$SnCl_2$-Mediated Heterocyclization Approach for the Synthesis of Benzisoxazole/Quinoline Embedded β-Carboline Scaffolds

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Supporting Information

Table of Contents

(*E*)-Methyl 9-methyl-1-(3-(2-nitrophenyl)-3-oxoprop-1-en-1-yl)-9*H*-pyrido[3,4-*b*]indole-3-carboxylate (2'A). Yield: 87% (0.203 g from 0.15 g) as a yellow solid; m.p. 207-208 °C; R_f = 0.30 (hexane/EtOAc, 70:30, v/v); IR (neat): ν_{max} = 1717 (CO_2CH_3), 1588 (CO); ^{1}H NMR (500 MHz, $CDCl_3$) δ = 4.03 (s, 3 H, NCH_3), 4.10 (s, 3 H, CO_2CH_3), 7.38 (t, J = 7.5 Hz, 1 H, ArH), 7.50 (d, J = 8.4 Hz, 1 H, ArH), 7.63 (d, J = 7.5 Hz, 1 H, ArH), 7.67 (d, J = 8.2 Hz, 2 H, ArH), 7.72 (d, J = 15.2 Hz, 1 H, ArH), 7.80 (t, J = 7.5 Hz, 1 H, ArH), 8.18 (t, J = 8.3 Hz, 2 H, ArH), 8.37 (d, J = 15.1 Hz, 1 H, ArH), 8.83 (s, 1 H, ArH) ppm; ^{13}C NMR (125 MHz, $CDCl_3$) δ = 33.6, 52.9, 110.1, 118.4, 121.2, 121.5, 122.0, 124.6, 129.0, 129.7, 130.5, 131.0, 131.5, 134.4, 136.3, 137.0, 137.6, 137.7, 139.3, 143.1, 146.8, 166.3, 191.9 ppm; HRMS (ESI) m/z: calcd. for $C_{23}H_{17}N_3O_5$ $[M + H]^+$: 416.1246, found: 416.1262.

(*E*)-Methyl 1-(2-(benzo[*c*]isoxazol-3-yl)vinyl)-9*H*-pyrido[3,4-*b*]indole-3-carboxylate (1A). Yield: 54% (0.118 g from 0.15 g) as a brown solid; m.p. >262-263 °C; R_f = 0.50 (hexane/EtOAc, 60:40, v/v); IR (neat): ν_{max} (cm^{-1}) = 3335, 3258, 3055, 2956, 2111, 1719, 1628, 1566, 1502, 1432, 1350, 1244, 1140, 1014; ^{1}H NMR (500 MHz, DMSO-d_6) δ = 3.98 (s, 3 H, CO_2CH_3), 7.24 (dd, J_1 = 8.6 Hz, J_2 = 6.4 Hz, 1 H, ArH), 7.36 (t, J = 7.4 Hz, 1 H, ArH), 7.50 (dd, J_1 = 8.9 Hz, J_2 = 6.4 Hz, 1 H, ArH), 7.66 (t, J = 7.5 Hz, 1 H, ArH), 7.70 (d, J = 9.1 Hz, 1 H, ArH), 7.73 (d, J = 8.3 Hz, 1 H, ArH), 8.18 (d, J = 8.7 Hz, 1 H, ArH), 8.23 (t, J = 15.5 Hz, 1 H, CH=C*H*), 8.41–8.45 (m, 2 H, ArH & C*H*=CH), 8.93 (s, 1 H, ArH), 12.60 (brs, 1 H, NH) ppm; ^{13}C NMR (125 MHz, DMSO-d_6) δ = 52.2, 112.4, 114.8, 115.6, 116.1, 117.6, 120.6, 120.8, 121.0, 122.4, 125.0, 128.3, 129.1, 129.3, 131.7, 136.2, 136.8, 136.9, 141.1, 157.0, 163.1, 165.8 ppm; HRMS (ESI) m/z: calcd. for $C_{22}H_{15}N_3O_3$ $[M + H]^+$: 370.1192, found: 370.1164.

(*E*)-Methyl 1-(2-(benzo[*c*]isoxazol-3-yl)vinyl)-9-methyl-9*H*-pyrido[3,4-*b*]indole-3-carboxylate (2A). Yield: 76% (0.163 g from 0.150 g) as a pale yellow solid; m.p. 245-246 °C; R_f = 0.50 (hexane/EtOAc, 70:30, v/v); IR (neat): ν_{max} (cm^{-1}) = 3050, 2955, 2891, 2082, 1993, 1707, 1625, 1552, 1523, 1443, 1259, 1128, 1054, 1001; ^{1}H NMR (500 MHz, $CDCl_3$) δ = 4.10 (s, 3 H, NCH_3), 4.31 (s, 3 H, CO_2CH_3), 7.08 (dd, J_1 = 8.5 Hz, J_2 = 6.5 Hz, 1 H, ArH), 7.33–7.40 (m, 2 H, ArH), 7.55 (d, J = 8.4 Hz, 1 H, ArH), 7.61 (d, J = 9.1 Hz, 1 H, ArH), 7.69 (t, J = 7.6 Hz, 1 H, ArH), 7.77 (d, J = 8.7 Hz, 1 H, ArH), 8.19 (d, J = 7.7 Hz, 1 H, ArH), 8.24 (d, J = 15.2 Hz, 1 H, C*H*=CH), 8.48 (d, J = 15.2 Hz, 1 H, C*H*=CH), 8.83 (s, 1 H, ArH) ppm; ^{13}C NMR (125 MHz, $CDCl_3$) δ = 33.7, 52.8, 100.1, 115.4, 117.0, 117.4, 120.2, 121.2, 121.3, 121.8, 124.7, 128.5, 129.5, 131.1, 131.3, 136.9, 137.6, 137.9, 143.0, 157.7, 163.2, 166.5 ppm; HRMS (ESI) m/z: calcd. for $C_{23}H_{17}N_3O_3$ $[M + H]^+$: 384.1348, found: 384.1327.

(*E*)-Methyl 1-(2-(benzo[*c*]isoxazol-3-yl)vinyl)-9-ethyl-9*H*-pyrido[3,4-*b*]indole-3-carboxylate (3A). Yield: 74% (0.157 g from 0.150 g) as a pale yellow solid; m.p. 239-240 °C; R_f = 0.45 (hexane/EtOAc, 70:30, v/v); IR (neat): ν_{max} (cm^{-1}) = 3055, 2946, 2114, 1732, 1620, 1552, 1517, 1426, 1343, 1209, 1142, 1075, 1016; ^{1}H NMR (500 MHz, $CDCl_3$) δ = 1.69 (t, J = 7.2 Hz, 3 H, NCH_2CH_3), 4.09 (s, 3 H, CO_2CH_3), 4.74 (q, J = 7.2 Hz, 2 H, NCH_2CH_3), 7.08 (dd, J_1 = 8.7 Hz, J_2 = 6.4 Hz, 1 H, ArH), 7.35 (dd, J_1 = 9.0 Hz, J_2 = 6.4 Hz, 1 H, ArH), 7.39 (t, J = 7.5 Hz, 1 H, ArH), 7.56 (d, J = 8.3 Hz, 1 H, ArH), 7.61 (d, J = 9.1 Hz, 1 H, ArH), 7.68 (t, J = 7.5 Hz, 1 H, ArH), 7.77 (d, J = 8.8 Hz, 1 H, ArH), 8.21 (d, J = 7.8 Hz, 1 H, ArH),

8.26 (d, *J* = 15.2 Hz, 1 H, CH=C*H*), 8.34 (d, *J* = 15.3 Hz, 1 H, C*H*=CH), 8.85 (s, 1 H, ArH) ppm; ^{13}C NMR (125 MHz, $CDCl_3$) δ = 15.3, 40.9, 52.9, 110.0, 115.5, 117.4, 117.5, 117.6, 120.1, 121.3, 121.6, 122.0, 124.8, 1285, 129.5, 131.3, 131.4, 136.0, 137.4, 137.5, 142.2, 157.8, 163.3, 166.6 ppm; HRMS (ESI) m/z: calcd. for $C_{24}H_{19}N_3O_3$ [M + H^+]: 398.1505, found: 398.1517.

(*E*)-Methyl 1-(2-(benzo[*c*]isoxazol-3-yl)vinyl)-9-propyl-9*H*-pyrido[3,4-*b*]indole-3-carboxylate (4A). Yield: 77% (0.16 g from 0.15 g) as a pale yellow solid; m.p. 225-226 °C; R_f = 0.50 (hexane/EtOAc, 70:30, v/v); IR (neat): ν_{max} (cm^{-1}) = 3029, 2953, 2119, 1729, 1618, 1549, 1521, 1431, 1347, 1213, 1146, 1069, 1021; ^{1}H NMR (500 MHz, $CDCl_3$) δ = 1.44 (t, *J* = 7.4 Hz, 3 H, $NCH_2CH_2CH_3$), 2.08–2.12 (m, 2 H, $NCH_2CH_2CH_3$), 4.09 (s, 3 H, CO_2CH_3), 4.58 (t, *J* = 7.7 Hz, 2 H, $NCH_2CH_2CH_3$), 7.07 (dd, J_1 = 8.7 Hz, J_2 = 6.4 Hz, 1 H, ArH), 7.32–7.38 (m, 2 H, ArH), 7.53 (d, *J* = 8.3 Hz, 1 H, ArH), 7.59 (d, *J* = 9.0 Hz, 1 H, ArH), 7.65 (t, *J* = 7.6 Hz, 1 H, ArH), 7.75 (d, *J* = 8.6 Hz, 1 H, ArH), 8.17 (d, *J* = 7.8 Hz, 1 H, ArH), 8.22 (d, *J* = 15.3 Hz, 1 H, CH=C*H*), 8.28 (d, *J* = 15.3 Hz, 1 H, C*H*=CH), 8.81 (s, 1 H, ArH) ppm; ^{13}C NMR (125 MHz, $CDCl_3$) δ = 11.4, 23.7, 47.5, 52.9, 110.3, 115.4, 117.3, 117.5, 120.1, 121.2, 121.3, 121.9, 124.7, 128.5, 129.4, 131.2, 131.3, 316.1, 137.3, 137.4, 142.6, 157.7, 163.2, 166.6 ppm; HRMS (ESI) m/z: calcd. for $C_{25}H_{21}N_3O_3$ [M + H^+]: 412.1661, found: 412.1667.

(*E*)-Methyl 9-allyl-1-(2-(benzo[*c*]isoxazol-3-yl)vinyl)-9*H*-pyrido[3,4-*b*]indole-3-carboxylate (5A). Yield: 79% (0.22 g from 0.20 g) as a brown solid; m.p. 193-194 °C; R_f = 0.60 (hexane/EtOAc, 60:40, v/v); IR (neat): ν_{max} (cm^{-1}) = 3056, 2951, 2107, 1711, 1627, 1551, 1426, 1353, 1324, 1239, 1226, 1142, 1073, 1002; ^{1}H NMR (400 MHz, $CDCl_3$) δ = 4.08 (s, 3 H, CO_2CH_3), 5.09 (d, *J* = 17.2 Hz, 1 H, NCH_2CHCH_2), 5.22 (t, *J* = 1.8 Hz, 2 H, NCH_2CHCH_2), 5.37 (d, *J* = 10.6 Hz, 1 H, NCH_2CHCH_2), 6.24–6.32 (m, 1 H, NCH_2CHCH_2), 7.06 (dd, J_1 = 8.7 Hz, J_2 = 6.4 Hz, 1 H, ArH), 7.32 (dd, J_1 = 9.1 Hz, J_2 = 6.4 Hz, 1 H, ArH), 7.38 (t, *J* = 7.5 Hz, 1 H, ArH), 7.47 (d, *J* = 8.3 Hz, 1 H, ArH), 7.58 (d, *J* = 9.1 Hz, 1 H, ArH), 7.62–7.66 (m, 1 H, ArH), 7.74 (d, *J* = 8.8 Hz, 1 H, ArH), 8.16–8.20 (m, 2 H, ArH & CH=C*H*), 8.24 (d, *J* = 15.4 Hz, 1 H, CH=C*H*), 8.81 (s, 1 H, ArH) ppm; ^{13}C NMR (100 MHz, $CDCl_3$) δ = 48.2, 52.8, 110.2, 115.4, 117.2, 117.4, 118.0, 120.1, 121.5, 121.9, 124.7, 128.9, 129.6, 131.1, 131.2, 132.1, 136.6, 137.7, 137.8, 142.7, 157.7, 163.3, 166.5 ppm; HRMS (ESI) m/z: calcd. for $C_{25}H_{19}N_3O_3$ [M + H^+]: 410.1505, found: 410.1513.

(*E*)-Methyl 1-(2-(benzo[*c*]isoxazol-3-yl)vinyl)-9-(prop-2-yn-1-yl)-9*H*-pyrido[3,4-*b*]indole-3-carboxylate (6A). Yield: 75% (0.21 g from 0.20 g) as a pale yellow solid; m.p. 225-226 °C; R_f = 0.50 (hexane/EtOAc, 70:30, v/v); IR (neat): ν_{max} (cm^{-1}) = 3304, 3052, 2947, 2120, 1719, 1623, 1553, 1454, 1403, 1357, 1271, 1137, 1058, 1006; ^{1}H NMR (500 MHz, $CDCl_3$) δ = 2.56 (t, *J* = 2.4 Hz, 1 H, $NCH_2C{\equiv}CH$), 4.10 (s, 3 H, CO_2CH_3), 5.36 (d, *J* = 2.4 Hz, 2 H, $NCH_2C{\equiv}CH$), 7.09 (dd, J_1 = 8.7 Hz, J_2 = 6.4 Hz, 1 H, ArH), 7.33–7.37 (m, 1 H, ArH), 7.41–7.45 (m, 1 H, ArH), 7.61–7.63 (m, 2 H, ArH), 7.69–7.74 (m, 1 H, ArH), 7.83 (d, *J* = 8.8 Hz, 1 H, ArH), 8.21 (d, *J* = 7.8 Hz, 1 H, ArH), 8.27 (d, *J* = 15.3 Hz, 1 H, CH=C*H*), 8.53 (d, *J* = 15.3 Hz, 1 H, C*H*=CH), 8.83 (s, 1 H, ArH) ppm; ^{13}C NMR (125 MHz, $CDCl_3$) δ = 36.1, 52.9, 75.1, 77.4, 110.1, 115.4, 117.3, 117.4, 118.3, 120.2, 121.7, 121.9, 122.1, 124.8, 128.7, 129.8, 131.2, 131.7, 136.1, 138.2, 138.5, 142.2, 157.7, 163.3, 166.5 ppm; HRMS (ESI) m/z: calcd. for $C_{25}H_{17}N_3O_3$ [M + H^+]: 408.1348, found: 408.1353.

(*E*)-Methyl 1-(2-(benzo[c]isoxazol-3-yl)vinyl)-9-benzyl-9*H*-pyrido[3,4-*b*]indole-3-carboxylate (7A). Yield: 73% (0.146 g from 0.150 g) as a light brown solid; m.p. 223-224 °C; R_f = 0.50 (hexane/EtOAc, 70:30, v/v); IR (neat): ν_{max} (cm^{-1}) = 3355, 2946, 2114, 1731, 1620, 1552, 1517, 1426, 1343, 1209, 1142, 1075; ^{1}H NMR (500 MHz, $CDCl_3$) δ = 4.09 (s, 3 H, CO_2CH_3), 5.89 (s, 2 H, NCH_2Ph), 6.95 (dd, J_1 = 8.6 Hz, J_2 = 6.5 Hz, 1 H, ArH), 7.21 (d, J = 7.5 Hz, 2 H, ArH), 7.28–7.33 (m, 2 H, ArH), 7.35–7.39 (m, 3 H, ArH), 7.43 (t, J = 7.5 Hz, 1 H, ArH), 7.52 (d, J = 8.3 Hz, 1 H, ArH), 7.56 (d, J = 9.1 Hz, 1 H, ArH), 7.66 (t, J = 7.7 Hz, 1 H, ArH), 8.05 (d, J = 15.3 Hz, 1 H, CH=C*H*), 8.14 (d, J = 15.3 Hz, 1 H, C*H*=CH), 8.27 (d, J = 7.8 Hz, 1 H, ArH), 8.89 (s, 1 H, ArH) ppm; ^{13}C NMR (100 MHz, $CDCl_3$) δ = 49.6, 52.9, 110.4, 115.5, 116.9, 117.5, 118.0, 120.1, 121.6, 121.7, 122.1, 124.7, 125.9, 128.3, 128.8, 129.6, 129.8, 131.0, 131.6, 136.2, 136.7, 138.0, 138.1, 143.2 157.6, 163.4, 166.6 ppm; HRMS (ESI) m/z: calcd. for $C_{29}H_{21}N_3O_3$ [M + H^+]: 460.1661, found: 460.1677.

(*E*)-Methyl 1-(2-(benzo[*c*]isoxazol-3-yl)vinyl)-9-(2-methoxy-2-oxoethyl)-9*H*-pyrido[3,4-*b*]indole-3-carboxylate (8A). Yield: 70% (0.19 g from 0.20 g) as a brown solid; m.p. 246-247 °C; R_f = 0.45 (hexane/EtOAc, 70:30, v/v); IR (neat): ν_{max} (cm^{-1}) = 3062, 2951, 2092, 1738, 1719, 1628, 1552, 1450, 1352, 1231, 1140, 1080, 1002; ^{1}H NMR (400 MHz, $CDCl_3$) δ = 3.89 (s, 3 H, $NCH_2CO_2CH_3$), 4.09 (s, 3 H, CO_2CH_3), 5.36 (s, 2 H, NC$H_2CO_2CH_3$), 7.08 (dd, J_1 = 8.6 Hz, J_2 = 6.4 Hz, 1 H, ArH), 7.32–7.36 (m, 1 H, ArH), 7.41 (t, J = 7.5 Hz, 1 H, ArH), 7.46 (d, J = 8.3 Hz, 1 H, ArH), 7.60 (d, J = 8.9 Hz, 1 H, ArH), 7.67 (t, J = 7.7 Hz, 1 H, ArH), 7.75 (d, J = 8.6 Hz, 1 H, ArH), 8.11 (d, J = 15.2 Hz, 1 H, CH=C*H*), 8.16–8.21 (m, 2 H, C*H*=CH & ArH), 8.83 (s, 1 H, ArH) ppm; ^{13}C NMR (100 MHz, $CDCl_3$) δ = 47.8, 52.9, 53.4, 109.9, 115.5, 117.3, 117.5, 118.2, 120.1, 121.8, 122.0, 122.1, 124.9, 127.9, 129.8, 131.3, 131.8, 136.7, 138.1, 138.5, 142.8, 157.7, 163.0, 166.4, 168.7 ppm; HRMS (ESI) m/z: calcd. for $C_{25}H_{19}N_3O_5$ [M + H^+]: 442.1403, found: 442.1396.

(*E*)-Methyl 1-(2-(benzo[*c*]isoxazol-3-yl)vinyl)-9-(2-ethoxy-2-oxoethyl)-9*H*-pyrido[3,4-*b*]indole-3-carboxylate (9A). Yield: 40% (0.080 g from 0.150 g) as a light brown solid; m.p. 231-232 °C; R_f = 0.50 (hexane/EtOAc, 70:30, v/v); IR (neat): ν_{max} (cm^{-1}) = 3059, 2954, 2105, 1729, 1716, 1623, 1546, 1457, 1361, 1237, 1137, 1073, 1011; ^{1}H NMR (500 MHz, $CDCl_3$) δ = 1.35 (t, J = 7.0 Hz, 3 H, $CO_2CH_2CH_3$), 4.09 (s, 3 H, CO_2CH_3), 4.34 (q, J = 7.0 Hz, 2 H, $CO_2CH_2CH_3$), 5.35 (s, 2 H, CH_2CO_2Et), 7.07 (t, J = 7.3 Hz, 1 H, ArH), 7.34 (t, J = 7.6 Hz, 1 H, ArH), 7.41 (t, J = 7.3 Hz, 1 H, ArH), 7.48 (d, J = 8.2 Hz, 1 H, ArH), 7.60 (d, J = 8.9 Hz, 1 H, ArH), 7.67 (t, J = 7.5 Hz, 1 H, ArH), 7.76 (d, J = 8.6 Hz, 1 H, ArH), 8.13–8.22 (m, 3 H, ArH & CH=CH), 8.84 (s, 1 H, ArH) ppm; HRMS (ESI) m/z: calcd. for $C_{26}H_{21}N_3O_5$ [M + H^+]: 456.1559, found: 456.1567.

(*E*)-Ethyl 1-(2-(benzo[*c*]isoxazol-3-yl)vinyl)-9*H*-pyrido[3,4-*b*]indole-3-carboxylate (10A). Yield: 47% (0.135 g from 0.20 g) as a brown solid; m.p. 253-254 °C; R_f = 0.40 (hexane/EtOAc, 70:30, v/v); IR (neat): ν_{max} (cm^{-1}) = 3352, 3071, 2958, 1711, 1631, 1554, 1505, 1429, 1339, 1243, 1132, 1007; ^{1}H NMR (500 MHz, DMSO-d_6) δ = 1.44 (t, J = 7.0 Hz, 3 H, $CO_2CH_2CH_3$), 4.45 (q, J = 7.0 Hz, 2 H, $CO_2CH_2CH_3$), 7.24 (t, J = 7.5 Hz, 1 H, ArH), 7.36 (t, J = 7.3 Hz, 1 H, ArH), 7.50 (t, J = 7.6 Hz, 1 H, ArH), 7.66 (t, J = 7.5 Hz, 1 H, ArH), 7.70–7.74 (m, 2 H, ArH), 8.17 (d, J = 8.7 Hz, 1 H, ArH), 8.24 (d, J = 15.8 Hz, 1 H, CH=C*H*),

8.41–8.45 (m, 2 H, C*H*=CH & ArH), 8.91 (s, 1 H, ArH), 12.59 (brs, 1 H, NH) ppm; ^{13}C NMR (125 MHz, DMSO-d_6) δ = 14.9, 61.4, 112.9, 115.4, 116.1, 116.7, 118.0, 121.1, 121.3, 121.6, 122.9, 125.6, 128.9, 129.7, 132.3, 136.8, 137.4, 137.8, 141.6, 157.6, 163.6, 165.8 ppm; HRMS (ESI) m/z: calcd. for $C_{23}H_{17}N_3O_3$ [M + H$^+$]: 384.1348, found: 384.1339.

(*E*)-Ethyl 1-(2-(benzo[*c*]isoxazol-3-yl)vinyl)-9-methyl-9*H*-pyrido[3,4-*b*]indole-3-carboxylate (11A). Yield: 74% (0.210 g from 0.200 g) as a brown solid; m.p. 215-216 ^{o}C; R_f = 0.60 (hexane/EtOAc, 70:30, v/v); IR (neat): ν_{max} (cm^{-1}) = 3090, 2991, 2945, 2098, 1731, 1626, 1552, 1454, 1344, 1322, 1215, 1148, 1026; ^{1}H NMR (400 MHz, $CDCl_3$) δ = 1.54 (t, *J* = 7.1 Hz, 3 H, $CO_2CH_2CH_3$), 4.31 (s, 3 H, NCH_3), 4.46 (q, *J* = 7.1 Hz, 2 H, $CO_2CH_2CH_3$), 7.07 (dd, J_1 = 8.5 Hz, J_2 = 6.4 Hz, 1 H, ArH), 7.32–7.40 (m, 2 H, ArH), 7.55 (d, *J* = 8.4 Hz, 1 H, ArH), 7.60 (d, *J* = 9.0 Hz, 1 H, ArH), 7.68 (t, *J* = 7.6 Hz, 1 H, ArH), 7.76 (d, *J* = 8.7 Hz, 1 H, ArH), 8.20 (d, *J* = 7.8 Hz, 1 H, ArH), 8.28 (d, *J* = 15.2 Hz, 1 H, CH=C*H*), 8.47 (d, *J* = 15.2 Hz, 1 H, CH=C*H*), 8.79 (s, 1 H, ArH), ppm; ^{13}C NMR (125 MHz, $CDCl_3$) δ = 14.9, 61.4, 112.9, 115.4, 116.1, 116.7, 118.0, 121.1, 121.3, 121.6, 122.9, 125.6, 128.9, 129.7, 132.3, 136.8, 137.4, 137.8, 141.6, 157.6, 163.6, 165.8 ppm; HRMS (ESI) m/z: calcd. for $C_{24}H_{19}N_3O_3$ [M + H$^+$]: 398.1505, found: 398.1517.

(*E*)-Ethyl 1-(2-(benzo[*c*]isoxazol-3-yl)vinyl)-9-ethyl-9*H*-pyrido[3,4-*b*]indole-3-carboxylate (12A). Yield: 71% (0.196 g from 0.200 g) as a brown solid; m.p. 186-187 ^{o}C; R_f = 0.50 (hexane/EtOAc, 70:30, v/v); IR (neat): ν_{max} (cm^{-1}) = 3062, 2975, 2119, 1707, 1622, 1552, 1453, 1341, 1250, 1140, 1084, 1018; ^{1}H NMR (400 MHz, $CDCl_3$) δ = 1.54 (t, *J* = 7.1 Hz, 3 H, NCH_2CH_3), 1.69 (t, *J* = 7.2 Hz, 3 H, $CO_2CH_2CH_3$), 4.56 (q, *J* = 7.1 Hz, 2 H, NCH_2CH_3), 4.75 (q, *J* = 7.2 Hz, 2 H, $CO_2CH_2CH_3$), 7.08 (dd, J_1 = 8.6 Hz, J_2 = 6.5 Hz, 1 H, ArH), 7.33–7.41 (m, 2 H, ArH), 7.56 (d, *J* = 8.3 Hz, 1 H, ArH), 7.61 (d, *J* = 9.1 Hz, 1 H, ArH), 7.68 (t, *J* = 7.7 Hz, 1 H, ArH), 7.77 (d, *J* = 8.7 Hz, 1 H, ArH), 8.22 (d, *J* = 7.8 Hz, 1 H, ArH), 8.29–8.37 (m, 2 H, CH=CH), 8.82 (s, 1 H, ArH), ppm; ^{13}C NMR (100 MHz, $CDCl_3$) δ = 14.7, 15.2, 40.9, 618, 110.0, 115.5, 117.3, 117.4, 117.5, 120.1, 121.2, 121.6, 122.0, 124.8, 128.5, 129.4, 131.3, 131.4, 135.9, 137.5, 137.8, 142.2, 157.8, 163.3, 166.1 ppm; HRMS (ESI) m/z: calcd. for $C_{25}H_{21}N_3O_3$ [M + H$^+$]: 412.1661, found: 412.1653.

(*E*)-Ethyl 1-(2-(benzo[*c*]isoxazol-3-yl)vinyl)-9-benzyl-9*H*-pyrido[3,4-*b*]indole-3-carboxylate (13A). Yield: 68% (0.18 g from 0.20 g) as a yellow solid; m.p. 174-175 ^{o}C; R_f = 0.60 (hexane/EtOAc, 70:30, v/v); IR (neat): ν_{max} (cm^{-1}) = 3053, 2954, 2108, 1719, 1625, 1557, 1453, 1347, 1227, 1155, 1083, 1009; ^{1}H NMR (400 MHz, $CDCl_3$) δ = 1.54 (t, *J* = 7.2 Hz, 3 H, $CO_2CH_2CH_3$), 4.56 (q, *J* = 7.2 Hz, 2 H, $CO_2CH_2CH_3$), 5.90 (s, 2 H, CH_2Ph), 6.94 (dd, J_1 = 8.7 Hz, J_2 = 6.4 Hz, 1 H, ArH), 7.21 (d, *J* = 7.2 Hz, 2 H, ArH), 7.28–7.31 (m, 2 H, ArH), 7.33–7.39 (m, 3 H, ArH), 7.43 (t, *J* = 7.5 Hz, 1 H, ArH), 7.52 (d, *J* = 8.4 Hz, 1 H, ArH), 7.57 (d, *J* = 9.1 Hz, 1 H, ArH), 7.64–7.68 (m, 1 H, ArH), 8.06 (d, *J* = 15.4 Hz, 1 H, CH=C*H*), 8.18 (d, *J* = 15.4 Hz, 1 H, C*H*=CH), 8.28 (d, *J* = 7.8 Hz, 1 H, ArH), 8.87 (s, 1 H, ArH), ppm; ^{13}C NMR (100 MHz, $CDCl_3$) δ = 14.6, 49.6, 61.8, 110.4, 115.5, 116.9, 117.3, 118.0, 120.1, 121.7, 122.1, 124.7, 126.0, 128.3, 128.8, 129.6, 129.8, 131.0, 131.6, 136.3, 136.7, 138.0, 138.5 143.2, 157.6, 163.5, 166.0 ppm; HRMS (ESI) m/z: calcd. for $C_{30}H_{23}N_3O_3$ [M + H$^+$]: 474.1818, found: 474.1807.

(*E*)-Isopropyl 1-(2-(benzo[*c*]isoxazol-3-yl)vinyl)-9-methyl-9*H*-pyrido[3,4-*b*]indole-3-carboxylate (14A). Yield: 55% (0.153 g from 0.200 g) as a brown solid; m.p. 284-285 ^{o}C; R_f = 0.50 (hexane/EtOAc, 70:30, v/v); IR (neat): ν_{max} (cm^{-1}) = 3071, 2977, 2111, 1711, 1629, 1583, 1460, 1360, 1322, 1262, 1110; ^{1}H NMR (400 MHz, $CDCl_3$) δ = 1.52 (d, J = 6.2 Hz, 6 H, $CO_2CH(CH_3)_2$), 4.31 (s, 3 H, NCH_3), 5.38–5.45 (m, 1 H, $CO_2CH(CH_3)_2$), 7.08 (dd, J_1 = 8.7 Hz, J_2 = 6.4 Hz, 1 H, ArH), 7.32–7.40 (m, 2 H, ArH), 7.55 (d, J = 8.3 Hz, 1 H, ArH), 7.60 (d, J = 9.0 Hz, 1 H, ArH), 7.68 (t, J = 7.7 Hz, 1 H, ArH), 7.76 (d, J = 8.7 Hz, 1 H, ArH), 8.21 (d, J = 7.8 Hz, 1 H, ArH), 8.32 (d, J = 15.2 Hz, 1 H, CH=C*H*), 8.47 (d, J = 15.0 Hz, 1 H, C*H*=CH), 8.76 (s, 1 H, ArH) ppm; ^{13}C NMR (100 MHz, $CDCl_3$) δ = 22.2, 33.8, 69.3, 110.1, 115.5, 117.0, 117.1, 117.4, 120.2, 121.1, 121.4, 121.9, 124.7, 128.6, 129.4, 131.1, 131.3, 136.8, 137.9, 138.2, 143.0, 157.8, 163.3, 166.4 ppm; HRMS (ESI) m/z: calcd. for $C_{25}H_{21}N_3O_3$ [M + H$^+$]: 412.1661, found: 412.1663.

(*E*)-Isopropyl 1-(2-(benzo[*c*]isoxazol-3-yl)vinyl)-9-benzyl-9*H*-pyrido[3,4-*b*]indole-3-carboxylate (15A). Yield: 50% (0.130 g from 0.200 g) as a pale yellow solid; m.p. 140-141 ^{o}C; R_f = 0.45 (hexane/EtOAc, 80:20, v/v); IR (neat): ν_{max} (cm^{-1}) = 3069, 2980, 2931, 2100, 1701, 1553, 1497, 1364, 1264, 1226, 1106, ; ^{1}H NMR (400 MHz, $CDCl_3$) δ = 1.51 (d, J = 6.2 Hz, 6 H, $CO_2CH(CH_3)_2$), 5.38–5.44 (m, 1 H, $CO_2CH(CH_3)_2$), 5.88 (s, 2 H, CH_2Ph), 6.94 (dd, J_1 = 8.5 Hz, J_2 = 6.5 Hz, 1 H, ArH), 7.20 (d, J = 7.2 Hz, 2 H, ArH), 7.27–7.40 (m, 5 H, ArH), 7.42 (t, J = 7.5 Hz, 1 H, ArH), 7.51 (d, J = 8.3 Hz, 1 H, ArH), 7.56 (d, J = 9.0 Hz, 1 H, ArH), 7.64 (t, J = 7.7 Hz, 1 H, ArH), 8.04 (d, J = 15.4 Hz, 1 H, CH=C*H*), 8.20 (d, J = 15.4 Hz, 1 H, C*H*=CH), 8.27 (d, J = 7.8 Hz, 1 H, ArH), 8.82 (s, 1 H, ArH) ppm; ^{13}C NMR (100 MHz, $CDCl_3$) δ = 22.2, 49.6, 69.3, 110.3, 115.4, 116.8, 117.1, 117.8, 120.1, 121.5, 121.6, 122.0, 124.6, 125.9, 128.3, 128.8, 129.5, 129.7, 131.0, 131.5, 136.3, 136.8, 138.0, 138.8, 143.2, 157.6, 163.5, 165.4 ppm; HRMS (ESI) m/z: calcd. for $C_{31}H_{25}N_3O_3$ [M + H$^+$]: 488.1974, found: 488.1987.

(*E*)-3-(2-(9-Methyl-9*H*-pyrido[3,4-*b*]indol-1-yl)vinyl)benzo[*c*]isoxazole (17A). Yield: 65% (0.252 g from 0.25 g) as a brown solid; m.p. 197-198 ^{o}C; R_f = 0.45 (hexane/EtOAc, 70:30, v/v); IR (neat): ν_{max} (cm^{-1}) = 3053, 2970, 2105, 1625, 1455, 1402, 1323, 1274, 1222, 1127, 1061; ^{1}H NMR (400 MHz, $CDCl_3$) δ = 4.28 (s, 3 H, NCH_3), 7.06 (dd, J_1 = 8.7 Hz, J_2 = 6.4 Hz, 1 H, ArH), 7.31–7.36 (m, 2 H, ArH), 7.51 (d, J = 8.4 Hz, 1 H, ArH), 7.60 (d, J = 9.1 Hz, 1 H, ArH), 7.63–7.67 (m, 1 H, ArH), 7.74 (d, J = 8.7 Hz, 1 H, ArH), 7.96 (d, J = 5.0 Hz, 1 H, ArH), 8.14–8.19 (m, 2 H, CH=C*H* & ArH), 8.50–8.55 (m, 2 H, C*H*=CH & ArH) ppm; ^{13}C NMR (100 MHz, $CDCl_3$) δ = 33.7, 109.8, 115.0, 115.4, 117.2, 120.1, 120.4, 121.1, 121.7, 124.6, 129.1, 129.5, 131.3, 135.9, 138.1, 139.3, 142.8, 157.8, 163.6 ppm; HRMS (ESI) m/z: calcd. for $C_{21}H_{15}N_3O$ [M + H$^+$]: 326.1293, found: 326.1287.

2-(9-Ethyl-9*H*-pyrido[3,4-*b*]indol-1-yl)quinolin-4(1*H*)-one (18A'). Yield: 22% (0.050 g from 0.15 g) as a resddish brown solid; m.p. 217-218 ^{o}C; R_f = 0.50 (hexane/EtOAc, 80:20, v/v); IR (neat): ν_{max} (cm^{-1}) = 3405, 3044, 2965, 2107, 1695, 1625, 1454, 1413, 1337, 1284, 1231, 1147, 1024; ^{1}H NMR (500 MHz, $CDCl_3$) δ = 1.63 (t, J = 7.2 Hz, 3 H, NCH_2CH_3), 4.72 (q, J = 7.1 Hz, 2 H, NCH_2CH_3), 6.92 (t, J = 7.3 Hz, 1 H, ArH), 7.03 (d, J = 8.0 Hz, 1 H, ArH), 7.30-7.32 (m, 2 H, ArH), 7.46 (t, J = 7.4 Hz, 1 H, ArH), 7.51 (d, J = 8.3 Hz, 1 H, ArH),

7.63 (t, J = 7.6 Hz, 1 H, ArH), 7.73 (d, J = 7.5 Hz, 1 H, ArH), 7.87 (d, J = 5.0 Hz, 1 H, ArH), 8.13 (d, J = 7.7 Hz, 1 H, ArH), 8.53 (d, J = 5.0 Hz, 1 H, ArH), 10.37 (brs, 1 H, N*H*) ^{13}C NMR (125 MHz, $CDCl_3$) δ = 14.9, 40.7, 101.5, 109.7, 111.8, 113.5, 120.2, 120.3, 121.2, 121.6, 125.2, 128.9, 130.4, 136.4, 138.4, 138.5, 141.7, 153.3, 187.7 ppm; HRMS (ESI) m/z: calcd. for $C_{27}H_{17}N_3O$ [M + H^+]: 340.1450, found: 340.1457.

(*E*)-3-(2-(9-Allyl-9*H*-pyrido[3,4-*b*]indol-1-yl)vinyl)benzo[*c*]isoxazole (19A). Yield: 66% (0.187 g from 0.190 g) as a pale yellow solid; m.p. 189-190 ^{o}C; R_f = 0.50 (hexane/EtOAc, 70:30, v/v); IR (neat): ν_{max} (cm^{-1}) = 3206, 3030, 2939, 2112, 1625, 1554, 1518, 1449, 1407, 1360, 1289, 1199, 1134, 1069; ^{1}H NMR (400 MHz, $CDCl_3$) δ = 5.14 (d, J = 17.4 Hz, 1 H, $NCH_2CH{=}CH_2$), 5.21 (s, 2 H, $NCH_2CH{=}CH_2$), 6.27–6.35 (m, 1 H, NCH2C*H*=CH_2), 5.38 (d, J = 10.4 Hz, 1 H, $NCH_2CH{=}CH_2$), 7.05 (t, J = 7.5 Hz, 1 H, ArH), 7.33 (t, J = 7.6 Hz, 2 H, ArH), 7.44 (d, J = 8.2 Hz, 1 H, ArH), 7.58–7.64 (m, 2 H, ArH), 7.72 (d, J = 8.7 Hz, 1 H, ArH), 7.96–7.98 (m, 1 H, ArH), 8.11 (dd, J_1 = 15.4 Hz, J_2 = 1.7 Hz, 1 H, CH=C*H*), 8.15 (d, J = 8.0 Hz, 1 H, ArH), 8.30 (dd, J_1 = 15.4 Hz, J_2 = 2.6 Hz, 1 H, C*H*=CH), 8.55 (dd, J_1 = 5.0 Hz, J_2 = 0.8 Hz, 1 H, ArH) ppm; ^{13}C NMR (100 MHz, $CDCl_3$) δ = 48.2, 109.8, 114.9, 115.3, 115.7, 117.0, 117.7, 120.1, 120.6, 121.2, 121.7, 124.4, 129.1, 129.8, 131.1, 132.5, 135.5, 137.8, 139.4, 142.4, 157.6, 163.7 ppm; HRMS (ESI) m/z: calcd. for $C_{23}H_{17}N_3O$ [M + H^+]: 352.1450, found: 352.1463.

(*E*)-3-(2-(9-(Prop-2-yn-1-yl)-9*H*-pyrido[3,4-*b*]indol-1-yl)vinyl)benzo[*c*]isoxazole (20A). Yield: 61% (0.110 g from 0.150 g) as a reddish brown solid; m.p. 219-220 ^{o}C; R_f = 0.45 (hexane/EtOAc, 70:30, v/v); IR (neat): ν_{max} (cm^{-1}) = 3304, 3052, 2945, 2120, 1627, 1561, 1469, 1435, 1358, 1265, 1147, 1063; ^{1}H NMR (400 MHz, $CDCl_3$ + DMSO-d_6) δ = 1.25 (s, 1 H, $NCH_2C{\equiv}CH$), 5.31 (s, 2 H, $NCH_2C{\equiv}CH$), 7.06 (t, J = 7.3 Hz, 1 H, ArH), 7.32–7.37 (m, 2 H, ArH), 7.55–7.62 (m, 2 H, ArH), 7.67 (t, J = 7.5 Hz, 1 H, ArH), 7.80 (d, J = 8.6 Hz, 1 H, ArH), 7.95 (d, J = 4.4 Hz, 1 H, ArH), 8.13–8.19 (m, 2 H, ArH & CH=C*H*), 8.54–8.57 (m, 2 H, ArH & C*H*=CH) ppm; ^{13}C NMR (100 MHz, $CDCl_3$) δ = 36.0, 74.6, 78.0, 109.7, 115.0, 115.5, 116.7, 117.0, 120.2, 121.2, 121.5, 121.9, 124.6, 129.4, 129.6, 131.1, 131.6, 135.0, 138.3, 140.0, 141.8, 157.7, 163.7 ppm; HRMS (ESI) m/z: calcd. for $C_{23}H_{15}N_3O$ [M + H^+]: 350.1293, found: 350.1283.

(*E*)-3-(2-(9-Benzyl-9*H*-pyrido[3,4-*b*]indol-1-yl)vinyl)benzo[*c*]isoxazole (21A). Yield: 63% (0.177 g from 0.200 g) as a pale yellow solid; m.p. 220-221 ^{o}C; R_f = 0.50 (hexane/EtOAc, 75:25, v/v); IR (neat): ν_{max} (cm^{-1}) = 3056, 2965, 2098, 1621, 1452, 1397, 1347, 1265, 1231, 1129, 1057; ^{1}H NMR (500 MHz, $CDCl_3$) δ = 5.85 (s, 2 H, NCH_2Ph), 6.92 (dd, J_1 = 8.7, J_2 = 6.4 Hz, 1 H, ArH), 7.25 (s, 1 H ArH), 7.27-7.30 (m, 1 H, ArH), 7.32-7.36 (m, 2 H, ArH), 7.37–7.41 (m, 3 H, ArH), 7.48 (d, J = 8.3 Hz, 1 H, ArH), 7.55 (d, J = 9.0 Hz, 1H), 7.61-7.64 (m, 1 H, ArH), 8.02 (d, J = 4.9 Hz, 1 H, ArH), 8.08 (s, 2 H, CH=CH), 8.21 (d, J = 7.9 Hz, 1 H, ArH), 8.57 (d, J = 4.9 Hz, 1H) ppm; ^{13}C NMR (100 MHz, $CDCl_3$) δ = 49.6, 11.0, 115.0, 115.4, 116.6, 116.7, 120.1, 120.9, 121.2, 121.9, 124.5, 126.0, 128.2, 129.2, 129.5, 131.0, 131.6, 135.6, 136.7, 137.9, 139.4, 143.0, 157.6, 163.6 ppm; HRMS (ESI) m/z: calcd. for $C_{27}H_{19}N_3O$ [M + H^+]: 402.1606, found: 402.1617.

(*E*)-Methyl 1-(2-(6-chlorobenzo[*c*]isoxazol-3-yl)vinyl)-9-ethyl-9*H*-pyrido[3,4-*b*]indole-3-carboxylate (3B). Yield: 56% (0.115 g from 0.20 g) as a pale yellow solid; m.p. 170-171 °C; R_f = 0.60 (hexane/EtOAc, 70:30, v/v); IR (neat): ν_{max} (cm^{-1}) = 3049, 2956, 2115, 1627, 1454, 1367, 1342, 1249, 1229, 1137, 1061; ^{1}H NMR (500 MHz, $CDCl_3$) δ = 1.64–1.69 (m, 3 H, NCH_2CH_3), 4.10 (s, 3 H,F3ra CO_2CH_3), 4.74 (d, J = 6.1 Hz, 2 H, NCH_2CH_3), 7.01 (d, J = 7.8 Hz, 1 H, ArH), 7.40 (t, J = 6.5 Hz, 1 H, ArH), 7.57 (d, J = 7.8 Hz, 1 H, ArH), 7.61 (s, 1 H, ArH), 7.69 (t, J = 7.2 Hz, 1 H, ArH), 7.73 (d, J = 8.7 Hz, 1 H, ArH), 8.21–8.25 (m, 2 H, ArH & CH=C*H*), 8.35 (d, J = 14.8 Hz, 1 H, C*H*=CH), 8.85 (s, 1 H, ArH) ppm; ^{13}C NMR (100 MHz, DMSO-d_6) δ = 14.7, 52.3, 56.5, 101.8, 110.7, 113.5, 113.7, 114.7, 116.6, 117.4, 120.6, 121.0, 121.3, 122.3, 122.8, 126.2, 129.5, 130.4, 136.5, 141.7, 145.1, 157.1, 164.0, 165.6 ppm; HRMS (ESI) m/z: calcd. for $C_{24}H_{18}ClN_3O_3$ [M + H^+]: 432.1115, found: 432.1129.

(*E*)-3-(2-(1-methyl-9*H*-pyrido[3,4-*b*]indol-3-yl)vinyl)benzo[*c*]isoxazole (22A). Yield: 78% (0.182 g from 0.150 g) as a light brown solid; m.p. >260 °C; R_f = 0.55 (hexane/EtOAc, 70:30, v/v); IR (neat): ν_{max} (cm^{-1}) = 3410, 3025, 2954, 1641, 1559, 1523, 1461, 1354, 1343, 1230, 1127, 1107, 1057, 1023; ^{1}H NMR (500 MHz, DMSO-d_6) δ = 2.86 (s, 3 H, $ArCH_3$), 7.12 (dd, J_1 = 8.6 Hz, J_2 = 6.5 Hz, 1 H, ArH), 7.29 (t, J = 7.4 Hz, 1 H, ArH), 7.43 (dd, J_1 = 8.9 Hz, J_2 = 6.4 Hz, 1 H, ArH), 7.57 (t, J = 7.6 Hz, 1 H, ArH), 7.60–7.64 (m, 2 H, ArH), 7.86 (d, J = 15.7 Hz, 1 H, CH=C*H*), 7.97 (d, J = 16.0 Hz, 1 H, C*H*=CH), 8.06 (d, J = 8.7 Hz, 1 H, ArH), 8.20 (d, J = 7.8 Hz, 1 H, ArH), 8.35 (s, 1 H, ArH), 11.87 (brs, 1 H, NH) ppm; ^{13}C NMR (125 MHz, DMDO-d_6) δ = 20.7, 111.3, 112.3, 114.5, 114.6, 115.2, 119.8, 120.8, 121.2, 121.6, 124.0, 127.4, 128.1, 131.5, 134.5, 135.7, 140.7, 142.2, 142.8, 156.9, 164.0 ppm; HRMS (ESI) m/z: calcd. for $C_{21}H_{15}N_3O$ [M + H^+]: 326.1293, found: 326.1273.

(*E*)-3-(2-(1,9-Dimethyl-9*H*-pyrido[3,4-*b*]indol-3-yl)vinyl)benzo[*c*]isoxazole (23A). Yield: 76% (0.230 g from 0.200 g) as a pale yellow solid; m.p. 221-222 °C; R_f = 0.40 (hexane/EtOAc, 70:30, v/v); IR (neat): ν_{max} (cm^{-1}) = 3052, 2924, 1632, 1577, 1549, 1517, 1460, 1431, 1392, 1334, 1287, 1253, 1125, 1084, 1024; ^{1}H NMR (400 MHz, $CDCl_3$) δ = 3.15 (s, 3 H, $ArCH_3$), 4.16 (s, 3 H, NCH_3), 7.10 (dd, J_1 = 8.6 Hz, J_2 = 6.4 Hz, 1 H, ArH), 7.29–7.34 (m, 2 H, ArH), 7.46 (d, J = 8.3 Hz, 1 H, ArH), 7.56 (d, J = 9.0 Hz, 1 H, ArH), 7.61 (t, J = 7.7 Hz, 1 H, ArH), 7.75–7.79 (m, 2 H, ArH), 7.94 (d, J = 15.0 Hz, 2 H, CH=CH), 8.13 (d, J = 7.8 Hz, 1 H, ArH) ppm; ^{13}C NMR (100 MHz, $CDCl_3$) δ = 24.3, 32.5, 109.8, 112.3, 114.4, 115.3, 116.1, 120.3, 120.5, 121.4, 121.6, 123.8, 128.5, 129.3, 131.0, 135.0, 135.8, 142.4, 1425, 142.9, 157.6, 164.4 ppm; HRMS (ESI) m/z: calcd. for $C_{22}H_{17}N_3O$ [M + H^+]: 340.1450, found: 340.1454.

(*E*)-3-(2-(9-Ethyl-1-methyl-9*H*-pyrido[3,4-*b*]indol-3-yl)vinyl)benzo[*c*]isoxazole (24A). Yield: 72% (0.214 g from 0.200 g) as a light brown solid; m.p. 185-186 °C; R_f = 0.45 (hexane/EtOAc, 70:30, v/v); IR (neat): ν_{max} (cm^{-1}) = IR (neat): ν_{max} (cm^{-1}) = 3025, 2970, 1637, 1554, 1520, 1461, 1354, 1341, 1230, 1127, 1110, 1054, 1027; ^{1}H NMR (400 MHz, $CDCl_3$) δ = 1.50 (t, J = 7.2 Hz, 3 H, NCH_2CH_3), 3.13 (s, 3 H, $ArCH_3$), 4.66 (q, J = 7.2 Hz, 2 H, NCH_2CH_3), 7.02 (dd, J_1 = 8.7 Hz, J_2 = 6.5 Hz, 1 H, ArH), 7.29–7.35 (m, 2 H, ArH), 7.50 (d, J = 8.3 Hz, 1 H, ArH), 7.56–7.63 (m, 2 H, ArH), 7.77–7.82 (m, 2 H, ArH & CH=C*H*), 7.96 (d, J = 15.8 Hz, 1 H, C*H*=CH), 8.00 (s, 1 H, ArH), 8.16 (d, J = 7.8 Hz, 1 H, ArH) ppm;

^{13}C NMR (100 MHz, $CDCl_3$) δ = 15.9, 24.0, 39.8, 101.8, 109.9, 112.3, 114.5, 114.6, 115.3, 120.3, 120.5, 123.8, 124.9, 128.5, 131.0, 132.1, 135.1, 137.4, 141.5, 142.1, 142.9, 157.6, 164.5 ppm; HRMS (ESI) m/z: calcd. for $C_{23}H_{19}N_3O$ [M + H^+]: 354.1606, found: 354.1433.

(*E*)-3-(2-(9-Allyl-1-methyl-9*H*-pyrido[3,4-*b*]indol-3-yl)vinyl)benzo[*c*]isoxazole (25A). Yield: 73% (0.106 g from 0.100 g) as a pale yellow solid; m.p. 204-205 ^{o}C; R_f = 0.45 (hexane/EtOAc, 70:30, v/v); IR (neat): ν_{max} (cm^{-1}) = 3052, 2924, 1632, 1577, 1549, 1517, 1460, 1431, 1392, 1334, 1287, 1253, 1125, 1084, 1024; ^{1}H NMR (500 MHz, $CDCl_3$) δ = 3.08 (s, 3 H, $ArCH_3$), 4.80(d, *J* = 17.3 Hz, 1 H, NCH_2CH=CH*H*), 5.19–5.21 (m, 3 H, NCH_2CH=C*H*H), 6.08–6.15 (m, 1 H, NCH_2CH=CH_2), 7.02 (dd, J_1 = 8.6 Hz, J_2 = 6.4 Hz, 1 H, ArH), 7.30–7.35 (m, 2 H, ArH), 7.42 (d, *J* = 8.3 Hz, 1 H, ArH), 7.56–7.61 (m, 2 H, ArH), 7.77 (d, *J* = 8.7 Hz, 1 H, ArH), 7.80 (d, *J* = 15.8 Hz, 1 H, CH=CH), 7.96 (d, *J* = 15.8 Hz, 1 H, CH=CH), 8.01 (s, 1 H, ArH), 8.16 (d, *J* = 7.8 Hz, 1 H, ArH) ppm; ^{13}C NMR (100 MHz, $CDCl_3$) δ = 23.6, 47.1, 110.1, 112.4, 114.5, 115.3, 116.2, 116.7, 120.5, 120.6, 121.6, 121.7, 123.8, 128.6, 129.5, 131.0, 133.3, 135.0, 135.4, 142.0, 142.3, 143.1, 157.6, 164.4 ppm; HRMS (ESI) m/z: calcd. for $C_{24}H_{19}N_3O$ [M + H^+]: 366.1606, found: 366.1587.

(*E*)-3-(2-(9-Methyl-1-phenyl-9*H*-pyrido[3,4-*b*]indol-3-yl)vinyl)benzo[*c*]isoxazole (26A). Yield: 69% (0.097 g from 0.100 g) as a pale yellow solid; m.p. 166-167 ^{o}C; R_f = 0.40 (hexane/EtOAc, 80:20, v/v); IR (neat): ν_{max} (cm^{-1}) = 3043, 2955, 1639, 1552, 1527, 1463, 1357, 1334, 1237, 1184, 1117, 1057, 1024; ^{1}H NMR (400 MHz, $CDCl_3$) δ = 3.48 (s, 3 H, NCH_3), 6.99 (dd, J_1 = 8.6 Hz, J_2 = 6.5 Hz, 1 H, ArH), 7.29 (dd, J_1 = 8.9 Hz, J_2 = 6.4 Hz, 1 H, ArH), 7.36 (t, *J* = 7.5 Hz, 1 H, ArH), 7.43 (d, *J* = 8.3 Hz, 1 H, ArH), 7.53–7.60 (m, 4 H, ArH), 7.62 (t, *J* = 7.7 Hz, 1 H, ArH), 7.71–7.74 (m, 3 H, ArH), 7.86 (d, *J* = 15.8 Hz, 1 H, C*H*=CH), 7.95 (d, *J* = 15.8 Hz, 1 H, C*H*=CH), 8.12 (s, 1 H, ArH), 8.21 (d, *J* = 7.8 Hz, 1 H, ArH) ppm; ^{13}C NMR (100 MHz, $CDCl_3$) δ = 33.2, 110.2, 113.1, 114.6, 115.3, 116.2, 120.5, 121.5, 121.7, 123.8, 128.4, 128.8, 129.9, 130.7, 131.0, 135.0, 135.1, 139.9, 143.3, 143.4, 144.7, 157.6, 164.3 ppm; HRMS (ESI) m/z: calcd. for $C_{27}H_{19}N_3O$ [M + H^+]: 402.1606, found: 402.1623.

(*E*)-3-(2-(1-(*p*-Tolyl)-9*H*-pyrido[3,4-*b*]indol-3-yl)vinyl)benzo[*c*]isoxazole (27A). Yield: 71% (0.163 g from 0.100 g) as a pale yellow solid; m.p. 187-188 ^{o}C; R_f = 0.55 (hexane/EtOAc, 70:30, v/v); IR (neat): ν_{max} (cm^{-1}) = 3352, 3039, 2963, 1637, 1557, 1463, 1361, 1344, 1235, 1125, 1063, 1024; ^{1}H NMR (400 MHz, $CDCl_3$) δ = 2.50 (s, 3 H, $ArCH_3$), 7.03 (d, *J* = 7.5 Hz, 1 H, ArH), 7.30–7.37 (m, 2 H, ArH), 7.45 (d, *J* = 7.4 Hz, 2 H, ArH), 7.51–7.58 (m, 3 H, ArH), 7.77 (d, *J* = 8.7 Hz, 1 H, ArH), 7.88 (d, *J* = 15.8 Hz, 1 H, C*H*=CH), 7.96 (d, *J* = 7.6 Hz, 2 H, ArH), 8.05 (d, *J* = 14.0 Hz, 2 H, C*H*=CH & ArH), 8.19 (d, *J* = 8.0 Hz, 1 H, ArH), 8.60 (brs, 1 H, NH) ppm; ^{13}C NMR (100 MHz, $CDCl_3$) δ = 21.6, 111.9, 113.1, 115.0, 115.3, 116.3, 120.5, 120.9, 122.0, 122.2, 123.9, 128.4, 128.8, 130.2, 130.4, 131.0, 133.5, 135.3, 139.4, 140.6, 143.5, 144.5, 157.6, 164.4 ppm; HRMS (ESI) m/z: calcd. for $C_{27}H_{19}N_3O$ [M + H^+]: 402.1606, found: 402.1617.

(*E*)-3-(2-(1-(4-Fluorophenyl)-9*H*-pyrido[3,4-*b*]indol-3-yl)vinyl)benzo[*c*]isoxazole (28A). Yield: 73% (0.153 g from 0.150 g) as a light brown solid; m.p. 233-234 ^{o}C; R_f = 0.55 (hexane/EtOAc, 60:40, v/v); IR (neat): ν_{max} (cm^{-1}) = 3344, 3047, 2952, 1637, 1554, 1467,

1351, 1339, 1235, 1185, 1123, 1055, 1027; ^{1}H NMR (500 MHz, DMSO-d_6) δ = 7.14 (dd, J_1 = 8.7 Hz, J_2 = 6.4 Hz, 1 H, ArH), 7.33 (t, J = 7.4 Hz, 1 H, ArH), 7.44 (dd, J = 9.0, J_2 = 6.6 Hz, 1 H, ArH), 7.47-7.51 (m, 2 H, ArH), 7.59 (t, J = 7.5 Hz, 1 H, ArH), 7.62 (d, J = 9.0 Hz, 1 H, ArH), 7.68 (d, J = 8.1 Hz, 1 H, ArH), 7.94 (d, J = 15.9 Hz, 1 H, C*H*=CH), 8.06-8.09 (m, 2 H, CH=C*H* and ArH), 8.18-8.22 (m, 2 H, ArH), 8.26 (d, J = 7.8 Hz, 1 H, ArH), 8.53 (s, 1 H, ArH), 11.80 (brs, 1 H, NH)ppm; ^{13}C NMR (125 MHz, DMSO-d_6) δ = 112.2, 112.8, 114.6, 115.4 (d, J = 11.3 Hz), 115.6, 115.8, 120.2, 121.0 (d, J = 19.1 Hz), 121.6, 124.2, 128.5, 129.9, 130.9 (d, J = 7.5 Hz), 131.6, 132.9, 134.4, 135.4, 141.5, 142.9, 156.9, 162.6 (d, J = 243.8 Hz), 163.9 ppm; HRMS (ESI) m/z: calcd. for $C_{26}H_{16}FN_3O$ [M + H$^+$]: 406.1356 found: 406.1363.

(*E*)-3-(2-(1-(4-Fluorophenyl)-9-methyl-9*H*-pyrido[3,4-*b*]indol-3-yl)vinyl)benzo[*c*]isoxazole (29A). Yield: 69% (0.154 g from 0.160 g) as a pale yellow solid; m.p. 195-196 ^{o}C; R_f = 0.60 (hexane/EtOAc, 70:30, v/v); IR (neat): ν_{max} (cm^{-1}) = 3047, 2974, 1631, 1557, 1519, 1464, 1355, 1337, 1233, 1187, 1125, 1056, 1021; ^{1}H NMR (400 MHz, $CDCl_3$) δ = 3.51 (s, 3 H, NCH_3), 7.00 (dd, J_1 = 8.6 Hz, J_2 = 6.4 Hz, 1 H, ArH), 7.27–7.32 (m, 3 H, ArH), 7.37 (t, J = 7.4 Hz, 1 H, ArH), 7.45 (d, J = 8.4 Hz, 1 H, ArH), 7.57 (d, J = 9.0 Hz, 1 H, ArH), 7.62–7.66 (m, 1 H, ArH), 7.70–7.75 (m, 3 H, ArH), 7.86 (d, J = 15.8 Hz, 1 H, C*H*=CH), 7.94 (d, J = 16.0 Hz, 1 H, C*H*=CH), 8.13 (s, 1 H, ArH), 8.22 (d, J = 7.8 Hz, 1 H, ArH), ppm; ^{13}C NMR (100 MHz, $CDCl_3$) δ = 33.2, 110.2, 113.0, 114.7, 115.2, 115.3, 115.5, 116.2, 120.5 (d, J = 20.0 Hz), 121.4, 121.7, 123.8, 128.9, 130.8, 130.9, 131.6, 131.7, 134.8, 135.0, 135.9 (d, J = 3.0 Hz), 143.3, 143.4 (d, J = 7.0 Hz), 157.6, 163.2 (d, J = 247.0 Hz), 164.2 ppm; HRMS (ESI) m/z: calcd. for $C_{27}H_{18}FN_3O$ [M + H$^+$]: 420.1512 found: 420.1521.

(*E*)-3-(2-(9-Ethyl-1-(4-fluorophenyl)-9*H*-pyrido[3,4-*b*]indol-3-yl)vinyl)benzo[*c*]isoxazole (30A). Yield: 71% (0.145 g from 0.150 g) as a light brown solid; m.p. 203-204 ^{o}C; R_f = 0.50 (hexane/EtOAc, 70:30, v/v); IR (neat): ν_{max} (cm^{-1}) = 3042, 2118, 1631, 1606, 1504, 1451, 1346, 1294, 1218, 1150, 1088, 1046; ^{1}H NMR (500 MHz, $CDCl_3$) δ = 1.02 (t, J = 7.1 Hz, 3 H, NCH_2CH_3), 4.04 (q, J = 7.2 Hz, 3 H, NCH_2CH_3), 7.00 (dd, J_1 = 8.7, J_2 = 6.4 Hz, 3 H, ArH), 7.26–7.32 (m, 3 H, ArH), 7.36 (t, J = 7.5 Hz, 1 H, ArH), 7.48 (d, J = 8.3 Hz, 1 H, ArH), 7.57 (d, J = 9.0 Hz, 1 H, ArH), 7.63 (t, J = 7.4 Hz, 1 H, ArH), 7.68–7.71 (m, 2 H, ArH), 7.74 (d, J = 8.7 Hz, 1 H, ArH), 7.87 (d, J = 15.9 Hz, 1 H, C*H*=CH), 7.93 (d, J = 15.9 Hz, 1 H, CH=C*H*), 8.16 (s, 1 H, ArH), 8.23 (d, J = 7.9 Hz, 1 H, ArH) ppm; ^{13}C NMR (125 MHz, $CDCl_3$) δ = 14.1, 39.5, 110.5, 113.1, 114.8, 115.3, 115.5 (d, J = 22.5 Hz), 116.2, 120.5 (d, J = 20 Hz), 121.8 (d, J = 4.3 Hz), 123.9, 128.9, 131.0, 131.2 (d, J = 8.8 Hz), 131.3, 134.0, 134.8, 136.2 (d, J = 2.9 Hz), 142.3, 143.3, 143.6, 157.6, 162.2, 164.2 ppm; HRMS (ESI) m/z: calcd. for $C_{28}H_{20}FN_3O$ [M + H$^+$]: 434.1669 found: 434.1681.

(*E*)-6-Chloro-3-(2-(9-ethyl-1-methyl-9*H*-pyrido[3,4-*b*]indol-3-yl)vinyl)benzo[*c*]isoxazole (24B). Yield: 53% (0.130 g from 0.150 g) as a light brown solid; m.p. 246-247 ^{o}C; R_f = 0.45 (hexane/EtOAc, 70:30, v/v); IR (neat): ν_{max} (cm^{-1}) = 3049, 2974, 1634, 1577, 1552, 1454, 1344, 1042, 956, 931; ^{1}H NMR (400 MHz, $CDCl_3$) δ = 1.49 (t, J = 7.0 Hz, 3 H, NCH_2CH_3), 3.13 (s, 3 H, $ArCH_3$), 4.61–4.68 (m, 2 H, NCH_2CH_3), 6.92–6.95 (m, 1 H, ArH), 7.33 (t, J = 7.5 Hz, 1 H, ArH), 7.48 (d, J = 8.4 Hz, 1 H, ArH), 7.55 (d, J = 1.3 Hz, 1 H, ArH), 7.61 (t, J = 7.7 Hz, 1 H, ArH), 7.70 (dd, J_1 = 9.1 Hz, J_2 = 4.0 Hz, 1 H, ArH), 7.79 (dd, J_1 = 15.8 Hz, J_2 =

4.5 Hz, 1 H, C*H*=CH), 7.91 (dd, J_1 = 15.8 Hz, J_2 = 4.7 Hz, 1 H, C*H*=CH), 7.98 (d, *J* = 4.6 Hz, 1 H, ArH), 8.15 (d, *J* = 7.8 Hz, 1 H, ArH) ppm; ^{13}C NMR (100 MHz, $CDCl_3$) δ = 15.9, 23.9, 39.7, 109.9, 111.6, 113.7, 114.4, 114.8, 120.4, 121.6, 121.8, 125.4, 128.5, 129.5, 135.0, 136.0, 137.3, 141.4, 142.0, 142.4, 157.6, 165.1 ppm; HRMS (ESI) m/z: calcd. for $C_{23}H_{18}ClN_3O$ [M + H^+]: 388.1217, found: 388.1205.

Methyl 9-methyl-1-(quinolin-2-yl)-9*H*-pyrido[3,4-*b*]indole-3-carboxylate (32a'). Yield: 27% (0.070 g from 0.200 g) as a reddish brown solid; m.p. 216-217 ^oC; R_f = 0.55 (hexane/EtOAc, 70:30, v/v); IR (neat): ν_{max} (cm^{-1}) = 2989, 2946, 1716, 1622, 1598, 1503, 1463, 1359, 1323, 1260, 1123, 1043; ^{1}H NMR (400 MHz, $CDCl_3$) δ = 3.68 (s, 3 H, NC*H*$_3$), 4.05 (s, 3 H, CO_2Me), 7.38 (t, *J* = 7.5 Hz, 1 H, ArH), 7.49 (d, *J* = 8.3 Hz, 1 H, ArH), 7.60-7.67 (m, 2 H, ArH), 7.77 (m, *J* = 7.5 Hz, 1 H, ArH), 7.93 (dt, *J* = 8.0 Hz, 1 H, ArH), 8.18 (d, *J* = 8.3 Hz, 1 H, ArH), 8.23-8.26 (m, 2 H, ArH), 8.38 (d, *J* = 8.2 Hz, 1 H, ArH), 8.97 (s, 1 H, ArH) ppm; ^{13}C NMR (100 MHz, $CDCl_3$) δ = 34.1, 52.8, 110.3, 117.7, 120.9, 121.5, 121.7, 123.1, 127.3, 127.8, 128.0, 129.2, 129.4, 130.1, 131.4, 136.8, 137.0, 137.2, 142.3, 143.5, 147.0, 157.4, 166.7 ppm; HRMS (ESI) m/z: calcd. for $C_{23}H_{17}N_3O_2$ [M + H^+]: 368.1399 found: 368.1384.

Methyl 1-(6-fluoroquinolin-2-yl)-9-methyl-9*H*-pyrido[3,4-*b*]indole-3-carboxylate (32b'). Yield: 29% (0.100 g from 0.150 g) as pale yellow solid; m.p. 247-248 ^oC; R_f = 0.40 (hexane/EtOAc, 70:30, v/v); IR (neat): ν_{max} (cm^{-1}) = 3054, 2951, 1710, 1628, 1561, 1500, 1464, 1432, 1334, 1257, 1210, 1121, 1042; ^{1}H NMR (500 MHz, $CDCl_3$) δ = 3.70 (s, 3 H, NCH_3), 4.06 (s, 3 H, CO_2CH_3), 7.40 (d, *J* = 7.4 Hz, 1 H, ArH), 7.52 (d, *J* = 8.3 Hz, 1 H, ArH), 7.56 (d, *J* = 8.4 Hz, 2 H, ArH), 7.68 (t, *J* = 7.3 Hz, 1 H, ArH), 8.16-8.19 (m, 1 H, ArH), 8.29 (d, *J* = 8.7 Hz, 2 H, ArH), 8.35 (d, *J* = 8.5 Hz, 1 H, ArH), 8.99 (s, 1 H, ArH) ppm; ^{13}C NMR (125 MHz, $CDCl_3$) δ = 34.1, 52.3, 110.4, 111.1 (d, *J* = 21.2 Hz), 117.8, 120.4 (d, *J* = 25 Hz), 121.1, 121.5, 121.8, 123.9, 128.5, 129.3, 131.5, 131.9 (d, *J* = 8.7 Hz), 136.6, 137.0 (d, *J* = 16.2 Hz), 142.0, 143.8 (d, *J* = 67.7 Hz), 156.9, 161.0 (d, *J* = 247.5), 166.7 ppm; HRMS (ESI) m/z: calcd. for $C_{23}H_{16}FN_3O_2$ [M + H^+]: 386.1305 found: 386.1297.

Methyl 1-(6-chloroquinolin-2-yl)-9-methyl-9*H*-pyrido[3,4-*b*]indole-3-carboxylate (32c'). Yield: 32% (0.045 g from 0.100 g) as an off white solid; m.p. 211-212 ^oC; R_f = 0.60 (hexane/EtOAc, 70:30, v/v); IR (neat): ν_{max} (cm^{-1}) = 3055, 2924, 1723, 1624, 1594, 1491, 1436, 1361, 1328, 1265, 1226, 1196, 1129, 1019; ^{1}H NMR (500 MHz, $CDCl_3$) δ = 3.69 (s, 3 H, NC*H*$_3$), 4.05 (s, 3 H, CO_2Me), 7.39 (t, *J* = 7.3 Hz, 1 H, ArH), 7.51 (d, *J* = 8.3 Hz, 1 H, ArH), 7.67 (d, *J* = 7.6 Hz, 1 H, ArH), 7.71 (d, *J* = 8.3 Hz, 1 H, ArH), 7.92 (s, 1 H, ArH), 8.11 (d, *J* = 8.8 Hz, 1 H, ArH), 8.25 (d, *J* = 7.8 Hz, 1 H, ArH), 8.29 (s, 2 H, ArH), 8.97 (s, 1 H, ArH) ppm; ^{13}C NMR (125 MHz, $CDCl_3$) δ = 34.2, 52.9, 110.4, 117.8, 121.1, 121.5, 121.8, 124.1, 126.7, 128.4, 129.3, 131.0, 131.1, 131.5, 133.0, 136.3, 136.9, 137.0, 141.8, 143.6, 145.4, 157.7, 166.6 ppm; HRMS (ESI) m/z: calcd. for $C_{23}H_{16}ClN_3O_2$ [M + H^+]: 402.1009 found: 402.1017.

Methyl 1-(6-bromoquinolin-2-yl)-9-methyl-9H-pyrido[3,4-b]indole-3-carboxylate (32d'). Yield: 30% (0.145 g from 0.300 g) as a light yellow solid; m.p. 251-252 ^oC; R_f = 0.45 (hexane/EtOAc, 70:30, v/v); IR (neat): ν_{max} (cm^{-1}) = 2930, 2854, 1746, 1585, 1460, 1364,

1327, 1249, 1217, 1130, 1046; ^{1}H NMR (500 MHz, $CDCl_3$) δ = 3.70 (s, 3 H, NCH_3), 4.06 (s, 3 H, CO_2Me), 7.41 (t, J = 7.5 Hz, 1 H, ArH), 7.52 (d, J = 8.3 Hz, 1 H, ArH), 766-7.70 (m, 1 H, ArH), 7.85 (d, J_1 = 8.9, J_2 = 2.2 Hz, 1 H, ArH), 8.05 (d, J = 8.9 Hz, 1 H, ArH), 8.11 (d, J = 2.1 Hz, 1 H, ArH), 8.27 (d, J = 7.8 Hz, 1 H, ArH), 8.31 (s, 2 H, ArH), 8.99 (s, 1 H, ArH) ppm; ^{13}C NMR (125 MHz, $CDCl_3$) δ = 34.2, 52.9, 110.4, 117.9, 121.1, 121.2, 121.5, 121.8, 124.1, 128.9, 129.3, 130.1, 131.2, 131.6, 133.7, 136.2, 137.0, 137.1, 141.8, 143.6, 145.6, 157.9, 166.7 ppm; HRMS (ESI) m/z: calcd. for $C_{23}H_{16}BrN_3O_2$ [M + H^+]: 446.0504 found: 446.10516.

Methyl 1-(6-chloroquinolin-2-yl)-9-ethyl-9*H*-pyrido[3,4-*b*]indole-3-carboxylate (33c'). Yield: 28% (0.060 g from 0.150 g) as an off white solid; m.p. 203-204 ^{o}C; R_f = 0.45 (hexane/EtOAc, 75:25, v/v); IR (neat): ν_{max} = 2845. 1722, 1635, 1594, 1498, 1423, 1354, 1337, 1250, 1194, 1127, 1047; ^{1}H NMR (500 MHz, $CDCl_3$) δ = 1.07 (t, J = 7.1 Hz, 3 H, NCH_2CH_3), 4.05 (s, 3 H, CO_2Me), 4.30 (q, J = 7.1 Hz, 2 H, NCH_2CH_3), 7.39 (t, J = 7.5 Hz, 1 H, ArH), 7.53 (d, J = 8.3 Hz, 1 H, ArH), 7.66 (t, J = 7.5 Hz, 1 H, ArH), 7.71 (dd, J_1 = 8.9, J_2 = 2.3 Hz, 1 H, ArH), 7.93 (d, J = 2.1 Hz, 1 H, ArH), 8.11 (d, J = 8.9 Hz, 1 H, ArH), 8.21 (d, J = 8.4 Hz, 1 H, ArH), 8.27 (d, J = 7.8 Hz, 1 H, ArH), 8.31 (d, J = 8.5 Hz, 1 H, ArH), 9.00 (s, 1 H, ArH) ppm; ^{13}C NMR (125 MHz, $CDCl_3$) δ = 14.2, 40.6, 52.9, 110.6, 117.9, 121.0, 121.8, 121.9, 124.0, 126.7, 128.4, 129.2, 131.0, 131.2, 131.7, 133.0, 135.7, 136.4, 136.8, 141.8, 142.4, 145.3, 158.1, 166.7 ppm; HRMS (ESI) m/z: calcd. for $C_{24}H_{18}ClN_3O_2$ [M + H^+]: 416.1166 found: 416.1154.

(*E*)-3-(2-(2-Chloroquinolin-3-yl)vinyl)benzo[c]isoxazole (36A). Yield: 40% (0.065 g from 0.100 g) as a pale yellow solid; m.p. 167-168 ^{o}C; R_f = 0.45 (hexane/EtOAc, 70:30, v/v); IR (neat): ν_{max} (cm^{-1}) = 3055, 2213, 1667, 1612, 1442, 1147, 953, 849, 737, 687; ^{1}H NMR (500 MHz, $CDCl_3$) δ = 7.11 (dd, J_1 = 8.6 Hz, J_2 = 6.4 Hz, 1 H, ArH), 7.36 (dd, J_1 = 9.0 Hz, J_2 = 6.4 Hz, 1 H, ArH), 7.49 (d, J = 16.4 Hz, 1 H, C*H*=CH), 7.59-7.64 (m, 2 H, ArH), 7.73 (d, J = 8.7 Hz, 1 H, AH), 7.75-7.78 (m, 1 H, ArH), 7.90 (d, J = 7.8 Hz, 1 H, ArH), 8.02-8.08 (m, 2 H, ArH and CH=C*H*), 8.50 (s, 1 H, ArH) ppm; ^{13}C NMR (100 MHz, $CDCl_3$) δ = 115.8, 116.2, 116.6, 119.7, 125.2, 127.4, 127.8, 128.0, 128.6, 128.8, 129.6, 131.2, 131.3, 134.7, 147.6, 150.2, 157.6, 162.7 ppm; HRMS (ESI) m/z: calcd. for $C_{26}H_{16}N_2O$ [M + H^+]: 307.0638, found: 307.0631.

(*E*)-3-(2-(2-(Phenylethynyl)quinolin-3-yl)vinyl)benzo[*c*]isoxazole (37A). Yield: 71% (0.32 g from 0.33 g) as a yellow solid; m.p. 182-184 ^{o}C; R_f = 0.50 (hexane/EtOAc, 70:30, v/v); IR (neat): ν_{max} = 3055, 2213, 1783, 1612, 1442, 1143, 953, 844, 734, 687 cm^{-1}; ^{1}H NMR (400 MHz, $CDCl_3$) δ = 7.0 (dd, J_1 = 6.4 Hz, J_2 = 8.6 Hz, 1 H, ArH), 7.30 (dd, J_1 = 6.4 Hz, J_2 = 9.0 Hz, 1 H, ArH), 7.38-7.42 (m, 3 H, ArH), 7.49-7.57 (m, 3 H, ArH), 7.66-7.68 (m, 2 H, ArH), 7.70-7.72 (m, 2 H, ArH), 7.80 (d, J = 8.0 Hz, 1 H, ArH), 8.05 (d, J = 8.44 Hz, 1 H, ArH), 8.21 (d, J = 16.5 Hz, 1 H, =CH), 8.40 (s, 1 H, ArH) ppm; ^{13}C NMR (100 MHz, $CDCl_3$) δ = 87.4, 94.8, 115.1, 115.6, 116.3, 119.8, 121.8, 124.8, 127.1, 127.8, 127.9, 128.7, 129.1, 129.7, 130.4, 130.6, 130.8, 131.1, 131.9, 132.3, 132.4, 132.4, 143.0, 148.0, 157.5, 163.1 ppm; HRMS (ESI) m/z: calcd. for $C_{26}H_{16}N_2O$ [M + H^+]: 372.1263, found: 372.1275.

(*E*)-3-(2-(6-Methyl-2-(phenylethynyl)quinolin-3 yl)vinyl)benzo[*c*]isoxazole (38A). Yield: 66% (0.28 g from 0.30 g) as a yellow solid; m.p. 188-190 °C; R_f = 0.50 (hexane/EtOAc, 70:30, v/v); IR (neat): ν_{max} = 3056, 2213, 1803, 1633, 1488, 1445, 1323, 1024, 954, 815, 741, 683 cm^{-1}; ^1H NMR (400 MHz, $CDCl_3$) δ = 2.45 (s, 3H, $ArCH_3$), 6.95-7.03 (dd, J_1 = 6.8 Hz, J_2 = 8.2 Hz, 1 H, ArH), 7.25-7.27 (m, 1 H, ArH), 7.34-7.35 (m, 3 H, ArH), 7.44-7.53 (m, 4 H, ArH), 7.62-7.66 (m, 3 H, ArH), 7.89 (d, J = 8.6 Hz, 1 H, ArH), 8.16 (d, J = 16.5 Hz, 1 H, =CH), 8.26 (s, 1 H, ArH) ppm; ^{13}C NMR (100 MHz, $CDCl_3$) δ = 21.8, 87.6, 94.5, 115.0, 115.6, 116.3, 119.9, 122.0, 124.7, 126.8, 127.3, 128.7, 128.9, 129.6, 130.4, 130.9, 131.0, 131.3, 132.4, 133.2, 138.1, 142.1, 146.8, 157.6, 163.3 ppm; HRMS (ESI) m/z: calcd. for $C_{27}H_{18}N_2O$ [M + H^+]: 386.1419, found: 386.1459.

(*E*)-3-(2-(8-Methyl-2-(phenylethynyl)quinolin-3-yl)vinyl)benzo[*c*]isoxazole (39A). Yield: 64% (0.28 g from 0.29 g) as a yellow solid; m.p. 200-202 °C; R_f = 0.50 (hexane/EtOAc, 70:30, v/v); IR (neat): ν_{max} = 3055, 2917, 2209, 1804, 1634, 1518, 1440, 1403, 955, 740, 685 cm^{-1}; ^1H NMR (400 MHz, $CDCl_3$) δ = 2.83 (s, 3H, $ArCH_3$), 7.01 (dd, J_1 = 6.4 Hz, J_2 = 8.6 Hz, 1 H, ArH), 7.30-7.34 (m, 1 H, ArH), 7.32 (dd, J_1 = 6.4 Hz, J_2 = 9.0 Hz, 4 H, ArH), 7.42-7.47 (m, 4 H, ArH), 7.55-7.61 (m, 3 H, ArH), 7.67-7.72 (m, 2 H, ArH), 7.74-7.76 (m, 2 H, ArH), 8.30 (d, J = 16.5 Hz, 1 H, =CH), 8.42 (s, 1H, ArH) ppm; ^{13}C NMR (100 MHz, $CDCl_3$) δ = 55.7, 87.5, 94.1, 105.0, 115.0, 115.6, 116.2, 119.9, 122.0, 124.0, 124.8, 128.3, 128.7, 129.4, 130.5, 130.6, 130.6, 131.0, 131.0, 132.2, 140.4, 144.3, 157.2, 158.8, 163.2 ppm; HRMS (ESI) m/z: calcd. for $C_{27}H_{18}N_2O$ [M + H^+]: 386.1419, found: 386.1443.

(*E*)-3-(2-(6,7-Dimethyl-2-(phenylethynyl)quinolin-3-yl)vinyl)benzo[*c*]isoxazole (40A). Yield: 58% (0.13 g from 0.18 g) as a yellow solid; m.p. 198-200 °C; R_f = 0.50 (hexane/EtOAc, 70:30, v/v); IR (neat): ν_{max} = 3051, 2966, 2213, 1799, 1613, 1444, 1322, 1142, 954, 733, 656; ^1H NMR (400 MHz, $CDCl_3$) δ = 2.44 (s, 3 H, $ArCH_3$), 2.45 (s, 3 H, $ArCH_3$), 7.01 (dd, J_1 = 6.5 Hz, J_2 = 8.5 Hz, 1 H, ArH), 7.33 (t, 1 H, ArH), 7.41-7.42 (m, 3 H, ArH), 7.53-7.61 (m, 3 H, ArH), 7.69-7.74 (m, 3 H, ArH), 7.85 (s, 1 H, ArH), 8.27 (d, J = 16.5 Hz, 1 H, =CH), 8.35 (s, 1 H, ArH) ppm; ^{13}C NMR (100 MHz, $CDCl_3$) δ = 20.3, 20.7, 87.7, 94.3, 114.6, 115.6, 116.2, 120.0, 122.1, 124.6, 126.0, 127.2, 128.6, 128.7, 129.5, 129.7, 131.0, 131.3, 132.4, 138.3, 141.6, 142.2, 147.4, 157.6, 163.5; HRMS (ESI) m/z: calcd. for $C_{28}H_{20}N_2O$ [M + H^+]: 400.1576, found: 400.1557.

(*E*)-3-(2-(6,8-Dimethyl-2-(phenylethynyl)quinolin-3-yl)vinyl)benzo[*c*]isoxazole (41A). Yield: 56% (0.23 g from 0.25 g) as a yellow solid; m.p. 208-210 °C; R_f = 0.50 (hexane/EtOAc, 70:30, v/v); IR (neat): ν_{max} = 3053, 2913, 2209, 1880, 1739, 1614, 1428, 1322, 1171, 955, 737, 688 cm^{-1}; ^1H NMR (400 MHz, $CDCl_3$) δ = 2.51 (s, 3 H, $ArCH_3$), 2.81 (s, 3 H, $ArCH_3$), 7.01 (t, 1 H, ArH), 7.34 (t, 1 H, ArH), 7.42-7.45 (m, 5 H, ArH), 7.60 (t, 2 H, ArH), 7.71-7.75 (m, 3 H, ArH), 8.30-8.35 (m, 2 H, ArH) ppm; ^{13}C NMR (100 MHz, $CDCl_3$) δ = 18.0, 21.8, 88.1, 93.9, 114.8, 115.6, 116.1, 120.0, 122.2, 124.6, 124.8, 127.4, 128.7, 129.4, 130.1, 131.1, 131.3, 131.5, 132.4, 133.4, 137.0, 137.7, 141.1, 146.1, 157.6, 163.5 ppm; HRMS (ESI) m/z: calcd. for $C_{28}H_{20}N_2O$ [M + H^+]: 400.1576, found: 400.1558.

(*E*)-3-(2-(6-Methoxy-2-(phenylethynyl)quinolin-3-yl)vinyl)benzo[*c*]isoxazole (42A). Yield: 54% (0.32 g from 0.38 g) as a yellow solid; m.p. 186-188 °C; R_f = 0.40

(hexane/EtOAc, 70:30, v/v); IR (neat): ν_{max} = 3051, 2837, 2215, 1621, 1485, 1225, 955, 826, 738, 686 cm^{-1}; ^1H NMR (400 MHz, $CDCl_3$) δ = 3.91 (s, 3H, $ArOCH_3$), 6.98-7.03 (m, 2 H, ArH), 7.26-7.33 (m, 2 H, ArH), 7.50-7.59 (m, 2 H, ArH), 7.66-7.70 (m, 3 H, ArH), 7.95 (d, *J* = 9.16 Hz, 1 H, ArH), 8.21 (d, *J* = 16.5 Hz, 1 H, =CH), 8.29 (s, 1 H, ArH) ppm; ^{13}C NMR (100 MHz, $CDCl_3$) δ = 55.7, 87.5, 94.1, 105.0, 115.0, 115.6, 116.2, 119.9, 122.0, 124.0, 124.8, 128.3, 128.7, 129.4, 130.5, 130.6, 130.6, 131.0, 131.0, 132.2, 140.4, 144.3, 157.2, 158.8, 163.2 ppm; HRMS (ESI) m/z: calcd. for $C_{27}H_{18}N_2O_2$ [M + H^+]: 402.1368, found: 402.1392.

(*E*)-3-(2-(6,7-Dimethoxy-2-(phenylethynyl)quinolin-3-yl)vinyl)benzo[*c*]isoxazole (43A). Yield: 57% (0.155 g from 0.20 g) as a yellow solid; m.p. 220-221 °C; R_f = 0.40 (hexane/EtOAc, 70:30, v/v); ν_{max} = 3064, 2996, 2833, 1614, 1583, 1492, 1454, 1408, 1351, 1225, 1148, 1004, 955, 920, 845 cm^{-1}; ^1H NMR (500 MHz, $CDCl_3$) δ = 4.05 (s, 3 H, $ArOCH_3$), 4.06 (s, 3 H, $ArOCH_3$), 7.03 (dd, J_1 = 8.4, J_2 = 6.6 Hz, 1 H, ArH), 7.09 (s, 1H, ArH), 7.32-7.36 (m, 1 H, ArH), 7.40-7.46 (m, 4 H, ArH), 7.55-7.62 (m, 2 H, ArH and *H*C=CHAr), 7.71-7.75 (m, 3 H, ArH), 8.30 (d, *J* = 16.4 Hz, 1 H, HC=C*H*Ar), 8.35 (s, 1H) ppm; ^{13}C NMR (125 MHz, $CDCl_3$) δ = 56.3, 56.4, 87.6, 94.1, 105.1, 105.3, 107.8, 114.2, 115.6, 116.1, 120.0, 122.2, 123.3, 124.6, 128.7, 129.0, 129.4, 130.2, 131.0, 131.4, 132.3, 140.7, 145.6, 151.1, 153.9, 157.6, 163.6 ppm; HRMS (ESI) m/z: calcd. for $C_{28}H_{20}N_2O_3$ [M + H^+]: 432.1474, found: 432.1487.

(*E*)-3-(2-(7-Fluoro-2-(phenylethynyl)quinolin-3-yl)vinyl)benzo[*c*]isoxazole (44A). Yield: 76% (0.14 g from 0.13 g) as a yellow solid; m.p. 190-192 °C; R_f = 0.40 (hexane/EtOAc, 70:30, v/v); IR (neat): ν_{max} = 3056, 2930, 2212, 1801, 1616, 1492, 1299, 1207, 954, 753, 687 cm^{-1}; ^1H NMR (500 MHz, $CDCl_3$) δ = 7.05 (dd, J_1 = 6.6, J_2 = 8.4 Hz, 1 H, ArH), 7.33-7.40 (m, 2 H, ArH), 7.42-7.45 (m, 3 H, ArH), 7.58-7.63 (m, 2 H, ArH and HC=C*H*Ar), 7.71-7.76 (m, 4 H, ArH), 7.88 (dd, J_1 = 6.0, J_2 = 8.7 Hz, 1 H, ArH), 8.30 (d, *J* = 16.5 Hz, 1 H, *H*C=CHAr), 8.49 (s, 1 H, ArH) ppm; ^{13}C NMR (100 MHz, $CDCl_3$) δ = 87.2, 95.7, 112.9 (d, *J* = 21 Hz), 115.2, 115.7, 116.4, 118.6 (d, *J* = 26 Hz), 119.8, 121.6, 124.3, 128.9, 130.0 (d, *J* = 3 Hz),, 130.5, 131.1, 131.9, 132.5, 144.1, 149.0 (d, *J* = 12 Hz),, 157.6, 163.1, 163.9 (d, *J* = 251 Hz) ppm; HRMS (ESI) m/z: calcd. for $C_{26}H_{15}FN_2O$ [M + H^+]: 391.1247, found: 391.1249.

(*E*)-3-(2-(7-Chloro-2-(phenylethynyl)quinolin-3-yl)vinyl)benzo[*c*]isoxazole (45A). Yield: 72% (0.16 g from 0.15 g) as a yellow solid; m.p. 203-205 °C; R_f = 0.40 (hexane/EtOAc, 70:30, v/v); IR (neat): ν_{max} = 3057, 2211, 1603, 1476, 1173, 1066, 954, 739, 683 cm^{-1}; ^1H NMR (400 MHz, $CDCl_3$) δ = 7.05 (dd, J_1 = 6.5 Hz, J_2 = 8.5 Hz, 1 H, ArH), 7.35 (dd, J_1 = 6.4 Hz, J_2 = 9.0 Hz, 1 H, ArH), 7.43-7.46 (m, 3 H, ArH), 7.53 (dd, J_1 = 1.9 Hz, J_2 = 8.7 Hz, 1 H, ArH), 7.59-7.64 (m, 2 H, ArH), 7.71 (d, J_2 = 8.7 Hz, 1 H, ArH), 7.74-7.77 (m, 2 H, ArH), 7.81 (d, *J* = 8.7 Hz, 1 H, ArH), 8.10 (d, *J* = 1.88 Hz, 1 H, ArH), 8.29 (d, *J* = 16.5 Hz, 1H, =CH), 8.47 (s, 1 H, ArH) ppm; HRMS (ESI) m/z: calcd. for $C_{26}H_{15}ClN_2O$ [M + H^+]: 407.0951, found: 407.0962

(*E*)-3-(2-(2-(*p*-Tolylethynyl)quinolin-3-yl)vinyl)benzo[*c*]isoxazole (46A). Yield: 79% (0.31 g from 0.27 g) as a yellow solid; m.p. 222-223 °C; R_f = 0.45 (hexane/EtOAc, 70:30, v/v); IR

(neat): ν_{max} = 3057, 2209, 1635, 1613, 1586, 1516, 1448, 1405, 1309, 1172, 1143, 1098 cm^{-1}; ^1H NMR (500 MHz, $CDCl_3$) δ = 2.42 (s, 3 H, $ArCH_3$), 7.05 (dd, J_1 = 8.4, J_2 = 6.6 Hz, 1 H, ArH), 7.24 (d, J = 7.9 Hz, 2 H, ArH), 7.35 (dd, J_1 = 8.8, J_2 = 6.6 Hz, 1 H, ArH), 7.59 (t, J = 7.5 Hz, 1H, ArH), 7.62-7.67 (m, 4 H, ArH & *H*C=CHAr), 7.73-7.76 (m, 2 H, ArH), 7.88 (d, J = 8.1 Hz, 1 H, ArH), 8.13 (d, J = 8.4 Hz, 1 H, ArH), 8.34 (d, J = 16.5 Hz, 1 H, HC=C*H*Ar), 8.50 (s, 1 H, ArH) ppm; ^{13}C NMR (125 MHz, $CDCl_3$) δ = 21.8, 87.1, 95.4, 115.2, 115.6, 116.3, 118.8, 119.9, 124.6, 127.1, 127.8, 128.0, 129.2, 129.5, 130.4, 130.8, 130.9, 131.0, 132.0, 132.4, 140.1, 143.3, 148.1, 157.5, 163.2 ppm; HRMS (ESI) m/z: calcd. for $C_{27}H_{18}N_2O$ [M + H^+]: 387.1497, found: 387.1493.

(*E*)-3-(2-(2-((4-Ethylphenyl)ethynyl)quinolin-3-yl)vinyl)benzo[*c*]isoxazole (47A). Yield: 82% (0.31 g from 0.25 g) as a yellow solid; m.p. 189-190 °C; R_f = 0.50 (hexane/EtOAc, 70:30, v/v); IR (neat): ν_{max} = 3018, 2964, 2205, 1800, 1611, 1514, 1443, 1141, 955, 736, 642 cm^{-1}; ^1H NMR (400 MHz, $CDCl_3$) δ = 1.26 (t, 3 H, $ArCH_2CH_3$), 2.70 (q, 2 H, $ArCH_2CH_3$), 7.00-7.04 (dd, J_1 = 6.4 Hz, J_2 = 8.6 Hz, 1 H, ArH), 7.23-7.25 (d, 2 H, ArH), 7.30-7.34 (m, 1 H, ArH), 7.51-7.60 (m, 3 H, ArH), 7.65-7.71 (m, 4 H, ArH), 7.82 (d, J = 7.8 Hz, 1 H, ArH), 8.07 (d, J = 8.5 Hz, 1 H, ArH), 8.27 (d, J = 16.5 Hz, 1H, *H*C=CHAr), 8.43 (s, 1 H, ArH) ppm; ^{13}C NMR (100 MHz, $CDCl_3$) δ = 15.42, 29.1, 87.0, 95.4, 115.1, 115.6, 116.3, 118.9, 119.9, 124.8, 128.0, 128.3, 130.4, 130.8, 131.1, 131.9, 132.5, 143.3, 146.3, 146.4, 148.0, 157.5, 163.2 ppm; HRMS (ESI) m/z: calcd. for $C_{28}H_{20}N_2O$ [M + H^+]: 401.1654, found: 401.1667.

(*E*)-3-(2-(2-((4-Propylphenyl)ethynyl)quinolin-3-yl)vinyl)benzo[*c*]isoxazole (48A). Yield: 79% (0.31 g from 0.28 g) as a yellow solid; m.p. 166-168 °C; R_f = 0.40 (hexane/EtOAc, 70:30, v/v); IR (neat): ν_{max} = 3055, 2962, 2870, 2204, 1801, 1635, 1516, 1447, 1143, 955, 742, 619 cm^{-1}; ^1H NMR (400 MHz, $CDCl_3$) δ = 0.96 (t, J = 7.3 Hz, 3 H, $ArCH_2CH_2CH_3$), 1.63-1.72 (m, 2 H, $ArCH_2CH_2CH_3$), 2.63 (t, J = 7.6 Hz, 2 H, $ArCH_2CH_2CH_3$), 7.03 (dd, J_1 = 8.5, J_2 = 6.6 Hz,1 H, ArH), 7.23 (d, J = 7.9 Hz, 2 H, ArH), 7.33 (dd, J_1 = 8.8, J_2 = 6.5 Hz, 1 H, ArH), 7.54-7.62 (m, 3 H, ArH), 7.66 (d, J = 8.0 Hz, 2 H, ArH), 7.70-7.74 (m, 2 H, ArH), 7.85 (d, J = 8.1 Hz, 1 H, ArH), 8.10 (d, J = 8.4 Hz, 1 H, ArH), 8.30 (d, J = 16.5 Hz, 1 H, *H*C=CHAr), 8.46 (s, 1 H, ArH) ppm; ^{13}C NMR (100 MHz, $CDCl_3$) δ = 13.9, 24.4, 38.2, 87.1, 95.5, 115.2, 115.7, 116.3, 119.0, 119.9, 124.8, 127.8, 128.0, 128.9, 129.2, 130.8, 130.9, 131.1, 132.4, 143.4, 144.9, 148.1, 157.6, 163.3 ppm; HRMS (ESI) m/z: calcd. for $C_{29}H_{22}N_2O$ [M + H^+]: 415.1810, found: 415.1806.

(*E*)-3-(2-(2-((4-Fluorophenyl)ethynyl)quinolin-3-yl)vinyl)benzo[*c*]isoxazole (49A). Yield: 58% (0.28 g from 0.34 g) as a yellow solid; m.p. 174-176 °C; R_f = 0.40 (hexane/EtOAc, 70:30, v/v); IR (neat): ν_{max} = 3059, 2196, 1998, 1620, 1508, 1403, 1226, 1082, 954, 739, 619 cm^{-1}; ^1H NMR (400 MHz, $CDCl_3$) δ = 3.60 (s, 1 H, ArH), 6.67 (d, J = 19.5 Hz, 1 H, C*H*=CHAr), 7.04-7.15 (m, 3 H, ArH), 7.34-7.37 (m, 1H, ArH), 7.57-7.64 (m, 2 H, ArH), 7.71-7.80 (m, 3 H, ArH), 7.85-7.89 (m, 2 H, ArH), 8.15 (dd, J_1 = 18.5, J_2 = 8.4 Hz, 1 H, ArH), 8.27 (d, 30.3 Hz, 1 H, ArH), 8.51 (s, 1 H, ArH) ppm; ^{13}C NMR (100 MHz, $CDCl_3$) δ = 55.2, 87.2, 93.8, 100.1, 105.4, 115.2, 115.5, 115.6 (d, J = 5.0 Hz), 115.7, 116.2 (d, J = 22.0 Hz), 116.4, 118.0, 119.8, 124.9, 127.0, 127.3, 128.4, 128.7, 129.3 (d, J = 22.0 Hz), 130.5,

130.9 (m), 131.5, 131.7, 132.1, 134.5 (d, J = 8.0 Hz), 143.0, 148.1, 150.2 (d, J = 17.0 Hz), 154.6, 157.6, 161.7 (d, J = 246.0 Hz), 163.1, 163.4 (d, J = 251.0 Hz) ppm; HRMS (ESI) m/z: calcd. for $C_{26}H_{15}FN_2O$ [M + H^+]: 391.1247, found: 391.1245.

(*E*)-3-(2-(2-(Cyclopropylethynyl)quinolin-3-yl)vinyl)benzo[*c*]isoxazole (50A). Yield: 69% (0.21 g from 0.20 g) as a yellow solid; m.p. 180-182 °C; R_f = 0.40 (hexane/EtOAc, 70:30, v/v); IR (neat): ν_{max} = 2398, 2225, 2179, 1632, 1584, 1514, 1482, 1404, 1309, 1195, 1129, 955, 856, 789, 743 cm^{-1}; ^1H NMR (500 MHz, $CDCl_3$) δ = 0.99-1.05 (m, 4H, CyPrCH_2), 1.62-1.69 (m, 1H, CyPrC*H*), 7.07 (dd, J_1 = 6.5, J_2 = 8.6 Hz, 1 H, ArH), 7.34 (dd, J_1 = 6.4, J_2 = 8.8 Hz, 1 H, ArH), 7.52 (t, J = 8.2 Hz, 2 H, ArH), 7.60 (d, J = 9.1 Hz, 1 H, ArH), 7.62-7.73 (m, 2H), 7.81 (d, J = 8.0 Hz, 1 H, ArH), 8.03 (d, J = 8.5 Hz, 1 H, ArH), 8.15 (d, J = 16.6 Hz, 1 H, =CH), 8.40 (s, 1H) ppm; ^{13}C NMR (100 MHz, $CDCl_3$) δ = 0.6, 9.4, 74.6, 100.5, 114.9, 115.7, 116.3, 119.8, 124.7, 127.0, 127.6, 127.9, 129.1, 130.3, 130.7, 131.1, 131.2, 131.9, 143.6, 148.0, 157.6, 163.3 HRMS (ESI) m/z: calcd. for $C_{23}H_{16}N_2O$ [M + H^+]: 337.1341, found: 337.1344.

(*E*)-3-(2-(2-((4-Methoxyphenyl)ethynyl)-6-methylquinolin-3-yl)vinyl)benzo[*c*]isoxazole (51A). Yield: 85% (0.37 g from 0.30 g) as a yellow solid; m.p. 210-212 °C; R_f = 0.40 (hexane/EtOAc, 70:30, v/v); IR (neat): ν_{max} = 3058, 2210, 1801, 1608, 1513, 1255, 1021, 821, 734, 639 cm^{-1}; ^1H NMR (500 MHz, $CDCl_3$) δ = 2.56 (s, 3 H, $ArCH_3$), 3.86 (s, 3 H, $ArOCH_3$), 6.95 (d, J = 8.8 Hz, 2H, ArH), 7.05 (dd, J_1 = 6.4, J_2 = 8.9 Hz, 1 H, ArH), 7.35 (dd, J_1 = 6.4, J_2 = 8.9 Hz, 1 H, ArH), 7.57 (dd, J_1 = 1.7, J_2 = 8.6 Hz, 1 H, ArH), 7.60-7.64 (m, 3 H, ArH), 7.69 (d, J = 8.8 Hz, 2 H, ArH), 7.75 (d, J = 8.8 Hz, 1 H, ArH), 8.01 (d, J = 8.6 Hz, 1 H, ArH), 8.33 (d, J = 16.5 Hz, 1 H, =CH), 8.40 (s, 1 H, ArH) ppm; HRMS (ESI) m/z: calcd. for $C_{28}H_{20}N_2O_2$ [M + H^+]: 417.1603, found: 417.1599.

(*E*)-6-Chloro-3-(2-(2-(p-tolylethynyl)quinolin-3-yl)vinyl)benzo[c]isoxazole (46B). Yield: 56% (0.13 g from 0.15 g) as a yellow solid; m.p. 190-192 °C; R_f = 0.40 (hexane/EtOAc, 70:30, v/v); IR (neat): ν_{max} = 3053, 2192, 1999, 1622, 1512, 1408, 1231, 1079, 957, 743, 619 cm^{-1}; ^1H NMR (500 MHz, $CDCl_3$) δ = 2.42 (s, 3H, $ArCH_3$), 6.98 (dd, J_1 = 1.4, J_2 = 9.0 Hz, 1 H, ArH), 7.23-7.24 (m, 2H, ArH), 7.59 (t, 7.4 Hz, 1 H, ArH), 7.63 (d, 6.4 Hz, 4 H, ArH), 7.69 (d, 9.1 Hz, 1 H, ArH), 7.76 (d, 8.1 Hz, 1 H, ArH), 7.87 (d, 8.1 Hz, 1 H, ArH), 8.12 (d, 8.5 Hz, 1 H, ArH), 8.34 8.27 (d, 16.5 Hz, 1 H, =C*H*), 8.49 (s, 1H, ArH) ppm; ^{13}C NMR (100 MHz, $CDCl_3$) δ = 21.8, 87.0, 96.4, 114.3, 114.7, 118.7, 121.3, 126.6, 127.9, 128.1, 129.3, 129.6, 130.2, 131.0, 132.2, 132.4, 137.4, 140.3, 143.3, 148.3, 157.7, 164.0 ppm; HRMS (ESI) m/z: calcd. for $C_{27}H_{17Cl}N_2O$ [M + H^+]: 421.1108, found: 421.1113.

(*E*)-6-Chloro-3-(2-(2-((4-propylphenyl)ethynyl)quinolin-3-yl)vinyl)benzo[c]isoxazole (48B). Yield: 59% (0.16 g from 0.18 g) as a yellow solid; m.p. 195-197 °C; R_f = 0.40 (hexane/EtOAc, 70:30, v/v); IR (neat): ν_{max} = 3057, 2197, 1995, 1627, 1518, 1413, 1229, 1078, 958, 747, 621 cm^{-1}; ^1H NMR (500 MHz, $CDCl_3$) δ = 0.97 (t, J = 7.3 Hz, 3 H, $ArCH_2CH_2CH_3$), 1.59-1.72 (m, 2 H, $ArCH_2CH_2CH_3$), 2.65 (t, J = 7.6 Hz, 2 H, $ArCH_2CH_2CH_3$), 6.96 (d, J = 9.1 Hz, 1 H, ArH), 7.24 (d, J = 7.3 Hz, 2 H, ArH), 7.57-7.60 (m, 2 H, ArH), 7.62-7.68 (m, 4 H, ArH), 7.75 (t, J = 7.4 Hz, 1 H, ArH), 7.86 (d, J = 7.9 Hz, 1 H, ArH), 8.11 (d, J = 8.4 Hz, 1 H, ArH), 8.34 (d, J = 16.6 Hz, 1 H, ArH), 8.48 (s, 1 H, ArH)

ppm; ^{13}C NMR (100 MHz, $CDCl_3$) δ = 13.9, 24.4, 38.2, 87.0, 95.6, 114.2, 114.7, 118.9, 121.2, 126.6, 127.1, 127.9, 128.1, 128.9, 129.3, 130.1, 131.0, 132.1, 132.4, 137.4, 143.3, 145.0, 148.2, 157.6, 164.0 ppm; HRMS (ESI) m/z: calcd. for $C_{29}H_{21}ClN_2O$ [M + H^+]: 449.1421, found: 449.1418.

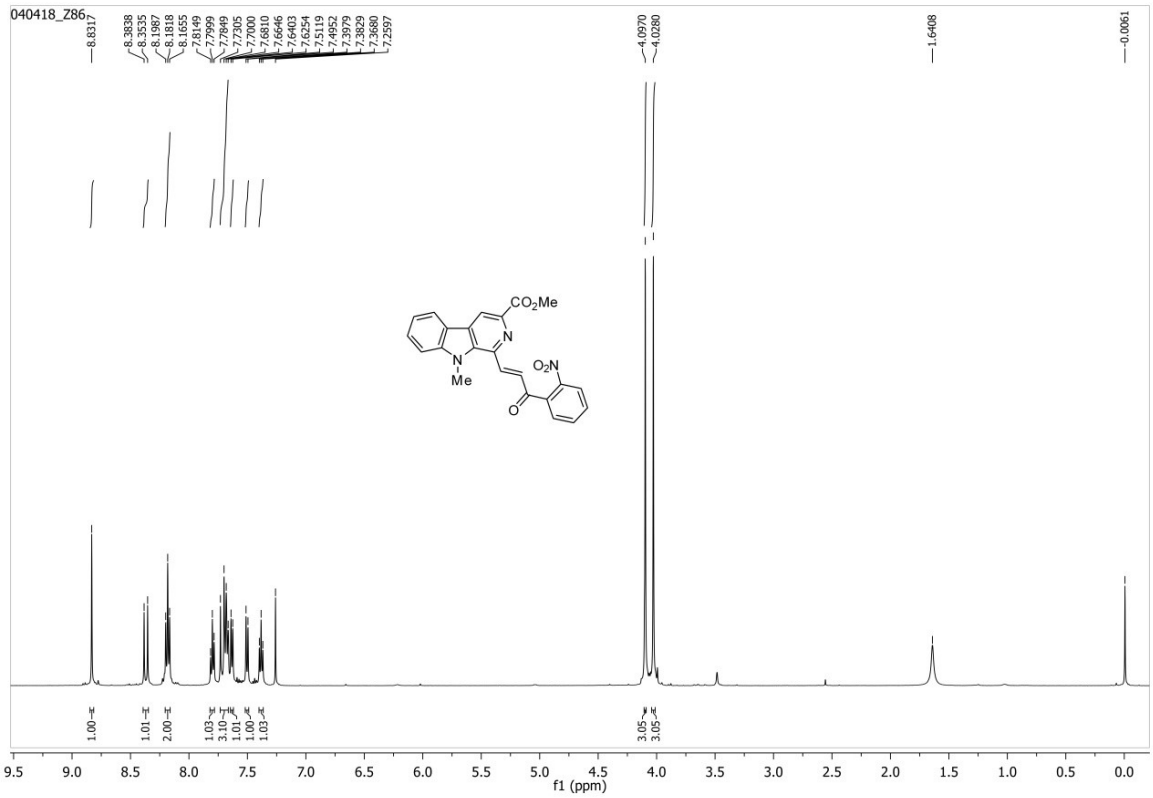

Fig S1. ^{1}H-NMR spectrum of **2'A**.

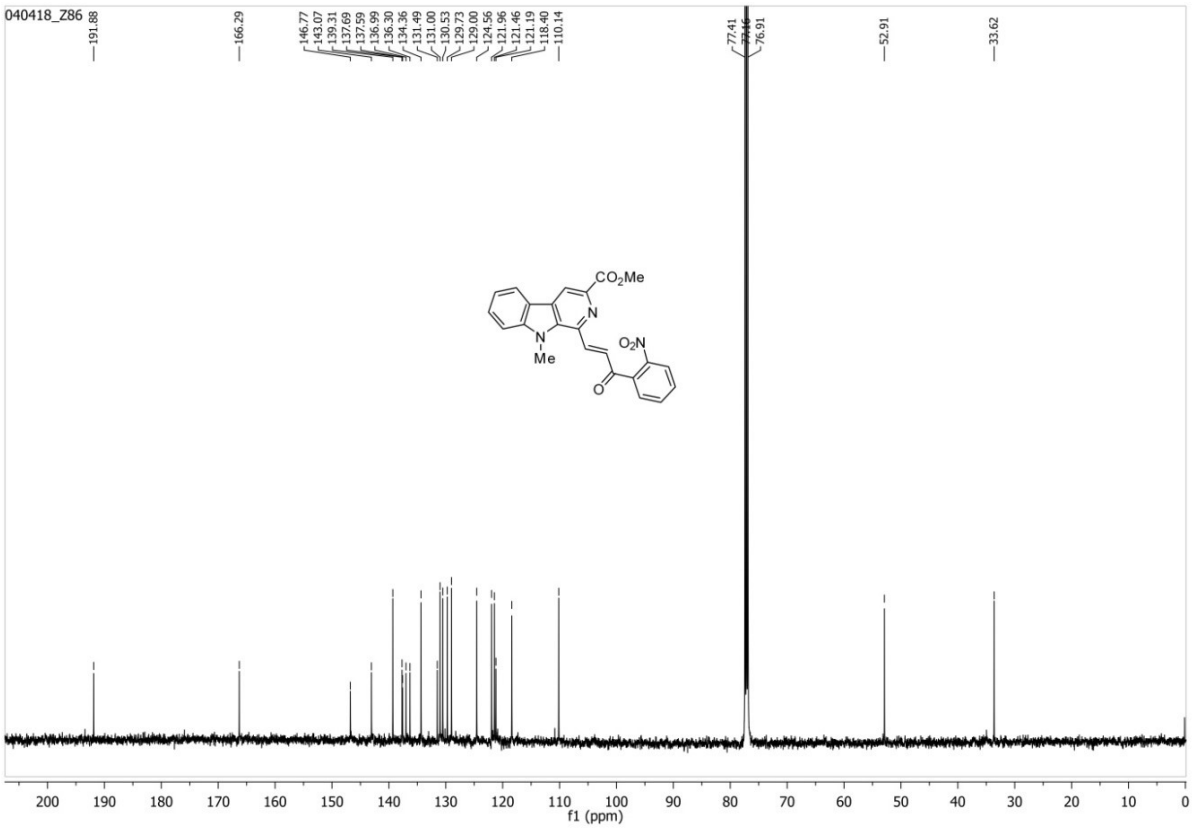

Fig S2. ^{13}C-NMR spectrum of **2'A**

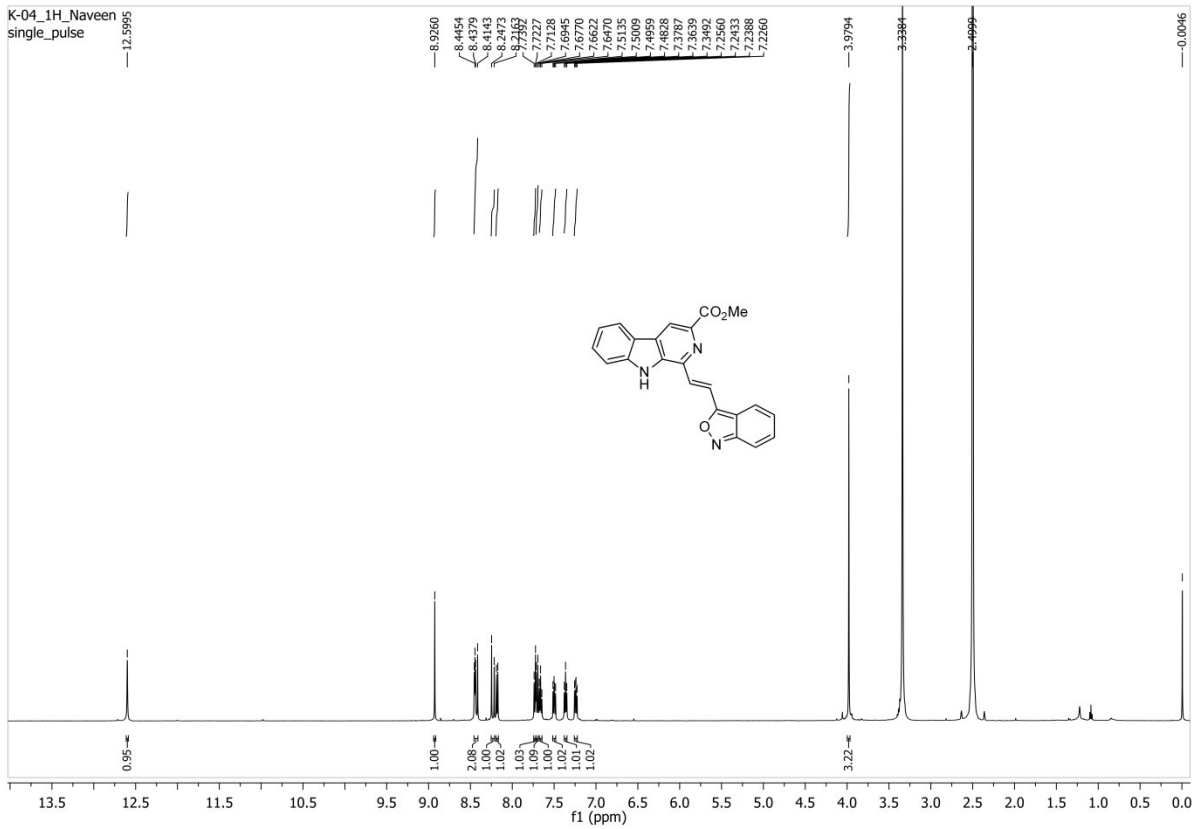

Fig S3. ^{1}H-NMR spectrum of **1A**

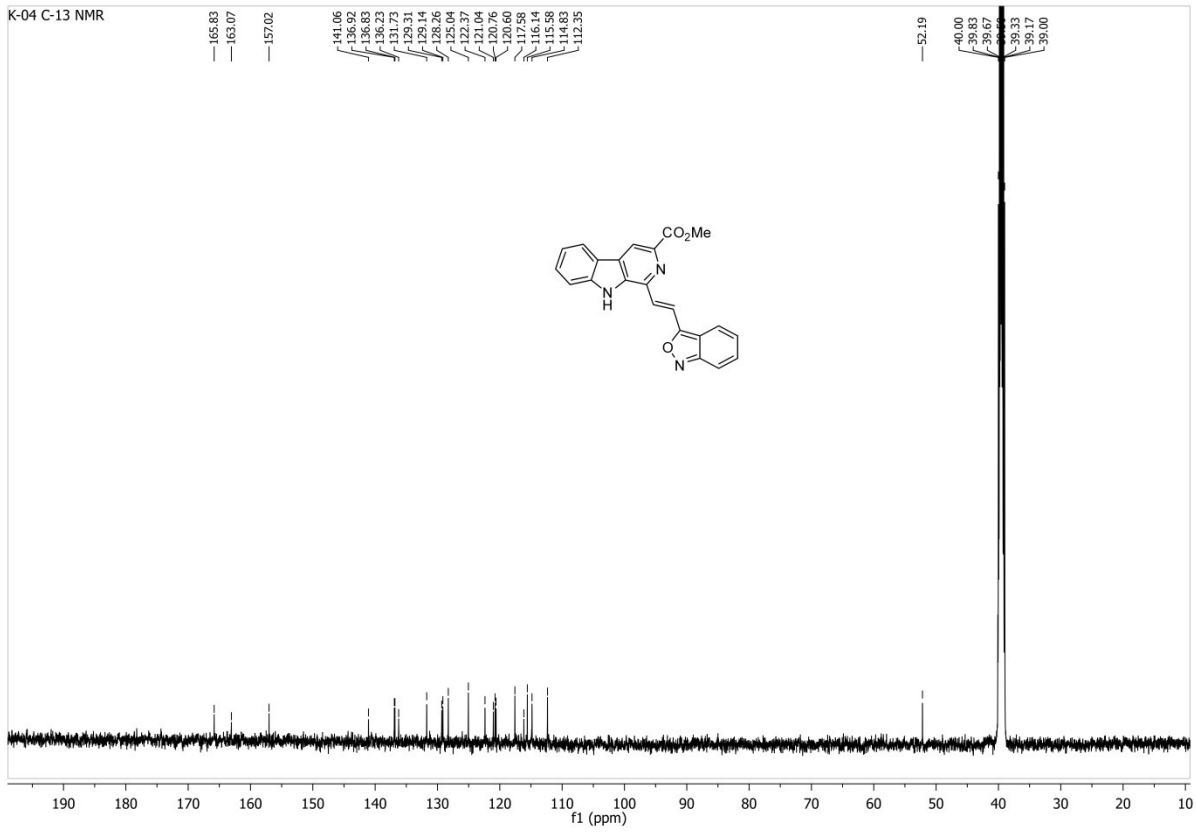

Fig S4. ^{13}C-NMR spectrum of **1A**

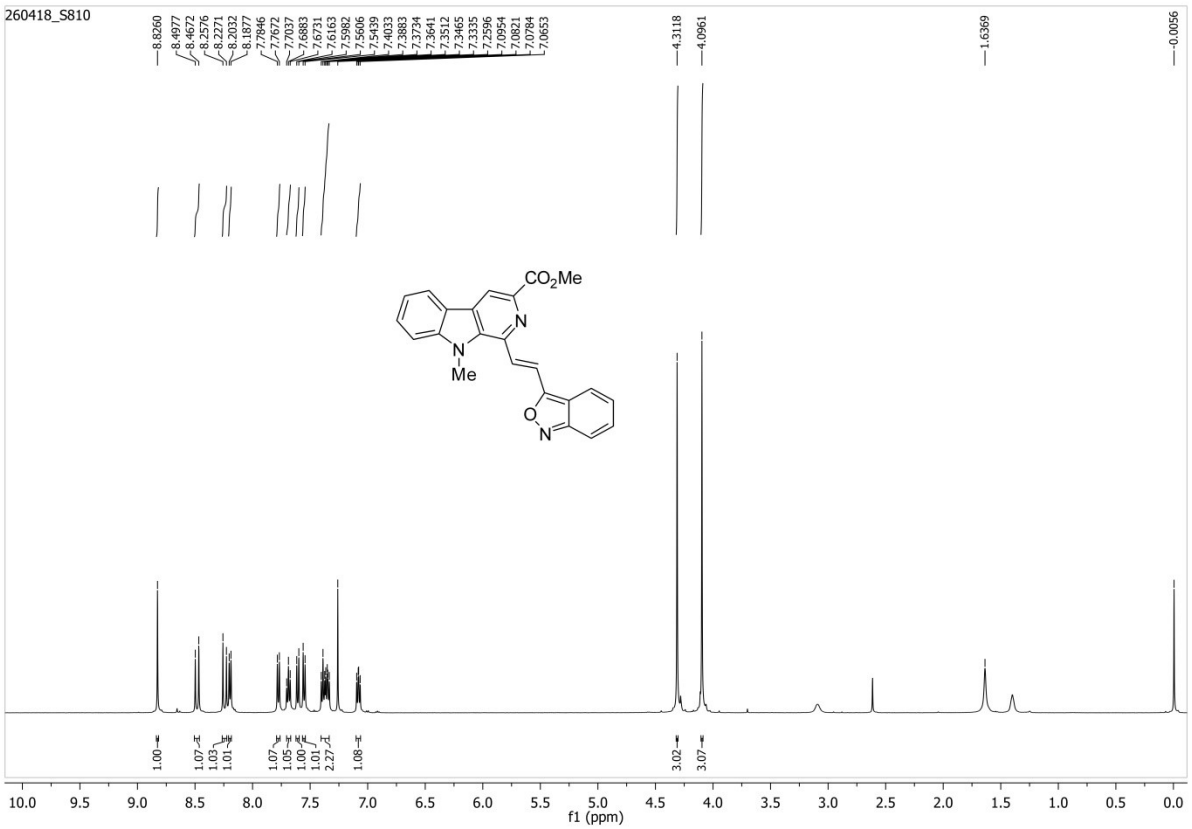

Fig S5. ^{1}H-NMR spectrum of **2A**

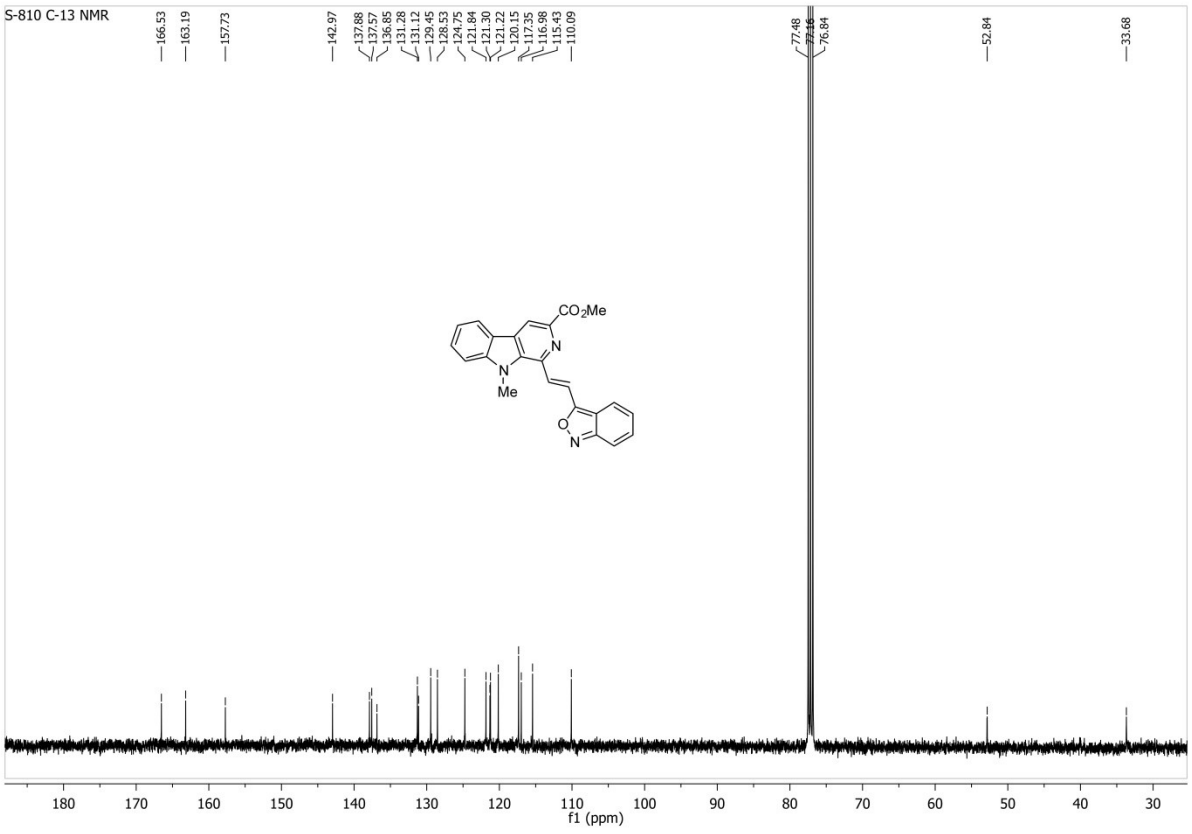

Fig S6. ^{13}C-NMR spectrum of **2A**

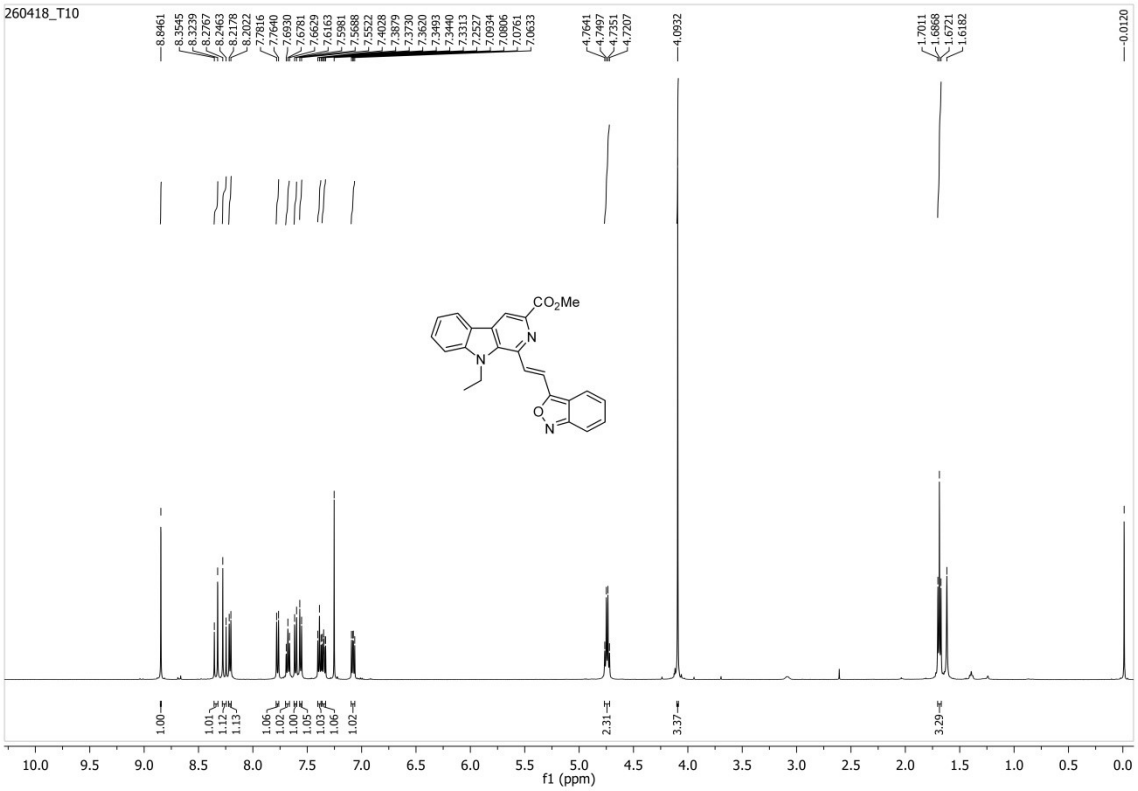

Fig S7. ^{1}H-NMR spectrum of **3A**

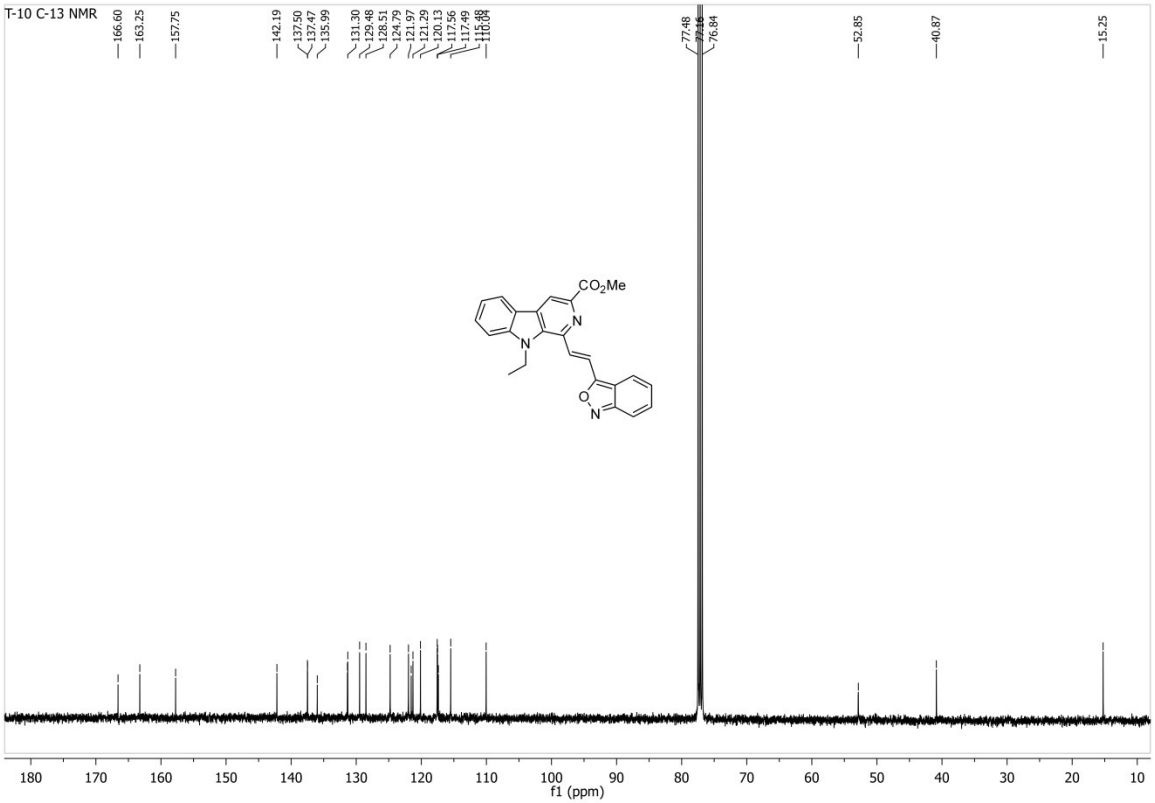

Fig S8. ^{13}C-NMR spectrum of **3A**

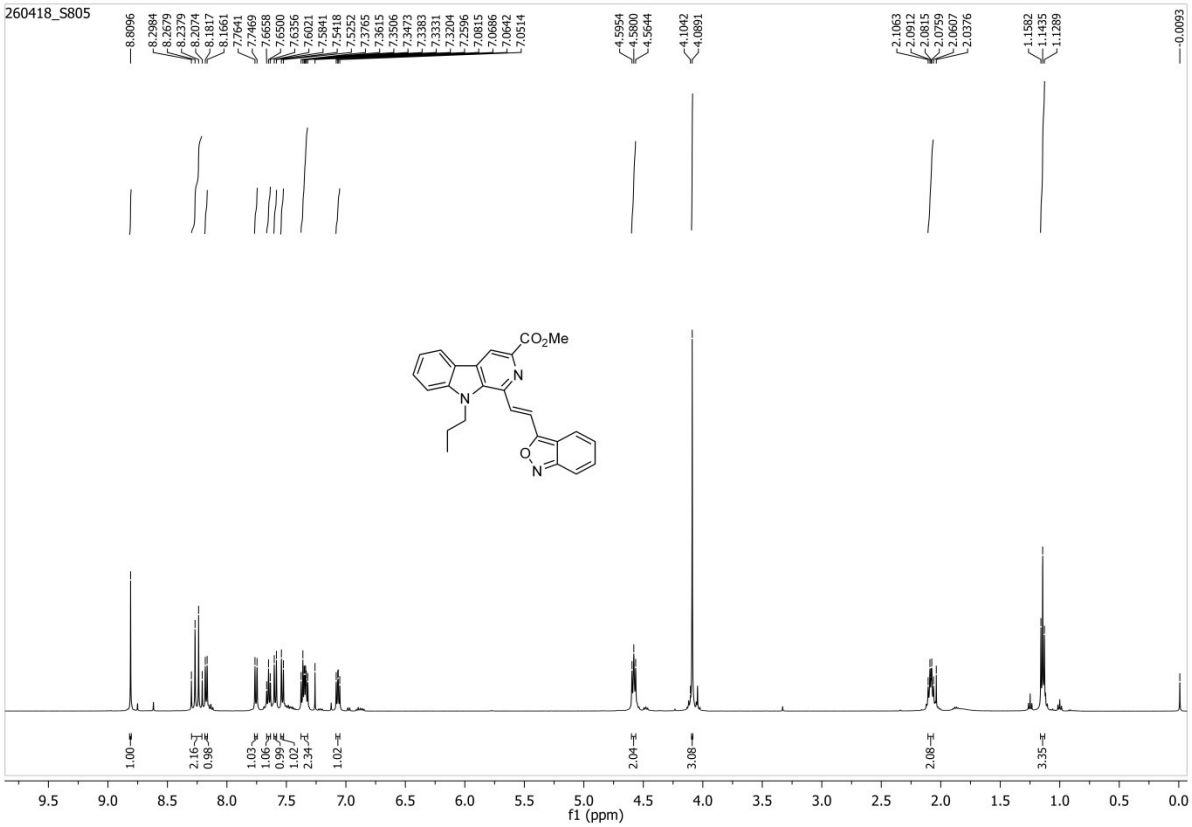

Fig S9. [1]H-NMR spectrum of **4A**

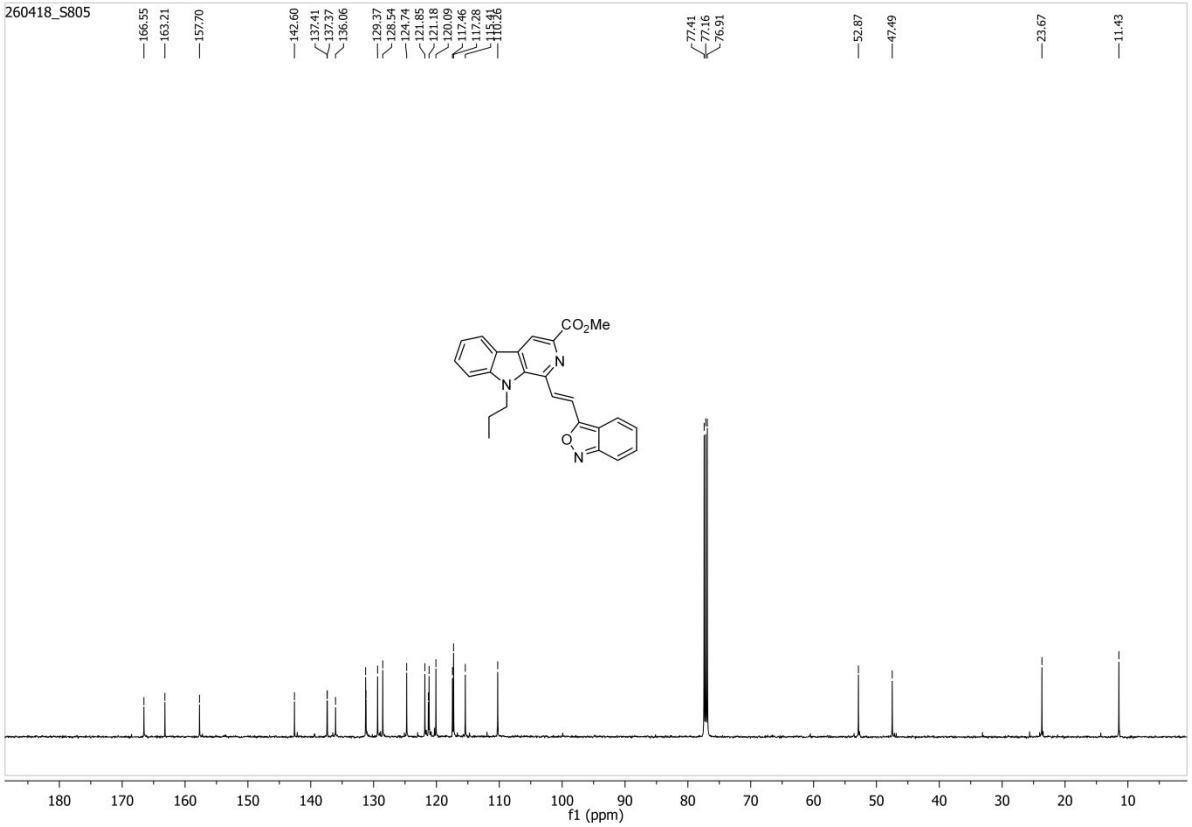

Fig S10. [13]C-NMR spectrum of **4A**

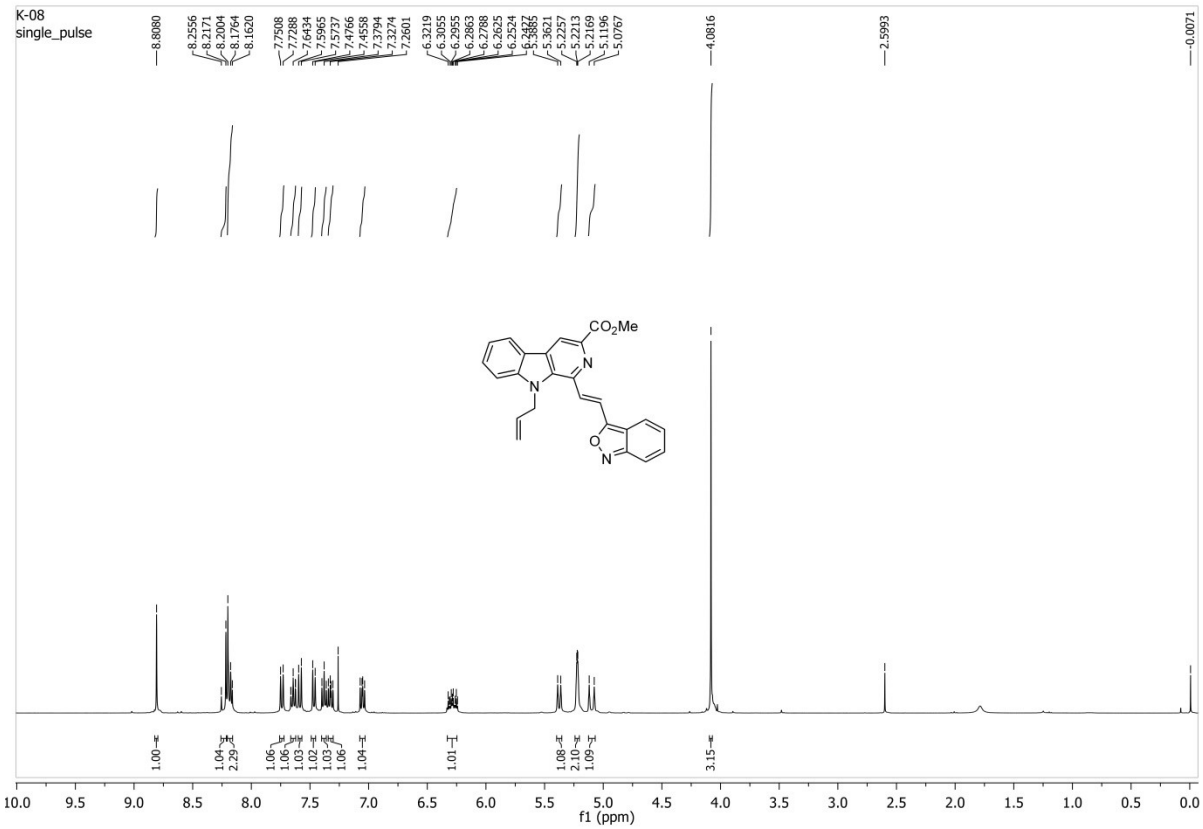

Fig S11. ^{1}H-NMR spectrum of **5A**

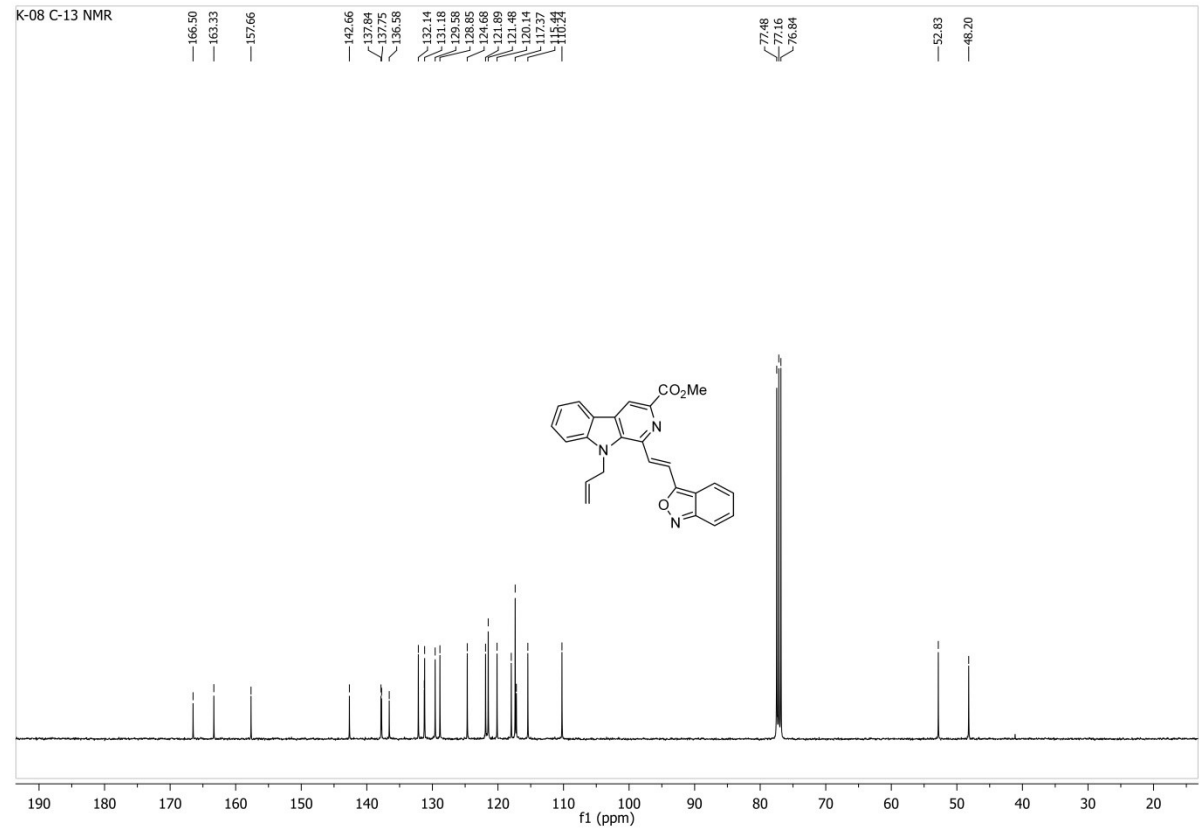

Fig S12. ^{13}C-NMR spectrum of **5A**

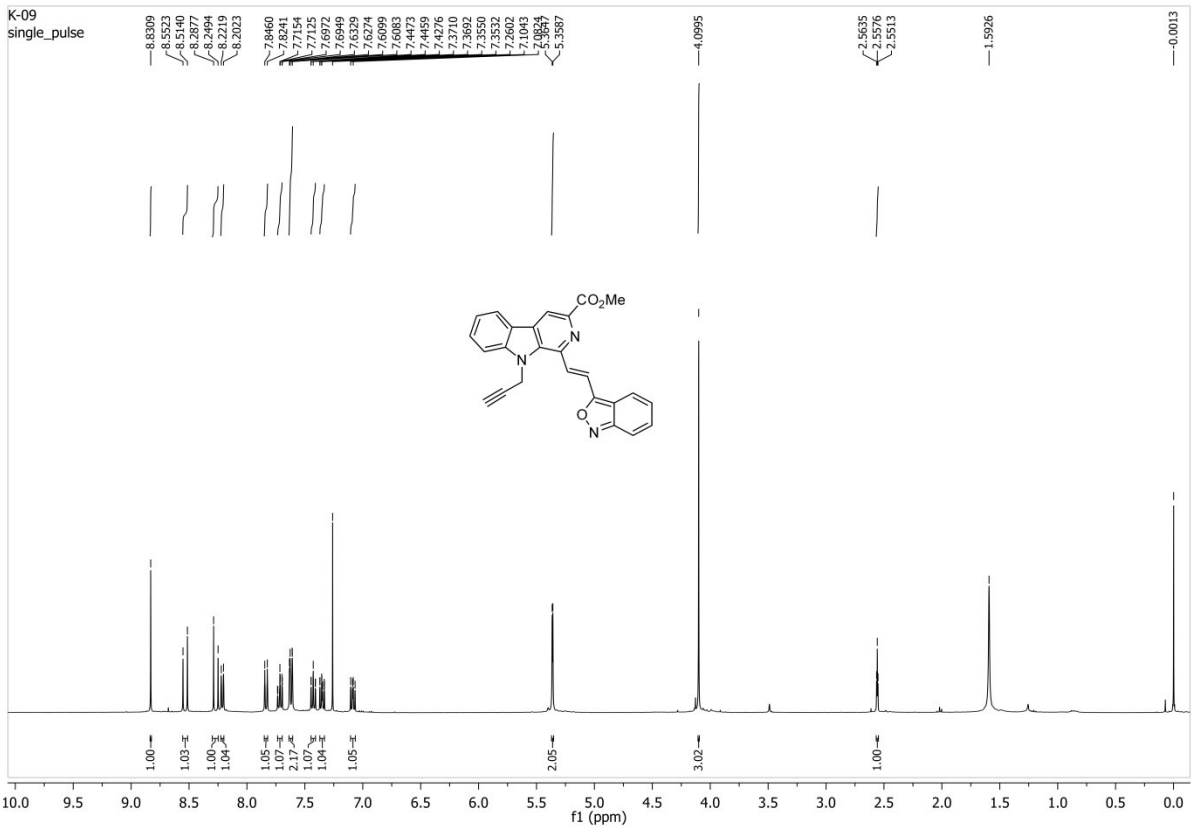

Fig S13. ^{1}H-NMR spectrum of **6A**

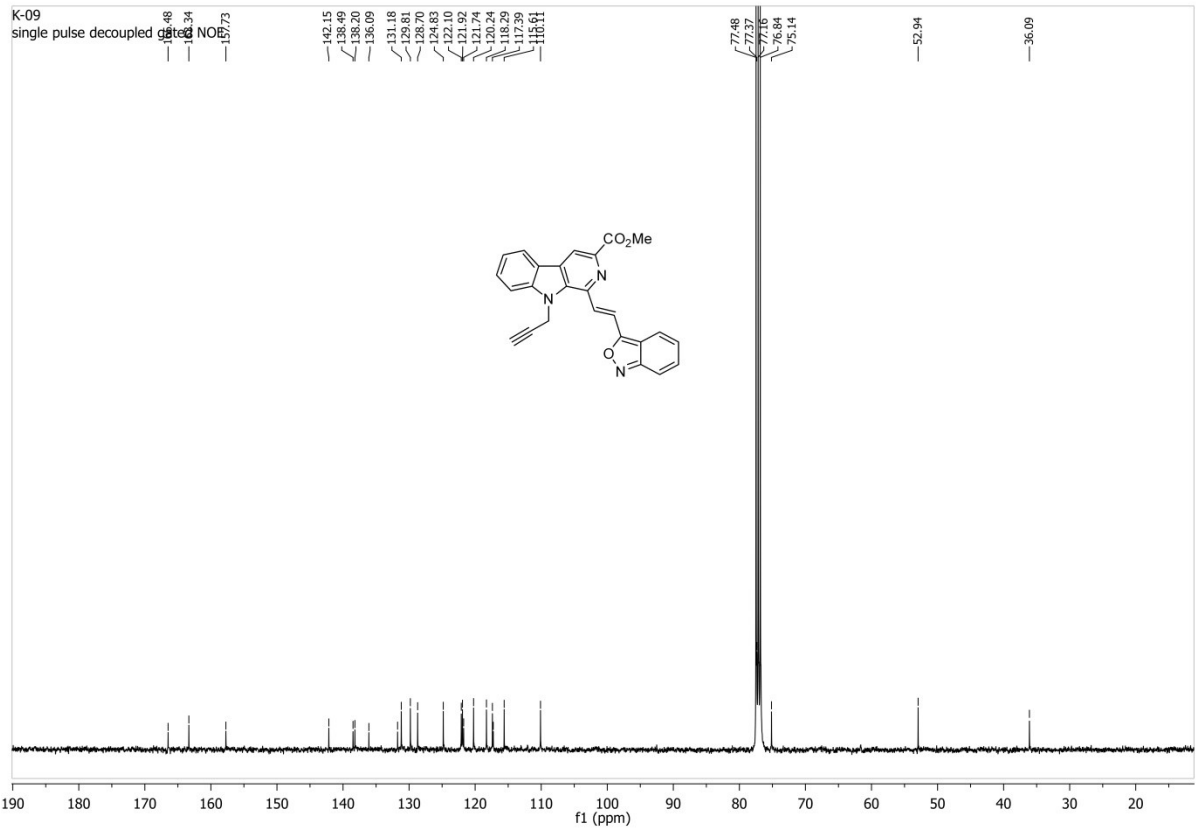

Fig S14. ^{13}C-NMR spectrum of **6A**

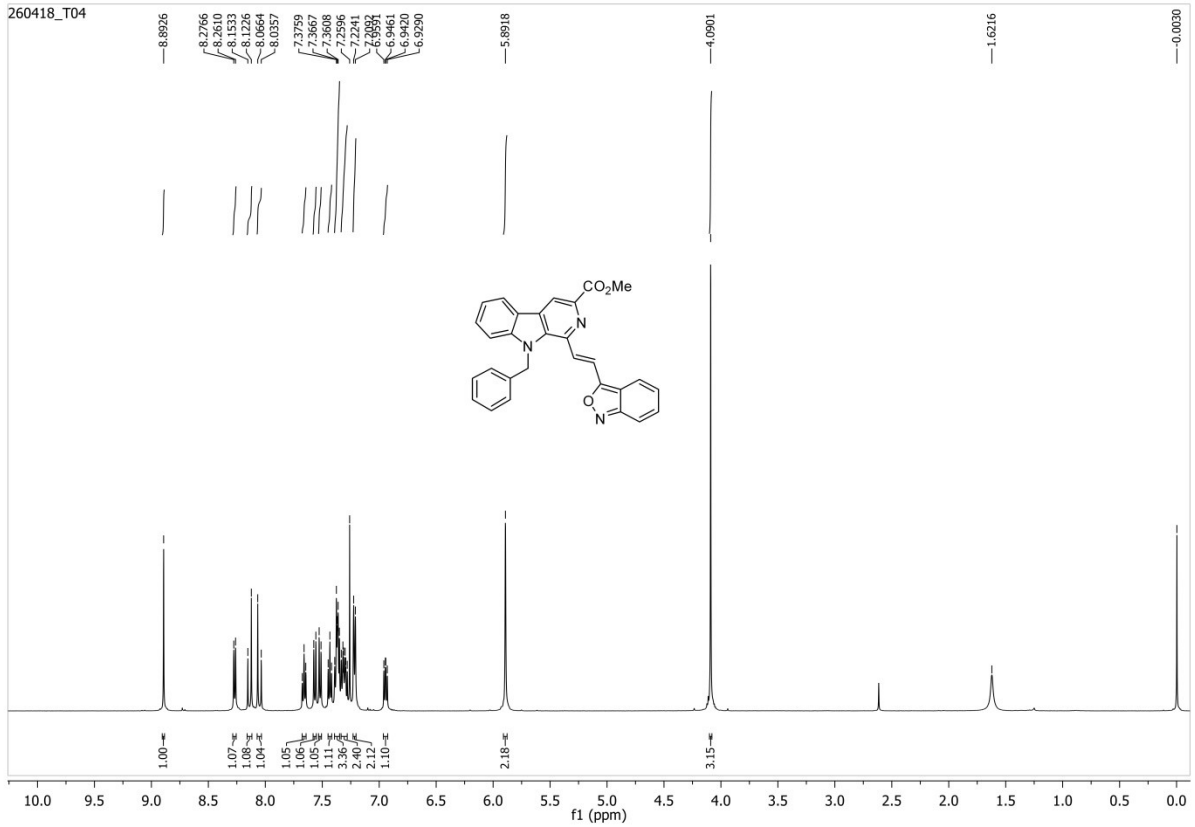

Fig S15. ^{1}H-NMR spectrum of **7A**

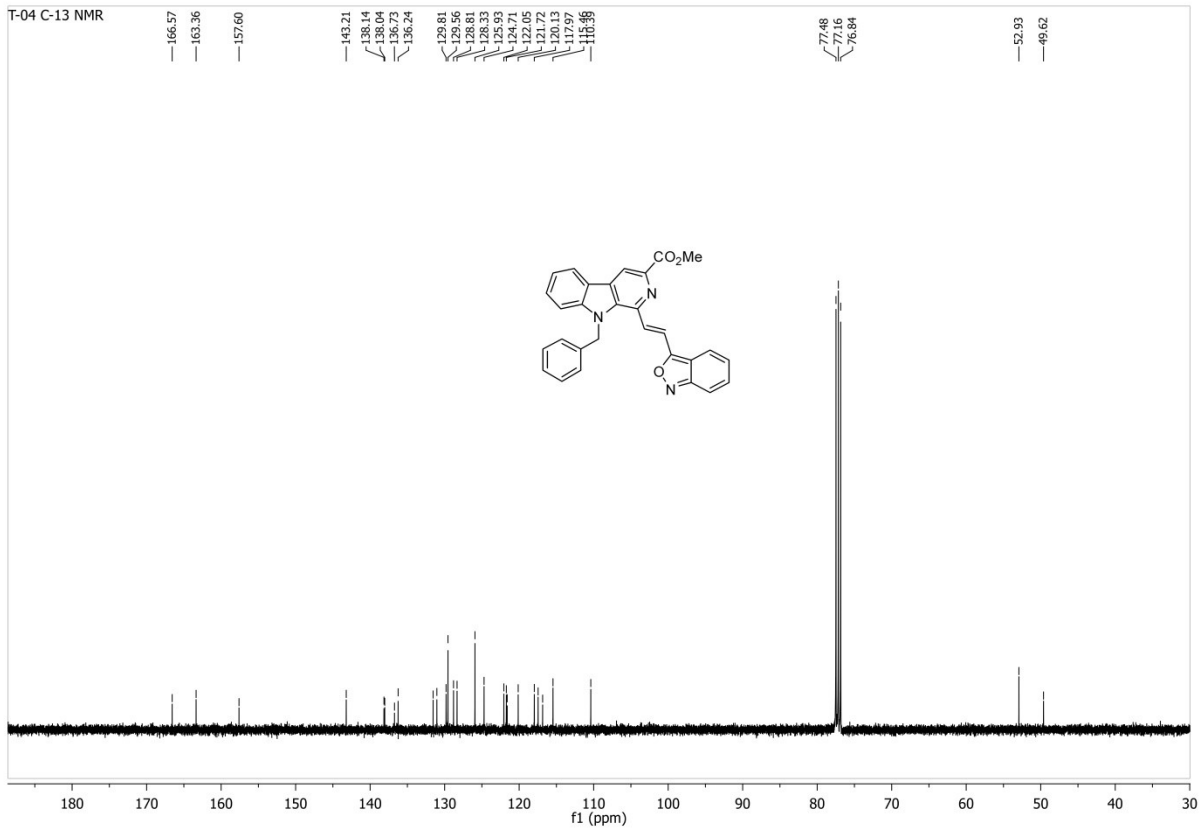

Fig S16. ^{13}C-NMR spectrum of **7A**

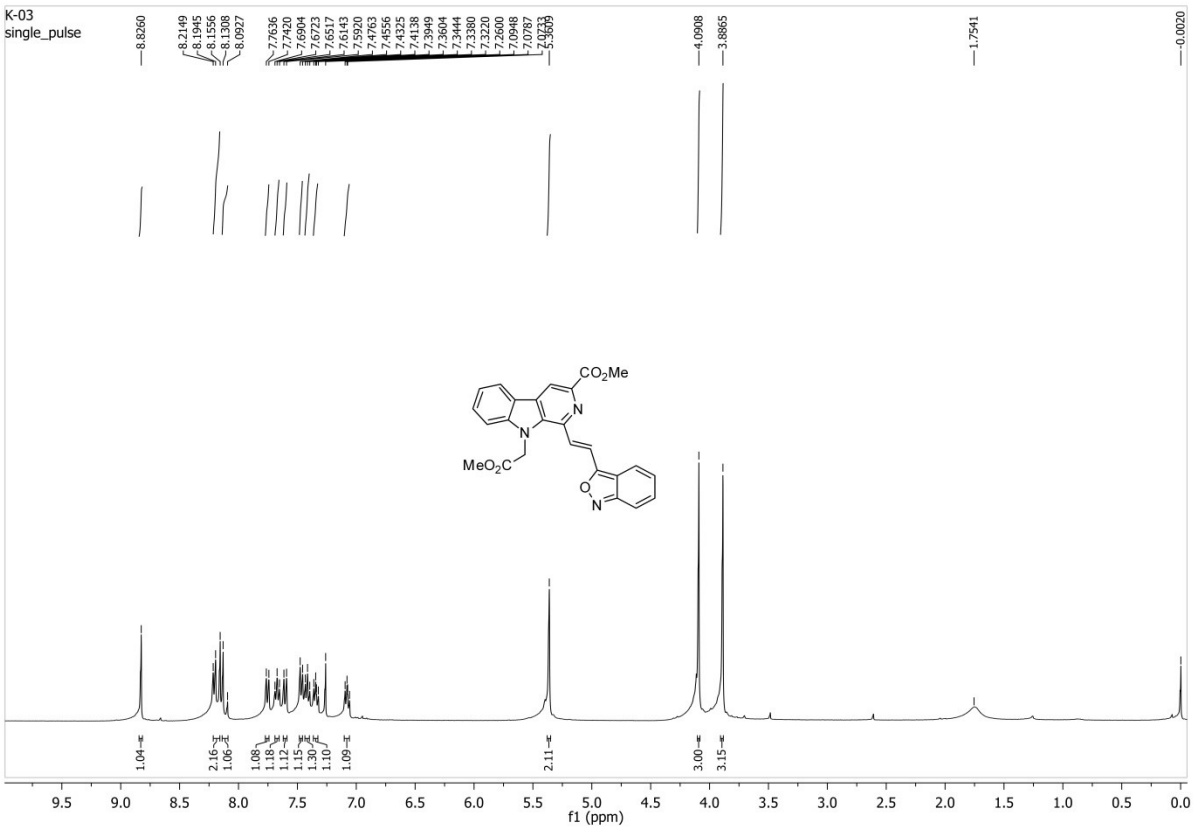

Fig S17. [1]H-NMR spectrum of **8A**

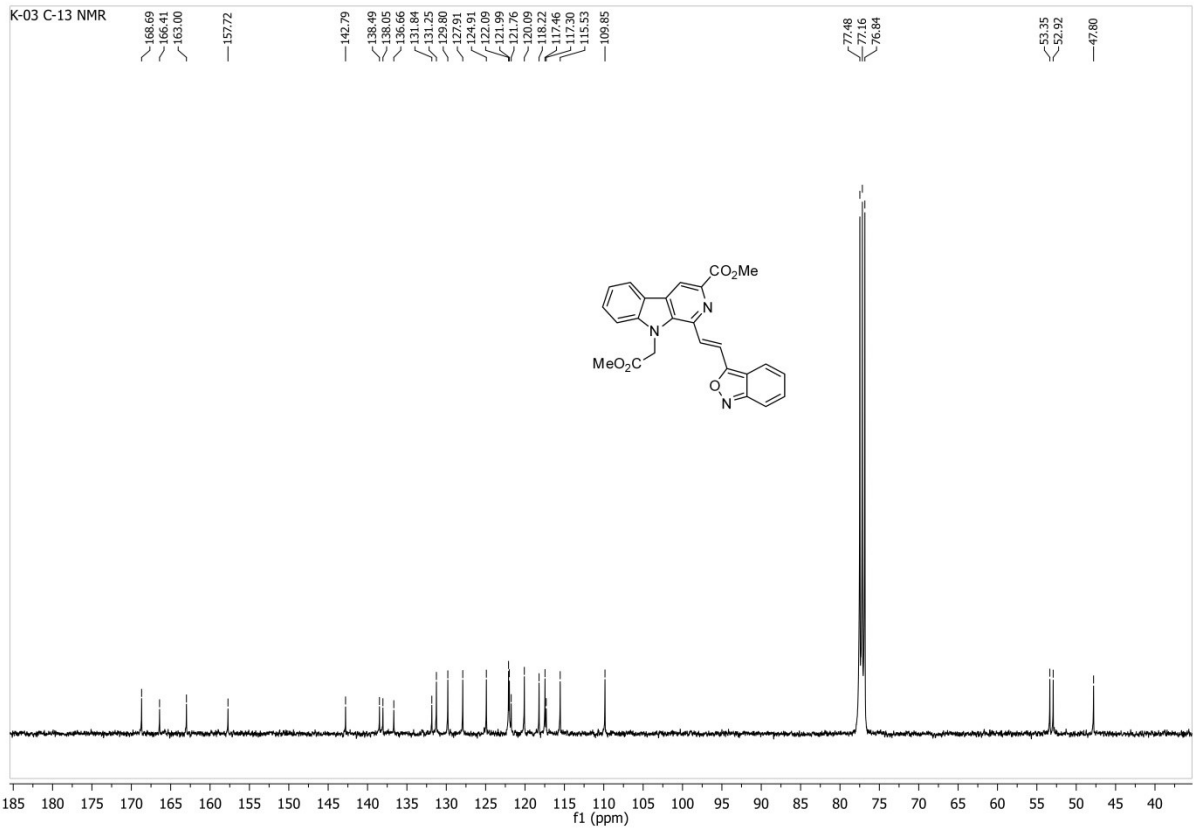

Fig S18. [13]C-NMR spectrum of **8A**

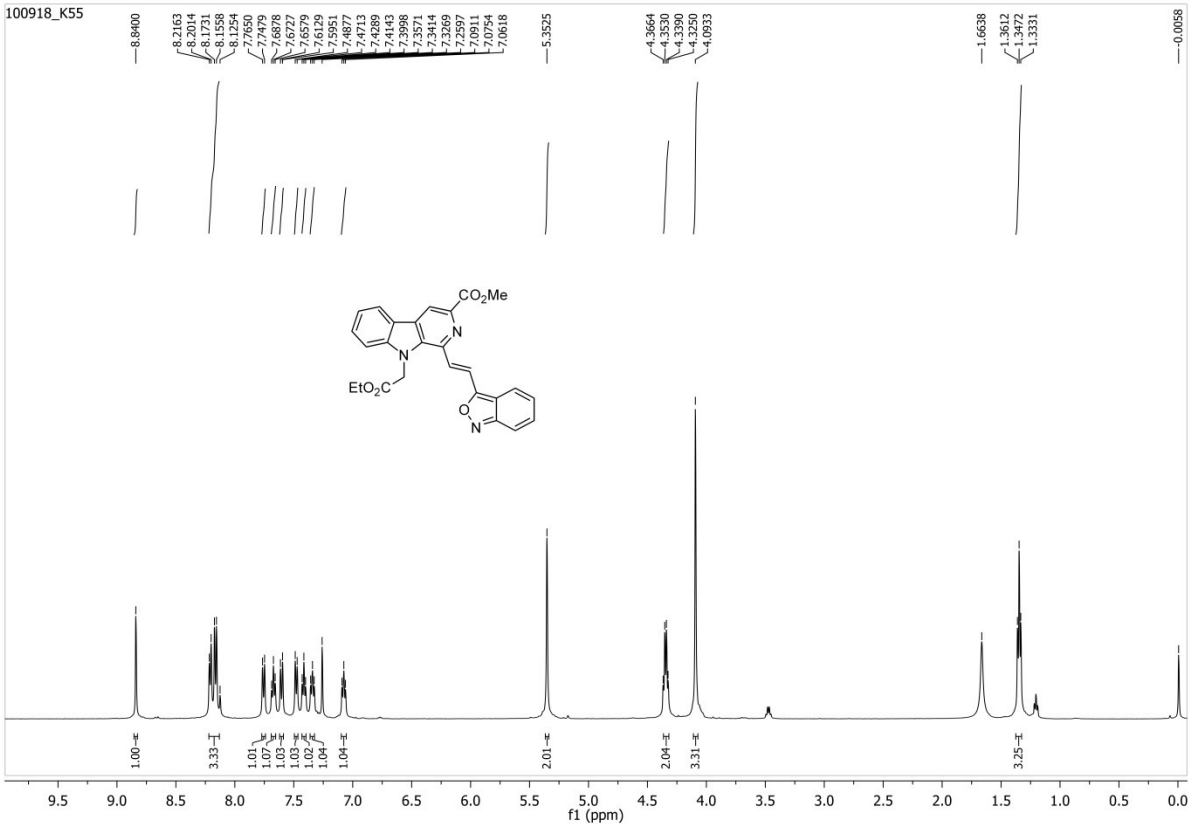

Fig S19. ^{1}H-NMR spectrum of **9A**

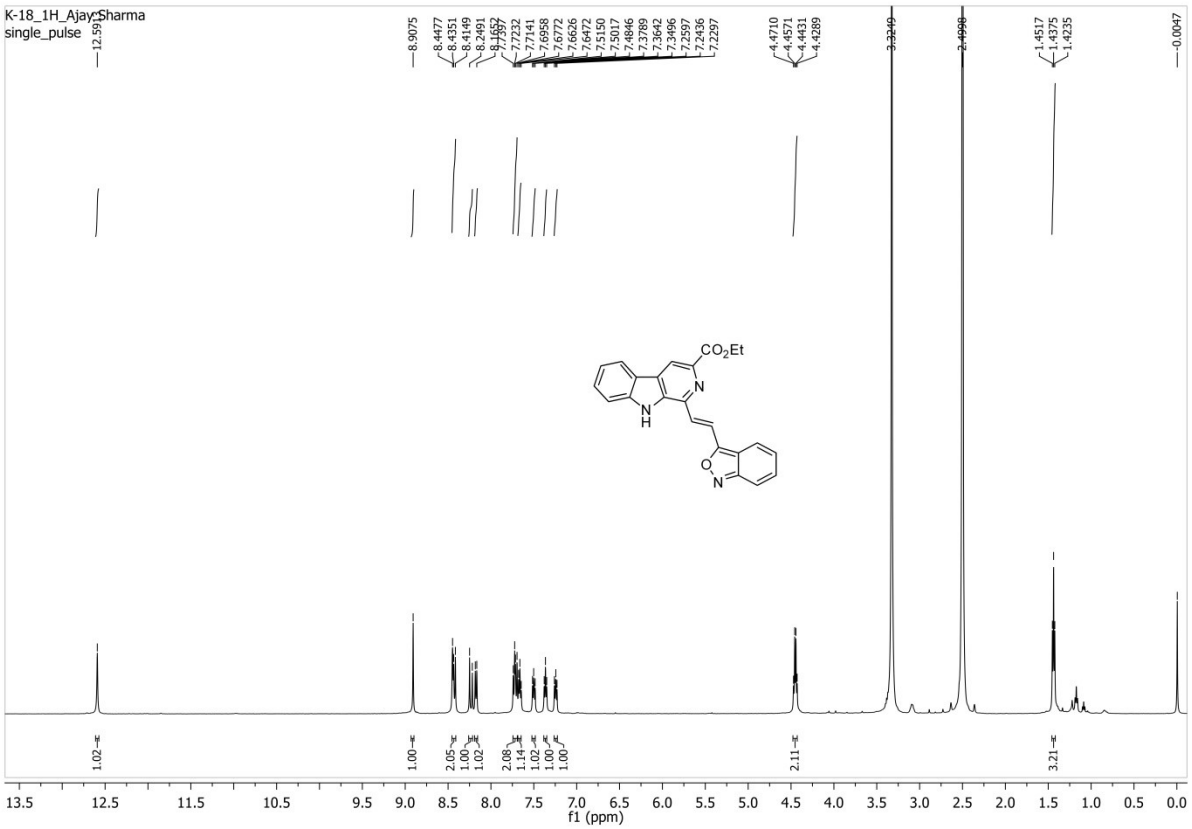

Fig S20. ^{1}H-NMR spectrum of **10A**

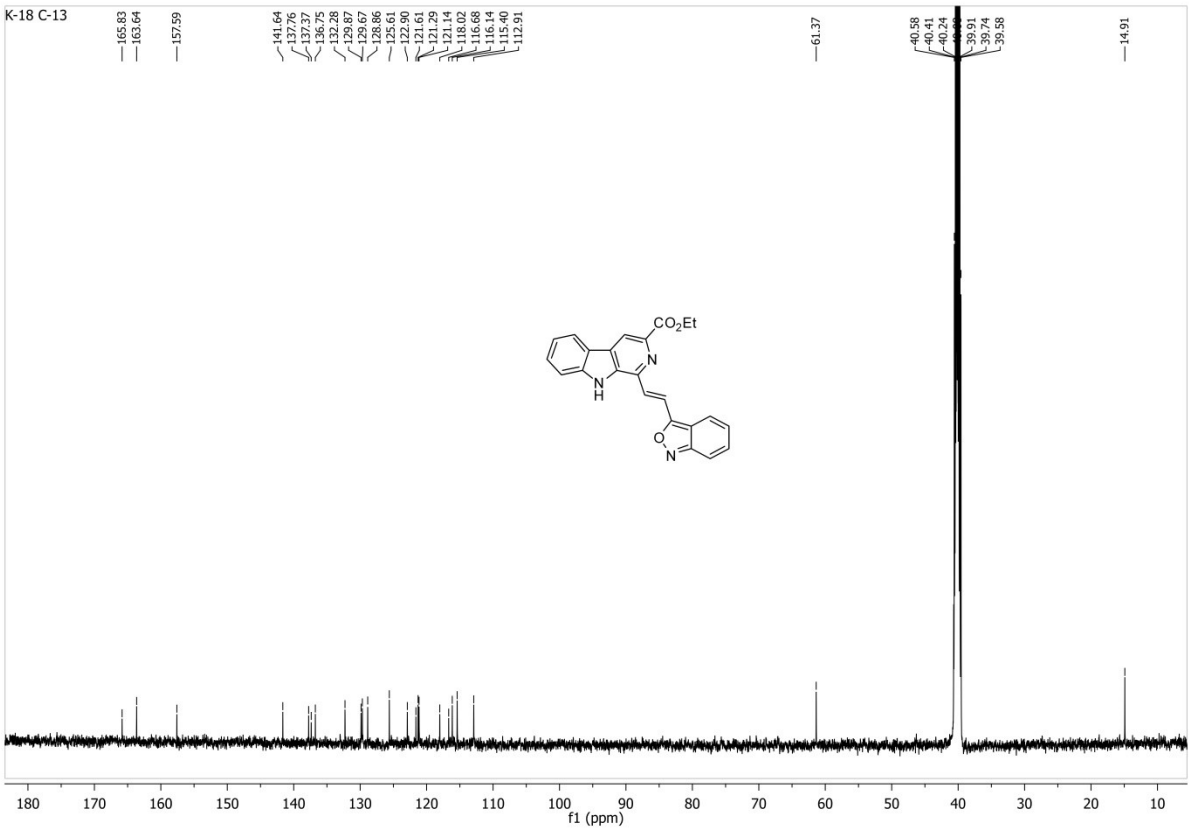

Fig S21. ^{13}C-NMR spectrum of **10A**

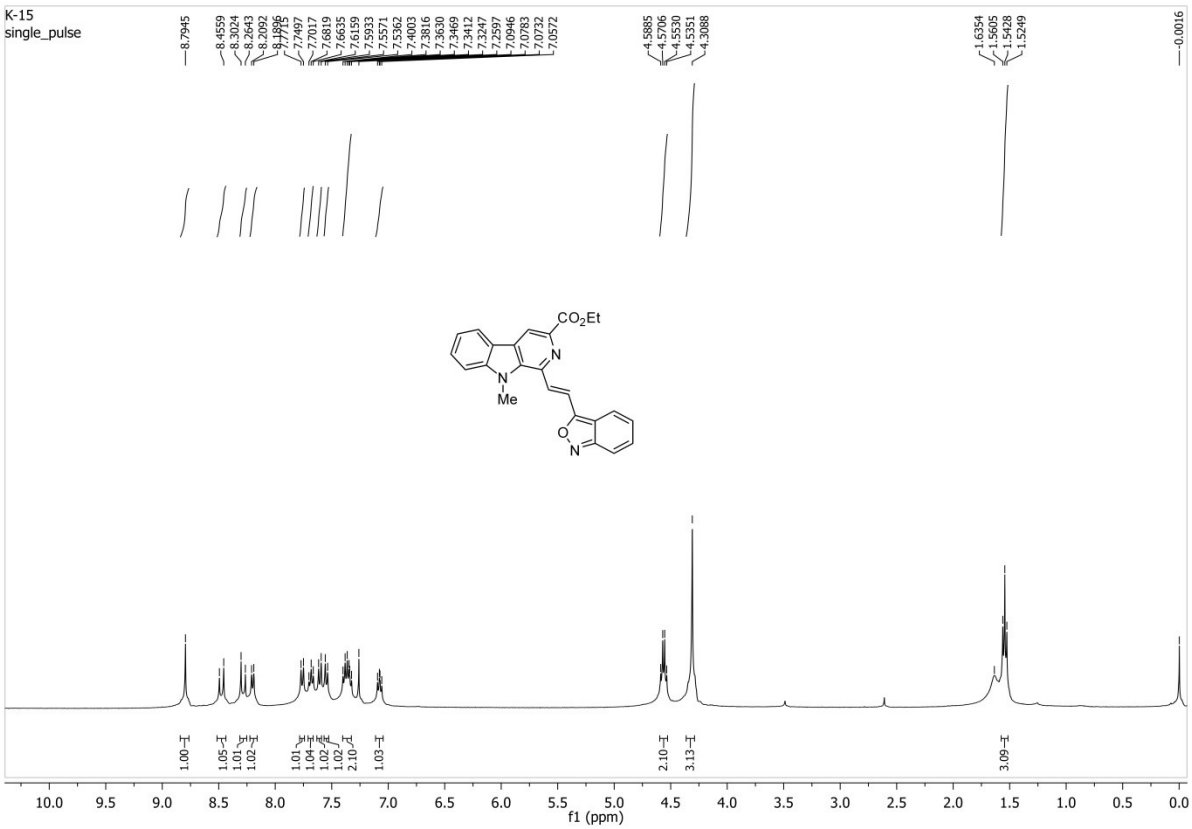

Fig S22. ^{1}H-NMR spectrum of **11A**

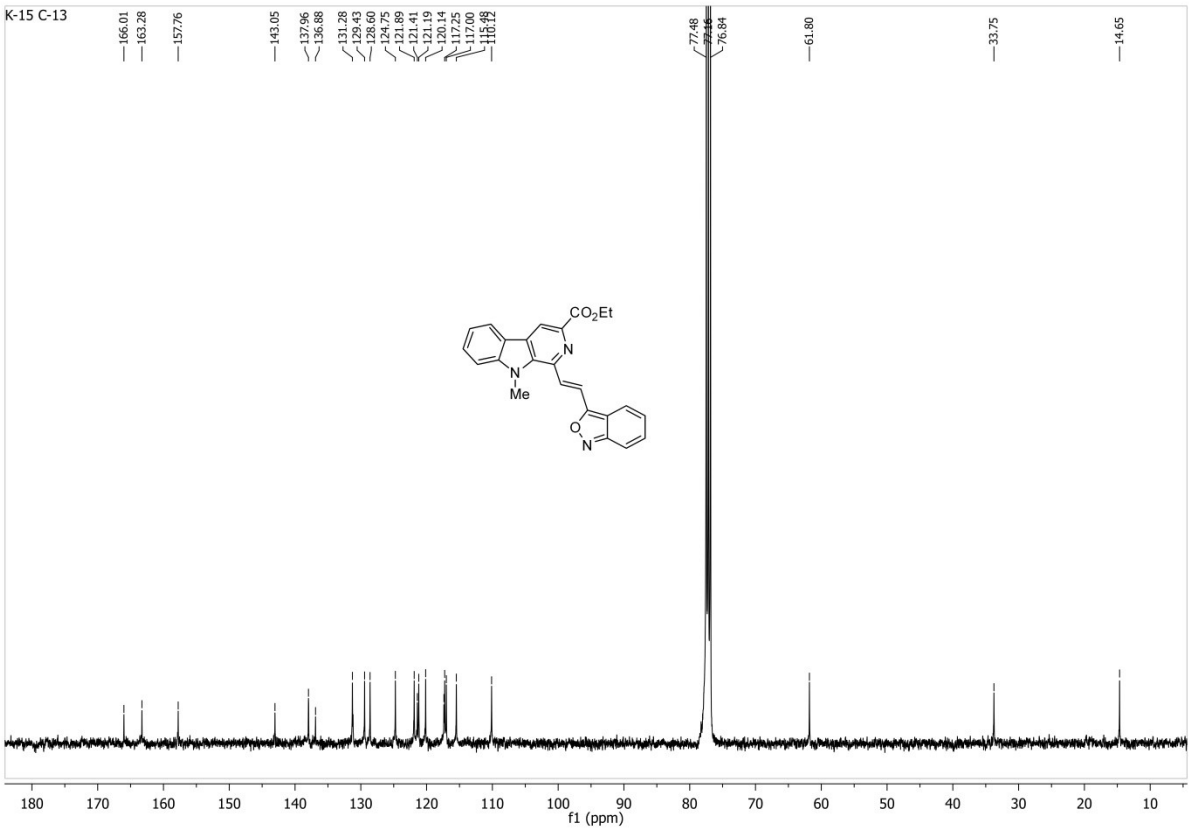

Fig S23. ^{13}C-NMR spectrum of **11A**

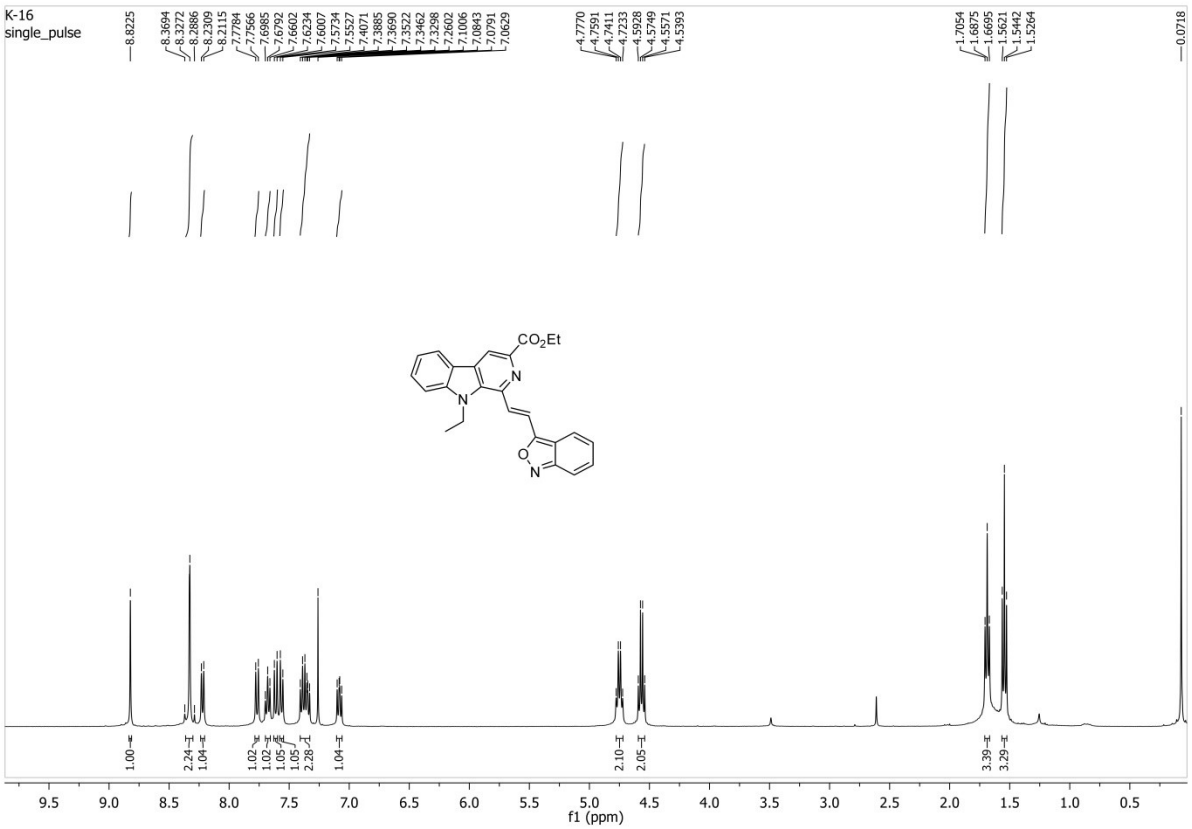

Fig S24. ^{1}H-NMR spectrum of **12A**

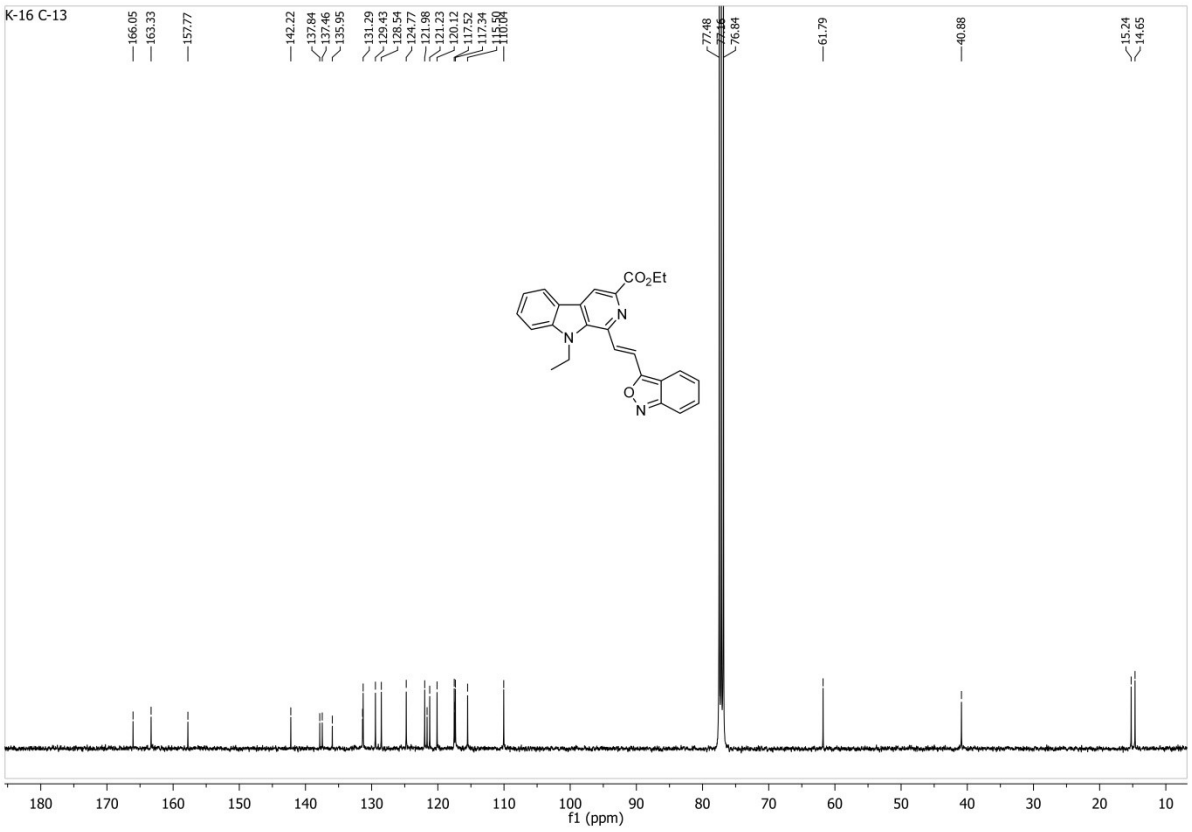

Fig S25. ^{13}C-NMR spectrum of **12A**

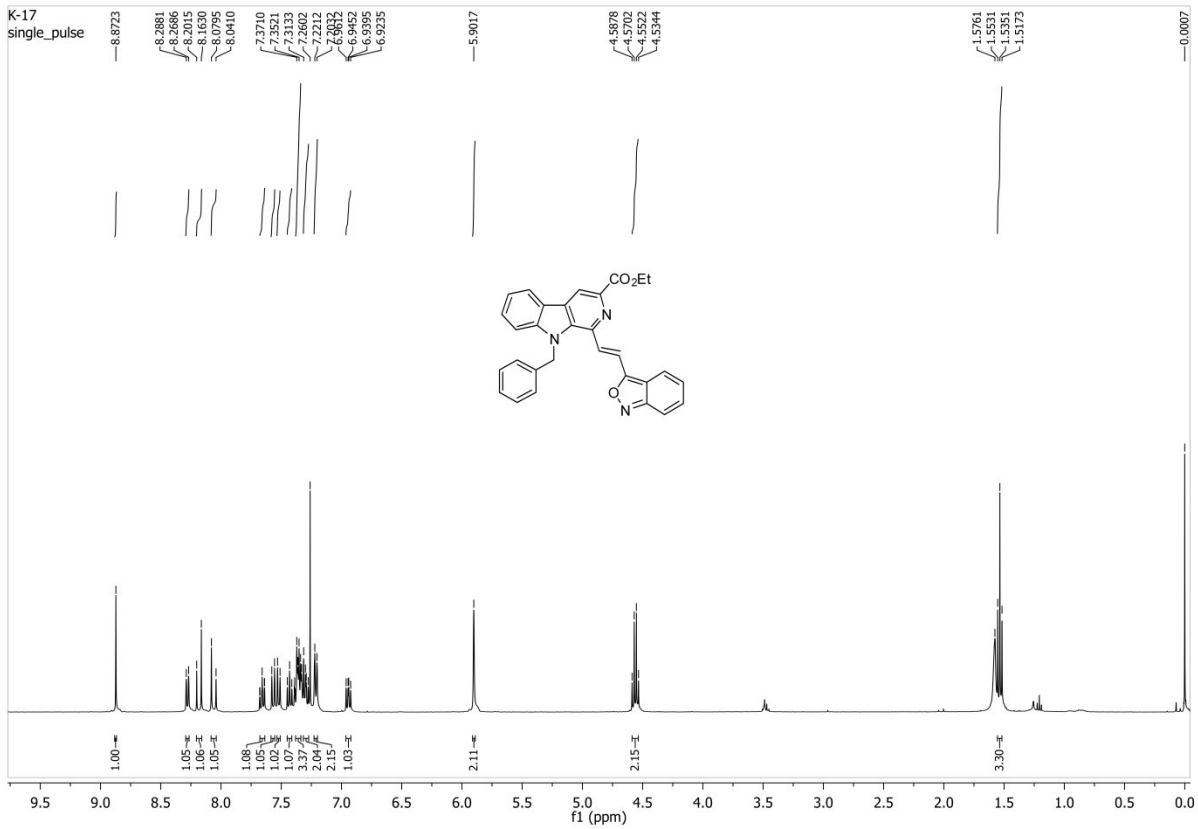

Fig S26. ^{1}H-NMR spectrum of **13A**

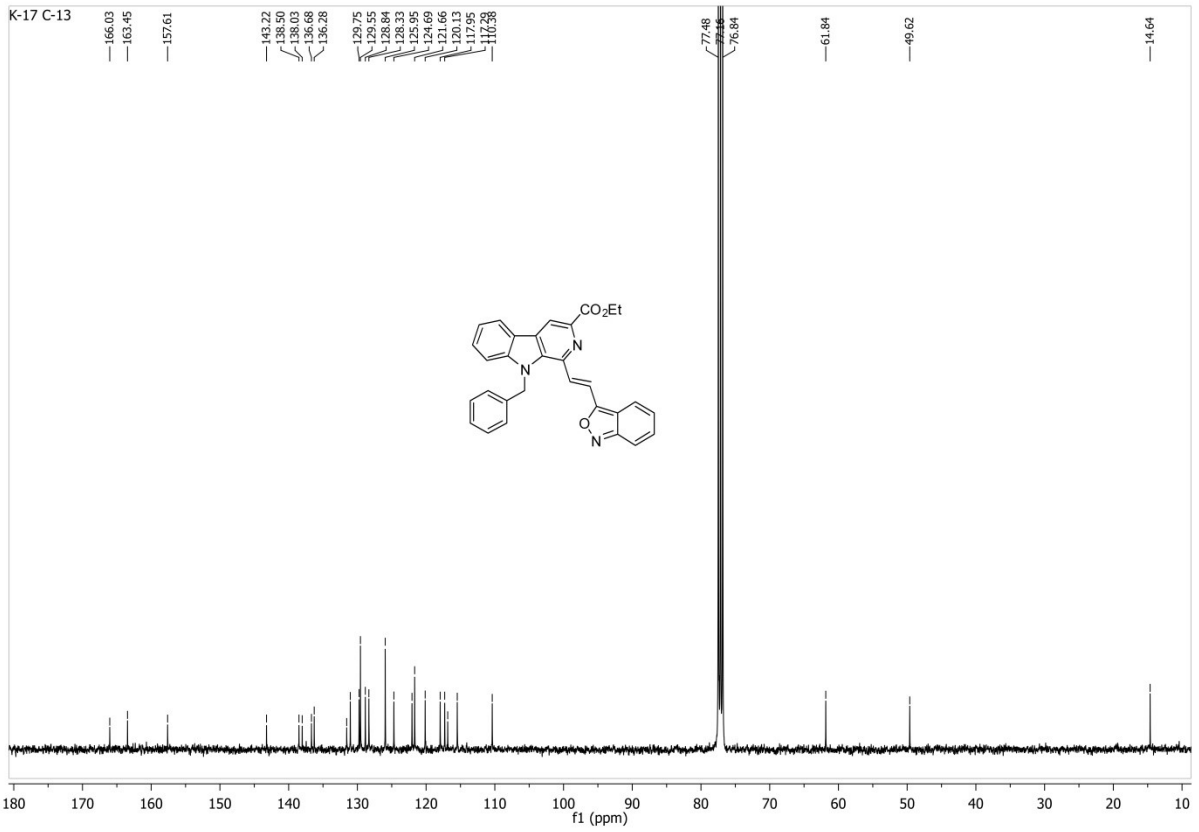

Fig S27. ^{13}C-NMR spectrum of **13A**

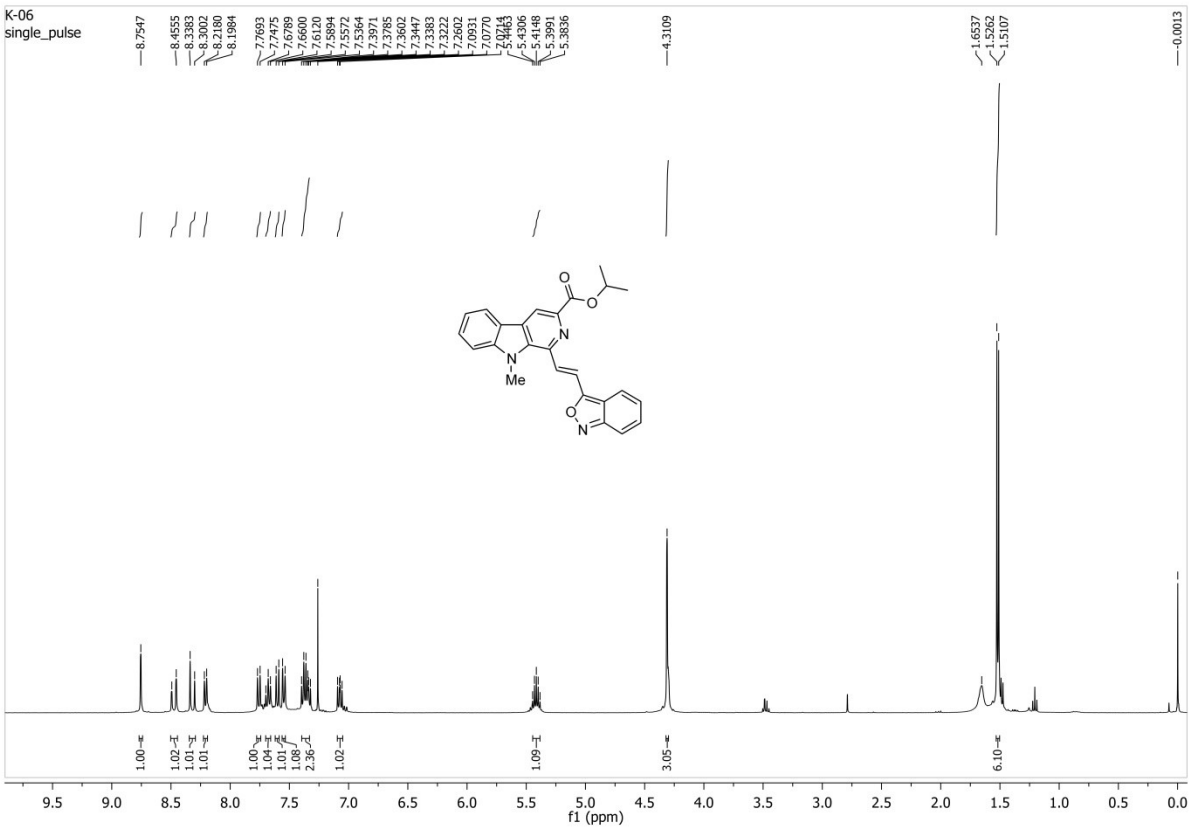

Fig S28. [1]H-NMR spectrum of **14A**

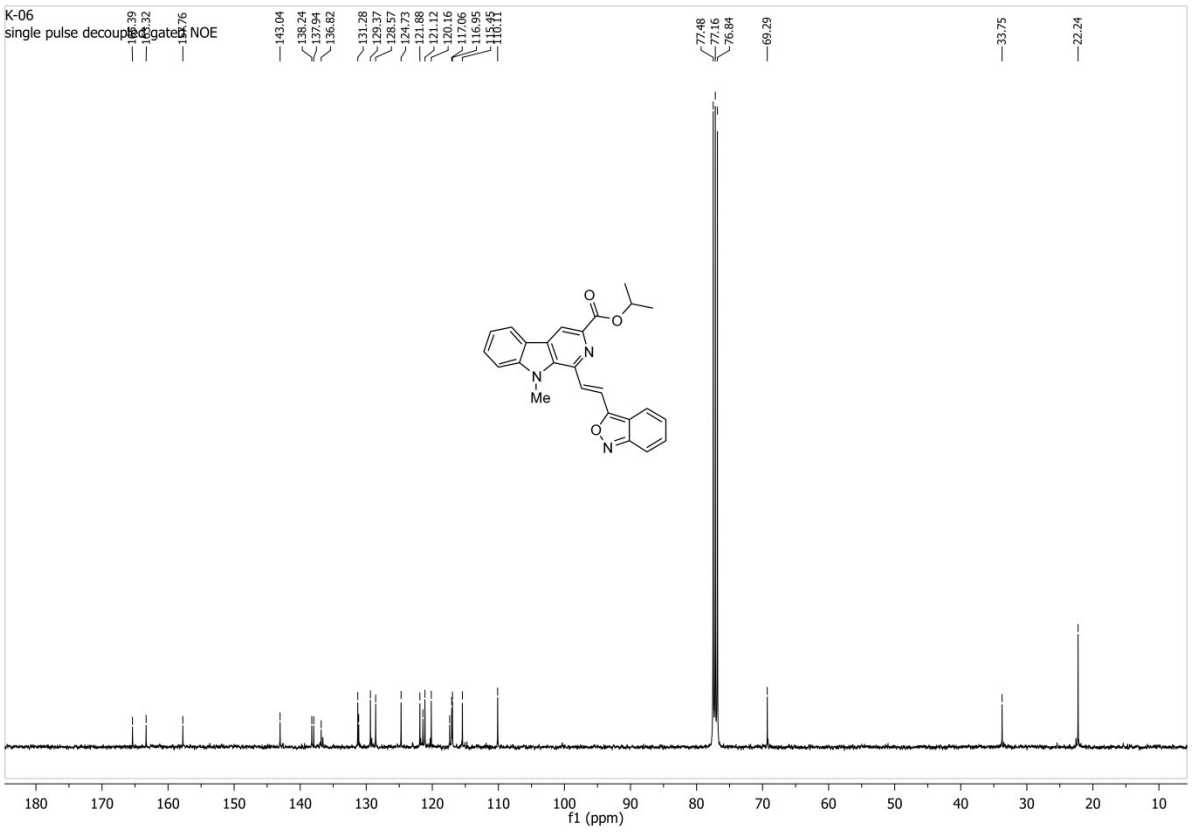

Fig S29. [13]C-NMR spectrum of **14A**

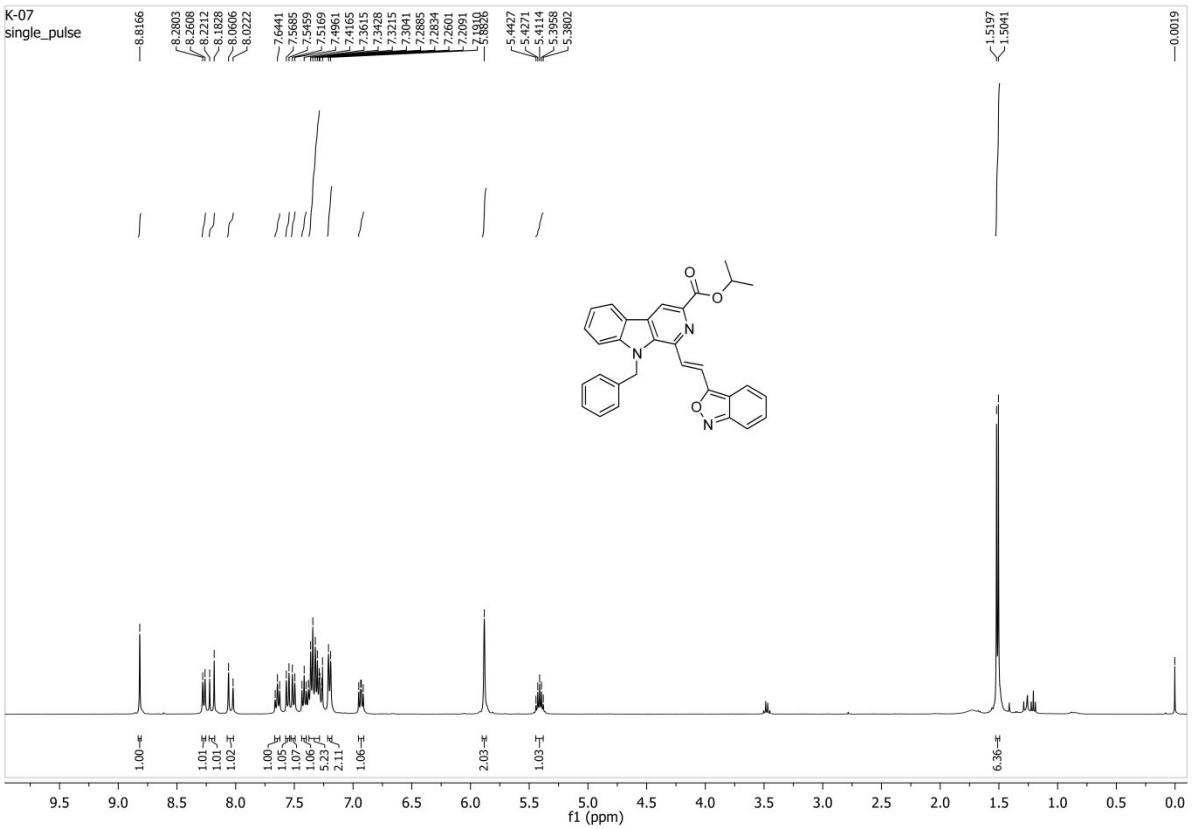

Fig S30. ^{1}H-NMR spectrum of **15A**

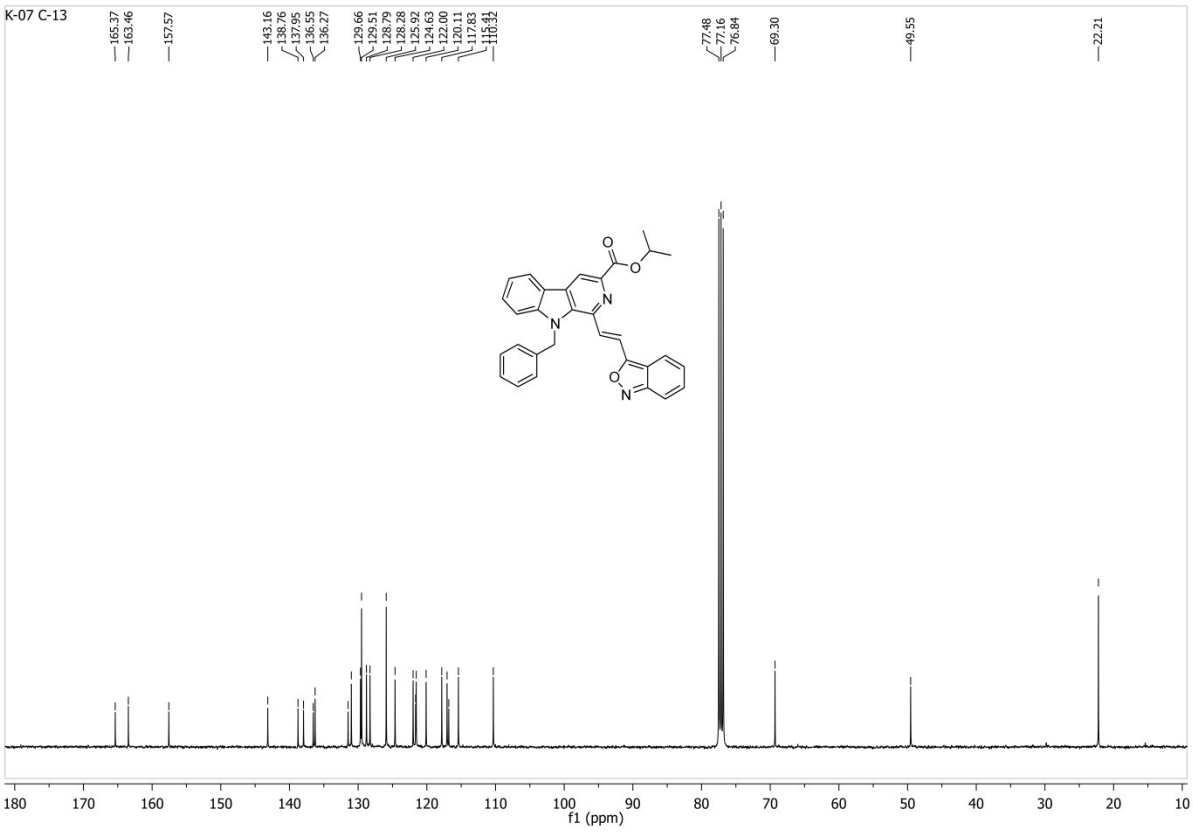

Fig S31. ^{13}C-NMR spectrum of **15A**

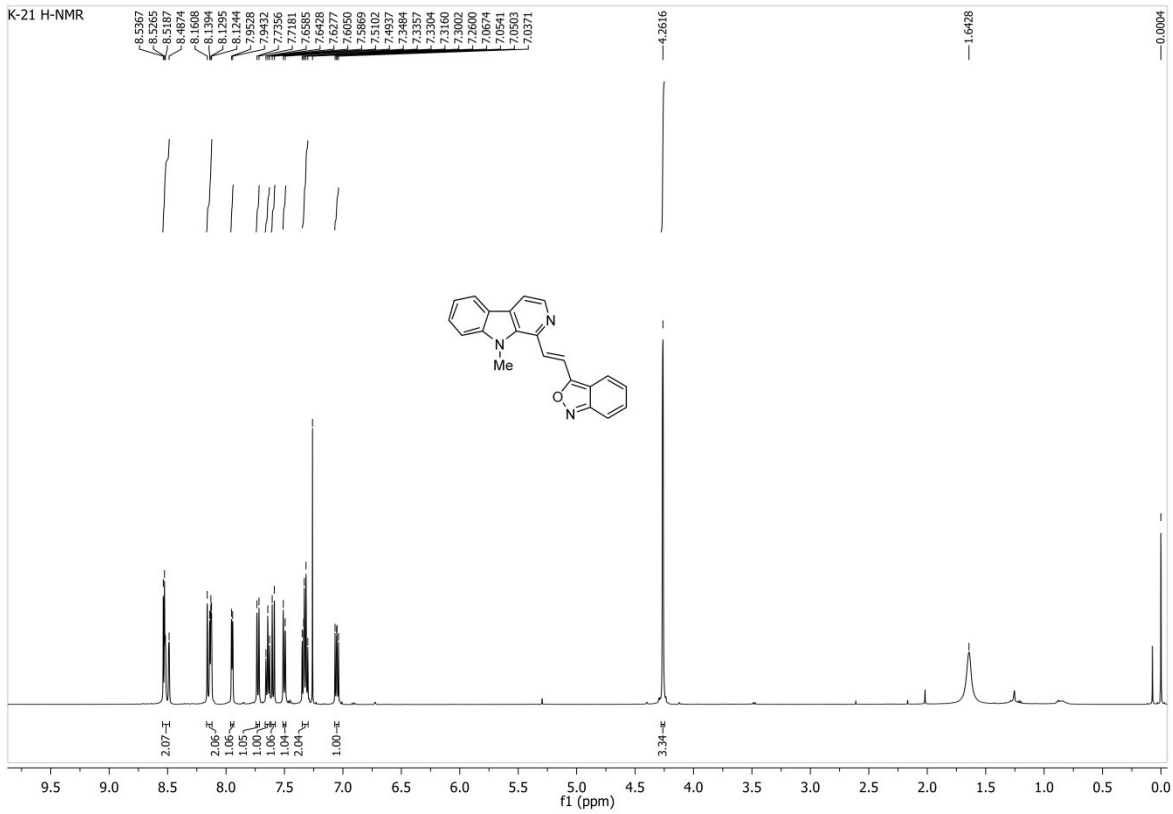

Fig S32. ^{1}H-NMR spectrum of **17A**

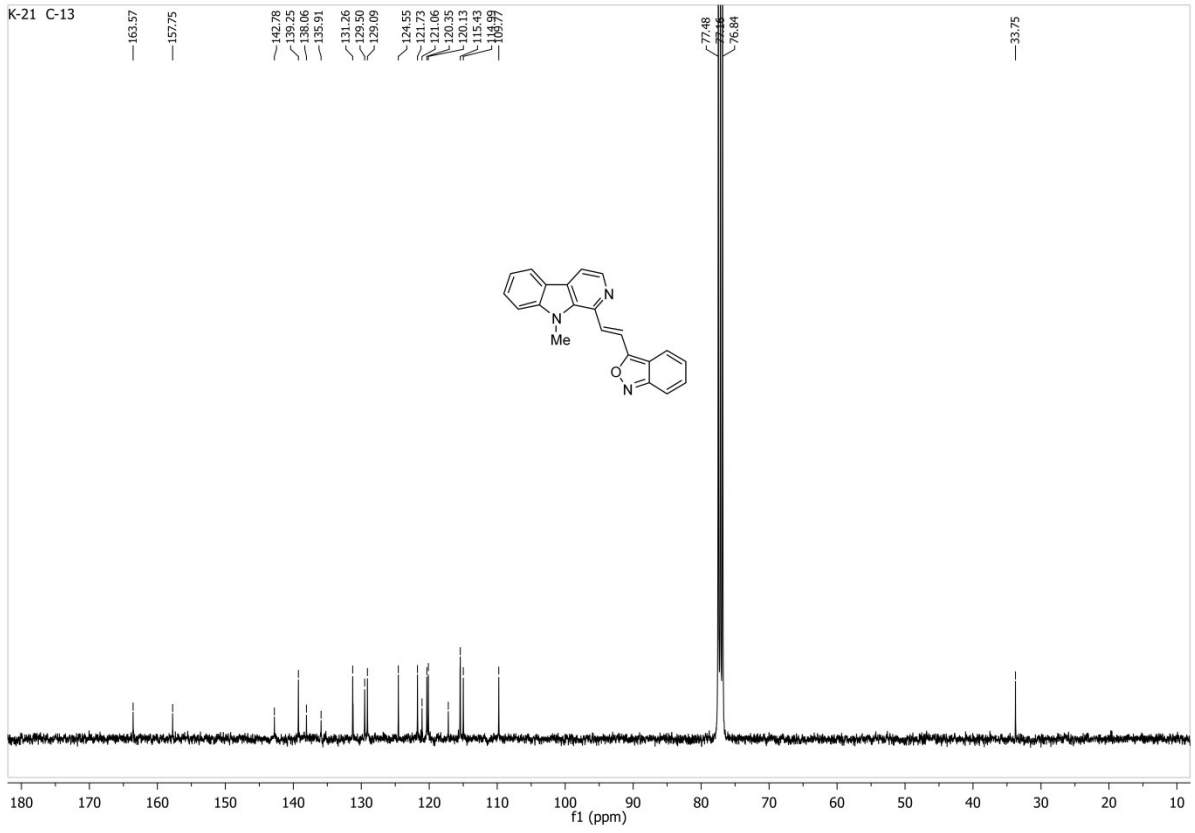

Fig S33. ^{13}C-NMR spectrum of **17A**

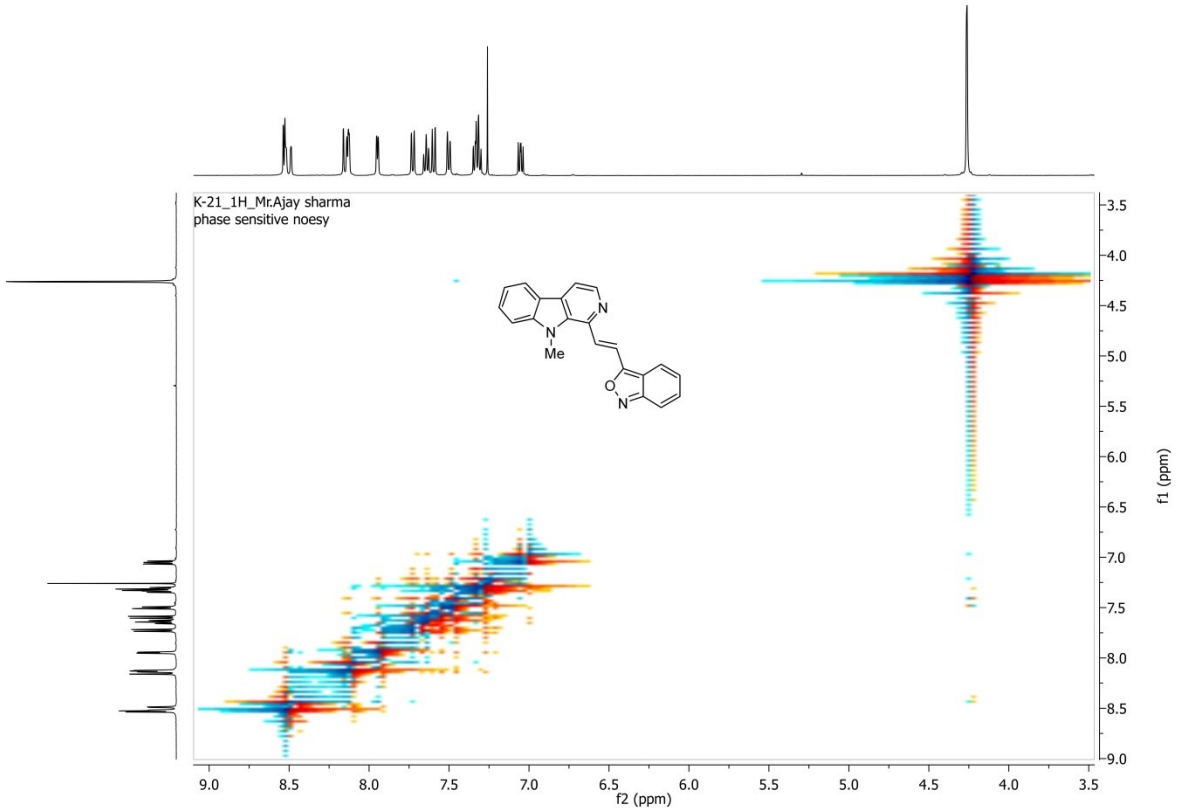

Fig S34. NOESY spectrum of **17A**

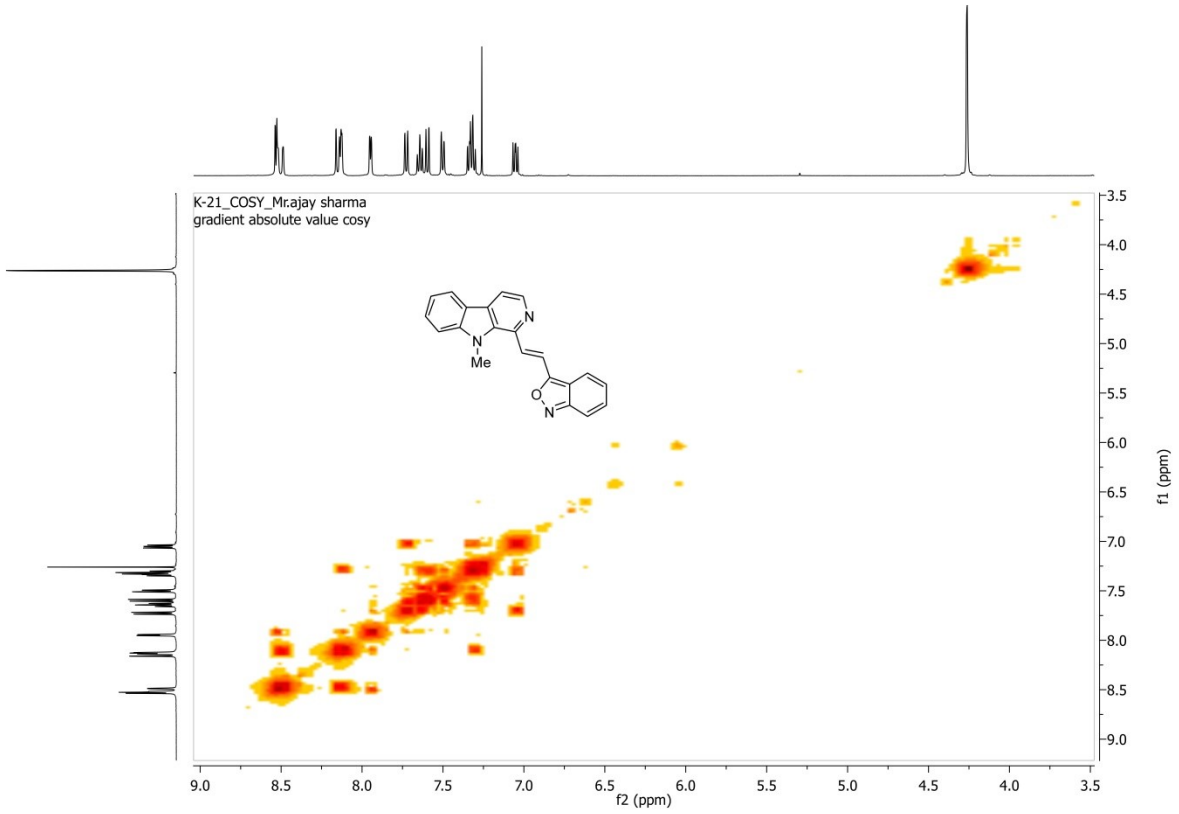

Fig S35. COSY spectrum of **17A**

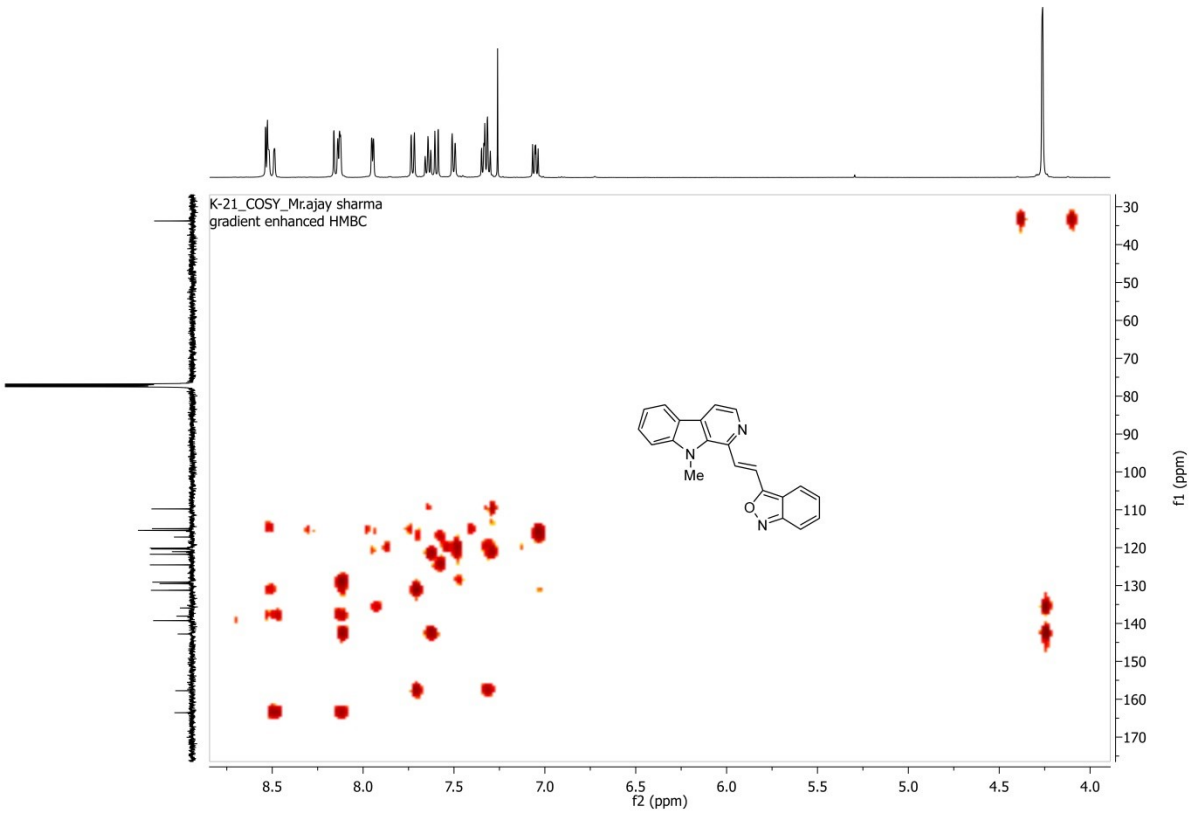

Fig S36. HMBC spectrum of **17A**

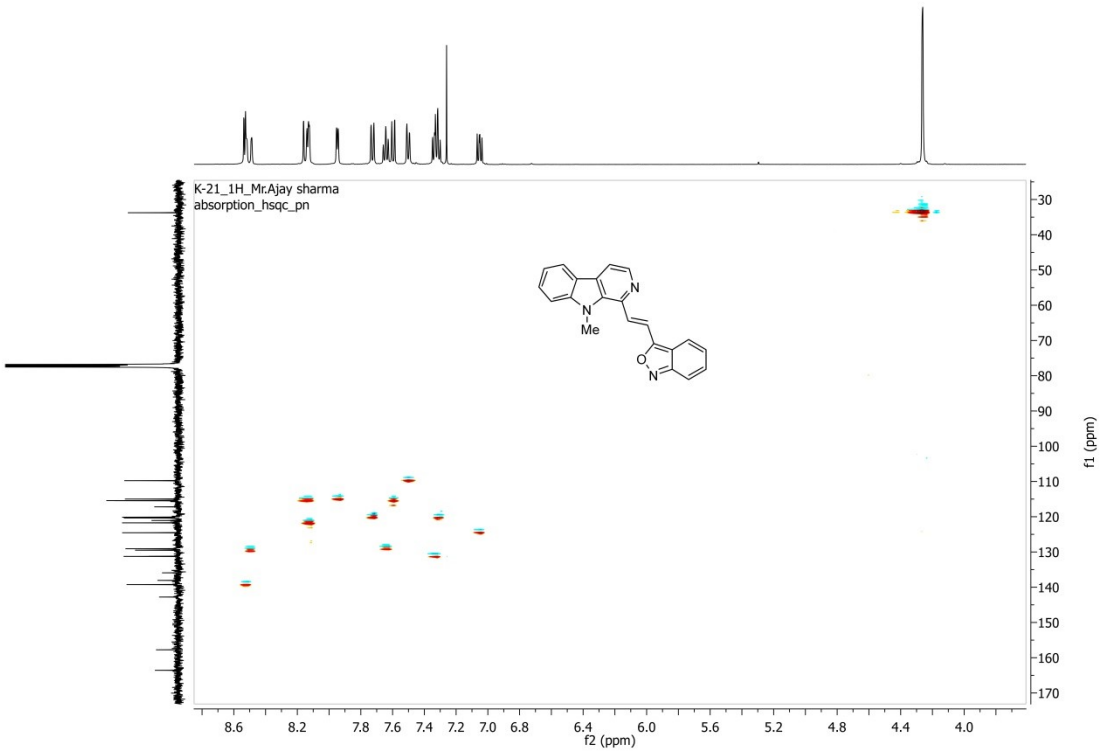

Fig S37. HSQC spectrum of **17A**

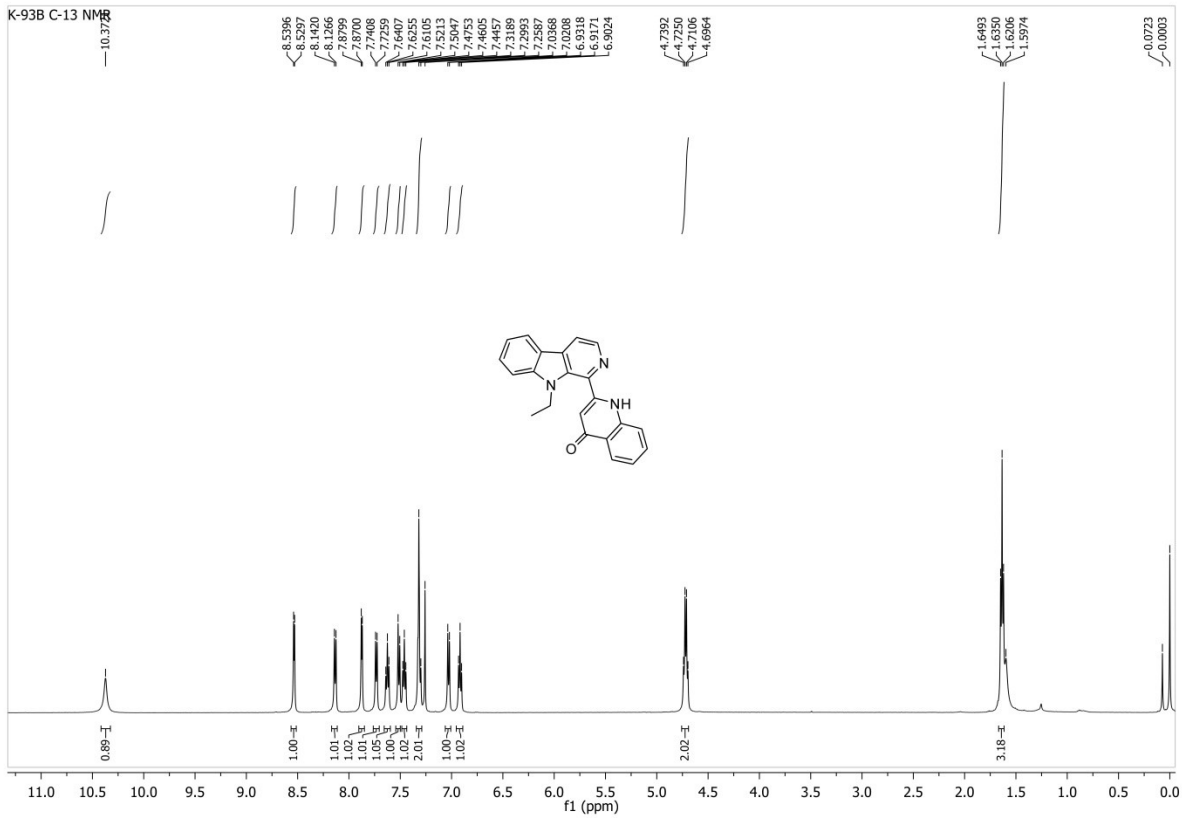

Fig S38. ^{1}H-NMR spectrum of **18A'**

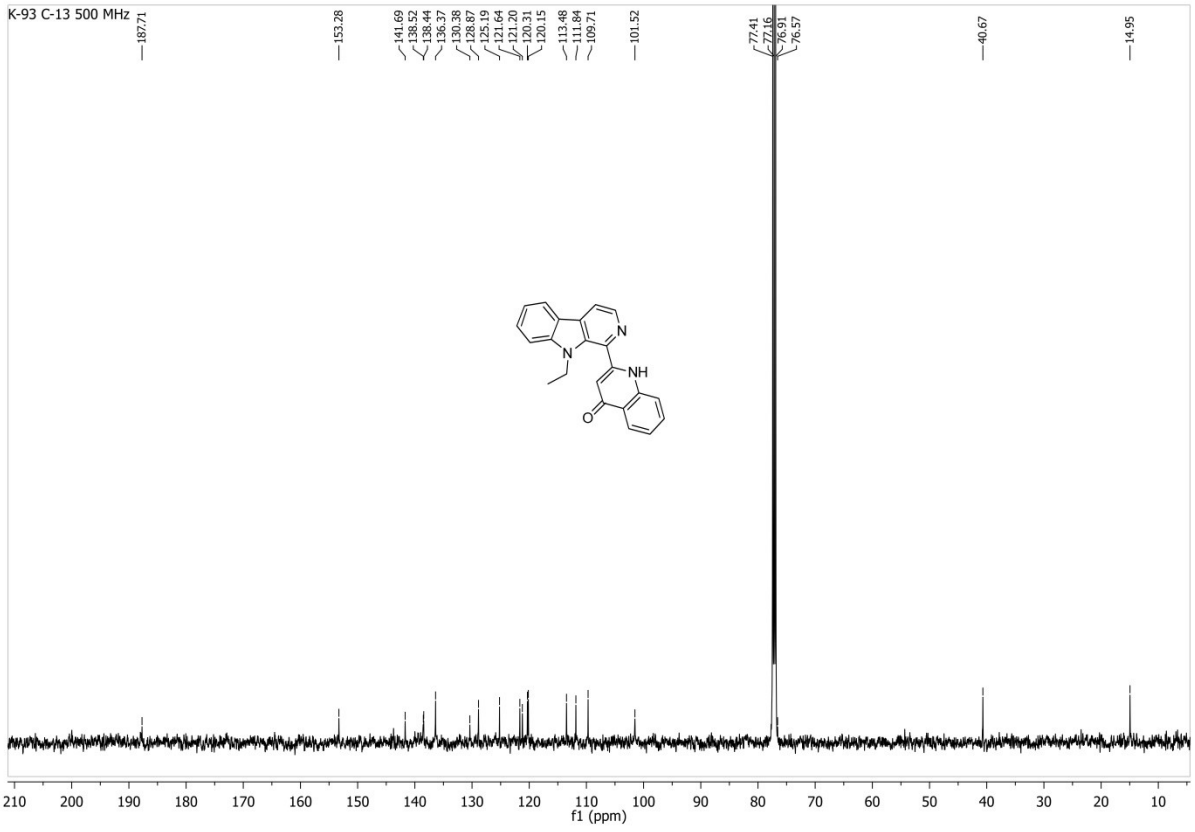

Fig S39. ^{13}C-NMR spectrum of **18A'**

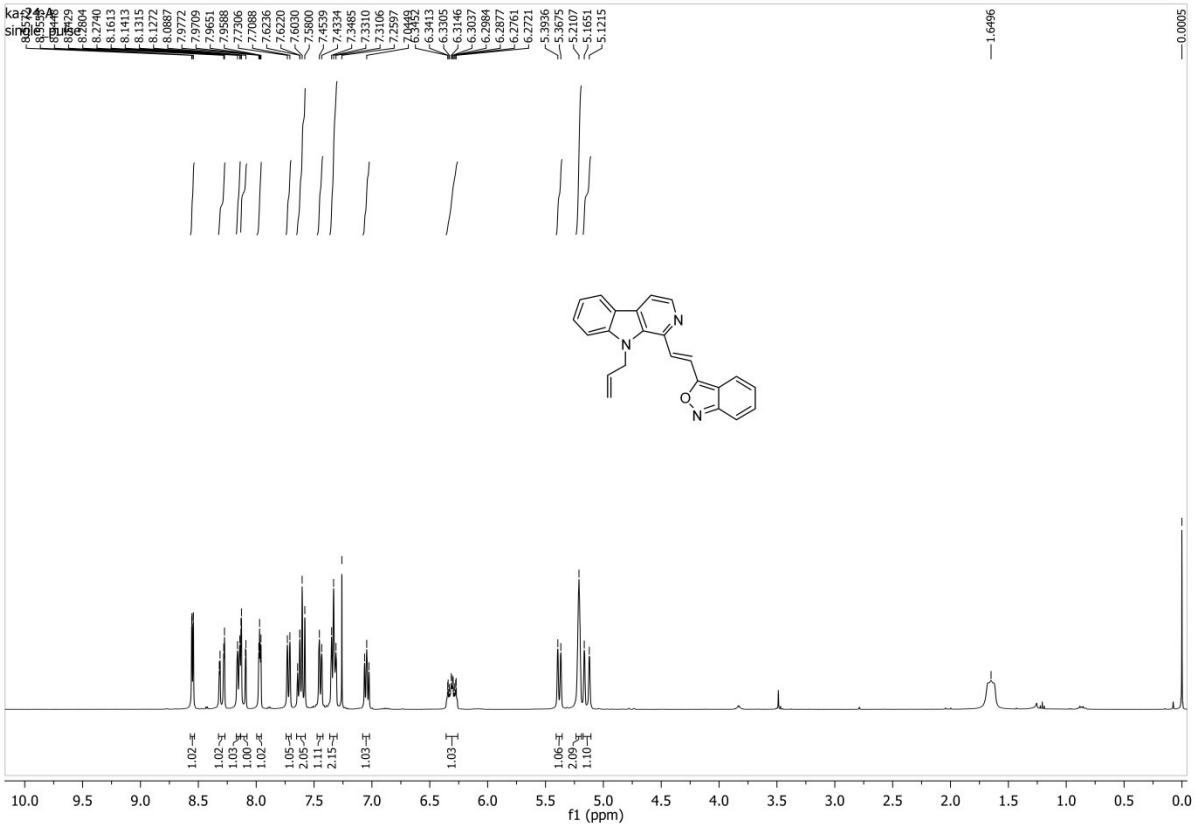

Fig S40. ^{1}H-NMR spectrum of **19A**

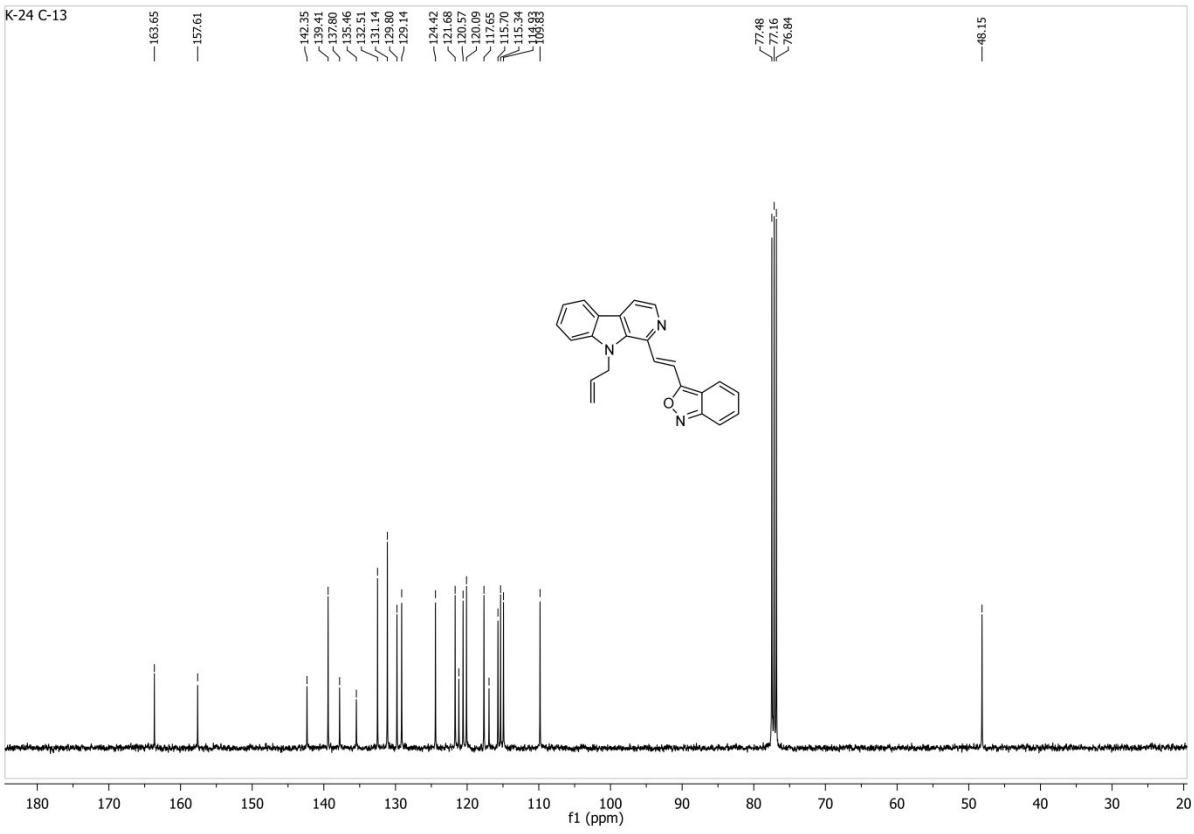

Fig S41. ^{13}C-NMR spectrum of **19A**

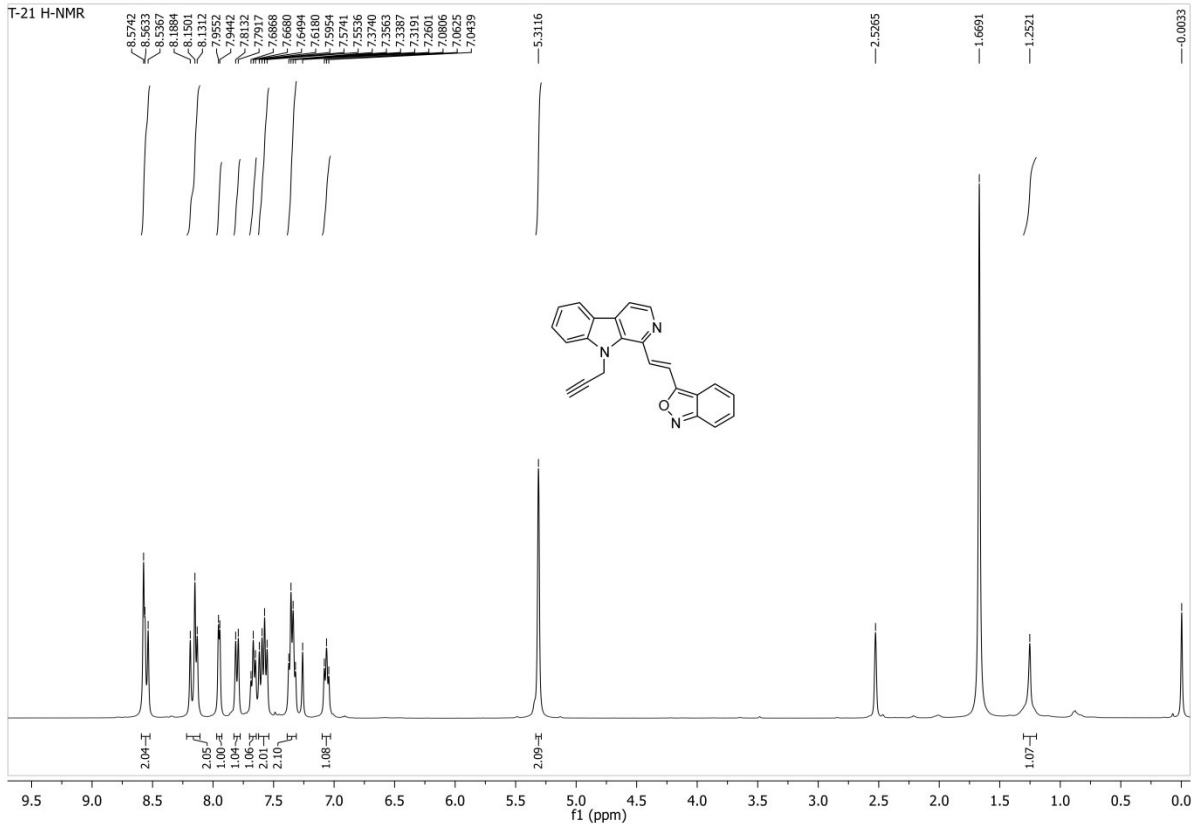

Fig S42. ^{1}H-NMR spectrum of **20A**

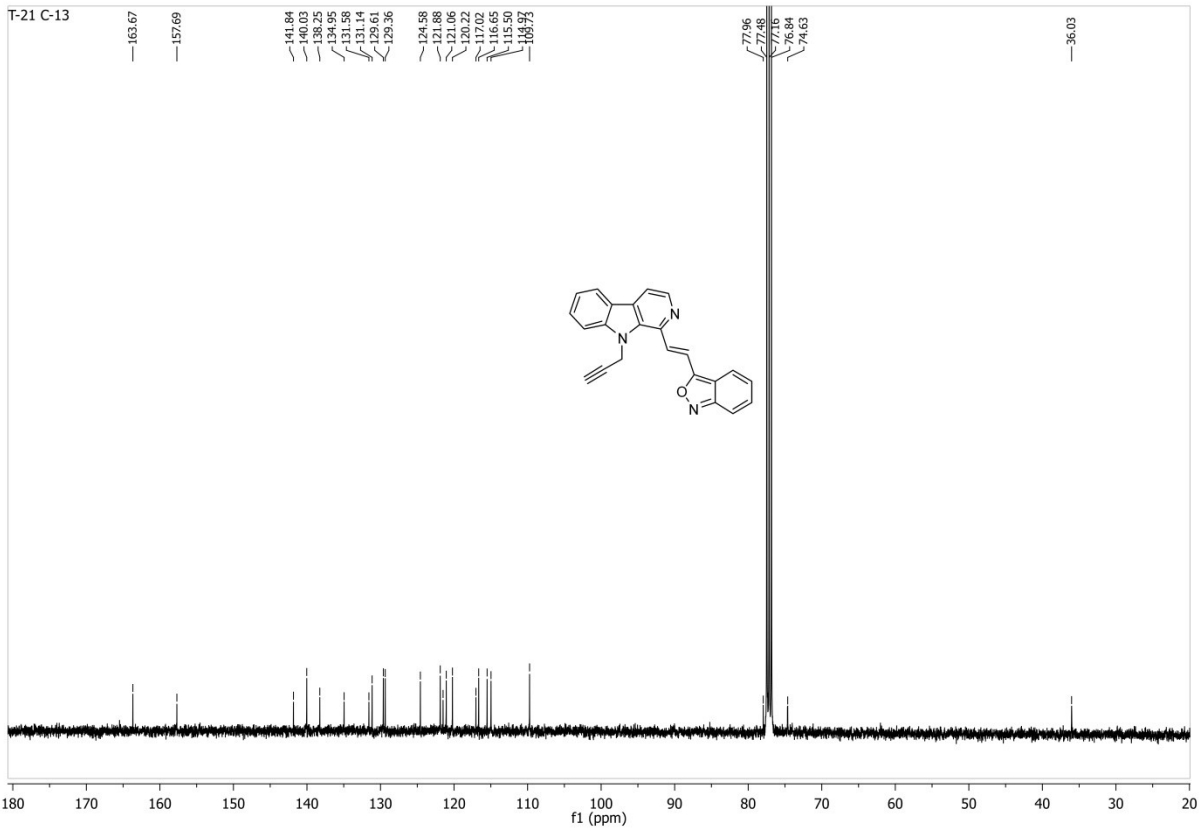

Fig S43. ^{13}C-NMR spectrum of **20A**

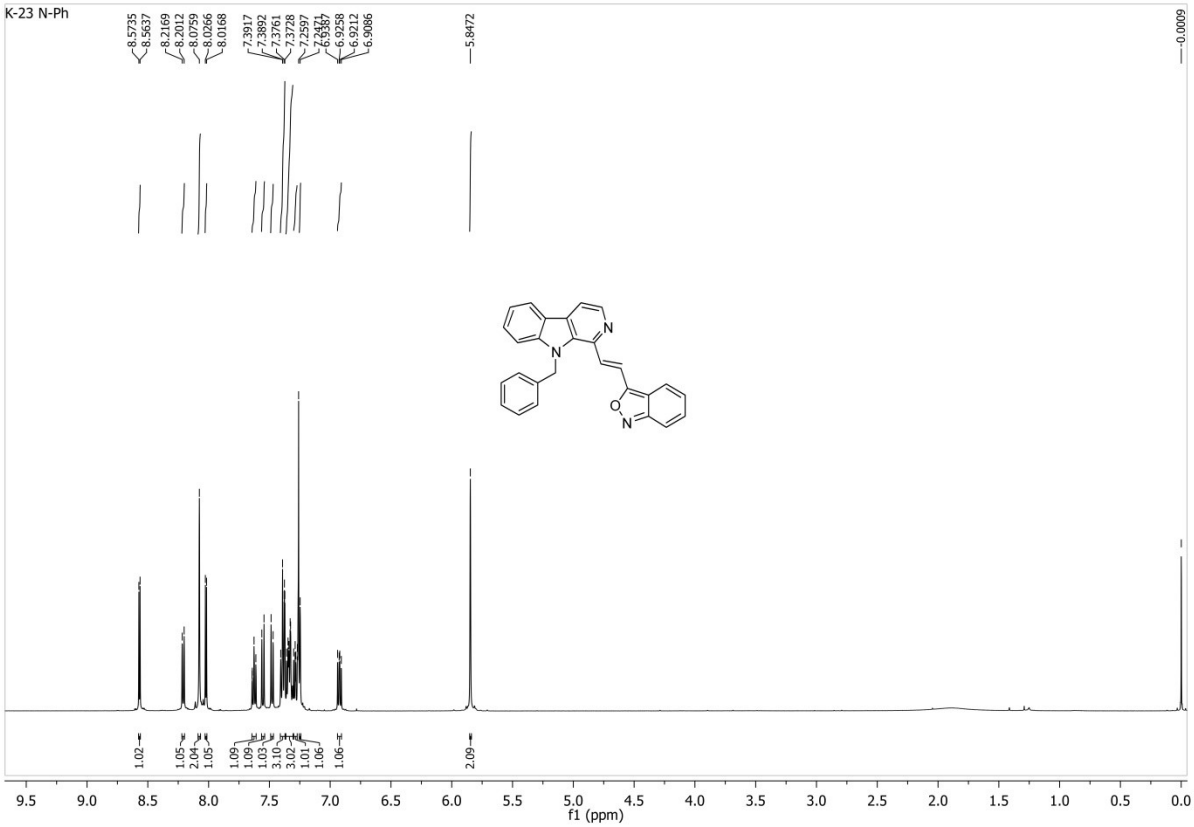

Fig S44. ^{1}H-NMR spectrum of **21A**

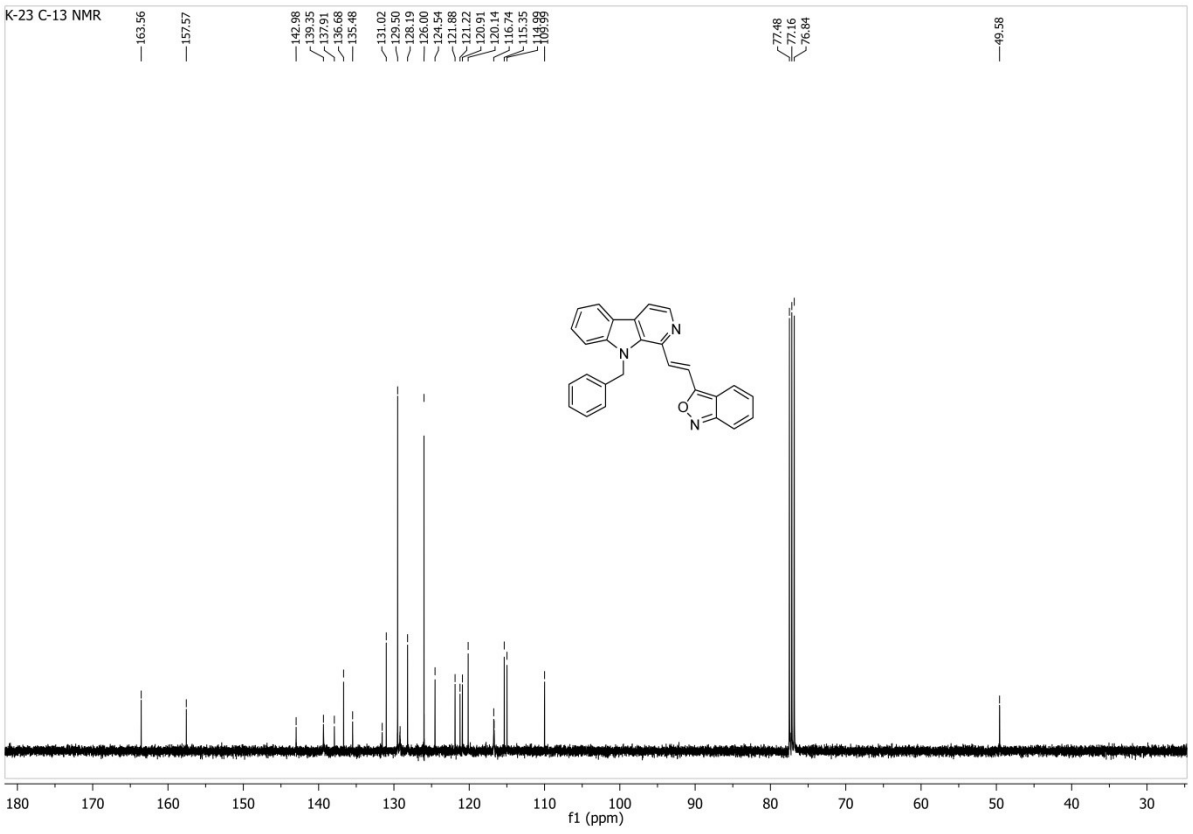

Fig S45. ^{13}C-NMR spectrum of **21A**

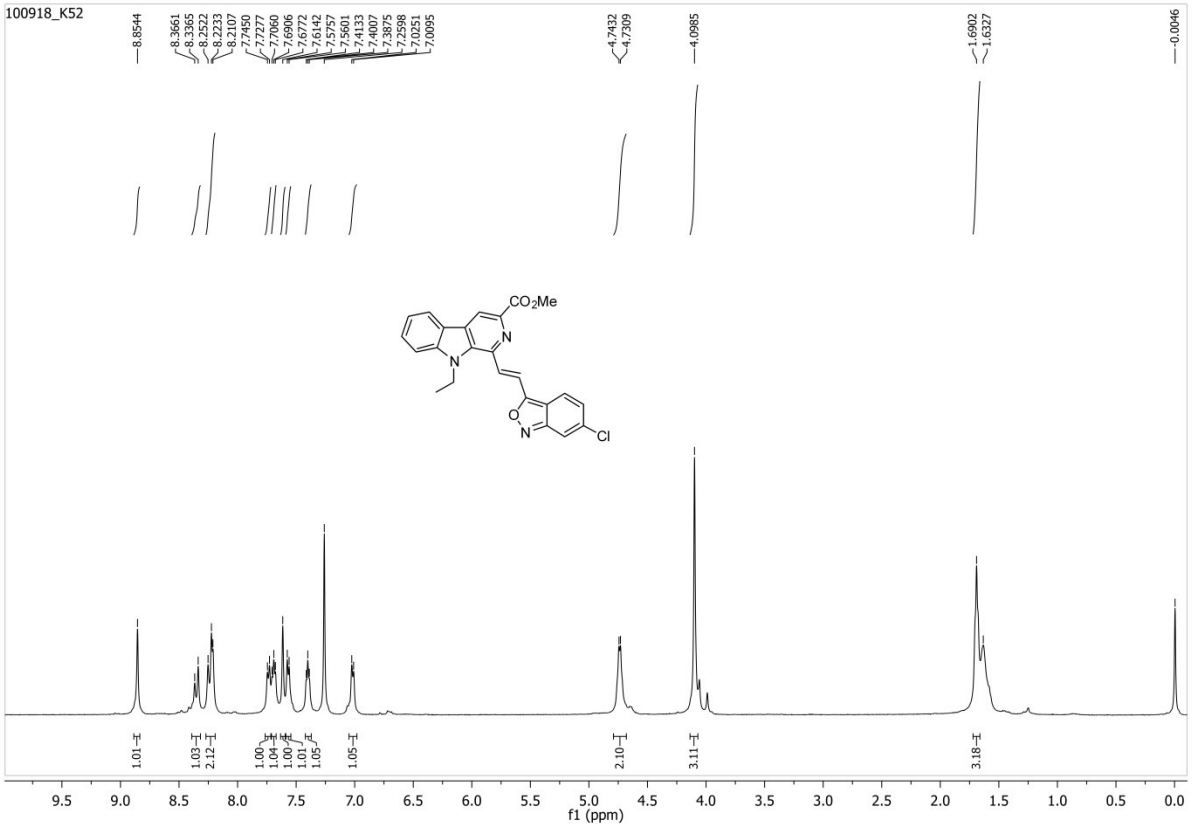

Fig S46. ^{1}H-NMR spectrum of **3B**

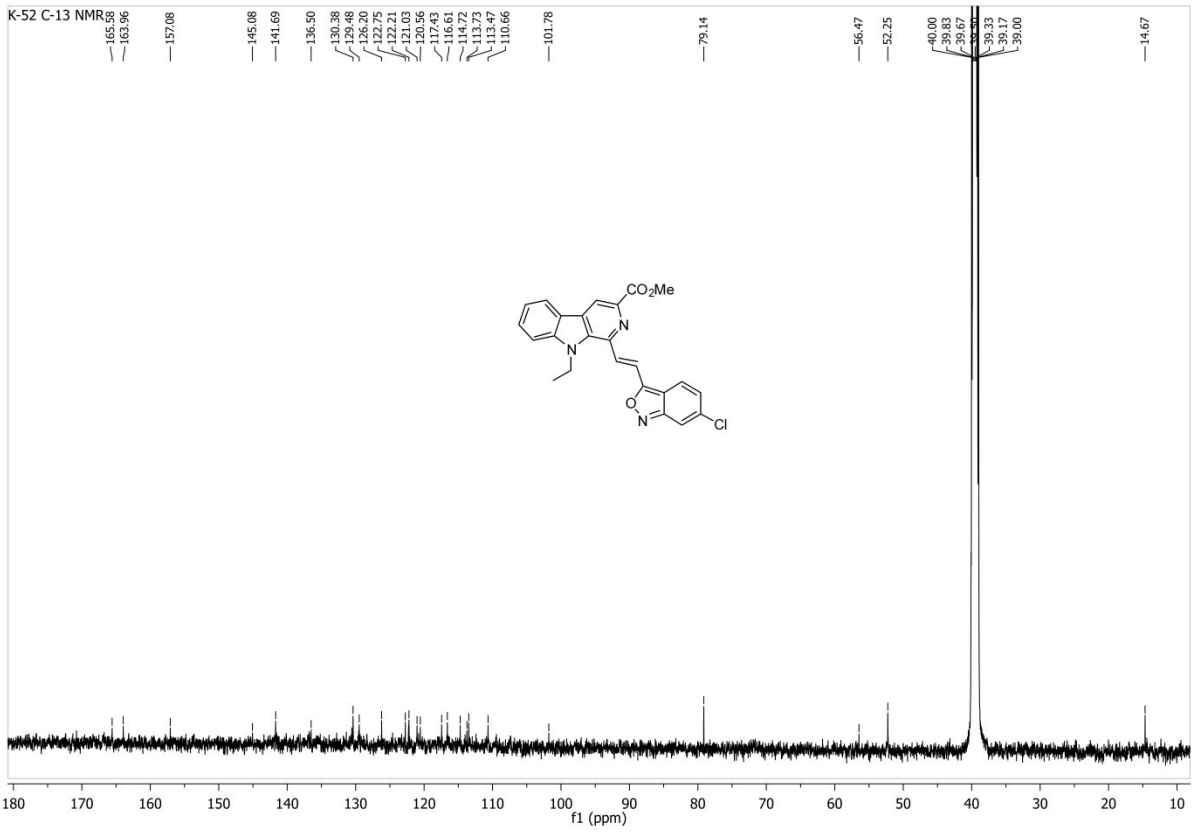

Fig S47. ^{13}C-NMR spectrum of **3B**

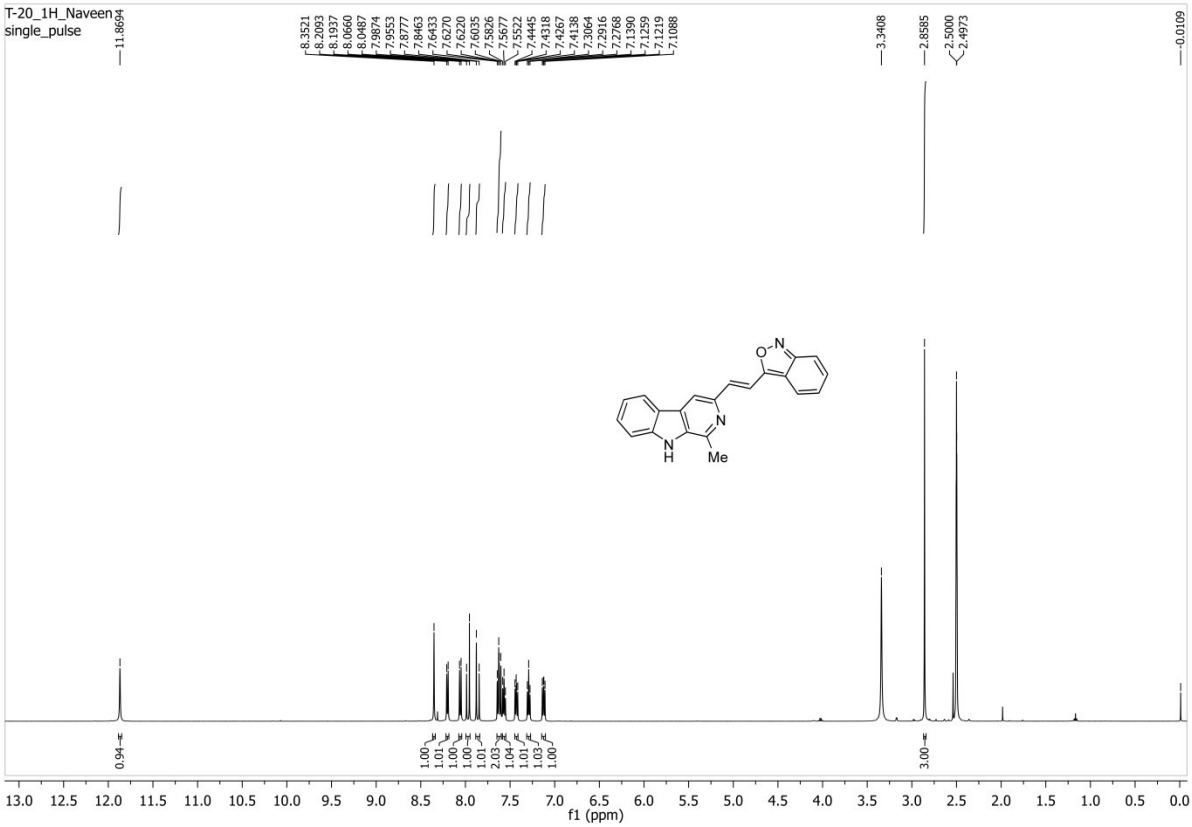

Fig S48. ^{1}H-NMR spectrum of **22A**

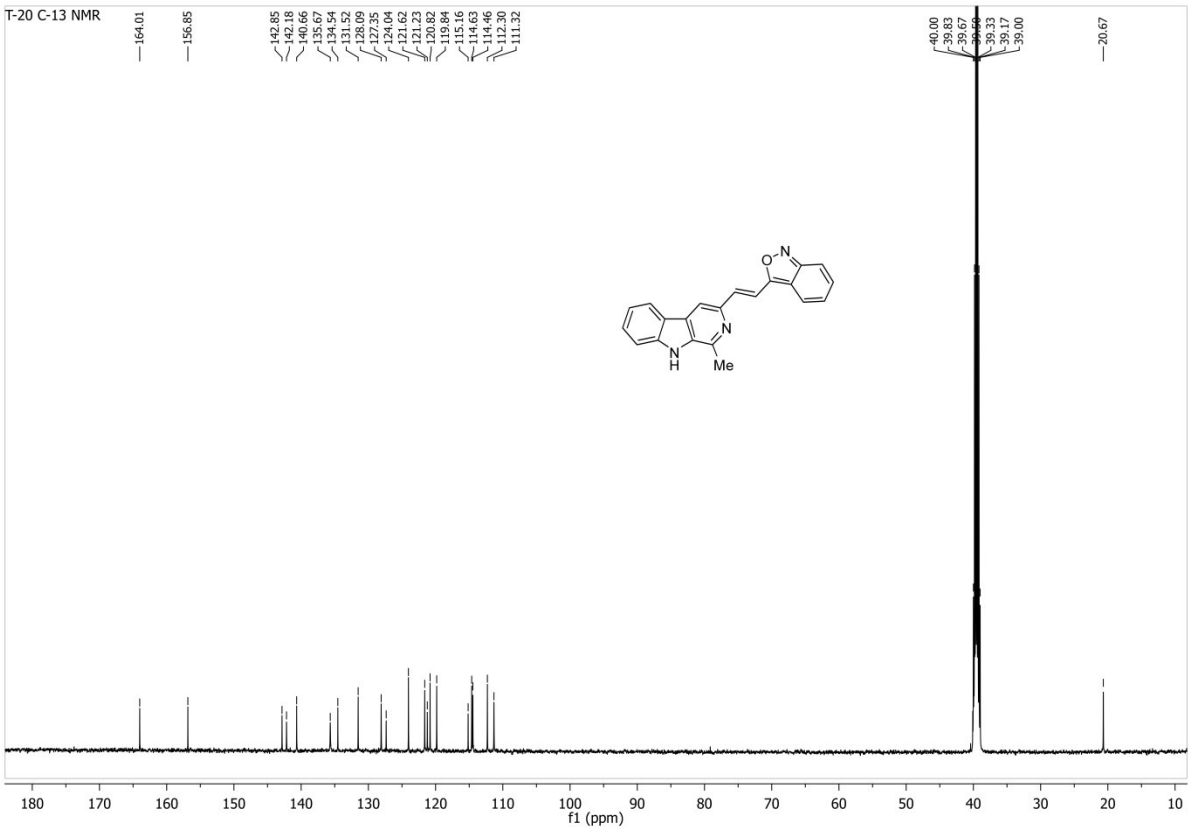

Fig S49. ^{13}C-NMR spectrum of **22A**

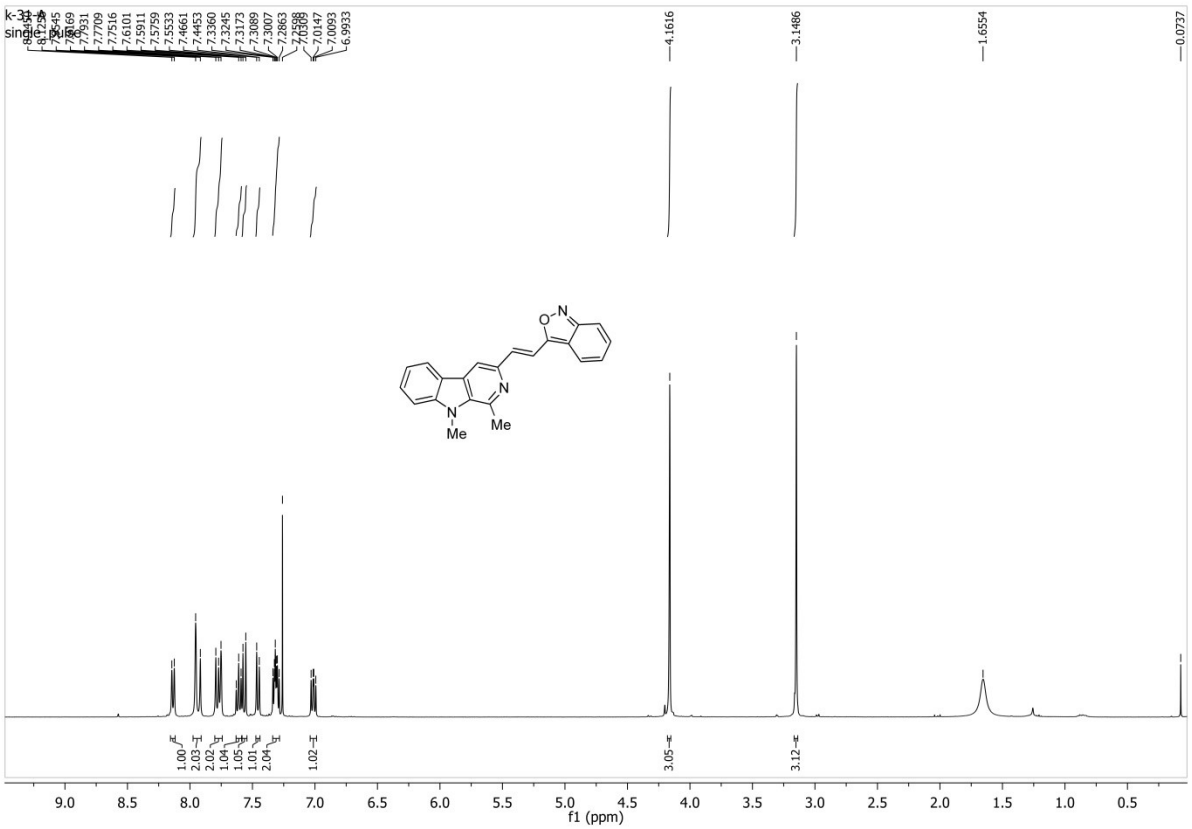

Fig S50. ^{1}H-NMR spectrum of **23A**

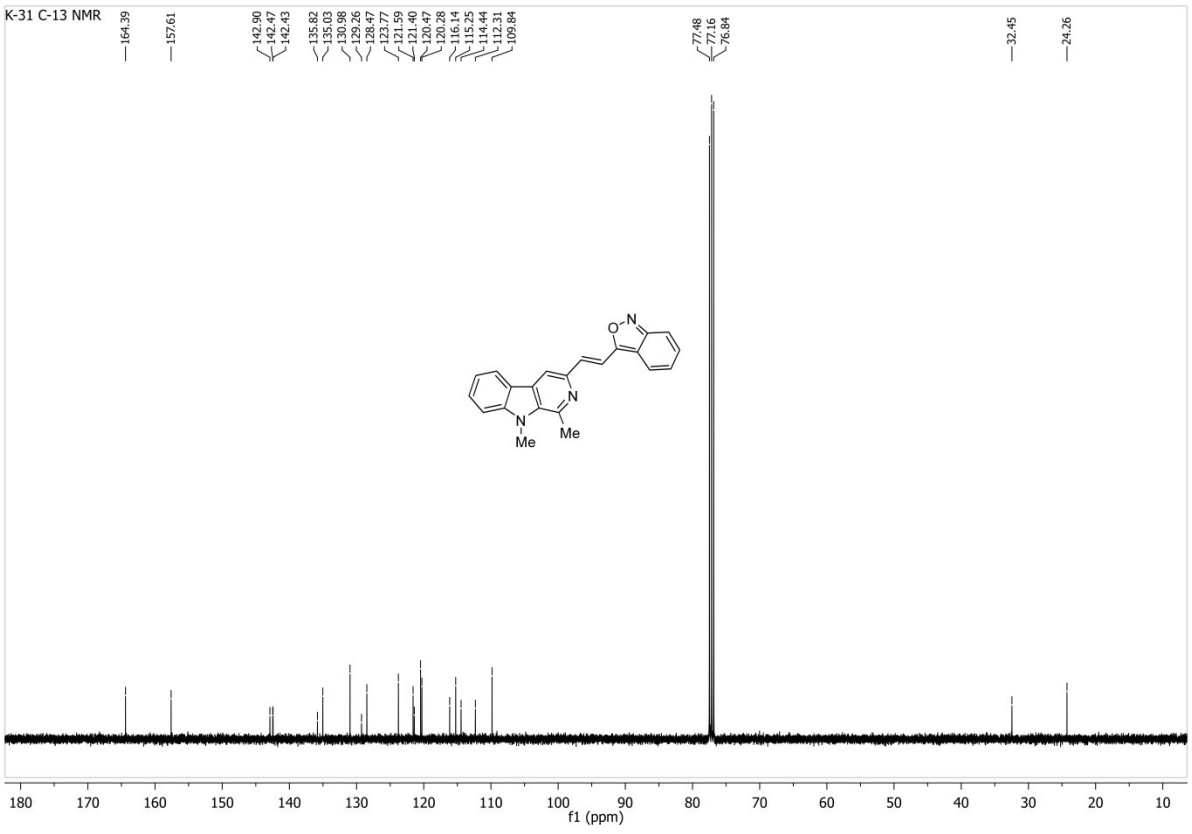

Fig S51. ^{13}C-NMR spectrum of **23A**

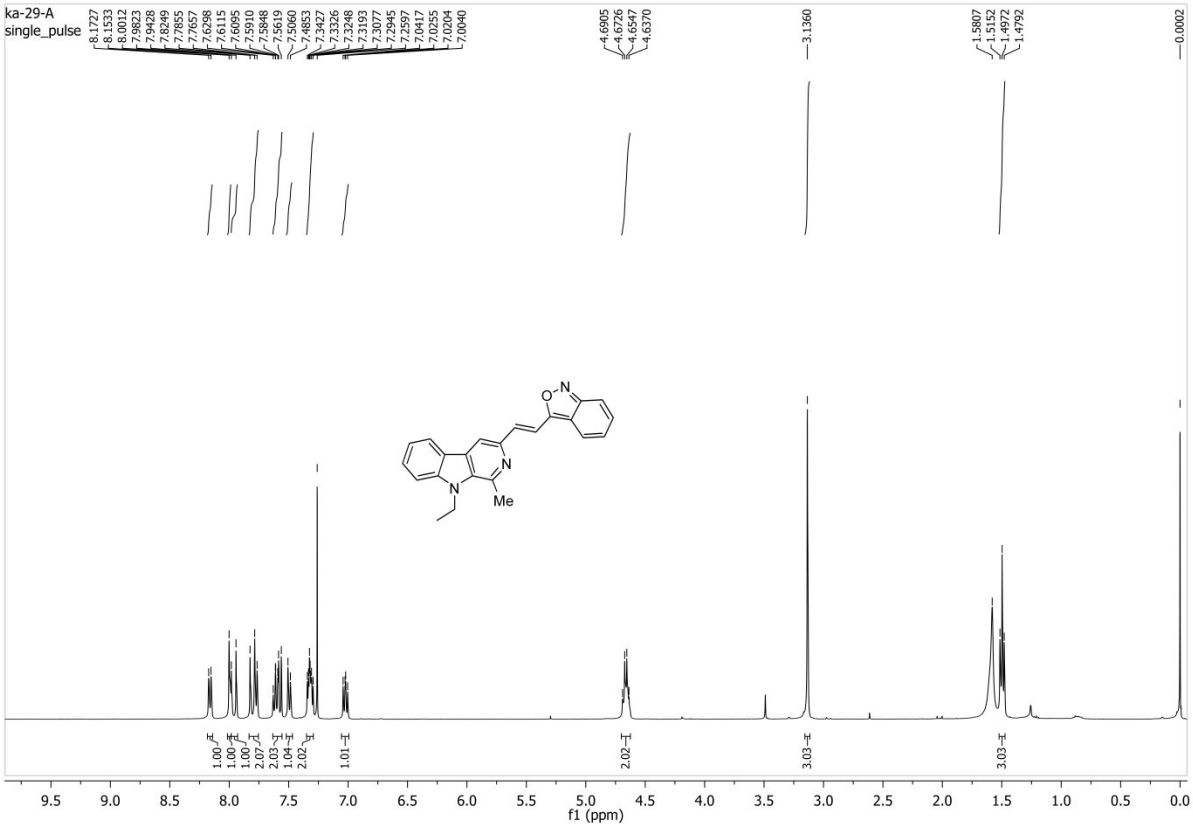

Fig S52. ^{1}H-NMR spectrum of **24A**

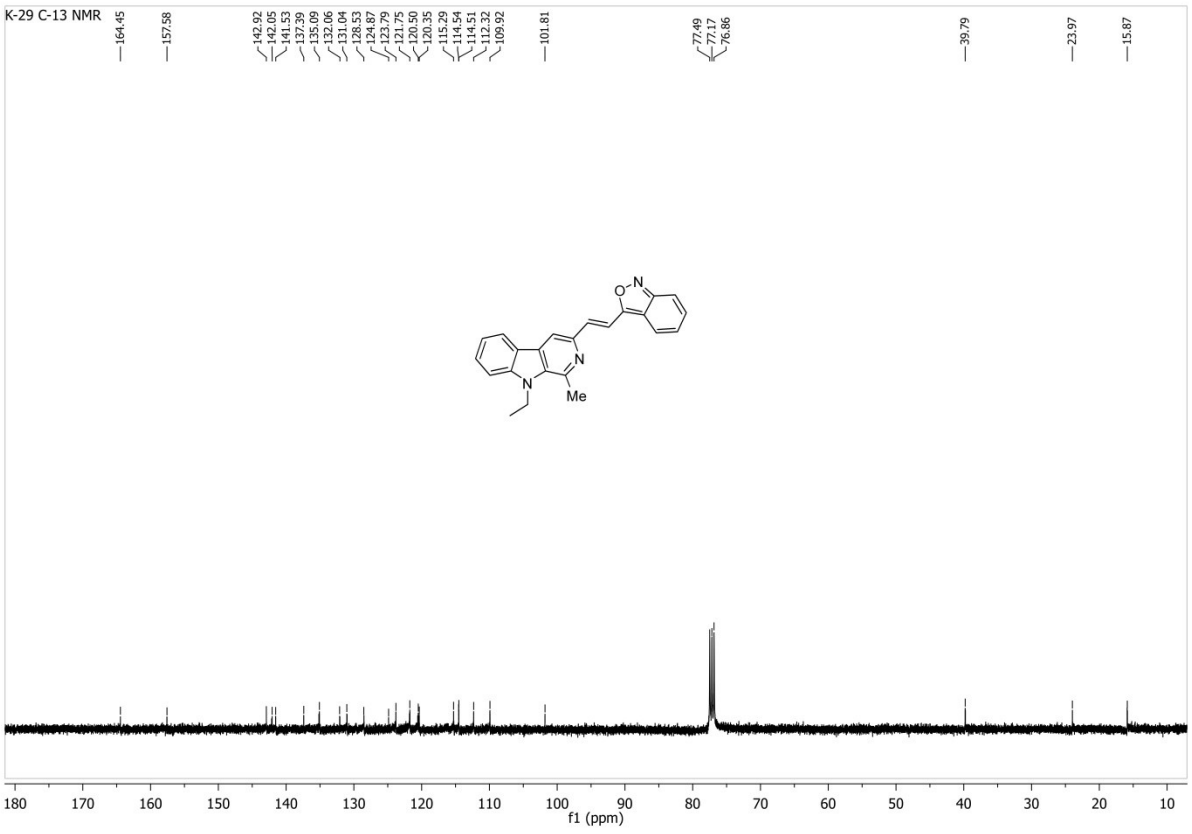

Fig S53. ^{13}C-NMR spectrum of **24A**

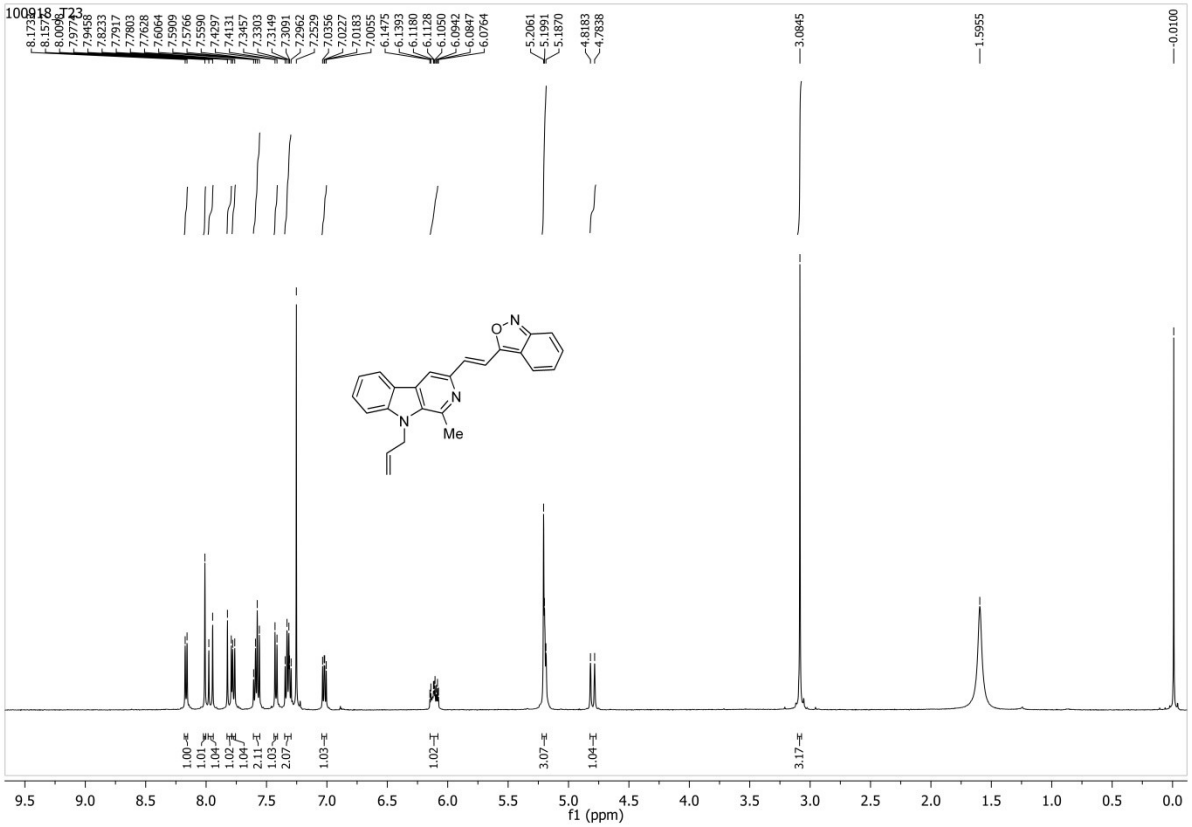

Fig S54. ^{1}H-NMR spectrum of **25A**

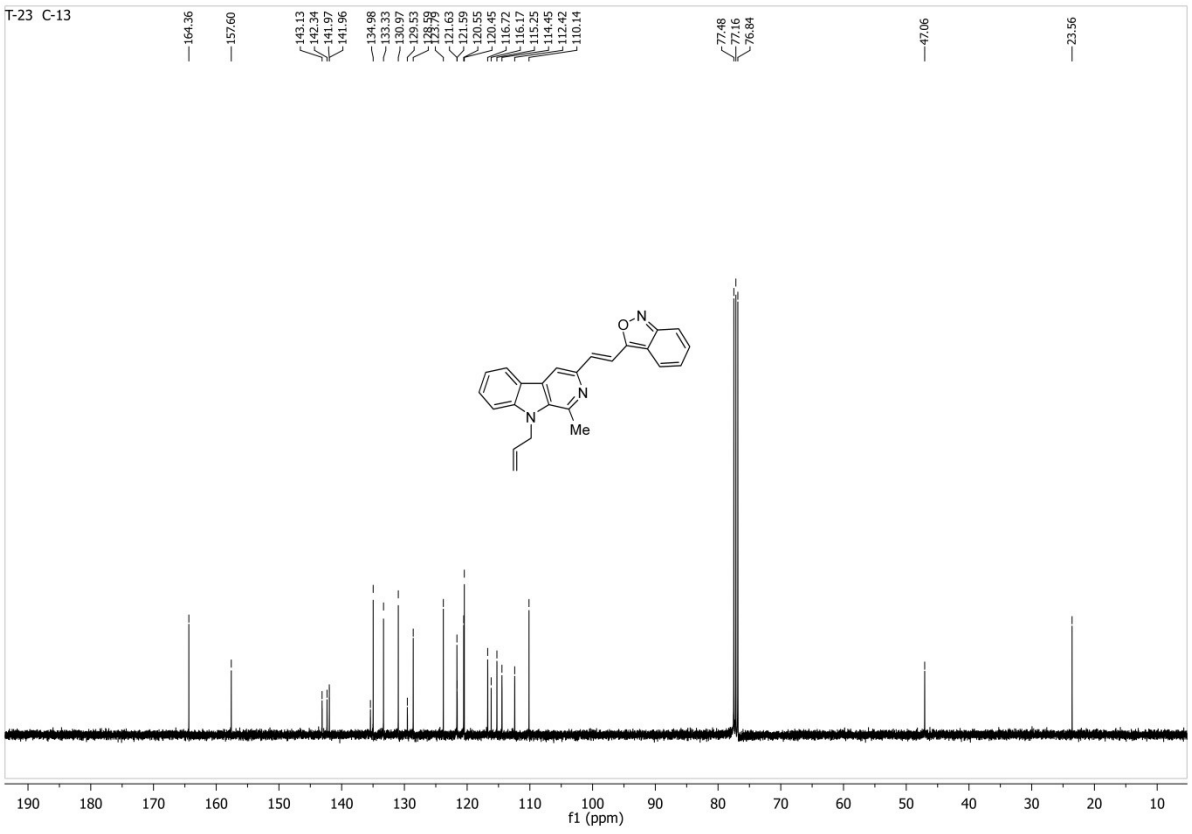

Fig S55. ^{13}C-NMR spectrum of **25A**

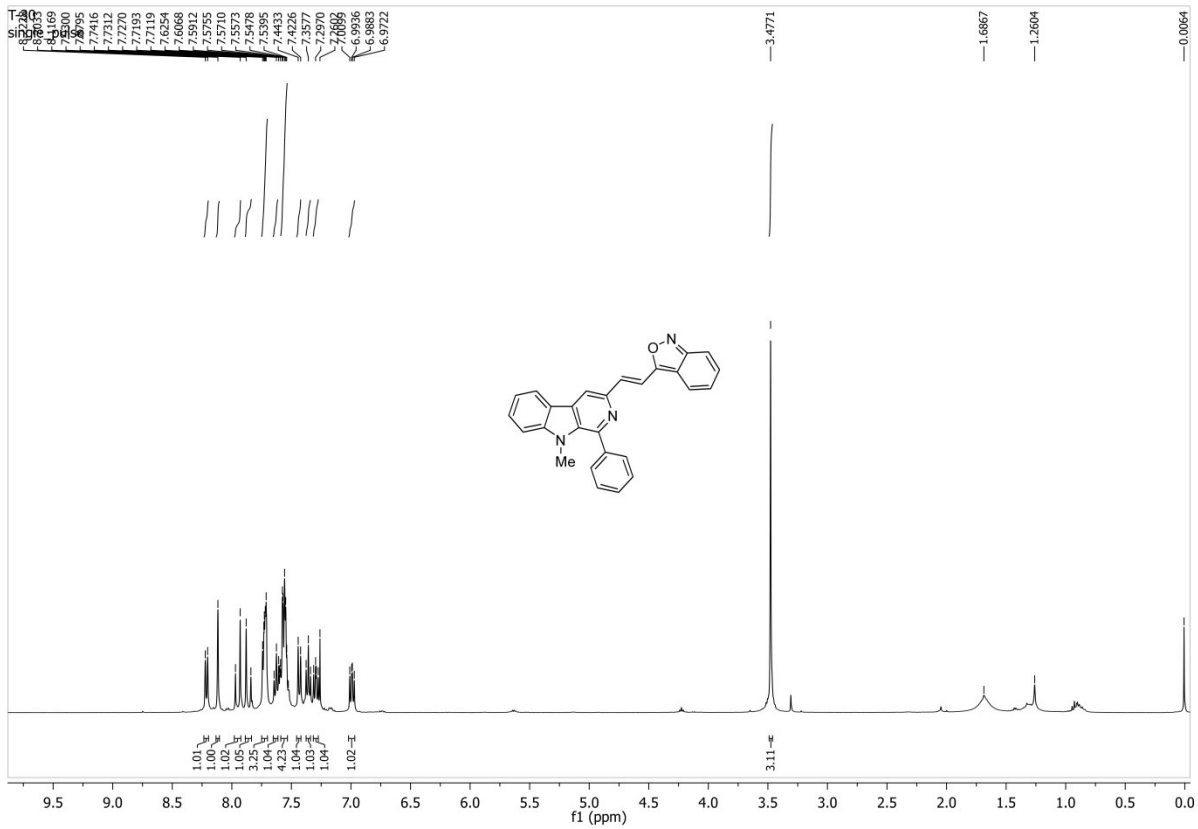

Fig S56. ^{1}H-NMR spectrum of **26A**

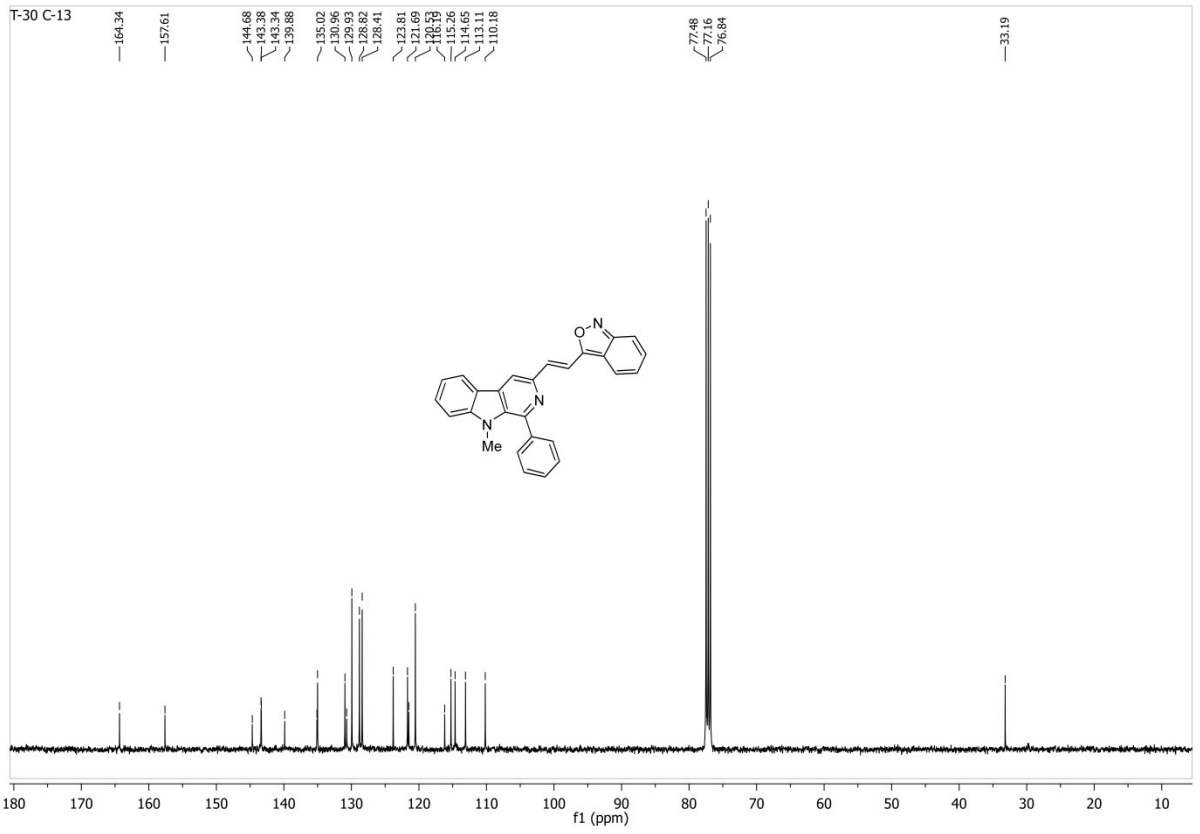

Fig S57. ^{13}C-NMR spectrum of **26A**

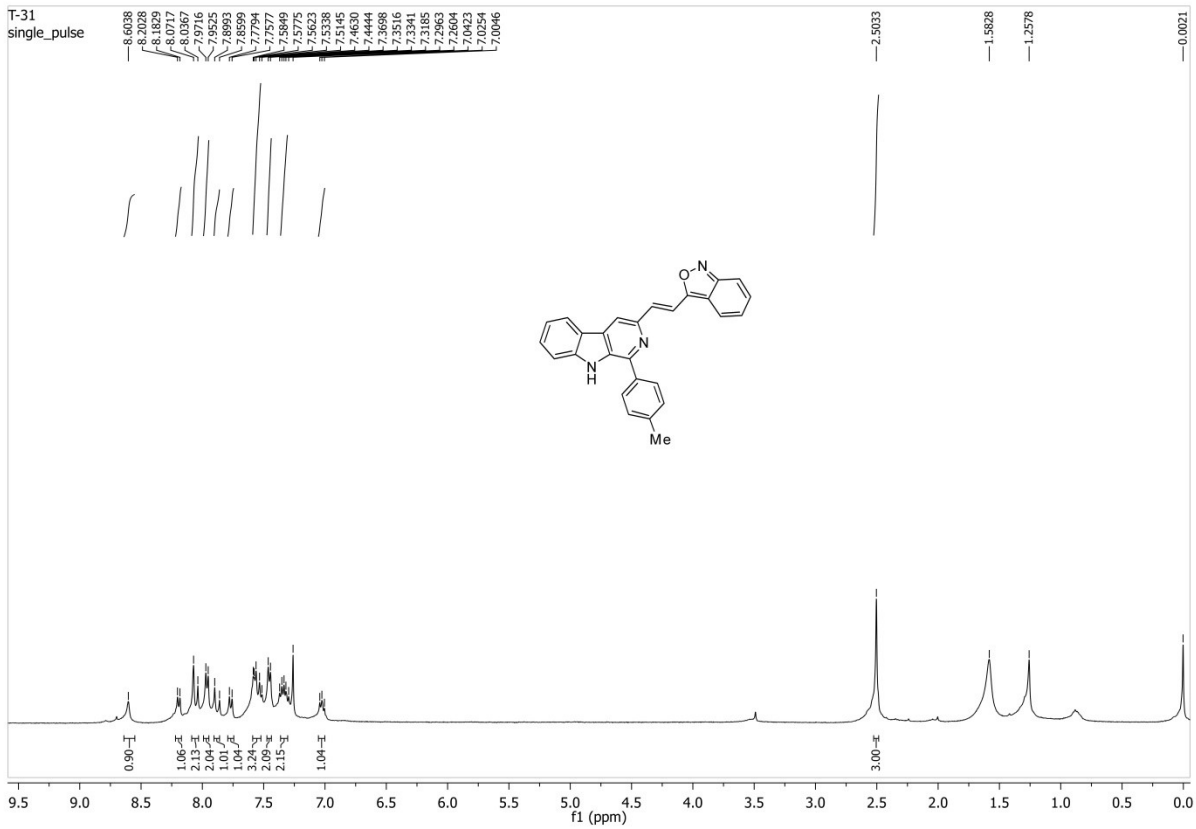

Fig S58. ^{1}H-NMR spectrum of **27A**

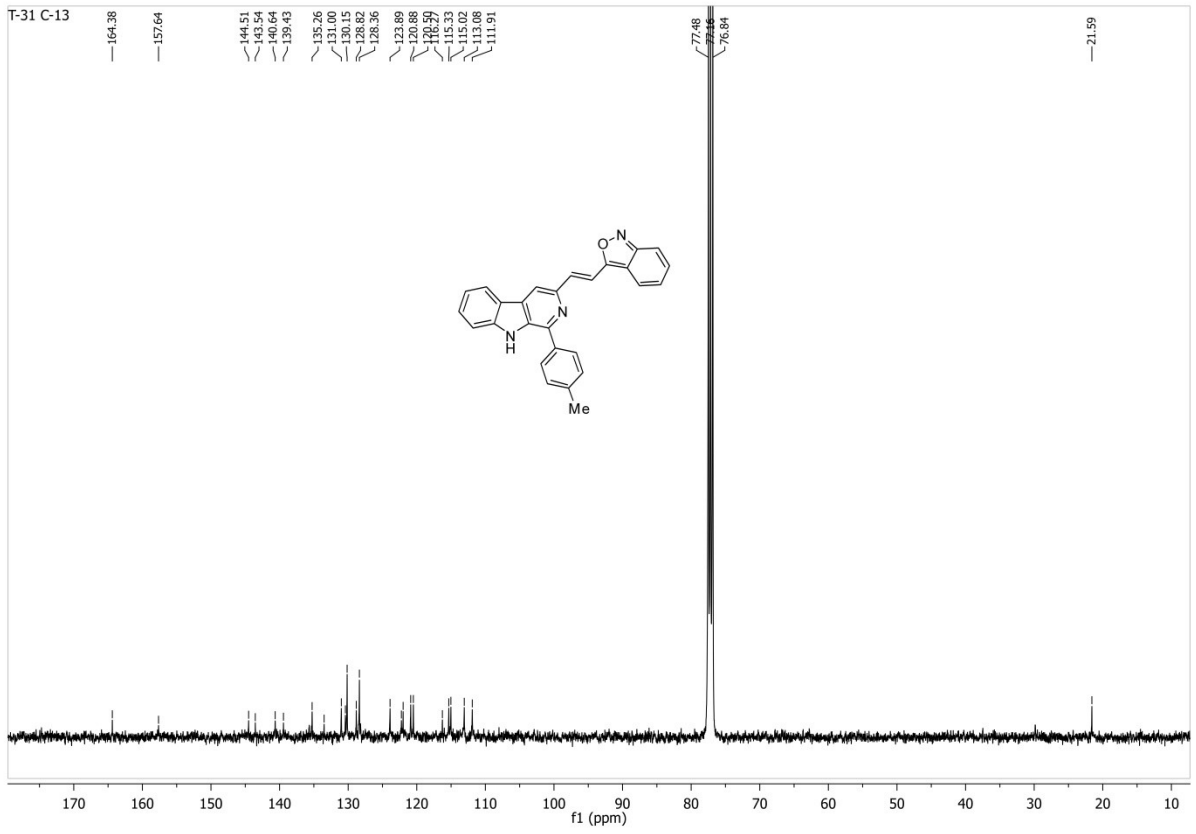

Fig S59. ^{13}C-NMR spectrum of **27A**

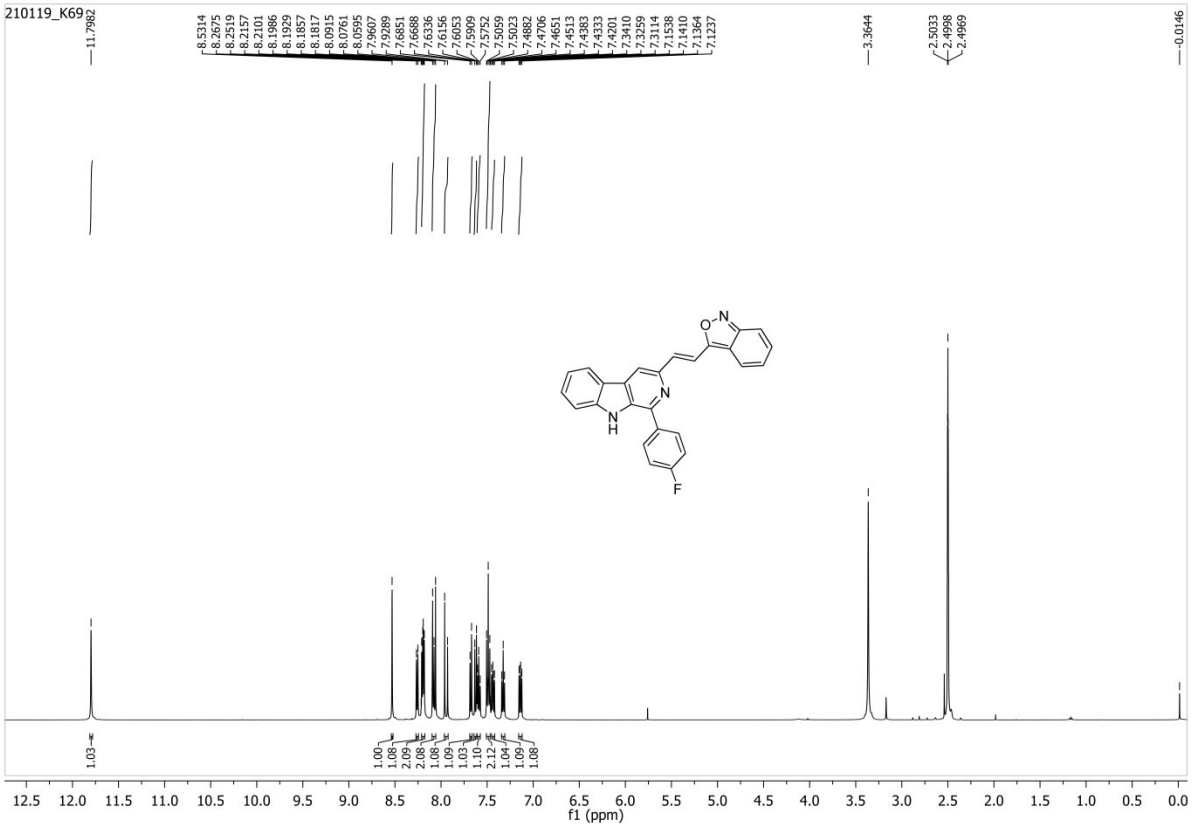

Fig S60. ^{1}H-NMR spectrum of **28A**

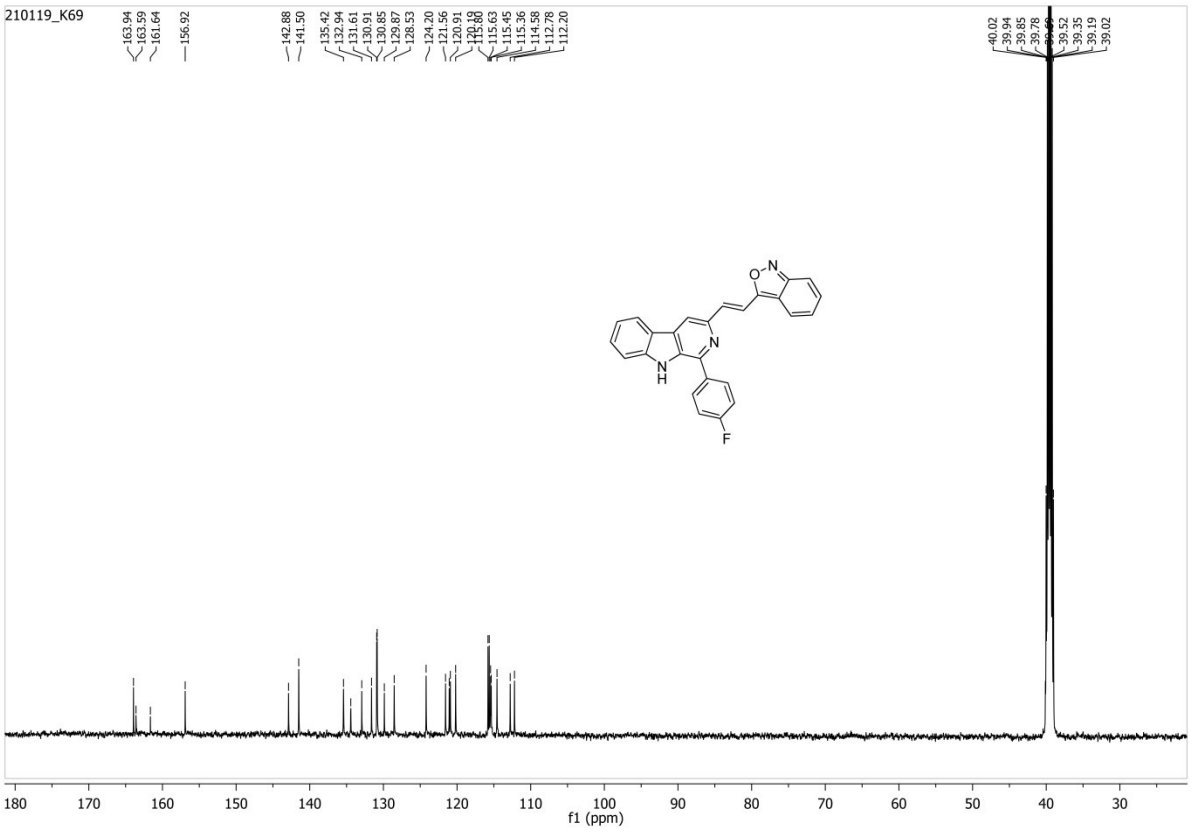

Fig S61. ^{13}C-NMR spectrum of **28A**

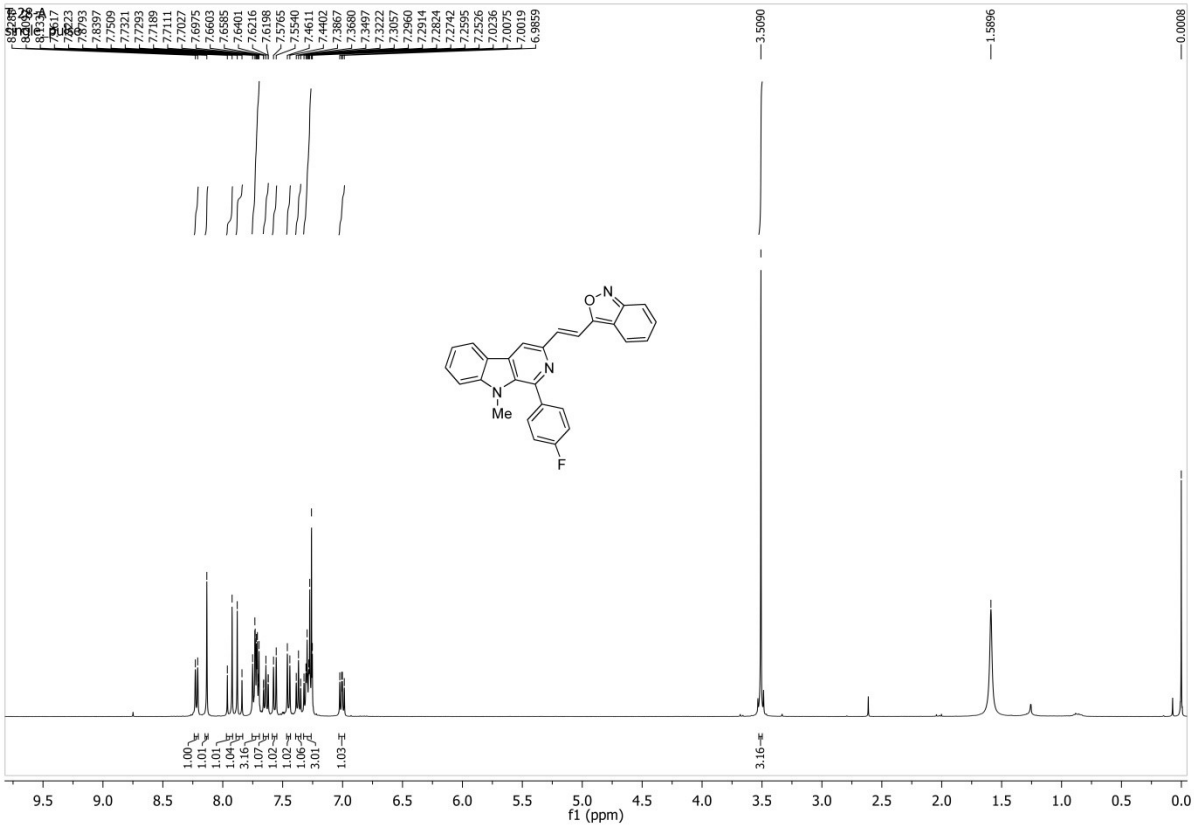

Fig S62. ^{1}H-NMR spectrum of **29A**

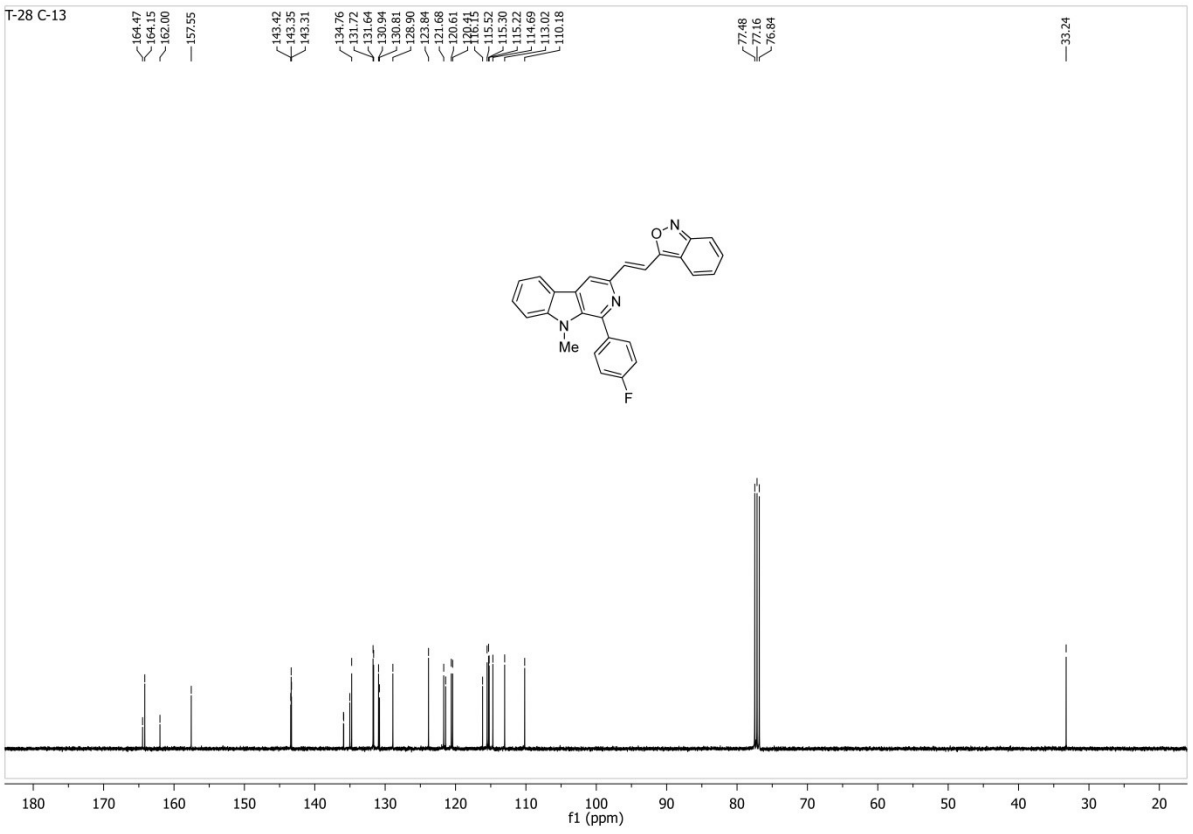

Fig S63. ^{13}C-NMR spectrum of **29A**

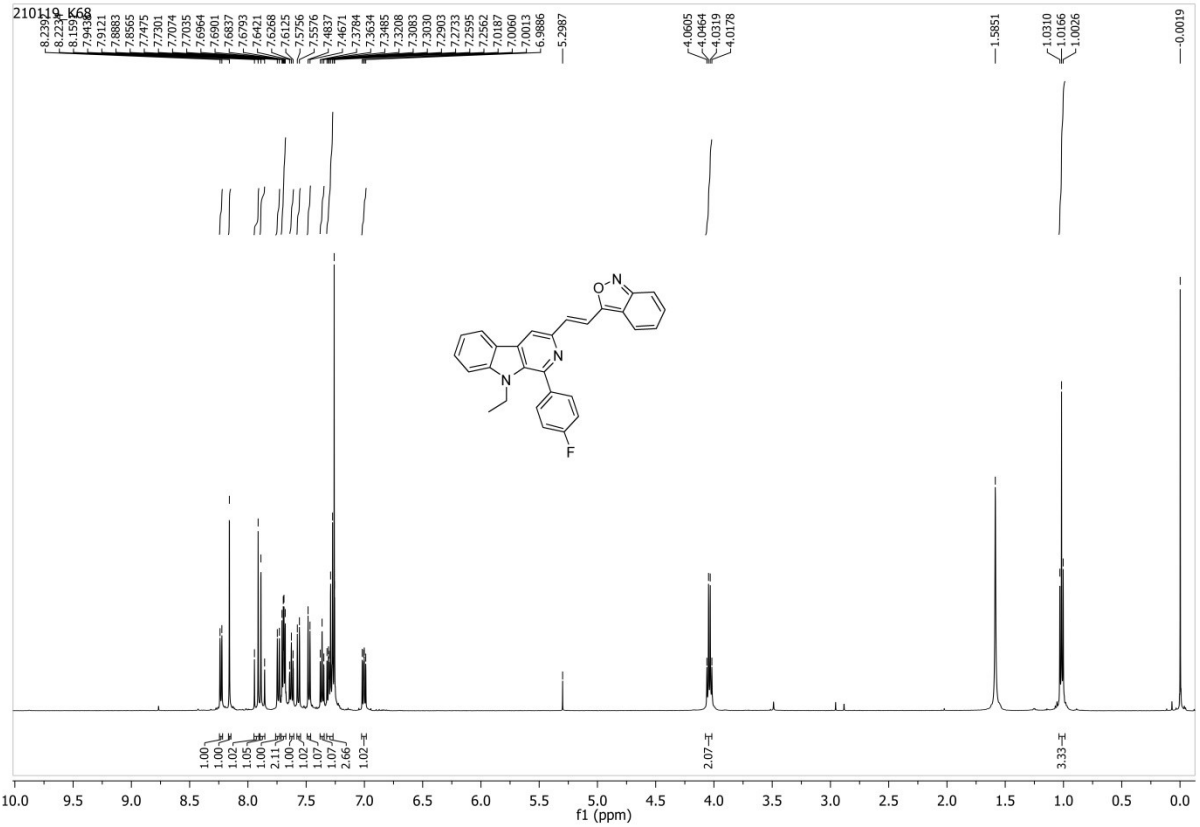

Fig S64. ^{1}H-NMR spectrum of **30A**

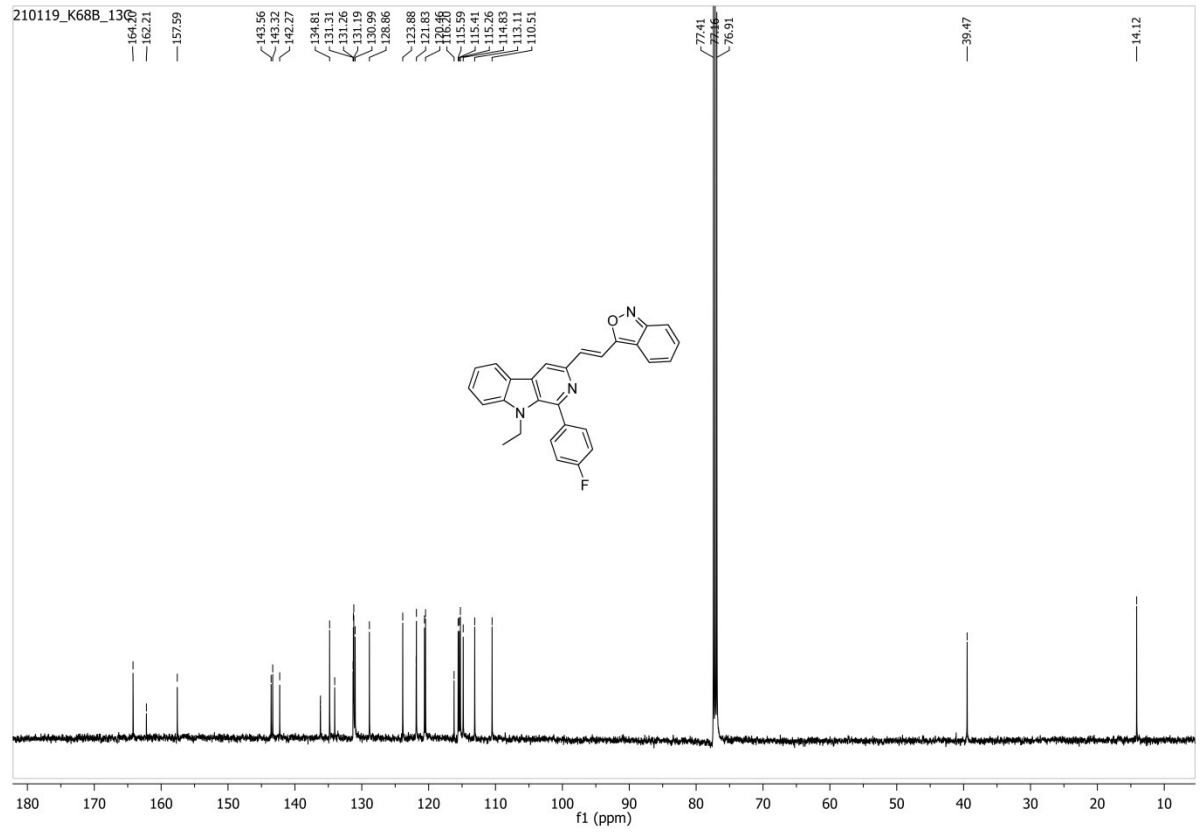

Fig S65. ^{13}C-NMR spectrum of **30A**

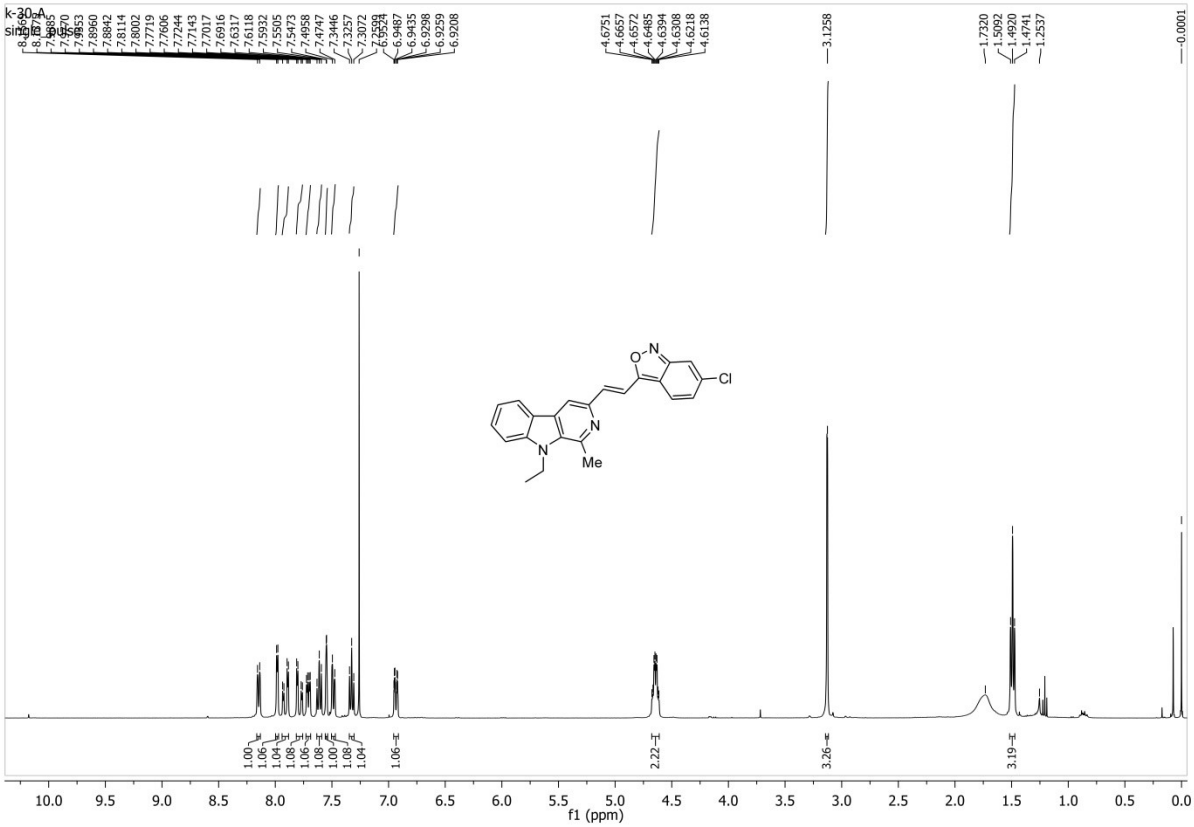

Fig S66. ^{1}H-NMR spectrum of **24B**

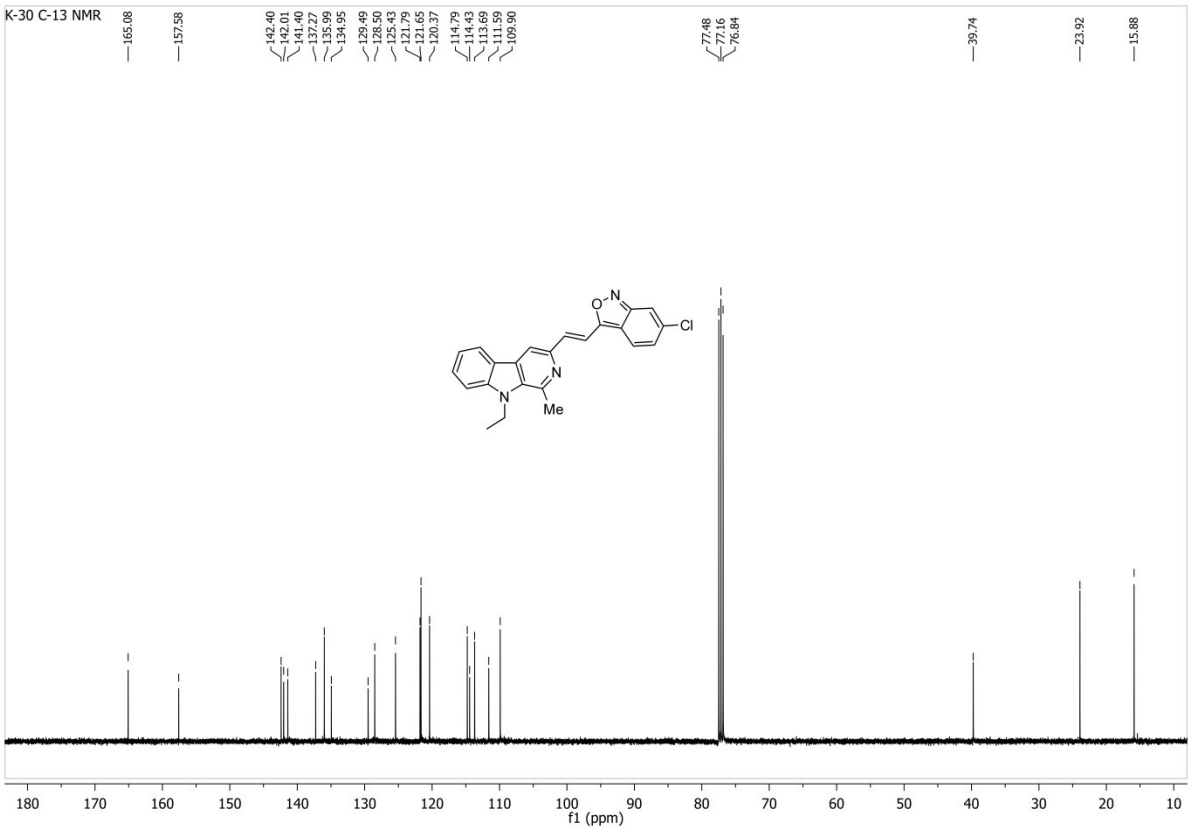

Fig S67. ^{13}C-NMR spectrum of **24B**

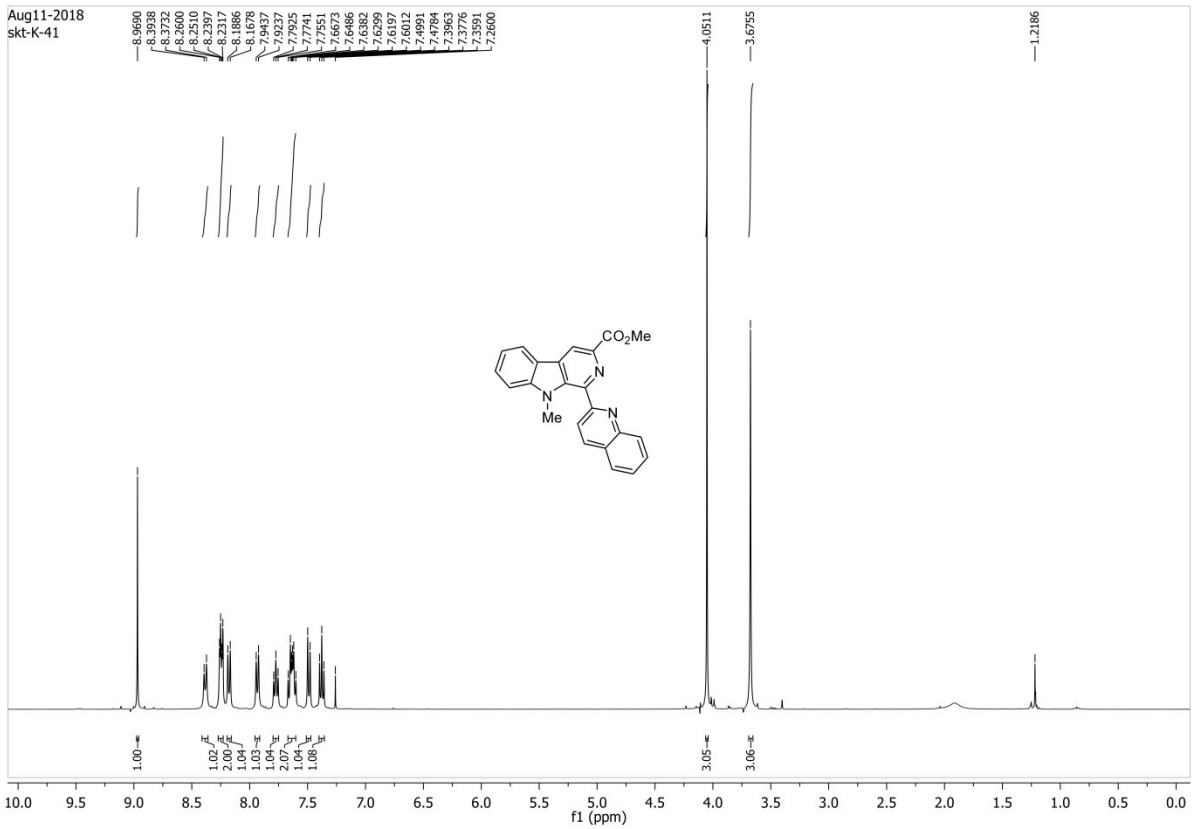

Fig S68. ^{1}H-NMR spectrum of **32a'**

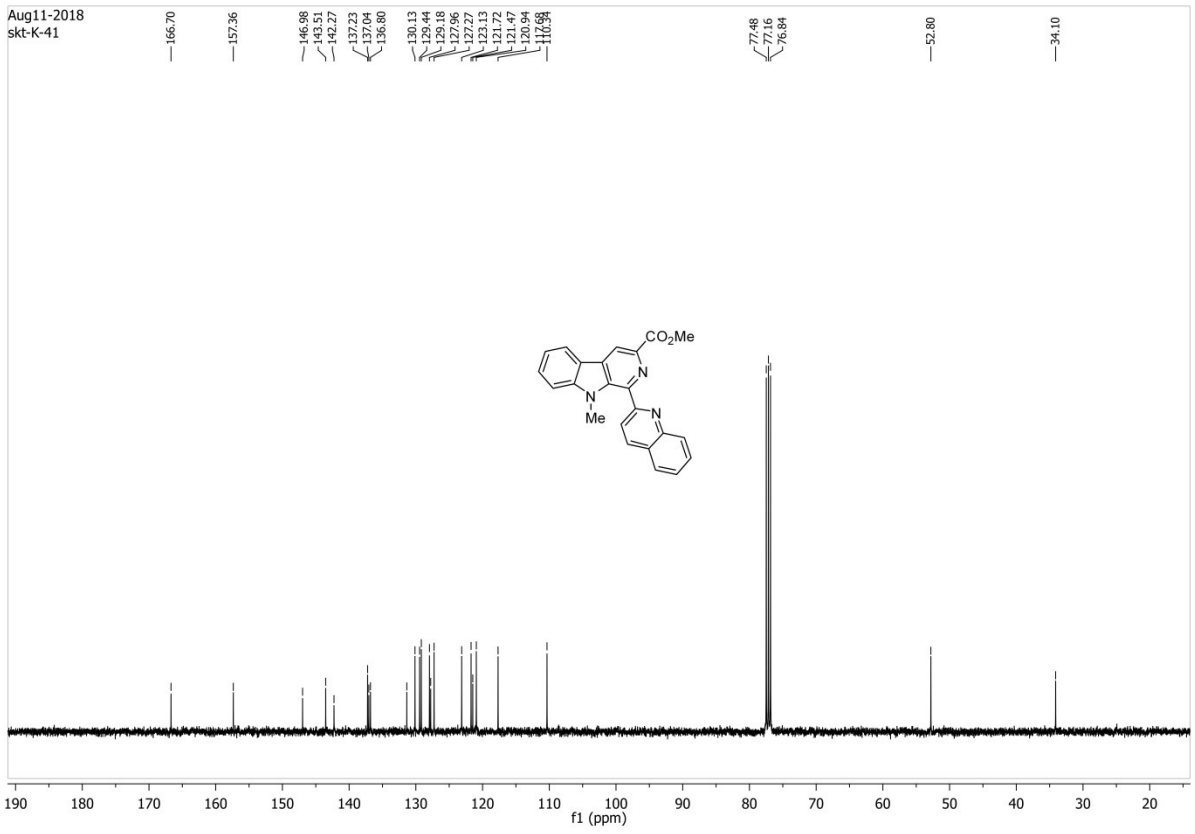

Fig S69. ^{13}C-NMR spectrum of **32a'**

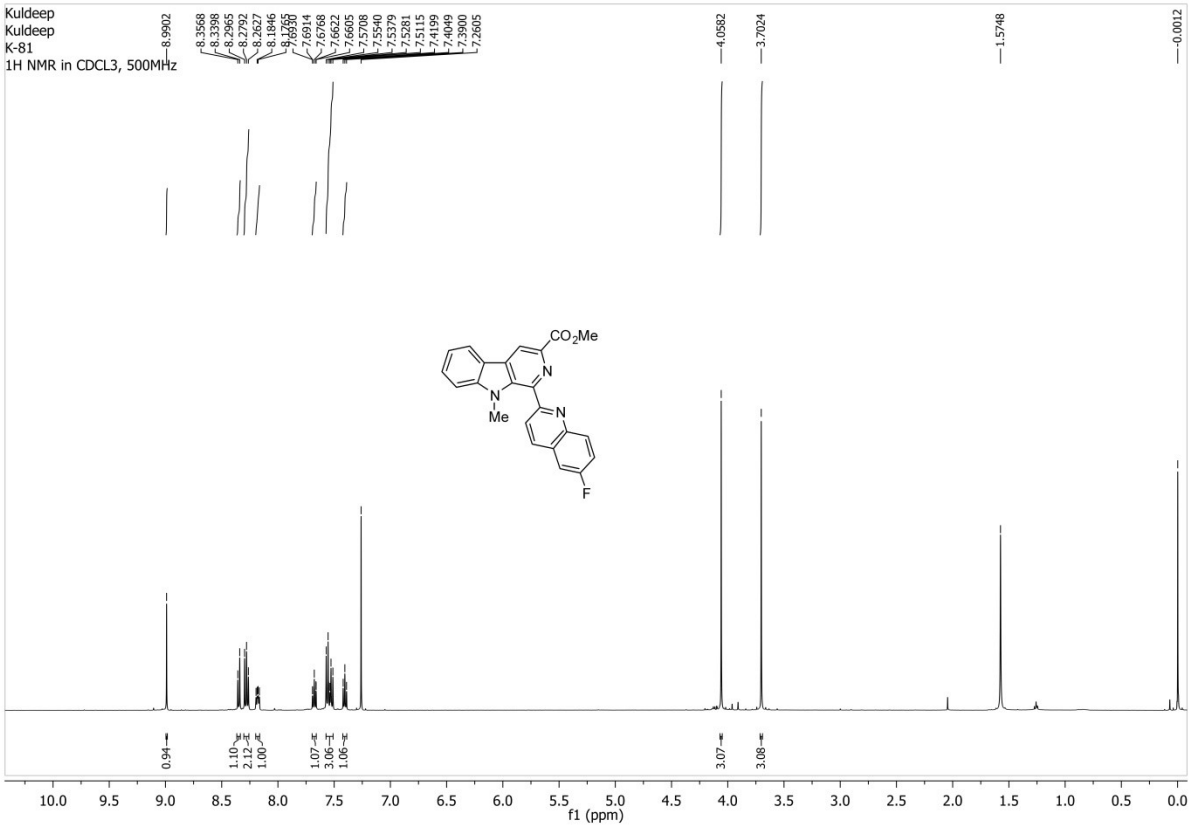

Fig S70. ^{1}H-NMR spectrum of **32b'**

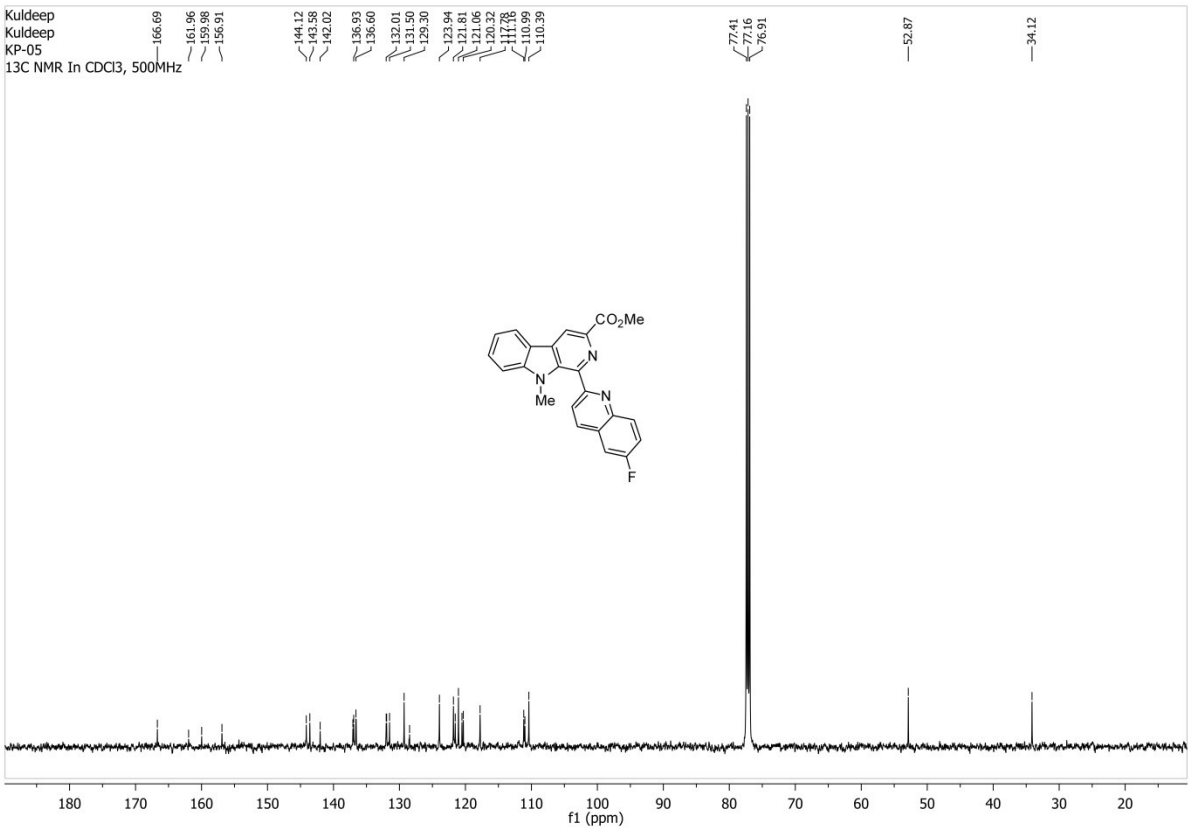

Fig S71. ^{13}C-NMR spectrum of **32b'**

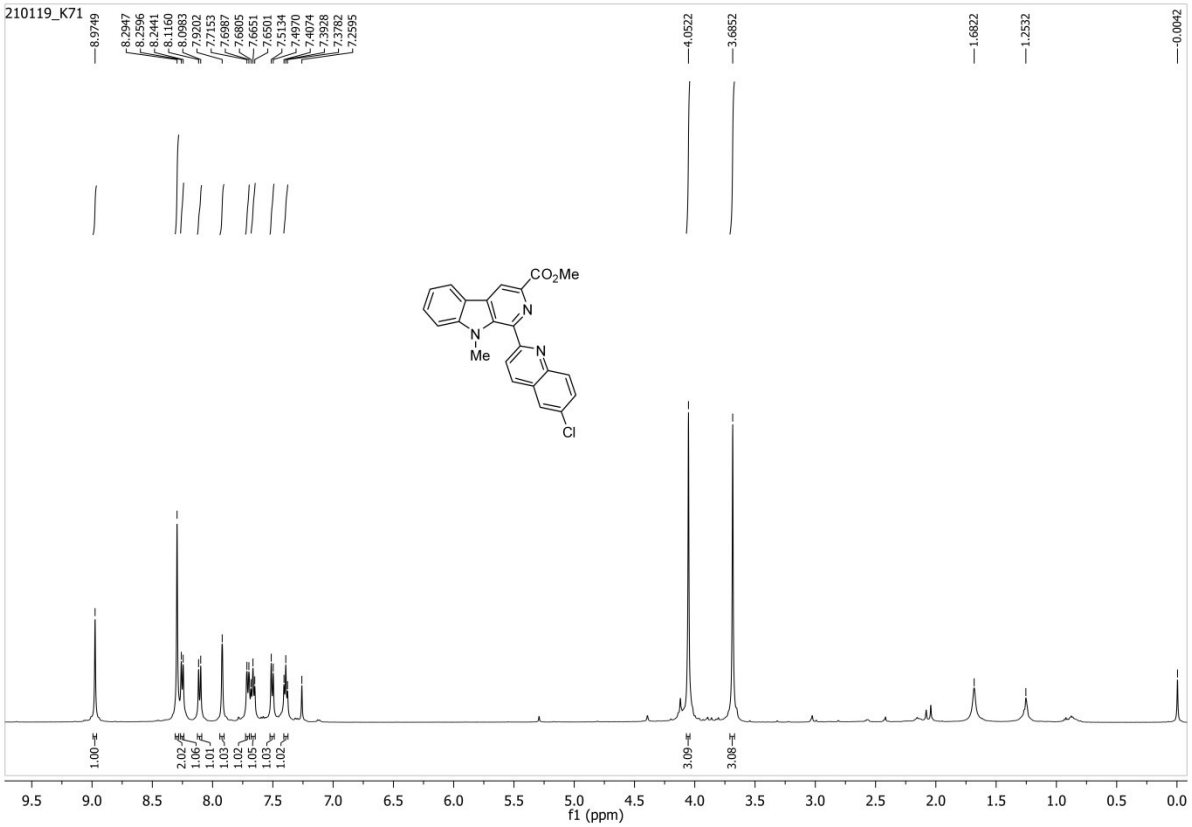

Fig S72. ^{1}H-NMR spectrum of **32c'**

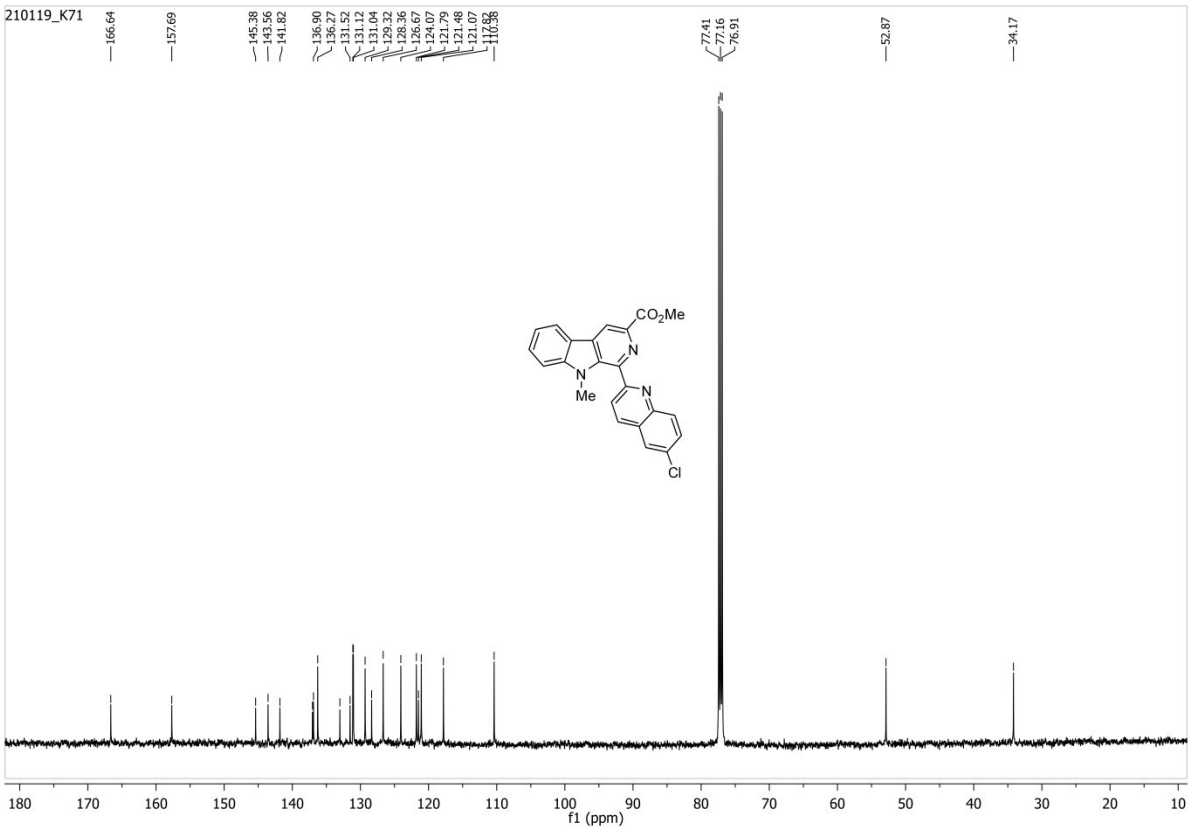

Fig S73. ^{13}C-NMR spectrum of **32c'**

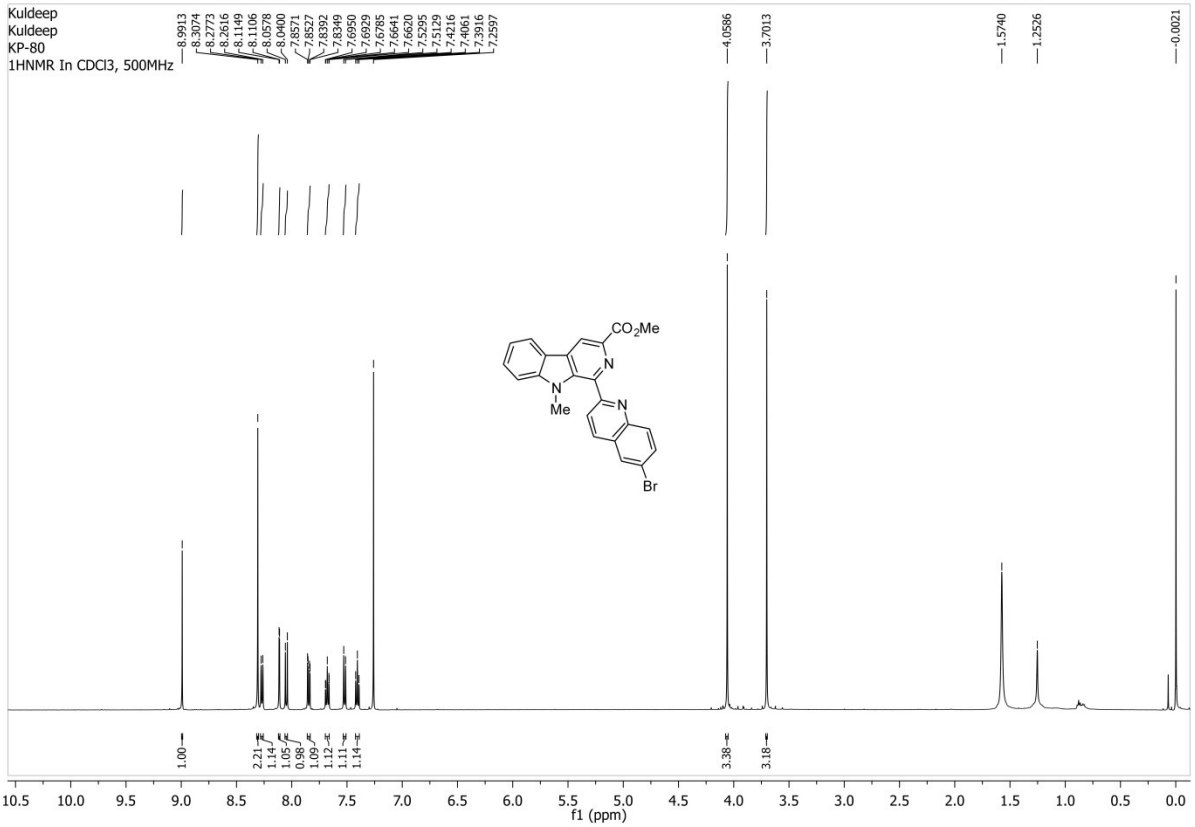

Fig S74. [1]H-NMR spectrum of **32d'**

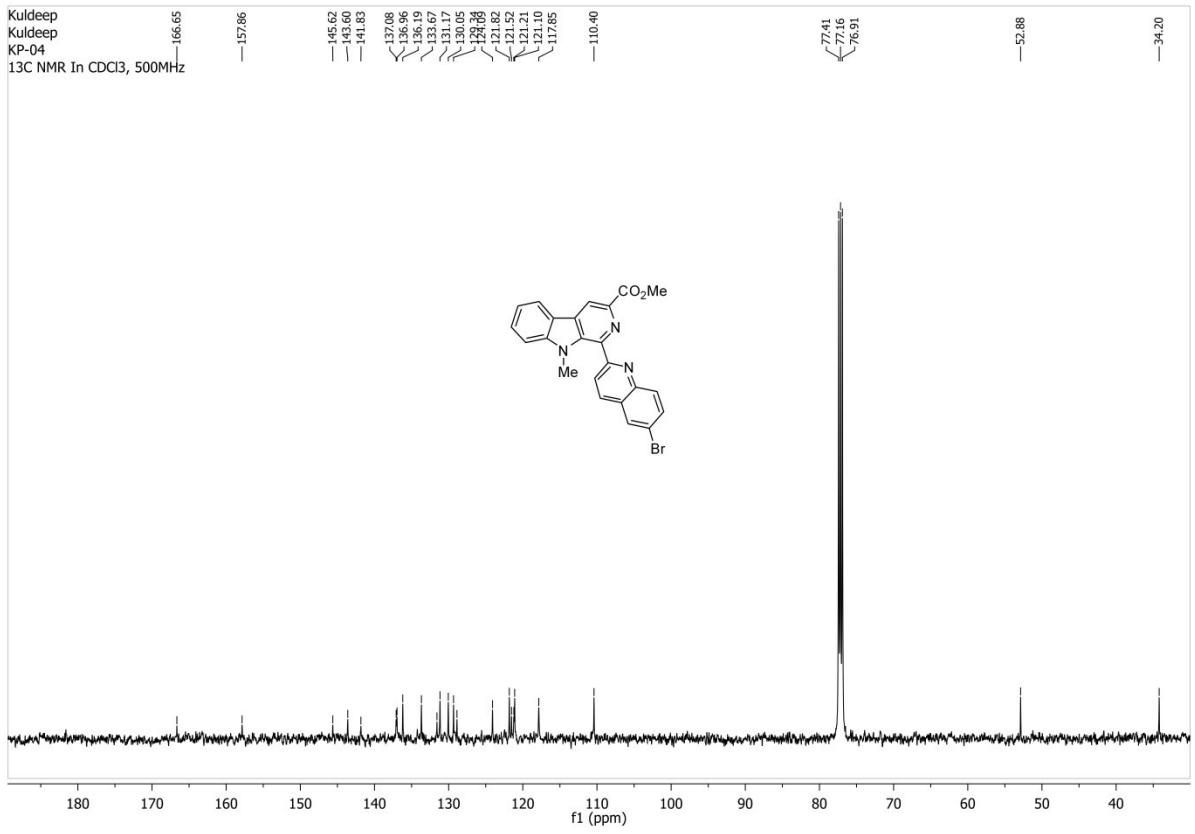

Fig S75. [13]C-NMR spectrum of **32d'**

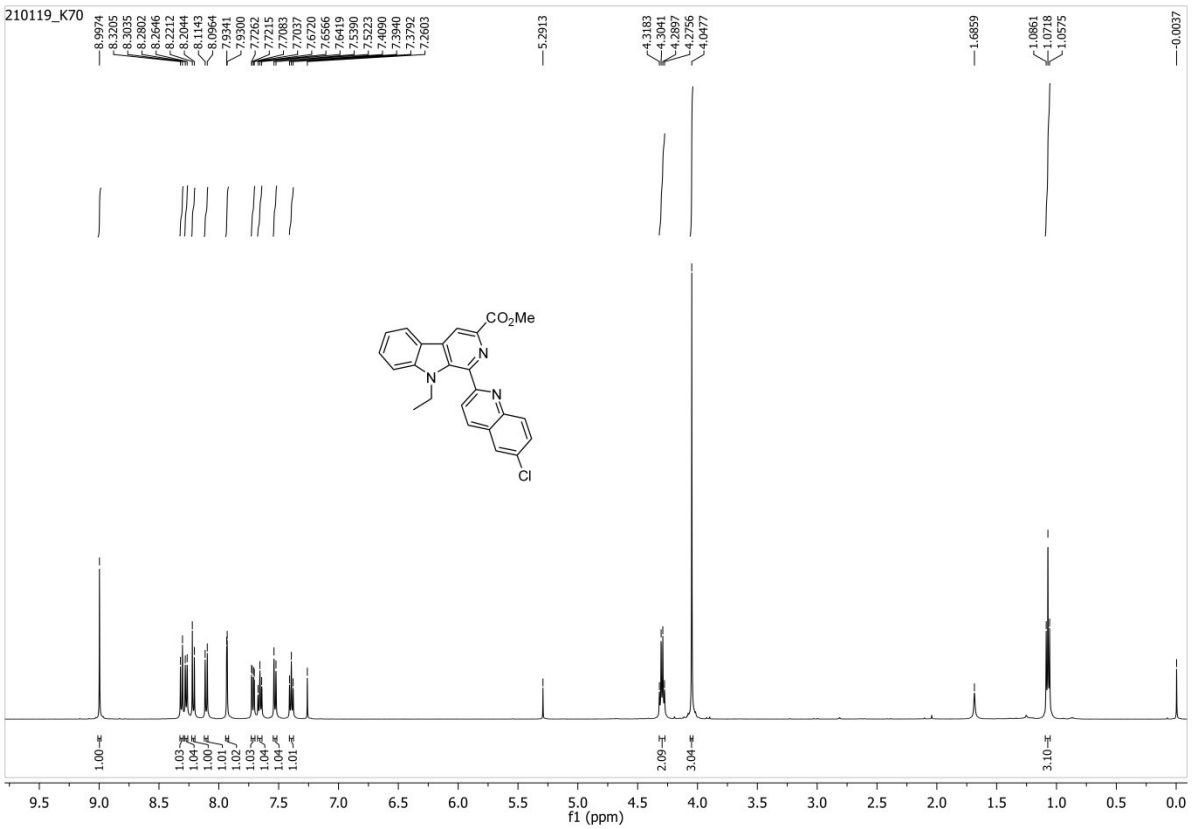

Fig S76. ^{1}H-NMR spectrum of **33c'**

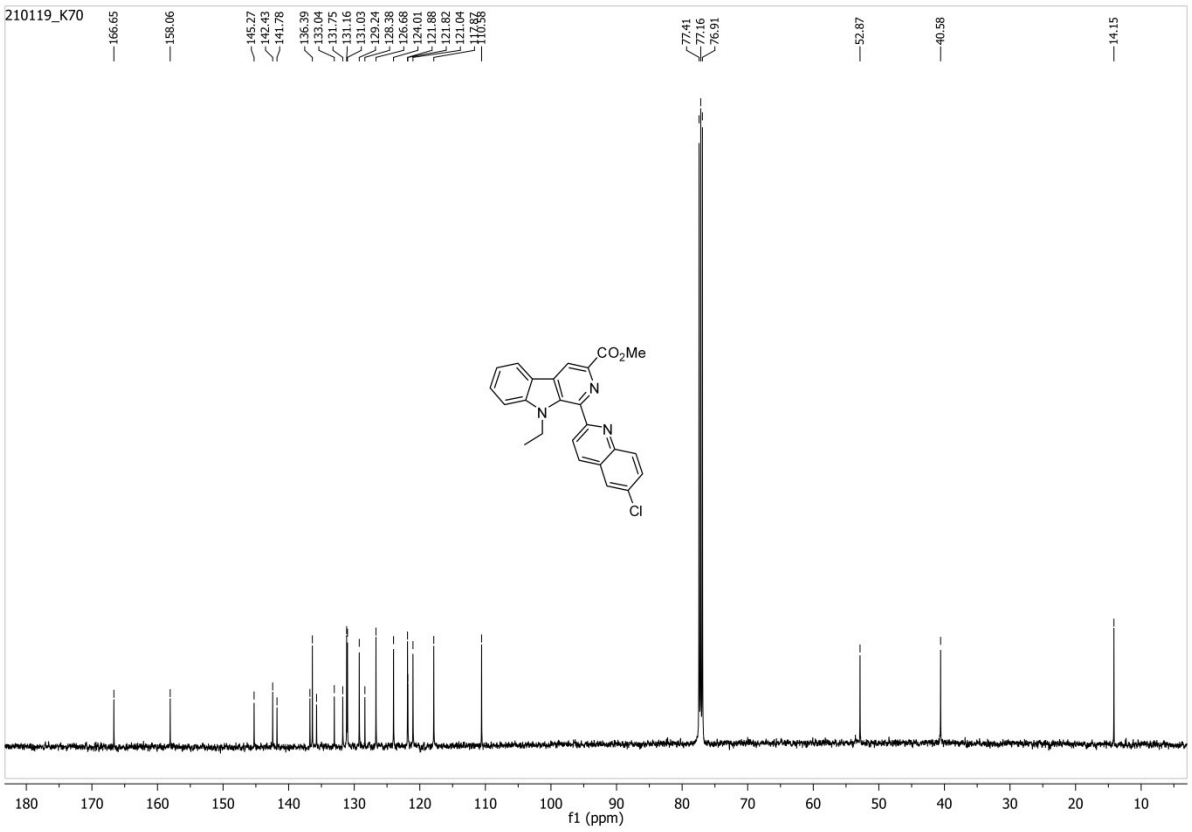

Fig S77. ^{13}C-NMR spectrum of **33c'**

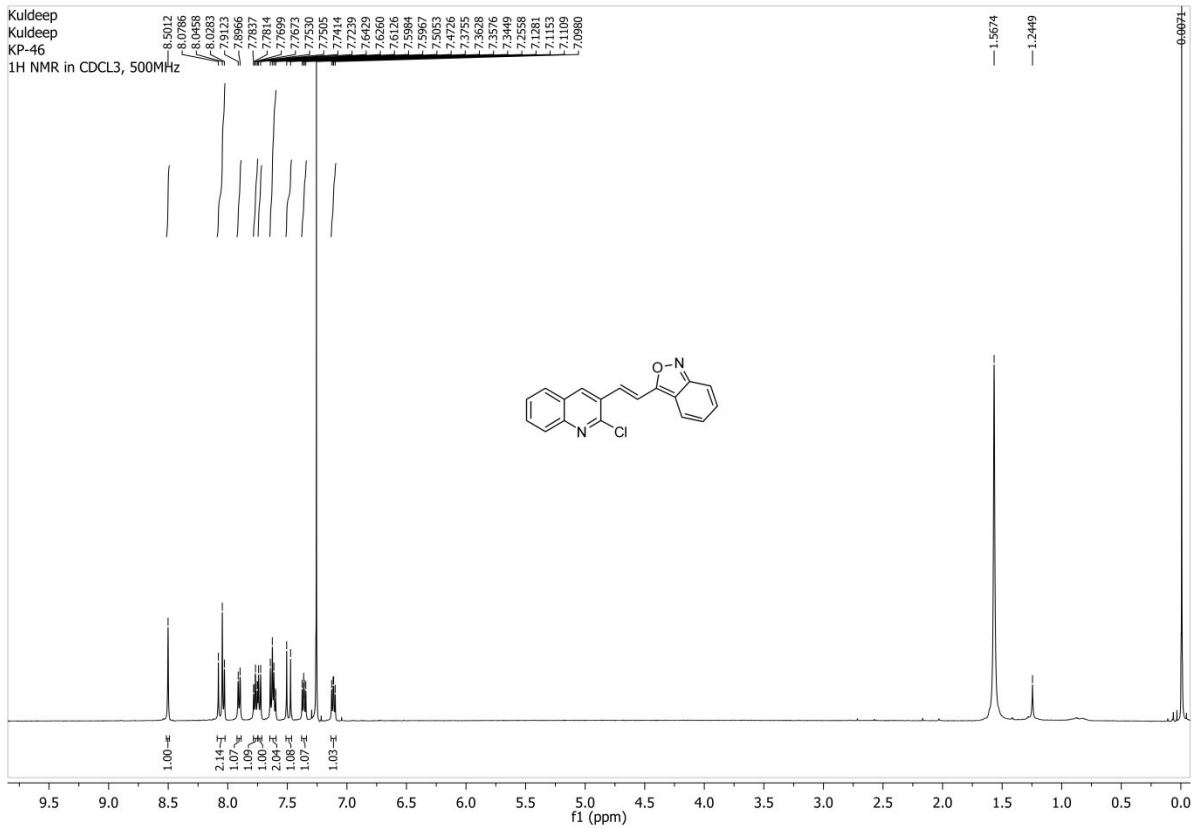

Fig. **S78**. [1]H-NMR spectrum of **36A**

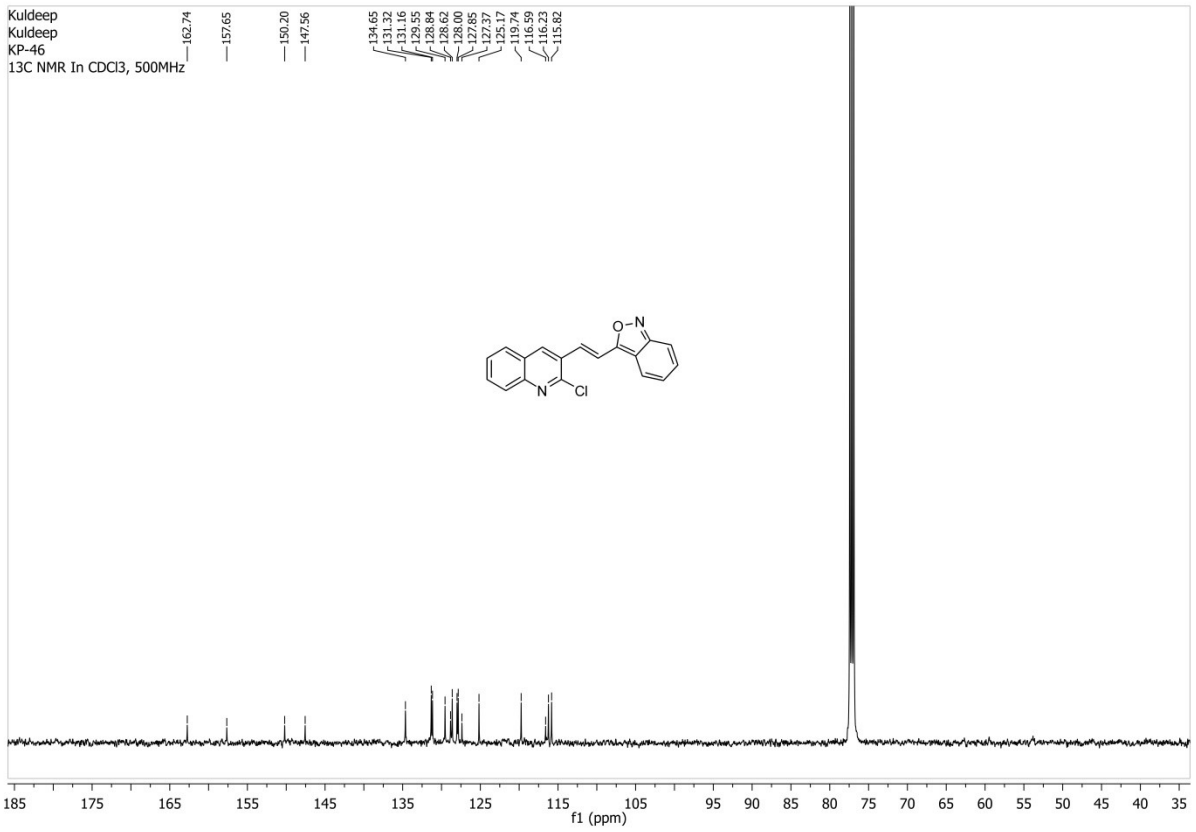

Fig. **S79**. [1]H-NMR spectrum of **36A**

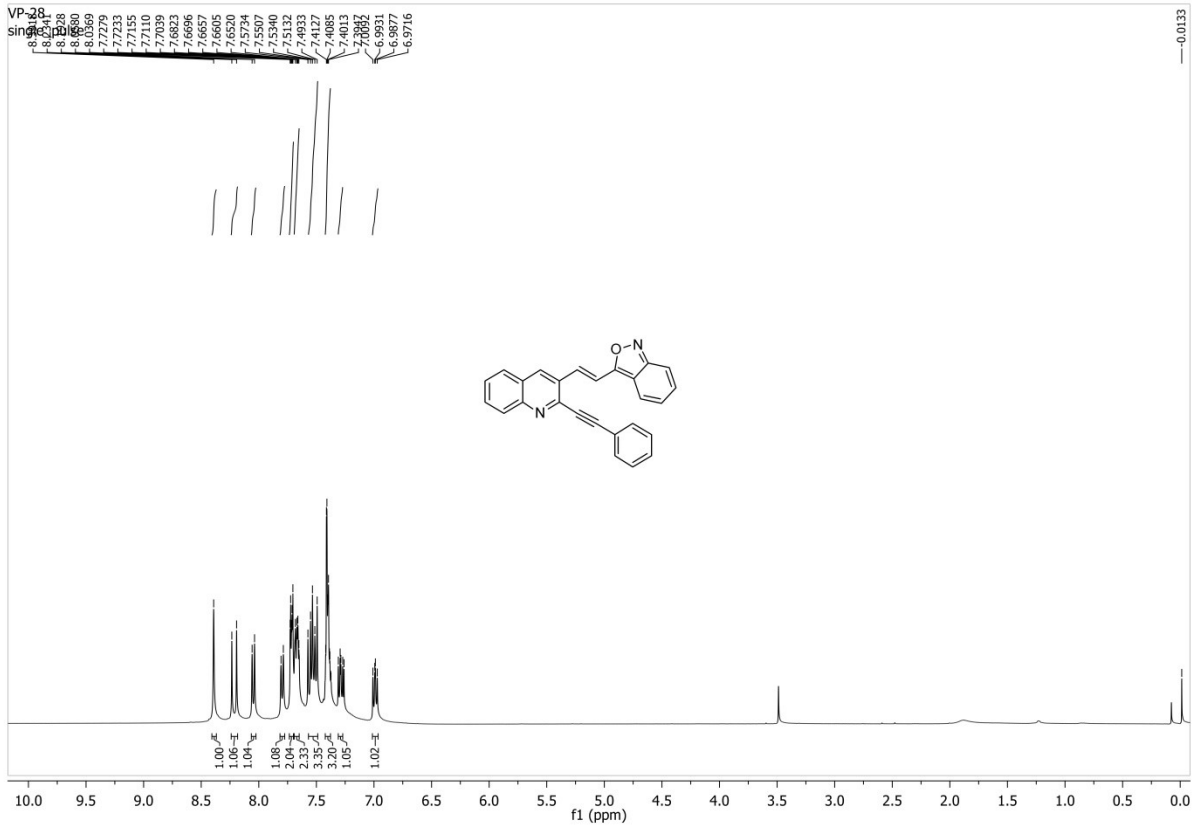

Fig. **S80**. ^{1}H-NMR spectrum of **37A**

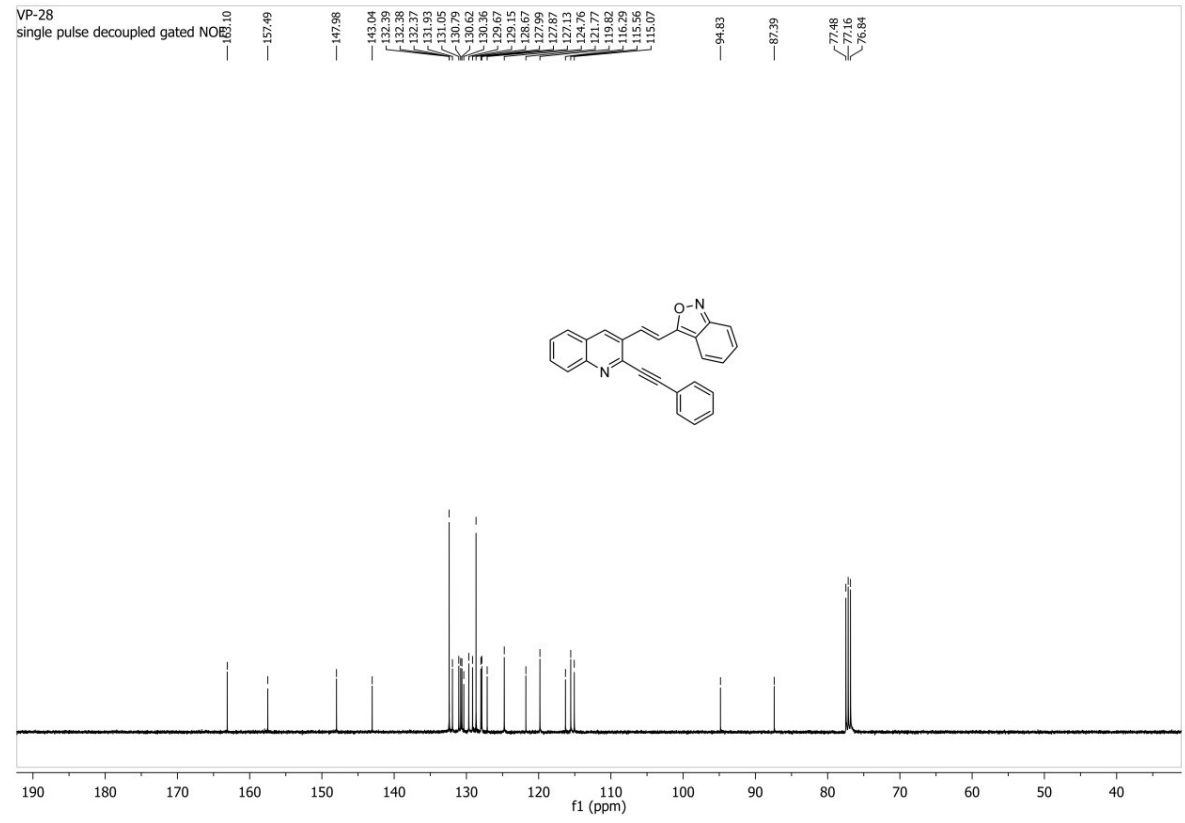

Fig. **S81**. ^{13}C-NMR spectrum of **37A**

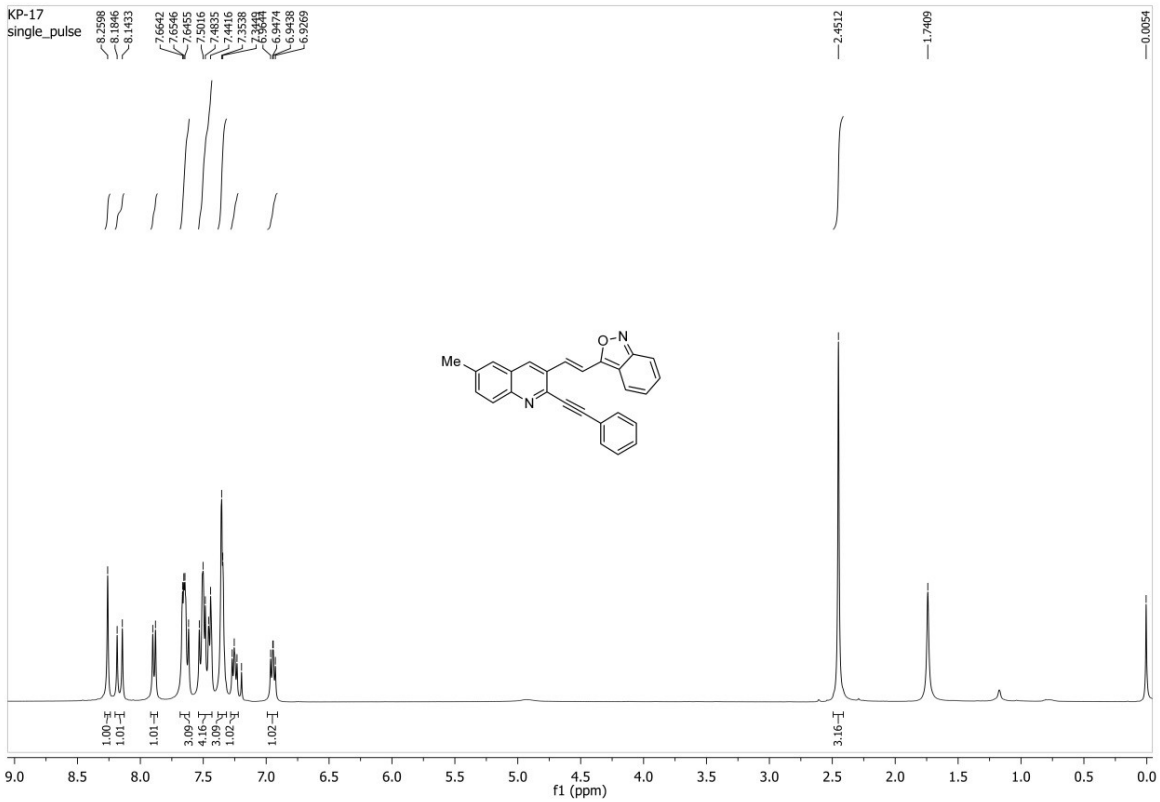

Fig. **S82**. ^{1}H-NMR spectrum of **38A**

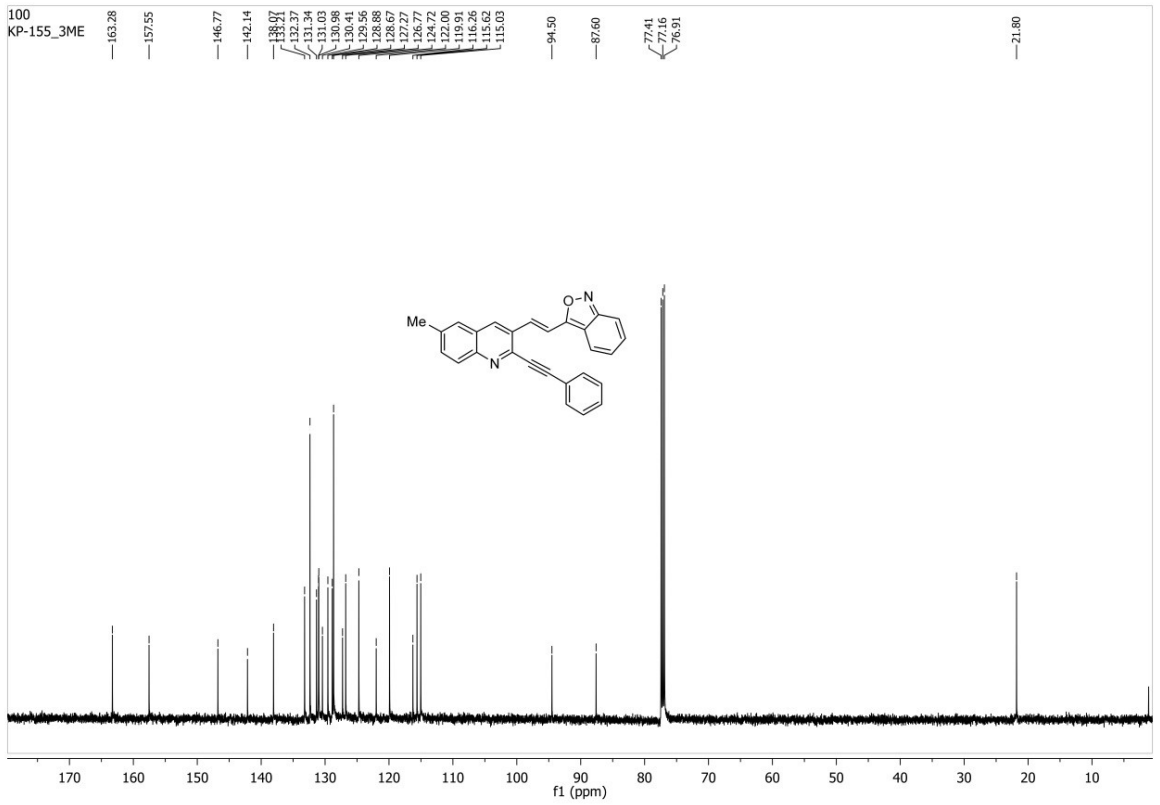

Fig. **S83**. ^{13}C-NMR spectrum of **38A**

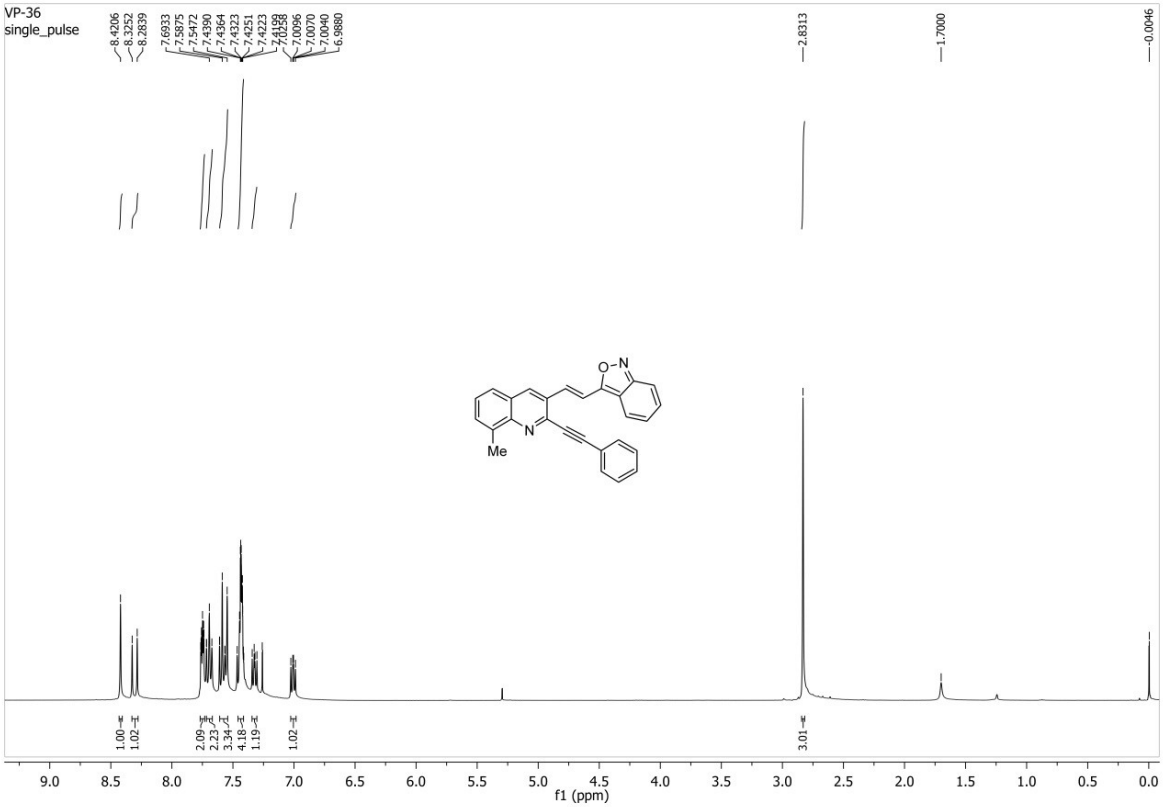

Fig. **S84**. ^{1}H-NMR spectrum of **39A**

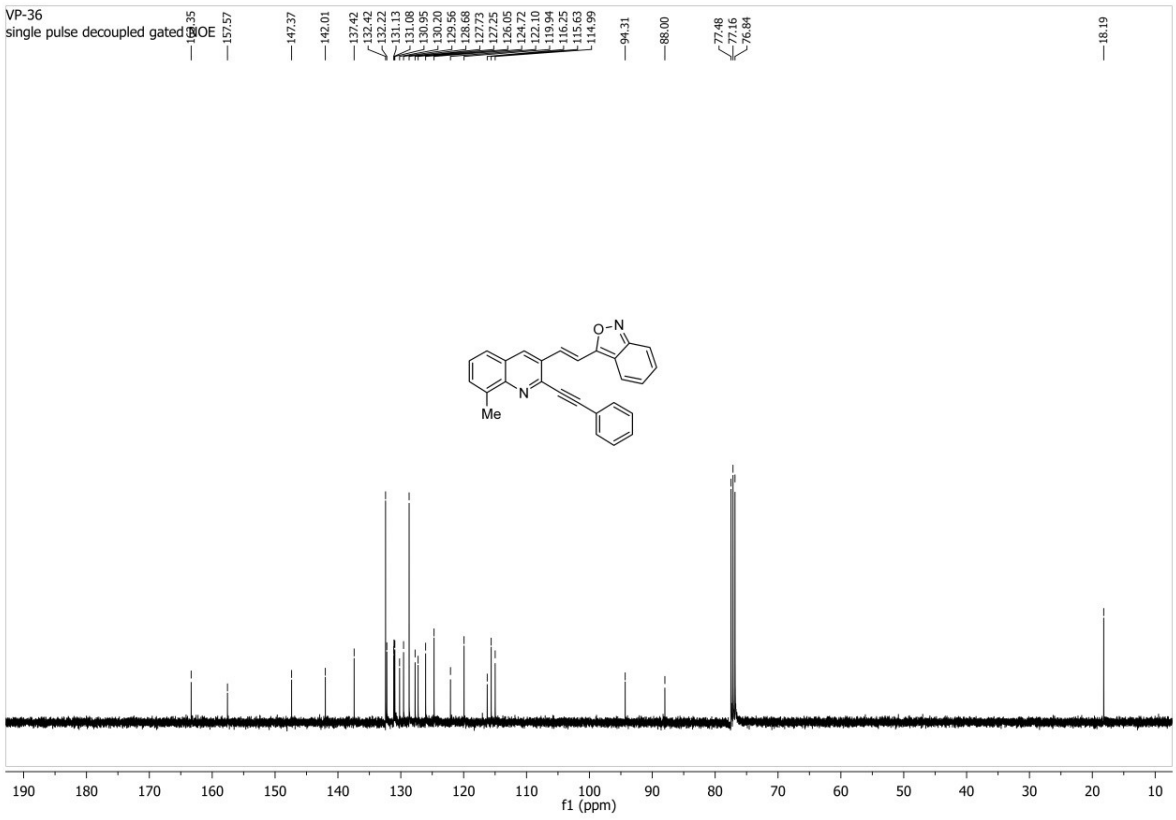

Fig. **S85**. ^{13}C-NMR spectrum of **39A**

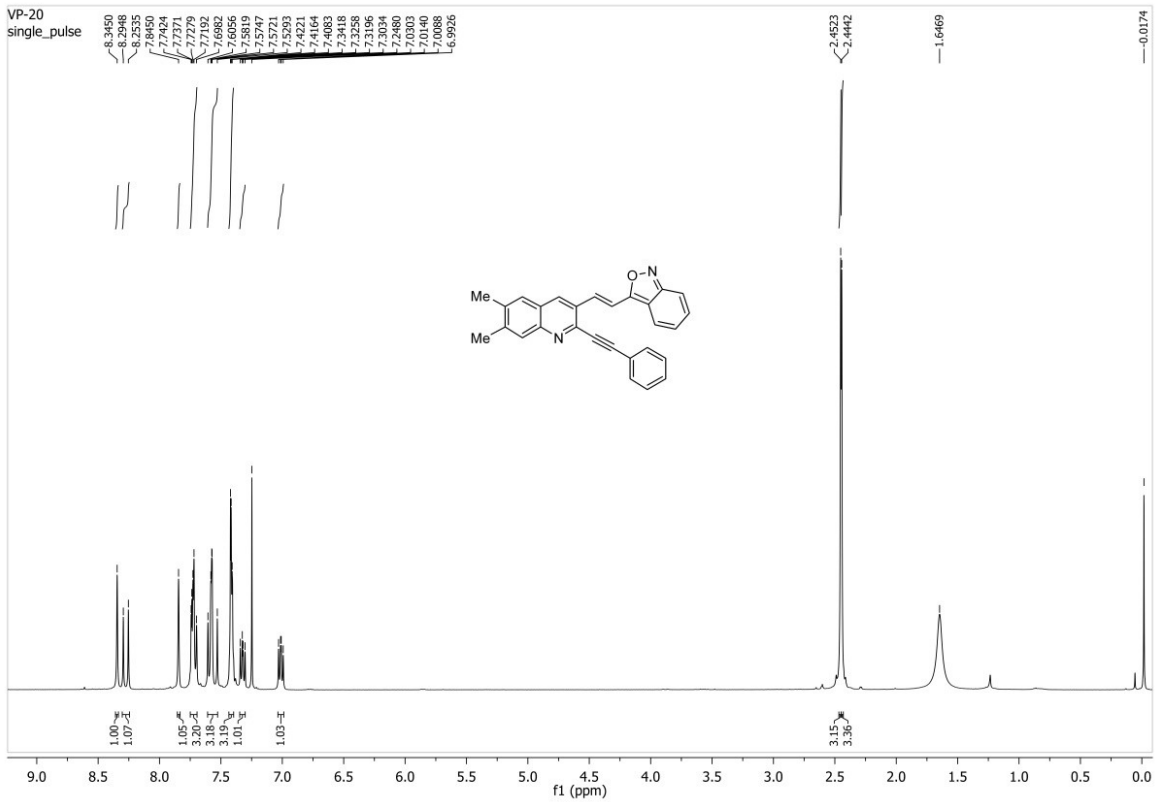

Fig. **S86**. ^{1}H-NMR spectrum of **40A**

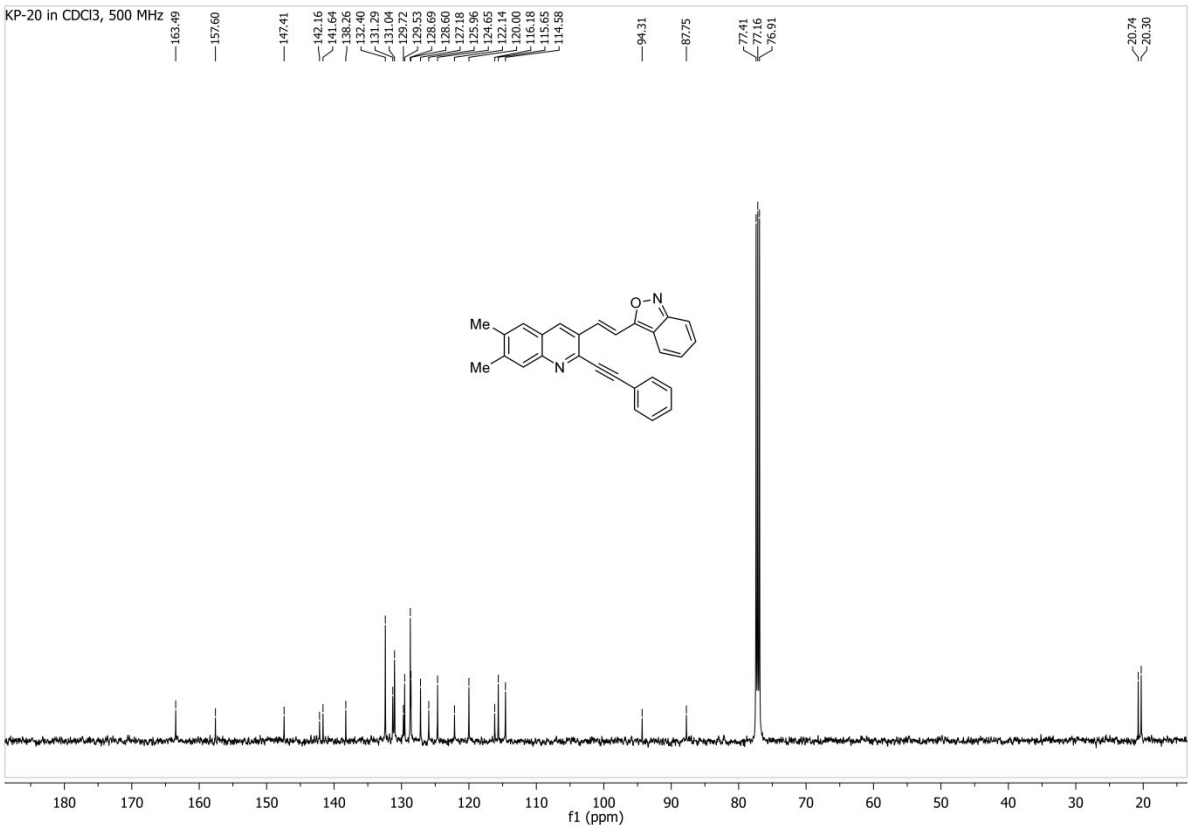

Fig. **S87**. ^{13}C-NMR spectrum of **40A**

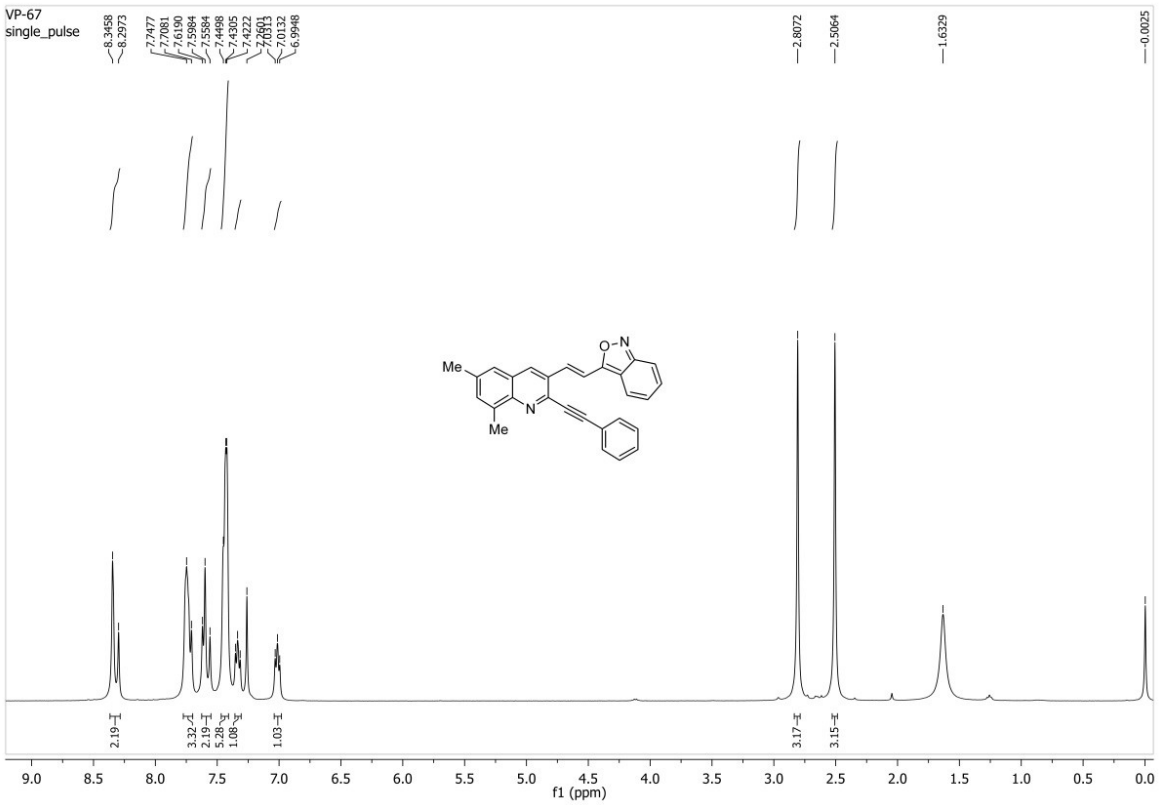

Fig. **S88**. ^{1}H-NMR spectrum of **41A**

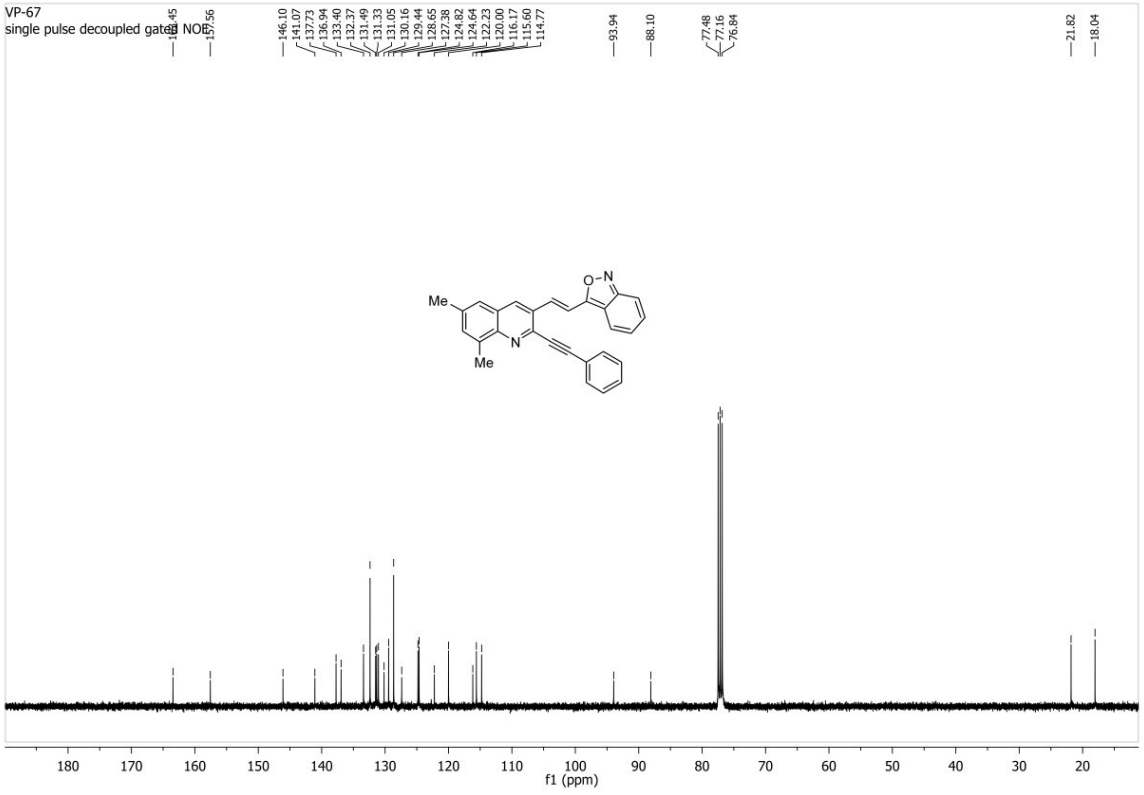

Fig. **S89**. ^{13}C-NMR spectrum of **41A**

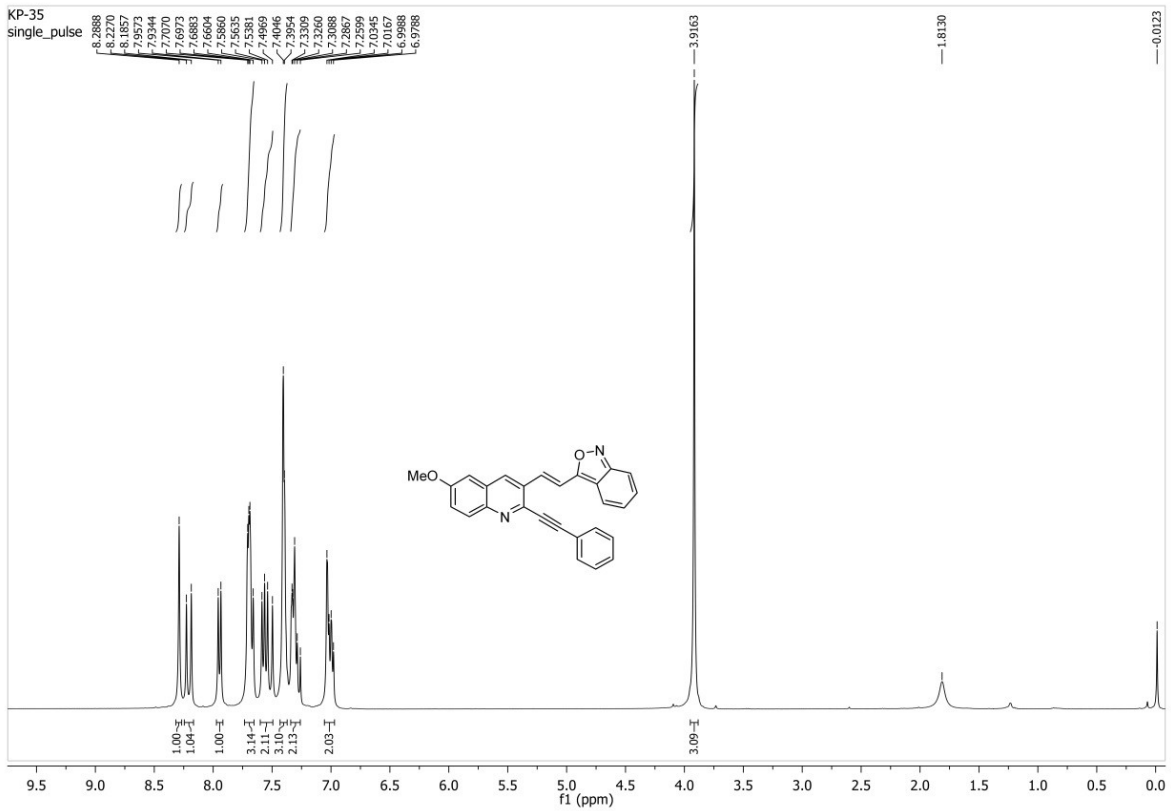

Fig. S90. ^{1}H-NMR spectrum of **42A**

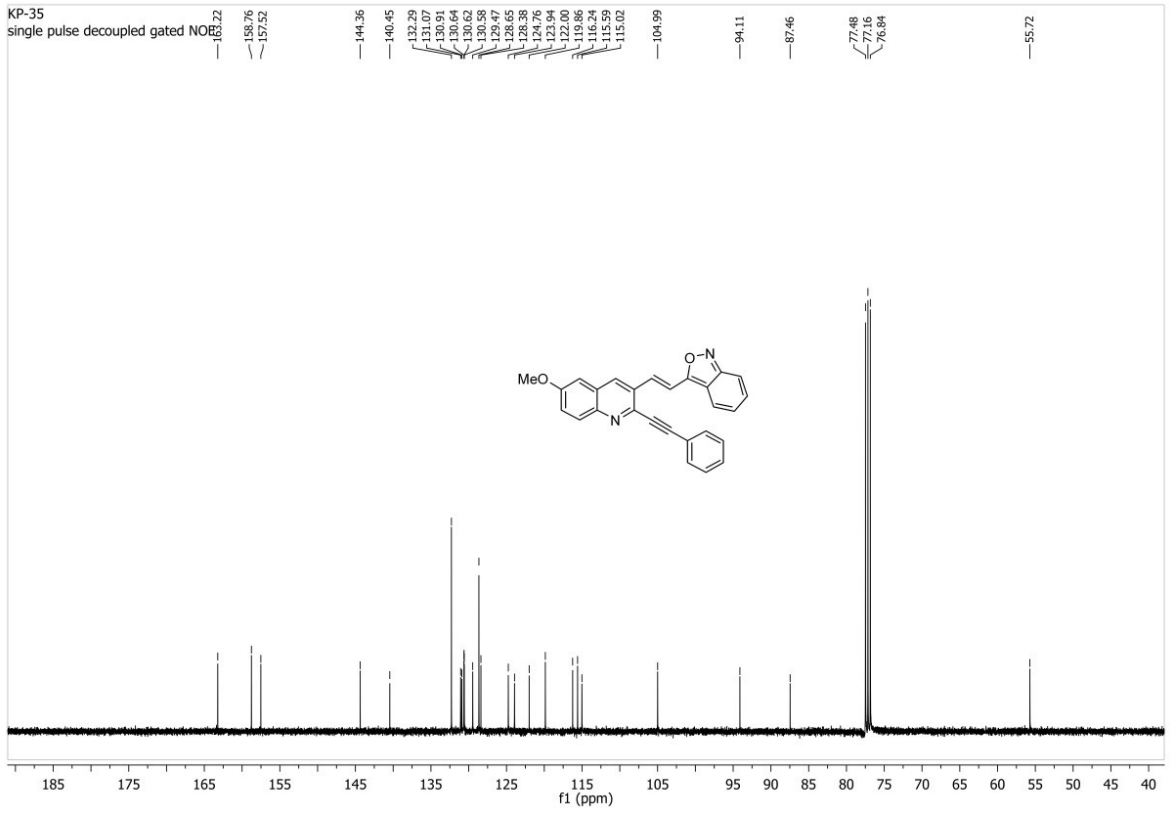

Fig. **S91**. ^{13}C-NMR spectrum of **42A**

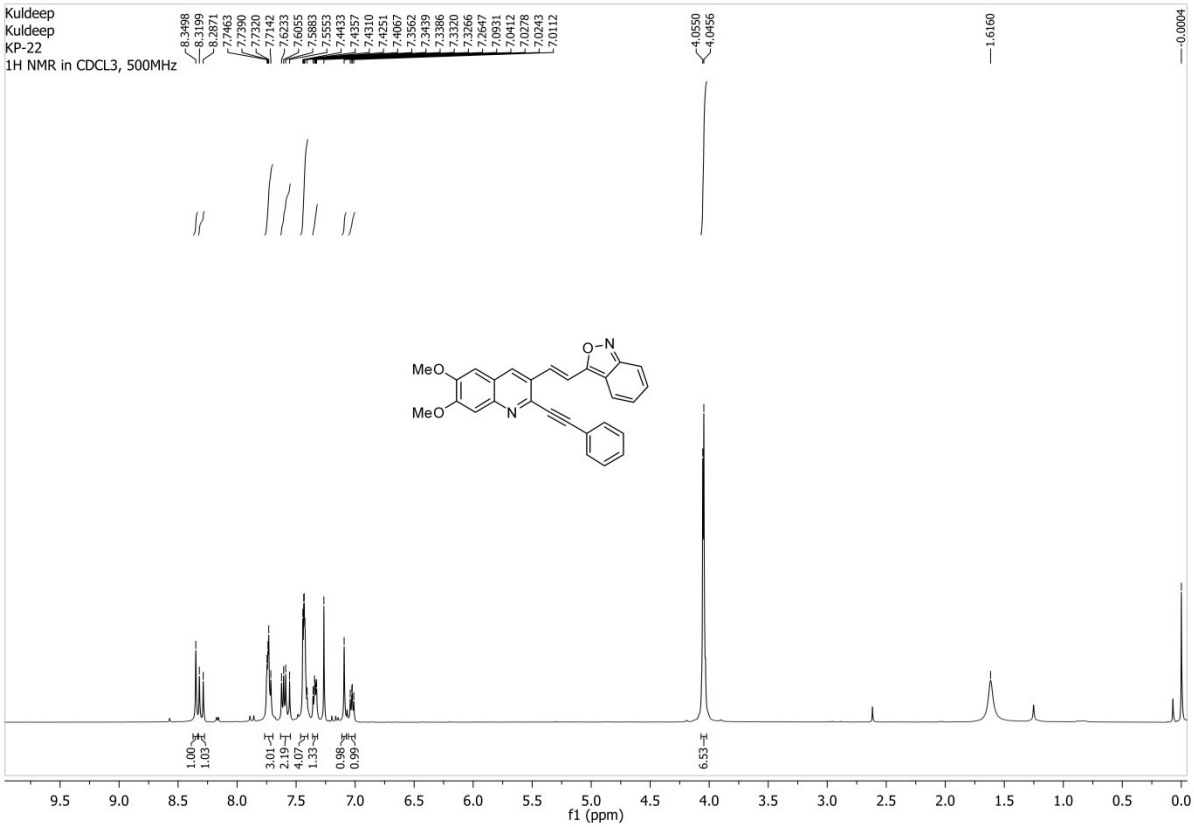

Fig. S92. ^{1}H-NMR spectrum of **43A**

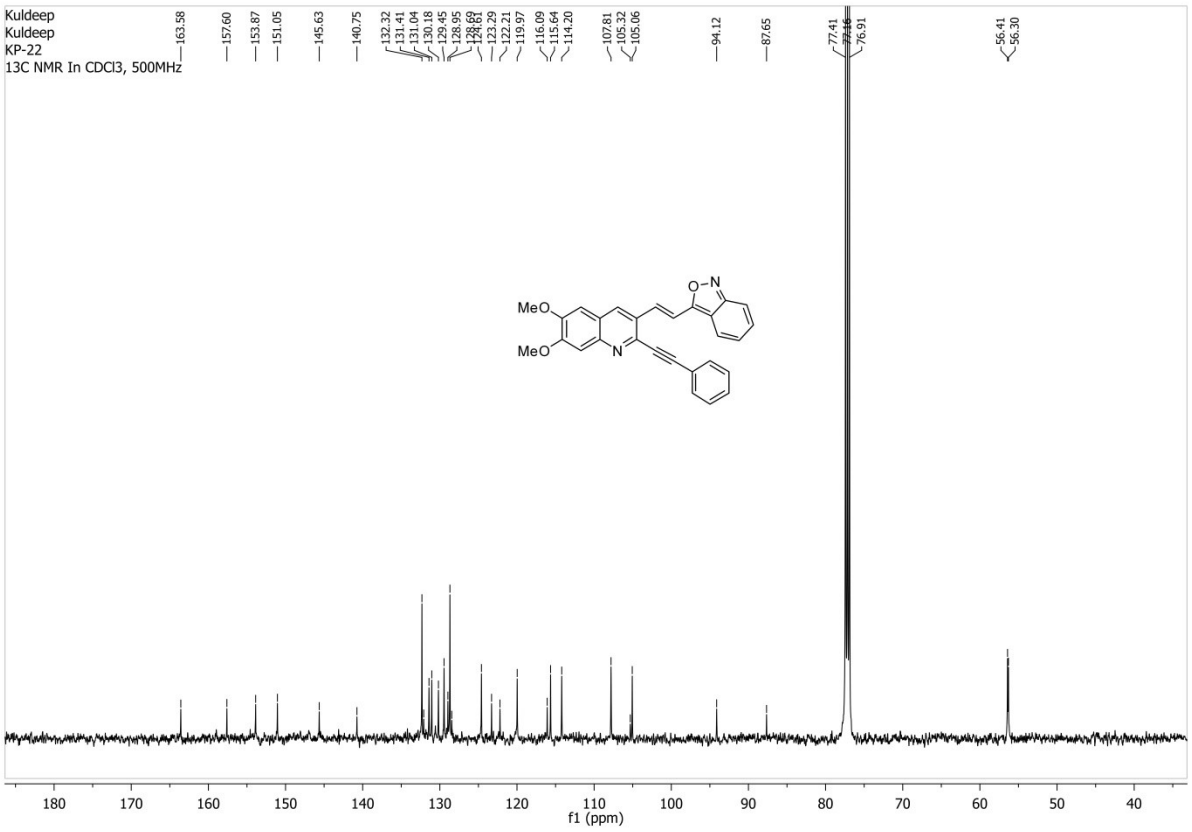

Fig. **S93**. ^{13}C-NMR spectrum of **43A**

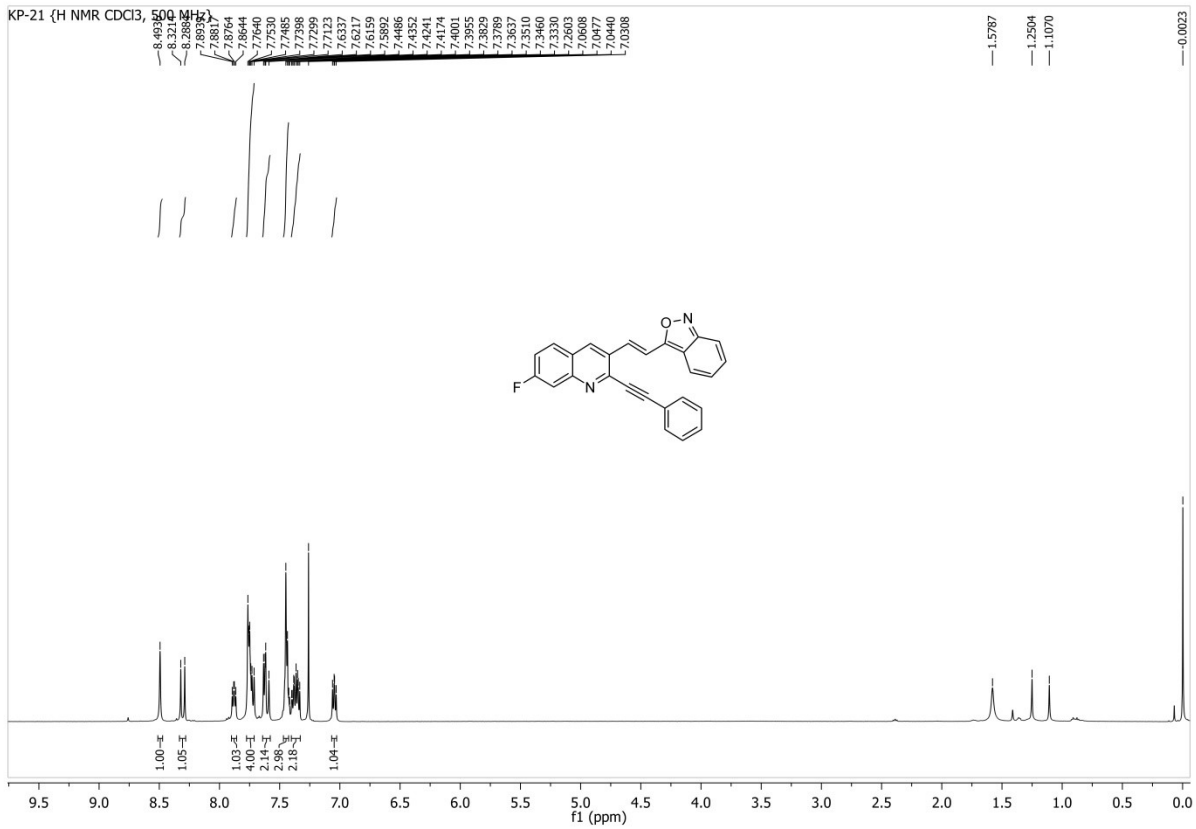

Fig. **S94**. ^{1}H-NMR spectrum of **44A**

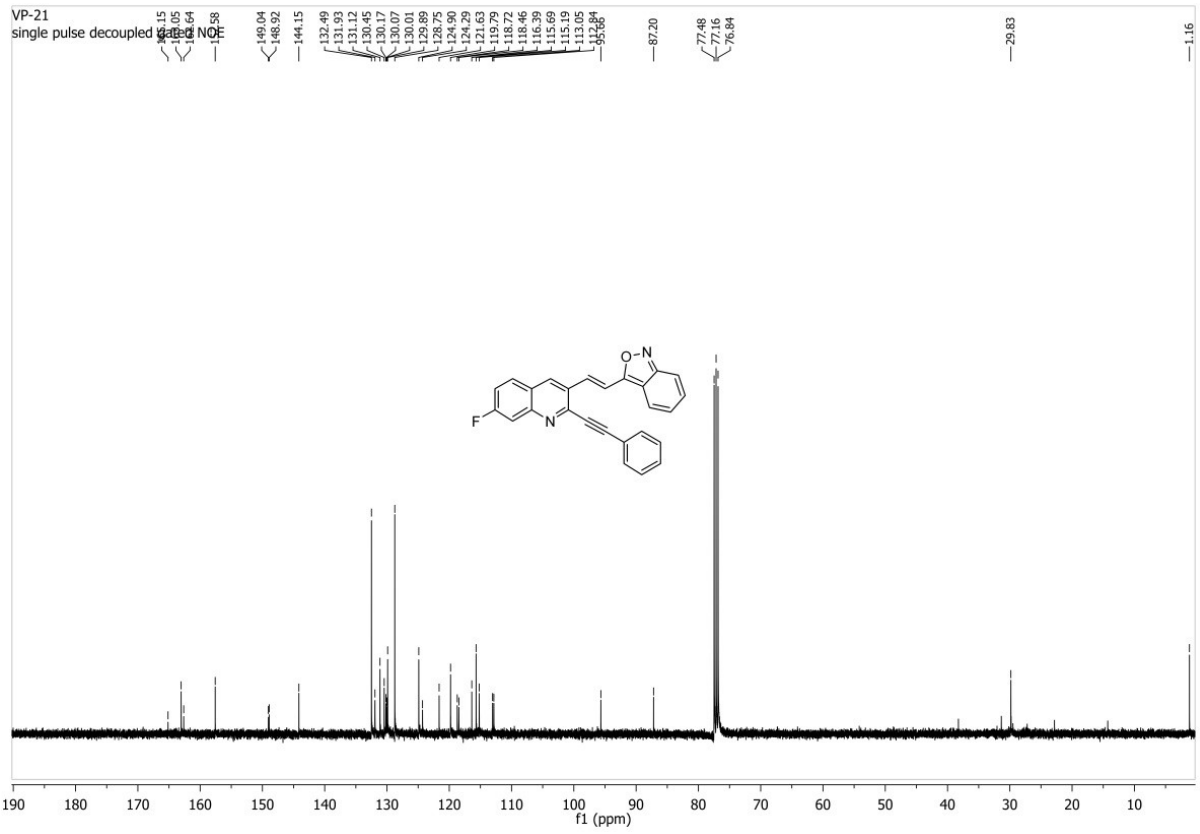

Fig. **S95**. ^{13}C-NMR spectrum of **44A**

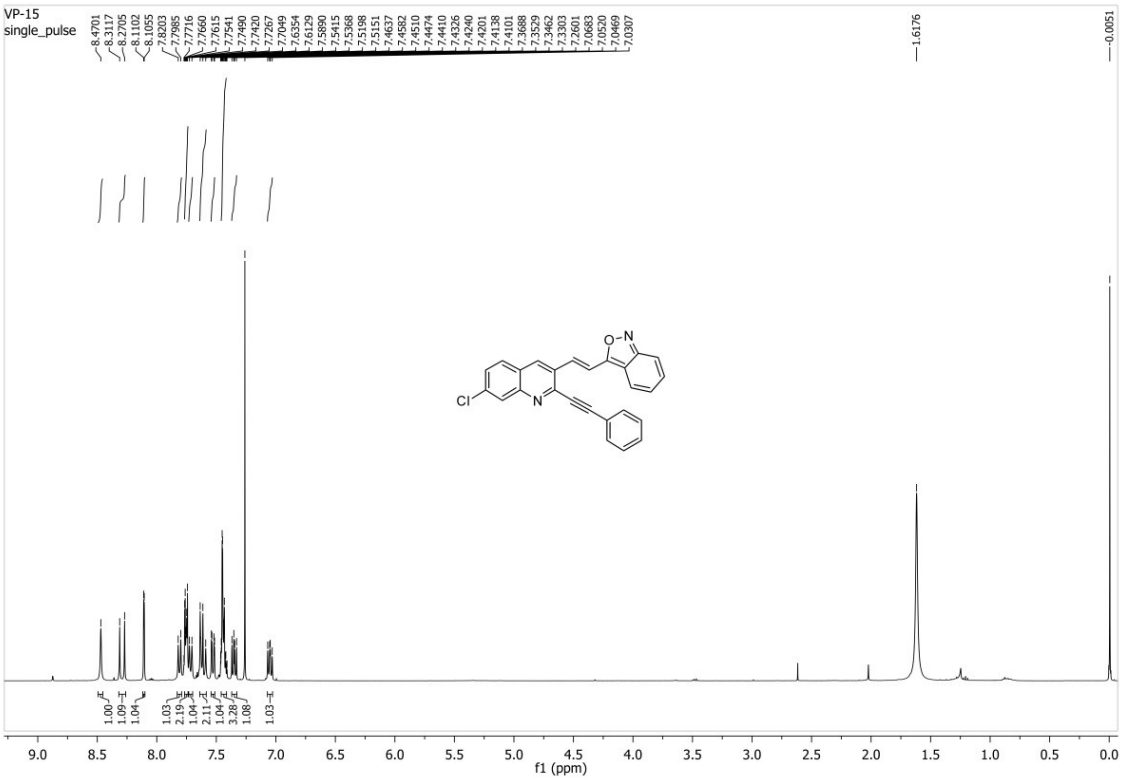

Fig. **S96**. ^{1}H-NMR spectrum of **45A**

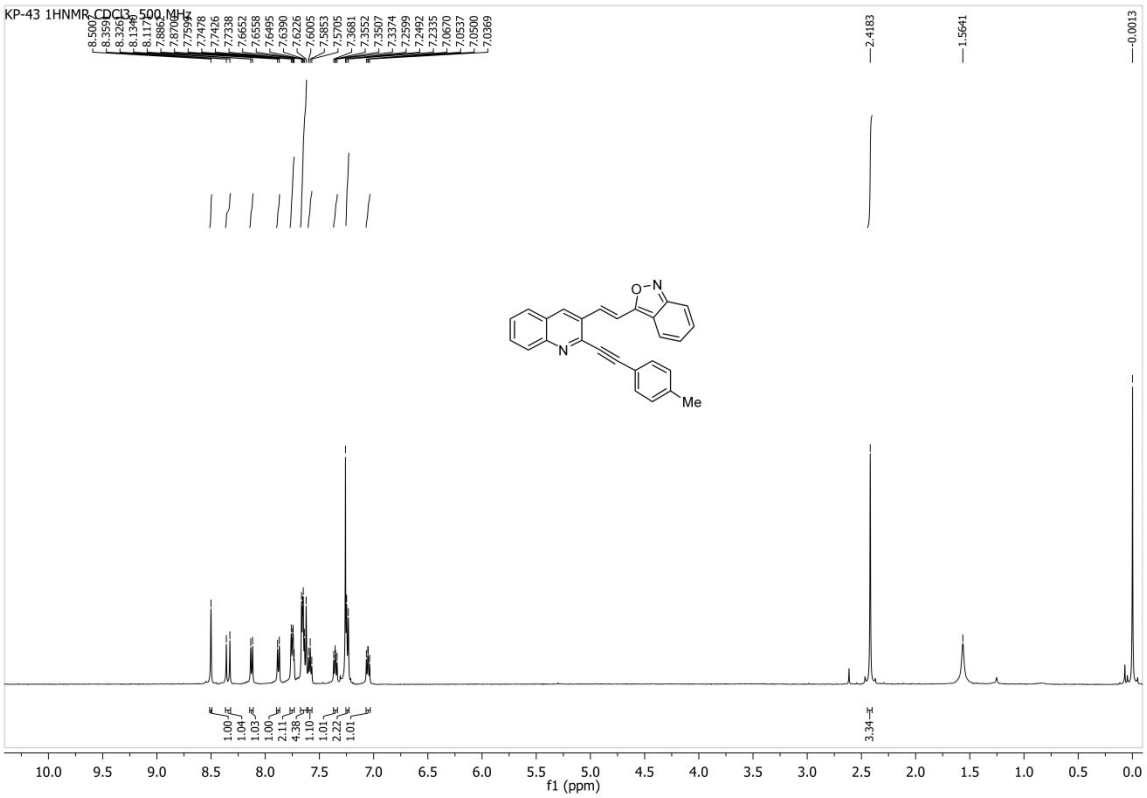

Fig. **S97**. ^{1}H-NMR spectrum of **46A**

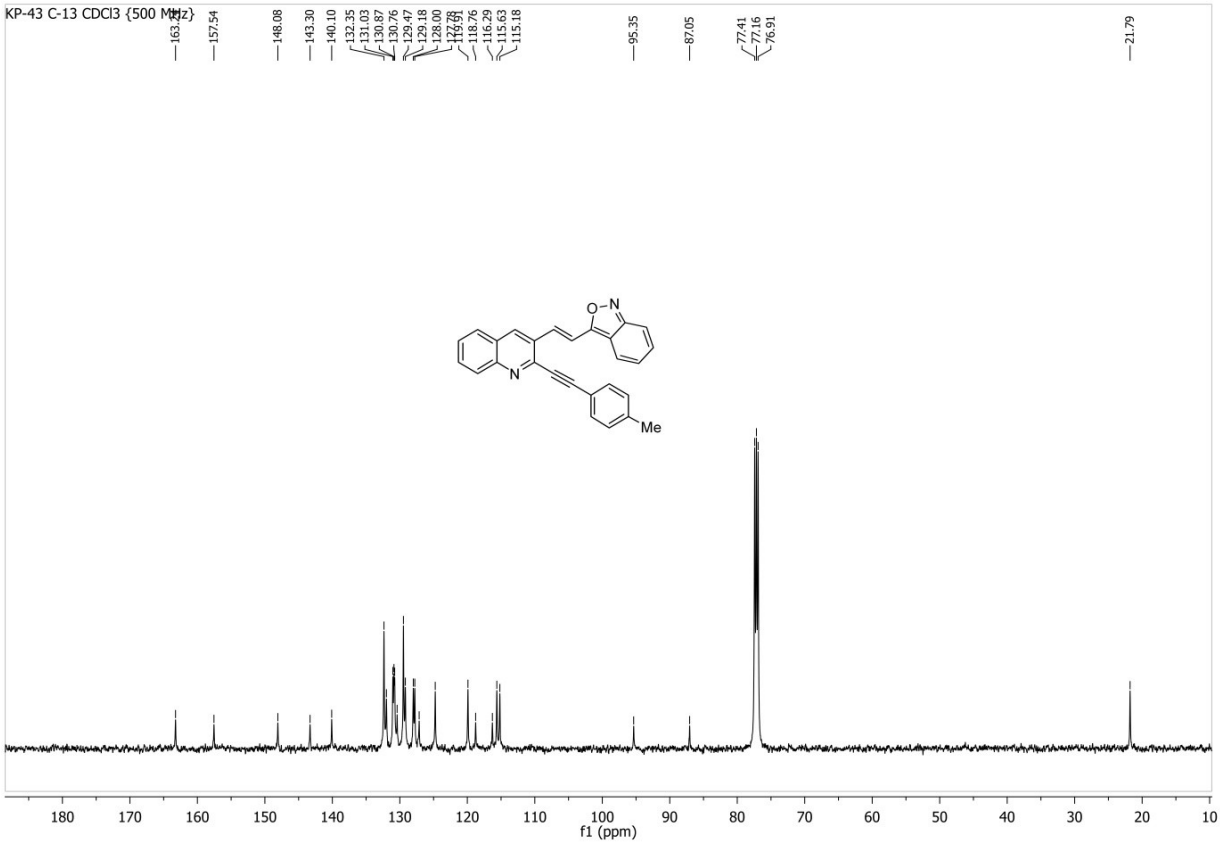

Fig. **S98**. ^{13}C-NMR spectrum of **46A**

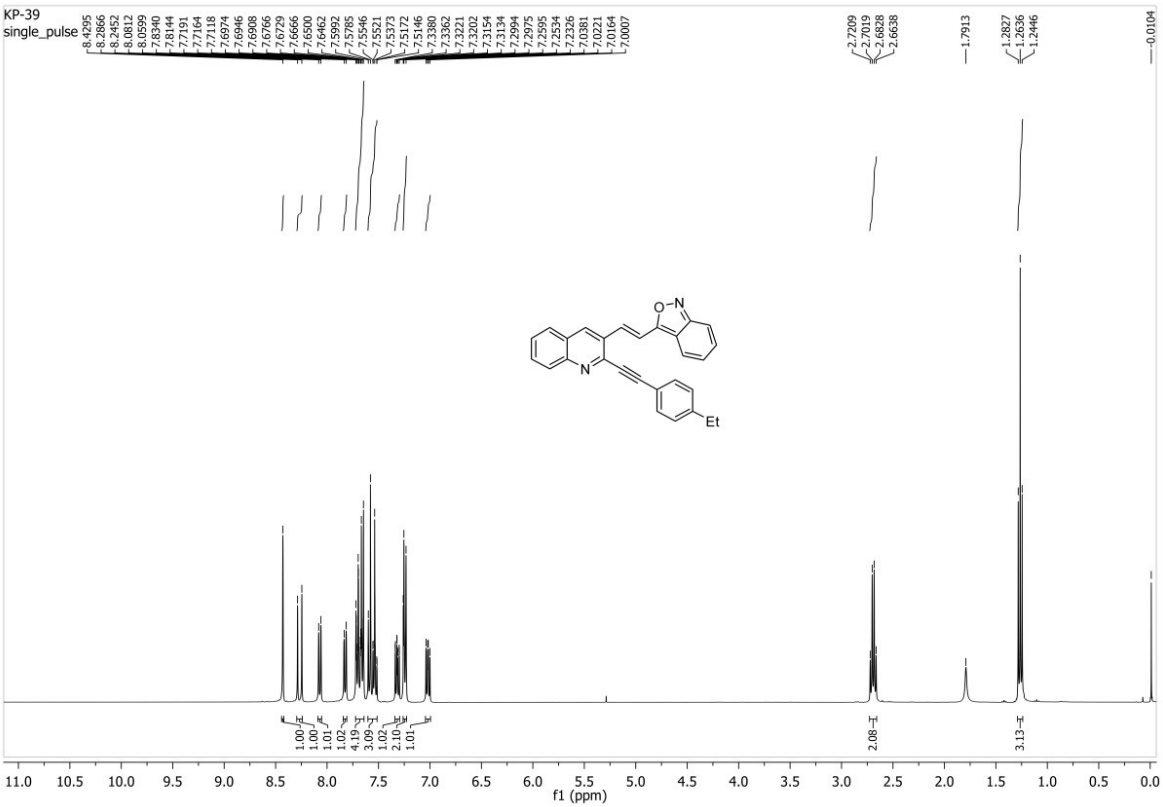

Fig. **S99**. ^{1}H-NMR spectrum of **47A**

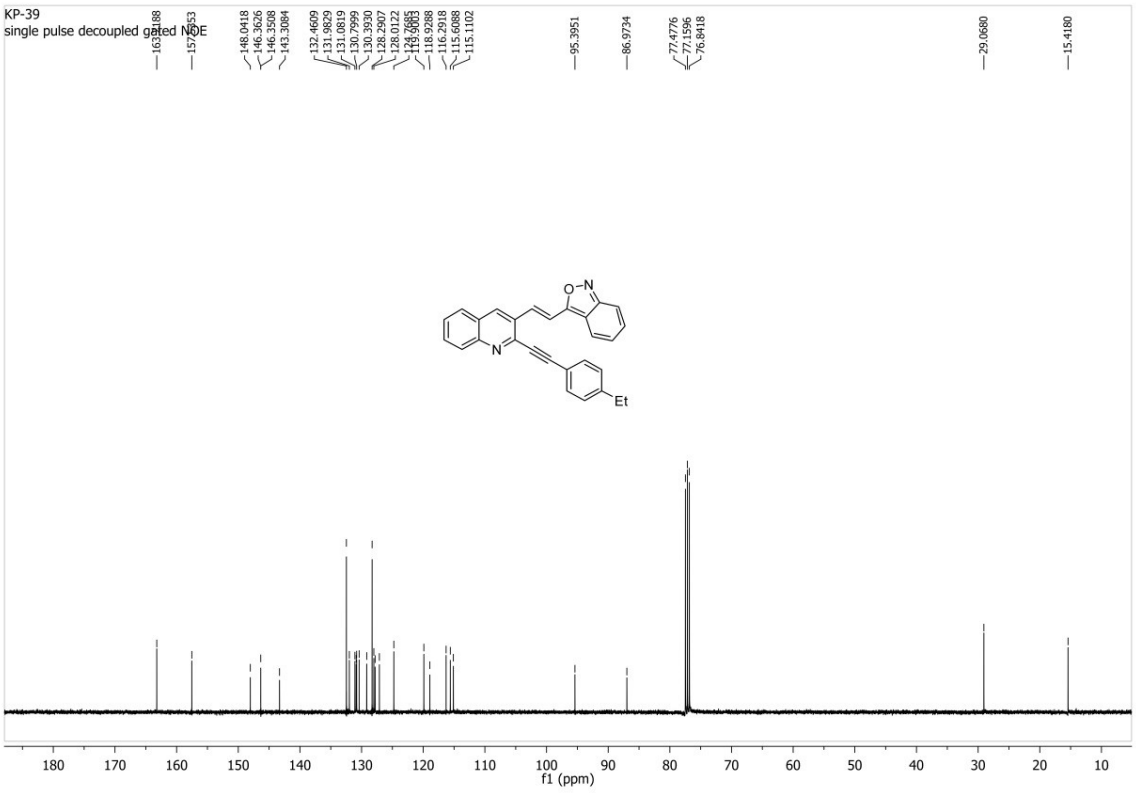

Fig. **S100**. ^{13}C-NMR spectrum of **47A**

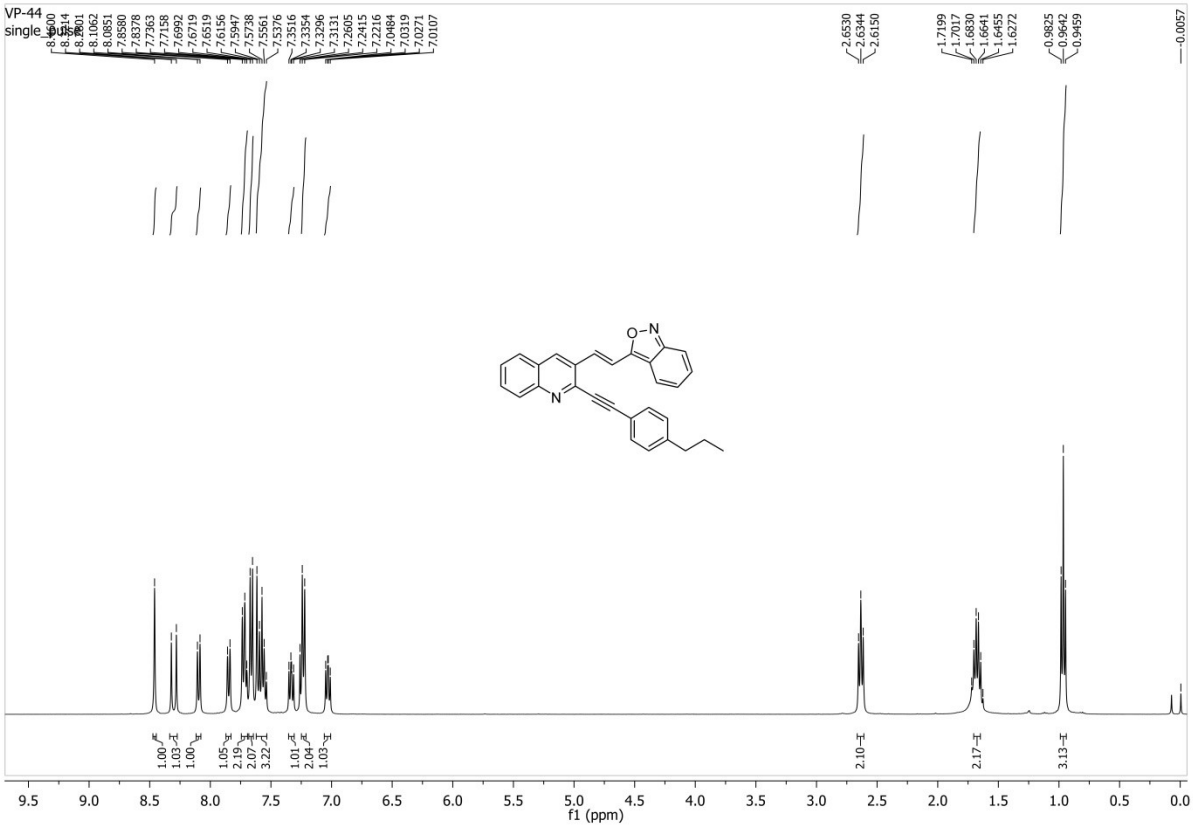

Fig. **S101**. ^{1}H-NMR spectrum of **48A**

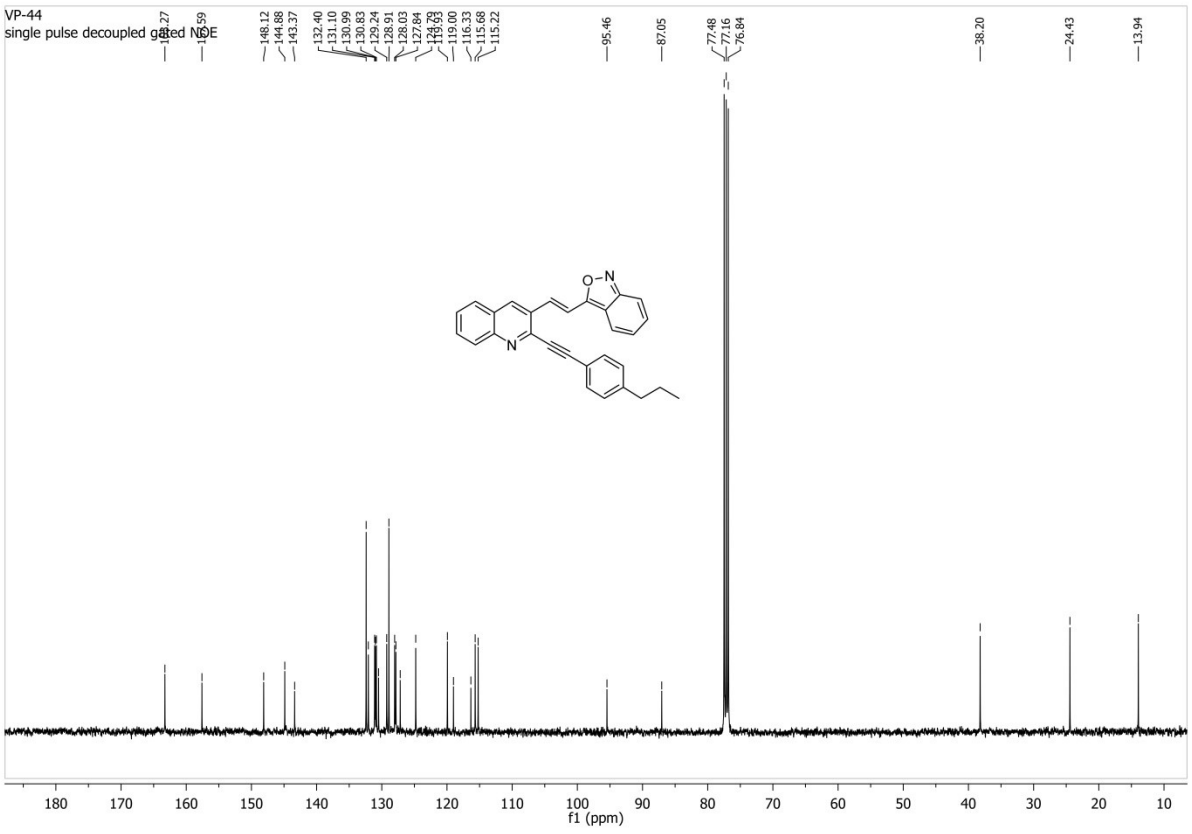

Fig. **S102**. ^{13}C-NMR spectrum of **48A**

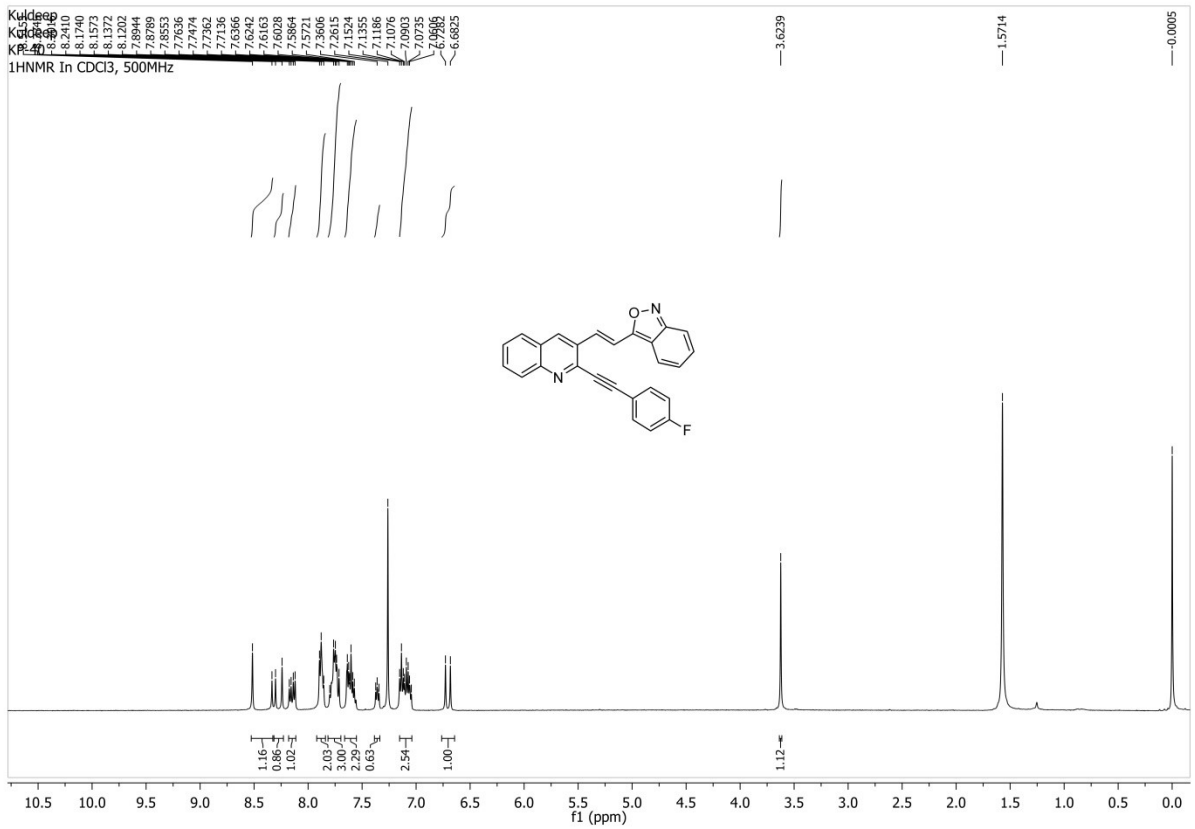

Fig. **S103**. ^{1}H-NMR spectrum of **49A**

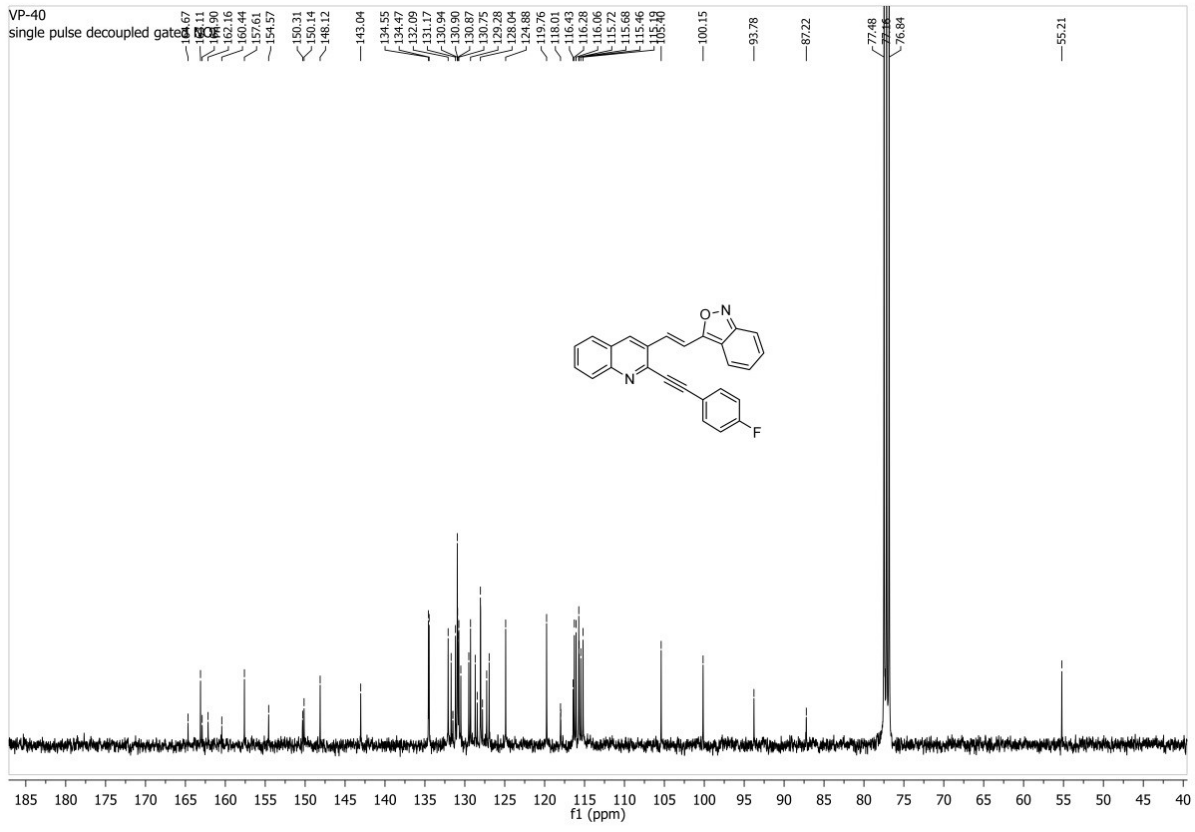

Fig. **S104**. ^{13}C-NMR spectrum of **49A**

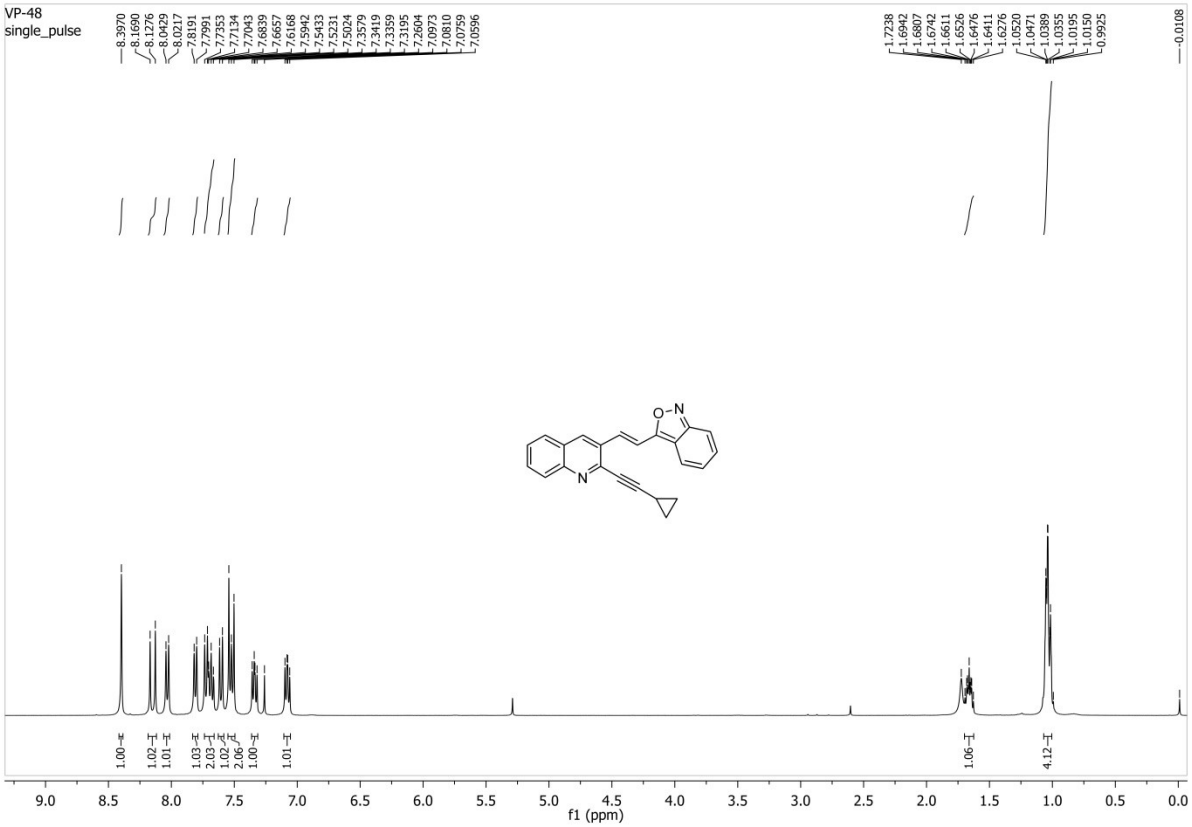

Fig. **S105**. ^{1}H-NMR spectrum of **50A**

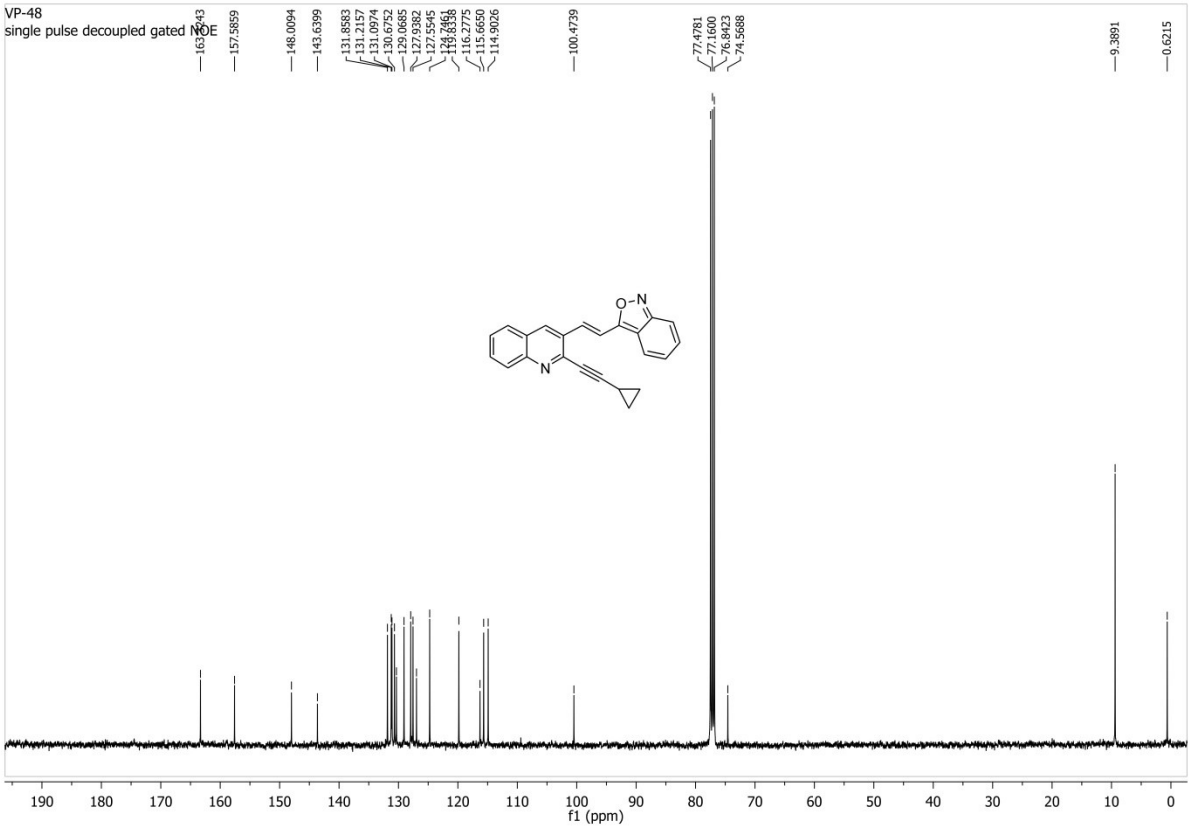

Fig. **S106**. ^{13}C-NMR spectrum of **50A**

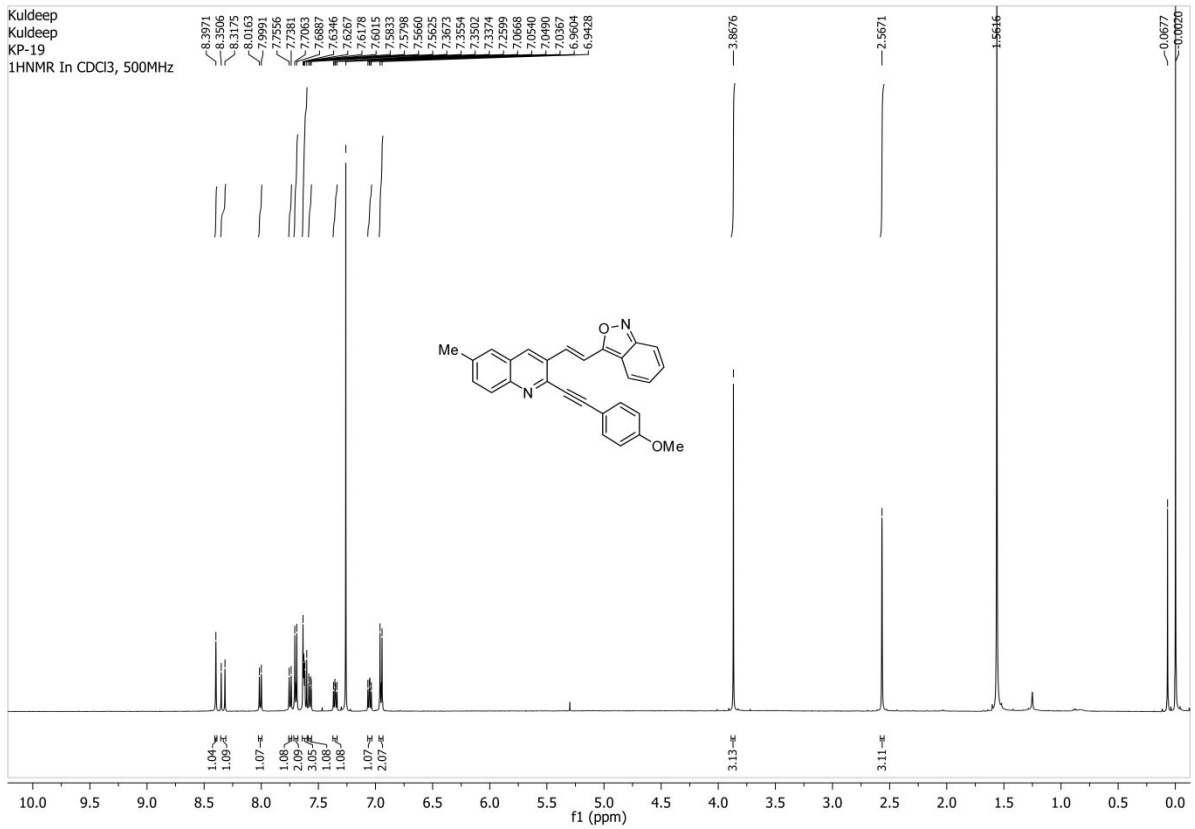

Fig. **S107**. [1]H-NMR spectrum of **51A**

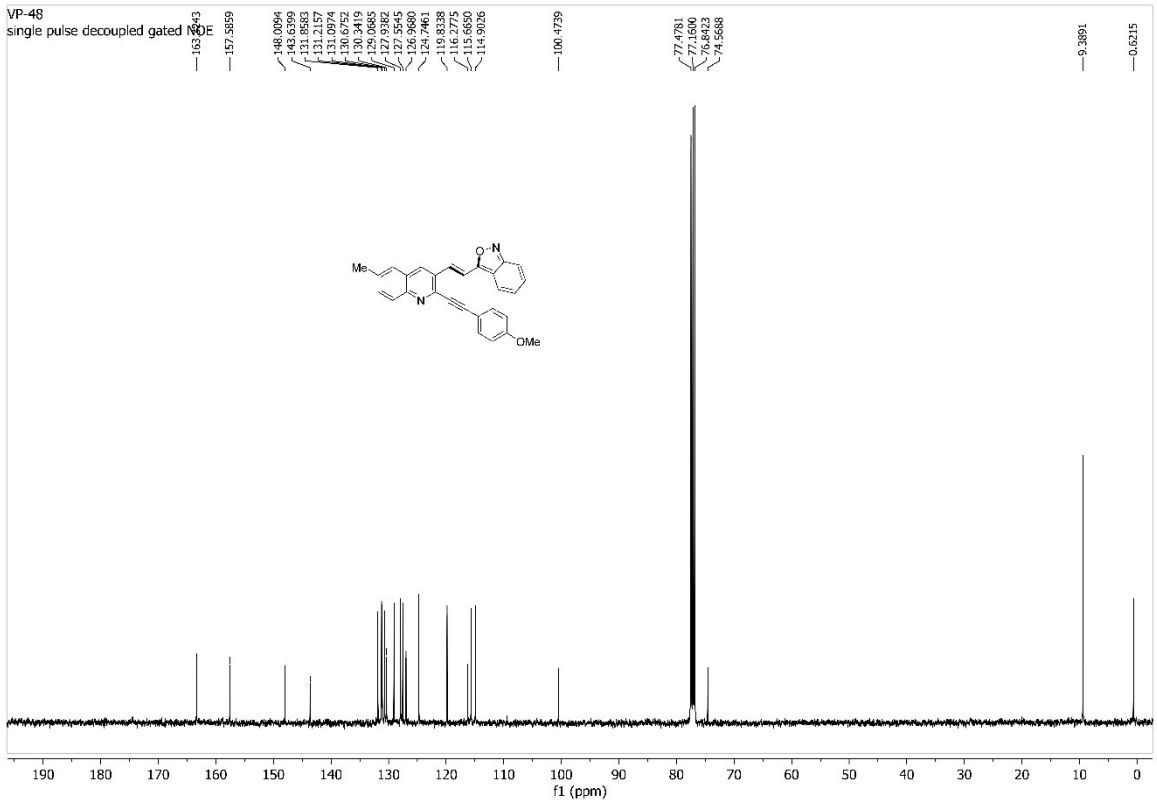

Fig. **S108**. [13]C-NMR spectrum of **51A**

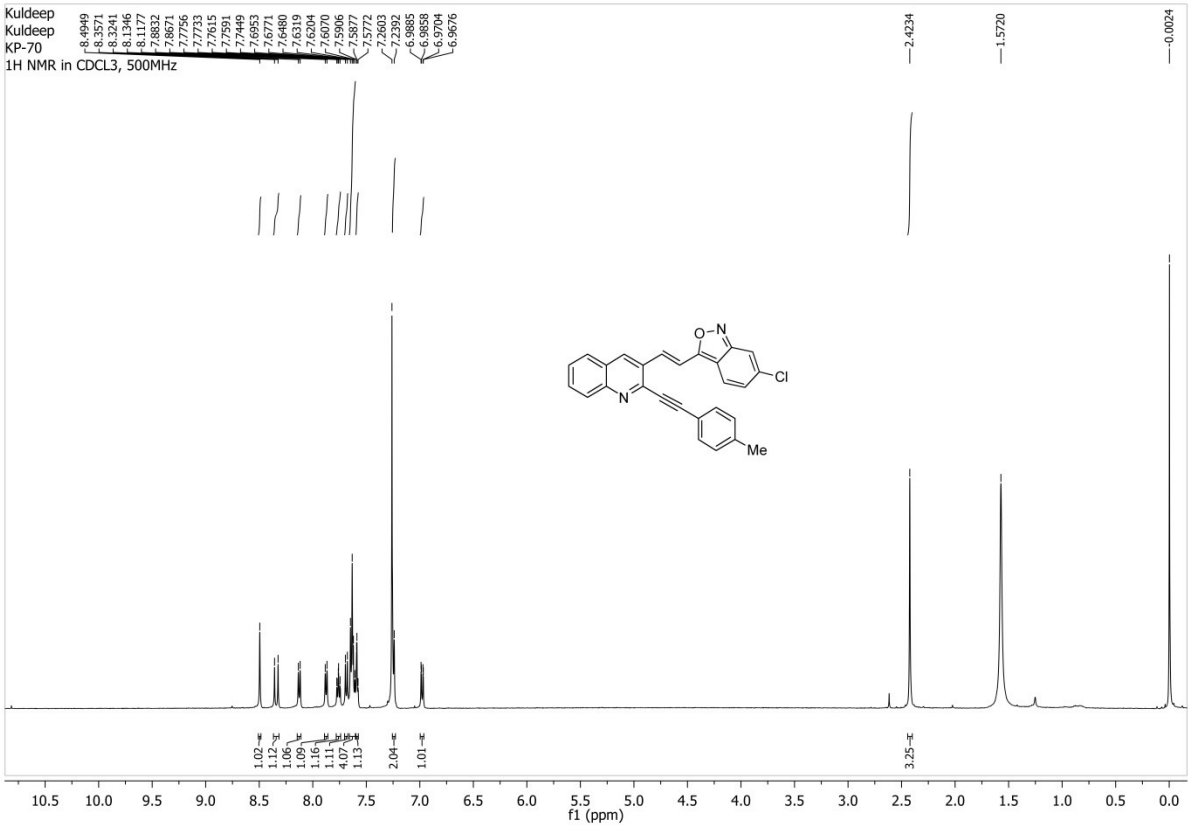

Fig. **S109**. ^{1}H-NMR spectrum of **46B**

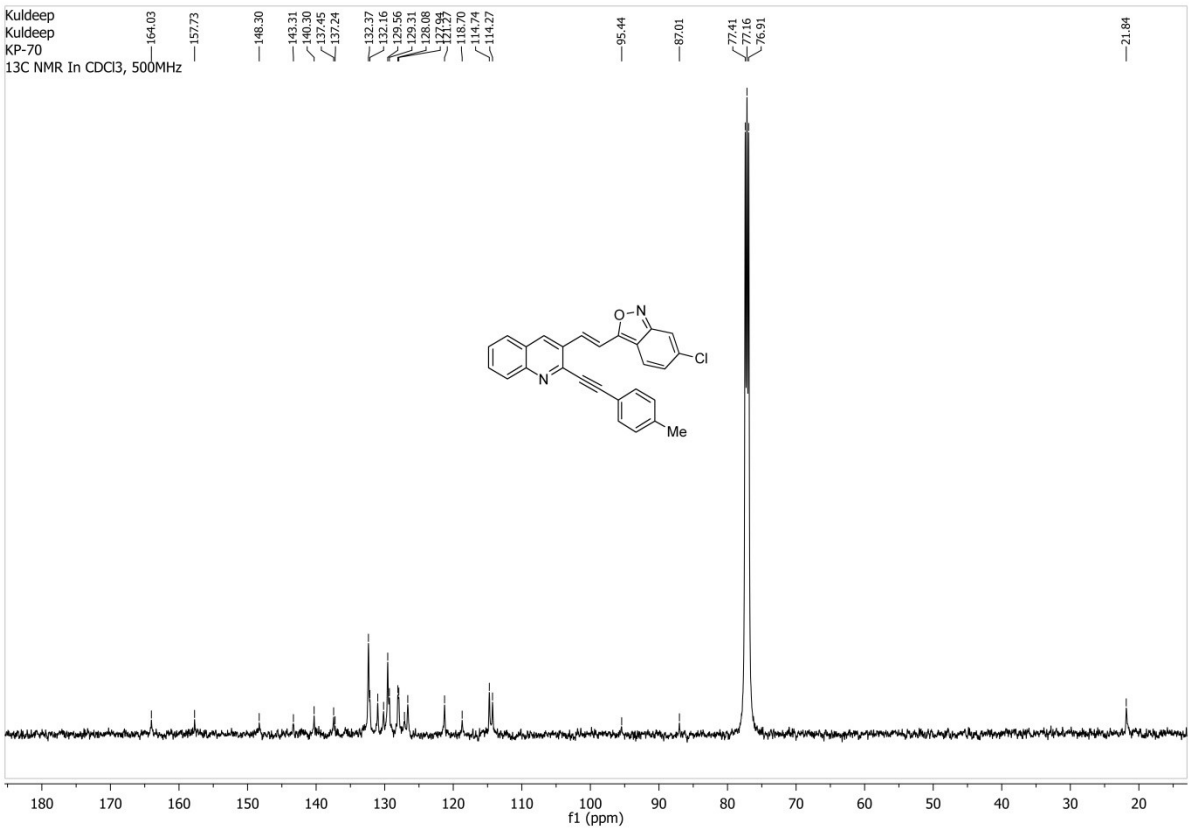

Fig. **S110**. ^{13}C-NMR spectrum of **46B**

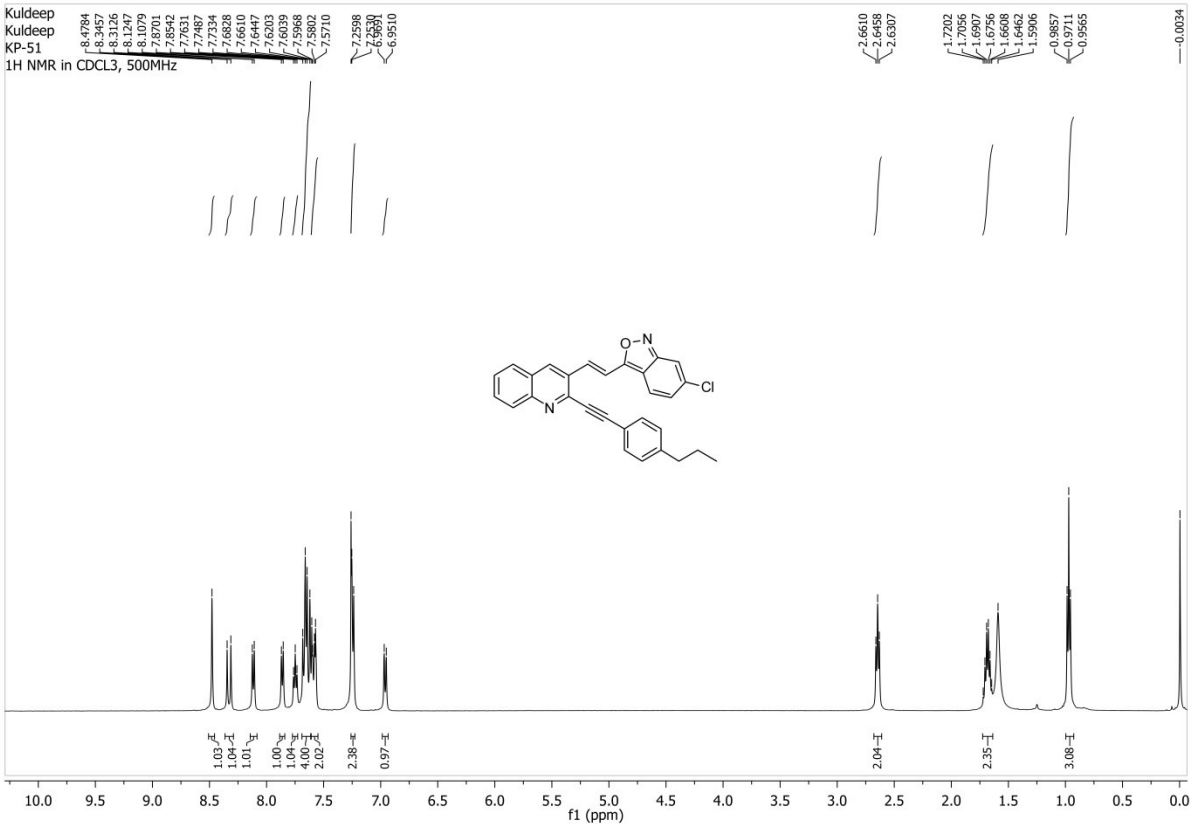

Fig. **S111**. ^{1}H-NMR spectrum of **48B**

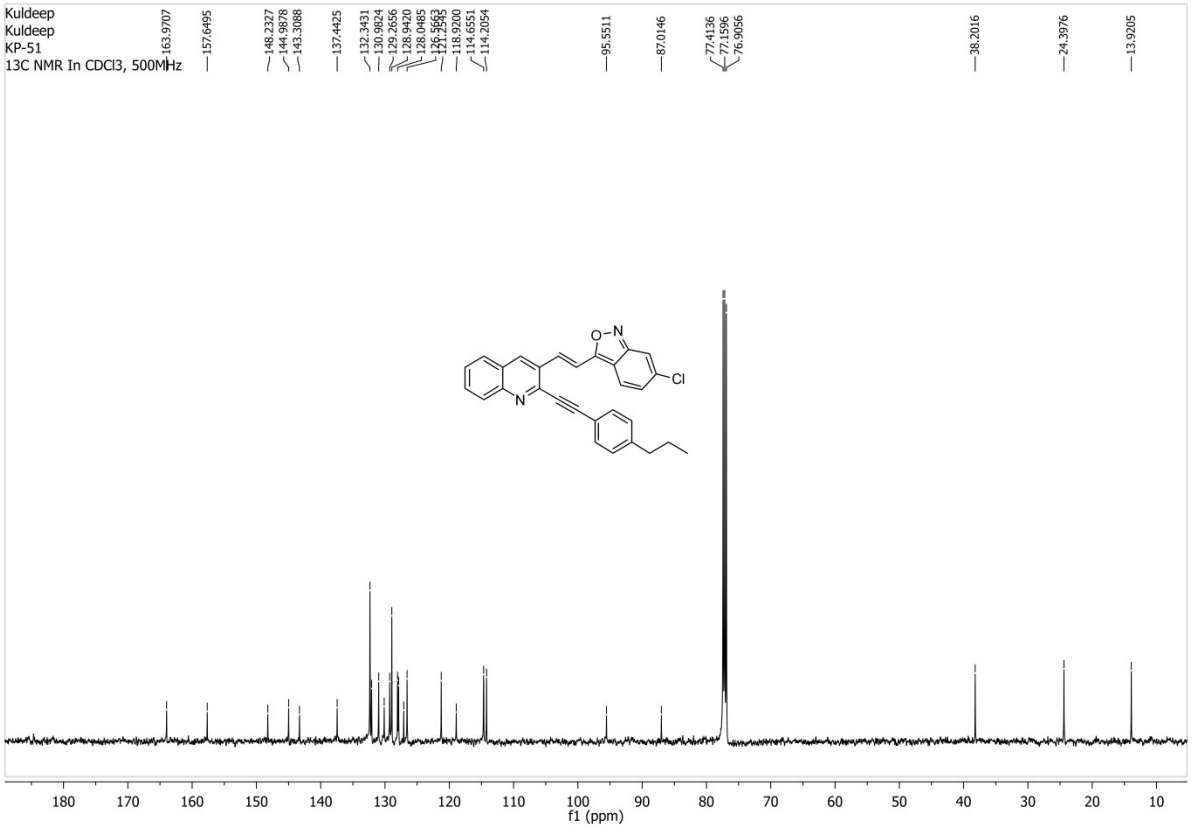

Fig. **S112**. ^{13}C-NMR spectrum of **48B**