

Supporting Information

Construction of multi-substituted pyrazoles via potassium carbonate -mediated [3+2] cycloaddition of *in situ* generated nitrile imines with cinnamic aldehydes

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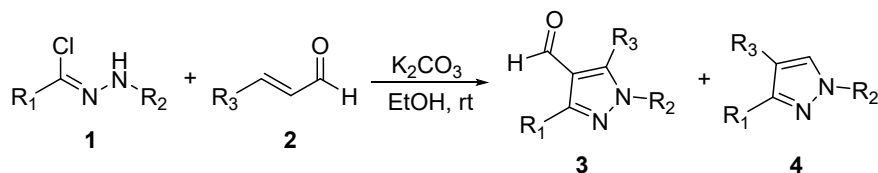
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1. General Information

All reactions were performed in oven-dried glassware with magnetic stirring. Unless otherwise noted, all reagents were purchased from Chengdu Pukang Biotechnology Co., Ltd and used without further purification. All solvents were purified and dried according to standard methods prior to use. Organic solutions were concentrated under reduced pressure on a rotary evaporator or an oil pump. Reactions were monitored through thin layer chromatography (TLC) on silica gel-precoated glass plates. Chromatograms were visualized by fluorescence quenching with UV light at 254 nm. Flash column chromatography was performed using flash silica gel (200–300 mesh). ^1H , ^{13}C and ^{19}F NMR spectra were recorded in CDCl_3 using a 600 or 700 MHz NMR instrument (Bruker Avance Neo). Chemical shifts (δ , ppm) are relative to tetramethylsilane (TMS) with the resonance of the non-deuterated solvent or TMS as the internal standard. ^1H NMR data are reported as follows: chemical shift, multiplicity (s = singlet; d = doublet; q = quartet; m = multiplet; br = broad), coupling constant (Hz), and integral. Data for ^{13}C and ^{19}F NMR spectra are reported in terms of chemical shift. Accurate mass measurements were performed on an electrospray ionization (ESI) apparatus using time-of-flight (TOF) mass spectrometry. Hydrazonoyl chlorides were synthesized according to the literature.¹⁻⁴

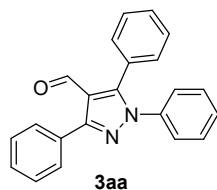
2. General Procedure for the synthesis of multi-substituted pyrazoles



A mixture of **1a** (100 mg, 0.43 mmol), **2a** (68.9 mg, 0.52 mmol) and K_2CO_3 (150.2 mg, 1.09 mmol) in C_2H_5OH (0.86 mL) was placed in a dried 10 mL vial, then the reaction mixture was stirred at room temperature overnight. After completion of the reaction, the mixture was filtered to remove K_2CO_3 , then the organic solvent was evaporated and the crude product was purified by silica-gel flash chromatography to furnish the corresponding product **3aa** and **4aa**. (Pet. ether /EtOAc = 30:1).

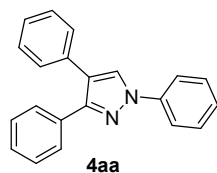
3. Characterization data

1,3,5-triphenyl-1*H*-pyrazole-4-carbaldehyde (**3aa**)^{5,8}



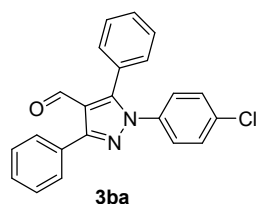
Compound **3aa** was synthesized according to general procedure using **1a** (100 mg, 0.43 mmol) as a yellow solid in 53% yield (74.6 mg, 0.23 mmol). R_f = 0.30 (Pet. ether /EtOAc = 30:1); mp 127-128 °C; ¹H NMR (600 MHz, $CDCl_3$) δ 9.87 (s, 1H), 7.97 – 7.92 (m, 2H), 7.50 – 7.39 (m, 6H), 7.37 – 7.34 (m, 2H), 7.34 – 7.28 (m, 5H). ¹³C NMR (151 MHz, $CDCl_3$) δ 185.7, 153.8, 149.2, 138.7, 131.5, 130.6, 129.8, 129.3, 129.2, 129.0, 128.7, 128.4, 128.3, 127.7, 125.4, 118.7. FT-IR (film of a solution in CH_2Cl_2) ν 3439, 3060, 2848, 2758, 1683, 1596, 1533, 1497, 1454, 1426, 1403, 1073, 1025, 978, 816, 768, 694 cm^{-1} . HRMS (ESI) m/z : $[M+H]^+$ calcd for $C_{21}H_{16}N_3O_2$ 342.1243; found, 342.1237.

1,3,4-triphenyl-1*H*-pyrazole (**4aa**)⁶



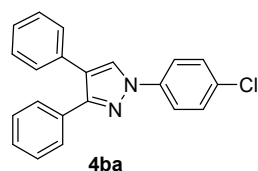
Compound **4aa** was synthesized according to general procedure using **1a** (100 mg, 0.43 mmol) as a light yellow oily liquid in 42% yield (54.1 mg, 0.18 mmol). R_f = 0.65 (Pet. ether /EtOAc = 30:1); ¹H NMR (600 MHz, $CDCl_3$) δ 8.02 (s, 1H), 7.82 – 7.78 (m, 2H), 7.64 – 7.57 (m, 2H), 7.50 – 7.45 (m, 2H), 7.38 – 7.31 (m, 7H), 7.31 – 7.27 (m, 2H). ¹³C NMR (151 MHz, $CDCl_3$) δ 150.3, 139.7, 132.9, 132.6, 129.3, 128.5, 128.3, 128.2, 128.1, 127.7, 126.7, 126.4, 126.3, 122.7, 118.7. FT-IR (film) ν 3403, 3058, 2918, 2853, 1599, 1553, 1503, 1437, 1404, 1352, 1218, 1073, 1059, 971, 957, 758, 697, 596 cm^{-1} . HRMS (ESI) m/z : $[M+H]^+$ calcd for $C_{21}H_{16}N_3O_2$ 342.1243; found, 342.1237.

1-(4-chlorophenyl)-3,5-diphenyl-1*H*-pyrazole-4-carbaldehyde (**3ba**)



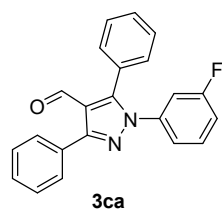
Compound **3ba** was synthesized according to general procedure using **1b** (100 mg, 0.38 mmol) as a yellow solid in 43% yield (58.3 mg, 0.16 mmol). R_f = 0.30 (Pet. ether /EtOAc = 30:1); mp 128-129 °C; $^1\text{H NMR}$ (600 MHz, CDCl_3) δ 9.86 (s, 1H), 7.98 – 7.90 (m, 2H), 7.52 – 7.39 (m, 6H), 7.38 – 7.32 (m, 2H), 7.32 – 7.27 (m, 2H), 7.27 – 7.22 (m, 2H). $^{13}\text{C NMR}$ (151 MHz, CDCl_3) δ 185.5, 154.1, 149.1, 137.2, 134.1, 131.3, 130.6, 130.1, 129.3, 129.2, 128.9, 128.4, 127.4, 126.4, 118.9. **FT-IR** (film of a solution in CH_2Cl_2) ν 3364, 3058, 2932, 2853, 2758, 1683, 1595, 1533, 1494, 1455, 1431, 1406, 1091, 1016, 970, 834, 812, 777, 727, 696 cm^{-1} . **HRMS** (ESI) m/z : $[\text{M}+\text{H}]^+$ calcd for $\text{C}_{22}\text{H}_{16}\text{ClN}_2\text{O}$ 359.0951; found, 359.0944.

1-(4-chlorophenyl)-3,4-diphenyl-1*H*-pyrazole (**4ba**)



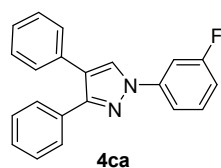
Compound **4ba** was synthesized according to general procedure using **1b** (100 mg, 0.38 mmol) as a light yellow solid in 28% yield (35.0 mg, 0.11 mmol). R_f = 0.65 (Pet. ether /EtOAc = 30:1); mp 110-111 °C; $^1\text{H NMR}$ (600 MHz, CDCl_3) δ 7.98 (s, 1H), 7.77 – 7.72 (m, 2H), 7.61 – 7.54 (m, 2H), 7.47 – 7.41 (m, 2H), 7.36 – 7.28 (m, 8H). $^{13}\text{C NMR}$ (151 MHz, CDCl_3) δ 150.8, 138.5, 132.9, 132.6, 131.9, 129.6, 128.7, 128.6, 128.4, 128.4, 128.1, 127.1, 126.5, 123.3, 120.0. **FT-IR** (film of a solution in CH_2Cl_2) ν 3436, 3055, 2929, 1597, 1552, 1500, 1489, 1434, 1397, 1352, 1220, 1056, 970, 956, 829, 762, 697, 593 cm^{-1} . **HRMS** (ESI) m/z : $[\text{M}+\text{H}]^+$ calcd for $\text{C}_{21}\text{H}_{16}\text{ClN}_2$ 331.1002; found, 331.0997.

1-(3-fluorophenyl)-3,5-diphenyl-1*H*-pyrazole-4-carbaldehyde (**3ca**)



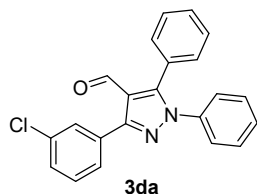
Compound **3ca** was synthesized according to general procedure using **1c** (100 mg, 0.40 mmol) as a red solid in 39% yield (53.8 mg, 0.16 mmol). R_f = 0.30 (Pet. ether /EtOAc = 30:1); mp 155-156 °C; $^1\text{H NMR}$ (600 MHz, CDCl_3) δ 9.86 (s, 1H), 7.96 – 7.91 (m, 2H), 7.53 – 7.41 (m, 7H), 7.41 – 7.34 (m, 2H), 7.30 – 7.23 (m, 1H), 7.12 (dt, J = 9.4, 2.2 Hz, 1H), 7.07 – 6.99 (m, 2H). $^{13}\text{C NMR}$ (151 MHz, CDCl_3) δ 185.6, 162.5 (d, J = 248.1 Hz), 154.1, 149.3, 140.0 (d, J = 10.0 Hz), 131.3, 130.5, 130.2 (d, J = 9.0 Hz), 130.2, 129.3, 129.3, 128.9, 128.4, 127.4, 120.9 (d, J = 3.3 Hz), 119.0, 115.3 (d, J = 21.0 Hz), 112.9 (d, J = 25.1 Hz). $^{19}\text{F NMR}$ (565 MHz, CDCl_3) δ -110.61. **FT-IR** (film of a solution in CH_2Cl_2) ν 3341, 3061, 2932, 2856, 2752, 1684, 1610, 1492, 1454, 1423, 1199, 1076, 879, 810, 768, 695 cm^{-1} . **HRMS** (ESI) m/z : $[\text{M}+\text{Na}]^+$ calcd for $\text{C}_{22}\text{H}_{15}\text{FN}_2\text{NaO}$ 365.1066; found, 365.1058.

1-(3-fluorophenyl)-3,4-diphenyl-1*H*-pyrazole (**4ca**)



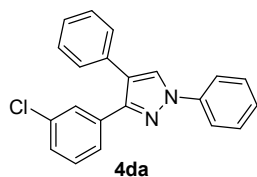
Compound **4ca** was synthesized according to general procedure using **1c** (100 mg, 0.40 mmol) as a light yellow oily liquid in 25% yield (31.7 mg, 0.10 mmol). R_f = 0.65 (Pet. ether /EtOAc = 30:1); **¹H NMR** (600 MHz, CDCl₃) δ 8.01 (s, 1H), 7.62 – 7.57 (m, 3H), 7.56 (dd, J = 8.0, 2.1 Hz, 1H), 7.43 (td, J = 8.2, 6.1 Hz, 1H), 7.38 – 7.27 (m, 8H), 7.04 – 6.97 (m, 1H). **¹³C NMR** (151 MHz, CDCl₃) δ 162.6 (d, J = 246.7 Hz), 150.1, 140.5 (d, J = 10.5 Hz), 132.0, 131.8, 130.0 (d, J = 9.4 Hz), 127.9, 127.8, 127.7, 127.6, 127.3, 126.4, 125.8, 122.6, 113.2 (d, J = 2.9 Hz), 112.4 (d, J = 21.4 Hz), 105.8 (d, J = 26.2 Hz). **¹⁹F NMR** (565 MHz, CDCl₃) δ -110.86. **FT-IR** (film) ν 3403, 3058, 2926, 1614, 1602, 1556, 1500, 1460, 1393, 1353, 1191, 1154, 866, 762, 697, 675 cm⁻¹. **HRMS** (ESI) m/z : [M+H]⁺ calcd for C₂₁H₁₆FN₂ 315.1298; found, 315.1291.

3-(3-chlorophenyl)-1,5-diphenyl-1*H*-pyrazole-4-carbaldehyde (**3da**)



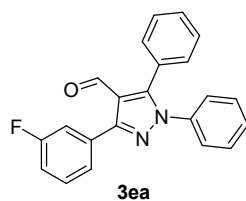
Compound **3da** was synthesized according to general procedure using **1d** (100 mg, 0.38 mmol) as a white solid in 41% yield (55.6 mg, 0.16 mmol). R_f = 0.30 (Pet. ether /EtOAc = 30:1); mp 158-159 °C; **¹H NMR** (600 MHz, CDCl₃) δ 9.83 (s, 1H), 8.01 (q, J = 1.4 Hz, 1H), 7.91 (ddd, J = 4.9, 3.5, 1.6 Hz, 1H), 7.50 – 7.44 (m, 1H), 7.44 – 7.40 (m, 4H), 7.37 – 7.32 (m, 5H), 7.30 (dt, J = 7.1, 2.2 Hz, 2H). **¹³C NMR** (151 MHz, CDCl₃) δ 185.4, 152.1, 149.9, 138.5, 134.2, 133.3, 130.6, 130.0, 129.5, 129.2, 129.1, 129.1, 128.8, 128.4, 127.5, 127.4, 125.3, 118.8. **FT-IR** (film of a solution in CH₂Cl₂) ν 3389, 3068, 2924, 2851, 2759, 1684, 1597, 1502, 1449, 1434, 1400, 1373, 1074, 795, 767, 693 cm⁻¹. **HRMS** (ESI) m/z : [M+H]⁺ calcd for C₂₂H₁₆ClN₂O 359.0951; found, 359.0943.

3-(3-chlorophenyl)-1,4-diphenyl-1*H*-pyrazole (**4da**)



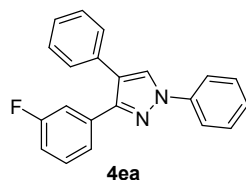
Compound **4da** was synthesized according to general procedure using **1d** (100 mg, 0.38 mmol) as a light yellow oily liquid in 28% yield (35.0 mg, 0.11 mmol). R_f = 0.65 (Pet. ether /EtOAc = 30:1); **¹H NMR** (600 MHz, CDCl₃) δ 8.01 (s, 1H), 7.81 – 7.78 (m, 2H), 7.69 (t, J = 1.9 Hz, 1H), 7.51 – 7.46 (m, 2H), 7.40 (dt, J = 7.7, 1.4 Hz, 1H), 7.38 – 7.28 (m, 7H), 7.23 (t, J = 7.8 Hz, 1H). **¹³C NMR** (151 MHz, CDCl₃) δ 149.0, 139.8, 135.0, 134.3, 132.4, 129.5, 129.5, 128.7, 128.7, 128.3, 128.0, 127.3, 126.9, 126.7, 126.6, 123.1, 119.0. **FT-IR** (film) ν 3420, 3061, 2918, 1599, 1552, 1507, 1435, 1402, 1342, 1218, 1079, 1059, 961, 777, 756, 699, 688 cm⁻¹. **HRMS** (ESI) m/z : [M+H]⁺ calcd for C₂₁H₁₆ClN₂ 331.1002; found, 331.0994.

3-(3-fluorophenyl)-1,5-diphenyl-1*H*-pyrazole-4-carbaldehyde (**3ea**)



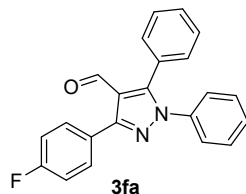
Compound **3ea** was synthesized according to general procedure using **1e** (100 mg, 0.40 mmol) as a yellow solid in 40% yield (55.2 mg, 0.16 mmol). R_f = 0.30 (Pet. ether /EtOAc = 30:1); mp 126-127 °C; $^1\text{H NMR}$ (600 MHz, CDCl_3) δ 9.84 (s, 1H), 7.81 (dt, J = 7.8, 1.2 Hz, 1H), 7.76 (ddd, J = 10.0, 2.6, 1.5 Hz, 1H), 7.49 – 7.39 (m, 4H), 7.37 – 7.32 (m, 5H), 7.30 (dt, J = 7.1, 2.2 Hz, 2H), 7.14 (tdd, J = 8.5, 2.6, 1.0 Hz, 1H). $^{13}\text{C NMR}$ (151 MHz, CDCl_3) δ 185.5, 162.7 (d, J = 245.0 Hz), 152.2 (d, J = 2.4 Hz), 149.9, 138.6, 133.7 (d, J = 8.4 Hz), 130.6, 130.0, 129.8 (d, J = 8.4 Hz), 129.1, 128.8, 128.4, 127.4, 125.3, 125.0 (d, J = 2.8 Hz), 118.8, 116.2 (d, J = 15.1 Hz), 116.1 (d, J = 13.0 Hz). $^{19}\text{F NMR}$ (565 MHz, CDCl_3) δ -113.22. **FT-IR** (film of a solution in CH_2Cl_2) ν 3422, 3069, 2923, 2845, 2758, 1683, 1616, 1588, 1533, 1496, 1463, 1402, 1269, 1198, 1070, 879, 813, 768, 693 cm^{-1} . **HRMS** (ESI) m/z : $[\text{M}+\text{H}]^+$ calcd for $\text{C}_{22}\text{H}_{16}\text{FN}_2\text{O}$ 343.1247; found, 343.1236.

3-(3-fluorophenyl)-1,4-diphenyl-1H-pyrazole (**4ea**)



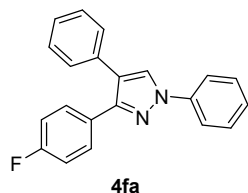
Compound **4ea** was synthesized according to general procedure using **1e** (100 mg, 0.40 mmol) as a white oily liquid in 26% yield (32.9 mg, 0.10 mmol). R_f = 0.65 (Pet. ether /EtOAc = 30:1); $^1\text{H NMR}$ (600 MHz, CDCl_3) δ 8.01 (s, 1H), 7.83 – 7.77 (m, 2H), 7.49 (t, J = 8.0 Hz, 2H), 7.39 – 7.26 (m, 9H), 7.04 – 6.98 (m, 1H). $^{13}\text{C NMR}$ (151 MHz, CDCl_3) δ 162.8 (d, J = 244.8 Hz), 149.2 (d, J = 2.8 Hz), 139.8, 135.3 (d, J = 8.4 Hz), 132.5, 129.8 (d, J = 8.4 Hz), 129.5, 128.8, 128.7, 127.2, 126.9, 126.7, 124.1 (d, J = 2.9 Hz), 123.1, 119.0, 115.2 (d, J = 22.6 Hz), 114.8 (d, J = 21.3 Hz). $^{19}\text{F NMR}$ (565 MHz, CDCl_3) δ -113.23. **FT-IR** (film) ν 3408, 3075, 2923, 2853, 1617, 1599, 1556, 1502, 1457, 1403, 1348, 1269, 1227, 1185, 1062, 961, 864, 757, 699, 686 cm^{-1} . **HRMS** (ESI) m/z : $[\text{M}+\text{H}]^+$ calcd for $\text{C}_{21}\text{H}_{16}\text{FN}_2$ 315.1298; found, 315.1289.

3-(4-fluorophenyl)-1,5-diphenyl-1H-pyrazole-4-carbaldehyde (**3fa**)



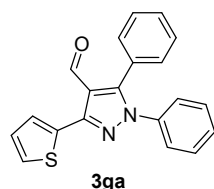
Compound **3fa** was synthesized according to general procedure using **1f** (100 mg, 0.40 mmol) as a light yellow solid in 35% yield (48.3 mg, 0.14 mmol). R_f = 0.30 (Pet. ether /EtOAc = 30:1); mp 138-139 °C; $^1\text{H NMR}$ (600 MHz, CDCl_3) δ 9.82 (s, 1H), 8.04 – 7.97 (m, 2H), 7.48 – 7.44 (m, 1H), 7.44 – 7.39 (m, 2H), 7.37 – 7.31 (m, 5H), 7.31 – 7.28 (m, 2H), 7.19 – 7.13 (m, 2H). $^{13}\text{C NMR}$ (151 MHz, CDCl_3) δ 185.6, 163.4 (d, J = 248.6 Hz), 152.4, 150.0, 138.6, 131.2 (d, J = 8.4 Hz), 130.6, 130.0, 129.1, 128.8, 128.4, 127.7 (d, J = 3.2 Hz), 127.5, 125.3, 118.7, 115.3 (d, J = 21.6 Hz). $^{19}\text{F NMR}$ (565 MHz, CDCl_3) δ -112.26. **FT-IR** (film of a solution in CH_2Cl_2) ν 3434, 3061, 2923, 2848, 2761, 1682, 1596, 1525, 1498, 1451, 1437, 1400, 1225, 1159, 843, 768, 735, 700, 607, 535 cm^{-1} . **HRMS** (ESI) m/z : $[\text{M}+\text{H}]^+$ calcd for $\text{C}_{22}\text{H}_{16}\text{FN}_2\text{O}$ 343.1247; found, 343.1237.

3-(4-fluorophenyl)-1,4-diphenyl-1H-pyrazole (**4fa**)⁶



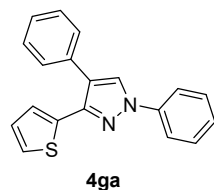
Compound **4fa** was synthesized according to general procedure using **1f** (100 mg, 0.40 mmol) as a light yellow solid in 27% yield (34.2 mg, 0.11 mmol). R_f = 0.65 (Pet. ether /EtOAc = 30:1); mp 108-109 °C; $^1\text{H NMR}$ (600 MHz, CDCl_3) δ 8.01 (s, 1H), 7.82 – 7.76 (m, 2H), 7.60 – 7.54 (m, 2H), 7.51 – 7.45 (m, 2H), 7.37 – 7.29 (m, 6H), 7.05 – 7.00 (m, 2H). $^{13}\text{C NMR}$ (151 MHz, CDCl_3) δ 162.0 (d, J = 246.9 Hz), 148.9, 139.2, 132.0, 129.5 (d, J = 8.0 Hz), 128.8, 128.0 (d, J = 7.9 Hz), 126.4, 126.1, 125.9, 122.1, 118.3, 114.7 (d, J = 21.5 Hz). $^{19}\text{F NMR}$ (565 MHz, CDCl_3) δ -114.08. **FT-IR** (film of a solution in CH_2Cl_2) ν 3425, 3055, 2918, 2856, 1600, 1525, 1505, 1435, 1402, 1217, 1157, 1059, 975, 955, 841, 757, 699, 689, 594 cm^{-1} . **HRMS** (ESI) m/z : $[\text{M}+\text{H}]^+$ calcd for $\text{C}_{21}\text{H}_{16}\text{FN}_2$ 315.1298; found, 315.1290.

1,5-diphenyl-3-(thiophen-2-yl)-1H-pyrazole-4-carbaldehyde (**3ga**)



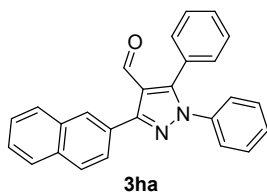
Compound **3ga** was synthesized according to general procedure using **1g** (100 mg, 0.42 mmol) as an orange solid in 45% yield (62.9 mg, 0.19 mmol). R_f = 0.30 (Pet. ether /EtOAc = 30:1); mp 133-134 °C; $^1\text{H NMR}$ (600 MHz, CDCl_3) δ 9.83 (s, 1H), 8.29 (dd, J = 3.7, 1.2 Hz, 1H), 7.48 – 7.44 (m, 1H), 7.44 – 7.38 (m, 3H), 7.35 – 7.30 (m, 5H), 7.29 (dt, J = 7.1, 2.2 Hz, 2H), 7.15 (dd, J = 5.1, 3.7 Hz, 1H). $^{13}\text{C NMR}$ (151 MHz, CDCl_3) δ 185.3, 150.3, 147.4, 138.4, 133.8, 130.6, 130.0, 129.7, 129.1, 128.8, 128.4, 127.7, 127.4, 127.1, 125.3, 118.4. **FT-IR** (film of a solution in CH_2Cl_2) ν 3392, 3106, 3072, 2761, 1681, 1596, 1498, 1460, 1432, 1406, 1241, 1073, 1045, 849, 769, 701 cm^{-1} . **HRMS** (ESI) m/z : $[\text{M}+\text{H}]^+$ calcd for $\text{C}_{20}\text{H}_{15}\text{N}_2\text{OS}$ 331.0905; found, 331.0897.

1,4-diphenyl-3-(thiophen-2-yl)-1H-pyrazole (**4ga**)



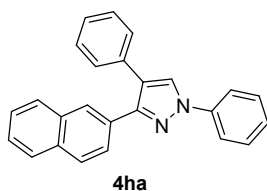
Compound **4ga** was synthesized according to general procedure using **1g** (100 mg, 0.42 mmol) as a brown oily liquid in 33% yield (42.4 mg, 0.14 mmol). R_f = 0.65 (Pet. ether /EtOAc = 30:1); $^1\text{H NMR}$ (600 MHz, CDCl_3) δ 7.95 (s, 1H), 7.80 – 7.75 (m, 2H), 7.52 – 7.43 (m, 4H), 7.43 – 7.38 (m, 2H), 7.38 – 7.34 (m, 1H), 7.33 – 7.28 (m, 1H), 7.27 – 7.24 (m, 1H), 7.08 (dd, J = 3.6, 1.2 Hz, 1H), 6.95 (dd, J = 5.1, 3.6 Hz, 1H). $^{13}\text{C NMR}$ (151 MHz, CDCl_3) δ 145.2, 139.7, 135.3, 132.5, 129.5, 129.3, 128.6, 127.5, 127.3, 127.0, 126.6, 126.0, 125.3, 122.7, 119.0. **FT-IR** (film) ν 3417, 3072, 2921, 1598, 1561, 1505, 1463, 1404, 1362, 1207, 1057, 959, 848, 757, 698 cm^{-1} . **HRMS** (ESI) m/z : $[\text{M}+\text{H}]^+$ calcd for $\text{C}_{19}\text{H}_{15}\text{N}_2\text{S}$ 303.0956; found, 303.0949.

3-(naphthalen-2-yl)-1,5-diphenyl-1H-pyrazole-4-carbaldehyde (**3ha**)



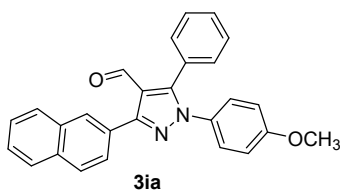
Compound **3ha** was synthesized according to general procedure using **1h** (100 mg, 0.36 mmol) as a red solid in 51% yield (68.1 mg, 0.18 mmol). R_f = 0.30 (Pet. ether /EtOAc = 30:1); mp 159-160 °C; **¹H NMR** (600 MHz, CDCl₃) δ 9.93 (s, 1H), 8.53 (d, J = 1.7 Hz, 1H), 8.07 (dd, J = 8.5, 1.8 Hz, 1H), 7.99 – 7.92 (m, 2H), 7.91 – 7.86 (m, 1H), 7.55 – 7.49 (m, 2H), 7.47 – 7.40 (m, 3H), 7.39 – 7.36 (m, 2H), 7.36 – 7.31 (m, 5H). **¹³C NMR** (151 MHz, CDCl₃) δ 185.7, 153.7, 149.5, 138.7, 133.7, 133.2, 130.7, 129.9, 129.1, 129.0, 128.9, 128.7, 128.7, 128.3, 127.9, 127.7, 127.7, 126.7, 126.6, 126.2, 125.4, 119.0. **FT-IR** (film of a solution in CH₂Cl₂) ν 3456, 3052, 2850, 2750, 1682, 1595, 1499, 1448, 1426, 821, 766, 736, 701, 481 cm⁻¹. **HRMS** (ESI) m/z : [M+H]⁺ calcd for C₂₆H₁₉N₂O 375.1497; found, 375.1486

3-(naphthalen-2-yl)-1,4-diphenyl-1H-pyrazole (**4ha**)



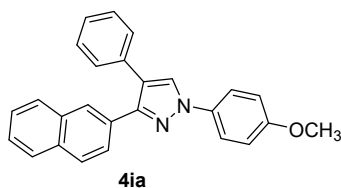
Compound **4ha** was synthesized according to general procedure using **1h** (100 mg, 0.36 mmol) as a yellow oily liquid in 37% yield (45.7 mg, 0.13 mmol). R_f = 0.65 (Pet. ether /EtOAc = 30:1); **¹H NMR** (600 MHz, CDCl₃) δ 8.11 (d, J = 1.6 Hz, 1H), 8.06 (s, 1H), 7.70 (dd, J = 8.5, 1.8 Hz, 1H), 7.54 – 7.42 (m, 4H), 7.40 – 7.36 (m, 2H), 7.38 – 7.26 (m, 4H). **¹³C NMR** (151 MHz, CDCl₃) δ 150.4, 140.0, 133.4, 133.0, 132.9, 130.7, 129.5, 128.8, 128.6, 128.4, 127.9, 127.7, 127.4, 127.1, 126.8, 126.6, 126.6, 126.1, 126.0, 123.2, 119.1. **FT-IR** (film) ν 3408, 3050, 2923, 1599, 1555, 1505, 1404, 1215, 1059, 959, 899, 861, 822, 753, 699, 477 cm⁻¹. **HRMS** (ESI) m/z : [M+H]⁺ calcd for C₂₅H₁₉N₂ 347.1548; found, 347.1541.

1-(4-methoxyphenyl)-3-(naphthalen-2-yl)-5-phenyl-1H-pyrazole-4-carbaldehyde (**3ia**)



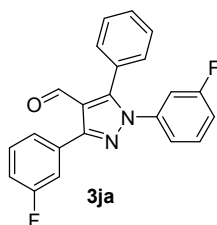
Compound **3ia** was synthesized according to general procedure using **1i** (100 mg, 0.32 mmol) as a red solid in 56% yield (73.0 mg, 0.18 mmol). R_f = 0.30 (Pet. ether /EtOAc = 30:1); mp 176-177 °C; **¹H NMR** (600 MHz, CDCl₃) δ 9.91 (s, 1H), 8.52 (d, J = 1.7 Hz, 1H), 8.06 (dd, J = 8.5, 1.8 Hz, 1H), 7.98 – 7.91 (m, 2H), 7.89 – 7.82 (m, 1H), 7.54 – 7.48 (m, 2H), 7.46 – 7.38 (m, 3H), 7.37 – 7.32 (m, 2H), 7.31 – 7.21 (m, 2H), 6.85 – 6.78 (m, 2H), 3.77 (s, 3H). **¹³C NMR** (151 MHz, CDCl₃) δ 184.1, 157.7, 151.9, 147.8, 132.0, 131.6, 130.2, 129.1, 128.2, 127.4, 127.3, 127.1, 127.0, 126.3, 126.1, 126.1, 125.2, 125.1, 125.0, 124.6, 117.1, 112.6, 53.9. **FT-IR** (film of a solution in CH₂Cl₂) ν 3394, 3055, 2932, 2836, 2758, 1681, 1605, 1511, 1454, 1301, 1251, 1171, 1032, 972, 862, 840, 823, 768, 755, 736, 701, 588, 532, 478 cm⁻¹. **HRMS** (ESI) m/z : [M+H]⁺ calcd for C₂₇H₂₁N₂O₂ 405.1603; found, 405.1600.

1-(4-methoxyphenyl)-3-(naphthalen-2-yl)-4-phenyl-1H-pyrazole (**4ia**)



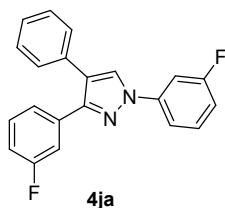
Compound **4ia** was synthesized according to general procedure using **1i** (100 mg, 0.32 mmol) as a yellow oily liquid in 37% yield (44.9 mg, 0.12 mmol). $R_f = 0.65$ (Pet. ether /EtOAc = 30:1); **¹H NMR** (600 MHz, CDCl₃) δ 8.12 – 8.09 (m, 1H), 7.97 (s, 1H), 7.87 – 7.81 (m, 1H), 7.81 – 7.75 (m, 2H), 7.77 – 7.71 (m, 2H), 7.69 (dd, $J = 8.5$, 1.7 Hz, 1H), 7.49 – 7.42 (m, 2H), 7.40 – 7.35 (m, 2H), 7.35 – 7.27 (m, 3H), 7.05 – 6.99 (m, 2H), 3.87 (s, 3H). **¹³C NMR** (151 MHz, CDCl₃) δ 158.4, 149.9, 133.8, 133.4, 133.0, 132.9, 130.8, 128.7, 128.6, 128.4, 127.8, 127.7, 127.3, 127.0, 126.9, 126.6, 126.0, 126.0, 122.8, 120.8, 114.6, 55.6. **FT-IR** (film) ν 3425, 3052, 2929, 2836, 1604, 1552, 1512, 1442, 1302, 1246, 1214, 1180, 1060, 1032, 961, 827, 761, 698, 619, 476 cm⁻¹. **HRMS** (ESI) m/z : [M+H]⁺ calcd for C₂₆H₂₁N₂O 377.1654; found, 377.1648.

1,3-bis(3-fluorophenyl)-5-phenyl-1H-pyrazole-4-carbaldehyde (**3ja**)



Compound **3ja** was synthesized according to general procedure using **1j** (100 mg, 0.38 mmol) as a red solid in 37% yield (50.1 mg, 0.14 mmol). $R_f = 0.30$ (Pet. ether /EtOAc = 30:1); mp 146-147 °C; **¹H NMR** (600 MHz, CDCl₃) δ 9.83 (s, 1H), 7.79 (dt, $J = 7.7$, 1.3 Hz, 1H), 7.74 (ddd, $J = 10.1$, 2.6, 1.6 Hz, 1H), 7.53 – 7.48 (m, 1H), 7.48 – 7.42 (m, 3H), 7.38 – 7.34 (m, 2H), 7.31 – 7.27 (m, 1H), 7.15 (tdd, $J = 8.4$, 2.6, 1.0 Hz, 1H), 7.11 (dt, $J = 9.4$, 2.3 Hz, 1H), 7.08 – 7.01 (m, 2H). **¹³C NMR** (151 MHz, CDCl₃) δ 183.8, 161.1 (d, $J = 244.6$ Hz), 160.9 (d, $J = 247.6$ Hz), 150.8 (d, $J = 2.7$ Hz), 148.5, 138.3 (d, $J = 10.0$ Hz), 131.8 (d, $J = 8.4$ Hz), 129.0, 128.76 (d, $J = 2.7$ Hz), 128.7 (d, $J = 5.9$ Hz), 128.3 (d, $J = 8.4$ Hz), 127.4, 125.6, 123.42 (d, $J = 2.9$ Hz), 119.2 (d, $J = 3.4$ Hz), 117.5, 114.71 (d, $J = 9.9$ Hz), 114.6 (d, $J = 12.0$ Hz), 113.9 (d, $J = 21.1$ Hz), 111.3 (d, $J = 25.3$ Hz). **¹⁹F NMR** (565 MHz, CDCl₃) δ -110.45, -113.06. **FT-IR** (film of a solution in CH₂Cl₂) ν 3347, 3064, 2921, 2842, 2764, 1686, 1612, 1601, 1492, 1461, 1272, 1210, 1073, 902, 862, 785, 768, 700, 683, 526 cm⁻¹. **HRMS** (ESI) m/z : [M+Na]⁺ calcd for C₂₂H₁₄F₂N₂NaO 383.0972; found, 383.0964.

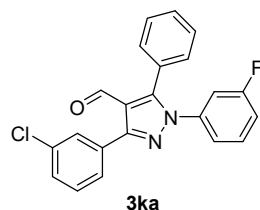
1,3-bis(3-fluorophenyl)-4-phenyl-1H-pyrazole (**4ja**)



Compound **4ja** was synthesized according to general procedure using **1j** (100 mg, 0.38 mmol) as a yellow solid in 23% yield (28.7 mg, 0.09 mmol). $R_f = 0.65$ (Pet. ether /EtOAc = 30:1); mp 101-102 °C; **¹H NMR** (600 MHz, CDCl₃) δ 8.00 (s, 1H), 7.61 – 7.53 (m, 2H), 7.44 (td, $J = 8.2$, 6.1 Hz, 1H), 7.39 – 7.31 (m, 7H), 7.31 – 7.27 (m, 1H), 7.05 – 6.98 (m, 2H). **¹³C NMR** (151 MHz, CDCl₃) δ 163.3 (d, $J = 247.6$ Hz), 162.8 (d, $J = 244.6$ Hz), 149.5 (d, $J = 2.7$ Hz), 141.1 (d, $J = 10.2$ Hz), 135.0 (d, $J = 8.4$ Hz), 132.2, 130.8 (d, $J = 9.1$ Hz), 129.9 (d, $J = 8.3$ Hz),

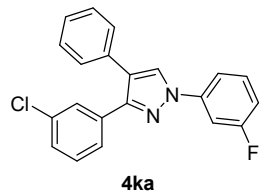
128.8, 128.7, 127.4, 126.8, 124.1 (d, $J = 2.9$ Hz), 123.6, 115.2 (d, $J = 22.6$ Hz), 115.0 (d, $J = 21.1$ Hz), 114.0 (d, $J = 3.0$ Hz), 113.4 (d, $J = 21.4$ Hz), 106.6 (d, $J = 26.5$ Hz). **^{19}F NMR** (565 MHz, CDCl_3) δ -110.69, -113.07. **FT-IR** (film of a solution in CH_2Cl_2) ν 3431, 3075, 2926, 2850, 1613, 1602, 1557, 1499, 1485, 1458, 1345, 1196, 1153, 1073, 1059, 874, 762, 699, 678, 529 cm^{-1} . **HRMS** (ESI) m/z : $[\text{M}+\text{H}]^+$ calcd for $\text{C}_{21}\text{H}_{15}\text{F}_2\text{N}_2$ 333.1203; found, 333.1196.

3-(3-chlorophenyl)-1-(3-fluorophenyl)-5-phenyl-1*H*-pyrazole-4-carbaldehyde (**3ka**)



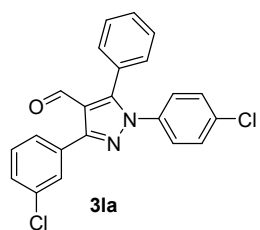
Compound **3ka** was synthesized according to general procedure using **1k** (100 mg, 0.35 mmol) as a red solid in 39% yield (52.0 mg, 0.14 mmol). $R_f = 0.30$ (Pet. ether /EtOAc = 30:1); mp 148-149 $^{\circ}\text{C}$; **^1H NMR** (600 MHz, CDCl_3) δ 9.81 (s, 1H), 8.00 (d, $J = 2.0$ Hz, 1H), 7.92 – 7.87 (m, 1H), 7.52 – 7.47 (m, 1H), 7.47 – 7.38 (m, 4H), 7.40 – 7.33 (m, 2H), 7.31 – 7.24 (m, 1H), 7.11 (dt, $J = 9.4, 2.3$ Hz, 1H), 7.03 (ddt, $J = 9.2, 7.4, 1.6$ Hz, 2H). **^{13}C NMR** (151 MHz, CDCl_3) δ 185.3, 162.5 (d, $J = 248.2$ Hz), 152.2, 150.0, 139.8 (d, $J = 9.9$ Hz), 134.3, 133.1, 130.5, 130.3 (d, $J = 4.0$ Hz), 130.3 (d, $J = 5.1$ Hz), 129.6, 129.4, 129.1, 129.0, 127.5, 127.1, 120.8 (d, $J = 3.3$ Hz), 119.1, 115.5 (d, $J = 20.9$ Hz), 112.9 (d, $J = 25.3$ Hz). **^{19}F NMR** (565 MHz, CDCl_3) δ -110.37. **FT-IR** (film of a solution in CH_2Cl_2) ν 3350, 3075, 2850, 2755, 1684, 1611, 1597, 1488, 1450, 1399, 1270, 1202, 1073, 885, 813, 790, 767, 703, 684, 521 cm^{-1} . **HRMS** (ESI) m/z : $[\text{M}+\text{H}]^+$ calcd for $\text{C}_{22}\text{H}_{15}\text{ClFN}_2\text{O}$ 377.0857; found, 377.0849.

3-(3-chlorophenyl)-1-(3-fluorophenyl)-4-phenyl-1*H*-pyrazole (**4ka**)



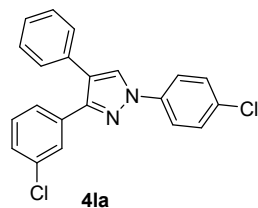
Compound **4ka** was synthesized according to general procedure using **1k** (100 mg, 0.35 mmol) as a light yellow oily liquid in 22% yield (27.2 mg, 0.08 mmol). $R_f = 0.65$ (Pet. ether /EtOAc = 30:1); **^1H NMR** (600 MHz, CDCl_3) δ 8.00 (s, 1H), 7.67 (t, $J = 1.8$ Hz, 1H), 7.57 (ddd, $J = 17.0, 9.0, 2.2$ Hz, 2H), 7.44 (td, $J = 8.2, 6.1$ Hz, 1H), 7.41 – 7.29 (m, 7H), 7.23 (t, $J = 7.8$ Hz, 1H), 7.05 – 6.98 (m, 1H). **^{13}C NMR** (151 MHz, CDCl_3) δ 163.3 (d, $J = 246.8$ Hz), 149.4, 141.1 (d, $J = 10.5$ Hz), 134.6, 134.3, 132.1, 130.8 (d, $J = 9.2$ Hz), 129.5, 128.7 (d, $J = 2.0$ Hz), 128.3, 128.1, 127.4, 126.8, 126.6, 123.6, 114.0, 114.0, 113.4 (d, $J = 21.4$ Hz), 106.6 (d, $J = 26.5$ Hz). **^{19}F NMR** (565 MHz, CDCl_3) δ -110.63. **FT-IR** (film) ν 3414, 3075, 2957, 2923, 2848, 1613, 1601, 1553, 1499, 1456, 1432, 1406, 1344, 1263, 1187, 1170, 1155, 1075, 1056, 981, 866, 775, 759, 700, 686, 678, 610, 512 cm^{-1} . **HRMS** (ESI) m/z : $[\text{M}+\text{H}]^+$ calcd for $\text{C}_{21}\text{H}_{15}\text{ClFN}_2$ 349.0908; found, 349.0901.

3-(3-chlorophenyl)-1-(4-chlorophenyl)-5-phenyl-1*H*-pyrazole-4-carbaldehyde (**3la**)



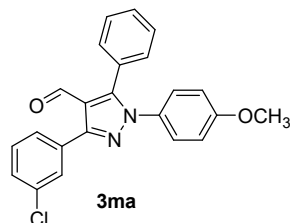
Compound **3la** was synthesized according to general procedure using **1l** (100 mg, 0.34 mmol) as a red oily liquid in 38% yield (50.0 mg, 0.13 mmol). R_f = 0.30 (Pet. ether /EtOAc = 30:1); $^1\text{H NMR}$ (600 MHz, CDCl_3) δ 9.82 (s, 1H), 7.98 (d, J = 0.9 Hz, 1H), 7.91 – 7.85 (m, 1H), 7.49 (d, J = 7.4 Hz, 1H), 7.48 – 7.39 (m, 4H), 7.36 – 7.33 (m, 2H), 7.33 – 7.29 (m, 2H), 7.26 – 7.22 (m, 2H). $^{13}\text{C NMR}$ (151 MHz, CDCl_3) δ 184.5, 151.5, 149.1, 136.3, 133.6, 133.5, 132.4, 129.8, 129.5, 128.8, 128.6, 128.6, 128.4, 128.2, 126.8, 126.4, 125.6, 118.3. **FT-IR** (film) ν 3383, 3072, 2926, 2850, 2758, 1683, 1603, 1491, 1457, 1401, 1093, 1011, 975, 835, 794, 768, 735, 699 cm^{-1} . **HRMS** (ESI) m/z : $[\text{M}+\text{H}]^+$ calcd for $\text{C}_{22}\text{H}_{15}\text{Cl}_2\text{N}_2\text{O}$ 393.0561; found, 393.0553.

3-(3-chlorophenyl)-1-(4-chlorophenyl)-4-phenyl-1H-pyrazole (**4la**)



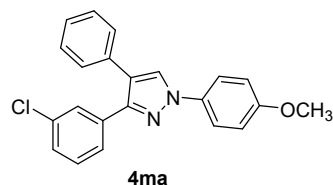
Compound **4la** was synthesized according to general procedure using **1l** (100 mg, 0.34 mmol) as a yellow solid in 25% yield (30.5 mg, 0.08 mmol). R_f = 0.65 (Pet. ether /EtOAc = 30:1); mp 101-102 $^{\circ}\text{C}$; $^1\text{H NMR}$ (600 MHz, CDCl_3) δ 7.98 (s, 1H), 7.74 (d, J = 8.8 Hz, 2H), 7.67 (t, J = 1.9 Hz, 1H), 7.48 – 7.43 (m, 2H), 7.40 – 7.35 (m, 3H), 7.34 – 7.31 (m, 3H), 7.30 (ddd, J = 8.0, 2.2, 1.1 Hz, 1H), 7.23 (t, J = 7.8 Hz, 1H). $^{13}\text{C NMR}$ (151 MHz, CDCl_3) δ 147.1, 136.1, 132.5, 132.1, 129.9, 129.9, 127.4, 127.3, 126.5, 126.0, 125.9, 125.2, 124.5, 124.3, 121.3, 117.8. **FT-IR** (film of a solution in CH_2Cl_2) ν 3422, 3069, 2926, 1598, 1552, 1497, 1435, 1396, 1339, 1222, 1095, 958, 829, 777, 760, 699, 605 cm^{-1} . **HRMS** (ESI) m/z : $[\text{M}+\text{H}]^+$ calcd for $\text{C}_{21}\text{H}_{15}\text{Cl}_2\text{N}_2$ 365.0612; found, 365.0607.

3-(3-chlorophenyl)-1-(4-methoxyphenyl)-5-phenyl-1H-pyrazole-4-carbaldehyde (**3ma**)



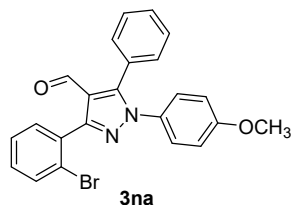
Compound **3ma** was synthesized according to general procedure using **1m** (100 mg, 0.34 mmol) as a red solid in 45% yield (59.4 mg, 0.15 mmol). R_f = 0.30 (Pet. ether /EtOAc = 30:1); mp 98-99 $^{\circ}\text{C}$; $^1\text{H NMR}$ (600 MHz, CDCl_3) δ 9.81 (s, 1H), 8.00 (dt, J = 1.7, 1.1 Hz, 1H), 7.90 (ddd, J = 5.0, 3.5, 1.6 Hz, 1H), 7.47 – 7.39 (m, 5H), 7.35 – 7.31 (m, 2H), 7.24 – 7.18 (m, 2H), 6.86 – 6.80 (m, 2H), 3.79 (s, 3H). $^{13}\text{C NMR}$ (151 MHz, CDCl_3) δ 183.7, 157.6, 150.0, 148.0, 132.5, 131.7, 129.8, 128.9, 128.2, 127.8, 127.4, 127.3, 127.0, 125.8, 125.7, 124.9, 116.8, 112.5, 53.8. **FT-IR** (film of a solution in CH_2Cl_2) ν 3338, 3069, 2842, 2752, 1681, 1600, 1569, 1517, 1483, 1455, 1401, 1301, 1253, 1171, 1031, 836, 802, 768, 737, 701, 686, 599, 546 cm^{-1} . **HRMS** (ESI) m/z : $[\text{M}+\text{Na}]^+$ calcd for $\text{C}_{23}\text{H}_{17}\text{ClN}_2\text{NaO}_2$ 411.0876; found, 411.0868.

3-(3-chlorophenyl)-1-(4-methoxyphenyl)-4-phenyl-1H-pyrazole (**4ma**)



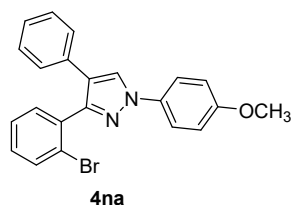
Compound **4ma** was synthesized according to general procedure using **1m** (100 mg, 0.34 mmol) as a yellow oily liquid in 36% yield (44.1 mg, 0.12 mmol). R_f = 0.65 (Pet. ether /EtOAc = 30:1); **¹H NMR** (600 MHz, CDCl₃) δ 7.91 (s, 1H), 7.72 – 7.66 (m, 3H), 7.39 (dt, J = 7.7, 1.3 Hz, 1H), 7.37 – 7.26 (m, 6H), 7.22 (t, J = 7.8 Hz, 1H), 7.03 – 6.97 (m, 2H), 3.86 (s, 3H). **¹³C NMR** (151 MHz, CDCl₃) δ 157.8, 147.9, 134.5, 133.6, 133.0, 131.9, 128.9, 128.1, 128.0, 127.7, 127.2, 126.5, 126.4, 126.0, 122.1, 120.1, 114.0, 55.0. **FT-IR** (film) ν 3408, 3075, 2831, 1600, 1550, 1518, 1456, 1442, 1300, 1253, 1062, 1032, 964, 830, 775, 760, 699, 680, 622 cm⁻¹. **HRMS** (ESI) m/z : [M+H]⁺ calcd for C₂₂H₁₈ClN₂O 361.1108; found, 361.1101.

3-(2-bromophenyl)-1-(4-methoxyphenyl)-5-phenyl-1*H*-pyrazole-4-carbaldehyde (**3na**)



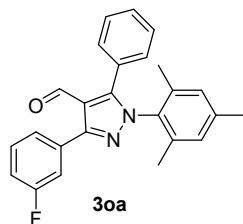
Compound **3na** was synthesized according to general procedure using **1n** (100 mg, 0.30 mmol) as a light yellow solid in 41% yield (52.4 mg, 0.12 mmol). R_f = 0.30 (Pet. ether /EtOAc = 10:1); mp 138-139 °C; **¹H NMR** (600 MHz, CDCl₃) δ 9.75 (s, 1H), 7.70 (dd, J = 8.1, 1.2 Hz, 1H), 7.56 (dd, J = 7.6, 1.7 Hz, 1H), 7.47 – 7.36 (m, 6H), 7.31 (td, J = 7.7, 1.8 Hz, 1H), 7.27 – 7.20 (m, 2H), 6.85 – 6.80 (m, 2H), 3.79 (s, 3H). **¹³C NMR** (151 MHz, CDCl₃) δ 185.2, 159.3, 152.9, 147.0, 133.3, 132.9, 132.0, 131.7, 130.6, 130.4, 129.8, 128.6, 127.6, 127.2, 126.7, 123.9, 119.3, 114.2, 55.5. **FT-IR** (film of a solution in CH₂Cl₂) ν 3414, 3055, 2960, 2932, 2836, 2750, 1682, 1608, 1517, 1485, 1453, 1301, 1253, 1173, 1029, 966, 836, 807, 771, 737, 700, 549, 532 cm⁻¹. **HRMS** (ESI) m/z : [M+Na]⁺ calcd for C₂₃H₁₇BrN₂NaO₂ 455.0371; found, 455.0369.

3-(2-bromophenyl)-1-(4-methoxyphenyl)-4-phenyl-1*H*-pyrazole (**4na**)



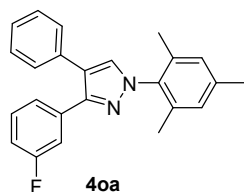
Compound **4na** was synthesized according to general procedure using **1n** (100 mg, 0.30 mmol) as a yellow oily liquid in 37% yield (44.2 mg, 0.11 mmol). R_f = 0.65 (Pet. ether /EtOAc = 10:1); **¹H NMR** (600 MHz, CDCl₃) δ 8.07 (s, 1H), 7.73 – 7.67 (m, 2H), 7.64 (dd, J = 8.2, 1.3 Hz, 1H), 7.49 (dd, J = 7.5, 1.8 Hz, 1H), 7.37 (td, J = 7.5, 1.3 Hz, 1H), 7.29 – 7.19 (m, 6H), 6.99 (d, J = 9.1 Hz, 2H), 3.86 (s, 3H). **¹³C NMR** (151 MHz, CDCl₃) δ 158.4, 149.9, 135.1, 133.6, 133.0, 132.6, 132.4, 129.9, 128.6, 127.3, 127.0, 126.6, 125.2, 124.3, 123.4, 120.8, 114.5, 55.6. **FT-IR** (film) ν 3417, 2954, 2923, 1603, 1555, 1519, 1306, 1250, 1213, 1062, 1029, 972, 958, 831, 761, 696, 619 cm⁻¹. **HRMS** (ESI) m/z : [M+H]⁺ calcd for C₂₂H₁₈BrN₂O 405.0603; found, 405.0597.

3-(3-fluorophenyl)-1-mesityl-5-phenyl-1*H*-pyrazole-4-carbaldehyde (**3oa**)



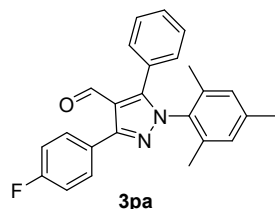
Compound **30a** was synthesized according to general procedure using **1o** (100 mg, 0.34 mmol) as a yellow solid in 56% yield (74.2 mg, 0.19 mmol). $R_f = 0.30$ (Pet. ether /EtOAc = 30:1); mp 226-227 °C; **¹H NMR** (600 MHz, CDCl₃) δ 9.89 (s, 1H), 7.82 (dt, $J = 7.8, 1.3$ Hz, 1H), 7.76 (ddd, $J = 10.1, 2.7, 1.5$ Hz, 1H), 7.45 – 7.37 (m, 2H), 7.37 – 7.33 (m, 2H), 7.29 – 7.24 (m, 2H), 7.13 (tdd, $J = 8.4, 2.7, 1.0$ Hz, 1H), 6.87 (s, 2H), 2.28 (s, 3H), 1.99 (s, 6H). **¹³C NMR** (151 MHz, CDCl₃) δ 185.6, 162.7 (d, $J = 244.9$ Hz), 152.4, 151.3, 139.6, 135.5, 134.3, 133.9 (d, $J = 8.4$ Hz), 129.9, 129.8, 129.7 (d, $J = 8.4$ Hz), 129.1, 128.5, 127.0, 125.0 (d, $J = 2.9$ Hz), 117.3, 116.2 (d, $J = 23.2$ Hz), 115.9 (d, $J = 21.0$ Hz), 21.1, 17.8. **¹⁹F NMR** (565 MHz, CDCl₃) δ -113.36. **FT-IR** (film of a solution in CH₂Cl₂) ν 3425, 3069, 2926, 2752, 1676, 1614, 1592, 1485, 1433, 1404, 1272, 1199, 879, 860, 809, 776, 736, 703, 684, 574, 523, 493 cm⁻¹. **HRMS** (ESI) m/z : [M+Na]⁺ calcd for C₂₅H₂₁FN₂NaO 407.1536; found, 407.1527.

3-(3-fluorophenyl)-1-mesityl-4-phenyl-1H-pyrazole (**40a**)



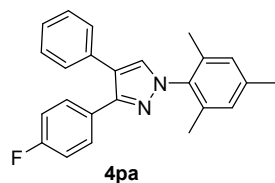
Compound **40a** was synthesized according to general procedure using **1o** (100 mg, 0.34 mmol) as a yellow oily liquid in 40% yield (49.1 mg, 0.14 mmol). $R_f = 0.65$ (Pet. ether /EtOAc = 30:1); **¹H NMR** (600 MHz, CDCl₃) δ 7.53 (s, 1H), 7.38 – 7.32 (m, 6H), 7.30 (d, $J = 7.0$ Hz, 1H), 7.27 – 7.23 (m, 2H), 6.97 (s, 2H), 2.34 (s, 3H), 2.12 (s, 6H). **¹³C NMR** (151 MHz, CDCl₃) δ 160.4 (d, $J = 245.0$ Hz), 145.6 (d, $J = 2.6$ Hz), 136.7, 134.2, 133.3, 133.2 (d, $J = 8.4$ Hz), 130.5, 129.0, 127.3 (d, $J = 8.3$ Hz), 126.6, 126.4, 126.2, 124.5, 121.7 (d, $J = 2.8$ Hz), 118.9, 112.8 (d, $J = 22.5$ Hz), 112.0 (d, $J = 21.3$ Hz), 18.7, 15.1. **¹⁹F NMR** (565 MHz, CDCl₃) δ -113.47. **FT-IR** (film) ν 3420, 3075, 3027, 2929, 2859, 1616, 1588, 1550, 1496, 1458, 1265, 1222, 1184, 1155, 864, 788, 764, 740, 699, 687, 529 cm⁻¹. **HRMS** (ESI) m/z : [M+H]⁺ calcd for C₂₄H₂₂FN₂ 357.1767; found, 357.1761.

3-(4-fluorophenyl)-1-mesityl-5-phenyl-1H-pyrazole-4-carbaldehyde (**3pa**)



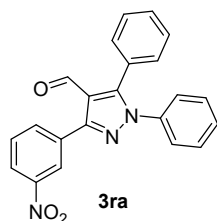
Compound **3pa** was synthesized according to general procedure using **1p** (100 mg, 0.34 mmol) as a yellow solid in 52% yield (68.9 mg, 0.18 mmol). $R_f = 0.30$ (Pet. ether /EtOAc = 30:1); mp 155-156 °C; **¹H NMR** (600 MHz, CDCl₃) δ 9.87 (s, 1H), 8.04 – 7.98 (m, 2H), 7.42 – 7.37 (m, 1H), 7.37 – 7.31 (m, 2H), 7.29 – 7.24 (m, 2H), 7.18 – 7.11 (m, 2H), 6.87 (s, 2H), 2.27 (s, 3H), 1.99 (s, 6H). **¹³C NMR** (151 MHz, CDCl₃) δ 184.5, 162.3 (d, $J = 248.3$ Hz), 151.5, 150.3, 138.5, 134.4, 133.2, 130.1 (d, $J = 8.4$ Hz), 128.8, 128.8, 128.0, 127.4, 126.8 (d, $J = 3.3$ Hz), 126.0, 116.0, 114.1 (d, $J = 21.6$ Hz), 20.0, 16.7. **¹⁹F NMR** (565 MHz, CDCl₃) δ -112.45. **FT-IR** (film of a solution in CH₂Cl₂) ν 3392, 2923, 2856, 2761, 1682, 1605, 1597, 1530, 1488, 1454, 1438, 1398, 1227, 1159, 1095, 843, 769, 740, 698, 532 cm⁻¹. **HRMS** (ESI) m/z : [M+Na]⁺ calcd for C₂₅H₂₁FN₂NaO 407.1537; found, 407.1528.

3-(4-fluorophenyl)-1-mesityl-4-phenyl-1H-pyrazole (**4pa**)



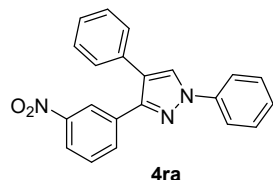
Compound **4pa** was synthesized according to general procedure using **1p** (100 mg, 0.34 mmol) as a light yellow solid in 41% yield (50.3 mg, 0.14 mmol). R_f = 0.65 (Pet. ether /EtOAc = 30:1); mp 65-66 °C; **¹H NMR** (600 MHz, CDCl₃) δ 7.58 – 7.54 (m, 2H), 7.52 (s, 1H), 7.37 – 7.31 (m, 4H), 7.31 – 7.25 (m, 1H), 7.03 – 6.95 (m, 4H), 2.33 (s, 3H), 2.12 (s, 6H). **¹³C NMR** (151 MHz, CDCl₃) δ 162.5 (d, J = 246.3 Hz), 148.4, 139.0, 136.7, 135.8, 133.1, 131.2, 130.2 (d, J = 8.2 Hz), 129.6 (d, J = 3.0 Hz), 128.9, 128.7, 128.6, 126.8, 120.9, 115.2 (d, J = 21.4 Hz), 21.2, 17.5. **¹⁹F NMR** (565 MHz, CDCl₃) δ -114.61. **FT-IR** (film of a solution in CH₂Cl₂) ν 3417, 3036, 2915, 2856, 1607, 1524, 1499, 1455, 1432, 1221, 1207, 1157, 973, 841, 765, 700, 627, 593, 557, 518 cm⁻¹. **HRMS** (ESI) m/z : [M+H]⁺ calcd for C₂₄H₂₂FN₂ 357.1767; found, 357.1758.

3-(3-nitrophenyl)-1,5-diphenyl-1H-pyrazole-4-carbaldehyde (**3ra**)



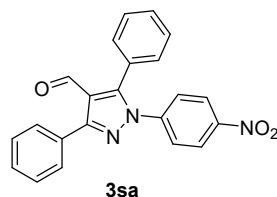
Compound **3ra** was synthesized according to general procedure using **1r** (100 mg, 0.36 mmol) as a brown solid in 40.33% yield (54.1 mg, 0.15 mmol). R_f = 0.20 (Pet. ether /EtOAc = 10:1); mp 148-149 °C; **¹H NMR** (700 MHz, CDCl₃) δ 9.81 (s, 1H), 8.95 (t, J = 2.0 Hz, 1H), 8.44 (ddd, J = 7.7, 1.7, 1.1 Hz, 1H), 8.29 (ddd, J = 8.2, 2.3, 1.1 Hz, 1H), 7.65 (t, J = 8.0 Hz, 1H), 7.52 – 7.47 (m, 1H), 7.47 – 7.42 (m, 2H), 7.36 (dtd, J = 5.3, 3.1, 2.6, 1.3 Hz, 5H), 7.34 – 7.31 (m, 2H). **¹³C NMR** (176 MHz, CDCl₃) δ 185.3, 150.9, 150.6, 148.2, 138.4, 135.3, 133.4, 130.6, 130.2, 129.2, 129.1, 128.9, 128.6, 127.0, 125.3, 124.2, 123.8, 119.0. **FT-IR** (film of a solution in CH₂Cl₂) ν 3344, 3089, 3061, 2848, 2764, 1683, 1596, 1532, 1496, 1450, 1436, 1422, 1402, 1349, 818, 769, 725, 692 cm⁻¹. **HRMS** (ESI) m/z : [M+Na]⁺ calcd for C₂₂H₁₅N₃NaO₃ 392.1011; found, 392.1005.

3-(3-nitrophenyl)-1,4-diphenyl-1H-pyrazole (**4ra**)



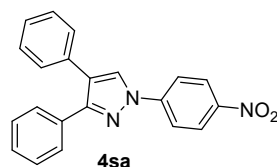
Compound **4ra** was synthesized according to general procedure using **1r** (100 mg, 0.36 mmol) as a brown solid in 20.38% yield (25.3 mg, 0.07 mmol). R_f = 0.50 (Pet. ether /EtOAc = 10:1); mp 125-126 °C; **¹H NMR** (700 MHz, CDCl₃) δ 8.56 (t, J = 2.0 Hz, 1H), 8.16 (ddd, J = 8.2, 2.3, 1.1 Hz, 1H), 8.05 (s, 1H), 7.87 (dt, J = 7.7, 1.3 Hz, 1H), 7.85 – 7.79 (m, 2H), 7.55 – 7.48 (m, 2H), 7.46 (t, J = 7.9 Hz, 1H), 7.40 – 7.32 (m, 6H). **¹³C NMR** (176 MHz, CDCl₃) δ 148.4, 147.9, 139.7, 135.0, 134.1, 132.1, 129.6, 129.2, 128.9, 128.8, 127.6, 127.2, 127.0, 123.4, 123.1, 122.6, 119.1. **FT-IR** (film of a solution in CH₂Cl₂) ν 3397, 3044, 1599, 1554, 1533, 1508, 1485, 1440, 1403, 1346, 1220, 1062, 960, 758, 701, 689 cm⁻¹. **HRMS** (ESI) m/z : [M+H]⁺ calcd for C₂₁H₁₆N₃O₂ 342.1243; found, 342.1235.

1-(4-nitrophenyl)-3,5-diphenyl-1*H*-pyrazole-4-carbaldehyde (**3sa**)



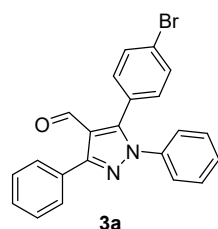
Compound **3sa** was synthesized according to general procedure using **1s** (100 mg, 0.36 mmol) as a yellow oily liquid in 17.60% yield (23.61 mg, 0.06 mmol). R_f = 0.30 (Pet. ether /EtOAc = 10:1); **¹H NMR** (700 MHz, CDCl₃) δ 9.88 (s, 1H), 8.19 (d, J = 9.1 Hz, 2H), 7.94 (dd, J = 8.1, 1.6 Hz, 2H), 7.50 (ddt, J = 8.7, 7.3, 3.3 Hz, 8H), 7.41 – 7.37 (m, 2H). **¹³C NMR** (176 MHz, CDCl₃) δ 185.32, 154.73, 149.51, 146.57, 143.60, 130.87, 130.57, 130.43, 129.59, 129.22, 129.18, 128.48, 127.15, 125.19, 124.50, 119.78. **FT-IR** (film) ν 3446, 2926, 2842, 2755, 1683, 1595, 1522, 1497, 1455, 1431, 1411, 1344, 1291, 1111, 855, 812, 770, 752, 695 cm⁻¹.

1-(4-nitrophenyl)-3,4-diphenyl-1*H*-pyrazole (**4sa**)



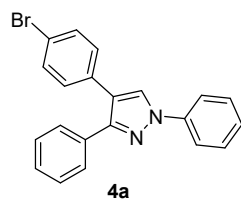
Compound **4sa** was synthesized according to general procedure using **1s** (100 mg, 0.36 mmol) as a yellow solid in 32.80% yield (40.72 mg, 0.12 mmol). R_f = 0.50 (Pet. ether /EtOAc = 10:1); **¹H NMR** (700 MHz, CDCl₃) δ 8.29 (d, J = 9.0 Hz, 2H), 8.23 (dd, J = 8.2, 1.5 Hz, 2H), 7.63 (d, J = 9.0 Hz, 2H), 7.58 – 7.54 (m, 2H), 7.52 – 7.42 (m, 7H). **¹³C NMR** (176 MHz, CDCl₃) δ 162.74, 155.37, 146.92, 142.94, 130.77, 130.06, 129.92, 129.09, 129.06, 128.71, 127.64, 126.71, 125.16, 124.81, 117.89. **FT-IR** (film of a solution in CH₂Cl₂) ν 3417, 3066, 2918, 2845, 1596, 1522, 1498, 1480, 1445, 1389, 1344, 1290, 1272, 1140, 1111, 989, 854, 729, 695 cm⁻¹.

5-(4-bromophenyl)-3-(cyclohexa-1,3-dien-1-yl)-1-phenyl-1*H*-pyrazole-4-carbaldehyde (**3a**)^[5]



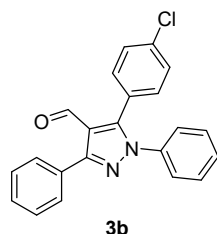
Compound **3a** was synthesized according to general procedure using **1a** (100 mg, 0.43 mmol) and 4-bromocinnamaldehyde as a light yellow oily liquid in 54% yield (94.4 mg, 0.23 mmol). R_f = 0.30 (Pet. ether /EtOAc = 30:1); **¹H NMR** (600 MHz, CDCl₃) δ 9.90 (s, 1H), 7.90 – 7.86 (m, 2H), 7.55 – 7.52 (m, 2H), 7.51 – 7.44 (m, 3H), 7.38 – 7.34 (m, 3H), 7.32 – 7.28 (m, 2H), 7.25 – 7.22 (m, 2H). **¹³C NMR** (151 MHz, CDCl₃) δ 185.5, 154.6, 146.9, 138.5, 132.1, 131.9, 131.2, 129.3, 129.2, 128.6, 128.5, 126.7, 125.5, 124.5, 118.6. **FT-IR** (film) ν 3414, 3066, 2856, 2758, 1684, 1596, 1505, 1482, 1451, 1431, 1072, 1013, 975, 807, 764, 733, 694, 504 cm⁻¹. **HRMS** (ESI) m/z : [M+Na]⁺ calcd for C₂₂H₁₅BrN₂NaO 425.0265; found, 425.0258.

4-(4-bromophenyl)-1,3-diphenyl-1*H*-pyrazole (**4a**)



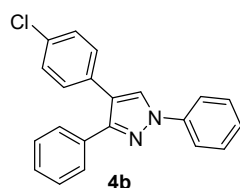
Compound **4a** was synthesized according to general procedure using **1a** (100 mg, 0.43 mmol) and 4-bromocinnamaldehyde as a yellow solid in 29% yield (47.2 mg, 0.13 mmol). R_f = 0.65 (Pet. ether /EtOAc = 30:1); mp 132-133 °C; $^1\text{H NMR}$ (600 MHz, CDCl_3) δ 8.01 (s, 1H), 7.81 – 7.77 (m, 2H), 7.60 – 7.54 (m, 2H), 7.51 – 7.44 (m, 4H), 7.38 – 7.33 (m, 3H), 7.33 – 7.29 (m, 1H), 7.24 – 7.19 (m, 2H). $^{13}\text{C NMR}$ (151 MHz, CDCl_3) δ 149.1, 138.5, 131.5, 130.5, 130.4, 128.9, 128.2, 127.1, 126.8, 125.3, 125.2, 120.4, 119.6, 117.7. **FT-IR** (film of a solution in CH_2Cl_2) ν 3394, 3066, 2929, 2850, 1599, 1549, 1502, 1484, 1409, 1348, 1217, 1072, 1011, 970, 955, 835, 756, 692, 593 cm^{-1} . **HRMS** (ESI) m/z : $[\text{M}+\text{H}]^+$ calcd for $\text{C}_{21}\text{H}_{16}\text{BrN}_2$ 375.0497; found, 375.0489.

5-(4-chlorophenyl)-1,3-diphenyl-1H-pyrazole-4-carbaldehyde (**3b**)⁵



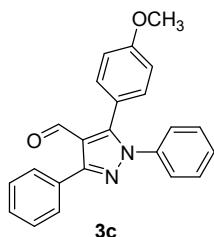
Compound **3b** was synthesized according to general procedure using **1a** (100 mg, 0.43 mmol) and 4-chlorocinnamaldehyde as a light yellow solid in 59% yield (91.8 mg, 0.26 mmol). R_f = 0.30 (Pet. ether /EtOAc = 30:1); mp 129-130 °C; $^1\text{H NMR}$ (600 MHz, CDCl_3) δ 9.90 (s, 1H), 7.91 – 7.86 (m, 2H), 7.52 – 7.43 (m, 3H), 7.40 – 7.34 (m, 5H), 7.30 (ddt, J = 7.0, 4.9, 2.1 Hz, 4H). $^{13}\text{C NMR}$ (151 MHz, CDCl_3) δ 184.1, 153.1, 145.5, 137.0, 134.7, 130.5, 129.8, 127.8, 127.8, 127.5, 127.1, 127.1, 124.8, 124.0, 117.2. **FT-IR** (film of a solution in CH_2Cl_2) ν 3392, 3061, 2923, 2859, 2761, 1684, 1597, 1498, 1485, 1454, 1431, 1092, 1022, 975, 868, 808, 765, 735, 694, 509 cm^{-1} . **HRMS** (ESI) m/z : $[\text{M}+\text{H}]^+$ calcd for $\text{C}_{22}\text{H}_{16}\text{ClN}_2\text{O}$ 359.0951; found, 359.0942.

4-(4-chlorophenyl)-1,3-diphenyl-1H-pyrazole (**4b**)⁷



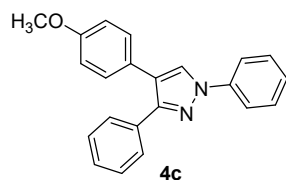
Compound **4b** was synthesized according to general procedure using **1a** (100 mg, 0.43 mmol) and 4-chlorocinnamaldehyde as a light yellow solid in 28% yield (40.2 mg, 0.12 mmol). R_f = 0.65 (Pet. ether /EtOAc = 30:1); mp 121-122 °C; $^1\text{H NMR}$ (600 MHz, CDCl_3) δ 8.01 (s, 1H), 7.81 – 7.76 (m, 2H), 7.60 – 7.54 (m, 2H), 7.52 – 7.45 (m, 2H), 7.35 (dq, J = 8.7, 3.0, 2.3 Hz, 3H), 7.33 – 7.25 (m, 5H). $^{13}\text{C NMR}$ (151 MHz, CDCl_3) δ 150.5, 139.8, 132.8, 131.4, 129.9, 129.5, 128.8, 128.5, 128.1, 126.6, 126.6, 121.8, 119.0. **FT-IR** (film of a solution in CH_2Cl_2) ν 3403, 3058, 2921, 1599, 1551, 1503, 1487, 1410, 1219, 1094, 1059, 1015, 971, 835, 798, 756, 698, 596 cm^{-1} . **HRMS** (ESI) m/z : $[\text{M}+\text{H}]^+$ calcd for $\text{C}_{21}\text{H}_{16}\text{ClN}_2$ 331.1002; found, 331.0994.

5-(4-methoxyphenyl)-1,3-diphenyl-1H-pyrazole-4-carbaldehyde (**3c**)⁸



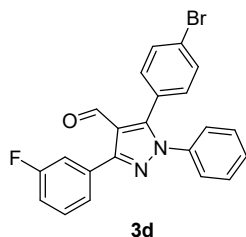
Compound **3c** was synthesized according to general procedure using **1a** (100 mg, 0.43 mmol) and 4-methoxycinnamaldehyde as a yellow solid in 48% yield (73.9 mg, 0.21 mmol). R_f = 0.30 (Pet. ether /EtOAc = 10:1); mp 165-166 °C; **¹H NMR** (600 MHz, CDCl₃) δ 9.87 (s, 1H), 7.96 – 7.91 (m, 2H), 7.51 – 7.41 (m, 3H), 7.33 (qd, J = 7.9, 7.2, 5.0 Hz, 5H), 7.30 – 7.26 (m, 2H), 6.94 – 6.89 (m, 2H), 3.83 (s, 3H). **¹³C NMR** (151 MHz, CDCl₃) δ 184.6, 159.4, 152.7, 147.8, 137.6, 130.8, 130.3, 128.0, 127.9, 127.8, 127.1, 126.9, 124.2, 118.4, 117.2, 112.9, 54.1. **FT-IR** (film of a solution in CH₂Cl₂) ν 3439, 3061, 2926, 2836, 2758, 1681, 1610, 1596, 1541, 1493, 1455, 1432, 1292, 1255, 1180, 1070, 1029, 969, 814, 763, 694 cm⁻¹. **HRMS** (ESI) m/z : [M+H]⁺ calcd for C₂₃H₁₉N₂O₂ 355.1447; found, 355.1434.

4-(4-methoxyphenyl)-1,3-diphenyl-1H-pyrazole (**4c**)⁹



Compound **4c** was synthesized according to general procedure using **1a** (100 mg, 0.43 mmol) and 4-methoxycinnamaldehyde as a light yellow oily liquid in 27% yield (37.8 mg, 0.12 mmol). R_f = 0.70 (Pet. ether /EtOAc = 10:1); **¹H NMR** (600 MHz, CDCl₃) δ 7.97 (s, 1H), 7.81 – 7.77 (m, 2H), 7.63 – 7.58 (m, 2H), 7.50 – 7.44 (m, 2H), 7.38 – 7.24 (m, 6H), 6.92 – 6.86 (m, 2H), 3.83 (s, 3H). **¹³C NMR** (151 MHz, CDCl₃) δ 156.6, 148.3, 137.9, 131.2, 127.8, 127.4, 126.3, 126.2, 125.8, 124.3, 123.1, 120.5, 116.8, 111.9, 53.2. **FT-IR** (film) ν 3420, 3055, 2949, 2926, 2836, 1599, 1557, 1497, 1448, 1401, 1290, 1248, 1218, 1177, 1034, 969, 836, 757, 697, 613, 596 cm⁻¹. **HRMS** (ESI) m/z : [M+H]⁺ calcd for C₂₂H₁₉N₂O 323.1497; found, 327.1492.

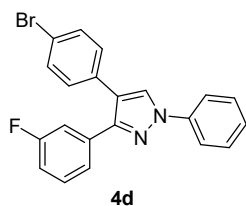
5-(4-bromophenyl)-3-(3-fluorophenyl)-1-phenyl-1H-pyrazole-4-carbaldehyde (**3d**)



Compound **3d** was synthesized according to general procedure using **1e** (100 mg, 0.40 mmol) and 4-bromocinnamaldehyde as a light yellow solid in 57% yield (96.5 mg, 0.23 mmol). R_f = 0.30 (Pet. ether /EtOAc = 30:1); mp 101-102 °C; **¹H NMR** (700 MHz, CDCl₃) δ 9.87 (s, 1H), 7.73 (dt, J = 7.7, 1.3 Hz, 1H), 7.69 (ddd, J = 9.9, 2.6, 1.5 Hz, 1H), 7.57 – 7.53 (m, 2H), 7.45 (td, J = 8.0, 5.9 Hz, 1H), 7.40 – 7.33 (m, 3H), 7.32 – 7.26 (m, 2H), 7.25 – 7.20 (m, 2H), 7.15 (tdd, J = 8.4, 2.6, 1.0 Hz, 1H). **¹³C NMR** (176 MHz, CDCl₃) δ 185.1, 162.7 (d, J = 245.5 Hz), 152.8 (d, J = 2.5 Hz), 147.8, 138.3, 133.4 (d, J = 8.3 Hz), 132.1 (d, J = 17.0 Hz), 129.9 (d, J = 8.2 Hz), 129.3, 128.7, 126.4, 125.4, 125.0, 125.0, 124.7, 118.7, 116.2, 116.1. **¹⁹F NMR** (565 MHz, CDCl₃) δ -112.92. **FT-IR** (film of a solution in CH₂Cl₂) ν 3425, 3072, 2926, 2850, 2764, 1683, 1614, 1595, 1496, 1482, 1461, 1437, 1266, 1199,

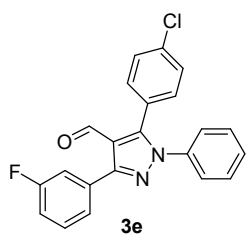
1072, 1013, 972, 880, 805, 765, 737, 691, 633 cm^{-1} . **HRMS** (ESI) m/z : $[M+Na]^+$ calcd for $\text{C}_{22}\text{H}_{14}\text{BrFN}_2\text{NaO}$ 443.0179; found, 443.0165.

4-(4-bromophenyl)-3-(3-fluorophenyl)-1-phenyl-1*H*-pyrazole (**4d**)



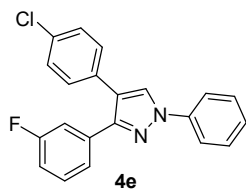
Compound **4d** was synthesized according to general procedure using **1e** (100 mg, 0.40 mmol) and 4-bromocinnamaldehyde as a brown solid in 24% yield (37.9 mg, 0.10 mmol). R_f = 0.65 (Pet. ether /EtOAc = 30:1); mp 148-149 $^{\circ}\text{C}$; **^1H NMR** (600 MHz, CDCl_3) δ 8.00 (d, J = 1.8 Hz, 1H), 7.80 – 7.76 (m, 2H), 7.52 – 7.43 (m, 4H), 7.36 – 7.27 (m, 4H), 7.24 – 7.17 (m, 2H), 7.06 – 6.99 (m, 1H). **^{13}C NMR** (176 MHz, CDCl_3) δ 162.8 (d, J = 245.5 Hz), 149.1 (d, J = 2.5 Hz), 139.7, 135.0 (d, J = 8.2 Hz), 131.8, 131.4, 130.3, 129.9 (d, J = 8.3 Hz), 129.5, 126.8 (d, J = 5.7 Hz), 124.1 (d, J = 2.7 Hz), 121.9, 121.2, 119.0, 115.2 (d, J = 22.4 Hz), 115.0, 114.9. **^{19}F NMR** (565 MHz, CDCl_3) δ -112.84. **FT-IR** (film of a solution in CH_2Cl_2) ν 3448, 3069, 3050, 1599, 1550, 1503, 1457, 1408, 1345, 1269, 1185, 1072, 989, 865, 756, 689 cm^{-1} . **HRMS** (ESI) m/z : $[M+H]^+$ calcd for $\text{C}_{21}\text{H}_{15}\text{BrFN}_2$ 393.0403; found, 393.0397.

5-(4-chlorophenyl)-3-(3-fluorophenyl)-1-phenyl-1*H*-pyrazole-4-carbaldehyde (**3e**)



Compound **3e** was synthesized according to general procedure using **1e** (100 mg, 0.40 mmol) and 4-chlorocinnamaldehyde as a yellow solid in 59% yield (89.5 mg, 0.24 mmol). R_f = 0.30 (Pet. ether /EtOAc = 30:1); mp 154-155 $^{\circ}\text{C}$; **^1H NMR** (600 MHz, CDCl_3) δ 9.87 (s, 1H), 7.73 (dt, J = 7.8, 1.3 Hz, 1H), 7.69 (ddd, J = 9.9, 2.6, 1.5 Hz, 1H), 7.45 (td, J = 8.0, 5.9 Hz, 1H), 7.40 – 7.33 (m, 5H), 7.32 – 7.26 (m, 4H), 7.15 (tdd, J = 8.3, 2.6, 1.0 Hz, 1H). **^{13}C NMR** (151 MHz, CDCl_3) δ 185.1, 162.7 (d, J = 245.4 Hz), 152.8 (d, J = 2.4 Hz), 147.8, 138.3, 136.4, 133.4 (d, J = 8.4 Hz), 131.9, 129.9 (d, J = 8.2 Hz), 129.3, 129.1, 128.7, 125.9, 125.4, 125.0 (d, J = 3.1 Hz), 118.8, 116.3, 116.1 (d, J = 2.9 Hz). **^{19}F NMR** (565 MHz, CDCl_3) δ -112.93. **FT-IR** (film of a solution in CH_2Cl_2) ν 3442, 3066, 2850, 2766, 1683, 1598, 1587, 1497, 1485, 1462, 1438, 1266, 1202, 1092, 1020, 978, 880, 806, 765, 735, 691 cm^{-1} . **HRMS** (ESI) m/z : $[M+Na]^+$ calcd for $\text{C}_{22}\text{H}_{14}\text{ClFN}_2\text{NaO}$ 399.0676; found, 399.0673.

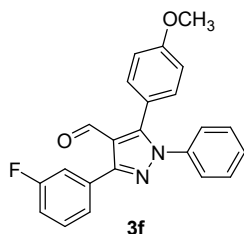
4-(4-chlorophenyl)-3-(3-fluorophenyl)-1-phenyl-1*H*-pyrazole (**4e**)



Compound **4e** was synthesized according to general procedure using **1e** (100 mg, 0.40 mmol) and 4-chlorocinnamaldehyde as a yellow oily liquid in 22% yield (30.9 mg, 0.09 mmol). R_f = 0.65 (Pet. ether /EtOAc = 30:1); **^1H NMR** (600 MHz, CDCl_3) δ 7.99 (s, 1H), 7.80 – 7.75 (m, 2H), 7.51 – 7.45 (m, 2H), 7.37 – 7.25 (m, 8H),

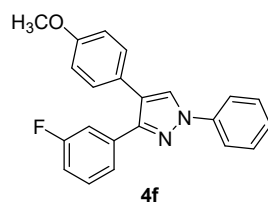
7.06 – 6.98 (m, 1H). **¹³C NMR** (151 MHz, CDCl₃) δ 162.8 (d, *J* = 245.3 Hz), 149.1 (d, *J* = 2.4 Hz), 139.7, 135.0 (d, *J* = 8.4 Hz), 133.1, 130.9, 130.0, 129.9, 129.5, 128.9, 126.8 (d, *J* = 3.4 Hz), 124.1 (d, *J* = 2.9 Hz), 121.9, 119.0, 115.2 (d, *J* = 22.6 Hz), 115.0, 114.9. **¹⁹F NMR** (565 MHz, CDCl₃) δ -112.89. **FT-IR** (film) ν 3434, 3072, 3050, 2926, 1785, 1599, 1552, 1503, 1457, 1410, 1345, 1266, 1227, 1185, 1094, 1059, 989, 961, 865, 756, 730, 688, 540 cm⁻¹. **HRMS** (ESI) *m/z*: [M+H]⁺ calcd for C₂₁H₁₅ClFN₂ 349.0908; found, 349.0903.

3-(3-fluorophenyl)-5-(4-methoxyphenyl)-1-phenyl-1*H*-pyrazole-4-carbaldehyde (**3f**)



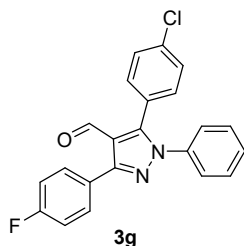
Compound **3f** was synthesized according to general procedure using **1e** (100 mg, 0.40 mmol) and 4-methoxycinnamaldehyde as a yellow solid in 50% yield (75.0 mg, 0.20 mmol). *R_f* = 0.30 (Pet. ether /EtOAc = 10:1); mp 138-139 °C; **¹H NMR** (700 MHz, CDCl₃) δ 9.84 (s, 1H), 7.79 (dt, *J* = 7.7, 1.3 Hz, 1H), 7.74 (ddd, *J* = 10.1, 2.7, 1.5 Hz, 1H), 7.43 (td, *J* = 7.9, 5.9 Hz, 1H), 7.39 – 7.29 (m, 5H), 7.29 – 7.21 (m, 2H), 7.13 (tdd, *J* = 8.4, 2.6, 1.1 Hz, 1H), 6.95 – 6.90 (m, 2H), 3.84 (s, 3H). **¹³C NMR** (176 MHz, CDCl₃) δ 185.6, 162.7 (d, *J* = 245.3 Hz), 160.8, 152.2 (d, *J* = 2.3 Hz), 149.8, 138.7, 133.8 (d, *J* = 8.4 Hz), 132.0, 129.8 (d, *J* = 8.1 Hz), 129.1, 128.3, 125.3, 125.0 (d, *J* = 2.9 Hz), 119.3, 118.6, 116.1 (d, *J* = 23.0 Hz), 116.0 (d, *J* = 21.1 Hz), 114.2, 55.4. **¹⁹F NMR** (565 MHz, CDCl₃) δ -113.25. **FT-IR** (film of a solution in CH₂Cl₂) ν 3428, 3075, 2932, 2834, 2755, 1682, 1611, 1588, 1495, 1462, 1438, 1404, 1293, 1255, 1180, 1025, 972, 880, 839, 793, 763, 693, 529 cm⁻¹. **HRMS** (ESI) *m/z*: [M+Na]⁺ calcd for C₂₃H₁₇FN₂NaO₂ 395.1172; found, 395.1167.

3-(3-fluorophenyl)-4-(4-methoxyphenyl)-1-phenyl-1*H*-pyrazole (**4f**)



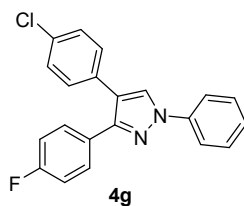
Compound **4f** was synthesized according to general procedure using **1e** (100 mg, 0.40 mmol) and 4-methoxycinnamaldehyde as a red oily liquid in 25% yield (34.7 mg, 0.10 mmol). *R_f* = 0.70 (Pet. ether /EtOAc = 10:1); **¹H NMR** (600 MHz, CDCl₃) δ 7.96 (s, 1H), 7.80 – 7.76 (m, 2H), 7.48 (tt, *J* = 7.4, 1.8 Hz, 2H), 7.40 – 7.34 (m, 2H), 7.34 – 7.23 (m, 4H), 7.03 – 6.97 (m, 1H), 6.92 – 6.87 (m, 2H), 3.84 (s, 3H). **¹³C NMR** (151 MHz, CDCl₃) δ 162.8 (d, *J* = 245.2 Hz), 158.9, 149.0 (d, *J* = 2.7 Hz), 139.9, 135.4 (d, *J* = 8.1 Hz), 130.0, 129.8 (d, *J* = 8.3 Hz), 129.5, 126.6 (d, *J* = 8.9 Hz), 124.8, 124.0 (d, *J* = 2.9 Hz), 122.8, 119.0, 115.1 (d, *J* = 22.6 Hz), 114.8, 114.6, 114.1, 55.3. **¹⁹F NMR** (565 MHz, CDCl₃) δ -113.21. **FT-IR** (film) ν 3448, 3066, 2960, 2932, 2831, 1615, 1599, 1560, 1498, 1457, 1414, 1340, 1291, 1248, 1179, 1061, 1034, 989, 959, 865, 840, 757, 734, 689, 605 cm⁻¹. **HRMS** (ESI) *m/z*: [M+H]⁺ calcd for C₂₂H₁₈FN₂O 345.1403; found, 345.1394.

5-(4-chlorophenyl)-3-(4-fluorophenyl)-1-phenyl-1*H*-pyrazole-4-carbaldehyde (**3g**)



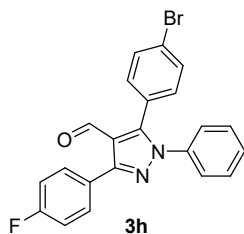
Compound **3g** was synthesized according to general procedure using **1f** (100 mg, 0.40 mmol) and 4-chlorocinnamaldehyde as a yellow solid in 55% yield (83.4 mg, 0.22 mmol). R_f = 0.30 (Pet. ether /EtOAc = 30:1); mp 156-157 °C; $^1\text{H NMR}$ (700 MHz, CDCl_3) δ 9.84 (s, 1H), 7.97 – 7.91 (m, 2H), 7.41 – 7.37 (m, 2H), 7.37 – 7.35 (m, 3H), 7.30 – 7.27 (m, 4H), 7.19 – 7.15 (m, 2H). $^{13}\text{C NMR}$ (176 MHz, CDCl_3) δ 185.2, 163.5 (d, J = 248.7 Hz), 153.0, 147.9, 138.4, 136.3, 131.9, 131.2 (d, J = 8.5 Hz), 129.2, 129.1, 128.6, 127.4 (d, J = 3.2 Hz), 126.0, 125.4, 118.6, 115.4 (d, J = 21.6 Hz). $^{19}\text{F NMR}$ (565 MHz, CDCl_3) δ -111.98. **FT-IR** (film of a solution in CH_2Cl_2) ν 3459, 3066, 2923, 2850, 2752, 1683, 1596, 1526, 1499, 1485, 1439, 1409, 1227, 1159, 1092, 1017, 840, 805, 766, 735, 692, 616, 537, 518 cm^{-1} . **HRMS** (ESI) m/z : $[\text{M}+\text{Na}]^+$ calcd for $\text{C}_{22}\text{H}_{14}\text{ClFN}_2\text{NaO}$ 399.0676; found, 399.0668.

4-(4-chlorophenyl)-3-(4-fluorophenyl)-1-phenyl-1H-pyrazole (**4g**)



Compound **4g** was synthesized according to general procedure using **1f** (100 mg, 0.40 mmol) and 4-chlorocinnamaldehyde as a yellow solid in 27% yield (37.9 mg, 0.11 mmol). R_f = 0.65 (Pet. ether /EtOAc = 30:1); mp 118-119 °C; $^1\text{H NMR}$ (600 MHz, CDCl_3) δ 8.00 (s, 1H), 7.80 – 7.75 (m, 2H), 7.57 – 7.51 (m, 2H), 7.51 – 7.45 (m, 2H), 7.37 – 7.29 (m, 3H), 7.32 – 7.23 (m, 2H), 7.08 – 7.01 (m, 2H). $^{13}\text{C NMR}$ (151 MHz, CDCl_3) δ 162.8 (d, J = 247.5 Hz), 149.6, 139.7, 133.0, 131.2, 130.2, 130.1, 129.9, 129.6, 128.9 (d, J = 3.4 Hz), 128.9, 126.7 (d, J = 5.6 Hz), 121.6, 119.0, 115.5 (d, J = 21.5 Hz). $^{19}\text{F NMR}$ (565 MHz, CDCl_3) δ -113.69. **FT-IR** (film of a solution in CH_2Cl_2) ν 3434, 3052, 2918, 2859, 1599, 1552, 1499, 1488, 1445, 1411, 1334, 1217, 1157, 1094, 1011, 972, 958, 837, 756, 737, 691, 596, 529, 512 cm^{-1} . **HRMS** (ESI) m/z : $[\text{M}+\text{H}]^+$ calcd for $\text{C}_{21}\text{H}_{15}\text{ClFN}_2$ 349.0908; found, 349.0903.

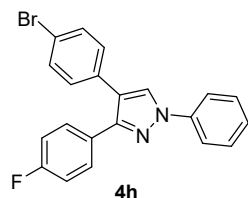
5-(4-bromophenyl)-3-(4-fluorophenyl)-1-phenyl-1H-pyrazole-4-carbaldehyde (**3h**)



Compound **3h** was synthesized according to general procedure using **1f** (100 mg, 0.40 mmol) and 4-bromocinnamaldehyde as a red solid in 50% yield (84.7 mg, 0.20 mmol). R_f = 0.30 (Pet. ether /EtOAc = 30:1); mp 118-119 °C; $^1\text{H NMR}$ (600 MHz, CDCl_3) δ 9.84 (s, 1H), 7.97 – 7.90 (m, 2H), 7.59 – 7.52 (m, 2H), 7.40 – 7.33 (m, 3H), 7.31 – 7.27 (m, 2H), 7.24 – 7.20 (m, 2H), 7.20 – 7.14 (m, 2H). $^{13}\text{C NMR}$ (151 MHz, CDCl_3) δ 185.2, 163.5

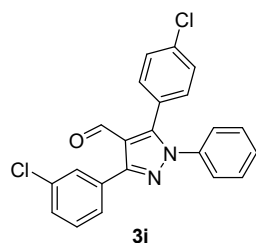
(d, $J = 248.7$ Hz), 153.1, 147.9, 138.4, 132.1 (d, $J = 11.4$ Hz), 131.2 (d, $J = 8.4$ Hz), 129.3, 128.6, 127.4 (d, $J = 3.3$ Hz), 126.4, 125.4, 124.7, 118.6, 115.4 (d, $J = 21.6$ Hz). **^{19}F NMR** (565 MHz, CDCl_3) δ -111.97. **FT-IR** (film of a solution in CH_2Cl_2) ν 3422, 3075, 2918, 2848, 2755, 1683, 1595, 1525, 1498, 1482, 1440, 1406, 1388, 1227, 1159, 1072, 1013, 972, 840, 804, 765, 740, 692 cm^{-1} . **HRMS** (ESI) m/z : $[\text{M}+\text{Na}]^+$ calcd for $\text{C}_{22}\text{H}_{14}\text{BrFN}_2\text{NaO}$ 443.0171; found, 443.0147.

4-(4-bromophenyl)-3-(4-fluorophenyl)-1-phenyl-1*H*-pyrazole (**4h**)



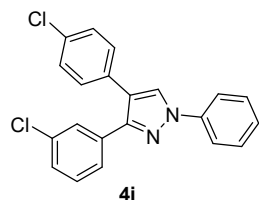
Compound **4h** was synthesized according to general procedure using **1f** (100 mg, 0.40 mmol) and 4-bromocinnamaldehyde as a light yellow solid in 27% yield (42.7 mg, 0.11 mmol). $R_f = 0.65$ (Pet. ether /EtOAc = 30:1); mp 102-103 $^{\circ}\text{C}$; **^1H NMR** (600 MHz, CDCl_3) δ 8.00 (s, 1H), 7.79 – 7.74 (m, 2H), 7.54 (ddd, $J = 8.7, 5.4, 2.6$ Hz, 2H), 7.52 – 7.43 (m, 4H), 7.34 – 7.30 (m, 1H), 7.22 – 7.17 (m, 2H), 7.08 – 7.01 (m, 2H). **^{13}C NMR** (151 MHz, CDCl_3) δ 162.8 (d, $J = 247.5$ Hz), 149.5, 139.7, 131.8, 131.6, 130.2, 130.2, 129.6, 128.9 (d, $J = 3.2$ Hz), 126.7 (d, $J = 13.0$ Hz), 121.6, 121.1, 119.0, 115.5 (d, $J = 21.5$ Hz). **^{19}F NMR** (565 MHz, CDCl_3) δ -113.66. **FT-IR** (film of a solution in CH_2Cl_2) ν 3431, 3072, 3047, 2926, 1599, 1549, 1504, 1484, 1447, 1409, 1336, 1264, 1218, 1157, 1072, 1012, 971, 841, 815, 757, 739, 689, 595, 509 cm^{-1} . **HRMS** (ESI) m/z : $[\text{M}+\text{H}]^+$ calcd for $\text{C}_{21}\text{H}_{15}\text{BrFN}_2$ 393.0403; found, 393.0393.

3-(3-chlorophenyl)-5-(4-chlorophenyl)-1-phenyl-1*H*-pyrazole-4-carbaldehyde (**3i**)



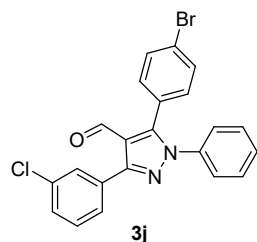
Compound **3i** was synthesized according to general procedure using **1d** (100 mg, 0.38 mmol) and 4-chlorocinnamaldehyde as a light yellow solid in 54% yield (80.2 mg, 0.20 mmol). $R_f = 0.30$ (Pet. ether /EtOAc = 30:1); mp 160-161 $^{\circ}\text{C}$; **^1H NMR** (600 MHz, CDCl_3) δ 9.86 (s, 1H), 7.95 (d, $J = 2.0$ Hz, 1H), 7.86 – 7.82 (m, 1H), 7.45 – 7.35 (m, 7H), 7.29 (dt, $J = 6.8, 1.9$ Hz, 4H). **^{13}C NMR** (151 MHz, CDCl_3) δ 185.1, 152.7, 147.8, 138.3, 136.4, 134.4, 133.1, 131.9, 129.7, 129.3, 129.3, 129.2, 129.1, 128.7, 127.5, 125.9, 125.4, 118.8. **FT-IR** (film of a solution in CH_2Cl_2) ν 3428, 2921, 2848, 2761, 1684, 1598, 1495, 1482, 1448, 1436, 1409, 1093, 1014, 972, 810, 734, 691 cm^{-1} . **HRMS** (ESI) m/z : $[\text{M}+\text{Na}]^+$ calcd for $\text{C}_{22}\text{H}_{14}\text{Cl}_2\text{N}_2\text{NaO}$ 415.0381; found, 415.0376.

3-(3-chlorophenyl)-4-(4-chlorophenyl)-1-phenyl-1*H*-pyrazole (**4i**)



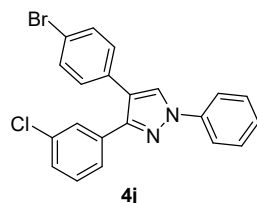
Compound **4i** was synthesized according to general procedure using **1d** (100 mg, 0.38 mmol) and 4-chlorocinnamaldehyde as a light yellow oily liquid in 27% yield (37.2 mg, 0.10 mmol). $R_f = 0.65$ (Pet. ether /EtOAc = 30:1); $^1\text{H NMR}$ (600 MHz, CDCl_3) δ 8.00 (s, 1H), 7.80 – 7.75 (m, 2H), 7.67 (t, $J = 1.9$ Hz, 1H), 7.52 – 7.46 (m, 2H), 7.39 – 7.28 (m, 5H), 7.28 – 7.22 (m, 3H). $^{13}\text{C NMR}$ (151 MHz, CDCl_3) δ 147.8, 138.5, 133.5, 133.2, 131.9, 129.7, 128.7, 128.4, 128.4, 127.7, 127.1, 127.0, 125.7, 125.6, 125.4, 120.7, 117.9. **FT-IR** (film) ν 3436, 2923, 2848, 1684, 1598, 1549, 1501, 1484, 1446, 1408, 1339, 1216, 1093, 982, 891, 836, 774, 756, 726, 688, 537, 509 cm^{-1} . **HRMS** (ESI) m/z : $[\text{M}+\text{H}]^+$ calcd for $\text{C}_{21}\text{H}_{15}\text{Cl}_2\text{N}_2$ 365.0612; found, 365.0606.

5-(4-bromophenyl)-3-(3-chlorophenyl)-1-phenyl-1*H*-pyrazole-4-carbaldehyde (**3j**)



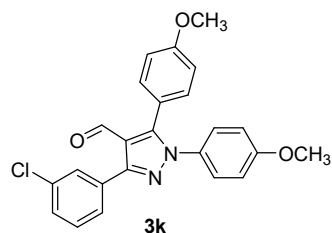
Compound **3j** was synthesized according to general procedure using **1d** (100 mg, 0.38 mmol) and 4-bromocinnamaldehyde as a yellow solid in 44% yield (72.5 mg, 0.17 mmol). $R_f = 0.30$ (Pet. ether /EtOAc = 30:1); mp 162-163 $^{\circ}\text{C}$; $^1\text{H NMR}$ (600 MHz, CDCl_3) δ 9.85 (s, 1H), 7.95 (d, $J = 1.9$ Hz, 1H), 7.87 – 7.80 (m, 1H), 7.58 – 7.52 (m, 2H), 7.45 – 7.40 (m, 2H), 7.36 (dd, $J = 5.3, 2.0$ Hz, 3H), 7.29 (dt, $J = 7.0, 2.2$ Hz, 2H), 7.24 – 7.20 (m, 2H). $^{13}\text{C NMR}$ (151 MHz, CDCl_3) δ 184.2, 151.8, 147.0, 137.4, 133.5, 132.2, 131.3, 131.2, 128.8, 128.5, 128.4, 128.3, 127.9, 126.7, 125.5, 124.6, 123.9, 117.9. **FT-IR** (film of a solution in CH_2Cl_2) ν 3392, 3075, 2850, 2761, 1683, 1597, 1494, 1480, 1460, 1448, 1073, 1013, 975, 810, 793, 763, 740, 690, 518, 442 cm^{-1} . **HRMS** (ESI) m/z : $[\text{M}+\text{Na}]^+$ calcd for $\text{C}_{22}\text{H}_{14}\text{BrClN}_2\text{NaO}$ 458.9876; found, 458.9873.

4-(4-bromophenyl)-3-(3-chlorophenyl)-1-phenyl-1*H*-pyrazole (**4j**)



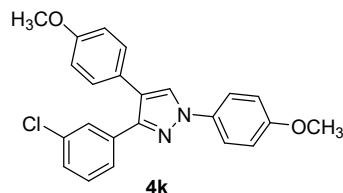
Compound **4j** was synthesized according to general procedure using **1d** (100 mg, 0.38 mmol) and 4-bromocinnamaldehyde as a yellow solid in 29% yield (44.8 mg, 0.11 mmol). $R_f = 0.65$ (Pet. ether /EtOAc = 30:1); mp 97-98 $^{\circ}\text{C}$; $^1\text{H NMR}$ (600 MHz, CDCl_3) δ 8.00 (s, 1H), 7.80 – 7.75 (m, 2H), 7.68 (t, $J = 1.9$ Hz, 1H), 7.49 (ddd, $J = 10.3, 7.0, 2.2$ Hz, 4H), 7.39 – 7.29 (m, 3H), 7.27 – 7.24 (m, 1H), 7.22 – 7.18 (m, 2H). $^{13}\text{C NMR}$ (151 MHz, CDCl_3) δ 149.0, 139.7, 134.7, 134.4, 131.9, 131.4, 130.2, 129.6, 129.6, 128.3, 128.2, 126.9, 126.8, 126.6, 121.9, 121.3, 119.1. **FT-IR** (film of a solution in CH_2Cl_2) ν 3420, 3047, 2923, 2853, 1681, 1598, 1547, 1501, 1482, 1408, 1339, 1264, 1216, 1073, 981, 955, 837, 756, 687 cm^{-1} . **HRMS** (ESI) m/z : $[\text{M}+\text{H}]^+$ calcd for $\text{C}_{21}\text{H}_{15}\text{BrClN}_2$ 409.0107; found, 409.0102.

3-(3-chlorophenyl)-1,5-bis(4-methoxyphenyl)-1*H*-pyrazole-4-carbaldehyde (**3k**)



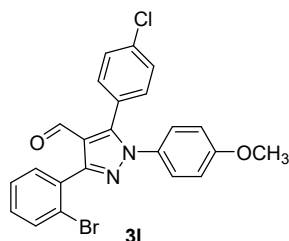
Compound **3k** was synthesized according to general procedure using **1m** (100 mg, 0.34 mmol) and 4-methoxycinnamaldehyde as a red solid in 52% yield (74.0 mg, 0.18 mmol). R_f = 0.15 (Pet. ether /EtOAc = 10:1); mp 105-106 °C; $^1\text{H NMR}$ (600 MHz, CDCl_3) δ 9.82 (s, 1H), 7.98 (dt, J = 1.7, 1.1 Hz, 1H), 7.88 (pd, J = 4.5, 1.6 Hz, 1H), 7.43 – 7.37 (m, 2H), 7.28 – 7.23 (m, 2H), 7.25 – 7.19 (m, 2H), 6.95 – 6.89 (m, 2H), 6.88 – 6.82 (m, 2H), 3.84 (s, 3H), 3.80 (s, 3H). $^{13}\text{C NMR}$ (151 MHz, CDCl_3) δ 185.5, 160.7, 159.3, 151.9, 149.7, 134.2, 133.5, 132.1, 131.7, 129.5, 129.1, 129.0, 127.5, 126.7, 119.4, 118.3, 114.2, 114.2, 55.5, 55.4. **FT-IR** (film of a solution in CH_2Cl_2) ν 3080, 3050, 2963, 2932, 2834, 2758, 1681, 1610, 1516, 1489, 1455, 1300, 1254, 1181, 1168, 1029, 972, 877, 836, 792, 736, 619, 535 cm^{-1} . **HRMS** (ESI) m/z : $[\text{M}+\text{Na}]^+$ calcd for $\text{C}_{24}\text{H}_{19}\text{ClN}_2\text{NaO}_3$ 441.0982; found, 441.0980.

3-(3-chlorophenyl)-1,4-bis(4-methoxyphenyl)-1H-pyrazole (**4k**)



Compound **4k** was synthesized according to general procedure using **1m** (100 mg, 0.34 mmol) and 4-methoxycinnamaldehyde as a light yellow oily liquid in 29% yield (38.5 mg, 0.10 mmol). R_f = 0.40 (Pet. ether /EtOAc = 10:1); $^1\text{H NMR}$ (600 MHz, CDCl_3) δ 7.86 (d, J = 1.5 Hz, 1H), 7.71 – 7.65 (m, 3H), 7.40 (dq, J = 7.6, 1.5 Hz, 1H), 7.33 – 7.16 (m, 4H), 6.99 (dd, J = 8.9, 1.6 Hz, 2H), 6.89 (dd, J = 8.6, 1.7 Hz, 2H), 3.86 (d, J = 1.4 Hz, 3H), 3.84 (d, J = 1.5 Hz, 3H). $^{13}\text{C NMR}$ (151 MHz, CDCl_3) δ 158.8, 158.4, 148.4, 135.2, 134.2, 133.6, 129.9, 129.5, 128.2, 127.7, 126.7, 126.5, 124.9, 122.4, 120.7, 114.6, 114.1, 55.6, 55.3. **FT-IR** (film) ν 3422, 2954, 2923, 2836, 1599, 1554, 1519, 1504, 1442, 1291, 1249, 1179, 1033, 986, 964, 833, 768, 641, 591, 540 cm^{-1} . **HRMS** (ESI) m/z : $[\text{M}+\text{H}]^+$ calcd for $\text{C}_{23}\text{H}_{20}\text{ClN}_2\text{O}_2$ 391.1213; found, 391.1205.

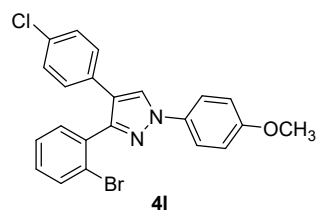
3-(2-bromophenyl)-5-(4-chlorophenyl)-1-(4-methoxyphenyl)-1H-pyrazole-4-carbaldehyde (**3l**)



Compound **3l** was synthesized according to general procedure using **1n** (100 mg, 0.30 mmol) and 4-chlorocinnamaldehyde as a red solid in 48% yield (66.2 mg, 0.14 mmol). R_f = 0.30 (Pet. ether /EtOAc = 10:1); mp 95-96 °C; $^1\text{H NMR}$ (600 MHz, CDCl_3) δ 9.74 (s, 1H), 7.71 (dd, J = 8.1, 1.2 Hz, 1H), 7.56 (dd, J = 7.5, 1.7 Hz, 1H), 7.43 (td, J = 7.5, 1.2 Hz, 1H), 7.40 – 7.36 (m, 2H), 7.36 – 7.30 (m, 3H), 7.25 – 7.19 (m, 2H), 6.88 – 6.83 (m, 2H), 3.81 (s, 3H). $^{13}\text{C NMR}$ (151 MHz, CDCl_3) δ 185.1, 159.5, 153.6, 145.1, 136.0, 133.0, 132.9, 132.1, 131.9, 131.4, 130.6, 128.9, 127.3, 126.8, 126.1, 123.9, 119.1, 114.3, 55.5. **FT-IR** (film of a solution in CH_2Cl_2) ν 3464,

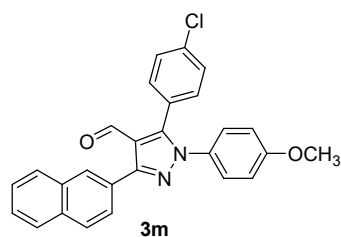
3055, 2937, 2836, 2750, 1683, 1600, 1516, 1483, 1447, 1301, 1253, 1173, 1092, 1029, 972, 865, 812, 836, 802, 764, 738, 650, 521 cm⁻¹. **HRMS** (ESI) *m/z*: [M+H]⁺ calcd for C₂₃H₁₇BrClN₂O₂ 467.0162; found, 467.0155.

3-(2-bromophenyl)-4-(4-chlorophenyl)-1-(4-methoxyphenyl)-1*H*-pyrazole (**4l**)



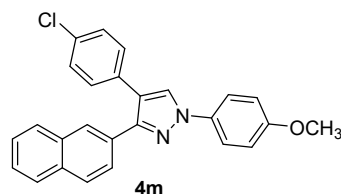
Compound **4l** was synthesized according to general procedure using **1n** (100 mg, 0.30 mmol) and 4-chlorocinnamaldehyde as a yellow oily liquid in 47% yield (60.9 mg, 0.14 mmol). *R_f* = 0.65 (Pet. ether /EtOAc = 10:1); **¹H NMR** (700 MHz, CDCl₃) δ 8.04 (s, 1H), 7.69 (d, *J* = 9.0 Hz, 2H), 7.63 (dd, *J* = 8.1, 1.2 Hz, 1H), 7.47 (dd, *J* = 7.6, 1.7 Hz, 1H), 7.38 (td, *J* = 7.5, 1.2 Hz, 1H), 7.30 – 7.25 (m, 1H), 7.24 – 7.19 (m, 2H), 7.15 – 7.10 (m, 2H), 7.02 – 6.97 (m, 2H), 3.85 (s, 3H). **¹³C NMR** (176 MHz, CDCl₃) δ 158.5, 149.8, 134.8, 133.5, 133.1, 132.4, 132.3, 131.2, 130.0, 128.8, 128.2, 127.4, 125.2, 124.2, 122.3, 120.8, 114.6, 55.6. **FT-IR** (film) ν 3442, 3050, 2963, 2935, 2839, 1550, 1519, 1486, 1441, 1345, 1303, 1250, 1214, 1090, 1060, 1031, 973, 955, 832, 802, 764, 735, 650, 630, 535, 439 cm⁻¹. **HRMS** (ESI) *m/z*: [M+H]⁺ calcd for C₂₂H₁₇BrClN₂O 439.0213; found, 439.0207.

5-(4-chlorophenyl)-1-(4-methoxyphenyl)-3-(naphthalen-2-yl)-1*H*-pyrazole-4-carbaldehyde (**3m**)



Compound **3m** was synthesized according to general procedure using **1i** (100 mg, 0.32 mmol) and 4-chlorocinnamaldehyde as a red solid in 56% yield (79.1 mg, 0.18 mmol). *R_f* = 0.30 (Pet. ether /EtOAc = 20:1); mp 102–103 °C; **¹H NMR** (600 MHz, CDCl₃) δ 9.96 (s, 1H), 8.42 (d, *J* = 1.6 Hz, 1H), 8.00 (dd, *J* = 8.5, 1.7 Hz, 1H), 7.97 – 7.92 (m, 2H), 7.91 – 7.87 (m, 1H), 7.56 – 7.50 (m, 2H), 7.42 – 7.36 (m, 2H), 7.35 – 7.29 (m, 2H), 7.26 – 7.21 (m, 2H), 6.90 – 6.84 (m, 2H), 3.81 (s, 3H). **¹³C NMR** (151 MHz, CDCl₃) δ 185.5, 159.5, 154.2, 147.2, 136.1, 133.6, 133.2, 132.0, 131.5, 128.9, 128.8, 128.6, 128.1, 127.8, 126.9, 126.7, 126.6, 126.4, 126.3, 118.6, 114.4, 55.6. **FT-IR** (film of a solution in CH₂Cl₂) ν 3420, 3050, 2960, 2932, 2839, 2752, 1682, 1601, 1515, 1480, 1448, 1301, 1171, 1091, 1030, 978, 836, 755, 738, 479 cm⁻¹. **HRMS** (ESI) *m/z*: [M+Na]⁺ calcd for C₂₇H₁₉ClN₂NaO₂ 461.1033; found, 461.1024.

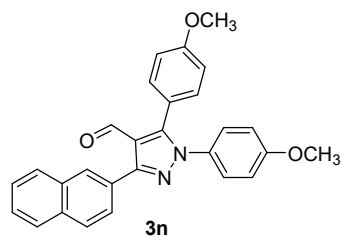
4-(4-chlorophenyl)-1-(4-methoxyphenyl)-3-(naphthalen-2-yl)-1*H*-pyrazole (**4m**)



Compound **4m** was synthesized according to general procedure using **1i** (100 mg, 0.32 mmol) and 4-chlorocinnamaldehyde as a yellow oily liquid in 30% yield (39.7 mg, 0.10 mmol). *R_f* = 0.65 (Pet. ether /EtOAc = 20:1); **¹H NMR** (700 MHz, CDCl₃) δ 8.10 – 8.06 (m, 1H), 7.96 (s, 1H), 7.85 – 7.78 (m, 3H), 7.75 – 7.69 (m, 2H), 7.65 (dd, *J* = 8.5, 1.7 Hz, 1H), 7.54 – 7.43 (m, 2H), 7.30 (d, *J* = 1.0 Hz, 4H), 7.02 (d, *J* = 9.0 Hz, 2H), 3.87 (s, 3H).

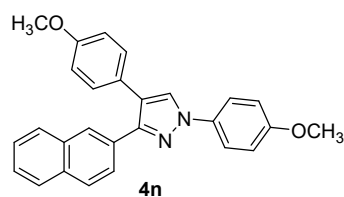
¹³C NMR (176 MHz, CDCl₃) δ 158.5, 149.9, 133.6, 133.4, 133.0, 132.8, 131.5, 130.5, 129.9, 128.8, 128.3, 127.9, 127.7, 126.9, 126.5, 126.1, 126.1, 121.6, 120.8, 114.6, 55.6. **FT-IR** (film) ν 3439, 3052, 2954, 2921, 1602, 1550, 1518, 1489, 1441, 1406, 1247, 1092, 1060, 1032, 829, 752, 627, 479 cm⁻¹. **HRMS** (ESI) m/z: [M+H]⁺ calcd for C₂₆H₂₀ClN₂O 411.1264; found, 411.1258.

1,5-bis(4-methoxyphenyl)-3-(naphthalen-2-yl)-1*H*-pyrazole-4-carbaldehyde (**3n**)



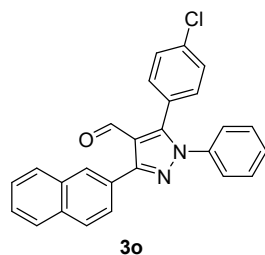
Compound **3n** was synthesized according to general procedure using **1i** (100 mg, 0.32 mmol) and 4-methoxycinnamaldehyde as a red solid in 54% yield (75.6 mg, 0.17 mmol). *R_f* = 0.10 (Pet. ether /EtOAc = 10:1); mp 167-168 °C; **¹H NMR** (600 MHz, CDCl₃) δ 9.91 (s, 1H), 8.52 – 8.48 (m, 1H), 8.05 (dd, *J* = 8.5, 1.7 Hz, 1H), 7.98 – 7.91 (m, 2H), 7.89 – 7.85 (m, 1H), 7.53 – 7.47 (m, 2H), 7.30 – 7.22 (m, 4H), 6.93 – 6.88 (m, 2H), 6.87 – 6.81 (m, 2H), 3.82 (s, 3H), 3.78 (s, 3H). **¹³C NMR** (151 MHz, CDCl₃) δ 185.8, 160.6, 159.3, 153.5, 149.3, 133.6, 133.2, 132.1, 131.9, 129.2, 128.9, 128.7, 127.9, 127.7, 126.8, 126.7, 126.6, 126.2, 119.7, 118.5, 114.2, 114.1, 55.5, 55.4. **FT-IR** (film of a solution in CH₂Cl₂) ν 3445, 3055, 2957, 2937, 2839, 2750, 1680, 1610, 1513, 1452, 1299, 1253, 1180, 1030, 975, 836, 756, 622, 476 cm⁻¹. **HRMS** (ESI) m/z: [M+Na]⁺ calcd for C₂₈H₂₂N₂NaO₃ 457.1528; found, 457.1523.

1,4-bis(4-methoxyphenyl)-3-(naphthalen-2-yl)-1*H*-pyrazole (**4n**)



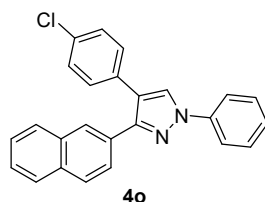
Compound **4n** was synthesized according to general procedure using **1i** (100 mg, 0.32 mmol) and 4-methoxycinnamaldehyde as a yellow oily liquid in 32% yield (41.9 mg, 0.10 mmol). *R_f* = 0.30 (Pet. ether /EtOAc = 10:1); **¹H NMR** (600 MHz, CDCl₃) δ 8.11 (d, *J* = 1.7 Hz, 1H), 7.92 (s, 1H), 7.85 – 7.76 (m, 3H), 7.74 – 7.67 (m, 3H), 7.45 (hept, *J* = 4.8 Hz, 2H), 7.31 – 7.28 (m, 2H), 7.04 – 6.98 (m, 2H), 6.92 – 6.84 (m, 2H), 3.86 (s, 3H), 3.83 (s, 3H). **¹³C NMR** (151 MHz, CDCl₃) δ 156.6, 156.2, 147.7, 131.8, 131.4, 130.8, 128.8, 127.8, 126.3, 125.7, 125.6, 125.2, 124.6, 124.5, 123.9, 123.3, 120.4, 118.7, 112.5, 111.9, 53.6, 53.2. **FT-IR** (film) ν 3442, 3055, 3007, 2954, 2932, 2834, 1617, 1557, 1519, 1502, 1463, 1437, 1306, 1286, 1247, 1179, 1067, 1033, 961, 831, 753, 666, 532, 479 cm⁻¹. **HRMS** (ESI) m/z: [M+H]⁺ calcd for C₂₇H₂₃N₂O₂ 407.1760; found, 407.1753.

5-(4-chlorophenyl)-3-(naphthalen-2-yl)-1-phenyl-1*H*-pyrazole-4-carbaldehyde (**3o**)



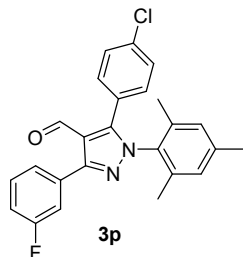
Compound **3o** was synthesized according to general procedure using **1h** (100 mg, 0.36 mmol) and 4-chlorocinnamaldehyde as a red solid in 54% yield (78.7 mg, 0.19 mmol). R_f = 0.30 (Pet. ether /EtOAc = 30:1); mp 195-196 °C; $^1\text{H NMR}$ (600 MHz, CDCl_3) δ 9.97 (s, 1H), 8.44 (d, J = 1.7 Hz, 1H), 8.01 (d, J = 1.7 Hz, 1H), 7.95 (d, J = 8.7 Hz, 2H), 7.92 – 7.87 (m, 1H), 7.56 – 7.50 (m, 2H), 7.42 – 7.30 (m, 9H). $^{13}\text{C NMR}$ (151 MHz, CDCl_3) δ 184.9, 153.7, 146.6, 137.8, 135.5, 133.0, 132.5, 131.3, 128.6, 128.3, 128.0, 127.9, 127.9, 127.4, 127.1, 126.1, 125.9, 125.7, 125.5, 124.8, 118.2. **FT-IR** (film of a solution in CH_2Cl_2) ν 3448, 3052, 2929, 2853, 2758, 1682, 1597, 1499, 1444, 1429, 1269, 1091, 1017, 972, 822, 805, 756, 734, 692, 515, 478 cm^{-1} . **HRMS** (ESI) m/z : $[\text{M}+\text{H}]^+$ calcd for $\text{C}_{26}\text{H}_{18}\text{ClN}_2\text{O}$ 409.1108; found, 409.1102.

4-(4-chlorophenyl)-3-(naphthalen-2-yl)-1-phenyl-1H-pyrazole (**4o**)



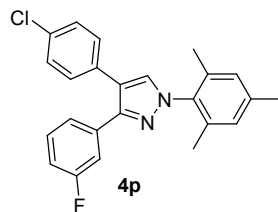
Compound **4o** was synthesized according to general procedure using **1h** (100 mg, 0.36 mmol) and 4-chlorocinnamaldehyde as a yellow solid in 31% yield (42.1 mg, 0.11 mmol). R_f = 0.65 (Pet. ether /EtOAc = 30:1); mp 145-146 °C; $^1\text{H NMR}$ (600 MHz, CDCl_3) δ 8.09 (d, J = 1.7 Hz, 1H), 8.04 (s, 1H), 7.87 – 7.76 (m, 5H), 7.66 (dd, J = 8.5, 1.7 Hz, 1H), 7.53 – 7.44 (m, 4H), 7.30 (s, 5H). $^{13}\text{C NMR}$ (151 MHz, CDCl_3) δ 148.1, 137.5, 131.1, 130.8, 130.6, 129.0, 128.0, 127.7, 127.3, 126.5, 126.1, 125.7, 125.4, 125.2, 124.5, 124.4, 124.1, 123.9, 123.9, 119.7, 116.8. **FT-IR** (film of a solution in CH_2Cl_2) ν 3439, 3047, 2921, 1599, 1552, 1504, 1411, 1265, 1214, 1092, 1059, 987, 959, 861, 847, 822, 753, 695, 535, 512, 477 cm^{-1} . **HRMS** (ESI) m/z : $[\text{M}+\text{H}]^+$ calcd for $\text{C}_{25}\text{H}_{18}\text{ClN}_2$ 381.1159; found, 381.1152.

5-(4-chlorophenyl)-3-(3-fluorophenyl)-1-mesityl-1H-pyrazole-4-carbaldehyde (**3p**)



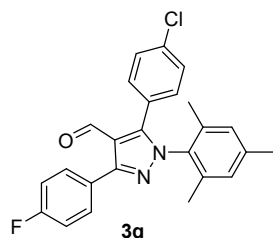
Compound **3p** was synthesized according to general procedure using **1o** (100 mg, 0.34 mmol) and 4-chlorocinnamaldehyde as a yellow solid in 67% yield (96.5 mg, 0.23 mmol). R_f = 0.30 (Pet. ether /EtOAc = 30:1); mp 207-208 °C; $^1\text{H NMR}$ (600 MHz, CDCl_3) δ 9.92 (s, 1H), 7.75 (dt, J = 7.7, 1.2 Hz, 1H), 7.72 – 7.67 (m, 1H), 7.44 (td, J = 8.0, 5.8 Hz, 1H), 7.34 – 7.29 (m, 2H), 7.24 – 7.18 (m, 2H), 7.17 – 7.11 (m, 1H), 6.89 (s, 2H), 2.29 (s, 3H), 1.98 (s, 6H). $^{13}\text{C NMR}$ (151 MHz, CDCl_3) δ 185.2, 162.7 (d, J = 245.7 Hz), 153.0 (d, J = 2.7 Hz), 149.2, 139.9, 136.3, 135.4, 134.0, 133.6 (d, J = 8.4 Hz), 131.1, 129.9 (d, J = 8.3 Hz), 129.3, 128.8, 125.6, 125.1 (d, J = 2.9 Hz), 117.3, 116.2 (d, J = 22.6 Hz), 116.1 (d, J = 20.7 Hz), 21.2, 17.8. $^{19}\text{F NMR}$ (565 MHz, CDCl_3) δ -113.05. **FT-IR** (film of a solution in CH_2Cl_2) ν 3442, 3072, 2929, 2853, 2750, 1682, 1613, 1587, 1484, 1463, 1439, 1407, 1391, 1268, 1199, 1096, 1015, 879, 855, 808, 744, 733, 684, 658, 509 cm^{-1} . **HRMS** (ESI) m/z : $[\text{M}+\text{H}]^+$ calcd for $\text{C}_{25}\text{H}_{21}\text{ClFN}_2\text{O}$ 419.1326; found, 419.1321.

4-(4-chlorophenyl)-3-(3-fluorophenyl)-1-mesityl-1H-pyrazole (**4p**)



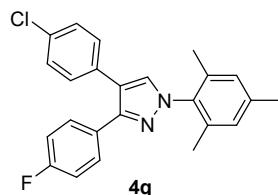
Compound **4p** was synthesized according to general procedure using **1o** (100 mg, 0.34 mmol) and 4-chlorocinnamaldehyde as a yellow oily liquid in 29% yield (39.0 mg, 0.10 mmol). R_f = 0.65 (Pet. ether /EtOAc = 30:1); $^1\text{H NMR}$ (600 MHz, CDCl_3) δ 7.52 (s, 1H), 7.35 – 7.26 (m, 7H), 7.03 – 6.97 (m, 3H), 2.34 (s, 3H), 2.11 (s, 6H). $^{13}\text{C NMR}$ (151 MHz, CDCl_3) δ 162.0 (d, J = 245.1 Hz), 147.2 (d, J = 2.4 Hz), 138.4, 135.7, 134.9, 134.6 (d, J = 8.1 Hz), 132.0, 130.6, 130.5, 129.2, 129.0 (d, J = 8.4 Hz), 128.2, 128.0, 123.3 (d, J = 2.8 Hz), 119.3, 114.4 (d, J = 22.5 Hz), 113.8 (d, J = 21.0 Hz), 20.3, 16.7. $^{19}\text{F NMR}$ (565 MHz, CDCl_3) δ -113.17. **FT-IR** (film) ν 3442, 2951, 2923, 2856, 1615, 1587, 1548, 1483, 1455, 1403, 1265, 1221, 1183, 1155, 1093, 1016, 991, 970, 865, 836, 816, 788, 732, 691, 627, 521 cm^{-1} . **HRMS** (ESI) m/z : $[\text{M}+\text{H}]^+$ calcd for $\text{C}_{24}\text{H}_{21}\text{ClFN}_2$ 391.1377; found, 391.1373.

5-(4-chlorophenyl)-3-(4-fluorophenyl)-1-mesityl-1H-pyrazole-4-carbaldehyde (**3q**)



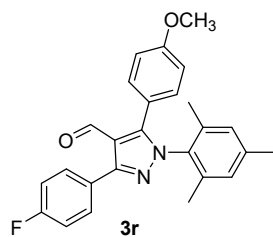
Compound **3q** was synthesized according to general procedure using **1p** (100 mg, 0.34 mmol) and 4-chlorocinnamaldehyde as a yellow solid in 65% yield (93.7 mg, 0.22 mmol). R_f = 0.30 (Pet. ether /EtOAc = 30:1); mp 113–114 $^{\circ}\text{C}$; $^1\text{H NMR}$ (600 MHz, CDCl_3) δ 9.89 (s, 1H), 7.98 – 7.91 (m, 2H), 7.34 – 7.29 (m, 2H), 7.23 – 7.19 (m, 2H), 7.19 – 7.12 (m, 2H), 6.89 (s, 2H), 2.29 (s, 3H), 1.98 (s, 6H). $^{13}\text{C NMR}$ (151 MHz, CDCl_3) δ 185.2, 163.3 (d, J = 248.8 Hz), 153.1, 149.1, 139.7, 136.1, 135.2, 133.9, 131.1 (d, J = 8.4 Hz), 131.0, 129.1, 128.7, 127.5 (d, J = 3.1 Hz), 125.5, 117.0, 115.2 (d, J = 21.6 Hz), 21.0, 17.7. $^{19}\text{F NMR}$ (565 MHz, CDCl_3) δ -112.19. **FT-IR** (film of a solution in CH_2Cl_2) ν 3442, 2951, 2932, 2853, 2755, 1683, 1597, 1524, 1485, 1448, 1407, 1229, 1159, 1094, 1014, 980, 841, 805, 737, 523 cm^{-1} . **HRMS** (ESI) m/z : $[\text{M}+\text{H}]^+$ calcd for $\text{C}_{25}\text{H}_{21}\text{ClFN}_2\text{O}$ 419.1326; found, 419.1322.

4-(4-chlorophenyl)-3-(4-fluorophenyl)-1-mesityl-1H-pyrazole (**4q**)



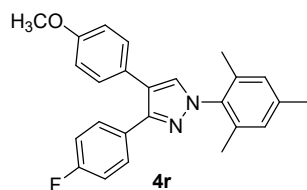
Compound **4q** was synthesized according to general procedure using **1p** (100 mg, 0.34 mmol) and 4-chlorocinnamaldehyde as a yellow solid in 30% yield (40.3 mg, 0.10 mmol). R_f = 0.65 (Pet. ether /EtOAc = 30:1); mp 63–64 $^{\circ}\text{C}$; $^1\text{H NMR}$ (600 MHz, CDCl_3) δ 7.55 – 7.50 (m, 3H), 7.33 – 7.25 (m, 4H), 7.05 – 6.98 (m, 2H), 6.97 (s, 2H), 2.34 (s, 3H), 2.11 (s, 6H). $^{13}\text{C NMR}$ (151 MHz, CDCl_3) δ 162.6 (d, J = 246.9 Hz), 148.4, 139.1, 136.5, 135.7, 132.6, 131.6, 131.2, 130.2 (d, J = 8.0 Hz), 129.9, 129.3 (d, J = 3.4 Hz), 129.0, 128.8, 119.7, 115.3 (d, J = 21.5 Hz), 21.1, 17.5. $^{19}\text{F NMR}$ (565 MHz, CDCl_3) δ -114.26. **FT-IR** (film of a solution in CH_2Cl_2) ν 3442, 3027, 2957, 2921, 2856, 1604, 1548, 1502, 1483, 1445, 1404, 1223, 1206, 1157, 1094, 1015, 973, 936, 838, 815, 740, 644, 555, 519 cm^{-1} . **HRMS** (ESI) m/z : $[\text{M}+\text{H}]^+$ calcd for $\text{C}_{24}\text{H}_{21}\text{ClFN}_2$ 391.1377; found, 391.1374.

3-(4-fluorophenyl)-1-mesityl-5-(4-methoxyphenyl)-1*H*-pyrazole-4-carbaldehyde (**3r**)



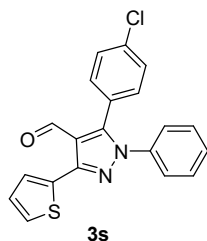
Compound **3r** was synthesized according to general procedure using **1p** (100 mg, 0.34 mmol) and 4-methoxycinnamaldehyde as a yellow solid in 60% yield (85.6 mg, 0.21 mmol). R_f = 0.30 (Pet. ether /EtOAc = 20:1); mp 154-155 °C; $^1\text{H NMR}$ (700 MHz, CDCl_3) δ 9.86 (s, 1H), 8.00 (dd, J = 8.6, 5.6 Hz, 2H), 7.19 (d, J = 8.6 Hz, 2H), 7.14 (t, J = 8.6 Hz, 2H), 6.88 (s, 2H), 6.85 (d, J = 8.5 Hz, 2H), 3.79 (s, 3H), 2.28 (s, 3H), 1.98 (s, 6H). $^{13}\text{C NMR}$ (176 MHz, CDCl_3) δ 185.7, 163.3 (d, J = 248.5 Hz), 160.7, 152.7, 151.2, 139.5, 135.5, 134.5, 131.3, 131.2 (d, J = 8.2 Hz), 129.1, 128.0 (d, J = 3.1 Hz), 119.1, 116.9, 115.2 (d, J = 21.6 Hz), 114.0, 55.3, 21.1, 17.8. $^{19}\text{F NMR}$ (565 MHz, CDCl_3) δ -112.57. **FT-IR** (film of a solution in CH_2Cl_2) ν 3434, 2954, 2923, 2836, 2750, 1681, 1610, 1539, 1492, 1450, 1394, 1294, 1255, 1225, 1180, 1159, 1034, 975, 839, 812, 791, 741, 588, 535 cm^{-1} . **HRMS** (ESI) m/z : $[\text{M}+\text{Na}]^+$ calcd for $\text{C}_{26}\text{H}_{23}\text{FN}_2\text{NaO}_2$ 437.1641; found, 437.1636.

3-(4-fluorophenyl)-1-mesityl-4-(4-methoxyphenyl)-1*H*-pyrazole (**4r**)



Compound **4r** was synthesized according to general procedure using **1p** (100 mg, 0.34 mmol) and 4-methoxycinnamaldehyde as a yellow oily liquid in 28% yield (37.3 mg, 0.10 mmol). R_f = 0.60 (Pet. ether /EtOAc = 20:1); $^1\text{H NMR}$ (600 MHz, CDCl_3) δ 7.59 – 7.53 (m, 2H), 7.47 (s, 1H), 7.29 – 7.24 (m, 2H), 7.03 – 6.95 (m, 4H), 6.93 – 6.86 (m, 2H), 3.83 (s, 3H), 2.34 (s, 3H), 2.11 (s, 6H). $^{13}\text{C NMR}$ (151 MHz, CDCl_3) δ 162.4 (d, J = 246.2 Hz), 158.6, 148.2, 139.0, 136.7, 135.8, 130.9, 130.1 (d, J = 7.9 Hz), 129.9, 129.7 (d, J = 3.3 Hz), 128.9, 125.4, 120.5, 115.2 (d, J = 21.4 Hz), 114.0, 55.3, 21.1, 17.5. $^{19}\text{F NMR}$ (565 MHz, CDCl_3) δ -114.79. **FT-IR** (film) ν 3439, 2955, 2924, 2836, 1613, 1595, 1556, 1524, 1506, 1489, 1445, 1413, 1396, 1289, 1246, 1222, 1207, 1178, 1157, 1034, 973, 838, 815, 740, 553 cm^{-1} . **HRMS** (ESI) m/z : $[\text{M}+\text{H}]^+$ calcd for $\text{C}_{25}\text{H}_{24}\text{FN}_2\text{O}$ 387.1873; found, 387.1870.

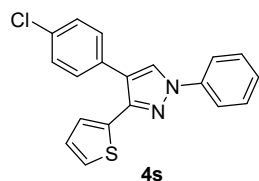
5-(4-chlorophenyl)-1-phenyl-3-(thiophen-2-yl)-1*H*-pyrazole-4-carbaldehyde (**3s**)



Compound **3s** was synthesized according to general procedure using **1g** (100 mg, 0.42 mmol) and 4-chlorocinnamaldehyde as a red solid in 59% yield (91.0 mg, 0.25 mmol). R_f = 0.30 (Pet. ether /EtOAc = 30:1); mp 146-147 °C; $^1\text{H NMR}$ (600 MHz, CDCl_3) δ 9.87 (s, 1H), 8.18 (dd, J = 3.7, 1.2 Hz, 1H), 7.43 – 7.37 (m, 3H), 7.35 (dd, J = 5.3, 2.0 Hz, 3H), 7.27 (ddt, J = 9.0, 4.4, 2.5 Hz, 4H), 7.16 (dd, J = 5.1, 3.7 Hz, 1H). $^{13}\text{C NMR}$ (151 MHz,

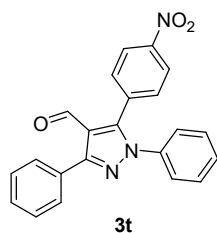
CDCl₃) δ 184.9, 148.4, 147.8, 138.2, 136.4, 133.5, 131.9, 129.6, 129.2, 129.2, 128.6, 127.8, 127.3, 125.9, 125.4, 118.4. **FT-IR** (film of a solution in CH₂Cl₂) ν 3456, 3069, 2926, 2850, 2761, 1682, 1597, 1496, 1463, 1435, 1409, 1092, 1017, 840, 803, 737, 709, 694, 501 cm⁻¹. **HRMS** (ESI) m/z : [M+Na]⁺ calcd for C₂₀H₁₃ClN₂NaOS 387.0335; found, 387.0326.

4-(4-chlorophenyl)-1-phenyl-3-(thiophen-2-yl)-1*H*-pyrazole (**4s**)



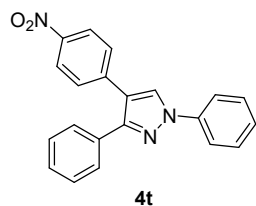
Compound **4s** was synthesized according to general procedure using **1g** (100 mg, 0.42 mmol) and 4-chlorocinnamaldehyde as a yellow oily liquid in 21% yield (29.9 mg, 0.09 mmol). R_f = 0.65 (Pet. ether /EtOAc = 30:1); **¹H NMR** (600 MHz, CDCl₃) δ 7.94 (s, 1H), 7.76 (dt, J = 8.4, 1.3 Hz, 2H), 7.54 – 7.42 (m, 2H), 7.37 (d, J = 1.2 Hz, 4H), 7.34 – 7.26 (m, 2H), 7.07 (dd, J = 3.6, 1.2 Hz, 1H), 6.97 (dd, J = 5.1, 3.6 Hz, 1H). **¹³C NMR** (176 MHz, CDCl₃) δ 145.1, 139.6, 134.9, 133.4, 130.9, 130.5, 129.5, 128.8, 127.3, 126.9, 126.7, 126.0, 125.5, 121.5, 119.0. **FT-IR** (film) ν 3459, 3066, 3047, 1598, 1557, 1504, 1464, 1405, 1360, 1334, 1262, 1206, 1092, 1062, 1014, 959, 932, 849, 833, 756, 695, 529 cm⁻¹. **HRMS** (ESI) m/z : [M+H]⁺ calcd for C₁₉H₁₄ClN₂S 337.0566; found, 337.0558.

5-(4-nitrophenyl)-1,3-diphenyl-1*H*-pyrazole-4-carbaldehyde (**3t**)



Compound **3t** was synthesized according to general procedure using **1a** (100 mg, 0.43 mmol) and 4-nitrocinnamaldehyde as a yellow solid in 42.43% yield (68.1 mg, 0.18 mmol). R_f = 0.20 (Pet. ether /EtOAc = 10:1); mp 156-157 °C; **¹H NMR** (700 MHz, CDCl₃) δ 9.97 (s, 1H), 8.23 (d, J = 8.8 Hz, 2H), 7.85 – 7.81 (m, 2H), 7.56 (d, J = 8.8 Hz, 2H), 7.53 – 7.48 (m, 3H), 7.37 (dd, J = 5.0, 2.0 Hz, 3H), 7.29 – 7.26 (m, 2H). **¹³C NMR** (176 MHz, CDCl₃) δ 185.4, 155.4, 148.3, 144.4, 138.2, 134.5, 131.8, 130.8, 129.5, 129.4, 129.4, 129.0, 128.7, 125.5, 123.6, 119.0. **FT-IR** (film of a solution in CH₂Cl₂) ν 3064, 2859, 2755, 1683, 1598, 1522, 1497, 1454, 1434, 1391, 1348, 1313, 1289, 1266, 1177, 1108, 1074, 973, 916, 870, 854, 811, 764, 735, 714, 695, 495 cm⁻¹. **HRMS** (ESI) m/z : [M+Na]⁺ calcd for C₂₂H₁₅N₃NaO₃ 392.1011; found, 392.1002.

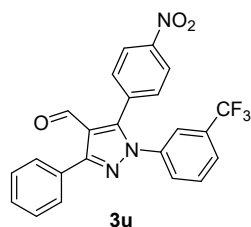
4-(4-nitrophenyl)-1,3-diphenyl-1*H*-pyrazole (**4t**)



Compound **4t** was synthesized according to general procedure using **1a** (100 mg, 0.43 mmol) and 4-nitrocinnamaldehyde as a yellow solid in 18.21% yield (27.0 mg, 0.08 mmol). R_f = 0.40 (Pet. ether /EtOAc = 10:1); mp 160-161 °C; **¹H NMR** (700 MHz, CDCl₃) δ 8.19 – 8.16 (m, 2H), 8.14 (s, 1H), 7.84 – 7.78 (m, 2H), 7.57 – 7.52

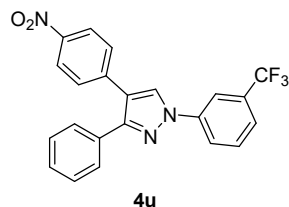
(m, 2H), 7.52 – 7.48 (m, 4H), 7.39 (dt, $J = 3.8, 1.3$ Hz, 3H), 7.36 – 7.33 (m, 1H). ^{13}C NMR (176 MHz, CDCl_3) δ 151.0, 146.5, 139.9, 139.6, 132.4, 129.6, 128.8, 128.7, 128.6, 128.6, 127.1, 127.1, 124.0, 120.8, 119.2. **FT-IR** (film of a solution in CH_2Cl_2) ν 3149, 3072, 1596, 1551, 1510, 1448, 1420, 1339, 1294, 1251, 1224, 1110, 972, 854, 775, 753, 700 cm^{-1} . **HRMS** (ESI) m/z : $[\text{M}+\text{H}]^+$ calcd for $\text{C}_{22}\text{H}_{17}\text{N}_2\text{O}$ 325.1341; found, 325.1333.

5-(4-nitrophenyl)-3-phenyl-1-(3-(trifluoromethyl)phenyl)-1H-pyrazole-4-carbaldehyde (**3u**)



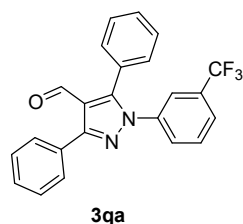
Compound **3u** was synthesized according to general procedure using **1q** (100 mg, 0.34 mmol) and 4-nitrocinnamaldehyde as a yellow solid in 41.32% yield (60.6 mg, 0.14 mmol). $R_f = 0.20$ (Pet. ether /EtOAc = 8:1); mp 148-149 $^{\circ}\text{C}$; ^1H NMR (700 MHz, CDCl_3) δ 9.99 – 9.94 (m, 1H), 8.30 – 8.25 (m, 2H), 7.83 (d, $J = 1.9$ Hz, 2H), 7.70 (d, $J = 2.0$ Hz, 1H), 7.63 (dd, $J = 7.7, 1.7$ Hz, 1H), 7.57 (dd, $J = 8.5, 1.3$ Hz, 2H), 7.55 – 7.51 (m, 3H), 7.47 (t, $J = 8.0$ Hz, 1H), 7.35 (dd, $J = 8.2, 2.1$ Hz, 1H). ^{13}C NMR (176 MHz, CDCl_3) δ 185.2, 155.8, 148.5, 144.6, 138.6, 134.0, 132.2 (q, $J = 33.5$ Hz), 131.7, 130.5, 130.0, 129.7, 129.3, 128.8, 128.3, 125.5 (q, $J = 3.6$ Hz), 123.8, 122.5 (q, $J = 3.9$ Hz), 119.5. ^{19}F NMR (565 MHz, CDCl_3) δ -62.90. **FT-IR** (film of a solution in CH_2Cl_2) ν 3064, 2853, 2764, 1688, 1601, 1525, 1496, 1470, 1455, 1347, 1331, 1285, 1171, 1131, 1071, 1017, 881, 854, 867, 799, 776, 758, 737, 717, 696 cm^{-1} . **HRMS** (ESI) m/z : $[\text{M}+\text{Na}]^+$ calcd for $\text{C}_{23}\text{H}_{14}\text{F}_3\text{N}_3\text{NaO}_3$ 460.0885; found, 460.0883.

4-(4-nitrophenyl)-3-phenyl-1-(3-(trifluoromethyl)phenyl)-1H-pyrazole (**4u**)



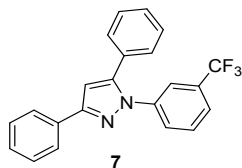
Compound **4u** was synthesized according to general procedure using **1q** (100 mg, 0.34 mmol) and 4-nitrocinnamaldehyde as a yellow solid in 23.10% yield (31.7 mg, 0.08 mmol). $R_f = 0.50$ (Pet. ether /EtOAc = 8:1); mp 168-169 $^{\circ}\text{C}$; ^1H NMR (700 MHz, CDCl_3) δ 8.22 – 8.17 (m, 3H), 8.10 (t, $J = 1.9$ Hz, 1H), 8.03 – 7.99 (m, 1H), 7.66 – 7.57 (m, 2H), 7.57 – 7.52 (m, 2H), 7.50 (d, $J = 8.8$ Hz, 2H), 7.44 – 7.37 (m, 3H). ^{13}C NMR (176 MHz, CDCl_3) δ 151.6, 146.8, 139.9, 139.4, 132.2 (q, $J = 33.0$ Hz), 132.0, 130.3, 129.0, 128.8, 128.7, 128.6, 127.0, 124.0, 123.5 (q, $J = 3.8$ Hz), 121.9, 121.6, 115.9 (q, $J = 3.8$ Hz). ^{19}F NMR (565 MHz, CDCl_3) δ -62.73. **FT-IR** (film of a solution in CH_2Cl_2) ν 3414, 1593, 1549, 1518, 1460, 1448, 1329, 1224, 1181, 1166, 1130, 1070, 1028, 974, 871, 854, 823, 801, 774, 754, 734, 703, 692, 652, 604, 507, 488 cm^{-1} . **HRMS** (ESI) m/z : $[\text{M}+\text{H}]^+$ calcd for $\text{C}_{22}\text{H}_{15}\text{F}_3\text{N}_3\text{O}_2$ 410.1116; found, 410.1107.

3,5-diphenyl-1-(3-(trifluoromethyl)phenyl)-1H-pyrazole-4-carbaldehyde (**3qa**)



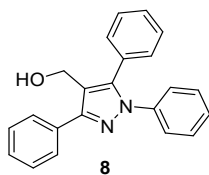
Compound **3qa** was synthesized according to general procedure using **1q** (100 mg, 0.34 mmol) as a grey solid in 35% yield (46.0 mg, 0.12 mmol). R_f = 0.20 (Pet. ether /EtOAc = 30:1); mp 120-121 °C; **¹H NMR** (600 MHz, CDCl₃) δ 9.89 (s, 1H), 7.96 – 7.91 (m, 2H), 7.64 (d, J = 2.3 Hz, 1H), 7.57 (dd, J = 5.2, 3.6 Hz, 1H), 7.52 – 7.43 (m, 8H), 7.39 – 7.34 (m, 2H). **¹³C NMR** (151 MHz, CDCl₃) δ 185.5, 154.3, 149.3, 139.1, 131.6 (q, J = 33.0 Hz), 131.1, 130.5, 130.3, 129.6, 129.4, 129.2, 128.9, 128.4, 128.1, 127.2, 124.7 (d, J = 3.8 Hz), 122.2 (d, J = 3.9 Hz), 119.2. **¹⁹F NMR** (565 MHz, CDCl₃) δ -62.95. **FT-IR** (film of a solution in CH₂Cl₂) ν 3411, 3066, 2923, 2848, 2755, 1686, 1496, 1488, 1470, 1455, 1426, 1330, 1284, 1171, 1129, 1071, 799, 767, 696 cm⁻¹. **HRMS** (ESI) m/z : [M+Na]⁺ calcd for C₂₃H₁₅F₃N₂NaO 415.1034; found, 415.1031.

3,5-diphenyl-1-(3-(trifluoromethyl)phenyl)-1H-pyrazole (**7**)¹⁰



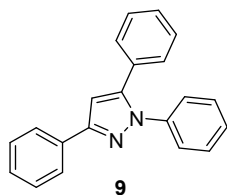
Deformylation of **3qa**: The aldehyde **3qa** (0.062 mmol) was dissolved in a mixture of conc. HCl (1.5 mL) and EtOH (1.5 mL), and refluxed for 12h, and then the EtOH were evaporated off. The residue was suspended in 20% NaOH and extracted with CH₂Cl₂ (10 mL × 3). The extract was dried over Na₂SO₄ and evaporated to dryness in vacuo, the crude product was purified by silica-gel flash chromatography to furnish the yellow solid product in 80% yield.^[11] (Pet. ether /EtOAc = 30:1); **¹H NMR** (600 MHz, CDCl₃) δ 7.95 – 7.90 (m, 2H), 7.73 (s, 1H), 7.54 (d, J = 7.7 Hz, 1H), 7.51 – 7.48 (m, 1H), 7.47 – 7.42 (m, 3H), 7.41 – 7.33 (m, 4H), 7.28 (dd, J = 7.4, 2.2 Hz, 2H), 6.85 (s, 1H). **¹³C NMR** (151 MHz, CDCl₃) δ 152.6, 144.6, 140.4, 132.7, 131.5 (q, J = 32.9 Hz), 130.1, 129.4, 128.8, 128.7, 128.7, 128.7, 128.3, 127.9, 125.9, 123.8 (q, J = 3.8 Hz), δ 123.5 (q, J = 272.7 Hz), 121.9 (q, J = 3.9 Hz), 106.0. **¹⁹F NMR** (565 MHz, CDCl₃) δ -62.84. **FT-IR** (film of a solution in CH₂Cl₂) ν 3436, 3066, 3044, 2921, 2848, 1597, 1496, 1469, 1458, 1364, 1328, 1284, 1258, 1170, 1129, 1096, 1067, 955, 895, 812, 801, 761, 695, 652 cm⁻¹. **HRMS** (ESI) m/z : [M+H]⁺ calcd for C₂₂H₁₆F₃N₂ 365.1266; found, 365.1259.

(1,3,5-triphenyl-1H-pyrazol-4-yl)methanol (**8**)



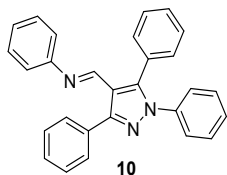
Reduction of **3aa**: A 25 mL round bottom flask was charged with **3aa** (50 mg, 0.15 mmol) in CH₂Cl₂ (10 mL). The solution was cooled to -5 °C and NaBH₄ (11.4 mg, 0.30 mmol) was added via solid addition funnel over 3 hours. The reaction was stirred at -5 °C for 10 minutes. The organic layer was washed with water (3 x 5 mL) and brine (2 x 5mL) and the combined organic extracts were dried with MgSO₄ and concentrated down. Then the organic solvent was evaporated and the crude product was purified by silica-gel flash chromatography to furnish the corresponding product **8** in 82% yield.¹² (Pet. ether /EtOAc = 5:1); **¹H NMR** (600 MHz, CDCl₃) δ 7.96 (d, J = 7.2 Hz, 2H), 7.47 (t, J = 7.6 Hz, 2H), 7.43 – 7.21 (m, 11H), 4.58 (s, 2H). **¹³C NMR** (151 MHz, CDCl₃) δ 152.1, 143.5, 139.8, 132.9, 130.1, 129.6, 128.8, 128.7, 128.7, 128.6, 128.2, 128.1, 127.3, 125.0, 117.8, 55.0. **FT-IR** (film) ν 3356, 3061, 2924, 2876, 1596, 1551, 1499, 1463, 1455, 1426, 1364, 1265, 1179, 1073, 1047, 1024, 1002, 964, 920, 796, 778, 764, 698, 632, 616, 519, 498 cm⁻¹.

1,3,5-triphenyl-1H-pyrazole (**9**)¹³



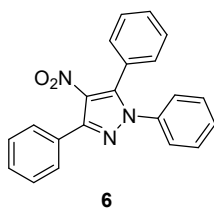
Deformylation of **3aa:** The aldehyde **3aa** (0.062 mmol) was dissolved in a mixture of conc. HCl (1.5 mL) and EtOH (1.5 mL), and refluxed for 12h, and then the EtOH were evaporated off. The residue was suspended in 20% NaOH and extracted with CH₂Cl₂ (10 mL×3). The extract was dried over Na₂SO₄ and evaporated to dryness in vacuo, the crude product was purified by silica-gel flash chromatography to furnish the yellow solid product **9** in 83% yield. (Pet. ether /EtOAc = 30:1); mp 141-142 °C; ¹H NMR (600 MHz, CDCl₃) δ 7.95 – 7.90 (m, 2H), 7.43 (t, *J* = 7.7 Hz, 2H), 7.40 – 7.27 (m, 11H), 6.83 (s, 1H). ¹³C NMR (151 MHz, CDCl₃) δ 152.0, 144.4, 140.1, 133.0, 130.6, 128.9, 128.8, 128.7, 128.5, 128.3, 128.0, 127.4, 125.8, 125.3, 105.2. **FT-IR** (film) ν 3446, 3064, 2918, 2845, 1595, 1498, 1485, 1458, 1411, 1362, 1315, 1180, 1123, 1076, 1028, 972, 913, 761, 692, 598 cm⁻¹.

(*E*)-*N*-phenyl-1-(1,3,5-triphenyl-1*H*-pyrazol-4-yl)methanimine (**10**)



Formation of imine **10:** In accordance with the literature known procedure,¹⁴ the necessary aldehyde **3aa** (10 mmol) was dissolved in CH₂Cl₂ (10 mL) along with 3 Å molecular sieves. To this the required aniline (10 mmol) was added. The reaction was left at ambient temperature for three hours at which point MgSO₄ was added with subsequent filtration. Volatiles were removed in vacuo to leave the yellow solid product **10** in 90% yields. (Pet. ether /EtOAc = 3:1); mp 173-174 °C; ¹H NMR (600 MHz, CDCl₃) δ 8.40 (s, 1H), 8.00 – 7.97 (m, 2H), 7.46 (t, *J* = 7.4 Hz, 2H), 7.41 (d, *J* = 7.3 Hz, 1H), 7.40 – 7.35 (m, 5H), 7.33 – 7.27 (m, 7H), 7.13 (t, *J* = 7.4 Hz, 1H), 7.03 – 6.98 (m, 2H). ¹³C NMR (151 MHz, CDCl₃) δ 153.0, 152.7, 152.6, 145.4, 139.3, 132.6, 130.8, 129.5, 129.1, 129.1, 128.9, 128.9, 128.5, 128.4, 128.1, 127.7, 125.4, 125.3, 120.8, 116.9. **FT-IR** (film of a solution in CH₂Cl₂) ν 3446, 3058, 2923, 2850, 1682, 1631, 1591, 1542, 1497, 1481, 1452, 1425, 1374, 1122, 1074, 1027, 918, 870, 761, 725, 694 cm⁻¹.

4-nitro-1,3,5-triphenyl-1*H*-pyrazole (**6**)



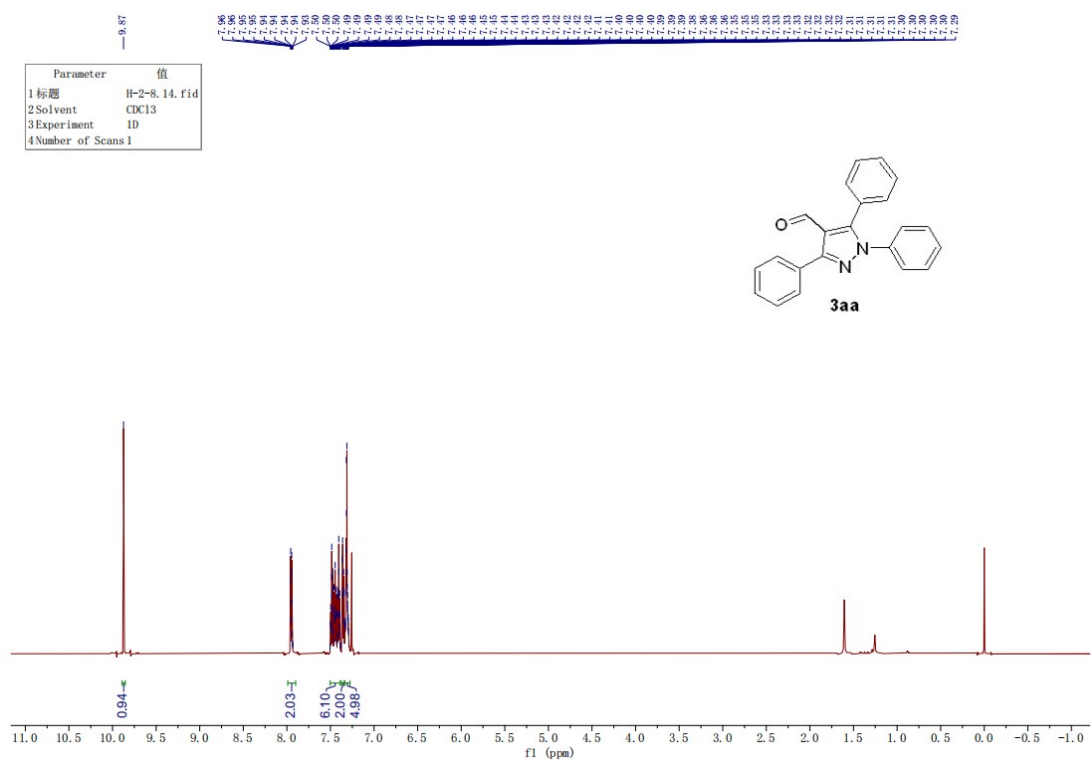
Compound **6** was synthesized according to general procedure using **1a** (100 mg, 0.43 mmol) and [(*E*)-2-nitroethenyl]benzene as a brown solid in 33% yield (48.8 mg, 0.14 mmol). *R*_f = 0.40 (Pet. ether /EtOAc = 20:1); mp 200-201 °C; ¹H NMR (700 MHz, CDCl₃) δ 7.79 – 7.73 (m, 2H), 7.50 – 7.46 (m, 3H), 7.45 – 7.43 (m, 1H), 7.42 – 7.38 (m, 2H), 7.37 – 7.35 (m, 3H), 7.32 (dd, *J* = 5.2, 1.9 Hz, 2H), 7.27 (dd, *J* = 4.7, 1.8 Hz, 2H). ¹³C NMR (176 MHz, CDCl₃) δ 148.0, 142.1, 138.5, 130.3, 130.2, 130.1, 129.4, 129.1, 129.0, 128.7, 128.6, 128.4, 127.0, 125.4. **FT-IR** (film of a solution in CH₂Cl₂) ν 3424, 2923, 1595, 1556, 1452, 1414, 1358, 1317, 1272, 1204, 1180, 1123, 1075, 1027, 970, 917, 838, 796, 761, 694, 541 cm⁻¹.

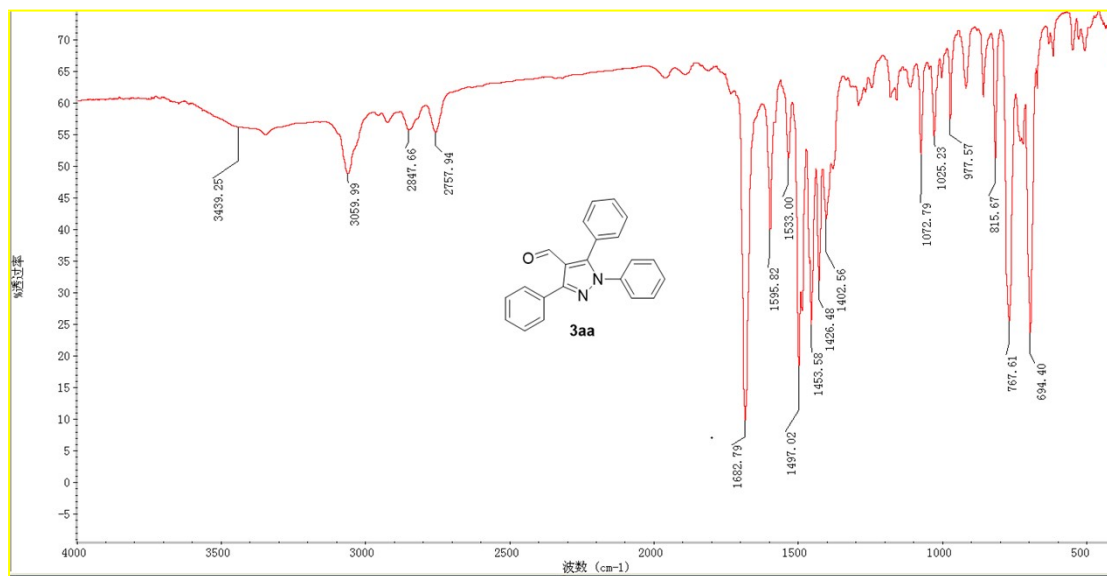
4. References

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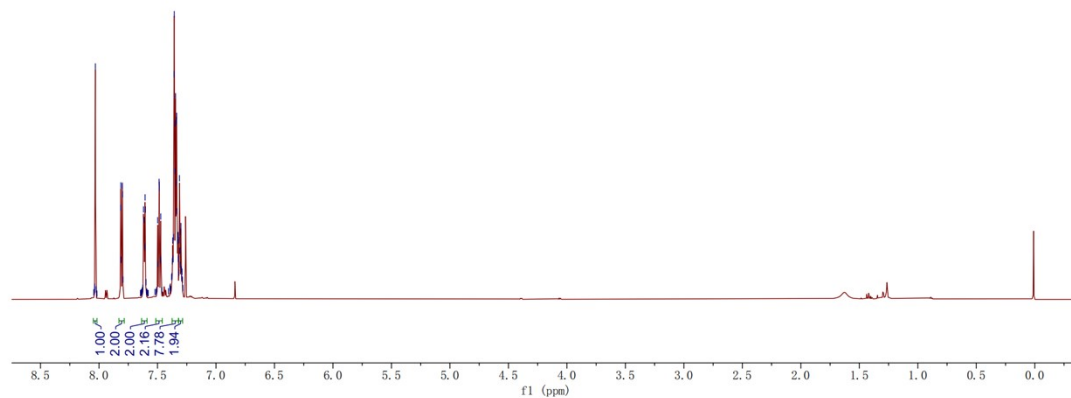
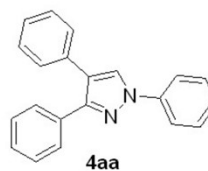
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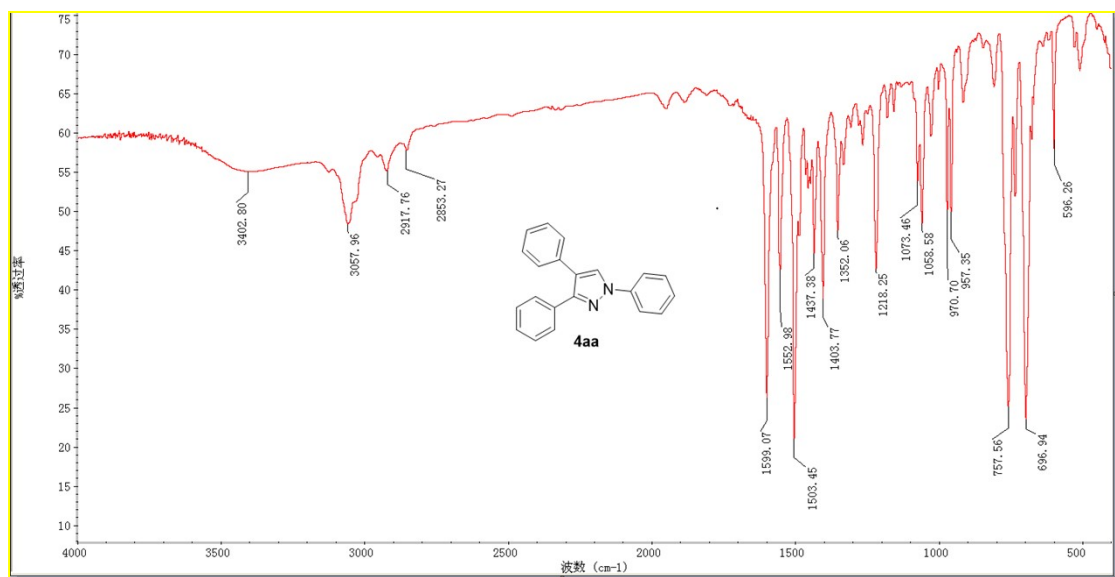
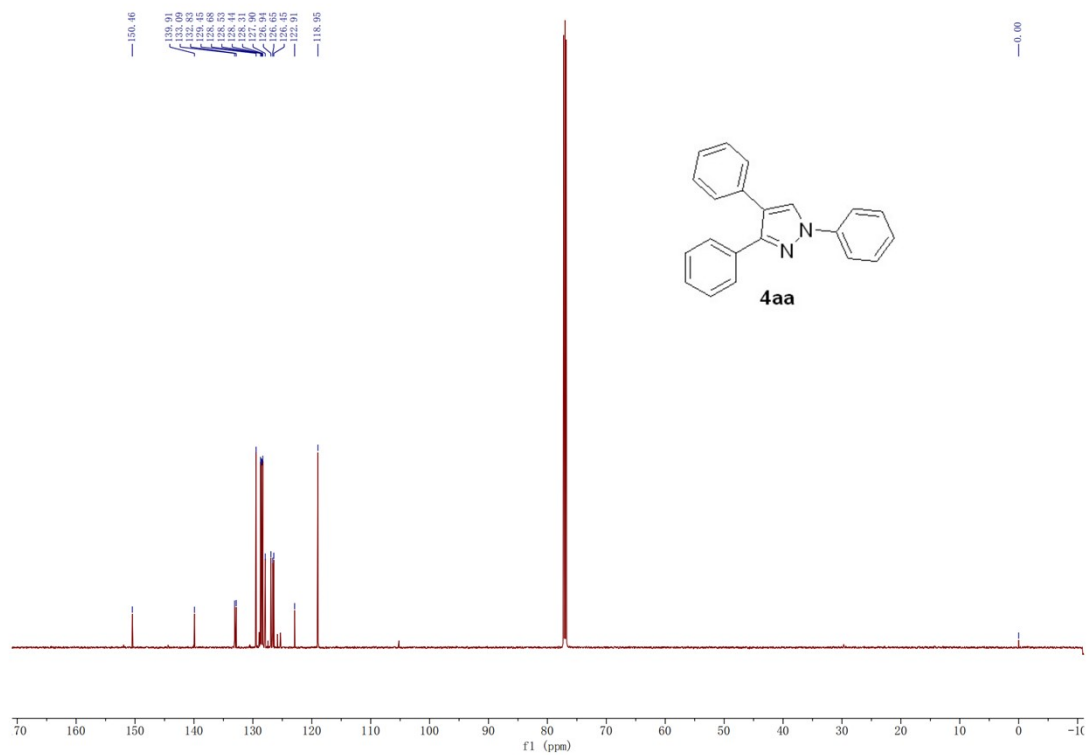
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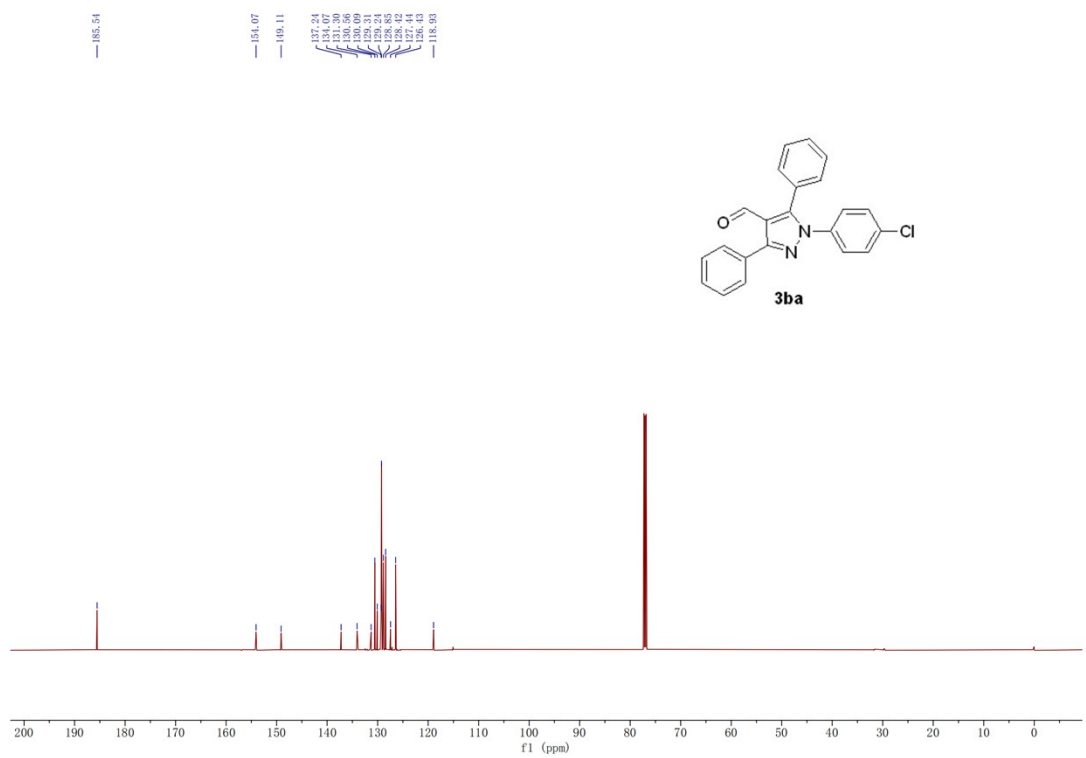
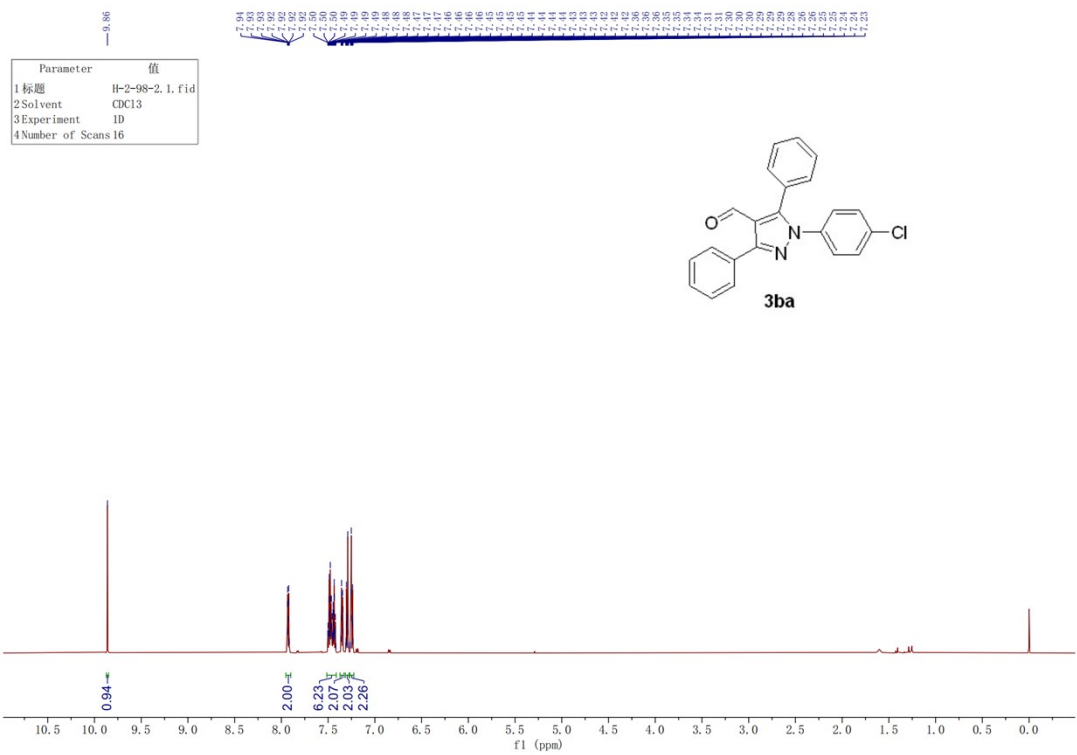


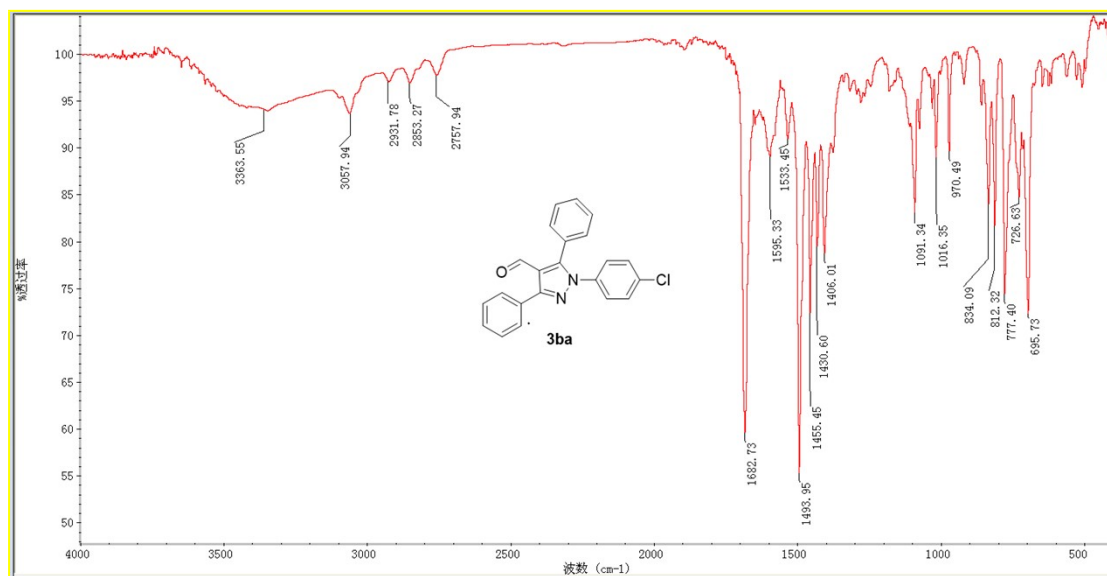


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3 Experiment	ID
4 Number of Scans	16

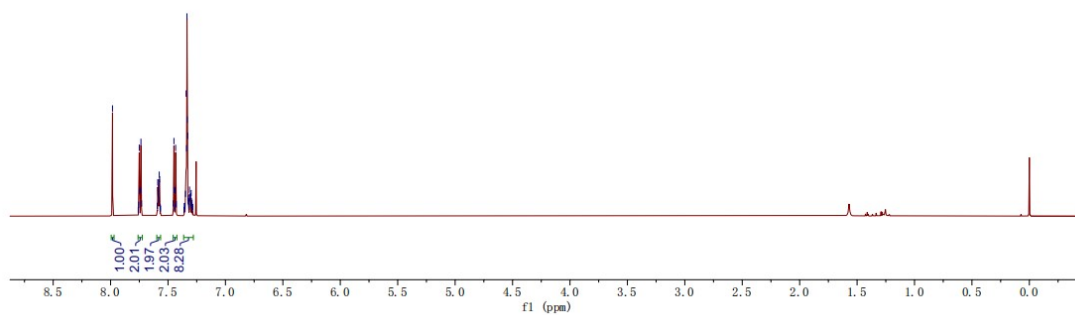
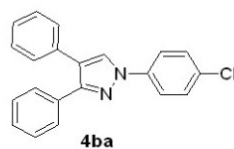


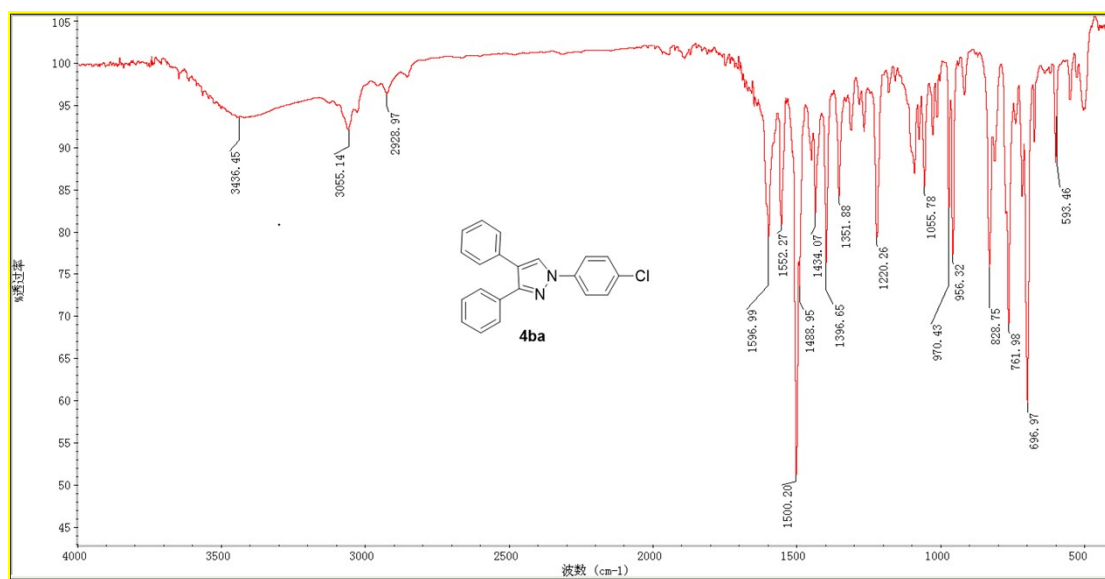
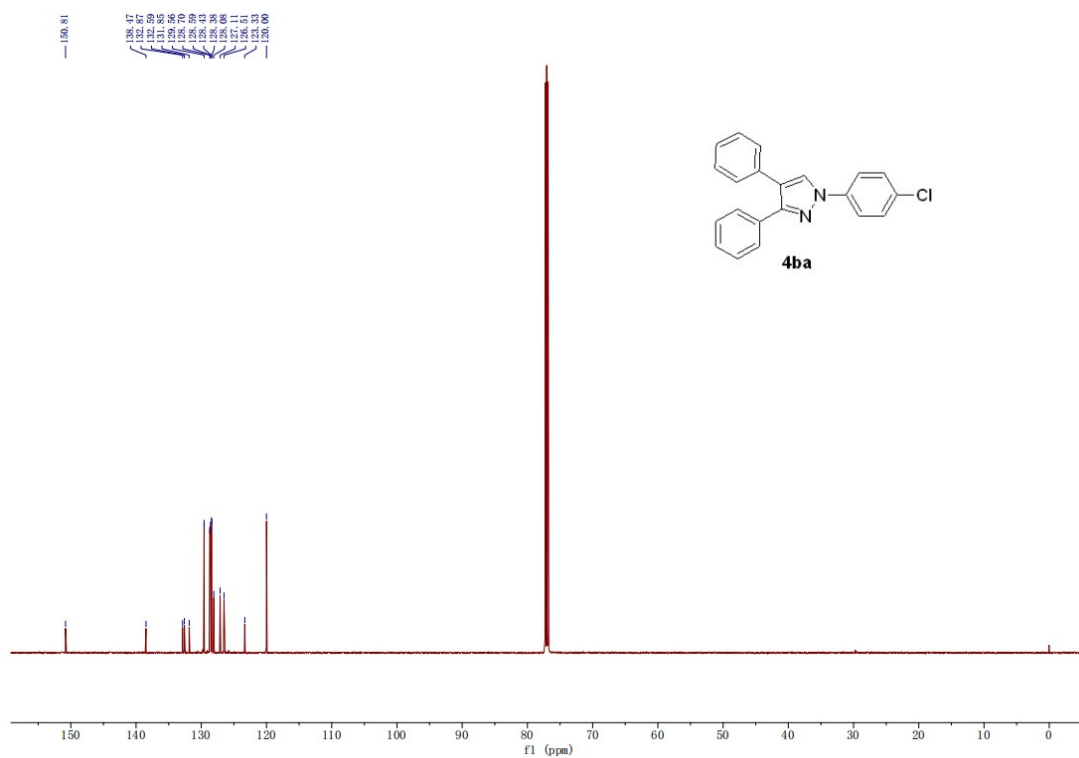


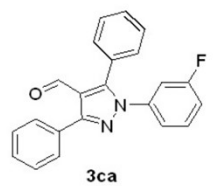
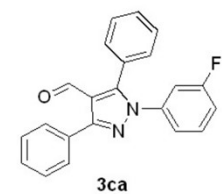


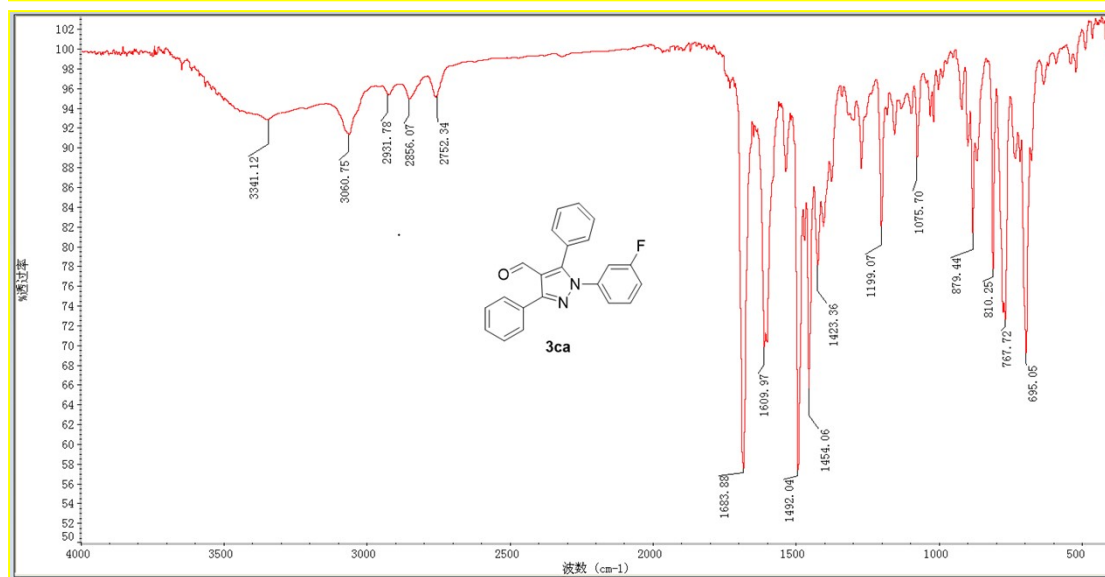
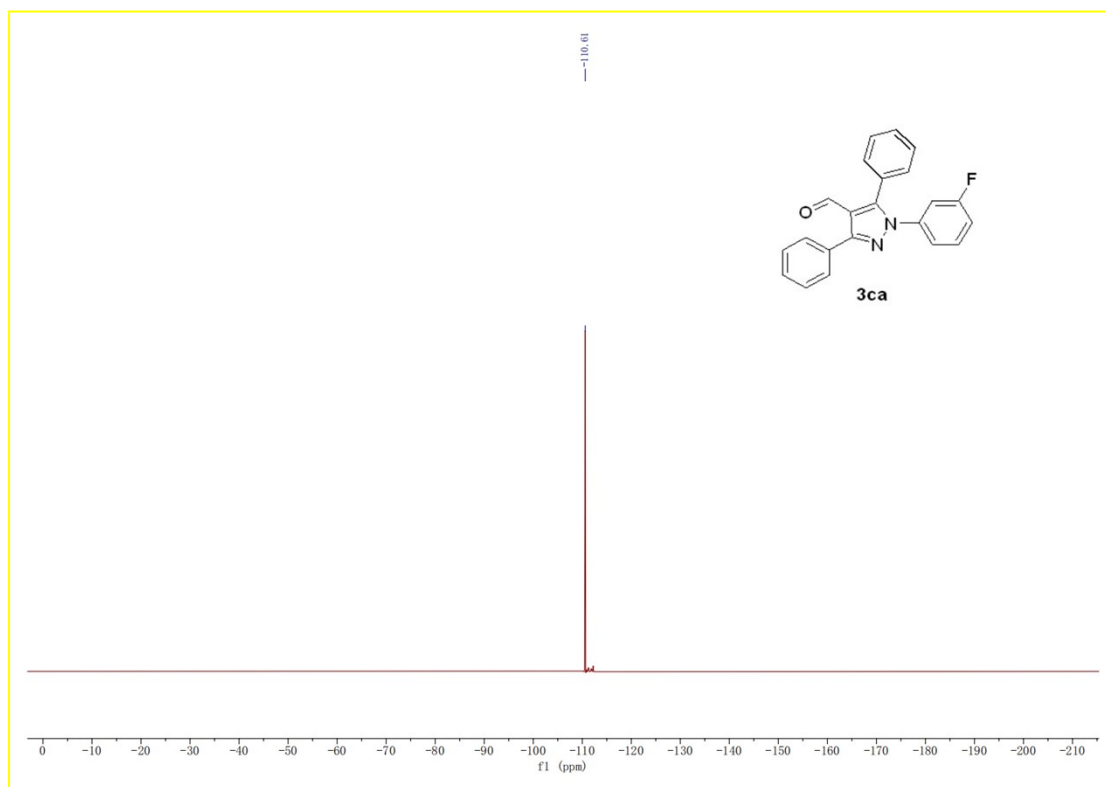


Parameter	值
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3 Experiment	1D
4 Number of Scans	16

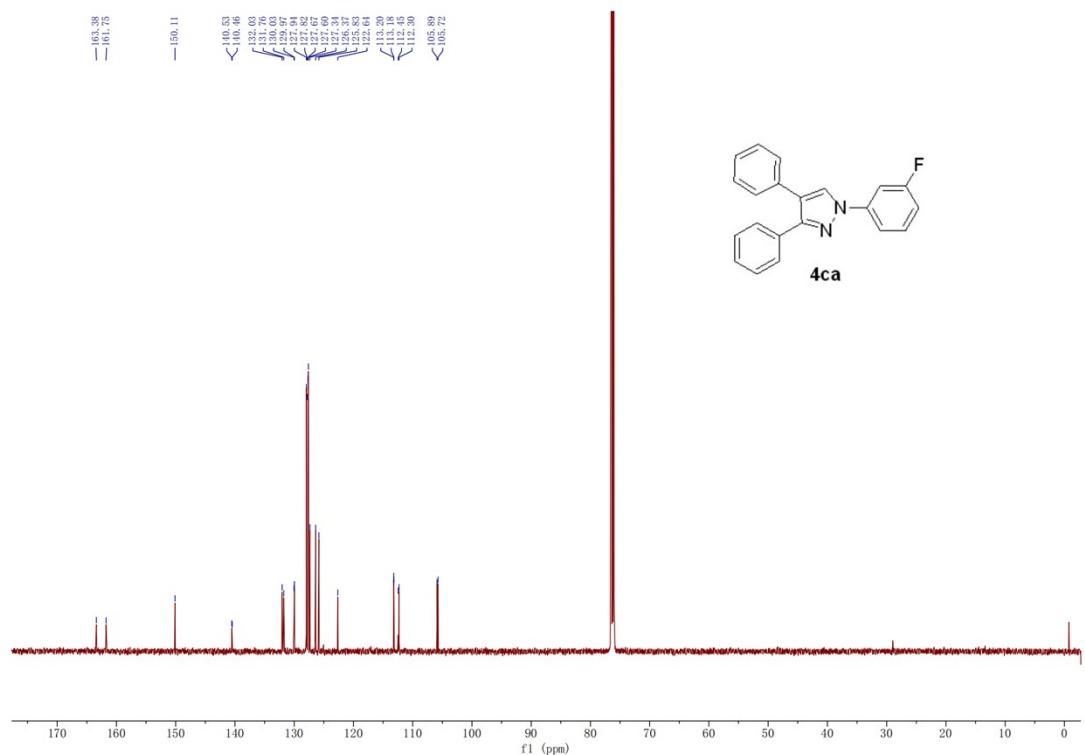
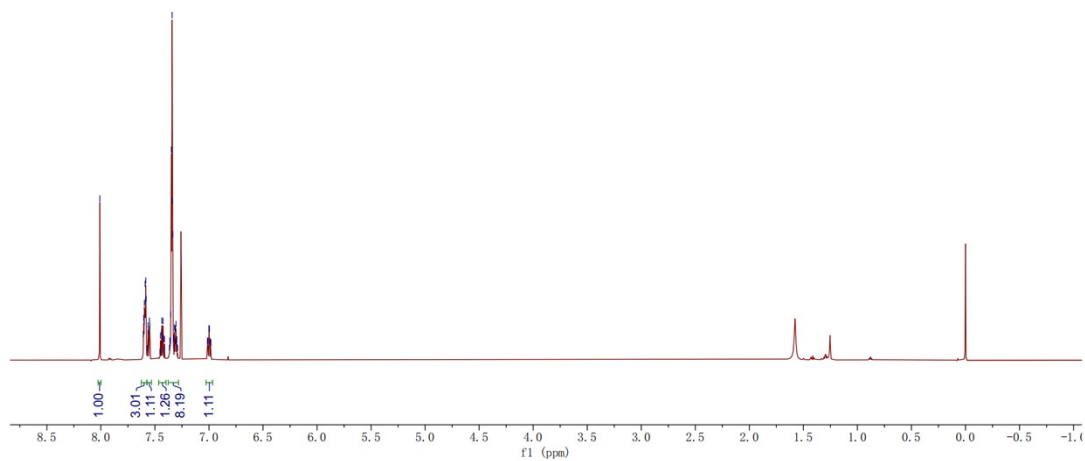
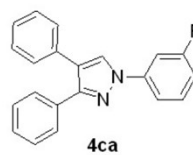


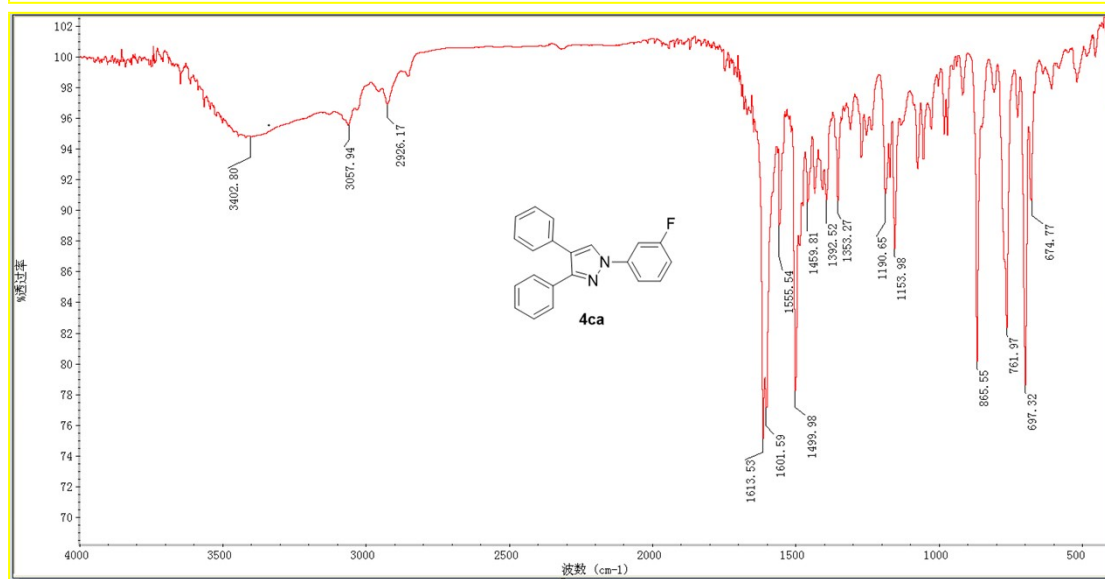
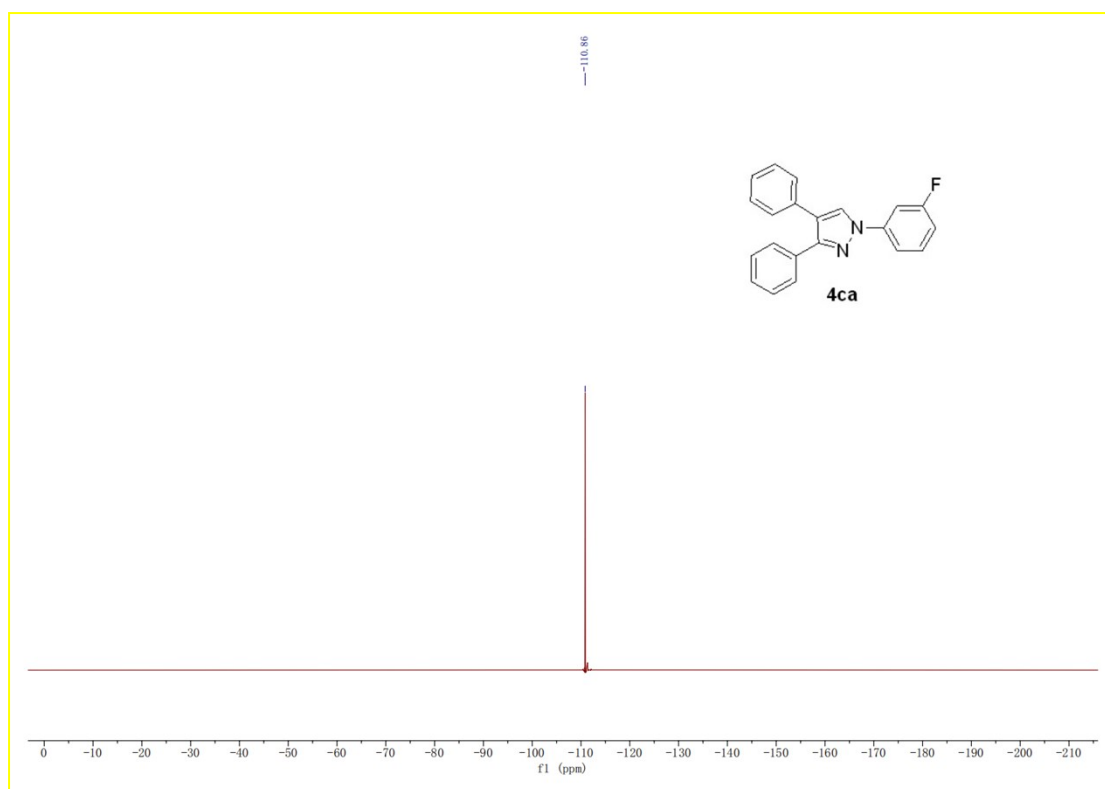


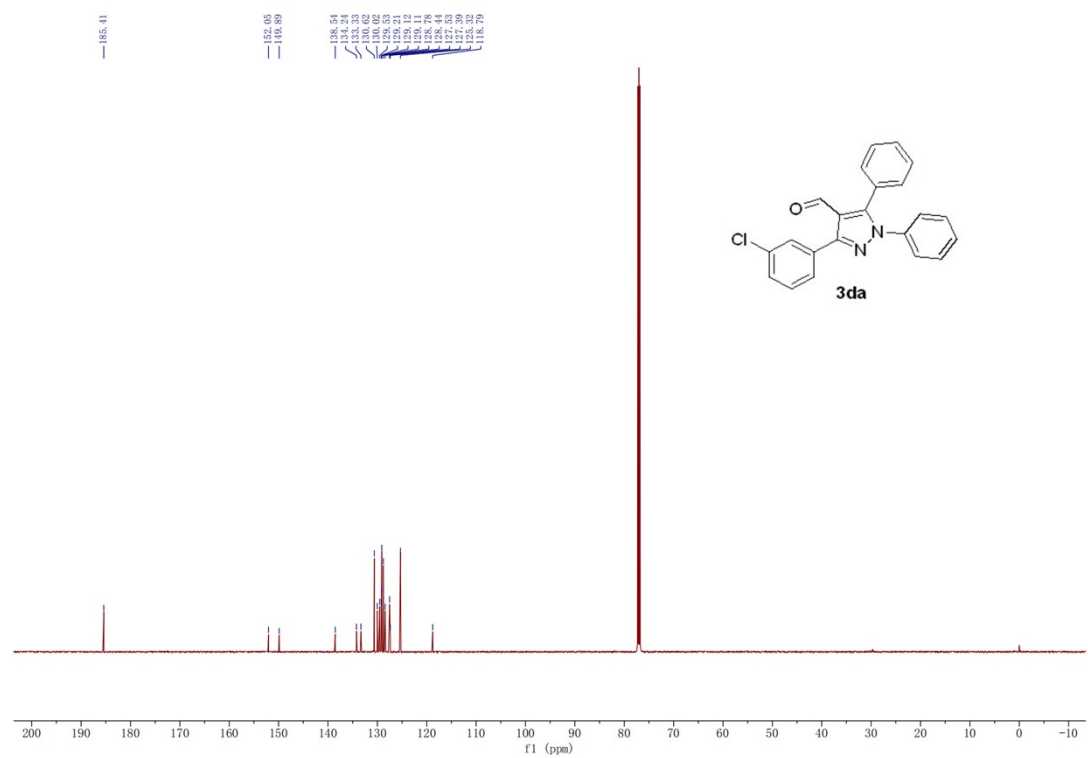
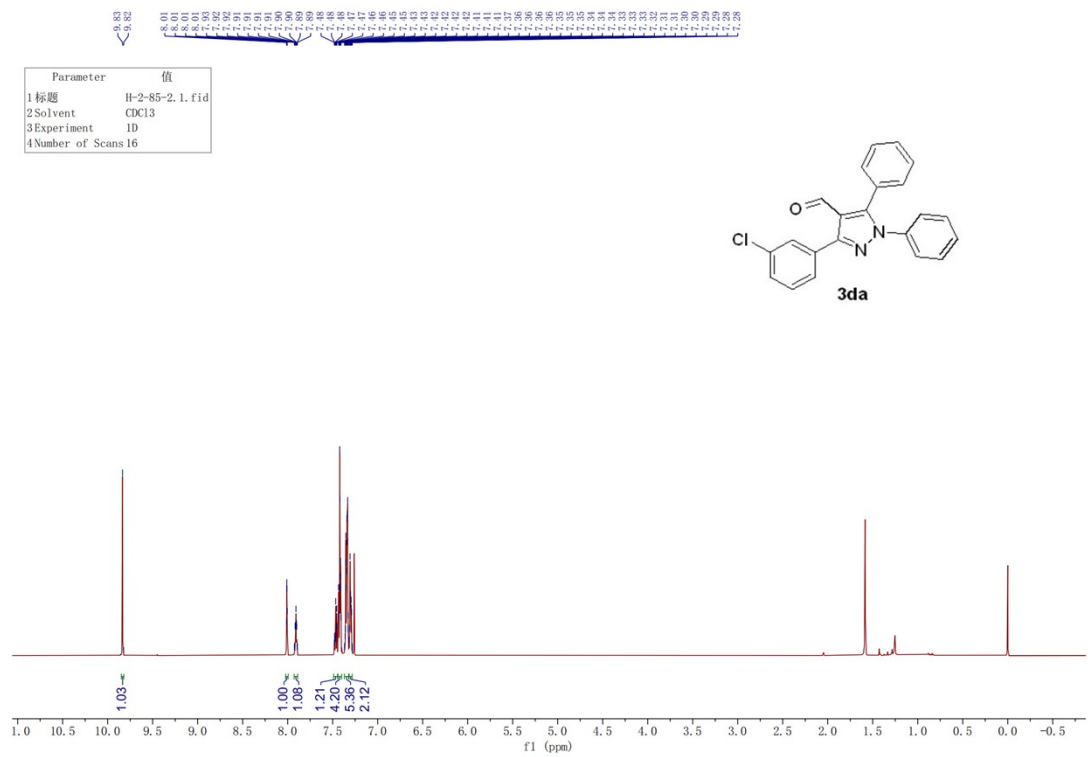


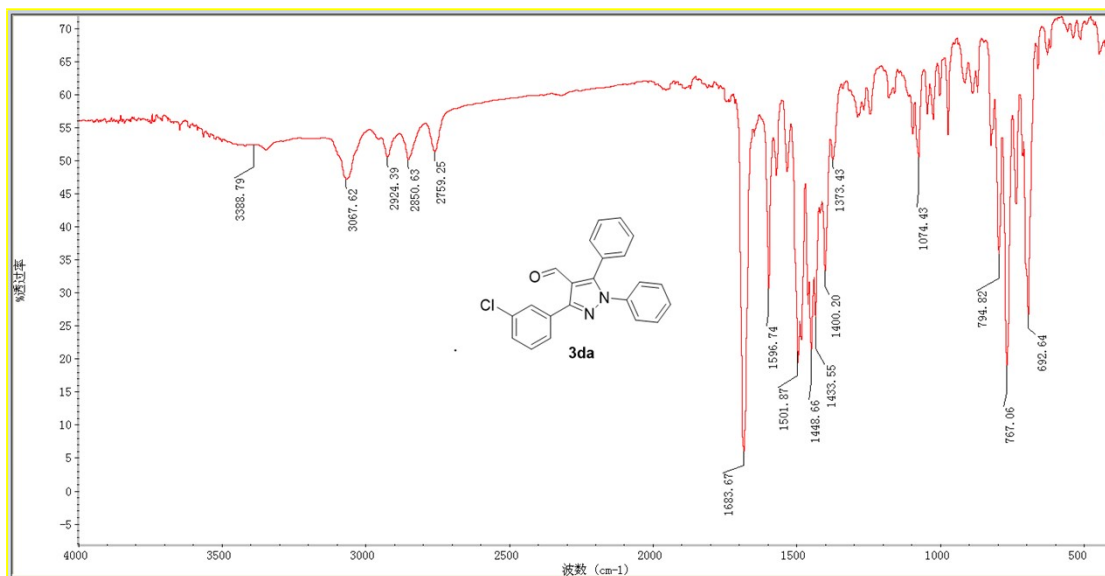


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2 Solvent	CDCl3
3 Experiment	1D
4 Number of Scans	16

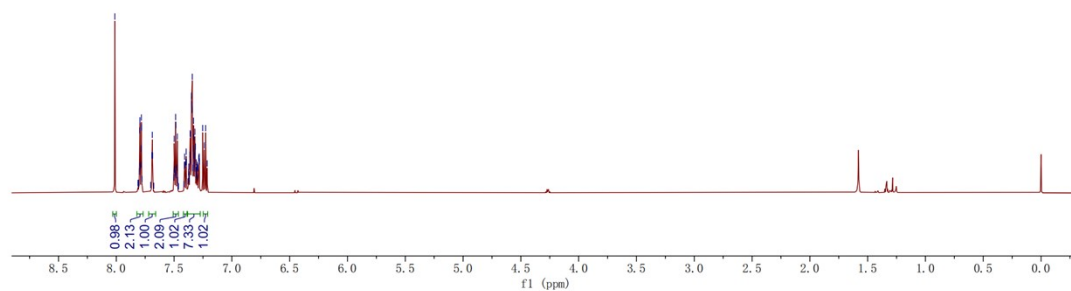
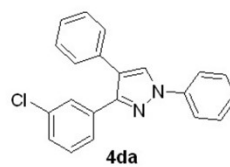


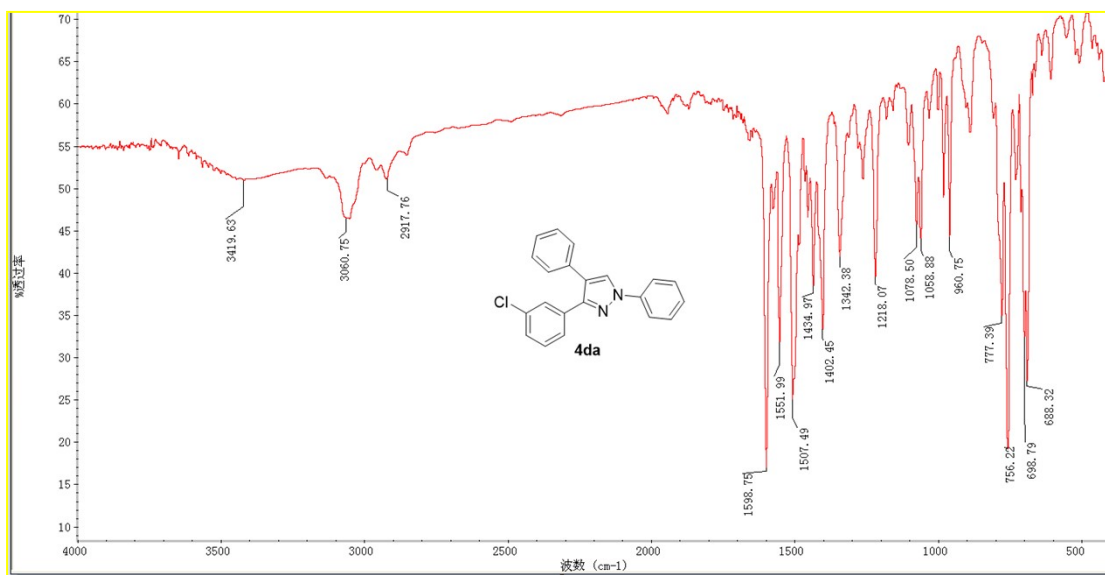
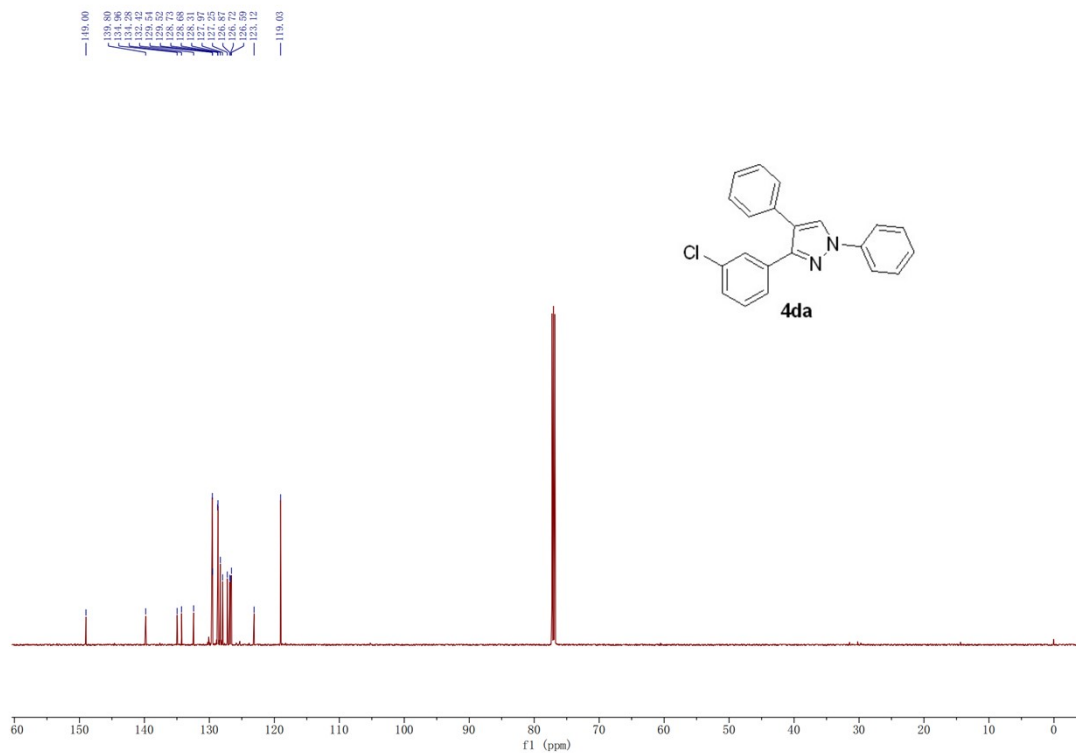


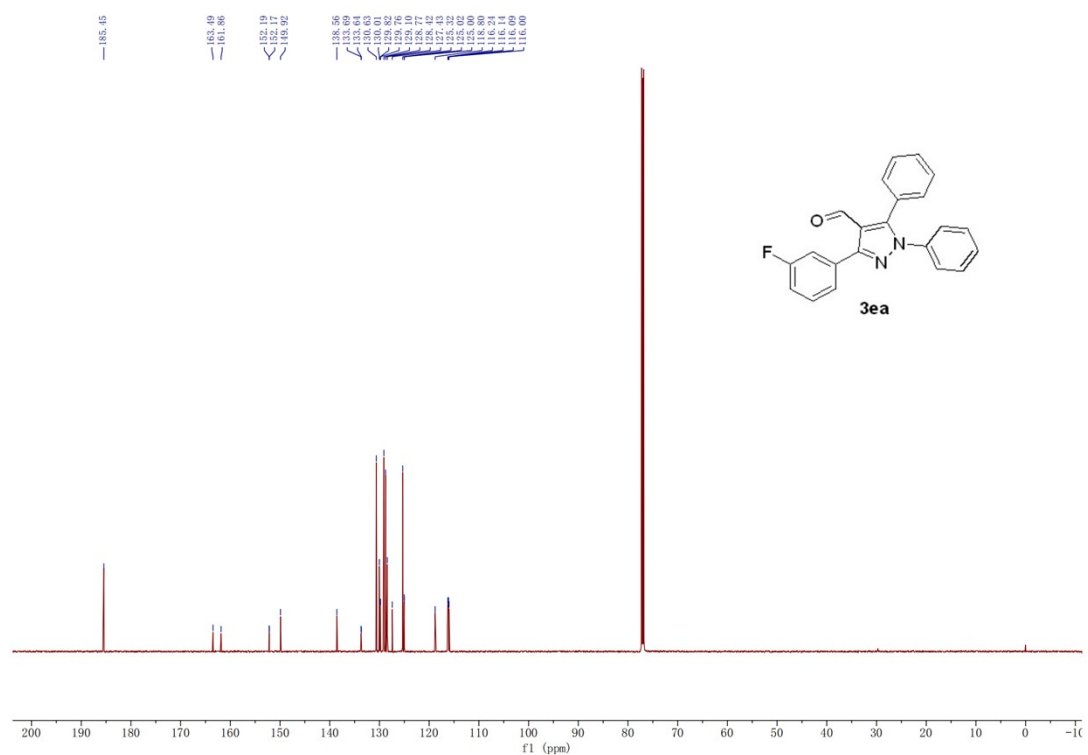
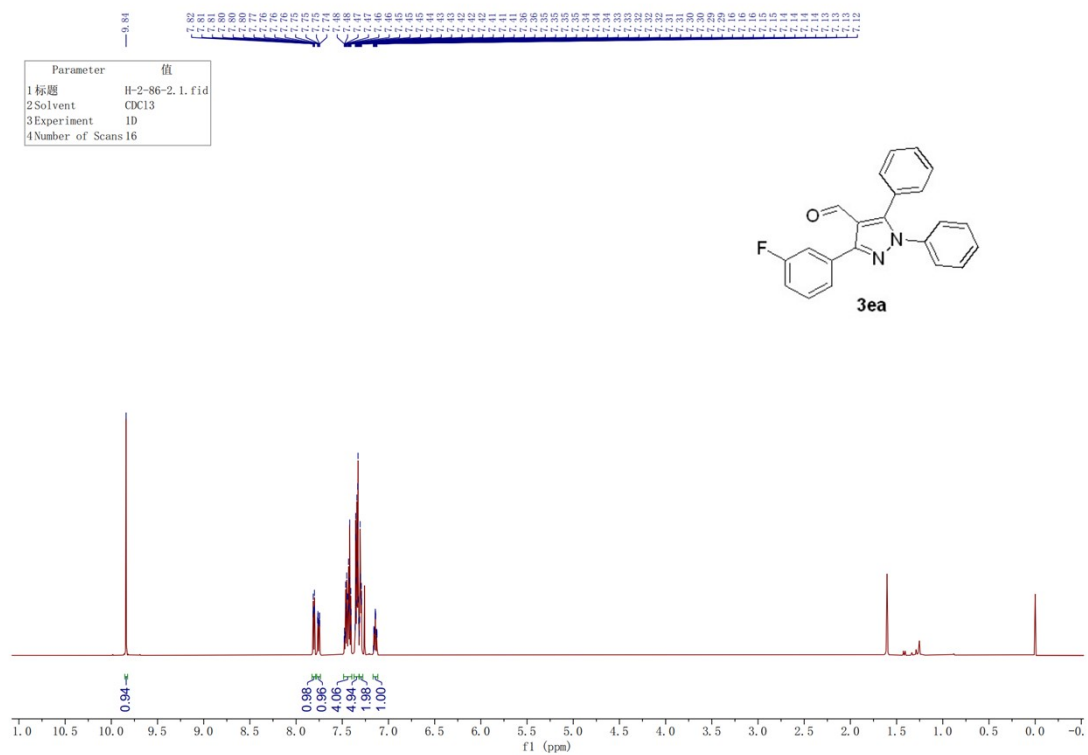


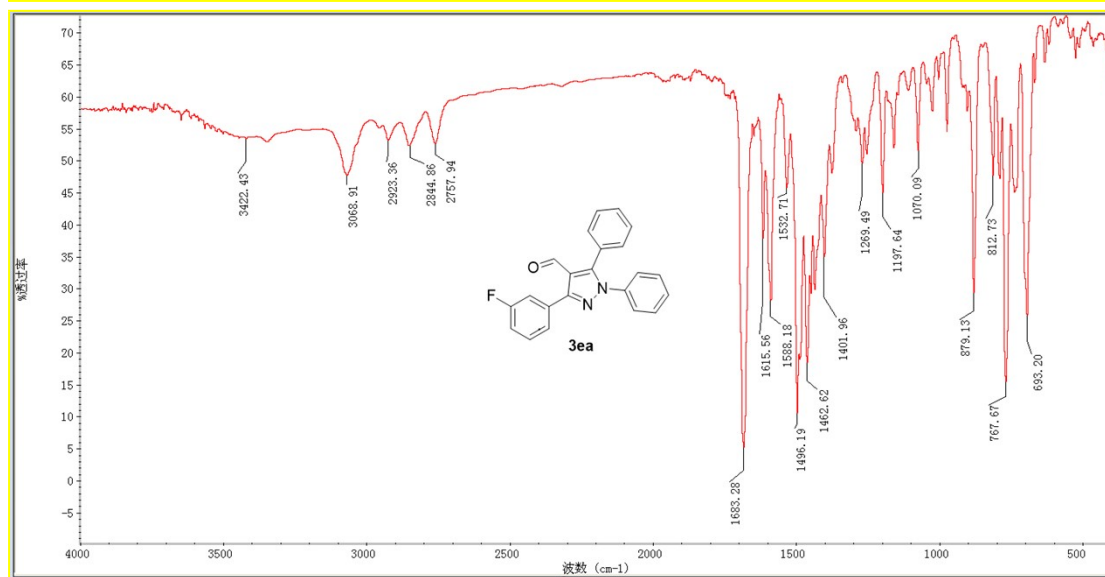
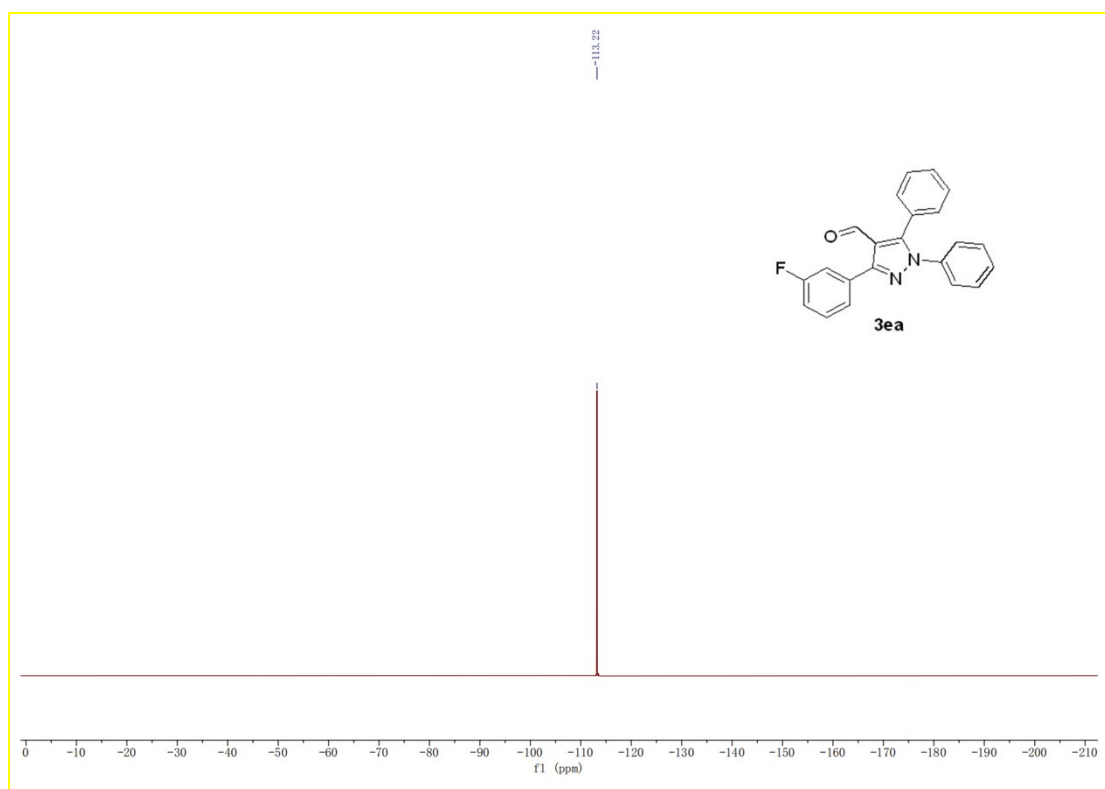


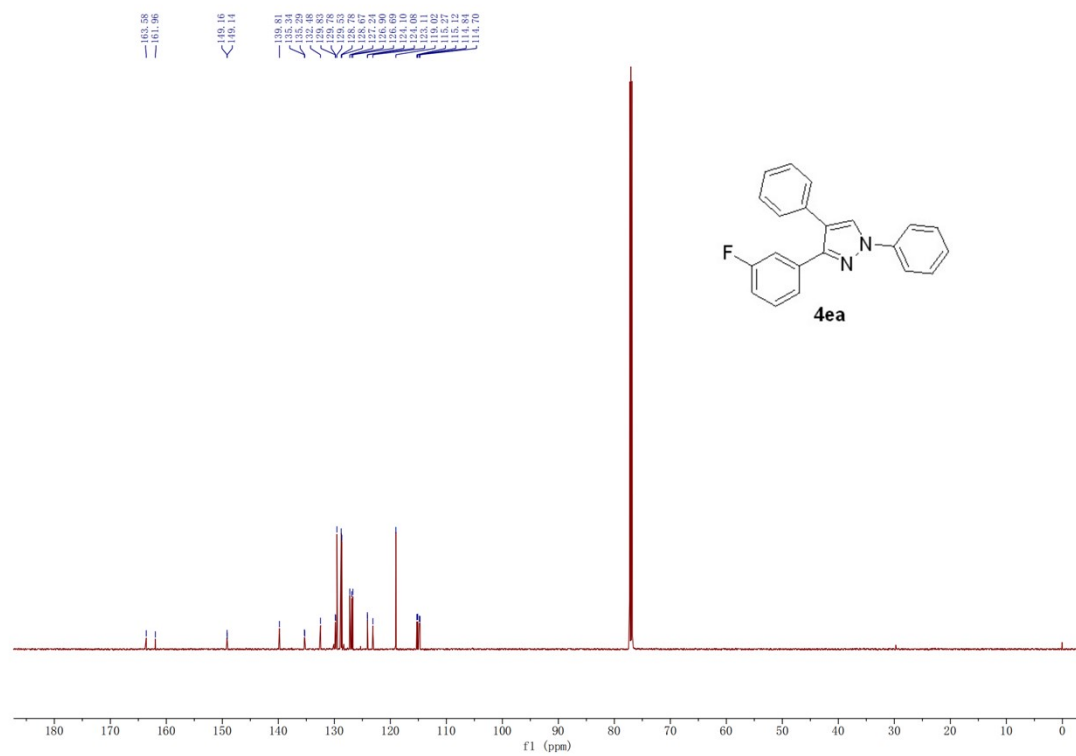
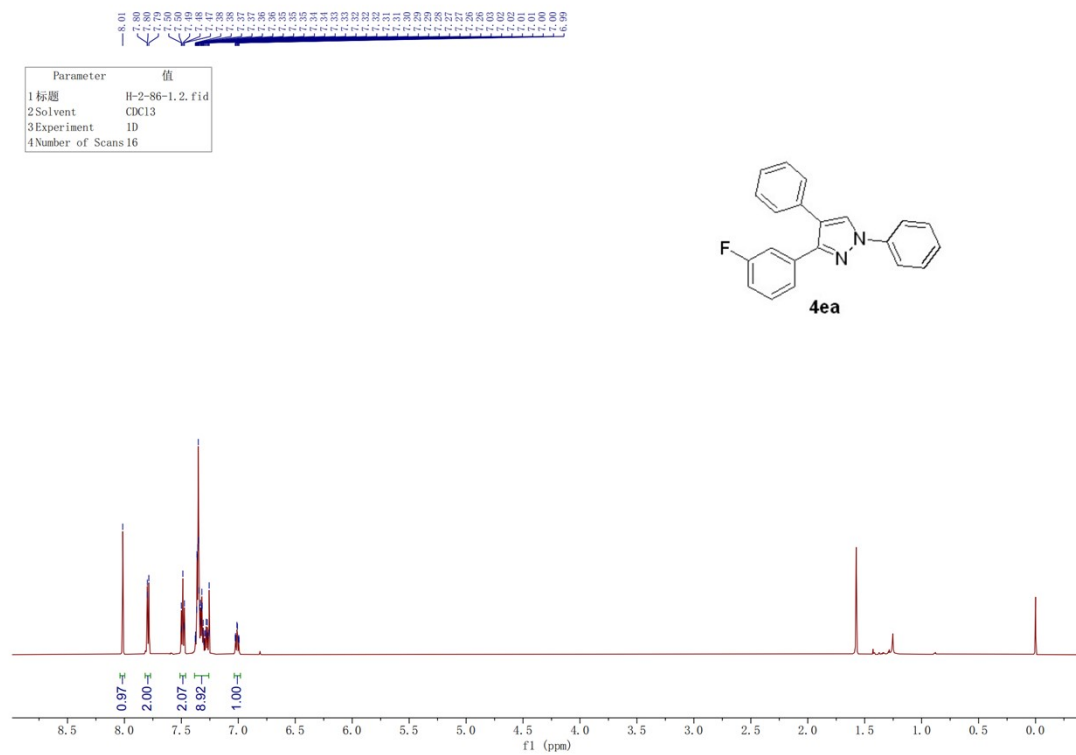
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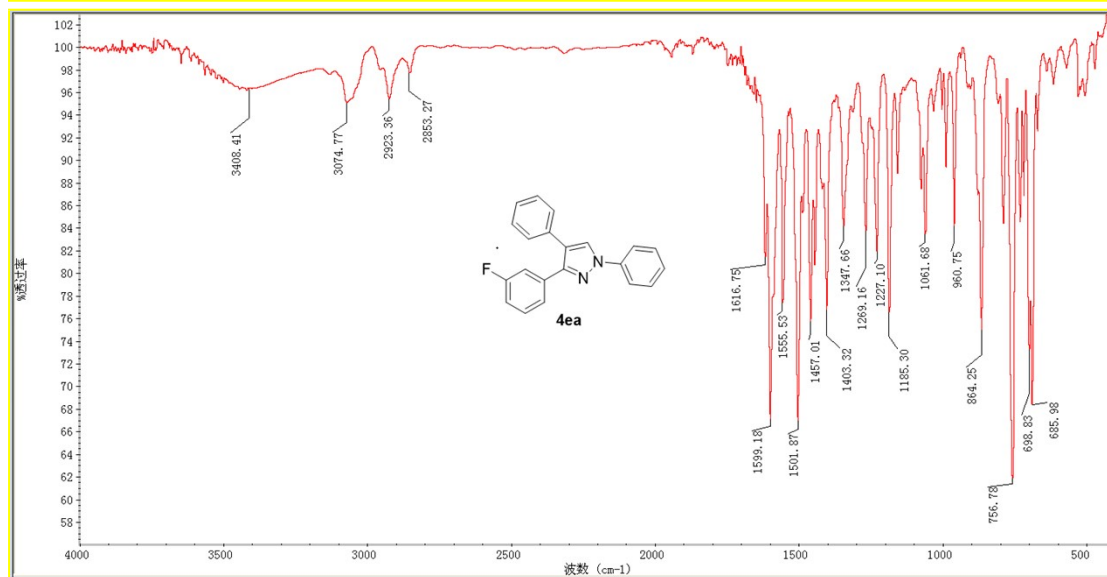
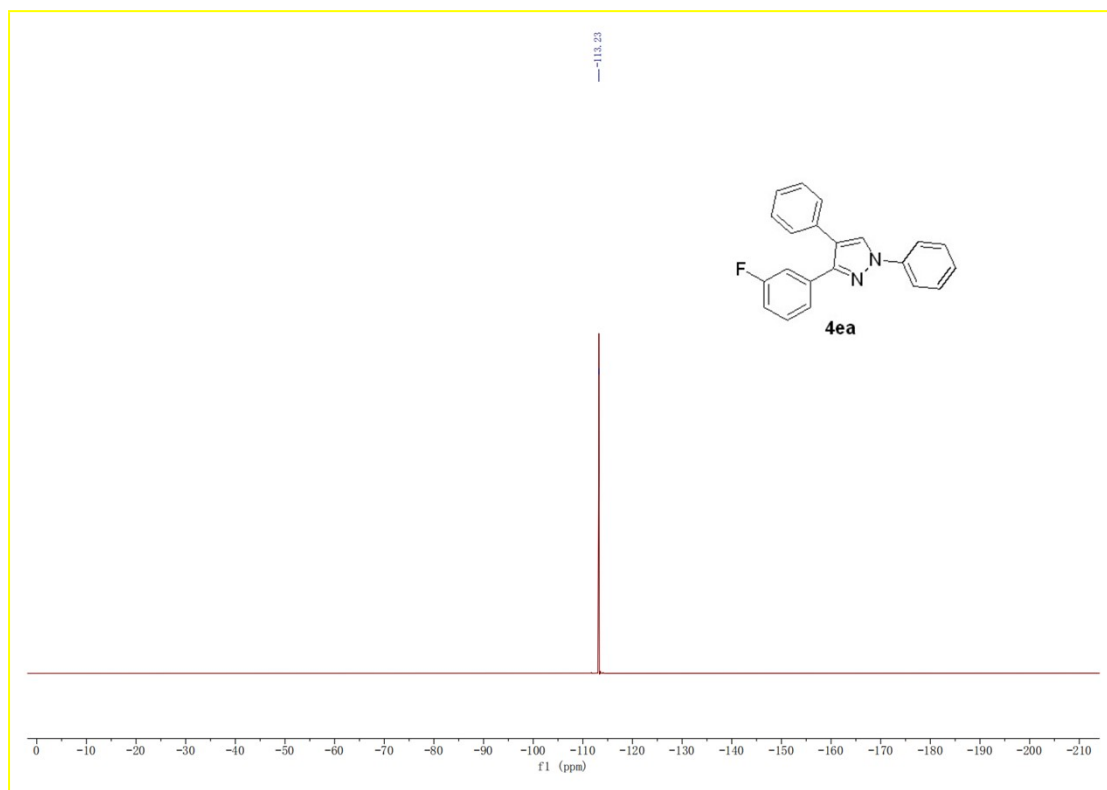


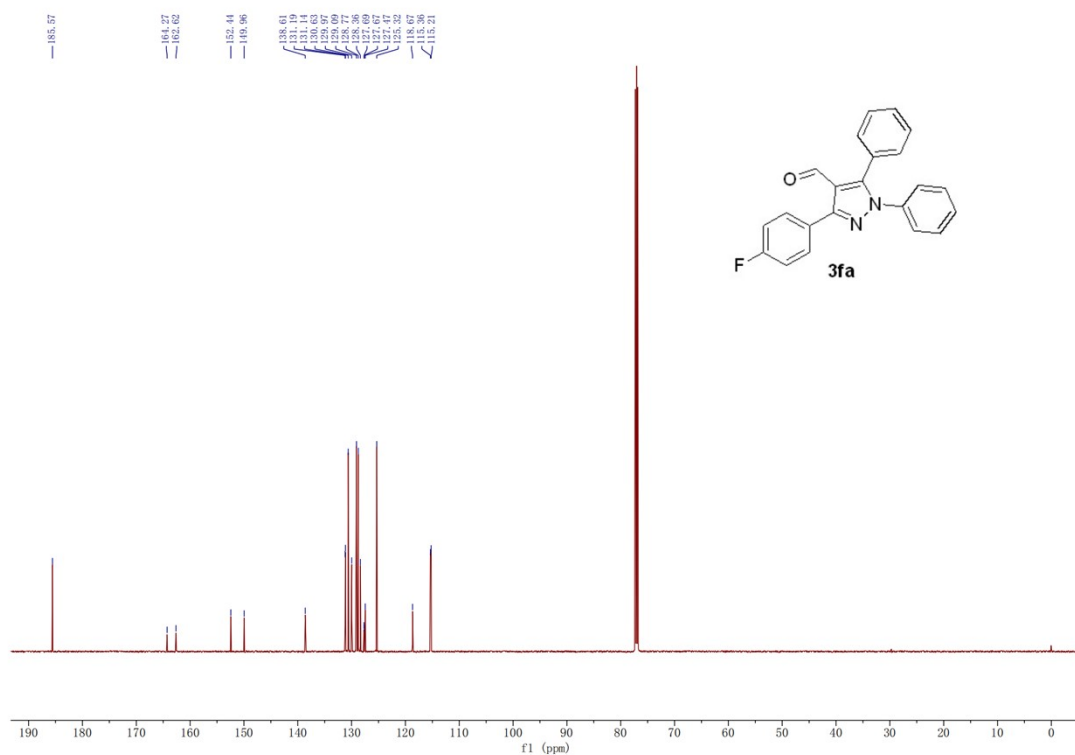
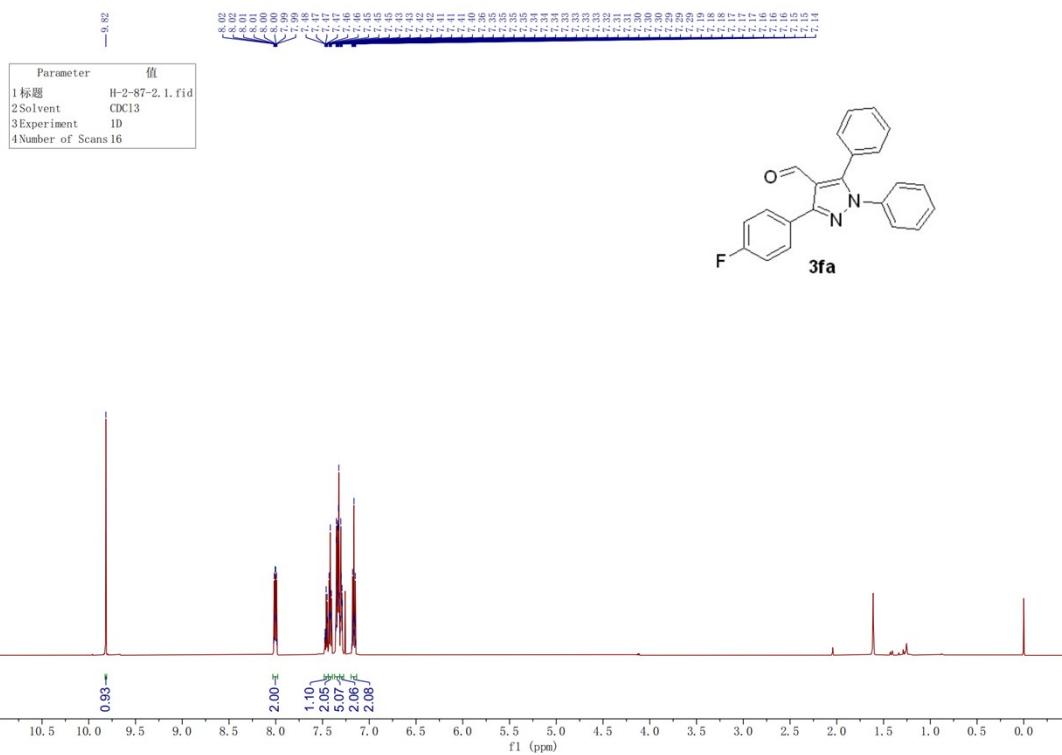


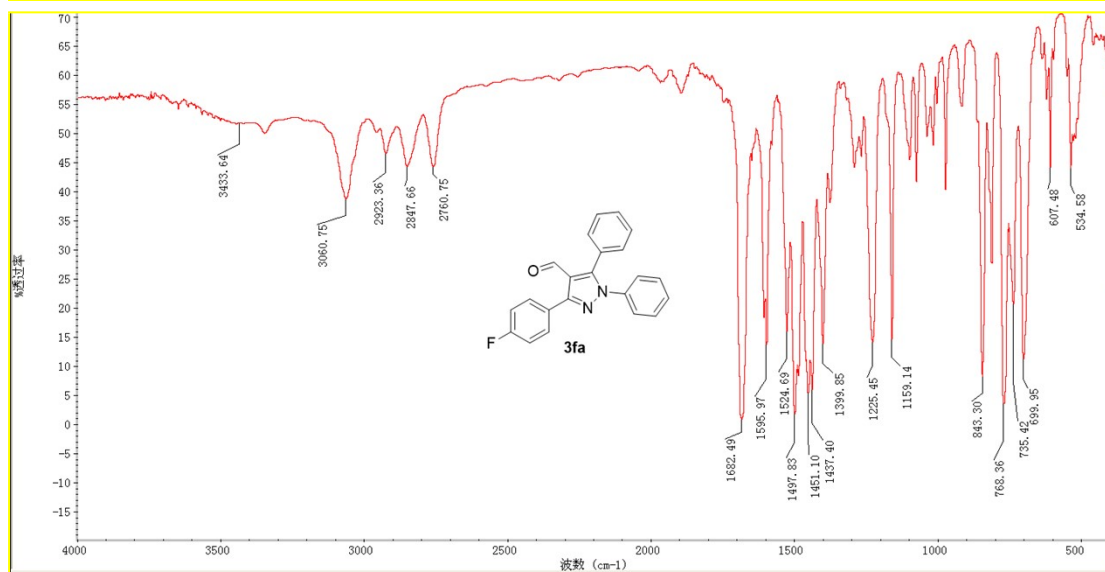
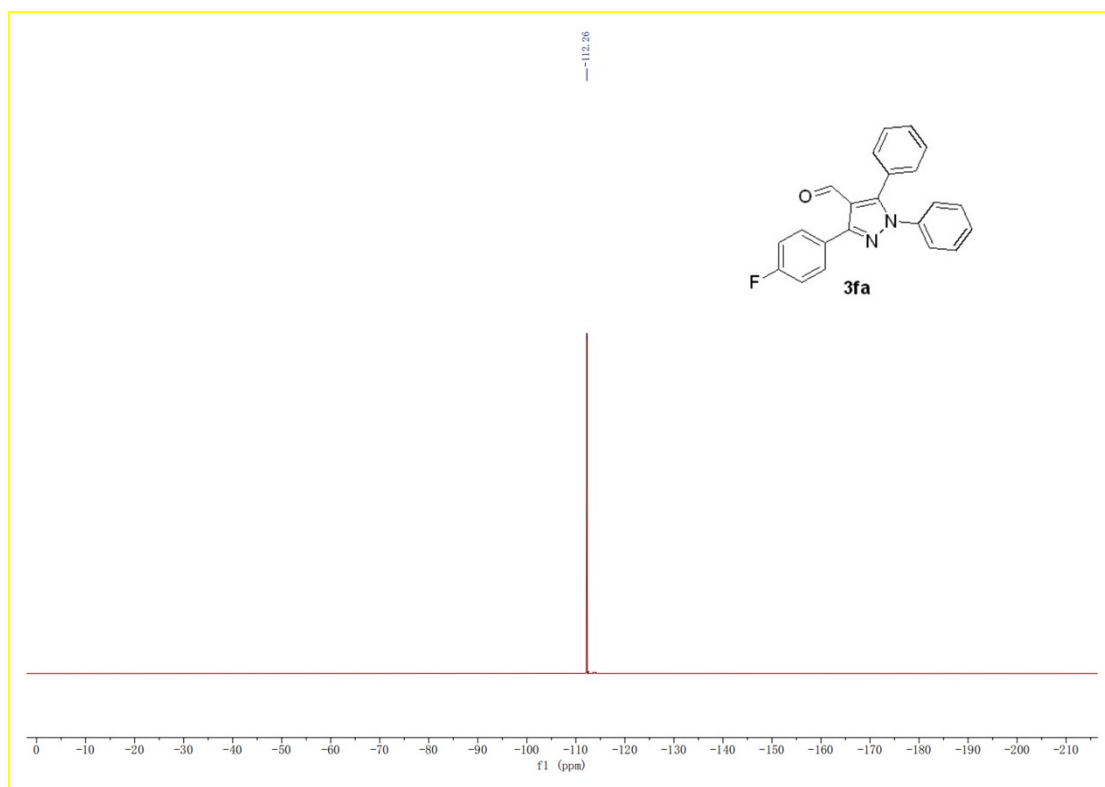




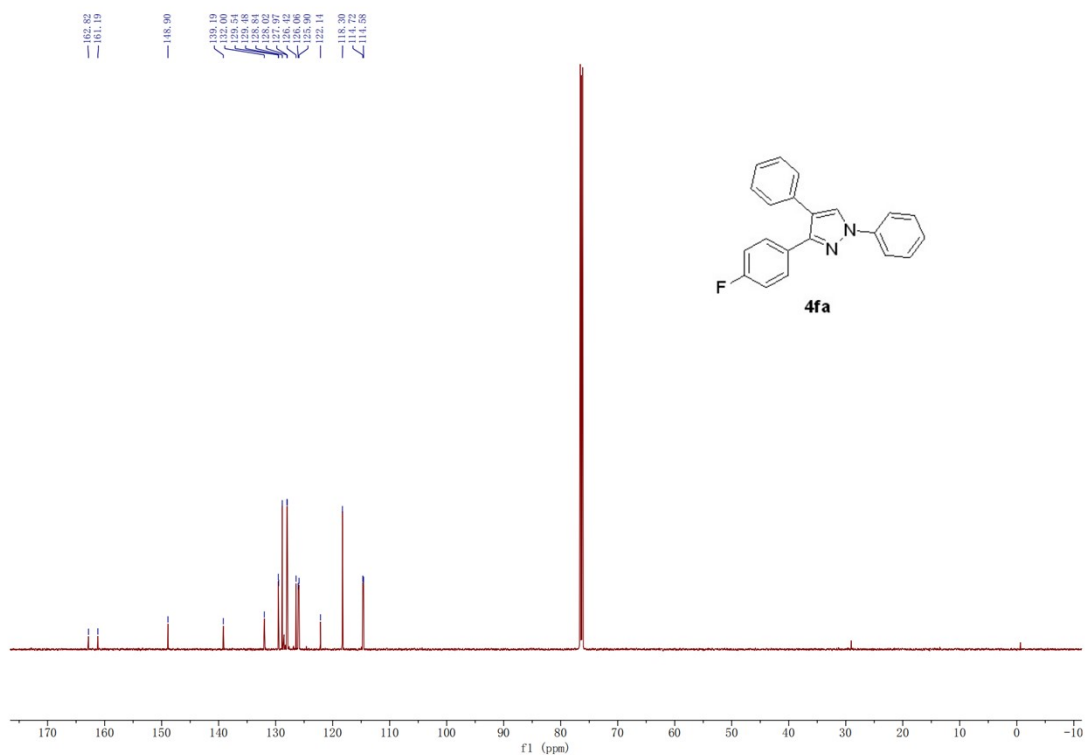
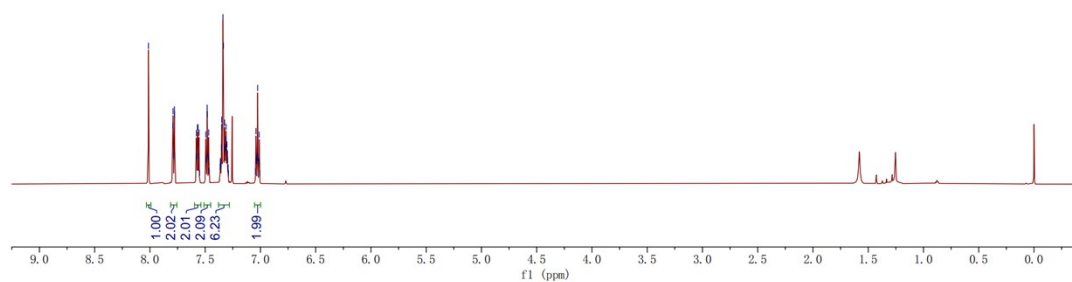
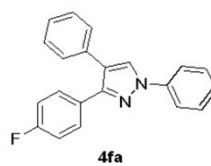


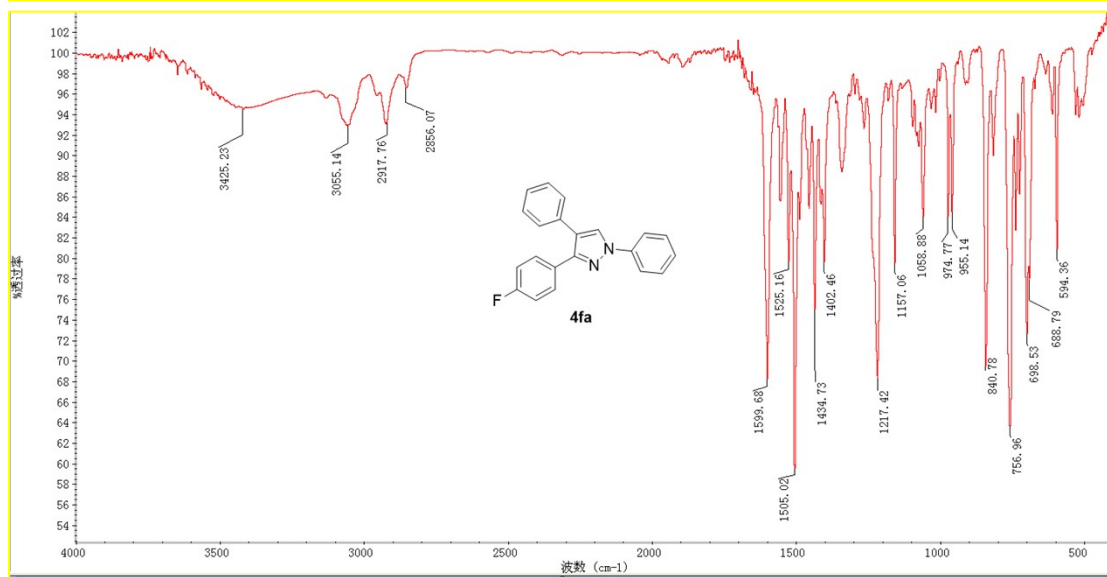
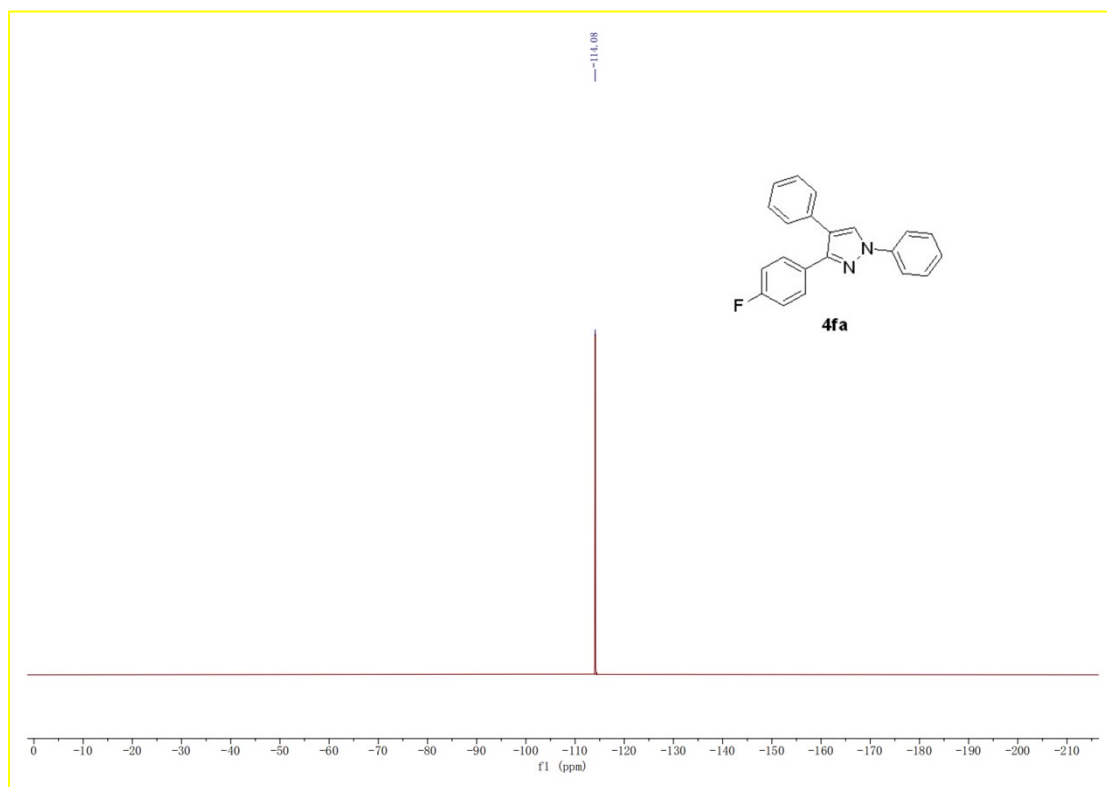






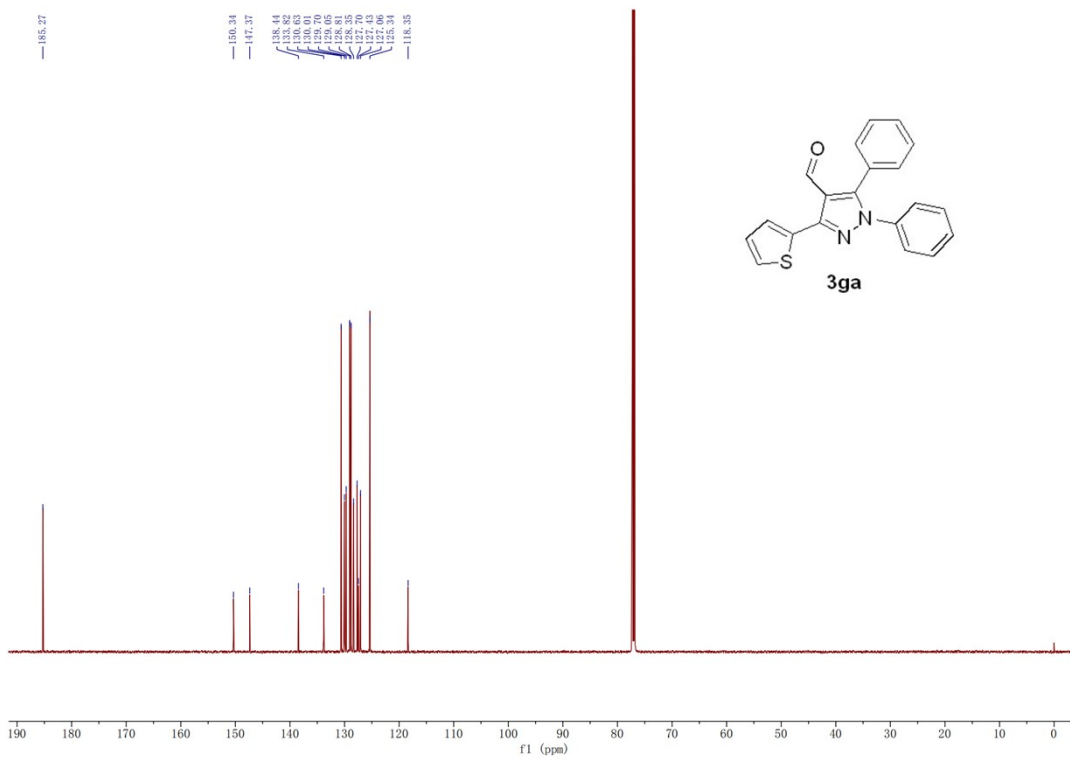
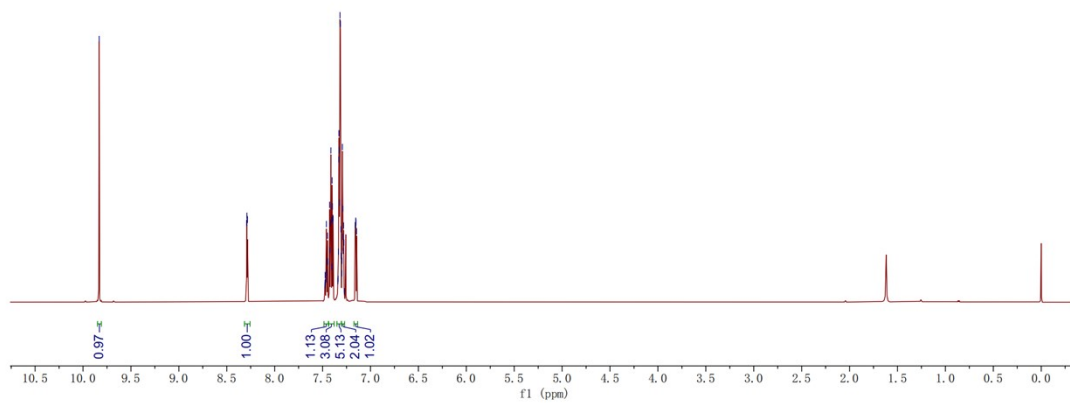
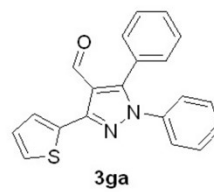
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3 Experiment	1D
4 Number of Scans	16

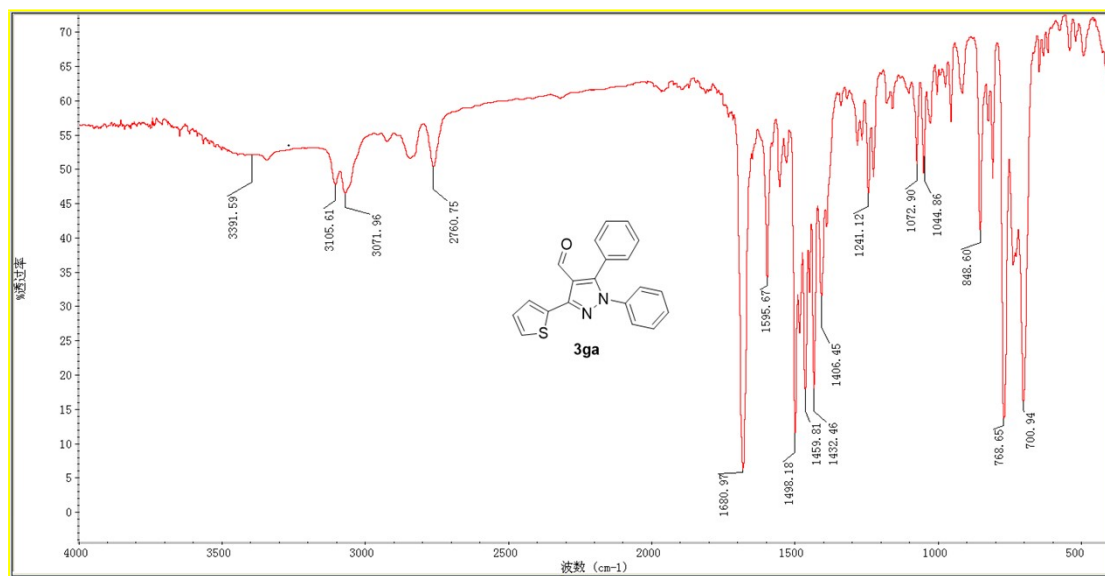




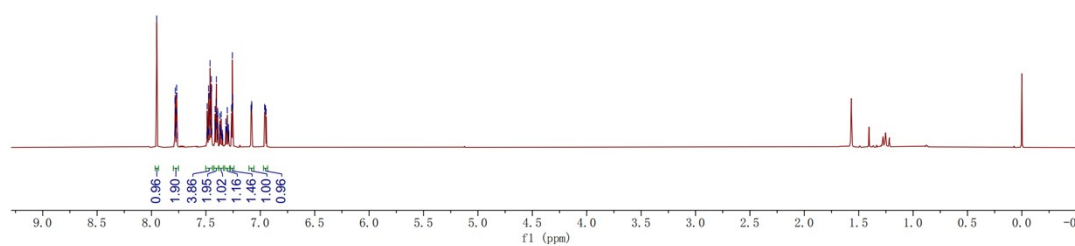
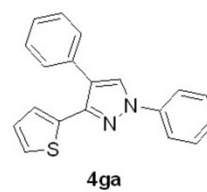
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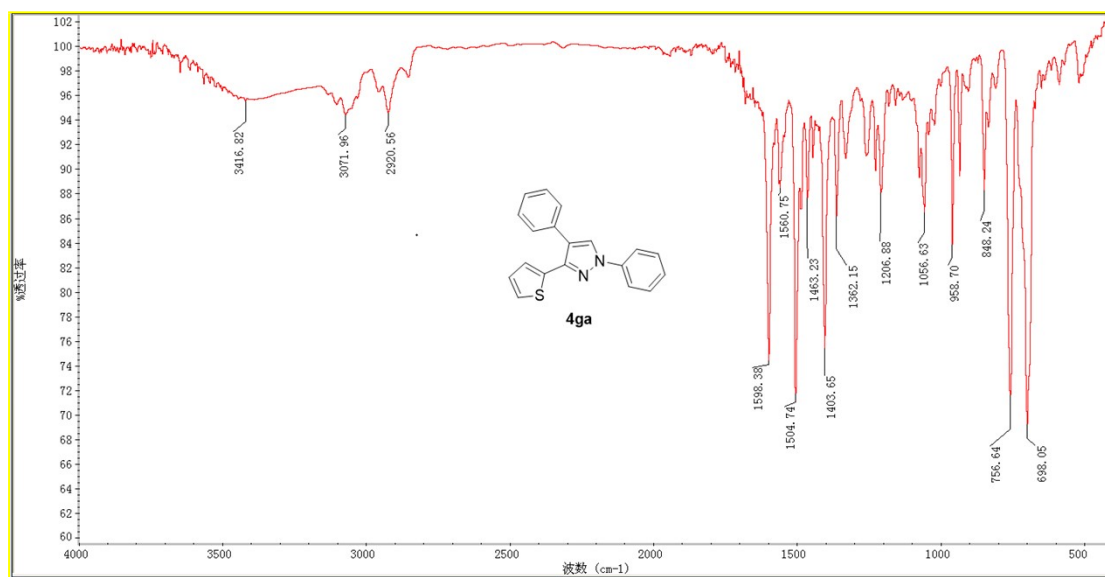
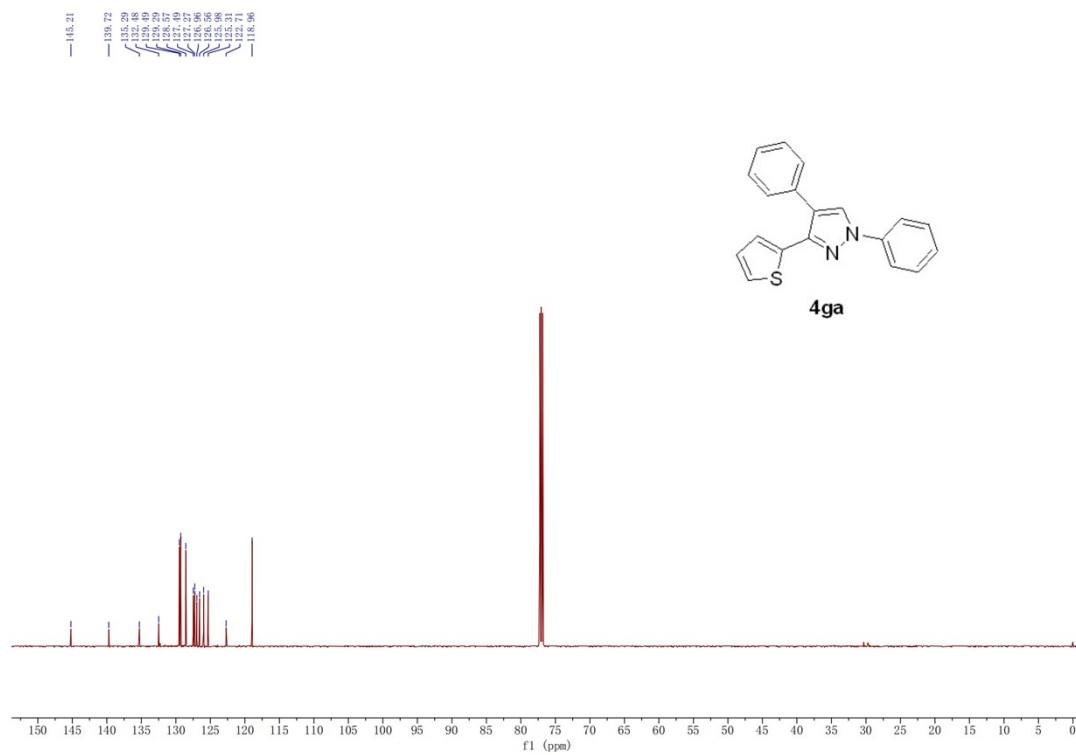
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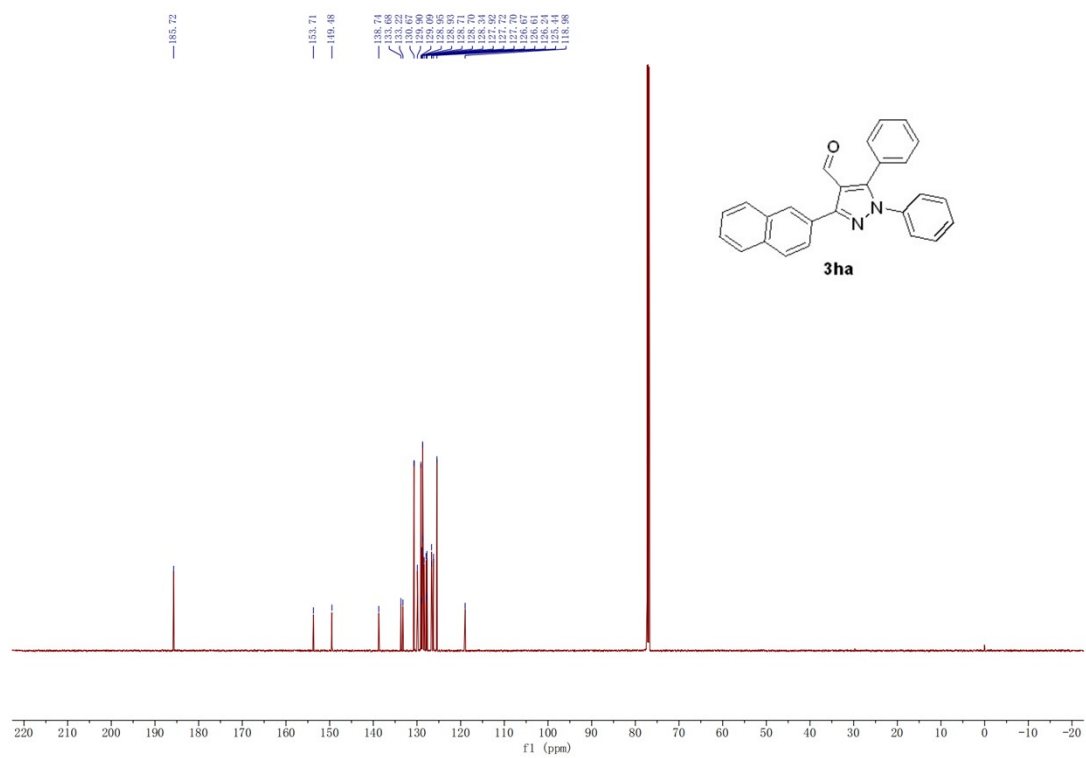
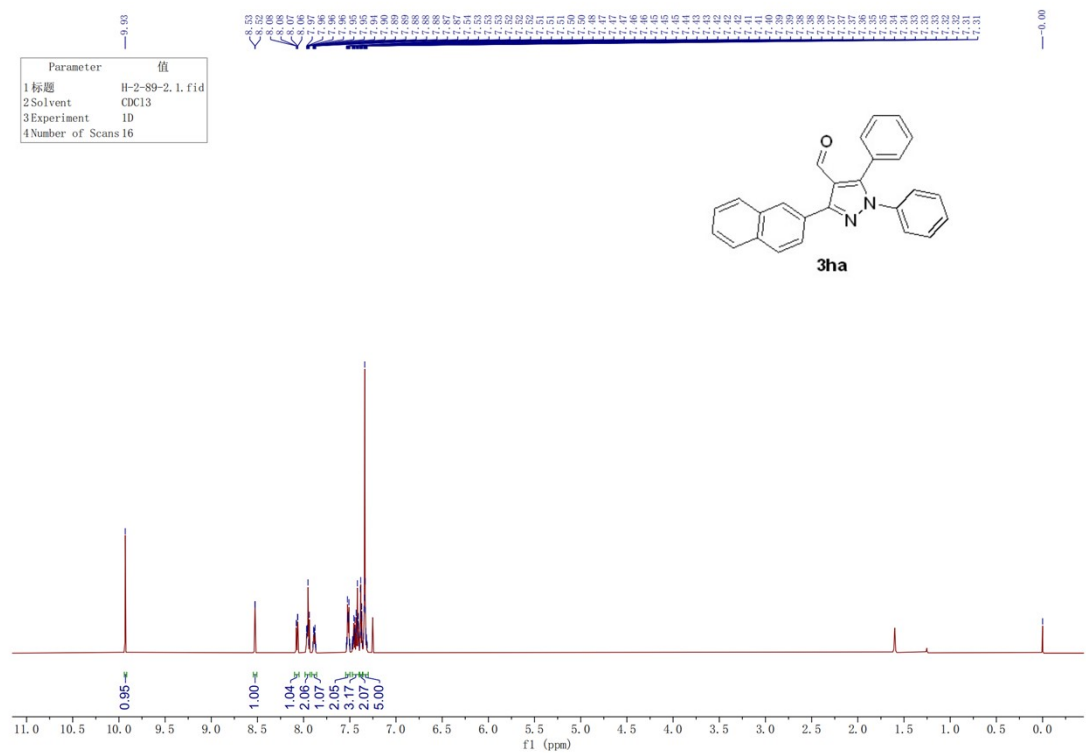


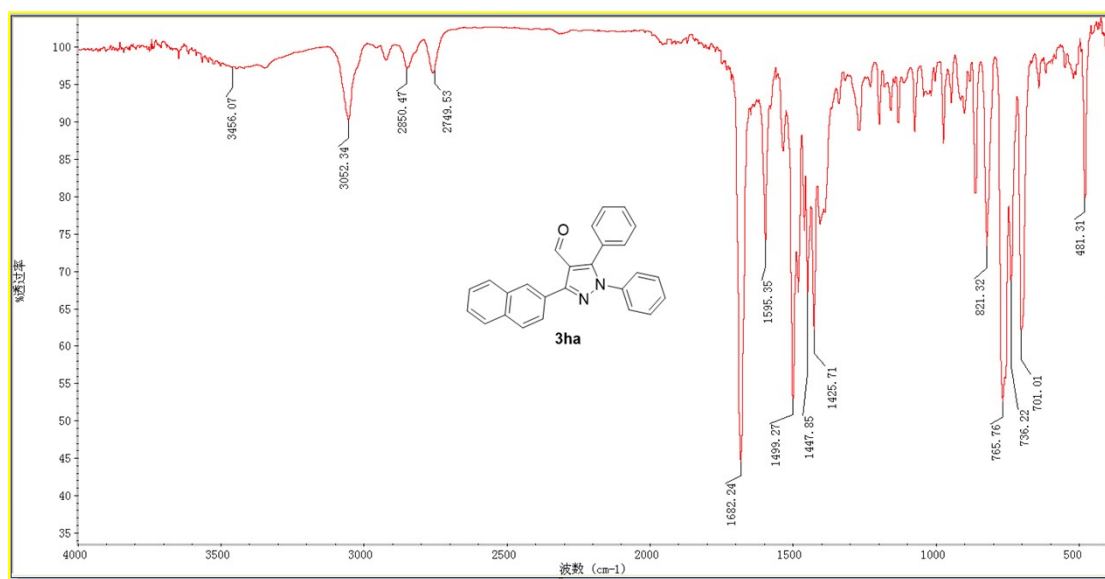


Parameter	值
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2 Solvent	CDCl3
3 Experiment	1D
4 Number of Scans	16

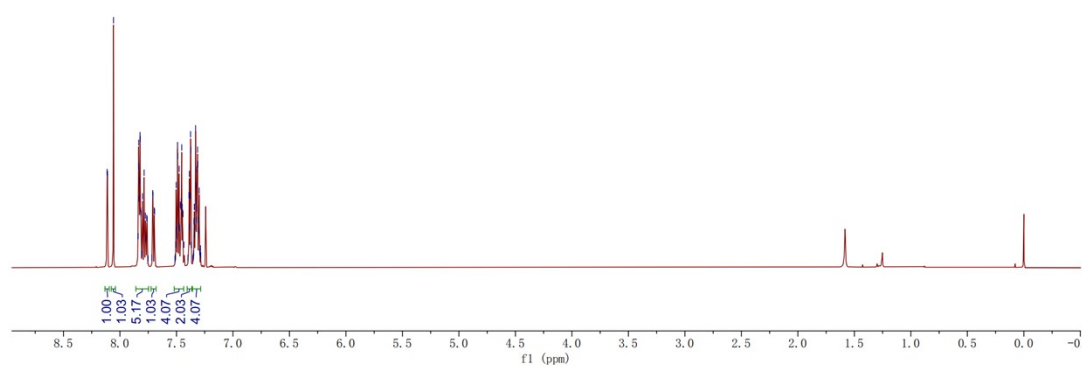
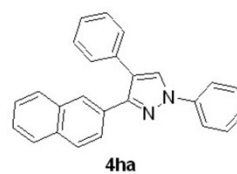


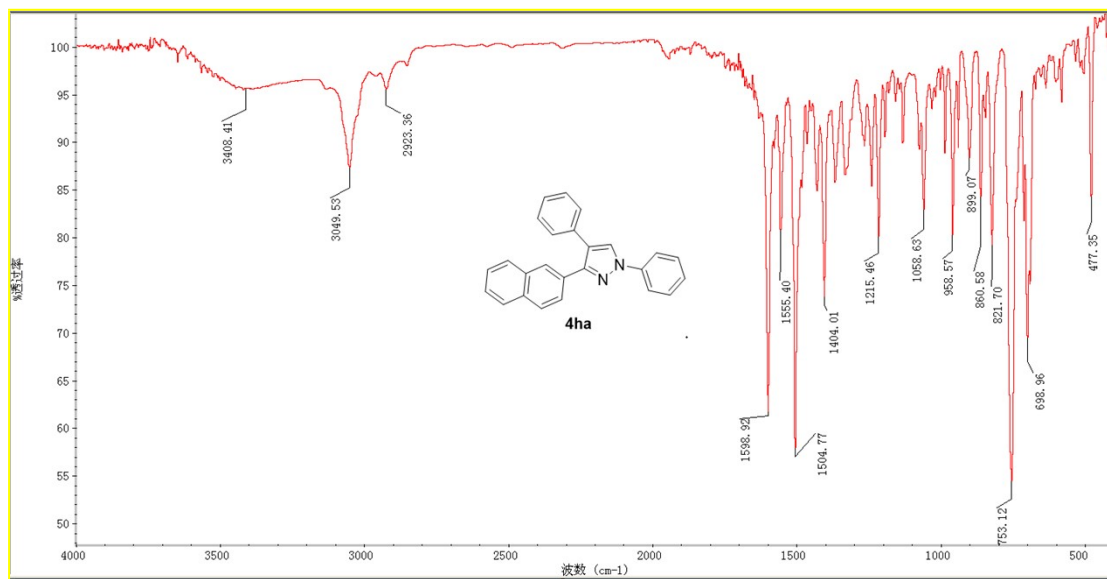
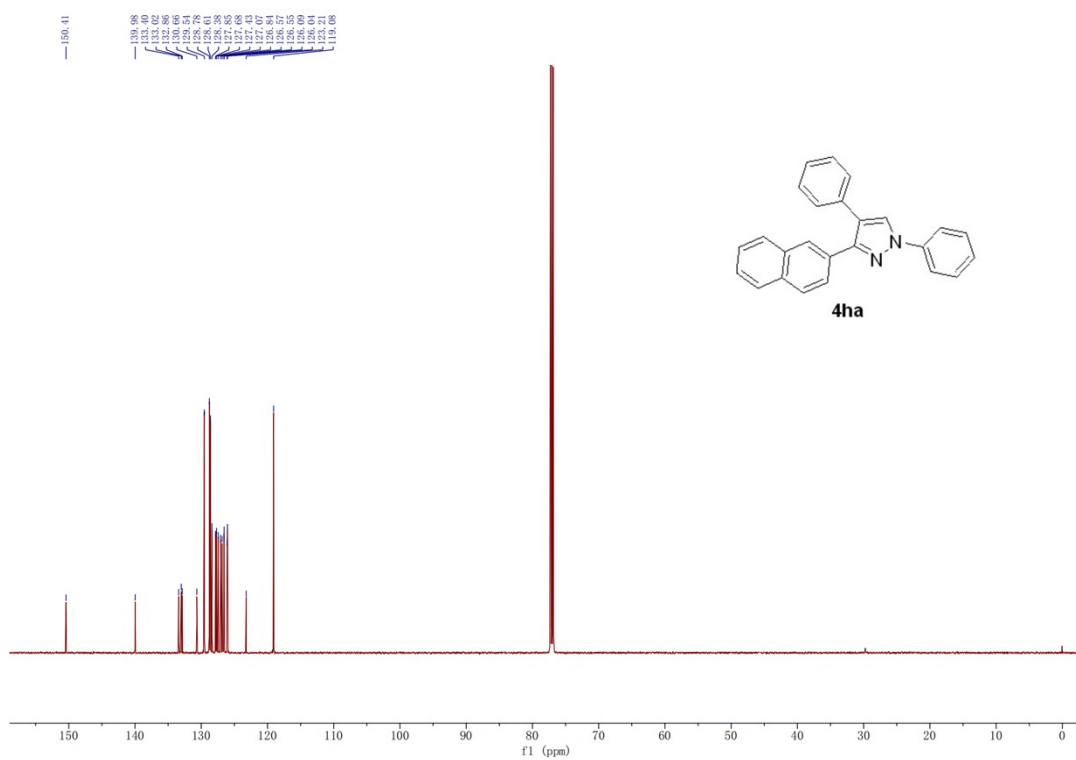


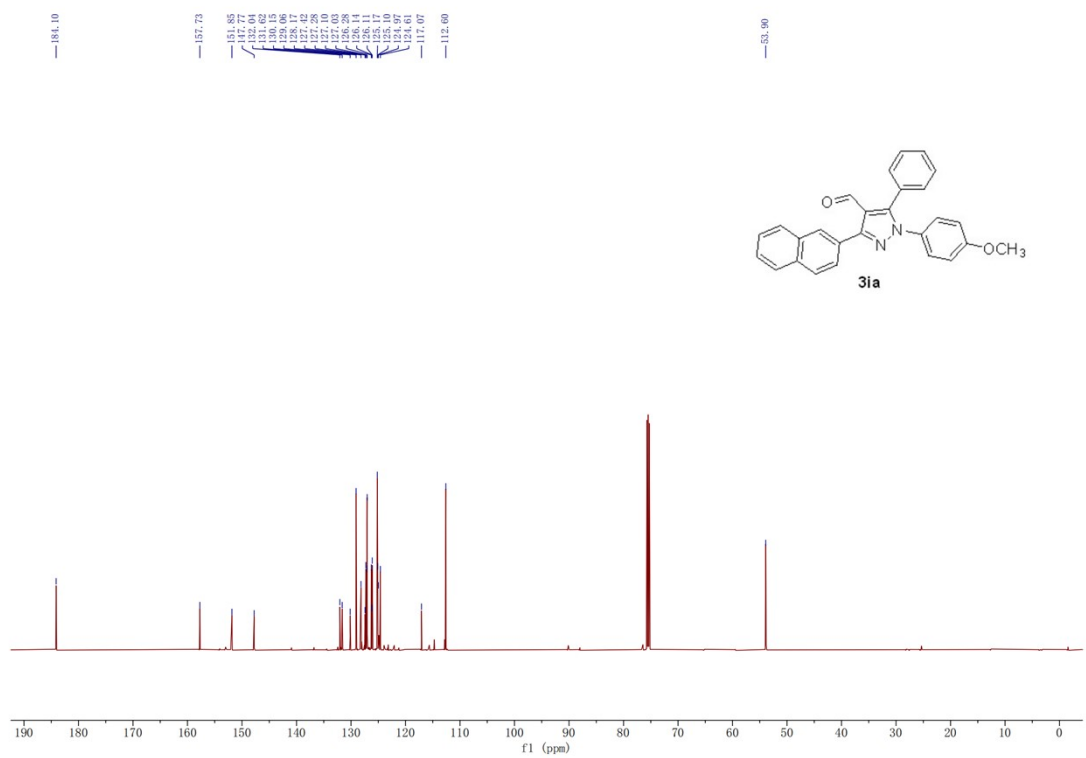
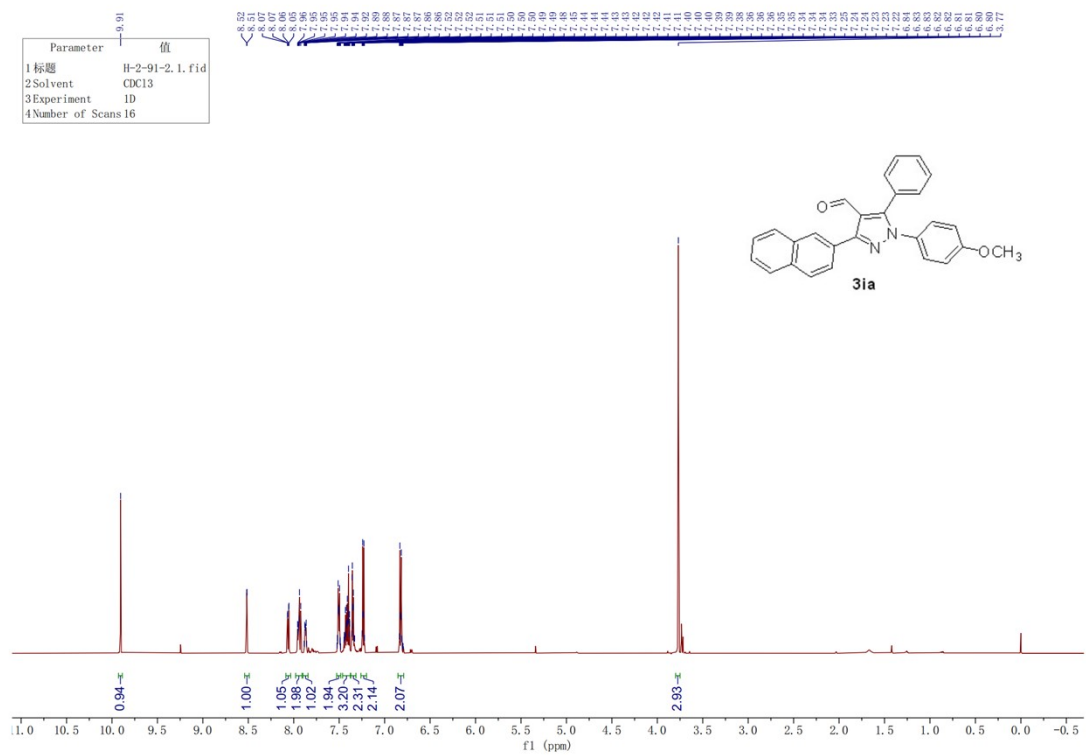


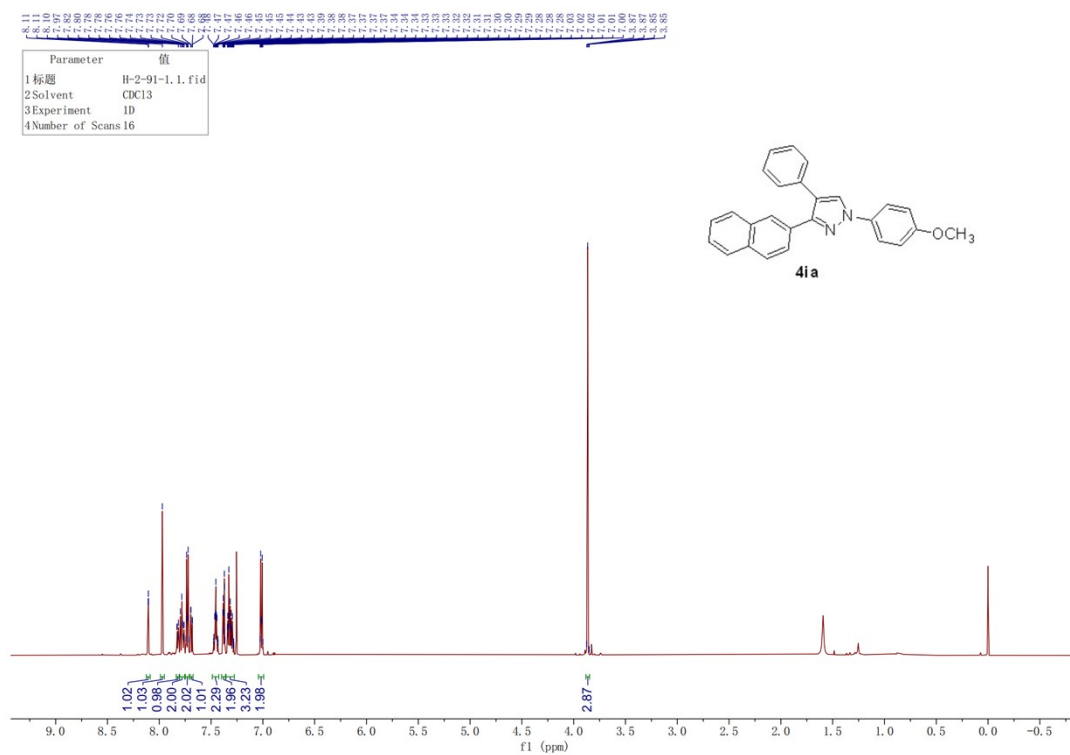
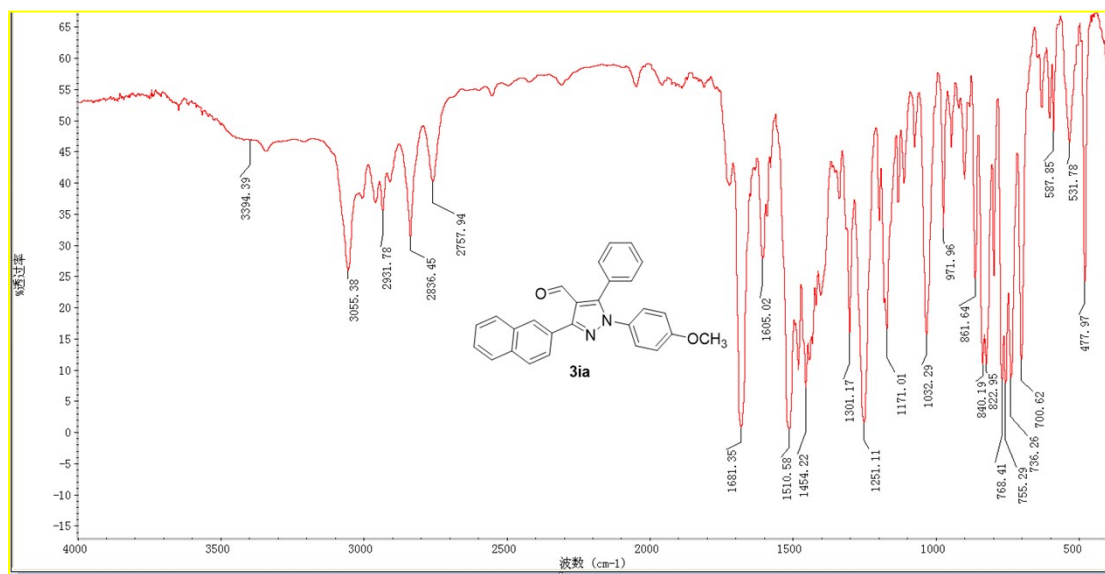


Parameter	值
1标题	H-2-89-1.1.fid
2Solvent	CDCl3
3Experiment	1D
4Number of Scans	16

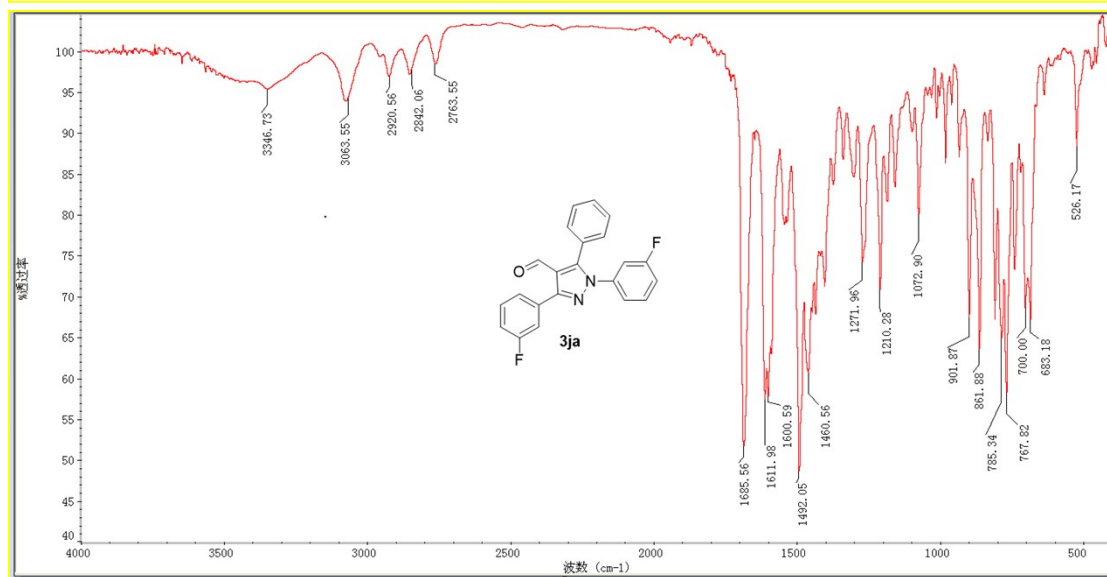
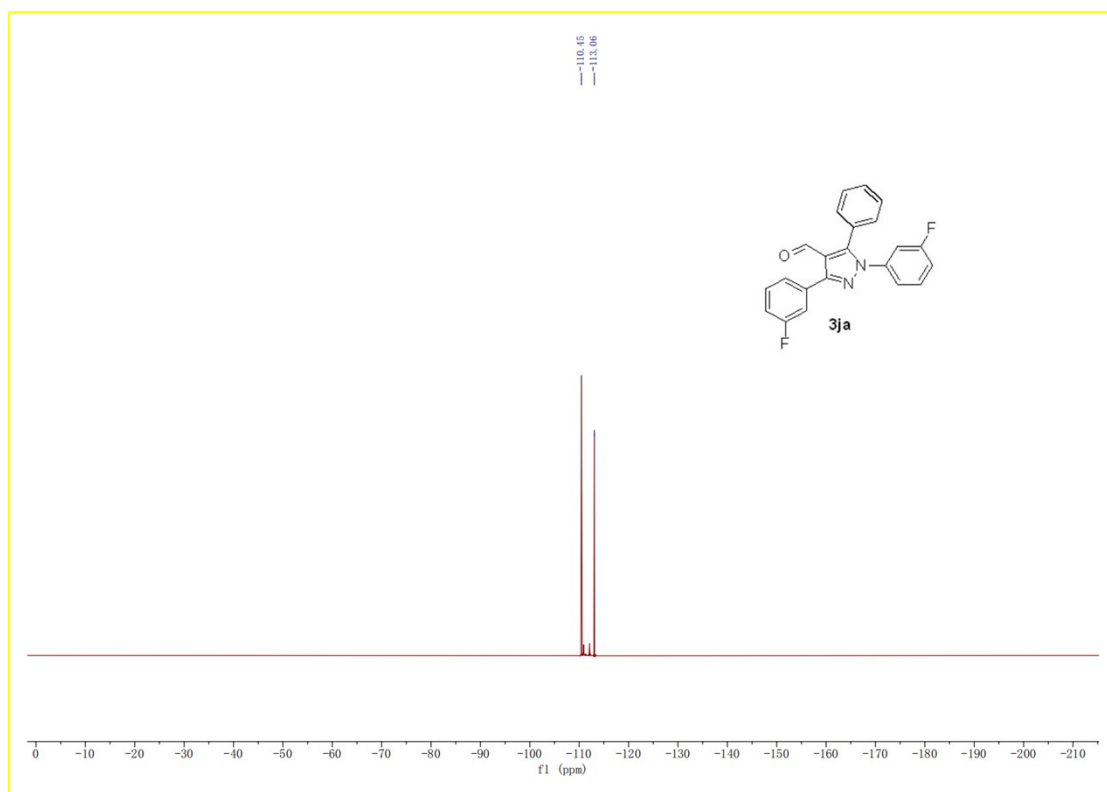


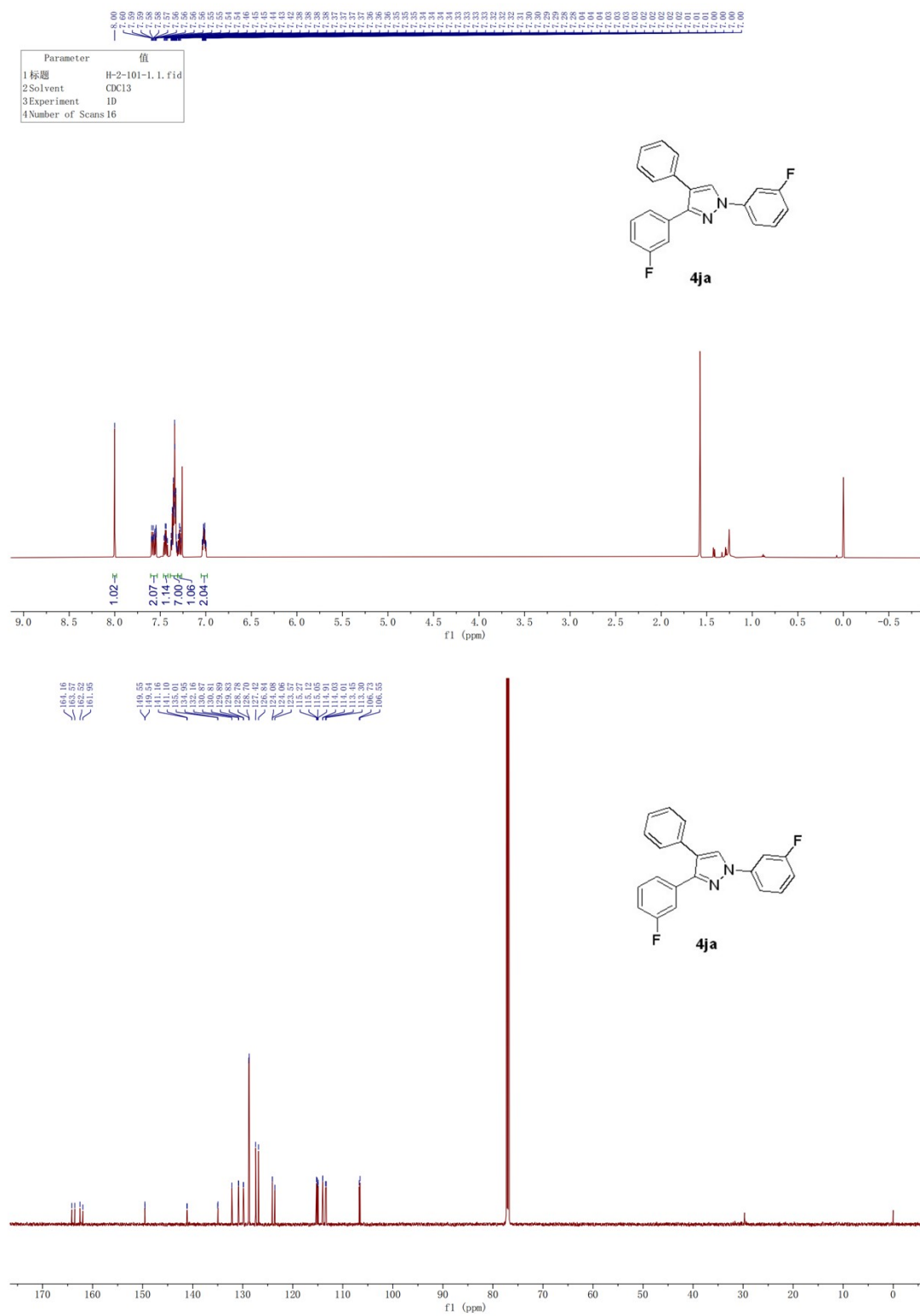


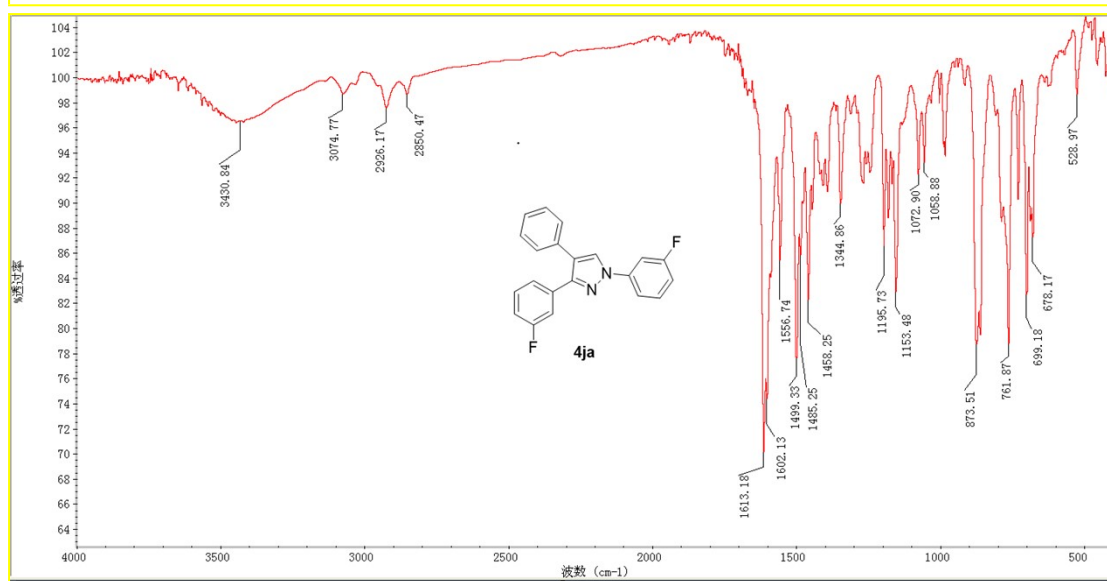
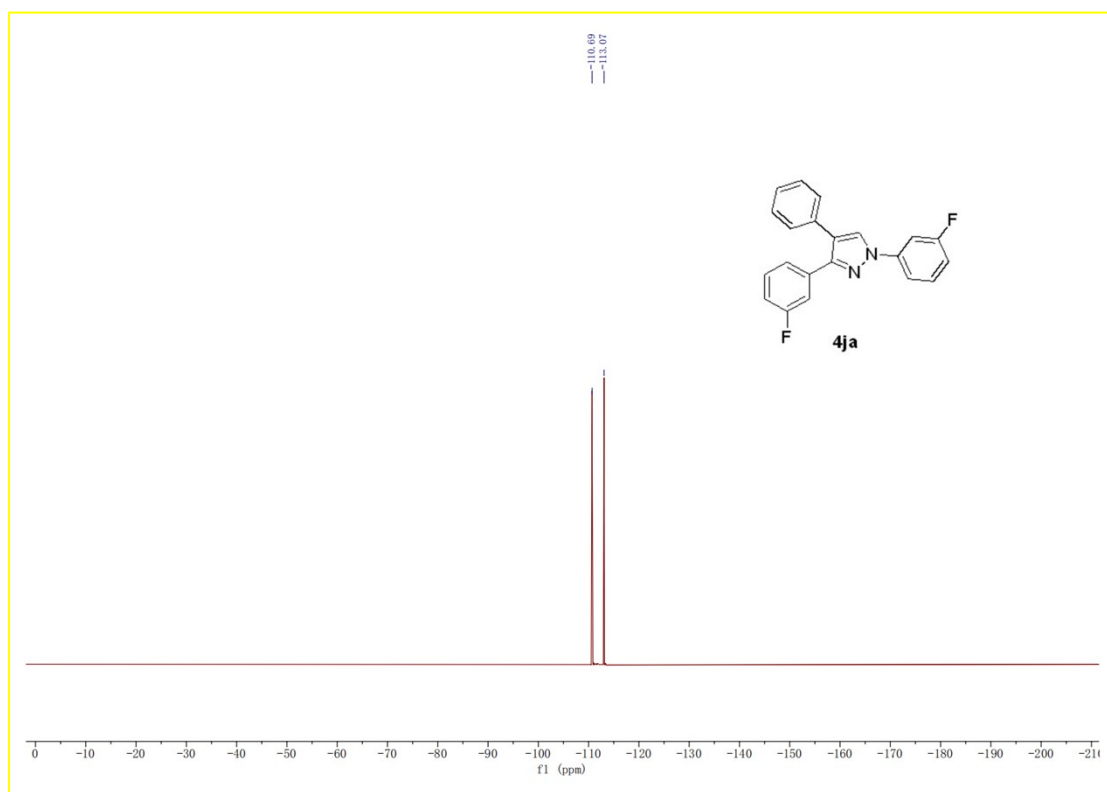


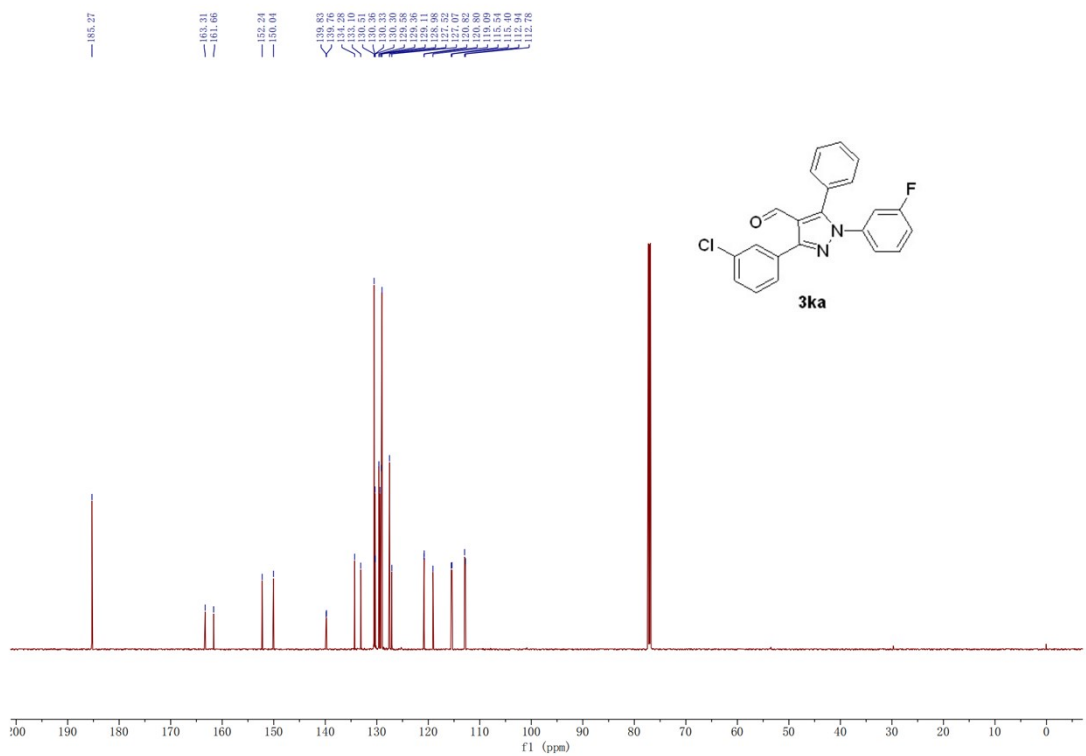
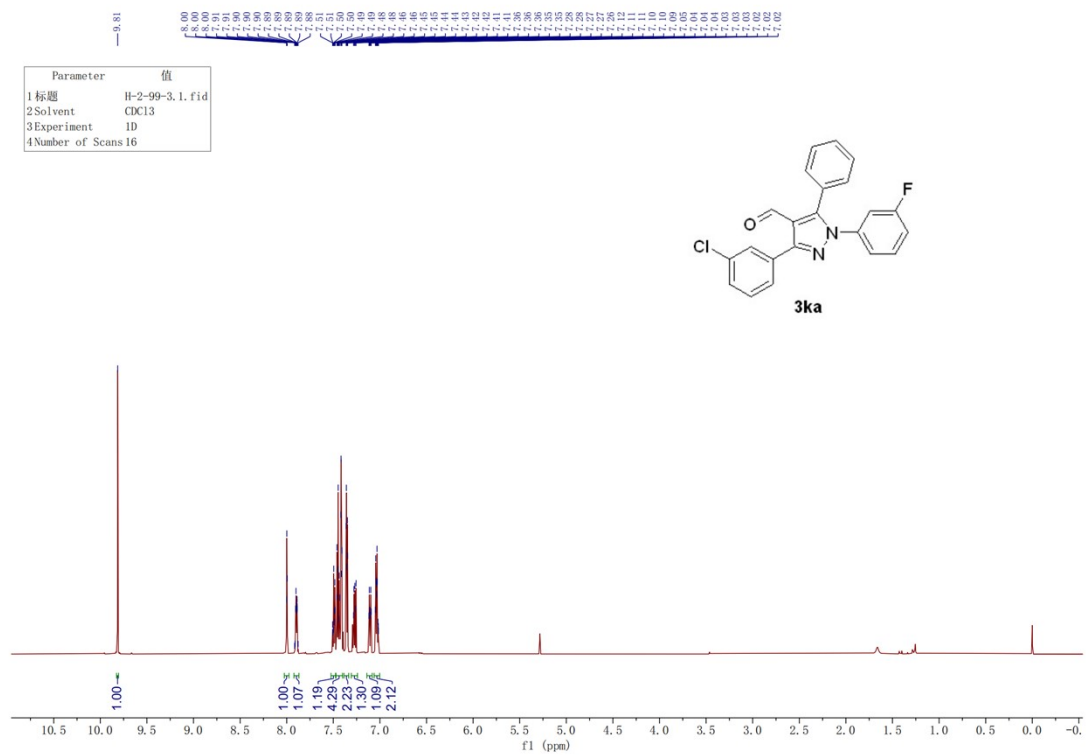


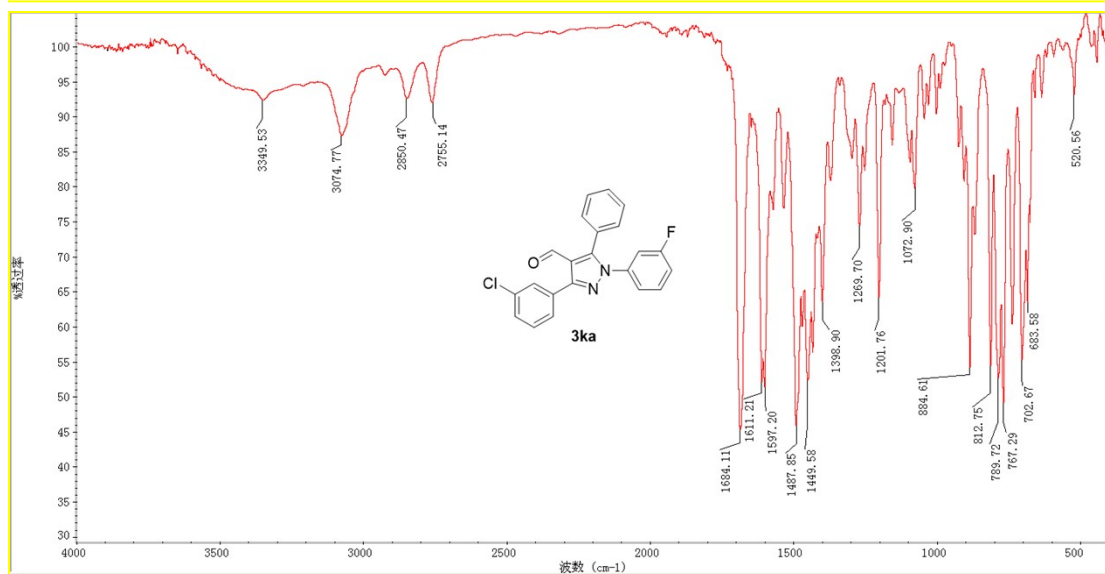
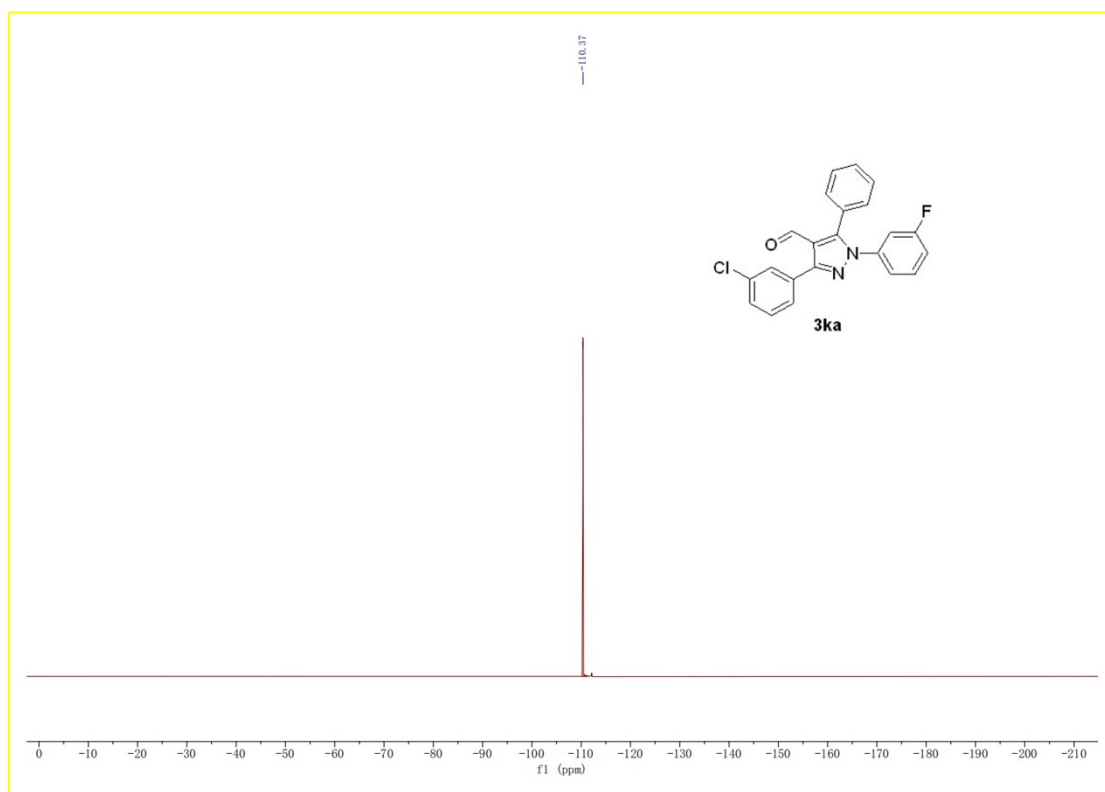


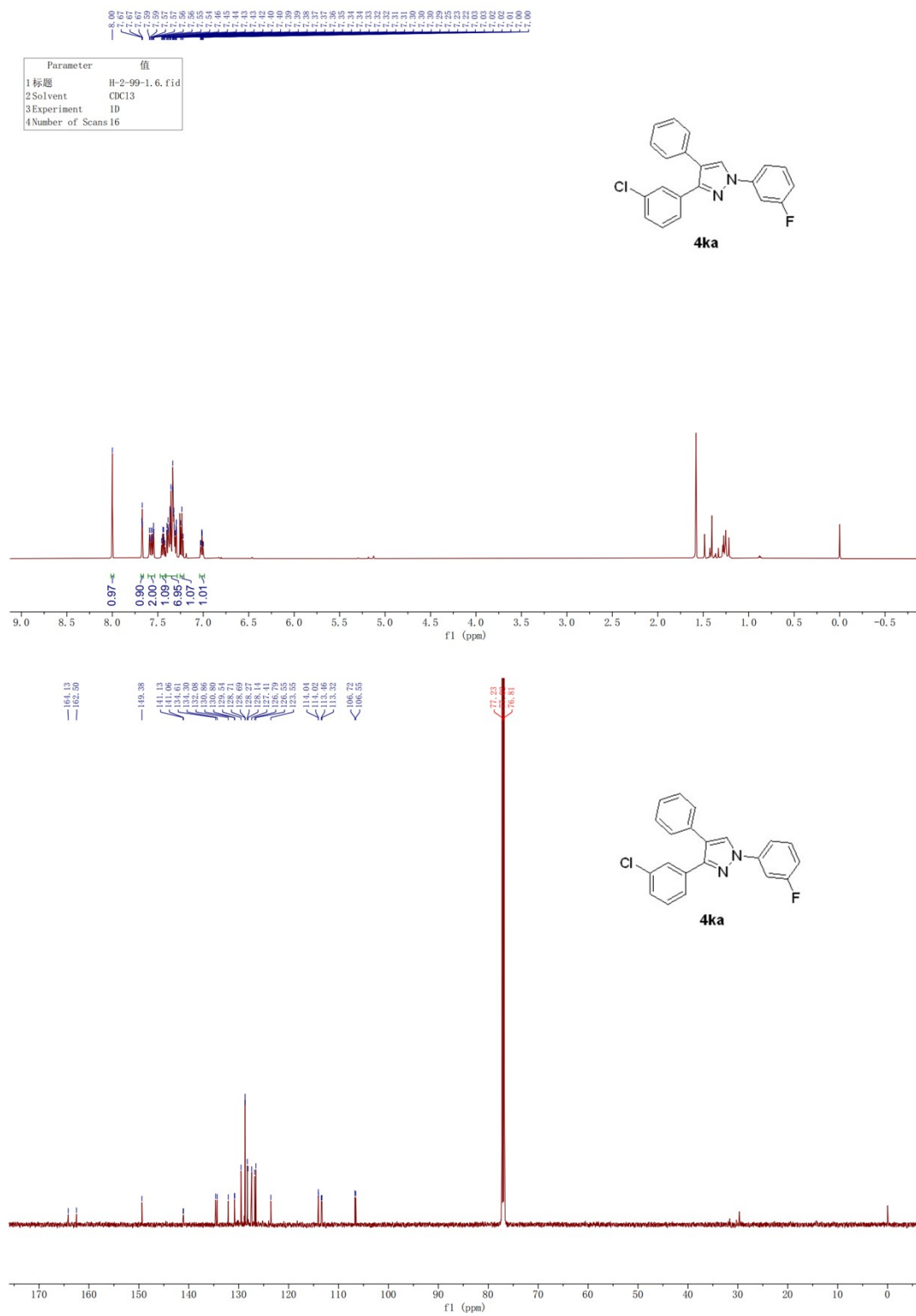


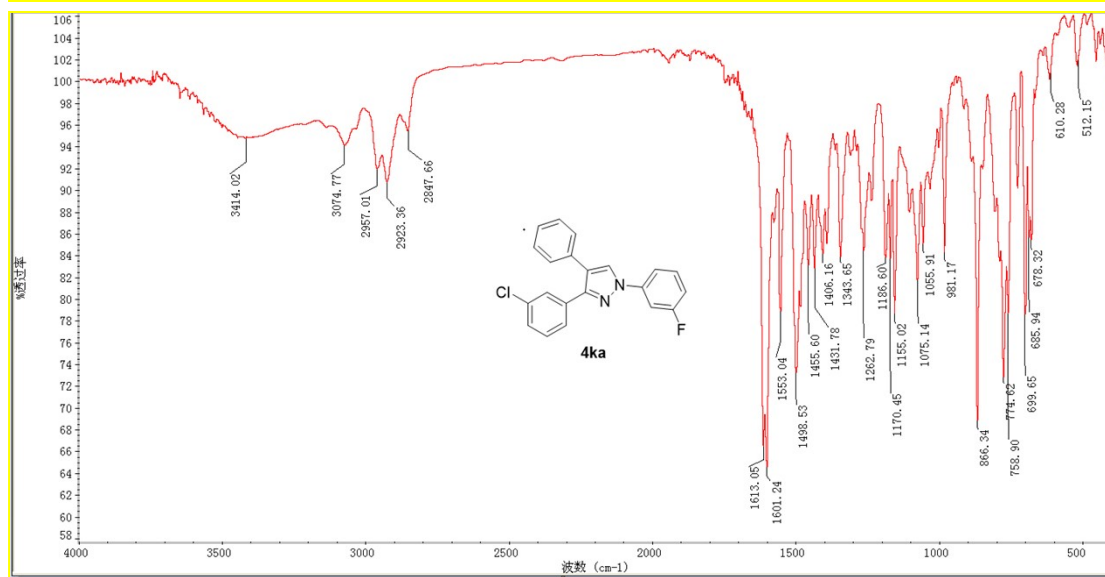
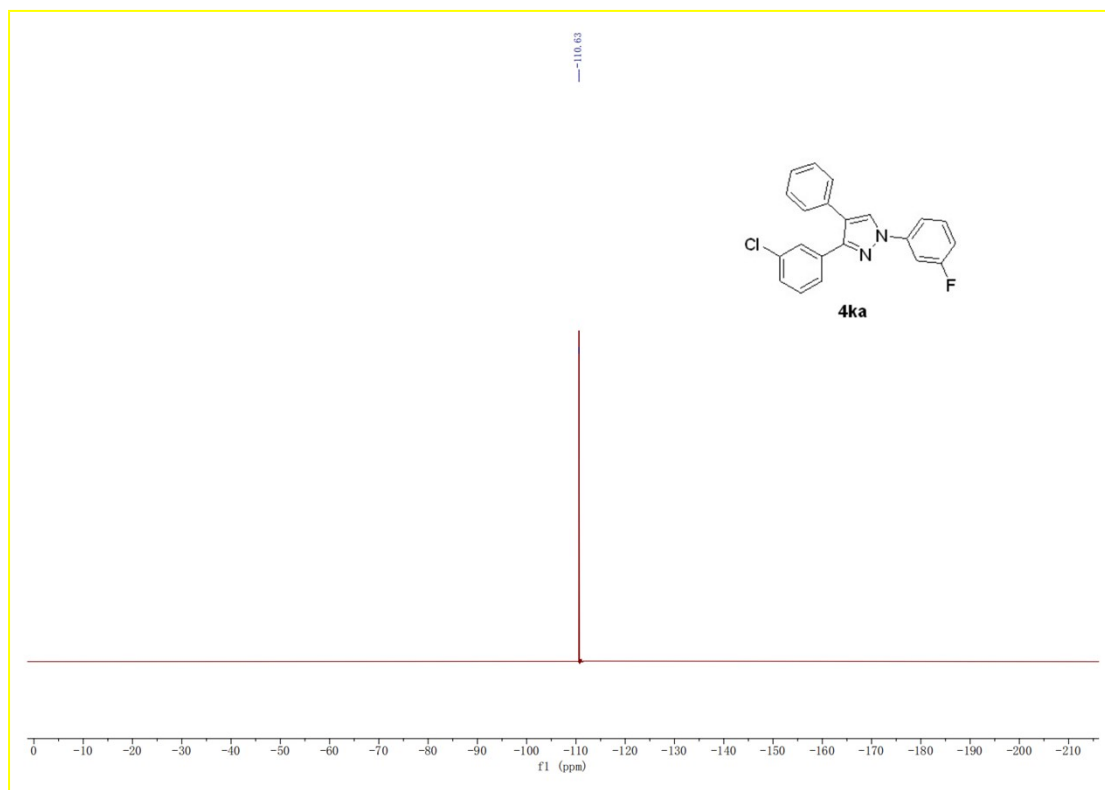


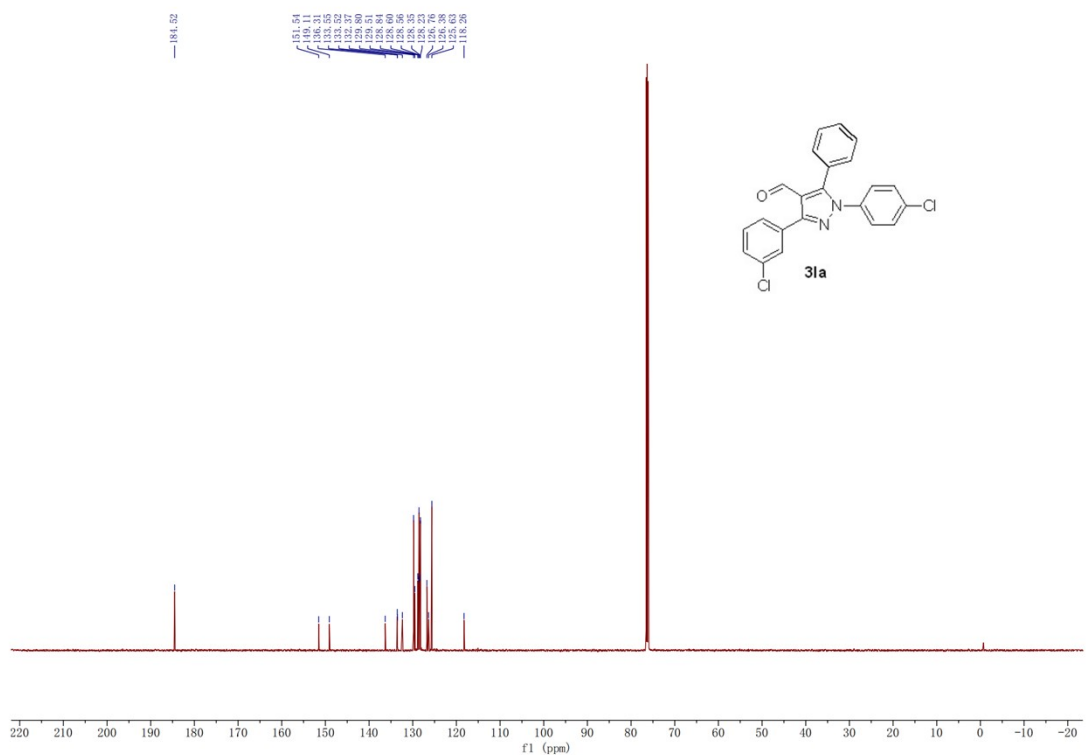
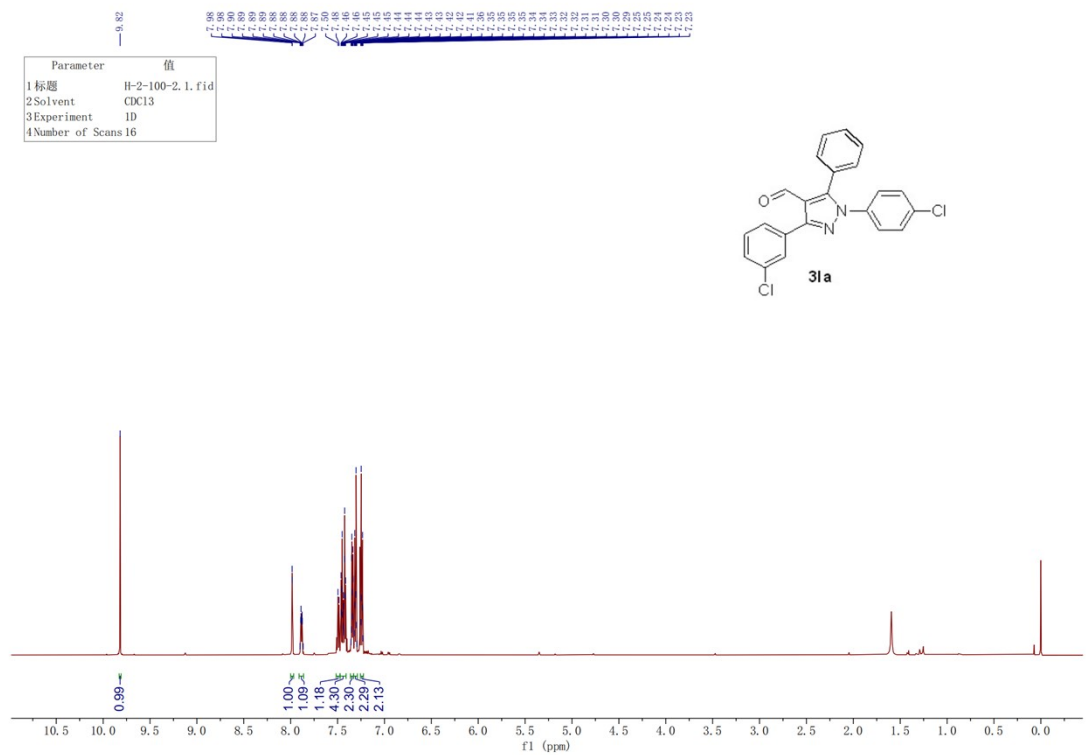


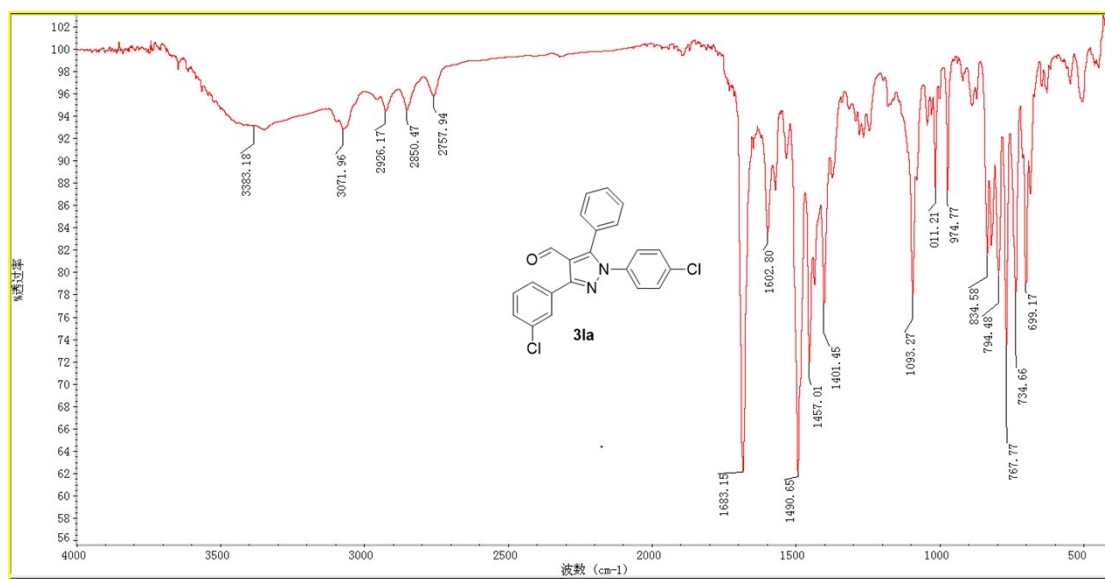




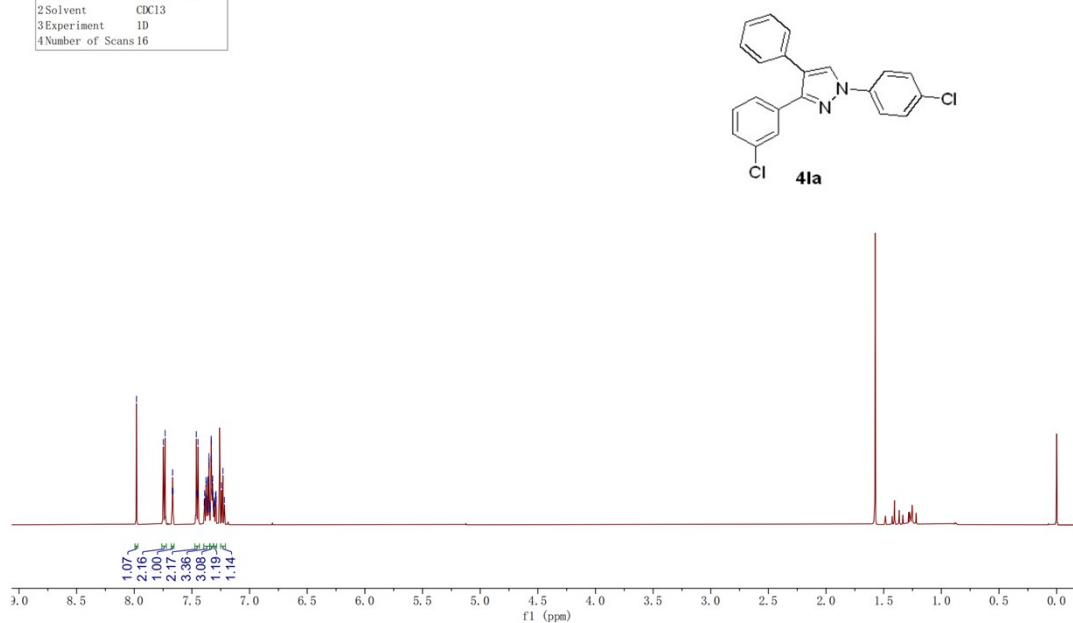


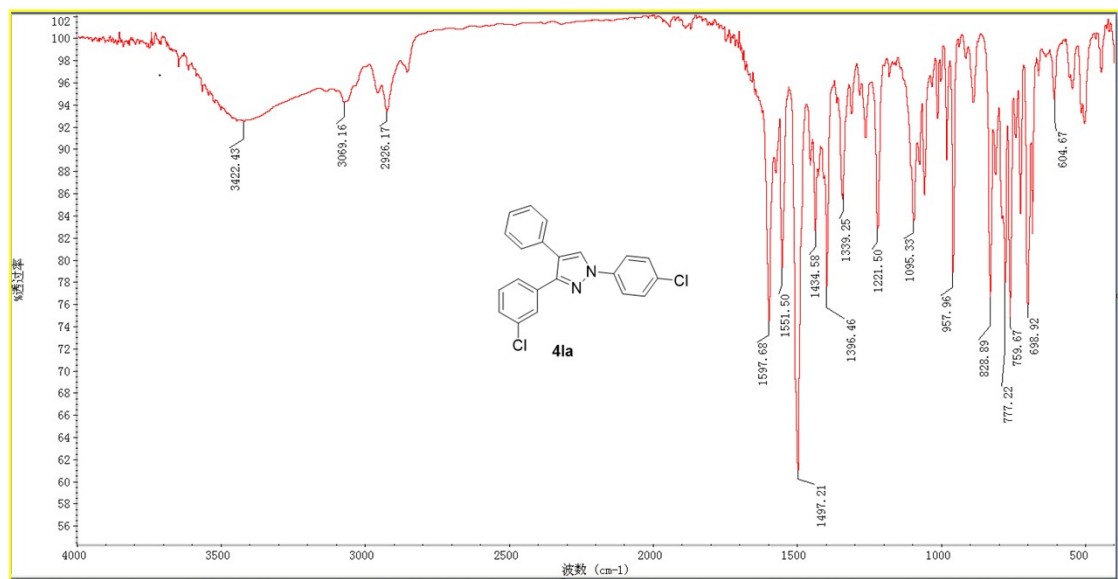
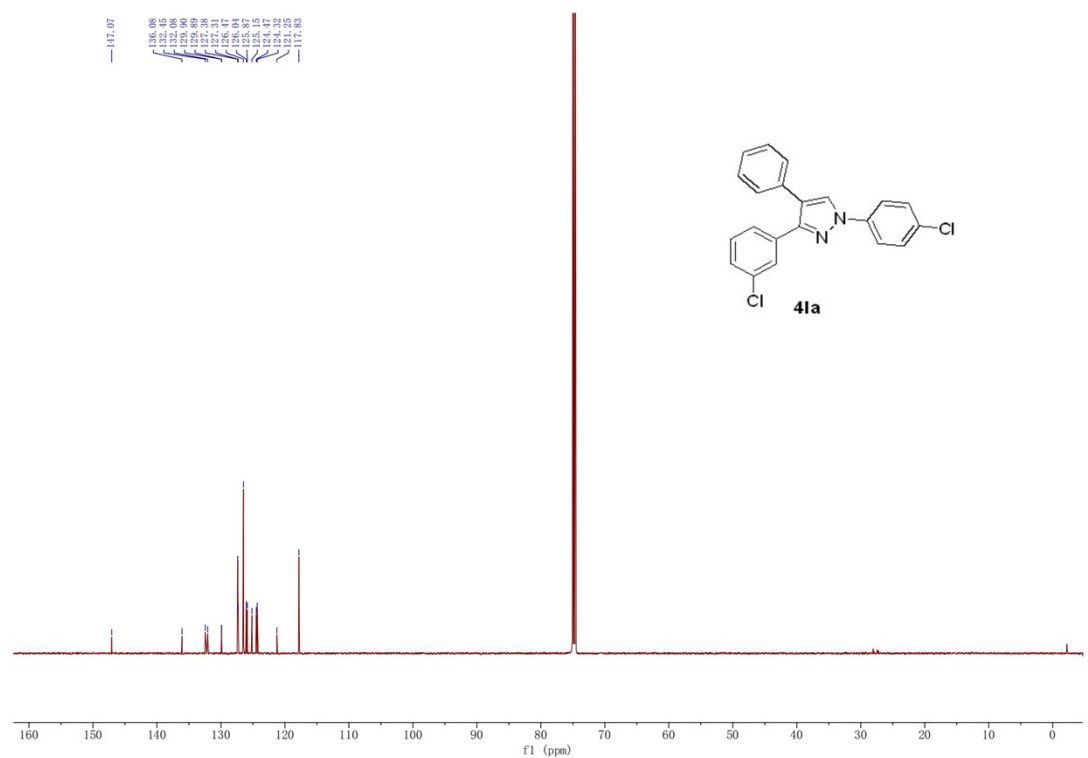


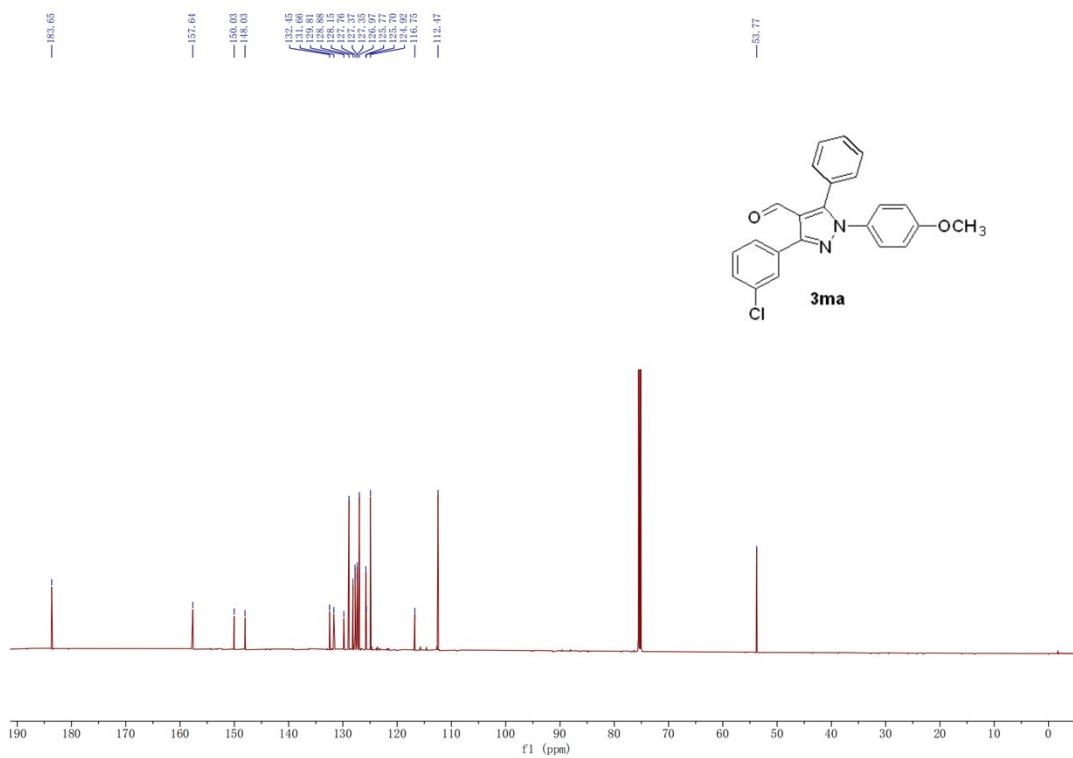
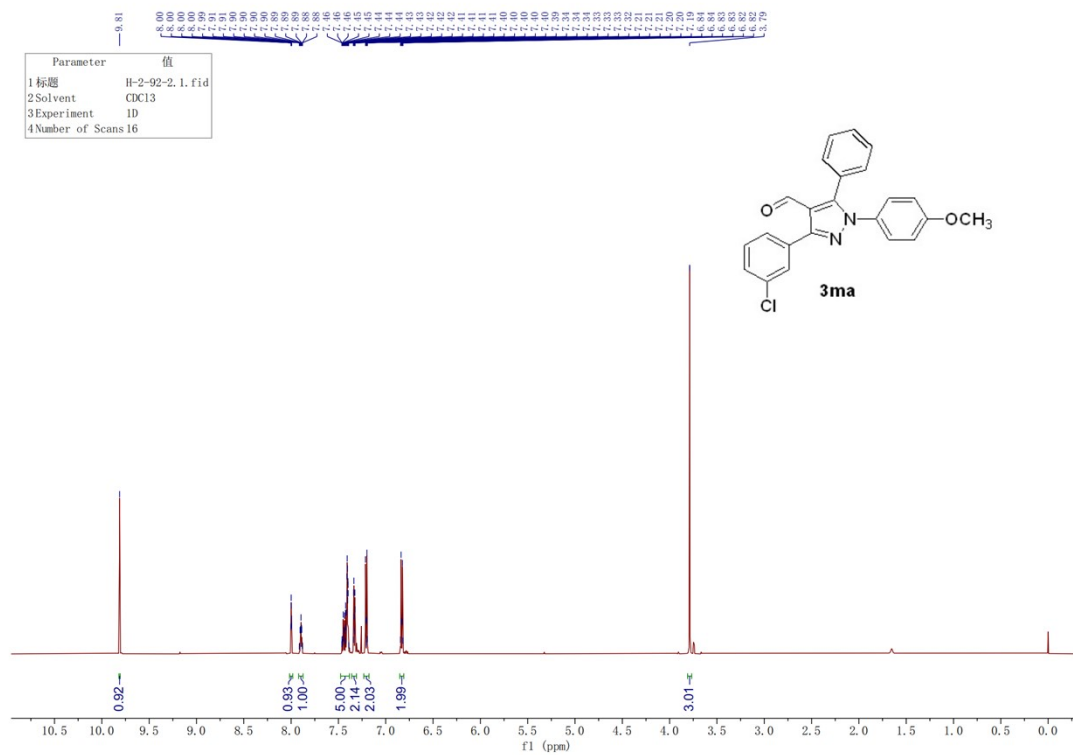


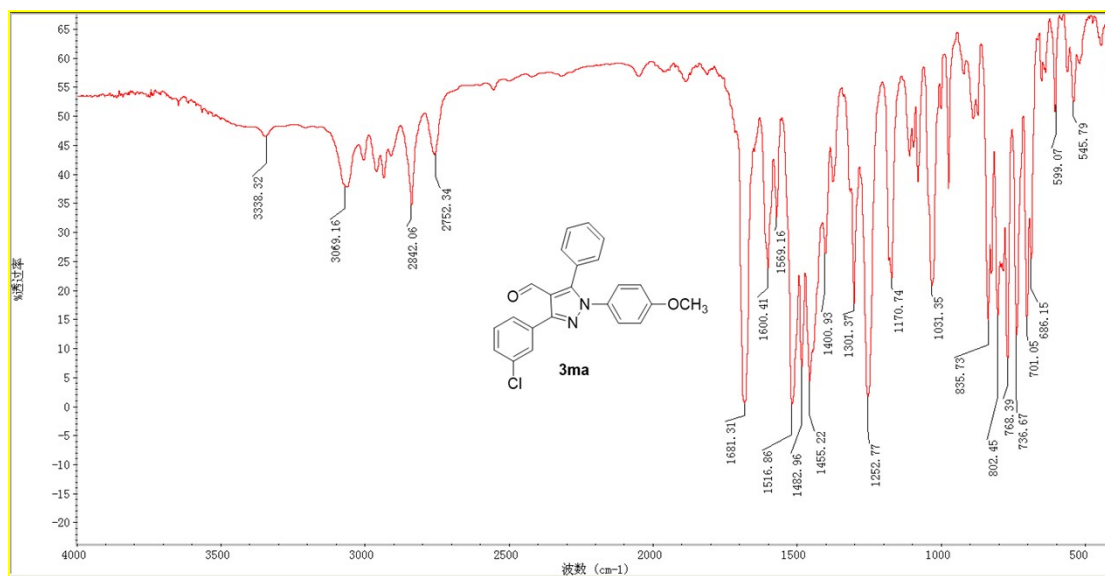


Parameter	值
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2 Solvent	CDCl3
3 Experiment	1D
4 Number of Scans	16

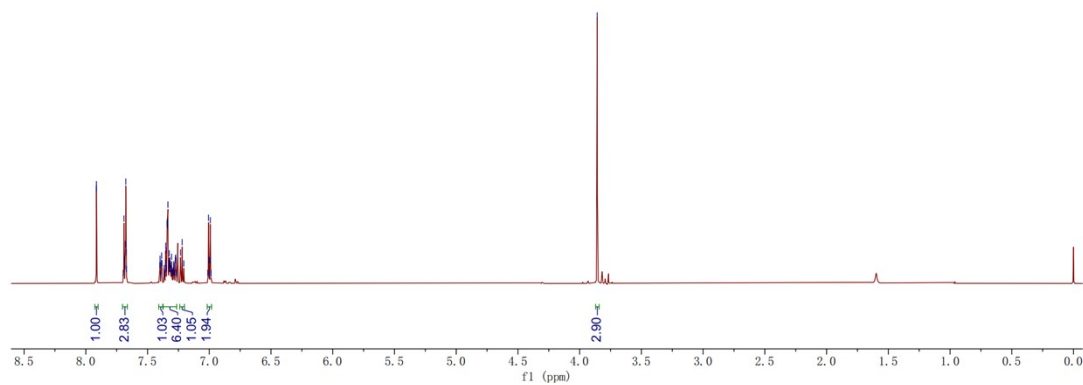
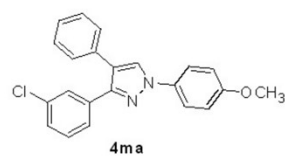


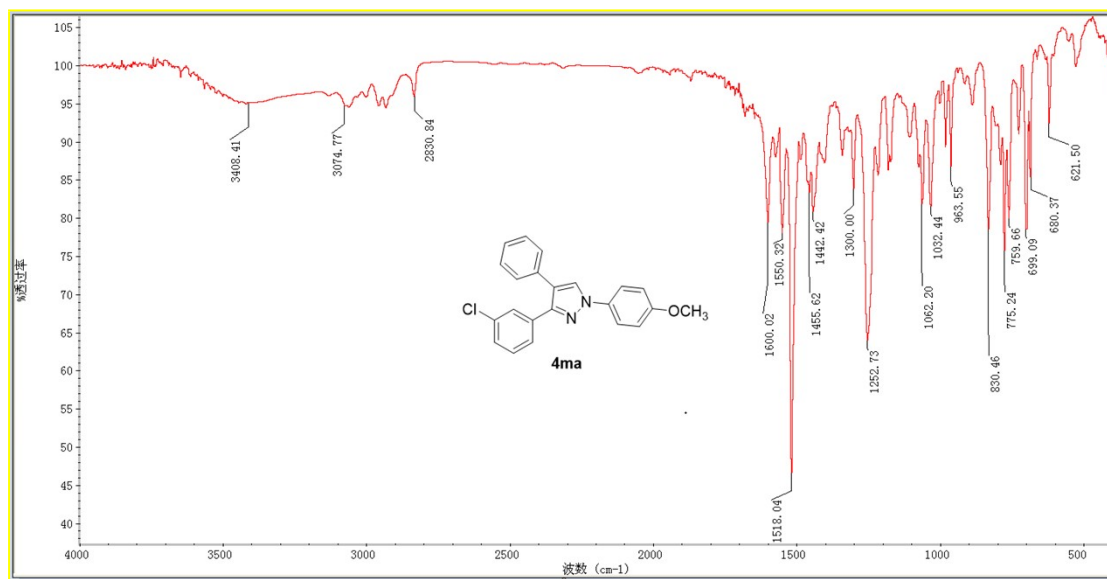
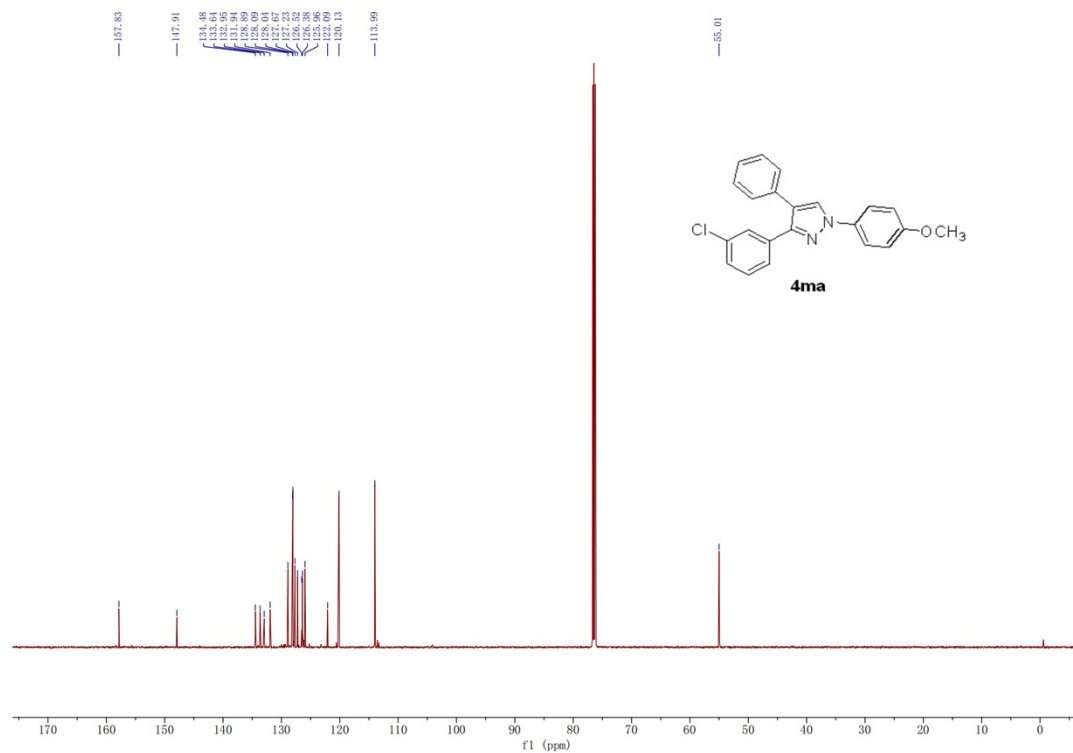


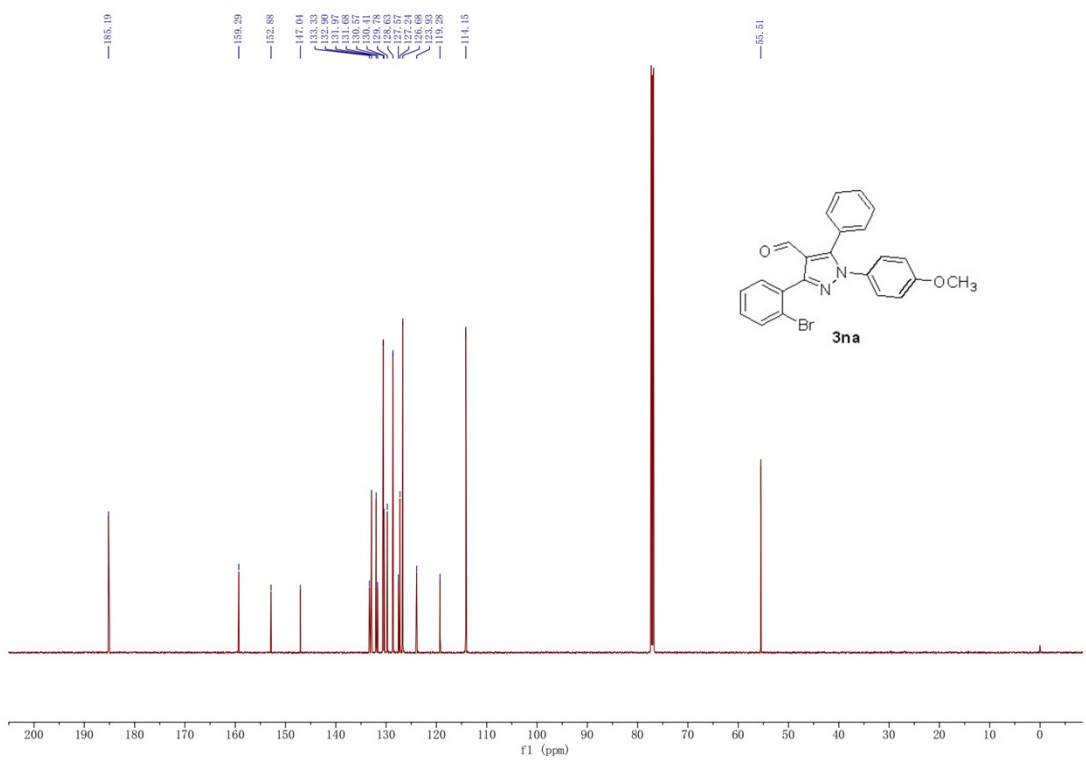
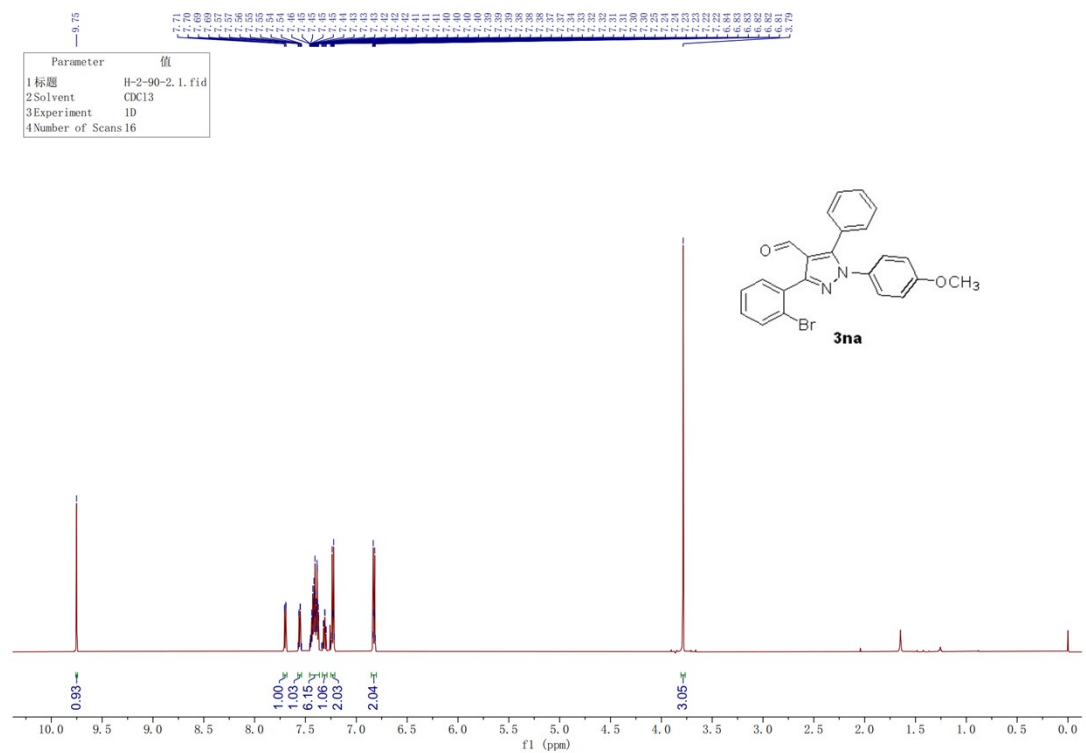


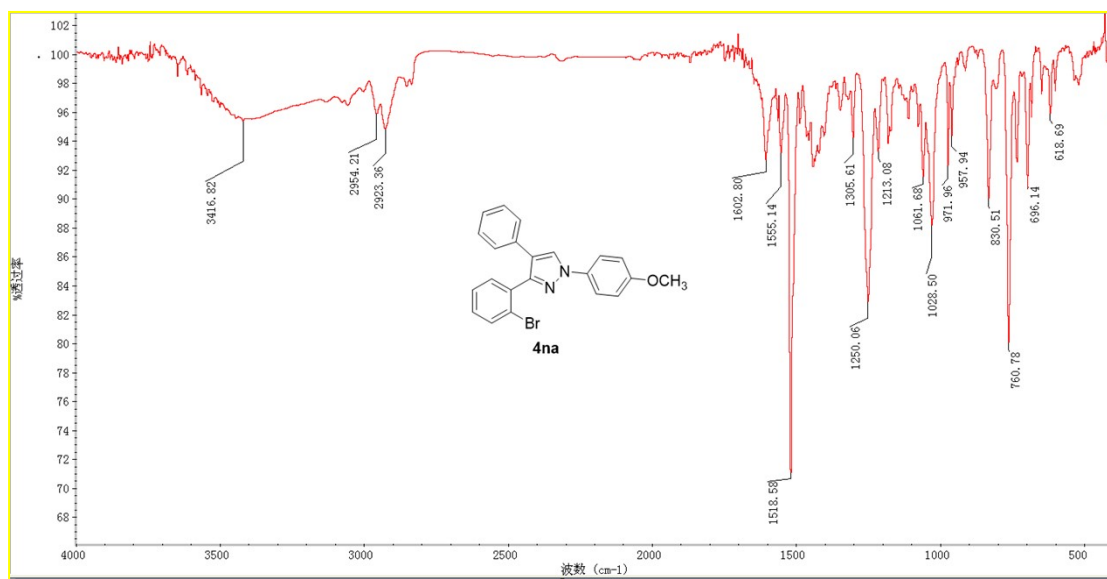
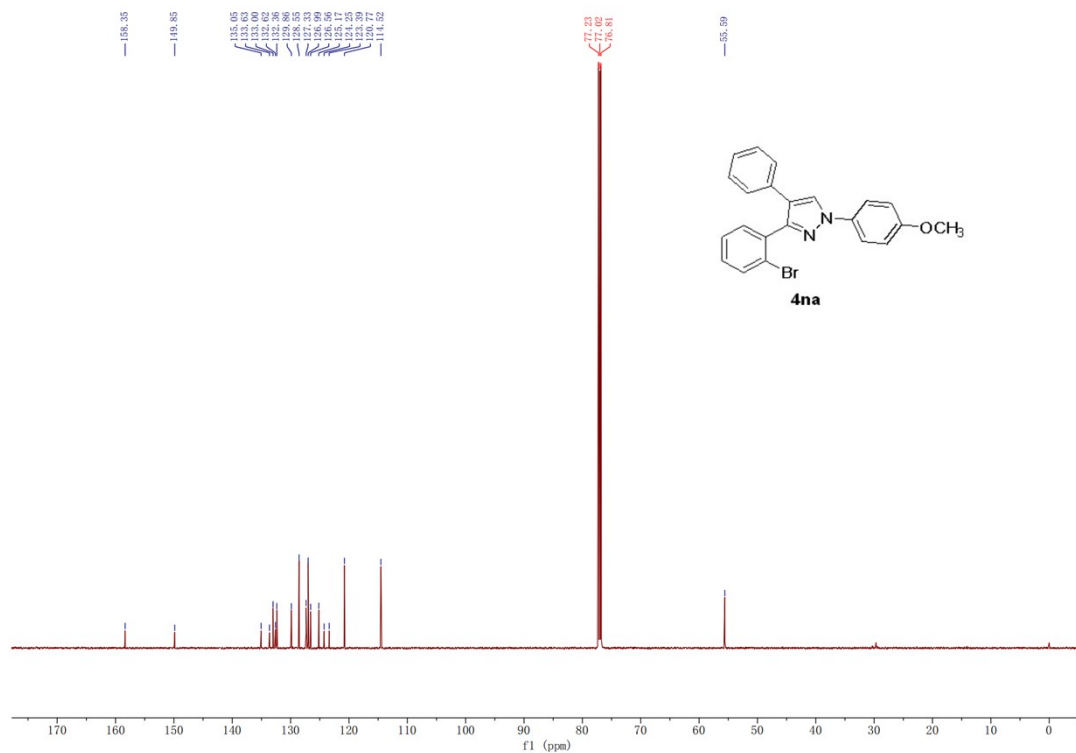


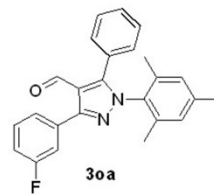
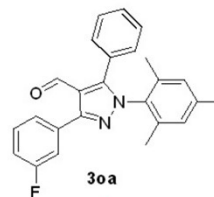
Parameter	值
1标题	H-2-92-1.1.fid
2Solvent	CDCl3
3Experiment	1D
4Number of Scans	16

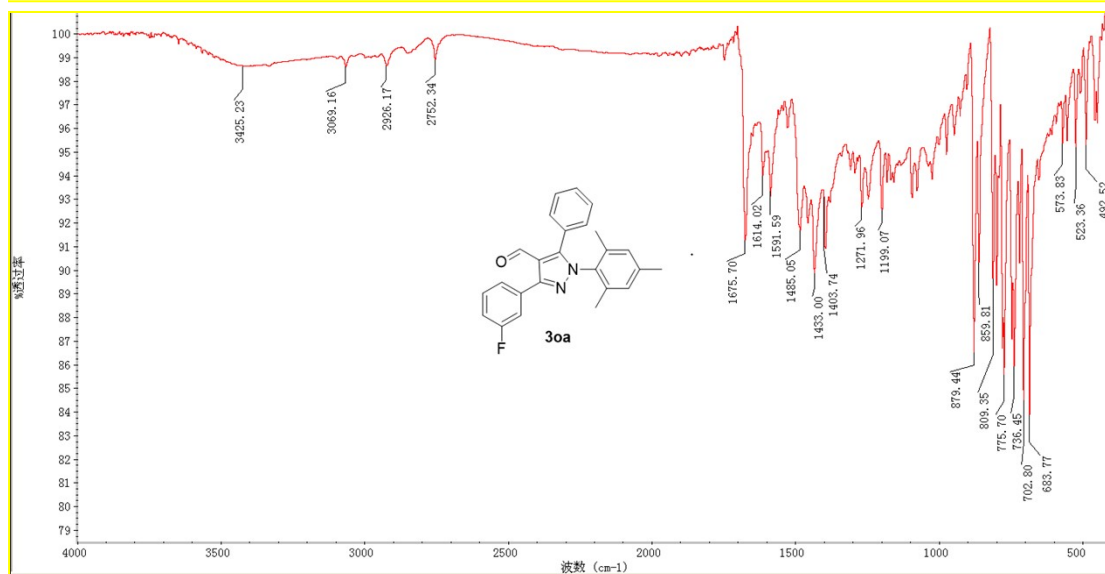
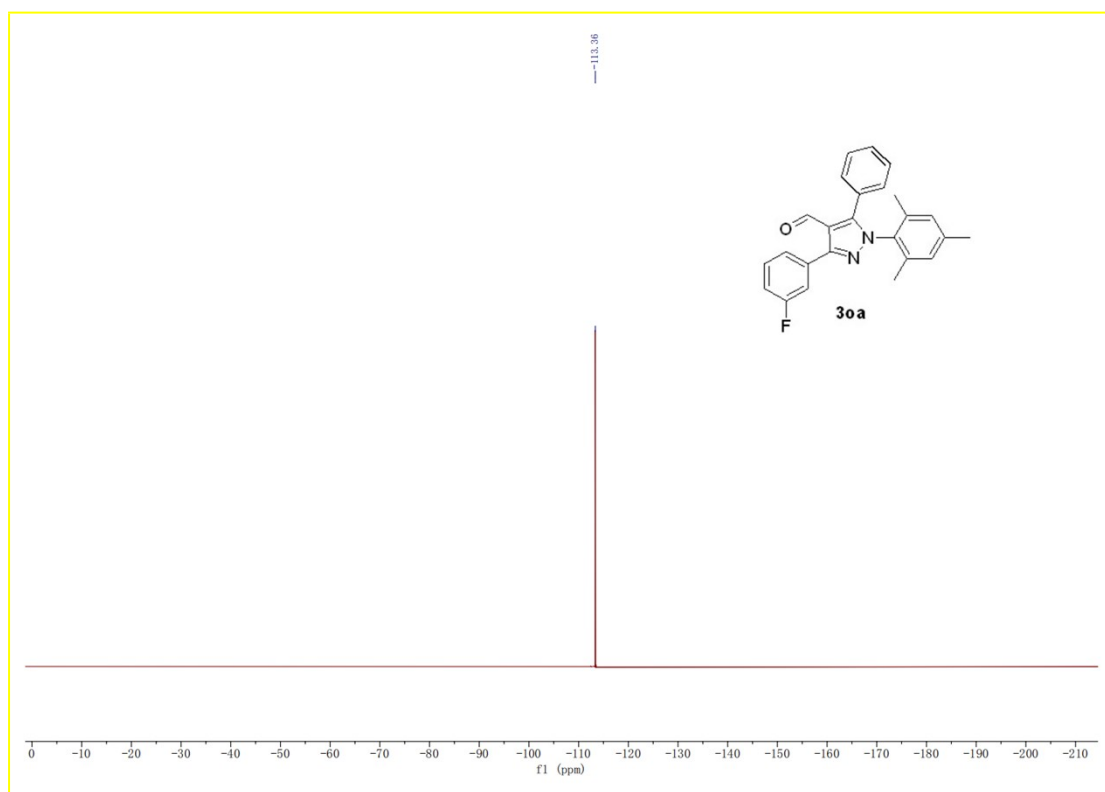


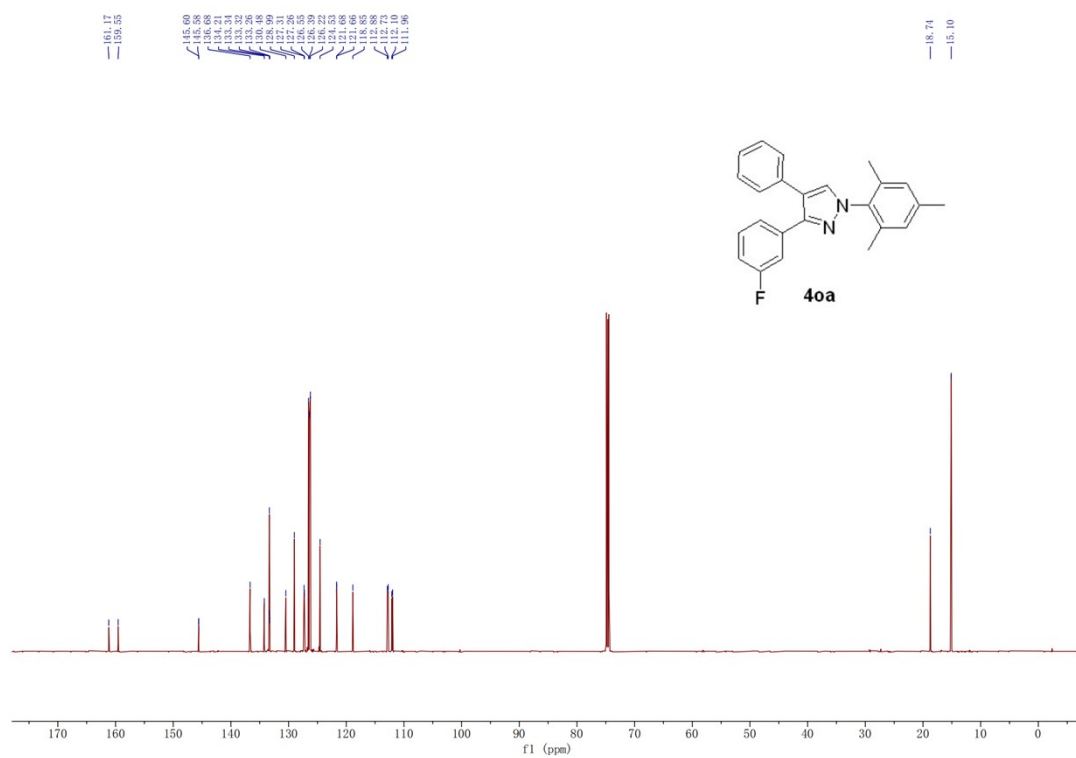
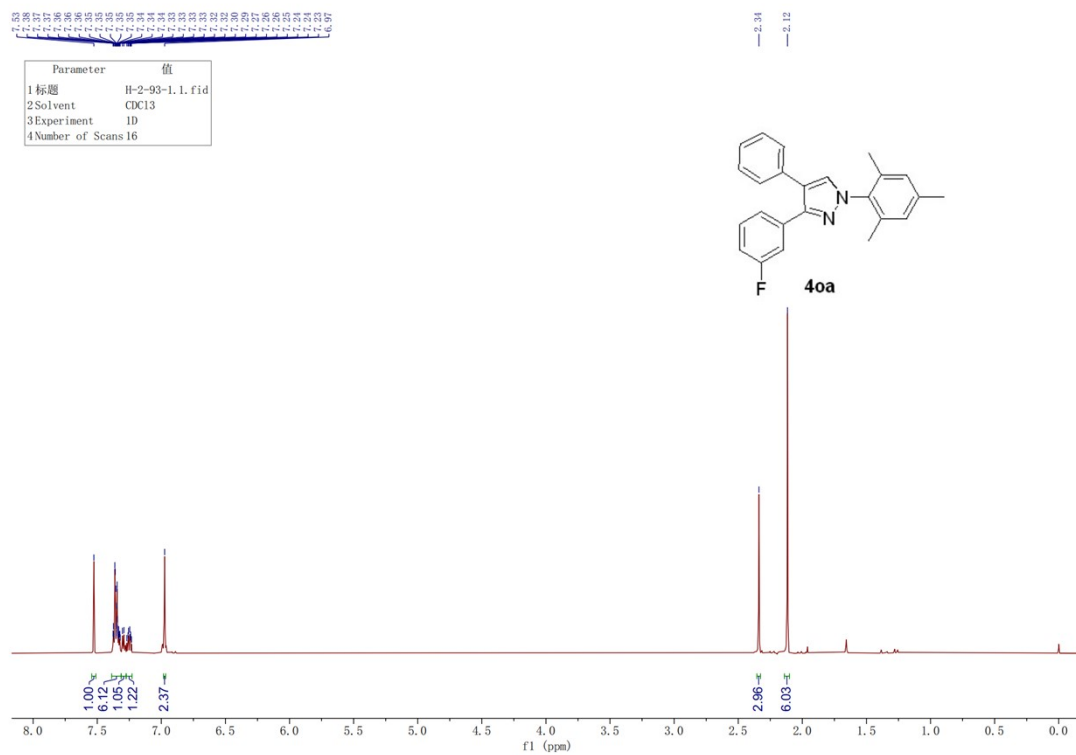


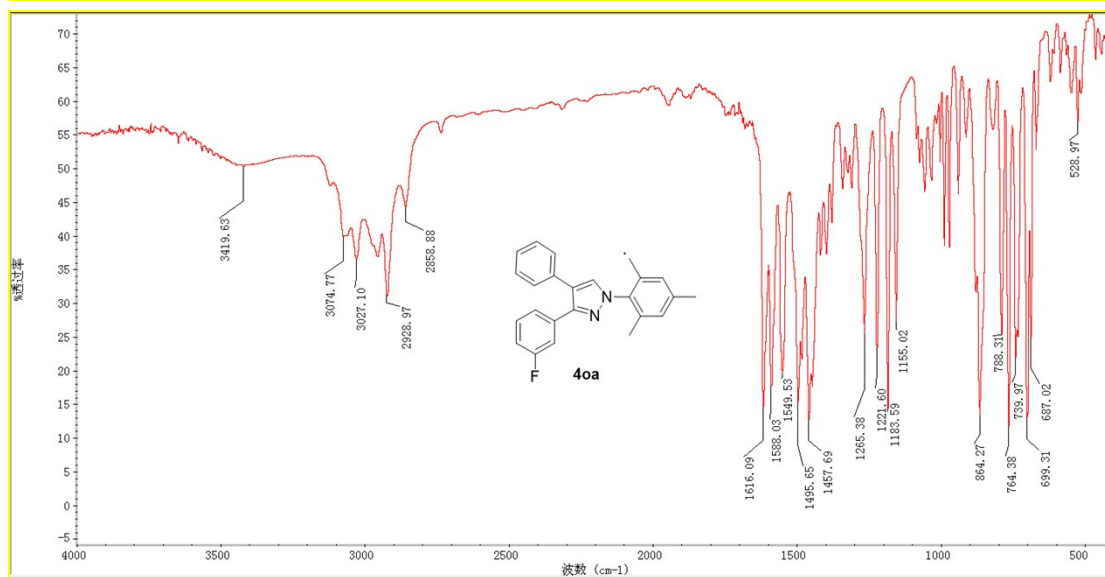
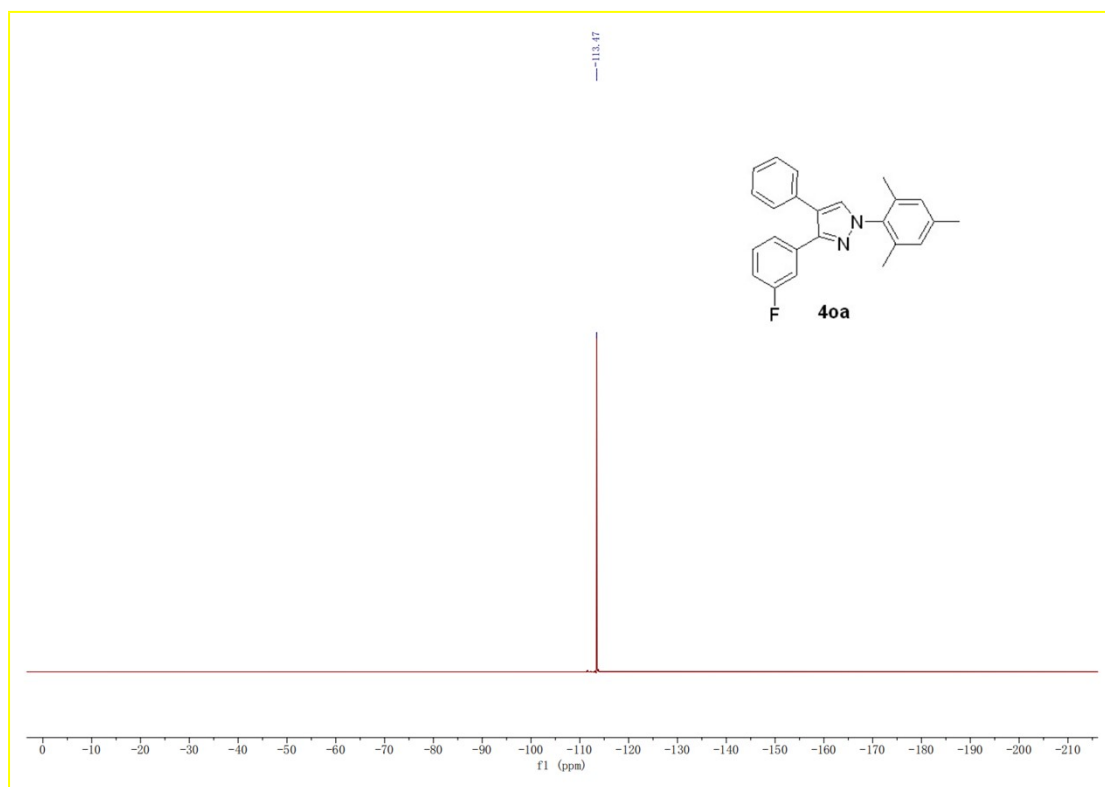


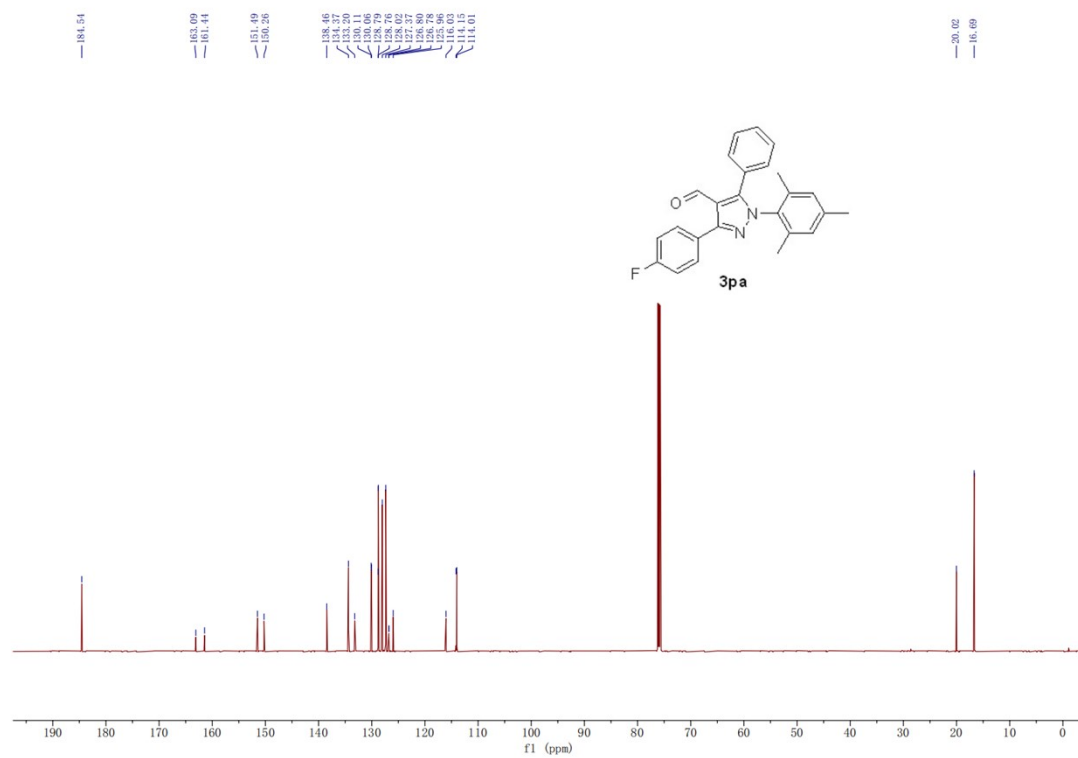
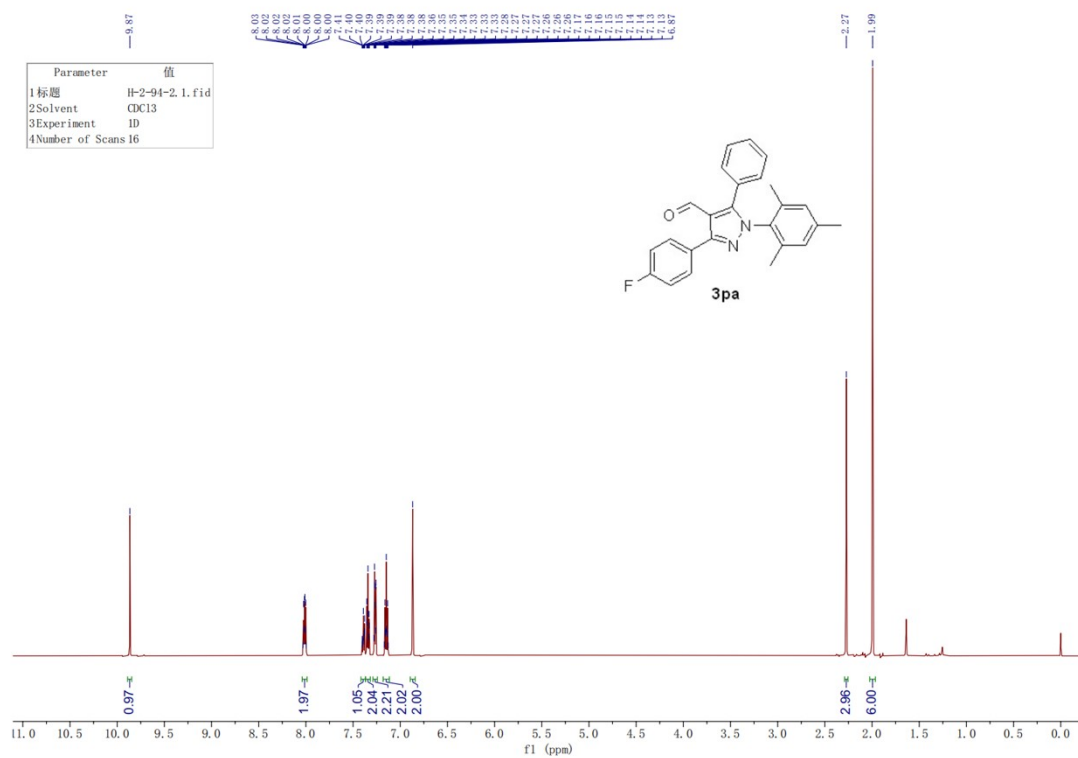


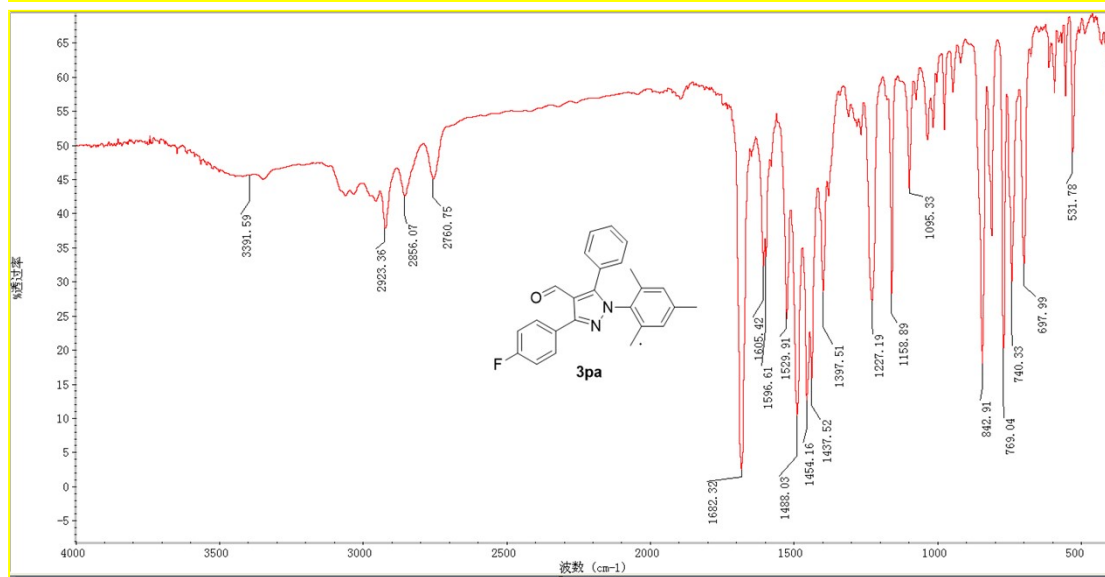
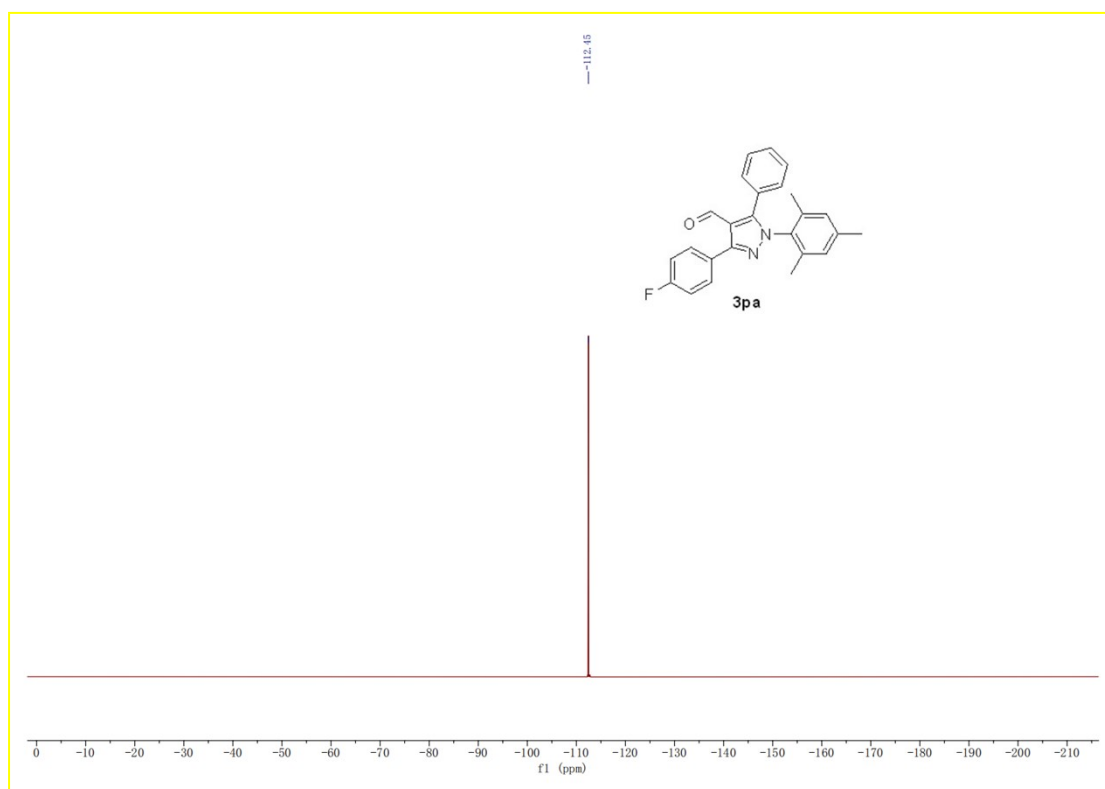




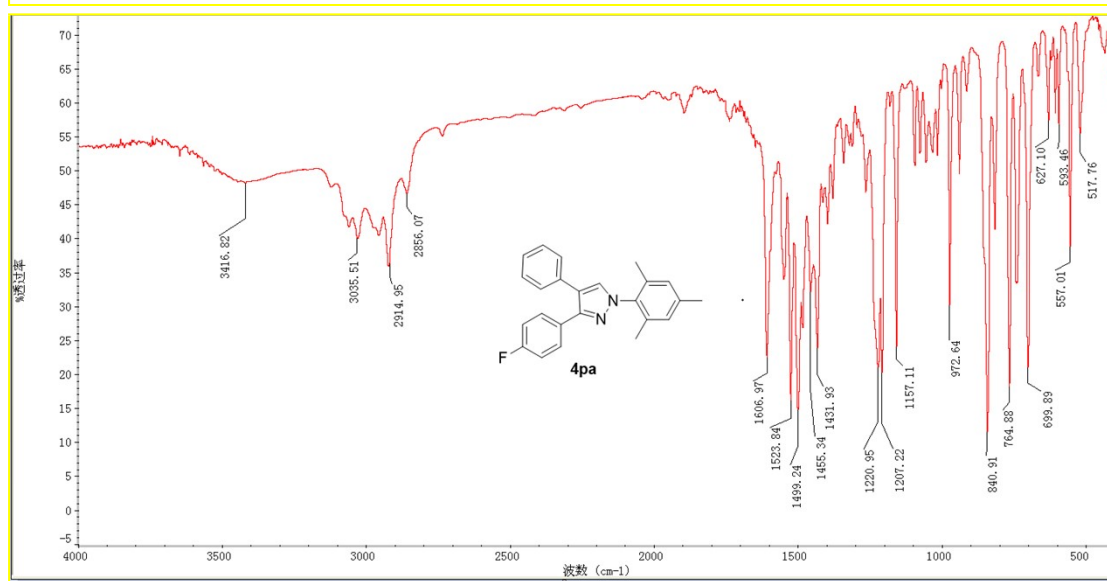
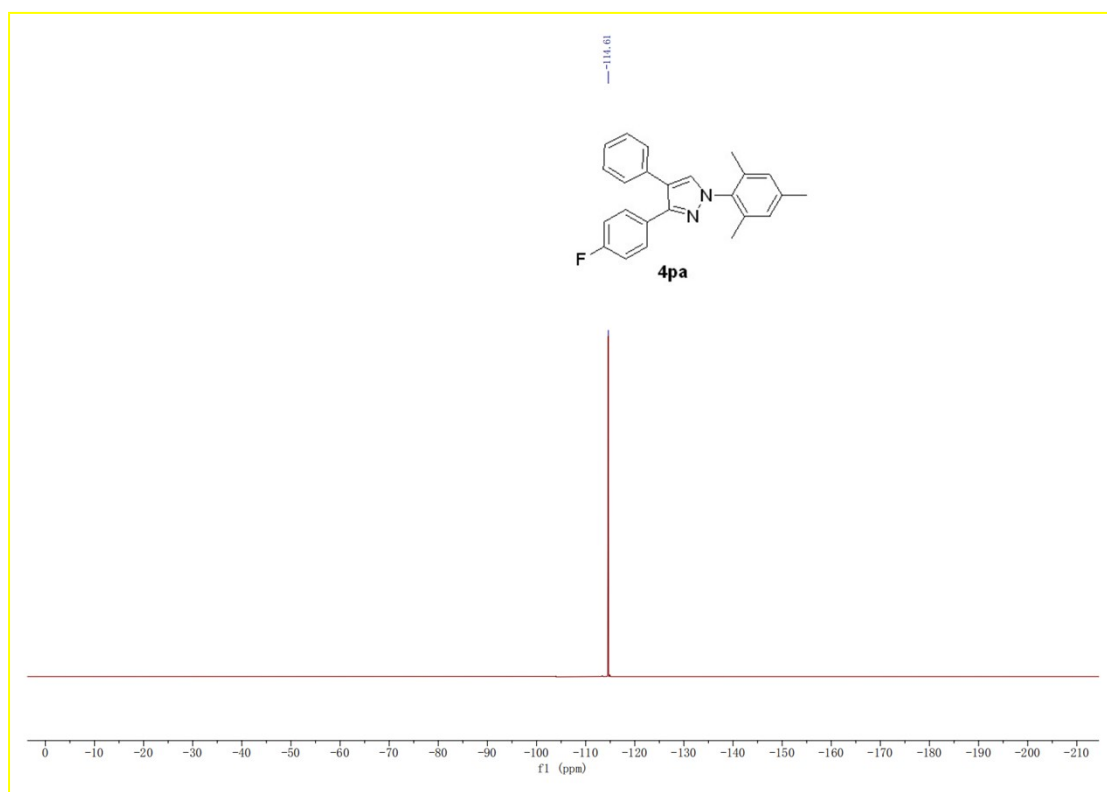


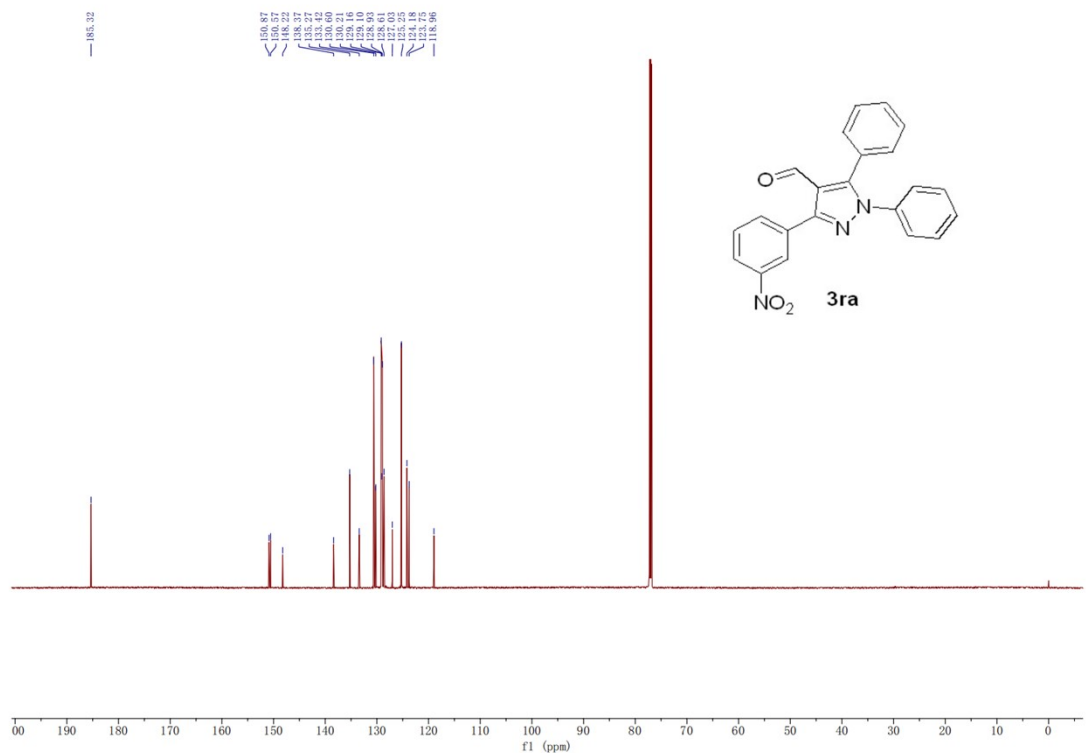
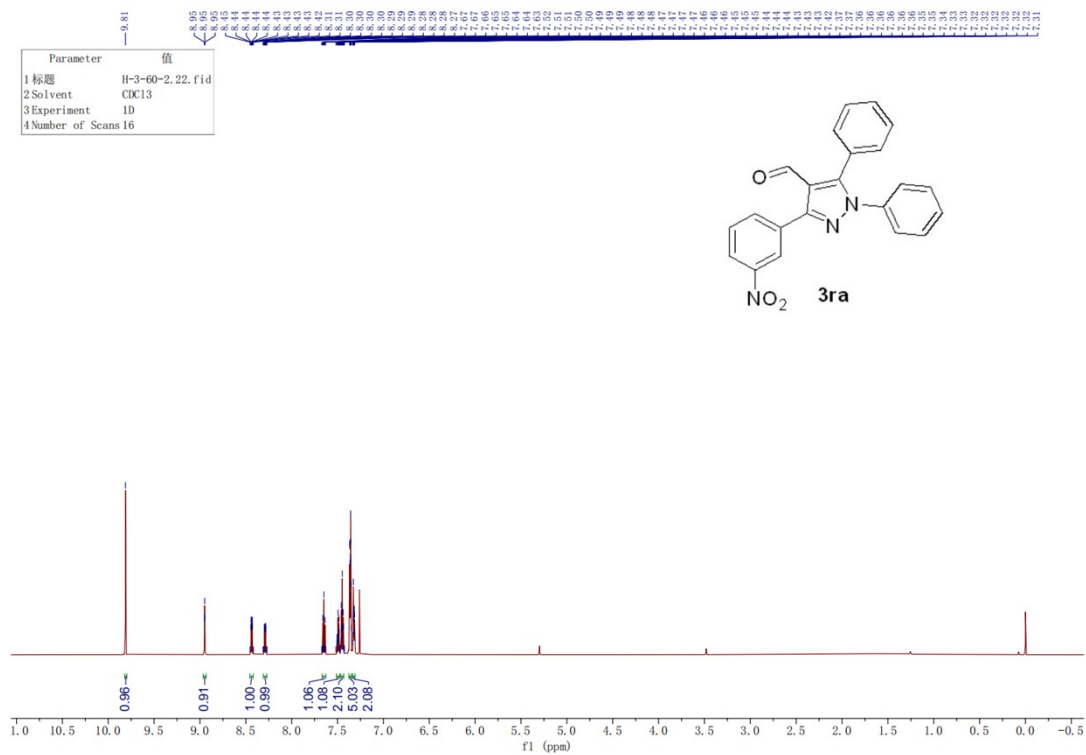


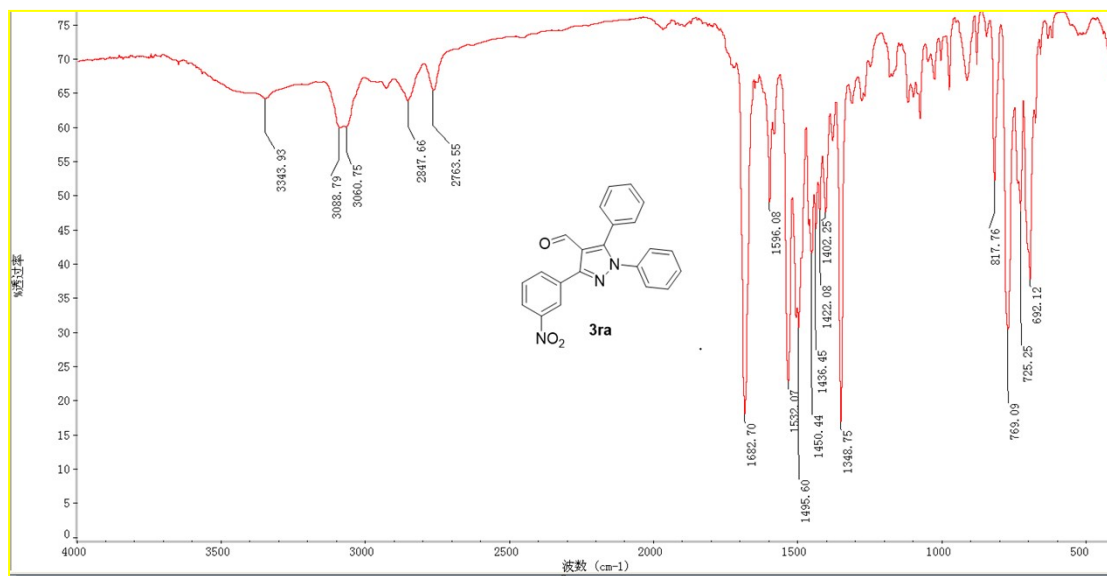




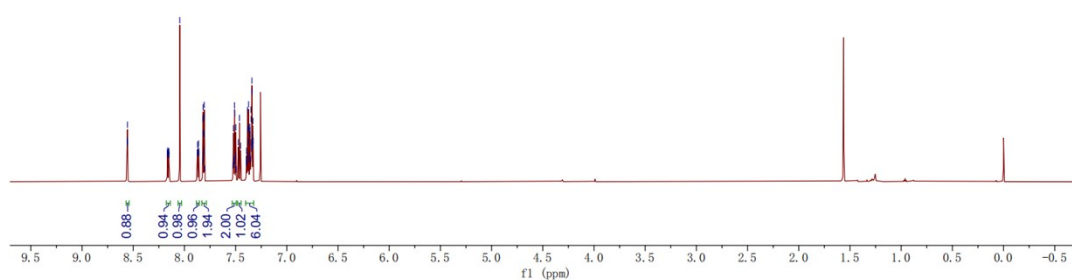
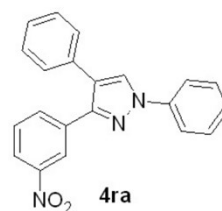


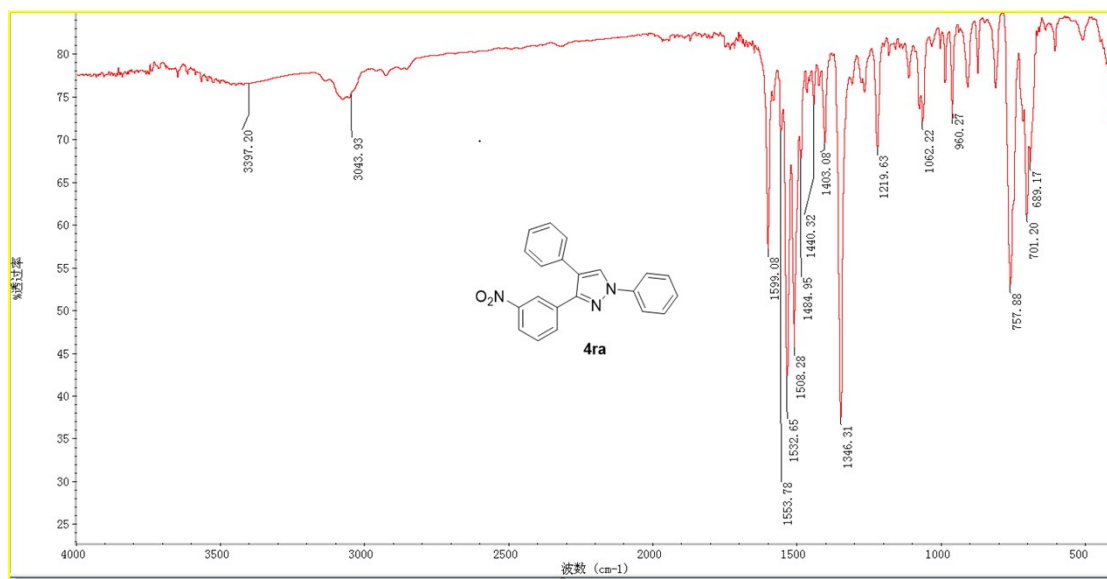
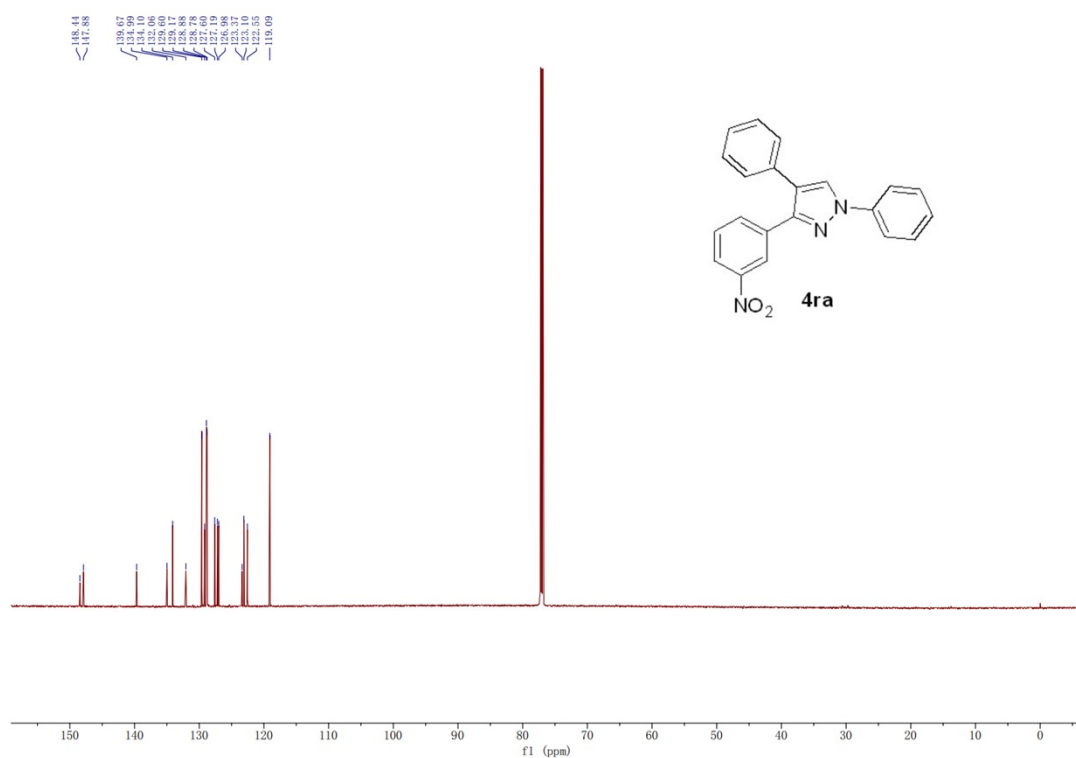


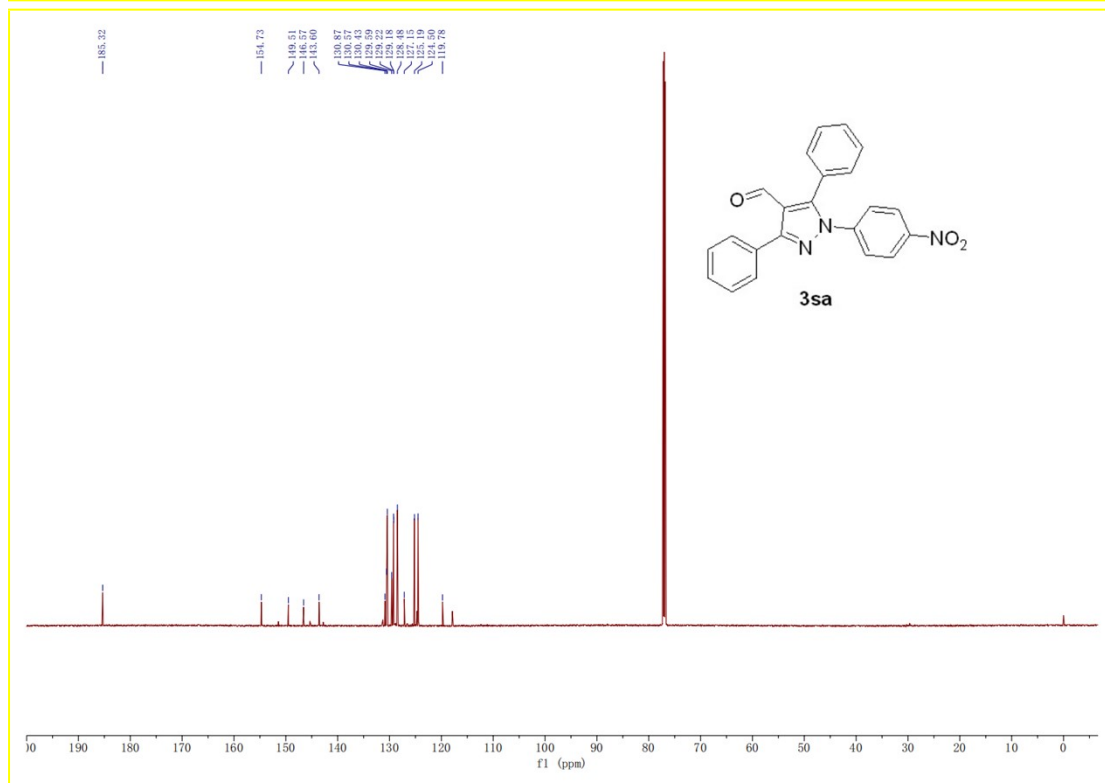
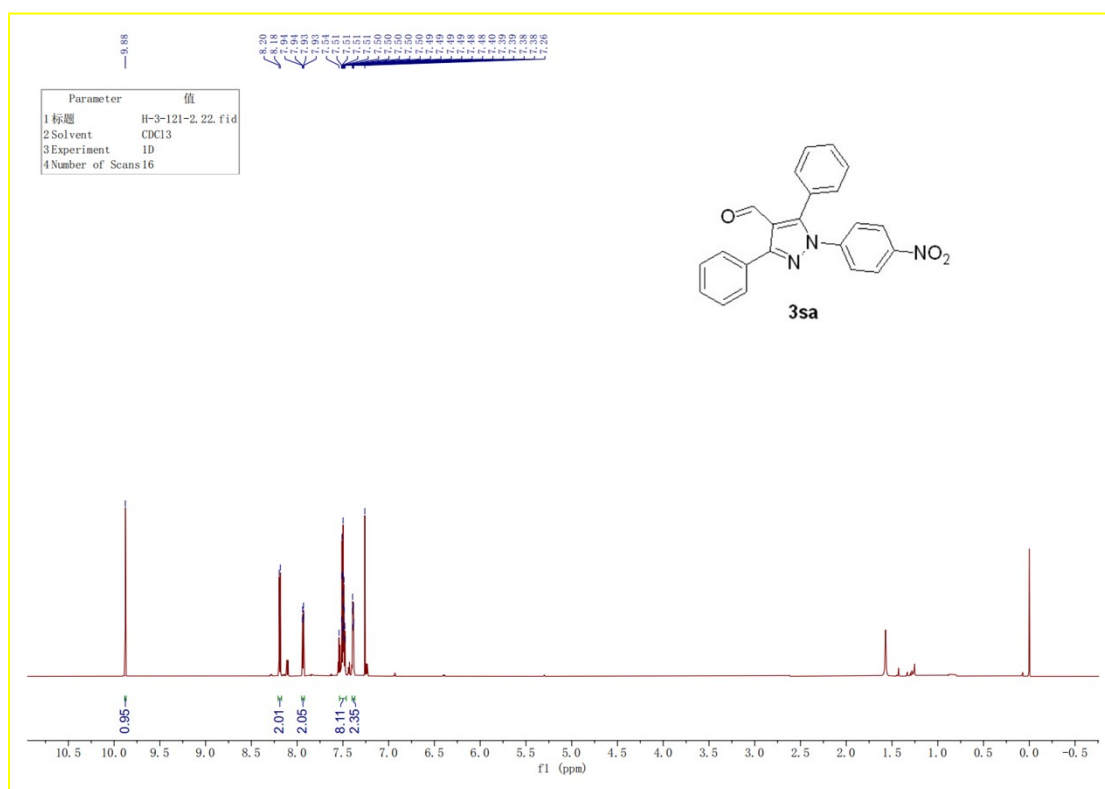


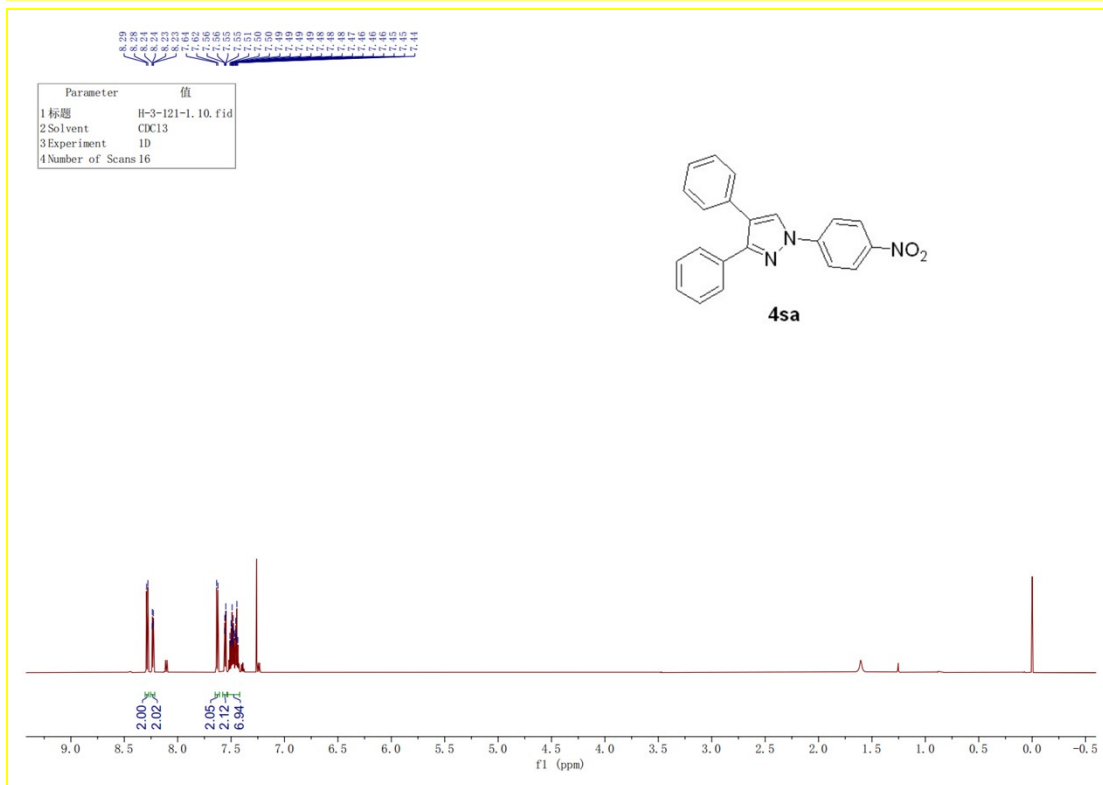
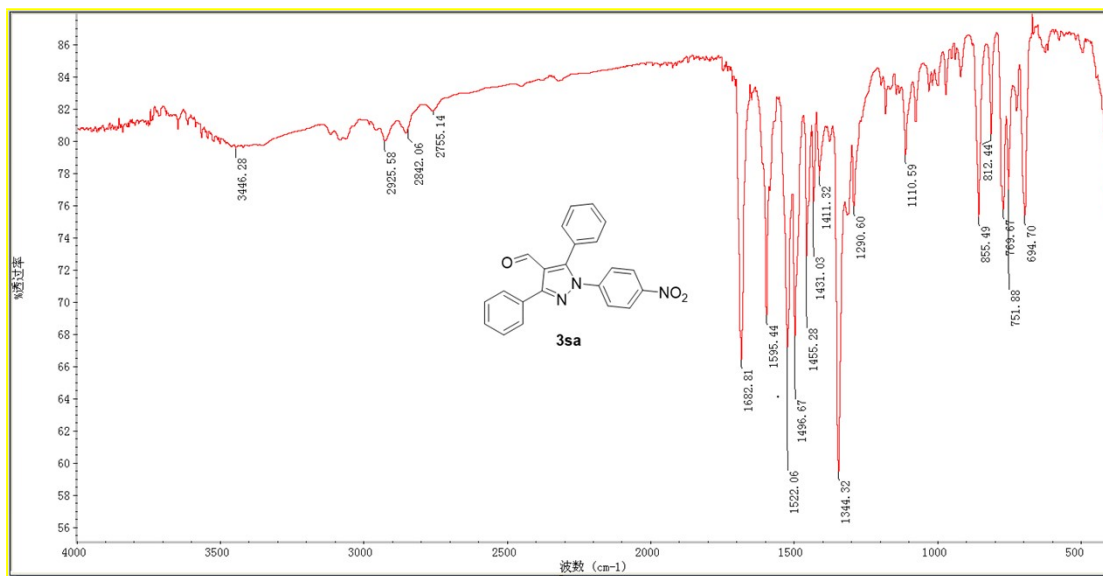


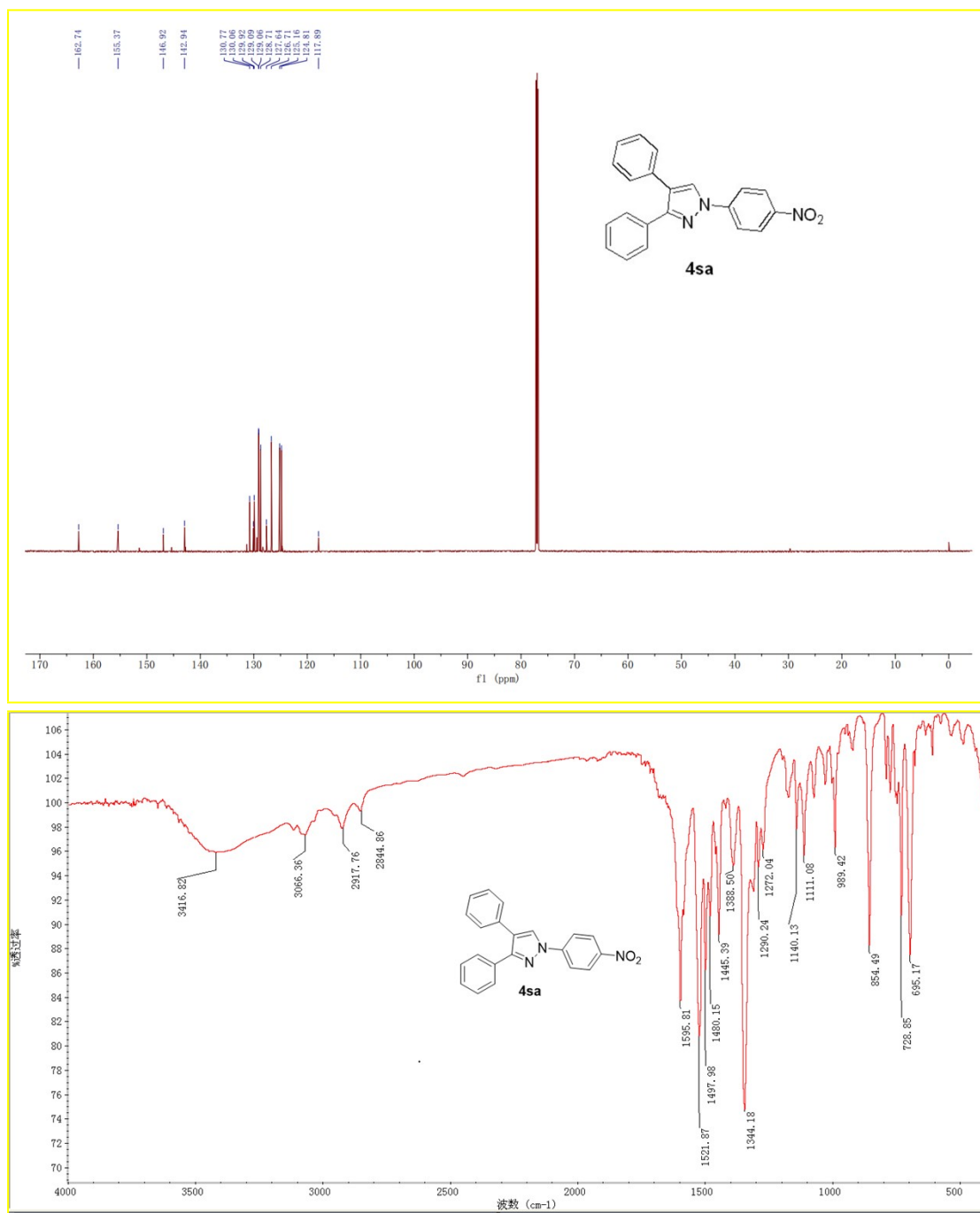
Parameter	值
1 标题	H-3-60-1.22.fid
2 Solvent	CDCl3
3 Experiment	1D
4 Number of Scans	16

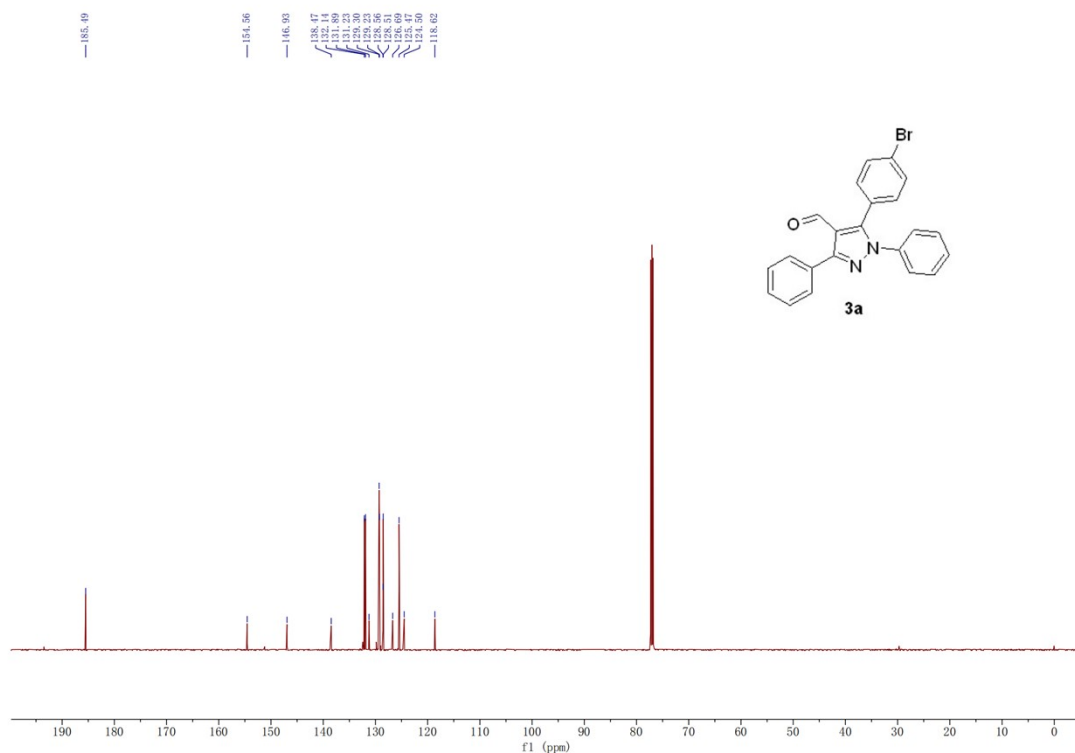
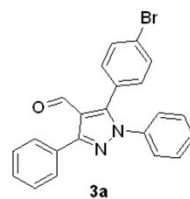
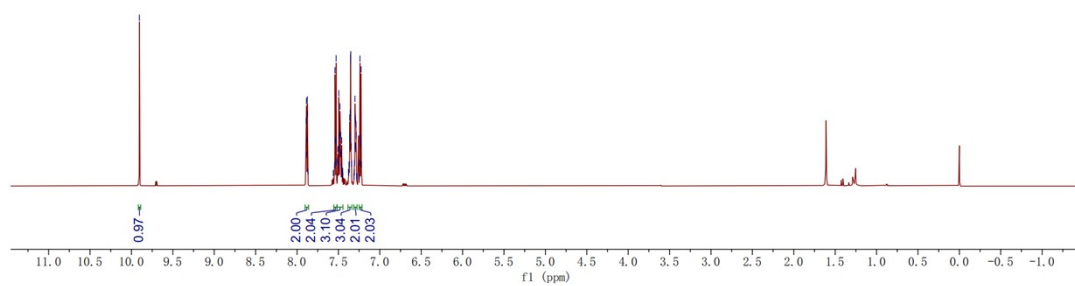
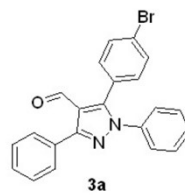


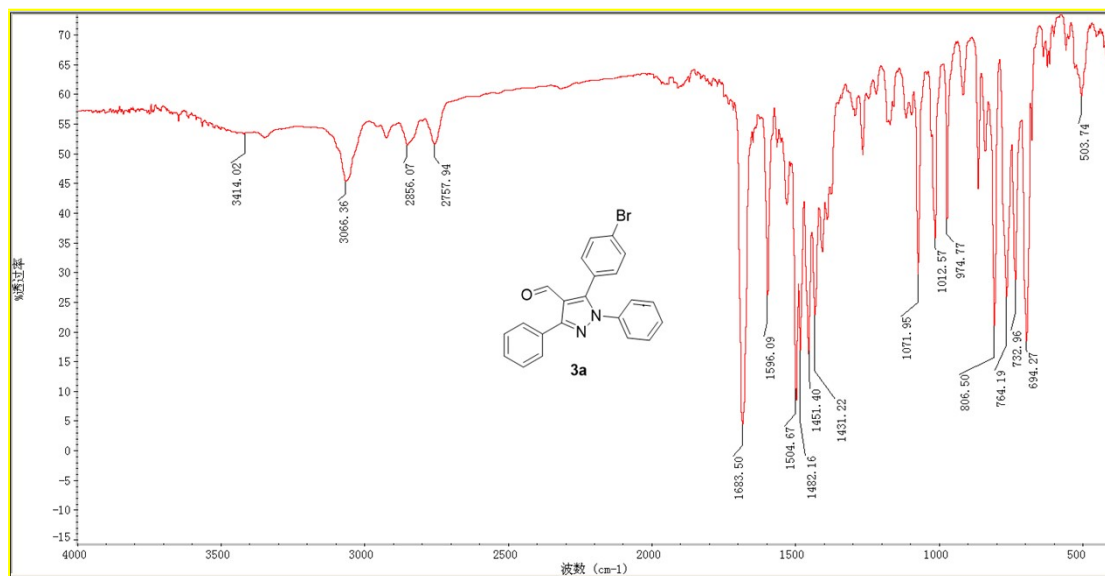




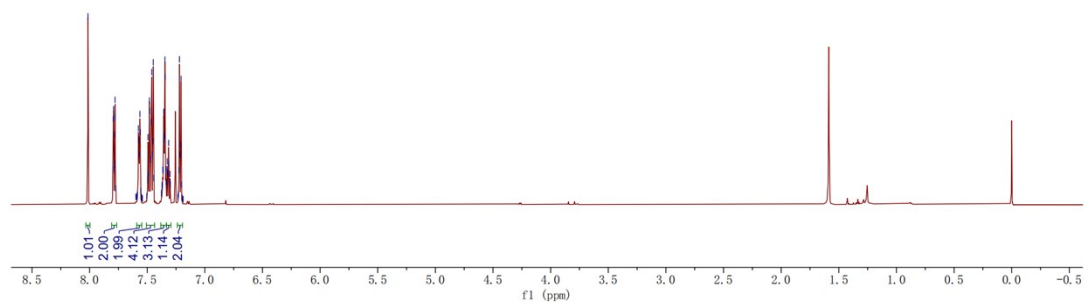
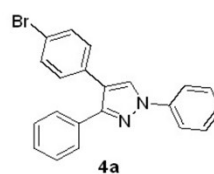


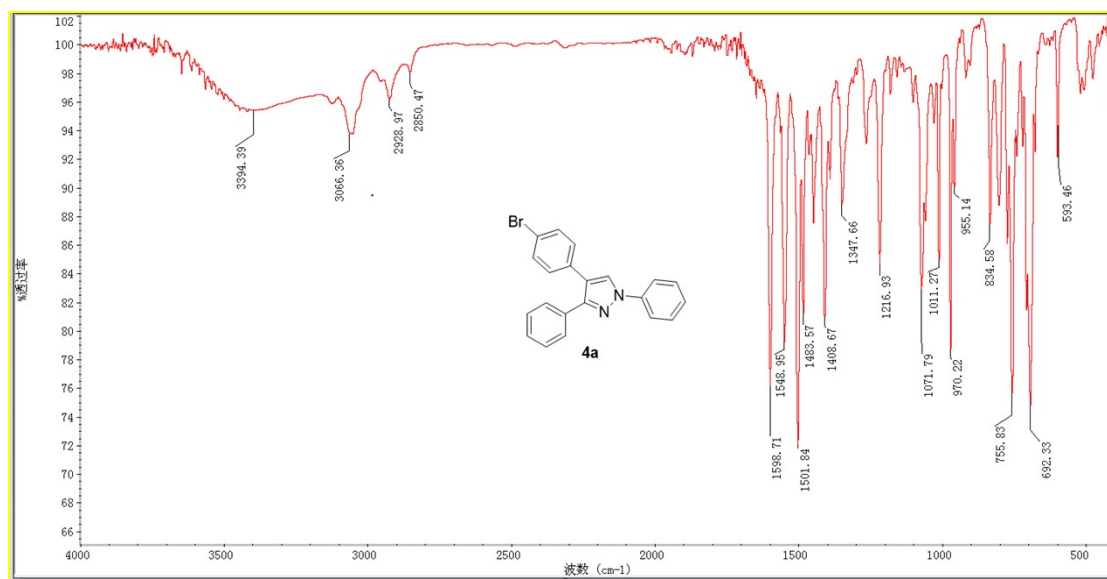
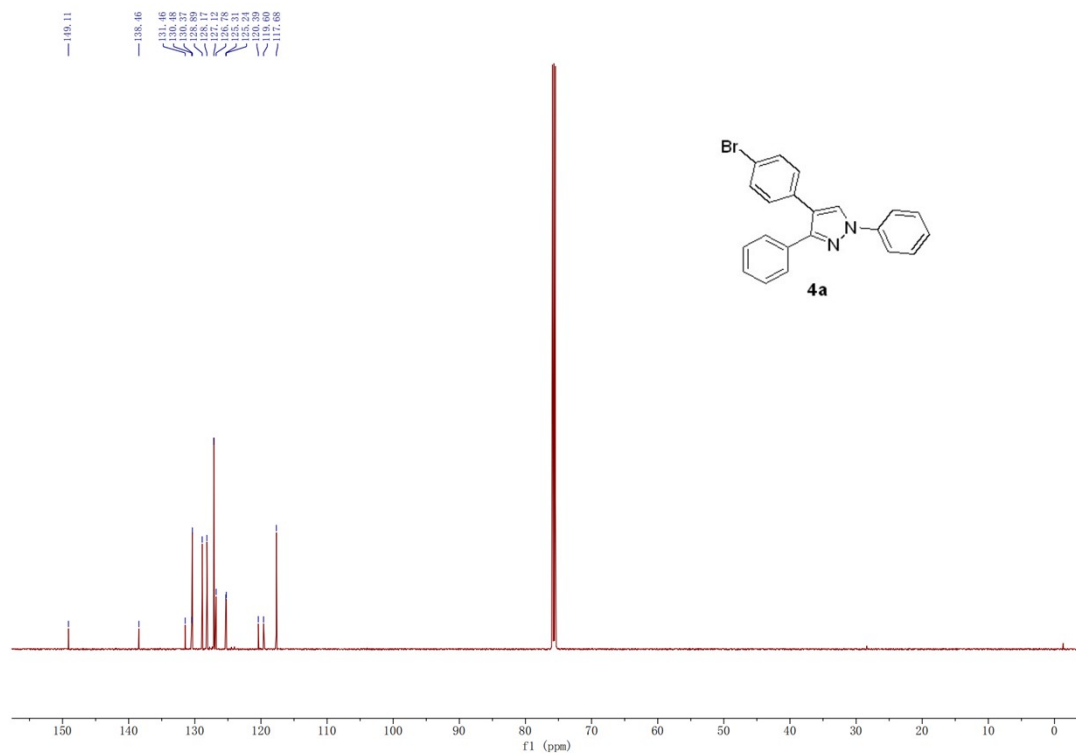


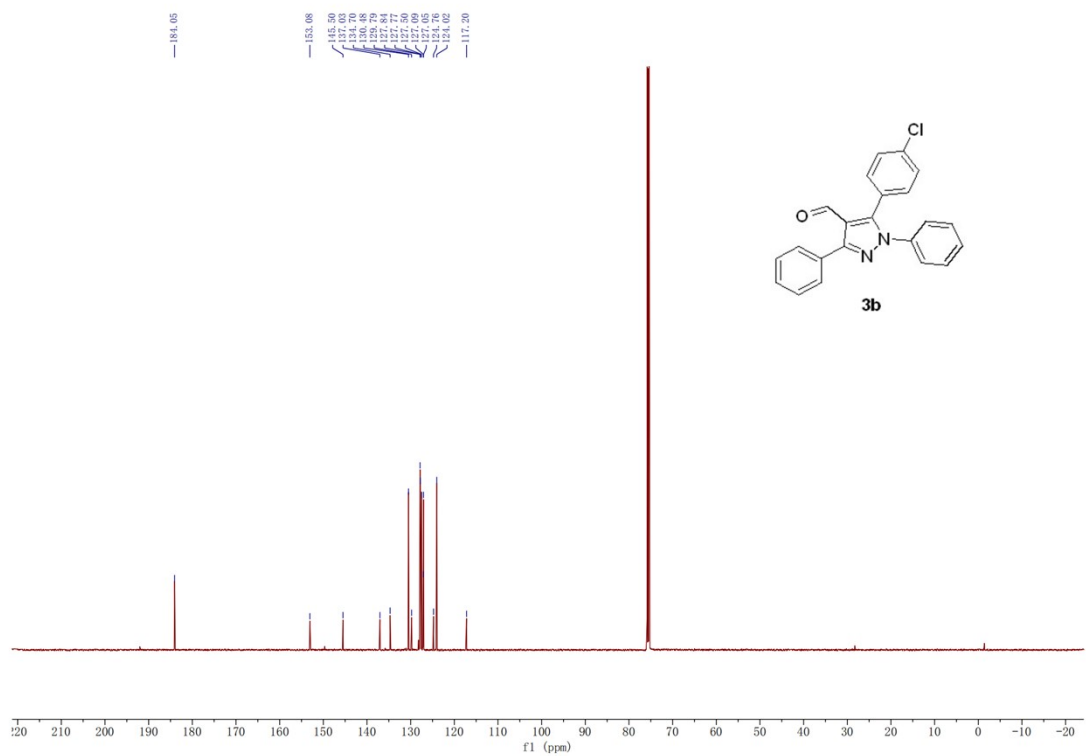
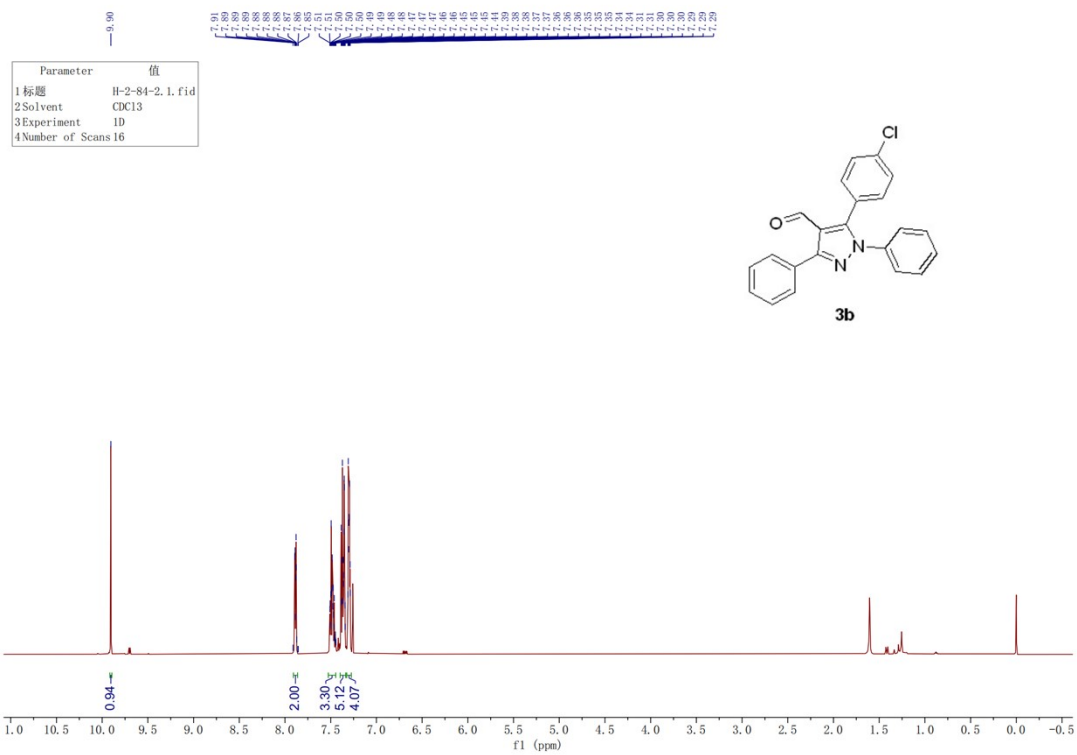
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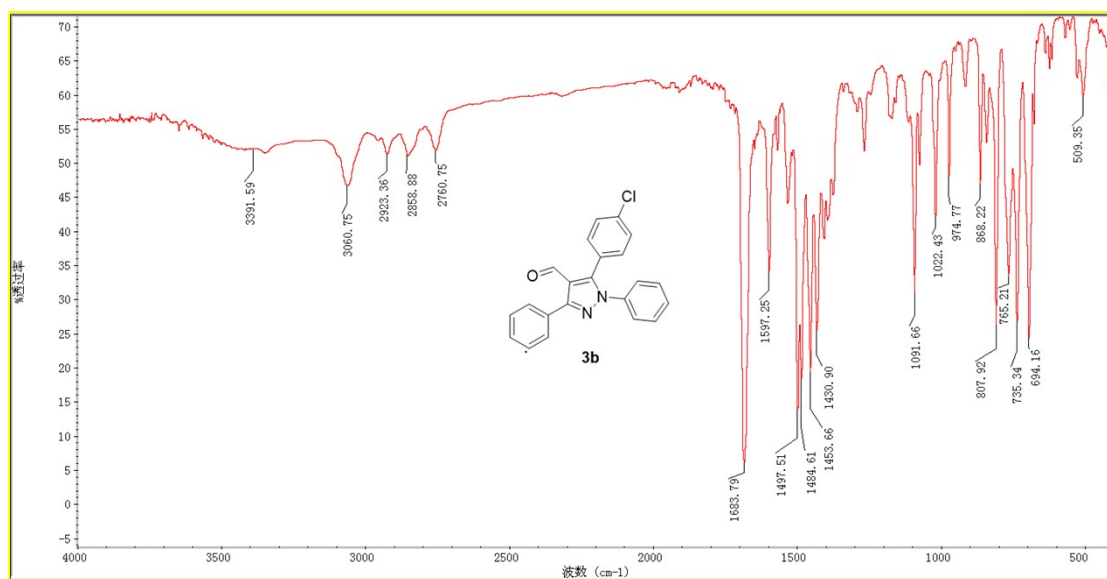


Parameter	值
1 标题	H-2-83-1.3.fid
2 Solvent	CDCl3
3 Experiment	ID
4 Number of Scans	16

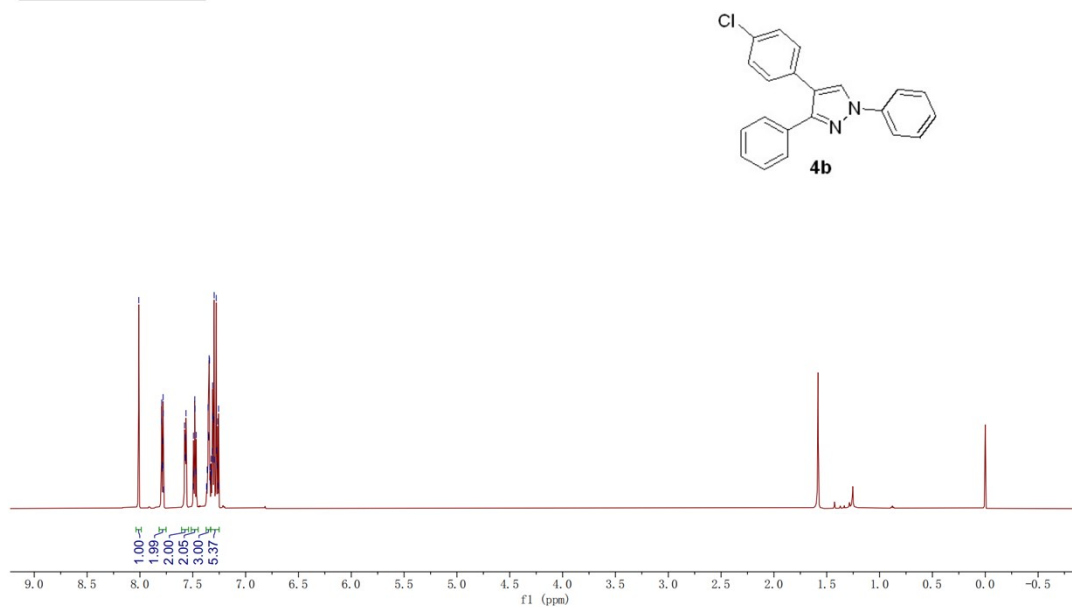


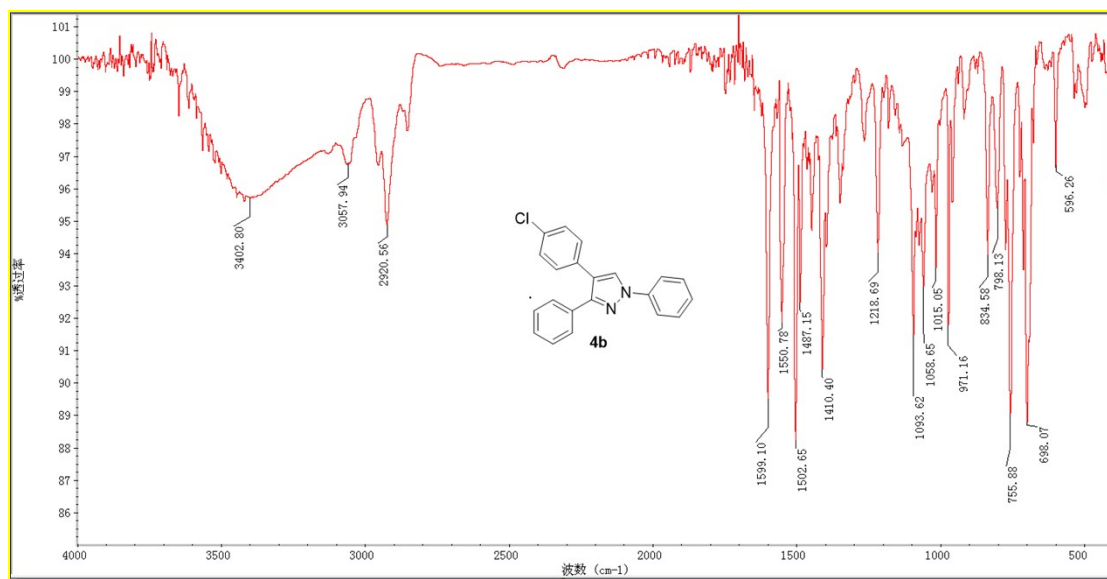
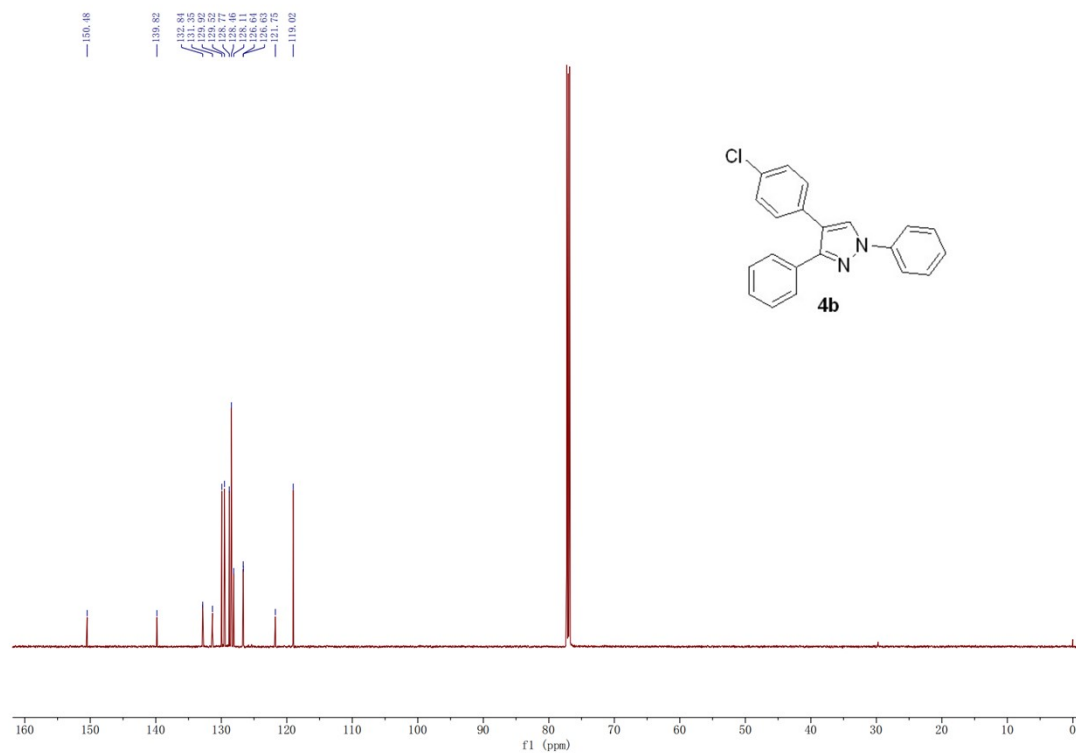


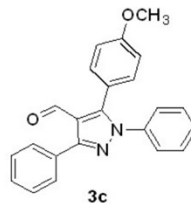
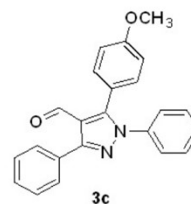


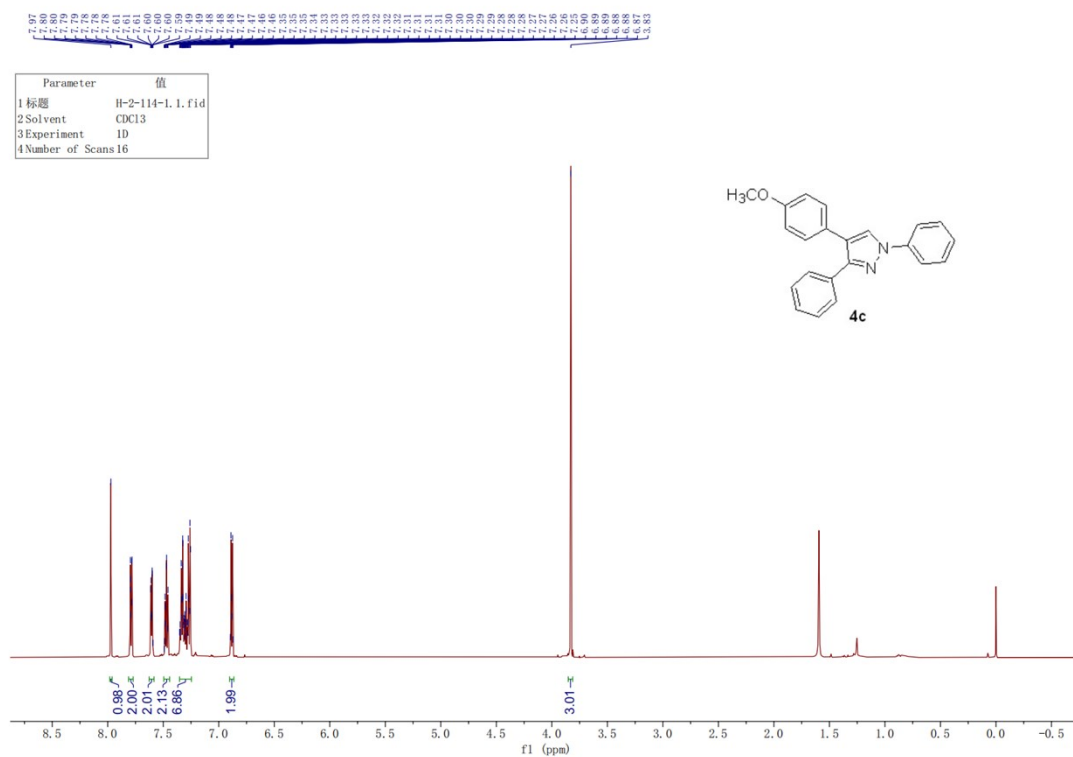
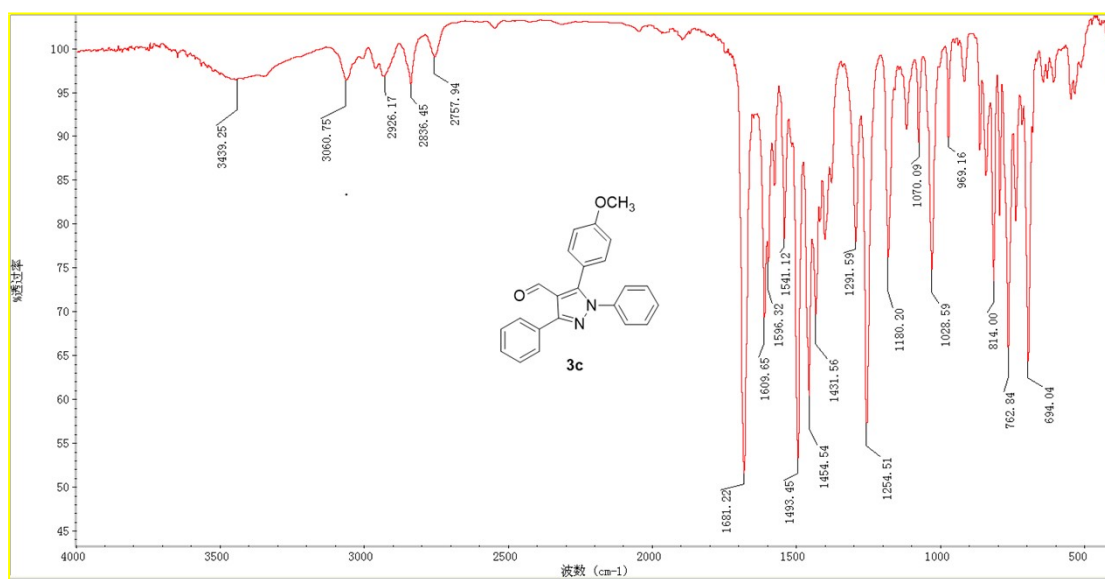


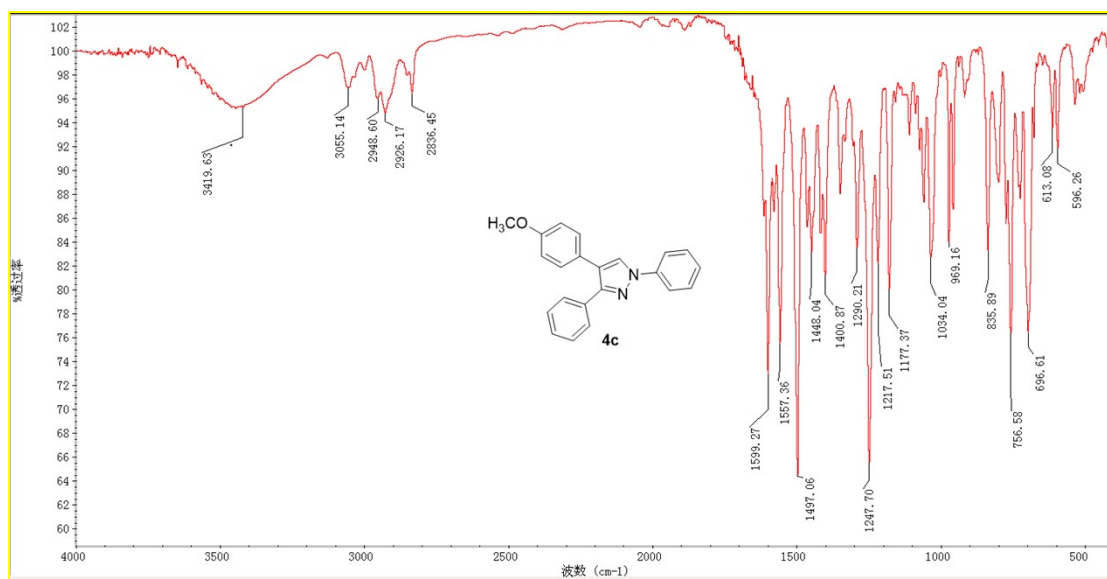
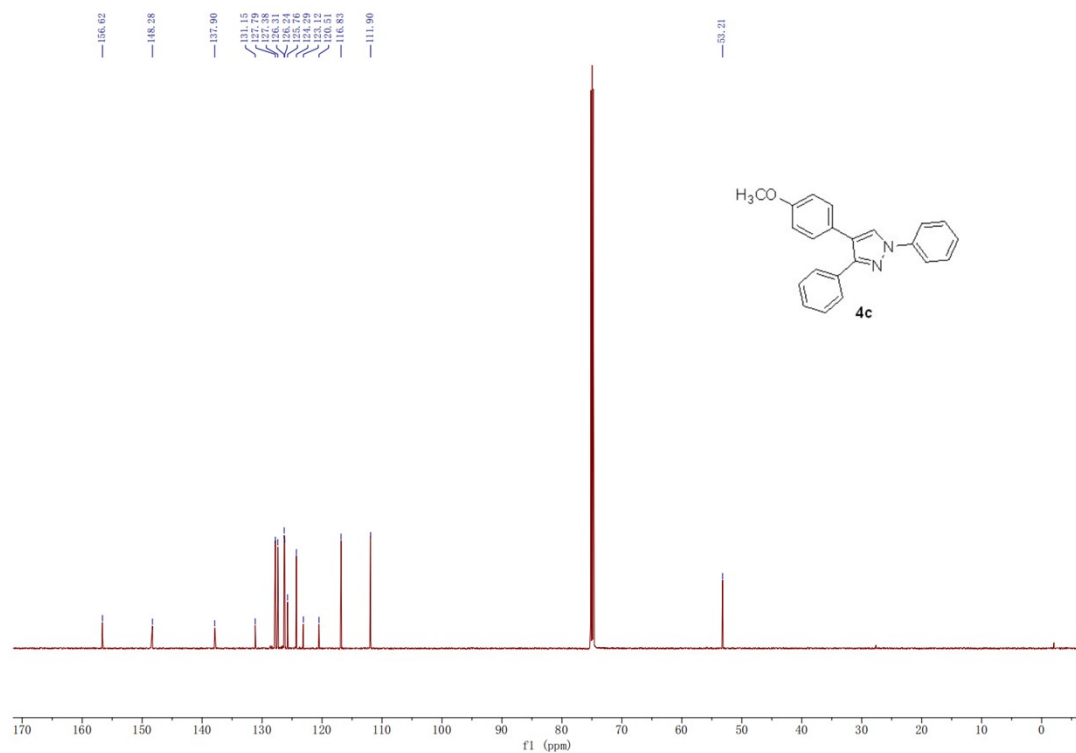
Parameter	值
1 标题	H-2-84-1.3. fid
2 Solvent	CDCl3
3 Experiment	1D
4 Number of Scans	16

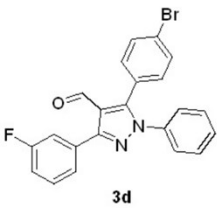


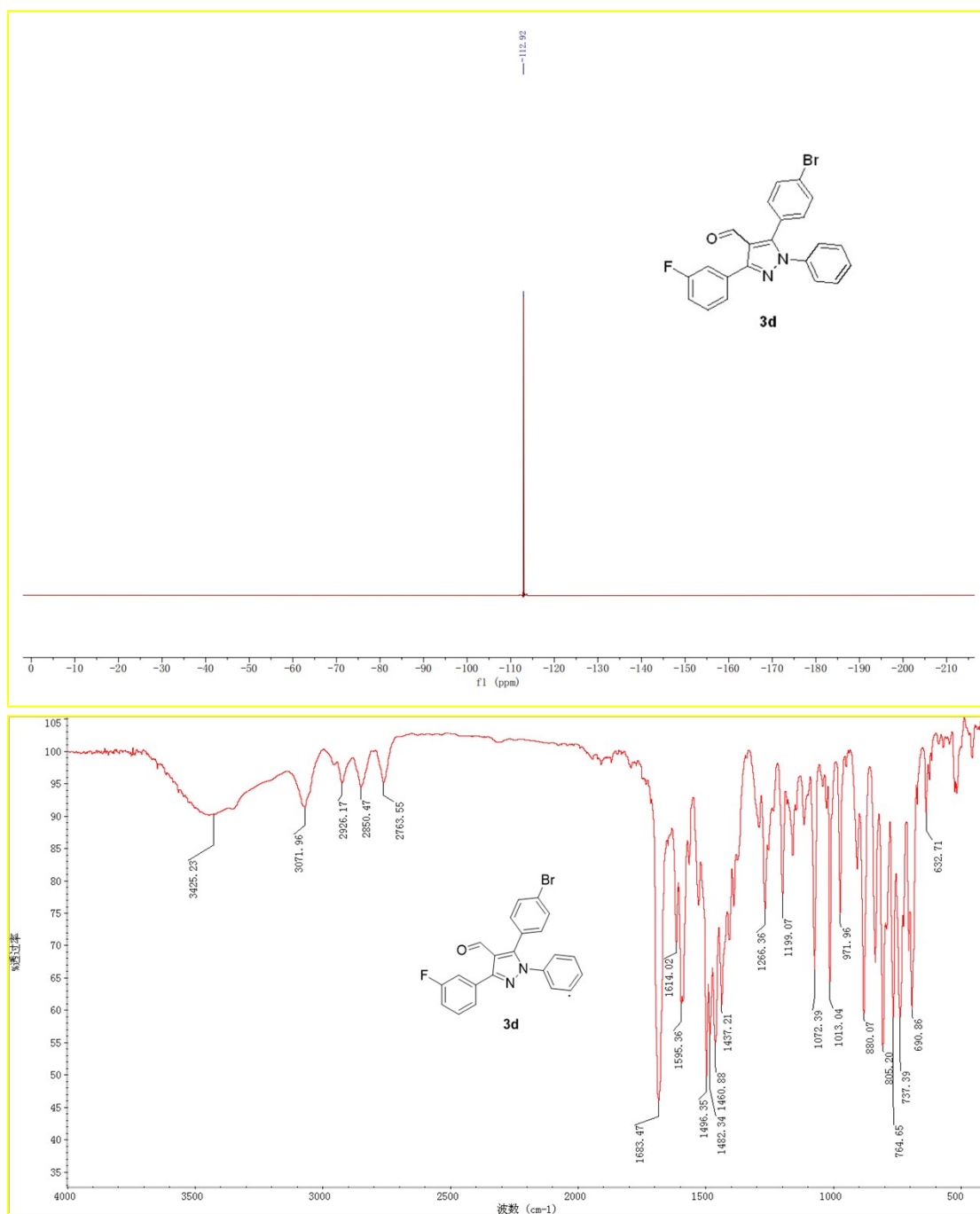


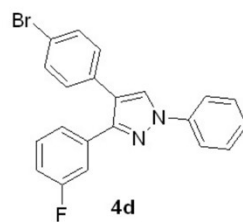
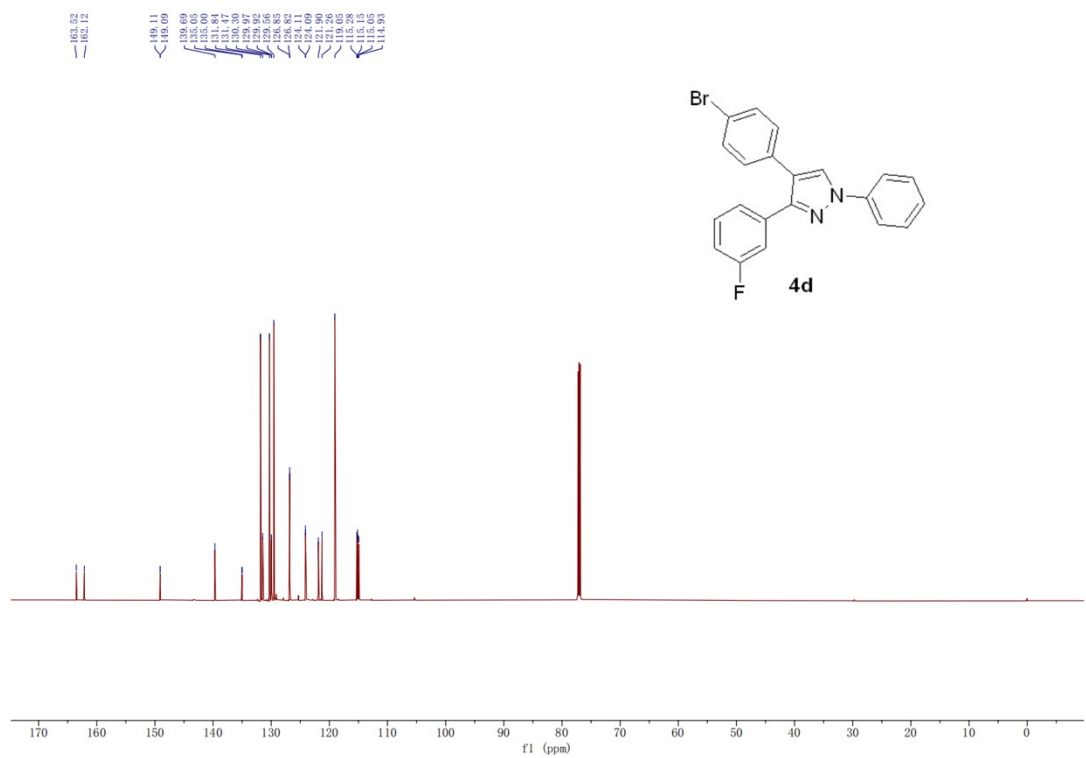
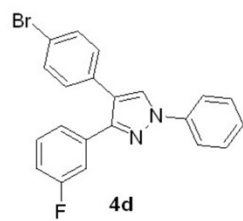
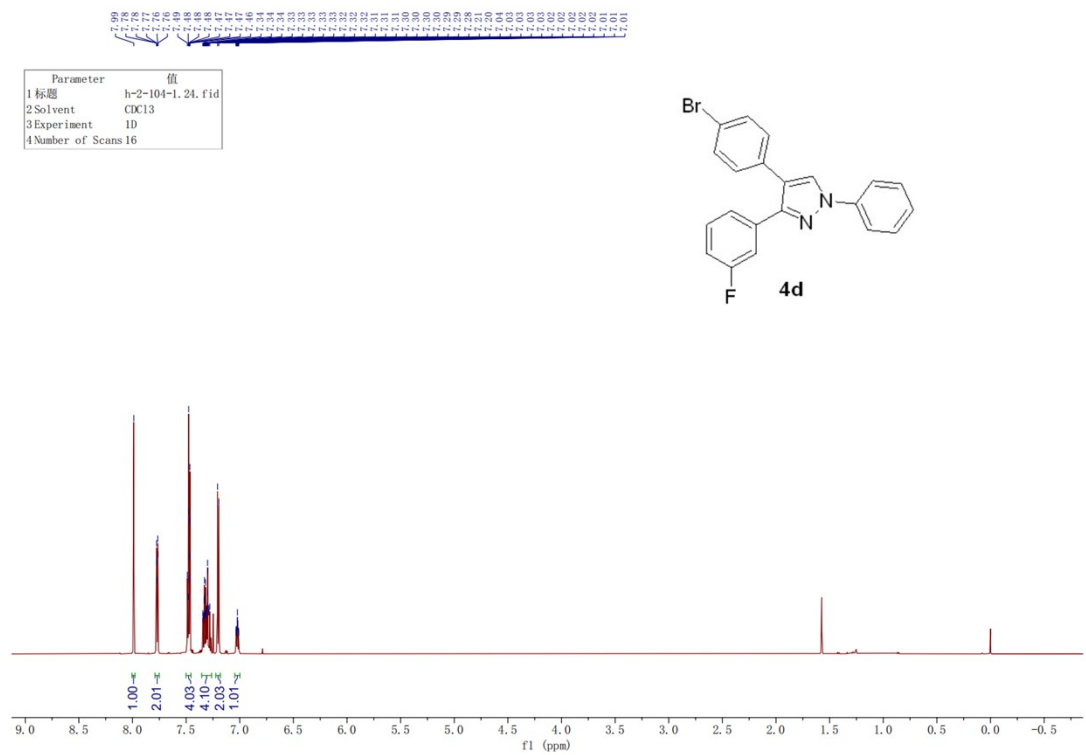


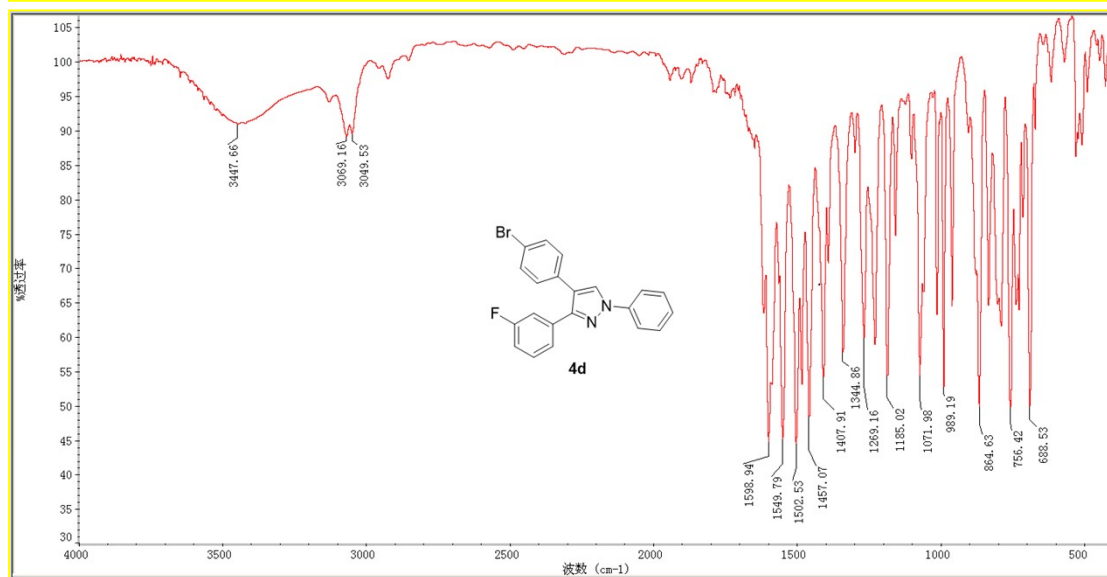
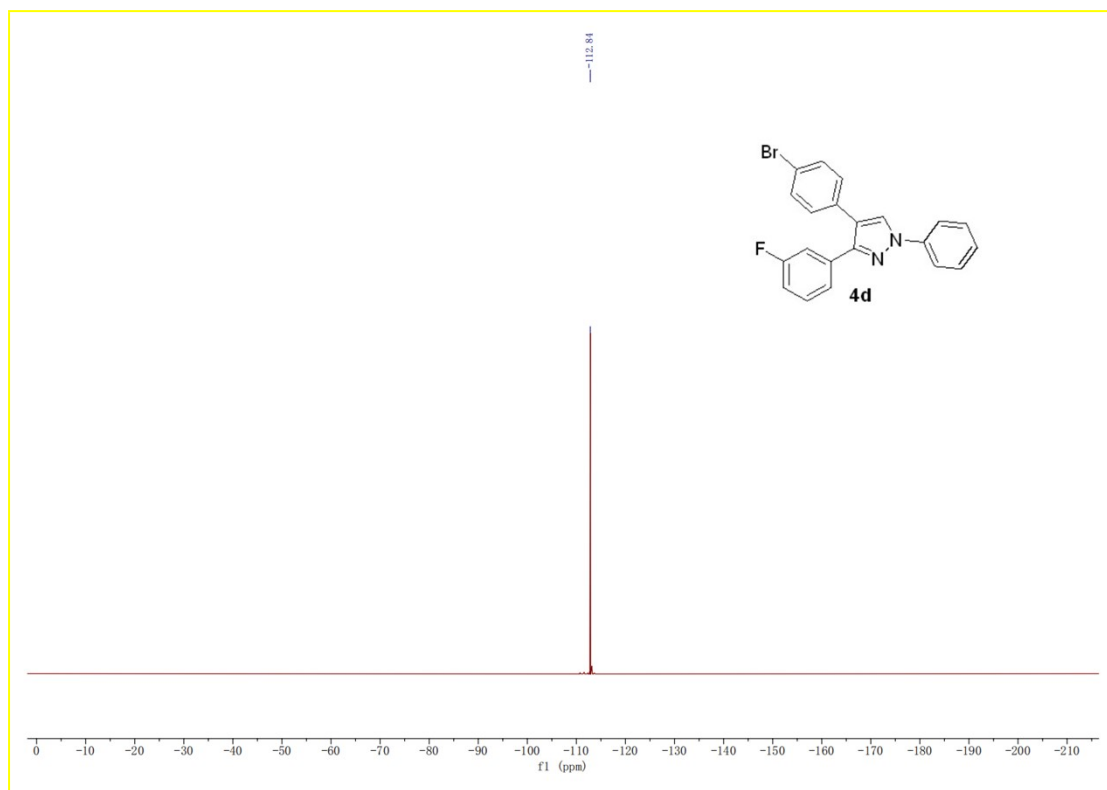


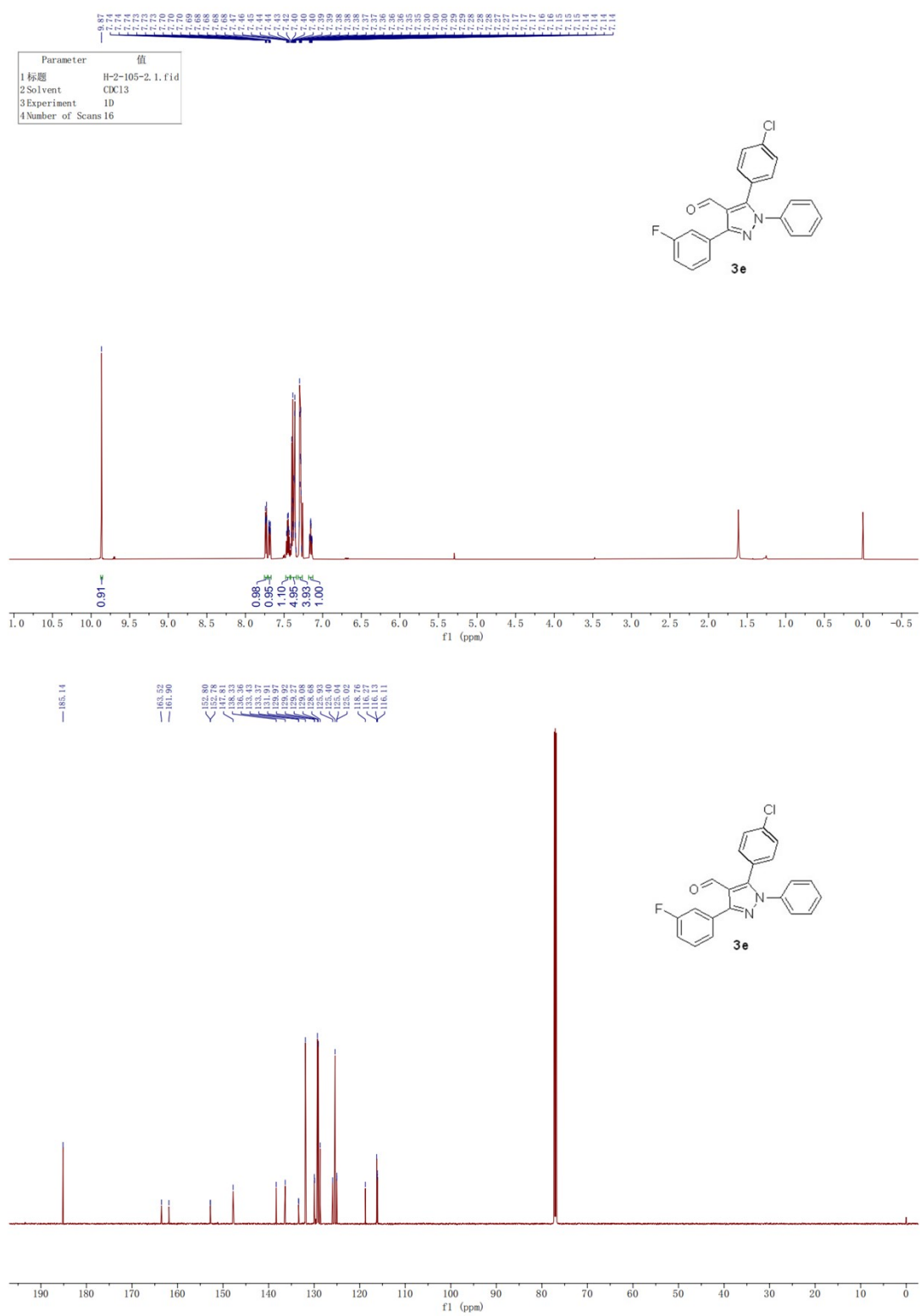


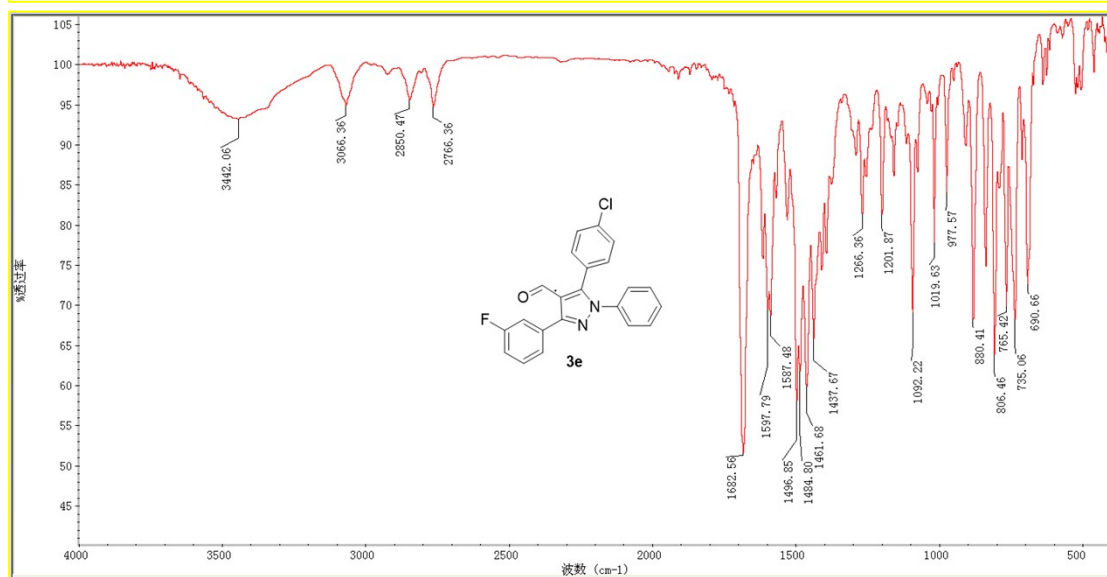
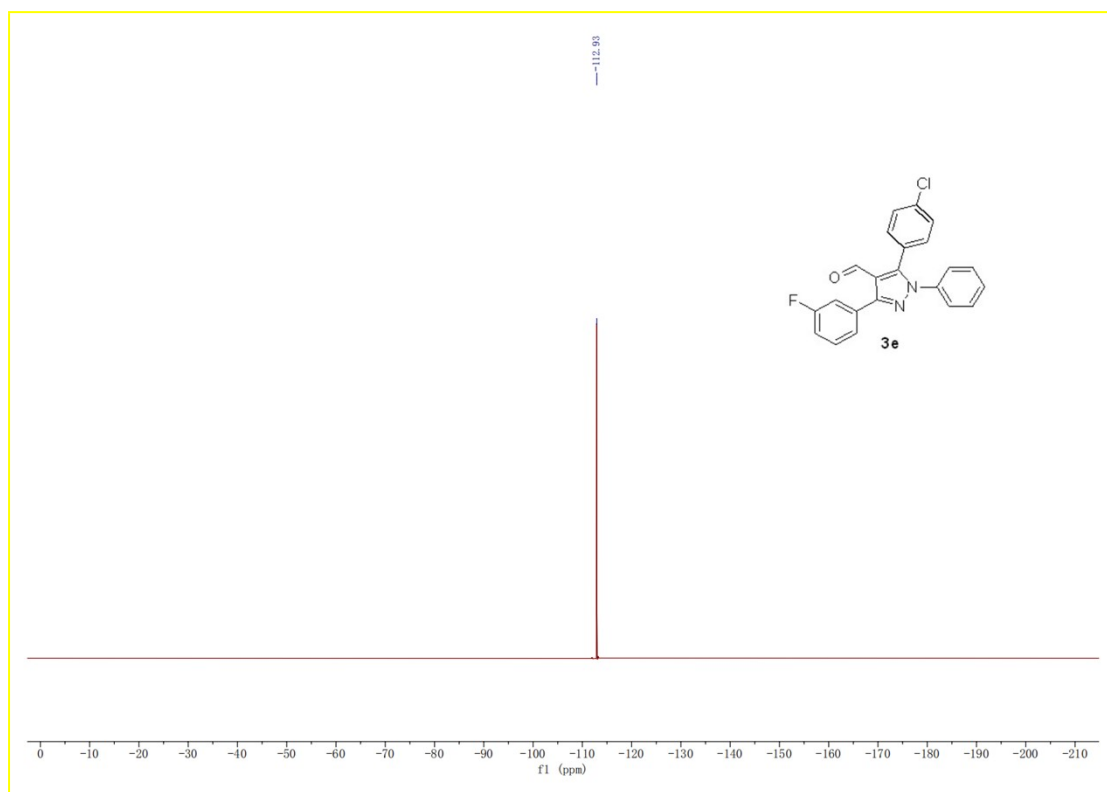






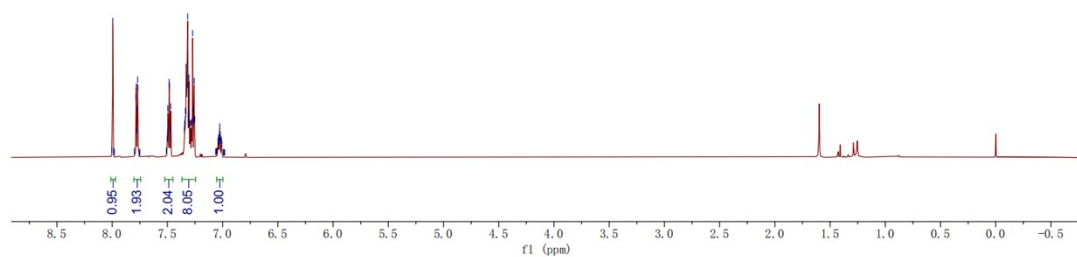
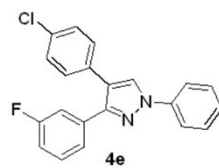




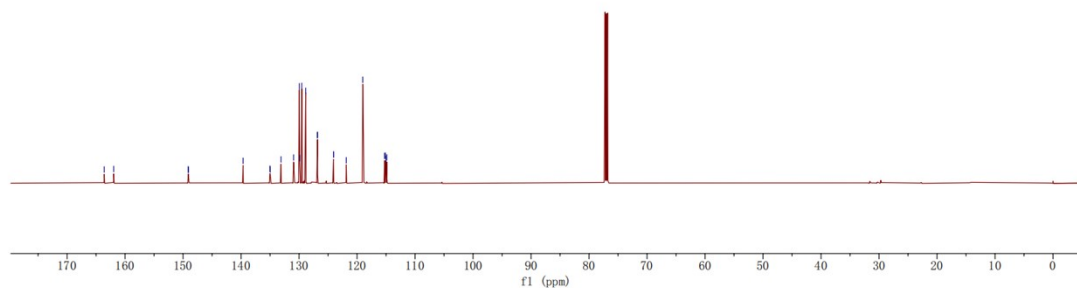
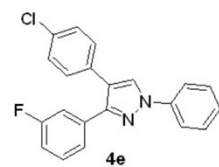


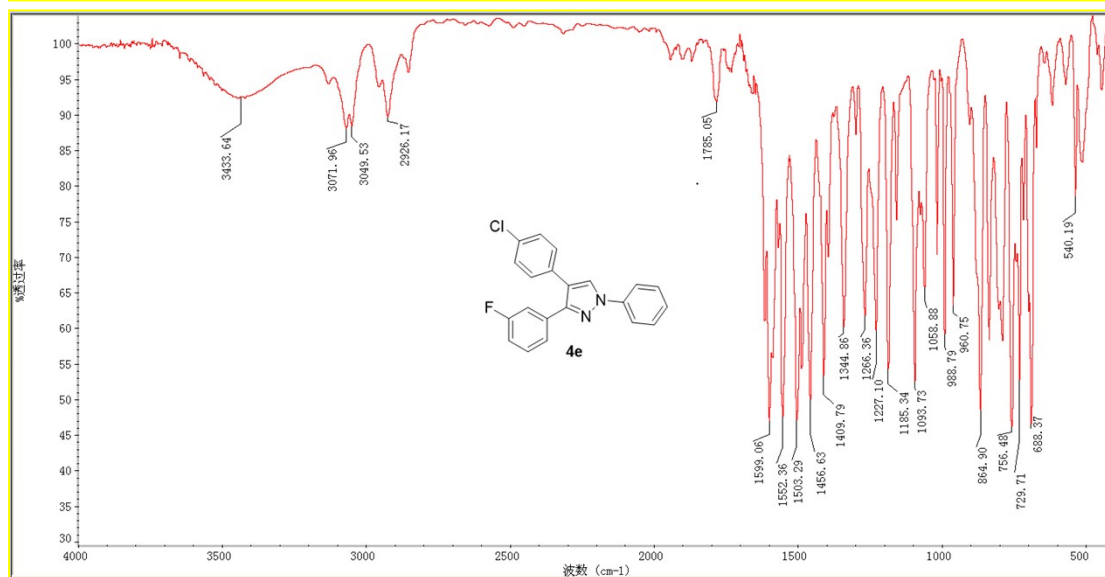
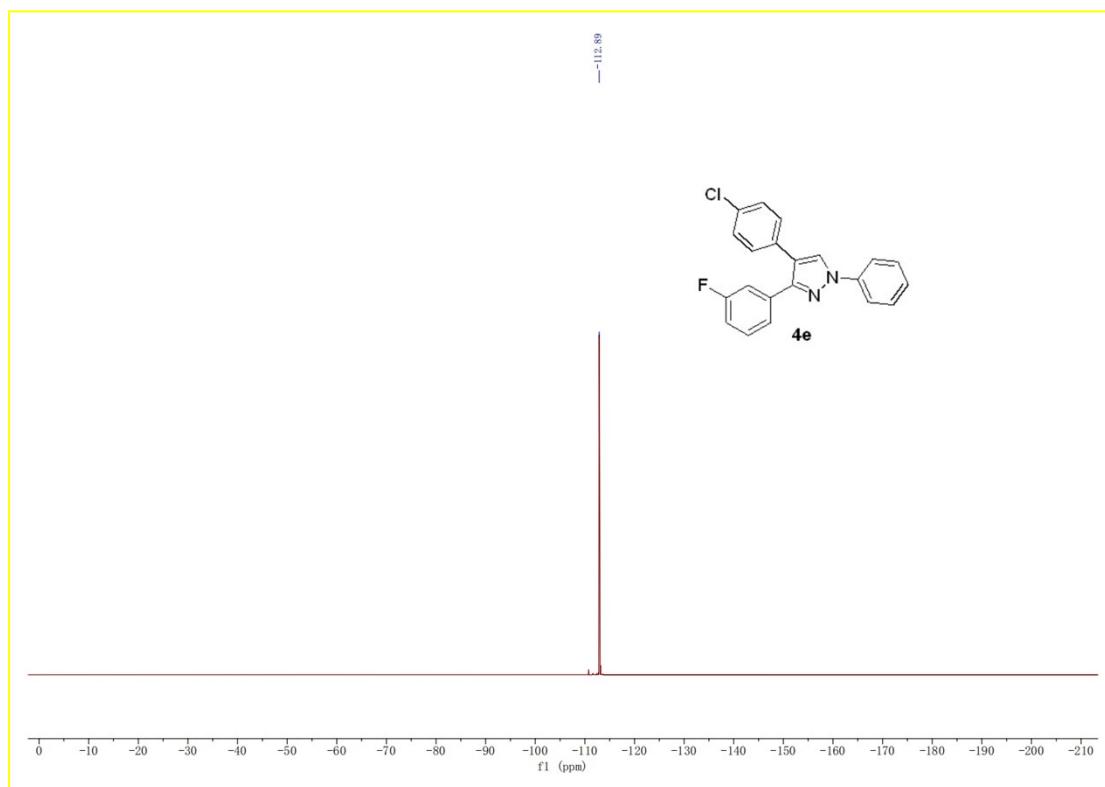
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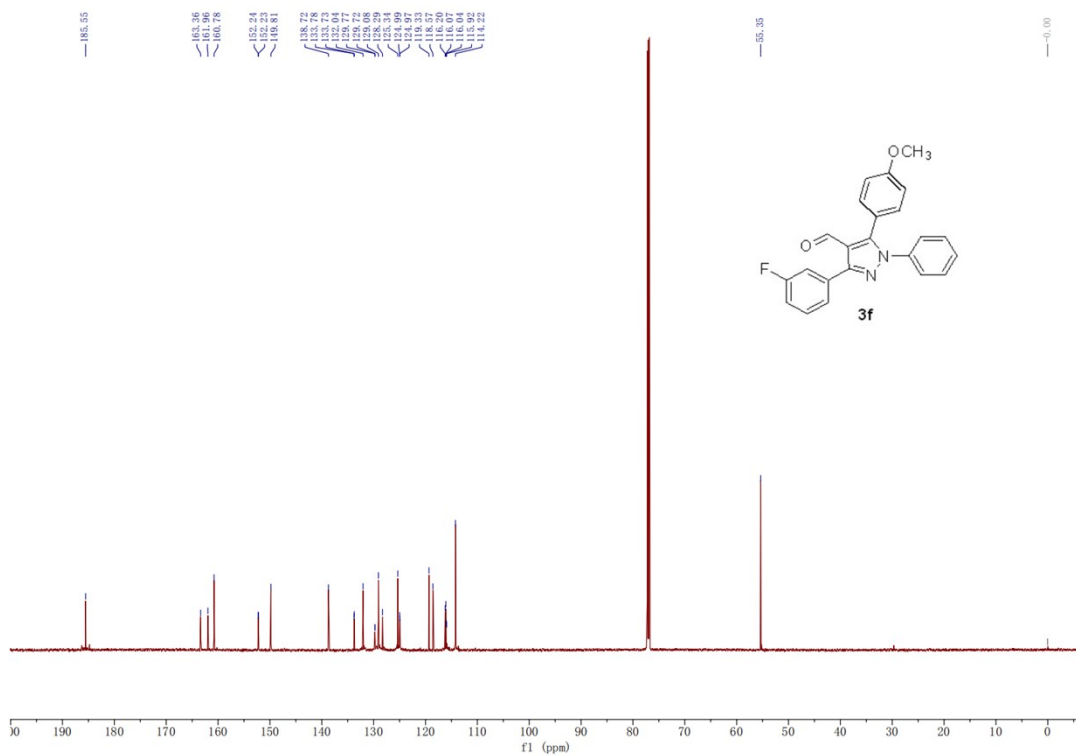
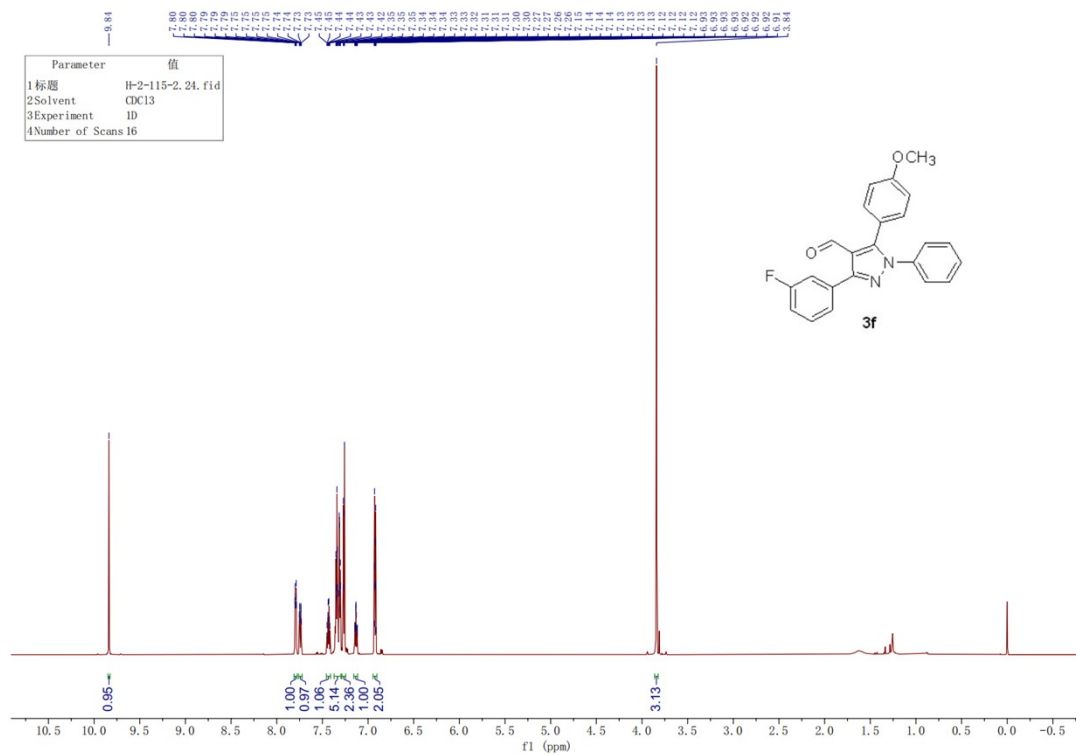
Parameter	值
1 标题	H-2-105-1.3. fid
2 Solvent	CDCl3
3 Experiment	1D
4 Number of Scans	16

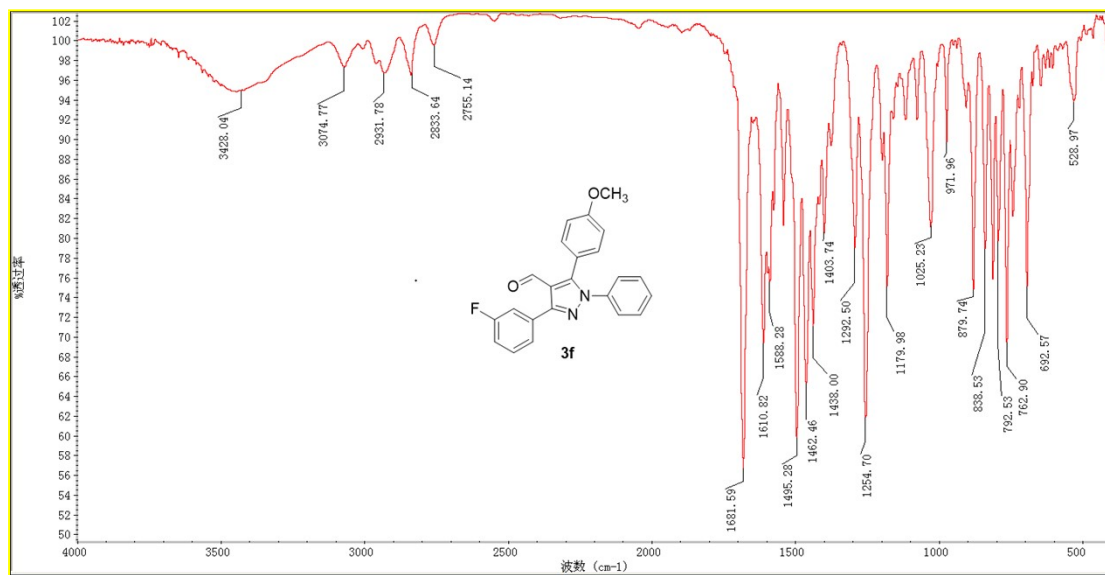
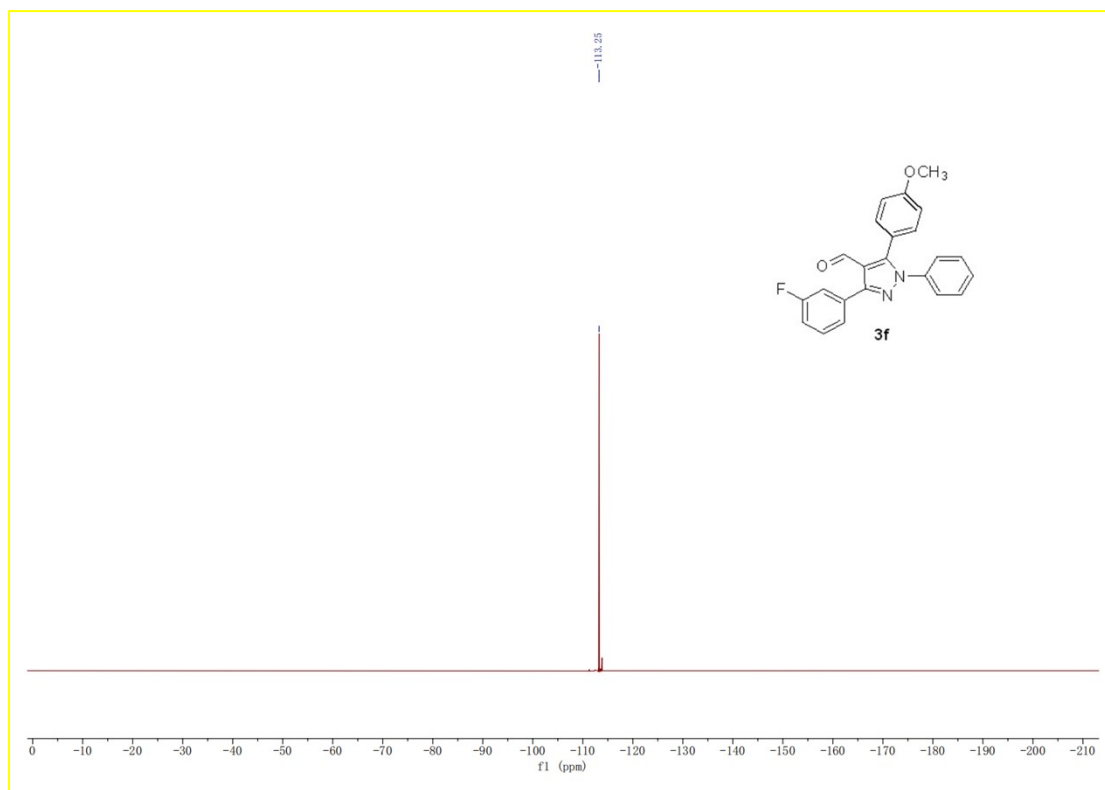


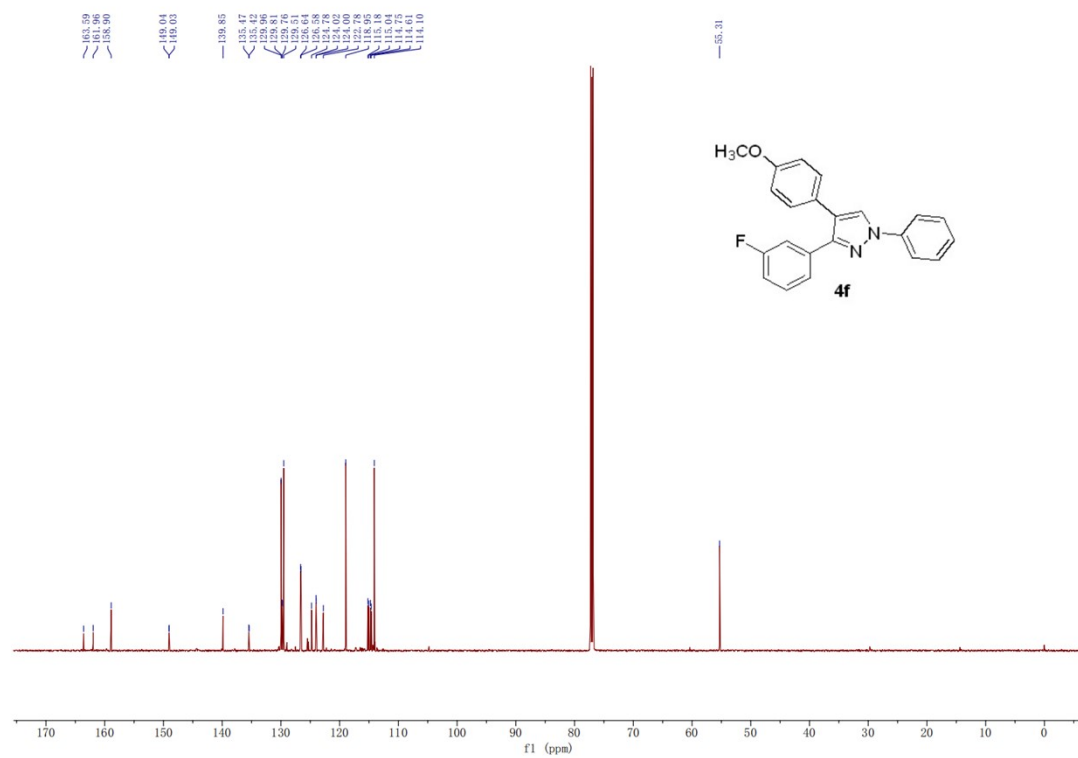
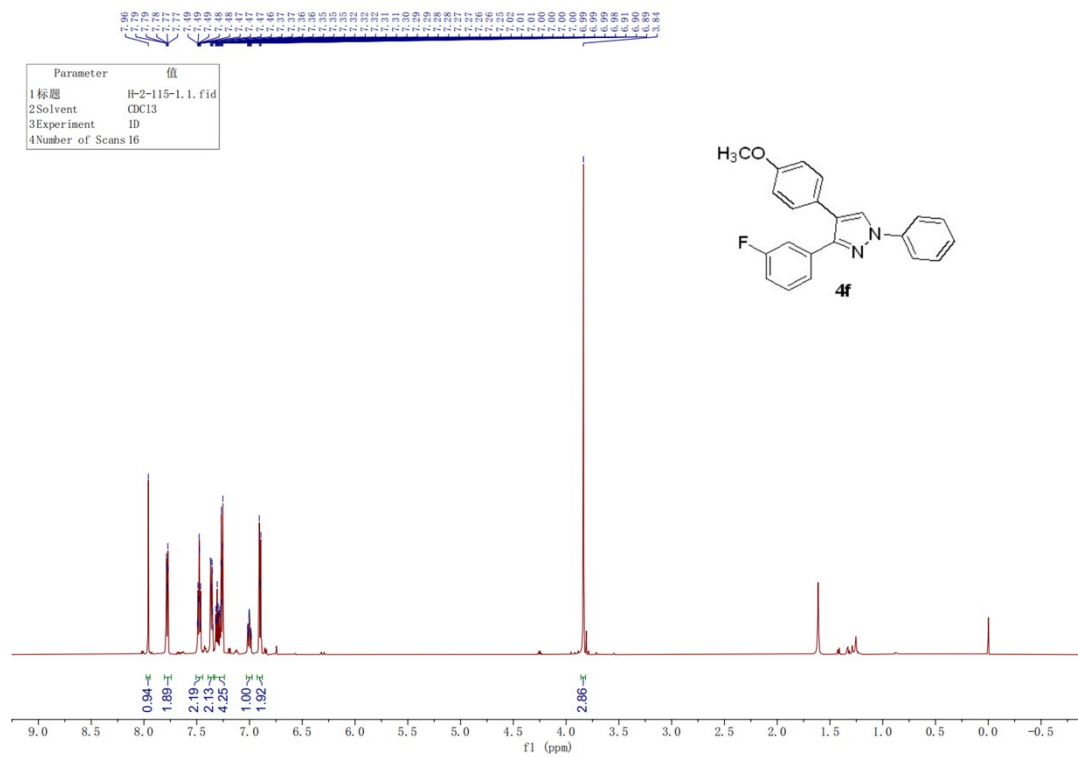
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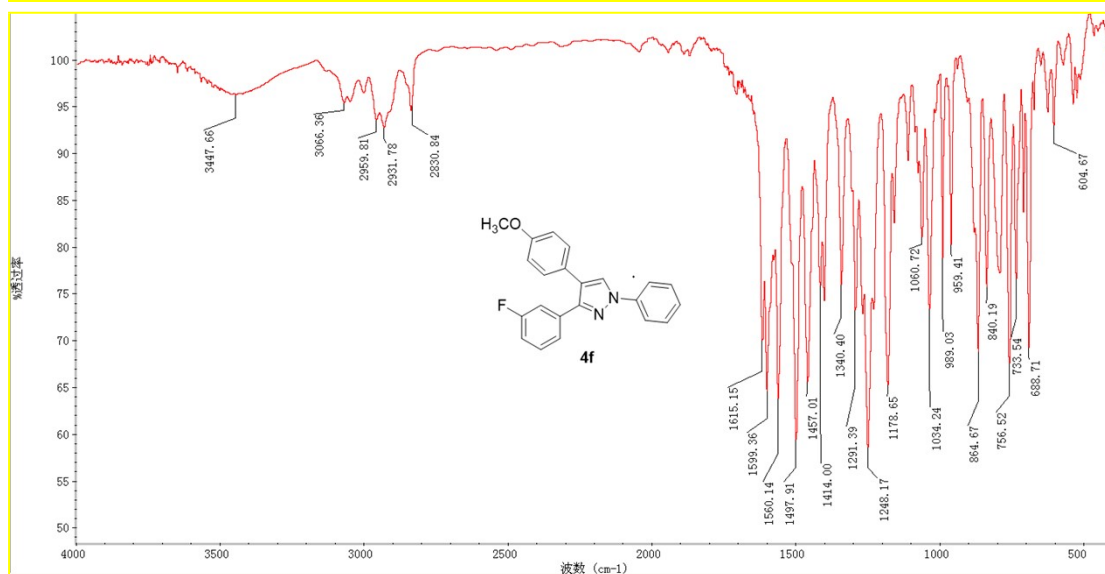
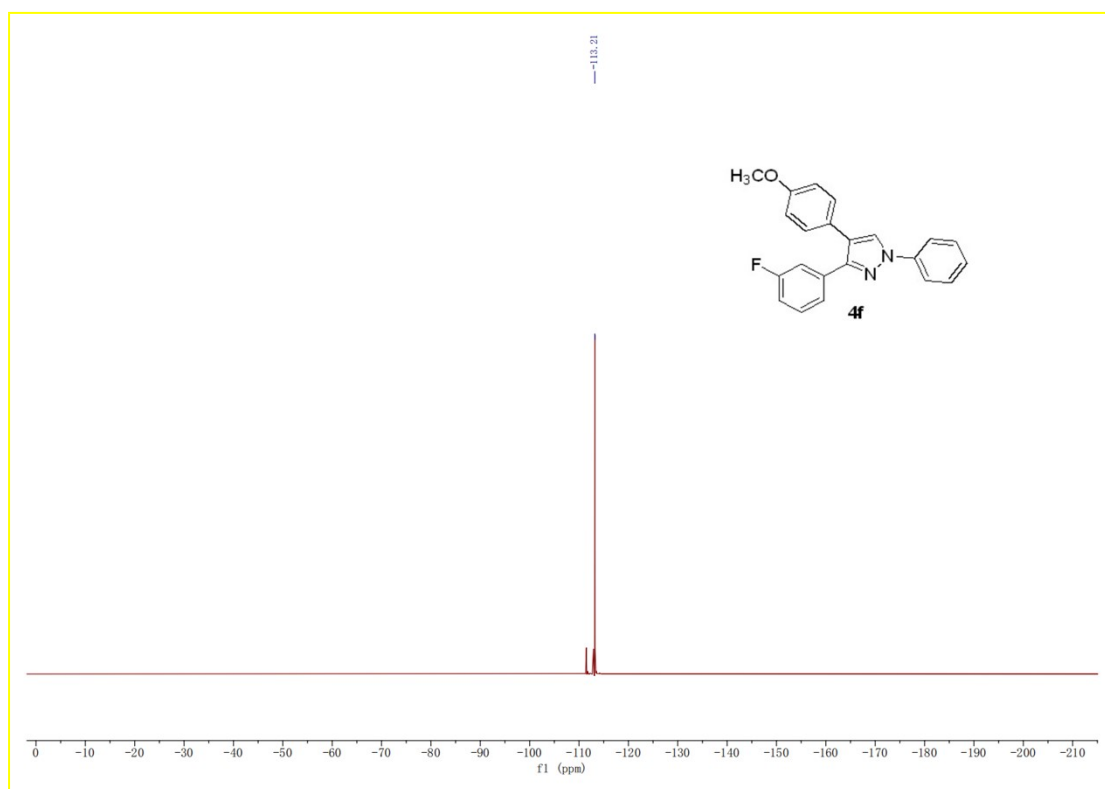


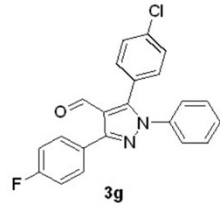


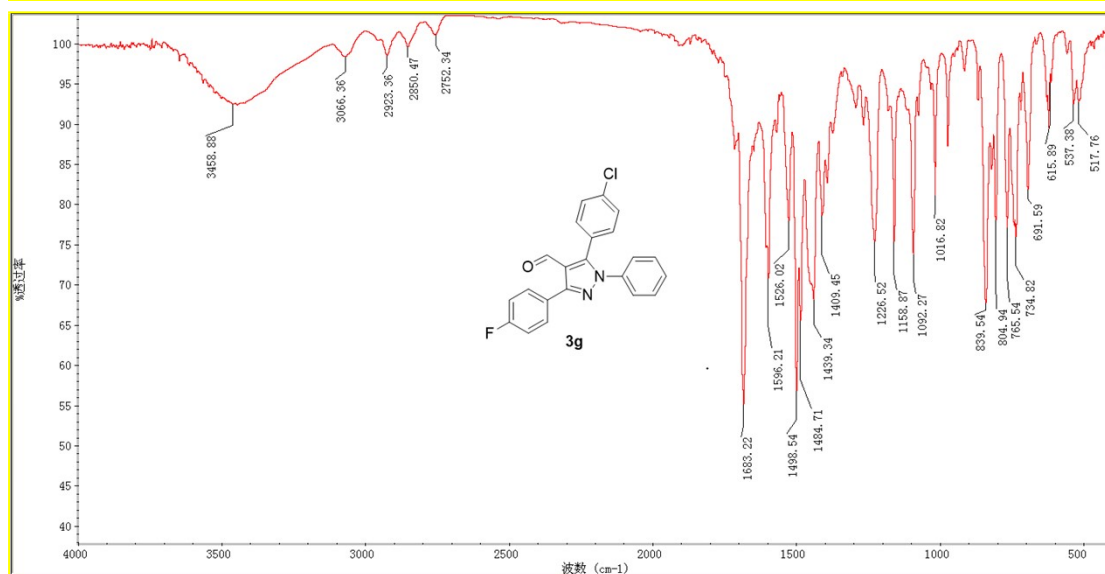
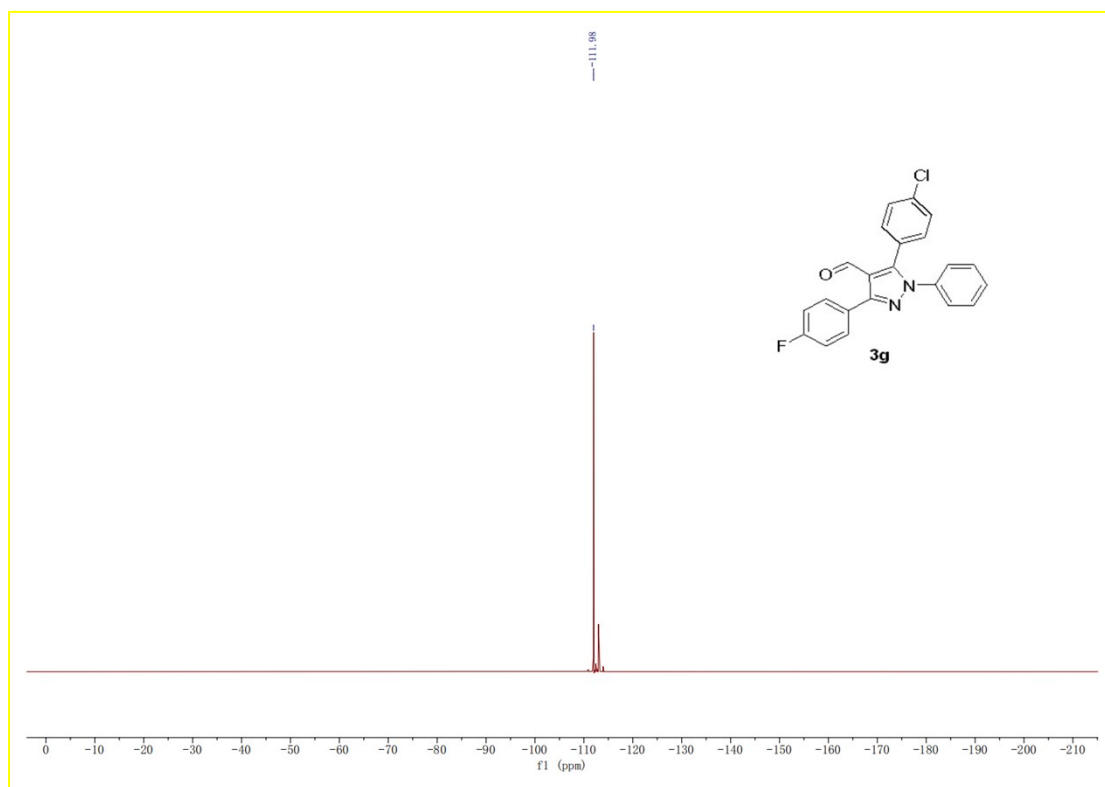


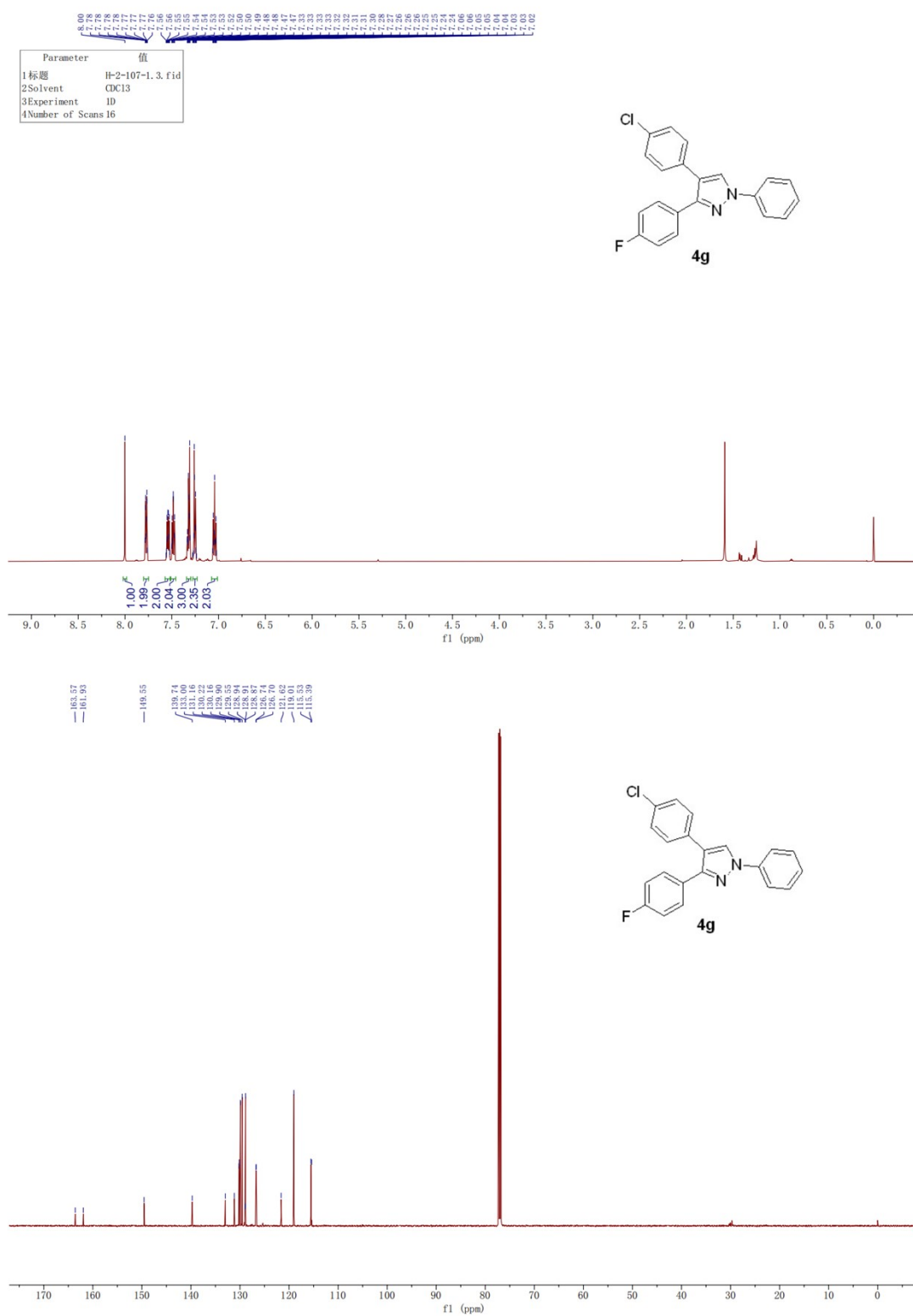


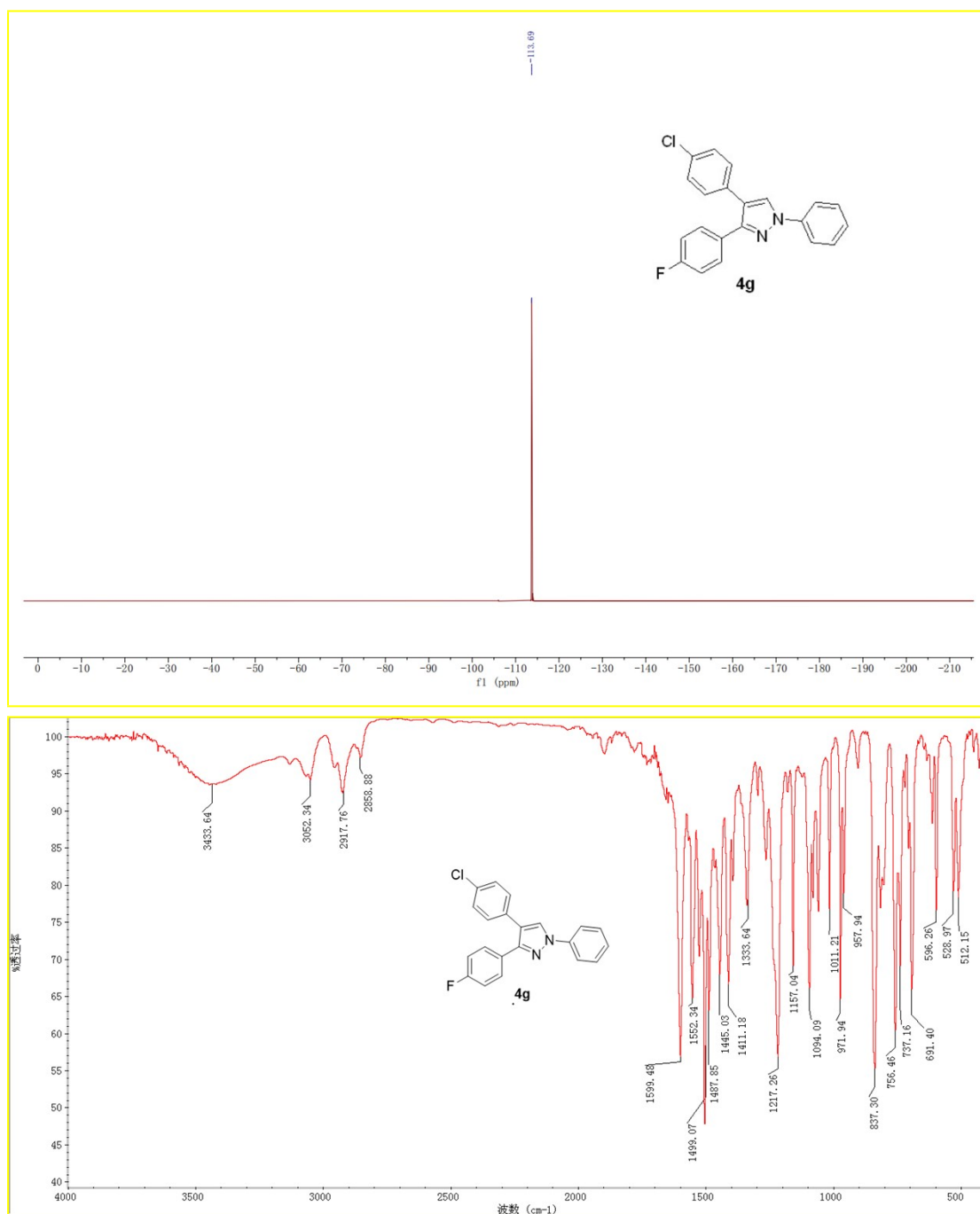




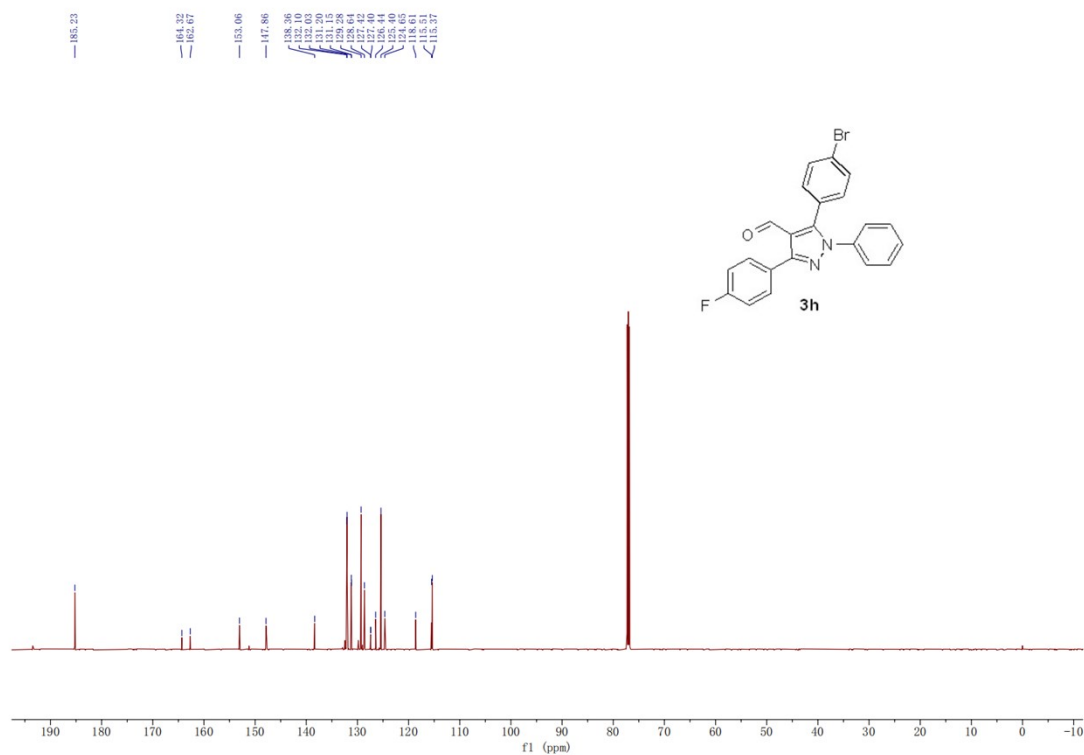
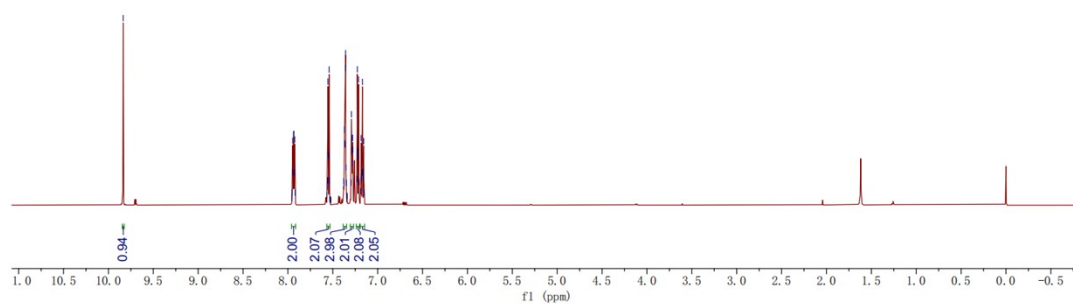
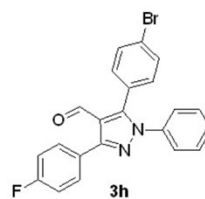


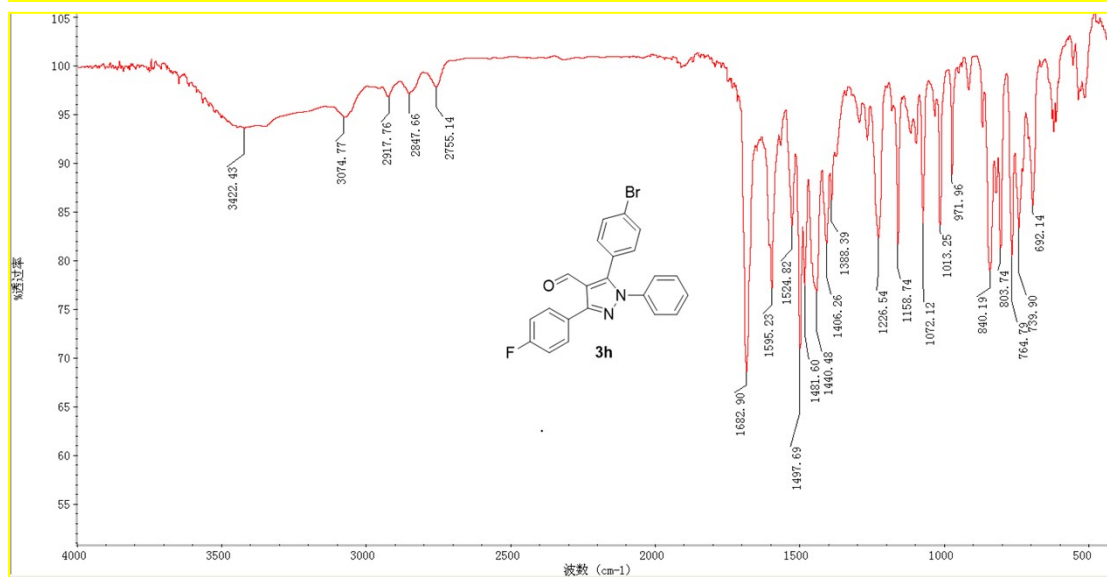
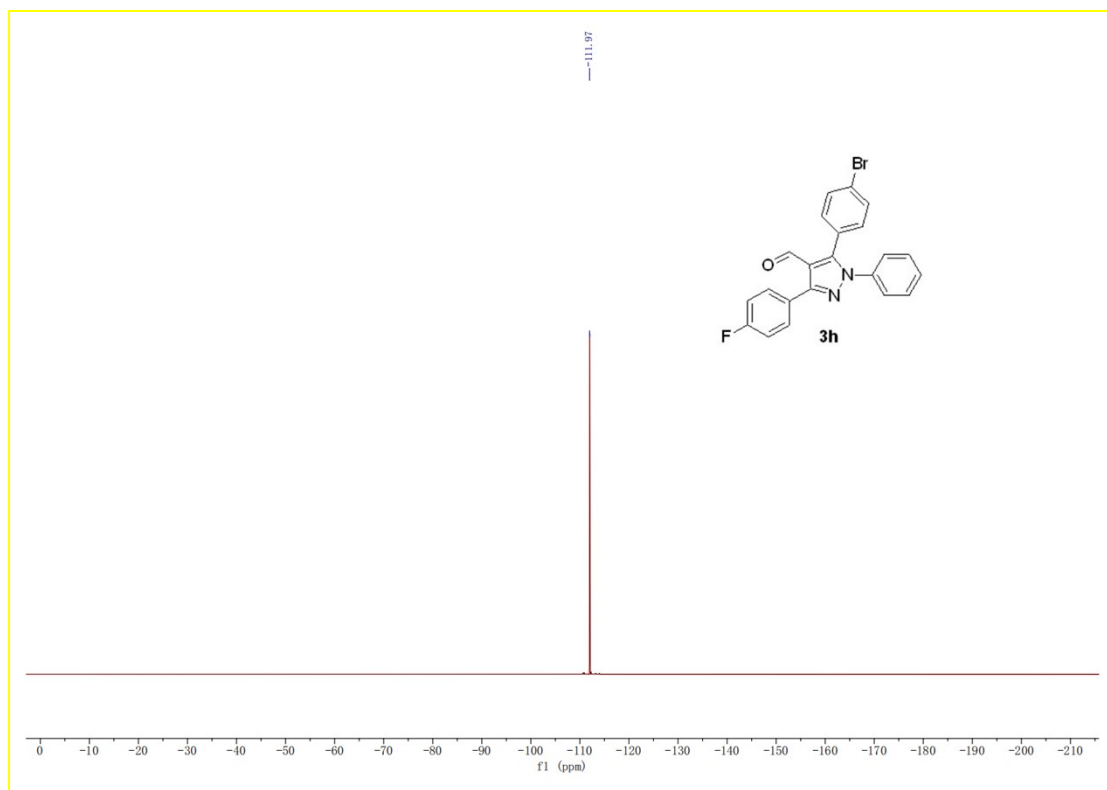




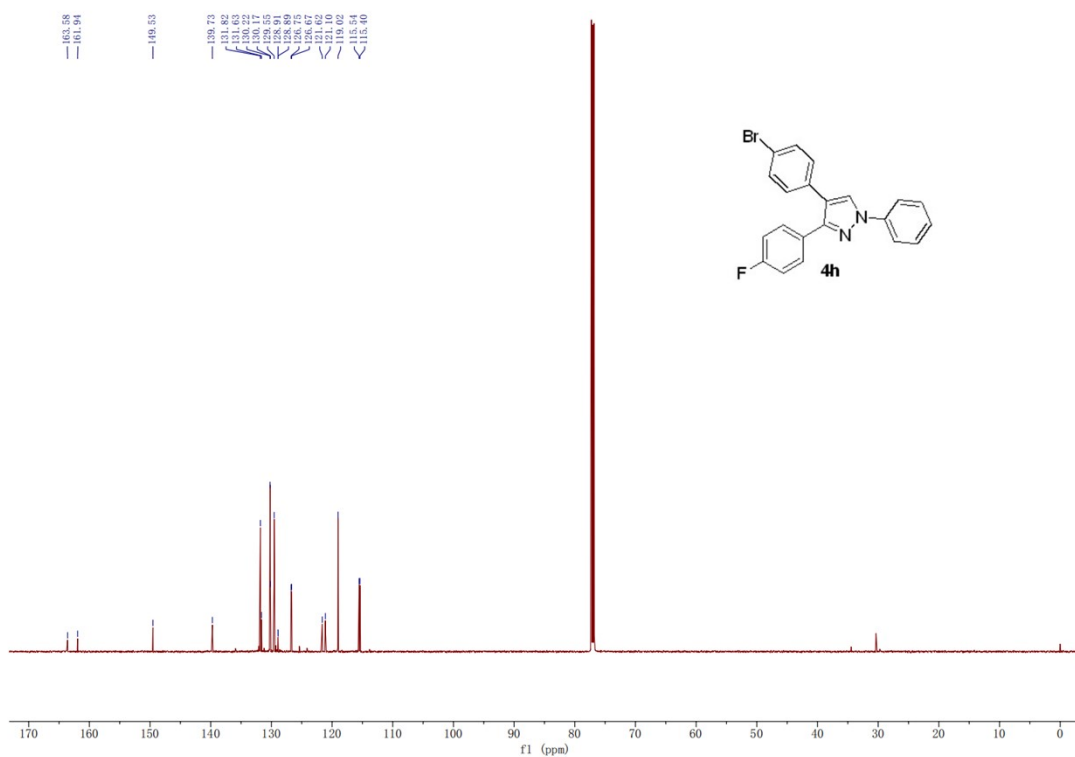
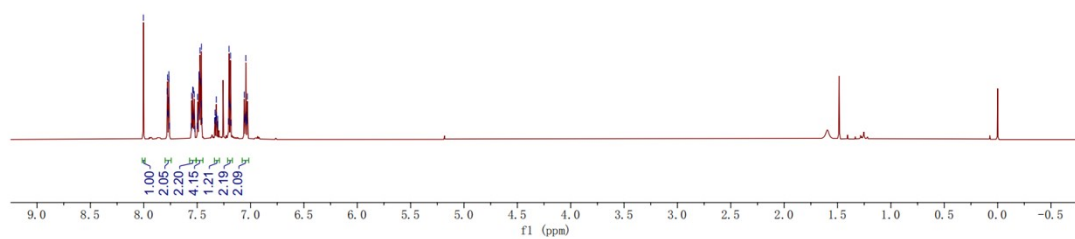
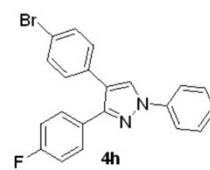


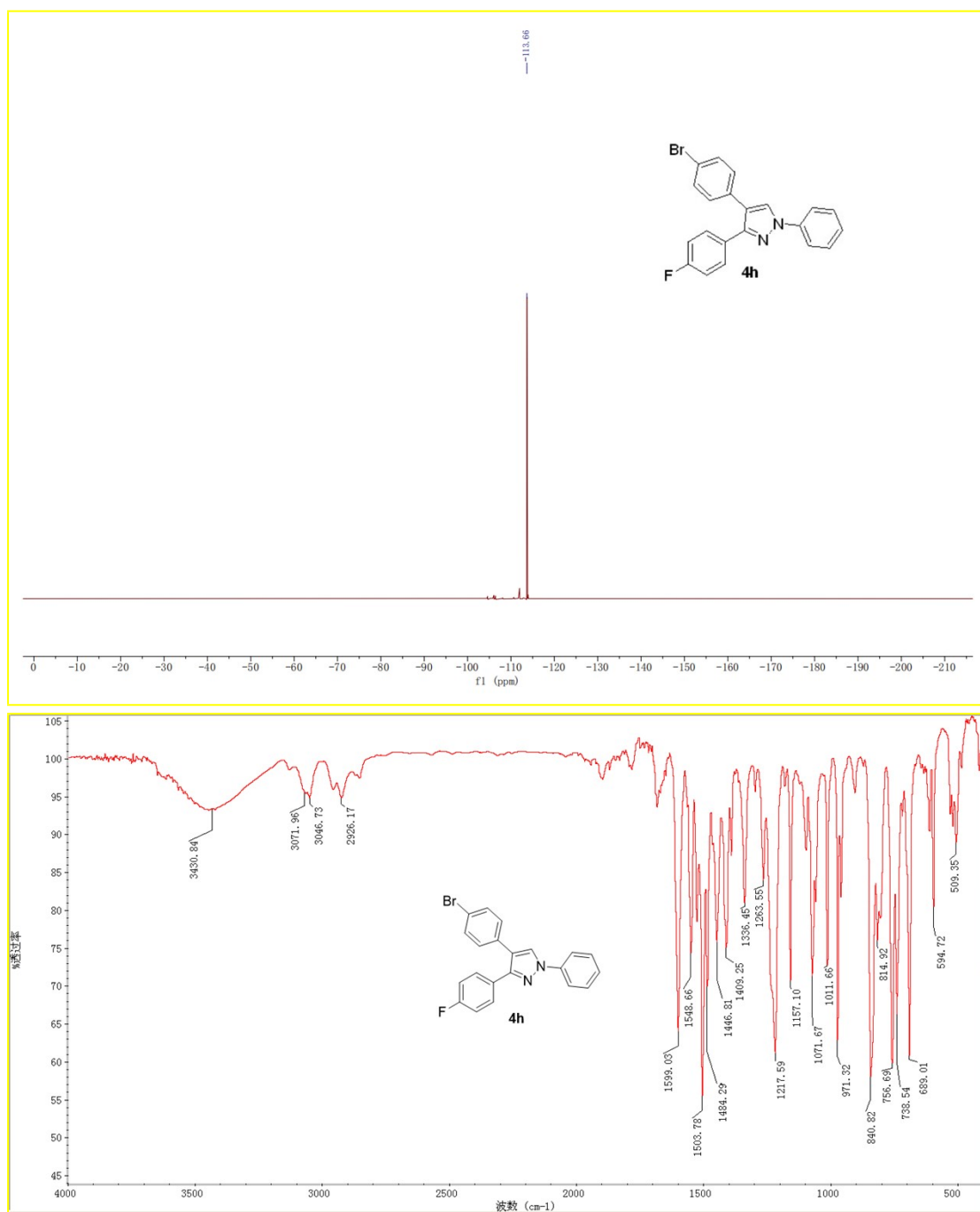
Parameter	值
1 标题	H-2-106-2.1.fid
2 Solvent	CDCl3
3 Experiment	1D
4 Number of Scans	16

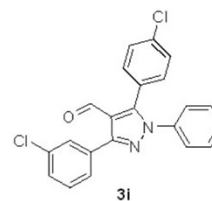
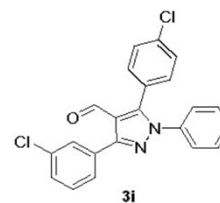


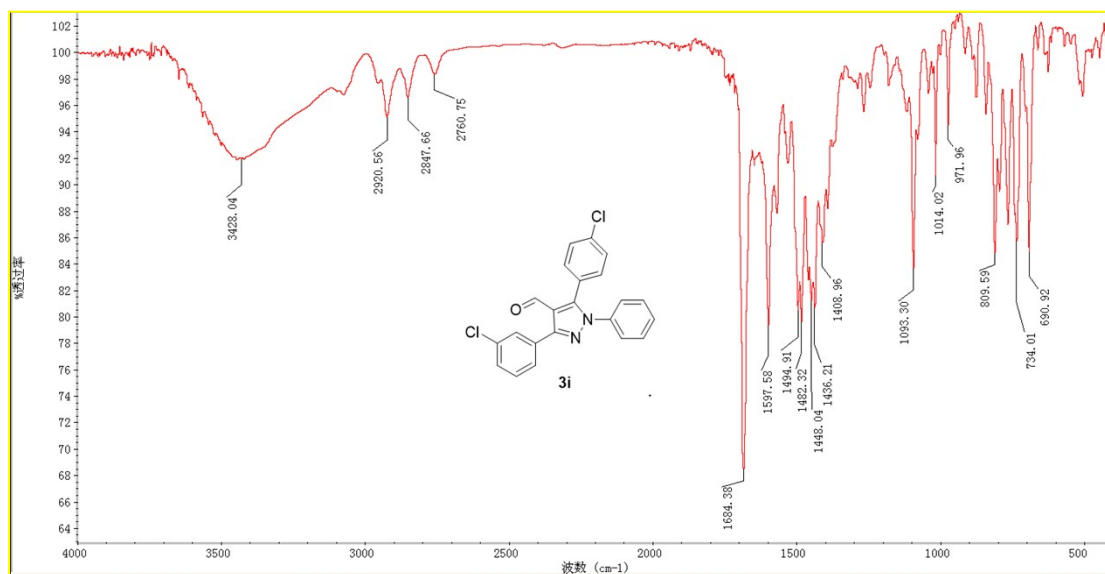


Parameter	值
1标题	H-2-106-1, 1. f1d
2Solvent	CDCl3
3Experiment	1D
4Number of Scans	16

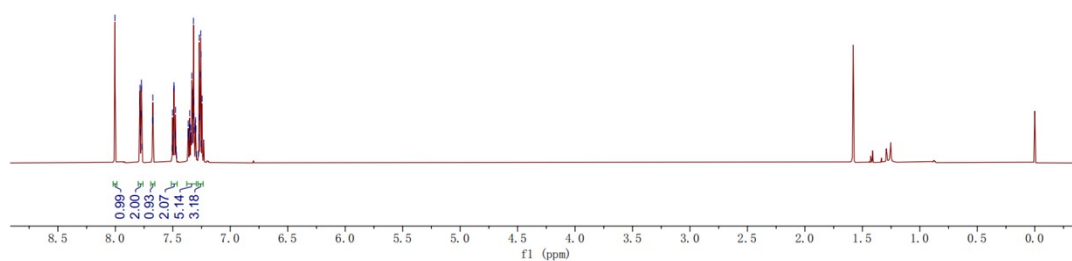
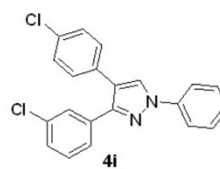


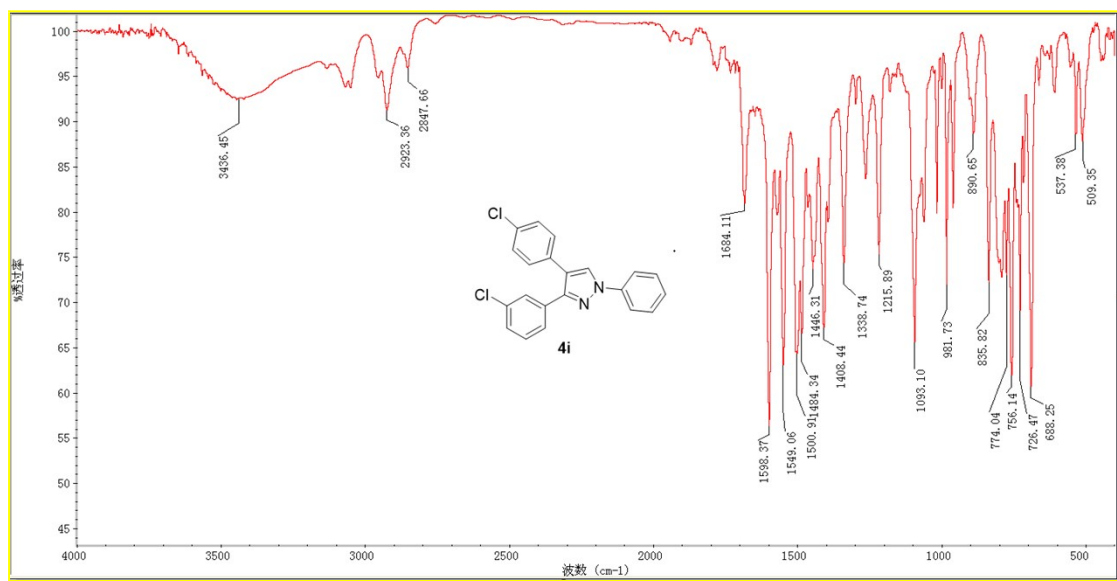
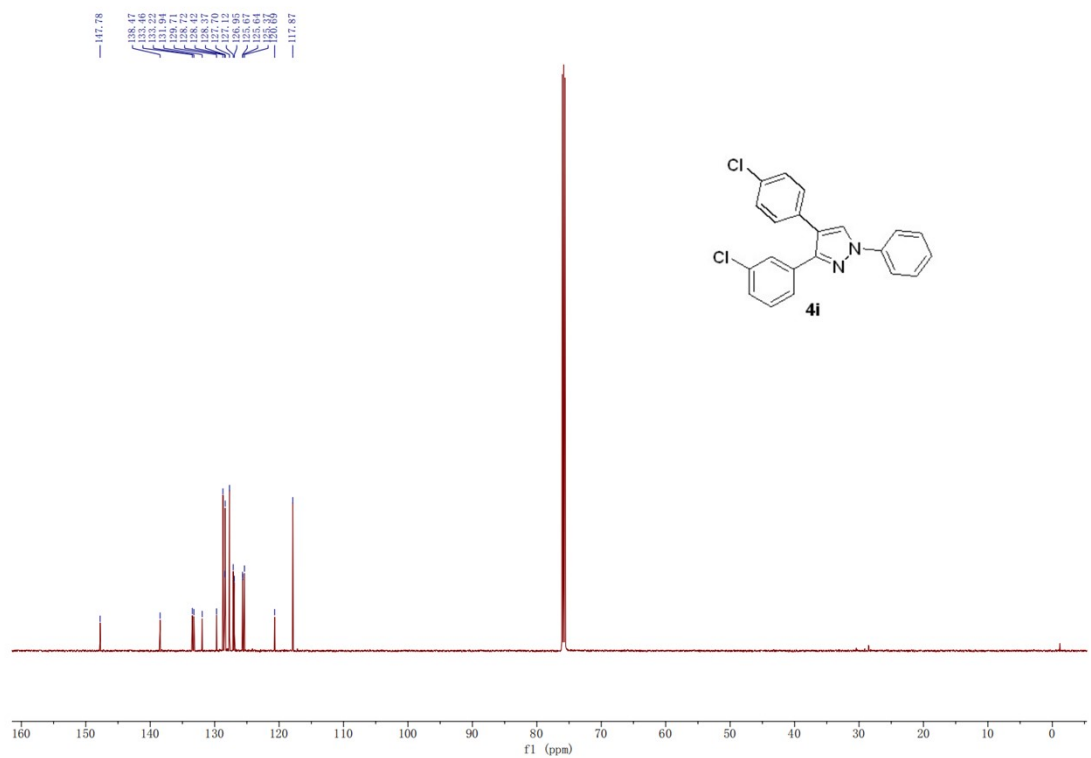


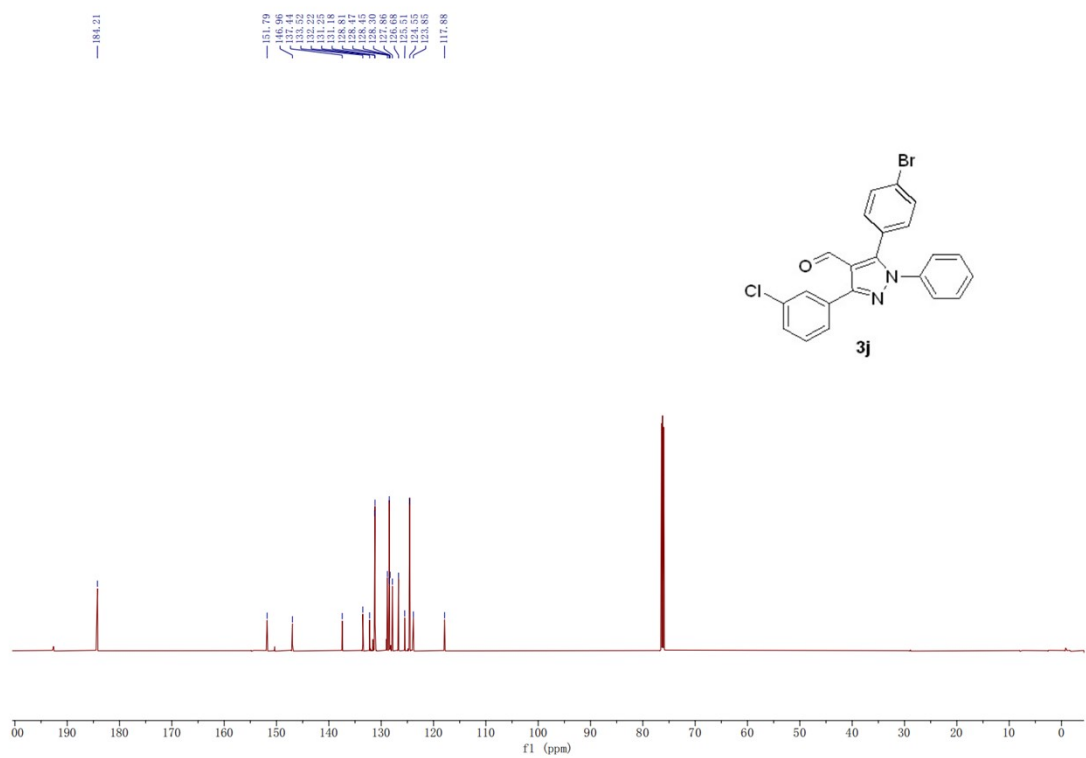
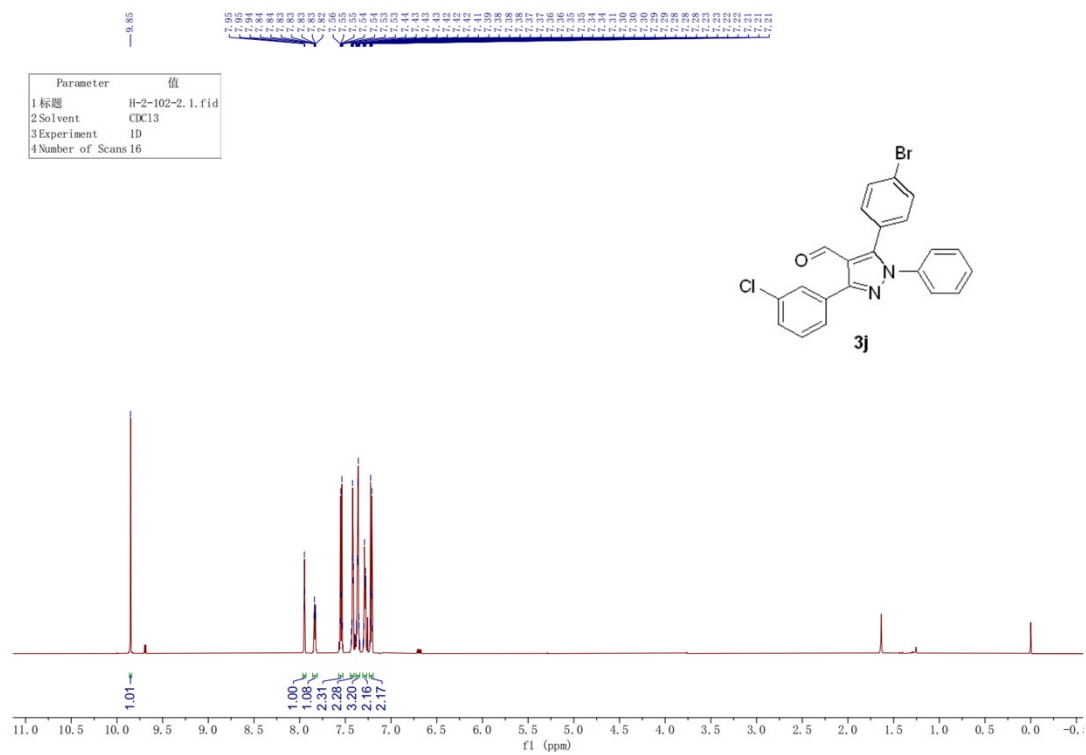


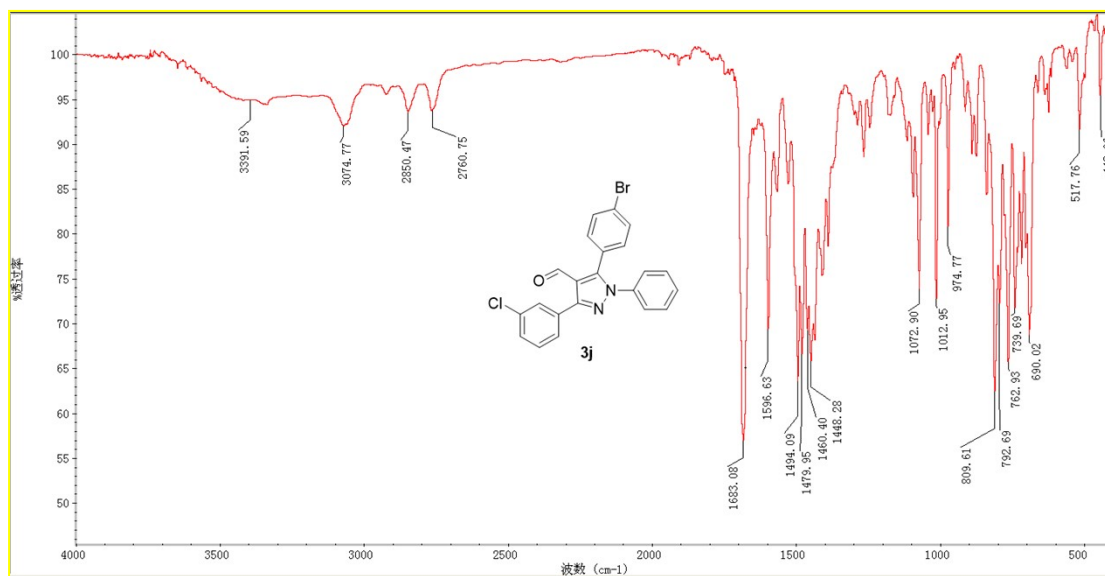


Parameter	值
1 标题	H-2-103-1.3.fid
2 Solvent	CDCl3
3 Experiment	1D
4 Number of Scans	16

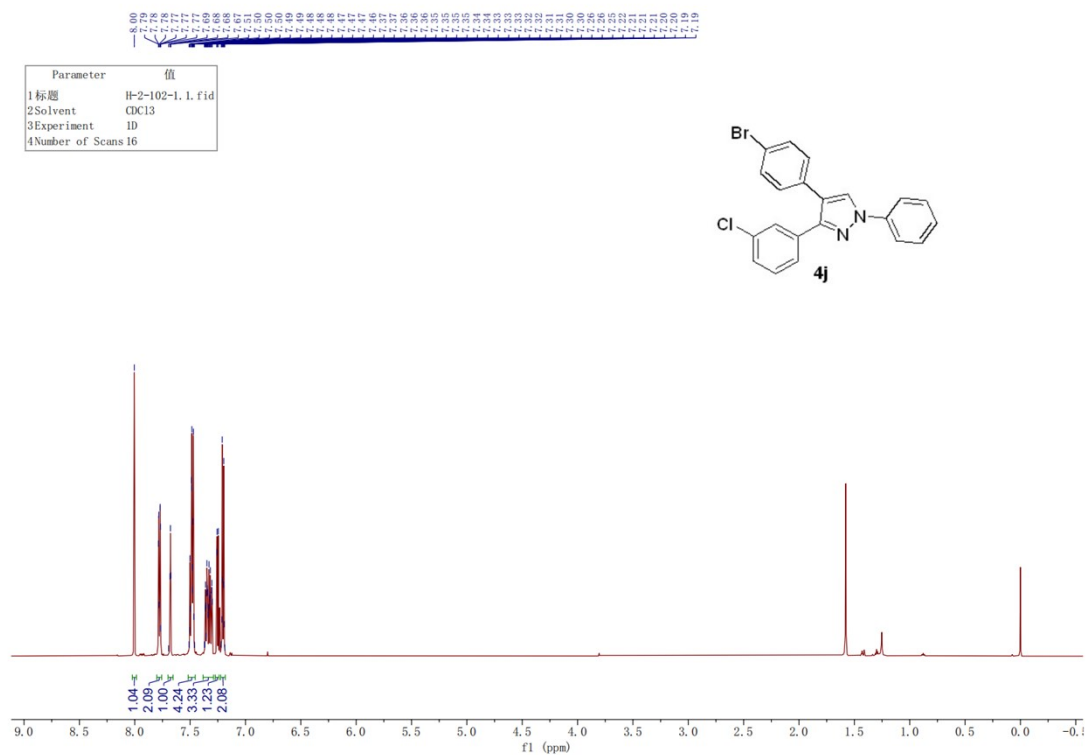


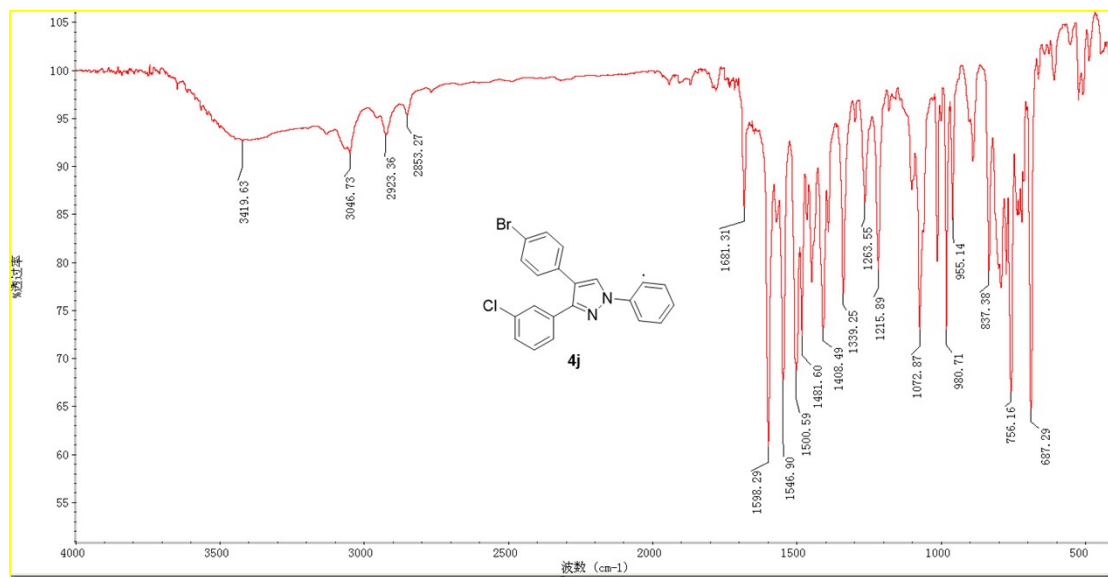
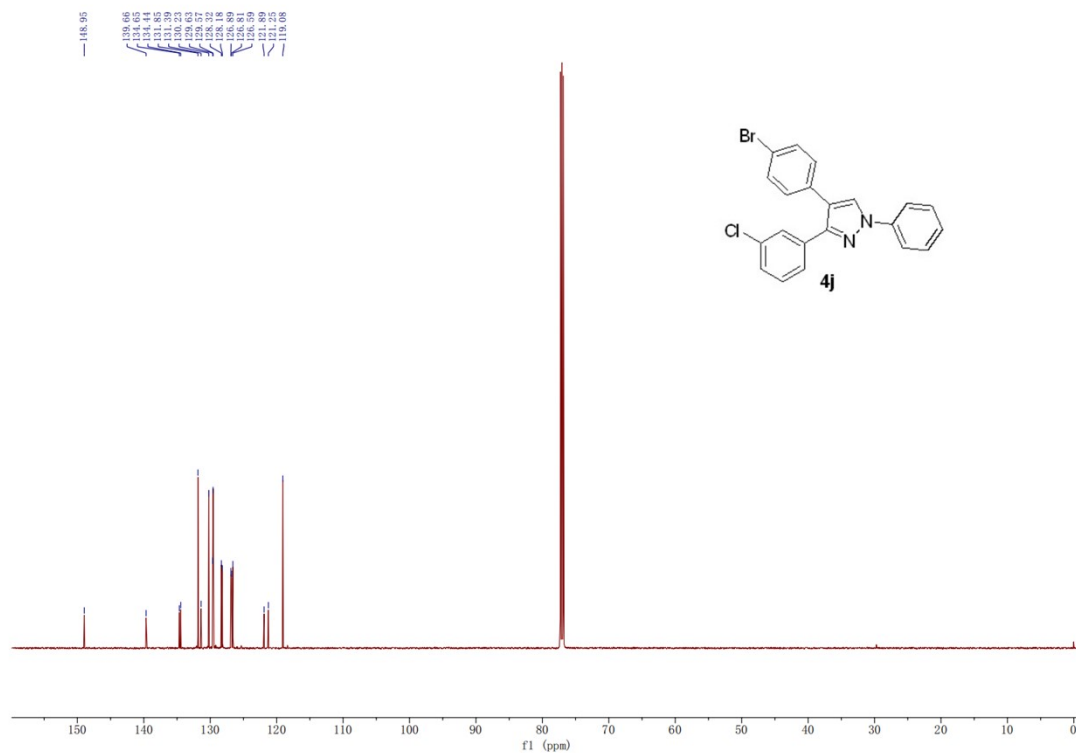


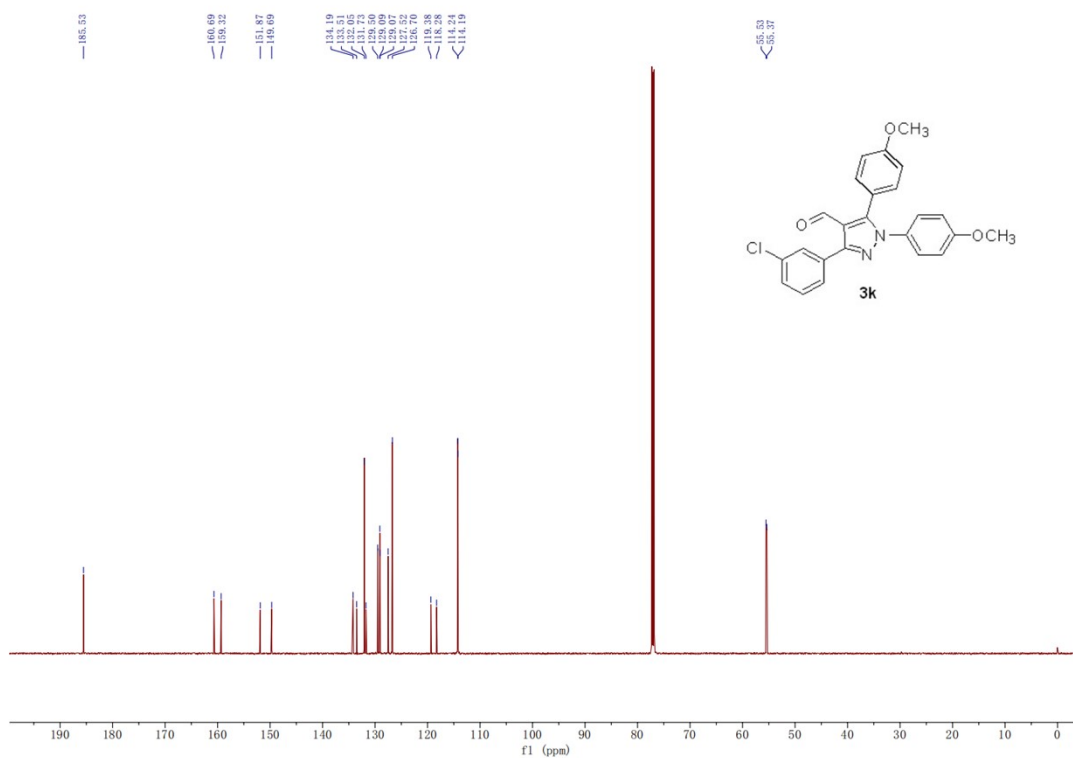
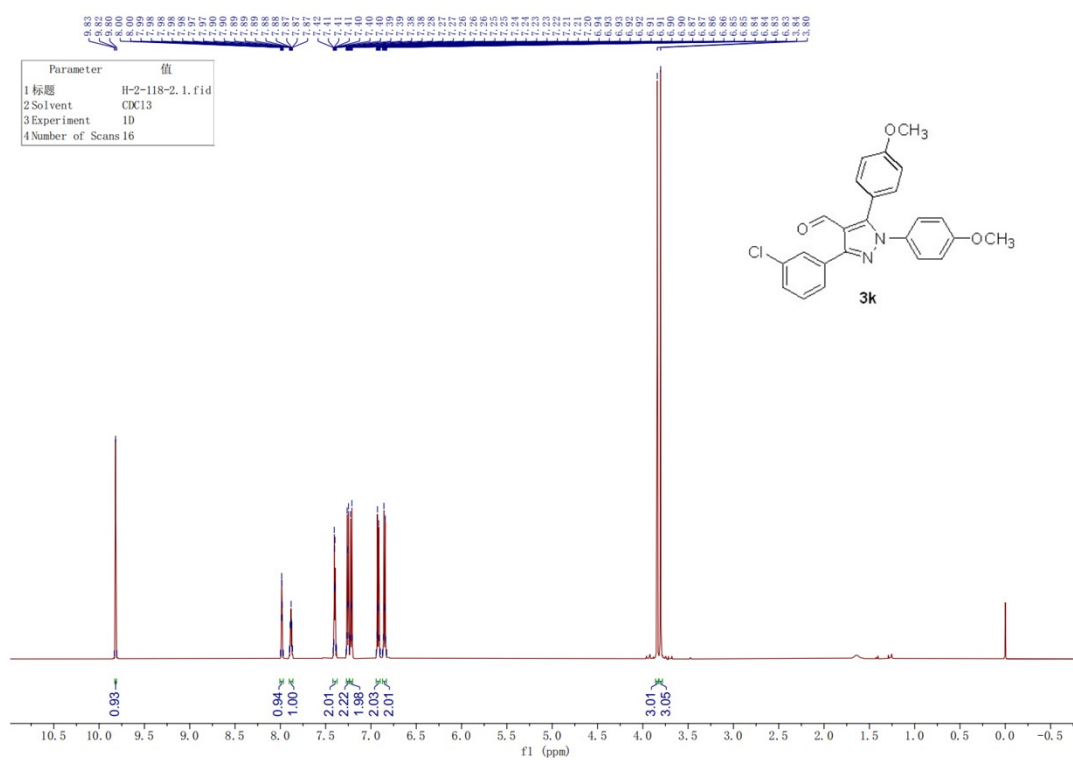


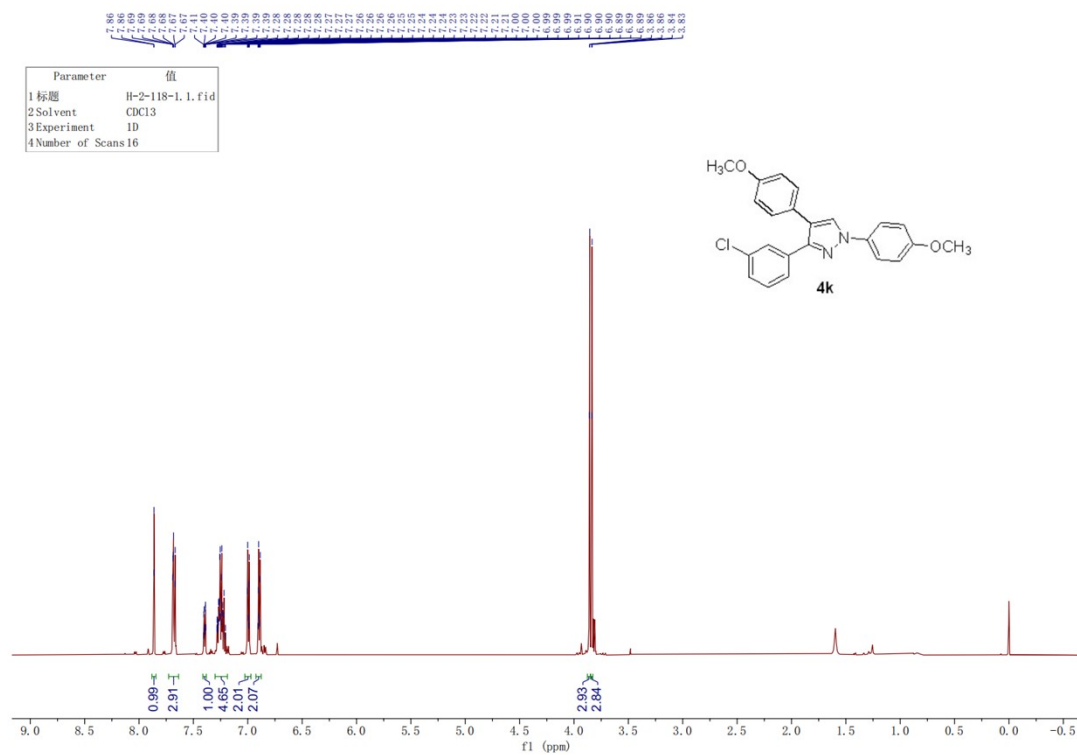
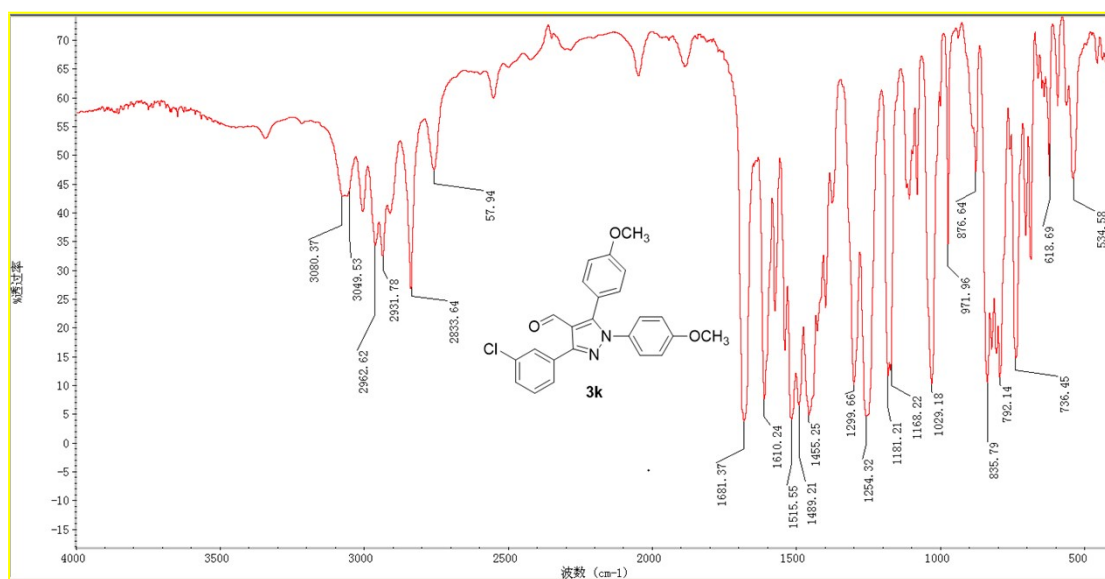


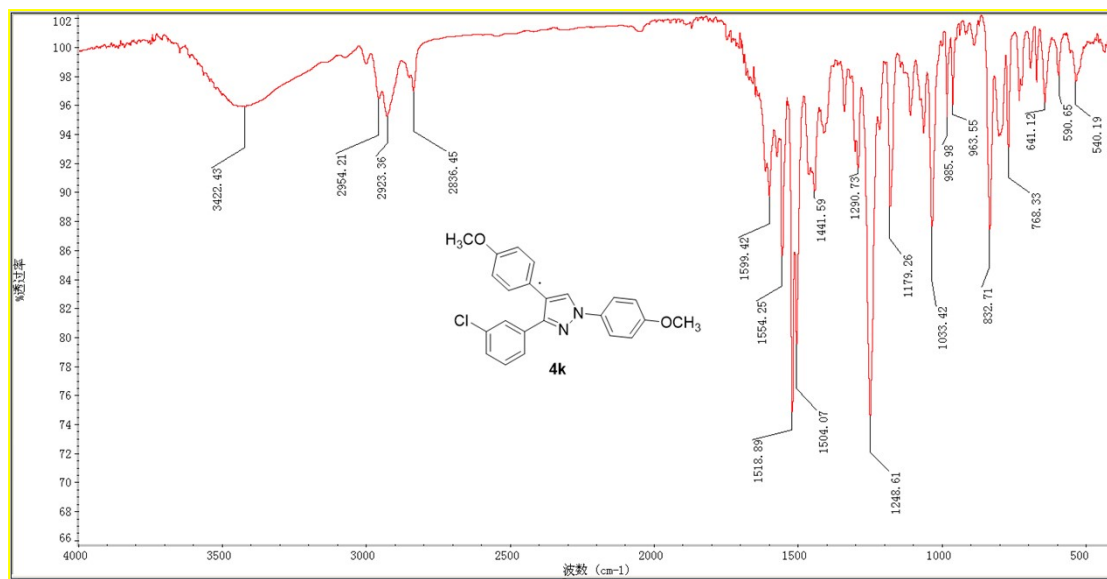
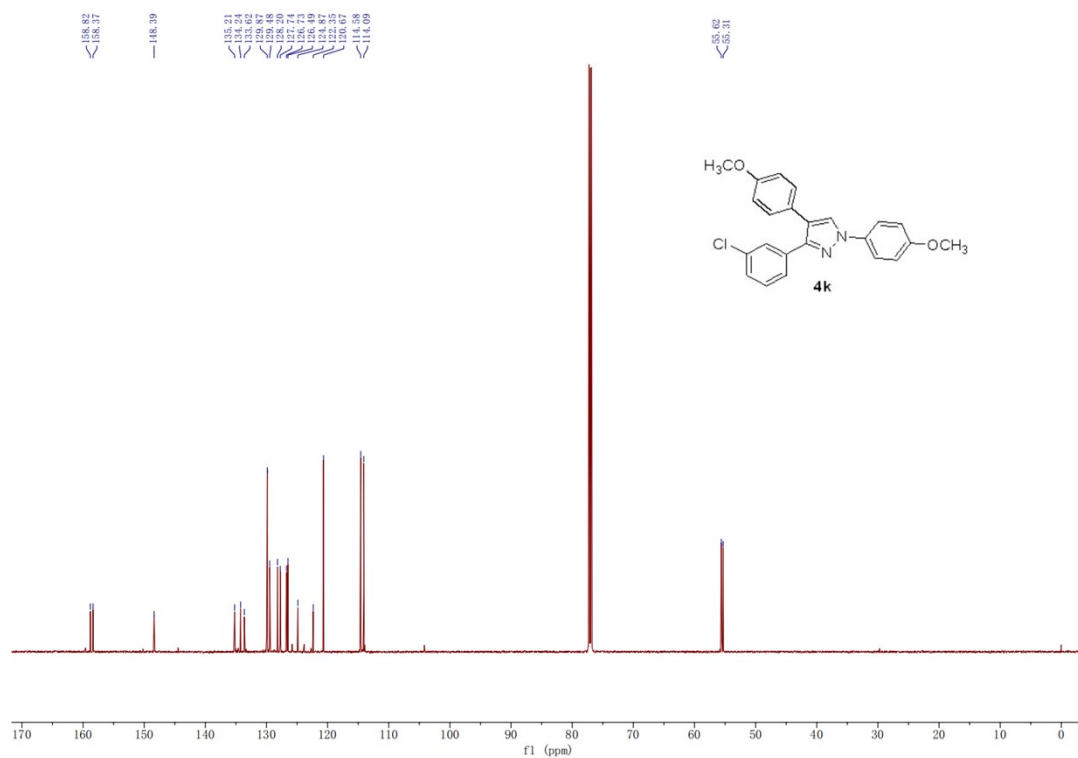
Parameter	值
1标题	11-2-102-1. 1. f1d
2Solvent	CDCl3
3Experiment	1D
4Number of Scans	16

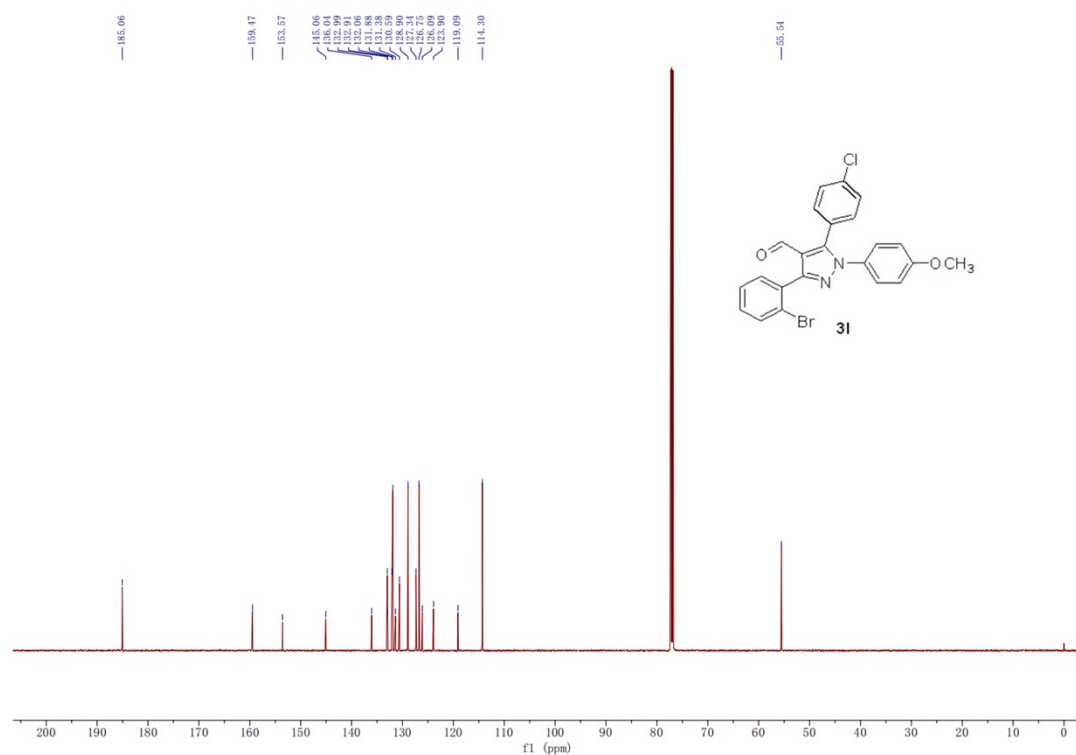
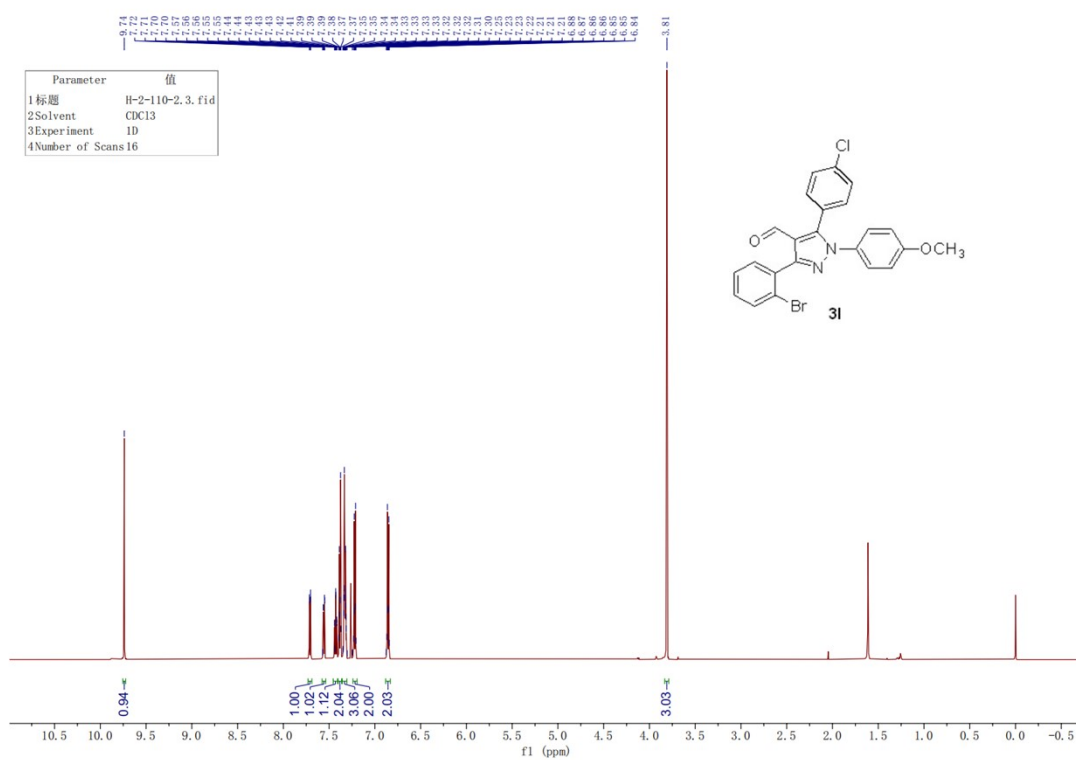


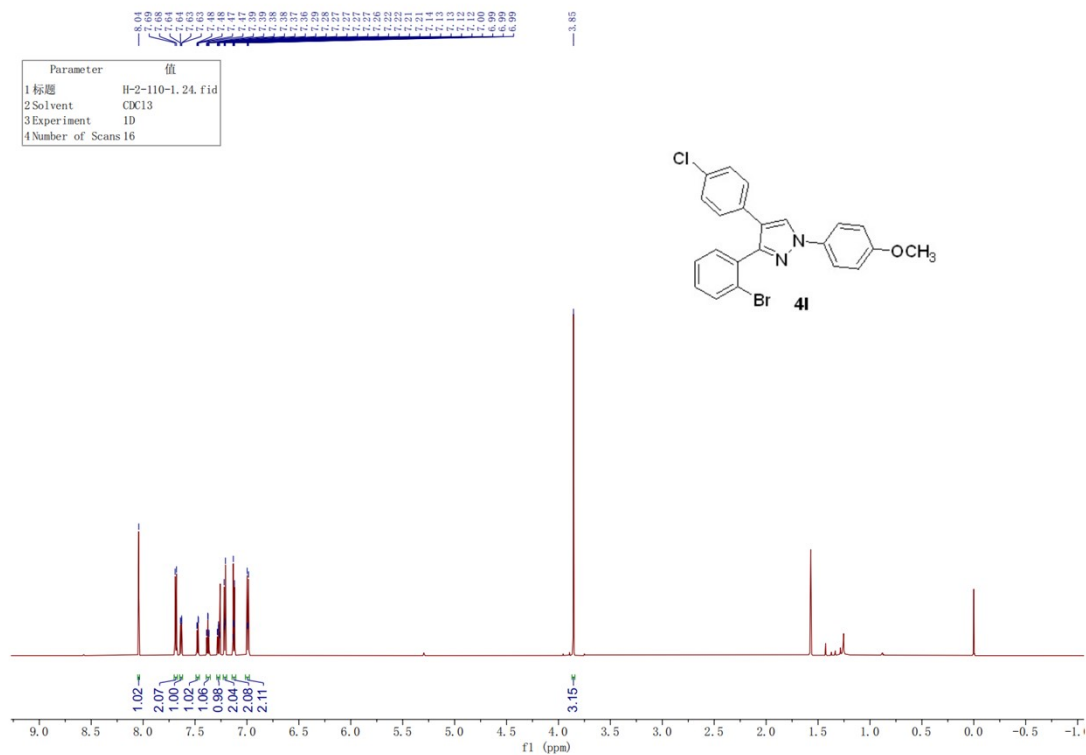
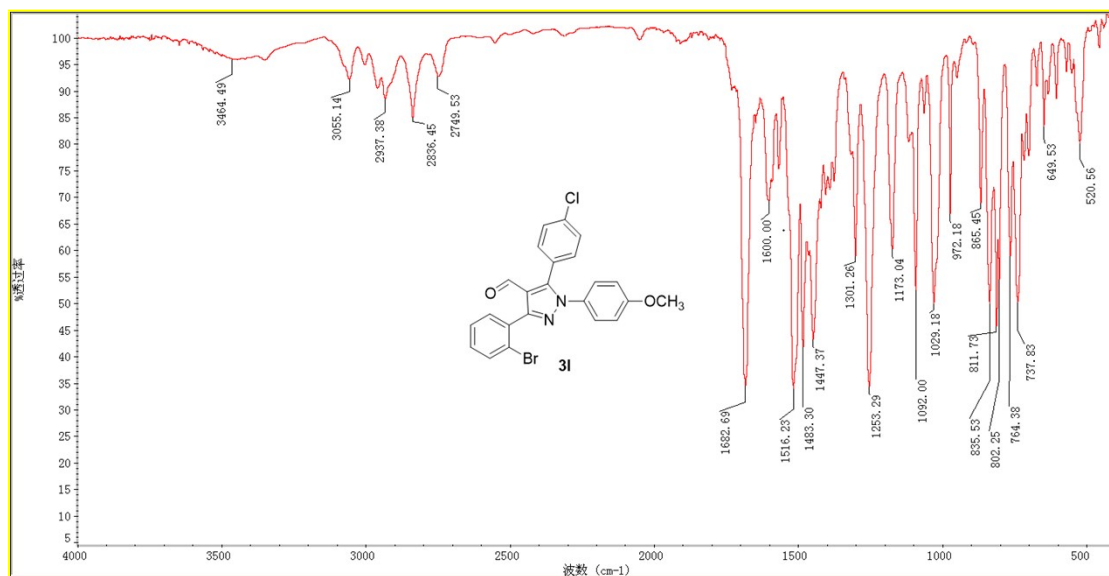


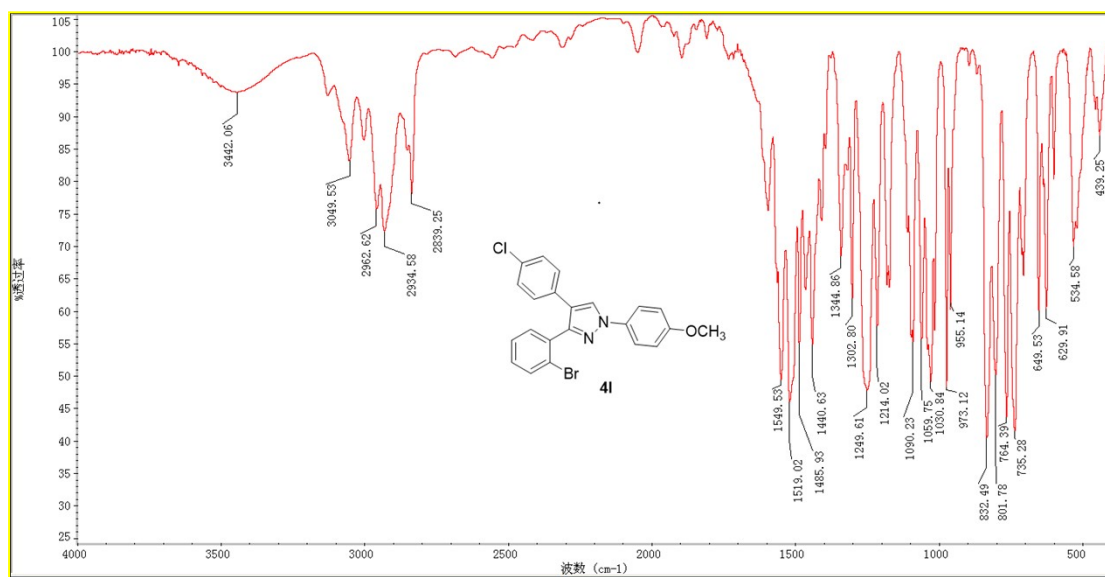
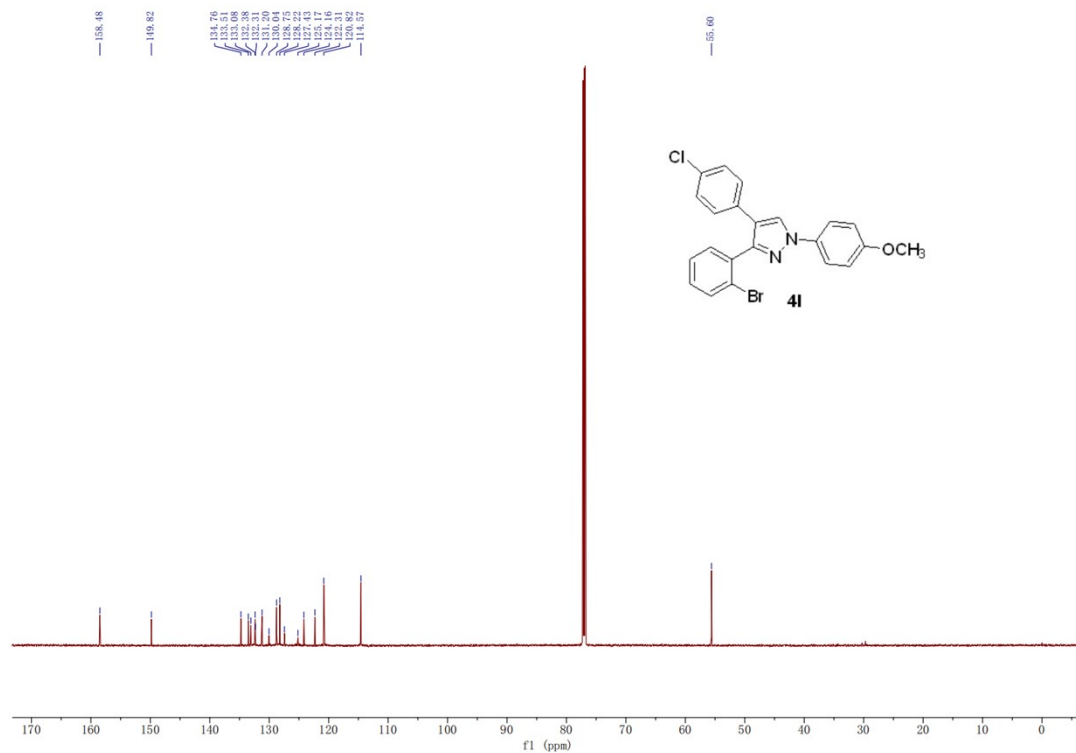


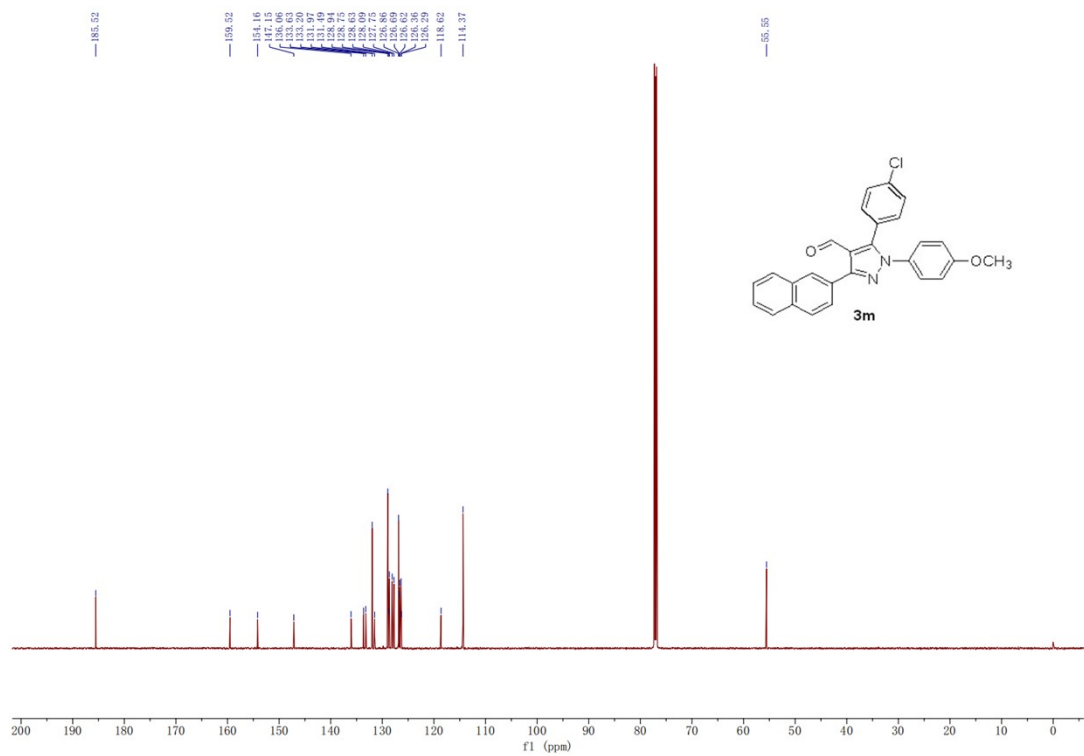
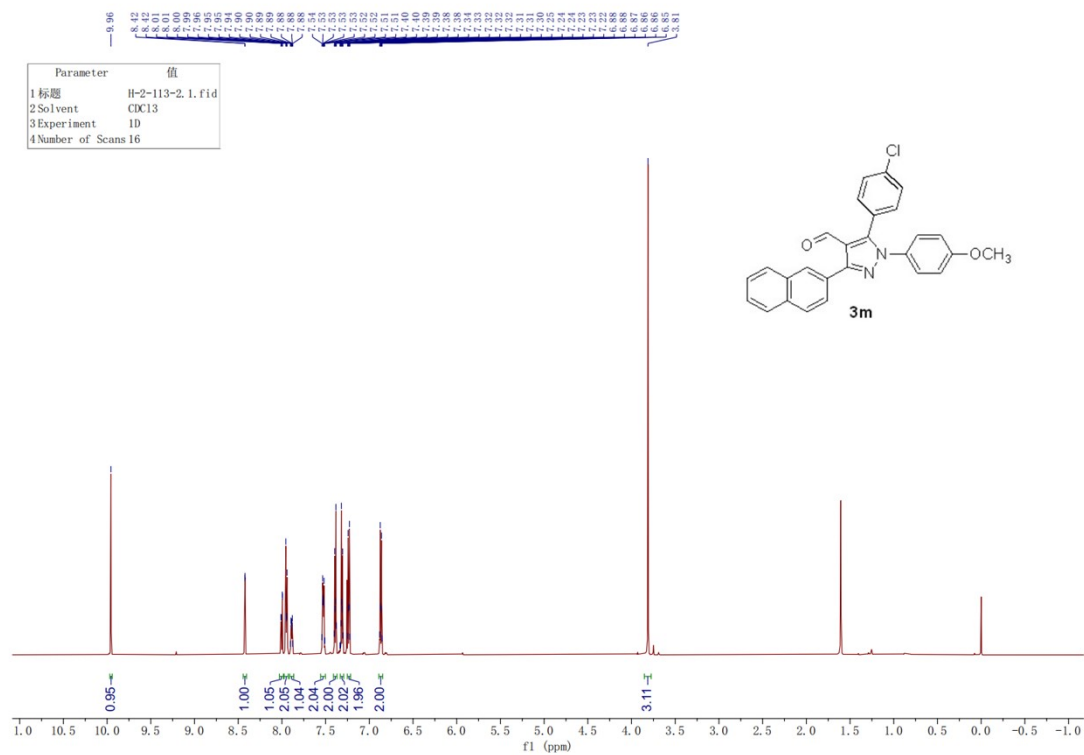


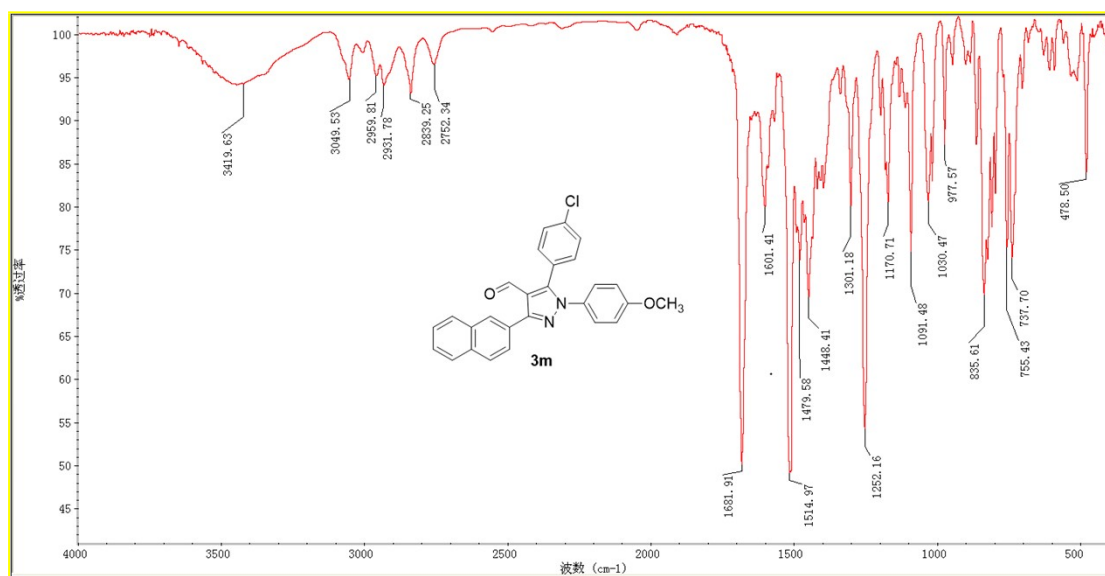




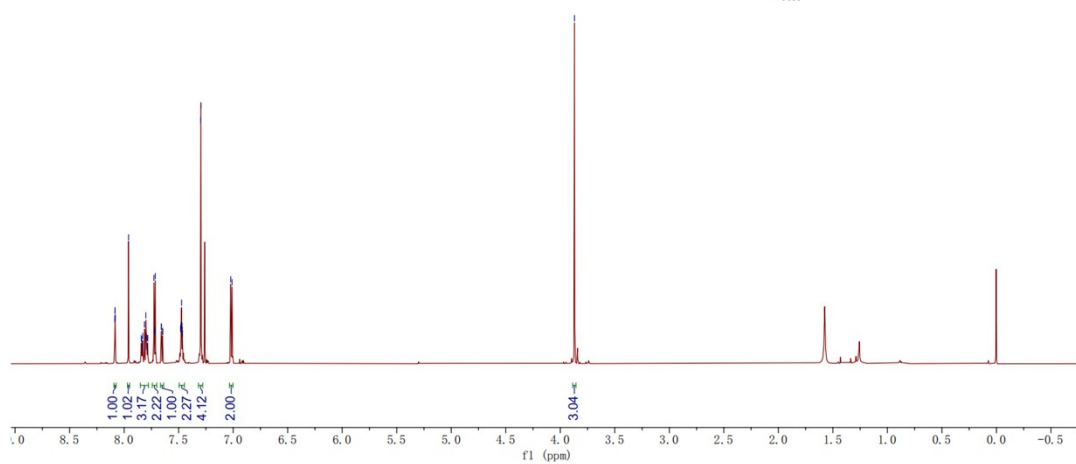
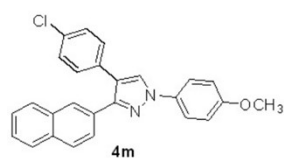


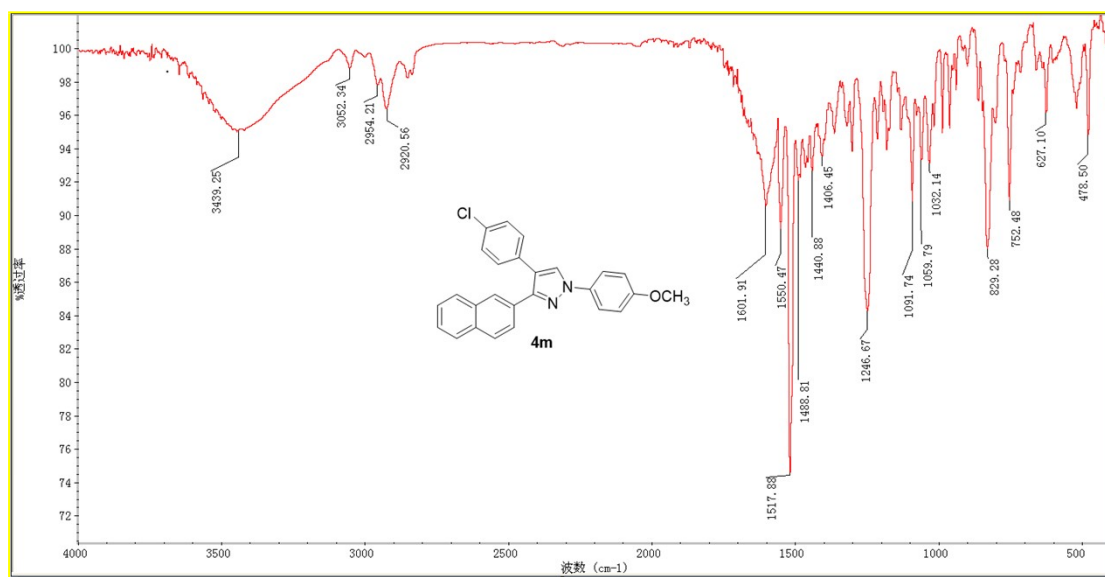
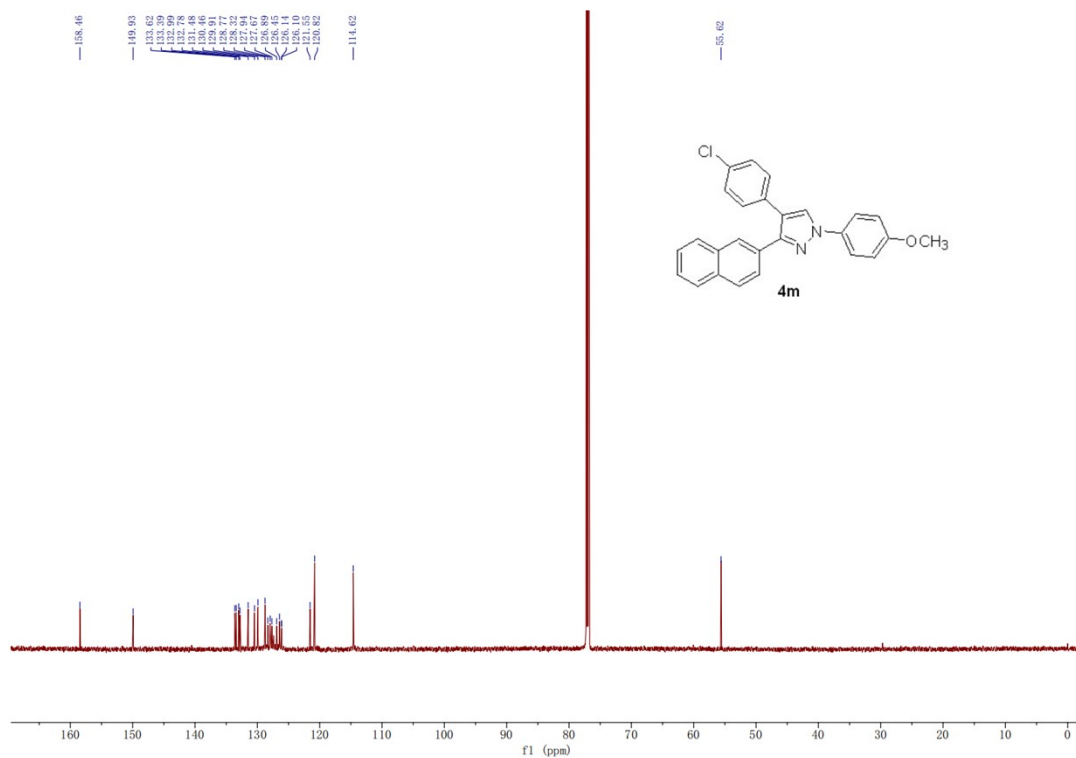


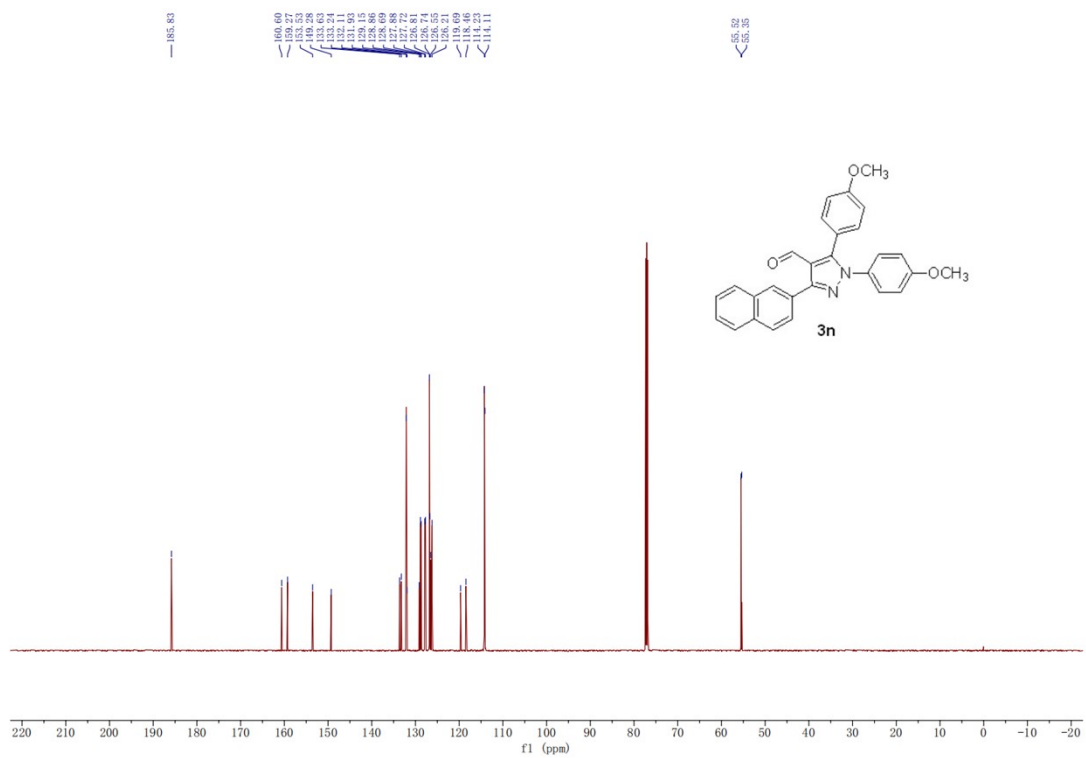
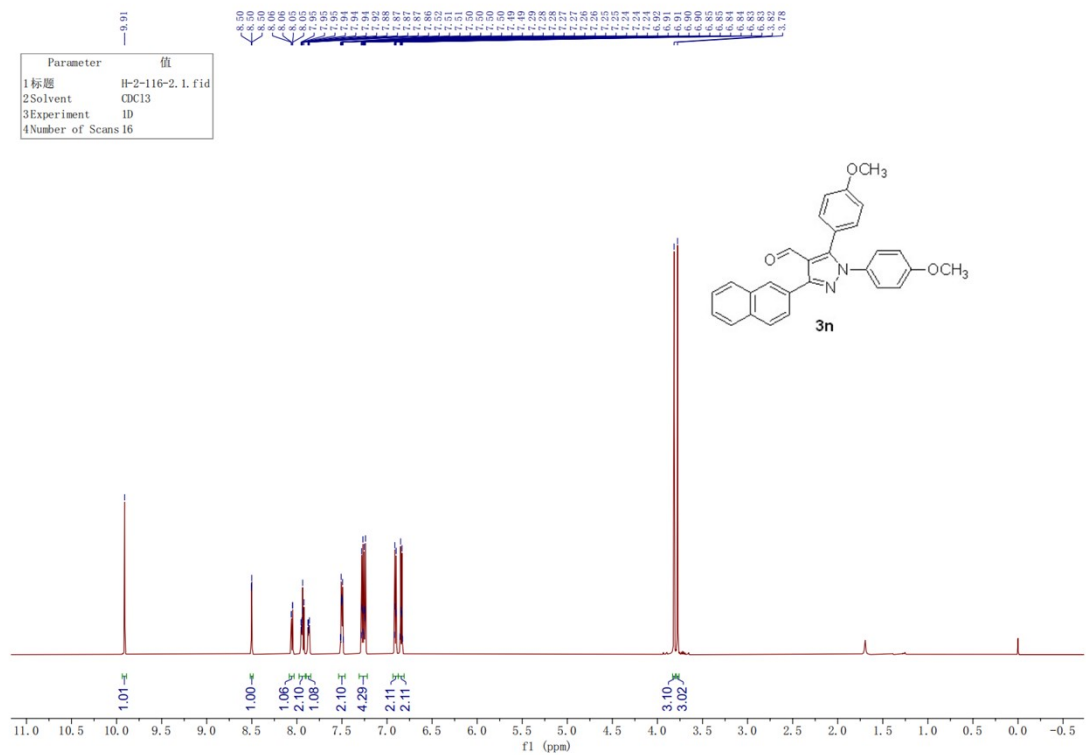


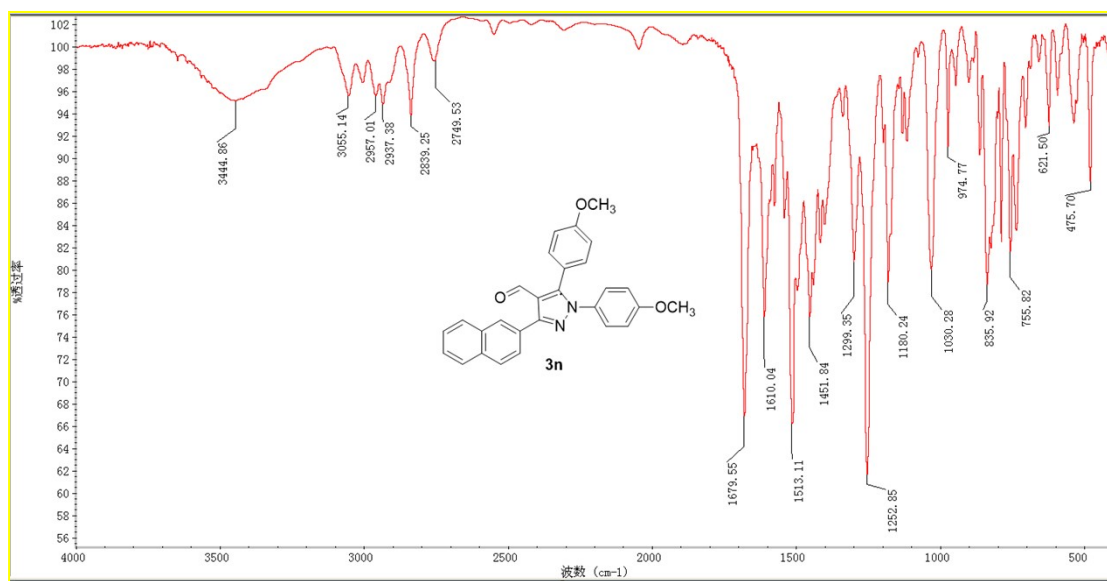


Parameter	值
1 标题	H-2-113-1.26.fid
2 Solvent	CDCl3
3 Experiment	1D
4 Number of Scans	16

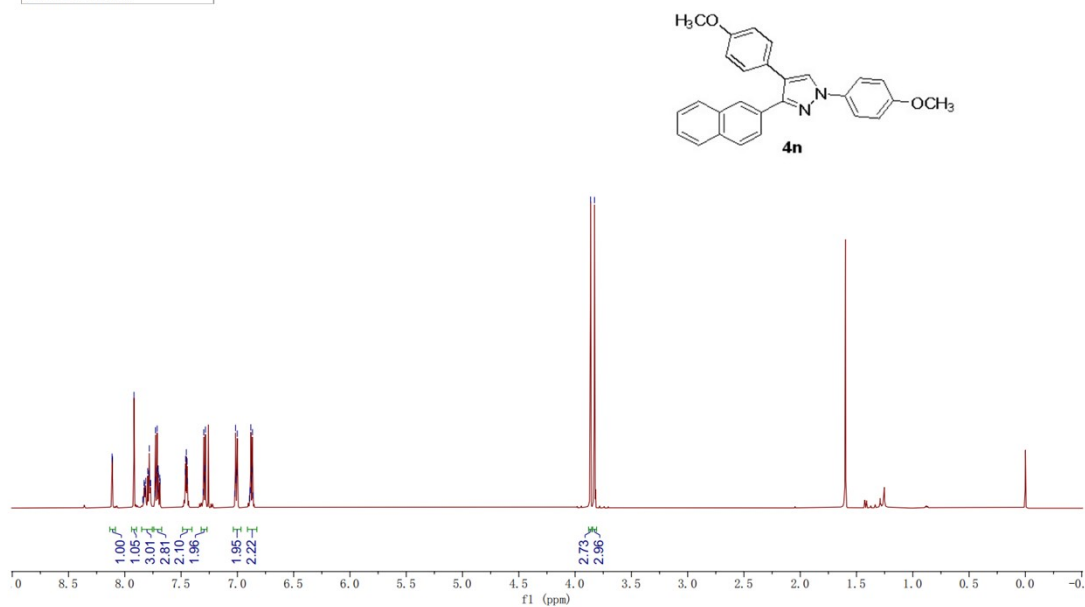


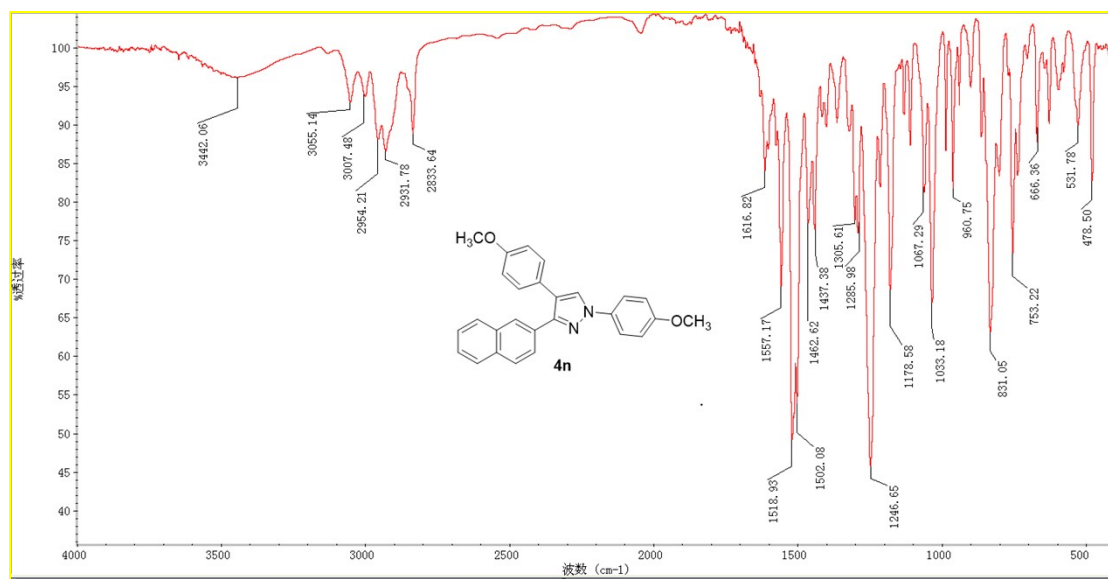
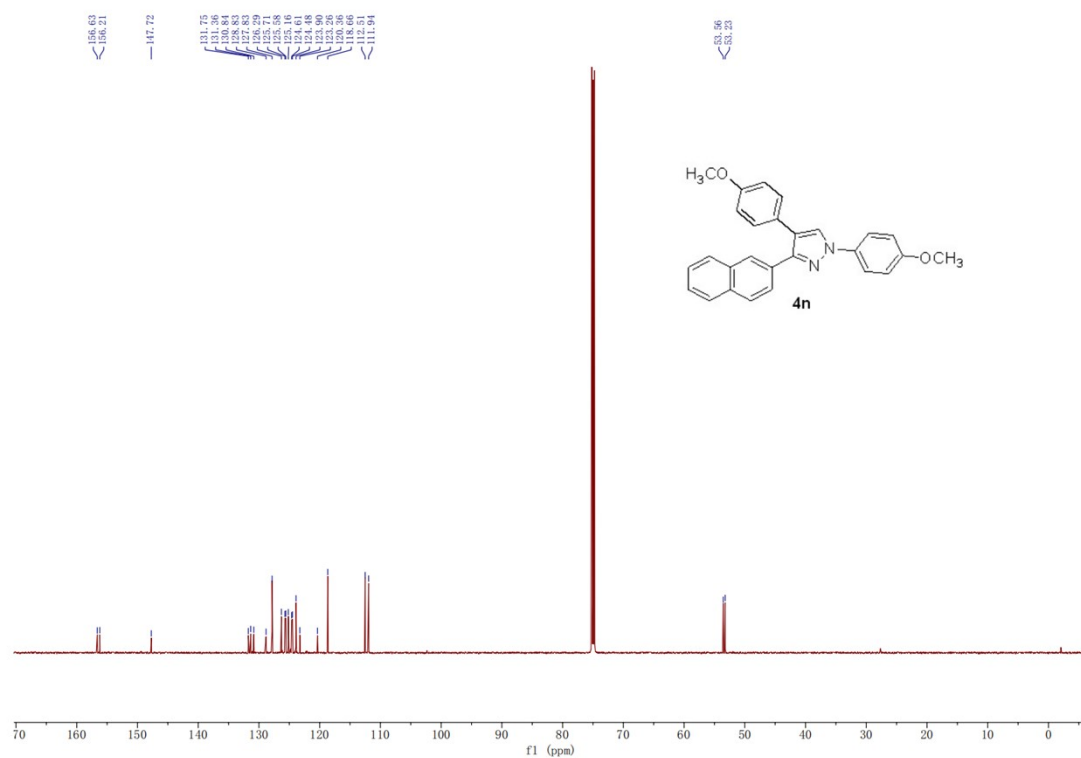


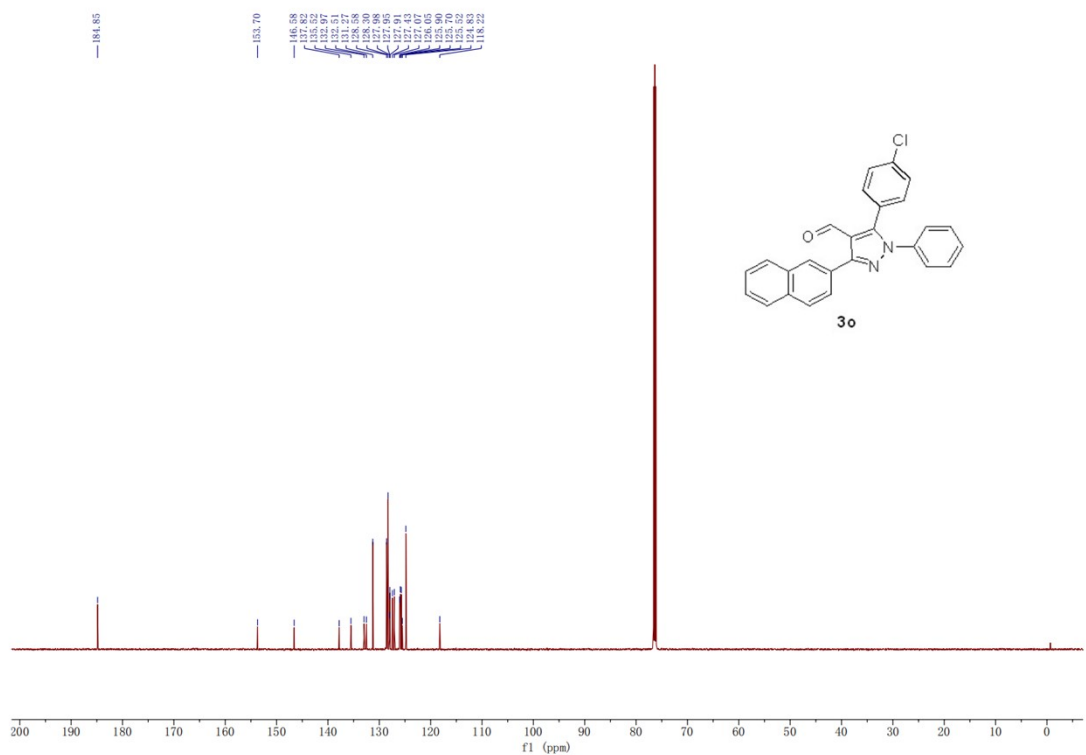
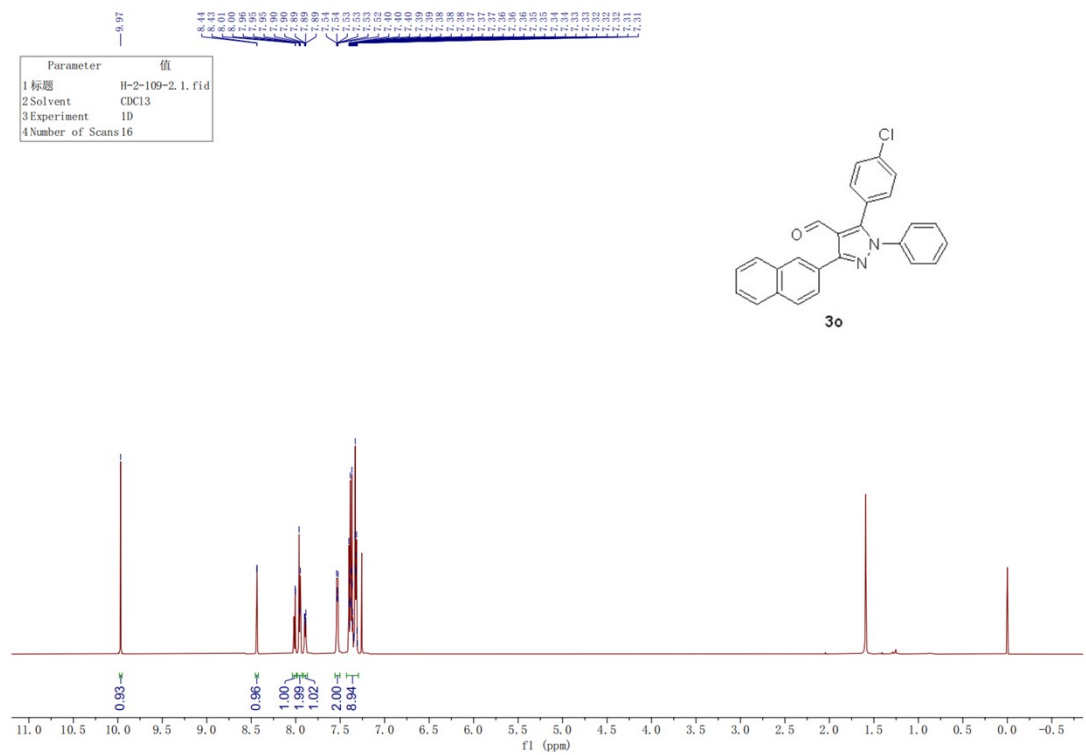


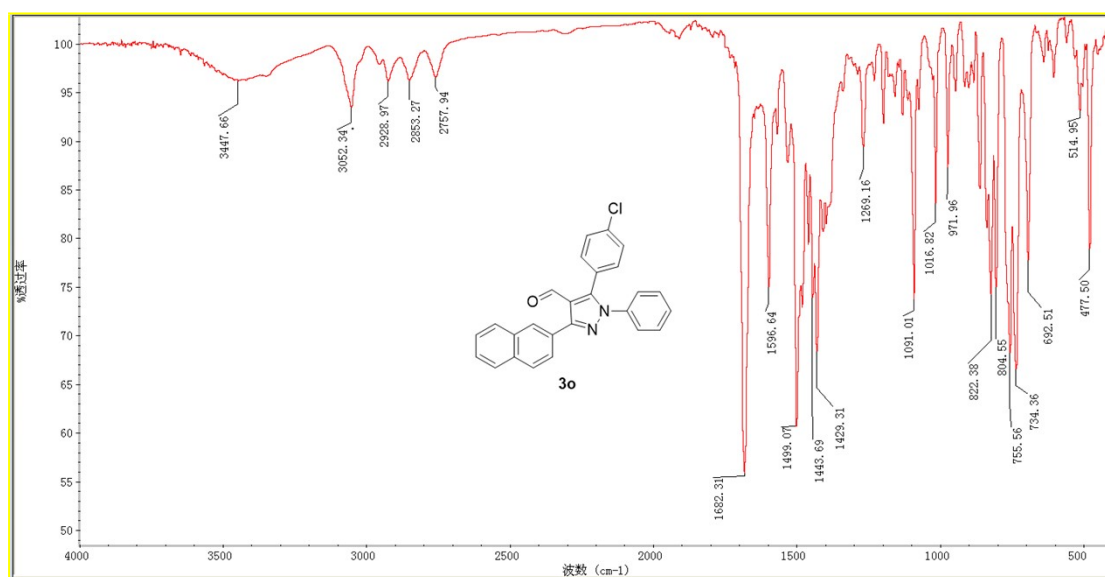


Parameter	值
1 标题	H-2-116-1.3.fid
2 Solvent	CDCl3
3 Experiment	1D
4 Number of Scans	16

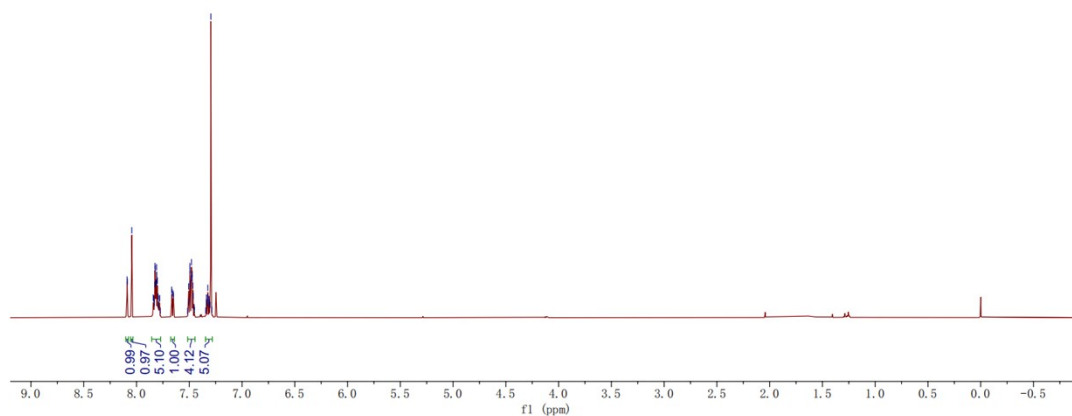
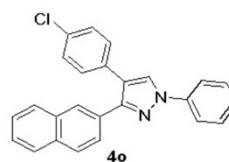


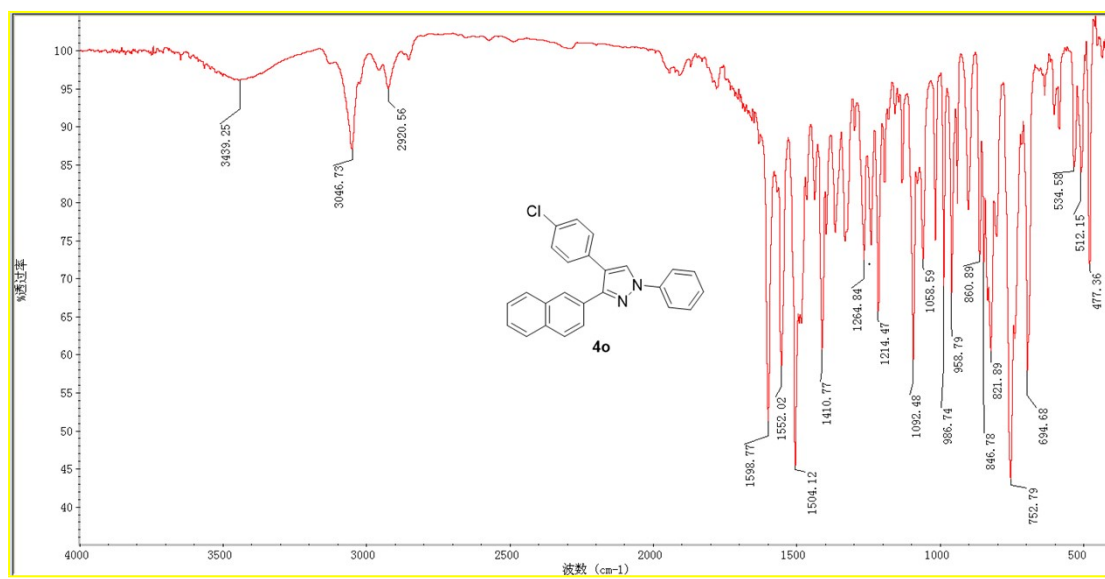
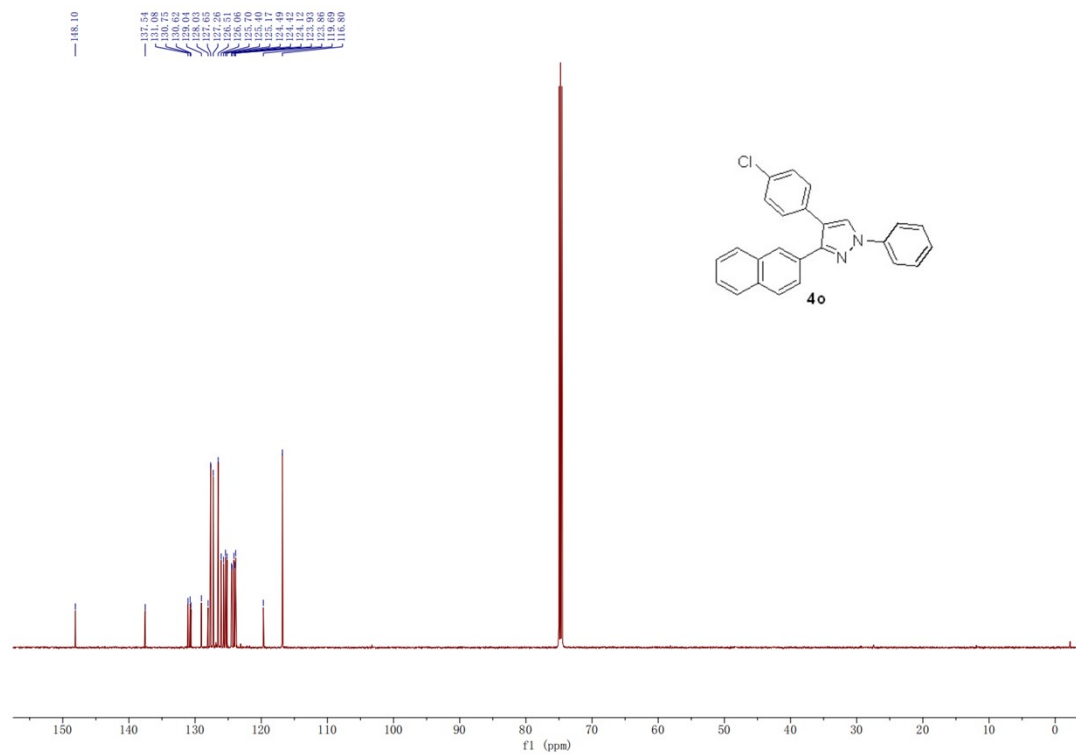


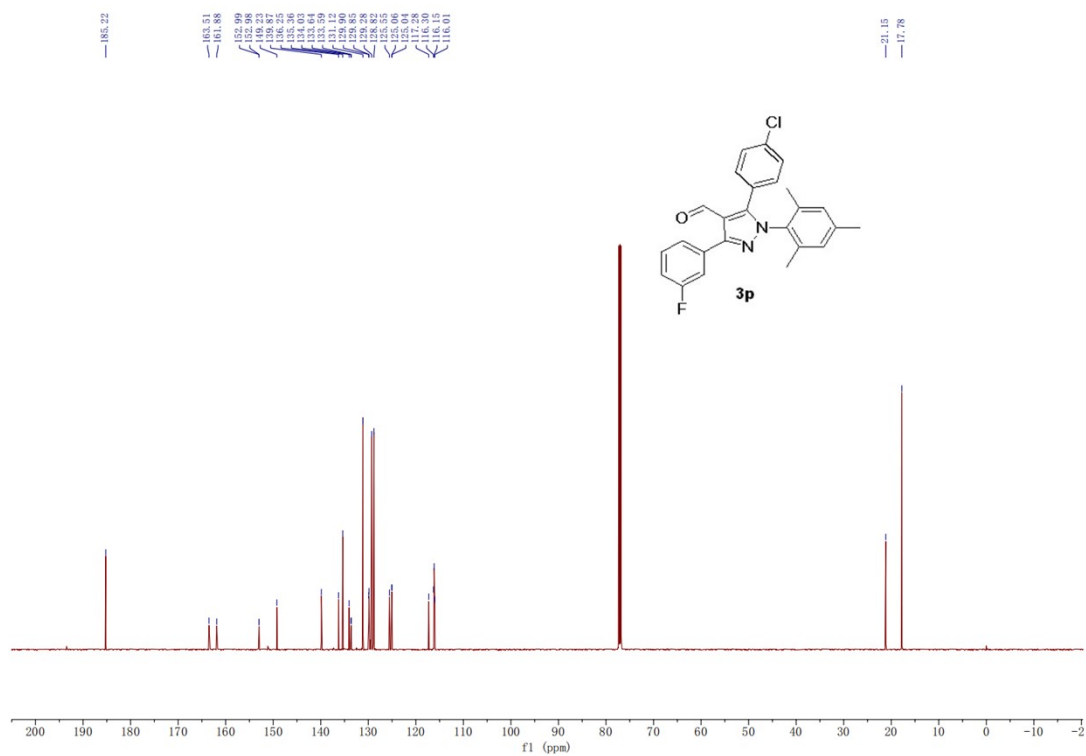
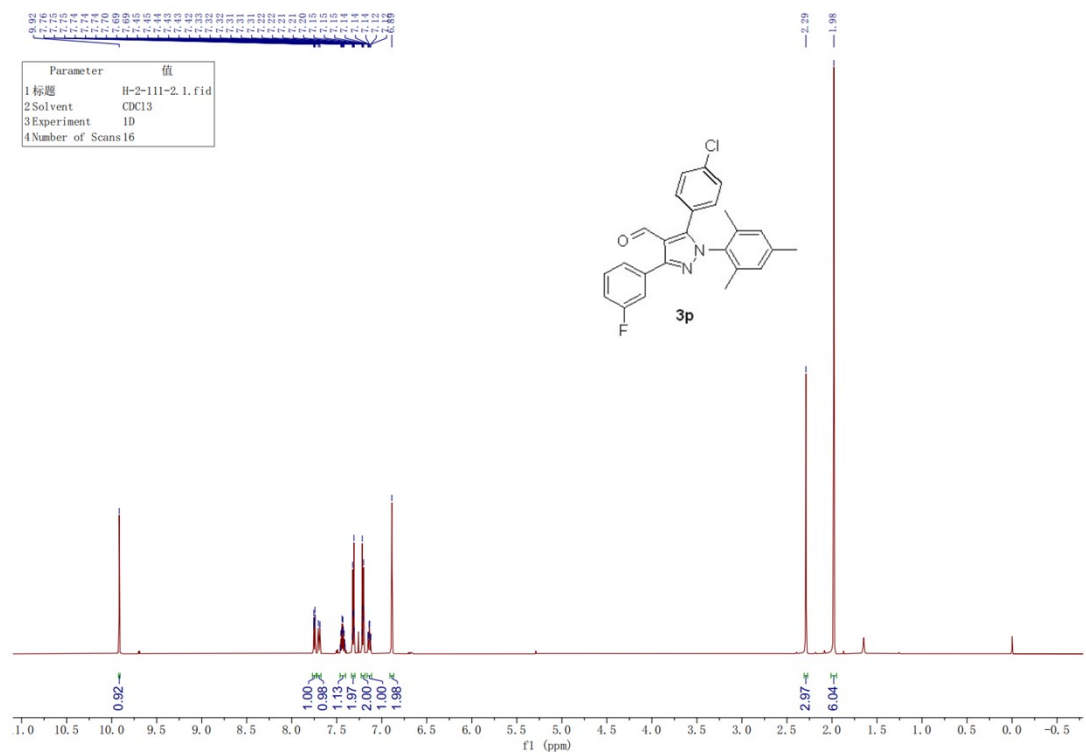


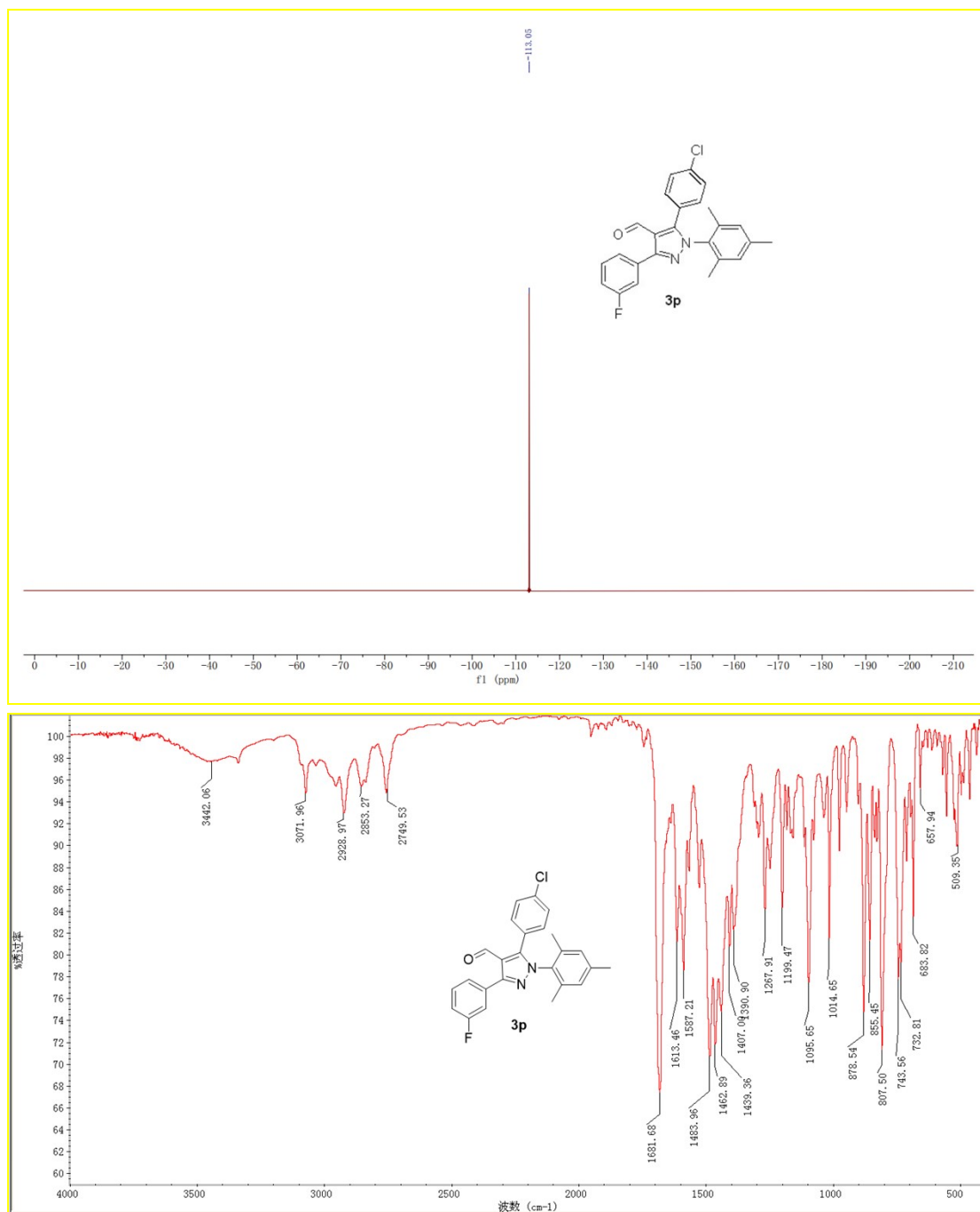


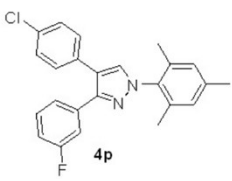
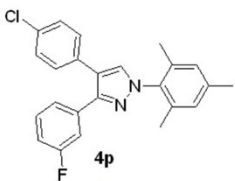
Parameter	值
1标题	H-2-109-1.1.fid
2Solvent	CDCl3
3Experiment	ID
4Number of Scans	16

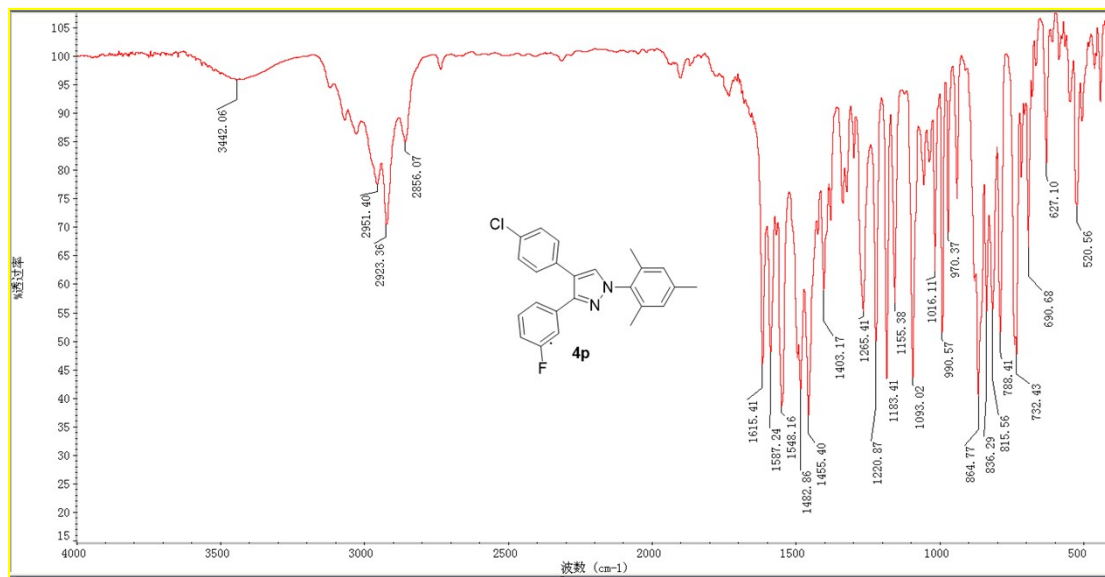
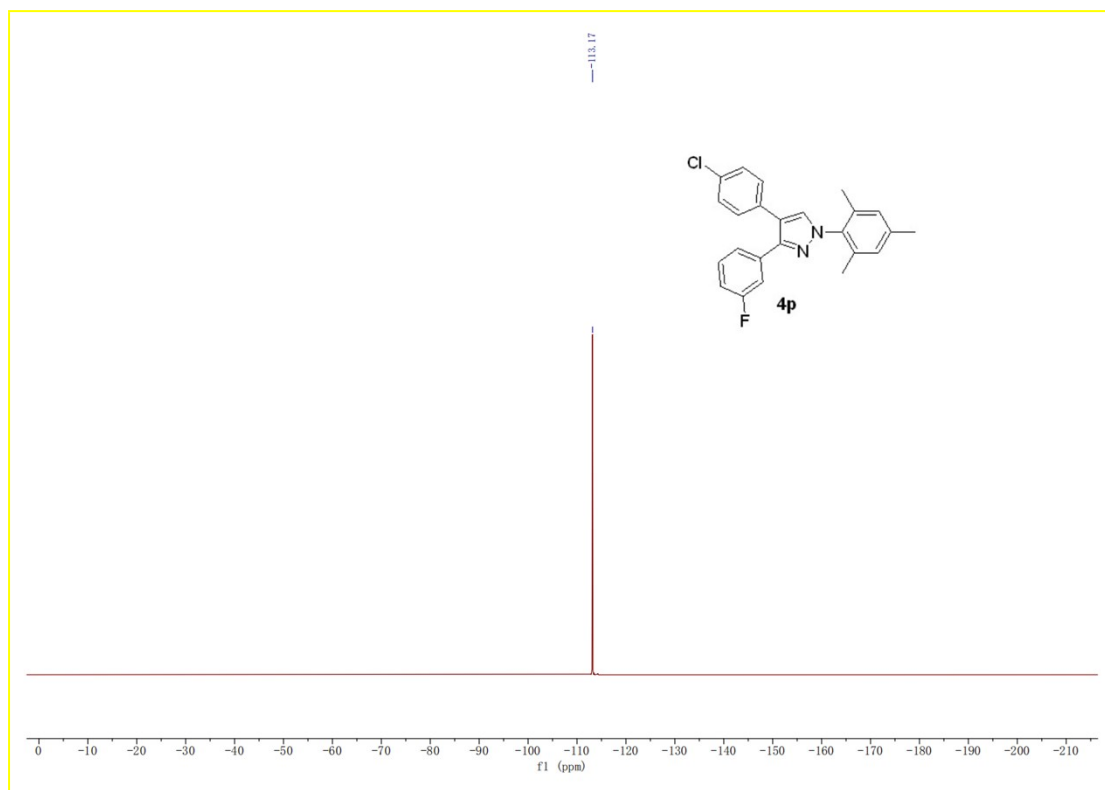


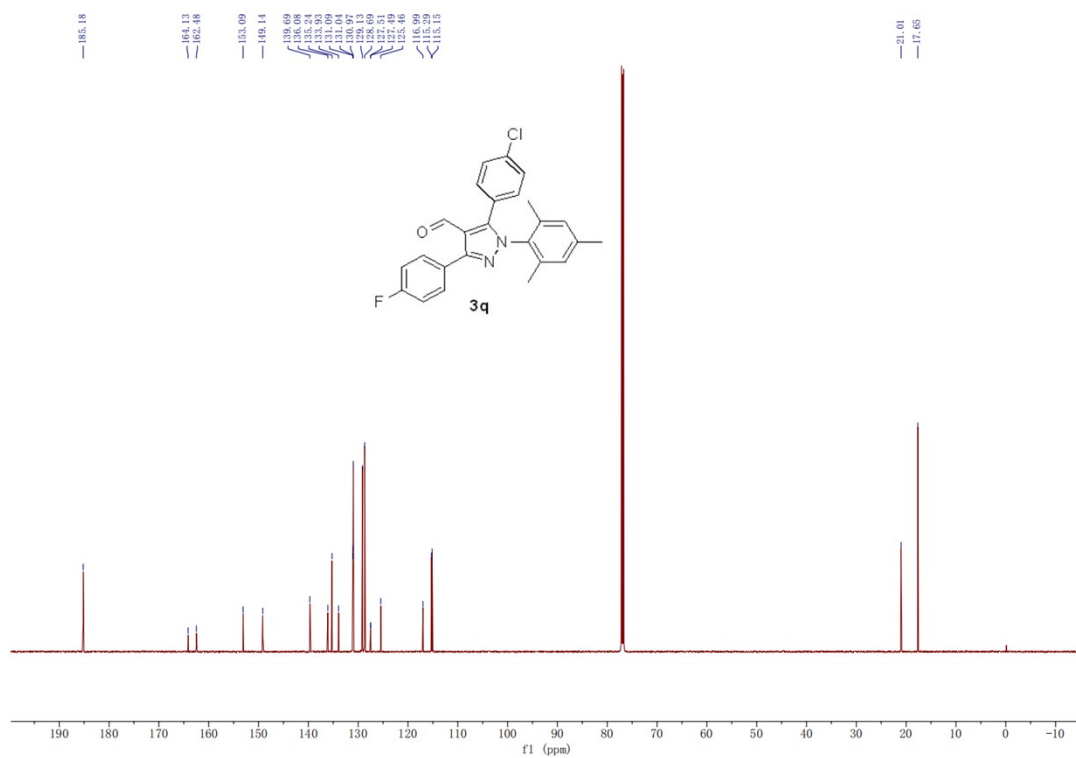


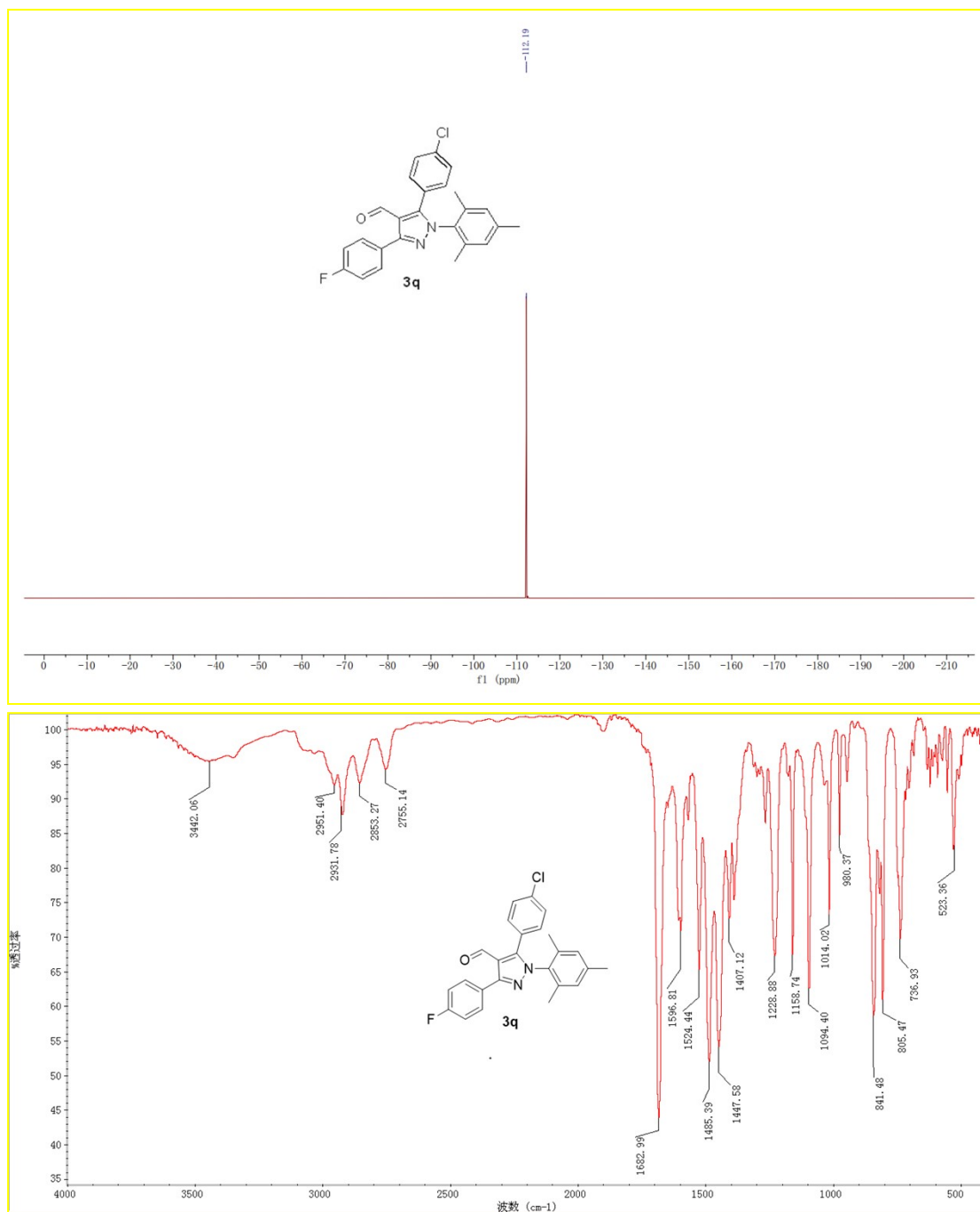


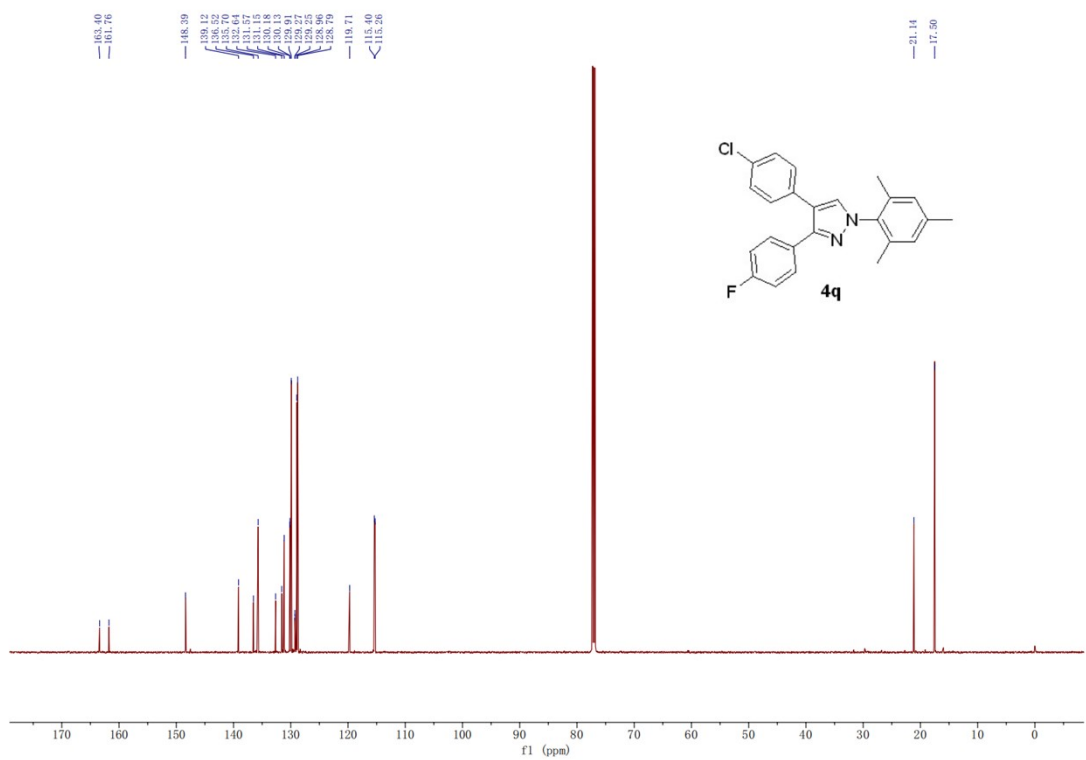
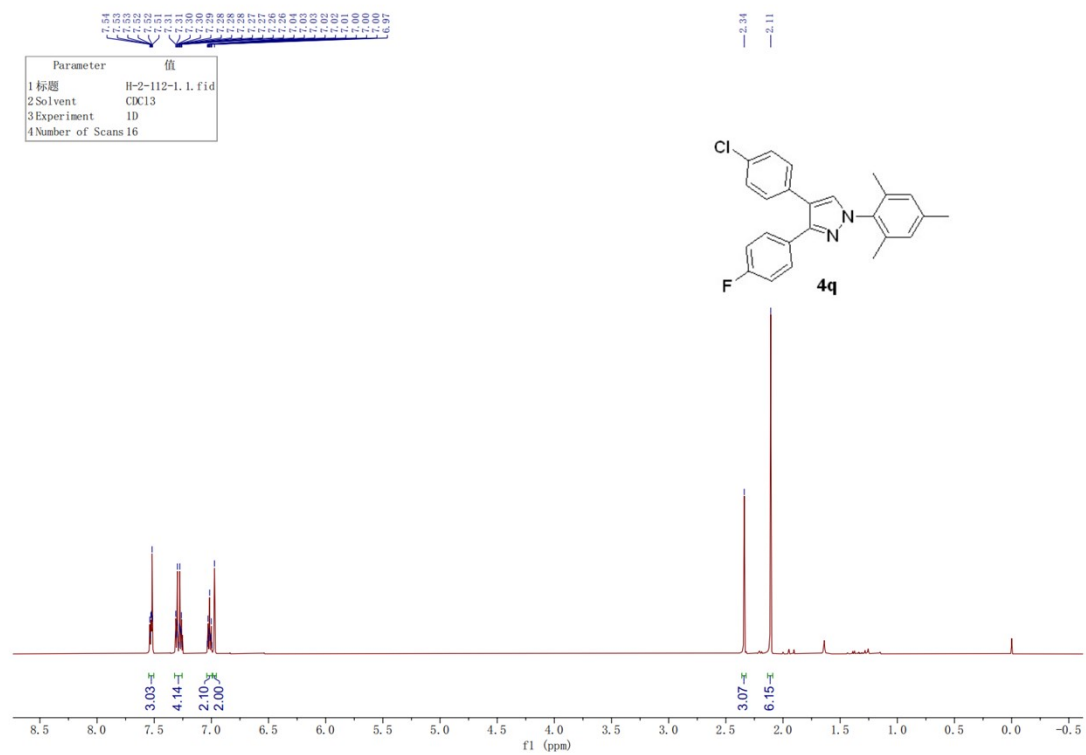


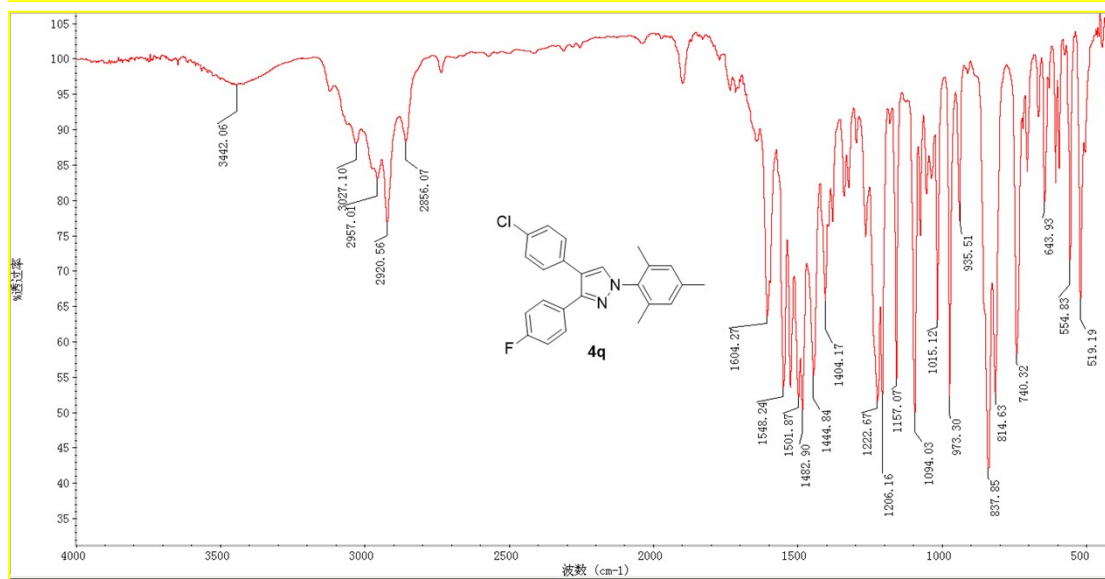
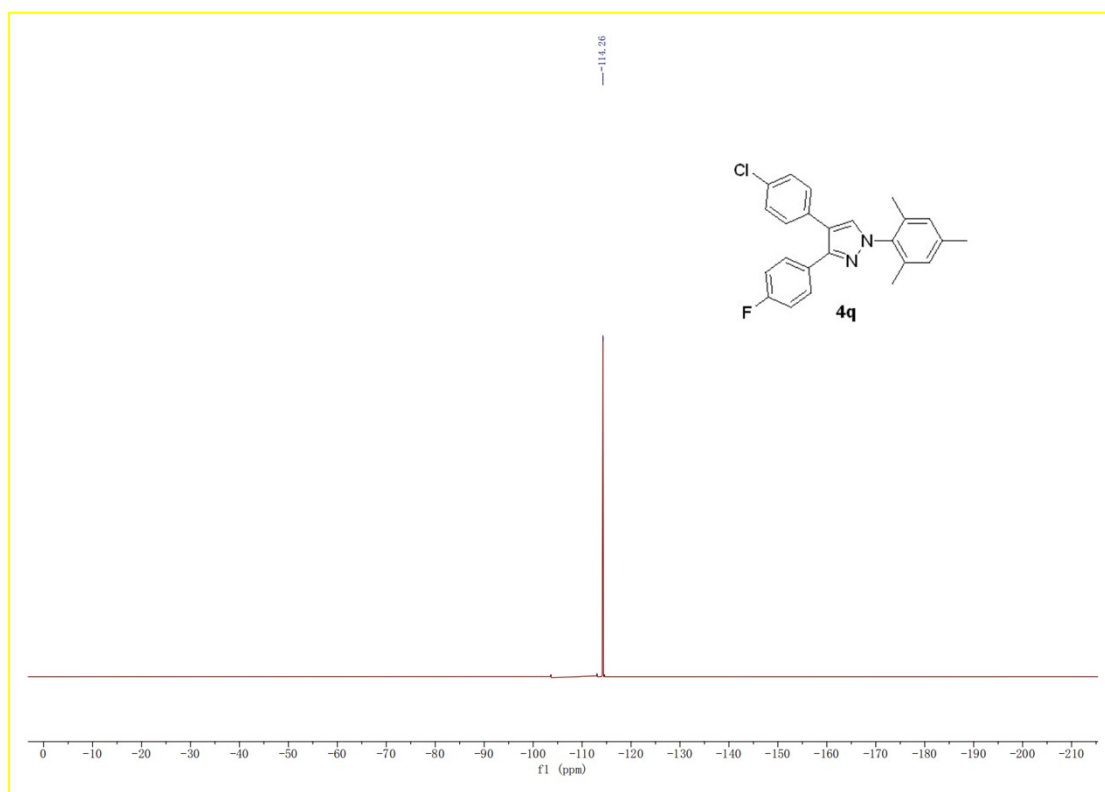


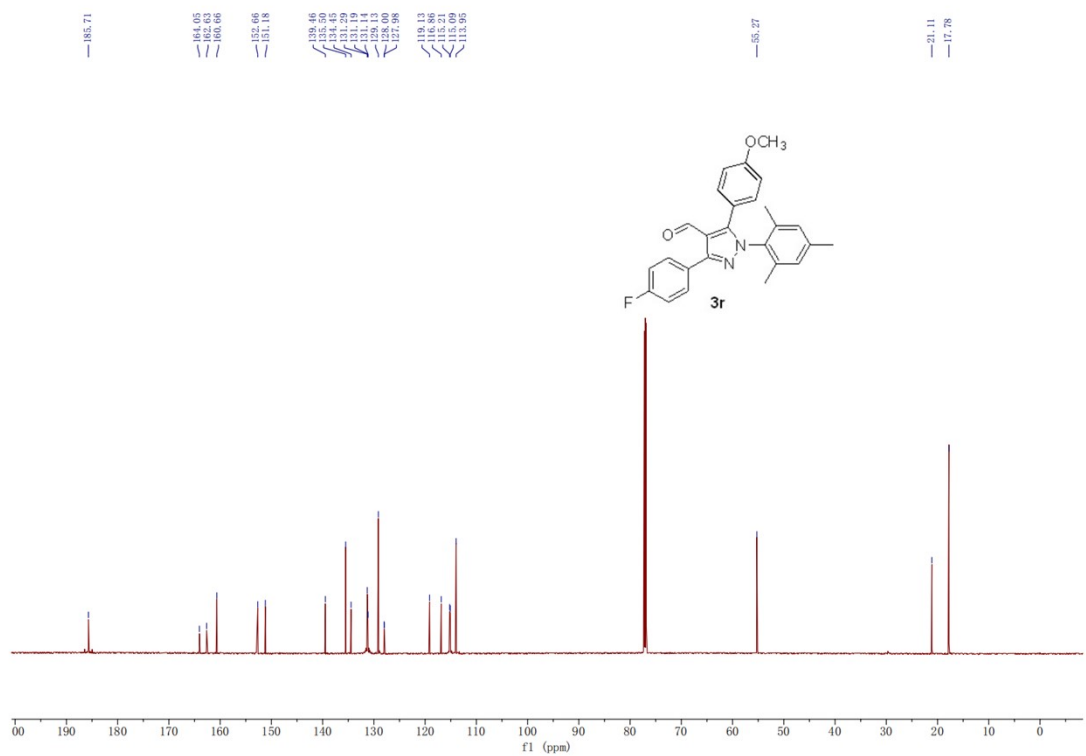
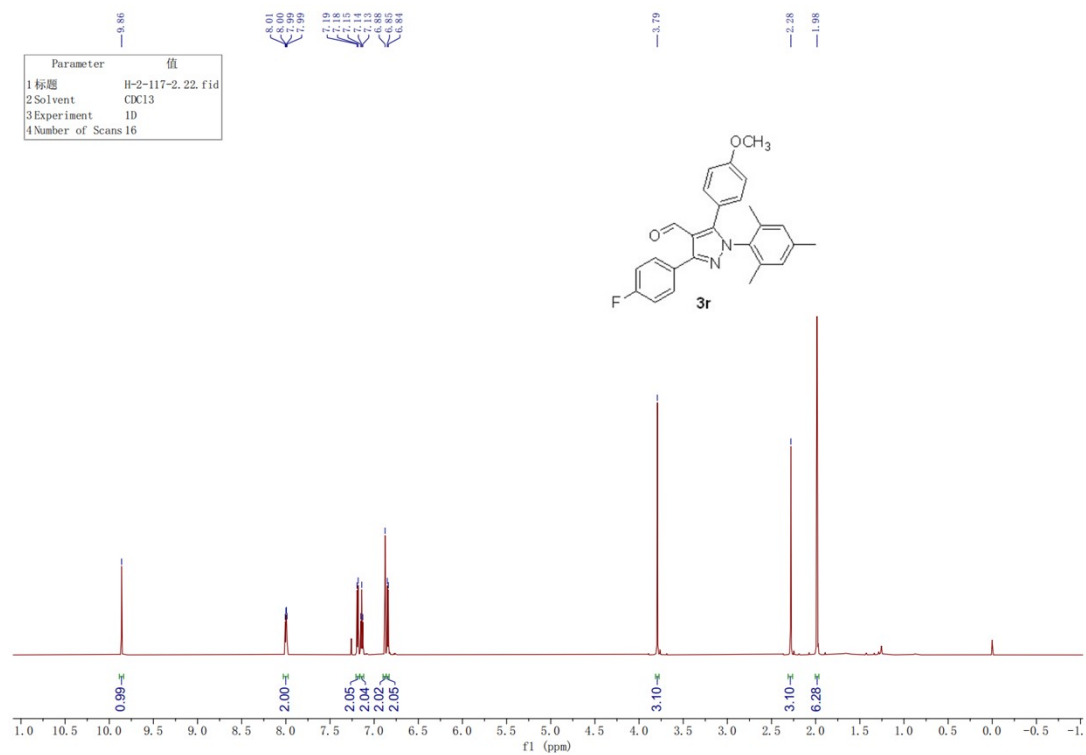


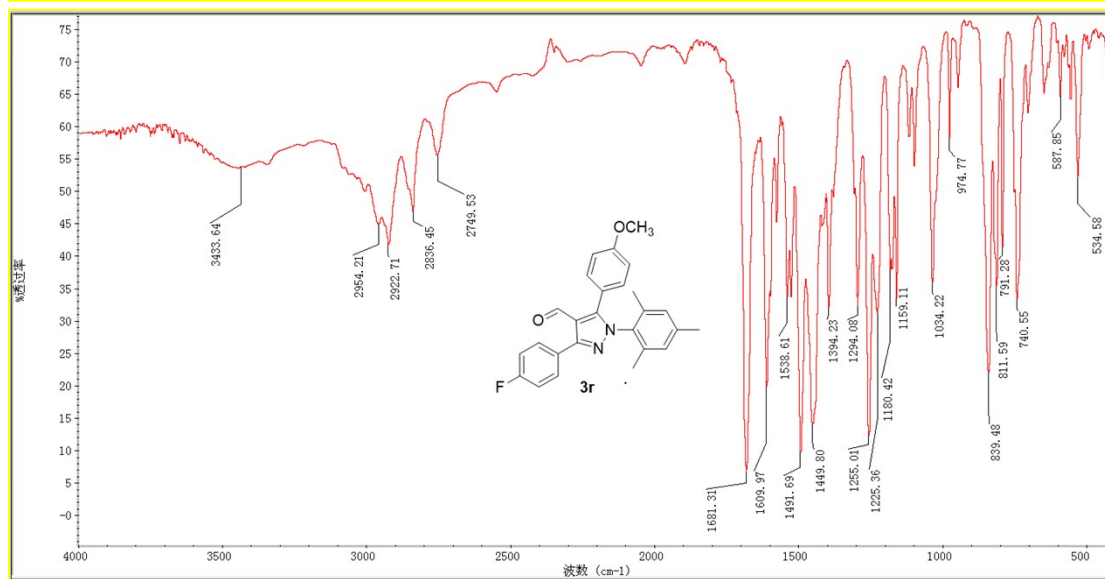
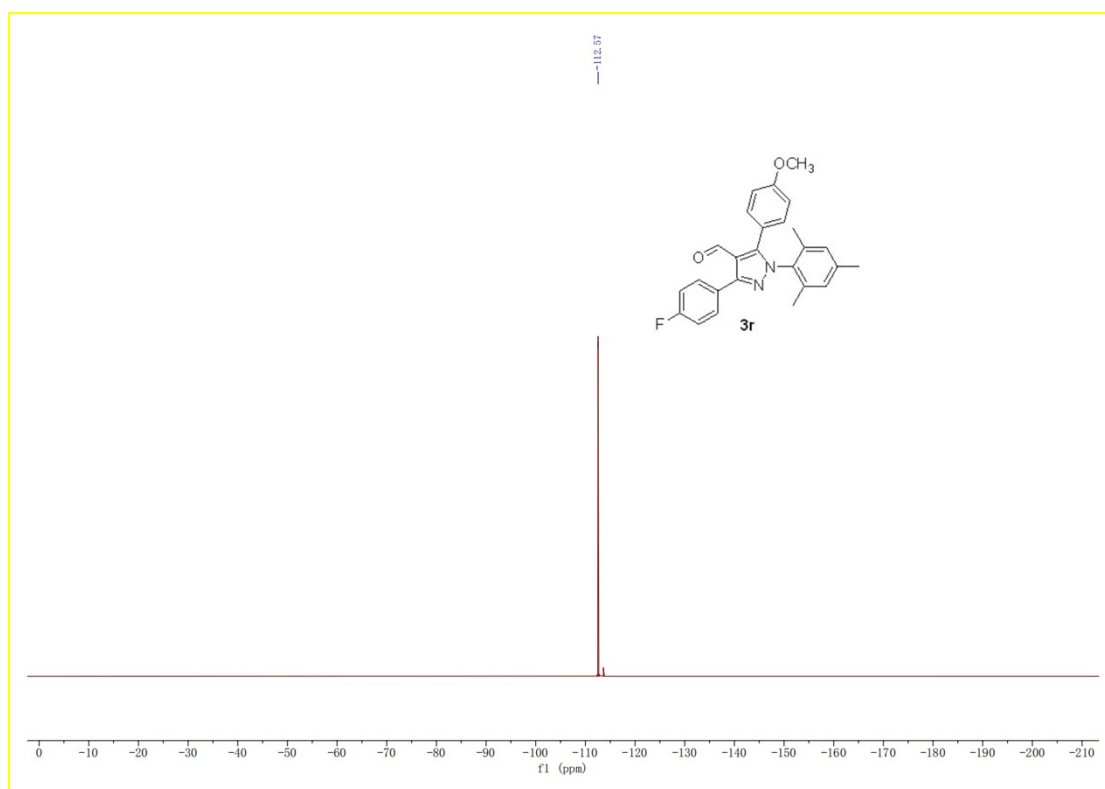


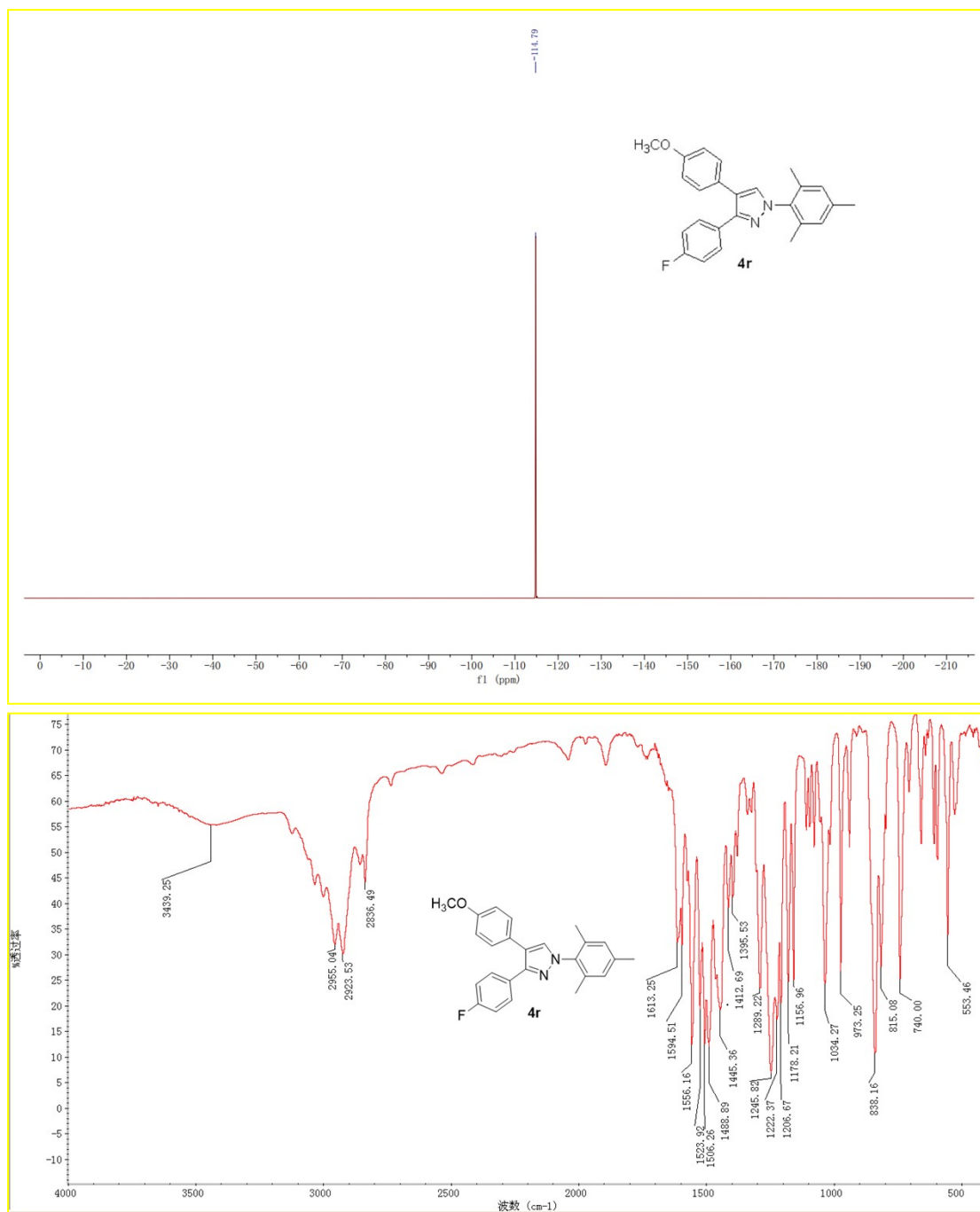


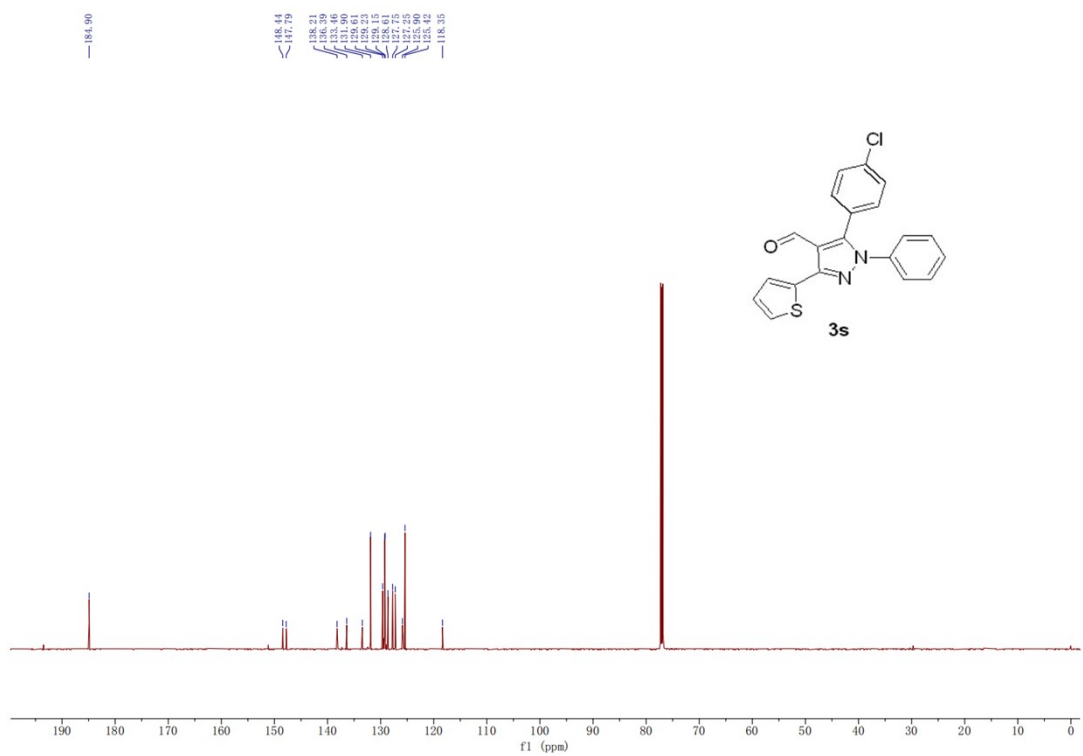
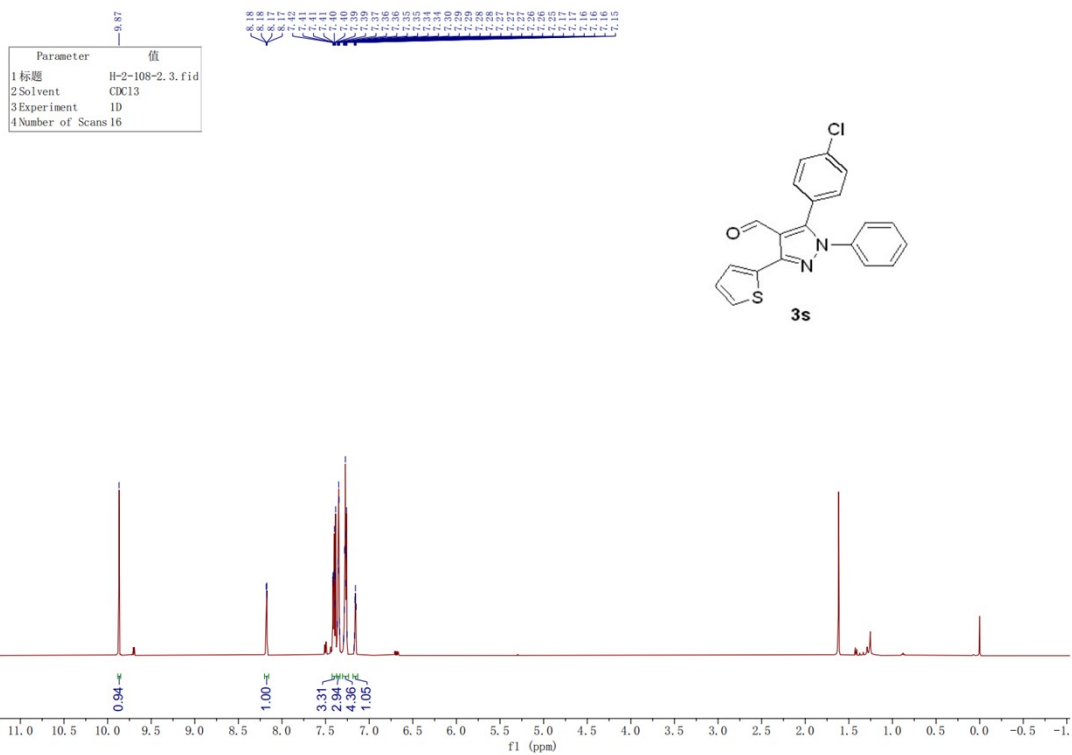


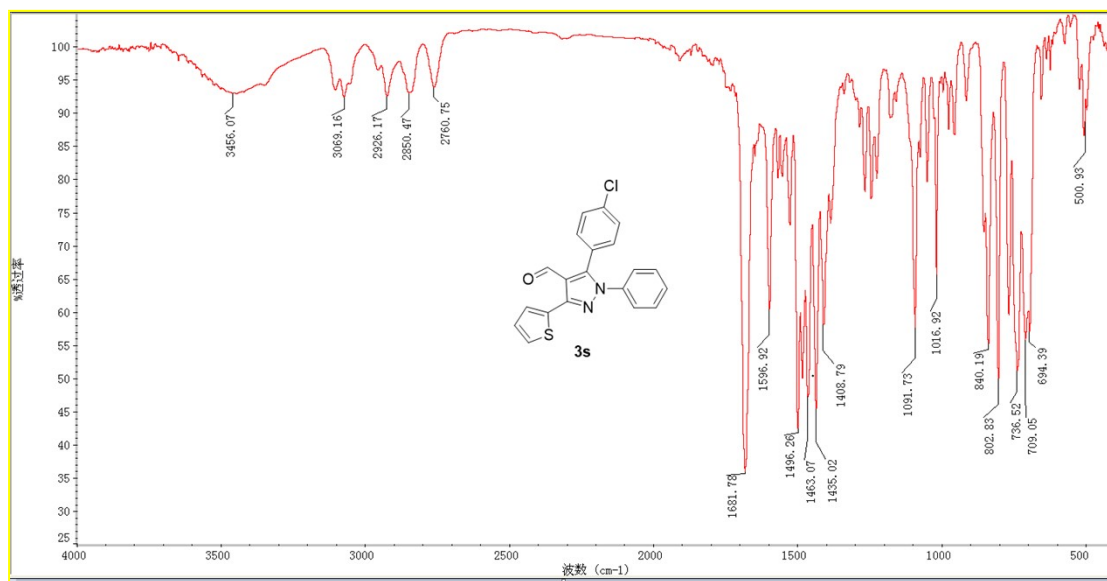




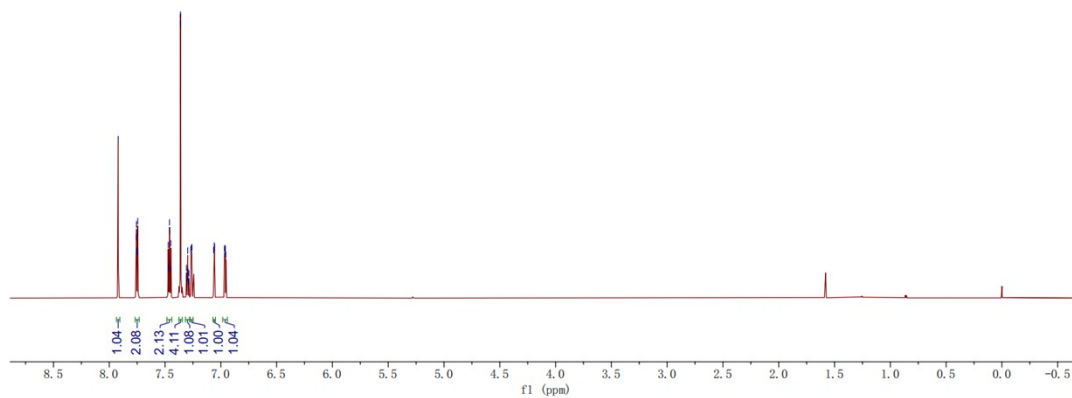
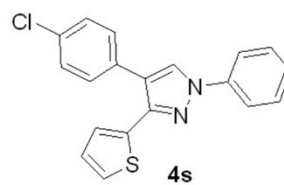


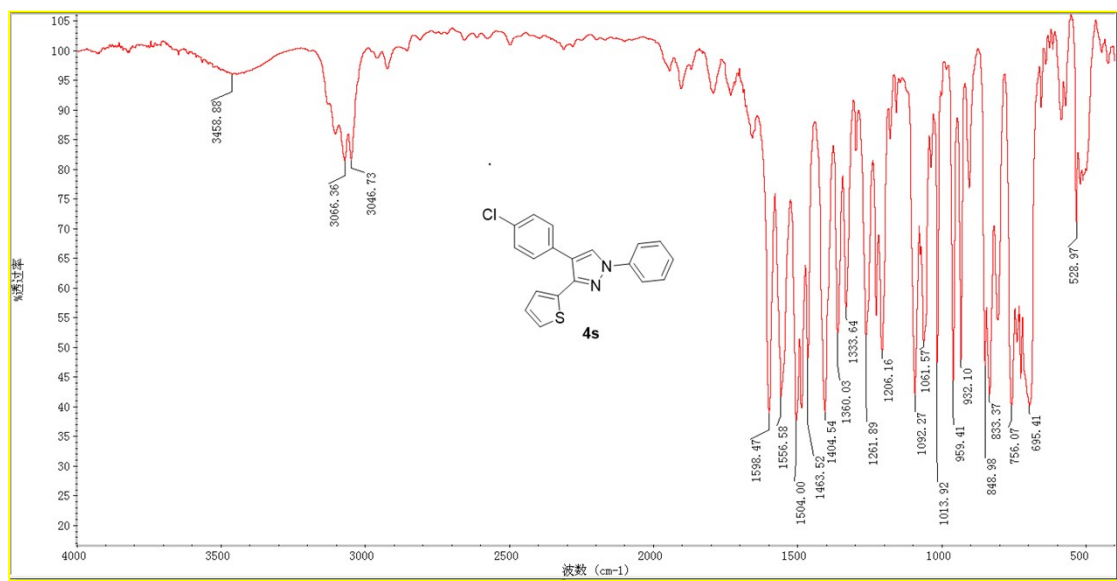
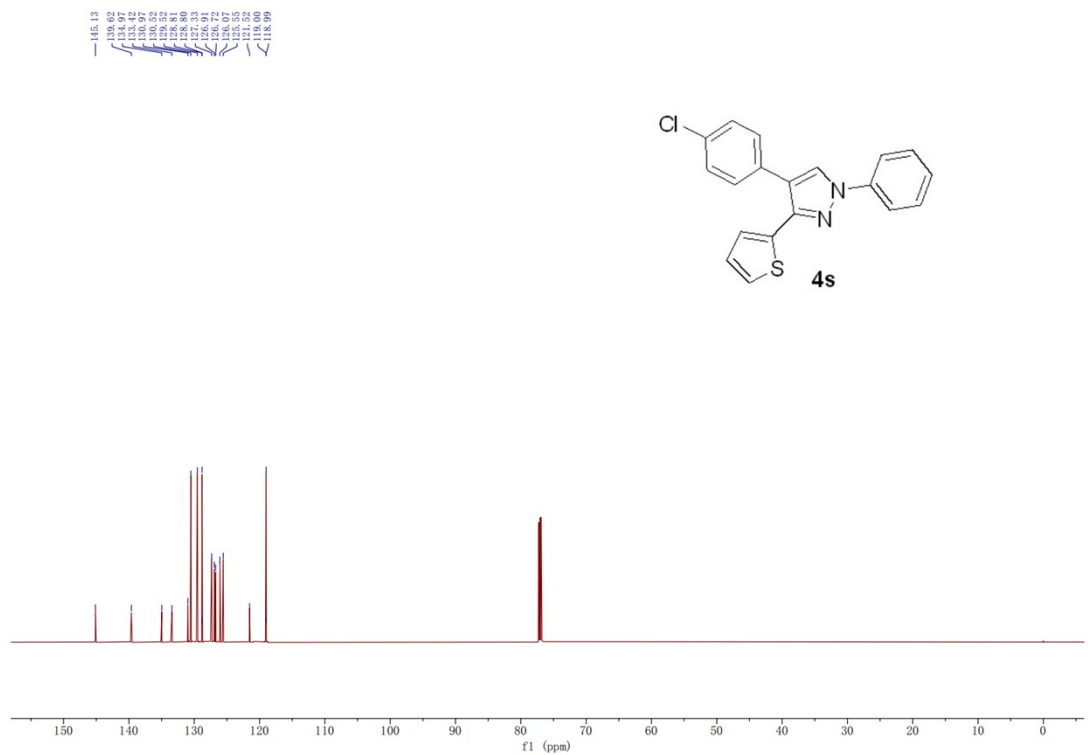




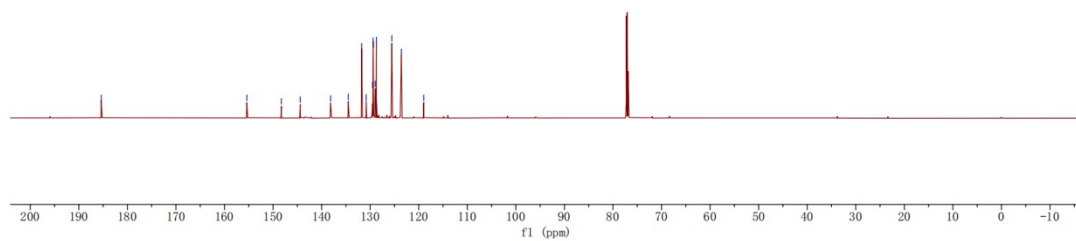
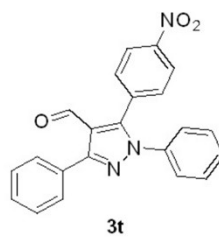
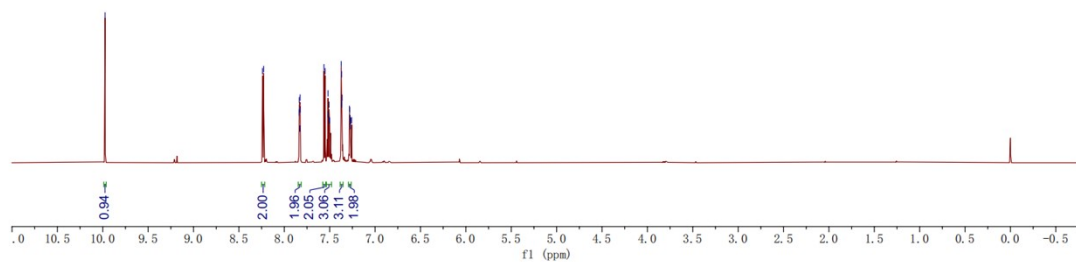
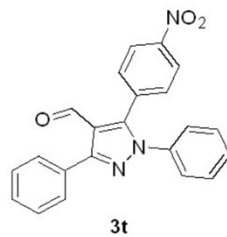


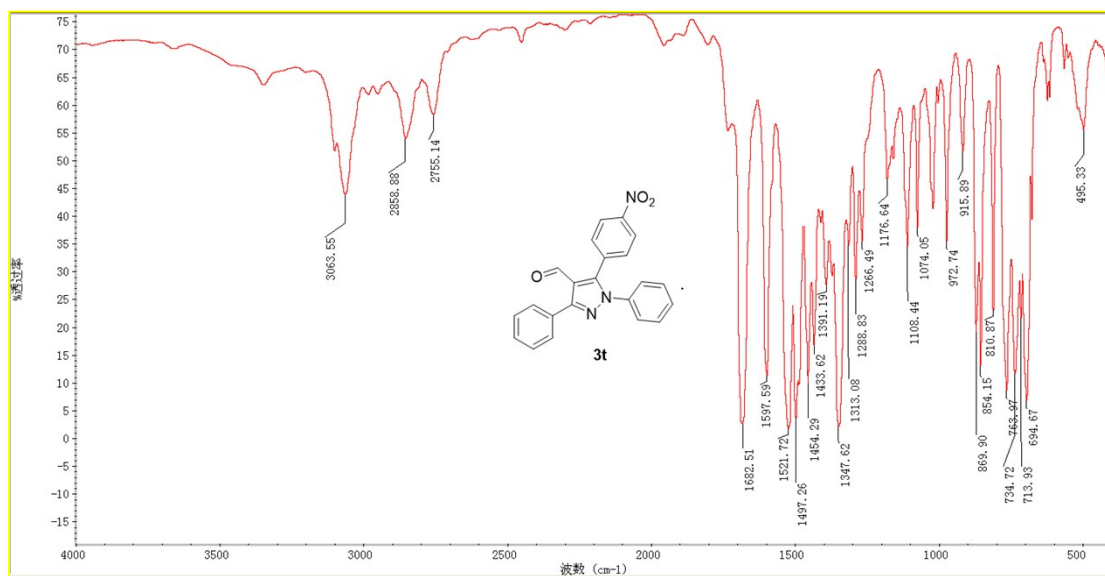
Parameter	值
1标题	H-2-108-1.22.fid
2Solvent	CDCl3
3Experiment	1D
4Number of Scans	16





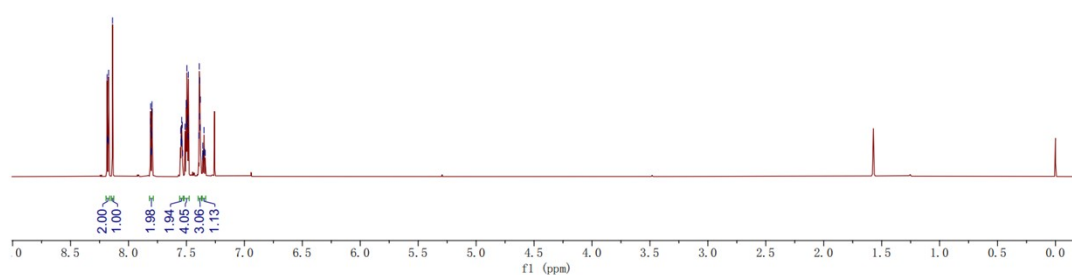
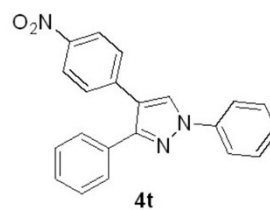
Parameter	值
1 标题	11-3-58-4.24.fid
2 Solvent	CDCl3
3 Experiment	1D
4 Number of Scans	16

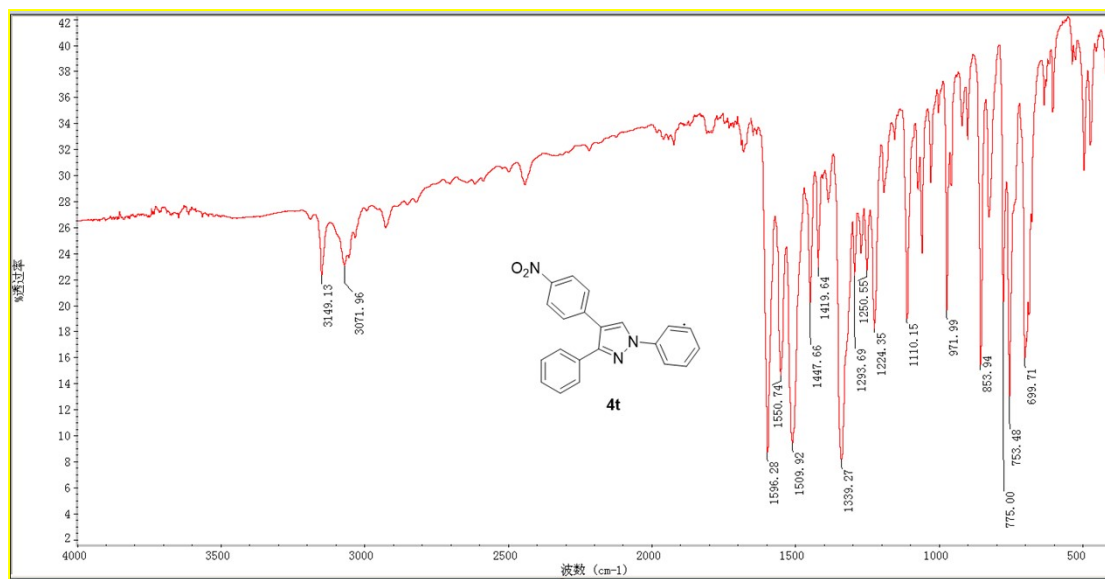
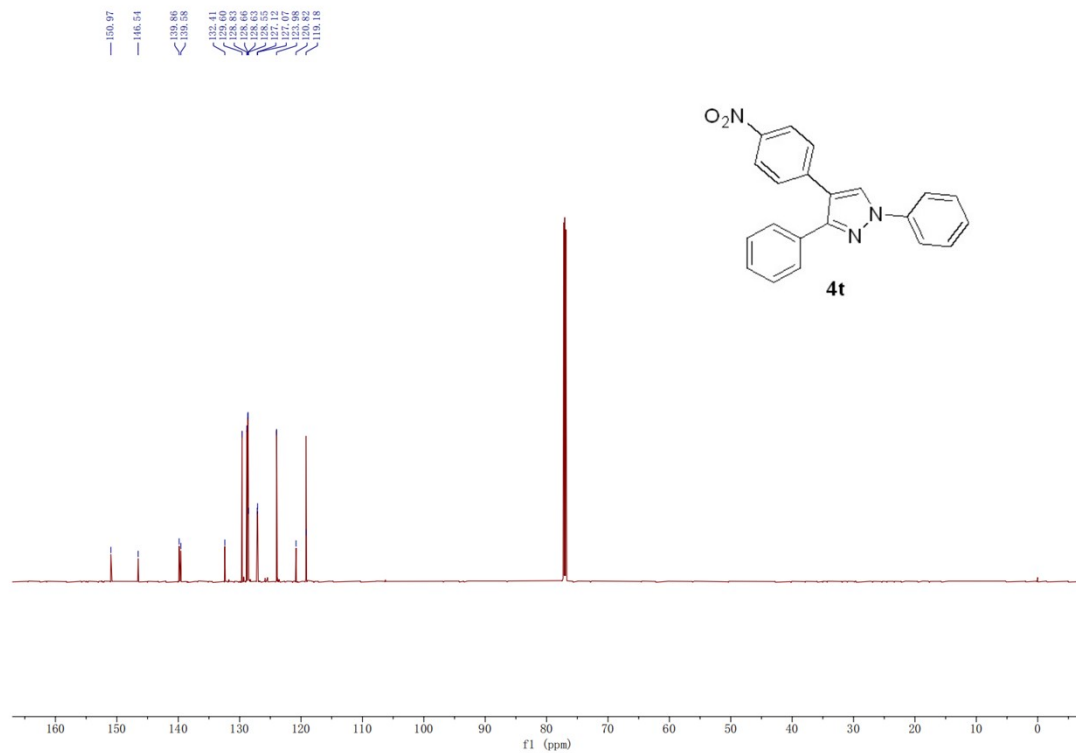




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Parameter	值
1 标题	H-3-58-2.24.fid
2 Solvent	CDCl3
3 Experiment	1D
4 Number of Scans	16

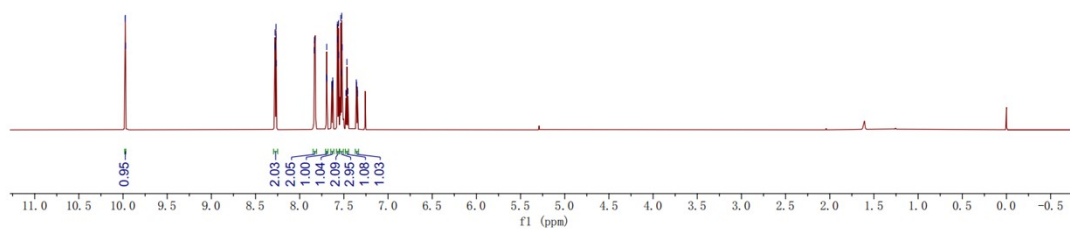




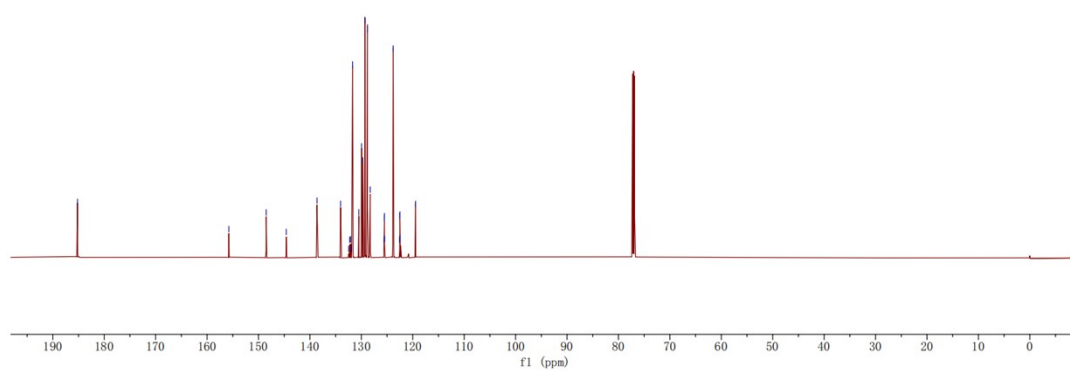
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9.97
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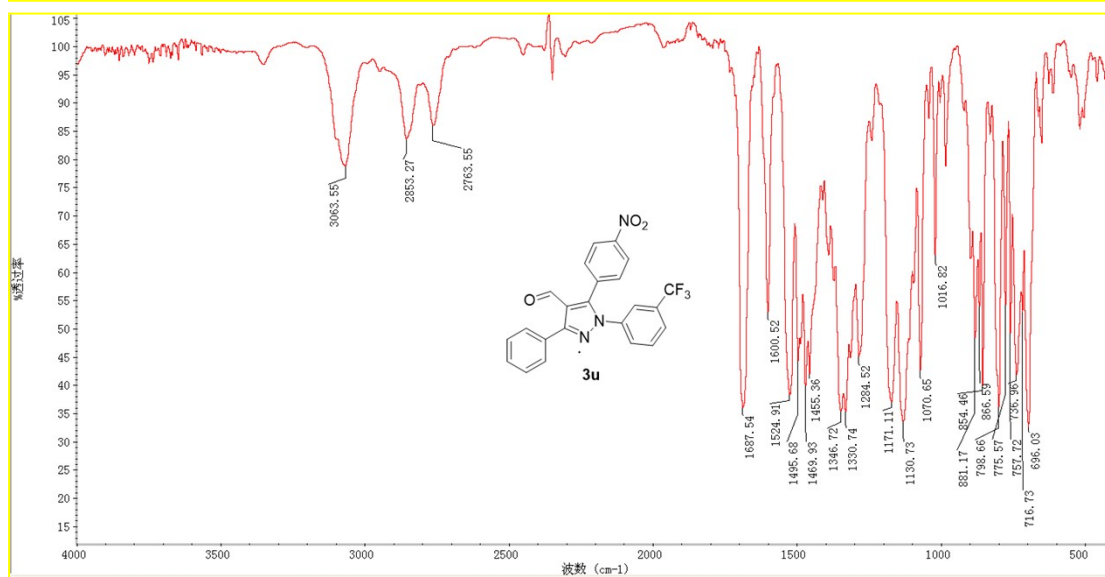
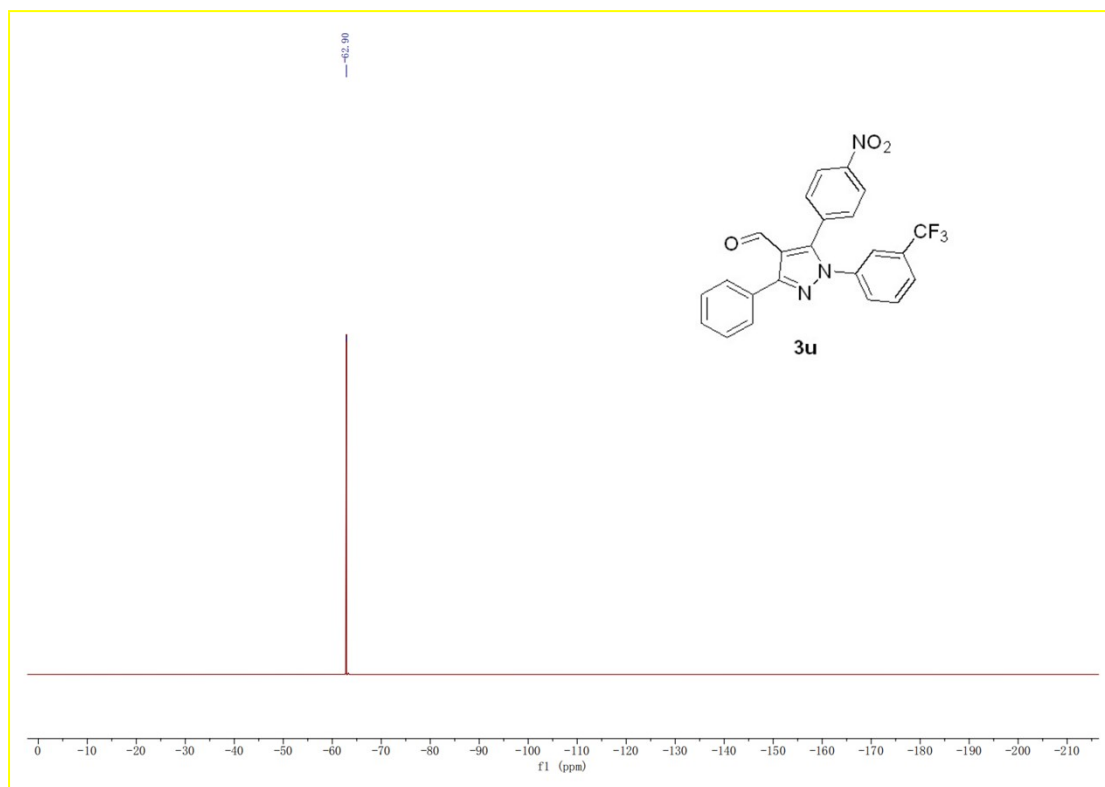


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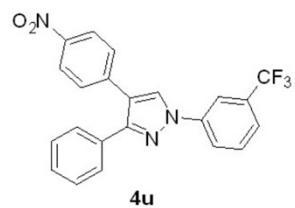
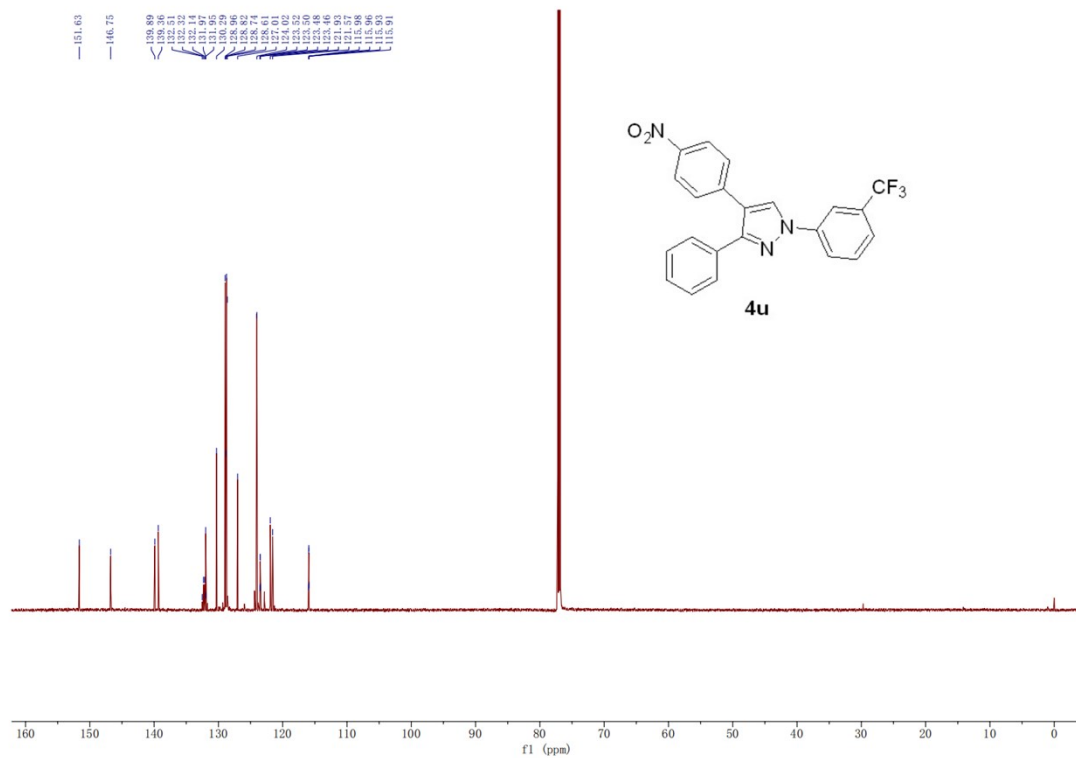
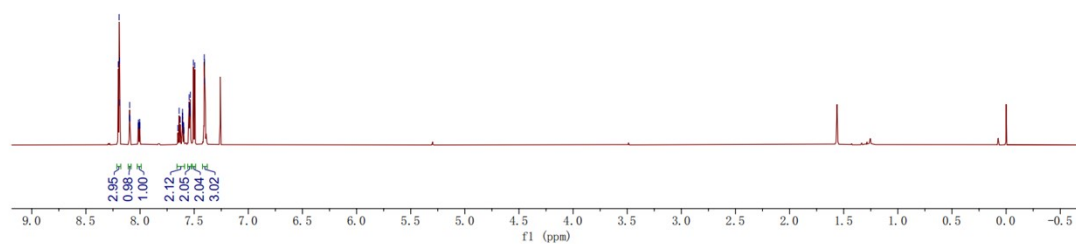
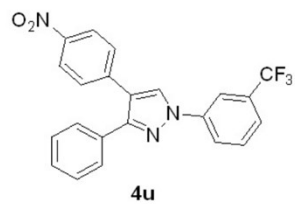
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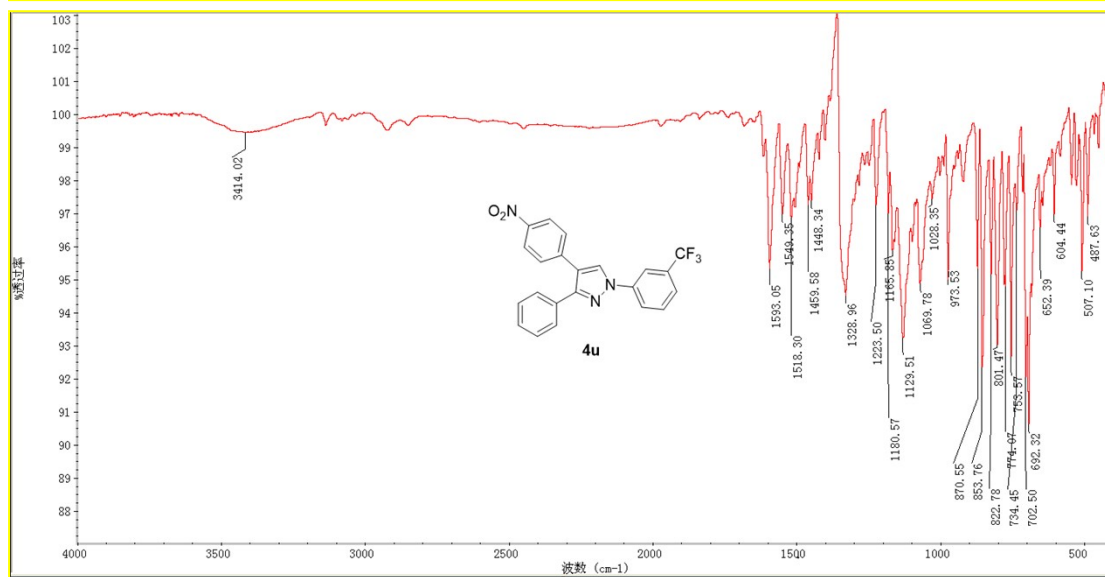
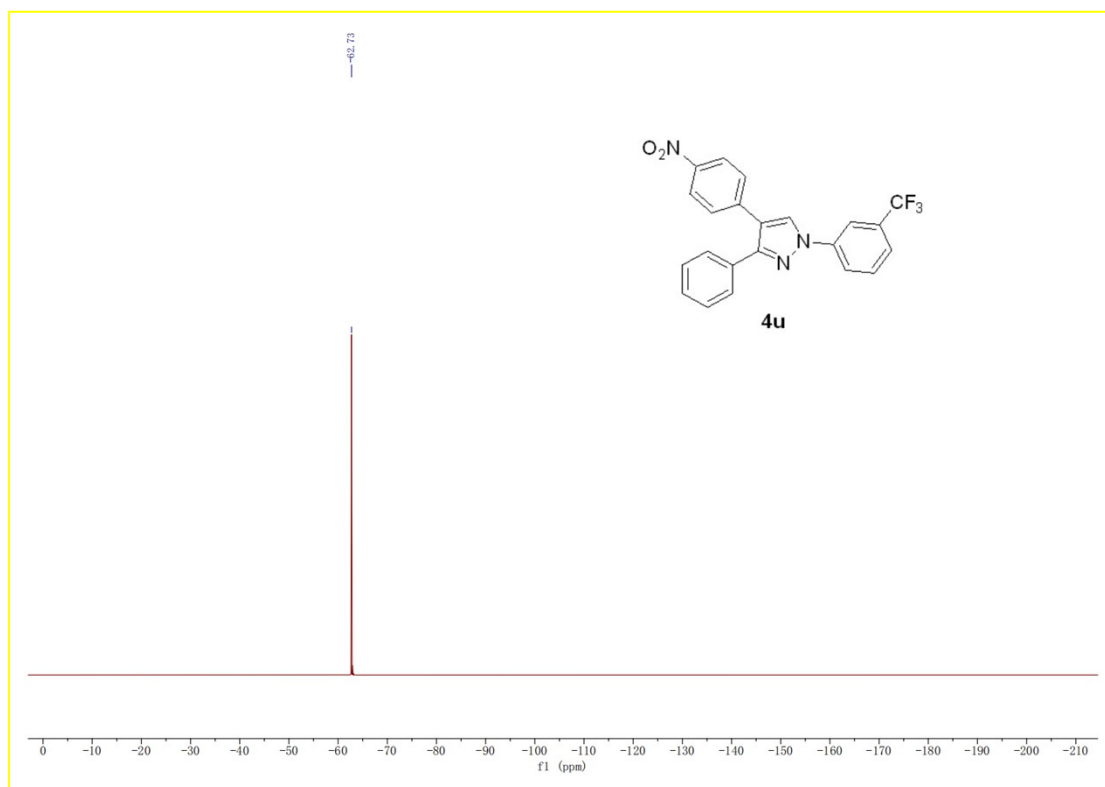


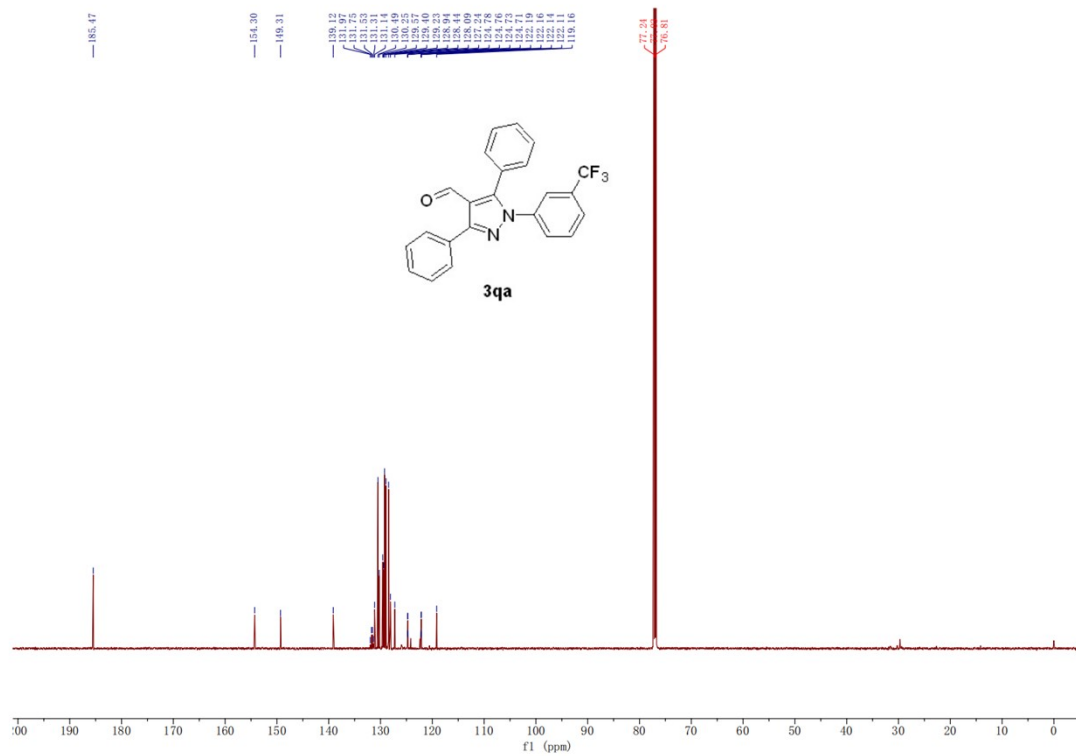


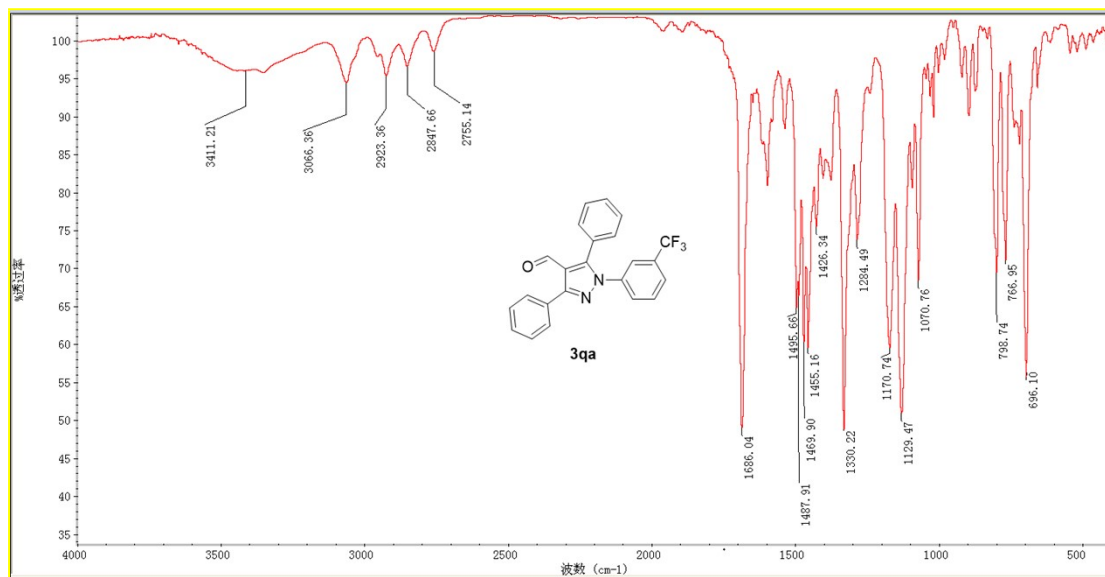
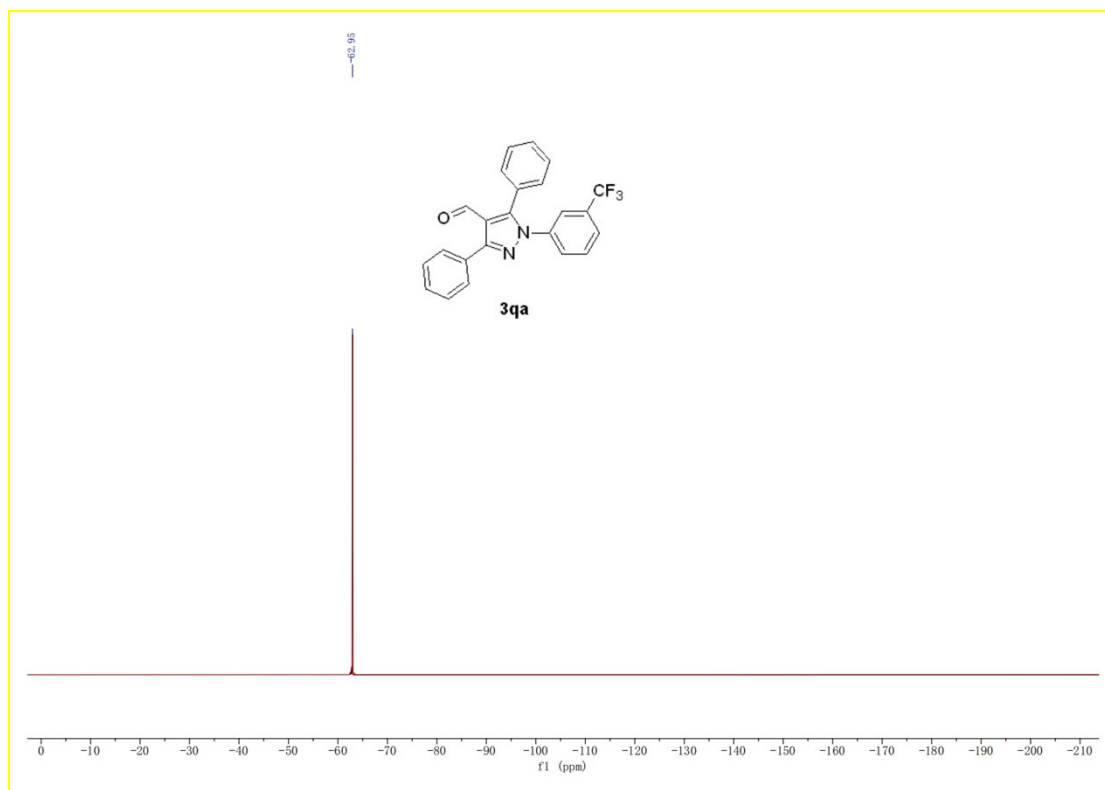


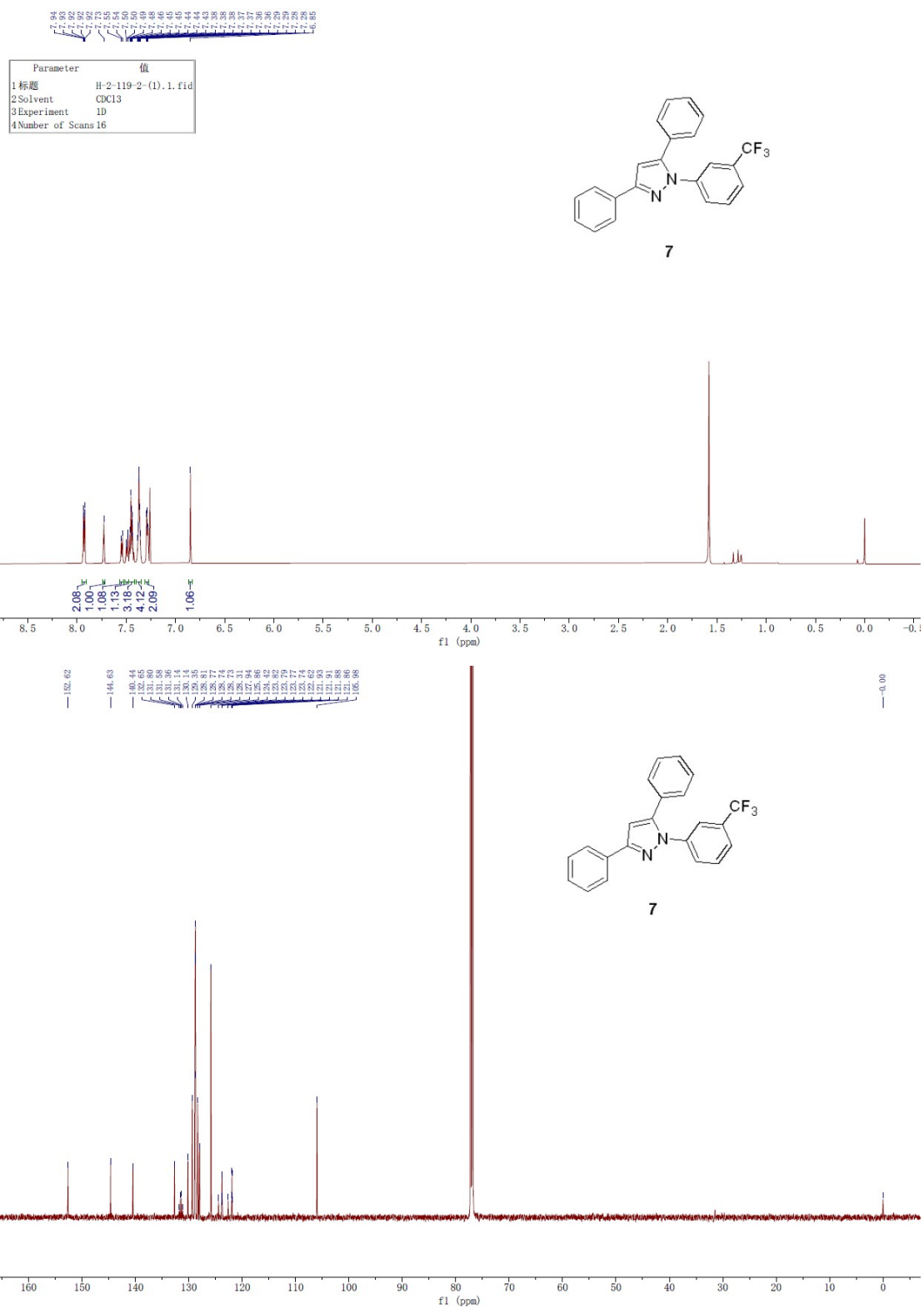
Parameter	值
1 标题	H-3-59-1.23.fid
2 Solvent	CDCl3
3 Experiment	1D
4 Number of Scans	16

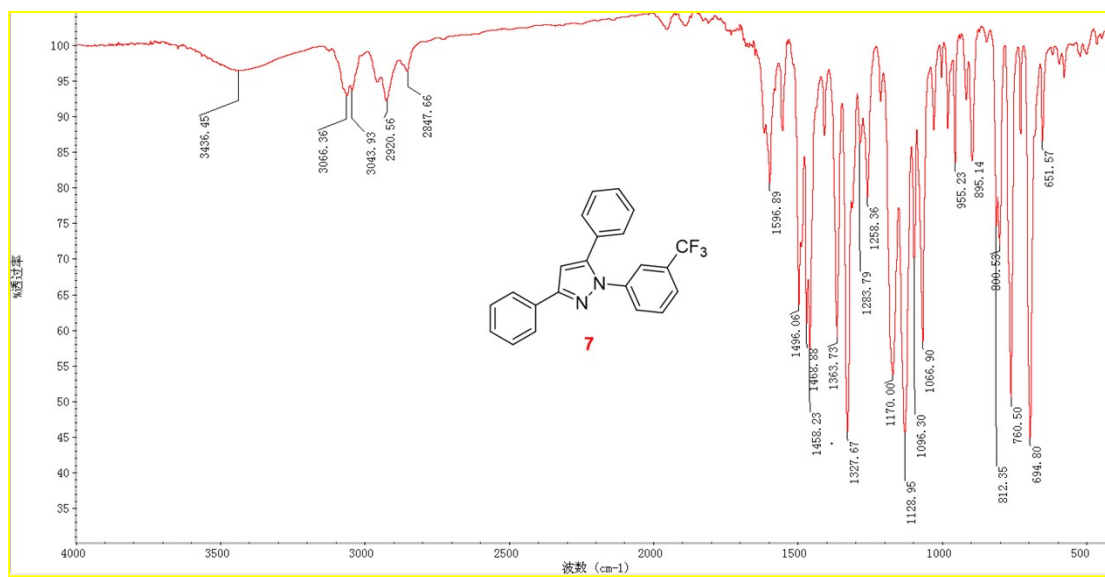
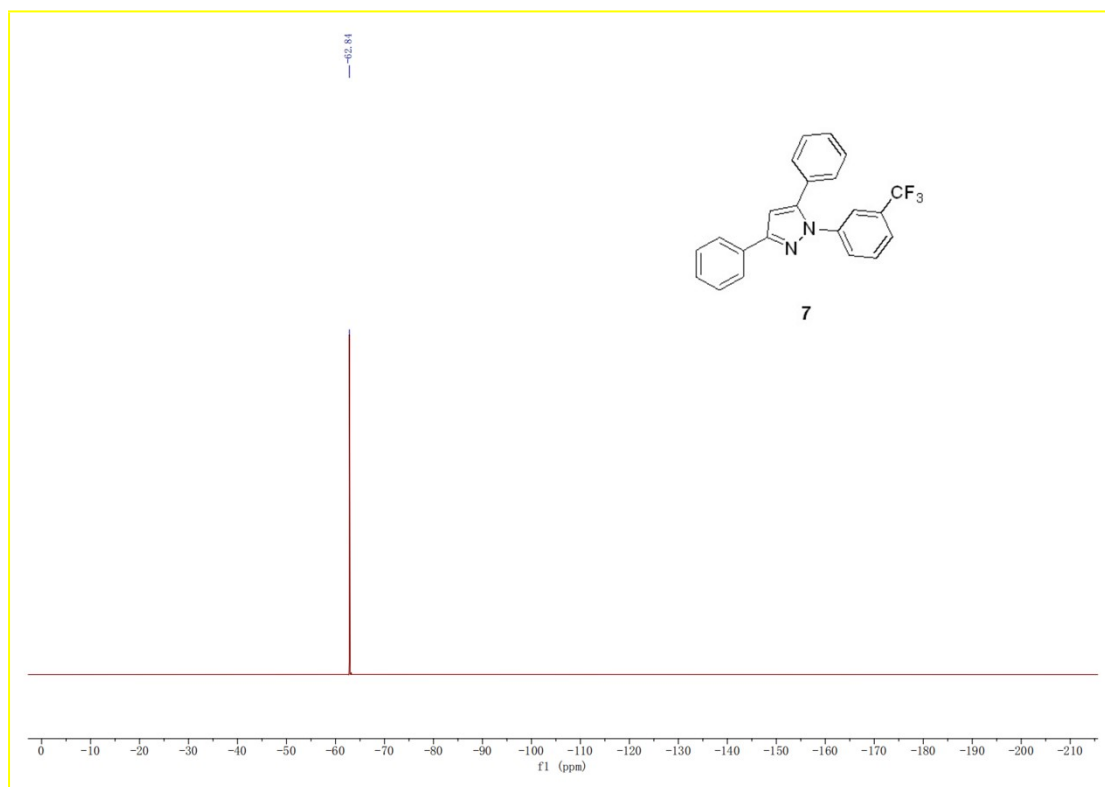


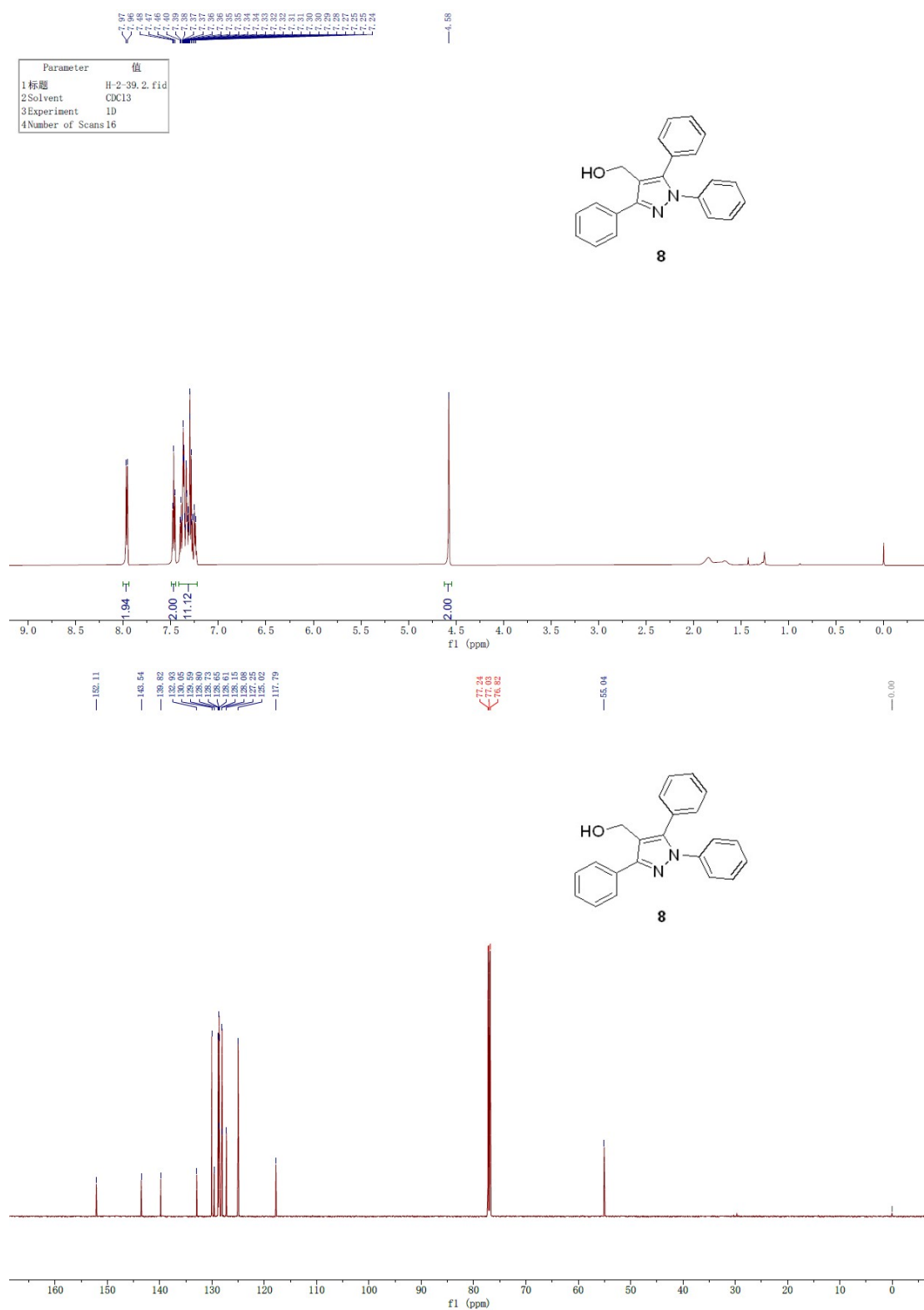


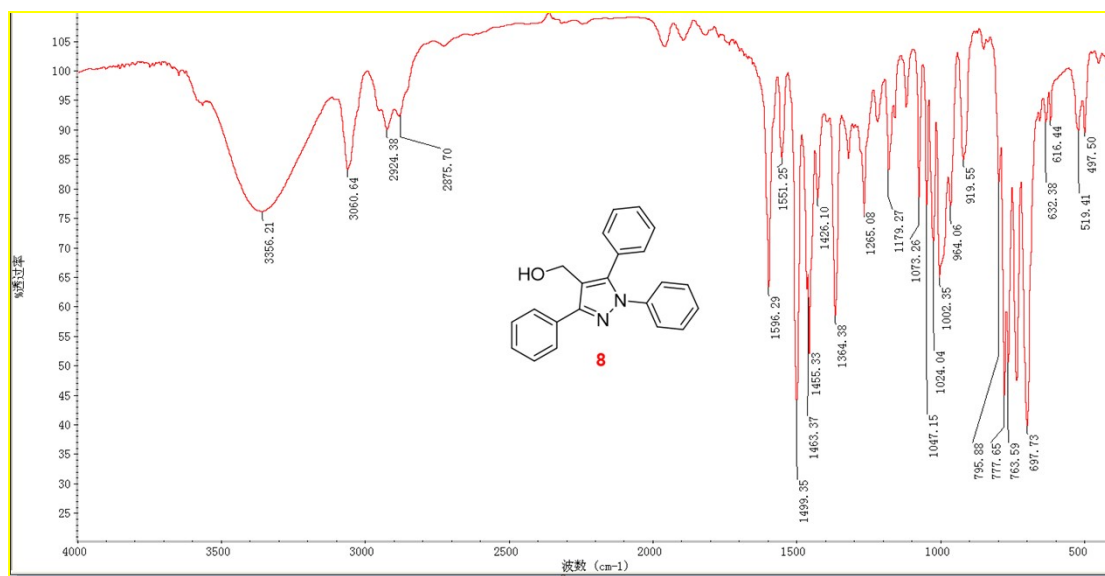


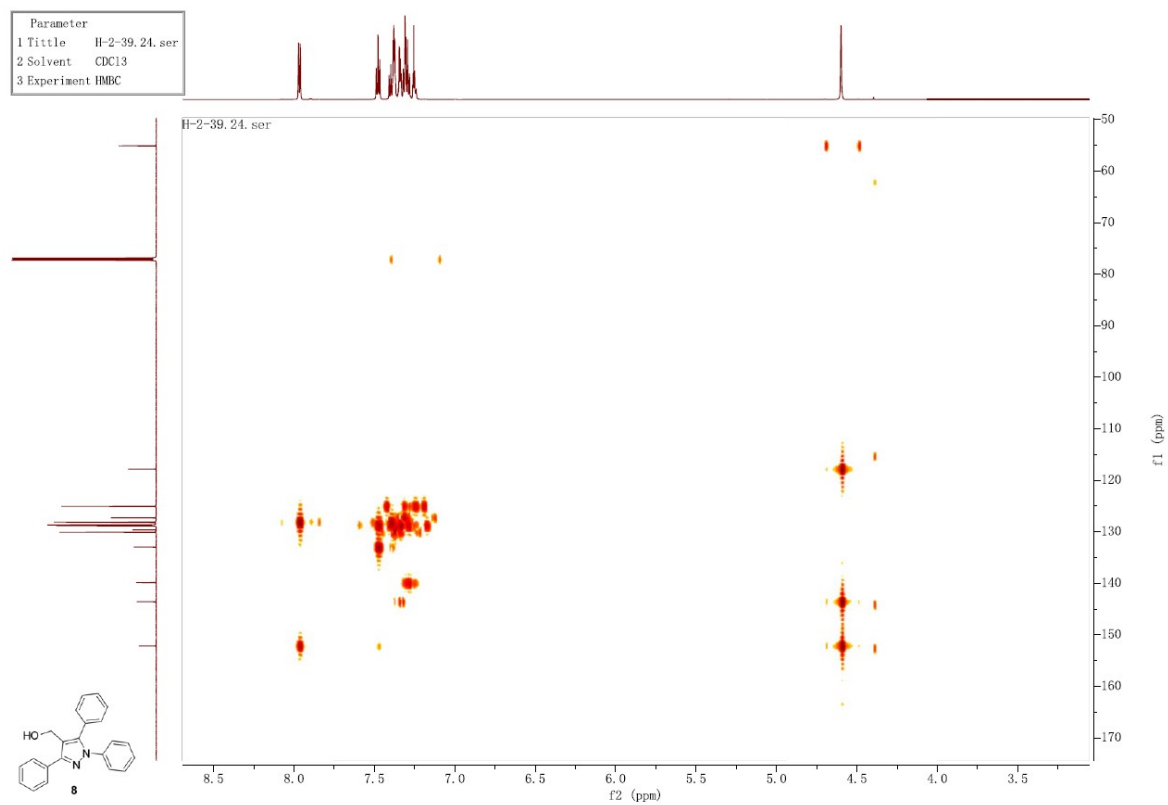
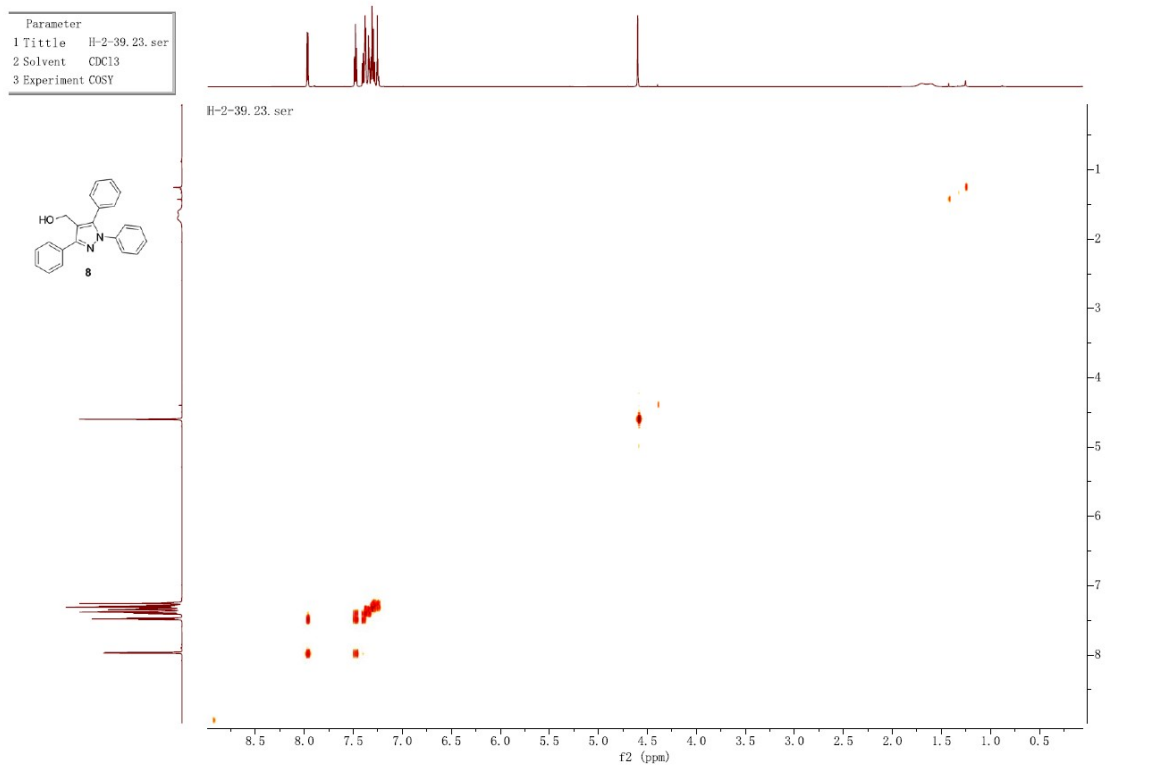




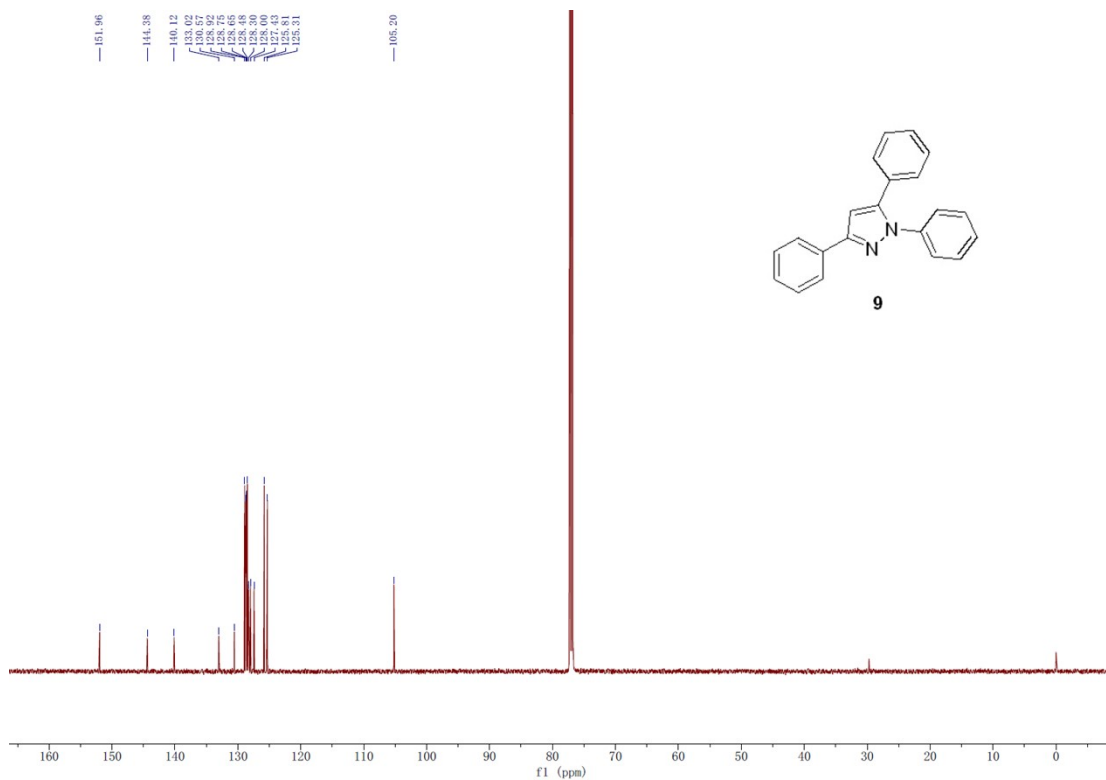
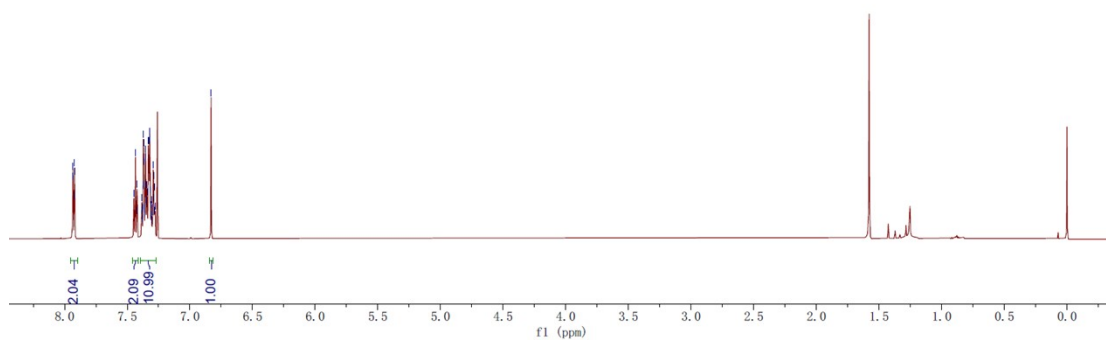
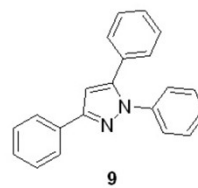


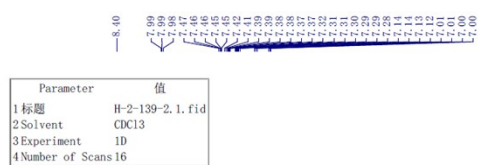
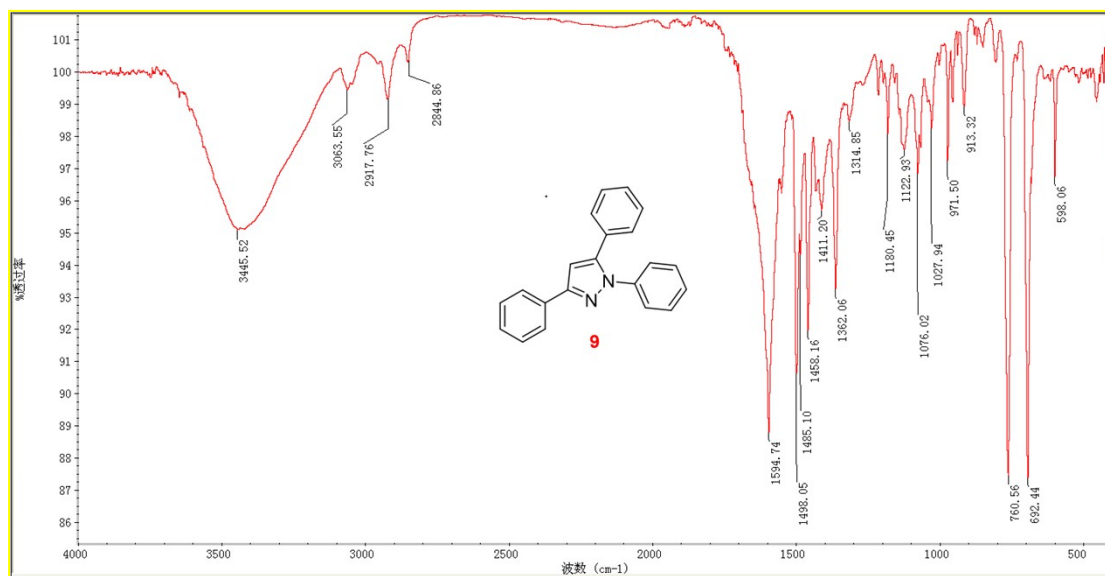






Parameter	值
1 标题	H-2-122.1.fid
2 Solvent	CDCl3
3 Experiment	1D
4 Number of Scans	16





Parameter	值
1 标题	H-2-139-2, 1. fid
2 Solvent	CDCl ₃
3 Experiment	1D
4 Number of Scans	16

