Electronic Supplementary Material (ESI) for ChemComm.

Supplementary Information

Selective remote C–H sulfonylation of aminoquinolines with arylsulfonyl chlorides *via* copper catalysis

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Materials and Methods

General. All reactions dealing with air- and moisture-sensitive compounds were carried out in dry reaction vessels under a nitrogen atmosphere. ^{1}H and ^{13}C nuclear magnetic resonance (NMR) spectra were recorded on Agilent 600 MHz NMR spectrometer. ^{1}H and ^{13}C NMR spectra are reported in parts per million (ppm) downfield from an internal standard, tetramethylsilane (0 ppm) and $CHCl_3$ (77.0 ppm), respectively. ESI high-resolution mass spectra (HRMS) were recorded on a Waters SYNPAT G2. Melting points were determined using a capillary melting point apparatus and are uncorrected.

Materials. Unless otherwise noted, materials were purchased from commercial suppliers and were used as received. Anhydrous toluene was distilled over CaH_2 and stored under Ar.

Preparation of Substrates

All carboxamides were synthesized by the reactions between the corresponding acyl chlorides or acids and aminoquinolines according to the literature procedures.[1-3] ^{1}H and ^{13}C NMR spectra data for the carboxamides showed good agreement with the literature data.

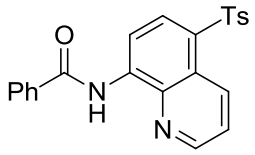
1 L. Grigorjeva and O. Daugulis, *Org. Lett.*, 2014, **16**, 4684.

2 N. Iranpoor, H. Firouzabadi, N. Nowrouzi and D. Khalili, *Tetrahedron*, 2009, **65**, 3893.

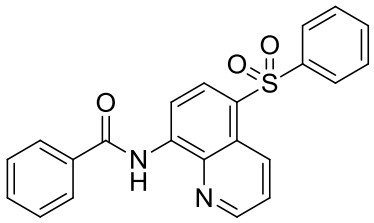
3 Y. Aihara, M. Tobisu, Y. Fukumoto and N. Chatani, *J. Am. Chem. Soc.*, 2014, **136**, 15509.

A General Procedure

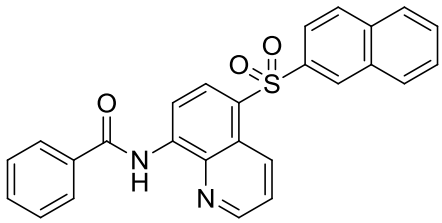
For reactions carried with arylsulfonyl chlorides: A 10 mL of Schlenk tube equipped with a stirrer bar was charged with carboxamide (0.2 mmol), arylsulfonyl (3 equiv), Na_2CO_3 (2 equiv) and CuCl (10 mol %) under Ar. Then, the Schlenk tube was quickly evacuated and refilled with Ar for three times, followed by addition of toluene (2 mL). The Schlenk tube was sealed with a Teflon screwcap and the reaction mixture was stirred at 110 ℃ for 24 h. Upon cooling to room temperature, the reaction mixture was diluted with 10 mL of ethyl acetate, filtered through a pad of silica gel, followed by washing the pad of the silica gel with ethyl acetate (20 mL). Subsequently, the filtrate was concentrated under reduced pressure. The residue was purified by flash chromatography on silica gel to afford the desired products.



***N*-(5-Tosylquinolin-8-yl)benzamide (3aa)**: Yellow solid (86% yield, eluent = petroleum ether/EtOAc (3:1)); Mp = 180–181 ^oC; **^{1}H NMR** (600 MHz, $CDCl_3$): δ 10.97 (s, 1H), 9.08 (dd, *J* = 8.7, 1.3 Hz, 1H), 9.04 (d, *J* = 8.4 Hz, 1H), 8.88 (dd, *J* = 4.1, 1.3 Hz, 1H), 8.55 (d, *J* = 8.4 Hz, 1H), 8.07 (d, *J* = 7.2 Hz, 2H), 7.84 (d, *J* = 8.3 Hz, 2H), 7.63–7.54 (m, 4H), 7.27 (d, *J* = 8.6 Hz, 2H), 2.37 (s, 3H); **^{13}C NMR** (150 MHz, $CDCl_3$): δ 165.7, 148.7, 144.1, 139.9, 139.0, 138.5, 134.3, 133.5, 132.4, 132.0, 129.9, 129.7, 128.9, 127.4, 127.3, 124.3, 123.3, 114.2, 21.5; **HRMS** (ESI): Calcd for $C_{23}H_{18}N_2O_3S$ $[M + H]^+$ 403.1116, found 403.1114.

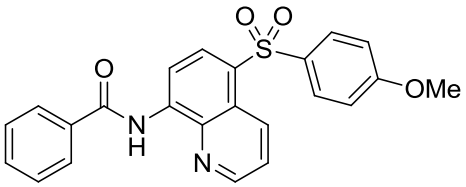


***N*-(5-(Phenylsulfonyl)quinolin-8-yl)benzamide (3ab)**: White solid (86% yield, eluent = petroleum ether/EtOAc (3:1)); Mp = 178–179 ^oC; **^{1}H NMR** (600 MHz, $CDCl_3$): δ 10.97 (s, 1H), 9.06 (dd, *J* = 14.5, 5.0 Hz, 2H), 8.87 (dd, *J* = 4.1, 1.3 Hz, 1H), 8.58 (d, *J* = 8.4 Hz, 1H), 8.06 (d, *J* = 7.4 Hz, 2H), 7.96 (d, *J* = 7.5 Hz, 2H), 7.62–7.51 (m, 5H), 7.48 (t, *J* = 7.6 Hz, 2H); **^{13}C NMR** (150 MHz, $CDCl_3$): δ 165.7, 148.8, 141.9, 140.1, 138.4, 134.3, 133.4, 133.1, 132.4, 132.3, 129.3, 128.9, 128.9, 127.4, 127.2, 124.3, 123.4, 114.2; **HRMS** (ESI): Calcd for $C_{22}H_{16}N_2O_3S$ $[M + H]^+$ 389.0960, found 389.0959.

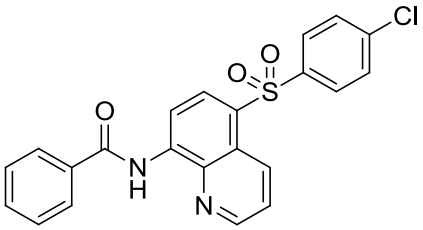


***N*-(5-(Naphthalen-2-ylsulfonyl)quinolin-8-yl)benzamide (3ac)**: White solid (68% yield, eluent

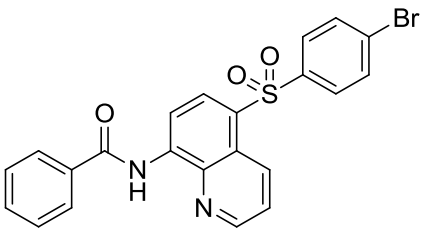
= petroleum ether/EtOAc (7:1)); Mp = 168–169 °C; **^{1}H NMR** (600 MHz, $CDCl_3$): δ 10.97 (s, 1H), 9.14 (dd, *J* = 8.7, 1.2 Hz, 1H), 9.07 (d, *J* = 8.4 Hz, 1H), 8.84 (dd, *J* = 4.1, 1.2 Hz, 1H), 8.65 (d, *J* = 8.4 Hz, 1H), 8.62 (s, 1H), 8.06 (d, *J* = 7.4 Hz, 2H), 7.98 (d, *J* = 7.7 Hz, 1H), 7.88 (d, *J* = 8.8 Hz, 1H), 7.85–7.78 (m, 2H), 7.63–7.53 (m, 6H); **^{13}C NMR** (150 MHz, $CDCl_3$): δ 165.7, 148.7, 140.1, 138.8, 138.4, 134.9, 134.7, 133.4, 132.4, 132.4, 132.1, 129.6, 129.3, 129.2, 128.9, 128.8, 128.4, 127.9, 127.7, 127.4, 124.3, 123.4, 122.3, 114.2; **HRMS** (ESI): Calcd for $C_{26}H_{18}N_2O_3S$ $[M + Na]^+$ 461.0936, found 461.0942.



***N*-(5-((4-Methoxyphenyl)sulfonyl)quinolin-8-yl)benzamide (3ad)**: white solid (69% yield, eluent = petroleum ether/EtOAc (6:1)); Mp = 210–211 °C; **^{1}H NMR** (600 MHz, $CDCl_3$): δ 10.97 (s, 1H), 9.11–9.07 (m, 1H), 9.02 (d, *J* = 8.4 Hz, 1H), 8.89–8.83 (m, 1H), 8.52 (d, *J* = 8.4 Hz, 1H), 8.07 (d, *J* = 7.6 Hz, 2H), 7.89 (d, *J* = 9.0 Hz, 2H), 7.66-7.51(m, 4H), 6.94 (d, *J* = 9.0 Hz, 2H), 3.81 (s, 3H). **^{13}C NMR** (150 MHz, $CDCl_3$): δ 165.7, 163.2, 148.7, 139.7, 138.5, 134.3, 133.5, 133.3, 132.4, 131.7, 129.7, 129.5, 128.9, 127.4, 124.1, 123.3, 114.5, 114.2, 55.6; **HRMS** (ESI): Calcd for $C_{23}H_{18}N_2O_4S$ $[M + H]^+$ 419.1066, found 419.1069.

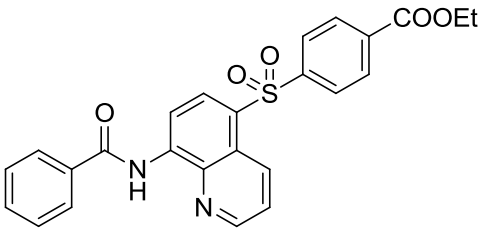


***N*-(5-((4-Chlorophenyl)sulfonyl)quinolin-8-yl)benzamide (3ae)**: White solid (89% yield, eluent = petroleum ether/EtOAc (5:1)); Mp = 205-206 °C; ^{1}H NMR (600 MHz, $CDCl_3$): δ 10.98 (s, 1H), 9.05 (dd, *J* = 13.7, 8.6 Hz, 2H), 8.90 (d, *J* = 3.5 Hz, 1H), 8.57 (d, *J* = 8.4 Hz, 1H), 8.07 (d, *J* = 7.5 Hz, 2H), 7.89 (d, *J* = 8.4 Hz, 2H), 7.64–7.55 (m, 4H), 7.45 (d, *J* = 8.5 Hz, 2H); **^{13}C NMR** (150 MHz, $CDCl_3$): δ 165.7, 148.9, 140.4, 140.3, 139.8, 138.5, 134.2, 133.2, 132.5, 129.6 (two signals are overlapped), 129.0, 128.7, 128.3, 127.4, 124.2, 123.6, 114.2; **HRMS** (ESI): Calcd for $C_{22}H_{15}ClN_2O_3S$ $[M + H]^+$ 423.0570, found 423.0569.

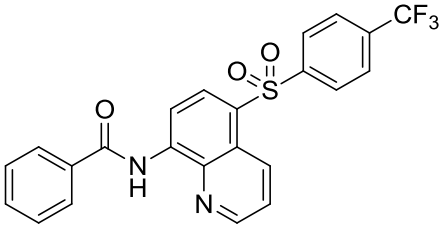


***N*-(5-((4-Bromophenyl)sulfonyl)quinolin-8-yl)benzamide (3af)**: White solid (75% yield, eluent = petroleum ether/EtOAc (5:1)); Mp = 214–215 °C; **^{1}H NMR** (600 MHz, $CDCl_3$): δ 10.98 (s, 1H),

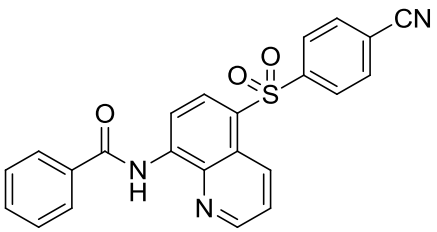
9.05 (d, *J* = 8.4 Hz, 1H), 9.02 (dd, *J* = 8.7, 1.2 Hz, 1H), 8.89 (dd, *J* = 4.1, 1.3 Hz, 1H), 8.56 (d, *J* = 8.4 Hz, 1H), 8.06 (d, *J* = 7.4 Hz, 2H), 7.81 (d, *J* = 8.7 Hz, 2H), 7.63–7.53 (m, 6H); **^{13}C NMR** (150 MHz, $CDCl_3$): δ 165.7, 148.9, 141.0, 140.3, 138.4, 134.2, 133.2, 132.6, 132.5, 132.5, 129.0, 128.7, 128.3, 128.3, 127.4, 124.2, 123.5, 114.2; **HRMS** (ESI): Calcd for $C_{22}H_{15}BrN_2O_3S$ $[M + H]^+$ 467.0065, found 467.0065.



Ethyl 4-((8-benzamidoquinolin-5-yl)sulfonyl)benzoate (3ag): White solid (83% yield, eluent = petroleum ether/EtOAc (5:1)); Mp = 204–205 ^oC; **^{1}H NMR** (600 MHz, $CDCl_3$): δ 10.98 (s, 1H), 9.07 (d, *J* = 8.4 Hz, 1H), 9.04–8.99 (m, 1H), 8.89–8.86 (m, 1H), 8.61 (d, *J* = 8.4 Hz, 1H), 8.12 (d, *J* = 8.6 Hz, 2H), 8.06 (d, *J* = 7.3 Hz, 2H), 8.01 (d, *J* = 8.6 Hz, 2H), 7.62–7.55 (m, 4H), 4.36 (q, *J* = 7.1 Hz, 2H), 1.36 (t, *J* = 7.1 Hz, 3H); **^{13}C NMR** (150 MHz, $CDCl_3$): δ 165.7, 164.8, 148.9, 145.7, 140.5, 138.4, 134.6, 134.2, 133.2, 132.8, 132.5, 130.4, 129.0, 128.0, 127.4, 127.1, 124.3, 123.5, 114.2, 61.7, 14.2; **HRMS** (ESI): Calcd for $C_{25}H_{20}N_2O_5S$ $[M + Na]^+$ 483.0991, found 483.0995

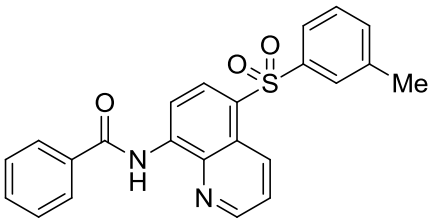


***N*-(5-((4-(Trifluoromethyl)phenyl)sulfonyl)quinolin-8-yl)benzamide (3ah)**: White solid (82% yield, eluent = petroleum ether/EtOAc (4:1)); Mp = 202–204 ^oC; **^{1}H NMR** (600 MHz, $CDCl_3$): δ 11.00 (s, 1H), 9.09 (d, *J* = 8.3 Hz, 1H), 9.04 (dd, *J* = 8.7, 0.5 Hz, 1H), 8.91 (d, *J* = 4.1 Hz, 1H), 8.62 (d, *J* = 8.4 Hz, 1H), 8.08 (dd, *J* = 7.2, 6.2 Hz, 4H), 7.74 (d, *J* = 8.4 Hz, 2H), 7.65–7.55 (m, 4H); **^{13}C NMR** (150 MHz, $CDCl_3$): δ 165.7, 148.9, 145.5, 140.6, 138.4, 134.9(q, $^2J_{C\text{-}F}$ = 32.9 Hz), 134.2, 133.1, 133.0, 132.5, 129.0, 127.7, 127.6, 127.4, 126.4 (q, $^3J_{C\text{-}F}$ = 3.6 Hz), 124.3, 123.9(q, $^1J_{C\text{-}F}$ = 271.5 Hz), 123.7, 114.3; **HRMS** (ESI): Calcd for $C_{23}H_{15}F_3N_2O_3S$ $[M + H]^+$ 457.0834, found 457.0832.

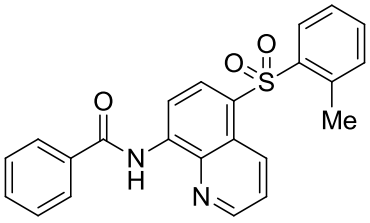


***N*-(5-((4-Cyanophenyl)sulfonyl)quinolin-8-yl)benzamide (3ai)**: White solid (27% yield, eluent = petroleum ether/EtOAc (5:1)); Mp = 209–210 ^oC; **^{1}H NMR** (600 MHz, $CDCl_3$): δ 11.01 (s, 1H), 9.09 (d, *J* = 8.4 Hz, 1H), 9.03–8.99 (m, 1H), 8.93–8.90 (m, 1H), 8.61 (d, *J* = 8.4 Hz, 1H), 8.07 (t, *J*

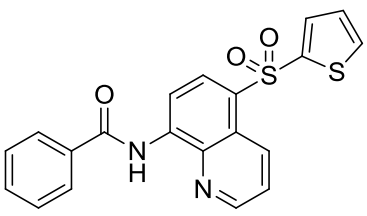
= 7.8 Hz, 4H), 7.77 (d, *J* = 8.3 Hz, 2H), 7.66–7.55 (m, 4H); **^{13}C NMR** (150 MHz, $CDCl_3$): δ 165.7, 149.0, 146.2, 140.9, 138.4, 134.1, 133.3, 133.0, 132.9, 132.6, 129.0, 127.7, 127.4, 127.1, 124.3, 123.7, 117.0, 116.9, 114.3; **HRMS** (ESI): Calcd for $C_{23}H_{15}N_3O_3S$ $[M + Na]^+$ 436.0732, found 436.0736



***N*-(5-(*m*-Tolylsulfonyl)quinolin-8-yl)benzamide (3aj)**: White solid (95% yield, eluent = petroleum ether/EtOAc (7:1)); Mp = 198–199 °C; **^{1}H NMR** (600 MHz, $CDCl_3$): δ 10.98 (s, 1H), 9.10–9.02 (m, 2H), 8.94–8.83 (m, 1H), 8.57 (d, *J* = 8.4 Hz, 1H), 8.07 (d, *J* = 7.5 Hz, 2H), 7.77 (d, *J* = 7.7 Hz, 1H), 7.73 (s, 1H), 7.52–7.52 (m, 4H), 7.39–7.31 (m, 2H), 2.37 (s, 3H); **^{13}C NMR** (150 MHz, $CDCl_3$): δ 165.7, 148.7, 141.8, 140.0, 139.6, 138.5, 134.3, 134.0, 133.5, 132.4, 132.2, 129.1, 129.0, 128.9, 127.5, 127.4, 124.3, 124.3, 123.3, 114.2, 21.3; **HRMS** (ESI): Calcd for $C_{23}H_{18}N_2O_3S$ $[M + H]^+$ 403.1116, found 403.1116.

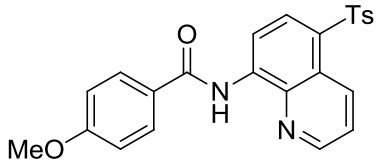


***N*-(5-(*o*-Tolylsulfonyl)quinolin-8-yl)benzamide (3ak)**: White solid (65% yield, eluent = petroleum ether/EtOAc (7:1)); Mp = 187–188 °C; **^{1}H NMR** (600 MHz, $CDCl_3$): δ 10.99 (s, 1H), 9.06 (d, *J* = 8.4 Hz, 1H), 8.87 (dd, *J* = 6.4, 5.2 Hz, 2H), 8.53 (d, *J* = 8.4 Hz, 1H), 8.29 (d, *J* = 7.9 Hz, 1H), 8.07 (d, *J* = 7.3 Hz, 2H), 7.63–7.41 (m, 6H), 7.21 (d, *J* = 7.4 Hz, 1H), 2.43 (s, 3H); **^{13}C NMR** (150 MHz, $CDCl_3$): δ 165.7, 148.7, 139.9, 139.6, 138.4, 138.1, 134.3, 133.5, 133.3, 132.9, 132.6, 132.4, 128.9, 128.9, 128.5, 127.4, 126.5, 124.2, 123.2, 113.8, 20.1; **HRMS** (ESI): Calcd for $C_{23}H_{18}N_2O_3S$ $[M + Na]^+$ 425.0936, found 425.0942.

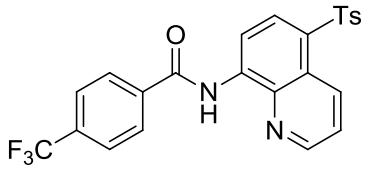


***N*-(5-(Thiophen-2-ylsulfonyl)quinolin-8-yl)benzamide (3al)**: White solid (86% yield, eluent = petroleum ether/EtOAc (7:1)); Mp = 184–185 °C; **^{1}H NMR** (600 MHz, $CDCl_3$): δ 10.99 (s, 1H), 9.24 (d, *J* = 8.7 Hz, 1H), 9.02 (d, *J* = 8.4 Hz, 1H), 8.90 (d, *J* = 3.4 Hz, 1H), 8.54 (d, *J* = 8.4 Hz, 1H), 8.06 (d, *J* = 7.4 Hz, 2H), 7.73 (d, *J* = 3.6 Hz, 1H), 7.65–7.53 (m, 5H), 7.04 (t, *J* = 4.4 Hz, 1H); **^{13}C NMR** (150 MHz, $CDCl_3$): δ 165.7, 148.8, 143.7, 140.2, 138.4, 134.2, 133.5, 133.5, 133.0, 132.5, 131.9, 129.7,

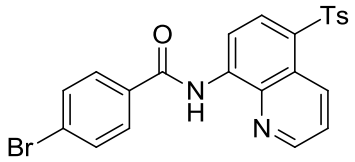
128.9, 127.7, 127.4, 124.2, 123.4, 114.3; **HRMS** (ESI): Calcd for $C_{20}H_{14}N_2O_3S_2$ $[M + Na]^+$ 417.0344, found 41.0350.



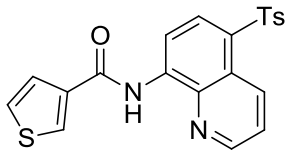
4-Methoxy-N-(5-tosylquinolin-8-yl)benzamide (3ba): White solid (84% yield, eluent = petroleum ether/EtOAc (5:1)); Mp = 183–184 ^oC; **^{1}H NMR** (600 MHz, $CDCl_3$): δ 10.90 (s, 1H), 9.06 (d, *J* = 8.7 Hz, 1H), 9.01 (d, *J* = 8.4 Hz, 1H), 8.88–8.83 (m, 1H), 8.54 (d, *J* = 8.4 Hz, 1H), 8.03 (d, *J* = 8.7 Hz, 2H), 7.83 (d, *J* = 8.1 Hz, 2H), 7.57 (dd, *J* = 8.7, 4.1 Hz, 1H), 7.26 (d, *J* = 8.1 Hz, 2H), 7.04 (d, *J* = 8.7 Hz, 2H), 3.89 (s, 3H), 2.36 (s, 3H); **^{13}C NMR** (150 MHz, $CDCl_3$): δ 165.1, 163.0, 148.6, 144.1, 140.1, 139.0, 138.4, 133.5, 132.1, 129.9, 129.3, 128.9, 127.2, 126.5, 124.2, 123.3, 114.1, 114.0, 55.5, 21.5; **HRMS** (ESI): Calcd for $C_{24}H_{20}N_2O_4S$ $[M + Na]^+$ 455.1041, found 455.1039.



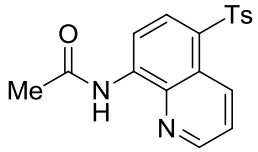
***N*-(5-Tosylquinolin-8-yl)-4-(trifluoromethyl)benzamide (3ca)**: White solid (78% yield, eluent = petroleum ether/EtOAc (3:1)); Mp = 201–202 ^oC; **^{1}H NMR** (600 MHz, $CDCl_3$): δ 10.99 (s, 1H), 9.10 (d, *J* = 8.7 Hz, 1H), 9.02 (d, *J* = 8.3 Hz, 1H), 8.88 (d, *J* = 4.1 Hz, 1H), 8.56 (d, *J* = 8.4 Hz, 1H), 8.17 (d, *J* = 8.1 Hz, 2H), 7.84 (dd, *J* = 8.0, 4.6 Hz, 4H), 7.60 (dd, *J* = 8.7, 4.1 Hz, 1H), 7.30–7.26 (m, 2H), 2.37 (s, 3H); **^{13}C NMR** (150 MHz, $CDCl_3$): δ 164.3, 148.8, 144.2, 139.3, 138.8, 138.4, 137.6, 134.1 (q, $^2J_{C\text{-}F}$ = 32.6 Hz), 133.6, 131.9, 130.0, 129.9, 127.9, 127.3, 126.0 (q, $^3J_{C\text{-}F}$ = 3.6 Hz), 124.4 (q, $^1J_{C\text{-}F}$ = 271.2 Hz), 124.2, 123.4, 114.5, 21.5; **HRMS** (ESI): Calcd for $C_{24}H_{17}F_3N_2O_3S$ $[M + H]^+$ 471.0990, found 471.0989.



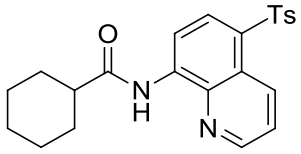
4-Bromo-N-(5-tosylquinolin-8-yl)benzamide (3da): White solid (75% yield, eluent = petroleum ether/EtOAc (4:1)); Mp = 170–172 ^oC; **^{1}H NMR** (600 MHz, $CDCl_3$): δ 10.93 (s, 1H), 9.10–9.07 (m, 1H), 9.00 (d, *J* = 8.4 Hz, 1H), 8.87 (d, *J* = 3.0 Hz, 1H), 8.55 (d, *J* = 8.4 Hz, 1H), 7.93 (d, *J* = 8.5 Hz, 2H), 7.84 (d, *J* = 8.3 Hz, 2H), 7.70 (d, *J* = 8.5 Hz, 2H), 7.59 (dd, *J* = 8.7, 4.2 Hz, 1H), 7.28 (s, 1H), 2.36 (s, 3H); **^{13}C NMR** (150 MHz, $CDCl_3$): δ 164.7, 148.8, 144.2, 139.6, 138.8, 138.4, 133.6, 133.1, 132.2, 131.9, 129.9, 129.6, 129.0, 127.3, 124.2, 123.4, 114.7, 114.3, 21.5; **HRMS** (ESI): Calcd for $C_{23}H_{17}BrN_2O_3S$ $[M + H]^+$ 481.0222, found 481.0219.



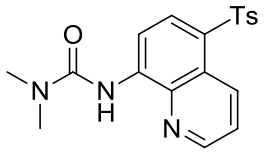
***N*-(5-Tosylquinolin-8-yl)thiophene-3-carboxamide (3ea)**: White solid (78% yield, eluent = petroleum ether/EtOAc (3:1)); Mp = 172–173 ^{o}C; **^{1}H NMR** (600 MHz, $CDCl_3$): δ 10.79 (s, 1H), 9.07 (d, *J* = 8.7 Hz, 1H), 8.93 (d, *J* = 8.4 Hz, 1H), 8.87 (d, *J* = 3.9 Hz, 1H), 8.52 (d, *J* = 8.4 Hz, 1H), 7.83 (d, *J* = 8.1 Hz, 3H), 7.63 (d, *J* = 4.9 Hz, 1H), 7.57 (dd, *J* = 8.7, 4.2 Hz, 1H), 7.27 (d, *J* = 8.1 Hz, 2H), 7.19 (t, *J* = 4.3 Hz, 1H), 2.36 (s, 3H); **^{13}C NMR** (150 MHz, $CDCl_3$): δ 160.1, 148.7, 144.1, 139.6, 139.1, 138.9, 138.2, 133.5, 131.9, 131.9, 129.9, 129.3, 129.1, 128.0, 127.3, 124.2, 123.3, 114.1, 21.5; **HRMS** (ESI): Calcd for $C_{21}H_{16}N_2O_3S_2$ $[M + H]^+$ 409.0681, found 409.0677.



***N*-(5-Tosylquinolin-8-yl)acetamide (3fa)**: Following the general procedure but the reaction was run using CuCl (20 mol %); White solid (78% yield, eluent = petroleum ether/EtOAc (3:1)); Mp = 163–164 ^{o}C; **^{1}H NMR** (600 MHz, $CDCl_3$): δ 10.01 (s, 1H), 9.03 (dd, *J* = 8.7, 1.3 Hz, 1H), 8.84 (d, *J* = 8.4 Hz, 1H), 8.80 (dd, *J* = 4.0, 1.3 Hz, 1H), 8.47 (d, *J* = 8.4 Hz, 1H), 7.81 (d, *J* = 8.3 Hz, 2H), 7.54 (dd, *J* = 8.7, 4.2 Hz, 1H), 7.25 (d, *J* = 8.4 Hz, 2H), 2.37 (s, 3H), 2.35 (s, 3H); **^{13}C NMR** (150 MHz, $CDCl_3$): δ 169.1, 148.5, 144.1, 139.7, 138.9, 137.9, 133.4, 131.9, 129.8, 129.1, 127.2, 124.1, 123.2, 114.0, 25.2, 21.5; **HRMS** (ESI): Calcd for $C_{18}H_{16}N_2O_3S$ $[M + H]^+$ 341.0960, found 341.0963.

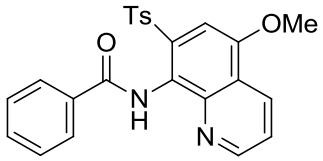


***N*-(5-Tosylquinolin-8-yl)cyclohexanecarboxamide (3ga)**: White solid (70% yield, eluent = petroleum ether/EtOAc (3:1)); Mp = 189–190 ^{o}C; **^{1}H NMR** (600 MHz, $CDCl_3$): δ 10.11 (s, 1H), 9.03 (dd, *J* = 8.7, 1.0 Hz, 1H), 8.88 (d, *J* = 8.4 Hz, 1H), 8.82 (dd, *J* = 4.0, 1.0 Hz, 1H), 8.48 (d, *J* = 8.4 Hz, 1H), 7.80 (d, *J* = 8.2 Hz, 2H), 7.54 (dd, *J* = 8.7, 4.2 Hz, 1H), 7.24 (d, *J* = 8.2 Hz, 2H), 2.51–2.45 (m, 1H), 2.35 (s, 3H), 2.06 (d, *J* = 11.8 Hz, 2H), 1.89–1.85 (m, 2H), 1.66–1.57 (m, 3H), 1.40–1.29 (m, 3H); **^{13}C NMR** (150 MHz, $CDCl_3$): δ 175.2, 148.5, 144.0, 140.0, 139.0, 138.1, 133.4, 132.0, 129.8, 128.8, 127.2, 124.2, 123.1, 114.0, 46.8, 29.6, 25.6, 25.7, 21.5; **HRMS** (ESI): Calcd for $C_{23}H_{24}N_2O_3S$ $[M + Na]^+$ 431.1405, found 431.1406.



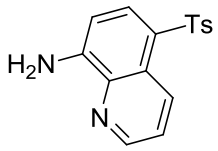
1,1-Dimethyl-3-(5-tosylquinolin-8-yl)urea (3ha): White solid (55% yield, eluent = petroleum ether/EtOAc (3:1)); Mp = 235–236 ^{o}C; **^{1}H NMR** (600 MHz, $CDCl_3$): δ 9.66 (s, 1H), 9.00 (dd, *J* =

8.7, 1.2 Hz, 1H), 8.76 (dd, *J* = 4.1, 1.1 Hz, 1H), 8.66 (d, *J* = 8.5 Hz, 1H), 8.48 (d, *J* = 8.5 Hz, 1H), 7.80 (d, *J* = 8.3 Hz, 2H), 7.51 (dd, *J* = 8.7, 4.2 Hz, 1H), 7.24 (d, *J* = 8.3 Hz, 2H), 3.16 (s, 6H), 2.35 (s, 3H); **^{13}C NMR** (150 MHz, $CDCl_3$): δ 154.7, 148.1, 143.8, 141.6, 139.3, 138.0, 133.4, 132.4, 129.8, 127.1, 126.6, 124.2, 123.0, 112.1, 36.5, 21.5; **HRMS** (ESI): Calcd for $C_{19}H_{19}N_3O_3S$ $[M + H]^+$ 370.1225, found 370.1227.

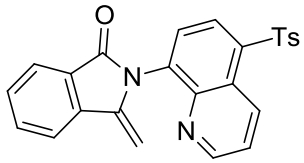


***N*-(5-Methoxy-7-tosylquinolin-8-yl)benzamide (3ia)**: White solid (70% yield, eluent = petroleum ether/EtOAc (1:1)); Mp = 203–204 ^{o}C; **^{1}H NMR** (600 MHz, $CDCl_3$): δ 8.94 (dd, *J* = 4.0, 1.5 Hz, 1H), 8.77 (s, 1H), 8.60 (dd, *J* = 8.5, 1.5 Hz, 1H), 7.92 (d, *J* = 7.5 Hz, 2H), 7.60 (dd, *J* = 15.7, 7.7 Hz, 4H), 7.54–7.45 (m, 3H), 7.06 (d, *J* = 8.3 Hz, 2H), 4.13 (s, 3H), 2.31 (s, 3H); **^{13}C NMR** (150 MHz, $CDCl_3$): δ 165.6, 154.4, 151.7, 144.6, 144.3, 136.8, 136.0, 133.7, 132.1, 131.0, 129.7, 128.6, 128.5, 127.7, 127.5, 124.0, 122.8, 101.7, 56.4, 21.6; **HRMS** (ESI): Calcd for $C_{24}H_{20}N_2O_4S$ $[M + H]^+$ 433.1222, found 433.1217.

Synthetic Transformations of 3aa



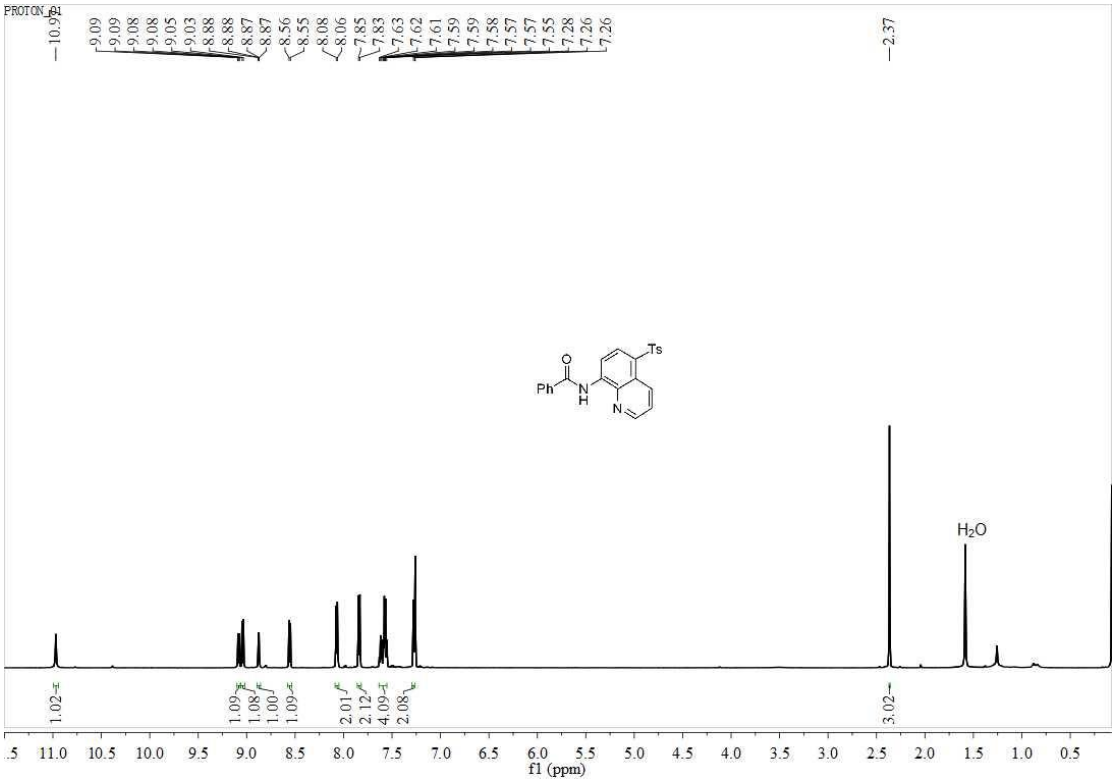
5-Tosylquinolin-8-amine (4): To a solution of **3aa** (0.2 mmol) in 2 mL of EtOH, 1mL of hydrochloric acid (1 M) was added. The mixture was refluxed for 8 h and then add 10mL of aq. $NaHCO_3$ and 10mL of ethyl acetate, organic layer were concentrated under reduced pressure. The residue was purified by flash chromatography on silica gel to afford the product **4**. White solid (92% yield, eluent = petroleum ether/EtOAc (10:1)); Mp = 169–170 ^oC; **^{1}H NMR** (600 MHz, $CDCl_3$): δ 8.91 (d, *J* = 8.7 Hz, 1H), 8.71 (d, *J* = 2.8 Hz, 1H), 8.31 (d, *J* = 8.3 Hz, 1H), 7.78 (d, *J* = 8.2 Hz, 2H), 7.45 (dd, *J* = 8.7, 4.1 Hz, 1H), 7.22 (d, *J* = 8.1 Hz, 2H), 6.89 (d, *J* = 8.3 Hz, 1H), 2.33 (s, 3H); **^{13}C NMR** (150 MHz, $CDCl_3$): δ 149.6, 147.2, 143.4, 140.0, 136.9, 133.2, 132.9, 129.7, 126.8, 125.4, 123.1, 121.5, 106.8, 21.5; **HRMS** (ESI): Calcd for $C_{16}H_{14}N_2O_2S$ $[M + H]^+$ 299.0854, found 299.0859.



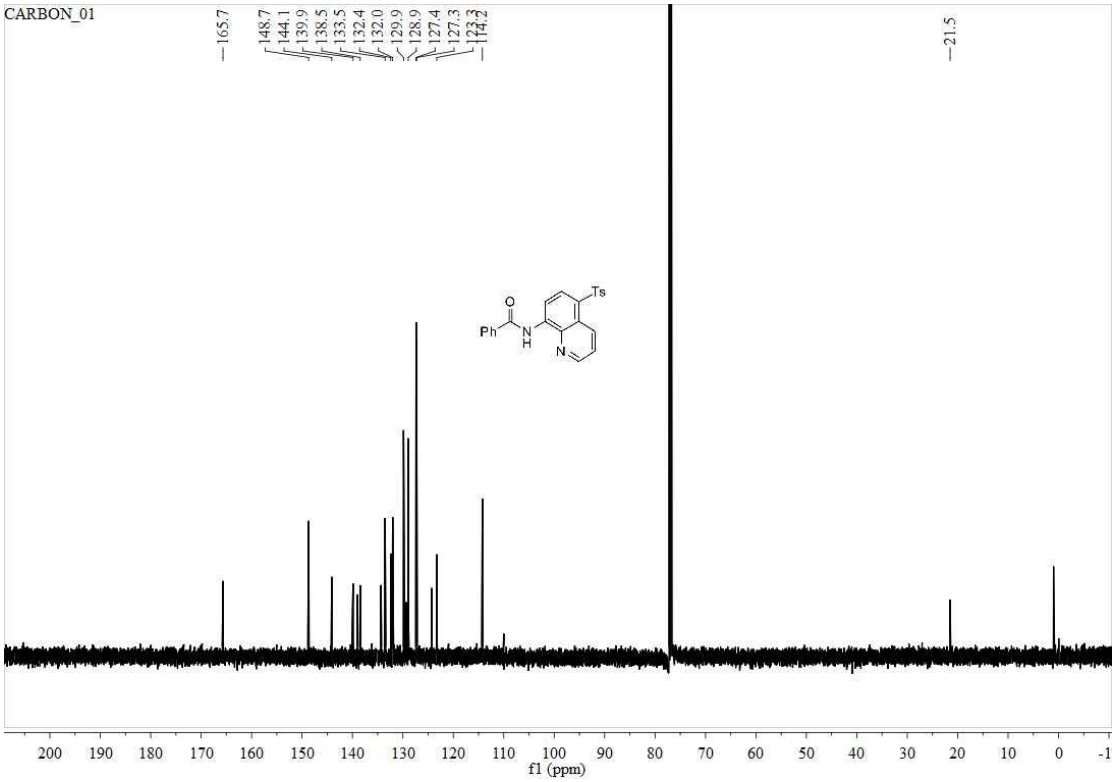
3-Methylene-2-(5-tosylquinolin-8-yl)isoindolin-1-one (5): A 10 mL of Schlenk tube equipped with a stirrer bar was charged with **3aa** (0.2 mmol) and $Pd(TFA)_2$ (5 mol%) under Ar. Then, the Schlenk tube was quickly evacuated and refilled with Ar for three times, followed by addition of toluene (2 mL) and acetic anhydride (0.4 mmol). The Schlenk tube was sealed with a Teflon screwcap and the reaction mixture was stirred at 130 ℃ for 12 h. Upon cooling to room temperature, the reaction mixture was diluted with 10 mL of ethyl acetate, filtered through a pad of silica gel, followed by washing the pad of the silica gel with ethyl acetate (20 mL). Subsequently, the filtrate was concentrated under reduced pressure. The residue was purified by flash chromatography on silica gel to afford the product. White solid (83% yield, eluent = petroleum ether/EtOAc (5:1)); Mp = 198–199 ^oC; **^{1}H NMR** (600 MHz, $CDCl_3$): 9.11 (dd, *J* = 8.8, 1.5 Hz, 1H), 8.89 (dd, *J* = 4.1, 1.5 Hz, 1H), 8.61 (d, *J* = 7.8 Hz, 1H), 7.96 (d, *J* = 7.6 Hz, 1H), 7.92–7.86 (m, 3H), 7.80 (d, *J* = 7.7 Hz, 1H), 7.68 (dd, *J* = 11.1, 4.0 Hz, 1H), 7.59 (t, *J* = 7.5 Hz, 1H), 7.52 (dd, *J* = 8.8, 4.1 Hz, 1H), 7.34 (d, *J* = 8.2 Hz, 2H), 5.21 (d, *J* = 2.4 Hz, 1H), 4.37 (d, *J* = 2.4 Hz, 1H), 2.41 (s, 3H); **^{13}C NMR** (150 MHz, $CDCl_3$): δ 167.2, 151.5, 144.9, 144.8, 143.5, 138.7, 137.9, 137.8, 136.7, 133.0, 132.5, 130.1, 129.8, 129.4, 129.0, 127.7, 125.6, 123.8, 123.2, 120.3, 90.6, 21.6; **HRMS** (ESI): Calcd for $C_{25}H_{18}N_2O_3S$ $[M + H]^+$ 427.1116, found 427.1115.

1H and 13C NMR Spectra

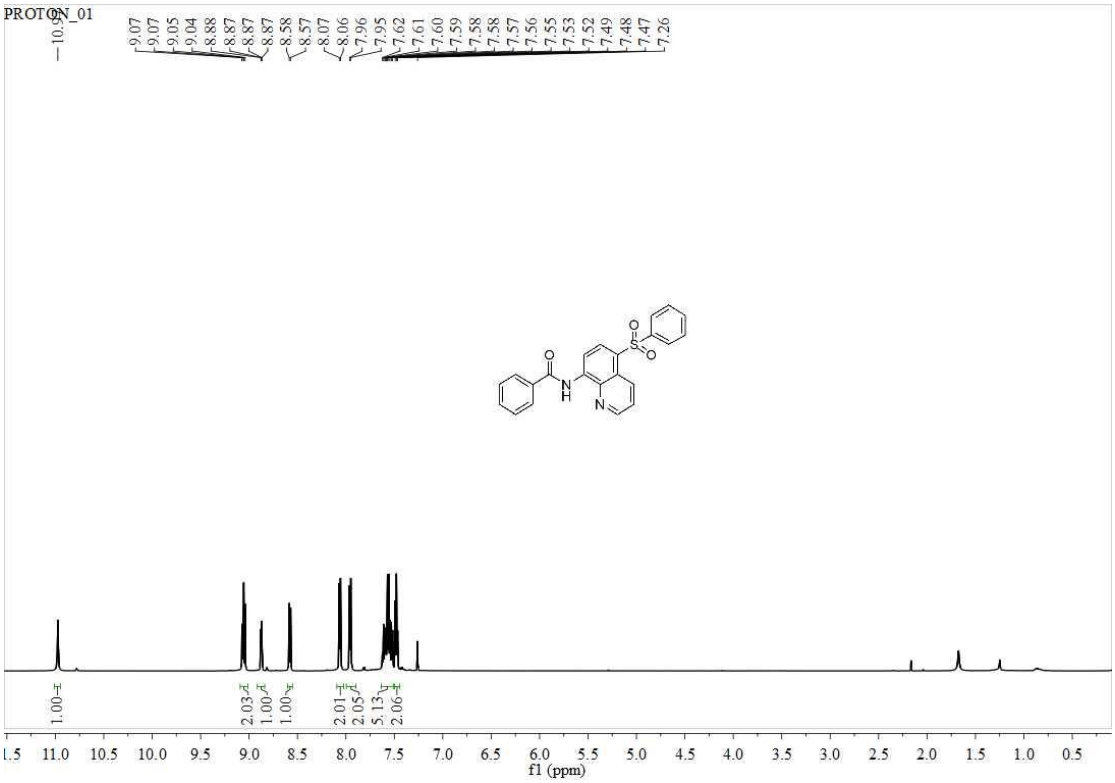
^{1}H NMR Spectrum of 3aa



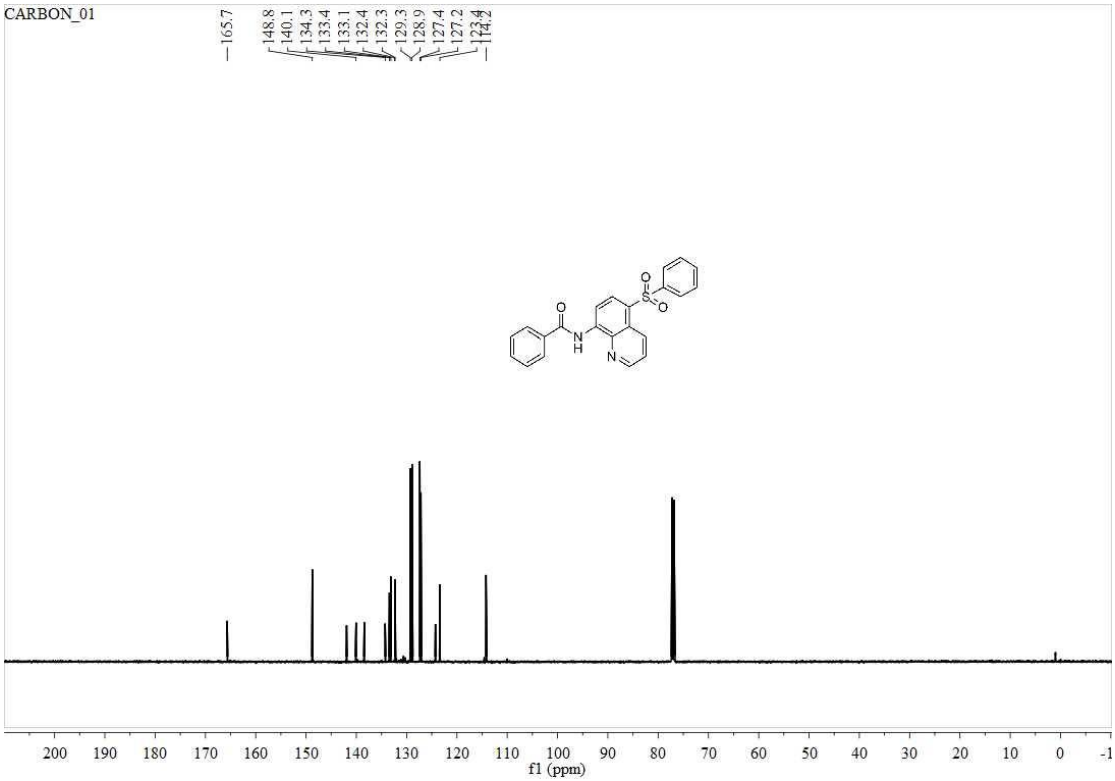
^{13}C NMR Spectrum of 3aa



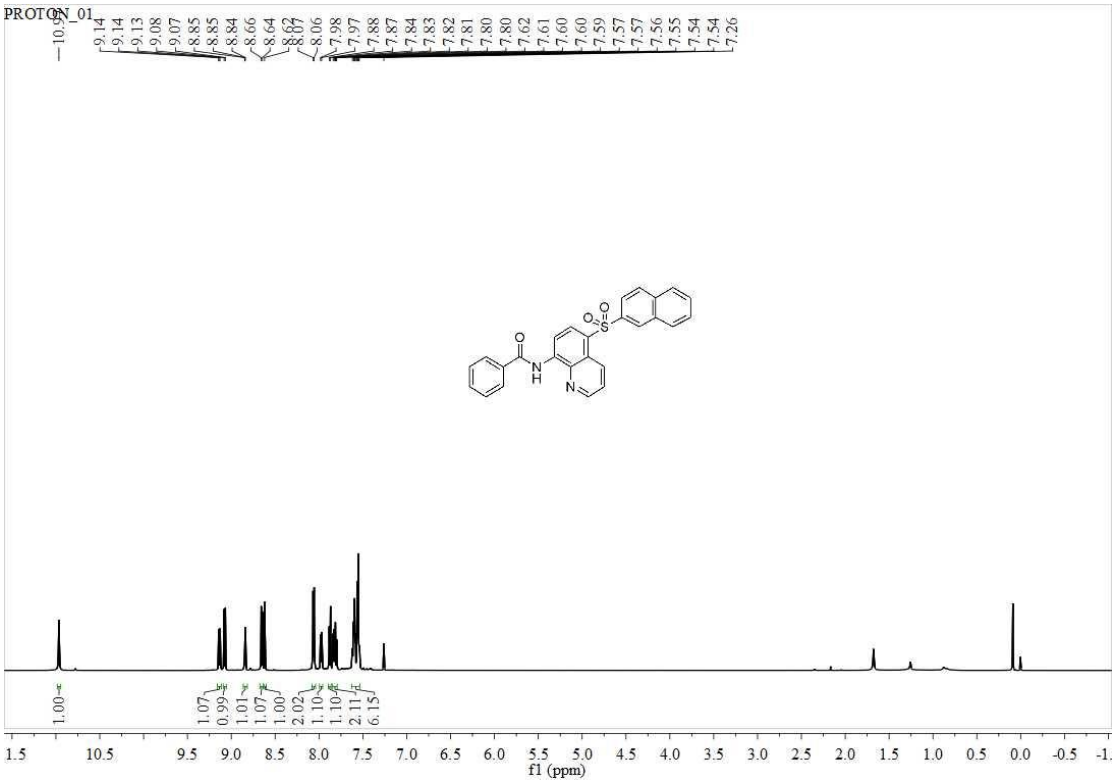
^{1}H NMR Spectrum of 3ab



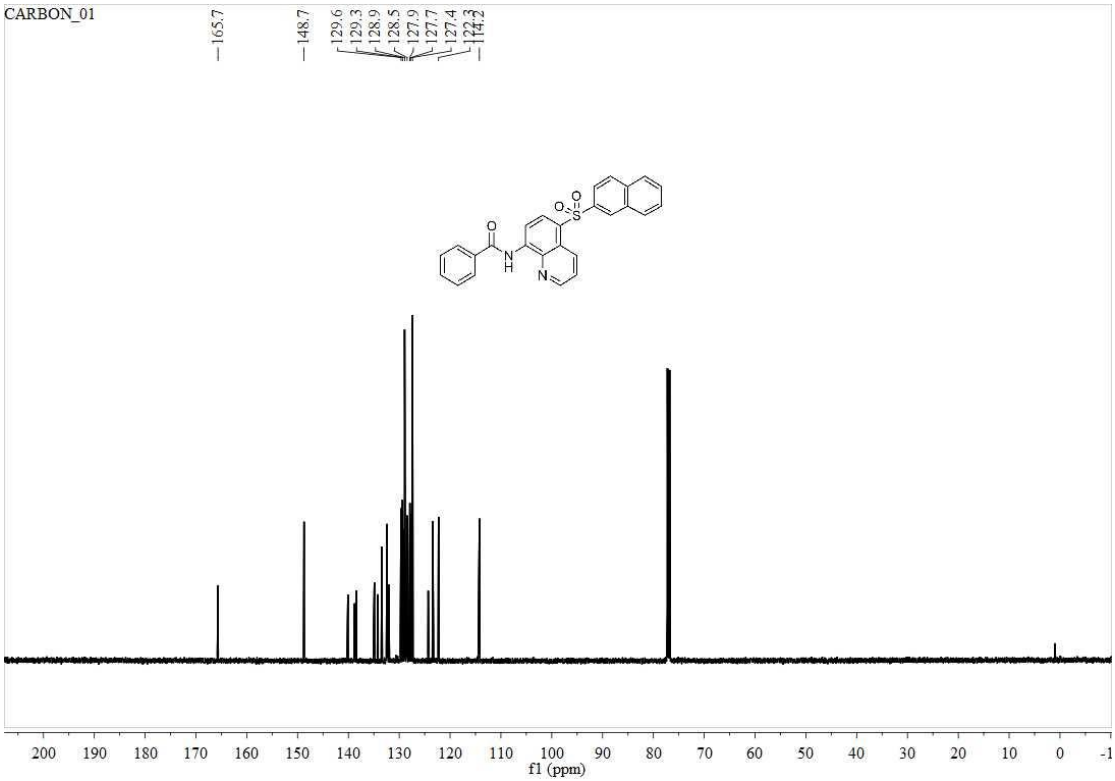
^{13}C NMR Spectrum of 3ab



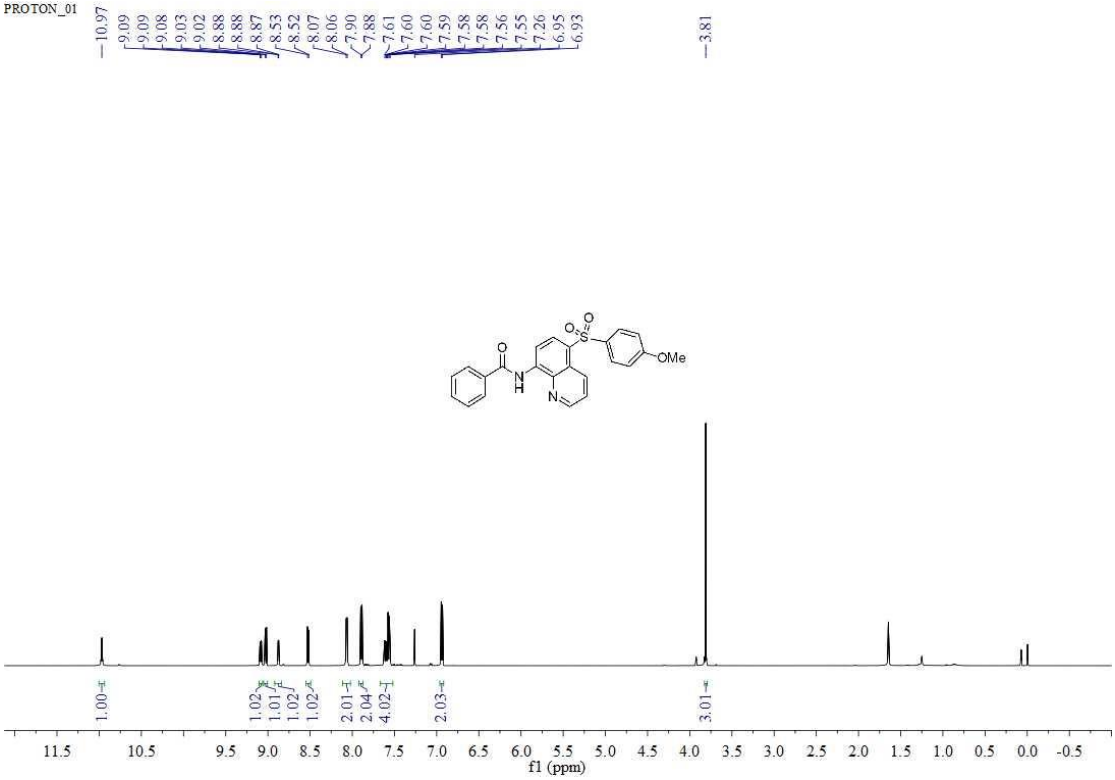
^{1}H NMR Spectrum of 3ac



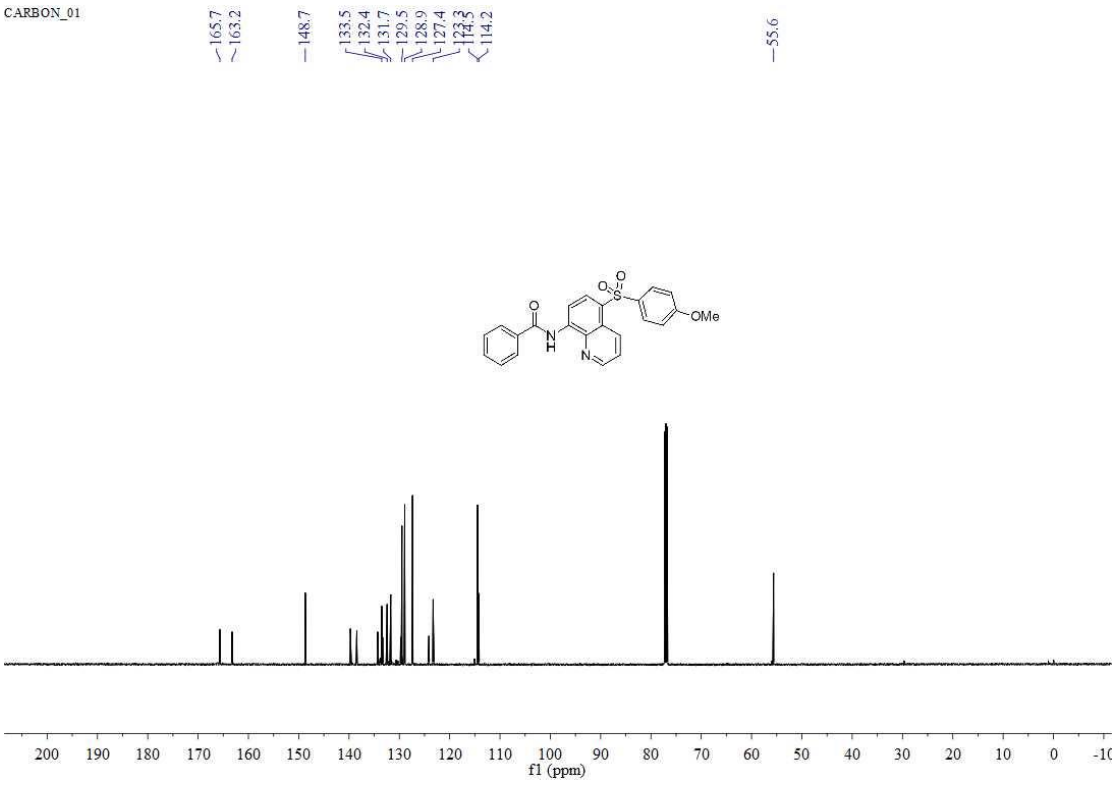
^{13}C NMR Spectrum of 3ac



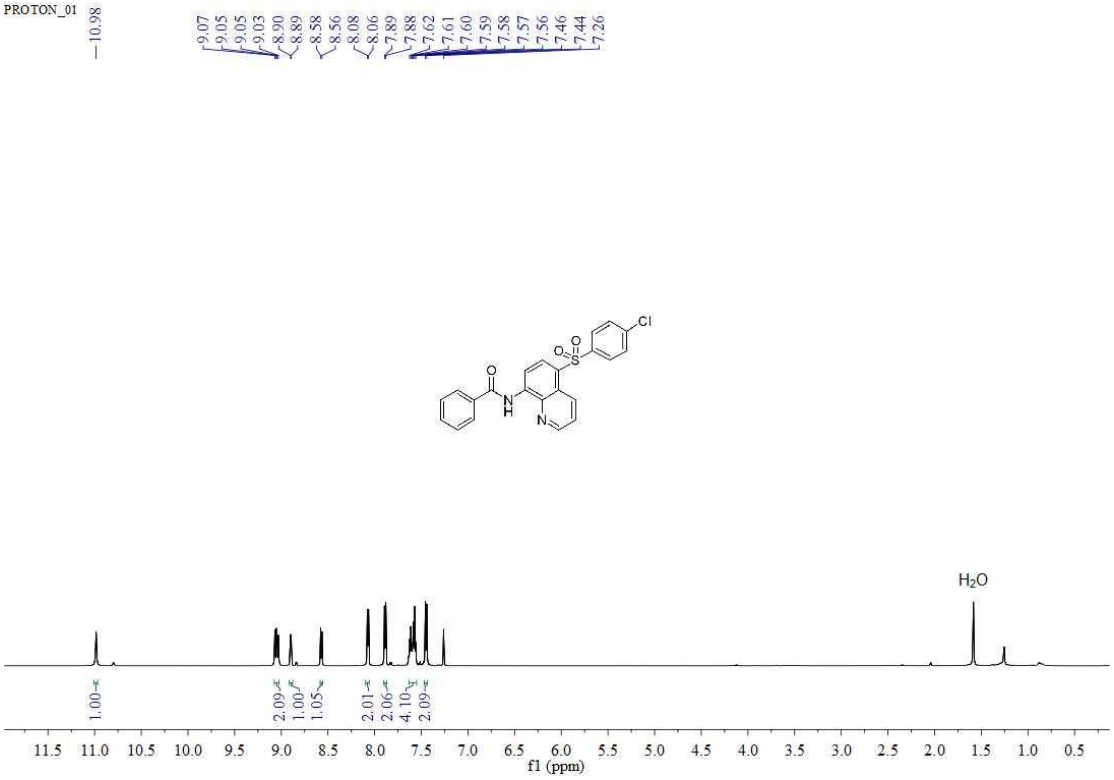
^{1}H NMR Spectrum of 3ad



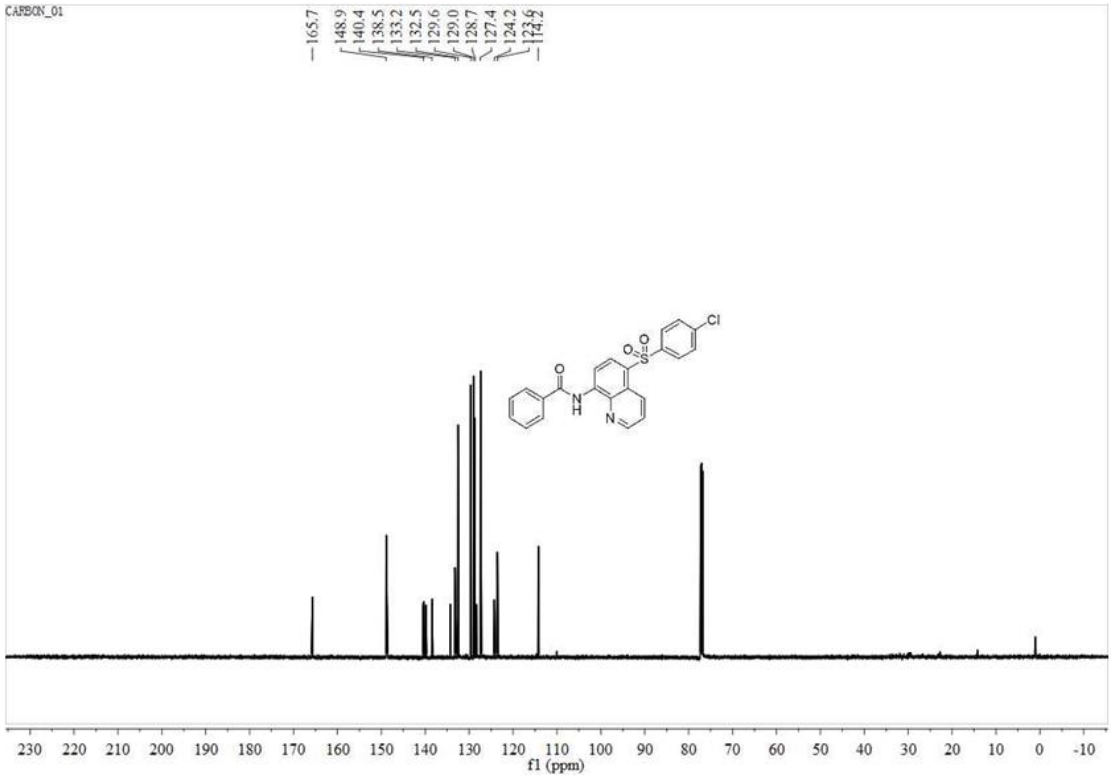
^{13}C NMR Spectrum of 3ad



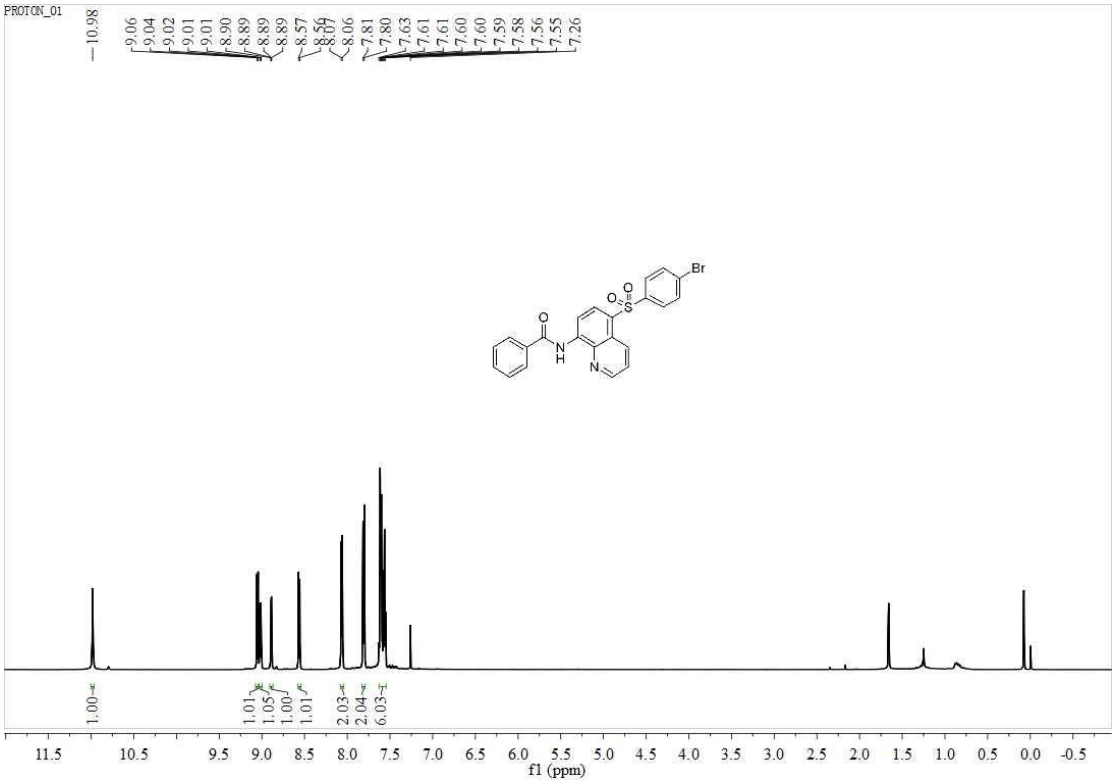
^{1}H NMR Spectrum of 3ae



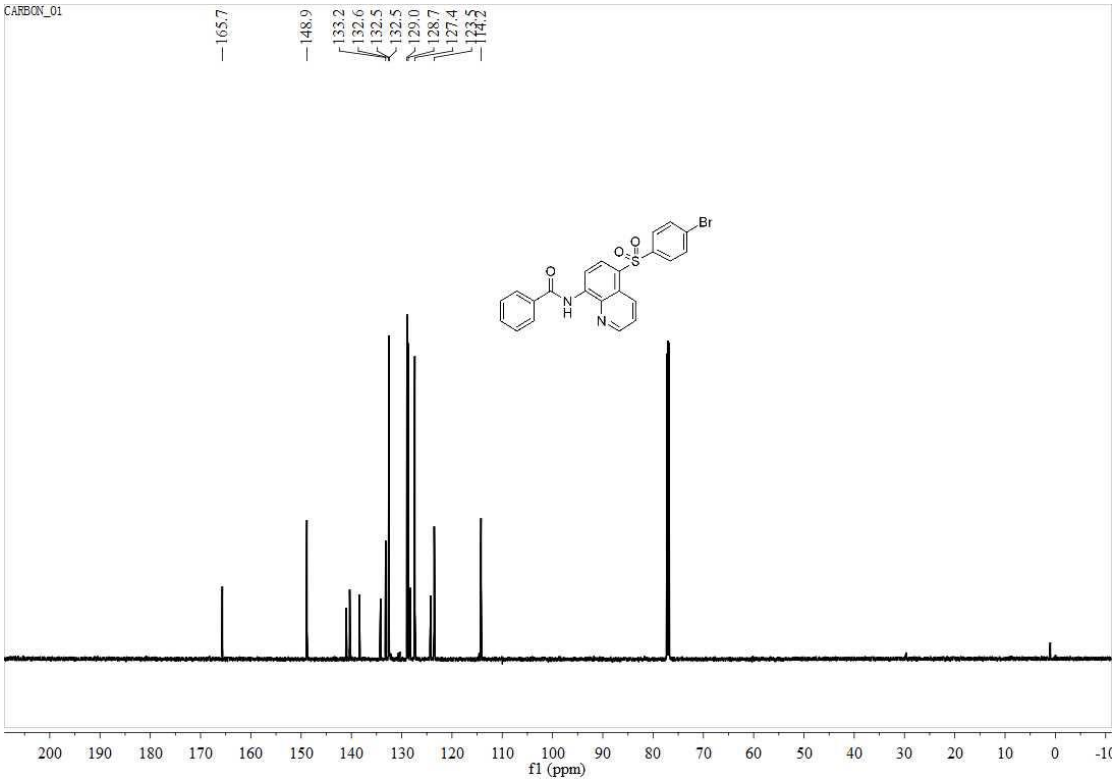
^{13}C NMR Spectrum of 3ae



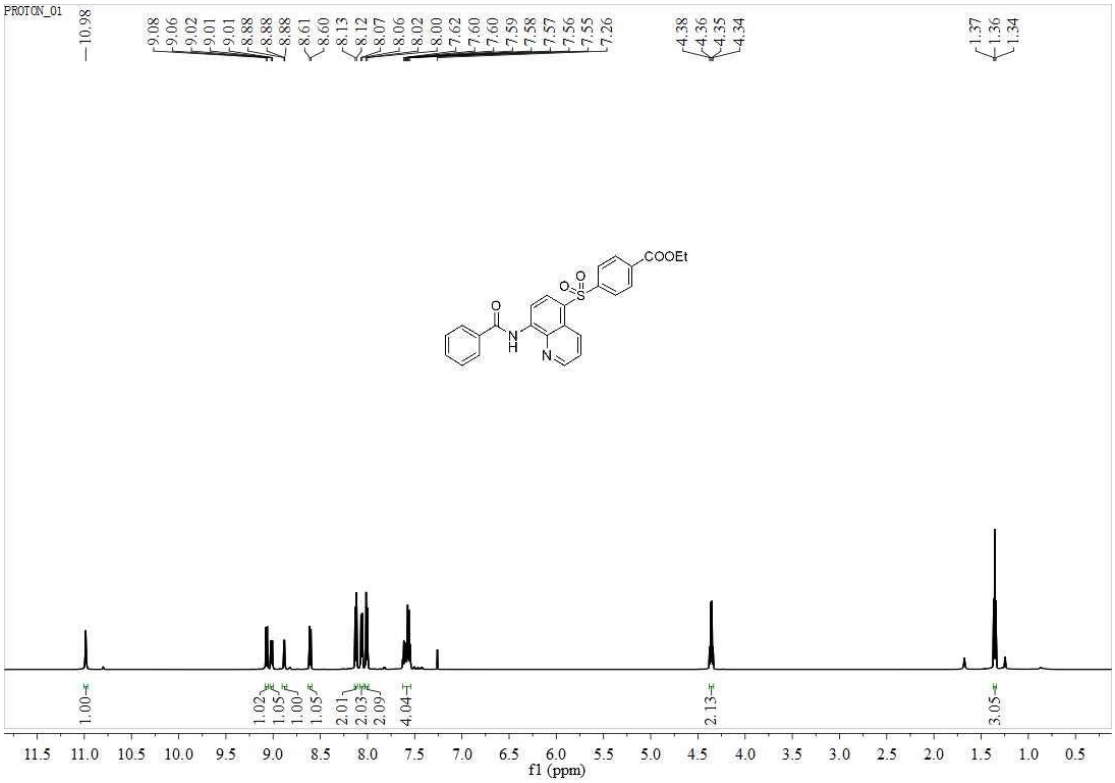
^{1}H NMR Spectrum of 3af



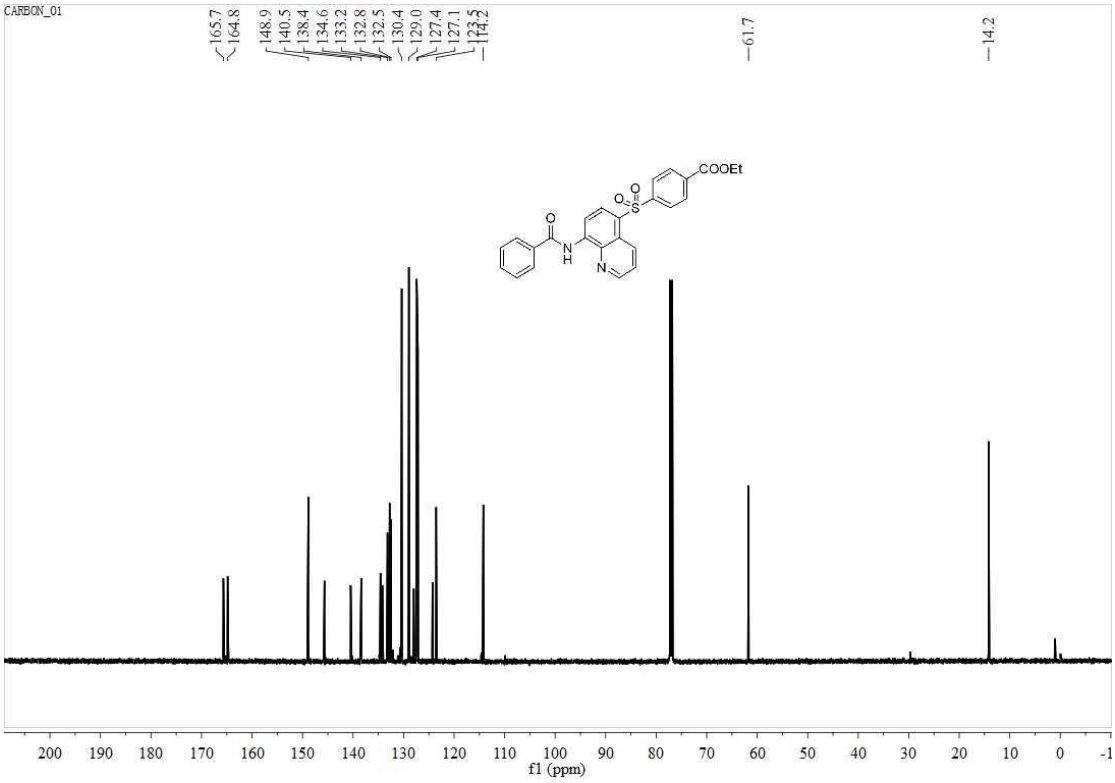
^{13}C NMR Spectrum of 3af



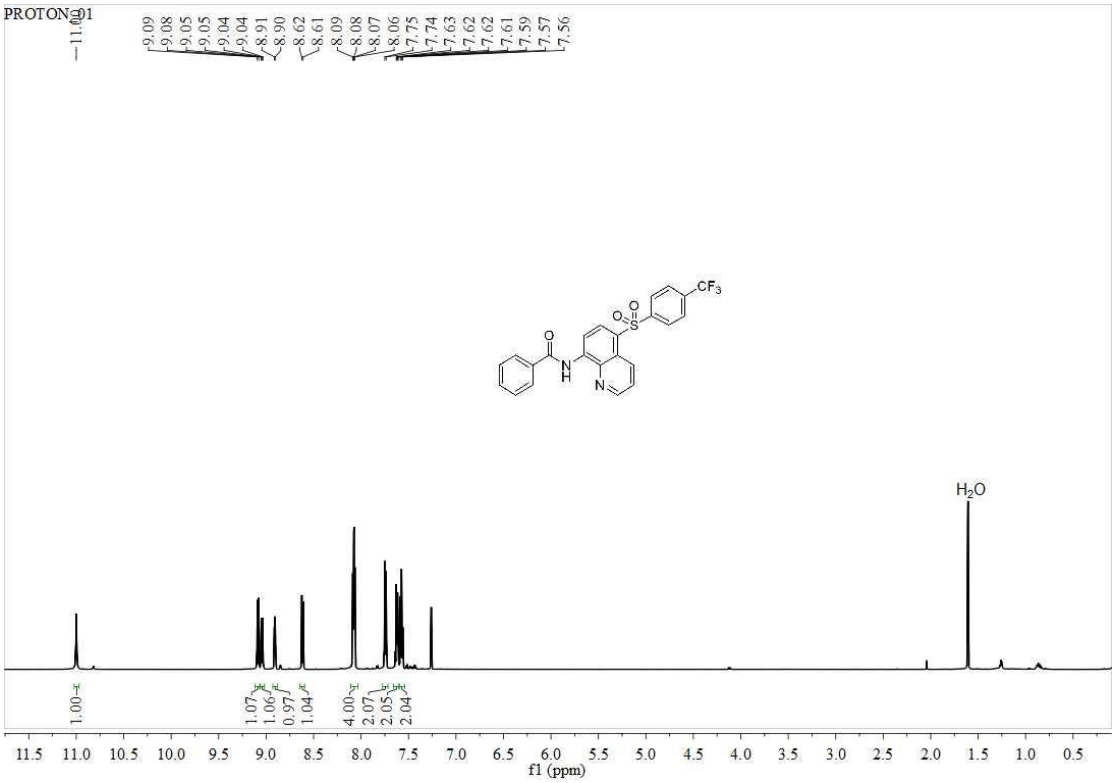
^{1}H NMR Spectrum of 3ag



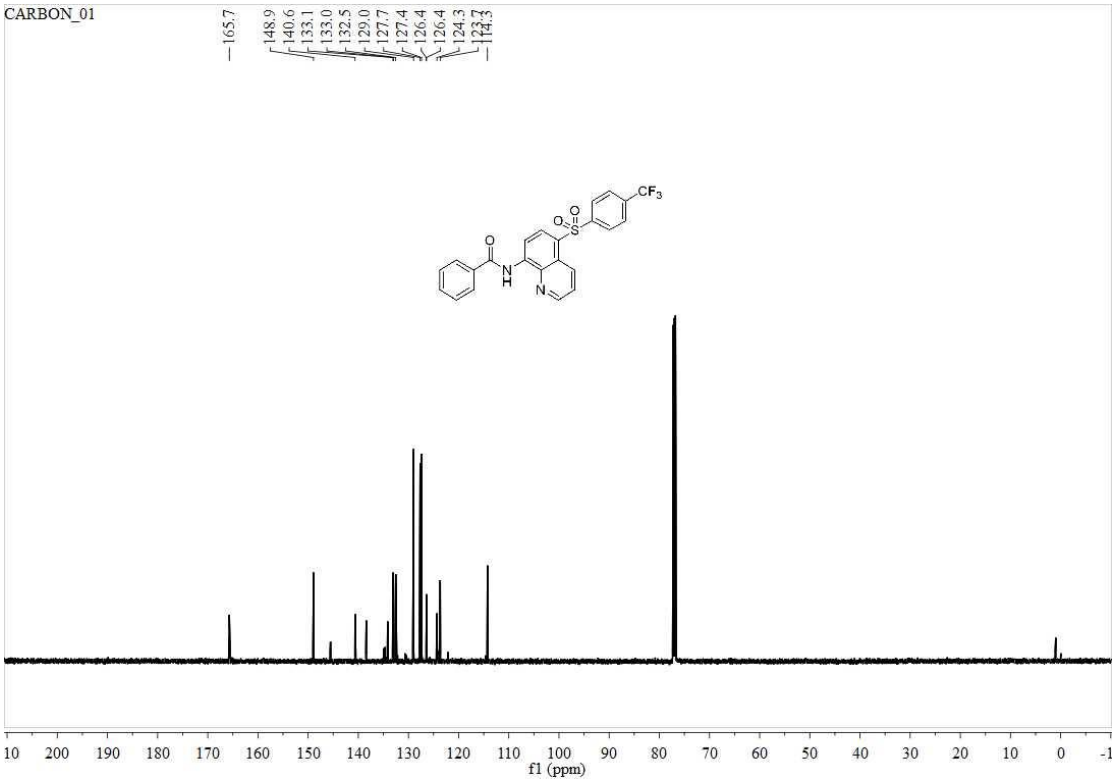
^{13}C NMR Spectrum of 3ag



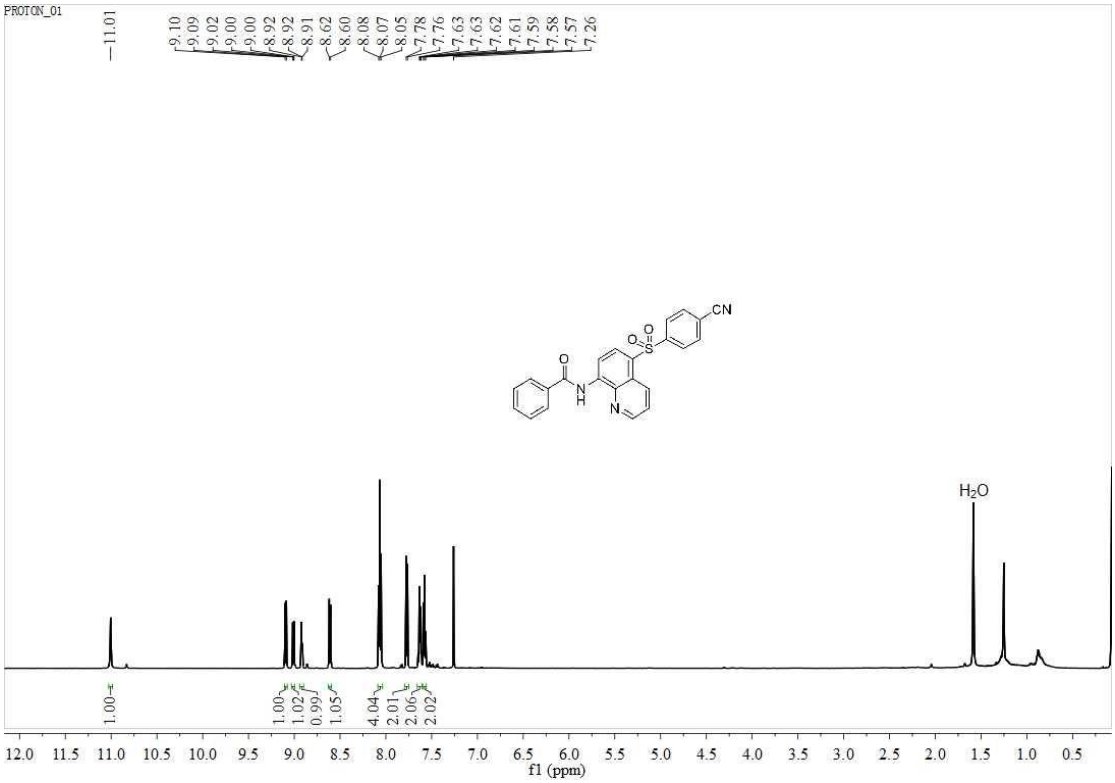
^{1}H NMR Spectrum of 3ah



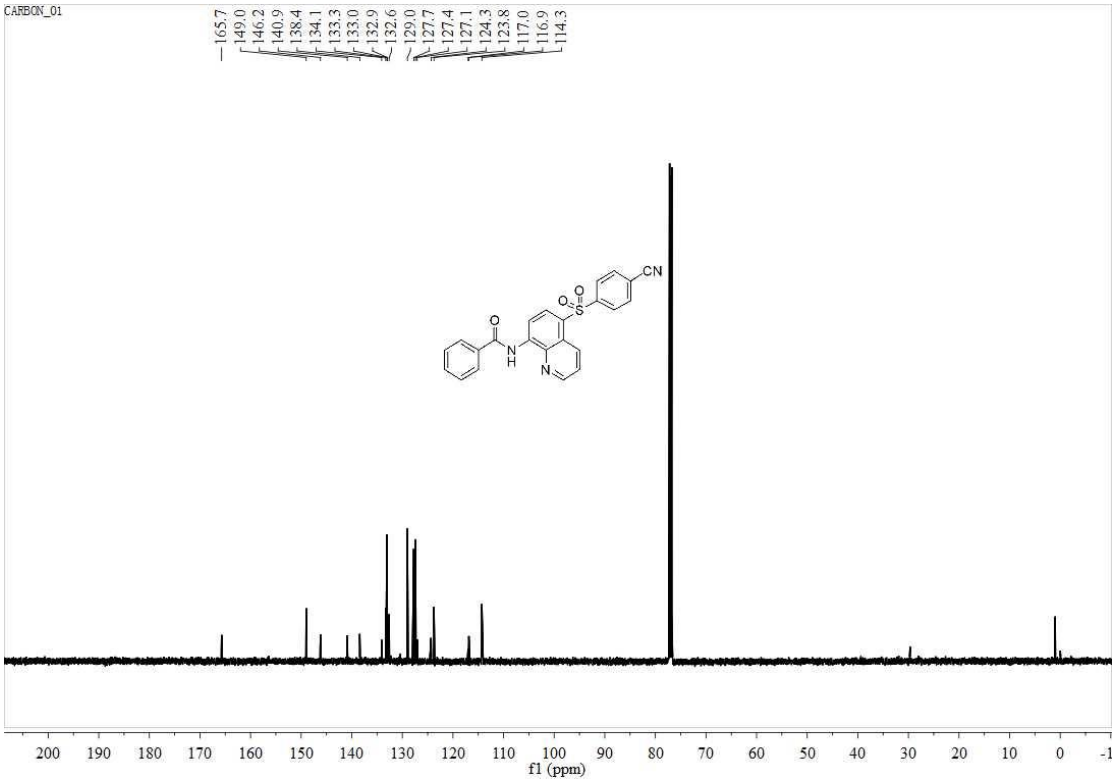
^{13}C NMR Spectrum of 3ah



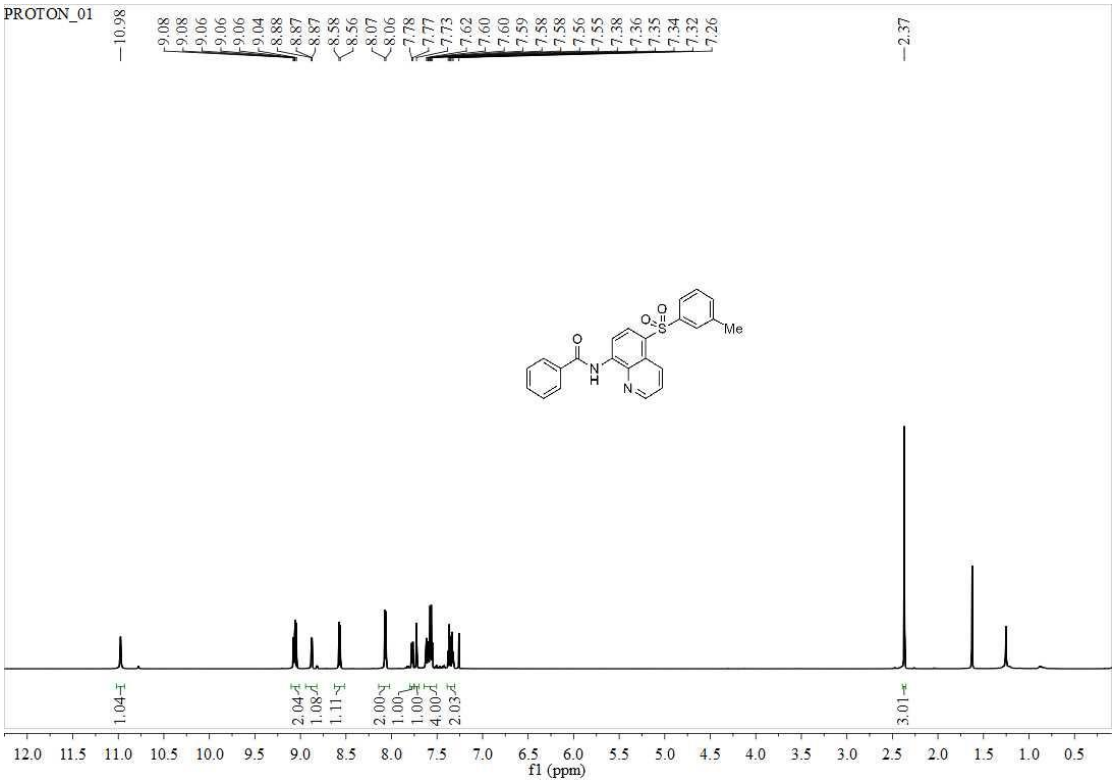
^{1}H NMR Spectrum of 3ai



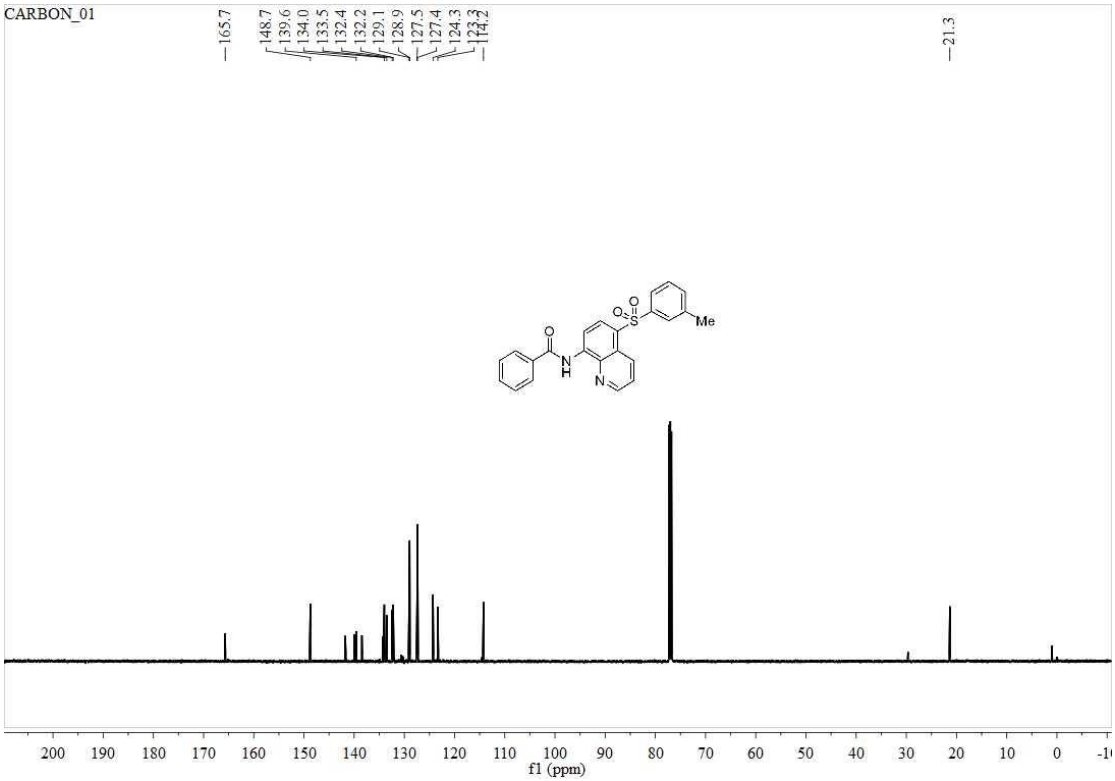
^{13}C NMR Spectrum of 3ai



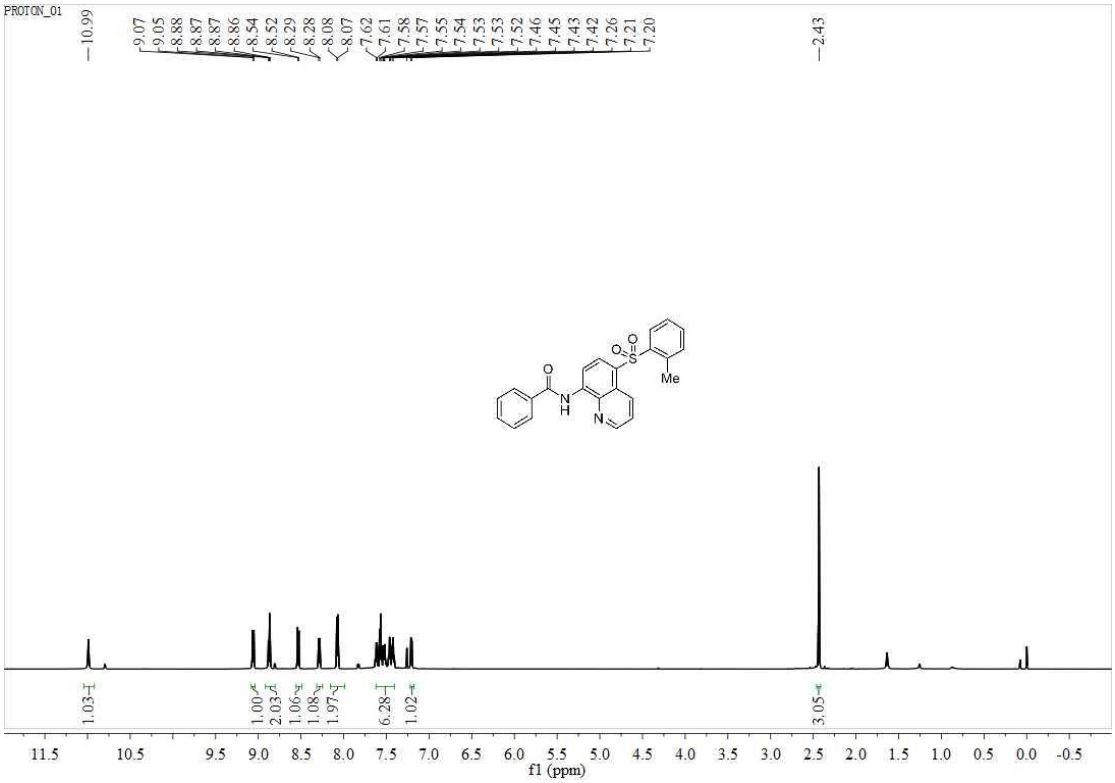
^{1}H NMR Spectrum of 3aj



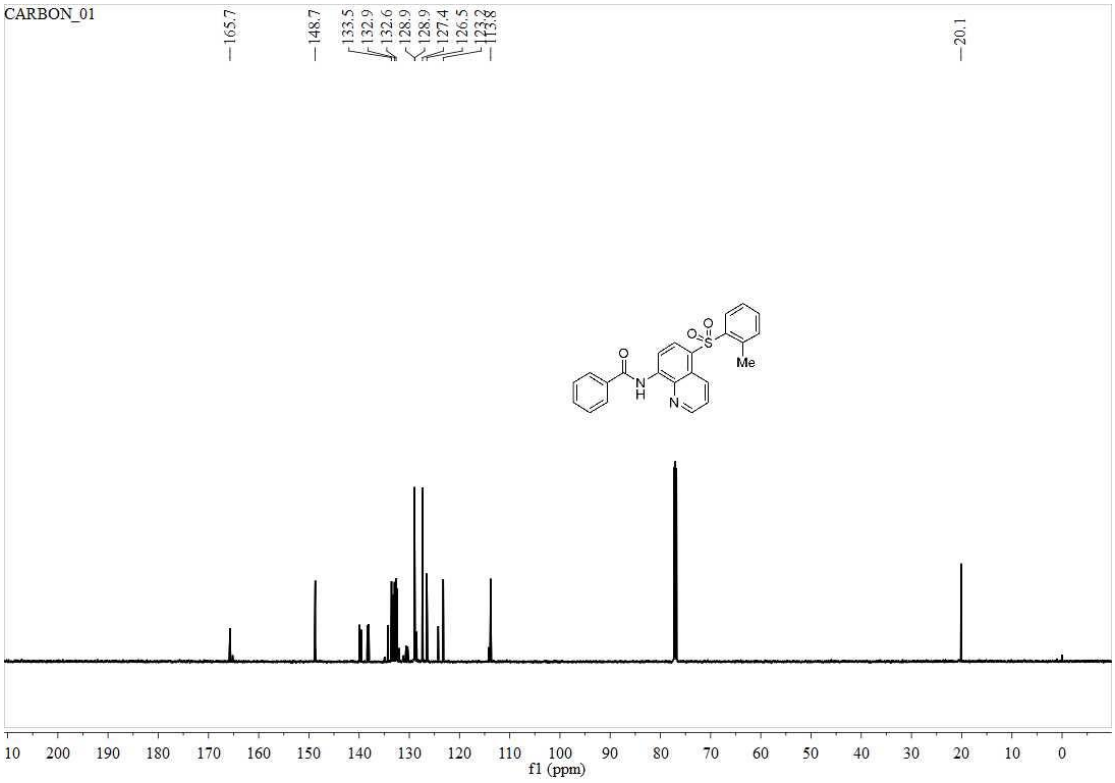
^{13}C NMR Spectrum of 3aj



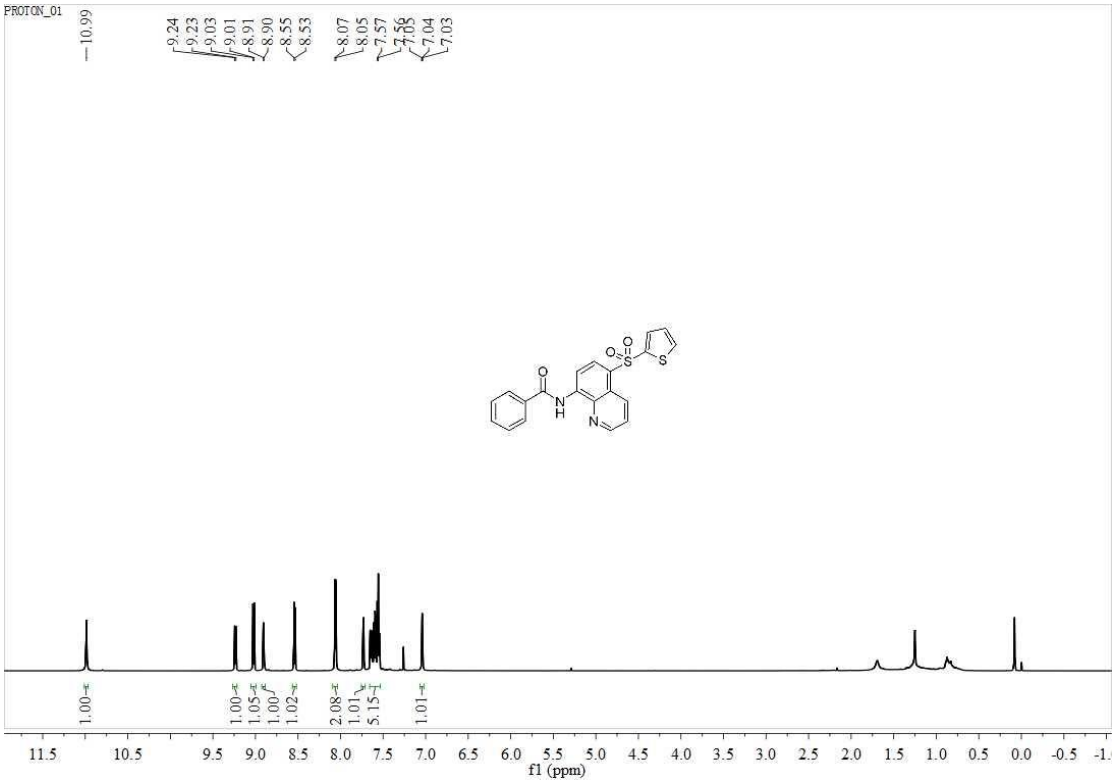
^{1}H NMR Spectrum of 3ak



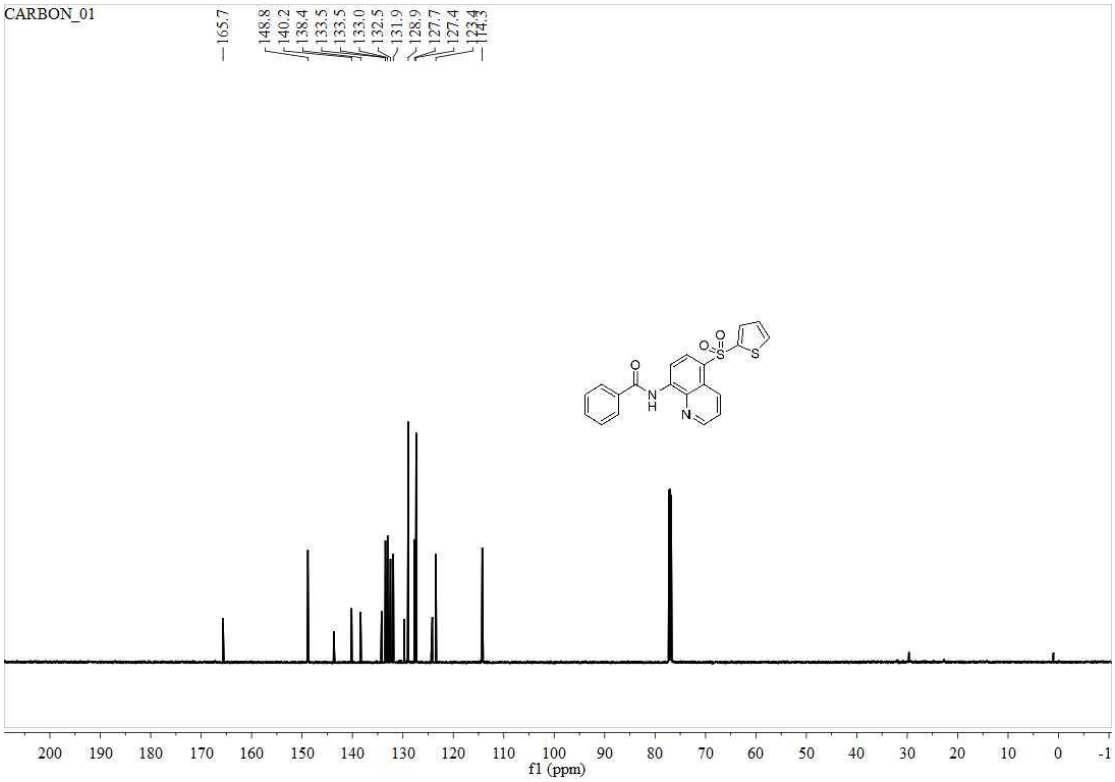
^{13}C NMR Spectrum of 3ak



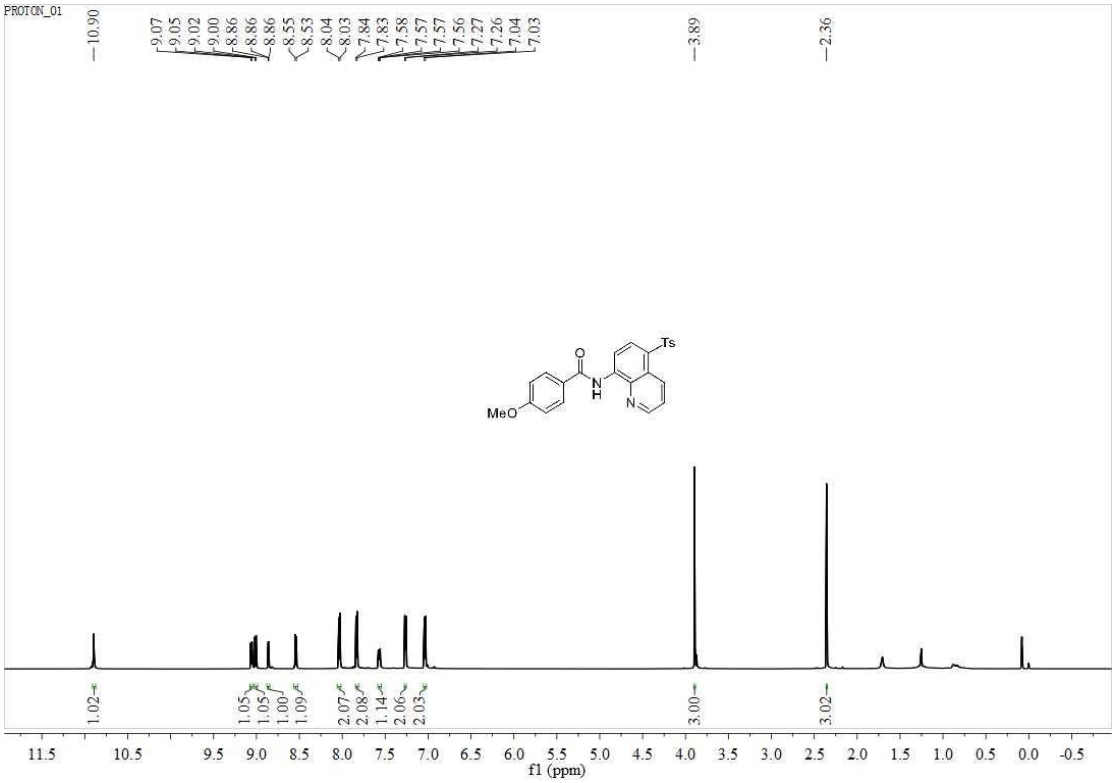
^{1}H NMR Spectrum of 3al



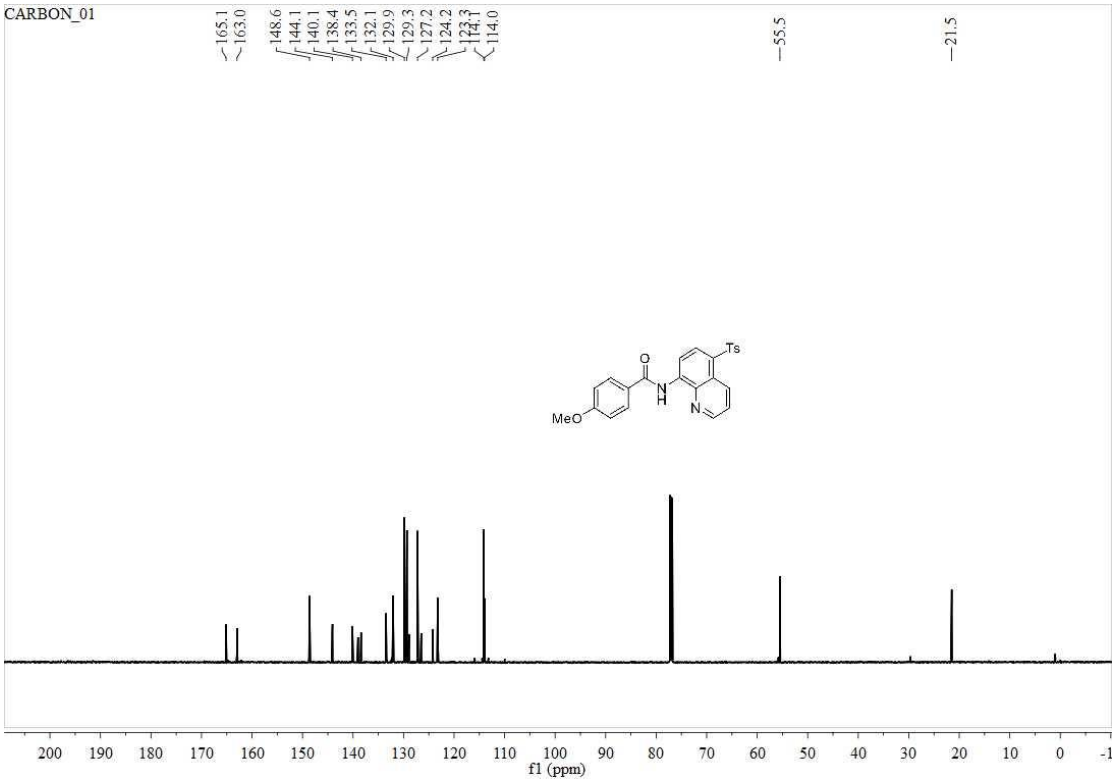
^{13}C NMR Spectrum of 3al



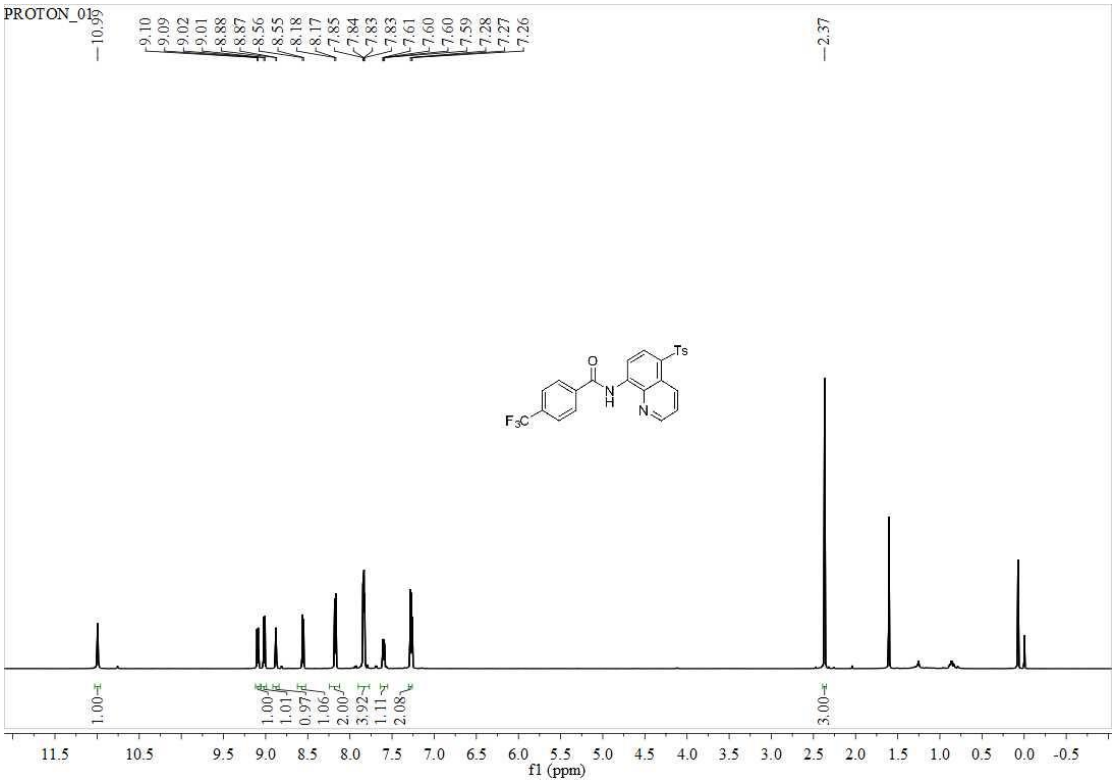
^{1}H NMR Spectrum of 3ba



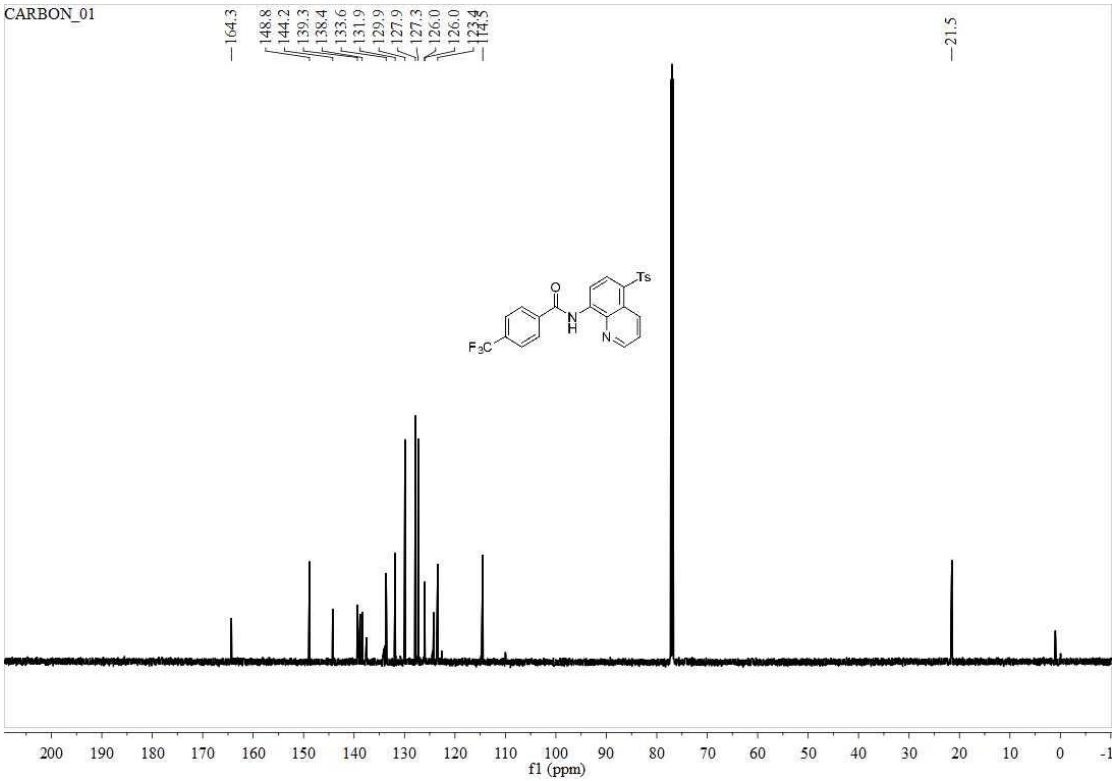
^{13}C NMR Spectrum of 3ba



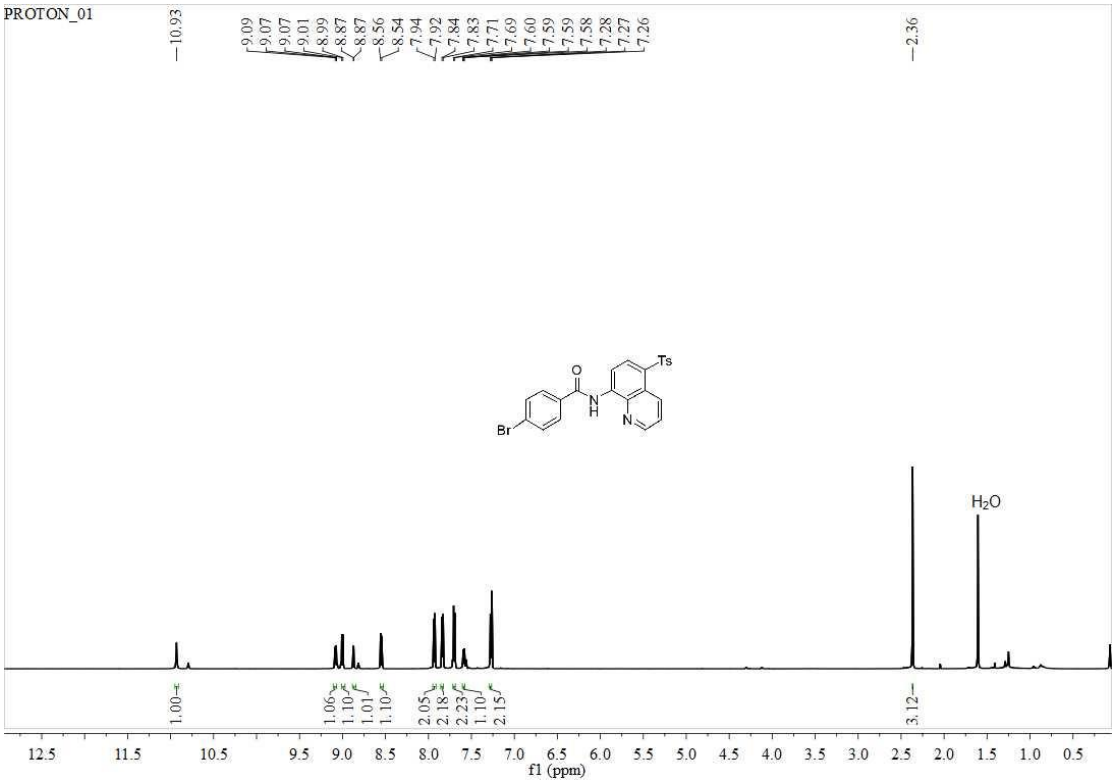
^{1}H NMR Spectrum of 3ca



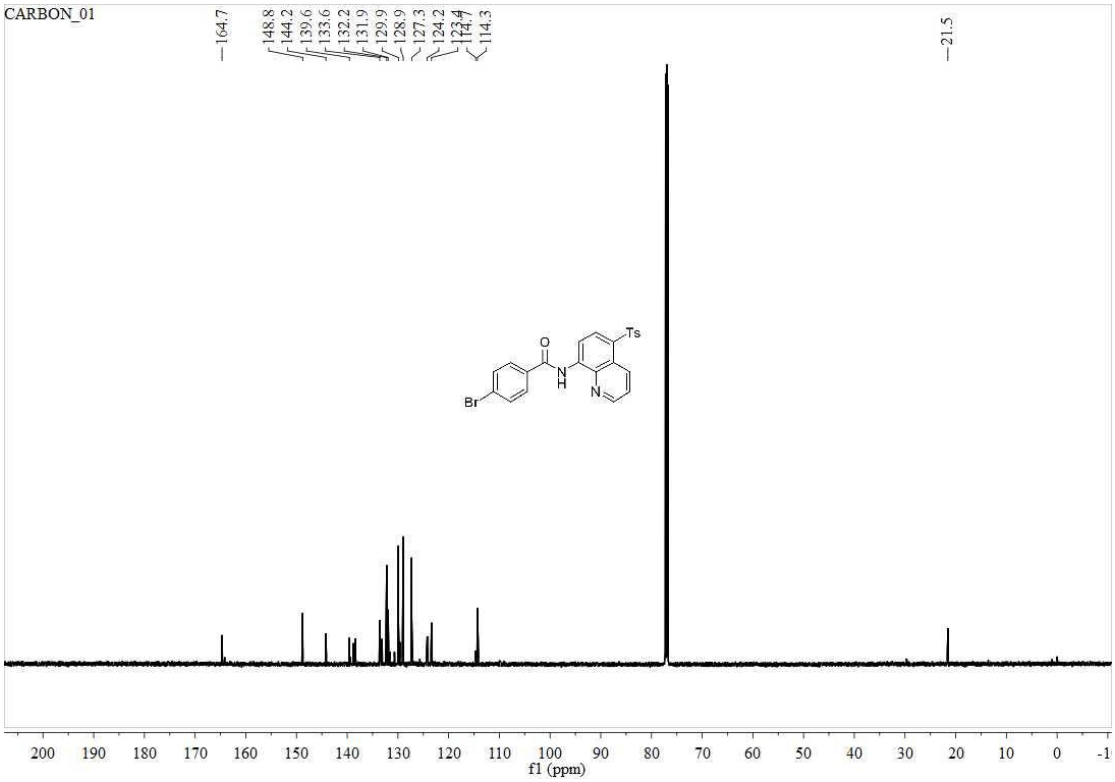
^{13}C NMR Spectrum of 3ca



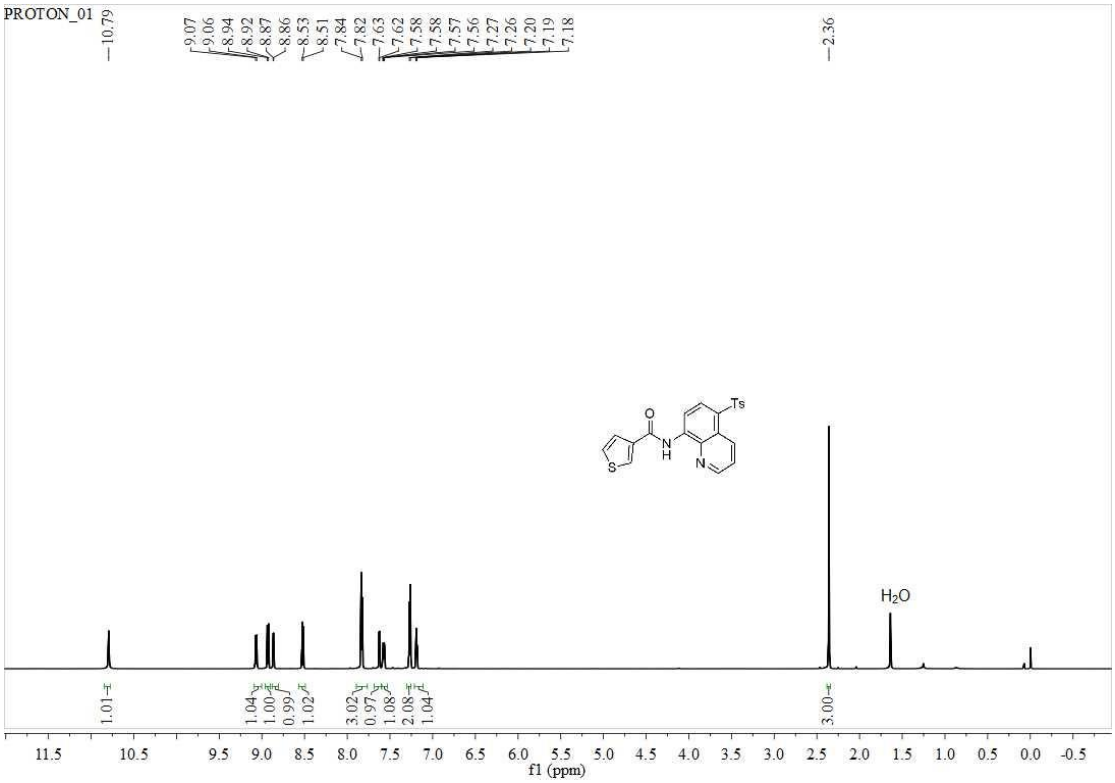
^{1}H NMR Spectrum of 3da



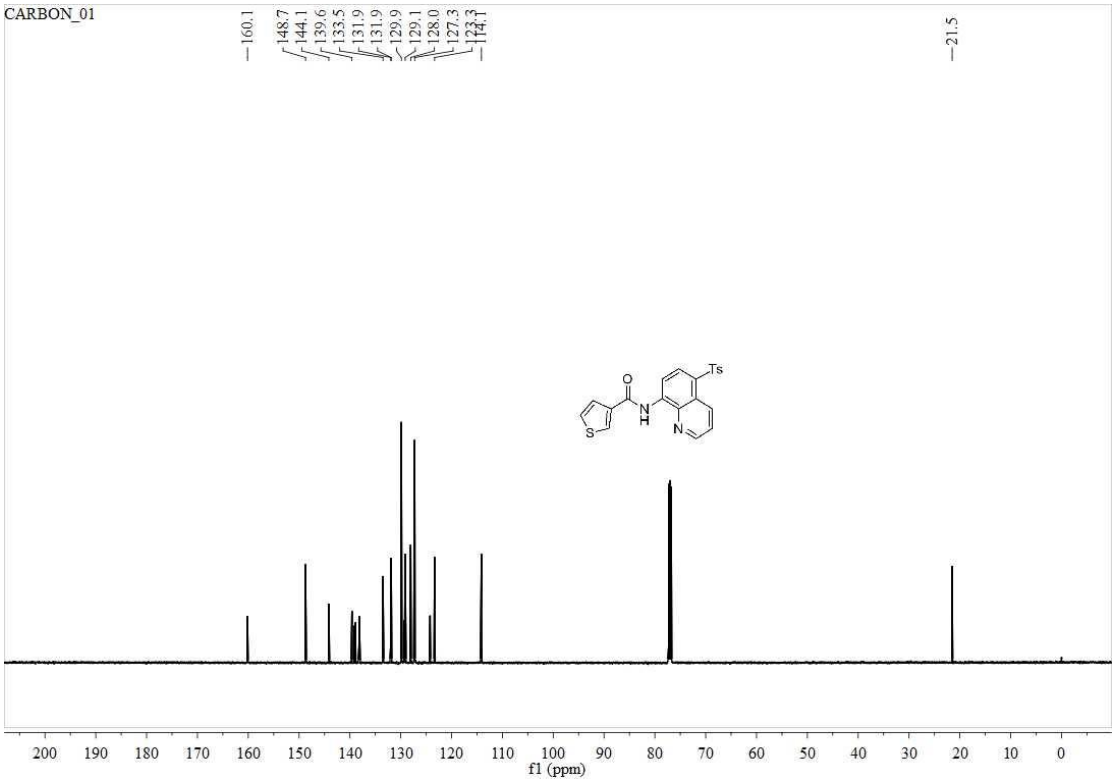
^{13}C NMR Spectrum of 3da



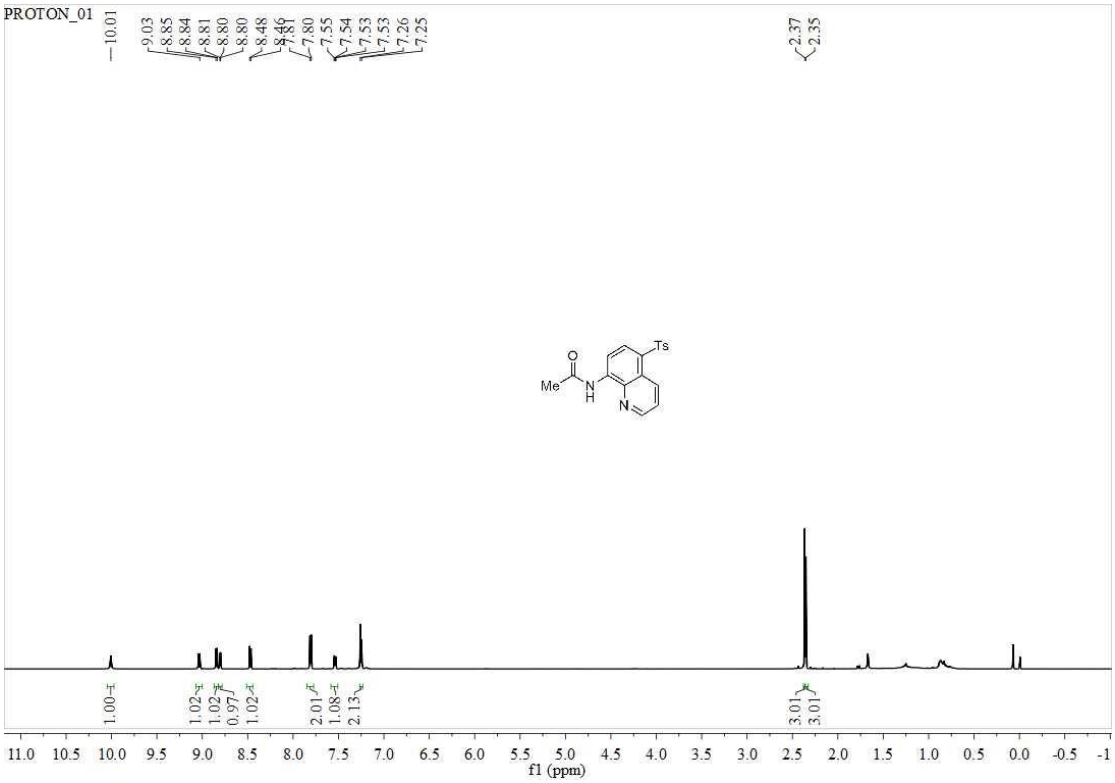
^{1}H NMR Spectrum of 3ea



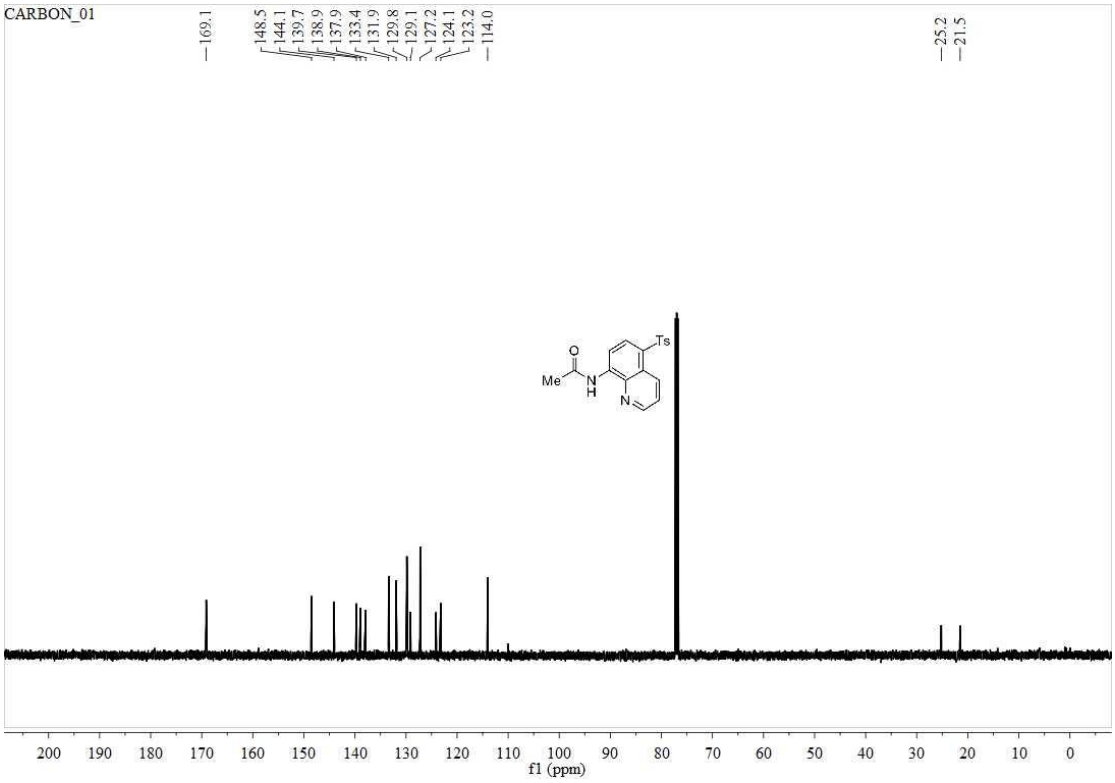
^{13}C NMR Spectrum of 3ea



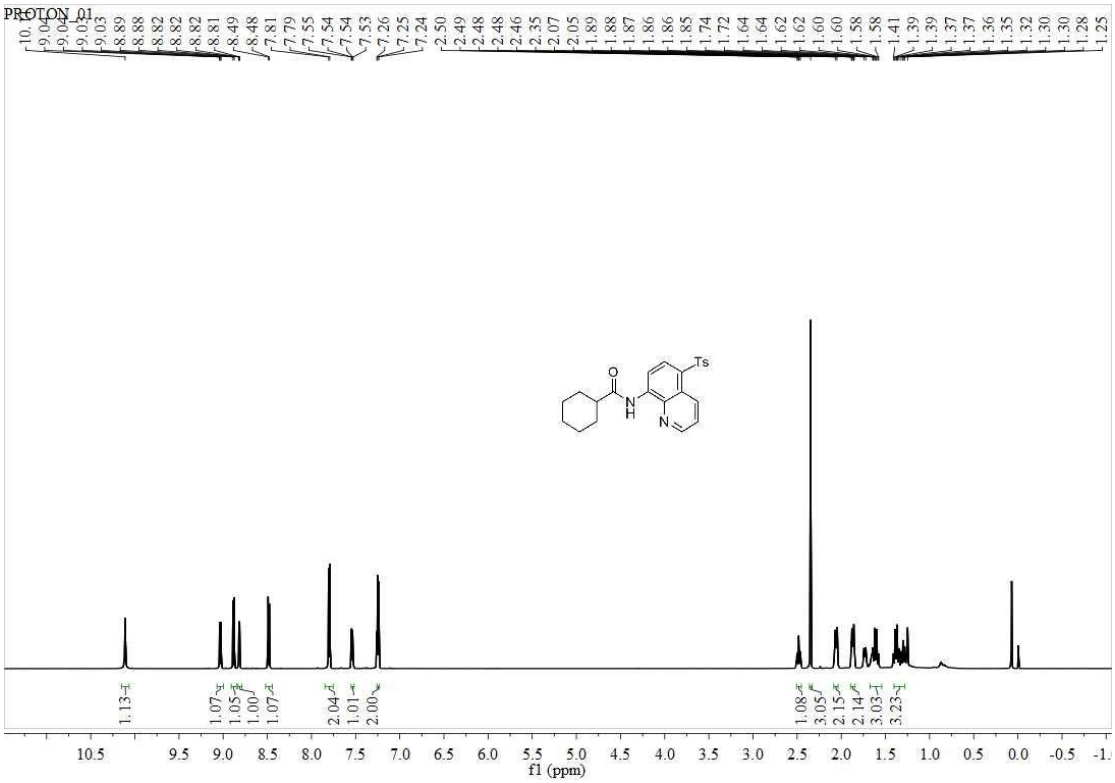
^{1}H NMR Spectrum of 3fa



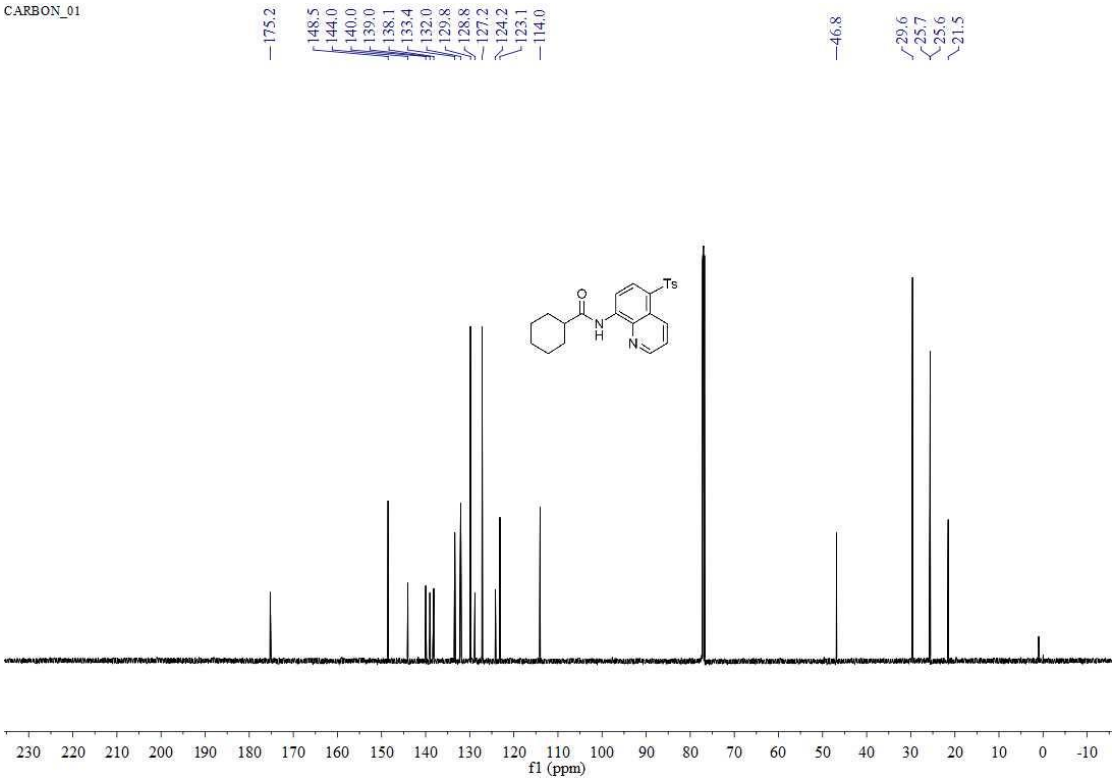
^{13}C NMR Spectrum of 3fa



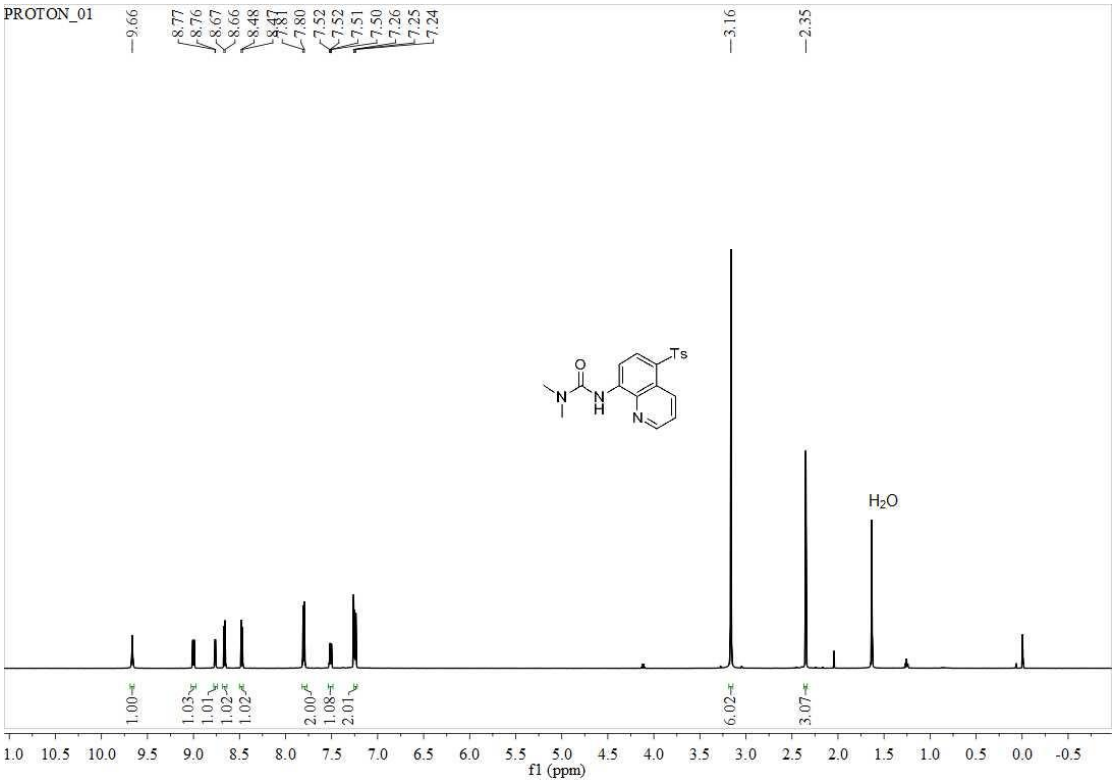
^{1}H NMR Spectrum of 3ga



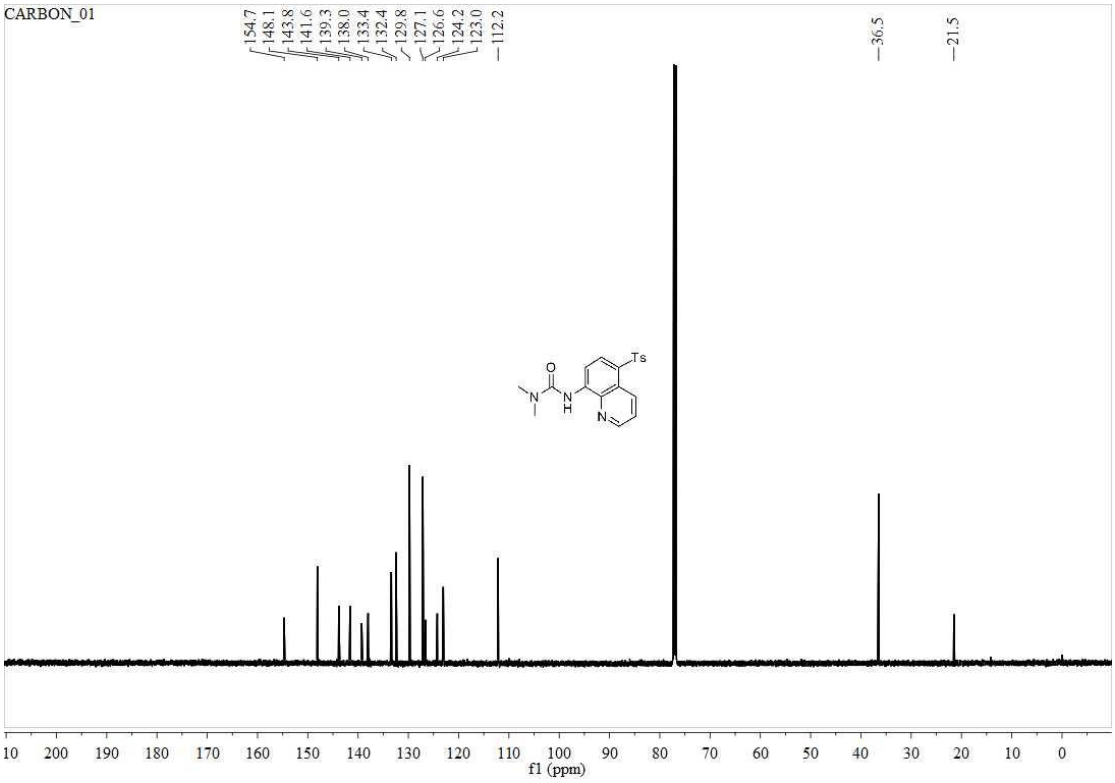
^{13}C NMR Spectrum of 3ga



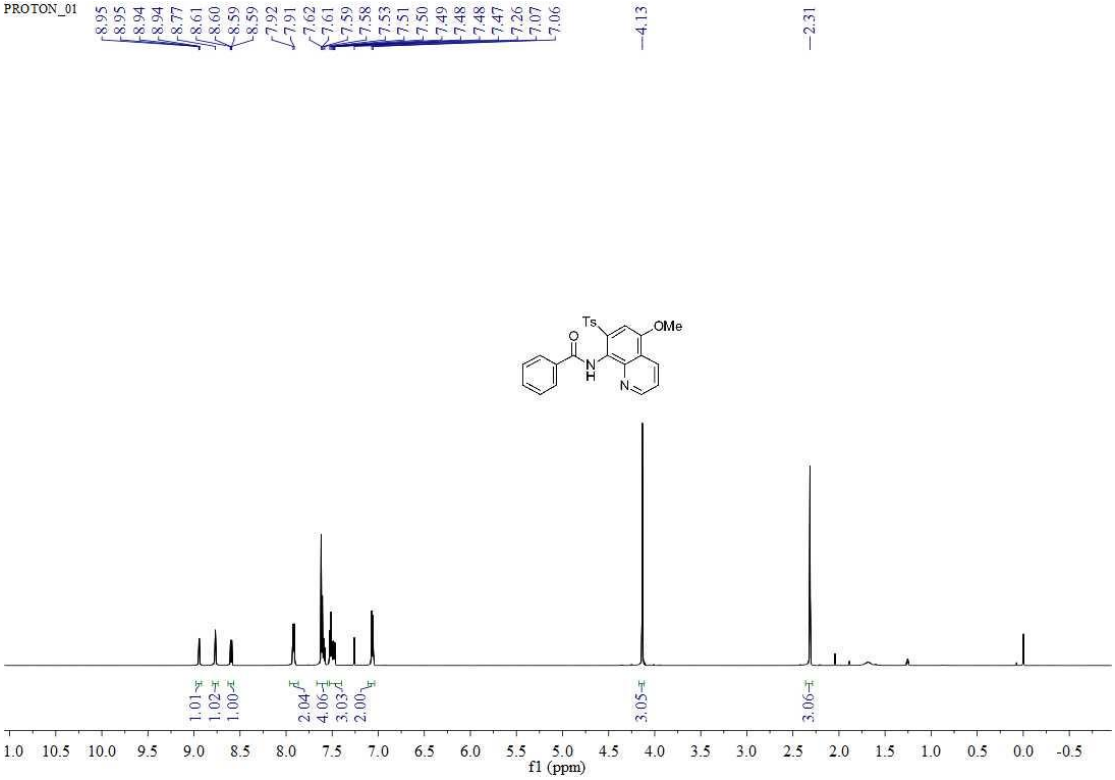
^{1}H NMR Spectrum of 3ha



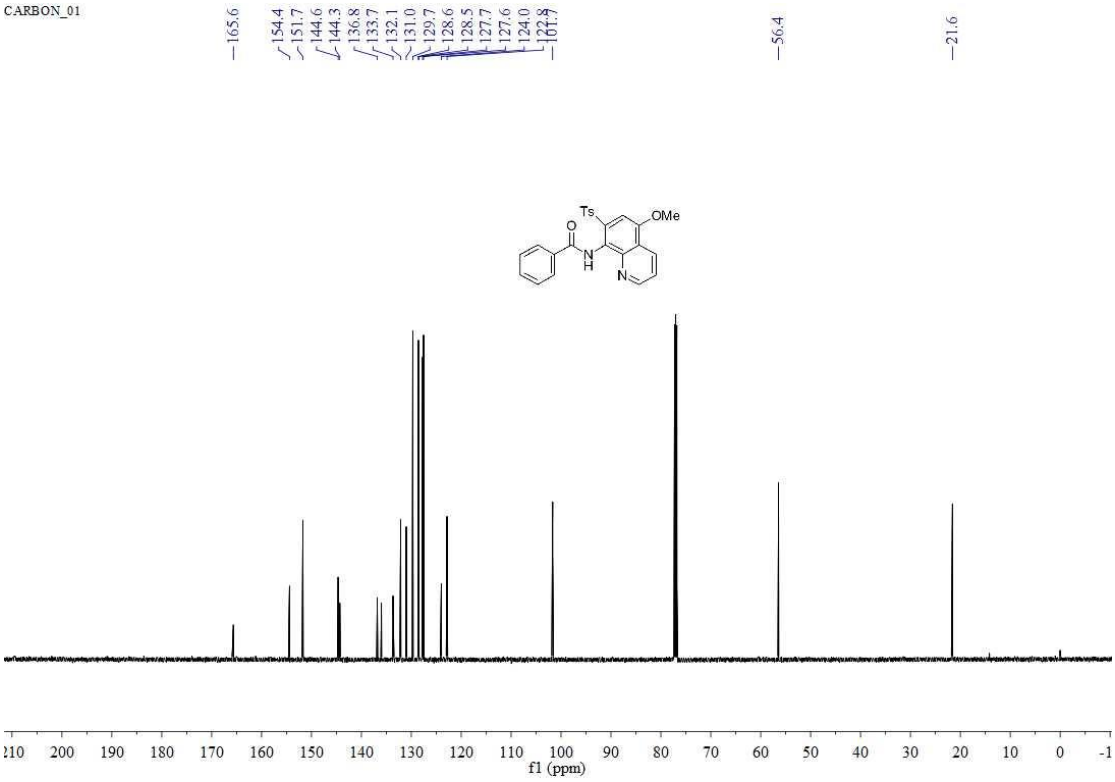
^{13}C NMR Spectrum of 3ha



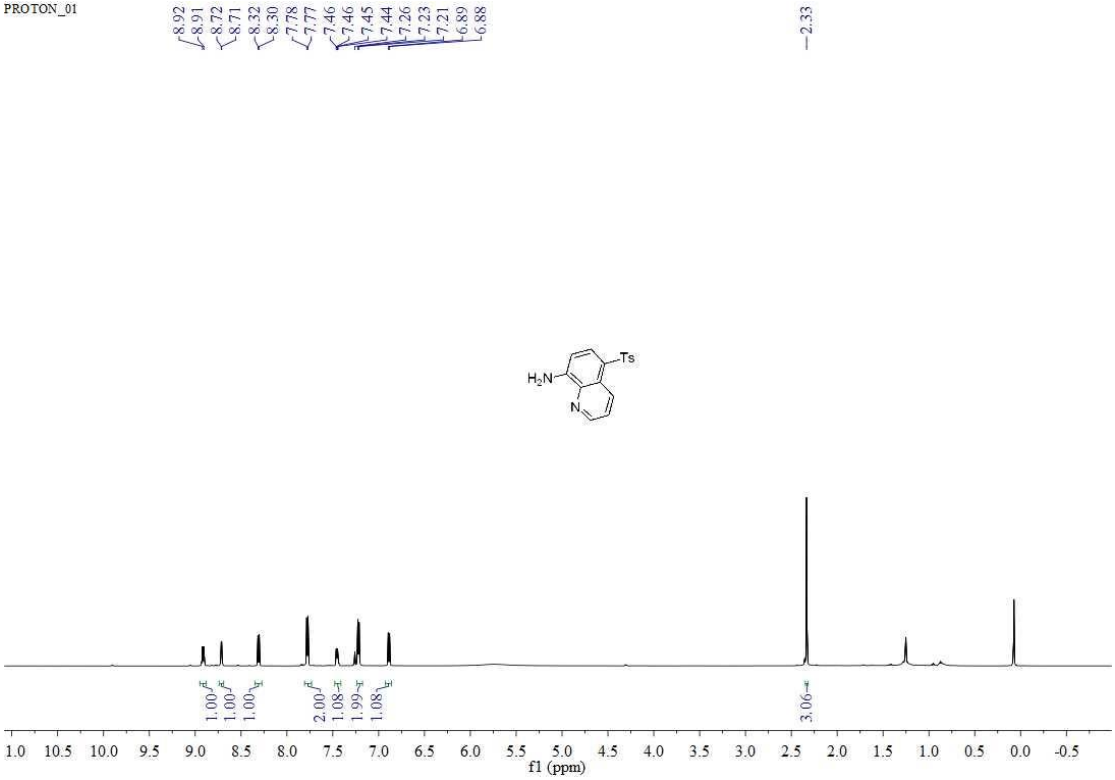
^{1}H NMR Spectrum of 3ia



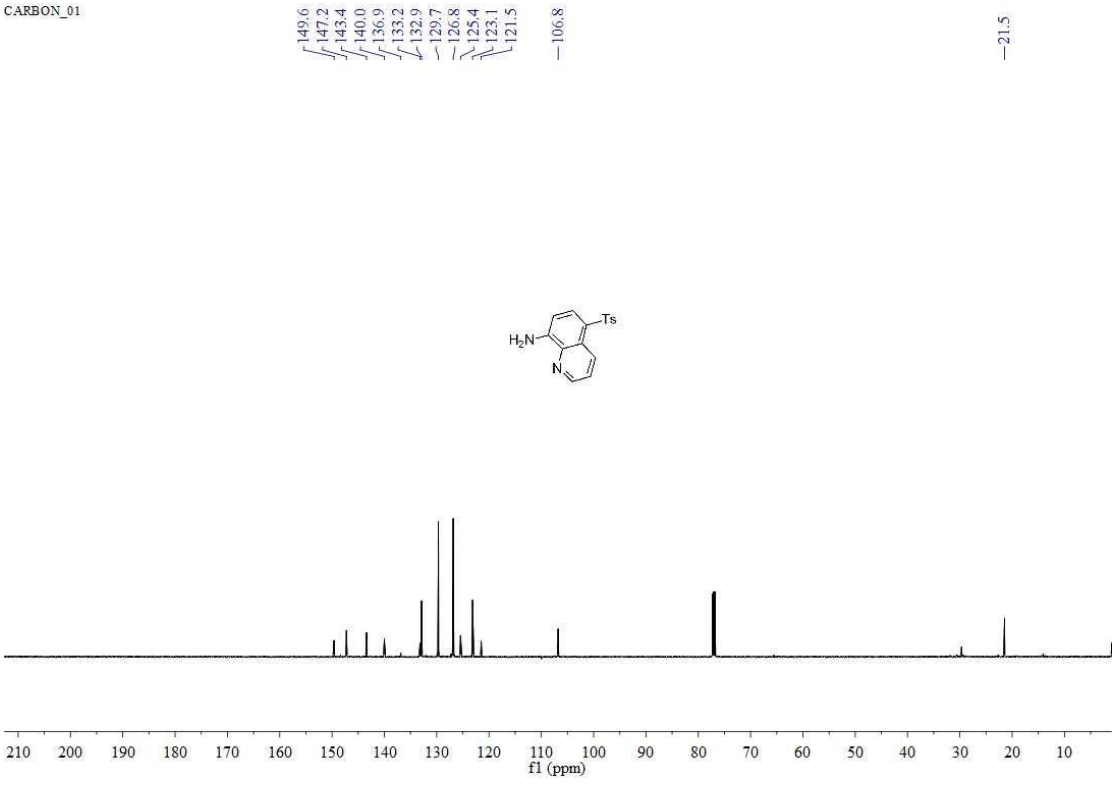
^{13}C NMR Spectrum of 3ia



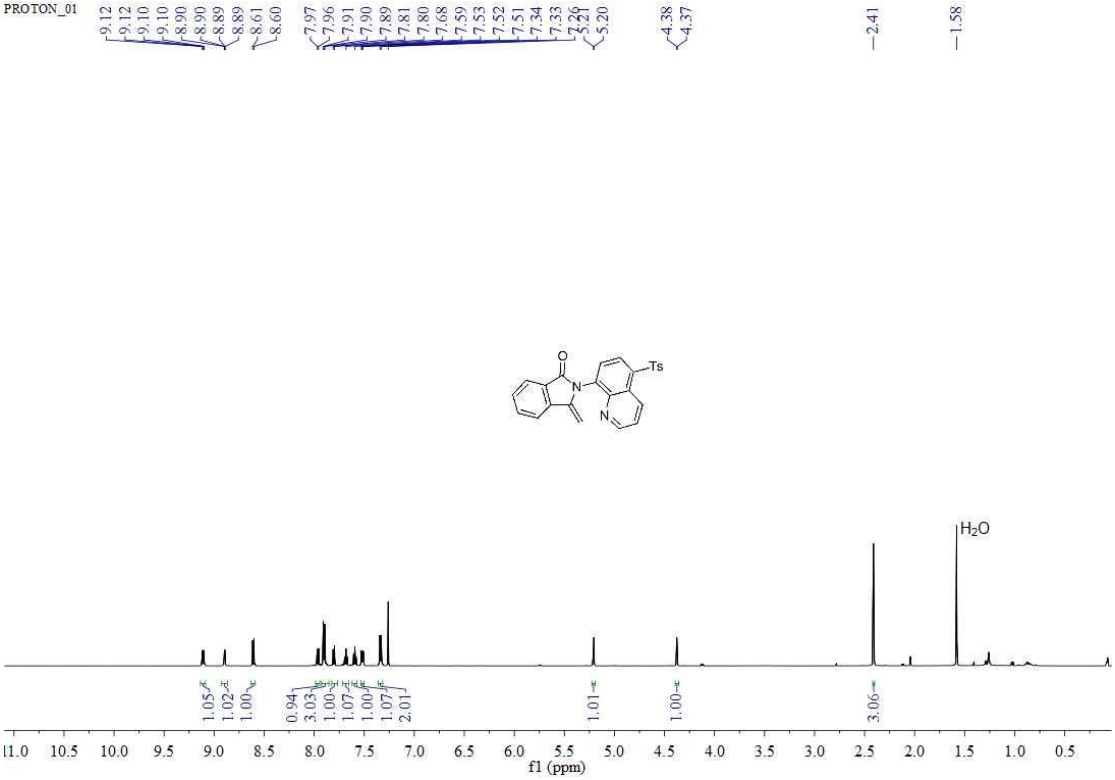
^{1}H NMR Spectrum of 4



^{13}C NMR Spectrum of 4



^{1}H NMR Spectrum of 5



^{13}C NMR Spectrum of 5