Electronic Supplementary Material (ESI) for Organic & Biomolecular Chemistry.

Supporting Information

Electrochemically Enhanced Deoxygenative Cross-Coupling of Aryl Ketones with Heteroarenes through in-situ Generated Benzyl Carbocations

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General Information

Unless otherwise noted, all electrochemical reactions for products preparation were handled under air, and performed in an undivided electrolysis cell (ElectraSyn 2.0). Aryl ketones **1a**-**1q**, the corresponding O-, S-, N-heteroarenes were purchased from Aladdin Ltd. (Shanghai, China), *J&K* Scientific, and TCI (Shanghai) Development Co., Ltd. Graphite plates (immersed in electrolyte≈1 x 1 cm), copper plates (≈1 x 1 cm), and other electrodes (≈1 x 1 cm) were used for reaction optimization and substrate scope studies. HPLC grade solvents, *N,N'*-dimethylforamide (DMF), dichloromethane (DCM), acetonitrile (MeCN), and tetrahydrofuran (THF) were purchased from commercial sources and used without further purification. The new products were fully characterized by using ^{1}H, ^{13}C NMR and HRMS. ^{1}H NMR spectra were recorded on a Bruker GPX 400 MHz spectrometer. Chemical shifts (δ) were reported in parts per million (ppm, δ) relative to residual chloroform (7.26 ppm for ^{1}H NMR; 77.0 ppm for ^{13}C NMR), Coupling constants were reported in Hertz. ^{1}H NMR assignment abbreviations were the following: singlet (s), doublet (d), triplet (t), quartet (q), doublet of doublets (dd), doublet of triplets (dt), and multiplet (m). ^{13}C NMR spectra were recorded at 101 MHz on the same spectrometer and reported in ppm. Known products were analyzed by GC-MS, ^{1}H NMR and verified by comparison with literature data. Melting points were measured on an SGW-4A microscopic melting point apparatus. High resolution mass spectra (HRMS) were recorded on a Waters Acquity UPLC Class I/Xevo G2 Q-Tof MS by using electrospray ionization (ESI) with a TOF mass analyzer.

Graphic presentation of reaction.

Figure S1. Typical reaction set-up of electrochemical reaction of aryl ketones and heteroarenes.

Controlled electrochemical studies of benzophenone and benzofuran

Notably, triflic acid, a super strong acid in organic media, can help stabilize benzylic carbocations even in organic media, which also serves as an efficient supporting electrolyte for the electrochemical reactions. Cyclic voltammetry (CV) measurements were performed to study the electrical behavior of **1a** and **2a** (Figure S2). Surprisingly, the initial current was around 4.5 mA even without an applied potential and substrates, such a phenomenon possibly arose from the reaction of triflic acid and CH_3CN.[17-18] The proton from triflic acid and the hydride from silane could work synergistically to reduce the carbonyl group, which could cause the current signal. Besides that, the CV investigation shows that benzophenone **1a** and benzofuran **2a** exhibit electrochemical reactivity at oxidative potentials with onset ~1.2-1.3 V vs Ag/AgCl. The mixture of **1a** and **2a** (green) shows an increased anodic current compared to the independent study of **1a** (red) and **2a** (blue), which is consistent with the occurrence of the rapid cross-coupling between benzyl carbocations and heteroarenes. It is also clear that the cross-coupling reaction between **1a** and **2a** (green) outcompetes the carbonyl deoxygenative reduction reaction (red). The increasing tendency to the applied potential of the carbonyl deoxygenative reduction reaction (red) probably suggests that the increased generation of benzyl carbocation and the reduction of benzyl carbocation in the presence of silane.

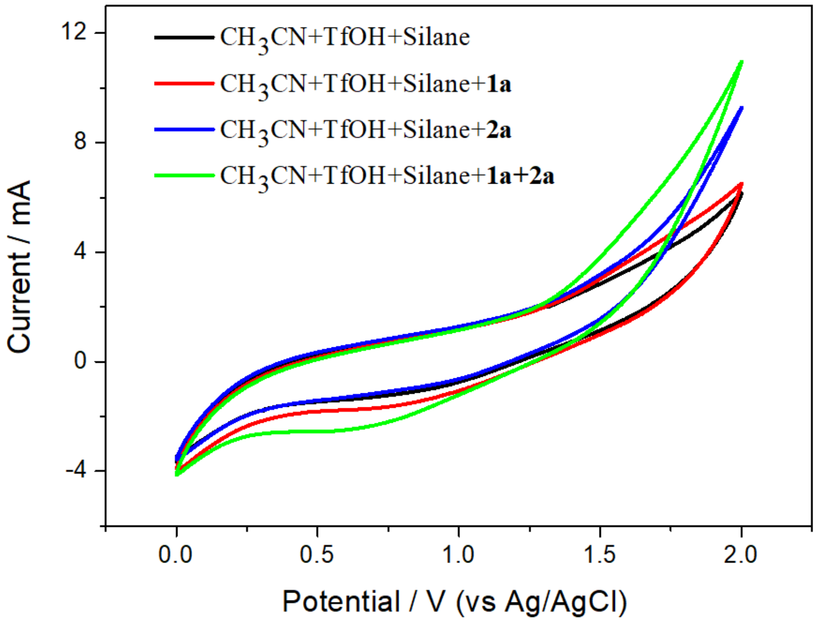
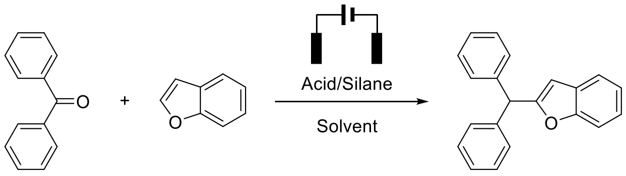


Figure S2. Electrochemical behaviors of **1a** and **2a** by CV techniques at scan rate 100 mv/s, vs (Ag/AgCl).

Reaction Conditions Optimization

Table S1. Optimization for electrochemical reaction of **1a** and **2a**.[a]



1a **2a** **3a**

Entry	Anode	Cathode	Acid	Silane	Current (mA)	Time (h)	Solvent (5.0 mL)	Yield of **3a** (%)
1	Graphite	Cu	CF_3SO_3H	0.25	0	3	CH_3CN	68
2	Graphite	Cu	CF_3SO_3H	0.25	2	3	CH_3CN	73
3	Graphite	Cu	CF_3SO_3H	0.25	5	3	CH_3CN	75
4	Graphite	Cu	CF_3SO_3H	0.25	10	3	CH_3CN	100 (82)
5	Graphite	Cu	CF_3SO_3H	0.25	10	0.5	CH_3CN	76
6	Graphite	Cu	CF_3SO_3H	0.25	10	1	CH_3CN	83
7	Graphite	Cu	CF_3SO_3H	0.25	10	2	CH_3CN	92
8	Graphite	Cu	CF_3SO_3H	0.25	10	3	CH_3CN	100

9	Graphite	Cu	CF_3SO_3H	0.25	10	3	CH_2Cl_2	0
10	Graphite	Cu	CF_3SO_3H	0.25	10	3	THF	0
11	Graphite	Cu	CF_3SO_3H	0.25	10	3	DMF	0
12	Glass carbon	Cu	CF_3SO_3H	0.25	10	3	CH_3CN	94
13	Graphite	C	CF_3SO_3H	0.25	10	3	CH_3CN	100
14	Graphite	Cu	None	0.25	10	3	CH_3CN	0
15	Graphite	Cu	CF_3COOH	0.25	10	3	CH_3CN	0
16	Graphite	Cu	CH_3COOH	0.25	10	3	CH_3CN	0
17	Graphite	Cu	TsOH	0.25	10	3	CH_3CN	0
18	Graphite	Cu	H_2SO_4	0.25	10	3	CH_3CN	0
19 [b]	Graphite	Cu	0.5mmol	0.25	10	3	CH_3CN	68
20 [c]	Graphite	Cu	0.75mmol	0.25	10	3	CH_3CN	100
21	Graphite	Cu	CF_3SO_3H	0	10	3	CH_3CN	0
22	Graphite	Cu	CF_3SO_3H	0.5	10	3	CH_3CN	100 (83)
23 [d]	-	-	CF_3SO_3H	0.25	50 ^{o}C	3	CH_3CN	71
24 [d]	-	-	CF_3SO_3H	0.25	70 ^{o}C	3	CH_3CN	77
25 [d]	-	-	CF_3SO_3H	0.25	90 ^{o}C	3	CH_3CN	81

[a] Reaction condition: **1a**, 0.5 mmol, **2a**, 2.0 equiv. 1.0 mmol, CF_3SO_3H, 1.8 equiv. 0.90 mmol, hydrosilane, 0.50 equiv. 0.25 mmol, Solvent, CH_3CN, 5.0 mL; 10 mA, 3.0 h at room temperature. Yields was determined GC by using 50 µL of dodecane as internal standard and isolated yield was given in parenthesis. [b] 1.0 equiv. CF_3SO_3H. [c] 1.5 equiv. CF_3SO_3H. [d] Reactions were performed in a 25 mL seal Schlenk.

General procedure for electrochemically enhanced cross-coupling reactions

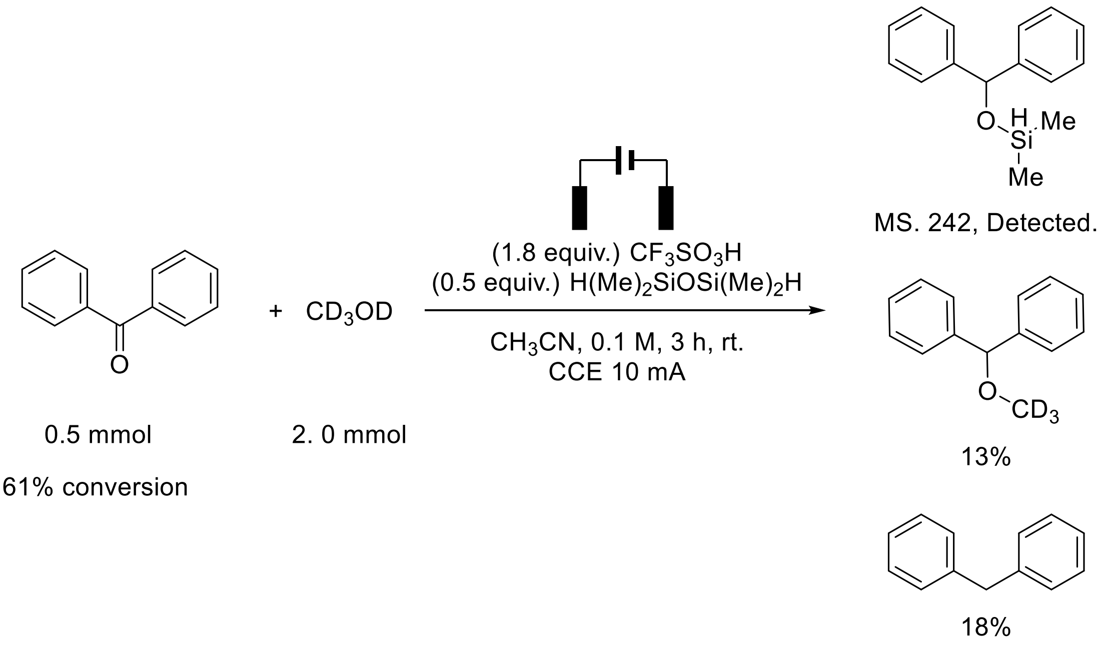
The reactions were performed in an undivided ElectraSyn 2.0 vial (10 mL), which was equipped with graphite plate (anode, ≈1 x 1 cm) and Cu plate (cathode, ≈1 x 1 cm) as electrodes. To this electrolysis vial, aryl ketone (0.5 mmol, 1.0 equiv.), 1,1,3,3-Tetramethyldisiloxane (0.25 mmol, 0.5 equiv.), heteroarene (1.0 mmol, 2.0 equiv.), CH_3CN (5.0 mL), and triflic acid (0.9 mmol, 1.8 equiv.) were added. The mixture was electrolyzed under 10 mA constant current at room temperature with rigid magnetic stirring, and the reaction was monitored by thin layer chromatography (TLC) after 3 hours till aryl ketone was completely converted. Then, a partial solution was filtered through a short silica gel column for GC and GC-MS analysis. The combined solution was concentrated under reduced pressure and purified by column chromatography on silica gel (petroleum ether/ethyl acetate) to afford the desired cross-coupling products.

Procedure for synthesis of 2-benzhydrylbenzofuran (3a)

To an undivided ElectraSyn 2.0 cell (10 mL), graphite plate (anode, ≈2 x 1 cm) and Cu plate (cathode, ≈2 x 1 cm) was equipped as electrodes. Benzophenone (**1a**, 1.0 mmol, 182.2 mg), 1,1,3,3-Tetramethyldisiloxane (0.5 mmol, 67.2 mg), benzofuran (**2a**, 2.0 mmol, 236.4 mg), CH_3CN (10.0 mL, 0.1 M), and triflic acid (1.8 mmol, 270.1 mg) were added subsequently to the electrolysis cell. The mixture was electrolyzed under 10 mA constant current at room temperature with rigid magnetic stirring for 3 hours, and TLC showed that benzophenone **1a** was completely converted. The reaction was filtrated through celites and a partial solution was submitted for GC and GC-MS analysis. The combined filtrate was concentrated under reduced pressure and purified by column chromatography on silica gel using petroleum ether as eluent, affording **3a** a white solid in 83% isolated yield, 236.0 mg.

Note: When the reaction was performed in 0.2 M (1.0 mmol **1a** in 5.0 mL CH_3CN), or 0.125 M (1.0 mmol **1a** in 8.0 mL CH_3CN), trace amount of diphenylmethane was observed as side product in the reaction mixture.

Deoxygenative cross-coupling of 1a and CD_3OD



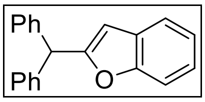
Scheme S1. Deoxygenative cross-coupling of **1a** with CD_3OD.

To an undivided ElectraSyn 2.0 cell (10 mL), graphite plate (anode, ≈2 x 1 cm) and

Cu plate (cathode, ≈2 x 1 cm) was equipped as electrodes. Benzophenone (**1a**, 0.5 mmol, 91.2 mg), 1,1,3,3-Tetramethyldisiloxane (0.25 mmol, 36.6 mg), CD_3OD (2.0 mmol, 72.1 mg), CH_3CN (5.0 mL, 0.1 M), and triflic acid (0.9 mmol, 135.1 mg) were added subsequently to the electrolysis cell. The mixture was electrolyzed under 10 mA constant current at room temperature with rigid magnetic stirring for 3 hours. The reaction was filtrated through a short silica gel column, and a partial solution was submitted for GC and GC-MS analysis. The products distribution was summarized in Scheme S1.

Analytical Data

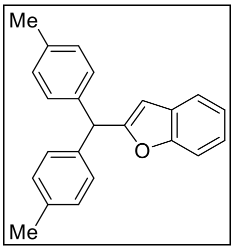
2-diphenylmethylbenzofuran[1,2] (3a):



From benzophenone (0.5 mmol, 91.1 mg) and benzofuran (1.0 mmol, 118.1 mg), **3a** was obtained according the general procedure using petroleum ether as eluent to give a white solid in 82% yield, 116.5 mg. **3a** was further analyzed by GC-MS, ^{1}H NMR, ^{13}C NMR and verified by comparison with literature data.

^{1}H NMR (400 MHz, $CDCl_3$): δ 7.46 (d, *J* = 7.2 Hz, 1H), 7.40 (d, *J* = 7.6 Hz, 1H), 7.33-7.15 (m, 12H), 6.27 (s, 1H), 5.58 (s, 1H); ^{13}C NMR (101 MHz, $CDCl_3$) δ 160.0, 155.2, 144.1, 142.3, 141.1, 129.2, 128.9, 128.9, 128.8, 128.7, 128.6, 128.6, 128.5, 128.4, 127.6, 127.3, 127.1, 126.8, 124.3, 124.1, 123.8, 122.7, 122.4, 120.7, 120.7, 111.5, 111.2, 105.7, 51.4, 47.7.

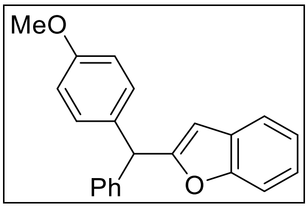
2-(di-p-tolylmethyl)benzofuran (3b):



From 4,4'-dimethylbenzophenone (0.5 mmol, 105.1 mg) and benzofuran (**2a**, 1.0 mmol, 118.1 mg), **3b** was obtained according the general procedure using petroleum ether as eluent to give a yellow oil in 32% yield, 50.0 mg.

^1H NMR (400 MHz, $CDCl_3$) δ 7.35 (dd, *J* = 23.2, 7.5 Hz, 2H), 7.17–7.09 (m, 2H), 7.07–7.02 (m, 8H), 6.19 (s, 1H), 5.43 (s, 1H), 2.26 (s, 6H); ^{13}C NMR (101 MHz, $CDCl_3$) δ 160.4, 155.1, 138.3, 136.5, 129.3, 128.7, 128.5, 123.7, 122.5, 120.6, 111.2, 105.4, 50.6, 21.1. HRMS (ESI) m/z: $[M+H]^+$ Calcd for $C_{23}H_{21}O^+$ 313.1592; found 313.1589.

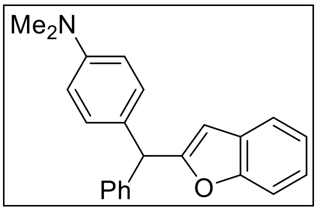
2-((4-methoxyphenyl)(phenyl)methyl)benzofuran[5] (3c):



From 4-methoxybenzophenone (0.5 mmol, 106.1 mg) and benzofuran (**2a**, 1.0 mmol, 118.1 mg), **3c** was obtained according the general procedure (EtOAc/petroleum ether=1:49) to give a colorless oil in 36% yield, 56.8 mg. **3c** was analyzed by GC-MS, ^1H NMR, ^{13}C NMR and verified by comparison with literature data.

^1H NMR (400 MHz, $CDCl_3$) δ 7.49–7.44 (m, 1H), 7.43–7.38 (m, 1H), 7.29 (ddt, *J* = 9.0, 4.2, 1.6 Hz, 3H), 7.24–7.10 (m, 6H), 6.88–6.81 (m, 2H), 6.25 (d, *J* = 0.8 Hz, 1H), 5.53 (s, 1H), 3.79 (s, 3H); ^{13}C NMR (101 MHz, $CDCl_3$) δ 160.3, 158.5, 155.1, 141.4, 133.2, 129.9, 128.8, 128.5, 128.5, 126.9, 123.7, 122.6, 120.3, 113.9, 111.1, 105.5, 55.2, 50.5.

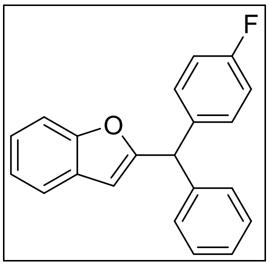
(2-benzofuryl) (4-dimethylaminophenyl)phenylmethane[4] (3d):



From 4-(dimethylamino)benzophenone (0.5 mmol, 112.6 mg) and benzofuran (**2a**, 1.0 mmol, 118.1 mg), **3d** was obtained according the general procedure (EtOAc/petroleum ether=1:49) to give a colorless oil in 33% yield, 54.6mg. **3d** was further analyzed by GC-MS, ^1H NMR, ^{13}C NMR and verified by comparison with literature data.

^1H NMR (400 MHz, $CDCl_3$) δ 7.41 (dt, *J* = 15.6, 7.4 Hz, 2H), 7.33–7.26 (m, 2H), 7.25–7.13 (m, 6H), 7.07 (t, *J* = 9.8 Hz, 2H), 6.67 (t, *J* = 7.3 Hz, 2H), 6.25 (s, 1H), 5.45 (d, *J* = 26.0 Hz, 1H), 2.89 (d, *J* = 7.7 Hz, 6H); ^{13}C NMR (101 MHz, $CDCl_3$) δ 160.9, 155.1, 149.5, 141.7, 129.5, 128.9, 128.8, 128.6, 128.4, 126.7, 123.5, 122.5, 120.5, 112.6, 111.1, 105.3, 50.4, 40.6.

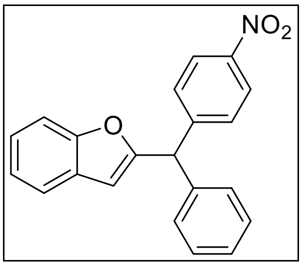
2-((4- fluorophenyl)(phenyl)methyl)benzofuran[13] (3e):



From 4-fluorobenzophenone (0.5 mmol, 100.1 mg) and benzofuran (**2a**, 1.0 mmol, 118.1 mg), **3e** was obtained according the general procedure (petroleum ether). The regioselectivity was determined by using GC and GC-Mass analysis (20:1), and purified using petroleum ether to give a colorless oil in 58% yield, 87.7 mg.

^{1}H NMR (400 MHz, CDCl$_3$) δ 7.42–7.37 (m, 1H), 7.33 (d, *J* = 7.9 Hz, 1H), 7.26 (t, *J* = 7.2 Hz, 2H), 7.20 (t, *J* = 5.1 Hz, 1H), 7.15–7.08 (m, 6H), 6.97–6.91 (m, 2H), 6.20 (d, *J* = 9.3 Hz, 1H), 5.49 (s, 1H); ^{13}C NMR (101 MHz, CDCl$_3$) δ 162.5, 154.9, 141.5, 140.5, 128.6, 127.4, 123.4, 122.5, 120.5, 111.0, 102.0, 39.3, 35.6, 31.6, 31.2, 22.6, 20.4, 14.1. HRMS (ESI) m/z: [M+H]$^+$ Calced for $C_{21}H_{16}FO^+$ 303.1185; found 303.1192.

2-((4-nitrophenyl)(phenyl)methyl)benzofuran (3f):

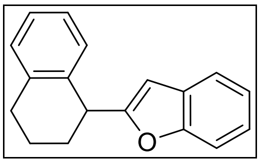


From 4-nitrobenzophenone (0.5 mmol, 113.6 mg) and benzofuran (**2a**, 1.0 mmol, 118.1 mg), **3f** was obtained according the general procedure (EtOAc/petroleum ether=1:49) to give a brown oil in 59% yield, 97.2 mg.

^{1}H NMR (400 MHz, CDCl$_3$) δ 8.21–8.04 (m, 2H), 7.41 (t, *J* = 9.6 Hz, 2H), 7.31 (dt, *J* = 15.7, 5.6 Hz, 4H), 7.27–7.21 (m, 3H), 7.21–7.11 (m, 2H), 6.25 (s, 1H), 5.60 (s, 1H); ^{13}C NMR

(101 MHz, $CDCl_3$) δ 158.0, 156.0, 155.2, 154.3, 148.5, 147.1, 142.1, 139.5, 129.8, 129.0, 128.8, 128.7, 128.1, 127.7, 124.3, 123.9, 123.0, 120.9, 111.2, 106.2, 51.1. HRMS (ESI) m/z: $[M+H]^+$ calcd for $C_{21}H_{16}NO_3^+$ 330.1130; found 330.1125.

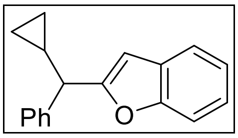
2-(1,2,3,4-tetrahydro-1-naphthalenyl)benzofuran[6] (3g)



From 1-tetralone (0.5 mmol, 73.1 mg) and benzofuran (**2a**, 1.0 mmol, 118.1 mg), **3g** was obtained according the general procedure (petroleum ether). The regioselectivity was determined by using GC and GC-Mass analysis (5.9:1), and purified using petroleum ether to give a yellow oil in 75% yield, 93.2 mg. **3g** was analyzed by GC-MS, ^1H NMR, ^{13}C NMR and verified by comparison with literature data.

^1H NMR (400 MHz, $CDCl_3$) δ 7.54–7.34 (m, 2H), 7.29–6.99 (m, 6H), 6.18 (s, 1H), 4.32 (t, *J* = 5.7 Hz, 1H), 2.98–2.73 (m, 2H), 2.36–2.20 (m, 1H), 2.17–2.05 (m, 1H), 1.93–1.64 (m, 2H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 162.4, 154.8, 137.4, 135.8, 129.9, 129.4, 128.7, 126.7, 125.7, 123.3, 122.5, 120.9, 111.0, 104.1, 39.1, 29.4, 28.5, 20.3; ^{13}C NMR (101 MHz, $CDCl_3$) δ 162.4, 154.8, 137.4, 135.8, 129.9, 129.4, 128.7, 126.7, 125.7, 123.3, 122.5, 120.4, 110.9, 104.1, 39.1, 29.4, 28.5, 20.3.

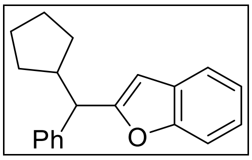
2-(cyclopropyl(phenyl)methyl)benzofuran[2] (3h):



From cyclopropyl phenyl ketone (0.5 mmol, 73.1 mg) and benzofuran (**2a**, 1.0 mmol, 118.1 mg), **3h** was obtained according the general procedure (petroleum ether). The regioselectivity was determined by using GC and GC-Mass analysis (6.3:1), and purified using petroleum ether to give a colorless oil in 19% yield, 23.6 mg. **3h** was analyzed by GC-MS, ^1H NMR, ^{13}C NMR and verified by comparison with literature data.

^{1}H NMR (400 MHz, CDCl$_3$) δ 7.55–7.46 (m, 1H), 7.43–7.29 (m, 4H), 7.25 (s, 2H), 7.23–7.15 (m, 2H), 6.62 (s, 1H), 3.38 (d, *J* = 9.4 Hz, 1H), 1.57–1.33 (m, 2H), 0.79–0.52 (m, 2H), 0.38 (ddt, *J* = 22.3, 9.4, 4.6 Hz, 2H); ^{13}C NMR (101 MHz, CDCl$_3$) δ 161.0, 154.9, 141.7, 128.7, 128.5, 128.4, 128.05, 128.0, 126.7, 123.4, 122.5, 120.5, 111.1, 102.9, 50.2, 15.6, 5.3, 4.6.

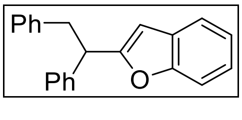
2-(cyclopentyl(phenyl)methyl)benzofuran (3i):



From cyclopentylphenylmethanone (0.5 mmol, 87.1 mg) and benzofuran (**2a**, 1.0 mmol, 118.1 mg), **3i** was obtained according the general procedure (petroleum ether) to give a colorless oil in 75% yield, 103.6 mg.

^{1}H NMR (400 MHz, CDCl$_3$) δ 7.43–7.37 (m, 1H), 7.35–7.26 (m, 4H), 7.24–7.20 (m, 1H), 7.17 (t, *J* = 6.4 Hz, 1H), 7.14–7.03 (m, 2H), 6.42 (s, 1H), 3.69 (t, *J* = 10.7 Hz, 1H), 2.75–2.46 (m, 1H), 1.45–1.32 (m, 2H), 1.28–1.19 (m, 2H), 1.09 (ddd, *J* = 24.5, 15.1, 11.5 Hz, 2H), 0.79 (ddd, *J* = 13.8, 13.0, 8.0 Hz, 2H); ^{13}C NMR (101 MHz, CDCl$_3$) δ 161.3, 154.7, 142.2, 128.4, 128.3, 126.6, 123.2, 122.4, 120.4, 111.0, 102.3, 52.0, 44.0, 32.0, 31.8, 25.3, 25.1. HRMS (ESI) (m/z): [M+H]$^+$ Calcd for $C_{20}H_{21}O^+$ 277.1592; found 277.1586.

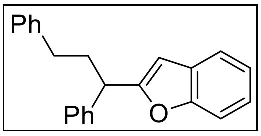
2-(1,2-diphenylethyl)benzofuran[2] **(3j):**



From 2-phenylacetophenone (0.5 mmol, 98.1 mg) and benzofuran (**2a**, 1.0 mmol, 118.1 mg), **3j** was obtained according the general procedure (petroleum ether) to give a colorless oil in 67% yield, 100.2 mg. **3j** was analyzed by GC-MS, ^{1}H NMR, ^{13}C NMR and verified by comparison with literature data.

^{1}H NMR (400 MHz, CDCl$_3$) δ 7.55–7.38 (m, 2H), 7.31–6.88 (m, 10H), 6.45 (d, *J* = 1.0 Hz, 1H), 4.35 (t, *J* = 7.7 Hz, 1H), 3.57 (dd, *J* = 13.7, 7.5 Hz, 1H), 3.25 (dd, *J* = 13.7, 8.1 Hz, 1H); ^{13}C NMR (101 MHz, CDCl$_3$) δ 160.1, 154.8, 141.3, 139.4, 129.0, 129.0, 128.6, 128.5, 128.4, 128.2, 128.2, 128.1, 128.1, 126.9, 126.2, 123.5, 122.5, 120.6, 111.0, 103.2, 47.8, 40.9.

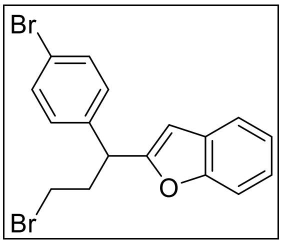
2-(1,3-diphenylpropyl)benzofuran (3k):



From 1,3-diphenyl-2-propen-1-one (0.5 mmol, 104.1 mg) and benzofuran (**2a**, 1.0 mmol, 118.1 mg), **3k** was obtained according the general procedure (petroleum ether) [using 1.0 equiv. tetramethyldisiloxane (1.0 mmol, 134.3 mg)]. The regioselectivity was determined by using GC and GC-Mass analysis (6.0:1), and purified using petroleum ether to give a yellow oil in 51% yield, 79.8 mg.

^{1}H NMR (400 MHz, CDCl$_3$) δ 7.45–7.38 (m, 1H), 7.32 (d, *J* = 7.8 Hz, 1H), 7.28–7.22 (m, 6H), 7.20 (d, *J* = 7.5 Hz, 1H), 7.16 (d, *J* = 5.5 Hz, 1H), 7.13–7.05 (m, 5H), 6.38 (s, 1H), 3.99 (t, *J* = 7.5 Hz, 1H), 2.56 (p, *J* = 7.8 Hz, 2H), 2.34–2.16 (m, 2H); ^{13}C NMR (101 MHz, CDCl$_3$) δ 160.9, 154.8, 141.7, 141.6, 128.7, 128.6, 128.5, 128.5, 128.1, 128.0, 126.9, 126.0, 123.5, 122.5, 120.5, 111.0, 102.6, 45.0, 36.0, 33.7. HRMS (ESI) m/z: [M+H]$^+$ Calcd for $C_{23}H_{21}O^+$ 313.1592; found 313.1585.

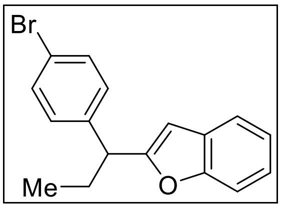
2-(3-bromo-1-(4-bromophenyl)propyl)benzofuran (3l):



From 3-bromo-1-(4-bromophenyl)propan-1-one (0.5 mmol, 146.0 mg) and benzofuran (1.0 mmol, 118.1 mg), **3l** was obtained according the general procedure. The regioselectivity was determined by using GC and GC-Mass analysis (5.6:1), and purified using petroleum ether to give a yellow oil in 27% yield, 53.2 mg. Meanwhile, **3m** was obtained in the same reaction mixture with C2:C3 regioselectivity as 3.3:1, and was isolated by using column chromatography (EtOAc/petroleum ether=1:99) to give a yellow oil in 31% yield, 49.1 mg.

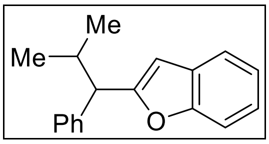
3l: ^{1}H NMR (400 MHz, CDCl$_3$) δ 7.46–7.41 (m, 3H), 7.28–7.24 (m, 2H), 7.18 (t, *J* = 3.4 Hz,2H), 7.16 (d, *J* = 2.8 Hz, 1H), 6.45 (s, 1H), 3.90 (dd, *J* = 13.3, 5.7 Hz, 1H), 2.23 (qt, *J* = 13.4, 6.8 Hz, 1H), 2.03–1.89 (m, 1H), 0.97–0.91 (m, 2H); ^{13}C NMR (101 MHz, CDCl$_3$) δ 160.4, 154.8, 141.2, 140.9, 131.6, 129.8, 123.5, 122.6, 120.5, 111.0, 102.6, 47.0, 27.4, 12.3. HRMS (ESI) m/z: [M+H]$^+$ Calcd for $C_{17}H_{15}Br_2O^+$ 392.9490; found 392.9504.

2-(1-(4-bromophenyl)propyl)benzofuran (3m):



^{1}H NMR (400 MHz, CDCl$_3$) δ 7.48 (ddd, *J* = 9.1, 5.1, 3.6 Hz, 1H), 7.45–7.35 (m, 3H), 7.27–7.19 (m, 2H), 7.17–7.14 (m, 2H), 6.45 (s, 1H), 3.90 (dd, *J* = 13.9, 6.3 Hz, 1H), 2.29–2.16 (m, 1H), 2.02–1.88 (m, 1H), 0.94 (t, *J* = 7.4 Hz, 3H); ^{13}C NMR (101 MHz, CDCl$_3$) δ 160.5, 154.8, 141.0, 131.6, 131.6, 129.8, 129.8, 128.5, 123.6, 122.6, 120.6, 120.5, 111.0, 102.6, 467.0, 27.4, 12.3. HRMS (ESI) m/z: [M+H]$^+$ Calcd for $C_{17}H_{16}BrO^+$ 315.0385; found 315.0390.

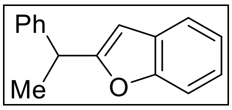
2-(2-methyl-1-phenylpropyl)benzofuran (3n):



From isobutyrophenone (0.5 mmol, 74.1 mg) and benzofuran (1.0 mmol, 118.1 mg), **3n** was prepared according the general procedure, and the regioselectivity was determined by using GC and GC-Mass analysis (4.9:1). **3n** was isolated by using column chromatography (petroleum ether) to give a colorless oil in 32% yield, 40.1 mg.

^{1}H NMR (400 MHz, CDCl$_3$) δ 7.42–7.35 (m, 1H), 7.34–7.24 (m, 1H), 7.15–7.05 (m, 5H), 7.04–6.97 (m, 2H), 6.33 (s, 1H), 4.19–4.06 (m, 1H), 2.46 (dt, *J* = 12.1, 8.1 Hz, 1H), 1.29–1.16 (m, 3H), 0.79 (q, *J* = 6.9 Hz, 3H); ^{13}C NMR (101 MHz, CDCl$_3$) δ 160.6, 154.7, 141.5, 128.5, 128.4, 126.6, 123.2, 122.4, 120.4, 111.0, 102.8, 54.1, 32.1, 21.7, 21.2. HRMS (ESI) m/z: $[M+H]^+$ Calcd for $C_{18}H_{19}O^+$ 251.1436; found 251.1433.

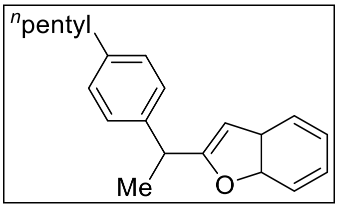
2-(1-phenylethyl)benzofran[2,3] (3o)



From acetophenone (0.5 mmol, 105.1 mg) and benzofuran (**2a**, 1.0 mmol, 118.1 mg), **3o** was obtained according the general procedure, and the regioselectivity was determined by using GC and GC-Mass analysis (4.9:1). Purification of the mixture using petroleum ether gave **3o** as a colorless oil in 71 yield, 156 mg. **3o** was analyzed by GC-MS, ^{1}H NMR, ^{13}C NMR and verified by comparison with literature data.

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.51–7.41 (m, 1H), 7.41–7.34 (m, 1H), 7.33–7.25 (m, 4H), 7.17 (dddd, *J* = 21.3, 15.5, 9.5, 6.9 Hz, 3H), 6.42 (s, 1H), 4.28–4.19 (m, 1H), 1.68 (dd, *J* = 7.2, 3.4 Hz, 3H); ^{13}C NMR (101 MHz, $CDCl_3$) δ 162.2, 154.9, 143.4, 128.7, 128.6, 128.6, 127.5, 127.4, 126.8, 123.5, 122.5, 120.5, 111.0, 102.2, 39.7, 20.4.

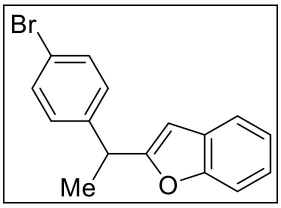
2-(1-(4-pentylphenyl)ethyl)-3a,7a-dihydrobenzofuran (3p)



From 4'-n-amylacetophenone (0.5 mmol, 95.1 mg) and benzofuran (**2a**, 1.0 mmol, 118.1 mg), **3p** was obtained according the general procedure. The regioselectivity was determined by using GC and GC-Mass analysis (11.1:1), and purified using petroleum ether to give **3p** as a colorless oil in 78% yield, 114.1 mg.

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.42–7.35 (m, 1H), 7.34–7.24 (m, 1H), 7.15–7.05 (m, 5H), 7.04–6.97 (m, 1H), 6.33 (s, 1H), 4.19–4.06 (m, 1H), 2.46 (dt, *J* = 12.1, 8.1 Hz, 3H), 1.69–1.55 (m, 2H), 1.50 (dd, *J* = 14.6, 7.0 Hz, 2H), 1.29–1.16 (m,4H), 0.79 (t, *J* = 6.9 Hz,3H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 162.5, 154.9, 141.5, 140.5, 128.6, 127.4, 123.4, 122.5, 120.5, 111.0, 102.0, 39.3, 35.6, 31.6, 31.2, 22.6, 20.4, 14.1. HRMS (ESI) m/z: $[M+H]^+$ Calcd for $C_{21}H_{25}O^+$ 293.1906, found 293.1920.

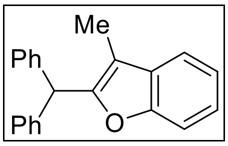
2-(1-(4-bromophenyl)ethyl)benzofuran (3q)



From 4'-bromoacetophenone (0.5 mmol, 99.5 mg) and benzofuran (1.0 mmol, 118.1 mg), **3q** was obtained according the general procedure. The regioselectivity was determined by using GC and GC-Mass analysis (3.1:1), and purified using EtOAc/petroleum ether (1:99) to give a yellow oil in 83% yield, 125.1 mg.

^1H NMR (400 MHz, $CDCl_3$) δ 7.51–7.43 (m, 2H), 7.40–7.36 (m,2H), 7.27–7.24 (m, 1H), 7.21 (d, *J* = 1.6 Hz, 1H), 7.18–7.13 (m, 2H), 6.44 (s, 1H), 4.28–4.13 (m, 1H), 1.67 (dd, *J* = 7.2, 2.8 Hz, 3H); ^{13}C NMR (101 MHz, $CDCl_3$) δ 161.3, 154.9, 142.3, 141.3, 131.7, 131.6, 129.3, 129.2, 128.5, 123.6, 122.6, 120.6, 111.0, 102.3, 39.2, 20.2. HRMS (ESI) m/z: $[M+H]^+$ calcd for $C_{16}H_{14}BrO^+$ 301.0228; found 301.0222.

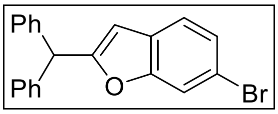
2-benzhydryl-3-methylbenzofuran (4a)



From benzophenone (**1a**, 0.5 mmol, 91.1 mg) and 3-methylbenzofuran (1.0 mmol, 132.2 mg), **4a** was obtained according the general procedure (petroleum ether) to give a white solid in 72% yield, 108.0 mg. Melting point: 69.5–71.2 ℃.

^1H NMR (400 MHz, $CDCl_3$) δ 7.40–7.34 (m, 1H), 7.32–7.26 (m, 1H), 7.21 (t, *J* = 6.4 Hz, 3H), 7.15 (dd, *J* = 11.7, 4.6 Hz, 7H), 7.11 (dd, *J* = 8.8, 5.1 Hz, 2H), 5.56 (s, 1H), 2.05 (s, 3H); ^{13}C NMR (101 MHz, $CDCl_3$) δ 154.2, 153.3, 141.3, 130.3, 129.1, 128.5, 126.8, 123.7, 122.2, 119.1, 111.7, 111.2, 49.0, 8.2. HRMS (ESI) m/z: $[M+H]^+$ Calcd for $C_{22}H_{19}O^+$ 299.1436; found 299.1427.

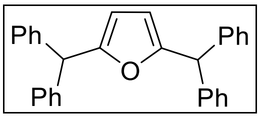
2-benzhydryl-6-bromobenzofuran (4b):



From benzophenone (**1a**, 0.5 mmol, 91.1 mg) and 6-bromobenzofuran (1.0 mmol, 98.5 mg), **4b** was obtained according the general procedure for 8 hours. Purification by using petroleum ether to give **4b** as a white solid in 47% yield, 85.3 mg. Melting point: 141.6-143.2 ℃.

^{1}H NMR (400 MHz, CDCl$_3$) δ 7.51 (d, *J* = 1.8 Hz, 1H), 7.27 (d, *J* = 6.9 Hz, 4H), 7.24–7.22 (m, 2H), 7.21–7.17 (m, 3H), 7.14 (d, *J* = 7.0 Hz, 3H), 6.15 (s, 1H), 5.50 (s, 1H); ^{13}C NMR (101 MHz, CDCl$_3$) δ 161.4, 153.9, 140.7, 130.5, 128.9, 128.7, 128.7, 127.2, 126.9, 126.6, 123.3, 115.7, 112.6, 105.2, 51.3. HRMS (ESI) m/z: [M+H]$^+$ Calcd for $C_{21}H_{16}BrO^+$ 363.0385; found 363.0398.

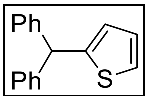
2, 5-dibenzhydrylfuran[14] (4c):



From benzophenone (**1a**, 0.5 mmol, 91.1 mg) and furan (1.0 mmol, 68 mg), **4c** was obtained according the general procedure (petroleum ether) to give a yellow oil in 78% yield, 285.6mg. **4c** was analyzed by GC-MS, ^{1}H NMR, ^{13}C NMR and verified by comparison with literature data.

^{1}H NMR (400 MHz, CDCl$_3$) δ 7.30–7.18 (m, 14H), 7.17–7.09 (m, 8H), 5.80 (d, *J* = 3.2 Hz, 2H), 5.39 (s, 2H); ^{13}C NMR (101 MHz, CDCl$_3$) δ 156.1, 141.9, 128.8, 128.3, 126.6, 108.9, 77.4, 77.0, 76.73, 50.9.

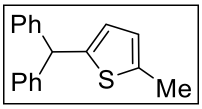
2-benzhydrylthiophene[7] (4d):



From benzophenone (0.5 mmol, 91.1 mg) and thiophene (1.0 mmol, 84.1 mg), **4d** was obtained according the general procedure (petroleum ether) to give a colorless oil in 55 yield, 68.8 mg. **4d** was analyzed by GC-MS, ^{1}H NMR, ^{13}C NMR and verified by comparison with literature data.

^{1}H NMR (400 MHz, CDCl$_3$) δ 7.31–7.22 (m, 9H), 7.25–7.17 (m, 4H), 7.18–7.10 (m, 7H), 5.80 (s, 2H), 5.39 (s, 2H); ^{13}C NMR (101 MHz, CDCl$_3$) δ 147.9, 143.8, 129.0, 128.8, 128.4, 128.4, 126.7, 126.6, 126.4, 124.6, 52.2.

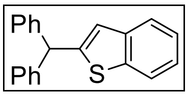
2-(diphenylmethyl)-5-methylthiophene[8] (4e):



From benzophenone (0.5 mmol, 91.1 mg) and 2-methylthiophene (1.0 mmol, 98.2 mg), **4e** was obtained according the general procedure (petroleum ether) to give a colorless oil in 31% yield, 41 mg. **4e** was analyzed by GC-MS, ^{1}H NMR, ^{13}C NMR and verified by comparison with literature data.

^{1}H NMR (400 MHz, CDCl$_3$) δ 7.22 (dd, *J* = 10.4, 4.4 Hz, 4H), 7.15 (dd, *J* = 7.1, 4.3 Hz, 6H), 6.49 (d, *J* = 2.4 Hz, 2H), 6.37 (d, *J* = 3.2 Hz, 2H), 5.51 (s, 1H), 2.33 (s, 3H); ^{13}C NMR (101 MHz, CDCl$_3$) δ 144.4, 142.8, 137.9, 127.8, 127.3, 125.6, 125.1, 123.5, 51.2, 14.3.

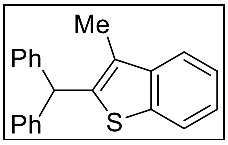
2-benzhydrylbenzo[*b*]thiophene[5] (4f):



From benzophenone (0.5 mmol, 91.1 mg) and benzo[b]thiophene (1.0 mmol, 134.2 mg), **4f** was obtained according the general procedure (petroleum ether) to give a white solid in 53% yield, 79.5 mg. **4f** was analyzed by GC-MS, ^{1}H NMR, ^{13}C NMR and verified by comparison with literature data.

^{1}H NMR (400 MHz, CDCl$_3$) δ 7.83 (d, *J* = 8.0 Hz, 1H), 7.54–7.41 (m, 1H), 7.33–7.08 (m, 12H), 6.71 (d, *J* = 0.9 Hz, 1H), 5.73 (d, *J* = 9.1 Hz, 1H); ^{13}C NMR (101 MHz, CDCl$_3$) δ 142.7, 140.8, 139.2, 138.5, 129.2, 128.6, 126.7, 125.2, 124.3, 124.0, 122.8, 122.8, 51.4.

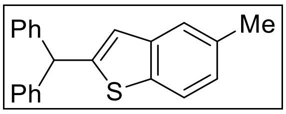
2-benzhydryl-3-methylbenzo[*b*]thiophene (4g):



From benzophenone (0.5 mmol, 91.1 mg) and 3-methylbenzo[b]thiophene (1.0 mmol, 148.2 mg), **4g** was obtained according the general procedure (petroleum ether) to give a white solid in 72% yield, 113.2 mg. Melting point: 98.7–100.2 ℃.

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.66 (dd, *J* = 19.6, 7.9 Hz, 2H), 7.33 (dd, *J* = 12.2, 4.2 Hz, 1H), 7.30–7.26 (m, 4H), 7.23 (dd, *J* = 6.7, 5.4 Hz, 7H), 5.85 (s, 1H), 2.26 (s, 3H); ^{13}C NMR (101 MHz, $CDCl_3$) δ 143.1, 142.4, 141.0, 139.0, 129.2, 129.1, 128.5, 128.0, 126.9, 124.0, 123.8, 122.3, 121.5, 50.6, 12.1. HRMS (ESI) m/z: $[M+H]^+$ calcd for $C_{22}H_{19}S^+$: 315.1208; found 315.1215.

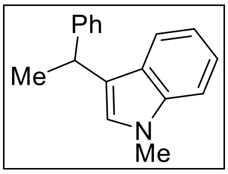
2-benzhydryl-5-methylbenzo[b]thiophene (4h):



From benzophenone (0.5 mmol, 91.1 mg) and 5-methylthianaphthene (1.0 mmol, 148.2 mg), **4h** was obtained according the general procedure. The regioselectivity was determined by using GC and GC-Mass (C2:C3=20:1), and purified using petroleum ether to give a white solid in 82% yield, 128.9 mg. Melting point: 126.9–128.1 ℃.

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.63 (d, *J* = 8.2 Hz, 1H), 7.30–7.16 (m, 6H), 7.17–7.11 (m, 2H), 7.12–7.05 (m, 3H), 7.03 (dd, *J* = 13.6, 7.6 Hz, 1H), 6.61 (s, 1H), 5.93–5.46 (m, 1H), 2.71–1.91 (m, 3H); ^{13}C NMR (101 MHz, $CDCl_3$) δ 142.8, 138.9, 138.7, 137.9, 133.7, 129.1, 128.5, 126.6, 126.1, 125.4, 122.6, 122.4, 51.3, 21.6. HRMS (ESI) m/z: $[M+H]^+$ calcd for $C_{22}H_{19}S^+$ 315.1208; found 315.1223.

1-methyl-3-(1-phenylethyl)-1H-indole[16] (4i):

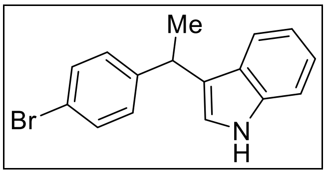


From acetophenone (0.5 mmol, 60.1 mg) and 1-methyl-1H-indole (1.0 mmol, 131.2

mg), **4i** was obtained according to a modified condition from general procedure (under electrolysis at 2.0 mA for 3.0 hours). Purification by column chromatography using EtOAc/petroleum ether (1:99) as eluent gave **4i** as a yellow oil in 53% yield, 62.4 mg.

^{1}H NMR (400 MHz, CDCl$_3$) δ 7.36 (dt, *J* = 8.1, 1.0 Hz, 1H), 7.32–7.19 (m, 5H), 7.20–7.10 (m, 2H), 6.97 (ddd, *J* = 8.0, 6.9, 1.1 Hz, 1H), 6.79 (d, *J* = 1.0 Hz, 1H), 4.35 (q, *J* = 7.1 Hz, 1H), 3.67 (s, 3H), 1.68 (d, *J* = 7.2 Hz, 3H); ^{13}C NMR (101 MHz, CDCl$_3$) δ 147.1, 137.5, 128.4, 127.6, 127.4, 126.1, 126.0, 121.6, 120.1, 119.9, 118.8, 109.2, 37.0, 32.7, 22.6.

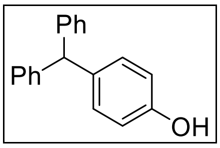
(R)-3-(1-(4-bromophenyl)ethyl)-1H-indole[15](4j):



From 1-(4-bromophenyl)ethan-1-one (0.5 mmol, 99.6 mg) and 1H-indole (1.0 mmol, 117.2 mg), **4j** was obtained according to a modified condition from general procedure (under electrolysis at 2.0 mA for 3.0 hours). Purification by column chromatography using EtOAc/petroleum ether (1:99) as eluent gave **4j** as a colorless oil in 58% yield, 87.1 mg.

^{1}H NMR (400 MHz, CDCl$_3$) δ 7.90 (s, 1H), 7.40–7.30 (m, 2H), 7.35–7.26 (m, 2H), 7.19–7.09 (m, 3H), 7.06–6.94 (m, 2H), 4.31 (q, *J* = 7.1 Hz, 1H), 1.66 (d, *J* = 7.2 Hz, 3H); ^{13}C NMR (101 MHz, CDCl$_3$) δ 145.9, 136.6, 131.3, 129.2, 126.6, 122.1, 121.1, 120.6, 119.5, 119.3, 111.1, 36.4, 22.2.

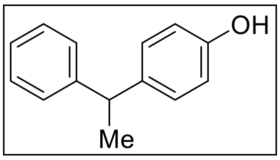
4-benzhydrylpheno[9] (4k):



From benzophenone (0.5 mmol, 91.1 mg) and phenol (1.0 mmol, 94.1 mg), **4k** was obtained according the general procedure (EtOAc/petroleum ether=3:47) to give a yellow oil in 86% yield, 112 mg. **4k** was analyzed by GC-MS, ^{1}H NMR, ^{13}C NMR and verified by comparison with literature data.

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.35–7.16 (m, 6H), 7.15–7.04 (m, 4H), 6.99 (dd, *J* = 16.8, 8.0 Hz, 2H), 6.73 (d, *J* = 8.4 Hz, 2H), 5.48 (s, 1H), 4.92 (s, 1H); ^{13}C NMR (101 MHz, $CDCl_3$) δ 153.9, 144.3, 136.4, 130.6, 129.4, 128.3, 126.3, 115.2, 56.0.

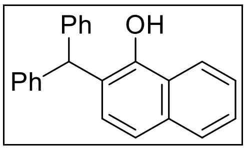
4-(1-phenylethyl)phenol[11] (4l):



From acetophenone (0.5 mmol, 105.1 mg) and phenol (1.0 mmol, 94.1 mg), **4l** was obtained according the general procedure (EtOAc/petroleum ether=3:47) to give a yellow oil in 87 yield, 86.2mg. **4l** was analyzed by GC-MS, ^{1}H NMR, ^{13}C NMR and verified by comparison with literature data.

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.38–7.04 (m, 7H), 6.82–6.61 (m, 2H), 5.18 (s, 1H), 4.08 (d, *J* = 7.2 Hz,1 H), 1.60 (d, *J* = 7.2 Hz, 3H); ^{13}C NMR (101 MHz, $CDCl_3$) δ 153.7, 146.8, 138.8, 128.8, 128.4, 127.6, 126.0, 115.2, 44.0, 22.1.

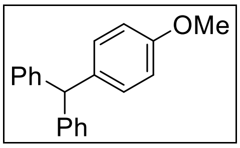
2-benzhydrylnaphthalen-1-ol[12] (4m):



From benzophenone (**1a**, 0.5 mmol, 91.1 mg) and 1-naphthol (1.0 mmol, 144.1 mg), **4m** was obtained according the general procedure (EtOAc/petroleum ether=3:47) to give a colorless oil in 82% yield, 127 mg. **4m** was analyzed by GC-MS, ^{1}H NMR, ^{13}C NMR and verified by comparison with literature data.

^{1}H NMR (400 MHz, $CDCl_3$) δ 8.22 (dd, *J* = 7.9, 1.7 Hz, 1H), 7.91 (dd, *J* = 8.1, 1.5 Hz, 1H), 7.53–7.33 (m, 3H), 7.32–7.01 (m, 9H), 6.76–6.49 (m, 2H), 6.17 (s, 1H), 5.39 (s, 1H); ^{13}C NMR (101 MHz, $CDCl_3$) δ 150.4, 144.0, 132.9, 132.52, 129.7, 128.4, 127.6, 126.7, 126.3, 124.9, 124.8, 124.4, 122.2, 107.8, 52.8.

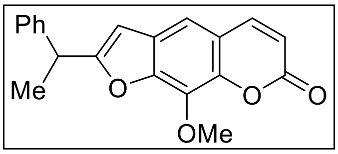
(4-methoxyphenyl)diphenylmethane[10] (4n):



From benzophenone (0.5 mmol, 91.1 mg) and anisole (1.0 mmol, 108.1 mg), **4n** was obtained according the general procedure (EtOAc/petroleum ether=1:49) to give a colorless oil in 64% yield, 87.7mg. **4n** was analyzed by GC-MS, ^{1}H NMR, ^{13}C NMR and verified by comparison with literature data.

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.27 (dd, *J* = 8.2, 6.7 Hz,4H), 7.23–7.15 (m,2H), 7.14–7.06 (m, 4H), 7.06–6.98 (m, 2H), 6.82 (dd, *J* = 8.6, 1.7 Hz, 2H), 5.50 (s,1H), 3.77 (d, *J* = 1.0 Hz, 3H); ^{13}C NMR (101 MHz, CDCl3) δ 158.1, 144.3, 136.1, 130.4, 129.4, 128.3, 126.3, 113.7, 56.1, 55.26.

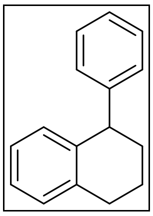
9-methoxy-2-(1-phenylethyl)-7H-furo[3,2-g]chromen-7-one (4o):



From acetophenone (0.5 mmol, 105.1 mg) and 8-methoxypsoralen (1.0 mmol, 216.2 mg), **4o** was obtained according the general procedure (EtOAc/petroleum ether=3:17) to give a colorless oil in 46% yield, 73.8 mg.

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.92 (t, *J* = 20.1 Hz, 1H), 7.55–7.39 (m, 1H), 7.26–7.20 (m, 2H), 7.14 (dd, *J* = 11.1, 7.4 Hz, 3H), 6.43 (d, *J* = 2.2 Hz, 1H), 6.23 (d, *J* = 10.0 Hz, 1H), 4.86–4.71 (m, 1H), 4.18 (s, 3H), 1.72 (d, *J* = 7.3 Hz, 3H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 160.2, 148.0, 145.8, 144.1, 143.9, 140.9, 131.5, 130.6, 128.7, 128.6, 127.2, 126.5, 125.2, 114.1, 106.2, 61.5, 38.3, 20.1. HRMS (ESI) m/z: $[M+H]^+$ calcd for $C_{20}H_{17}O_4^+$ 321.1127; found 321.1139.

1-phenyl-1,2,3,4-tetrahydronaphthalene[19] (4p)



From 1,4-diphenylbutan-1-one **1p** (0.5 mmol, 112.1 mg), **4p** was obtained according the general procedure (petroleum ether) to give a colorless oil in 73% yield, 76.1 mg. ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.32–7.24 (m, 2H), 7.23–7.18 (m, 1H), 7.16–7.08 (m, 4H), 7.03 (ddd, *J* = 7.7, 6.2, 2.5 Hz, 1H), 6.84 (d, *J* = 7.7 Hz, 1H), 4.13 (t, *J* = 6.7 Hz, 1H), 3.00–2.80 (m, 2H), 2.23–2.11 (m, 1H), 1.89 (dddd, *J* = 15.7, 12.6, 7.1, 3.0 Hz, 2H), 1.77 (dddd, *J* = 14.1, 8.5, 6.0, 2.4 Hz, 1H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 147.5, 139.4, 137.6, 130.2, 129.0, 128.9, 128.2, 126.0, 125.9, 125.6, 45.6, 33.3, 29.8, 21.0.

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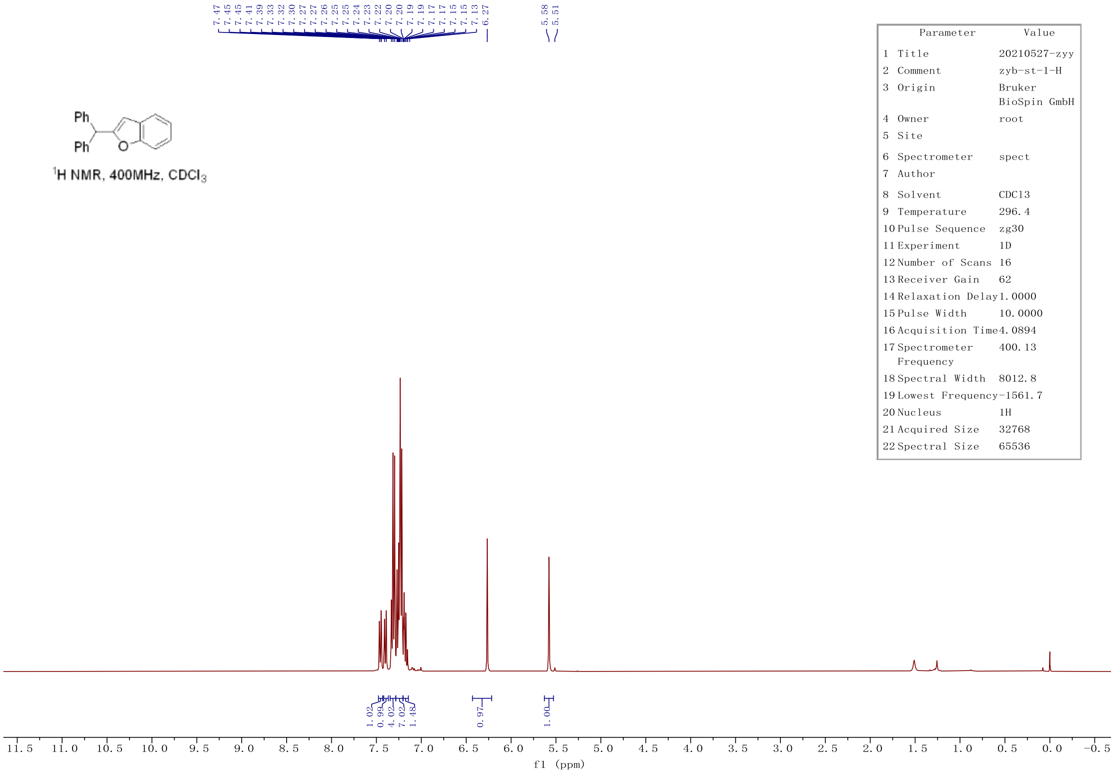
NMR Spectra

2-diphenylmethylbenzofuran (3a)：



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7 Author	
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19 Lowest Frequency	-1561.7
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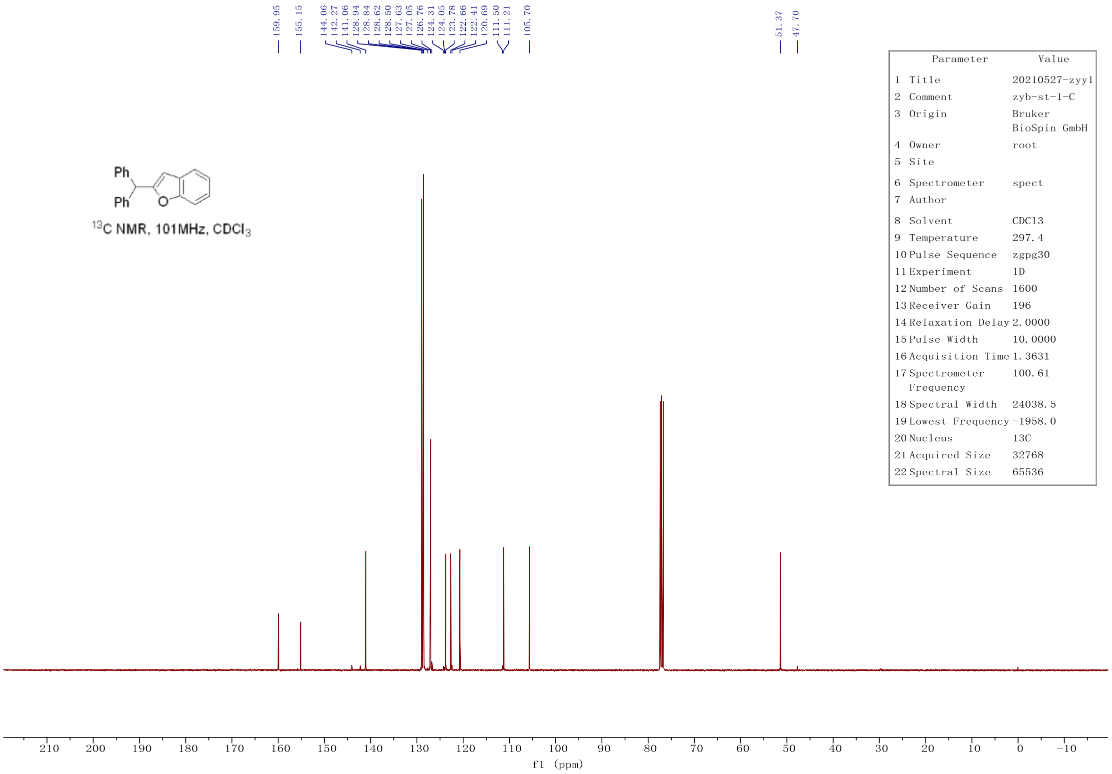

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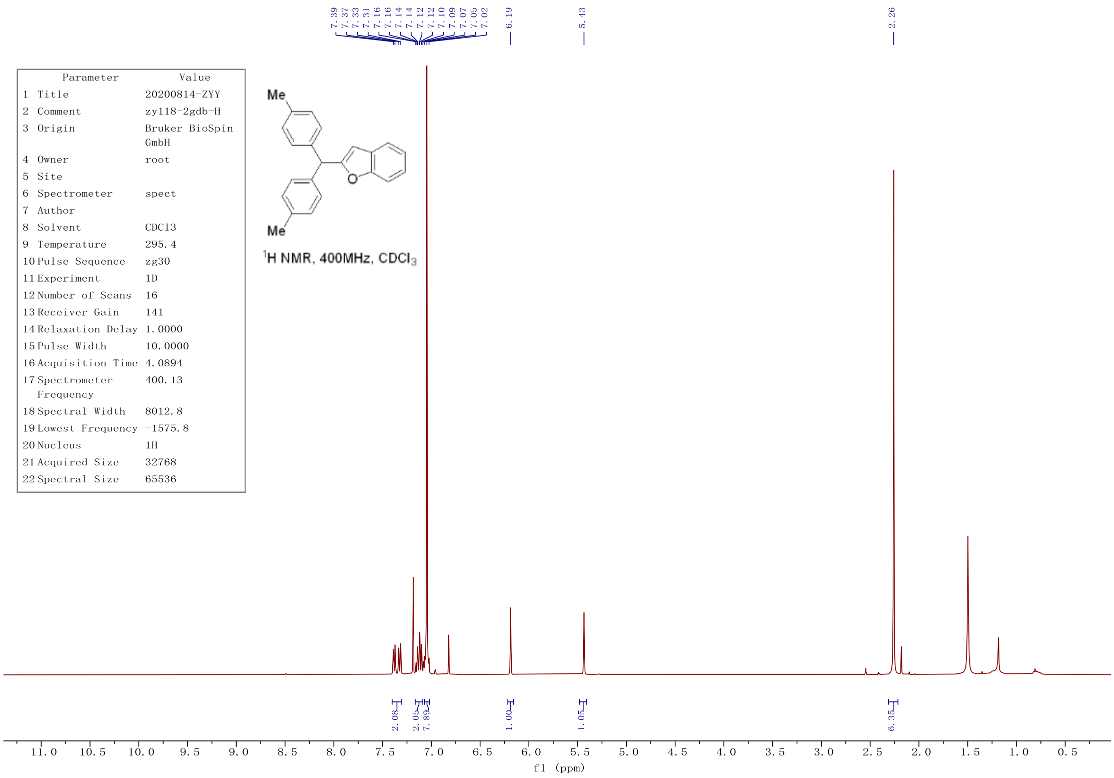
2-(di-p-tolylmethyl)benzofuran (3b):



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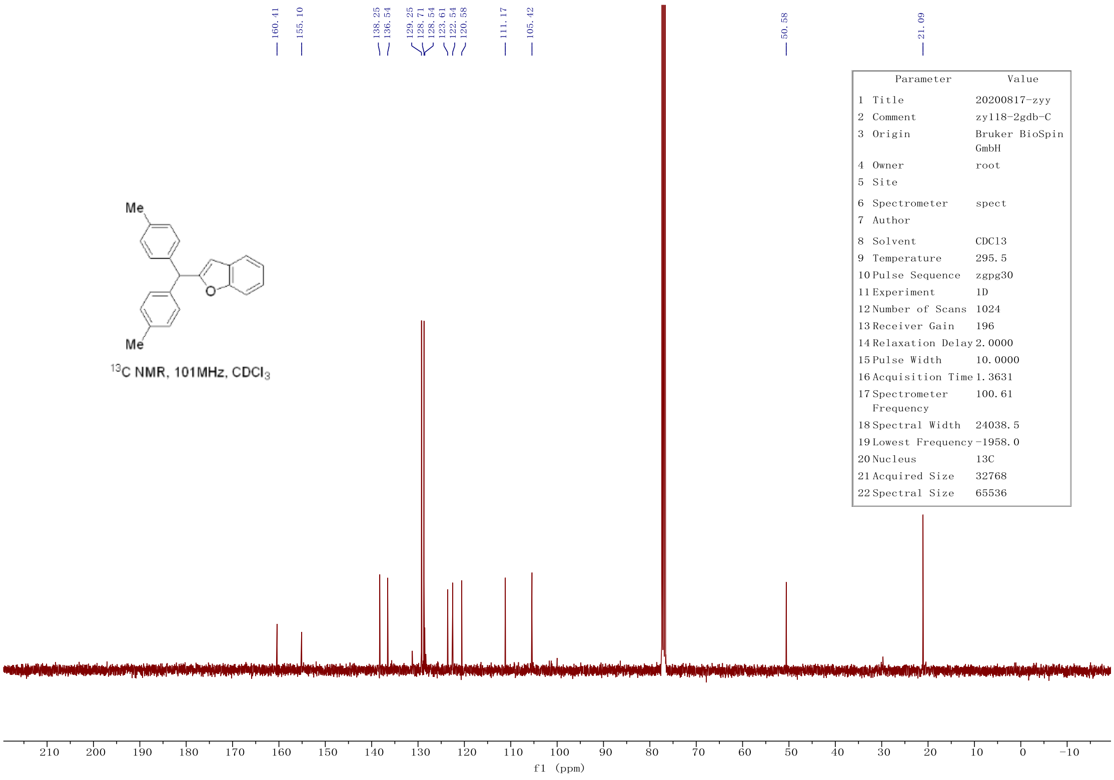

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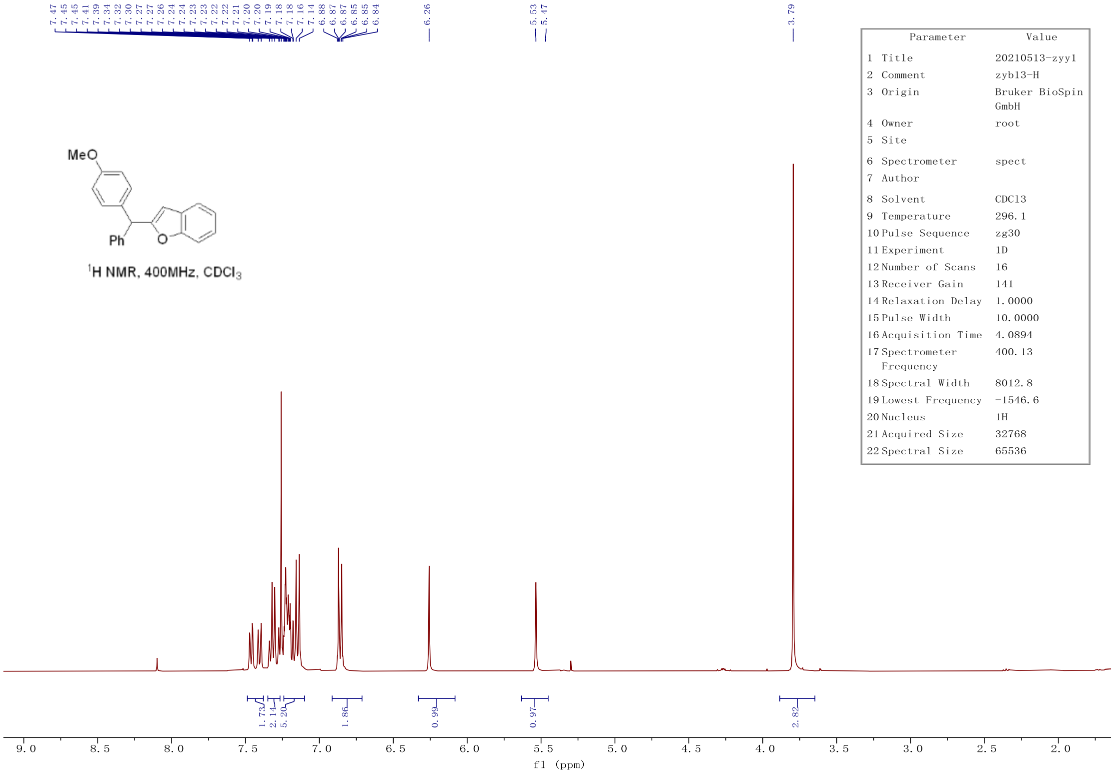
2-((4-methoxyphenyl)(phenyl)methyl)benzofuran (3c):



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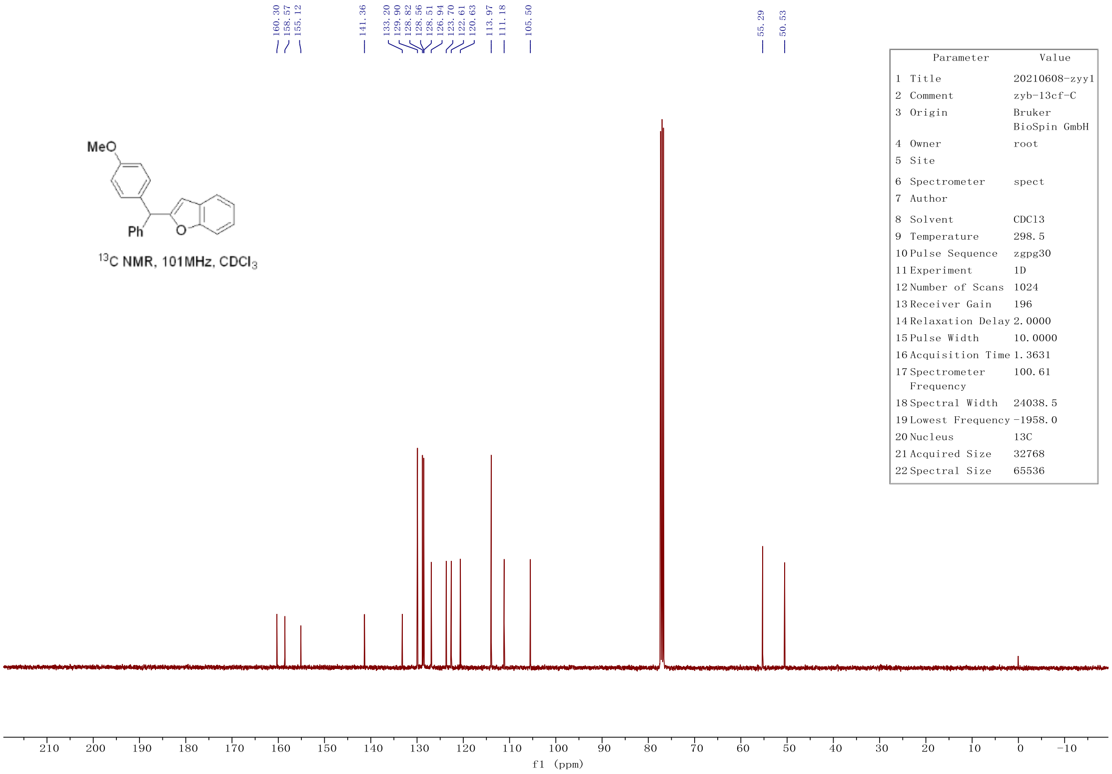

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18	Spectral Width	24038.5
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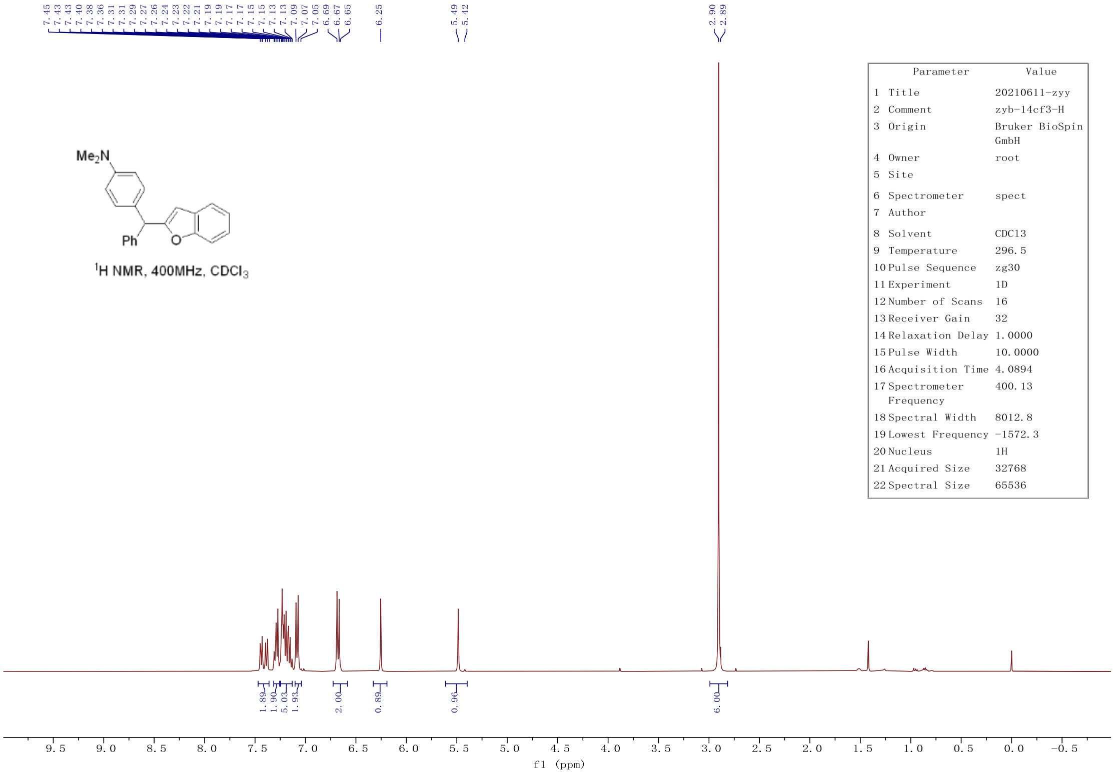
22	Spectral Size	65536

(2-benzofuryl) (4-dimethylaminophenyl)phenylmethane (3d):



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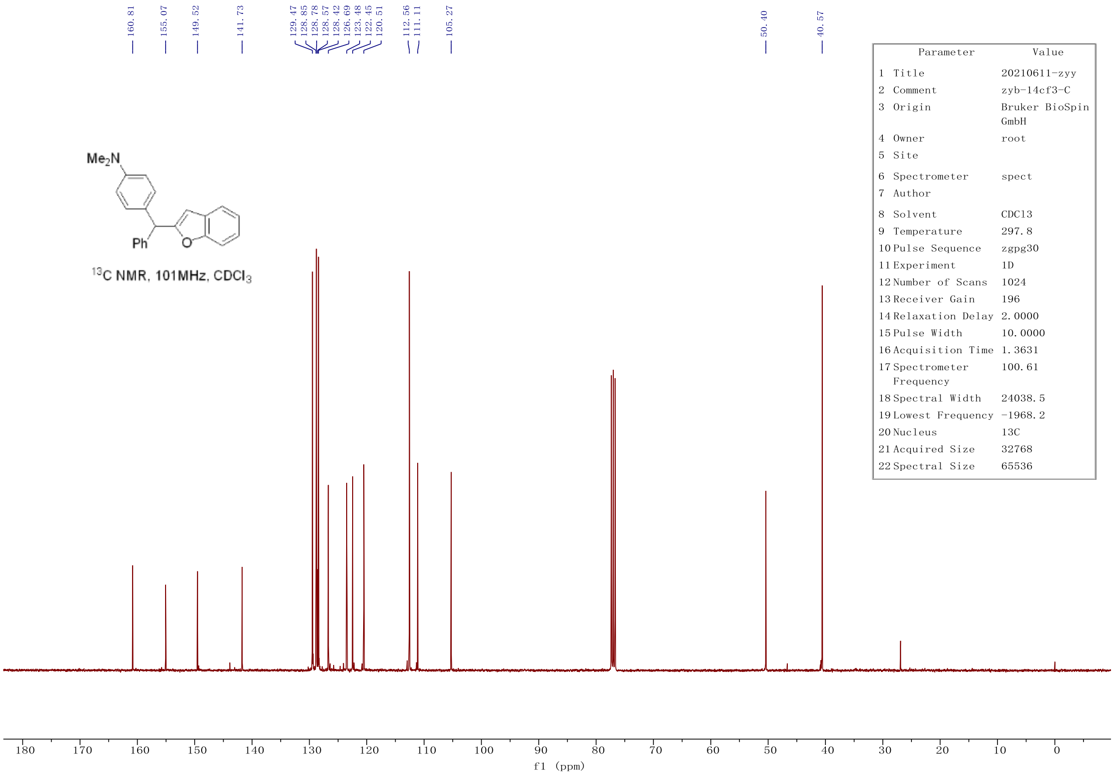

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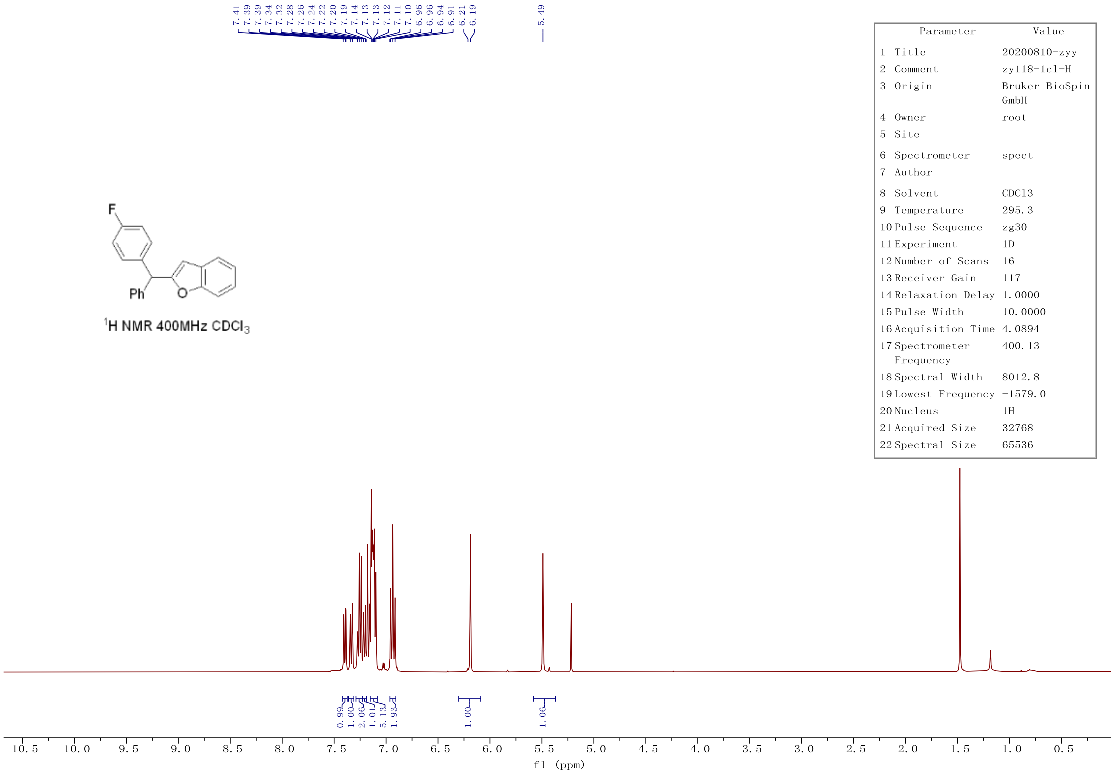
2-((4- fluorophenyl)(phenyl)methyl)benzofuran (3e):



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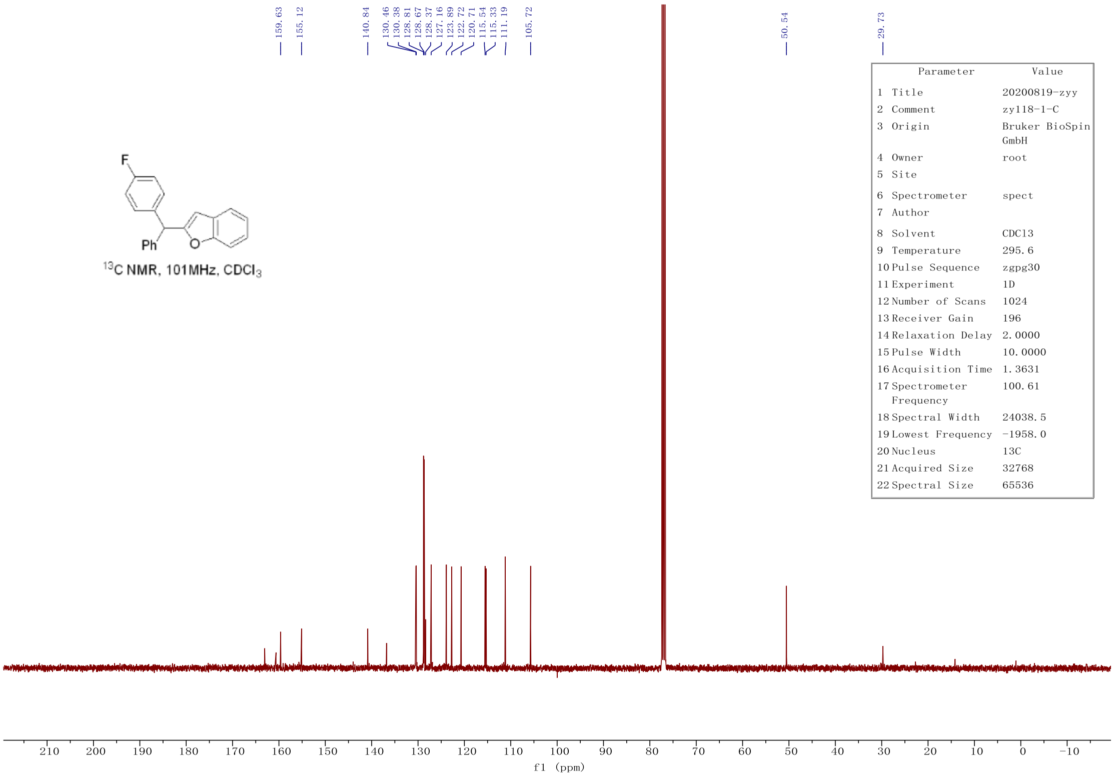

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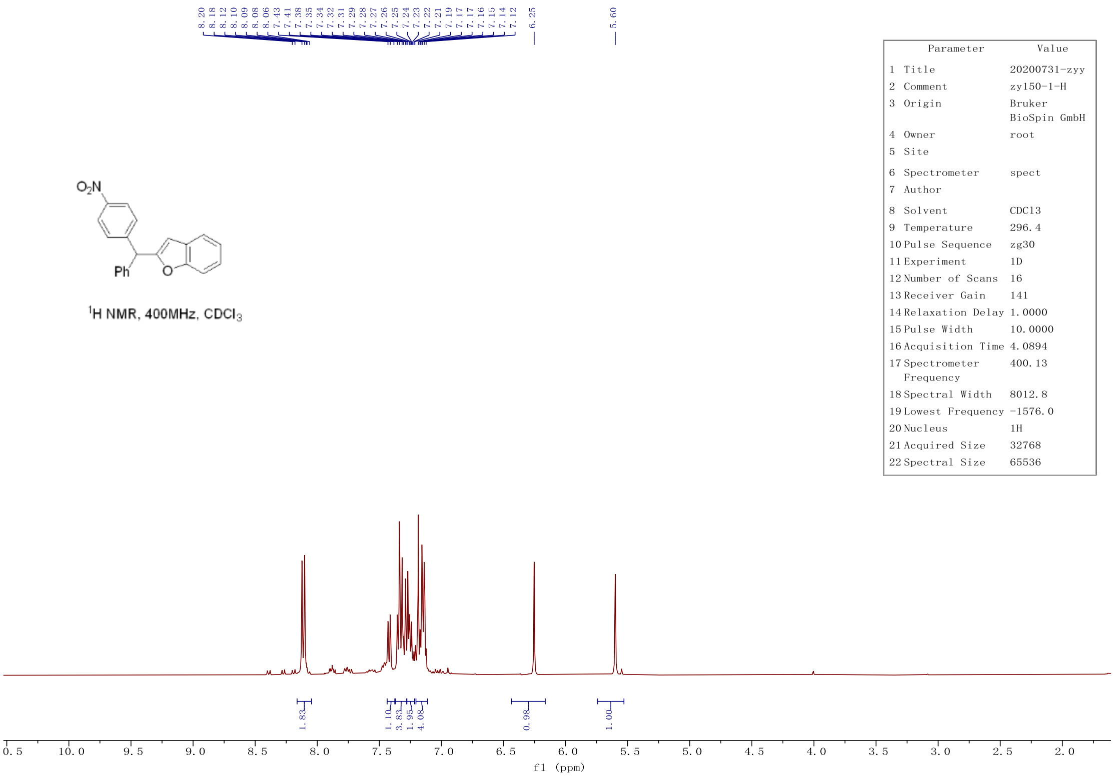
22 Spectral Size	65536

2-((4-nitrophenyl)(phenyl)methyl)benzofuran (3f):



^{1}H NMR, 400MHz, $CDCl_3$

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13	Receiver Gain	141
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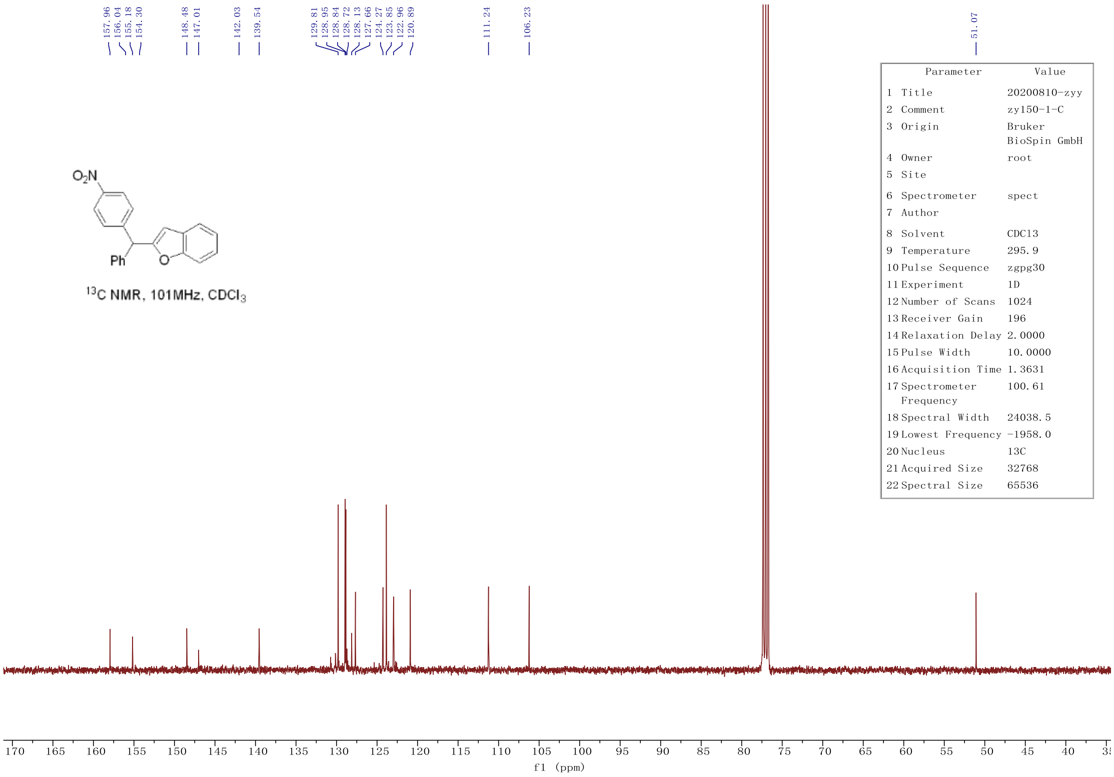

^{13}C NMR, 101MHz, $CDCl_3$

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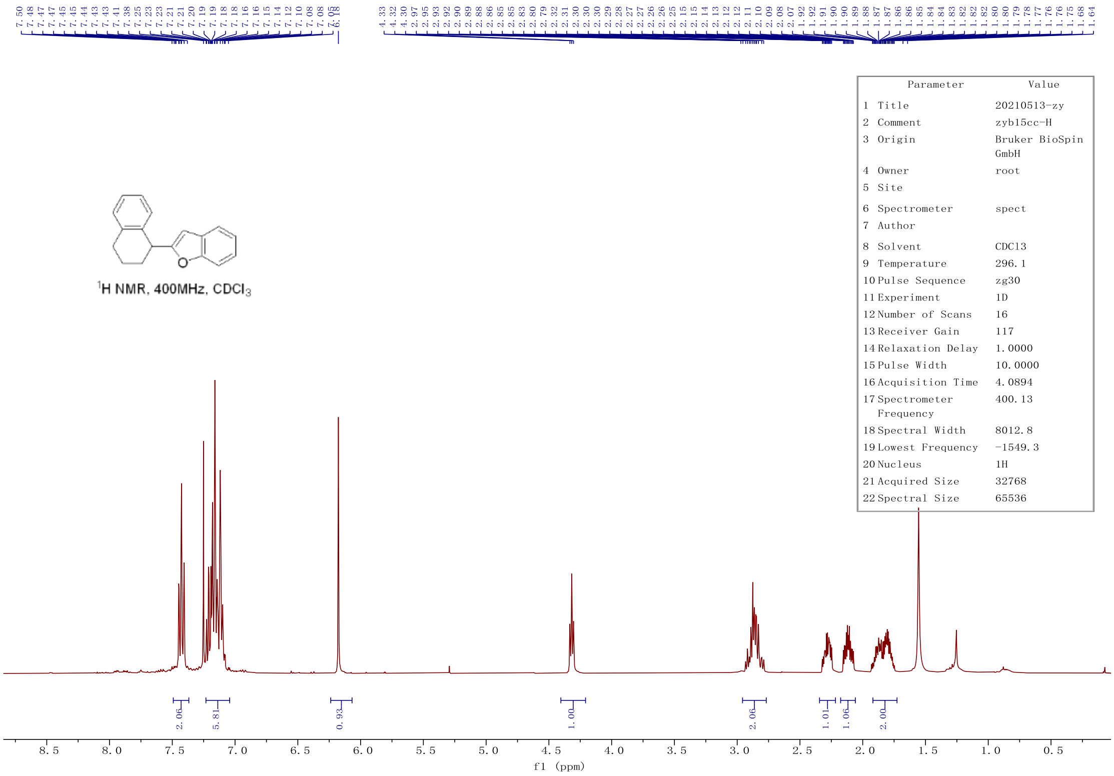
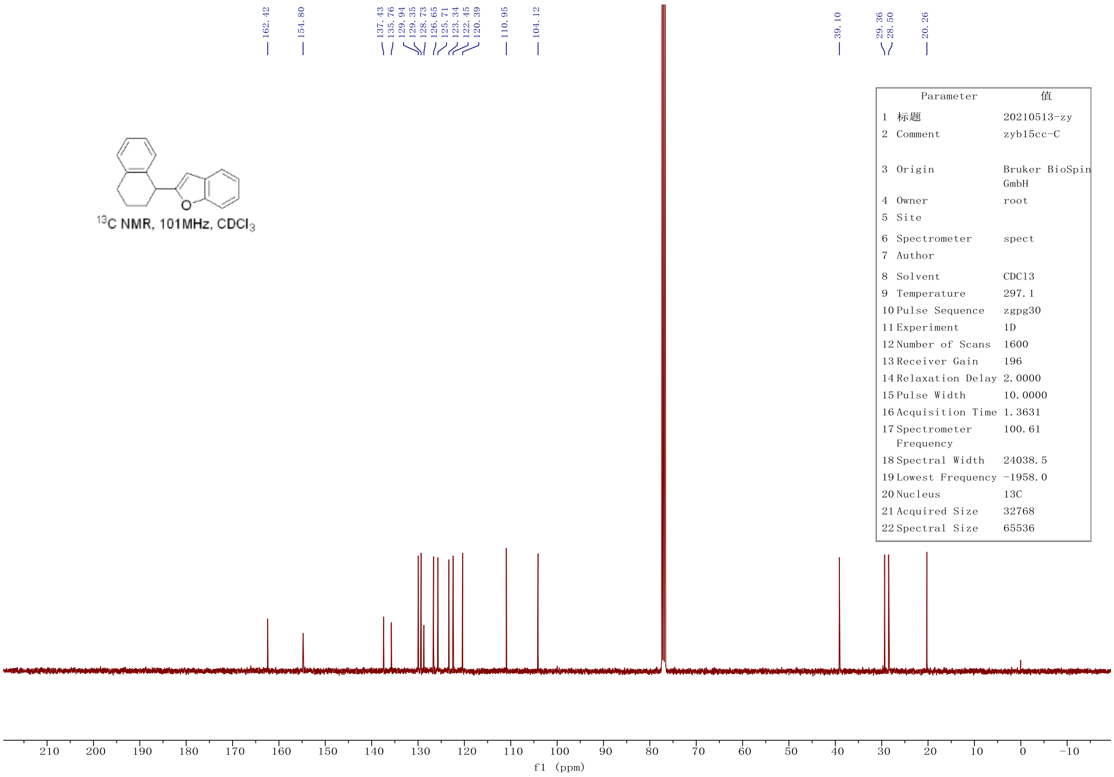
10	Pulse Sequence	zgpg30
11	Experiment	1D
12	Number of Scans	1024
13	Receiver Gain	196
14	Relaxation Delay	2.0000
15	Pulse Width	10.0000
16	Acquisition Time	1.3631
17	Spectrometer Frequency	100.61
18	Spectral Width	24038.5
19	Lowest Frequency	-1958.0
20	Nucleus	13C
21	Acquired Size	32768
22	Spectral Size	65536

2-(1,2,3,4-tetrahydro-1-naphthalenyl)benzofuran(3g)

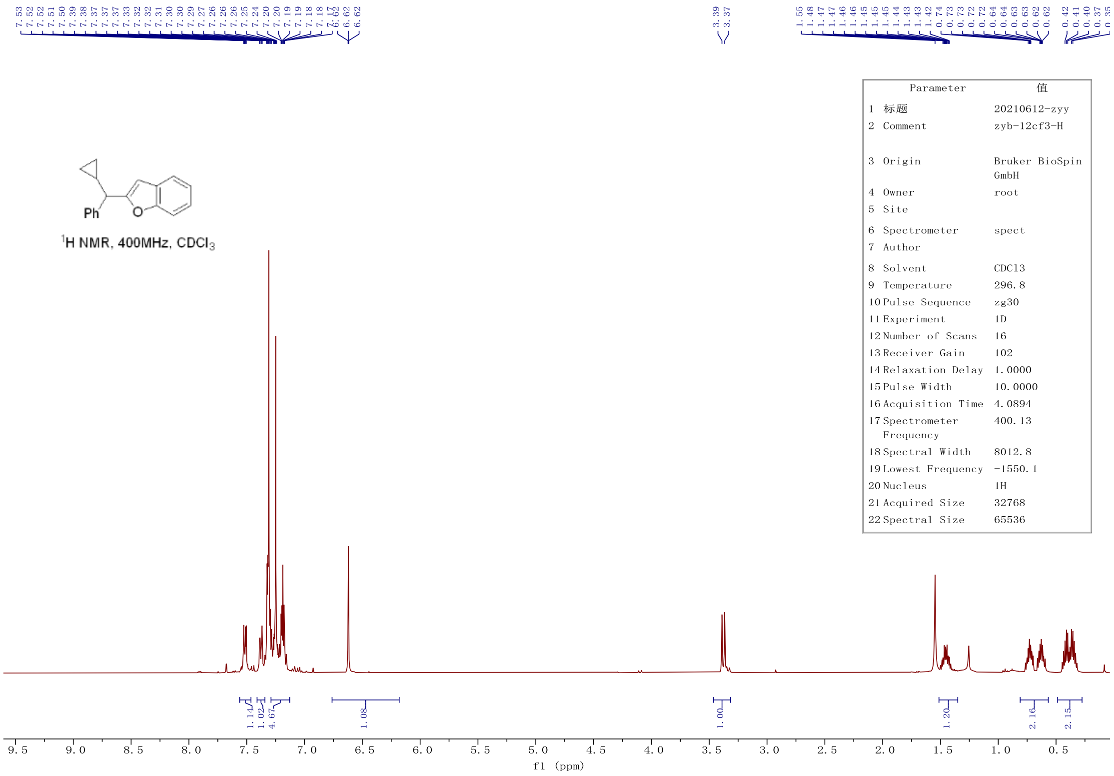


	Parameter	Value
1	Title	20210513-zy
2	Comment	zyb15cc-H
3	Origin	Bruker BioSpin GmbH
4	Owner	root
5	Site	
6	Spectrometer	spect
7	Author	
8	Solvent	CDCl3
9	Temperature	296.1
10	Pulse Sequence	zg30
11	Experiment	1D
12	Number of Scans	16
13	Receiver Gain	117
14	Relaxation Delay	1.0000
15	Pulse Width	10.0000
16	Acquisition Time	4.0894
17	Spectrometer Frequency	400.13
18	Spectral Width	8012.8
19	Lowest Frequency	-1549.3
20	Nucleus	1H
21	Acquired Size	32768
22	Spectral Size	65536

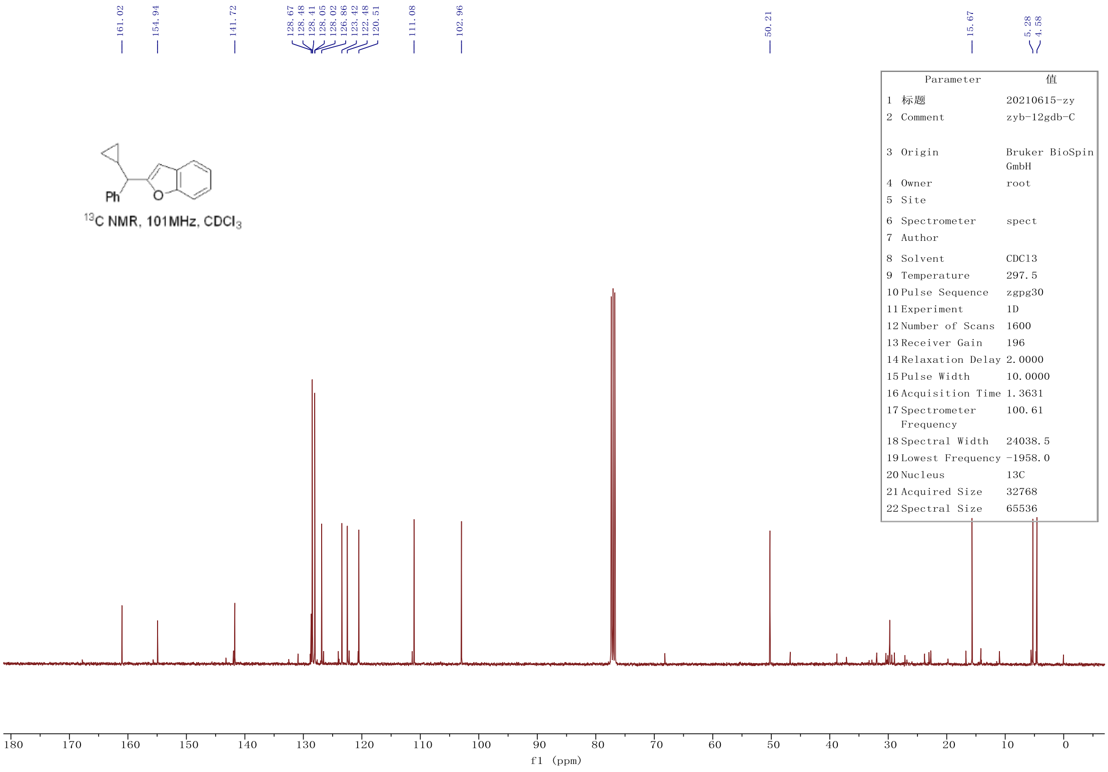


	Parameter	值
1	标题	20210513-zy
2	Comment	zyb15cc-C
3	Origin	Bruker BioSpin GmbH
4	Owner	root
5	Site	
6	Spectrometer	spect
7	Author	
8	Solvent	CDCl3
9	Temperature	297.1
10	Pulse Sequence	zgpg30
11	Experiment	1D
12	Number of Scans	1600
13	Receiver Gain	196
14	Relaxation Delay	2.0000
15	Pulse Width	10.0000
16	Acquisition Time	1.3631
17	Spectrometer Frequency	100.61
18	Spectral Width	24038.5
19	Lowest Frequency	-1958.0
20	Nucleus	13C
21	Acquired Size	32768
22	Spectral Size	65536

2-(cyclopropyl(phenyl)methyl)benzofuran (3h):

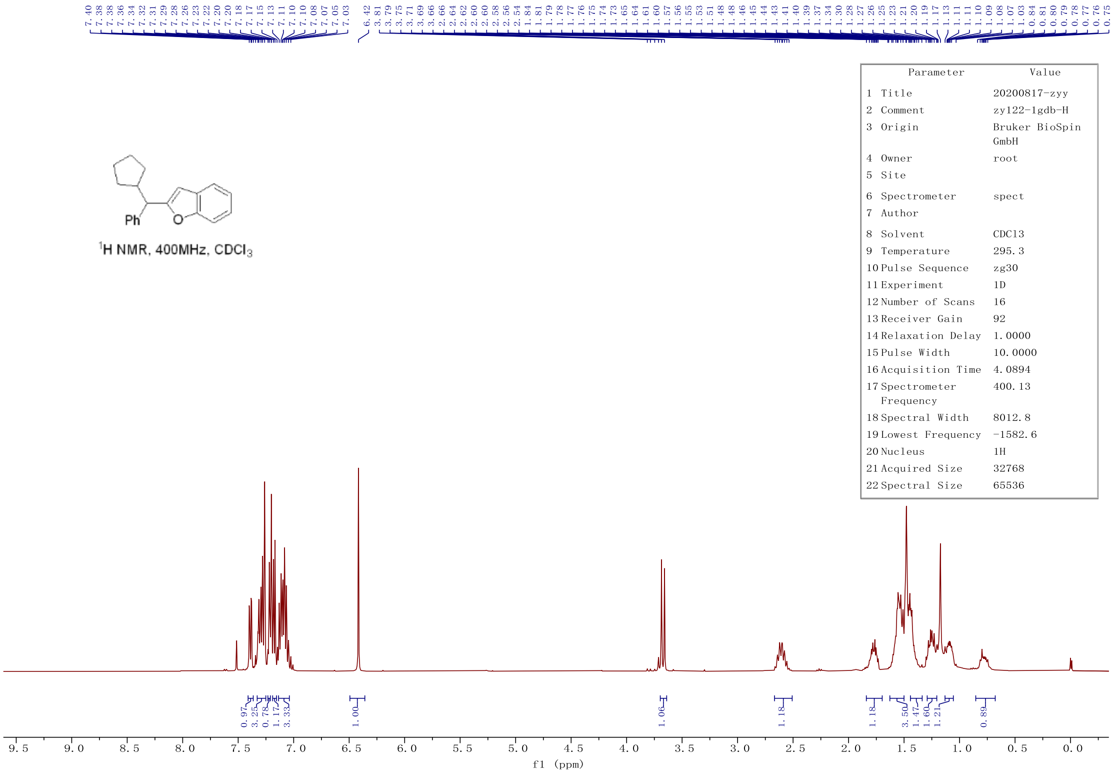


	Parameter	值
1	标题	20210612-zyy
2	Comment	zyb-12cf3-H
3	Origin	Bruker BioSpin GmbH
4	Owner	root
5	Site	
6	Spectrometer	spect
7	Author	
8	Solvent	CDCl3
9	Temperature	296.8
10	Pulse Sequence	zg30
11	Experiment	1D
12	Number of Scans	16
13	Receiver Gain	102
14	Relaxation Delay	1.0000
15	Pulse Width	10.0000
16	Acquisition Time	4.0894
17	Spectrometer Frequency	400.13
18	Spectral Width	8012.8
19	Lowest Frequency	-1550.1
20	Nucleus	1H
21	Acquired Size	32768
22	Spectral Size	65536



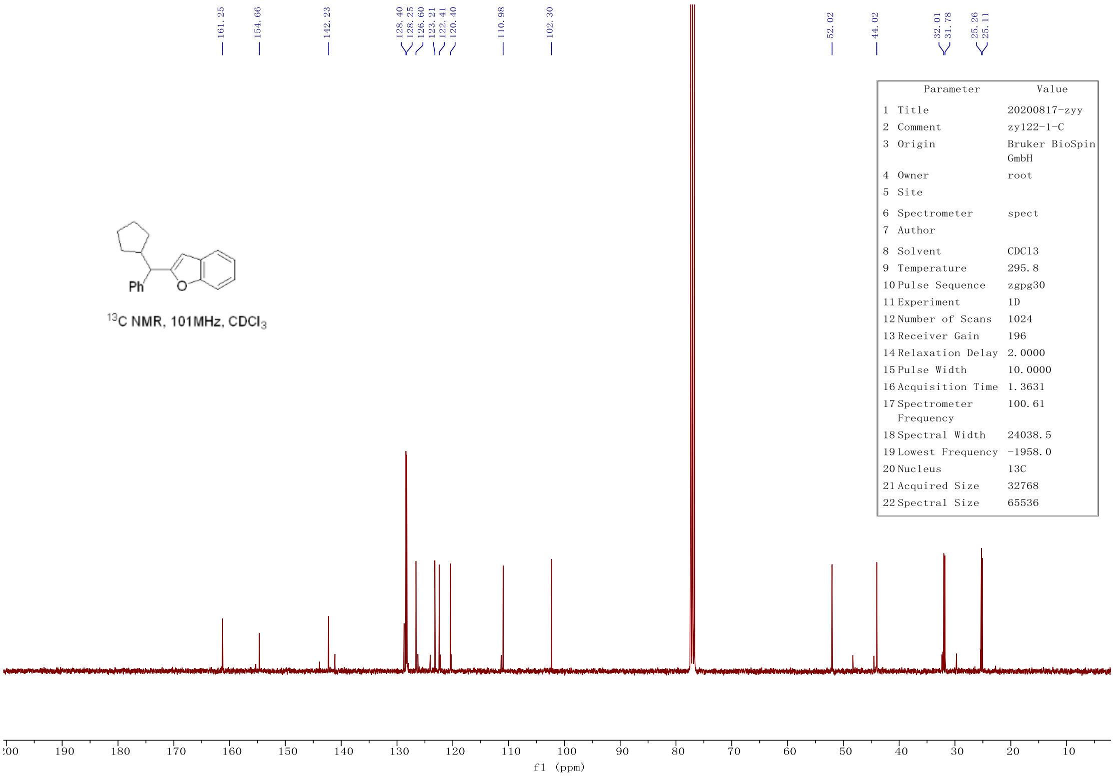
	Parameter	值
1	标题	20210615-zy
2	Comment	zyb-12gdb-C
3	Origin	Bruker BioSpin GmbH
4	Owner	root
5	Site	
6	Spectrometer	spect
7	Author	
8	Solvent	CDCl3
9	Temperature	297.5
10	Pulse Sequence	zgpg30
11	Experiment	1D
12	Number of Scans	1600
13	Receiver Gain	196
14	Relaxation Delay	2.0000
15	Pulse Width	10.0000
16	Acquisition Time	1.3631
17	Spectrometer Frequency	100.61
18	Spectral Width	24038.5
19	Lowest Frequency	-1958.0
20	Nucleus	13C
21	Acquired Size	32768
22	Spectral Size	65536

2-(cyclopentyl(phenyl)methyl)benzofuran (3i):



^{1}H NMR, 400MHz, CDCl$_3$

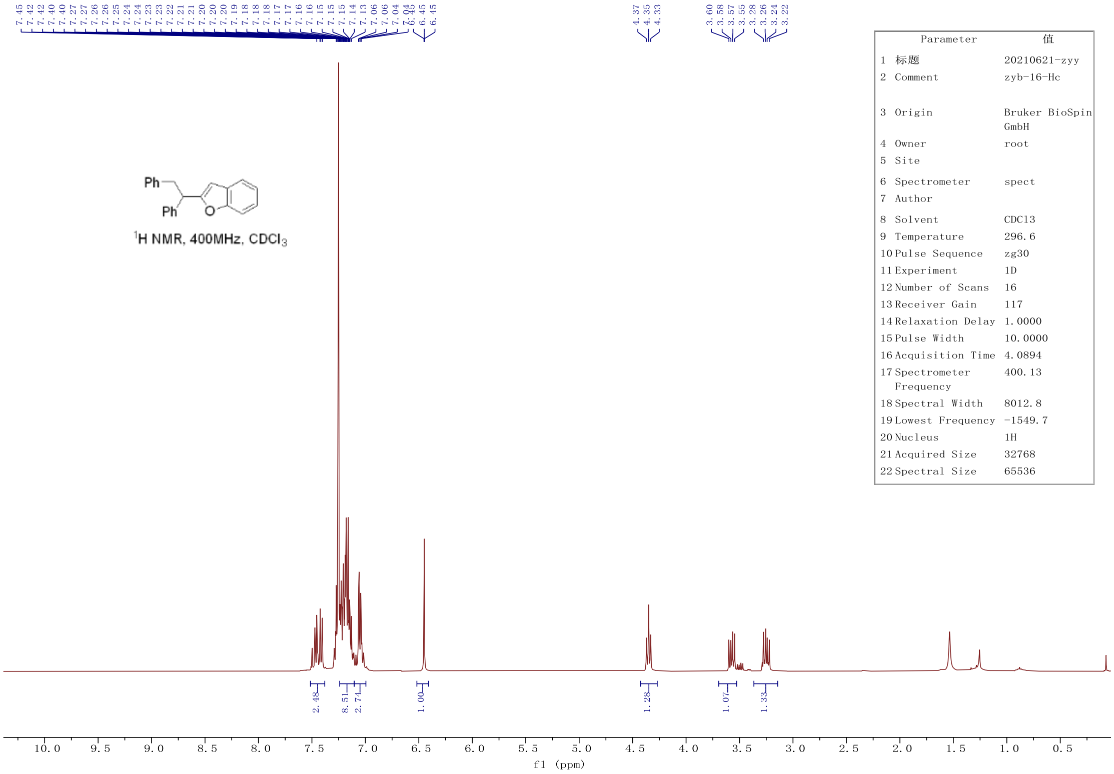
Parameter	Value
1 Title	20200817-zyy
2 Comment	zy122-1gdb-H
3 Origin	Bruker BioSpin GmbH
4 Owner	root
5 Site	
6 Spectrometer	spect
7 Author	
8 Solvent	CDC13
9 Temperature	295.3
10 Pulse Sequence	zg30
11 Experiment	1D
12 Number of Scans	16
13 Receiver Gain	92
14 Relaxation Delay	1.0000
15 Pulse Width	10.0000
16 Acquisition Time	4.0894
17 Spectrometer Frequency	400.13
18 Spectral Width	8012.8
19 Lowest Frequency	-1582.6
20 Nucleus	1H
21 Acquired Size	32768
22 Spectral Size	65536



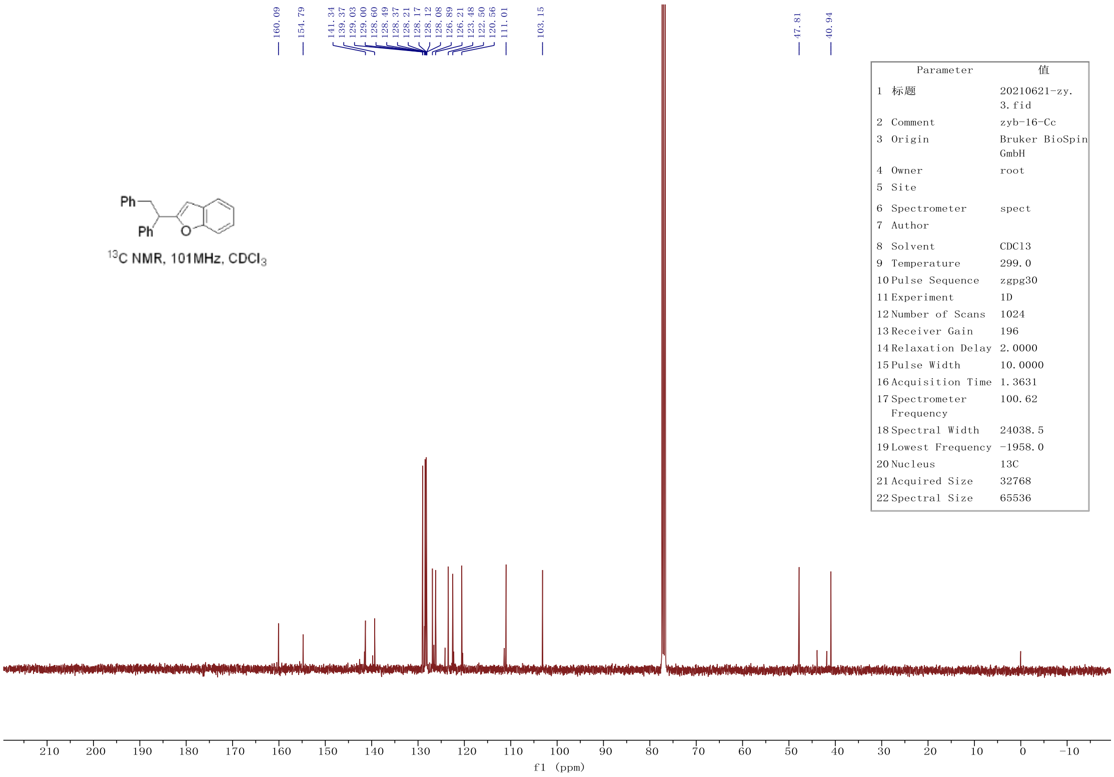
^{13}C NMR, 101MHz, CDCl$_3$

Parameter	Value
1 Title	20200817-zyy
2 Comment	zy122-1-C
3 Origin	Bruker BioSpin GmbH
4 Owner	root
5 Site	
6 Spectrometer	spect
7 Author	
8 Solvent	CDC13
9 Temperature	295.8
10 Pulse Sequence	zgpg30
11 Experiment	1D
12 Number of Scans	1024
13 Receiver Gain	196
14 Relaxation Delay	2.0000
15 Pulse Width	10.0000
16 Acquisition Time	1.3631
17 Spectrometer Frequency	100.61
18 Spectral Width	24038.5
19 Lowest Frequency	-1958.0
20 Nucleus	13C
21 Acquired Size	32768
22 Spectral Size	65536

2-(1,2-diphenylethyl)benzofuran (3j):

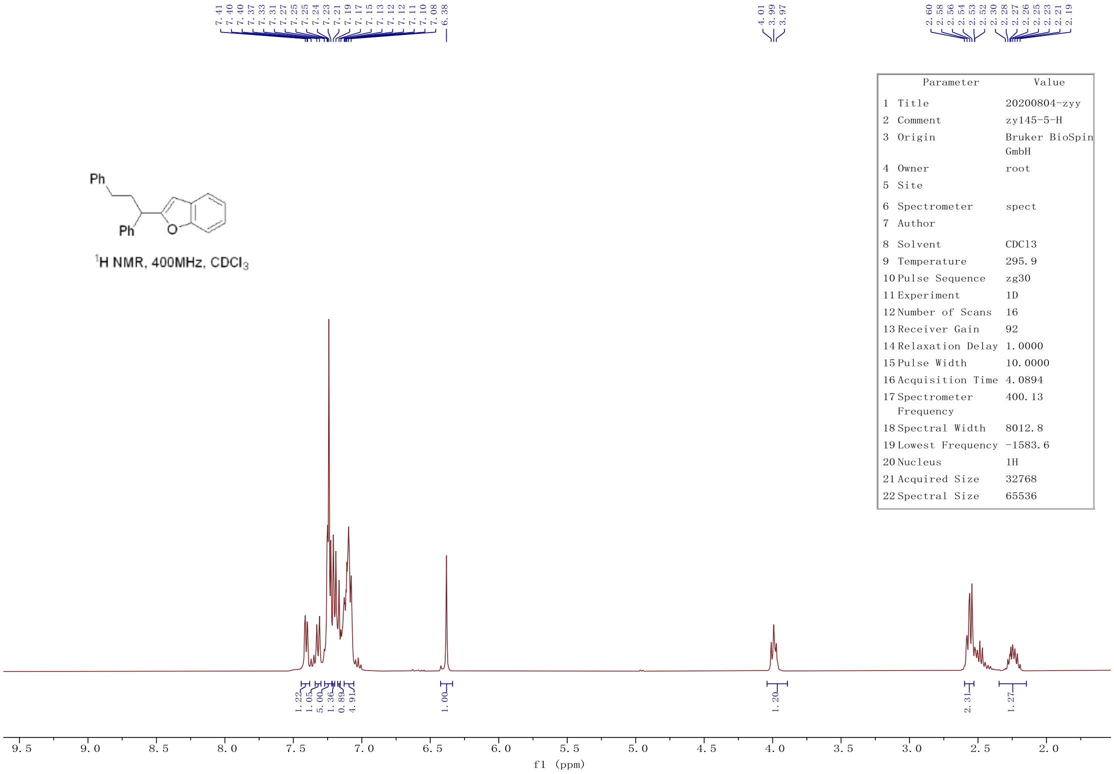


Parameter	值
1 标题	20210621-zyy
2 Comment	zyb-16-Hc
3 Origin	Bruker BioSpin GmbH
4 Owner	root
5 Site	
6 Spectrometer	spect
7 Author	
8 Solvent	CDCl3
9 Temperature	296.6
10 Pulse Sequence	zg30
11 Experiment	1D
12 Number of Scans	16
13 Receiver Gain	117
14 Relaxation Delay	1.0000
15 Pulse Width	10.0000
16 Acquisition Time	4.0894
17 Spectrometer Frequency	400.13
18 Spectral Width	8012.8
19 Lowest Frequency	-1549.7
20 Nucleus	1H
21 Acquired Size	32768
22 Spectral Size	65536

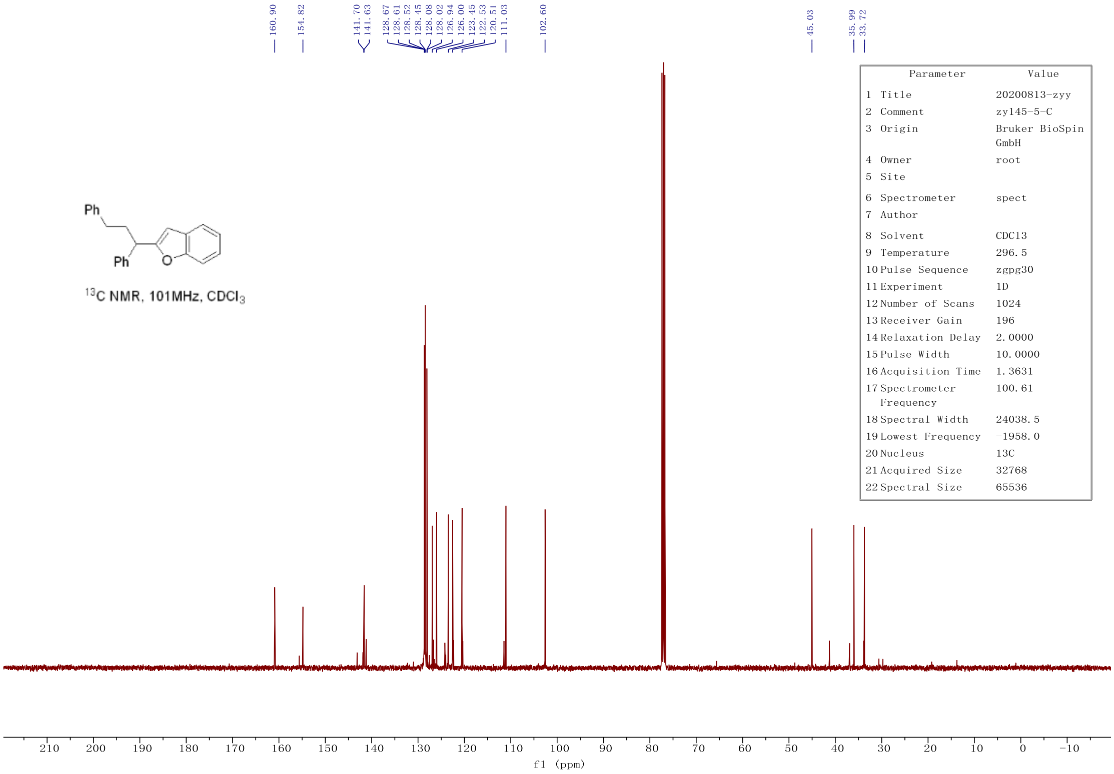


Parameter	值
1 标题	20210621-zy.3.fid
2 Comment	zyb-16-Cc
3 Origin	Bruker BioSpin GmbH
4 Owner	root
5 Site	
6 Spectrometer	spect
7 Author	
8 Solvent	CDCl3
9 Temperature	299.0
10 Pulse Sequence	zgpg30
11 Experiment	1D
12 Number of Scans	1024
13 Receiver Gain	196
14 Relaxation Delay	2.0000
15 Pulse Width	10.0000
16 Acquisition Time	1.3631
17 Spectrometer Frequency	100.62
18 Spectral Width	24038.5
19 Lowest Frequency	-1958.0
20 Nucleus	13C
21 Acquired Size	32768
22 Spectral Size	65536

2-(1,3-diphenylpropyl)benzofuran (3k):

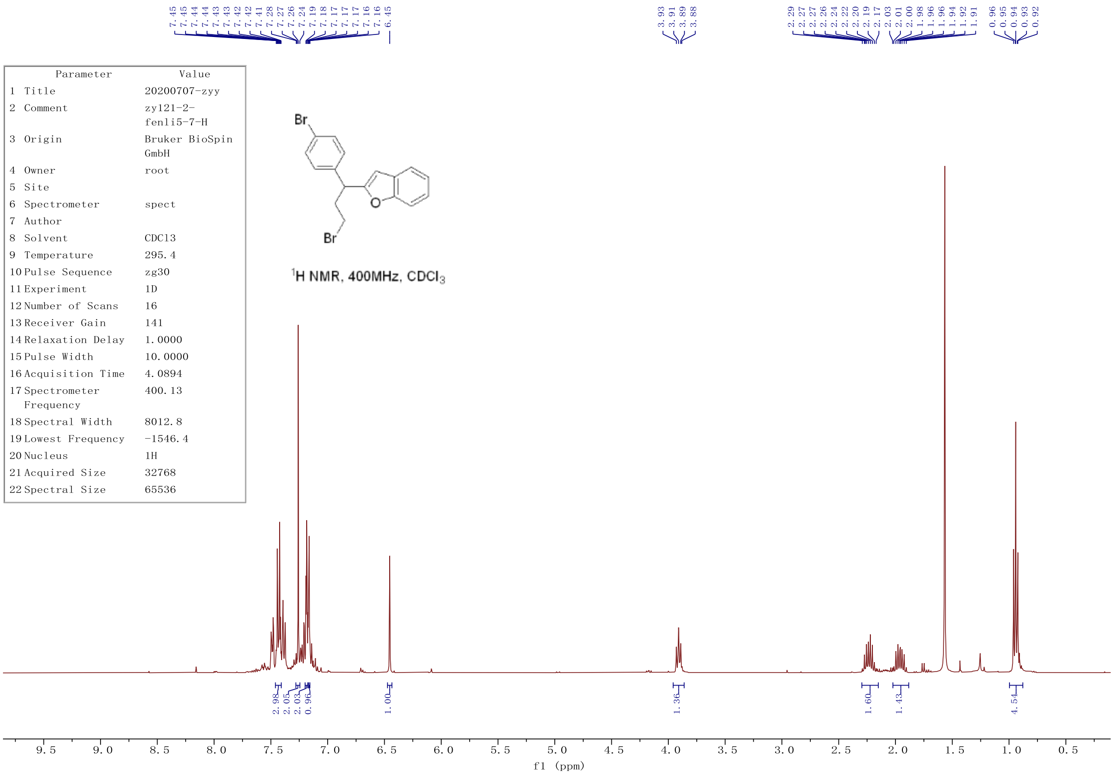


	Parameter	Value
1	Title	20200804-zyy
2	Comment	zy145-5-H
3	Origin	Bruker BioSpin GmbH
4	Owner	root
5	Site	
6	Spectrometer	spect
7	Author	
8	Solvent	CDCl3
9	Temperature	295.9
10	Pulse Sequence	zg30
11	Experiment	1D
12	Number of Scans	16
13	Receiver Gain	92
14	Relaxation Delay	1.0000
15	Pulse Width	10.0000
16	Acquisition Time	4.0894
17	Spectrometer Frequency	400.13
18	Spectral Width	8012.8
19	Lowest Frequency	-1583.6
20	Nucleus	1H
21	Acquired Size	32768
22	Spectral Size	65536

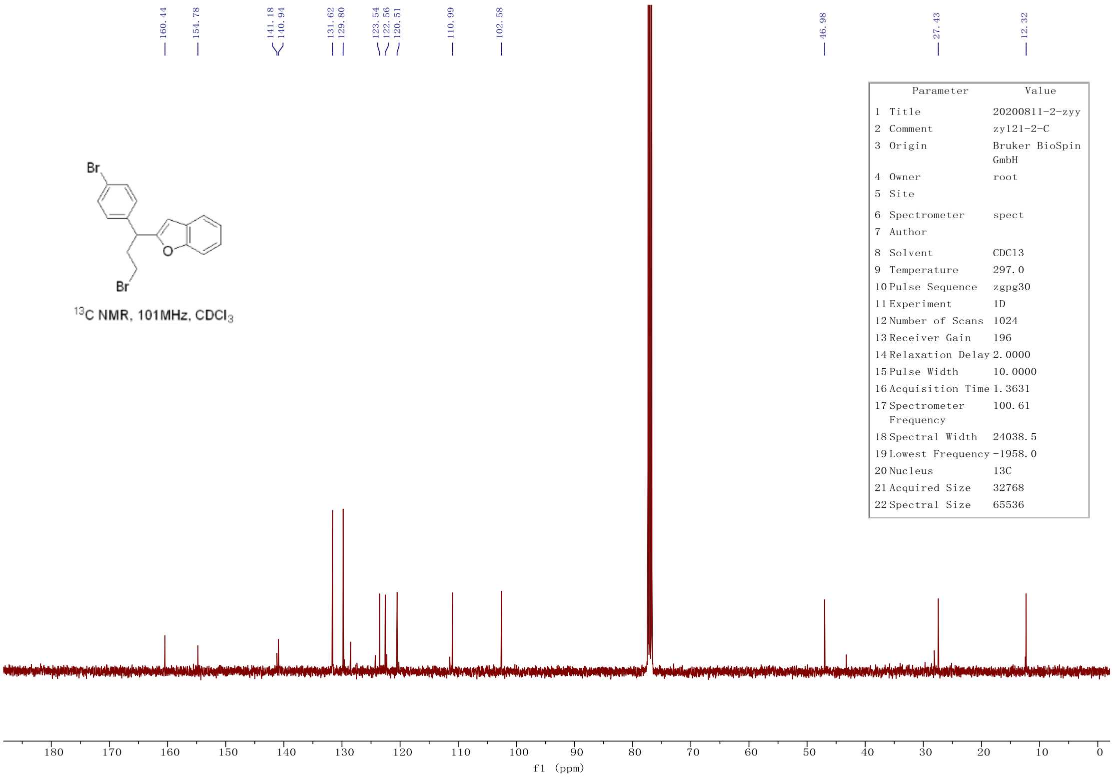


	Parameter	Value
1	Title	20200813-zyy
2	Comment	zy145-5-C
3	Origin	Bruker BioSpin GmbH
4	Owner	root
5	Site	
6	Spectrometer	spect
7	Author	
8	Solvent	CDCl3
9	Temperature	296.5
10	Pulse Sequence	zgpg30
11	Experiment	1D
12	Number of Scans	1024
13	Receiver Gain	196
14	Relaxation Delay	2.0000
15	Pulse Width	10.0000
16	Acquisition Time	1.3631
17	Spectrometer Frequency	100.61
18	Spectral Width	24038.5
19	Lowest Frequency	-1958.0
20	Nucleus	13C
21	Acquired Size	32768
22	Spectral Size	65536

2-(3-bromo-1-(4-bromophenyl)propyl)benzofuran (3l):

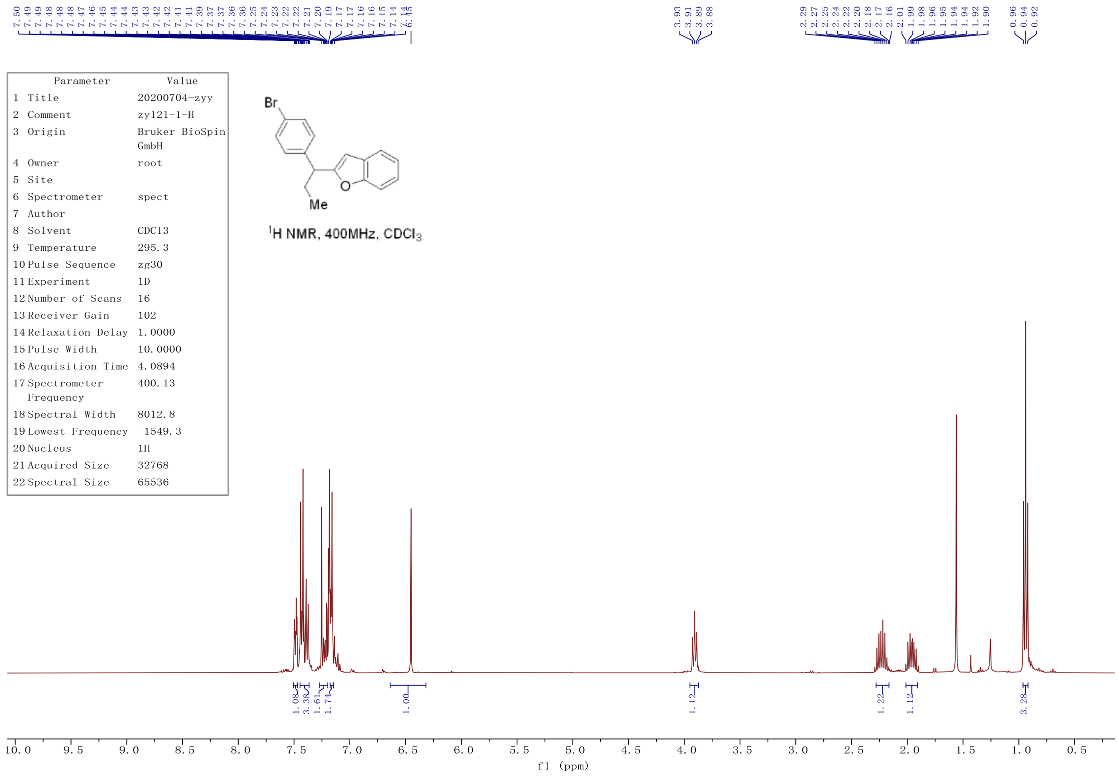


	Parameter	Value
1	Title	20200707-zyy
2	Comment	zy121-2-fenli5-7-H
3	Origin	Bruker BioSpin GmbH
4	Owner	root
5	Site	
6	Spectrometer	spect
7	Author	
8	Solvent	CDCl3
9	Temperature	295.4
10	Pulse Sequence	zg30
11	Experiment	1D
12	Number of Scans	16
13	Receiver Gain	141
14	Relaxation Delay	1.0000
15	Pulse Width	10.0000
16	Acquisition Time	4.0894
17	Spectrometer Frequency	400.13
18	Spectral Width	8012.8
19	Lowest Frequency	-1546.4
20	Nucleus	1H
21	Acquired Size	32768
22	Spectral Size	65536

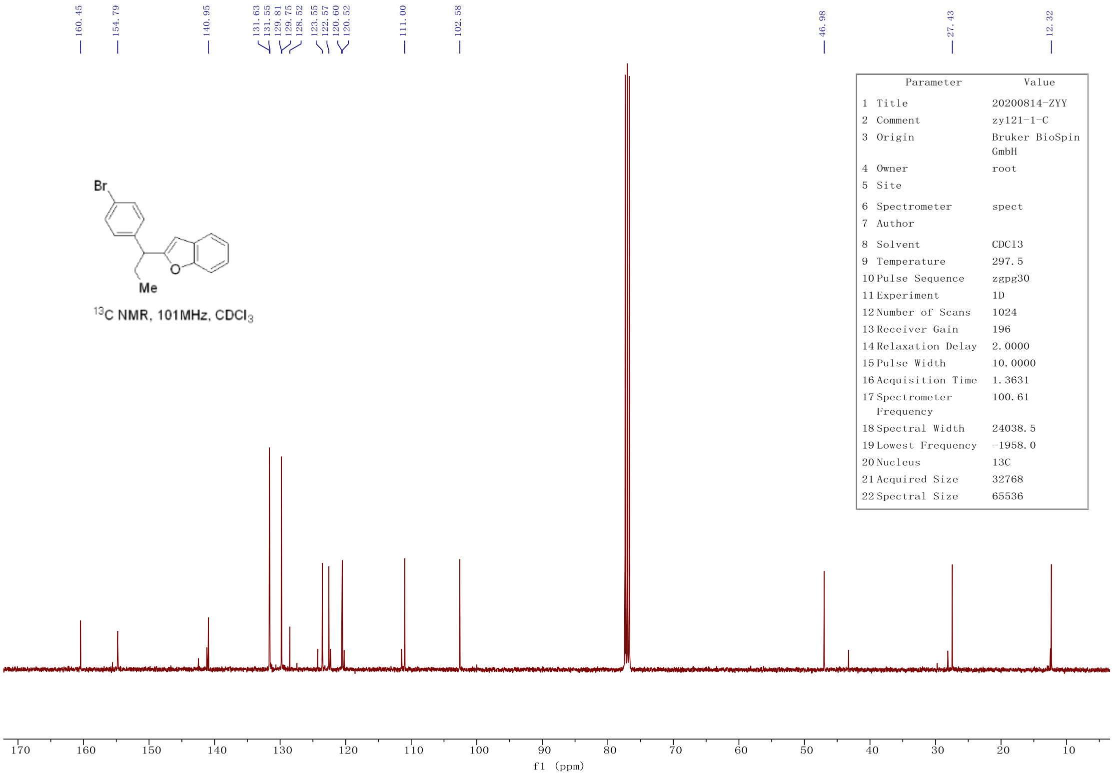


	Parameter	Value
1	Title	20200811-2-zyy
2	Comment	zy121-2-C
3	Origin	Bruker BioSpin GmbH
4	Owner	root
5	Site	
6	Spectrometer	spect
7	Author	
8	Solvent	CDCl3
9	Temperature	297.0
10	Pulse Sequence	zgpg30
11	Experiment	1D
12	Number of Scans	1024
13	Receiver Gain	196
14	Relaxation Delay	2.0000
15	Pulse Width	10.0000
16	Acquisition Time	1.3631
17	Spectrometer Frequency	100.61
18	Spectral Width	24038.5
19	Lowest Frequency	-1958.0
20	Nucleus	13C
21	Acquired Size	32768
22	Spectral Size	65536

2-(1-(4-bromophenyl)propyl)benzofuran (3m):

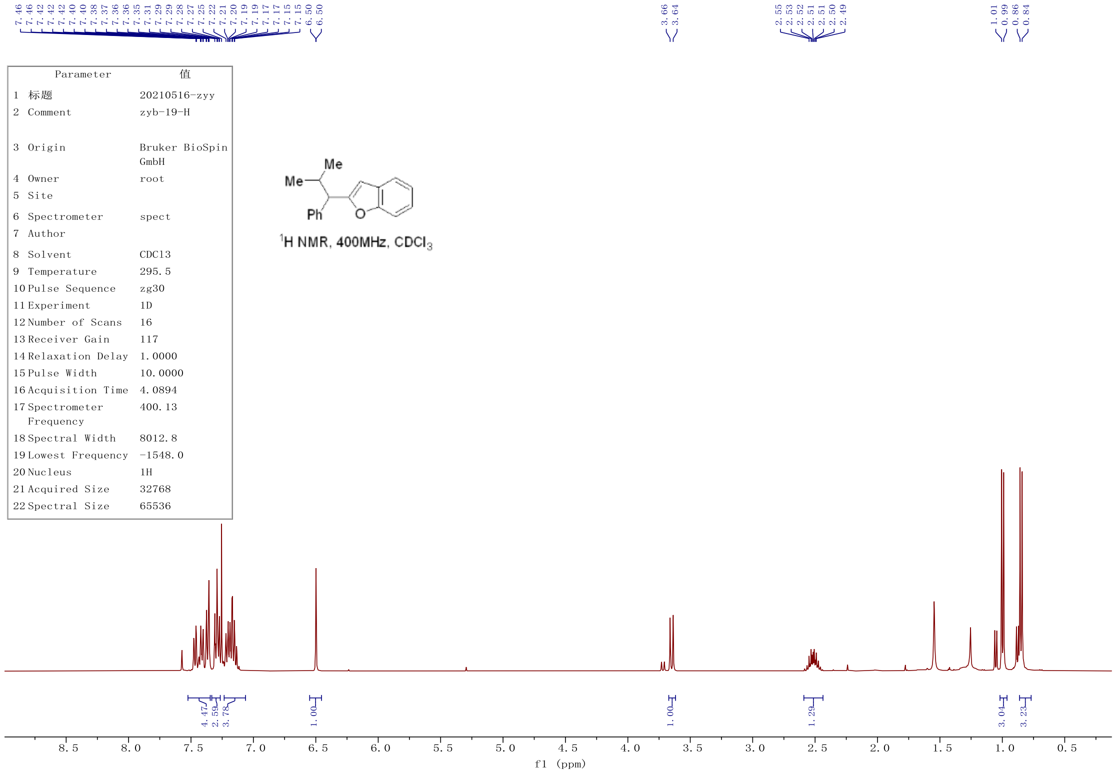


	Parameter	Value
1	Title	20200704-zyy
2	Comment	zy121-1-H
3	Origin	Bruker BioSpin GmbH
4	Owner	root
5	Site	
6	Spectrometer	spect
7	Author	
8	Solvent	CDCl3
9	Temperature	295.3
10	Pulse Sequence	zg30
11	Experiment	1D
12	Number of Scans	16
13	Receiver Gain	102
14	Relaxation Delay	1.0000
15	Pulse Width	10.0000
16	Acquisition Time	4.0894
17	Spectrometer Frequency	400.13
18	Spectral Width	8012.8
19	Lowest Frequency	-1549.3
20	Nucleus	1H
21	Acquired Size	32768
22	Spectral Size	65536



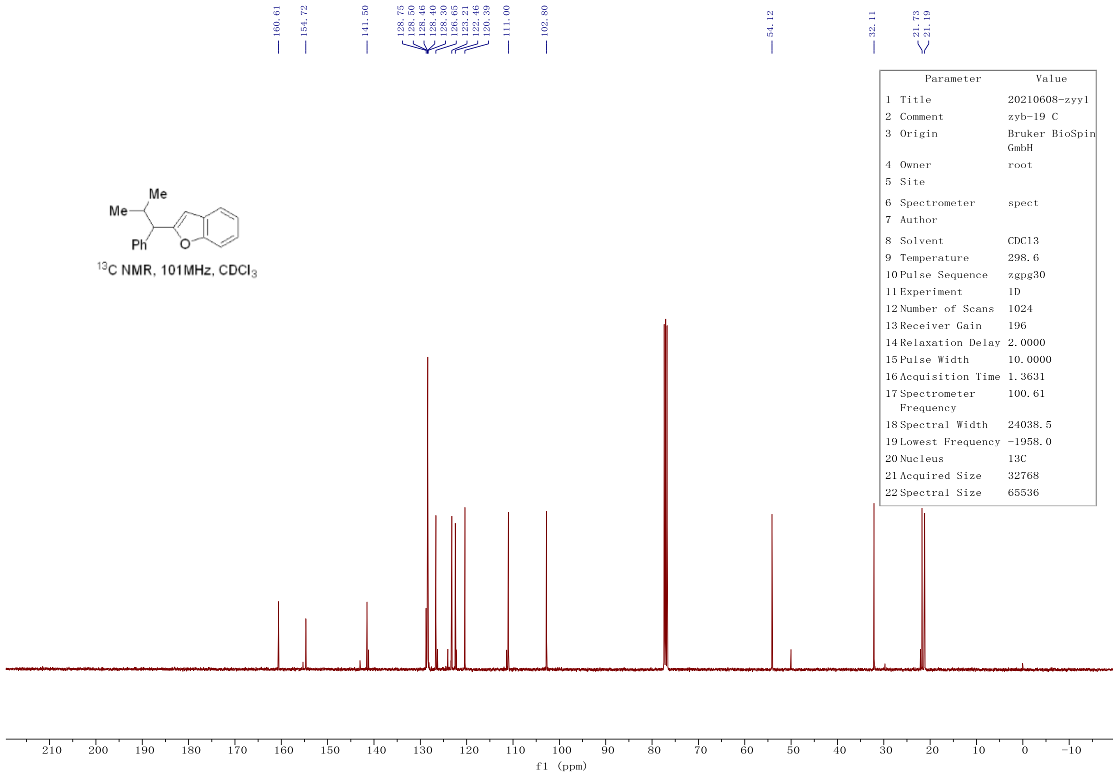
	Parameter	Value
1	Title	20200814-ZYY
2	Comment	zy121-1-C
3	Origin	Bruker BioSpin GmbH
4	Owner	root
5	Site	
6	Spectrometer	spect
7	Author	
8	Solvent	CDCl3
9	Temperature	297.5
10	Pulse Sequence	zgpg30
11	Experiment	1D
12	Number of Scans	1024
13	Receiver Gain	196
14	Relaxation Delay	2.0000
15	Pulse Width	10.0000
16	Acquisition Time	1.3631
17	Spectrometer Frequency	100.61
18	Spectral Width	24038.5
19	Lowest Frequency	-1958.0
20	Nucleus	13C
21	Acquired Size	32768
22	Spectral Size	65536

2-(2-methyl-1-phenylpropyl)benzofuran (3n):



^{1}H NMR, 400MHz, CDCl$_3$

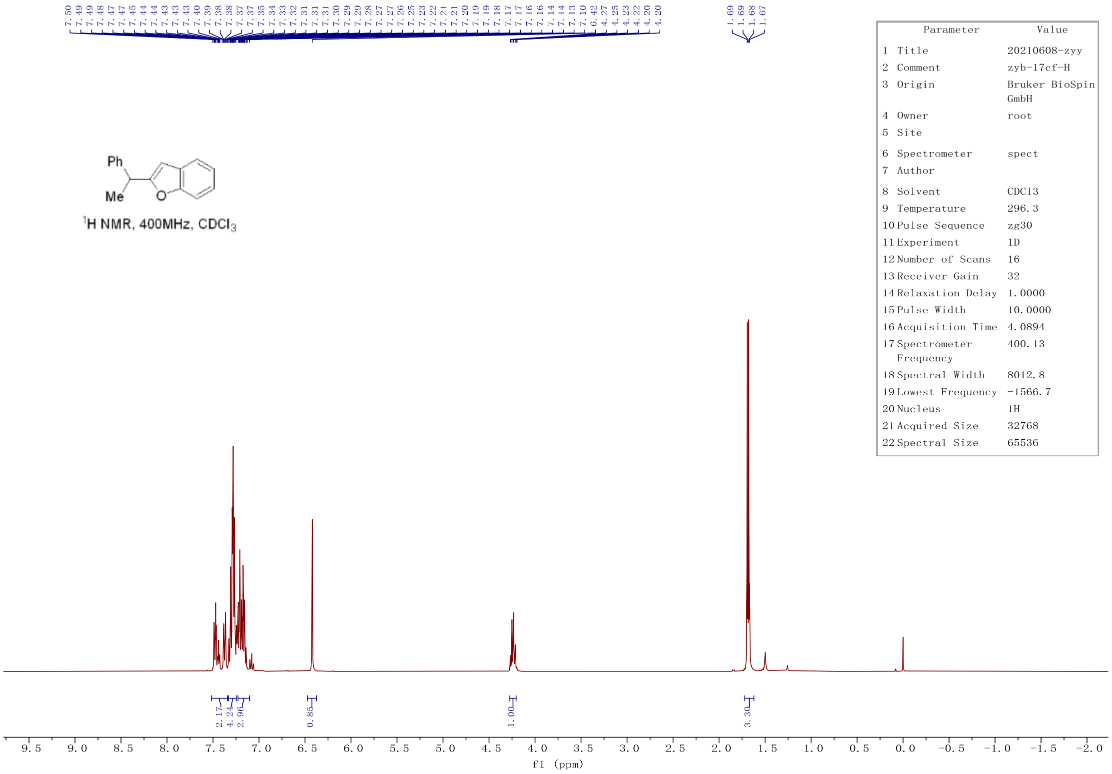
Parameter	值
1 标题	20210516-zyy
2 Comment	zyb-19-H
3 Origin	Bruker BioSpin GmbH
4 Owner	root
5 Site	
6 Spectrometer	spect
7 Author	
8 Solvent	CDCl3
9 Temperature	295.5
10 Pulse Sequence	zg30
11 Experiment	1D
12 Number of Scans	16
13 Receiver Gain	117
14 Relaxation Delay	1.0000
15 Pulse Width	10.0000
16 Acquisition Time	4.0894
17 Spectrometer Frequency	400.13
18 Spectral Width	8012.8
19 Lowest Frequency	-1548.0
20 Nucleus	1H
21 Acquired Size	32768
22 Spectral Size	65536



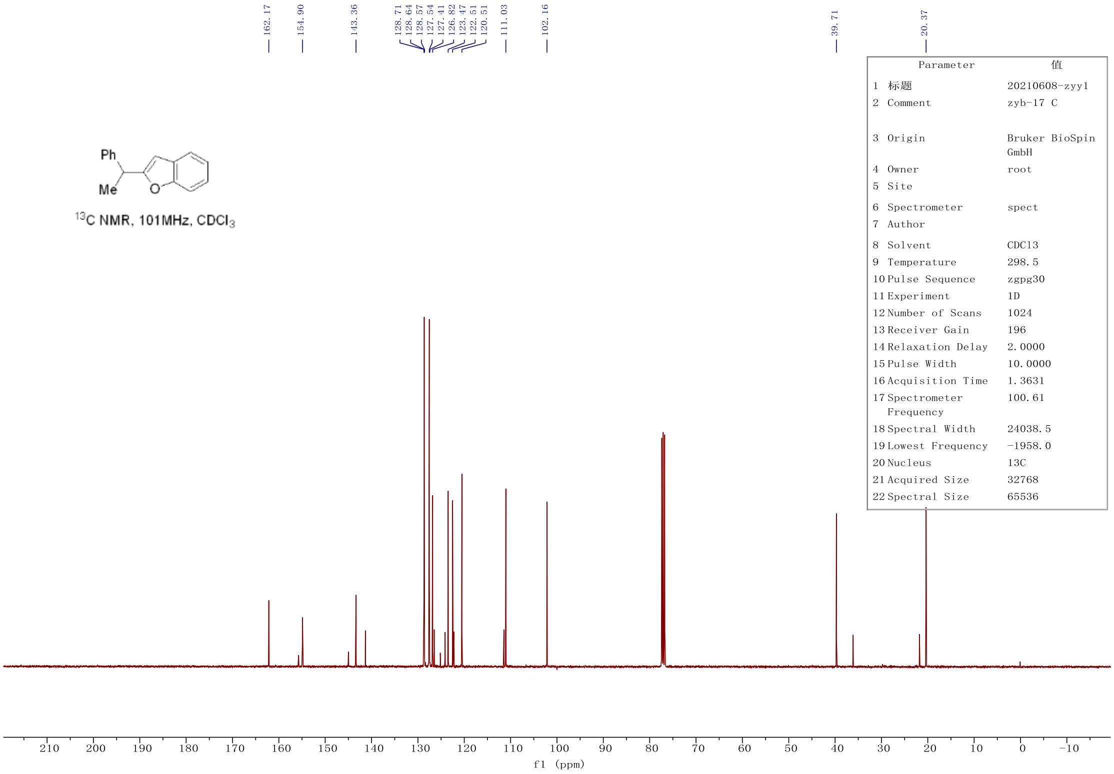
^{13}C NMR, 101MHz, CDCl$_3$

Parameter	Value
1 Title	20210608-zyy1
2 Comment	zyb-19 C
3 Origin	Bruker BioSpin GmbH
4 Owner	root
5 Site	
6 Spectrometer	spect
7 Author	
8 Solvent	CDCl3
9 Temperature	298.6
10 Pulse Sequence	zgpg30
11 Experiment	1D
12 Number of Scans	1024
13 Receiver Gain	196
14 Relaxation Delay	2.0000
15 Pulse Width	10.0000
16 Acquisition Time	1.3631
17 Spectrometer Frequency	100.61
18 Spectral Width	24038.5
19 Lowest Frequency	-1958.0
20 Nucleus	13C
21 Acquired Size	32768
22 Spectral Size	65536

2-(1-phenylethyl)benzofran (3o)

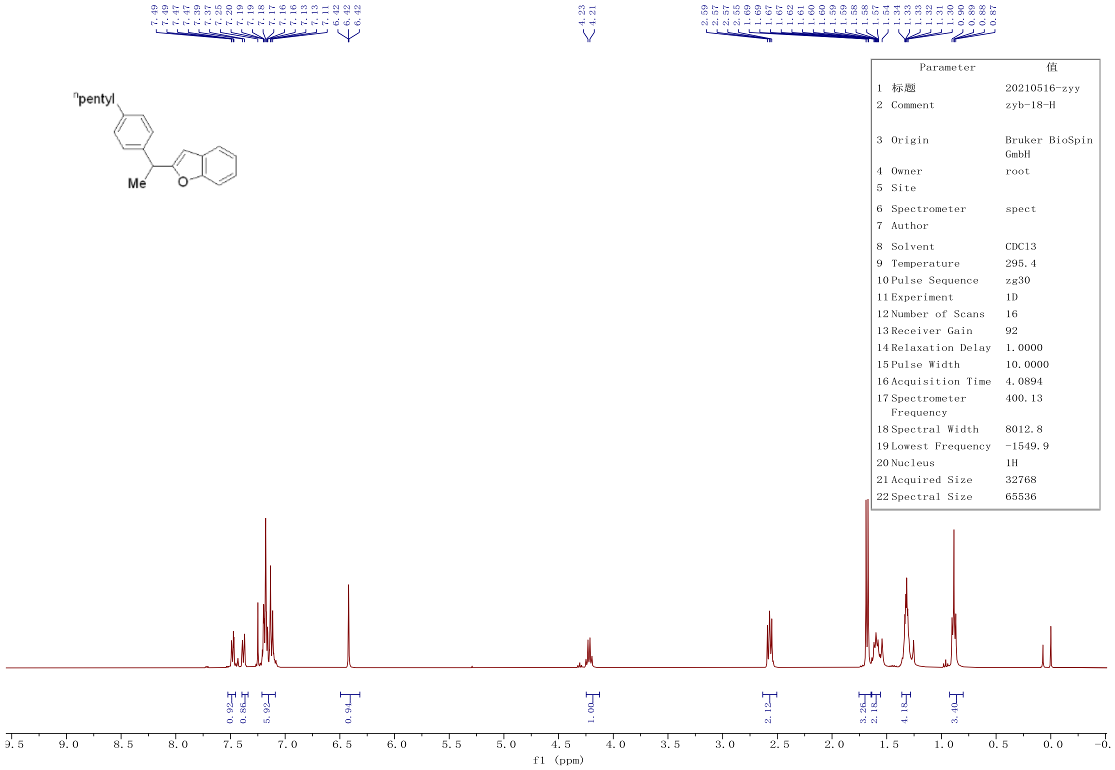


	Parameter	Value
1	Title	20210608-zyy
2	Comment	zyb-17cf-H
3	Origin	Bruker BioSpin GmbH
4	Owner	root
5	Site	
6	Spectrometer	spect
7	Author	
8	Solvent	CDCl3
9	Temperature	296.3
10	Pulse Sequence	zg30
11	Experiment	1D
12	Number of Scans	16
13	Receiver Gain	32
14	Relaxation Delay	1.0000
15	Pulse Width	10.0000
16	Acquisition Time	4.0894
17	Spectrometer Frequency	400.13
18	Spectral Width	8012.8
19	Lowest Frequency	-1566.7
20	Nucleus	1H
21	Acquired Size	32768
22	Spectral Size	65536

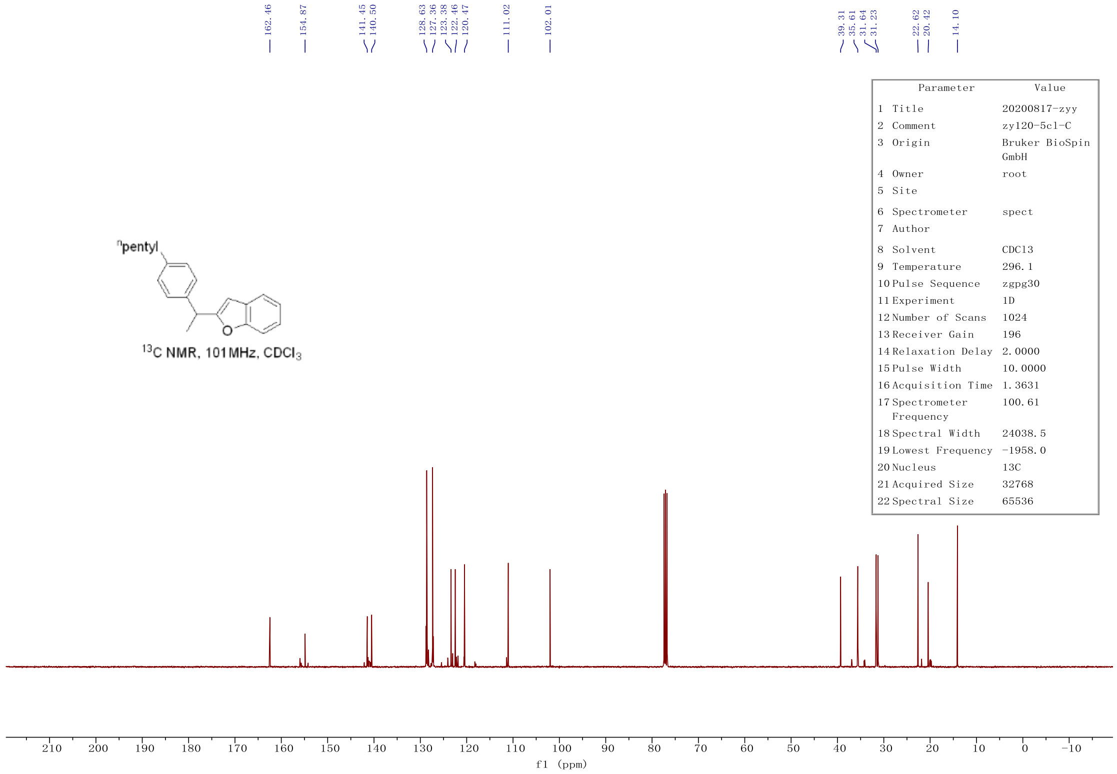


	Parameter	值
1	标题	20210608-zyy1
2	Comment	zyb-17 C
3	Origin	Bruker BioSpin GmbH
4	Owner	root
5	Site	
6	Spectrometer	spect
7	Author	
8	Solvent	CDCl3
9	Temperature	298.5
10	Pulse Sequence	zgpg30
11	Experiment	1D
12	Number of Scans	1024
13	Receiver Gain	196
14	Relaxation Delay	2.0000
15	Pulse Width	10.0000
16	Acquisition Time	1.3631
17	Spectrometer Frequency	100.61
18	Spectral Width	24038.5
19	Lowest Frequency	-1958.0
20	Nucleus	13C
21	Acquired Size	32768
22	Spectral Size	65536

2-(1-(4-pentylphenyl)ethyl)-3a,7a-dihydrobenzofuran (3p):



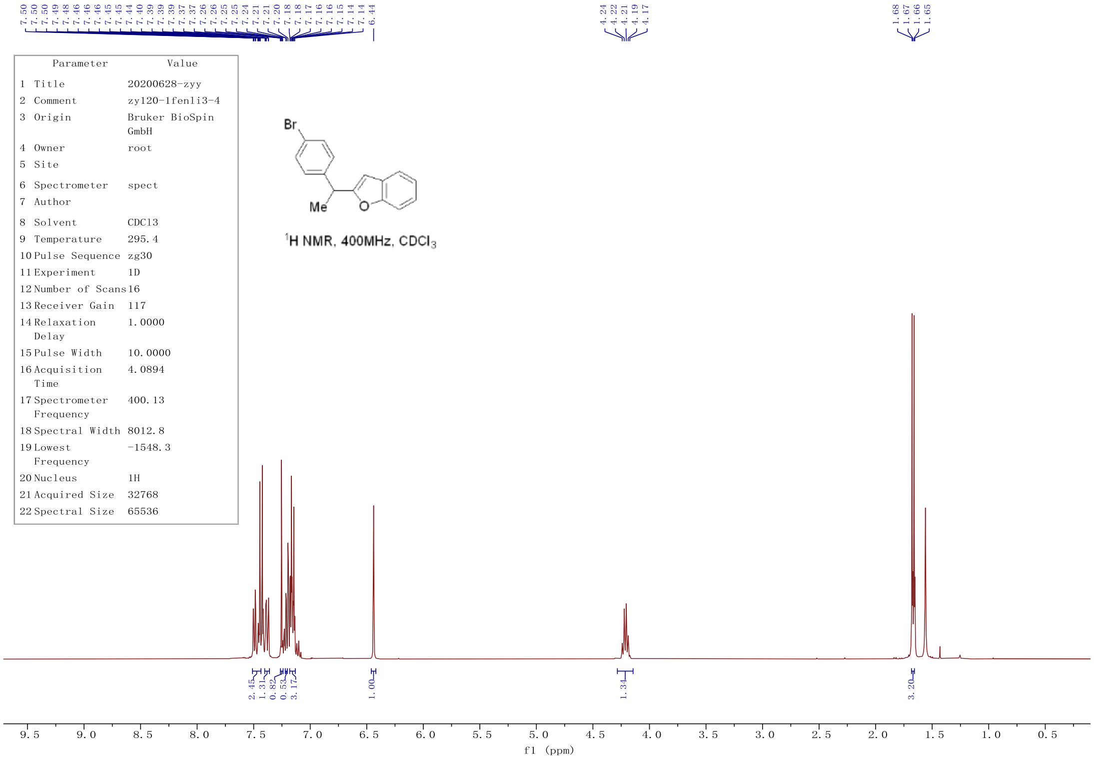
	Parameter	值
1	标题	20210516-zyy
2	Comment	zyb-18-H
3	Origin	Bruker BioSpin GmbH
4	Owner	root
5	Site	
6	Spectrometer	spect
7	Author	
8	Solvent	CDCl3
9	Temperature	295.4
10	Pulse Sequence	zg30
11	Experiment	1D
12	Number of Scans	16
13	Receiver Gain	92
14	Relaxation Delay	1.0000
15	Pulse Width	10.0000
16	Acquisition Time	4.0894
17	Spectrometer Frequency	400.13
18	Spectral Width	8012.8
19	Lowest Frequency	-1549.9
20	Nucleus	1H
21	Acquired Size	32768
22	Spectral Size	65536



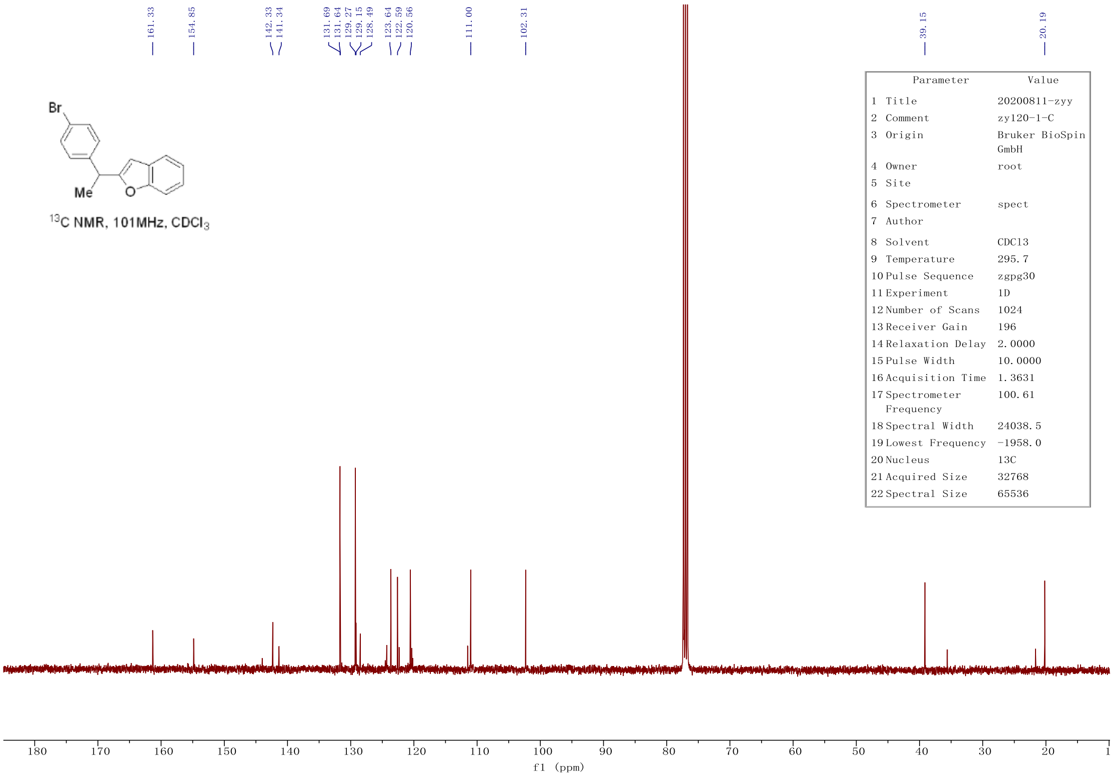
^{13}C NMR, 101 MHz, CDCl$_3$

	Parameter	Value
1	Title	20200817-zyy
2	Comment	zy120-5c1-C
3	Origin	Bruker BioSpin GmbH
4	Owner	root
5	Site	
6	Spectrometer	spect
7	Author	
8	Solvent	CDCl3
9	Temperature	296.1
10	Pulse Sequence	zgpg30
11	Experiment	1D
12	Number of Scans	1024
13	Receiver Gain	196
14	Relaxation Delay	2.0000
15	Pulse Width	10.0000
16	Acquisition Time	1.3631
17	Spectrometer Frequency	100.61
18	Spectral Width	24038.5
19	Lowest Frequency	-1958.0
20	Nucleus	13C
21	Acquired Size	32768
22	Spectral Size	65536

2-(1-(4-bromophenyl)ethyl)benzofuran (3q):

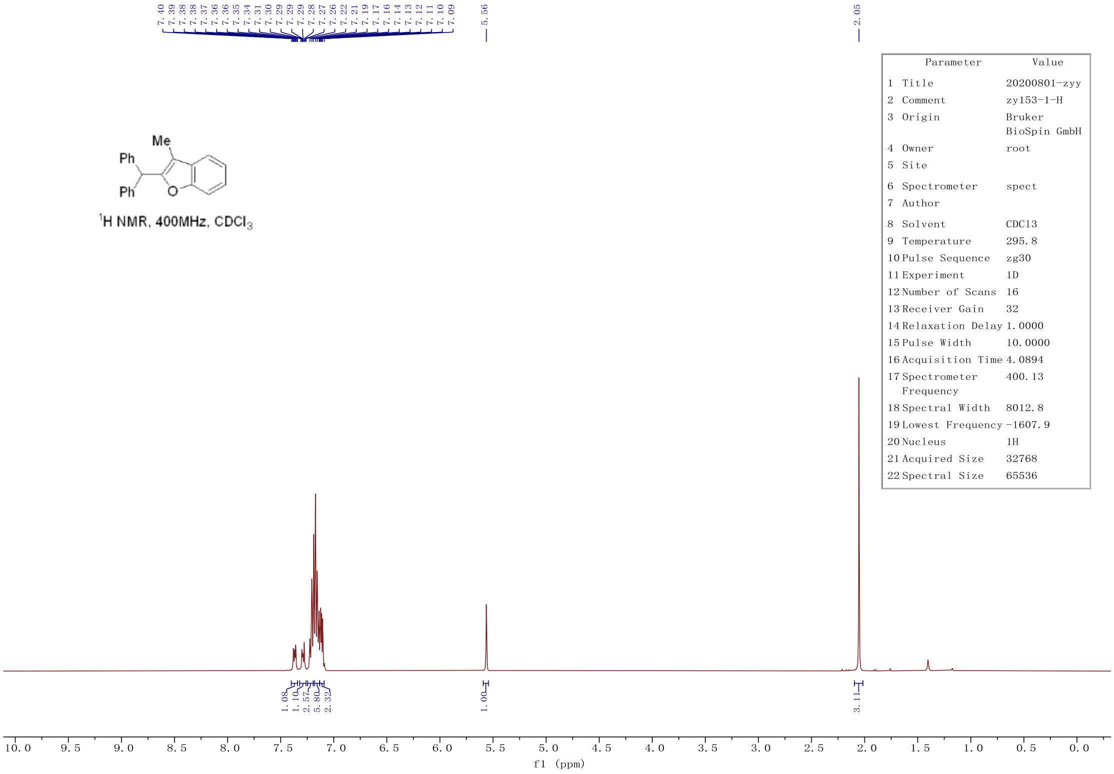


Parameter	Value
1 Title	20200628-zyy
2 Comment	zy120-1fenli3-4
3 Origin	Bruker BioSpin GmbH
4 Owner	root
5 Site	
6 Spectrometer	spect
7 Author	
8 Solvent	CDCl3
9 Temperature	295.4
10 Pulse Sequence	zg30
11 Experiment	1D
12 Number of Scans	16
13 Receiver Gain	117
14 Relaxation Delay	1.0000
15 Pulse Width	10.0000
16 Acquisition Time	4.0894
17 Spectrometer Frequency	400.13
18 Spectral Width	8012.8
19 Lowest Frequency	-1548.3
20 Nucleus	1H
21 Acquired Size	32768
22 Spectral Size	65536

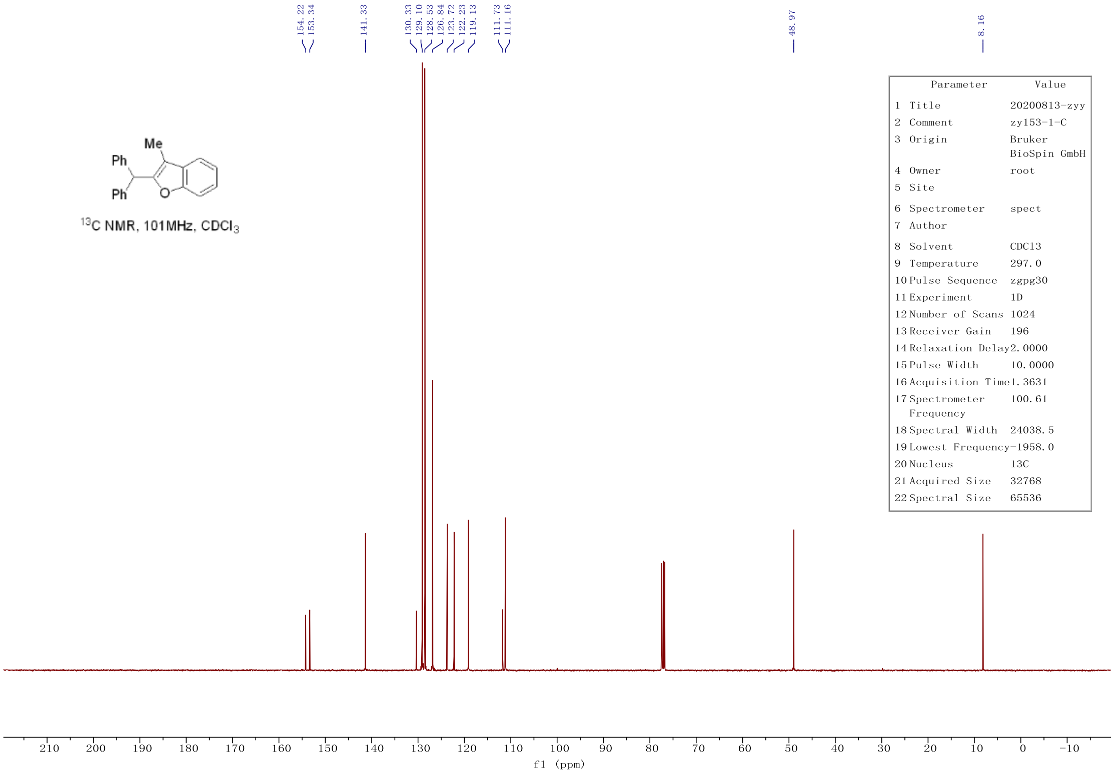


Parameter	Value
1 Title	20200811-zyy
2 Comment	zy120-1-C
3 Origin	Bruker BioSpin GmbH
4 Owner	root
5 Site	
6 Spectrometer	spect
7 Author	
8 Solvent	CDCl3
9 Temperature	295.7
10 Pulse Sequence	zgpg30
11 Experiment	1D
12 Number of Scans	1024
13 Receiver Gain	196
14 Relaxation Delay	2.0000
15 Pulse Width	10.0000
16 Acquisition Time	1.3631
17 Spectrometer Frequency	100.61
18 Spectral Width	24038.5
19 Lowest Frequency	-1958.0
20 Nucleus	13C
21 Acquired Size	32768
22 Spectral Size	65536

2-benzhydryl-3-methylbenzofuran (4a):

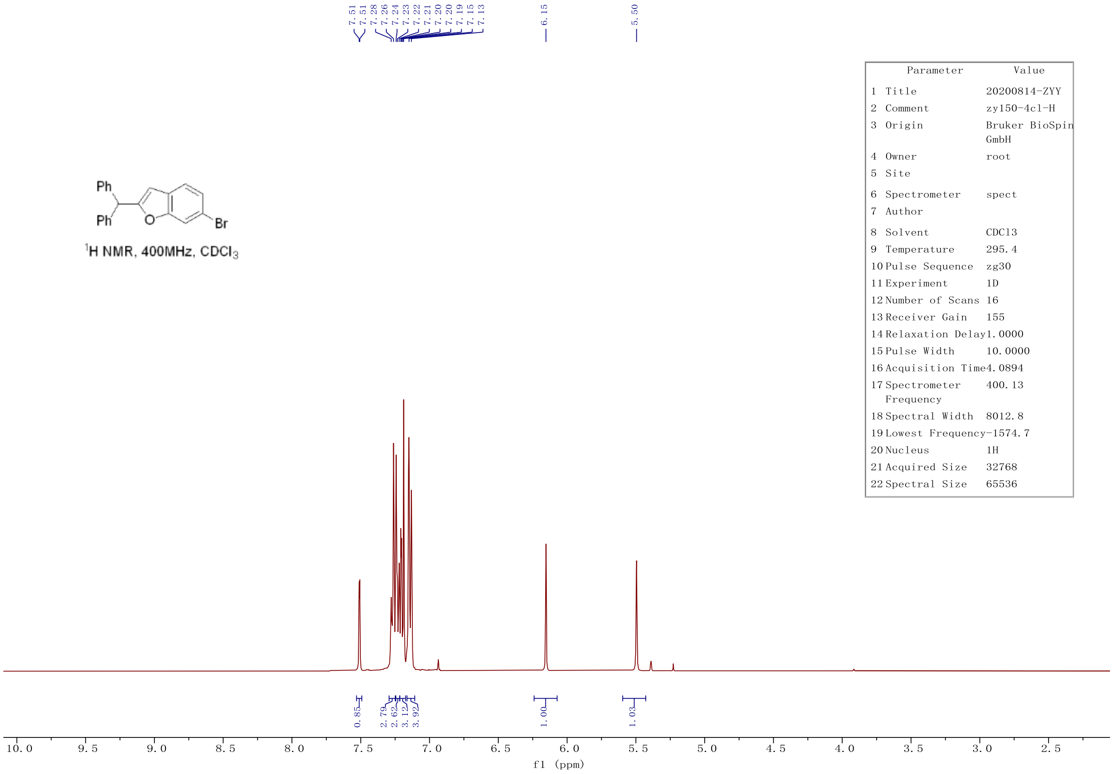


	Parameter	Value
1	Title	20200801-zyy
2	Comment	zy153-1-H
3	Origin	Bruker BioSpin GmbH
4	Owner	root
5	Site	
6	Spectrometer	spect
7	Author	
8	Solvent	CDCl3
9	Temperature	295.8
10	Pulse Sequence	zg30
11	Experiment	1D
12	Number of Scans	16
13	Receiver Gain	32
14	Relaxation Delay	1.0000
15	Pulse Width	10.0000
16	Acquisition Time	4.0894
17	Spectrometer Frequency	400.13
18	Spectral Width	8012.8
19	Lowest Frequency	-1607.9
20	Nucleus	1H
21	Acquired Size	32768
22	Spectral Size	65536

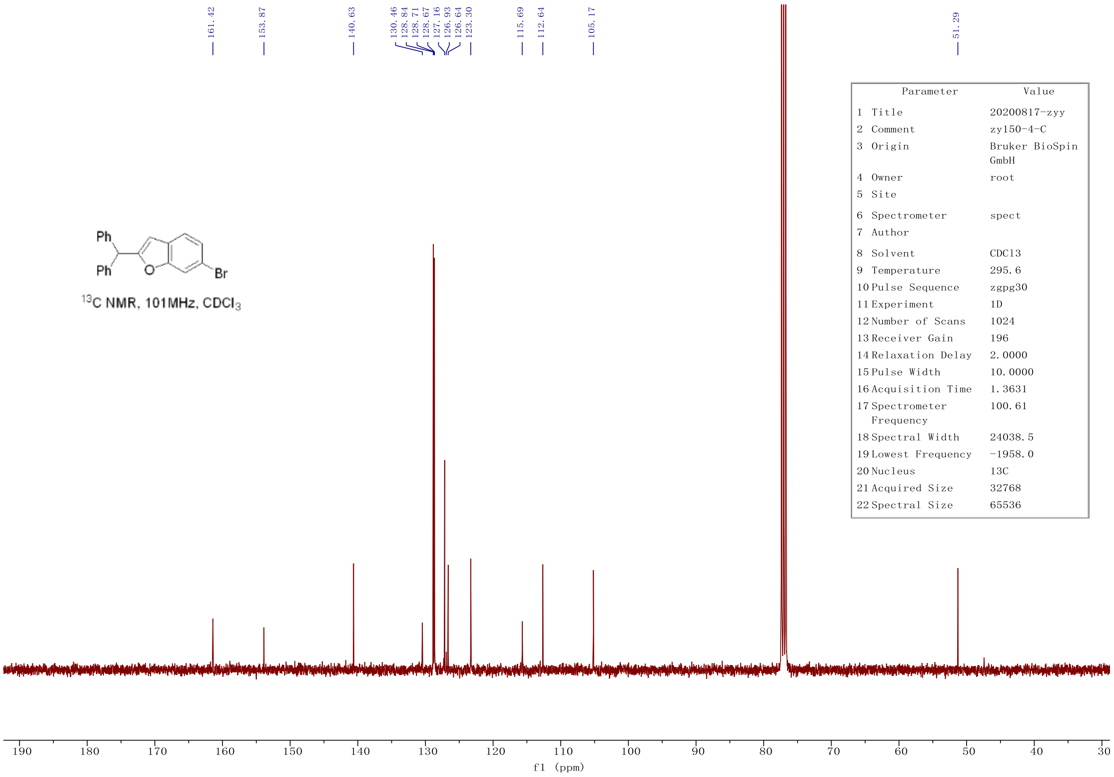


	Parameter	Value
1	Title	20200813-zyy
2	Comment	zy153-1-C
3	Origin	Bruker BioSpin GmbH
4	Owner	root
5	Site	
6	Spectrometer	spect
7	Author	
8	Solvent	CDCl3
9	Temperature	297.0
10	Pulse Sequence	zgpg30
11	Experiment	1D
12	Number of Scans	1024
13	Receiver Gain	196
14	Relaxation Delay	2.0000
15	Pulse Width	10.0000
16	Acquisition Time	1.3631
17	Spectrometer Frequency	100.61
18	Spectral Width	24038.5
19	Lowest Frequency	-1958.0
20	Nucleus	13C
21	Acquired Size	32768
22	Spectral Size	65536

2-benzhydryl-6-bromobenzofuran (4b):

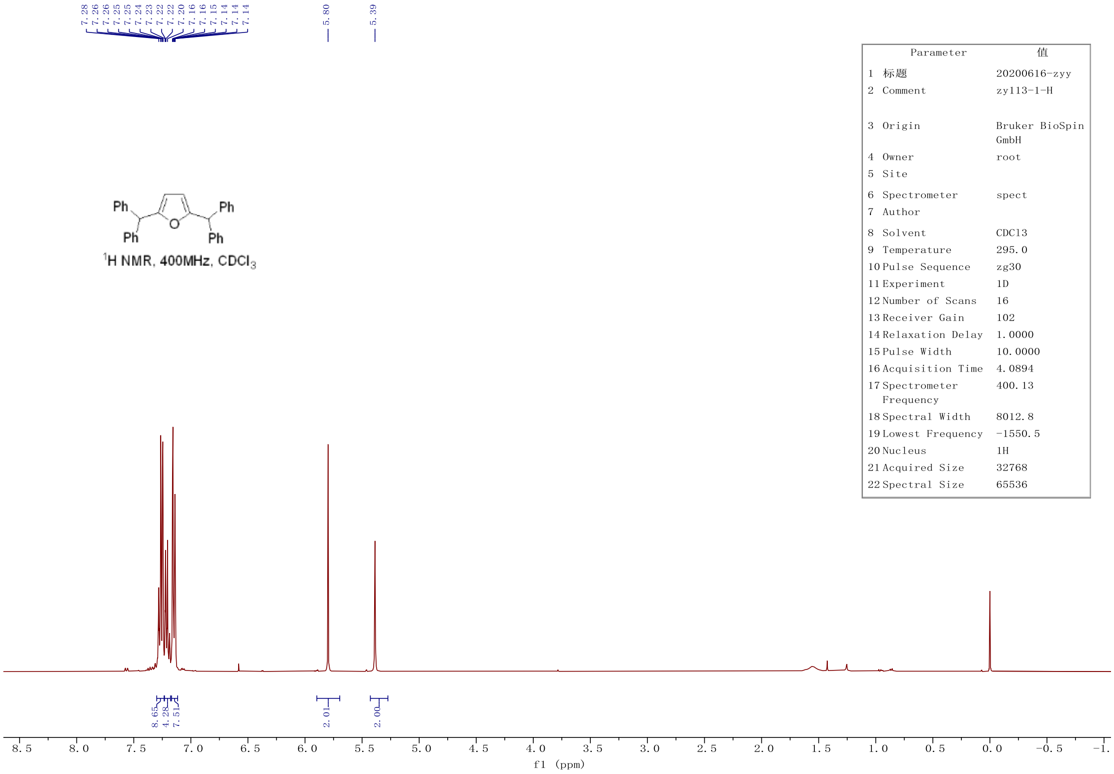


	Parameter	Value
1	Title	20200814-ZYY
2	Comment	zy150-4c1-H
3	Origin	Bruker BioSpin GmbH
4	Owner	root
5	Site	
6	Spectrometer	spect
7	Author	
8	Solvent	CDCl3
9	Temperature	295.4
10	Pulse Sequence	zg30
11	Experiment	1D
12	Number of Scans	16
13	Receiver Gain	155
14	Relaxation Delay	1.0000
15	Pulse Width	10.0000
16	Acquisition Time	4.0894
17	Spectrometer Frequency	400.13
18	Spectral Width	8012.8
19	Lowest Frequency	-1574.7
20	Nucleus	1H
21	Acquired Size	32768
22	Spectral Size	65536



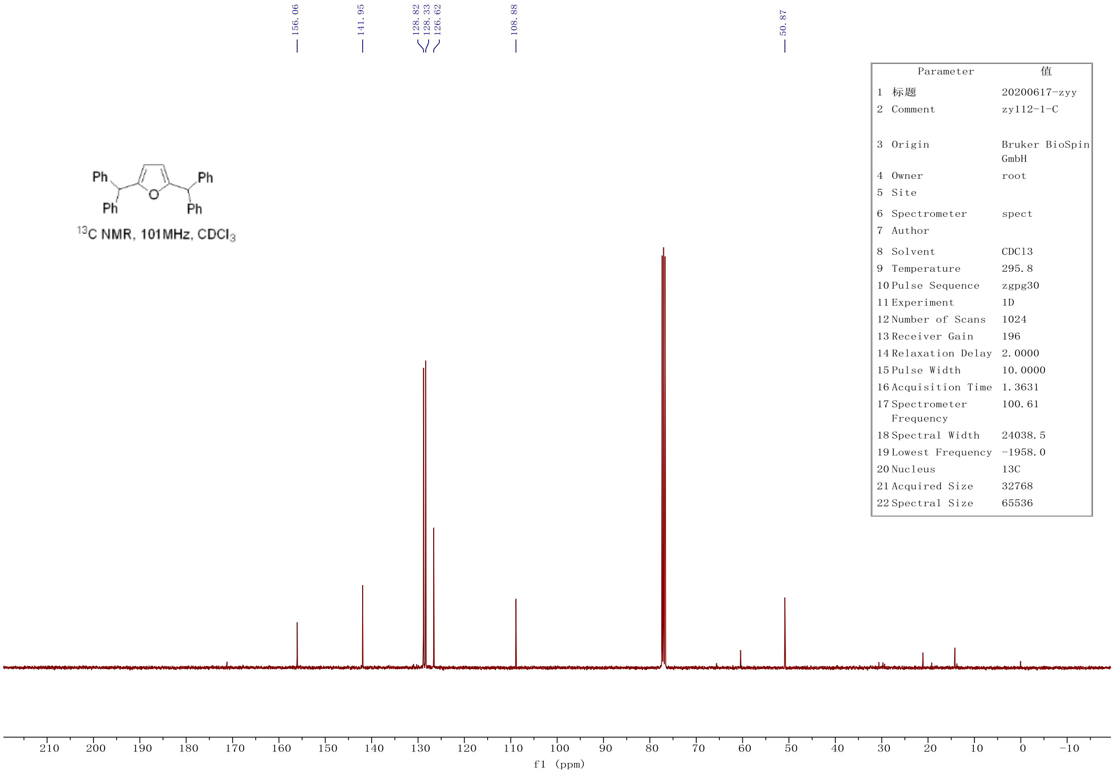
	Parameter	Value
1	Title	20200817-zyy
2	Comment	zy150-4-C
3	Origin	Bruker BioSpin GmbH
4	Owner	root
5	Site	
6	Spectrometer	spect
7	Author	
8	Solvent	CDCl3
9	Temperature	295.6
10	Pulse Sequence	zgpg30
11	Experiment	1D
12	Number of Scans	1024
13	Receiver Gain	196
14	Relaxation Delay	2.0000
15	Pulse Width	10.0000
16	Acquisition Time	1.3631
17	Spectrometer Frequency	100.61
18	Spectral Width	24038.5
19	Lowest Frequency	-1958.0
20	Nucleus	13C
21	Acquired Size	32768
22	Spectral Size	65536

2, 5-dibenzhydrylfuran (4c):



^{1}H NMR, 400MHz, CDCl$_3$

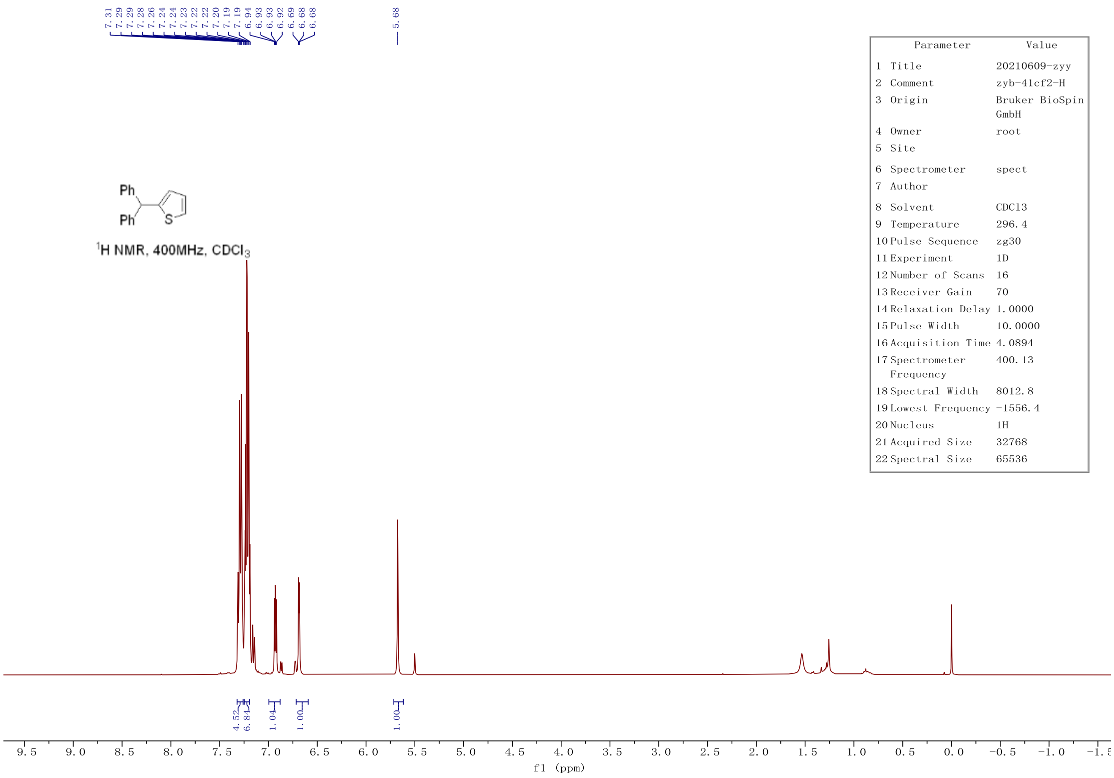
Parameter	值
1 标题	20200616-zyy
2 Comment	zy113-1-H
3 Origin	Bruker BioSpin GmbH
4 Owner	root
5 Site	
6 Spectrometer	spect
7 Author	
8 Solvent	CDCl3
9 Temperature	295.0
10 Pulse Sequence	zg30
11 Experiment	1D
12 Number of Scans	16
13 Receiver Gain	102
14 Relaxation Delay	1.0000
15 Pulse Width	10.0000
16 Acquisition Time	4.0894
17 Spectrometer Frequency	400.13
18 Spectral Width	8012.8
19 Lowest Frequency	-1550.5
20 Nucleus	1H
21 Acquired Size	32768
22 Spectral Size	65536



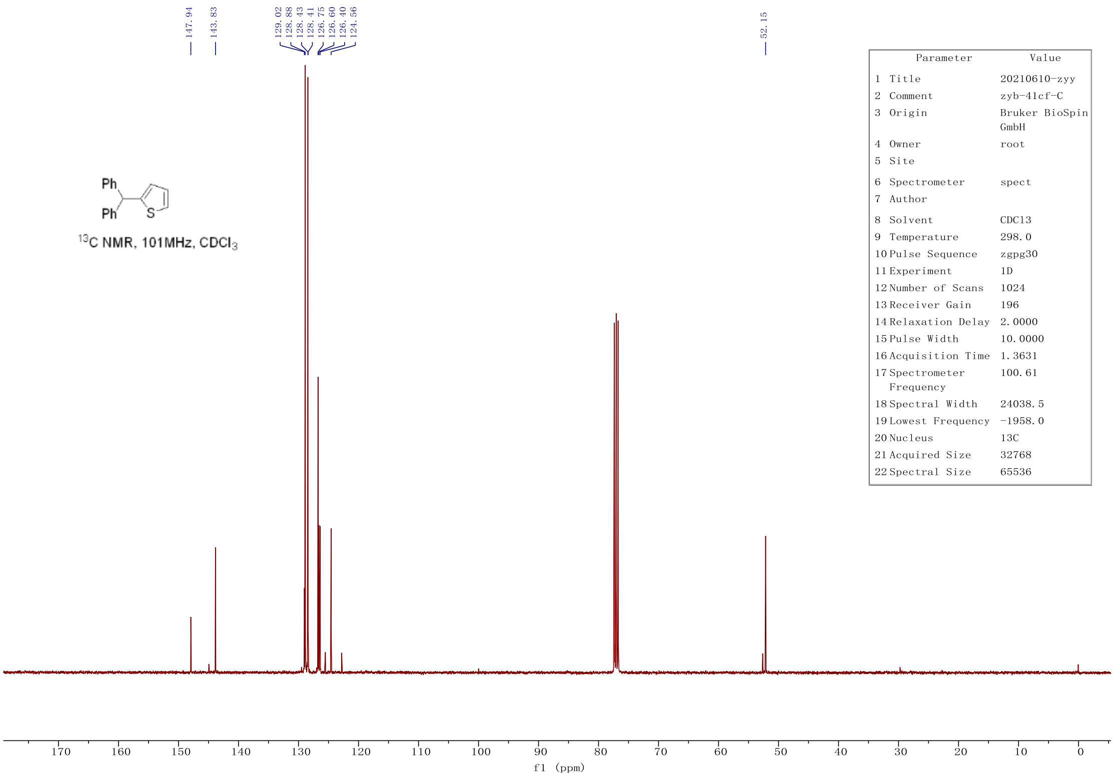
^{13}C NMR, 101MHz, CDCl$_3$

Parameter	值
1 标题	20200617-zyy
2 Comment	zy112-1-C
3 Origin	Bruker BioSpin GmbH
4 Owner	root
5 Site	
6 Spectrometer	spect
7 Author	
8 Solvent	CDCl3
9 Temperature	295.8
10 Pulse Sequence	zgpg30
11 Experiment	1D
12 Number of Scans	1024
13 Receiver Gain	196
14 Relaxation Delay	2.0000
15 Pulse Width	10.0000
16 Acquisition Time	1.3631
17 Spectrometer Frequency	100.61
18 Spectral Width	24038.5
19 Lowest Frequency	-1958.0
20 Nucleus	13C
21 Acquired Size	32768
22 Spectral Size	65536

2-benzhydrylthiophene (4d):

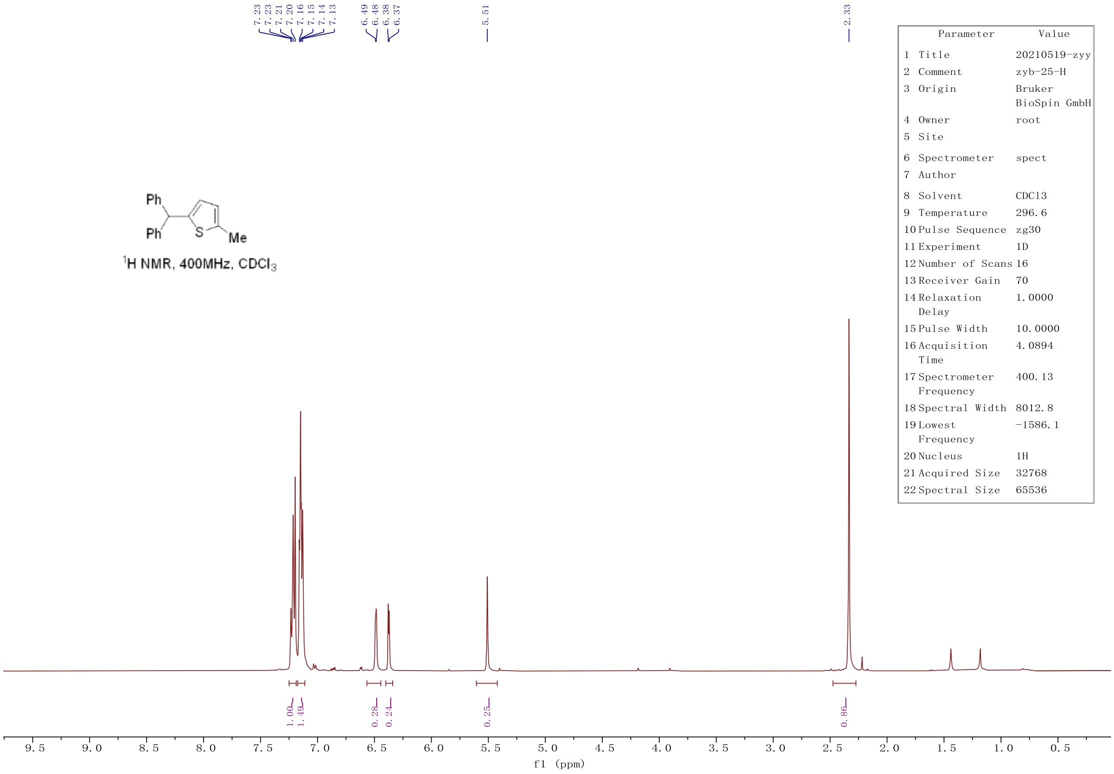


	Parameter	Value
1	Title	20210609-zyy
2	Comment	zyb-41cf2-H
3	Origin	Bruker BioSpin GmbH
4	Owner	root
5	Site	
6	Spectrometer	spect
7	Author	
8	Solvent	CDCl3
9	Temperature	296.4
10	Pulse Sequence	zg30
11	Experiment	1D
12	Number of Scans	16
13	Receiver Gain	70
14	Relaxation Delay	1.0000
15	Pulse Width	10.0000
16	Acquisition Time	4.0894
17	Spectrometer Frequency	400.13
18	Spectral Width	8012.8
19	Lowest Frequency	-1556.4
20	Nucleus	1H
21	Acquired Size	32768
22	Spectral Size	65536

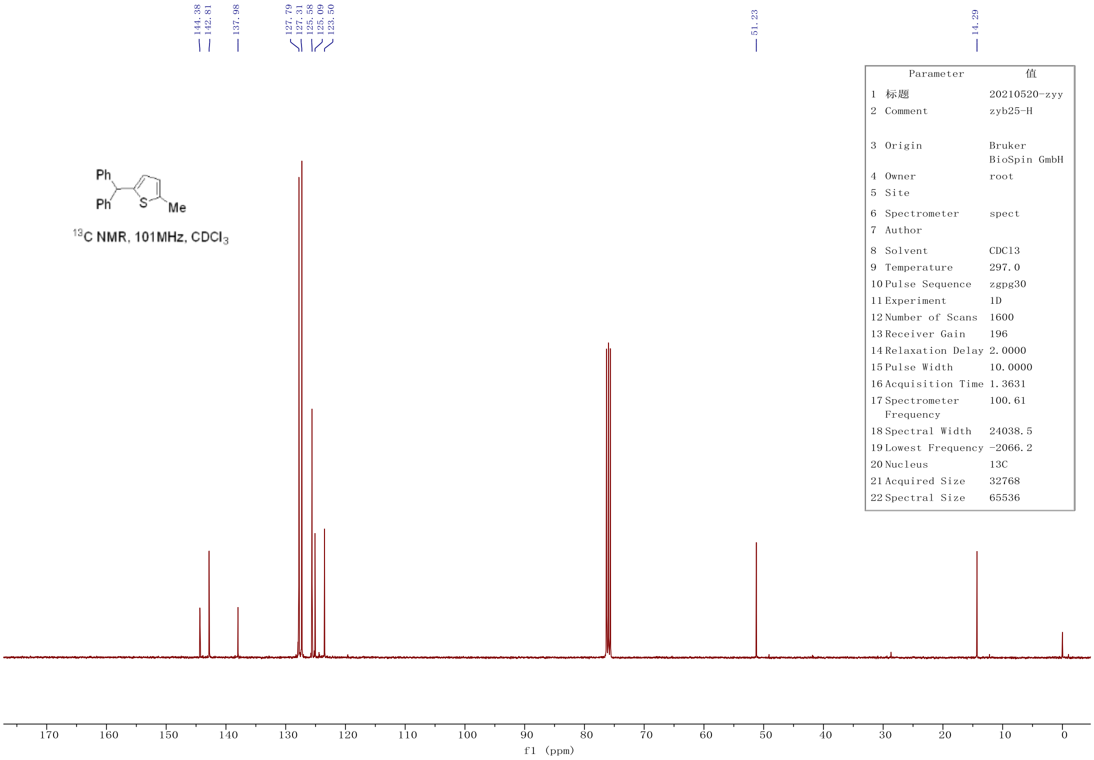


	Parameter	Value
1	Title	20210610-zyy
2	Comment	zyb-41cf-C
3	Origin	Bruker BioSpin GmbH
4	Owner	root
5	Site	
6	Spectrometer	spect
7	Author	
8	Solvent	CDCl3
9	Temperature	298.0
10	Pulse Sequence	zgpg30
11	Experiment	1D
12	Number of Scans	1024
13	Receiver Gain	196
14	Relaxation Delay	2.0000
15	Pulse Width	10.0000
16	Acquisition Time	1.3631
17	Spectrometer Frequency	100.61
18	Spectral Width	24038.5
19	Lowest Frequency	-1958.0
20	Nucleus	13C
21	Acquired Size	32768
22	Spectral Size	65536

2-(diphenylmethyl)-5-methylthiophene (4e):

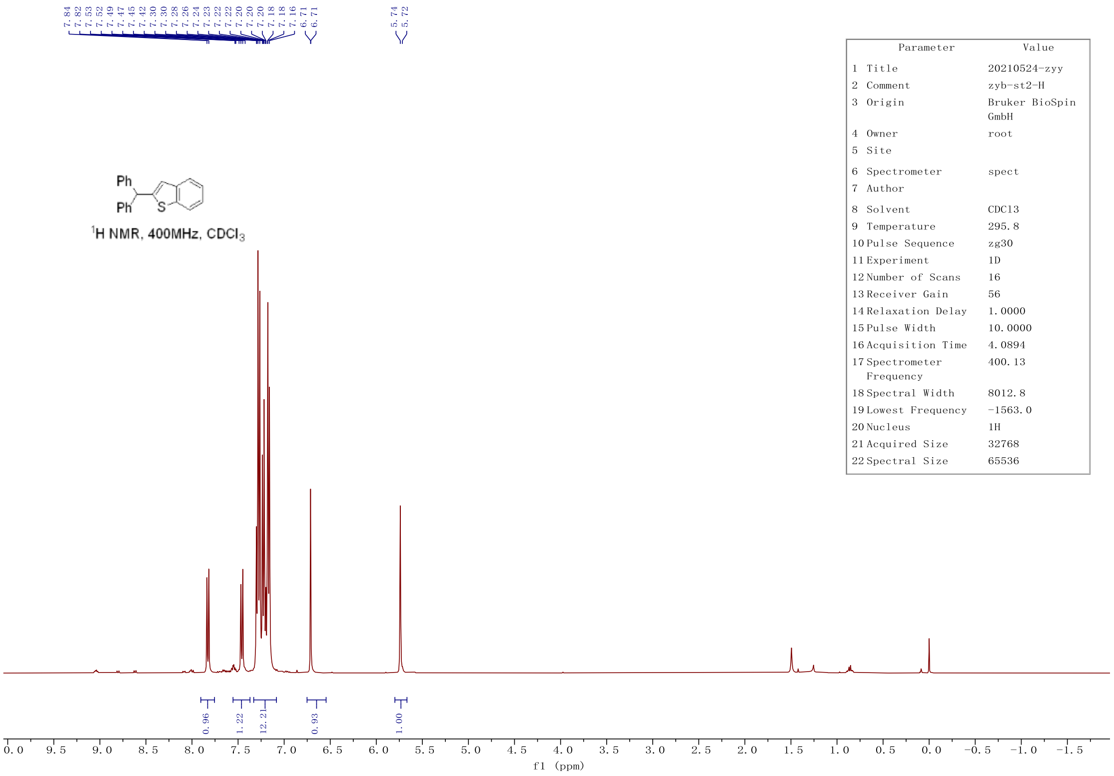


	Parameter	Value
1	Title	20210519-zyy
2	Comment	zyb-25-H
3	Origin	Bruker BioSpin GmbH
4	Owner	root
5	Site	
6	Spectrometer	spect
7	Author	
8	Solvent	CDCl3
9	Temperature	296.6
10	Pulse Sequence	zg30
11	Experiment	1D
12	Number of Scans	16
13	Receiver Gain	70
14	Relaxation Delay	1.0000
15	Pulse Width	10.0000
16	Acquisition Time	4.0894
17	Spectrometer Frequency	400.13
18	Spectral Width	8012.8
19	Lowest Frequency	-1586.1
20	Nucleus	1H
21	Acquired Size	32768
22	Spectral Size	65536



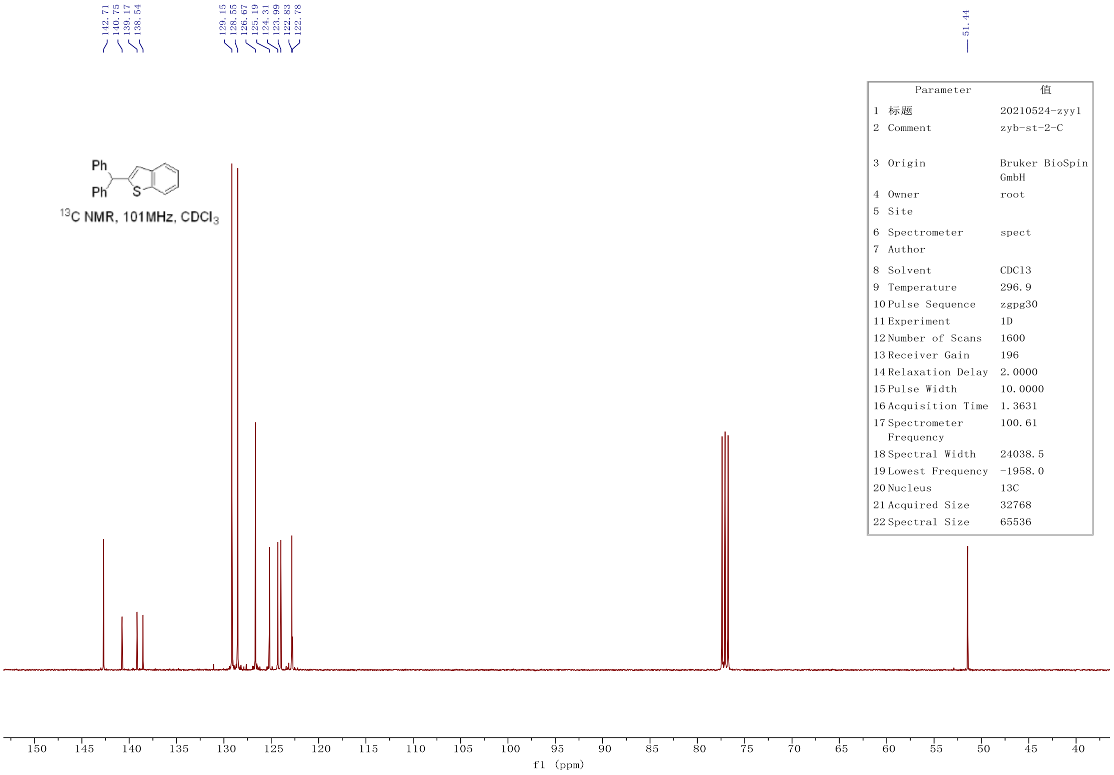
	Parameter	值
1	标题	20210520-zyy
2	Comment	zyb25-H
3	Origin	Bruker BioSpin GmbH
4	Owner	root
5	Site	
6	Spectrometer	spect
7	Author	
8	Solvent	CDCl3
9	Temperature	297.0
10	Pulse Sequence	zgpg30
11	Experiment	1D
12	Number of Scans	1600
13	Receiver Gain	196
14	Relaxation Delay	2.0000
15	Pulse Width	10.0000
16	Acquisition Time	1.3631
17	Spectrometer Frequency	100.61
18	Spectral Width	24038.5
19	Lowest Frequency	-2066.2
20	Nucleus	13C
21	Acquired Size	32768
22	Spectral Size	65536

2-benzhydrylbenzo[*b*]thiophene (4f):



^{1}H NMR, 400MHz, CDCl$_3$

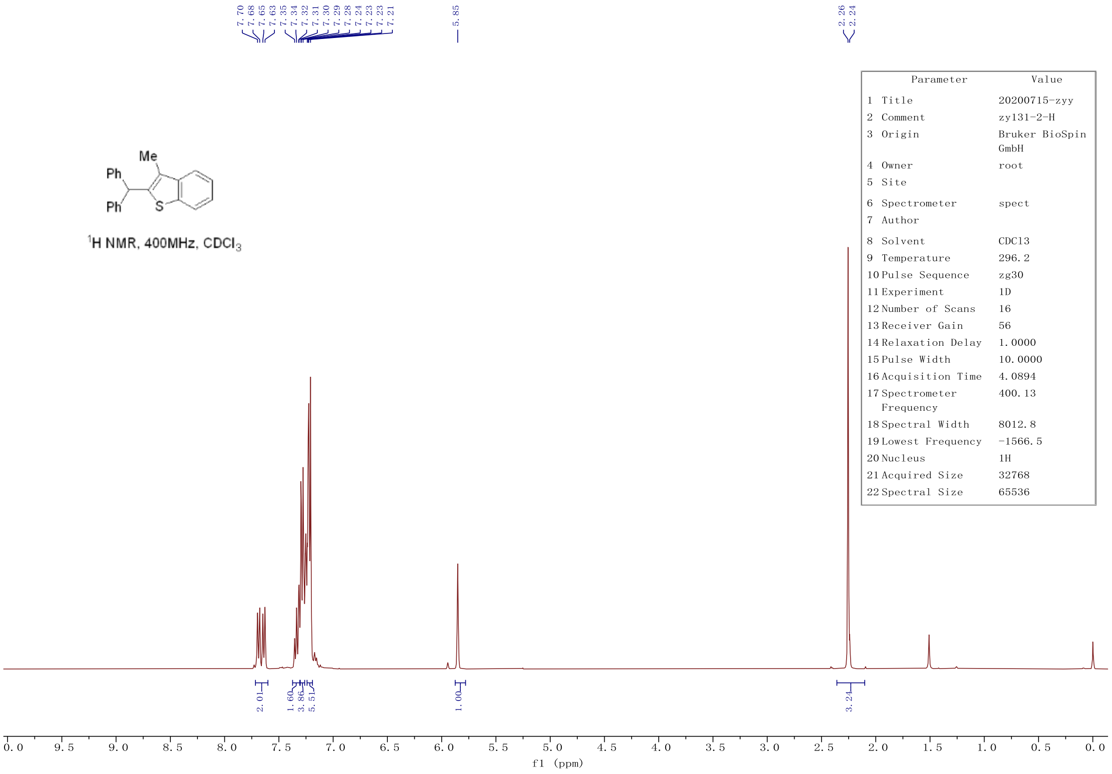
	Parameter	Value
1	Title	20210524-zyy
2	Comment	zyb-st2-H
3	Origin	Bruker BioSpin GmbH
4	Owner	root
5	Site	
6	Spectrometer	spect
7	Author	
8	Solvent	CDCl3
9	Temperature	295.8
10	Pulse Sequence	zg30
11	Experiment	1D
12	Number of Scans	16
13	Receiver Gain	56
14	Relaxation Delay	1.0000
15	Pulse Width	10.0000
16	Acquisition Time	4.0894
17	Spectrometer Frequency	400.13
18	Spectral Width	8012.8
19	Lowest Frequency	-1563.0
20	Nucleus	1H
21	Acquired Size	32768
22	Spectral Size	65536



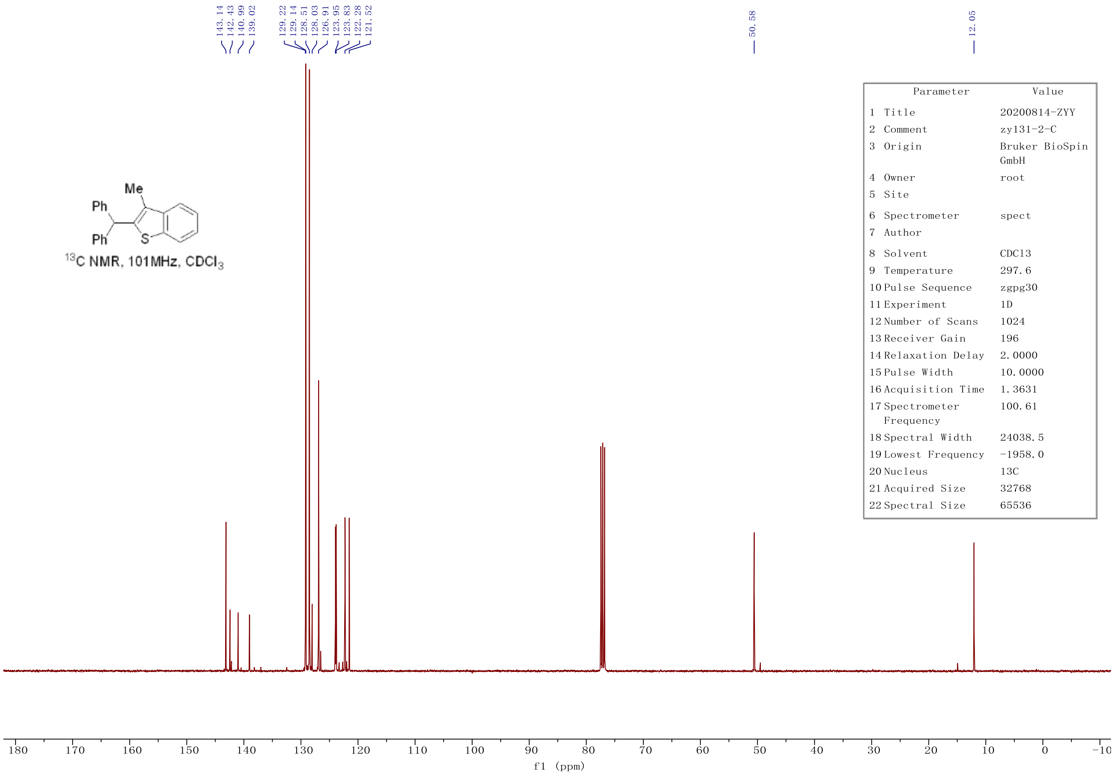
^{13}C NMR, 101MHz, CDCl$_3$

	Parameter	值
1	标题	20210524-zyy1
2	Comment	zyb-st-2-C
3	Origin	Bruker BioSpin GmbH
4	Owner	root
5	Site	
6	Spectrometer	spect
7	Author	
8	Solvent	CDCl3
9	Temperature	296.9
10	Pulse Sequence	zgpg30
11	Experiment	1D
12	Number of Scans	1600
13	Receiver Gain	196
14	Relaxation Delay	2.0000
15	Pulse Width	10.0000
16	Acquisition Time	1.3631
17	Spectrometer Frequency	100.61
18	Spectral Width	24038.5
19	Lowest Frequency	-1958.0
20	Nucleus	13C
21	Acquired Size	32768
22	Spectral Size	65536

2-benzhydryl-3-methylbenzo[*b*]thiophene (4g):

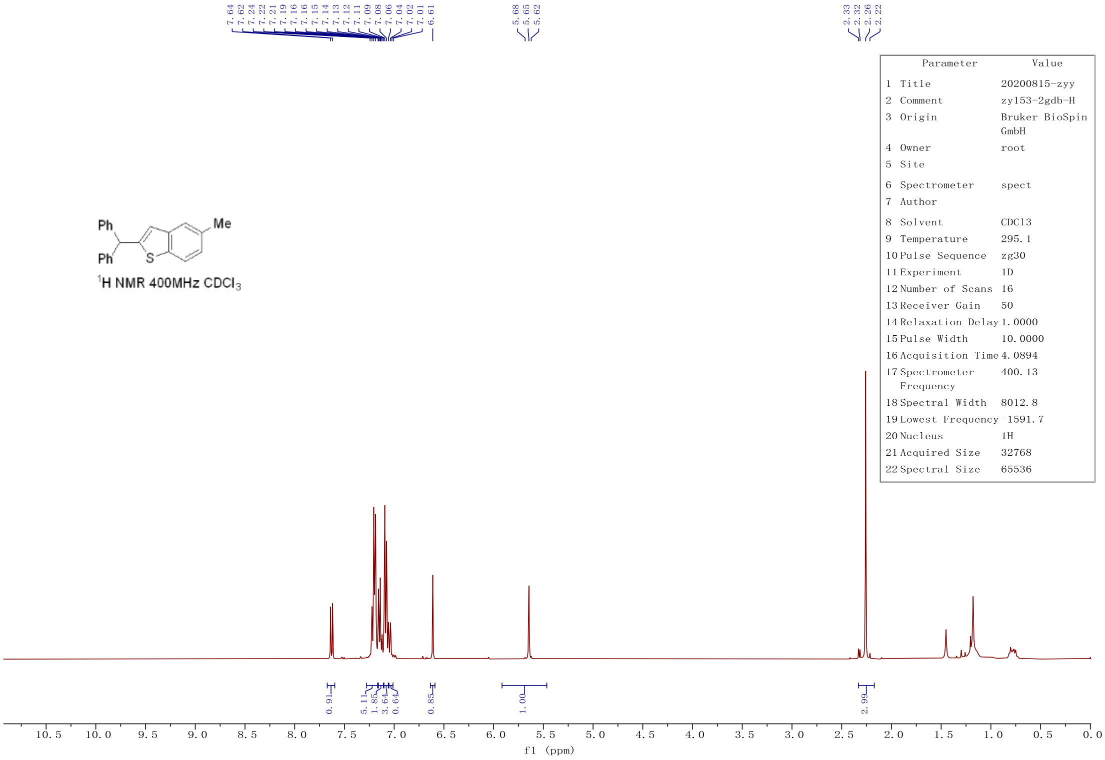


	Parameter	Value
1	Title	20200715-zyy
2	Comment	zy131-2-H
3	Origin	Bruker BioSpin GmbH
4	Owner	root
5	Site	
6	Spectrometer	spect
7	Author	
8	Solvent	CDCl3
9	Temperature	296.2
10	Pulse Sequence	zg30
11	Experiment	1D
12	Number of Scans	16
13	Receiver Gain	56
14	Relaxation Delay	1.0000
15	Pulse Width	10.0000
16	Acquisition Time	4.0894
17	Spectrometer Frequency	400.13
18	Spectral Width	8012.8
19	Lowest Frequency	-1566.5
20	Nucleus	1H
21	Acquired Size	32768
22	Spectral Size	65536

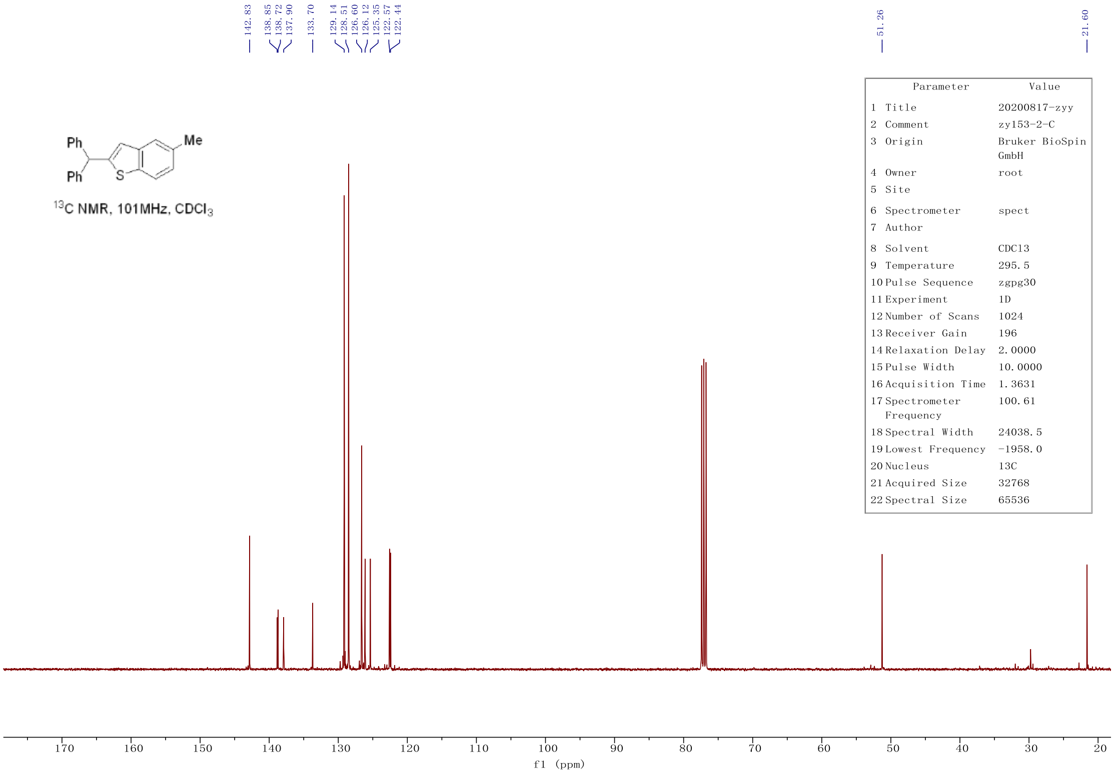


	Parameter	Value
1	Title	20200814-ZYY
2	Comment	zy131-2-C
3	Origin	Bruker BioSpin GmbH
4	Owner	root
5	Site	
6	Spectrometer	spect
7	Author	
8	Solvent	CDCl3
9	Temperature	297.6
10	Pulse Sequence	zgpg30
11	Experiment	1D
12	Number of Scans	1024
13	Receiver Gain	196
14	Relaxation Delay	2.0000
15	Pulse Width	10.0000
16	Acquisition Time	1.3631
17	Spectrometer Frequency	100.61
18	Spectral Width	24038.5
19	Lowest Frequency	-1958.0
20	Nucleus	13C
21	Acquired Size	32768
22	Spectral Size	65536

2-benzhydryl-5-methylbenzo[b]thiophene (4h):

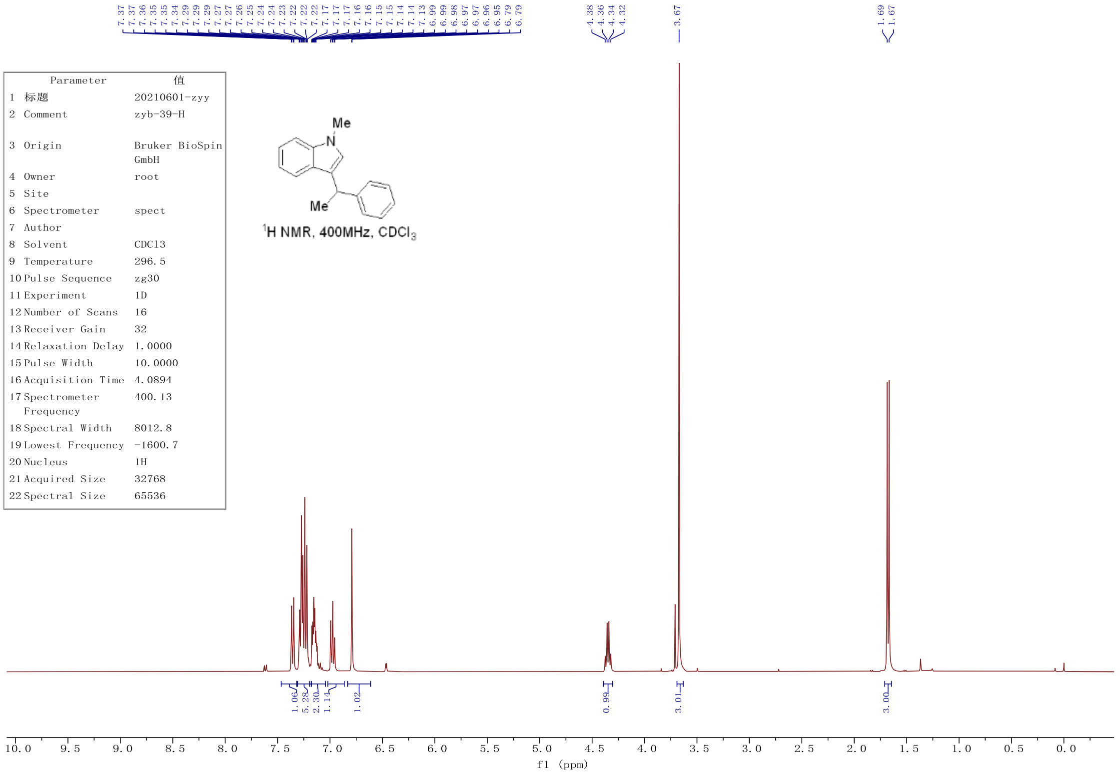


	Parameter	Value
1	Title	20200815-zyy
2	Comment	zy153-2gdb-H
3	Origin	Bruker BioSpin GmbH
4	Owner	root
5	Site	
6	Spectrometer	spect
7	Author	
8	Solvent	CDCl3
9	Temperature	295.1
10	Pulse Sequence	zg30
11	Experiment	1D
12	Number of Scans	16
13	Receiver Gain	50
14	Relaxation Delay	1.0000
15	Pulse Width	10.0000
16	Acquisition Time	4.0894
17	Spectrometer Frequency	400.13
18	Spectral Width	8012.8
19	Lowest Frequency	-1591.7
20	Nucleus	1H
21	Acquired Size	32768
22	Spectral Size	65536

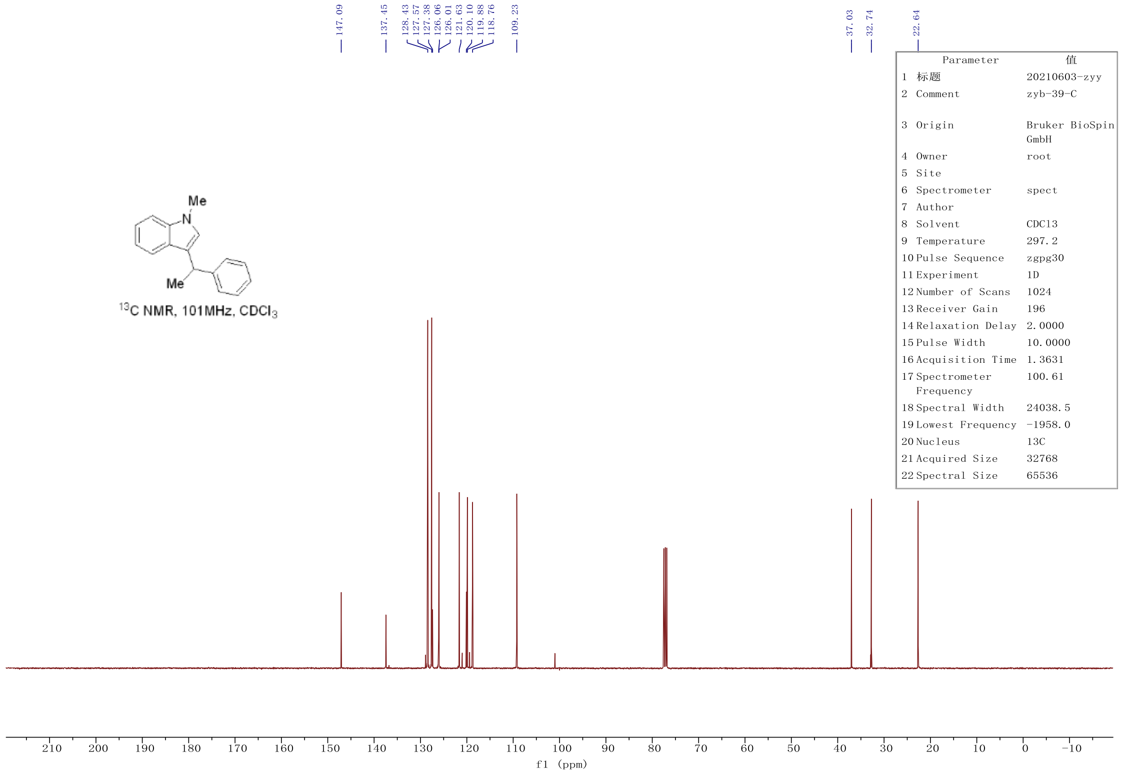


	Parameter	Value
1	Title	20200817-zyy
2	Comment	zy153-2-C
3	Origin	Bruker BioSpin GmbH
4	Owner	root
5	Site	
6	Spectrometer	spect
7	Author	
8	Solvent	CDCl3
9	Temperature	295.5
10	Pulse Sequence	zgpg30
11	Experiment	1D
12	Number of Scans	1024
13	Receiver Gain	196
14	Relaxation Delay	2.0000
15	Pulse Width	10.0000
16	Acquisition Time	1.3631
17	Spectrometer Frequency	100.61
18	Spectral Width	24038.5
19	Lowest Frequency	-1958.0
20	Nucleus	13C
21	Acquired Size	32768
22	Spectral Size	65536

1-methyl-3-(1-phenylethyl)-1H-indole (4i):

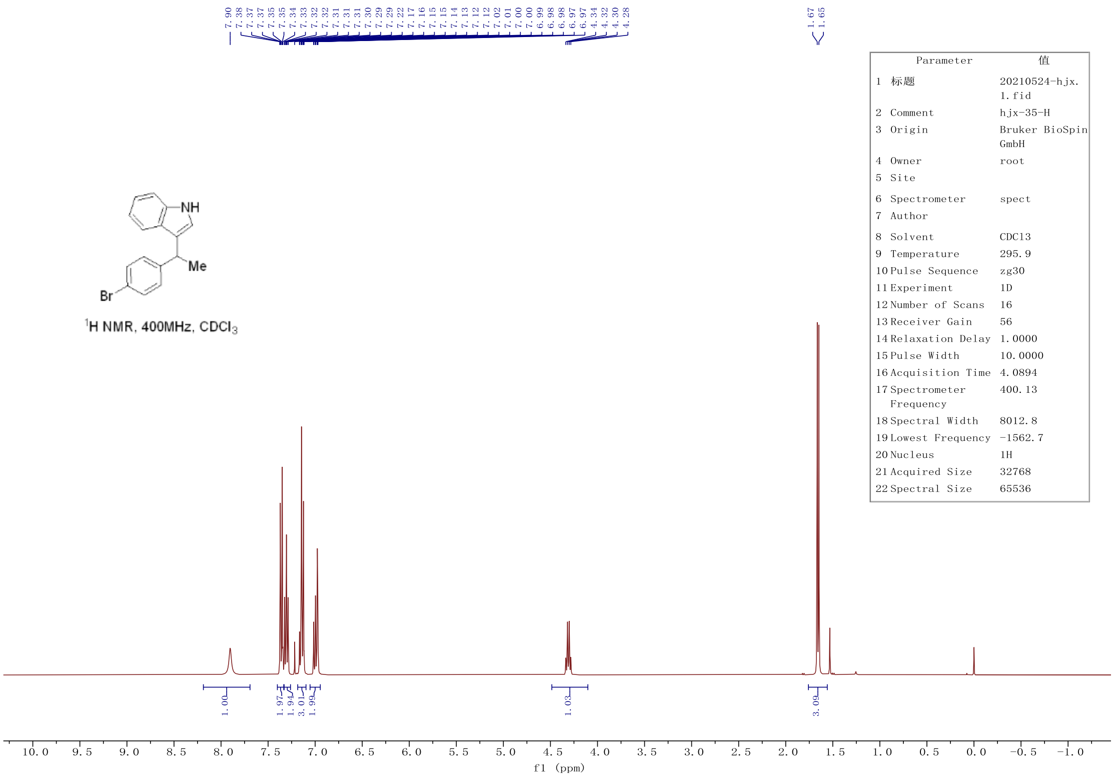


	Parameter	值
1	标题	20210601-zyy
2	Comment	zyb-39-H
3	Origin	Bruker BioSpin GmbH
4	Owner	root
5	Site	
6	Spectrometer	spect
7	Author	
8	Solvent	CDC13
9	Temperature	296.5
10	Pulse Sequence	zg30
11	Experiment	1D
12	Number of Scans	16
13	Receiver Gain	32
14	Relaxation Delay	1.0000
15	Pulse Width	10.0000
16	Acquisition Time	4.0894
17	Spectrometer Frequency	400.13
18	Spectral Width	8012.8
19	Lowest Frequency	-1600.7
20	Nucleus	1H
21	Acquired Size	32768
22	Spectral Size	65536



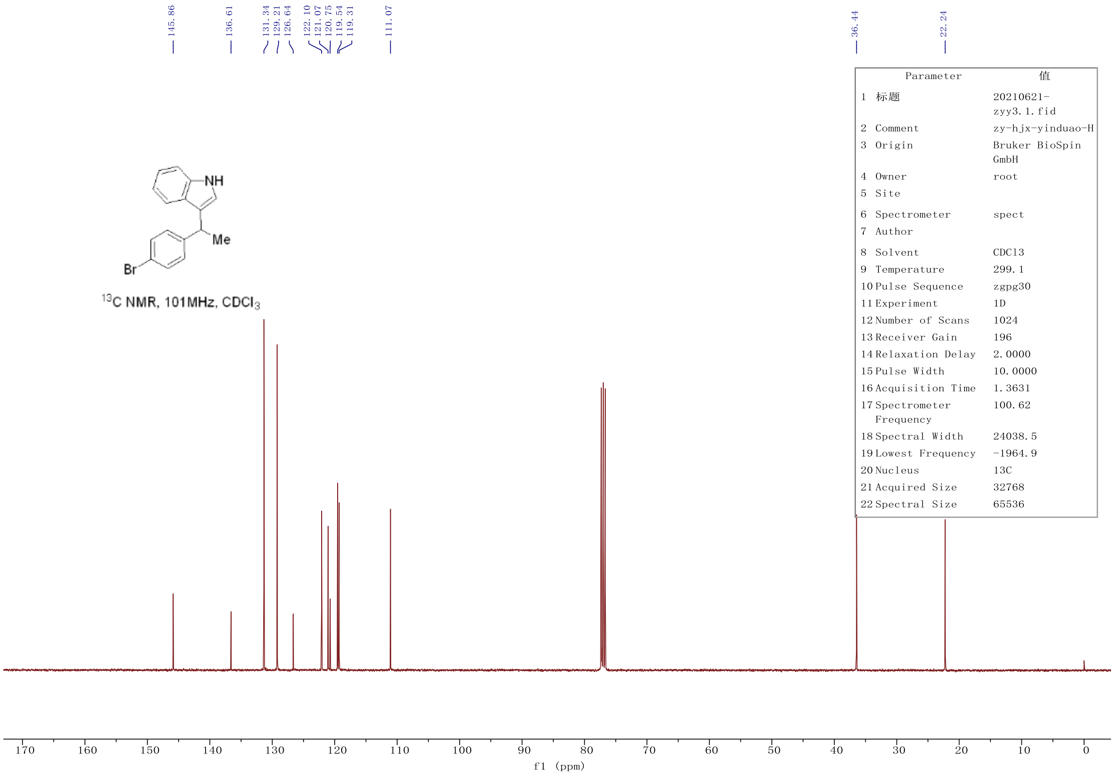
	Parameter	值
1	标题	20210603-zyy
2	Comment	zyb-39-C
3	Origin	Bruker BioSpin GmbH
4	Owner	root
5	Site	
6	Spectrometer	spect
7	Author	
8	Solvent	CDC13
9	Temperature	297.2
10	Pulse Sequence	zgpg30
11	Experiment	1D
12	Number of Scans	1024
13	Receiver Gain	196
14	Relaxation Delay	2.0000
15	Pulse Width	10.0000
16	Acquisition Time	1.3631
17	Spectrometer Frequency	100.61
18	Spectral Width	24038.5
19	Lowest Frequency	-1958.0
20	Nucleus	13C
21	Acquired Size	32768
22	Spectral Size	65536

3-(1-(4-bromophenyl)ethyl)-1H-indole (4j):



^{1}H NMR, 400MHz, CDCl$_3$

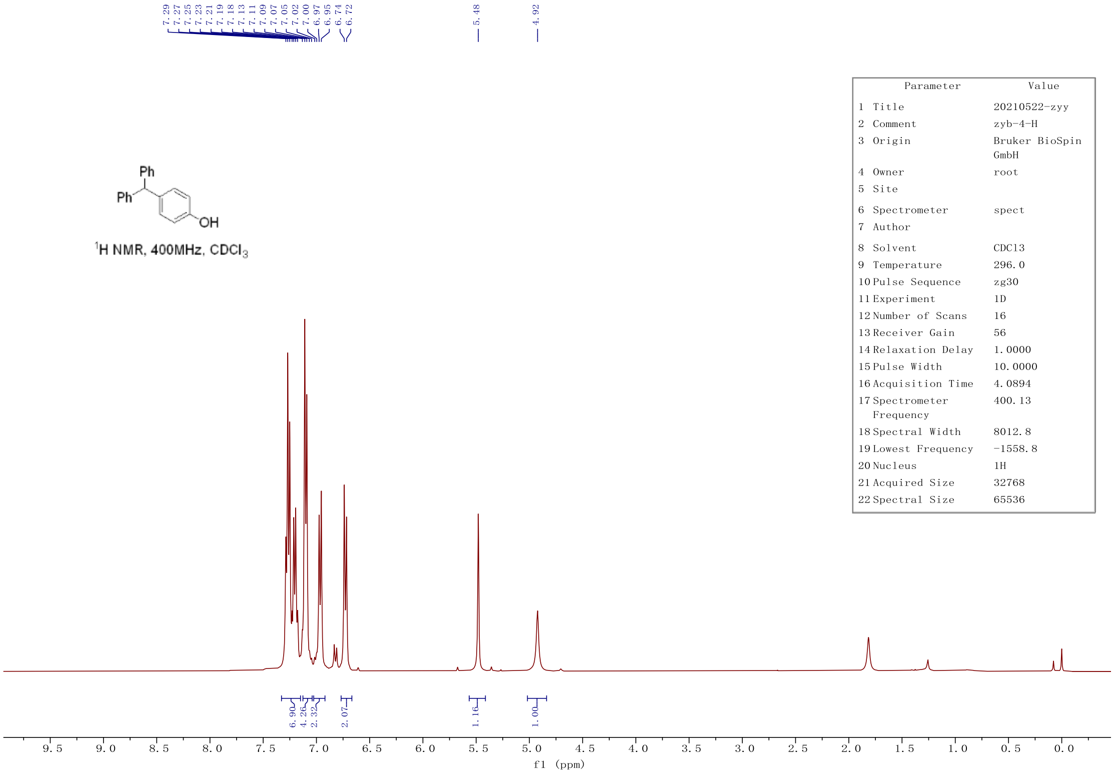
Parameter	值
1 标题	20210524-hjx.1.fid
2 Comment	hjx-35-H
3 Origin	Bruker BioSpin GmbH
4 Owner	root
5 Site	
6 Spectrometer	spect
7 Author	
8 Solvent	CDCl3
9 Temperature	295.9
10 Pulse Sequence	zg30
11 Experiment	1D
12 Number of Scans	16
13 Receiver Gain	56
14 Relaxation Delay	1.0000
15 Pulse Width	10.0000
16 Acquisition Time	4.0894
17 Spectrometer Frequency	400.13
18 Spectral Width	8012.8
19 Lowest Frequency	-1562.7
20 Nucleus	1H
21 Acquired Size	32768
22 Spectral Size	65536



^{13}C NMR, 101MHz, CDCl$_3$

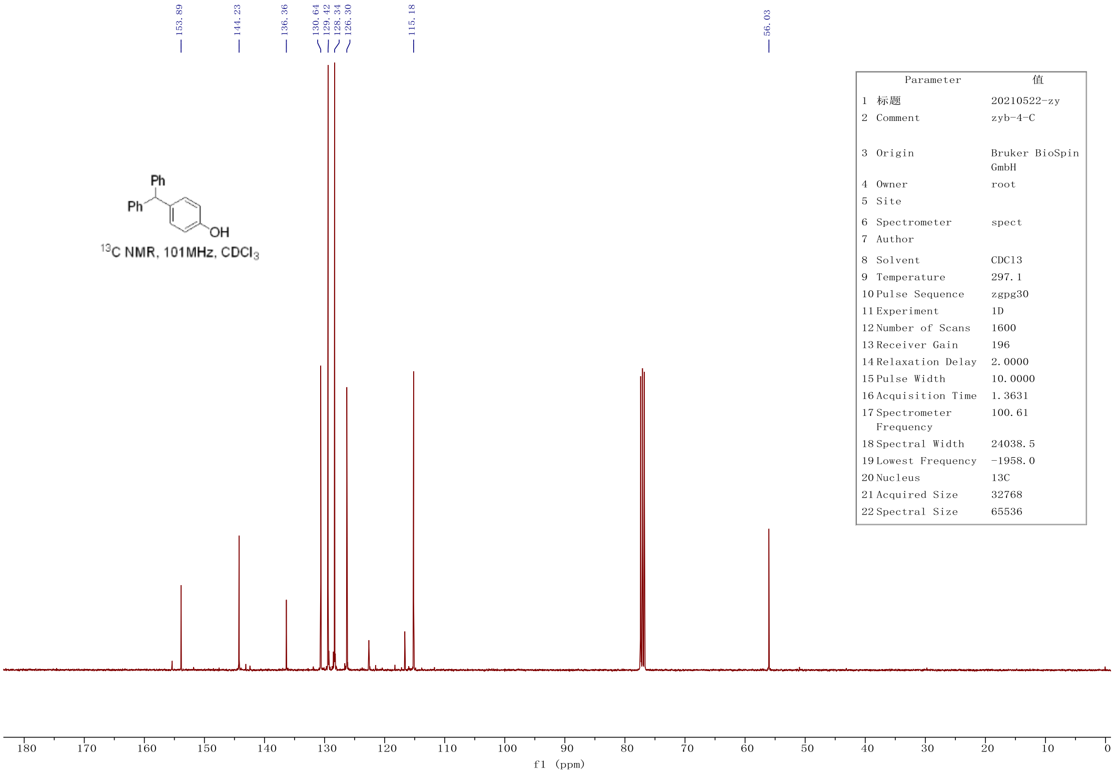
Parameter	值
1 标题	20210621-zyy3.1.fid
2 Comment	zy-hjx-yinduao-H
3 Origin	Bruker BioSpin GmbH
4 Owner	root
5 Site	
6 Spectrometer	spect
7 Author	
8 Solvent	CDCl3
9 Temperature	299.1
10 Pulse Sequence	zgpg30
11 Experiment	1D
12 Number of Scans	1024
13 Receiver Gain	196
14 Relaxation Delay	2.0000
15 Pulse Width	10.0000
16 Acquisition Time	1.3631
17 Spectrometer Frequency	100.62
18 Spectral Width	24038.5
19 Lowest Frequency	-1964.9
20 Nucleus	13C
21 Acquired Size	32768
22 Spectral Size	65536

4-benzhydrylpheno (4k):



^{1}H NMR, 400MHz, CDCl$_3$

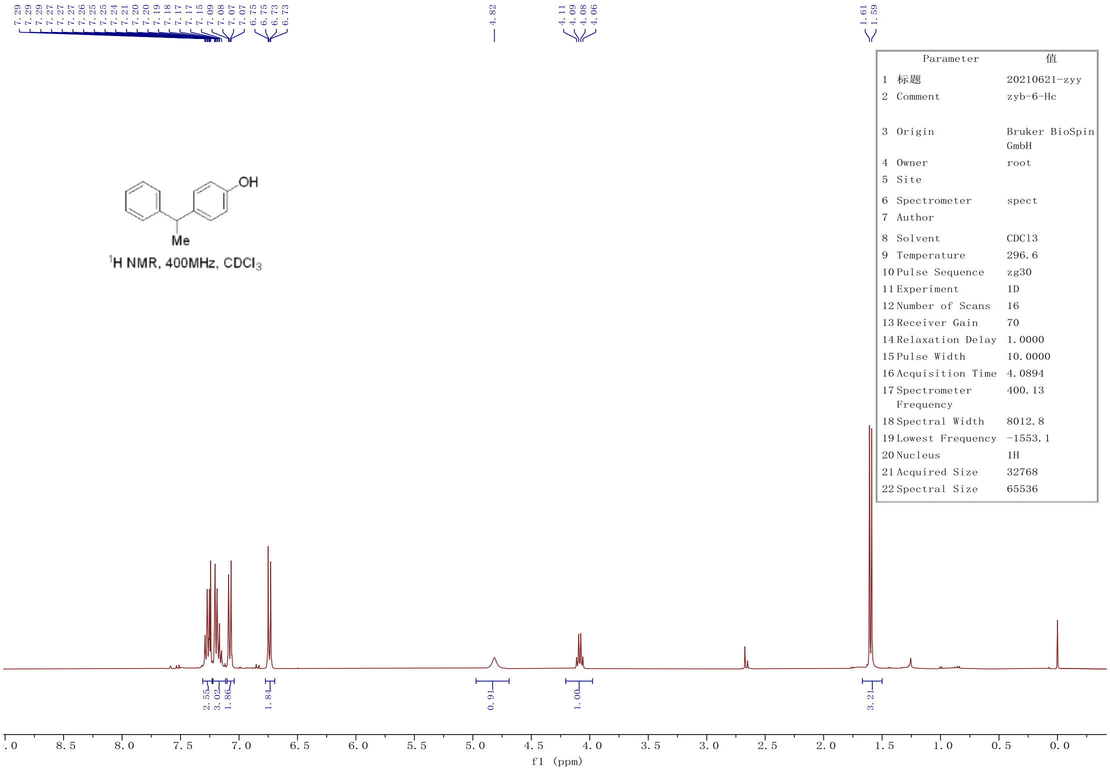
Parameter	Value
1 Title	20210522-zyy
2 Comment	zyb-4-H
3 Origin	Bruker BioSpin GmbH
4 Owner	root
5 Site	
6 Spectrometer	spect
7 Author	
8 Solvent	CDCl3
9 Temperature	296.0
10 Pulse Sequence	zg30
11 Experiment	1D
12 Number of Scans	16
13 Receiver Gain	56
14 Relaxation Delay	1.0000
15 Pulse Width	10.0000
16 Acquisition Time	4.0894
17 Spectrometer Frequency	400.13
18 Spectral Width	8012.8
19 Lowest Frequency	-1558.8
20 Nucleus	1H
21 Acquired Size	32768
22 Spectral Size	65536



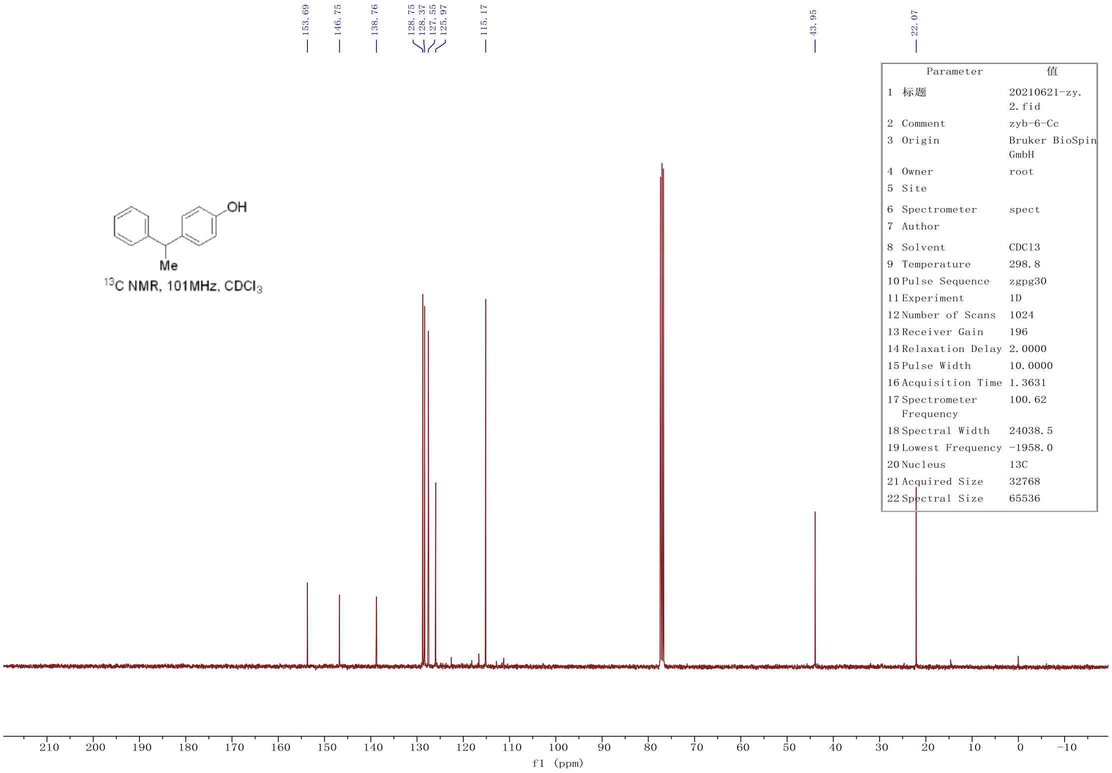
^{13}C NMR, 101MHz, CDCl$_3$

Parameter	值
1 标题	20210522-zy
2 Comment	zyb-4-C
3 Origin	Bruker BioSpin GmbH
4 Owner	root
5 Site	
6 Spectrometer	spect
7 Author	
8 Solvent	CDCl3
9 Temperature	297.1
10 Pulse Sequence	zgpg30
11 Experiment	1D
12 Number of Scans	1600
13 Receiver Gain	196
14 Relaxation Delay	2.0000
15 Pulse Width	10.0000
16 Acquisition Time	1.3631
17 Spectrometer Frequency	100.61
18 Spectral Width	24038.5
19 Lowest Frequency	-1958.0
20 Nucleus	13C
21 Acquired Size	32768
22 Spectral Size	65536

4-(1-phenylethyl)phenol (4l):

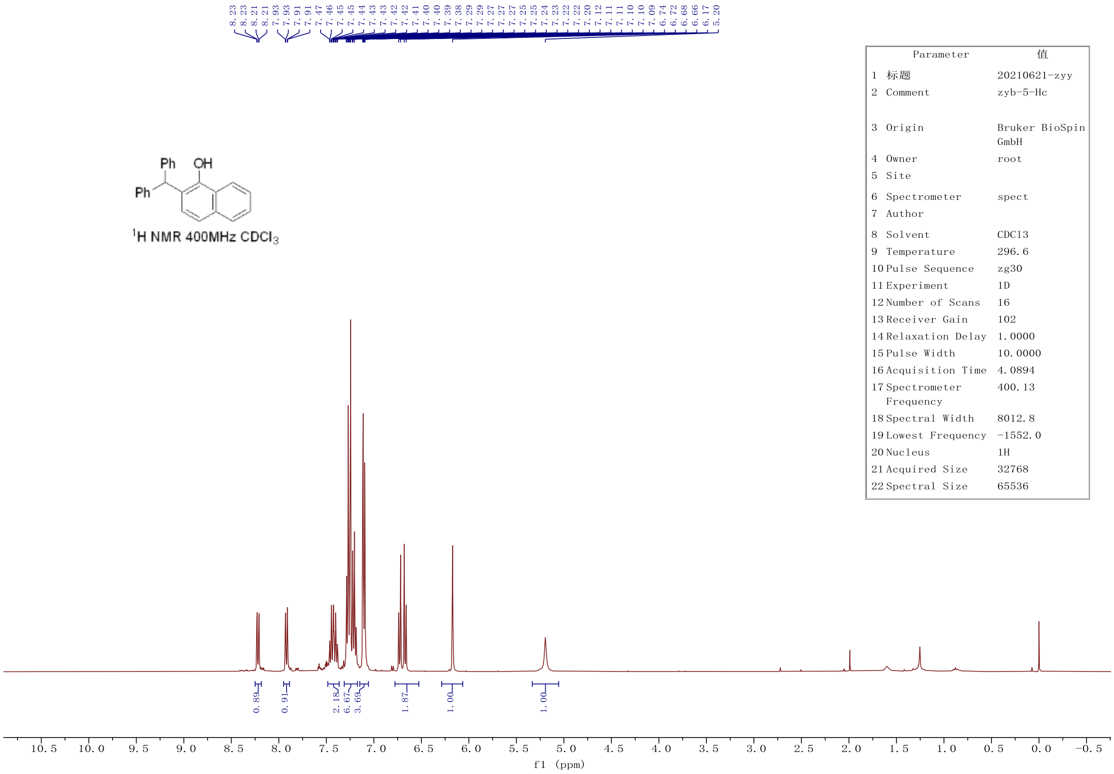


	Parameter	值
1	标题	20210621-zyy
2	Comment	zyb-6-Hc
3	Origin	Bruker BioSpin GmbH
4	Owner	root
5	Site	
6	Spectrometer	spect
7	Author	
8	Solvent	CDCl3
9	Temperature	296.6
10	Pulse Sequence	zg30
11	Experiment	1D
12	Number of Scans	16
13	Receiver Gain	70
14	Relaxation Delay	1.0000
15	Pulse Width	10.0000
16	Acquisition Time	4.0894
17	Spectrometer Frequency	400.13
18	Spectral Width	8012.8
19	Lowest Frequency	-1553.1
20	Nucleus	1H
21	Acquired Size	32768
22	Spectral Size	65536



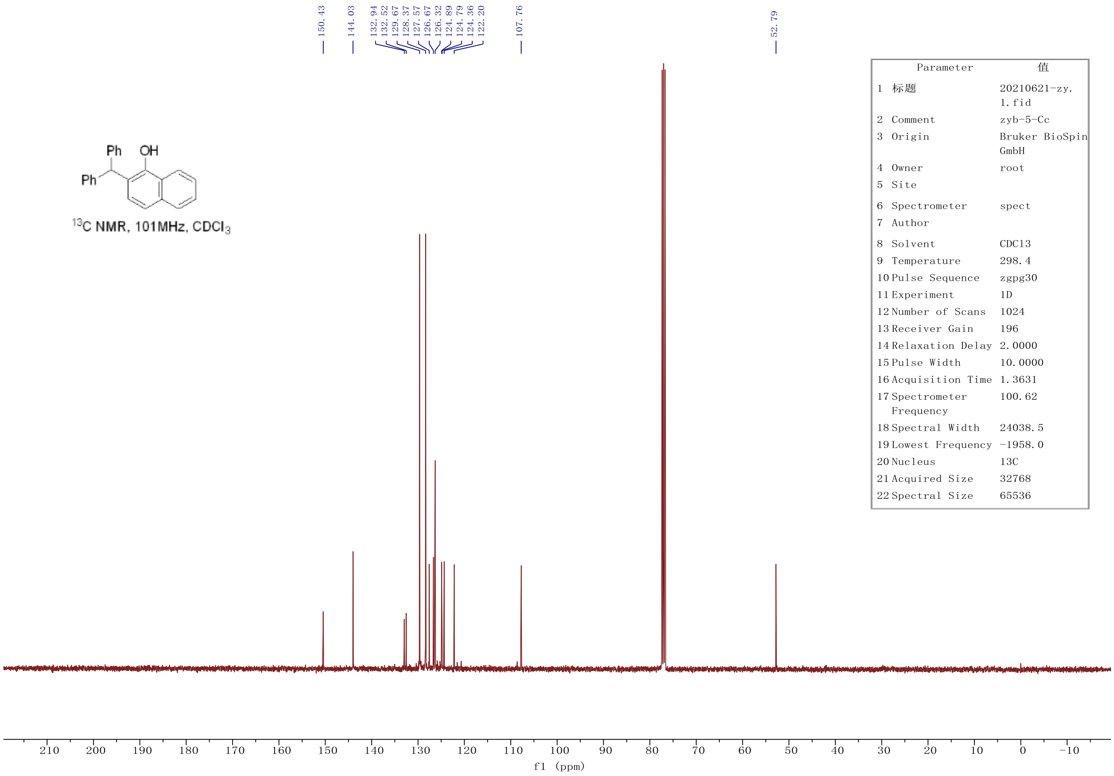
	Parameter	值
1	标题	20210621-zy. 2.fid
2	Comment	zyb-6-Cc
3	Origin	Bruker BioSpin GmbH
4	Owner	root
5	Site	
6	Spectrometer	spect
7	Author	
8	Solvent	CDCl3
9	Temperature	298.8
10	Pulse Sequence	zgpg30
11	Experiment	1D
12	Number of Scans	1024
13	Receiver Gain	196
14	Relaxation Delay	2.0000
15	Pulse Width	10.0000
16	Acquisition Time	1.3631
17	Spectrometer Frequency	100.62
18	Spectral Width	24038.5
19	Lowest Frequency	-1958.0
20	Nucleus	13C
21	Acquired Size	32768
22	Spectral Size	65536

2-benzhydrylnaphthalen-1-ol (4m):



^{1}H NMR 400MHz CDCl$_3$

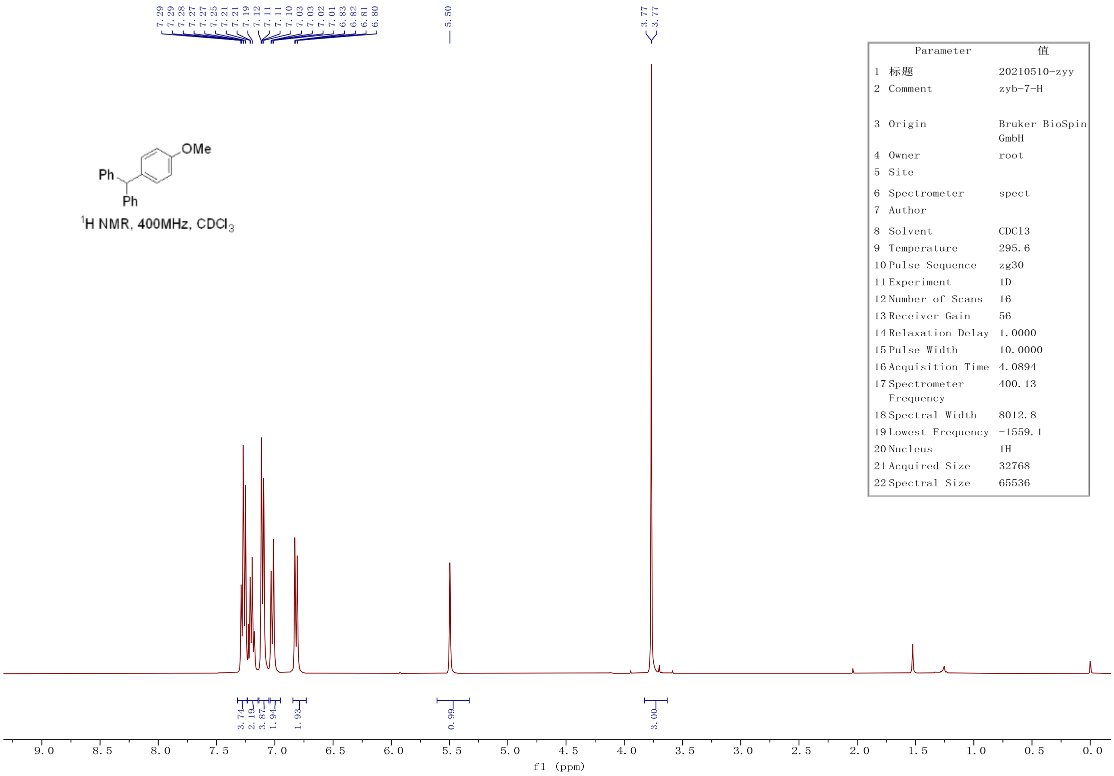
	Parameter	值
1	标题	20210621-zyy
2	Comment	zyb-5-Hc
3	Origin	Bruker BioSpin GmbH
4	Owner	root
5	Site	
6	Spectrometer	spect
7	Author	
8	Solvent	CDCl3
9	Temperature	296.6
10	Pulse Sequence	zg30
11	Experiment	1D
12	Number of Scans	16
13	Receiver Gain	102
14	Relaxation Delay	1.0000
15	Pulse Width	10.0000
16	Acquisition Time	4.0894
17	Spectrometer Frequency	400.13
18	Spectral Width	8012.8
19	Lowest Frequency	-1552.0
20	Nucleus	1H
21	Acquired Size	32768
22	Spectral Size	65536



^{13}C NMR, 101MHz, CDCl$_3$

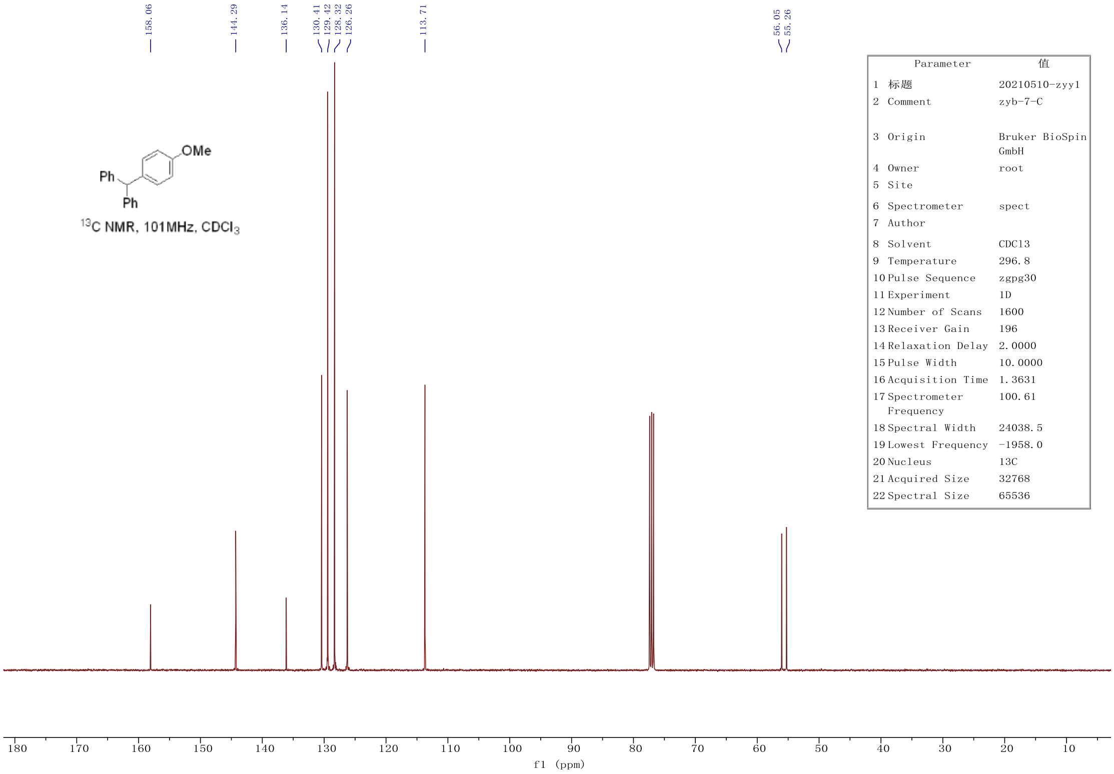
	Parameter	值
1	标题	20210621-zy. 1.fid
2	Comment	zyb-5-Cc
3	Origin	Bruker BioSpin GmbH
4	Owner	root
5	Site	
6	Spectrometer	spect
7	Author	
8	Solvent	CDCl3
9	Temperature	298.4
10	Pulse Sequence	zgpg30
11	Experiment	1D
12	Number of Scans	1024
13	Receiver Gain	196
14	Relaxation Delay	2.0000
15	Pulse Width	10.0000
16	Acquisition Time	1.3631
17	Spectrometer Frequency	100.62
18	Spectral Width	24038.5
19	Lowest Frequency	-1958.0
20	Nucleus	13C
21	Acquired Size	32768
22	Spectral Size	65536

(4-methoxyphenyl)diphenylmethane(4n)



^{1}H NMR, 400MHz, CDCl$_3$

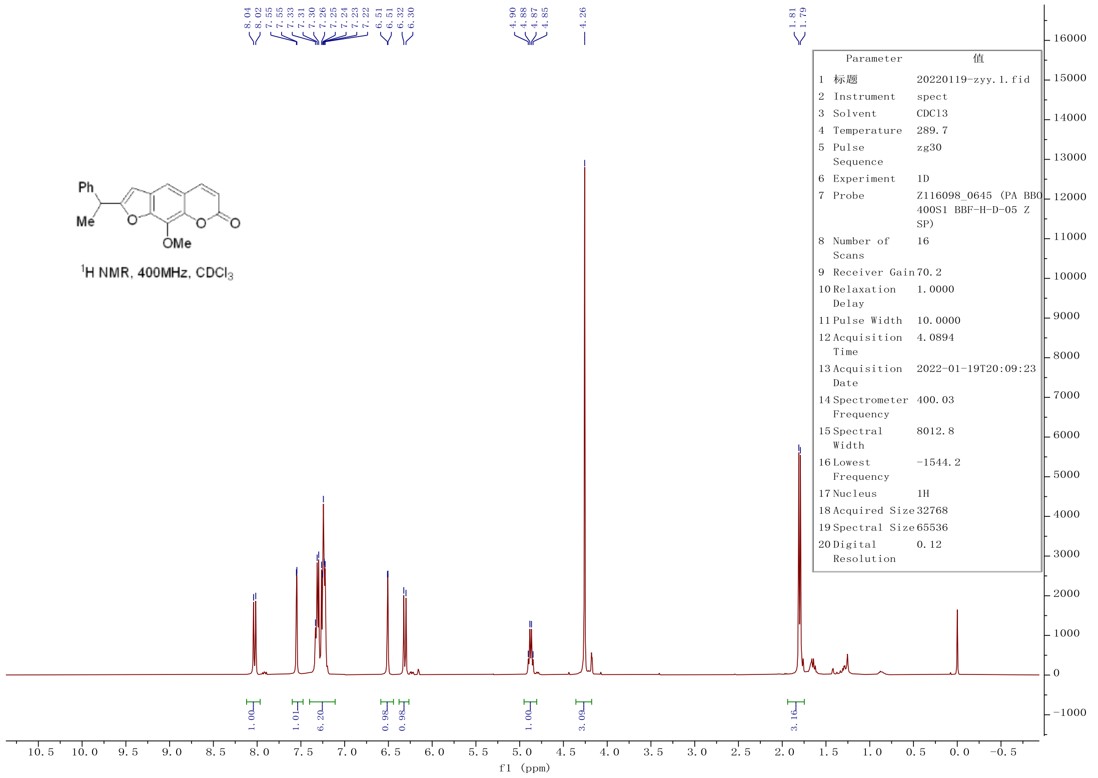
Parameter	值
1 标题	20210510-zyy
2 Comment	zyb-7-H
3 Origin	Bruker BioSpin GmbH
4 Owner	root
5 Site	
6 Spectrometer	spect
7 Author	
8 Solvent	CDCl3
9 Temperature	295.6
10 Pulse Sequence	zg30
11 Experiment	1D
12 Number of Scans	16
13 Receiver Gain	56
14 Relaxation Delay	1.0000
15 Pulse Width	10.0000
16 Acquisition Time	4.0894
17 Spectrometer Frequency	400.13
18 Spectral Width	8012.8
19 Lowest Frequency	-1559.1
20 Nucleus	1H
21 Acquired Size	32768
22 Spectral Size	65536



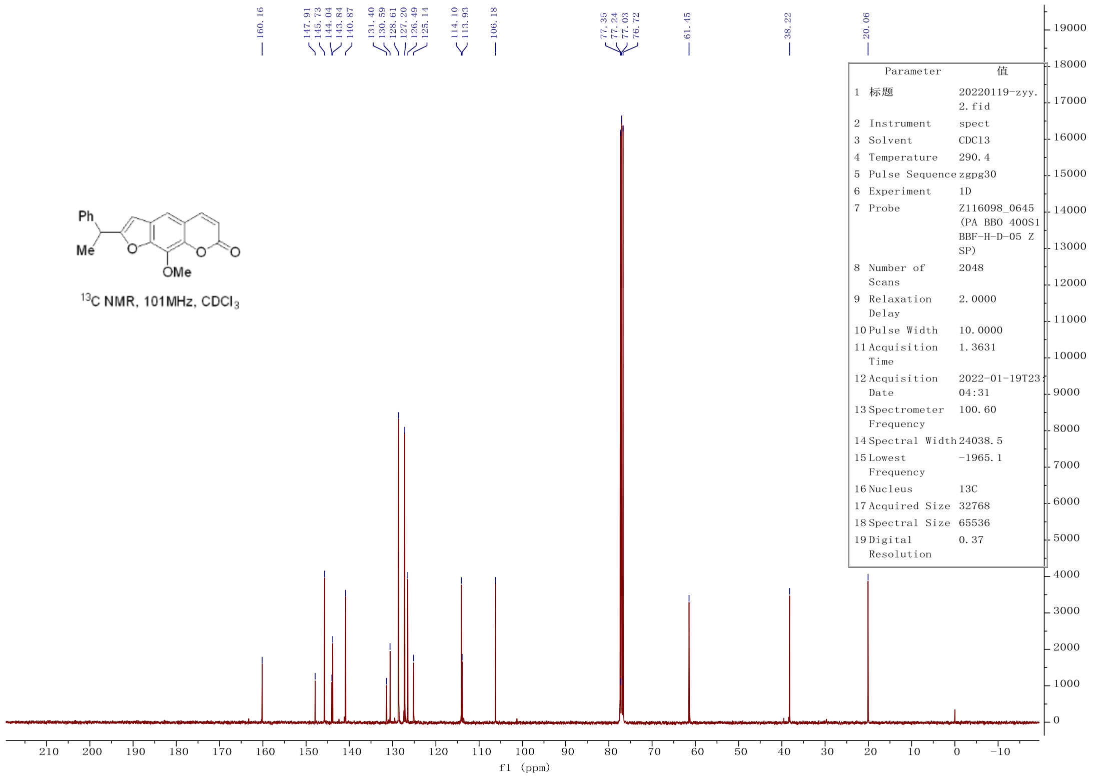
^{13}C NMR, 101MHz, CDCl$_3$

Parameter	值
1 标题	20210510-zyy1
2 Comment	zyb-7-C
3 Origin	Bruker BioSpin GmbH
4 Owner	root
5 Site	
6 Spectrometer	spect
7 Author	
8 Solvent	CDCl3
9 Temperature	296.8
10 Pulse Sequence	zgpg30
11 Experiment	1D
12 Number of Scans	1600
13 Receiver Gain	196
14 Relaxation Delay	2.0000
15 Pulse Width	10.0000
16 Acquisition Time	1.3631
17 Spectrometer Frequency	100.61
18 Spectral Width	24038.5
19 Lowest Frequency	-1958.0
20 Nucleus	13C
21 Acquired Size	32768
22 Spectral Size	65536

9-methoxy-2-(1-phenylethyl)-7H-furo[3,2-g]chromen-7-one (4o):



	Parameter	值
1	标题	20220119-zyy.1.fid
2	Instrument	spect
3	Solvent	CDCl3
4	Temperature	289.7
5	Pulse Sequence	zg30
6	Experiment	1D
7	Probe	Z116098_0645 (PA BBO 400S1 BBF-H-D-05 Z SP)
8	Number of Scans	16
9	Receiver Gain	70.2
10	Relaxation Delay	1.0000
11	Pulse Width	10.0000
12	Acquisition Time	4.0894
13	Acquisition Date	2022-01-19T20:09:23
14	Spectrometer Frequency	400.03
15	Spectral Width	8012.8
16	Lowest Frequency	-1544.2
17	Nucleus	1H
18	Acquired Size	32768
19	Spectral Size	65536
20	Digital Resolution	0.12



	Parameter	值
1	标题	20220119-zyy.2.fid
2	Instrument	spect
3	Solvent	CDCl3
4	Temperature	290.4
5	Pulse Sequence	zgpg30
6	Experiment	1D
7	Probe	Z116098_0645 (PA BBO 400S1 BBF-H-D-05 Z SP)
8	Number of Scans	2048
9	Relaxation Delay	2.0000
10	Pulse Width	10.0000
11	Acquisition Time	1.3631
12	Acquisition Date	2022-01-19T23:04:31
13	Spectrometer Frequency	100.60
14	Spectral Width	24038.5
15	Lowest Frequency	-1965.1
16	Nucleus	13C
17	Acquired Size	32768
18	Spectral Size	65536
19	Digital Resolution	0.37

1-phenyl-1,2,3,4-tetrahydronaphthalene (4p)