

Silver(I) triflate-catalyzed reaction of 1-(cyclopropylidenemethyl)-2-alkynyl)arene with 2-alkynylbenzaldoxime

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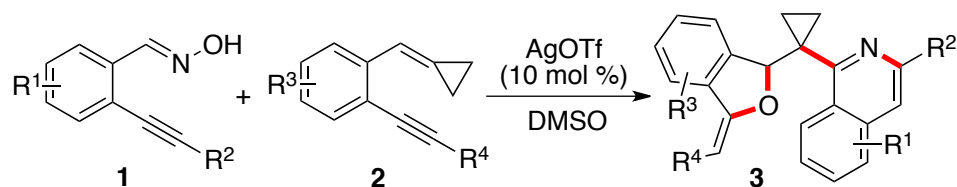
Supporting Information

1. General experimental methods (S2).
2. General experimental procedure and characterization data (S2-S13).
3. ¹H and ¹³C NMR spectra of compound **3** (S14-S55).

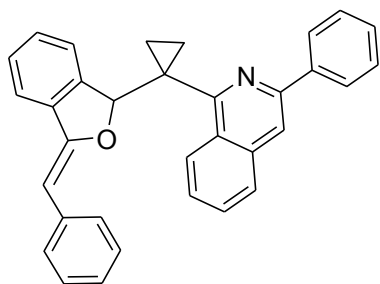
General Materials and Methods:

Unless otherwise stated, all commercial reagents were used as received. All solvents were dried and distilled according to standard procedures. Flash column chromatography was performed using silica gel (60-Å pore size, 32–63 μm, standard grade). Analytical thin-layer chromatography was performed using glass plates pre-coated with 0.25 mm 230–400 mesh silica gel impregnated with a fluorescent indicator (254 nm). Thin layer chromatography plates were visualized by exposure to ultraviolet light. Organic solutions were concentrated on rotary evaporators at ~20 Torr at 25–35 °C. Nuclear magnetic resonance (NMR) spectra are recorded in parts per million from internal tetramethylsilane on the δ scale. ^1H and ^{13}C NMR spectra were recorded in CDCl_3 on a Bruker DRX-400 spectrometer operating at 400 MHz and 100 MHz, respectively. All chemical shift values are quoted in ppm and coupling constants quoted in Hz. High resolution mass spectrometry (HRMS) spectra were obtained on a micrOTOF II Instrument.

General procedure for the silver(I) triflate-catalyzed reaction of 1-(cyclopropylidenemethyl)-2-alkynyl)arene with 2-alkynylbenzaldoxime.

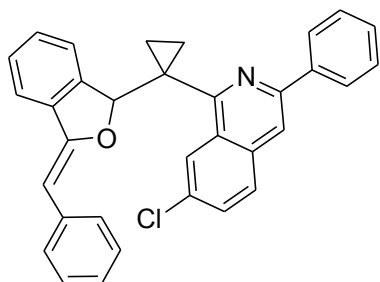


A solution of 2-alkynylbenzaldoxime **1** (0.2 mmol) and AgOTf (0.02 mmol, 5.1 mg) in DMSO (2.0 mL) was stirred at 75 °C under N₂ atmosphere for half an hour. Subsequently, 1-(cyclopropylidenemethyl)-2-alkynyl)arene **2** (0.2 mmol) was added to the reaction mixture. After completion of the reaction as indicated by TLC, the reaction solution was poured into water (20.0 mL), and the mixture was extracted with EtOAc (3 × 5.0 mL). The combined organic layer was dried with anhydrous Na₂SO₄ and concentrated in vacuo. The residue was purified by column chromatography on silica gel to provide the product **3**.



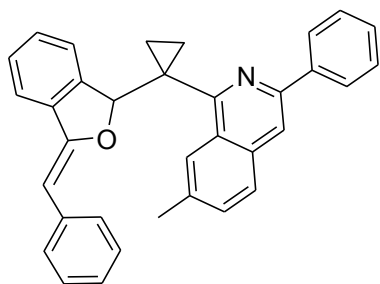
(Z)-1-(1-(3-Benzylidene-1,3-dihydroisobenzofuran-1-yl)cyclopropyl)-3-phenylisoquinoline (**3a**)

White solid; ^1H NMR (400 MHz, CDCl_3) δ 1.30–1.34 (m, 2H), 1.51–1.55 (m, 2H), 5.72 (s, 1H), 5.94 (s, 1H), 7.12–7.22 (m, 4H), 7.29–7.38 (m, 5H), 7.43–7.47 (m, 2H), 7.50–7.54 (m, 1H), 7.70 (d, $J = 7.5$ Hz, 2H), 7.75 (d, $J = 8.2$ Hz, 1H), 7.89 (s, 1H), 8.05 (d, $J = 7.3$ Hz, 2H), 8.75 (d, $J = 8.4$ Hz, 1H); ^{13}C NMR (100 MHz, CDCl_3) δ 9.7, 11.1, 29.7, 89.8, 96.0, 115.8, 119.5, 123.6, 125.2, 126.6, 126.9, 127.3, 127.4, 127.9, 128.0, 128.3, 128.6, 129.8, 135.0, 136.4, 137.4, 139.7, 140.4, 149.4, 155.0, 159.0; HRMS (ESI) calcd for $\text{C}_{33}\text{H}_{26}\text{NO}$: 452.2009 ($\text{M} + \text{H}^+$), found: 452.2027.



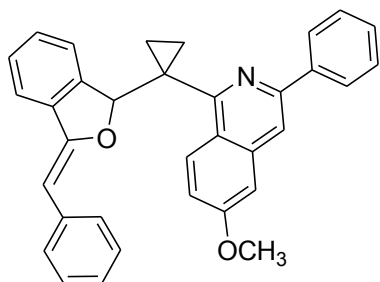
(Z)-1-(1-(3-Benzylidene-1,3-dihydroisobenzofuran-1-yl)cyclopropyl)-7-chloro-3-phenylisoquinoline (**3b**)

White solid; ^1H NMR (400 MHz, CDCl_3) δ 1.32–1.35 (m, 2H), 1.44–1.52 (m, 2H), 5.72 (s, 1H), 5.81 (s, 1H), 7.12–7.15 (m, 1H), 7.22–7.28 (m, 2H), 7.31–7.40 (m, 5H), 7.43–7.48 (m, 3H), 7.66–7.71 (m, 3H), 7.85 (s, 1H), 7.97–8.00 (m, 3H), 8.74 (d, $J = 1.6$ Hz, 1H); ^{13}C NMR (100 MHz, CDCl_3) δ 10.5, 10.8, 29.6, 90.5, 96.2, 115.3, 119.5, 123.6, 125.2, 125.8, 126.8, 127.9, 128.0, 128.3, 128.4, 128.5, 128.6, 129.0, 130.9, 132.3, 135.0, 135.6, 136.0, 139.2, 140.1, 149.7, 154.7, 158.0; HRMS (ESI) calcd for $\text{C}_{33}\text{H}_{25}\text{ClNO}$: 486.1619 ($\text{M} + \text{H}^+$), found: 486.1628.



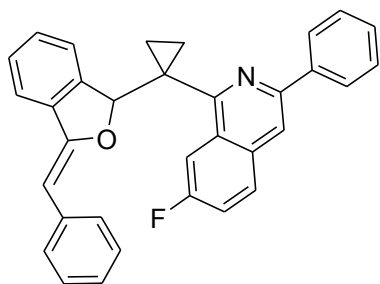
(Z)-1-(1-(3-Benzylidene-1,3-dihydroisobenzofuran-1-yl)cyclopropyl)-7-methyl-3-phenylisoquinoline (**3c**)

White solid; ^1H NMR (400 MHz, CDCl_3) δ 1.28–1.37 (m, 3H), 1.50–1.52 (m, 1H), 2.36 (s, 3H), 5.74 (s, 1H), 5.93 (s, 1H), 7.13 (t, $J = 7.4$ Hz, 1H), 7.21–7.25 (m, 3H), 7.29–7.33 (m, 2H), 7.36–7.39 (m, 3H), 7.43–7.47 (m, 2H), 7.68–7.71 (m, 3H), 7.87 (s, 1H), 8.04–8.06 (m, 2H), 8.48 (s, 1H); ^{13}C NMR (100 MHz, CDCl_3) δ 9.7, 11.3, 22.0, 29.7, 90.1, 95.8, 115.6, 119.5, 123.6, 125.0, 125.5, 126.8, 127.2, 127.5, 127.8, 128.0, 128.1, 128.2, 128.3, 128.5, 132.1, 135.0, 135.6, 136.4, 136.7, 139.8, 140.5, 148.6, 155.1, 158.1; HRMS (ESI) calcd for $\text{C}_{34}\text{H}_{28}\text{NO}$: 466.2165 ($\text{M} + \text{H}^+$), found: 466.2174.



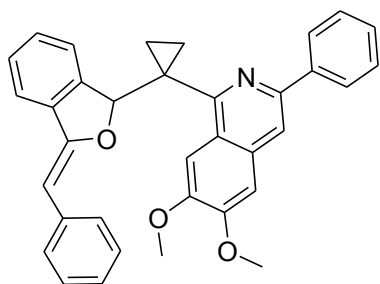
(Z)-1-(1-(3-Benzylidene-1,3-dihydroisobenzofuran-1-yl)cyclopropyl)-6-methoxy-3-phenylisoquinoline (**3d**)

White solid; ^1H NMR (400 MHz, CDCl_3) δ 1.29–1.33 (m, 3H), 1.49–1.52 (m, 1H), 3.87 (s, 3H), 5.73 (s, 1H), 5.91 (s, 1H), 6.99 (dd, $J_1 = 9.2$ Hz, $J_2 = 2.5$ Hz, 1H), 7.04 (d, $J = 2.5$ Hz, 1H), 7.13–7.18 (m, 2H), 7.19–7.24 (m, 2H), 7.29–7.39 (m, 4H), 7.43–7.46 (m, 2H), 7.69–7.71 (m, 2H), 7.81 (s, 1H), 8.03–8.05 (m, 2H), 8.65 (d, $J = 9.2$ Hz, 1H); ^{13}C NMR (100 MHz, CDCl_3) δ 9.7, 11.1, 29.7, 55.3, 89.8, 95.9, 105.0, 115.2, 119.2, 119.5, 123.1, 123.6, 125.2, 126.9, 127.9, 128.0, 128.20, 128.24, 128.5, 128.8, 134.9, 136.4, 139.4, 139.8, 140.4, 150.0, 155.0, 158.4, 160.4; HRMS (ESI) calcd for $\text{C}_{34}\text{H}_{28}\text{NO}_2$: 482.2115 ($\text{M} + \text{H}^+$), found: 482.2107.



(Z)-1-(1-(3-Benzylidene-1,3-dihydroisobenzofuran-1-yl)cyclopropyl)-7-fluoro-3-phenylisoquinoline (**3e**)

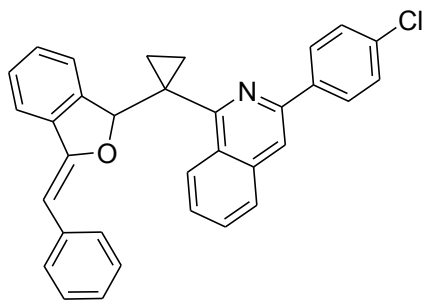
White solid; ^1H NMR (400 MHz, CDCl_3) δ 1.26–1.34 (m, 2H), 1.40–1.51 (m, 2H), 5.70 (s, 1H), 5.81 (s, 1H), 7.13 (t, $J = 7.4$ Hz, 1H), 7.21–7.26 (m, 2H), 7.28–7.38 (m, 6H), 7.42–7.45 (m, 2H), 7.67 (d, $J = 7.4$ Hz, 2H), 7.43 (dd, $J_1 = 5.5$ Hz, $J_2 = 9.0$ Hz, 1H), 7.86 (s, 1H), 7.97–7.99 (m, 2H), 8.38 (dd, $J_1 = 2.3$ Hz, $J_2 = 10.2$ Hz, 1H); ^{13}C NMR (100 MHz, CDCl_3) δ 10.4, 10.7, 27.7, 90.4, 96.1, 110.6 (d, $^2J_{\text{CF}} = 21.6$ Hz), 115.4, 119.5, 120.5 (d, $^2J_{\text{CF}} = 25.5$ Hz), 123.5, 125.2, 126.8, 127.8, 128.0, 128.1, 128.26, 128.31, 128.6, 129.8 (d, $^3J_{\text{CF}} = 8.5$ Hz), 134.4, 135.0, 136.0, 139.3, 140.2, 149.1, 154.7, 158.3, 159.1, 161.5; HRMS (ESI) calcd for $\text{C}_{33}\text{H}_{25}\text{FNO}$: 470.1915 ($\text{M} + \text{H}^+$), found: 470.1898.



(Z)-1-(1-(3-Benzylidene-1,3-dihydroisobenzofuran-1-yl)cyclopropyl)-6,7-dimethoxy-3-phenylisoquinoline (**3f**)

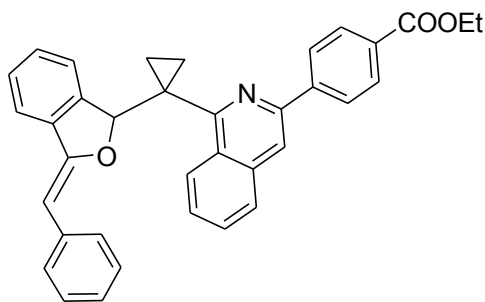
White solid; ^1H NMR (400 MHz, CDCl_3) δ 1.26–1.33 (m, 3H), 1.48–1.51 (m, 1H), 3.85 (s, 3H), 4.00 (s, 3H), 5.81 (s, 1H), 6.03 (s, 1H), 7.08 (s, 1H), 7.10–7.14 (m, 2H), 7.17–7.21 (m, 1H), 7.24–7.28 (m, 3H), 7.35–7.39 (m, 1H), 7.42–7.48 (m, 3H), 7.65 (d, $J = 7.4$ Hz, 2H), 7.83 (d, $J = 0.9$ Hz, 2H), 8.05–8.07 (m, 2H); ^{13}C NMR (100 MHz, CDCl_3) δ 9.7, 11.4, 29.7, 55.8, 56.0, 89.3, 95.9, 104.9, 105.4, 114.9, 119.5, 123.4, 123.7, 125.3, 126.7, 127.8, 128.0, 128.1, 128.2, 128.6, 134.2, 135.1, 136.2, 140.5, 148.7, 149.6, 152.6, 155.2, 156.8; HRMS (ESI) calcd for $\text{C}_{35}\text{H}_{30}\text{NO}_3$: 512.2220 ($\text{M} +$

H⁺), found: 512.2207.



(Z)-1-(1-(3-Benzylidene-1,3-dihydroisobenzofuran-1-yl)cyclopropyl)-3-(4-chlorophenyl)isoquinoline (**3g**)

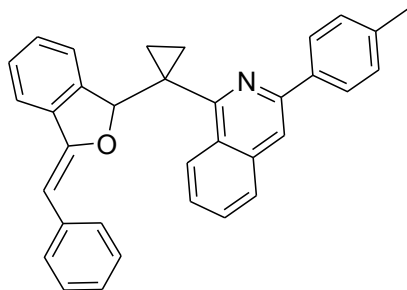
White solid; ¹H NMR (400 MHz, CDCl₃) δ 1.25–1.38 (m, 3H), 1.50–1.52 (m, 1H), 5.70 (s, 1H), 5.90 (s, 1H), 7.13–7.16 (m, 1H), 7.19–7.23 (m, 3H), 7.29–7.37 (m, 4H), 7.39–7.41 (m, 2H), 7.50–7.54 (m, 1H), 7.69 (d, *J* = 7.4 Hz, 2H), 7.74 (d, *J* = 8.2 Hz, 1H), 7.85 (s, 1H), 7.98 (d, *J* = 8.6 Hz, 2H), 8.76 (d, *J* = 8.4 Hz, 1H); ¹³C NMR (100 MHz, CDCl₃) δ 9.9, 10.9, 29.7, 89.9, 96.0, 115.7, 119.6, 123.5, 125.2, 126.8, 127.0, 127.4, 127.9, 128.0, 128.1, 128.2, 128.5, 128.7, 129.9, 134.3, 135.0, 136.3, 137.3, 138.0, 140.3, 148.1, 154.9, 159.1; HRMS (ESI) calcd for C₃₃H₂₅ClNO: 486.1619 (M + H⁺), found: 486.1620.



(Z)-Ethyl-4-(1-(1-(3-benzylidene-1,3-dihydroisobenzofuran-1-yl)cyclopropyl)isoquinolin-3-yl)benzoate (**3h**)

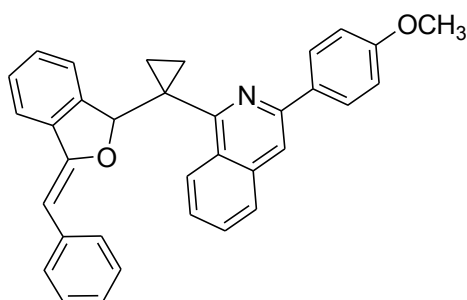
White solid; ¹H NMR (400 MHz, CDCl₃) δ 1.28–1.35 (m, 3H), 1.42 (t, *J* = 7.1 Hz, 3H), 1.50–1.54 (m, 1H), 4.41 (q, *J* = 7.1 Hz, 2H), 5.68 (s, 1H), 5.87 (s, 1H), 7.14 (t, *J* = 7.4 Hz, 1H), 7.19–7.23 (m, 3H), 7.29–7.32 (m, 3H), 7.35–7.39 (m, 1H), 7.49–7.53 (m, 1H), 7.69 (d, *J* = 7.4 Hz, 2H), 7.74 (d, *J* = 8.2 Hz, 1H), 7.92 (s, 1H), 8.08–8.12 (m, 4H), 8.78 (d, *J* = 8.4 Hz, 1H); ¹³C NMR (100 MHz, CDCl₃) δ 10.1, 11.0, 14.4, 29.7, 61.0, 90.2, 96.0, 116.7, 119.5, 123.5, 125.2, 126.6, 127.06, 127.12, 127.5, 127.7,

127.9, 128.0, 128.2, 128.3, 129.8, 130.0, 134.9, 136.3, 137.1, 140.3, 143.7, 148.0, 154.9, 159.2, 166.7; HRMS (ESI) calcd for C₃₆H₃₀NO₃: 524.2220 (M + H⁺), found: 524.2189.



(Z)-1-(1-(3-Benzylidene-1,3-dihydroisobenzofuran-1-yl)cyclopropyl)-3-*p*-tolylisoquinoline (**3i**)

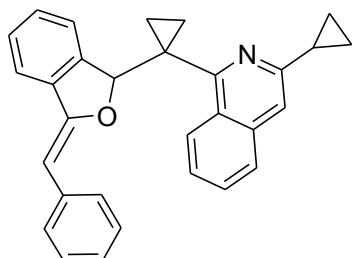
White solid; ¹H NMR (400 MHz, CDCl₃) δ 1.23–1.33 (m, 3H), 1.52–1.55 (m, 1H), 2.41 (s, 3H), 5.73 (s, 1H), 5.95 (s, 1H), 7.13–7.17 (m, 2H), 7.19–7.22 (m, 2H), 7.26 (d, *J* = 8.0 Hz, 2H), 7.30–7.34 (m, 2H), 7.35–7.38 (m, 2H), 7.51–7.55 (m, 1H), 7.71 (d, *J* = 7.5 Hz, 2H), 7.76 (d, *J* = 8.2 Hz, 1H), 7.88 (s, 1H), 7.96 (d, *J* = 8.1 Hz, 2H), 8.74 (d, *J* = 8.4 Hz, 1H); ¹³C NMR (100 MHz, CDCl₃) δ 9.6, 11.1, 21.3, 29.7, 89.6, 95.9, 115.3, 119.5, 123.6, 125.1, 126.4, 126.8, 126.9, 127.1, 127.4, 127.9, 128.0, 128.19, 128.23, 129.3, 129.7, 134.9, 136.4, 136.9, 137.4, 138.2, 140.5, 149.4, 155.1, 158.9; HRMS (ESI) calcd for C₃₄H₂₈NO: 466.2165 (M + H⁺), found: 466.2150.



(Z)-1-(1-(3-Benzylidene-1,3-dihydroisobenzofuran-1-yl)cyclopropyl)-3-(4-methoxyphenyl)isoquinoline (**3j**)

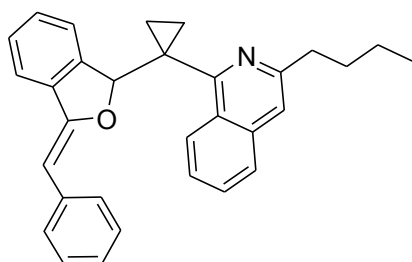
White solid; ¹H NMR (400 MHz, CDCl₃) δ 1.20–1.36 (m, 3H), 1.52–1.55 (m, 1H), 3.86 (s, 3H), 5.73 (s, 1H), 5.95 (s, 1H), 6.96–7.00 (m, 2H), 7.14–7.24 (m, 4H), 7.31–7.38 (m, 4H), 7.49–7.53 (m, 1H), 7.71–7.73 (m, 3H), 7.81 (s, 1H), 8.01–8.03 (m, 2H), 8.74 (d, *J* = 8.4 Hz, 1H); ¹³C NMR (100 MHz, CDCl₃) δ 9.6, 11.0, 29.7, 55.3,

89.6, 95.9, 113.9, 114.6, 119.5, 123.5, 125.1, 126.2, 126.8, 126.9, 127.2, 127.87, 127.95, 128.07, 128.16, 128.21, 129.7, 132.3, 134.9, 136.3, 137.5, 140.4, 149.1, 155.0, 158.8, 159.9; HRMS (ESI) calcd for $C_{34}H_{28}NO_2$: 482.2115 ($M + H^+$), found: 482.2124.



(Z)-1-(1-(3-Benzylidene-1,3-dihydroisobenzofuran-1-yl)cyclopropyl)-3-cyclopropylisoquinoline (**3k**)

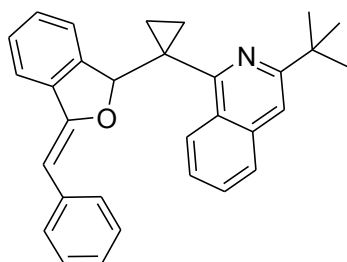
White solid; 1H NMR (400 MHz, $CDCl_3$) δ 1.02–1.09 (m, 2H), 1.14–1.17 (m, 2H), 1.19–1.30 (m, 3H), 1.47–1.50 (m, 1H), 2.00–2.07 (m, 1H), 5.71 (s, 1H), 5.86 (s, 1H), 6.98 (d, $J = 7.1$ Hz, 1H); 7.16 (t, $J = 7.4$ Hz, 1H); 7.20–7.24 (m, 2H), 7.29–7.32 (m, 3H), 7.34–7.36 (m, 2H), 7.45–7.49 (m, 1H), 7.61 (d, $J = 8.2$ Hz, 1H); 7.70 (d, $J = 7.8$ Hz, 2H); 8.68 (d, $J = 8.5$ Hz, 1H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 8.8, 8.9, 9.3, 11.0, 16.7, 29.6, 89.6, 95.8, 116.1, 119.4, 123.5, 125.1, 125.4, 126.1, 126.5, 126.7, 127.85, 127.91, 128.1, 128.2, 129.5, 134.8, 136.4, 137.0, 140.5, 154.1, 155.0, 158.4; HRMS (ESI) calcd for $C_{30}H_{26}NO$: 416.2009 ($M + H^+$), found: 416.2024.



(Z)-1-(1-(3-Benzylidene-1,3-dihydroisobenzofuran-1-yl)cyclopropyl)-3-butylisoquinoline (**3l**)

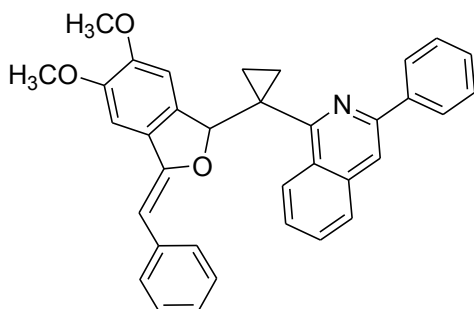
White solid; 1H NMR (400 MHz, $CDCl_3$) δ 1.20–1.24 (m, 3H), 1.27–1.30 (m, 2H), 1.35–1.38 (m, 2H), 1.41–1.42 (m, 1H), 1.48–1.51 (m, 1H), 1.53–1.54 (m, 1H), 1.55–1.58 (m, 3H), 5.70 (s, 1H), 5.87 (s, 1H), 7.00 (d, $J = 7.7$ Hz, 1H), 7.14–7.20 (m, 3H), 7.31–7.33 (m, 2H), 7.34–7.37 (m, 2H), 7.40 (s, 1H), 7.46–7.50 (m, 1H), 7.68 (d,

$J = 8.2$ Hz, 1H), 7.72 (d, $J = 7.8$ Hz, 2H), 8.73 (d, $J = 8.4$ Hz, 1H); ^{13}C NMR (100 MHz, CDCl_3) δ 9.2, 11.2, 14.1, 22.7, 29.7, 31.9, 37.1, 89.7, 95.8, 113.4, 119.3, 123.8, 125.1, 125.9, 126.2, 126.6, 127.0, 127.9, 128.0, 128.2, 129.2, 130.5, 134.7, 136.5, 137.1, 140.7, 155.1, 157.5, 161.2; HRMS (ESI) calcd for $\text{C}_{31}\text{H}_{30}\text{NO}$: 432.2322 ($\text{M} + \text{H}^+$), found: 432.2325.



(Z)-1-(1-(3-Benzylidene-1,3-dihydroisobenzofuran-1-yl)cyclopropyl)-3-tert-butylisoquinoline (**3m**)

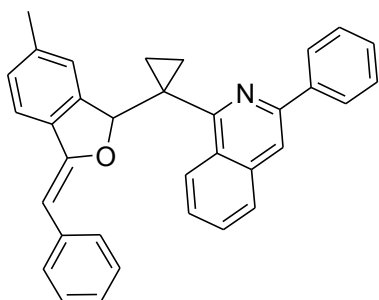
White solid; ^1H NMR (400 MHz, CDCl_3) δ 1.28–1.30 (m, 2H), 1.33 (s, 9H), 1.53–1.59 (m, 2H), 5.71 (s, 1H), 5.87 (s, 1H), 7.00 (d, $J = 7.6$ Hz, 1H), 7.13–7.22 (m, 3H), 7.31–7.34 (m, 2H), 7.35–7.37 (m, 2H), 7.40 (s, 1H), 7.47–7.51 (m, 1H), 7.68 (d, $J = 8.2$ Hz, 1H), 7.73 (d, $J = 7.4$ Hz, 2H), 8.73 (d, $J = 8.4$ Hz, 1H); ^{13}C NMR (100 MHz, CDCl_3) δ 9.2, 11.2, 29.7, 30.0, 37.1, 89.7, 95.8, 113.4, 119.3, 123.8, 125.1, 125.9, 126.2, 126.6, 127.0, 127.9, 128.0, 128.2, 129.2, 134.7, 136.5, 137.1, 140.7, 155.1, 157.4, 161.2; HRMS (ESI) calcd for $\text{C}_{31}\text{H}_{30}\text{NO}$: 432.2322 ($\text{M} + \text{H}^+$), found: 432.2320.



(Z)-1-(1-(3-Benzylidene-5,6-dimethoxy-1,3-dihydroisobenzofuran-1-yl)cyclopropyl)-3-phenylisoquinoline (**3n**)

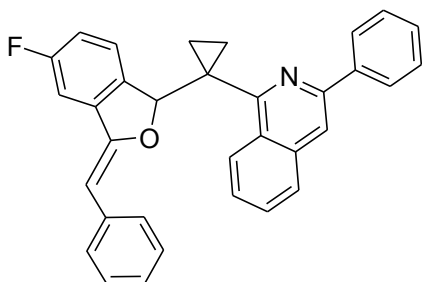
White solid; ^1H NMR (400 MHz, CDCl_3) δ 1.31–1.32 (m, 2H), 1.63–1.65 (m, 2H), 3.54 (s, 3H), 3.84 (s, 3H), 5.59 (s, 1H), 5.88 (s, 1H), 6.45 (s, 1H), 6.79 (s, 1H), 7.14 (t, $J = 7.4$ Hz, 1H), 7.32–7.38 (m, 3H), 7.41–7.46 (m, 3H), 7.57 (t, $J = 7.1$ Hz, 1H), 7.72

(d, $J = 7.4$ Hz, 2H), 7.80 (d, $J = 8.2$ Hz, 1H), 7.94 (s, 1H), 8.09–8.11 (m, 2H), 8.75 (d, $J = 8.4$ Hz, 1H); ^{13}C NMR (100 MHz, CDCl_3) δ 8.8, 11.7, 29.7, 55.6, 55.9, 88.9, 94.2, 101.4, 105.8, 115.7, 124.8, 126.8, 126.9, 127.0, 127.3, 127.4, 127.5, 128.3, 128.4, 128.6, 129.9, 133.7, 136.7, 137.4, 139.5, 149.3, 149.7, 149.9, 155.6, 157.2, 159.2; HRMS (ESI) calcd for $\text{C}_{35}\text{H}_{30}\text{NO}_3$: 512.2220 ($\text{M} + \text{H}^+$), found: 512.2220.



(*Z*)-1-(1-(3-Benzylidene-6-methyl-1,3-dihydroisobenzofuran-1-yl)cyclopropyl)-3-phenylisoquinoline (**3o**)

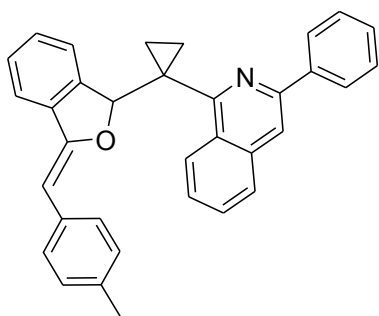
White solid; ^1H NMR (400 MHz, CDCl_3) δ 1.29–1.36 (m, 2H), 1.53–1.58 (m, 2H), 2.31 (s, 3H), 5.65 (s, 1H), 5.84 (s, 1H), 7.02–7.06 (m, 2H), 7.14 (t, $J = 7.4$ Hz, 1H), 7.23 (d, $J = 7.8$ Hz, 1H), 7.30–7.35 (m, 2H), 7.37–7.40 (m, 2H), 7.45–7.48 (m, 2H), 7.52–7.56 (m, 1H), 7.73 (d, $J = 7.8$ Hz, 2H), 7.78 (d, $J = 8.2$ Hz, 1H), 7.90 (s, 1H), 8.05–8.07 (m, 2H), 8.79 (d, $J = 8.4$ Hz, 1H); ^{13}C NMR (100 MHz, CDCl_3) δ 9.8, 11.1, 21.5, 29.7, 89.9, 95.1, 115.7, 119.3, 124.1, 124.9, 126.6, 126.9, 127.0, 127.3, 127.7, 128.19, 128.24, 128.6, 129.3, 129.8, 132.4, 136.6, 137.3, 138.2, 139.7, 140.8, 149.3, 155.2, 159.0; HRMS (ESI) calcd for $\text{C}_{34}\text{H}_{28}\text{NO}$: 466.2165 ($\text{M} + \text{H}^+$), found: 466.2160.



(*Z*)-1-(1-(3-Benzylidene-5-fluoro-1,3-dihydroisobenzofuran-1-yl)cyclopropyl)-3-phenylisoquinoline (**3p**)

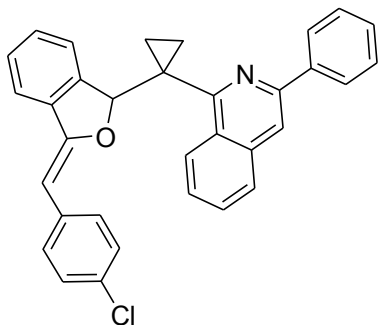
White solid; ^1H NMR (400 MHz, CDCl_3) δ 1.28–1.37 (m, 3H), 1.51–1.54 (m, 1H), 5.66 (s, 1H), 5.86 (s, 1H), 6.88 (td, $J_1 = 8.6$ Hz, $J_2 = 2.2$ Hz, 1H), 6.98 (dd, $J_1 = 8.6$ Hz, $J_2 = 2.2$ Hz, 1H), 7.10 (dd, $J_1 = 8.2$ Hz, $J_2 = 4.8$ Hz, 1H), 7.17 (t, $J = 7.4$ Hz, 1H),

7.31–7.36 (m, 3H), 7.37–7.40 (m, 1H), 7.44–7.48 (m, 2H), 7.51–7.55 (m, 1H), 7.69 (d, $J = 7.3$ Hz, 2H), 7.77 (d, $J = 8.2$ Hz, 1H), 7.91 (s, 1H), 8.05–8.07 (m, 2H), 8.73 (d, $J = 8.4$ Hz, 1H); ^{13}C NMR (100 MHz, CDCl_3) δ 9.7, 11.2, 29.7, 89.6, 97.0, 106.1 (d, $^2J_{\text{CF}} = 24.0$ Hz), 115.6 (d, $^2J_{\text{CF}} = 23.6$ Hz), 115.8, 125.0 (d, $^3J_{\text{CF}} = 9.1$ Hz), 125.6, 126.7, 126.8, 127.3, 127.4, 128.1, 128.3, 128.4, 128.6, 129.9, 135.9, 136.0, 137.1, 137.4, 139.5, 149.3, 154.1, 158.7, 161.9, 164.3; HRMS (ESI) calcd for $\text{C}_{33}\text{H}_{25}\text{FNO}$: 470.1915 ($\text{M} + \text{H}^+$), found: 470.1917.



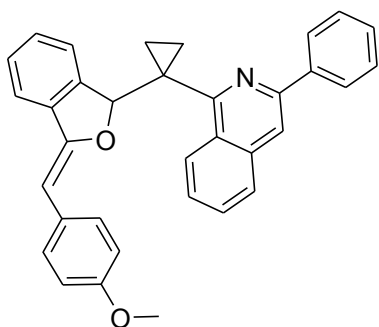
(*Z*)-1-(1-(3-(4-Methylbenzylidene)-1,3-dihydroisobenzofuran-1-yl)cyclopropyl)-3-phenylisoquinoline (**3q**)

White solid; ^1H NMR (400 MHz, CDCl_3) δ 1.27–1.35 (m, 2H), 1.54–1.59 (m, 2H), 2.38 (s, 3H), 5.73 (s, 1H), 5.97 (s, 1H), 7.12–7.15 (m, 3H), 7.17–7.24 (m, 2H), 7.36 (d, $J = 7.2$ Hz, 1H), 7.39–7.44 (m, 2H), 7.45–7.49 (m, 2H), 7.55–7.59 (m, 1H), 7.62 (d, $J = 8.1$ Hz, 2H), 7.81 (d, $J = 8.2$ Hz, 1H), 7.93 (s, 1H), 8.08–8.10 (m, 2H), 8.77 (d, $J = 8.4$ Hz, 1H); ^{13}C NMR (100 MHz, CDCl_3) δ 9.5, 11.1, 21.3, 29.9, 89.4, 95.9, 115.8, 119.4, 123.5, 126.6, 126.9, 127.3, 127.4, 127.8, 128.2, 128.3, 128.6, 129.0, 129.8, 133.5, 134.8, 135.1, 137.4, 139.7, 140.3, 149.4, 154.4, 159.1; HRMS (ESI) calcd for $\text{C}_{34}\text{H}_{28}\text{NO}$: 466.2165 ($\text{M} + \text{H}^+$), found: 466.2145.



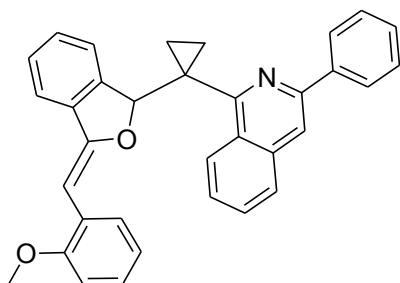
(*Z*)-1-(1-(3-(4-Chlorobenzylidene)-1,3-dihydroisobenzofuran-1-yl)cyclopropyl)-3-phenylisoquinoline (**3r**)

White solid; ^1H NMR (400 MHz, CDCl_3) δ 1.30–1.38 (m, 3H), 1.43–1.46 (m, 1H), 5.64 (s, 1H), 5.91 (s, 1H), 7.19–7.24 (m, 5H), 7.31–7.40 (m, 3H), 7.43–7.47 (m, 2H), 7.52–7.56 (m, 1H), 7.60 (d, J = 8.6 Hz, 2H), 7.77 (d, J = 8.2 Hz, 2H), 7.90 (s, 1H), 8.04–8.06 (m, 2H), 8.71 (d, J = 8.4 Hz, 1H); ^{13}C NMR (100 MHz, CDCl_3) δ 10.0, 10.8, 29.8, 90.3, 94.8, 115.8, 119.6, 123.6, 126.6, 126.8, 126.9, 127.2, 127.4, 128.27, 128.31, 128.6, 129.0, 129.8, 130.3, 134.7, 134.9, 137.4, 139.6, 140.4, 149.4, 155.4, 158.8; HRMS (ESI) calcd for $\text{C}_{33}\text{H}_{25}\text{ClNO}$: 486.1619 ($\text{M} + \text{H}^+$), found: 486.1592.



(*Z*)-1-(1-(3-(4-Methoxybenzylidene)-1,3-dihydroisobenzofuran-1-yl)cyclopropyl)-3-*p*-henyliisoquinoline (**3s**)

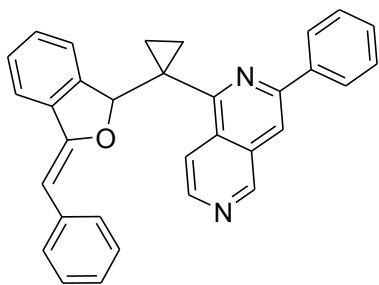
White solid; ^1H NMR (400 MHz, CDCl_3) δ 1.25–1.37 (m, 3H), 1.48–1.51 (m, 1H), 3.83 (s, 3H), 5.69 (s, 1H), 5.95 (s, 1H), 6.84–6.87 (m, 2H), 7.13–7.23 (m, 3H), 7.34 (d, J = 6.8 Hz, 1H), 7.37–7.42 (m, 2H), 7.44–7.48 (m, 2H), 7.54–7.58 (m, 1H), 7.63–7.66 (m, 2H), 7.80 (d, J = 8.2 Hz, 1H), 7.92 (s, 1H), 8.07–8.09 (m, 2H), 8.75 (d, J = 8.1 Hz, 1H); ^{13}C NMR (100 MHz, CDCl_3) δ 9.7, 10.9, 30.0, 55.3, 89.3, 95.5, 113.7, 115.7, 119.2, 123.5, 126.6, 126.9, 127.4, 127.6, 128.1, 128.3, 128.6, 129.1, 129.8, 135.2, 136.2, 137.4, 139.7, 140.0, 144.2, 149.4, 153.5, 157.3, 159.2; HRMS (ESI) calcd for $\text{C}_{34}\text{H}_{28}\text{NO}_2$: 482.2115 ($\text{M} + \text{H}^+$), found: 482.2110.



(*Z*)-1-(1-(3-(2-Methoxybenzylidene)-1,3-dihydroisobenzofuran-1-yl)cyclopropyl)-3-*p*-henyliisoquinoline (**3t**)

White solid; ^1H NMR (400 MHz, CDCl_3) δ 1.25–1.33 (m, 3H), 1.50–1.54 (m, 1H),

3.83 (s, 3H), 5.97 (s, 1H), 6.22 (s, 1H), 6.85 (d, $J = 8.2$ Hz, 1H), 6.94–6.98 (m, 1H), 7.11–7.23 (m, 4H), 7.35–7.42 (m, 2H), 7.44–7.47 (m, 3H), 7.53–7.57 (m, 1H), 7.79 (d, $J = 8.2$ Hz, 1H), 7.92 (s, 1H), 8.06–8.08 (m, 2H), 7.26 (dd, $J_1 = 7.7$ Hz, $J_2 = 1.6$ Hz, 1H), 8.75 (d, $J = 8.5$ Hz, 1H); ^{13}C NMR (100 MHz, CDCl_3) δ 9.6, 10.9, 29.9, 55.5, 89.0, 89.3, 110.2, 115.8, 119.8, 120.6, 123.4, 125.3, 126.1, 126.6, 126.9, 127.2, 127.4, 127.8, 128.1, 128.3, 128.6, 129.0, 129.8, 135.4, 137.4, 139.7, 140.3, 149.4, 155.1, 155.6, 159.1; HRMS (ESI) calcd for $\text{C}_{34}\text{H}_{28}\text{NO}_2$: 482.2115 ($\text{M} + \text{H}^+$), found: 482.2109.



(*Z*)-1-(1-(3-Benzylidene-1,3-dihydroisobenzofuran-1-yl)cyclopropyl)-3-phenyl-2,6-naphthyridine (**3u**)

White solid; ^1H NMR (400 MHz, CDCl_3) δ 1.28–1.29 (m, 1H), 1.34–1.39 (m, 1H), 1.43–1.54 (m, 2H), 5.64 (s, 1H), 5.75 (s, 1H), 7.14–7.24 (m, 4H), 7.26–7.33 (m, 4H), 7.37–7.41 (m, 2H), 7.44–7.48 (m, 2H), 7.65 (d, $J = 7.6$ Hz, 2H), 7.93 (s, 1H), 7.99–8.02 (m, 2H), 8.55 (b, 1H); ^{13}C NMR (100 MHz, CDCl_3) δ 10.4, 10.5, 29.7, 90.9, 96.3, 114.1, 119.6, 123.4, 125.4, 126.9, 127.9, 128.1, 128.3, 128.4, 128.7, 128.8, 134.9, 135.9, 136.09, 136.14, 138.8, 139.7, 151.2, 154.5, 159.0; HRMS (ESI) calcd for $\text{C}_{32}\text{H}_{25}\text{N}_2\text{O}$: 453.1961 ($\text{M} + \text{H}^+$), found: 453.1958.

