

Supplementary Information

Au-catalyzed Cascade Addition/Cyclization/H-transfer Reactions of 3-(1-alkynyl)chromones to Construct 4*H*-Furo[3, 2-*c*]pyrans Scaffold†

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General information

Solvents were purified according to *Purification of Laboratory Chemicals* except as noted. Petroleum ether refers to the fraction with boiling point in the range 60–90 °C. All ^1H NMR and ^{13}C NMR spectra were measured with TMS as the internal standard on a 500, 400 or 300 MHz NMR spectrometer. Chemical shift are expressed in ppm and J value are given in Hz. High resolution mass spectra were recorded on a mass spectrometer (EI). Column chromatography was performed with 300–400 mesh silica gel using flash column techniques.

A typical procedure for Table 2

To the solution of the substrates **1** (0.30 mmol) in dichloromethane (3 mL) was added $(\text{PPh}_3)\text{AuCl}$ (0.003 mmol), AgOTf (0.003 mmol) and hydrogen source **3** (0.36 mmol, 1.2 eq). The mixture was stirred at room temperature for the corresponding time and then evaporated. The crude product was directly purified by column chromatography to afford the corresponding product **2**.

Characterization of the products

2-phenyl-4H-furo[3,2-c]chromene (**2a**)

White solid; Yield: 90%; mp 91-92 °C; ^1H NMR (400MHz, CDCl_3): δ = 7.78 – 7.67 (m, 2H), 7.48 (dd, J = 7.5, 1.7 Hz, 1H), 7.44 – 7.38 (m, 2H), 7.33 – 7.25 (m, 1H), 7.19 -7.07 (m, 1H), 7.02 – 6.94 (m, 1H), 6.93 – 6.86 (m, 1H), 6.54 (s, 1H), 5.41 (s, 2H); ^{13}C NMR (100MHz, CDCl_3): δ = 154.3, 152.9, 145.3, 130.4, 128.7, 128.4, 127.5, 123.6, 121.5, 119.4, 116.7, 116.1, 115.6, 103.2, 65.8; HRMS calcd for $\text{C}_{17}\text{H}_{12}\text{O}_2$: 248.0837, found: 248.0841.

2-(4-(trifluoromethyl)phenyl)-4H-furo[3,2-c]chromene (**2b**)

Colorless oil; Yield: 87% ^1H NMR (500MHz, CDCl_3): δ = 7.71 (d, J = 8.3 Hz, 2H), 7.57 (d, J = 8.4 Hz, 2H), 7.41 (dd, J = 7.5, 1.5 Hz, 1H), 7.08 (td, J = 7.8, 1.5 Hz, 1H), 6.92 (dt, J = 7.4, 3.7 Hz, 1H), 6.83 (d, J = 8.1 Hz, 1H), 6.57 (s, 1H), 5.33 (s, 2H); ^{13}C NMR (125MHz, CDCl_3): δ = 153.2, 152.8, 146.6, 133.5, 129.1 (q, J = 25.6 Hz), 129.0, 125.8 (q, J = 2.8 Hz), 124.2 (q, J = 215.2 Hz), 123.6, 121.6, 119.7, 116.4, 115.8, 105.2, 65.7; HRMS calcd for $\text{C}_{18}\text{H}_{11}\text{F}_3\text{O}_2$: 316.0711, found: 316.0715.

2-(4-methoxyphenyl)-4H-furo[3,2-c]chromene (**2c**)

Colorless oil; Yield: 84%; ^1H NMR (500MHz, CDCl_3): δ = 7.62 – 7.55 (m, 2H), 7.38 (dd, J = 7.5, 1.6 Hz, 1H), 7.03 (td, J = 7.9, 1.6 Hz, 1H), 6.93 – 6.86 (m, 3H), 6.80 (d, J = 8.1 Hz, 1H), 6.34 (s, 1H), 5.34 (s, 2H), 3.78 (s, 3H); ^{13}C NMR

(125MHz, CDCl₃): δ = 159.3, 154.6, 152.8, 144.7, 128.1, 125.2, 123.5, 121.5, 119.2, 116.9, 116.1, 115.7, 114.2, 101.7, 66.0, 55.4; HRMS calcd for C₁₈H₁₄O₃: 278.0943, found: 278.0944.

4-(4H-furo[3,2-c]chromen-2-yl)butanenitrile (**2d**)

Yellow oil; Yield: 81% ¹H NMR (500MHz, CDCl₃): δ = 7.31 (dd, J = 7.5, 1.6 Hz, 1H), 7.11 – 7.04 (m, 1H), 6.91 (t, J = 7.5 Hz, 1H), 6.84 (d, J = 8.1 Hz, 1H), 5.98 (s, 1H), 5.33 (s, 2H), 2.90 – 2.80 (m, 2H), 2.40 (t, J = 7.1 Hz, 2H), 2.04 (p, J = 7.1 Hz, 2H); ¹³C NMR (125MHz, CDCl₃): δ = 154.1, 152.6, 144.9, 128.2, 121.4, 119.2, 119.1, 116.9, 116.1, 114.2, 105.0, 65.9, 26.9, 24.1, 16.4; HRMS calcd for C₁₅H₁₃NO₂: 239.0946, found: 239.0950.

2-(tert-butyl)-4H-furo[3,2-c]chromene (**2e**)

Colorless oil; Yield: 71%; ¹H NMR (300MHz, CDCl₃): δ = 7.35 (d, J = 8.0 Hz, 1H), 7.10 – 7.01 (m, 1H), 6.95 – 6.87 (m, 1H), 6.83 (d, J = 8.0 Hz, 1H), 5.87 (s, 1H), 5.34 (s, 2H), 1.33 (s, 9H). ¹³C NMR (125MHz, CDCl₃): δ = 165.3, 152.5, 143.8, 127.7, 121.3, 119.0, 117.3, 115.9, 114.0, 100.6, 66.2, 33.0, 29.1; HRMS calcd for C₁₅H₁₆O₂: 228.1150, found: 228.1153.

8-chloro-2-phenyl-4H-furo[3,2-c]chromene (**2f**)

White solid; Yield: 72%; mp 121-123 °C; ¹H NMR (500MHz, CDCl₃): δ = 7.64 (d, J = 8.3 Hz, 2H), 7.38 – 7.32 (m, 3H), 7.24 (d, J = 7.4 Hz, 1H), 6.97 (dd, J = 8.6, 2.5 Hz, 1H), 6.72 (d, J = 8.6 Hz, 1H), 6.47 (s, 1H), 5.33 (s, 2H); ¹³C NMR (125MHz, CDCl₃): δ = 155.1, 151.3, 144.2, 130.1, 128.8, 127.9, 127.8, 126.5, 123.8, 119.2, 117.9, 117.4, 116.6, 103.2, 66.1; HRMS calcd for C₁₇H₁₁ClO₂: 282.0448, found: 282.0450.

8-methoxy-2-phenyl-4H-furo[3,2-c]chromene (**2g**)

White solid; Yield: 91%; mp 109-111 °C; ¹H NMR (500MHz, CDCl₃): δ = 7.67 – 7.63 (m, 2H), 7.37 – 7.32 (m, 2H), 7.25 – 7.21 (m, 1H), 6.96 (d, J = 3.0 Hz, 1H), 6.76 (d, J = 8.8 Hz, 1H), 6.61 (dd, J = 8.8, 3.0 Hz, 1H), 6.48 (s, 1H), 5.26 (s, 2H), 3.77 (s, 3H); ¹³C NMR (125MHz, CDCl₃): δ = 154.5, 154.5, 146.9, 145.6, 130.4, 128.8, 127.7, 123.8, 117.3, 116.9, 116.6, 113.8, 104.5, 103.4, 65.6, 55.9; HRMS calcd for C₁₈H₁₄O₃: 278.0943, found: 278.0944.

4-methyl-2-phenyl-4H-furo[3,2-c]chromene (**2h**)

Colorless oil; Yield: 88%; ¹H NMR (300MHz, CDCl₃): δ = 7.77 – 7.69 (m, 2H), 7.48 (dd, J = 7.4, 1.3 Hz, 1H), 7.45 - 7.37 (m, 2H), 7.33 – 7.24 (m, 1H), 7.16 – 7.09 (m, 1H), 7.00 – 6.93 (m, 1H), 6.90 (d, J = 8.0 Hz, 1H), 6.54 (s, 1H), 5.65 (q,

$J = 6.5$ Hz, 1H), 1.67 (d, $J = 6.5$ Hz, 3H); ^{13}C NMR (125MHz, CDCl_3): $\delta = 154.3, 152.7, 145.1, 130.5, 128.8, 128.4, 127.6, 123.7, 121.3, 120.6, 119.4, 116.5, 116.4, 103.1, 72.8, 22.0$; HRMS calcd for $\text{C}_{18}\text{H}_{14}\text{O}_2$: 262.0994, found: 262.0997.

4-ethyl-2-phenyl-4H-furo[3,2-c]chromene (**2i**)

Colorless oil; Yield: 80%; ^1H NMR (400MHz, CDCl_3): $\delta = 7.76 - 7.70$ (m, 2H), 7.49 (dd, $J = 7.5, 1.6$ Hz, 1H), 7.45 – 7.38 (m, 2H), 7.31- 7.27 (m, 1H), 7.13 (t, $J = 7.8$ Hz, 1H), 6.96 (t, $J = 7.5$ Hz, 1H), 6.91 (d, $J = 8.1$ Hz, 1H), 6.54 (s, 1H), 5.49 (t, $J = 5.8$ Hz, 1H), 2.02 – 1.92 (m, 2H), 1.10 (t, $J = 7.4$ Hz, 3H). ^{13}C NMR (125MHz, CDCl_3): $\delta = 154.2, 152.9, 145.4, 130.5, 128.8, 128.4, 127.6, 123.7, 121.1, 119.4, 119.2, 116.3, 116.3, 103.5, 77.6, 29.3, 9.1$; HRMS calcd for $\text{C}_{19}\text{H}_{16}\text{O}_2$: 276.1150, found: 276.1156.

2,4-diphenyl-4H-furo[3,2-c]chromene (**2j**)

Colorless oil; Yield: 52%; ^1H NMR (500MHz, CDCl_3): $\delta = 7.74 - 7.68$ (m, 2H), 7.58 (dd, $J = 7.5, 1.6$ Hz, 1H), 7.54 – 7.50 (m, 2H), 7.47 - 7.37 (m, 5H), 7.33 – 7.27 (m, 1H), 7.20 – 7.12 (m, 1H), 7.02 (td, $J = 7.5, 1.0$ Hz, 1H), 6.95 (d, $J = 8.1$ Hz, 1H), 6.54 (s, 1H), 6.40 (s, 1H); ^{13}C NMR (125MHz, CDCl_3): $\delta = 154.4, 152.6, 145.4, 140.4, 130.4, 128.9, 128.8, 128.7, 127.7, 127.5, 123.7, 121.5, 119.6, 118.8, 116.5, 116.2, 104.2, 78.7$; HRMS calcd for $\text{C}_{23}\text{H}_{16}\text{O}_2$: 324.1150, found: 324.1156.

2-phenyl-4-(4-(trifluoromethyl)phenyl)-4H-furo[3,2-c]chromene (**2k**)

Colorless oil; Yield: 61%; ^1H NMR (500MHz, CDCl_3): $\delta = 7.72 - 7.65$ (m, 4H), 7.61 (d, $J = 8.1$ Hz, 2H), 7.59 – 7.54 (m, 1H), 7.40 (t, $J = 7.7$ Hz, 2H), 7.29 (t, $J = 7.4$ Hz, 1H), 7.19 – 7.14 (m, 1H), 7.02 (t, $J = 7.5$ Hz, 1H), 6.93 (d, $J = 8.1$ Hz, 1H), 6.57 (s, 1H), 6.39 (s, 1H). ^{13}C NMR (125MHz, CDCl_3): $\delta = 154.7, 152.2, 145.3, 144.17, 130.8$ (q, $J = 32.5$), 130.1, 128.8, 128.8, 127.8, 127.6, 125.7 (d, $J = 3.75$), 124.0 (q, $J = 270.0$), 123.7, 121.8, 119.6, 117.9, 116.4, 116.0, 103.8, 77.7; HRMS calcd for $\text{C}_{24}\text{H}_{15}\text{F}_3\text{O}_2$: 392.1024, found: 392.1028.

4-(4-methoxyphenyl)-2-phenyl-4H-furo[3,2-c]chromene (**2l**)

Colorless oil; Yield: 50%; ^1H NMR (400MHz, CDCl_3): $\delta = 7.73 - 7.67$ (m, 2H), 7.55 (dd, $J = 7.5, 1.5$ Hz, 1H), 7.45 – 7.36 (m, 4H), 7.31 – 7.26 (m, 1H), 7.13 (td, $J = 7.9, 1.6$ Hz, 1H), 6.99 (t, $J = 7.5$ Hz, 1H), 6.96 – 6.87 (m, 3H), 6.49 (s, 1H), 6.39 (s, 1H), 3.82 (s, 3H). ^{13}C NMR (100MHz, CDCl_3): $\delta = 160.1, 154.4, 152.6, 145.6, 132.5, 130.4, 129.1, 128.8, 128.6, 127.6, 123.7, 121.4, 119.5, 118.8, 116.5, 116.2, 114.1, 104.3, 78.3, 55.4$; HRMS calcd for $\text{C}_{23}\text{H}_{16}\text{O}_2$: 354.1256, found: 354.1261.

4-methyl-2-(*p*-tolyl)-4H-furo[3,2-*c*]chromene (**2m**)

Colorless oil; Yield: 83%; ^1H NMR (500MHz, CDCl_3): δ = 7.61 (d, J = 8.1 Hz, 2H), 7.46 (dd, J = 7.5, 1.1 Hz, 1H), 7.21 (d, J = 8.0 Hz, 2H), 7.10 (td, J = 8.0, 1.5 Hz, 1H), 6.99 – 6.92 (m, 1H), 6.88 (d, J = 8.1 Hz, 1H), 6.48 (s, 1H), 5.64 (q, J = 6.5 Hz, 1H), 2.38 (s, 3H), 1.66 (d, J = 6.5 Hz, 3H); ^{13}C NMR (125MHz, CDCl_3): δ = 154.6, 152.6, 144.6, 137.5, 129.5, 128.2, 127.8, 123.7, 121.3, 120.6, 119.3, 116.6, 116.3, 102.4, 72.8, 22.0, 21.3; HRMS calcd for $\text{C}_{19}\text{H}_{16}\text{O}_2$: 276.1150, found: 276.1156.

2-(4-methoxyphenyl)-4-methyl-4H-furo[3,2-*c*]chromene (**2n**)

Colorless oil; Yield: 86%; ^1H NMR (500MHz, CDCl_3): δ = 7.67 – 7.62 (m, 2H), 7.45 (dd, J = 7.5, 1.5 Hz, 1H), 7.10 (td, J = 8.0, 1.6 Hz, 1H), 6.98 – 6.92 (m, 3H), 6.88 (d, J = 8.1 Hz, 1H), 6.40 (s, 1H), 5.63 (q, J = 6.5 Hz, 1H), 3.85 (s, 3H), 1.66 (d, J = 6.5 Hz, 3H); ^{13}C NMR (125MHz, CDCl_3): δ = 159.3, 154.4, 152.6, 144.3, 128.1, 125.2, 123.6, 121.3, 120.7, 119.2, 116.6, 116.3, 114.2, 101.6, 72.8, 55.4, 22.0; HRMS calcd for $\text{C}_{19}\text{H}_{16}\text{O}_3$: 292.1099, found: 292.1103.

2-(*tert*-butyl)-4-methyl-4H-furo[3,2-*c*]chromene (**2o**)

Colorless oil; Yield: 68%; ^1H NMR (500MHz, CDCl_3): δ = 7.34 (dd, J = 7.5, 1.6 Hz, 1H), 7.07 – 7.03 (m, 1H), 6.90 (td, J = 7.5, 1.1 Hz, 1H), 6.84 (d, J = 8.1 Hz, 1H), 5.85 (s, 1H), 5.56 (q, J = 6.5 Hz, 1H), 1.60 (d, J = 6.5 Hz, 3H), 1.32 (s, 9H); ^{13}C NMR (125MHz, CDCl_3): δ = 165.2, 152.3, 143.4, 127.6, 121.1, 118.9, 118.9, 117.0, 116.1, 100.3, 73.0, 33.0, 29.1, 22.0; HRMS calcd for $\text{C}_{16}\text{H}_{18}\text{O}_2$: 242.1307, found: 242.1310.

8-methoxy-4-methyl-2-phenyl-4H-furo[3,2-*c*]chromene (**2p**)

Yellow oil; Yield: 83%; ^1H NMR (500MHz, CDCl_3): δ = 7.72 (dd, J = 5.1, 3.4 Hz, 2H), 7.41 (dd, J = 10.7, 4.9 Hz, 2H), 7.30 – 7.26 (m, 1H), 7.03 (d, J = 3.0 Hz, 1H), 6.83 (d, J = 8.8 Hz, 1H), 6.67 (dd, J = 8.8, 3.0 Hz, 1H), 6.54 (s, 1H), 5.55 (q, J = 6.5 Hz, 1H), 3.83 (s, 3H), 1.64 (d, J = 6.5 Hz, 3H); ^{13}C NMR (125MHz, CDCl_3): δ = 154.4, 154.3, 146.6, 145.2, 130.4, 128.8, 127.6, 123.7, 121.5, 117.1, 117.0, 113.9, 104.5, 103.2, 72.4, 55.9, 21.6; HRMS calcd for $\text{C}_{19}\text{H}_{16}\text{O}_3$: 292.1099, found: 292.1101.

8-bromo-4-methyl-2-phenyl-4H-furo[3,2-*c*]chromene (**2q**)

Yellow oil; Yield: 77%; ^1H NMR (400MHz, CDCl_3): δ = 7.73 – 7.68 (m, 2H), 7.56 (d, J = 2.4 Hz, 1H), 7.44 – 7.38 (m, 2H), 7.34 – 7.26 (m, 1H), 7.18 (dd, J = 8.6, 2.4 Hz, 1H), 6.75 (d, J = 8.6 Hz, 1H), 6.52 (s, 1H), 5.63 (q, J = 6.5 Hz, 1H), 1.65 (d, J = 6.5 Hz, 3H); ^{13}C NMR (125MHz, CDCl_3): δ = 155.0, 151.6, 143.7,

130.8, 130.1, 128.8, 127.9, 123.8, 122.0, 121.5, 118.1, 113.5, 103.1, 73.1, 22.0; HRMS calcd for C₁₈H₁₃BrO₂: 340.0099, found: 340.0103.

8-chloro-4-methyl-2-(thiophen-3-yl)-4H-furo[3,2-c]chromene (**2r**)

White solid; Yield: 75%; mp 77-79 °C; ¹H NMR (400MHz, CDCl₃): δ = 7.55 (dd, *J* = 2.9, 1.2 Hz, 1H), 7.41 – 7.31 (m, 3H), 7.03 (dd, *J* = 8.6, 2.5 Hz, 1H), 6.79 (d, *J* = 8.6 Hz, 1H), 6.35 (s, 1H), 5.61 (q, *J* = 6.5 Hz, 1H), 1.64 (d, *J* = 6.5 Hz, 3H); ¹³C NMR (100MHz, CDCl₃): δ = 151.9, 151.0, 143.2, 131.8, 127.7, 126.5, 126.3, 124.5, 121.2, 119.6, 119.0, 117.5, 102.8, 73.0, 21.9; HRMS calcd for C₁₆H₁₁ClO₂S: 302.0168, found: 302.0171.

Methyl 4-(4H-furo[3,2-c]chromen-2-yl)benzoate (**2s**)

Yellow solid; Yield: 81%; mp 130-131 °C; ¹H NMR (300 MHz, CDCl₃) δ 8.05 (d, *J* = 8.7 Hz, 2H), 7.72 (d, *J* = 8.7 Hz, 2H), 7.47 (dd, *J* = 7.5, 1.6 Hz, 1H), 7.17 – 7.09 (m, 1H), 6.97 (td, *J* = 7.5, 1.1 Hz, 1H), 6.88 (dd, *J* = 8.1, 1.1 Hz, 1H), 6.64 (s, 1H), 5.39 (s, 2H), 3.92 (s, 3H) ppm; ¹³C NMR (100 MHz, CDCl₃) δ 166.83, 153.32, 146.69, 134.34, 130.27, 129.06, 128.69, 123.29, 121.72, 119.81, 116.42, 115.96, 105.59, 65.81, 52.26 ppm; HRMS calcd for C₁₉H₁₄O₄: 306.0892, found: 306.0888.

2-phenyl-4H-furo[3,2-c]chromen-7-ol (**2t**)

White solid; Yield: 87%; mp 143-144 °C; ¹H NMR (300 MHz, CDCl₃) δ 7.69 (d, *J* = 7.1 Hz, 2H), 7.39 (t, *J* = 7.6 Hz, 2H), 7.34 (d, *J* = 8.1 Hz, 1H), 7.26 (t, *J* = 8.1 Hz, 1H), 6.51 (s, 1H), 6.48 – 6.41 (m, 2H), 5.38 (s, 2H), 5.03 (s, 1H) ppm; ¹³C NMR (100 MHz, CDCl₃) δ 156.19, 154.60, 153.67, 145.69, 130.65, 128.86, 127.44, 123.60, 120.61, 113.32, 110.50, 108.59, 104.07, 103.33, 66.35 ppm; HRMS calcd for C₁₇H₁₂O₃: 264.0786, found: 264.0788.

2-phenyl-4,5,6,7-tetrahydrobenzofuran (**2u**)

Colorless oil; Yield: 61%; ¹H NMR (400MHz, CDCl₃): δ = 7.65 – 7.59 (m, 2H), 7.38 – 7.32 (m, 2H), 7.23 – 7.17 (m, 1H), 6.48 (s, 1H), 2.70 – 2.63 (m, 2H), 2.47 (m, 2H), 1.92 – 1.82 (m, 2H), 1.80 – 1.72 (m, 2H); ¹³C NMR (125MHz, CDCl₃): δ = 151.6, 150.8, 131.5, 128.6, 126.6, 123.3, 119.0, 106.0, 23.3, 23.2, 23.1, 22.2; HRMS calcd for C₁₄H₁₄O: 198.1045, found: 198.1050.

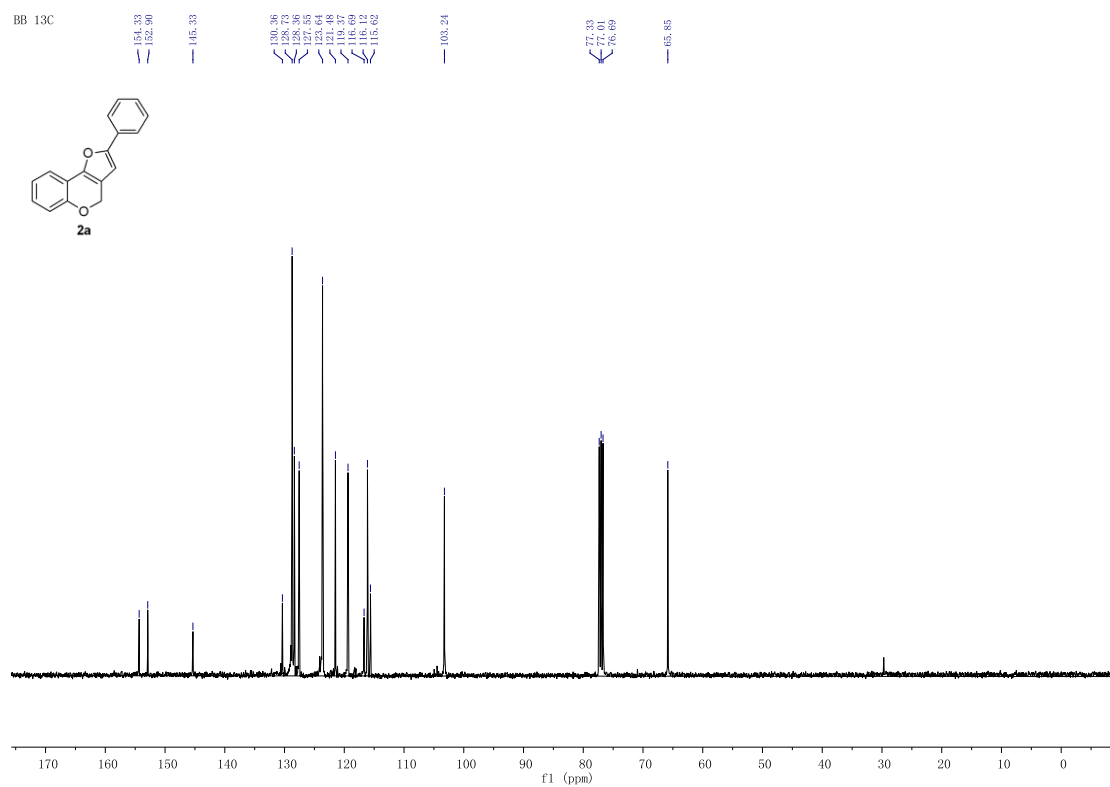
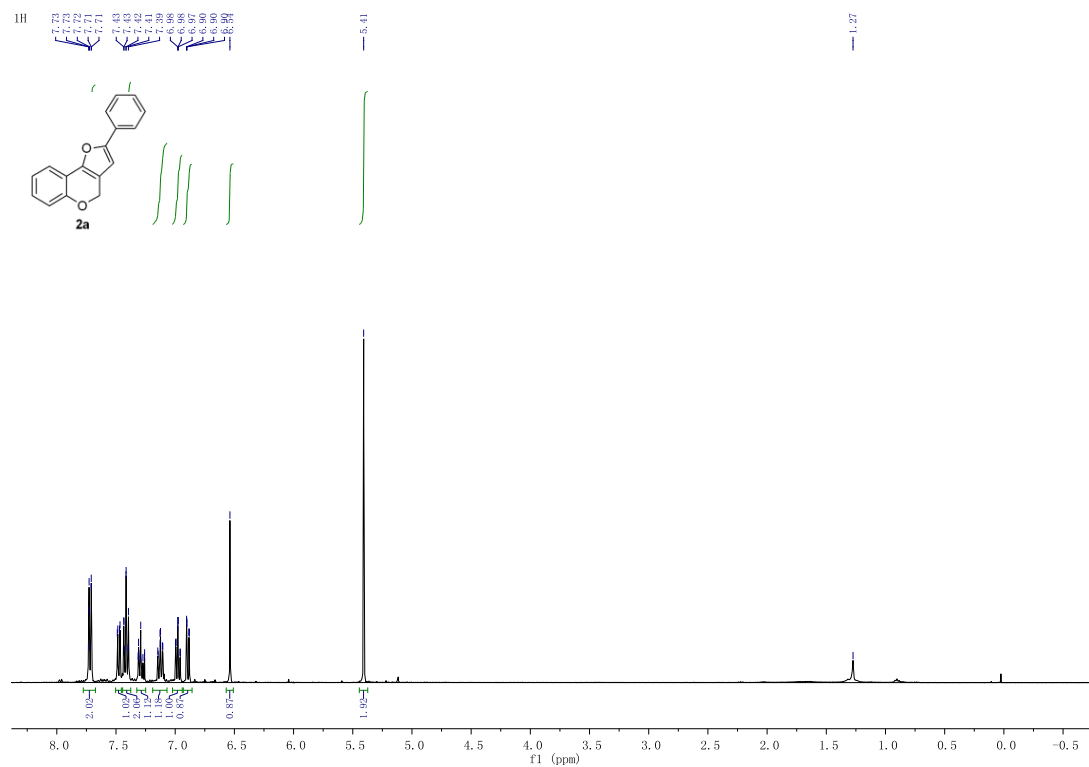
2-isopropyl-4H-furo[3,2-c]chromene (**2v**)

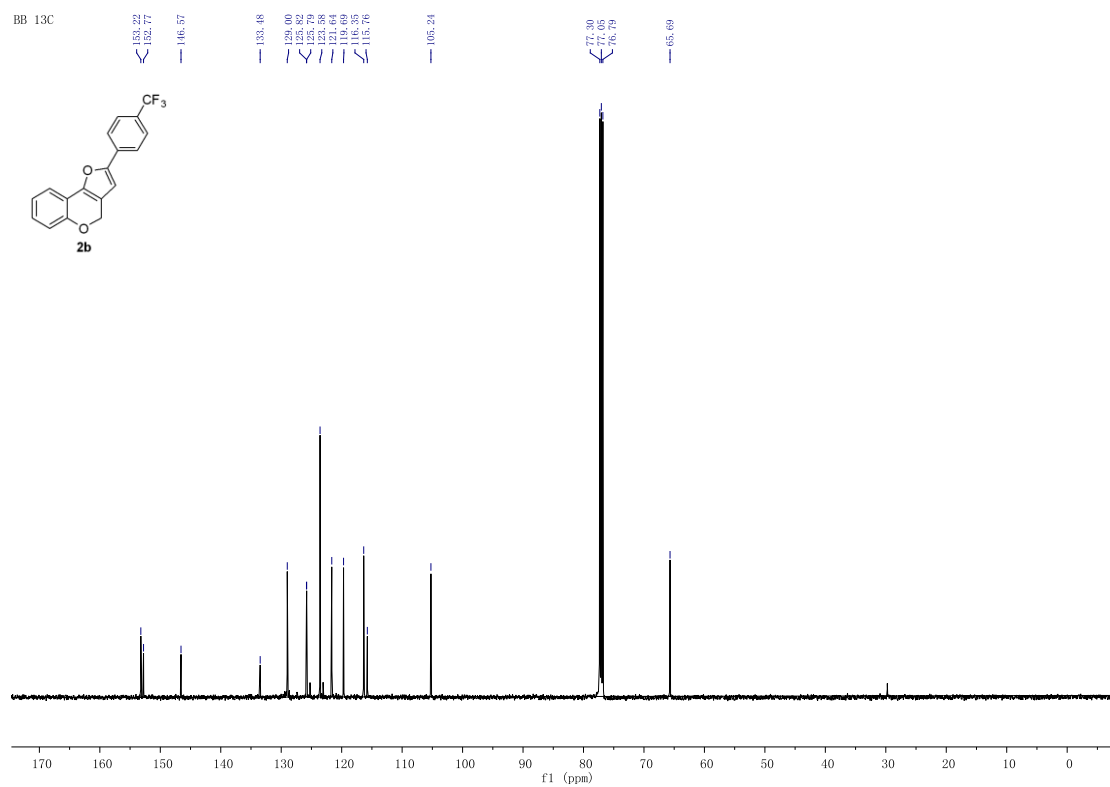
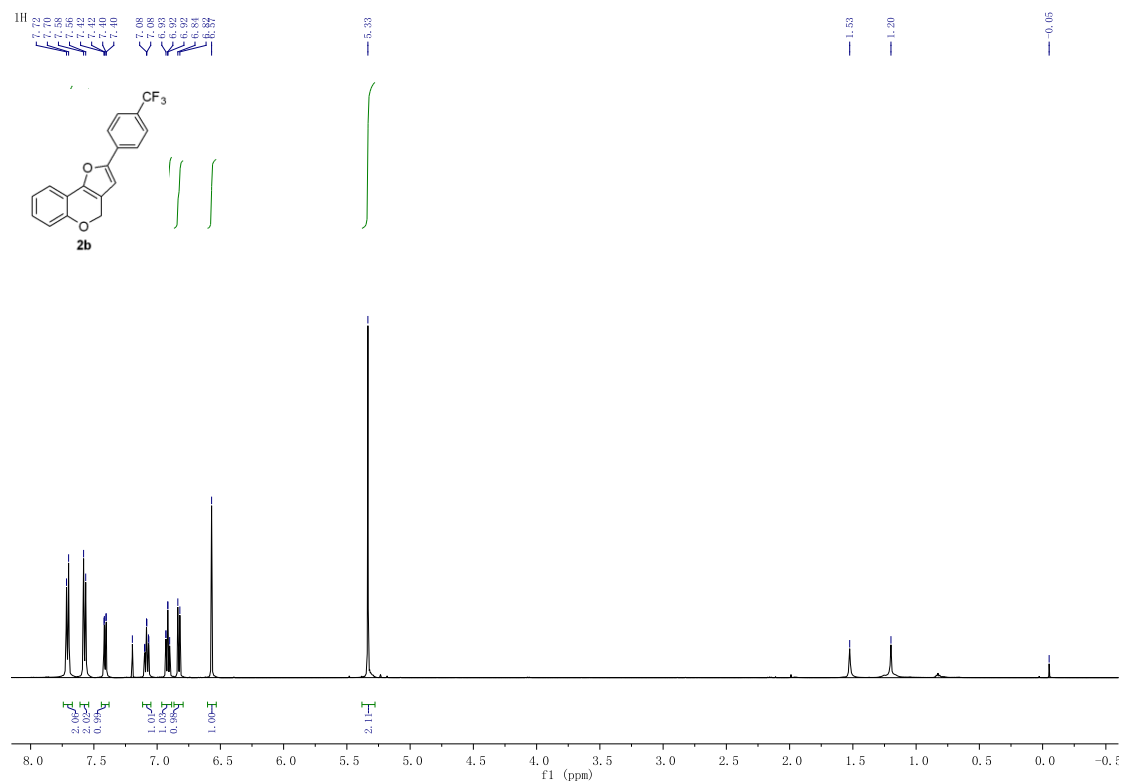
Colorless oil; Yield: 82%; ¹H NMR (500MHz, CDCl₃): δ = 7.34 (dd, *J* = 7.5, 1.4 Hz, 1H), 7.06 (td, *J* = 8.0, 1.5 Hz, 1H), 6.94 – 6.90 (m, 1H), 6.86 – 6.82 (m, 1H), 5.88 (s, 1H), 5.35 (s, 2H), 3.04 – 2.97 (m, 1H), 1.30 (d, *J* = 6.9 Hz, 6H); ¹³C

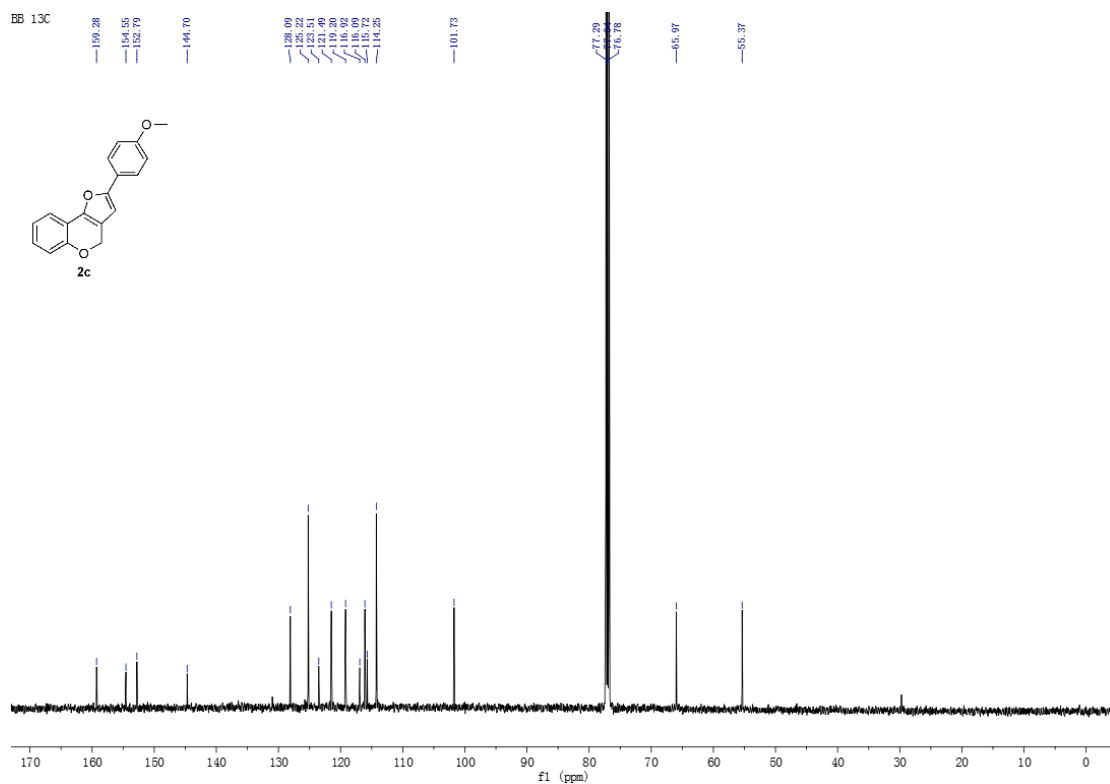
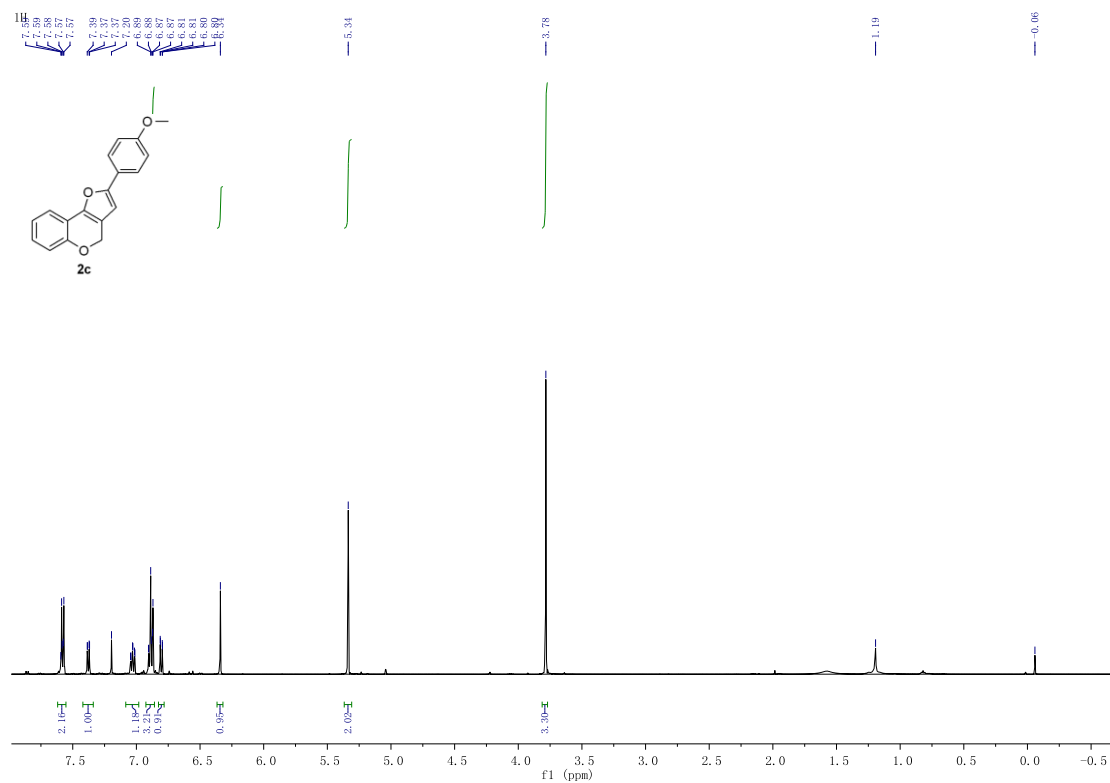
NMR (125MHz, CDCl₃): δ = 162.8, 152.5, 143.8, 127.7, 121.3, 118.9, 117.2, 115.9, 114.1, 101.3, 66.1, 28.1, 21.2; HRMS calcd for C₁₄H₁₄O₂: 214.0994, found: 214.0996.

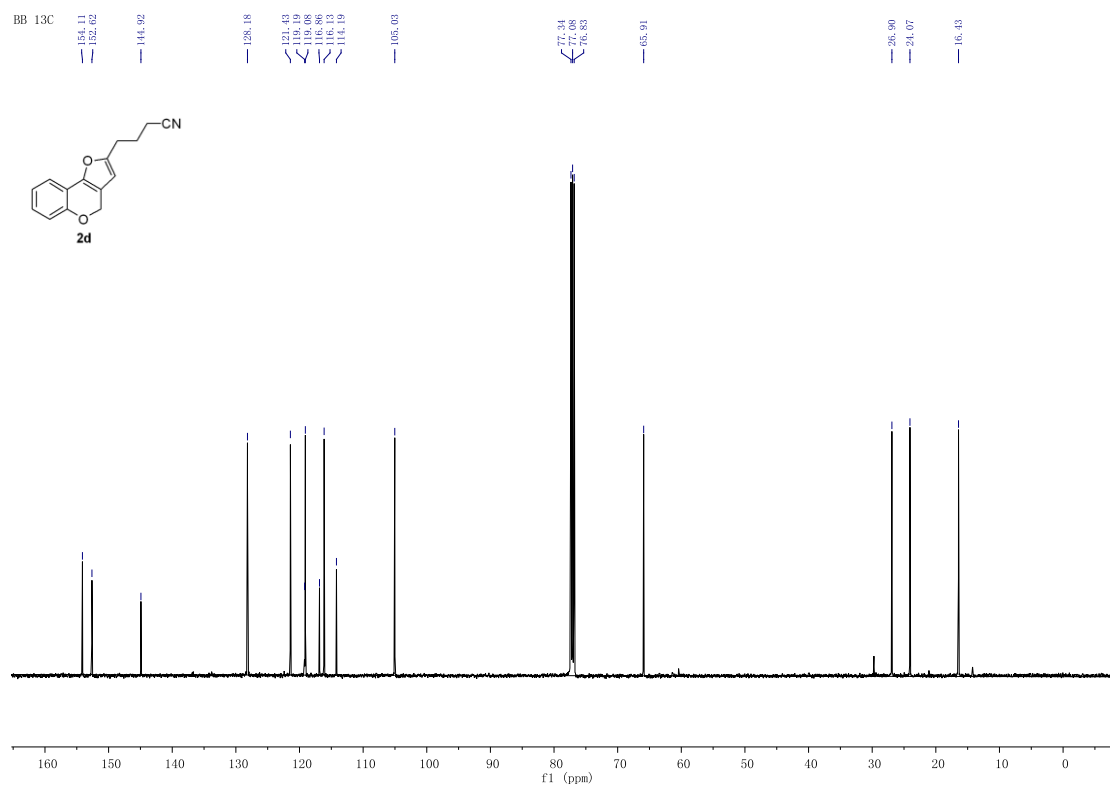
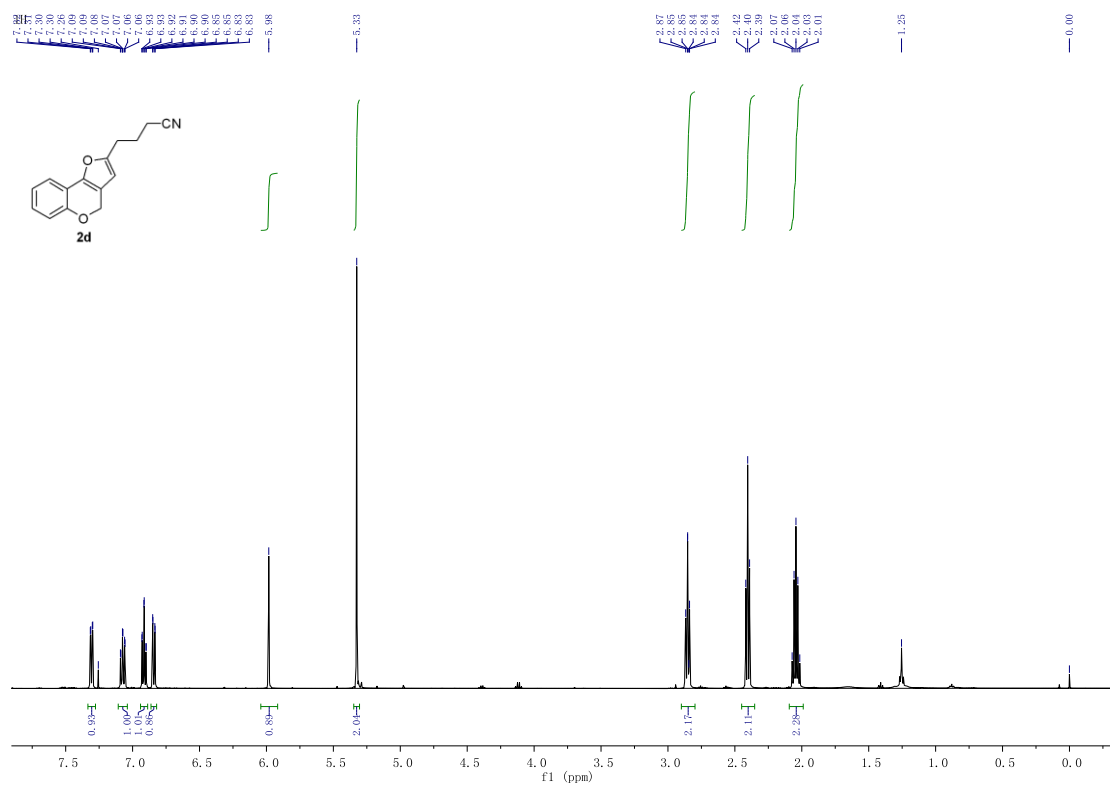
2-(2-hydroxyphenyl)-5-phenylfuran-3-carbaldehyde (**2w**)

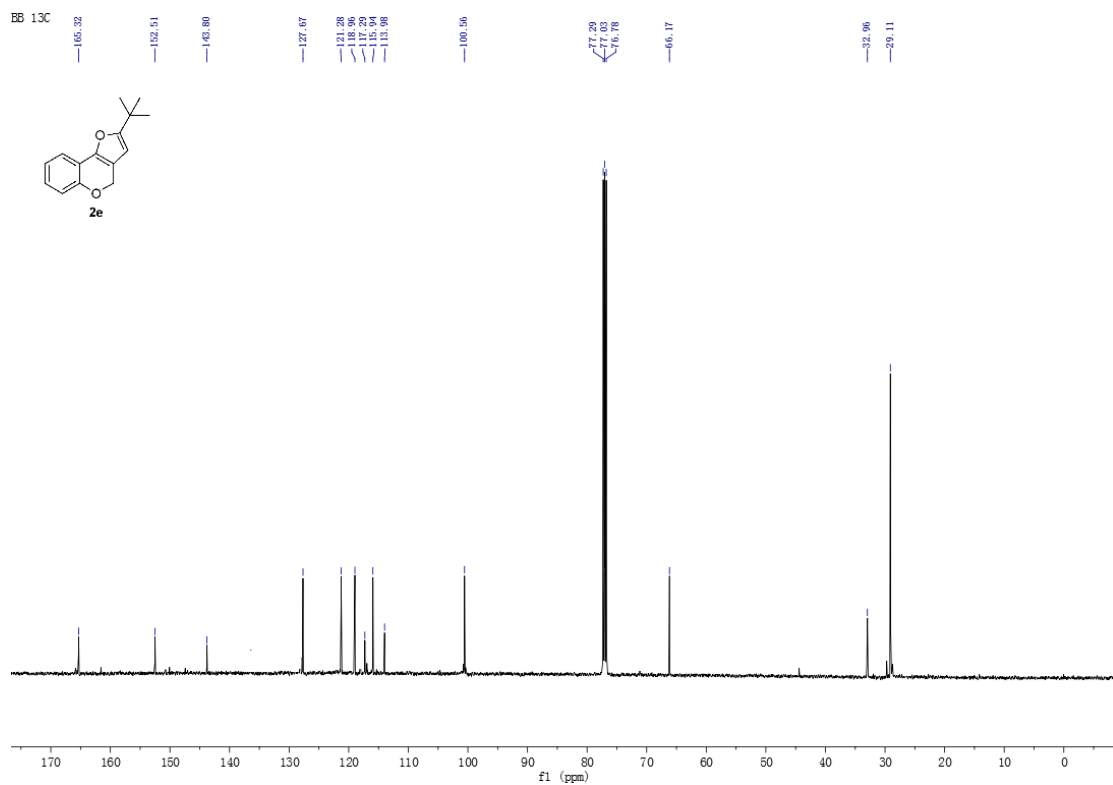
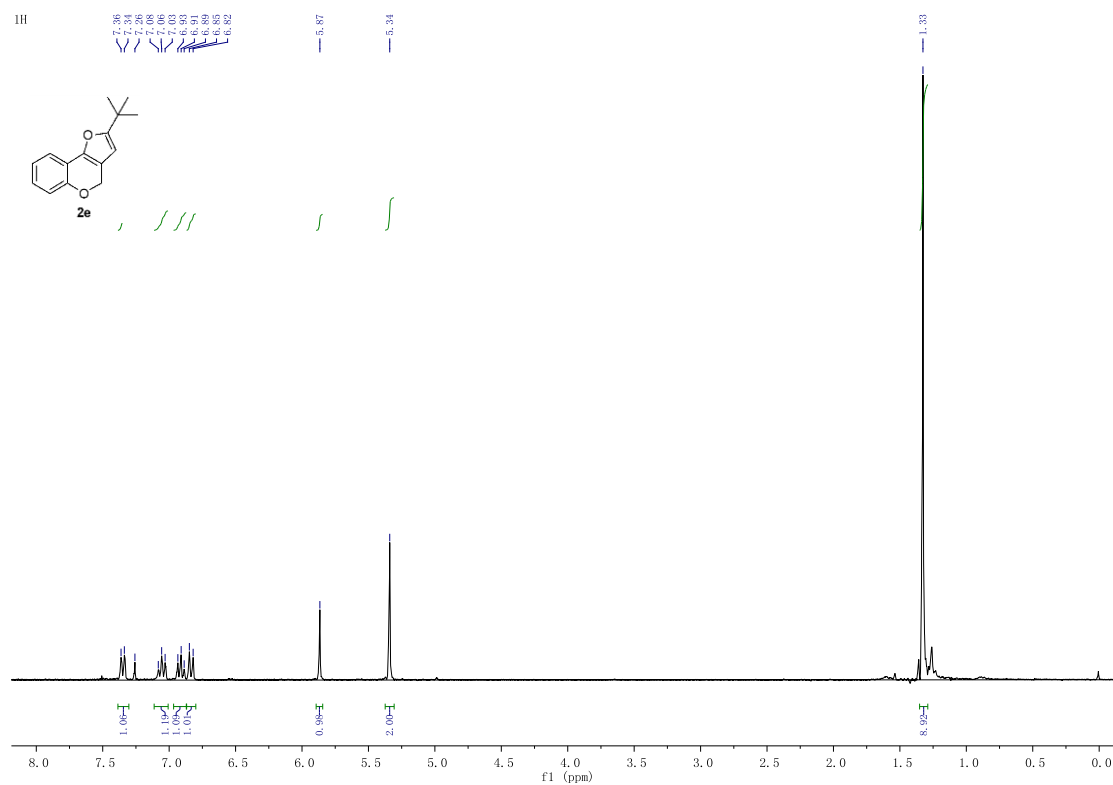
White solid; Yield: 72%; mp 131-133 °C; ¹H NMR (500MHz, DMSO-*d*₆): δ = 10.39 (s, 1H), 9.97 (s, 1H), 7.84 – 7.81 (m, 2H), 7.62 (dd, *J* = 8.2, 1.6 Hz, 1H), 7.47 (t, *J* = 7.7 Hz, 2H), 7.41 – 7.34 (m, 2H), 7.33 (s, 1H), 7.08 – 7.05 (m, 1H), 7.01 (t, *J* = 7.6 Hz, 1H); ¹³C NMR (125MHz, DMSO-*d*₆): δ = 187.2, 158.4, 155.5, 154.0, 132.3, 131.1, 129.6, 129.5, 128.9, 124.9, 124.4, 120.1, 117.0, 116.2, 104.1; HRMS calcd for C₁₇H₁₂O₃: 264.0786, found: 264.0790.

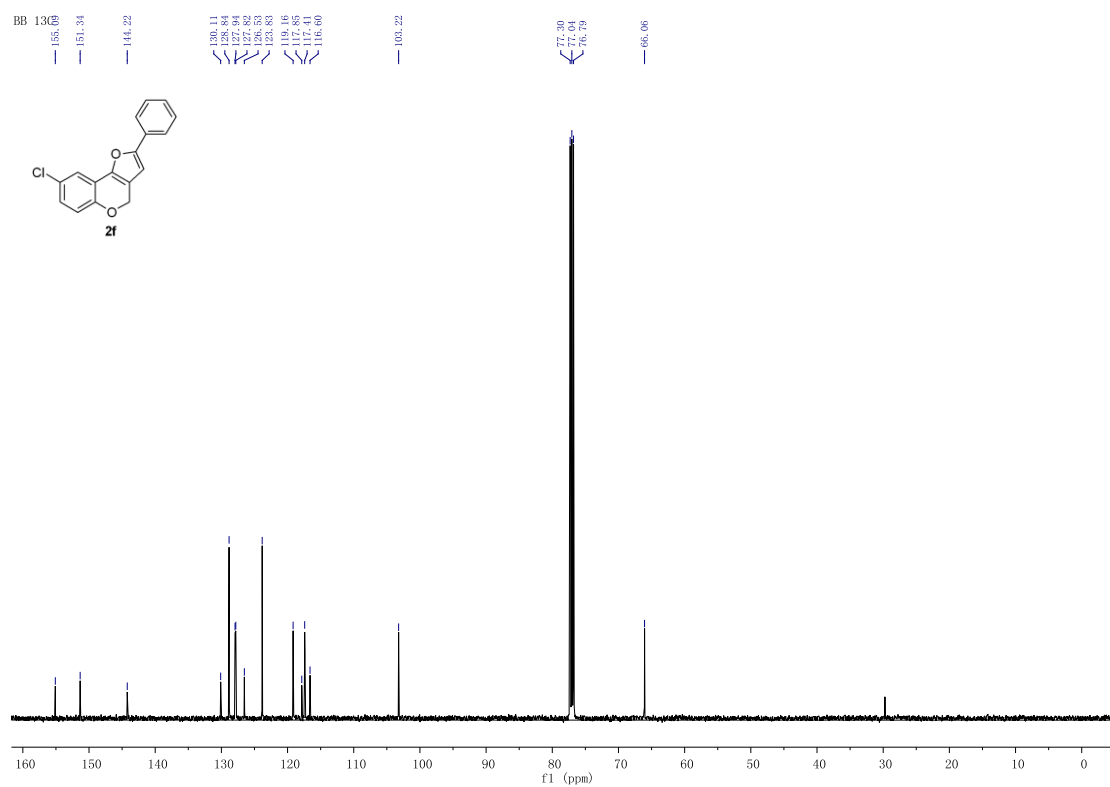
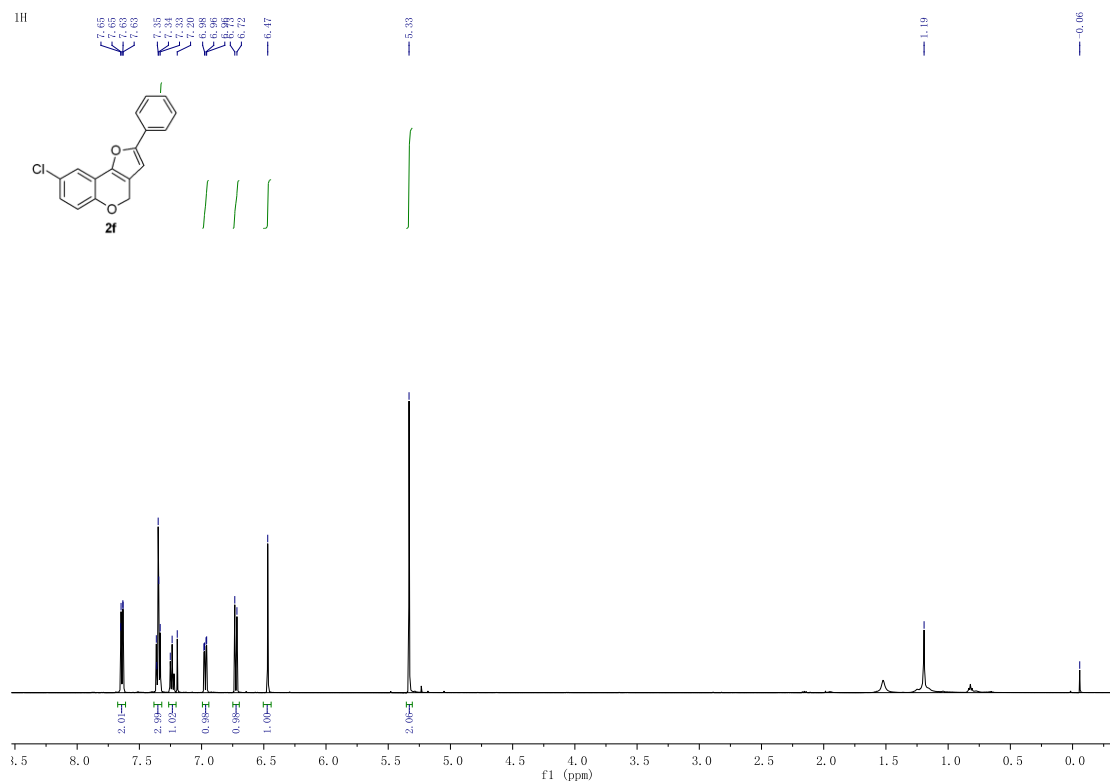


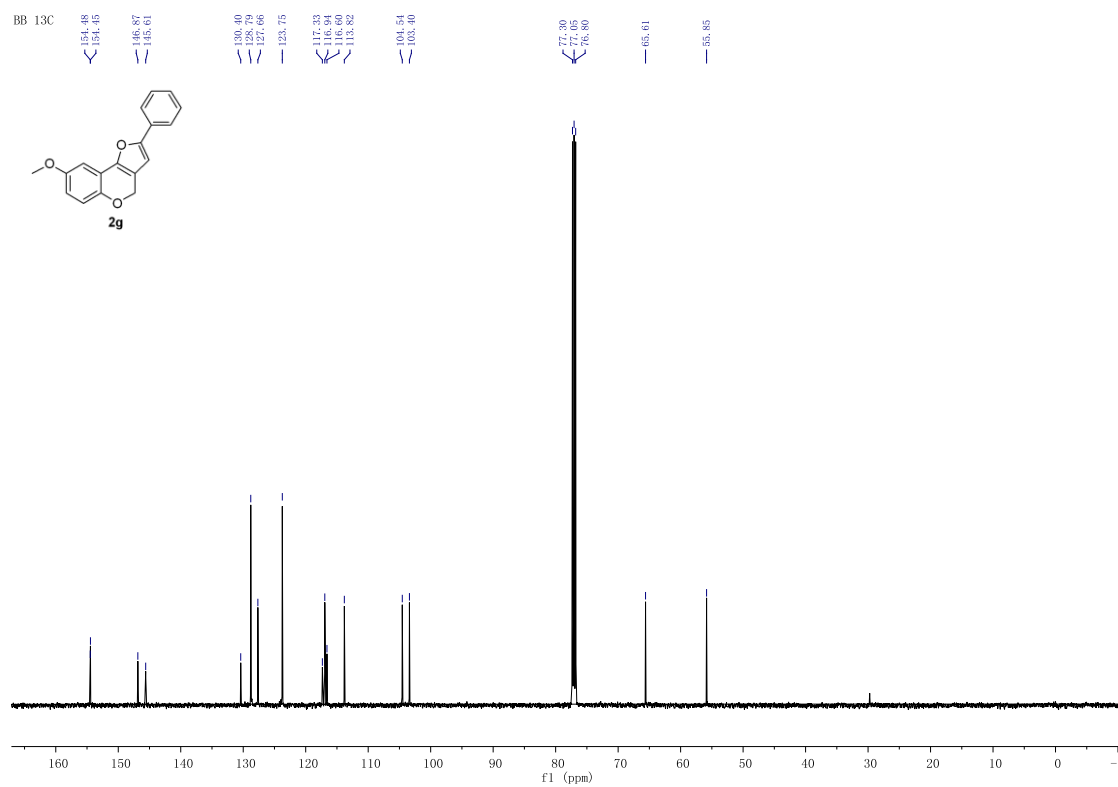
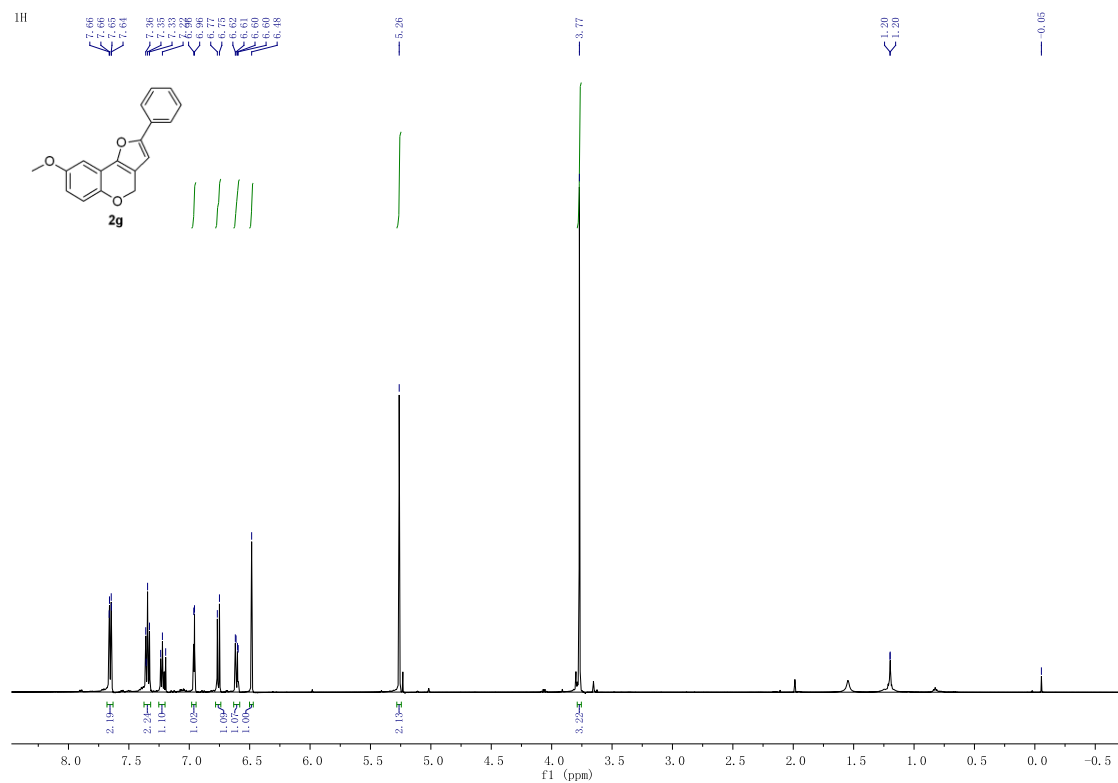






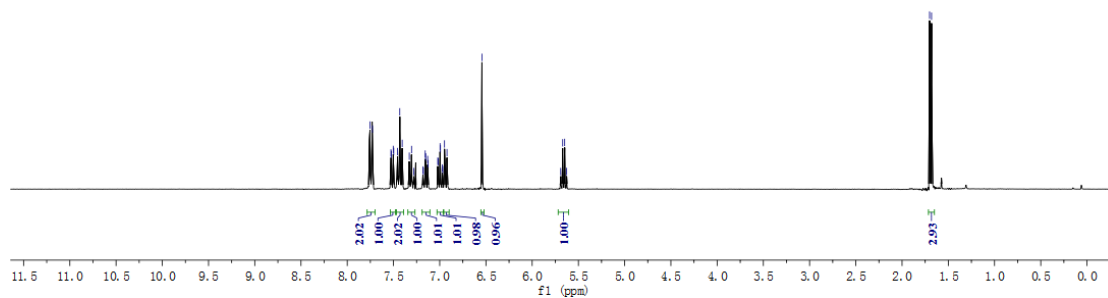
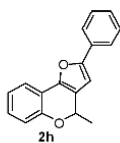






h1p91
STANDARD 1H OBSERVE

7.73
7.53
7.50
7.49
7.41
7.39
7.28
7.18
7.15
7.13
7.02
7.00
6.99
6.97
6.95
6.92
6.91
5.69
5.65
5.63



BB 13C

154.31
152.74
146.06

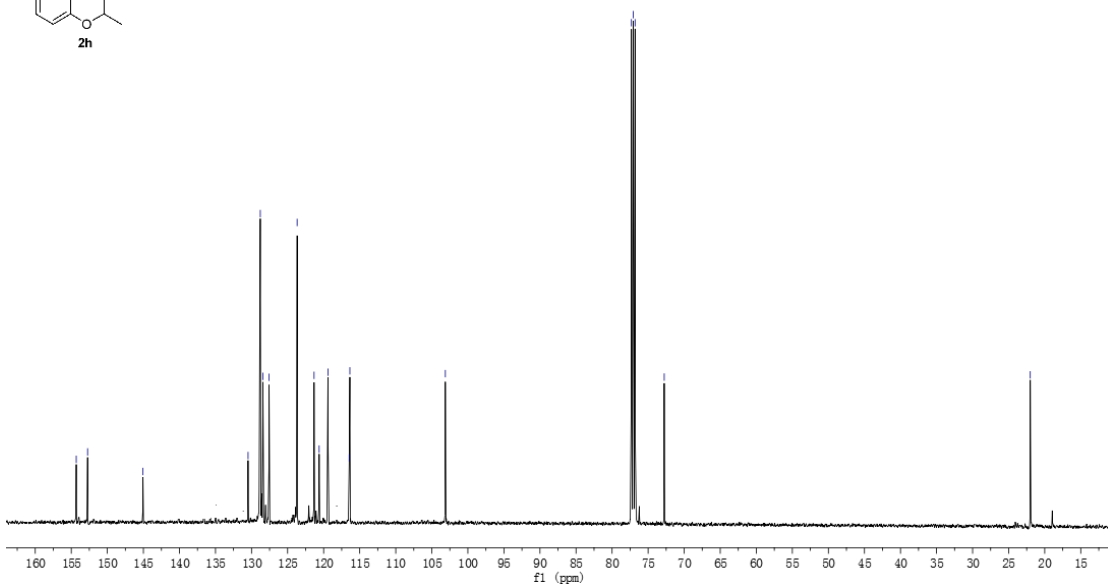
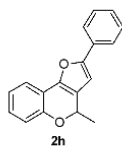
130.48
128.70
128.43
127.57

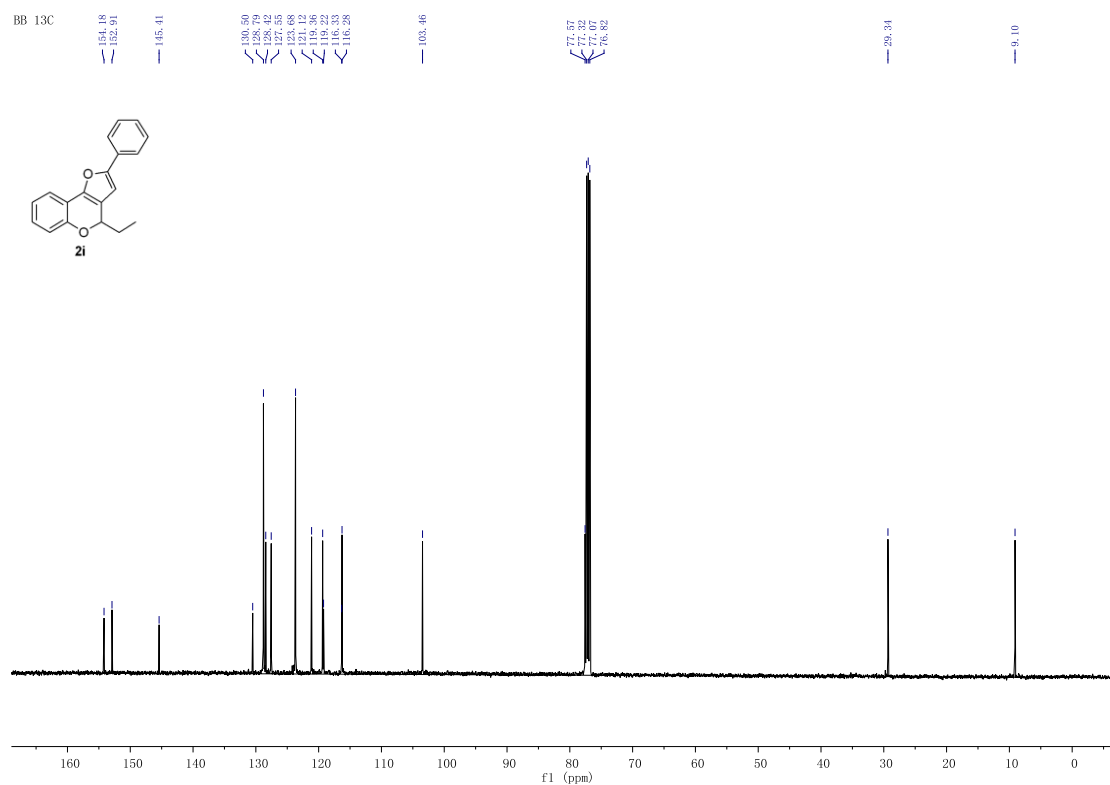
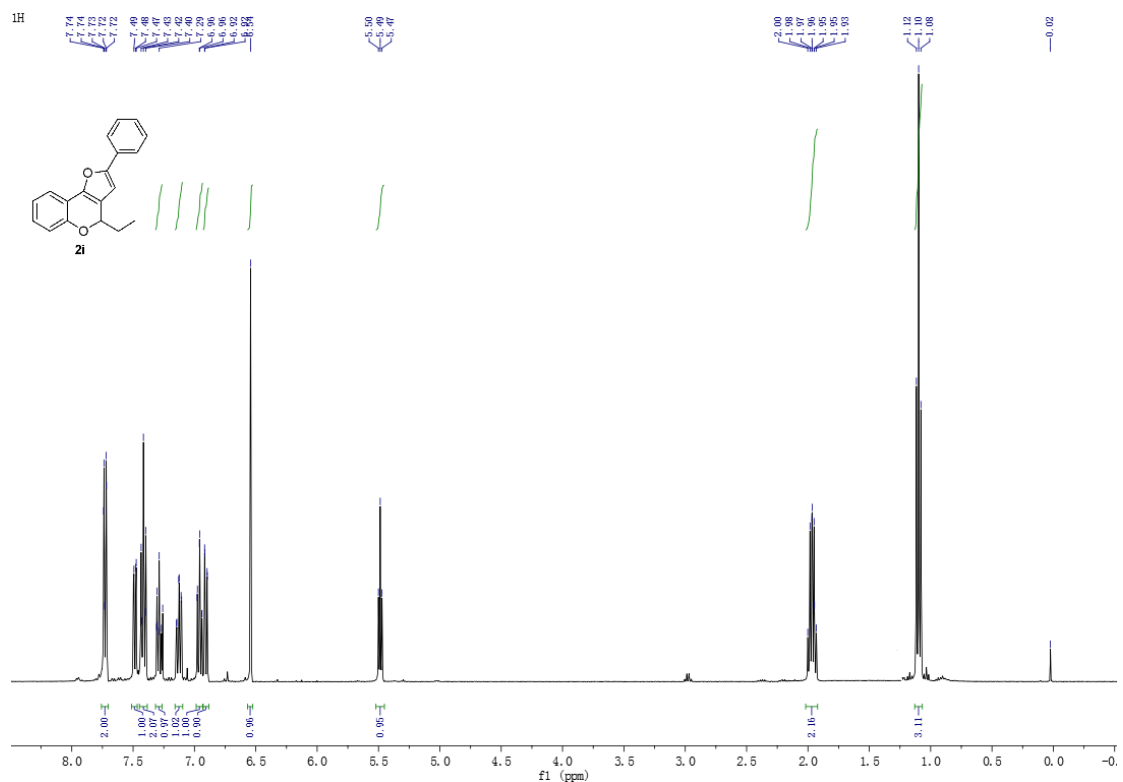
123.68
120.62
119.40
118.36

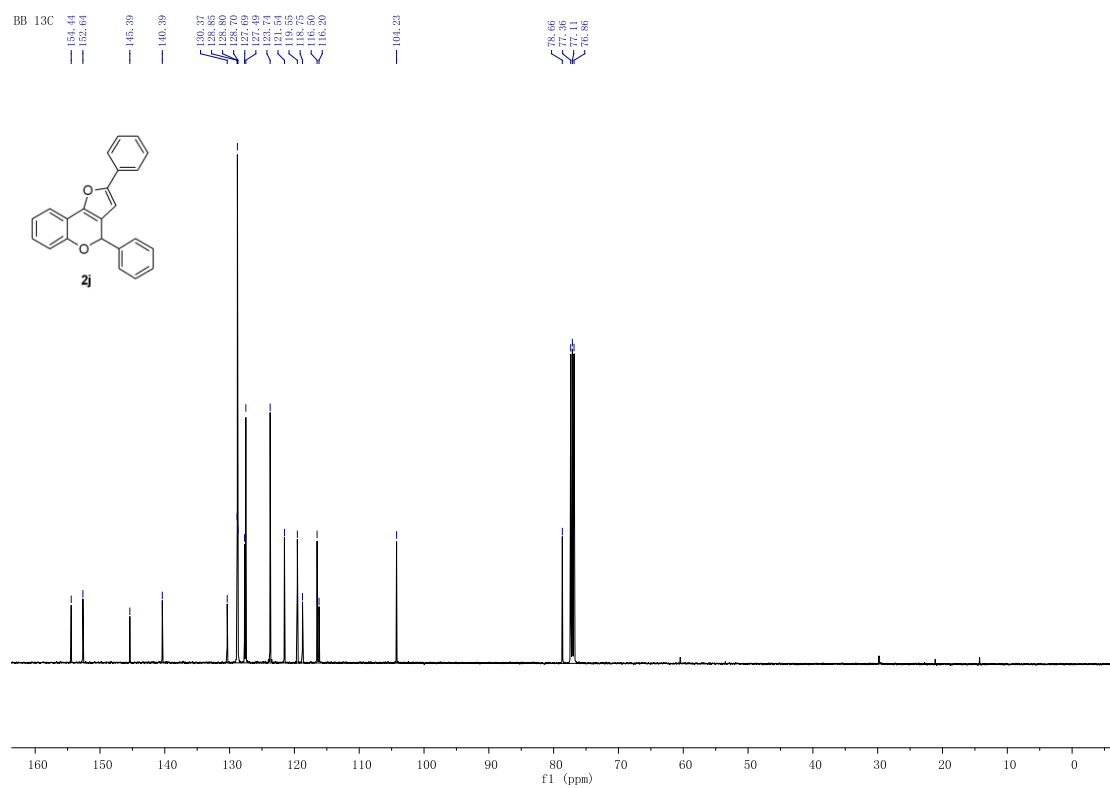
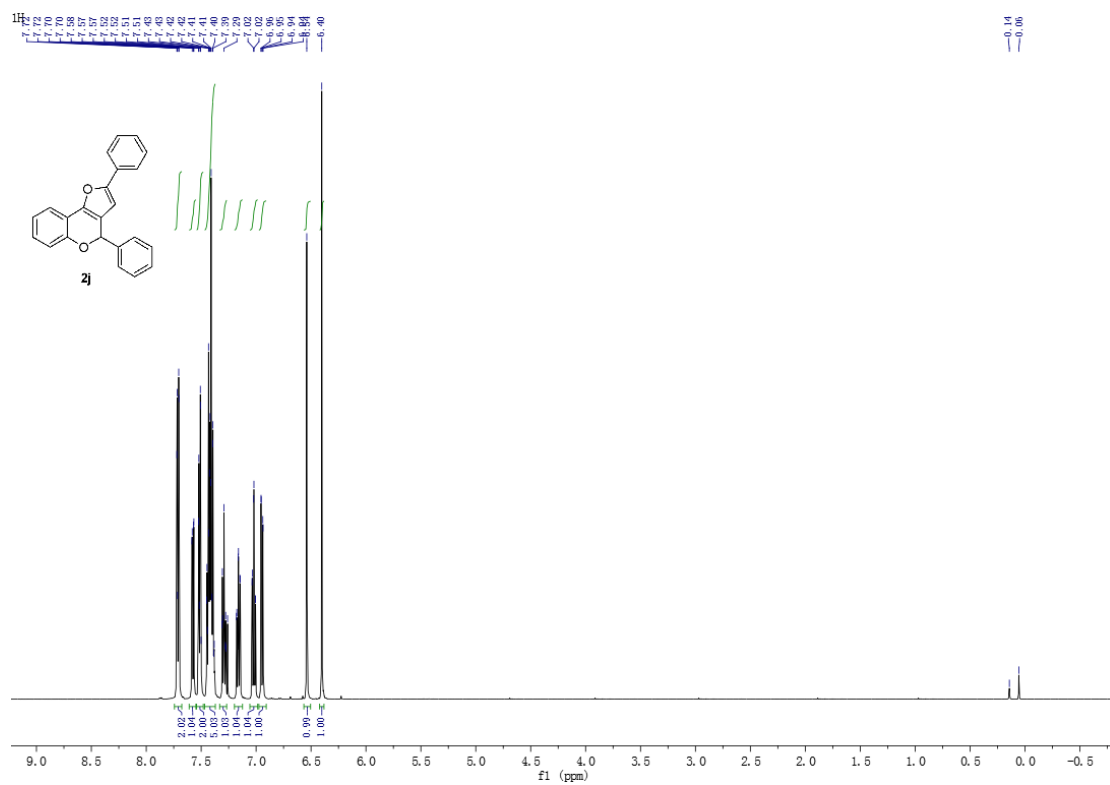
103.12

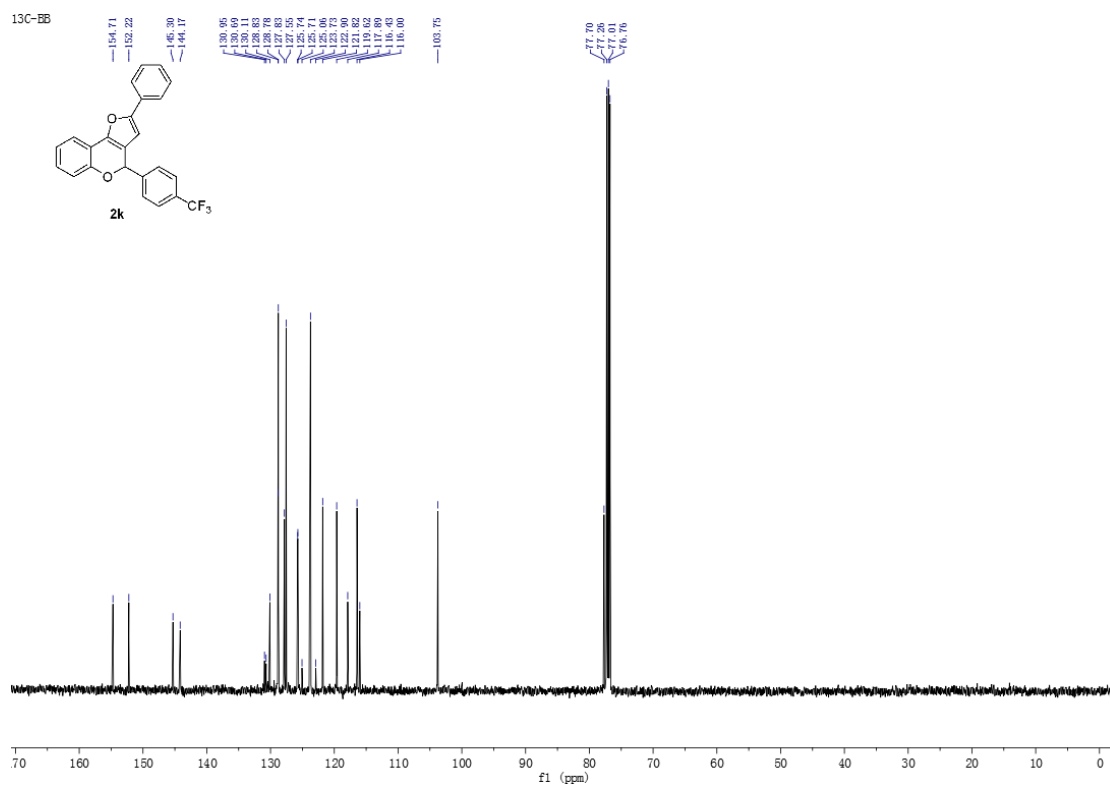
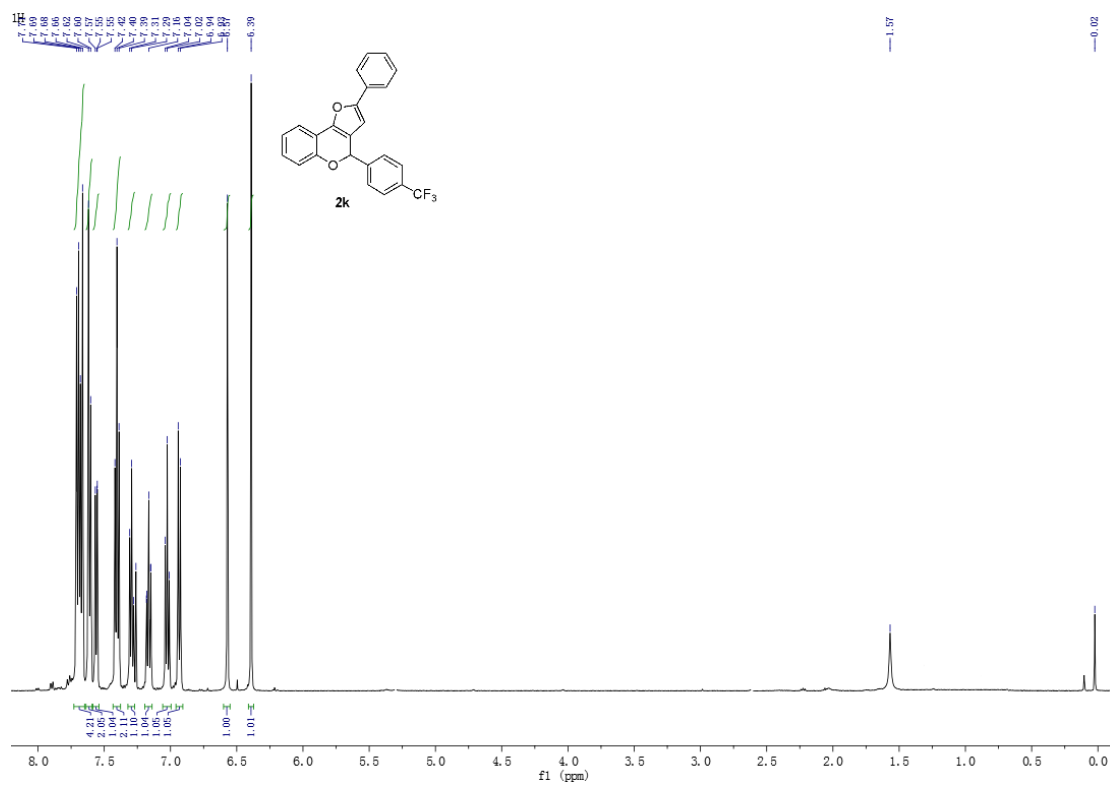
77.32
77.06
76.81

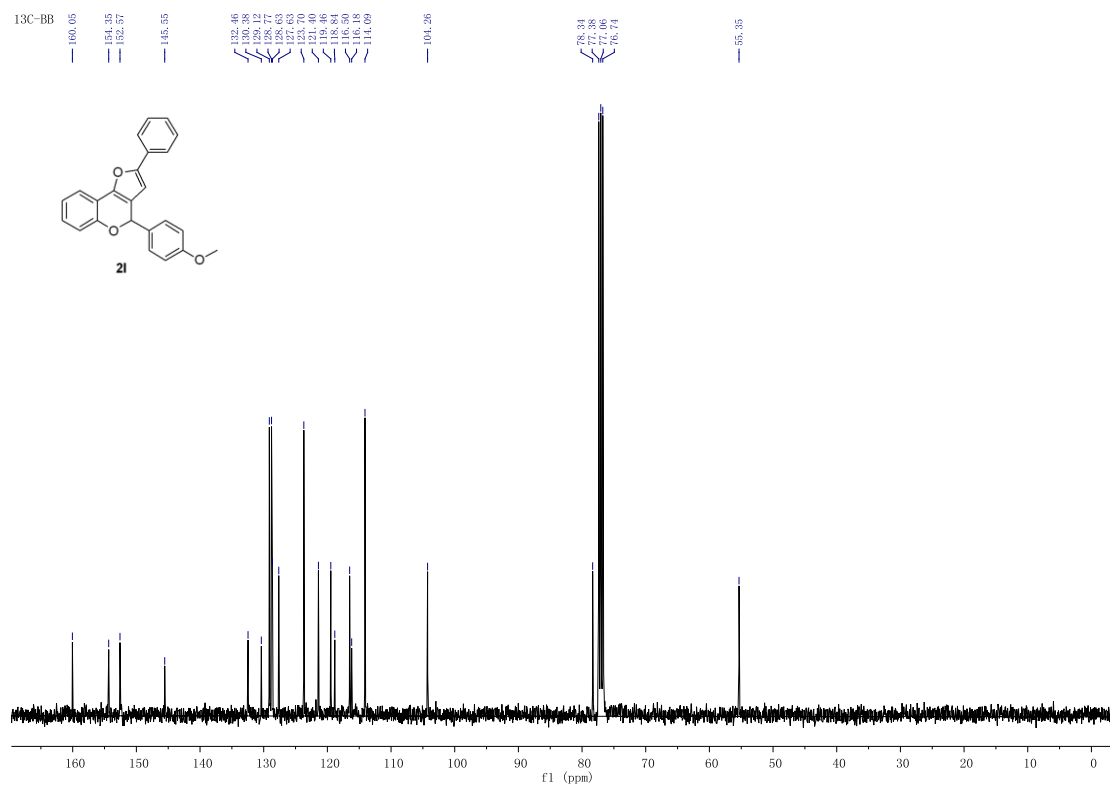
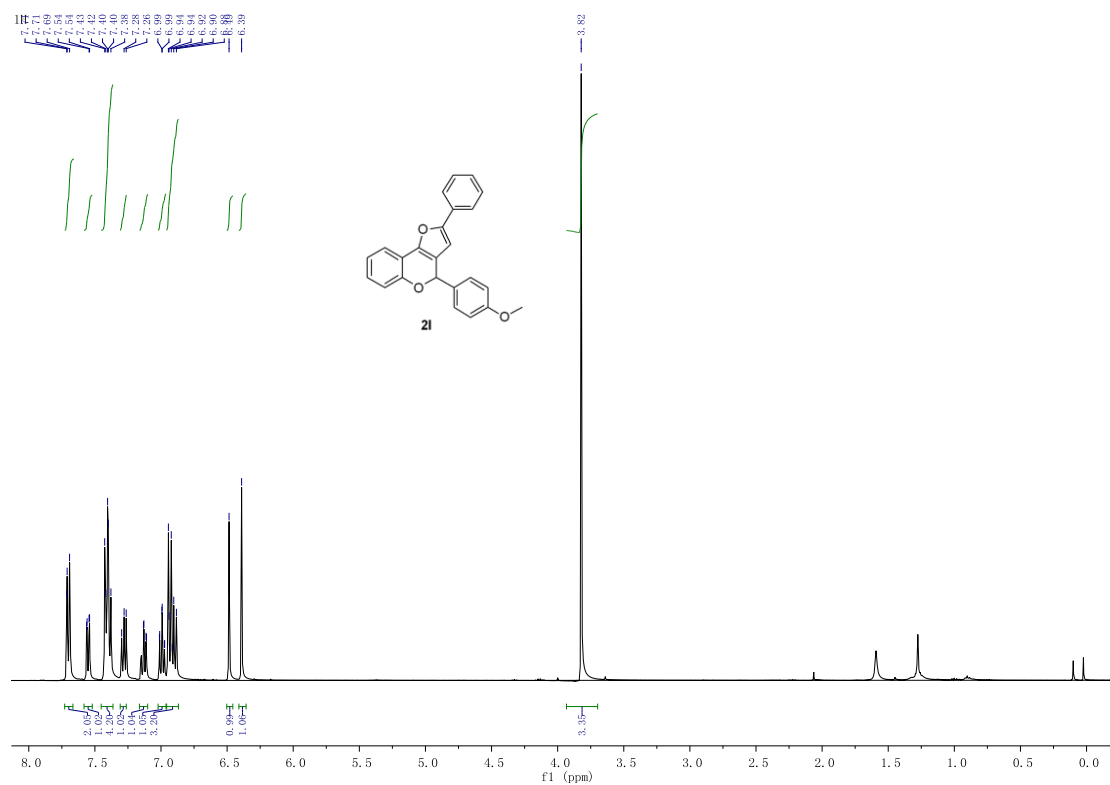
22.00

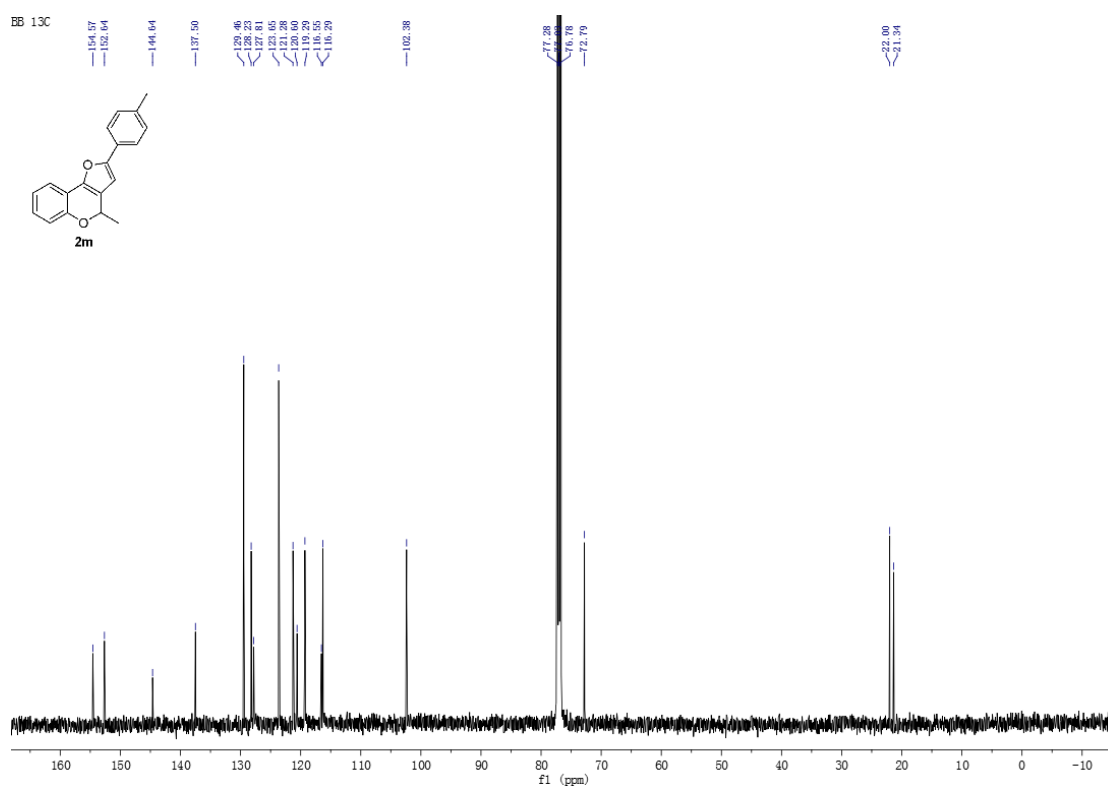
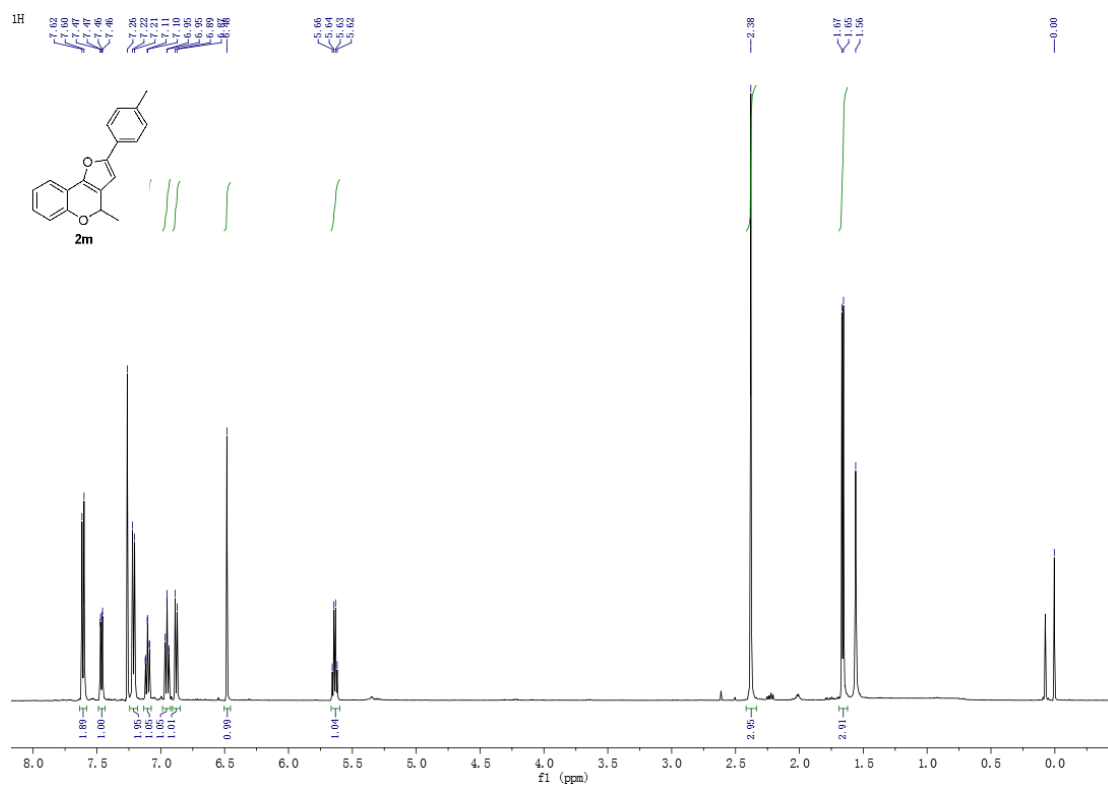


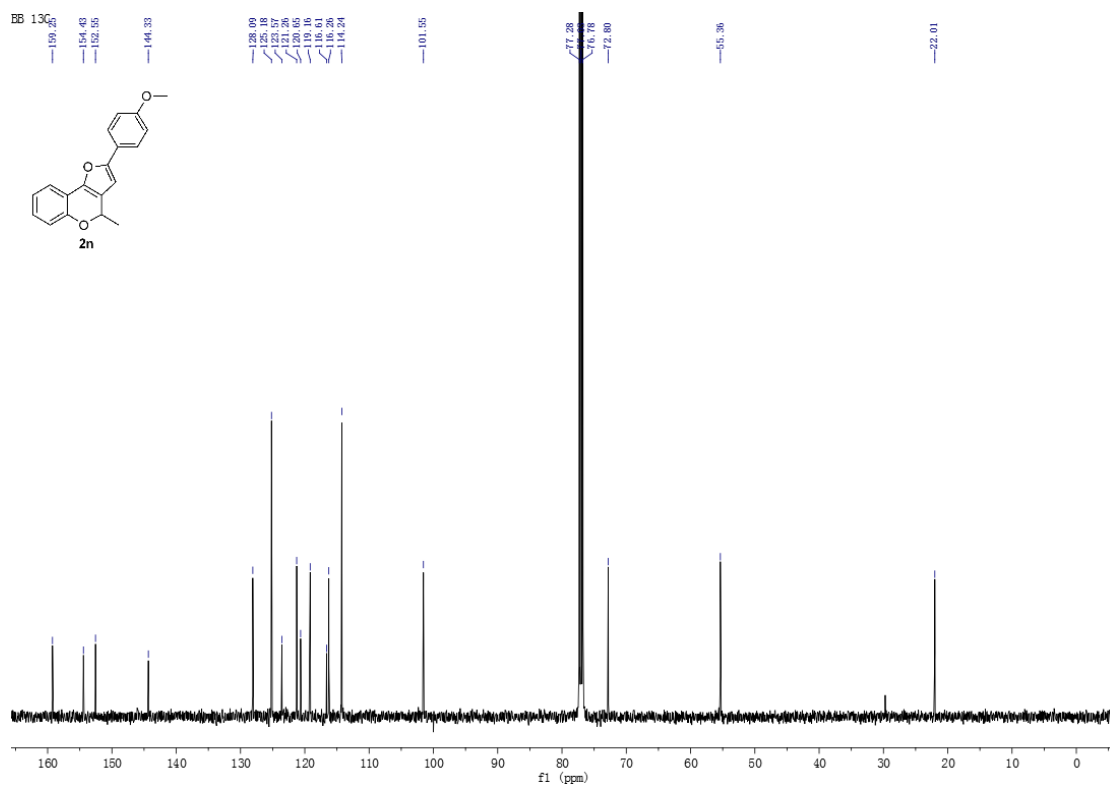
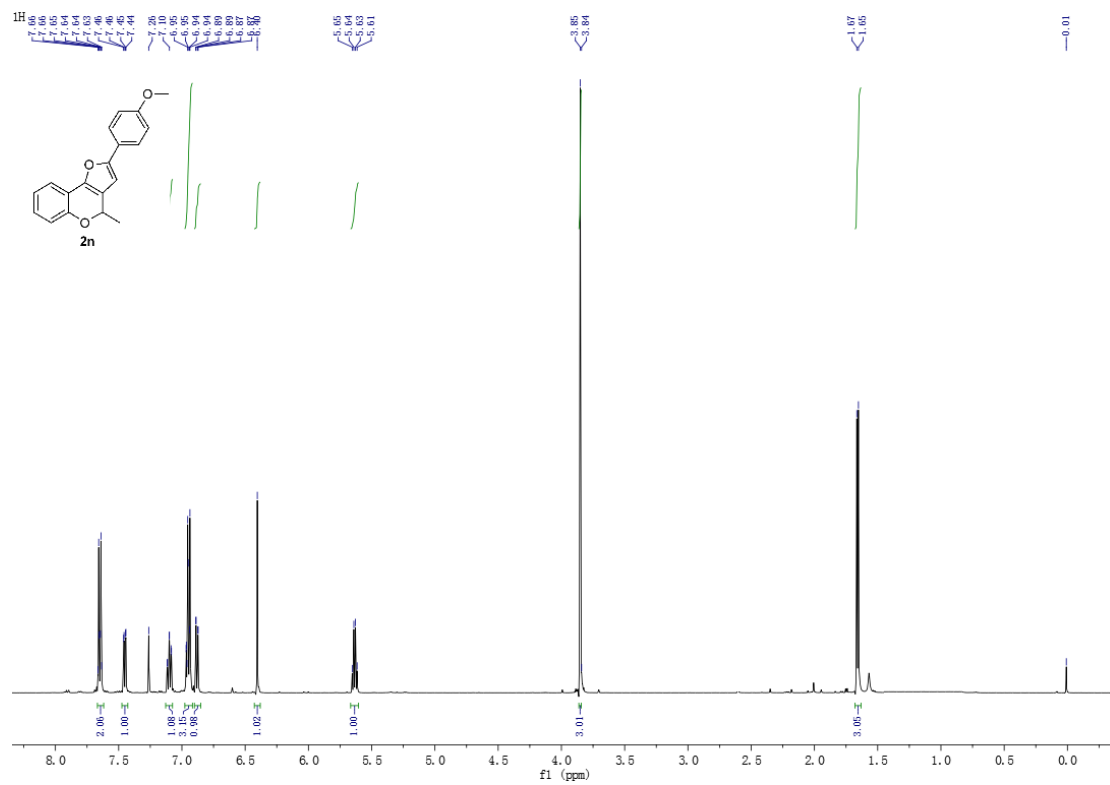


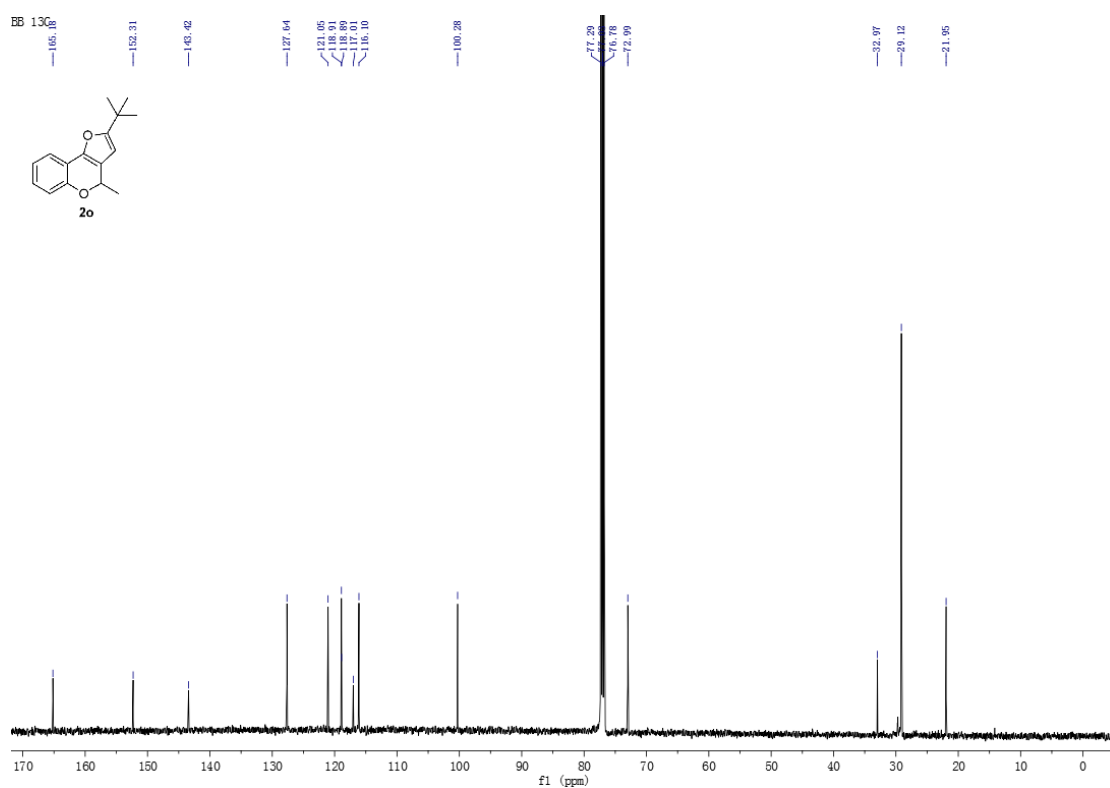
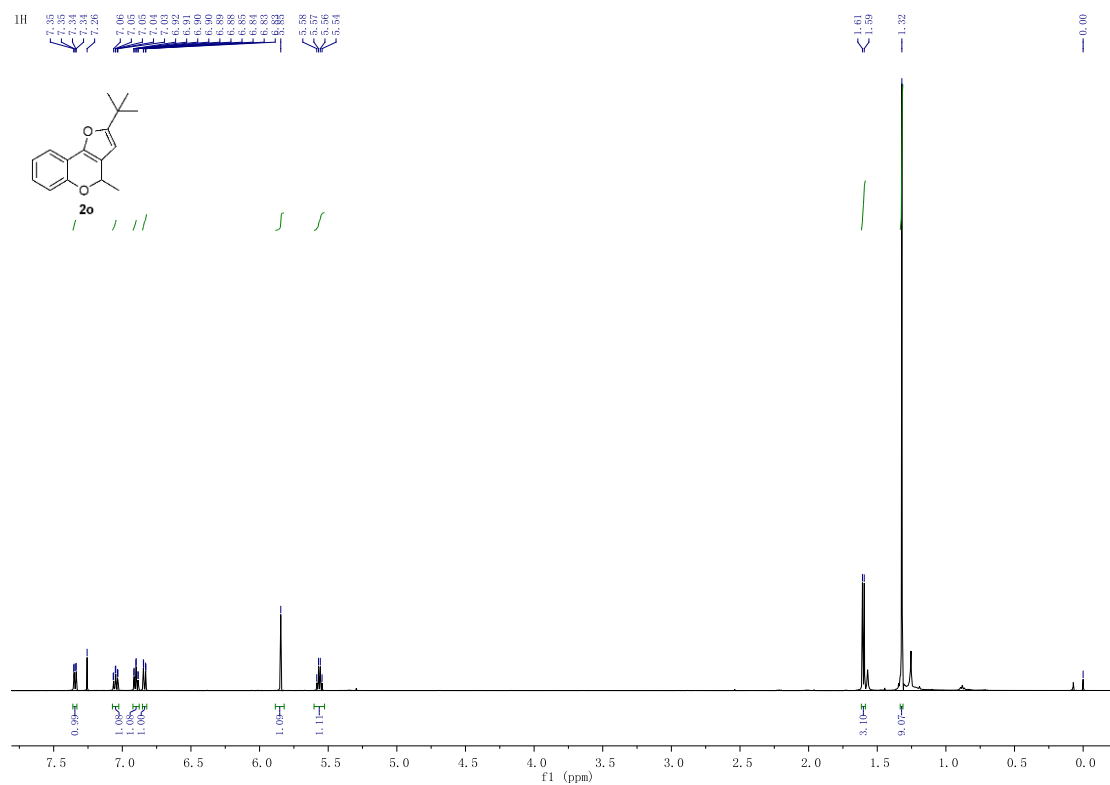


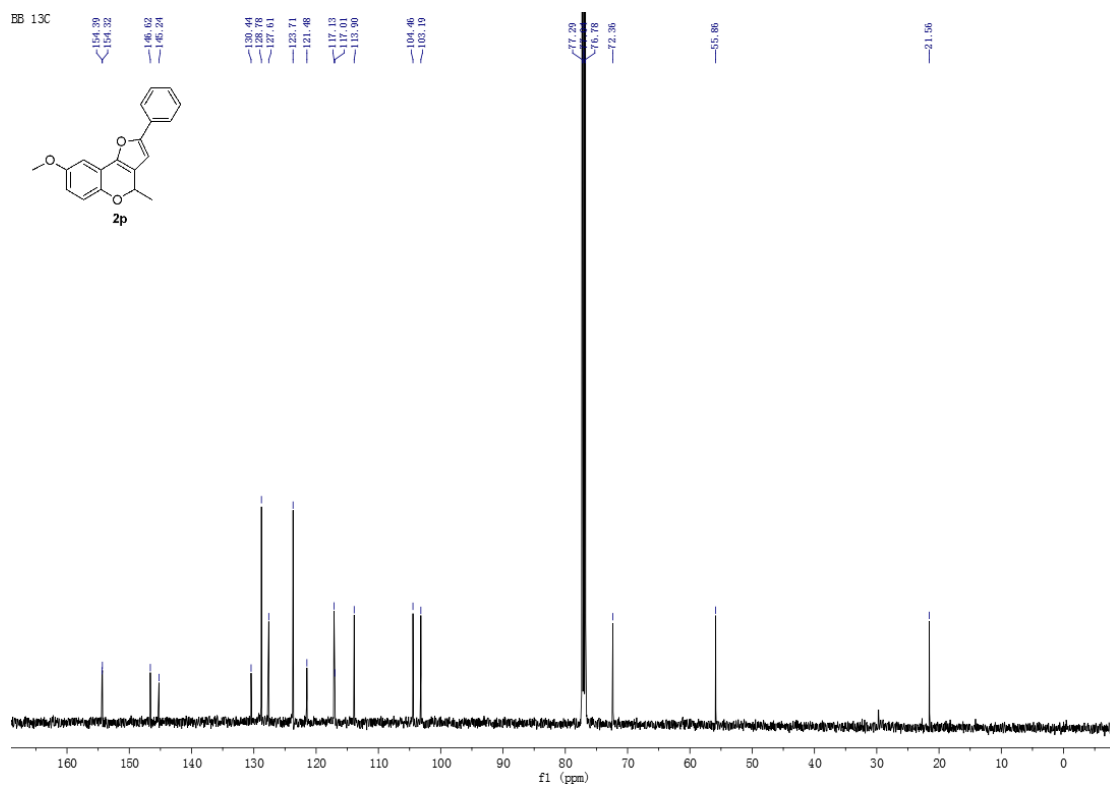
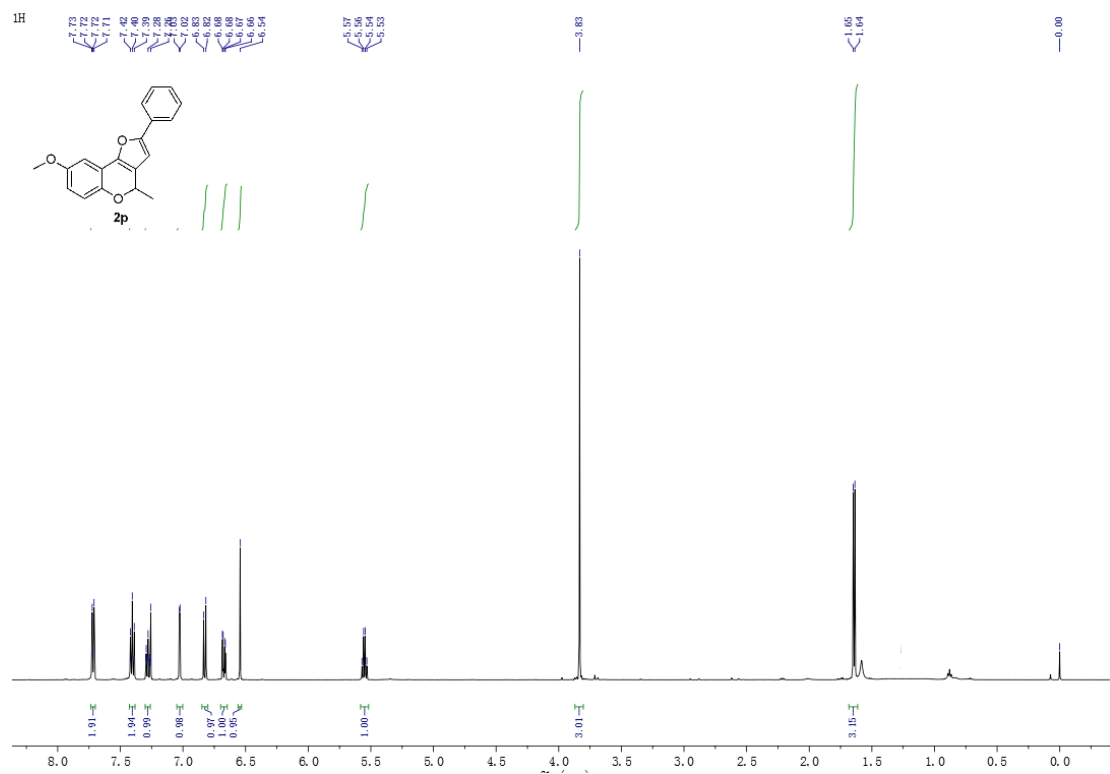


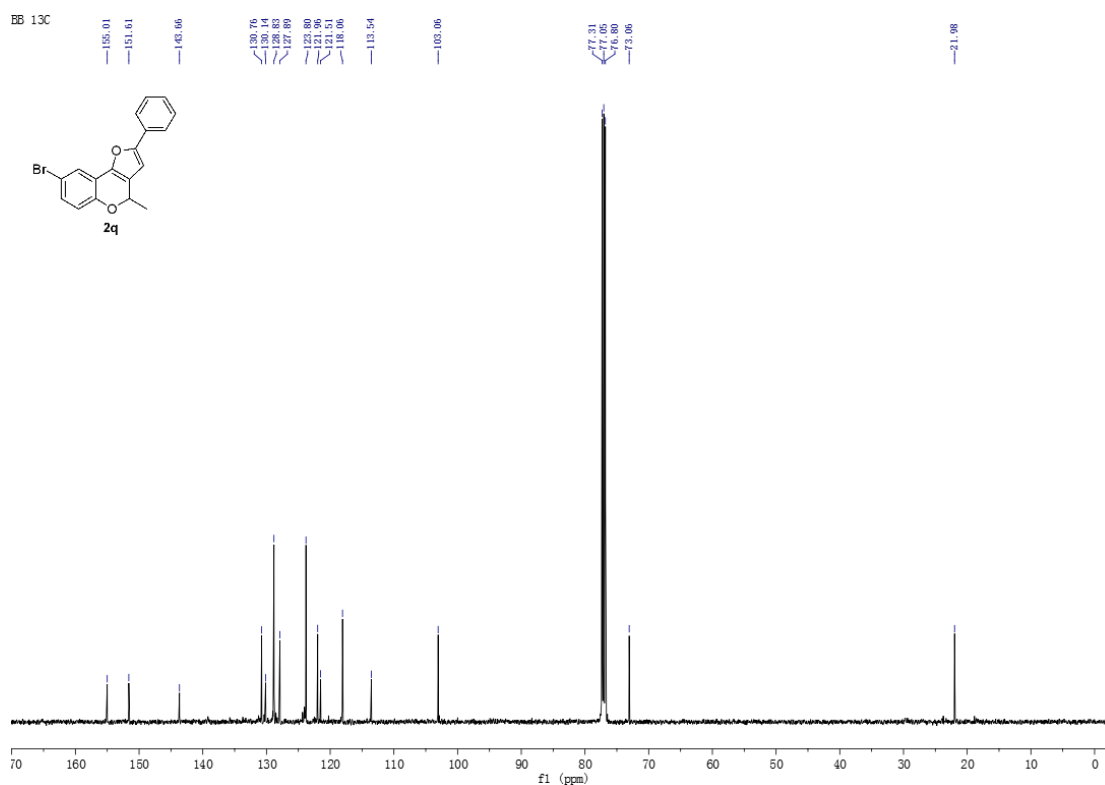
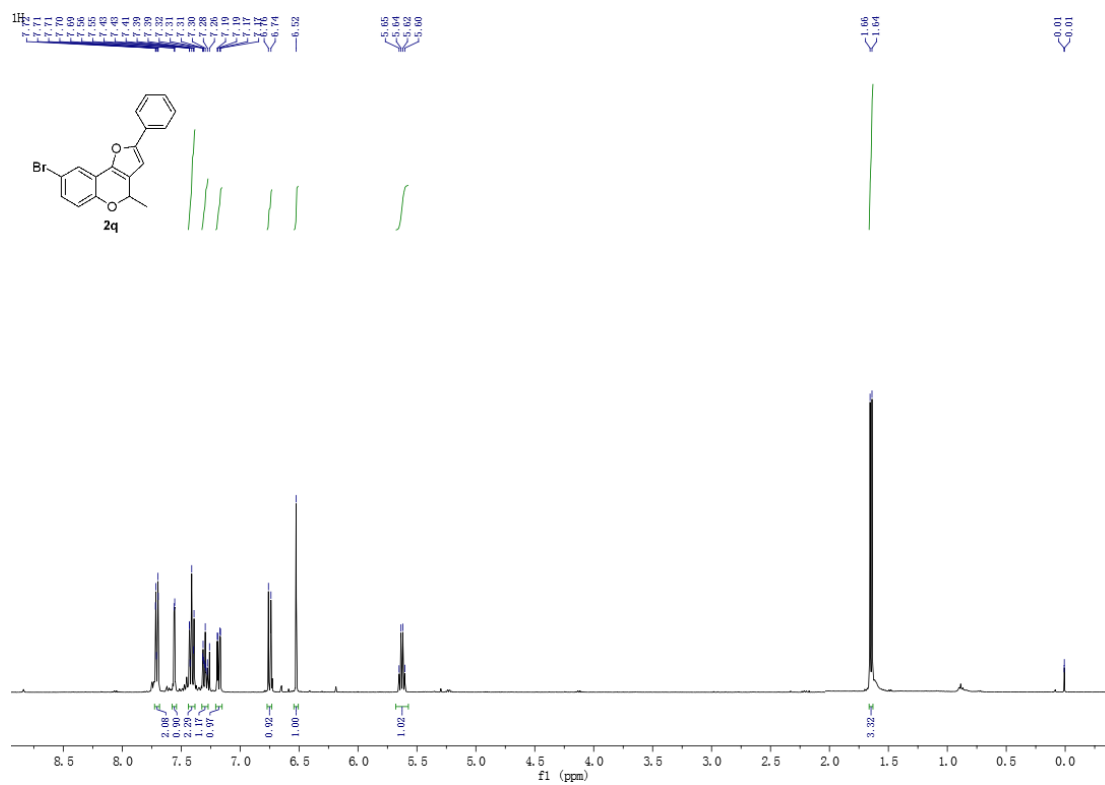


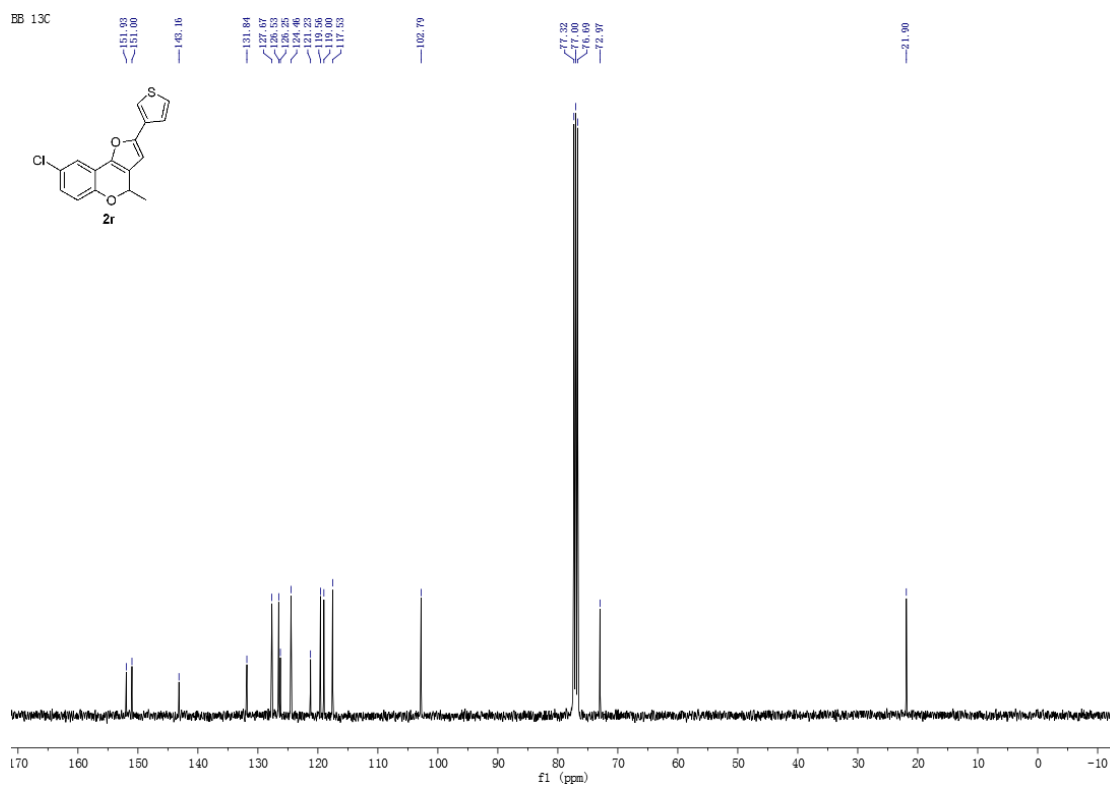
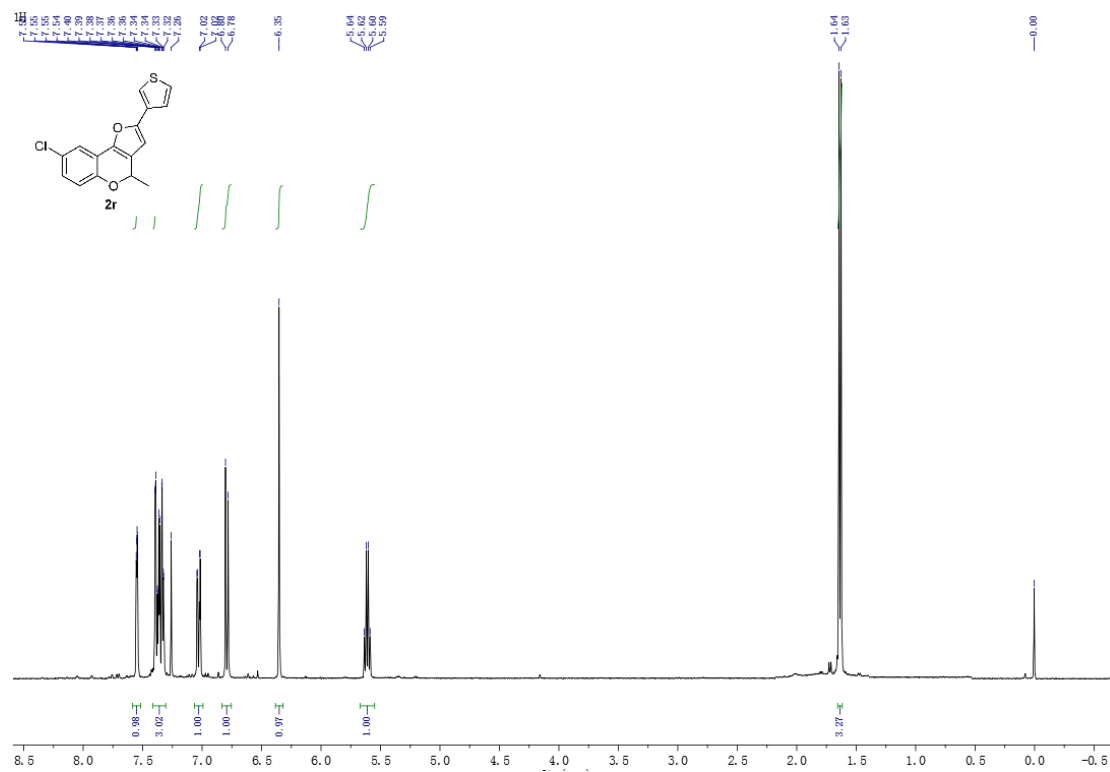






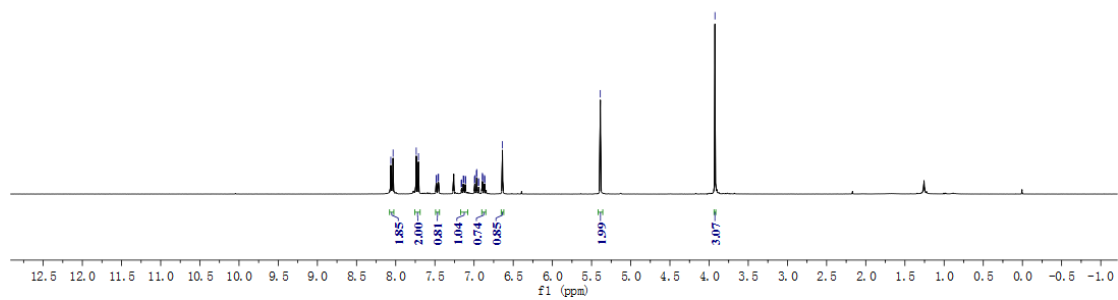
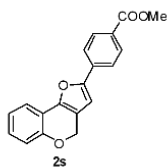






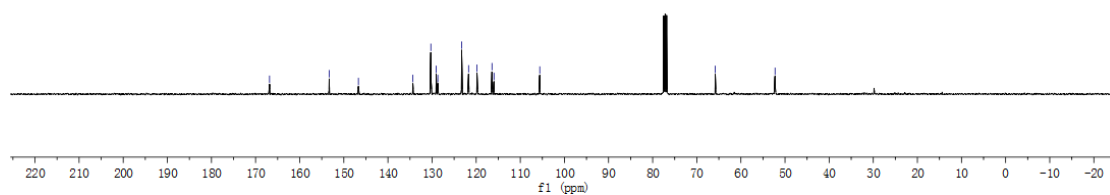
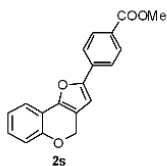
h1p83 (0919)
 STANDARD 1H OBSERVE

8.03
 7.74
 7.46
 7.13
 7.11
 6.99
 6.97
 6.89
 6.82
 6.86
 6.99
 3.93



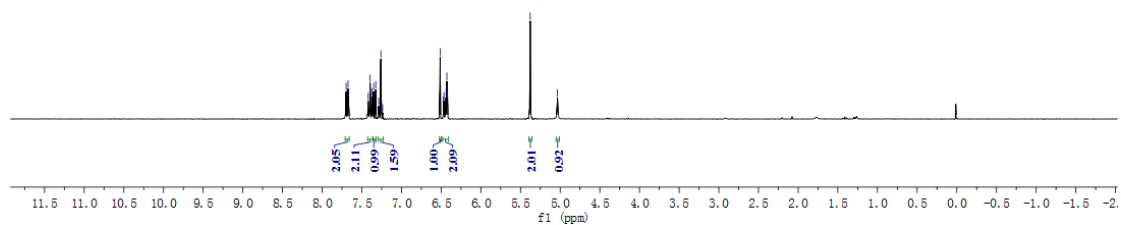
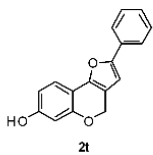
HLP93
 HLP93 CDC13 13C-BB

166.83
 153.32
 146.09
 134.24
 130.76
 128.69
 123.29
 119.81
 116.42
 115.96
 105.99
 65.81
 52.26



h1p95-0919
STANDARD 1H OBSERVE

7.07 7.07 7.07 7.07
6.42 6.42 6.42
6.35 6.35 6.35
6.28 6.28 6.28
6.21 6.21 6.21
6.14 6.14 6.14
6.07 6.07 6.07
6.00 6.00 6.00
4.98 4.98
0.03 0.03



HLP95
HLP95 CDC13 13C-BB

156.10 154.00 153.07
146.00
138.05 137.06 136.44 128.00 128.61
117.25 110.55 108.59
104.07 103.33
46.35

