"On water" nano-Cu_2O-catalyzed CO-free one-pot multicomponent cascade cyanation-annulation-aminolysis reaction toward phthalimides

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Supporting Information

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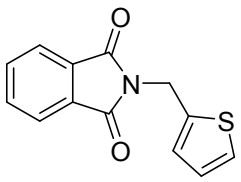
A. General method

^{1}H and ^{13}C NMR spectra were obtained on a 400 and 100 MHz NMR spectrometer. The chemical shifts are referenced to signals at 7.26 and 77.0 ppm, respectively, chloroform is solvent with TMS as the internal standard unless otherwise noted. Mass spectra were recorded on a GC-MS spectrometer at an ionization voltage of 70 eV equipped with a DB-WAX capillary column (internal diameter: 0.25 mm, length: 30 m). High resolution mass spectra (HRMS) (TOF) were measured using an electrospray ionization (ESI) mass spectrometry. Silica gel (300-400 mesh) was used for flash column chromatograph, eluting (unless otherwise stated) with ethyl acetate/petroleum ether (PE) (60-90 ^{o}C) mixture.

B. General procedure for the synthesis of phthalimides

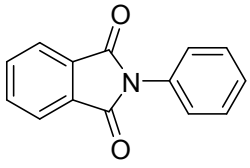
A mixture of 2-halobenzoic acid (0.2 mmol), amine (0.2 mmol), trimethylsilyl cyanide (0.24 mmol) and nano-Cu_2O (5 mol%) in H_2O (1.0 mL) was placed in a test tube (10 mL) equipped with a magnetic stirring bar. The tube was placed in a preheated oil bath at 100 ^{o}C and the mixture was stirred vigorously for 8 h. After the reaction was finished, water (5 mL) was added and the solution was extracted with ethyl acetate (3×5 mL), the combined extract was dried with anhydrous $MgSO_4$. Solvent was removed, and the residue was separated by column chromatography to give the pure sample.

C. Analytical data



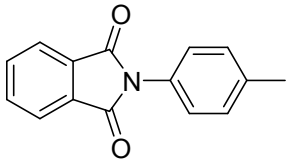
2-(Thiophen-2-ylmethyl)isoindoline-1,3-dione (3a)[1]

Yellow solid (45 mg, 92%); mp = 126−127 °C; R_f = 0.31 (petroleum ether / ethyl acetate = 8:1); ^{1}H NMR (400 MHz, $CDCl_3$): δ = 7.87 – 7.78 (m, 2H), 7.71 – 7.65 (m, 2H), 7.20 (dd, J = 5.1, 1.1 Hz, 1H), 7.16 – 7.10 (m, 1H), 6.92 (dd, J = 5.1, 3.5 Hz, 1H), 5.00 (s, 2H). ^{13}C NMR (100 MHz, $CDCl_3$): δ = 167.4, 137.9, 133.9, 131.9, 127.6, 126.8, 125.7, 123.3, 35.6. MS (EI) m/z: 243, 214, 182, 160, 130, 110, 96, 50, 39.



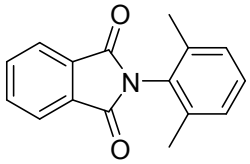
2-Phenylisoindoline-1,3-dione (3b)[1]

Yellow solid (39 mg, 88%); mp = 209−210 °C; R_f = 0.35 (petroleum ether / ethyl acetate = 8:1); ^{1}H NMR (400 MHz, $CDCl_3$): δ = 8.00 – 7.93 (m, 2H), 7.83 – 7.76 (m, 2H), 7.55 – 7.48 (m, 2H), 7.47 – 7.37 (m, 3H). ^{13}C NMR (100 MHz, CDCl3): δ = 167.3, 134.4, 131.8, 131.7, 129.1, 128.1, 126.6, 123.7. MS (EI) m/z: 223, 179, 152, 140, 104, 76, 50, 39.



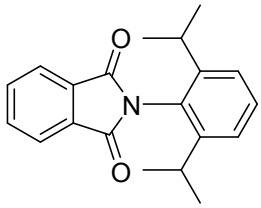
2-(*p*-Tolyl)isoindoline-1,3-dione (3c)[1]

Yellow solid (39 mg, 83%); mp = 205−206 °C; R_f = 0.36 (petroleum ether / ethyl acetate = 8:1); ^{1}H NMR (400 MHz, $CDCl_3$): δ = 7.98 – 7.91 (m, 2H), 7.81 – 7.74 (m, 2H), 7.31 (s, 4H), 2.41 (s, 3H). ^{13}C NMR (100 MHz, $CDCl_3$): δ = 167.4, 138.2, 134.3, 131.8, 129.8, 129.0, 126.4, 123.7, 21.2. MS (EI) m/z: 237, 208, 193, 165, 130, 104, 76, 50, 39.



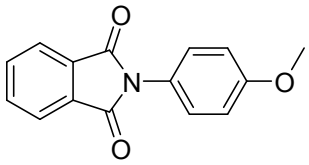
2-(2,6-Dimethylphenyl)isoindoline-1,3-dione (3d)[1]

White solid (40 mg, 80%); mp = 204−205 °C; R_f = 0.38 (petroleum ether / ethyl acetate = 8:1); ^{1}H NMR (400 MHz, $CDCl_3$): δ = 8.03 – 7.92 (m, 2H), 7.86 – 7.76 (m, 2H), 7.32 – 7.25 (m, 1H), 7.19 (d, J = 7.5 Hz, 2H), 2.17 (s, 6H). ^{13}C NMR (100 MHz, $CDCl_3$): δ = 167.2, 136.8, 134.3, 132.0, 129.8, 129.4, 128.5, 123.8, 18.1. MS (EI) m/z: 251, 233, 206, 125, 104, 76, 50, 39.



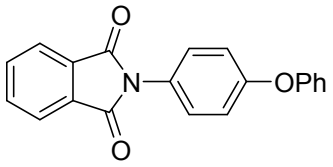
2-(2,6-Diisopropylphenyl)isoindoline-1,3-dione (3e)[2]

Yellow solid (48 mg, 78%); mp =170−171 °C; R_f = 0.51 (petroleum ether / ethyl acetate = 4:1); ^{1}H NMR (400 MHz, $CDCl_3$): δ = 8.02 – 7.95 (m, 2H), 7.85 – 7.78 (m, 2H), 7.50 – 7.43 (m, 1H), 7.30 (d, J = 7.8 Hz, 2H), 2.73 (hept, J = 6.8 Hz, 2H), 1.18 (d, J = 6.9 Hz, 12H). ^{13}C NMR (100 MHz, $CDCl_3$): δ = 168.2, 147.3, 134.3, 131.9, 130.2, 126.8, 124.0, 123.9, 29.3, 24.0.MS (EI) m/z: 307, 292, 264, 246, 222, 178, 160, 145, 105, 77, 51, 41.



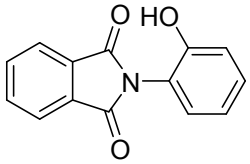
2-(4-Methoxyphenyl)isoindoline-1,3-dione (3f)[1]

Yellow solid (44 mg, 88%); mp = 160−161 °C; R_f = 0.39 (petroleum ether / ethyl acetate = 4:1); ^{1}H NMR (400 MHz, $CDCl_3$): δ = 7.97 – 7.91 (m, 2H), 7.81 – 7.74 (m, 2H), 7.38 – 7.30 (m, 2H), 7.06 – 6.98 (m, 2H), 3.85 (s, 3H). ^{13}C NMR (100 MHz, $CDCl_3$): δ = 167.5, 159.2, 134.3, 131.8, 127.9, 124.3, 123.6, 114.5, 55.5. MS (EI) m/z: 253, 238, 210, 182, 154, 130, 106, 76, 50, 39.



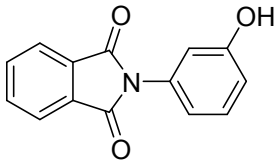
2-(4-Phenoxyphenyl)isoindoline-1,3-dione (3g)[3]

White solid (53 mg, 85%); mp 154−155 °C; R_f = 0.55 (petroleum ether / ethyl acetate = 4:1); ^{1}H NMR (400 MHz, $CDCl_3$): δ = 7.98 – 7.92 (m, 2H), 7.81 – 7.75 (m, 2H), 7.42 – 7.34 (m, 4H), 7.18 – 7.05 (m, 5H). ^{13}C NMR (100 MHz, $CDCl_3$): δ = 167.3, 157.1, 156.5, 134.3, 131.7, 129.8, 128.0, 126.3, 123.8, 123.7, 119.5, 118.8. MS (EI) m/z: 315, 287, 271, 238, 210, 182, 168, 139, 104, 76, 51, 39.



2-(2-Hydroxyphenyl)isoindoline-1,3-dione (3h)[4]

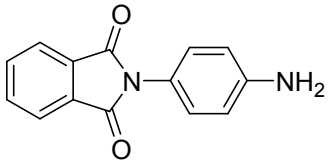
Brown solid (40 mg, 84%); mp = 227-228 °C; R_f = 0.40 (petroleum ether / ethyl acetate = 2:1); ^{1}H NMR (400 MHz, DMSO): δ = 9.88 (s, 1H), 8.06 – 7.79 (m, 4H), 7.39 – 7.19 (m, 2H), 7.01 (d, J = 8.2 Hz, 1H), 6.93 (t, J = 7.6 Hz, 1H). ^{13}C NMR (100 MHz, DMSO): δ = 167.7, 154.5, 135.1, 132.5, 130.9, 130.9, 123.8, 119.7, 119.4, 117.1. MS (EI) m/z: 239, 194, 104, 91, 50, 39.



2-(3-Hydroxyphenyl)isoindoline-1,3-dione (3i)[5]

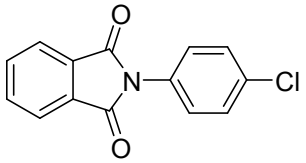
White solid (43 mg, 89%); mp = 227-229 °C; R_f = 0.32 (petroleum ether / ethyl acetate = 2:1); ^{1}H NMR (400 MHz, DMSO): δ = 9.76 (s, 1H), 8.06 – 7.76 (m, 4H),

7.30 (dd, J = 10.0, 6.2 Hz, 1H), 6.85 (t, J = 6.4 Hz, 3H). ^{13}C NMR (100 MHz, DMSO): δ = 167.5, 158.1, 135.1, 133.3, 132.0, 130.0, 123.9, 118.4, 115.6, 114.9. MS (EI) m/z: 239, 195, 167, 104, 76, 50, 41.



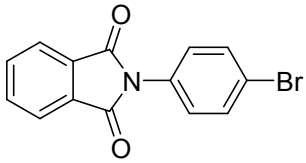
2-(4-Aminophenyl)isoindoline-1,3-dione (3j)[6]

Yellow solid (29 mg, 62%); mp = 235−237 °C; R_f = 0.26 (petroleum ether / ethyl acetate = 2:1); ^{1}H NMR (400 MHz, DMSO): δ = 8.10 – 7.93 (m, 4H), 7.11 (d, J = 8.4 Hz, 2H), 6.74 (d, J = 8.4 Hz, 2H), 5.45 (s, 2H). ^{13}C NMR (100 MHz, DMSO) δ = 168.1, 149.3, 135.0, 132.1, 128.7, 123.7, 120.1, 114.0. MS (EI) m/z: 238, 194, 167, 130, 104, 91, 50, 39.



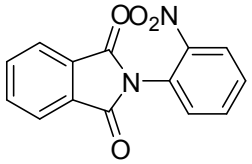
2-(4-Chlorophenyl)isoindoline-1,3-dione (3k)[1]

White solid (42 mg, 81%); mp = 182−183 °C; R_f = 0.61 (petroleum ether / ethyl acetate = 4:1); ^{1}H NMR (400 MHz, $CDCl_3$): δ = 7.98 – 7.92 (m, 2H), 7.83 – 7.76 (m, 2H), 7.51 – 7.44 (m, 2H), 7.44 – 7.38 (m, 2H). ^{13}C NMR (100 MHz, $CDCl_3$): δ = 166.9, 134.5, 133.8, 131.6, 130.2, 129.3, 127.6, 123.8. MS (EI) m/z: 257, 229, 213, 178, 151, 125, 104, 76, 50, 39.



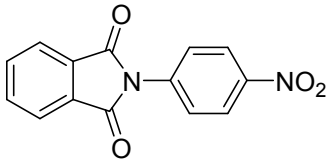
2-(4-Bromophenyl)isoindoline-1,3-dione (3l)[1]

White solid (48 mg, 79%); mp 201−203 °C; R_f = 0.63 (petroleum ether / ethyl acetate = 4:1); ^{1}H NMR (400 MHz, $CDCl_3$): δ = 8.00 – 7.92 (m, 2H), 7.84 – 7.76 (m, 2H), 7.67 – 7.59 (m, 2H), 7.40 – 7.32 (m, 2H). ^{13}C NMR (100 MHz, $CDCl_3$): δ = 166.9, 134.6, 132.3, 131.6, 130.7, 127.9, 123.8, 121.8. MS (EI) m/z: 301, 259, 178, 151, 130, 104, 76, 50, 39.



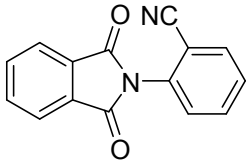
2-(2-Nitrophenyl)isoindoline-1,3-dione (3m)[5]

Yellow solid (33 mg, 61%); mp = 199-200 °C; R_f = 0.31 (petroleum ether / ethyl acetate = 4:1); ^{1}H NMR (400 MHz, $CDCl_3$): δ = 8.18 (dd, J = 8.2, 1.4 Hz, 1H), 8.04 – 7.91 (m, 2H), 7.88 – 7.73 (m, 3H), 7.62 (td, J = 8.2, 1.4 Hz, 1H), 7.53 (dd, J = 7.9, 1.3 Hz, 1H). ^{13}C NMR (100 MHz, $CDCl_3$): δ = 166.3, 145.7, 134.8, 134.1, 131.9, 130.9, 129.7, 125.8, 125.6, 124.2. MS (EI) m/z: 268, 222, 194, 166, 140, 104, 76, 50, 39.



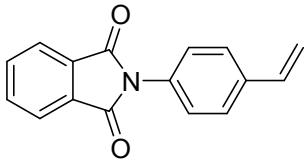
2-(4-Nitrophenyl)isoindoline-1,3-dione (3n)[4]

White solid (37 mg, 70%); mp = 259-262 °C; R_f = 0.35 (petroleum ether / ethyl acetate = 4:1); ^{1}H NMR (400 MHz, $CDCl_3$): δ = 8.38 (d, J = 8.8 Hz, 2H), 8.00 (dd, J = 5.1, 3.0 Hz, 2H), 7.91 – 7.70 (m, 4H). ^{13}C NMR (100 MHz, $CDCl_3$): δ = 166.4, 146.4, 137.5, 134.9, 131.3, 126.3, 124.4, 124.1. MS (EI) m/z: 268, 238, 207, 178, 166, 104, 76, 50, 39.



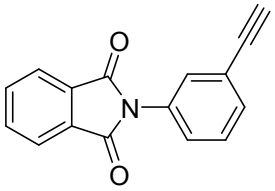
2-(1,3-Dioxoisoindolin-2-yl)benzonitrile (3o)[7]

Yellow solid (40 mg, 80%); mp = 170-174 °C; R_f = 0.29 (petroleum ether / ethyl acetate = 4:1); ^{1}H NMR (400 MHz, $CDCl_3$): δ = 8.05 – 7.95 (m, 2H), 7.88 – 7.81 (m, 3H), 7.77 (td, J = 7.9, 1.5 Hz, 1H), 7.58 (td, J = 7.7, 1.0 Hz, 1H), 7.48 (d, J = 7.5 Hz, 1H). ^{13}C NMR (100 MHz, $CDCl_3$): δ = 166.1, 134.8, 134.3, 133.7, 131.6, 129.5, 129.2, 124.3, 115.9, 112.8. MS (EI) m/z: 248, 204, 177, 104, 76, 50, 39.



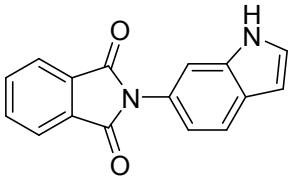
2-(4-Vinylphenyl)isoindoline-1,3-dione (3p)[8]

Yellow solid (36 mg, 73%); mp 201−202 °C; R_f = 0.8 (petroleum ether / ethyl acetate = 4:1); ^{1}H NMR (400 MHz, $CDCl_3$): δ = 7.99 – 7.91 (m, 2H), 7.81 – 7.75 (m, 2H), 7.53 (d, J = 8.5 Hz, 2H), 7.41 (dd, J = 8.7, 2.1 Hz, 2H), 6.75 (dd, J = 17.6, 10.9 Hz, 1H), 5.79 (d, J = 17.6 Hz, 1H), 5.31 (d, J = 10.9 Hz, 1H). ^{13}C NMR (100 MHz, $CDCl_3$): δ = 167.1, 137.3, 135.9, 134.3, 131.7, 130.9, 126.7, 126.4, 123.6, 114.9. MS (EI) m/z: 249, 223, 205, 178, 165, 124, 102, 76, 50, 39.



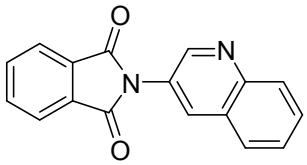
2-(3-Ethynylphenyl)isoindoline-1,3-dione (3q)

White solid (34 mg, 70%); mp = 197-199 °C; R_f = 0.27 (petroleum ether / ethyl acetate = 8:1); ^{1}H NMR (400 MHz, $CDCl_3$): δ = 7.96 (dd, J = 5.4, 3.1 Hz, 2H), 7.80 (dd, J = 5.4, 3.0 Hz, 2H), 7.60 (s, 1H), 7.55 – 7.41 (m, 3H), 3.12 (s, 1H). ^{13}C NMR (100 MHz, $CDCl_3$): δ = 166.9, 134.5, 131.8, 131.6, 131.6, 130.0, 129.1, 126.9, 123.8, 123.2, 82.6, 78.3. MS (EI) m/z: 247, 203, 176, 163, 123, 104, 76, 50, 39. HRMS (ESI): calcd for $C_{16}H_{10}NO_2$ $[M+H]^+$ 248.0706; found 248.0708.



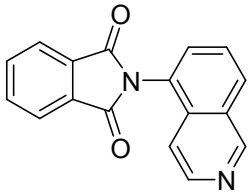
2-(1H-Indol-6-yl)isoindoline-1,3-dione (3r)

Yellow solid (35 mg, 67%); mp = 200-202 °C; R_f = 0.53 (petroleum ether / ethyl acetate = 8:1); ^{1}H NMR (400 MHz, DMSO): δ = 11.31 (s, 1H), 7.98 – 7.92 (m, 2H), 7.91 – 7.86 (m, 2H), 7.58 (d, J = 1.9 Hz, 1H), 7.52 (d, J = 8.6 Hz, 1H), 7.46 (t, J = 2.8 Hz, 1H), 7.11 (dd, J = 8.6, 1.9 Hz, 1H), 6.55 – 6.48 (m, 1H). ^{13}C NMR (100 MHz, DMSO): δ = 168.3, 135.8, 135.0, 132.2, 128.0, 127.2, 123.8, 123.7, 121.2, 120.1, 112.0, 102.0. MS (EI) m/z: 262, 218, 190, 151, 130, 115, 76, 50, 39. HRMS (ESI): calcd for $C_{16}H_{11}N_2O_2$ $[M+H]^+$ 263.0815; found 263.0817.



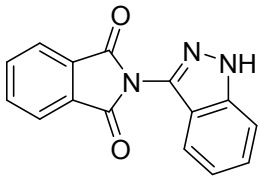
2-(Quinolin-3-yl)isoindoline-1,3-dione (3s)[2]

White solid (46 mg, 85%); mp = 200-201 °C; R_f = 0.26 (petroleum ether / ethyl acetate = 4:1); ^{1}H NMR (400 MHz, DMSO): δ = 9.01 (d, J = 2.3 Hz, 1H), 8.51 (d, J = 2.2 Hz, 1H), 8.10 (t, J = 9.3 Hz, 2H), 8.06 – 7.99 (m, 2H), 7.98 – 7.91 (m, 2H), 7.86 (t, J = 7.6 Hz, 1H), 7.70 (t, J = 7.5 Hz, 1H). ^{13}C NMR (100 MHz, DMSO): δ = 167.4, 149.5, 146.8, 135.4, 134.0, 132.1, 130.8, 129.2, 128.8, 127.9, 127.7, 126.2, 124.1. MS (EI) m/z: 274, 230, 190, 127, 104, 76, 50, 39.



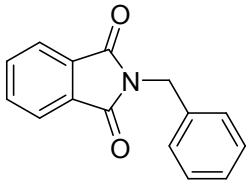
2-(Isoquinolin-5-yl)isoindoline-1,3-dione (3t)[9]

Yellow solid (40 mg, 73%); mp = 236-237 °C; R_f = 0.46 (petroleum ether / ethyl acetate = 1:1); ^{1}H NMR (400 MHz, $CDCl_3$): δ = 9.36 (s, 1H), 8.54 (d, J = 3.9 Hz, 1H), 8.11 (d, J = 7.9 Hz, 1H), 8.06 – 7.95 (m, 2H), 7.89 – 7.79 (m, 2H), 7.78 – 7.64 (m, 2H), 7.43 (d, J = 5.8 Hz, 1H). ^{13}C NMR (100 MHz, $CDCl_3$): δ = 167.3, 152.9, 143.9, 134.7, 133.0, 131.8, 131.2, 129.3, 127.5, 126.9, 124.0, 115.6. MS (EI) m/z: 274, 257, 229, 203, 190, 123, 104, 76, 50, 39.



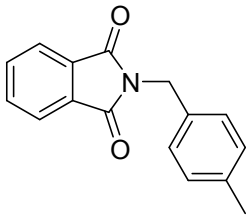
2-(1H-Indazol-3-yl)isoindoline-1,3-dione (3u)[10]

Yellow solid (28 mg, 54%); mp = 230-231 °C; R_f = 0.50 (petroleum ether / ethyl acetate = 1:1); ^{1}H NMR (400 MHz, DMSO): δ = 13.44 (s, 1H), 8.09 – 8.00 (m, 2H), 7.99 – 7.92 (m, 2H), 7.70 (d, J = 8.2 Hz, 1H), 7.63 (d, J = 8.5 Hz, 1H), 7.48 – 7.41 (m, 1H), 7.22 – 7.12 (m, 1H). ^{13}C NMR (100 MHz, DMSO): δ = 167.2, 141.5, 135.5, 133.7, 132.0, 127.3, 124.2, 121.6, 120.2, 119.0, 111.2. MS (EI) m/z: 263, 235, 219, 192, 130, 104, 76, 50, 39.



2-Benzylisoindoline-1,3-dione (3v)[1]

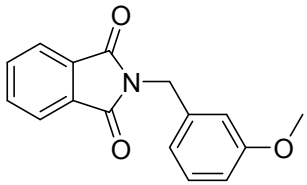
White solid (41 mg, 87%); mp = 116-117 °C; R_f = 0.43 (petroleum ether / ethyl acetate = 8:1); ^{1}H NMR (400 MHz, $CDCl_3$): δ = 7.94 – 7.74 (m, 2H), 7.69 (d, J = 3.1 Hz, 2H), 7.42 (t, J = 7.6 Hz, 2H), 7.28 (dt, J = 14.6, 8.5 Hz, 3H), 4.84 (d, J = 8.9 Hz, 2H). ^{13}C NMR (100 MHz, $CDCl_3$): δ = 168.0, 136.3, 134.0, 132.1, 128.6, 128.6, 127.8, 123.3, 41.6. MS (EI) m/z: 237, 219, 180, 165, 130, 104, 77, 50, 39.



2-(4-Methylbenzyl)isoindoline-1,3-dione (3w)[11]

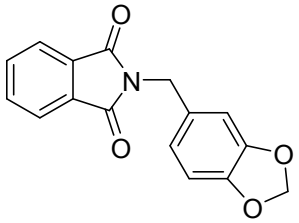
White solid (39 mg, 77%); mp = 116-117 °C; R_f = 0.54 (petroleum ether / ethyl acetate = 8:1); ^{1}H NMR (400 MHz, $CDCl_3$): δ = 7.86 – 7.79 (m, 2H), 7.72 – 7.64 (m, 2H), 7.33 (d, J = 8.0 Hz, 2H), 7.12 (d, J = 7.8 Hz, 2H), 4.80 (s, 2H), 2.30 (s, 3H). ^{13}C NMR (100 MHz, $CDCl_3$): δ = 168.0, 137.5, 133.9, 133.4, 132.1, 129.3, 128.6, 123.2,

41.3, 21.1. MS (EI) m/z: 251, 236, 222, 160, 130, 118, 77, 50, 39.



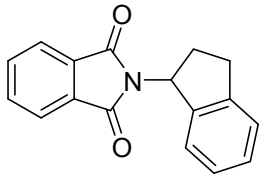
2-(3-Methoxybenzyl)isoindoline-1,3-dione (3x)[12]

Yellow solid (45 mg, 85%); mp = 125−126 °C; R_f = 0.46 (petroleum ether / ethyl acetate = 4:1); ^{1}H NMR (400 MHz, $CDCl_3$): δ = 7.86 – 7.79 (m, 2H), 7.71 – 7.65 (m, 2H), 7.22 (t, J = 7.9 Hz, 1H), 7.05 – 6.93 (m, 2H), 6.84 – 6.72 (m, 1H). ^{13}C NMR (100 MHz, $CDCl_3$): δ = 167.9, 159.7, 137.8, 133.9, 132.0, 129.6, 123.3, 120.7, 113.97, 113.3, 55.1, 41.5. MS (EI) m/z: 267, 234, 206, 180, 160, 134, 105, 77, 51, 39.



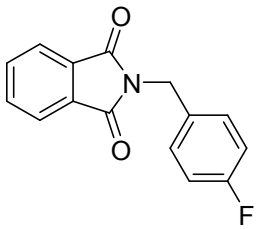
2-(Benzo[d][1,3]dioxol-5-ylmethyl)isoindoline-1,3-dione (3y)[13]

White solid (43 mg, 76%); mp = 133−135 °C; R_f = 0.35 (petroleum ether / ethyl acetate = 8:1); ^{1}H NMR (400 MHz, $CDCl_3$): δ = 7.86 – 7.80 (m, 2H), 7.73 – 7.66 (m, 2H), 6.97 – 6.88 (m, 2H), 6.73 (dd, J = 7.4, 1.0 Hz, 1H), 5.91 (s, 2H), 4.74 (s, 2H). ^{13}C NMR (100 MHz, $CDCl_3$): δ = 168.0, 147.8, 147.2, 134.0, 132.1, 130.2, 123.3, 122.3, 109.3, 108.3, 101.0, 41.37. MS (EI) m/z: 281, 263, 223, 205, 195, 148, 130, 104, 77, 51, 39.



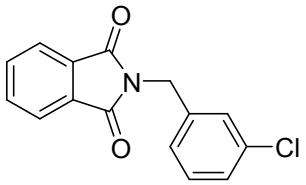
2-(2,3-Dihydro-1H-inden-1-yl)isoindoline-1,3-dione (3z)[14]

Yellow solid (37 mg, 72%); mp 174−176 °C; R_f = 0.67 (petroleum ether / ethyl acetate = 4:1); ^{1}H NMR (400 MHz, $CDCl_3$): δ = 7.85 – 7.79 (m, 2H), 7.74 – 7.67 (m, 2H), 7.30 (d, J = 7.5 Hz, 1H), 7.27 – 7.22 (m, 1H), 7.18 – 7.08 (m, 2H), 5.89 (dd, J = 8.7, 6.7 Hz, 1H), 3.46 – 3.29 (m, 1H), 3.08 – 2.93 (m, 1H), 2.63 – 2.42 (m, 2H). ^{13}C NMR (100 MHz, $CDCl_3$): δ = 167.9, 143.8, 140.4, 133.9, 132.0, 128.0, 126.5, 124.8, 123.3, 123.1, 54.7, 31.1, 29.7. MS (EI) m/z: 263, 234, 220, 189, 148, 130, 116, 76, 50, 39.



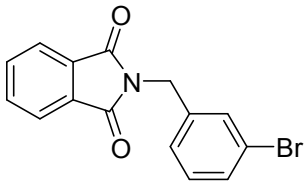
2-(4-Fluorobenzyl)isoindoline-1,3-dione (3aa)[1]

White solid (38 mg, 74%); mp = 132−134 °C; R_f = 0.38 (petroleum ether / ethyl acetate = 8:1); ^{1}H NMR (400 MHz, $CDCl_3$): δ = 7.90 – 7.81 (m, 2H), 7.76 – 7.68 (m, 2H), 7.48 – 7.39 (m, 2H), 7.05 – 6.94 (m, 2H), 4.82 (s, 2H). ^{13}C NMR (100 MHz, $CDCl_3$): δ = 167.9, 162.3 (d, J = 245 Hz), 134.0, 132.2 (d, J = 3 Hz), 132.0, 130.5 (d, J = 8 Hz), 123.3, 115.5 (d, J = 21 Hz), 40.8. ^{19}F NMR (376 MHz, $CDCl_3$): δ = -112.6 (s, 1F). MS (EI) m/z: 255, 237, 198, 130, 122, 76, 50, 39.



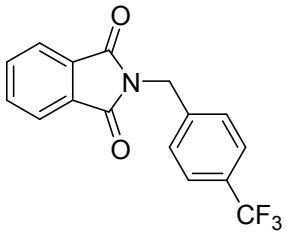
2-(3-Chlorobenzyl)isoindoline-1,3-dione (3ab)[15]

White solid (38 mg, 70%); mp = 127−129 °C; R_f = 0.6 (petroleum ether / ethyl acetate = 8:1); ^{1}H NMR (400 MHz, $CDCl_3$): δ = 7.85 (dd, J = 5.5, 3.0 Hz, 2H), 7.71 (dd, J = 5.5, 3.1 Hz, 2H), 7.40 (d, J = 0.9 Hz, 1H), 7.30 (qd, J = 4.5, 1.7 Hz, 1H), 7.25 – 7.22 (m, 2H), 4.81 (s, 2H). ^{13}C NMR (100 MHz, $CDCl_3$): δ = 167.8, 138.1, 134.4, 134.0, 131.9, 129.9, 128.6, 128.0, 126.7, 123.4, 40.9. MS (EI) m/z: 271, 236, 208, 180, 152, 130, 105, 77, 50, 39.



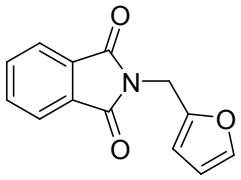
2-(3-Bromobenzyl)isoindoline-1,3-dione (3ac)[16]

Yellow solid (43 mg, 69%); mp = 138−139 °C; R_f = 0.38 (petroleum ether / ethyl acetate = 8:1); ^{1}H NMR (400 MHz, $CDCl_3$): δ = 7.89 – 7.81 (m, 2H), 7.76 – 7.68 (m, 2H), 7.57 (t, J = 1.7 Hz, 1H), 7.43 – 7.33 (m, 2H), 7.18 (t, J = 7.8 Hz, 1H), 4.80 (s, 2H). ^{13}C NMR (100 MHz, $CDCl_3$): δ = 167.8, 138.5, 134.1, 132.0, 131.5, 131.0, 130.2, 127.2, 123.5, 122.7, 40.94. MS (EI) m/z: 315, 297, 236, 218, 18, 130, 104, 76, 50, 39.



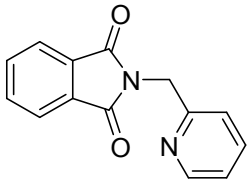
2-(4-(Trifluoromethyl)benzyl)isoindoline-1,3-dione (3ad)[11]

White solid (40 mg, 66%); mp = 115−116 °C; R_f = 0.38 (petroleum ether / ethyl acetate = 8:1); ^{1}H NMR (400 MHz, $CDCl_3$): δ = 7.84 (dt, J = 7.4, 3.7 Hz, 2H), 7.75 – 7.67 (m, 2H), 7.55 (q, J = 8.5 Hz, 4H), 4.89 (s, 2H). ^{13}C NMR (100 MHz, $CDCl_3$): δ = 167.8, 140.1, 134.1, 131.9, 130.1 (q, J = 32 Hz), 128.8, 125.6 (q, J = 4 Hz), 125.3, 123.9 (q, J = 270 Hz), 123.4, 41.0. ^{19}F NMR (376 MHz, $CDCl_3$): δ = -62.6 (s, 3F). MS (EI) m/z: 305, 287, 248, 236, 208, 172, 130, 105, 76, 50, 39.



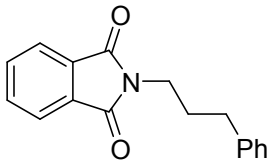
2-(Furan-2-ylmethyl)isoindoline-1,3-dione (3ae)[13]

White solid (41 mg, 90%); mp = 113−114 °C; R_f = 0.35 (petroleum ether / ethyl acetate = 8:1); ^{1}H NMR (400 MHz, $CDCl_3$): δ = 7.89 – 7.81 (m, 2H), 7.74 – 7.67 (m, 2H), 7.32 (d, J = 1.0 Hz, 1H), 6.35 (d, J = 3.2 Hz, 1H), 6.29 (dd, J = 3.1, 1.9 Hz, 1H), 4.85 (s, 2H). ^{13}C NMR (100 MHz, $CDCl_3$): δ = 167.6, 149.3, 142.4, 134.0, 132.0, 123.4, 110.4, 108.7, 34.3. MS (EI) m/z: 227, 198, 182, 170, 133, 104, 76, 50, 39.



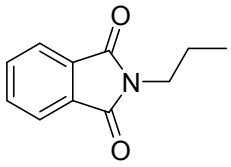
2-(Pyridin-2-ylmethyl)isoindoline-1,3-dione (3af)[13]

White solid (34 mg, 73%); mp = 106−107 °C; R_f = 0.41 (petroleum ether / ethyl acetate = 2:1); ^{1}H NMR (400 MHz, $CDCl_3$): δ = 8.49 (d, J = 4.8 Hz, 1H), 7.90 – 7.82 (m, 2H), 7.74 – 7.67 (m, 2H), 7.61 (td, J = 7.6, 1.2 Hz, 1H), 7.28 – 7.23 (m, 1H), 7.17 – 7.10 (m, 1H), 5.00 (s, 2H). ^{13}C NMR (100 MHz, $CDCl_3$): δ = 168.1, 155.3, 149.6, 136.6, 134.0, 132.1, 123.4, 122.4, 121.5, 42.9. MS (EI) m/z: 238, 209, 181, 167, 133, 105, 76, 50, 39.



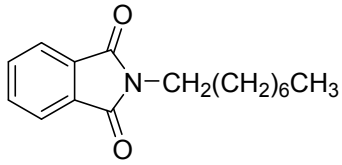
2-(3-Phenylpropyl)isoindoline-1,3-dione (3ag)[17]

White solid (35 mg, 67%); mp = 54−55 °C; R_f = 0.43 (petroleum ether / ethyl acetate = 8:1); ^{1}H NMR (400 MHz, $CDCl_3$): δ = 7.85 – 7.79 (m, 2H), 7.72 – 7.66 (m, 2H), 7.28 – 7.11 (m, 5H), 3.82 – 3.68 (m, 2H), 2.75 – 2.62 (m, 2H), 2.04 (tt, J = 9.3, 6.9 Hz, 2H). ^{13}C NMR (100 MHz, $CDCl_3$): δ = 168.3, 141.0, 133.8, 132.1, 128.3, 128.2, 125.9, 123.1, 37.8, 33.1, 29.8. MS (EI) m/z: 265, 174, 161, 130, 117, 77, 65, 39.



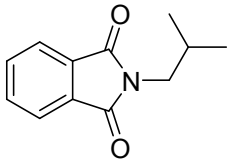
2-Propylisoindoline-1,3-dione (3ah)[18]

White solid (28 mg, 75%); mp = 61−62 °C; R_f = 0.55 (petroleum ether / ethyl acetate = 8:1); ^{1}H NMR (400 MHz, $CDCl_3$): δ = 7.86 – 7.80 (m, 2H), 7.73 – 7.67 (m, 2H), 3.67 – 3.61 (m, 2H), 1.75 – 1.65 (m, 2H), 0.94 (t, J = 7.4 Hz, 3H). ^{13}C NMR (100 MHz, $CDCl_3$): δ = 168.5, 133.8, 132.2, 123.1, 39.6, 21.9, 11.3. MS (EI) m/z: 189, 160, 130, 122, 94, 77, 50, 39.



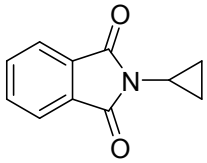
2-Octylisoindoline-1,3-dione (3ai)[18]

White solid (31 mg, 60%); mp = 45−47 °C; R_f = 0.61 (petroleum ether / ethyl acetate = 8:1); ^{1}H NMR (400 MHz, $CDCl_3$): δ = 7.81 – 7.74 (m, 2H), 7.68 – 7.61 (m, 2H), 3.66 – 3.57 (m, 2H), 1.70 – 1.54 (m, 2H), 1.31 – 1.18 (m, 10H), 0.81 (t, J = 6.9 Hz, 3H). ^{13}C NMR (100 MHz, $CDCl_3$): δ = 168.2, 133.6, 132.1, 122.9, 37.9, 31.6, 29.0, 28.5, 26.7, 22.5, 13.9. MS (EI) m/z: 259, 230, 202, 174, 160, 130, 104, 77, 55, 41.



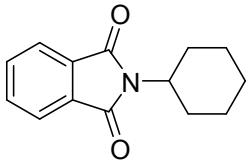
2-Isobutylisoindoline-1,3-dione (3aj)[3]

Yellow solid (29 mg, 71%); mp = 84−86 °C; R_f = 0.56 (petroleum ether / ethyl acetate = 8:1); ^{1}H NMR (400 MHz, $CDCl_3$): δ = 7.83 – 7.74 (m, 2H), 7.71 – 7.62 (m, 2H), 3.46 (d, J = 7.4 Hz, 2H), 2.08 (dp, J = 13.8, 6.9 Hz, 1H), 0.90 (d, J = 6.7 Hz, 6H). ^{13}C NMR (100 MHz, $CDCl_3$): δ = 168.4, 133.8, 132.1, 123.1, 39.6, 21.8, 11.2. MS (EI) m/z: 203, 188, 160, 130, 104, 77, 50, 41.



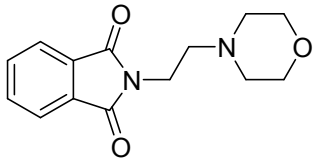
2-Cyclopropylisoindoline-1,3-dione (3ak)[2]

White solid (25 mg, 68%); mp = 136−137 °C; R_f = 0.43 (petroleum ether / ethyl acetate = 8:1); ^{1}H NMR (400 MHz, $CDCl_3$): δ = 7.72 (dt, J = 7.0, 3.5 Hz, 2H), 7.67 – 7.58 (m, 2H), 2.69 – 2.59 (m, 1H), 0.99 – 0.91 (m, 4H). ^{13}C NMR (100 MHz, $CDCl_3$): δ = 168.6, 133.8, 131.6, 122.9, 20.8, 5.0. MS (EI) m/z: 187, 169, 130, 104, 76, 50, 39.



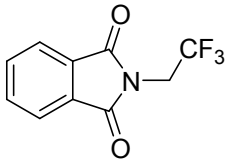
2-Cyclohexylisoindoline-1,3-dione (3al)[1]

White solid (33 mg, 73%); mp = 167−168 °C; R_f = 0.60 (petroleum ether / ethyl acetate = 8:1); ^{1}H NMR (400 MHz, $CDCl_3$): δ = 7.84 – 7.76 (m, 2H), 7.72 – 7.64 (m, 2H), 4.10 (tt, J = 12.3, 3.9 Hz, 1H), 2.20 (qd, J = 12.5, 3.2 Hz, 2H), 1.90 – 1.83 (m, 2H), 1.78 – 1.60 (m, 4H), 1.35 (ddd, J = 17.5, 14.1, 3.6 Hz, 2H). ^{13}C NMR (100 MHz, $CDCl_3$): δ = 168.4, 133.7, 132.1, 123.0, 50.9, 29.9, 26.0, 25.1. MS (EI) m/z: 229, 200, 186, 148, 130, 104, 76, 67, 41.



2-(2-Morpholinoethyl)isoindoline-1,3-dione (3am)[19]

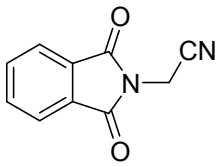
White solid (32 mg, 62%); mp = 127−128 °C; R_f = 0.39 (petroleum ether / ethyl acetate = 2:1); ^{1}H NMR (400 MHz, $CDCl_3$): δ = 7.84 (dt, J = 6.9, 3.5 Hz, 2H), 7.71 (dd, J = 5.4, 3.1 Hz, 2H), 3.81 (t, J = 6.5 Hz, 2H), 3.67 – 3.56 (m, 4H), 2.63 (t, J = 6.5 Hz, 2H), 2.51 (s, 4H).^{13}C NMR (100 MHz, $CDCl_3$): δ = 168.3, 133.9, 132.1, 123.2, 66.9, 56.1, 53.5, 34.9. MS (EI) m/z: 260, 160, 130, 100, 77, 56, 42.



2-(2,2,2-Trifluoroethyl)isoindoline-1,3-dione (3an)[20]

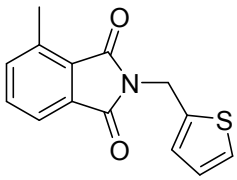
Yellow solid (30 mg, 66%); mp = 128−129 °C; R_f = 0.38 (petroleum ether / ethyl acetate = 8:1); ^{1}H NMR (400 MHz, $CDCl_3$): δ = 7.95 – 7.86 (m, 2H), 7.82 – 7.73 (m,

2H), 4.30 (q, J = 8.6 Hz, 2H). ^{13}C NMR (100 MHz, $CDCl_3$): δ = 166.7, 134.6, 131.6, 123.9, 123.2 (q, J = 278 Hz), 38.9 (q, J = 36 Hz). ^{19}F NMR (376 MHz, $CDCl_3$): δ = -70.5 (s, 3F). MS (EI) m/z: 229, 210, 185, 160, 133, 104, 76, 50, 38.



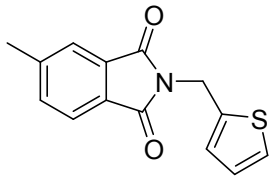
2-(1,3-Dioxoisoindolin-2-yl)acetonitrile (3ao)[21]

White solid (27 mg, 73%); mp = 126−127 °C; R_f = 0.48 (petroleum ether / ethyl acetate = 2:1); ^{1}H NMR (400 MHz, $CDCl_3$): δ = 7.96 – 7.88 (m, 2H), 7.84 – 7.75 (m, 2H), 4.57 (s, 2H). ^{13}C NMR (100 MHz, $CDCl_3$): δ = 166.0, 134.8, 131.4, 124.1, 113.5, 25.1. MS (EI) m/z: 186, 142, 132, 104, 76, 50, 39.



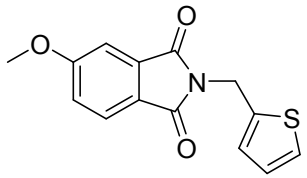
4-Methyl-2-(thiophen-2-ylmethyl)isoindoline-1,3-dione (4a)

White solid (32 mg, 63%); mp = 126−127 °C; R_f = 0.49 (petroleum ether / ethyl acetate = 8:1); ^{1}H NMR (400 MHz, $CDCl_3$): δ = 7.67 (d, J = 7.3 Hz, 1H), 7.54 (t, J = 7.5 Hz, 1H), 7.43 (d, J = 7.7 Hz, 1H), 7.20 (dd, J = 5.1, 1.2 Hz, 1H), 7.16 – 7.13 (m, 1H), 6.93 (dd, J = 5.1, 3.5 Hz, 1H), 4.99 (s, 2H), 2.69 (s, 3H). ^{13}C NMR (100 MHz, $CDCl_3$): δ = 168.3, 167.6, 138.2, 138.1, 136.4, 133.5, 132.4, 128.7, 127.6, 126.8, 125.8, 121.0, 35.5, 17.6. MS (EI) m/z: 257, 228, 214, 196, 173, 144, 118, 97, 63, 45. HRMS (ESI): calcd for $C_{14}H_{11}NNaO_2S$ $[M + Na]^+$ 280.0403; found 280.0408.



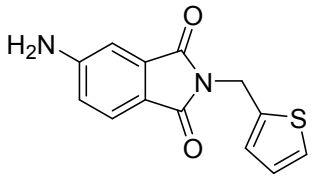
5-Methyl-2-(thiophen-2-ylmethyl)isoindoline-1,3-dione (4b)

Yellow solid (39 mg, 76%); mp 180−181 °C; R_f = 0.64 (petroleum ether / ethyl acetate = 6:1); ^{1}H NMR (400 MHz, $CDCl_3$): δ = 7.71 (d, J = 7.6 Hz, 1H), 7.66 – 7.60 (m, 1H), 7.47 (ddd, J = 7.6, 1.4, 0.7 Hz, 1H), 7.19 (dd, J = 5.1, 1.2 Hz, 1H), 7.14 – 7.11 (m, 1H), 6.92 (dd, J = 5.1, 3.5 Hz, 1H), 4.99 (s, 2H), 2.48 (s, 3H). ^{13}C NMR (100 MHz, $CDCl_3$): δ = 167.6, 167.5, 145.2, 138.2, 134.4, 132.3, 129.3, 127.5, 126.7, 125.7, 123.8, 123.2, 35.5, 21.9. MS (EI) m/z: 257, 228, 214, 196, 171, 144, 110, 96, 63, 39. HRMS (ESI): calcd for $C_{14}H_{11}NNaO_2S$ [M + Na] 280.0403; found 280.0398.



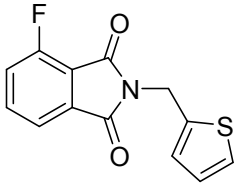
5-Methoxy-2-(thiophen-2-ylmethyl)isoindoline-1,3-dione (4c)

White solid (44 mg, 81%); mp = 129−130 °C; R_f = 0.41 (petroleum ether / ethyl acetate = 8:1); ^{1}H NMR (400 MHz, $CDCl_3$): δ = 7.74 (d, J = 8.3 Hz, 1H), 7.32 (d, J = 2.3 Hz, 1H), 7.20 (dd, J = 5.1, 1.2 Hz, 1H), 7.14 (dd, J = 8.3, 2.3 Hz, 2H), 6.92 (dd, J = 5.1, 3.5 Hz, 1H), 4.98 (s, 2H), 3.91 (s, 3H). ^{13}C NMR (100 MHz, $CDCl_3$): δ = 167.4, 167.3, 164.7, 138.3, 134.6, 127.6, 126.8, 125.8, 125.1, 123.9, 119.7, 108.2, 56.0, 35.7. MS (EI) m/z: 273, 244, 202, 160, 135, 110, 97, 63, 45. HRMS (ESI): calcd for $C_{14}H_{11}NO_3S$ $[M + H]^+$ 274.0532; found 274.0532.



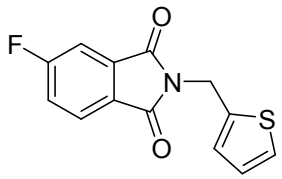
5-Amino-2-(thiophen-2-ylmethyl)isoindoline-1,3-dione (4d)

Yellow solid (36 mg, 70%); mp = 142−146 °C; R_f = 0.36 (petroleum ether / ethyl acetate = 2:1); ^{1}H NMR (400 MHz, DMSO): δ = 7.51 (d, J = 8.2 Hz, 1H), 7.40 (dd, J = 5.1, 1.2 Hz, 1H), 7.04 (dd, J = 3.4, 0.9 Hz, 1H), 6.95 (q, J = 3.4 Hz, 2H), 6.81 (dd, J = 8.2, 2.0 Hz, 1H), 6.51 (s, 2H), 4.84 (s, 2H). ^{13}C NMR (100 MHz, DMSO): δ = 168.1, 167.7, 155.6, 139.8, 134.8, 127.4, 127.2, 126.3, 125.6, 117.2, 116.8, 107.6, 35.7. MS (EI) m/z: 258, 229, 197, 145, 120, 97, 65, 41. HRMS (ESI): calcd for $C_{13}H_{10}N_2O_2S$ $[M + H]^+$ 259.0536; found 259.0536.



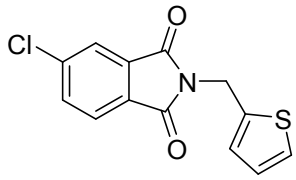
4-Fluoro-2-(thiophen-2-ylmethyl)isoindoline-1,3-dione (4e)

White solid (30 mg, 58%); mp = 146−147 °C; R_f = 0.40 (petroleum ether / ethyl acetate = 8:1); ^{1}H NMR (400 MHz, $CDCl_3$): δ = 7.70 (ddd, J = 18.6, 9.1, 5.7 Hz, 2H), 7.40 – 7.32 (m, 1H), 7.21 (dd, J = 5.1, 1.2 Hz, 1H), 7.15 (d, J = 3.0 Hz, 1H), 6.93 (dd, J = 5.1, 3.5 Hz, 1H), 5.00 (s, 2H). ^{13}C NMR (100 MHz, $CDCl_3$): δ = 166.3, 164.2, 157.5 (d, J = 265 Hz), 137.5, 136.6 (d, J = 8 Hz), 134.2 (d, J = 2 Hz), 127.9, 126.8, 125.9, 122.4 (d, J = 19 Hz), 119.6 (d, J = 4 Hz), 117.7 (d, J = 13 Hz), 35.7. ^{19}F NMR (376 MHz, $CDCl_3$): δ = -112.5 (s, 1F). MS (EI) m/z: 261, 232, 200, 178, 148, 123, 110, 96, 53, 45. HRMS (ESI): calcd for $C_{13}H_9FNO_2S$ $[M + H]^+$ 262.0333; found 262.0333.



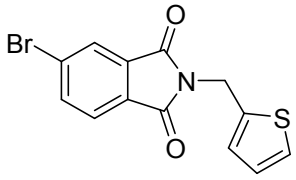
5-Fluoro-2-(thiophen-2-ylmethyl)isoindoline-1,3-dione (4f)

Orange solid (37 mg, 71%); mp = 87−88 °C; R_f = 0.53 (petroleum ether / ethyl acetate = 8:1); ^{1}H NMR (400 MHz, $CDCl_3$): δ = 7.85 (dd, J = 8.2, 4.5 Hz, 1H), 7.52 (dd, J = 7.0, 2.3 Hz, 1H), 7.39 – 7.33 (m, 1H), 7.21 (dd, J = 5.1, 1.2 Hz, 1H), 7.15 – 7.12 (m, 1H), 6.93 (dd, J = 5.1, 3.5 Hz, 1H), 5.00 (s, 2H). ^{13}C NMR (100 MHz, $CDCl_3$): δ = 166.4, 166.3 (d, J = 256 Hz), 166.1, 137.7, 134.8 (d, J = 9 Hz), 127.8, 127.7 (d, J = 4 Hz), 126.8, 125.9, 125.7 (d, J = 9 Hz), 121.0 (d, J = 24 Hz), 111.2 (d, J = 25 Hz), 35.8. ^{19}F NMR (376 MHz, $CDCl_3$): δ = -101.6 (s, 1F). MS (EI) m/z: 261, 232, 200, 178, 148, 123, 110, 96, 53, 45. HRMS (ESI): calcd for $C_{13}H_8FNNaO_2S$ $[M + Na]^+$ 284.0152; found 284.0156.



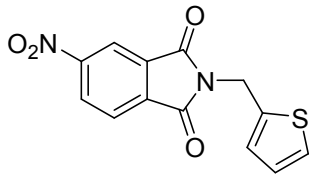
5-Chloro-2-(thiophen-2-ylmethyl)isoindoline-1,3-dione (4g)

White solid (43 mg, 78%); mp = 98−99 °C; R_f = 0.51 (petroleum ether / ethyl acetate = 8:1); ^{1}H NMR (400 MHz, $CDCl_3$): δ = 7.79 (dd, J = 11.6, 4.8 Hz, 2H), 7.66 (dd, J = 8.0, 1.8 Hz, 1H), 7.21 (dd, J = 5.1, 1.1 Hz, 1H), 7.13 (d, J = 3.0 Hz, 1H), 6.93 (dd, J = 5.1, 3.5 Hz, 1H), 5.00 (s, 2H). ^{13}C NMR (100 MHz, $CDCl_3$): δ = 166.5, 166.2, 140.8, 137.6, 134.1, 133.7, 130.0, 127.8, 126.9, 126.0, 124.6, 123.9, 35.9. MS (EI) m/z: 277, 248, 214, 186, 164, 138, 110, 96, 53, 45. HRMS (ESI): calcd for $C_{13}H_8ClNNaO_2S$ $[M + Na]^+$ 299.9856; found 299.9862.



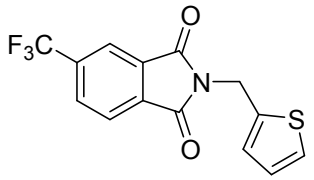
5-Bromo-2-(thiophen-2-ylmethyl)isoindoline-1,3-dione (4h)

Yellow solid (37 mg, 58%); mp = 102−104 °C; R_f = 0.47 (petroleum ether / ethyl acetate = 8:1); ^{1}H NMR (400 MHz, $CDCl_3$): δ = 7.99 – 7.95 (m, 1H), 7.84 (dd, J = 7.9, 1.7 Hz, 1H), 7.73 – 7.68 (m, 1H), 7.21 (dd, J = 5.1, 1.2 Hz, 1H), 7.15 – 7.11 (m, 1H), 6.93 (dd, J = 5.1, 3.5 Hz, 1H), 5.00 (s, 2H). ^{13}C NMR (100 MHz, $CDCl_3$): δ = 166.7, 166.2, 137.6, 137.0, 133.7, 130.5, 129.0, 127.8, 126.9, 126.8, 126.0, 124.8, 35.9. MS (EI) m/z: 321, 294, 260, 238, 214, 182, 154, 130, 110, 97, 53, 45. HRMS (ESI): calcd for $C_{13}H_9BrNO_2S$ $[M + H]^+$ 321.9532; found 321.9537.



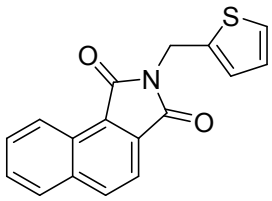
5-Nitro-2-(thiophen-2-ylmethyl)isoindoline-1,3-dione (4i)

White solid (46 mg, 80%); mp = 128−129 °C; R_f = 0.36 (petroleum ether / ethyl acetate = 8:1); ^{1}H NMR (400 MHz, $CDCl_3$): δ = 7.79 (dd, J = 11.6, 4.8 Hz, 2H), 7.66 (dd, J = 8.0, 1.8 Hz, 1H), 7.21 (dd, J = 5.1, 1.1 Hz, 1H), 7.13 (d, J = 3.0 Hz, 1H), 6.93 (dd, J = 5.1, 3.5 Hz, 1H), 5.00 (s, 2H). ^{13}C NMR (100 MHz, $CDCl_3$): δ = 166.5, 166.2, 140.8, 137.6, 134.1, 133.7, 130.0, 127.8, 126.9, 126.0, 124.6, 123.9, 35.9. MS (EI) m/z: 288, 258, 207, 186, 130, 110, 97, 75, 45. HRMS (ESI): calcd for $C_{13}H_7N_2O_4S$ $[M-H]^+$ 287.0121; found 287.0123.



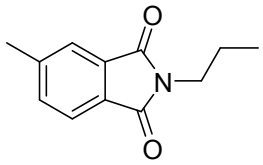
2-(Thiophen-2-ylmethyl)-5-(trifluoromethyl)isoindoline-1,3-dione (4j)

White solid (46 mg, 74%); mp = 64−65 °C; R_f = 0.43 (petroleum ether / ethyl acetate = 8:1); ^{1}H NMR (400 MHz, $CDCl_3$): δ = 8.11 (s, 1H), 8.03 – 7.95 (m, 2H), 7.21 (dd, J = 5.1, 1.1 Hz, 1H), 7.18 – 7.12 (m, 1H), 6.93 (dd, J = 5.1, 3.5 Hz, 1H), 5.04 (s, 2H). ^{13}C NMR (100 MHz, $CDCl_3$): δ = 166.1, 166.0, 137.3, 136.1 (q, J = 33 Hz), 134.8, 132.6, 131.2 (q, J = 4 Hz), 128.0, 127.0, 126.1, 123.9, 122.9 (q, J = 271 Hz), 120.6 (q, J = 4 Hz), 35.9. ^{19}F NMR (376 MHz, $CDCl_3$): δ = -63.0 (s, 3F). MS (EI) m/z: 311, 282, 250, 198, 173, 144, 110, 97, 63, 45. HRMS (ESI): calcd for $C_{14}H_7F_3NO_2S$ $[M-H]^+$ 310.0144; found 310.0145.



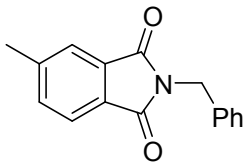
2-(Thiophen-2-ylmethyl)-1H-benzo[e]isoindole-1,3(2H)-dione (4k)

White solid (28 mg, 49%); mp = 180−182 °C; R_f = 0.46 (petroleum ether / ethyl acetate = 10:1); ^{1}H NMR (400 MHz, CDCl3): δ = 8.94 (d, J = 8.4 Hz, 1H), 8.15 (d, J = 8.2 Hz, 1H), 7.94 (d, J = 8.2 Hz, 1H), 7.86 (d, J = 8.2 Hz, 1H), 7.76 – 7.60 (m, 2H), 7.24 – 7.14 (m, 2H), 6.94 (dd, J = 5.0, 3.6 Hz, 1H), 5.06 (s, 2H). ^{13}C NMR (100 MHz, $CDCl_3$): δ = 168.9, 168.2, 138.3, 136.6, 135.0, 131.2, 129.5, 128.8, 128.7, 128.0, 127.6, 127.4, 126.9, 125.8, 124.9, 118.5, 35.6. MS (EI) m/z: 293, 264, 236, 180, 154, 126, 97, 53, 39. HRMS (ESI): calcd for $C_{17}H_{11}NO_2S$ $[M + H]^+$ 294.0583; found 294.0588.



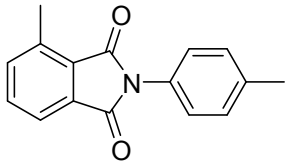
5-Methyl-2-propylisoindoline-1,3-dione (4l)[22]

White solid (34 mg, 84%); mp = 60−62 °C; R_f = 0.5 (petroleum ether / ethyl acetate = 8:1); ^{1}H NMR (400 MHz, $CDCl_3$): δ = 7.69 (d, J = 7.6 Hz, 1H), 7.61 (s, 1H), 7.47 (d, J = 7.6 Hz, 1H), 3.64 – 3.58 (m, 2H), 2.48 (s, 3H), 1.73 – 1.62 (m, 2H), 0.92 (t, J = 7.4 Hz, 3H). ^{13}C NMR (100 MHz, $CDCl_3$): δ = 168.6, 168.5, 145.0, 134.3, 132.5, 129.5, 123.6, 123.0, 39.5, 21.9, 21.9, 11.3. MS (EI) m/z: 203, 174, 161, 147, 118, 89, 63, 39.



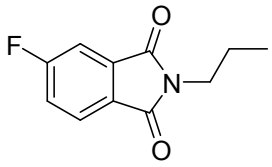
2-Benzyl-5-methylisoindoline-1,3-dione (4m)[13]

White solid (37 mg, 74%); mp 123−124 °C; R_f = 0.60 (petroleum ether / ethyl acetate = 8:1); ^{1}H NMR (400 MHz, $CDCl_3$): δ = 7.72 (d, J = 7.6 Hz, 1H), 7.66 – 7.62 (m, 1H), 7.48 (dd, J = 7.6, 0.6 Hz, 1H), 7.45 – 7.39 (m, 2H), 7.33 – 7.28 (m, 2H), 7.27 – 7.25 (m, 1H), 4.83 (s, 2H), 2.49 (s, 3H). ^{13}C NMR (100 MHz, $CDCl_3$): δ = 168.2, 168.1, 145.2, 136.5, 134.5, 132.5, 129.5, 128.6, 128.5, 127.7, 123.9, 123.2, 41.5, 22.0. MS (EI) m/z: 251, 233, 222, 194, 165, 144, 104, 91, 65, 39.



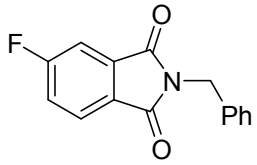
4-Methyl-2-(*p*-tolyl)isoindoline-1,3-dione (4n)[23]

White solid (35 mg, 70%); mp = 160−161 °C; R_f = 0.51 (petroleum ether / ethyl acetate = 8:1); ^{1}H NMR (400 MHz, $CDCl_3$): δ = 7.77 (d, J = 7.3 Hz, 1H), 7.62 (t, J = 7.5 Hz, 1H), 7.52 (d, J = 7.7 Hz, 1H), 7.30 (s, 4H), 2.74 (s, 3H), 2.41 (s, 3H). ^{13}C NMR (100 MHz, $CDCl_3$): δ = 168.1, 167.4, 138.4, 138.0, 136.6, 133.7, 132.3, 129.7, 129.0, 128.4, 126.5, 121.3, 21.2, 17.7. MS (EI) m/z: 251, 223, 207, 192, 165, 132, 118, 89, 63, 39.



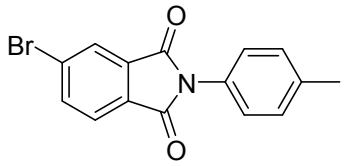
5-Fluoro-2-propylisoindoline-1,3-dione (4o)

White solid (29 mg, 71%); mp = 56−57 °C; R_f = 0.58 (petroleum ether / ethyl acetate = 8:1); ^{1}H NMR (400 MHz, $CDCl_3$): δ = 7.83 (dd, J = 8.2, 4.5 Hz, 1H), 7.50 (dd, J = 7.0, 2.2 Hz, 1H), 7.36 (ddd, J = 8.8, 8.3, 2.3 Hz, 1H), 3.64 (dd, J = 7.8, 6.8 Hz, 2H), 1.70 (dt, J = 14.7, 7.4 Hz, 2H), 0.94 (t, J = 7.4 Hz, 3H). ^{13}C NMR (100 MHz, $CDCl_3$): δ = 167.3, 167.0 (d, J = 3 Hz), 166.3 (d, J = 255 Hz), 134.9 (d, J = 9 Hz), 127.9 (d, J = 3 Hz), 125.4 (d, J = 9 Hz), 120.7 (d, J = 24 Hz), 111.0 (d, J = 25 Hz), 39.8, 21.8, 21.2. ^{19}F NMR (376 MHz, $CDCl_3$): δ = -102.3 (s, 1F). MS (EI) m/z: 207, 192, 178, 151, 122, 94, 50, 41. HRMS (ESI): calcd for $C_{15}H_{10}FNNaO_2$ $[M + Na]^+$ 278.0588; found 278.0596.



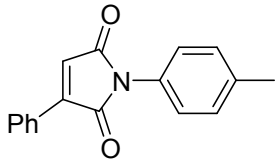
2-Benzyl-5-fluoroisoindoline-1,3-dione (4p)[24]

Yellow solid (38 mg, 75%); mp = 118−119 °C; R_f = 0.48 (petroleum ether / ethyl acetate = 8:1); ^{1}H NMR (400 MHz, $CDCl_3$): δ = 7.84 (dd, J = 8.2, 4.5 Hz, 1H), 7.51 (dd, J = 7.0, 2.2 Hz, 1H), 7.42 (d, J = 7.1 Hz, 2H), 7.39 – 7.33 (m, 2H), 7.29 (dd, J = 5.9, 4.7 Hz, 2H), 4.84 (s, 2H). ^{13}C NMR (100 MHz, $CDCl_3$): δ = 166.9, 166.5 (d, J = 3 Hz), 166.3 (d, J = 255 Hz), 136.0, 134.9 (d, J = 9 Hz), 128.6, 128.5, 127.8, 127.8 (d, J = 4 Hz), 125.6 (d, J = 9 Hz), 120.9 (d, J = 24 Hz), 111.1 (d, J = 25 Hz), 41.8. ^{19}F NMR (376 MHz, $CDCl_3$): δ = -101.8 (s, 1F). MS (EI) m/z: 255, 237, 198, 1458, 123, 104, 94, 65, 39.



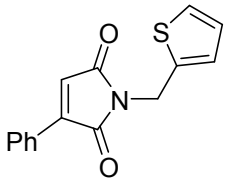
5-Bromo-2-(*p*-tolyl)isoindoline-1,3-dione (4q)[25]

Yellow solid (42 mg, 67%); mp = 176−178 °C; R_f = 0.54 (petroleum ether / ethyl acetate = 8:1); ^{1}H NMR (400 MHz, $CDCl_3$): δ = 8.08 (d, J = 1.3 Hz, 1H), 7.92 (dd, J = 7.9, 1.7 Hz, 1H), 7.81 (d, J = 7.9 Hz, 1H), 7.33 – 7.28 (m, 4H), 2.41 (s, 3H). ^{13}C NMR (100 MHz, $CDCl_3$): δ = 166.6, 166.1, 138.4, 137.3, 133.5, 130.4, 129.8, 129.2, 128.8, 127.0, 126.4, 125.0, 21.2. MS (EI) m/z: 315, 271, 236, 207, 192, 165, 130, 104, 75, 50, 39.



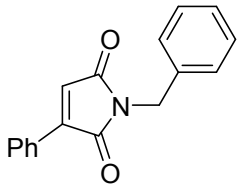
3-Phenyl-1-(*p*-tolyl)-1H-pyrrole-2,5-dione (5a)

Yellow solid (39 mg, 75%); mp = 118−119 °C; R_f = 0.25 (petroleum ether / ethyl acetate = 10:1); ^{1}H NMR (400 MHz, $CDCl_3$): δ = 8.03 – 7.95 (m, 2H), 7.53 – 7.44 (m, 3H), 7.32 – 7.27 (m, 4H), 6.86 – 6.82 (m, 1H), 2.41 (s, 3H). ^{13}C NMR (100 MHz, $CDCl_3$): δ = 169.4, 169.1, 143.4, 137.7, 131.1, 129.6, 128.8, 128.7, 128.6, 128.5, 126.0, 123.9, 21.0. MS (EI) m/z: 263, 234, 207, 133, 102, 85, 57, 43. HRMS (ESI): calcd for $C_{17}H_{14}NO_2$ $[M + H]^+$ 264.1019; found 264.1024.



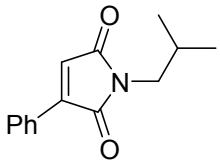
3-Phenyl-1-(thiophen-2-ylmethyl)-1H-pyrrole-2,5-dione (5b)

Yellow solid (37 mg, 69%); mp = 136−138 °C; R_f = 0.27 (petroleum ether / ethyl acetate = 10:1); ^{1}H NMR (400 MHz, $CDCl_3$): δ = 7.95 – 7.87 (m, 2H), 7.49 – 7.40 (m, 3H), 7.22 (dd, J = 5.1, 1.2 Hz, 1H), 7.12 (d, J = 3.4 Hz, 1H), 6.94 (dd, J = 5.1, 3.5 Hz, 1H), 6.74 – 6.70 (m, 1H), 4.91 (s, 2H). ^{13}C NMR (100 MHz, $CDCl_3$): δ = 169.8, 169.4, 143.8, 138.1, 131.1, 128.9, 128.5, 127.5, 126.8, 125.8, 123.8, 35.6. MS (EI) m/z: 269, 224, 212, 102, 97, 53, 39. HRMS (ESI): calcd for $C_{15}H_{12}NO_2S$ $[M + H]^+$ 270.0583; found 270.0589.



1-Benzyl-3-phenyl-1H-pyrrole-2,5-dione (5c)[26]

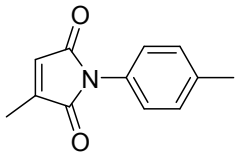
White solid (30 mg, 57%); mp = 148−149 °C; R_f = 0.29 (petroleum ether / ethyl acetate = 10:1); ^{1}H NMR (400 MHz, $CDCl_3$): δ = 8.03 – 7.95 (m, 2H), 7.53 – 7.44 (m, 3H), 7.32 – 7.27 (m, 4H), 6.86 – 6.82 (m, 1H), 2.41 (s, 3H). ^{13}C NMR (100 MHz, $CDCl_3$): δ = 170.3, 169.9, 143.7, 136.3, 131.1, 128.9, 128.6, 128.6, 128.4, 127.8, 123.8, 41.5. MS (EI) m/z: 263, 235, 218, 131, 102, 77, 65, 39.



1-Isobutyl-3-phenyl-1H-pyrrole-2,5-dione (5d)

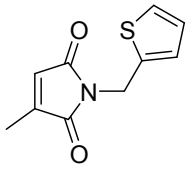
White solid (19 mg, 42%); mp = 71−73 °C; R_f = 0.41 (petroleum ether / ethyl acetate = 10:1); ^{1}H NMR (400 MHz, $CDCl_3$): δ = 7.95 – 7.88 (m, 2H), 7.48 – 7.39 (m, 3H), 6.76 – 6.67 (m, 1H), 3.38 (d, J = 7.4 Hz, 2H), 2.04 (dhept, J = 13.7, 6.8 Hz, 1H), 0.91 (d, J = 6.7 Hz, 6H). ^{13}C NMR (100 MHz, $CDCl_3$): δ = 170.8, 170.6, 143.3, 130.9,

128.8, 128.7, 128.5, 123.7, 45.2, 27.7, 20.0. MS (EI) m/z: 229, 186, 174, 158, 102, 91, 56, 41. HRMS (ESI): calcd for $C_{14}H_{16}NO_2$ $[M + H]^+$ 230.1176; found 230.1181.



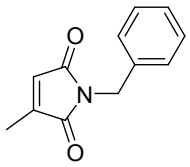
3-Methyl-1-(*p*-tolyl)-1H-pyrrole-2,5-dione (5e)[27]

White solid (35 mg, 87%); mp = 117−119 °C; R_f = 0.20 (petroleum ether / ethyl acetate = 10:1); ^{1}H NMR (400 MHz, $CDCl_3$): δ = 7.28 – 7.24 (m, 2H), 7.20 (d, J = 8.4 Hz, 2H), 6.46 (dd, J = 3.5, 1.7 Hz, 1H), 2.37 (s, 3H), 2.16 (d, J = 1.8 Hz, 3H). ^{13}C NMR (100 MHz, $CDCl_3$): δ = 170.7, 169.7, 145.7, 137.7, 129.6, 128.9, 127.4, 125.8, 21.1, 11.1. MS (EI) m/z: 201, 186, 157, 132, 117, 77, 68, 40.



3-Methyl-1-(thiophen-2-ylmethyl)-1H-pyrrole-2,5-dione (5f)

Yellow oil (29 mg, 71%); R_f = 0.24 (petroleum ether / ethyl acetate = 8:1); ^{1}H NMR (400 MHz, $CDCl_3$): δ = 7.18 (dd, J = 5.1, 1.2 Hz, 1H), 7.04 (d, J = 3.0 Hz, 1H), 6.90 (dd, J = 5.1, 3.5 Hz, 1H), 6.31 (q, J = 1.8 Hz, 1H), 4.80 (s, 2H), 2.05 (d, J = 1.9 Hz, 3H). ^{13}C NMR (100 MHz, $CDCl_3$): δ = 170.9, 169.9, 145.7, 138.2, 127.3, 127.3, 126.8, 125.6, 35.5, 10.9. MS (EI) m/z: 207, 178, 164, 110, 97, 53, 39. HRMS (ESI): calcd for $C_{10}H_{10}NO_2S$ $[M + H]^+$ 208.0427; found 208.0430.



1-Benzyl-3-methyl-1H-pyrrole-2,5-dione (5g)[28]

Yellow oil (25 mg, 62%); R_f = 0.27 (petroleum ether / ethyl acetate = 8:1); ^{1}H NMR (400 MHz, $CDCl_3$): δ = 7.37 – 7.28 (m, 4H), 7.28 – 7.23 (m, 1H), 6.32 (q, J = 1.8 Hz, 1H), 4.65 (s, 2H), 2.07 (d, J = 1.8 Hz, 3H). ^{13}C NMR (100 MHz, $CDCl_3$): δ = 171.4, 170.4, 145.7, 136.4, 128.6, 128.3, 127.7, 127.3, 41.4, 10.9. MS (EI) m/z: 201, 172, 158, 144, 104, 78, 65, 39.

D. Reference

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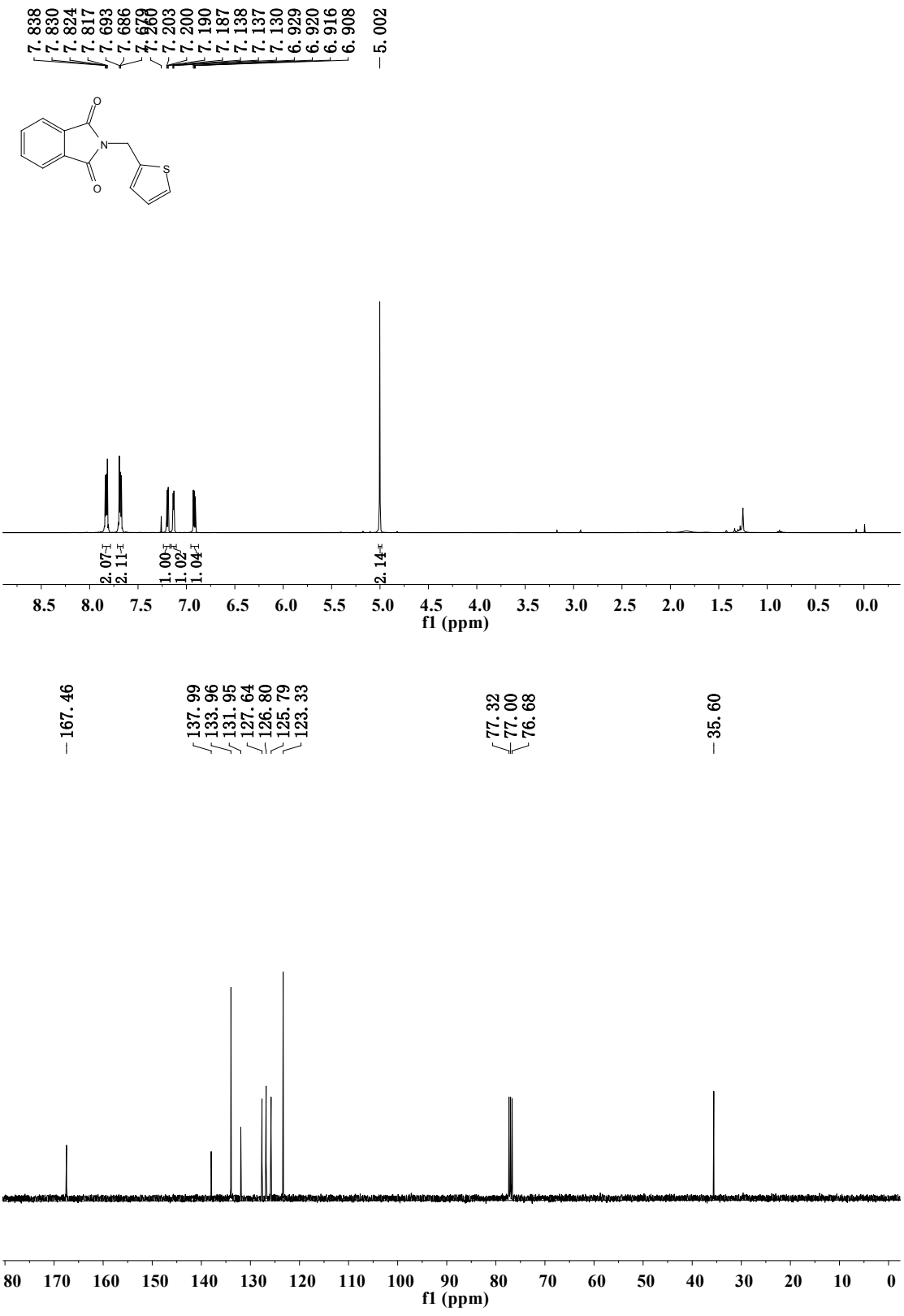
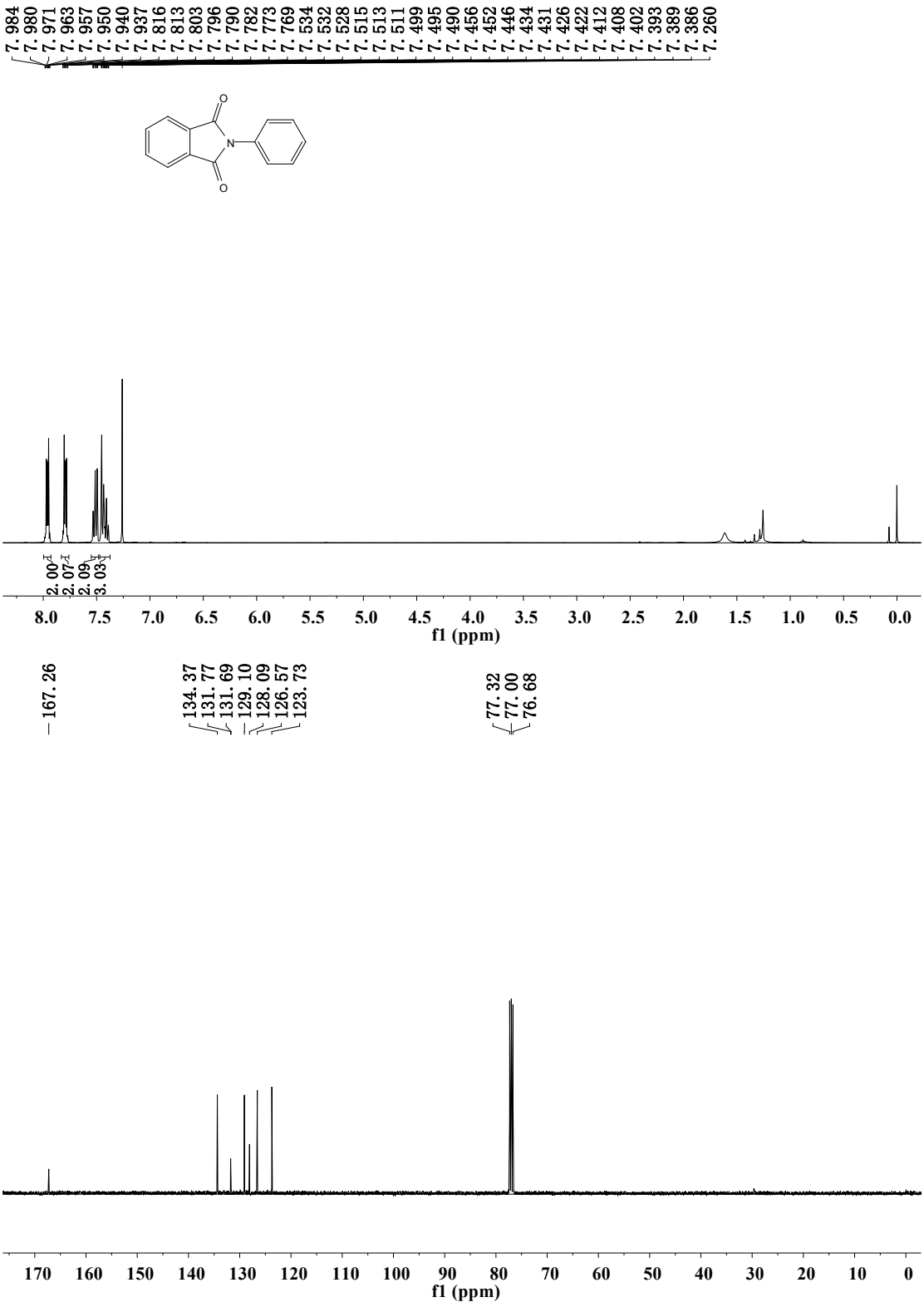
Org. Lett., **2016**, *18*, 2568-2571.

E. NMR Spectra

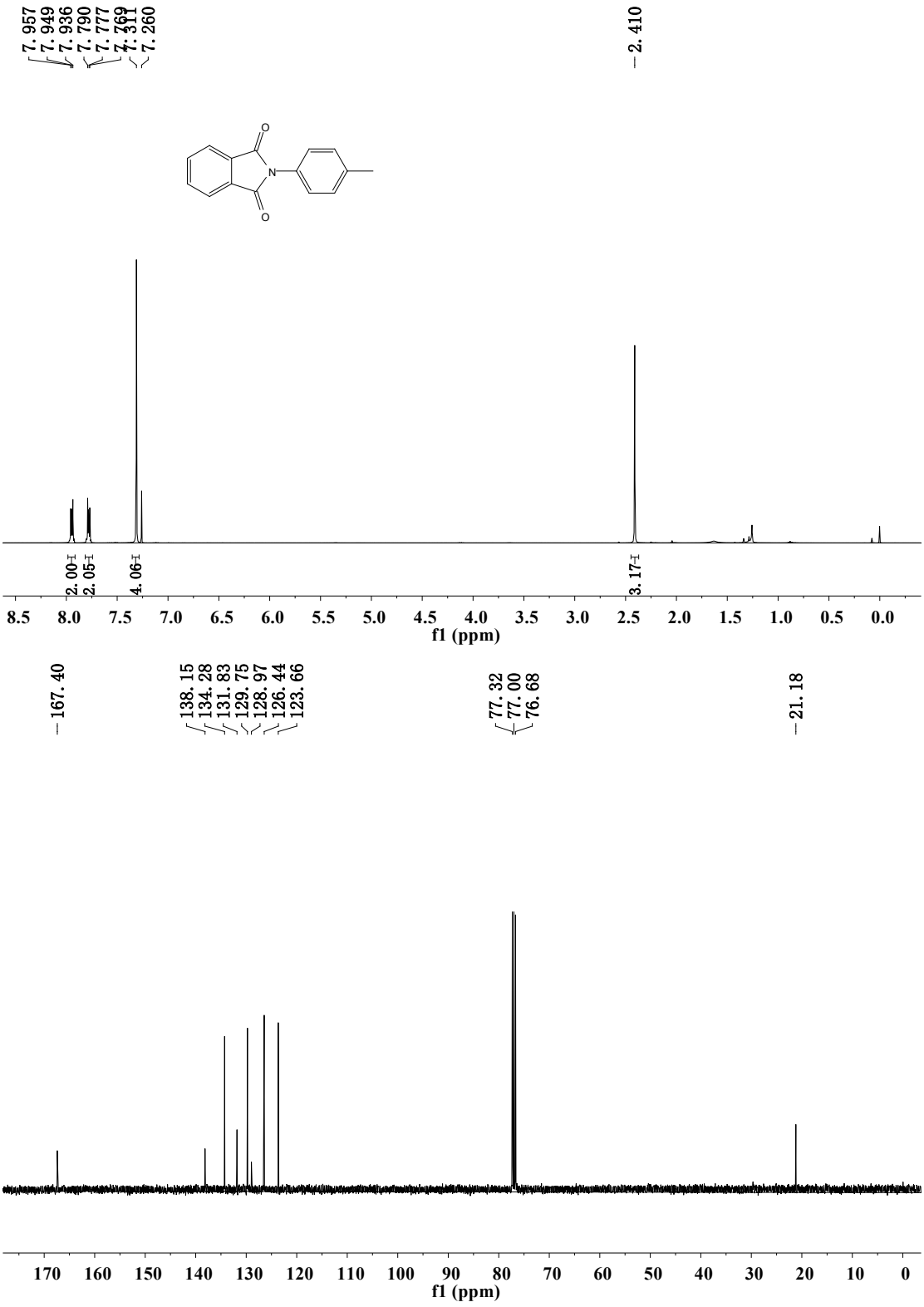
^{1}H NMR and ^{13}C NMR of 2-(thiophen-2-ylmethyl)isoindoline-1,3-dione (3a)



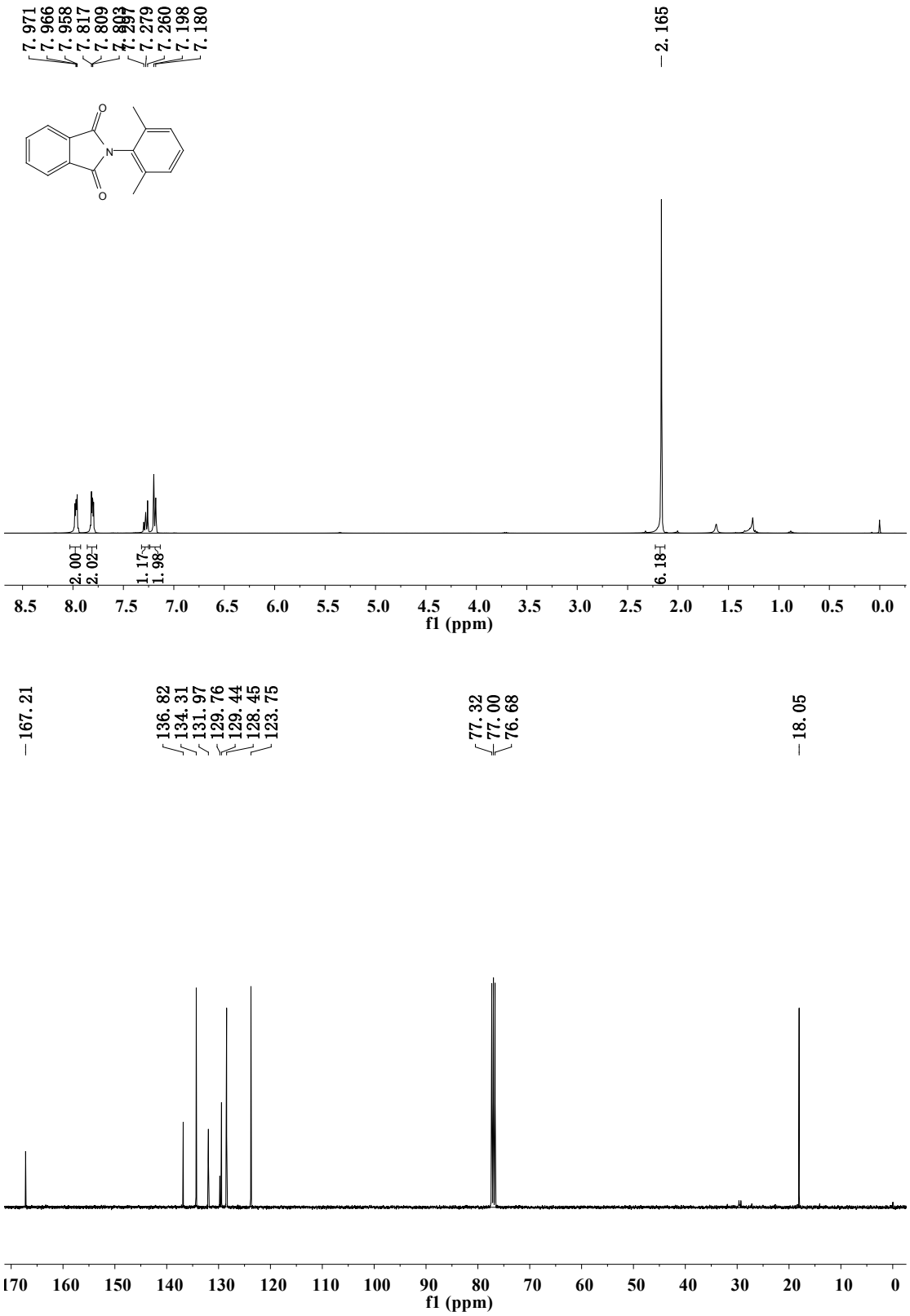
^{1}H NMR and ^{13}C NMR of 2-phenylisoindoline-1,3-dione (3b)



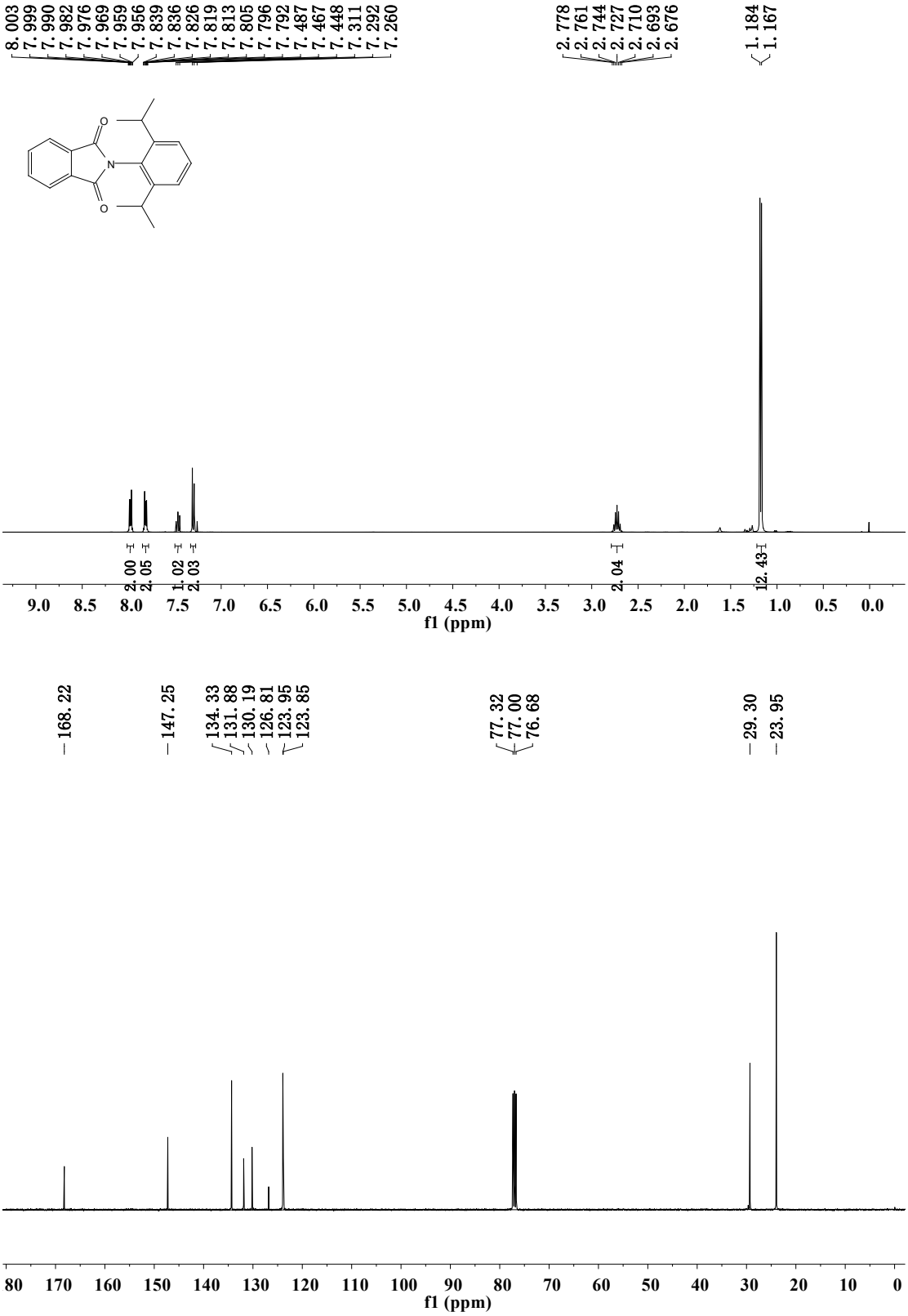
^{1}H NMR and ^{13}C NMR of 2-(*p*-tolyl)isoindoline-1,3-dione (3c)



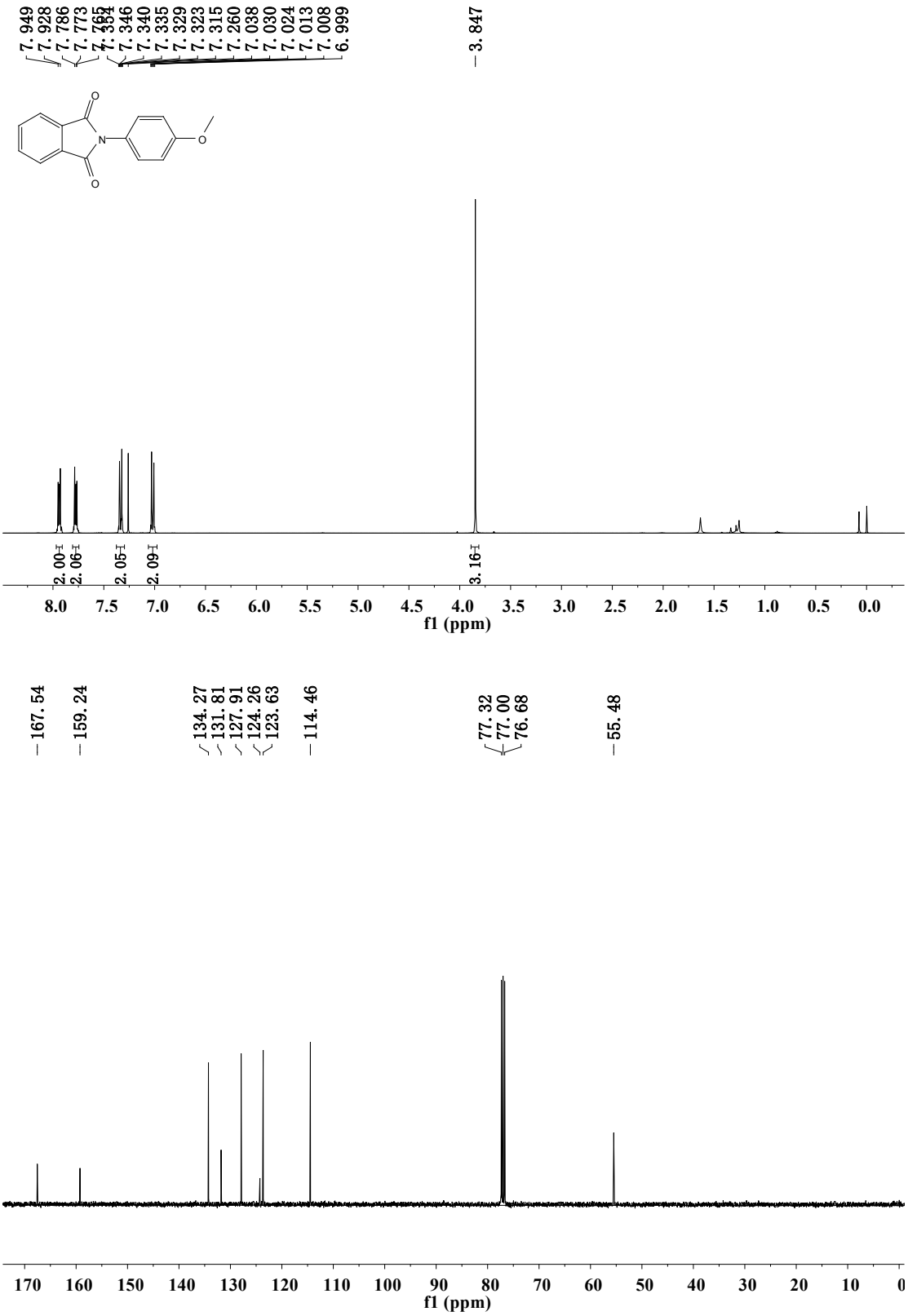
^{1}H NMR and ^{13}C NMR of 2-(2,6-dimethylphenyl)isoindoline-1,3-dione (3d)



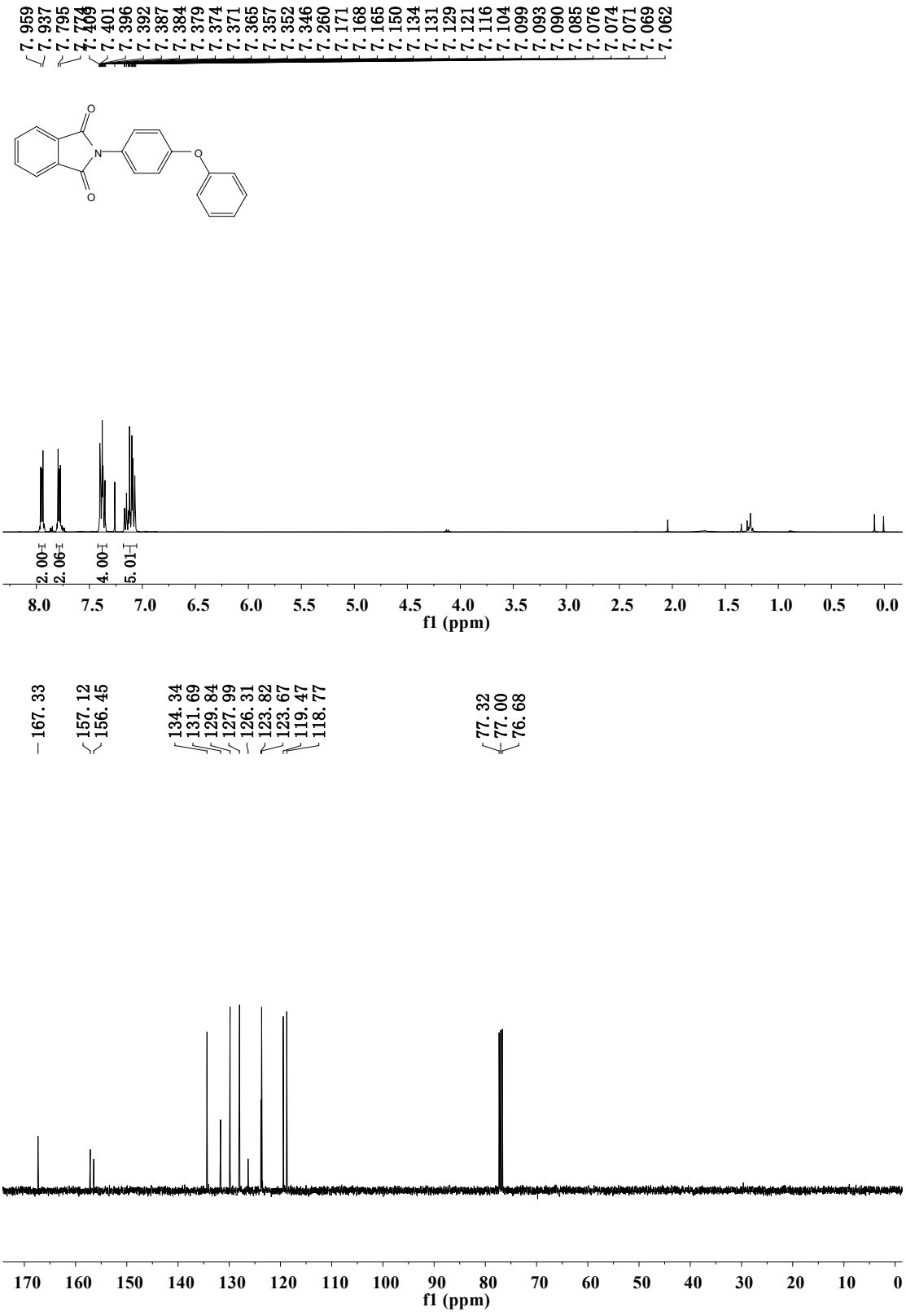
^{1}H NMR and ^{13}C NMR of 2-(2,6-diisopropylphenyl)isoindoline-1,3-dione (3e)



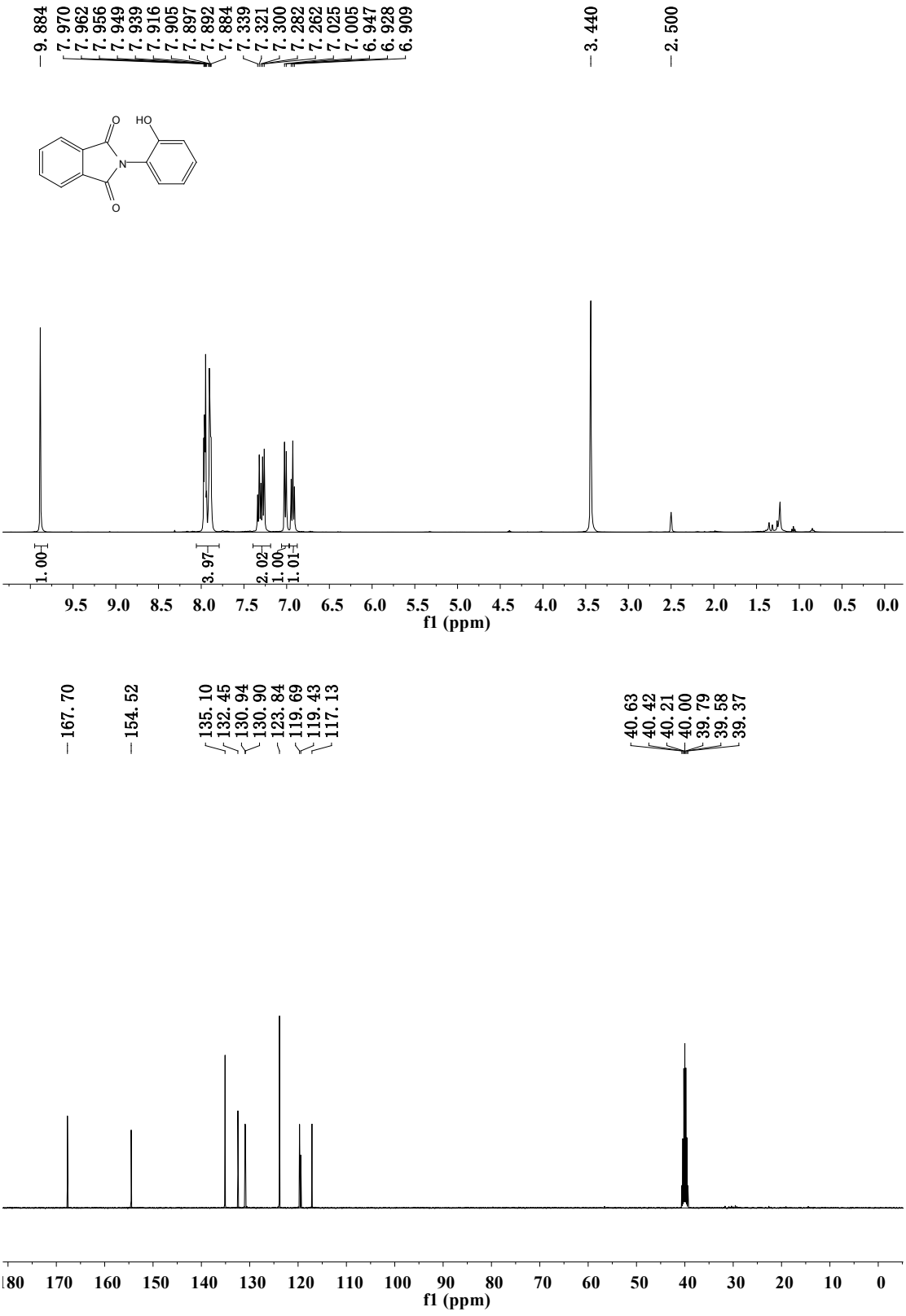
^{1}H NMR and ^{13}C NMR of 2-(4-methoxyphenyl)isoindoline-1,3-dione (3f)



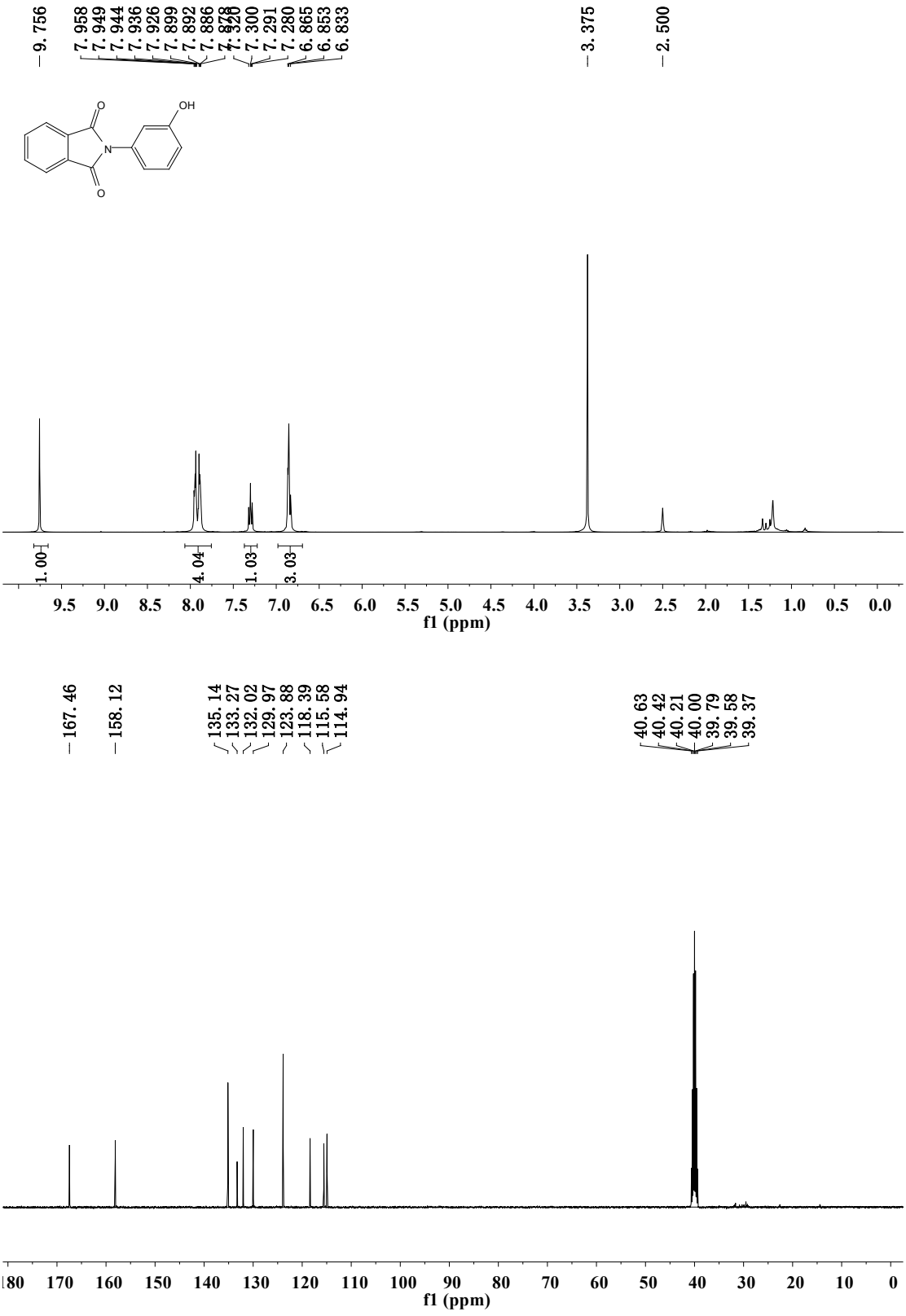
^{1}H NMR and ^{13}C NMR of 2-(4-phenoxyphenyl)isoindoline-1,3-dione (3g)



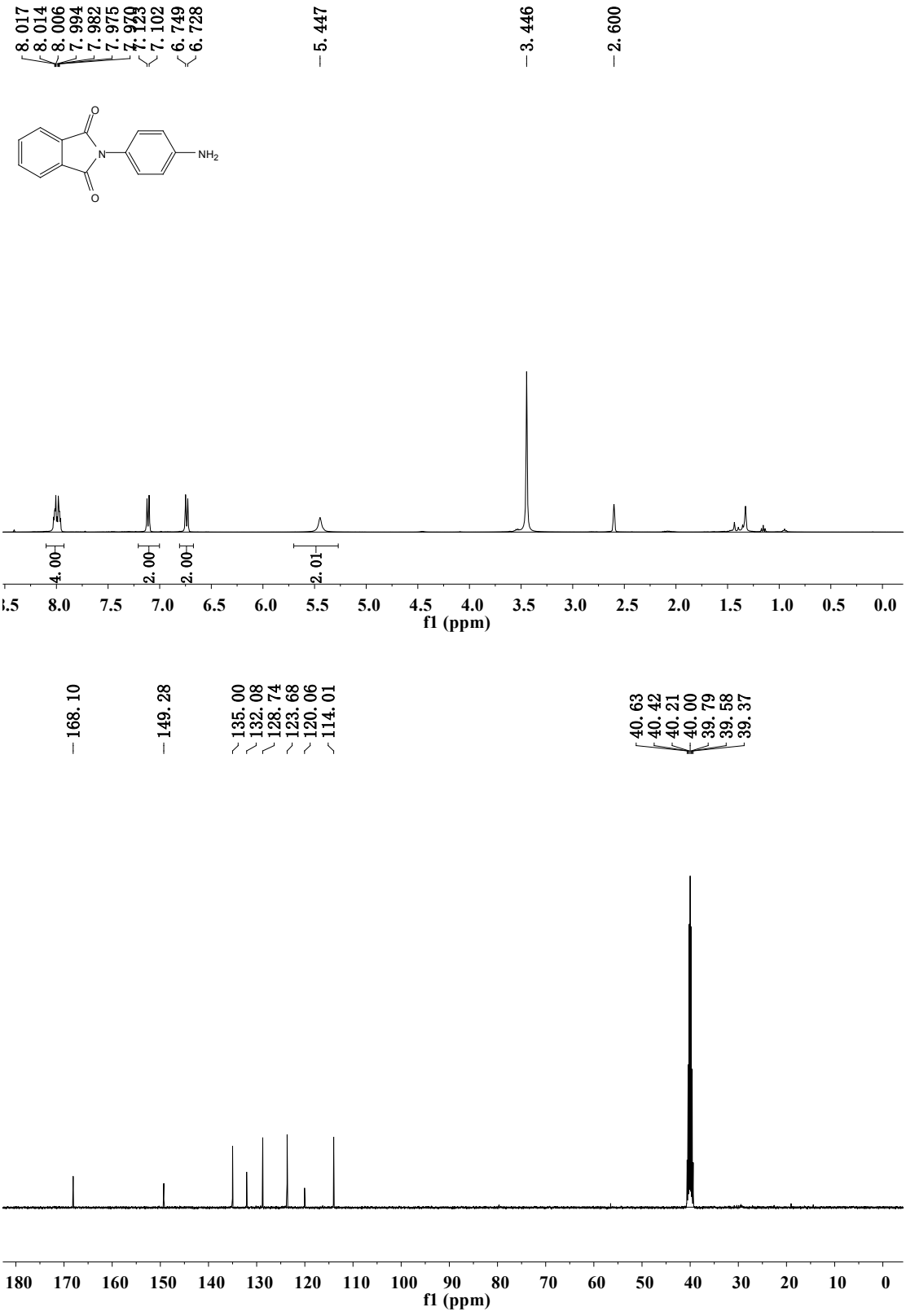
^{1}H NMR and ^{13}C NMR of 2-(2-hydroxyphenyl)isoindoline-1,3-dione (3h)



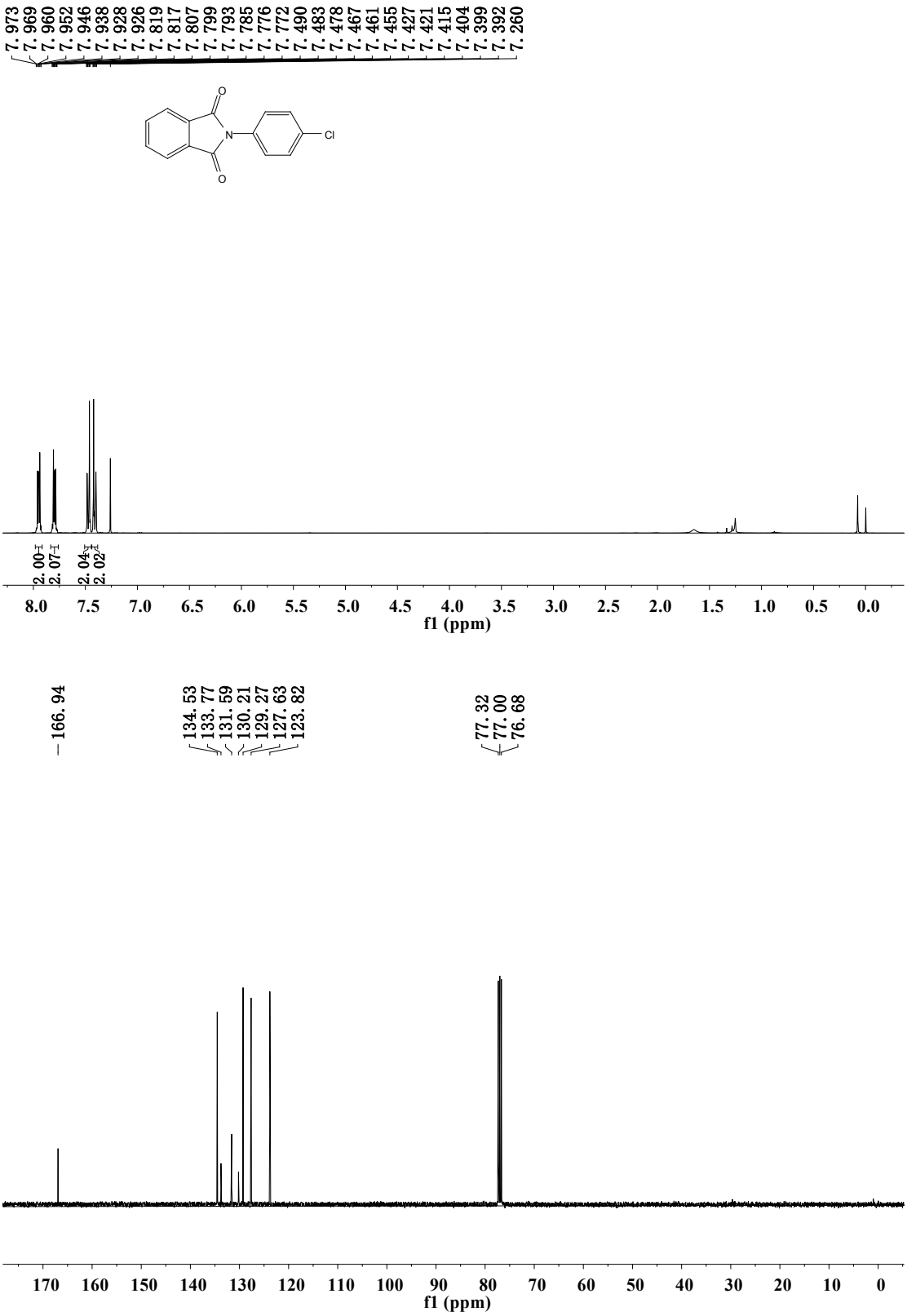
^{1}H NMR and ^{13}C NMR of 2-(3-hydroxyphenyl)isoindoline-1,3-dione (3i)



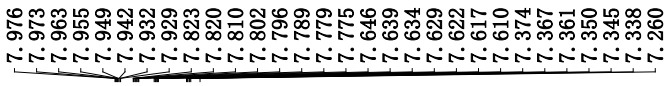
^{1}H NMR and ^{13}C NMR of 2-(4-aminophenyl)isoindoline-1,3-dione (3j)

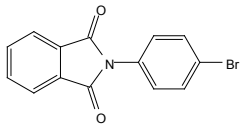


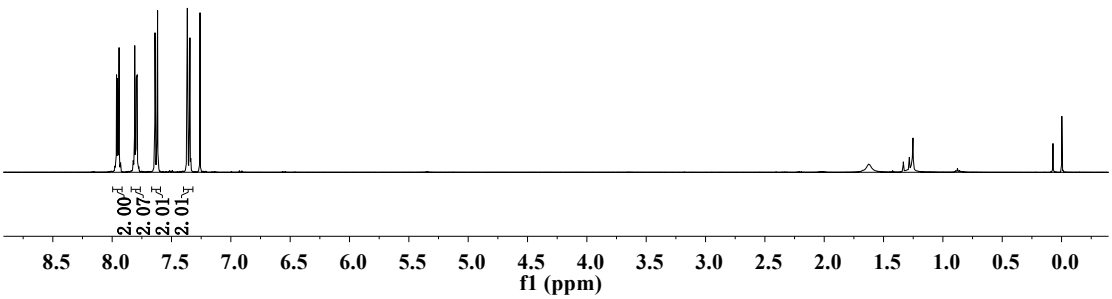
^{1}H NMR and ^{13}C NMR of 2-(4-chlorophenyl)isoindoline-1,3-dione (3k)

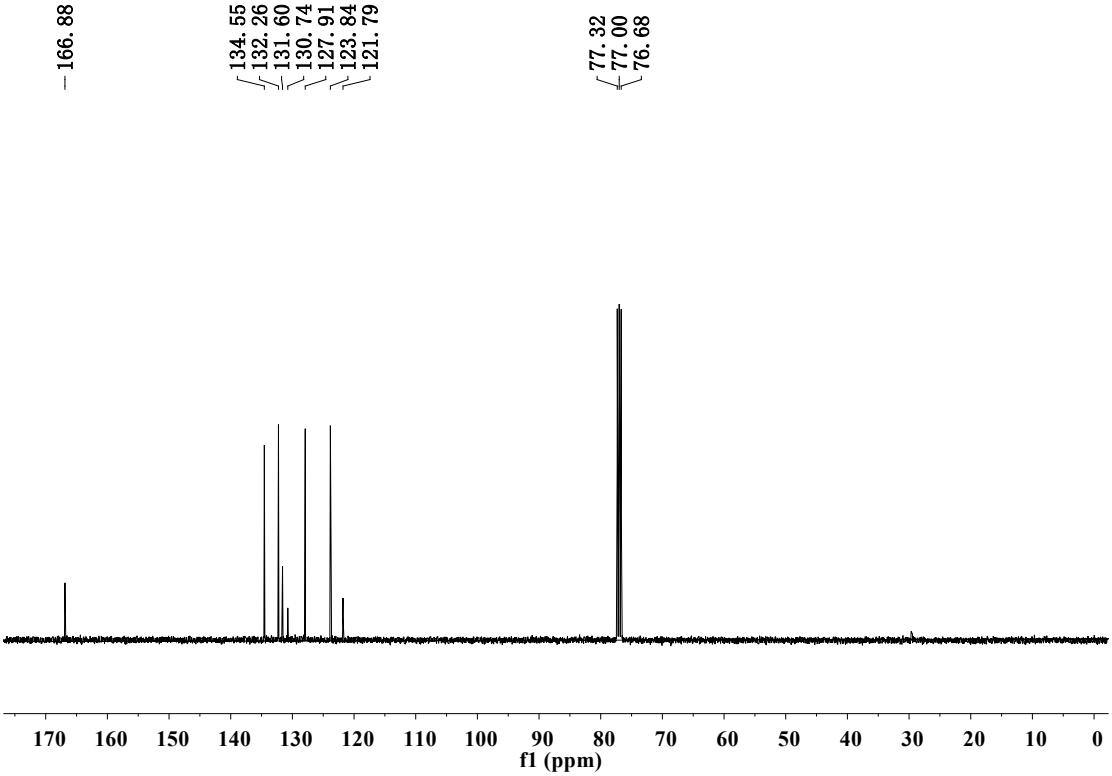


^{1}H NMR and ^{13}C NMR of 2-(4-bromophenyl)isoindoline-1,3-dione (3l)

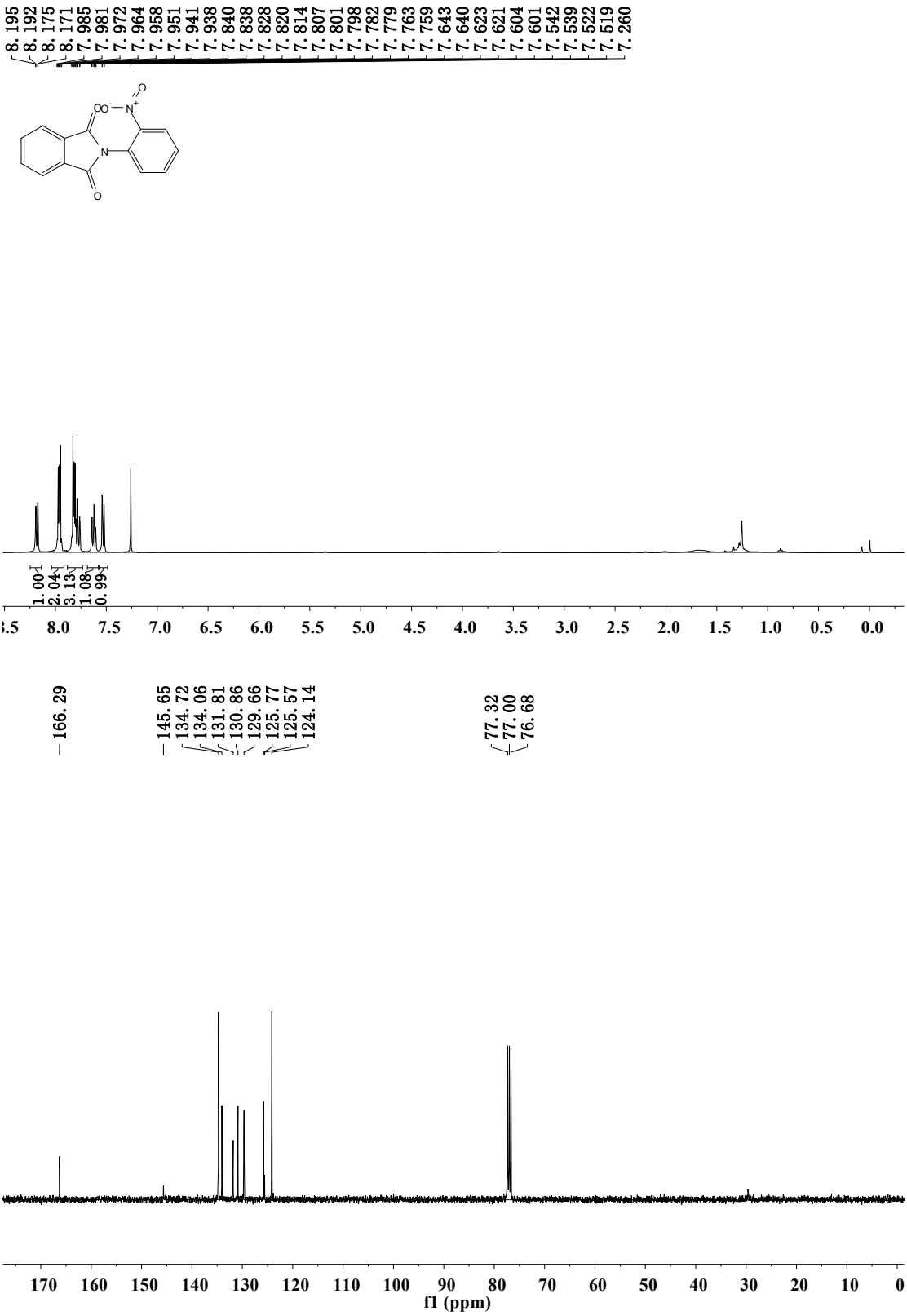




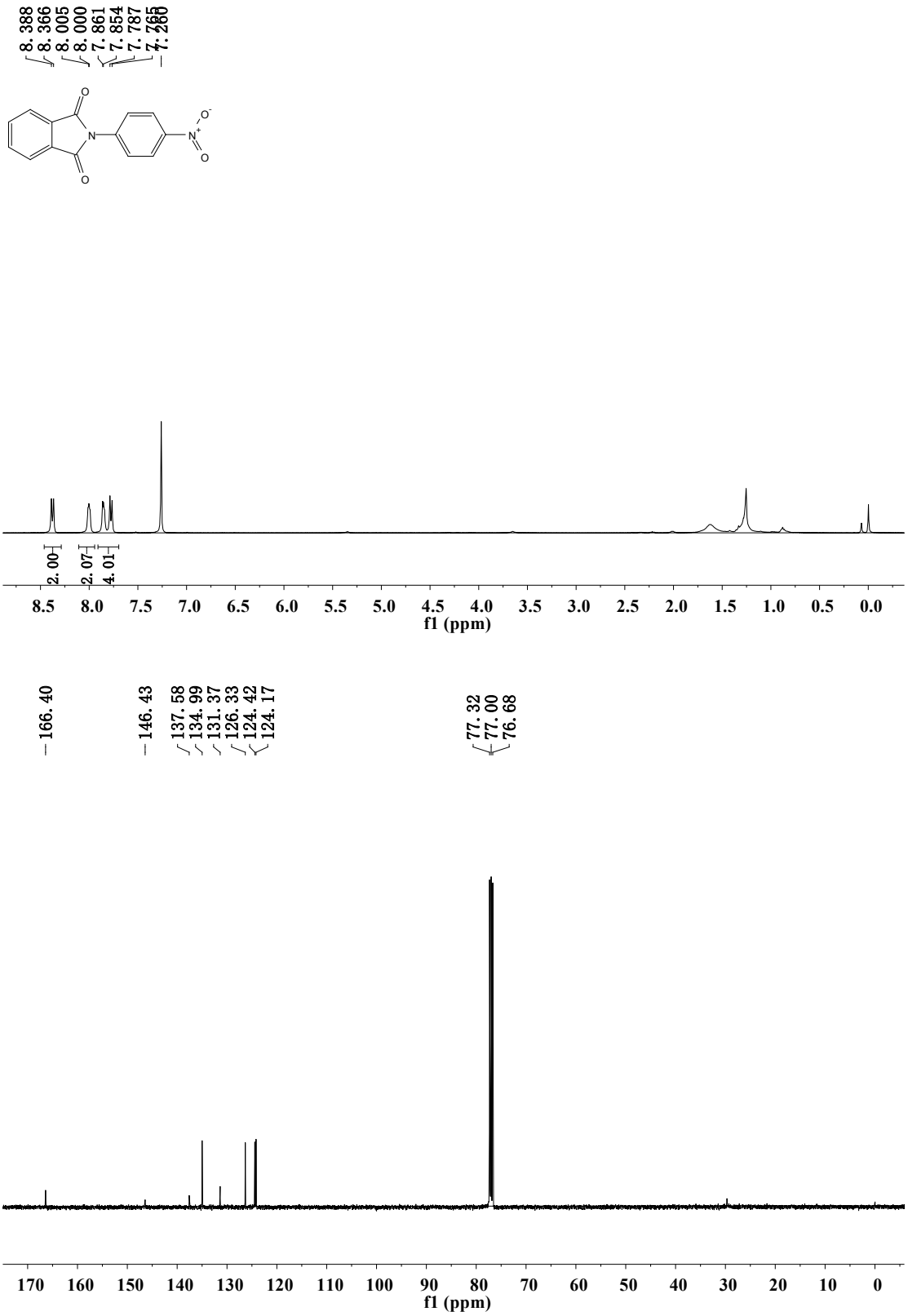




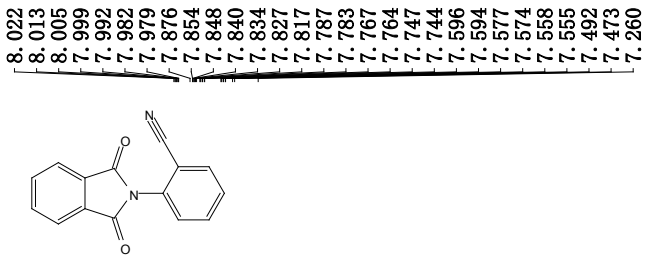
^{1}H NMR and ^{13}C NMR of 2-(2-nitrophenyl)isoindoline-1,3-dione (3m)

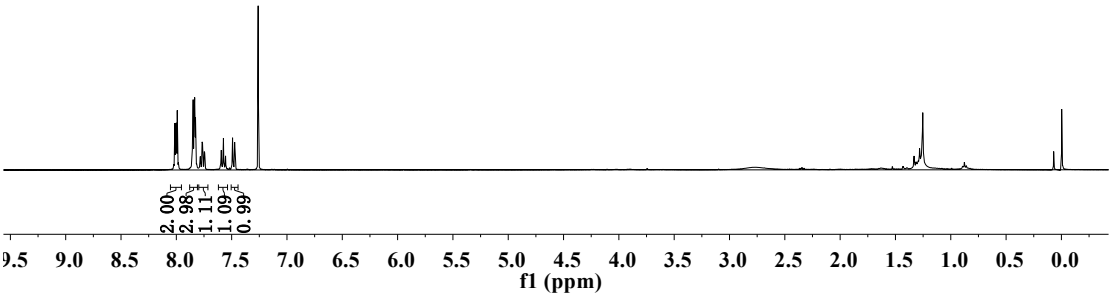


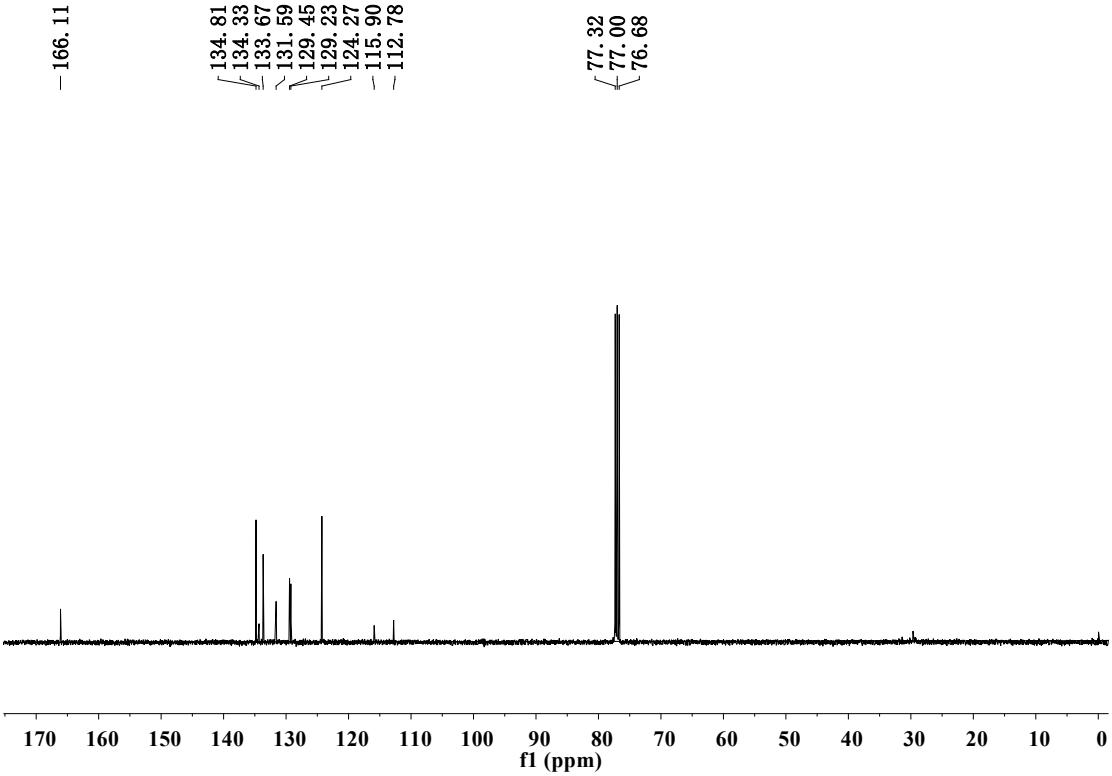
^{1}H NMR and ^{13}C NMR of 2-(4-nitrophenyl)isoindoline-1,3-dione (3n)



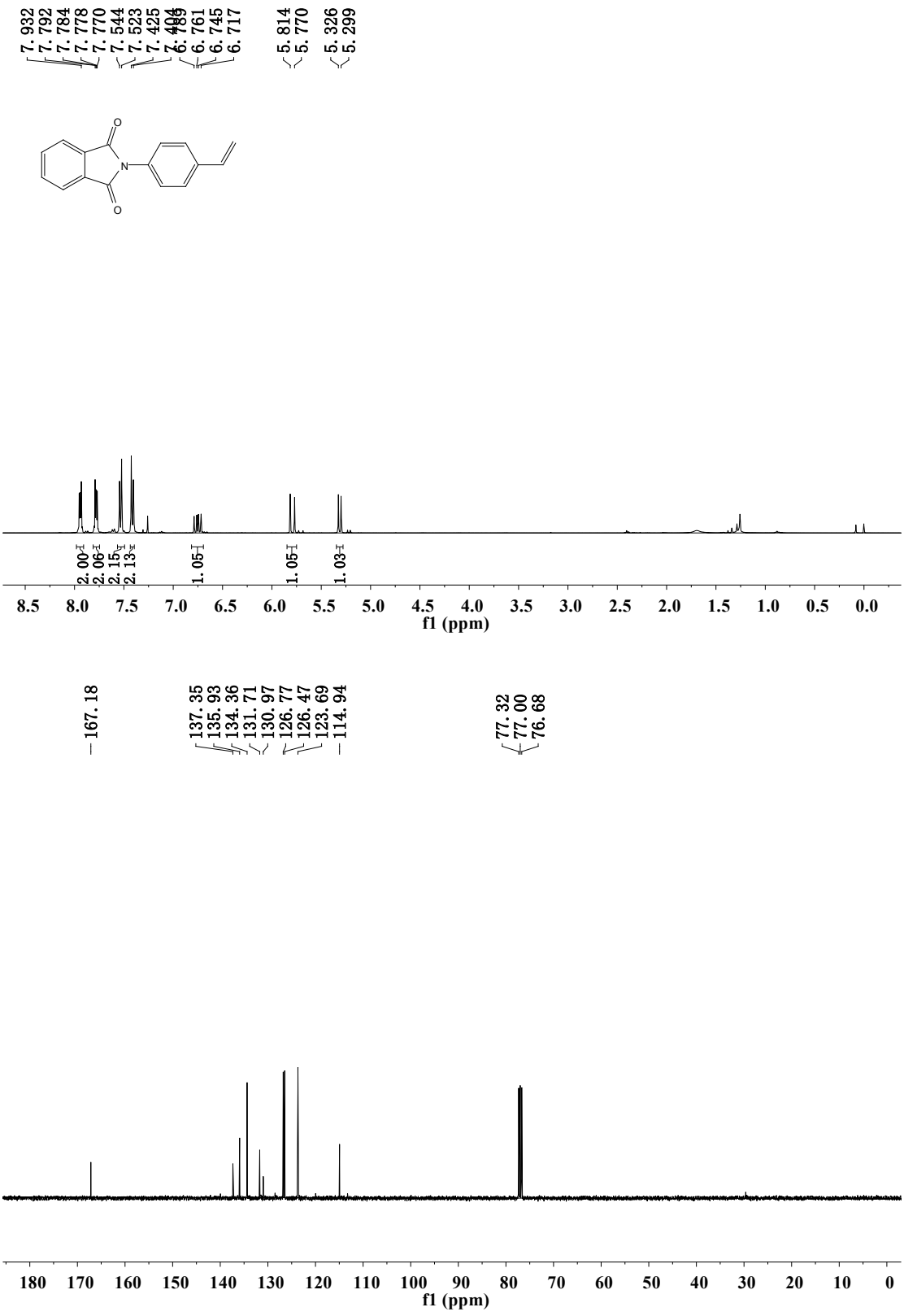
^{1}H NMR and ^{13}C NMR of 2-(1,3-dioxoisoindolin-2-yl)benzonitrile (3o)



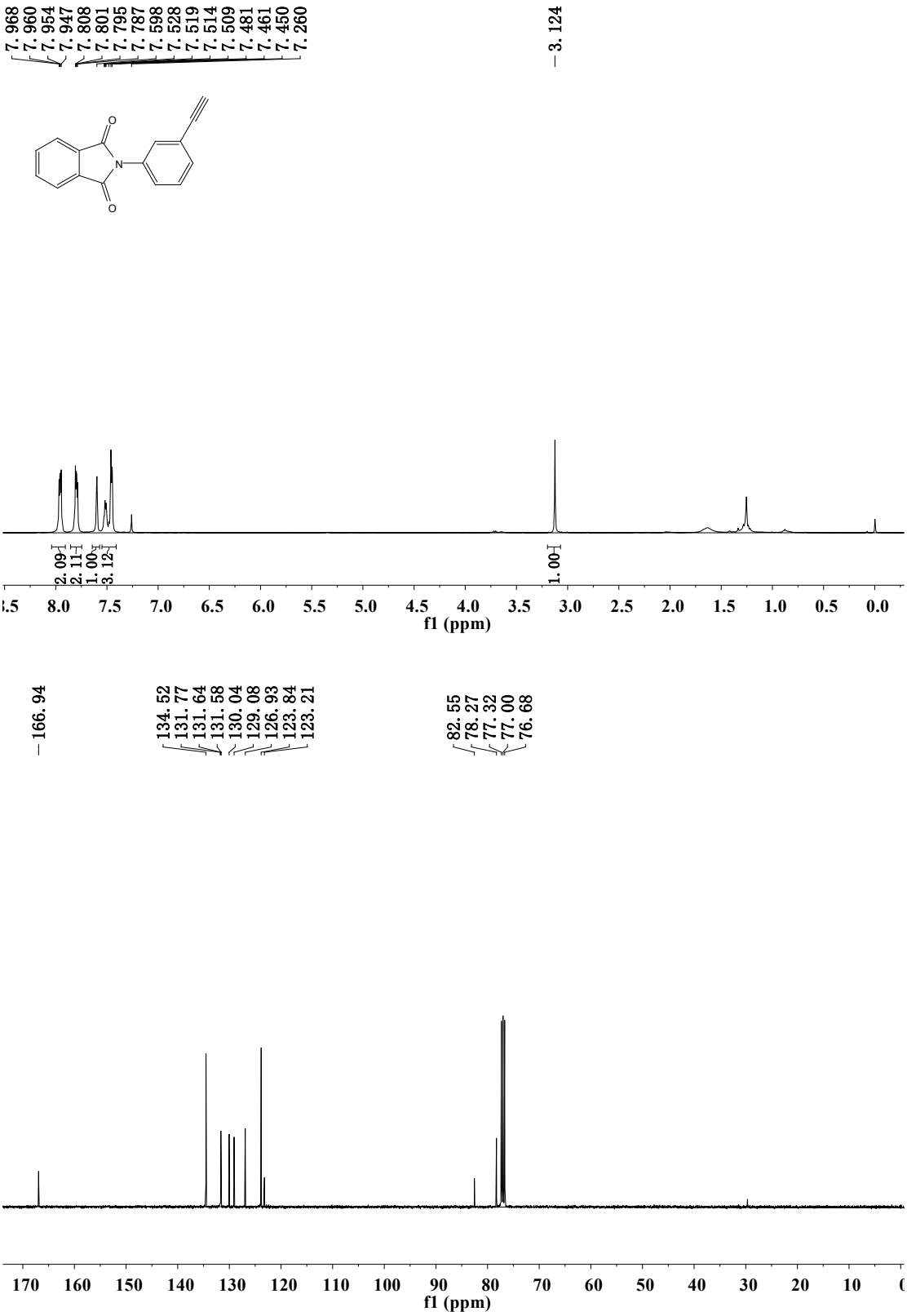




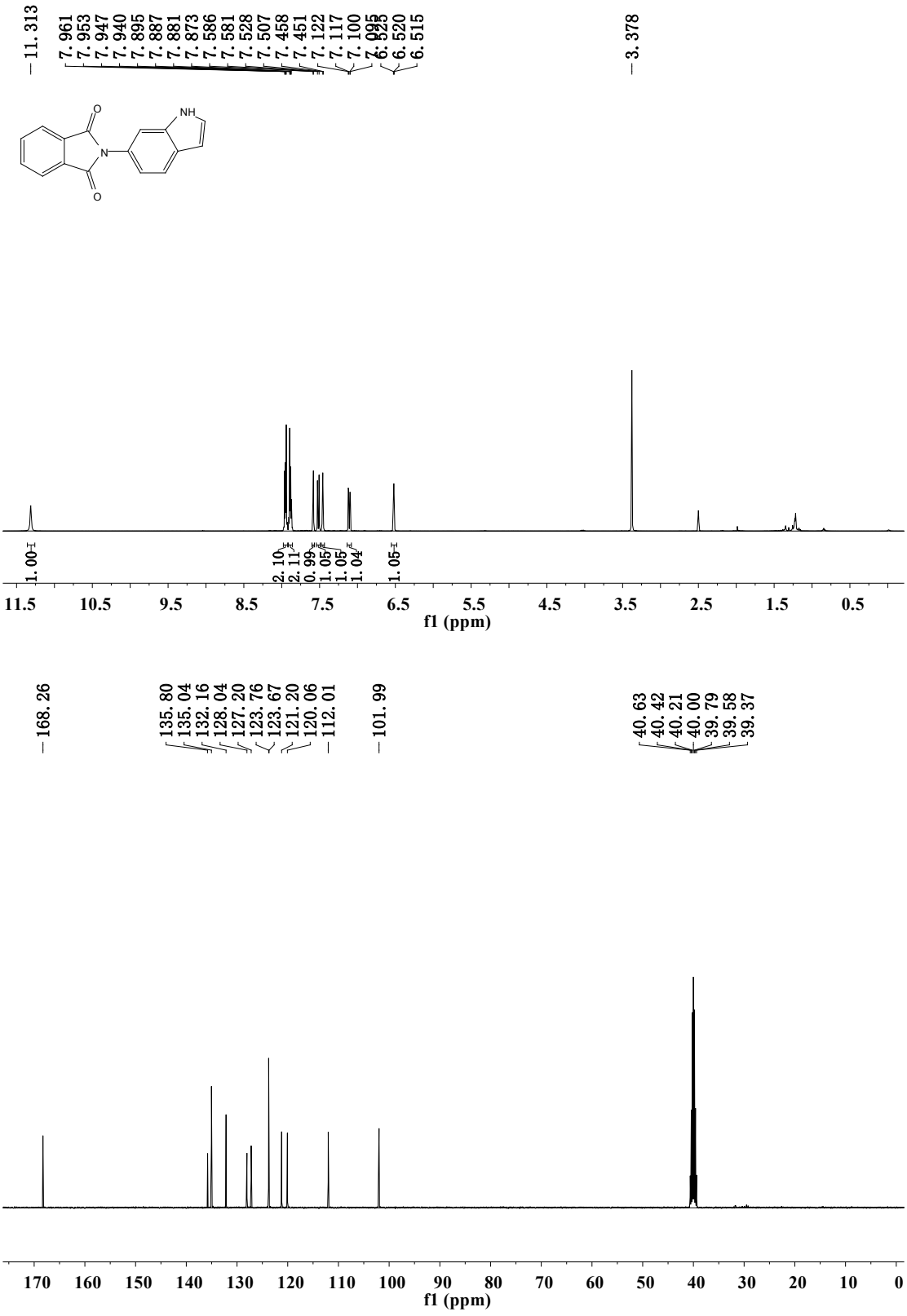
^{1}H NMR and ^{13}C NMR of 2-(4-vinylphenyl)isoindoline-1,3-dione (3p)



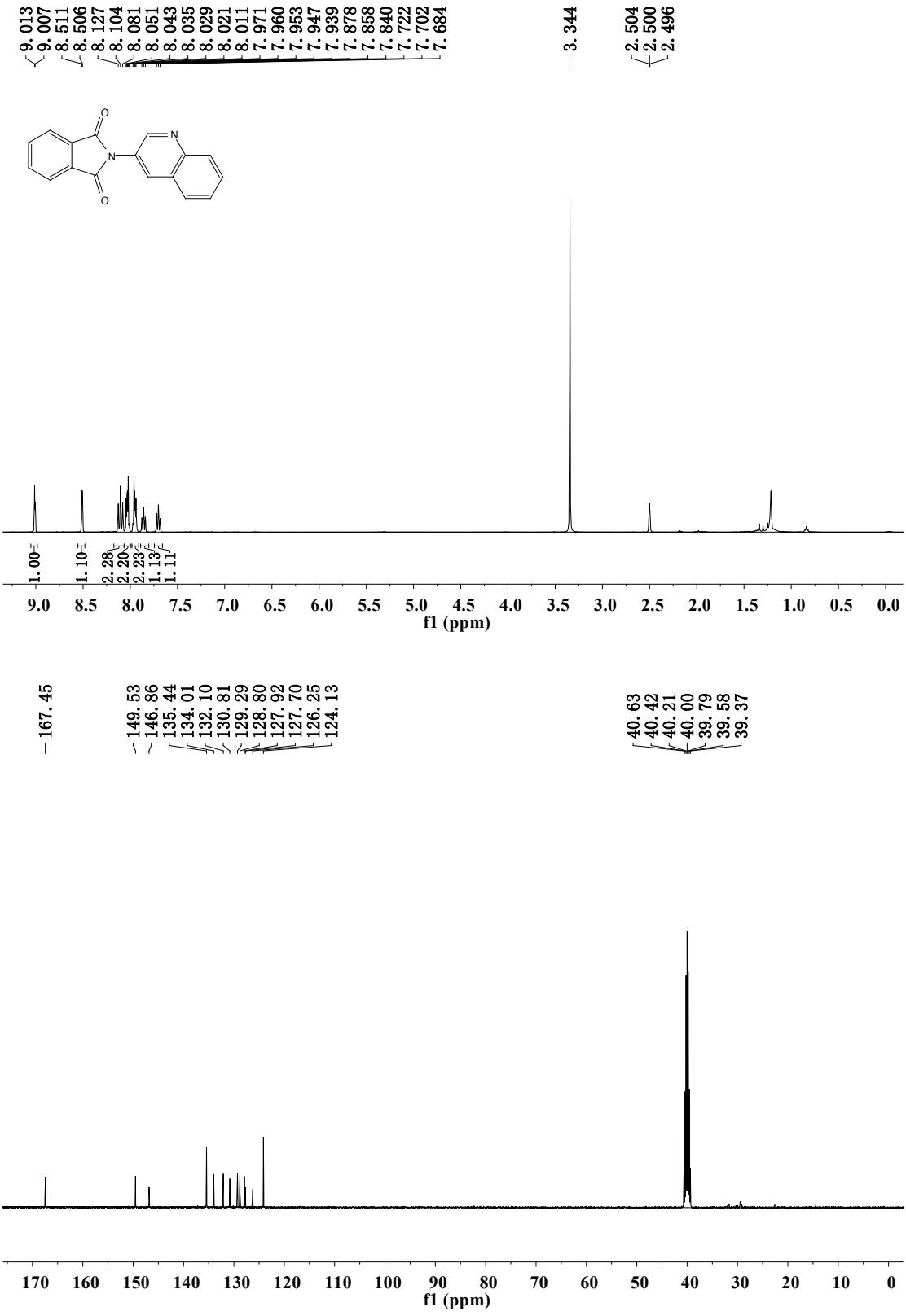
^{1}H NMR and ^{13}C NMR of 2-(3-ethynylphenyl)isoindoline-1,3-dione (3q)



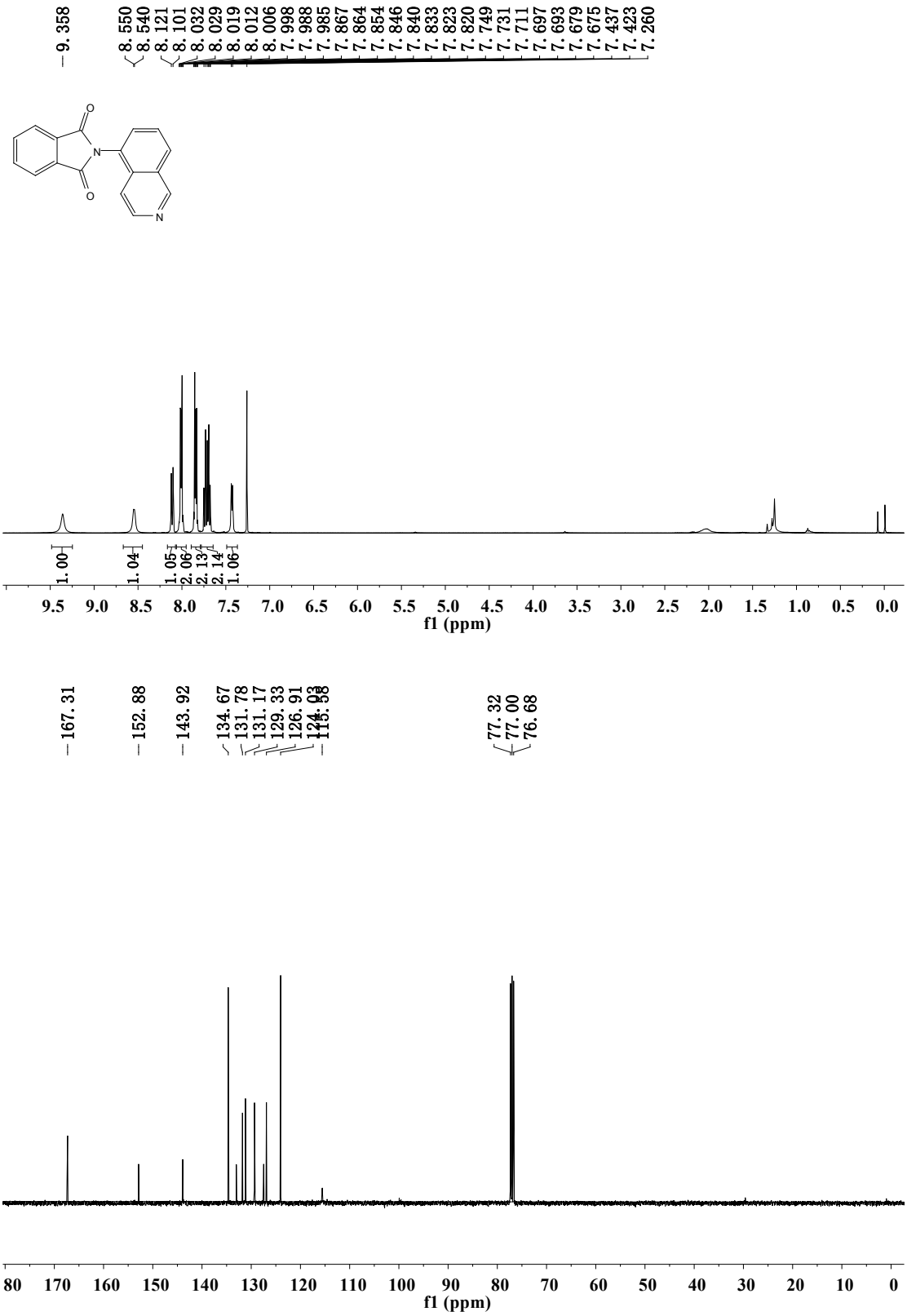
^{1}H NMR and ^{13}C NMR of 2-(1H-indol-6-yl)isoindoline-1,3-dione (3r)



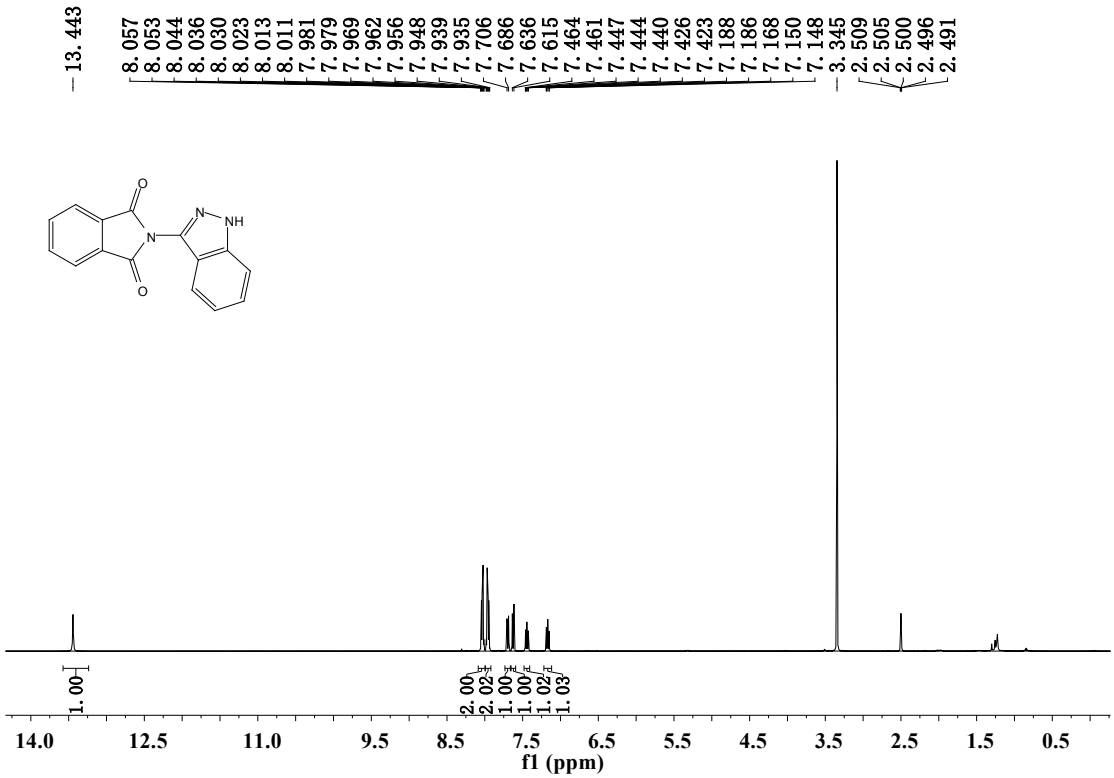
^{1}H NMR and ^{13}C NMR of 2-(quinolin-3-yl)isoindoline-1,3-dione (3s)

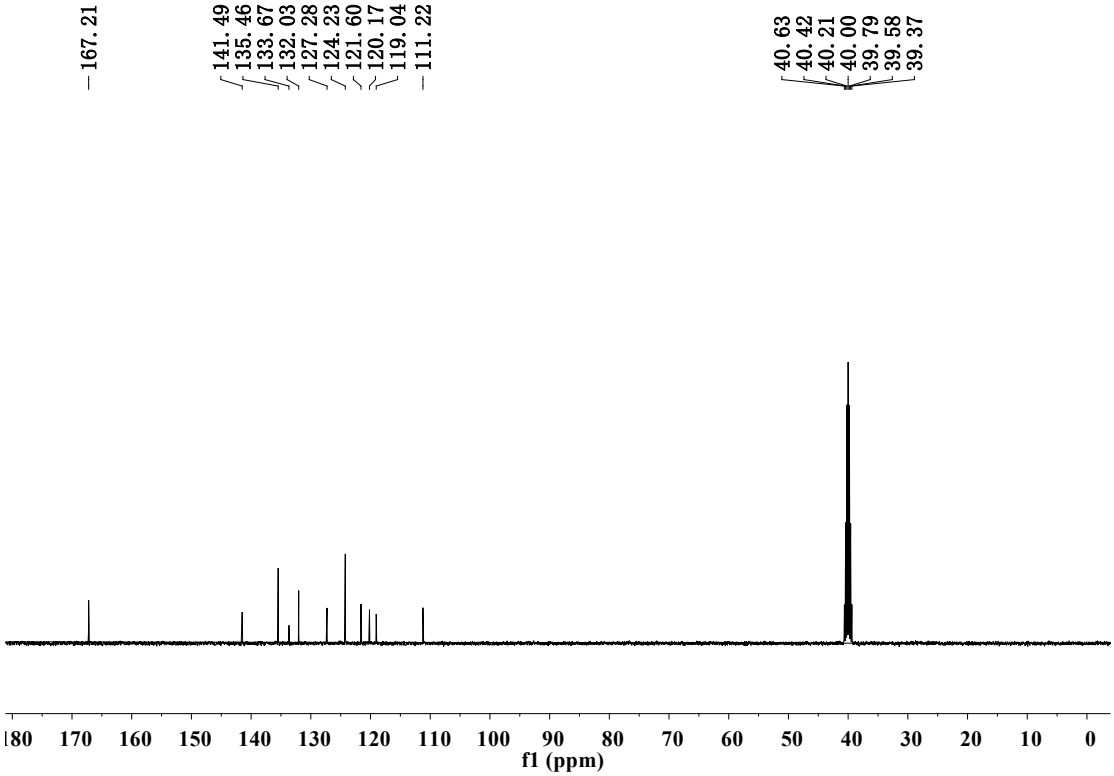


^{1}H NMR and ^{13}C NMR of 2-(isoquinolin-5-yl)isoindoline-1,3-dione (3t)

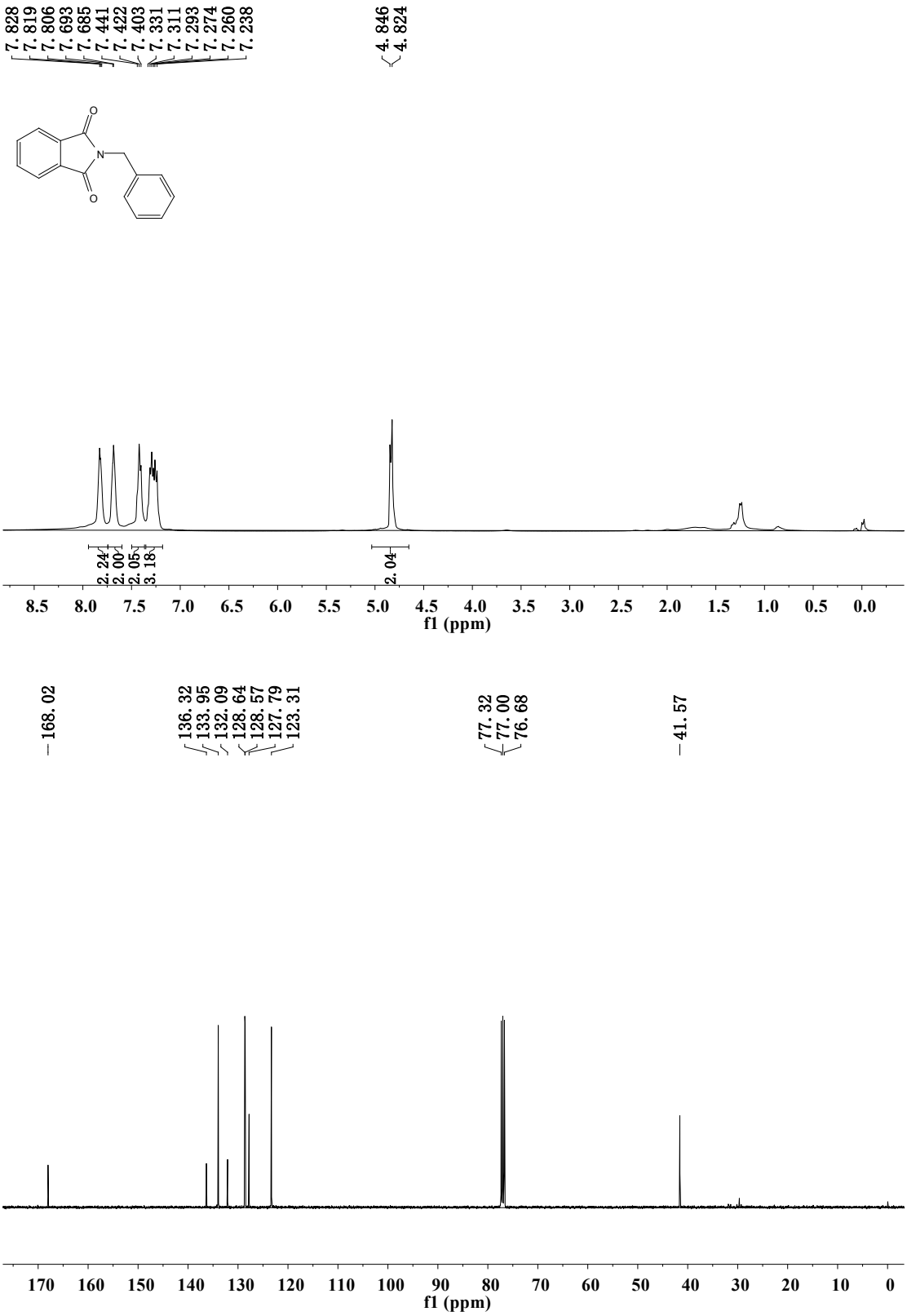


^{1}H NMR and ^{13}C NMR of 2-(1H-indazol-3-yl)isoindoline-1,3-dione (3u)

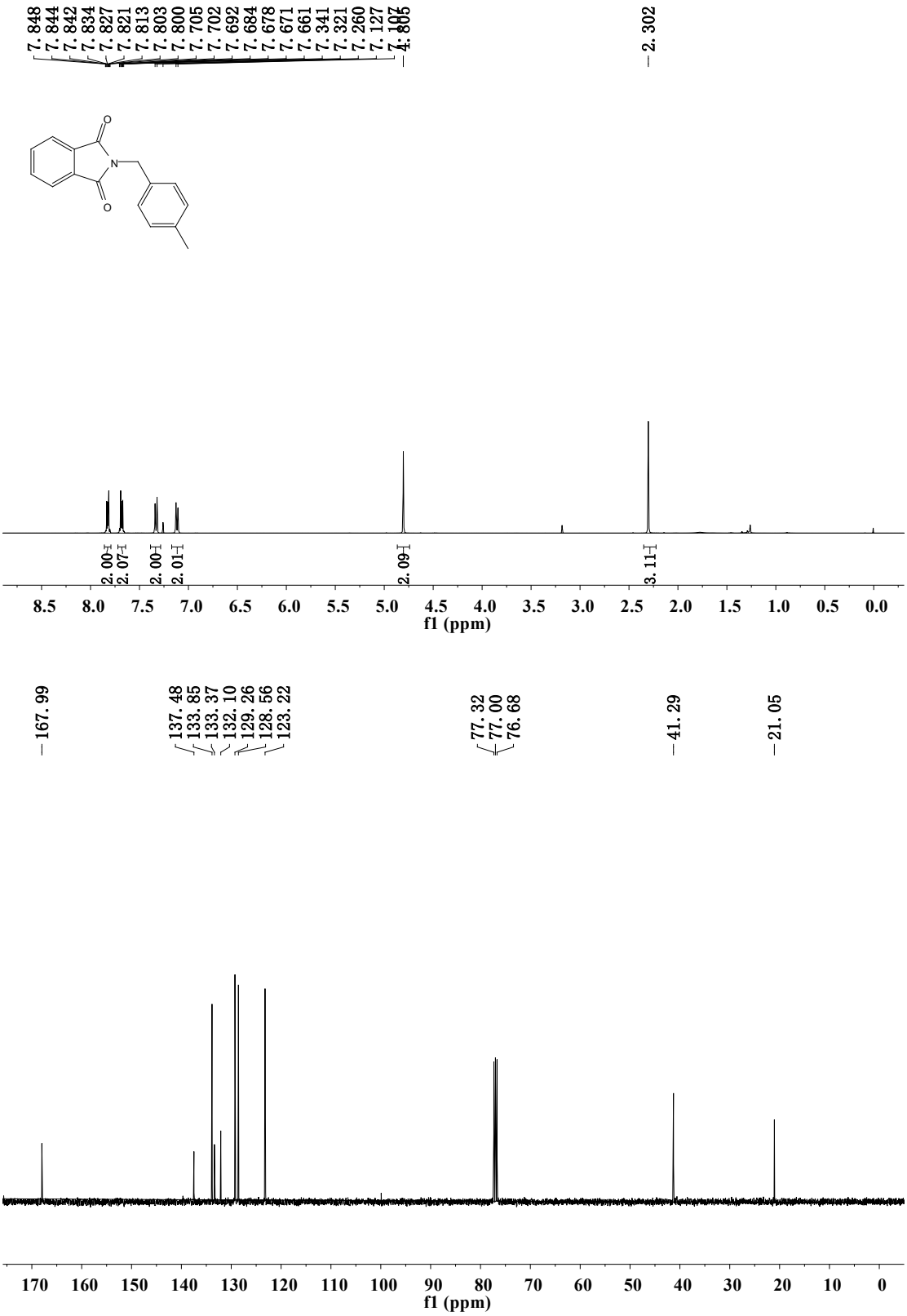




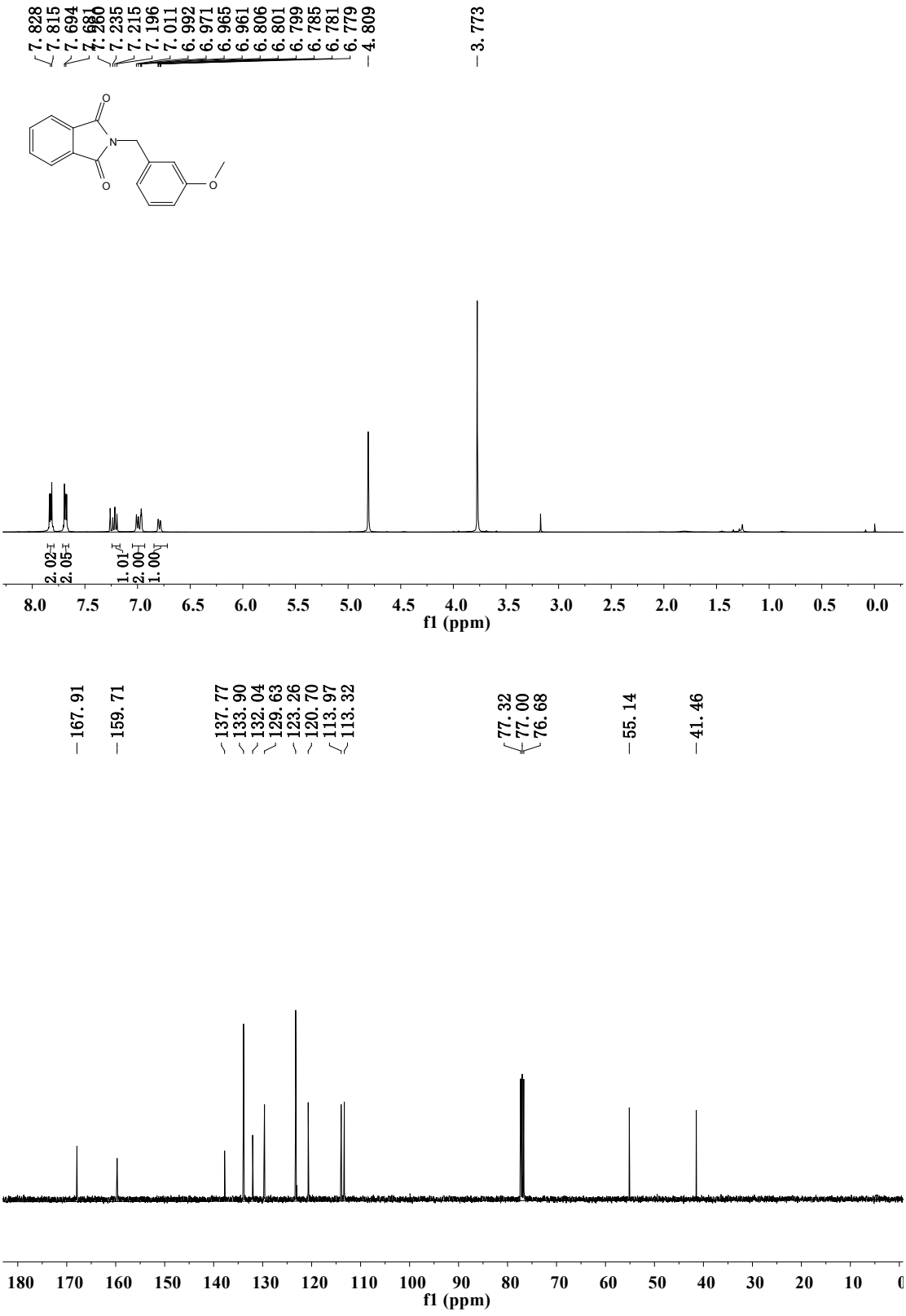
^{1}H NMR and ^{13}C NMR of 2-benzylisoindoline-1,3-dione (3v)



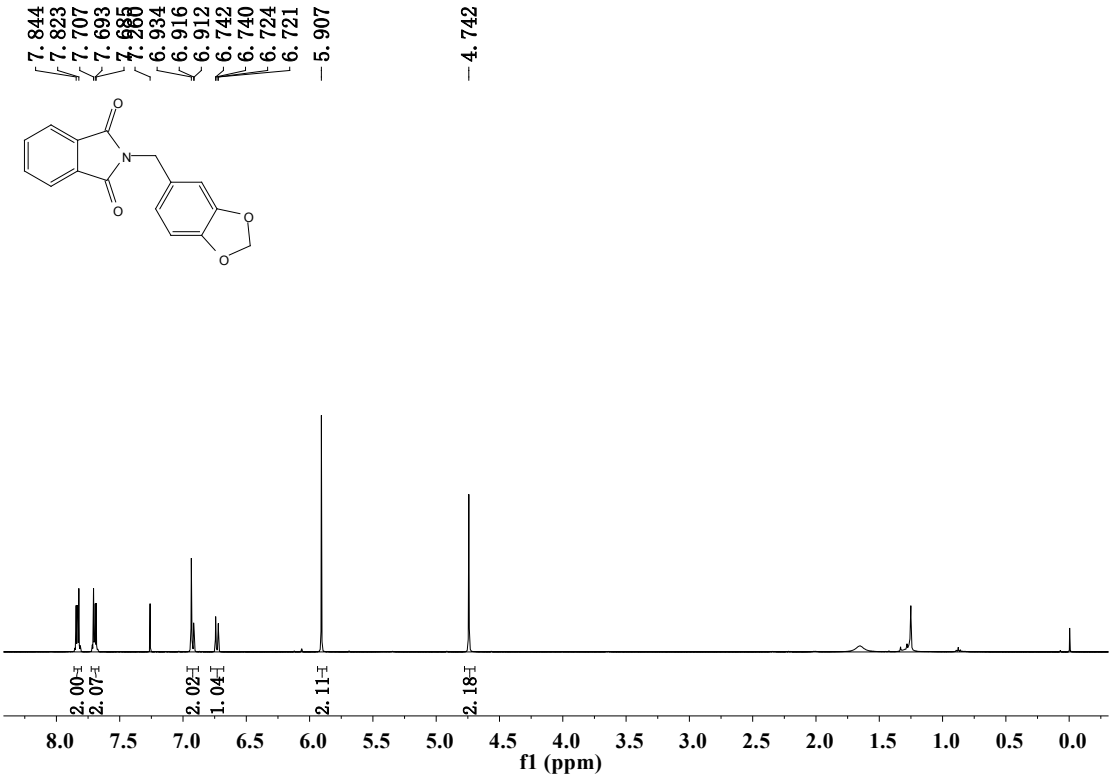
^{1}H NMR and ^{13}C NMR of 2-(4-methylbenzyl)isoindoline-1,3-dione (3w)

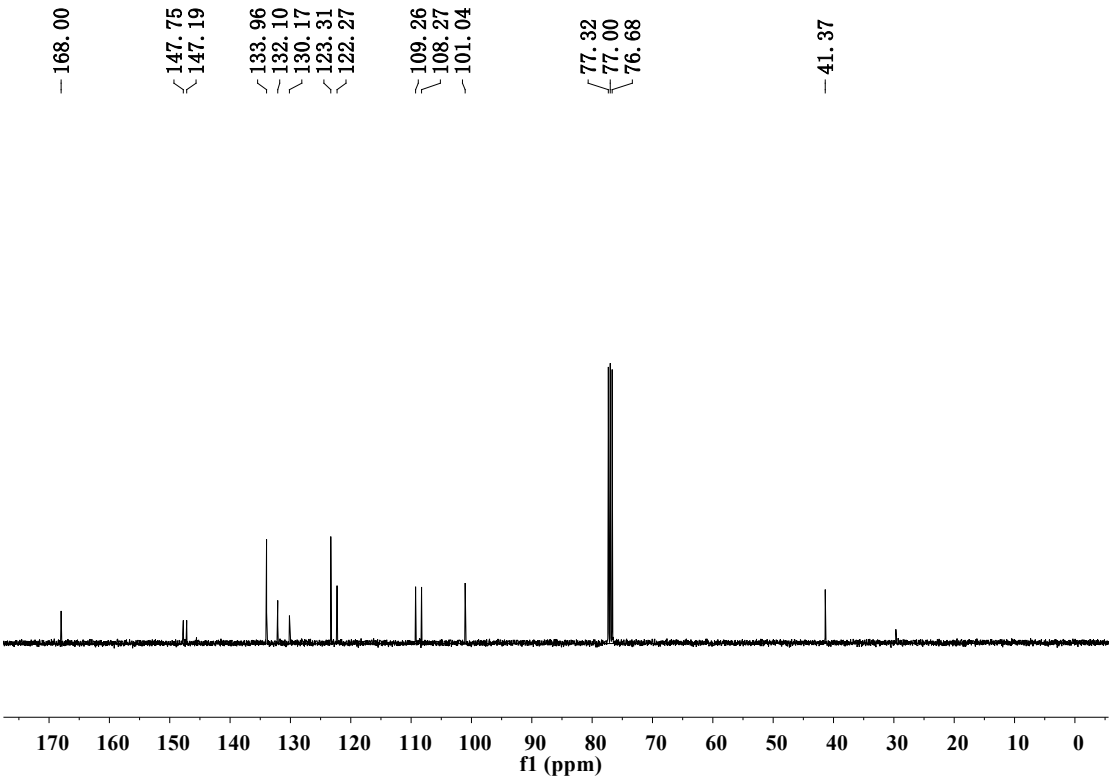


^{1}H NMR and ^{13}C NMR of 2-(3-methoxybenzyl)isoindoline-1,3-dione (3x)

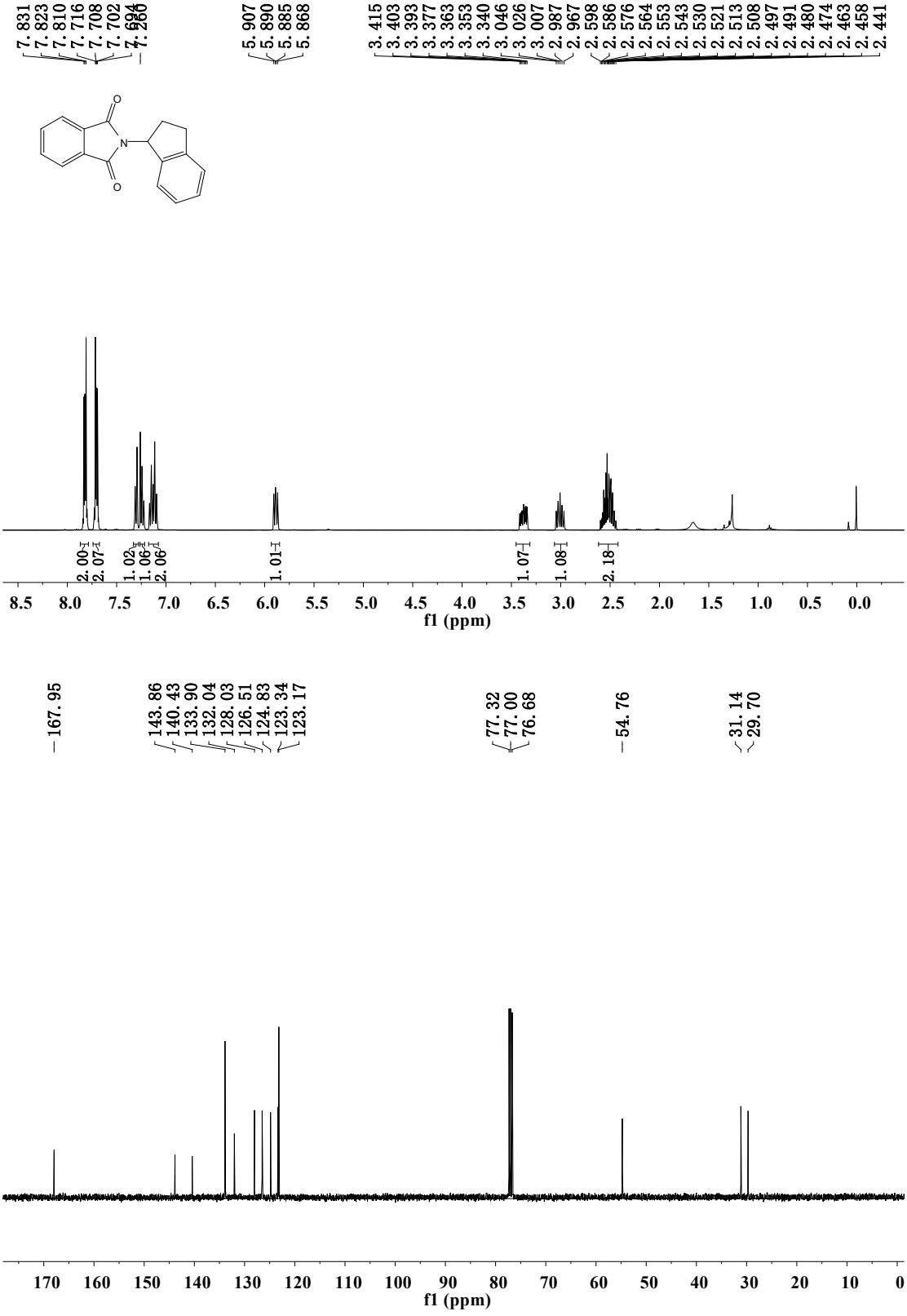


^{1}H NMR and ^{13}C NMR of 2-(benzo[d][1,3]dioxol-5-ylmethyl)isoindoline-1,3-dione (3y)

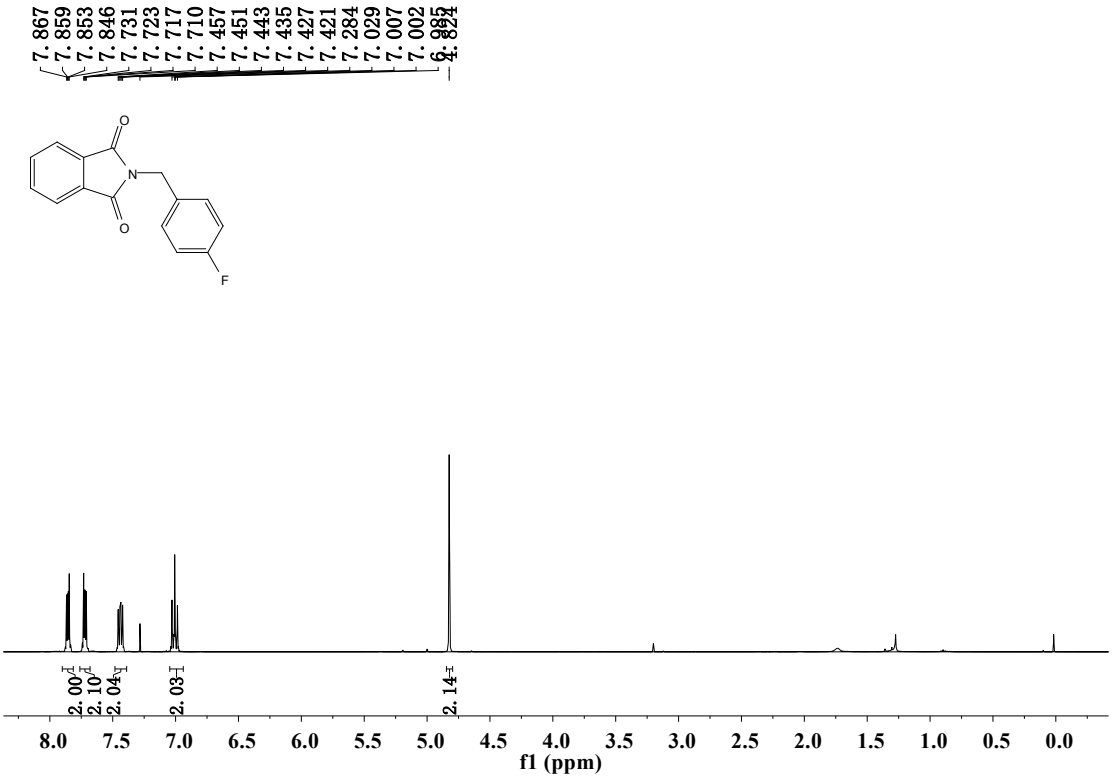


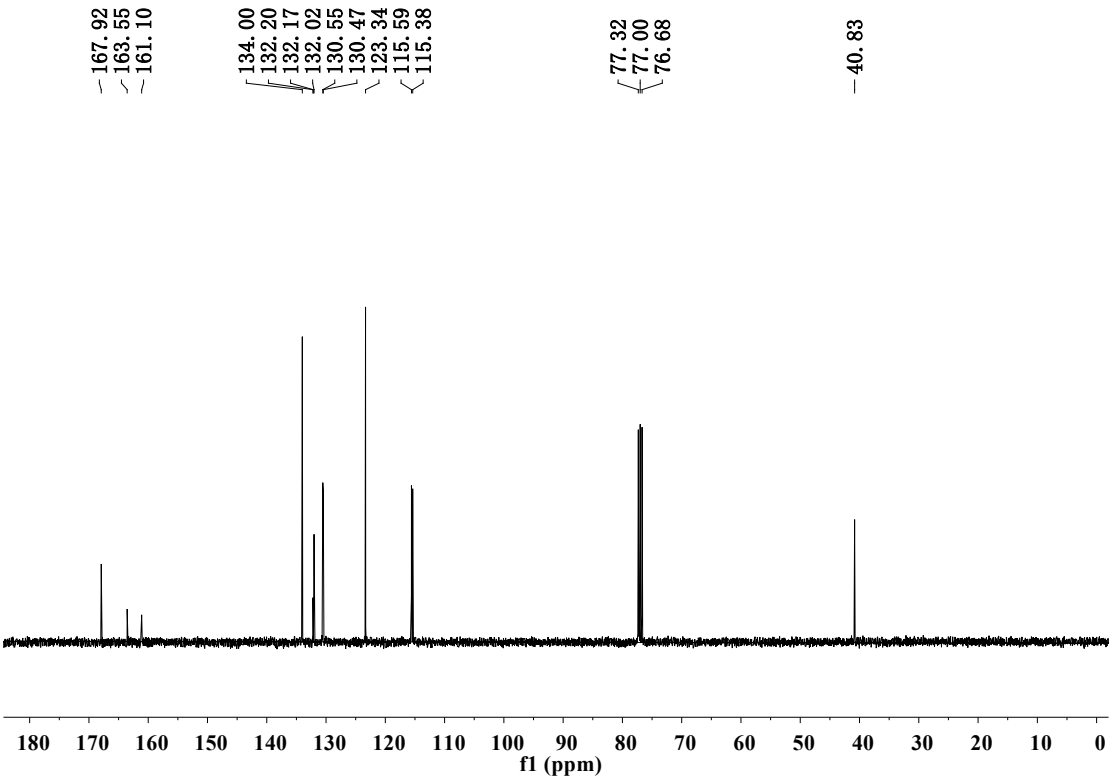


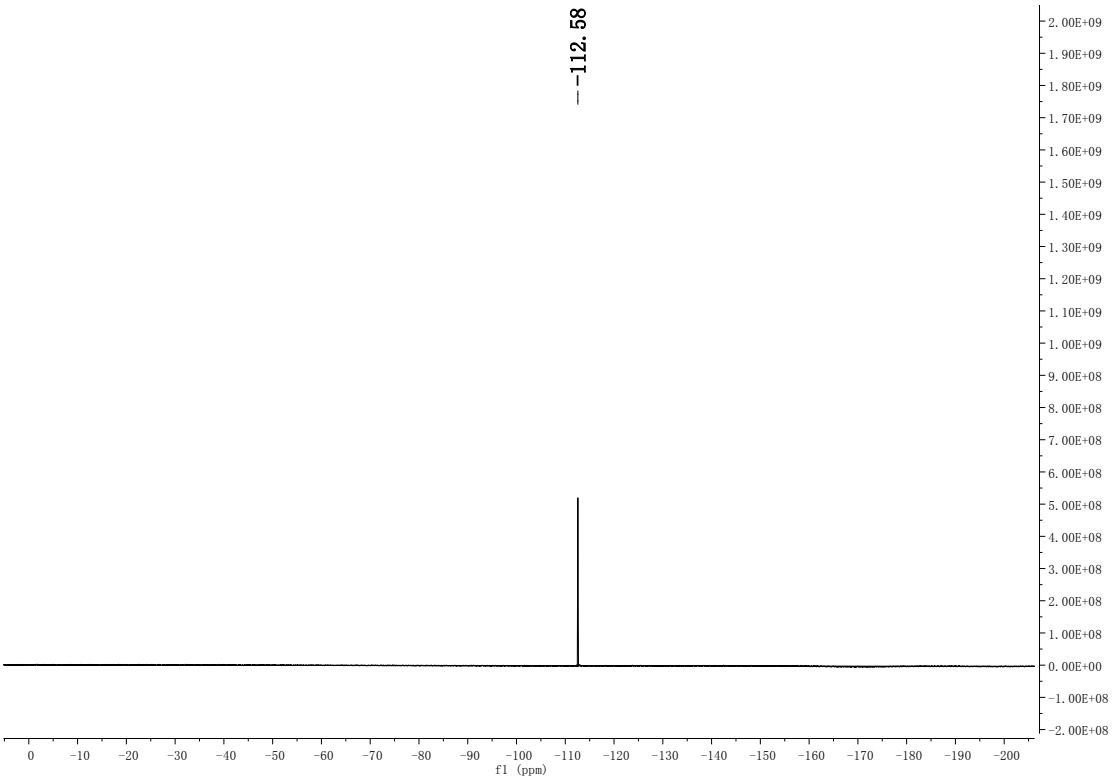
^{1}H NMR and ^{13}C NMR of
2-(2,3-dihydro-1H-inden-1-yl)isoindoline-1,3-dione (3z)



^{1}H NMR, ^{13}C NMR and ^{19}F NMR
of 2-(4-fluorobenzyl)isoindoline-1,3-dione (3aa)



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5.00E+08
4.00E+08
3.00E+08
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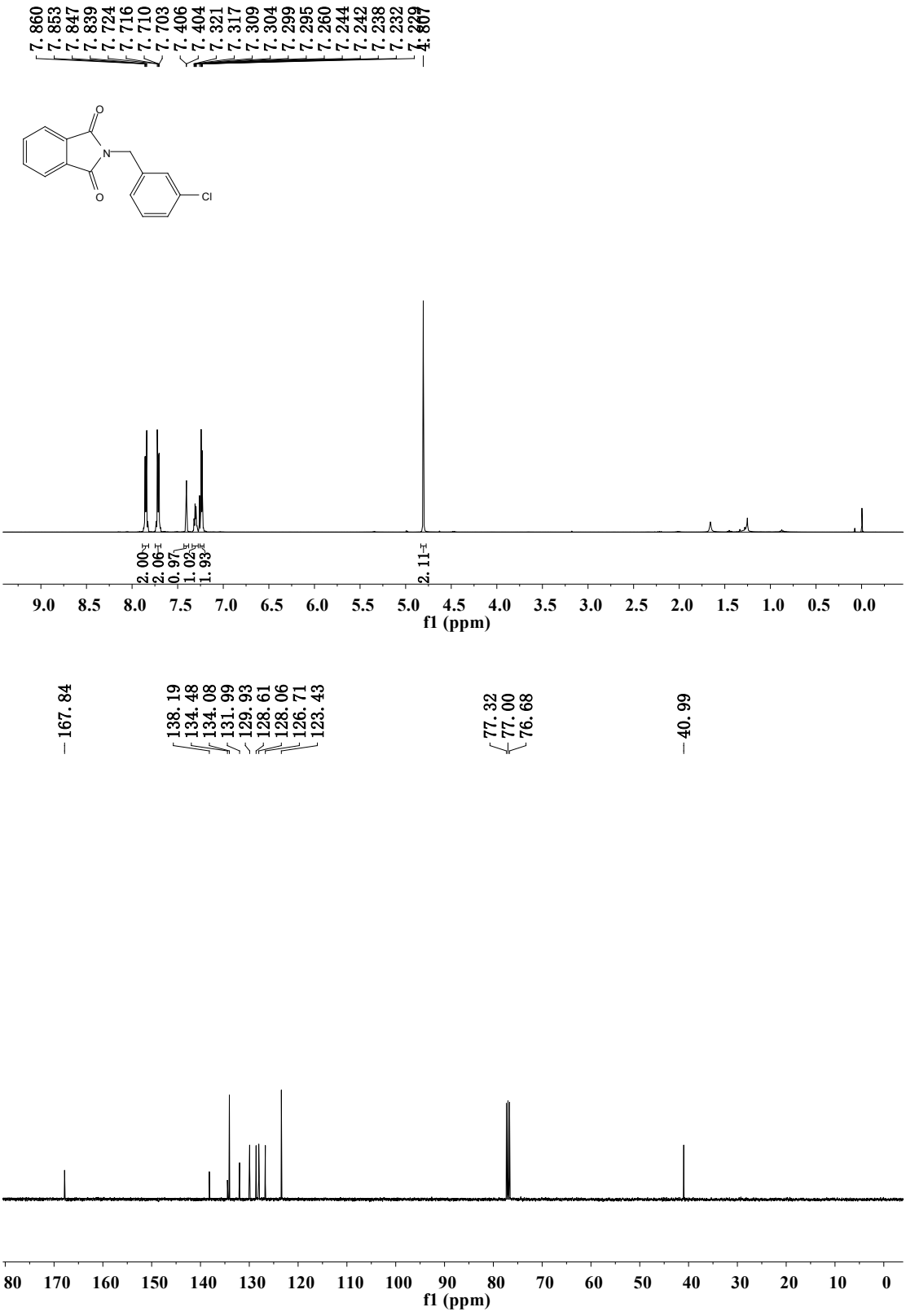
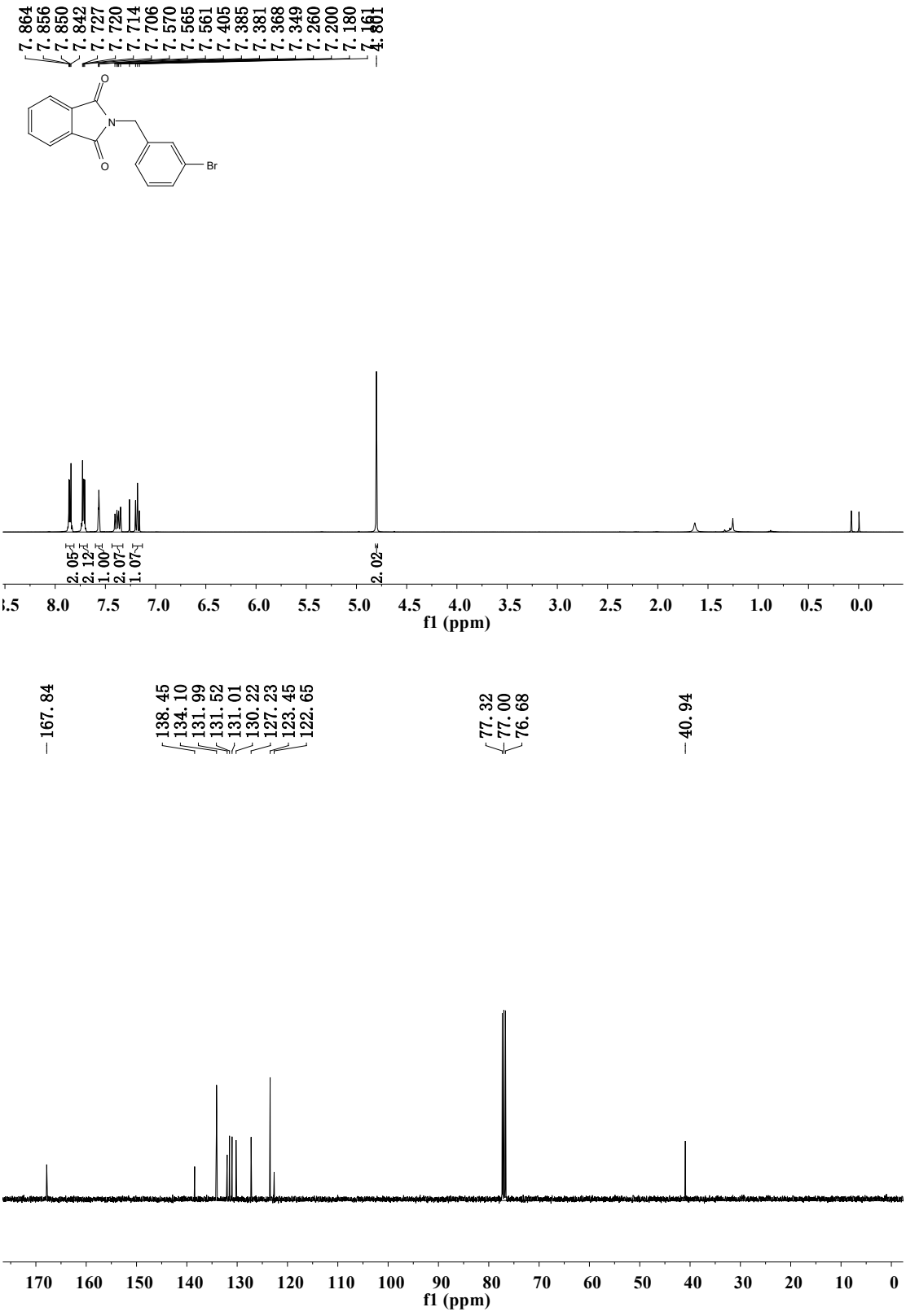
-2.00E+08
0 -10 -20 -30 -40 -50 -60 -70 -80 -90 -100 -110 -120 -130 -140 -150 -160 -170 -180 -190 -200
f1 (ppm)

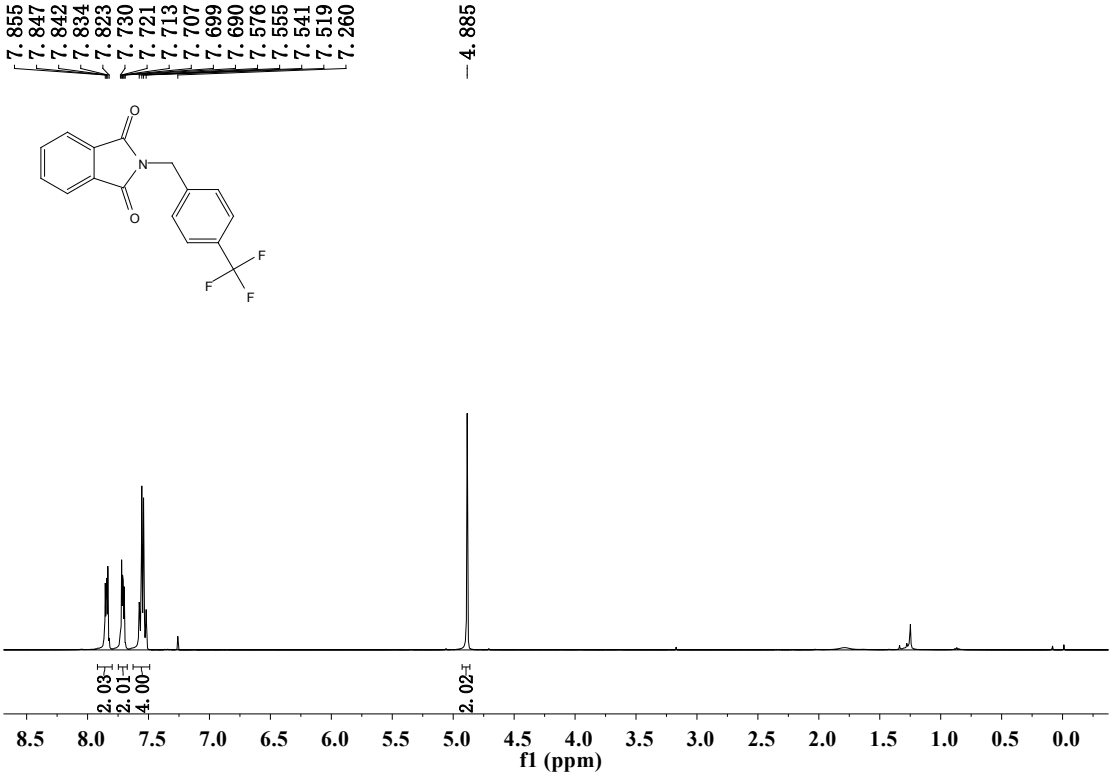
^{1}H NMR and ^{13}C NMR of 2-(3-chlorobenzyl)isoindoline-1,3-dione (3ab)

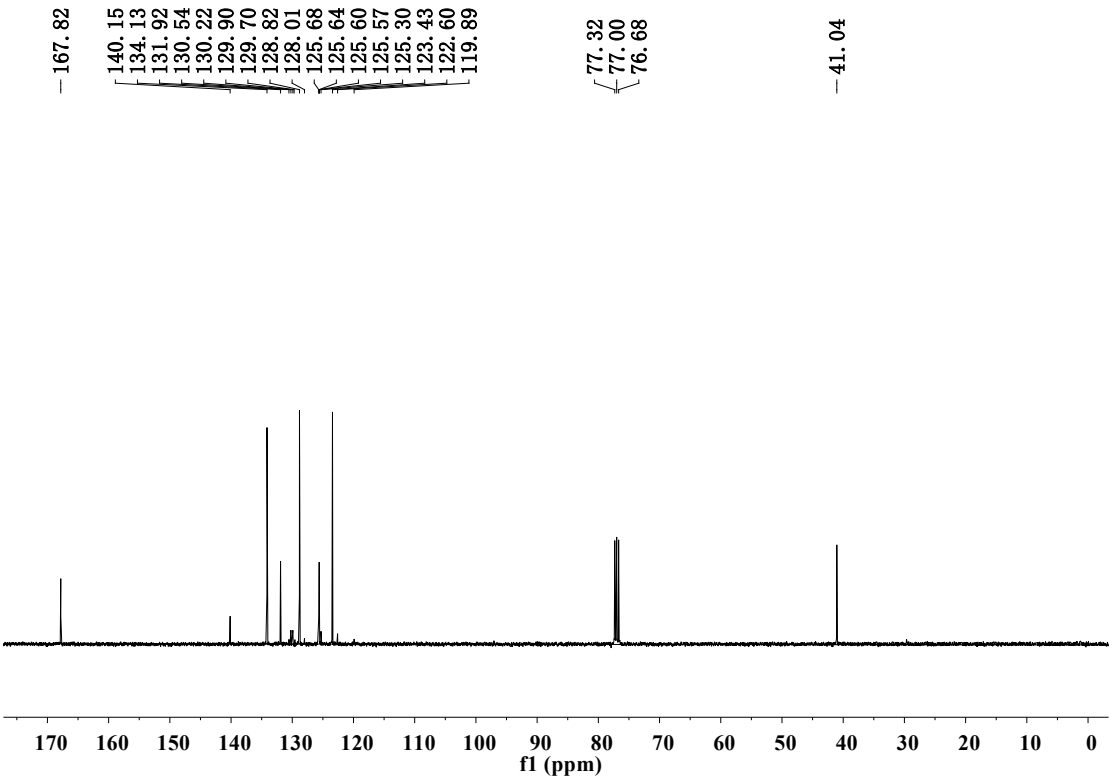


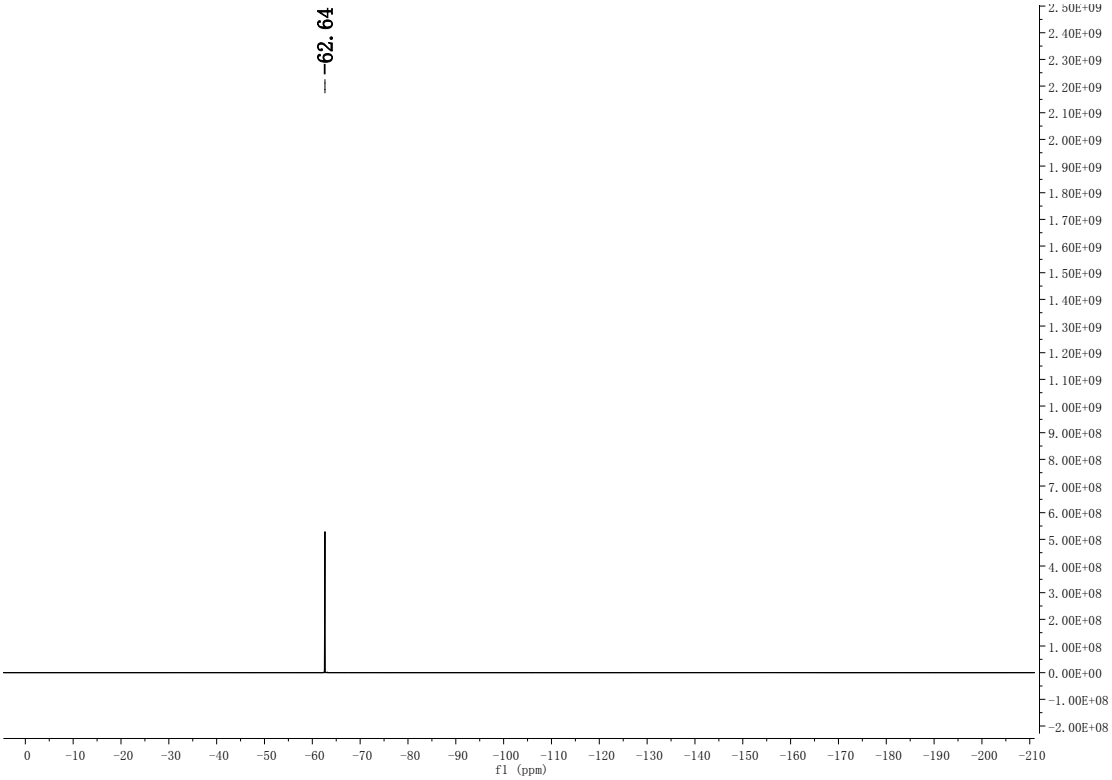
^{1}H NMR and ^{13}C NMR of 2-(3-bromobenzyl)isoindoline-1,3-dione (3ac)



^{1}H NMR, ^{13}C NMR and ^{19}F NMR of 2-(4-(trifluoromethyl)benzyl)isoindoline-1,3-dione (3ad)



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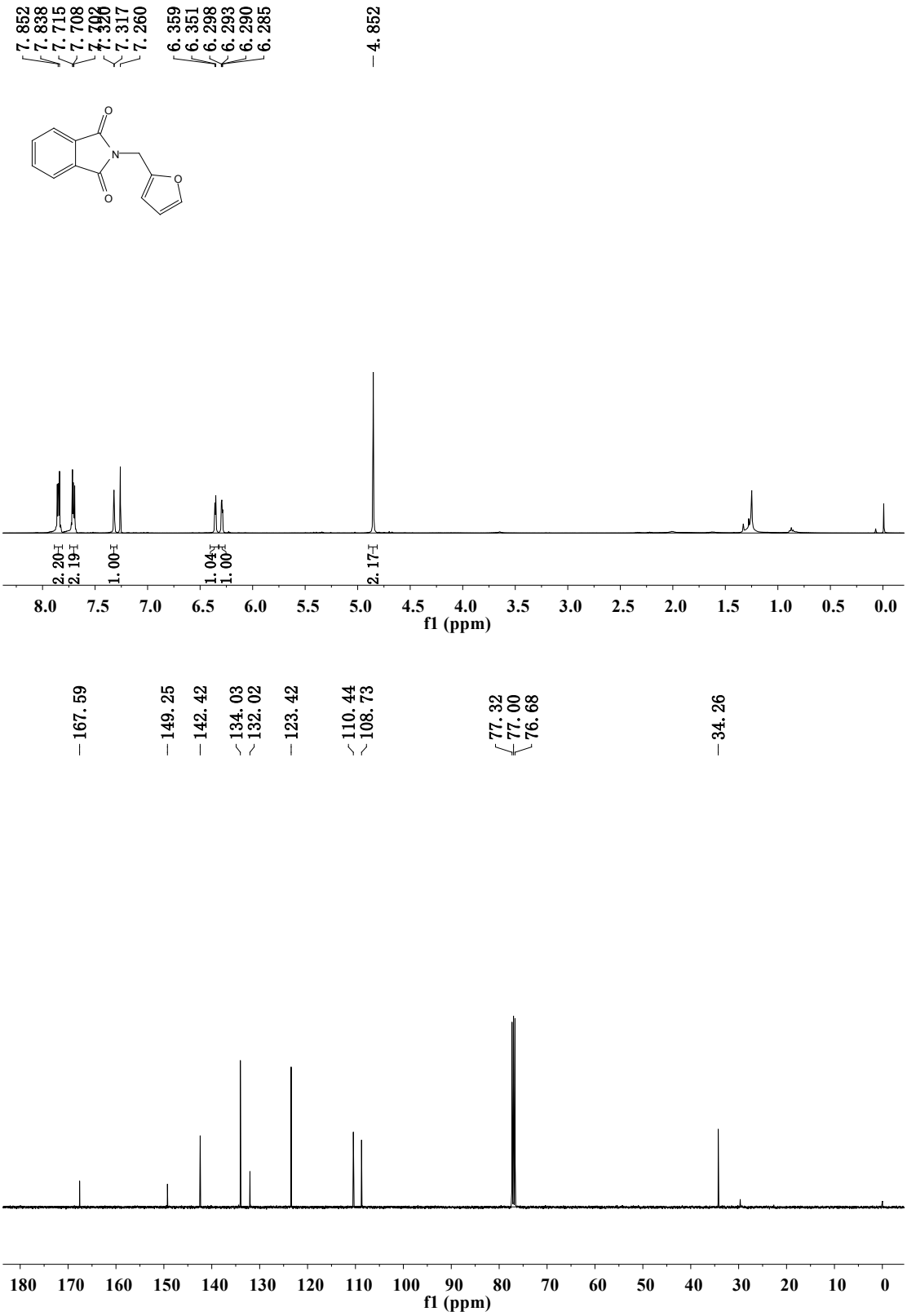
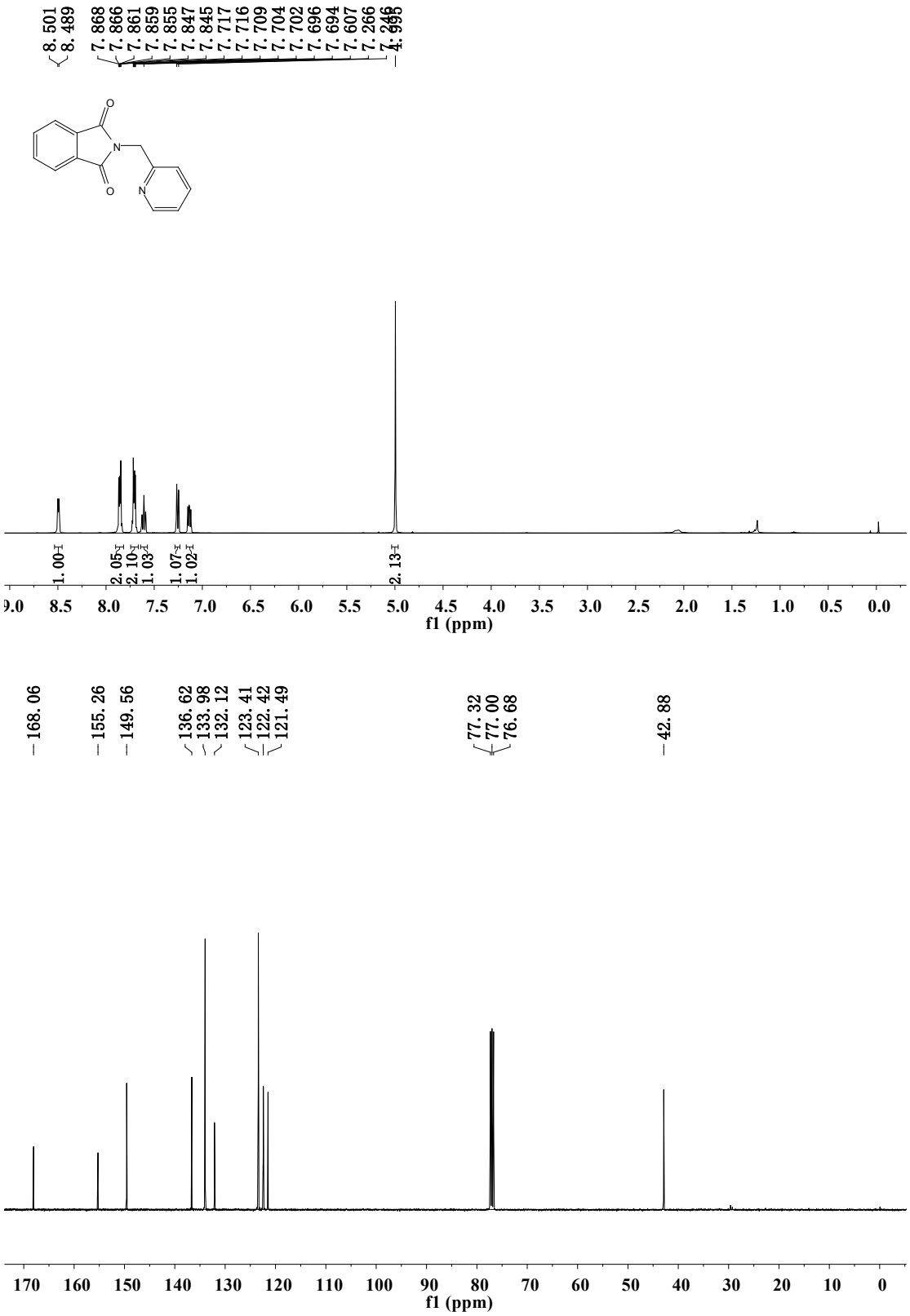
0 -10 -20 -30 -40 -50 -60 -70 -80 -90 -100 -110 -120 -130 -140 -150 -160 -170 -180 -190 -200 -210
f1 (ppm)

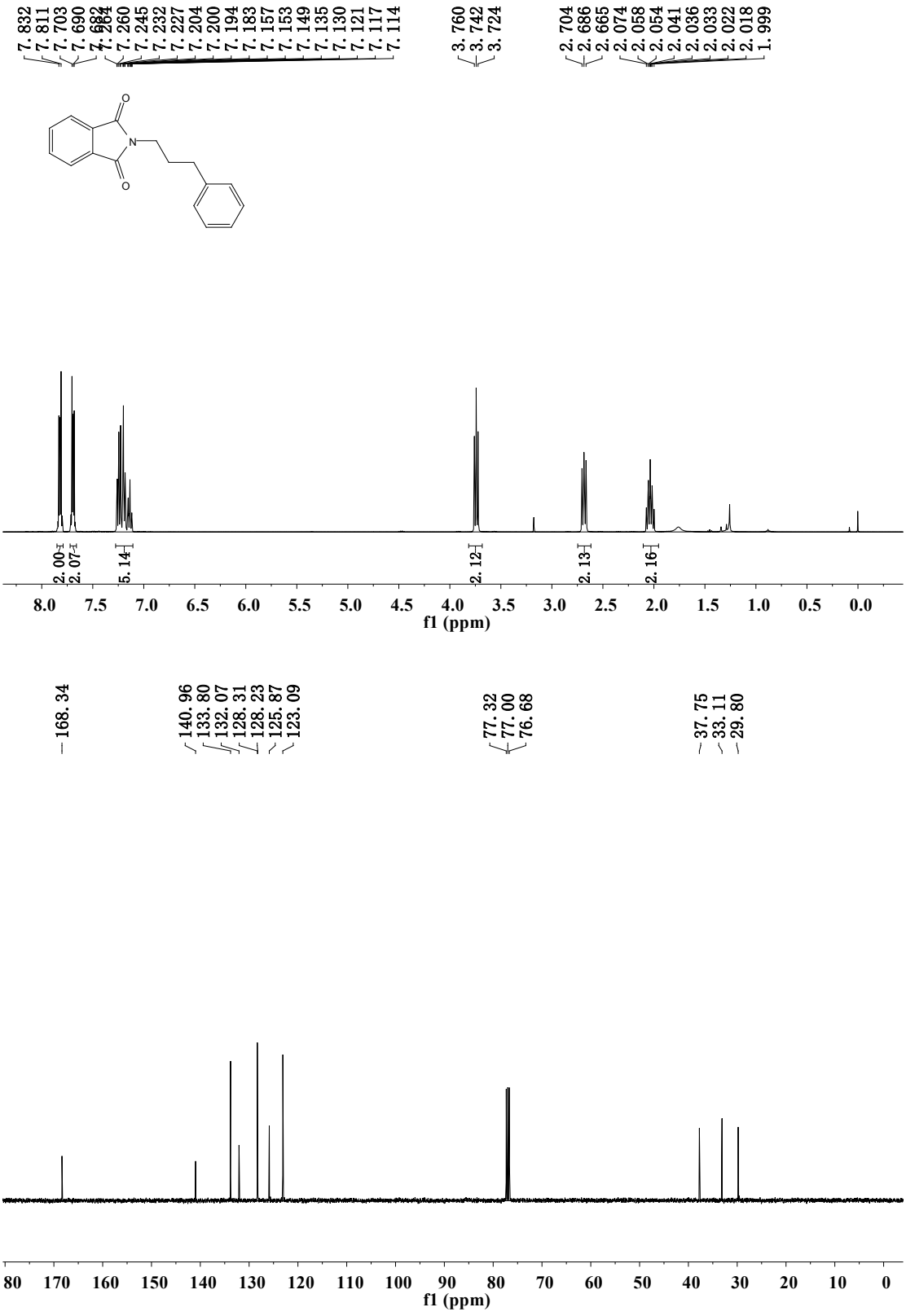
^{1}H NMR and ^{13}C NMR of 2-(furan-2-ylmethyl)isoindoline-1,3-dione (3ae)



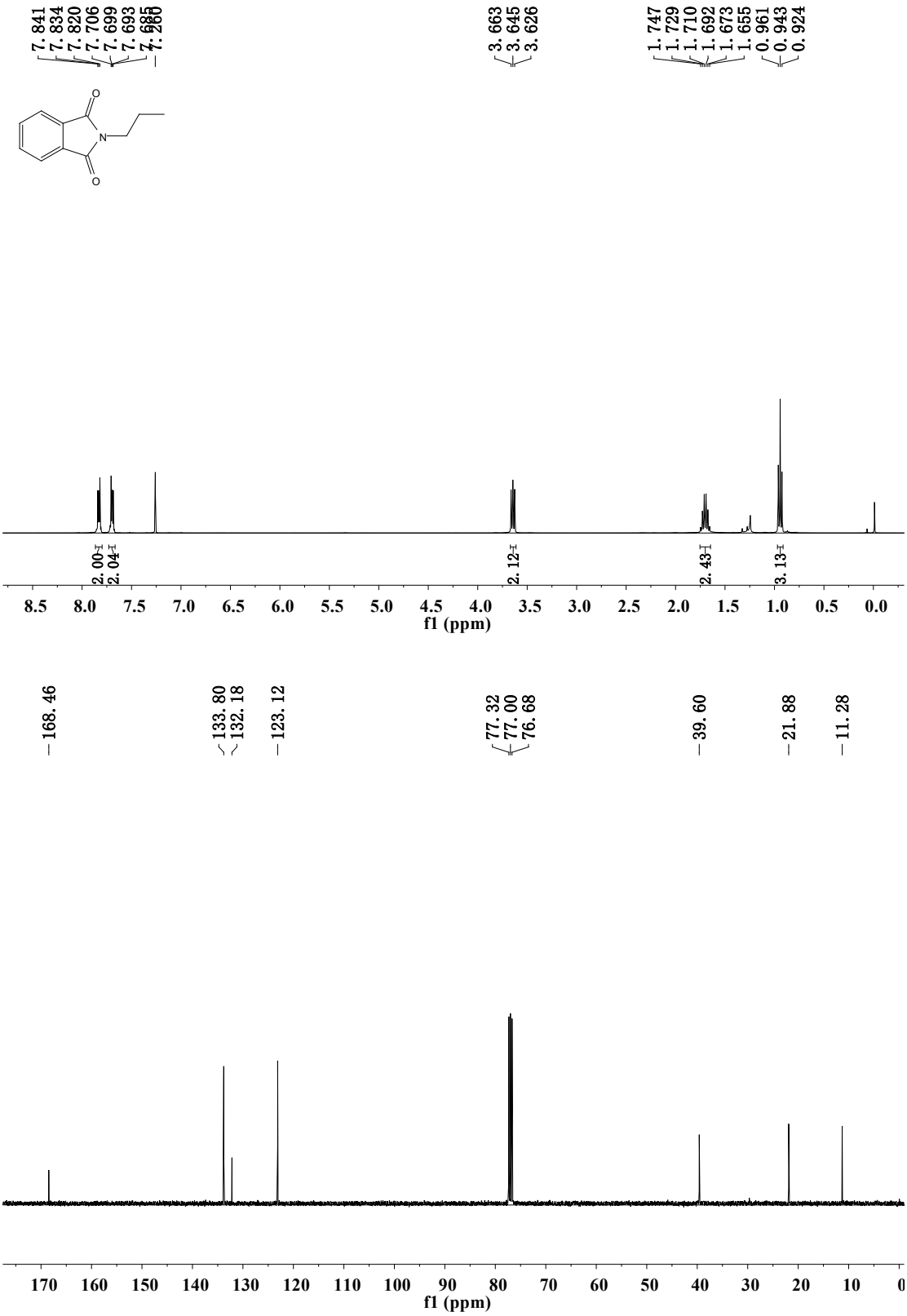
^{1}H NMR and ^{13}C NMR of 2-(pyridin-2-ylmethyl)isoindoline-1,3-dione (3af)



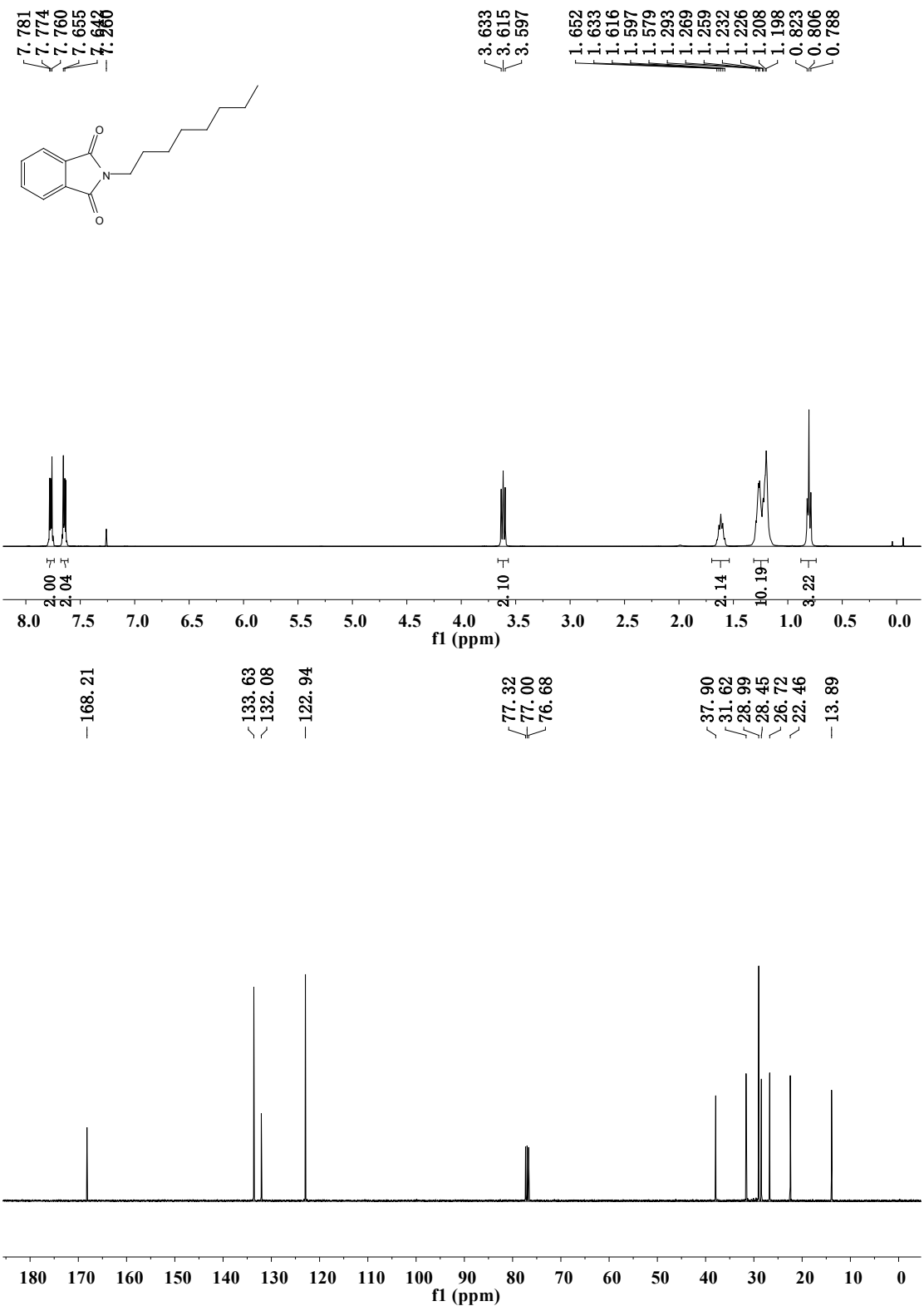
^{1}H NMR and ^{13}C NMR of 2-(3-phenylpropyl)isoindoline-1,3-dione (3ag)



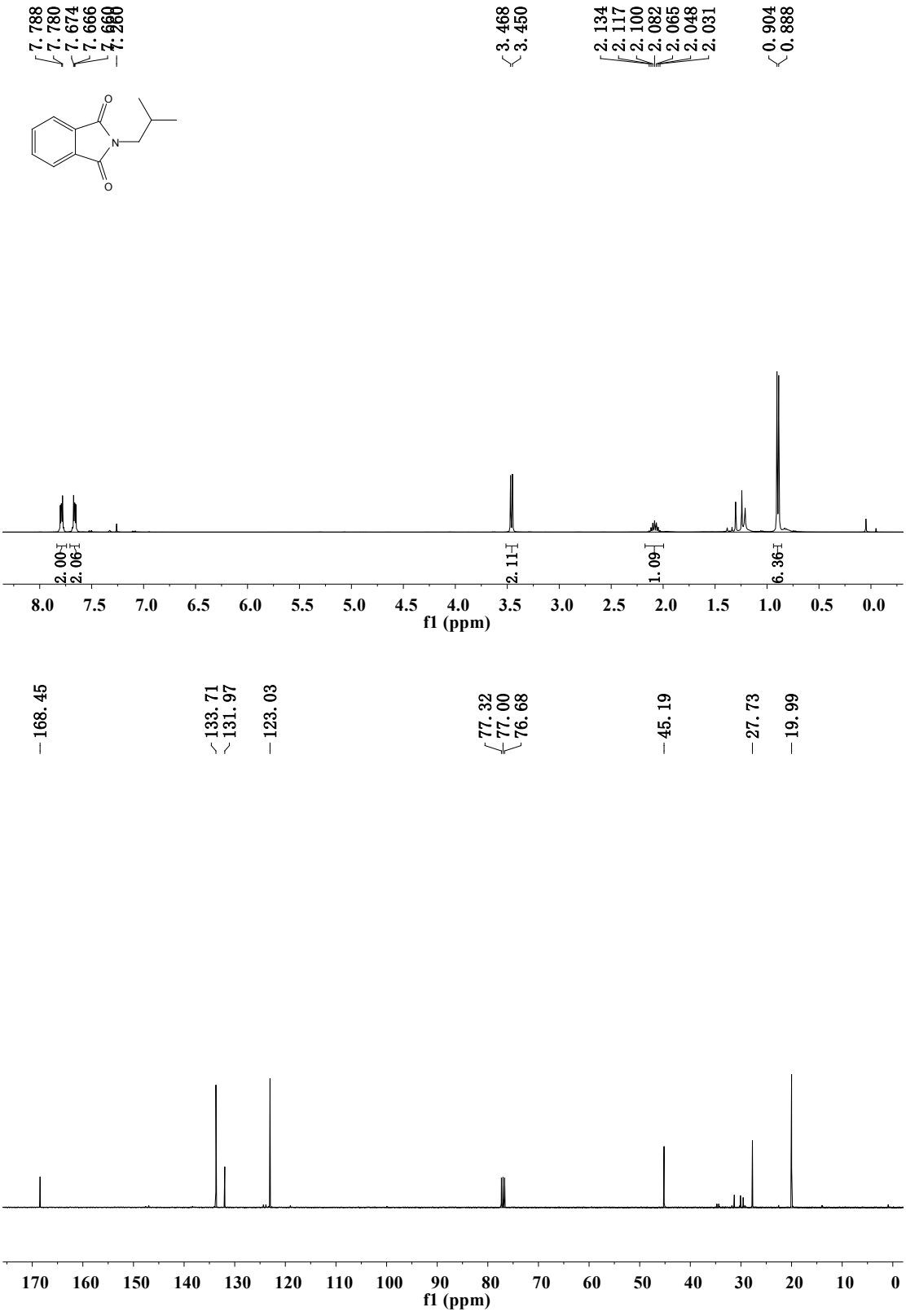
^{1}H NMR and ^{13}C NMR of 2-propylisoindoline-1,3-dione (3ah)



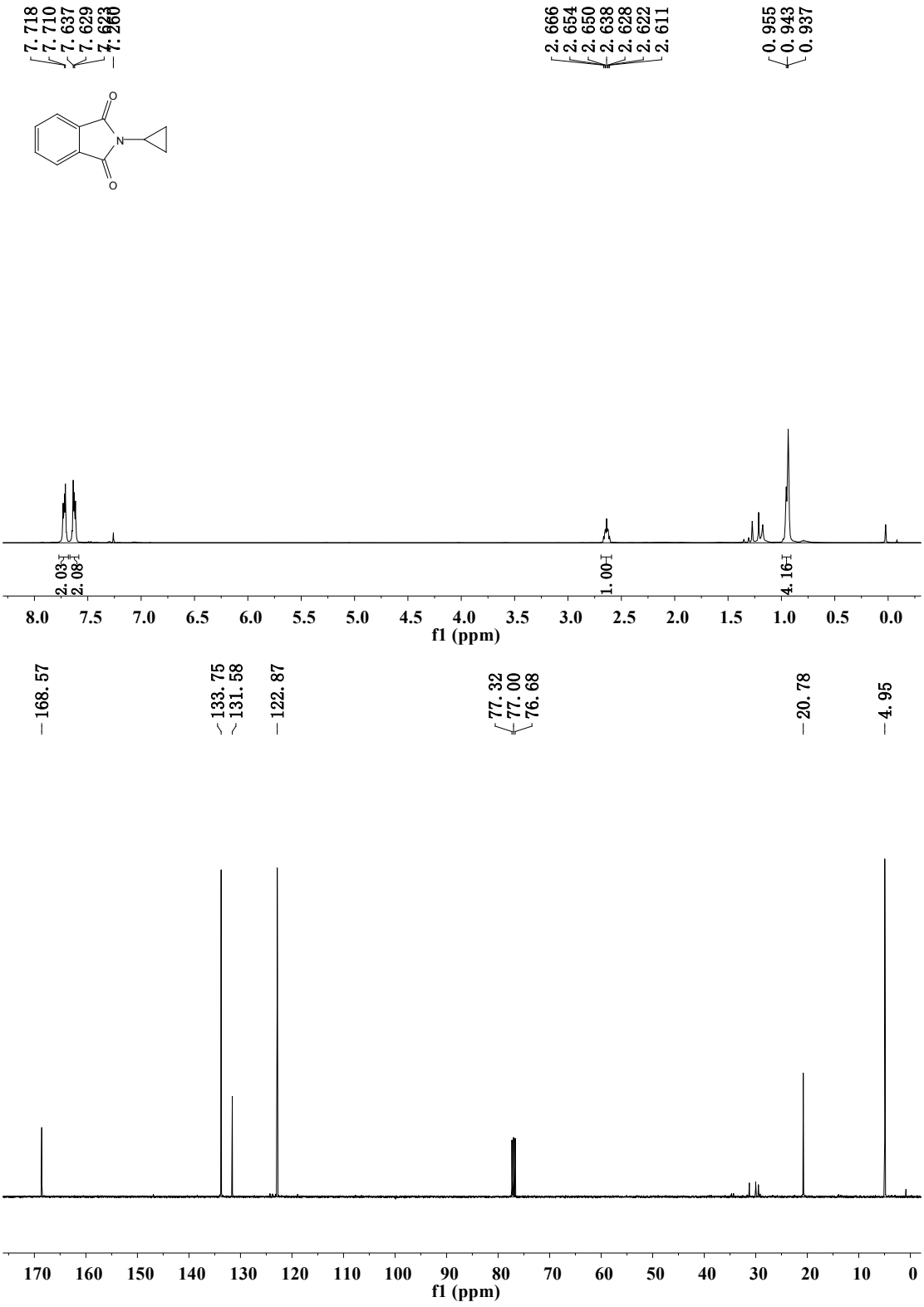
^{1}H NMR and ^{13}C NMR of 2-octylisoindoline-1,3-dione (3ai)



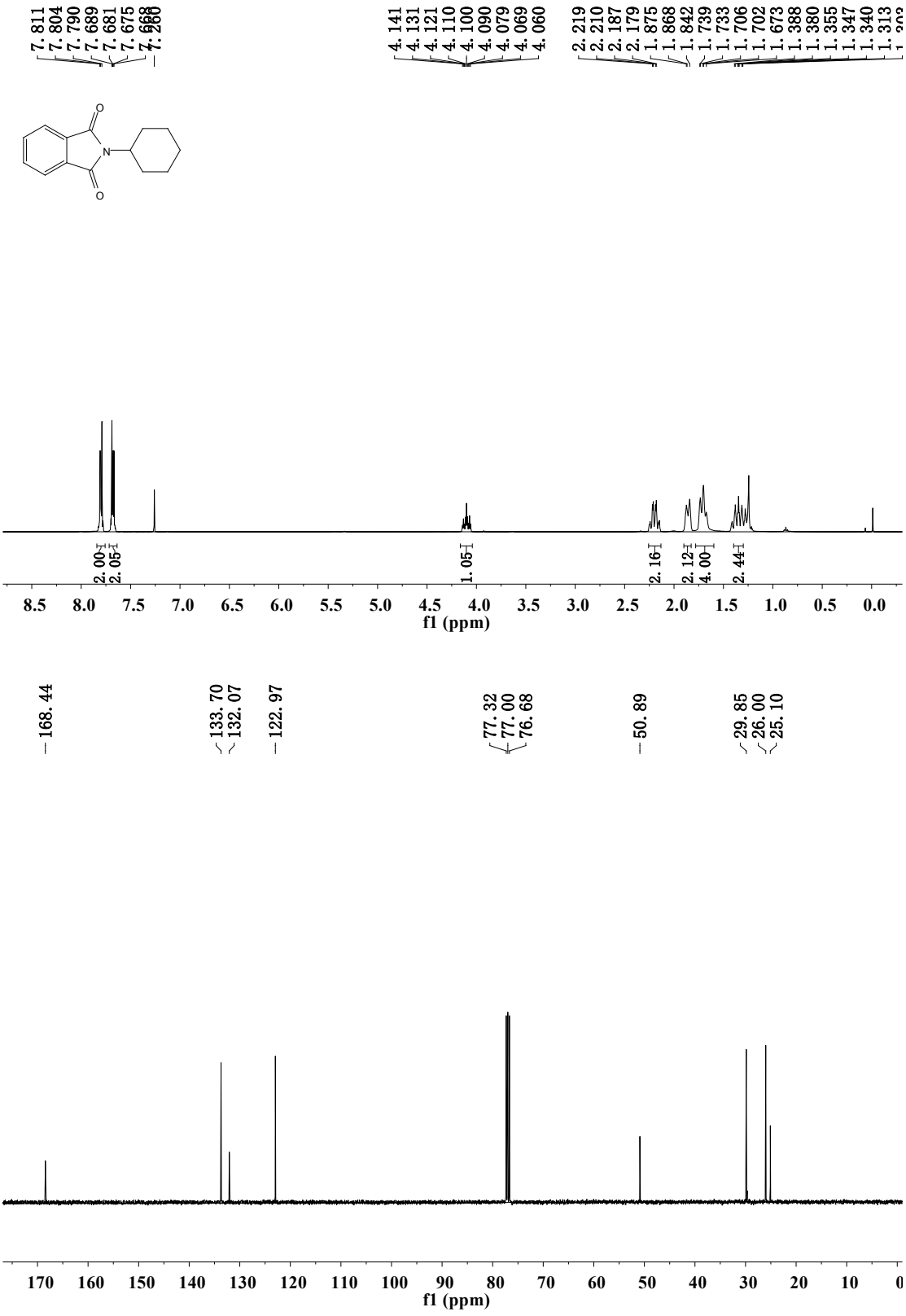
^{1}H NMR and ^{13}C NMR of 2-isobutylisoindoline-1,3-dione (3aj)



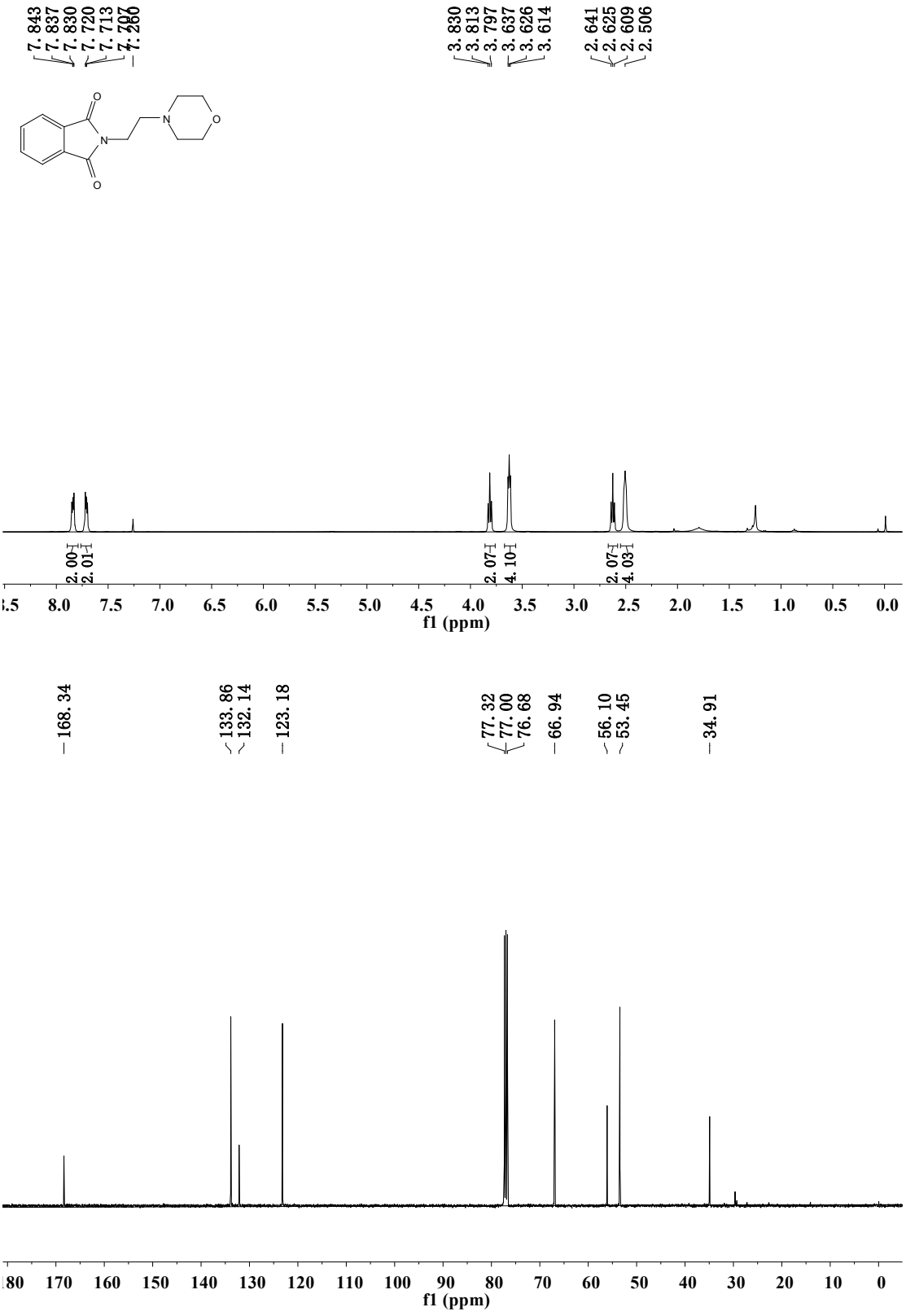
^{1}H NMR and ^{13}C NMR of 2-cyclopropylisoindoline-1,3-dione (3ak)



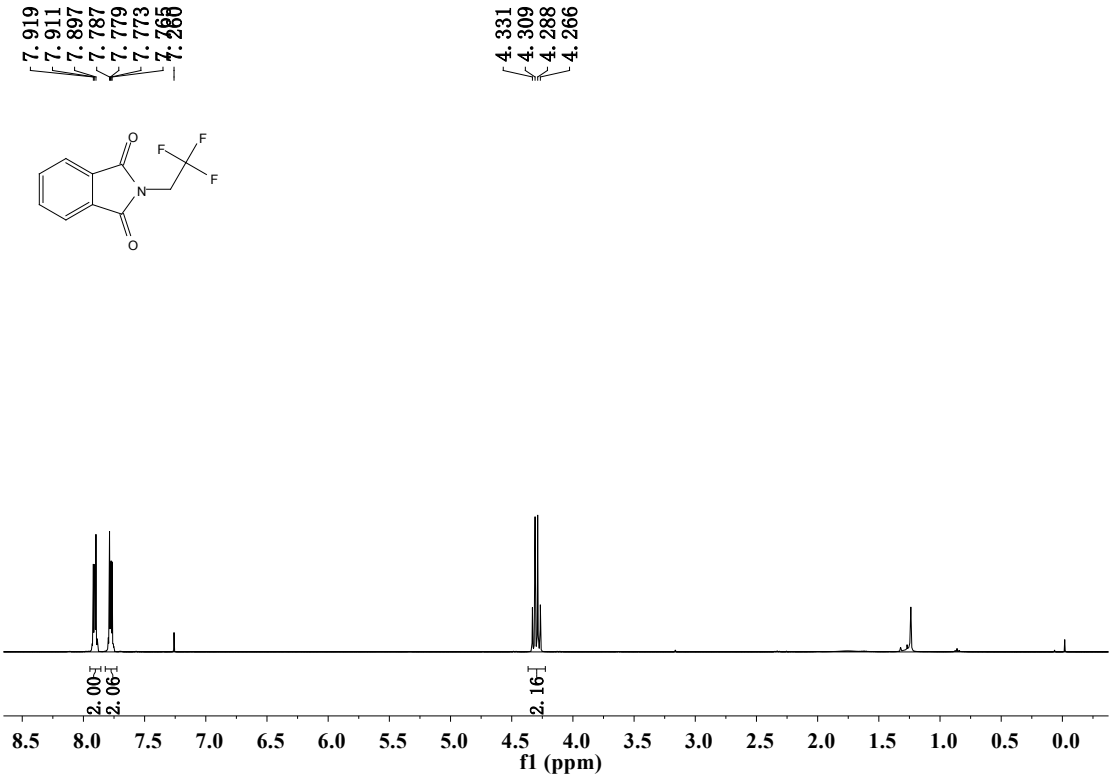
^{1}H NMR and ^{13}C NMR of 2-cyclohexylisoindoline-1,3-dione (3al)

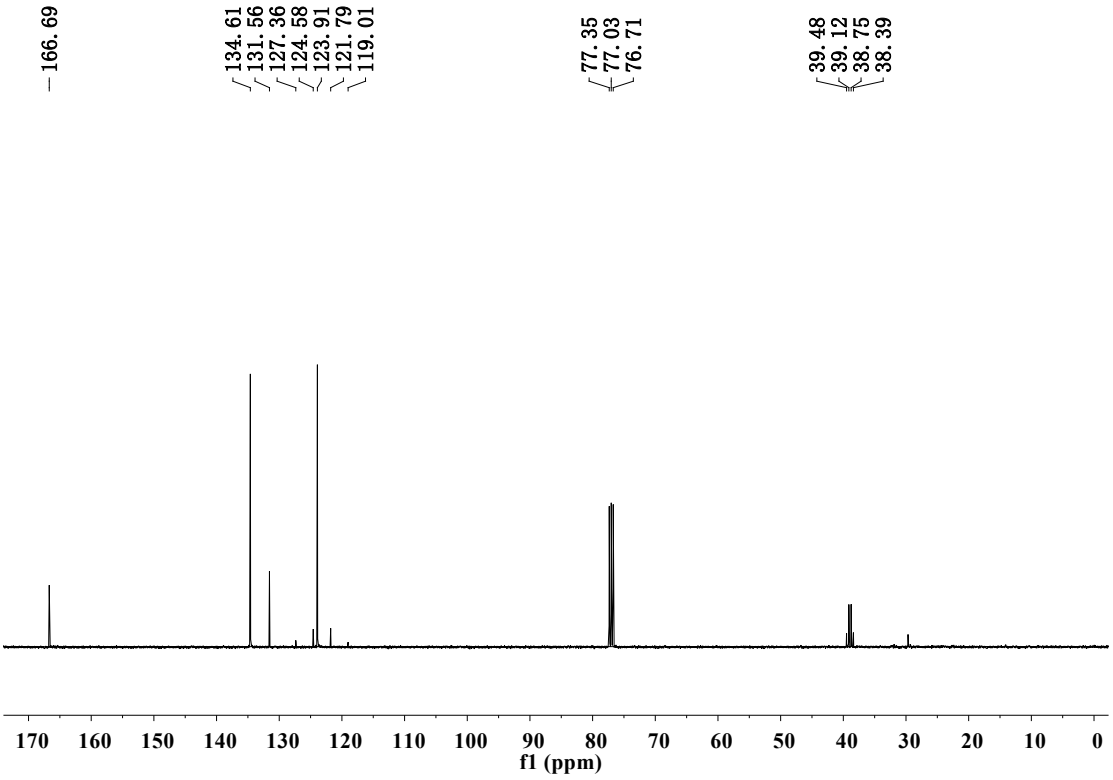


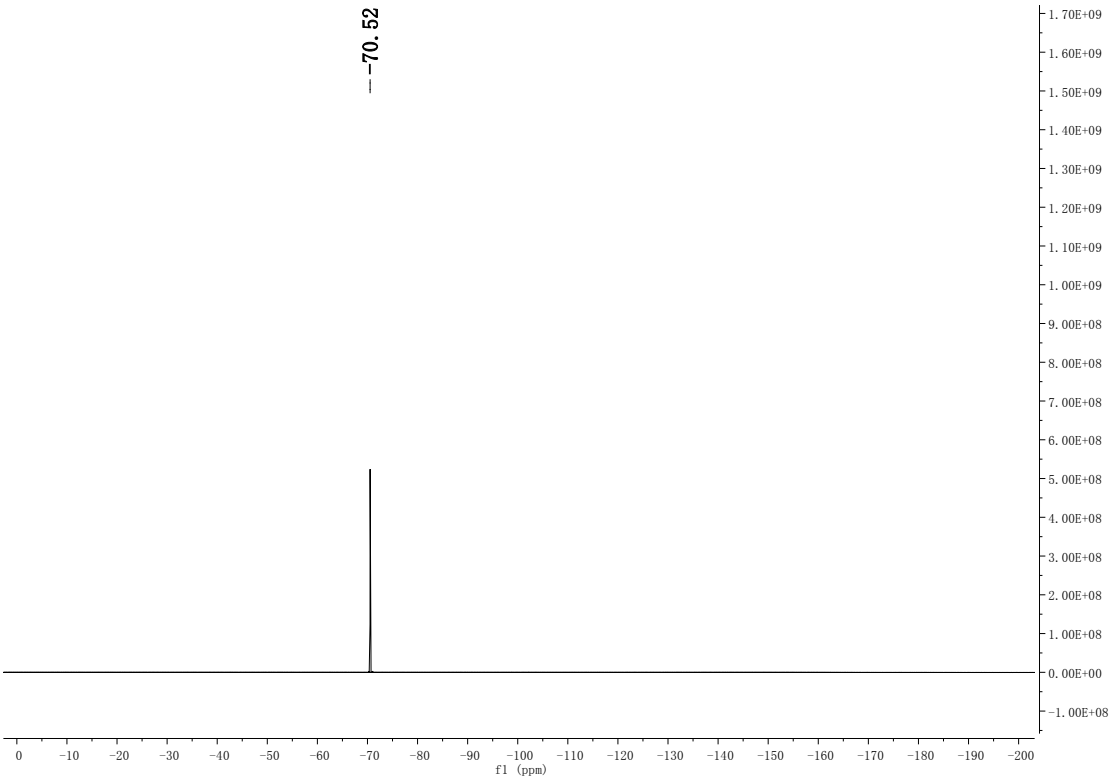
^{1}H NMR and ^{13}C NMR of 2-(2-morpholinoethyl)isoindoline-1,3-dione (3am)



^{1}H NMR, ^{13}C NMR and ^{19}F NMR of 2-(2,2,2-trifluoroethyl)isoindoline-1,3-dione (3an)



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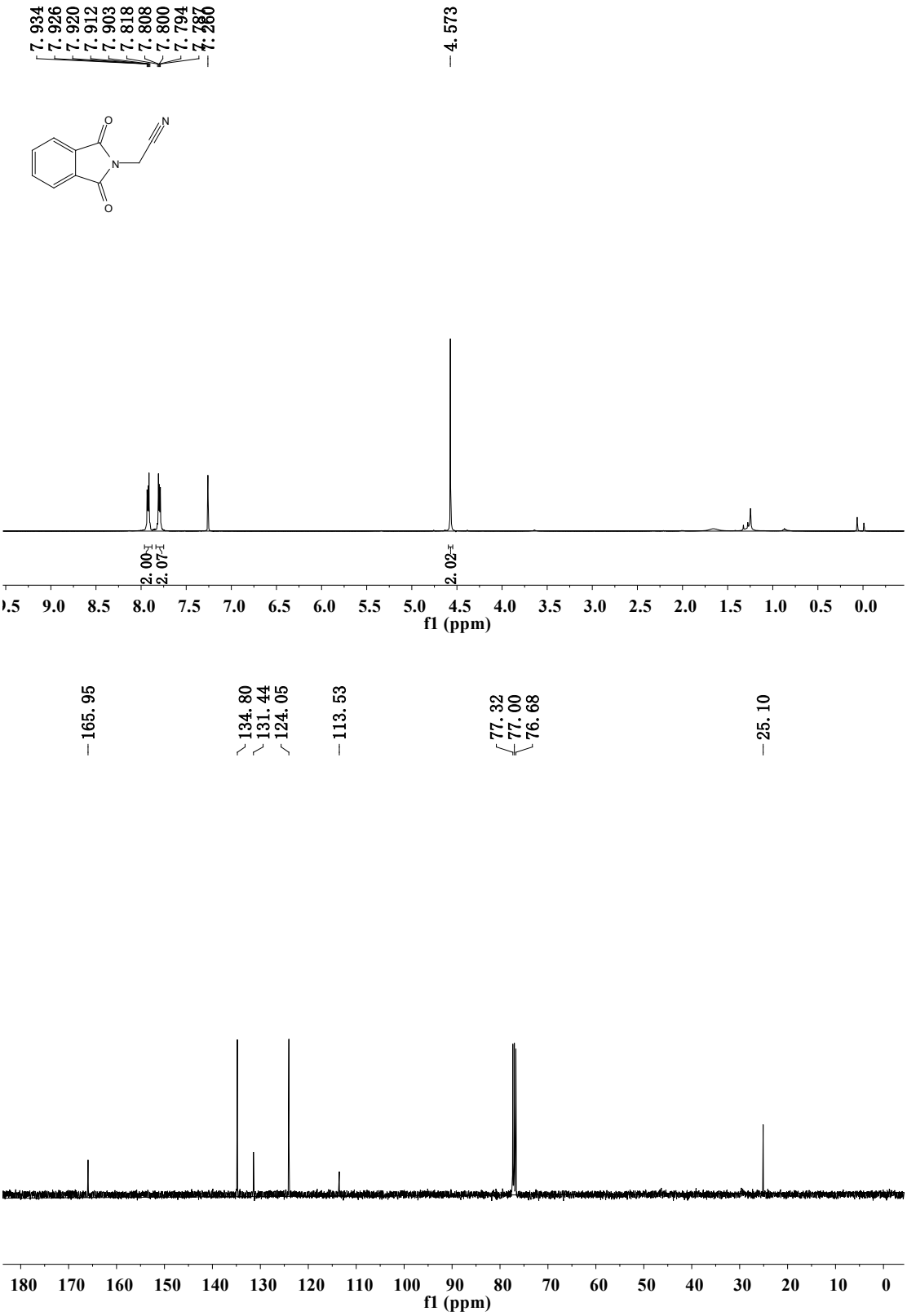
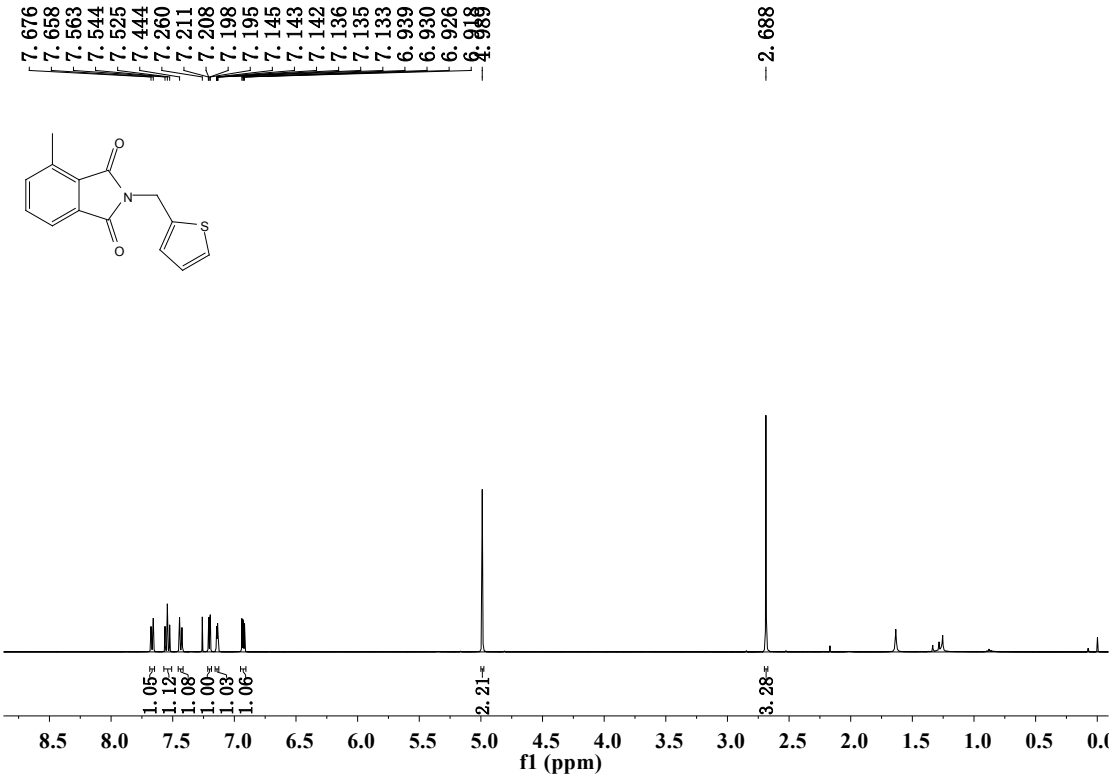
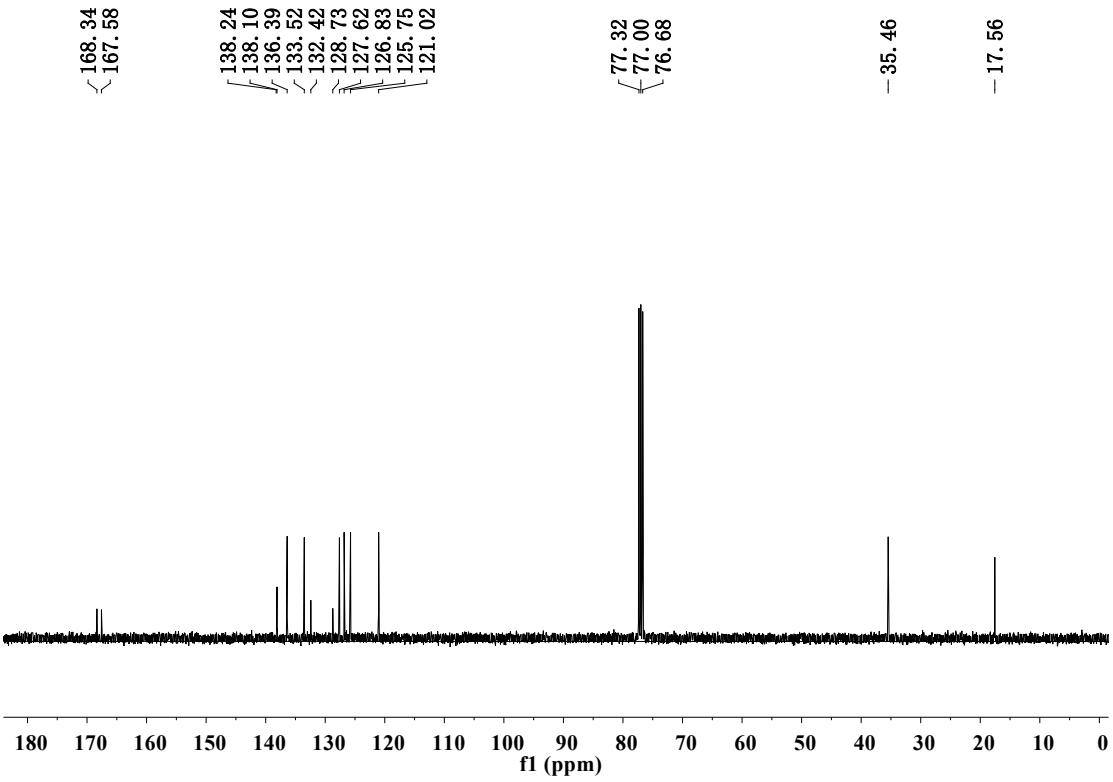
2.00E+08
1.00E+08
0.00E+00
-1.00E+08
0 −10 −20 −30 −40 −50 −60 −70 −80 −90 −100 −110 −120 −130 −140 −150 −160 −170 −180 −190 −200
f1 (ppm)

^{1}H NMR and ^{13}C NMR of 2-(1,3-dioxoisoindolin-2-yl)acetonitrile (3ao)

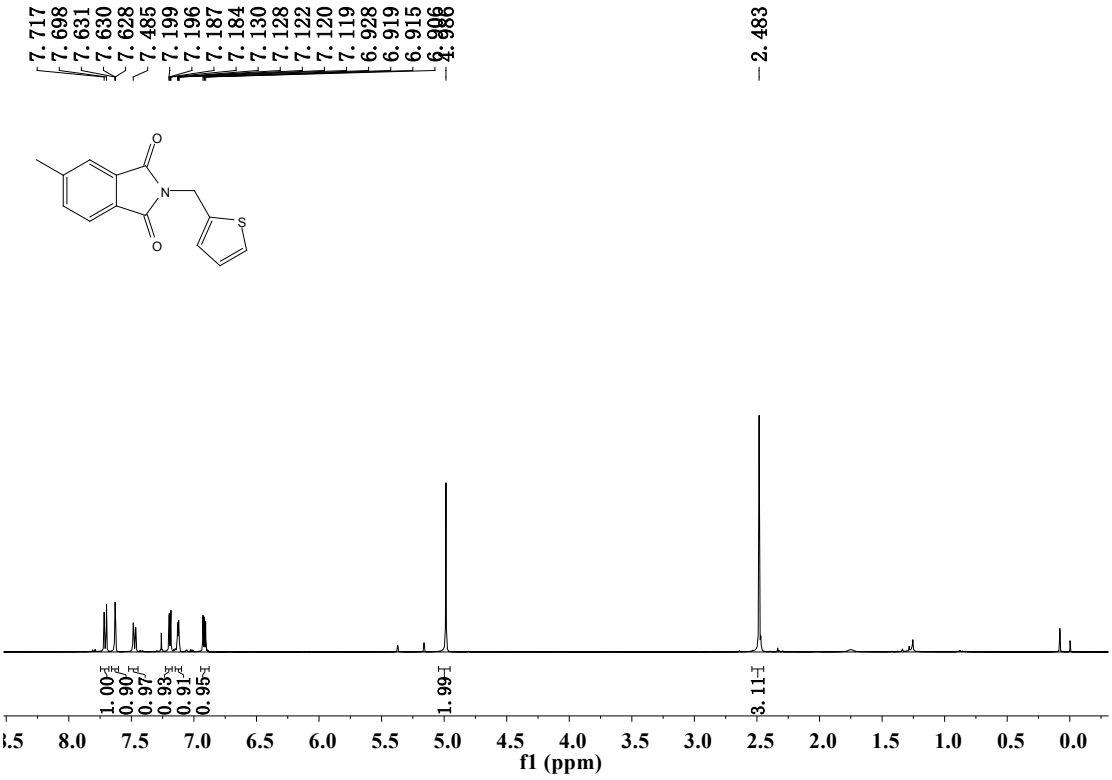


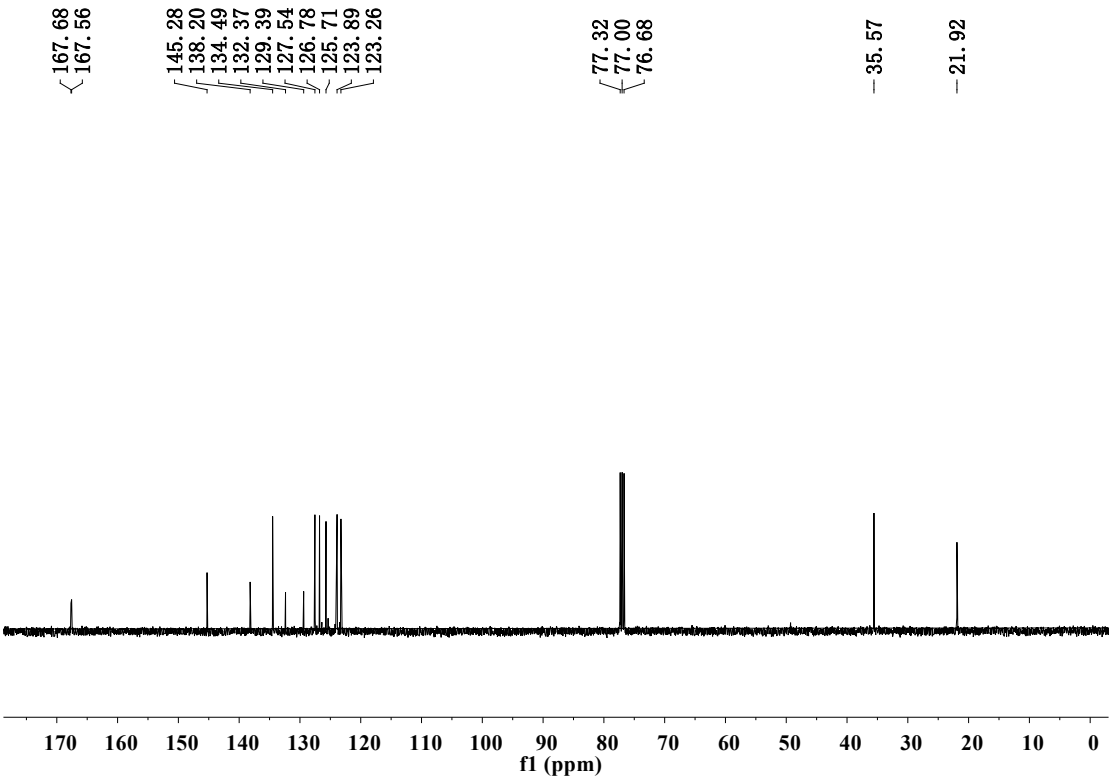
^{1}H NMR and ^{13}C NMR of
4-methyl-2-(thiophen-2-ylmethyl)isoindoline-1,3-dione (4a)



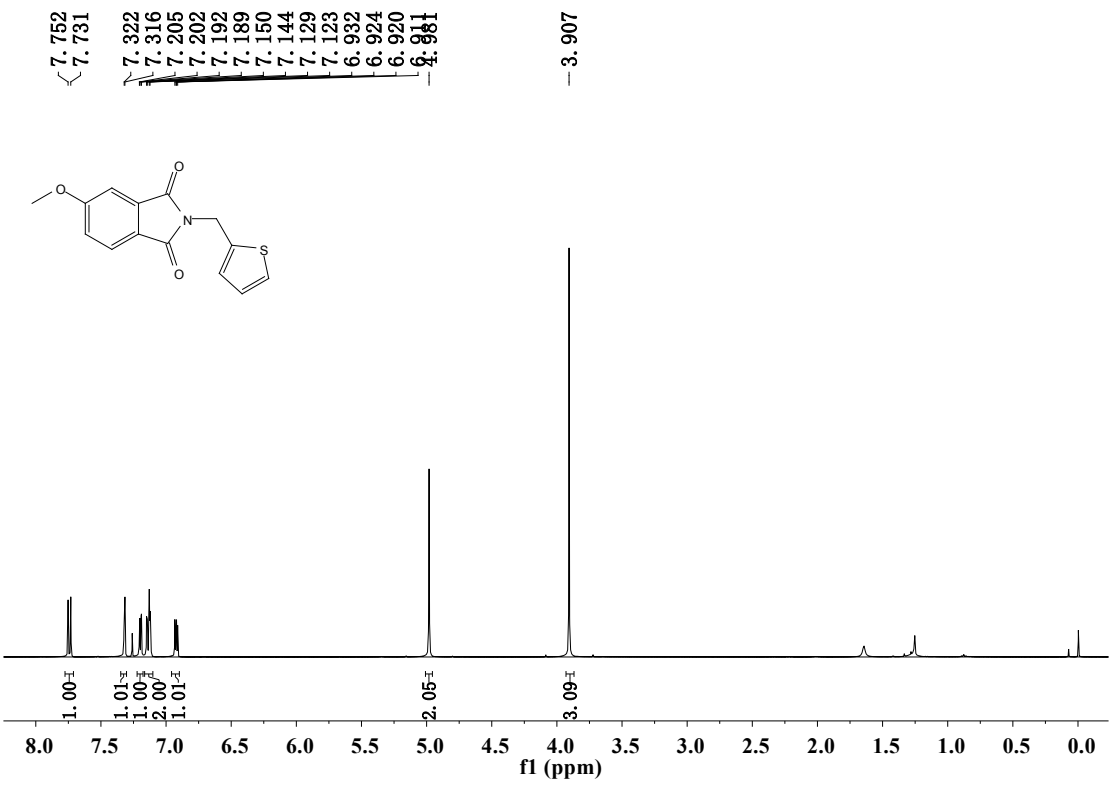


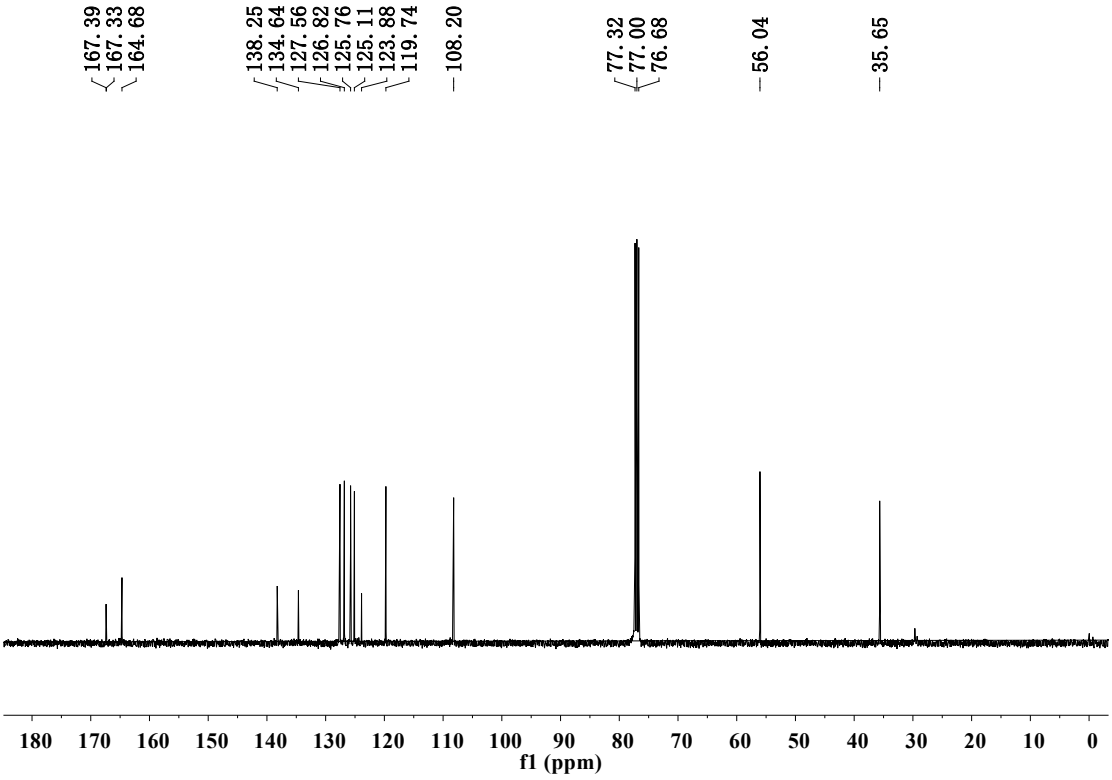
^{1}H NMR and ^{13}C NMR of 5-methyl-2-(thiophen-2-ylmethyl)isoindoline-1,3-dione (4b)



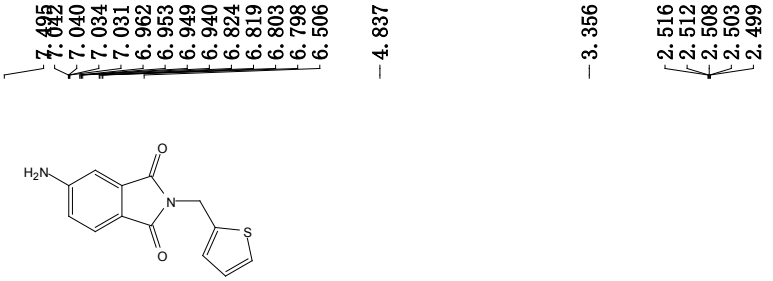


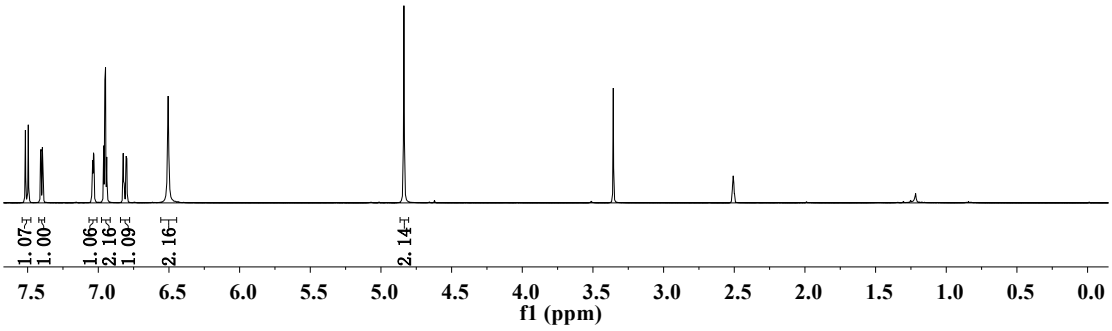
^{1}H NMR and ^{13}C NMR of 5-methoxy-2-(thiophen-2-ylmethyl)isoindoline-1,3-dione (4c)

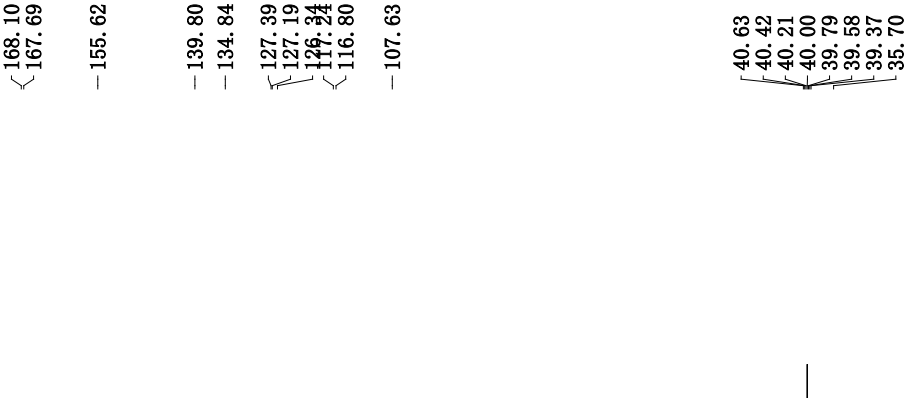




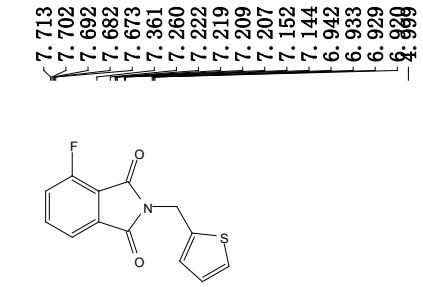
^{1}H NMR and ^{13}C NMR of
5-amino-2-(thiophen-2-ylmethyl)isoindoline-1,3-dione (4d)

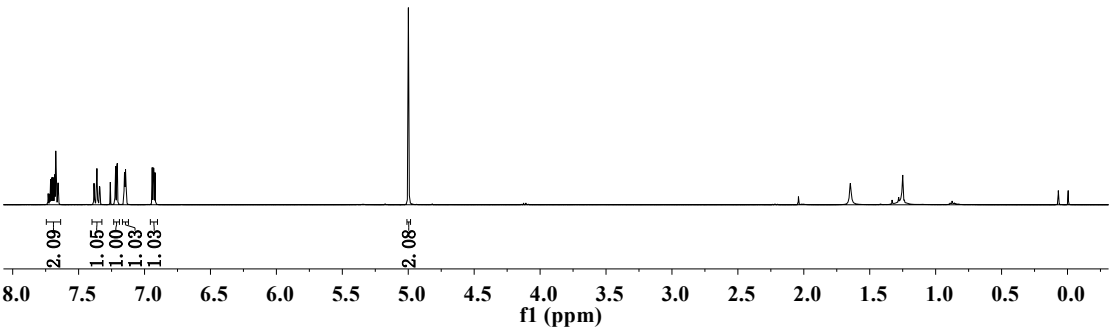


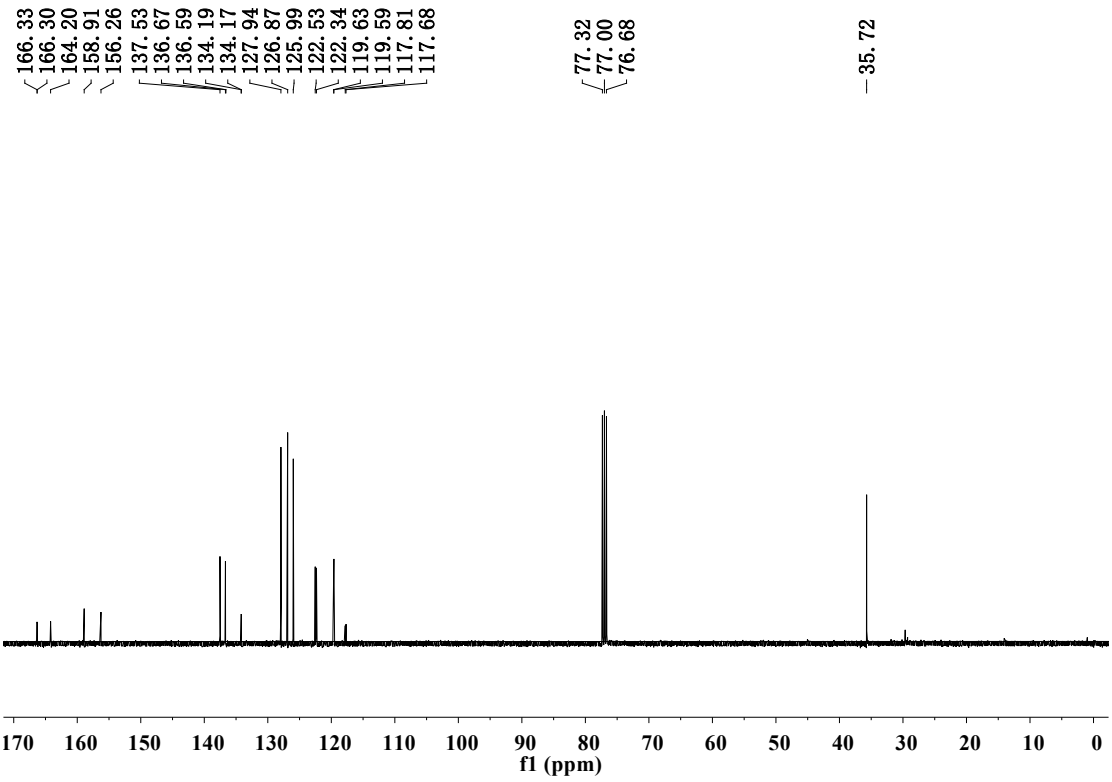


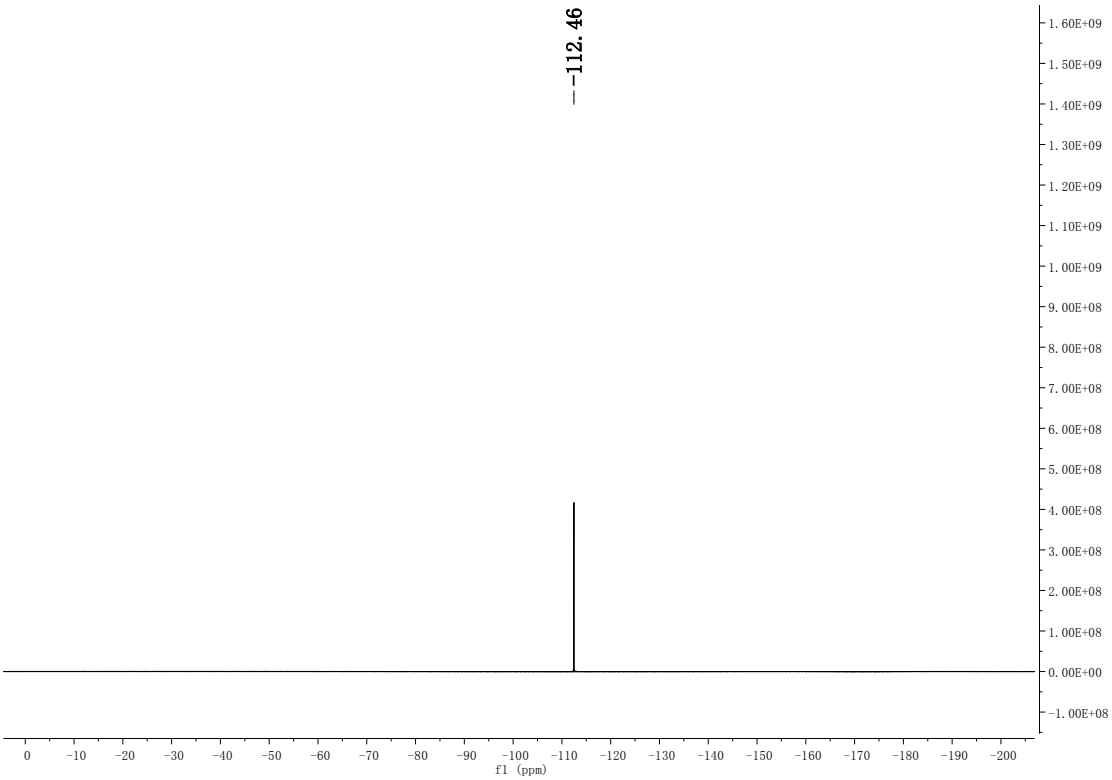


^{1}H NMR,^{13}C NMR and ^{19}F NMR of
4-fluoro-2-(thiophen-2-ylmethyl)isoindoline-1,3-dione (4e)





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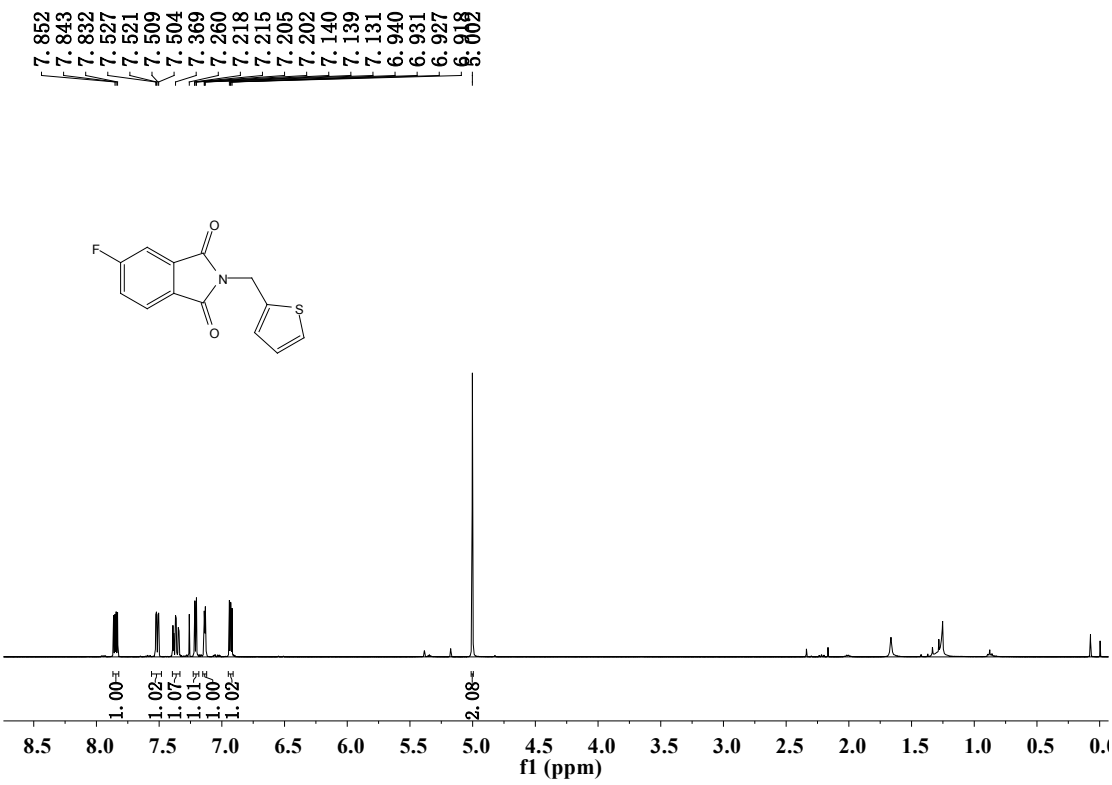
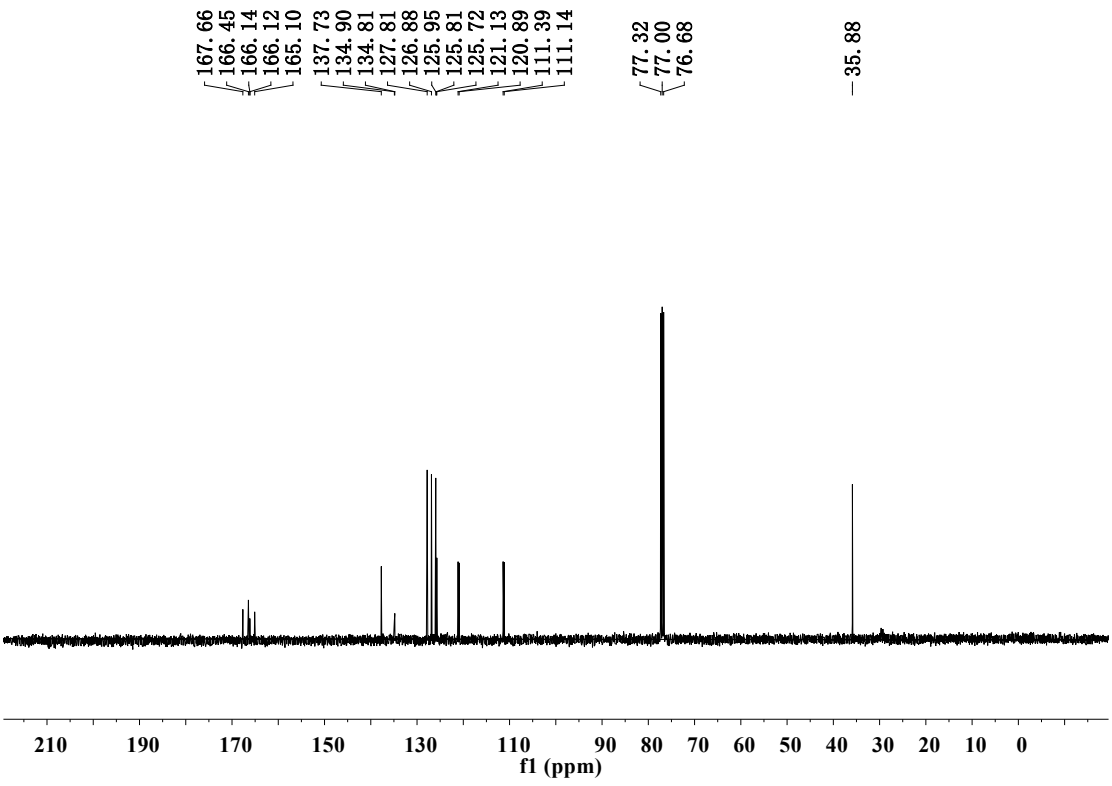
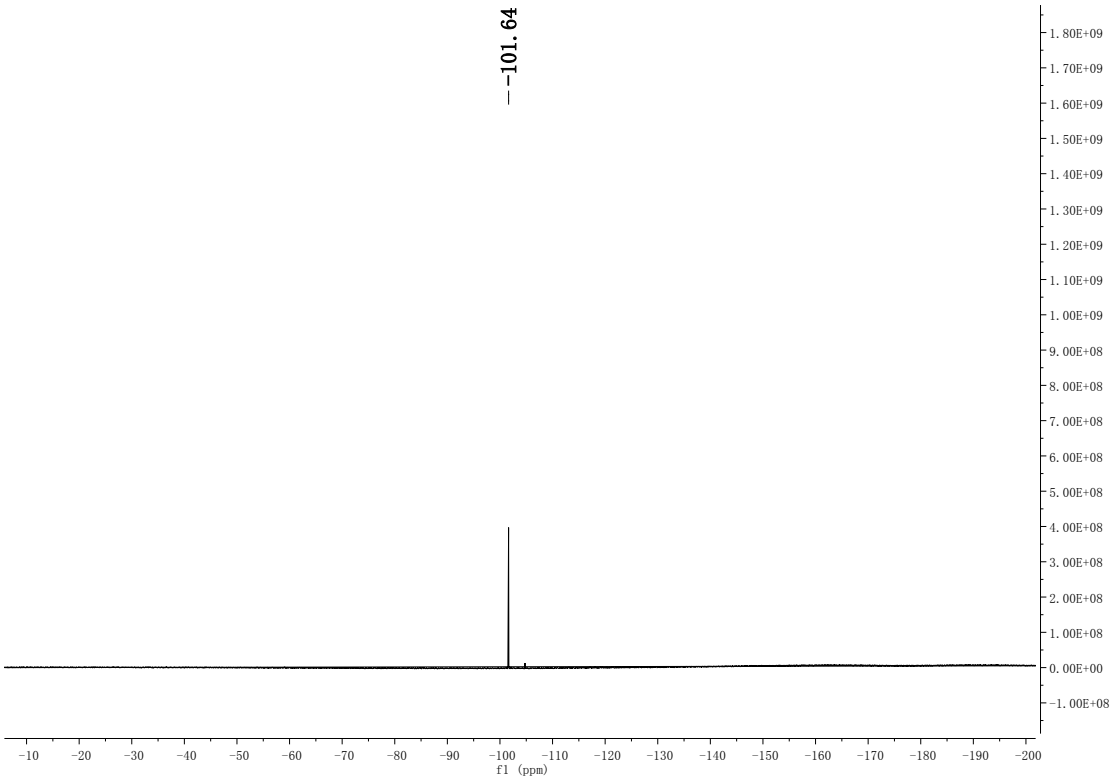
-130
-140
-150
-160
-170
-180
-190
-200
f1 (ppm)

^{1}H NMR,^{13}C NMR and ^{19}F NMR of
5-fluoro-2-(thiophen-2-ylmethyl)isoindoline-1,3-dione (4f)



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9.00E+08
8.00E+08
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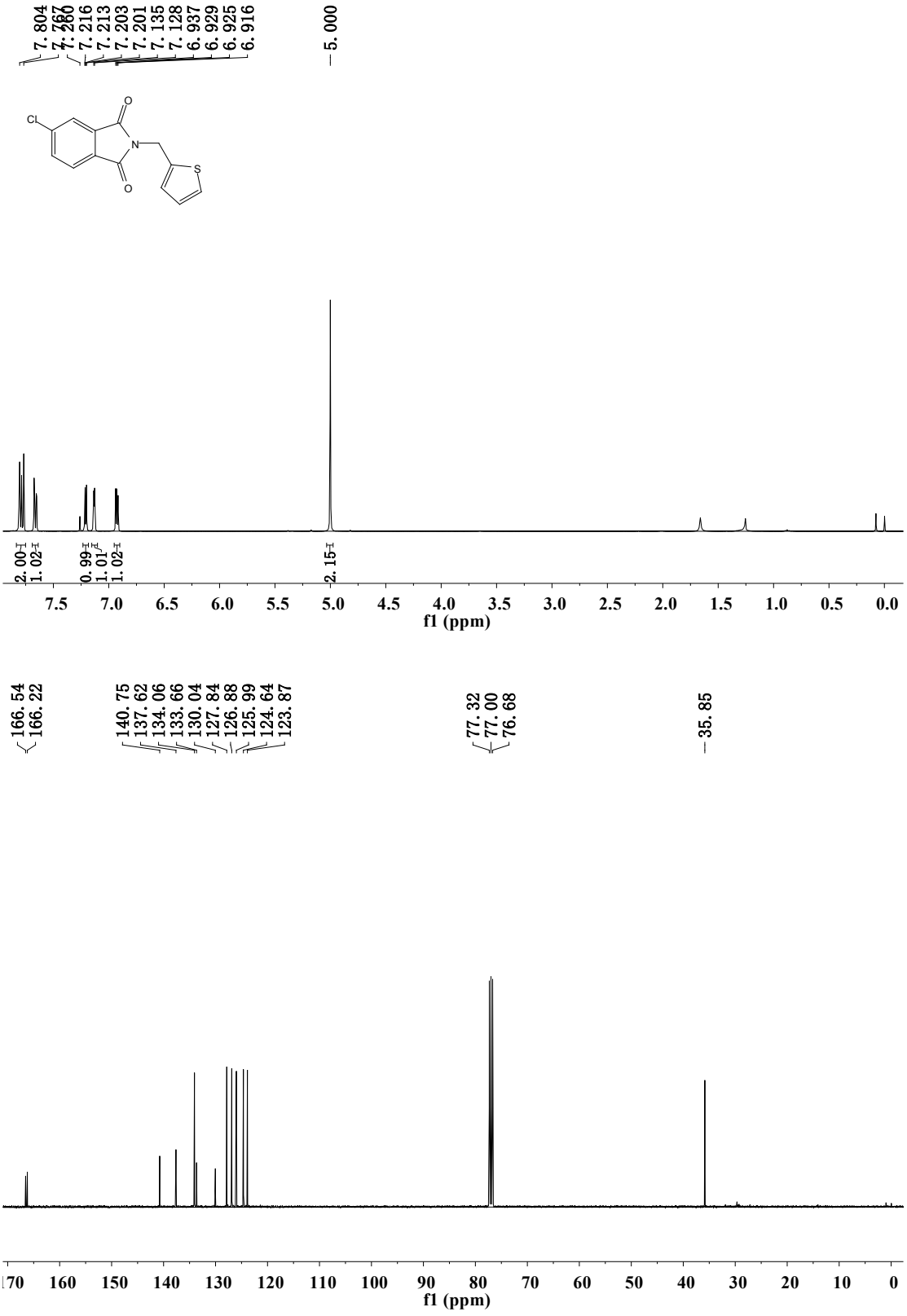
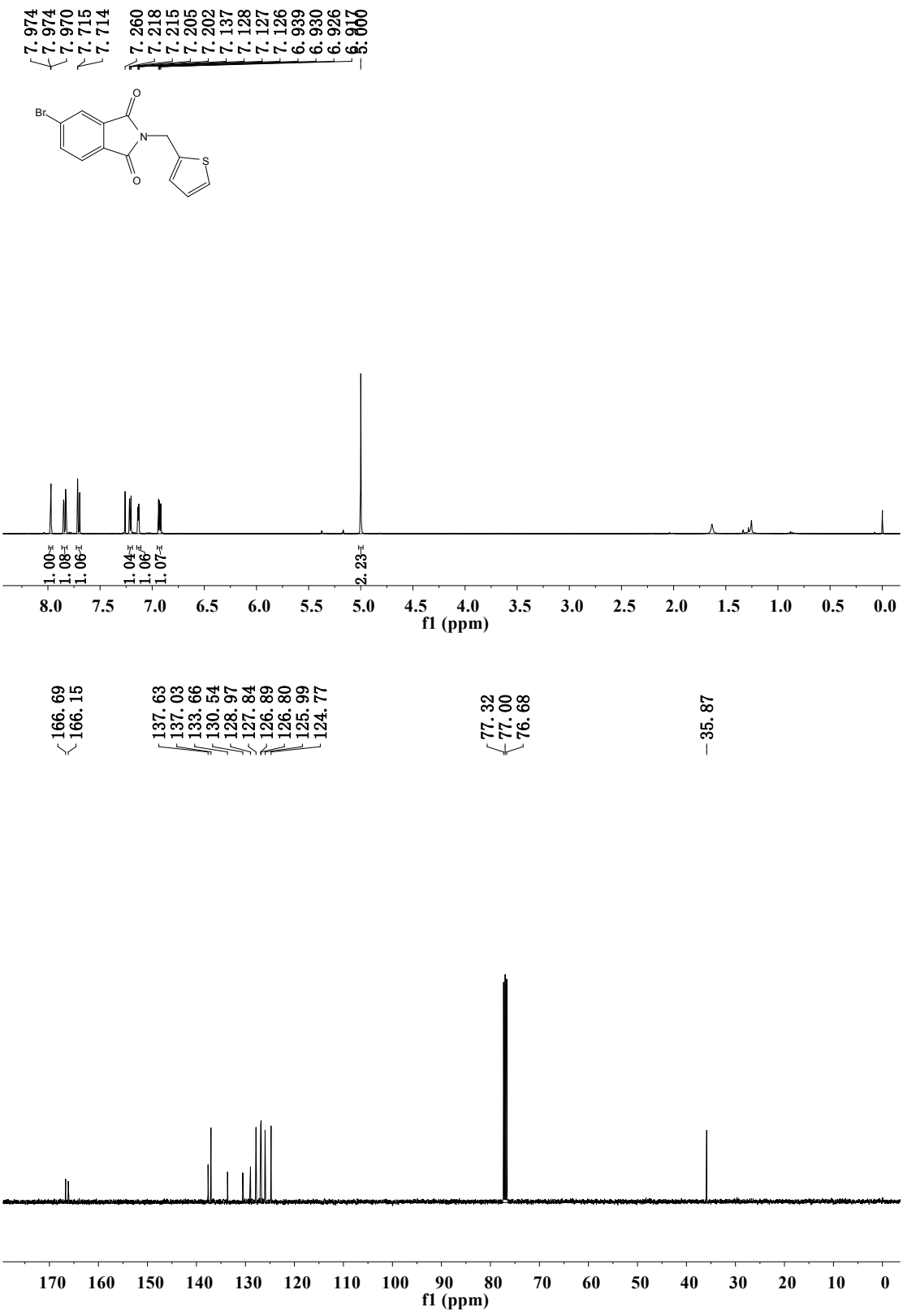
5.00E+08
4.00E+08
3.00E+08
2.00E+08
1.00E+08
0.00E+00
-1.00E+08
-10 -20 -30 -40 -50 -60 -70 -80 -90 -100 -110 -120 -130 -140 -150 -160 -170 -180 -190 -200
f1 (ppm)

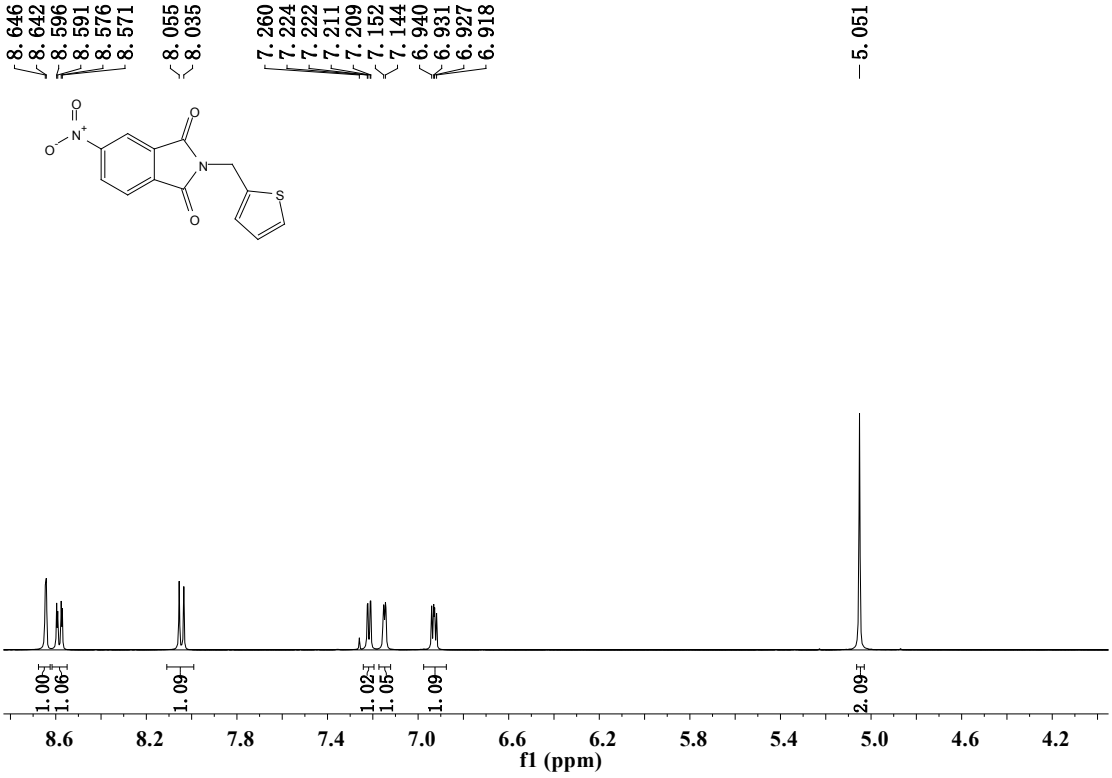
^{1}H NMR and ^{13}C NMR of
5-chloro-2-(thiophen-2-ylmethyl)isoindoline-1,3-dione (4g)

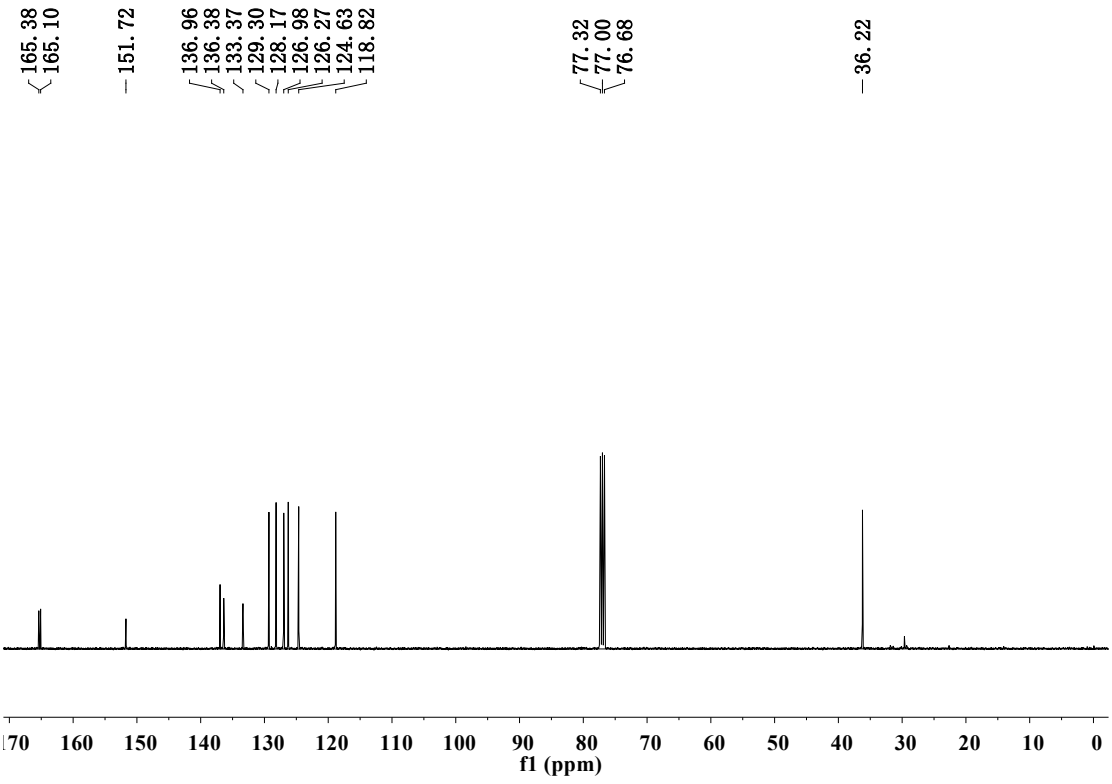


^{1}H NMR and ^{13}C NMR of
5-bromo-2-(thiophen-2-ylmethyl)isoindoline-1,3-dione (4h)

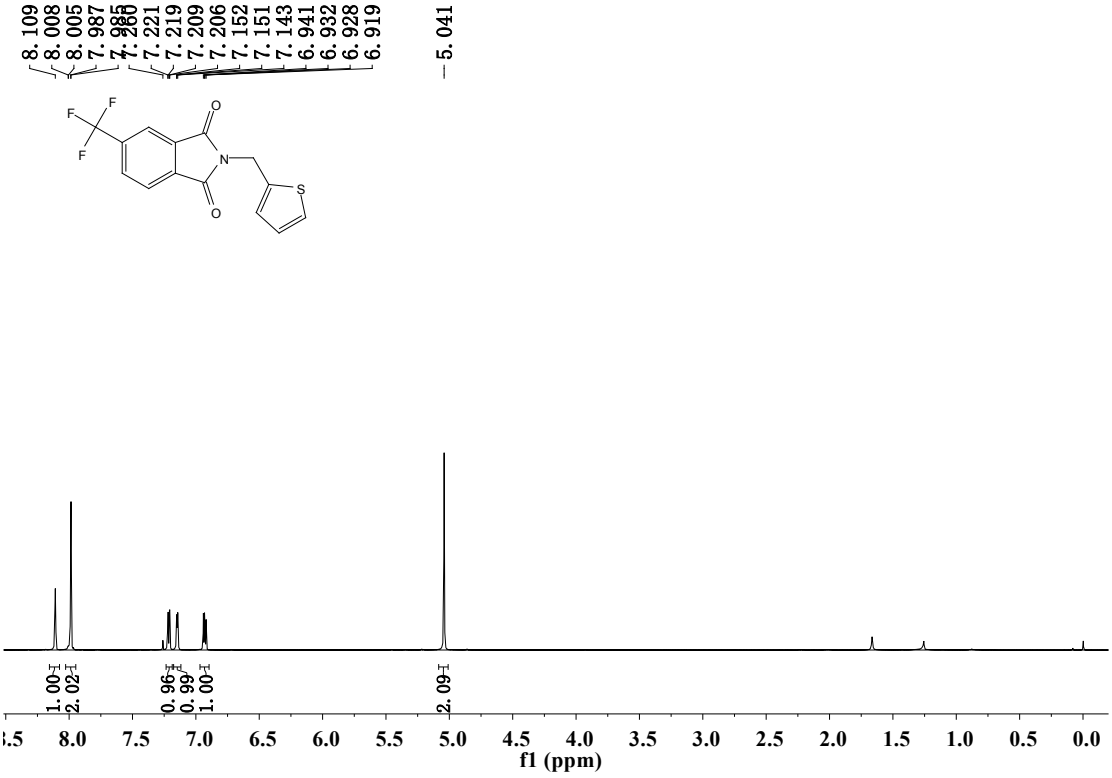


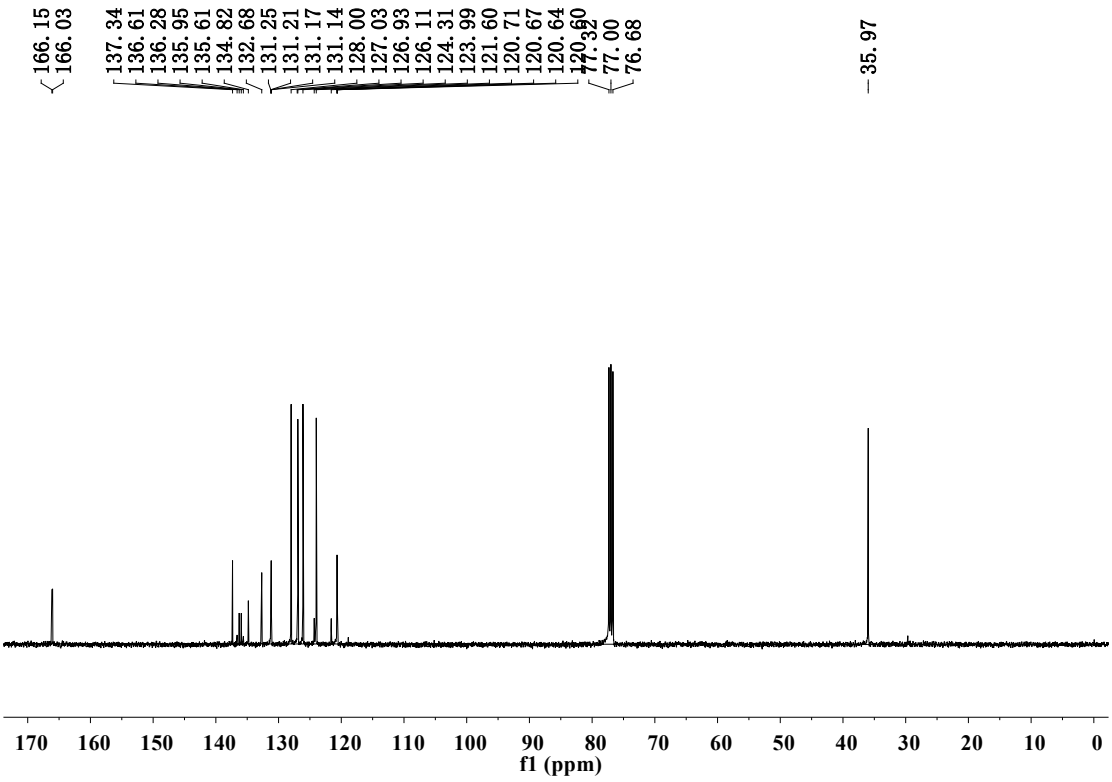
^{1}H NMR and ^{13}C NMR of 5-nitro-2-(thiophen-2-ylmethyl)isoindoline-1,3-dione (4i)

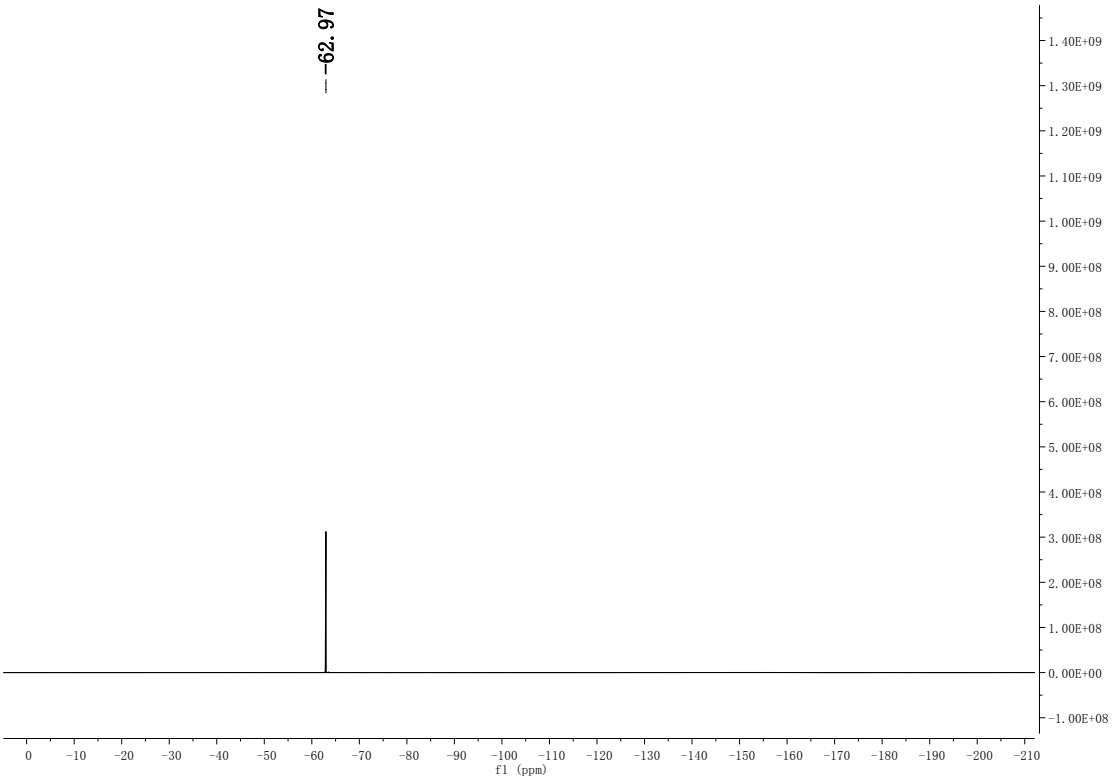




^{1}H NMR,^{13}C NMR and ^{19}F NMR of 2-(thiophen-2-ylmethyl)-5-(trifluoromethyl)isoindoline-1,3-dione (4j)



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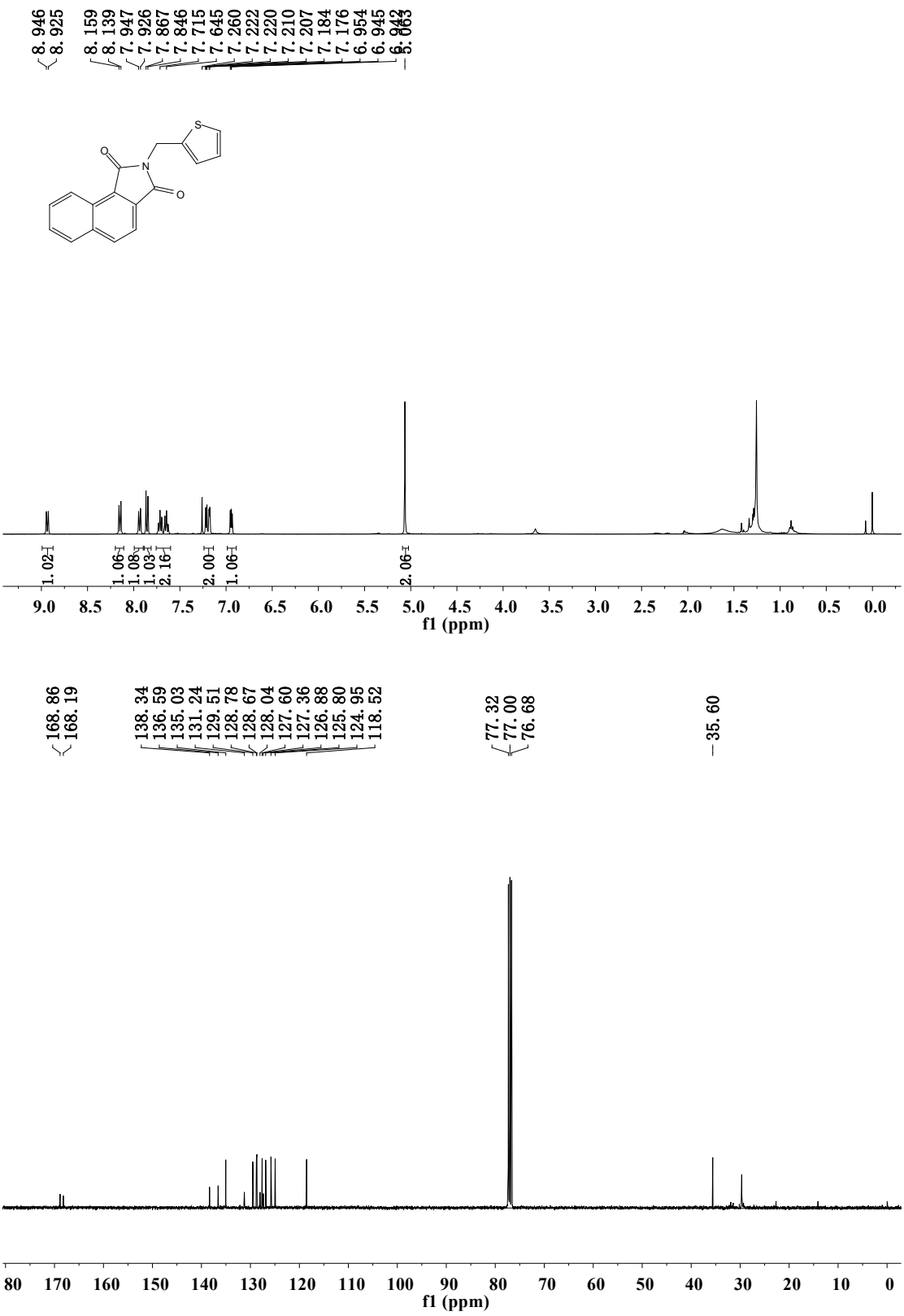
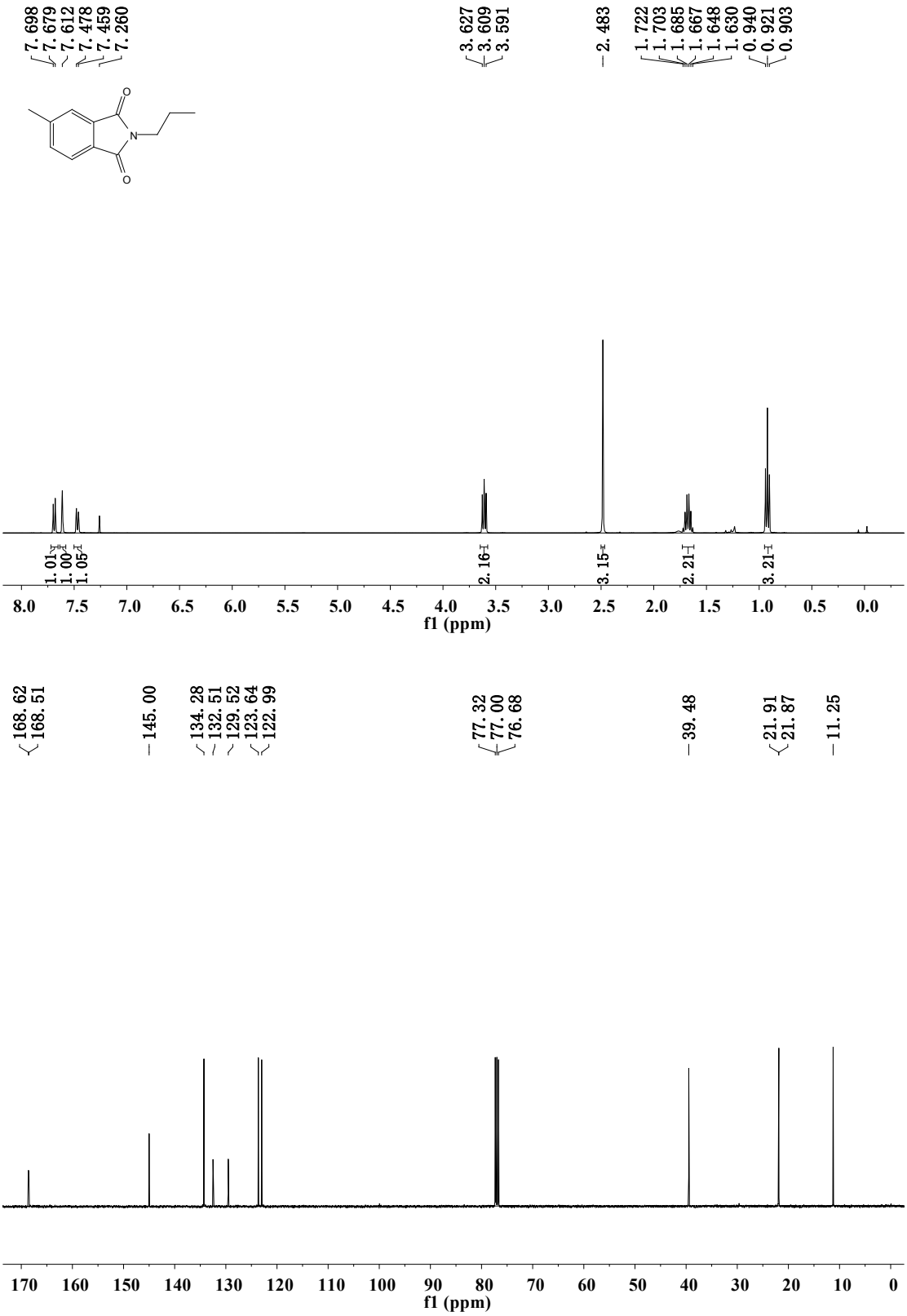
5.00E+08
4.00E+08
3.00E+08
2.00E+08
1.00E+08
0.00E+00
-1.00E+08
0 -10 -20 -30 -40 -50 -60 -70 -80 -90 -100 -110 -120 -130 -140 -150 -160 -170 -180 -190 -200 -210
f1 (ppm)

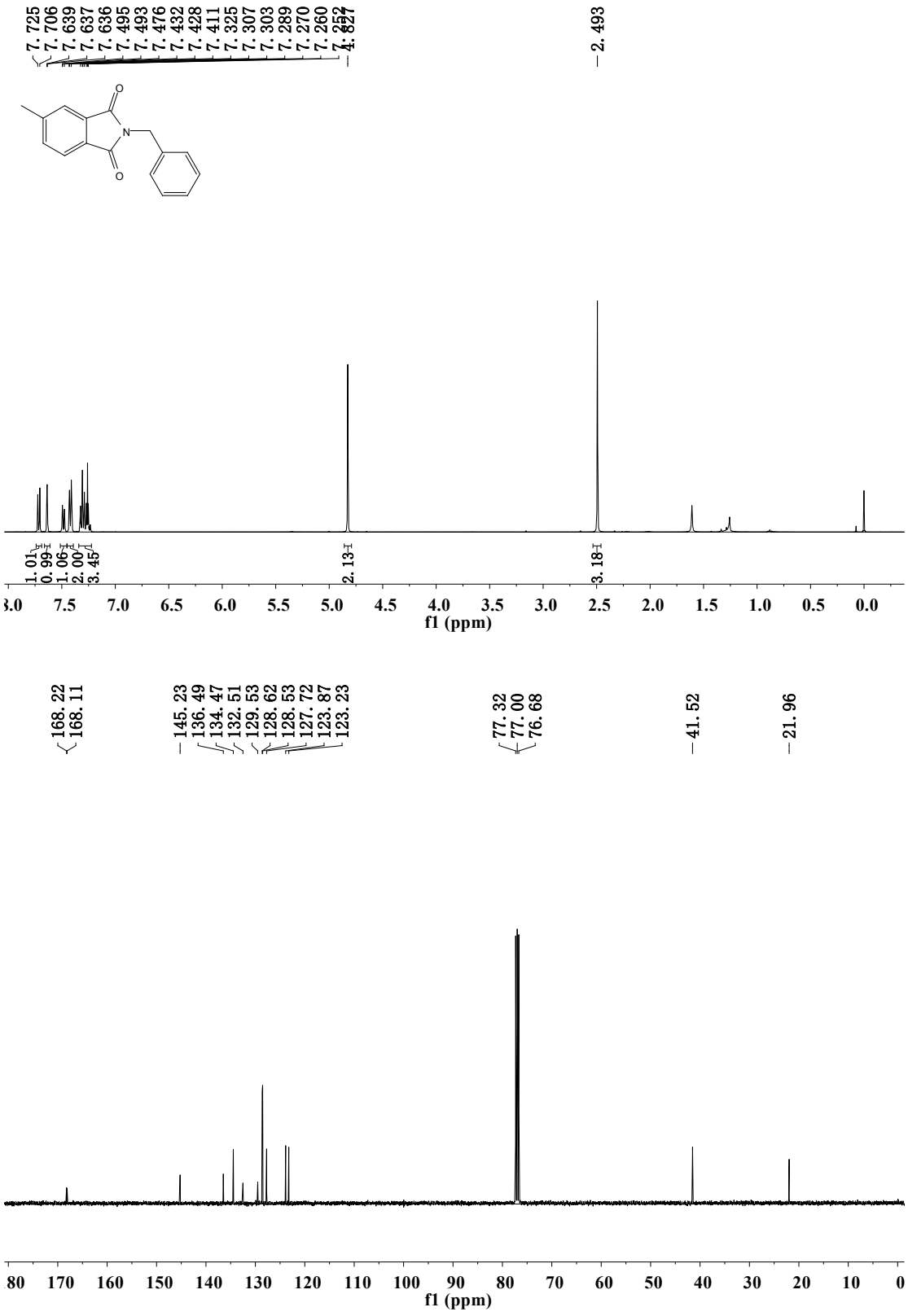
^{1}H NMR and ^{13}C NMR of 2-(thiophen-2-ylmethyl)-1H-benzo[e]isoindole-1,3(2H)-dione (4k)



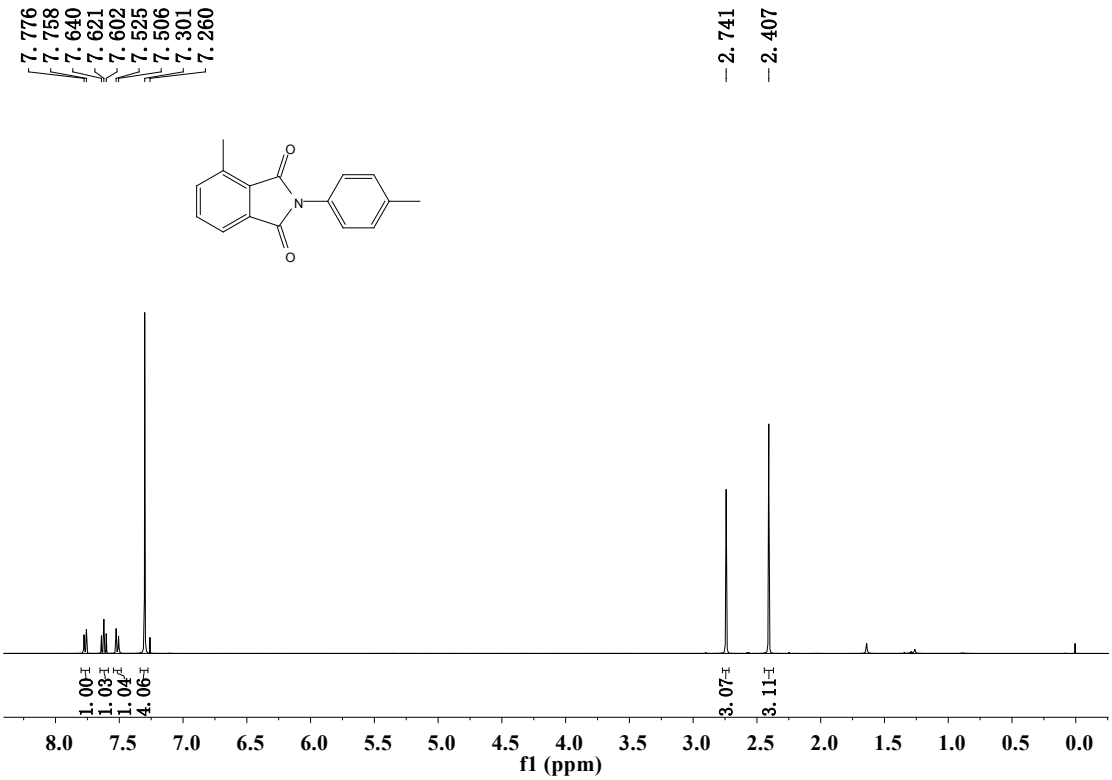
^{1}H NMR and ^{13}C NMR of 5-methyl-2-propylisoindoline-1,3-dione (4l)

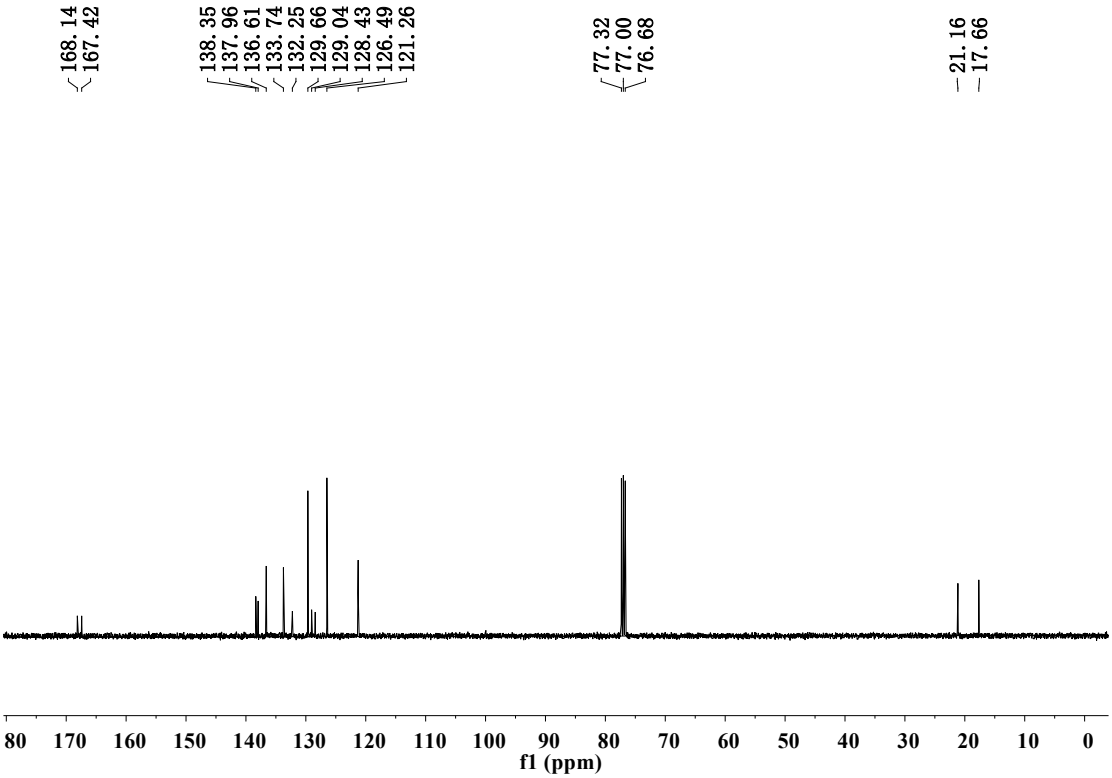


^{1}H NMR and ^{13}C NMR of 2-benzyl-5-methylisoindoline-1,3-dione (4m)

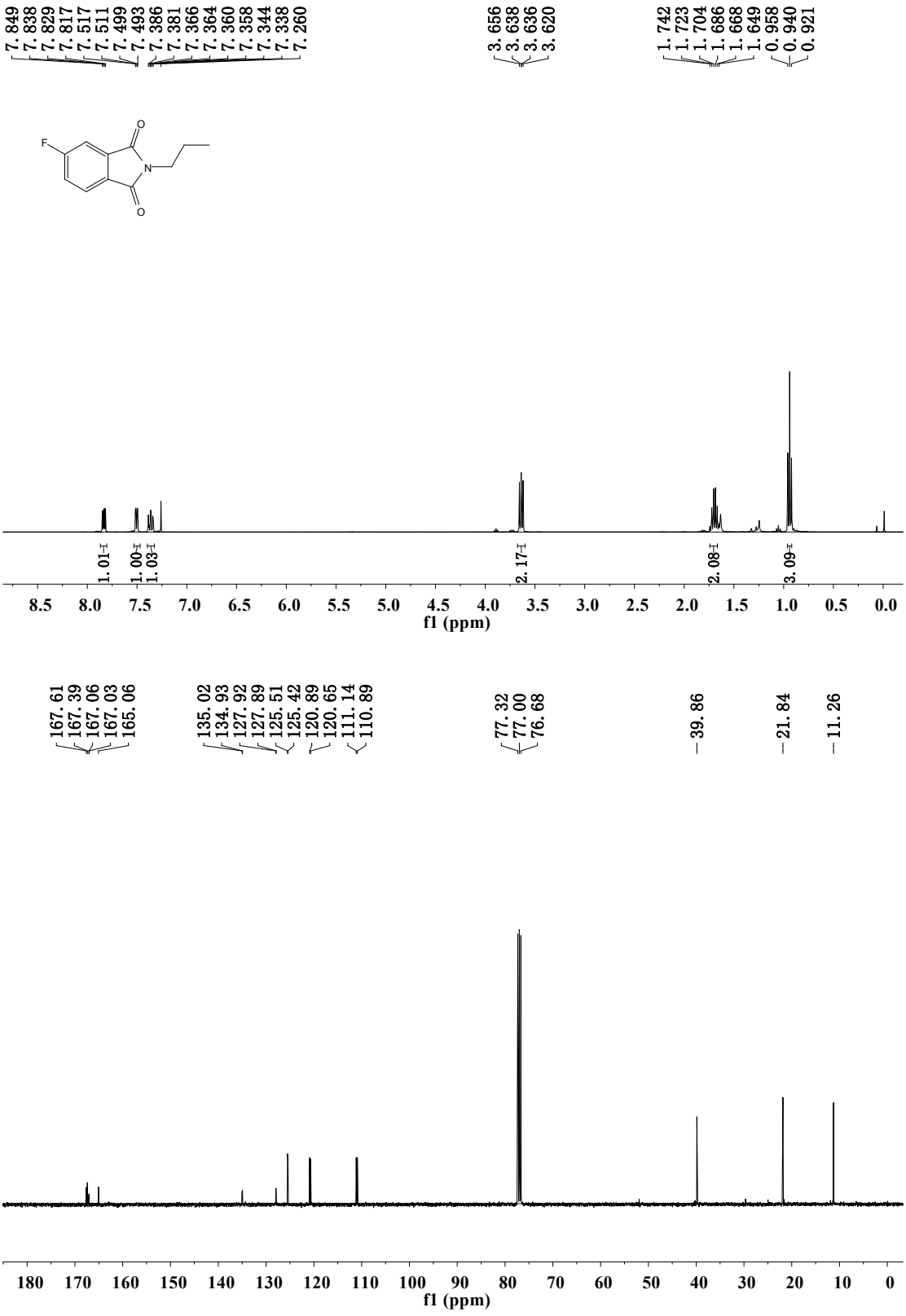


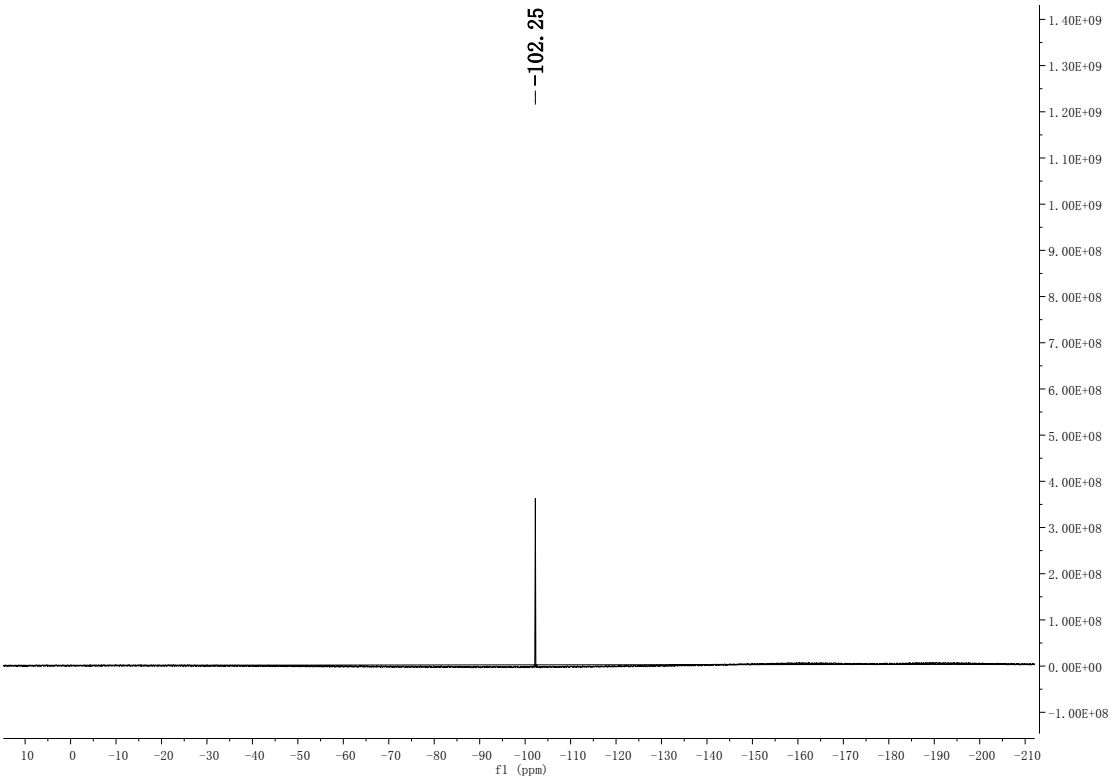
^{1}H NMR and ^{13}C NMR of 4-methyl-2-(*p*-tolyl)isoindoline-1,3-dione (4n)





^{1}H NMR,^{13}C NMR and ^{19}F NMR of 5-fluoro-2-propylisoindoline-1,3-dione (4o)

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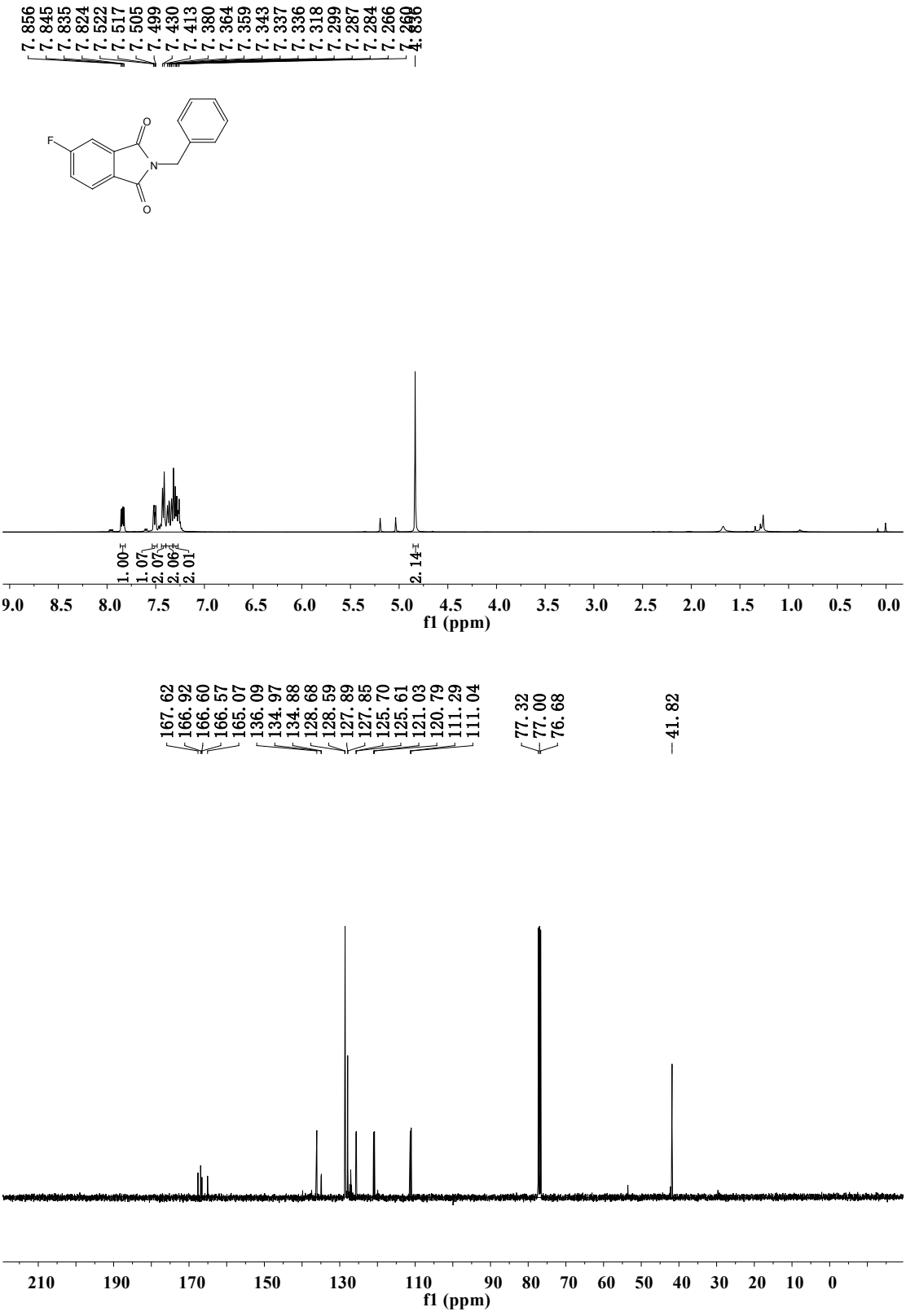
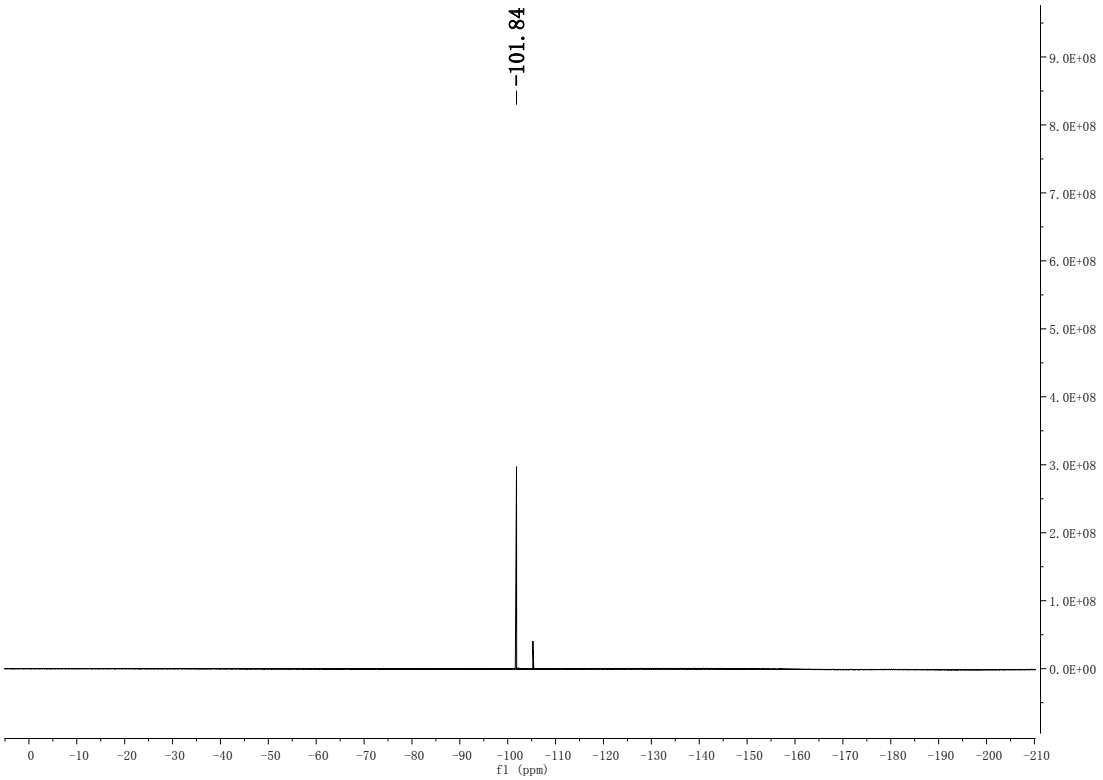
7.00E+08
6.00E+08
5.00E+08
4.00E+08
3.00E+08
2.00E+08
1.00E+08
0.00E+00
-1.00E+08
10 0 -10 -20 -30 -40 -50 -60 -70 -80 -90 -100 -110 -120 -130 -140 -150 -160 -170 -180 -190 -200 -210
f1 (ppm)

^{1}H NMR,^{13}C NMR and ^{19}F NMR of 2-benzyl-5-fluoroisoindoline-1,3-dione (4p)

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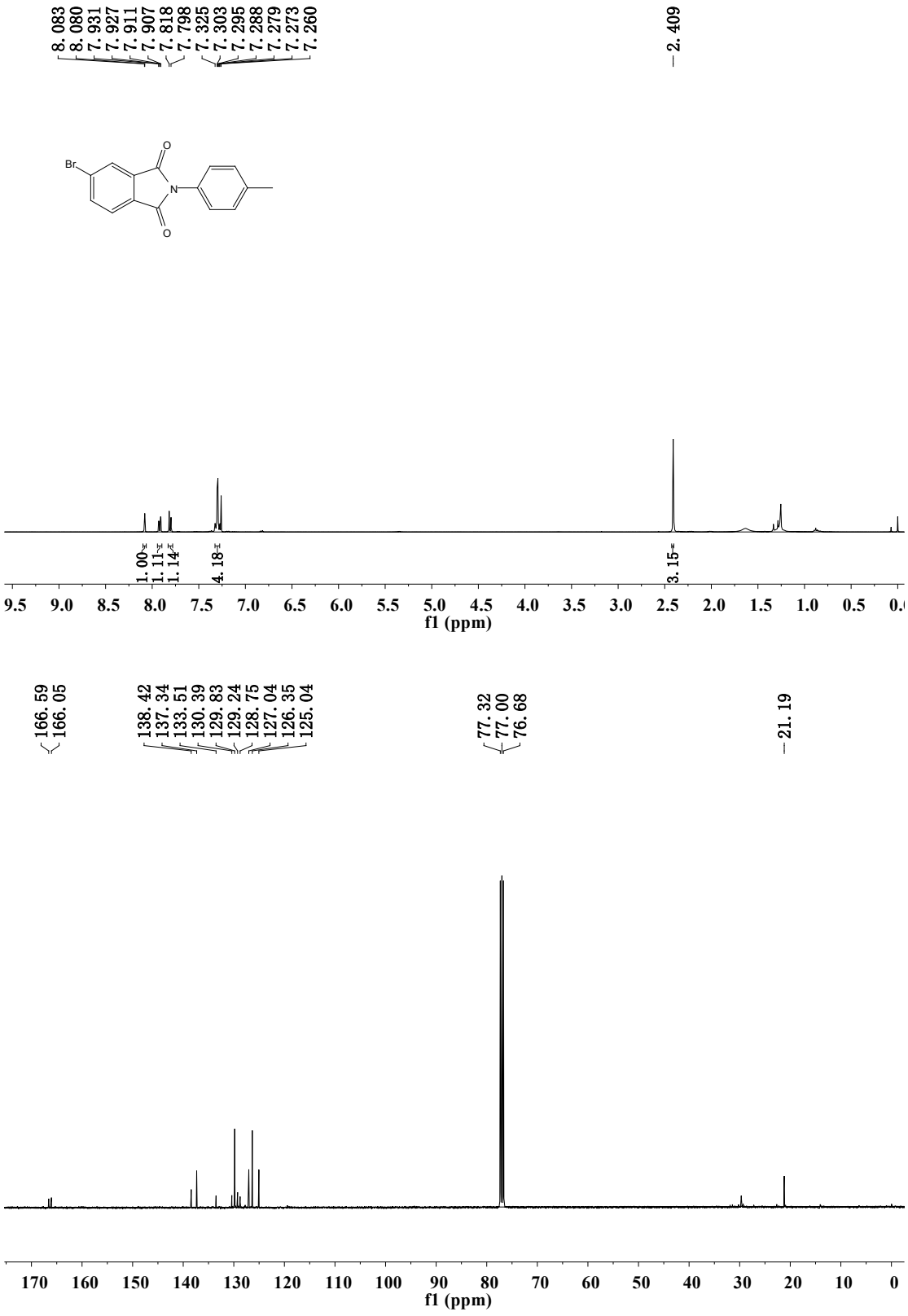
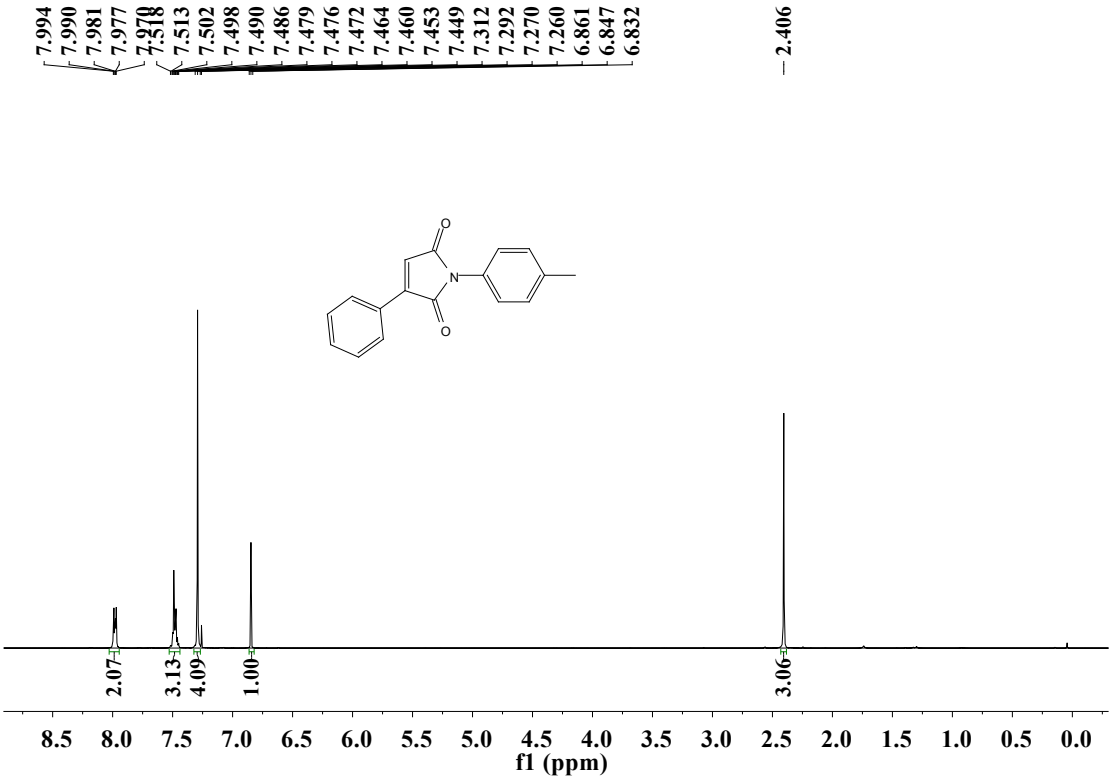
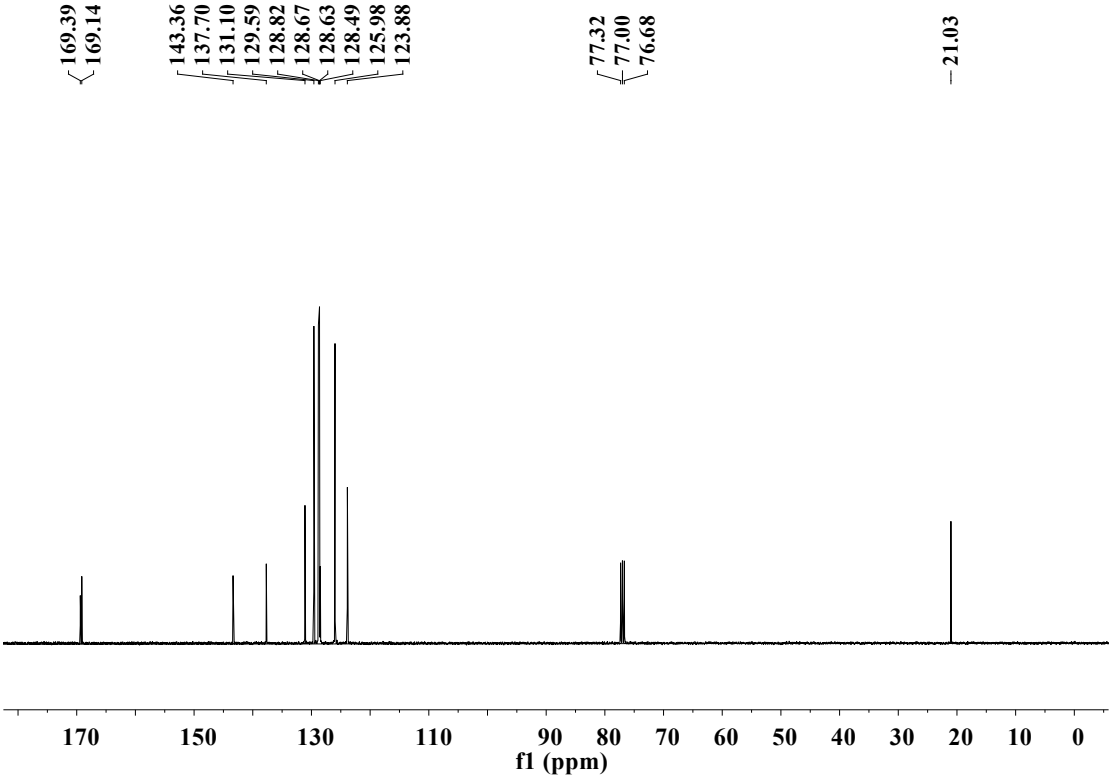
4.0E+08
3.0E+08
2.0E+08
1.0E+08
0.0E+00
0 -10 -20 -30 -40 -50 -60 -70 -80 -90 -100 -110 -120 -130 -140 -150 -160 -170 -180 -190 -200 -210
f1 (ppm)

^{1}H NMR and ^{13}C NMR of 5-bromo-2-(p-tolyl)isoindoline-1,3-dione (4q)

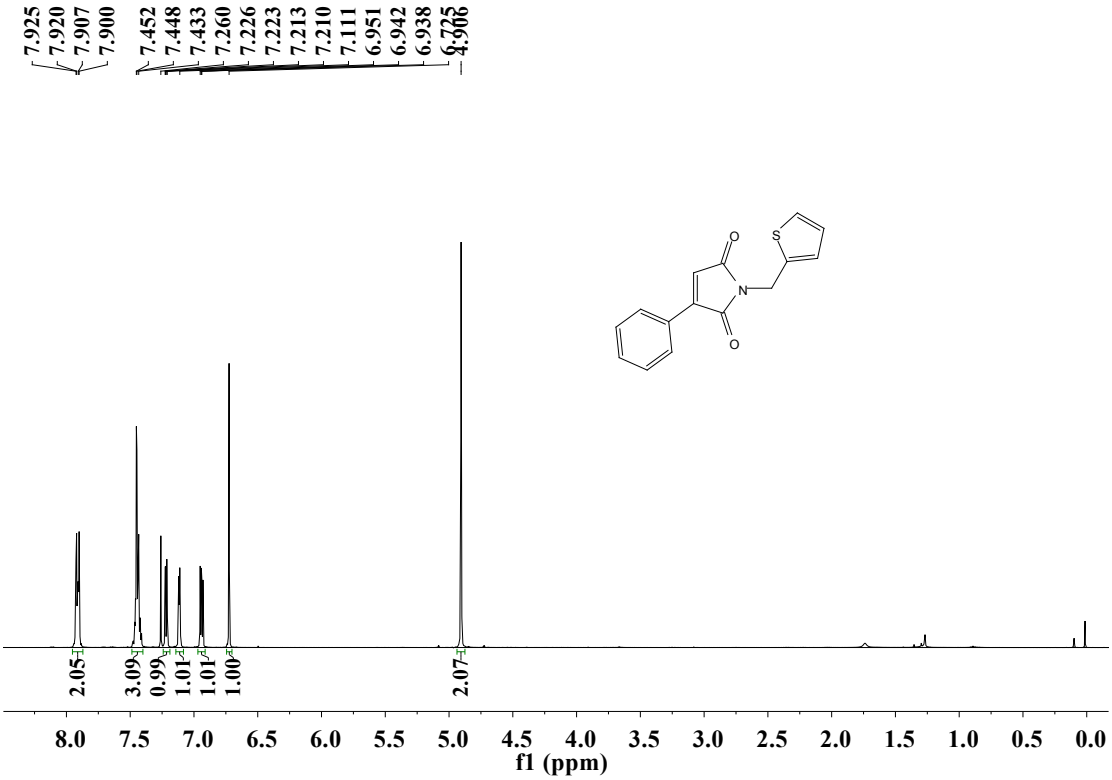


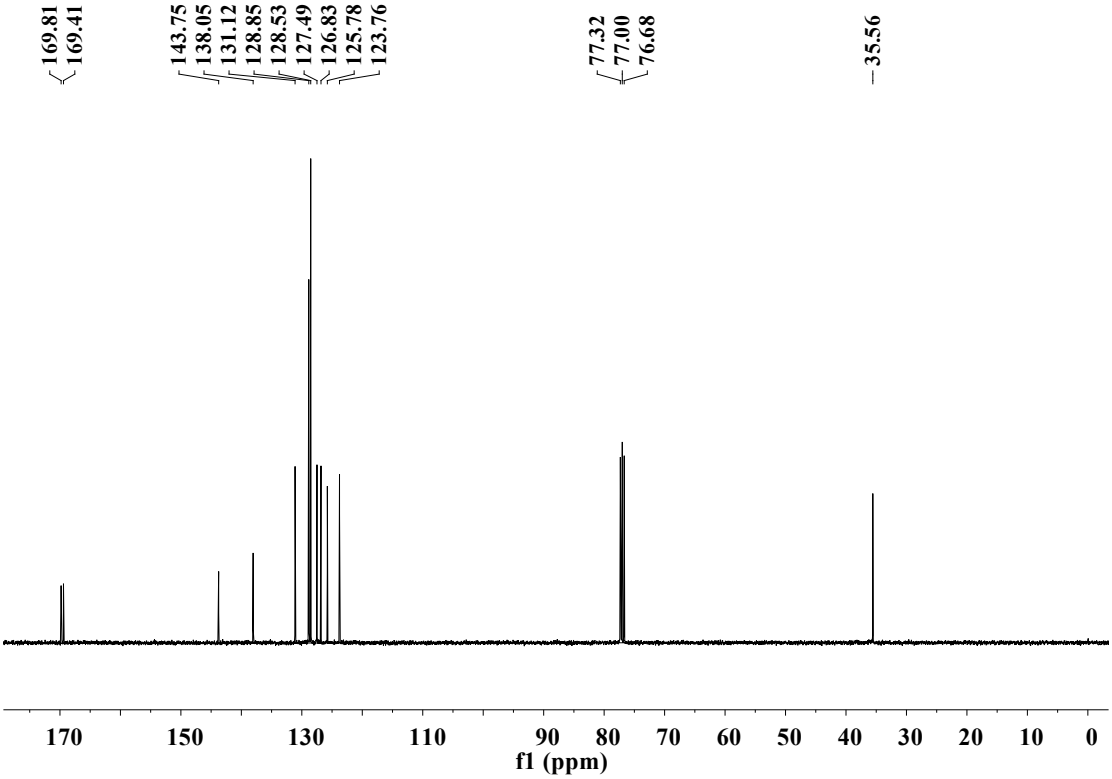
^{1}H NMR and ^{13}C NMR of 3-phenyl-1-(*p*-tolyl)-1H-pyrrole-2,5-dione (5a)



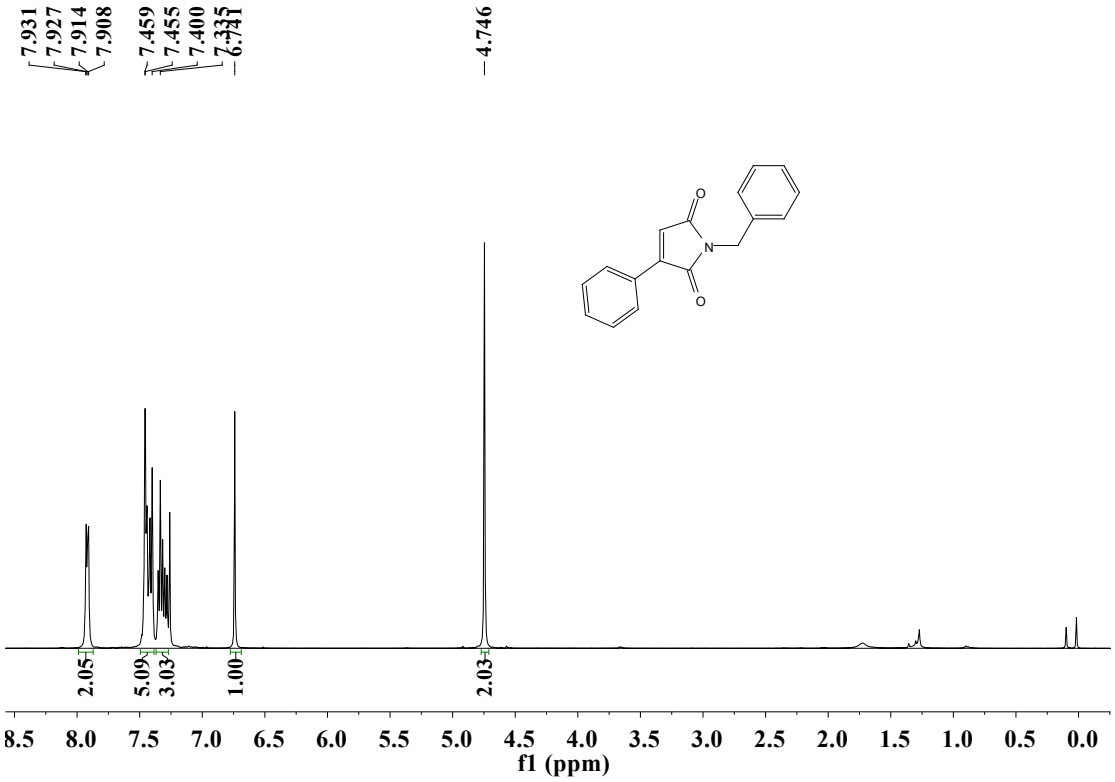


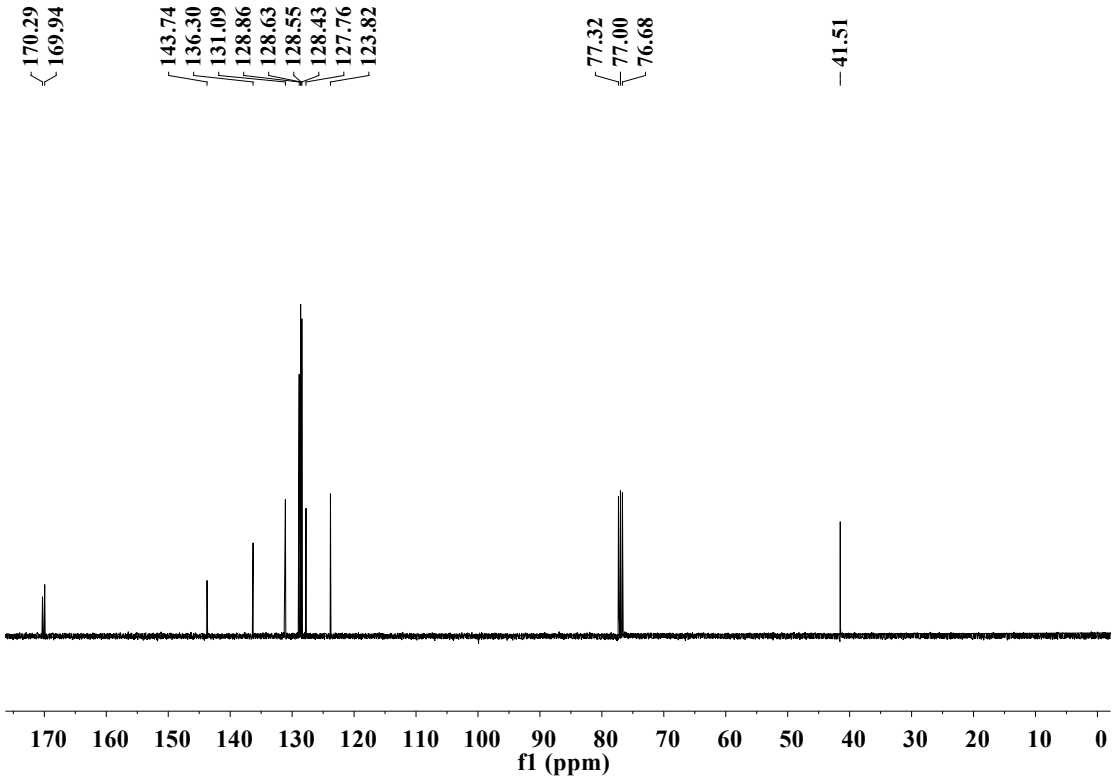
^{1}H NMR and ^{13}C NMR of 3-phenyl-1-(thiophen-2-ylmethyl)-1H-pyrrole-2,5-dione (5b)



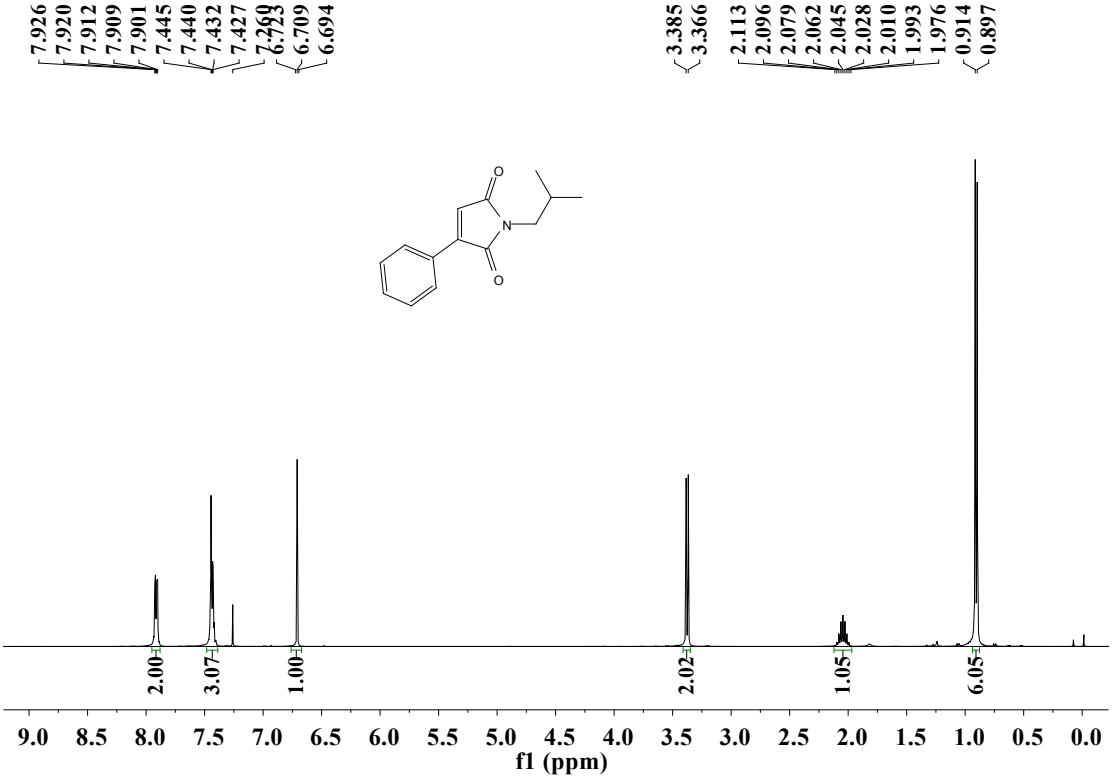


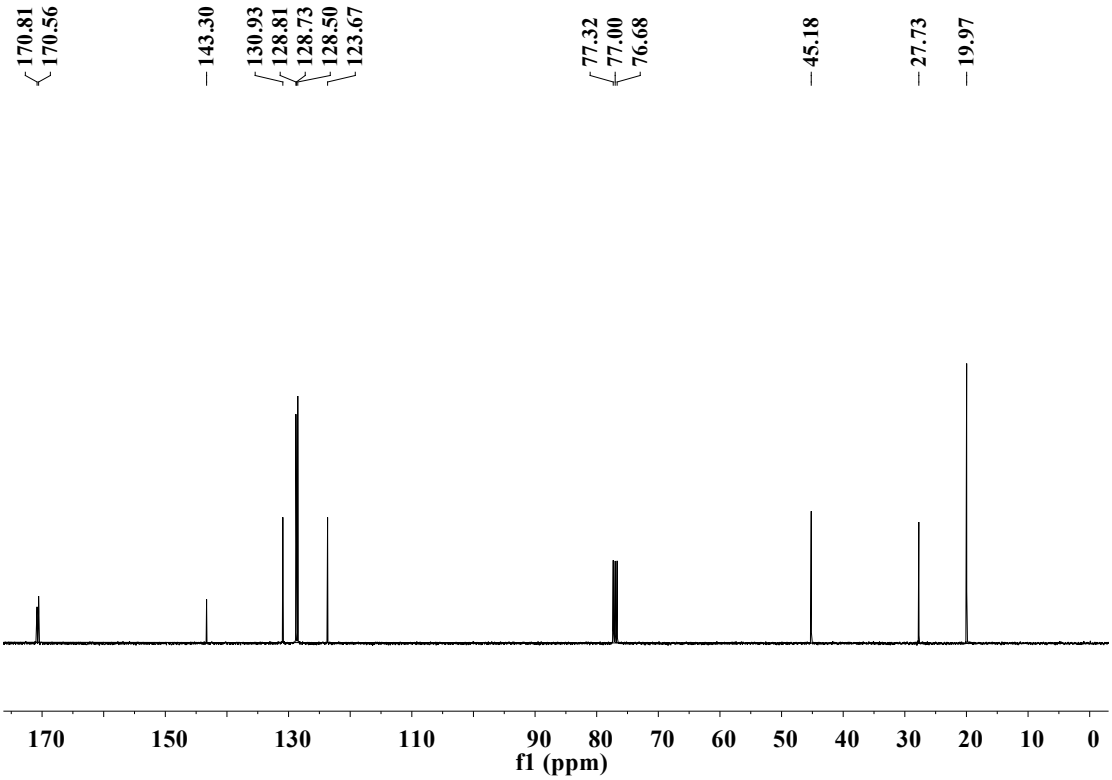
^{1}H NMR and ^{13}C NMR of 1-benzyl-3-phenyl-1H-pyrrole-2,5-dione (5c)



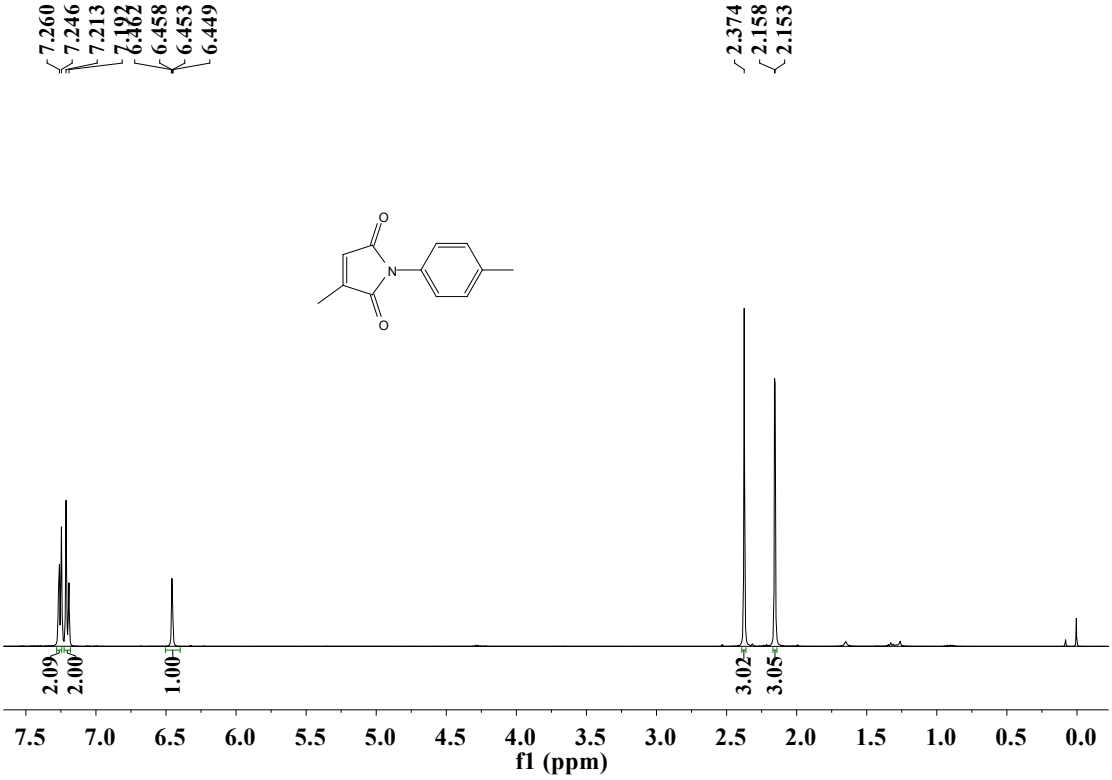


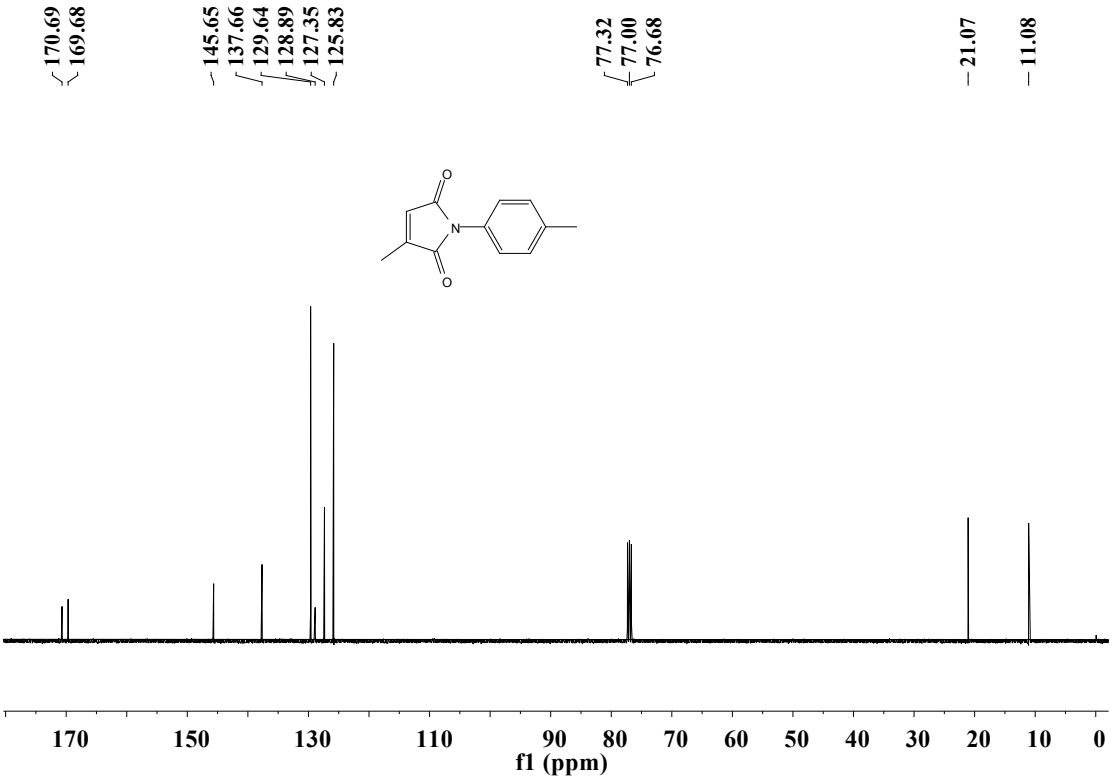
^{1}H NMR and ^{13}C NMR of 1-isobutyl-3-phenyl-1H-pyrrole-2,5-dione (5d)



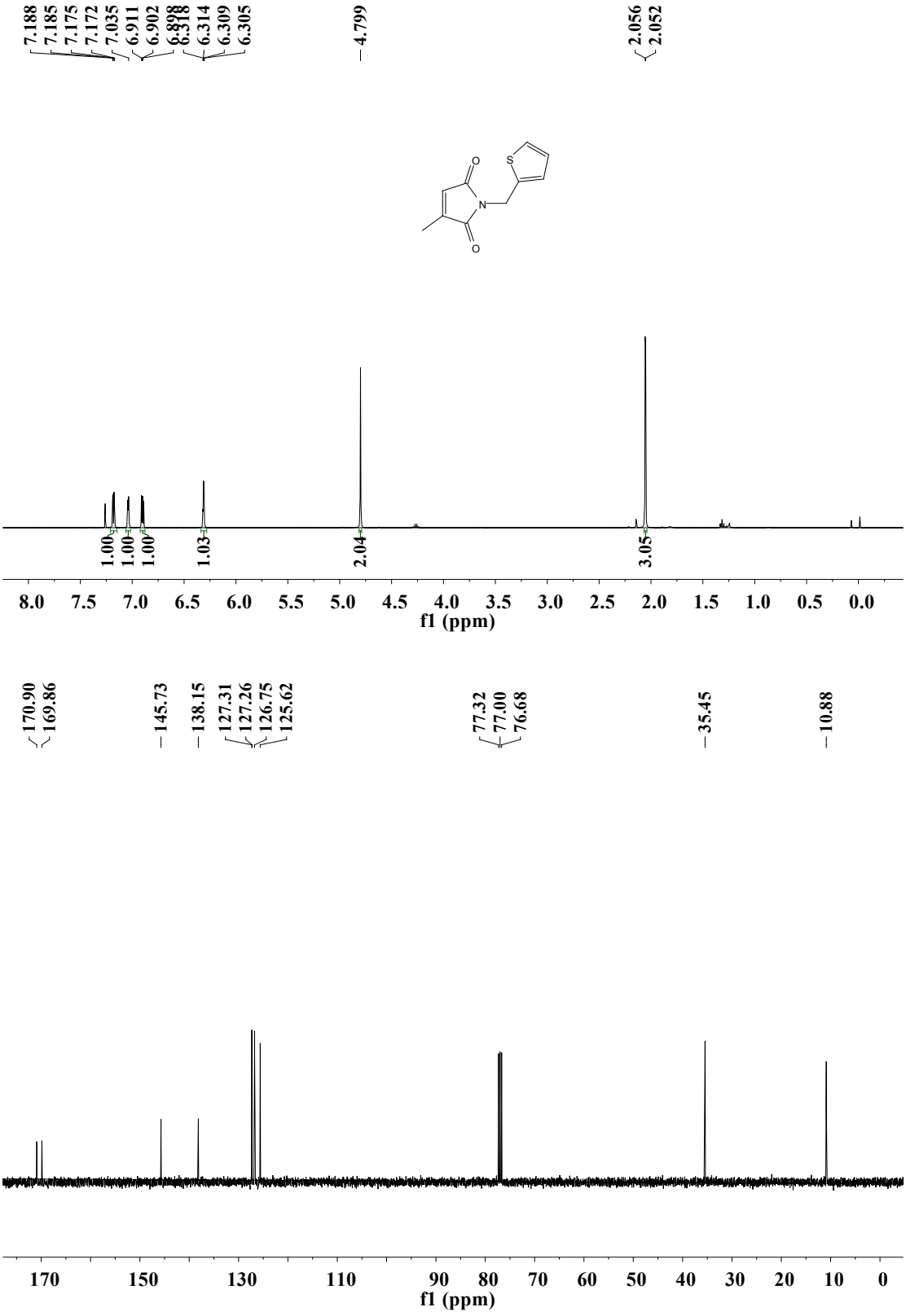


^{1}H NMR and ^{13}C NMR of 3-methyl-1-(*p*-tolyl)-1H-pyrrole-2,5-dione (5e)





^{1}H NMR and ^{13}C NMR of 3-methyl-1-(thiophen-2-ylmethyl)-1H-pyrrole-2,5-dione (5f)



^{1}H NMR and ^{13}C NMR of 1-benzyl-3-methyl-1H-pyrrole-2,5-dione (5g)