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Supplementary Data

A simple and convenient synthesis of 3-salicyloylquinoline-4-carboxylic esters from chromone and isatin

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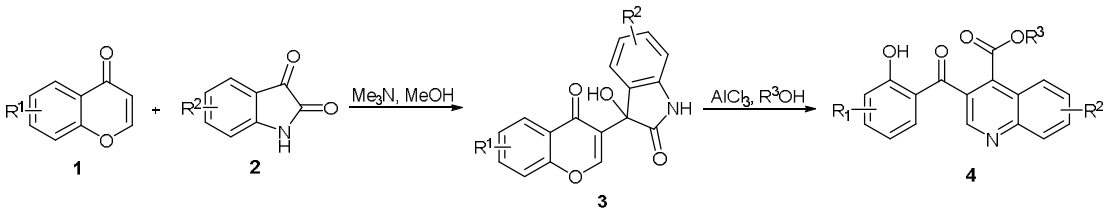
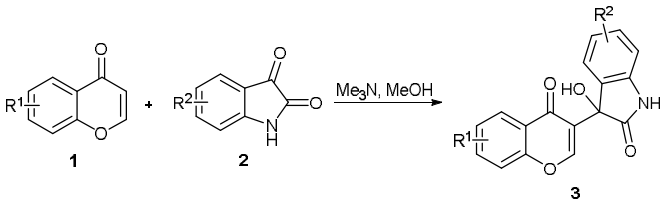
1. General Experimental

Melting points were tested on XT-4A melting-point apparatus and were uncorrected. The NMR spectra were recorded on a Bruker Avance 400 (^{1}H: 400 MHz, ^{13}C:100 MHz) spectrometer. HRMS were taken on AB QSTAR Pulsar mass spectrometer. IR spectra were recorded on a FT-IR Thermo Nicolet Avatar 360 using a KBr pellet. Silica gel (200-300 mesh) for column chromatography and silica GF_{254} for TLC were produced by Qingdao Marine Chemical Company (China). Starting materials and reagents used in the reactions were obtained from Acros, Aldrich, Greagent and Adamas without further purification.

2. Experimental Procedures and Analytical Data

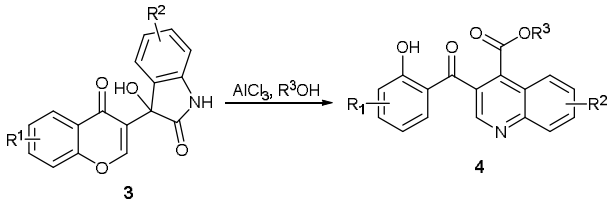


2.1 Synthesis of 3-hydroxy-3-(4-oxo-4*H*-chromen-3-yl)indolin-2-ones 3



A mixture of chromones **1** (1.5 mmol), isatin-derivatives **2** (1.5 mmol) and methanolic trimethylamine (25% w/w, 1.5 mmol) was stirred in methanol (3 mL) at room temperature for 12 h. An insoluble substance was formed. After completion of the reaction as indicated by TLC, the precipitate was filtered and washed with methanol (3-10 mL), then dried to afford 3-hydroxy-3-(4-oxo-4*H*-chromen-3-yl)indolin-2-ones **3**.

2.2 Synthesis of 3-salicyloylquinoline-4-carboxylic esters 4



To a stirred solution of **3** (0.5 mmol) in alcohol (3 mL) at room temperature, $AlCl_3$ (67mg, 0.5 mmol) was added slowly. Then being stirred for 1 h at reflux, the solution was cooled to room temperature and quenched with saturated sodium bicarbonate solution (5 mL). The residue was extracted with dichloromethane (4×4 mL), and the combined extract was washed with brine and dried over anhydrous Na_2SO_4. The solvent was evaporated under reduced pressure and the residue was chromatographed on silica gel (petroleum ether 60-90 °C:ethyl acetate = 8:1) to afford **4**.

Methyl 3-salicyloylquinoline-4-carboxylate (4a)

Yield 85%;White solid; Mp 89-90 ℃; IR (KBr): 3449, 1736, 1630, 1611, 1570, 1482, 1435, 1340, 1257, 1216, 1152, 1138, 1054, 773 cm^{-1}; ^1H NMR (400 MHz, DMSO-d_6): δ 0.60 (s, 1H), 9.04 (s, 1H), 8.19 (d, J = 8.0 Hz, 1H), 8.08 (dd, J = 8.4, 0.8 Hz, 1H), 7.99-7.95 (m, 1H), 7.82-7.78 (m, 1H), 7.56-7.52 (m, 2H), 7.01-6.97 (m, 2H), 3.78 (s, 3H); ^{13}C NMR (100 MHz, DMSO-d_6): δ 195.34, 166.79, 158.56, 150.14, 148.78, 137.90, 135.84, 132.33, 131.75, 130.33, 129.85, 129.22, 126.36, 123.75, 123.08, 119.99, 117.63, 53.43; HRMS (ESI-TOF): *m/z* calcd for $C_{18}H_{13}NO_4$ $[M+H]^+$: 308.0917, found: 308.0916.

Methyl 3-(2-hydroxybenzoyl)-6-methylquinoline-4-carboxylate (4b)

Yield 86%;White solid; Mp 132-133 ℃; IR (KBr): 3438, 2951, 1736, 1628, 1573, 1484, 1452, 1341, 1363, 1285, 1252, 1227, 1150, 900, 759 cm^{-1}; ^1H NMR (400 MHz, DMSO-d_6): δ 10.59 (s, 1H), 8.95 (s, 1H), 8.08 (d, J = 8.0 Hz, 1H), 7.82-7.80 (m, 2H), 7.56-7.51 (m, 2H), 7.01-6.97 (m, 2H), 3.78 (s, 3H), 2.56 (s, 3H); ^{13}C NMR (100 MHz, DMSO-d_6): δ 195.54, 166.89, 158.55, 149.18, 147.55, 139.14, 137.31, 135.77, 134.51, 131.75, 130.16, 129.57, 124.79, 123.78, 123.11, 119.96, 117.62, 53.39, 21.82; HRMS (ESI-TOF): *m/z* calcd for $C_{19}H_{15}NO_4$ $[M+H]^+$: 322.1074, found: 322.1077.

Methyl 3-(2-hydroxybenzoyl)-6-methoxyquinoline-4-carboxylate (4c)

Yield 81%; Yellow solid; Mp 147-148 ℃; IR (KBr): 3425, 2956, 1732, 1653, 1567, 1505, 1483, 1356, 1283, 1257, 1214, 1146, 1028, 906, 688 cm^{-1}; ^1H NMR (400 MHz, DMSO-d_6): δ 10.64 (s, 1H), 8.86 (s, 1H), 8.10 (d, J = 9.2 Hz, 1H), 7.63 (dd, J = 9.2, 2.8 Hz, 1H), 7.56-7.50 (m, 2H), 7.37 (d, J = 2.8 Hz, 1H), 7.00-6.96 (m, 2H), 3.92 (s, 3H), 3.74 (s, 3H); ^{13}C NMR (100 MHz, DMSO-d_6): δ 196.00, 166.75, 159.21, 158.87, 147.10, 45.20, 135.96, 135.79, 131.83, 131.49, 131.29, 124.70, 124.47, 123.50, 119.93, 117.72, 103.79, 56.15, 53.35; HRMS (ESI-TOF): *m/z* calcd for $C_{19}H_{15}NO_5$ $[M+H]^+$: 338.1023, found: 338.1021.

Methyl 6-bromo-3-(2-hydroxybenzoyl)quinoline-4-carboxylate (4d)

Yield 77%; Yellow solid; Mp 112-113 ℃; IR (KBr): 3446, 2960, 1739, 1654, 1613, 1570, 1482, 1256, 1215, 1151, 1073, 933, 837, 767 cm^{-1}; ^1H NMR (400 MHz,

DMSO-d_6): δ 10.61 (s, 1H), 9.07 (s, 1H), 8.31 (dd, J = 2.0, 0.8 Hz, 1H), 8.14 (d, J = 8.8 Hz, 1H), 8.10 (dd, J = 8.8, 2.0 Hz, 1H), 7.58-7.53 (m, 2H), 7.02-6.97 (m, 2H), 3.74 (s, 3H); ^{13}C NMR (100 MHz, DMSO-d_6): δ 195.02, 166.09, 158.77, 150.41, 147.35, 136.14, 136.07, 135.21, 132.11, 132.03, 131.74, 128.20, 124.36, 123.42, 122.60, 120.02, 117.72, 53.61; HRMS (ESI-TOF): *m/z* calcd for $C_{18}H_{12}BrNO_4$ $[M+H]^+$: 386.0022, found: 386.0018.

Methyl 6-fluoro-3-(2-hydroxybenzoyl)quinoline-4-carboxylate (4e)

Yield 92%; Yellow solid; Mp 118-119 °C; IR (KBr): 3233, 2952, 1747, 1614, 1504, 1477, 1433, 1363, 1248, 1201, 1142, 1110, 838, 761 cm^{-1}; ^{1}H NMR (400 MHz, DMSO-d_6): δ 10.63 (s, 1H), 9.02 (s, 1H), 8.29-8.26 (m, 1H), 7.94-7.87 (m, 2H), 7.57-7.53 (m, 2H), 7.02-6.98 (m, 2H), 3.75 (s, 3H); ^{13}C NMR (100 MHz, DMSO-d_6): δ 195.29, 166.23, 161.39 (d, J = 247.0 Hz), 158.82, 149.30 (d, J = 2.0 Hz), 146.05, 136.60 (d, J = 6.0 Hz), 136.11, 132.93 (d, J = 10.0 Hz), 132.01, 131,76, 124.09 (d, J = 11.0 Hz), 123.42, 122.34 (d, J = 25.0 Hz), 120.00, 117.72, 109.91 (d, J = 24.0 Hz), 53.53; HRMS (ESI-TOF): *m/z* calcd for $C_{18}H_{12}FNO_4$ $[M+H]^+$: 326.0823, found: 326.0820.

Methyl 3-(2-hydroxybenzoyl)-6-iodoquinoline-4-carboxylate (4f)

Yield 68%; Yellow solid; Mp 128-129 °C; IR (KBr): 3438, 2949, 1729, 1632, 1576, 1484, 1435, 1362, 1287, 1251, 1217, 1148, 995, 925, 757 cm^{-1}; ^{1}H NMR (400 MHz, DMSO-d_6): δ 10.60 (s, 1H), 9.04 (s, 1H), 8.47 (d, J = 1.6 Hz, 1H), 8.23 (dd, J = 8.8, 1.6 Hz, 1H), 7.95 (d, J = 8.8 Hz, 1H), 7.56-7.52 (m, 2H), 7.01-6.96 (m, 2H), 3.73 (s, 3H); ^{13}C NMR (100 MHz, DMSO-d_6): δ 195.03, 166.17, 158.72, 150.38, 147.62, 140.54, 136.10, 135.85, 134.46, 131.73, 131.61, 124.73, 123.47, 120.02, 117.71, 96.39, 53.59; HRMS (ESI-TOF): *m/z* calcd for $C_{18}H_{12}INO_4$ $[M+H]^+$: 433.9884, found: 433.9884.

Methyl 3-(2-hydroxybenzoyl)-6, 8-dimethylquinoline-4-carboxylate (4g)

Yield 74%; Yellow solid; Mp 106-107 °C; IR (KBr): 3415, 2956, 1734, 1643, 1575, 1482, 1458, 1351, 1256, 1239, 1150, 1104, 1045, 895, 809, 762 cm^{-1}; ^{1}H NMR (400 MHz, DMSO-d_6): δ 10.61 (s, 1H), 8.95 (s, 1H), 7.63 (m, 2H), 7.56-7.49 (m, 2H), 7.00-6.97 (m, 2H), 3.77 (s, 3H), 2.72 (s, 3H), 2.50 (s, 3H); ^{13}C NMR (100 MHz, DMSO-d_6): δ 195.72, 167.13, 158.56, 148.12, 146.51, 138.68, 137.74, 137.17, 135.77,

134.51, 131.76, 129.72, 123.77, 123.19, 122.63, 119.97, 117.60, 53.35, 21.81, 18.19; HRMS (ESI-TOF): *m/z* calcd for $C_{20}H_{17}NO_4$ $[M+H]^+$: 336.1230, found: 336.1235.

Methyl 3-(5-chloro-2-hydroxybenzoyl)quinoline-4-carboxylate (4h)

Yield 79%; Yellow solid; Mp 97-98 °C; IR (KBr): 3416, 1735, 1636, 1572, 1469, 1340, 1254, 1120, 1166, 1137, 1095, 772 cm^{-1}; ^1H NMR (400 MHz, DMSO-d_6): δ 10.77 (s, 1H), 9.03 (s, 1H), 8.18 (d, J = 8.4 Hz, 1H), 8.05 (dd, J = 8.4, 0.8 Hz, 1H), 8.00-7.95 (m, 1H), 7.82-7.78 (m, 1H), 7.57-7.54 (m, 2H), 7.00 (dd, J = 8.4, 1.2 Hz, 1H), 3.82 (s, 3H); ^{13}C NMR (100 MHz, DMSO-d_6): δ 193.34, 166.86, 156.70, 150.33, 148.87, 138.24, 134.88, 132.54, 130.37, 129.82, 129.61, 129,25, 126.42, 125.65, 123.61, 123.03, 119.51, 53.48; HRMS (ESI-TOF): *m/z* calcd for $C_{18}H_{12}ClNO_4$ $[M+H]^+$: 342.0528, found: 342.0530.

Methyl 3-(5-bromo-2-hydroxybenzoyl)quinoline-4-carboxylate (4i)

Yield 82%; Yellow solid; Mp 104-105 °C; IR (KBr): 3416, 2946, 1741, 1624, 1605, 1575, 1470, 1336, 1254, 1216, 1176, 1140, 1054, 790, 726, 627 cm^{-1}; ^1H NMR (400 MHz, DMSO-d_6): δ 10.75 (s, 1H), 9.03 (s, 1H), 8.18 (d, J = 8.8 Hz, 1H), 8.05 (d, J = 8.4 Hz, 1H), 7.89-7.94 (m, 1H), 7.82-7.77 (m, 1H), 7.68-7.65 (m, 2H), 6.96-6.93 (m, 1H), 3.82 (s, 3H); ^{13}C NMR (100 MHz, DMSO-d_6): δ 193.25, 166.86, 157.11, 150.35, 148.88, 138.22, 137.67, 133.27, 132.50, 129.84, 129.62, 129.22, 126.43, 126.21, 123.03, 119.95, 110.99, 53.48; HRMS (ESI-TOF): *m/z* calcd for $C_{18}H_{12}BrNO_4$ $[M+H]^+$: 386.0022, found: 386.0021.

Methyl 3-(2-hydroxy-4-methoxybenzoyl)quinoline-4-carboxylate (4j)

Yield 74%; White solid; Mp 104-105 °C; IR (KBr): 3418, 2952, 1725, 1622, 1596, 1499, 1433, 1365, 1346, 1249, 1172, 1122, 1053, 761, 639 cm^{-1}; ^1H NMR (400 MHz, DMSO-d_6): δ 11.38 (s, 1H), 9.06 (s, 1H), 8.20 (d, J = 8.0 Hz, 1H), 8.14 (dd, J = 8.4, 0.8 Hz, 1H), 7.80-7.96 (m, 1H), 7.83-7.79 (m, 1H), 7.46 (d, J = 9.6 Hz, 1H), 6.58-6.55 (m, 2H), 3.85 (s, 3H), 3.78 (s, 3H); ^{13}C NMR (100 MHz, DMSO-d_6): δ 195.24, 166.53, 166.30, 163.05, 149.47, 148.67, 137.35, 134.48, 132.10, 131.01, 129.93, 129.26, 126.25, 123.11, 115.72, 108.01, 101.56, 56.25, 53.51; HRMS (ESI-TOF): *m/z* calcd for $C_{19}H_{15}NO_5$ $[M+H]^+$: 338.1023, found: 338.1025.

Methyl 3-(2-hydroxy-5-methylbenzoyl)quinoline-4-carboxylate (4k)

Yield 90%; Yellow solid; Mp 137-138 °C; IR (KBr): 3457, 2951, 1736, 1633, 1576, 1483, 1429, 1338, 1246, 1213, 1162, 1139, 1053, 825, 768 cm^{-1}; ^1H NMR (400 MHz, DMSO-d_6): δ 10.41 (s, 1H), 9.03 (s, 1H), 8.19 (d, J = 8.0 Hz, 1H), 8.08 (d, J = 8.0 Hz, 1H), 8.00-7.96 (m, 1H), 7.83-7.78 (m, 1H), 7.37-7.34 (m, 2H), 6.90 (d, J = 8.4 Hz, 1H), 3.79 (s, 3H), 2.25 (s, 3H); ^{13}C NMR (100 MHz, DMSO-d_6): δ 195.47, 166.79, 156.66, 150.12, 148.76, 137.89, 136.71, 132.29, 131.47, 130.44, 129.85, 129.20, 128.72, 126.36, 123.21, 123.10, 117.61, 53.42, 20.27; HRMS (ESI-TOF): *m/z* calcd for $C_{19}H_{15}NO_4$ $[M+H]^+$: 322.1074, found: 322.1071.

Methyl 3-(2-hydroxy-5-nitrobenzoyl)quinoline-4-carboxylate (4l)

Yield 61%; Yellow solid; Mp 129-130 °C; IR (KBr): 3442, 2951, 1737, 1635, 1574, 1525, 1472, 1341, 1258, 1214, 1140, 1097, 1052, 734 cm^{-1}; ^1H NMR (400 MHz, DMSO-d_6): δ 9.05 (s, 1H), 8.42-8.37 (m, 2H), 8.19 (d, J = 8.4 Hz, 1H), 8.05 (d, J = 8.4 Hz, 1H), 8.02-7.98 (m, 1H), 7.83-7.80 (m, 1H), 7.15 (d, J = 9.2 Hz, 1H), 3.84 (s, 3H); ^{13}C NMR (100 MHz, DMSO-d_6): δ 192.52, 166.89, 163.16, 150.38, 148.97, 140.19, 138.53, 132.77, 130.16, 129.84, 129.37, 129.12, 127.64, 126.49, 124.77, 122.96, 118.45, 53.58; HRMS (ESI-TOF): *m/z* calcd for $C_{18}H_{12}N_2O_6$ $[M+H]^+$: 353.0768, found: 353.0769.

Methyl 3-(1-hydroxy-2-naphthoyl)quinoline-4-carboxylate (4m)

Yield 72%;Yellow solid; Mp 124-125 °C; IR (KBr): 3420, 3063, 2951, 1736, 1604, 1565, 1498, 1462, 1360, 1335, 1251, 1207, 1066, 955, 791, 770 cm^{-1}; ^1H NMR (400 MHz, DMSO-d_6): δ 12.99 (s, 1H), 9.20 (s, 1H), 8.43 (d, J = 8.4 Hz, 1H), 8.26-8.23 (m, 2H), 8.02 (td, J = 6.8, 1.2 Hz, 1H), 7.97 (d, J = 8.0 Hz, 1H), 7.86 (td, J = 8.4, 1.2 Hz, 1H), 7.79 (td, J = 6.8, 1.2 Hz, 1H), 7.68 (td, J = 8.0, 1.2 Hz, 1H), 7.43 (d, J = 9.2 Hz, 1H), 7.39 (d, J = 8.8 Hz, 1H), 3.73 (s, 3H); ^{13}C NMR (100 MHz, DMSO-d_6): δ 198.85, 166.24, 161.50, 149.15, 148.89, 137.57, 137.39, 132.39, 131.31, 130.45, 130.08, 129.55, 128.39, 127.14, 126.85, 126.38, 124.72, 124.20, 123.08, 119.59, 114.54, 53.64; HRMS (ESI-TOF): *m/z* calcd for $C_{22}H_{15}NO_4$ $[M+H]^+$: 358.1074, found: 358.1073.

Methyl 3-(5-chloro-2-hydroxybenzoyl)-6-fluoroquinoline-4-carboxylate (4n)

Yield 84%; Yellow solid; Mp 129-130 ℃; IR (KBr): 3416, 3065, 2945, 1737, 1635, 1574, 1500, 1470, 1361, 1327, 1282, 1194, 1146, 839, 729 cm^{-1}; ^{1}H NMR (400 MHz, DMSO-d_6): δ 10.76 (s, 1H), 9.01 (s, 1H), 8.29-8.25 (m, 1H), 7.94-7.89 (m, 1H), 7.86 (dd, J = 10.0, 2.8 Hz, 1H), 7.58-7.55 (m, 2H), 7.00-6.97 (m, 1H), 3.78 (s, 3H); ^{13}C NMR (100 MHz, DMSO-d_6): δ 193.27, 166.29, 161.38 (d, J = 247.0 Hz), 157.00, 149.46, 146.14, 136.88 (d, J = 6.0 Hz), 135.18, 132.92 (d, J = 10.0 Hz), 131.44, 130.34, 125.27, 124.04 (d, J = 11.0 Hz), 123.62, 122.51 (d, J =26.0 Hz), 119.67, 109.97 (d, J = 23.0 Hz), 53.59; HRMS (ESI-TOF): *m/z* calcd for $C_{18}H_{11}ClFNO_4$ $[M+H]^+$: 360.0433, found: 360.0436.

Methyl 3-(2-hydroxy-5-methoxybenzoyl)-6-methoxyquinoline-4-carboxylate (4o)

Yield 92%; Yellow solid; Mp 162-163 ℃; IR (KBr): 3416, 1732, 1618, 1501, 1433, 1354, 1264, 1235, 1208, 1154, 1115, 1026, 963, 891, 830 cm^{-1}; ^{1}H NMR (400 MHz, DMSO-d_6): δ 11.48 (s, 1H), 8.87 (s, 1H), 8.11 (d, J = 9.2 Hz, 1H), 7.64-7.61 (m, 1H), 7.44 (d, J = 2.8 Hz, 1H), 7.41 (d, J = 9.2 Hz, 1H), 6.56-6.53 (m, 2H), 3.93 (s, 3H), 3.85 (s, 3H), 3.74 (s, 3H); ^{13}C NMR (100 MHz, DMSO-d_6): δ 195.98, 166.52, 166.36, 163.37, 159.28, 146.46, 145.10, 135.29, 134.54, 131.67, 131.56, 124.55, 115.48, 108.04, 103.78, 101.56, 56.28, 56.15, 53.42; HRMS (ESI-TOF): *m/z* calcd for $C_{20}H_{17}NO_6$ $[M+H]^+$: 368.1129, found: 368.1132.

Methyl 6-fluoro-3-(2-hydroxy-5-methylbenzoyl)quinoline-4-carboxylate (4p)

Yield 81%; Yellow solid; Mp 119-120 ℃; IR (KBr): 3416, 2947, 1743 1635, 1573, 1501, 1434, 1362, 1285, 1217, 1190, 1138, 1056, 961, 836, 738 cm^{-1}; ^{1}H NMR (400 MHz, DMSO-d_6): δ 10.43 (s, 1H), 9.01 (s, 1H), 8.29-8.25 (m, 1H), 7.94-7.86 (m, 2H), 7.38-7.35 (m, 2H), 6.89 (d, J = 8.4 Hz, 1H), 3.75 (s, 3H), 2.25 (s, 3H); ^{13}C NMR (100 MHz, DMSO-d_6): δ 195.42, 166.25, 161.38 (d, J = 247.0 Hz), 156.92, 149.30 (d, J = 3.0 Hz), 146.03, 137.00, 136.61 (d, J = 6.0 Hz), 132.94 (d, J = 9. 0 Hz), 132.09, 131.43, 128.74, 124.11 (d, J = 10 Hz), 122.89, 122.31 (d, J = 30 Hz), 117.69, 109.92 (d, J = 24 Hz), 53.52, 20.25; HRMS (ESI-TOF): *m/z* calcd for $C_{19}H_{14}FNO_4$ $[M+H]^+$: 340.0980, found: 340.0985.

Methyl 3-(5-chloro-2-hydroxybenzoyl)-6-methylquinoline-4-carboxylate (4q)

Yield 78%; Yellow solid; Mp 103-104 °C; IR (KBr): 3417, 2953, 1730, 1630, 1571, 1469, 1361, 1341, 1287, 1276, 1209, 1153, 916, 828 cm^{-1}; ^1H NMR (400 MHz, DMSO-d_6): δ 10.71 (s, 1H), 8.95 (s, 1H), 8.08 (d, J = 8.0 Hz, 1H), 7.82-7.90 (m, 2H), 7.56 (dd, J = 8.8, 2.8 Hz, 1H), 7.53 (d, J = 2.4 Hz, 1H), 7.01 (d, J = 8.8 Hz, 1H), 3.83 (s, 3H), 2.55 (s, 3H); ^{13}C NMR (100 MHz, DMSO-d_6): δ 193.49, 166.97, 156.66, 149.41, 147.66, 139.16, 137.65, 134.78, 134.70, 130.35, 129.55, 129.44, 125.75, 124.85, 123.56, 123.07, 119.50, 53.43, 21.79; HRMS (ESI-TOF): *m/z* calcd for $C_{19}H_{14}ClNO_4$ $[M+H]^+$: 356.0684, found: 356.0685.

Methyl 3-(5-chloro-2-hydroxybenzoyl)-6-methoxyquinoline-4-carboxylate (4r)

Yield 74%; Yellow solid; Mp 146-147 °C; IR (KBr): 3458, 3232, 2949, 1738, 1261, 1563, 1502, 1467, 1329, 1270, 1236, 1218, 1155, 1116, 1022, 838, 722 cm^{-1}; ^1H NMR (400 MHz, DMSO-d_6): δ 10.72 (s, 1H), 8.85 (s, 1H), 8.09 (d, J = 9.2 Hz, 1H), 7.63 (dd, J = 9.2, 2.8 Hz, 1H), 7.57-7.53 (m, 2H), 7.32 (d, J = 2.4 Hz, 1H), 6.99 (d, J = 8.8 Hz, 1H), 3.92 (s, 3H), 3.78 (s, 3H); ^{13}C NMR (100 MHz, DMSO-d_6): δ 193.80, 166.84, 159.19, 156.90, 147.33, 145.29, 136.11, 134.94, 131.47, 130.69, 130.34, 125.53, 124.86, 124.41, 123.53, 119.61, 103.80, 56.16, 53.39; HRMS (ESI-TOF): *m/z* calcd for $C_{19}H_{14}ClNO_5$ $[M+H]^+$: 372.0633, found: 372.0633.

Methyl 7-chloro-3-(2-hydroxybenzoyl)quinoline-4-carboxylate (4s)

Yield 83%; Yellow solid; Mp 115-116 °C; IR (KBr): 3417, 3063, 1733, 1629, 1605, 1486, 1437, 1288, 1254, 1134, 1113, 895, 816, 761 cm^{-1}; ^1H NMR (400 MHz, DMSO-d_6): δ 10.60 (s, 1H), 9.07 (s, 1H), 8.28 (d, J = 2.0 Hz, 1H), 8.13 (dd, J = 9.2, 0.4 Hz, 1H), 7.84 (dd, J = 9.2, 2.0 Hz, 1H), 7.57-7.52 (m, 2H), 7.02-6.98 (m, 2H), 3.77 (s, 3H); ^{13}C NMR (100 MHz, DMSO-d_6): δ 194.85, 166.36, 158.58, 151.43, 149.08, 137.63, 136.93, 135.98, 131.72, 131.06, 129.82, 128.58, 128.43, 123.60, 121.84, 120.03, 117.66, 53.57; HRMS (ESI-TOF): *m/z* calcd for $C_{18}H_{12}ClNO_4$ $[M+H]^+$: 342.0528, found: 342.0531.

Ethyl 3-(2-hydroxybenzoyl)quinoline-4-carboxylate (4t)

Yield 84%; Yellow solid; Mp 70-71 °C; IR (KBr): 3435, 2982, 1726, 1620, 1570, 1486, 1364, 1337, 1240, 1214, 1136, 1053, 885, 759 cm^{-1}; ^1H NMR (400 MHz, DMSO-d_6): δ

10.71 (s, 1H), 9.06 (s, 1H), 8.20 (d, J = 8.0 Hz, 1H), 8.13 (dd, J = 8.4, 0.4 Hz, 1H), 7.98 (t, J = 7.2 Hz, 1H), 7.82 (t, J = 7.2 Hz, 1H), 7.58-7.54 (m, 2H), 7.02-6.97 (m, 2H), 4.27-4.21 (m, 2H), 1.18 (t, J = 7.2 Hz, 3H); ^{13}C NMR (100 MHz, DMSO-d_6): δ 195.76, 166.12, 159.00, 149.89, 148.76, 137.72, 136.08, 132.21, 131.97, 130.50, 129.90, 129.24, 126.23, 123.44, 123.08, 119.98, 117.71, 62.56, 13.92; HRMS (ESI-TOF): *m/z* calcd for $C_{19}H_{15}NO_4$ $[M+H]^+$: 322.1074, found: 322.1072.

Isopropyl 3-(2-hydroxybenzoyl)quinoline-4-carboxylate (4u)

Yield 62%;White solid; Mp 127-128 ℃; IR (KBr): 3415, 2978, 1726, 1631, 1570, 1481, 1360, 1290, 1159, 1102, 1049, 764 cm^{-1}; ^{1}H NMR (400 MHz, DMSO-d_6): δ 10.80 (s, 1H), 9.04 (s, 1H), 8.20 (d, J = 8.4 Hz, 1H), 8.14 (dd, J = 7.6, 0.4 Hz, 1H), 7.99-7.96 (m, 1H), 7.84-7.80 (m, 1H), 7.59-7.52 (m, 2H), 7.03-6.97 (m, 2H), 5.17-5.11 (m, 1H), 1.19 (d, J = 6.4 Hz, 6H); ^{13}C NMR (100 MHz, DMSO-d_6): δ 196.05, 165.53, 159.37, 149.75, 148.72, 137.71, 136.33, 132.25, 132.14, 130.48, 129.93, 129.29, 126.08, 123.13, 120.02, 117.80, 70.65, 21.48; HRMS (ESI-TOF): *m/z* calcd for $C_{20}H_{17}NO_4$ $[M+H]^+$: 336.1230, found: 336.1231.

Butyl 3-(2-hydroxybenzoyl)quinoline-4-carboxylate (4v)

Yield 81%;Yellow oil; IR (KBr): 3429, 2961, 1732, 1629, 1574, 1484, 1464, 1362, 1250, 1212, 1156, 1052, 762 cm^{-1}; ^{1}H NMR (400 MHz, DMSO-d_6): δ 10.73 (s, 1H), 9.04 (s, 1H), 8.20 (d, J = 8.0 Hz, 1H), 8.11 (dd, J = 8.8, 0.8 Hz, 1H), 8.00-7.96 (m, 1H), 7.84-7.80 (m, 1H), 7.58-7.53 (m, 2H), 7.02-6.97 (m, 2H), 4.19 (t, J = 6.8 Hz, 2H), 1.56-1.49 (m, 2H), 1.27-1.18 (m, 2H), 0.80 (t, J = 7.2 Hz, 3H); ^{13}C NMR (100 MHz, DMSO-d_6): δ 195.85, 166.18, 159.18, 149.78, 148.74, 137.66, 136.19, 132.19, 132.05, 130.71, 129.92, 129.25, 126.17, 123.25, 123.13, 119.97, 117.74, 66.21, 30.04, 18.99, 13.90; HRMS (ESI-TOF): *m/z* calcd for $C_{21}H_{19}NO_4$ $[M+H]^+$: 350.1387, found: 350.1385.

Ethyl 3-(5-chloro-2-hydroxybenzoyl)-6-fluoroquinoline-4-carboxylate (4w)

Yield 82%; Yellow solid; Mp 84-85 ℃; IR (KBr): 3441, 3060, 1729, 1134, 1575, 1501, 1468, 1361, 1280, 1217, 1096, 877, 841, 728 cm^{-1}; ^{1}H NMR (400 MHz, DMSO-d_6): δ 10.79 (s, 1H), 9.02 (s, 1H), 8.29-8.25 (m, 1H), 7.94-7.86 (m, 2H), 7.59-7.56 (m, 2H),

7.00-6.97 (m, 1H), 4.26-4.21 (m, 2H), 1.17 (t, J = 7.2 Hz, 3H); ^{13}C NMR (100 MHz, DMSO-d_6): δ 193.47, 165.68, 161.38 (d, J = 247.0 Hz), 157.31, 149.27, 146.11, 136.64 (d, J = 6.0 Hz), 135.34, 132.97 (d, J = 10.0 Hz), 131.76, 130.43, 125.05, 124.04 (d, J = 11.0 Hz), 123.60, 122.38 (d, J = 26.0 Hz), 119.76, 109.83 (d, J = 24 Hz), 62.81, 13.84; HRMS (ESI-TOF): *m/z* calcd for $C_{19}H_{13}ClFNO_4$ $[M+H]^+$: 374.0590, found: 374.0594.

Isopropyl 6-fluoro-3-(2-hydroxy-5-methylbenzoyl)quinoline-4-carboxylate (4x)

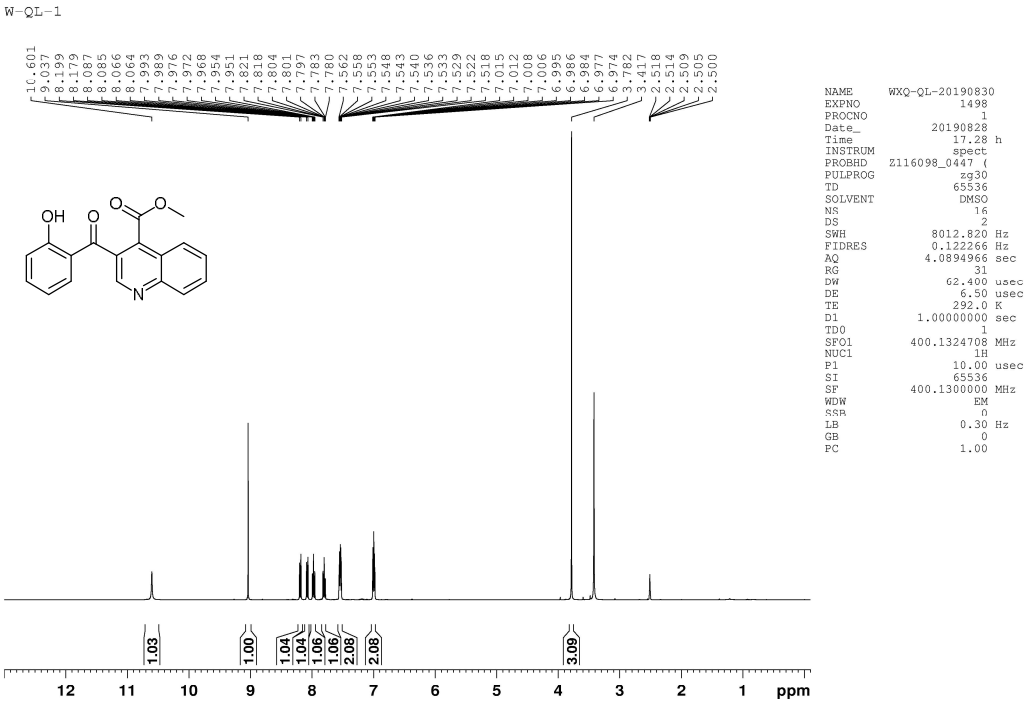
Yield 61%; Yellow solid; Mp 89-90 ℃; IR (KBr): 3417, 2980, 1729, 1631, 1505, 1487, 1364, 1285, 1263, 1215, 1191, 1102, 1054, 916, 850 cm^{-1}; ^{1}H NMR (400 MHz, DMSO-d_6): δ 10.67 (s, 1H), 9.01 (s, 1H), 8.30-8.26 (m, 1H), 7.94-7.89 (m, 2H), 7.39 (dd, J = 8.4, 2.4 Hz, 1H), 7.33 (d, J = 1.6 Hz, 1H), 6.91 (d, J = 8.4 Hz, 1H), 5.13-5.07 (m, 1H), 2.22 (s, 3H), 1.13 (d, J = 6.4 Hz, 6H); ^{13}C NMR (100 MHz, DMSO-d_6): δ 196.18, 164.95, 161.39 (d, J = 246.0 Hz), 157.83, 148.90, 145.99, 137.55, 136.20 (d, J = 6.0 Hz), 133.07 (d, J = 9.0 Hz), 132.30, 131.87, 128.78, 124.17 (d, J = 11.0 Hz), 122.27, 122.00, 117.86, 109.64 (d, J = 24 Hz), 70.92, 21.32, 20.25; HRMS (ESI-TOF): *m/z* calcd for $C_{21}H_{18}FNO_4$ $[M+H]^+$: 368.1293, found: 368.1292.

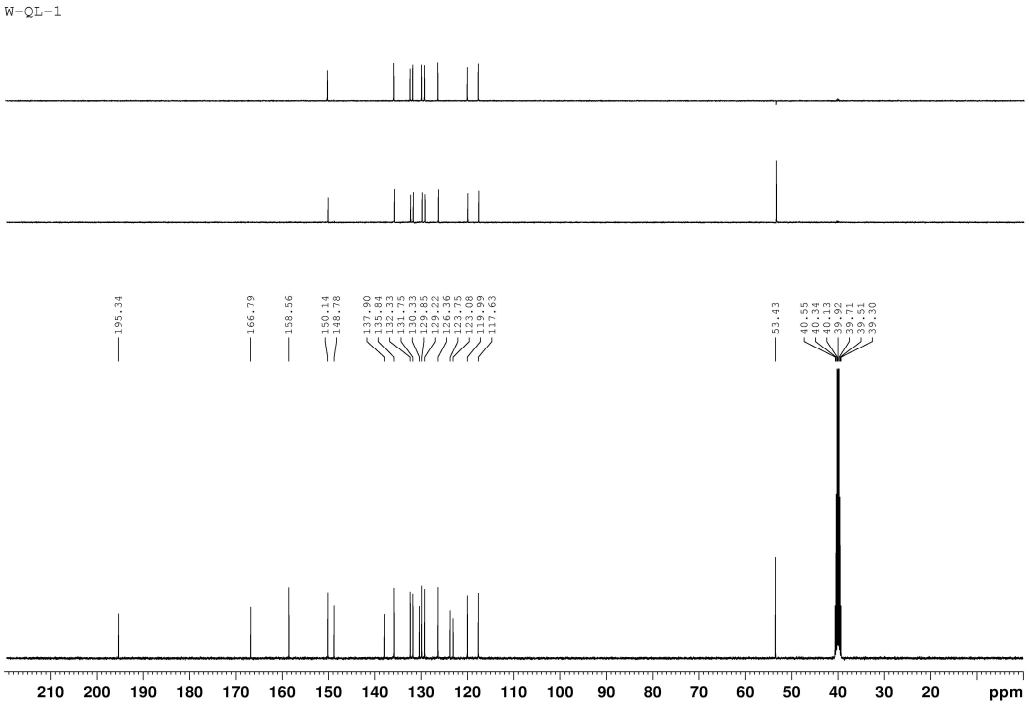
Butyl 6-chloro-3-(2-hydroxybenzoyl)quinoline-4-carboxylate (4y)

Yield 88%; Yellow solid; Mp 73-74 ℃; IR (KBr): 3416, 2958, 1741, 1623, 1574, 1486, 1454, 1364, 1280, 1254, 1207, 1157, 1091, 835, 816, 759 cm^{-1}; ^{1}H NMR (400 MHz, DMSO-d_6): δ 10.74 (s, 1H), 9.06 (s, 1H), 8.23-8.20 (m, 2H), 8.00 (dd, J = 8.8, 2.0 Hz, 1H), 7.58-7.54 (m, 2H), 7.00-6.96 (m, 2H), 4.15 (t, J = 6.4 Hz, 2H), 1.51-1.44 (m, 2H), 1.22-1.17 (m, 2H), 0.78 (t, J = 7.2 Hz, 3H); ^{13}C NMR (100 MHz, DMSO-d_6): δ 195.55, 165.52, 159.46, 149.98, 147.14, 136.53, 135.86, 133.87, 132.63, 132.50, 132.10, 132.06, 124.90, 124.00, 122.88, 120.00, 117.84, 66.43, 29.93, 18.97, 13.89; HRMS (ESI-TOF): *m/z* calcd for $C_{21}H_{18}ClNO_4$ $[M+H]^+$: 384.0997, found: 384.0998.

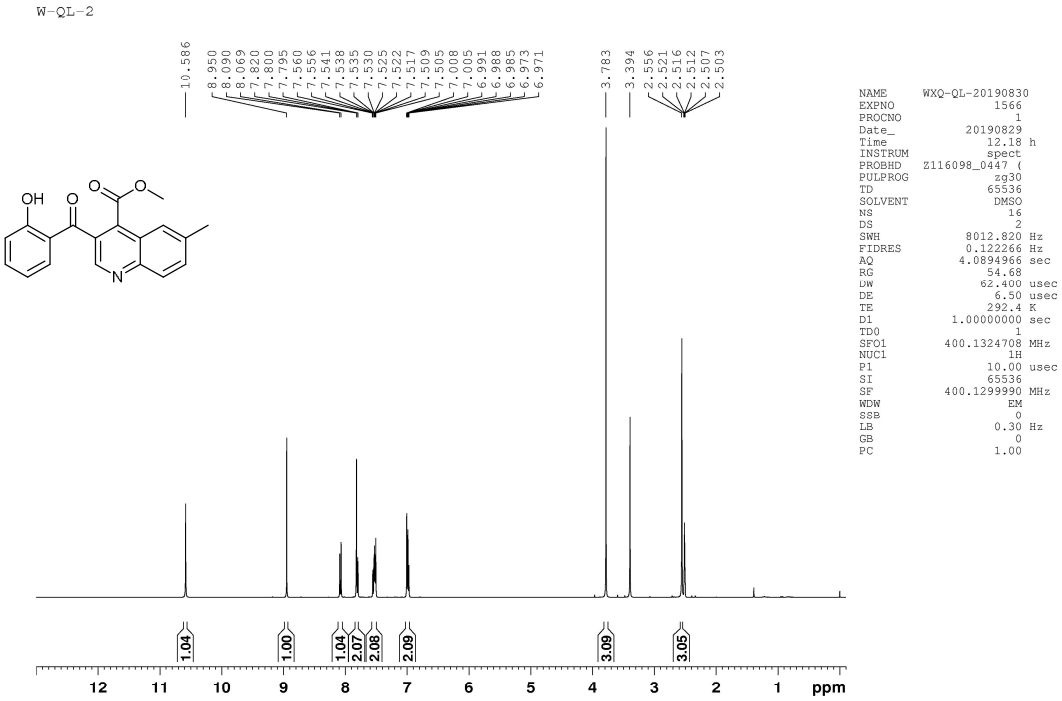
3. ^{1}H-NMR and ^{13}C-NMR Spectral of New Compounds

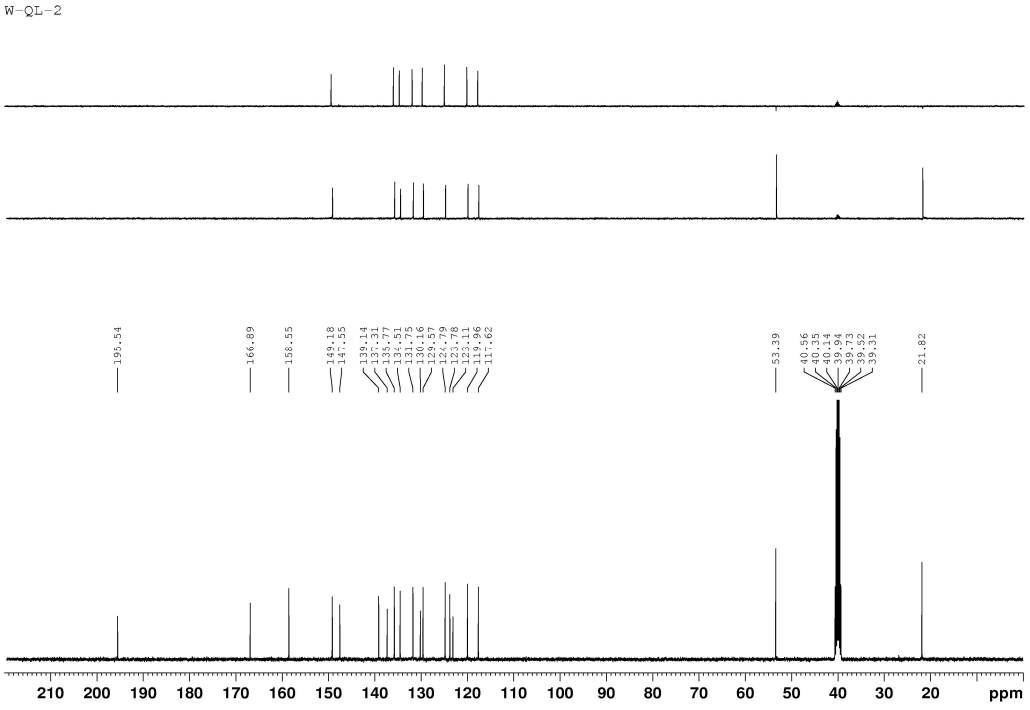
^{1}H-NMR and ^{13}C-NMR spectral of compound 4a



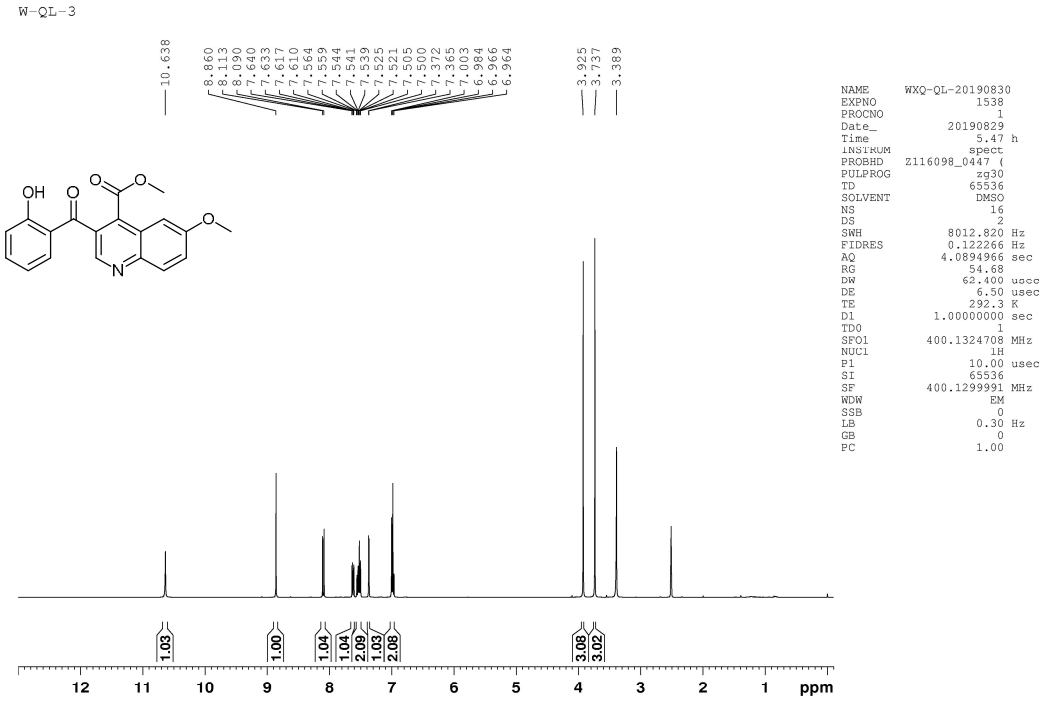


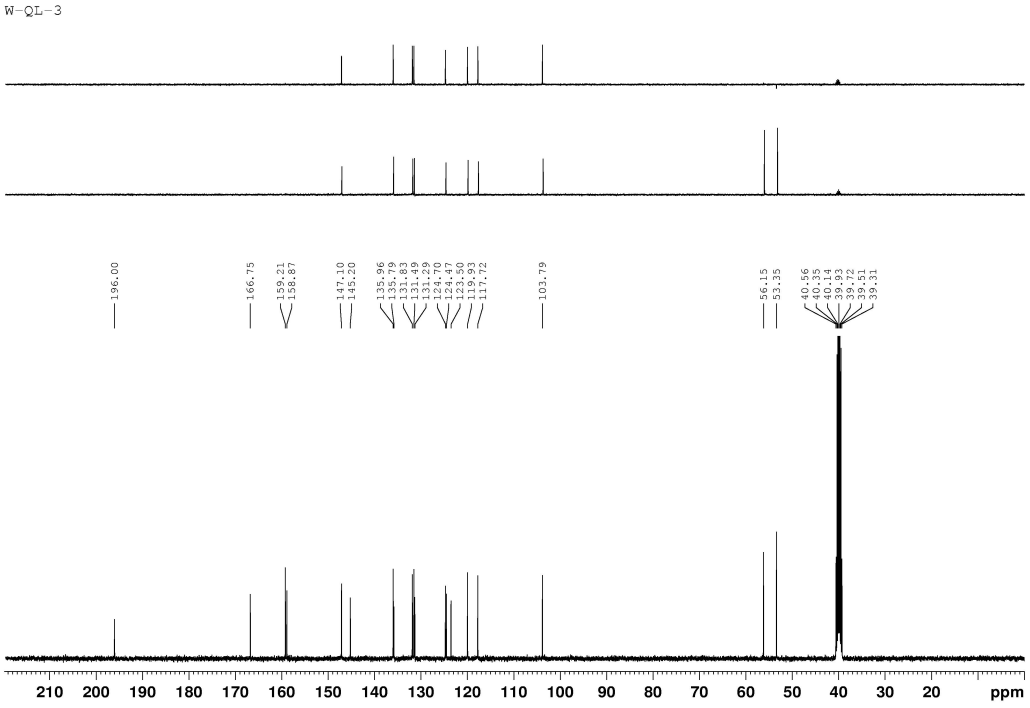
^{1}H-NMR and ^{13}C-NMR spectral of compound 4b



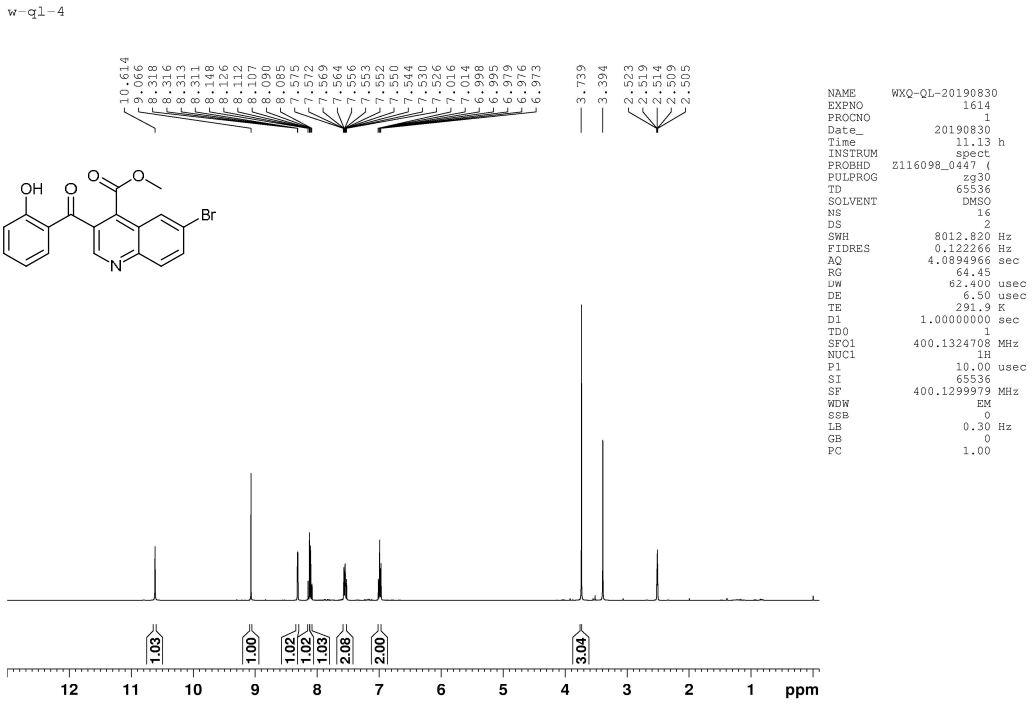


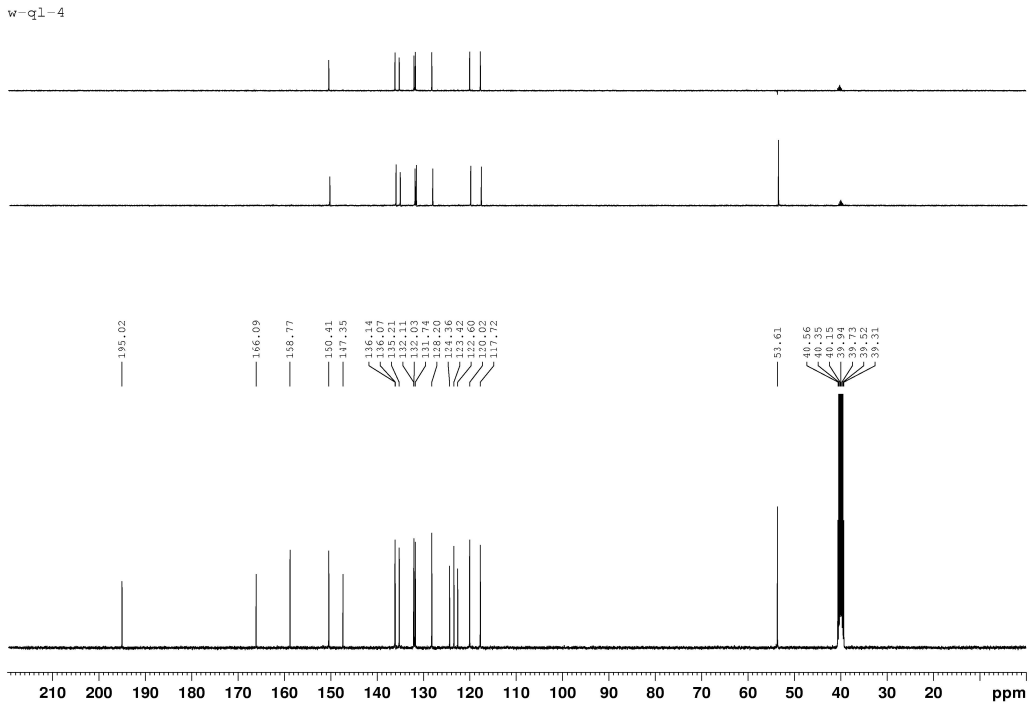
^{1}H-NMR and ^{13}C-NMR spectral of compound 4c



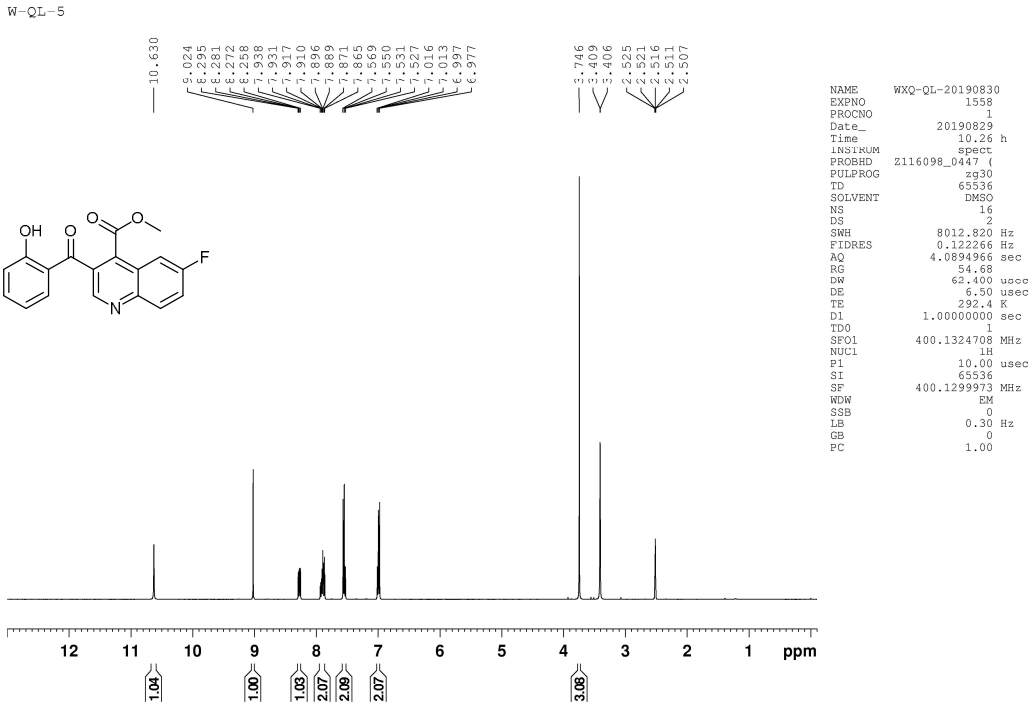


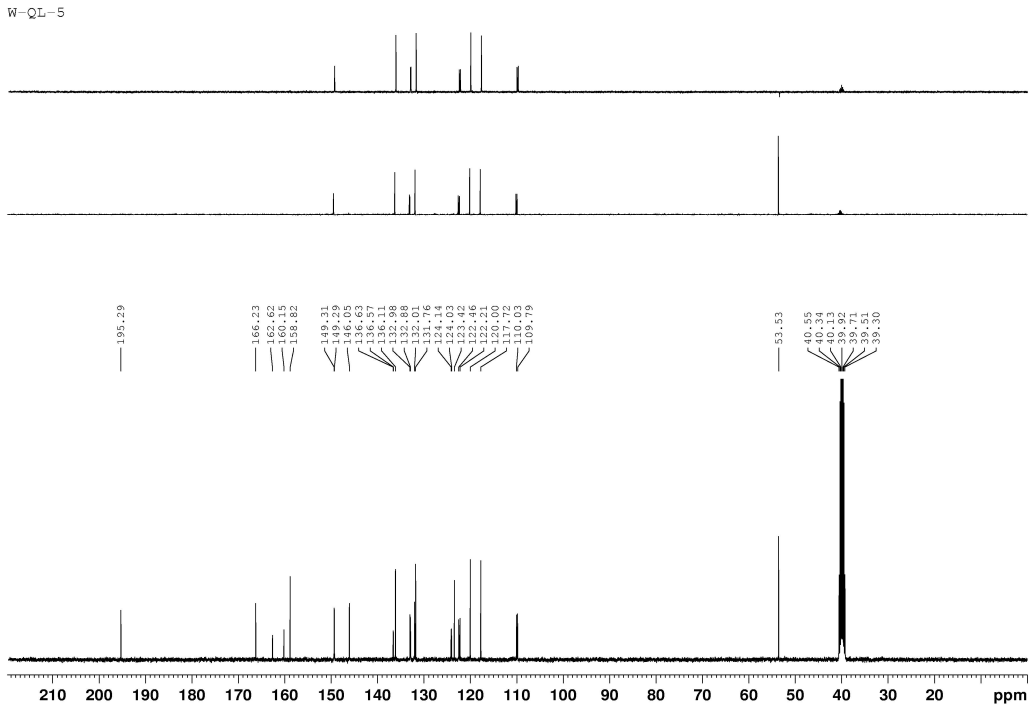
^{1}H-NMR and ^{13}C-NMR spectral of compound 4d



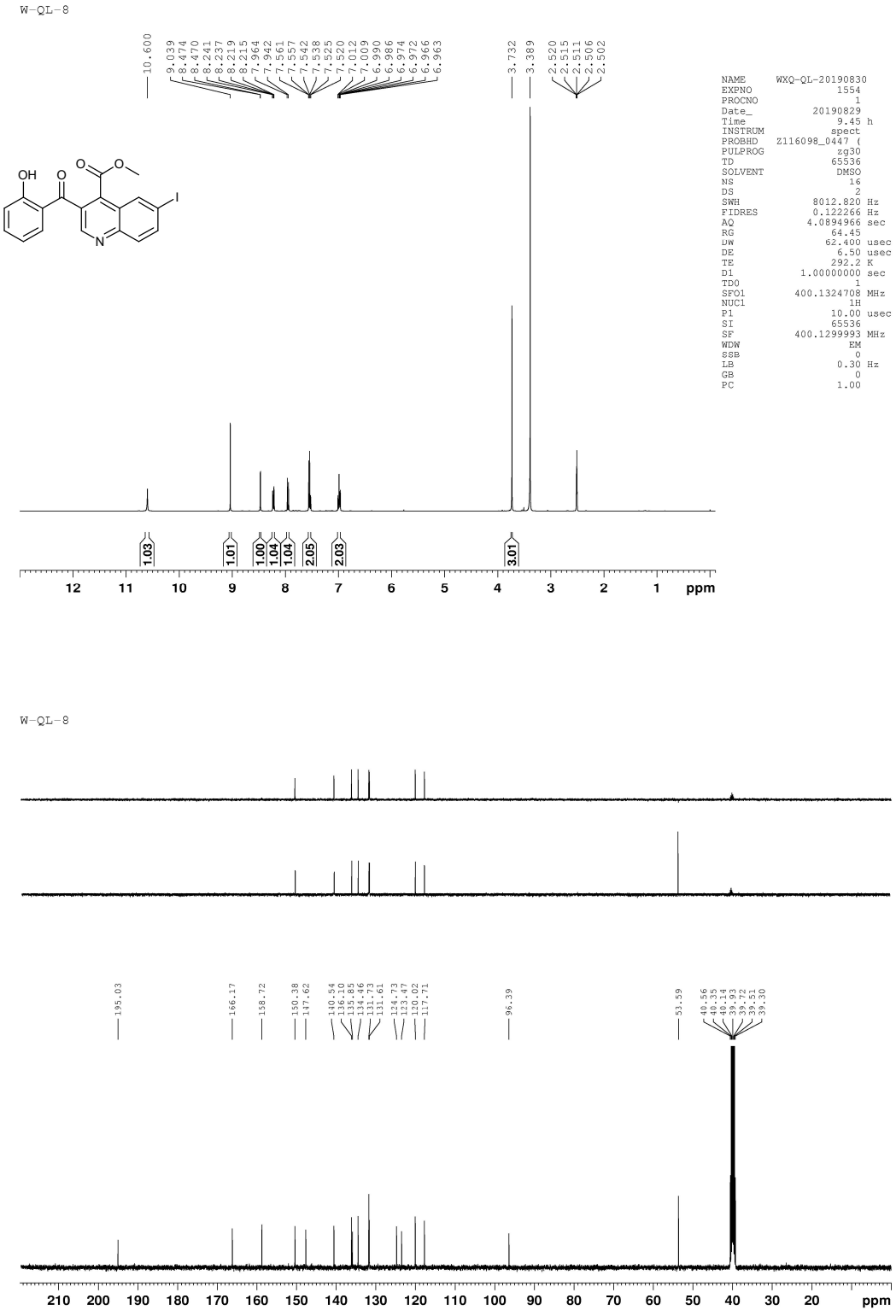


^{1}H-NMR and ^{13}C-NMR spectral of compound 4e

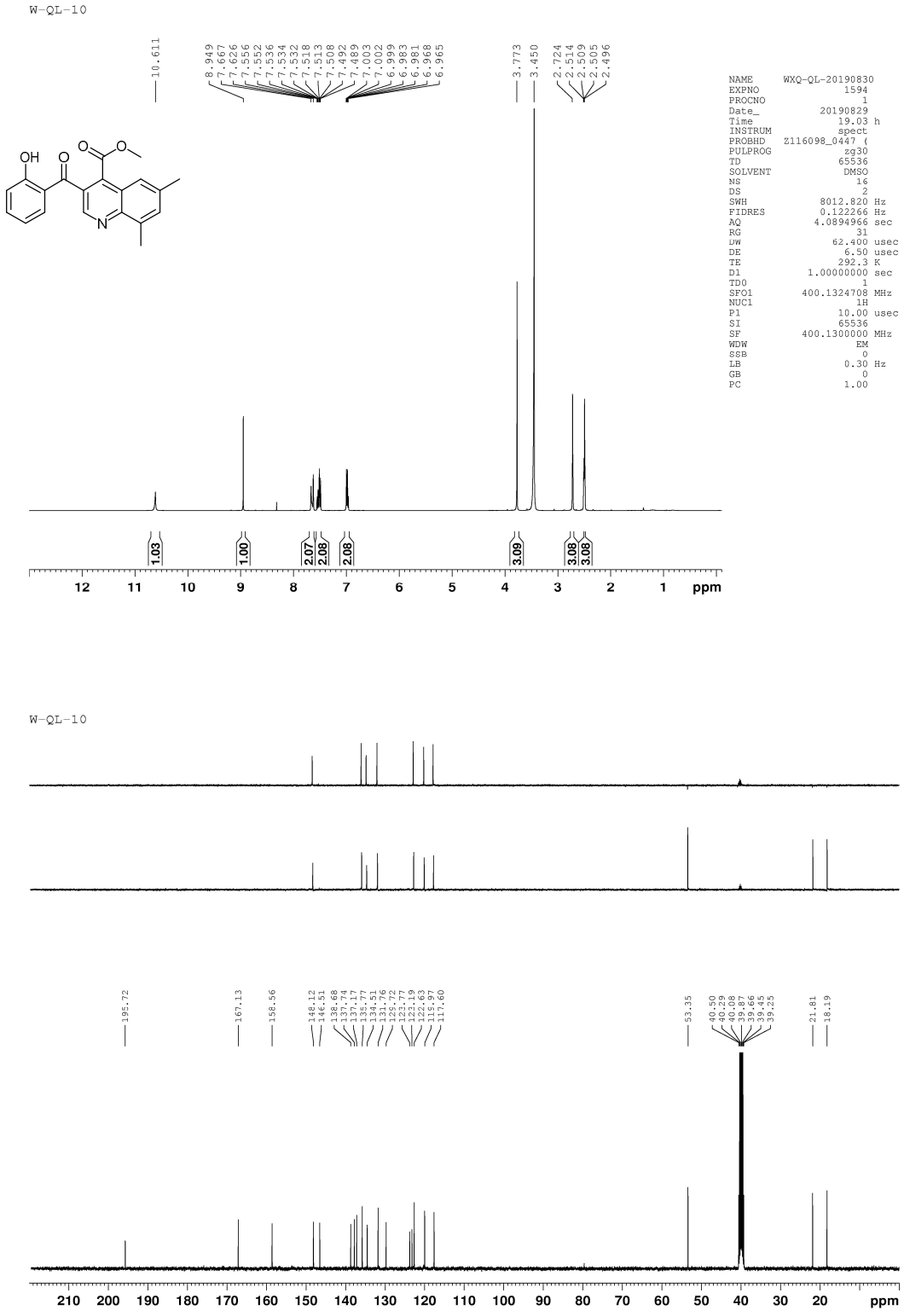




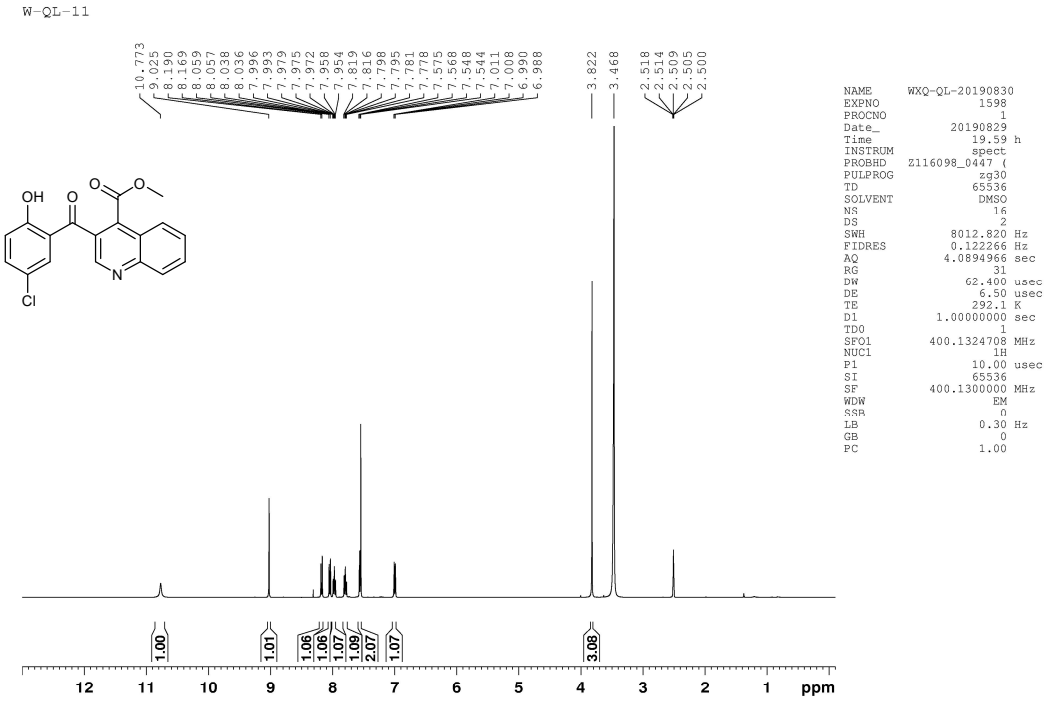
^{1}H-NMR and ^{13}C-NMR spectral of compound 4f

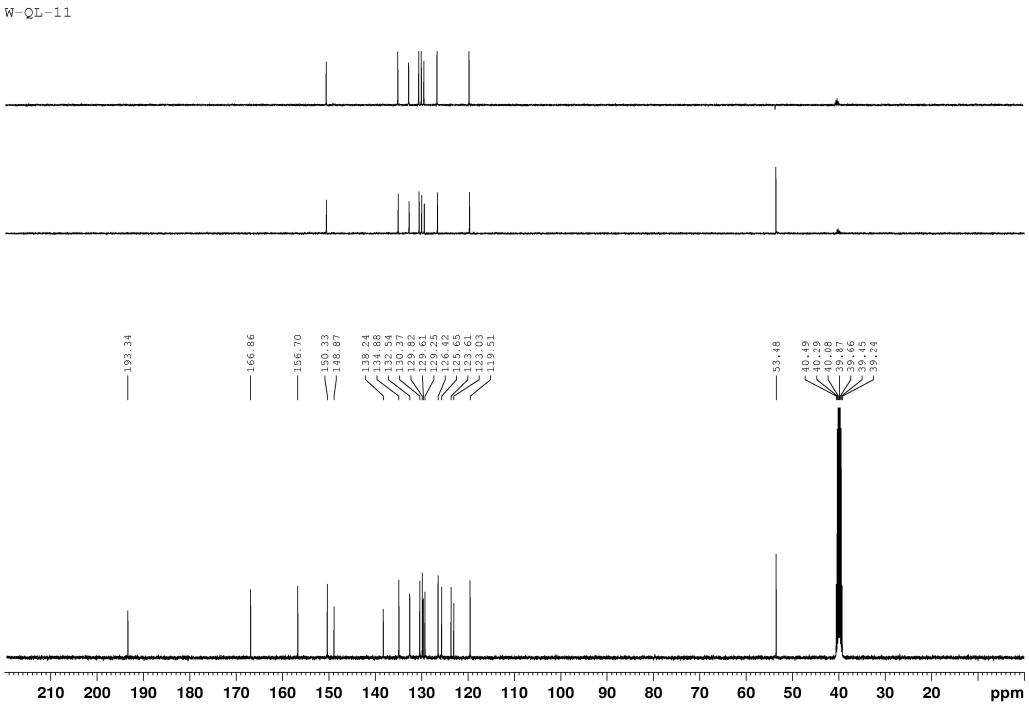


^{1}H-NMR and ^{13}C-NMR spectral of compound 4g

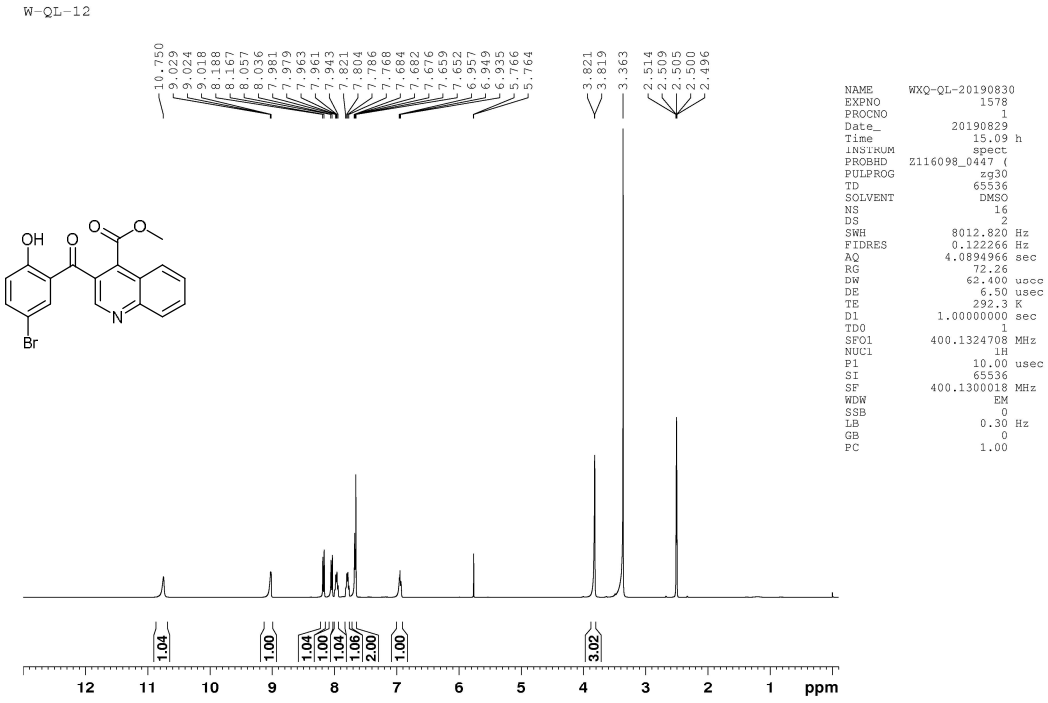


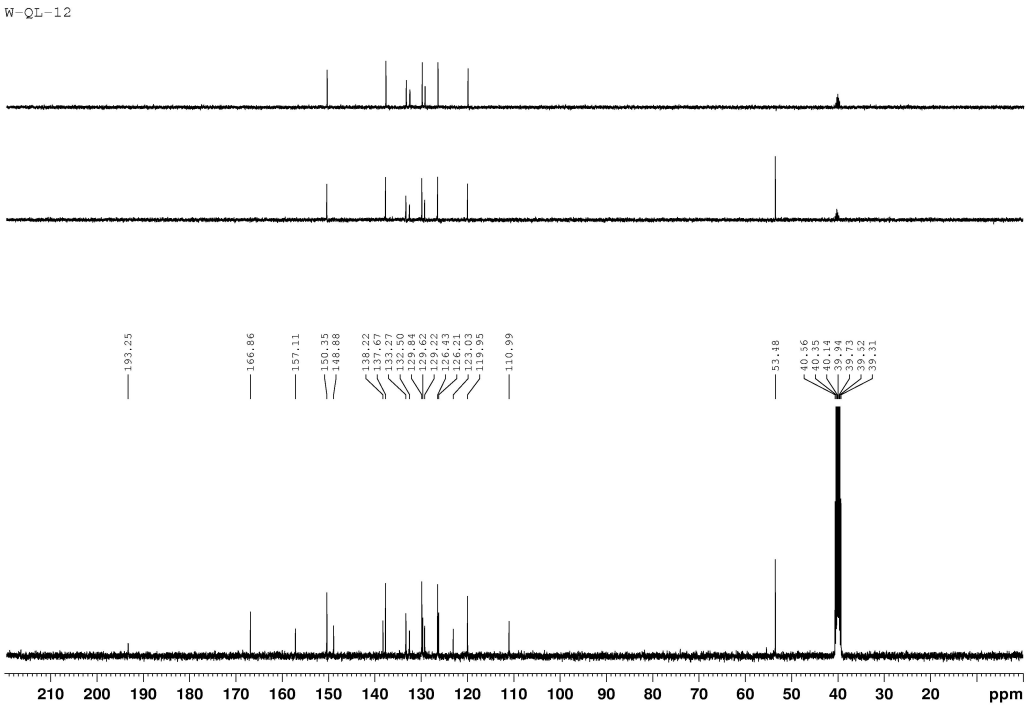
^{1}H-NMR and ^{13}C-NMR spectral of compound 4h



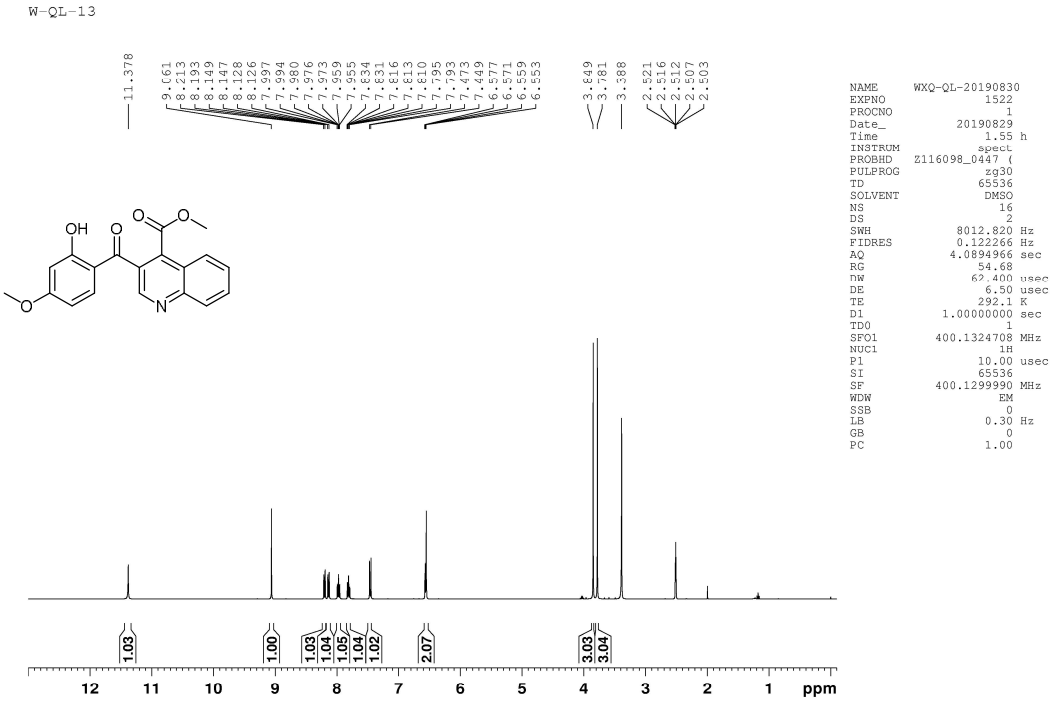


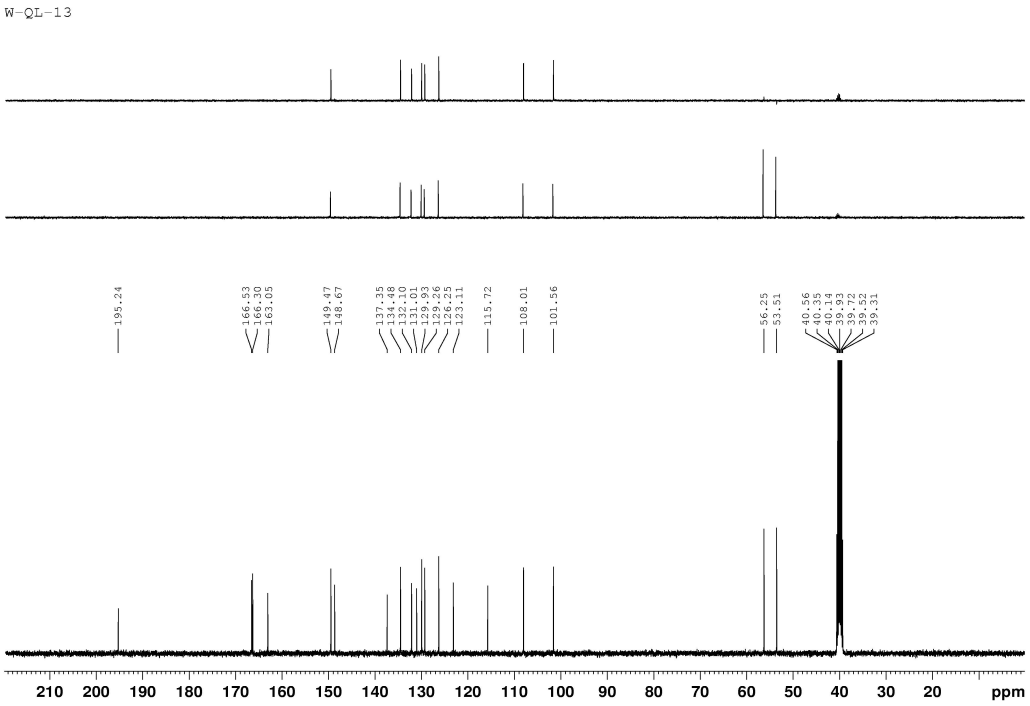
^{1}H-NMR and ^{13}C-NMR spectral of compound 4i



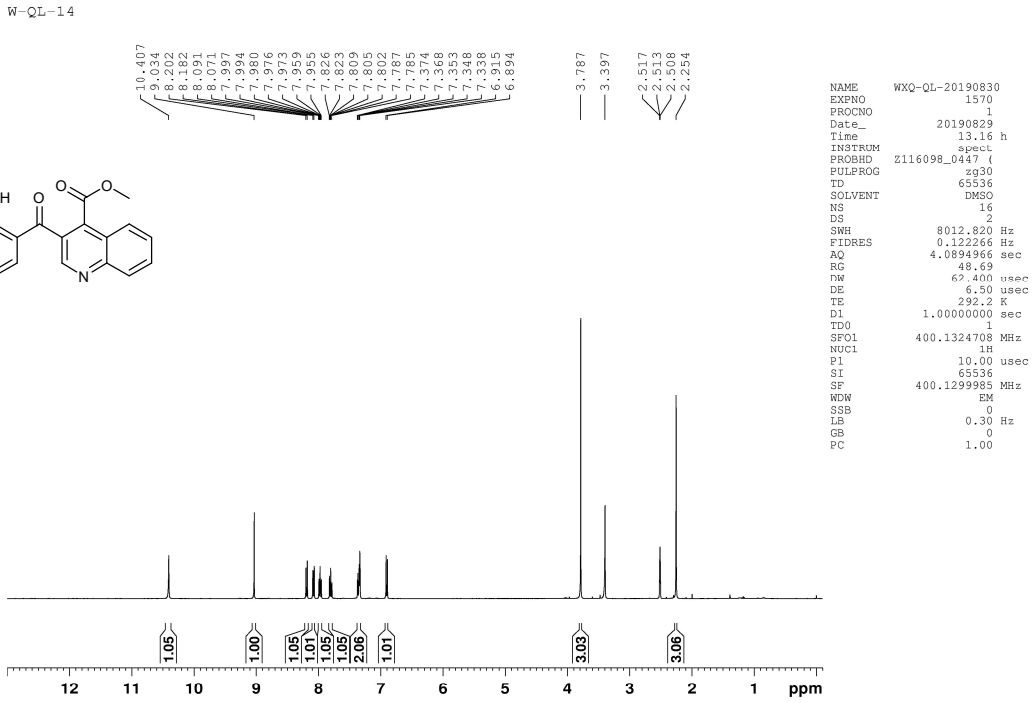


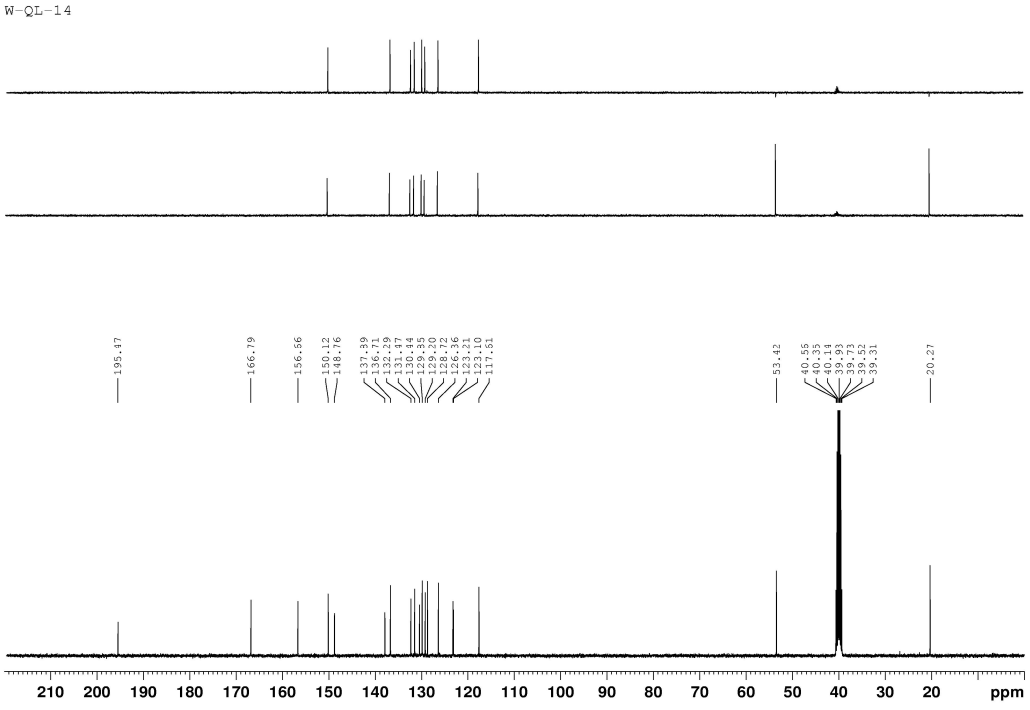
^{1}H-NMR and ^{13}C-NMR spectral of compound 4j



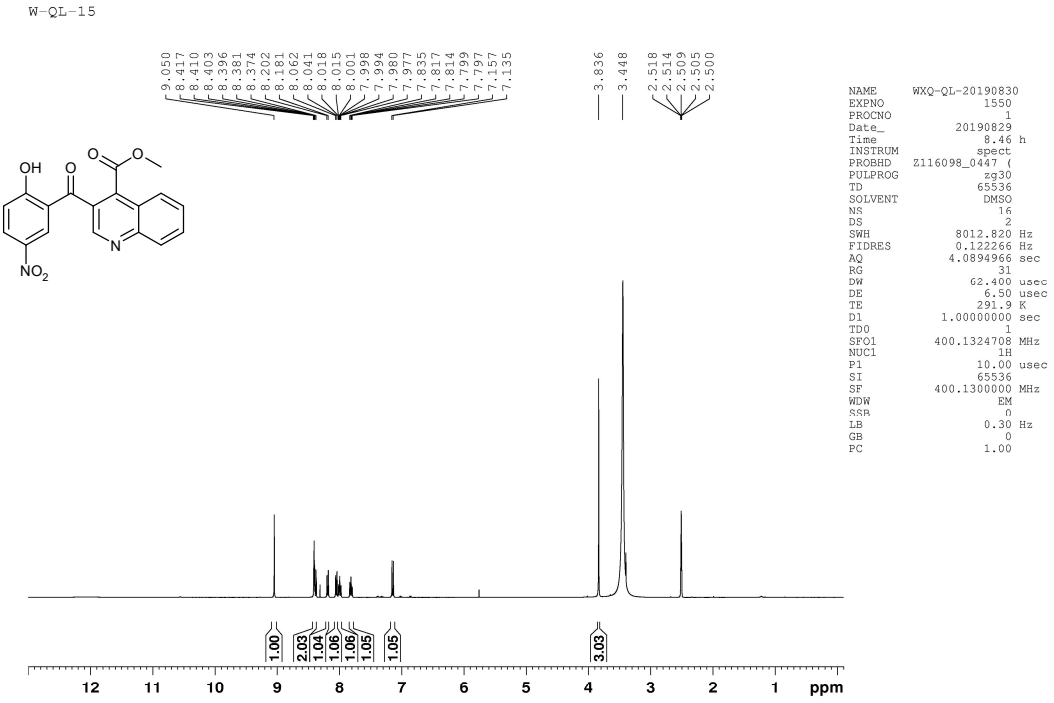


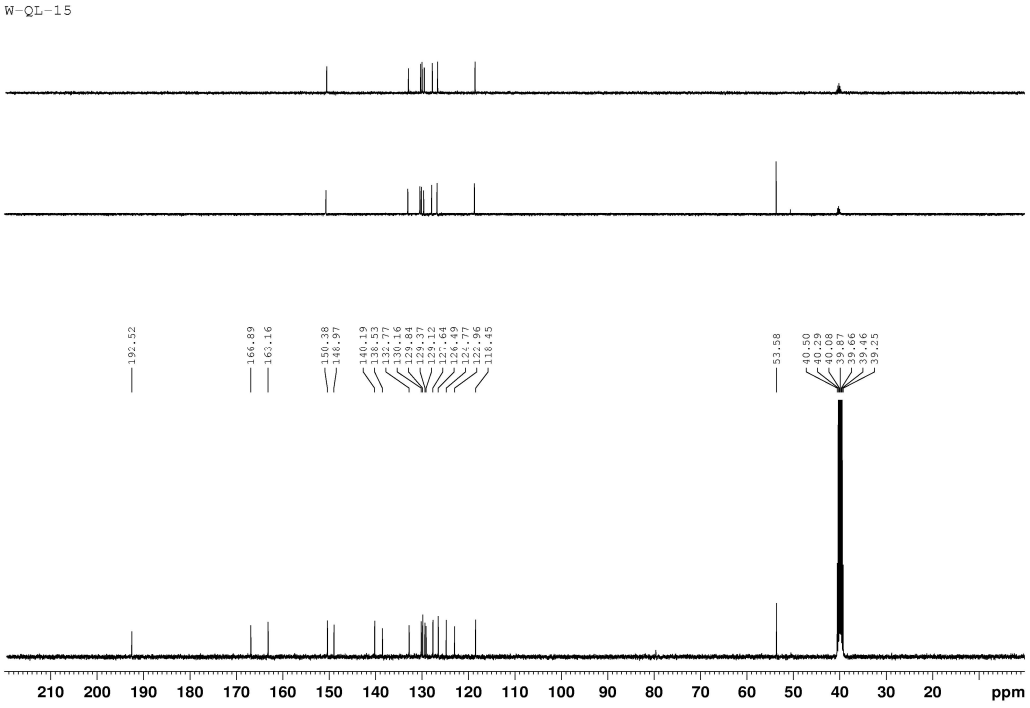
^{1}H-NMR and ^{13}C-NMR spectral of compound 4k



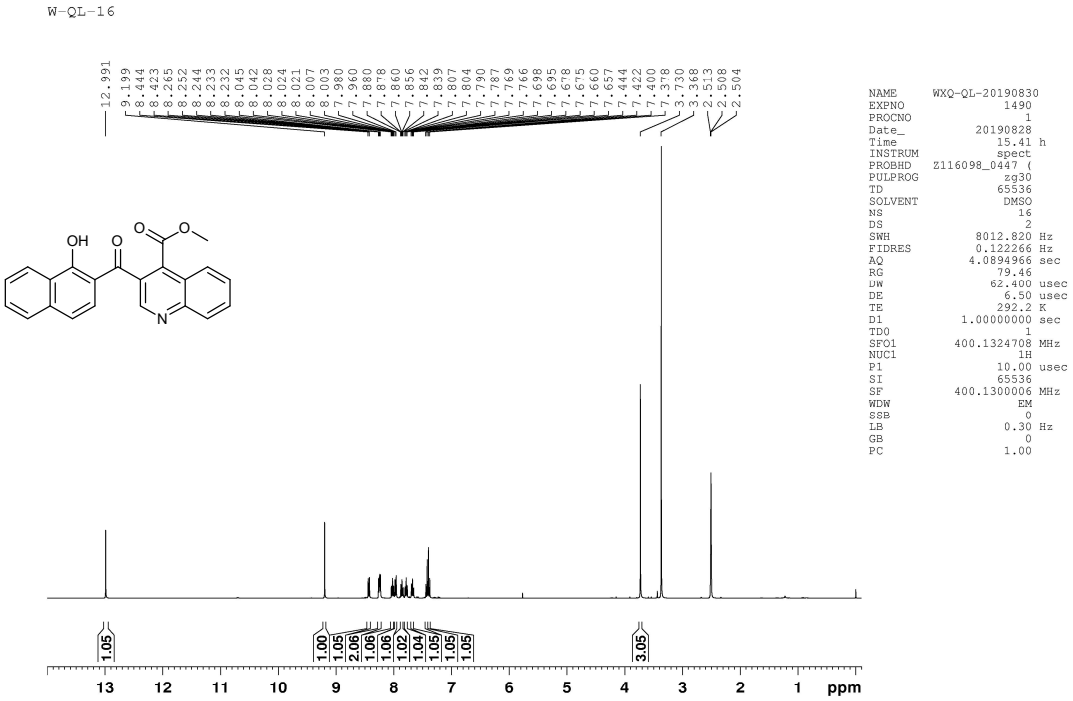


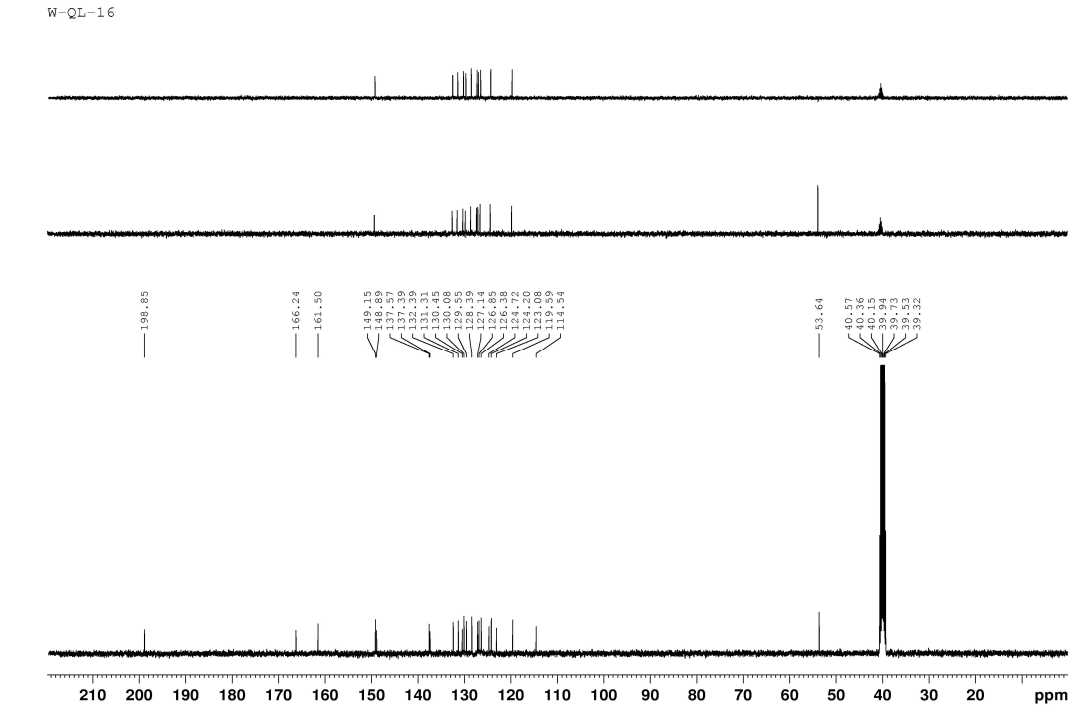
^{1}H-NMR and ^{13}C-NMR spectral of compound 4l



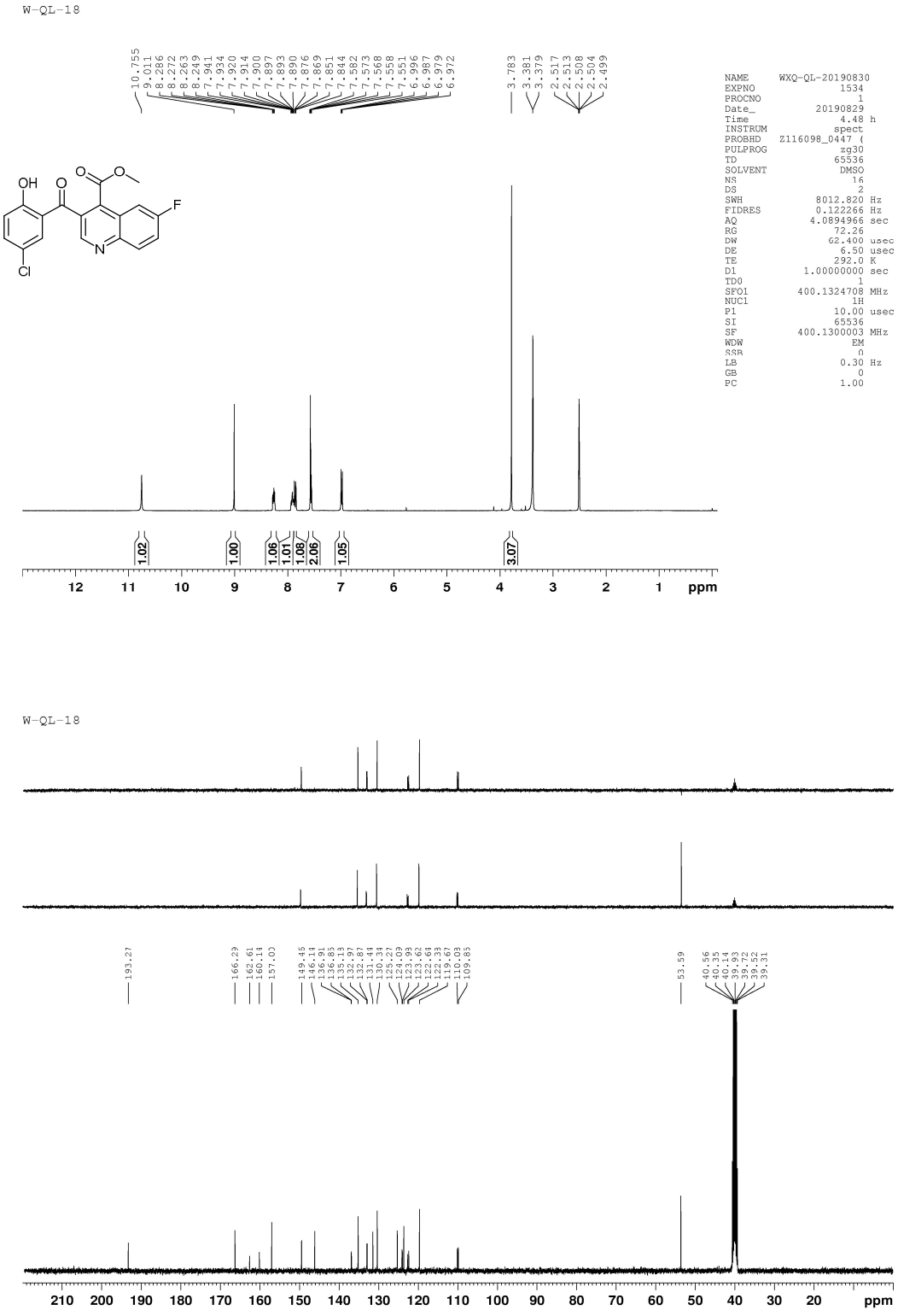


^{1}H-NMR and ^{13}C-NMR spectral of compound 4m

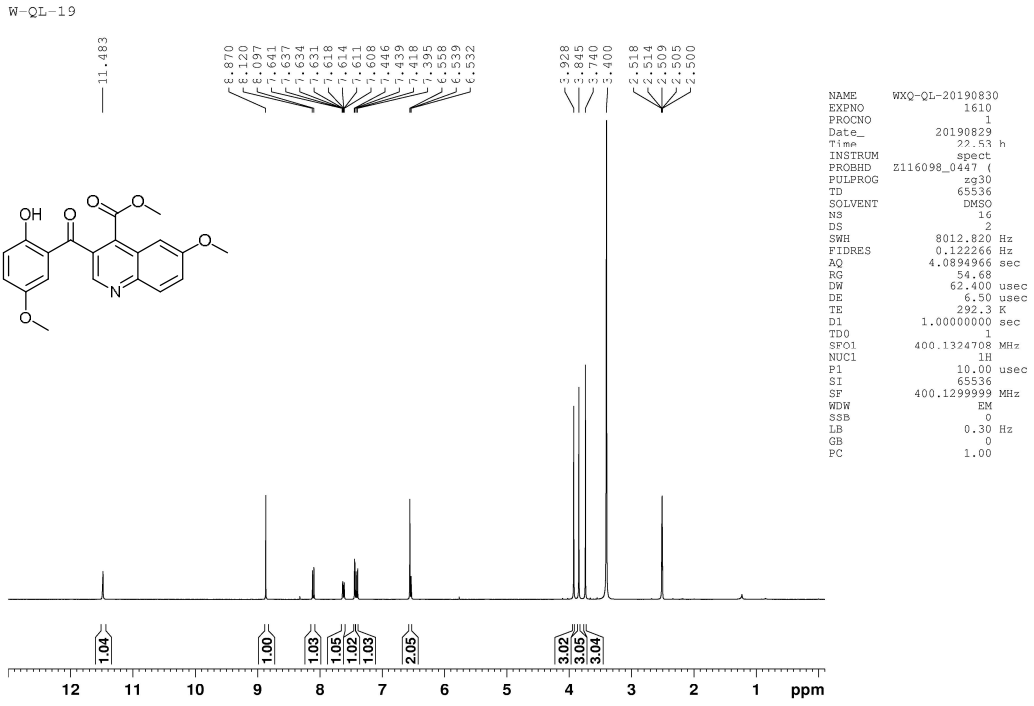


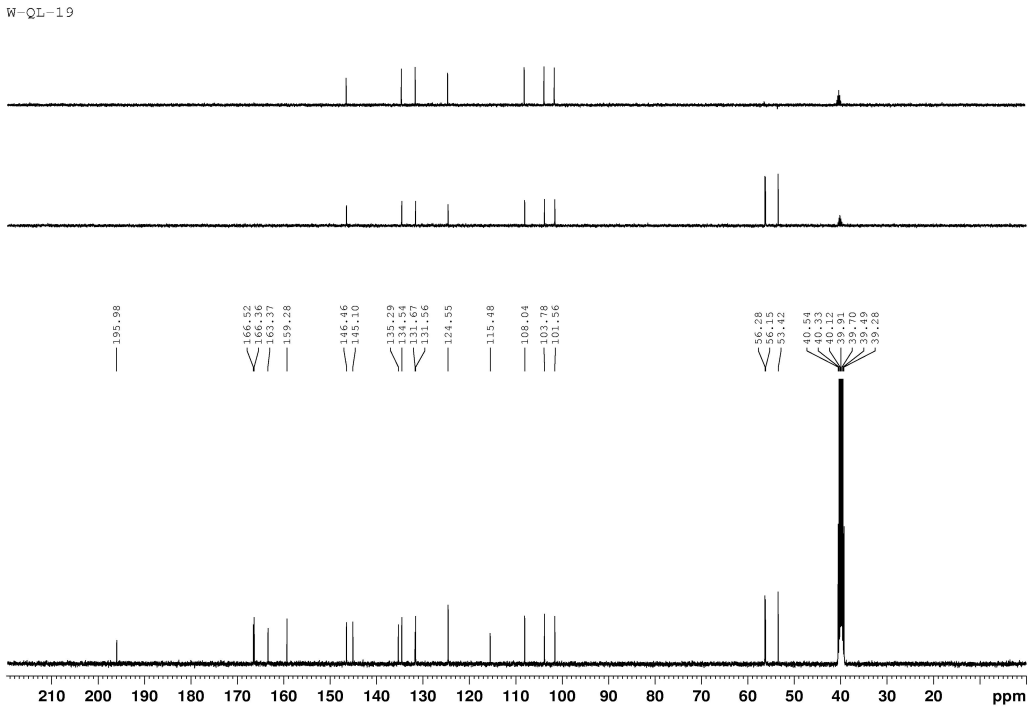


^{1}H-NMR and ^{13}C-NMR spectral of compound 4n

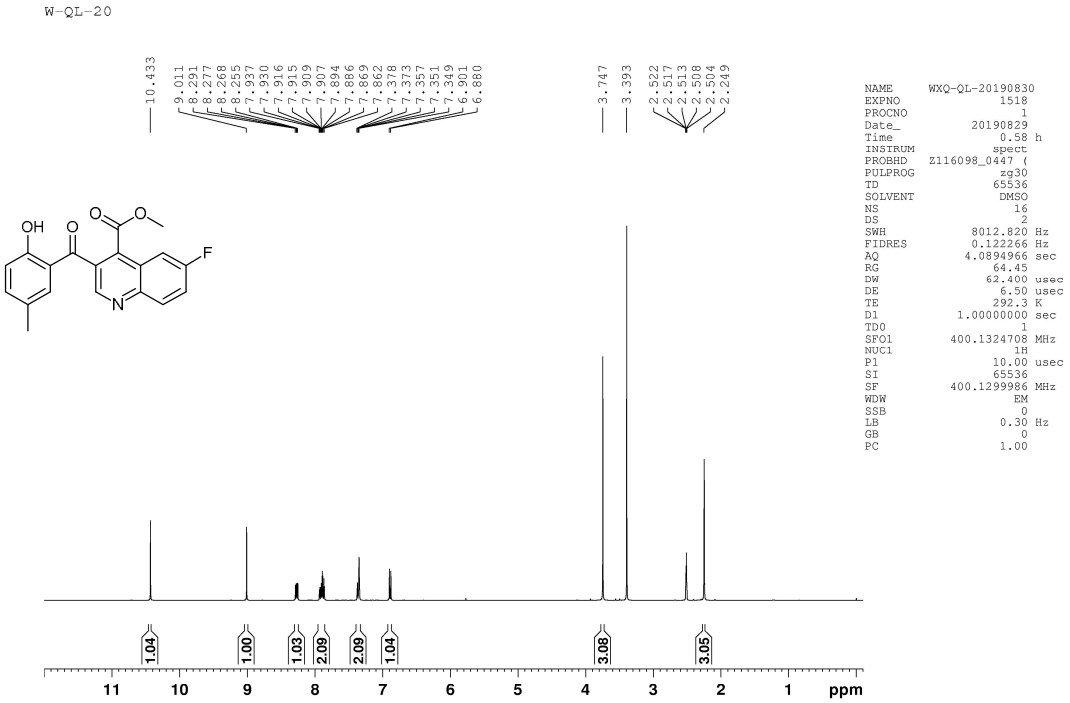


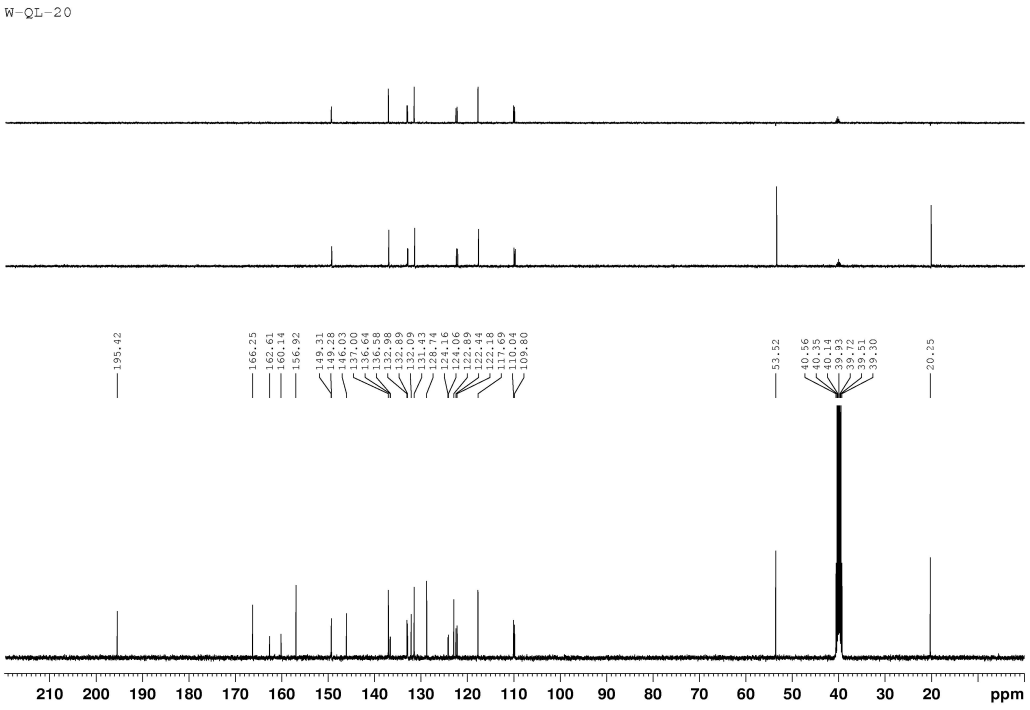
^{1}H-NMR and ^{13}C-NMR spectral of compound 4o



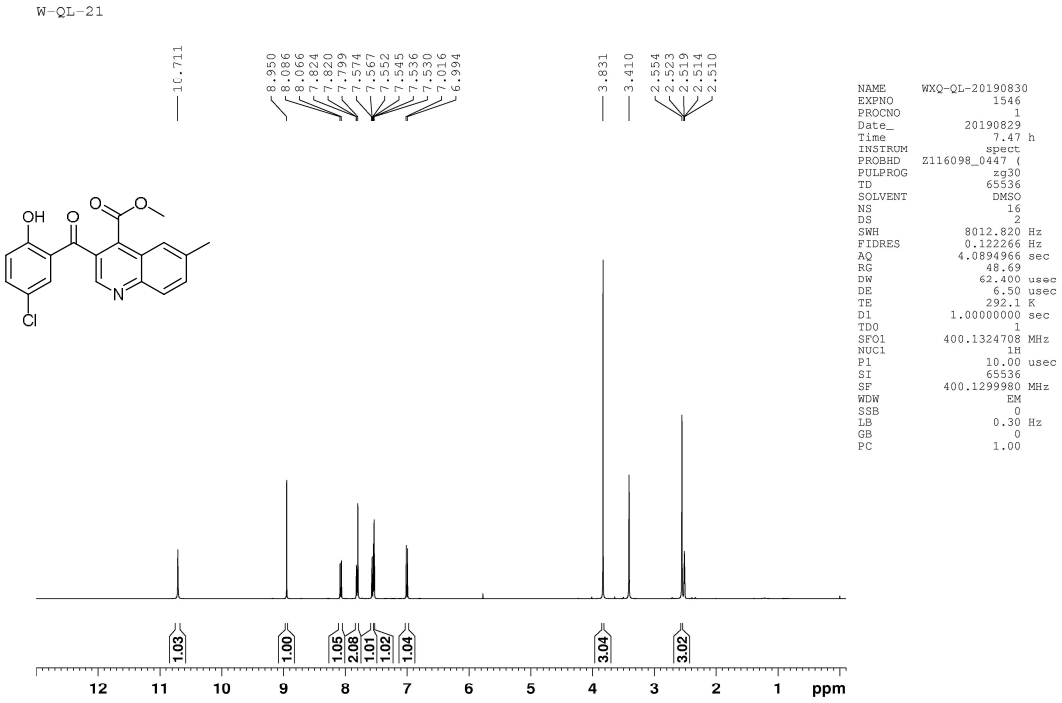


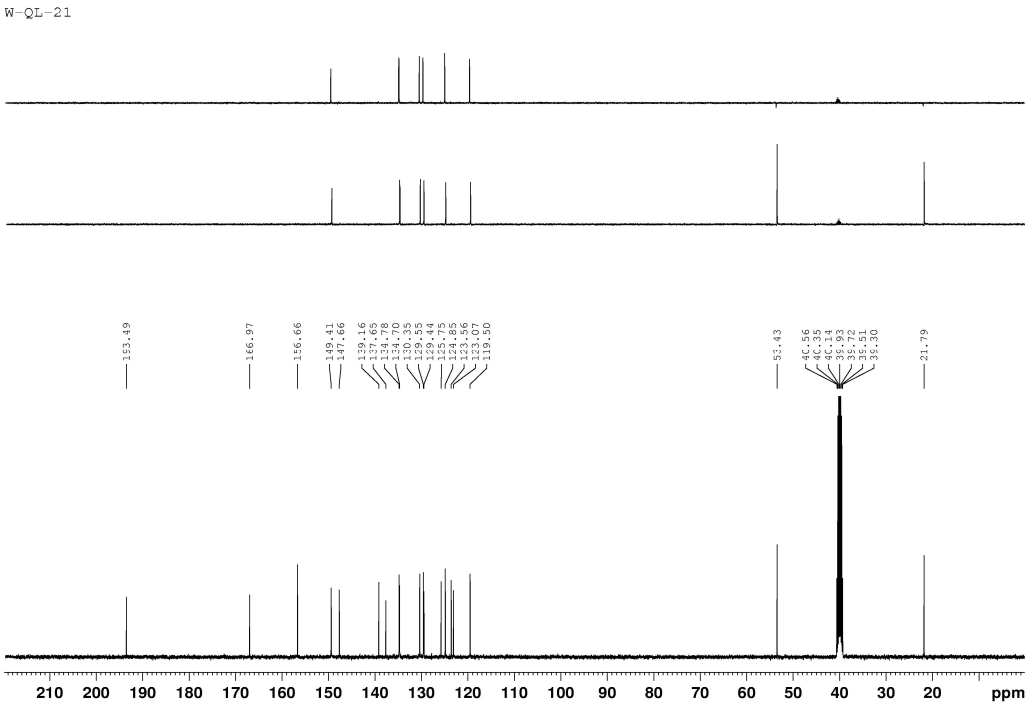
^{1}H-NMR and ^{13}C-NMR spectral of compound 4p



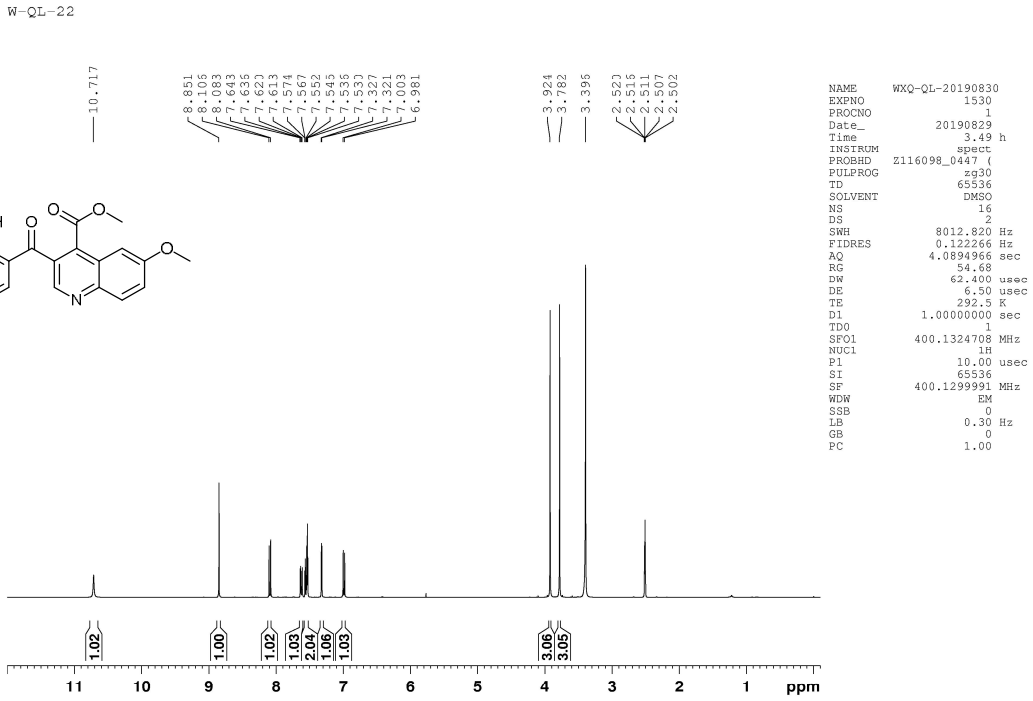


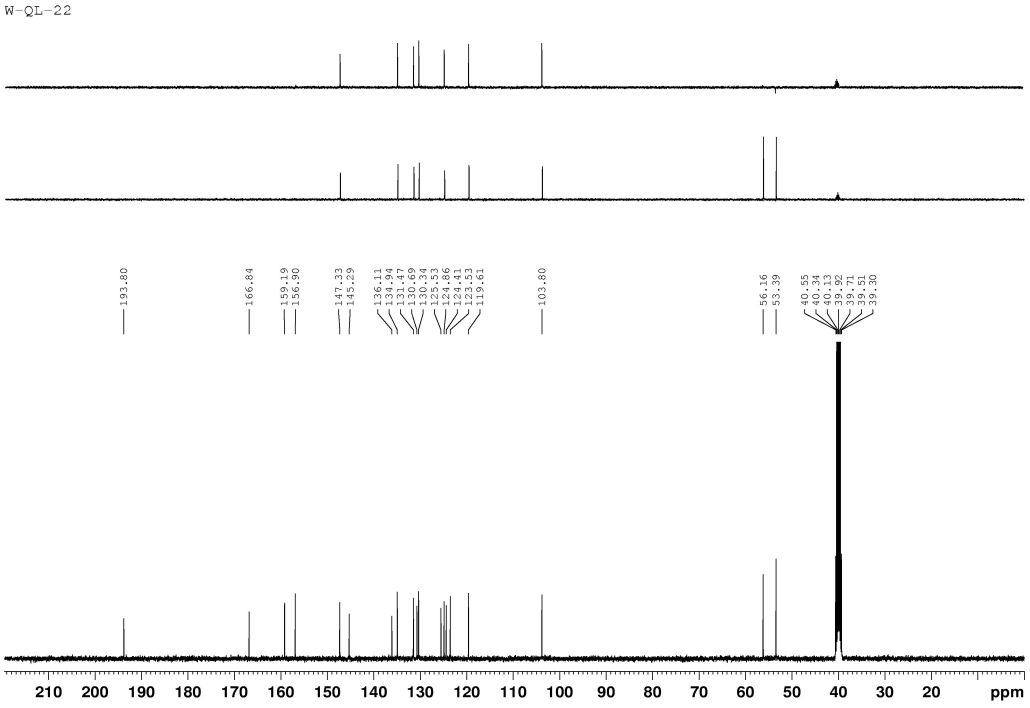
^{1}H-NMR and ^{13}C-NMR spectral of compound 4q



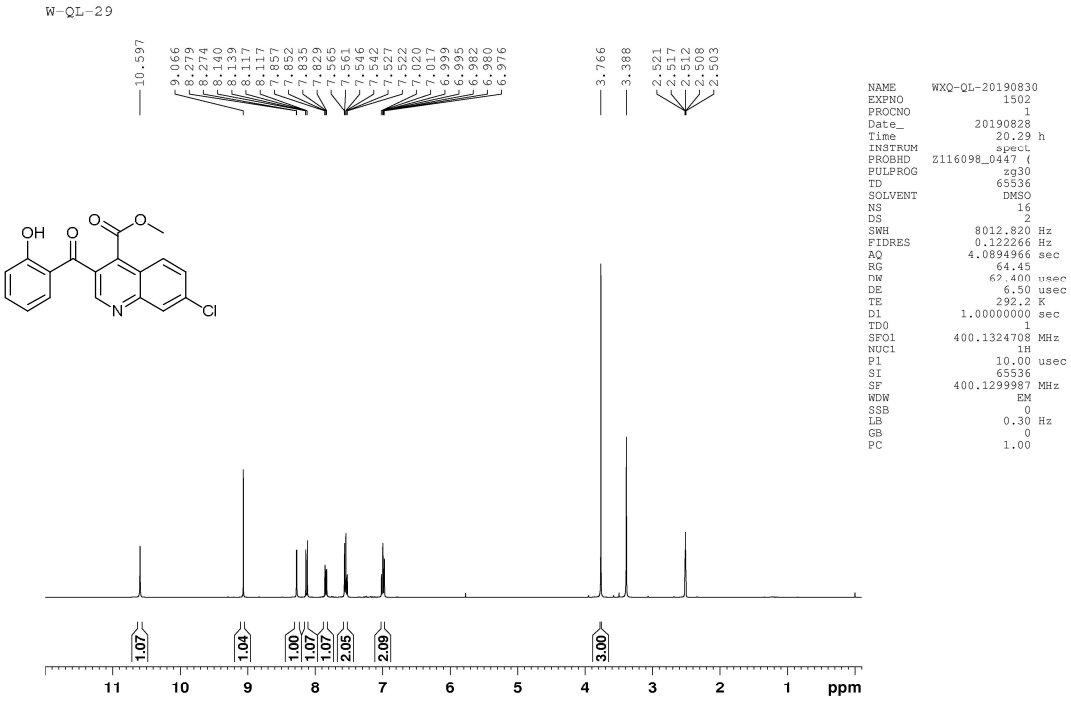


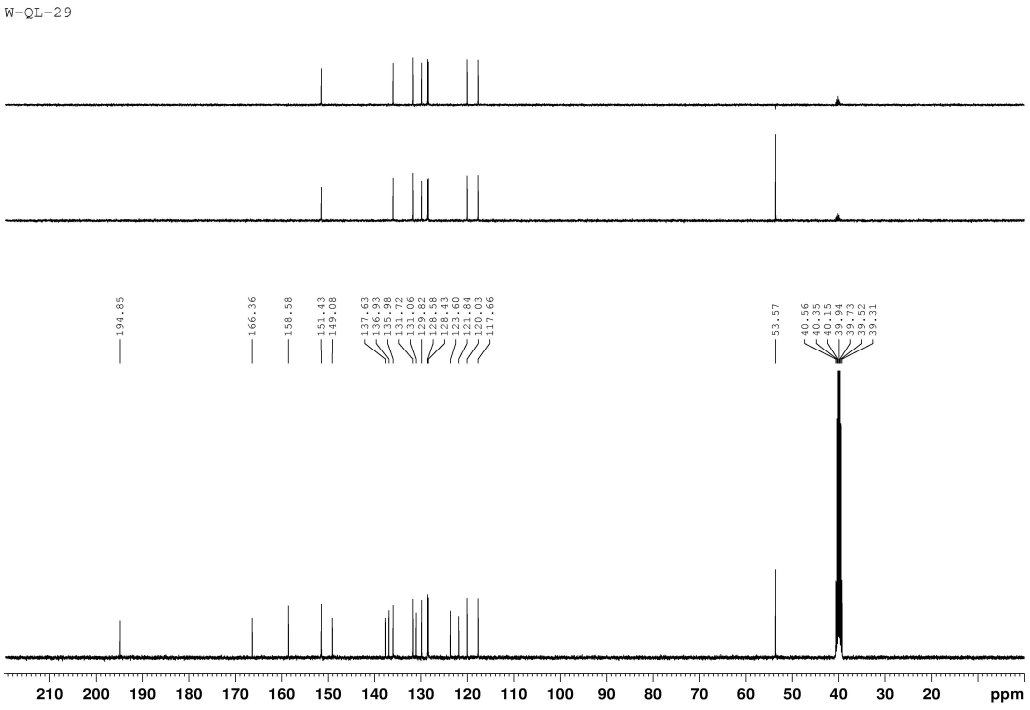
^{1}H-NMR and ^{13}C-NMR spectral of compound 4r



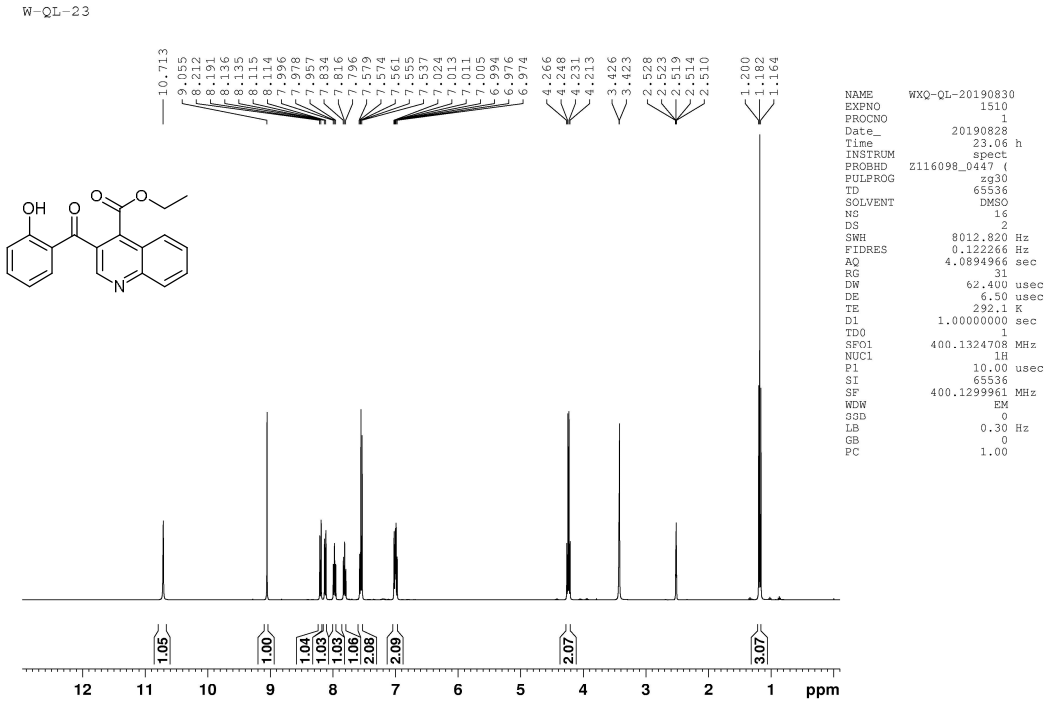


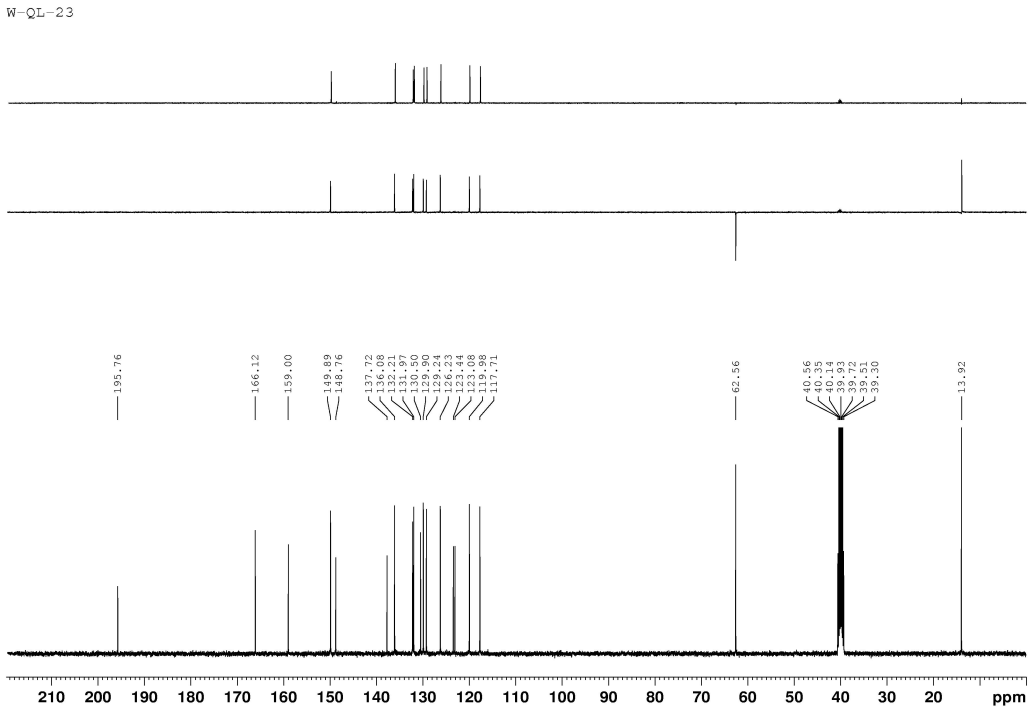
^{1}H-NMR and ^{13}C-NMR spectral of compound 4s



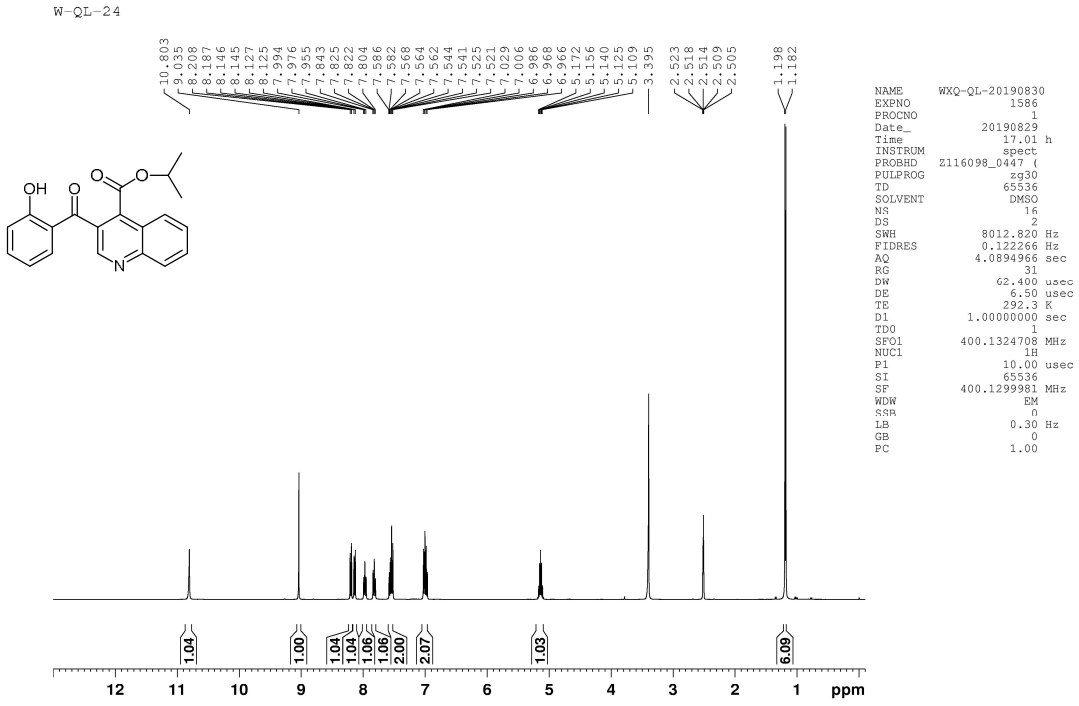


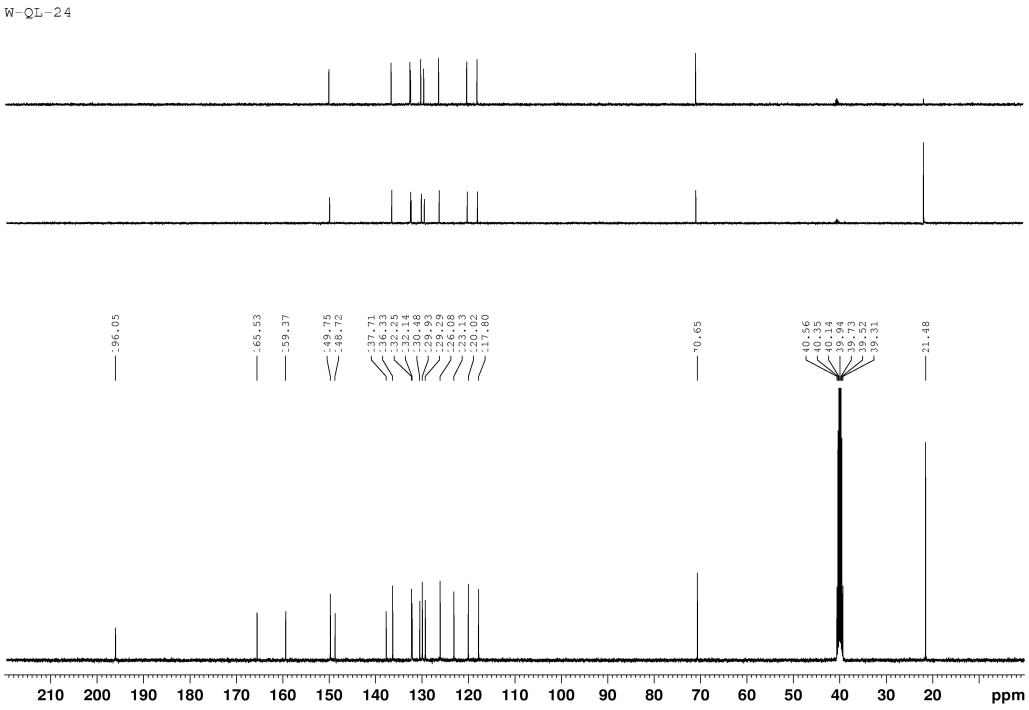
^{1}H-NMR and ^{13}C-NMR spectral of compound 4t



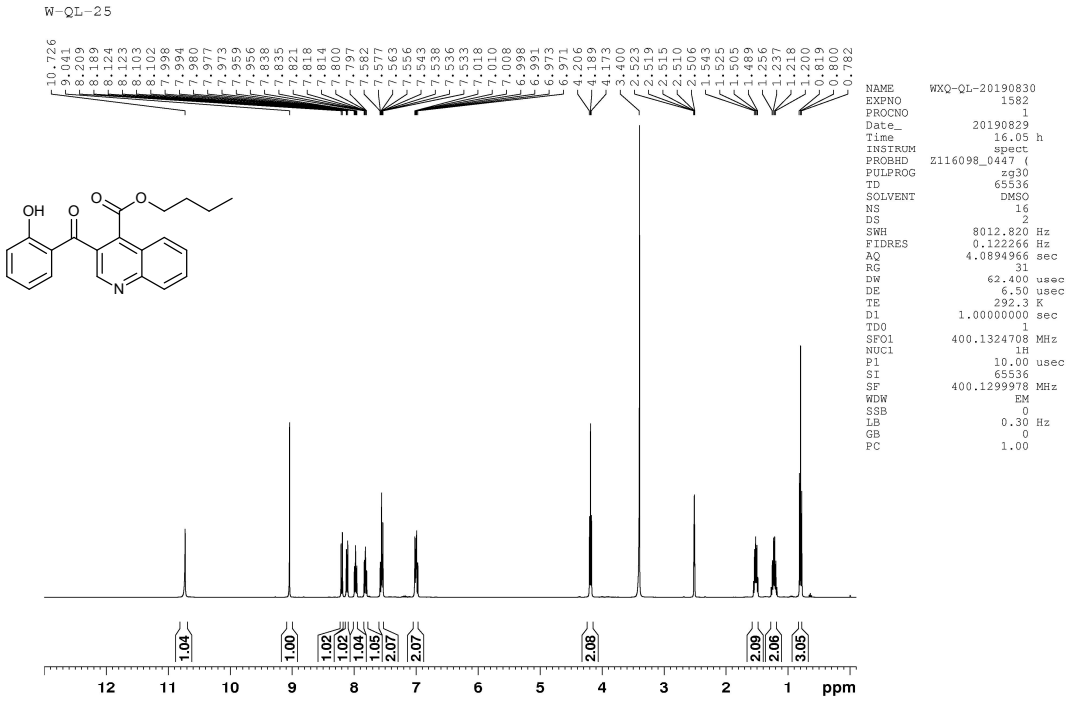


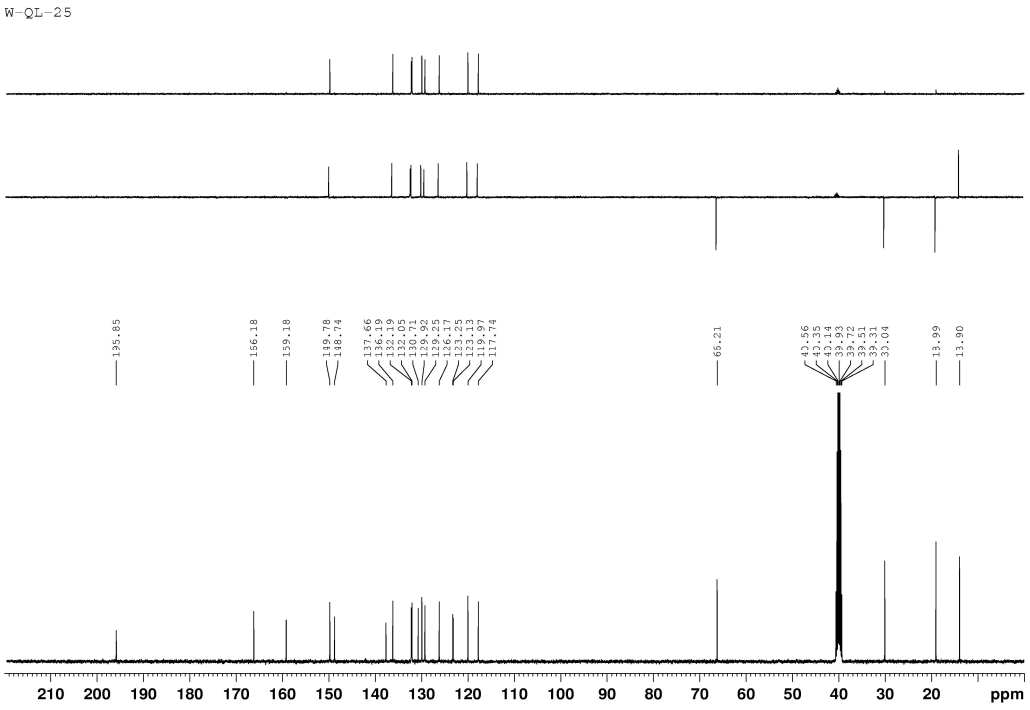
^{1}H-NMR and ^{13}C-NMR spectral of compound 4u



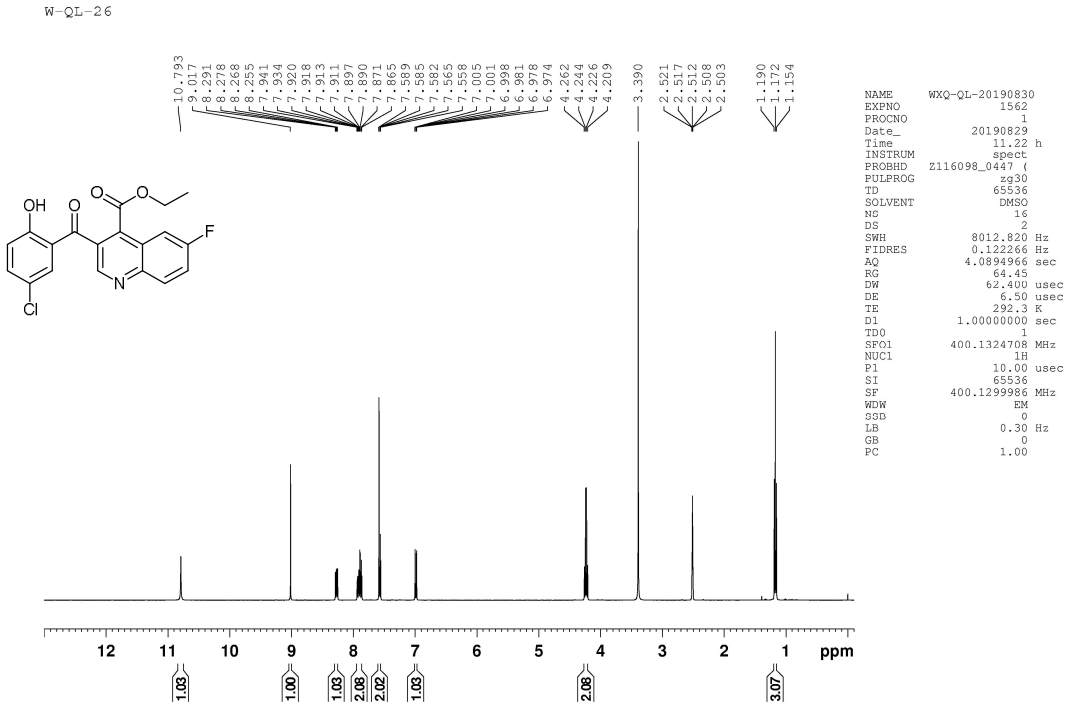


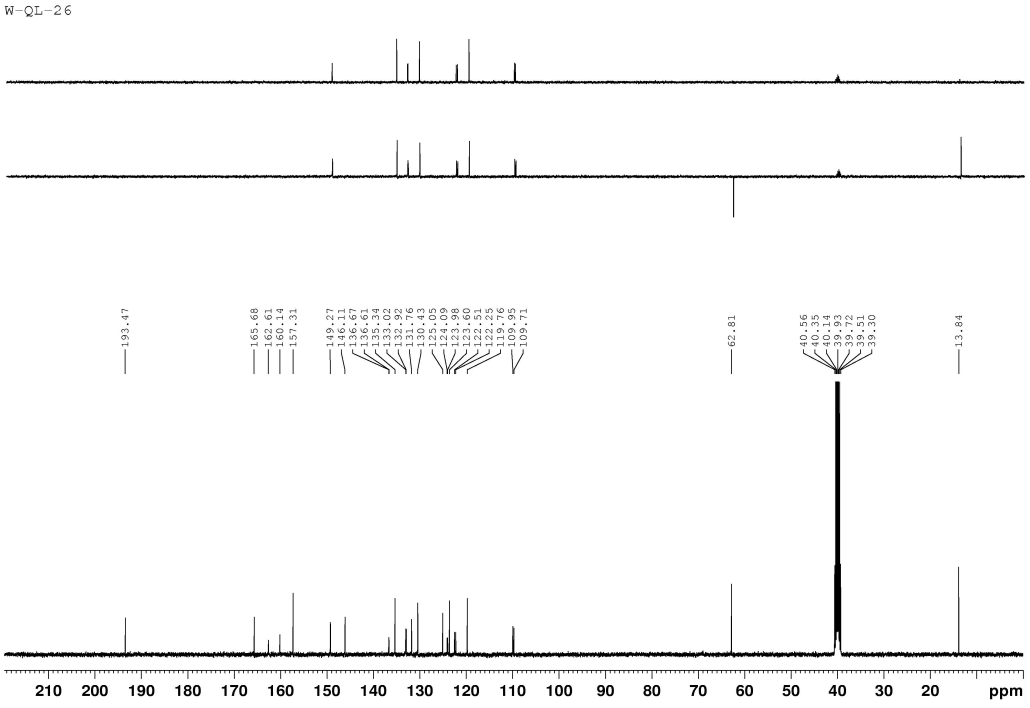
^{1}H-NMR and ^{13}C-NMR spectral of compound 4v



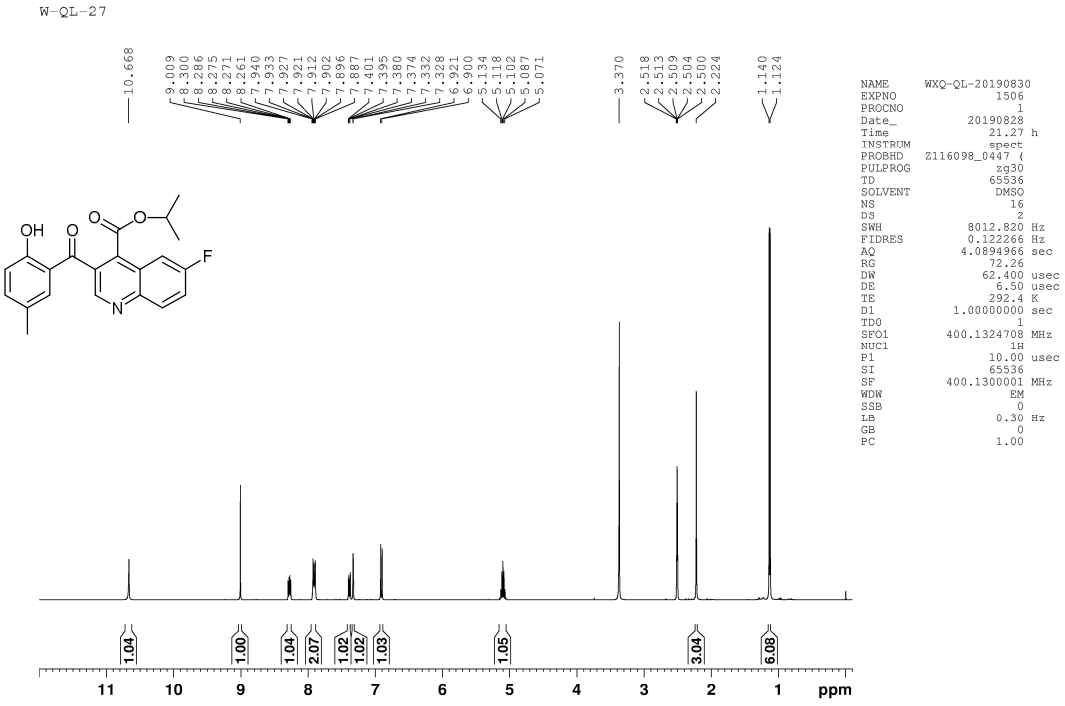


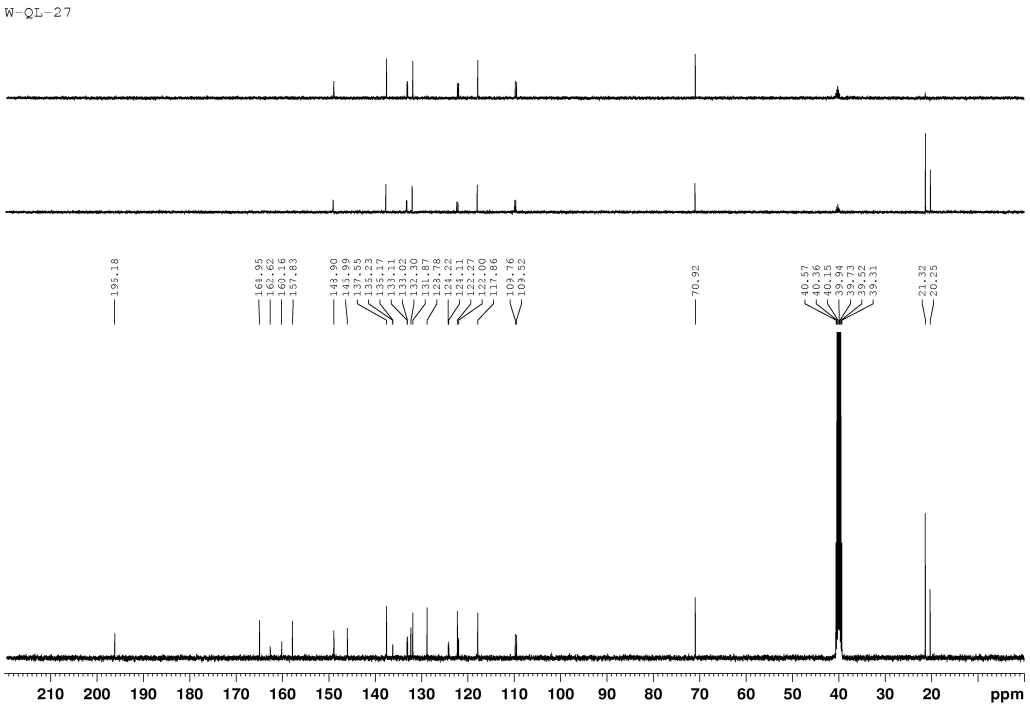
^{1}H-NMR and ^{13}C-NMR spectral of compound 4w





^{1}H-NMR and ^{13}C-NMR spectral of compound 4x





^{1}H-NMR and ^{13}C-NMR spectral of compound 4y