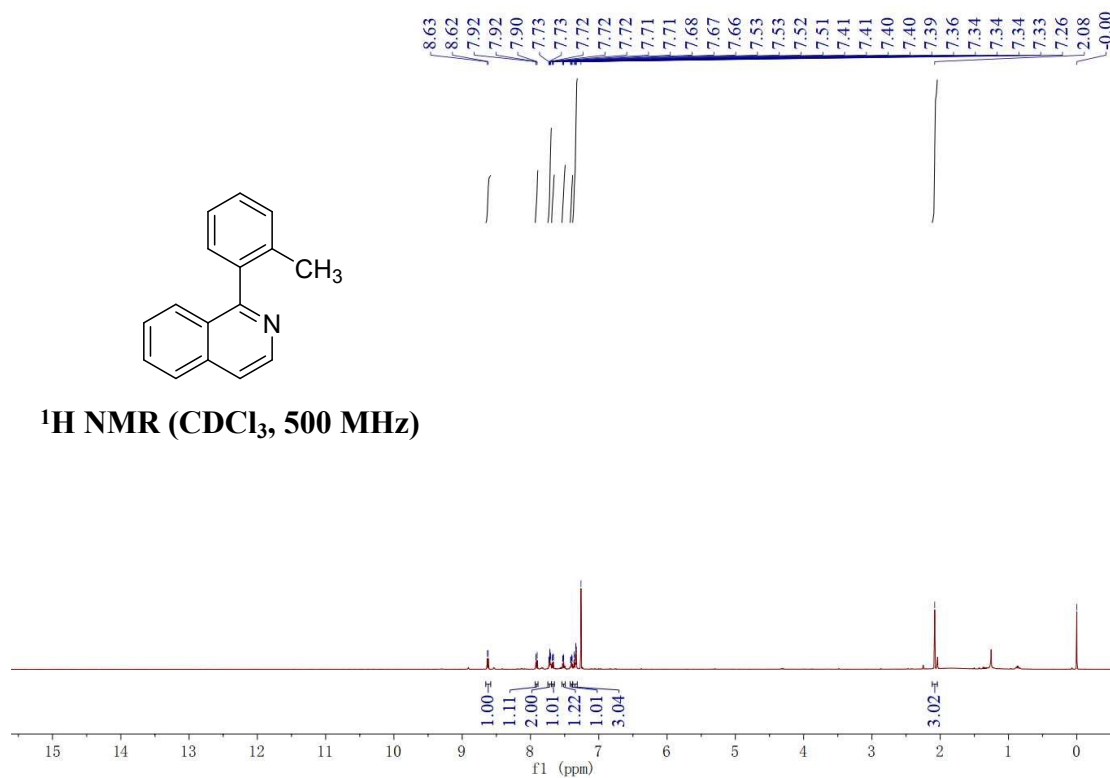
$^{13}\text{C}\{^1\text{H}\}$ NMR (CDCl_3 , 126 MHz)



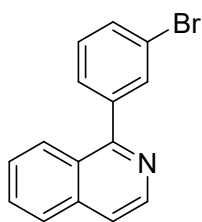
¹H NMR Spectrum of Compound b6



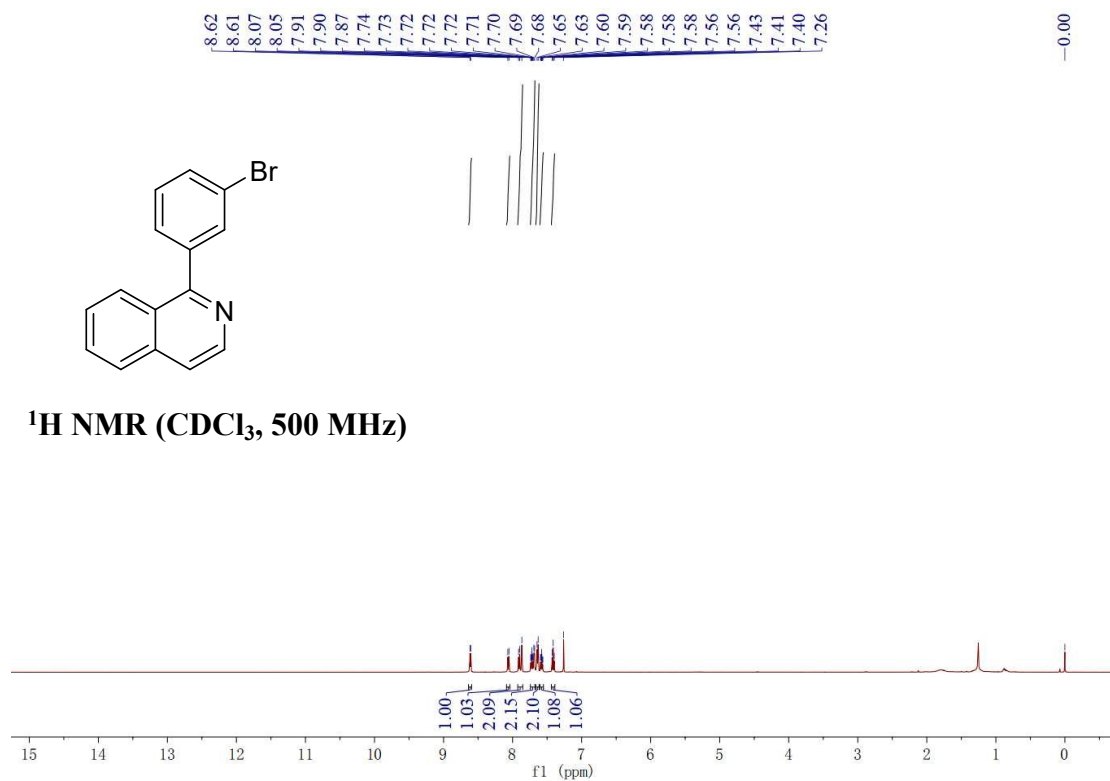
¹H NMR (CDCl₃, 500 MHz)



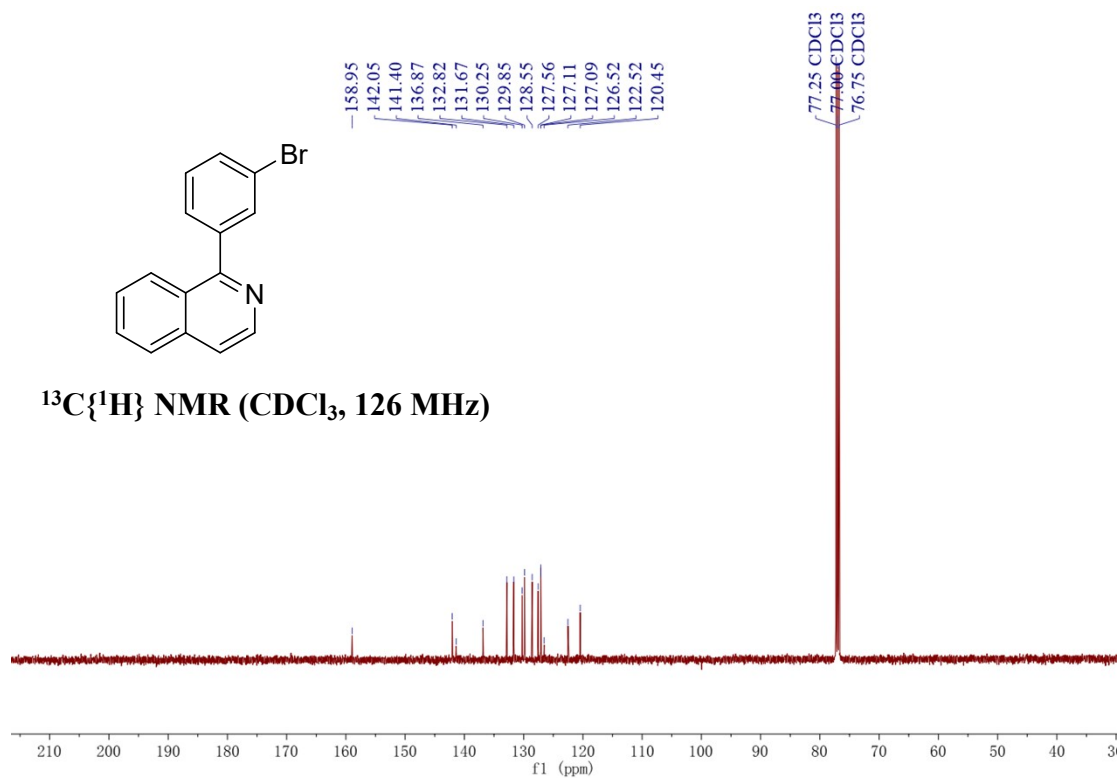
¹H NMR Spectrum of Compound b7



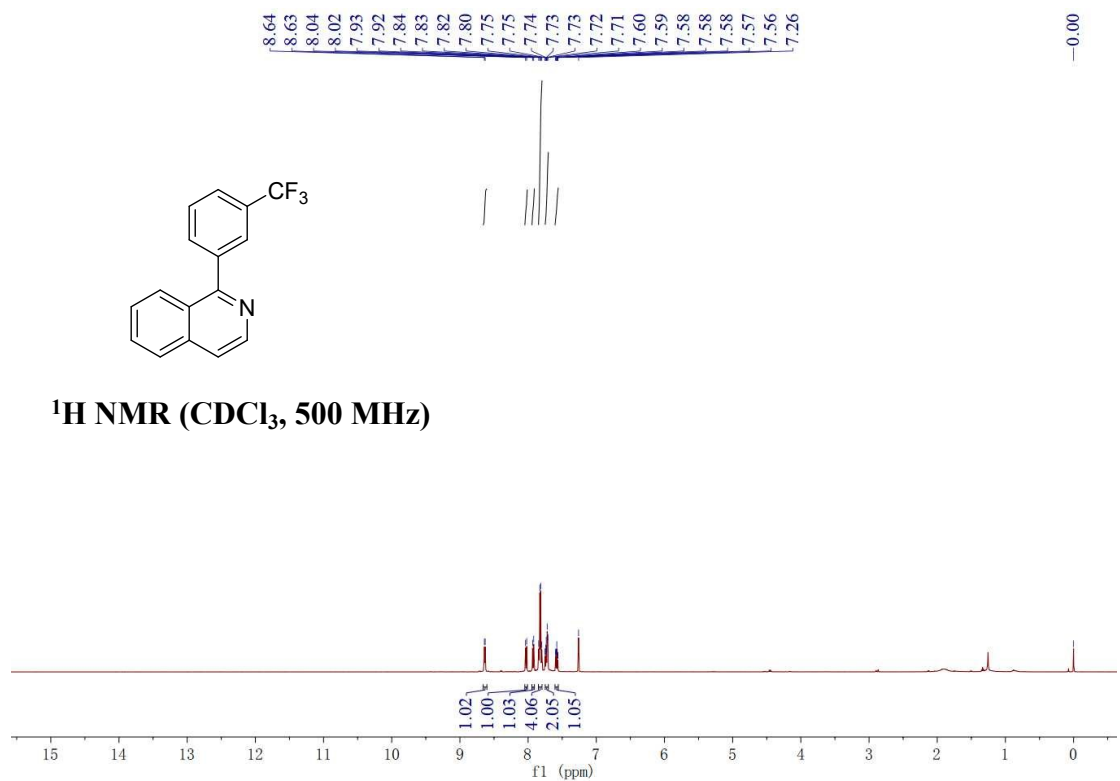
¹H NMR (CDCl₃, 500 MHz)



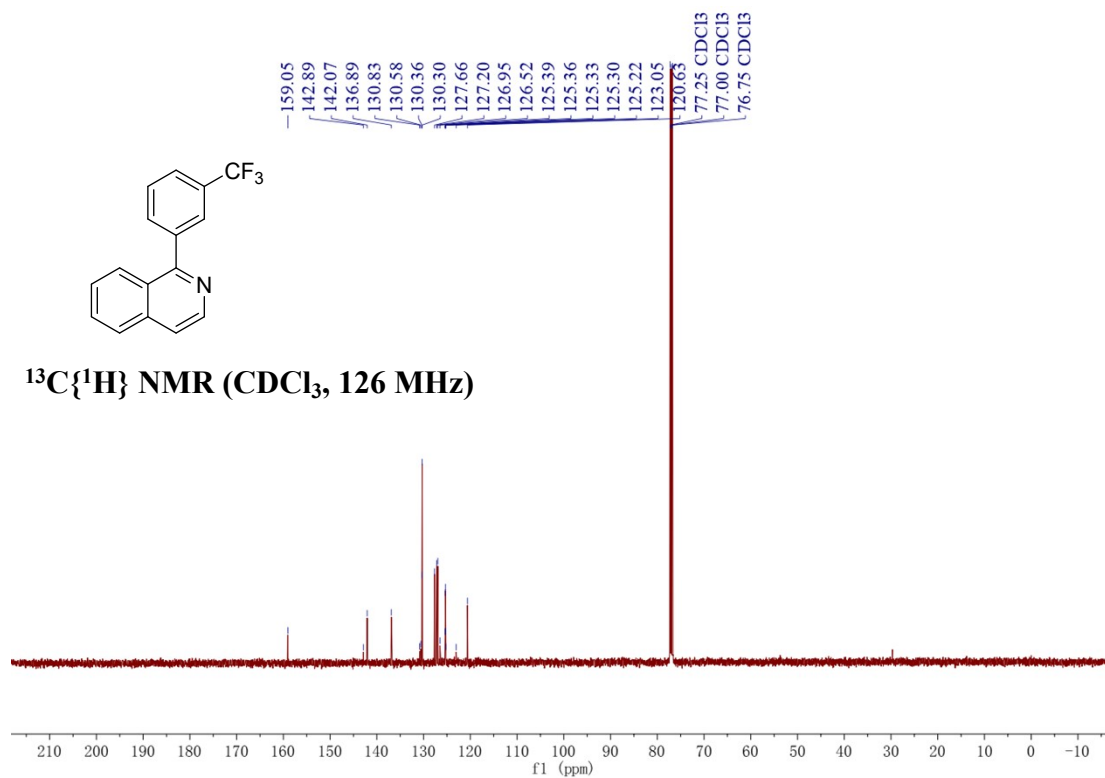
$^{13}\text{C}\{^1\text{H}\}$ NMR Spectrum of Compound b7



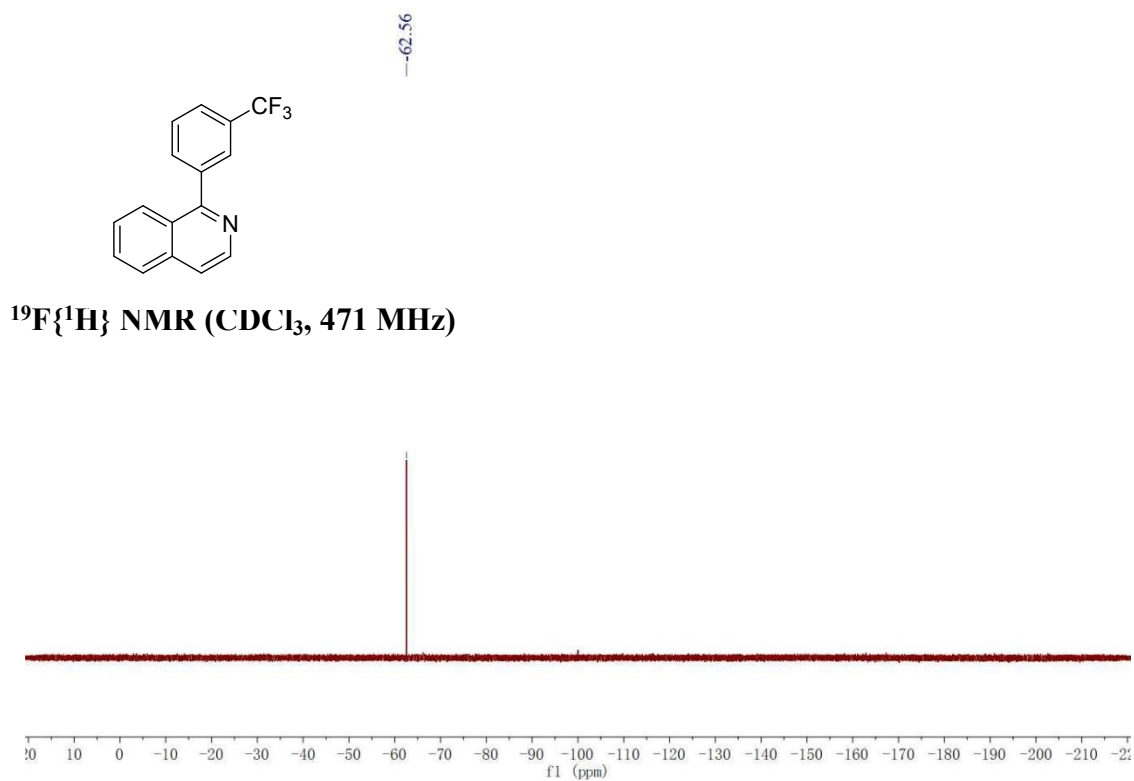
^1H NMR Spectrum of Compound b8



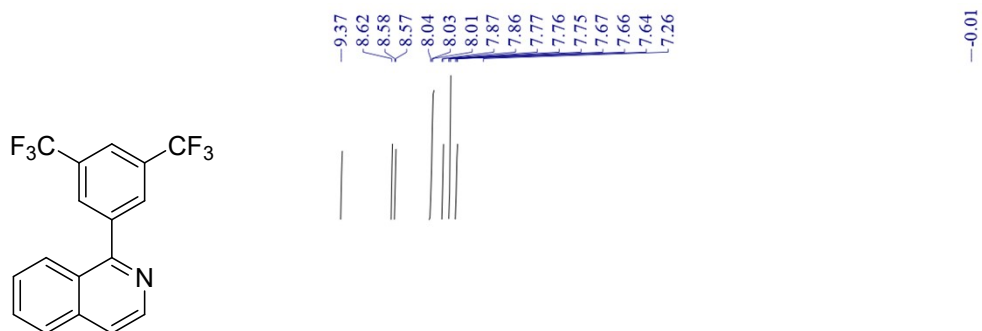
$^{13}\text{C}\{^1\text{H}\}$ NMR Spectrum of Compound b8



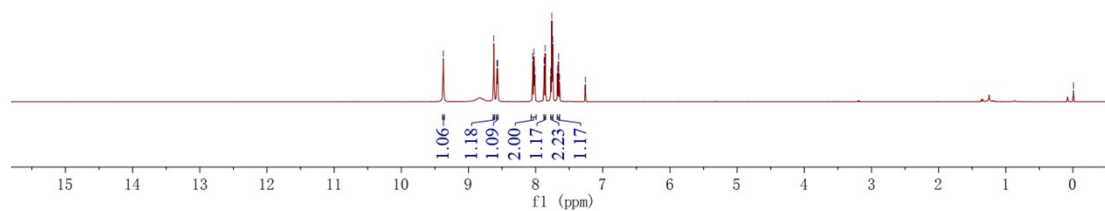
$^{19}\text{F}\{^1\text{H}\}$ NMR Spectrum of Compound b8



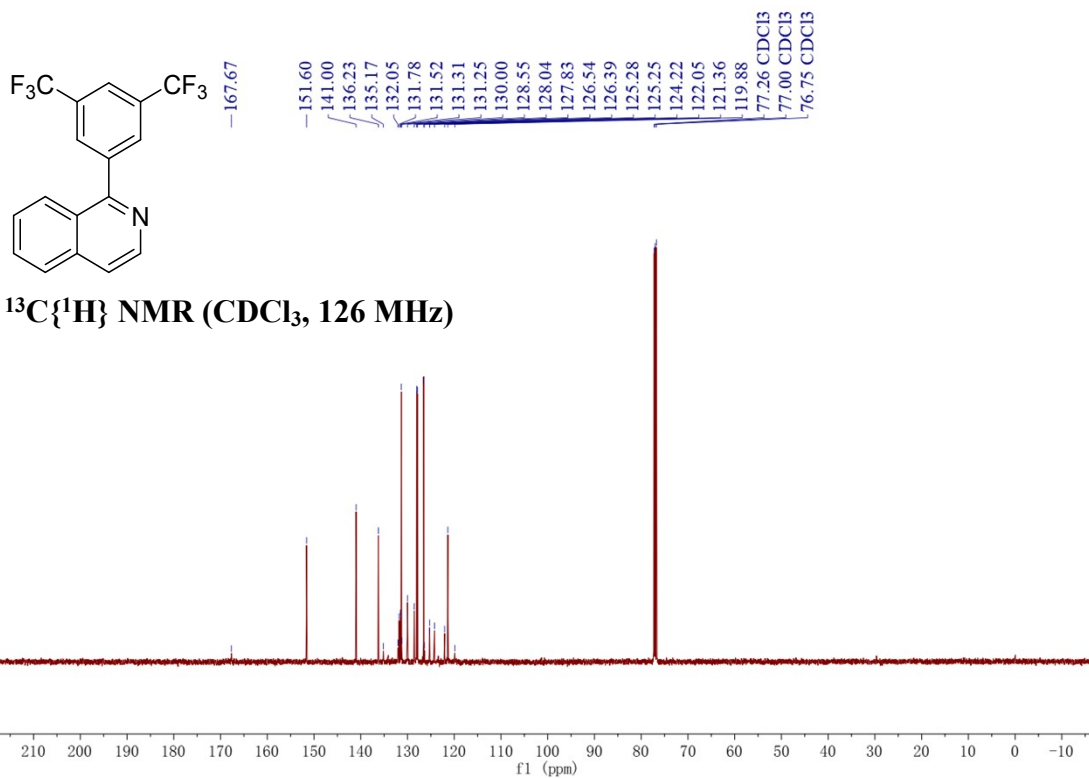
¹H NMR Spectrum of Compound b9



¹H NMR (CDCl₃, 500 MHz)

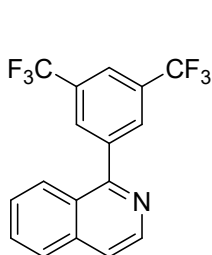


¹³C{¹H} NMR Spectrum of Compound b9



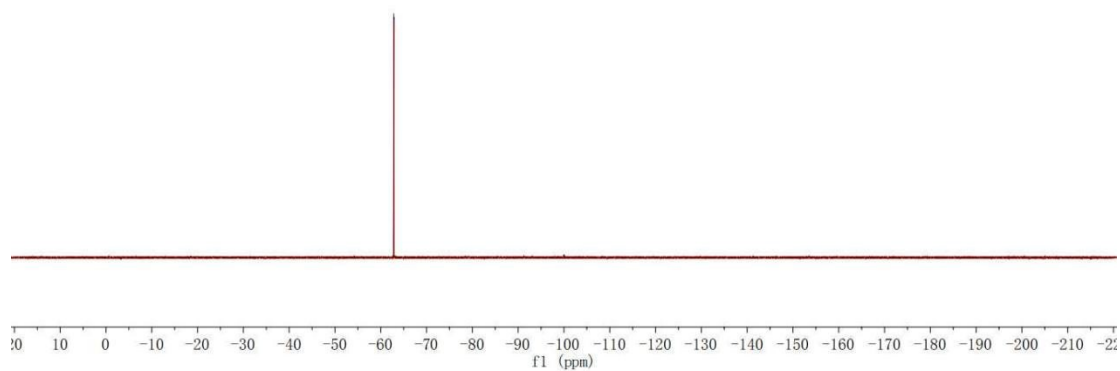
¹³C{¹H} NMR (CDCl₃, 126 MHz)

$^{19}\text{F}\{^1\text{H}\}$ NMR Spectrum of Compound b9

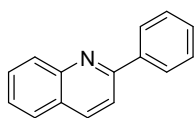


---62.86

$^{19}\text{F}\{^1\text{H}\}$ NMR (CDCl_3 , 471 MHz)



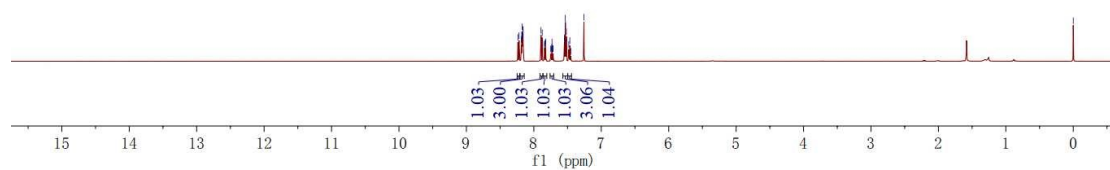
^1H NMR Spectrum of Compound c1



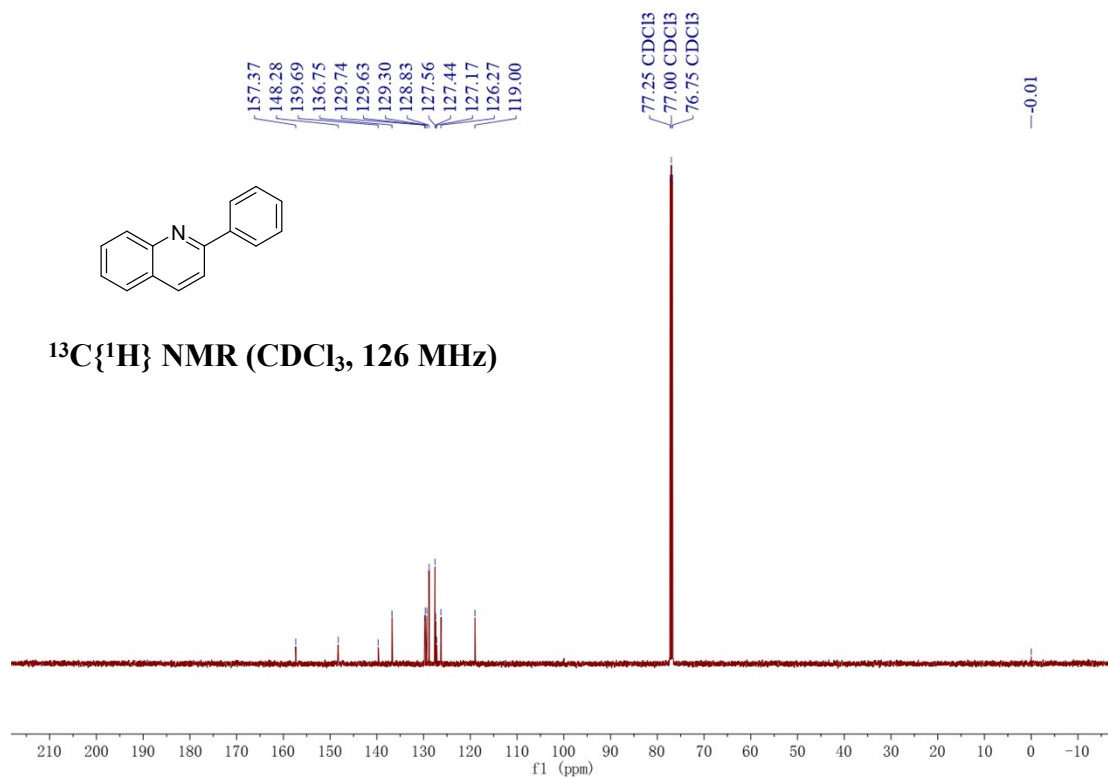
8.24, 8.22, 8.19, 8.18, 8.18, 8.17, 8.16, 8.16, 8.16, 7.89, 7.88, 7.84, 7.84, 7.83, 7.82, 7.75, 7.74, 7.73, 7.73, 7.72, 7.71, 7.55, 7.54, 7.53, 7.53, 7.52, 7.48, 7.47, 7.45, 7.26

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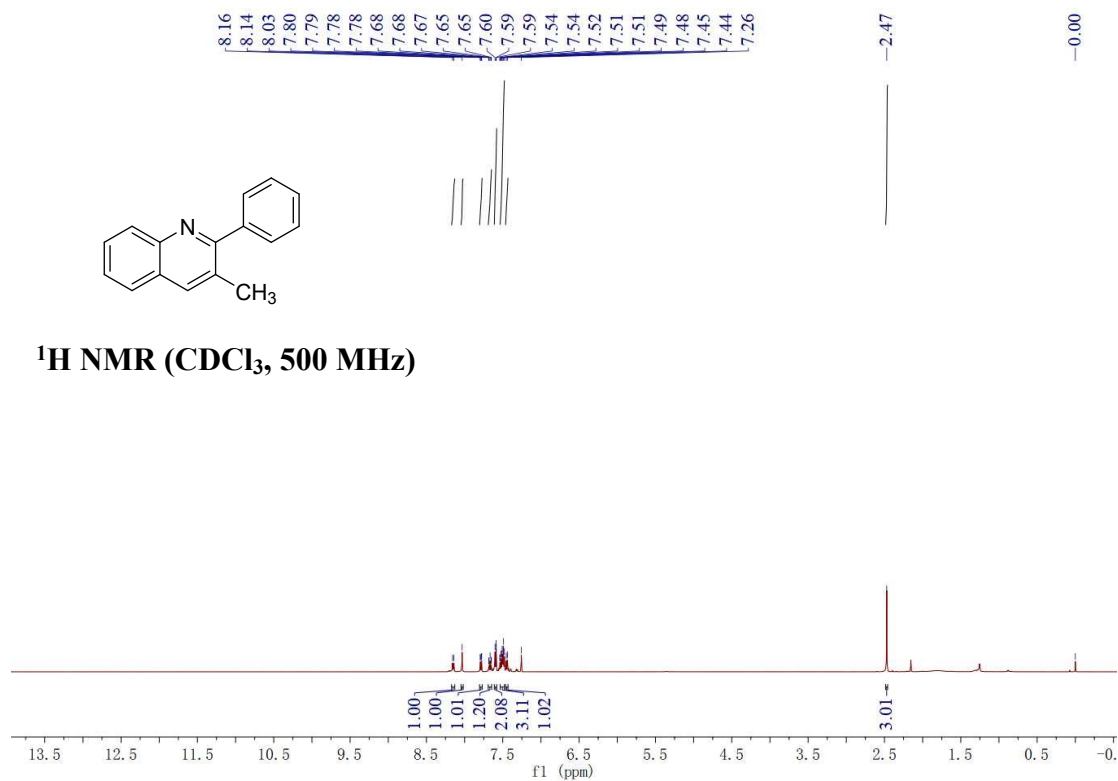
^1H NMR (CDCl_3 , 500 MHz)



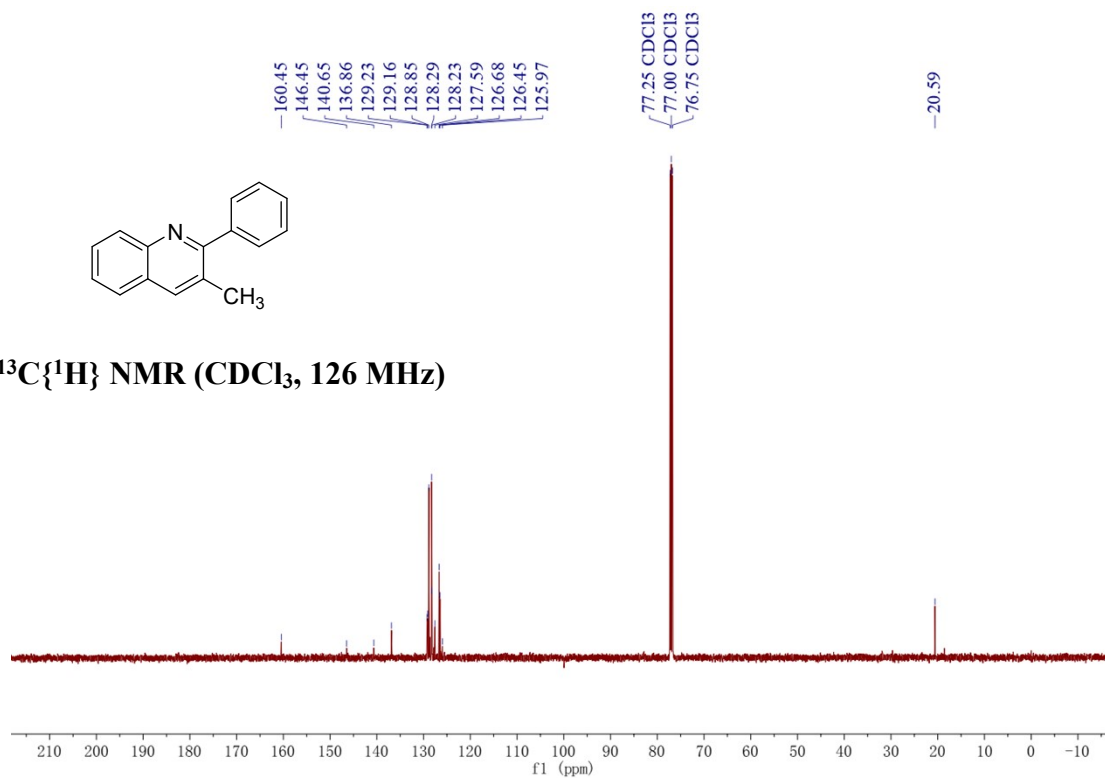
$^{13}\text{C}\{^1\text{H}\}$ NMR Spectrum of Compound c1



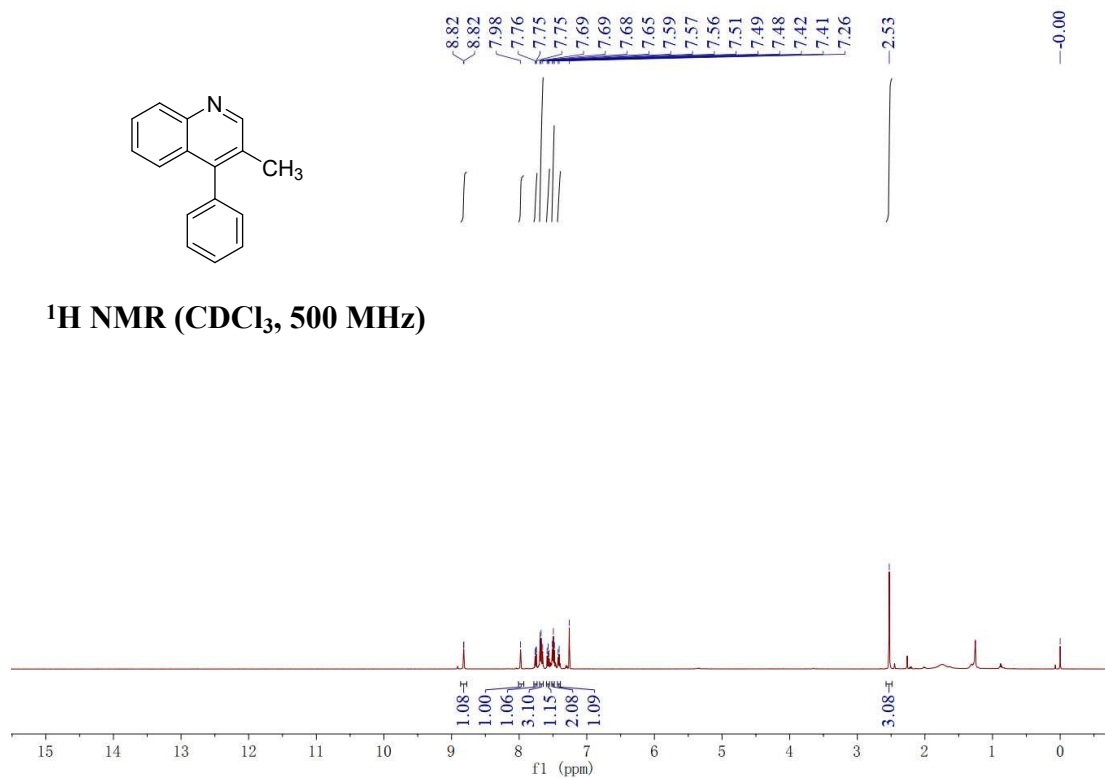
^1H NMR Spectrum of Compound c2-1



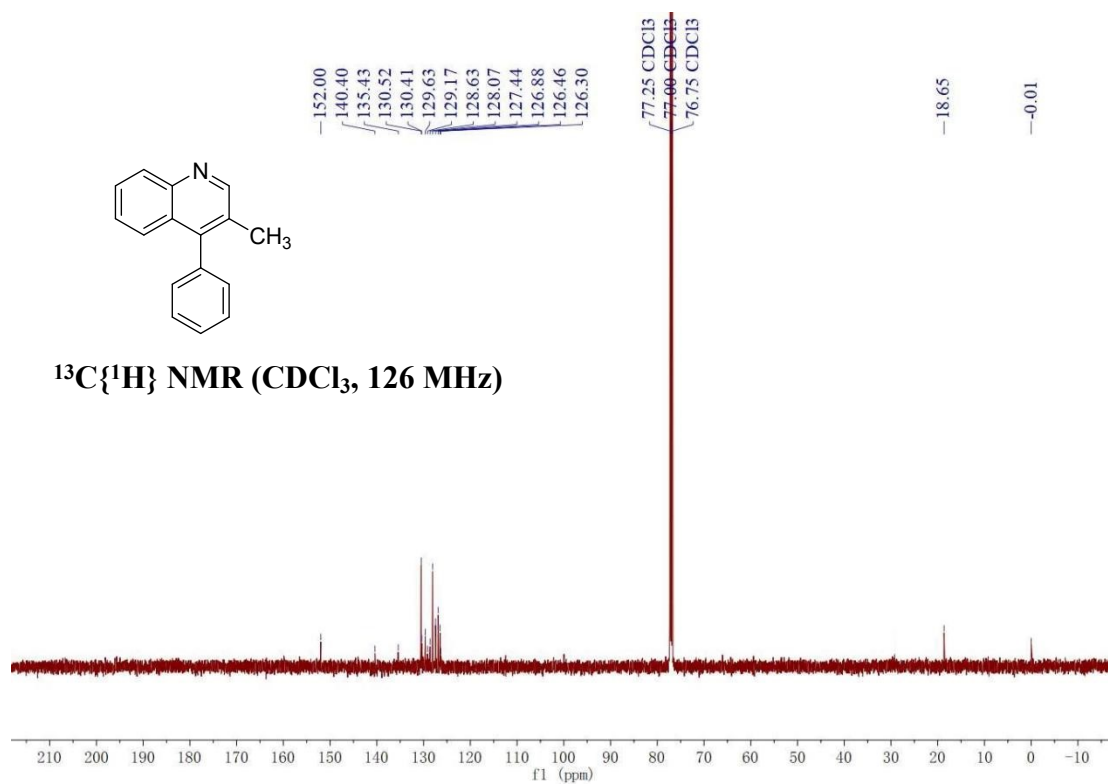
$^{13}\text{C}\{^1\text{H}\}$ NMR Spectrum of Compound c2-1



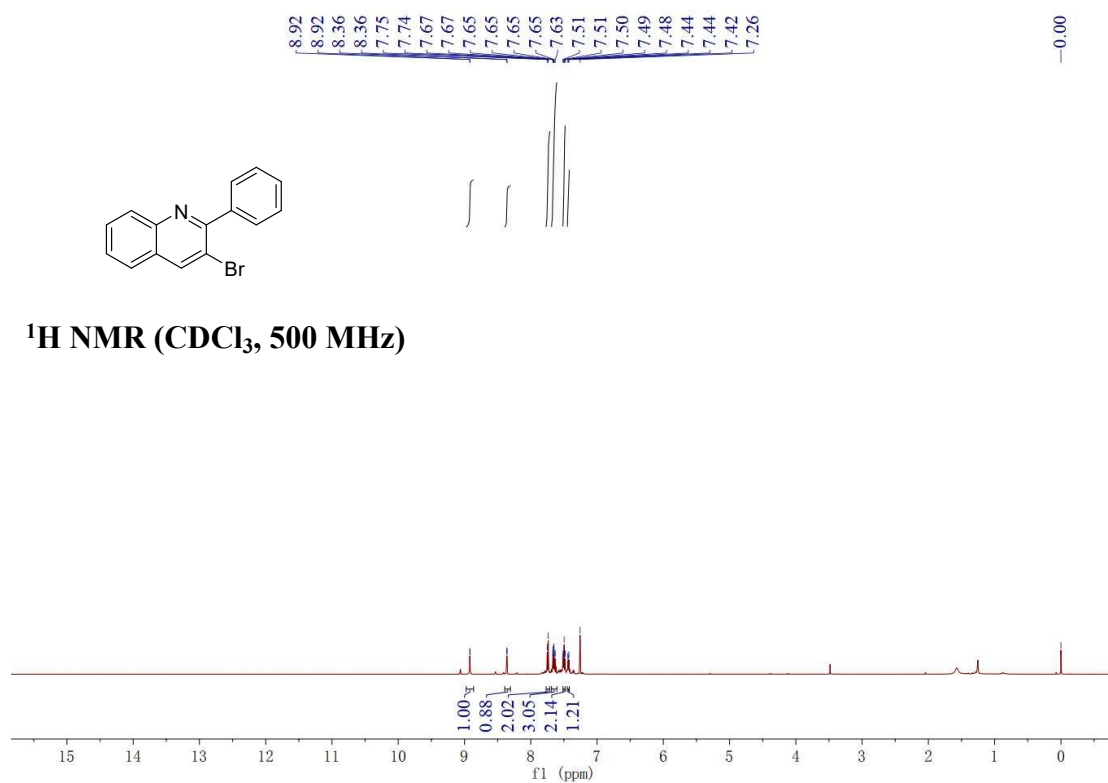
^1H NMR Spectrum of Compound c2-2



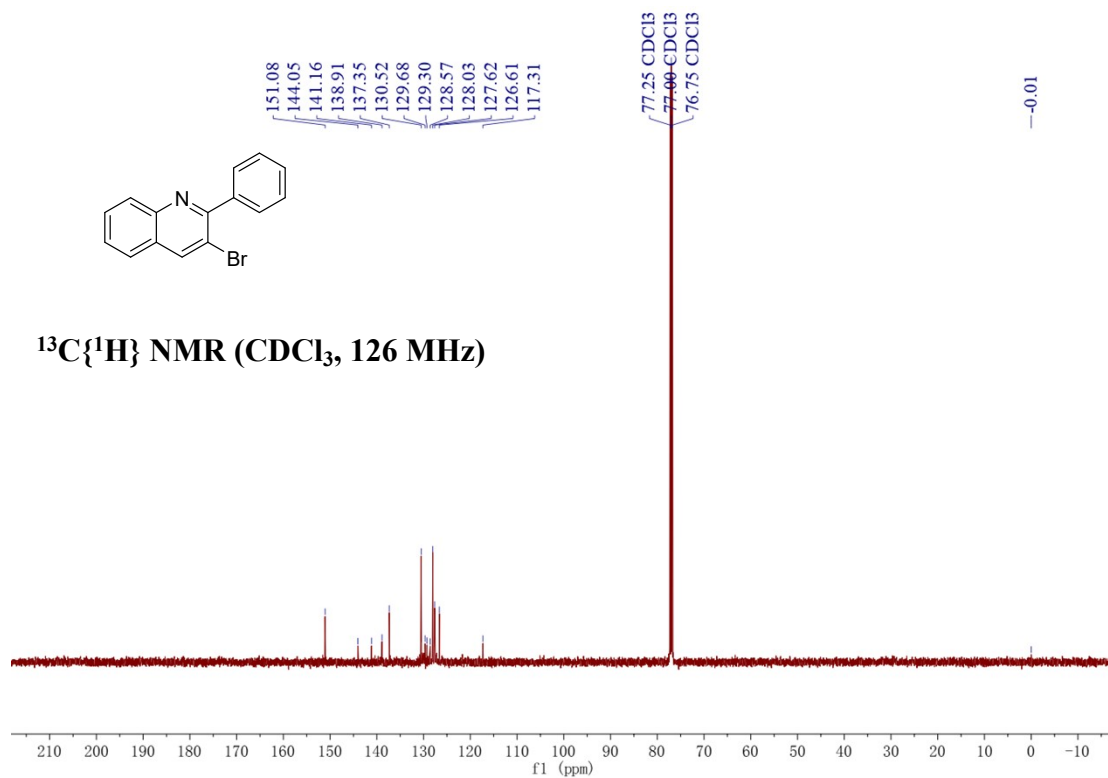
$^{13}\text{C}\{^1\text{H}\}$ NMR Spectrum of Compound c2-2



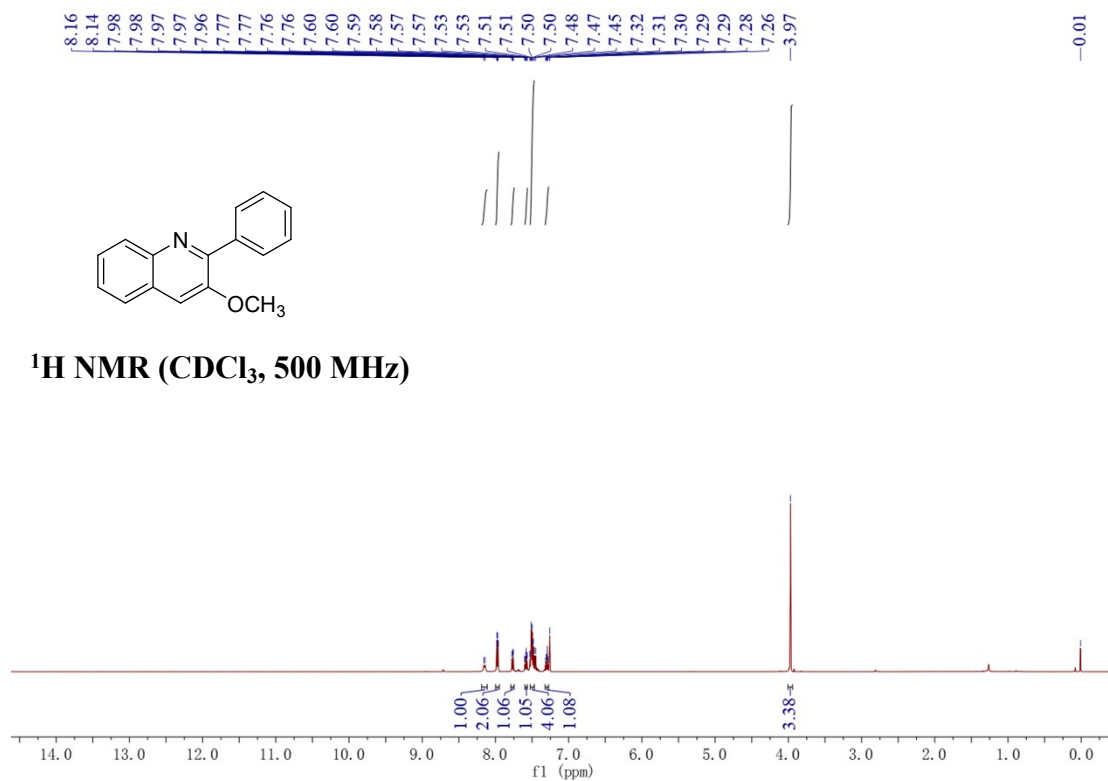
^1H NMR Spectrum of Compound c3



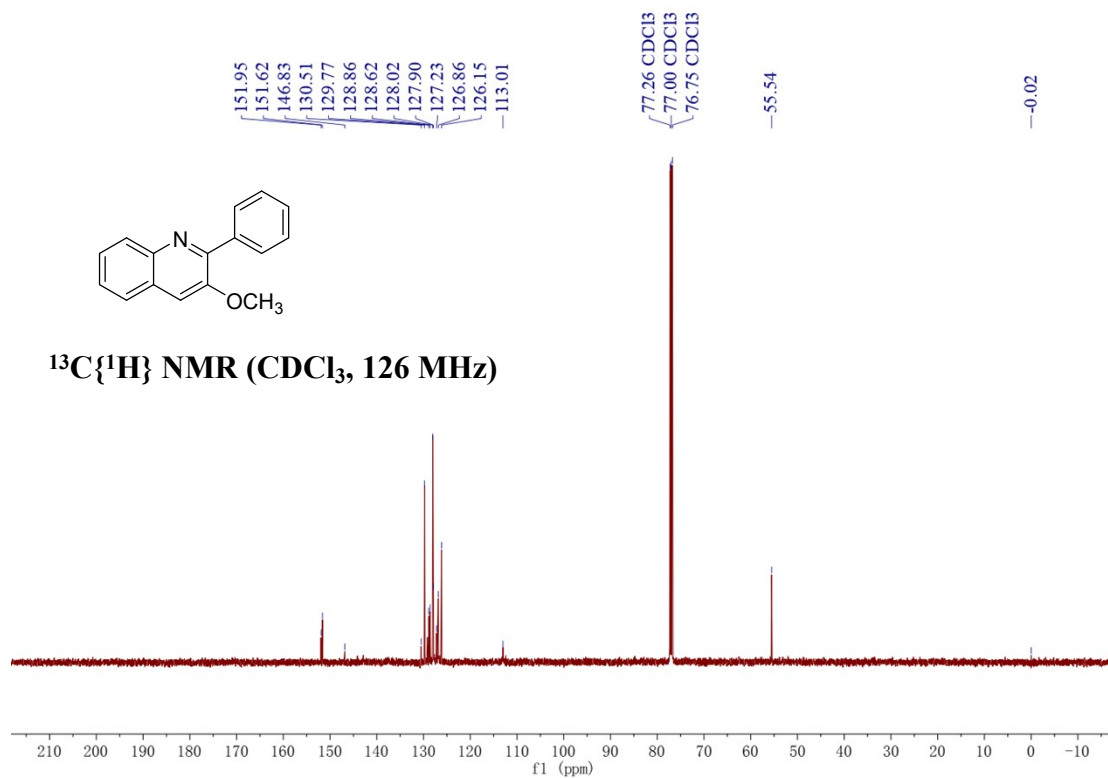
$^{13}\text{C}\{^1\text{H}\}$ NMR Spectrum of Compound c3



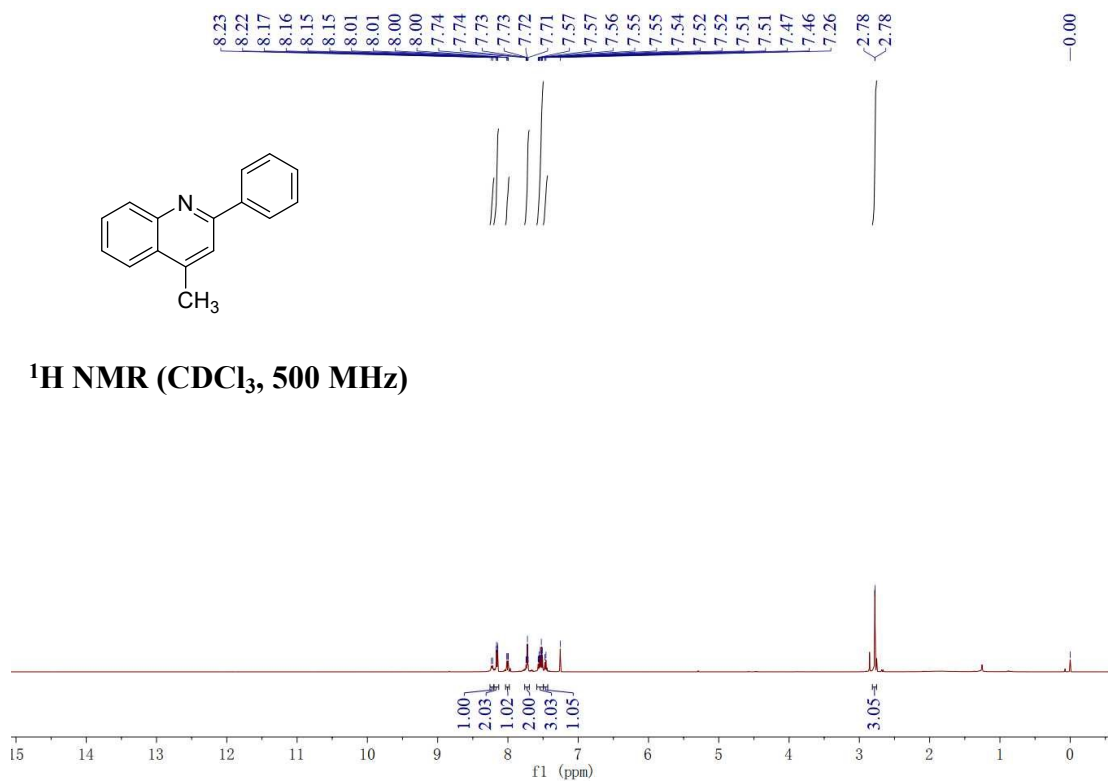
^1H NMR Spectrum of Compound c4



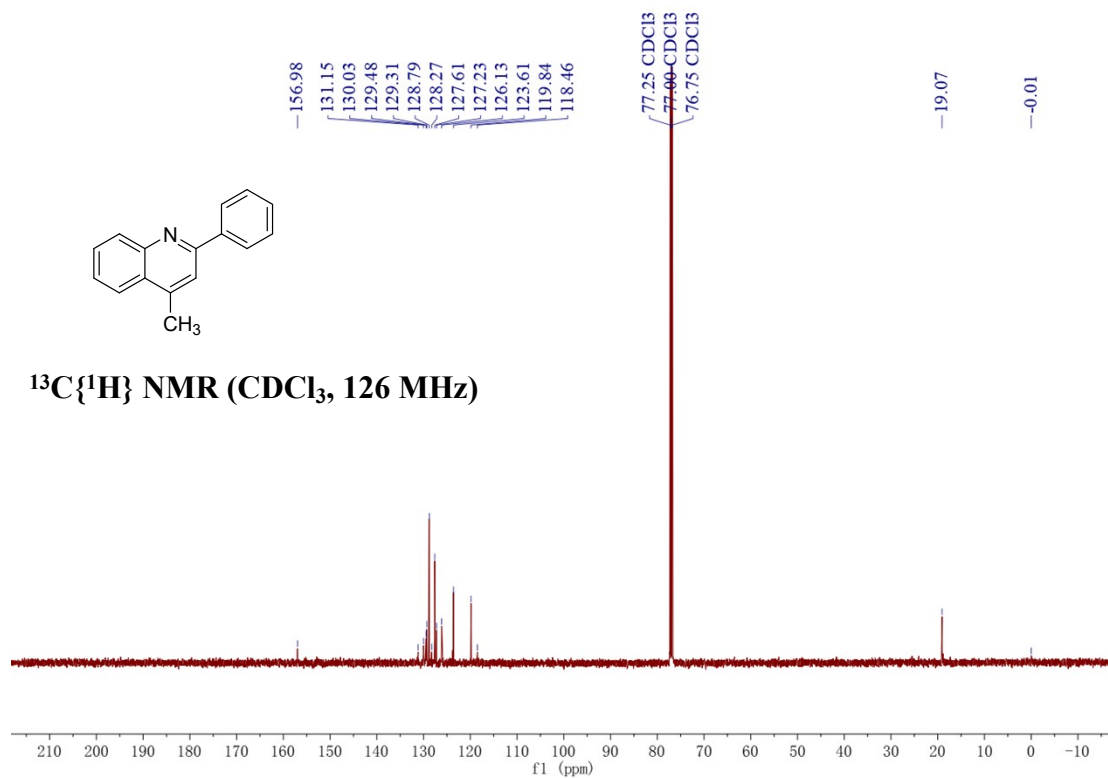
$^{13}\text{C}\{^1\text{H}\}$ NMR Spectrum of Compound c4



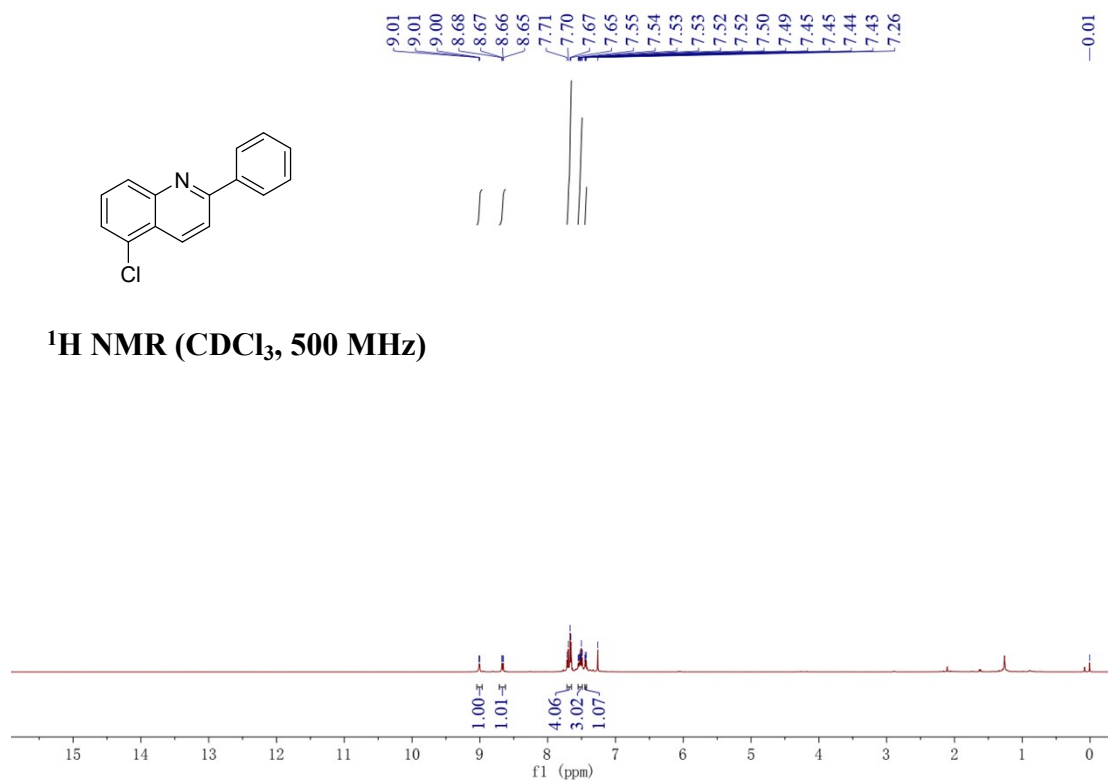
^1H NMR Spectrum of Compound c5



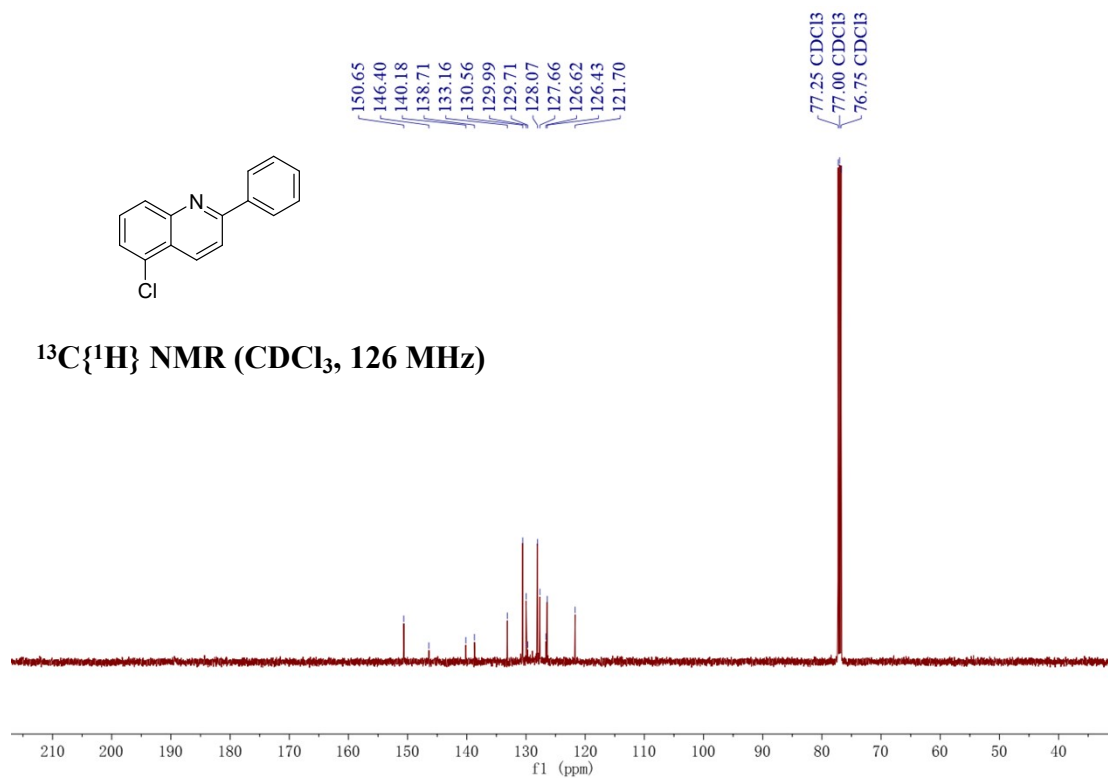
$^{13}\text{C}\{^1\text{H}\}$ NMR Spectrum of Compound c5



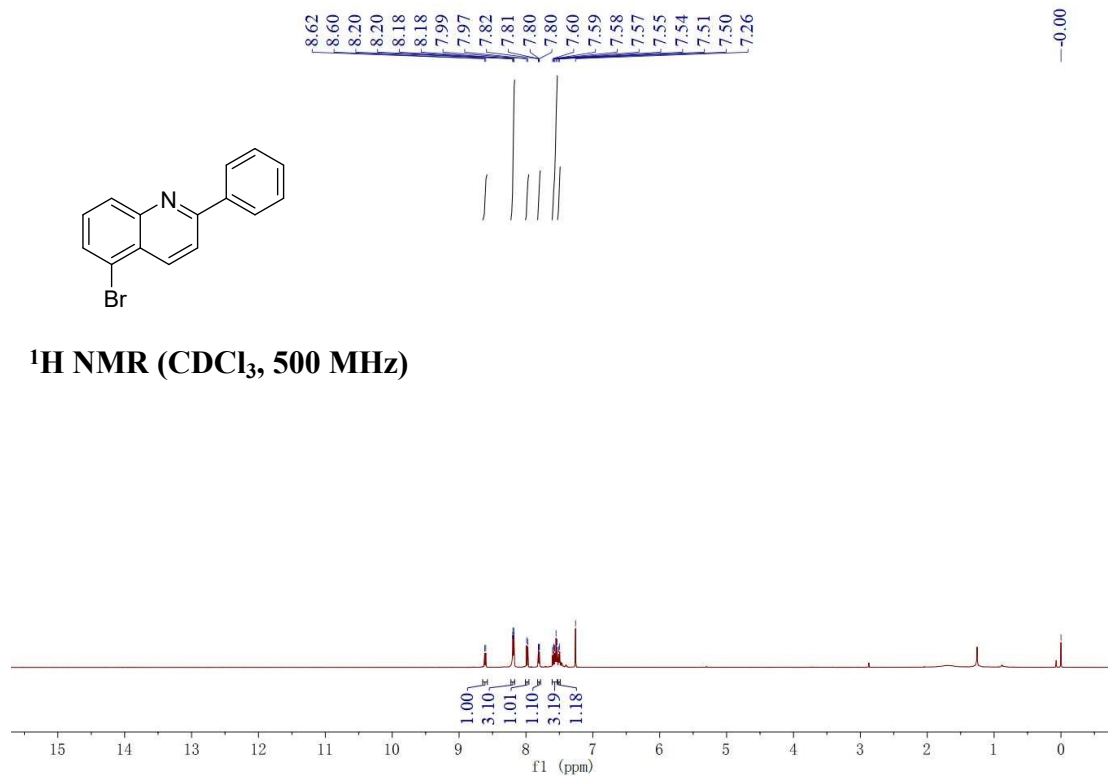
^1H NMR Spectrum of Compound c6



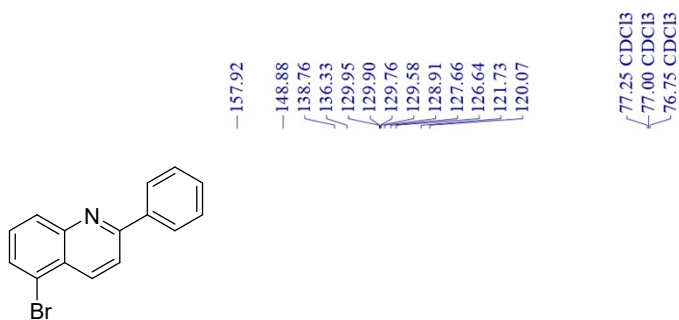
$^{13}\text{C}\{^1\text{H}\}$ NMR Spectrum of Compound c6



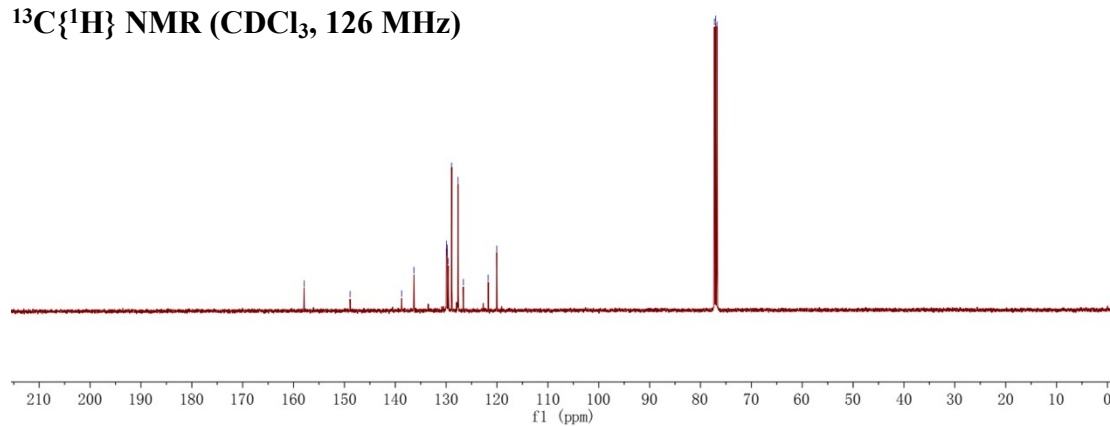
^1H NMR Spectrum of Compound c7



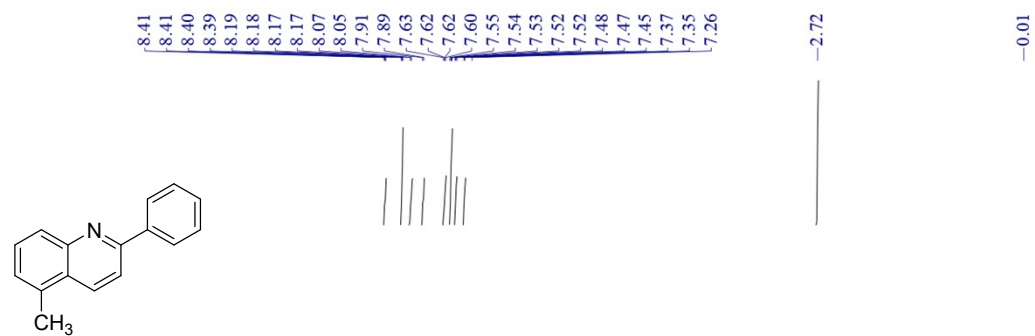
$^{13}\text{C}\{^1\text{H}\}$ NMR Spectrum of Compound c7



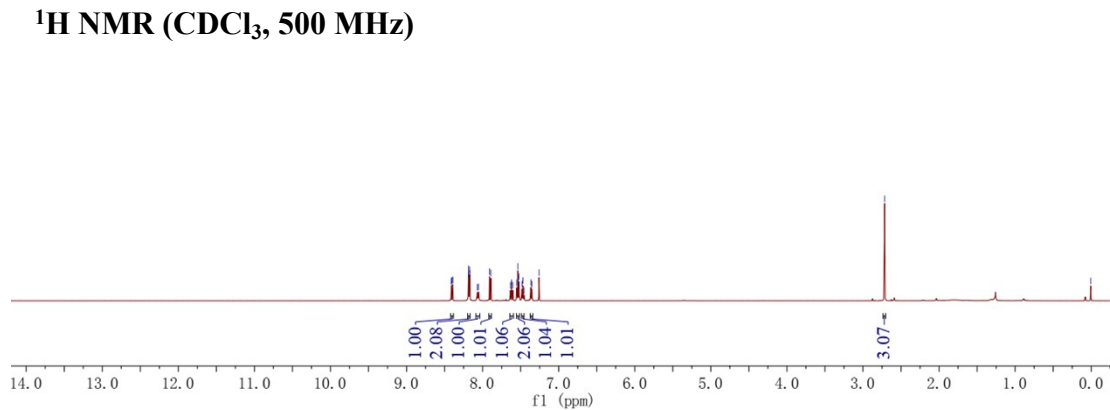
$^{13}\text{C}\{^1\text{H}\}$ NMR (CDCl₃, 126 MHz)



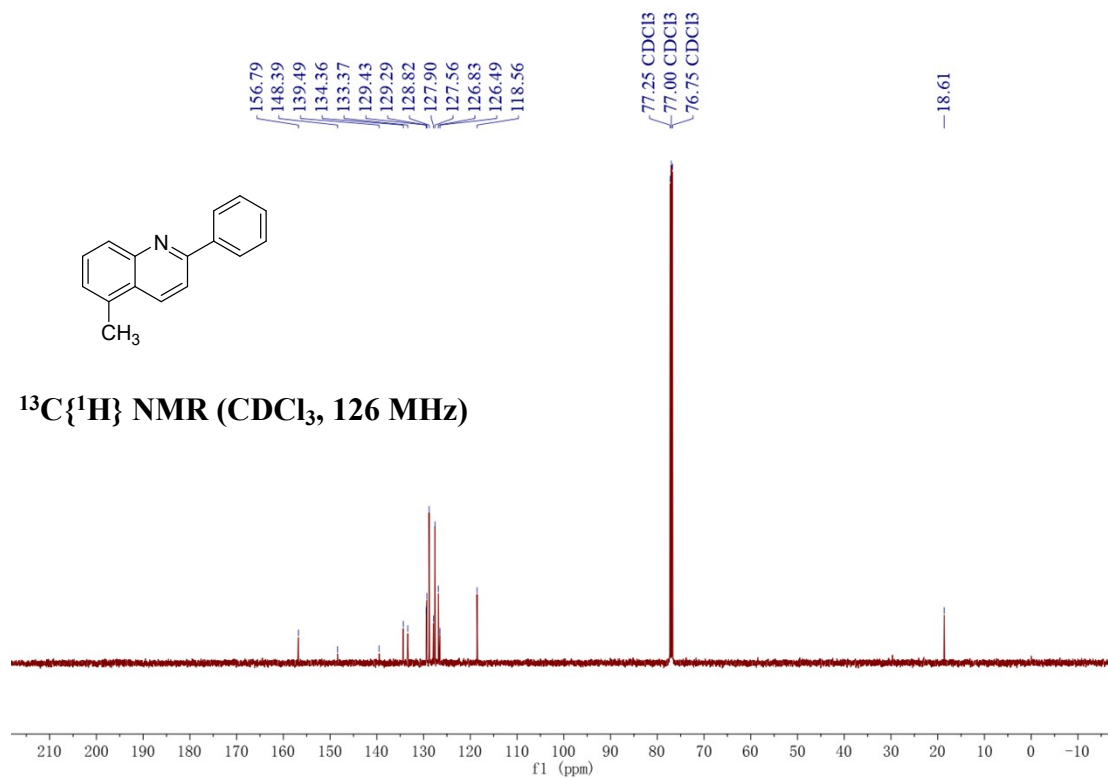
^1H NMR Spectrum of Compound c8-1



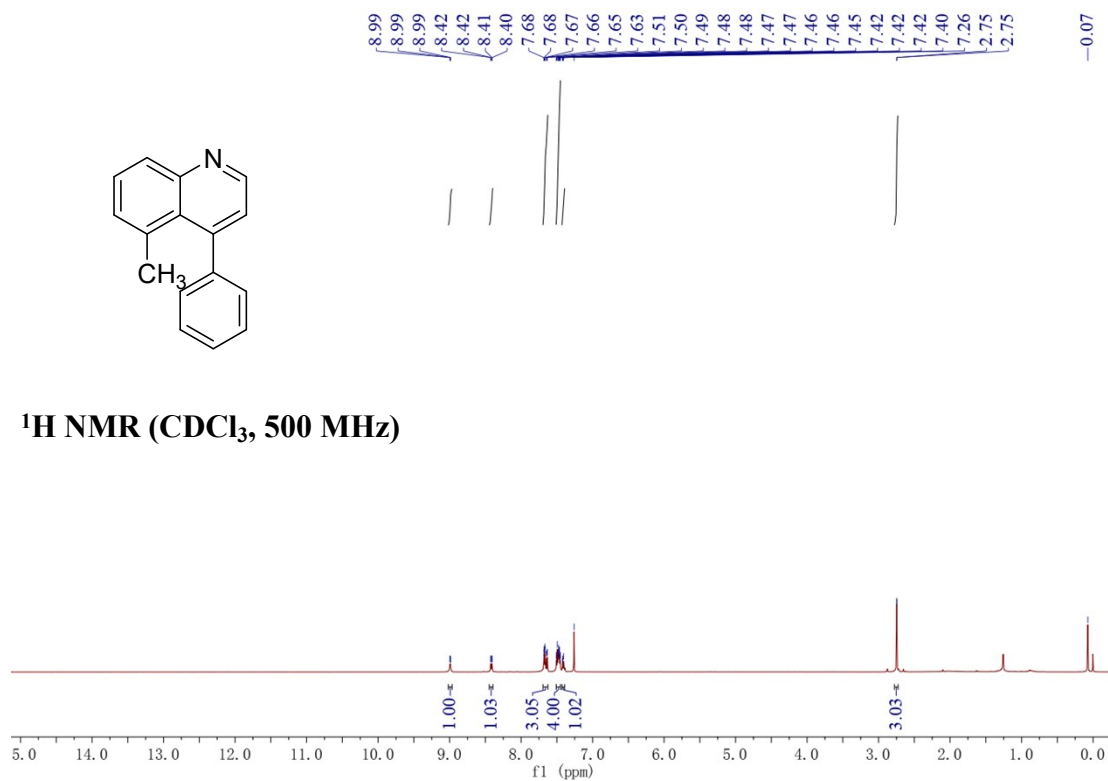
^1H NMR (CDCl₃, 500 MHz)



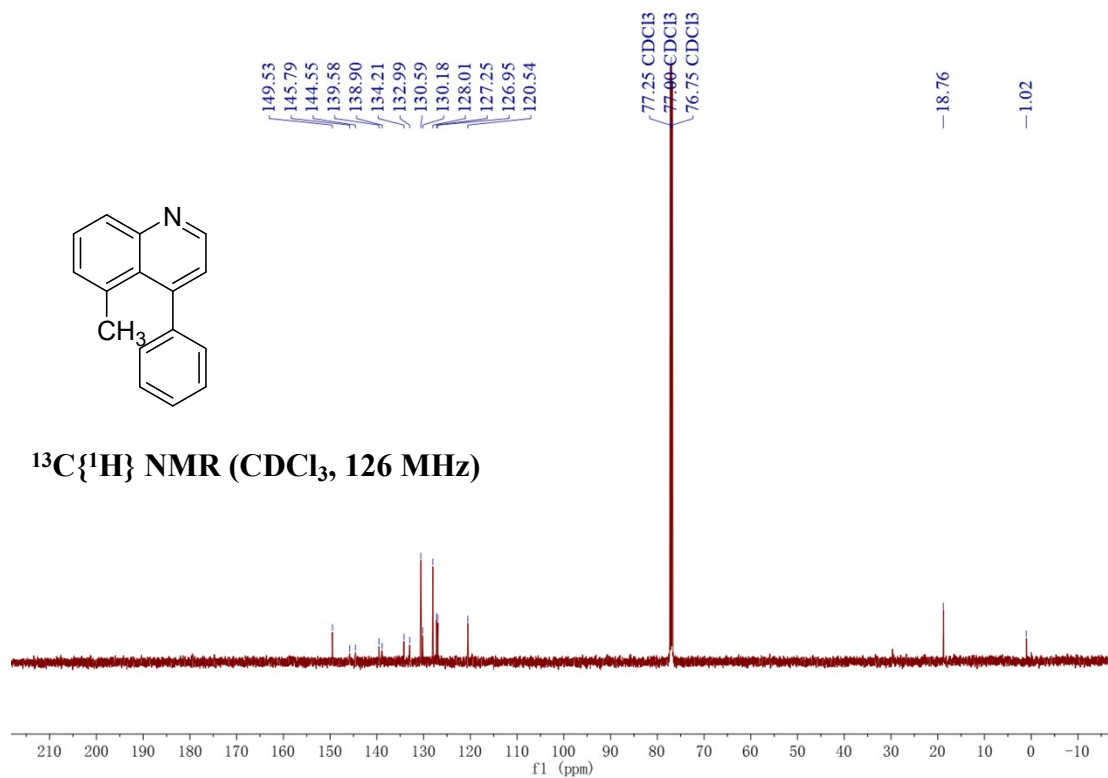
$^{13}\text{C}\{^1\text{H}\}$ NMR Spectrum of Compound c8-1



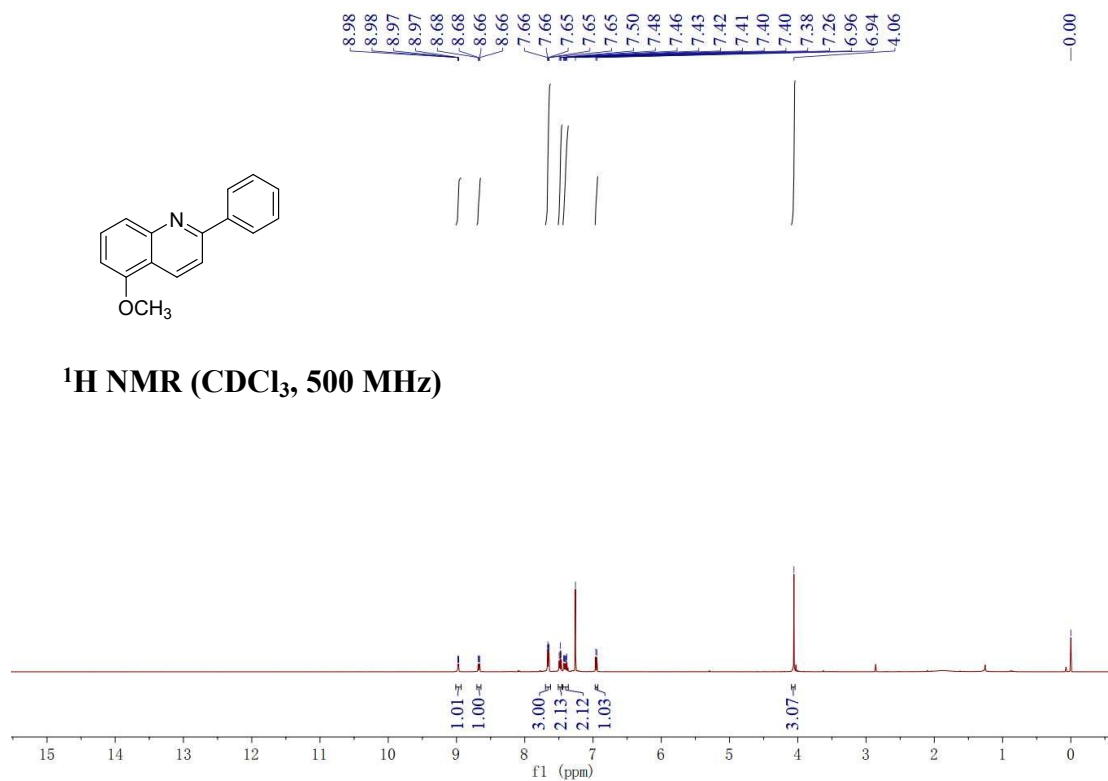
^1H NMR Spectrum of Compound c8-2



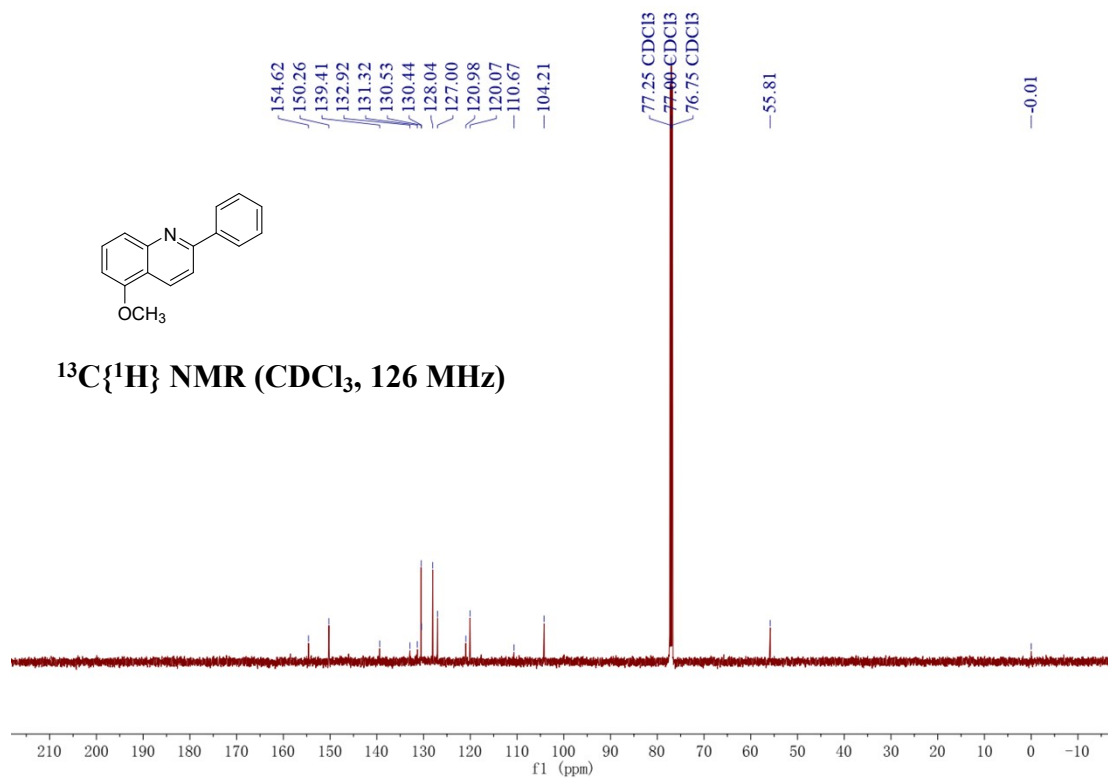
$^{13}\text{C}\{^1\text{H}\}$ NMR Spectrum of Compound c8-2



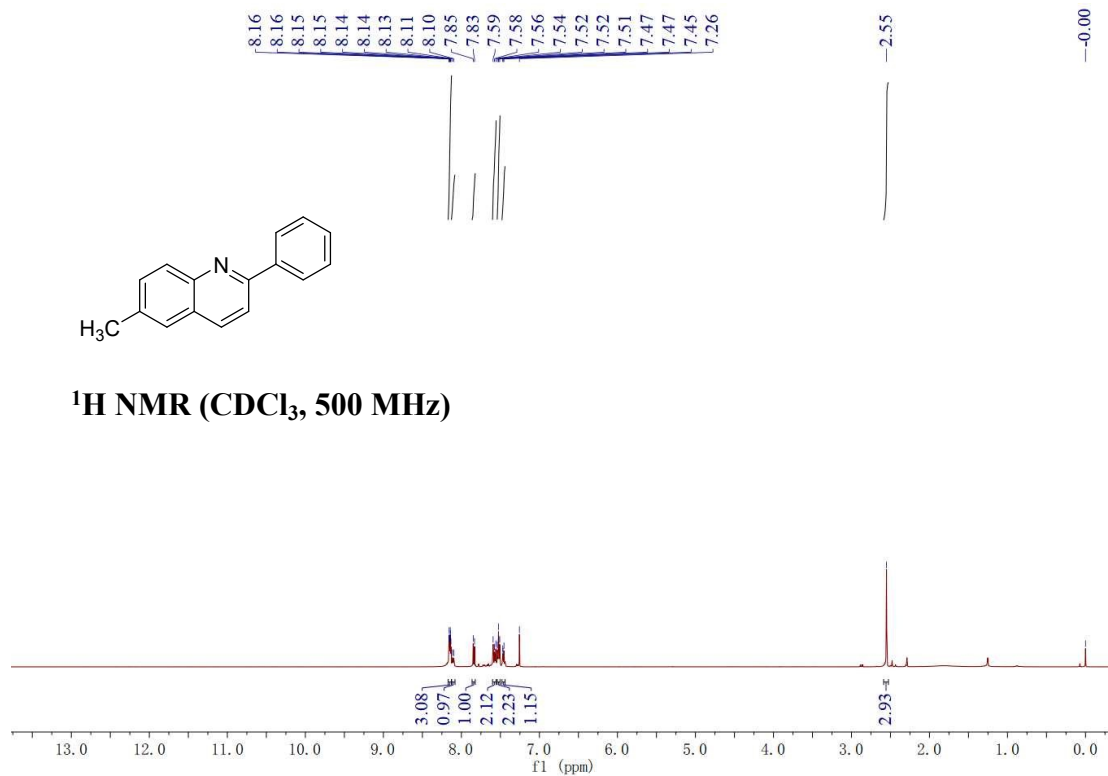
^1H NMR Spectrum of Compound c9



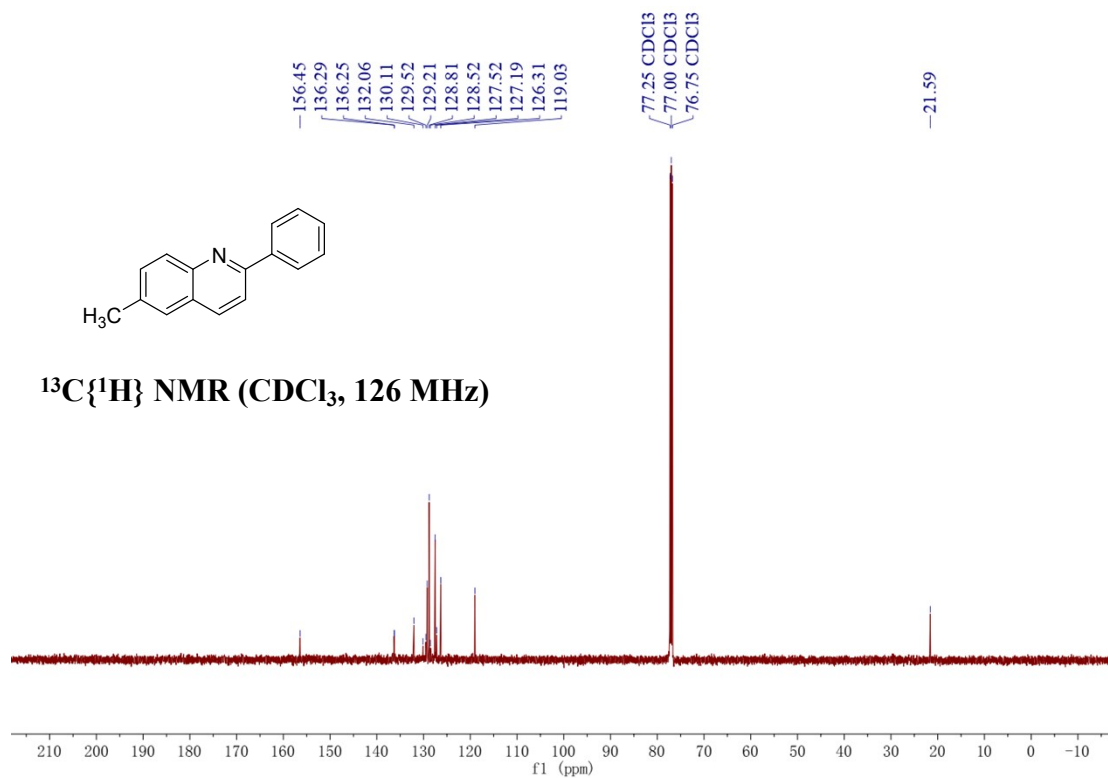
$^{13}\text{C}\{^1\text{H}\}$ NMR Spectrum of Compound c9



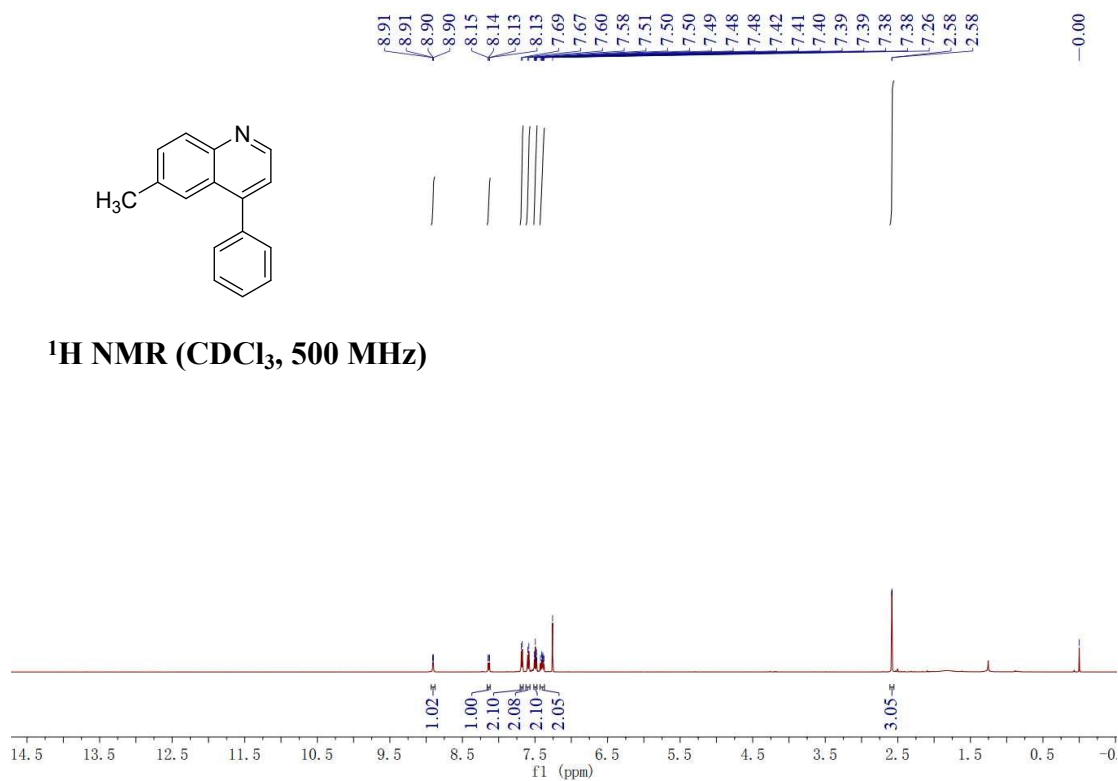
^1H NMR Spectrum of Compound c10-1



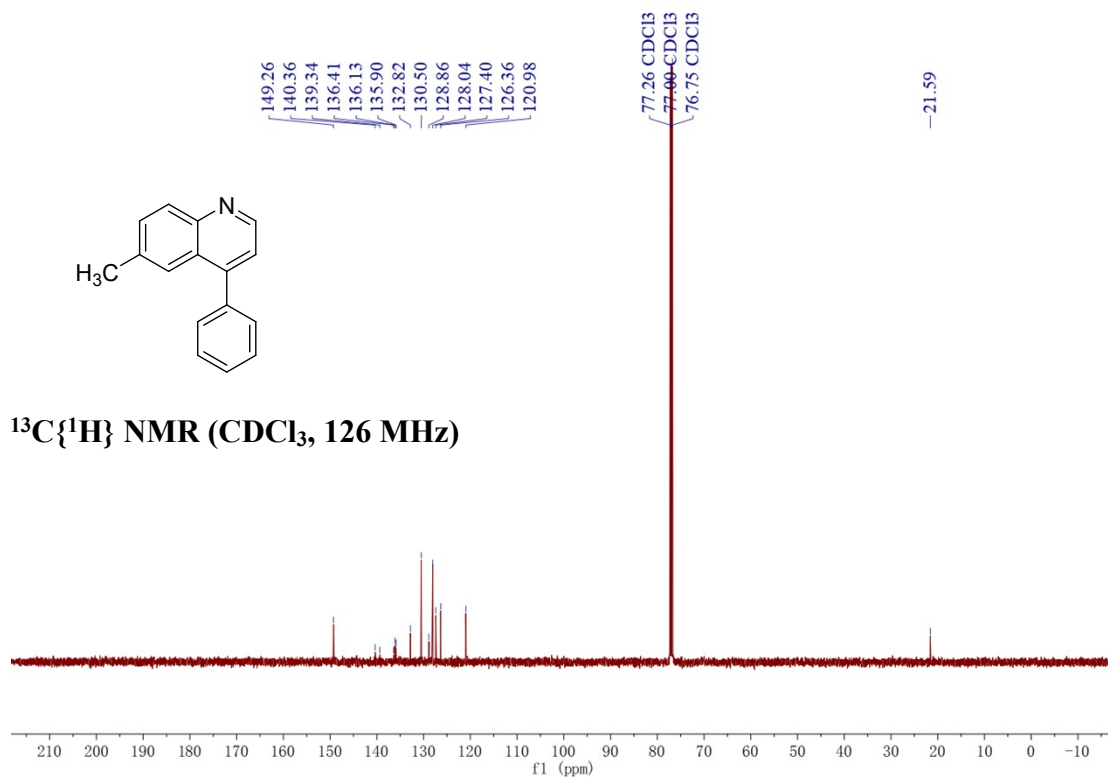
$^{13}\text{C}\{^1\text{H}\}$ NMR Spectrum of Compound c10-1



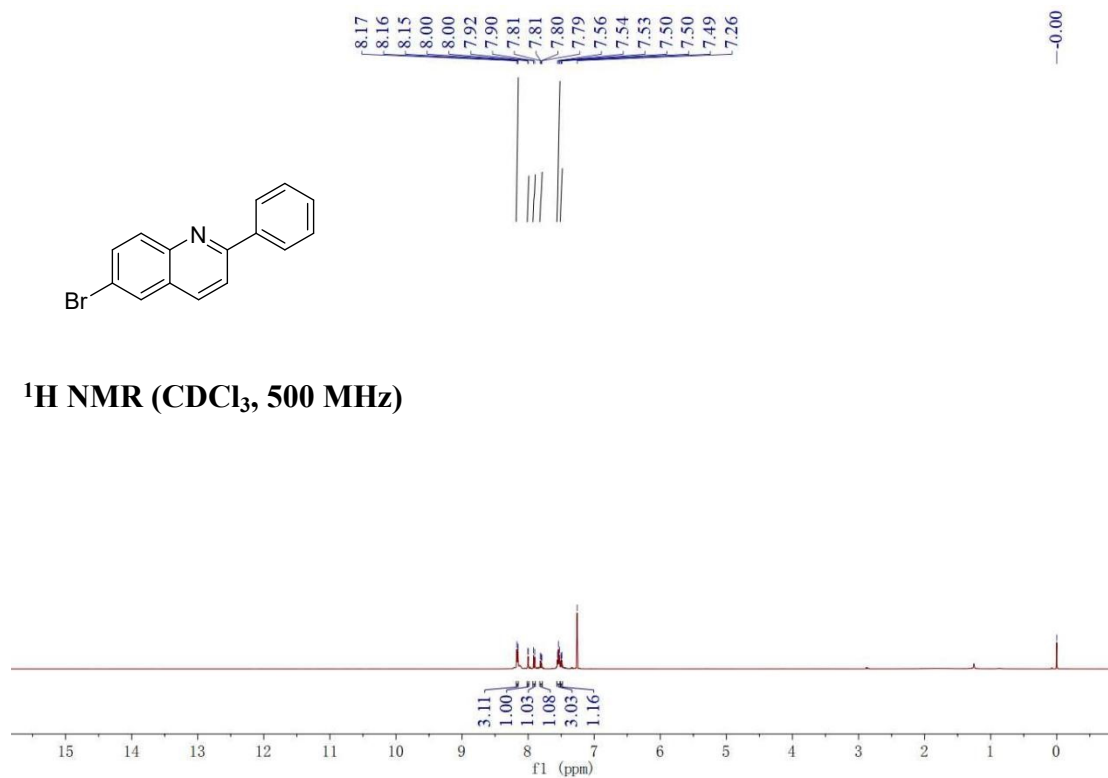
^1H NMR Spectrum of Compound c10-2



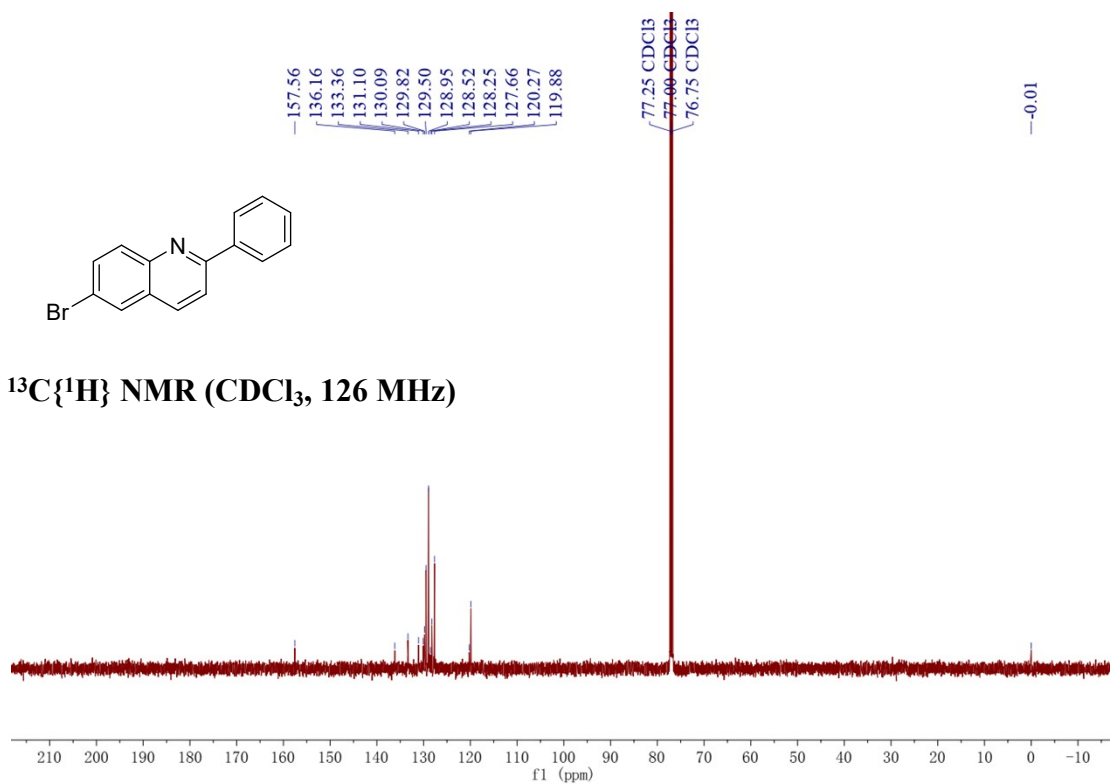
$^{13}\text{C}\{^1\text{H}\}$ NMR Spectrum of Compound c10-2



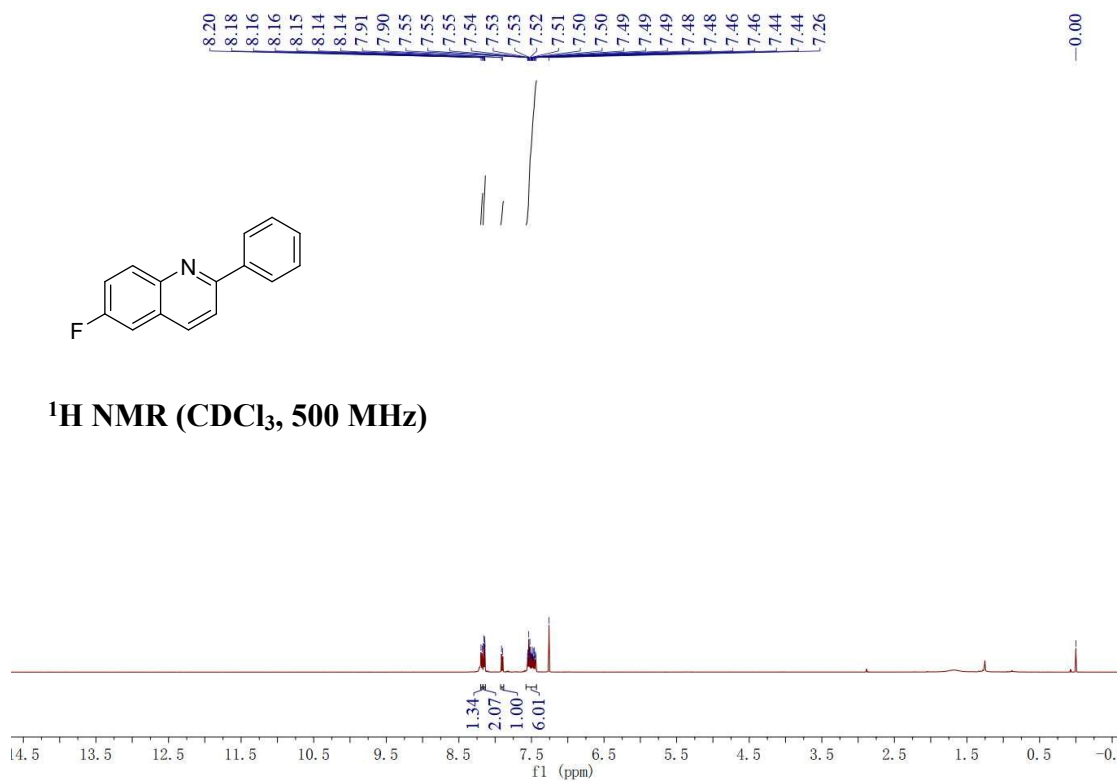
^1H NMR Spectrum of Compound c11



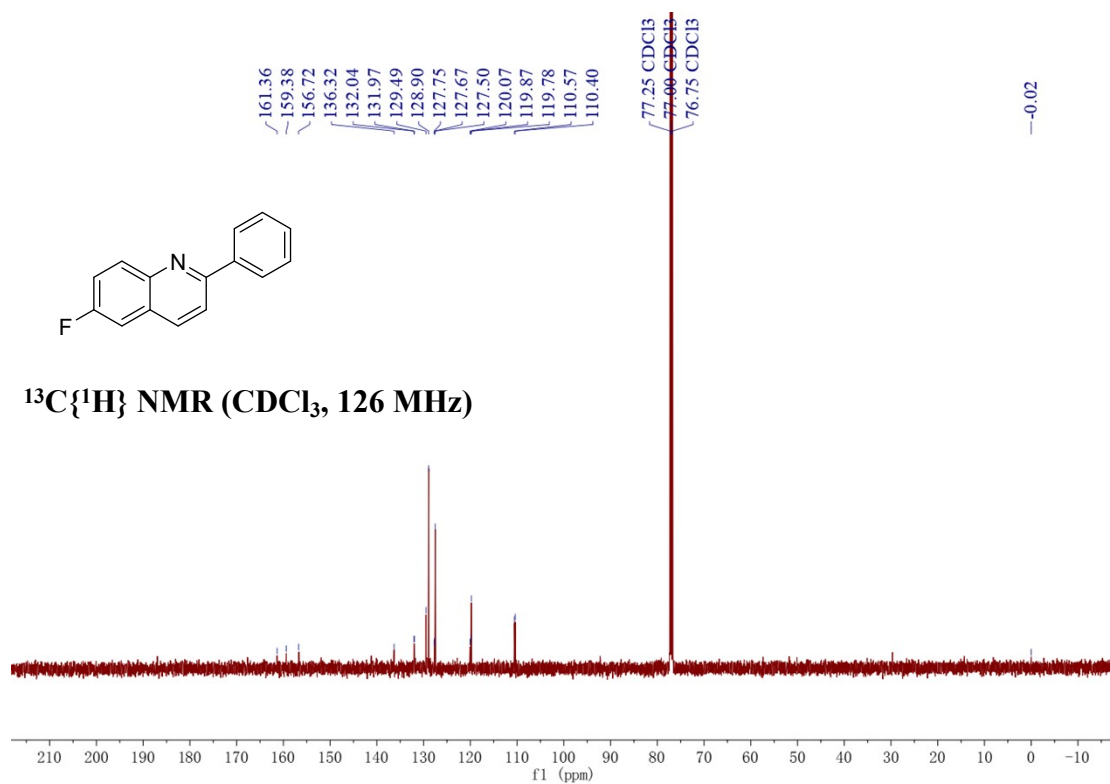
$^{13}\text{C}\{^1\text{H}\}$ NMR Spectrum of Compound c11



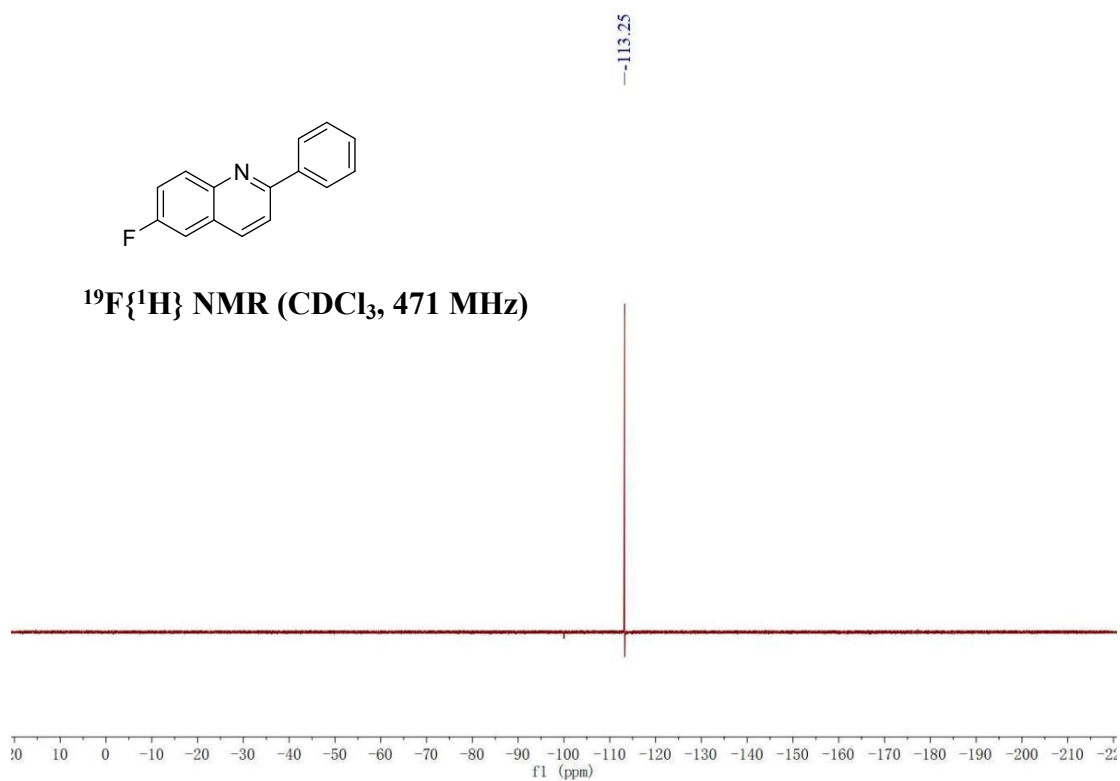
^1H NMR Spectrum of Compound c12-1



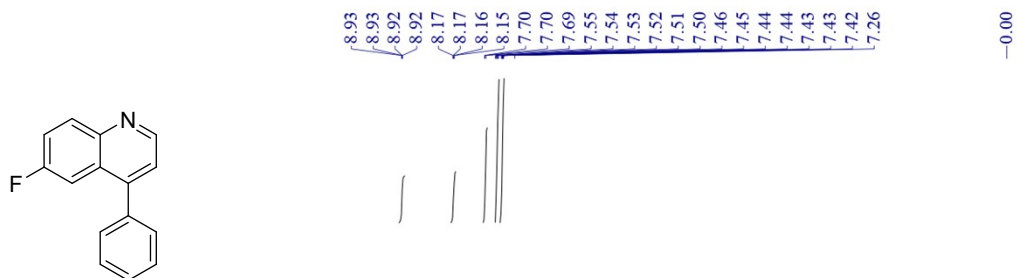
$^{13}\text{C}\{^1\text{H}\}$ NMR Spectrum of Compound c12-1



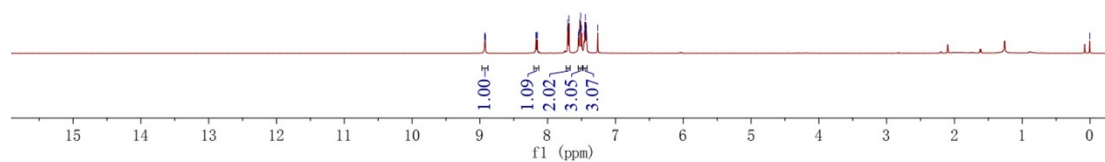
^{19}F NMR Spectrum of Compound c12-1



¹H NMR Spectrum of Compound c12-2



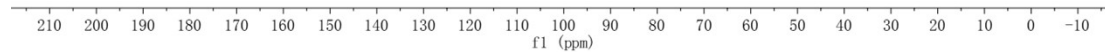
¹H NMR (CDCl₃, 500 MHz)



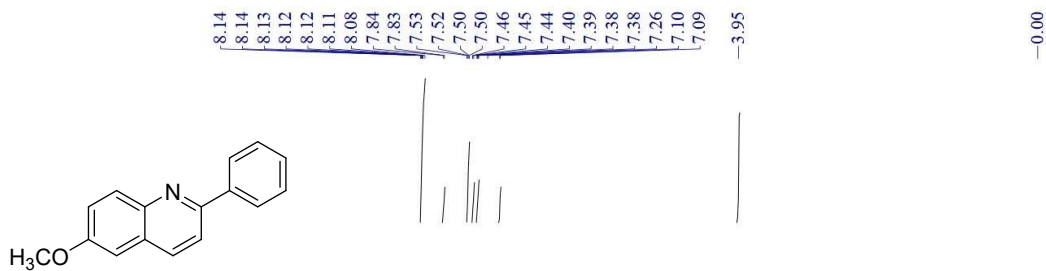
¹³C{¹H} NMR Spectrum of Compound c12-2



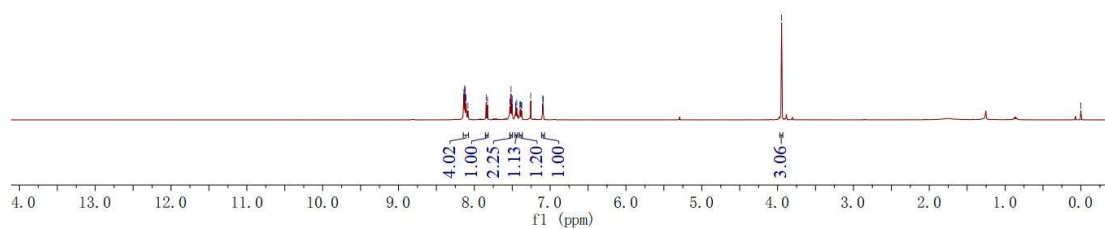
¹³C{¹H} NMR (CDCl₃, 126 MHz)



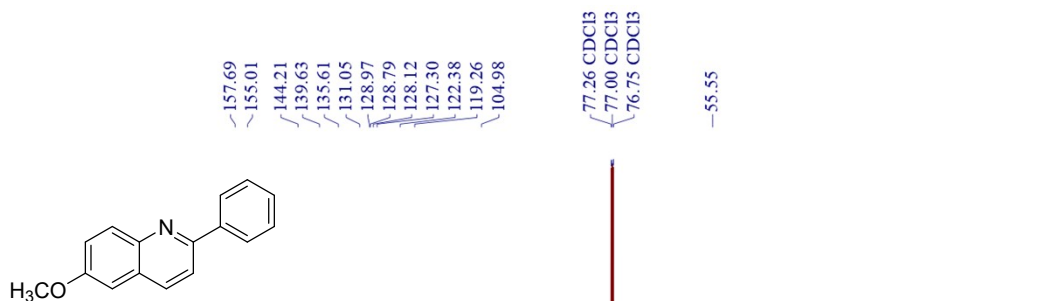
¹H NMR Spectrum of Compound c13



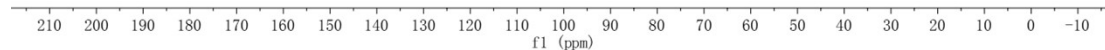
¹H NMR (CDCl₃, 500 MHz)



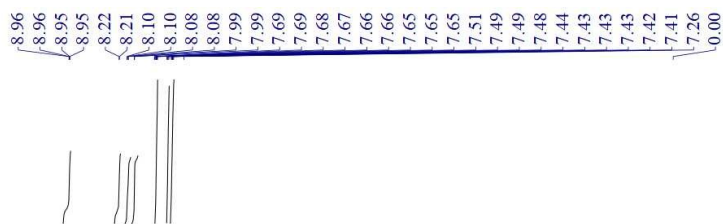
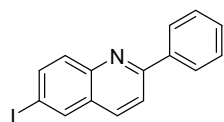
¹³C{¹H} NMR Spectrum of Compound c13



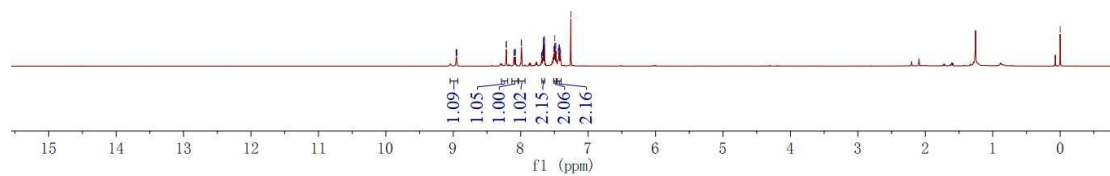
¹³C{¹H} NMR (CDCl₃, 126 MHz)



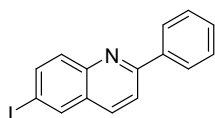
^1H NMR Spectrum of Compound c14



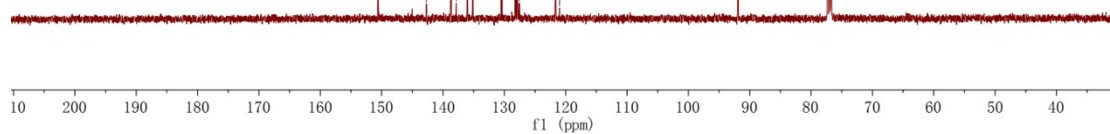
^1H NMR (CDCl_3 , 500 MHz)



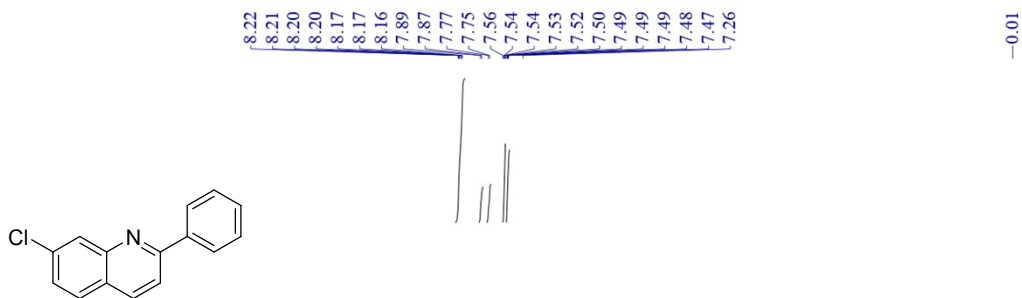
$^{13}\text{C}\{^1\text{H}\}$ NMR Spectrum of Compound c14



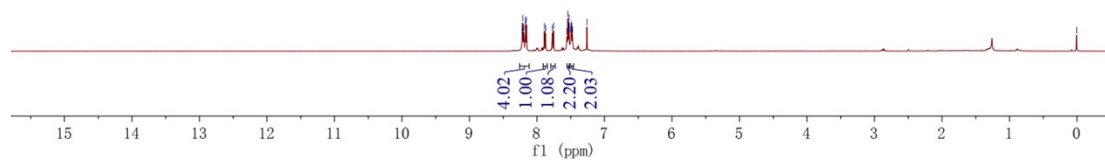
$^{13}\text{C}\{^1\text{H}\}$ NMR (CDCl_3 , 126 MHz)



¹H NMR Spectrum of Compound c15



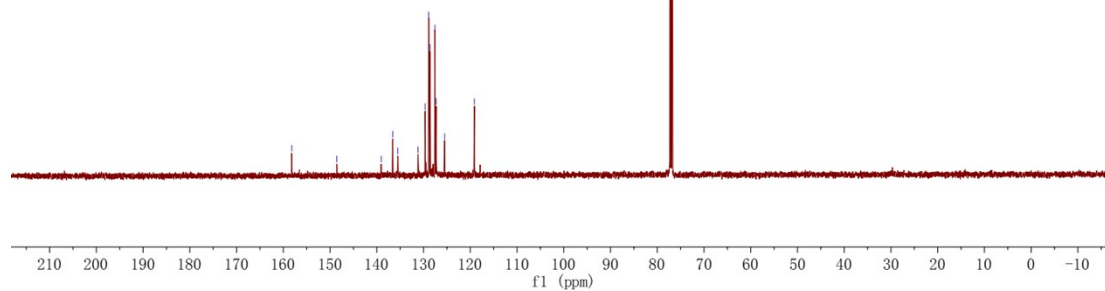
¹H NMR (CDCl₃, 500 MHz)



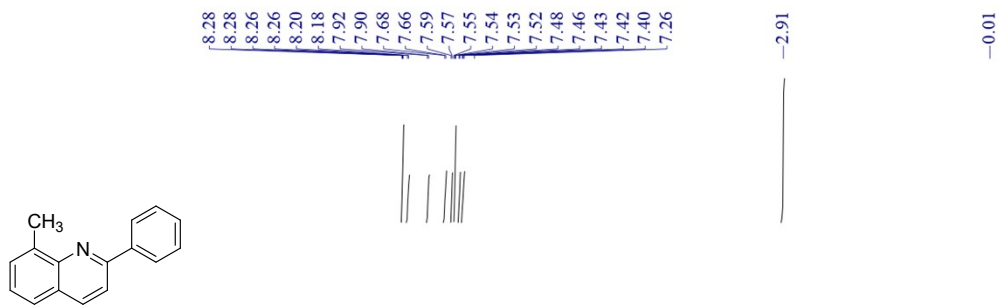
¹³C{¹H} NMR Spectrum of Compound c15



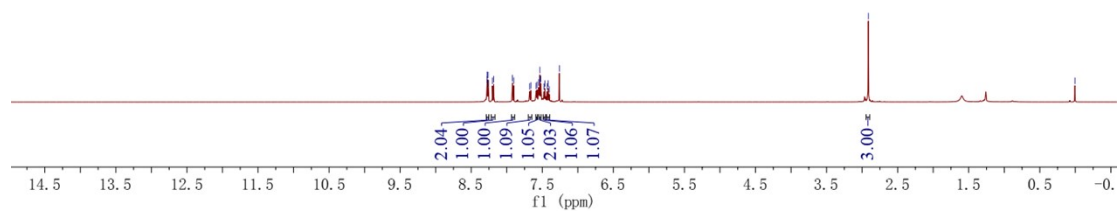
¹³C{¹H} NMR (CDCl₃, 126 MHz)



¹H NMR Spectrum of Compound c16



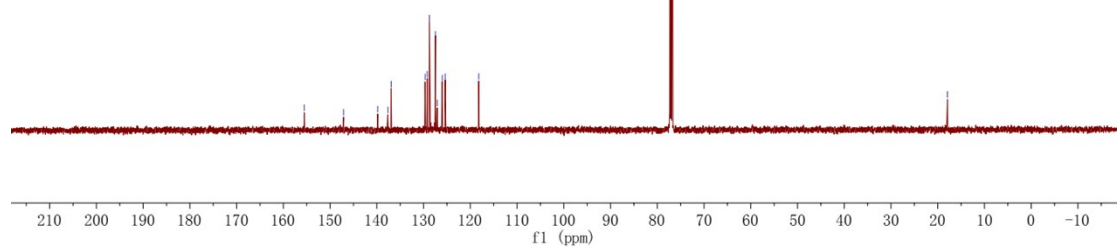
¹H NMR (CDCl₃, 500 MHz)



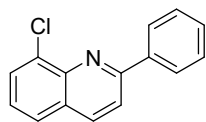
¹³C{¹H} NMR Spectrum of Compound c16



¹³C{¹H} NMR (CDCl₃, 126 MHz)



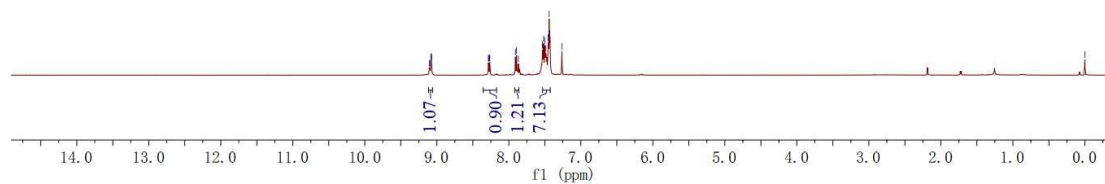
¹H NMR Spectrum of Compound c17



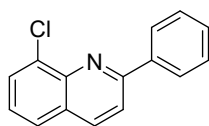
9.11
9.10
9.08
9.08
9.07
8.28
8.28
8.27
8.26
7.91
7.89
7.87
7.53
7.53
7.52
7.50
7.49
7.45
7.44
7.43
7.43
7.26

-0.00

¹H NMR (CDCl₃, 500 MHz)



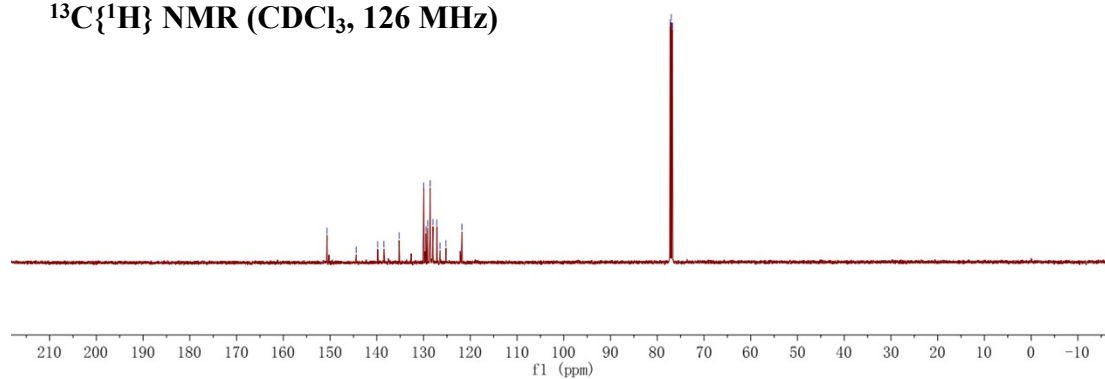
¹³C{¹H} NMR Spectrum of Compound c17



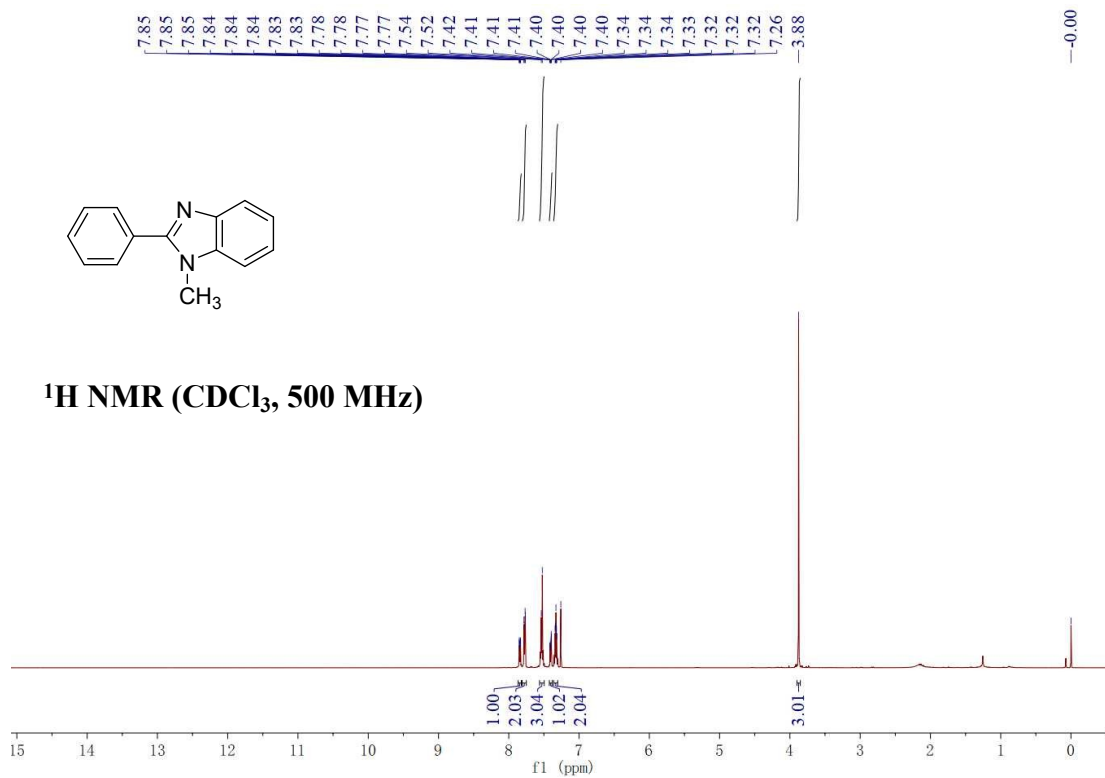
150.64
144.39
139.81
138.47
135.23
129.95
129.50
129.12
128.58
127.98
127.14
126.46
125.21
121.78

77.25 CDCl₃
77.00 CDCl₃
76.75 CDCl₃

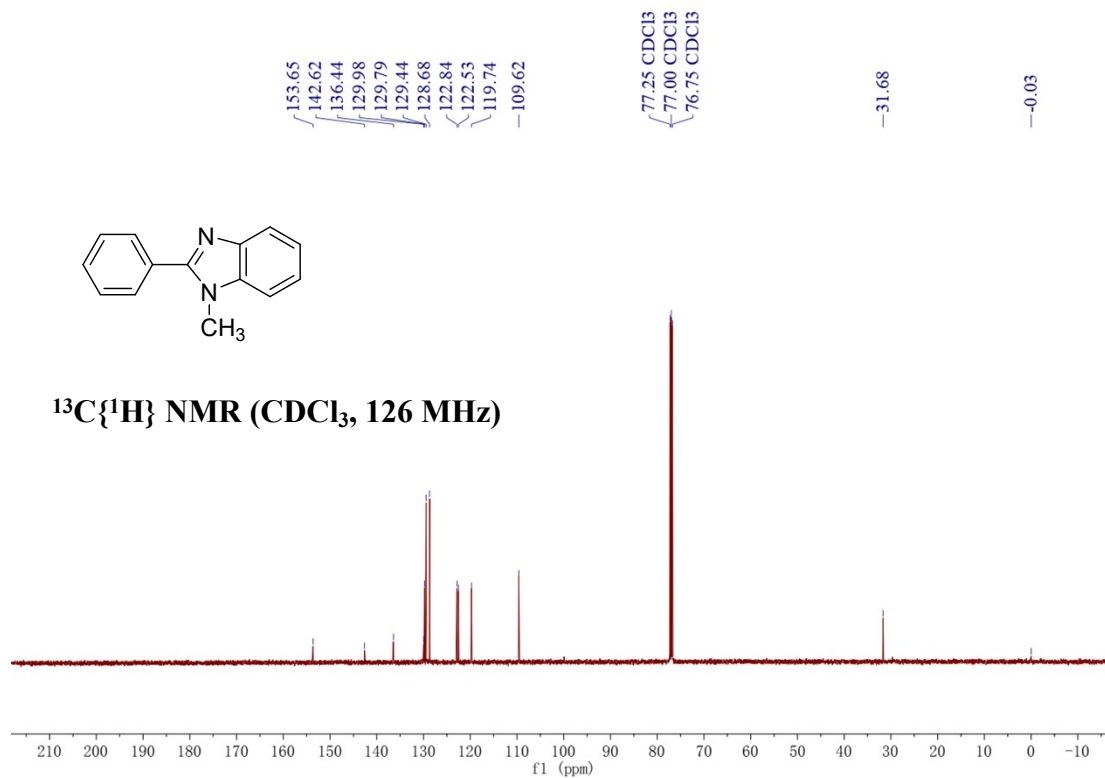
¹³C{¹H} NMR (CDCl₃, 126 MHz)



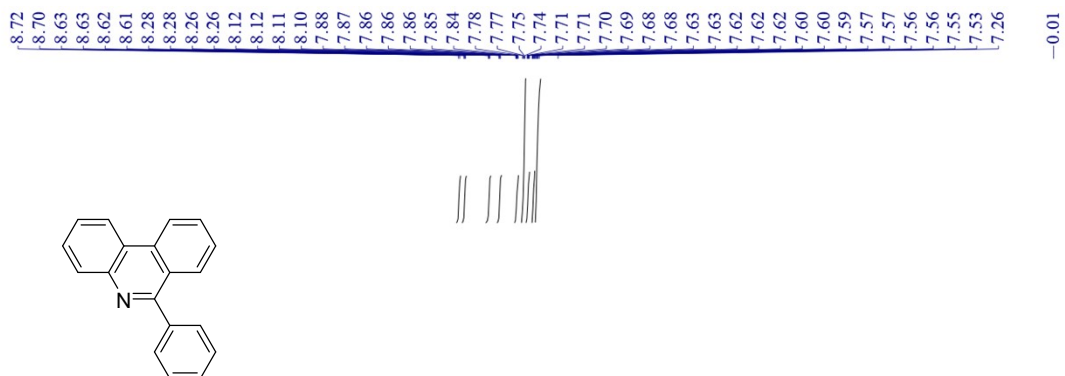
¹H NMR Spectrum of Compound c18



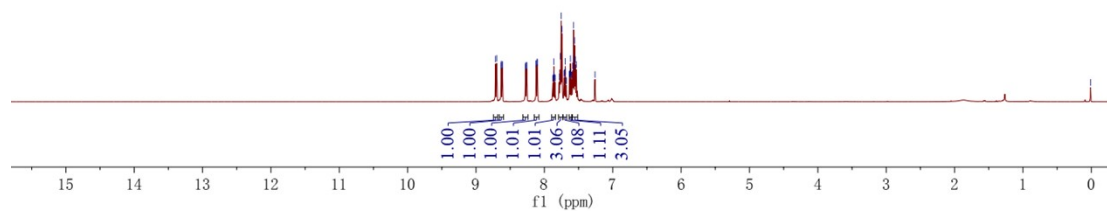
¹³C{¹H} NMR Spectrum of Compound c18



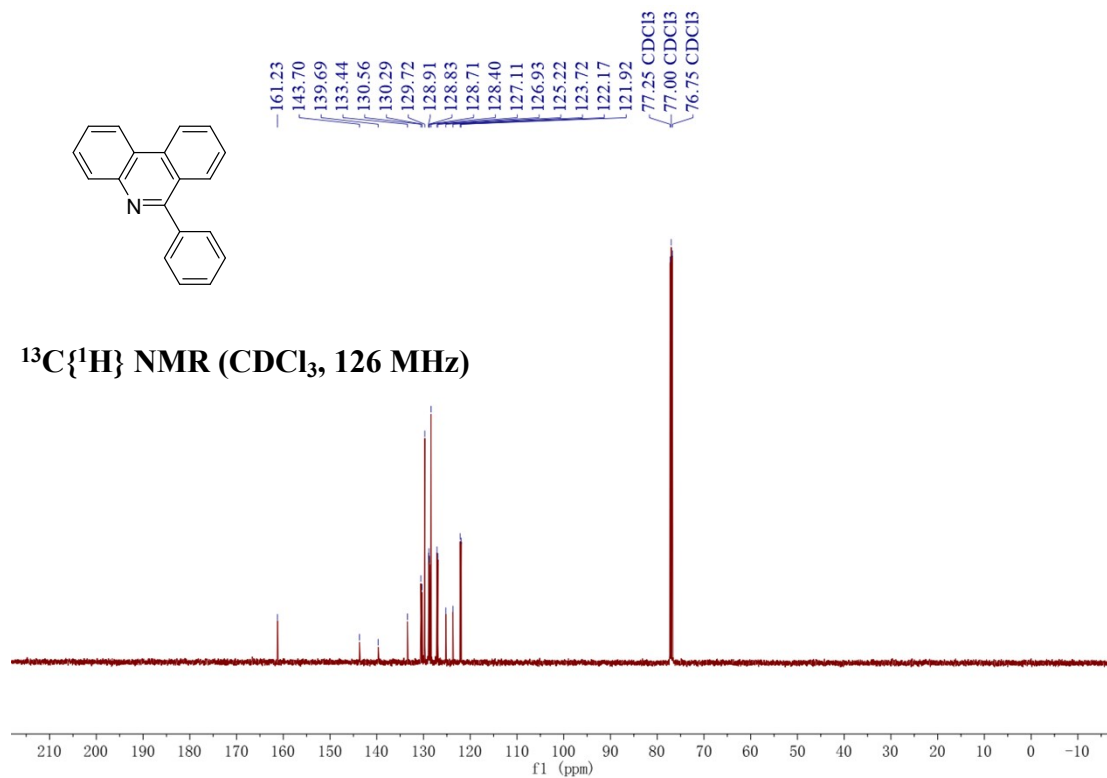
^1H NMR Spectrum of Compound c19



^1H NMR (CDCl_3 , 500 MHz)

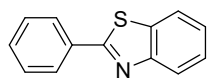


$^{13}\text{C}\{^1\text{H}\}$ NMR Spectrum of Compound c19

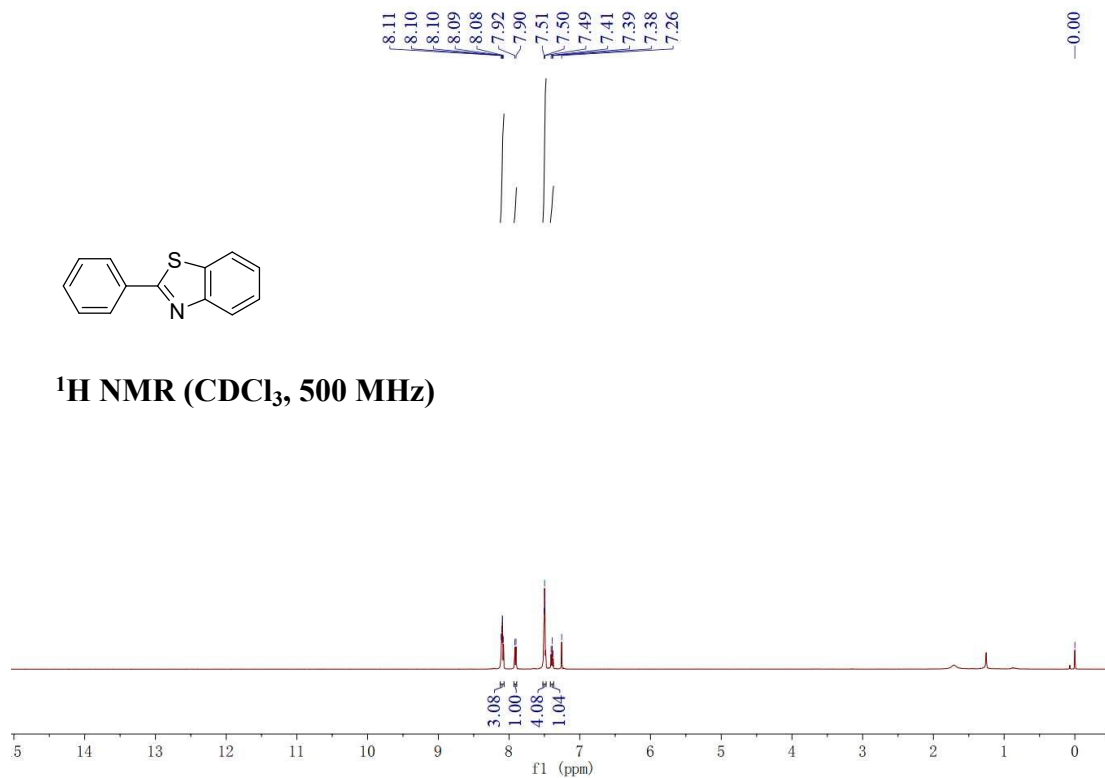


$^{13}\text{C}\{^1\text{H}\}$ NMR (CDCl_3 , 126 MHz)

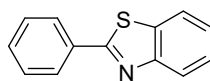
¹H NMR Spectrum of Compound c20



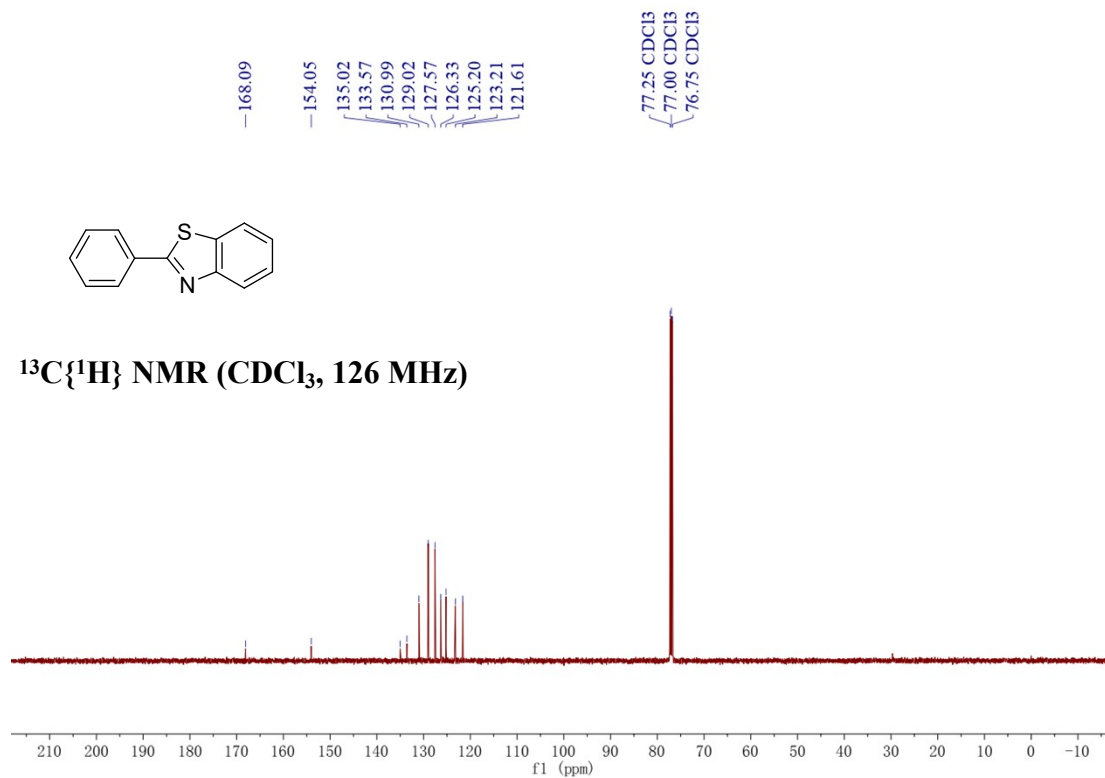
¹H NMR (CDCl₃, 500 MHz)



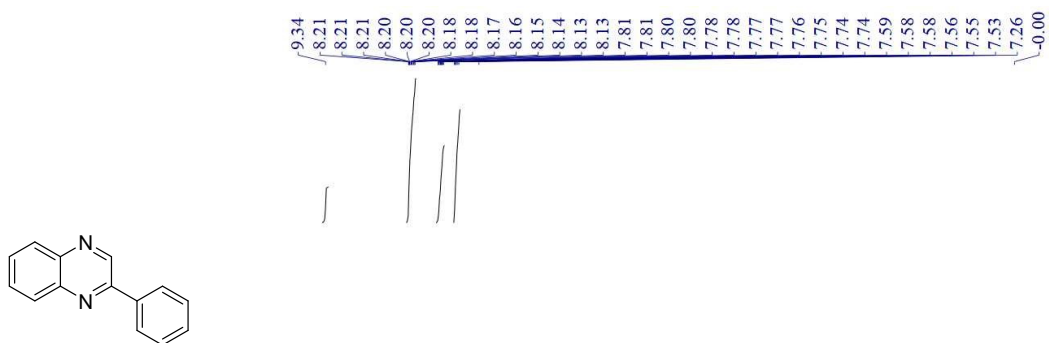
¹³C{¹H} NMR Spectrum of Compound c20



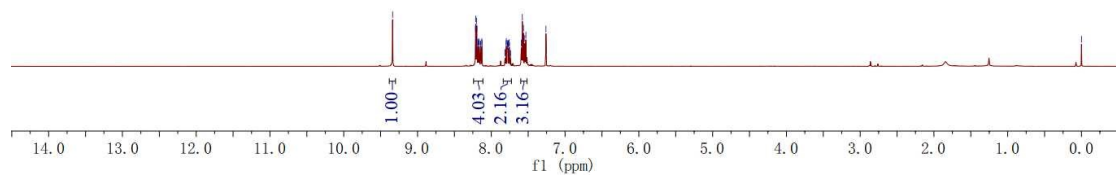
¹³C{¹H} NMR (CDCl₃, 126 MHz)



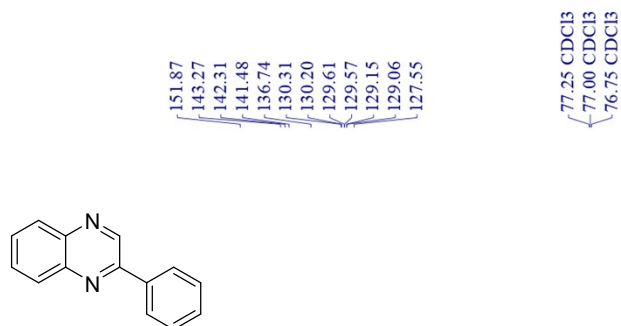
¹H NMR Spectrum of Compound c21



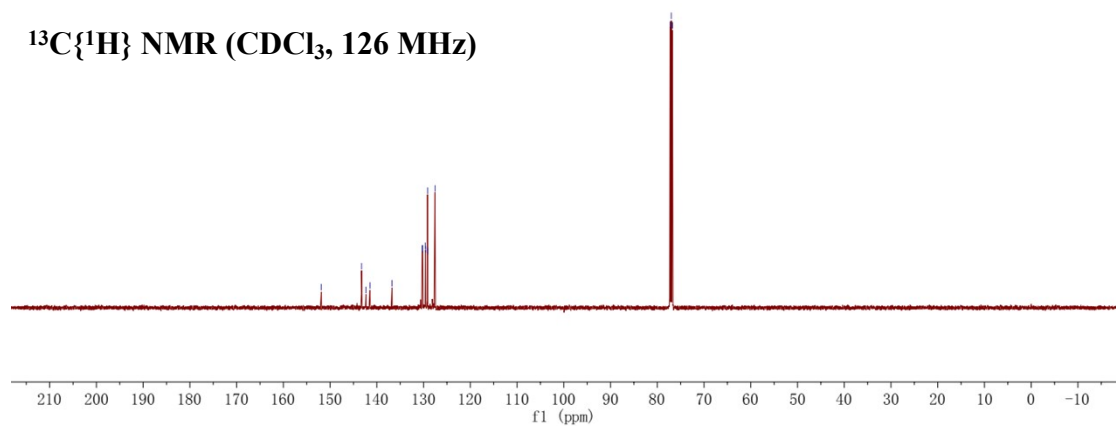
¹H NMR (CDCl₃, 500 MHz)



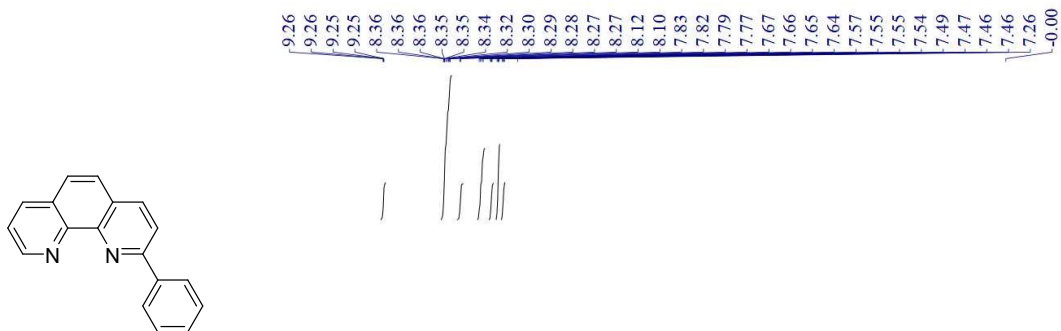
¹³C{¹H} NMR Spectrum of Compound c21



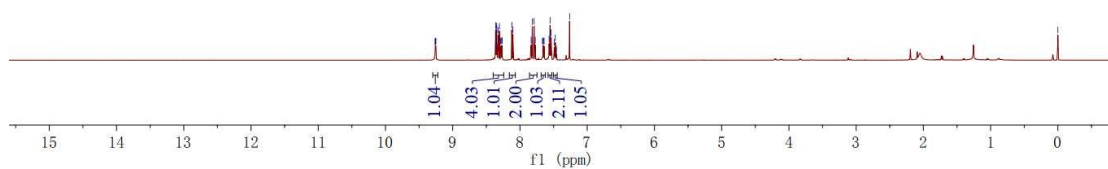
¹³C{¹H} NMR (CDCl₃, 126 MHz)



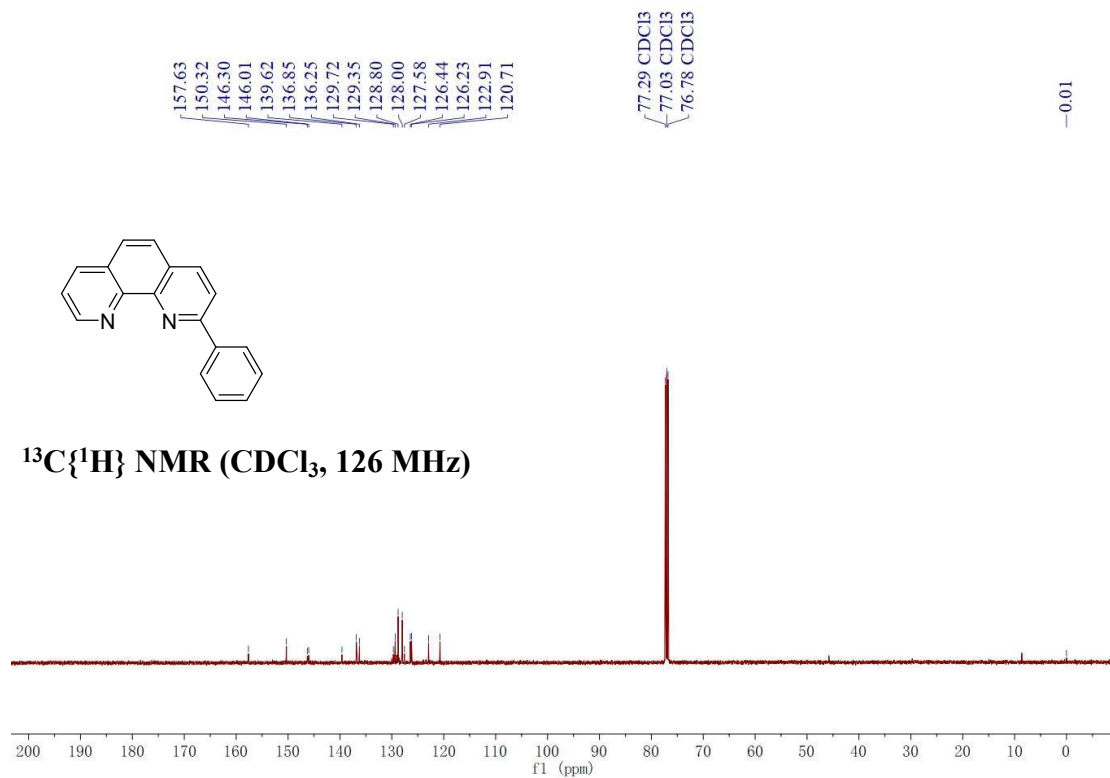
¹H NMR Spectrum of Compound c22



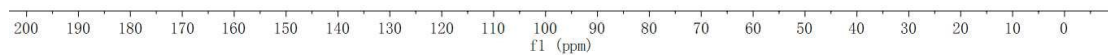
¹H NMR (CDCl₃, 500 MHz)



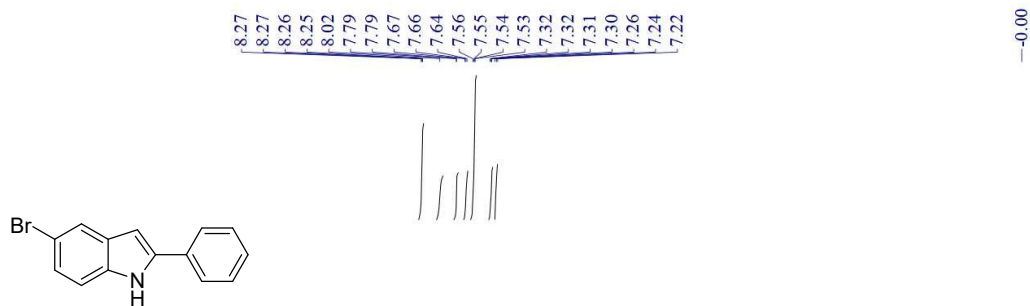
¹³C{¹H} NMR Spectrum of Compound c22



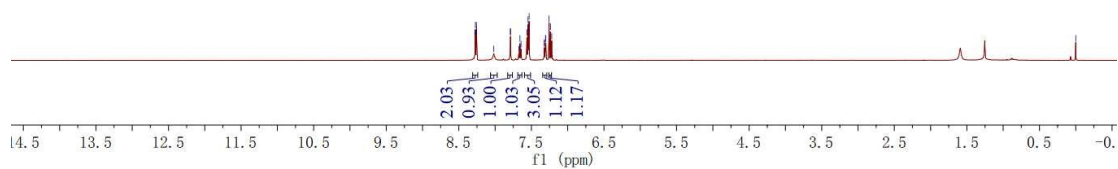
¹³C{¹H} NMR (CDCl₃, 126 MHz)



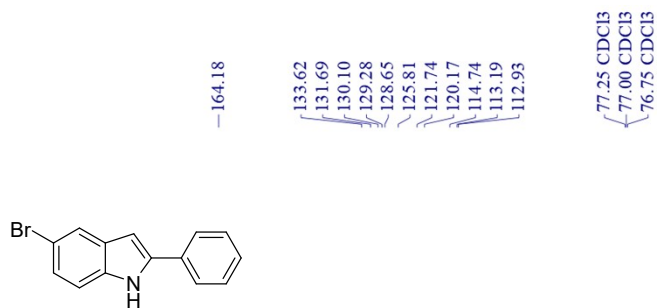
^1H NMR Spectrum of Compound c23



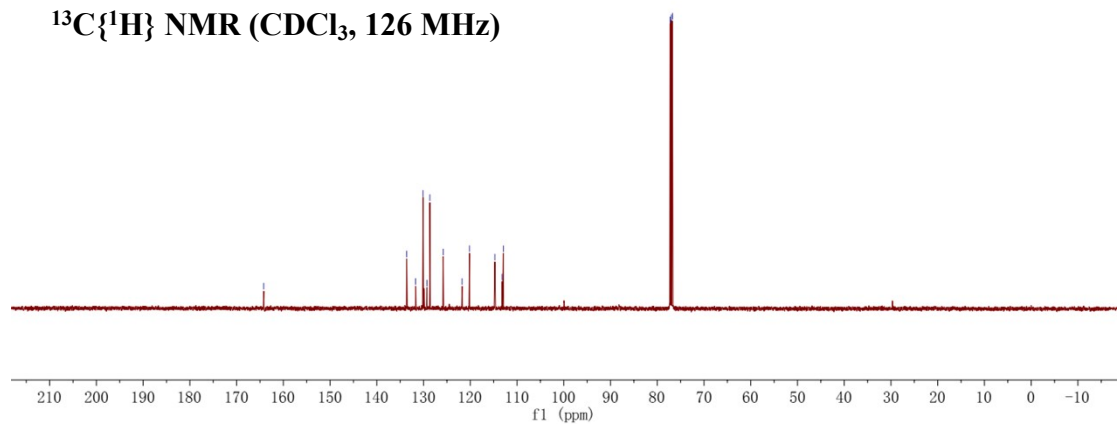
^1H NMR (CDCl₃, 500 MHz)



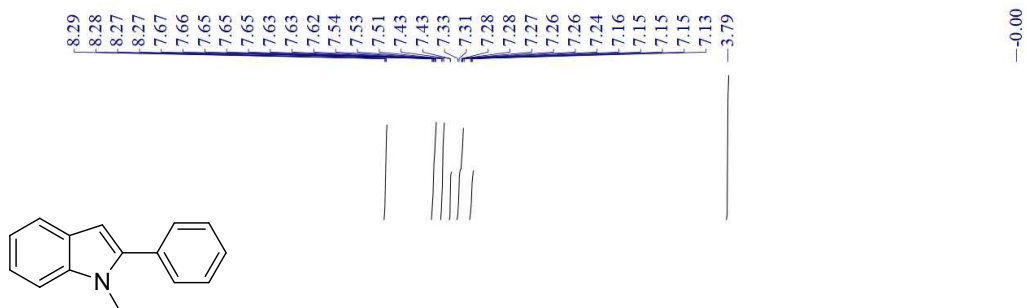
$^{13}\text{C}\{^1\text{H}\}$ NMR Spectrum of Compound c23



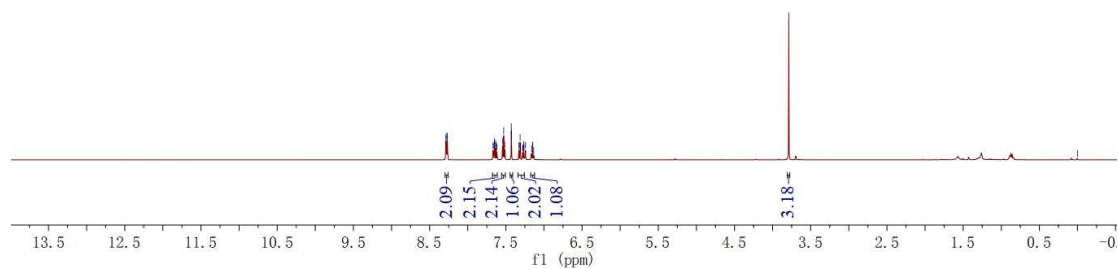
$^{13}\text{C}\{^1\text{H}\}$ NMR (CDCl₃, 126 MHz)



^1H NMR Spectrum of Compound c24



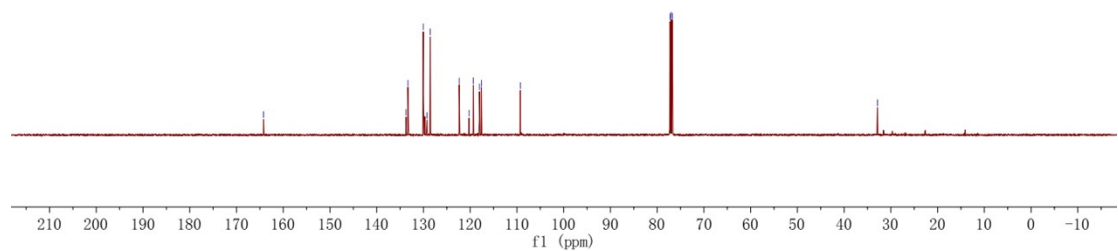
^1H NMR (CDCl_3 , 500 MHz)



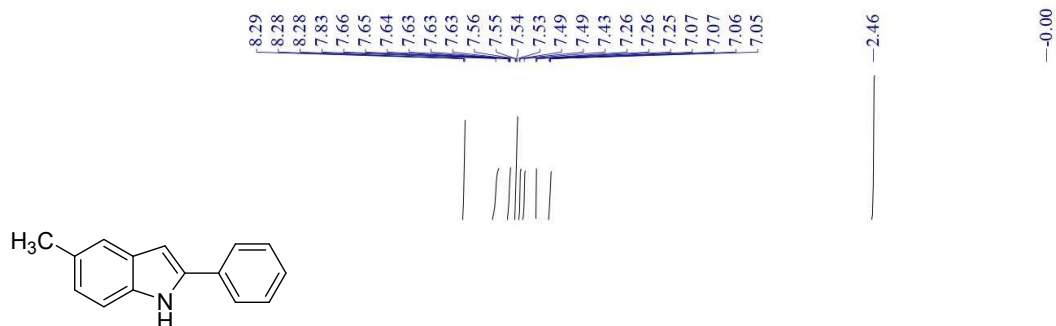
$^{13}\text{C}\{^1\text{H}\}$ NMR Spectrum of Compound c24



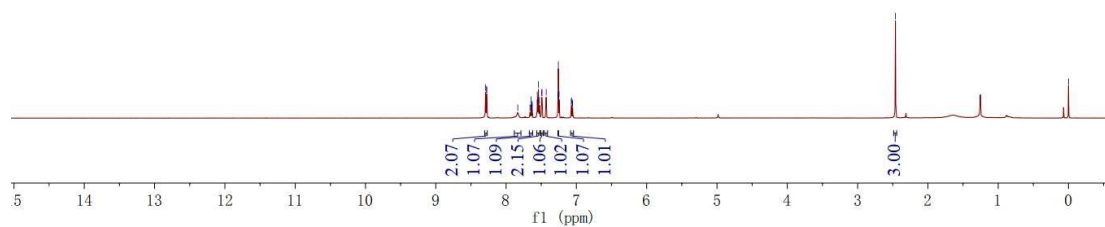
$^{13}\text{C}\{^1\text{H}\}$ NMR (CDCl_3 , 126 MHz)



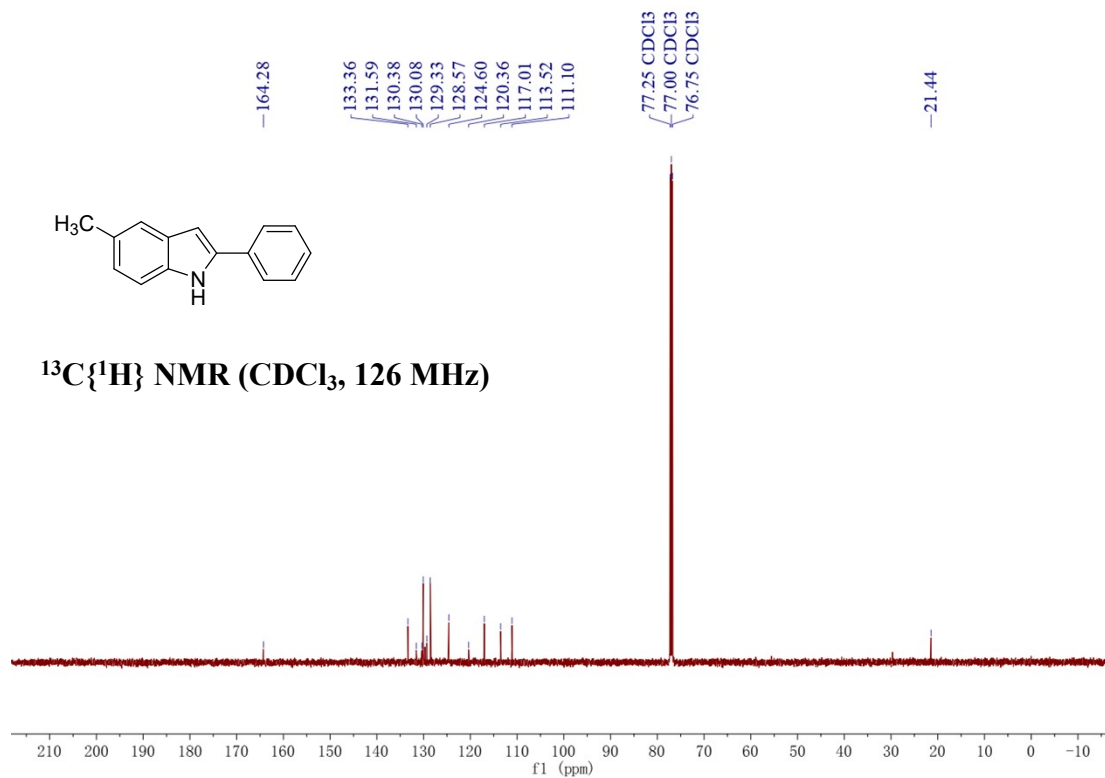
^1H NMR Spectrum of Compound c25



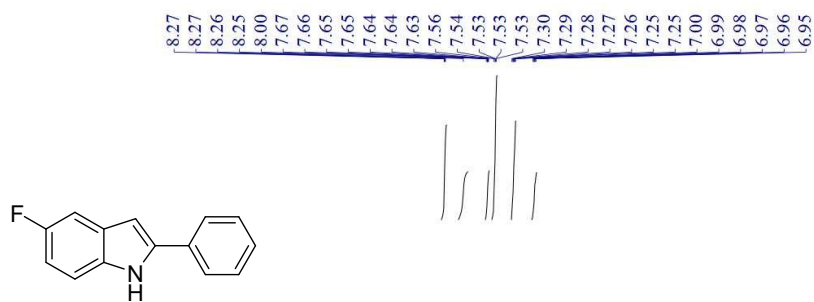
^1H NMR (CDCl₃, 500 MHz)



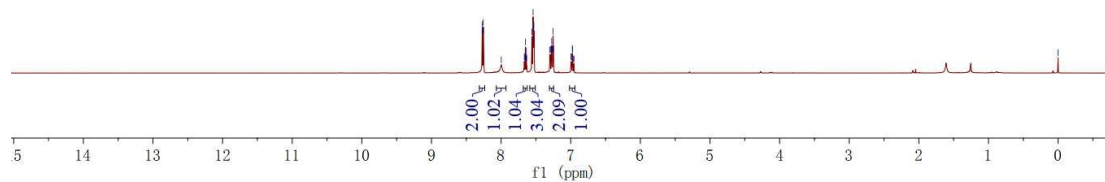
$^{13}\text{C}\{^1\text{H}\}$ NMR Spectrum of Compound c25



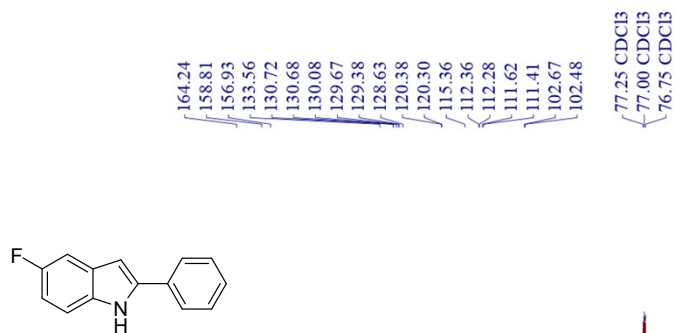
¹H NMR Spectrum of Compound c26



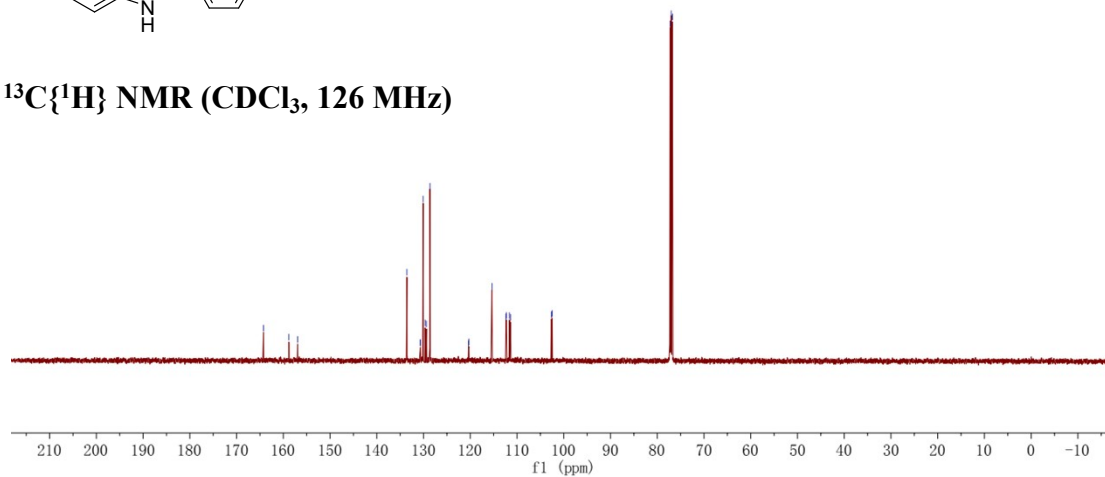
¹H NMR (CDCl₃, 500 MHz)



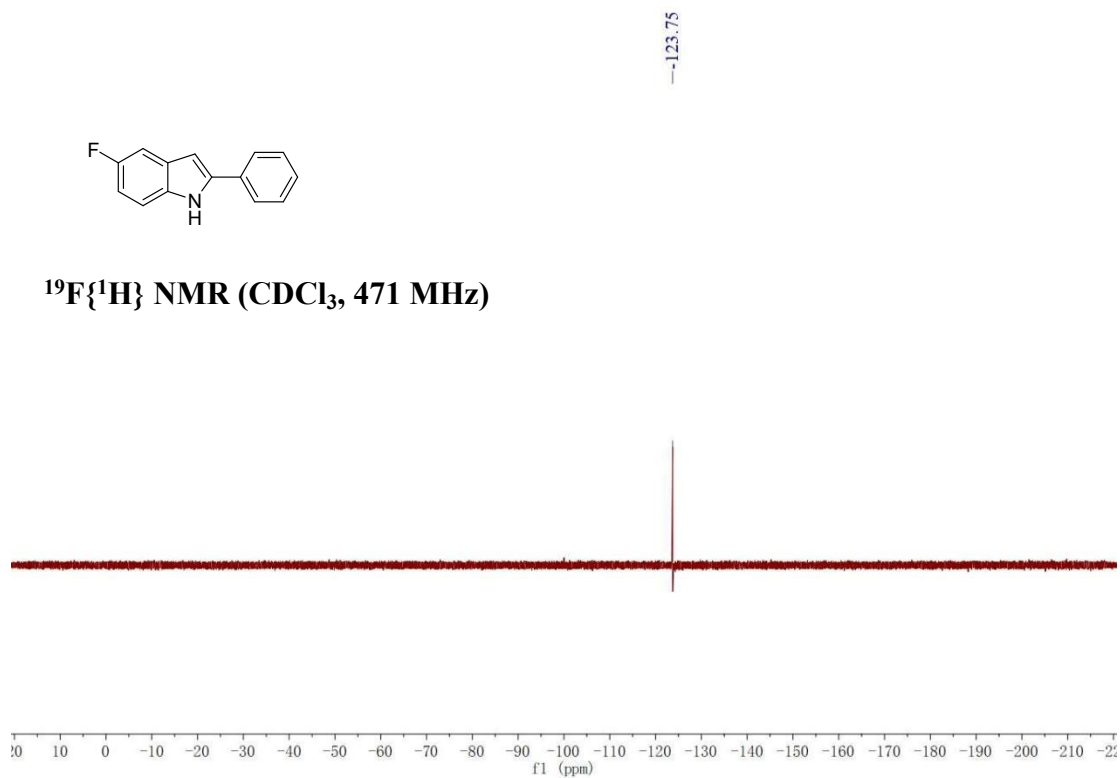
¹³C{¹H} NMR Spectrum of Compound c26



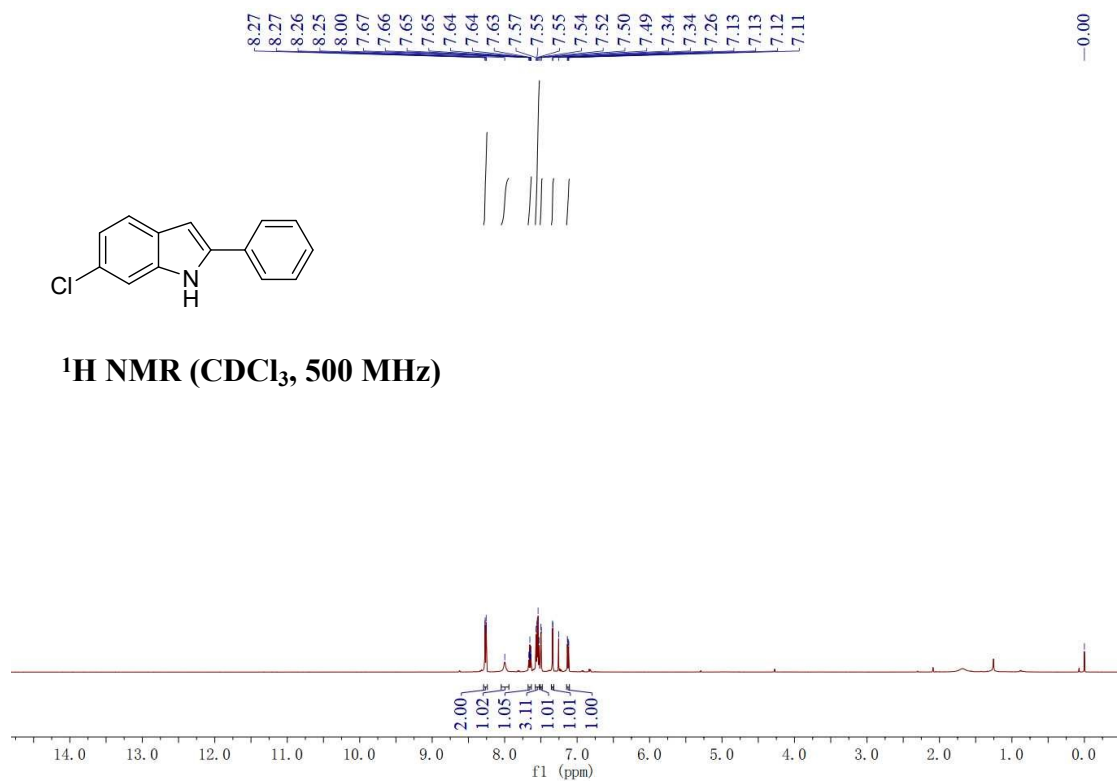
¹³C{¹H} NMR (CDCl₃, 126 MHz)



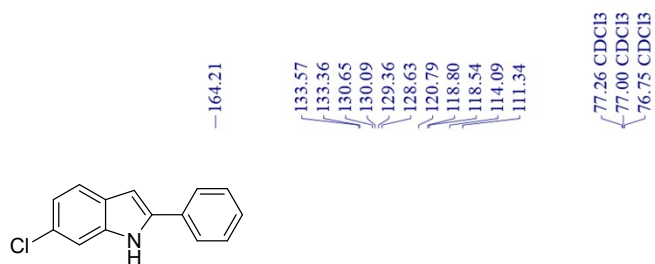
$^{19}\text{F}\{^1\text{H}\}$ NMR Spectrum of Compound c26



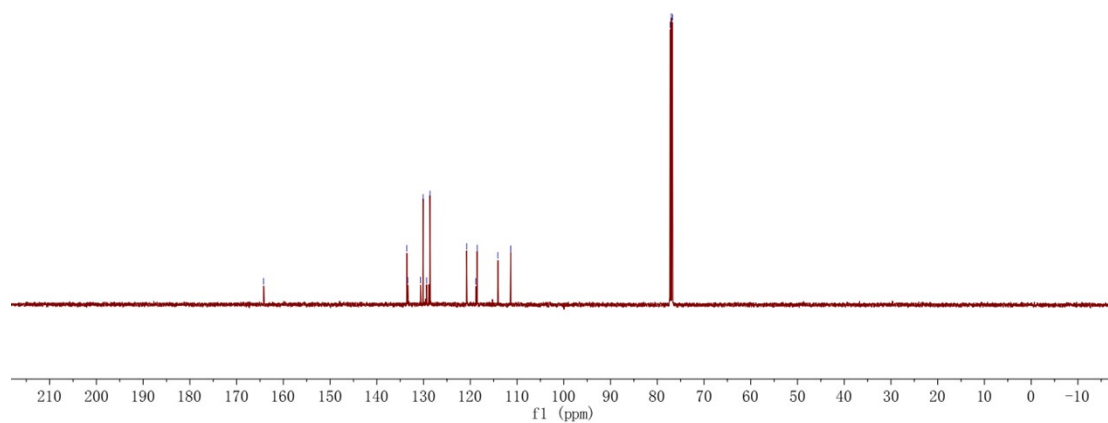
^1H NMR Spectrum of Compound c27



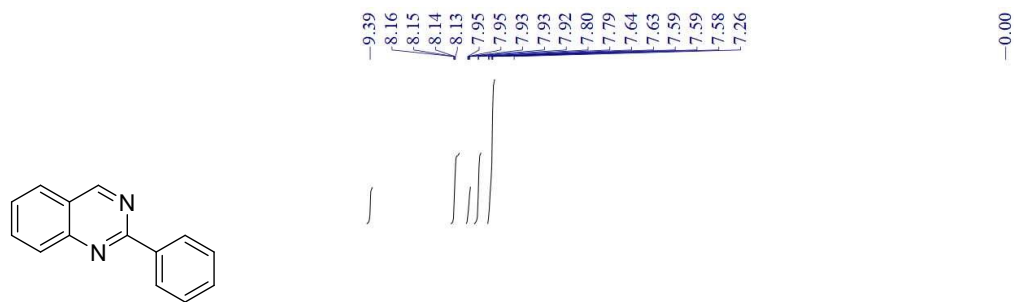
$^{13}\text{C}\{^1\text{H}\}$ NMR Spectrum of Compound c27



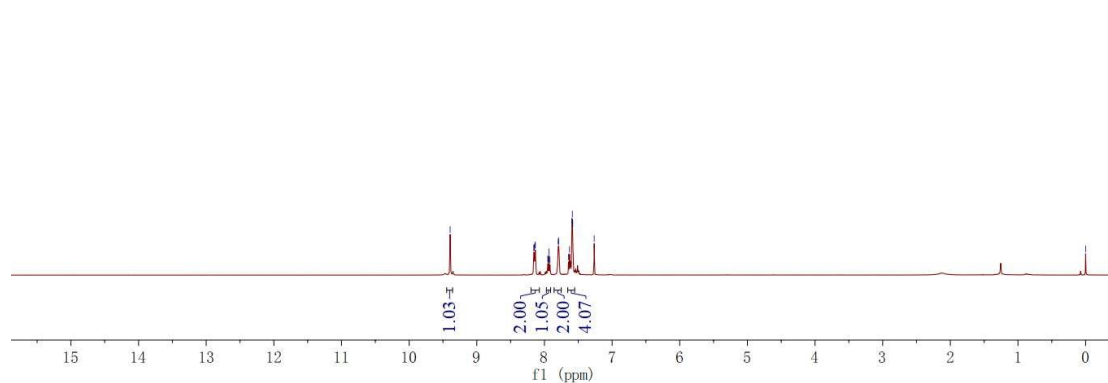
$^{13}\text{C}\{^1\text{H}\}$ NMR (CDCl₃, 126 MHz)



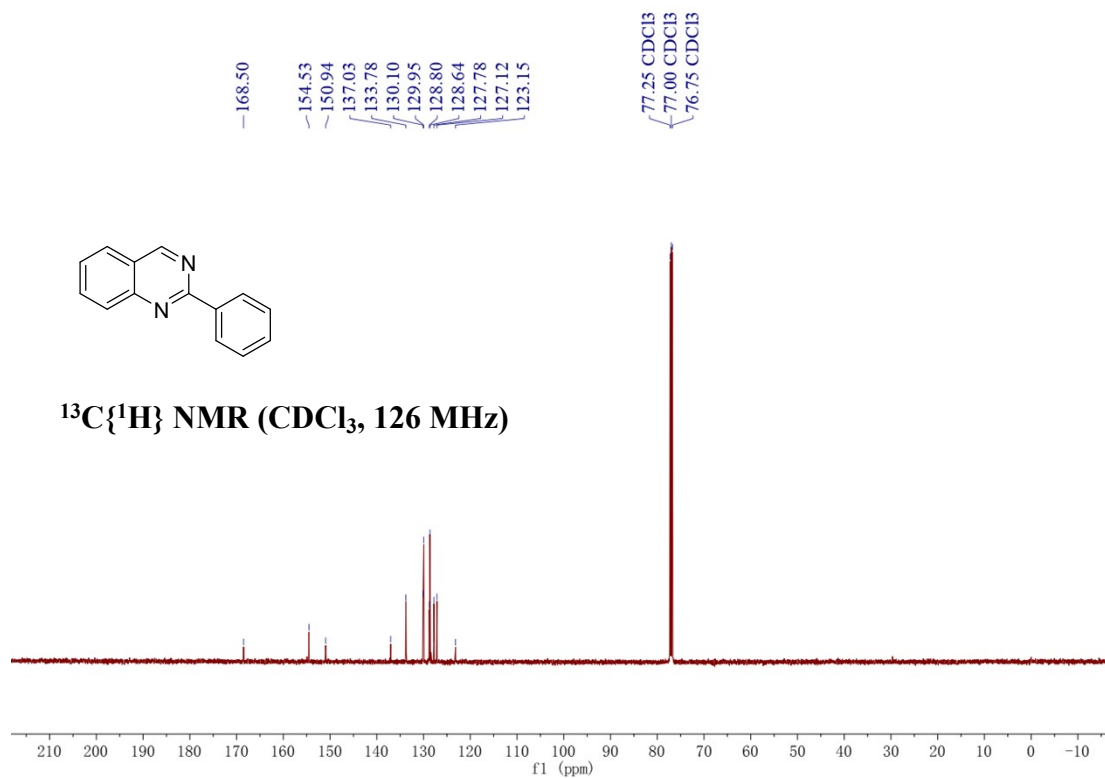
^1H NMR Spectrum of Compound c28



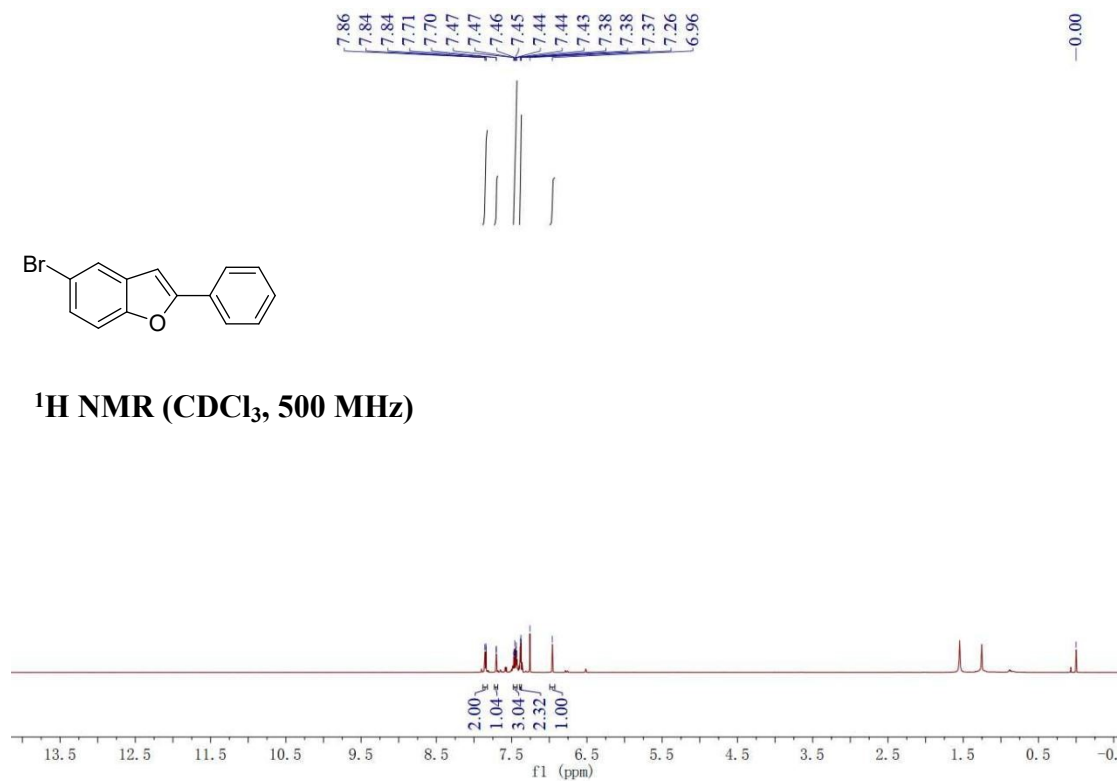
^1H NMR (CDCl₃, 500 MHz)



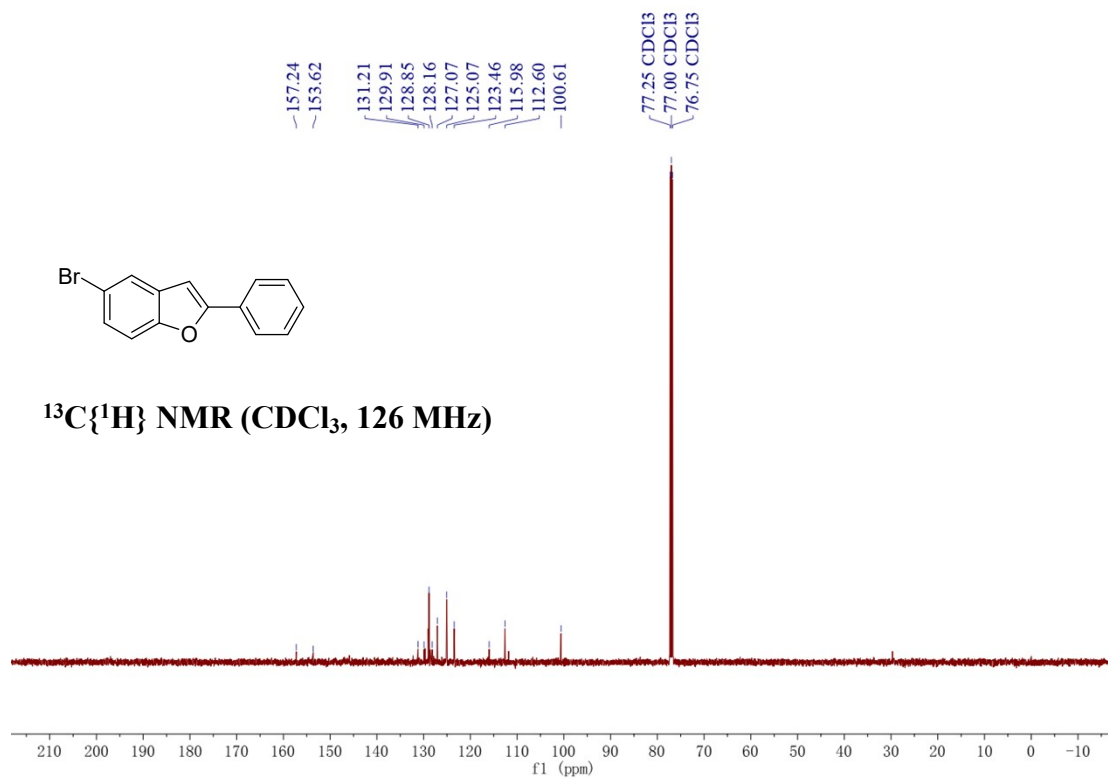
$^{13}\text{C}\{^1\text{H}\}$ NMR Spectrum of Compound c28



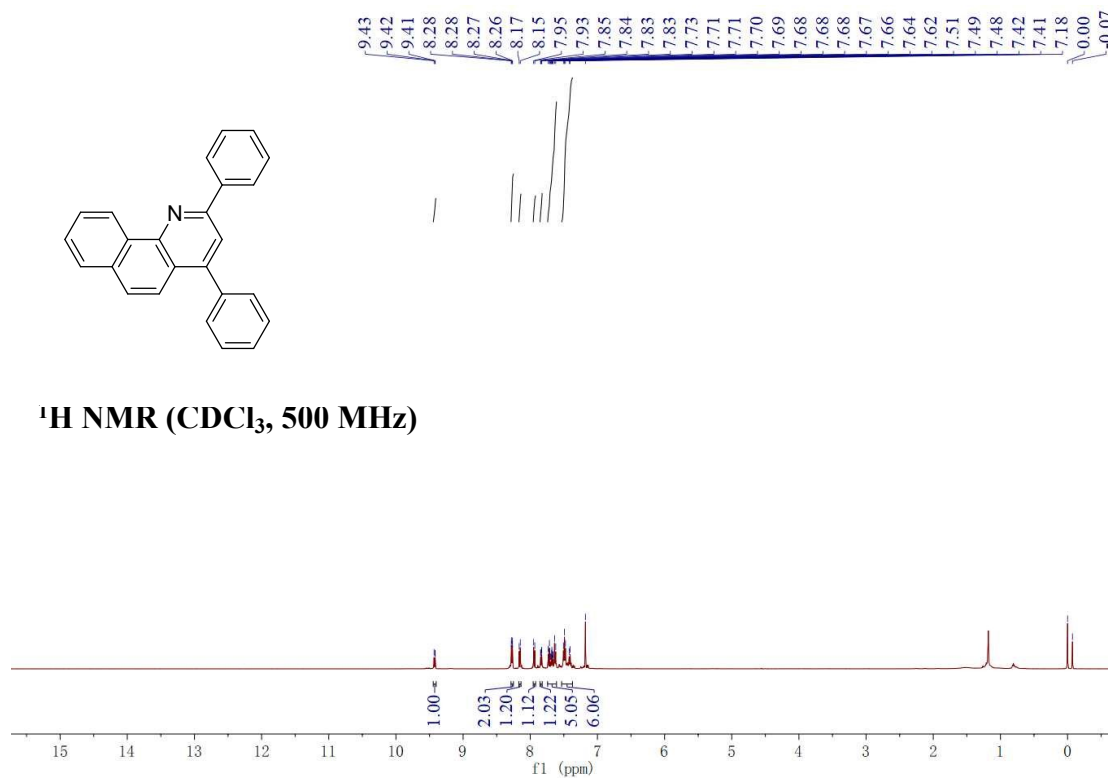
^1H NMR Spectrum of Compound c29



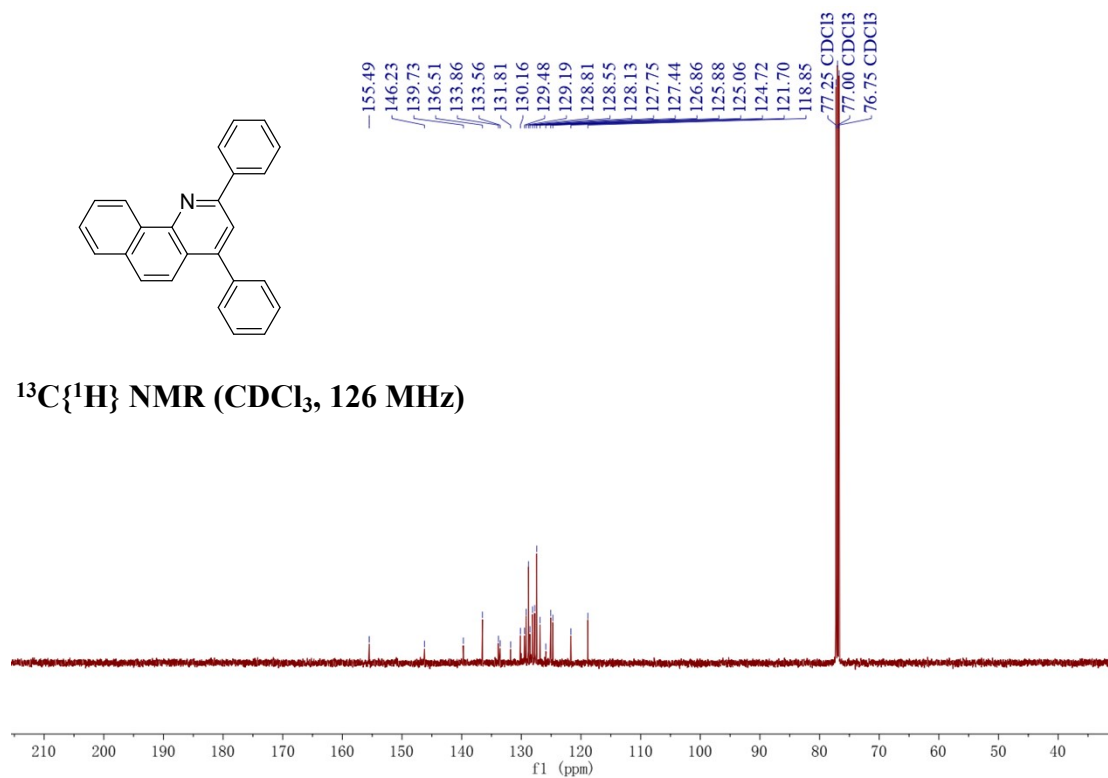
$^{13}\text{C}\{^1\text{H}\}$ NMR Spectrum of Compound c29



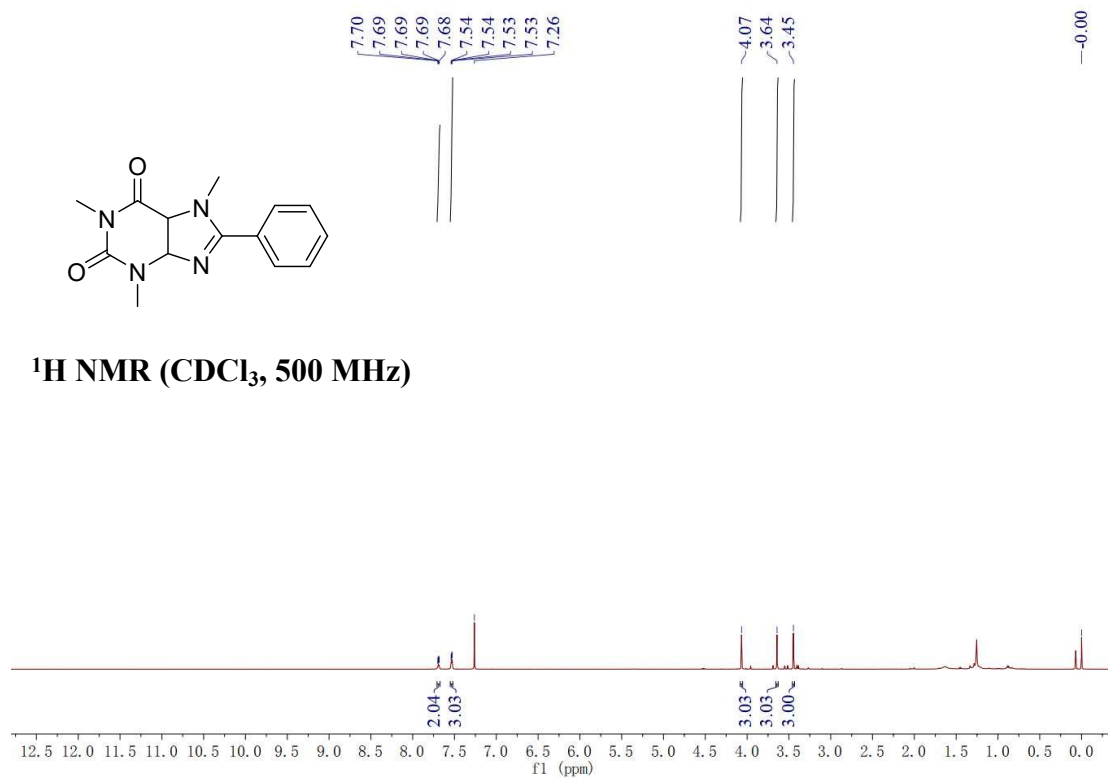
^1H NMR Spectrum of Compound c30



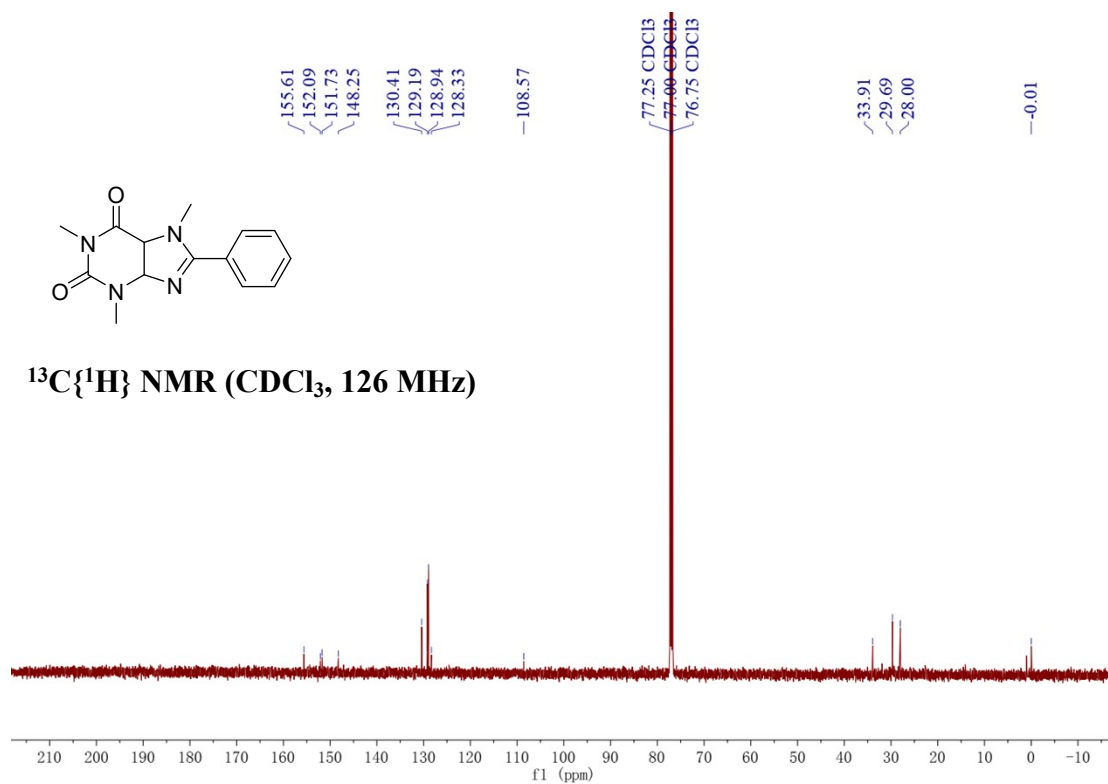
$^{13}\text{C}\{^1\text{H}\}$ NMR Spectrum of Compound c30



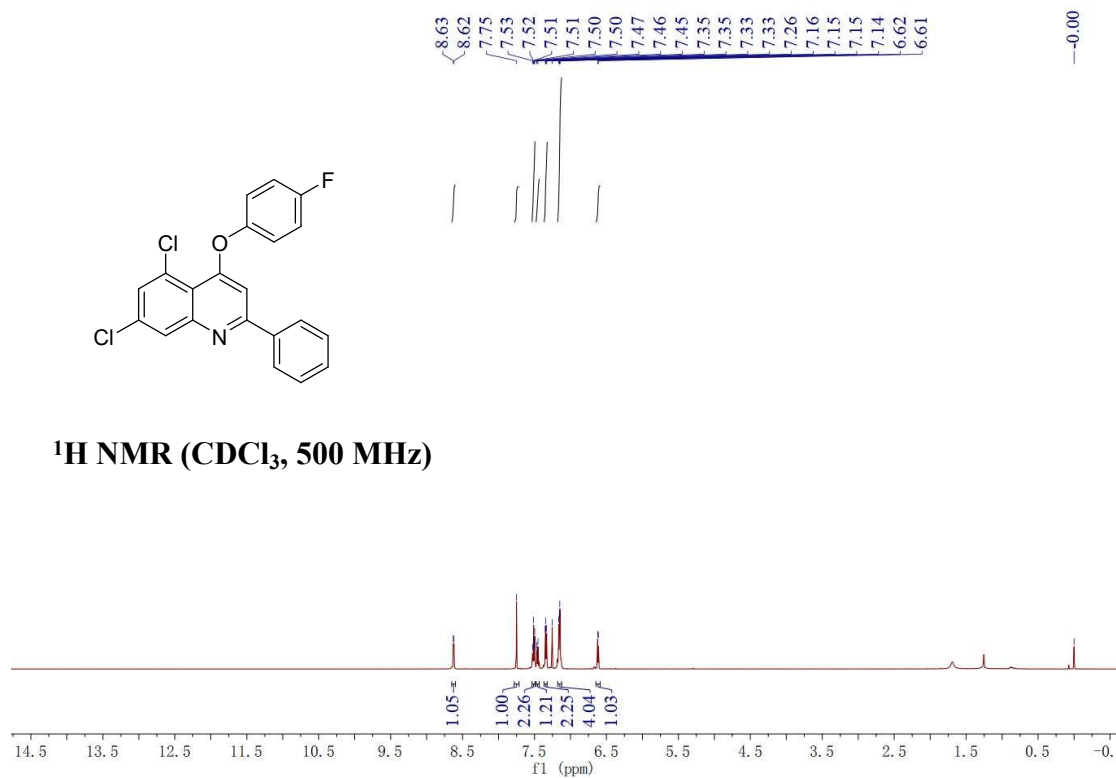
^1H NMR Spectrum of Compound d1



$^{13}\text{C}\{^1\text{H}\}$ NMR Spectrum of Compound d1



^1H NMR Spectrum of Compound d2



$^{13}\text{C}\{^1\text{H}\}$ NMR Spectrum of Compound d2

