Supporting Information

Visible-light-mediated dehalogenative Borylation of inactivated aryl and alkyl halides with a palladium complex

Jia-Hui Zhao[a,†], Zhao-Zhao Zhou,[a,b,†] Yue Zhang,[a] Xuan Su,[a] Xi-Meng Chen[b] and Yong-Min Liang[*a]

[a] *State Key Laboratory of Applied Organic Chemistry, Lanzhou University, Lanzhou 730000, P.R. China*

[b] *School of Nuclear Science and Technology, Lanzhou University, Lanzhou 730000, P.R. China.*

Email: liangym@lzu.edu.cn

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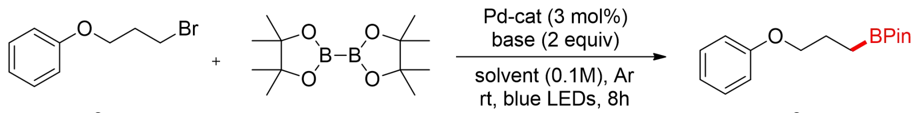
1. General Information and Materials

Silica products was purified by flash column chromatography on silica gel (Innochem SilicaFlashP60, 230-400 mesh) and GF_{254} TLC. Reactions were stirred using Teflon - coated magnetic stir bars, Organic solutions were concentrated using a rotary evaporator with a diaphragm vacuum pump. The reaction apparatus for the common blue light transmission straight glass reaction tube, light wavelength is 75W, 445 nm Kessil LEDs lights, The temperature of reaction system is controlled between 25°C and 30°C by box reactor and fan. ^{1}H NMR spectra were recorded on 400 MHz in $CDCl_3$, ^{13}C NMR spectra were recorded on 100 MHz in $CDCl_3$, ^{19}F NMR spectra were recorded on 376 MHz in $CDCl_3$ using TMS as internal standard. Melting points were determined on a microscopic apparatus and were uncorrected. All products were further characterized by HRMS (high resolution mass spectra). Copies of their ^{1}H NMR and ^{13}C NMR spectra were provided. The yield was calculated by GC-MS, with 0.1mmol dodecane as internal standard. The starting materials were purchased from Sigma-Aldrich, Acros, TCI, Adamas or J&K Chemicals and used without further purification.

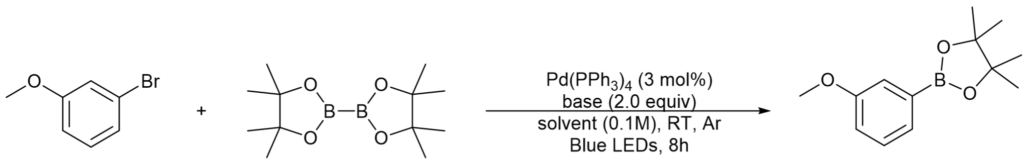
2. Optimization of Reaction Conditions of alkyl/aryl boronates



3a 3aa

entries	catalyst	ligand	solvent	base	Yield[a]
1	$Pd(OAc)_2$	PPh_3	DMF	K_3PO_4	43%
2	$Pd(OAc)_2$	PPh_3	THF	K_3PO_4	30%
3	$Pd(OAc)_2$	PPh_3	dioxane	K_3PO_4	36%
4	$Pd(OAc)_2$	PPh_3	PhMe	K_3PO_4	41%
5	$Pd(OAc)_2$	PPh_3	MeCN	K_3PO_4	54%
6	$Pd(OAc)_2$	Xantphos	MeCN	K_3PO_4	none
7	$Pd(OAc)_2$	DPEphos	MeCN	K_3PO_4	33%
8	$Pd(OAc)_2$	dipy	MeCN	K_3PO_4	none
9	$Pd(OAc)_2$	BINAP	MeCN	K_3PO_4	Trace
10	$Pd(OAc)_2$	PPh_3	MeCN	$CsCO_3$	28%
11	$Pd(OAc)_2$	PPh_3	MeCN	K_2CO_3	42%
12	$Pd(OAc)_2$	PPh_3	MeCN	^{t}BuOK	Trace
13	$Pd(OAc)_2$	PPh_3	MeCN	KOMe	33%
14	$Pd(OAc)_2$	PPh_3	MeCN	DBU	24%
15	**$Pd(PPh_3)_4$**	**-**	**MeCN**	**K_3PO_4**	**75%(55%[b])**
16	$Pd_2(dba)_3$	-	MeCN	K_3PO_4	none
17	$Pd(PPh_3)_2Cl_2$	-	MeCN	K_3PO_4	15%
18	-	-	MeCN	K_3PO_4	none
19	$Pd(PPh_3)_4$	-	MeCN	-	none
20[c]	$Pd(PPh_3)_4$	-	MeCN	K_3PO_4	none

a. Reaction conditions: 1a (0.2 mmol), catalyst (3 mol %), ligand (6 mol %), base (2.0 equiv), B_2pin_2 (2.0 equiv), solvent (2 mL), blue LEDs light, Ar, 25°C, 8h. The conversions and yields were determined by GC-MS using n-dodecane as an internal standard. b. Isolated yield. c. Without light.



entry	catalyst	solvent	base	Yield[a]
1	$Pd(PPh_3)_4$	MeCN	$CsCO_3$	42%
2	$Pd(PPh_3)_4$	THF	$CsCO_3$	0
3	$Pd(PPh_3)_4$	DCE	$CsCO_3$	0
4	$Pd(PPh_3)_4$	MeOH	$CsCO_3$	Trace
5	$Pd(PPh_3)_4$	DMF	$CsCO_3$	Trace
6	$Pd(PPh_3)_4$	DMA	$CsCO_3$	0
7	$Pd(PPh_3)_4$	MeCN	K_2CO_3	21%
8	$Pd(PPh_3)_4$	MeCN	K_3PO_4	52%
9	$Pd(PPh_3)_4$	MeCN	NaOAc	Trace
10	$Pd(PPh_3)_4$	MeCN	DBU	38%
11	$Pd(PPh_3)_4$	MeCN	NaO^tBu	20%
12	$Pd(PPh_3)_4$	MeCN	Et_3N	13%
13	$Pd(PPh_3)_4$	MeCN	-	Trace
14[b,c]	$Pd(PPh_3)_4$	MeCN	K_3PO_4	57%
15[b,d]	$Pd(PPh_3)_4$	MeCN	K_3PO_4	74%
16[b,e]	$Pd(PPh_3)_4$	MeCN	K_3PO_4	31%
17[b]	**$Pd(PPh_3)_4$**	**MeCN**	**K_3PO_4**	**95%(75%[f])**
18[b,g]	$Pd(PPh_3)_4$	MeCN	K_3PO_4	None

a) *Reactions were carried out using 0.2 mmol of aryl halide, catalyst (3 mol %), 2.0 equiv of B_2pin_2, 1.0 equiv of base in 2.0 mL of solvent. The yields were determined by GC-MS analysis versus a calibrated internal standard and are averages of two experiments. b) 2.0 equiv of base. c) 1.0 equiv of B_2pin_2. d) 3.0 equiv of B_2pin_2. e) MeCN:H_2O=19:1. f)Yield of isolated product. g) Without light.*

3. General Procedure for the Photooxidation boronizing of Aryl and Alkyl Halides (GP1)

In a 5.0 mL reaction tube with Teflon cover and magnetic stirring bar the alkyl/aryl bromides or chlorides **1a**-**3c, 4a, 4b** (0.2 mmol, 1.0 equiv), palladium catalyst (0.006 mmol, 3 mol %), Bis(pinacolato)diboronand (0.4 mmol, 2.0 equiv) and base (0.4 mmol, 2.0 equiv) were dissolved in 2.0 mL of dry MeCN. After degassing with argon by syringe needle for 5 minutes, the reaction mixture was then irradiated in reactor with cooling device using a 440 (± 15) nm LED (75 W) for 8 hours. The reaction progress was monitored by GC-MS analysis. After full conversion, the reaction mixture was transferred into a flask and concentrated in vacuum. Purification of the crude product was achieved by flash column chromatography using petroleum ether/ethyl acetate as eluents on silica gel.

4. General Procedure for the Photooxidation boronizing of the secondary and tertiary Alkyl Bromides (GP2)

In a 5.0 mL reaction tube with Teflon cover and magnetic stirring bar the secondary and tertiary alkyl bromides **3d**-**3h** (0.2 mmol, 1.0 equiv), palladium catalyst (0.006 mmol, 3 mol %), bis(catecholato)diboron (0.4

mmol, 2.0 equiv) and base (0.4 mmol, 2.0 equiv) were dissolved in 2.0 mL of dry MeCN. After degassing with argon by syringe needle for 5 minutes, the reaction mixture was then irradiated in reactor with cooling device using a 440 (± 15) nm LED (75 W) for 8 hours. The reaction progress was monitored by GC-MS analysis. After full conversion, a solution of pinacol (95 mg, 0.80 mmol) in triethylamine (0.7 mL) was added to the mixture. After 1 hour, water (15 mL) was added and the aqueous layer was extracted with ethyl acetate (3 x 15 mL). The combined organic layers were dried over $MgSO_4$, filtered and concentrated. The reaction mixture was added transferred into a flask and concentrated in vacuum. Purification of the crude product was achieved by flash column chromatography using petroleum ether/ethyl acetate as eluents on silica gel.

5. The synthesis procedure of compound 6aa, 6ba, 6ca and 6da

6aa: To a stirred solution of 2-napthaleneboronic acid pinacol ester (1.0 mmol, 1.0 equiv) in methanol or acetonitrile solvent (1 mL) was added Urea-Hydrogen peroxide (UHP) (1.0 mmol, 1.0 equiv) at room temperature and the progress of the reaction was monitored by TLC after 15 minutes. After completion, the reaction mixture was diluted with water and extracted with dichloromethane (DCM). The combined organic layer was dried over anhydrous sodium sulfate (Na_2SO_4). The resultant mixture was evaporated under reduced pressure and the residue was purified by flash column chromatography on a silica gel using the mixture of PE and EtOAc as eluents to give the product.

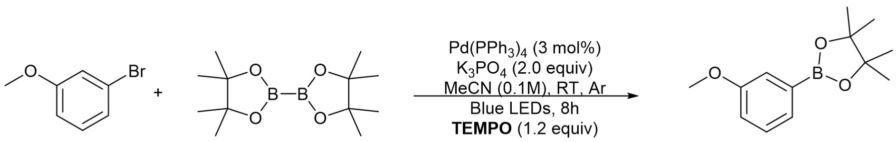
6ba: In a nitrogen-filled glovebox, a 10-mL vial was charged with 2-napthaleneboronic acid pinacol ester (0.2 mmol), LiOtBu (0.22 mmol, 1.1 equiv), LiI (0.10 mmol, 10 mol%), CuI (0.02 mmol, 5.0 mol%), DMI (0.3 mL), $PO(OMe)_3$ (0.22 mmol, 1.1 equiv) and a magnetic stir bar. The vial was sealed with a Teflon-lined cap. The reaction mixture was heated at 50ºC with stirring for 16 h in an aluminum block outside the glovebox. The reaction was quenched by H_2O (10 mL) and extracted with toluene (10 mL × 3). The organic layer was condensed, and the resultant mixture was evaporated under reduced pressure and the residue was purified by flash column chromatography on a silica gel using the mixture of PE and EtOAc as eluents to give the product.

6ca: 2-napthaleneboronic acid pinacol ester (0.4 mmol, 2.0 equiv), piperidine (0.20 mmol, 1 equiv), $Cu(OAc)_2$ (0.20 mmol, 1.0 equiv), Et_3N (0.40 mmol, 2.0 equiv) and powdered activated 4 Å molecular sieves (200 mg) in DCM (0.8 mL). After 24 h, the resultant mixture was evaporated under reduced pressure and the residue was purified by flash column chromatography on a silica gel using the mixture of PE and EtOAc as eluents to give the product.

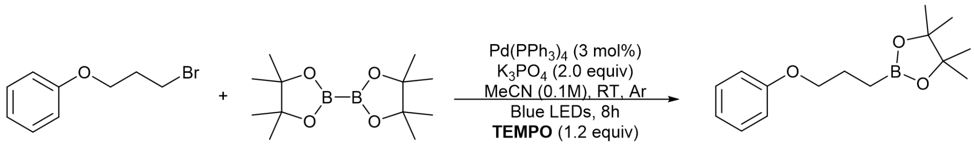
6da: To an oven-dried Schlenck tube was charged 2-napthaleneboronic acid pinacol ester (1.5 mmol, 2.0 equiv.), N,N'-dimethylenediamine (0.9 mmol, 1.2 equiv.), Cu_2O (0.3 mmol, 40 mol%), and a magnetic bar. The tube was evacuated three times under vacuum and backfilled with O_2, and then connected to an oxygen balloon via a needle. Dried CH_3CN (3 mL) and TMSCN (0.75 mmol, 1.0 equiv.) were injected via syringe. The mixture was stirred at 25ºC for 12 h. The resultant mixture was evaporated under reduced pressure and the residue was purified by flash column chromatography on a silica gel using the mixture of PE and EtOAc as eluents to give the product.

6. Mechanism characterization

a) Radical capture experiments



1g **1ga**, 0%



3a **3aa**, 0%

For aryl and alkyl halides, boronizing products could be totally inhibited.

b) Turn on/off experiments

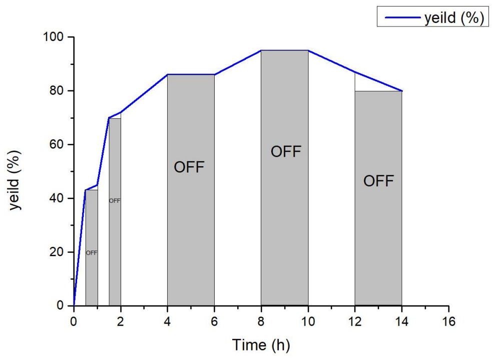


Figure 1. Turn on/off experiment of 3-bromoanisole with GC-MS and used dodecane (0.1 mmol) as standard.

c) Fluorescence quenching experiments

Rates of quenching (K_{sv}) were determined using Stern–Volmer plot, and R-Square is fitting index.

$$I_0/I = 1+k_{sv}C_q$$

$$K_q = K_{sv}/\tau_0$$

These experiments were performed using CH_3CN as solvent. Before theFluorescence quenching experiments, the emission spectrum experiment which is mixed solution of $Pd(PPh_3)_4$ (0.01mmol) in CH_3CN(5.0 mL) was measured and get the maximum λ_{max} = 410 nm. The Stern-Volmer plots indicated a process of decreasing fluorescence intensity caused by the interaction between the added substances and the fluorescence molecules. In other words, the fluorescence intensity decreased as the concentration of the added substances increased. Three different conditions were tested by fluorescence quenching experiments, and the S-V plots were obtained through origin.

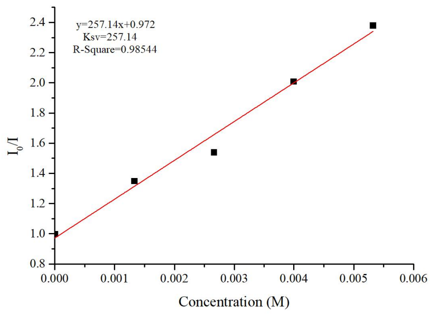


Figure 2. Fluorescence quenching plots of mixed solution $Pd(PPh_3)_4$ (2.00× 10^{-3} M) and 3-bromoanisole (0 M, 1.30 × 10^{-3} M, 2.60× 10^{-3} M, 3.90 × 10^{-3} M, 5.20 × 10^{-3} M) in MeCN. Stern–Volmer plots of the mixed solution of $Pd(PPh_3)_4$ and 3-bromoanisole are presented. I_0 is the luminescence intensity without the quencher, and I is the intensity with the quencher. K_{sv}=257.14

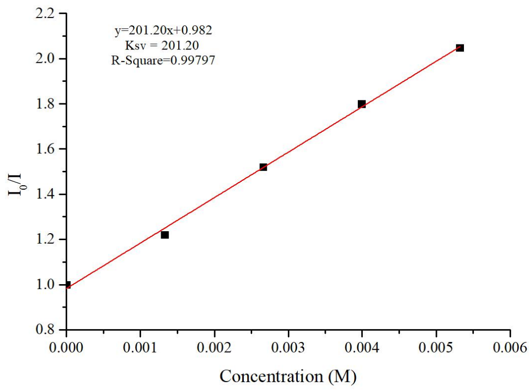
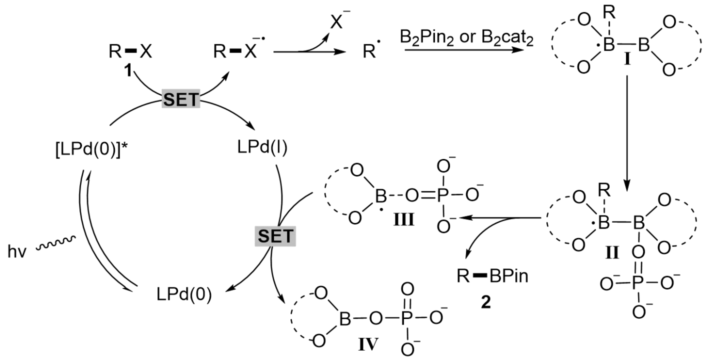
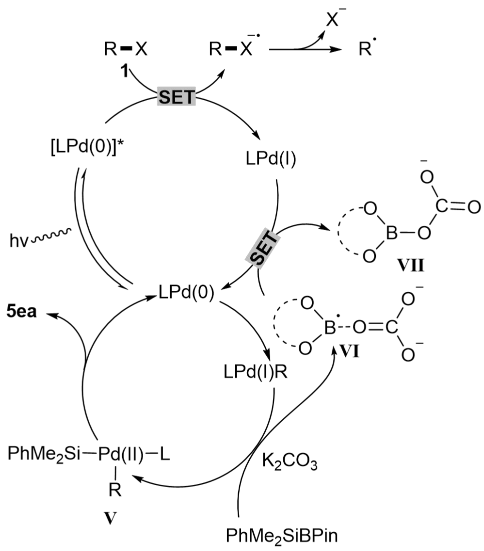


Figure 3. Fluorescence quenching plots of mixed solution $Pd(PPh_3)_4$ (2.00× 10^{-3} M) and 3-phenoxypropyl bromide (0 M, 1.30 × 10^{-3} M, 2.60 × 10^{-3} M, 3.90 × 10^{-3} M, 5.20 × 10^{-3} M) in MeCN. Stern–Volmer plots of the mixed solution of $Pd(PPh_3)_4$ and 3-phenoxypropyl bromide are presented. I_0 is the luminescence intensity of the solvent without quencher, and I represents the intensity after adding the indicated concentration of the corresponding quencher. K_{sv}=201.20

d) Propose mechanism

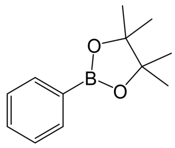


a) proposed mechanism of boronylation



b) Proposed mechanism of silylation.

7. Characterization Data of Products

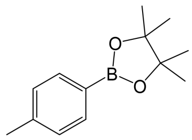


1aa: according to **GP1**; Colorless oil; Eluent: petroleum ether/EtOAc = 25/1;

^{1}H NMR (400 MHz, $CDCl_3$, δ ppm) 7.82-7.80 (m, 2H), 7.48-7.44 (m, 1H), 7.39-7.34 (m, 2H), 1.35 (s, 12H);

^{13}C NMR (100 MHz, $CDCl_3$, δ ppm) 134.7, 131.2, 127.7, 83.8, 24.9;

Carbon bearing boron not observed. The chemical shifts were consistent with those reported in the literature, CAS: 24388-23-6.[1]

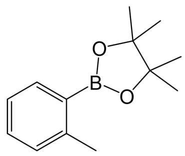


1ba: according to **GP1**; Colorless oil; Eluent: petroleum ether/EtOAc = 25/1;

^{1}H NMR (400 MHz, $CDCl_3$, δ ppm) 7.71-7.69 (d, *J* = 7.8 Hz, 2H), 7.19-7.17 (d, *J* = 7.6 Hz, 2H), 2.36 (s, 3H), 1.33 (s, 12H);

^{13}C NMR (100 MHz, $CDCl_3$, δ ppm) 141.4, 134.8, 128.5, 83.6, 24.8, 21.7;

Carbon bearing boron not observed. The chemical shifts were consistent with those reported in the literature, CAS: 195062-57-8. [1]

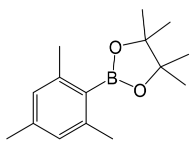


1ca: according to **GP1**; Colorless oil; Eluent: petroleum ether/EtOAc = 25/1;

^{1}H NMR (400 MHz, $CDCl_3$, δ ppm) 7.77-7.75 (d, *J* = 7.8Hz, 1H), 7.33-7.29 (m, 1H), 7.17-7.14 (m, 2H), 2.54 (s, 3H), 1.34 (s, 12H);

^{13}C NMR (100 MHz, $CDCl_3$, δ ppm) 144.8, 135.8, 130.7, 129.7, 124.7, 83.4, 24.9, 22.2;

Carbon bearing boron not observed. The chemical shifts were consistent with those reported in the literature, CAS: 195062-59-0. [1]

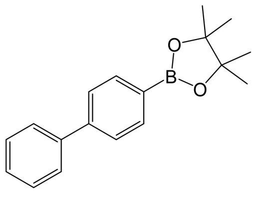


1da: according to **GP1**; Colorless oil; Eluent: petroleum ether/EtOAc = 25/1;

^{1}H NMR (400 MHz, $CDCl_3$, δ ppm) 6.77 (s, 2H), 2.36 (s, 6H), 2.24 (s, 3H), 1.37 (s, 12H);

^{13}C NMR (100 MHz, $CDCl_3$, δ ppm) 142.1, 138.9, 127.4, 83.4, 24.9, 22.2, 21.2;

Carbon bearing boron not observed. The chemical shifts were consistent with those reported in the literature, CAS: 171364-84-4. [1]

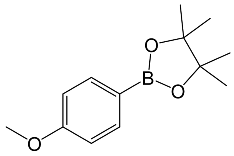


1ea: according to **GP1**; White solid; Eluent: petroleum ether/EtOAc = 25/1;

^{1}H NMR (400 MHz, $CDCl_3$, δ ppm) 7.90-7.88 (d, *J* = 8.1 Hz, 2H), 7.62-7.60 (d, *J* = 7.8 Hz, 4H), 7.44-7.40 (t, *J* = 7.5 Hz, 2H), 7.35-7.32 (t, *J* = 7.3 Hz, 1H), 1.35 (s, 12H);

^{13}C NMR (100 MHz, $CDCl_3$, δ ppm) 143.8, 141.0, 135.2, 128.7, 127.5, 127.2, 126.4, 83.8, 24.8;

Carbon bearing boron not observed. The chemical shifts were consistent with those reported in the literature, CAS: 144432-80-4. [3]

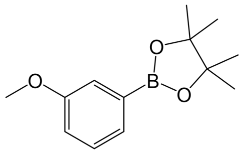


1fa: according to **GP1**; Colorless oil; Eluent: petroleum ether/EtOAc = 25/1;

^{1}H NMR (400 MHz, $CDCl_3$, δ ppm) 7.77-7.75 (m, 1H), 6.90-6.88 (m, 1H), 3.82 (s, 3H), 1.33 (s, 12H);

^{13}C NMR (100 MHz, $CDCl_3$, δ ppm) 162.1, 136.5, 113.3, 83.5, 55.0, 24.8;

Carbon bearing boron not observed. The chemical shifts were consistent with those reported in the literature, CAS: 171364-79-7. [1]

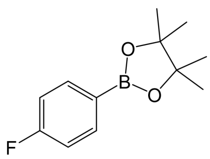


1ga: according to **GP1**; Colorless oil; Eluent: petroleum ether/EtOAc = 25/1;

^{1}H NMR (400 MHz, $CDCl_3$, δ ppm) 7.41-7.39 (m, 1H), 7.33-7.28 (m, 2H), 7.02-7.00 (m, 1H), 3.83 (s, 3H), 1.35 (s, 12H);

^{13}C NMR (100 MHz, $CDCl_3$, δ ppm) 159.0, 128.9, 127.2, 118.7, 117.9, 83.8, 55.2, 24.9;

Carbon bearing boron not observed. The chemical shifts were consistent with those reported in the literature, CAS: 325142-84-5. [3]



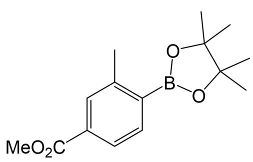
1ha: according to **GP1**; Colorless oil; Eluent: petroleum ether/EtOAc = 25/1;

^{1}H NMR (400 MHz, $CDCl_3$, δ ppm) 7.82-7.77 (m, 2H), 7.07-7.02 (m, 2H), 1.34 (s, 12H);

^{13}C NMR (100 MHz, $CDCl_3$, δ ppm) 165.07 (d, J_{C-F} = 248.0 Hz), 137.0, 136.9, 114.9, 114.7, 83.9, 24.9;

^{19}F NMR (376 MHz, $CDCl_3$, δ ppm) -108.44;

Carbon bearing boron not observed. The chemical shifts were consistent with those reported in the literature, CAS: 214360-58-4. [1]

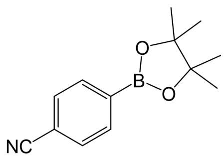


1ia: according to **GP1**; White solid; Eluent: petroleum ether/EtOAc = 25/1;

^{1}H NMR (400 MHz, $CDCl_3$, δ ppm) 7.82-7.80 (m, 3H), 3.91 (s, 3H), 2.57 (s, 3H), 1.36 (s, 12H);

^{13}C NMR (100 MHz, $CDCl_3$, δ ppm) 167.3, 144.9, 135.7, 131.7, 130.4, 125.5, 83.8, 52.1, 24.9, 22.1;

Carbon bearing boron not observed. The chemical shifts were consistent with those reported in the literature, CAS: 473596-87-1. [4]

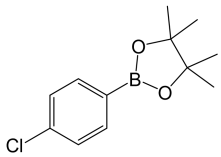


1ja: according to **GP1**; Colorless oil; Eluent: petroleum ether/EtOAc = 25/1;

^{1}H NMR (400 MHz, $CDCl_3$, δ ppm) 7.90-7.88 (d, *J* = 8.1 Hz, 2H), 7.65-7.63 (d, *J* = 8.2 Hz, 2H), 1.35 (s, 12H);

^{13}C NMR (100 MHz, $CDCl_3$, δ ppm) 135.0, 131.1, 118.8, 114.5, 84.4, 24.8;

Carbon bearing boron not observed. The chemical shifts were consistent with those reported in the literature, CAS: 171364-82-2. [1]

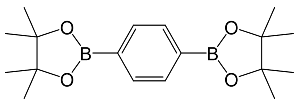


1ka: according to **GP1**; Colorless oil; Eluent: petroleum ether/EtOAc = 25/1;

^{1}H NMR (400 MHz, $CDCl_3$, δ ppm) 7.74-7.72 (m, 2H), 7.35-7.33 (m, 2H), 1.34 (s, 12H);

^{13}C NMR (100 MHz, $CDCl_3$, δ ppm) 137.5, 136.1, 128.0, 84.0, 24.9;

Carbon bearing boron not observed. The chemical shifts were consistent with those reported in the literature, CAS: 195062-61-4. [1]

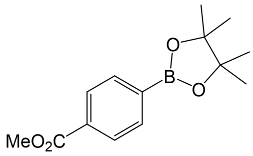


1kb: according to **GP1**; White solid; Eluent: petroleum ether/EtOAc = 25/1;

^{1}H NMR (400 MHz, $CDCl_3$, δ ppm) 7.80 (s, 4H), 1.35 (s, 24H);

^{13}C NMR (100 MHz, $CDCl_3$, δ ppm) 133.9, 83.8, 24.9;

Carbon bearing boron not observed. The chemical shifts were consistent with those reported in the literature, CAS: 99770-93-1. [1]

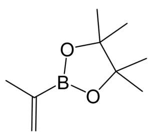


1la: according to **GP1**; White solid; Eluent: petroleum ether/EtOAc = 25/1;

^{1}H NMR (400 MHz, $CDCl_3$, δ ppm) 8.03-8.01 (d, *J* = 8.1 Hz, 2H), 7.88-7.86 (d, *J* = 8.1 Hz, 2H), 3.93 (s, 3H), 1.36 (s, 12H);

^{13}C NMR (100 MHz, $CDCl_3$, δ ppm) 167.1, 134.6, 132.3, 128.6, 84.2, 52.2, 24.9;

Carbon bearing boron not observed. The chemical shifts were consistent with those reported in the literature, CAS: 171364-80-0. [1]

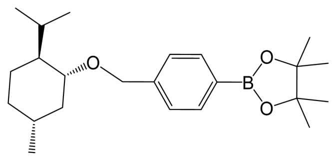


1ma: according to **GP1**; Colorless oil; Eluent: petroleum ether/EtOAc = 25/1;

^{1}H NMR (400 MHz, $CDCl_3$, δ ppm) 5.76-5.63 (m, 2H), 1.82 (t, J = 1.5 Hz, 3H), 1.27 (s, 12H);

^{13}C NMR (100 MHz, $CDCl_3$, δ ppm) 130.0, 83.4, 24.8, 21.2;

Carbon bearing boron not observed. The chemical shifts were consistent with those reported in the literature, CAS: 126726-62-3.



1na: according to **GP1**; White solid; Eluent: petroleum ether/EtOAc = 25/1;

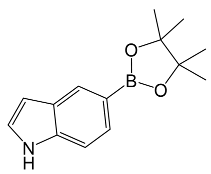
^{1}H NMR (400 MHz, $CDCl_3$, δ ppm) 7.78-7.77 (d, J = 8.0 Hz, 2H), 7.35-7.33 (d, J = 8.0 Hz, 2H), 4.68-4.65 (d, J = 12.0 Hz, 1H), 4.44-4.41 (d, J = 12.0 Hz, 1H), 3.19-3.12 (m, 1H), 2.33-2.25 (m, 1H), 2.20-2.14 (m, 1H), 1.67-1.60 (m, 2H), 1.34 (s, 12H), 1.32-1.25 (m, 2H), 0.94-0.86 (dd, J_1 = 13.7 Hz, J_2 = 6.8 Hz, 8H), 0.71-0.69 (d, J = 6.9 Hz, 3H);

^{13}C NMR (100 MHz, $CDCl_3$, δ ppm) 142.4, 134.8, 126.9, 83.7, 78.8, 70.2, 48.3, 40.3, 34.6, 31.5, 25.5, 24.9, 24.8, 23.3, 22.4, 21.0, 16.1;

IR: 2977.1, 2925.7, 2868.5, 1454.5, 1281.7, 1170.7, 1123.9, 851.4.

HRMS (ESI+) m/z 373.2919 (373.2909 calcd for $C_{23}H_{37}BO_3$+, [M+H]+)

Carbon bearing boron not observed.

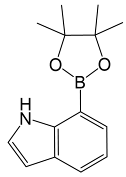


2aa: according to **GP1**; Pale brown soild; Eluent: petroleum ether/EtOAc = 25/1;

^{1}H NMR (400 MHz, $CDCl_3$, δ ppm) 8.26 (s, 1H), 8.19 (s, 1H), 7.65-7.63 (d, J = 8.2 Hz, 1H), 7.35-7.33 (d, J = 8.2 Hz, 1H), 7.15-7.13 (m, 1H), 6.55-6.54 (m, 1H), 1.36 (s, 12H);

^{13}C NMR (100 MHz, $CDCl_3$, δ ppm) 137.8, 128.6, 128.0, 127.6, 124.2, 110.5, 103.0, 83.4, 24.9;

Carbon bearing boron not observed. The chemical shifts were consistent with those reported in the literature, CAS: 269410-24-4; CCDC: No.2000793. [1]

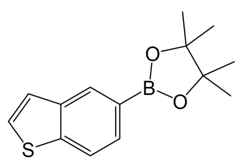


2ba: according to **GP1**; Pale brown soild; Eluent: petroleum ether/EtOAc = 25/1;

^{1}H NMR (400 MHz, $CDCl_3$, δ ppm) 9.23 (s, 1H), 7.78-7.75 (m, 1H), 7.66-7.64 (m, 1H), 7.26-7.24 (m, 1H), 7.15-7.10 (m, 1H), 6.55-6.53 (m, 1H), 1.38 (s, 12H);

^{13}C NMR (100 MHz, $CDCl_3$, δ ppm) 140.9, 129.2, 126.8, 124.2, 124.1, 119.2, 101.9, 83.8, 24.97, 24.82;

Carbon bearing boron not observed. The chemical shifts were consistent with those reported in the literature, CAS: 642494-37-9. [5]

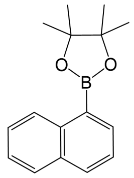


2ca: according to **GP1**; White solid; Eluent: petroleum ether/EtOAc = 25/1;

^{1}H NMR (400 MHz, $CDCl_3$, δ ppm) 8.31 (s, 1H), 7.90-7.88 (m, 1H), 7.76-7.74 (m, 1H), 7.42-7.41 (d, *J* = 5.5 Hz, 1H), 7.36-7.34 (m, 1H), 1.37 (s, 12H);

^{13}C NMR (100 MHz, $CDCl_3$, δ ppm) 142.7, 139.2, 130.7, 129.7, 126.0, 124.1, 121.8, 83.8, 24.9;

Carbon bearing boron not observed. The chemical shifts were consistent with those reported in the literature, CAS: 501945-71-7. [5]

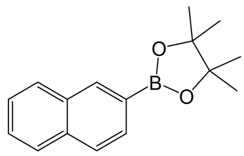


2da: according to **GP1**; White solid; Eluent: petroleum ether/EtOAc = 25/1;

^{1}H NMR (400 MHz, $CDCl_3$, δ ppm) 8.78-8.76 (d, *J* = 8.3 Hz, 1H), 8.09-8.07 (d, *J* = 8.2 Hz, 1H), 7.93-7.91 (d, *J* = 8.3 Hz, 1H), 7.83-7.81 (d, *J* = 7.9 Hz, 1H), 7.55-7.51 (m, 1H), 7.48-7.44 (m, 2H), 1.41 (s, 12H);

^{13}C NMR (100 MHz, $CDCl_3$, δ ppm) 136.9, 135.6, 133.2, 131.6, 128.4, 128.3, 126.3, 125.6, 124.9, 83.7, 24.9;

Carbon bearing boron not observed. The chemical shifts were consistent with those reported in the literature, CAS: 68716-52-9. [2]

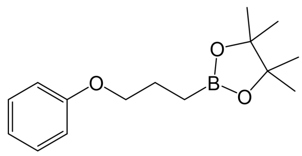


2ea: according to **GP1**; White solid; Eluent: petroleum ether/EtOAc = 25/1;

^{1}H NMR (400 MHz, $CDCl_3$, δ ppm) 8.38 (s, 1H), 7.89-7.81 (m, 4H), 7.52-7.44 (m, 2H), 1.38 (s, 12H);

^{13}C NMR (100 MHz, $CDCl_3$, δ ppm) 136.2, 135.0, 132.8, 130.4, 128.6, 127.7, 127.0, 126.9, 125.8, 83.9, 24.9;

Carbon bearing boron not observed. The chemical shifts were consistent with those reported in the literature, CAS: 256652-04-7. [3]

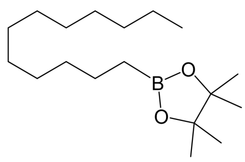


3aa: according to **GP1**; Colorless oil; Eluent: petroleum ether/EtOAc = 25/1;

^{1}H NMR (400 MHz, $CDCl_3$, δ ppm) 7.28-7.24 (m, 2H), 6.94-6.89 (m, 3H), 3.95-3.92 (t, *J* = 6.7 Hz, 2H), 1.93-1.86 (m, 2H), 1.25 (s, 12H), 0.94-0.90 (t, *J* = 7.9 Hz, 2H);

^{13}C NMR (100 MHz, $CDCl_3$, δ ppm) 159.1, 129.3, 120.3, 114.6, 83.1, 69.5, 24.8, 23.8;

Carbon bearing boron not observed. The chemical shifts were consistent with those reported in the literature, CAS: 177950-03-7. [6]

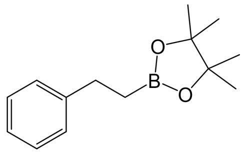


3ba: according to **GP1**; Colorless oil; Eluent: petroleum ether/EtOAc = 25/1;

^{1}H NMR (400 MHz, $CDCl_3$, δ ppm) 1.25-1.24 (m, 32H), 0.89-0.86 (t, *J* = 6.8 Hz, 3H), 0.78-0.74 (t, *J* = 7.7 Hz, 2H);

^{13}C NMR (100 MHz, $CDCl_3$, δ ppm) 82.8, 32.4, 31.9, 29.7, 29.7, 29.6, 29.4, 29.4, 24.8, 24.0, 22.7, 14.1;

Carbon bearing boron not observed. The chemical shifts were consistent with those reported in the literature, CAS: 177035-82-4. [7]

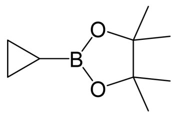


3ca: according to **GP1**; Colorless oil; Eluent: petroleum ether/EtOAc = 25/1;

^{1}H NMR (400 MHz, $CDCl_3$, δ ppm) 7.28-7.20 (m, 4H), 7.17-7.13 (m, 1H), 2.77-7.72 (t, *J* = 8.2 Hz, 2H), 1.22 (s, 12H), 1.16-1.12 (t, *J* = 8.2 Hz, 2H);

^{13}C NMR (100 MHz, $CDCl_3$, δ ppm) 144.4, 128.2, 128.0, 125.5, 83.1, 29.9, 24.8;

Carbon bearing boron not observed. The chemical shifts were consistent with those reported in the literature, CAS: 165904-22-3. [6]

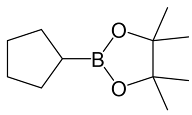


3da: according to **GP2**; Colorless oil; Eluent: petroleum ether/EtOAc = 25/1;

^{1}H NMR (400 MHz, $CDCl_3$, δ ppm) 1.22 (s, 12H), 0.65-0.58 (m, 2H), 0.53-0.48 (m, 2H), -0.15- -0.23 (m, 1H);

^{13}C NMR (100 MHz, $CDCl_3$, δ ppm) 82.8, 24.7, 3.8;

Carbon bearing boron not observed. The chemical shifts were consistent with those reported in the literature, CAS: 126689-01-8. [8]

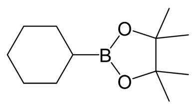


3ea: according to **GP2**; Colorless oil; Eluent: petroleum ether/EtOAc = 25/1;

^{1}H NMR (400 MHz, $CDCl_3$, δ ppm) 1.71-1.62 (m, 2H), 1.54-1.35 (m, 6H), 1.17 (s, 12H), 1.15-1.04 (m, 1H);

^{13}C NMR (100 MHz, $CDCl_3$, δ ppm) 82.7, 28.5, 26.8, 24.7;

Carbon bearing boron not observed. The chemical shifts were consistent with those reported in the literature, CAS: 66217-55-8. [8]

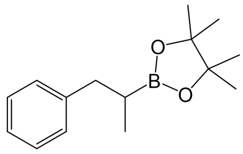


3fa: according to **GP2**; Colorless oil; Eluent: petroleum ether/EtOAc = 25/1;

^{1}H NMR (400 MHz, $CDCl_3$, δ ppm) 1.68-1.57 (m, 5H), 1.35-1.23 (m, 5H), 1.23 (s, 12H), 0.98 (s, 1H);

^{13}C NMR (100 MHz, $CDCl_3$, δ ppm) 82.7, 27.9, 27.1, 26.7, 24.7;

Carbon bearing boron not observed. The chemical shifts were consistent with those reported in the literature, CAS: 87100-15-0. [8]

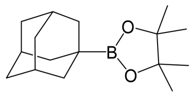


3ga: according to **GP2**; Colorless oil; Eluent: petroleum ether/EtOAc = 25/1;

^{1}H NMR (400 MHz, $CDCl_3$, δ ppm) 7.26-7.23 (m, 2H), 7.20-7.19 (m, 2H), 7.17-7.13 (m, 1H), 5.30 (s, 1H) 2.83-2.51 (m, 2H), 1.19-1.18 (d, *J* = 4.6 Hz, 12H), 0.97-0.95 (d, *J* = 7.4 Hz, 3H);

^{13}C NMR (100 MHz, $CDCl_3$, δ ppm) 142.3, 128.9, 128.0, 125.5, 83.0, 38.9, 24.7, 24.7, 15.2;

Carbon bearing boron not observed, CAS: 916658-74-7. [8]

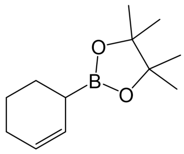


3ha: according to **GP2**; White solid; Eluent: petroleum ether/EtOAc = 25/1;

^{1}H NMR (400 MHz, $CDCl_3$, δ ppm) 1.85 (s, 3H), 1.75 (d, *J* = 3.1 Hz, 12H), 1.21 (s, 12H);

^{13}C NMR (100 MHz, $CDCl_3$, δ ppm) 82.6, 38.0, 37.5, 27.6, 24.6;

Carbon bearing boron not observed. The chemical shifts were consistent with those reported in the literature, CAS: 1357000-33-9. [8]

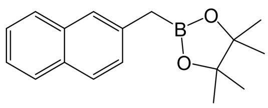


4aa: according to **GP1**; Colorless oil; Eluent: petroleum ether/EtOAc = 25/1;

^{1}H NMR (400 MHz, $CDCl_3$, δ ppm) 5.74-5.64 (m, 2H), 2.01-1.96 (m, 2H), 1.80-1.73 (m, 2H), 1.69-1.57 (m, 3H), 1.25 (s, 12H);

^{13}C NMR (100 MHz, $CDCl_3$, δ ppm) 127.6, 126.0, 83.1, 25.0, 24.8, 24.7, 24.1, 22.5;

Carbon bearing boron not observed, CAS: 167773-14-0. [8]

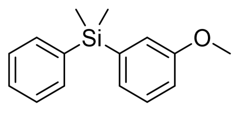


4ba: according to **GP1**; White solid; Eluent: petroleum ether/EtOAc = 25/1;

^{1}H NMR (400 MHz, $CDCl_3$, δ ppm) 7.78-7.71 (m, 3H), 7.61 (m, 1H), 7.41-7.32 (m, 3H), 2.45 (s, 2H), 1.22 (s, 12H);

^{13}C NMR (100 MHz, $CDCl_3$, δ ppm) 136.3, 133.8, 131.4, 128.2, 127.6, 127.5, 127.2, 126.6, 125.6, 124.6, 83.5, 24.7;

Carbon bearing boron not observed. The chemical shifts were consistent with those reported in the literature, CAS: 1379610-55-5. [9]

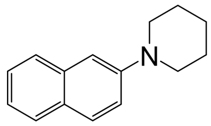


5ea: White solid; Eluent: petroleum ether/EtOAc = 25/1;

^{1}H NMR (400 MHz, $CDCl_3$, δ ppm) 7.54-7.50 (m, 2H), 7.36-7.33 (m, 3H), 7.11-7.09 (m, 1H), 7.06-7.05 (m, 1H), 6.91-6.88 (m, 1H), 3.77 (s, 3H), 0.54 (s, 6H);

^{13}C NMR (100 MHz, $CDCl_3$, δ ppm) 159.0, 139.9, 138.1, 134.1, 129.1, 129.0, 127.8, 126.4, 119.8, 114.2, 55.0, -2.4;

The chemical shifts were consistent with those reported in the literature, CAS: 1006715-18-9. [10]

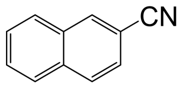


6aa: White solid; Eluent: petroleum ether/EtOAc = 25/1

^{1}H NMR (400 MHz, $CDCl_3$, δ ppm) 7.71-7.66 (m, 3H), 7.39-7.35 (m, 1H), 7.29-7.24 (m, 2H), 7.12-7.11 (d, *J* = 2.4 Hz, 1H), 3.26-3.24 (m, 4H), 1.79-1.73 (m, 4H), 1.64-1.58 (m, 2H);

^{13}C NMR (100 MHz, $CDCl_3$, δ ppm) 150.1, 134.7, 128.5, 128.3, 127.4, 126.6, 126.1, 123.1, 120.2, 110.3, 51.0, 25.9, 24.4;

CAS: 5465-85-0.

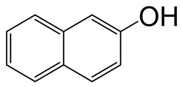


6ba: White solid; Eluent: petroleum ether/EtOAc = 50/1

^{1}H NMR (400 MHz, $CDCl_3$, δ ppm) 8.18 (s, 1H), 7.98-7.93 (m, 2H), 7.90-7.88 (m, 2H), 7.55-7.48 (m, 2H);

^{13}C NMR (100 MHz, $CDCl_3$, δ ppm) 138.4, 133.7, 132.7, 128.5, 128.2, 127.8, 127.7, 126.4, 126.1, 126.0, 125.7;

CAS: 613-46-7.

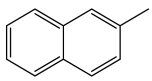


6ca: White solid; Eluent: petroleum ether/EtOAc = 25/1

^{1}H NMR (400 MHz, MeOD, δ ppm) 7.71-7.68 (m, 2H), 7.63-7,61 (m, 1H), 7.37-7.33 (m, 1H), 7.25-7.21 (m, 1H), 7.13-7.12 (m, 1H), 7.10-7.07 (m, 1H), 4.92 (s, 1H);

^{13}C NMR (100 MHz, MeOD, δ ppm) 156.3, 136.4, 130.4, 129.9, 128.6, 127.1, 127.1, 123.9, 119.2, 109.9;

CAS: 135-19-3.



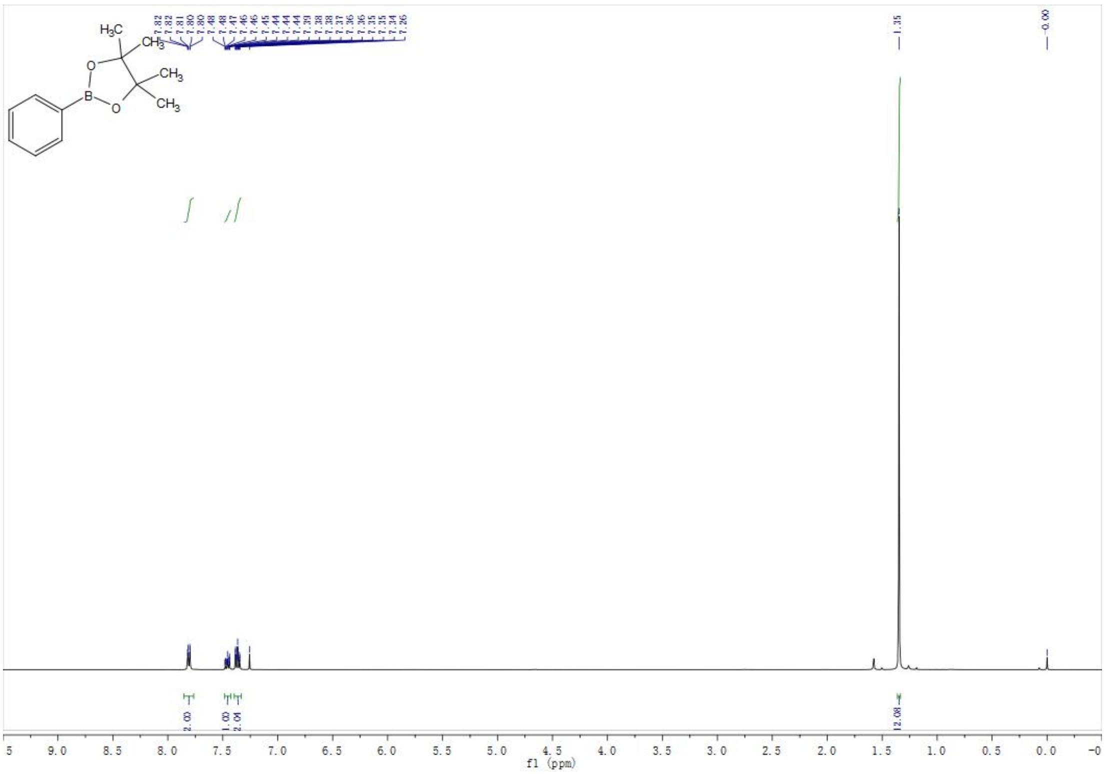
6da: White solid; Eluent: petroleum ether

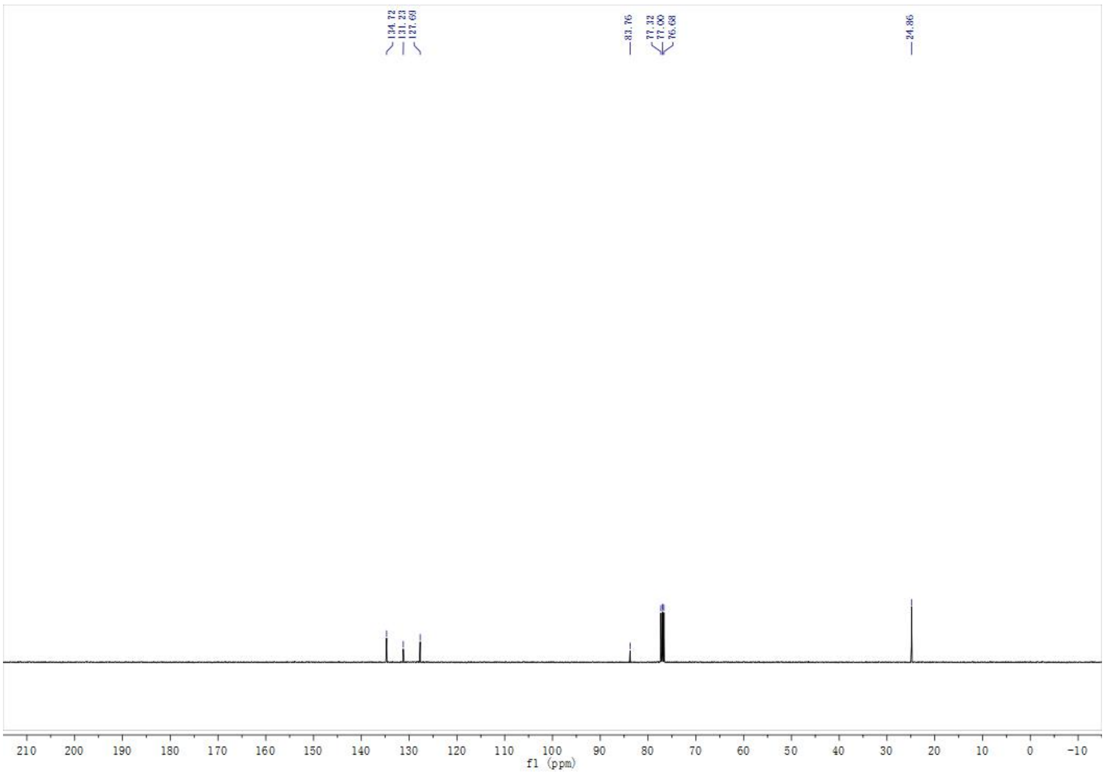
^{1}H NMR (400 MHz, $CDCl_3$, δ ppm) 7.81-7.79 (m, 1H), 7.76-7.74 (m, 2H), 7.62 (s, 1H), 7.44-7.40 (m, 2H), 7.33-7.31 (m, 1H), 2.52 (s, 3H);

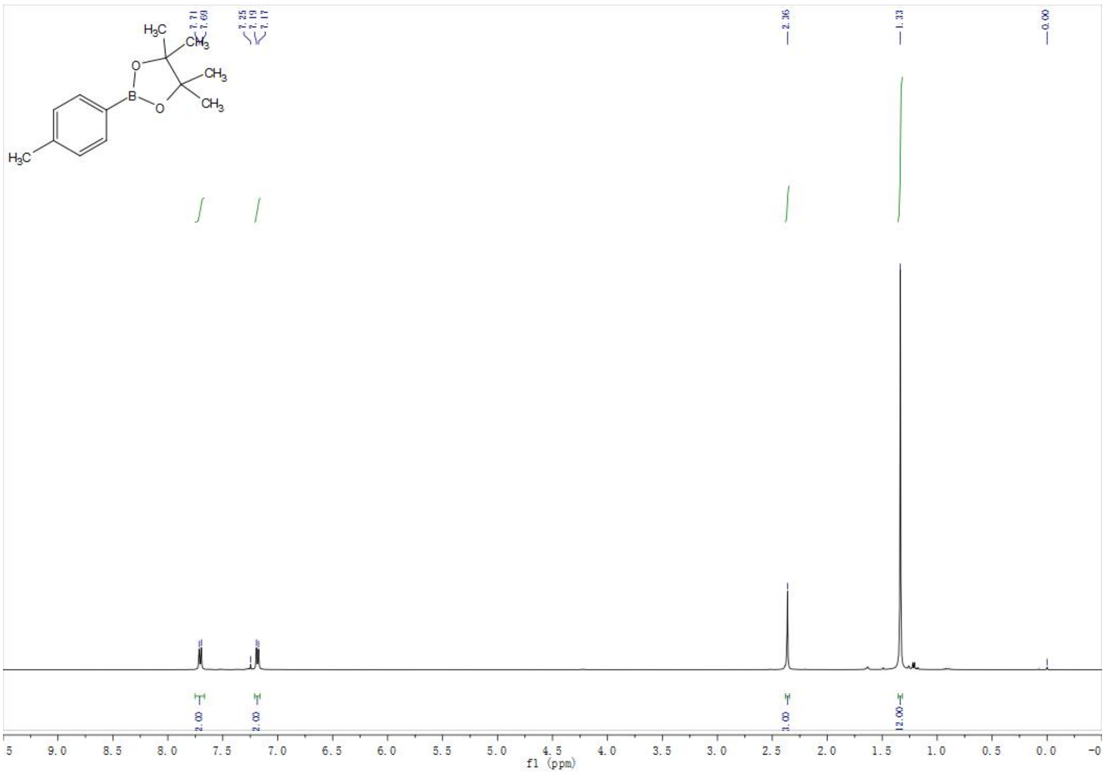
^{13}C NMR (100 MHz, $CDCl_3$, δ ppm) 138.4, 133.7, 132.7, 128.5, 127.7, 127.6, 127.2, 126.8, 125.7, 124.9, 29.7;

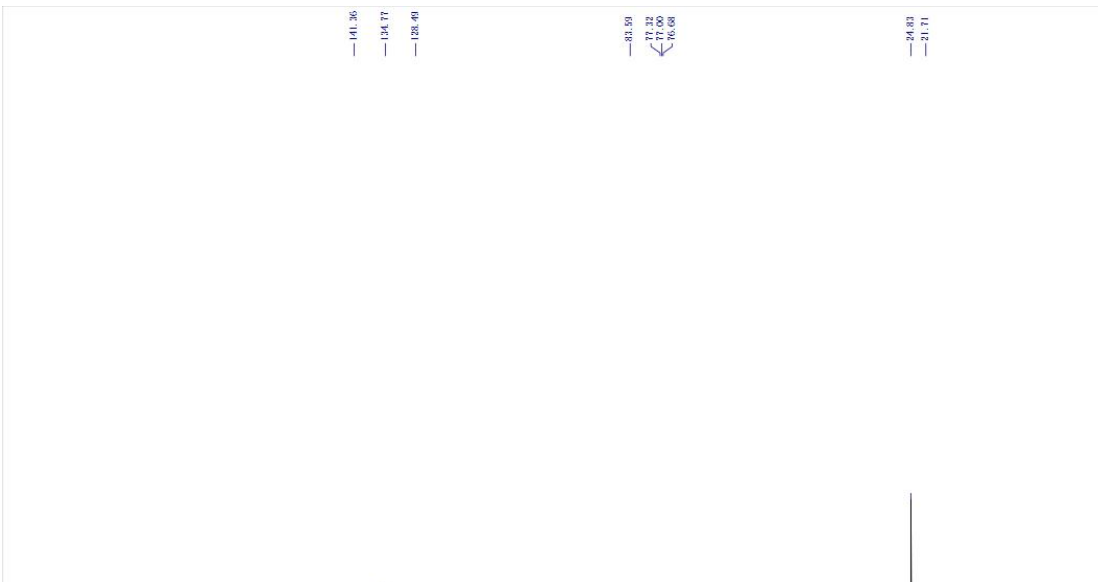
CAS: 91-57-6.

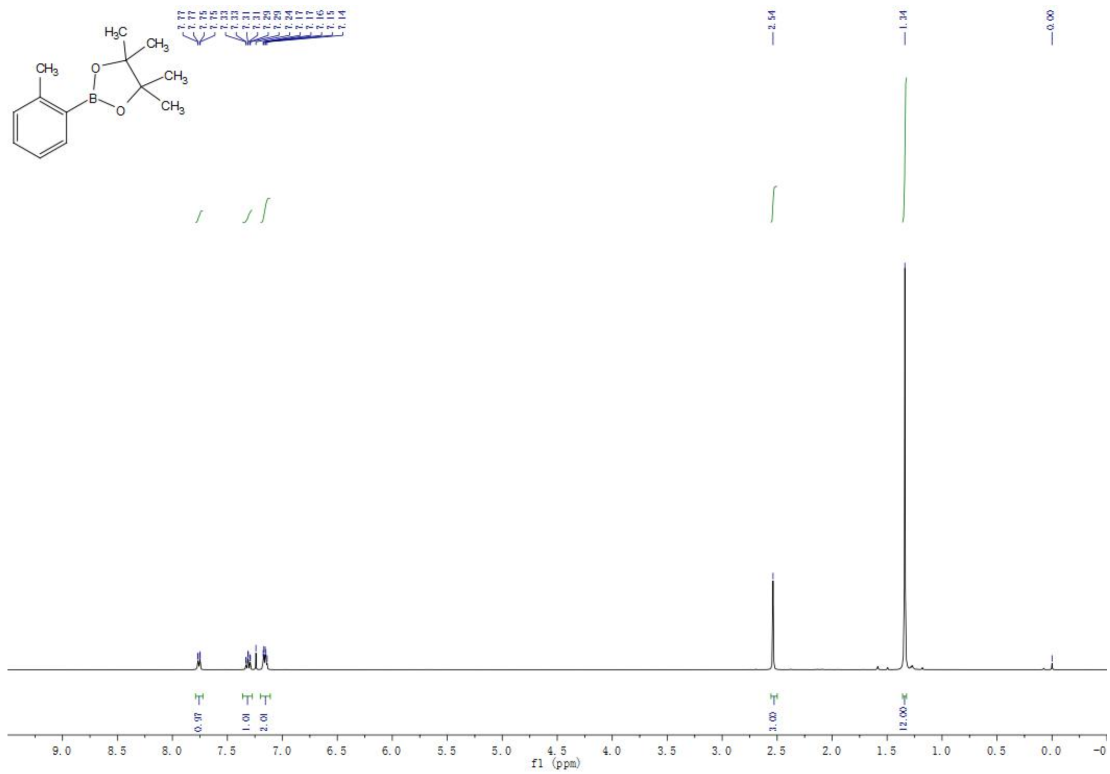
8. **NMR Spectra data for Products:**

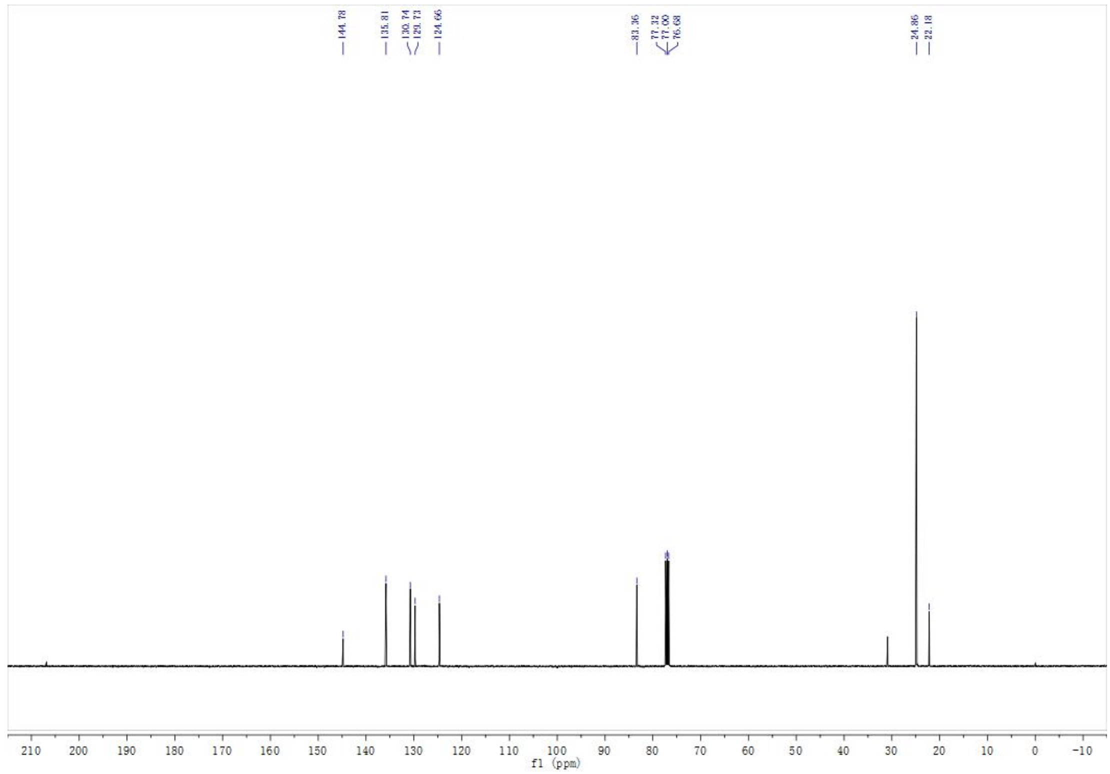





7.71
7.69
7.25
7.19
7.17
2.36
1.33
0.00
2.00
2.00
3.00
12.00
f1 (ppm)


141.36
134.77
128.49
83.59
77.32
77.00
76.68
24.83
21.71
f1 (ppm)


CH3
H3C
CH3
CH3
CH3
O
B
O
7.77 7.77 7.75 7.75 7.33 7.33 7.31 7.31 7.29 7.29 7.24 7.17 7.16 7.15 7.14
2.54
1.34
0.00
0.97
1.01
2.01
3.00
12.00
9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0
f1 (ppm)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135.81
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129.73
124.66
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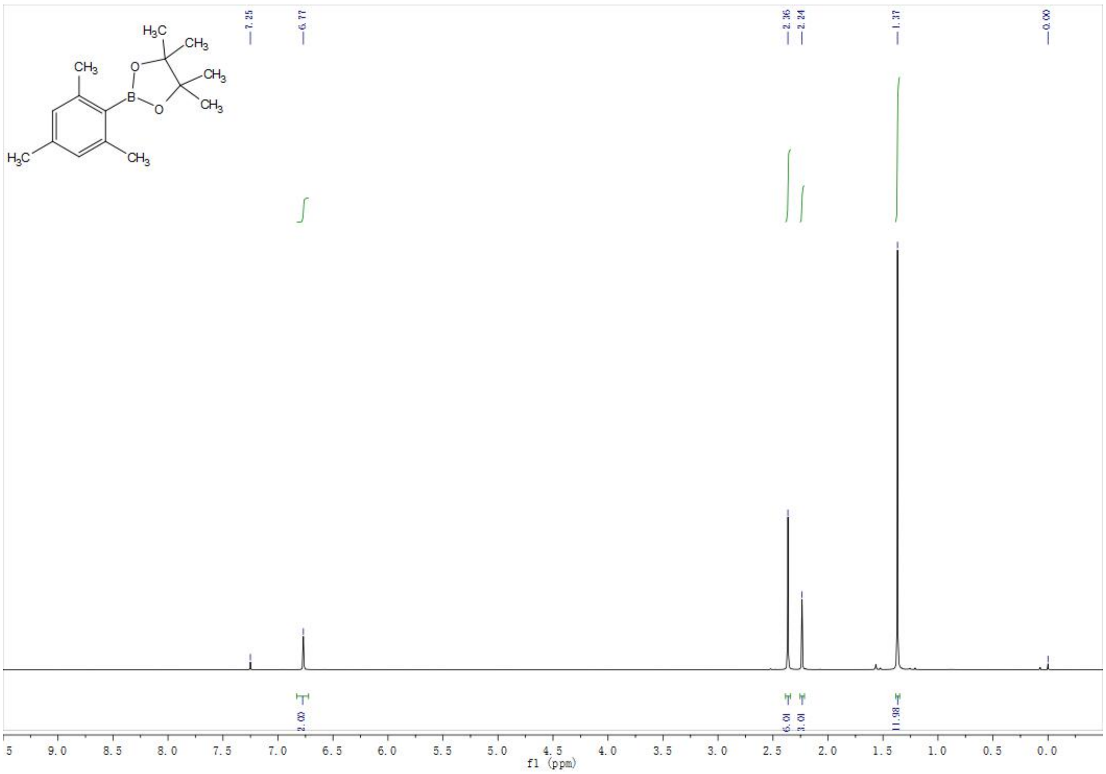
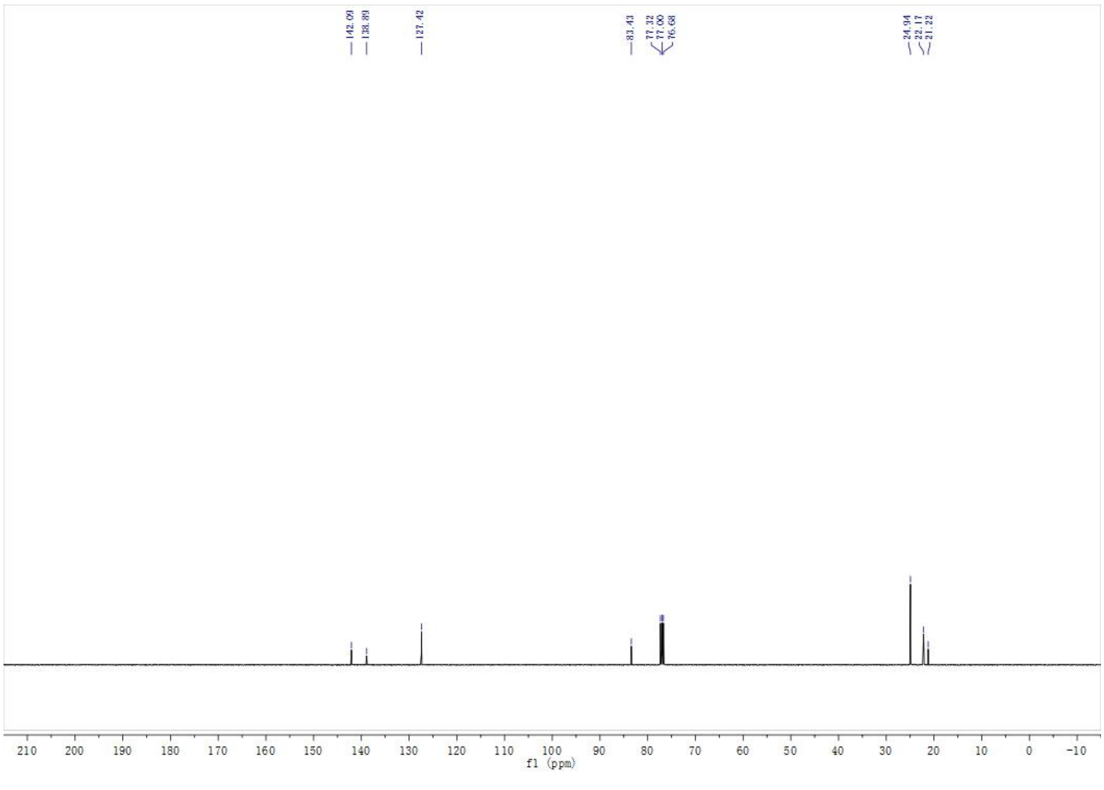
77.00
76.68
24.86
22.18
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 -10
f1 (ppm)



7.25
6.77
2.36
2.24
1.37
0.00
2.00
6.01
3.01
11.98
f1 (ppm)



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83.43
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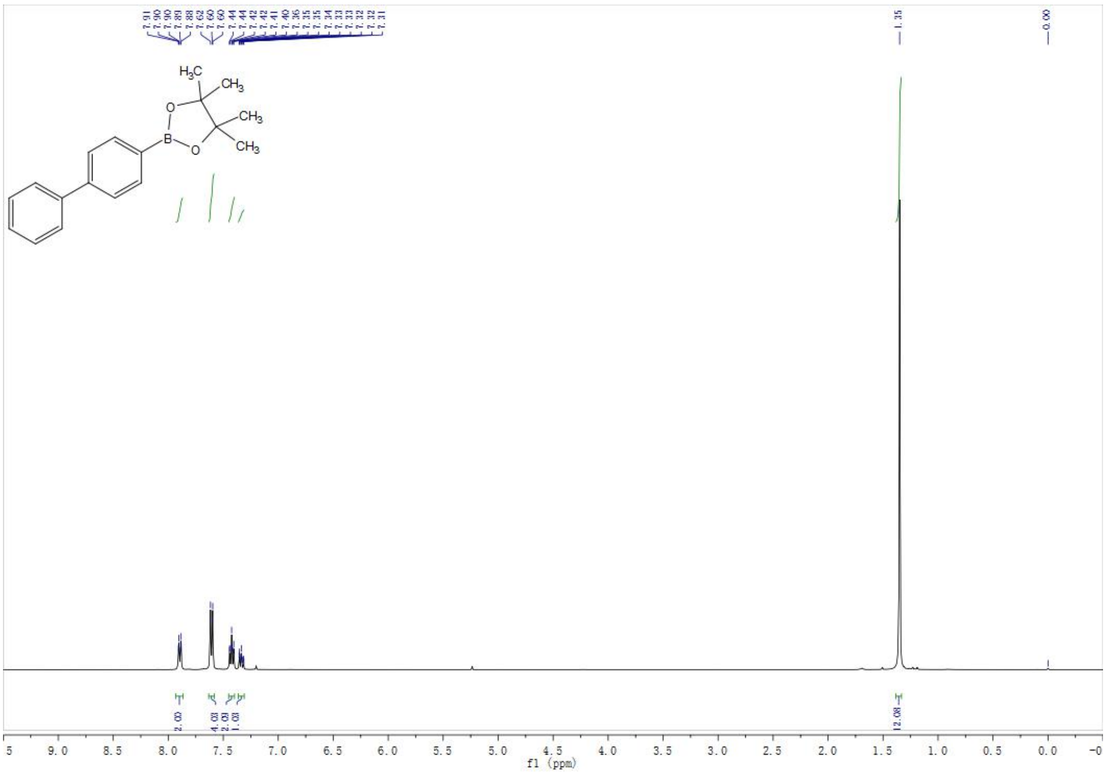
77.00
76.68
24.94
22.17
21.22
f1 (ppm)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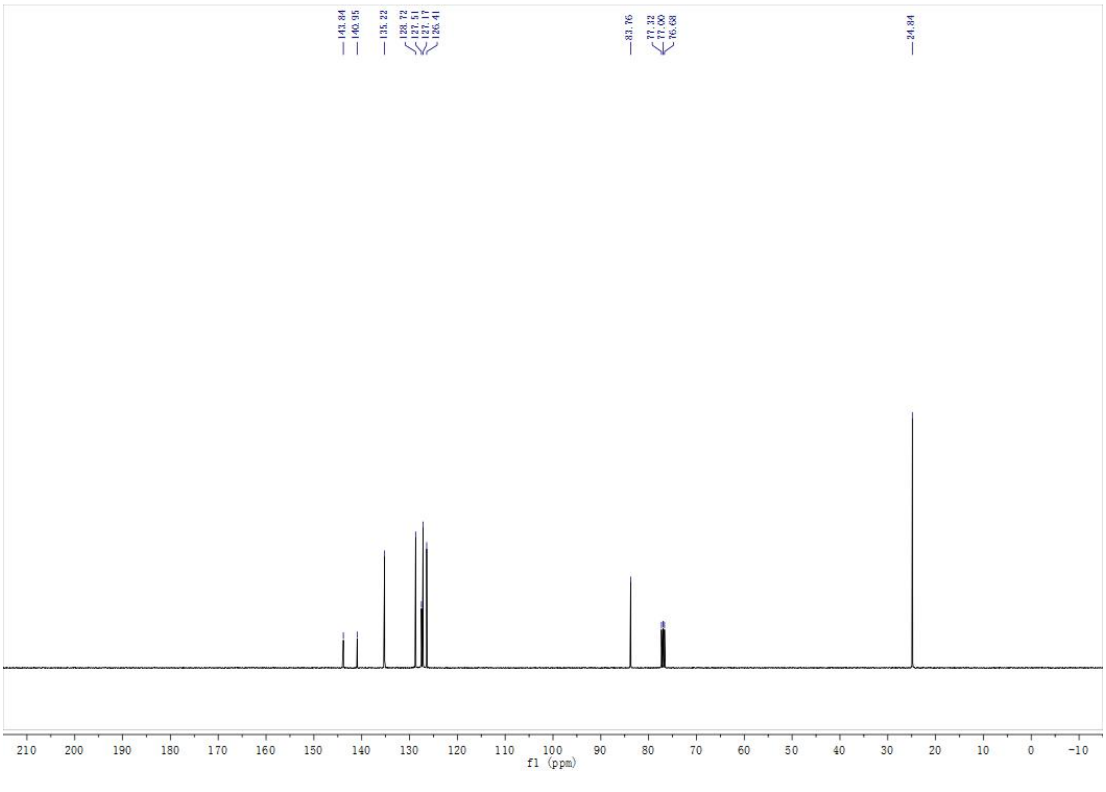
7.90
7.89
7.88
7.62
7.60
7.60
7.44
7.44
7.42
7.42
7.41
7.40
7.36
7.35
7.35
7.34
7.33
7.33
7.32
7.31
1.35
0.00
H_3C
CH_3
CH_3
CH_3
O
B
O
2.00
4.03
2.03
1.03
12.08
f1 (ppm)


143.84
140.95
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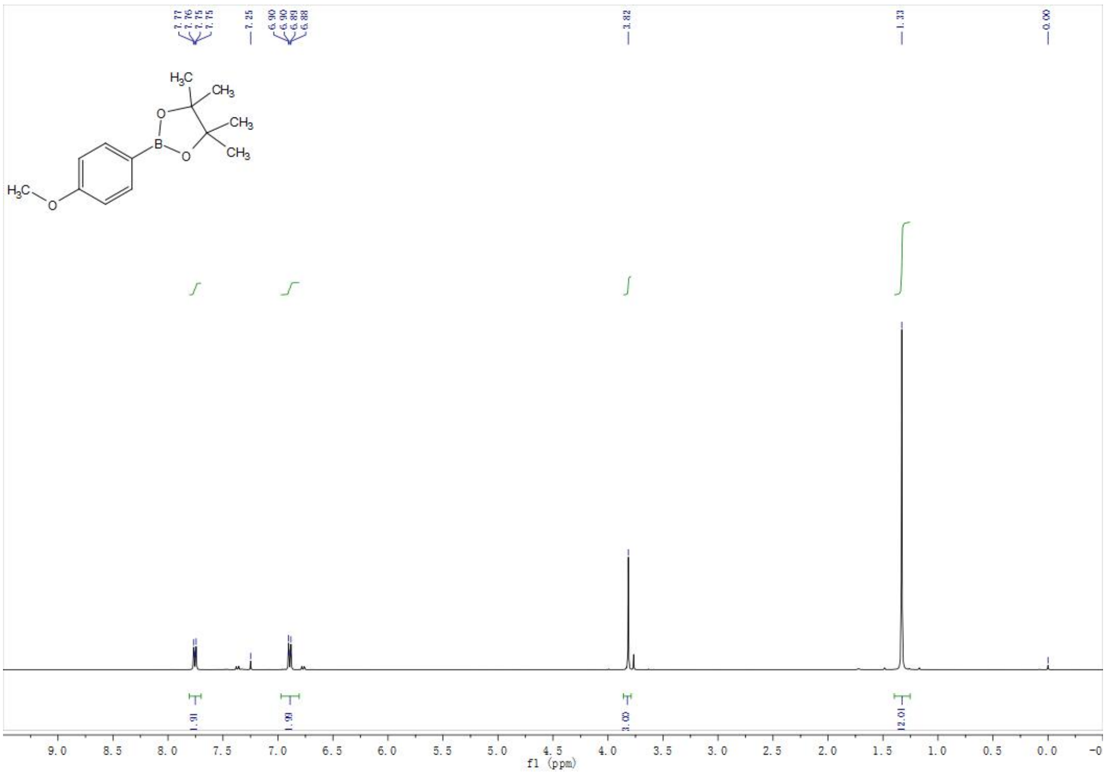
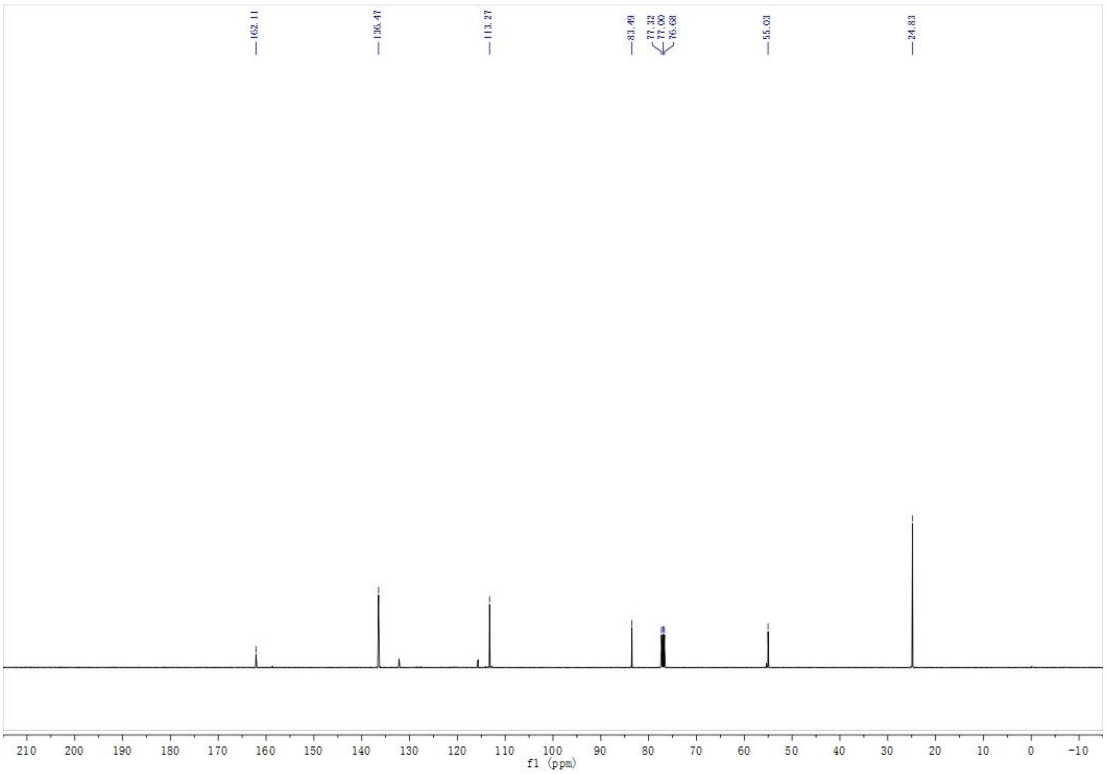
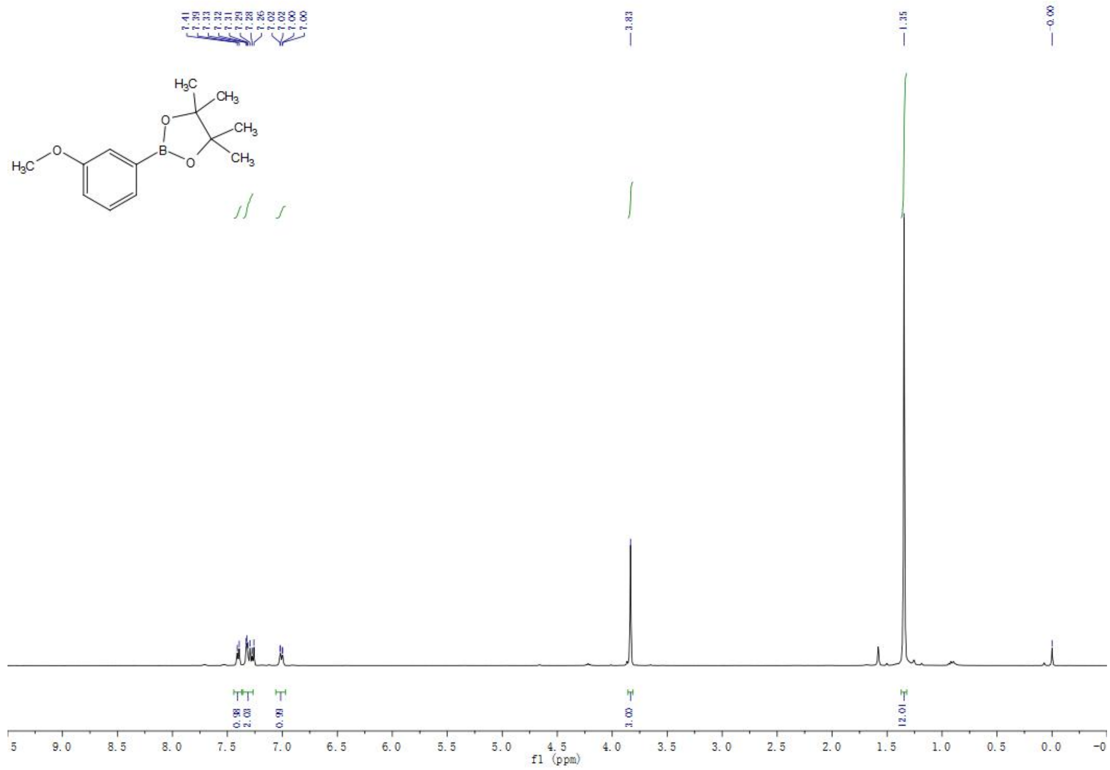
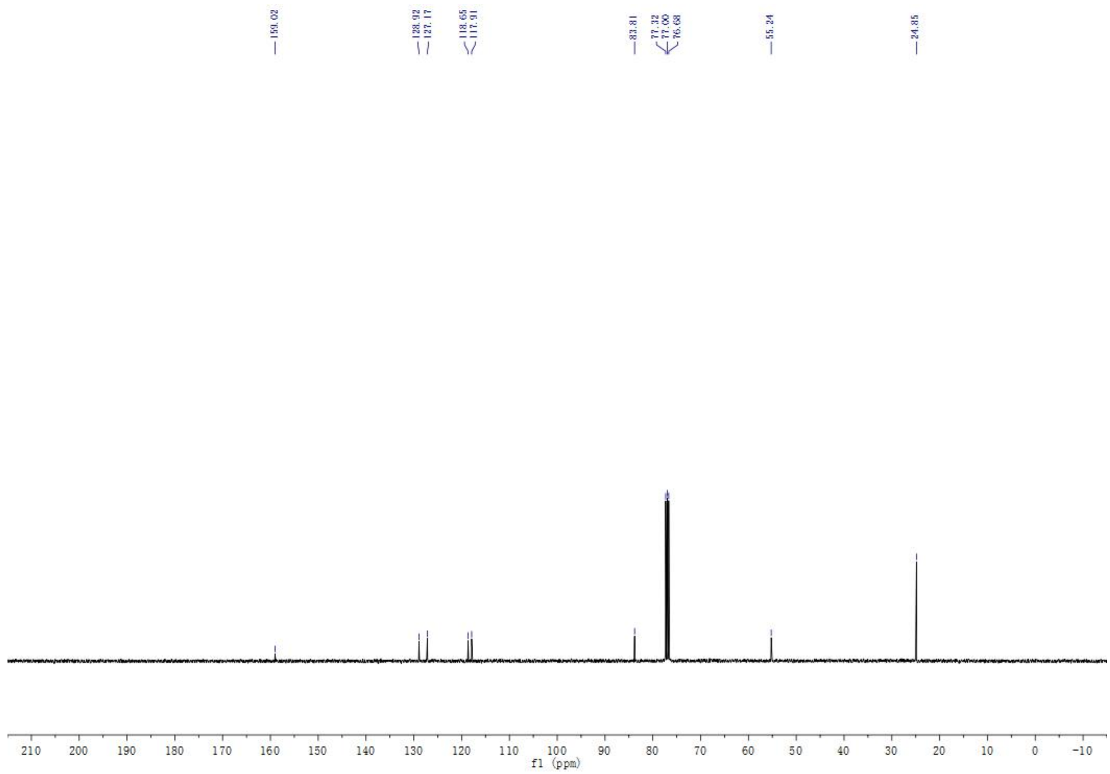
127.17
126.41
83.76
77.32
77.00
76.68
24.84
f1 (ppm)






7.41
7.39
7.33
7.32
7.31
7.29
7.28
7.26
7.02
7.02
7.00
7.00
3.83
1.35
-0.00
0.98
2.03
0.99
3.00
12.01
f1 (ppm)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128.92
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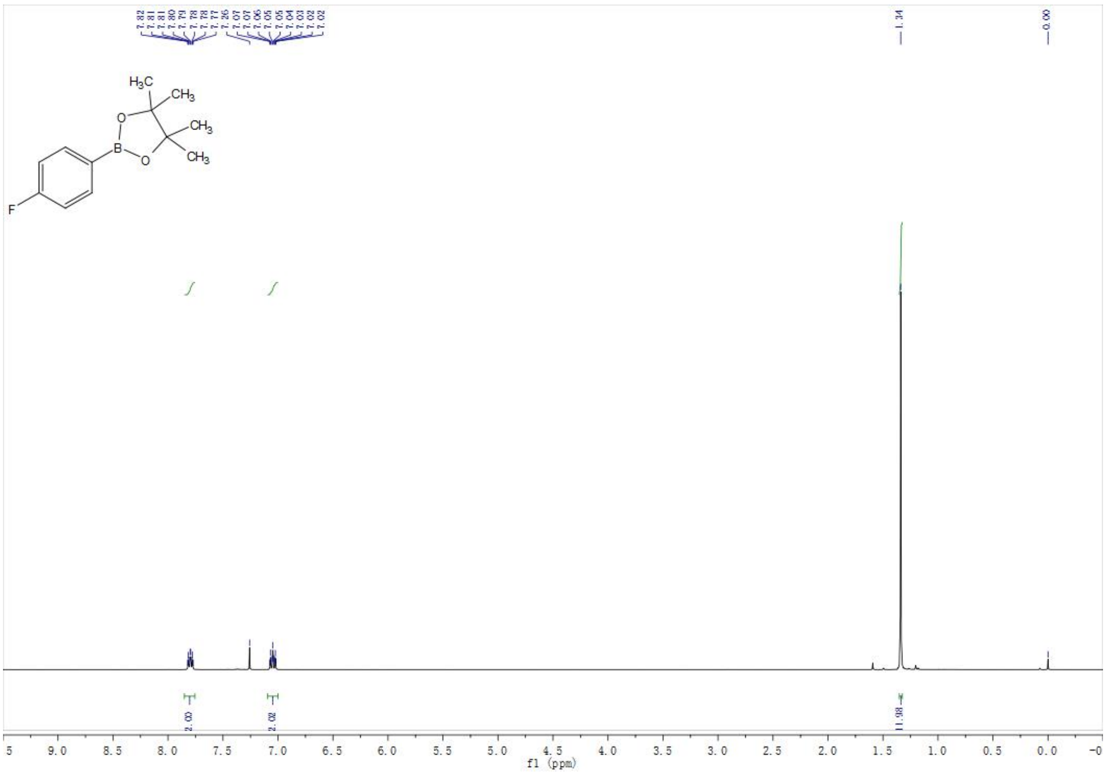
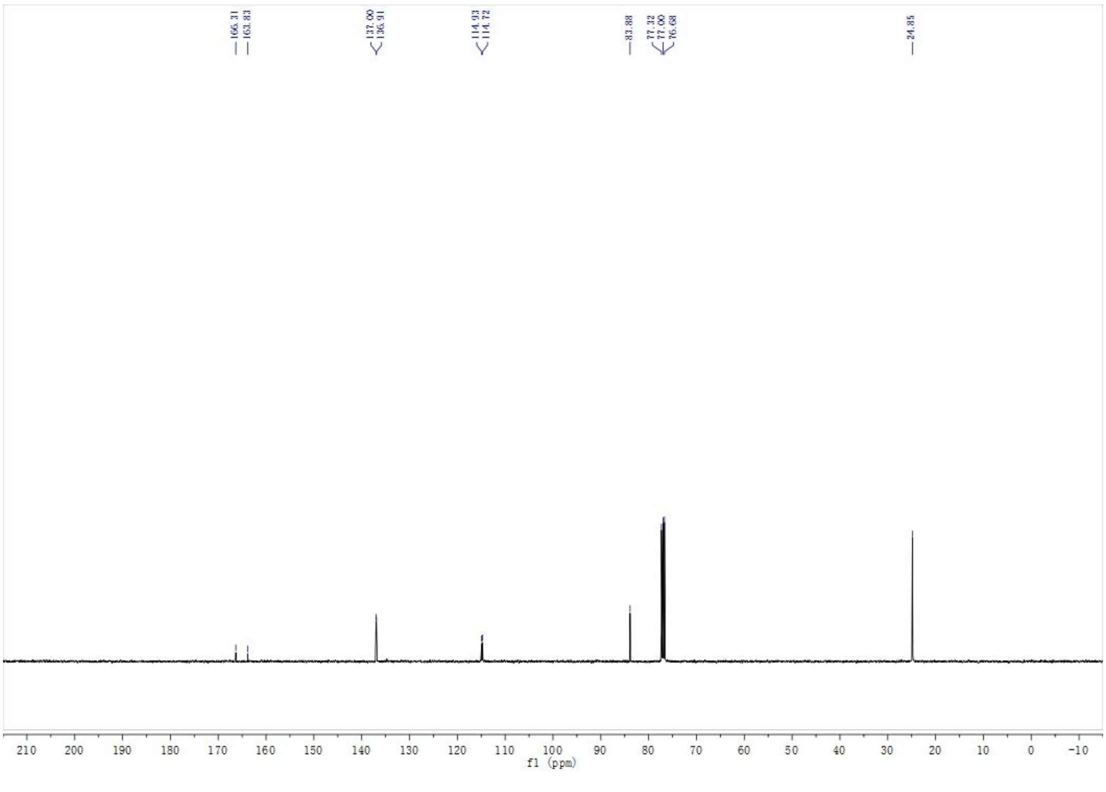
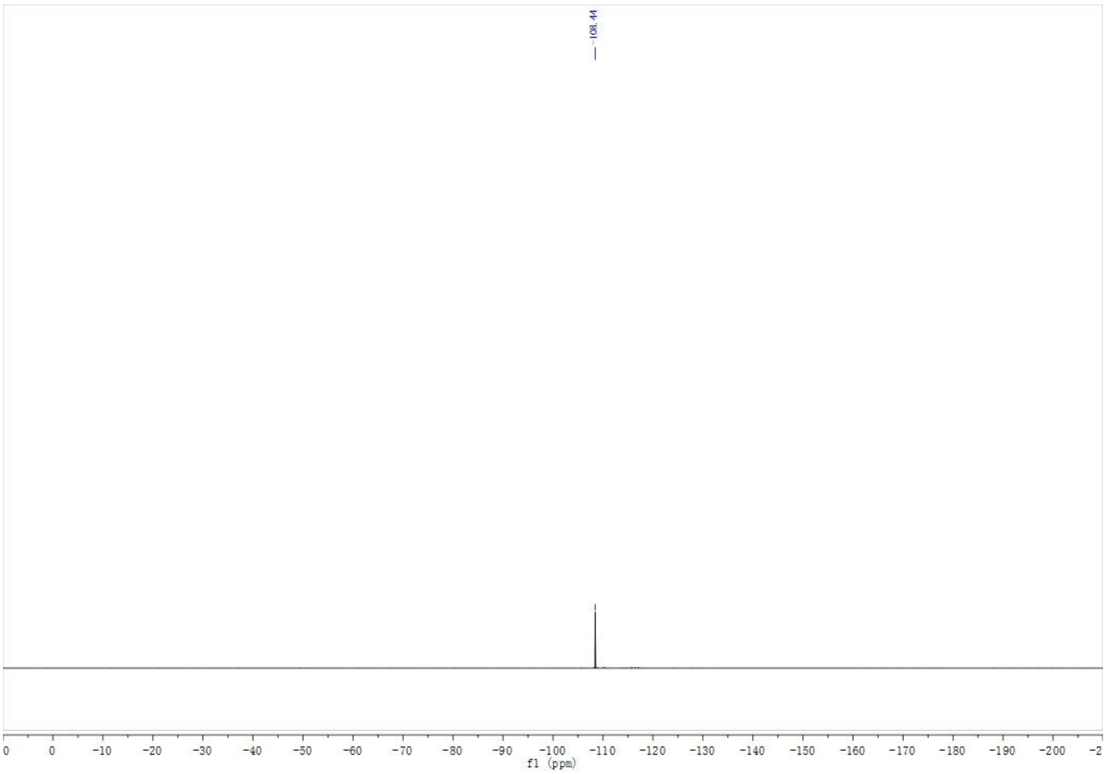
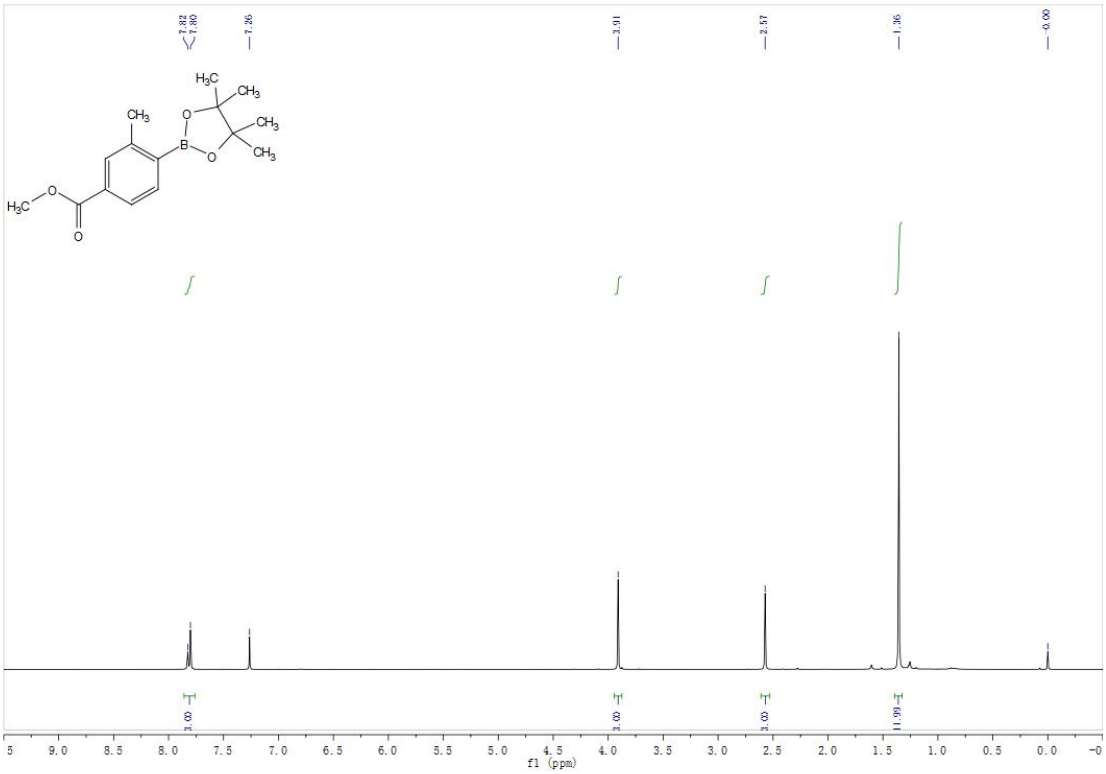
118.65
117.91
83.81
77.32
77.00
76.68
55.24
24.85
f1 (ppm)






-108.44
f1 (ppm)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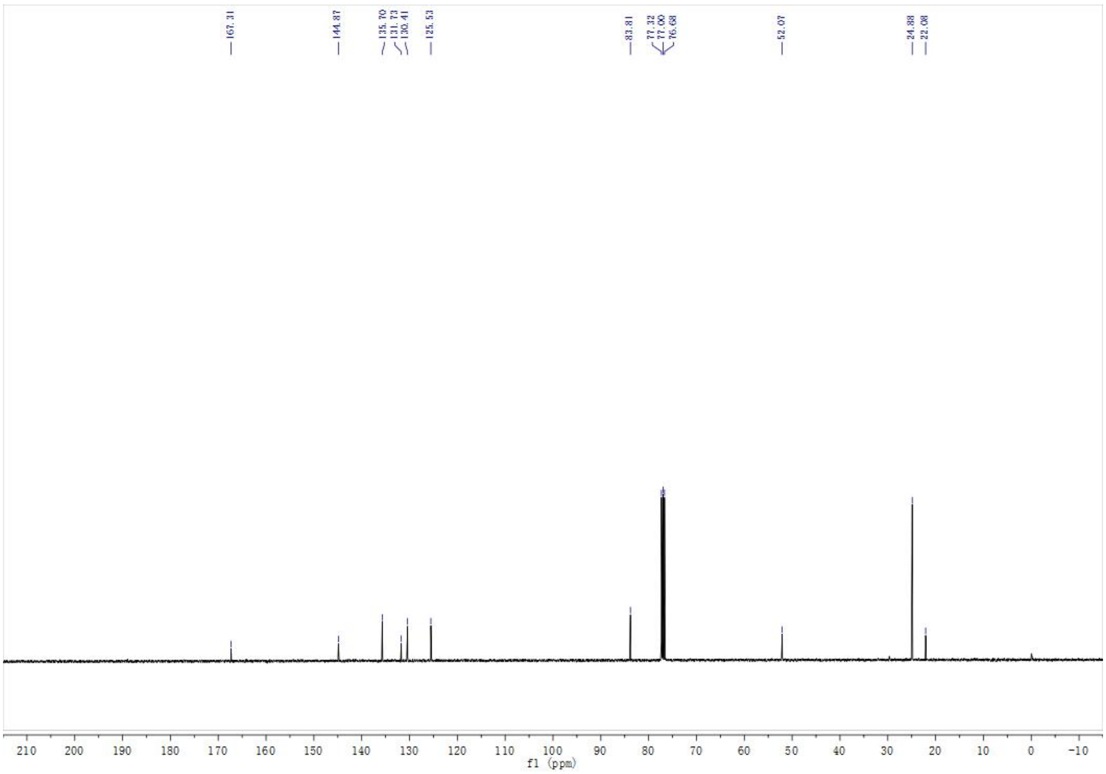
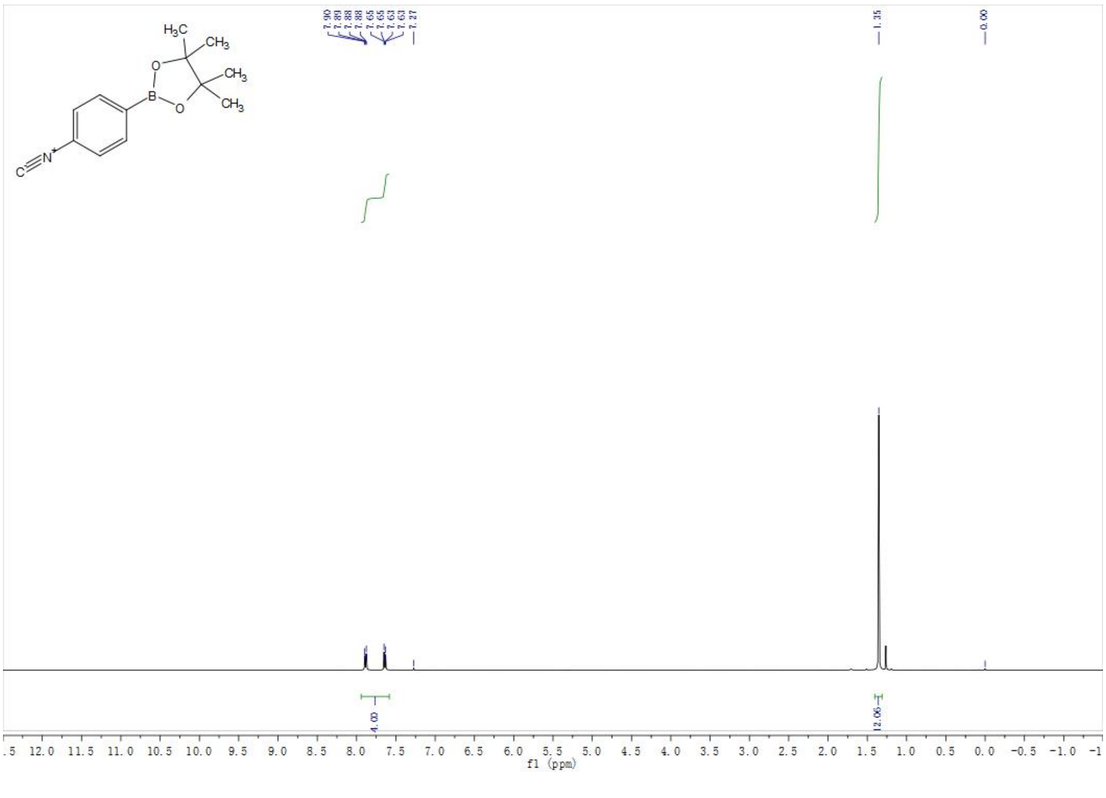
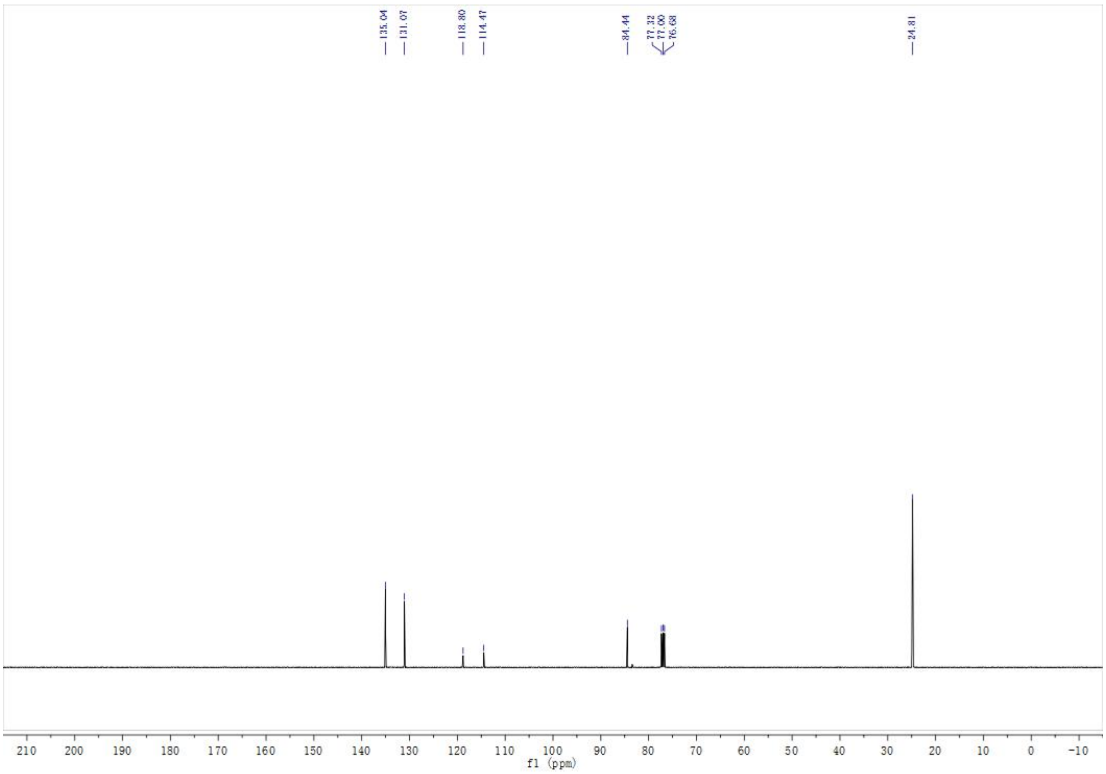
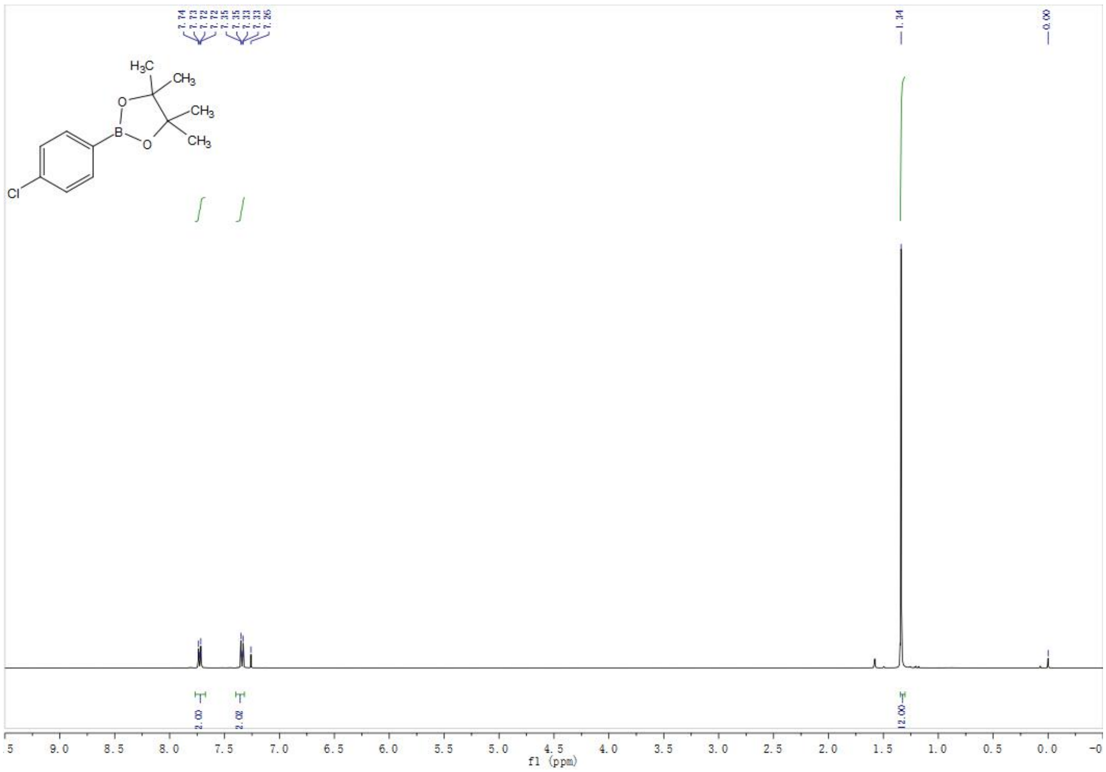
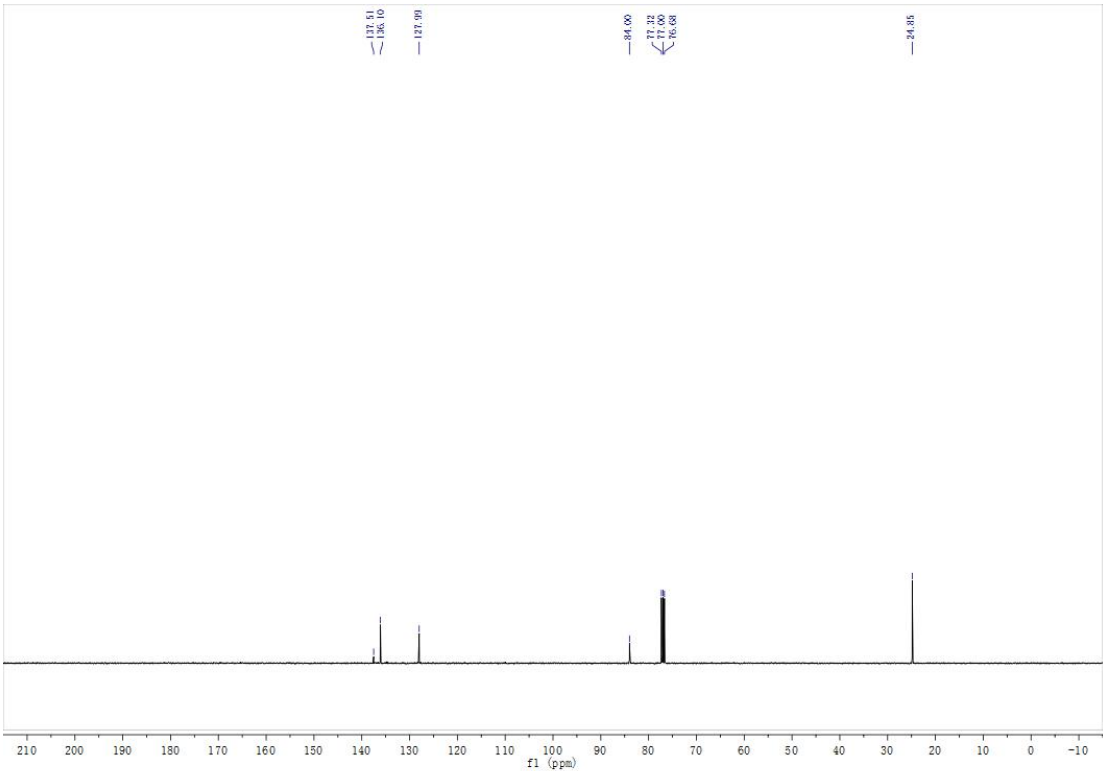
7.80
7.26
3.91
2.57
1.36
-0.00
3.00
3.00
3.00
11.99
f1 (ppm)

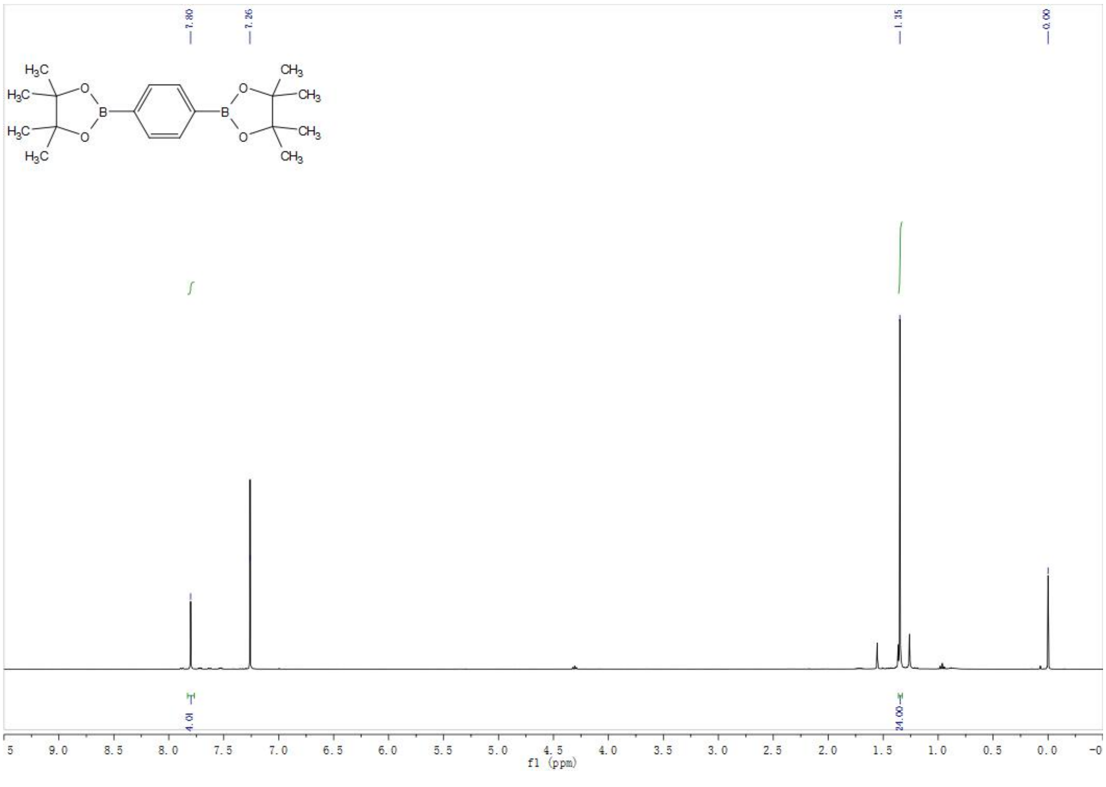

167.31
144.87
135.70
131.73
130.41
125.53
83.81
77.32
77.00
76.68
52.07
24.88
22.08
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 -10
f1 (ppm)

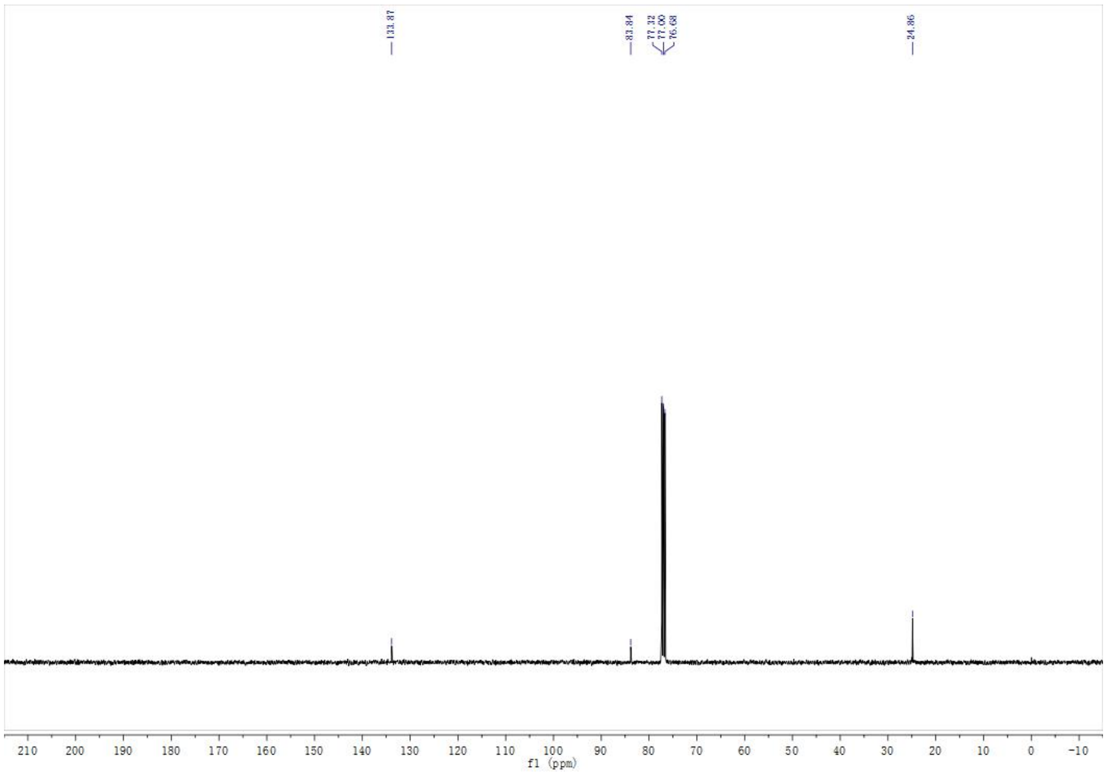

H3C
CH3
CH3
CH3
O
B
O
C
N+
7.90
7.89
7.88
7.88
7.65
7.65
7.63
7.63
7.27
1.35
0.00
4.00
12.06
.5 12.0 11.5 11.0 10.5 10.0 9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0 -0.5 -1.0 -1
f1 (ppm)

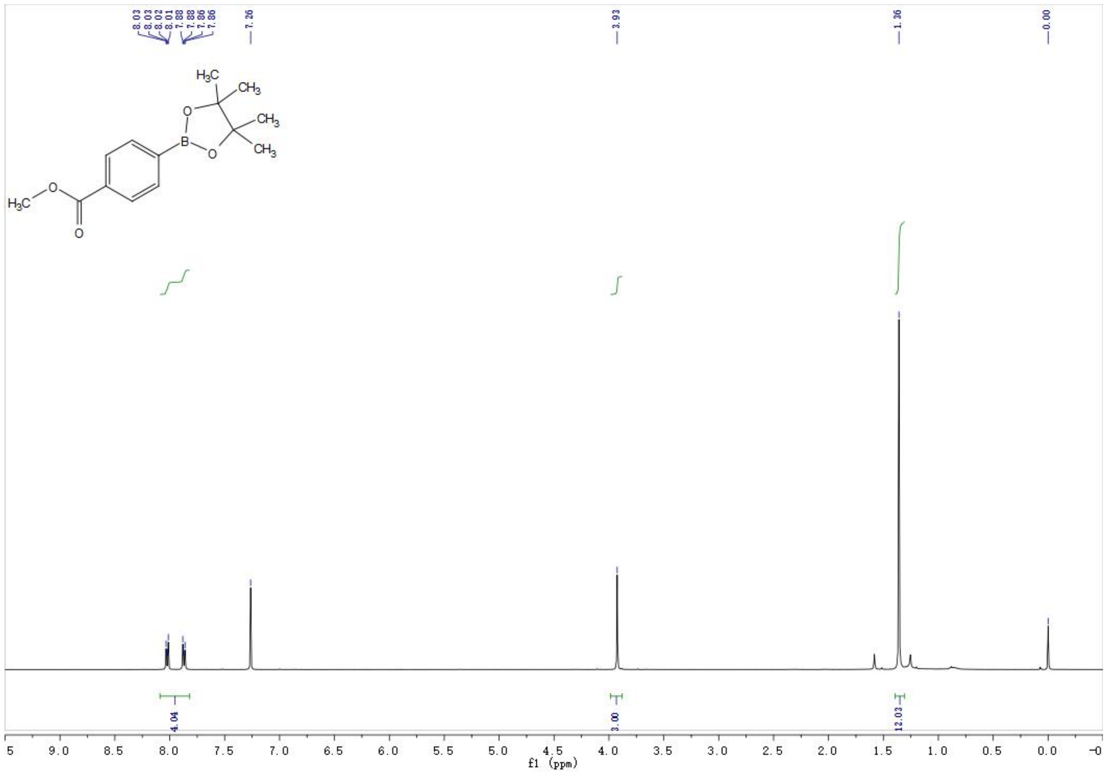

135.04
131.07
118.80
114.47
84.44
77.32
77.00
76.68
24.81
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 -10
f1 (ppm)

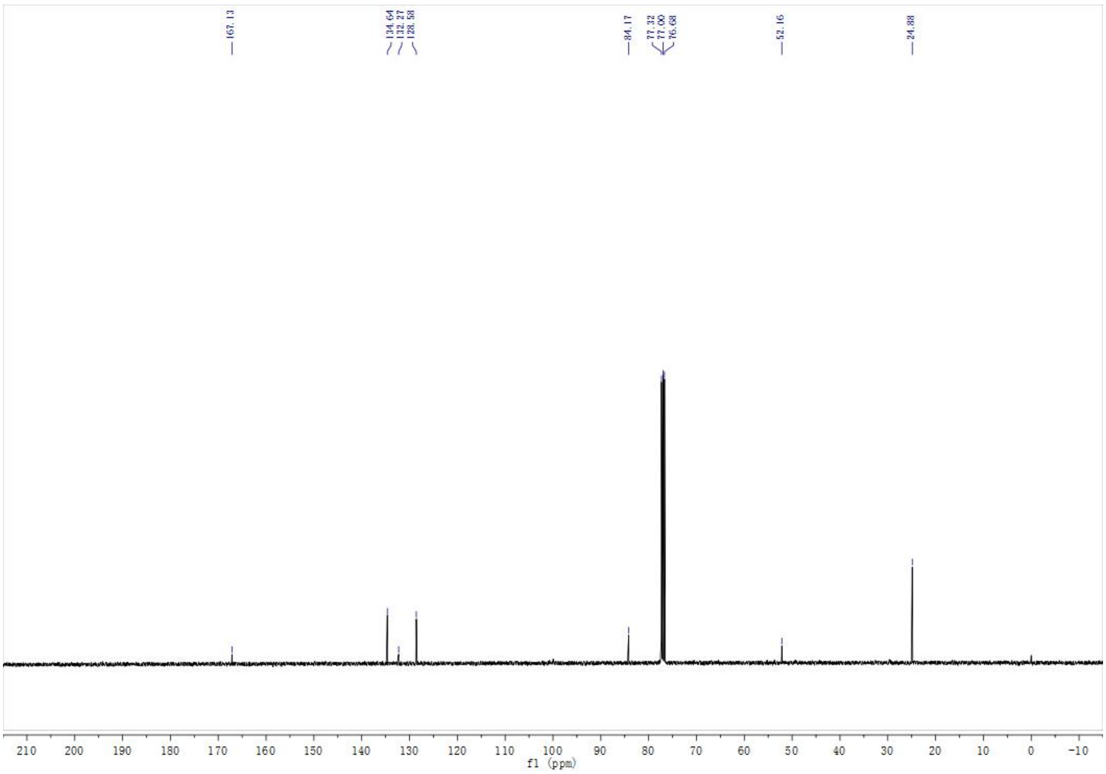

7.74
7.73
7.72
7.72
7.35
7.35
7.33
7.33
7.26
1.34
0.00
H3C
CH3
CH3
CH3
O
B
O
Cl
2.00
2.02
12.00
9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0
f1 (ppm)


137.51
136.10
127.99
84.00
77.32
77.00
76.68
24.85
f1 (ppm)


7.80
7.26
1.35
0.00
4.01
24.00
f1 (ppm)


133.87
83.84
77.32
77.00
76.68
24.86
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 -10
f1 (ppm)


8.03
8.02
8.02
8.01
7.88
7.88
7.86
7.86
7.26
3.93
1.36
0.00
4.04
3.00
12.03
9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0
f1 (ppm)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132.27
128.58
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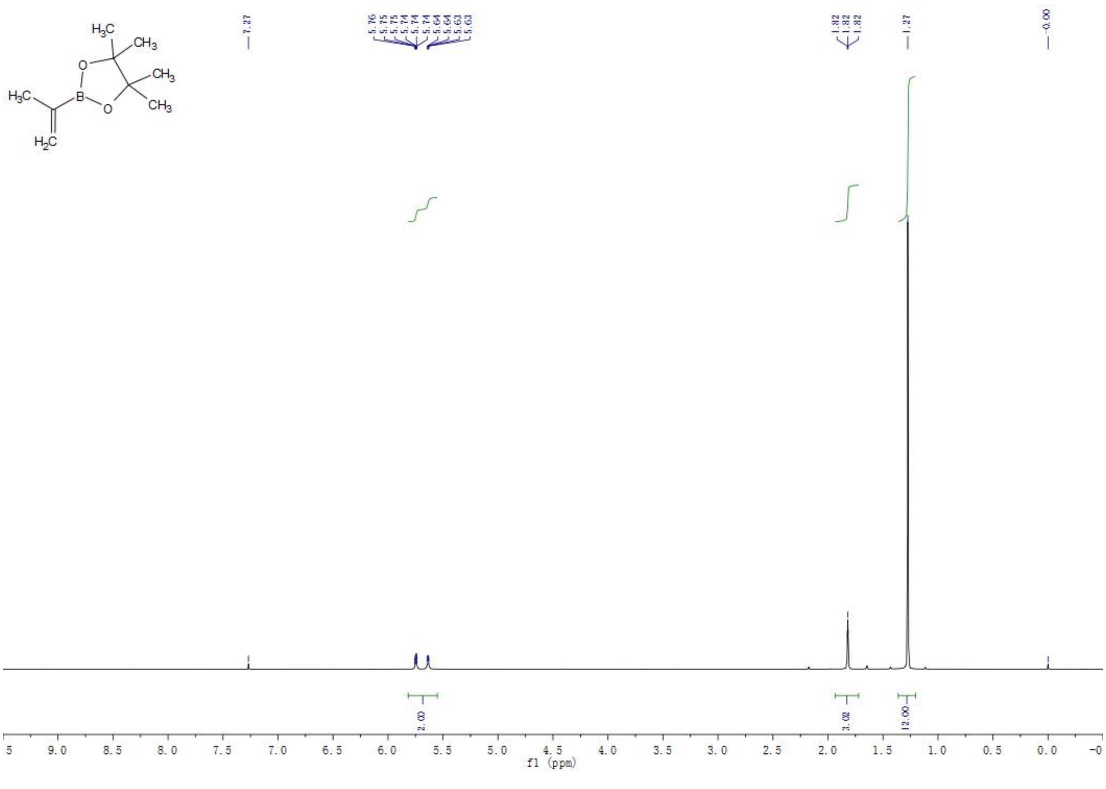
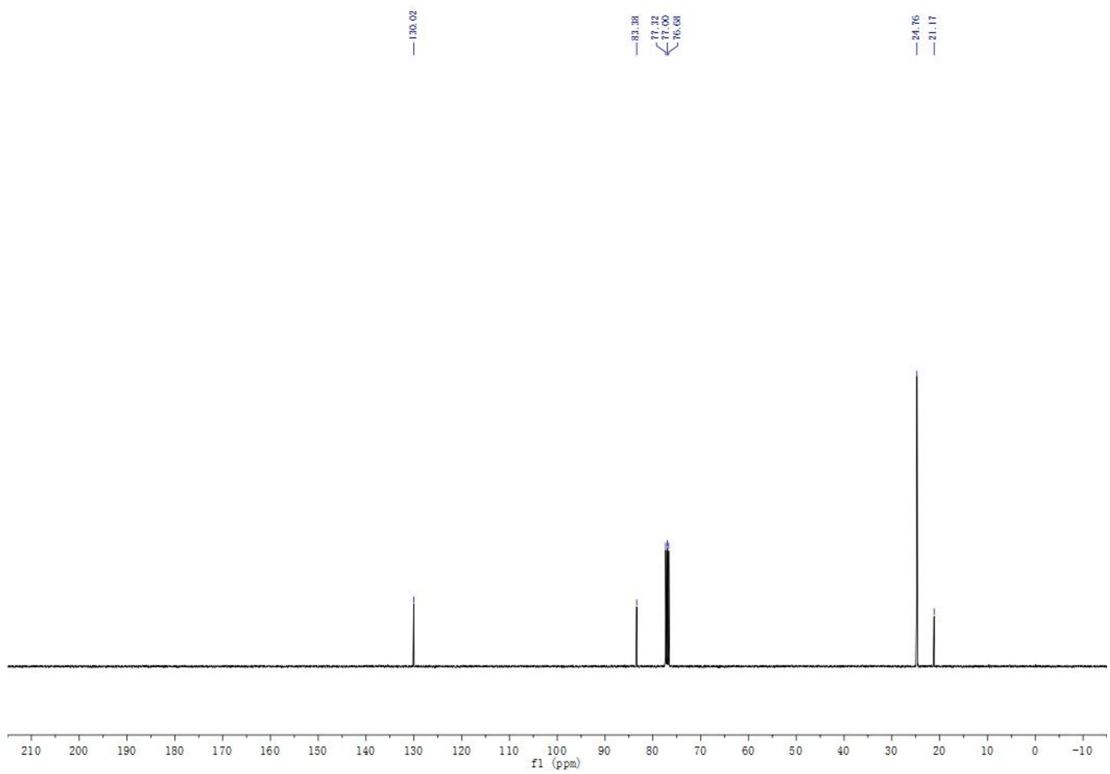
77.32
77.00
76.68
52.16
24.88
f1 (ppm)


H3C
CH3
CH3
CH3
H3C
B
O
O
H2C
7.27
5.76
5.75
5.74
5.74
5.74
5.64
5.63
5.63
5.63
1.82
1.82
1.82
1.27
-0.00
2.00
3.02
12.00
f1 (ppm)


130.02
83.38
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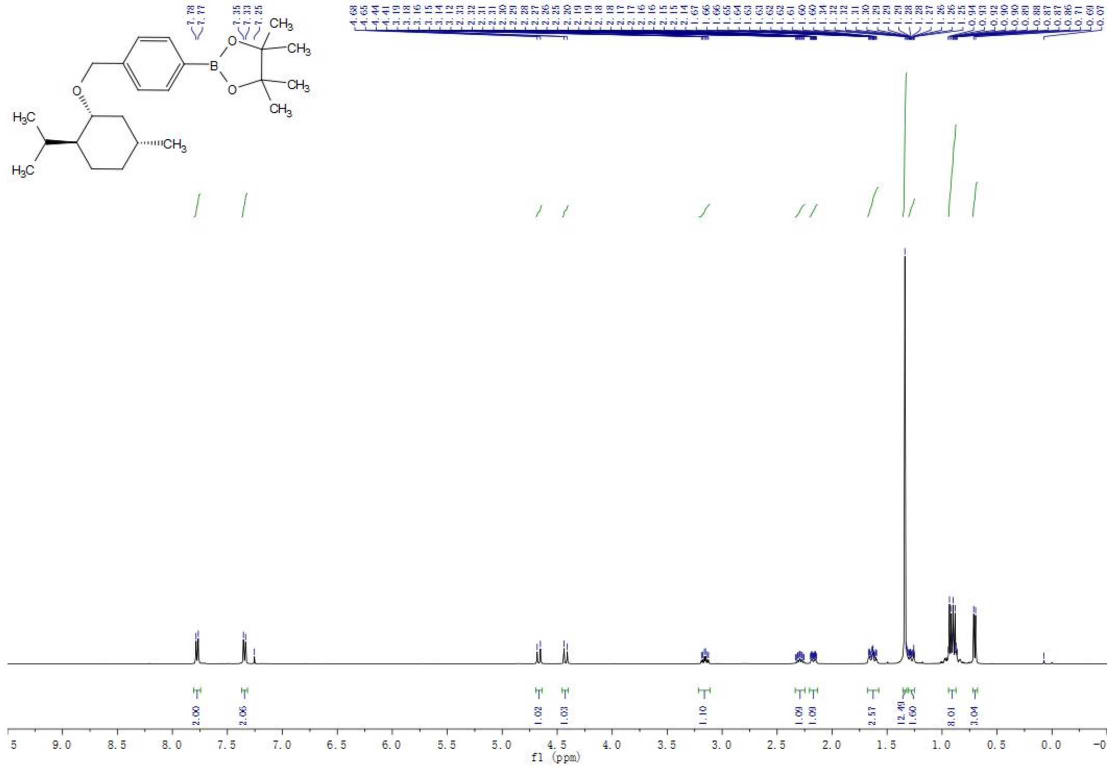
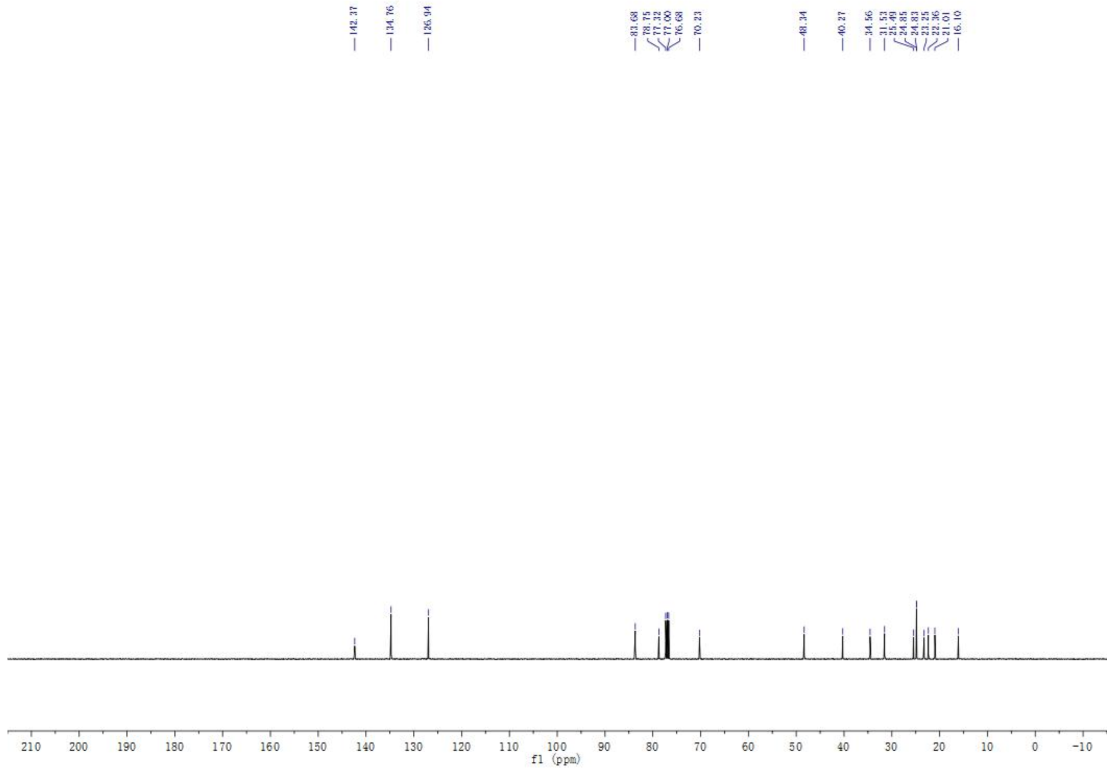
76.68
24.76
21.17
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 -10
f1 (ppm)


7.78
7.77
7.35
7.33
7.25
CH3
CH3
CH3
CH3
B
O
O
O
H3C
H3C
CH3
4.68 4.65 4.44 4.41 3.19 3.18 3.16 3.15 3.14 3.12 2.33 2.32 2.31 2.30 2.29 2.28 2.27 2.25 2.20 2.19 2.19 2.18 2.17 2.16 2.15 2.15 2.14 1.67 1.66 1.65 1.64 1.63 1.62 1.61 1.60 1.60 1.34 1.32 1.31 1.30 1.29 1.29 1.28 1.28 1.27 1.26 1.25 0.94 0.93 0.92 0.90 0.90 0.89 0.88 0.87 0.86 0.71 0.69 0.07
2.00
2.06
1.02
1.03
1.10
1.09
1.09
2.57
12.49
1.60
8.01
3.04
9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0
f1 (ppm)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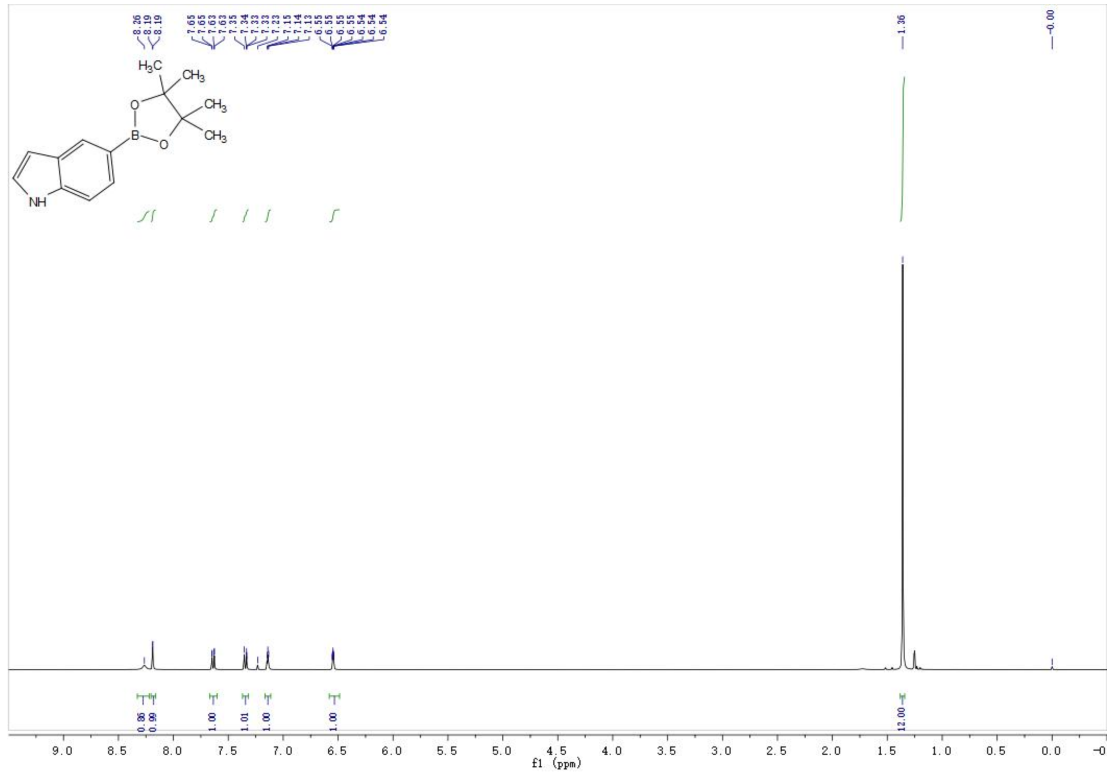
77.32
77.00
76.68
70.23
48.34
40.27
34.56
31.53
25.49
24.85
24.83
23.25
22.36
21.01
16.10
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 -10
f1 (ppm)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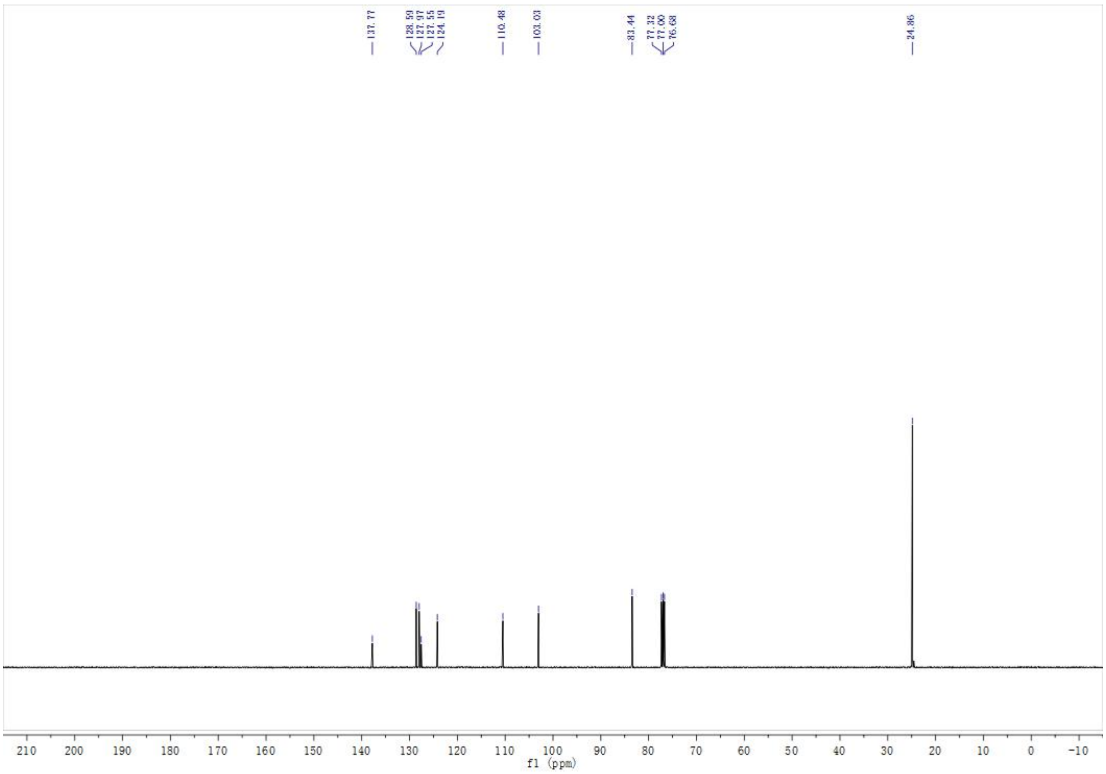
7.63
7.63
7.35
7.34
7.33
7.33
7.23
7.15
7.14
7.13
6.55
6.55
6.55
6.54
6.54
6.54
1.36
-0.00
H_3C
CH_3
CH_3
CH_3
O
B
O
NH
0.88
0.90
1.00
1.01
1.00
1.00
12.00
9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0 -0
f1 (ppm)


137.77
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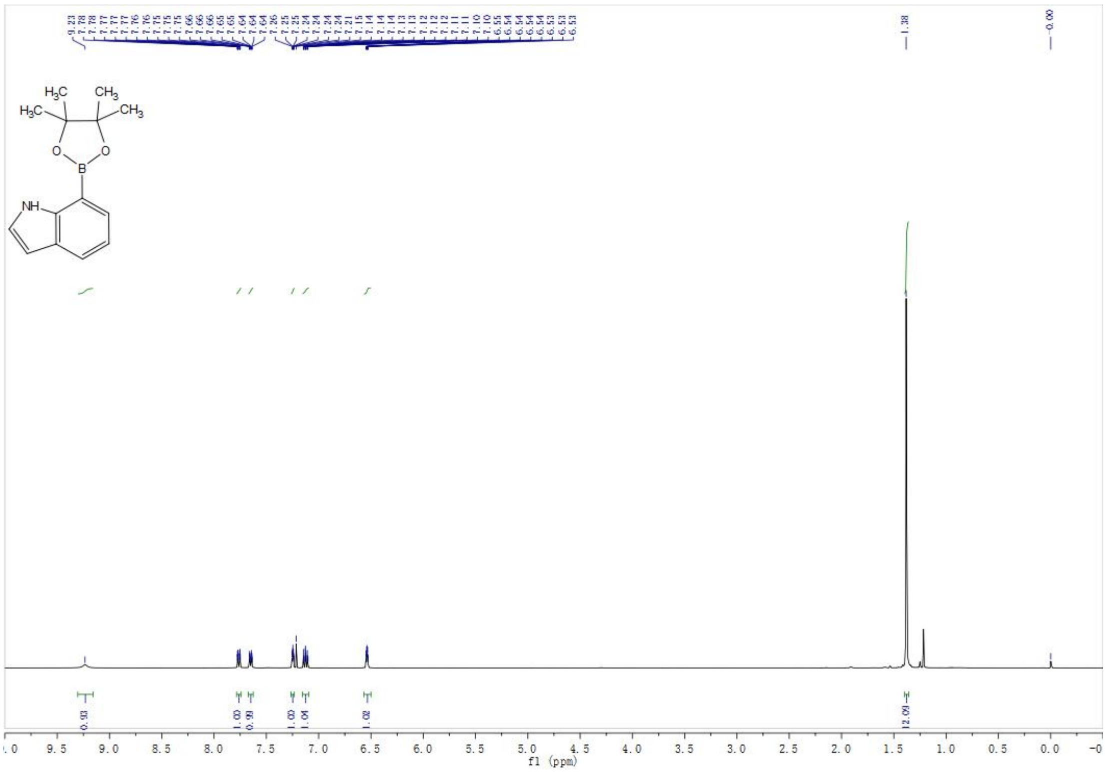
127.55
124.19
110.48
103.03
83.44
77.32
77.00
76.68
24.86
f1 (ppm)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CH3
O
B
NH
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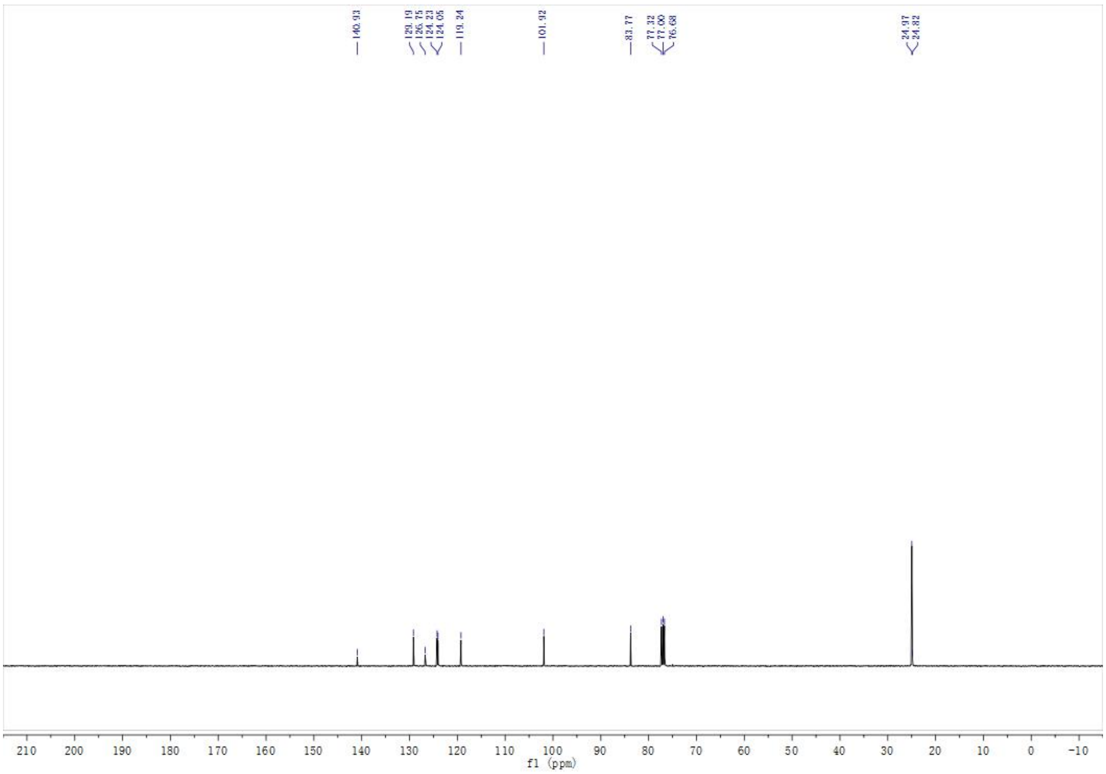
0.91
1.00
1.04
1.02
12.09
f1 (ppm)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124.05
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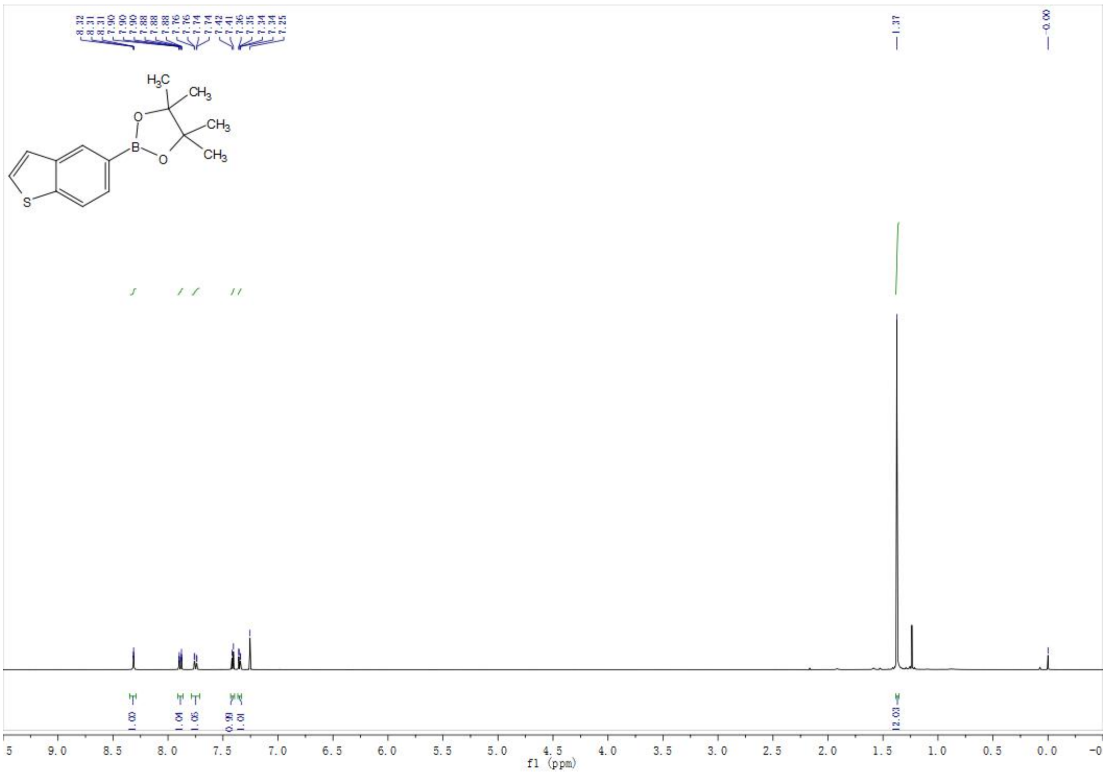
101.92
83.77
77.32
77.00
76.68
24.97
24.82
210
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
-10
f1 (ppm)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7.90
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7.88
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7.76
7.76
7.74
7.74
7.42
7.41
7.36
7.35
7.34
7.34
7.25
1.37
-0.00
H3C
CH3
CH3
CH3
O
B
O
S
1.00
1.04
1.06
0.99
1.01
12.03
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
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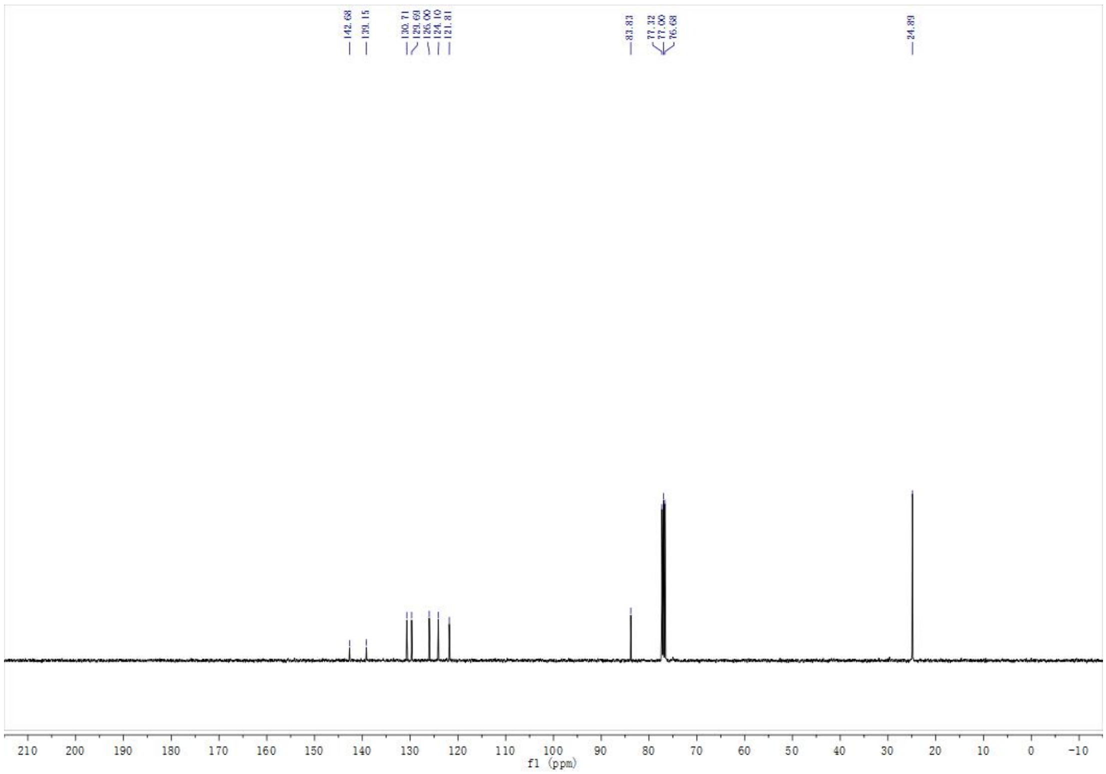
0.0
f1 (ppm)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124.10
121.81
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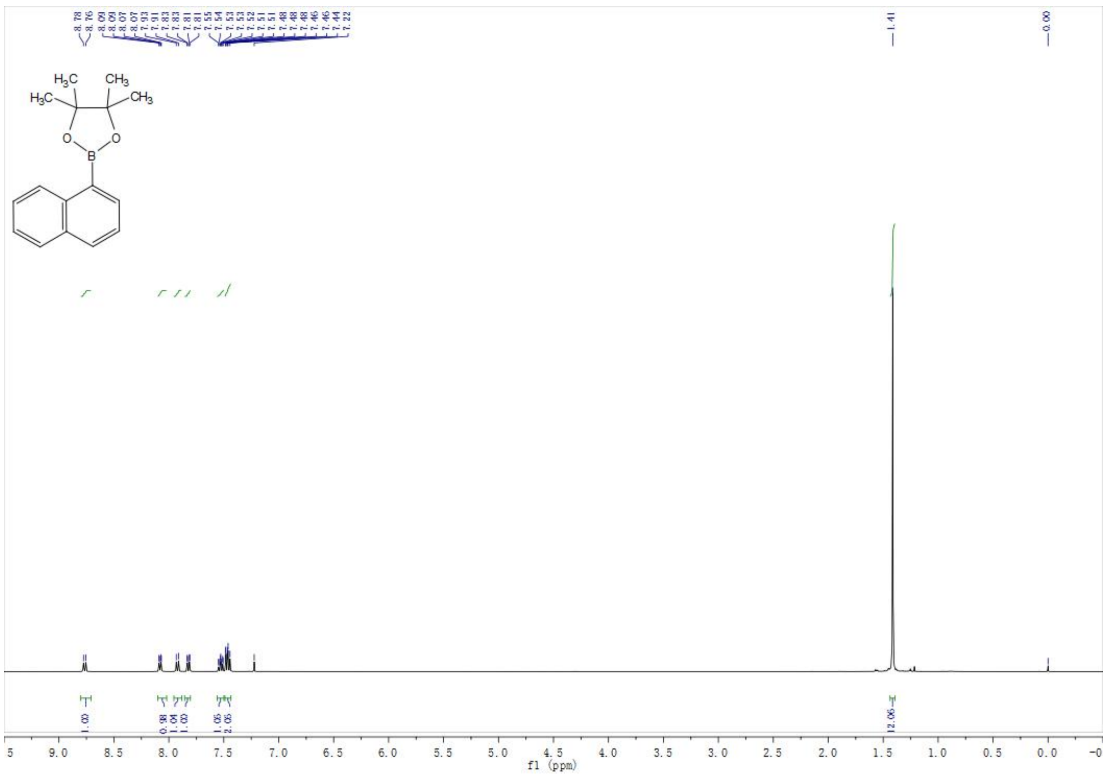
77.32
77.00
76.68
24.89
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 -10
f1 (ppm)


8.78
8.76
8.09
8.09
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8.07
7.93
7.91
7.83
7.83
7.81
7.55
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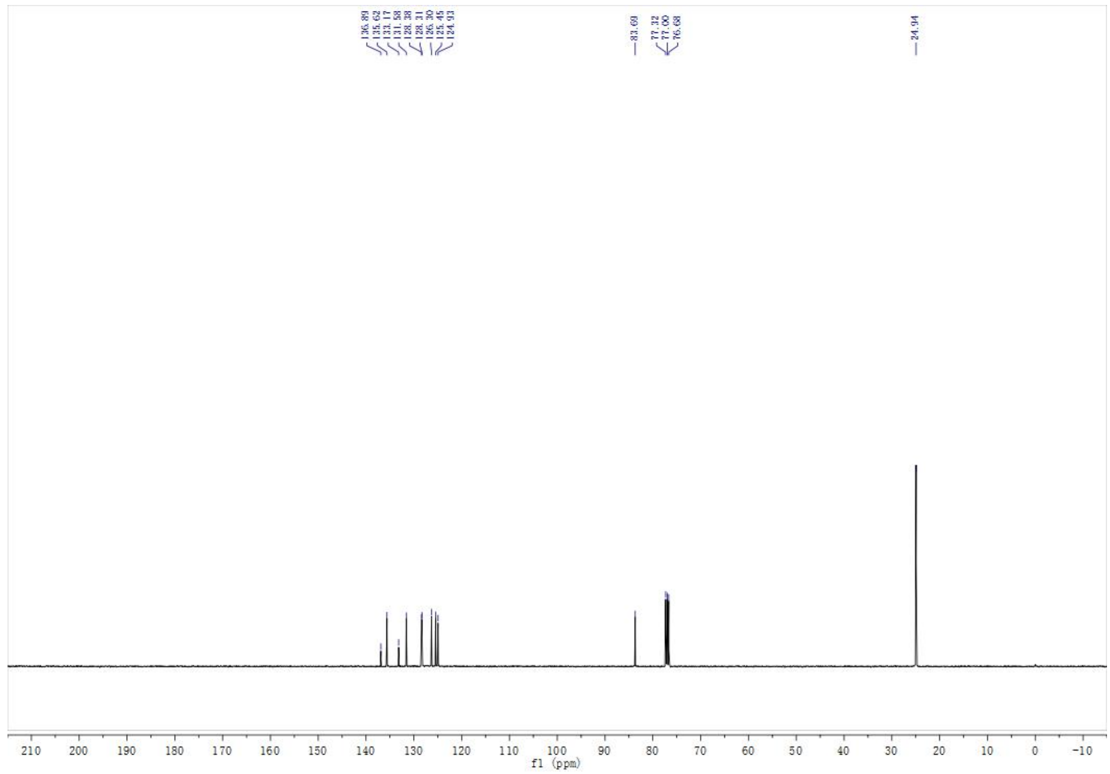
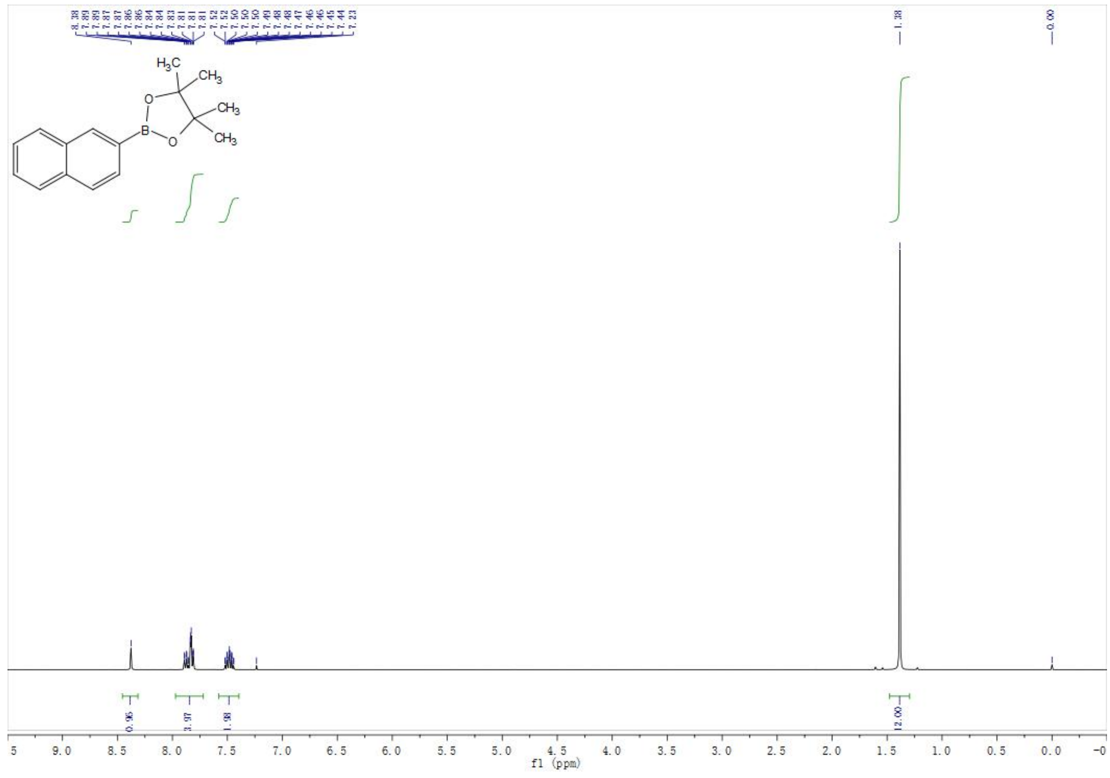
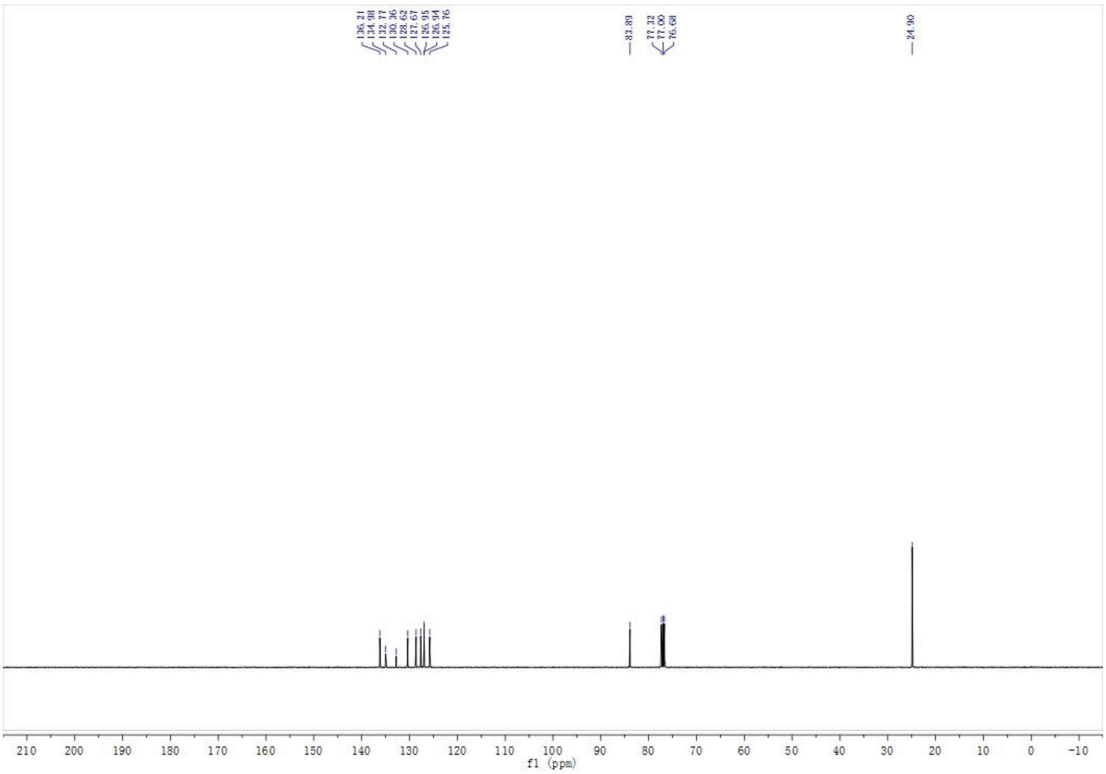
7.53
7.53
7.52
7.51
7.51
7.48
7.48
7.46
7.44
7.22
1.41
0.00
1.00
0.98
1.04
1.00
1.05
2.05
12.06
9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0
f1 (ppm)



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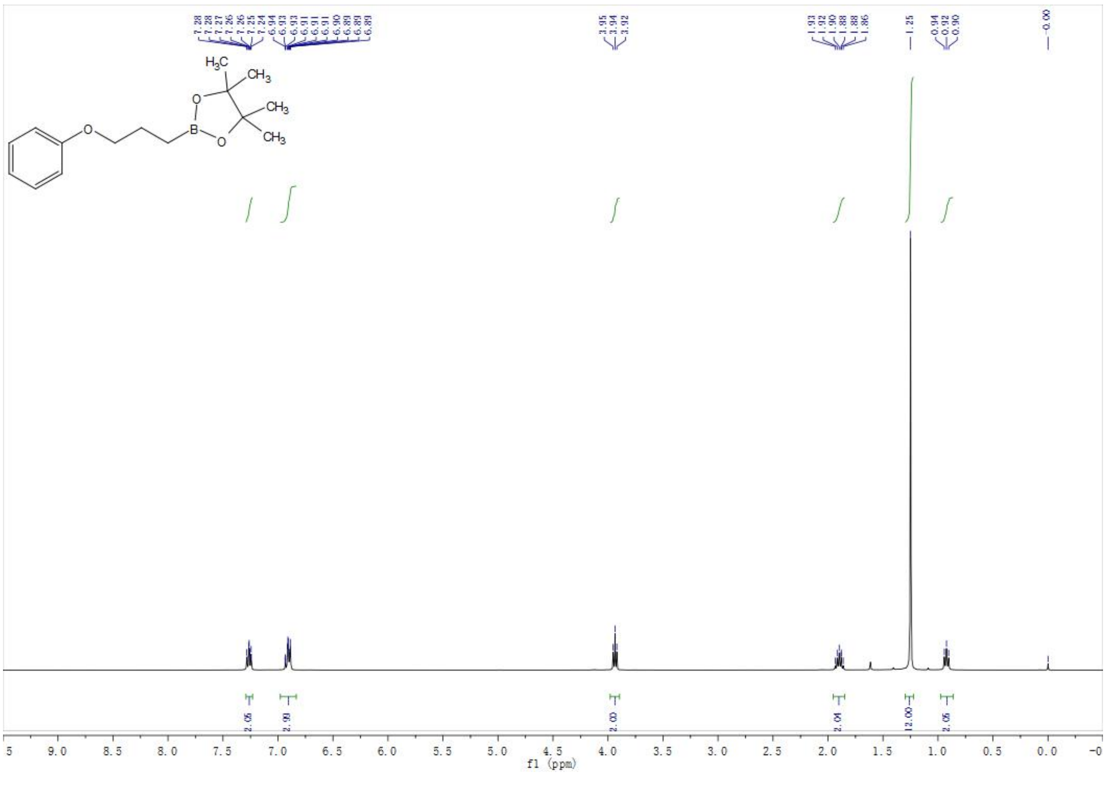
126.94
125.76
83.89
77.32
77.00
76.68
24.90
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 -10
f1 (ppm)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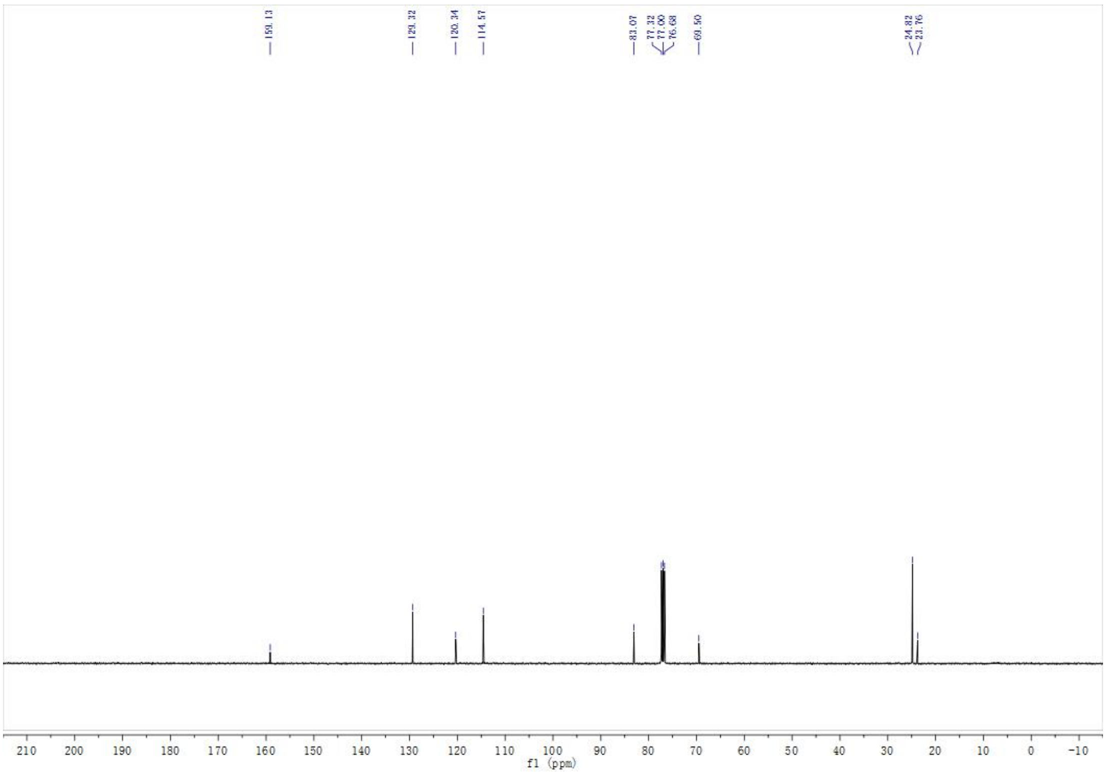
6.89
3.95
3.94
3.92
1.93
1.92
1.90
1.88
1.88
1.86
1.25
0.94
0.92
0.90
0.00
H_3C
CH_3
CH_3
CH_3
O
B
2.05
2.99
2.00
2.04
12.00
2.05
9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0
f1 (ppm)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114.57
83.07
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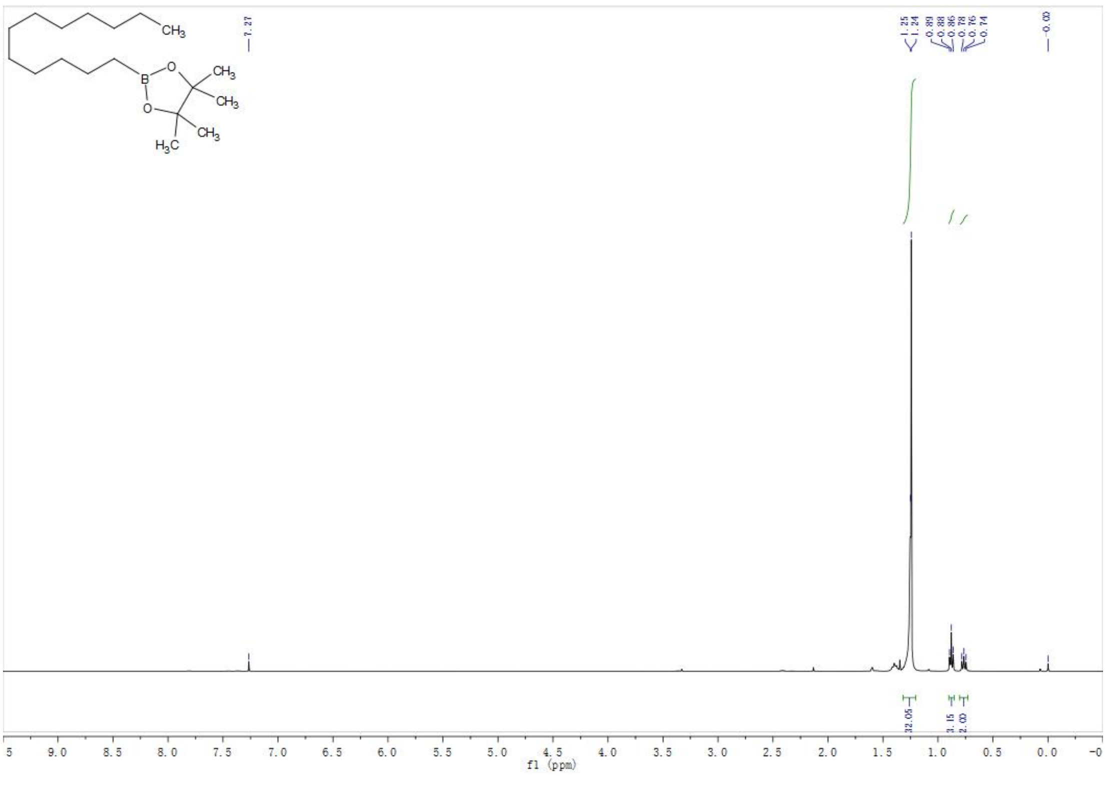
69.50
24.82
23.76
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 -10
f1 (ppm)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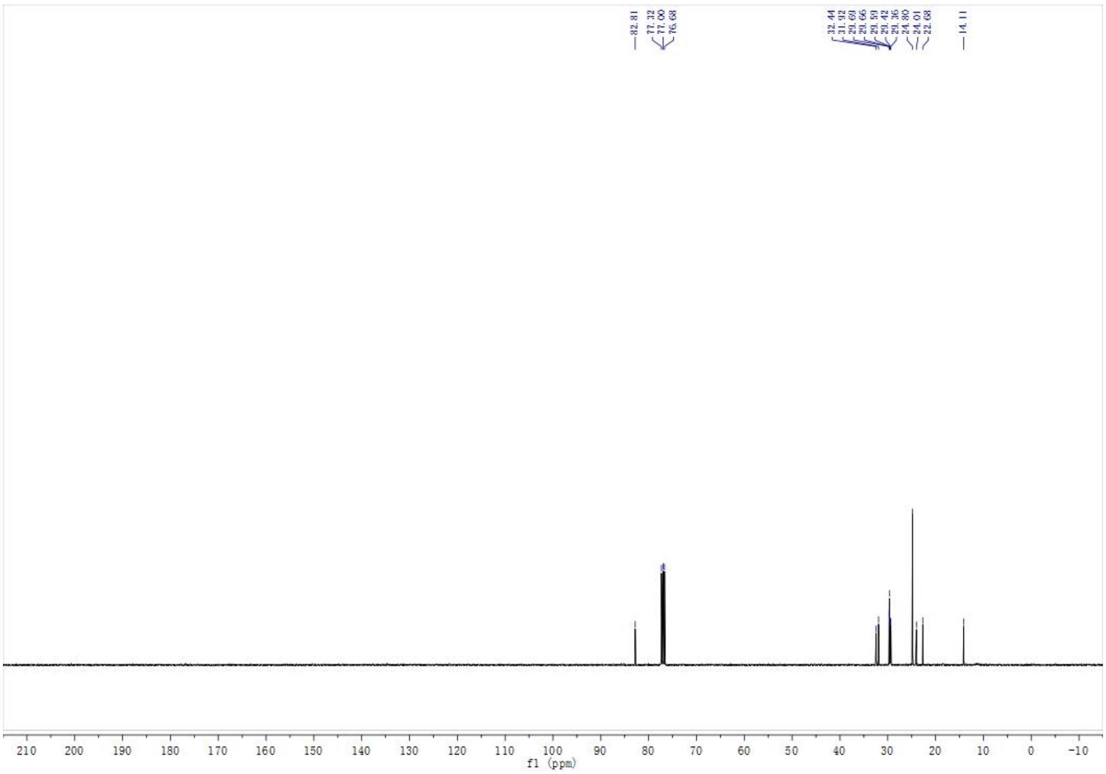
B
O
O
CH3
CH3
CH3
H3C
7.27
1.25
1.24
0.89
0.88
0.86
0.78
0.76
0.74
-0.00
32.05
3.15
2.00
9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0
f1 (ppm)



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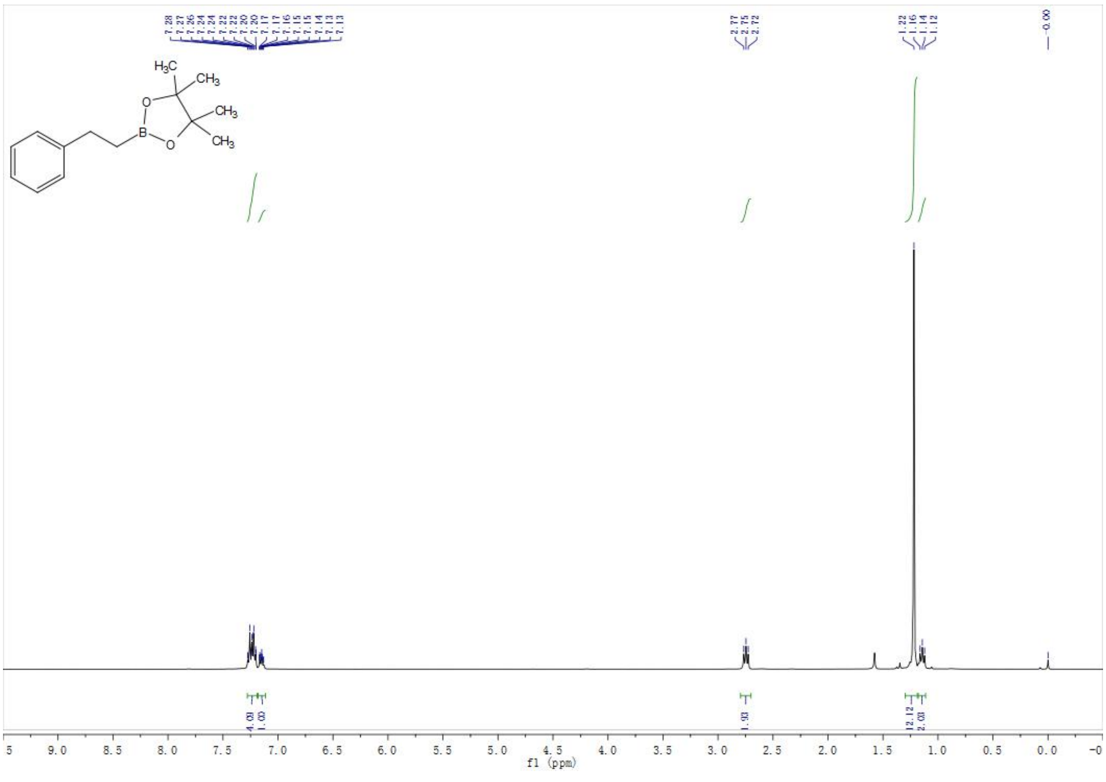
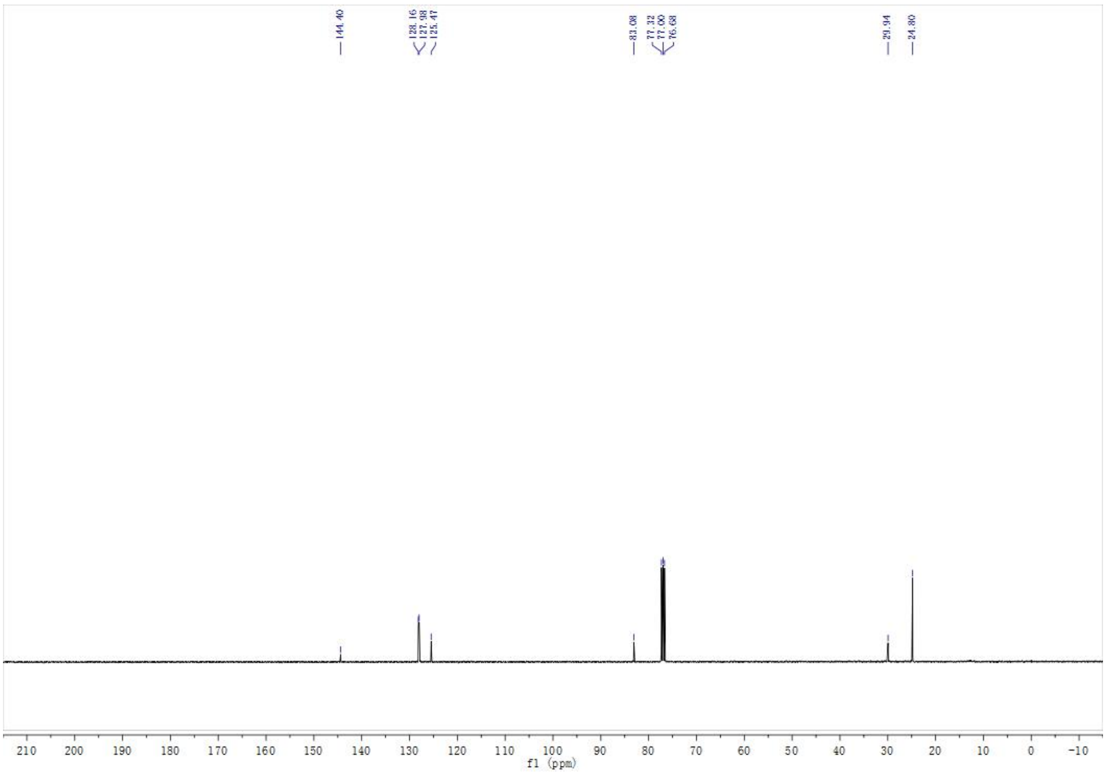
77.00
76.68
32.44
31.92
29.69
29.66
29.59
29.42
29.36
24.80
24.01
22.68
14.11
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 -10
f1 (ppm)



7.28
7.27
7.26
7.24
7.24
7.22
7.22
7.20
7.20
7.17
7.16
7.15
7.15
7.14
7.13
7.13
2.77
2.75
2.72
1.22
1.16
1.14
1.12
-0.00
H_3C
CH_3
CH_3
CH_3
O
B
O
4.01
1.00
1.93
12.12
2.01
9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0
f1 (ppm)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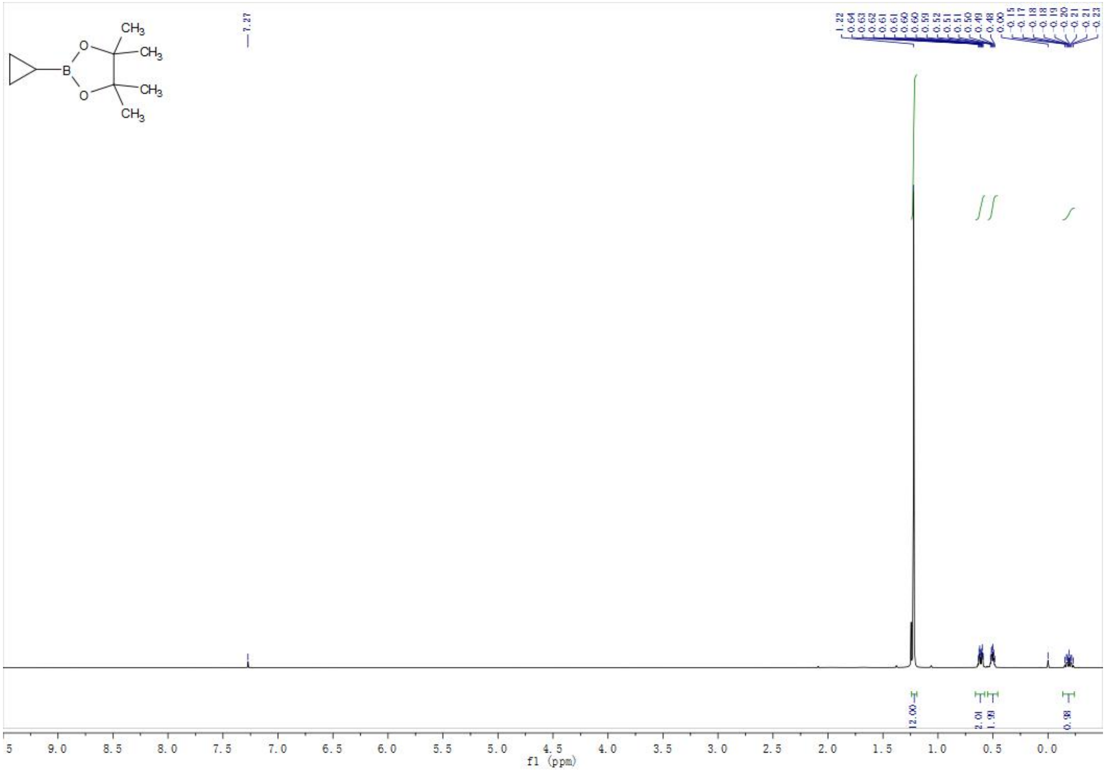
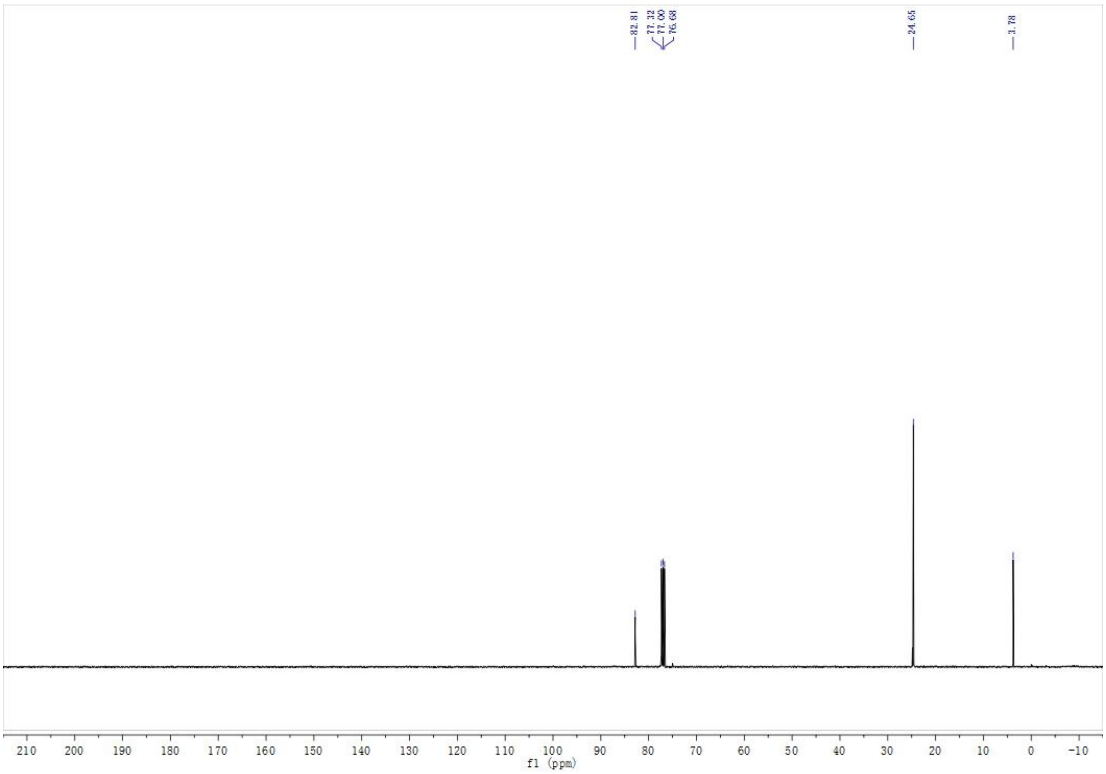
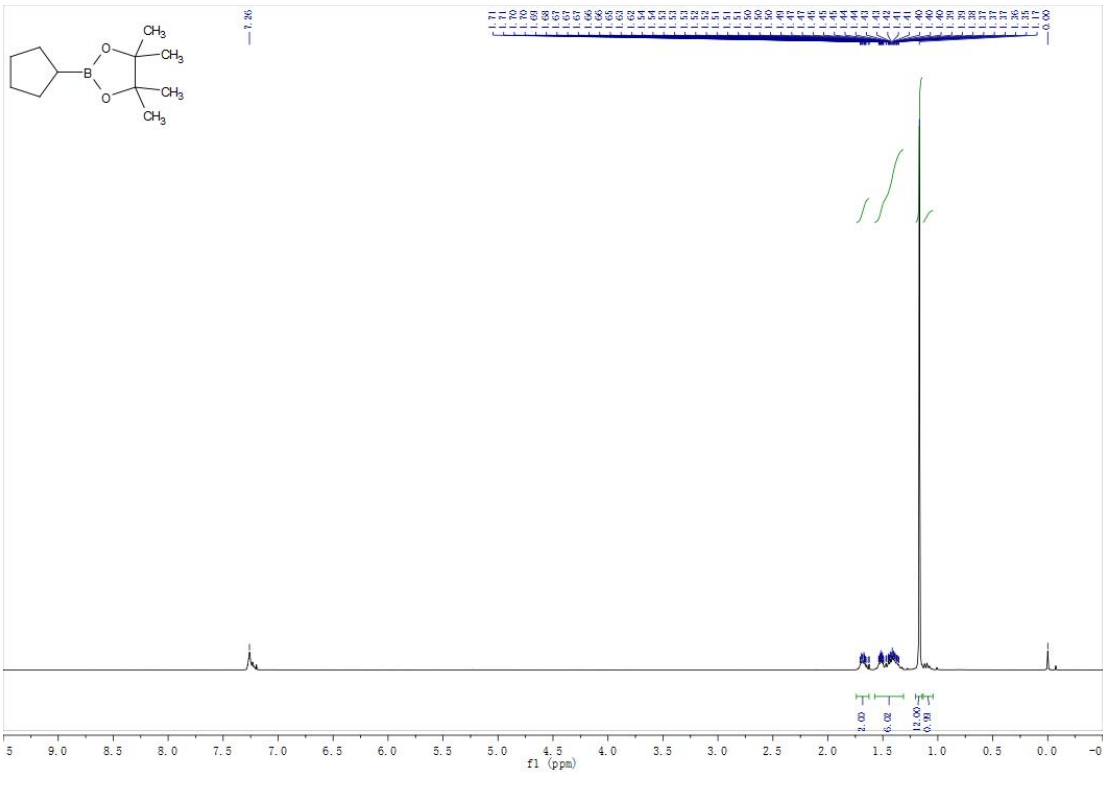
128.16
127.98
125.47
83.08
77.32
77.00
76.68
29.94
24.80
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 -10
f1 (ppm)

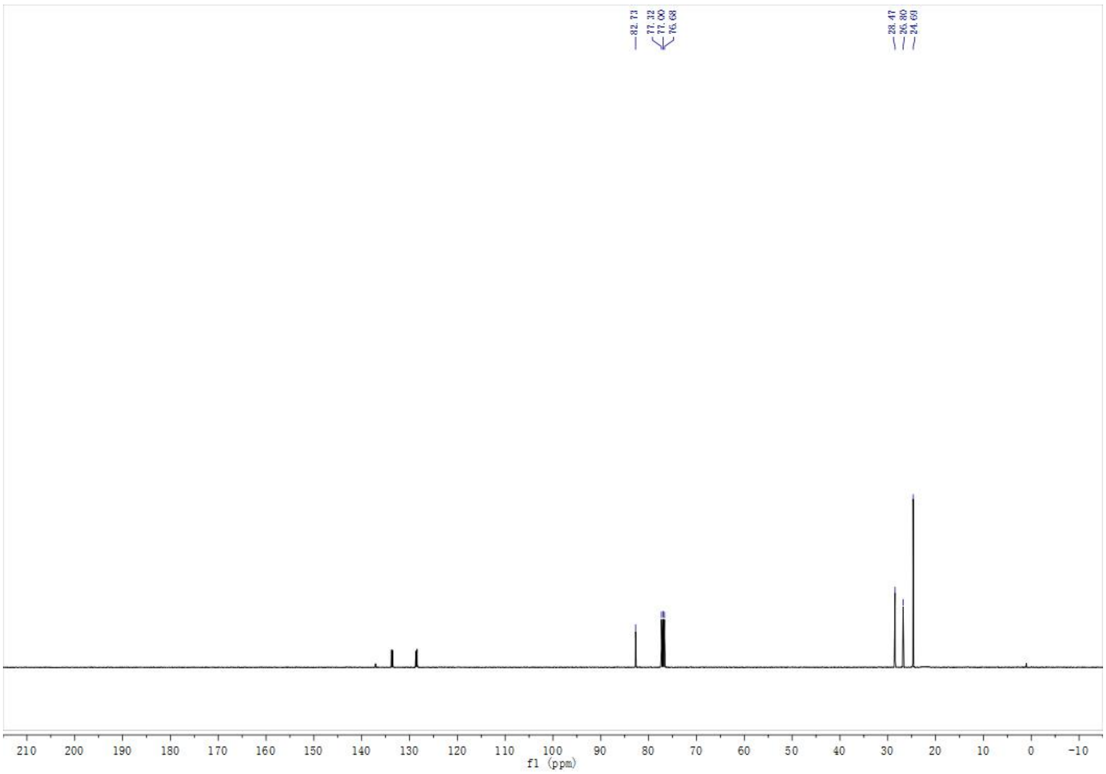

CH3
CH3
CH3
CH3
B
O
O
7.27
1.22
0.64
0.63
0.62
0.61
0.60
0.60
0.59
0.52
0.51
0.51
0.50
0.49
0.48
0.00
-0.15
-0.17
-0.18
-0.18
-0.19
-0.20
-0.21
-0.21
-0.23
12.00
2.01
1.99
0.98
9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0
f1 (ppm)

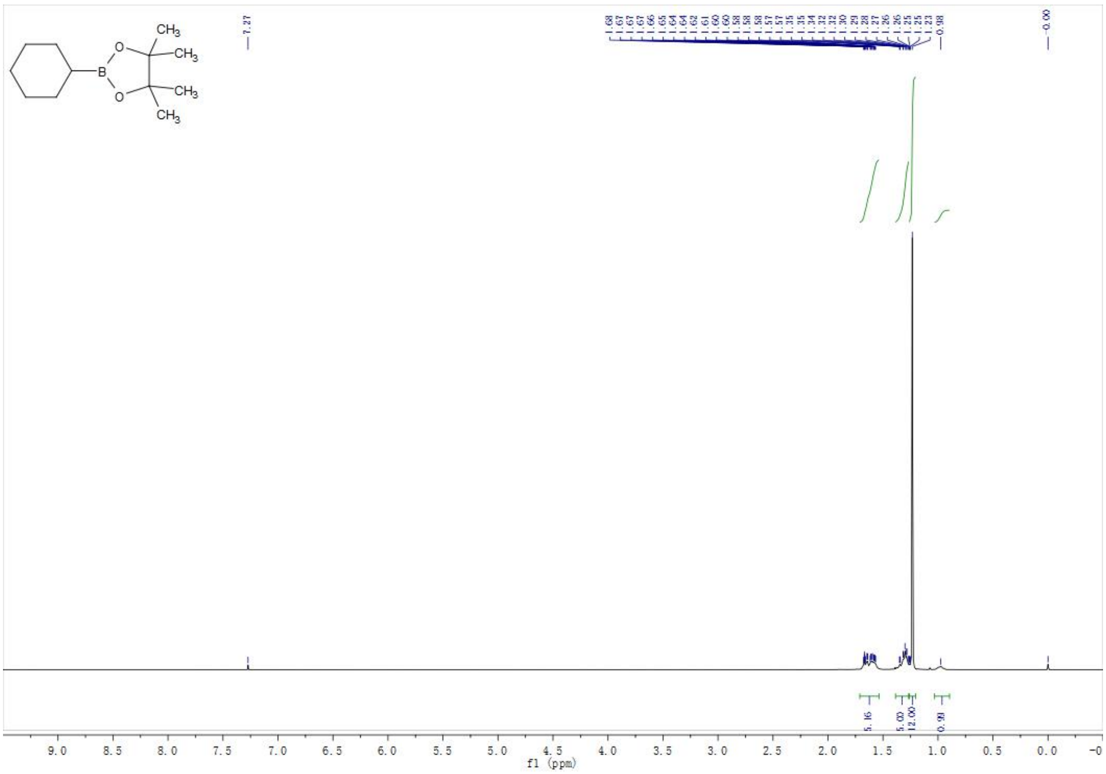


82.81
77.32
77.00
76.68
24.65
3.78
f1 (ppm)



7.26
0.00
2.00
6.02
12.00
0.99
f1 (ppm)


82.73
77.32
77.00
76.68
28.47
26.80
24.69
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 -10
f1 (ppm)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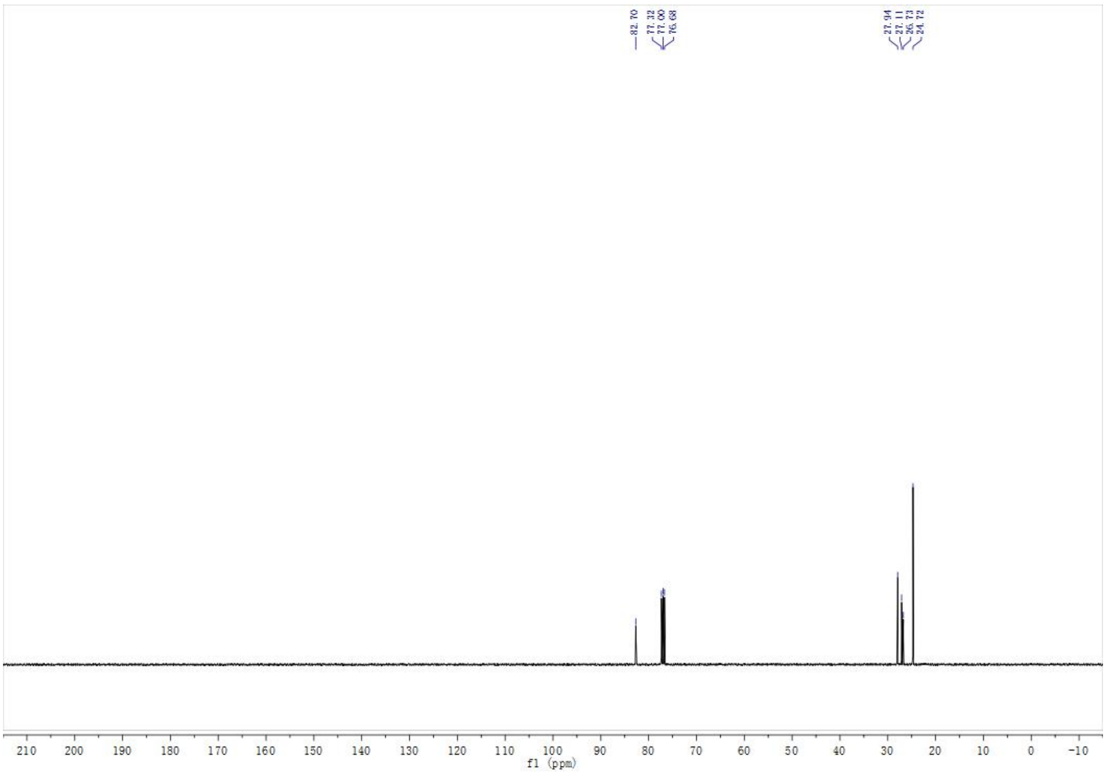
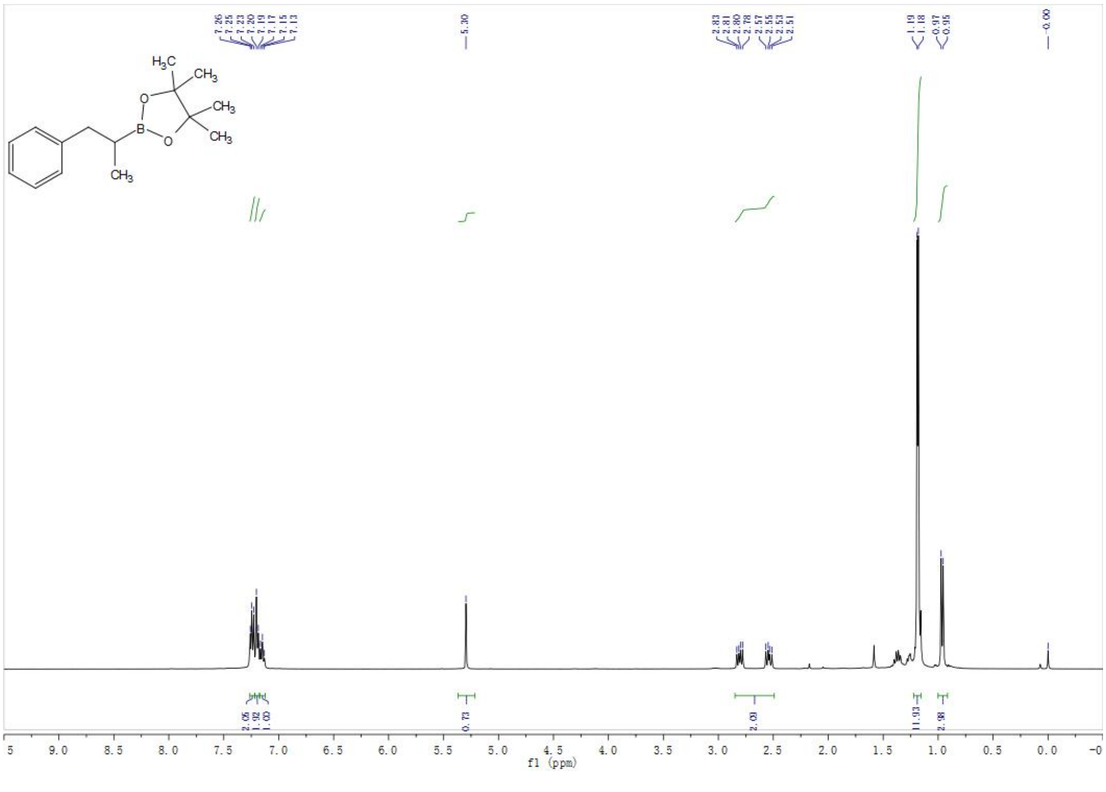
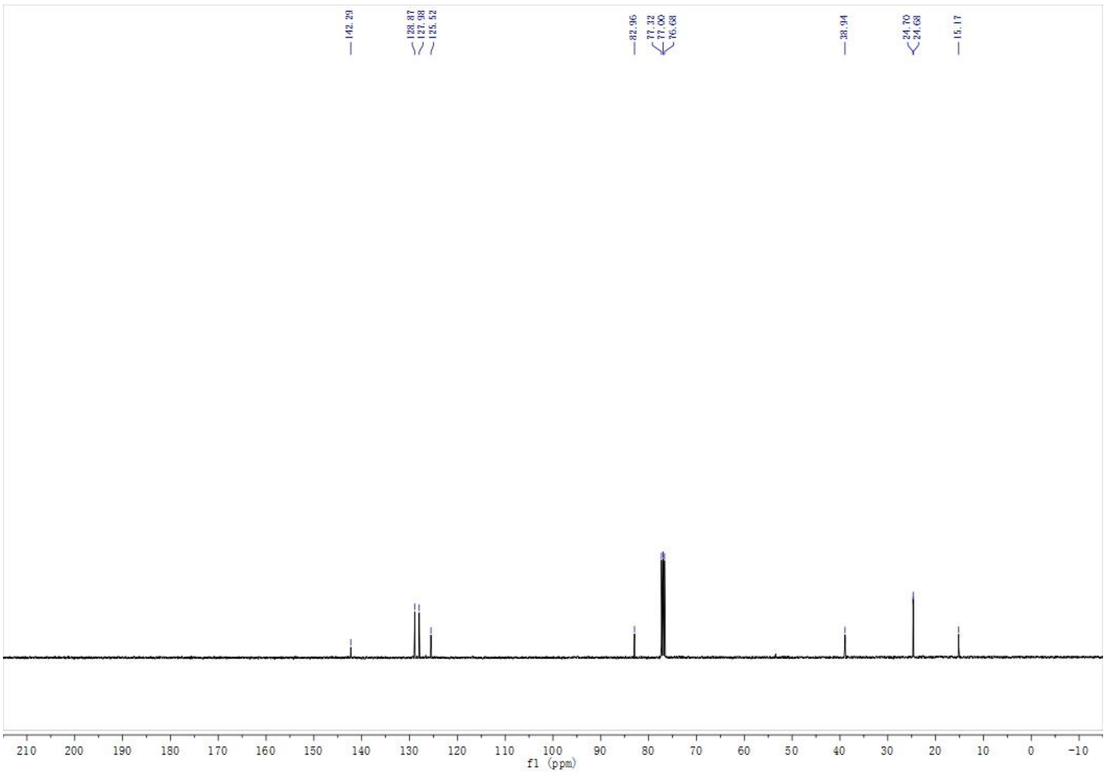
CH3
CH3
CH3
B
O
O
7.27
0.98
0.00
5.16
5.00
12.00
0.99
9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0
f1 (ppm)

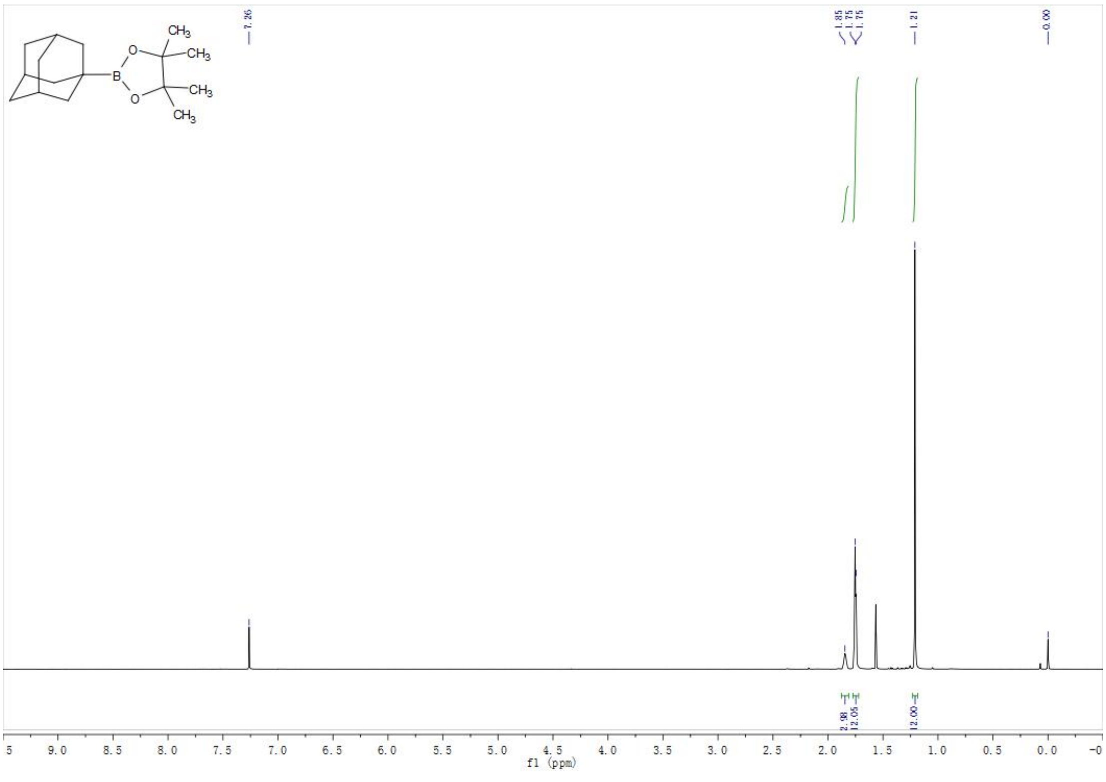


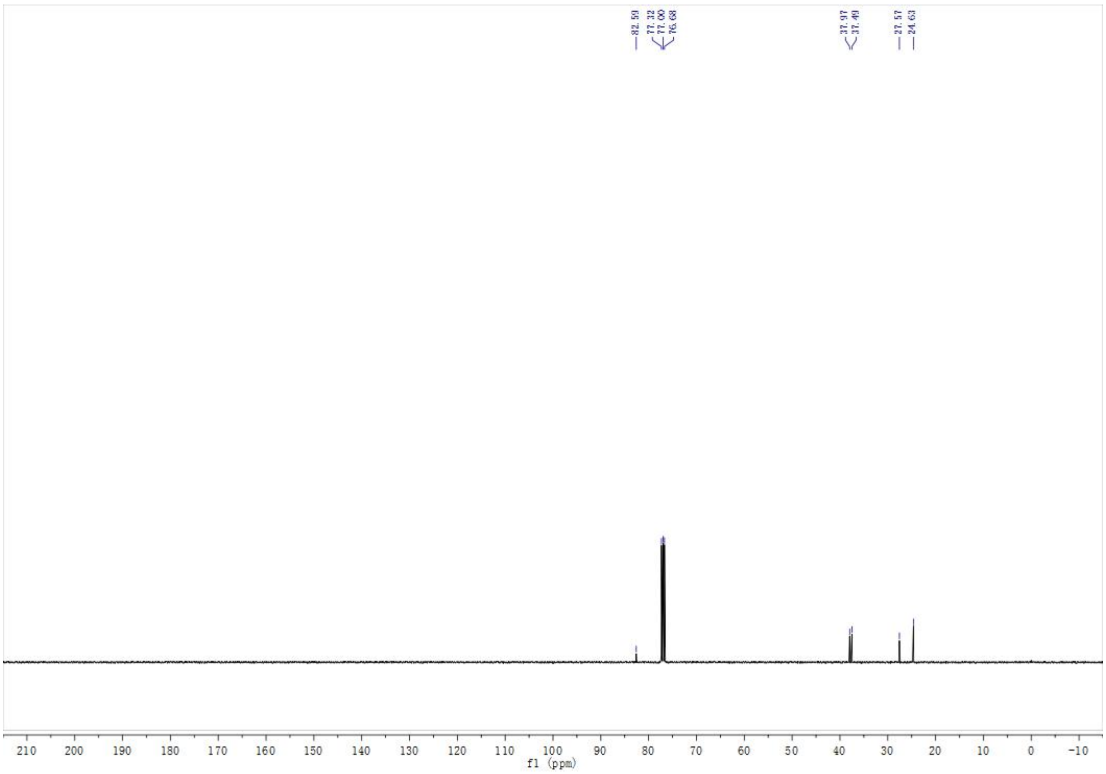
82.70
77.32
77.00
76.68
27.94
27.11
26.73
24.72
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 -10
f1 (ppm)



7.26
7.25
7.23
7.20
7.19
7.17
7.15
7.13
5.30
2.83
2.81
2.80
2.78
2.57
2.55
2.53
2.51
1.19
1.18
0.97
0.95
0.00
2.06
1.92
1.00
0.73
2.00
11.93
2.98
9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0
f1 (ppm)


142.29
128.87
127.98
125.52
82.96
77.32
77.00
76.68
38.94
24.70
24.68
15.17
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 -10
f1 (ppm)


CH3
CH3
CH3
CH3
B
O
O
7.26
1.85
1.75
1.75
1.21
0.00
2.98
12.05
12.00
9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0
f1 (ppm)



82.59
77.32
77.00
76.68
37.97
37.49
27.57
24.63
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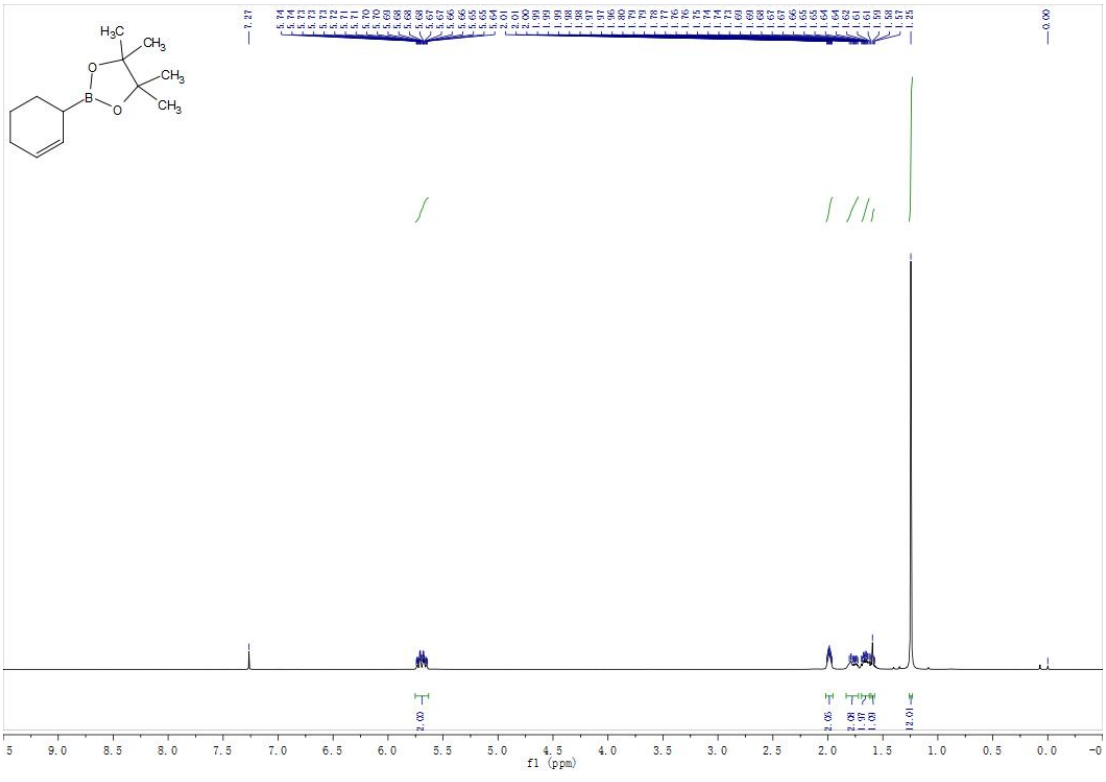
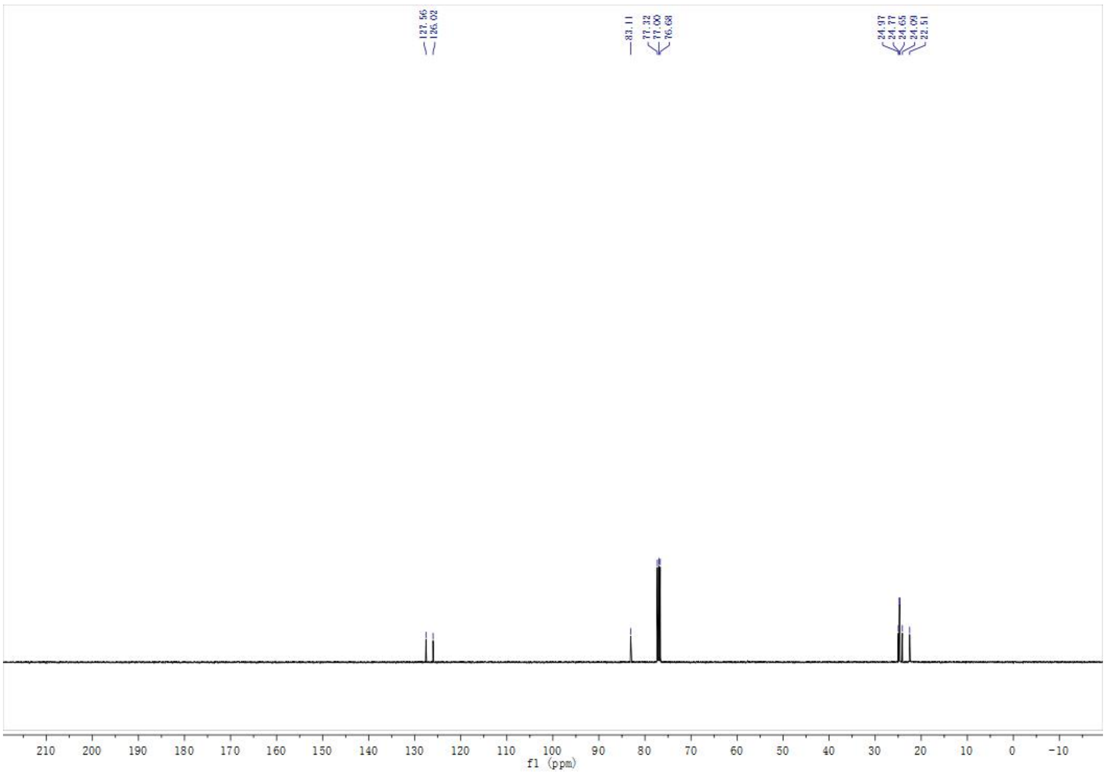
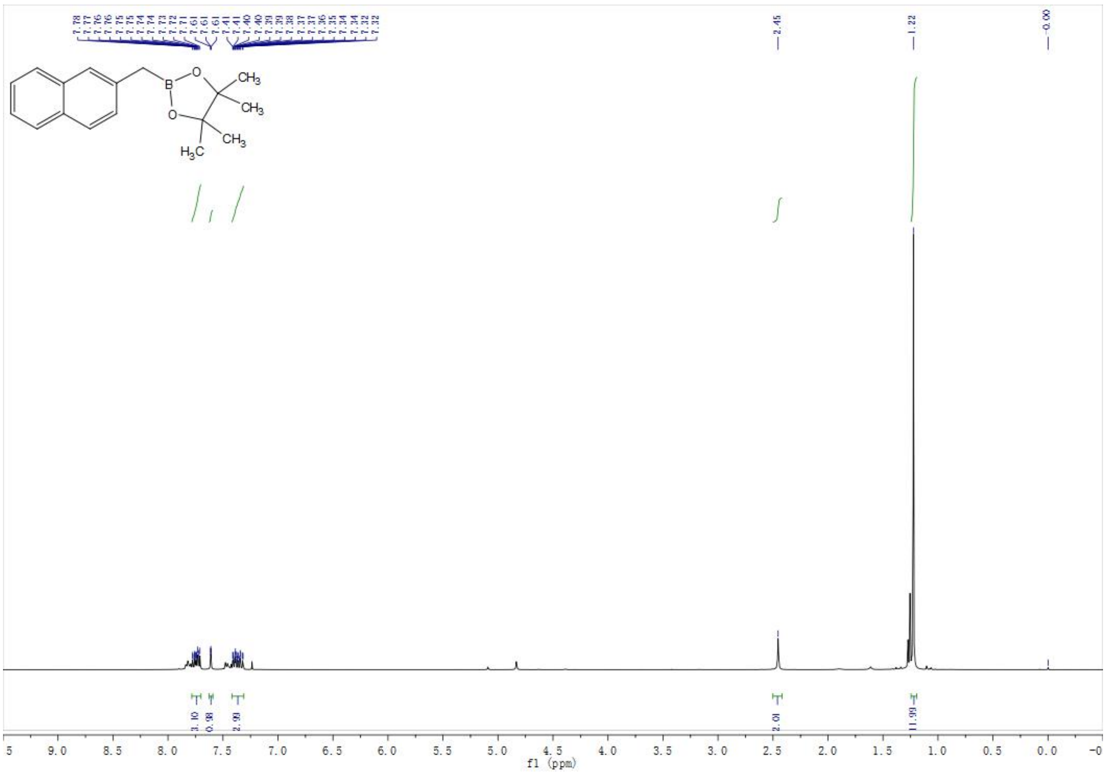
f1 (ppm)



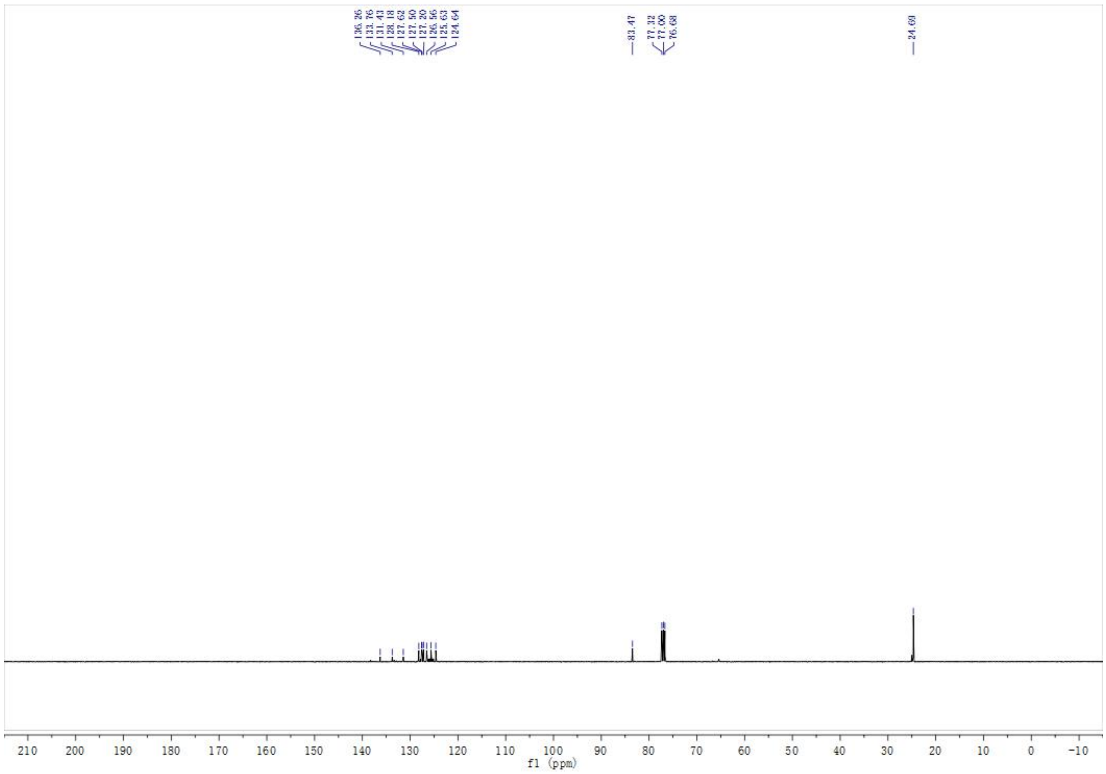
H3C
CH3
CH3
CH3
O
B
O
7.27
1.25
0.00
2.00
2.05
2.08
1.97
1.00
12.01
9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0
f1 (ppm)

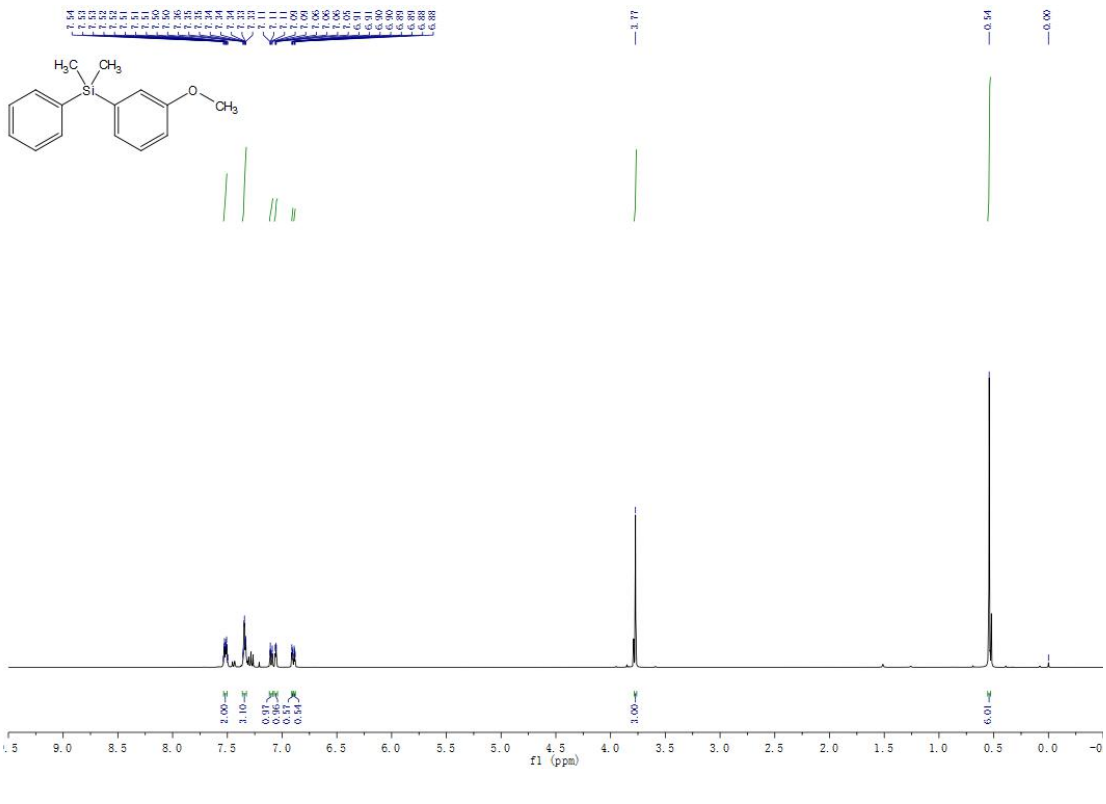


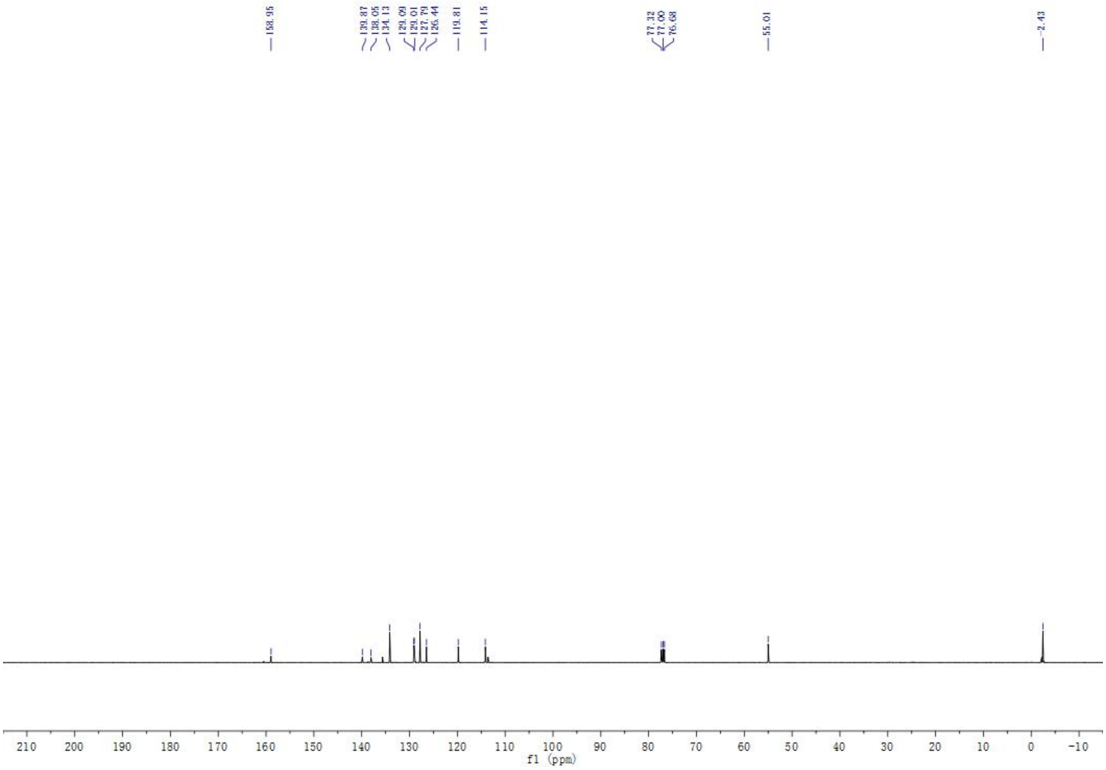
127.56
126.02
83.11
77.32
77.00
76.68
24.97
24.77
24.65
24.09
22.51
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 -10
f1 (ppm)

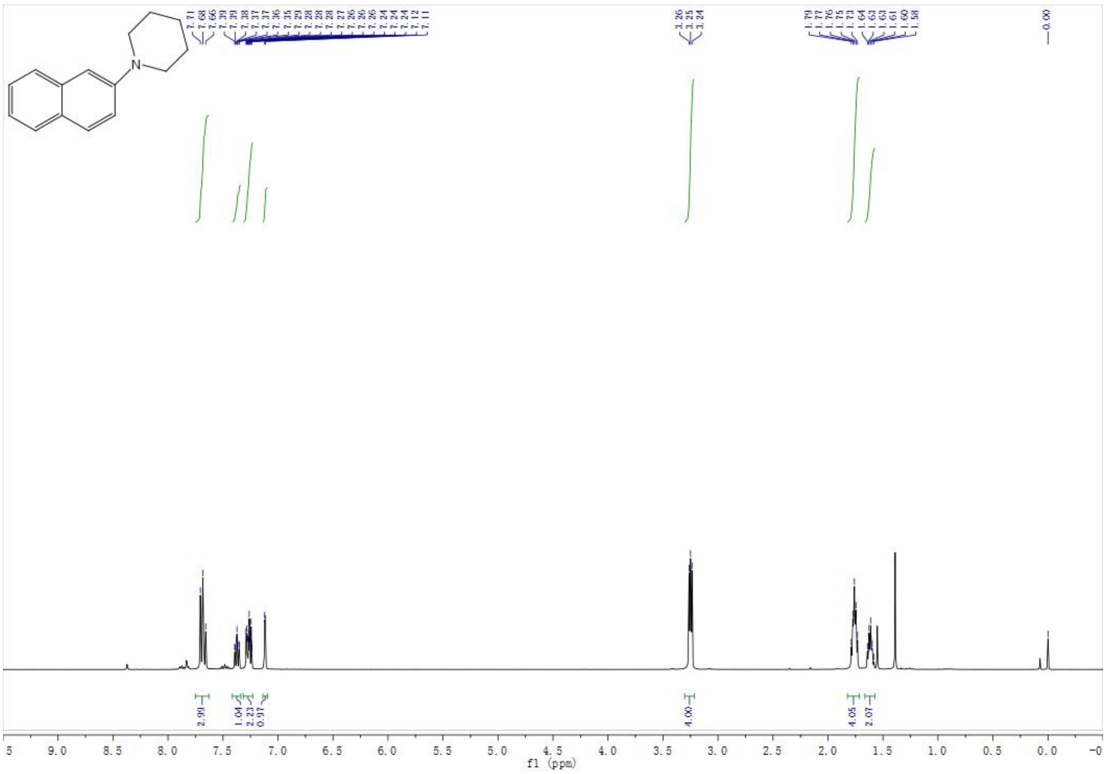


2.45
1.22
0.00
CH3
CH3
CH3
H3C
O
B
O
3.10
0.98
2.99
2.01
11.99
9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0
f1 (ppm)


136.26
133.76
131.43
128.18
127.62
127.50
127.20
126.56
125.63
124.64
83.47
77.32
77.00
76.68
24.69
f1 (ppm)


3.77
0.54
0.00
2.00
3.10
0.97
0.96
0.57
0.54
3.00
6.01
f1 (ppm)


158.95
139.87
138.05
134.13
129.09
129.01
127.79
126.44
119.81
114.15
77.32
77.00
76.68
55.01
-2.43
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 -10
f1 (ppm)


7.71
7.68
7.66
7.39
7.39
7.38
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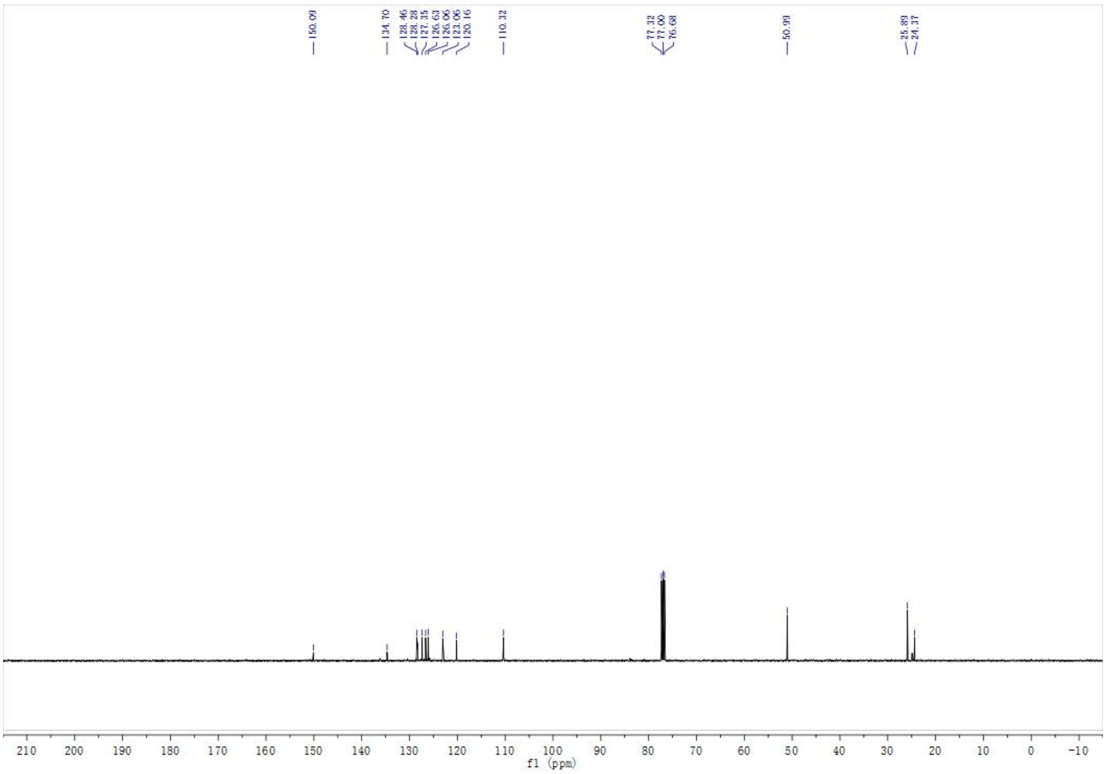
7.37
7.36
7.35
7.29
7.28
7.28
7.27
7.26
7.26
7.25
7.24
7.24
7.24
7.12
7.11
3.26
3.25
3.24
1.79
1.77
1.76
1.75
1.73
1.64
1.63
1.61
1.60
1.58
0.00
2.99
1.04
2.23
0.97
4.00
4.05
2.07
9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0
f1 (ppm)


150.09
134.70
128.46
128.28
127.35
126.63
126.06
121.06
120.16
110.32
77.32
77.00
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50.99
25.89
24.37
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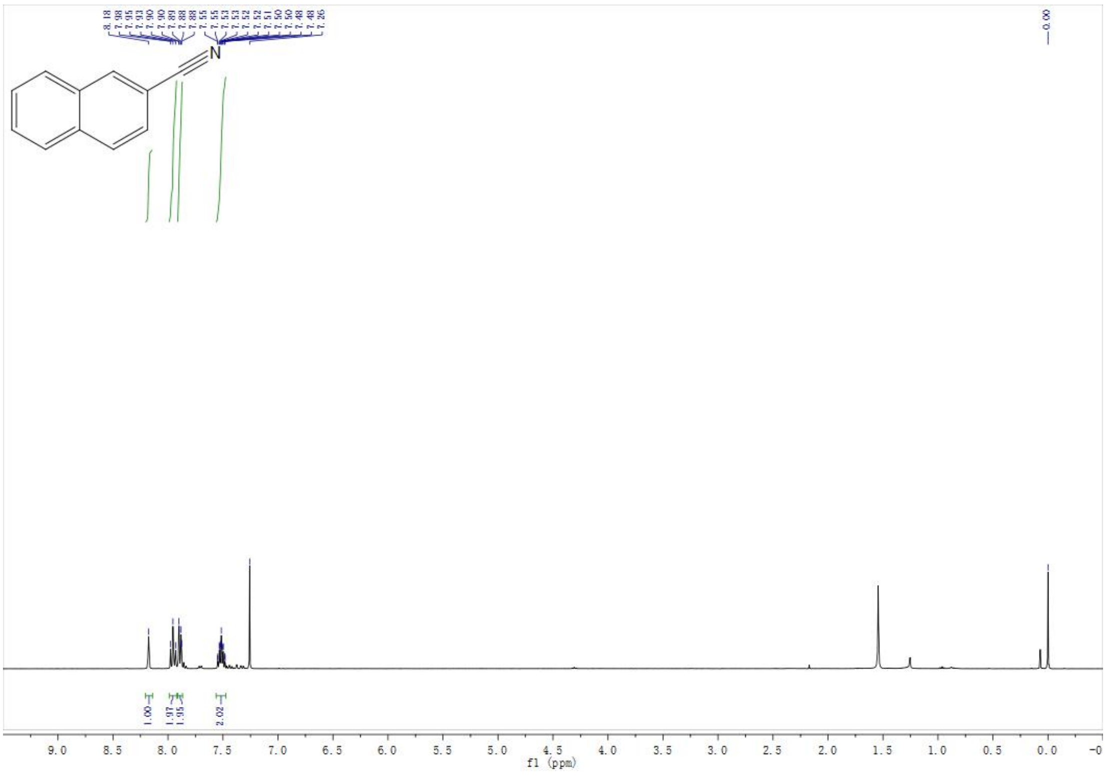
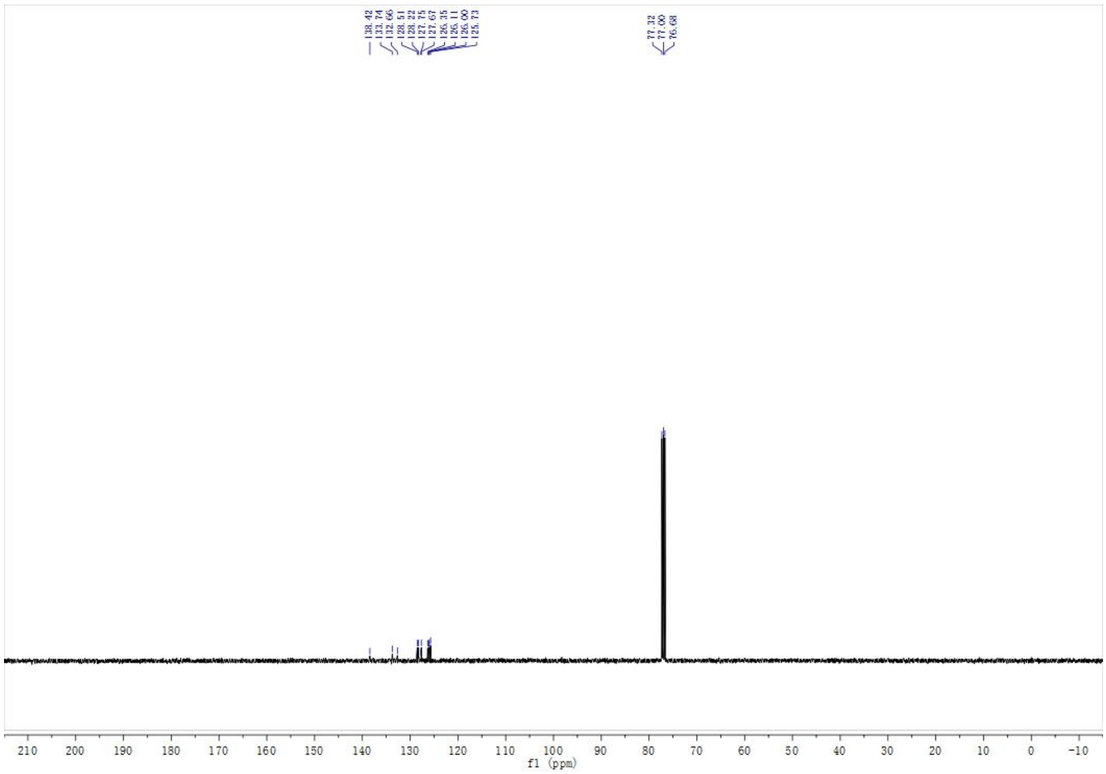
f1 (ppm)


8.18
7.98
7.95
7.93
7.90
7.90
7.89
7.88
7.88
7.55
7.55
7.53
7.53
7.52
7.52
7.51
7.50
7.50
7.48
7.48
7.26
0.00
N
1.00
1.97
1.95
2.02
9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0
f1 (ppm)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133.74
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126.35
126.11
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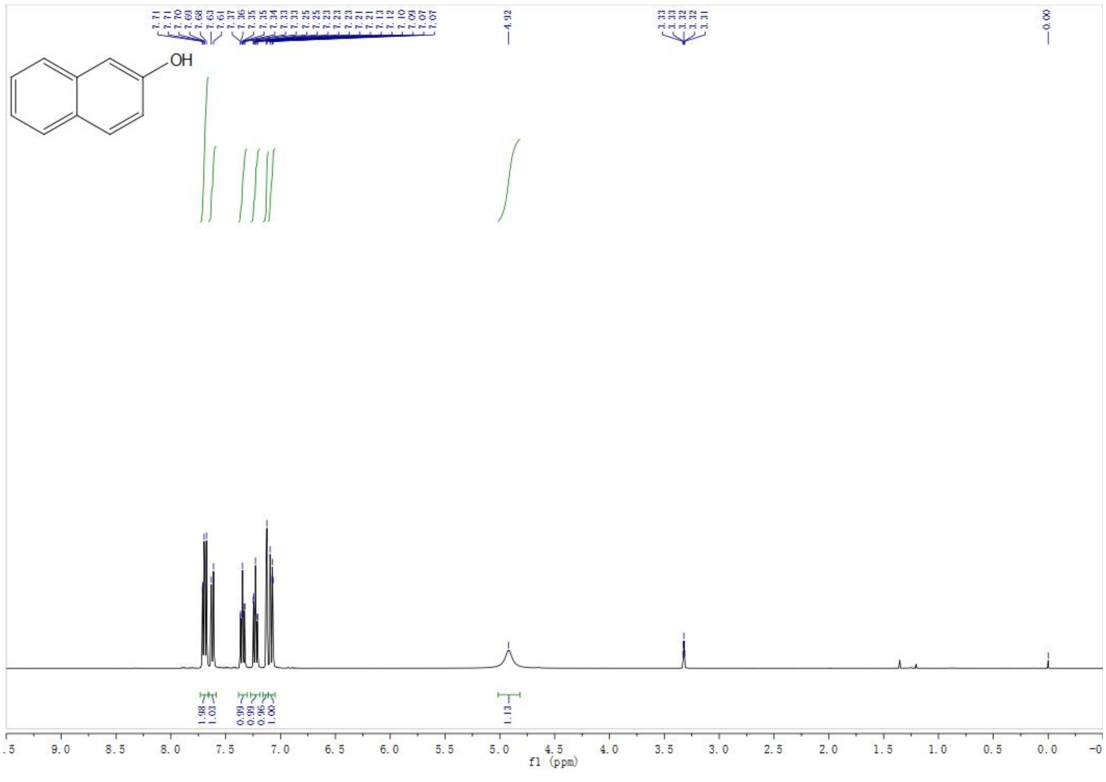
77.32
77.00
76.68
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 -10
f1 (ppm)


OH
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7.71
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7.68
7.63
7.61
7.37
7.36
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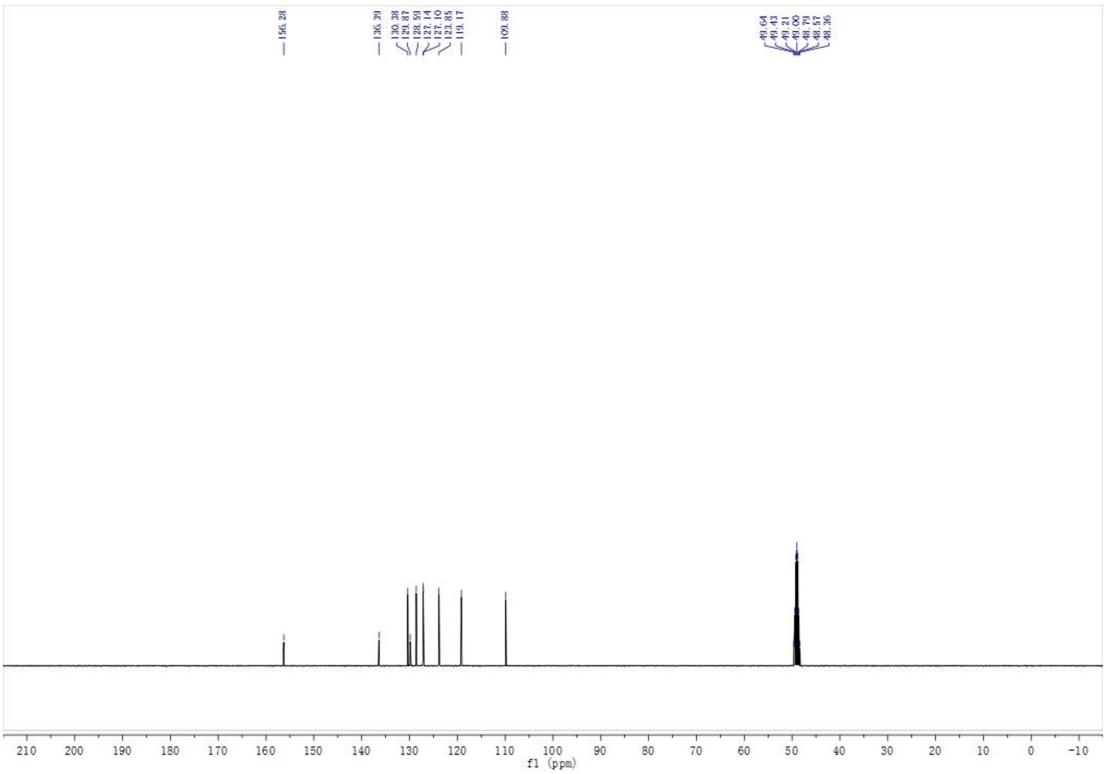
7.35
7.34
7.33
7.33
7.25
7.25
7.23
7.23
7.23
7.21
7.21
7.13
7.12
7.10
7.09
7.07
7.07
4.92
3.33
3.33
3.32
3.32
3.31
0.00
1.98
1.03
0.99
0.99
0.96
1.00
1.13
9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0
f1 (ppm)


156.28
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130.38
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128.59
127.14
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123.85
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109.88
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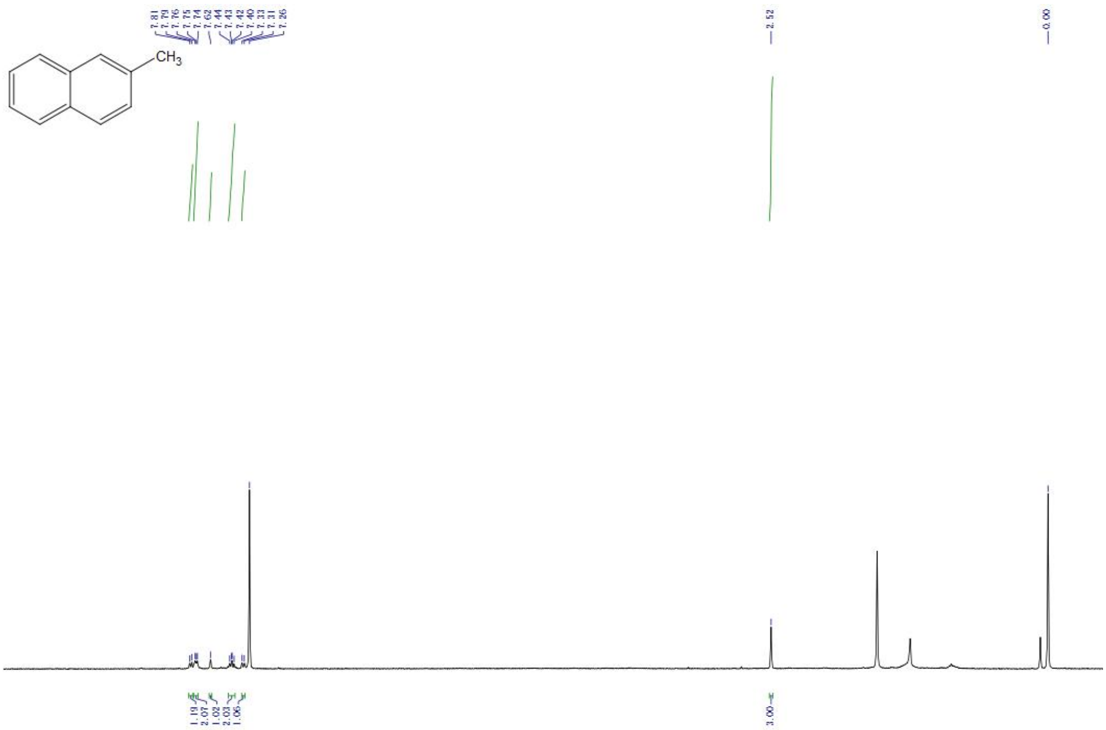
49.43
49.21
49.00
48.79
48.57
48.36
f1 (ppm)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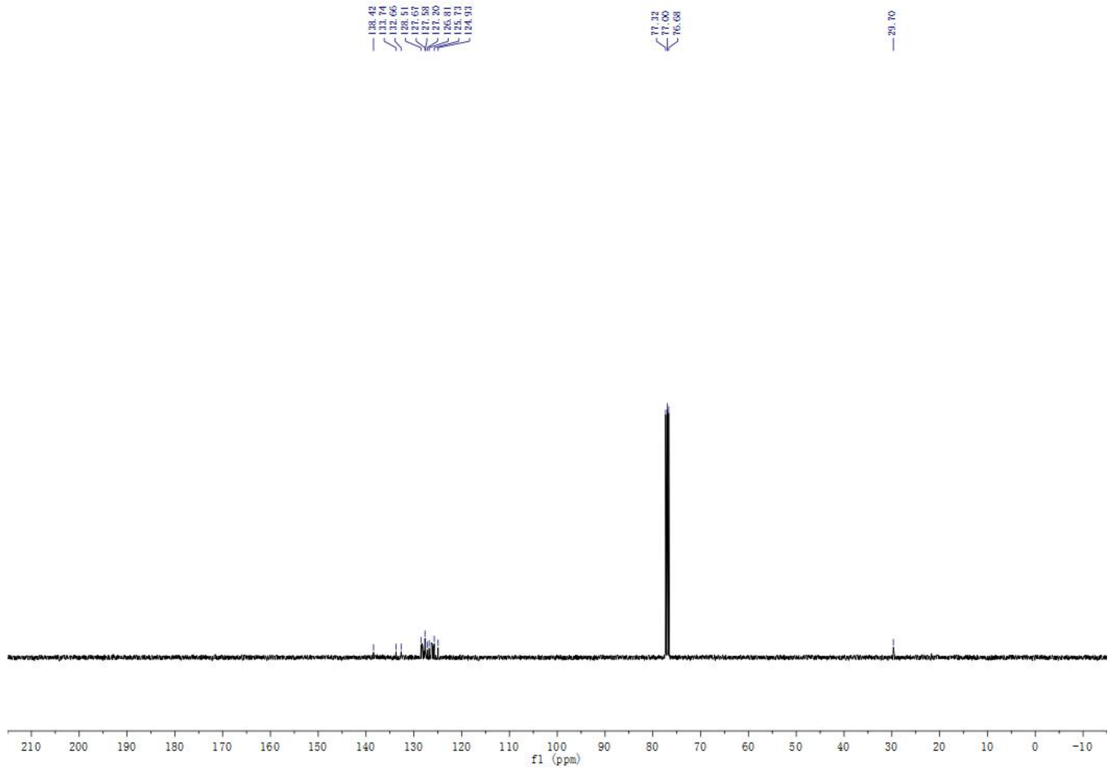
7.43
7.42
7.40
7.33
7.31
7.26
2.52
0.00
CH3
1.19
2.07
1.02
2.03
1.06
3.00
f1 (ppm)



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