Supporting Information

Stereoselective Synthesis of 3,3'-Bisindolines by Organocatalytic Michael Additions of Fluorooxindole Enolates to Isatylidene Malononitriles in Aqueous Solution

Kaluvu Balaraman, Ransheng Ding and Christian Wolf*

Georgetown University, Chemistry Department, Washington, DC, USA.

E-mail: cw27@georgetown.edu

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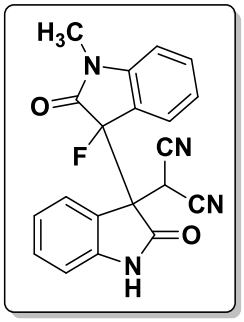
1. General information

Commercially available isatins, oxindoles, reagents and solvents were used as purchased without further purification. Isatylidene malononitriles[1] and 3-fluorooxindoles[2] were synthesized by following literature procedures. NMR spectra were obtained at 400 MHz (^{1}H NMR), 376 MHz (^{19}F NMR) and 100 MHz (^{13}C NMR) in deuterated solvents. Chemical shifts are reported in ppm relative to TMS. Reaction products were purified by column chromatography on silica gel (particle size 40-63 μm) as described below.

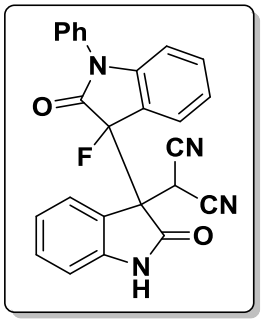
2. General synthetic procedure and product characterization

To a solution of 3-fluorooxindole (0.22 mmol) and isatylidene malononitrile (0.2 mmol) in water (0.5 mL) or in a 1:1 ethanol-water mixture (0.5 mL) was added triethylamine (10-20 mol%). The reaction was stirred at room temperature and monitored by TLC. When most of the isatylidene malononitrile was consumed, the mixture was sonicated (40 minutes) to achieve complete conversion which was ascertained by TLC and ^{19}F NMR spectroscopy. The reaction mixture was poured onto brine (10 mL) and extracted with ethyl acetate (3 × 5 mL). The combined organic layers were dried over anhydrous Na_2SO_4, filtered, and concentrated under reduced pressure. The crude product was purified by flash chromatography on silica gel using hexanes-ethyl acetate as mobile phase as described below.

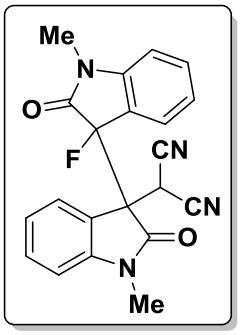


2-(3-Fluoro-1-methyl-2,2'-dioxo-[3,3'-biindolin]-3'-yl)malononitrile (3). Compound **3** was obtained as a colorless solid in 99% yield (71 mg, 0.198 mmol) from 2-(2-oxoindolin-3-ylidene)malononitrile (39 mg, 0.2 mmol) and 3-fluoro-1-methylindolin-2-one (33 mg, 0.2 mmol) in the presence of 10 mol% Et_3N in 0.5 mL of water after 3 hours at 25 ^{o}C by following the general procedure described above. R_f = 0.4 (hexanes/EtOAc, 1:1); ^{1}H NMR (400 MHz, DMSO-d_6) δ = 11.17 (s, 1H), 7.86 (dd, *J* = 7.7, 1.7 Hz, 1H), 7.61 (dd, *J* = 7.7, 7.7 Hz, 1H), 7.43 (dd, *J* =

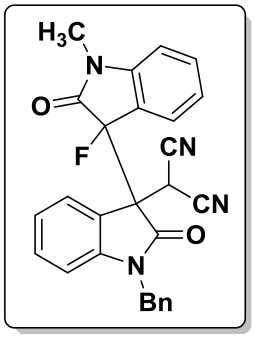
7.8, 7.7 Hz, 1H), 7.38 (dd, *J* = 7.7, 1.7 Hz, 1H), 7.13 (dd, *J* = 7.7, 1.8 Hz, 1H), 7.01 (dd, *J* = 7.8, 1.7 Hz, 1H), 6.82 (dd, *J* = 7.8, 7.7 Hz, 1H), 6.09 (s, 1H), 5.82 (dd, *J* = 7.7, 1.8 Hz, 1H), 3.20 (s, 3H); ^{13}C NMR (100 MHz, DMSO-d_6) δ = 170.7 (d, $J_{C\text{-}F}$ = 9.3 Hz), 168.9 (d, $J_{C\text{-}F}$ = 21.2 Hz), 144.7 (d, $J_{C\text{-}F}$ = 5.1 Hz), 143.7, 133.6 (d, $J_{C\text{-}F}$ = 3.1 Hz), 132.5, 126.4 (d, $J_{C\text{-}F}$ = 2.7 Hz), 124.6, 123.9, 123.5 (d, $J_{C\text{-}F}$ = 2.7 Hz), 122.6, 121.1 (d, $J_{C\text{-}F}$ = 18.2 Hz), 112.7, 112.1, 111.5, 110.6, 91.3 (d, $J_{C\text{-}F}$ = 198.7 Hz), 56.8 (d, $J_{C\text{-}F}$ = 23.7 Hz), 26.9, 25.4; ^{19}F NMR (376 MHz, DMSO-d_6) δ = -164.2; Anal. Calcd. For $C_{20}H_{13}FN_4O_2$: C, 66.66; H, 3.64; N, 15.55. Found: C, 66.61; H, 3.81; N, 15.78.



2-(3-Fluoro-2,2'-dioxo-1-phenyl-[3,3'-biindolin]-3'-yl)malononitrile (4). Compound **4** was obtained as a colorless solid in 94% yield (79 mg, 0.188 mmol) from 2-(2-oxoindolin-3-ylidene)malononitrile (39 mg, 0.2 mmol) and 3-fluoro-1-phenylindolin-2-one (45 mg, 0.2 mmol) in the presence of 10 mol% Et_3N in 0.5 mL of water after 4 hours at 25 ºC by following the general procedure described above. R_f = 0.6 (hexanes/EtOAc, 1:1); ^{1}H NMR (400 MHz, Acetone-d_6) δ = 9.98 (s, 1H), 8.08 (dd, *J* = 7.6, 1.6 Hz, 1H), 7.71 – 7.61 (m, 3H), 7.58 – 7.51 (m, 3H), 7.47 (dd, *J* = 7.8, 7.7 Hz, 1H), 7.38 (dd, *J* = 7.7, 7.7 Hz, 1H), 7.13 (dd, *J* = 7.7, 1.8 Hz, 1H), 6.86 (dd, *J* = 7.7, 7.6 Hz, 1H), 6.77 (dd, *J* = 7.8, 1.7 Hz, 1H), 6.07 – 6.03 (m, 2H); ^{13}C NMR (100 MHz, Acetone-d_6) δ = 171.4 (d, $J_{C\text{-}F}$ = 9.4 Hz), 169.5 (d, $J_{C\text{-}F}$ = 21.3 Hz), 145.9 (d, $J_{C\text{-}F}$ = 5.0 Hz), 144.3, 134.2, 133.9 (d, $J_{C\text{-}F}$ = 3.1 Hz), 133.0, 130.7, 129.9, 127.9, 127.5, 127.4, 126.1, 124.6, 124.4 (d, $J_{C\text{-}F}$ = 2.7 Hz), 123.1, 121.8 (d, $J_{C\text{-}F}$ = 18.6 Hz), 112.7, 112.1, 111.2, 92.1 (d, $J_{C\text{-}F}$ = 201.2 Hz), 58.2 (d, $J_{C\text{-}F}$ = 23.9 Hz), 25.3; ^{19}F NMR (376 MHz, Acetone-d_6) δ = -165.6; Anal. Calcd. For $C_{25}H_{15}FN_4O_2$: C, 71.08; H, 3.58; N, 13.26. Found: C, 71.37; H, 3.82; N, 13.48.

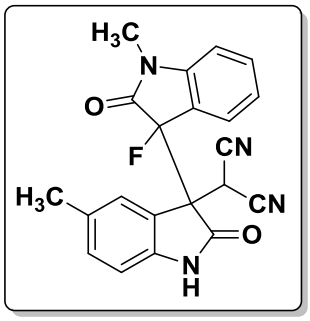


2-(3-Fluoro-1,1'-dimethyl-2,2'-dioxo-[3,3'-biindolin]-3'-yl)malononitrile (5). Compound **5** was obtained as a colorless solid in 95% yield (71 mg, 0.19 mmol) from 2-(1-methyl-2-oxoindolin-3-ylidene)malononitrile (42 mg, 0.2 mmol) and 3-fluoro-1-methylindolin-2-one (33 mg, 0.2 mmol) in the presence of 10 mol% Et_3N in 1:1 ethanol-water (0.5 mL) after 4 hours at 25 ^oC by following the general procedure described above. R_f = 0.4 (hexanes/EtOAc, 8:2); ^1H NMR (399 MHz, Chloroform-*d*) δ 8.13 (dd, *J* = 7.9, 1.9 Hz, 1H), 7.63 (dd, *J* = 7.9, 7.8 Hz, 1H), 7.41 (dd, *J* = 7.8, 7.8 Hz, 1H), 7.32 (dd, *J* = 7.9, 7.8 Hz, 1H), 6.92 (dd, *J* = 7.8, 2.0 Hz, 1H), 6.81 (dd, *J* = 7.9, 1.9 Hz, 1H), 6.70 (dd, *J* = 7.8, 7.7 Hz, 1H), 5.95 (s, 1H), 5.86 (dd, *J* = 7.8, 1.9 Hz, 1H), 3.27 (s, 3H), 2.90 (s, 3H); ^{13}C NMR (100 MHz, Chloroform-*d*) δ 169.2 (d, J_{C-F} = 21.3 Hz), 169.0 (d, J_{C-F} = 9.5 Hz), 144.7, 144.4 (d, J_{C-F} = 5.0 Hz), 132.8 (d, J_{C-F} = 3.0 Hz), 132.0, 126.9 (d, J_{C-F} = 2.8 Hz), 124.8, 124.5, 123.0 (d, J_{C-F} = 2.7 Hz), 121.3, 121.1, 120.9, 111.0, 110.4, 109.3 (d, J_{C-F} = 2.0 Hz), 90.7 (d, J_{C-F} = 202.2 Hz), 56.6 (d, J_{C-F} = 24.3 Hz), 26.5, 26.4, 23.8; ^{19}F NMR (376 MHz, Chloroform-*d*) δ -164.8; Anal. Calcd. For $C_{21}H_{15}FN_4O_2$: C, 67.37; H, 4.04; N, 14.97. Found: C, 67.21; H, 4.09; N, 15.18.

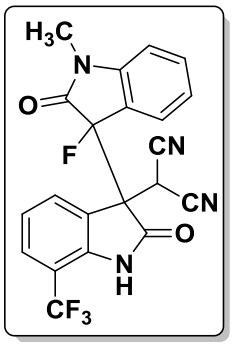


2-(1'-Benzyl-3-fluoro-1-methyl-2,2'-dioxo-[3,3'-biindolin]-3'-yl)malononitrile (6). Compound **6** was obtained as a colorless solid in 93% yield (84 mg, 0.186 mmol) from 2-(1-benzyl-2-oxoindolin-3-ylidene)malononitrile (57 mg, 0.2 mmol) and 3-fluoro-1-methylindolin-2-one (33 mg, 0.2 mmol) in the presence of 10 mol% Et_3N in 1:1 ethanol-water (0.5 mL) after 8 hours at 25

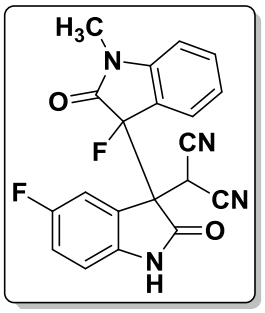
°C by following the general procedure described above. R_f = 0.6 (hexanes/EtOAc, 8:2); ^{1}H NMR (400 MHz, Chloroform-*d*) δ = 8.15 (dd, *J* = 7.7, 1.8 Hz, 1H), 7.48 (dd, *J* = 7.9, 7.8 Hz, 1H), 7.44 – 7.32 (m, 2H), 7.18 (dd, *J* = 7.8, 7.7 Hz, 1H), 7.15 – 7.05 (m, 2H), 6.86 (dd, *J* = 7.8. 1.7 Hz, 1H), 6.75 (dd, *J* = 7.7, 1.8 Hz, 1H), 6.66 (dd, *J* = 7.7, 7.6 Hz, 1H), 6.58 (dd, *J* = 7.7, 1.8 Hz, 2H), 6.06 (s, 1H), 5.90 (dd, *J* = 7.6, 1.7 Hz, 1H), 4.90 (d, *J* = 15.9 Hz, 1H), 4.40 (d, *J* = 15.9 Hz, 1H), 3.29 (s, 3H); ^{13}C NMR (100 MHz, Chloroform-*d*) δ = 169.4 (d, J_{C-F} = 21.1 Hz), 169.2 (d, J_{C-F} = 9.6 Hz), 144.6 (d, J_{C-F} = 4.9 Hz), 143.8, 133.8, 132.7 (d, J_{C-F} = 3.0 Hz), 131.9, 128.8, 127.7, 126.9 (d, J_{C-F} = 2.7 Hz), 126.6, 125.5, 124.4, 123.3 (d, J_{C-F} = 2.7 Hz), 121.4, 121.1 (d, J_{C-F} = 18.4 Hz), 111.0, 110.5, 110.4 (d, J_{C-F} = 1.6 Hz), 109.3, 90.8 (d, J_{C-F} = 202.2 Hz), 56.6 (d, J_{C-F} = 24.4 Hz), 44.3, 26.5, 24.0; ^{19}F NMR (376 MHz, Chloroform-*d*) δ = -164.6; Anal. Calcd. For $C_{27}H_{19}FN_4O_2$: C, 71.99; H, 4.25; N, 12.44. Found: C, 71.88; H, 4.36; N, 12.66.



2-(3-Fluoro-1,5'-dimethyl-2,2'-dioxo-[3,3'-biindolin]-3'-yl)malononitrile (7). Compound **7** was obtained as a colorless solid in 97% yield (72 mg, 0.194 mmol) from 2-(5-methyl-2-oxoindolin-3-ylidene)malononitrile (42 mg, 0.2 mmol) and 3-fluoro-1-methylindolin-2-one (33 mg, 0.2 mmol) in the presence of 10 mol% Et_3N in 0.5 mL of water after 3 hours at 25 °C by following the general procedure described above. R_f = 0.4 (hexanes/EtOAc, 1:1); ^{1}H NMR (400 MHz, DMSO-d_6) δ = 11.05 (s, 1H), 7.66 (s, 1H), 7.47 – 7.38 (m, 2H), 7.12 (dd, *J* = 7.8, 1.8 Hz, 1H), 6.91 (dd, *J* = 7.8, 1.7 Hz, 1H), 6.83 (dd, *J* = 7.9, 7.8 Hz, 1H), 6.05 (s, 1H), 5.86 (dd, *J* = 7.7, 1.7 Hz, 1H), 3.19 (s, 3H), 2.45 (s, 3H); ^{13}C NMR (100 MHz, DMSO-d_6) δ = 170.6 (d, J_{C-F} = 9.4 Hz), 169.0 (d, J_{C-F} = 21.3 Hz), 144.7 (d, J_{C-F} = 5.1 Hz), 141.3, 133.6 (d, J_{C-F} = 3.1 Hz), 133.1, 132.8, 126.7 (d, J_{C-F} = 2.7 Hz), 124.8, 123.5 (d, J_{C-F} = 2.7 Hz), 122.7, 121.1 (d, J_{C-F} = 18.2 Hz), 112.7, 112.1, 111.3, 110.5, 91.4 (d, J_{C-F} = 198.5 Hz), 56.9 (d, J_{C-F} = 23.7 Hz), 26.9, 25.5, 21.4; ^{19}F NMR (376 MHz, DMSO-d_6) δ = -164.2; Anal. Calcd. For $C_{21}H_{15}FN_4O_2$: C, 67.37; H, 4.04; N, 14.97. Found: C, 67.61; H, 4.26; N, 14.78.

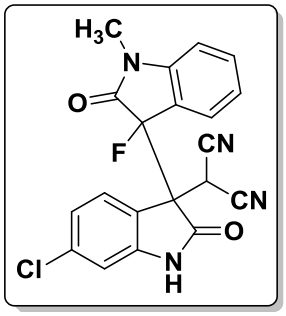


2-(3-Fluoro-1-methyl-2,2'-dioxo-7'-(trifluoromethyl)-[3,3'-biindolin]-3'-yl)malononitrile (8). Compound **8** was obtained as a colorless solid in 96% yield (82 mg, 0.192 mmol) from 2-(2-oxo-7-(trifluoromethyl)indolin-3-ylidene)malononitrile (53 mg, 0.2 mmol) and 3-fluoro-1-methylindolin-2-one (33 mg, 0.2 mmol) in the presence of 20 mol% Et_3N in 1:1 ethanol-water (0.5 mL) after 5 hours at 25 ^oC by following the general procedure described above. R_f = 0.6 (hexanes/EtOAc, 1:1); ^1H NMR (399 MHz, Acetone-d_6) δ 10.48 (s, 1H), 8.31 (dd, J = 7.7, 1.8 Hz, 1H), 7.98 (d, J = 7.9 Hz, 1H), 7.68 (dd, J = 7.8, 7.7 Hz, 1H), 7.47 (dd, J = 7.9, 7.7 Hz, 1H), 7.11 (d, J = 8.0 Hz, 1H), 6.86 (dd, J = 7.8, 7.7 Hz, 1H), 6.12 (s, 1H), 5.98 (dd, J = 7.7, 1.8 Hz, 1H), 3.27 (s, 3H); ^{13}C NMR (100 MHz, Acetone-d_6) δ 171.4 (d, $J_{C\text{-}F}$ = 9.2 Hz), 169.4 (d, $J_{C\text{-}F}$ = 21.1 Hz), 145.7 (d, $J_{C\text{-}F}$ = 5.2 Hz), 141.5 (q, $J_{C\text{-}F}$ = 2.1 Hz), 134.3 (d, $J_{C\text{-}F}$ = 3.1 Hz), 131.3 (d, $J_{C\text{-}F}$ = 2.9 Hz), 129.4 (q, $J_{C\text{-}F}$ = 4.4 Hz), 125.3, 125.0, 124.9, 124.1 (q, $J_{C\text{-}F}$ = 270.3 Hz), 124.0 (d, $J_{C\text{-}F}$ = 2.8 Hz), 121.6 (d, $J_{C\text{-}F}$ = 18.4 Hz), 114.1 (q, $J_{C\text{-}F}$ = 33.9 Hz), 112.4, 111.8 (d, $J_{C\text{-}F}$ = 1.3 Hz), 110.9 (d, $J_{C\text{-}F}$ = 1.3 Hz), 91.8 (d, $J_{C\text{-}F}$ = 201.4 Hz), 57.1 (d, $J_{C\text{-}F}$ = 24.0 Hz), 26.8, 25.2; ^{19}F NMR (376 MHz, Acetone-d_6) δ -62.5 (s, 3F), -165.5 (s, 1F); Anal. Calcd. For $C_{21}H_{12}F_4N_4O_2$: C, 58.88; H, 2.82; N, 13.08. Found: C, 58.53; H, 2.93; N, 12.79.



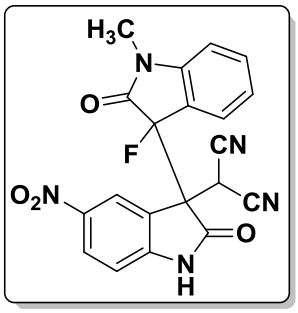
2-(3,5'-Difluoro-1-methyl-2,2'-dioxo-[3,3'-biindolin]-3'-yl)malononitrile (9). Compound **9** was obtained as a colorless solid in 97% yield (73 mg, 0.194 mmol) from 2-(5-fluoro-2-oxoindolin-3-ylidene)malononitrile (42 mg, 0.2 mmol) and 3-fluoro-1-methylindolin-2-one (33

mg, 0.2 mmol) in the presence of 20 mol% Et_3N in 0.5 mL of water after 4 hours at 25 ^oC by following the general procedure described above. R_f = 0.4 (hexanes/EtOAc, 1:1); ^1H NMR (399 MHz, Acetone-d_6) δ 10.02 (s, 1H), 7.78 (dd, J = 7.9, 1.9 Hz, 1H), 7.50 – 7.42 (m, 2H), 7.16 (dd, J = 7.9, 7.8 Hz, 1H), 7.09 (d, J = 7.9 Hz, 1H), 6.87 (dd, J = 7.9, 7.8 Hz, 1H), 6.13 (dd, J = 7.8, 1.6 Hz, 1H), 6.10 (s, 1H), 3.26 (s, 3H); ^{13}C NMR (100 MHz, Acetone-d_6) δ 171.0 (d, J_{C-F} = 9.3 Hz), 169.6 (d, J_{C-F} = 21.0 Hz), 160.0 (d, J_{C-F} = 241.5 Hz), 145.7 (d, J_{C-F} = 5.2 Hz), 140.5 (d, J_{C-F} = 2.3 Hz), 134.1 (d, J_{C-F} = 3.2 Hz), 125.6, 124.5 (d, J_{C-F} = 8.5 Hz), 124.0 (d, J_{C-F} = 2.8 Hz), 121.8 (d, J_{C-F} = 18.3 Hz), 119.6 (d, J_{C-F} = 23.6 Hz), 115.0 (dd, J_{C-F} = 25.9, 2.8 Hz), 113.3 (d, J_{C-F} = 8.2 Hz), 112.6, 111.9 (d, J_{C-F} = 1.5 Hz), 110.7 (d, J_{C-F} = 1.3 Hz), 91.8 (d, J_{C-F} = 199.8 Hz), 58.1 (dd, J_{C-F} = 23.7, 2.0 Hz), 26.8, 25.2; ^{19}F NMR (376 MHz, Acetone-d_6) δ -119.5 (m, 1F), -165.3 (s, 1F); Anal. Calcd. For $C_{20}H_{12}F_2N_4O_2$: C, 63.49; H, 3.20; N, 14.81. Found: C, 63.71; H, 3.35; N, 15.07.

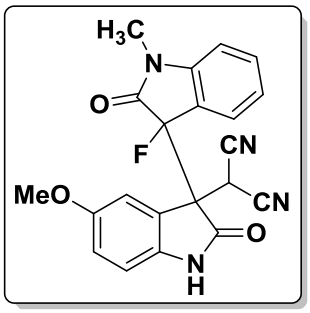


2-(6'-Chloro-3-fluoro-1-methyl-2,2'-dioxo-[3,3'-biindolin]-3'-yl)malononitrile (10). Compound **10** was obtained as a colorless solid in 91% yield (72 mg, 0.182 mmol) from 2-(6-chloro-2-oxoindolin-3-ylidene)malononitrile (46 mg, 0.2 mmol) and 3-fluoro-1-methylindolin-2-one (33 mg, 0.2 mmol) in the presence of 10 mol% Et_3N in 0.5 mL of water after 8 hours at 25 ^oC by following the general procedure described above. R_f = 0.4 (hexanes/EtOAc, 1:1); ^1H NMR (399 MHz, Acetone-d_6) δ 10.16 (s, 1H), 8.01 (dd, J = 7.9, 1.8 Hz, 1H), 7.50 – 7.44 (m, 2H), 7.17 (d, J = 1.8 Hz, 1H), 7.10 (d, J = 7.9 Hz, 1H), 6.89 (dd, J = 7.8, 7.7 Hz, 1H), 6.16 (dd, J = 7.8, 1.8 Hz, 1H), 6.08 (s, 1H), 3.26 (s, 3H); ^{13}C NMR (100 MHz, Acetone-d_6) δ 171.2 (d, J_{C-F} = 9.4 Hz), 169.7 (d, J_{C-F} = 21.2 Hz), 145.7 (d, J_{C-F} = 5.2 Hz), 145.5, 138.3, 134.1 (d, J_{C-F} = 3.1 Hz), 128.7 (d, J_{C-F} = 2.8 Hz), 125.6, 124.6, 124.1 (d, J_{C-F} = 2.8 Hz), 122.0 (d, J_{C-F} = 3.0 Hz), 121.8, 112.6 (d, J_{C-F} = 22.6 Hz), 112.4, 112.0, 110.7 (d, J_{C-F} = 1.3 Hz), 91.8 (d, J_{C-F} = 200.0 Hz), 57.6 (d, J_{C-F} =

24.0 Hz), 26.8, 25.3; ^{19}F NMR (376 MHz, Acetone-d_6) δ -165.1; Anal. Calcd. For $C_{20}H_{12}ClFN_4O_2$: C, 60.85; H, 3.06; N, 14.19. Found: C, 61.02; H, 3.21; N, 14.25.

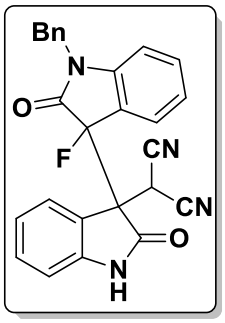


2-(3-Fluoro-1-methyl-5'-nitro-2,2'-dioxo-[3,3'-biindolin]-3'-yl)malononitrile (11). Compound **11** was obtained as a colorless solid in 91% yield (74 mg, 0.182 mmol) from 2-(5-nitro-2-oxoindolin-3-ylidene)malononitrile (48 mg, 0.2 mmol) and 3-fluoro-1-methylindolin-2-one (33 mg, 0.2 mmol) in the presence of 20 mol% Et_3N in 1:1 ethanol-water (0.5 mL) after 8 hours at 25 ^oC by following the general procedure described above. R_f = 0.3 (hexanes/EtOAc, 1:3); ^{1}H NMR (399 MHz, Acetone-d_6) δ 10.62 (s, 1H), 8.88 (s, 1H), 8.61 (dd, J = 7.9, 1.9 Hz, 1H), 7.48 (dd, J = 7.8, 7.7 Hz, 1H), 7.39 (d, J = 8.8 Hz, 1H), 7.12 (d, J = 7.9 Hz, 1H), 6.85 (dd, J = 7.8, 7.7 Hz, 1H), 6.27 (dd, J = 7.8, 1.8 Hz, 1H), 6.19 (s, 1H), 3.28 (s, 3H); ^{13}C NMR (100 MHz, Acetone-d_6) δ 171.4 (d, $J_{C\text{-}F}$ = 9.1 Hz), 169.4 (d, $J_{C\text{-}F}$ = 21.0 Hz), 149.8, 145.7 (d, $J_{C\text{-}F}$ = 5.3 Hz), 145.1, 134.3 (d, $J_{C\text{-}F}$ = 3.1 Hz), 129.6, 125.7, 124.2 (d, $J_{C\text{-}F}$ = 2.8 Hz), 123.9, 123.0 (d, $J_{C\text{-}F}$ = 3.0 Hz), 121.5 (d, $J_{C\text{-}F}$ = 18.5 Hz), 112.4, 112.4, 111.7 (d, $J_{C\text{-}F}$ = 1.4 Hz), 110.9 (d, $J_{C\text{-}F}$ = 1.3 Hz), 91.7 (d, $J_{C\text{-}F}$ = 201.3 Hz), 57.8 (d, $J_{C\text{-}F}$ = 24.0 Hz), 26.8, 25.2; ^{19}F NMR (376 MHz, Acetone-d_6) δ -165.3; Anal. Calcd. For $C_{20}H_{12}FN_5O_4$: C, 59.26; H, 2.98; N, 17.28. Found: C, 59.08; H, 3.12; N, 17.07.



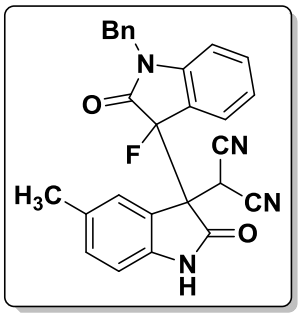
2-(3-Fluoro-5'-methoxy-1-methyl-2,2'-dioxo-[3,3'-biindolin]-3'-yl)malononitrile (12). Compound **12** was obtained as a colorless solid in 99% yield (77 mg, 0.198 mmol) from 2-(5-methoxy-2-oxoindolin-3-ylidene)malononitrile (45 mg, 0.2 mmol) and 3-fluoro-1-methylindolin-

2-one (33 mg, 0.2 mmol) in the presence of 10 mol% Et_3N in 0.5 mL of water after 4 hours at 25 ^oC by following the general procedure described above. R_f = 0.4 (hexanes/EtOAc, 1:3); ^1H NMR (399 MHz, Acetone-d_6) δ 9.80 (s, 1H), 7.62 (d, J = 2.3 Hz, 1H), 7.45 (dd, J = 8.2, 7.9 Hz, 1H), 7.21 (dd, J = 8.2, 2.4 Hz, 1H), 7.11 – 7.02 (m, 2H), 6.83 (dd, J = 7.8, 7.7 Hz, 1H), 6.09 (dd, J = 7.7, 1.8 Hz, 1H), 6.07 (s, 1H), 3.92 (s, 3H), 3.25 (s, 3H); ^{13}C NMR (100 MHz, Acetone-d_6) δ 170.9 (d, J_{C-F} = 9.4 Hz), 169.9 (d, J_{C-F} = 21.2 Hz), 157.4, 145.7 (d, J_{C-F} = 5.1 Hz), 137.3, 133.9 (d, J_{C-F} = 3.1 Hz), 125.8, 124.3, 123.9 (d, J_{C-F} = 2.8 Hz), 122.1 (d, J_{C-F} = 18.3 Hz), 117.5, 114.0 (d, J_{C-F} = 2.8 Hz), 112.7 (d, J_{C-F} = 28.5 Hz), 112.6, 112.1 (d, J_{C-F} = 1.5 Hz), 110.5 (d, J_{C-F} = 1.4 Hz), 92.0 (d, J_{C-F} = 199.3 Hz), 58.0 (d, J_{C-F} = 23.5 Hz), 56.3, 26.7, 25.2; ^{19}F NMR (376 MHz, Acetone-d_6) δ -165.8; Anal. Calcd. For $C_{21}H_{15}FN_4O_3$: C, 64.61; H, 3.87; N, 14.35. Found: C, 64.67; H, 3.99; N, 14.42.

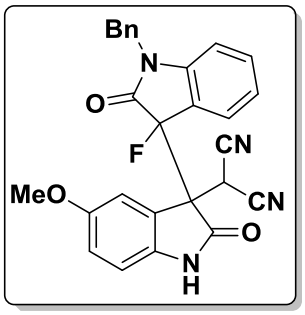


2-(1-Benzyl-3-fluoro-2,2'-dioxo-[3,3'-biindolin]-3'-yl)malononitrile (13). Compound **13** was obtained as a colorless solid in 92% yield (80 mg, 0.184 mmol) from 2-(2-oxoindolin-3-ylidene)malononitrile (39 mg, 0.2 mmol) and 1-benzyl-3-fluoroindolin-2-one (48 mg, 0.2 mmol) in the presence of 10 mol% Et_3N in 1:1 ethanol-water (0.5 mL) after 6 hours at 25 ^oC by following the general procedure described above. R_f = 0.6 (hexanes/EtOAc, 1:1); ^1H NMR (399 MHz, Acetone-d_6) δ 10.06 (s, 1H), 8.06 (dd, J = 7.8, 1.7 Hz, 1H), 7.66 (dd, J = 7.9, 7.8 Hz, 1H), 7.51 (dd, J = 7.9, 1.7 Hz, 2H), 7.45 (dd, J = 7.8, 7.7 Hz, 1H), 7.39 – 7.29 (m, 4H), 7.14 (d, J = 7.9 Hz, 1H), 6.87 (d, J = 7.9 Hz, 1H), 6.79 (dd, J = 7.8, 7.7 Hz, 1H), 6.17 (s, 1H), 5.99 (dd, J = 7.8, 1.8 Hz, 1H), 5.14 (d, J = 15.9 Hz, 1H), 4.91 (d, J = 15.9 Hz, 1H); ^{13}C NMR (100 MHz, Acetone-d_6) δ 171.3 (d, J_{C-F} = 9.5 Hz), 170.3 (d, J_{C-F} = 21.4 Hz), 144.9 (d, J_{C-F} = 5.1 Hz), 144.2, 136.0, 133.8 (d, J_{C-F} = 3.3 Hz), 133.0, 129.6, 128.6, 128.4, 127.5 (d, J_{C-F} = 2.8 Hz), 125.8, 124.6, 124.1 (d, J_{C-F} = 2.9 Hz), 123.3, 122.3 (d, J_{C-F} = 18.2 Hz), 112.8, 112.1 (d, J_{C-F} = 1.5 Hz), 112.0, 111.6 (d, J_{C-F} = 1.5 Hz), 92.0 (d, J_{C-F} = 198.5 Hz), 57.7 (d, J_{C-F} = 24.0 Hz), 44.7, 25.5; ^{19}F NMR

(376 MHz, Acetone-d_6) δ -161.9; Anal. Calcd. For $C_{26}H_{17}FN_4O_2$: C, 71.55; H, 3.93; N, 12.84. Found: C, 71.72; H, 3.81; N, 12.55.

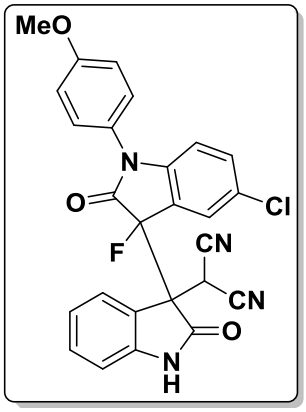


2-(1-Benzyl-3-fluoro-5'-methyl-2,2'-dioxo-[3,3'-biindolin]-3'-yl)malononitrile (14). Compound **14** was obtained as a colorless solid in 99% yield (89 mg, 0.198 mmol) from 2-(5-methyl-2-oxoindolin-3-ylidene)malononitrile (42 mg, 0.2 mmol) and 1-benzyl-3-fluoroindolin-2-one (48 mg, 0.2 mmol) in the presence of 20 mol% Et_3N in 1:1 ethanol-water (0.5 mL) after 4 hours at 25 ^oC by following the general procedure described above. R_f = 0.6 (hexanes/EtOAc, 1:1); ^1H NMR (399 MHz, Acetone-d_6) δ 9.94 (s, 1H), 7.88 (s, 1H), 7.53 – 7.45 (m, 3H), 7.39 – 7.33 (m, 2H), 7.33 – 7.27 (m, 2H), 7.02 (d, J = 8.0 Hz, 1H), 6.86 (d, J = 8.0 Hz, 1H), 6.79 (dd, J = 7.6, 7.6 Hz, 1H), 6.14 (s, 1H), 6.03 (d, J = 7.7 Hz, 1H), 5.14 (d, J = 15.9 Hz, 1H), 4.90 (d, J = 15.9 Hz, 1H), 2.51 (s, 3H); ^{13}C NMR (100 MHz, Acetone-d_6) δ 171.3 (d, J = 9.4 Hz), 170.4 (d, J = 21.4 Hz), 145.0 (d, J = 5.1 Hz), 141.8, 136.0, 134.3, 133.7 (d, J = 3.3 Hz), 133.3, 129.6, 128.6, 128.4, 127.9 (d, J = 2.7 Hz), 126.0, 124.0 (d, J = 2.9 Hz), 123.4, 122.3 (d, J = 18.3 Hz), 112.8, 112.1, 111.8, 111.5 (d, J = 1.6 Hz), 92.0 (d, J = 198.3 Hz), 57.8 (d, J = 23.8 Hz), 44.7, 25.5, 21.3; ^{19}F NMR (376 MHz, Acetone-d_6) δ -161.9; Anal. Calcd. For $C_{27}H_{19}FN_4O_2$: C, 71.99; H, 4.25; N, 12.44. Found: C, 72.26; H, 4.48; N, 12.76.



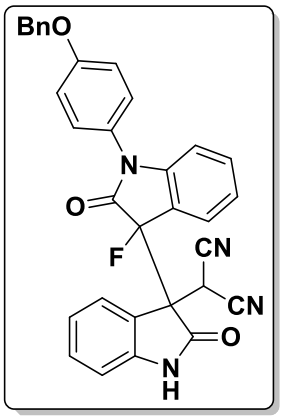
2-(1-Benzyl-3-fluoro-5'-methoxy-2,2'-dioxo-[3,3'-biindolin]-3'-yl)malononitrile (15). Compound **15** was obtained as a colorless solid in 99% yield (92 mg, 0.198 mmol) from 2-(5-

methoxy-2-oxoindolin-3-ylidene)malononitrile (45 mg, 0.2 mmol) and 1-benzyl-3-fluoroindolin-2-one (48 mg, 0.2 mmol) in the presence of 20 mol% Et_3N in 1:1 ethanol-water (0.5 mL) after 8 hours at 25 ^oC by following the general procedure described above. R_f = 0.3 (hexanes/EtOAc, 1:1); ^1H NMR (399 MHz, Acetone-d_6) δ 9.88 (s, 1H), 7.65 (d, J = 2.3 Hz, 1H), 7.53 – 7.47 (m, 2H), 7.39 – 7.33 (m, 2H), 7.33 – 7.26 (m, 2H), 7.23 (dd, J = 8.6, 2.4 Hz, 1H), 7.07 (d, J = 8.6 Hz, 1H), 6.86 (d, J = 7.9 Hz, 1H), 6.81 (dd, J = 7.8, 7.7 Hz, 1H), 6.17 (s, 1H), 6.10 (dd, J = 7.8, 1.8 Hz, 1H), 5.14 (d, J = 16.0 Hz, 1H), 4.90 (d, J = 16.0 Hz, 1H), 3.92 (s, 3H); ^{13}C NMR (100 MHz, Acetone-d_6) δ 171.1 (d, J_{C-F} = 9.4 Hz), 170.3 (d, J_{C-F} = 21.2 Hz), 157.5, 145.0 (d, J_{C-F} = 5.2 Hz), 137.3, 136.0, 133.8 (d, J_{C-F} = 3.3 Hz), 129.6, 128.6, 128.3, 126.1, 124.3, 124.1 (d, J_{C-F} = 2.9 Hz), 122.3 (d, J_{C-F} = 18.2 Hz), 117.5, 114.1 (d, J_{C-F} = 2.9 Hz), 112.8 (d, J_{C-F} = 19.3 Hz), 112.7, 112.1 (d, J_{C-F} = 1.4 Hz), 111.5 (d, J_{C-F} = 1.6 Hz), 91.9 (d, J_{C-F} = 198.3 Hz), 58.0 (d, J_{C-F} = 23.6 Hz), 56.3, 44.8, 25.5; ^{19}F NMR (376 MHz, Acetone-d_6) δ -162.2; Anal. Calcd. For $C_{27}H_{19}FN_4O_3$: C, 69.52; H, 4.11; N, 12.01. Found: C, 69.71; H, 4.02; N, 12.22.

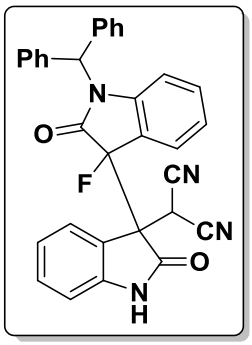


2-(5-Chloro-3-fluoro-1-(4-methoxyphenyl)-2,2'-dioxo-[3,3'-biindolin]-3'-yl)malononitrile (16). Compound **16** was obtained as a colorless solid in 91% yield (88 mg, 0.182 mmol) from 2-(2-oxoindolin-3-ylidene)malononitrile (39 mg, 0.2 mmol) and 5-chloro-3-fluoro-1-(4-methoxyphenyl)indolin-2-one (58 mg, 0.2 mmol) in the presence of 20 mol% Et_3N in 1:1 ethanol-water (0.5 mL) after 6 hours at 25 ^oC by following the general procedure described above. R_f = 0.3 (hexanes/EtOAc, 1:1); ^1H NMR (399 MHz, DMSO-d_6) δ 11.35 (s, 1H), 7.89 (d, J = 7.8 Hz, 1H), 7.67 (dd, J = 7.9, 7.8 Hz, 1H), 7.48 – 7.35 (m, 4H), 7.21 – 7.14 (m, 2H), 7.08 (d, J = 7.9 Hz, 1H), 6.71 (d, J = 8.6 Hz, 1H), 6.09 (s, 1H), 5.76 (s, 1H), 3.84 (s, 3H); ^{13}C NMR (100 MHz, DMSO-d_6) δ 170.6 (d, J_{C-F} = 9.0 Hz), 168.2 (d, J_{C-F} = 21.2 Hz), 160.1, 144.1 (d, J_{C-F} = 4.7 Hz), 143.8, 133.5 (d, J_{C-F} = 2.8 Hz), 132.8, 128.6, 127.6 (d, J_{C-F} = 3.0 Hz), 126.4 (d, J_{C-F} = 2.6

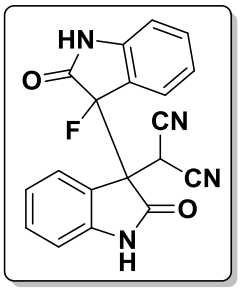
Hz), 125.2 (d, $J_{C\text{-}F}$ = 8.5 Hz), 124.2, 122.2 (d, $J_{C\text{-}F}$ = 18.5 Hz), 122.0, 115.7, 115.4, 112.4, 112.3, 111.7 (d, $J_{C\text{-}F}$ = 26.2 Hz), 111.6, 91.1 (d, $J_{C\text{-}F}$ = 203.0 Hz), 57.1 (d, $J_{C\text{-}F}$ = 23.4 Hz), 56.0, 25.3; ^{19}F NMR (376 MHz, DMSO-d_6) δ -166.4; Anal. Calcd. For $C_{26}H_{16}ClFN_4O_3$: C, 64.14; H, 3.31; N, 11.51. Found: C, 64.45; H, 3.48; N, 11.57.



2-(1-(4-(Benzyloxy)phenyl)-3-fluoro-2,2'-dioxo-[3,3'-biindolin]-3'-yl)malononitrile (17). Compound **17** was obtained as a colorless solid in 96% yield (101 mg, 0.192 mmol) from 2-(2-oxoindolin-3-ylidene)malononitrile (39 mg, 0.2 mmol) and 1-(4-(benzyloxy)phenyl)-3-fluoroindolin-2-one (67 mg, 0.2 mmol) in the presence of 20 mol% Et_3N in 1:1 ethanol-water (0.5 mL) after 6 hours at 25 ^oC by following the general procedure described above. R_f = 0.4 (hexanes/EtOAc, 1:1); ^{1}H NMR (399 MHz, Acetone-d_6) δ 10.07 (s, 1H), 8.08 (dd, J = 7.7, 1.7 Hz, 1H), 7.66 (dd, J = 7.8, 7.7 Hz, 1H), 7.56 – 7.52 (m, 2H), 7.49 – 7.41 (m, 5H), 7.40 – 7.33 (m, 2H), 7.28 – 7.24 (m, 2H), 7.12 (dd, J = 7.8, 1.6 Hz, 1H), 6.84 (dd, J = 7.8, 7.7 Hz, 1H), 6.72 (dd, J = 7.7, 1.7 Hz, 1H), 6.07 (s, 1H), 6.05 (dd, J = 7.8, 1.7 Hz, 1H), 5.23 (s, 2H); ^{13}C NMR (100 MHz, Acetone-d_6) δ 171.4 (d, $J_{C\text{-}F}$ = 9.4 Hz), 169.7 (d, $J_{C\text{-}F}$ = 21.2 Hz), 160.1, 146.3 (d, $J_{C\text{-}F}$ = 5.0 Hz), 144.3, 138.0, 133.9 (d, $J_{C\text{-}F}$ = 3.0 Hz), 133.0, 129.5, 129.4, 129.3, 128.8, 128.5, 127.5 (d, $J_{C\text{-}F}$ = 2.7 Hz), 126.9, 126.0, 124.6, 124.2 (d, $J_{C\text{-}F}$ = 2.7 Hz), 123.2, 121.8 (d, $J_{C\text{-}F}$ = 18.5 Hz), 116.8, 112.7, 112.1 (d, $J_{C\text{-}F}$ = 2.4 Hz), 111.1, 92.1 (d, $J_{C\text{-}F}$ = 201.0 Hz), 70.9, 58.2 (d, $J_{C\text{-}F}$ = 23.9 Hz), 25.3; ^{19}F NMR (376 MHz, Acetone-d_6) δ -165.8; Anal. Calcd. For $C_{32}H_{21}FN_4O_3$: C, 72.72; H, 4.00; N, 10.60. Found: C, 72.59; H, 4.17; N, 10.27.

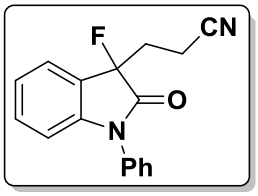


2-(1-Benzhydryl-3-fluoro-2,2'-dioxo-[3,3'-biindolin]-3'-yl)malononitrile (18). Compound **18** was obtained as a colorless solid in 93% yield (95 mg, 0.186 mmol) from 2-(2-oxoindolin-3-ylidene)malononitrile (39 mg, 0.2 mmol) and 1-benzhydryl-3-fluoroindolin-2-one (63 mg, 0.2 mmol) in the presence of 20 mol% Et_3N in 1:1 ethanol-water (0.5 mL) after 5 hours at 25 ^oC by following the general procedure described above. R_f = 0.2 (hexanes/EtOAc, 8:2); ^1H NMR (399 MHz, Acetone-d_6) δ 10.13 (s, 1H), 8.04 (d, J = 7.7, 1.8 Hz, 1H), 7.66 (dd, J = 7.8, 7.7 Hz, 1H), 7.49 – 7.29 (m, 11H), 7.24 – 7.12 (m, 2H), 6.98 (s, 1H), 6.76 (dd, J = 7.8, 7.7 Hz, 1H), 6.55 (dd, J = 7.7, 1.7 Hz, 1H), 6.11 (s, 1H), 6.00 (dd, J = 7.8, 1.7 Hz, 1H).; ^{13}C NMR (100 MHz, Acetone-d_6) δ 171.5 (d, $J_{C\text{-}F}$ = 9.4 Hz), 170.5 (d, $J_{C\text{-}F}$ = 21.2 Hz), 144.7 (d, $J_{C\text{-}F}$ = 5.2 Hz), 144.3, 138.2, 137.6, 133.4 (d, $J_{C\text{-}F}$ = 3.3 Hz), 133.0, 129.7, 129.5, 129.4, 129.3, 129.0 (d, $J_{C\text{-}F}$ = 14.1 Hz), 127.5 (d, $J_{C\text{-}F}$ = 2.8 Hz), 126.0, 124.7, 123.9 (d, $J_{C\text{-}F}$ = 2.8 Hz), 123.3, 122.7, 122.5, 113.7 (d, $J_{C\text{-}F}$ = 1.6 Hz), 112.8, 112.1, 112.0 (d, $J_{C\text{-}F}$ = 25.8 Hz), 91.6 (d, $J_{C\text{-}F}$ = 198.1 Hz), 60.3, 57.8 (d, $J_{C\text{-}F}$ = 24.1 Hz), 25.6; ^{19}F NMR (376 MHz, Acetone-d_6) δ -161.2; Anal. Calcd. For $C_{32}H_{21}FN_4O_2$: C, 74.99; H, 4.13; N, 10.93. Found: C, 75.23; H, 4.35; N, 10.82.

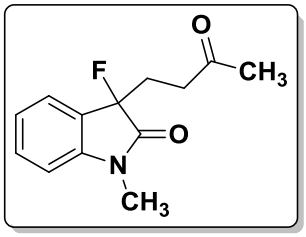


2-(3-Fluoro-2,2'-dioxo-[3,3'-biindolin]-3'-yl)malononitrile (19). Compound **19** was obtained as a colorless solid in 98% yield (68 mg, 0.196 mmol) from 2-(2-oxoindolin-3-ylidene)malononitrile (39 mg, 0.2 mmol) and 3-fluoroindolin-2-one (30 mg, 0.2 mmol) in the presence of 10 mol% Et_3N in 0.5 mL of water after 5 hours at 25 ^oC by following the general

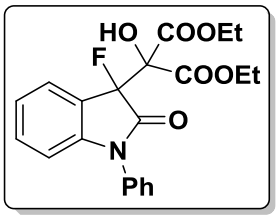
procedure described above. R_f = 0.2 (hexanes/EtOAc, 2:8); ^{1}H NMR (399 MHz, Acetone-d_6) δ 10.10 (s, 1H), 10.01 (s, 1H), 8.03 (dd, J = 7.8, 1.8 Hz, 1H), 7.64 (dd, J = 7.8, 7.7 Hz, 1H), 7.43 (dd, J = 7.9, 7.7 Hz, 1H), 7.36 (dd, J = 7.9, 7.8 Hz, 1H), 7.11 (dd, J = 7.8, 1.7 Hz, 1H), 6.98 (dd, J = 7.9, 1.7 Hz, 1H), 6.75 (dd, J = 7.9, 7.8 Hz, 1H), 6.09 (s, 1H), 5.94 (dd, J = 7.7, 1.8 Hz, 1H); ^{13}C NMR (100 MHz, Acetone-d_6) δ 171.3 (d, $J_{C\text{-}F}$ = 14.0 Hz), 171.1 (d, $J_{C\text{-}F}$ = 2.8 Hz), 144.3, 144.0 (d, $J_{C\text{-}F}$ = 5.4 Hz), 133.8 (d, $J_{C\text{-}F}$ = 3.3 Hz), 132.8, 127.4 (d, $J_{C\text{-}F}$ = 2.7 Hz), 126.1, 124.4, 123.4 (d, $J_{C\text{-}F}$ = 3.0 Hz), 122.7, 122.6, 112.8, 112.2, 112.0 (d, $J_{C\text{-}F}$ = 1.6 Hz), 111.9, 92.1 (d, $J_{C\text{-}F}$ = 198.8 Hz), 57.7 (d, $J_{C\text{-}F}$ = 23.8 Hz), 25.1; ^{19}F NMR (376 MHz, Acetone-d_6) δ -163.1; Anal. Calcd. For $C_{19}H_{11}FN_4O_2$: C, 65.90; H, 3.20; N, 16.18. Found: C, 65.89; H, 3.25; N, 16.24.



Synthesis of 3-(3-fluoro-2-oxo-1-phenylindolin-3-yl)propanenitrile (20). Et_3N (6 μL, 0.04 mmol) was added to a mixture of 3-fluoro-1-phenylindolin-2-one (45 mg, 0.2 mmol) and acrylonitrile (16 μL, 0.24 mmol) in 1:1 ethanol-water (0.5 mL). The resulting mixture was stirred at room temperature for 36 hours. The reaction mixture was extracted with EtOAc, washed with water and dried over Na_2SO_4 and the solvent was removed *in vacuo*. The crude product was purified by flash chromatography on silica gel using hexanes-ethyl acetate (9:1) as mobile phase. Compound **20** was obtained as a colorless solid in 92% yield (52 mg, 0.184 mmol). R_f = 0.4 (hexanes/EtOAc, 9:1); ^{1}H NMR (399 MHz, Chloroform-d) δ 7.58 – 7.51 (m, 2H), 7.51 – 7.44 (m, 2H), 7.44 – 7.39 (m, 2H), 7.36 (m, 1H), 7.19 (dd, J = 7.8, 7.7 Hz, 1H), 6.86 (dd, J = 7.7, 1.8 Hz, 1H), 2.84 (m, 1H), 2.78 – 2.64 (m, 2H), 2.44 (m, 1H); ^{13}C NMR (100 MHz, Chloroform-d) δ 170.8 (d, $J_{C\text{-}F}$ = 21.7 Hz), 143.9 (d, $J_{C\text{-}F}$ = 5.1 Hz), 133.1, 131.8 (d, $J_{C\text{-}F}$ = 3.0 Hz), 129.8, 128.6, 126.2, 124.7 (d, $J_{C\text{-}F}$ = 1.1 Hz), 124.3 (d, $J_{C\text{-}F}$ = 18.3 Hz), 124.0 (d, $J_{C\text{-}F}$ = 2.7 Hz), 118.4, 110.4 (d, $J_{C\text{-}F}$ = 1.3 Hz), 90.7 (d, $J_{C\text{-}F}$ = 190.2 Hz), 31.4 (d, $J_{C\text{-}F}$ = 29.2 Hz), 11.0 (d, $J_{C\text{-}F}$ = 6.9 Hz); ^{19}F NMR (376 MHz, Chloroform-d) δ -158.9 (dd, J = 22.7, 22.6 Hz); Anal. Calcd. For $C_{17}H_{13}FN_2O$: C, 72.85; H, 4.67; N, 9.99. Found: C, 72.89; H, 4.85; N, 10.23.

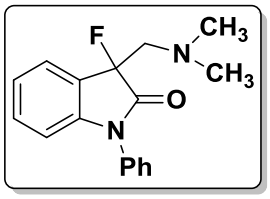


Synthesis of 3-fluoro-1-methyl-3-(3-oxobutyl)indolin-2-one (21). To a solution of *N*-methyl 3-fluorooxindole (33 mg, 0.2 mmol) and methyl vinyl ketone (15.4 mg, 0.22 mmol) in 1:1 ethanol-water (0.5 mL) was added 1,8-diazabicyclo[5.4.0]undec-7-ene (6.1 mg, 0.04 mmol). The mixture was stirred at room temperature for 2 hours. The reaction mixture was extracted with EtOAc, washed with water and dried over Na_2SO_4 and the solvent was removed *in vacuo*. The crude product was purified by flash chromatography on silica gel using hexanes-ethyl acetate (4:1) as mobile phase. Compound **21** was obtained as a colorless solid in 96% yield (45 mg, 0.192 mmol). R_f = 0.2 (hexanes/EtOAc, 2:1); ^{1}H NMR (399 MHz, Chloroform-*d*) δ 7.41 – 7.36 (m, 2H), 7.11 (dd, *J* = 7.8, 7.7 Hz, 1H), 6.84 (dd, *J* = 7.8, 1.8 Hz, 1H), 3.19 (s, 3H), 2.79 – 2.58 (m, 2H), 2.45 (m, 1H), 2.31 (m, 1H), 2.13 (s, 3H); ^{13}C NMR (100 MHz, Chloroform-*d*) δ 206.6, 172.5 (d, $J_{C\text{-}F}$ = 22.0 Hz), 143.7 (d, $J_{C\text{-}F}$ = 5.2 Hz), 131.3 (d, $J_{C\text{-}F}$ = 2.8 Hz), 126.0 (d, $J_{C\text{-}F}$ = 18.7 Hz), 124.4, 123.3 (d, $J_{C\text{-}F}$ = 2.6 Hz), 108.7, 92.1 (d, $J_{C\text{-}F}$ = 187.8 Hz), 36.2 (d, $J_{C\text{-}F}$ = 4.3 Hz), 29.9, 29.2 (d, $J_{C\text{-}F}$ = 28.2 Hz), 26.2; ^{19}F NMR (376 MHz, Chloroform-*d*) δ -160.2 (dd, *J* = 24.1, 24.1 Hz); Anal. Calcd. For $C_{13}H_{14}FNO_2$: C, 66.37; H, 6.00; N, 5.95. Found: C, 66.36; H, 6.38; N, 5.92.



Synthesis of diethyl 2-(3-fluoro-2-oxo-1-phenylindolin-3-yl)-2-hydroxymalonate (22). Et_3N (6 μL, 0.04 mmol) was added to a mixture of 3-fluoro-1-phenylindolin-2-one (45 mg, 0.2 mmol) and diethyl 2-oxomalonate (42 mg, 0.24 mmol) in 1:1 ethanol-water (0.5 mL). The resulting mixture was stirred at room temperature for 24 hours. The reaction mixture was extracted with EtOAc, washed with water and dried over Na_2SO_4 and the solvent was removed *in vacuo*. The crude product was purified by flash chromatography on silica gel using hexanes-ethyl acetate

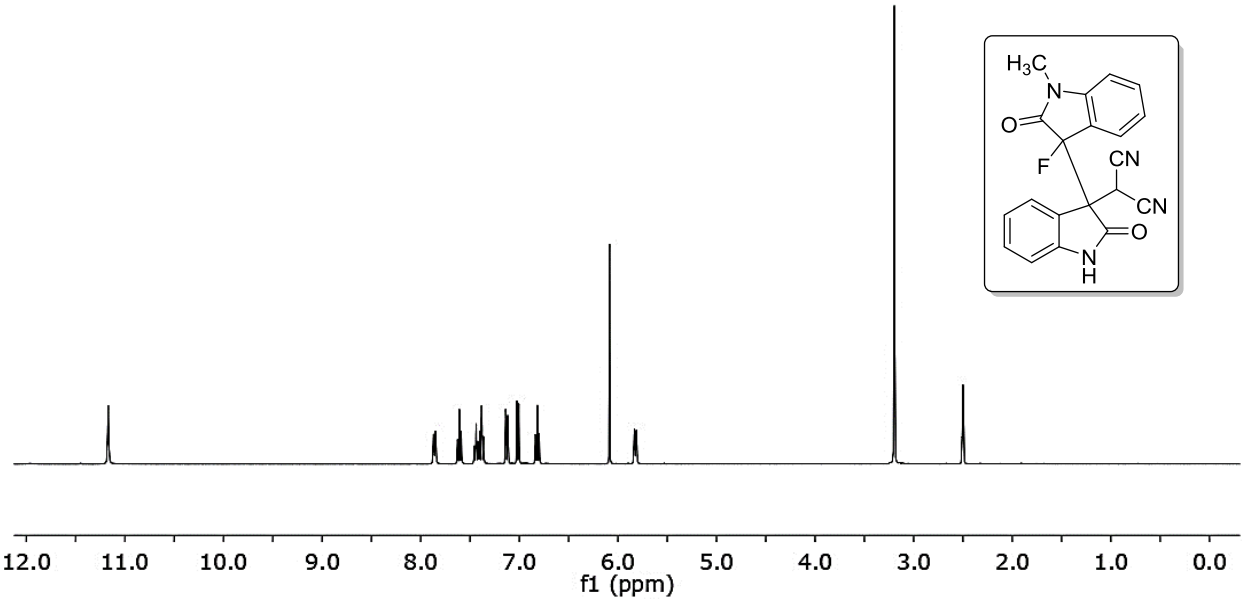
(4:1) as mobile phase. Compound **22** was obtained as a colorless solid in 97% yield (78 mg, 0.194 mmol). R_f = 0.3 (hexanes/EtOAc, 4:1); ^{1}H NMR (399 MHz, Chloroform-*d*) δ 7.82 (dd, *J* = 7.7, 1.8 Hz, 1H), 7.57 – 7.49 (m, 2H), 7.47 – 7.39 (m, 3H), 7.33 (dd, *J* = 7.8, 7.7 Hz, 1H), 7.10 (dd, *J* = 7.8, 7.7 Hz, 1H), 6.80 (dd, *J* = 7.7, 1.8 Hz, 1H), 4.47 (s, 1H), 4.45 – 4.32 (m, 2H), 4.32 – 4.18 (m, 2H), 1.33 (t, *J* = 7.1 Hz, 3H), 1.18 (t, *J* = 7.1 Hz, 3H); ^{13}C NMR (100 MHz, Chloroform-*d*) δ 168.9 (d, $J_{C\text{-}F}$ = 21.0 Hz), 166.7 (d, $J_{C\text{-}F}$ = 3.8 Hz), 166.6 (d, $J_{C\text{-}F}$ = 3.2 Hz), 145.5 (d, $J_{C\text{-}F}$ = 5.1 Hz), 133.5, 131.8 (d, $J_{C\text{-}F}$ = 3.2 Hz), 129.8, 128.5, 127.2, 126.3, 123.7 (d, $J_{C\text{-}F}$ = 2.8 Hz), 122.8 (d, $J_{C\text{-}F}$ = 17.9 Hz), 109.8 (d, $J_{C\text{-}F}$ = 1.4 Hz), 91.7 (d, $J_{C\text{-}F}$ = 199.8 Hz), 80.4 (d, $J_{C\text{-}F}$ = 25.3 Hz), 63.3, 63.2, 13.9, 13.8; ^{19}F NMR (376 MHz, Chloroform-*d*) δ -164.4; Anal. Calcd. For $C_{21}H_{20}FNO_6$: C, 62.84; H, 5.02; N, 3.49. Found: C, 62.73; H, 5.25; N, 3.72.



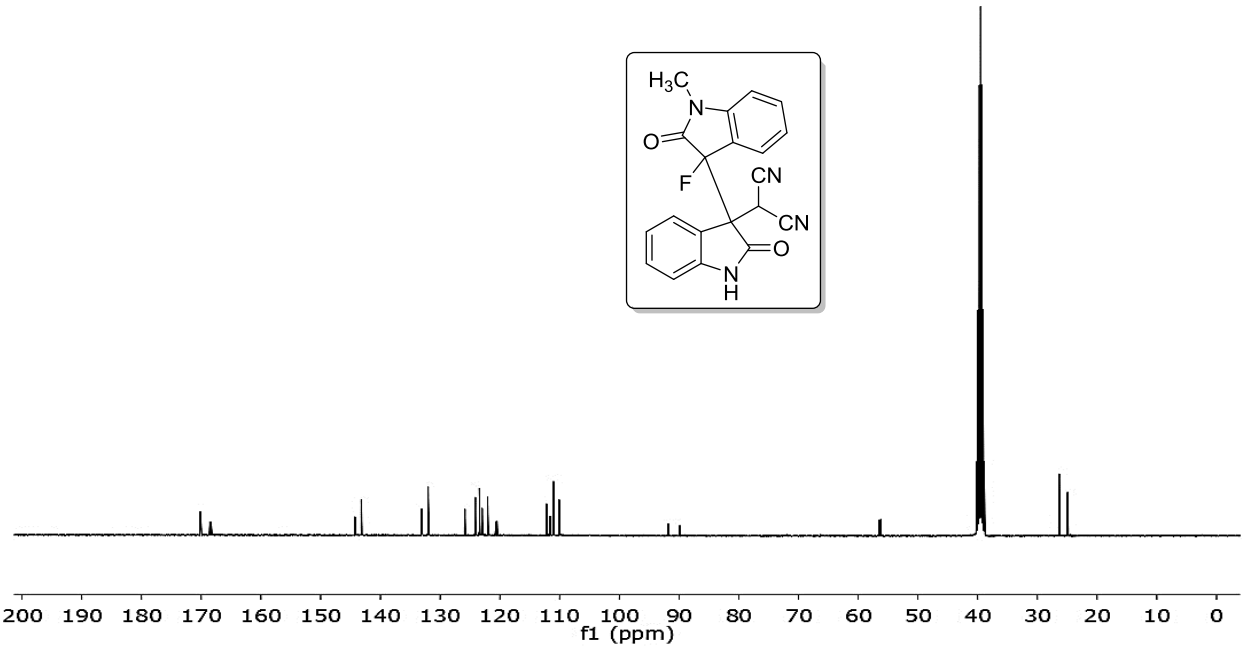
Synthesis of 3-((dimethylamino)methyl)-3-fluoro-1-phenylindolin-2-one (23). Et_3N (33 μL, 0.24 mmol) was added to a mixture of 3-fluoro-1-phenylindolin-2-one (45 mg, 0.2 mmol) and dimethylmethylideneammonium iodide (44 mg, 0.24 mmol) in 1:1 ethanol-water (0.5 mL). The resulting mixture was stirred at room temperature for 6 hours. The reaction mixture was extracted with EtOAc, washed with water and dried over Na_2SO_4 and the solvent was removed *in vacuo*. The crude product was purified by flash chromatography on silica gel using hexanes-ethyl acetate (4:1) as mobile phase. Compound **23** was obtained as a colorless solid in 99% yield (56 mg, 0.198 mmol). R_f = 0.3 (hexanes/EtOAc, 1:1); ^{1}H NMR (399 MHz, Chloroform-*d*) δ 7.60 (dd, *J* = 7.7, 1.8 Hz, 1H), 7.56 – 7.48 (m, 2H), 7.44 – 7.39 (m, 3H), 7.31 (dd, *J* = 7.8, 7.6 Hz, 1H), 7.14 (dd, *J* = 7.7, 7.7 Hz, 1H), 6.83 (dd, *J* = 7.7, 1.8 Hz, 1H), 3.14 – 3.07 (m, 2H), 2.25 (s, 6H); ^{13}C NMR (100 MHz, Chloroform-*d*) δ 172.0 (d, $J_{C\text{-}F}$ = 20.6 Hz), 144.7 (d, $J_{C\text{-}F}$ = 5.4 Hz), 133.8, 130.9 (d, $J_{C\text{-}F}$ = 3.1 Hz), 129.6, 128.3, 126.4, 125.9 (d, $J_{C\text{-}F}$ = 1.1 Hz), 125.5 (d, $J_{C\text{-}F}$ = 18.5 Hz), 123.3 (d, $J_{C\text{-}F}$ = 2.8 Hz), 109.8 (d, $J_{C\text{-}F}$ = 1.2 Hz), 92.3 (d, $J_{C\text{-}F}$ = 188.0 Hz), 62.1 (d, $J_{C\text{-}F}$ = 31.0 Hz), 47.3, 47.2; ^{19}F NMR (376 MHz, Chloroform-*d*) δ -158.9 (t, *J* = 12.8 Hz); Anal. Calcd. For $C_{17}H_{17}FN_2O$: C, 71.81; H, 6.03; N, 9.85. Found: C, 71.97; H, 6.17; N, 9.92.

3. NMR spectra

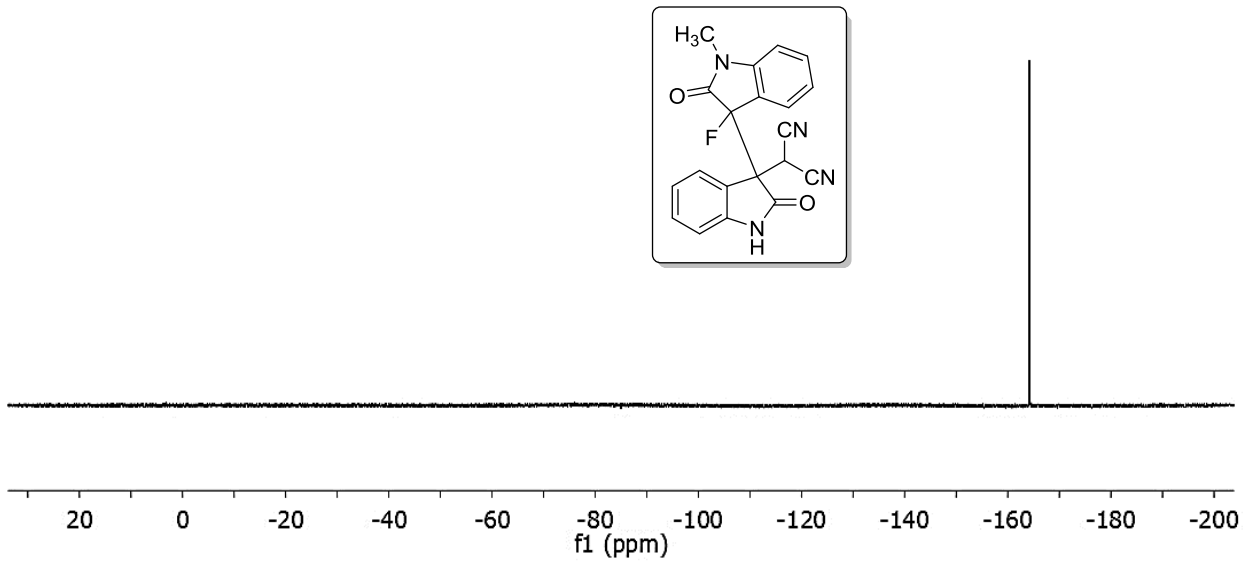
^{1}H NMR spectrum of 2-(3-fluoro-1-methyl-2,2'-dioxo-[3,3'-biindolin]-3'-yl)malononitrile (3).



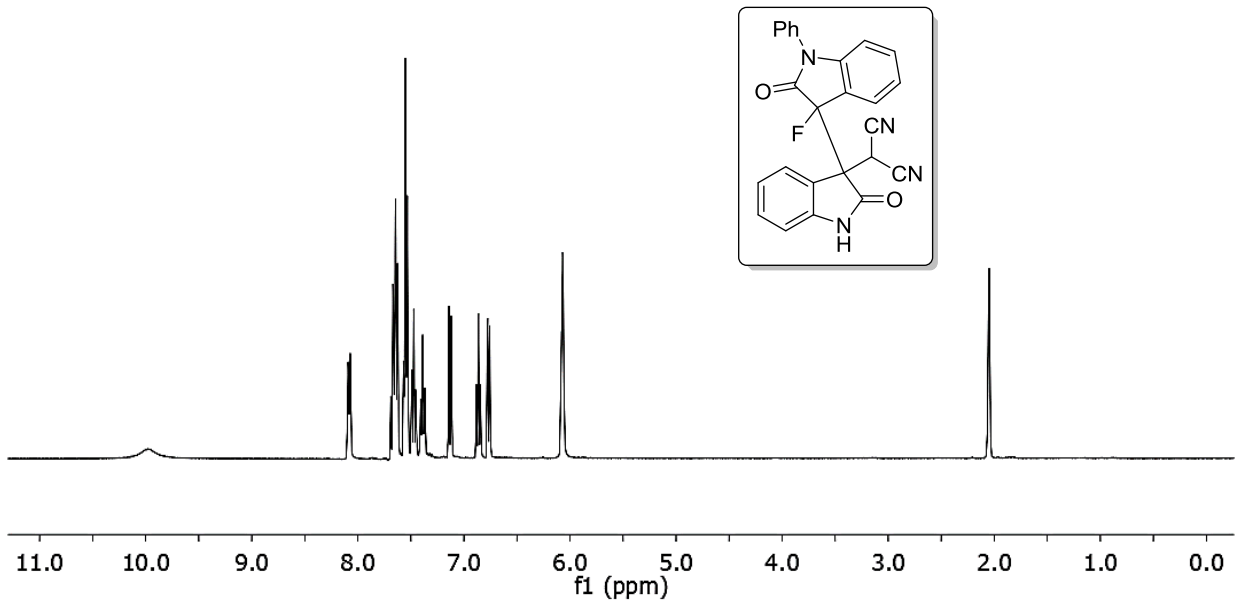
^{13}C NMR spectrum of 2-(3-fluoro-1-methyl-2,2'-dioxo-[3,3'-biindolin]-3'-yl)malononitrile (3).



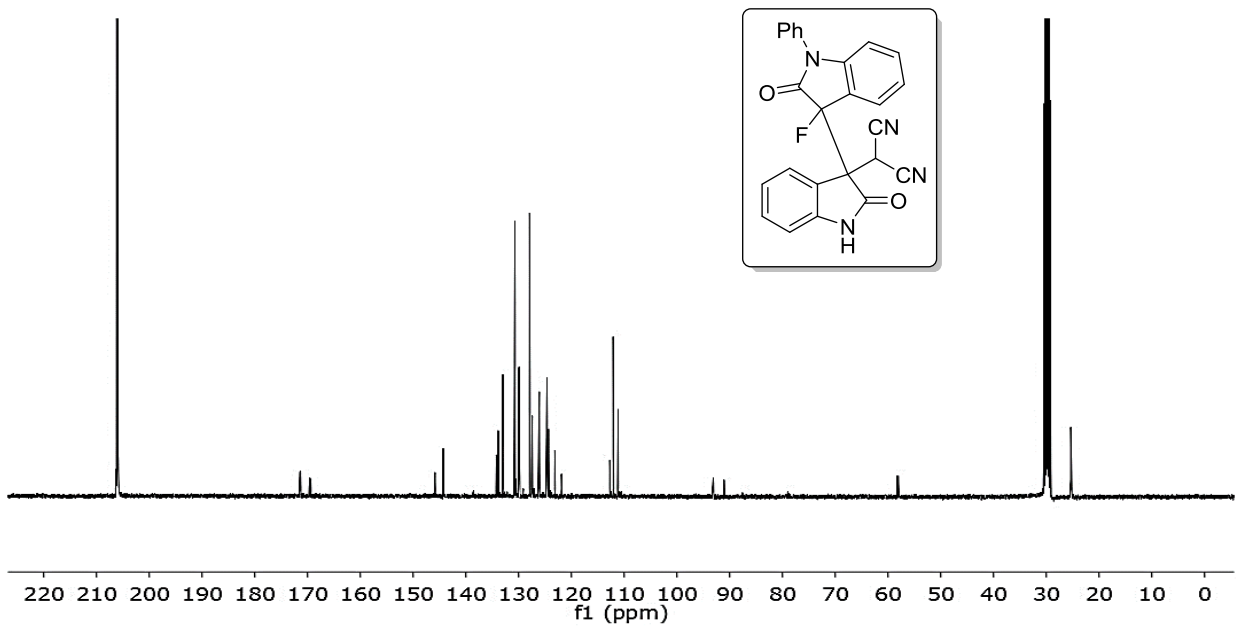
^{19}F NMR spectrum of 2-(3-fluoro-1-methyl-2,2'-dioxo-[3,3'-biindolin]-3'-yl)malononitrile (3).



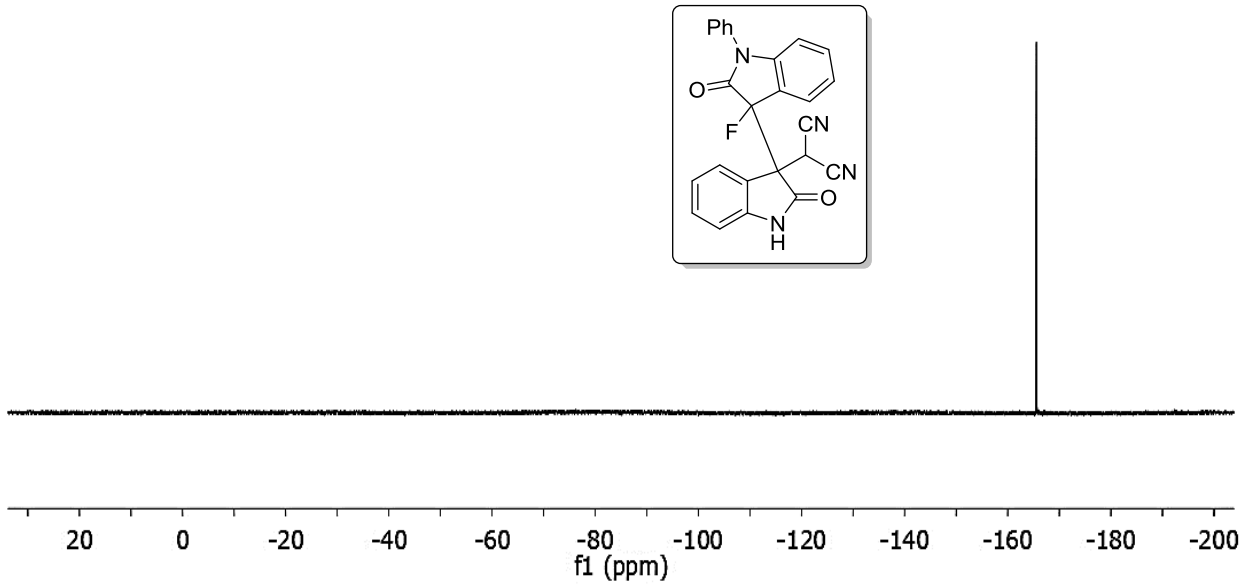
^{1}H NMR spectrum of 2-(3-fluoro-2,2'-dioxo-1-phenyl-[3,3'-biindolin]-3'-yl)malononitrile (4).



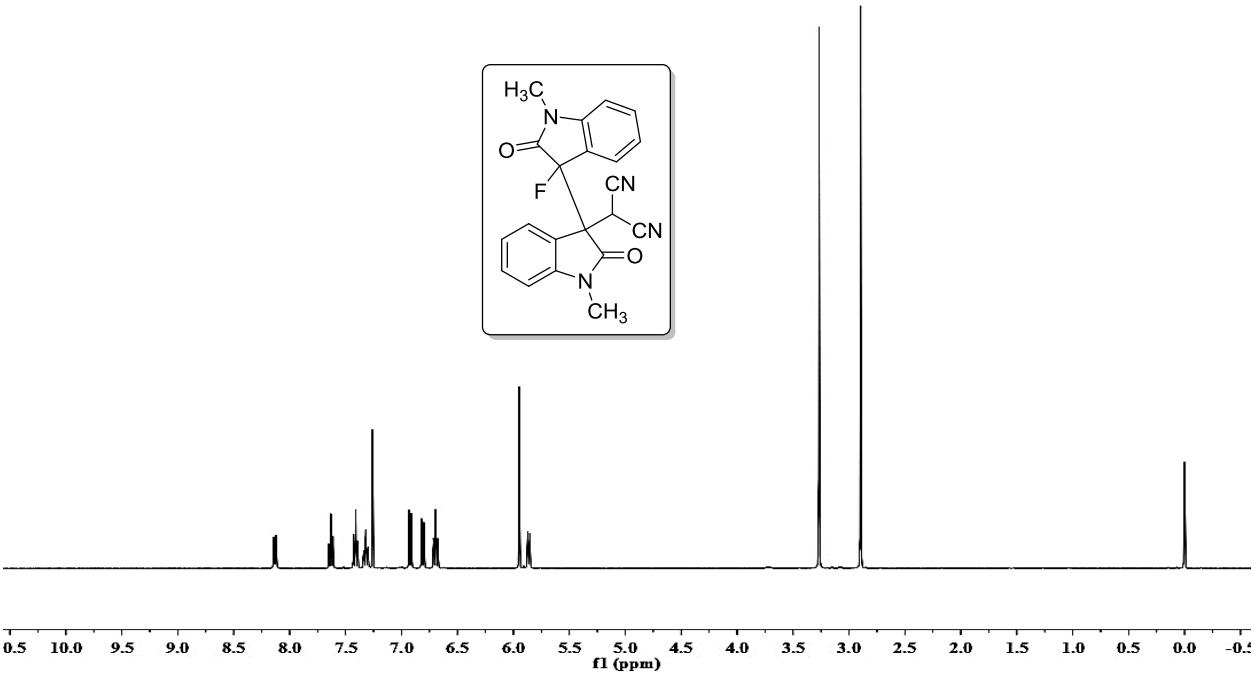
^{13}C NMR spectrum of 2-(3-fluoro-2,2'-dioxo-1-phenyl-[3,3'-biindolin]-3'-yl)malononitrile (4).



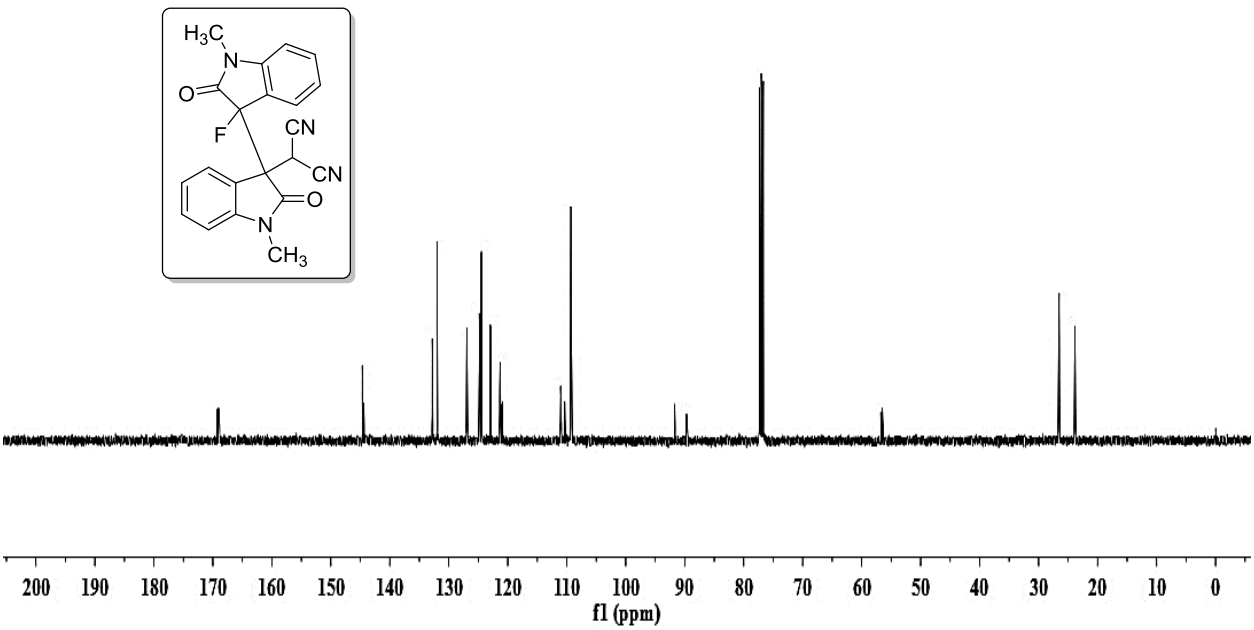
^{19}F NMR spectrum of 2-(3-fluoro-2,2'-dioxo-1-phenyl-[3,3'-biindolin]-3'-yl)malononitrile (4).



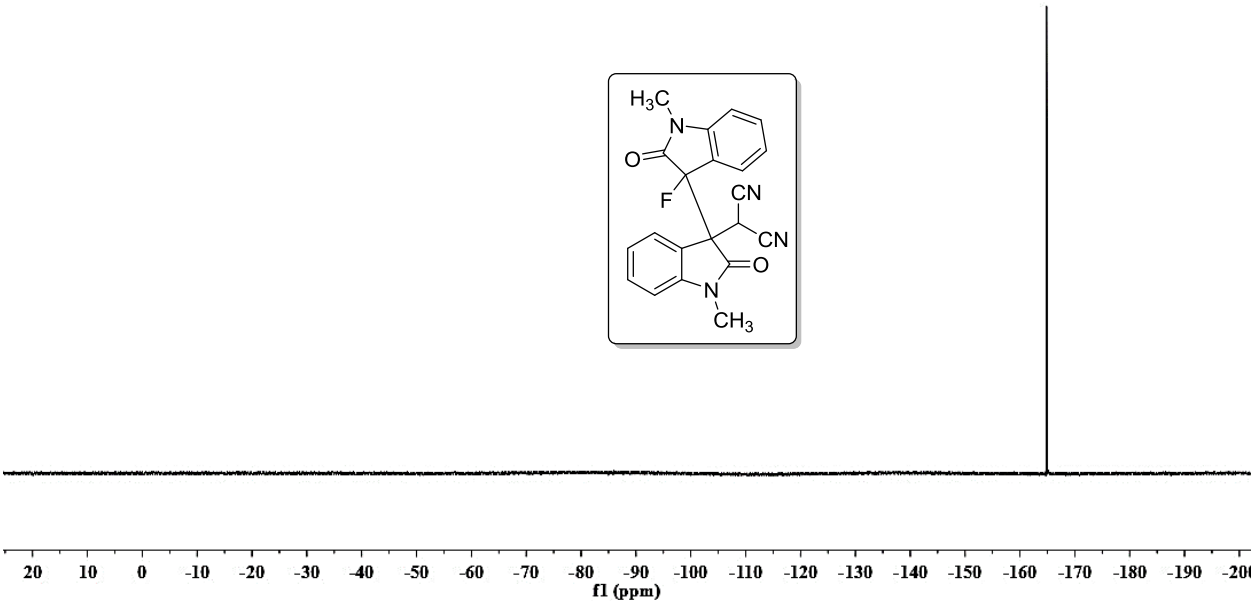
^{1}H NMR spectrum of 2-(3-fluoro-1,1'-dimethyl-2,2'-dioxo-[3,3'-biindolin]-3'-yl)malononitrile (5).



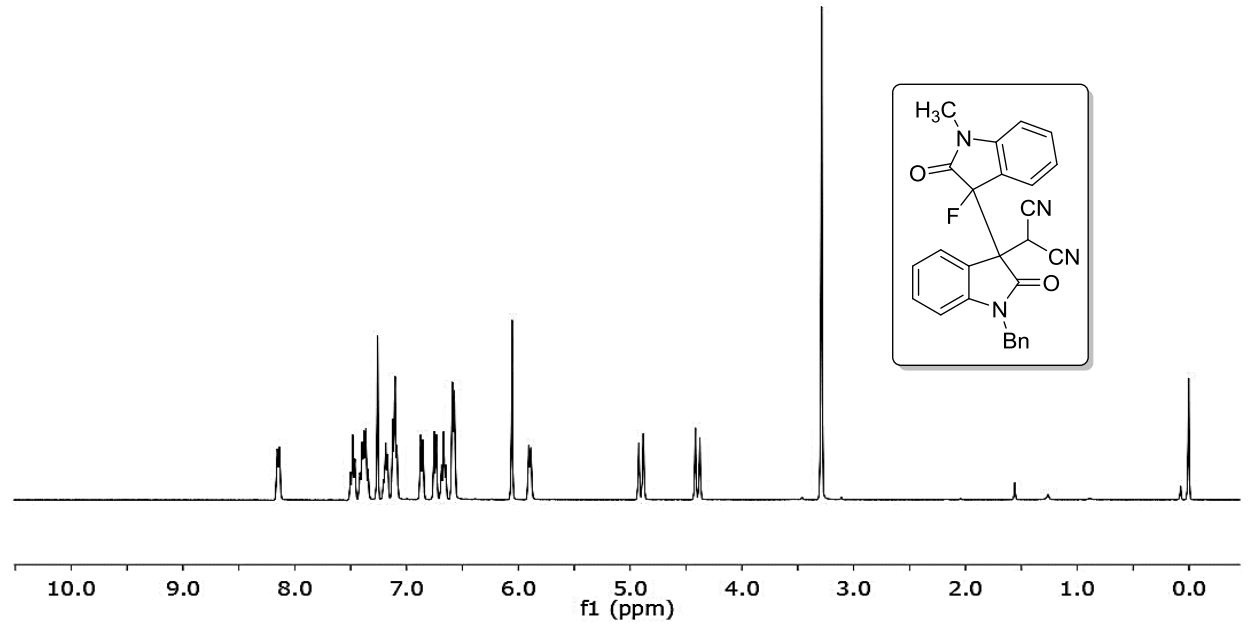
^{13}C NMR spectrum of 2-(3-fluoro-1,1'-dimethyl-2,2'-dioxo-[3,3'-biindolin]-3'-yl)malononitrile (5).



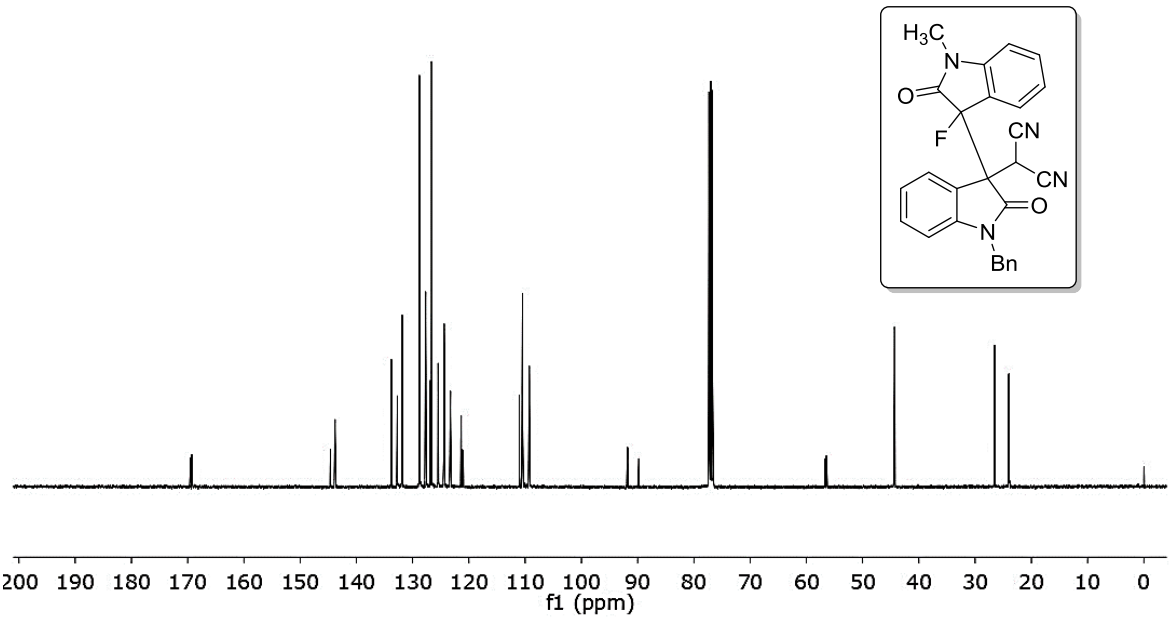
^{19}F NMR spectrum of 2-(3-fluoro-1,1'-dimethyl-2,2'-dioxo-[3,3'-biindolin]-3'-yl)malononitrile (5).



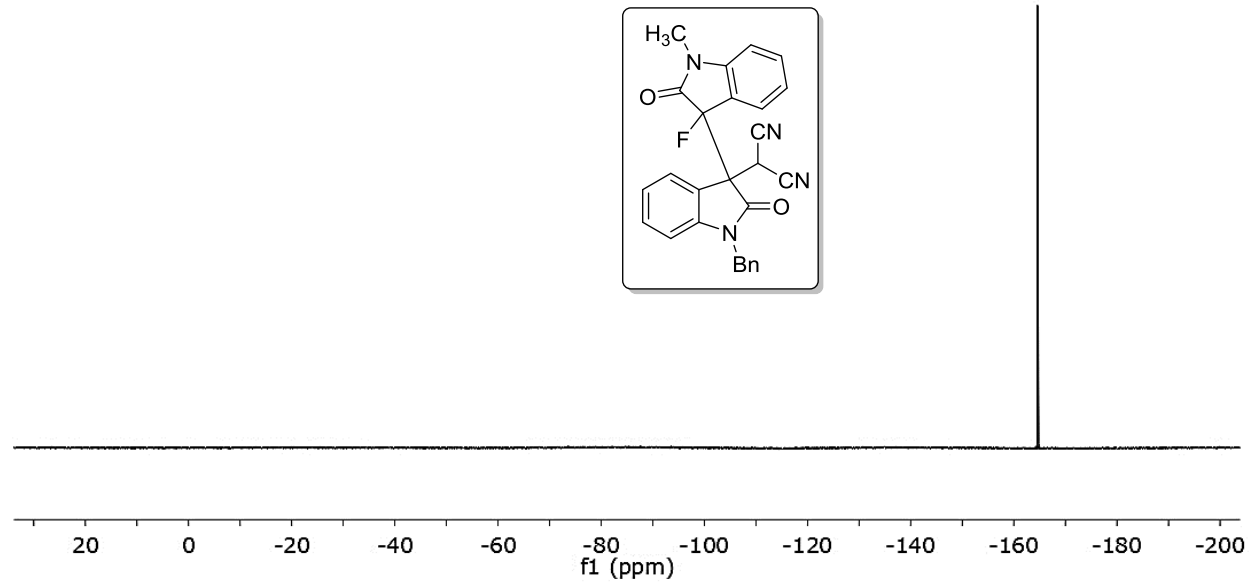
^{1}H NMR spectrum of 2-(1'-benzyl-3-fluoro-1-methyl-2,2'-dioxo-[3,3'-biindolin]-3'-yl)malononitrile (6).



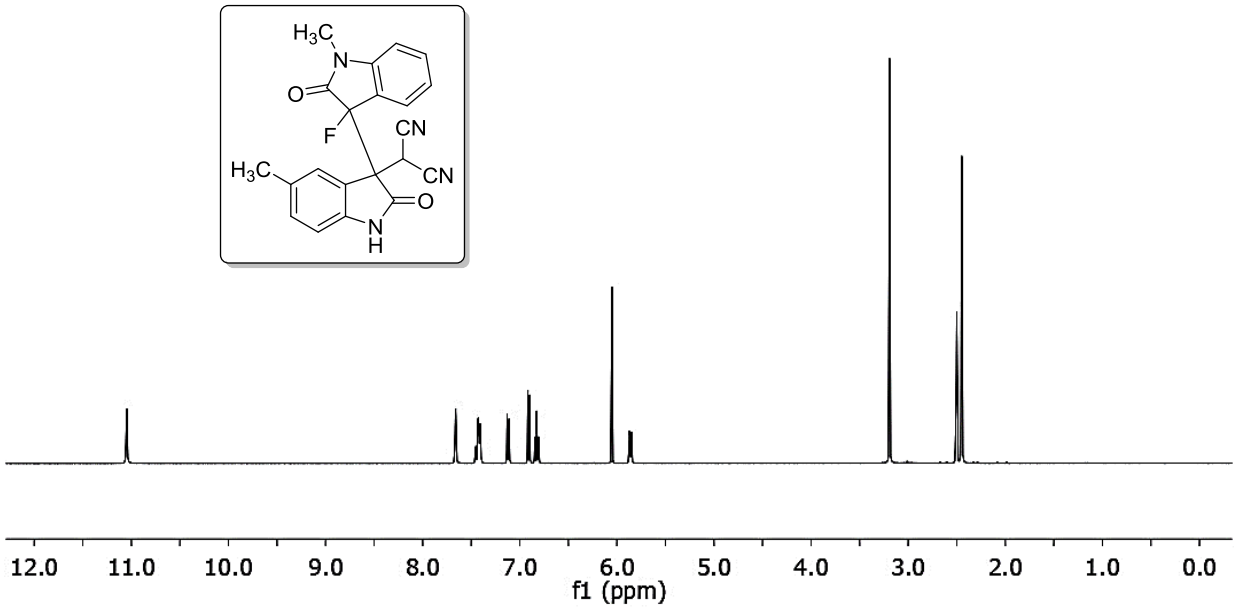
^{13}C NMR spectrum of 2-(1'-benzyl-3-fluoro-1-methyl-2,2'-dioxo-[3,3'-biindolin]-3'-yl)malononitrile (6).



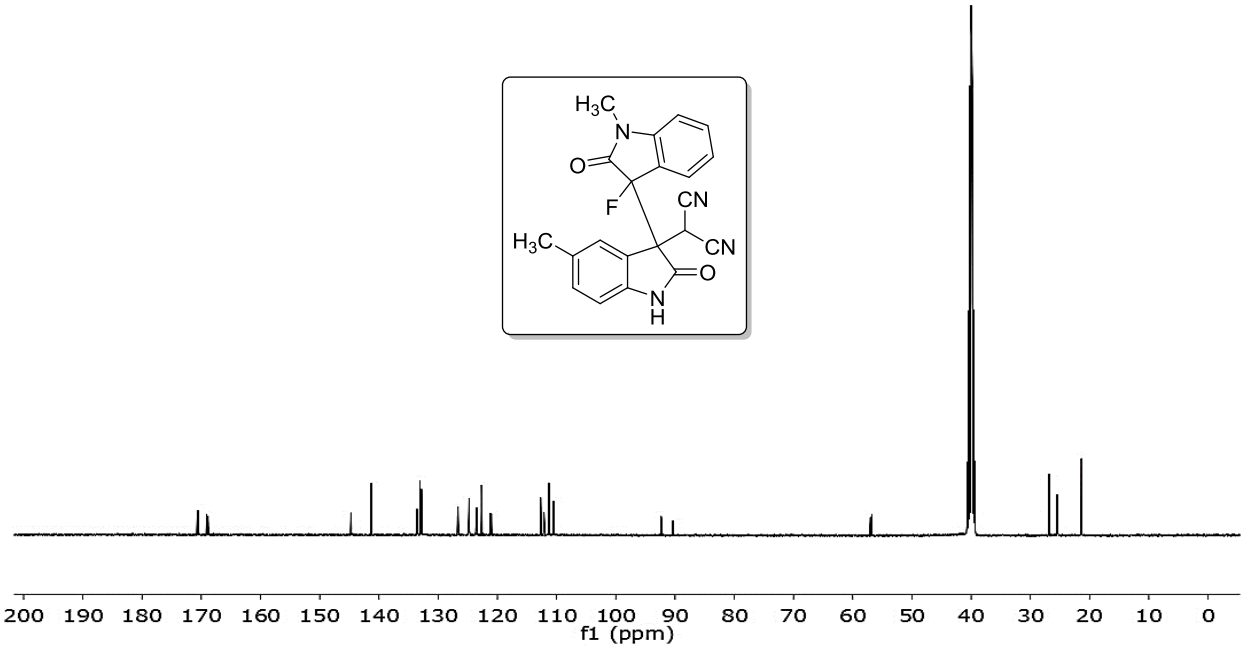
^{19}F NMR spectrum of 2-(1'-benzyl-3-fluoro-1-methyl-2,2'-dioxo-[3,3'-biindolin]-3'-yl)malononitrile (6).



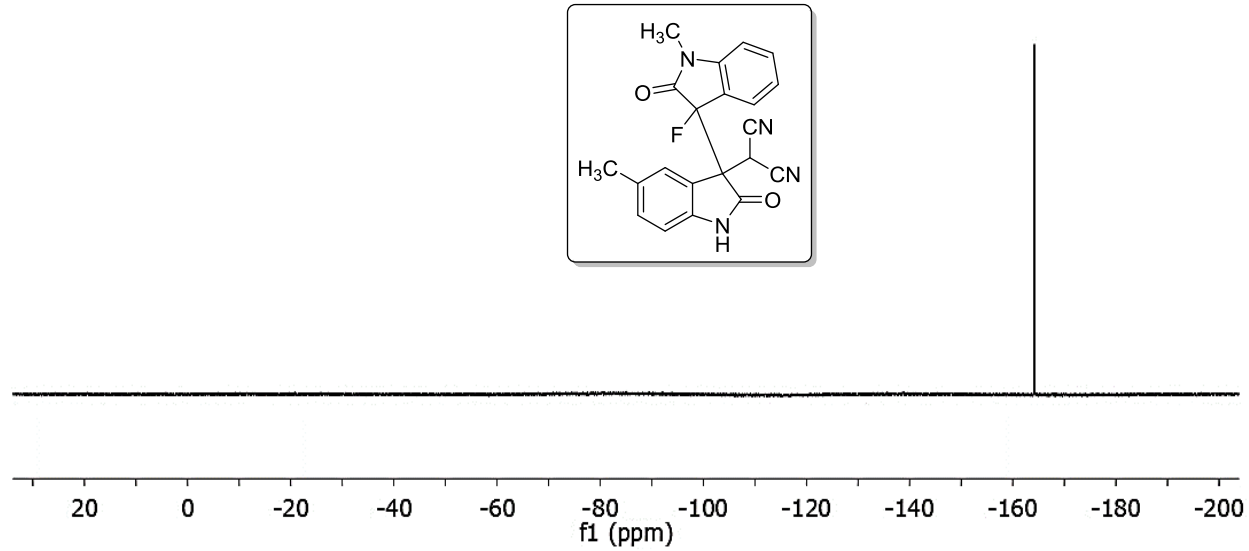
^{1}H NMR spectrum of 2-(3-fluoro-1,5'-dimethyl-2,2'-dioxo-[3,3'-biindolin]-3'-yl)malononitrile (7).



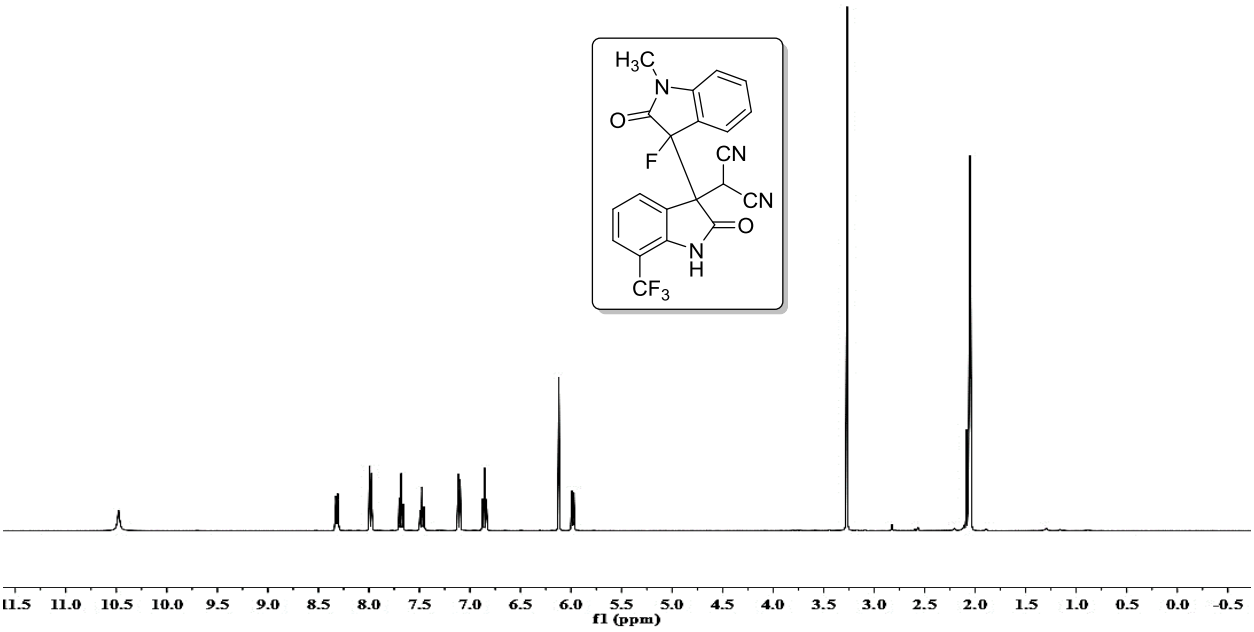
^{13}C NMR spectrum of 2-(3-fluoro-1,5'-dimethyl-2,2'-dioxo-[3,3'-biindolin]-3'-yl)malononitrile (7).



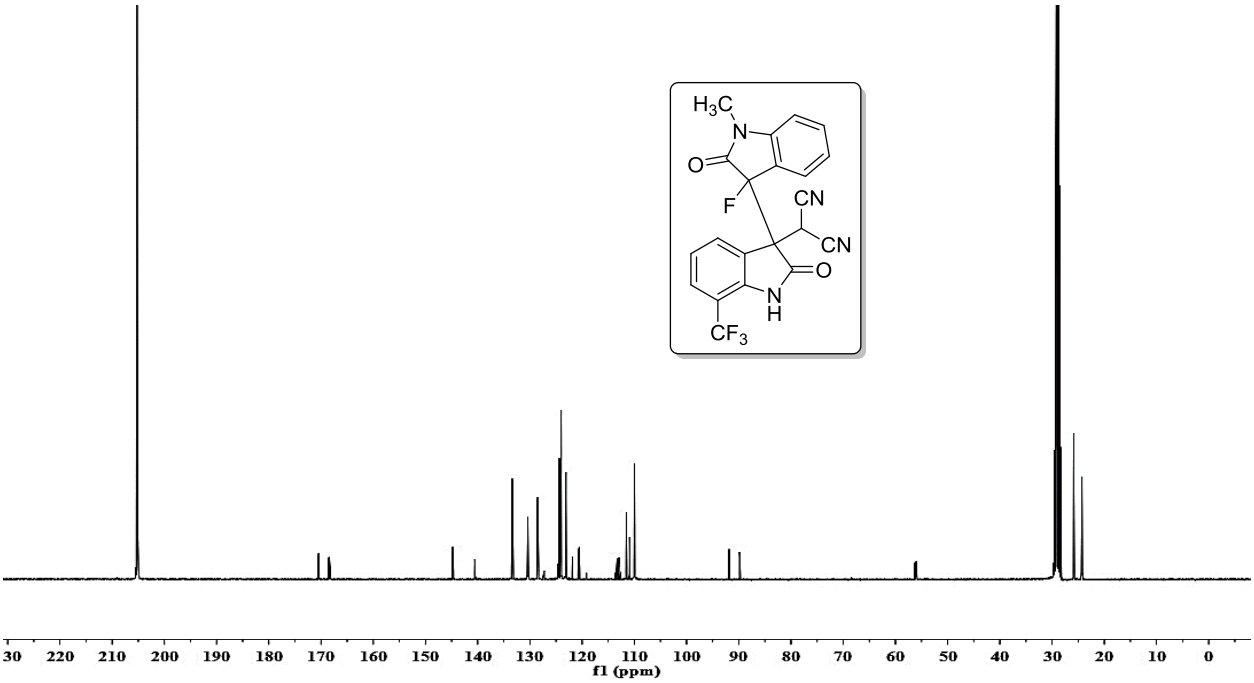
^{19}F NMR spectrum of 2-(3-fluoro-1,5'-dimethyl-2,2'-dioxo-[3,3'-biindolin]-3'-yl)malononitrile (7).



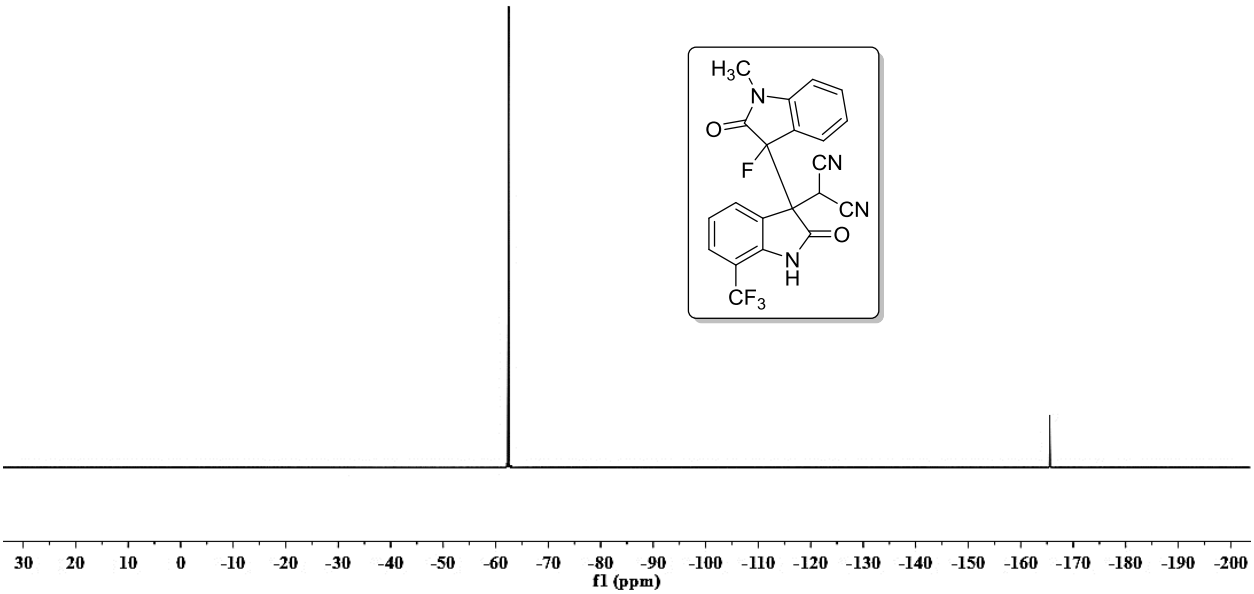
^{1}H NMR spectrum of 2-(3-fluoro-1-methyl-2,2'-dioxo-7'-(trifluoromethyl)-[3,3'-biindolin]-3'-yl)malononitrile (8).



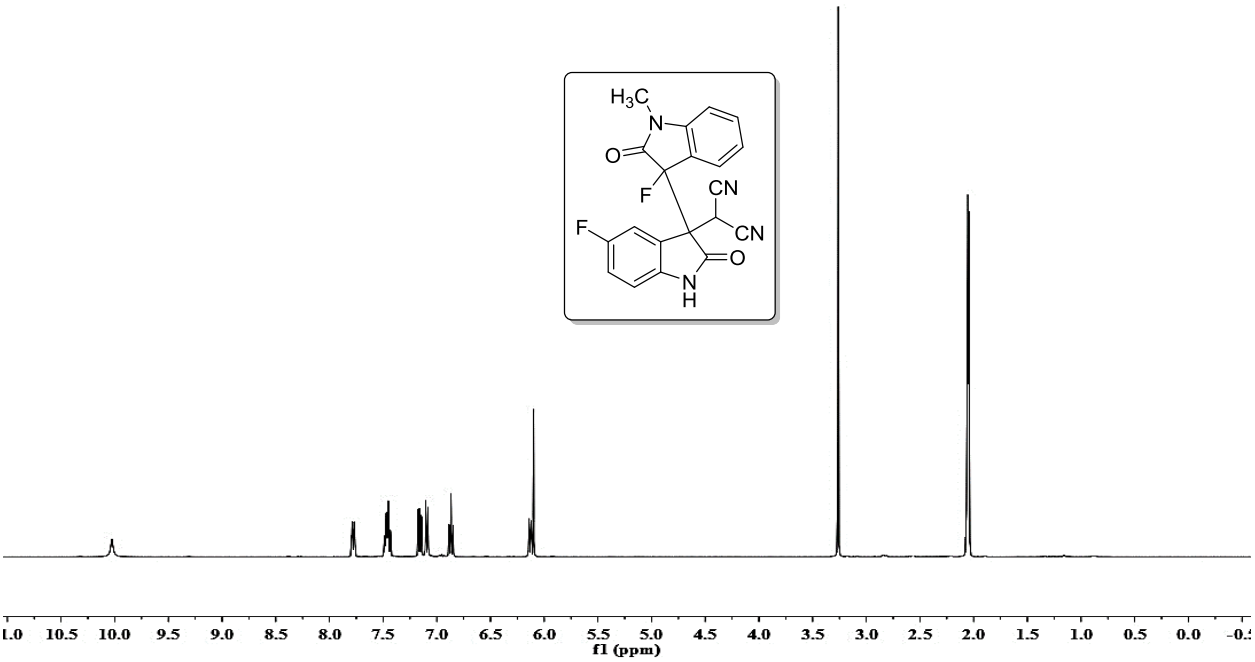
^{13}C NMR spectrum of 2-(3-fluoro-1-methyl-2,2'-dioxo-7'-(trifluoromethyl)-[3,3'-biindolin]-3'-yl)malononitrile (8).



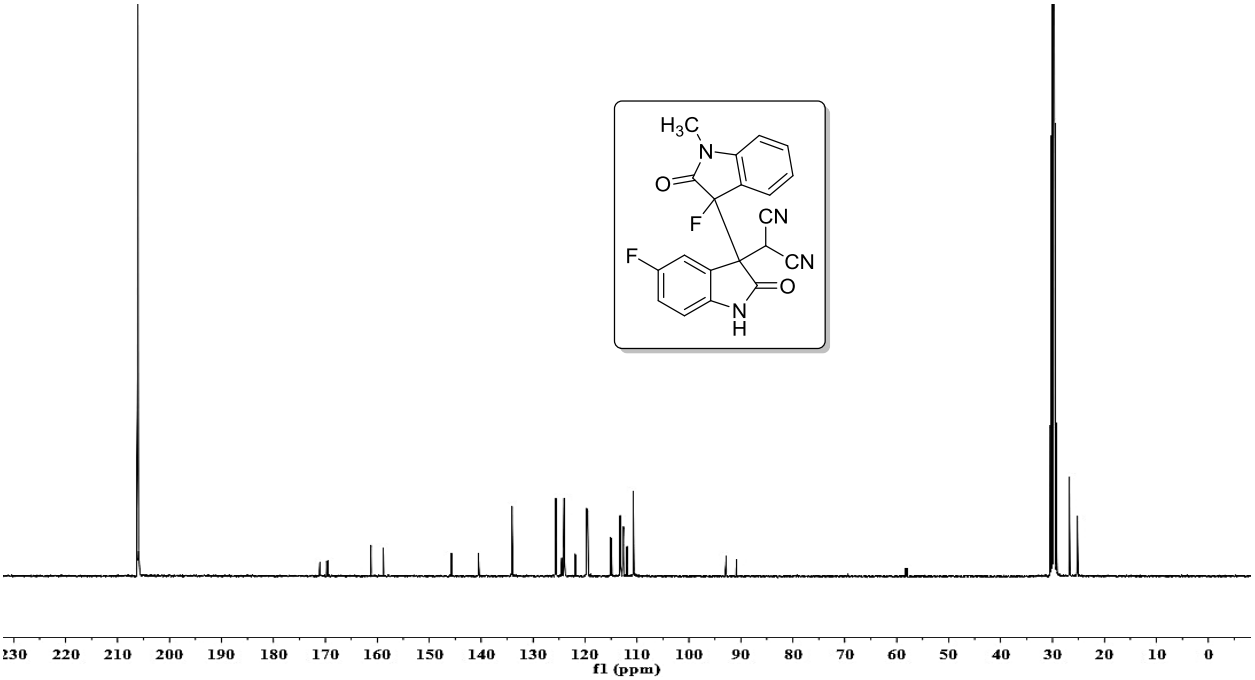
^{19}F NMR spectrum of 2-(3-fluoro-1-methyl-2,2'-dioxo-7'-(trifluoromethyl)-[3,3'-biindolin]-3'-yl)malononitrile (8).



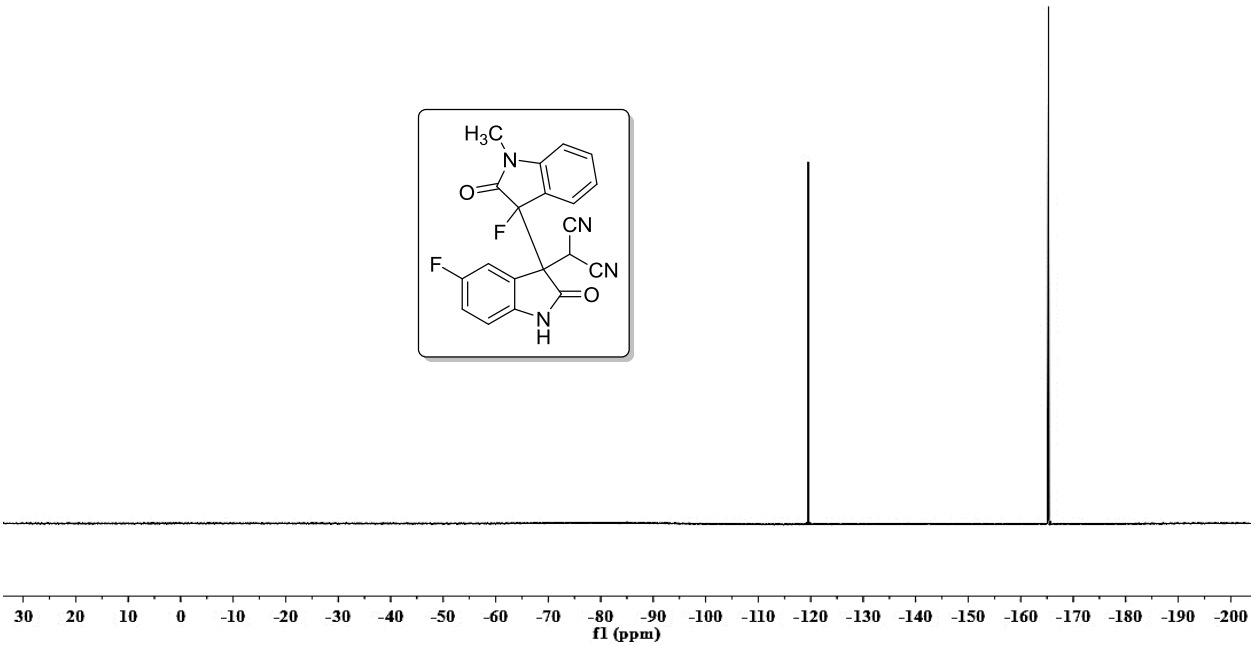
^{1}H NMR spectrum of 2-(3,5'-difluoro-1-methyl-2,2'-dioxo-[3,3'-biindolin]-3'-yl)malononitrile (9).



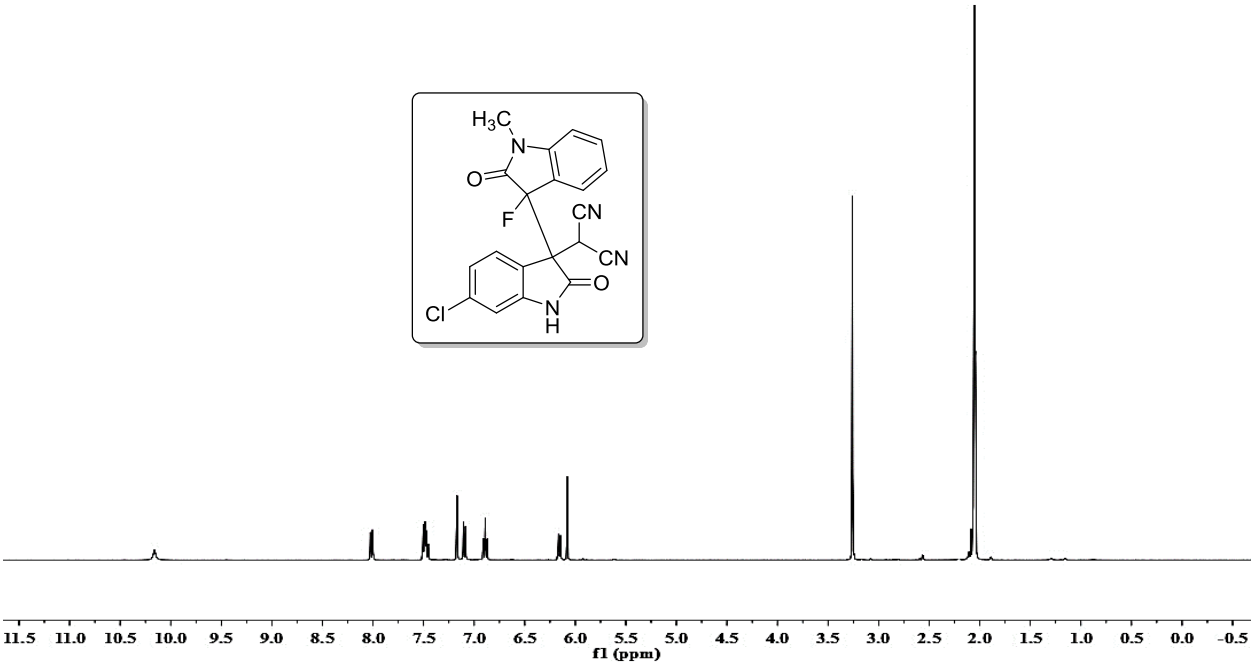
^{13}C NMR spectrum of 2-(3,5'-difluoro-1-methyl-2,2'-dioxo-[3,3'-biindolin]-3'-yl)malononitrile (9).



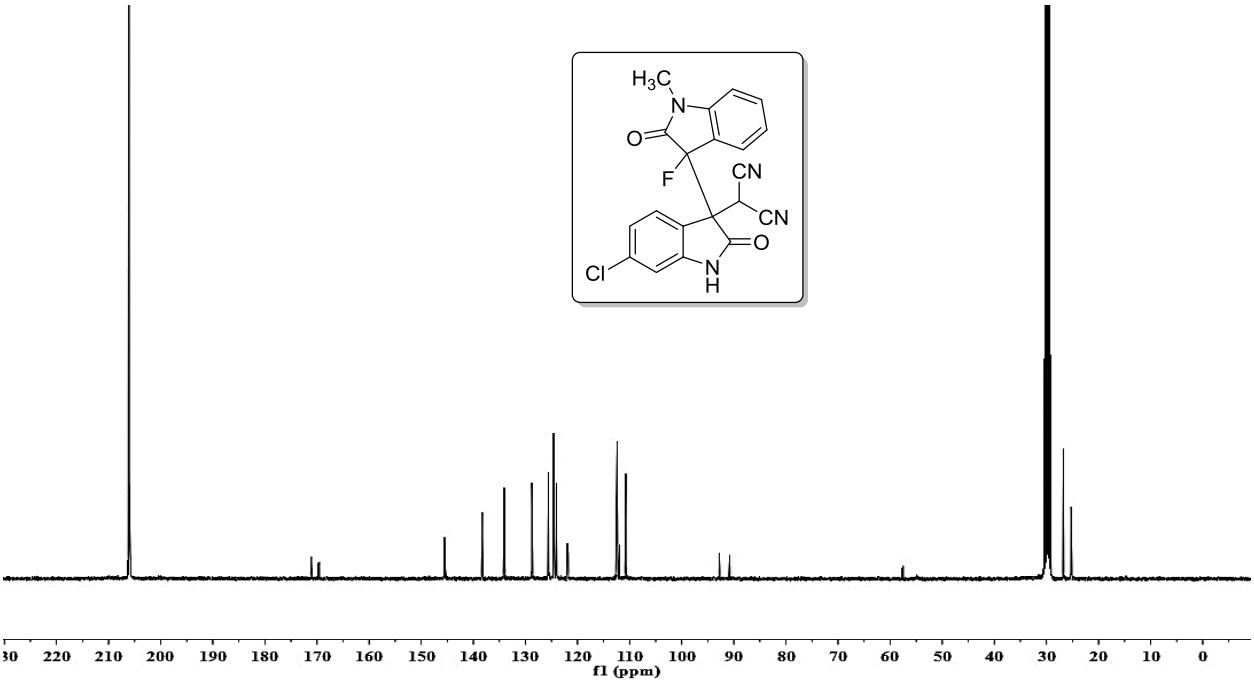
^{19}F NMR spectrum of 2-(3,5'-difluoro-1-methyl-2,2'-dioxo-[3,3'-biindolin]-3'-yl)malononitrile (9).



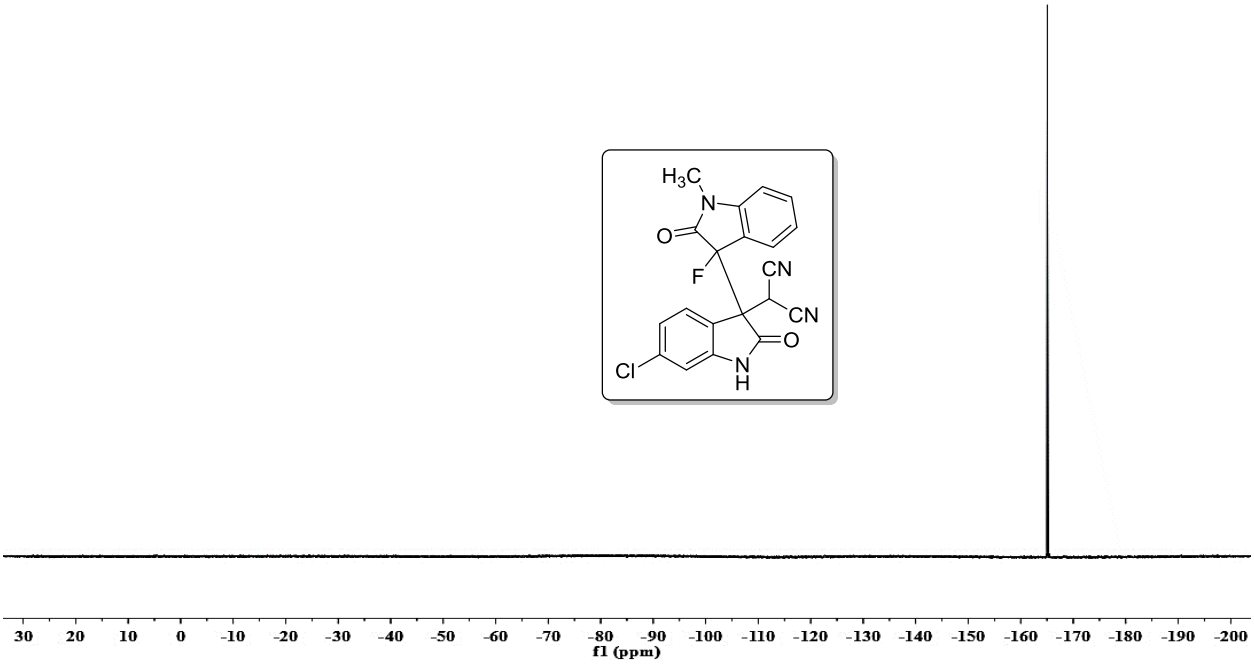
^{1}H NMR spectrum of 2-(6'-chloro-3-fluoro-1-methyl-2,2'-dioxo-[3,3'-biindolin]-3'-yl)malononitrile (10).



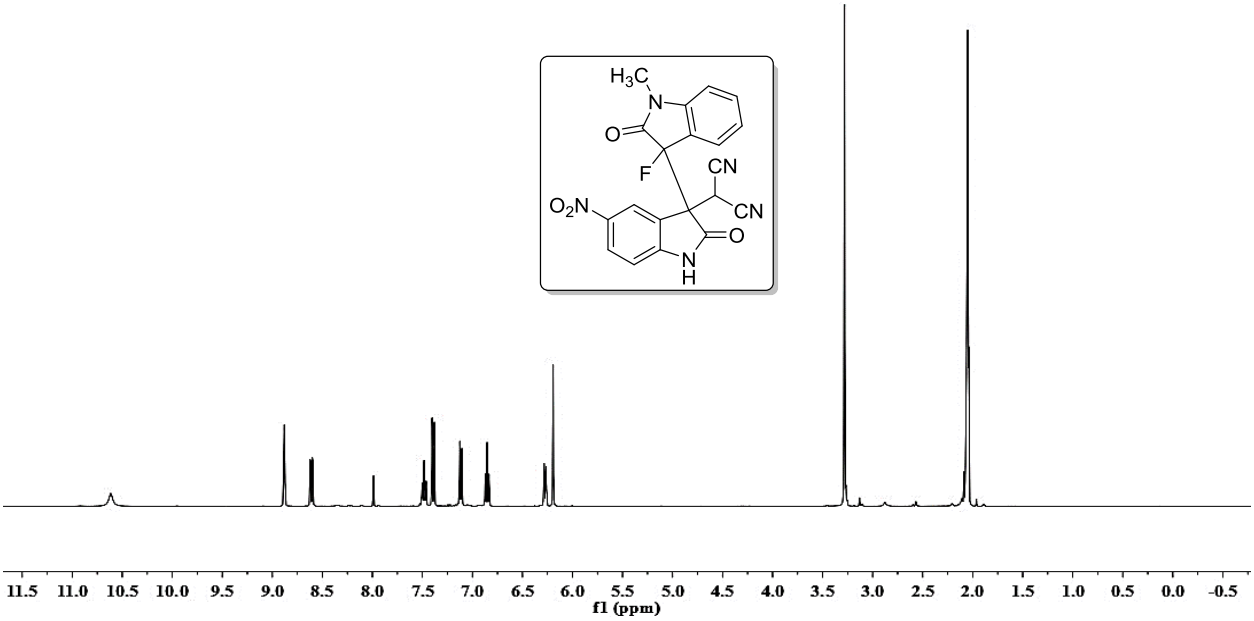
^{13}C NMR spectrum of 2-(6'-chloro-3-fluoro-1-methyl-2,2'-dioxo-[3,3'-biindolin]-3'-yl)malononitrile (10).



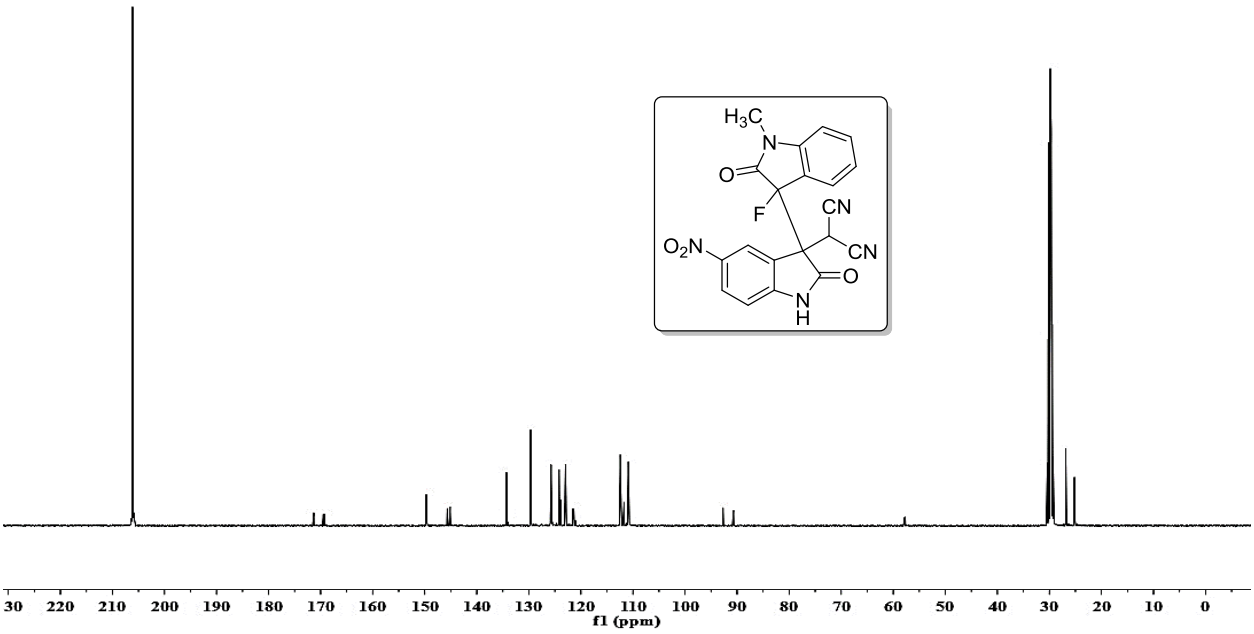
^{19}F NMR spectrum of 2-(6'-chloro-3-fluoro-1-methyl-2,2'-dioxo-[3,3'-biindolin]-3'-yl)malononitrile (10).



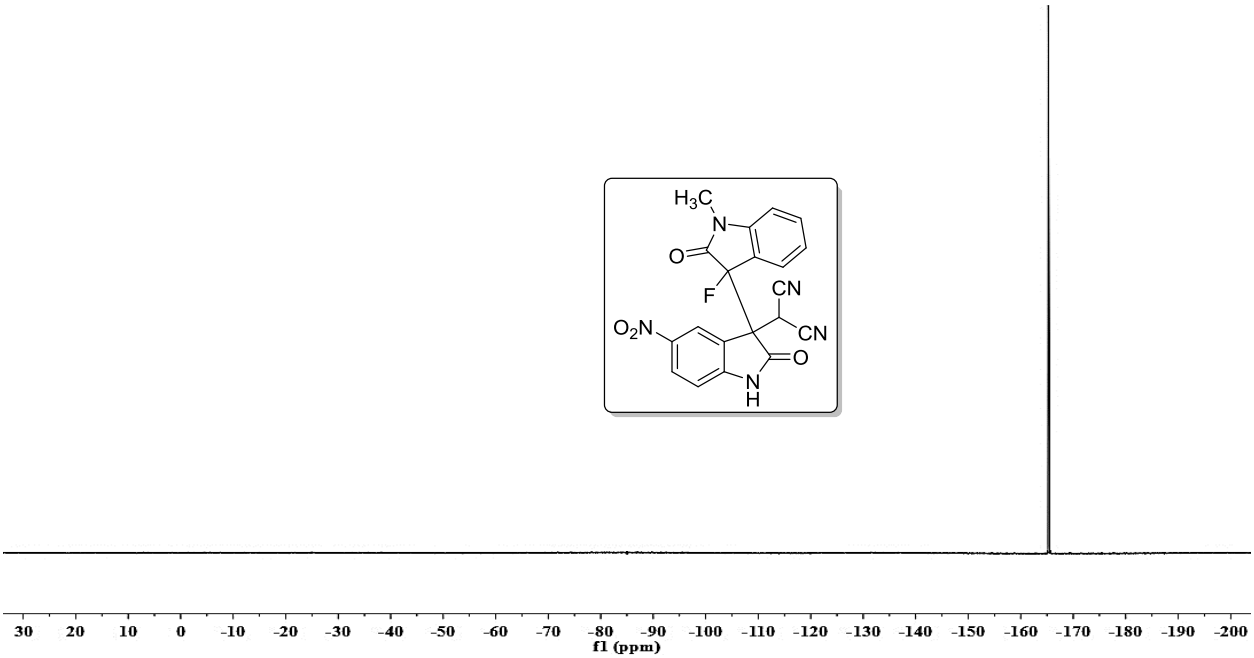
^{1}H NMR spectrum of 2-(3-fluoro-1-methyl-5'-nitro-2,2'-dioxo-[3,3'-biindolin]-3'-yl)malononitrile (11).



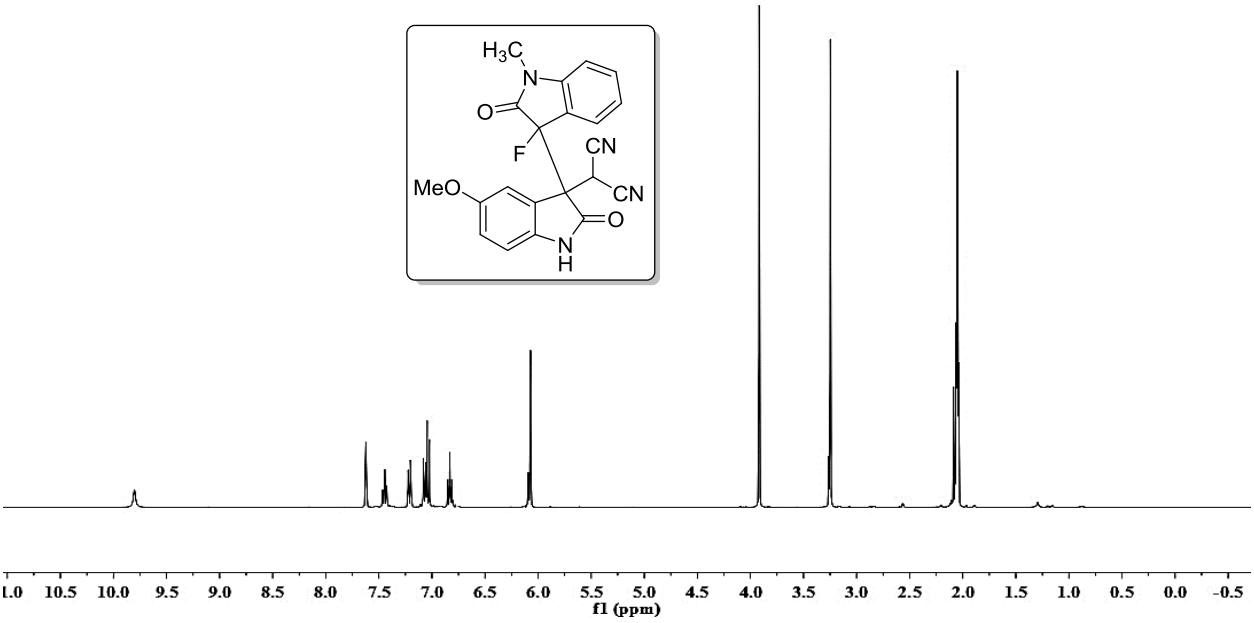
^{13}C NMR spectrum of 2-(3-fluoro-1-methyl-5'-nitro-2,2'-dioxo-[3,3'-biindolin]-3'-yl)malononitrile (11).



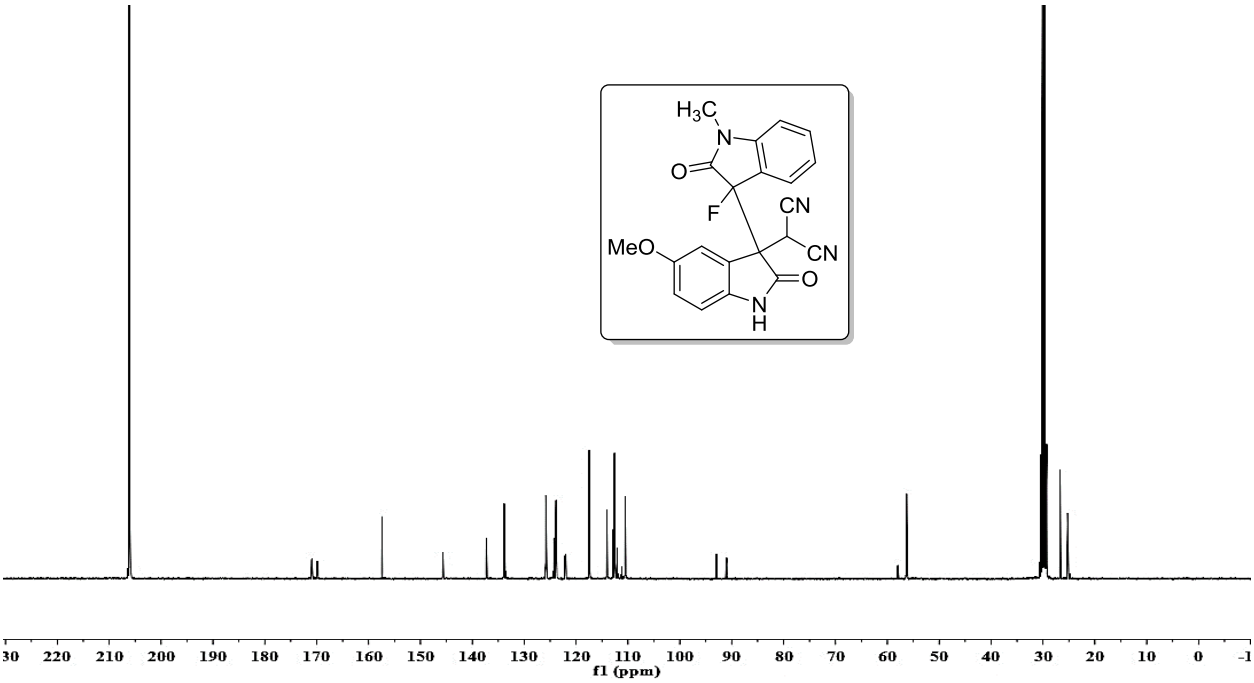
^{19}F NMR spectrum of 2-(3-fluoro-1-methyl-5'-nitro-2,2'-dioxo-[3,3'-biindolin]-3'-yl)malononitrile (11).



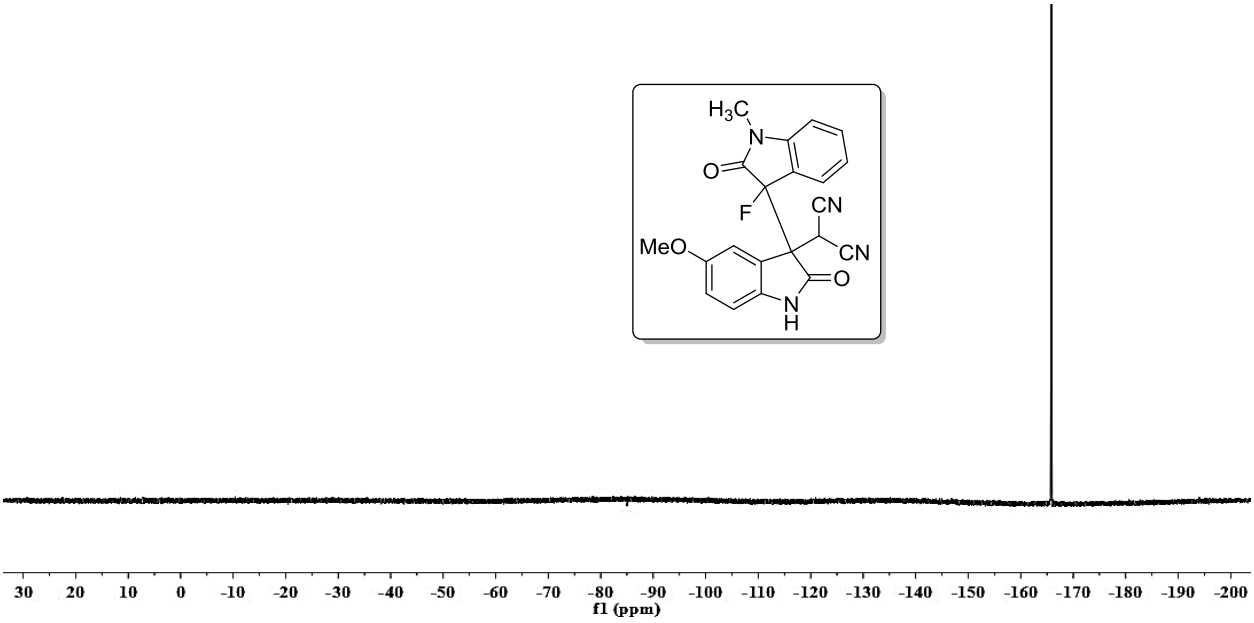
^{1}H NMR spectrum of 2-(3-fluoro-5'-methoxy-1-methyl-2,2'-dioxo-[3,3'-biindolin]-3'-yl)malononitrile (12).



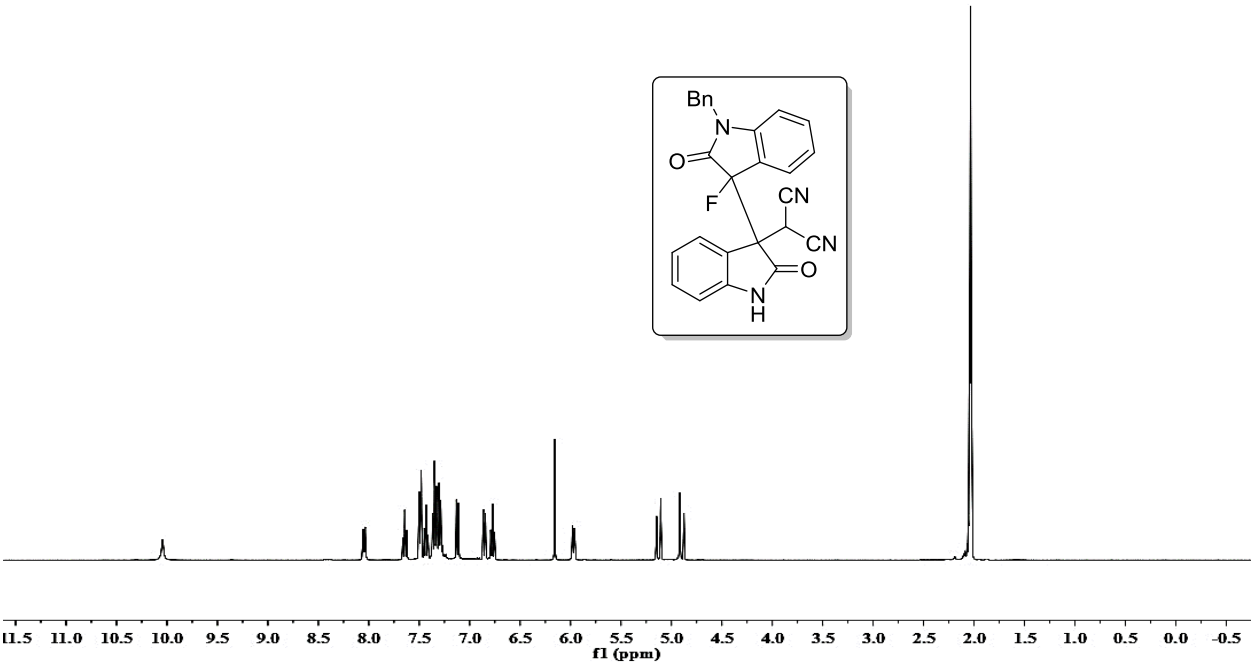
^{13}C NMR spectrum of 2-(3-fluoro-5'-methoxy-1-methyl-2,2'-dioxo-[3,3'-biindolin]-3'-yl)malononitrile (12).



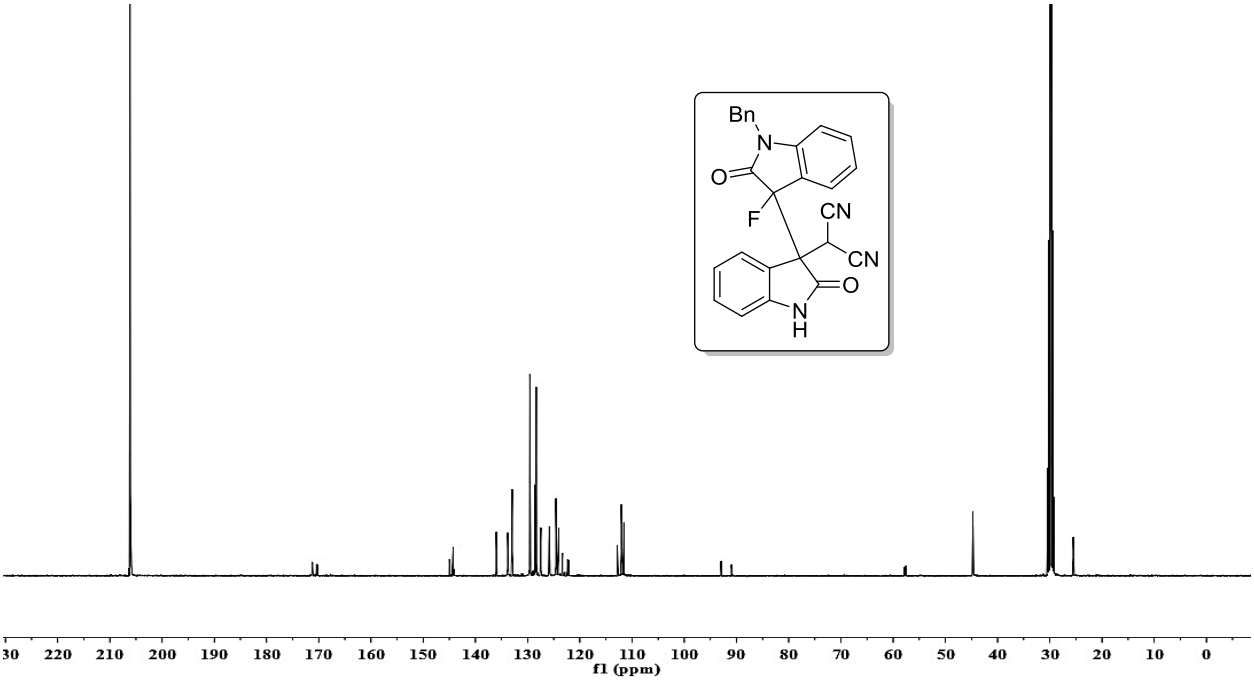
^{19}F NMR spectrum of 2-(3-fluoro-5'-methoxy-1-methyl-2,2'-dioxo-[3,3'-biindolin]-3'-yl)malononitrile (12).



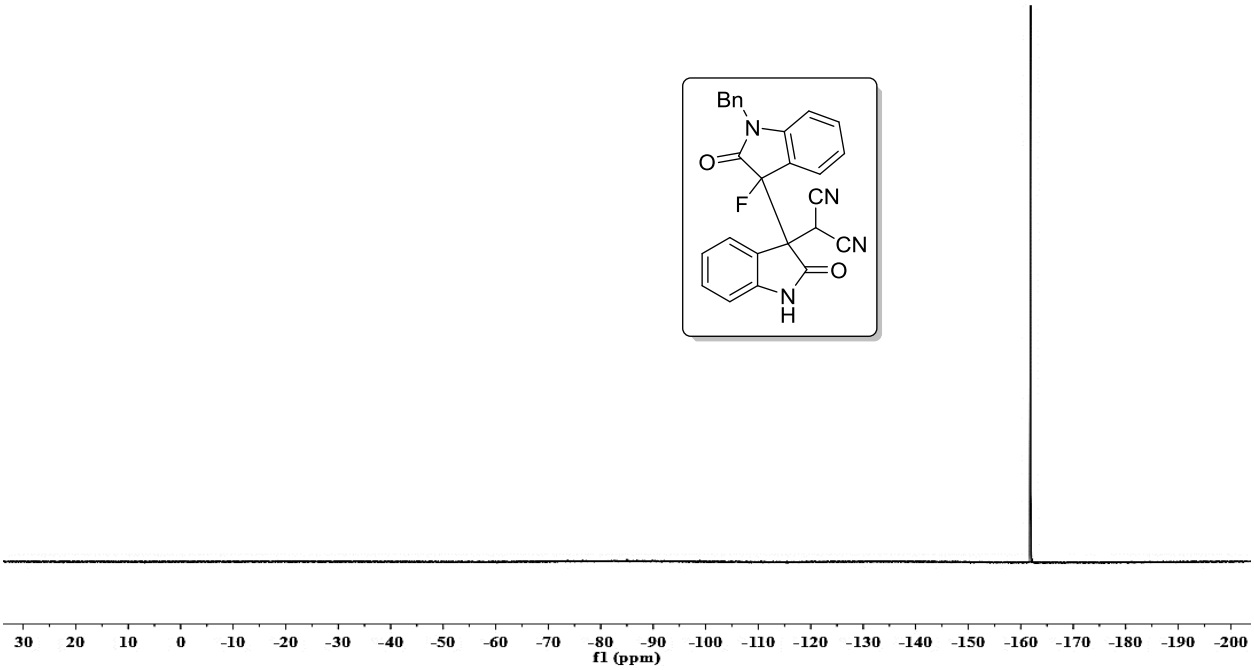
^{1}H NMR spectrum of 2-(1-benzyl-3-fluoro-2,2'-dioxo-[3,3'-biindolin]-3'-yl)malononitrile (13).



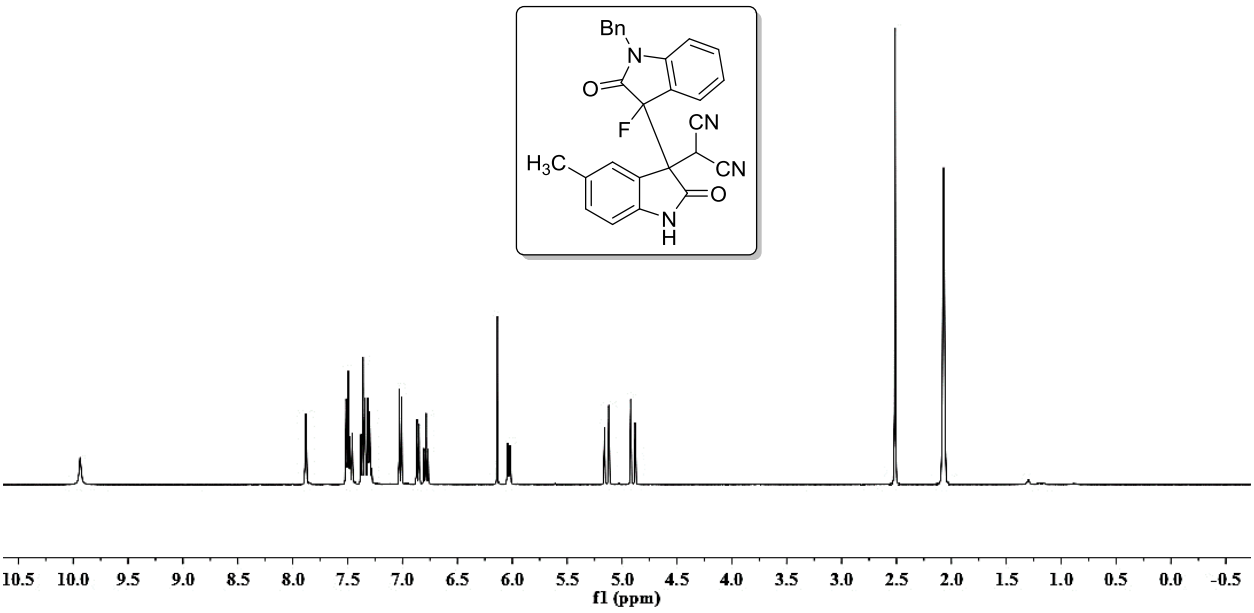
^{13}C NMR spectrum of 2-(1-benzyl-3-fluoro-2,2'-dioxo-[3,3'-biindolin]-3'-yl)malononitrile (13).



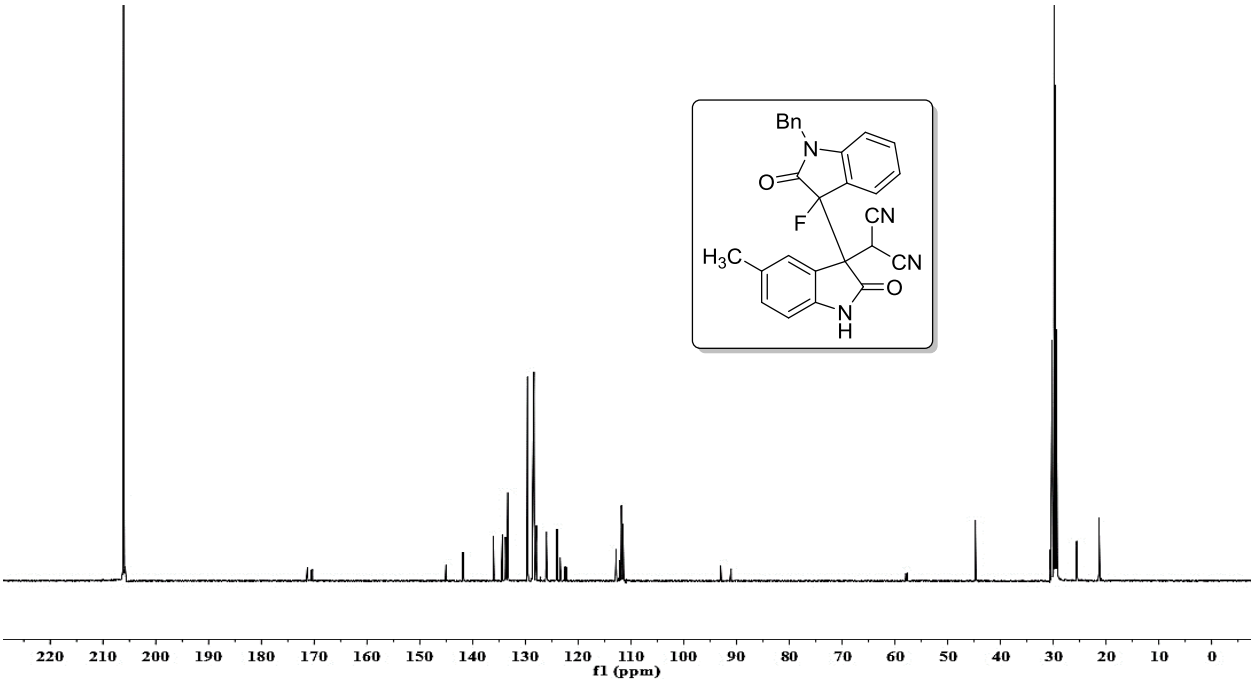
^{19}F NMR spectrum of 2-(1-benzyl-3-fluoro-2,2'-dioxo-[3,3'-biindolin]-3'-yl)malononitrile (13).



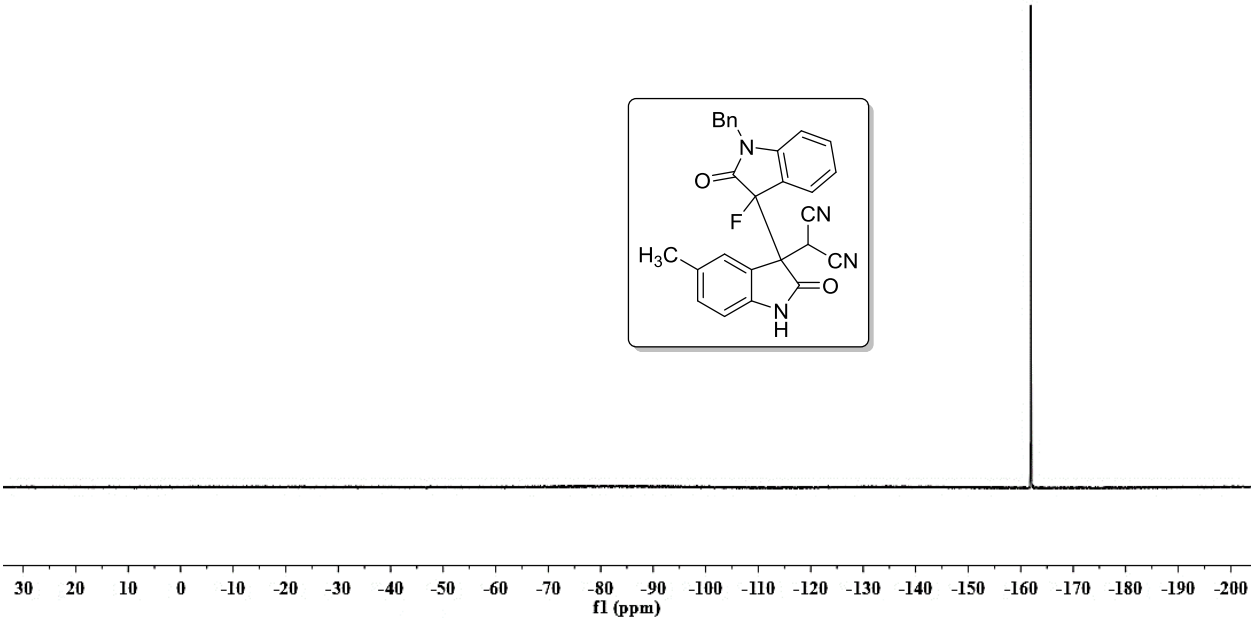
^{1}H NMR spectrum of 2-(1-benzyl-3-fluoro-5'-methyl-2,2'-dioxo-[3,3'-biindolin]-3'-yl)malononitrile (14).



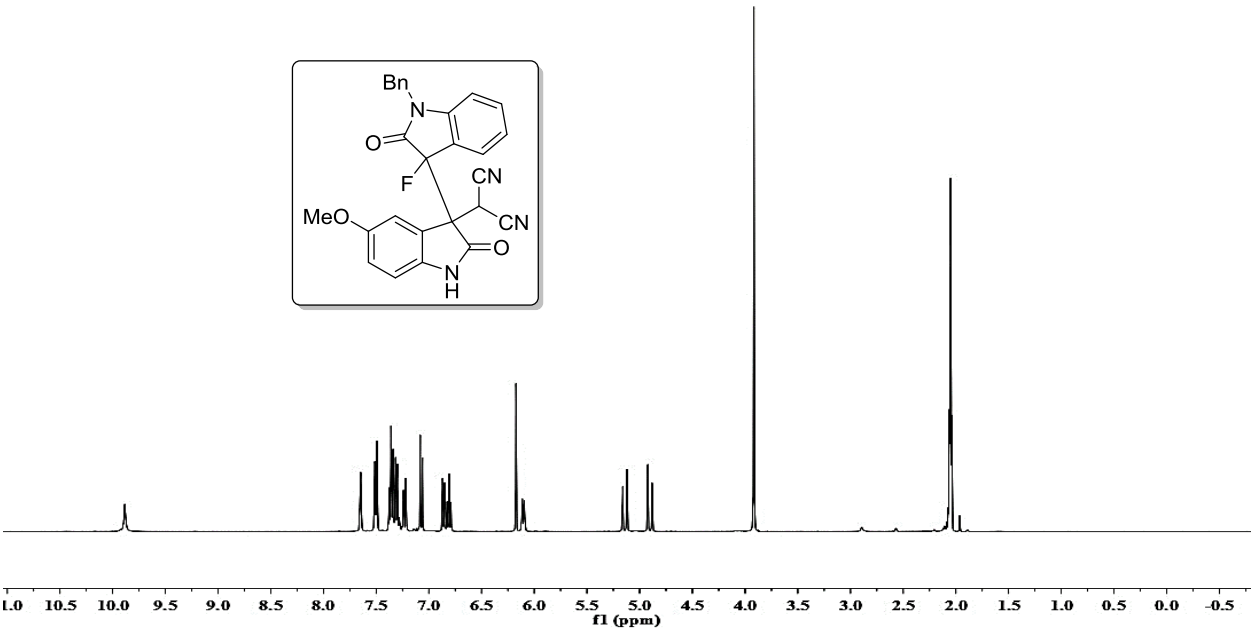
^{13}C NMR spectrum of 2-(1-benzyl-3-fluoro-5'-methyl-2,2'-dioxo-[3,3'-biindolin]-3'-yl)malononitrile (14).



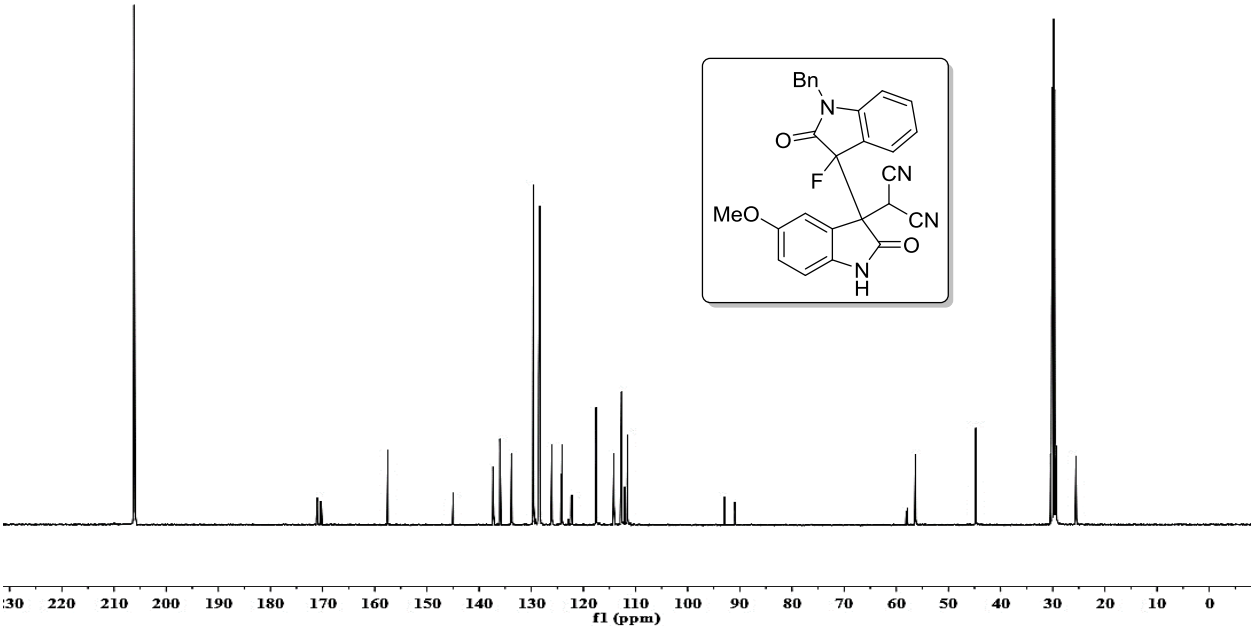
^{19}F NMR spectrum of 2-(1-benzyl-3-fluoro-5'-methyl-2,2'-dioxo-[3,3'-biindolin]-3'-yl)malononitrile (14).



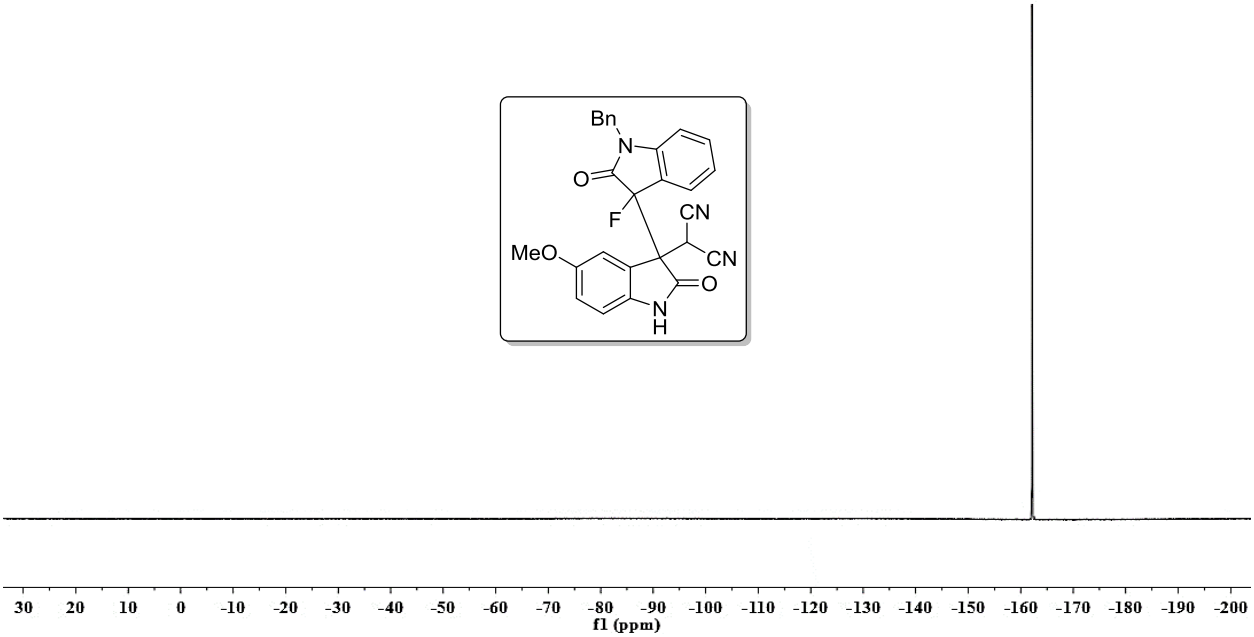
^{1}H NMR spectrum of 2-(1-benzyl-3-fluoro-5'-methoxy-2,2'-dioxo-[3,3'-biindolin]-3'-yl)malononitrile (15).



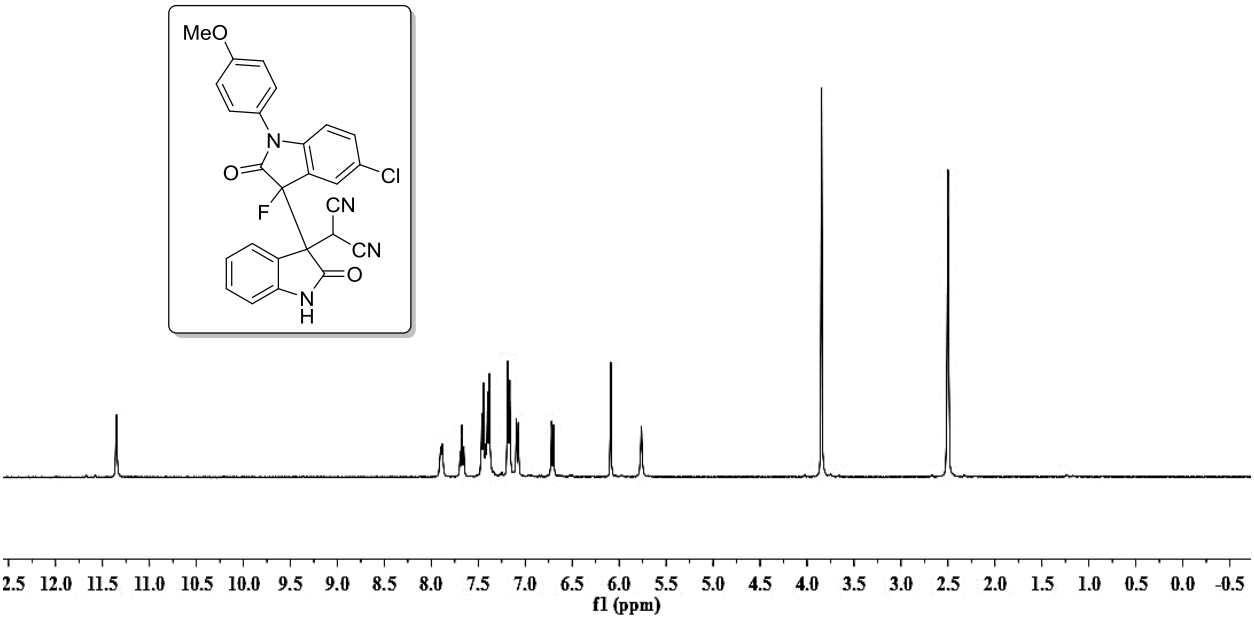
^{13}C NMR spectrum of 2-(1-benzyl-3-fluoro-5'-methoxy-2,2'-dioxo-[3,3'-biindolin]-3'-yl)malononitrile (15).



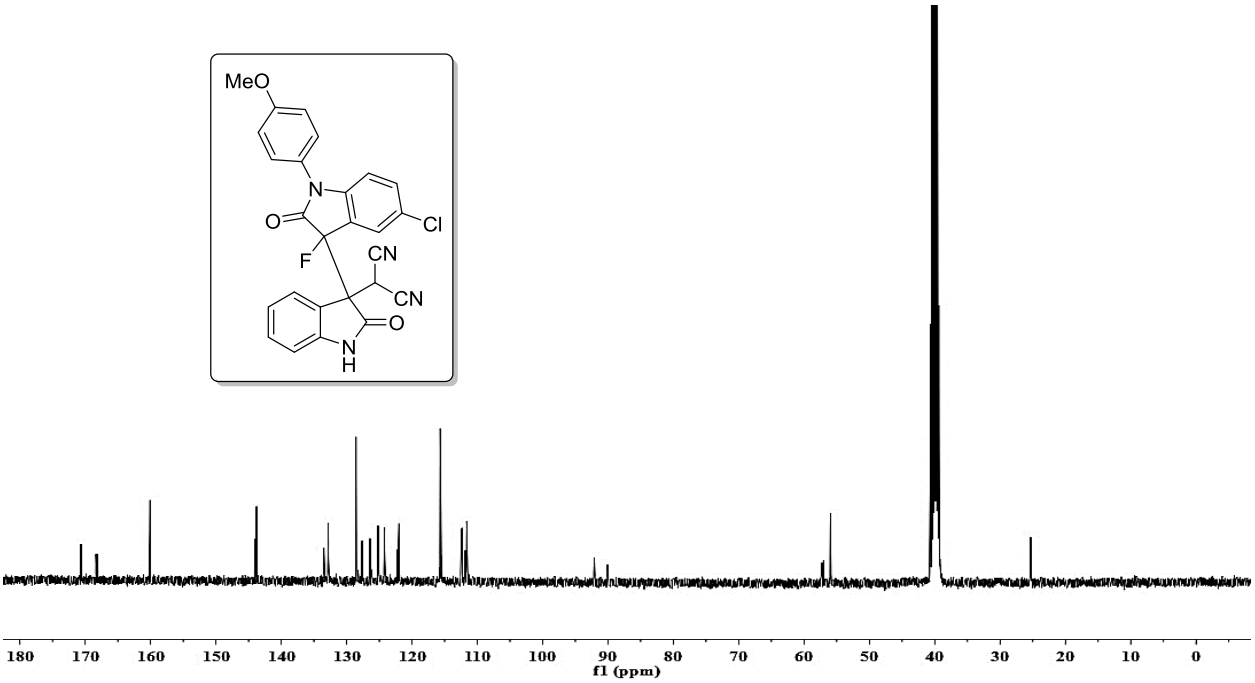
^{19}F NMR spectrum of 2-(1-benzyl-3-fluoro-5'-methoxy-2,2'-dioxo-[3,3'-biindolin]-3'-yl)malononitrile (15).



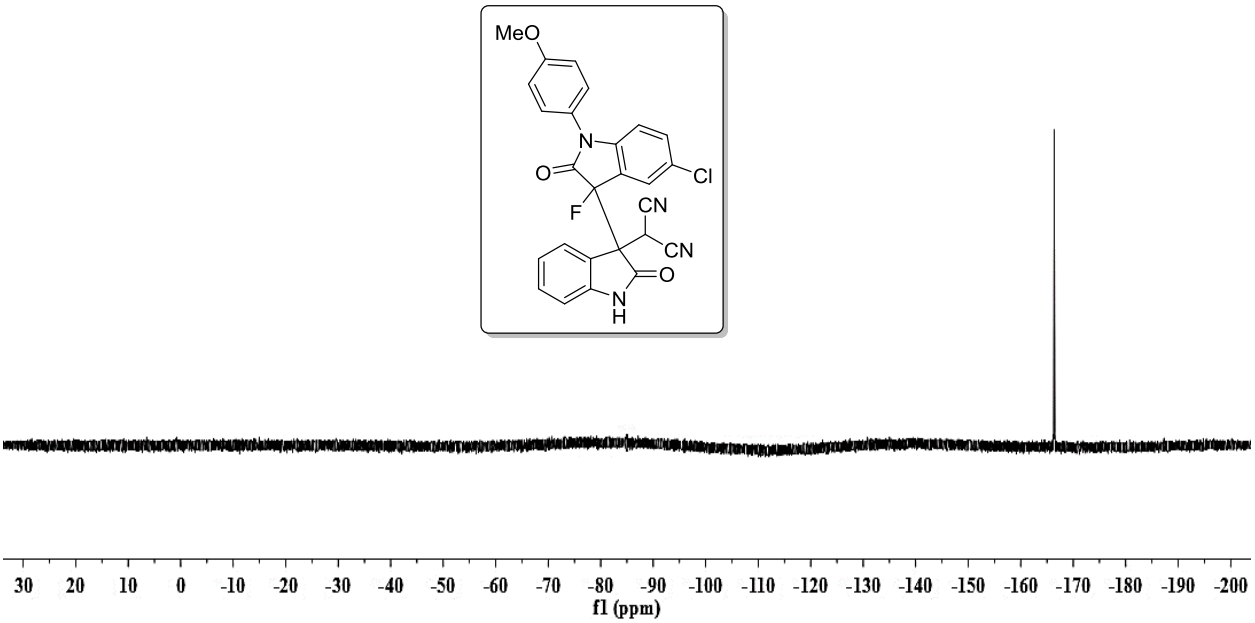
^{1}H NMR spectrum of 2-(5-chloro-3-fluoro-1-(4-methoxyphenyl)-2,2'-dioxo-[3,3'-biindolin]-3'-yl)malononitrile (16).



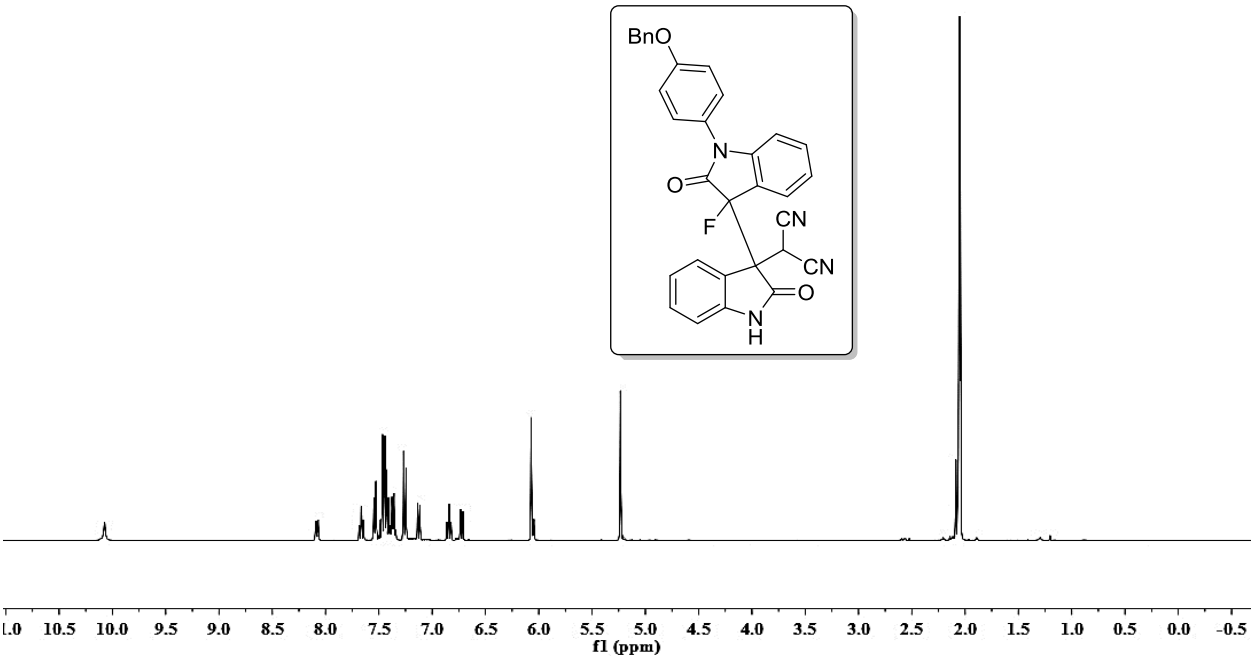
^{13}C NMR spectrum of 2-(5-chloro-3-fluoro-1-(4-methoxyphenyl)-2,2'-dioxo-[3,3'-biindolin]-3'-yl)malononitrile (16).



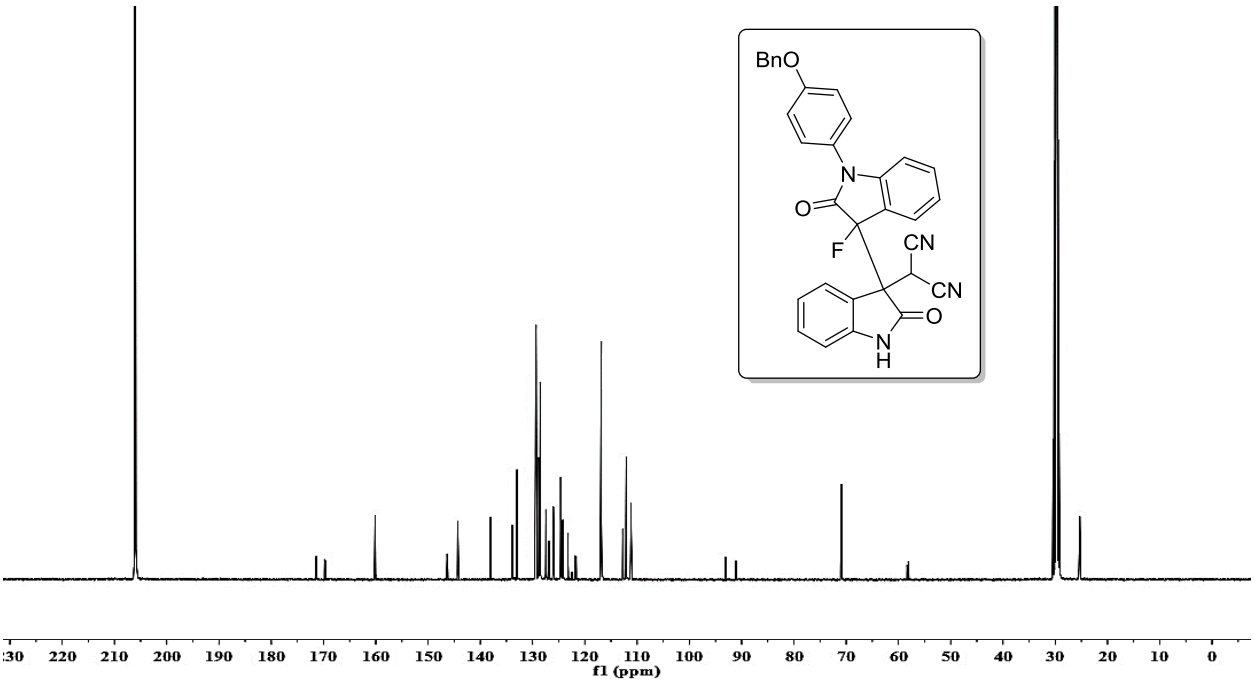
^{19}F NMR spectrum of 2-(5-chloro-3-fluoro-1-(4-methoxyphenyl)-2,2'-dioxo-[3,3'-biindolin]-3'-yl)malononitrile (16).



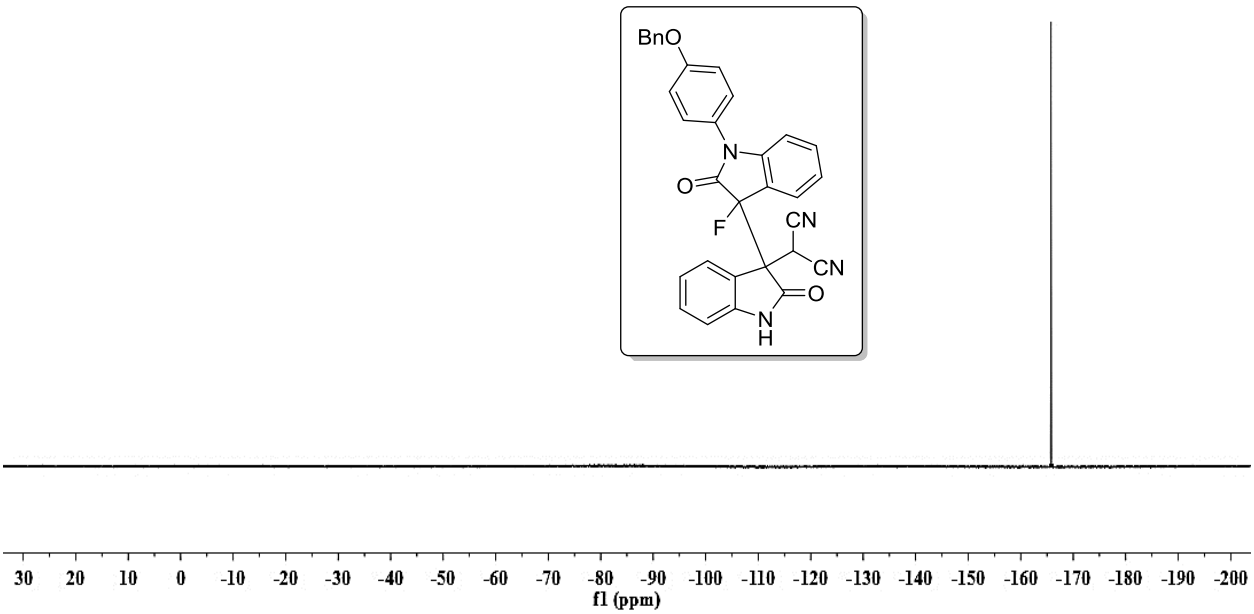
^{1}H NMR spectrum of 2-(1-(4-(benzyloxy)phenyl)-3-fluoro-2,2'-dioxo-[3,3'-biindolin]-3'-yl)malononitrile (17).



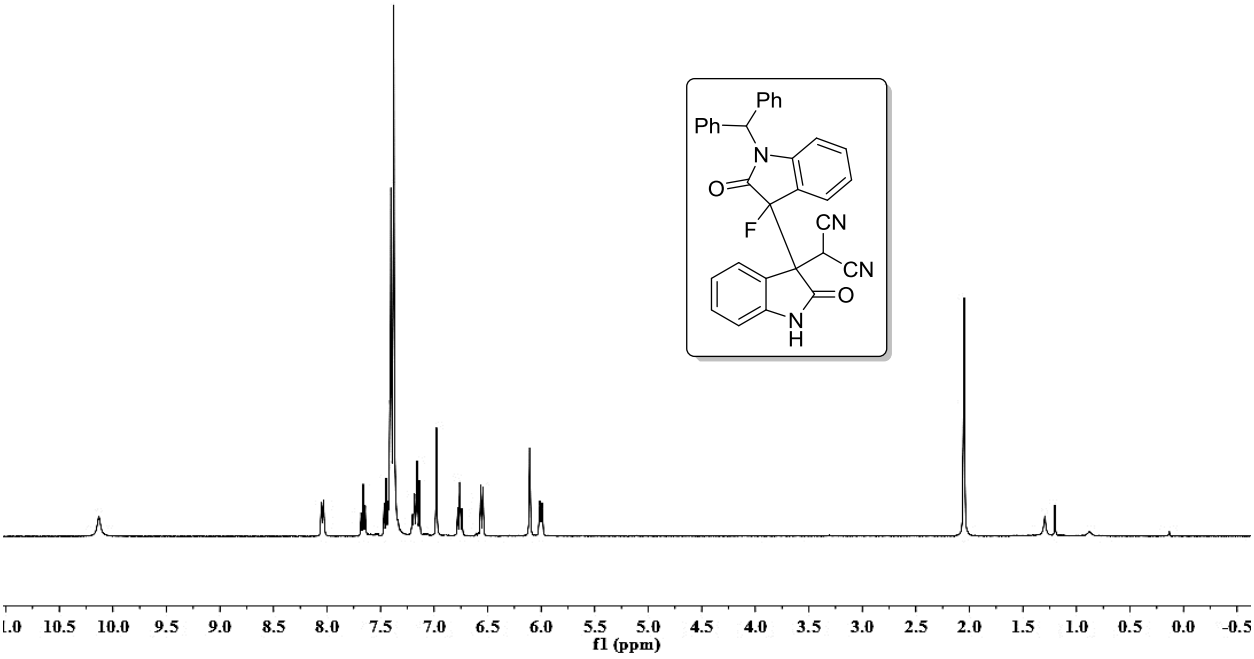
^{13}C NMR spectrum of 2-(1-(4-(benzyloxy)phenyl)-3-fluoro-2,2'-dioxo-[3,3'-biindolin]-3'-yl)malononitrile (17).



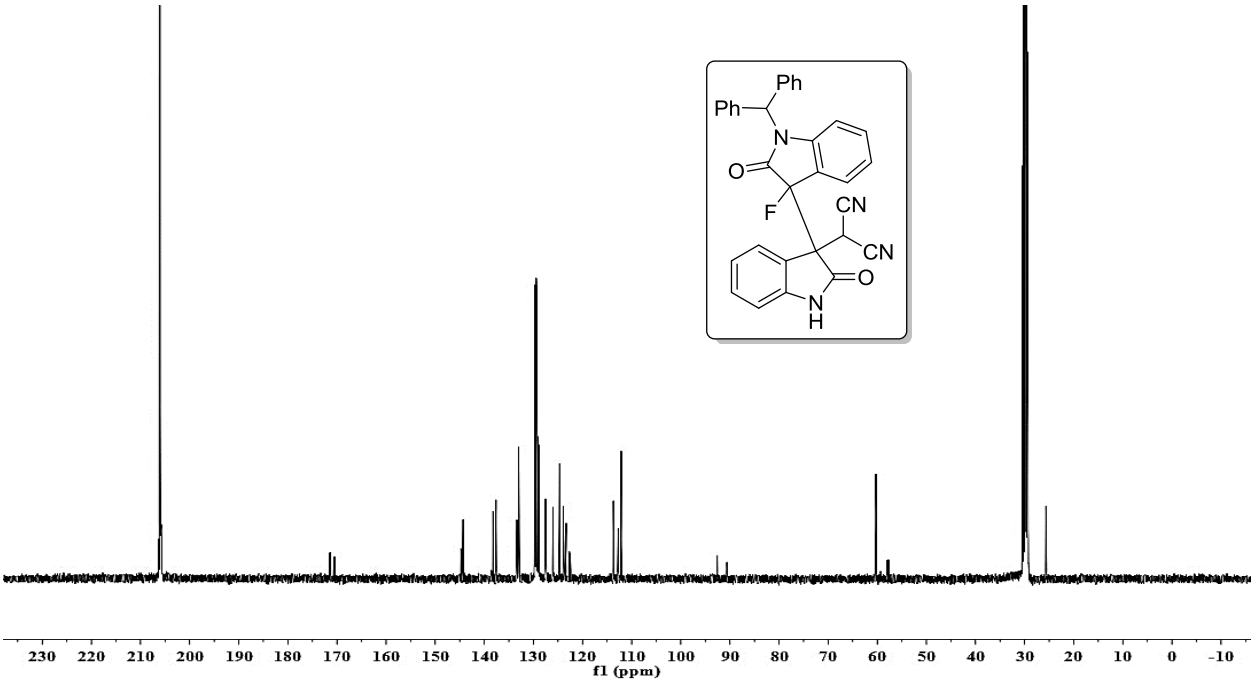
^{19}F NMR spectrum of 2-(1-(4-(benzyloxy)phenyl)-3-fluoro-2,2'-dioxo-[3,3'-biindolin]-3'-yl)malononitrile (17).



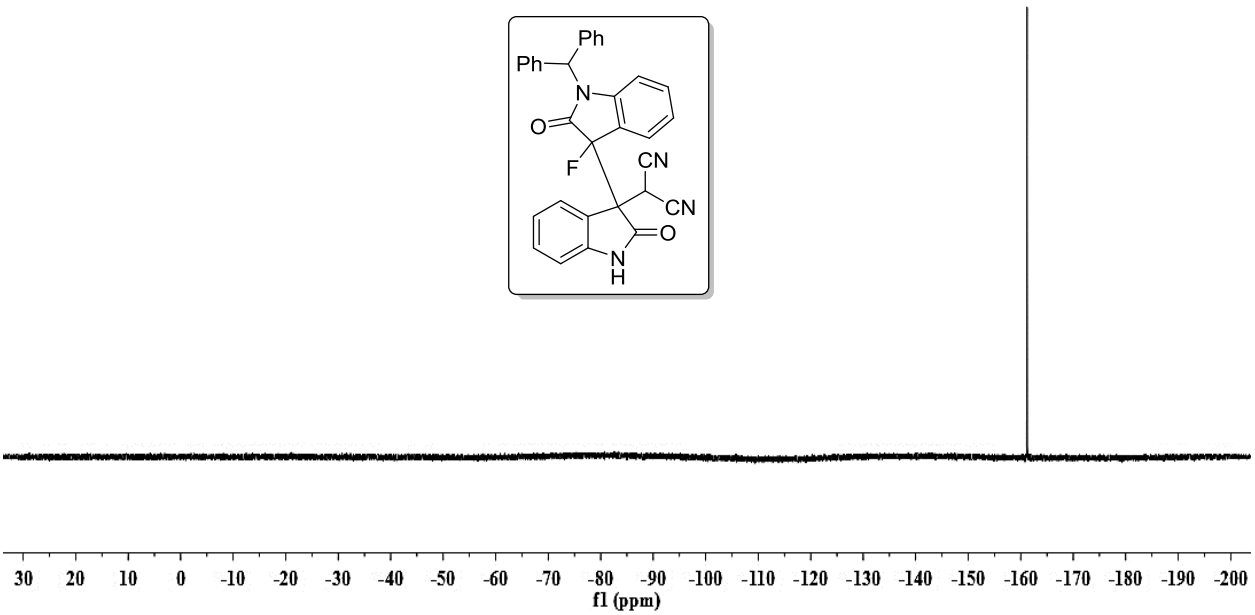
^{1}H NMR spectrum of 2-(1-benzhydryl-3-fluoro-2,2'-dioxo-[3,3'-biindolin]-3'-yl)malononitrile (18).



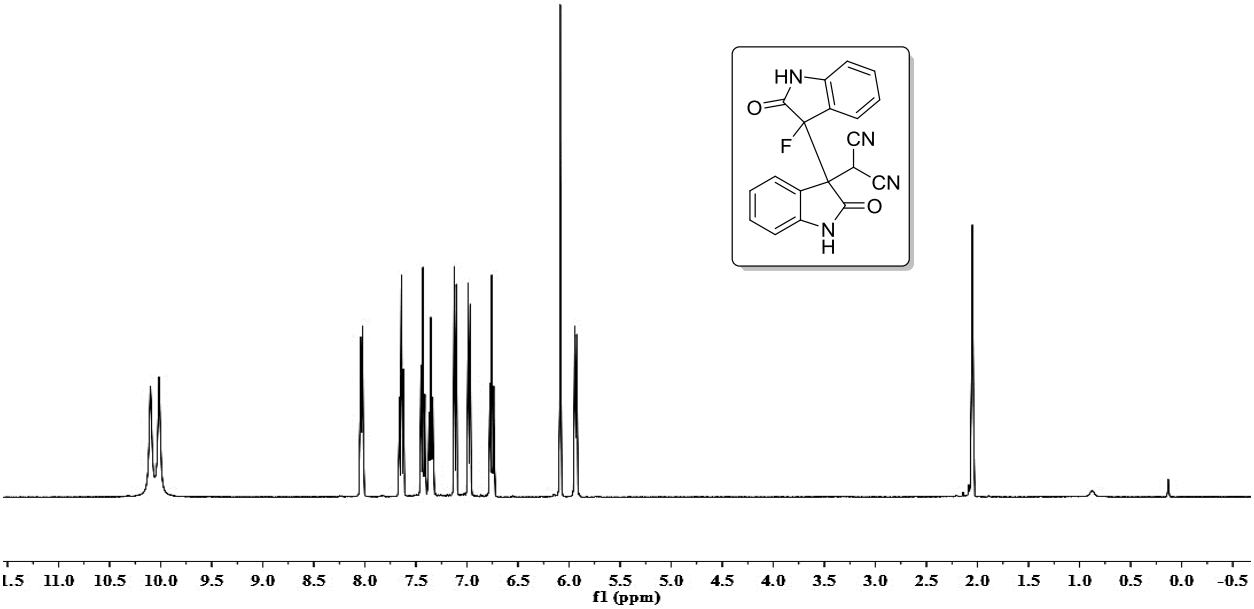
^{13}C NMR spectrum of 2-(1-benzhydryl-3-fluoro-2,2'-dioxo-[3,3'-biindolin]-3'-yl)malononitrile (18).



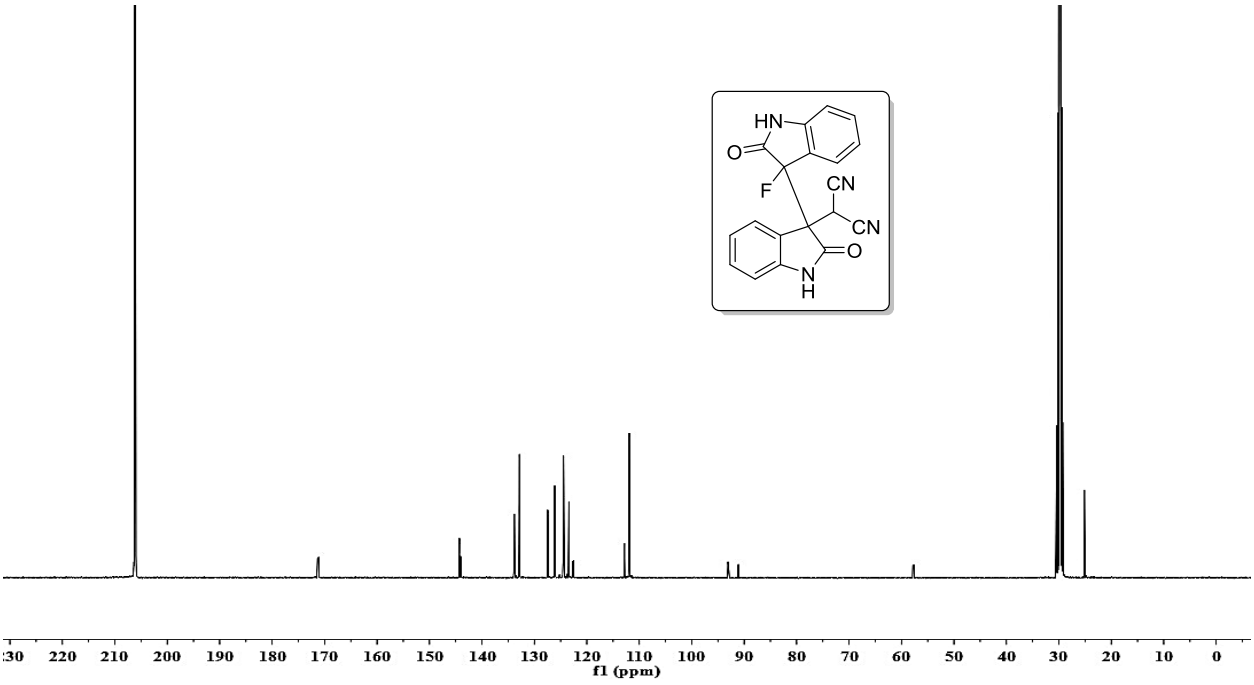
^{19}F NMR spectrum of 2-(1-benzhydryl-3-fluoro-2,2'-dioxo-[3,3'-biindolin]-3'-yl)malononitrile (18).



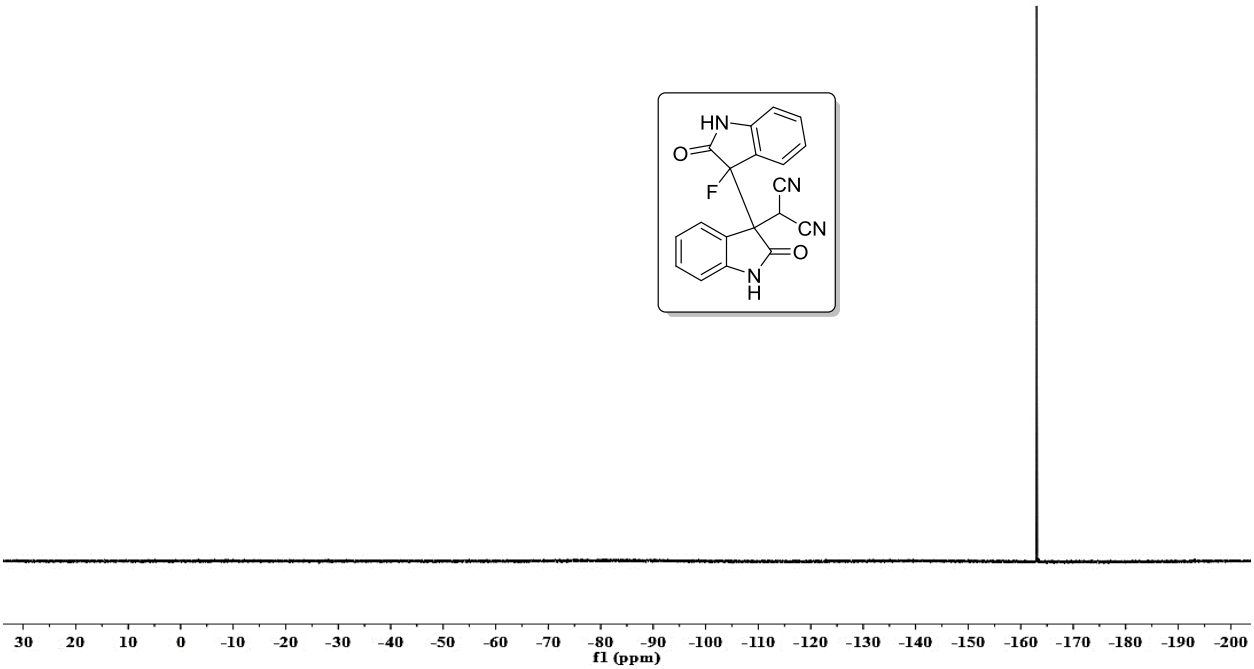
^{1}H NMR spectrum of 2-(3-fluoro-2,2'-dioxo-[3,3'-biindolin]-3'-yl)malononitrile (19).



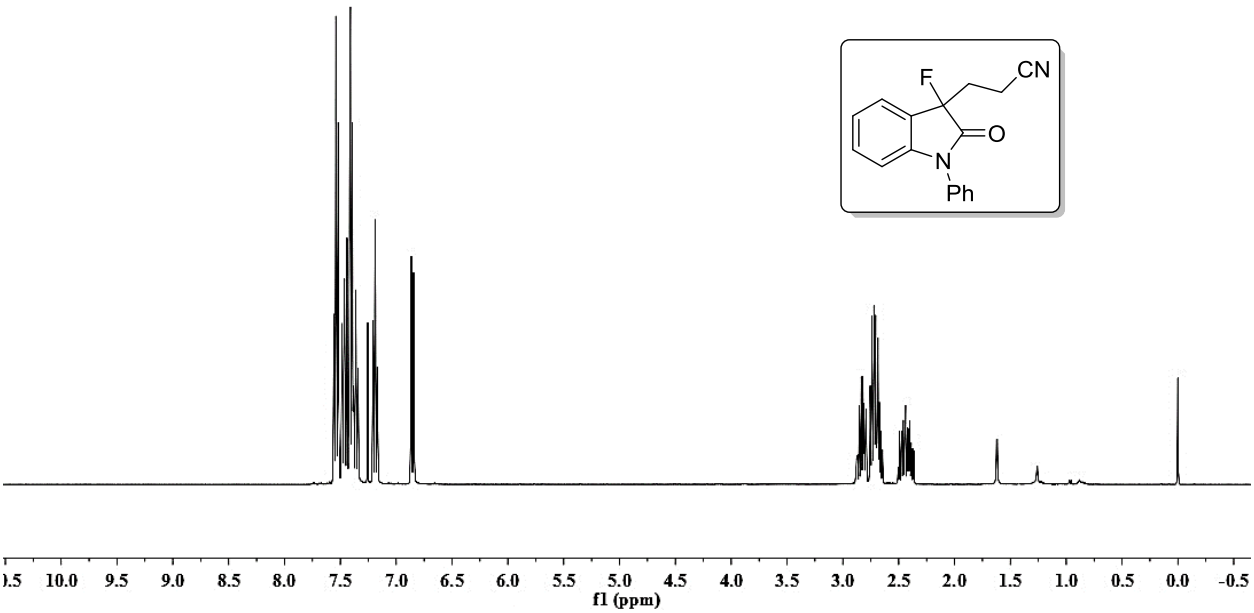
^{13}C NMR spectrum of 2-(3-fluoro-2,2'-dioxo-[3,3'-biindolin]-3'-yl)malononitrile (19).



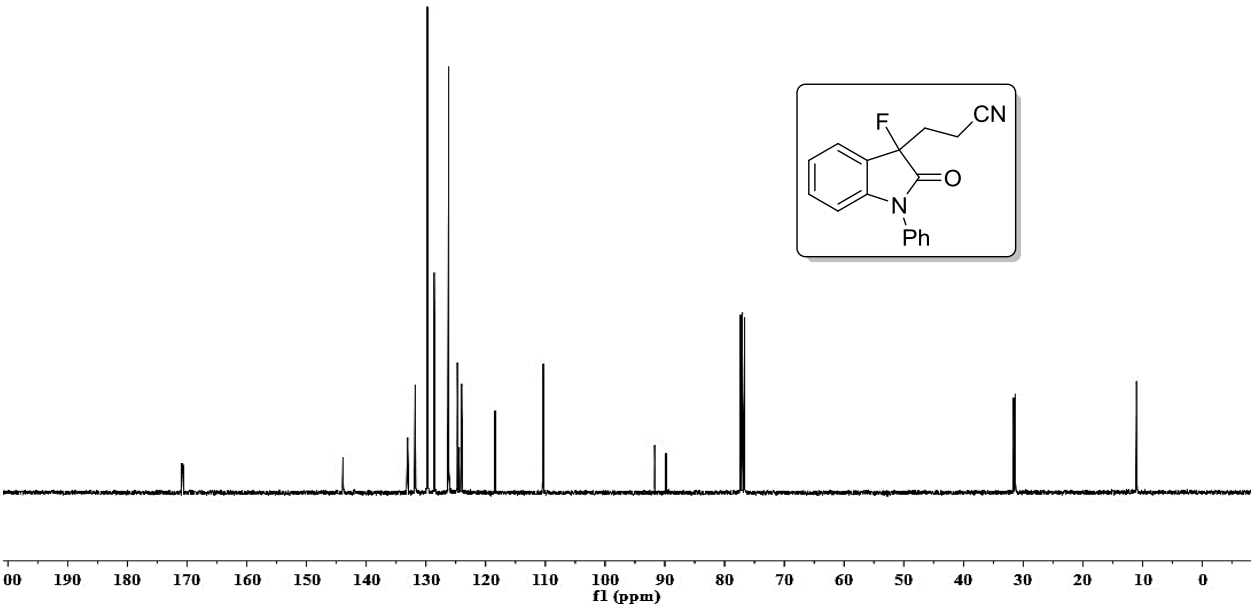
^{19}F NMR spectrum of 2-(3-fluoro-2,2'-dioxo-[3,3'-biindolin]-3'-yl)malononitrile (19).



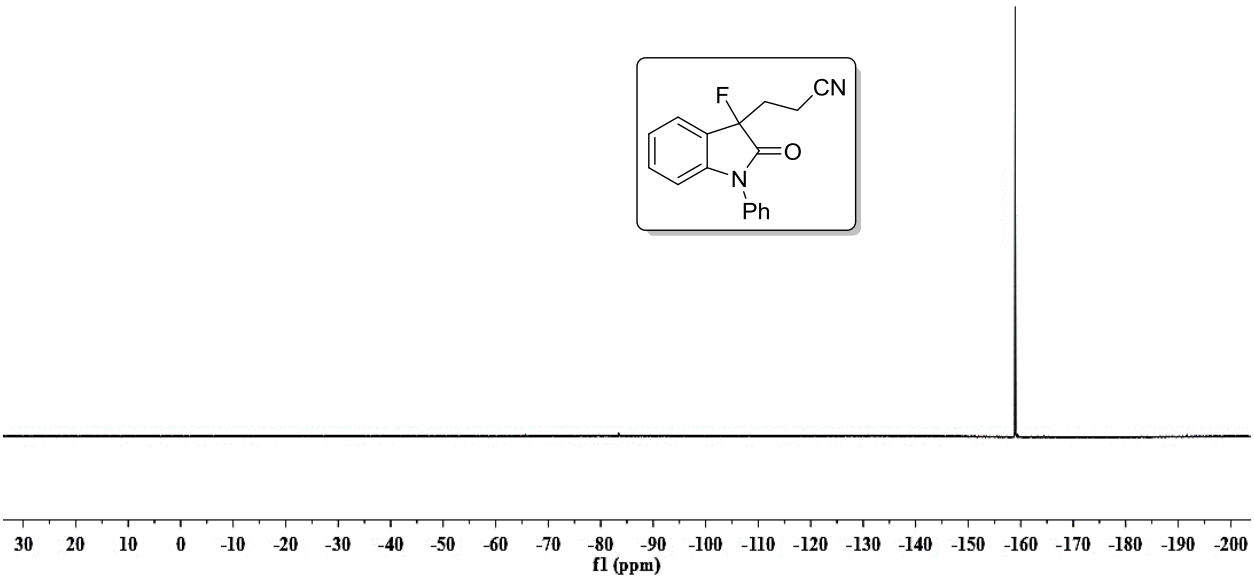
^{1}H NMR spectrum of 3-(3-fluoro-2-oxo-1-phenylindolin-3-yl)propanenitrile (20).



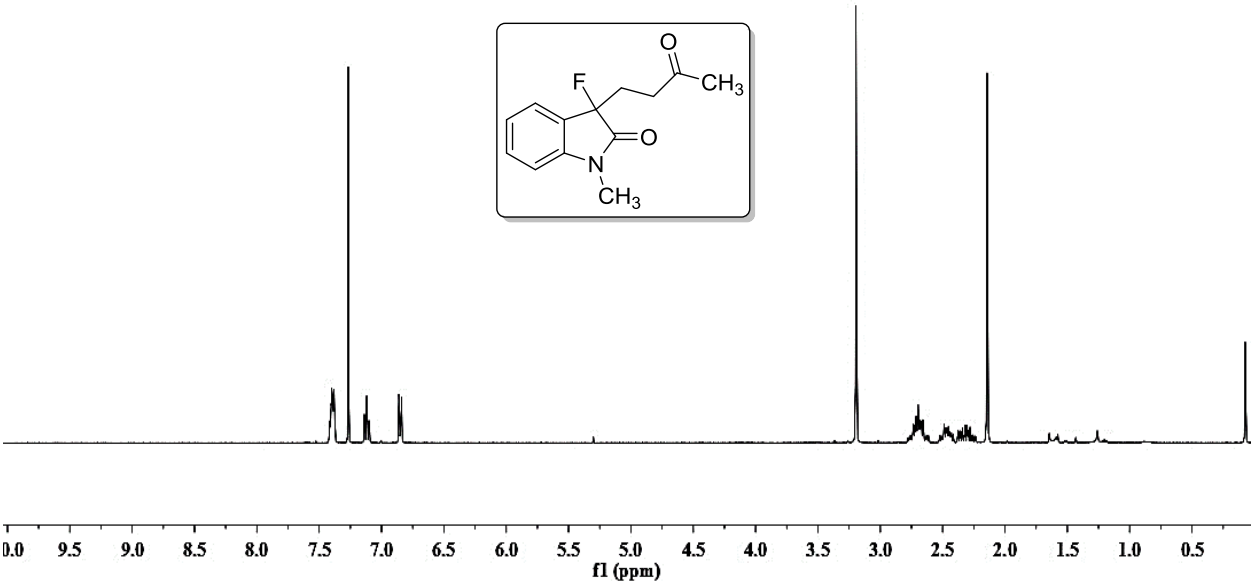
^{13}C NMR spectrum of 3-(3-fluoro-2-oxo-1-phenylindolin-3-yl)propanenitrile (20).



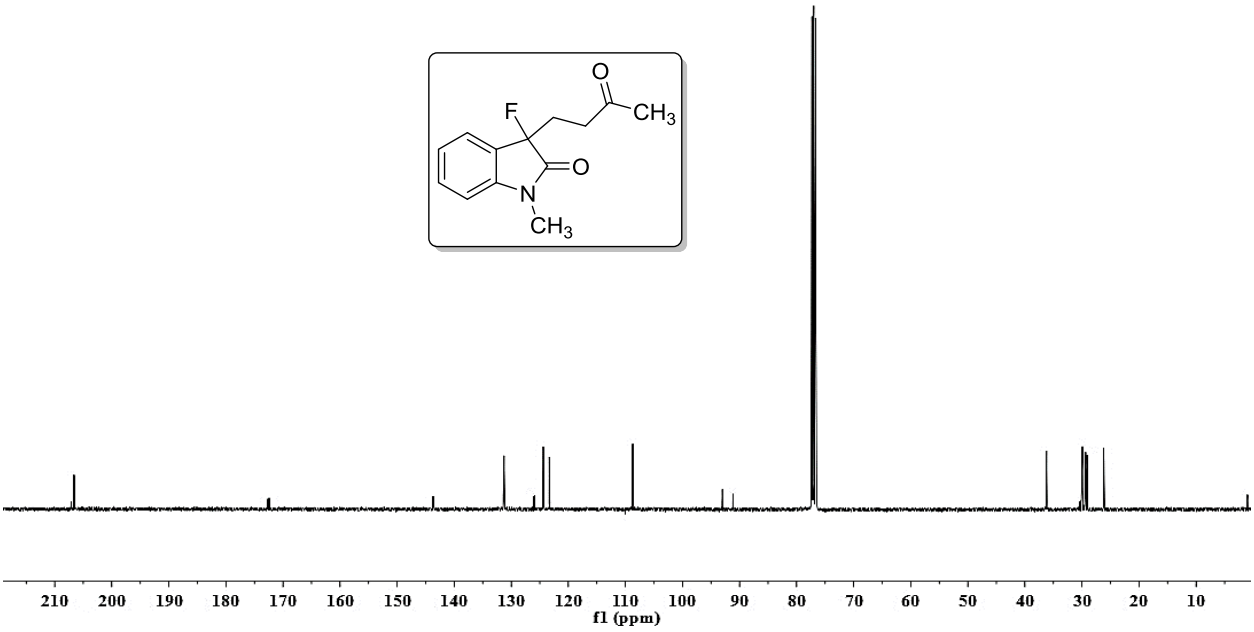
^{19}F NMR spectrum of 3-(3-fluoro-2-oxo-1-phenylindolin-3-yl)propanenitrile (20).



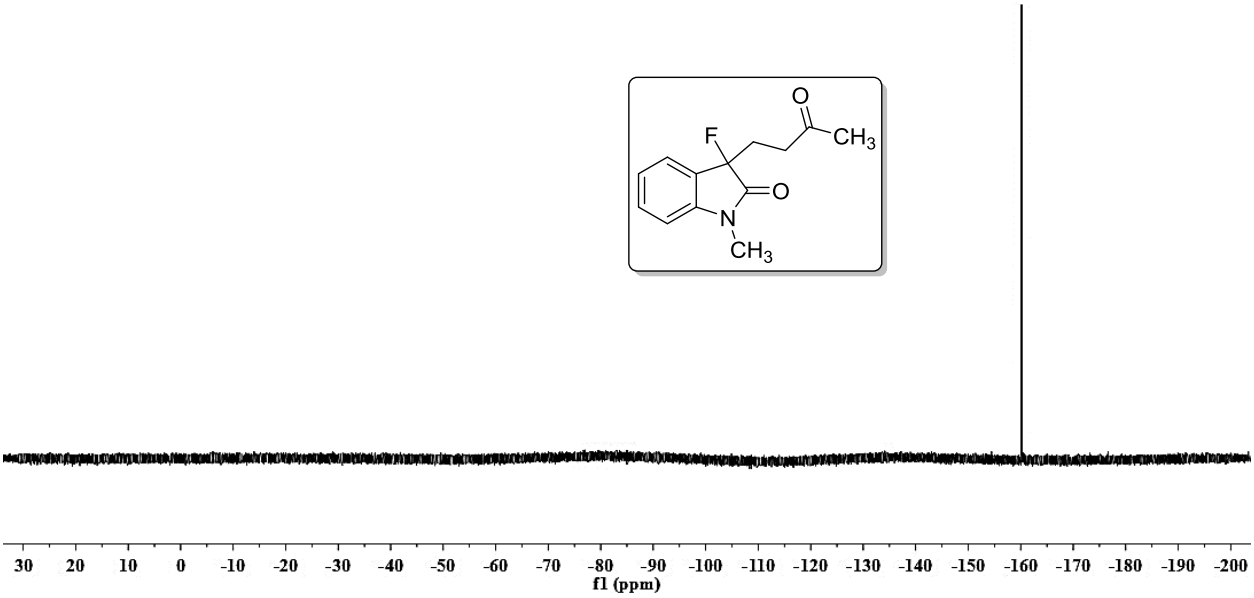
^{1}H NMR spectrum of 3-fluoro-1-methyl-3-(3-oxobutyl)indolin-2-one (21).



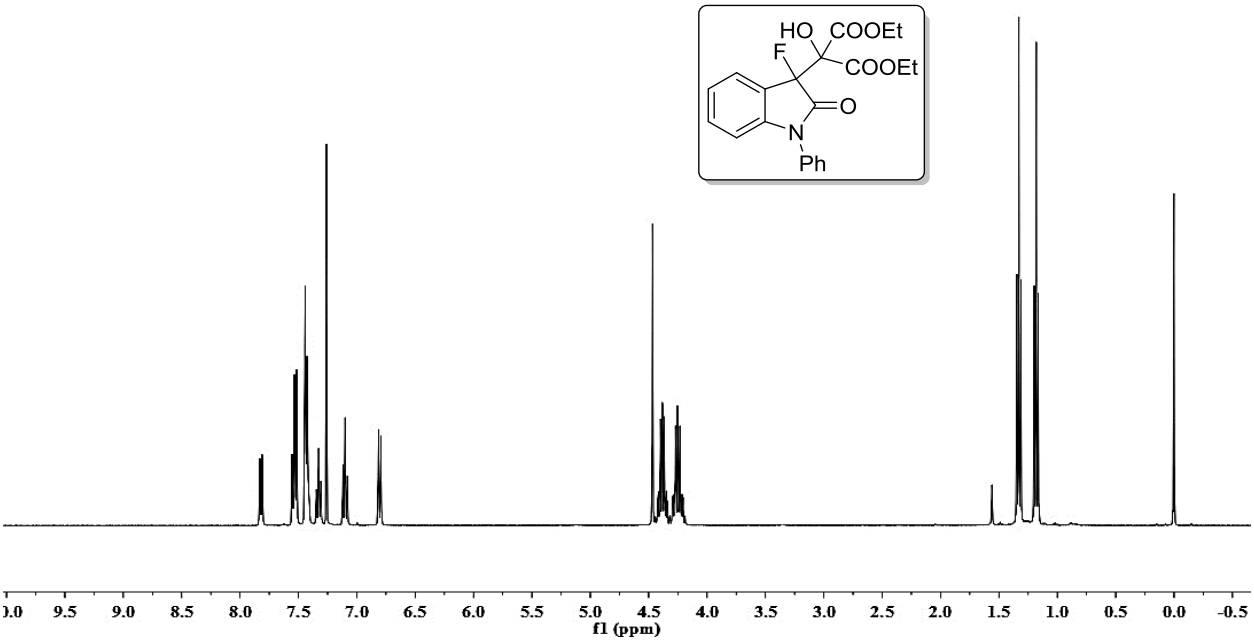
^{13}C NMR spectrum of 3-fluoro-1-methyl-3-(3-oxobutyl)indolin-2-one (21).



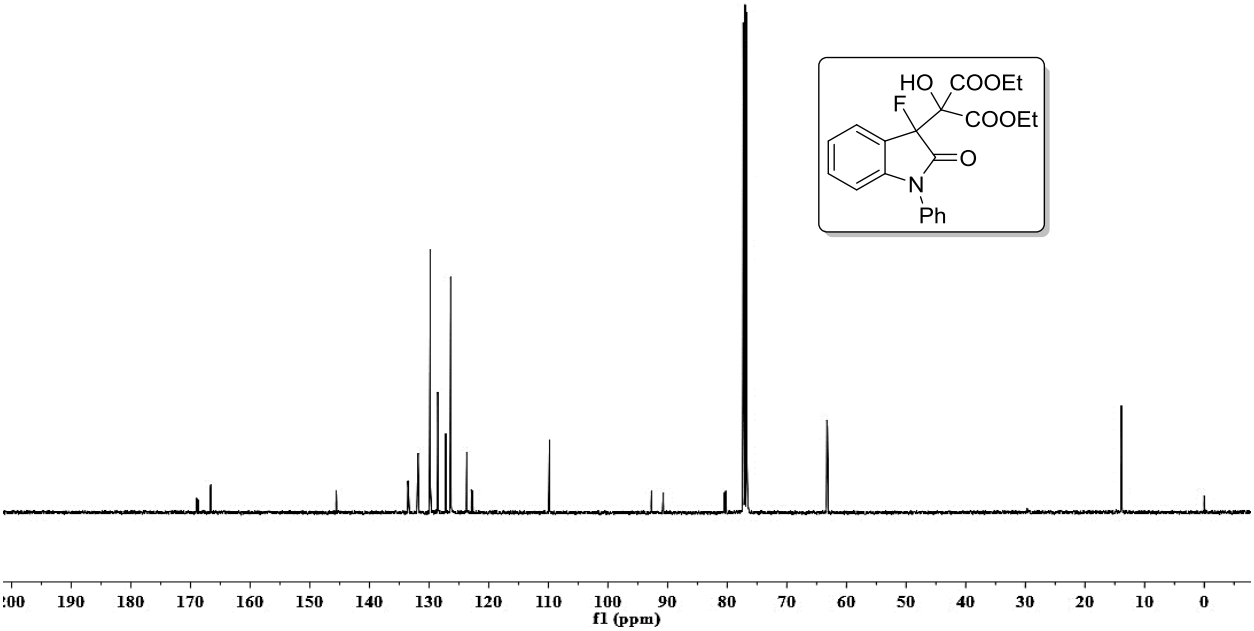
^{19}F NMR spectrum of 3-fluoro-1-methyl-3-(3-oxobutyl)indolin-2-one (21).



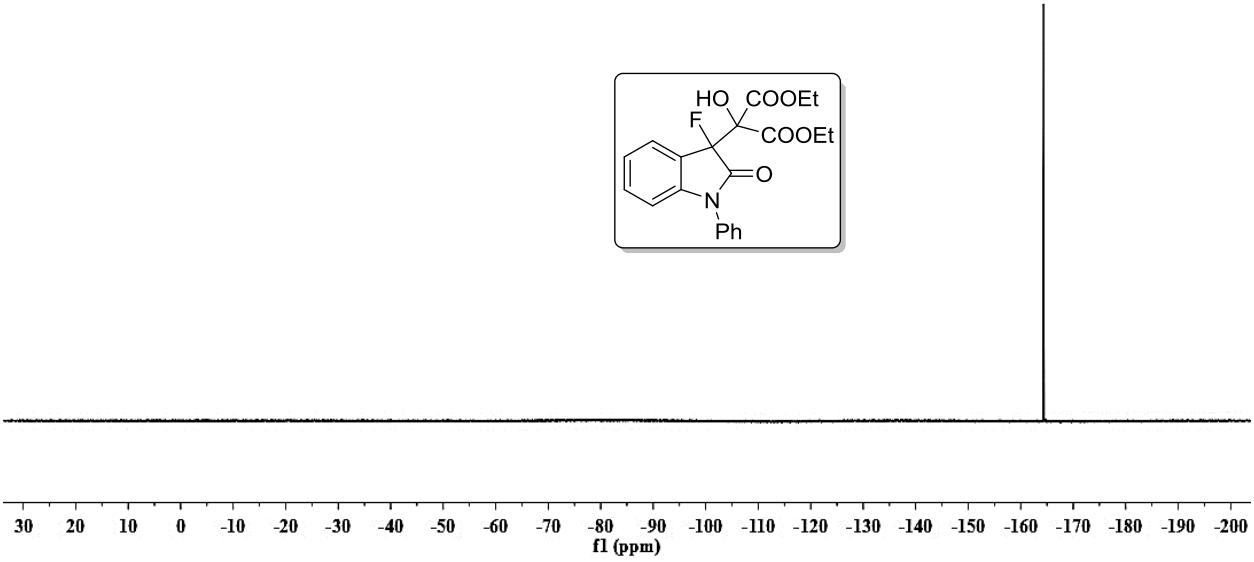
^{1}H NMR spectrum of diethyl 2-(3-fluoro-2-oxo-1-phenylindolin-3-yl)-2-hydroxymalonate (22).



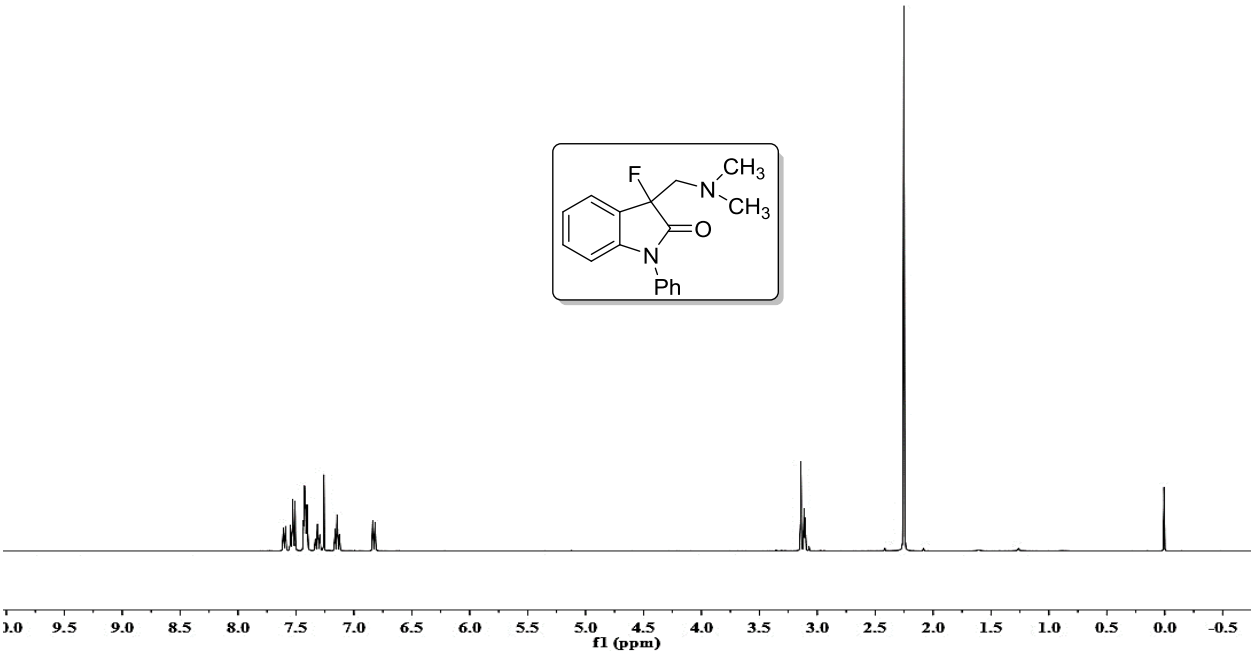
^{13}C NMR spectrum of diethyl 2-(3-fluoro-2-oxo-1-phenylindolin-3-yl)-2-hydroxymalonate (22).



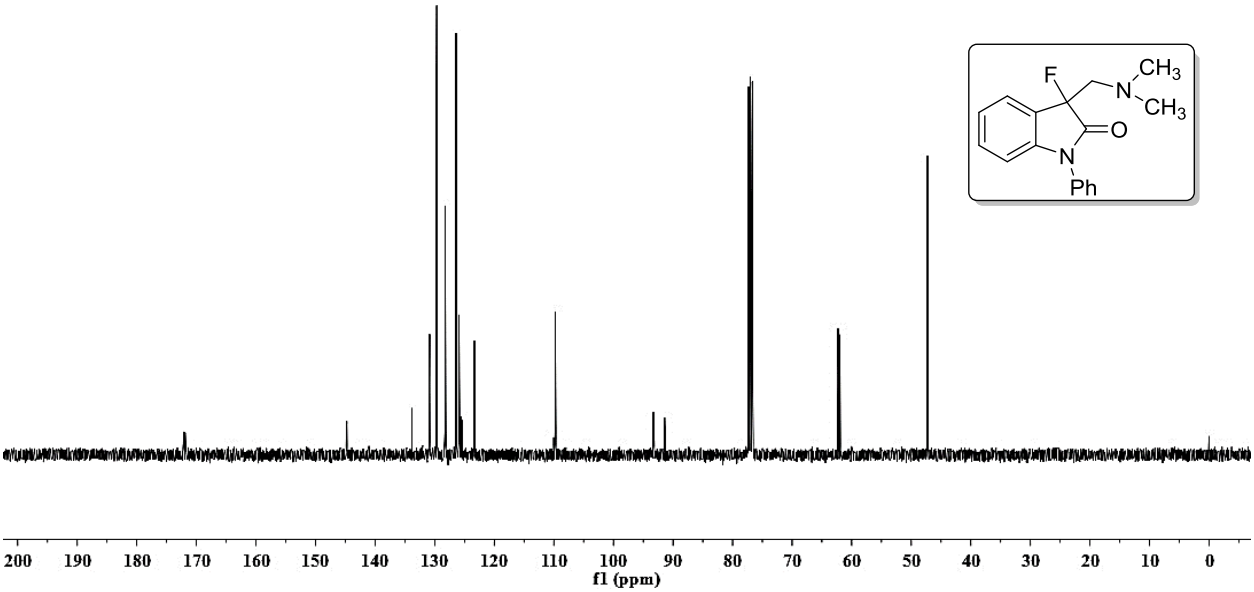
^{19}F NMR spectrum of diethyl 2-(3-fluoro-2-oxo-1-phenylindolin-3-yl)-2-hydroxymalonate (22).



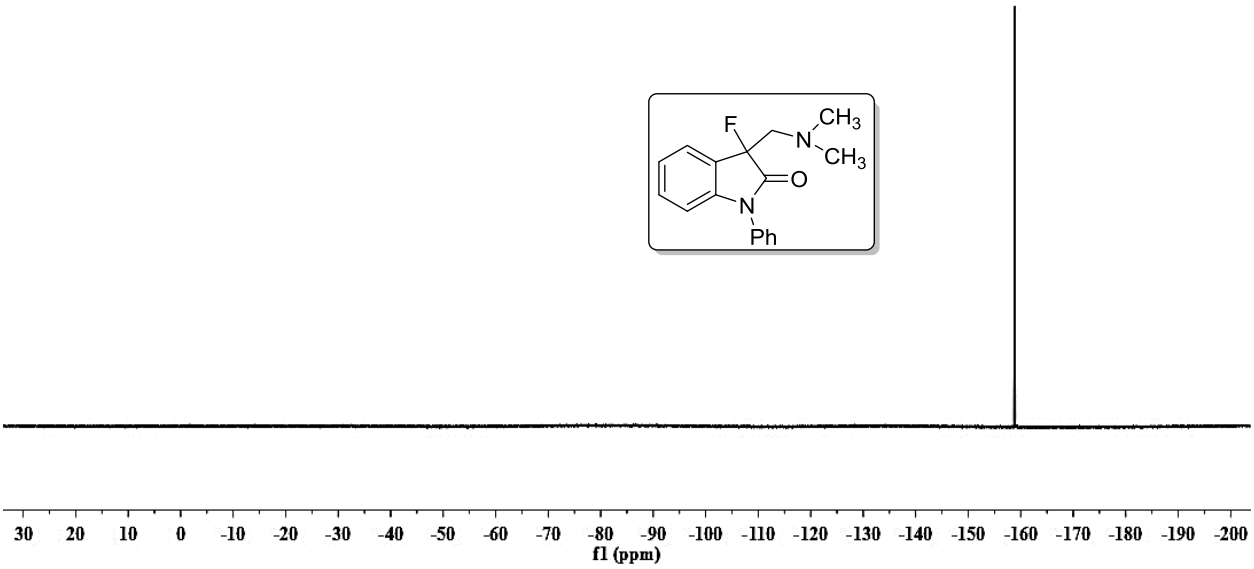
^{1}H NMR spectrum of 3-((dimethylamino)methyl)-3-fluoro-1-phenylindolin-2-one (23).



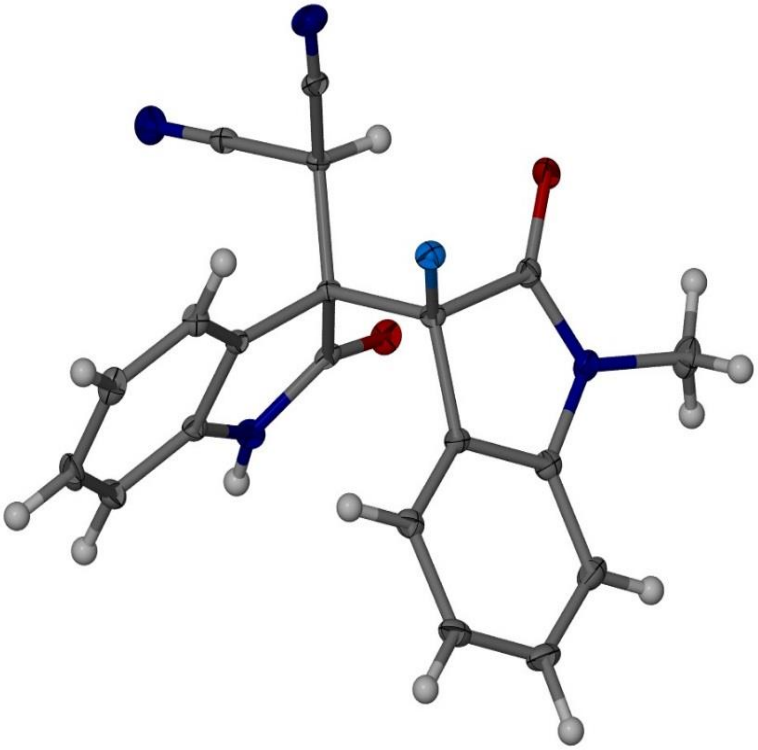
^{13}C NMR spectrum of 3-((dimethylamino)methyl)-3-fluoro-1-phenylindolin-2-one (23).



^{19}F NMR spectrum of 3-((dimethylamino)methyl)-3-fluoro-1-phenylindolin-2-one (23).

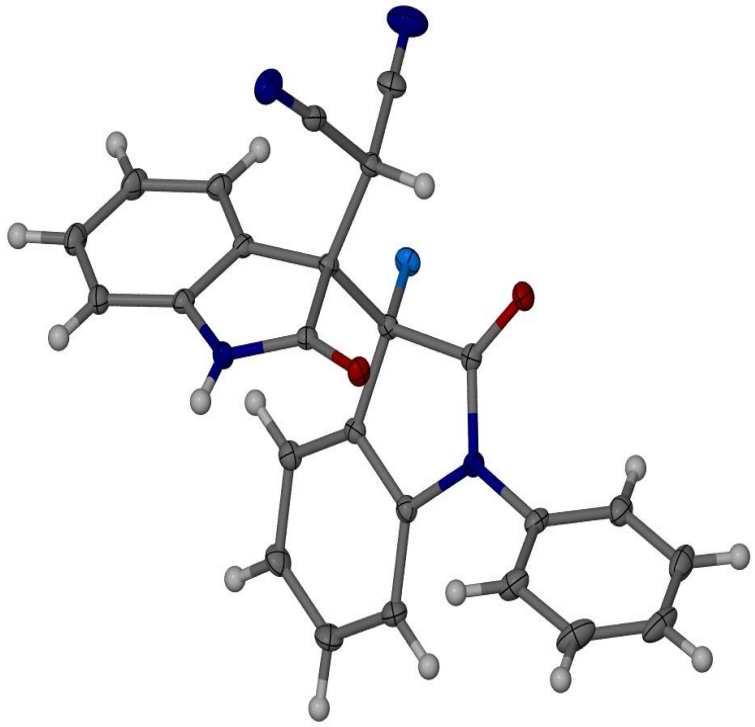


4. Crystallographic data



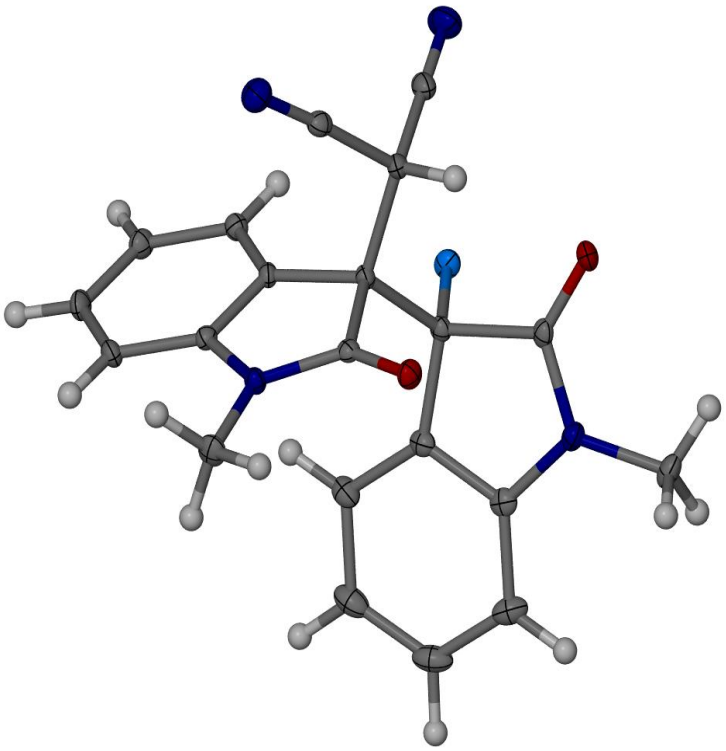
2-(3-Fluoro-1-methyl-2,2'-dioxo-[3,3'-biindolin]-3'-yl)malononitrile (3).

A single crystal was obtained by slow evaporation of a solution containing the chiral compound in a mixture of ethyl acetate and hexanes (20% EtOAc in hexanes). Single crystal X-ray analysis was performed at 100 K using a Siemens platform diffractometer with graphite monochromated Mo-Kα radiation (λ = 0.71073 Å). Data were integrated and corrected using the Apex 2 program. The structures were solved by direct methods and refined with full-matrix least-square analysis using SHELX-97-2 software. Non-hydrogen atoms were refined with anisotropic displacement parameter. Crystal data: $C_{20}H_{13}FN_4O_2$, M = 360.34, colorless block, 0.18 x 0.08 x 0.06 mm^3, monoclinic, space group $P2_1/n$, a = 8.84491(10), b = 16.961(2), c = 12.4315(15) Å, V = 1736.1(4) $Å^3$, Z = 4.



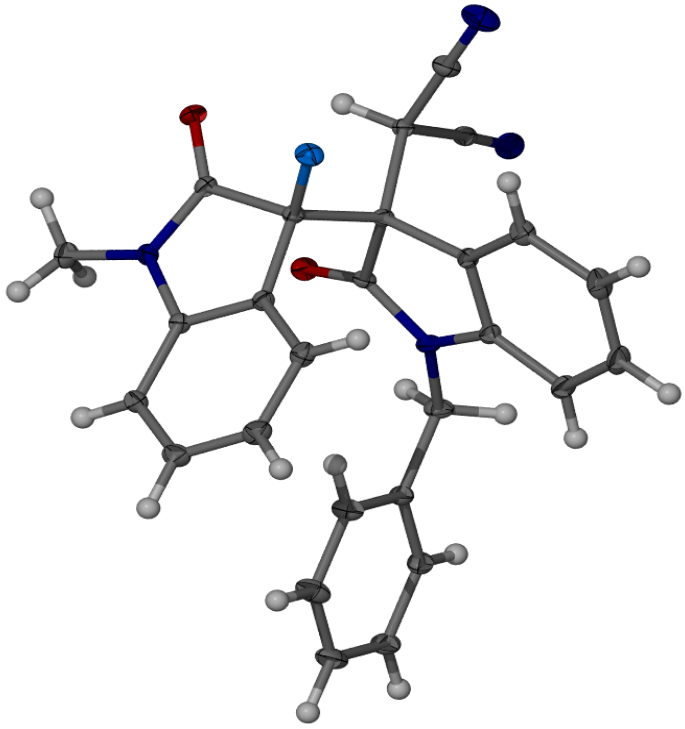
2-(3-Fluoro-2,2'-dioxo-1-phenyl-[3,3'-biindolin]-3'-yl)malononitrile (4).

A single crystal was obtained by slow evaporation of a solution containing the chiral compound in a mixture of ethyl acetate and hexanes (20% EtOAc in hexanes). Single crystal X-ray analysis was performed at 100 K using a Siemens platform diffractometer with graphite monochromated Mo-Kα radiation (λ = 0.71073 Å). Data were integrated and corrected using the Apex 2 program. The structures were solved by direct methods and refined with full-matrix least-square analysis using SHELX-97-2 software. Non-hydrogen atoms were refined with anisotropic displacement parameter. Crystal data: $C_{25}H_{15}FN_4O_2$, M = 422.41, colorless block 0.25 x 0.16 x 0.10 mm^3, triclinic, space group *P-1*, a = 8.875(6), b = 10.2759(7), c = 12.1117(9) Å, V = 1010.93(12) $Å^3$, Z = 2.



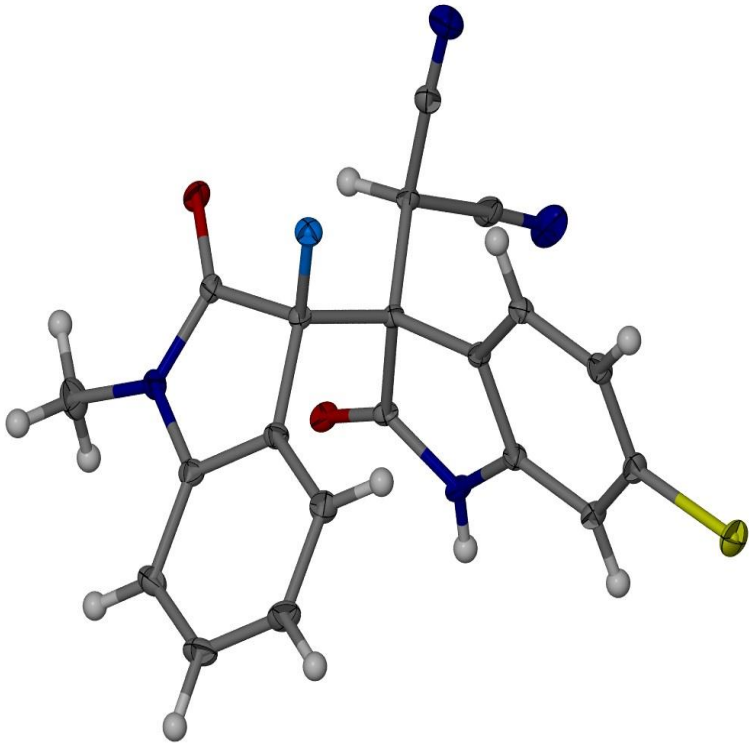
2-(3-Fluoro-1,1'-dimethyl-2,2'-dioxo-[3,3'-biindolin]-3'-yl)malononitrile (5).

A single crystal was obtained by slow evaporation of a solution containing the chiral compound in a mixture of ethyl acetate and hexanes (10% EtOAc in hexanes). Single crystal X-ray analysis was performed at 100 K using a Siemens platform diffractometer with graphite monochromated Mo-Kα radiation (λ = 0.71073 Å). Data were integrated and corrected using the Apex 2 program. The structures were solved by direct methods and refined with full-matrix least-square analysis using SHELX-97-2 software. Non-hydrogen atoms were refined with anisotropic displacement parameter. Crystal data: $C_{21}H_{15}FN_4O_2$, M = 374.37, colorless plate, 0.21 x 0.10 x 0.08 mm^3, monoclinic, space group $P2_1/n$, a = 9.9397(6), b = 14.1798(9), c = 12.6336(8) Å, V = 1778.90(19) $Å^3$, Z = 4.



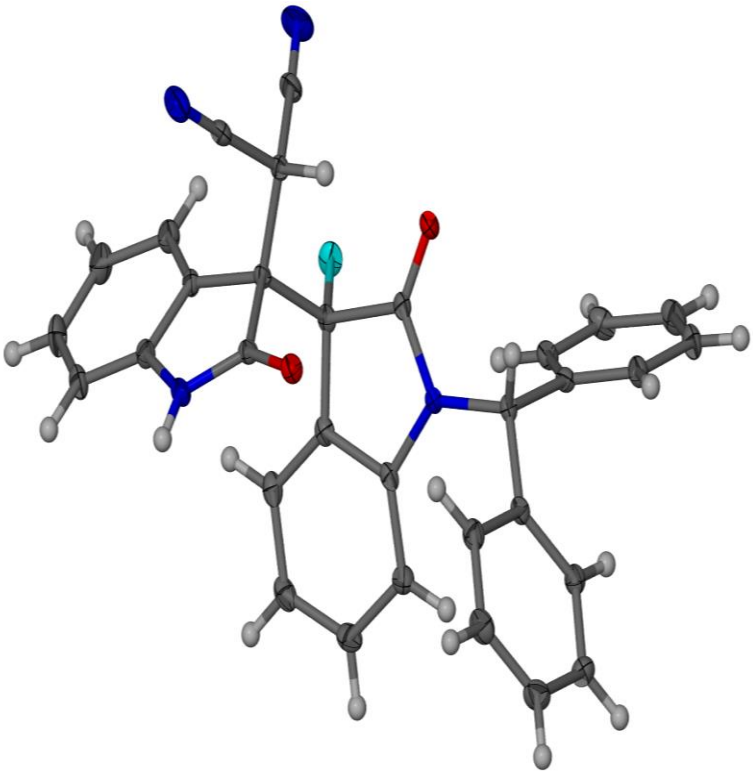
2-(1'-Benzyl-3-fluoro-1-methyl-2,2'-dioxo-[3,3'-biindolin]-3'-yl)malononitrile (6).

A single crystal was obtained by slow evaporation of a solution containing the chiral compound in a mixture of ethyl acetate and hexanes (5% EtOAc in hexanes). Single crystal X-ray analysis was performed at 100 K using a Siemens platform diffractometer with graphite monochromated Mo-Kα radiation (λ = 0.71073 Å). Data were integrated and corrected using the Apex 2 program. The structures were solved by direct methods and refined with full-matrix least-square analysis using SHELX-97-2 software. Non-hydrogen atoms were refined with anisotropic displacement parameter. Crystal data: $C_{27}H_{19}FN_4O_2$, M = 450.46, yellow plate, 0.21 x 0.09 x 0.08 mm^3, triclinic, space group *P-1*, a = 10.4842(10), b = 13.5061(13), c = 16.4403(16) Å, V = 2163.7(4) $Å^3$, Z = 4.



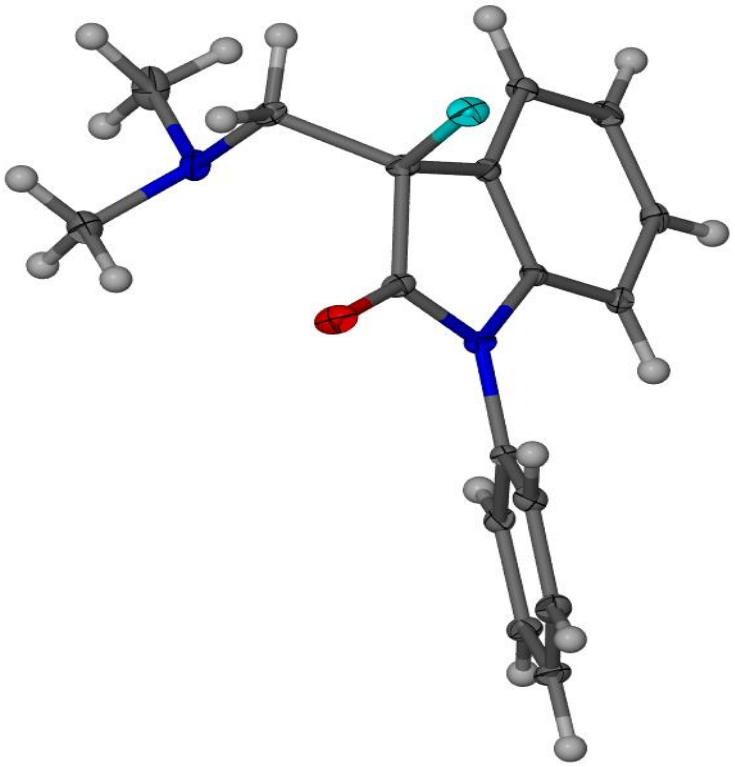
2-(6'-Chloro-3-fluoro-1-methyl-2,2'-dioxo-[3,3'-biindolin]-3'-yl)malononitrile (10).

A single crystal was obtained by slow evaporation of a solution containing the chiral compound in a mixture of ethyl acetate and hexanes (25% EtOAc in hexanes). Single crystal X-ray analysis was performed at 100 K using a Siemens platform diffractometer with graphite monochromated Mo-Kα radiation (λ = 0.71073 Å). Data were integrated and corrected using the Apex 2 program. The structures were solved by direct methods and refined with full-matrix least-square analysis using SHELX-97-2 software. Non-hydrogen atoms were refined with anisotropic displacement parameter. Crystal data: $C_{20}H_{12}ClFN_4O_2$, M = 394.78, colorless block, 0.32 x 0.16 x 0.10 mm^3, monoclinic, space group *C2/c*, a = 18.2744(11), b = 11.9114(7), c = 19.1146(16) Å, V = 3697.7(4) $Å^3$, Z = 8.



2-(1-Benzhydryl-3-fluoro-2,2'-dioxo-[3,3'-biindolin]-3'-yl)malononitrile (18).

A single crystal was obtained by slow evaporation of a solution containing the chiral compound in a mixture of ethyl acetate and hexanes (20% EtOAc in hexanes). Single crystal X-ray analysis was performed at 100 K using a Siemens platform diffractometer with graphite monochromated Mo-Kα radiation (λ = 0.71073 Å). Data were integrated and corrected using the Apex 2 program. The structures were solved by direct methods and refined with full-matrix least-square analysis using SHELX-97-2 software. Non-hydrogen atoms were refined with anisotropic displacement parameter. Crystal data: $C_{32}H_{21}FN_4O_2$, M = 512.53, colorless block, 0.24 x 0.18 x 0.10 mm^3, monoclinic, space group *C2/c*, a = 22.2092(19), b = 11.6447(10), c = 19.7358(17) Å, V = 5013.6(7) $Å^3$, Z = 8.



3-((Dimethylamino)methyl)-3-fluoro-1-phenylindolin-2-one (23).

A single crystal was obtained by slow evaporation of a solution containing the chiral compound in a mixture of ethyl acetate and hexanes (20% EtOAc in hexanes). Single crystal X-ray analysis was performed at 100 K using a Siemens platform diffractometer with graphite monochromated Mo-Kα radiation (λ = 0.71073 Å). Data were integrated and corrected using the Apex 2 program. The structures were solved by direct methods and refined with full-matrix least-square analysis using SHELX-97-2 software. Non-hydrogen atoms were refined with anisotropic displacement parameter. Crystal data: $C_{17}H_{17}FN_2O$, M = 284.33, colorless block, 0.244 x 0.173 x 0.114 mm^3, orthorhombic, space group $P2_12_12_1$, a = 7.3042(4), b = 10.8341(5), c = 18.1590(9) Å, V = 1437.00(13) $Å^3$, Z = 4.

5. References

1. (a) G. Li , X. Feng, H. Du. *Org. Biomol. Chem*. **2015**, *13*, 5826-5830; (b) T. He, Q. Zeng, D. Yang, Y. He, Z. Guan. *RSC Adv*. **2015**, *5*, 37843-37852; (c) A. Dandia , H. Taneja , R. Gupta, S. Paul. *Synth. Commun.* **1999**, *29*, 2323-2335.
2. (a) K. Balaraman, C. Wolf. *Angew. Chem., Int. Ed*. **2017**, *56*,1390 –1395; (b) C. Xie, L. Zhang, W. Sha, V. A. Soloshonok, J. Han, Y. Pan. *Org. Lett*. **2016**, *18*, 3270-3273; (c) T. Wang, D. L. Hoona, Y. Lu, *Chem. Commun*. **2015**, *51*, 10186-10189; (d) X. Dou, Y. Lu, *Org. Biomol. Chem*. **2013**, *11*, 5217-5221.