

Supporting Information

for

**PPh₃-Mediated synthesis of multifunctional indolin-3-one
derivatives from 2-(ethynyl)nitrobenzene**

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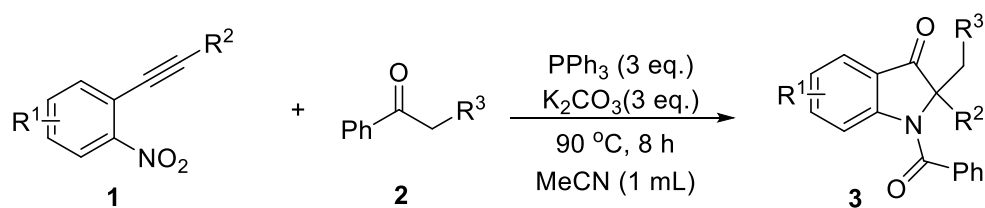
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General Considerations

Unless specified, all reagents and starting materials were purchased from commercial sources and used as received. Solvents were purified following standard literature procedures. Analytical thin layer chromatography (TLC) was performed using pre-coated silica gel plate. Visualization was achieved by UV light (254 nm). Flash chromatography was performed using silica gel and a gradient solvent system (Ethyl acetate: Petrol ether as eluant). ^1H , ^{13}C and ^{19}F NMR spectra were measured on 400 MHz spectrometers. Chemical shifts (ppm) were recorded with tetramethylsilane (TMS) as the internal reference standard. Multiplicities are given as: s (singlet), bs (broad singlet), d (doublet), t (triplet), dd (doublet of doublets) or m (multiplet). The number of protons (n) for a given resonance is indicated by nH and coupling constants are reported as a J value in Hz. All the starting materials **1** (1-nitro-2-(phenylethynyl)benzenes) were prepared by reported methods¹.

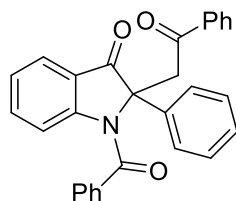
General experimental procedure for the synthesis of product 3



To a 10 mL of test tube was added **1** (0.1 mmol, 1 equiv.), **2** (0.15 mmol, 1.5 equiv.), PPh₃ (0.3 mmol, 3 equiv.), K₂CO₃ (0.3 mmol, 3 equiv.) and MeCN (1 mL). The reaction solution was then stirred at 90 °C under N₂ and monitored by TLC analysis. On completion, the reaction mixture was directly subjected to purification by flash column chromatography on silica gel to give the desired product **3**. (eluent: petrol ether: ethyl acetate = 20:1 to 8:1).

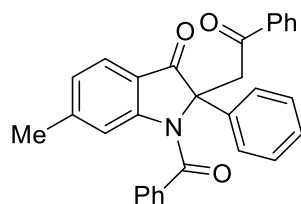
Characterization data of compounds

1-Benzoyl-2-(2-oxo-2-phenylethyl)-2-phenylindolin-3-one (3aa)



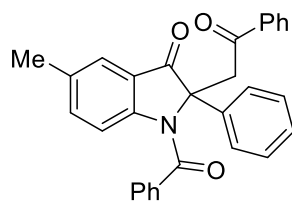
Known compound ²; isolated yield = 87%; yellow solid; ¹H NMR (400 MHz, CDCl₃) δ = 7.94 (d, J = 7.7 Hz, 2 H), 7.78 (d, J = 7.6 Hz, 1 H), 7.58 – 7.46 (m, 6 H), 7.44 – 7.34 (m, 6 H), 7.34 – 7.28 (m, 2 H), 7.17 – 7.08 (m, 1 H), 6.44 (bs, 1 H), 5.00 (d, J = 18.3 Hz, 1 H), 4.41 (d, J = 18.2 Hz, 1 H); ¹³C NMR (101 MHz, CDCl₃) δ = 197.4, 196.7, 168.0, 152.8, 136.2, 135.9, 135.8, 135.0, 133.5, 131.3, 128.9, 128.6, 128.1, 128.1, 128.0, 125.3, 124.9, 124.3, 123.9, 117.0, 74.3, 44.9.

1-Benzoyl-6-methyl-2-(2-oxo-2-phenylethyl)-2-phenylindolin-3-one (3ba)



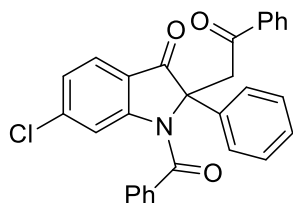
Unknown compound; isolated yield = 81%; yellow solid; ¹H NMR(400 MHz, CDCl₃) δ = 7.93 (d, J = 7.7 Hz, 2 H), 7.66 (d, J = 7.8 Hz, 1 H), 7.58 – 7.45 (m, 6 H), 7.45 – 7.33 (m, 6 H), 7.33 – 7.29 (m, 1 H), 6.95 (d, J = 7.8 Hz, 1 H), 6.19 (bs, 1 H), 4.94 (d, J = 18.2 Hz, 1 H), 4.38 (d, J = 18.1 Hz, 1 H), 2.16 (s, 3 H); ¹³C NMR (101 MHz, CDCl₃) δ = 196.9, 196.7, 168.1, 153.2, 146.6, 136.6, 136.1, 136.0, 133.5, 131.2, 128.9, 128.7, 128.6, 128.2, 128.1, 128.0, 125.3, 124.7, 122.1, 117.6, 74.5, 44.7, 22.5.

1-Benzoyl-5-methyl-2-(2-oxo-2-phenylethyl)-2-phenylindolin-3-one (3ca)



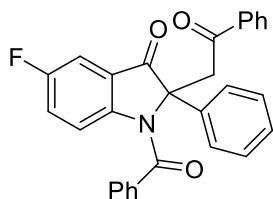
Known compound²; isolated yield = 87 %; yellow solid; ¹H NMR(400 MHz, CDCl₃) δ = 7.94 (d, J = 7.7 Hz, 2 H), 7.61 – 7.46 (m, 7 H), 7.45 – 7.34 (m, 6 H), 7.32 (d, J = 7.2 Hz, 1 H), 7.11 (d, J = 8.5 Hz, 1 H), 6.26 (bs, 1 H), 5.03 (d, J = 12.8 Hz, 1 H), 4.39 (d, J = 18.1 Hz, 1 H), 2.31 (s, 3 H); ¹³C NMR (101 MHz, CDCl₃) δ = 197.5, 196.8, 167.8, 150.8, 136.2, 135.9, 133.9, 133.5, 132.4, 131.2, 128.9, 128.6, 128.6, 128.2, 128.0, 128.0, 127.1, 125.3, 124.6, 124.4, 116.7, 74.4, 44.9, 20.5.

1-Benzoyl-6-chloro-2-(2-oxo-2-phenylethyl)-2-phenylindolin-3-one (3da)



Known compound²; isolated yield = 77%; yellow solid; ¹H NMR (400 MHz, CDCl₃) δ = 7.92 (d, J = 7.2 Hz, 2 H), 7.69 (d, J = 8.2 Hz, 1 H), 7.60 – 7.51 (m, 3 H), 7.48 (d, J = 7.7 Hz, 3 H), 7.44 – 7.37 (m, 5 H), 7.37 – 7.30 (m, 2 H), 7.12 (dd, J_1 = 8.2, J_2 = 1.6 Hz, 1 H), 6.39 (bs, 1 H), 4.91 (d, J = 17.8 Hz, 1 H), 4.38 (d, J = 18.2 Hz, 1 H); ¹³C NMR (101 MHz, CDCl₃) δ = 196.7, 196.1, 168.1, 153.4, 141.6, 135.8, 135.8, 135.2, 133.7, 131.7, 129.0, 128.7, 128.3, 128.0, 127.9, 125.8, 125.2, 124.6, 122.8, 117.5, 74.7, 45.0.

1-Benzoyl-5-fluoro-2-(2-oxo-2-phenylethyl)-2-phenylindolin-3-one (3ea)

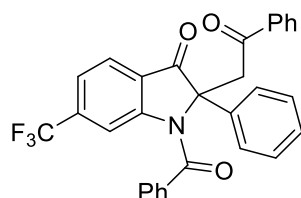


Known compound²; isolated yield = 82%; yellow solid; ¹H NMR(400 MHz, CDCl₃) δ = 7.92 (d, J = 7.7 Hz, 2 H), 7.56 – 7.47 (m, 6 H), 7.45 – 7.36 (m, 7 H), 7.35 – 7.30 (m, 1 H), 7.08 – 6.97 (m, 1 H), 6.36 (bs, 1 H), 4.99 (s, 1 H), 4.38 (d, J = 18.2 Hz, 1 H); ¹³C NMR (101 MHz, CDCl₃) δ = 196.7, 196.7, 167.8, 159.0, (d, J = 247.5 Hz), 149.0, 135.8, 135.6, 133.7, 131.5, 129.0, 128.6, 128.3, 128.2, 127.9, 125.7(d, J = 7.1 Hz),

125.4, 122.6, 122.4, 118.4, 118.4, 110.5(d, $J = 23.2\text{Hz}$), 75.0, 45.3; ^{19}F NMR (377 MHz, CDCl_3) $\delta = -117.83$.

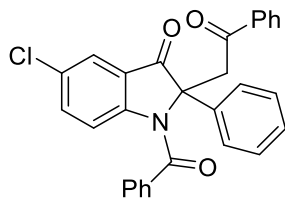
1-Benzoyl-2-(2-oxo-2-phenylethyl)-2-phenyl-6-(trifluoromethyl)indolin-3-one

(3fa)



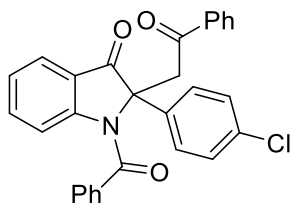
Known compound²; isolated yield = 55%; brown solid; ^1H NMR(400 MHz, CDCl_3) $\delta = 7.92$ (d, $J = 7.8$ Hz, 2 H), 7.87 (d, $J = 8.1$ Hz, 1 H), $7.62 - 7.47$ (m, 5 H), $7.46 - 7.30$ (m, 9 H), 6.62 (bs, 1 H), 5.00 (d, $J = 18.4$ Hz, 1 H), 4.42 (d, $J = 18.2$ Hz, 1 H); ^{13}C NMR (101 MHz, CDCl_3) $\delta = 196.8, 196.7, 168.2, 152.5, 136.2$ (q, $J = 32.6$ Hz), $135.6, 135.3, 135.1, 133.8, 131.8, 129.1, 128.7, 128.5, 128.2, 127.8, 126.3, 125.5, 125.3, 123.0$ (q, $J = 273.7$ Hz), 120.63 (q, $J = 3.7$ Hz), $118.4, 114.3, 74.8, 45.5$; ^{19}F NMR (377 MHz, CDCl_3) $\delta = -60.44 - -64.52$ (m).

1-Benzoyl-5-chloro-2-(2-oxo-2-phenylethyl)-2-phenylindolin-3-one (3ga)



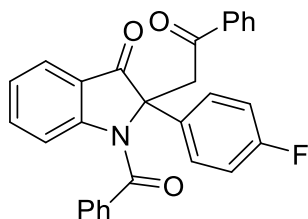
Known compound²; isolated yield = 88%; yellow solid; ^1H NMR(400 MHz, CDCl_3) $\delta = 7.92$ (d, $J = 7.7$ Hz, 2 H), 7.78 (d, $J = 7.6$ Hz, 1 H), $7.56 - 7.45$ (m, 6 H), $7.45 - 7.36$ (m, 4 H), $7.34 - 7.27$ (m, 1 H), $7.17 - 7.11$ (m, 1 H), $7.09 - 7.00$ (m, 2 H), 6.39 (bs, 1 H), 4.97 (d, $J = 18.2$ Hz, 1 H), 4.34 (dd, $J = 18.1, 2.1$ Hz, 1 H); ^{13}C NMR (101 MHz, CDCl_3) $\delta = 196.7, 196.3, 167.9, 151.1, 135.7, 135.6, 135.5, 134.9, 133.7, 131.6, 129.6, 129.0, 128.7, 128.4, 128.2, 128.0, 125.7, 125.3, 124.5, 118.2, 74.9, 45.2$.

1-Benzoyl-2-(4-chlorophenyl)-2-(2-oxo-2-phenylethyl)indolin-3-one (3ha)



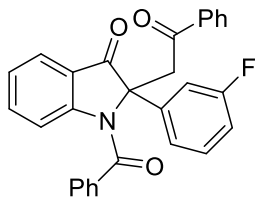
Known compound²; isolated yield = 87%; yellow solid; ¹H NMR(400 MHz, CDCl₃) δ = 7.92 (d, J = 7.8 Hz, 2 H), 7.72 (d, J = 2.3 Hz, 1 H), 7.54 – 7.49 (m, 3 H), 7.47 – 7.45 (m, 3 H), 7.42 – 7.38 (m, 4 H), 7.34 – 7.32 (m, 2 H), 7.30 – 7.26 (m, 1 H), 7.16 – 7.12 (m, 1 H), 6.47 – 6.39 (bs, 1 H), 4.97 (s, 1 H), 4.39 (d, J = 18.2 Hz, 1 H); ¹³C NMR (101 MHz, CDCl₃) δ = 197.1, 196.5, 168.1, 152.7, 135.8, 135.5, 135.2, 134.8, 134.2, 133.7, 131.6, 129.1, 128.6, 128.2, 128.1, 126.9, 125.0, 124.2, 124.1, 117.0, 73.9, 44.8.

1-Benzoyl-2-(4-fluorophenyl)-2-(2-oxo-2-phenylethyl)indolin-3-one (3ia)



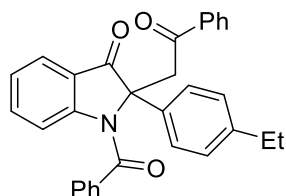
Unknown compound; isolated yield = 95%; yellow solid; ¹H NMR(400 MHz, CDCl₃) δ = 7.92 (d, J = 7.3 Hz, 2 H), 7.78 (d, J = 7.7 Hz, 1 H), 7.59 – 7.47 (m, 3 H), 7.46 (d, J = 8.7 Hz, 3 H), 7.43 – 7.36 (m, 4 H), 7.33 (d, J = 8.7 Hz, 2 H), 7.29 (d, J = 7.3 Hz, 1 H), 7.18 – 7.08 (m, 1 H), 6.39 (bs, 1 H), 4.97 (d, J = 18.1 Hz, 1 H), 4.34 (d, J = 18.1 Hz, 1 H); ¹³C NMR (101 MHz, CDCl₃) δ = 197.3, 196.6, 168.1, 162.5 (d, J = 247.4 Hz), 152.7, 135.8, 135.6, 135.2, 133.6, 132.0, 131.5, 128.6, 128.2, 128.1, 127.3 (d, J = 8.3 Hz), 125.0, 124.2, 124.0, 117.1, 115.8 (d, J = 21.6 Hz), 73.8, 45.0; ¹⁹F NMR (377 MHz, CDCl₃) δ = -114.19.

1-Benzoyl-2-(3-fluorophenyl)-2-(2-oxo-2-phenylethyl)indolin-3-one (3ja)



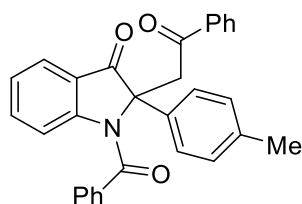
Known compound²; isolated yield = 89%; yellow solid; ¹H NMR(400 MHz, CDCl₃) δ = 7.93 (d, J = 6.9 Hz, 2 H), 7.78 (d, J = 6.3 Hz, 1H), 7.59 – 7.47 (m, 4 H), 7.46 – 7.36 (m, 4 H), 7.36 – 7.28 (m, 3 H), 7.24 – 7.19 (m, 1 H), 7.18 – 7.09 (m, 1 H), 7.05 – 6.96 (m, 1 H), 6.39 (bs, 1 H), 4.99 (d, J = 18.1 Hz, 1 H), 4.35 (d, J = 18.1 Hz, 1 H); ¹³C NMR (101 MHz, CDCl₃) δ = 196.9, 196.5, 168.1, 163.0 (d, J = 246.3 Hz), 152.7, 135.8, 135.5, 135.3, 133.7, 131.6, 130.4 (d, J = 8.3 Hz), 128.6, 128.2, 128.1, 125.0, 124.1, 124.1, 121.1 (d, J = 2.9 Hz), 117.1, 115.1 (d, J = 21.1 Hz), 112.9 (d, J = 23.7 Hz), 73.9, 44.8; ¹⁹F NMR (377 MHz, CDCl₃) δ = -111.67.

1-Benzoyl-2-(4-ethylphenyl)-2-(2-oxo-2-phenylethyl)indolin-3-one (3ka)



Known compound²; isolated yield = 79%; yellow solid; ¹H NMR(400 MHz, CDCl₃) δ = 7.94 (d, J = 7.2 Hz, 2 H), 7.77 (d, J = 6.2 Hz, 1 H), 7.56 – 7.47 (m, 4 H), 7.45 – 7.36 (m, 6 H), 7.32 – 7.26 (m, 1 H), 7.20 (d, J = 8.3 Hz, 2 H), 7.15 – 7.09 (m, 1 H), 6.40 (bs, 1 H), 4.99 (d, J = 18.6 Hz, 1 H), 4.39 (d, J = 18.2 Hz, 1 H), 2.63 (q, J = 7.6 Hz, 2 H), 1.21 (t, J = 7.6 Hz, 3 H); ¹³C NMR (101 MHz, CDCl₃) δ = 197.6, 196.8, 168.1, 152.7, 144.2, 135.9, 135.9, 135.0, 133.5, 131.3, 128.6, 128.4, 128.4, 128.3, 128.2, 128.1, 125.3, 125.0, 124.4, 123.8, 117.0, 74.2, 44.9, 28.3, 15.3.

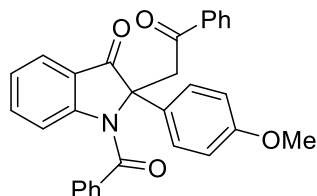
1-Benzoyl-2-(2-oxo-2-phenylethyl)-2-(p-tolyl)indolin-3-one (3la)



Known compound²; isolated yield = 87%; yellow solid; ¹H NMR(400 MHz, CDCl₃) δ = 7.93 (d, J = 6.8 Hz, 2 H), 7.77 (d, J = 6.3 Hz, 1 H), 7.56 – 7.45 (m, 3 H), 7.43 – 7.36 (m, 6 H), 7.32 – 7.26 (m, 2 H), 7.18 (d, J = 8.1 Hz, 2 H), 7.15 – 7.10 (m, 1 H), 6.40 (bs, 1 H), 4.97 (d, J = 16.7 Hz, 1 H), 4.38 (d, J = 18.2 Hz, 1 H), 2.32 (s, 3 H); ¹³C

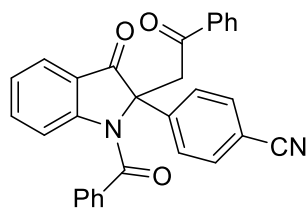
NMR (101 MHz, CDCl₃) δ = 197.6, 196.8, 168.1, 152.8, 138.0, 136.0, 135.9, 135.0, 133.5, 133.2, 131.4, 129.7, 128.6, 128.2, 128.1, 125.2, 125.0, 124.4, 123.9, 117.0, 74.2, 44.9, 20.9.

1-Benzoyl-2-(4-methoxyphenyl)-2-(2-oxo-2-phenylethyl)indolin-3-one (3ma)



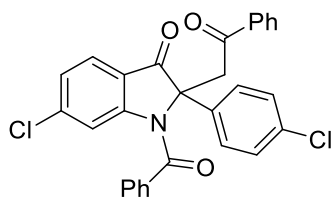
Known compound²; isolated yield = 73%; yellow solid; ¹H NMR(400 MHz, CDCl₃) δ = 7.92 (d, J = 7.7 Hz, 2 H), 7.77 (d, J = 7.6 Hz, 1 H), 7.58 – 7.46 (m, 3 H), 7.46 – 7.34 (m, 7 H), 7.32 – 7.26 (m, 1 H), 7.16 – 7.08 (m, 1 H), 6.89 (d, J = 7.0 Hz, 2 H), 6.40 (bs, 1 H), 4.96 (d, J = 13.6 Hz, 1 H), 4.35 (d, J = 18.1 Hz, 1 H), 3.77 (s, 3 H); ¹³C NMR (101 MHz, CDCl₃) δ = 197.7, 196.8, 168.1, 159.4, 152.7, 135.9, 135.8, 135.0, 133.5, 131.4, 128.6, 128.1, 128.0, 126.6, 124.9, 124.3, 123.9, 117.1, 114.3, 73.9, 55.2, 44.9.

4-(1-Benzoyl-3-oxo-2-(2-oxo-2-phenylethyl)indolin-2-yl)benzonitrile (3na)



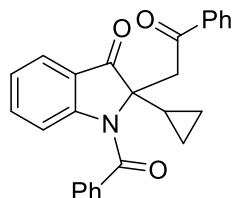
Unknown compound; isolated yield = 62%; yellow solid; ¹H NMR (400 MHz, CDCl₃) δ = 7.94 – 7.89 (m, 2 H), 7.77 (d, J = 6.2 Hz, 1 H), 7.64 (d, J = 1.5 Hz, 4 H), 7.56 – 7.50 (m, 4 H), 7.40 (m, 4 H), 7.34 – 7.29 (m, 1 H), 7.16 (m, 1 H), 6.39 (d, J = 8.5 Hz, 1 H), 4.96 (d, J = 18.0 Hz, 1 H), 4.35 (d, J = 18.0 Hz, 1 H); ¹³C NMR (151 MHz, CDCl₃) δ = 196.3, 196.2, 168.1, 152.7, 141.6, 135.6, 135.5, 135.2, 133.8, 132.6, 131.8, 128.7, 128.2, 126.4, 125.1, 124.3, 124.0, 118.4, 117.0, 74.1, 44.7.

1-Benzoyl-6-chloro-2-(4-chlorophenyl)-2-(2-oxo-2-phenylethyl)indolin-3-one (3oa)



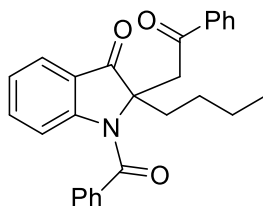
Known compound²; isolated yield = 53%; yellow solid; ¹H NMR(600 MHz, CDCl₃) δ = 7.91 (d, *J* = 6.9 Hz, 2 H), 7.69 (d, *J* = 8.2 Hz, 1 H), 7.59 – 7.49 (m, 3 H), 7.48 – 7.37 (m, 7 H), 7.37 – 7.31 (m, 2 H), 7.12 (dd, *J* = 8.2, 1.6 Hz, 1 H), 6.35 (bs, 1 H), 4.90 (d, *J* = 16.4 Hz, 1 H), 4.32 (d, *J* = 18.1 Hz, 1 H); ¹³C NMR (151 MHz, CDCl₃) δ = 196.5, 195.8, 168.1, 153.3, 141.8, 135.7, 135.0, 134.5, 134.4, 133.8, 131.9, 129.2, 128.7, 128.2, 127.9, 126.8, 125.9, 124.7, 122.6, 117.5, 74.3, 44.9.

1-Benzoyl-2-cyclopropyl-2-(2-oxo-2-phenylethyl)indolin-3-one (3pa)



Known compound²; isolated yield = 81%; yellow solid; ¹H NMR(400 MHz, CDCl₃) δ = 7.92 (d, *J* = 7.7 Hz, 2 H), 7.76 (d, *J* = 7.6 Hz, 1 H), 7.56 – 7.44 (m, 4 H), 7.44 – 7.35 (m, 4 H), 7.24 – 7.18 (m, 1 H), 7.14 – 7.06 (m, 1 H), 6.17 (d, *J* = 8.2 Hz, 1 H), 4.94 (d, *J* = 18.3 Hz, 1 H), 3.89 (d, *J* = 18.3 Hz, 1 H), 2.07 – 1.87 (m, 1 H), 0.76 – 0.61 (m, 1 H), 0.58 – 0.41 (m, 2 H), 0.41 – 0.29 (m, 1 H); ¹³C NMR (101 MHz, CDCl₃) δ = 198.6, 197.0, 168.7, 152.6, 136.2, 135.9, 134.8, 133.4, 131.2, 128.8, 128.5, 128.1, 127.9, 125.3, 123.8, 123.5, 117.3, 71.9, 44.6, 16.4, 1.7, 0.5.

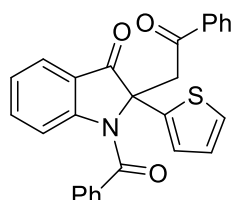
1-Benzoyl-2-butyl-2-(2-oxo-2-phenylethyl)indolin-3-one (3ra)



Unknown compound; isolated yield = 78%; yellow solid; ¹H NMR (400 MHz, CDCl₃) δ = 7.90 (d, *J* = 7.7 Hz, 2 H), 7.82 (d, *J* = 7.6 Hz, 1 H), 7.51 (q, *J* = 6.6 Hz, 3 H), 7.40

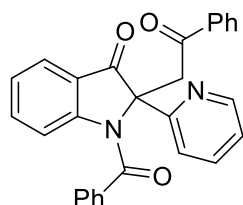
(m, 4 H), 7.27 (s, 1 H), 7.23 (d, $J = 8.7$ Hz, 1 H), 7.12 (m, 1 H), 6.18 (d, $J = 8.4$ Hz, 1 H), 4.71 (d, $J = 18.2$ Hz, 1 H), 3.76 (d, $J = 18.3$ Hz, 1 H), 2.60 (m, 1 H), 2.06 (m, 1 H), 1.24 (m, 3 H), 1.00 – 0.88 (m, 1 H), 0.82 (m, 3 H); ^{13}C NMR (151 MHz, CDCl_3) $\delta = 201.4, 196.8, 168.5, 152.9, 136.3, 136.0, 135.0, 133.4, 131.3, 128.5, 128.1, 127.9, 125.8, 123.7, 123.4, 116.6, 72.6, 45.0, 37.2, 24.9, 22.6, 13.8$.

1-Benzoyl-2-(2-oxo-2-phenylethyl)-2-(thiophen-2-yl)indolin-3-one (3sa)



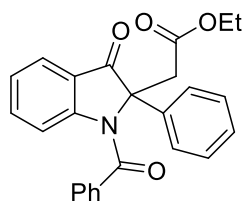
Known compound²; isolated yield = 56%; yellow solid; ^1H NMR(400 MHz, CDCl_3) $\delta = 7.93$ (d, $J = 7.7$ Hz, 2 H), 7.83 (d, $J = 7.7$ Hz, 1 H), 7.60 – 7.46 (m, 4 H), 7.44 – 7.37 (m, 4 H), 7.34 – 7.27 (m, 2 H), 7.19 – 7.08 (m, 2 H), 7.00 – 6.93 (m, 1 H), 6.37 (bs, 1 H), 5.09 (d, $J = 18.2$ Hz, 1 H), 4.32 (d, $J = 18.3$ Hz, 1 H); ^{13}C NMR (101 MHz, CDCl_3) $\delta = 196.2, 196.2, 168.0, 152.3, 140.5, 135.7, 135.3, 135.0, 133.7, 131.4, 128.9, 128.6, 128.2, 127.9, 127.1, 125.4, 125.2, 124.7, 124.1, 123.7, 117.2, 72.0, 45.5$.

1-Benzoyl-2-(2-oxo-2-phenylethyl)-2-(pyridin-2-yl)indolin-3-one (3ta)



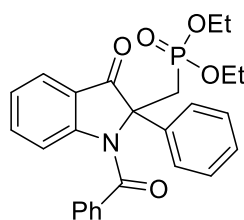
Unknown compound; isolated yield = 73%; yellow solid; ^1H NMR (600 MHz, CDCl_3) $\delta = 8.64$ (s, 1 H), 7.98 (d, $J = 7.8$ Hz, 2 H), 7.80 (d, $J = 7.7$ Hz, 1 H), 7.63 (m, 1 H), 7.51 (m, 4 H), 7.43 – 7.29 (m, 6 H), 7.18 (m, 2 H), 6.44 (s, 1 H), 4.93 (s, 2 H); ^{13}C NMR (151 MHz, CDCl_3) $\delta = 197.1, 196.1, 168.1, 154.9, 153.3, 149.7, 136.9, 136.1, 135.8, 135.2, 133.4, 131.5, 128.9, 128.5, 128.2, 128.0, 125.0, 124.3, 123.8, 122.9, 119.6, 116.4, 75.6, 43.8$.

Ethyl 2-(1-benzoyl-3-oxo-2-phenylindolin-2-yl)acetate (3ab)



Known compound²; isolated yield = 64%; yellow solid; ¹H NMR(400 MHz, CDCl₃) δ = 7.73 (d, J = 7.7 Hz, 1 H), 7.59 – 7.51 (m, 3 H), 7.49 – 7.40 (m, 2 H), 7.38 – 7.27 (m, 6 H), 7.15 – 7.06 (m, 1 H), 6.50 (bs, 1 H), 4.12 – 3.97 (m, 2 H), 3.97 – 3.87 (m, 2 H), 1.11 (t, J = 7.1 Hz, 3 H); ¹³C NMR (101 MHz, CDCl₃) δ = 197.3, 170.1, 167.9, 153.1, 136.0, 135.8, 135.5, 131.5, 129.0, 128.8, 128.2, 128.0, 125.1, 124.0, 123.9, 116.8, 73.8, 61.0, 39.2, 13.9.

Diethyl ((1-benzoyl-3-oxo-2-phenylindolin-2-yl)methyl)phosphonate (3ad)



Known compound²; isolated yield = 25%; brown solid; ¹H NMR(600 MHz, CDCl₃) δ = 8.00 (d, J = 7.0 Hz, 2 H), 7.81 (d, J = 7.7 Hz, 1 H), 7.66 – 7.59 (m, 1 H), 7.57 – 7.53 (m, 1 H), 7.51 (d, J = 8.3 Hz, 1 H), 7.48 – 7.41 (m, 4 H), 7.34 – 7.27 (m, 3 H), 7.19 – 7.11 (m, 1 H), 5.12 (d, J = 17.7 Hz, 1 H), 4.22 (d, J = 17.6 Hz, 1 H), 3.94 – 3.86 (m, 1 H), 3.85 – 3.77 (m, 1 H), 3.77 – 3.70 (m, 1 H), 3.61 – 3.48 (m, 1 H), 1.13 (t, J = 7.1, 0.9 Hz, 3 H), 1.01 (t, J = 7.1, 1.0 Hz, 3 H); ¹³C NMR (151 MHz, CDCl₃) δ = 196.4, 176.3, 155.8 (d, J = 4.5 Hz), 138.2, 136.4, 136.2, 133.4, 128.7, 128.6, 128.3, 128.2, 125.8, 124.9, 123.3 (d, J = 5.5 Hz), 122.2, 114.3, 73.2 (d, J = 4.1 Hz), 63.3 (d, J = 5.5 Hz), 63.1 (d, J = 5.5 Hz), 45.0, 15.9 (d, J = 7.1 Hz), 15.7 (d, J = 7.3 Hz).

Copies of the ^1H , ^{13}C and ^{19}F NMR spectra.

Figure S1. ^1H NMR Spectra of compound **3aa** (400 MHz, CDCl_3).

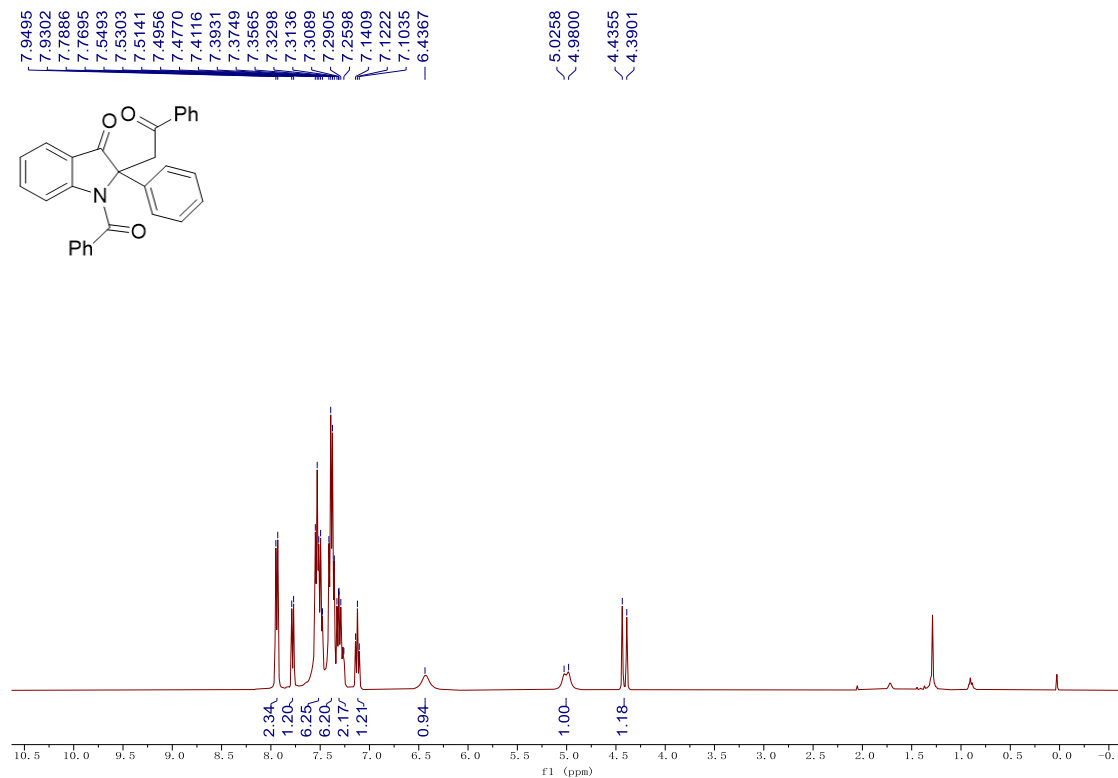


Figure S2. ^{13}C NMR Spectra of compound **3aa** (400 MHz, CDCl_3).

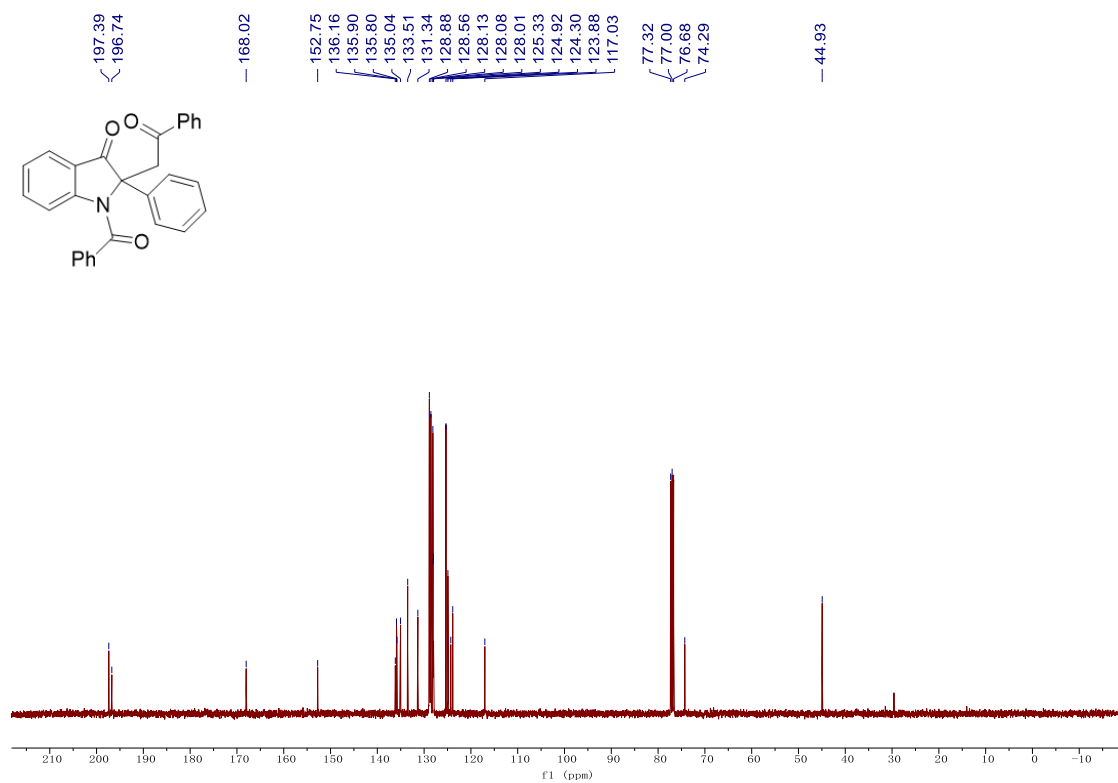


Figure S3. ^1H NMR Spectra of compound **3ba** (400 MHz, CDCl_3).

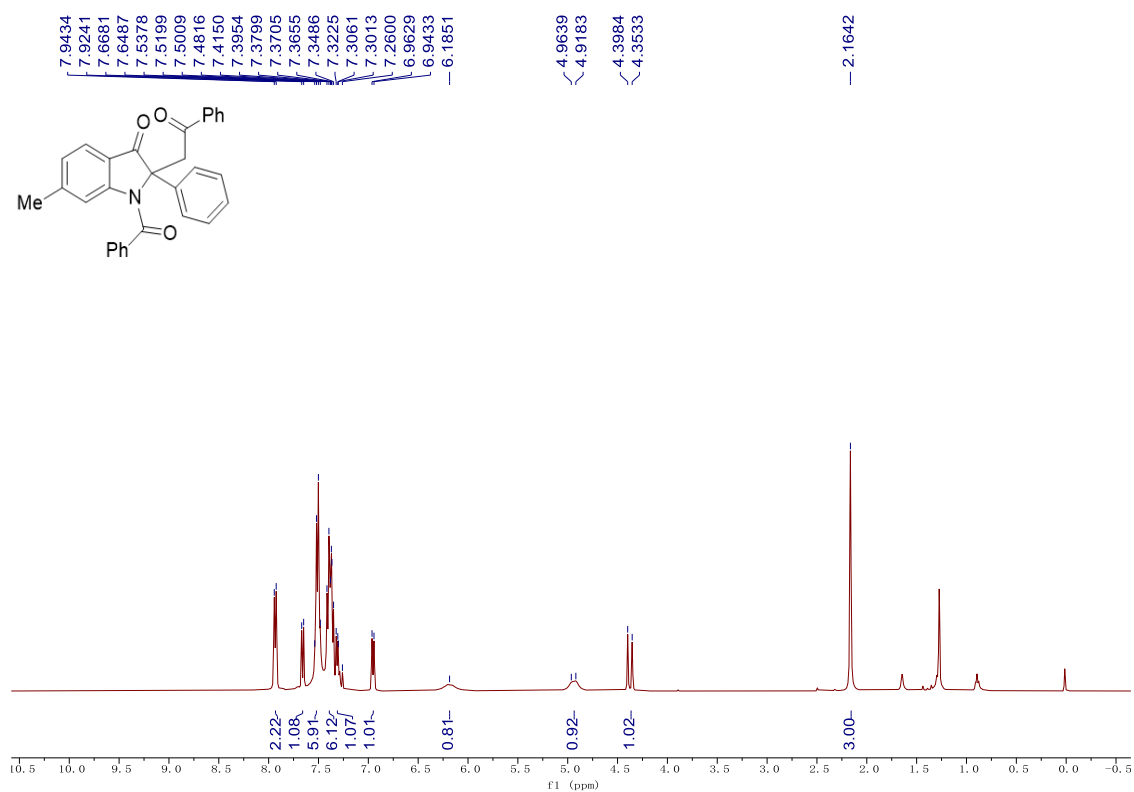


Figure S4. ^{13}C NMR Spectra of compound **3ba** (400 MHz, CDCl_3).

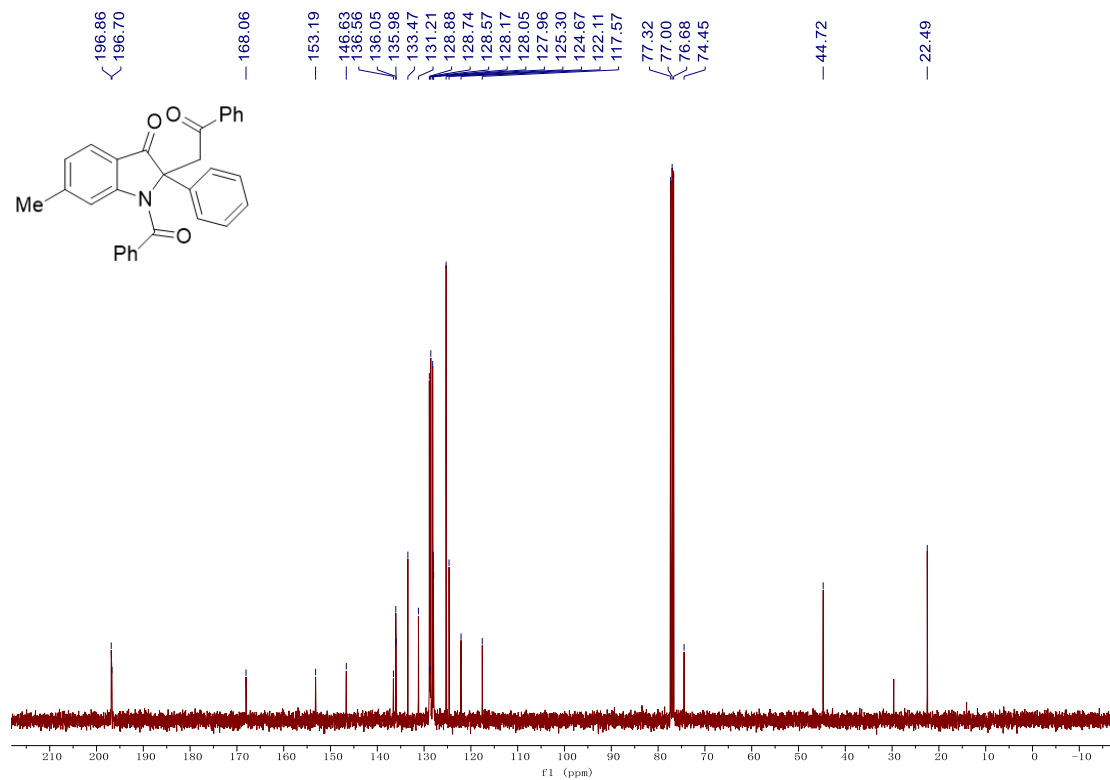


Figure S5. ^1H NMR Spectra of compound **3ca** (400 MHz, CDCl_3).

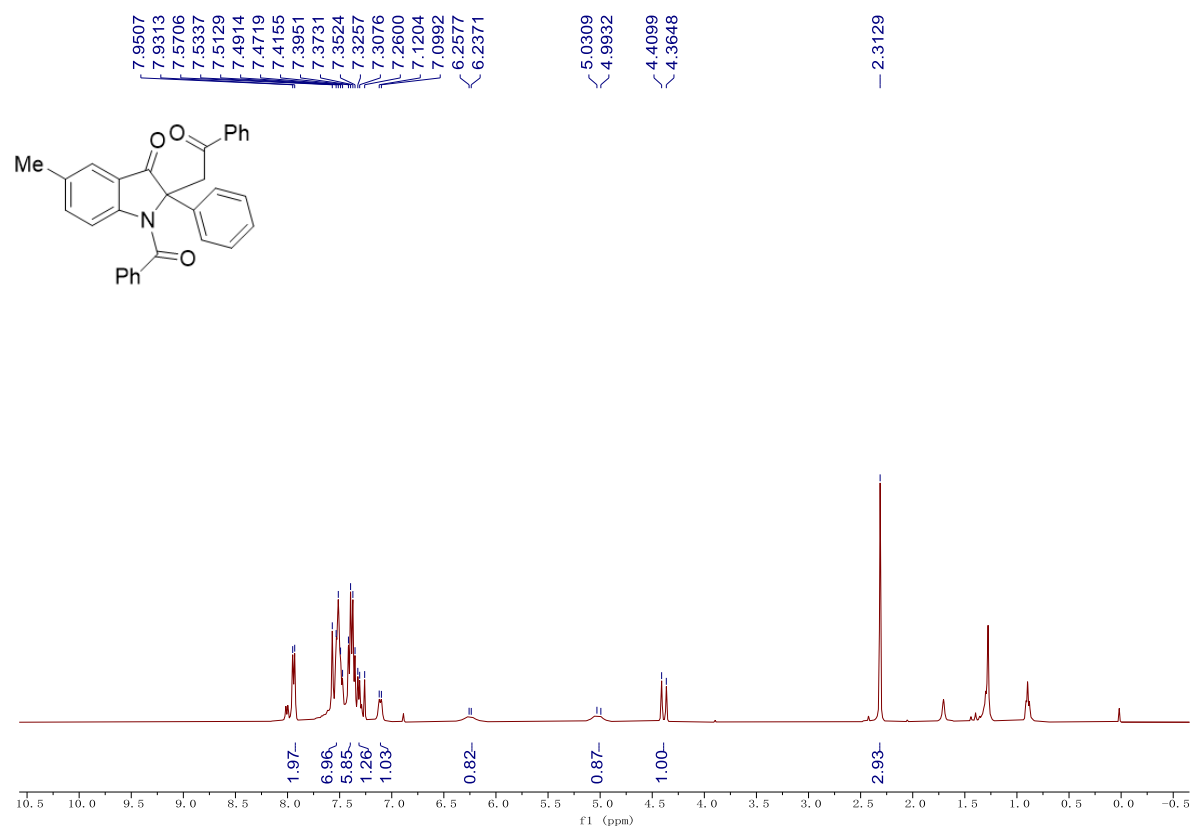


Figure S6. ^{13}C NMR Spectra of compound **3ca** (400 MHz, CDCl_3).

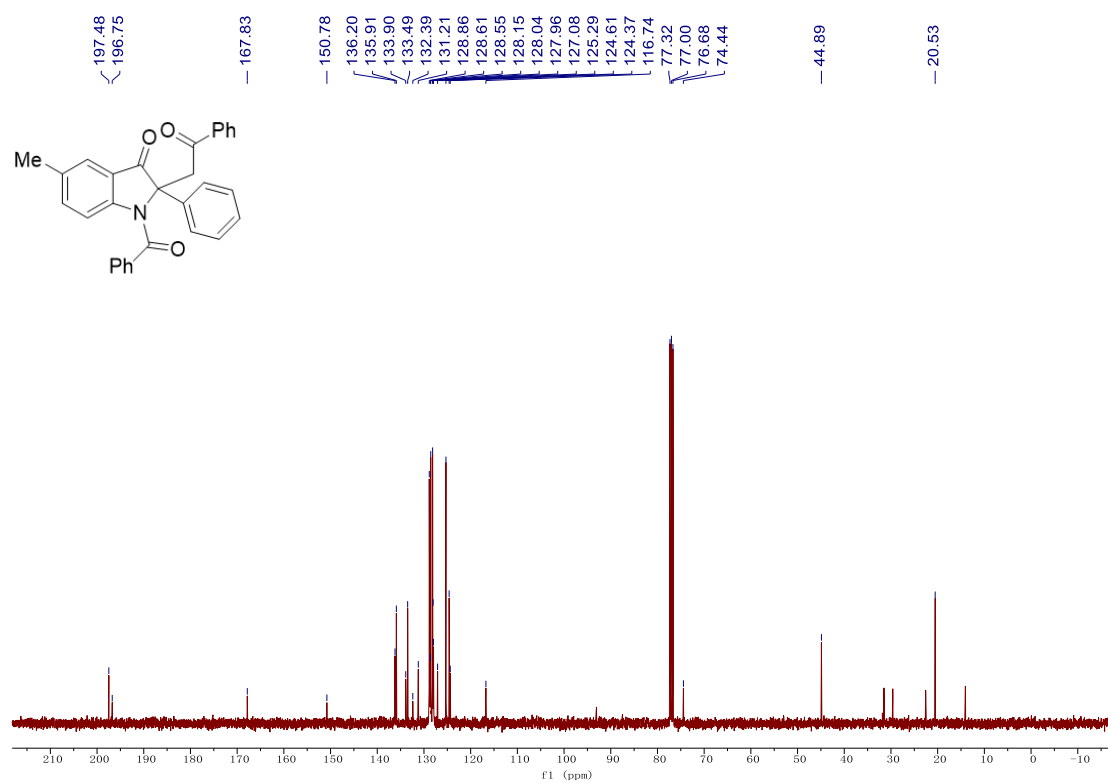


Figure S7. ^1H NMR Spectra of compound **3da** (400 MHz, CDCl_3).

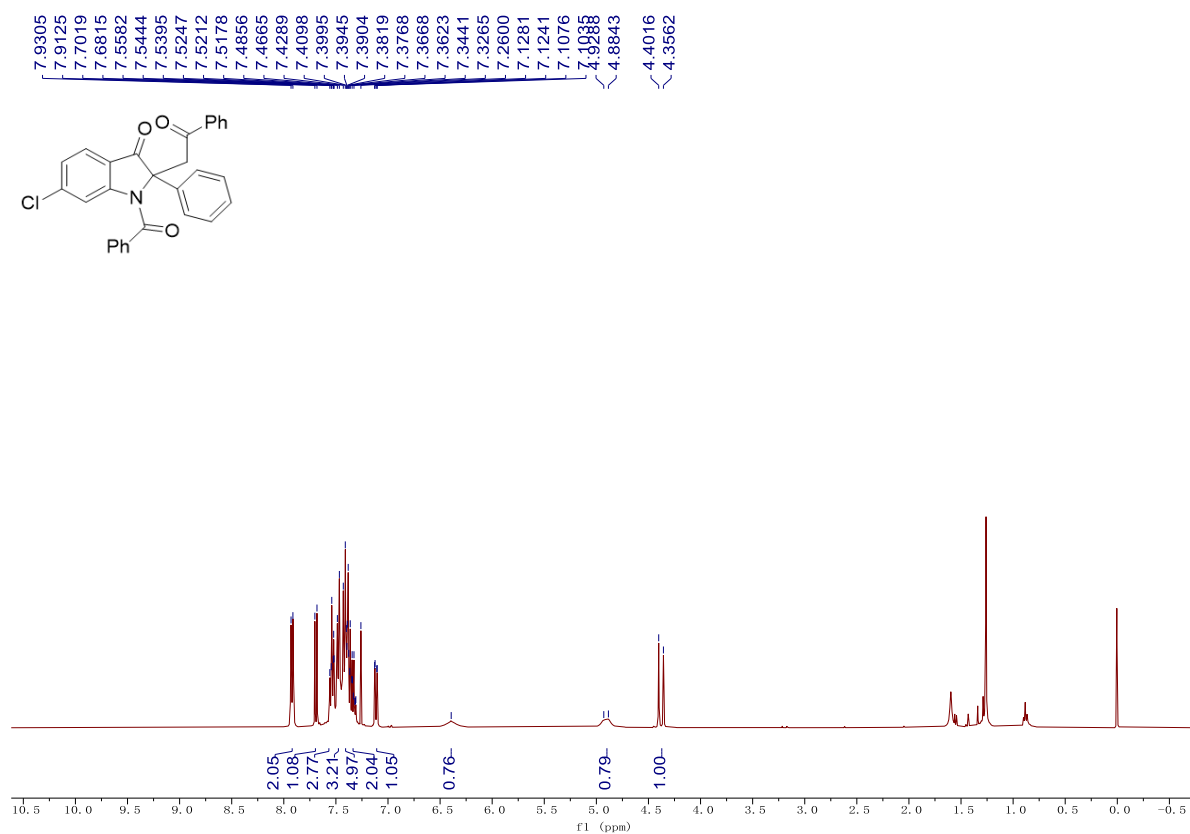


Figure S8. ^{13}C NMR Spectra of compound **3da** (400 MHz, CDCl_3).

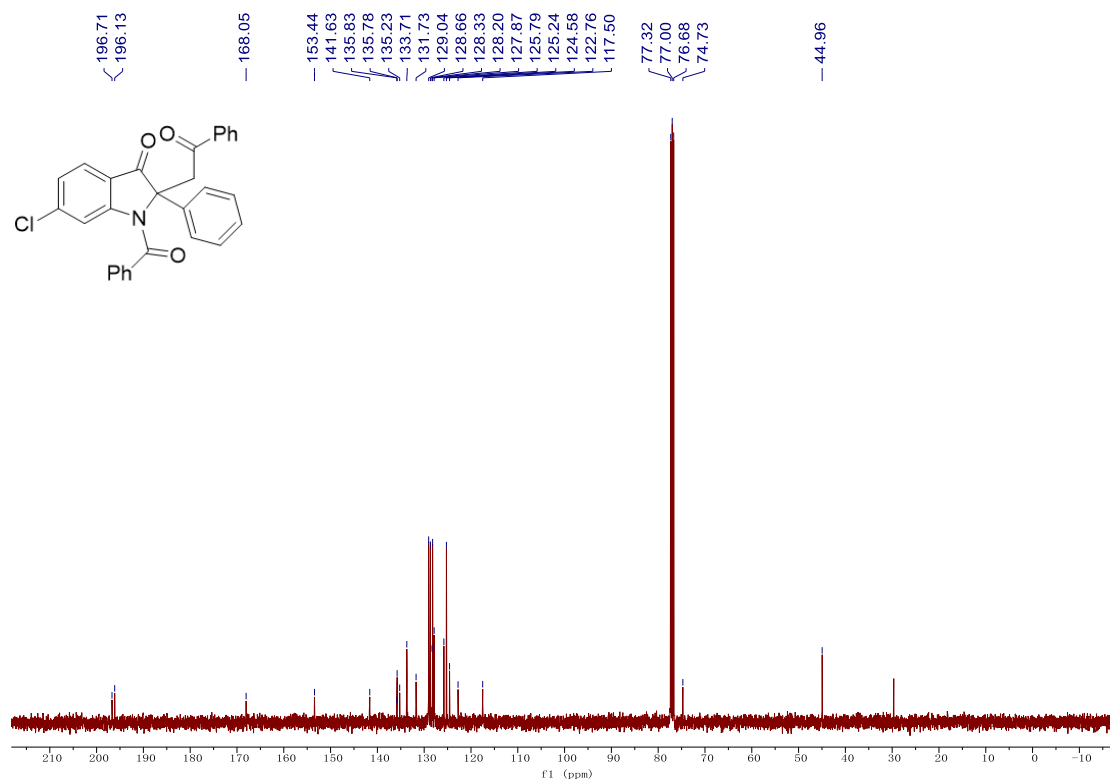


Figure S9. ^1H NMR Spectra of compound **3ea** (400 MHz, CDCl_3).

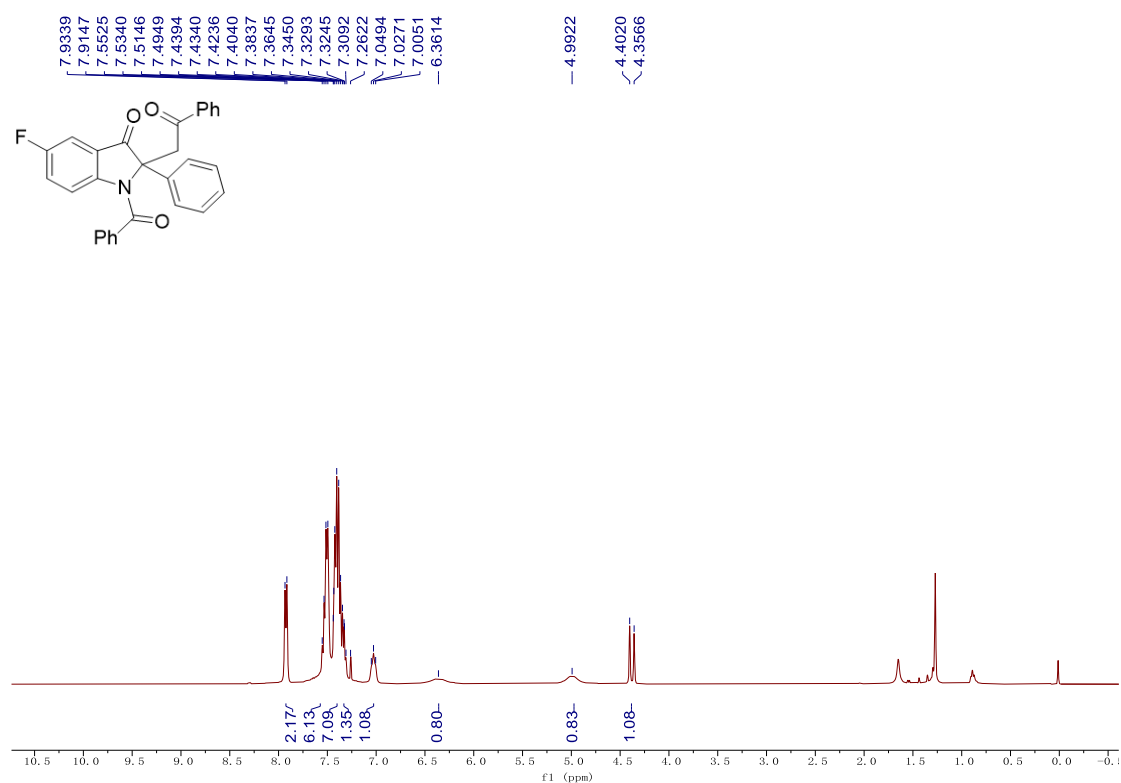


Figure S10. ^{13}C NMR Spectra of compound **3ea** (400 MHz, CDCl_3).

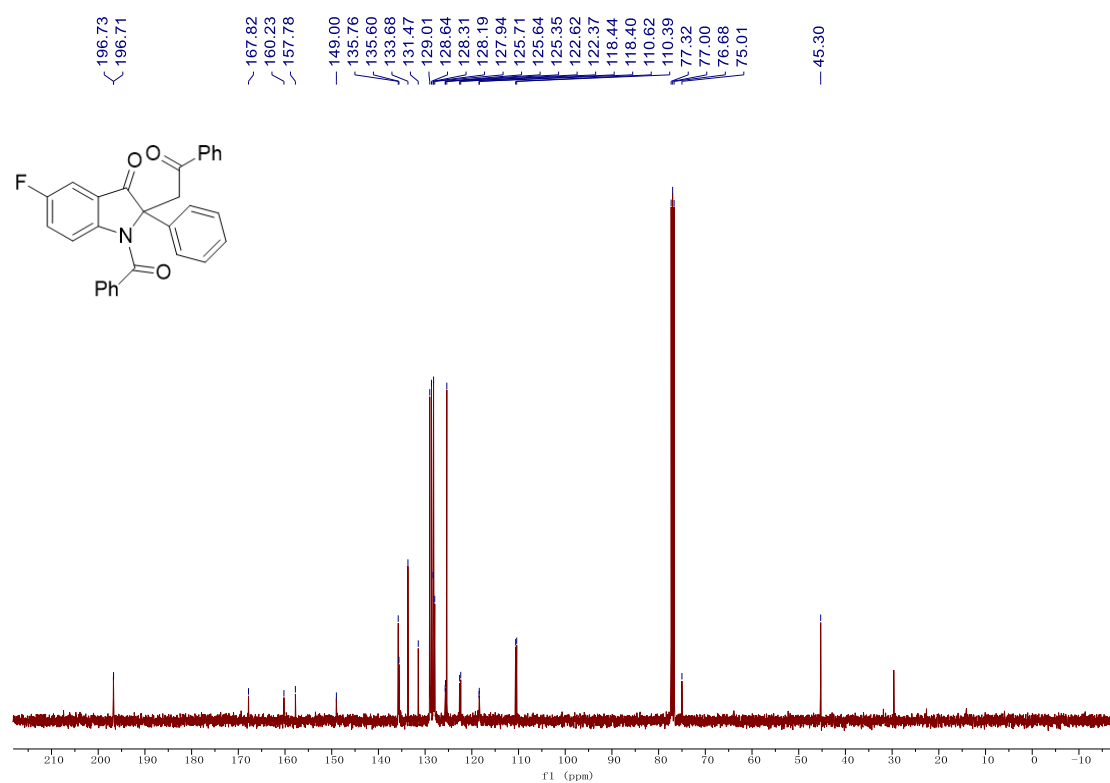


Figure S11. ^{19}F NMR Spectra of compound **3ea** (400 MHz, CDCl_3).

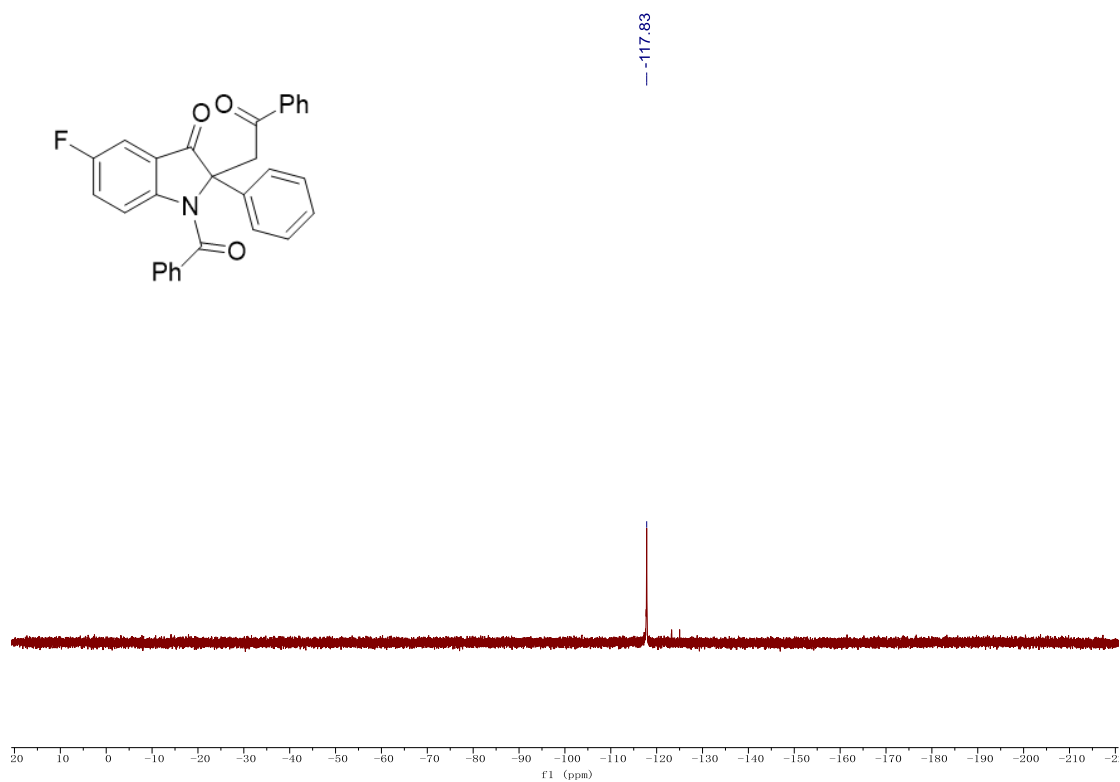


Figure S12. ^1H NMR Spectra of compound **3fa** (400 MHz, CDCl_3).

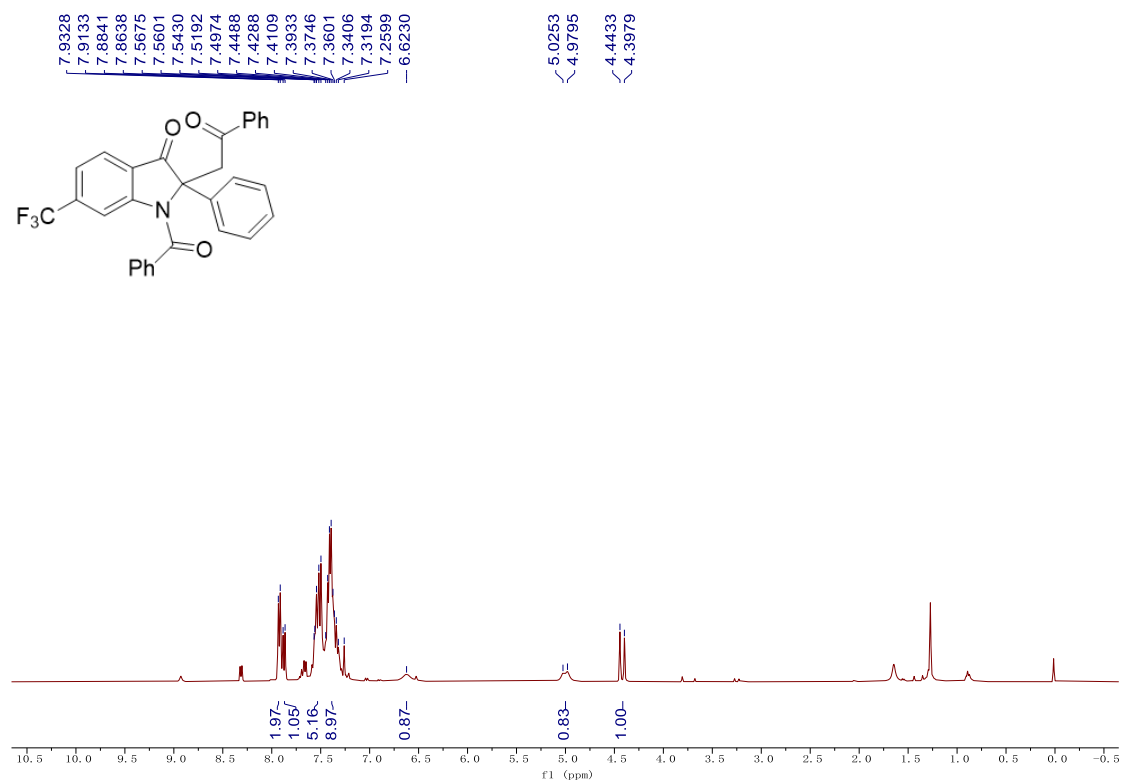


Figure S13. ^{13}C NMR Spectra of compound **3fa** (400 MHz, CDCl_3).

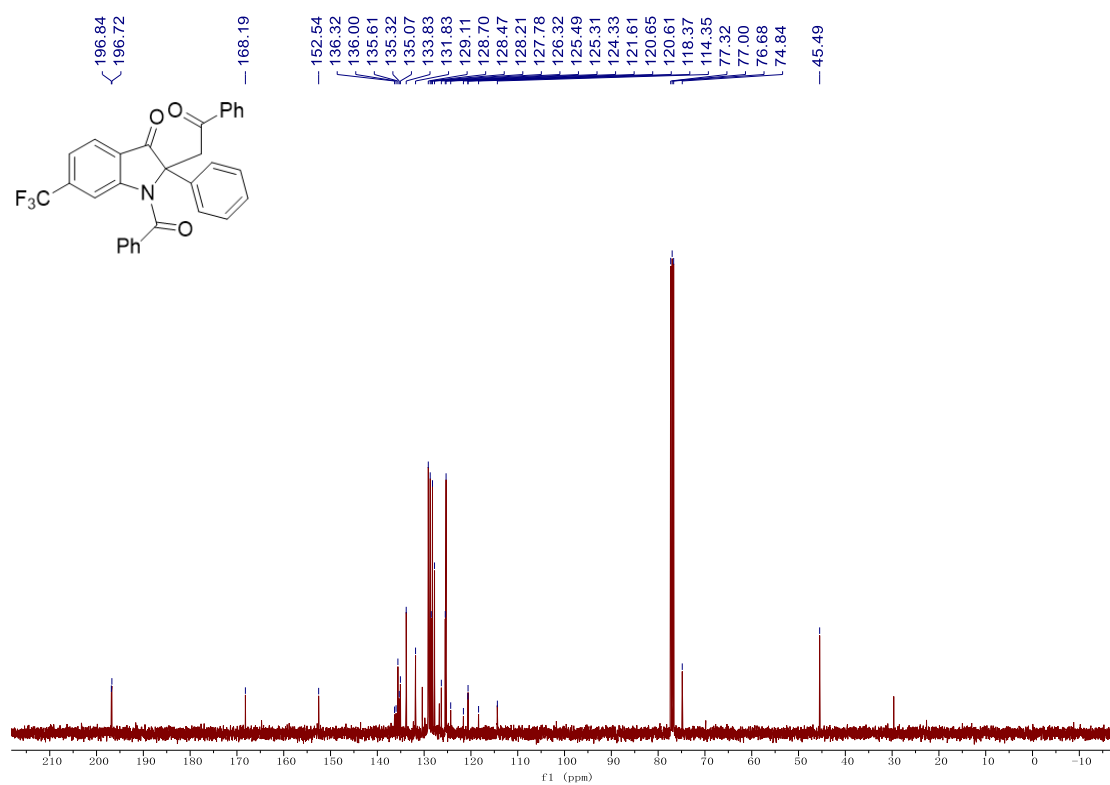


Figure S14. ^{19}F NMR Spectra of compound **3fa** (400 MHz, CDCl_3).



Figure S15. ^1H NMR Spectra of compound **3ga** (400 MHz, CDCl_3).

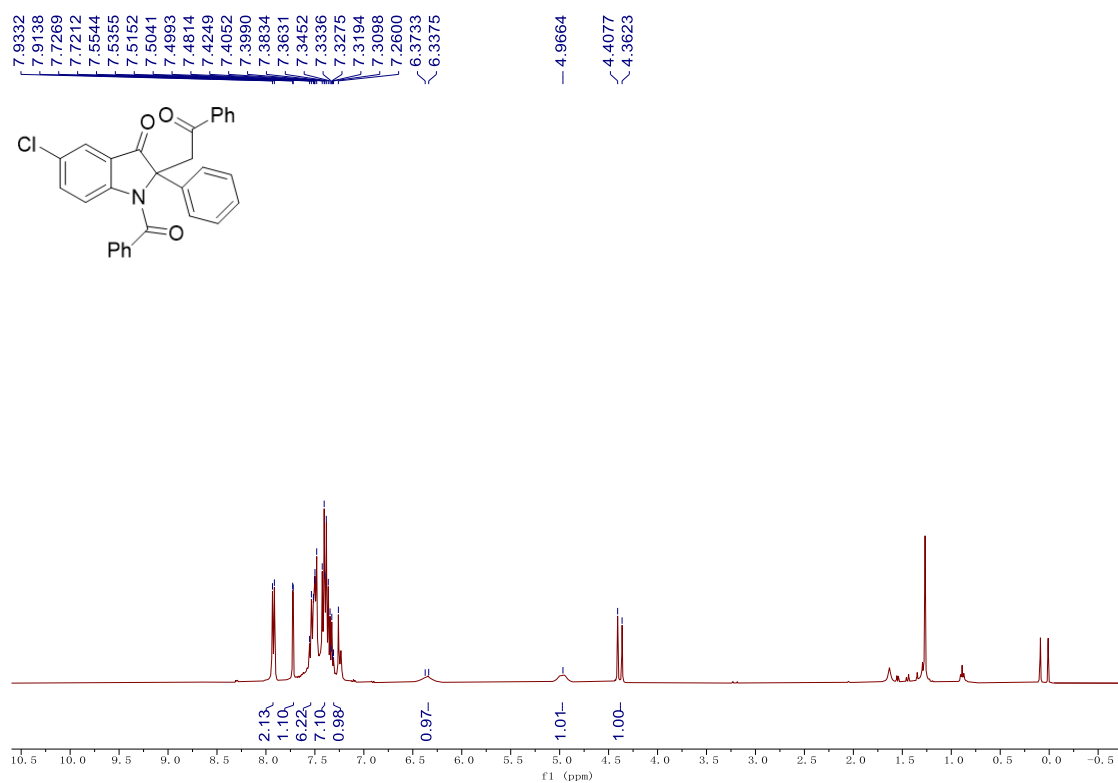


Figure S16. ^{13}C NMR Spectra of compound **3ga** (400 MHz, CDCl_3).

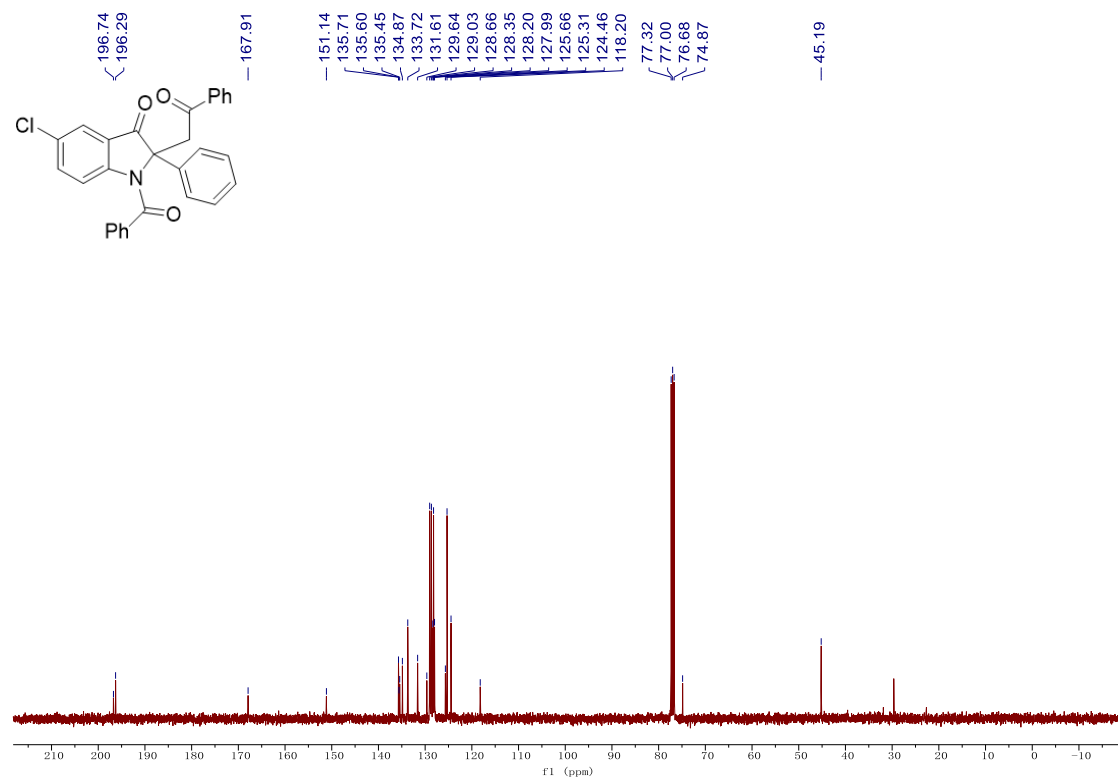


Figure S17. ^1H NMR Spectra of compound **3ha** (400 MHz, CDCl_3).

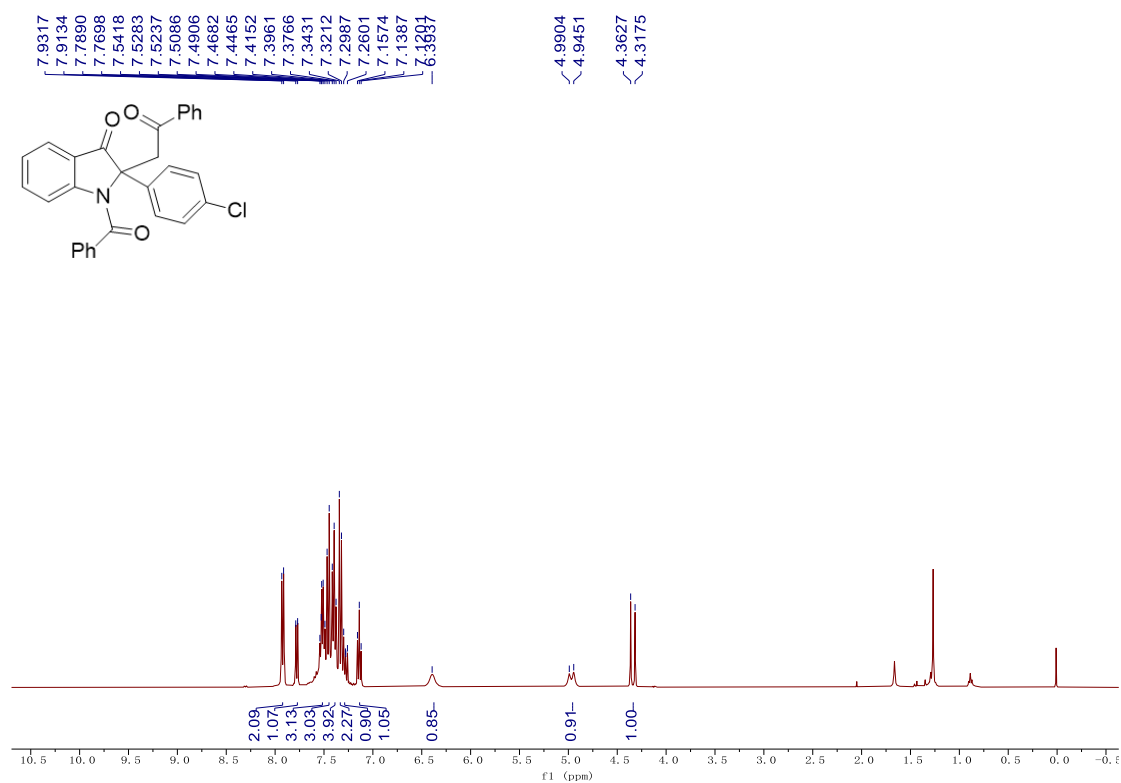


Figure S18. ^{13}C NMR Spectra of compound **3ha** (400 MHz, CDCl_3).

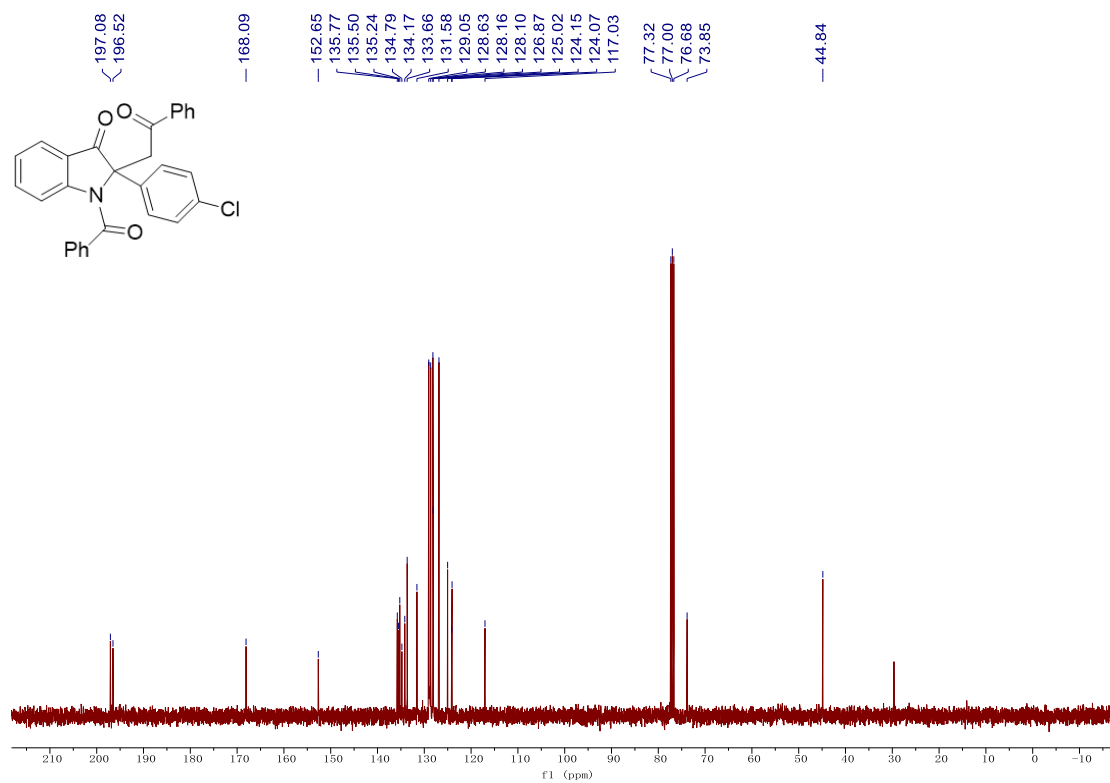


Figure S19. ^1H NMR Spectra of compound **3ia** (400 MHz, CDCl_3).

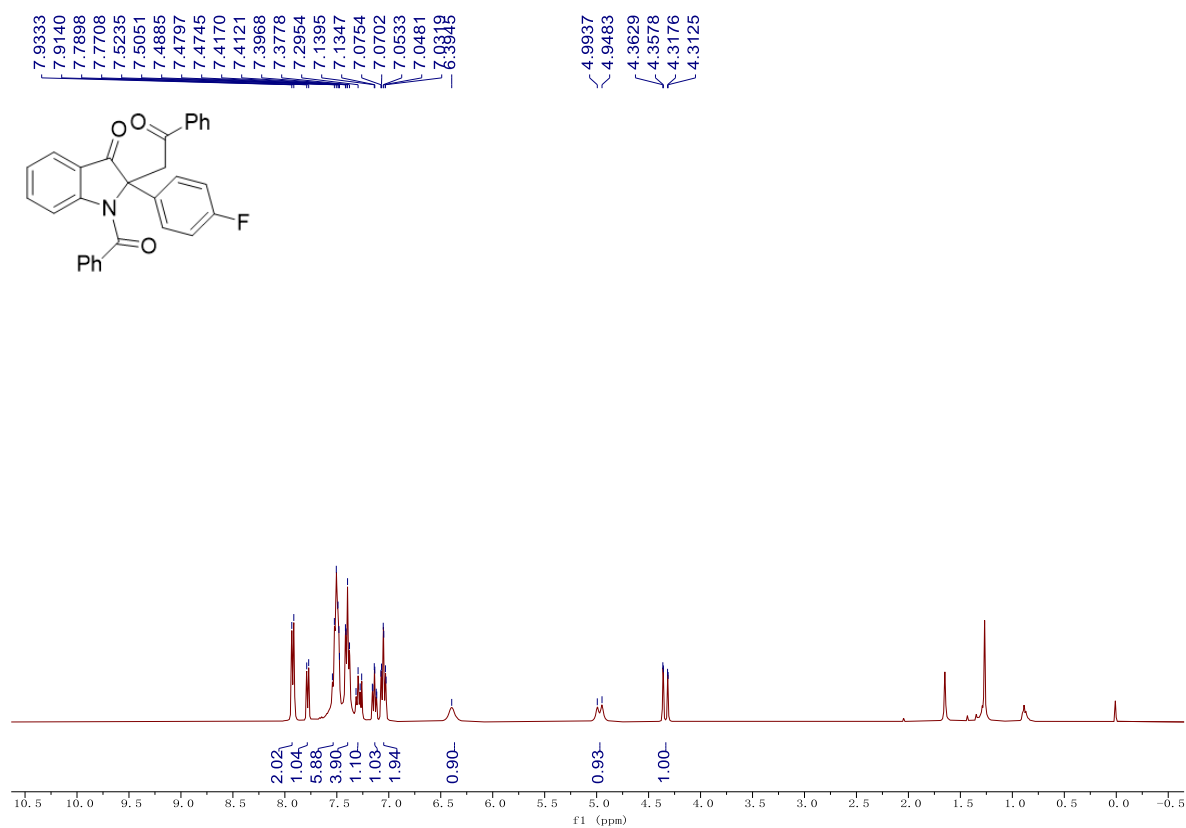


Figure S20. ^{13}C NMR Spectra of compound **3ia** (400 MHz, CDCl_3).

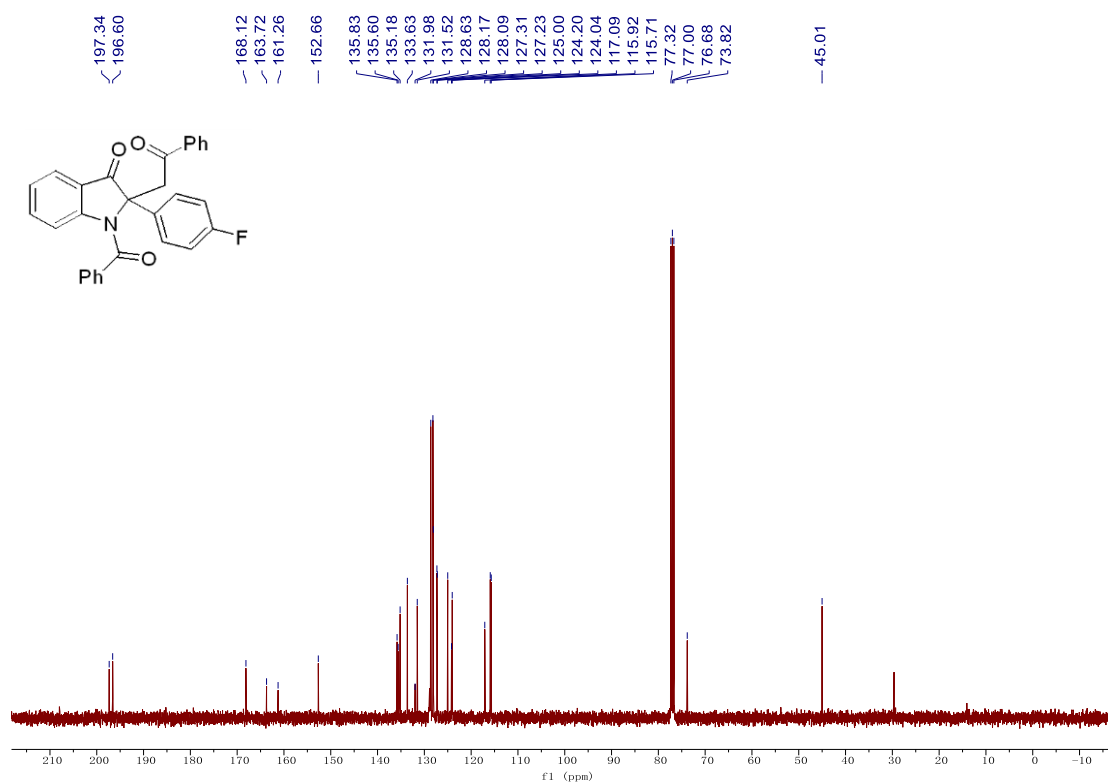


Figure S21. ^{19}F NMR Spectra of compound **3ia** (400 MHz, CDCl_3).

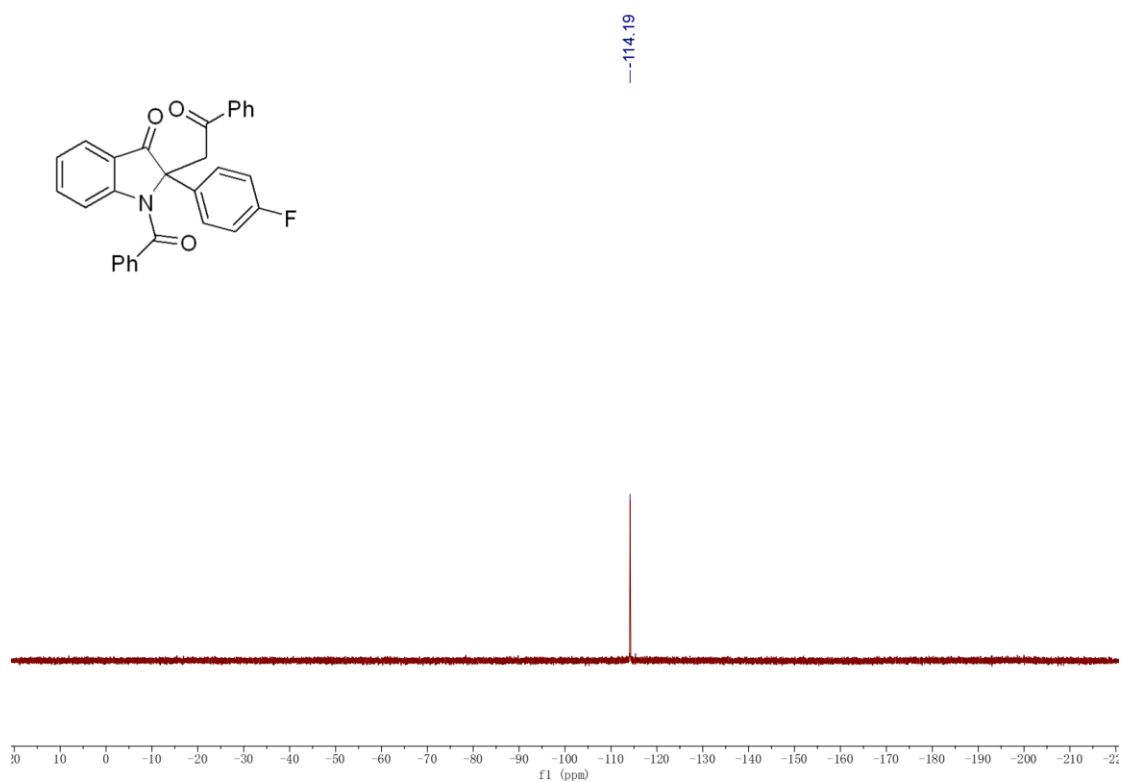


Figure S22. ^1H NMR Spectra of compound **3ja** (400 MHz, CDCl_3).

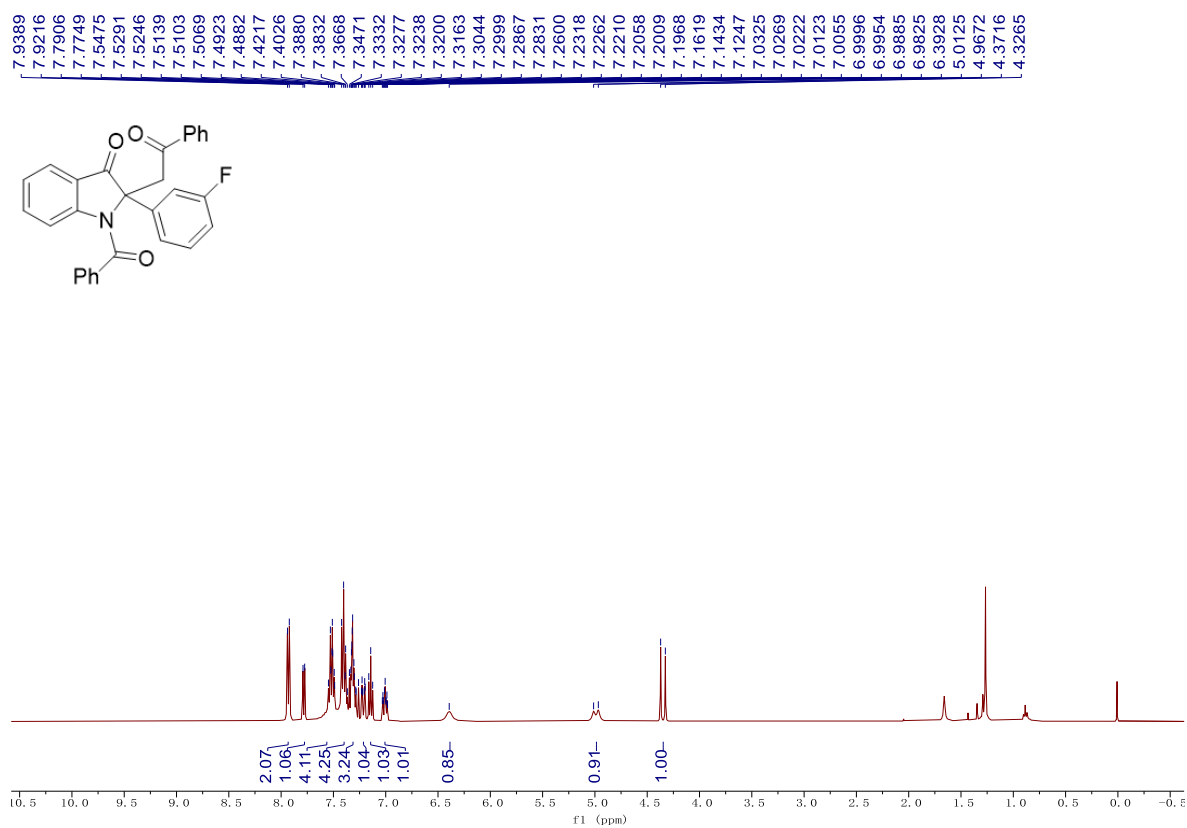


Figure S23. ^{13}C NMR Spectra of compound **3ja** (400 MHz, CDCl_3).

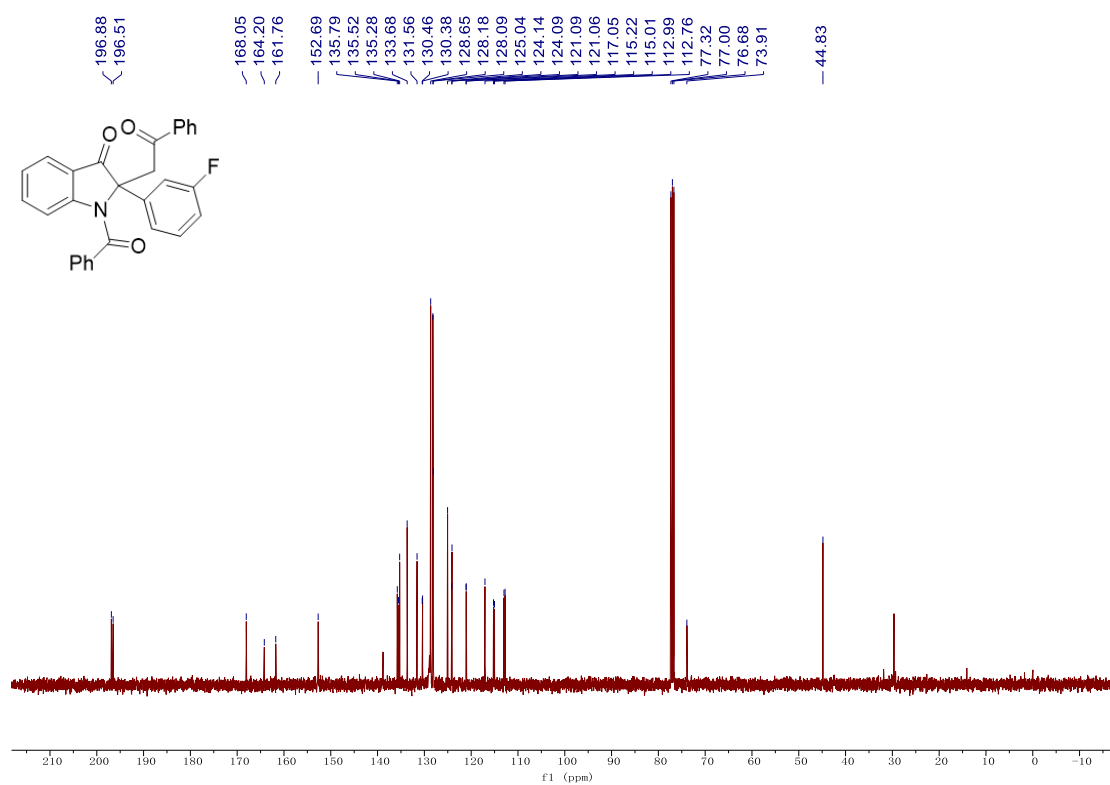


Figure S24. ^{19}F NMR Spectra of compound **3ja** (400 MHz, CDCl_3).

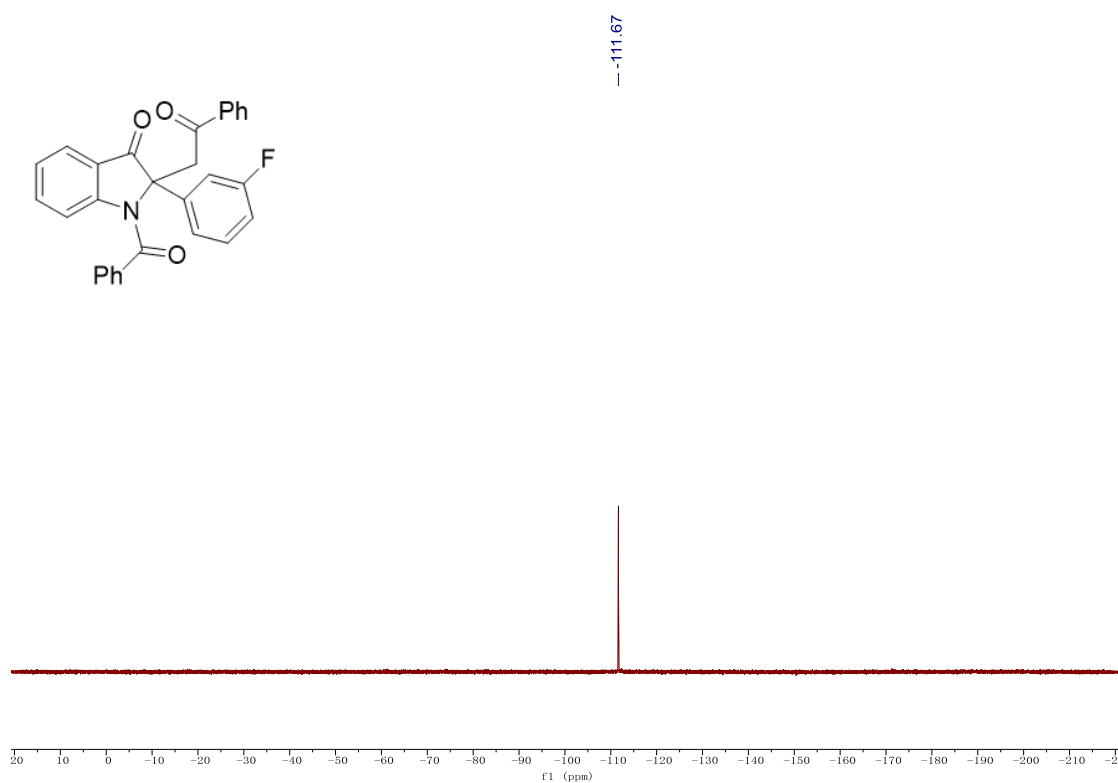


Figure S25. ^1H NMR Spectra of compound **3ka** (400 MHz, CDCl_3).

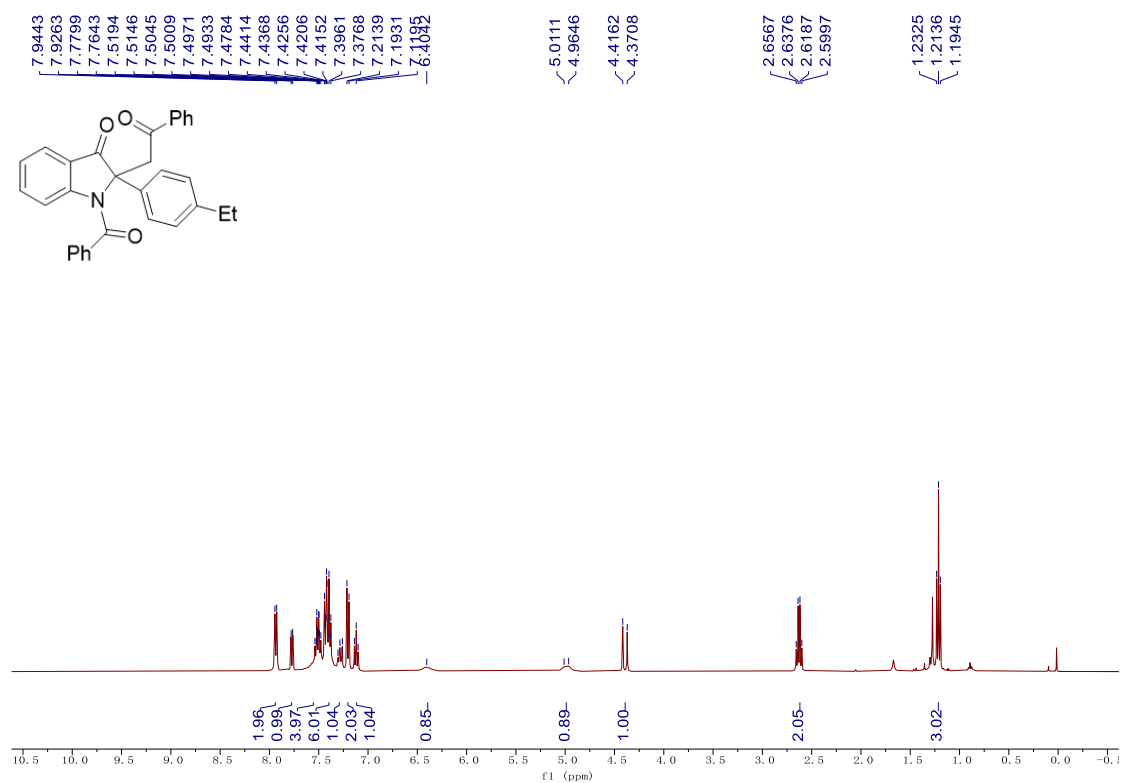


Figure S26. ^{13}C NMR Spectra of compound **3ka** (400 MHz, CDCl_3).

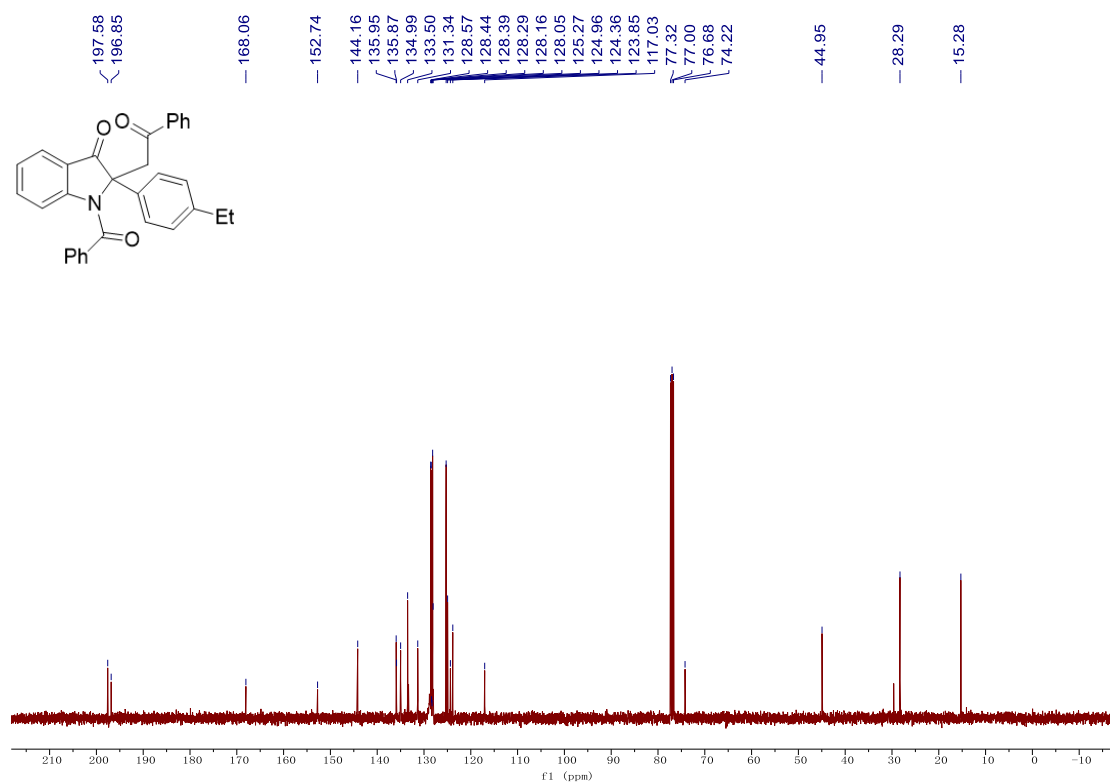


Figure S27. ^1H NMR Spectra of compound **3la** (400 MHz, CDCl_3).

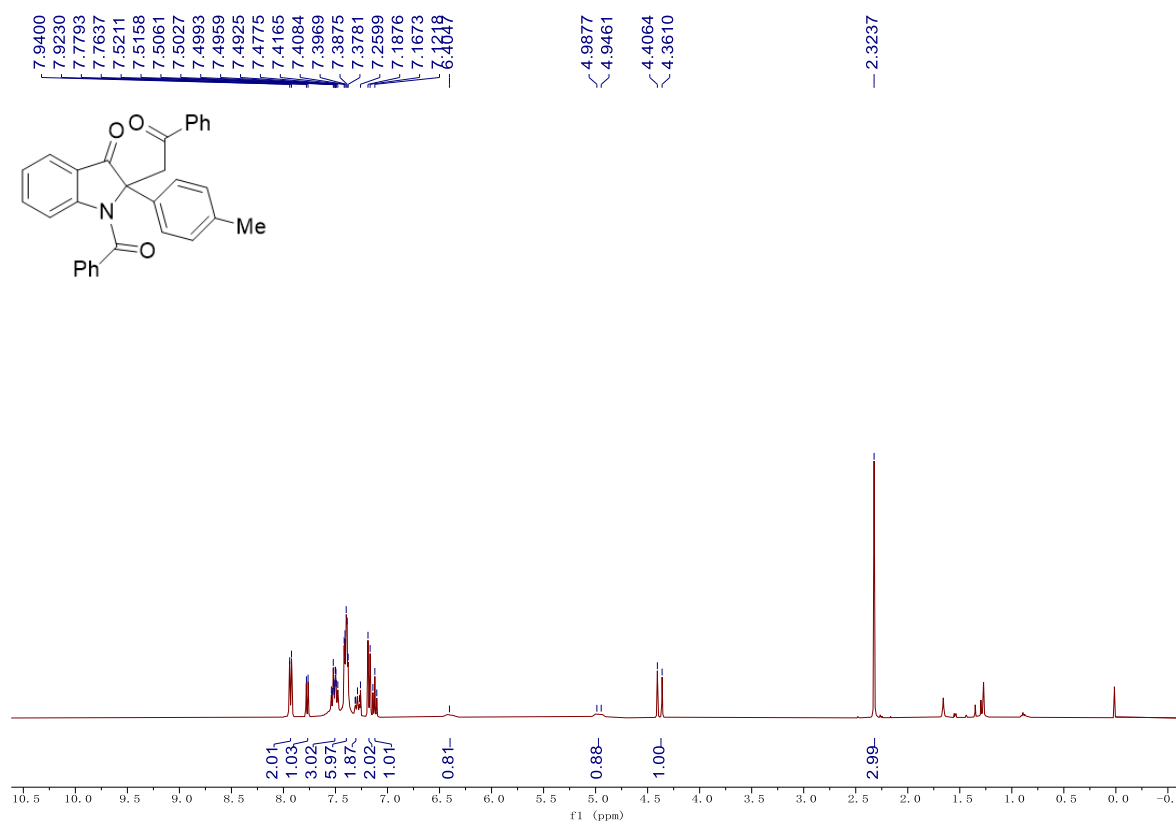


Figure S28. ^{13}C NMR Spectra of compound **3la** (400 MHz, CDCl_3).

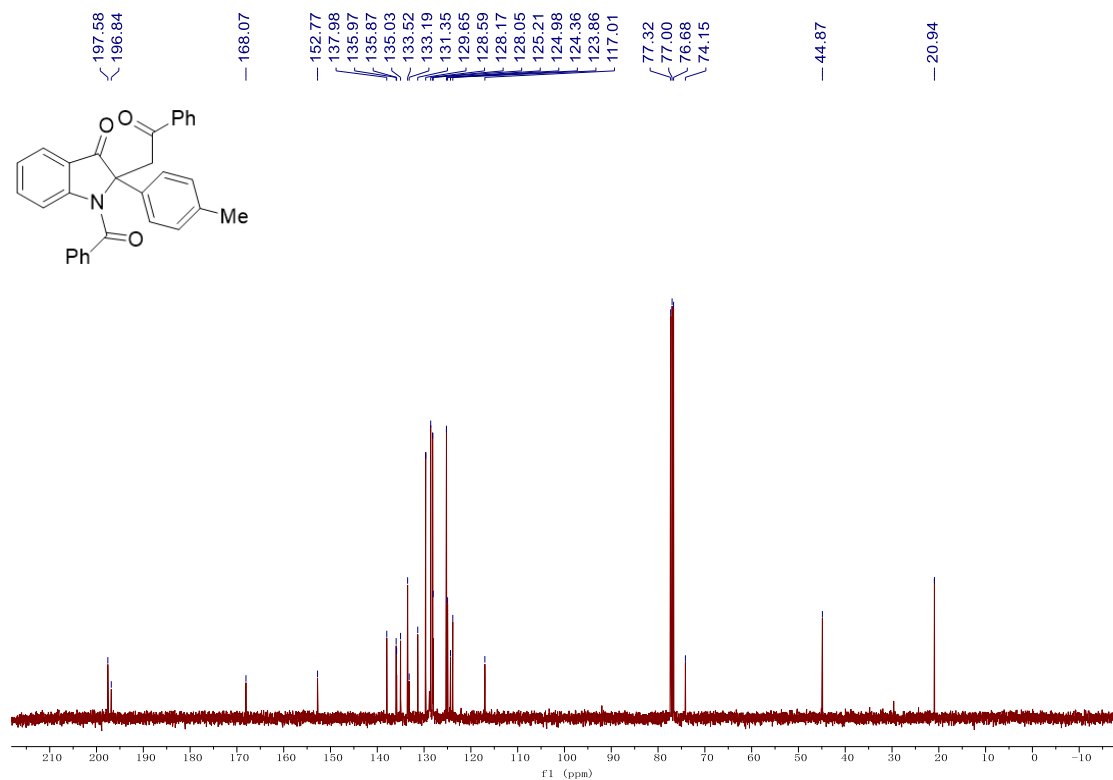


Figure S29. ^1H NMR Spectra of compound **3ma** (400 MHz, CDCl_3).

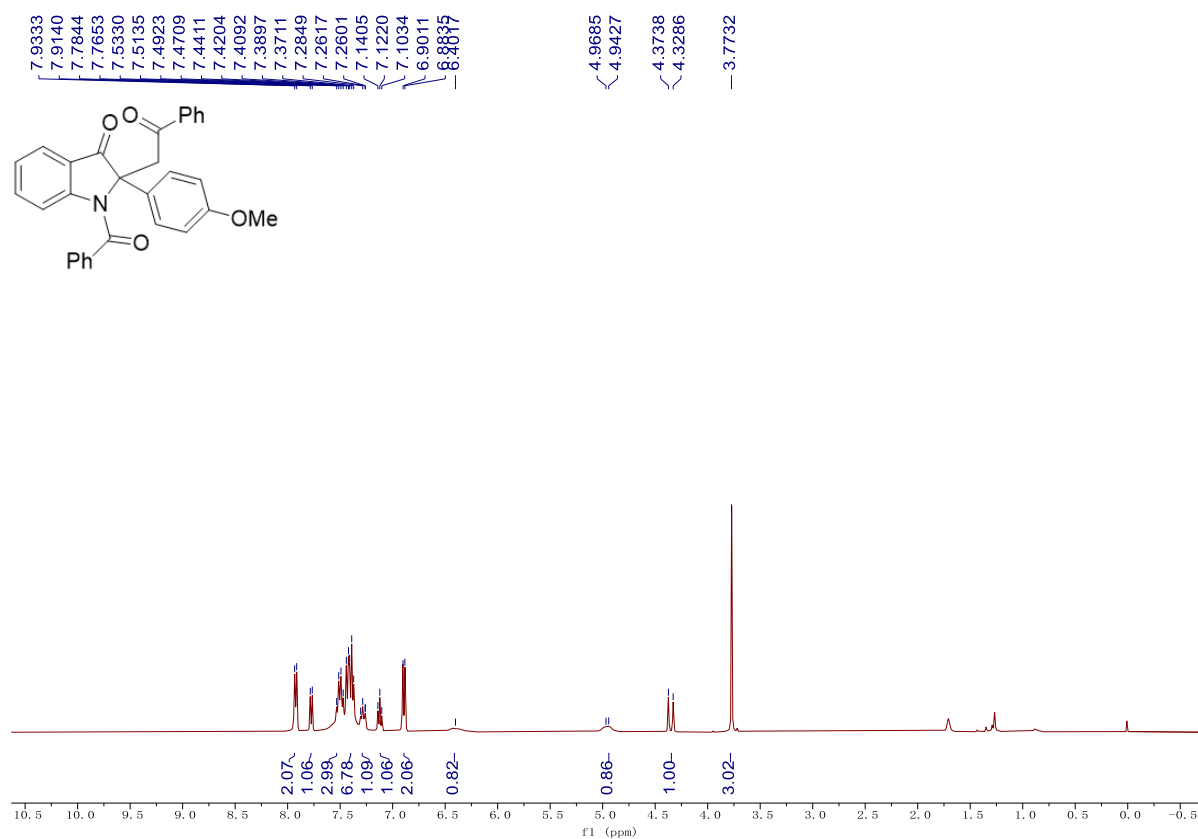


Figure S30. ^{13}C NMR Spectra of compound **3ma** (400 MHz, CDCl_3).

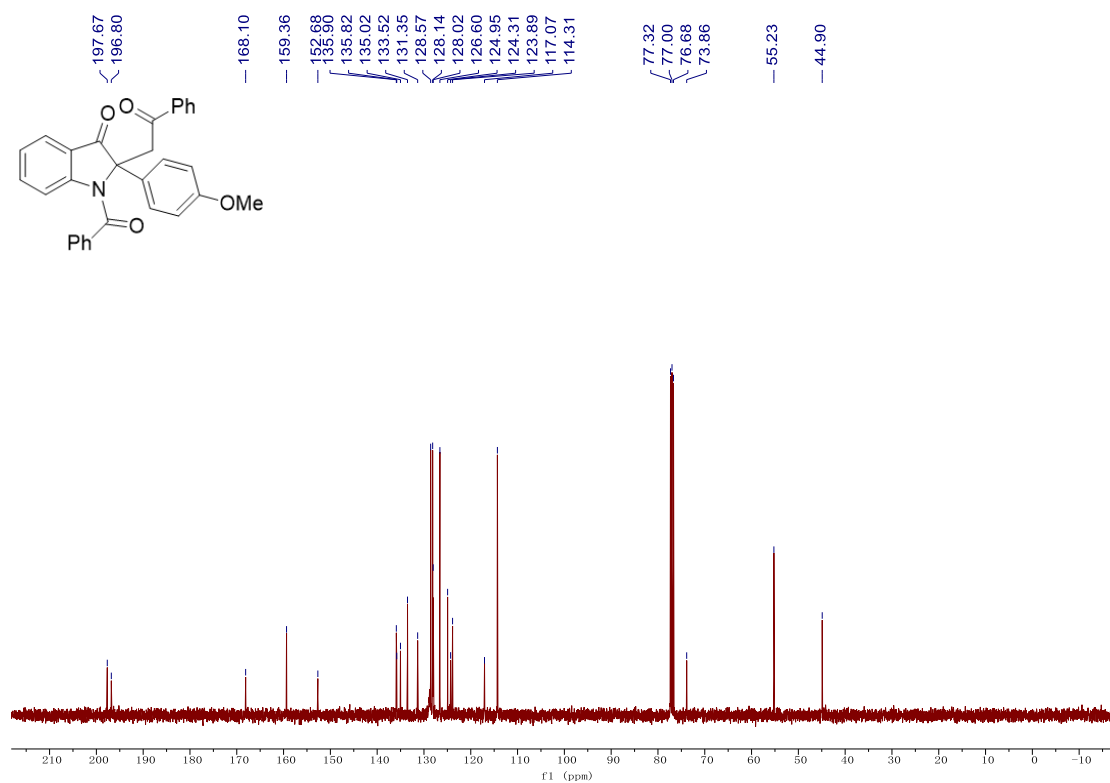


Figure S31. ¹H NMR Spectra of compound **3na** (400 MHz, CDCl₃).

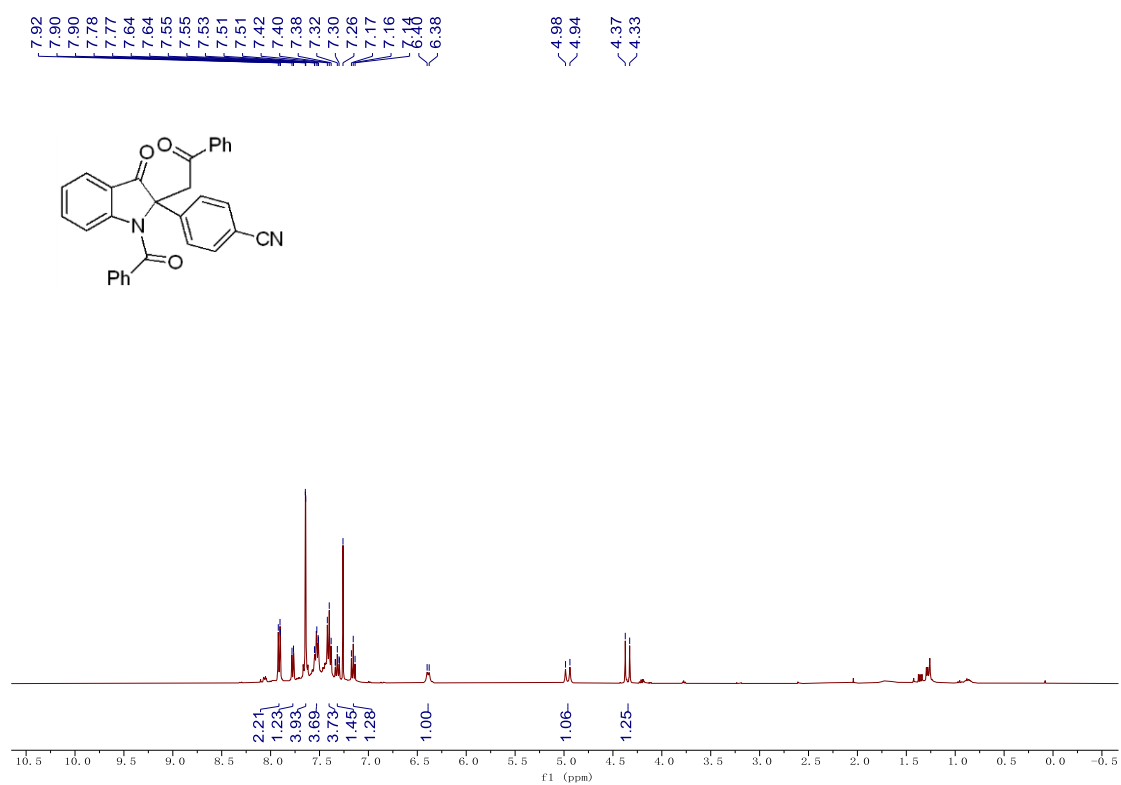


Figure S32. ¹³C NMR Spectra of compound **3na** (600 MHz, CDCl₃).

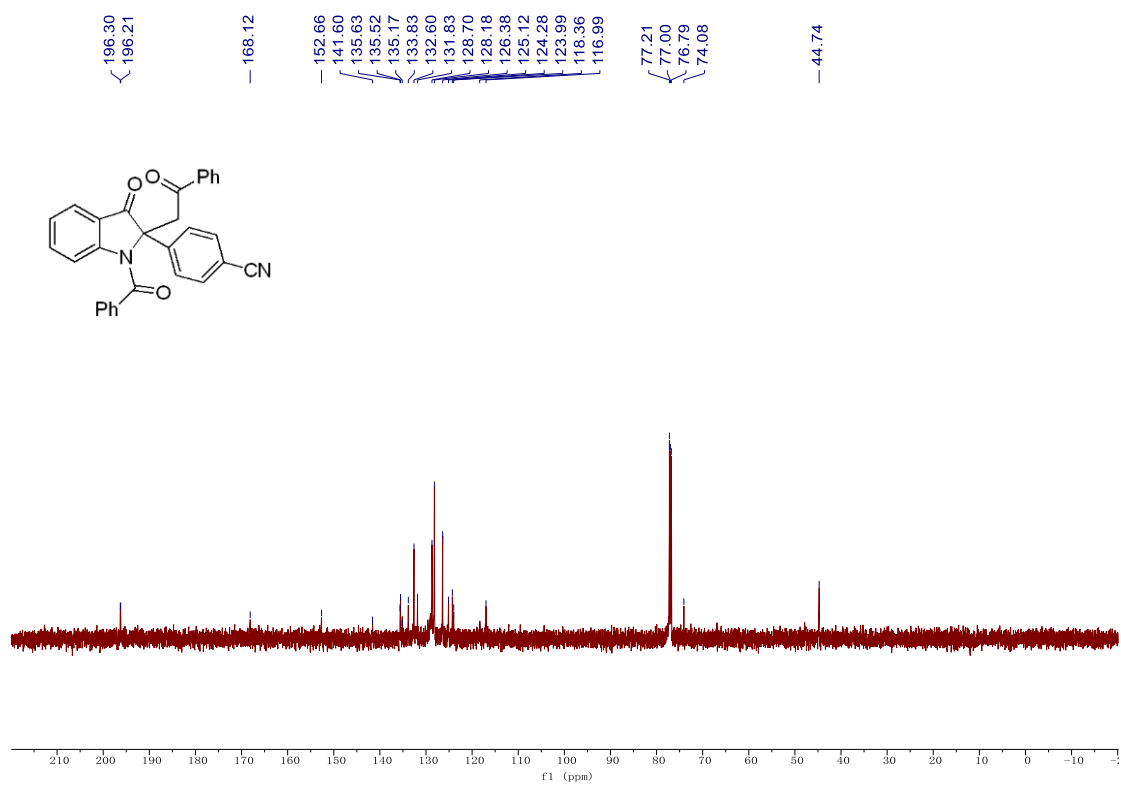


Figure S33. ^1H NMR Spectra of compound **30a** (400 MHz, CDCl_3).

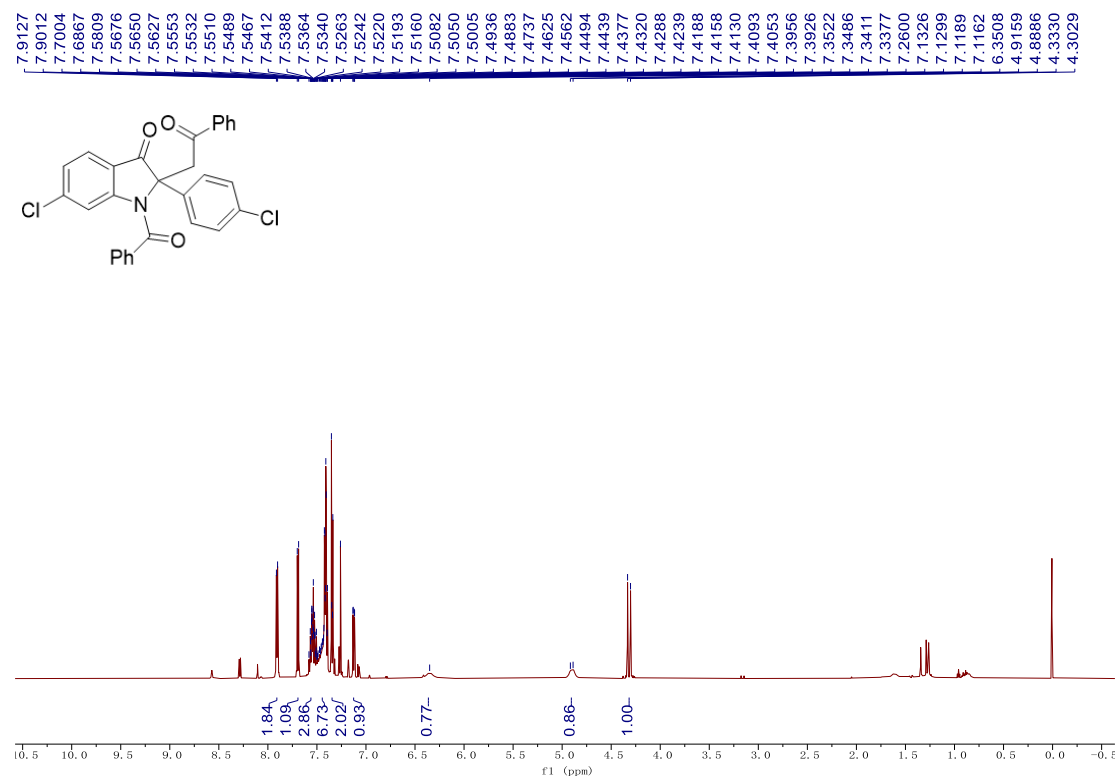


Figure S34. ^{13}C NMR Spectra of compound **30a** (400 MHz, CDCl_3).

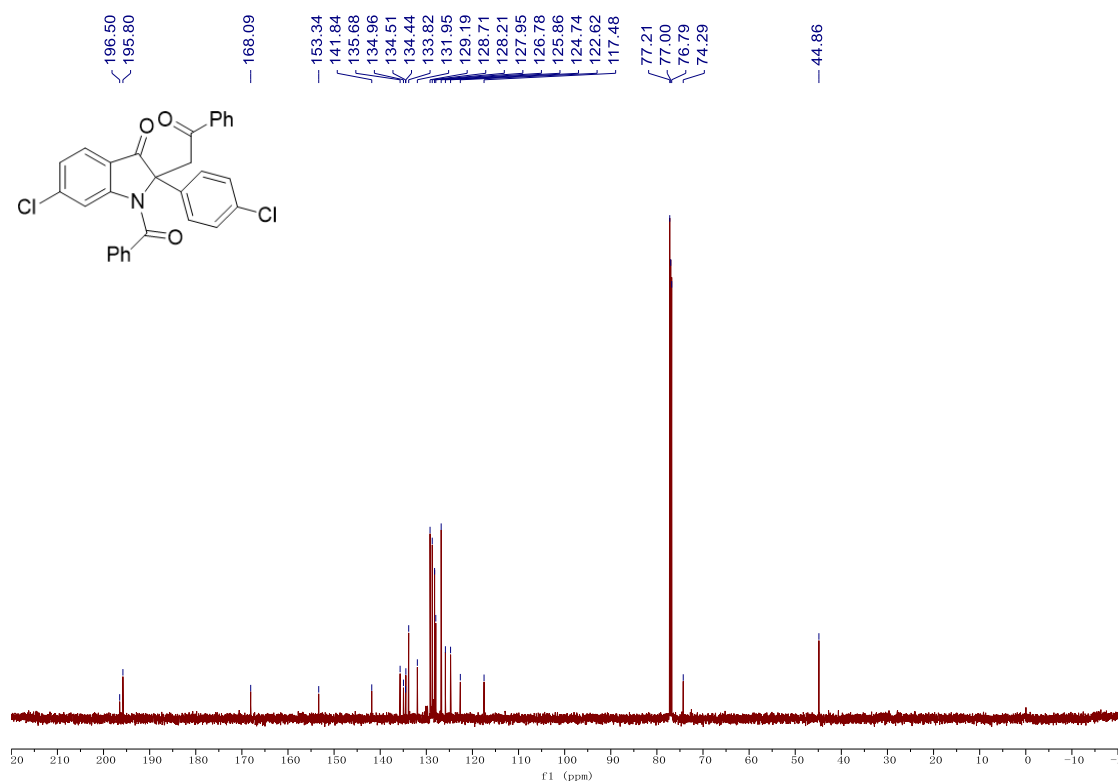


Figure S35. ^1H NMR Spectra of compound **3pa** (400 MHz, CDCl_3).

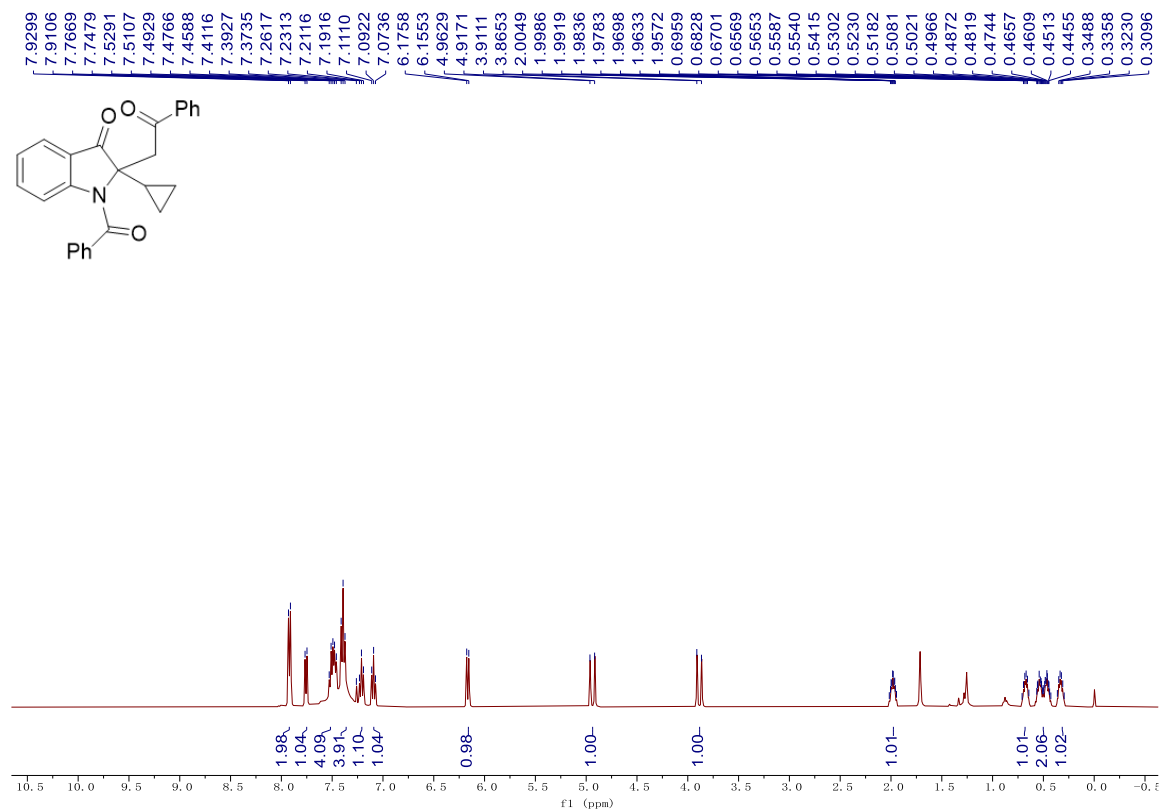


Figure S36. ^{13}C NMR Spectra of compound **3pa** (400 MHz, CDCl_3).

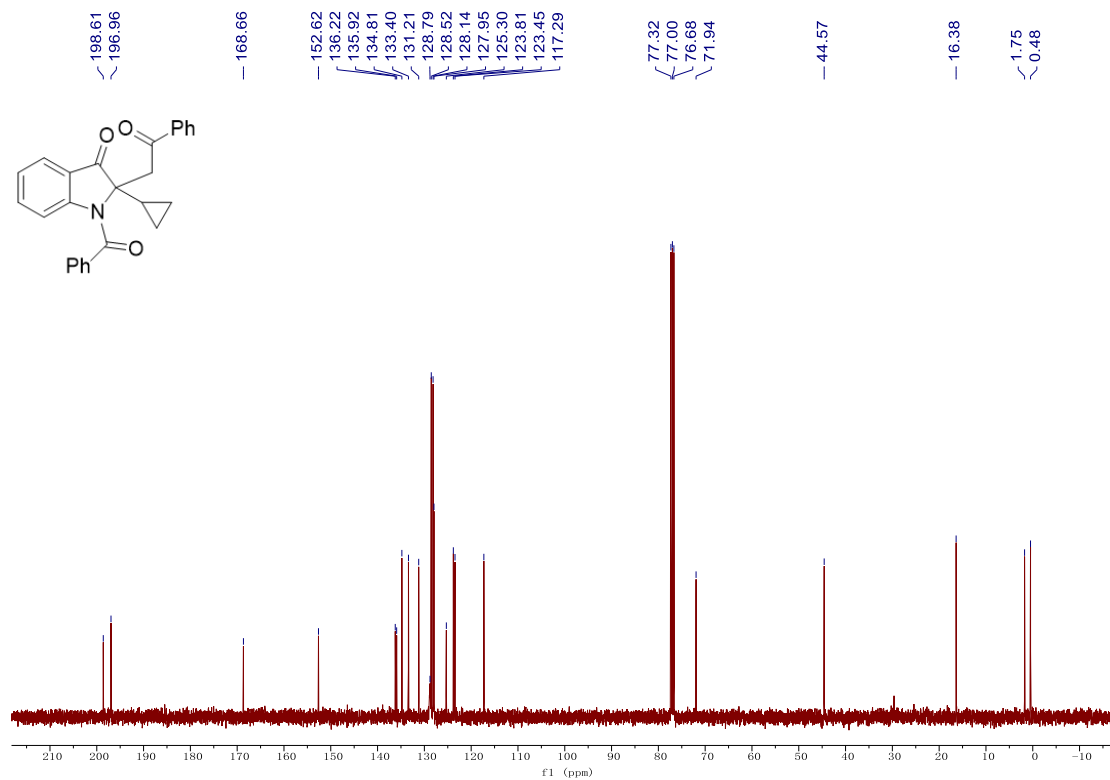


Figure S37. ¹H NMR Spectra of compound 3ra (400 MHz, CDCl₃).

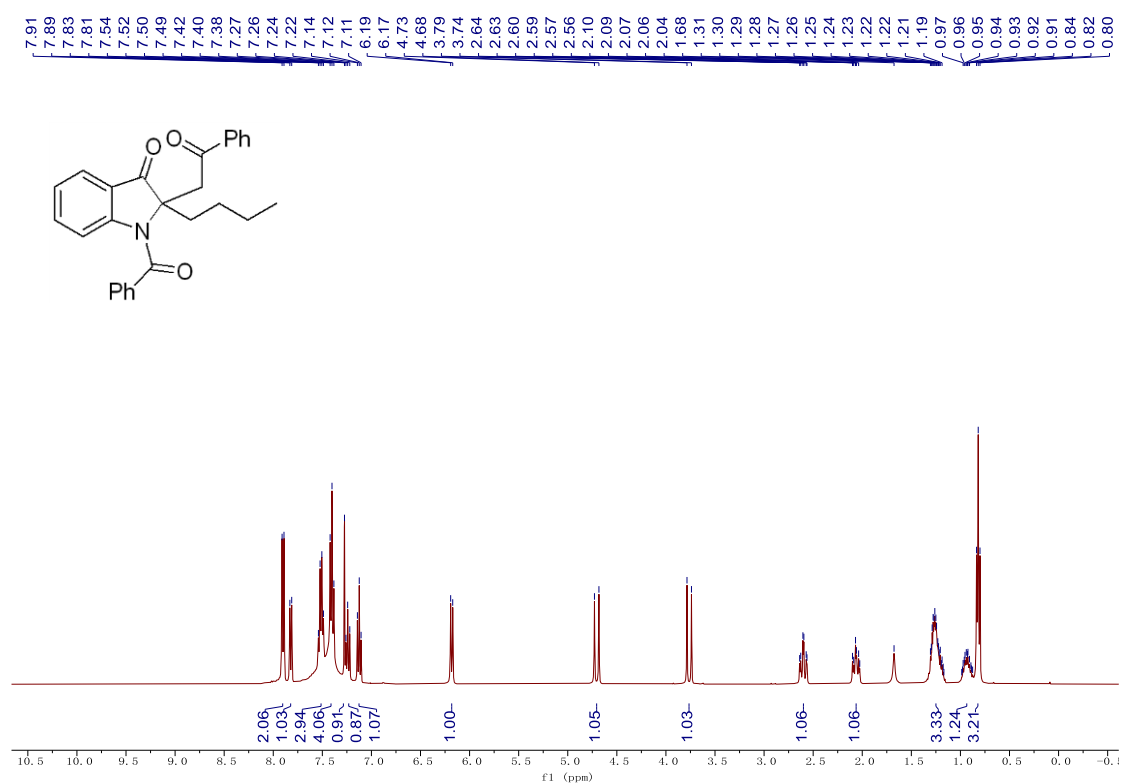


Figure S38. ¹³C NMR Spectra of compound 3ra (600 MHz, CDCl₃).

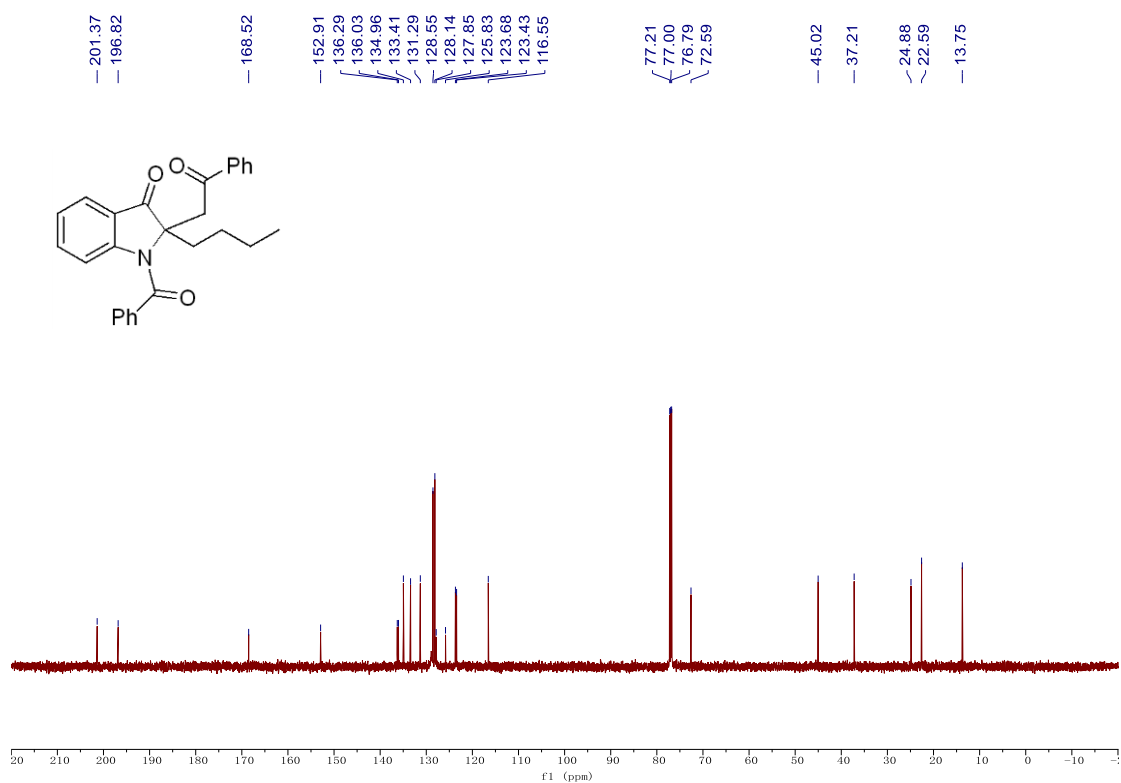


Figure S39. ^1H NMR Spectra of compound **3sa** (400 MHz, CDCl_3).

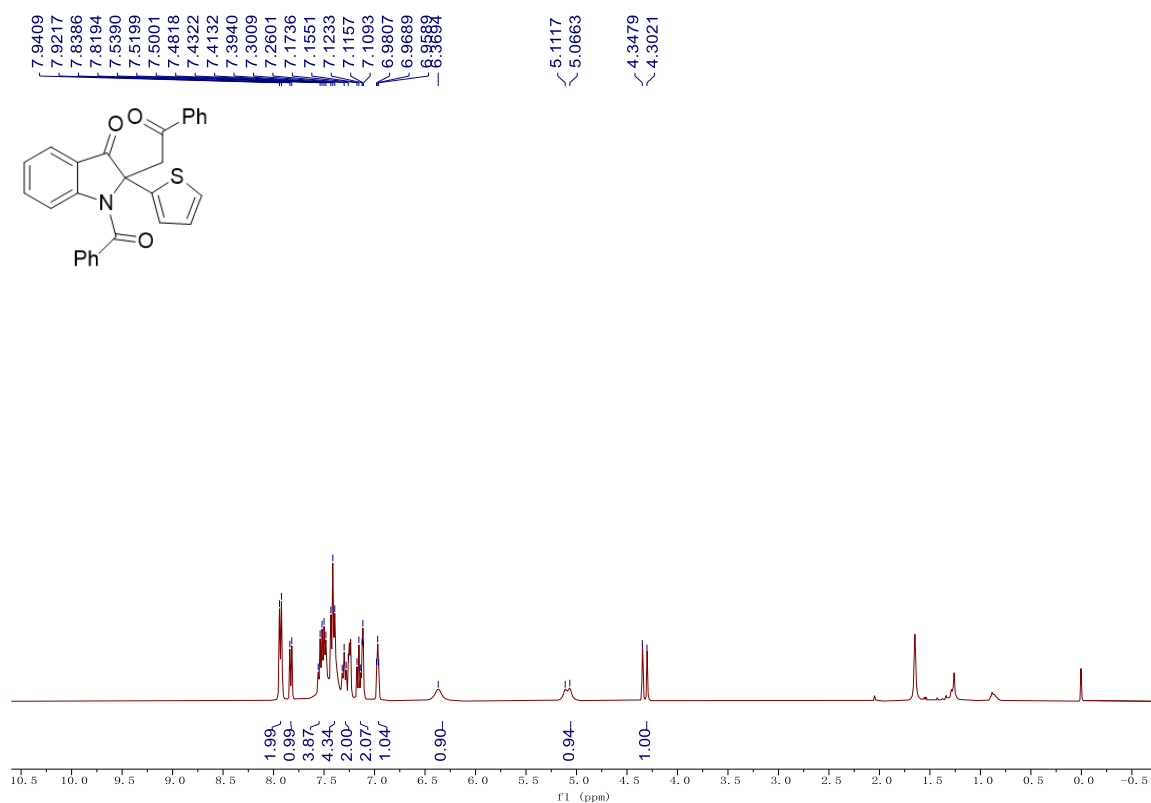


Figure S40. ^{13}C NMR Spectra of compound **3sa** (400 MHz, CDCl_3).

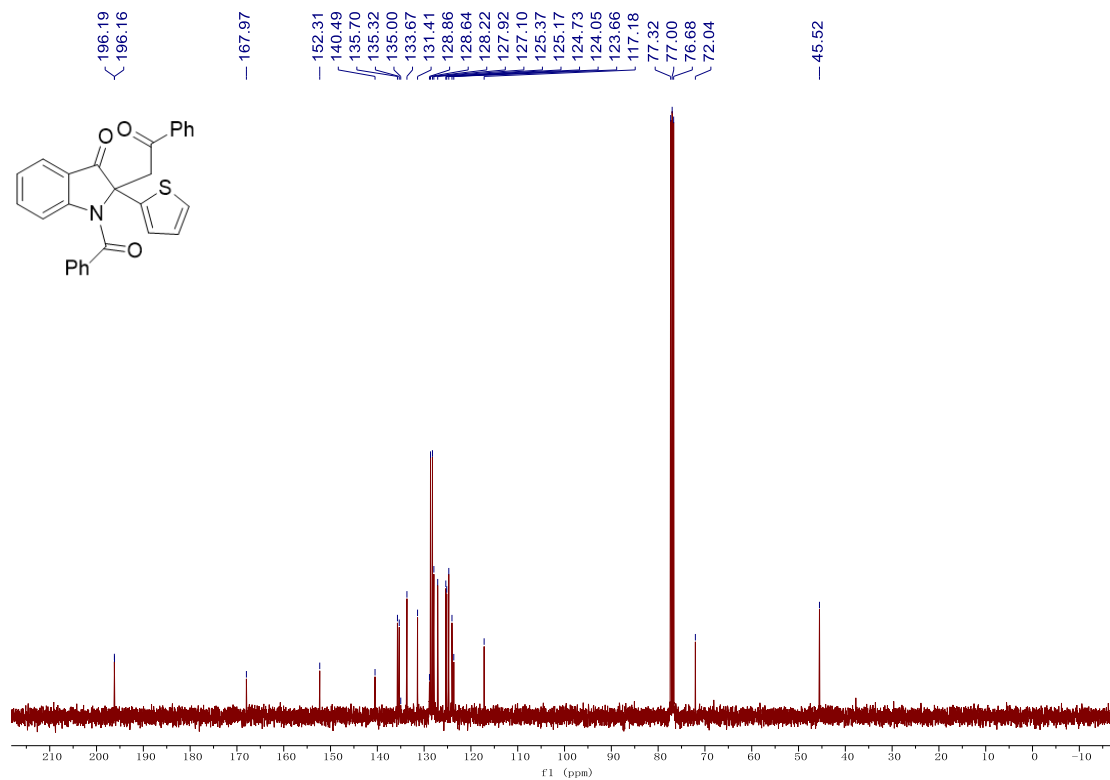


Figure S41. ^1H NMR Spectra of compound **3ta** (600 MHz, CDCl_3).

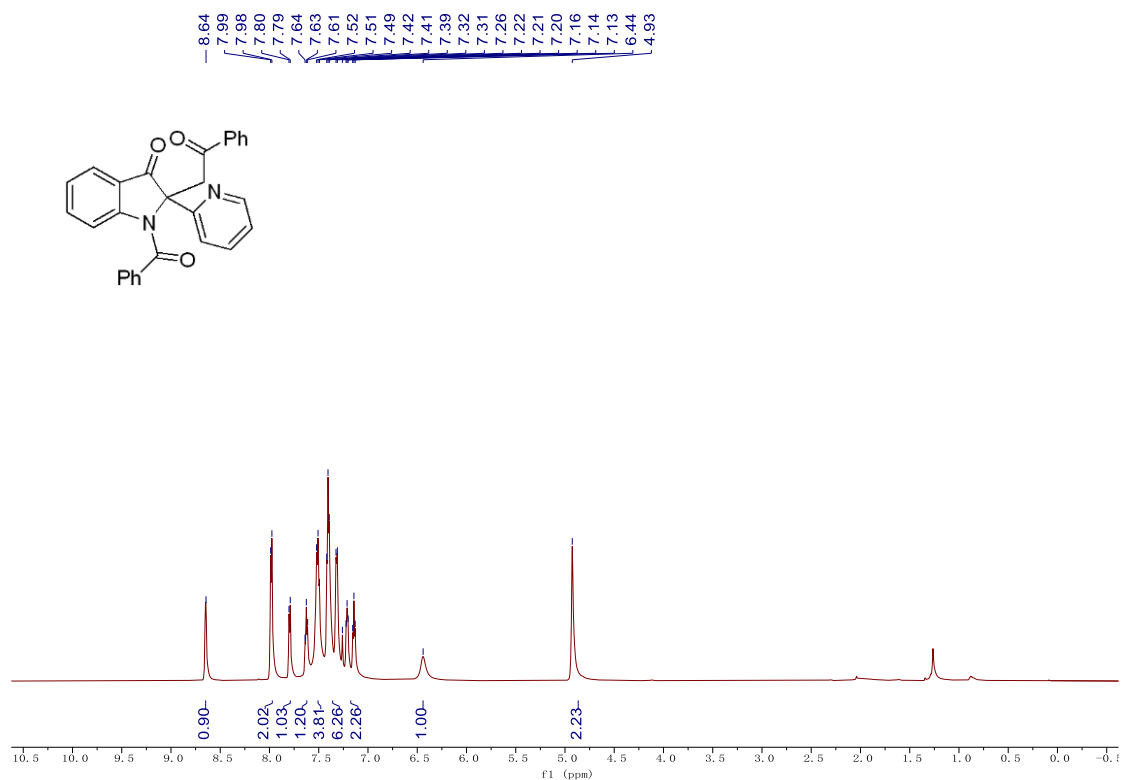


Figure S42. ^{13}C NMR Spectra of compound **3ta** (600 MHz, CDCl_3).

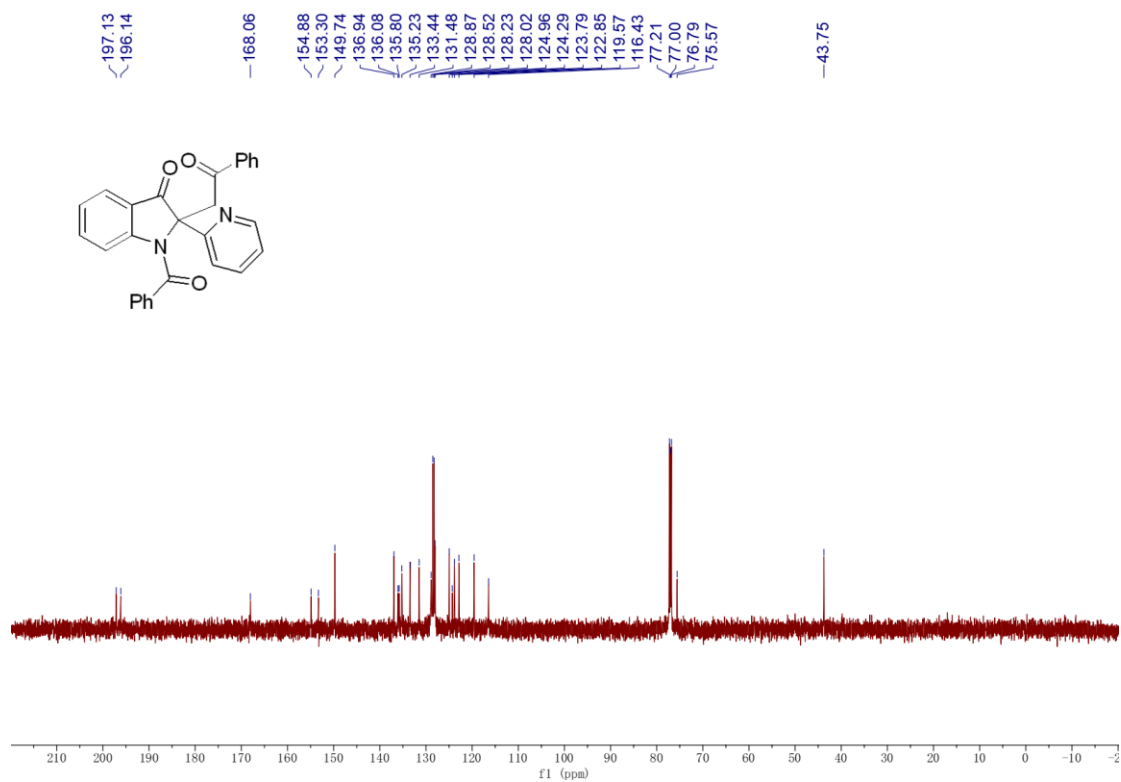


Figure S43. ^1H NMR Spectra of compound **3ab** (400 MHz, CDCl_3).

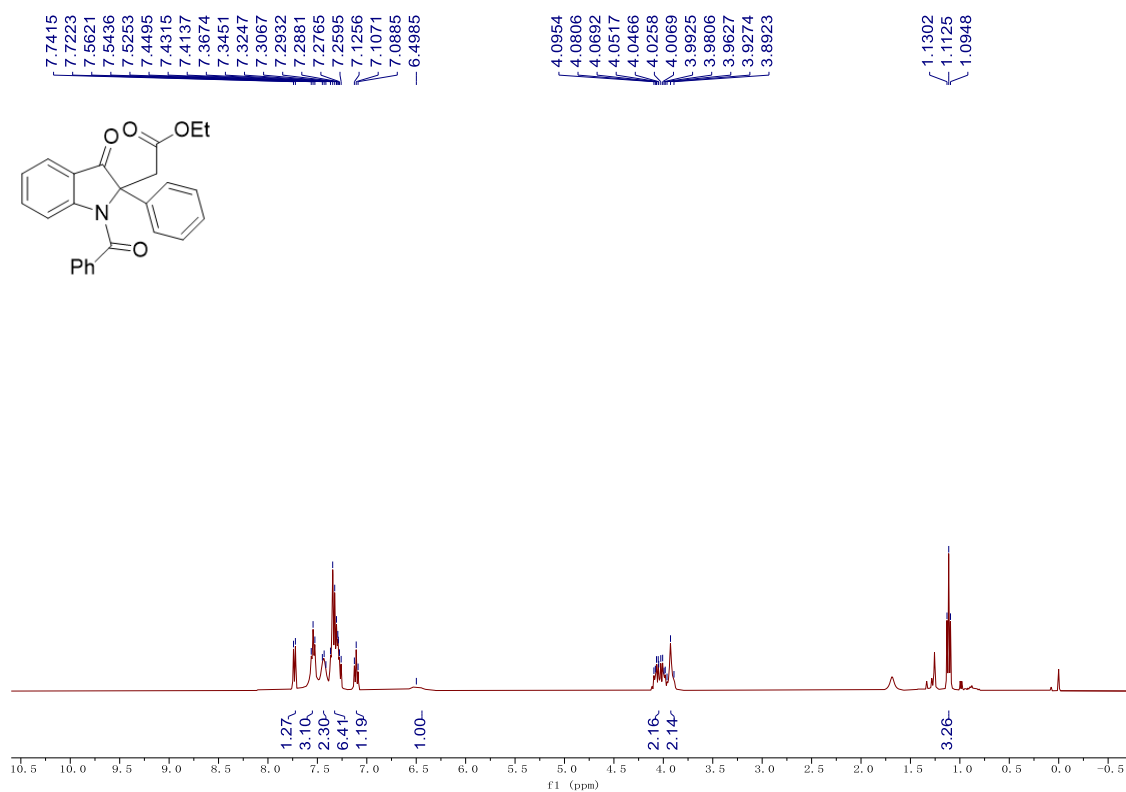


Figure S44. ^{13}C NMR Spectra of compound **3ab** (400 MHz, CDCl_3).

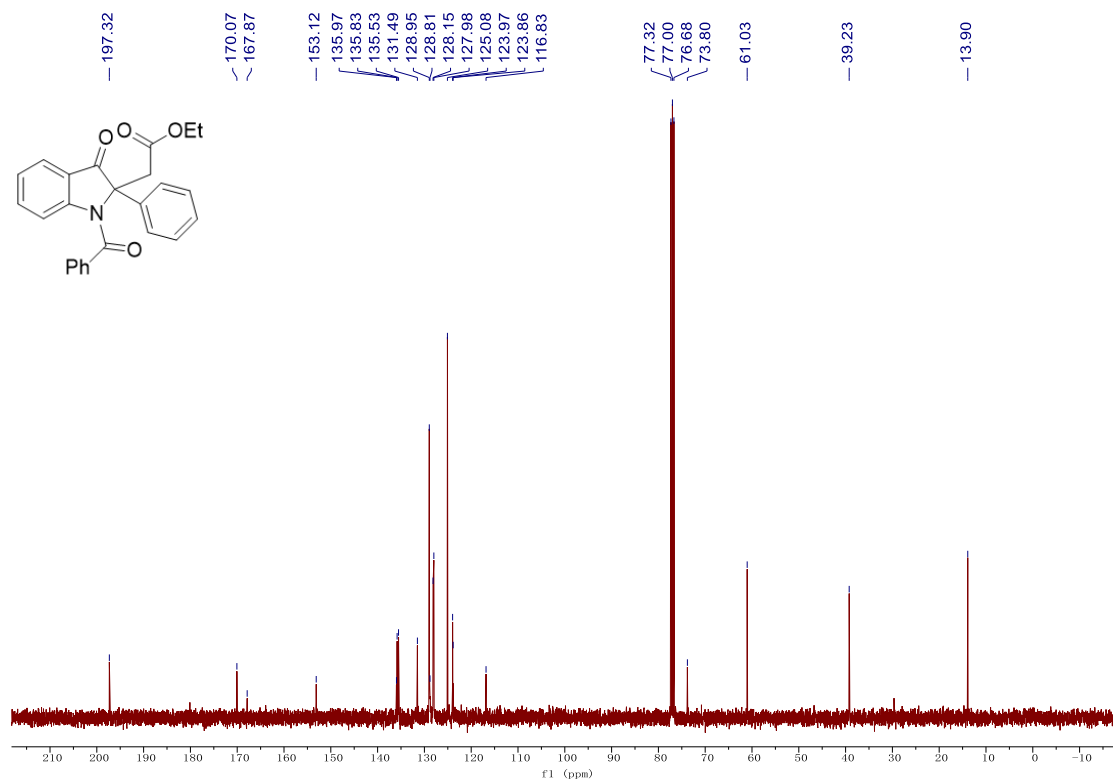


Figure S45. ^1H NMR Spectra of compound **3ad** (400 MHz, CDCl_3).

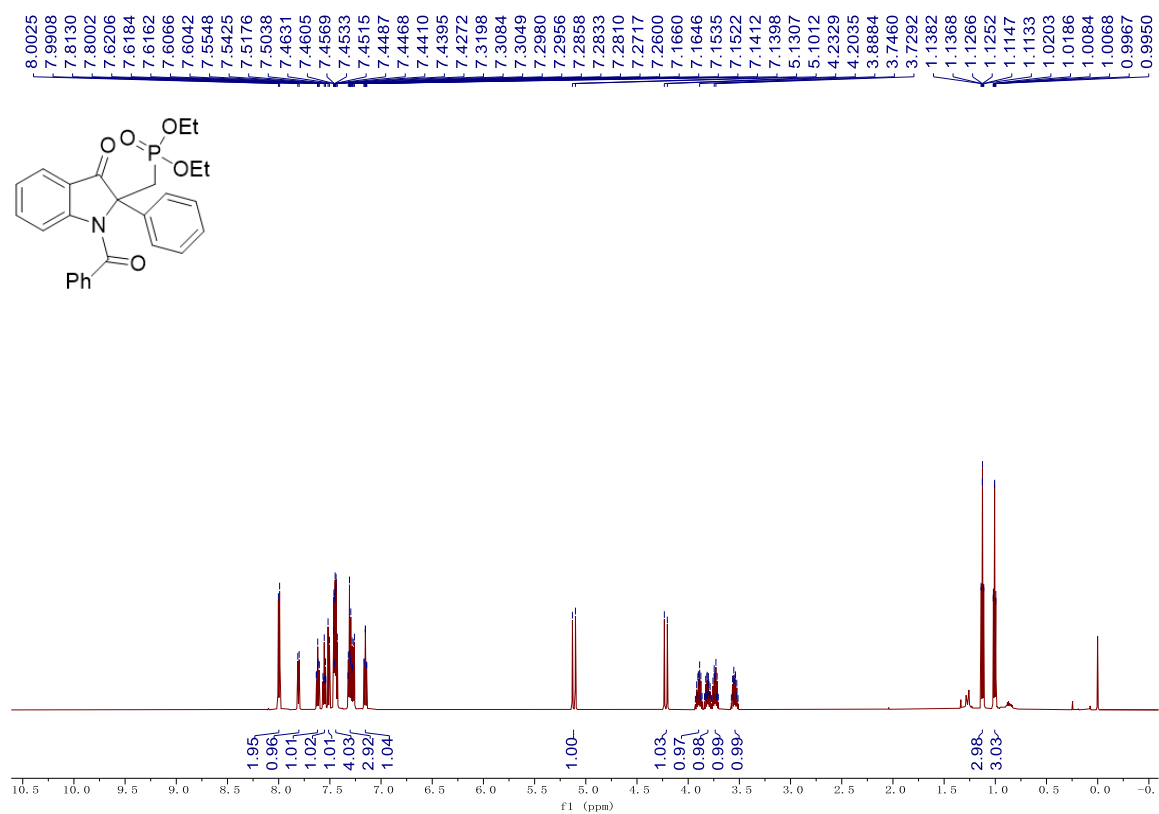
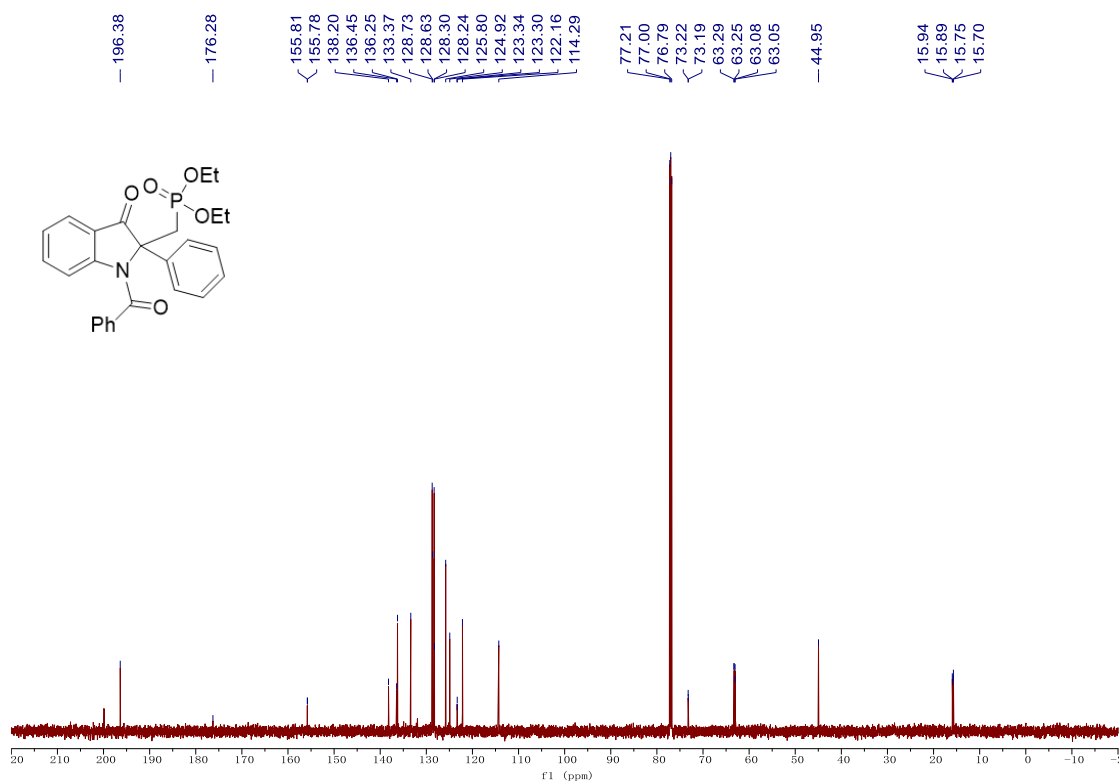


Figure S46. ^{13}C NMR Spectra of compound **3ad** (400 MHz, CDCl_3).



References:

- 1 (a) A. Wetzel and F. Gagosz, *Angew. Chem. Int. Edit.*, 2011, **50**, 7354-7358; (b) N. A. Bumagin, L. I. Sukhomlinova, E. V. Luzikova, T. P. Tolstaya and I. P. Beletskaya, *Tetrahedron Lett.*, 1996, **37**, 897-900.
- 2 P. Li, W. X. Yong, R. Sheng, W. D. Rao, X. B. Zhu and X. X. Zhang, *Adv. Synth. Catal.*, 2019, **361**, 201-207.