

Supporting Information

A Facile Access to Cis-dihydrofurobenzofuran from 2-(2,5-Dihydro-furan-2-yl)-phenol

Xiao-Hui Hu,^a Xiao-Qiu Pu,^a Rui Liu,^a Chun-Xiao Cui,^a Jun Yang,^{*b} Xian-Jin Yang^{*a,b}

^aKey Lab for Advanced Materials & Institute of Fine Chemicals, East China University of Science and Technology, 130 Meilong Road, Shanghai 200237, China

^bKey Laboratory of Organofluorine Chemistry, Shanghai Institute of Organic Chemistry, Chinese Academy of Science, 345 Lingling Road, Shanghai 200032, China

Email Address: yxj@ecust.edu.cn

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1. General information

All commercial reagents and solvents were used without further purification. Synthesis of 2-(2,5-dihydro-furan-2-yl)-phenols **3** were undertaken as previously described.¹ The products were purified by column chromatography over silica gel. All ¹H NMR spectra were recorded on a Bruker spectrometer at 400 MHz. The ¹⁹F NMR spectra were recorded on a Bruker spectrometer at 376 MHz. The ¹³C NMR spectra were recorded on a Bruker spectrometer at 100 MHz. Chemical shifts (δ value) were reported in *ppm* down field from internal tetramethylsilane (TMS). IR spectra (KBr) were recorded on a Nicolet 6700 spectrophotometer in the range of 400~4000 cm^{-1} . HRMS (EI) Mass Spectra were recorded on a Waters GCT Premier mass spectrometer with electron impact.

2. Typical procedures

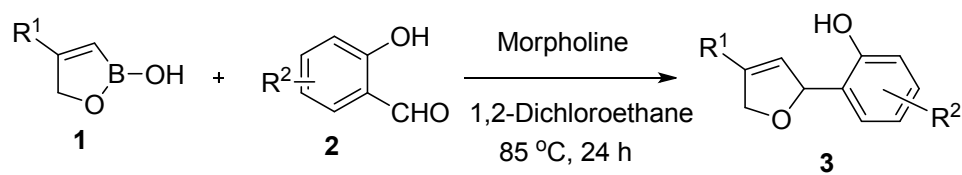
General procedure for the preparation of 2-(2,5-dihydro-furan-2-yl)-phenols **3a-m** (**3a** as an example):

4-Phenyl-1,2-oxaborol-2(5H)-ol **1a** (320 mg, 2.0 mmol), salicylaldehyde **2a** (244 mg, 2.0 mmol), morpholine (194 mg, 2.2 mmol) and in 1,2-dichloroethane (6.0 mL) were added into a flask with a condenser. The mixture was stirred at 85°C for 24 h. The reaction mixture was concentrated under reduced pressure. The product was isolated by flash chromatography (silica gel, petroleum ether : EtOAc = 10 : 1) to give **3a** (410.8 mg, 85%) as a white solid.

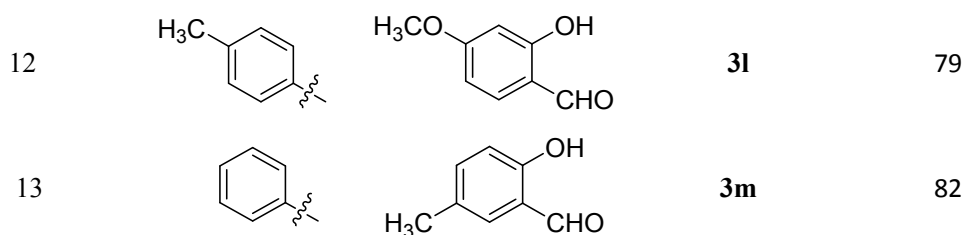
General procedure for the preparation of **4** (**4a** as an example):

2-(4-Phenyl-2,5-dihydrofuran-2-yl)phenol **3a** (47.6 mg, 0.2 mmol), AgOAc (66.8 mg, 0.4 mmol), Pd(OAc)₂ (10 mol %) and MeCN (3.0 mL) were added into a tube, then the mixture was stirred at 85 °C for 12 h. The reaction mixture was concentrated under reduced pressure. The product was isolated by flash chromatography (silica gel, petroleum ether : EtOAc = 30 : 1) to give **4a** (34.0 mg, 72%) as a white solid.

Table1. General procedure for the preparation of 3

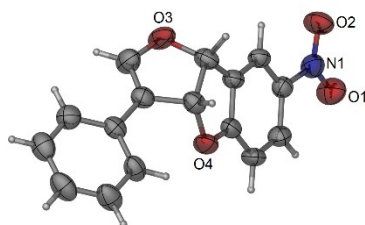


entry	R ¹	2	3	yield (%) ^b
1		2a	3a	86
2			3b	88
3			3c	85
4			3d	79
5			3e	89
6			3f	83
7			3g	80
8			3h	85
9			3i	90
10			3j	84
11		2a	3k	87



^a The reaction was performed with 4-substituted 1,2-oxaborol-2(5H)-ols **1** (2.0 mmol), salicylaldehydes **2** (2.0 mmol), and morpholine (2.2 mmol) in 1,2-dichloroethane (6 mL) at 85 °C for 24 h. ^b Isolated yields.

3. X-ray diffraction parameters and data for 4j



Bond precision:	C-C = 0.0031 Å	Wavelength=0.71073
Cell:	a=10.6863(5) b=11.6232(6)	c=11.9288(6)
	alpha=76.255(1) beta=64.109(1)	gamma=88.571(1)
Temperature: 296 K		
	Calculated	Reported
Volume	1289.50(11)	1289.50(11)
Space group	P -1	P-1
Hall group	-P 1	?
Moiety formula	C ₁₆ H ₁₁ N O ₄	?
Sum formula	C ₁₆ H ₁₁ N O ₄	C6.50 H6.50 N6.50 O6.50
Mr	281.26	279.68
Dx, g cm ⁻³	1.449	1.441
Z	4	4
Mu (mm ⁻¹)	0.106	0.129
F000	584.0	572.0
F000'	584.32	
h,k,lmax	12,13,14	12,13,14
Nref	4546	4517
Tmin,Tmax	0.947,0.967	0.948,0.967
Tmin'	0.947	
Correction method=	MULTI-SCAN	

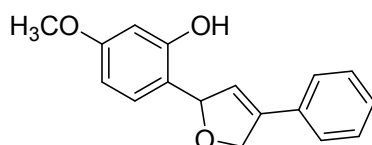
Data completeness= 0.994 Theta(max)= 25.010
R(reflections)= 0.0406(3384) wR2(reflections)= 0.1289(4517)
S = 1.040 Npar= 379

4. Notes and references

1. Cui, C.-X.; Li, H.; Yang X.-J.; Y, J.; Li, X.-Q. *Org. Lett.* **2013**, *15*, 5944.

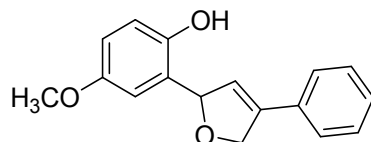
5. Analytical data for the products

5-Methoxy-2-(4-phenyl-2,5-dihydrofuran-2-yl)phenol (**3b**)



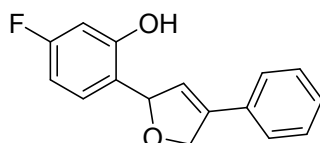
Compound 3b A white solid; $^1\text{H NMR}$ (400 MHz, CDCl_3) δ : 7.86 (s, 1H), 7.37-7.31 (m, 5H), 6.98 (d, $J = 8.8$ Hz, 1H), 6.47-6.43 (m, 2H), 6.35 (q, $J = 2.0, 4.0$ Hz, 1H), 6.21 (t, $J = 4.8$ Hz, 1H), 5.23-5.17 (m, 1H), 5.14-5.09 (m, 1H), 3.78 (s, 1H); $^{13}\text{C NMR}$ (100 MHz, CDCl_3) δ : 160.7, 156.7, 139.1, 131.9, 128.9, 128.7, 127.7, 126.1, 122.9, 117.3, 106.2, 102.6, 88.3, 75.2, 55.5; IR (KBr, cm^{-1}): $\nu = 3236, 2900, 2880, 2860, 1614, 1519, 1450, 1428, 1388, 1288, 1213, 1061, 831, 748, 688$; HRMS (EI): Exact mass calcd for $\text{C}_{17}\text{H}_{16}\text{O}_3$: 268.1099, Found 268.1094.

4-Methoxy-2-(4-phenyl-2,5-dihydrofuran-2-yl)phenol (**3c**)



Compound 3c A white solid; $^1\text{H NMR}$ (400 MHz, CDCl_3) δ : 7.37-7.31 (m, 5H), 6.81 (d, $J = 8.8$ Hz, 1H), 6.76-6.72 (m, 1H), 6.70 (d, $J = 2.8$ Hz, 1H), 6.37 (q, $J = 2.0, 4.0$ Hz, 1H), 6.24 (t, $J = 4.8$ Hz, 1H), 5.25-5.19 (m, 1H), 5.17-5.11 (m, 1H), 3.77 (s, 3H); $^{13}\text{C NMR}$ (100 MHz, CDCl_3) δ : 153.3, 148.8, 139.0, 131.9, 128.9, 128.7, 126.2, 126.1, 122.5, 117.7, 114.1, 112.5, 87.9, 75.5, 55.9; IR (KBr, cm^{-1}): $\nu = 3352, 2964, 2855, 2835, 1611, 1542, 1450, 1432, 1262, 1037, 804, 754, 694$; HRMS (EI): Exact mass calcd for $\text{C}_{17}\text{H}_{16}\text{O}_3$: 268.1099, Found 268.1096.

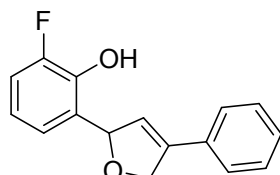
5-Fluoro-2-(4-phenyl-2,5-dihydrofuran-2-yl)phenol (**3e**)



Compound 3e A white solid; $^1\text{H NMR}$ (400 MHz, CDCl_3) δ : 8.11 (s, 1H), 7.40-7.31 (m, 5H), 7.05-7.01 (m, 1H), 6.62-6.56 (m, 2H), 6.35 (q, $J = 2.0, 4.0$ Hz, 1H), 6.24 (t, $J = 4.4$ Hz, 1H), 5.24-5.18 (m, 1H), 5.15-5.11 (m, 1H); $^{19}\text{F NMR}$ (376 MHz, CDCl_3) δ :

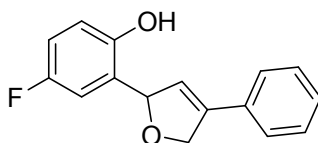
-133.07; ^{13}C NMR (100 MHz, CDCl_3) δ : 163.3 (d, $J = 243.9$ Hz), 156.9 (d, $J = 11.9$ Hz), 113.1, 131.7, 128.9, 128.9, 127.8 (d, $J = 10.1$ Hz), 126.1, 122.3, 121.0 (d, $J = 3.4$ Hz), 106.9 (d, $J = 21.6$ Hz), 104.7 (d, $J = 24.1$ Hz), 88.1, 75.4; IR (KBr, cm^{-1}): $\nu = 3185, 2903, 2885, 2861, 1606, 1511, 1497, 1435, 1270, 1150, 846, 745, 685$; HRMS (EI): Exact mass calcd for $\text{C}_{16}\text{H}_{13}\text{FO}_2$: 256.0900, Found 256.0897.

2-Fluoro-6-(4-phenyl-2,5-dihydrofuran-2-yl)phenol (3f)



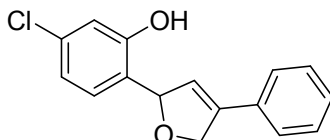
Compound 3f A white solid; ^1H NMR (400 MHz, CDCl_3) δ : 7.36 (d, $J = 4.4$ Hz, 4H), 7.29-7.34 (m, 1H), 6.98-7.03 (m, 1H), 6.90 (s, 1H), 6.80-6.85 (m, 1H), 5.22-5.27 (m, 1H), 5.14-5.19 m, 1H); ^{13}C NMR (100 MHz, CDCl_3) δ : 151.6 (d, $J = 238.8$ Hz), 142.3 (d, $J = 13.8$ Hz), 132.0, 128.9, 128.9, 128.9, 126.1, 122.4, 121.9 (d, $J = 3.2$ Hz), 120.0 (d, $J = 7.1$ Hz), 115.0 (d, $J = 18.1$ Hz), 86.2 (d, $J = 2.9$ Hz), 75.6; IR (KBr, cm^{-1}): $\nu = 3148, 2922, 2867, 1613, 1578, 1496, 1545, 1475, 1264, 1061, 946, 841, 687$; HRMS (EI): Exact mass calcd for $\text{C}_{16}\text{H}_{13}\text{FO}_2$: 256.0900, Found 256.0898.

4-Fluoro-2-(4-phenyl-2,5-dihydrofuran-2-yl)phenol (3g)



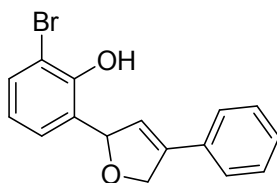
Compound 3g A white solid; ^1H NMR (400 MHz, CDCl_3) δ : 7.52 (s, 1H), 7.38-7.34 (m, 5H), 6.88-6.84 (m, 2H), 6.82-6.79 (m, 1H), 6.35 (q, $J = 2.0, 4.0$ Hz, 1H), 6.23 (t, $J = 4.4$ Hz, 1H), 5.25-5.20 (m, 1H), 5.17-5.13 (m, 1H); ^{19}F NMR (376 MHz, CDCl_3) δ : -124.19; ^{13}C NMR (100 MHz, CDCl_3) δ : 156.7 (d, $J = 236.4$ Hz), 150.7 (d, $J = 2.0$ Hz), 139.3, 131.7, 128.9, 128.8, 126.9 (d, $J = 6.1$ Hz), 126.1, 121.9, 117.8 (d, $J = 7.9$ Hz), 115.3 (d, $J = 22.9$ Hz), 113.2 (d, $J = 23.7$ Hz), 87.1 (d, $J = 1.5$ Hz), 75.5; IR (KBr, cm^{-1}): $\nu = 3345, 3079, 2922, 2853, 1600, 1575, 1496, 1435, 1256, 1067, 758, 743, 689$; HRMS (EI): Exact mass calcd for $\text{C}_{16}\text{H}_{13}\text{FO}_2$: 256.0900, Found 256.0886.

5-Chloro-2-(4-phenyl-2,5-dihydrofuran-2-yl)phenol (3h)



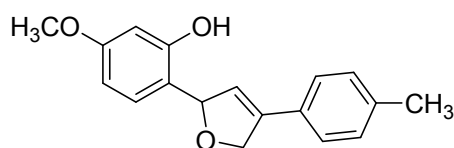
Compound 3f A white solid; ^1H NMR (400 MHz, CDCl_3) δ : 8.05 (s, 1H), 7.38-7.32 (m, 5H), 7.00 (d, $J = 4$ Hz, 1H), 6.89-6.84 (m, 2H), 6.33 (q, $J = 2.0, 4.0$ Hz, 1H), 6.23 (t, $J = 8$ Hz, 1H), 5.24-5.18 (m, 1H), 5.17-5.10 (m, 1H); ^{13}C NMR (100 MHz, CDCl_3) δ : 156.2, 139.4, 134.4, 131.7, 128.9, 128.9, 127.7, 126.1, 123.5, 122.1, 120.2, 117.6, 88.16, 75.51; IR (KBr, cm^{-1}): $\nu = 3284, 3057, 2889, 2850, 1594, 1497, 1448, 1415, 1254, 1065, 898, 844, 740$; HRMS (EI): Exact mass calcd for $\text{C}_{16}\text{H}_{13}\text{ClO}_2$: 272.0604, Found 272.0433.

2-Bromo-6-(4-phenyl-2,5-dihydrofuran-2-yl)phenol (3i)



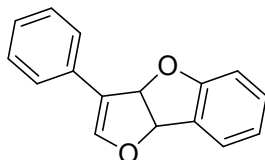
Compound 3i A white solid; ^1H NMR (400 MHz, CDCl_3) δ : 7.31 (dd, $J = 6.4$ Hz, 8.0 Hz, 1H), 7.24-7.28 (m, 4H), 7.18-7.23 (m, 1H), 7.13-7.15 (m, 1H), 6.93 (s, 1H), 6.70 (t, $J = 8.0$ Hz, 1H), 6.25-6.26 (m, 1H), 6.19-6.21 (m, 1H), 5.12-5.16 (m, 1H), 5.04-5.09 (m, 1H); ^{13}C NMR (100 MHz, CDCl_3) δ : 150.1, 138.8, 132.0, 131.6, 128.8, 128.6, 128.5, 126.0, 125.2, 122.5, 121.5, 110.9, 86.1, 75.6. IR (KBr, cm^{-1}): $\nu = 3326$, 3029, 2858, 2827, 1596, 1594, 1494, 1449, 1240, 1115, 869, 762, 702; HRMS (EI): Exact mass calcd for $\text{C}_{16}\text{H}_{13}\text{BrO}_2$: 316.0099, Found 315.9934.

5-Methoxy-2-(4-(p-tolyl)-2,5-dihydrofuran-2-yl)phenol (3l)



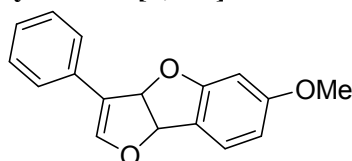
Compound 3k A white solid; ^1H NMR (400 MHz, CDCl_3) δ : 7.90 (s, 1H), 7.25 (d, $J = 8.8$ Hz, 2H), 7.16 (d, $J = 8.0$ Hz, 2H), 6.97 (d, $J = 9.2$ Hz, 1H), 6.46-6.42 (m, 2H), 6.27 (q, $J = 2.0, 4.0$ Hz, 1H), 6.19 (t, $J = 4.4$ Hz, 1H), 5.20-5.15 (m, 1H), 5.12-5.06 (m, 1H) 3.77 (s, 3H), 2.36 (s, 3H); ^{13}C NMR (100 MHz, CDCl_3) δ : 160.7, 156.7, 138.9, 138.7, 129.6, 127.7, 129.1, 126.0, 121.8, 117.4, 106.2, 102.6, 88.4, 75.3, 55.5, 21.4; IR (KBr, cm^{-1}): $\nu = 3230$, 3020, 2911, 2831, 1610, 1596, 1515, 1446, 1201, 1059, 958, 807, 798; HRMS (EI): Exact mass calcd for $\text{C}_{18}\text{H}_{18}\text{O}_3$: 282.1256, Found 282.1248.

3-Phenyl-3a,8b-dihydrofuro[3,2-b]benzofuran (4a)



Compound 4a A white solid; ^1H NMR (400 MHz, CD_3CN) δ : 7.53-7.47 (m, 3H), 7.38-7.28 (m, 3H), 7.24-7.19 (m, 2H), 6.79 (dt, $J = 0.8, 7.6$ Hz, 1H), 6.87 (d, $J = 8.0$ Hz, 1H), 6.33 (d, $J = 7.6$ Hz, 1H), 6.28 (d, $J = 8.0$ Hz, 1H); ^{13}C NMR (100 MHz, CD_3CN) δ : 160.3, 147.6, 133.5, 132.3, 129.6, 127.5, 127.2, 126.3, 125.5, 121.8, 116.7, 111.5, 89.8, 87.2; IR (KBr, cm^{-1}): 3084, 3058, 3025, 2963, 1630, 1473, 1448, 1238, 1180, 1117, 1102, 747, 730, 685; HRMS (EI): Exact mass calcd for $\text{C}_{16}\text{H}_{12}\text{O}_2$: 236.0837, Found 236.0838.

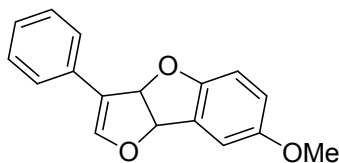
6-Methoxy-3-phenyl-3a,8b-dihydrofuro[3,2-b]benzofuran (4b)



Compound 4a A white solid; ^1H NMR (400 MHz, CDCl_3) δ : 7.47 (d, $J = 7.6$ Hz, 2H), 6.38-6.32 (m, 3H), 7.21 (t, $J = 7.6$ Hz, 1H), 7.06 (s, 1H), 6.52 (dd, $J = 2.4, 8.4$ Hz, 1H), 6.46 (d, $J = 2.4$ Hz, 1H), 6.28 (d, $J = 7.6$ Hz, 1H), 6.19 (d, $J = 7.6$ Hz, 1H), 3.77

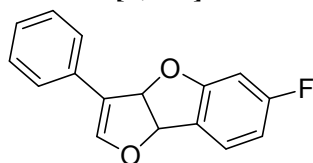
(s, 3H); ^{13}C NMR (100 MHz, CDCl_3) δ : 163.0, 161.4, 146.5, 132.5, 128.9, 126.7, 126.5, 124.7, 117.2, 115.8, 107.9, 96.5, 90.2, 86.4, 55.7; IR (KBr, cm^{-1}): 3033, 2965, 2923, 2853, 1652, 1631, 1498, 1469, 1152, 1115, 1026, 826, 790, 760; HRMS (EI): Exact mass calcd for $\text{C}_{17}\text{H}_{14}\text{O}_3$: 266.0943, Found 266.0945.

7-Methoxy-3-phenyl-3a,8b-dihydrofuro[3,2-b]benzofuran (4c)

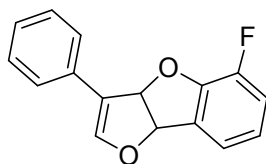


Compound 4c A white solid; ^1H NMR (400 MHz, CD_3CN) δ : 7.50-7.47 (m, 2H), 7.35 (t, $J = 7.2$ Hz, 2H), 7.24-7.19 (m, 2H), 7.08 (d, $J = 2.8$ Hz, 1H), 6.88 (dd, $J = 2.4$, 8.4 Hz, 1H), 6.77 (d, $J = 8.8$ Hz, 1H), 6.31 (d, $J = 7.6$ Hz, 1H), 6.24 (d, $J = 7.6$ Hz, 1H), 3.76 (s, 3H); ^{13}C NMR (100 MHz, CD_3CN) δ : 155.3, 154.2, 147.4, 133.5, 129.6, 127.2, 126.7, 125.5, 118.6, 116.8, 111.9, 111.8, 89.9, 87.5, 56.5; IR (KBr, cm^{-1}): 3021, 2953, 2925, 2830, 1630, 1603, 1490, 1435, 1233, 1197, 1126, 1036, 943, 907, 753, 687; HRMS (EI): Exact mass calcd for $\text{C}_{17}\text{H}_{14}\text{O}_3$: 266.0943, Found 266.0942.

6-Fluoro-3-phenyl-3a,8b-dihydrofuro[3,2-b]benzofuran (4e)

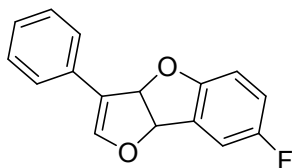


Compound 4e A white solid; ^1H NMR (400 MHz, CDCl_3) δ : 7.46-7.48 (m, 2H), 7.40-7.44 (m, 1H), 7.36 (t, $J = 7.6$ Hz, 2H), 7.23 (t, $J = 7.6$ Hz, 1H), 7.06 (s, 1H), 6.64-6.69 (m, 1H), 6.59-6.62 (m, 1H), 6.32 (d, $J = 7.6$ Hz, 1H), 6.19 (d, $J = 7.6$ Hz, 1H); ^{13}C NMR (100 MHz, CDCl_3) δ : 166.5 (d, $J = 245.9$ Hz), 161.2 (d, $J = 13.8$ Hz), 146.5, 132.1, 129.0, 127.1 (d, $J = 11.0$ Hz), 126.7, 124.8, 121.0 (d, $J = 2.2$ Hz), 120.9, 115.8, 108.2 (d, $J = 23.3$ Hz), 99.3 (d, $J = 26.3$ Hz), 90.7, 85.7; IR (KBr, cm^{-1}): 3028, 2962, 2924, 2854, 1654, 1630, 1494, 1464, 1263, 1136, 1100, 824, 790; HRMS (EI): Exact mass calcd for $\text{C}_{16}\text{H}_{11}\text{FO}_2$: 254.0743, Found 254.0742. **5-Fluoro-3-phenyl-3a,8b-dihydrofuro[3,2-b]benzofuran (4f)**



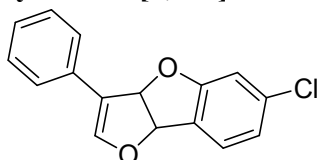
Compound 4f A white solid; ^1H NMR (400 MHz, CD_3CN) δ : ^1H NMR (400 MHz, CDCl_3) δ : 7.49-7.52 (m, 2H), 7.36 (t, $J = 7.6$ Hz, 2H), 7.24-7.27 (m, 2H), 7.07 (s, 1H), 7.05-7.10 (m, 1H), 6.90-6.93 (m, 1H), 6.36 (d, $J = 7.6$ Hz, 1H), 6.26 (d, $J = 7.6$ Hz, 1H); ^{19}F NMR (376 MHz, CD_3CN) δ : -139.11; ^{13}C NMR (100 MHz, CDCl_3) δ : 148.4 (d, $J = 245.6$ Hz), 146.8 (d, $J = 31.0$ Hz), 146.6, 132.0, 128.9, 128.5 (d, $J = 2.7$ Hz), 126.8, 124.9, 121.7 (t, $J = 8.2$ Hz), 118.2 (d, $J = 16.6$ Hz), 115.8, 90.8, 86.3 (d, $J = 2.4$ Hz); IR (KBr, cm^{-1}): 3091, 2962, 1633, 1599, 1490, 1465, 1259, 1195, 1114, 758, 737, 692; HRMS (EI): Exact mass calcd for $\text{C}_{16}\text{H}_{11}\text{FO}_2$: 254.0743, Found 254.0741.

7-Fluoro-3-phenyl-3a,8b-dihydrofuro[3,2-b]benzofuran (4g)



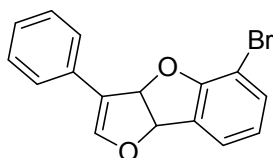
Compound 4g A white solid; ^1H NMR (400 MHz, CD_3CN) δ : 7.50-7.45 (m, 2H), 7.36 (t, $J = 8.0$ Hz, 2H), 7.27 (dd, $J = 2.8, 8.0$ Hz, 1H), 7.21 (s, 1H), 7.22 (t, $J = 8.0$ Hz, 1H), 7.06 (dt, $J = 2.8, 9.2$ Hz, 1H), 6.83 (dd, $J = 4.0, 8.8$ Hz, 1H), 6.38 (d, $J = 8.0$ Hz, 1H), 6.26 (d, $J = 7.6$ Hz, 1H); ^{19}F NMR (376 MHz, CD_3CN) δ : -125.52; ^{13}C NMR (100 MHz, CD_3CN) δ : 158.1 (d, $J = 234.6$ Hz), 156.5 (d, $J = 1.0$ Hz), 147.6, 133.2, 129.7, 127.4 (d, $J = 8.8$ Hz), 127.3, 125.6, 118.8 (d, $J = 24.7$ Hz), 116.7, 113.8 (d, $J = 24.7$ Hz), 112.6 (d, $J = 8.5$ Hz), 90.7, 86.9 (d, $J = 24.7$ Hz); IR (KBr, cm^{-1}): 2973, 2926, 2900, 1655, 1629, 1487, 1447, 1113, 1093, 1050, 818, 752; HRMS (EI): Exact mass calcd for $\text{C}_{16}\text{H}_{11}\text{FO}_2$: 254.0743, Found 254.0739.

6-Chloro-3-phenyl-3a,8b-dihydrofuro[3,2-b]benzofuran (4h)



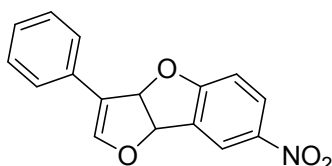
Compound 4h A white solid; ^1H NMR (400 MHz, CDCl_3) δ : 7.48-7.45 (m, 2H), 7.37 (dd, $J = 8.4, 16.8$ Hz, 3H), 7.23 (t, $J = 7.2$ Hz, 1H), 7.05 (s, 1H), 6.94 (dd, $J = 2.0, 8.0$ Hz, 1H), 6.91 (d, $J = 1.6$ Hz, 1H), 6.30 (d, $J = 7.6$ Hz, 1H), 6.18 (d, $J = 7.6$ Hz, 1H); ^{13}C NMR (100 MHz, CDCl_3) δ : 160.6, 146.5, 137.1, 132.1, 128.9, 127.0, 126.7, 124.8, 123.8, 121.4, 115.8, 111.9, 90.3, 85.6; IR (KBr, cm^{-1}): 3028, 2962, 2924, 2854, 1654, 1628, 1607, 1477, 1117, 1064, 789, 752, 686; HRMS (EI): Exact mass calcd for $\text{C}_{16}\text{H}_{11}\text{ClO}_2$: 270.0448, Found 270.0449.

5-Bromo-3-phenyl-3a,8b-dihydrofuro[3,2-b]benzofuran (4i)



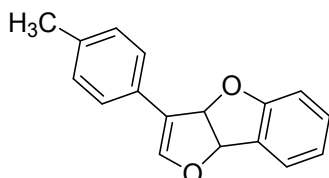
Compound 4i A white solid; ^1H NMR (400 MHz, CD_3CN) δ : ^1H NMR (400 MHz, CDCl_3) δ : 7.56 (d, $J = 7.2$ Hz, 2H), 7.45-7.51 (m, 2H), 7.41 (t, $J = 7.6$ Hz, 2H), 7.29 (d, $J = 6.8$ Hz, 1H), 7.09 (s, 1H), 6.89 (t, $J = 7.6$ Hz, 1H), 6.35 (d, $J = 7.6$ Hz, 1H), 6.32 (d, $J = 7.6$ Hz, 1H); ^{13}C NMR (100 MHz, CDCl_3) δ : 157.1, 140.7, 134.5, 132.1, 128.9, 126.7, 126.2, 125.4, 125.0, 122.4, 115.8, 104.2, 89.8, 86.8; IR (KBr, cm^{-1}): 3058, 3023, 2863, 2925, 1628, 1448, 1427, 1260, 1019, 798, 705; HRMS (EI): Exact mass calcd for $\text{C}_{16}\text{H}_{11}\text{BrO}_2$: 313.9942, Found 313.9944.

7-Nitro-3-phenyl-3a,8b-dihydrofuro[3,2-b]benzofuran (4j)



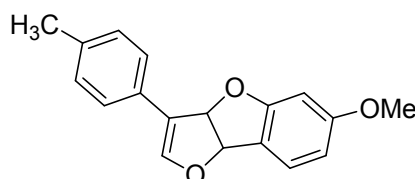
Compound 4j A white solid; ^1H NMR (400 MHz, CDCl_3) δ : 8.41 (d, $J = 2.0$ Hz, 1H), 8.25 (dd, $J = 2.4, 8.8$ Hz, 1H), 7.46 (d, $J = 7.6$ Hz, 2H), 7.37 (t, $J = 7.6$ Hz, 2H), 7.27-7.23 (m, 1H), 7.08 (s, 1H), 6.96 (d, $J = 8.8$ Hz, 1H), 6.45 (d, $J = 8.0$ Hz, 1H), 6.25 (d, $J = 7.6$ Hz, 1H); ^{13}C NMR (100 MHz, CDCl_3) δ : 164.8, 146.9, 142.3, 131.5, 129.0, 128.4, 127.1, 126.4, 124.8, 123.4, 115.6, 111.4, 92.0, 84.6; IR (KBr, cm^{-1}): 3084, 2961, 2923, 2852, 1628, 1598, 1527, 1473, 1339, 1239, 1107, 761, 688; HRMS (EI): Exact mass calcd for $\text{C}_{16}\text{H}_{11}\text{NO}_4$: 281.0688, Found 281.0692.

3-(p-tolyl)-3a,8b-dihydrofuro[3,2-b]benzofuran (4k)



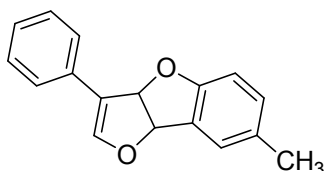
Compound 4k A white solid; ^1H NMR (400 MHz, CDCl_3) δ : 7.50 (d, $J = 7.4$ Hz, 1H), 7.39 (d, $J = 8.0$ Hz, 2H), 7.31 (t, $J = 7.6$ Hz, 1H), 7.18 (d, $J = 7.6$ Hz, 2H), 7.01 (s, 1H), 6.97 (dt, $J = 0.8, 7.6$ Hz, 1H), 6.92 (d, $J = 8.0$ Hz, 1H), 6.25 (d, $J = 8.4$ Hz, 1H), 6.22 (d, $J = 8.0$ Hz, 1H), 3.62 (s, 3H); ^{13}C NMR (100 MHz, CDCl_3) δ : 159.7, 145.6, 136.3, 131.5, 129.6, 129.4, 126.4, 125.0, 124.7, 121.0, 115.8, 111.2, 89.2, 86.3, 21.3; IR (KBr, cm^{-1}): 3083, 2965, 2922, 2853, 1656, 1630, 1436, 1446, 1236, 1109, 1027, 812, 761, 686; HRMS (EI): Exact mass calcd for $\text{C}_{17}\text{H}_{14}\text{O}_2$: 250.0994, Found 250.0993.

6-Methoxy-3-(p-tolyl)-3a,8b-dihydrofuro[3,2-b]benzofuran (4l)



Compound 4l A white solid; ^1H NMR (400 MHz, CD_3CN) δ : 7.37 (dd, $J = 2.0, 8.0$ Hz, 3H), 7.17 (d, $J = 7.6$ Hz, 2H), 7.14 (s, 1H), 6.52 (dd, $J = 2.4, 8.4$ Hz, 1H), 6.43 (d, $J = 2.0$ Hz, 1H), 6.32 (d, $J = 7.6$ Hz, 1H), 6.18 (d, $J = 8.0$ Hz, 1H), 3.75 (s, 3H), 2.32 (s, 3H); ^{13}C NMR (100 MHz, CD_3CN) δ : 163.8, 162.1, 146.9, 136.9, 130.6, 130.2, 127.8, 125.4, 118.5, 116.5, 108.3, 96.9, 91.1, 86.8, 56.1, 21.1; IR (KBr, cm^{-1}): 3028, 2963, 2923, 2854, 1654, 1630, 1500, 1446, 1109, 1027, 812; HRMS (EI): Exact mass calcd for $\text{C}_{18}\text{H}_{16}\text{O}_3$: 280.1099, Found 280.1101.

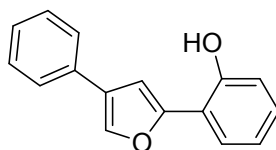
7-Methyl-3-phenyl-3a,8b-dihydrofuro[3,2-b]benzofuran (4m)



Compound 4m A white solid; ^1H NMR (400 MHz, CD_3CN) δ : 7.91 (s, 1H), 7.63-7.60 (m, 2H), 7.57 (d, $J = 2.4$ Hz, 1H), 7.40 (t, $J = 7.6$ Hz, 3H), 7.29 (t, $J = 8.0$ Hz, 2H), 6.99 (d, $J = 8.0$ Hz, 1H), 6.76 (d, $J = 8.0$ Hz, 1H), 2.30 (s, 3H); ^{13}C NMR (100 MHz, CD_3CN) δ : 152.7, 151.7, 138.3, 133.4, 130.3, 130.1, 129.8, 129.0, 128.0, 126.9,

126.6, 118.1, 117.0, 108.6, 20.6; IR (KBr, cm^{-1}): 3028, 2920, 2853, 1607, 1509, 1488, 1449, 1195, 1144, 753, 695; HRMS (EI): Exact mass calcd for $\text{C}_{17}\text{H}_{14}\text{O}_2$: 250.0994, Found 250.0995.

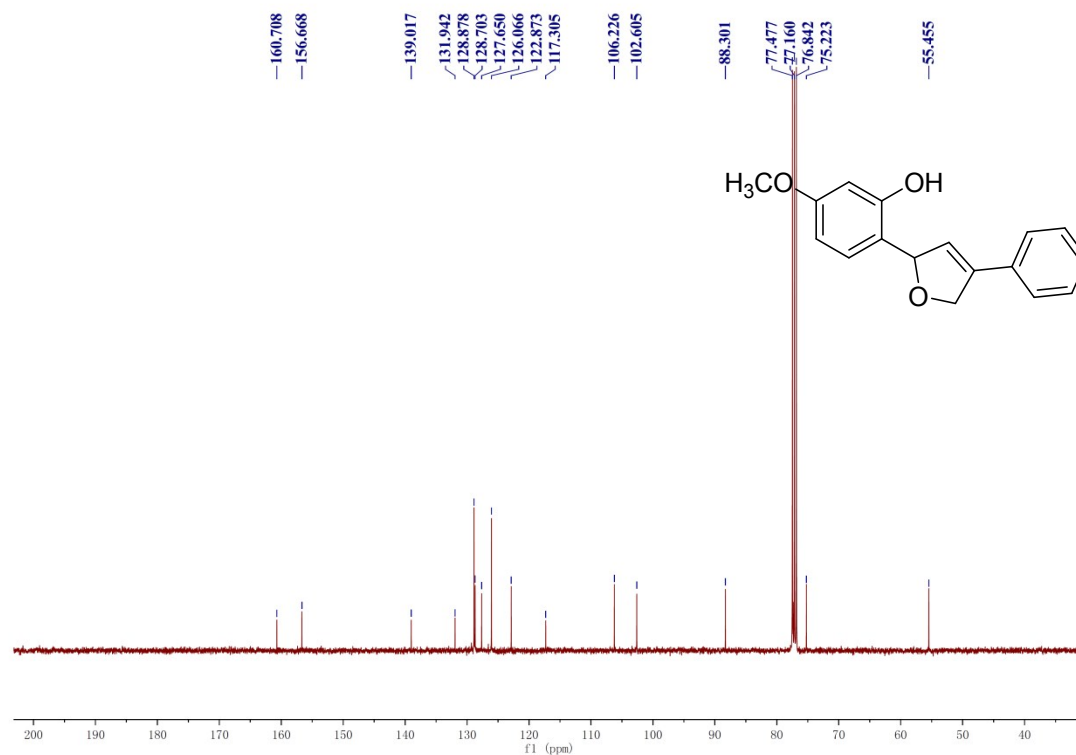
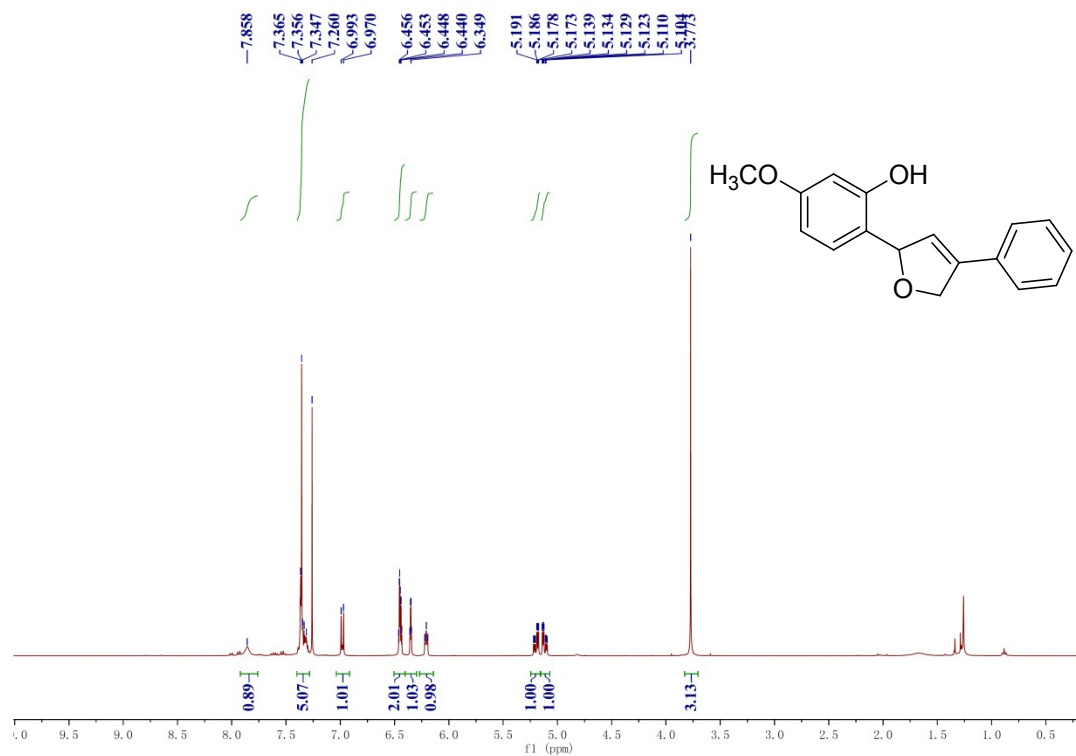
2-(4-Phenylfuran-2-yl)phenol (5a)



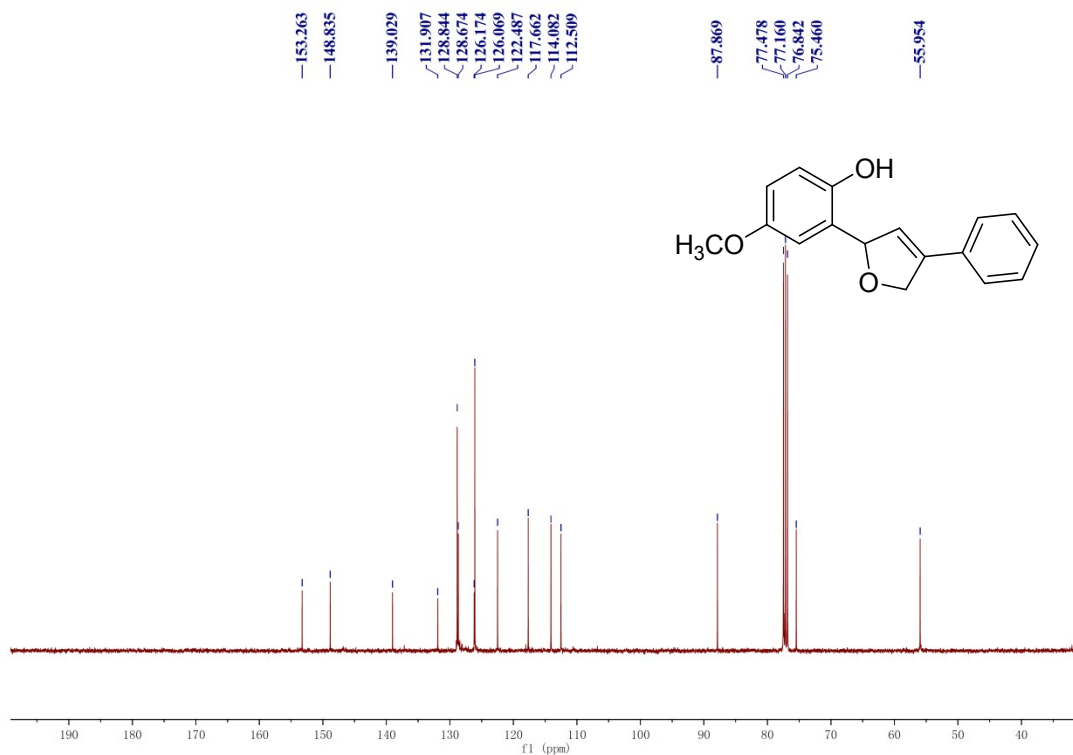
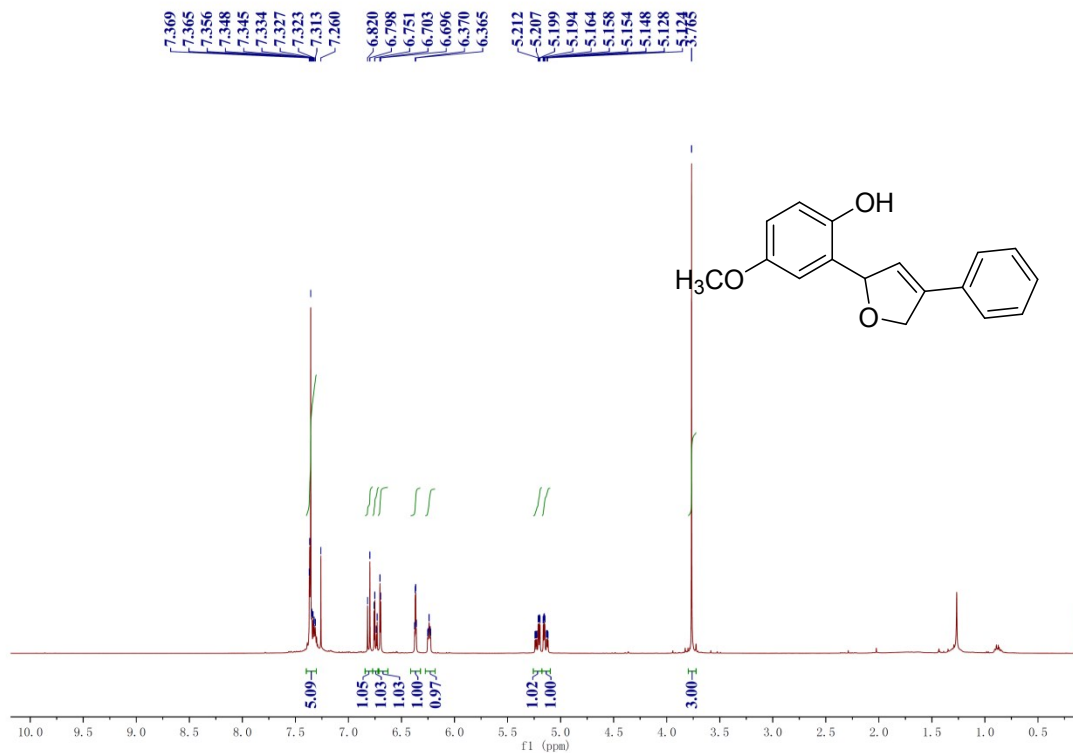
Compound 5a A white solid; ^1H NMR (400 MHz, CDCl_3) δ : 7.80 (s, 1H), 7.60 (d, $J = 8.0$ Hz, 1H), 7.55 (d, $J = 8.0$ Hz, 2H), 7.42 (t, $J = 7.6$ Hz, 2H), 7.31 (t, $J = 7.6$ Hz, 1H), 7.23 (t, $J = 7.8$ Hz, 1H), 7.04 (s, 1H), 7.00-6.96 (m, 2H), 6.89 (s, 1H); ^{13}C NMR (100 MHz, CDCl_3) δ : 153.5, 152.7, 137.1, 132.0, 129.5, 129.0, 128.5, 127.6, 126.4, 126.1, 120.9, 117.3, 116.6, 106.1; IR (KBr, cm^{-1}): $\nu = 3344, 3150, 3065, 2926, 1587, 1531, 1497, 1450, 913, 823, 753, 690$; HRMS (EI): Exact mass calcd for $\text{C}_{16}\text{H}_{12}\text{O}_2$: 236.0837, Found 236.0839.

6. ^1H , ^{19}F and ^{13}C NMR spectral data

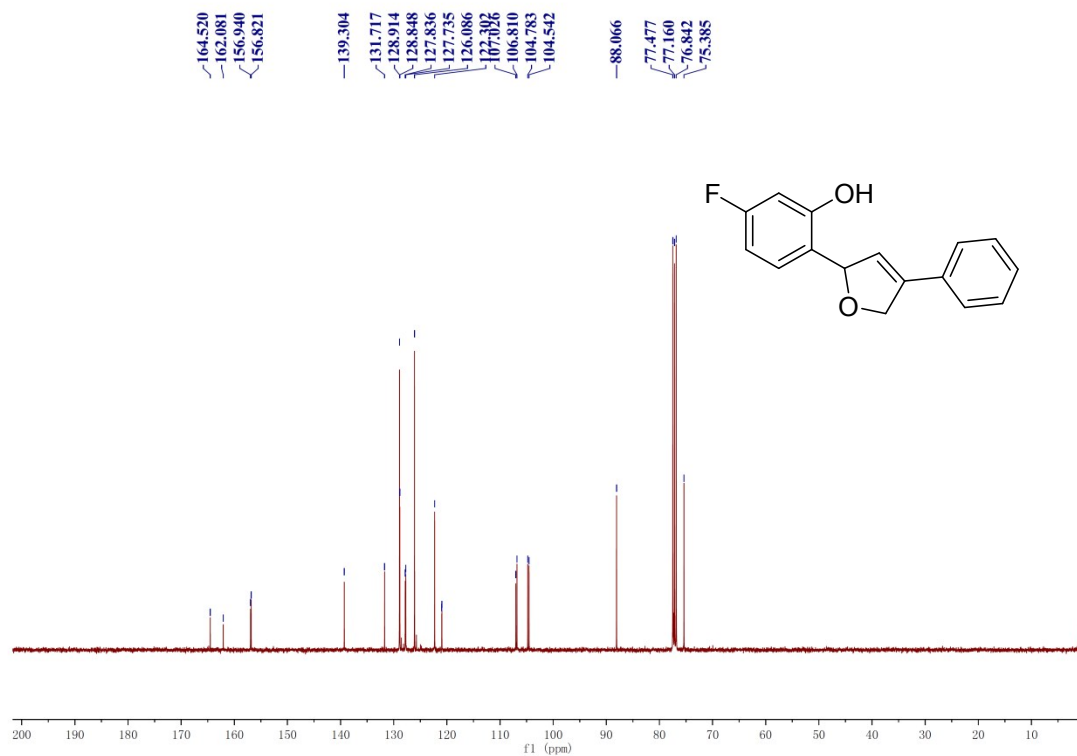
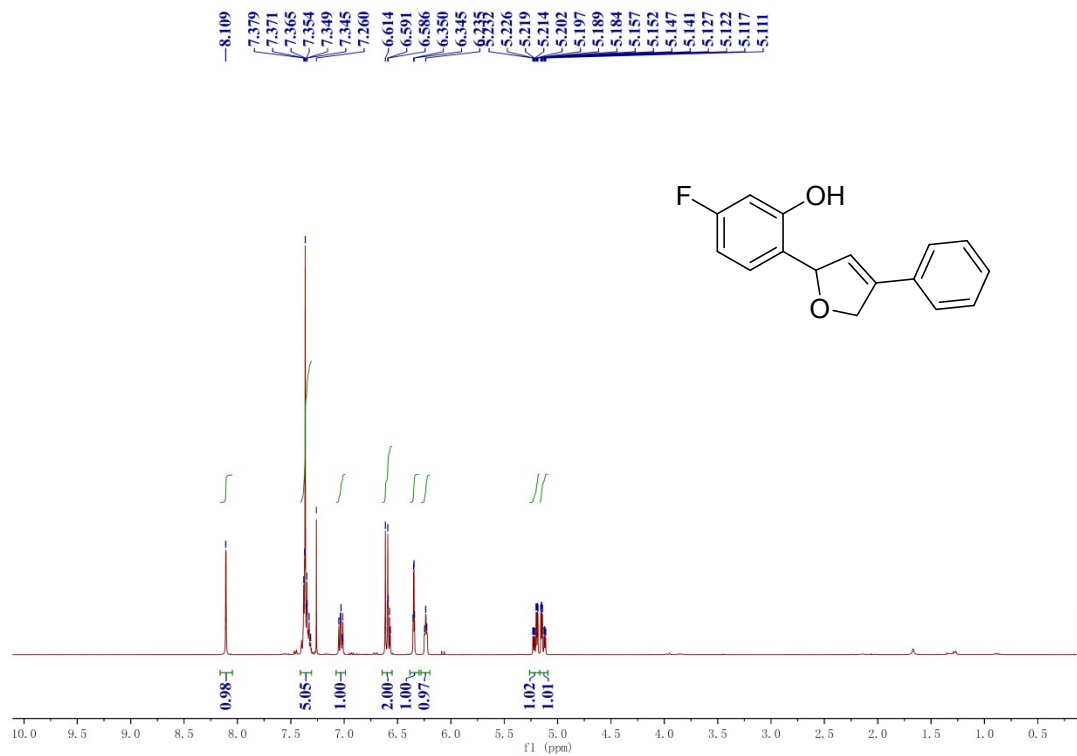
3b (CDCl_3)



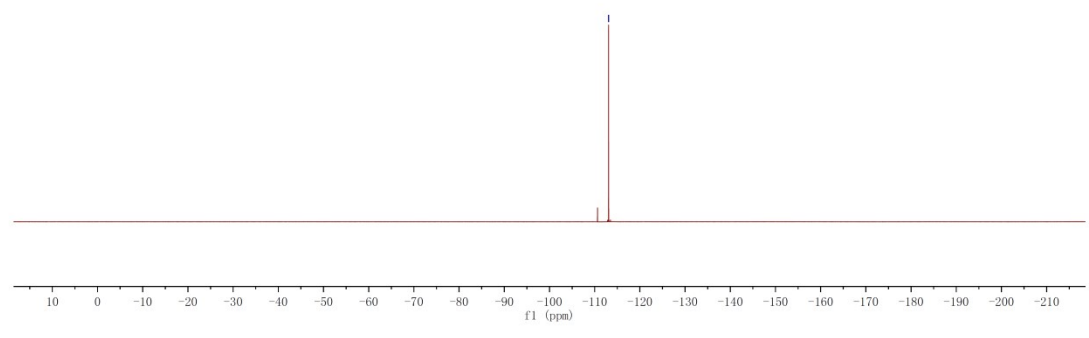
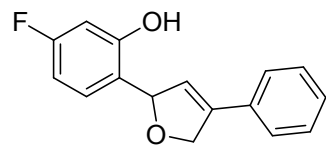
3c (CDCl₃)

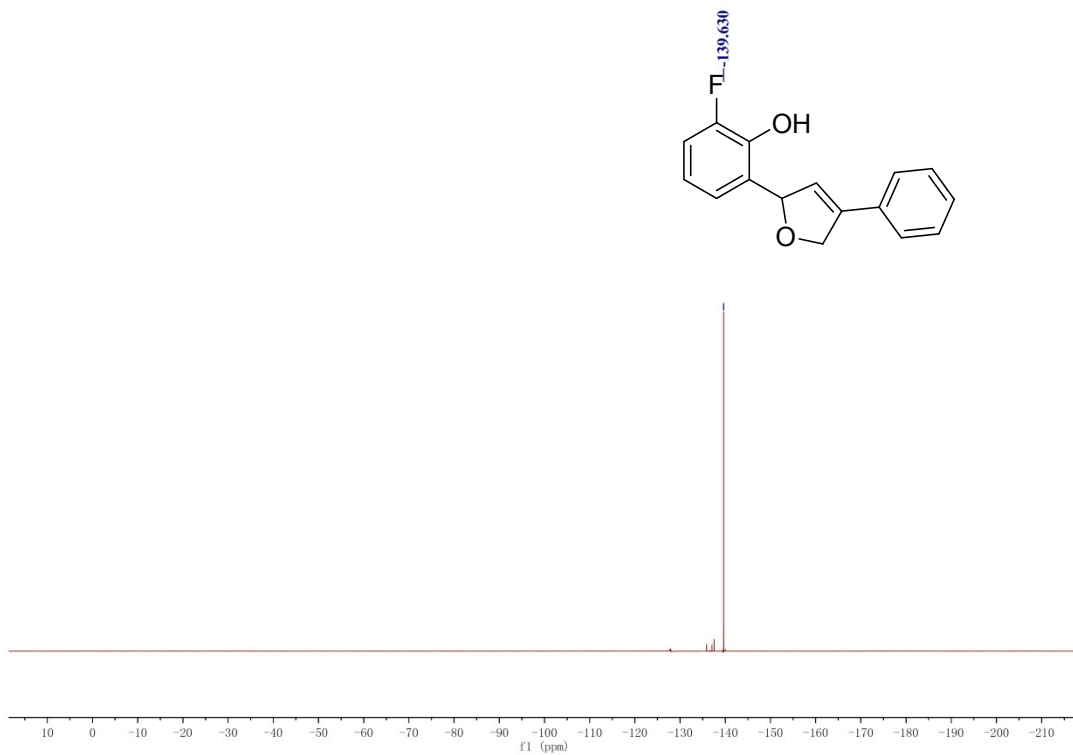


3e (CDCl₃)

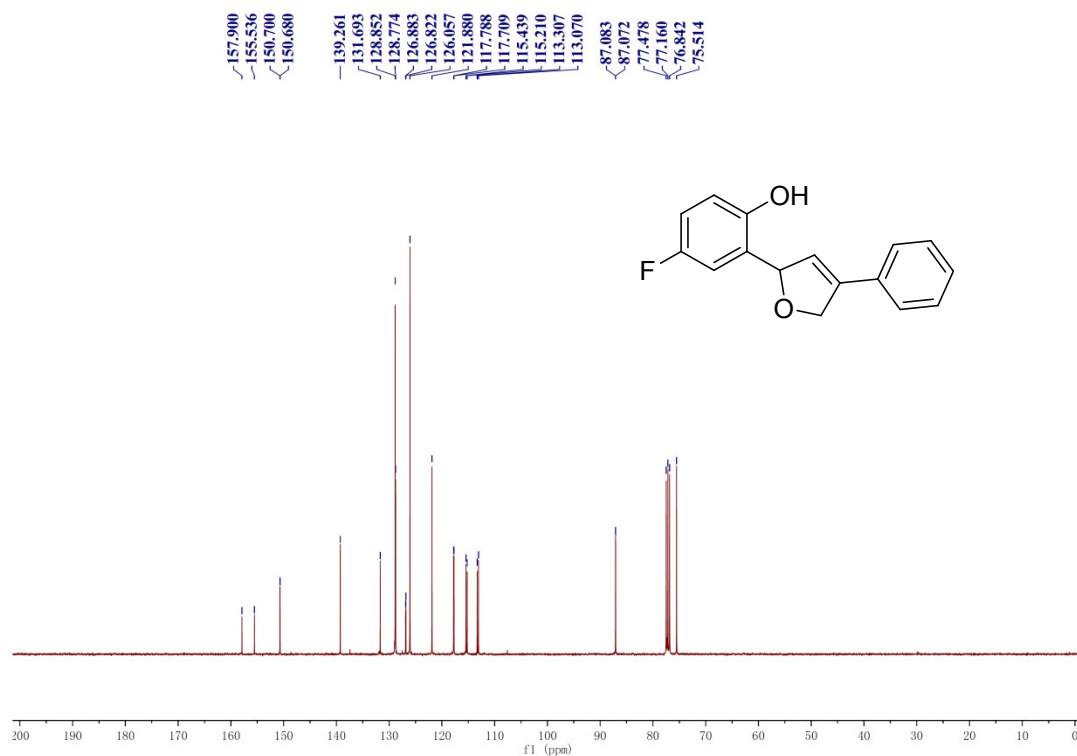
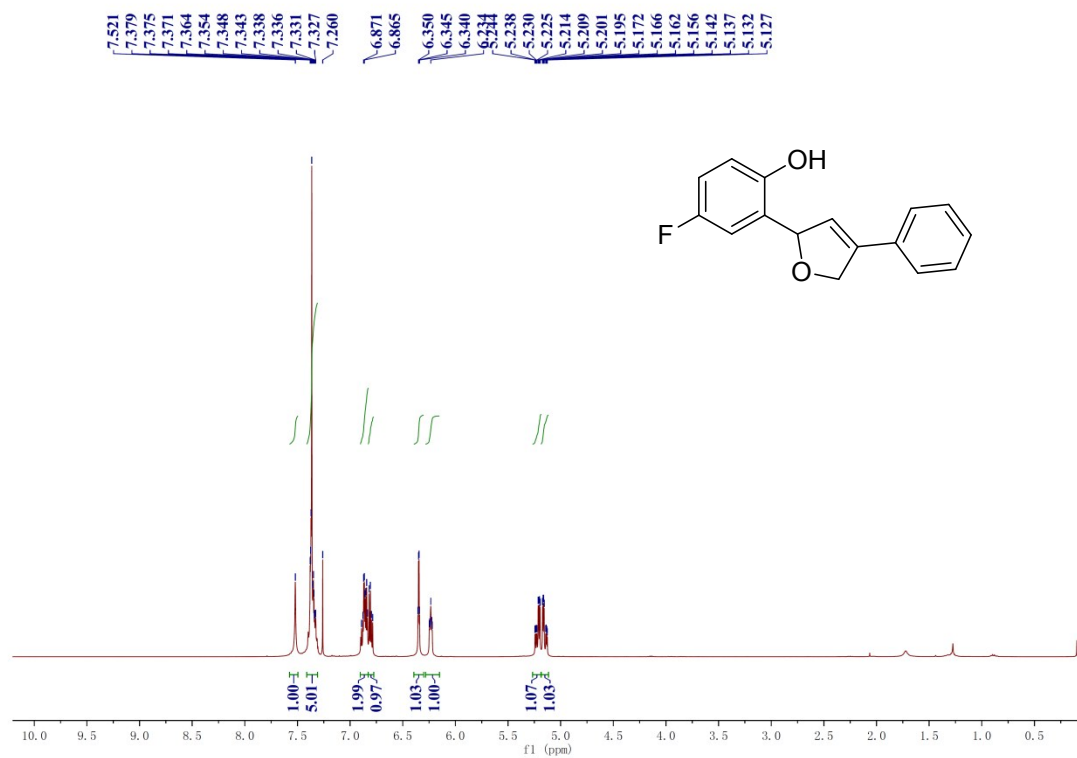


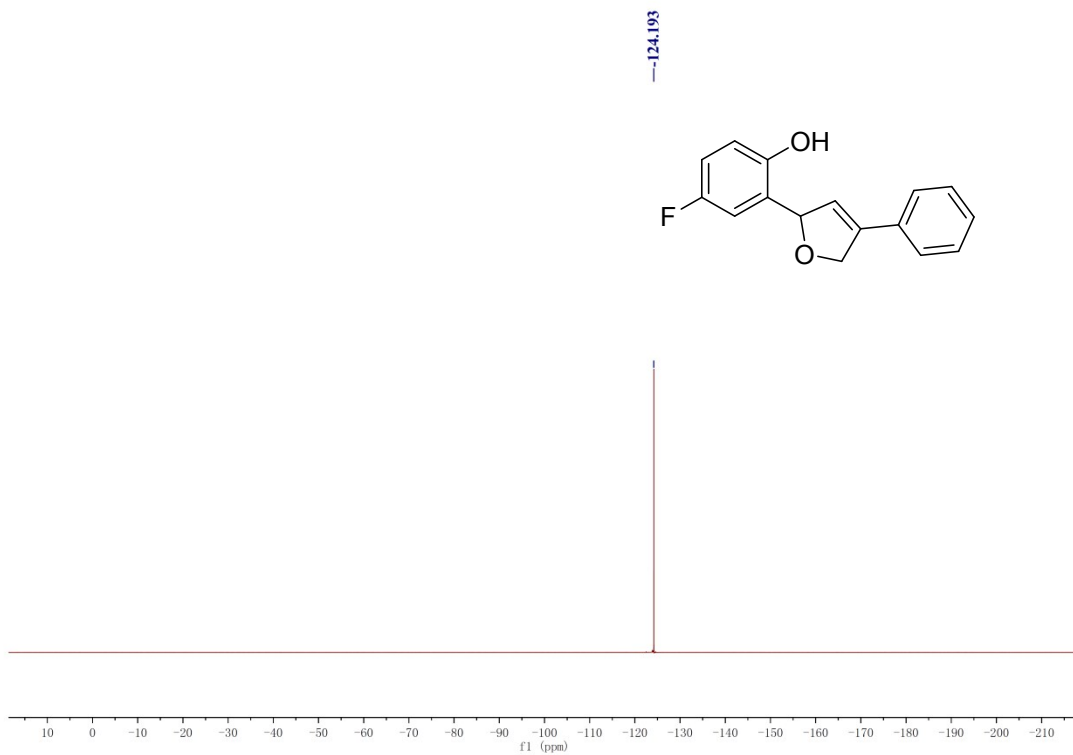
-113.077



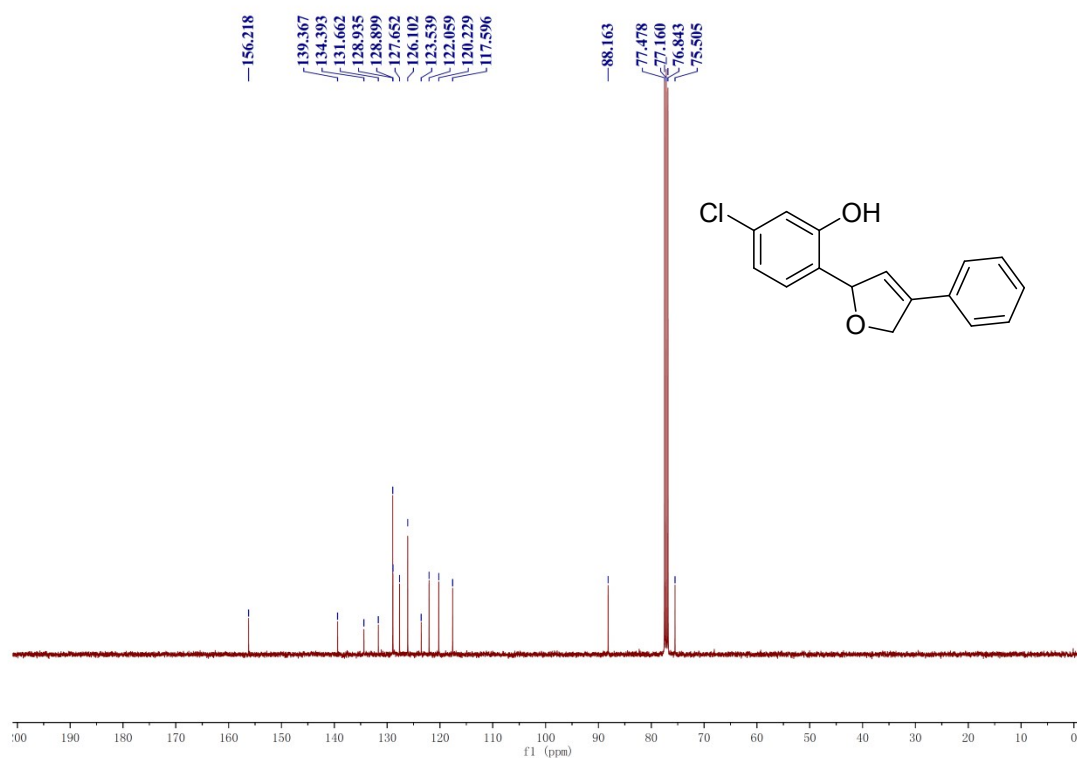
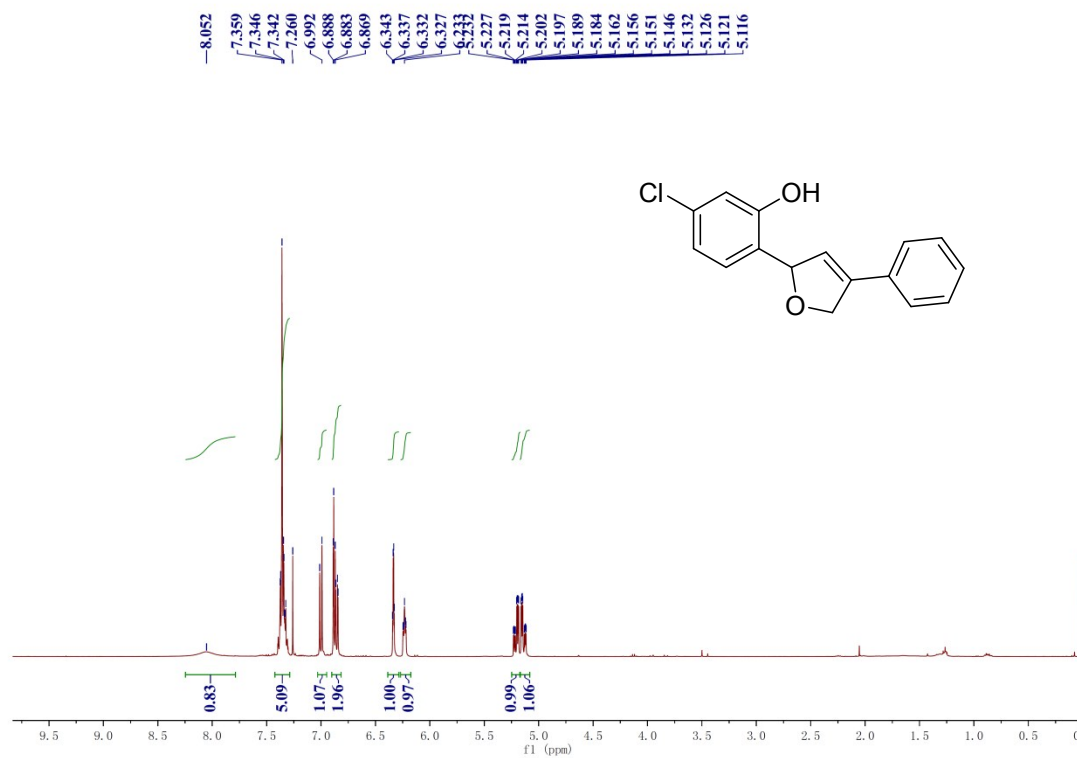


3g (CDCl₃)

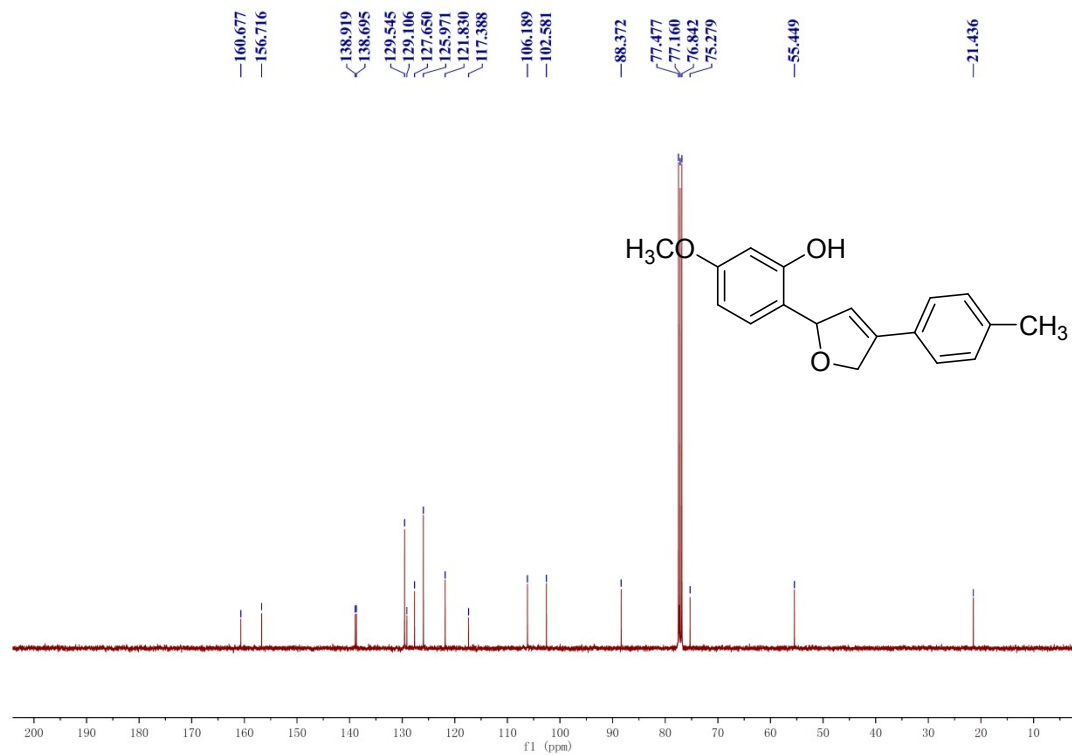
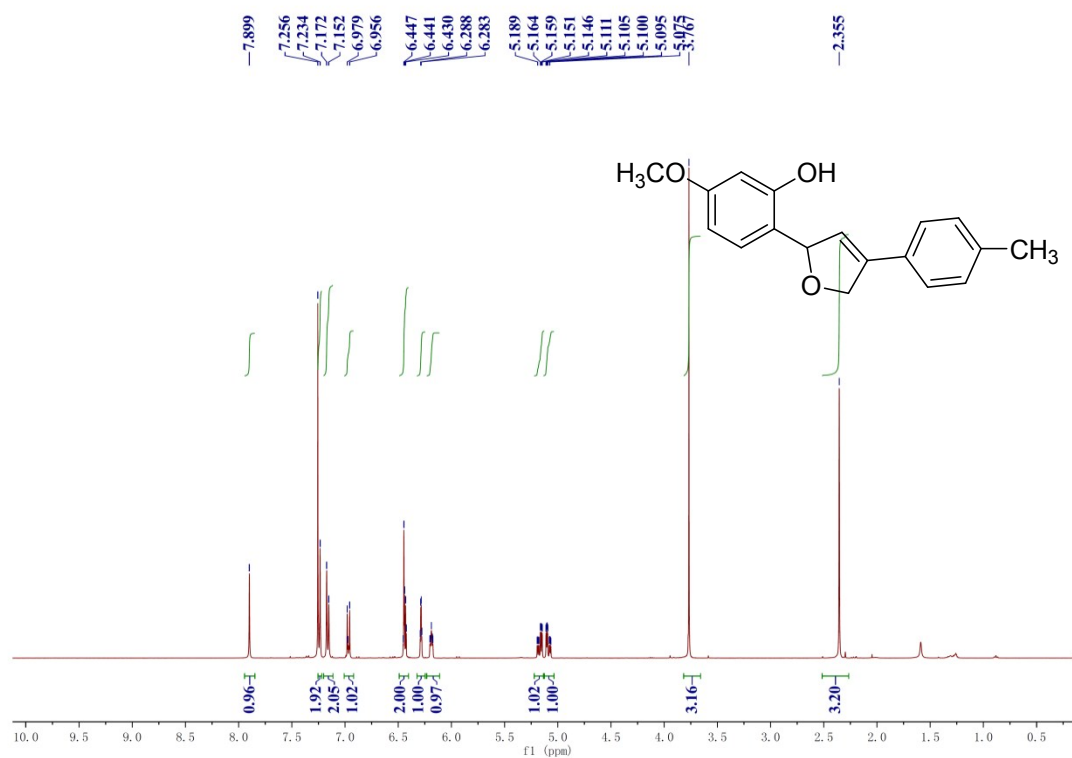




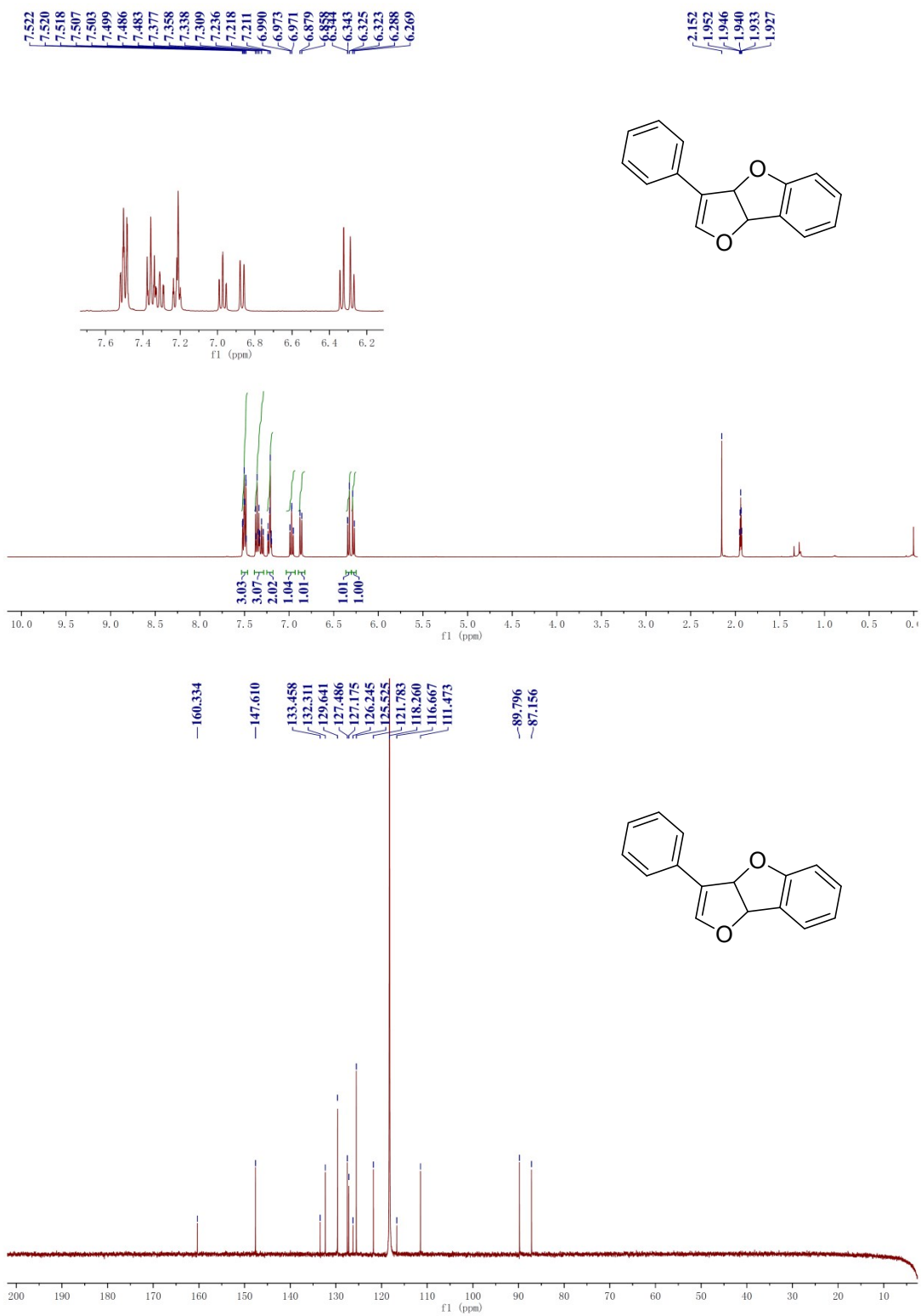
3h (CDCl₃)



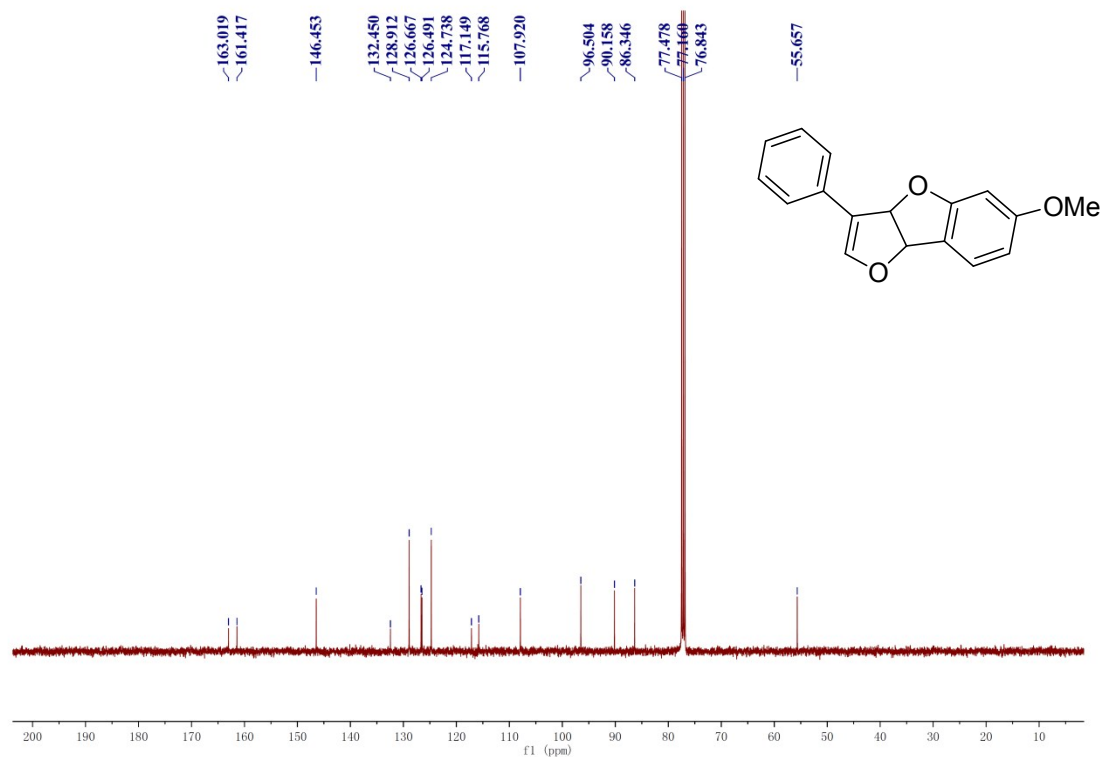
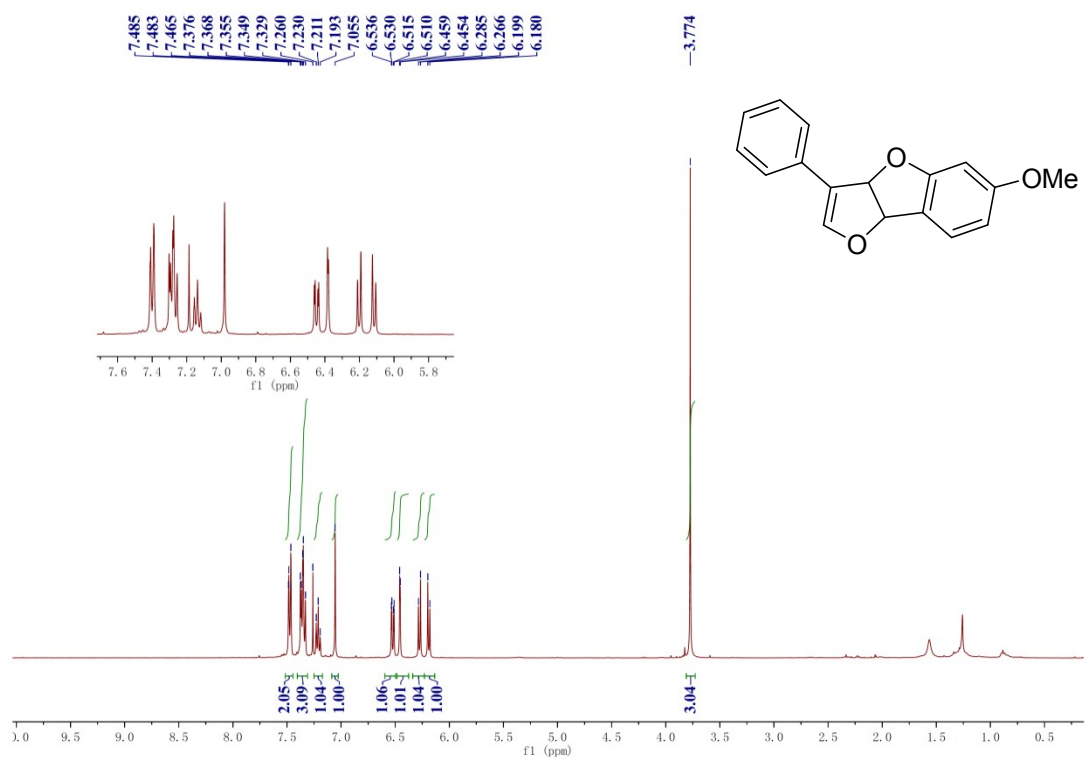
3I (CDCl₃)



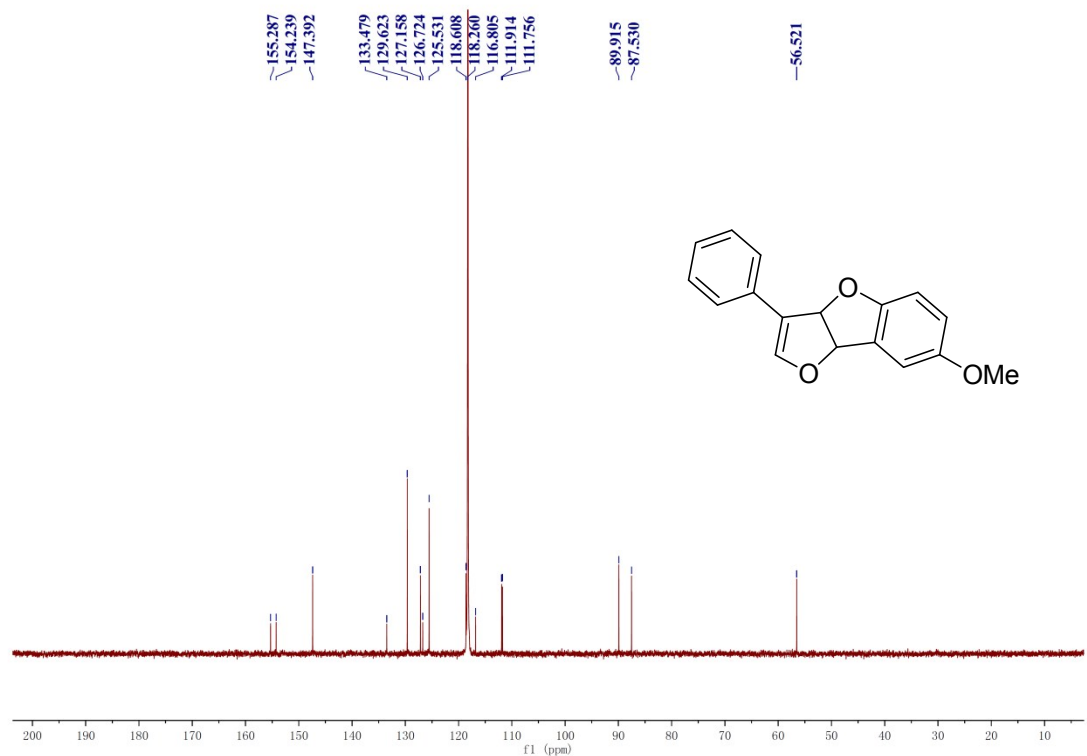
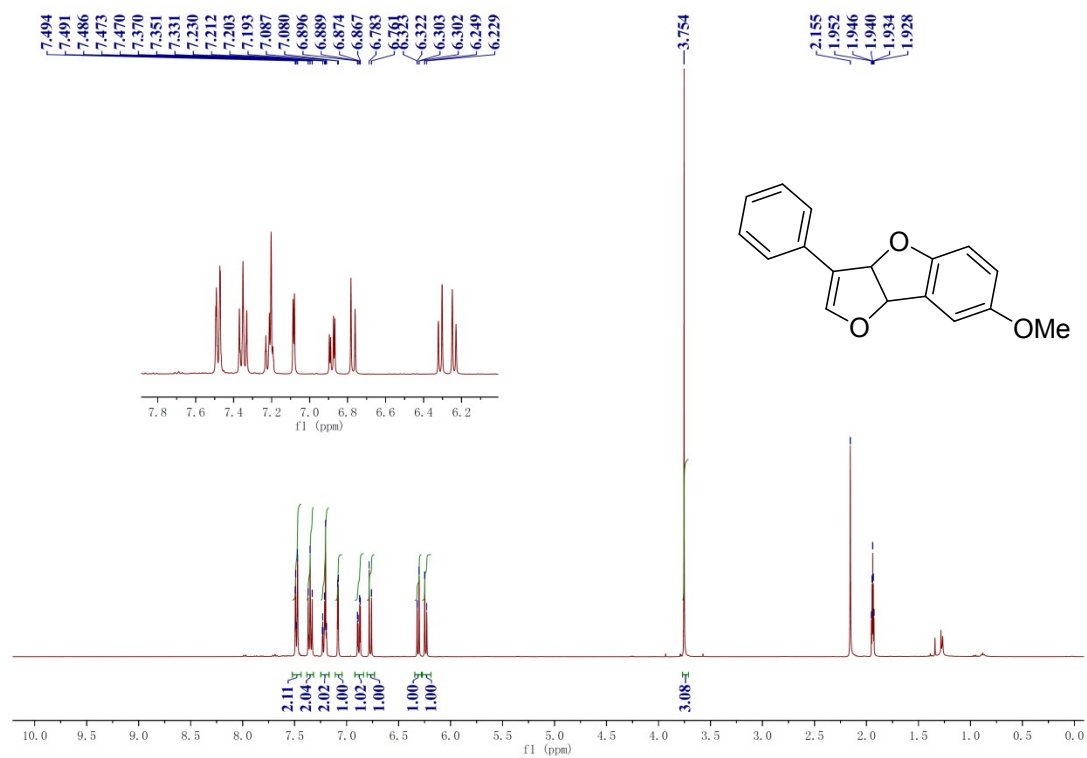
4a (CD₃CN)



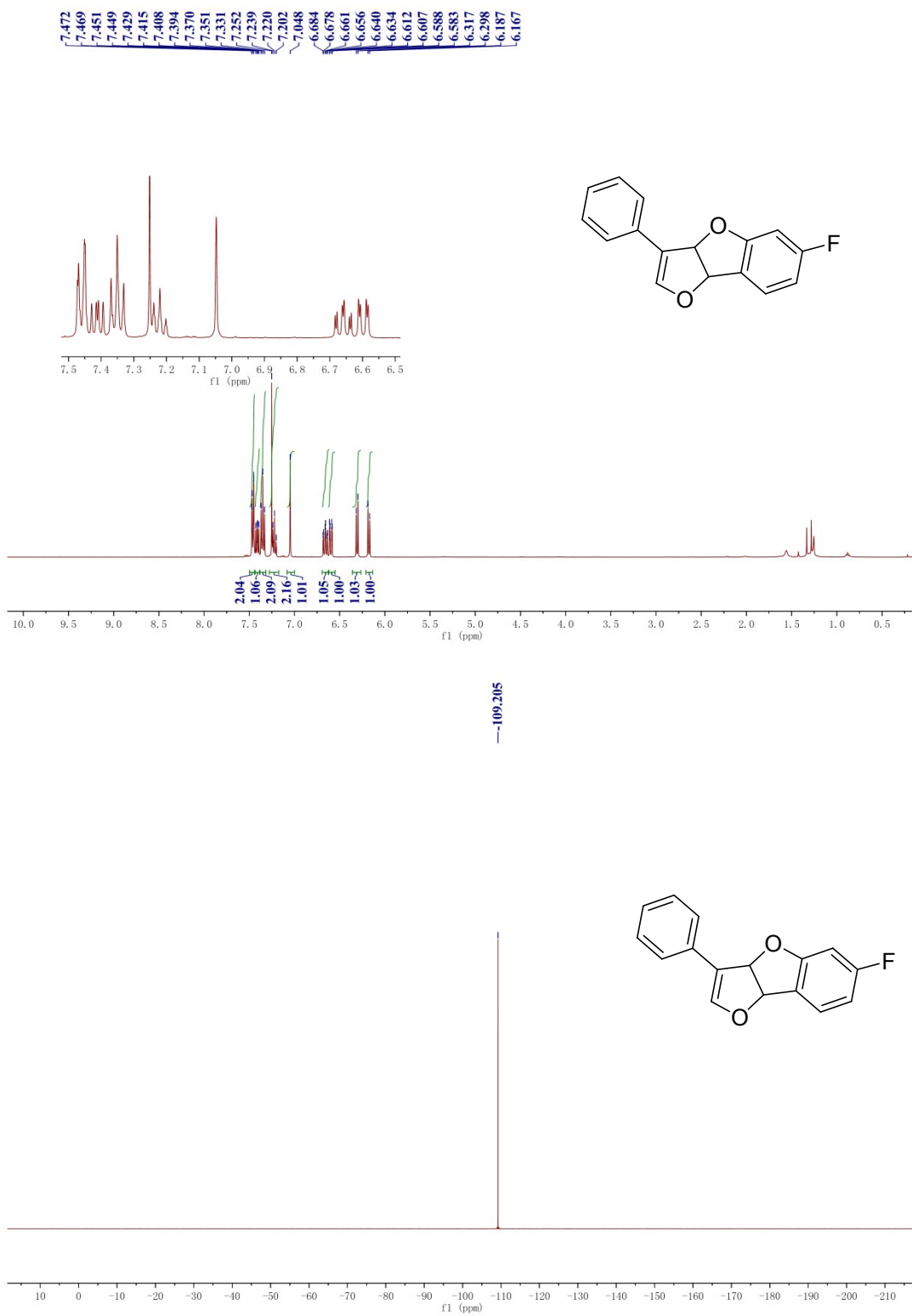
4b (CDCl₃)

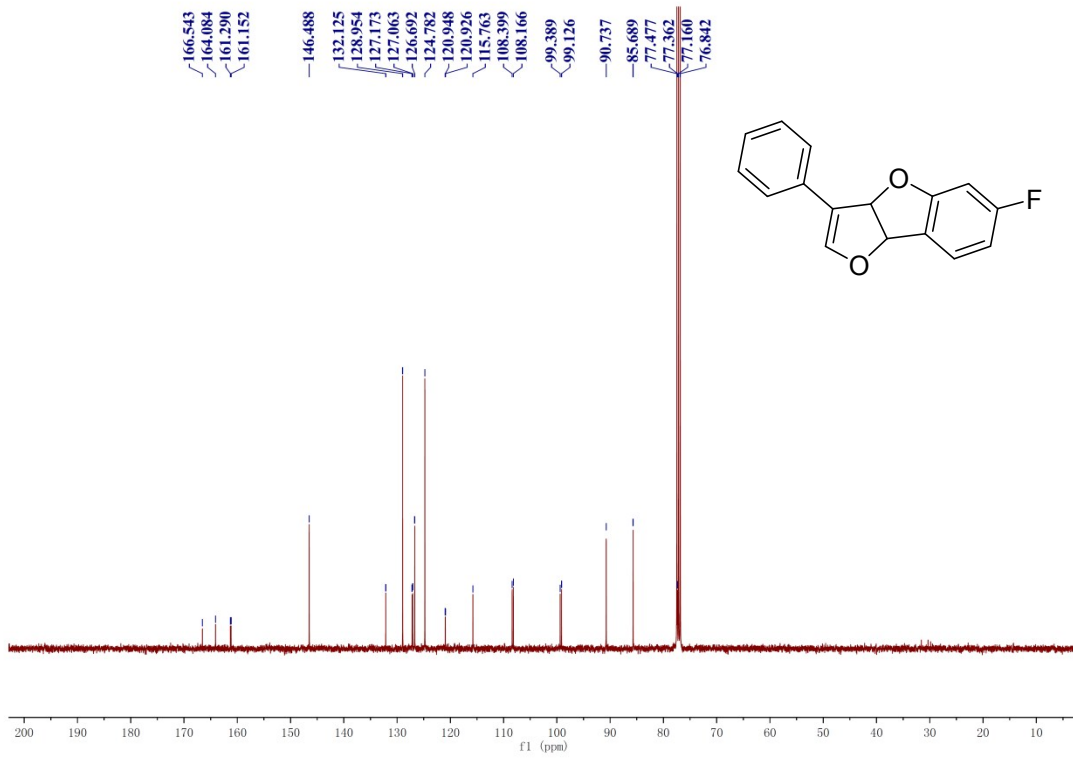


4c (CD₃CN)

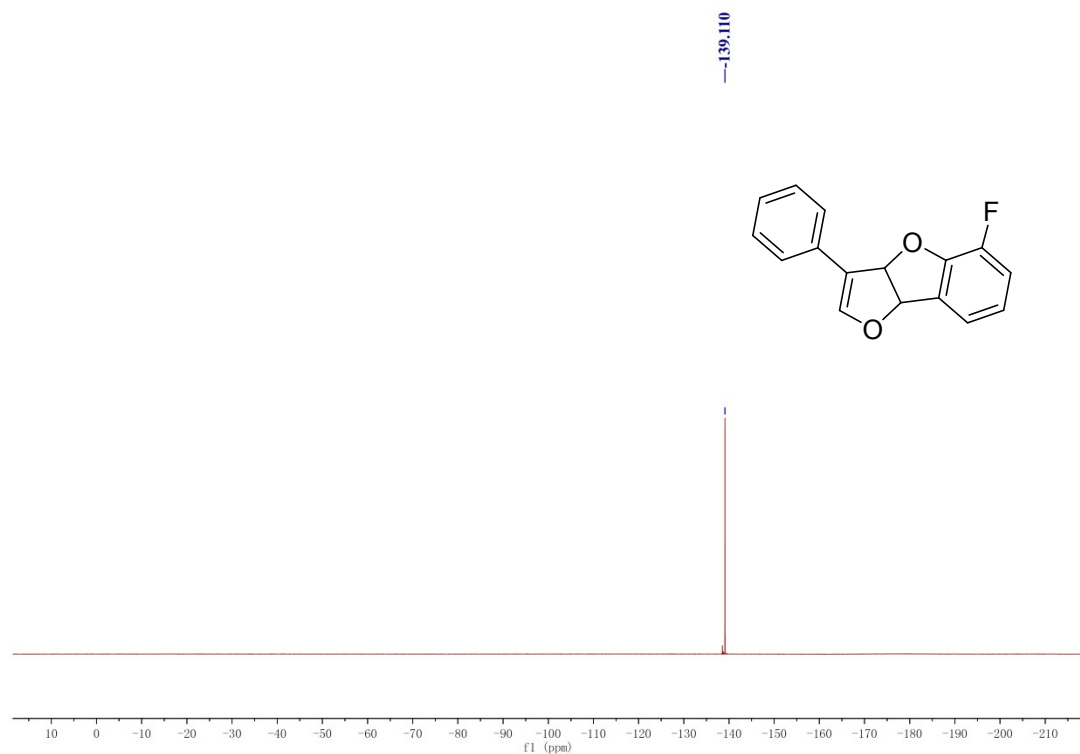
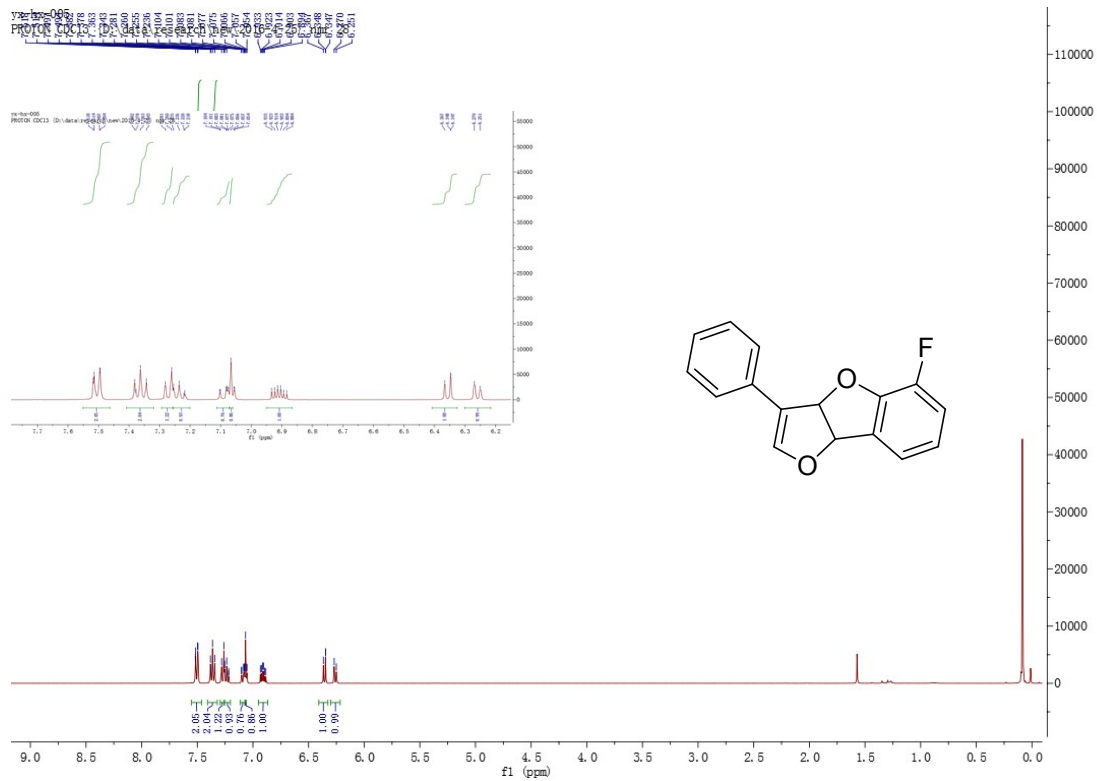


4e (CDCl₃)





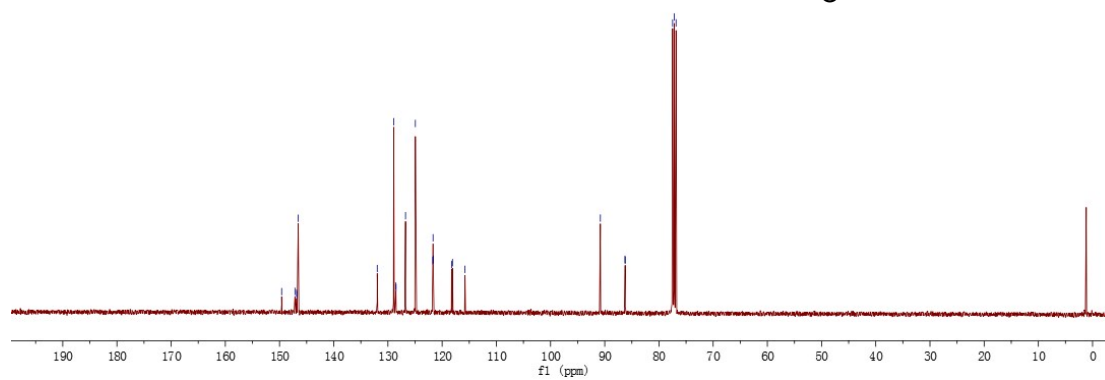
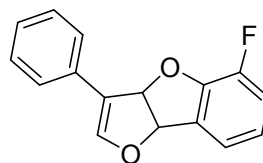
4f (CD₃CN)



yx-hx-005
C13CPD CDCl3 {D:\data\research\new\2016

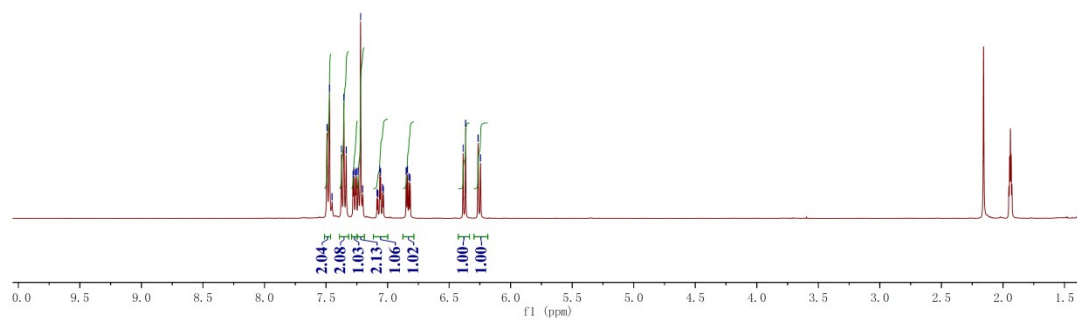
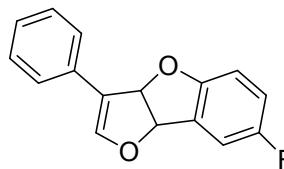
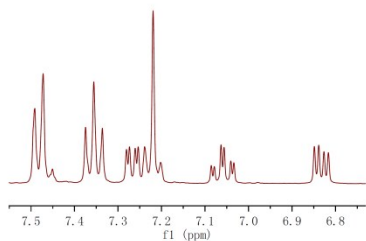
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149.731
149.651
46
133.873
128.933
128.532
128.525
128.525
124.939
121.719
121.637
118.268
118.252
115.785

80.286
86.259
86.255
77.476
77.100
76.842

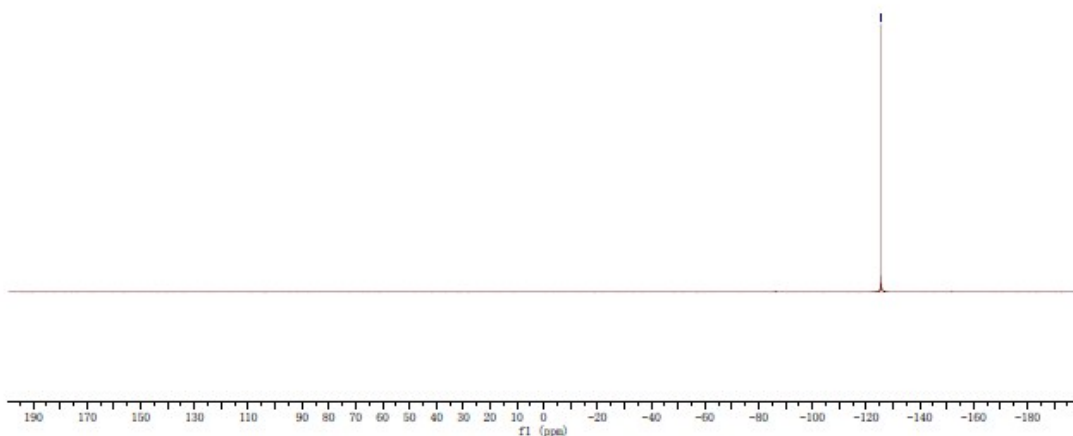
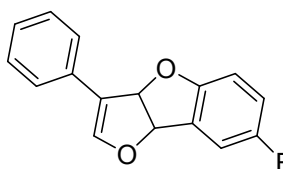


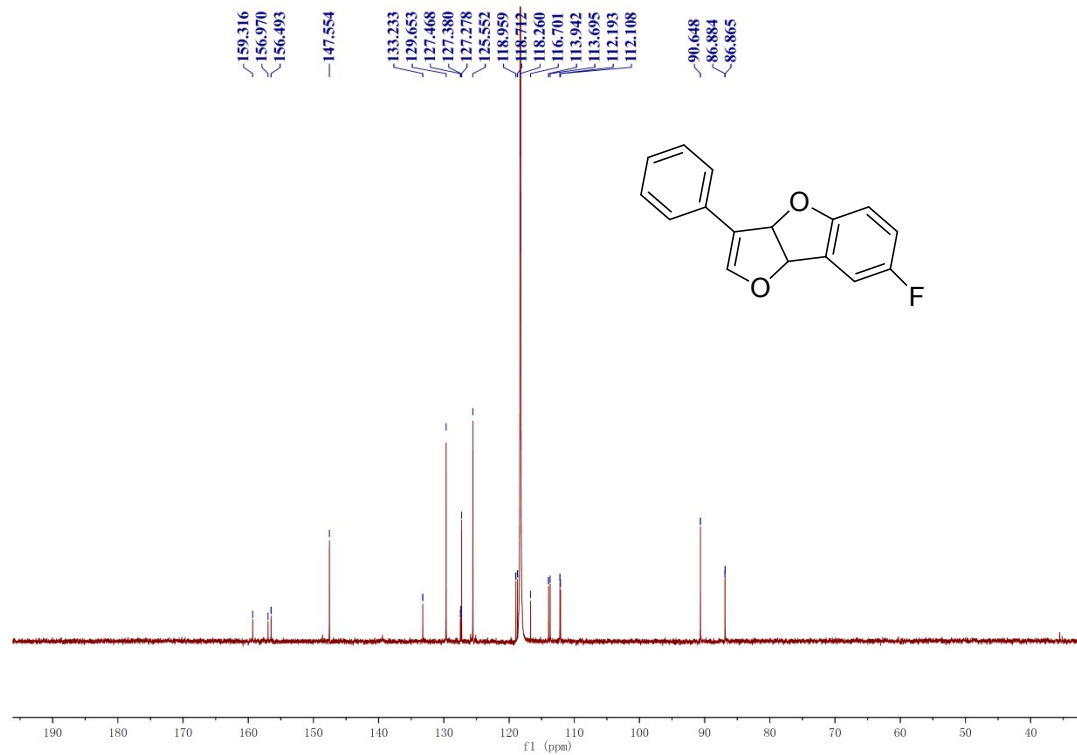
4g (CD₃CN)

7.491
7.472
7.451
7.375
7.356
7.336
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7.274
7.261
7.254
7.239
7.219
7.202
7.086
7.079
7.063
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7.034
6.849
6.839
6.827
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6.366
6.265
6.245

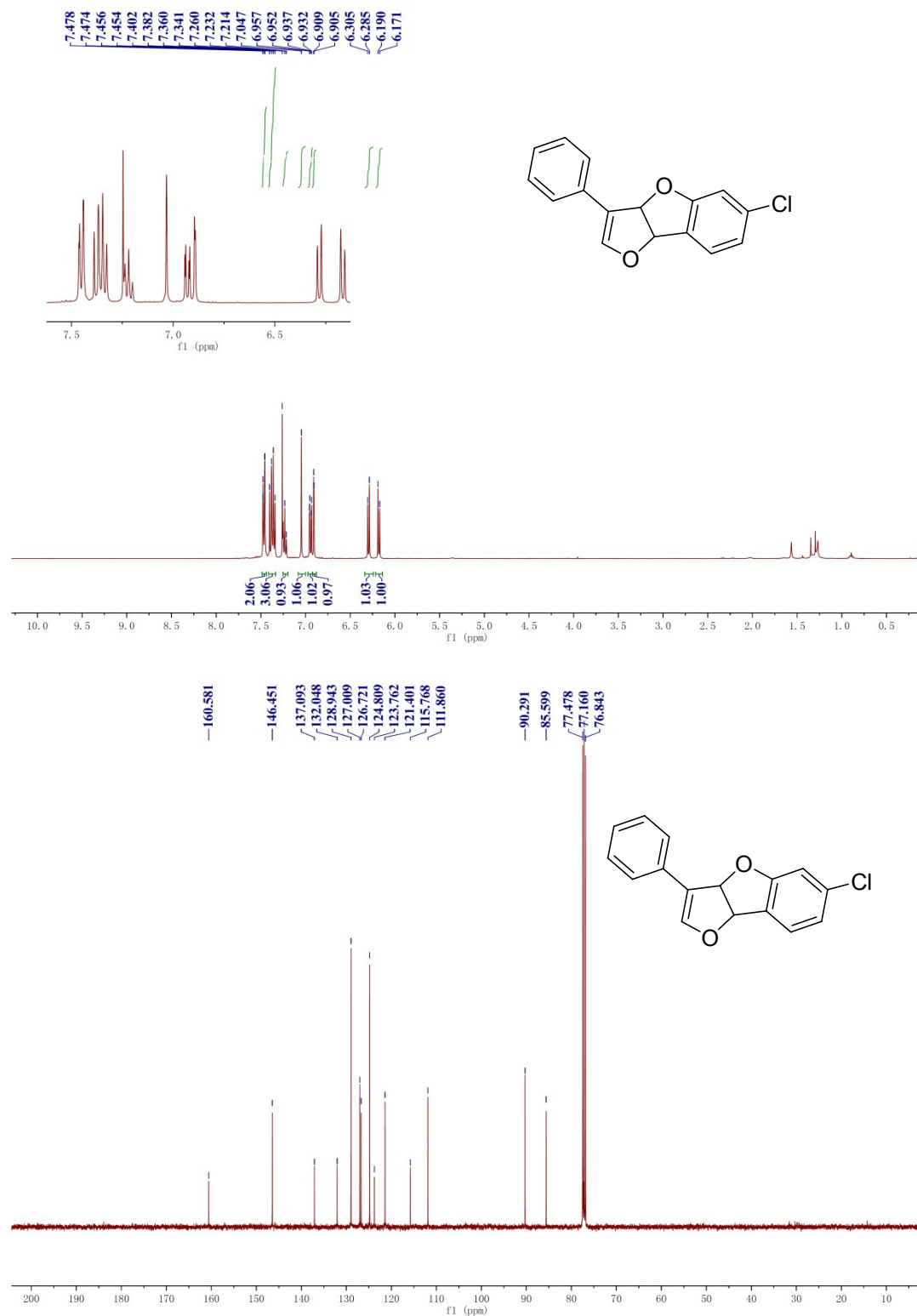


-125.523

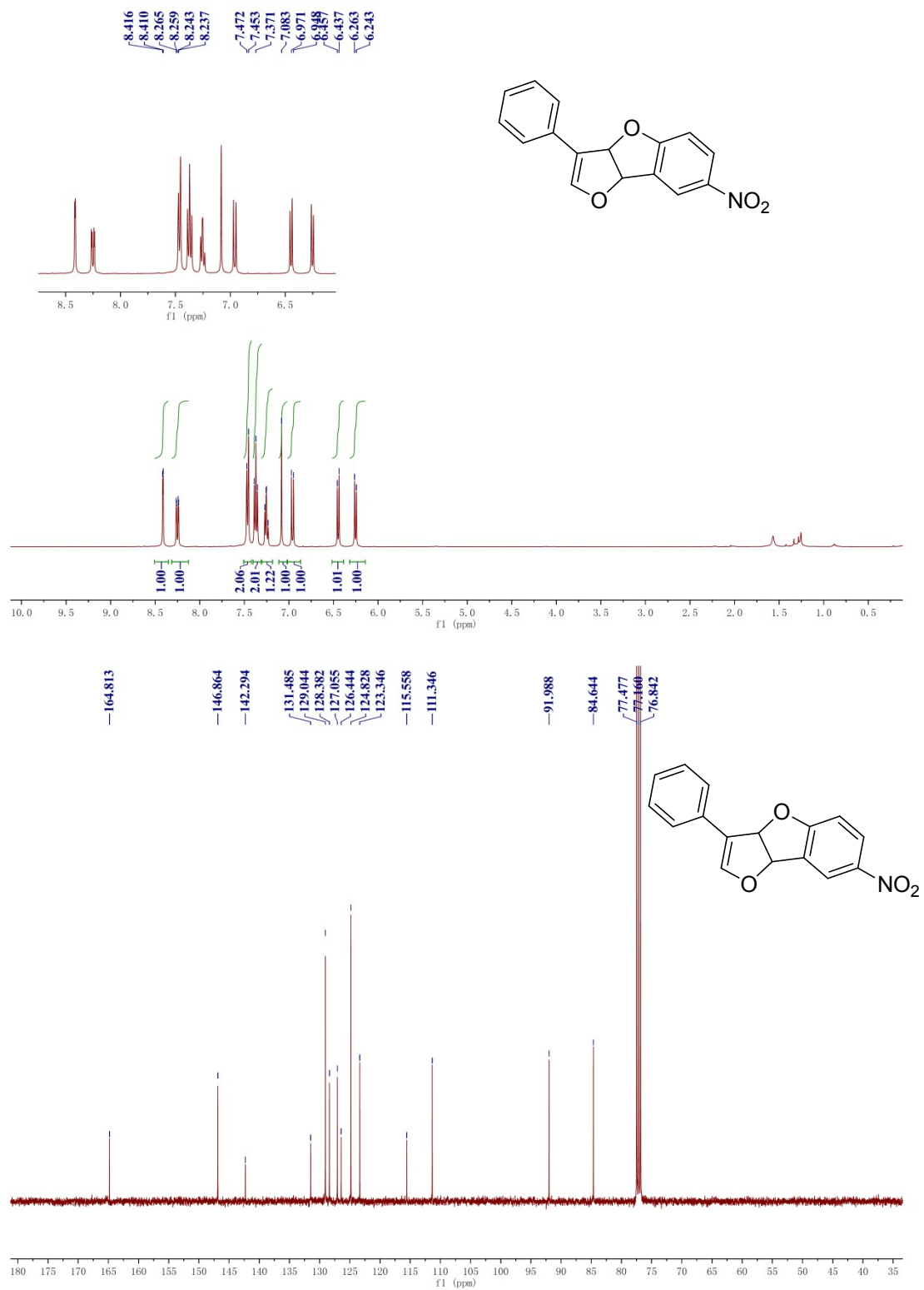




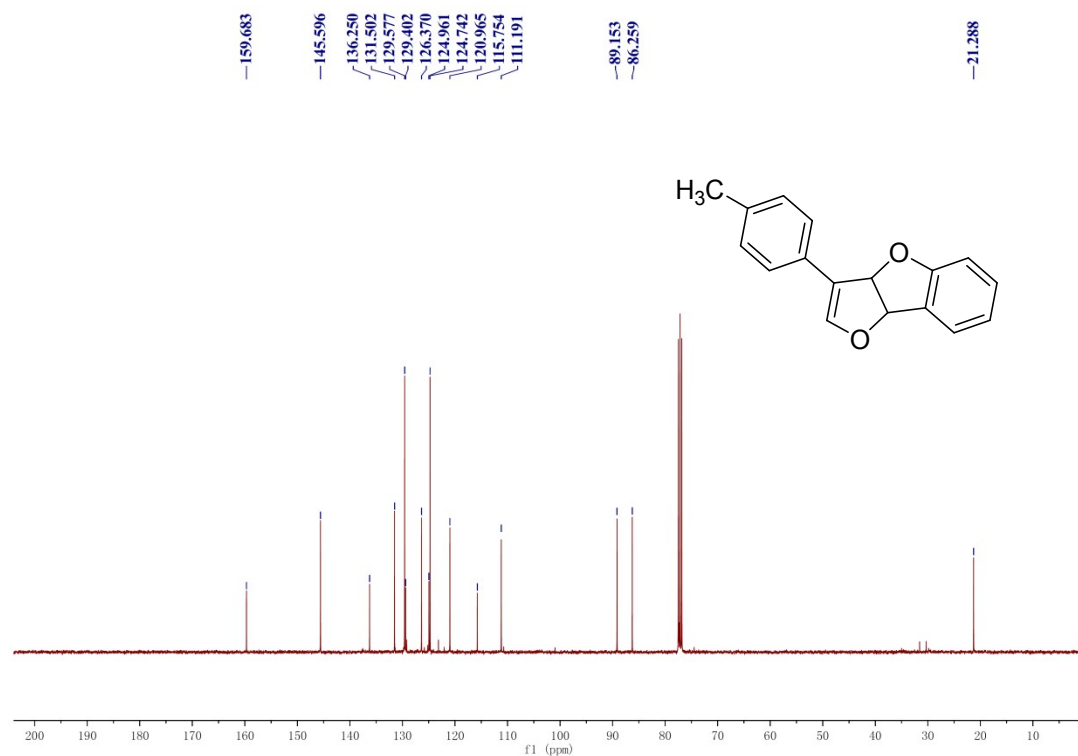
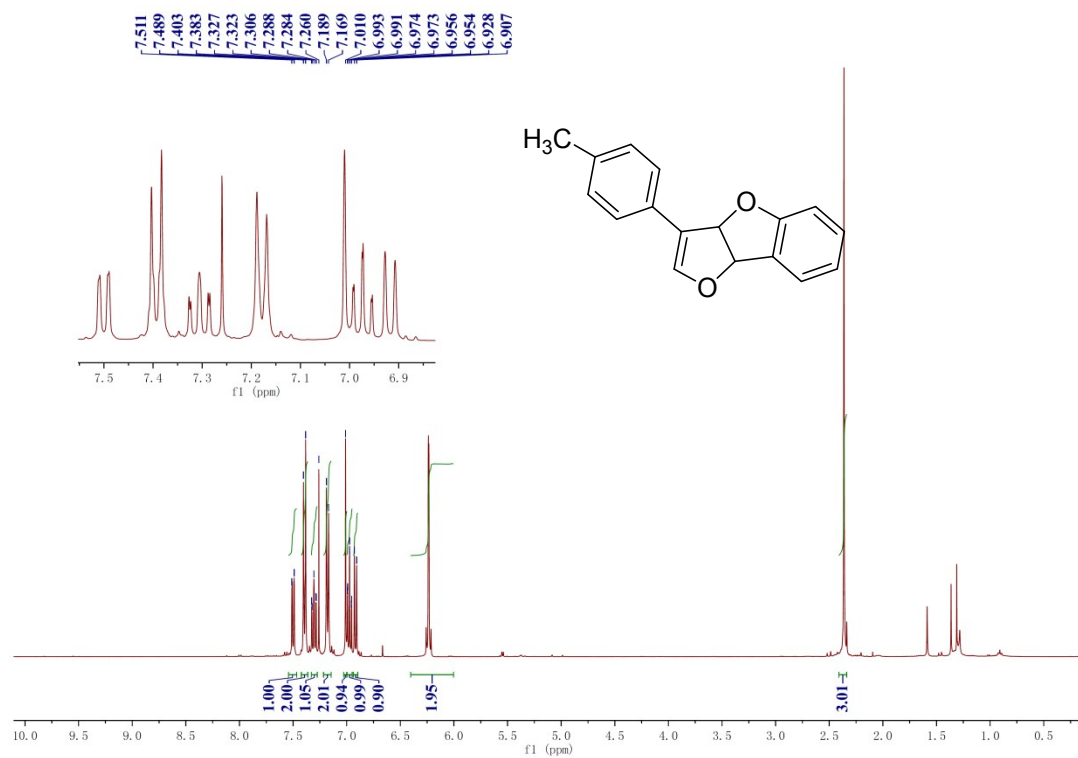
4h (CDCl₃)



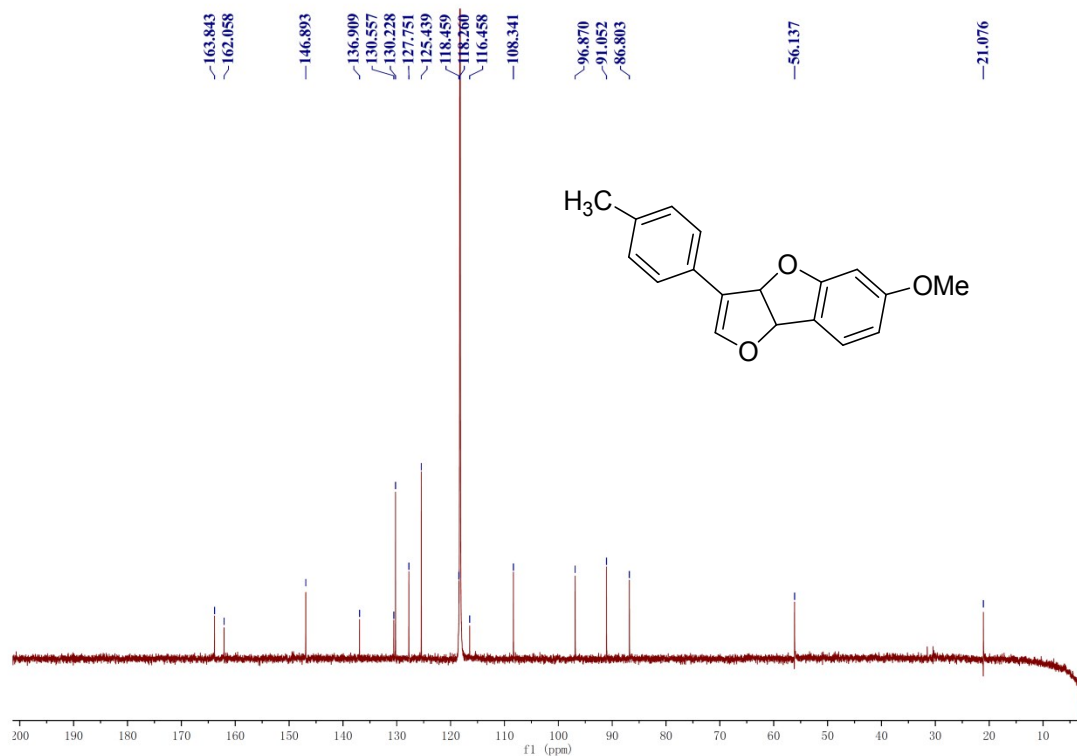
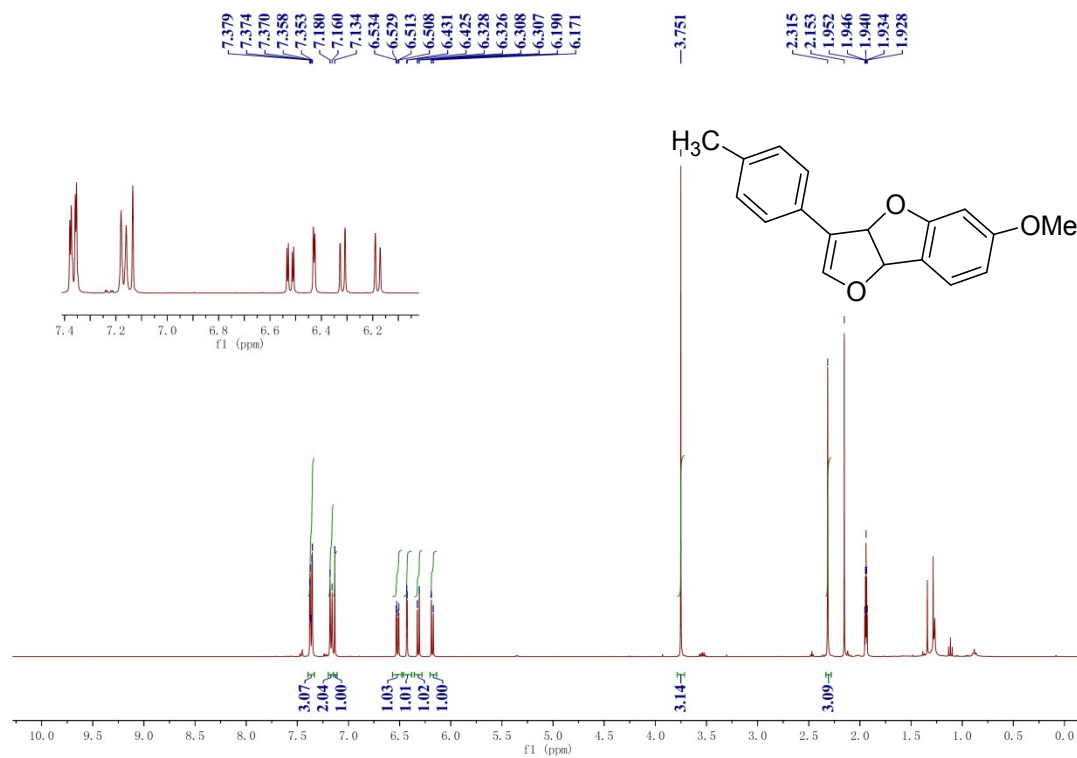
4j (CDCl₃)



4k (CDCl₃)



4I (CD₃CN)



4m (CD₃CN)

