

**Diastereoselective synthesis of spirocyclic
isoxazolo[5,4-*c*]pyrrolo[2,1-*a*]isoquinolines via cascade Double
[3+2]cycloadditions**

Dan Liu, Jing Sun*, Yu Zhang, Chao-Guo Yan*

Supporting Information

Figures of single crystal structures of the compounds 2-4

¹H, ¹³C NMR and HRMS spectra characterization data 5-103

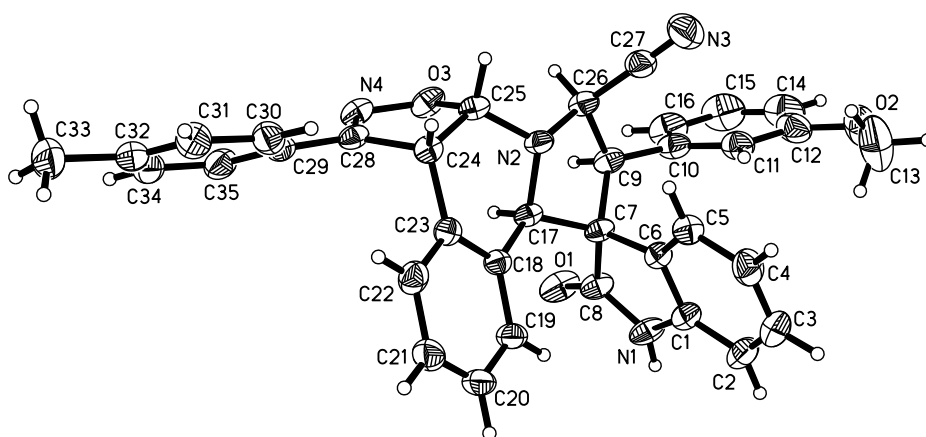


Fig. s1 ORTEP-drawing (30%) of the crystal structure of **1e**

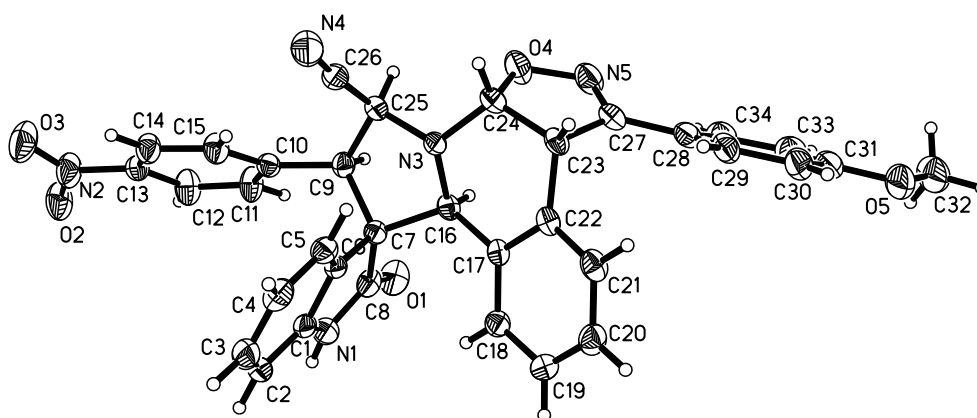


Fig. s2 ORTEP-drawing (30%) of the crystal structure of **1l**

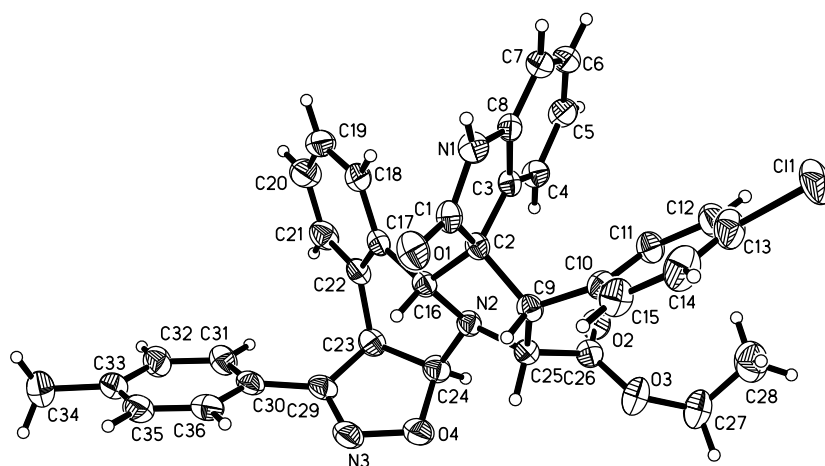


Fig. s3 ORTEP-drawing (30%) of the crystal structure of **2c**

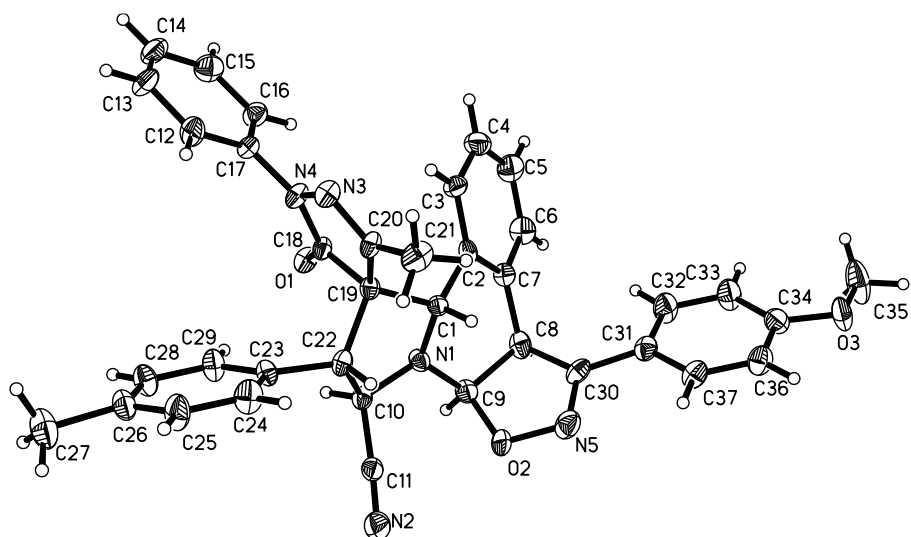


Fig. s4 ORTEP-drawing (30%) of the crystal structure of **4f**

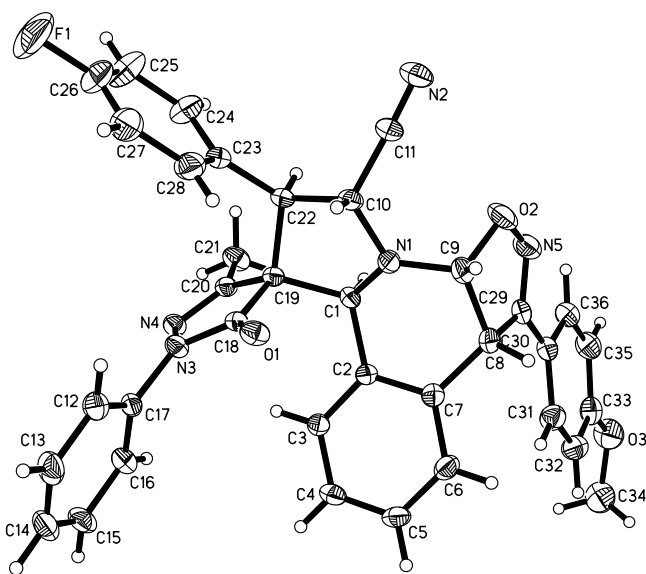


Fig. s5 ORTEP-drawing (30%) of the crystal structure of **4j**

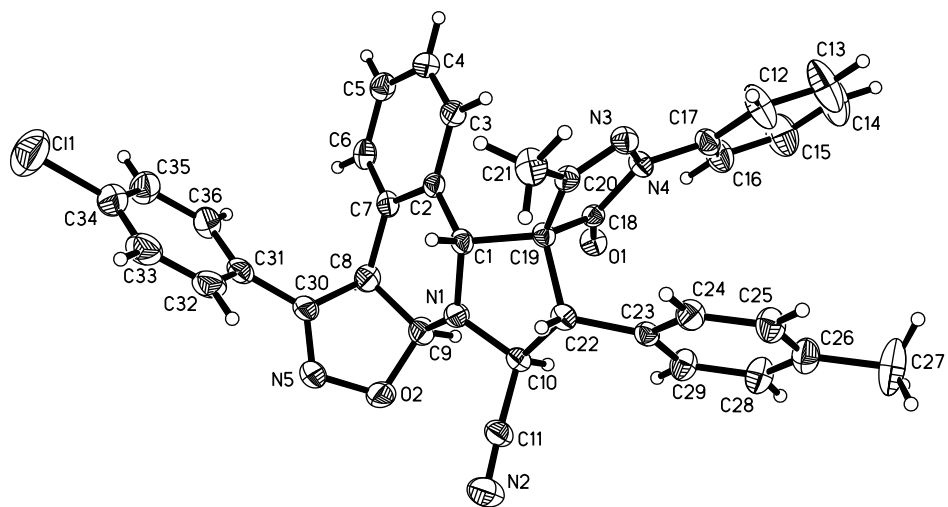


Fig. s6 ORTEP-drawing (30%) of the crystal structure of **4l**

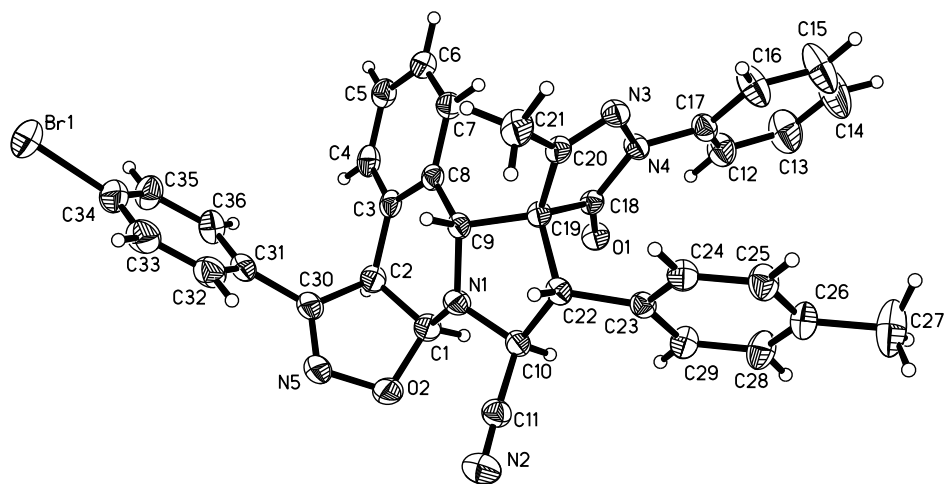


Fig. s7 ORTEP-drawing (30%) of the crystal structure of **4n**

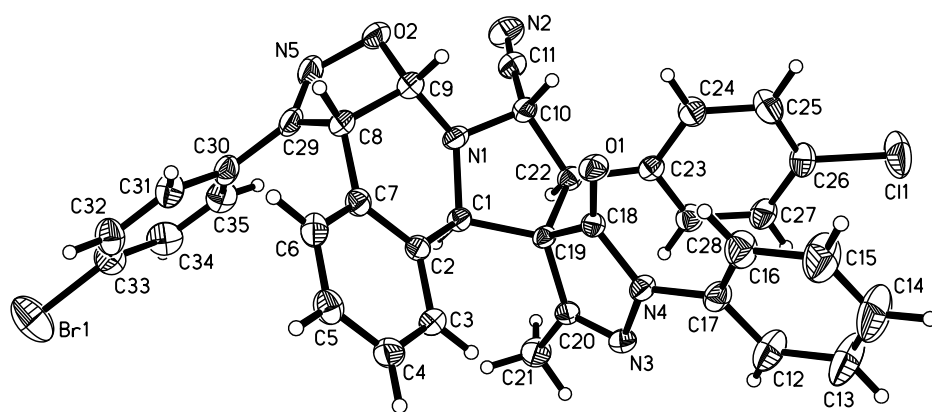


Fig. s8 ORTEP-drawing (30%) of the crystal structure of **4o**

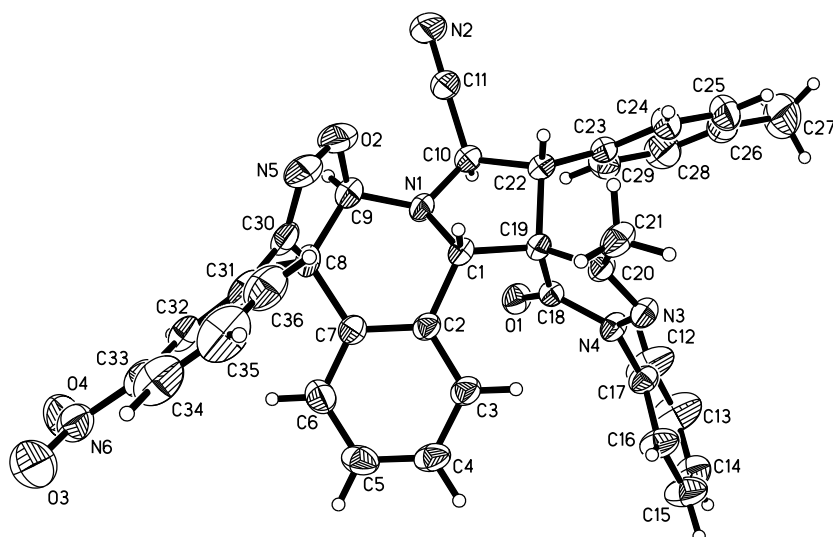
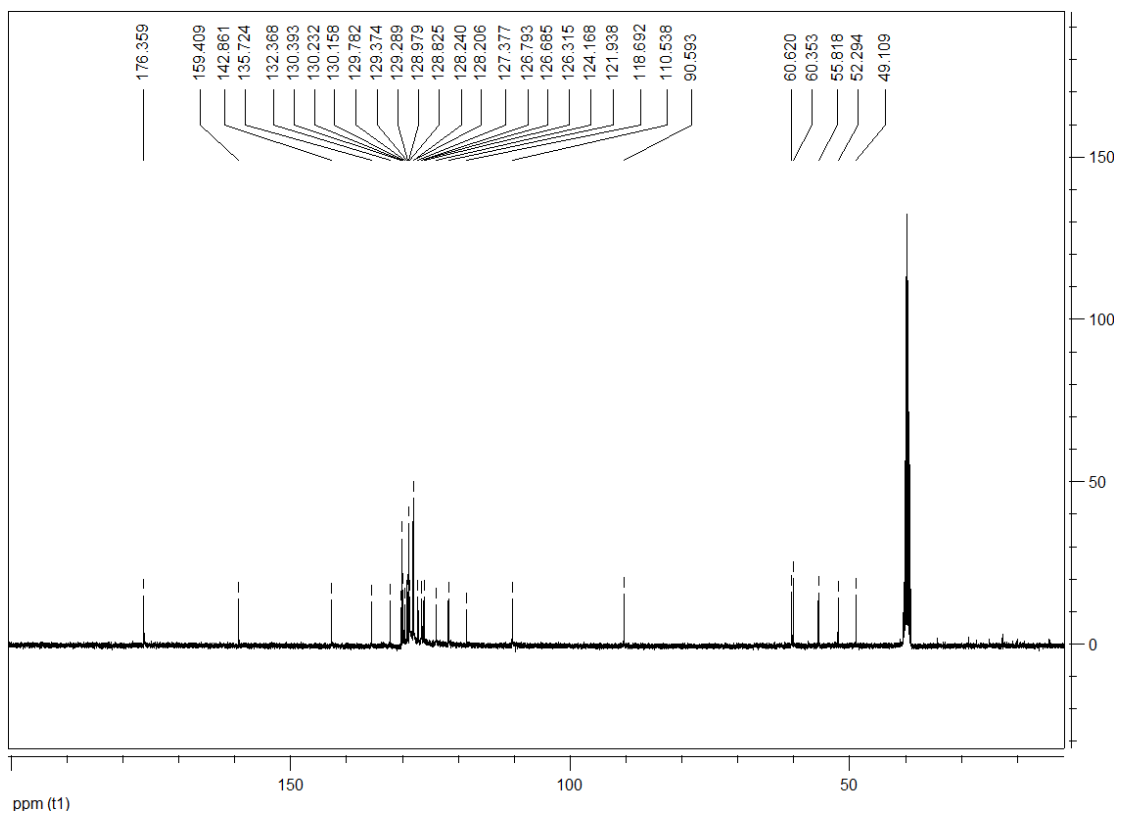
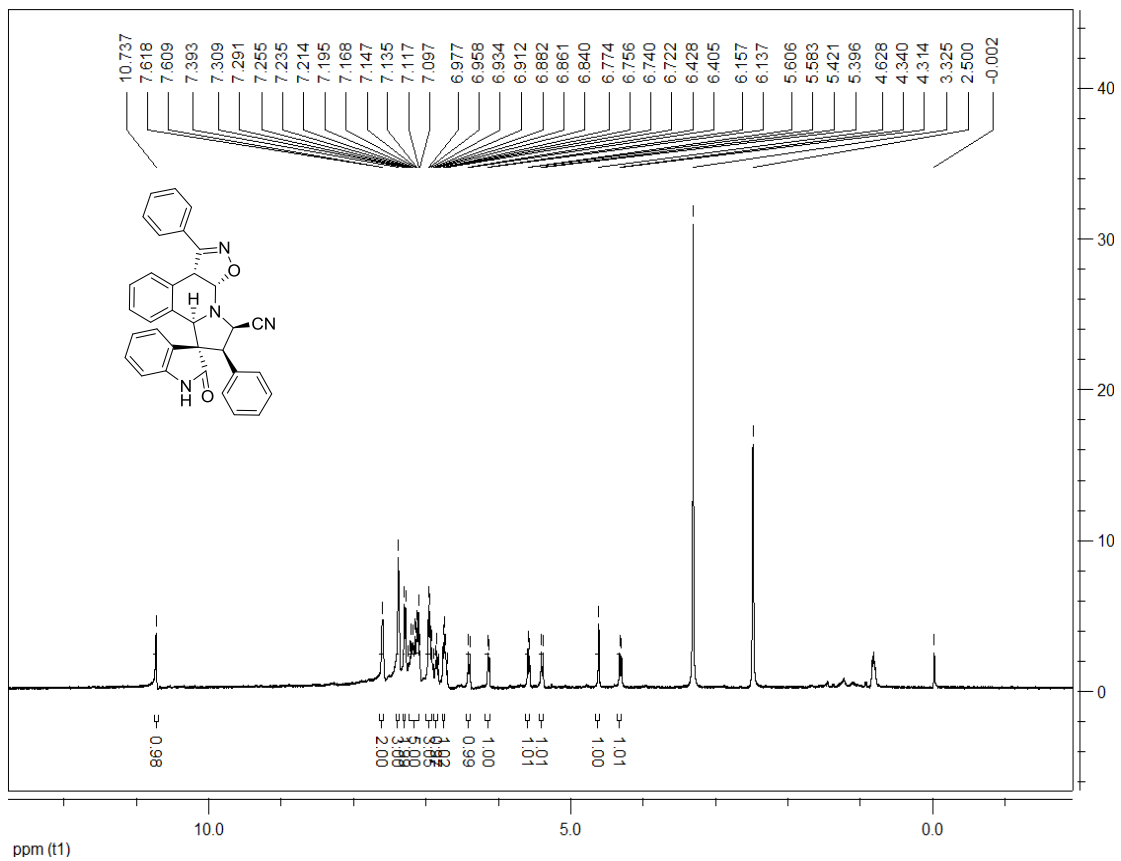
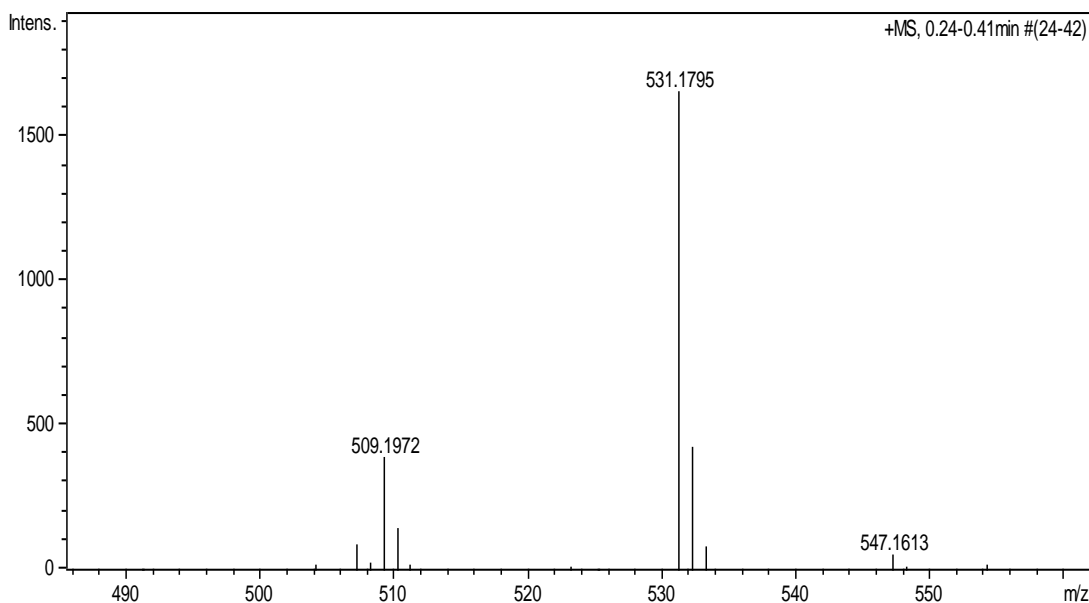


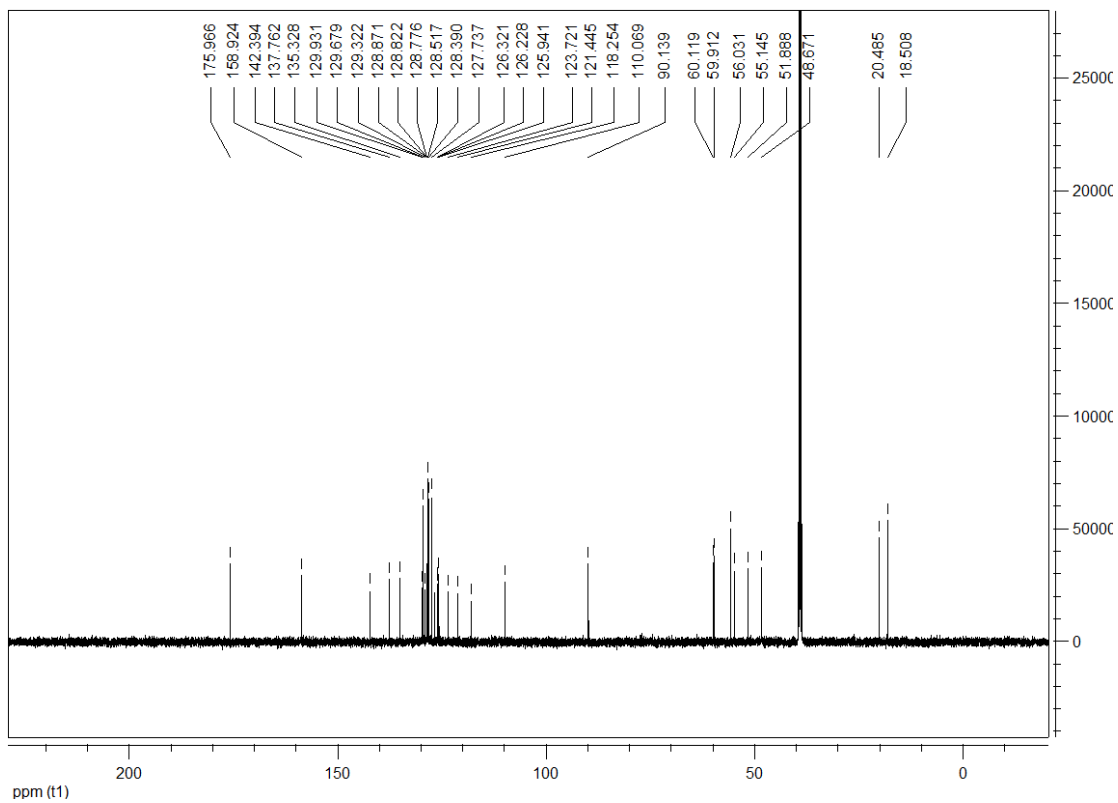
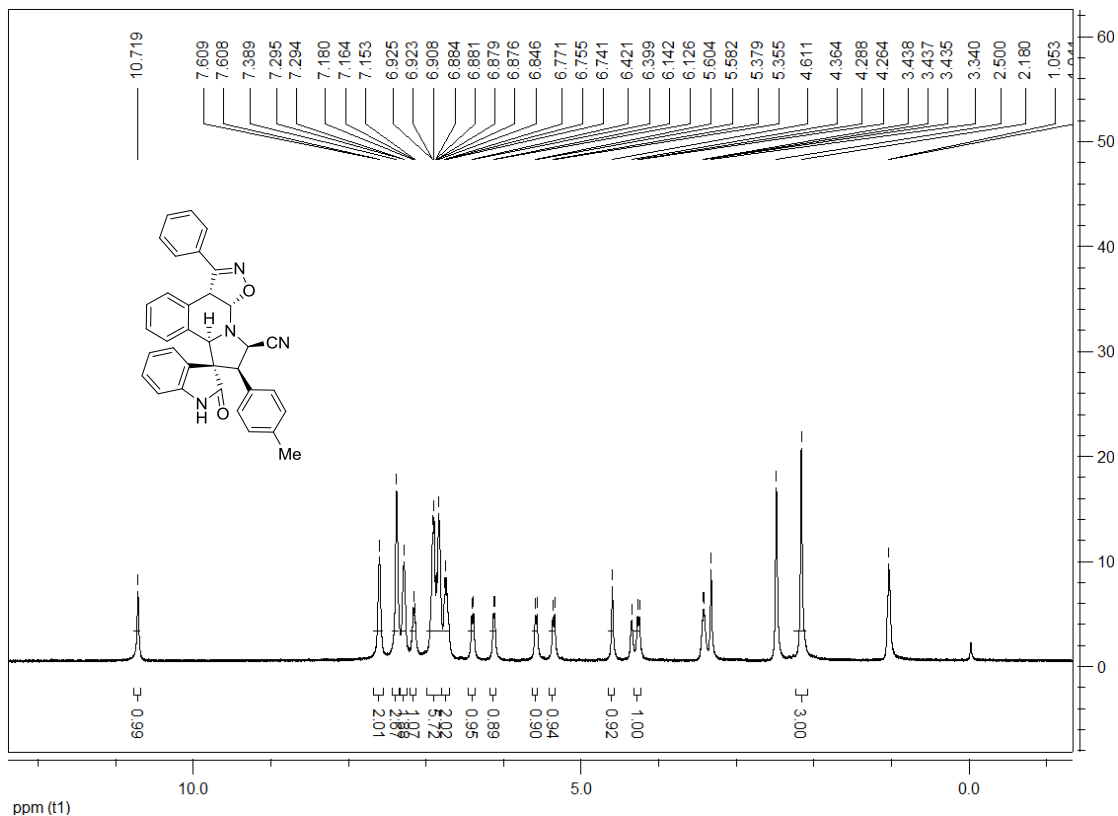
Fig. s9 ORTEP-drawing (30%) of the crystal structure of **4p**

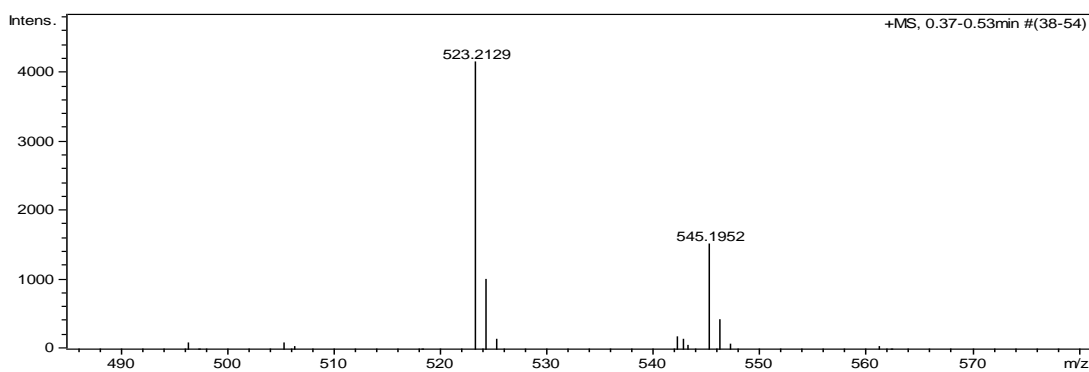
2-oxo-3',9'-diphenyl-3a',9',10',11a'-tetrahydro-7b'H-spiro[indoline-3,8'-isoxazolo[5,4-c]pyrrolo[2,1-a]isoquinoline]-10'-carbonitrile (1a): yellow solid, 64%, m.p. 183-185°C; ¹H NMR (400 MHz, DMSO-*d*₆) δ: 10.74 (s, 1H, NH), 7.62-7.60 (m, 2H, ArH), 7.39 (s, 3H, ArH), 7.30 (d, *J* = 7.2 Hz, 2H, ArH), 7.24-7.10 (m, 5H, ArH), 6.98-6.91 (m, 3H, ArH), 6.88-6.84 (m, 1H, ArH), 6.77-6.74 (m, 1H, ArH), 6.42 (d, *J* = 9.2 Hz, 1H, ArH), 6.15 (d, *J* = 8.0 Hz, 1H, CH), 5.59 (d, *J* = 9.2 Hz, 1H, CH), 5.41 (d, *J* = 10.0 Hz, 1H, CH), 4.63 (s, 1H, CH), 4.33 (d, *J* = 10.4 Hz, 1H, CH); ¹³C NMR (100 MHz, DMSO-*d*₆) δ: 176.3, 159.4, 142.8, 135.7, 132.3, 130.3, 130.2, 130.1, 129.7, 129.3, 129.2, 128.9, 128.8, 128.2, 128.2, 127.3, 126.7, 126.6, 126.3, 124.1, 121.9, 118.6, 110.5, 90.5, 60.6, 60.3, 55.8, 52.2, 49.1; IR (KBr) ν: 3262, 3062, 2954, 2204, 1717, 1619, 1495, 1471, 1399, 1334, 1226, 1189, 1024, 906, 757 cm⁻¹; MS (*m/z*): HRMS (ESI) Calcd. for C₃₃H₂₄NaN₄O₂ ([M+Na]⁺): 531.1791, found: 531.1795.



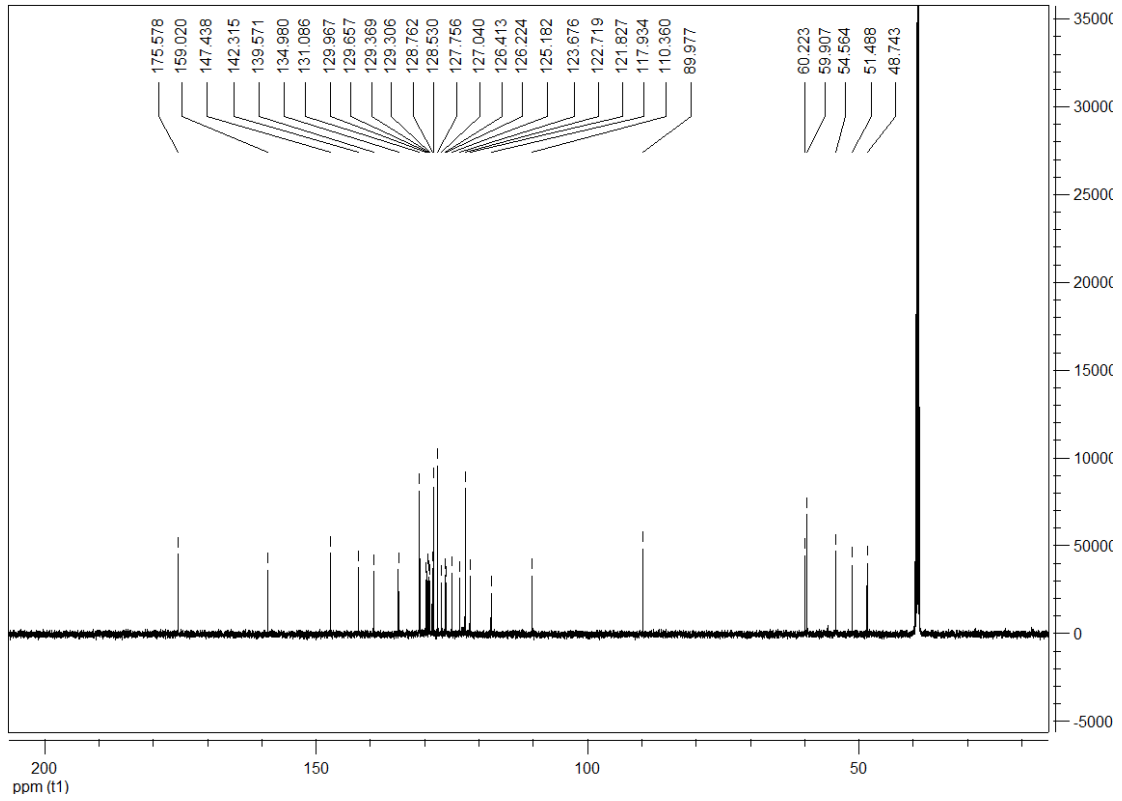
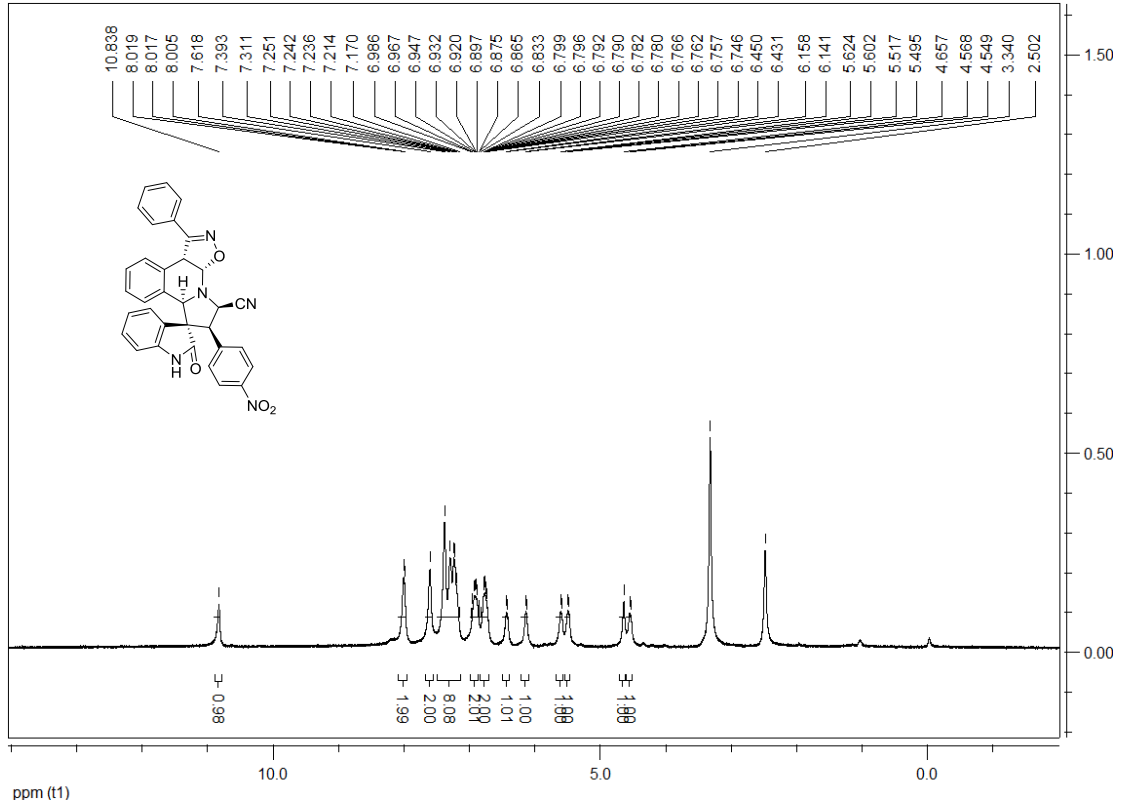


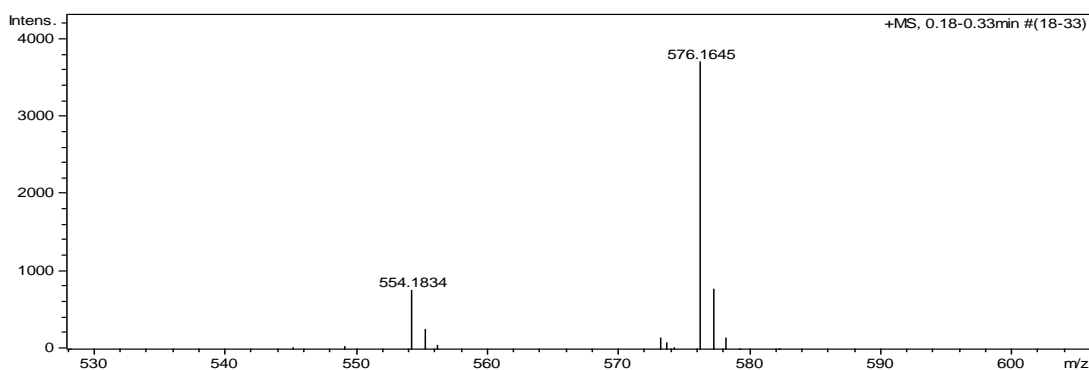
2-oxo-3'-phenyl-9'-(*p*-tolyl)-3a',9',10',11a'-tetrahydro-7b'*H*-spiro[indoline-3,8'-isoxazolo[5,4-*c*]pyrrolo[2,1-*a*]isoquinoline]-10'-carbonitrile (1b): white solid, 71%, m.p. 186-188°C; ¹H NMR (400 MHz, DMSO-*d*₆) δ: 10.72 (s, 1H, NH), 7.61 (s, 2H, ArH), 7.39 (s, 3H, ArH), 7.30-7.29 (m, 2H, ArH), 7.18-7.15 (m, 1H, ArH), 6.93-6.85 (m, 6H, ArH), 6.77-6.74 (m, 2H, ArH), 6.41 (d, *J* = 8.8 Hz, 1H, ArH), 6.13 (d, *J* = 6.4 Hz, 1H, CH), 5.59 (d, *J* = 8.8 Hz, 1H, CH), 5.37 (d, *J* = 9.6 Hz, 1H, CH), 4.61 (s, 1H, CH), 4.27 (d, *J* = 9.6 Hz, 1H, CH), 2.18 (s, 3H, CH₃); ¹³C NMR (150 MHz, DMSO-*d*₆) δ: 175.9, 158.9, 142.3, 137.7, 135.3, 129.9, 129.6, 129.3, 128.8, 128.8, 128.7, 128.5, 128.3, 127.7, 126.3, 126.2, 125.9, 123.7, 121.4, 118.2, 110.0, 90.1, 60.1, 59.9, 56.0, 55.1, 51.8, 48.6, 20.4, 18.5; IR (KBr) ν: 3674, 3184, 2265, 2973, 1717, 1622, 1564, 1492, 1402, 1336, 1283, 1193, 1079, 930, 876, 747 cm⁻¹; MS (*m/z*): HRMS (ESI) Calcd. for C₃₄H₂₇N₄O₂ ([M+H]⁺): 523.2129, found: 523.2129.



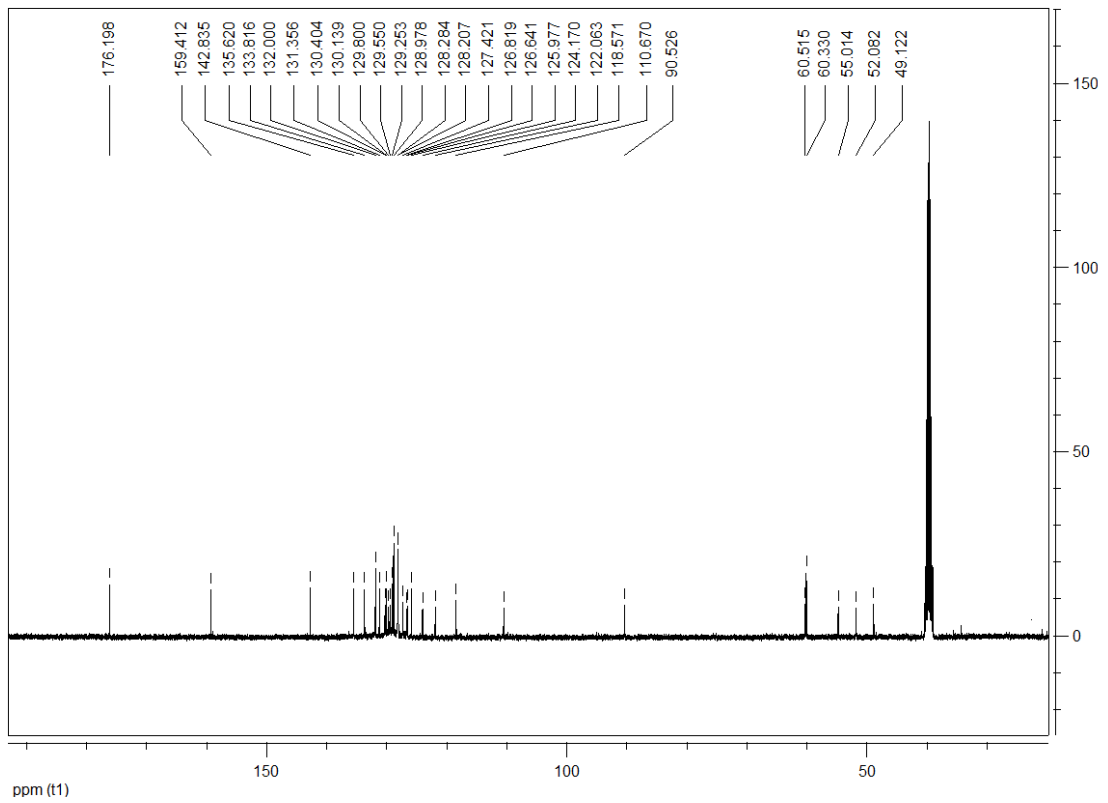
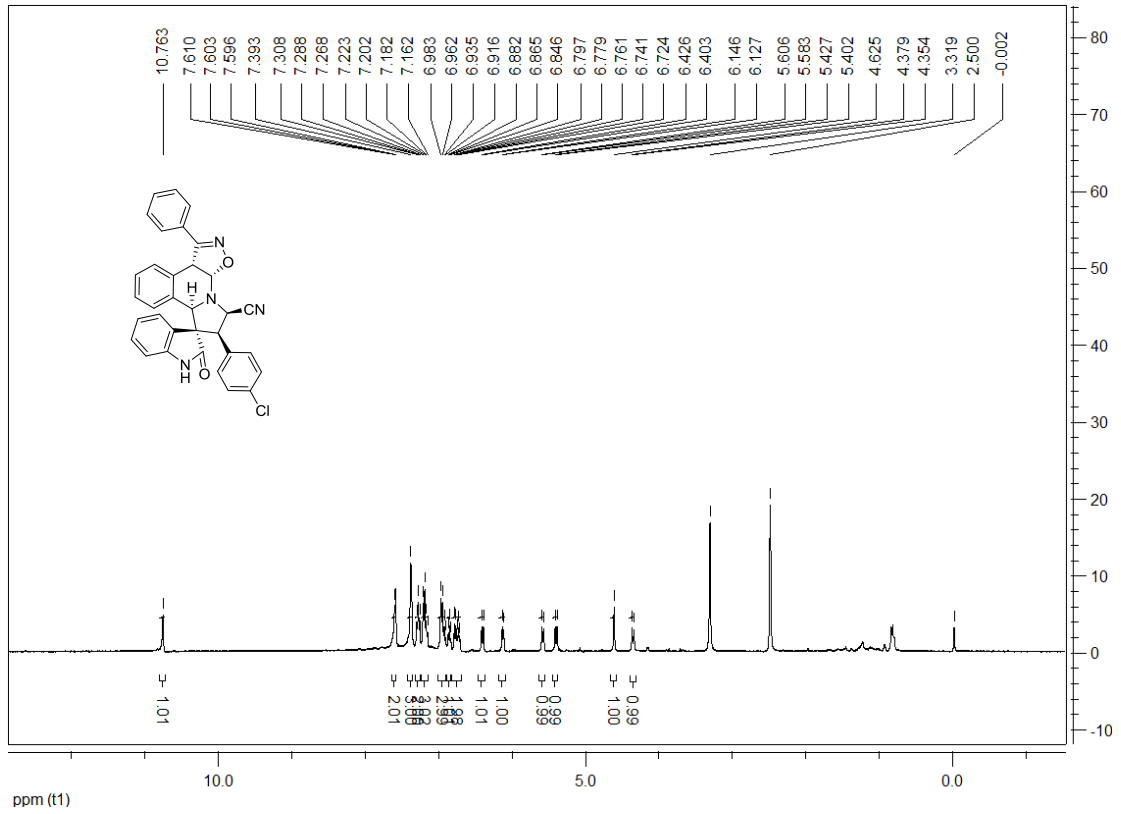


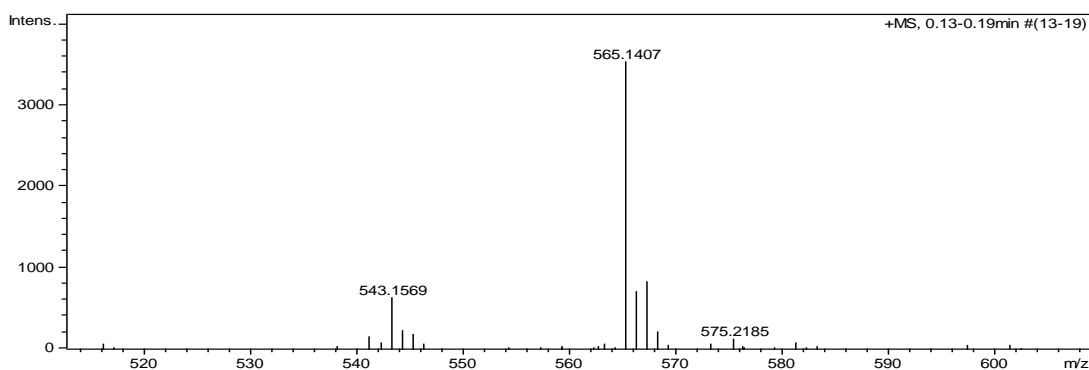
9'-(4-nitrophenyl)-2-oxo-3'-phenyl-3a',9',10',11a'-tetrahydro-7b'H-spiro[indoline-3,8'-isoxazolo[5,4-c]pyrrolo[2,1-a]isoquinoline]-10'-carbonitrile (1c): yellow solid, 76%, m.p. 265-267°C; ^1H NMR (400 MHz, $\text{DMSO-}d_6$) δ : 10.84 (s, 1H, NH), 8.05-8.01 (m, 2H, ArH), 7.62 (s, 3H, ArH), 7.40-7.17 (m, 8H, ArH), 6.99-6.87 (m, 2H, ArH), 6.83-6.75 (m, 2H, ArH), 6.44 (d, $J = 7.6$ Hz, 1H, ArH), 6.15 (d, $J = 6.8$ Hz, 1H, CH), 5.61 (d, $J = 8.8$ Hz, 1H, CH), 5.51 (d, $J = 8.8$ Hz, 1H, CH), 4.66 (s, 1H, CH), 4.56 (d, $J = 7.6$ Hz, 1H, CH); ^{13}C NMR (150 MHz, $\text{DMSO-}d_6$) δ : 175.5, 159.0, 147.4, 142.3, 139.5, 134.9, 131.0, 129.9, 129.6, 129.3, 129.3, 128.7, 128.5, 127.7, 127.0, 126.4, 126.2, 125.1, 123.6, 122.7, 121.8, 117.9, 110.3, 89.9, 60.2, 59.9, 54.5, 51.4, 48.7; IR (KBr) ν : 3199, 3067, 2213, 1618, 1522, 1494, 1399, 1231, 1142, 1107, 1015, 910, 858, 811, 759 cm^{-1} ; MS (m/z): HRMS (ESI) Calcd. for $\text{C}_{33}\text{H}_{23}\text{NaN}_5\text{O}_4$ ($[\text{M}+\text{Na}]^+$): 576.1642, found: 576.1645.



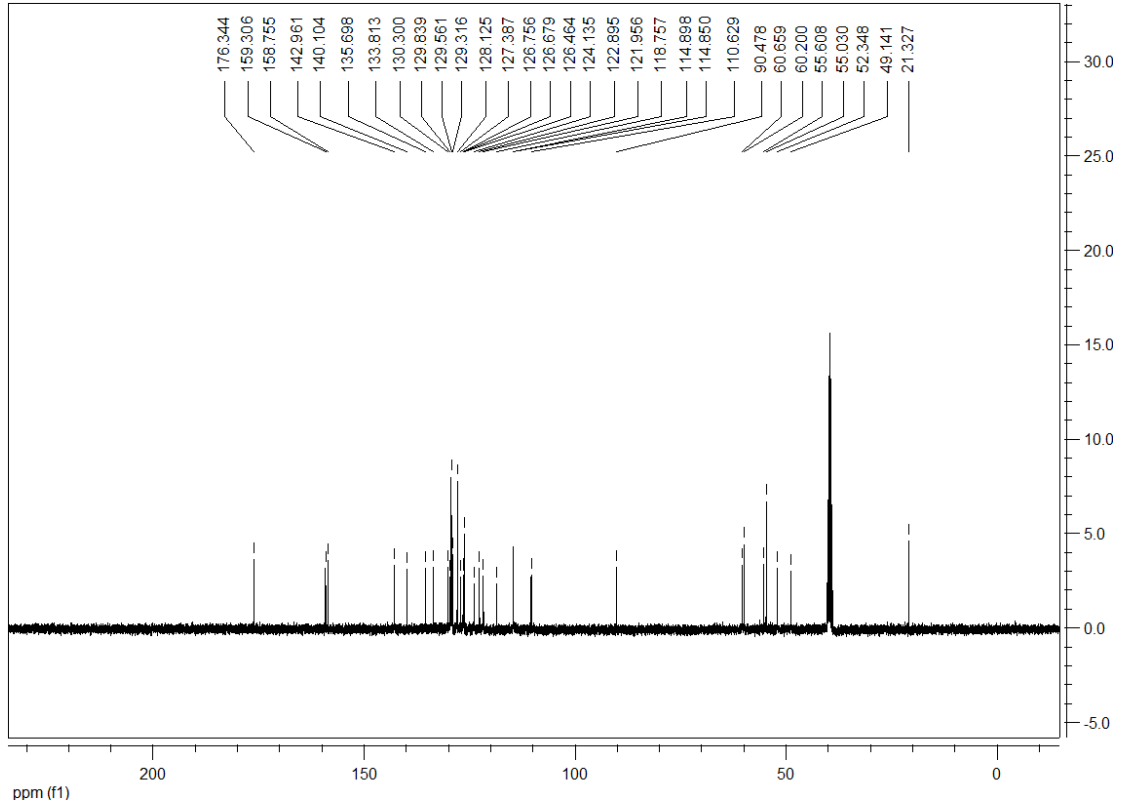
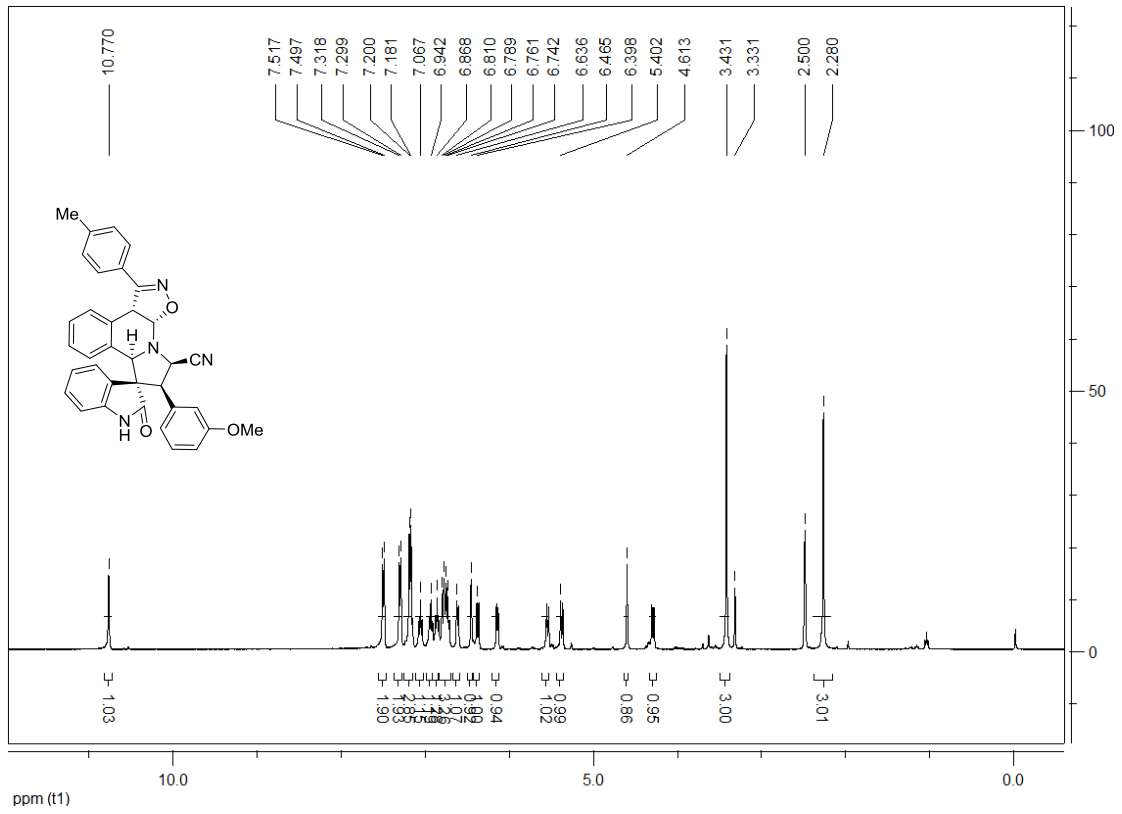


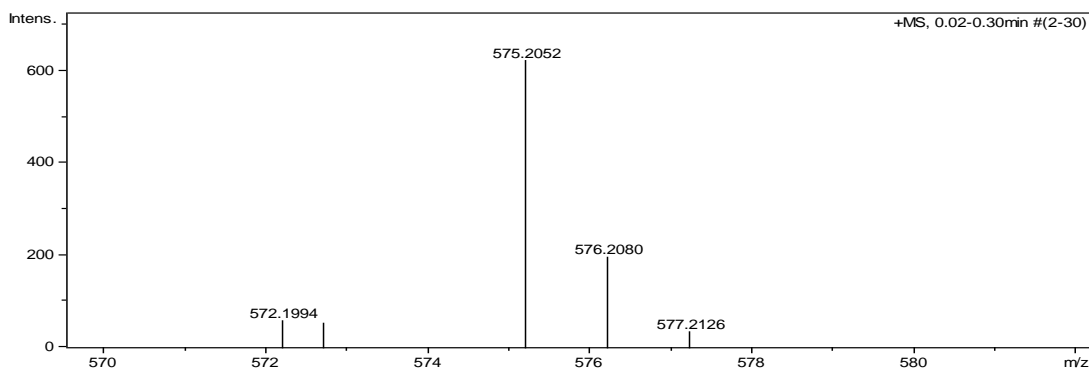
9'-(4-chlorophenyl)-2-oxo-3'-phenyl-3a',9',10',11a'-tetrahydro-7b'H-spiro[indoline-3,8'-isoxazolo[5,4-c]pyrrolo[2,1-a]isoquinoline]-10'-carbonitrile (1d): yellow solid, 78%, m.p. 183-185 °C; ¹H NMR (400 MHz, DMSO-*d*₆) δ: 10.76 (s, 1H, NH), 7.61-7.60 (m, 2H, ArH), 7.39 (s, 3H, ArH), 7.31-7.27 (m, 2H, ArH), 7.22-7.16 (m, 3H, ArH), 6.98-6.92 (m, 3H, ArH), 6.88-6.85 (m, 1H, ArH), 6.80-6.72 (m, 2H, ArH), 6.41 (d, *J* = 7.2 Hz, 1H, ArH), 6.13 (d, *J* = 7.6 Hz, 1H, CH), 5.59 (d, *J* = 7.2 Hz, 1H, CH), 5.41 (d, *J* = 10.0 Hz, 1H, CH), 4.63 (s, 1H, CH), 4.36 (d, *J* = 10.0 Hz, 1H, CH); ¹³C NMR (100 MHz, DMSO-*d*₆) δ: 176.1, 159.4, 142.8, 135.6, 133.8, 131.9, 131.3, 130.4, 130.1, 129.8, 129.5, 129.2, 128.9, 128.2, 128.2, 127.4, 126.8, 126.6, 125.9, 124.1, 122.0, 118.5, 110.6, 90.5, 60.5, 60.3, 55.0, 52.0, 49.1; IR (KBr) ν: 3254, 2216, 2954, 1716, 1619, 1597, 1522, 1494, 1471, 1396, 1334, 1226, 1189, 1094, 1015, 908, 831, 800, 752, 716 cm⁻¹; MS (*m/z*): HRMS (ESI) Calcd. for C₃₃H₂₃ClN₄O₂ ([M+Na]⁺): 565.1402, found: 565.1407.



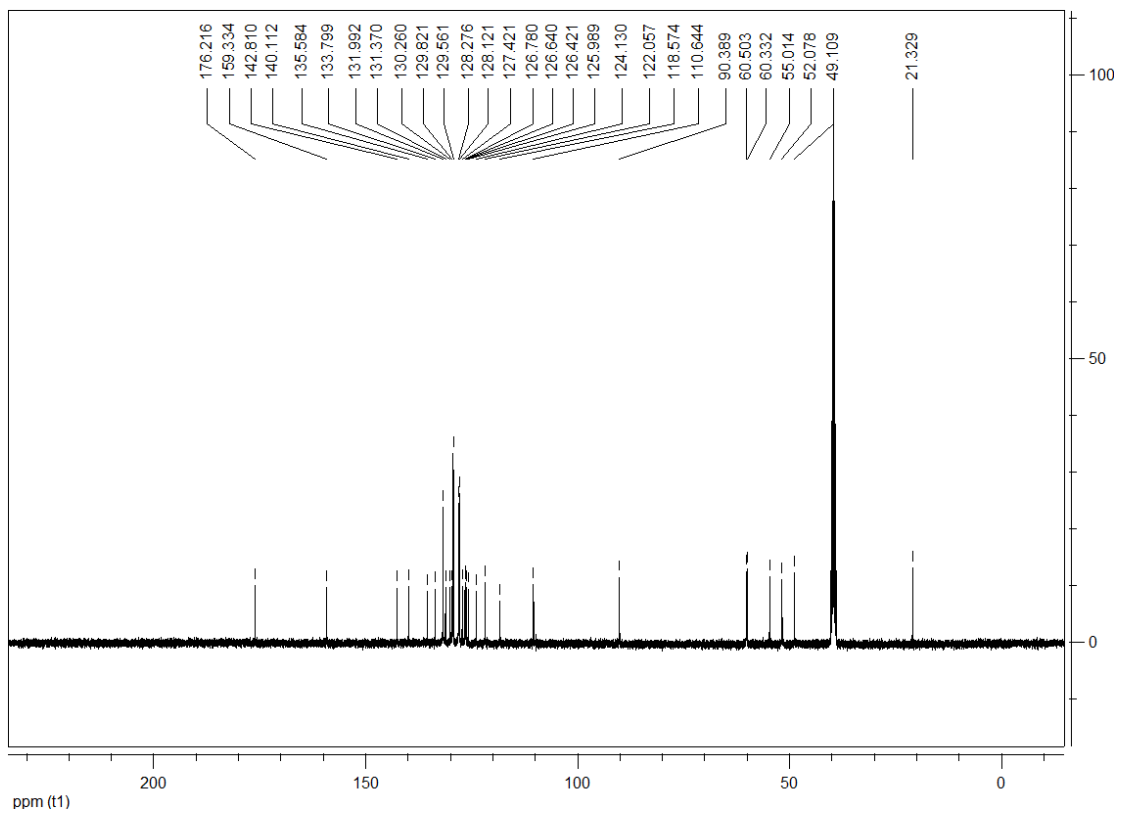
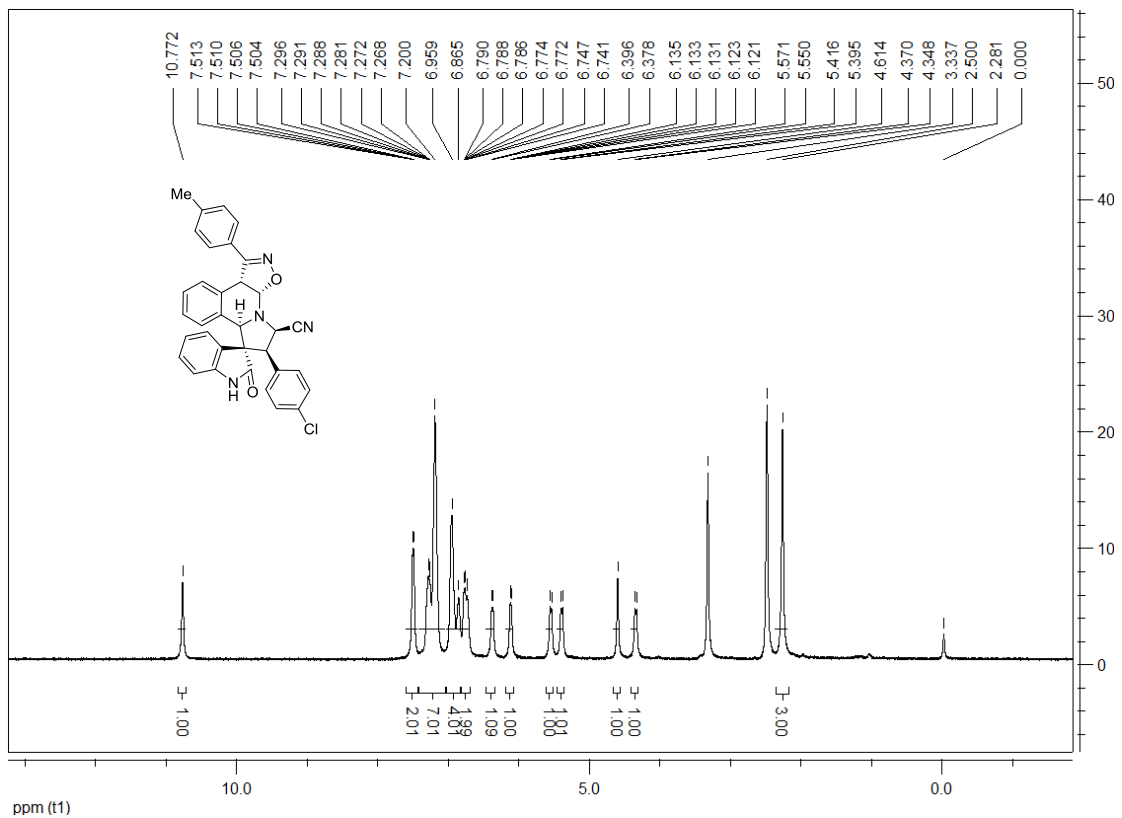


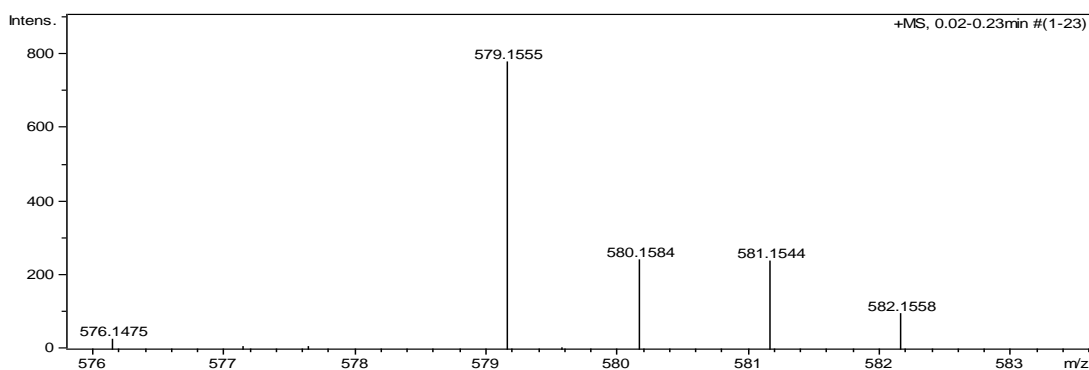
9'-(3-methoxyphenyl)-2-oxo-3'-(*p*-tolyl)-3a',9',10',11a'-tetrahydro-7b'*H*-spiro[indoline-3,8'-isoxazolo[5,4-*c*]pyrrolo[2,1-*a*]isoquinoline]-10'-carbonitrile (1e): white solid, 73%, m.p. 246-248°C; ¹H NMR (400 MHz, DMSO-*d*₆) δ: 10.77 (s, 1H, NH), 7.51 (d, *J* = 8.0 Hz, 2H, ArH), 7.31 (d, *J* = 7.6 Hz, 2H, ArH), 7.20-7.16 (m, 3H, ArH), 7.09-7.05 (m, 1H, ArH), 6.96-6.92 (m, 1H, ArH), 6.89-6.85 (m, 1H, ArH), 6.81-6.72 (m, 3H, ArH), 6.64-6.62 (d, *J* = 7.6 Hz, 1H, ArH), 6.47 (s, 1H, ArH), 6.38 (d, *J* = 9.6 Hz, 1H, ArH), 6.15 (d, *J* = 7.6 Hz, 1H, CH), 5.55 (d, *J* = 9.6 Hz, 1H, CH), 5.39 (d, *J* = 10.0 Hz, 1H, CH), 4.61 (s, 1H, CH), 4.30 (d, *J* = 10.0 Hz, 1H, CH), 3.43 (s, 3H, OCH₃), 2.28 (s, 3H, CH₃); ¹³C NMR (100 MHz, DMSO-*d*₆) δ: 176.3, 159.3, 158.7, 142.9, 140.1, 135.6, 133.8, 130.3, 129.8, 129.5, 129.3, 128.1, 127.3, 126.7, 126.6, 126.4, 124.1, 122.8, 121.9, 118.7, 114.8, 114.8, 110.6, 90.4, 60.6, 60.2, 55.6, 55.0, 52.3, 49.1, 21.3; IR (KBr) ν: 3140, 2240, 2837, 1917, 1707, 1616, 1584, 1496, 1338, 1206, 1140, 1080, 990, 878, 784, 741 cm⁻¹; MS (*m/z*): HRMS (ESI) Calcd. for C₃₅H₂₈NaN₄O₃ ([M+Na]⁺): 575.2054, found: 575.2052.



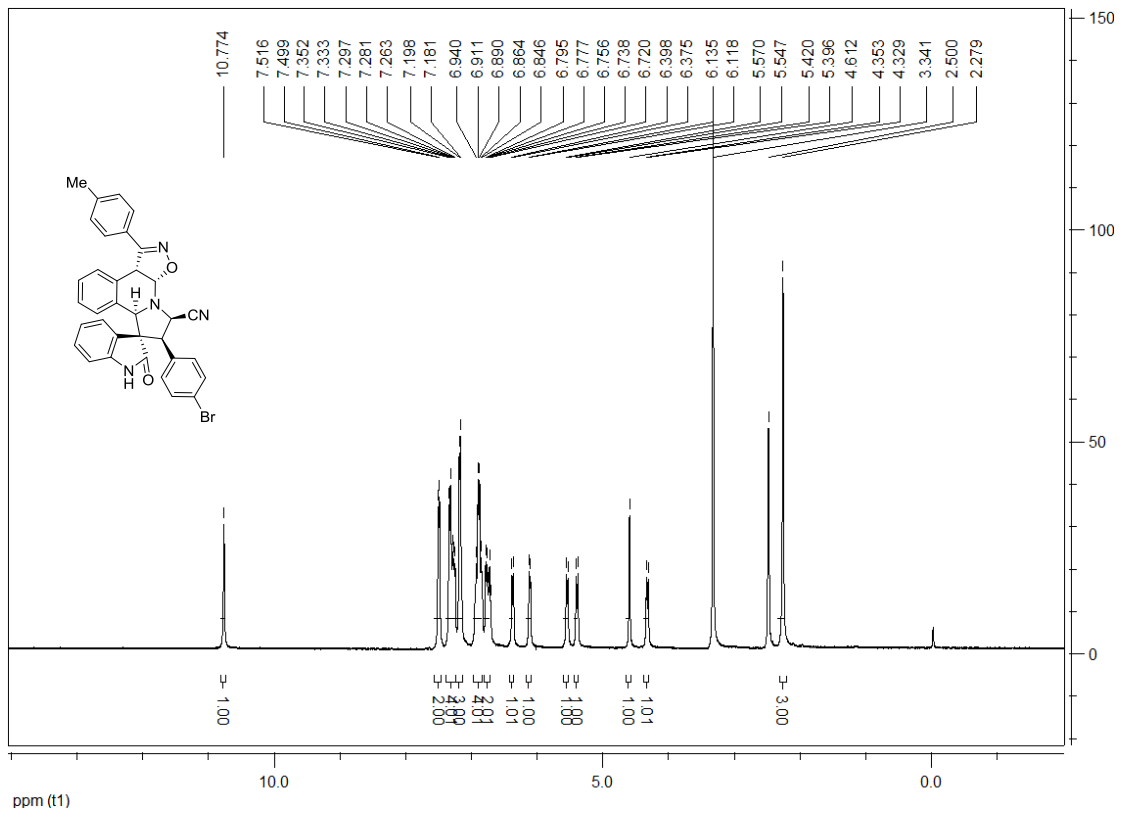


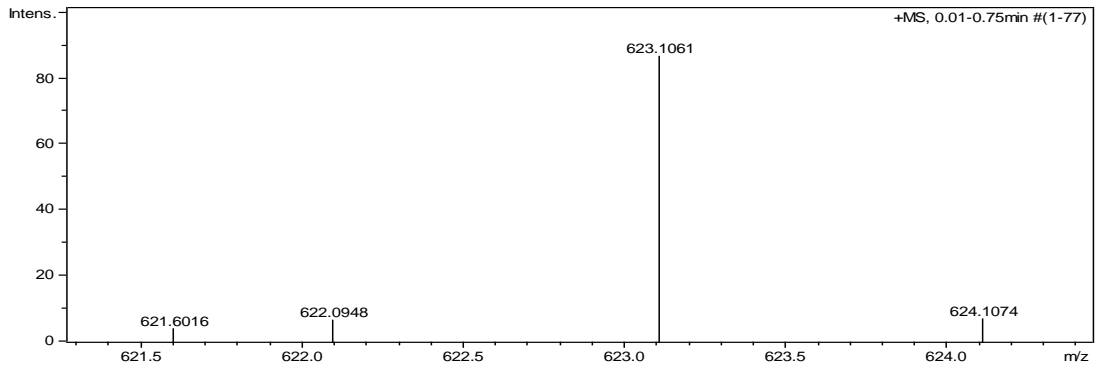
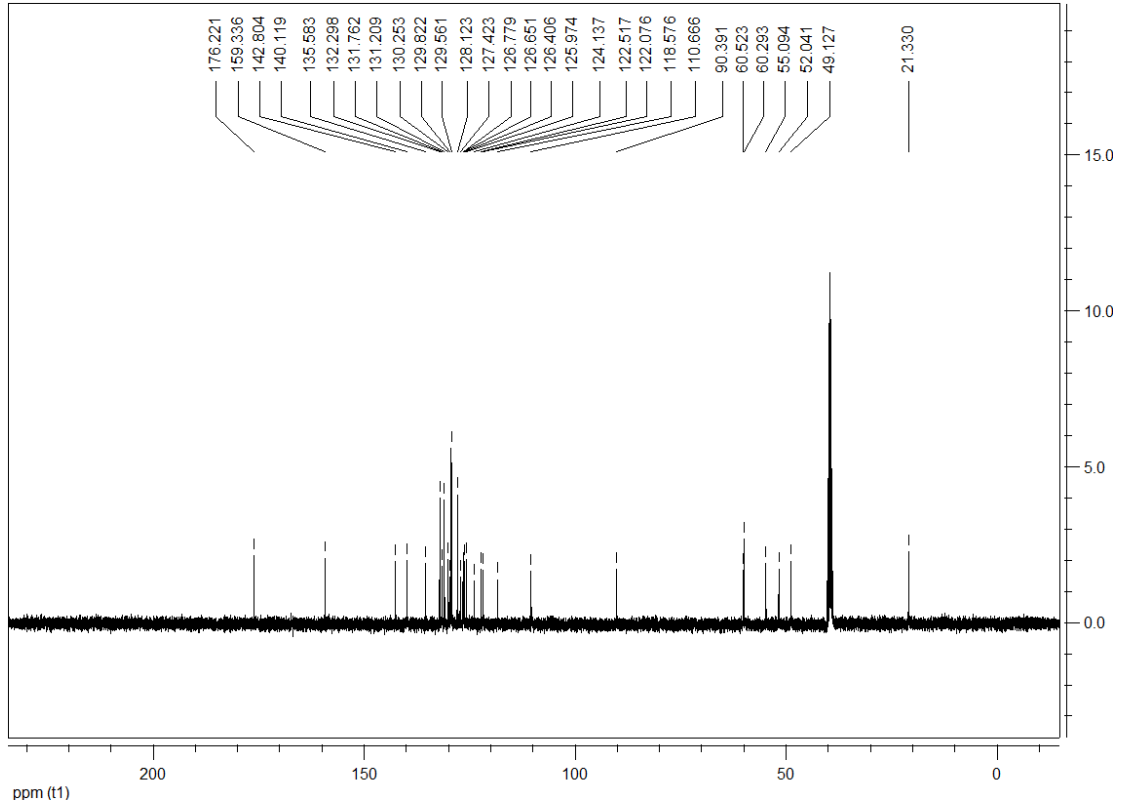
9'-(4-chlorophenyl)-2-oxo-3'-(*p*-tolyl)-3a',9',10',11a'-tetrahydro-7b'*H*-spiro[indoline-3,8'-isoxazolo[5,4-*c*]pyrrolo[2,1-*a*]isoquinoline]-10'-carbonitrile (1f): white solid, 77%, m.p. 258-260°C; ¹H NMR (400 MHz, DMSO-*d*₆) δ: 10.77 (s, 1H, NH), 7.51-7.50 (m, 2H, ArH), 7.30-7.20 (m, 7H, ArH), 6.96-6.87 (m, 4H, ArH), 6.79-6.74 (m, 2H, ArH), 6.39 (d, *J* = 7.2 Hz, 1H, ArH), 6.14-6.12 (m, 1H, CH), 5.56 (d, *J* = 8.4 Hz, 1H, CH), 5.40 (d, *J* = 8.4 Hz, 1H, CH), 4.61 (s, 1H, CH), 4.36 (d, *J* = 8.8 Hz, 1H, CH), 2.28 (s, 3H, CH₃); ¹³C NMR (100 MHz, DMSO-*d*₆) δ: 176.2, 159.3, 142.8, 140.1, 135.5, 133.7, 131.9, 131.3, 130.2, 129.8, 129.5, 128.2, 128.1, 127.4, 126.7, 126.6, 126.4, 125.9, 124.1, 122.0, 118.5, 110.6, 90.3, 60.5, 60.3, 55.0, 52.0, 49.1, 21.3; IR (KBr) ν: 3632, 3395, 3290, 2233, 1721, 1620, 1512, 1455, 1390, 1203, 1015, 921, 908, 820, 788, 754 cm⁻¹; MS (*m/z*): HRMS (ESI) Calcd. for C₃₄H₂₅ClNaN₄O₂ ([M+Na]⁺): 579.1558, found: 579.1555.



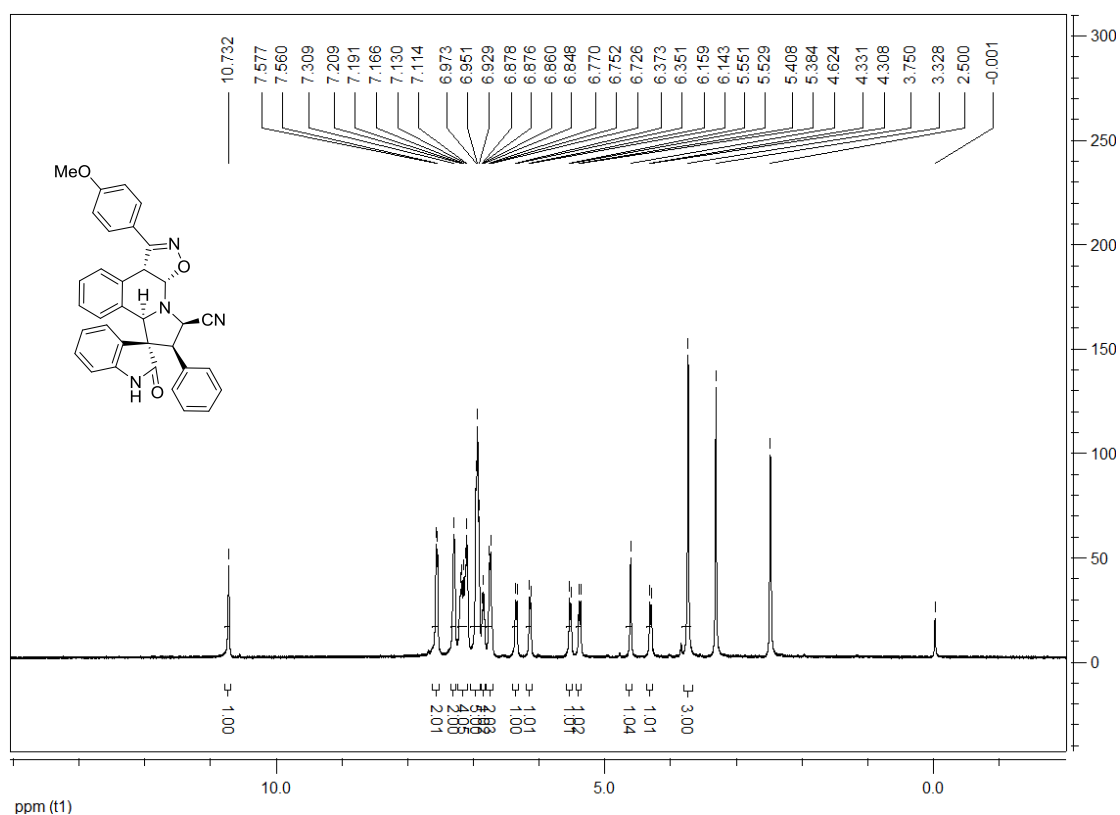


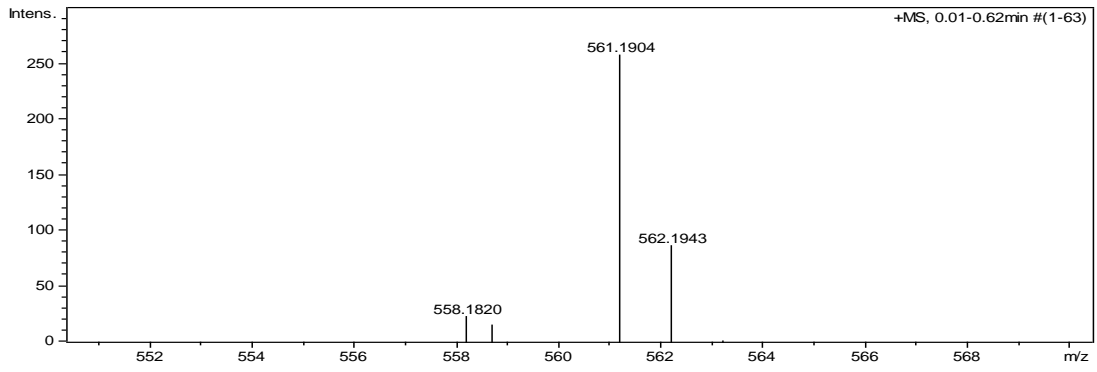
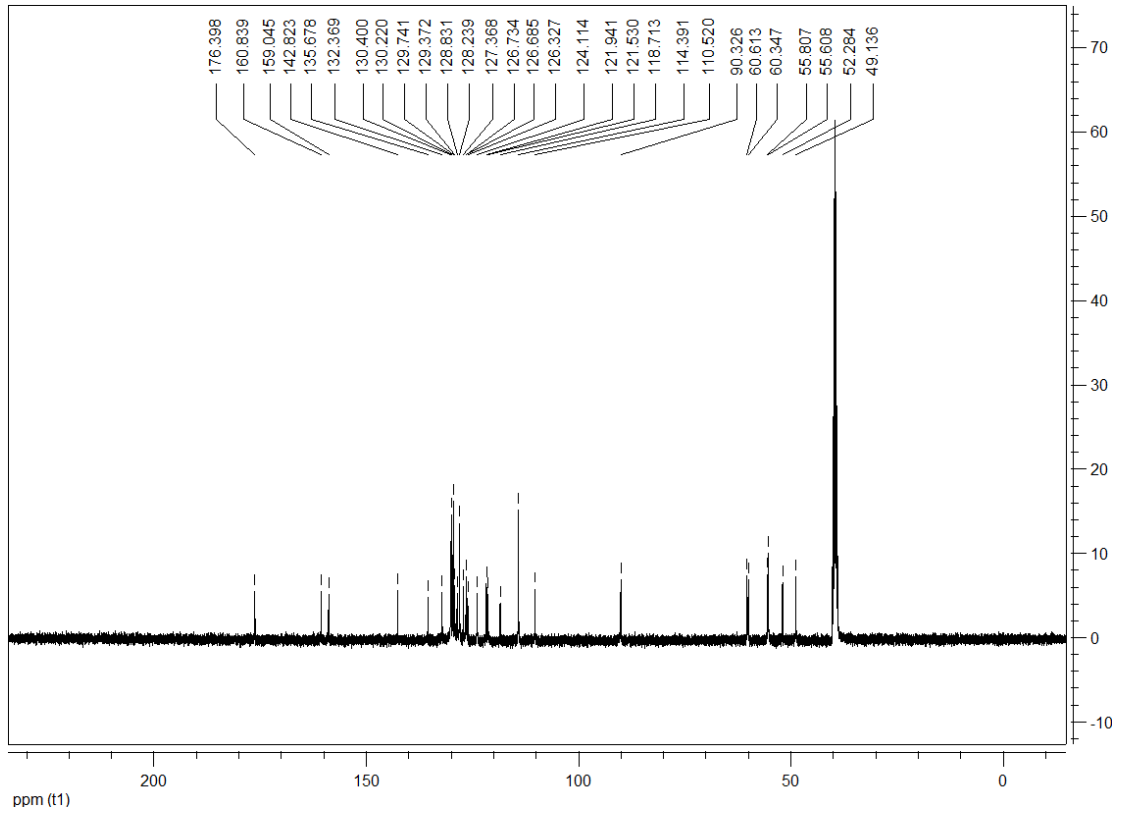
9'-(4-bromophenyl)-2-oxo-3'-(*p*-tolyl)-3a',9',10',11a'-tetrahydro-7b'*H*-spiro[indoline-3,8'-isoxazolo[5,4-*c*]pyrrolo[2,1-*a*]isoquinoline]-10'-carbonitrile (1g): white solid, 79%, m.p. 267-269°C; ¹H NMR (400 MHz, DMSO-*d*₆) δ: 10.77 (s, 1H, NH), 7.51 (d, *J* = 6.8 Hz, 2H, ArH), 7.35-7.26 (m, 4H, ArH), 7.20-7.18 (m, 3H, ArH), 6.94-6.85 (m, 4H, ArH), 6.80-6.72 (m, 2H, ArH), 6.39 (d, *J* = 7.2 Hz, 1H, ArH), 6.12 (d, *J* = 6.8 Hz, 1H, CH), 5.56 (d, *J* = 9.2 Hz, 1H, CH), 5.41 (d, *J* = 9.6 Hz, 1H, CH), 4.61 (s, 1H, CH), 4.34 (d, *J* = 9.6 Hz, 1H, CH), 2.28 (s, 3H, CH₃); ¹³C NMR (100 MHz, DMSO-*d*₆) δ: 176.2, 159.3, 142.8, 140.1, 135.5, 132.2, 131.7, 131.2, 130.2, 129.8, 129.5, 128.1, 127.4, 126.7, 126.6, 126.4, 125.9, 124.1, 122.5, 122.0, 118.5, 110.6, 90.3, 60.5, 60.2, 55.0, 52.0, 49.1, 21.3; IR (KBr) ν: 3630, 3397, 3289, 2920, 2219, 1619, 1512, 1491, 1333, 1202, 1125, 1011, 921, 872, 788, 716 cm⁻¹; MS (*m/z*): HRMS (ESI) Calcd. for C₃₄H₂₅BrNaN₄O₂ ([M+Na]⁺): 623.1053, found: 623.1061.



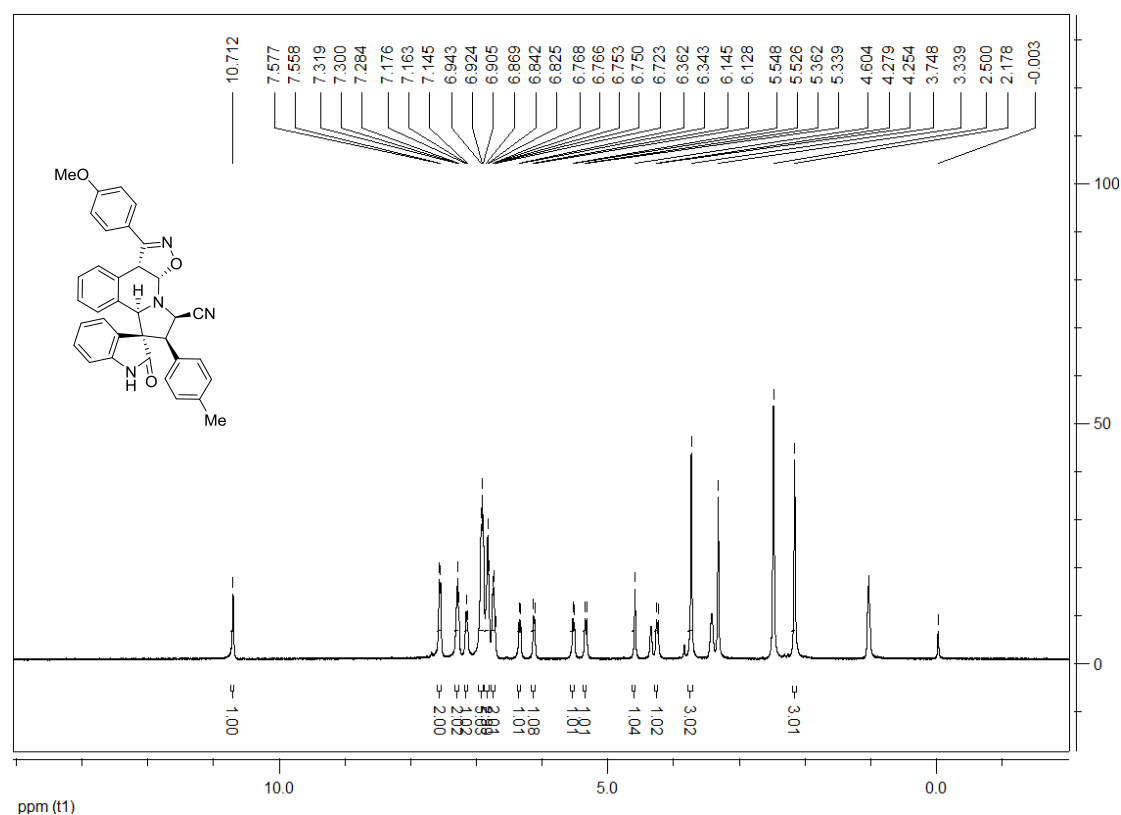


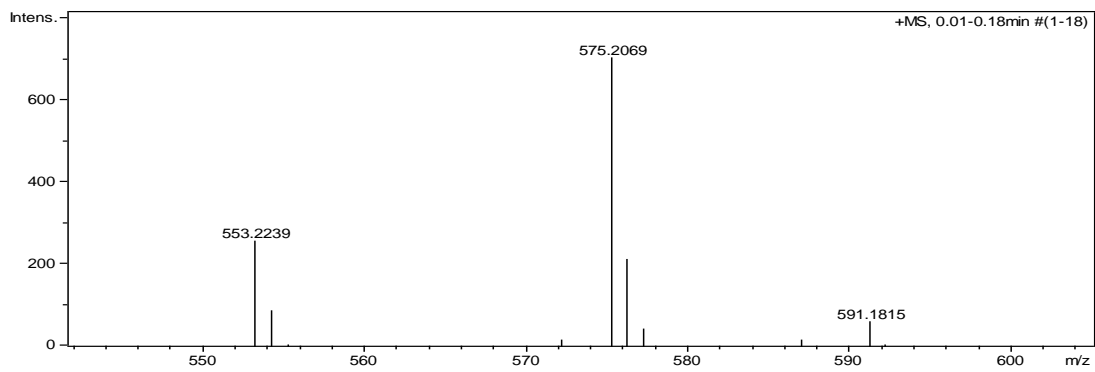
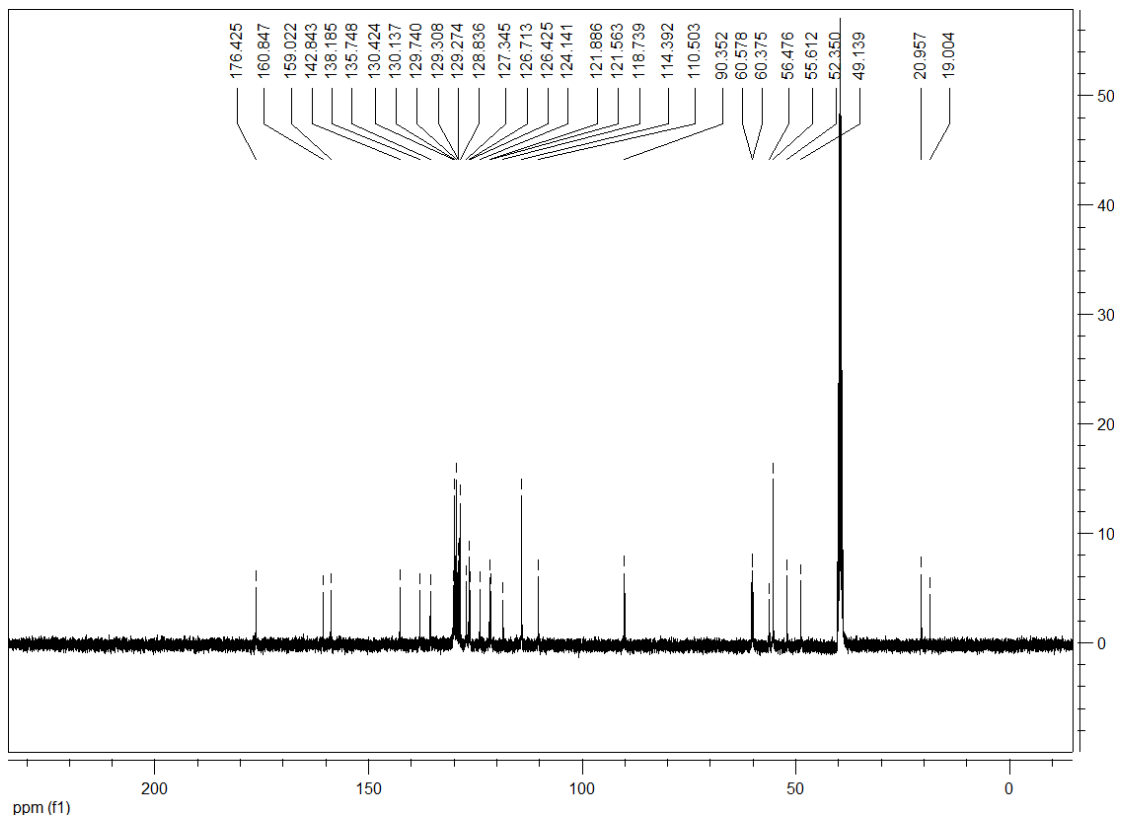
3'-(4-methoxyphenyl)-2-oxo-9'-phenyl-3a',9',10',11a'-tetrahydro-7b'*H*-spiro[indoline-3,8'-isoxazolo[5,4-*c*]pyrrolo[2,1-*a*]isoquinoline]-10'-carbonitrile (1h): white solid, 68%, m.p. 256-258°C; ¹H NMR (400 MHz, DMSO-*d*₆) δ: 10.73 (s, 1H, NH), 7.57 (d, *J* = 6.8 Hz, 2H, ArH), 7.31 (s, 2H, ArH), 7.21-7.11 (m, 4H, ArH), 6.97-6.93 (m, 5H, ArH), 6.88-6.85 (m, 1H, ArH), 6.77-6.73 (m, 2H, ArH), 6.36 (d, *J* = 8.8 Hz, 1H, ArH), 6.15 (d, *J* = 6.4 Hz, 1H, CH), 5.54 (d, *J* = 8.8 Hz, 1H, CH), 5.39 (d, *J* = 9.6 Hz, 1H, CH), 4.62 (s, 1H, CH), 4.32 (d, *J* = 7.2 Hz, 1H, CH), 3.75 (s, 3H, OCH₃); ¹³C NMR (100 MHz, DMSO-*d*₆) δ: 176.3, 160.8, 159.0, 142.8, 135.6, 132.3, 130.3, 130.2, 129.7, 129.3, 128.8, 128.2, 127.3, 126.7, 126.6, 126.3, 124.1, 121.9, 121.5, 118.7, 114.3, 110.5, 90.3, 60.6, 60.3, 55.8, 55.6, 52.2, 49.1; IR (KBr) ν: 3631, 3383, 3037, 2935, 2237, 1720, 1609, 1514, 1471, 1338, 1259, 1045, 920, 809, 701 cm⁻¹; MS (*m/z*): HRMS (ESI) Calcd. for C₃₄H₂₆NaN₄O₃ ([M+Na]⁺): 561.1897, found: 561.1904.



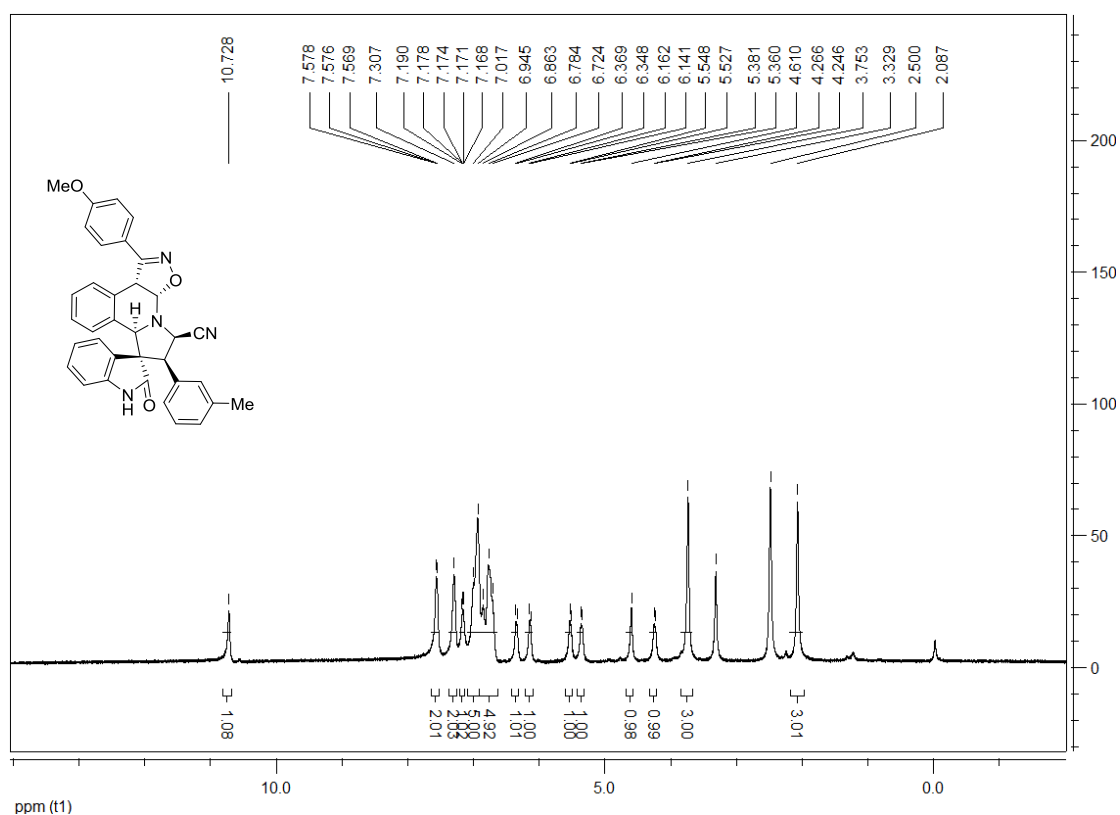


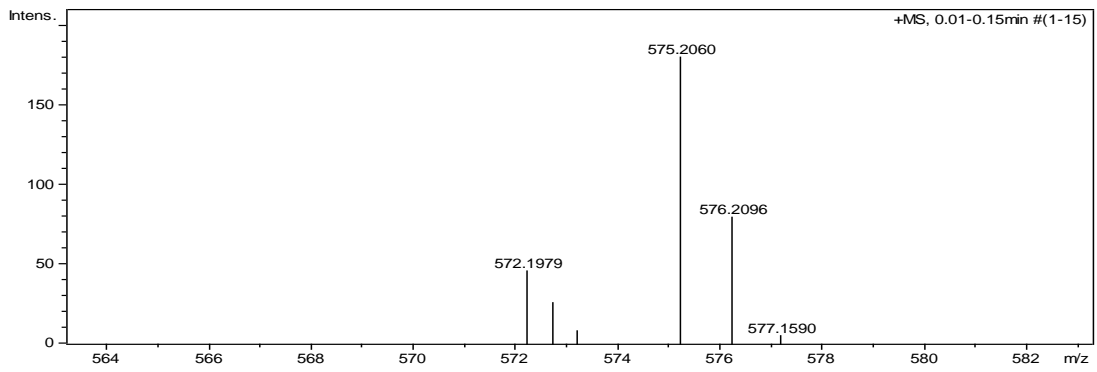
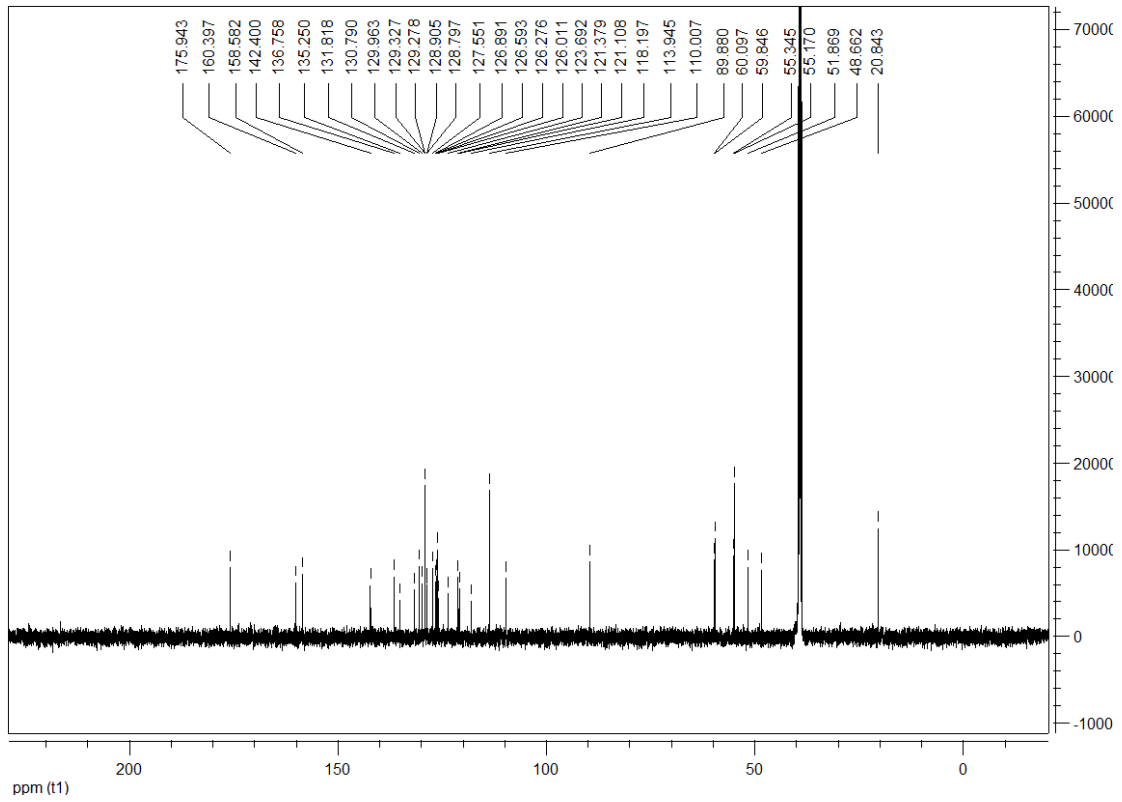
3'-(4-methoxyphenyl)-2-oxo-9'-(*p*-tolyl)-3a',9',10',11a'-tetrahydro-7b'*H*-spiro[indoline-3,8'-isoxazolo[5,4-*c*]pyrrolo[2,1-*a*]isoquinoline]-10'-carbonitrile (1i): white solid, 73%, m.p. 185-187°C; ¹H NMR (400 MHz, DMSO-*d*₆) δ: 10.71 (s, 1H, NH), 7.57 (d, *J* = 7.6 Hz, 2H, ArH), 7.32-7.28 (m, 2H, ArH), 7.18-7.14 (m, 1H, ArH), 6.94-6.91 (m, 5H, ArH), 6.87-6.83 (m, 3H, ArH), 6.77-6.72 (m, 2H, ArH), 6.35 (d, *J* = 7.6 Hz, 1H, ArH), 6.13 (d, *J* = 6.8 Hz, 1H, CH), 5.53 (d, *J* = 8.8 Hz, 1H, CH), 5.35 (d, *J* = 9.2 Hz, 1H, CH), 4.60 (s, 1H, CH), 4.26 (d, *J* = 10.0 Hz, 1H, CH), 3.75 (s, 3H, OCH₃), 2.18 (s, 3H, CH₃); ¹³C NMR (100 MHz, DMSO-*d*₆) δ: 176.4, 160.8, 159.0, 142.8, 138.1, 135.7, 130.4, 130.1, 129.7, 129.3, 129.2, 128.8, 127.3, 126.7, 126.4, 124.1, 121.8, 121.5, 118.7, 114.3, 110.5, 90.3, 60.5, 60.3, 56.4, 55.6, 52.3, 49.1, 20.9, 19.0; IR (KBr) ν: 3677, 2961, 2221, 1612, 1517, 1400, 1360, 1256, 1181, 1028, 987, 913, 839, 740, 719 cm⁻¹; MS (*m/z*): HRMS (ESI) Calcd. for C₃₅H₂₈NaN₄O₃ ([M+Na]⁺): 575.2054, found: 575.2059.



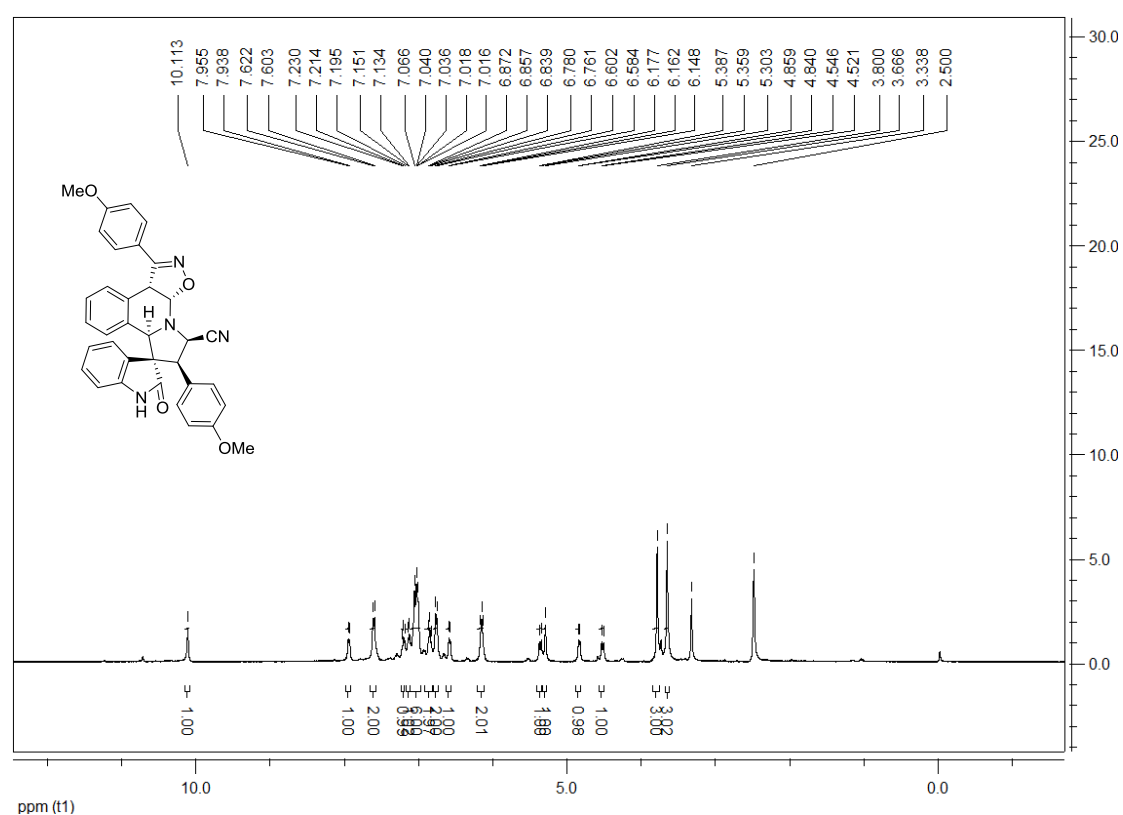


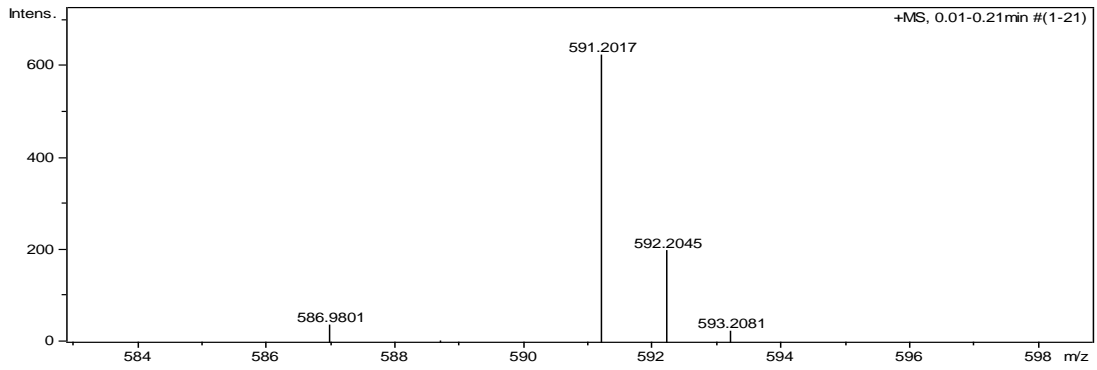
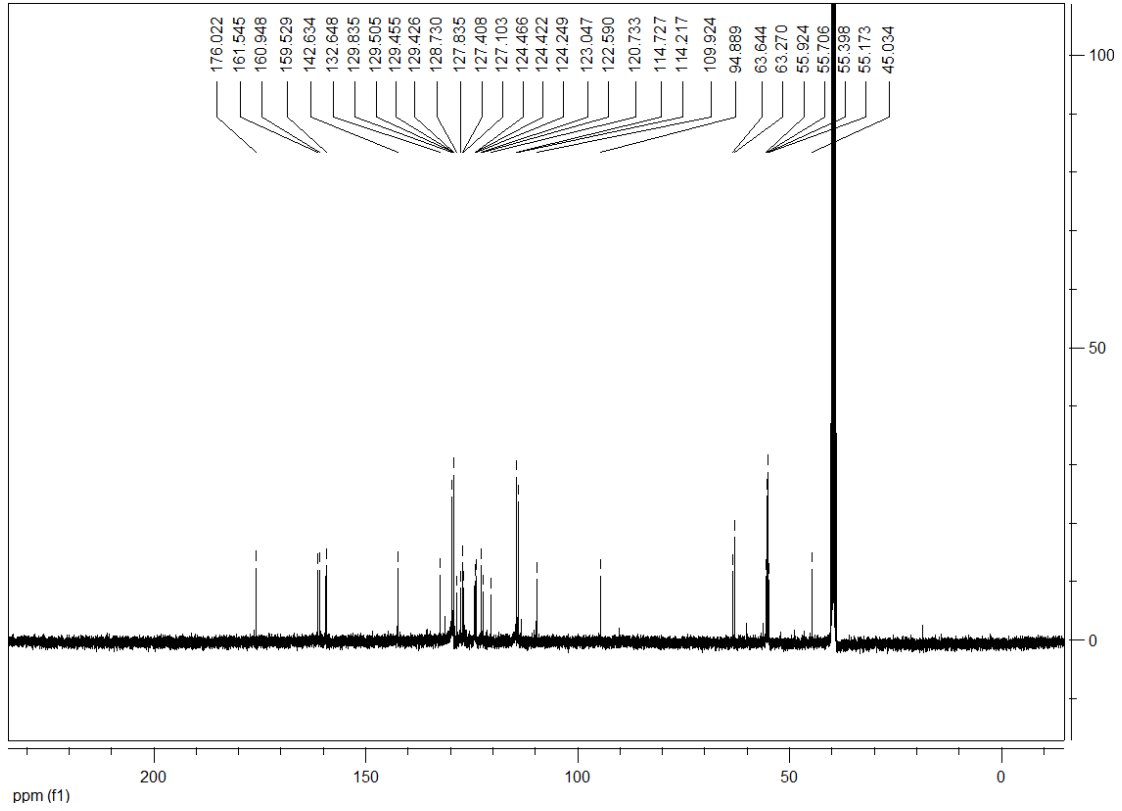
3'-(4-methoxyphenyl)-2-oxo-9'-(*m*-tolyl)-3a',9',10',11a'-tetrahydro-7b'*H*-spiro[indoline-3,8'-i soxazolo[5,4-*c*]pyrrolo[2,1-*a*]isoquinoline]-10'-carbonitrile (1j): white solid, 72%, m.p. 266-268°C; ¹H NMR (400 MHz, DMSO-*d*₆) δ: 10.73 (s, 1H, NH), 7.58-7.57 (m, 2H, ArH), 7.31 (s, 2H, ArH), 7.19-7.17 (m, 1H, ArH), 7.02-6.95 (m, 5H, ArH), 6.86-6.72 (m, 5H, ArH), 6.36 (d, *J* = 8.4 Hz, 1H, ArH), 6.15 (d, *J* = 8.4 Hz, 1H, CH), 5.54 (d, *J* = 8.4 Hz, 1H, CH), 5.37 (d, *J* = 8.4 Hz, 1H, CH), 4.61 (s, 1H, CH), 4.25 (d, *J* = 8.0 Hz, 1H, CH), 3.75 (s, 3H, OCH₃); ¹³C NMR (100 MHz, DMSO-*d*₆) δ: 175.9, 160.3, 158.5, 142.3, 136.7, 135.2, 131.8, 130.7, 129.9, 129.3, 129.2, 128.9, 128.7, 127.5, 126.8, 126.5, 126.2, 126.0, 123.6, 121.3, 121.1, 118.1, 113.9, 110.0, 89.8, 60.0, 59.8, 55.3, 55.1, 51.8, 48.6, 20.8; IR (KBr) ν: 3189, 3039, 2915, 2236, 1705, 1622, 1515, 1474, 1343, 1256, 1144, 1025, 906, 806, 781, 747 cm⁻¹; MS (*m/z*): HRMS (ESI) Calcd. for C₃₅H₂₈NaN₄O₃ ([M+Na]⁺): 575.2060, found: 575.2054.



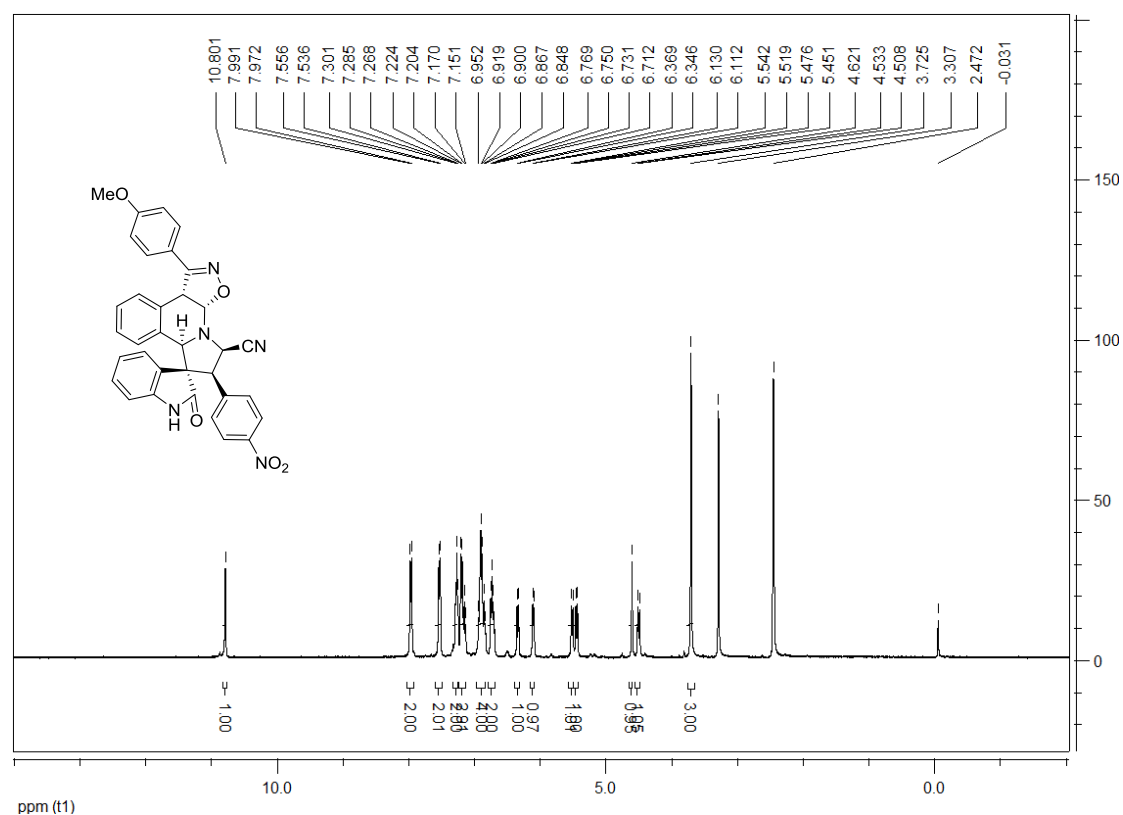


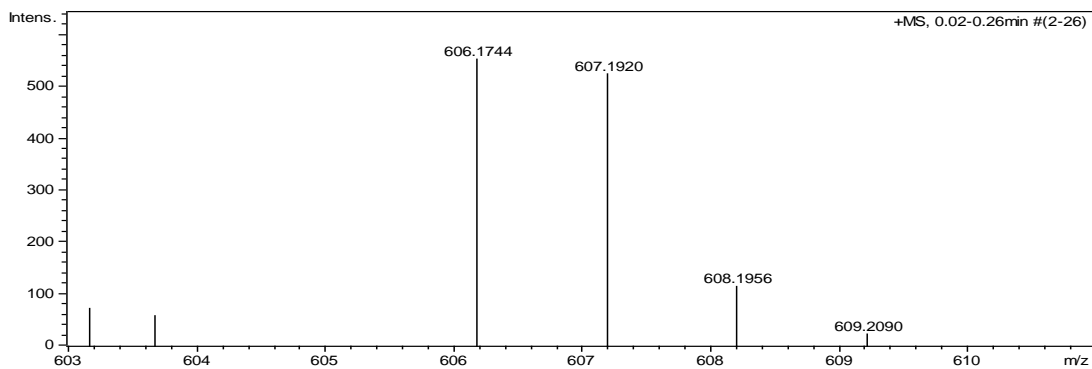
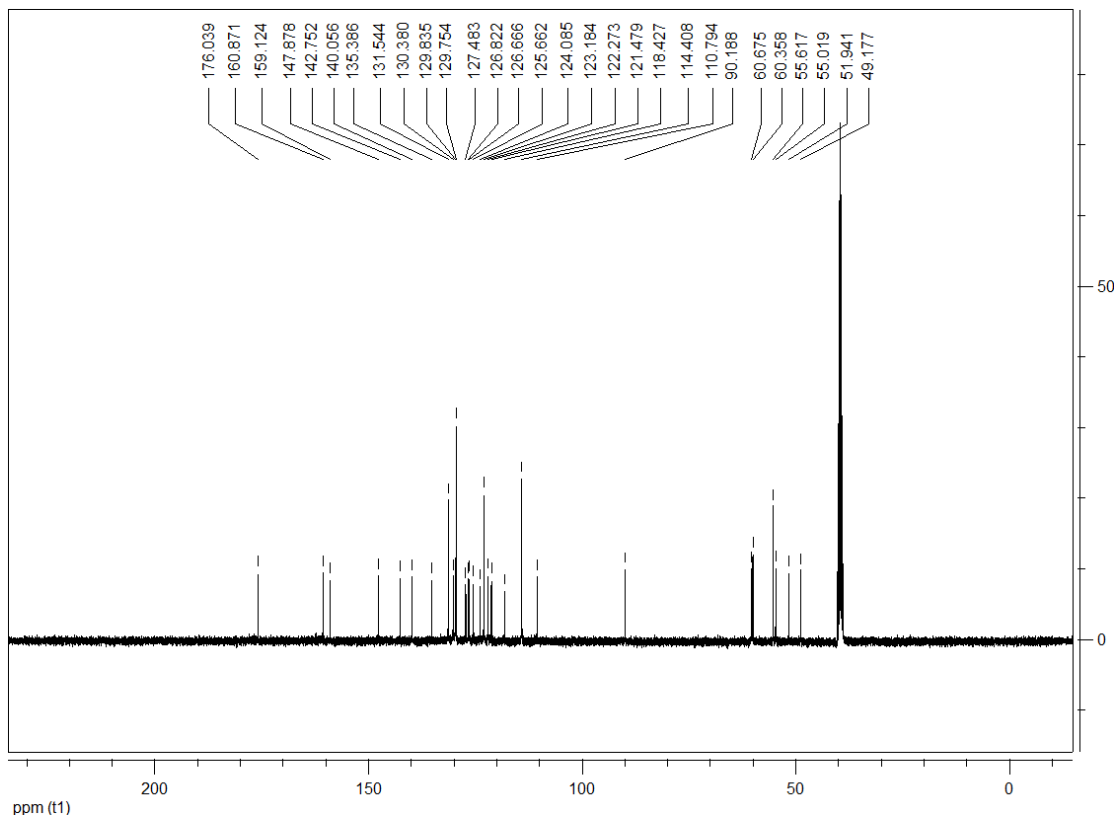
3',9'-bis(4-methoxyphenyl)-2-oxo-3a',9',10',11a'-tetrahydro-7b'H-spiro[indoline-3,8'-isoxazolo[5,4-c]pyrrolo[2,1-a]isoquinoline]-10'-carbonitrile (1k): white solid, 73%, m.p. 254-256 °C; ¹H NMR (400 MHz, DMSO-*d*₆) δ: 10.11 (s, 1H, NH), 7.95 (d, *J* = 6.8 Hz, 1H, ArH), 7.61 (d, *J* = 7.6 Hz, 2H, ArH), 7.23-7.20 (m, 1H, ArH), 7.15-7.13 (m, 1H, ArH), 7.07-7.02 (m, 6H, ArH), 6.87-6.84 (m, 2H, ArH), 6.77 (d, *J* = 7.6 Hz, 2H, ArH), 6.59 (d, *J* = 7.2 Hz, 1H, ArH), 6.18-6.15 (m, 2H, CH), 5.37 (d, *J* = 11.2 Hz, 1H, CH), 5.30 (s, 1H, CH), 4.85 (d, *J* = 7.6 Hz, 1H, CH), 4.53 (d, *J* = 10.0 Hz, 1H, CH), 3.80 (s, 3H, OCH₃), 3.67 (s, 3H, OCH₃); ¹³C NMR (100 MHz, DMSO-*d*₆) δ: 176.0, 161.5, 160.9, 159.5, 142.6, 132.6, 129.8, 129.5, 129.4, 129.4, 128.7, 127.8, 127.4, 127.1, 124.4, 124.4, 124.2, 123.0, 122.5, 120.7, 114.7, 114.2, 109.9, 94.8, 63.6, 63.2, 55.9, 55.7, 55.3, 55.1, 45.0; IR (KBr) ν: 3200, 2935, 2237, 1706, 1609, 1515, 1472, 1419, 1341, 1304, 1254, 1180, 1114, 1027, 908, 837, 756 cm⁻¹; MS (*m/z*): HRMS (ESI) Calcd. for C₃₅H₂₈NaN₄O₄ ([M+Na]⁺): 591.2003, found: 591.2017.



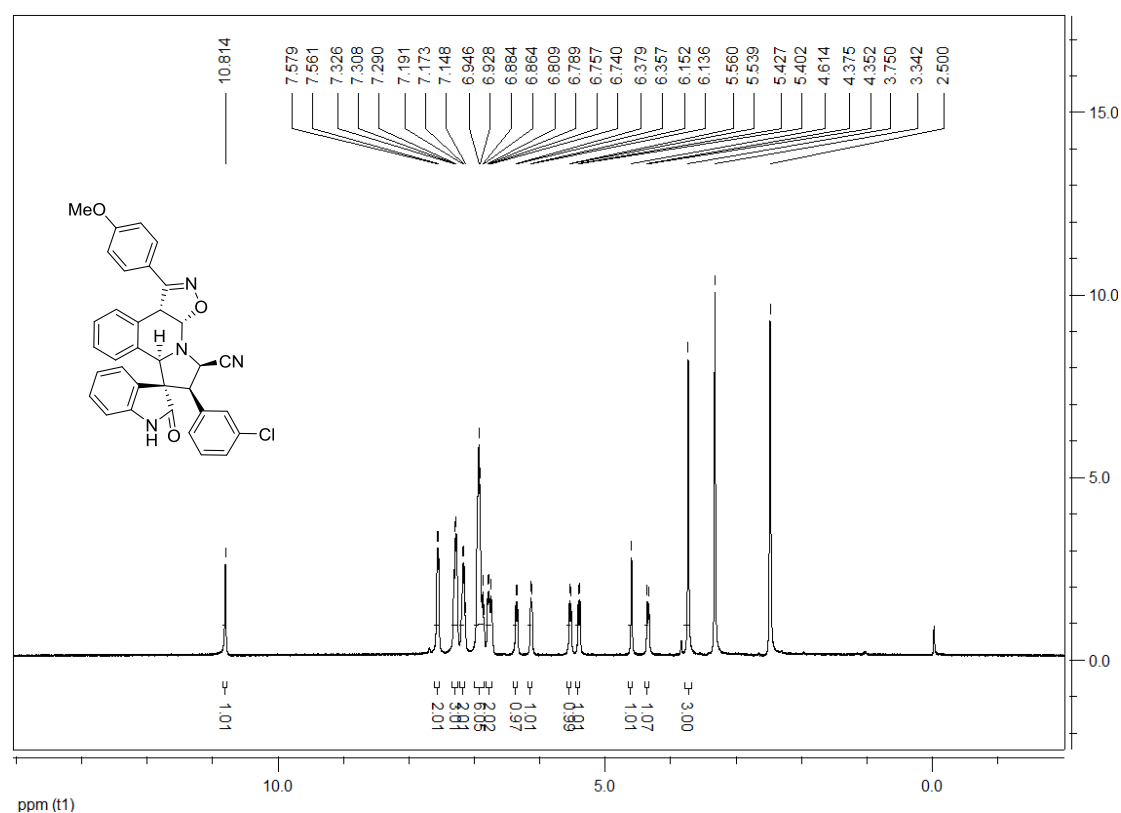


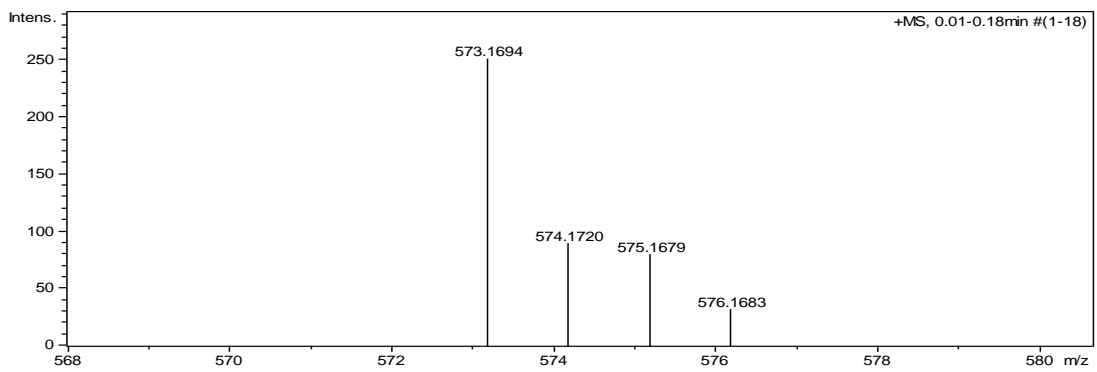
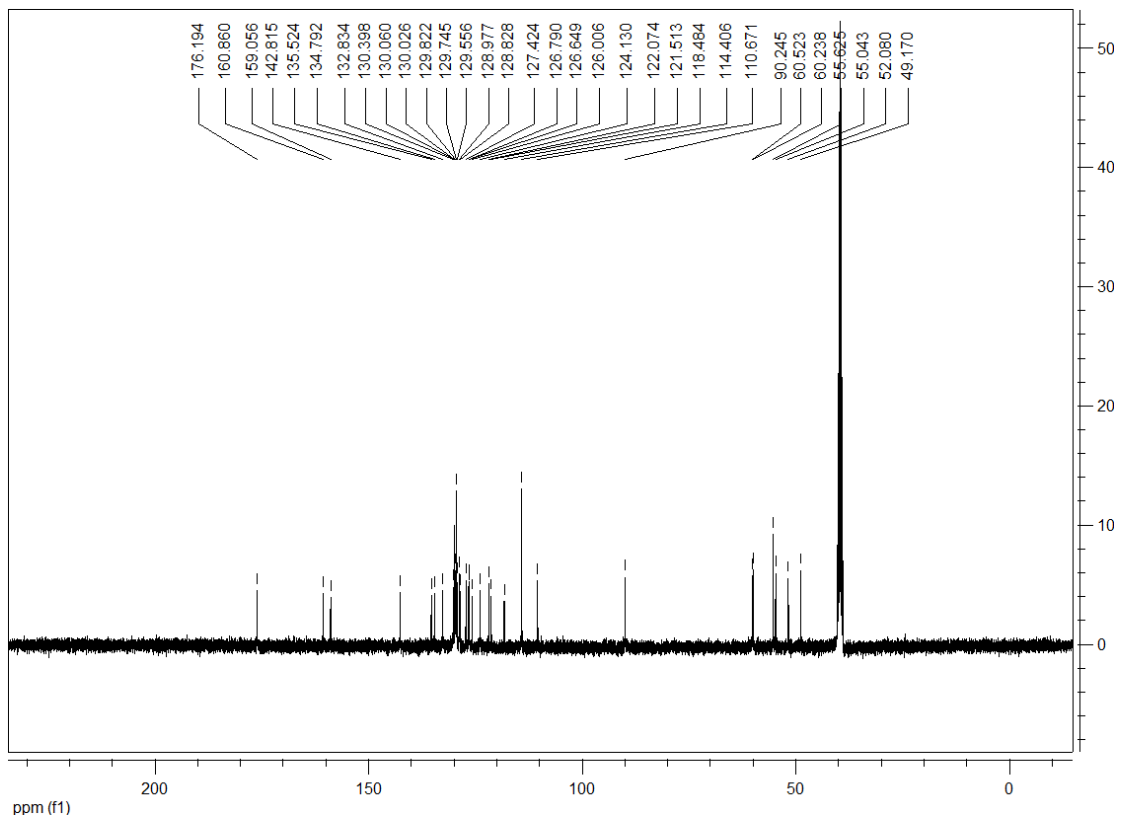
3'-(4-methoxyphenyl)-9'-(4-nitrophenyl)-2-oxo-3a',9',10',11a'-tetrahydro-7b'H-spiro[indoline-3,8'-isoxazolo[5,4-c]pyrrolo[2,1-a]isoquinoline]-10'-carbonitrile (11): white solid, 75%, m.p. 267-269°C; ¹H NMR (400 MHz, DMSO-*d*₆) δ: 10.80 (s, 1H, NH), 7.98 (d, *J* = 7.6 Hz, 2H, ArH), 7.54 (d, *J* = 8.0 Hz, 2H, ArH), 7.30-7.27 (m, 2H, ArH), 7.22-7.15 (m, 3H, ArH), 6.95-6.85 (m, 4H, ArH), 6.77-6.71 (m, 2H, ArH), 6.36 (d, *J* = 8.0 Hz, 1H, ArH), 6.12 (d, *J* = 7.2 Hz, 1H, CH), 5.53 (d, *J* = 9.2 Hz, 1H, CH), 5.46 (d, *J* = 10.0 Hz, 1H, CH), 4.62 (s, 1H, CH), 4.52 (d, *J* = 10.0 Hz, 1H, CH), 3.73 (s, 3H, OCH₃); ¹³C NMR (100 MHz, DMSO-*d*₆) δ: 176.0, 160.8, 159.1, 147.8, 142.7, 140.0, 135.3, 131.5, 130.3, 129.8, 129.7, 127.4, 126.8, 126.6, 125.6, 124.0, 123.1, 122.2, 121.4, 118.4, 114.4, 110.7, 90.1, 60.6, 60.3, 55.6, 55.0, 51.9, 49.1; IR (KBr) ν: 3632, 3080, 2936, 2235, 1723, 1606, 1521, 1400, 1351, 1261, 1173, 1023, 944, 899, 811, 764, 725 cm⁻¹; MS (*m/z*): HRMS (ESI) Calcd. for C₃₄H₂₅N₅O₅ ([M+Na]⁺): 606.1748, found: 606.1744.



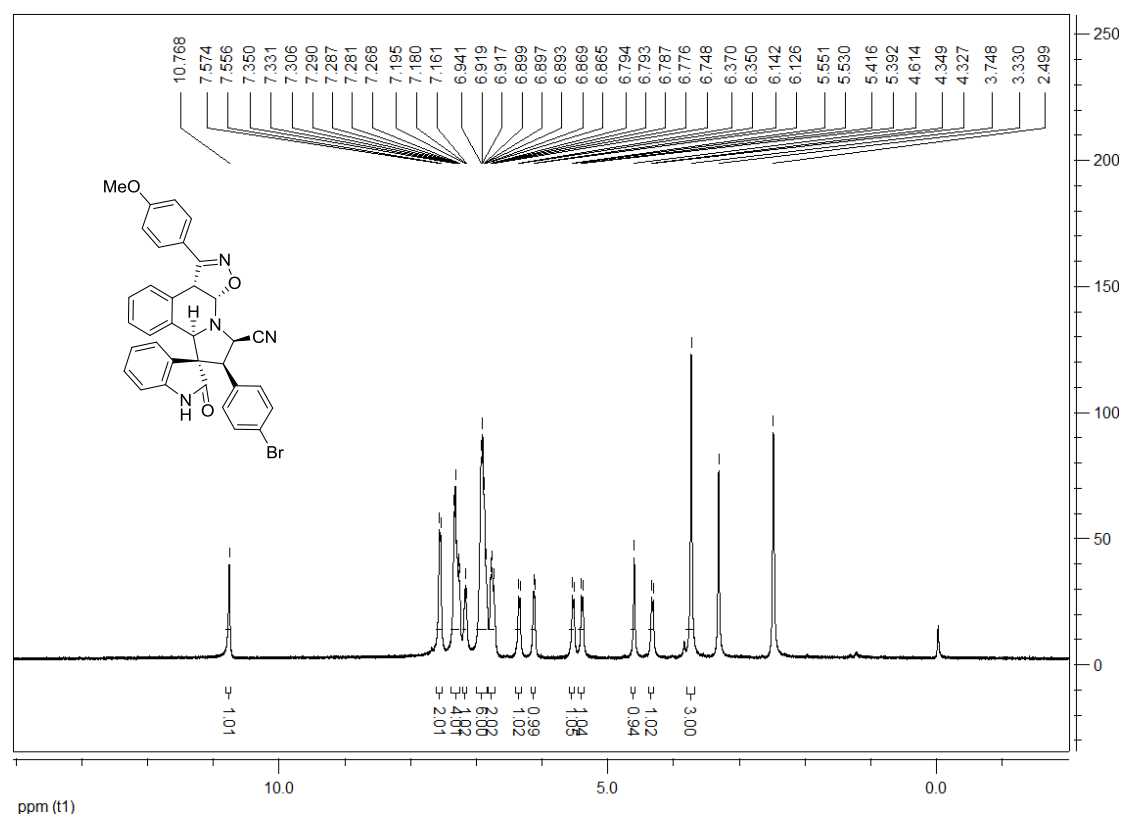


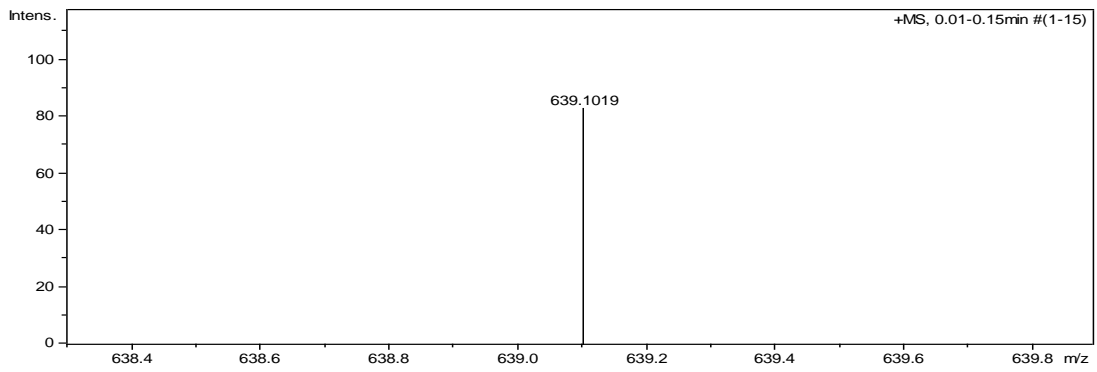
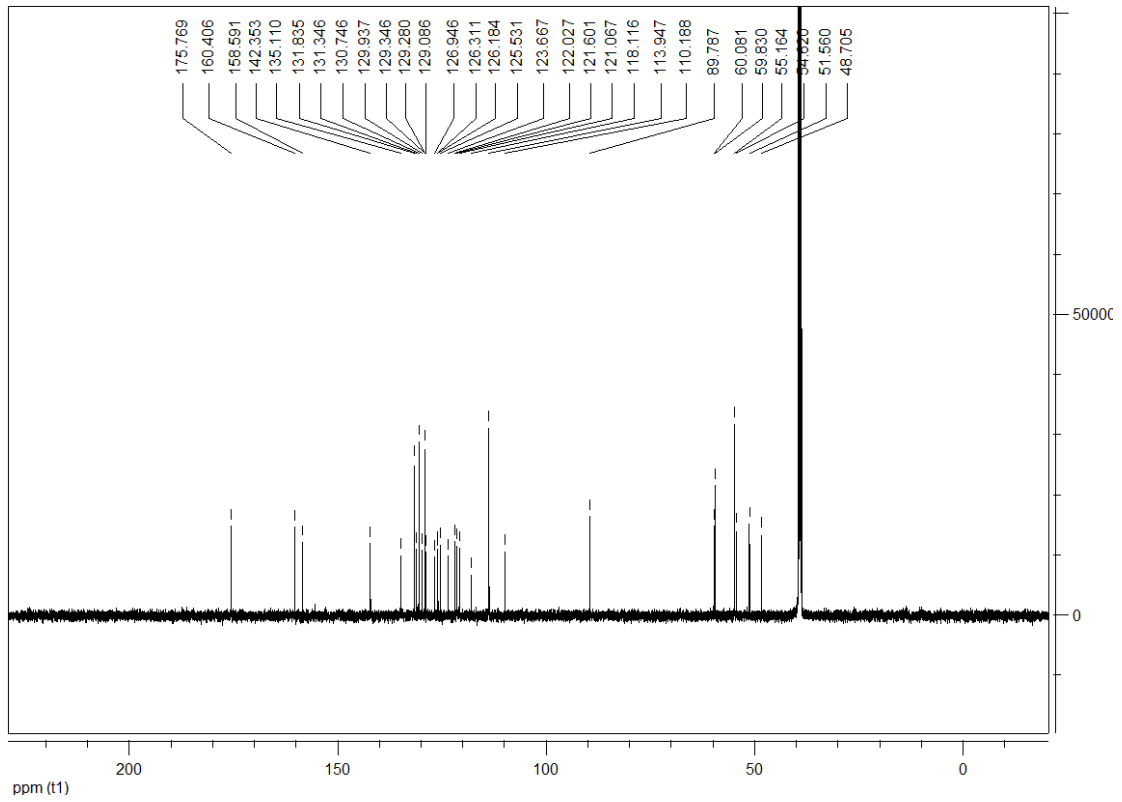
9'-(3-chlorophenyl)-3'-(4-methoxyphenyl)-2-oxo-3a',9',10',11a'-tetrahydro-7b'H-spiro[indoline-3,8'-isoxazolo[5,4-c]pyrrolo[2,1-a]isoquinoline]-10'-carbonitrile (1m): white solid, 74%, m.p. 220-222°C; ¹H NMR (400 MHz, DMSO-*d*₆) δ: 10.81 (s, 1H, NH), 7.57 (d, *J* = 7.2 Hz, 2H, ArH), 7.33-7.29 (m, 3H, ArH), 7.19-7.15 (m, 2H, ArH), 6.95-6.86 (m, 6H, ArH), 6.81-6.74 (m, 2H, ArH), 6.37 (d, *J* = 8.8 Hz, 1H, ArH), 6.14 (d, *J* = 6.4 Hz, 1H, ArH), 5.55 (d, *J* = 8.4 Hz, 1H, CH), 5.41 (d, *J* = 10.0 Hz, 1H, CH), 4.61 (s, 1H, CH), 4.36 (d, *J* = 9.4 Hz, 1H, CH), 3.75 (s, 3H, OCH₃); ¹³C NMR (100 MHz, DMSO-*d*₆) δ: 176.1, 160.8, 159.0, 142.8, 135.5, 134.7, 132.8, 130.3, 130.0, 129.8, 129.7, 129.5, 128.9, 128.8, 127.4, 126.7, 126.6, 126.0, 124.1, 122.0, 121.5, 118.4, 114.4, 110.6, 90.2, 60.5, 60.2, 55.6, 55.0, 52.0, 49.1; IR (KBr) ν: 3664, 2962, 2237, 1722, 1610, 1515, 1461, 1322, 1257, 1178, 1043, 945, 832, 727, 713 cm⁻¹; MS (*m/z*): HRMS (ESI) Calcd. for C₃₄H₂₆ClN₄O₃ ([M+H]⁺): 573.1688, found: 573.1694.





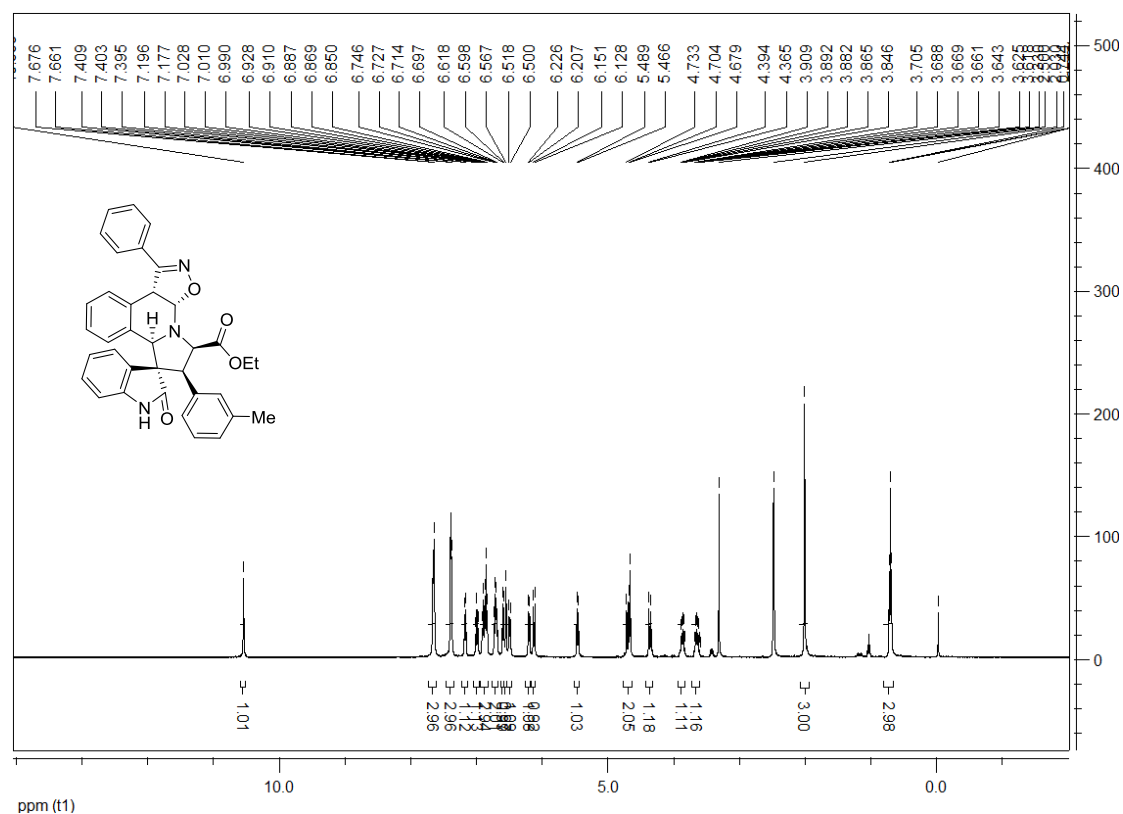
9'-(4-bromophenyl)-3'-(4-methoxyphenyl)-2-oxo-3a',9',10',11a'-tetrahydro-7b'H-spiro[indoline-3,8'-isoxazolo[5,4-c]pyrrolo[2,1-a]isoquinoline]-10'-carbonitrile (1n): white solid, 77%, m.p. 267-269°C; ¹H NMR (400 MHz, DMSO-*d*₆) δ: 10.77 (s, 1H, NH), 7.56 (d, *J* = 7.2 Hz, 2H, ArH), 7.35-7.27 (m, 4H, ArH), 7.20-7.16 (m, 1H, ArH), 6.94-6.87 (m, 6H, ArH), 6.79-6.75 (m, 2H, ArH), 6.36 (d, *J* = 8.0 Hz, 1H, ArH), 6.13 (d, *J* = 6.4 Hz, 1H, CH), 5.54 (d, *J* = 8.4 Hz, 1H, CH), 5.40 (d, *J* = 9.6 Hz, 1H, CH), 4.61 (s, 1H, CH), 4.34 (d, *J* = 8.8 Hz, 1H, CH), 3.75 (s, 3H, OCH₃); ¹³C NMR (150 MHz, DMSO-*d*₆) δ: 175.7, 160.4, 158.5, 142.3, 135.1, 131.8, 131.3, 130.7, 129.9, 129.3, 129.2, 129.0, 126.9, 126.3, 126.1, 125.5, 123.6, 122.0, 121.6, 121.0, 118.1, 113.9, 110.1, 89.7, 60.0, 59.8, 55.1, 54.6, 51.5, 48.7; IR (KBr) ν: 3626, 3401, 3291, 2836, 2234, 1724, 1609, 1514, 1417, 1390, 1278, 1137, 1046, 919, 831, 788 cm⁻¹; MS (*m/z*): HRMS (ESI) Calcd. for C₃₄H₂₅BrNaN₄O₃ ([M+Na]⁺): 639.1002, found: 639.1019.

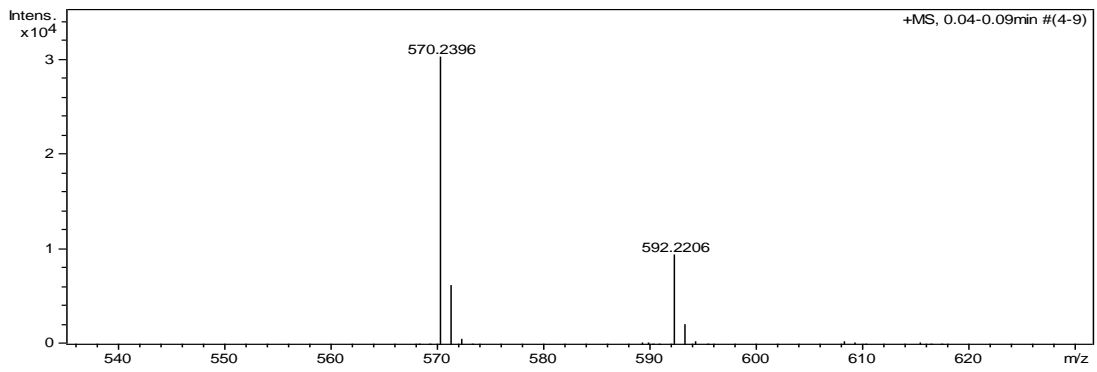
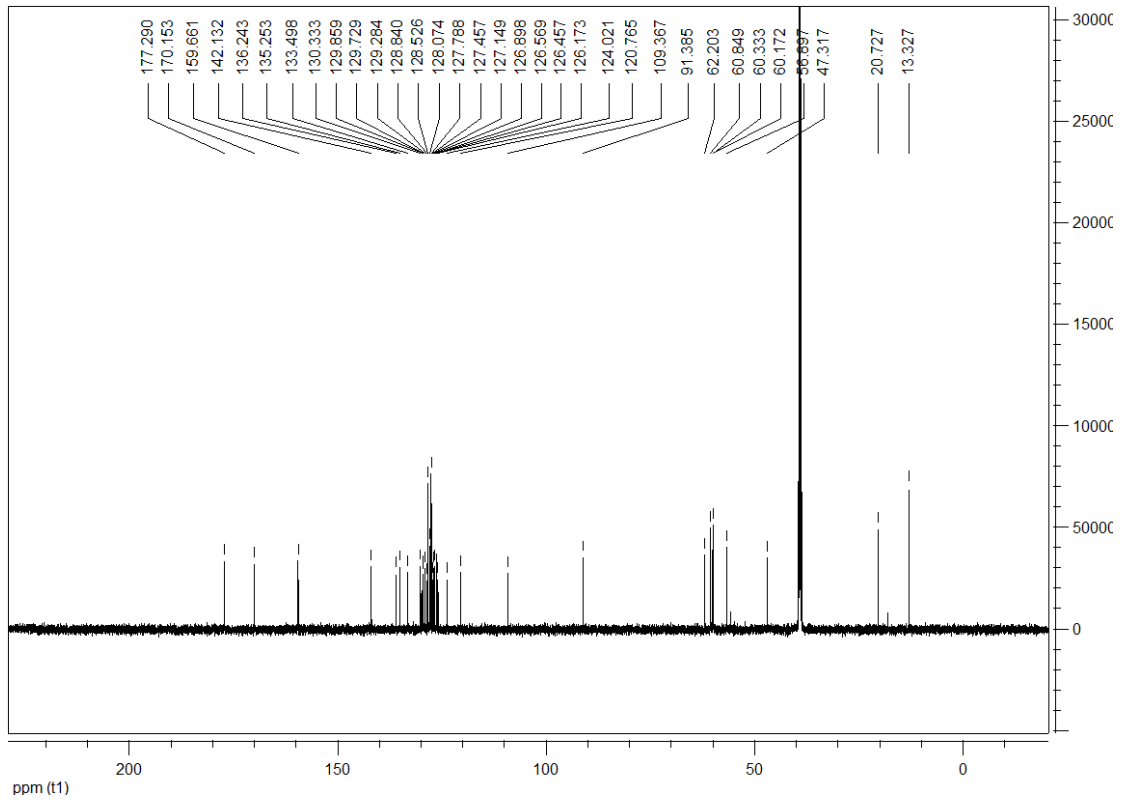




Ethyl

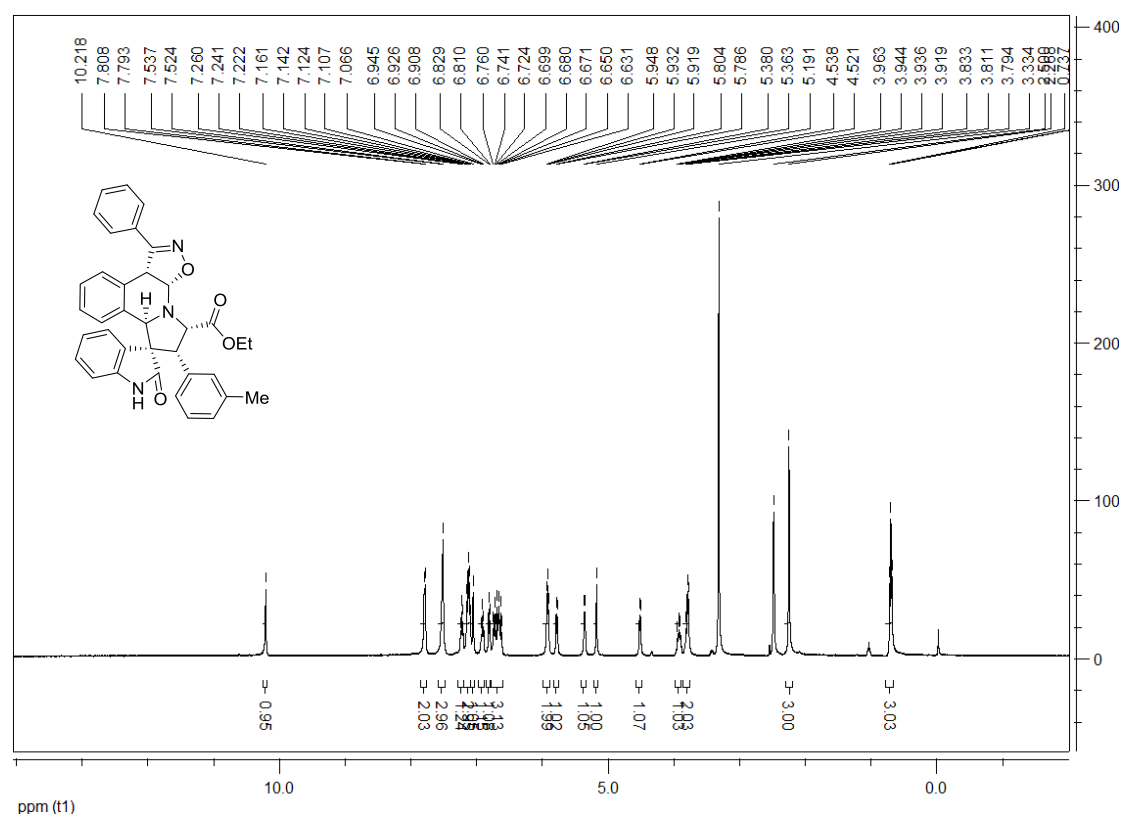
2-oxo-3'-phenyl-9'-(*m*-tolyl)-3a',9',10',11a'-tetrahydro-7b'*H*-spiro[indoline-3,8'-isoxazolo[5,4-*c*]pyrrolo[2,1-*a*]isoquinoline]-10'-carboxylate (2a): white solid, 40%, m.p. 217-219°C; ¹H NMR (400 MHz, DMSO-*d*₆) δ: 10.55 (s, 1H, NH), 7.68-7.66 (m, 3H, ArH), 7.41-7.39 (m, 3H, ArH), 7.19 (d, *J* = 7.6 Hz, 1H, ArH), 7.03-6.99 (m, 1H, ArH), 6.93-6.85 (m, 3H, ArH), 6.75-6.69 (m, 2H, ArH), 6.61 (d, *J* = 8.0 Hz, 1H, ArH), 6.57 (s, 1H, ArH), 6.21 (d, *J* = 7.6 Hz, 1H, ArH), 6.14 (d, *J* = 5.2 Hz, 1H, CH), 5.48 (d, *J* = 8.0 Hz, 1H, CH), 4.73-4.68 (m, 2H, CH), 4.38 (d, *J* = 11.6 Hz, 1H, CH), 3.91-3.84 (m, 1H, CH), 3.71-3.62 (m, 1H, CH), 2.03 (s, 3H, CH₃), 0.73 (t, *J* = 7.2 Hz, 3H, CH₃); ¹³C NMR (150 MHz, DMSO-*d*₆) δ: 177.2, 170.1, 159.6, 142.1, 136.2, 135.2, 133.4, 130.3, 129.8, 129.7, 129.2, 128.8, 128.5, 128.0, 127.7, 127.4, 127.1, 126.8, 126.5, 126.4, 126.1, 124.0, 120.7, 109.3, 91.3, 62.2, 60.8, 60.3, 60.1, 56.8, 47.3, 20.7, 13.3; IR (KBr) ν: 3536, 2920, 2850, 1698, 1596, 1515, 1493, 1446, 1380, 1335, 1261, 1228, 1204, 1078, 1023, 903, 796, 757, 734 cm⁻¹; MS (*m/z*): HRMS (ESI) Calcd. for C₃₆H₃₂N₃O₄ ([M+H]⁺): 570.2387, found: 570.2398.

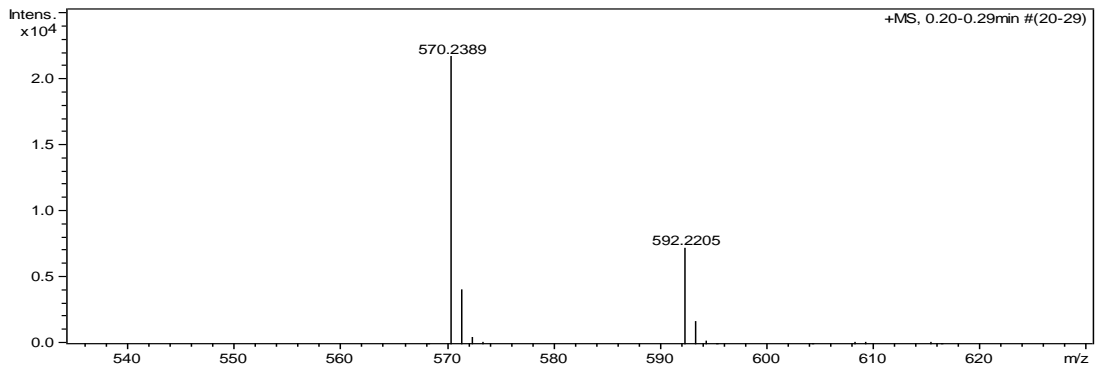
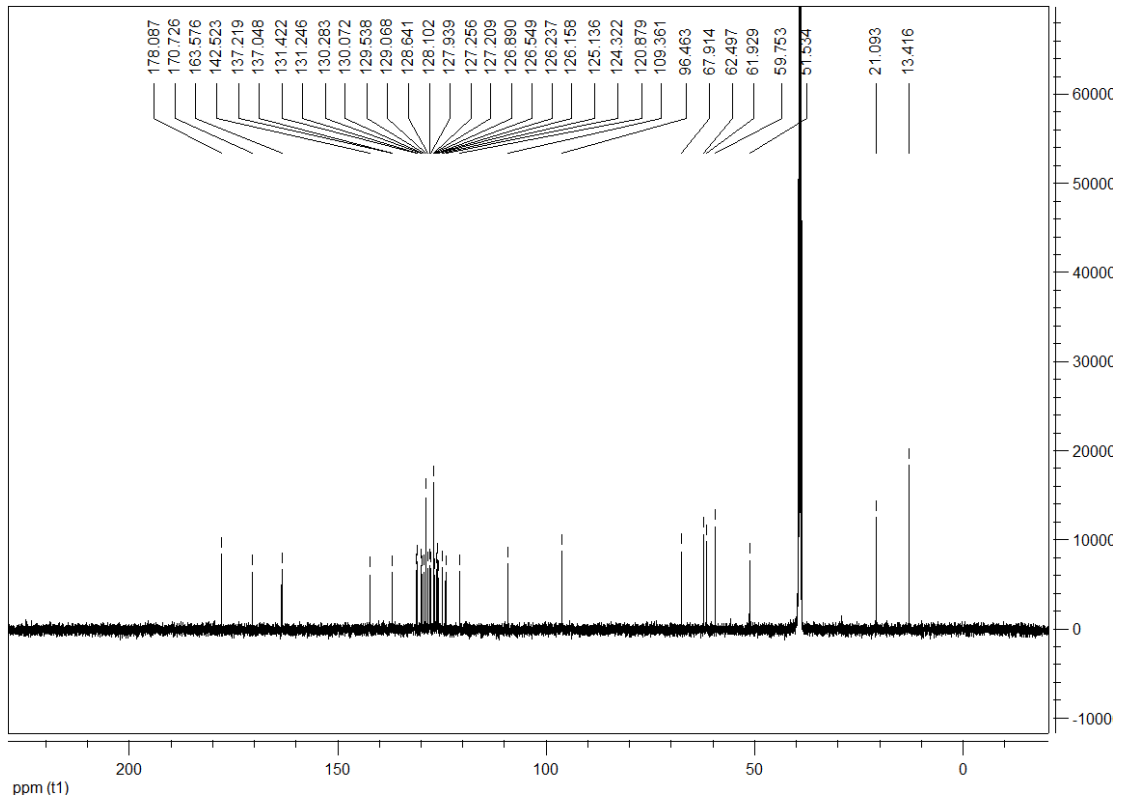




Ethyl

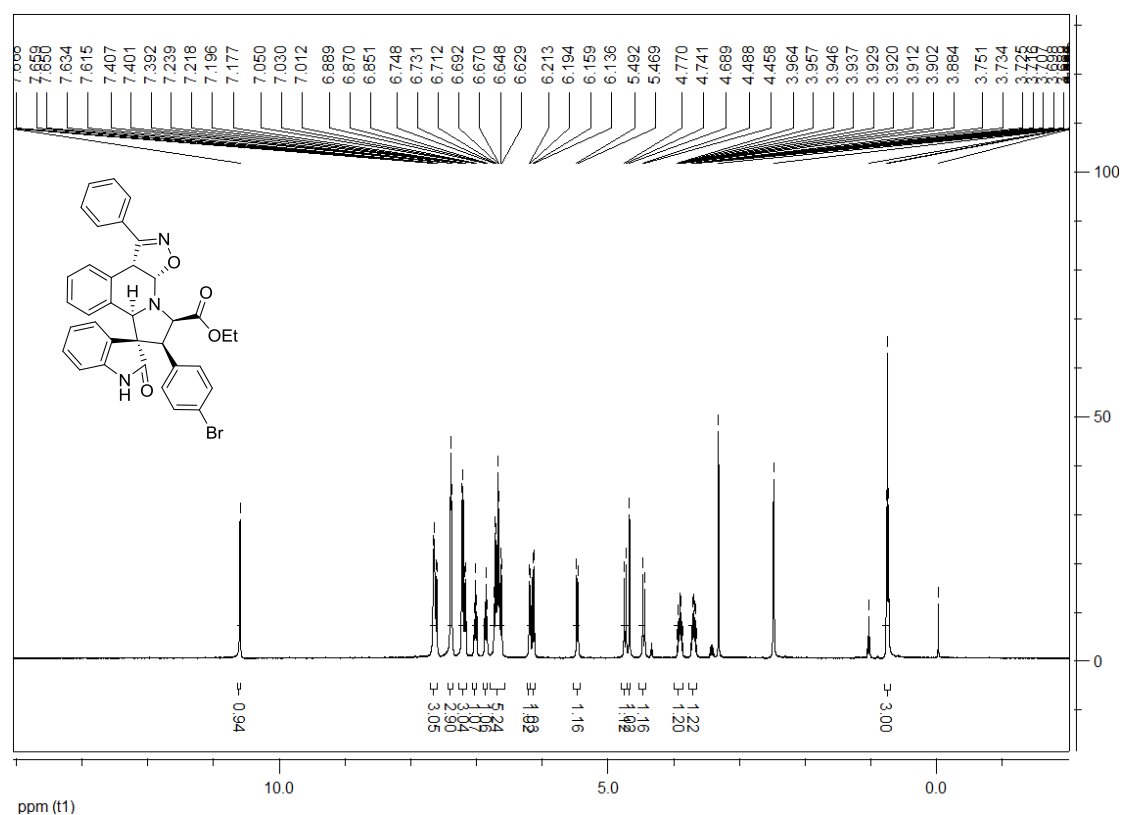
2-oxo-3'-phenyl-9'-(*m*-tolyl)-3a',9',10',11a'-tetrahydro-7b'*H*-spiro[indoline-3,8'-isoxazolo[5,4-*c*]pyrrolo[2,1-*a*]isoquinoline]-10'-carboxylate (2a'): white solid, 31%, m.p. 196-198 °C; ¹H NMR (400 MHz, DMSO-*d*₆) δ: 10.22 (s, 1H, NH), 7.81-7.79 (m, 2H, ArH), 7.54-7.52 (m, 3H, ArH), 7.26-7.22 (m, 1H, ArH), 7.16-7.10 (M, 31H, ArH), 7.07 (s, 1H, ArH), 6.95-6.91 (m, 1H, ArH), 6.82 (d, *J* = 7.6 Hz, 1H, ArH), 6.76-6.63 (m, 3H, ArH), 5.95-5.92 (m, 2H, ArH), 5.79 (d, *J* = 7.2 Hz, 1H, CH), 5.37 (d, *J* = 6.8 Hz, 1H, CH), 5.19 (s, 1H, CH), 4.53 (d, *J* = 6.8 Hz, 1H, CH), 3.96-3.92 (m, 1H, CH), 3.83-3.79 (m, 1H, CH), 2.27 (s, 3H, CH₃), 0.72 (t, *J* = 7.2 Hz, 3H, CH₃); ¹³C NMR (150 MHz, DMSO-*d*₆) δ: 178.0, 170.7, 163.5, 142.5, 137.2, 137.0, 131.4, 131.2, 130.2, 130.0, 129.5, 129.0, 128.6, 128.1, 127.9, 127.2, 127.2, 126.8, 126.5, 126.2, 126.1, 125.1, 124.3, 120.8, 109.3, 96.4, 67.9, 62.4, 61.9, 59.7, 51.5, 21.0, 13.4; IR (KBr) ν: 3464, 2918, 2847, 1674, 1601, 1512, 1495, 1454, 1324, 1304, 1257, 1205, 1177, 1022, 976, 914, 871, 832, 814, 797, 781, 752, 736 cm⁻¹; MS (*m/z*): HRMS (ESI) Calcd. for C₃₆H₃₂N₃O₄ ([M+H]⁺): 570.2387, found: 570.2389.

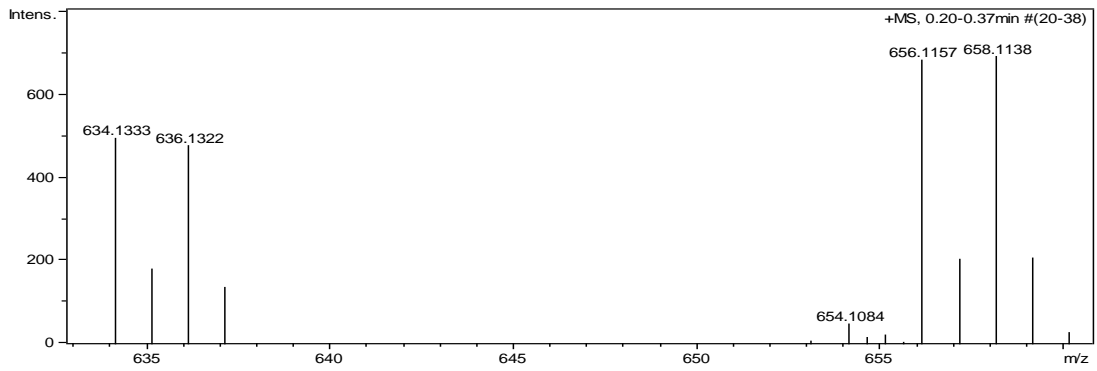
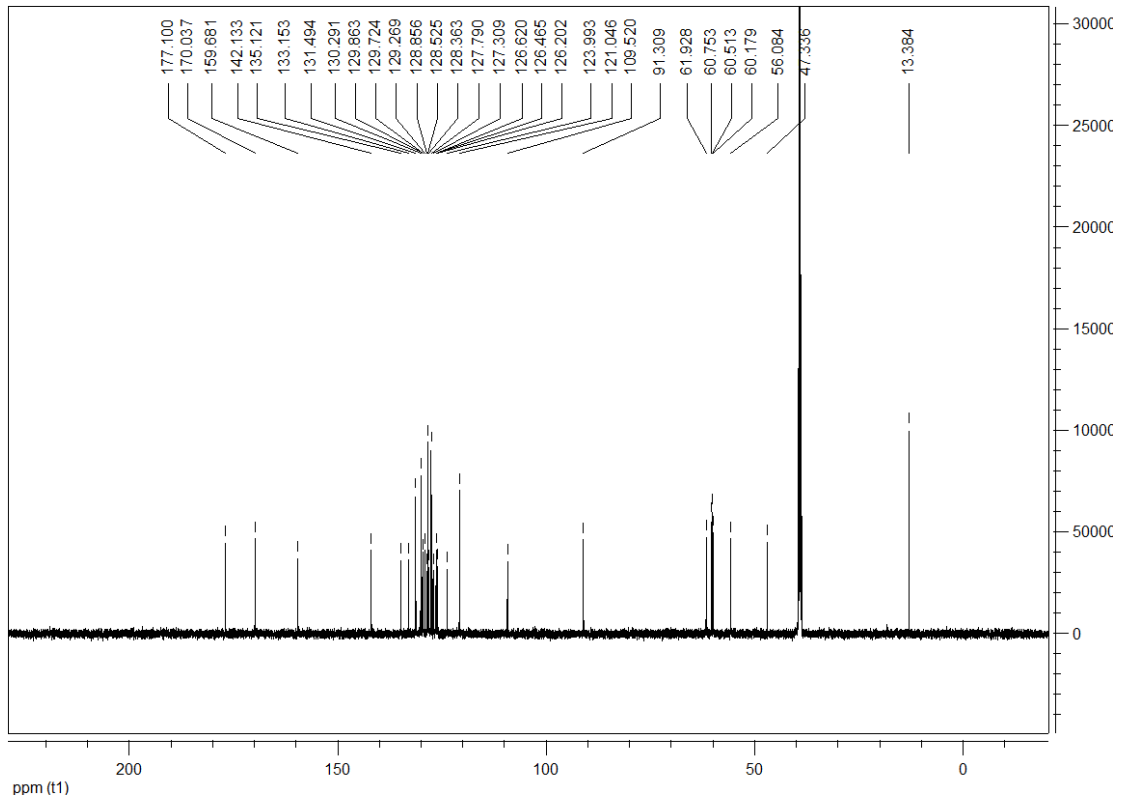




Ethyl

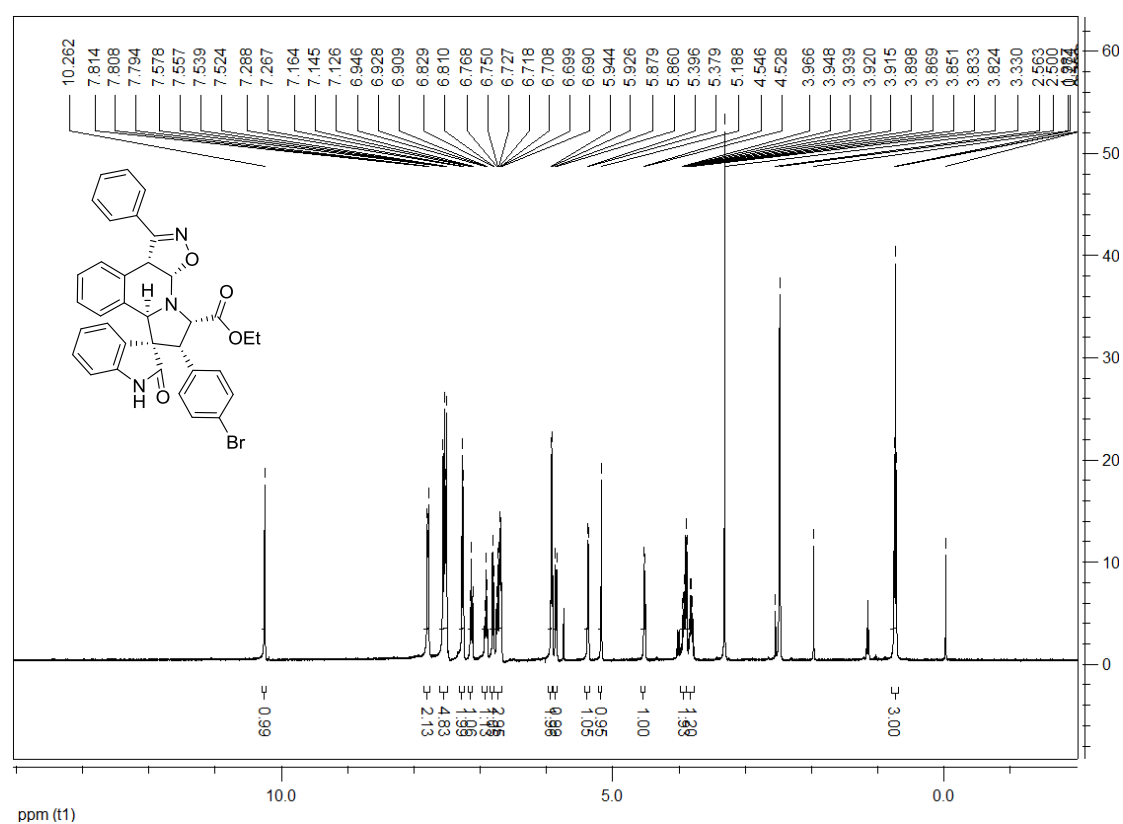
9'-(4-bromophenyl)-2-oxo-3'-phenyl-3a',9',10',11a'-tetrahydro-7b'H-spiro[indoline-3,8'-isoxazolo[5,4-c]pyrrolo[2,1-a]isoquinoline]-10'-carboxylate (2b): white solid, 38%, m.p. 242-244 °C; ¹H NMR (400 MHz, DMSO-*d*₆) δ: 10.61 (s, 1H, NH), 7.67-7.62 (m, 3H, ArH), 7.41-7.39 (m, 3H, ArH), 7.24-7.18 (m, 3H, ArH), 7.05-7.01 (m, 1H, ArH), 6.89-6.85 (m, 1H, ArH), 6.75-6.63 (m, 5H, ArH), 6.20 (d, *J* = 7.6 Hz, 1H, ArH), 6.15 (d, *J* = 9.2 Hz, 1H, CH), 5.48 (d, *J* = 9.2 Hz, 1H, CH), 4.75 (d, *J* = 11.6 Hz, 1H, CH), 4.69 (s, 1H, CH), 4.47 (d, *J* = 12.0 Hz, 1H, CH), 3.96-3.88 (m, 1H, CH), 3.75-3.67 (m, 1H, CH), 0.77 (t, *J* = 7.2 Hz, 3H, CH₃); ¹³C NMR (150 MHz, DMSO-*d*₆) δ: 177.1, 170.0, 159.6, 142.1, 135.1, 133.1, 131.4, 130.2, 129.8, 129.7, 129.2, 128.8, 128.5, 128.3, 127.7, 127.3, 126.6, 126.4, 126.2, 123.9, 121.0, 109.5, 91.3, 61.9, 60.7, 60.5, 60.1, 56.0, 47.3, 13.3; IR (KBr) ν: 3289, 1726, 1705, 1619, 1488, 1472, 1336, 1252, 1146, 1103, 1063, 916, 826, 751 cm⁻¹; MS (*m/z*): HRMS (ESI) Calcd. for C₃₅H₂₈BrNaN₃O₄ ([M+Na]⁺): 656.1155, found: 656.1157.

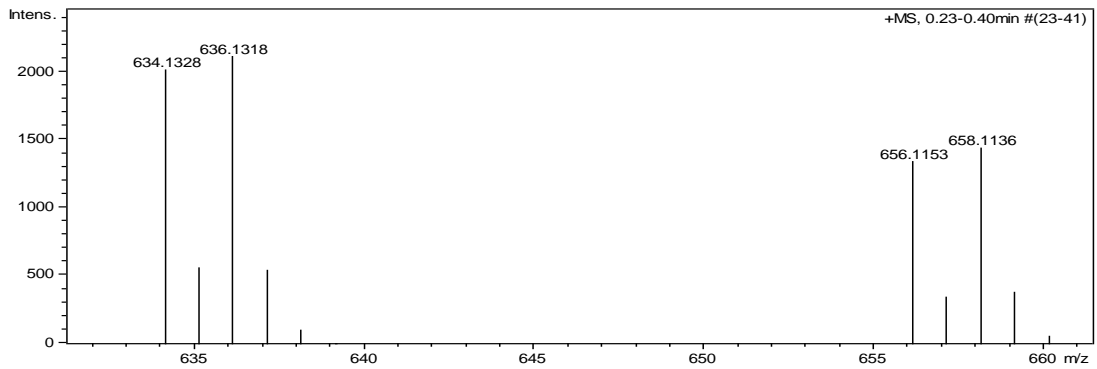
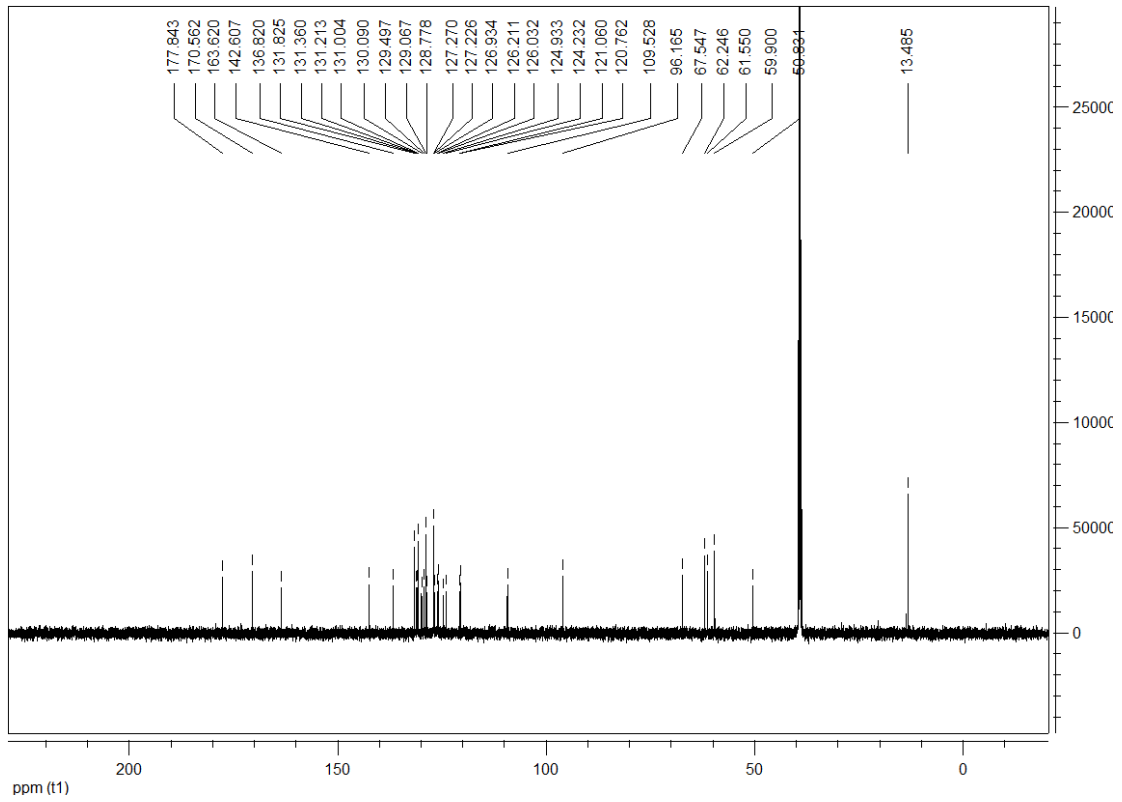




Ethyl

9'-(4-bromophenyl)-2-oxo-3'-phenyl-3a',9',10',11a'-tetrahydro-7b'H-spiro[indoline-3,8'-isoxazolo[5,4-c]pyrrolo[2,1-a]isoquinoline]-10'-carboxylate (2b¹): white solid, 38%, m.p. 237-239°C; ¹H NMR (400 MHz, DMSO-*d*₆) δ: 10.26 (s, 1H, NH), 7.81-7.79 (m, 2H, ArH), 7.58-7.52 (m, 5H, ArH), 7.28 (d, *J* = 8.4 Hz, 2H, ArH), 7.16-7.13 (m, 1H, ArH), 6.95-6.91 (m, 1H, ArH), 6.82 (d, *J* = 7.6 Hz, 1H, ArH), 6.77-6.69 (m, 3H, ArH), 5.93 (d, *J* = 7.2 Hz, 2H, ArH), 5.87 (d, *J* = 7.6 Hz, 1H, CH), 5.39 (d, *J* = 6.8 Hz, 1H, CH), 5.19 (s, 1H, CH), 4.54 (d, *J* = 7.2 Hz, 1H, CH), 3.97-3.89 (m, 2H, CH₂), 3.87-3.82 (m, 1H, CH), 0.76 (t, *J* = 6.8 Hz, 3H, CH₃); ¹³C NMR (150 MHz, DMSO-*d*₆) δ: 177.8, 170.5, 163.6, 142.6, 136.8, 131.8, 131.3, 131.2, 131.0, 130.0, 129.4, 129.0, 128.7, 127.2, 127.1, 126.9, 126.2, 126.0, 124.9, 124.2, 121.0, 120.7, 109.5, 96.1, 67.5, 62.2, 61.5, 59.8, 50.8, 13.4; IR (KBr) ν: 3297, 1725, 1617, 1475, 1402, 1335, 1217, 1149, 928, 795, 758 cm⁻¹; MS (*m/z*): HRMS (ESI) Calcd. for C₃₅H₂₉BrN₃O₄ ([M+H]⁺): 634.1336, found: 634.1328.

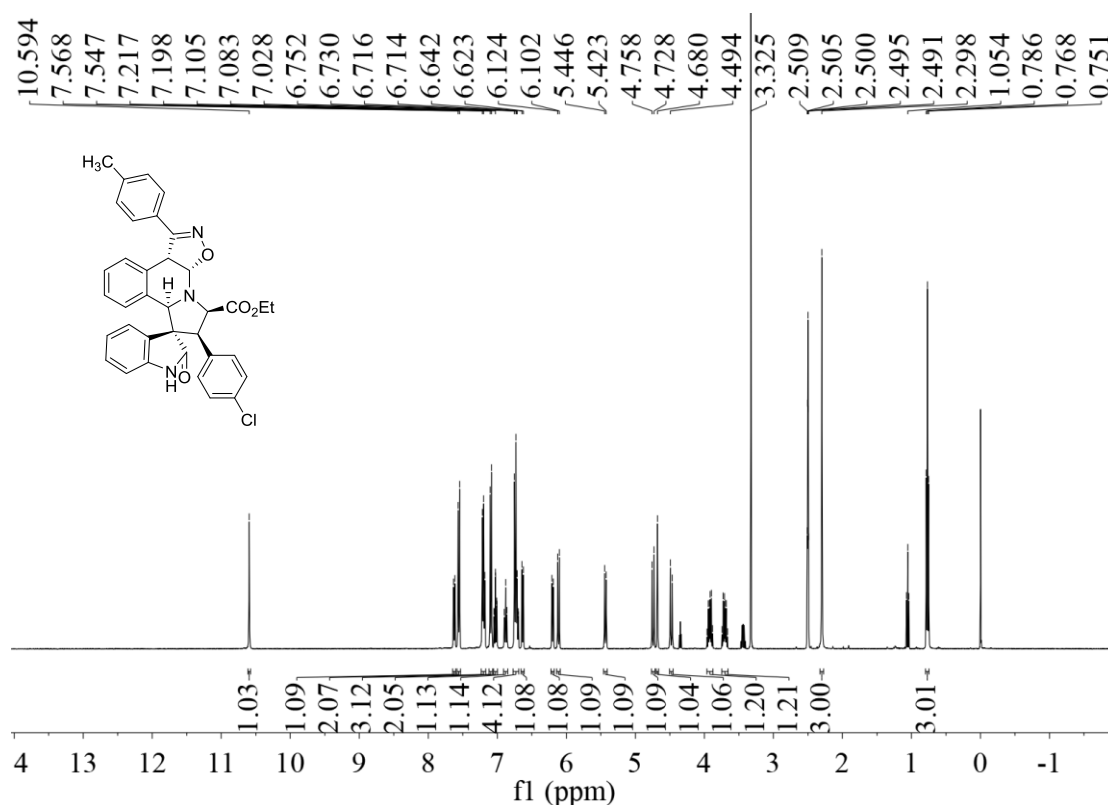


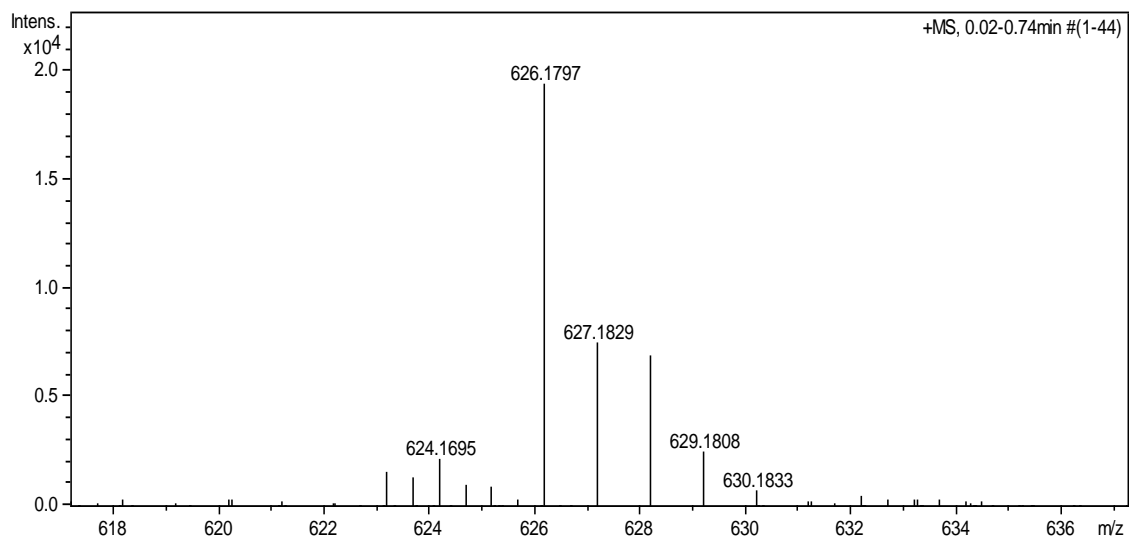
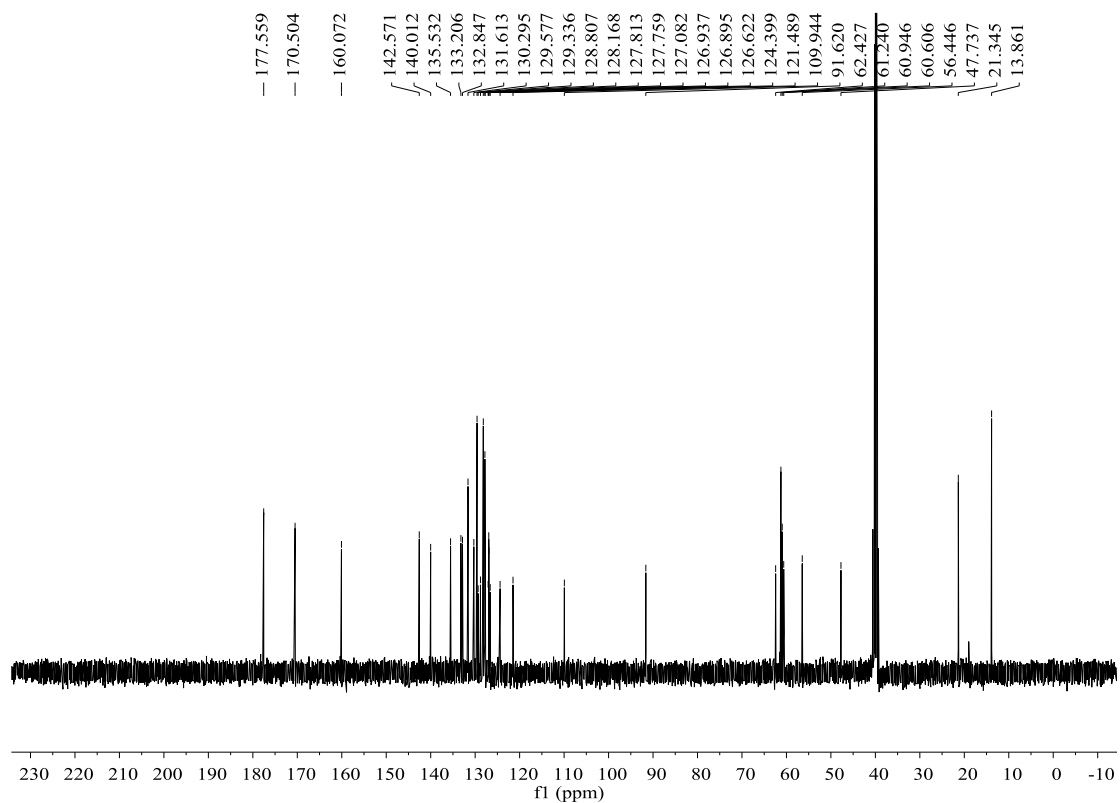


Ethyl

(3R,3a'R,7b'R,9'S,10'R,11a'S)-9'-(4-chlorophenyl)-2-oxo-3'-(*p*-tolyl)-3a',9',10',11a'-tetrahydro-*o*-7b'*H*-spiro[indoline-3,8'-isoxazolo[5,4-*c*]pyrrolo[2,1-*a*]isoquinoline]-10'-carboxylate (2c):

white solid, 36%, m.p. 238-240°C; ¹H NMR (400 MHz, DMSO-*d*₆) δ: 10.59 (s, 1H, NH), 7.62 (d, *J* = 7.2 Hz, 1H, ArH), 7.56 (d, *J* = 8.4 Hz, 2H, ArH), 7.20 (t, *J* = 7.6 Hz, 3H, ArH), 7.09 (d, *J* = 8.8 Hz, 2H, ArH), 7.05-7.00 (m, 1H, ArH), 6.88 (t, *J* = 7.6 Hz, 1H, ArH), 6.75-6.69 (m, 4H, ArH), 6.63 (d, *J* = 7.6 Hz, 1H, ArH), 6.20 (d, *J* = 7.6 Hz, 1H, CH), 6.11 (d, *J* = 8.8 Hz, 1H, CH), 5.43 (d, *J* = 9.2 Hz, 1H, CH), 4.74 (d, *J* = 12.0 Hz, 1H, CH), 4.68 (s, 1H, CH), 4.48 (d, *J* = 11.6 Hz, 1H, CH), 3.96-3.88 (m, 1H, CH), 3.74-3.66 (m, 1H, CH), 2.30 (s, 3H, CH₃), 0.77 (t, *J* = 7.2 Hz, 3H, CH₃); ¹³C NMR (150 MHz, DMSO-*d*₆) δ: 177.5, 170.5, 160.0, 142.5, 140.0, 135.5, 133.2, 132.8, 131.6, 130.2, 129.5, 129.3, 128.8, 128.1, 127.8, 127.7, 127.0, 126.9, 126.8, 126.6, 124.3, 121.4, 109.9, 91.6, 62.4, 61.2, 60.9, 60.6, 56.4, 47.7, 21.3, 13.8.; IR (KBr) ν: 3281, 2928, 1720, 1616, 1479, 1396, 1334, 1198, 1099, 1019, 910, 818, 750 cm⁻¹; MS (*m/z*): HRMS (ESI) Calcd. for C₃₆H₃₀ClNaN₃O₄ ([M+Na]⁺): 626.1797, found: 626.1817.

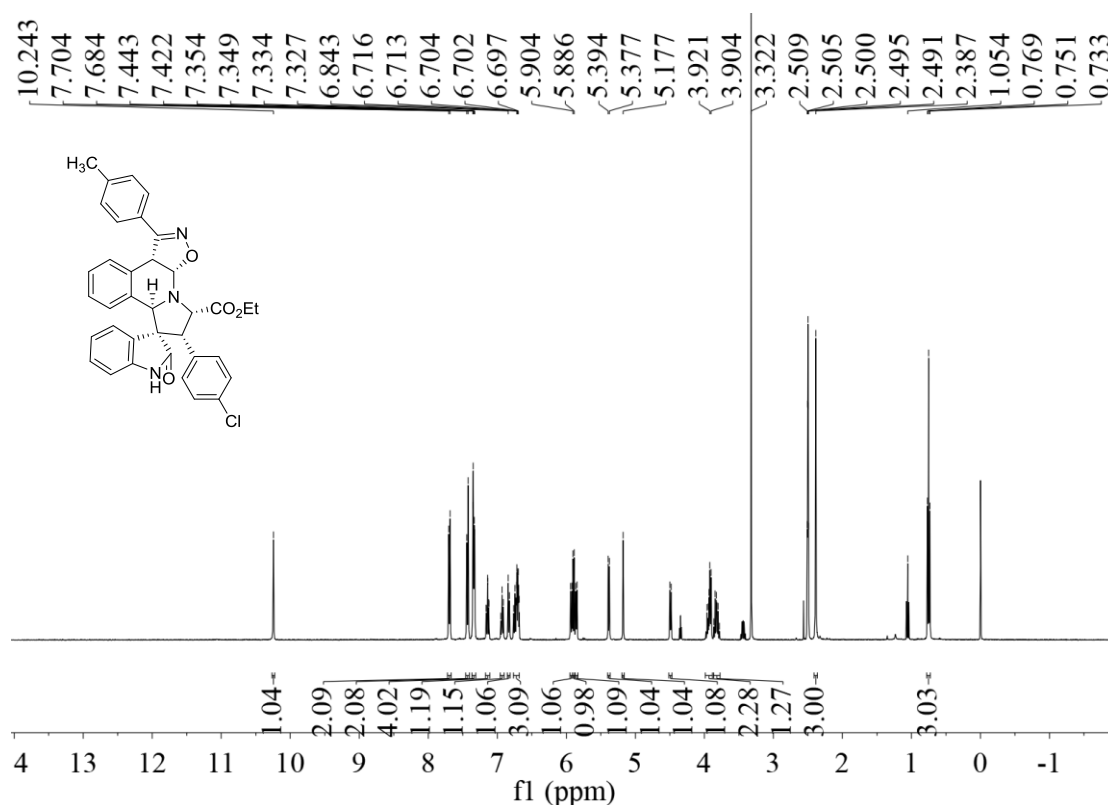


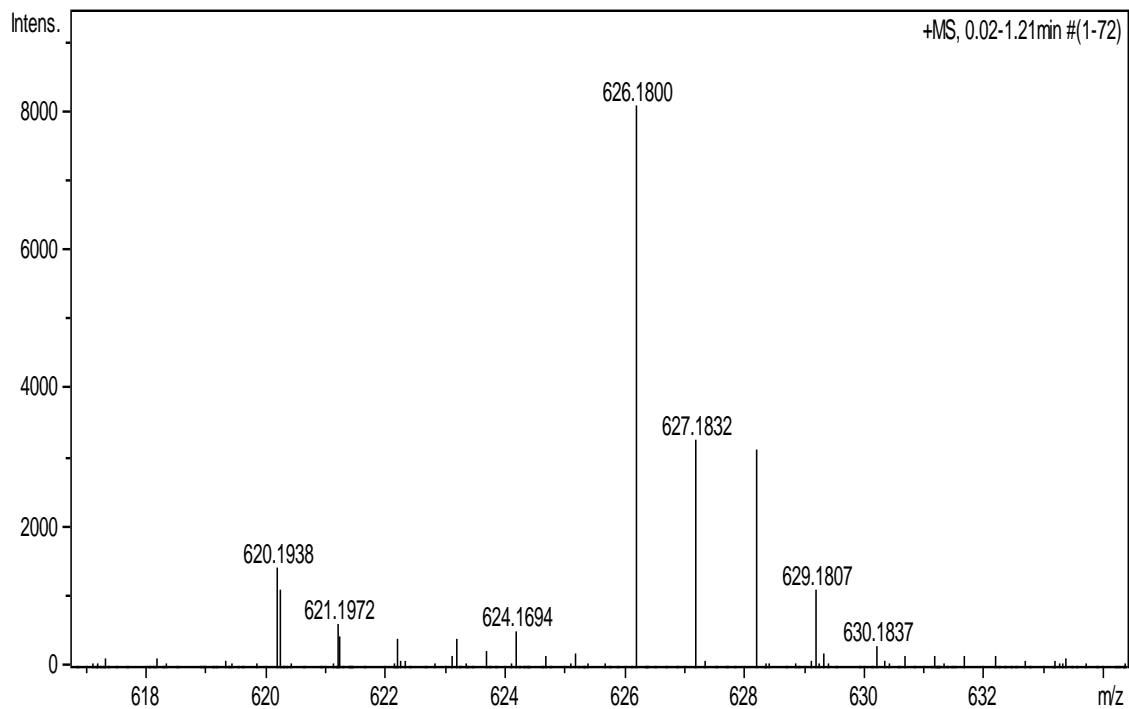
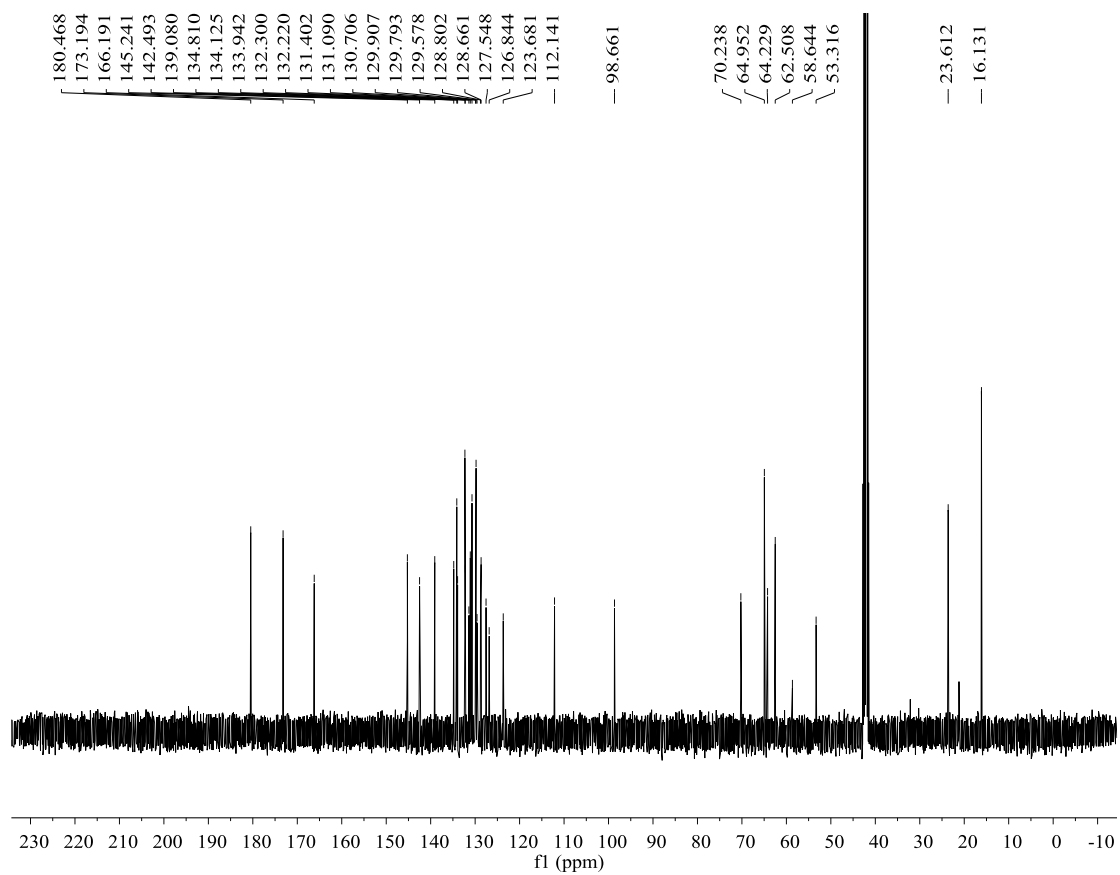


Ethyl

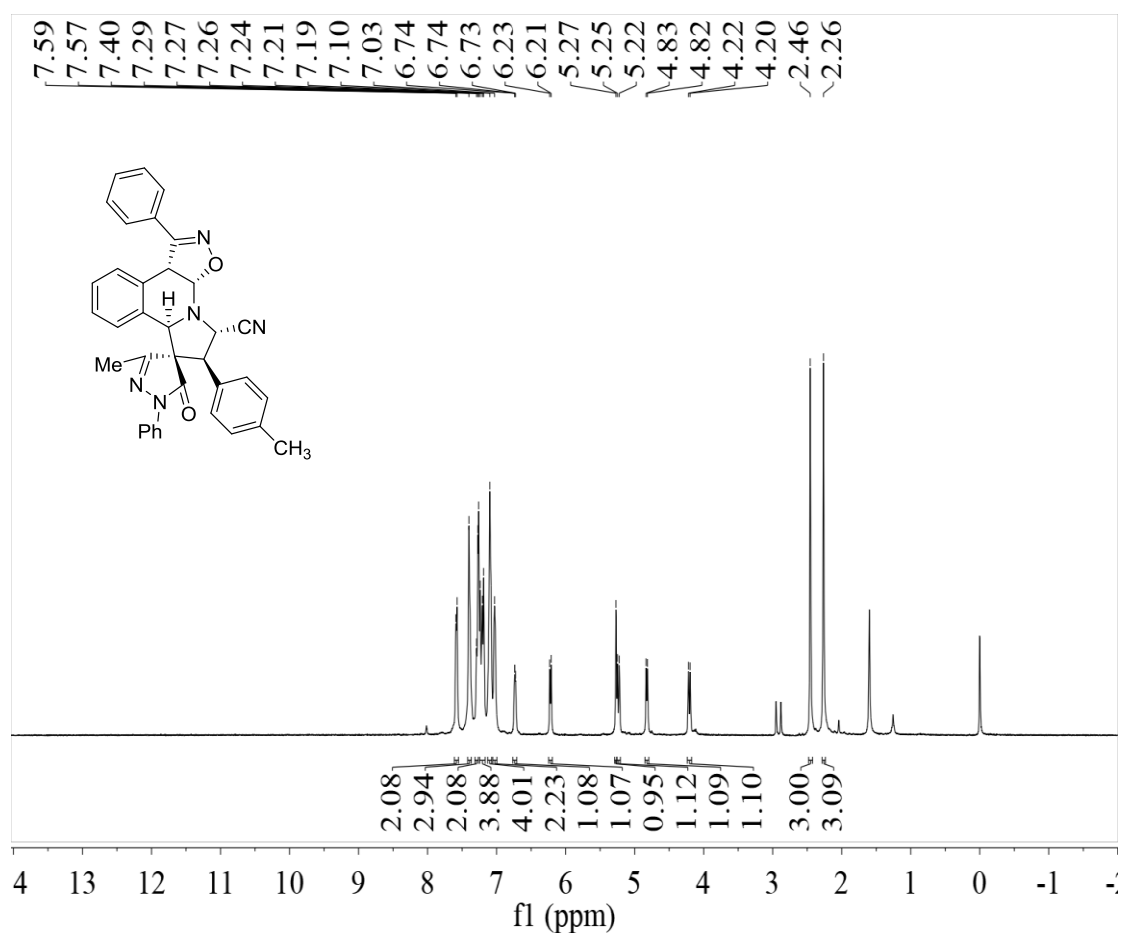
(3a'R,7b'R,9'R,10'S,11a'S)-9'-(4-chlorophenyl)-2-oxo-3'-(*p*-tolyl)-3a',9',10',11a'-tetrahydro-7b'H-spiro[indoline-3,8'-isoxazolo[5,4-c]pyrrolo[2,1-a]isoquinoline]-10'-carboxylate (2c')

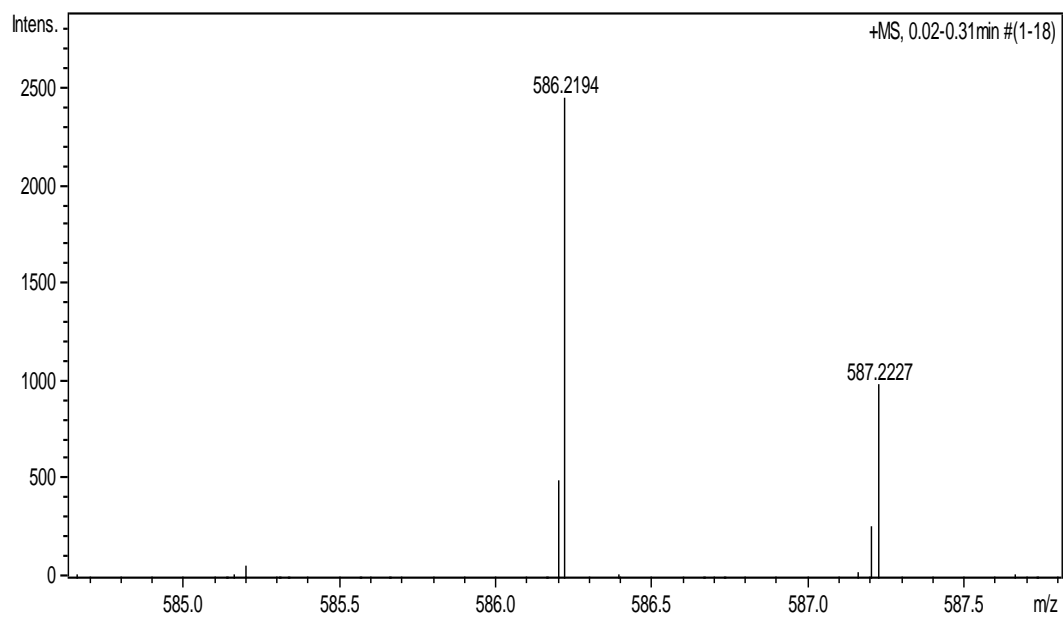
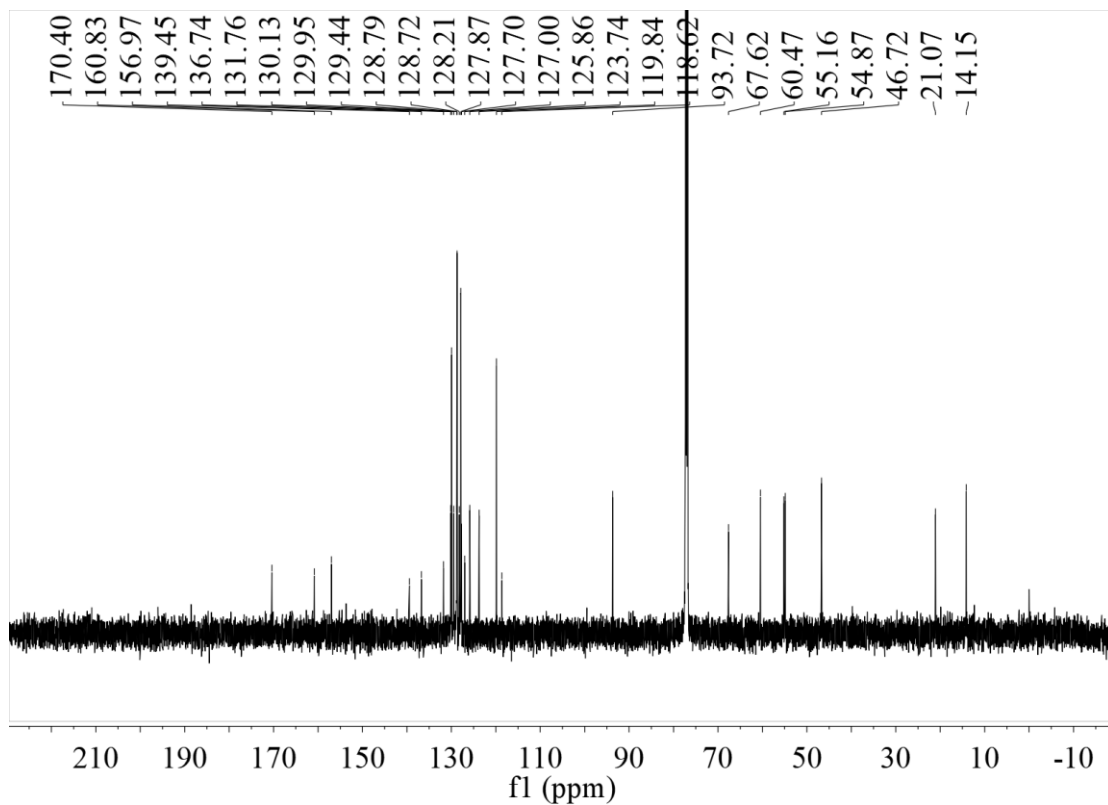
white solid, 32%, m.p. 232-234 °C; ¹H NMR (400 MHz, DMSO-*d*₆) δ: 10.24 (s, 1H, NH), 7.69 (d, *J* = 8.0 Hz, 2H, ArH), 7.43 (d, *J* = 8.4 Hz, 2H, ArH), 7.35-7.33 (m, 4H, ArH), 7.16-7.12 (m, 1H, ArH), 6.93 (t, *J* = 7.6 Hz, 1H, ArH), 6.83 (d, *J* = 7.6 Hz, 1H, ArH), 6.76-6.67 (m, 3H, ArH), 5.93 (d, *J* = 7.6 Hz, 2H, CH), 5.89 (d, *J* = 7.2 Hz, 1H, CH), 5.85 (d, *J* = 7.6 Hz, 1H, CH), 5.38 (d, *J* = 6.8 Hz, 1H, CH), 5.18 (s, 1H, CH), 4.49 (d, *J* = 7.6 Hz, 1H, CH), 3.96-3.90 (m, 2H, CH₂), 3.86-3.78 (m, 1H, CH), 2.39 (s, 3H, CH₃), 0.75 (t, *J* = 7.2 Hz, 3H, CH₃); ¹³C NMR (150 MHz, DMSO-*d*₆) δ: 180.4, 173.1, 166.1, 145.2, 142.4, 139.0, 134.8, 134.1, 133.9, 132.2, 132.1, 131.4, 131.0, 130.7, 129.9, 129.7, 129.5, 128.8, 128.6, 127.5, 126.8, 123.6, 112.1, 98.6, 70.2, 64.9, 64.2, 62.5, 58.6, 53.3, 23.6, 16.1; IR (KBr) ν: 3185, 3071, 1712, 1659, 1618, 1479, 1383, 1295, 1182, 1096, 1019, 785, 748 cm⁻¹; MS (*m/z*): HRMS (ESI) Calcd. for C₃₅H₂₉BrN₃O₄ ([M+H]⁺): 626.1800, found: 626.1817.



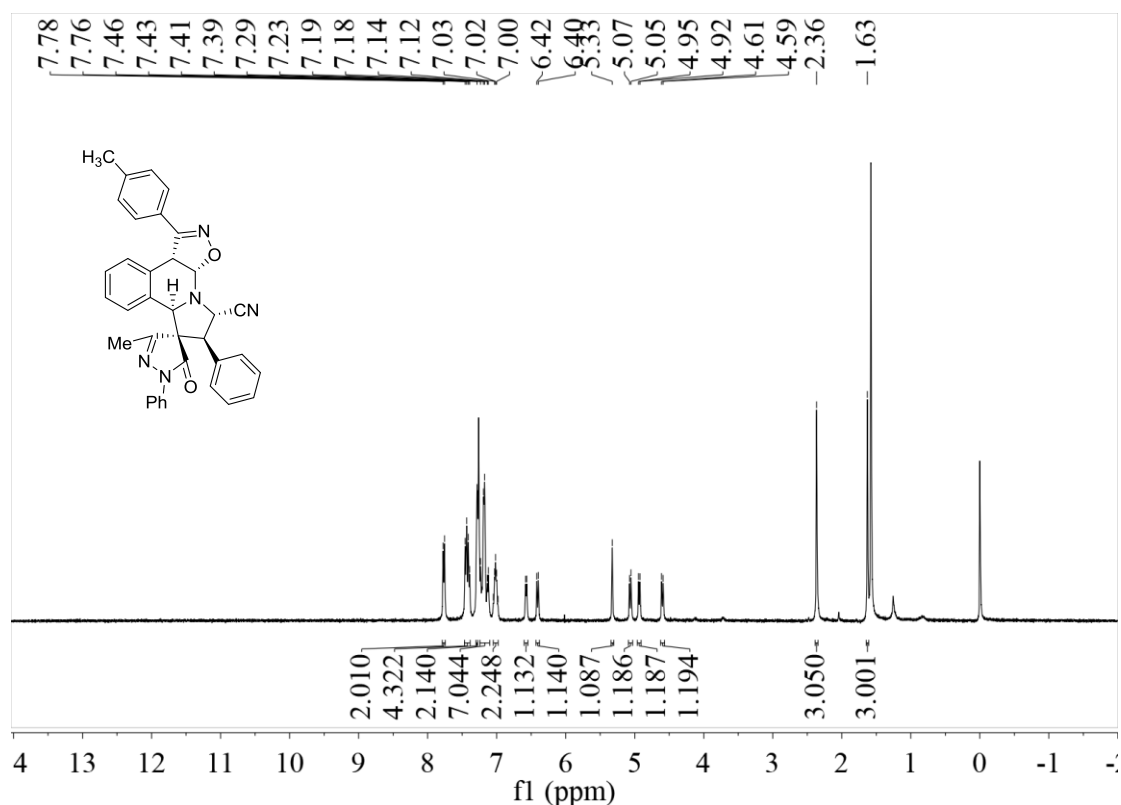


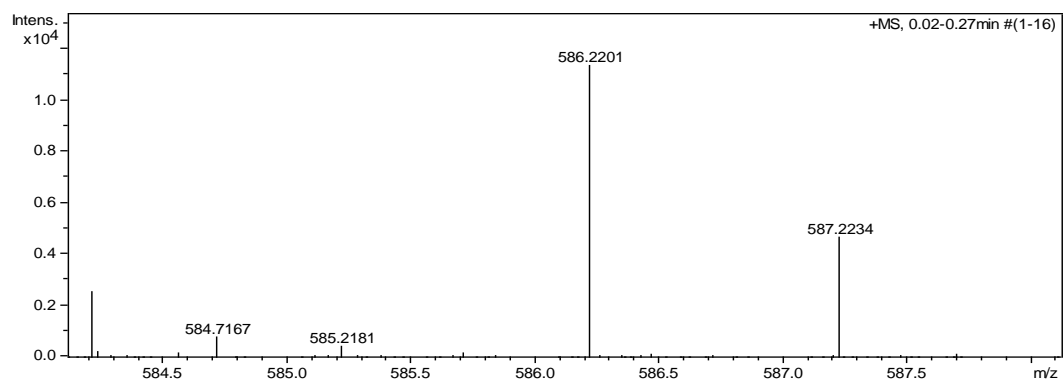
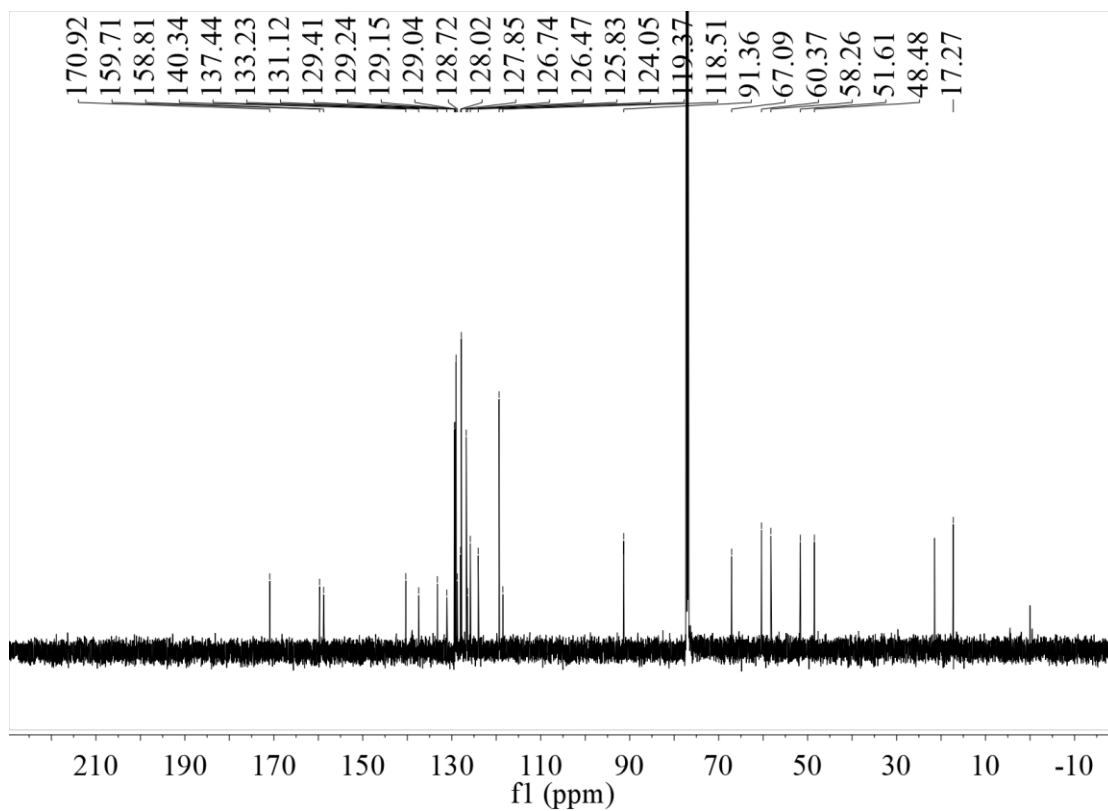
3'-methyl-5'-oxo-1',3-diphenyl-9-(*p*-tolyl)-1',3a,5',9,10,11a-hexahydro-7*b*H-spiro[isoxazolo[5,4-*c*]pyrrolo[2,1-*a*]isoquinoline-8,4'-pyrazole]-10-carbonitrile (3a) : white solid, 50 %, m.p. 239-241 °C; ¹H NMR (400 MHz, CDCl₃) δ: 7.58 (d, *J* = 6.4 Hz, 2H, ArH), 7.40 (s, 3H, ArH), 7.28 (d, *J* = 8.0 Hz, 2H, ArH), 7.24-7.19 (m, 4H, ArH), 7.10 (s, 4H, ArH) 7.03 (s, 2H, ArH), 6.73 (d, *J* = 5.2 Hz, 1H, CH), 6.22 (d, *J* = 8.0 Hz, 1H, CH), 5.27 (s, 1H, CH), 5.24 (d, *J* = 10.8 Hz, 1H, CH), 4.83 (d, *J* = 8.0 Hz, 1H, CH), 4.21 (d, *J* = 10.4 Hz, 1H, CH), 2.46 (s, 3H, CH₃), 2.27 (s, 3H, CH₃); ¹³C NMR (100 MHz, CDCl₃) δ: 170.3, 160.8, 156.9, 139.4, 136.7, 131.7, 130.1, 129.9, 129.4, 128.7, 128.7, 128.2, 127.8, 127.7, 127.0, 125.8, 123.7, 119.8, 118.6, 93.7, 93.7, 67.6, 60.4, 55.1, 54.8, 46.7, 21.0, 14.1; IR(KBr) ν: 3670, 3034, 2910, 2238, 1708, 1595, 1522, 1497, 1449, 1406, 1368, 1339, 1310, 1205, 1158, 1128, 1094, 990, 893, 848, 819, 752 cm⁻¹; MS (*m/z*): HRMS (ESI) Calcd. For C₃₆H₂₉N₅NaO₂ ([M+Na]⁺): 586.2194, found: 586.2213.



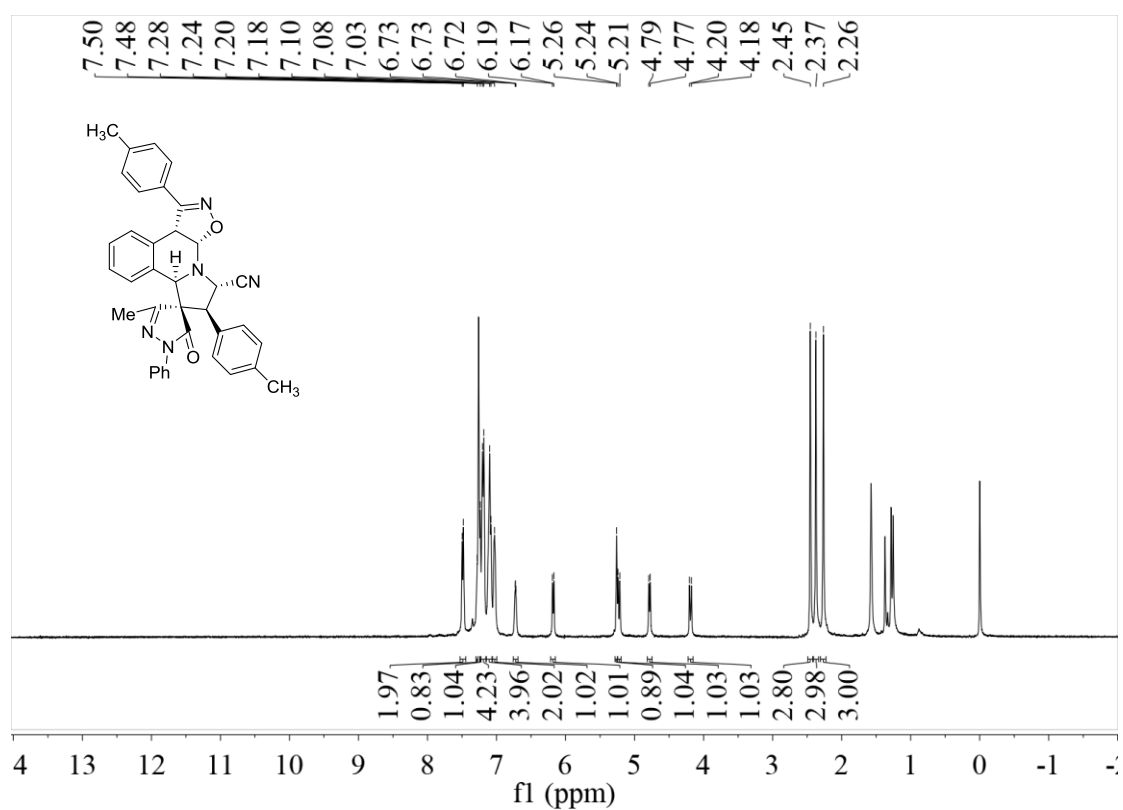


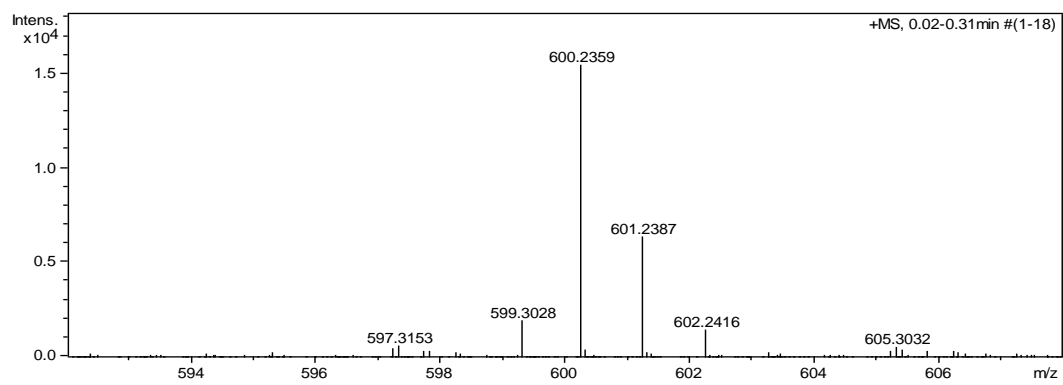
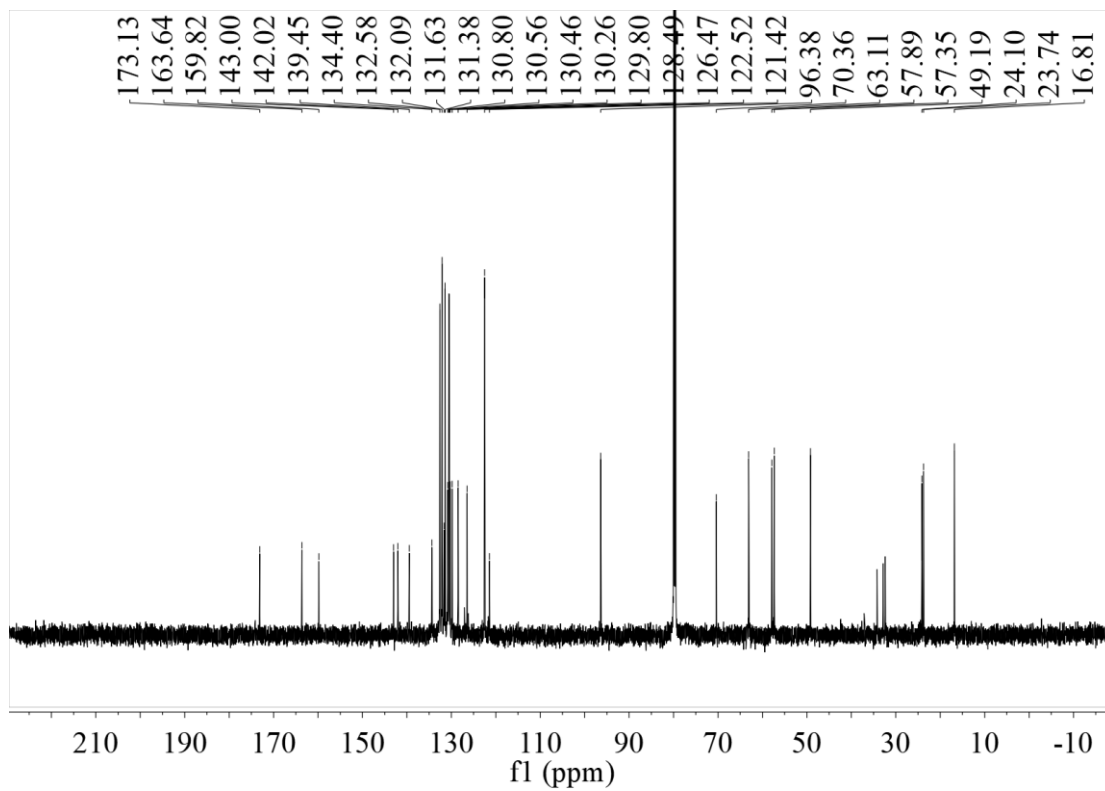
3'-methyl-5'-oxo-1',9-diphenyl-3-(*p*-tolyl)-1',3a,5',9,10,11a-hexahydro-7*b*H-spiro[isoxazolo[5,4-*c*]pyrrolo[2,1-*a*]isoquinoline-8,4'-pyrazole]-10-carbonitrile (3b) : white solid, 48 %, m.p. 178-180 °C; ¹H NMR (400 MHz, CDCl₃) δ: 7.77 (d, *J* = 7.6 Hz, 2H, ArH), 7.46-7.39 (m, 4H, ArH), 7.27 (s, 2H, ArH), 7.24-7.12 (m, 7H, ArH), 7.05-6.98 (m, 2H, ArH), 6.57 (d, *J* = 6.8 Hz, 1H, ArH), 6.41 (d, *J* = 8.4 Hz, 1H, CH), 5.33 (s, 1H, CH), 5.06 (d, *J* = 8.8 Hz, 1H, CH), 4.93 (d, *J* = 8.4 Hz, 1H, CH), 4.60 (d, *J* = 9.2 Hz, 1H, CH), 2.37 (s, 3H, CH₃), 1.63 (s, 3H, CH₃); ¹³C NMR (100 MHz, CDCl₃) δ: 170.9, 159.7, 158.8, 140.3, 137.4, 133.2, 131.1, 129.4, 129.2, 129.1, 129.0, 128.7, 128.0, 127.8, 126.7, 126.4, 125.8, 124.0, 119.3, 118.5, 91.3, 67.0, 60.3, 58.2, 51.6, 48.4, 17.2; IR(KBr) ν: 3601, 3037, 2979, 2953, 2914, 2835, 1708, 1595, 1497, 1454, 1400, 1352, 1228, 1204, 1150, 1111, 999, 953, 908, 830, 765, 743 cm⁻¹; MS (*m/z*): HRMS (ESI) Calcd. For C₃₆H₂₉N₅NaO₂ ([M+Na]⁺): 586.2201, found: 586.2213.



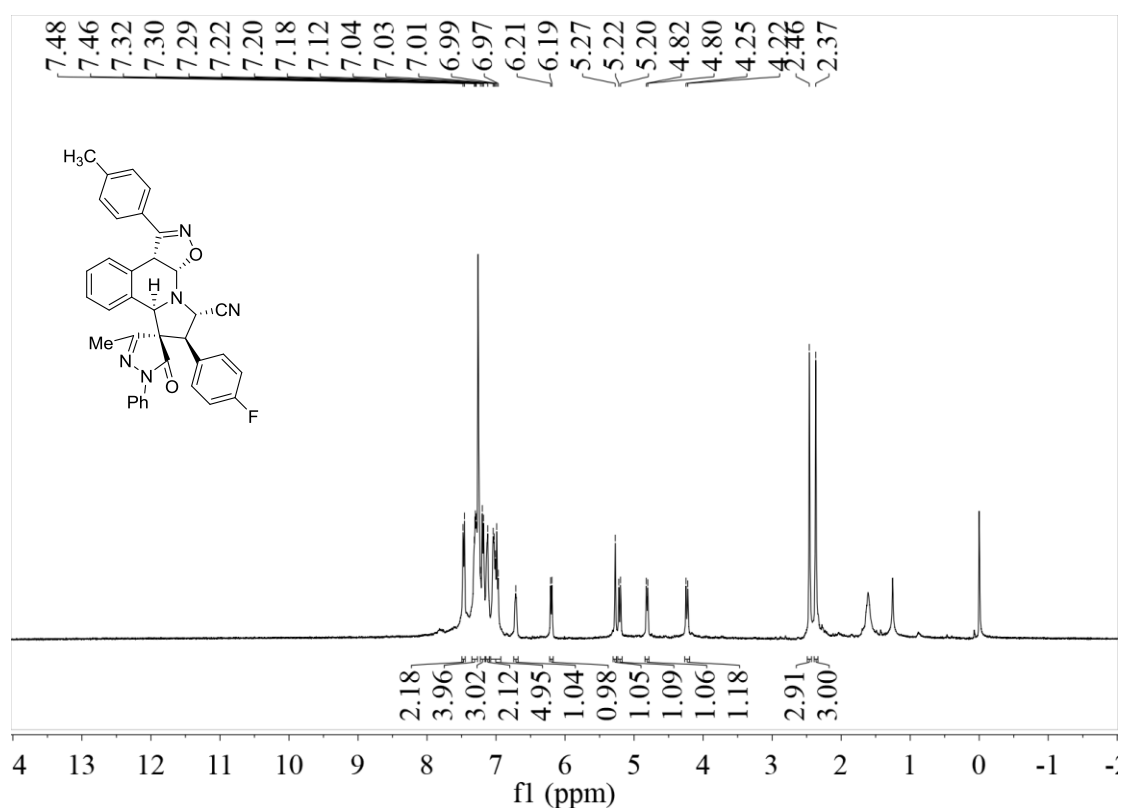


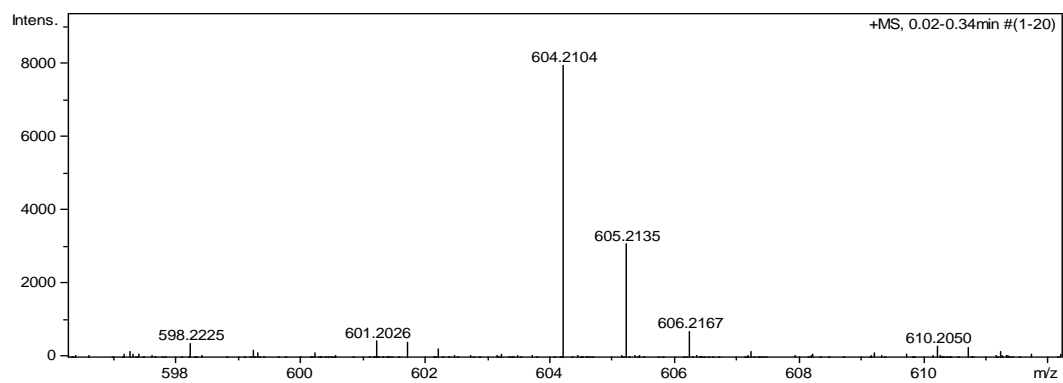
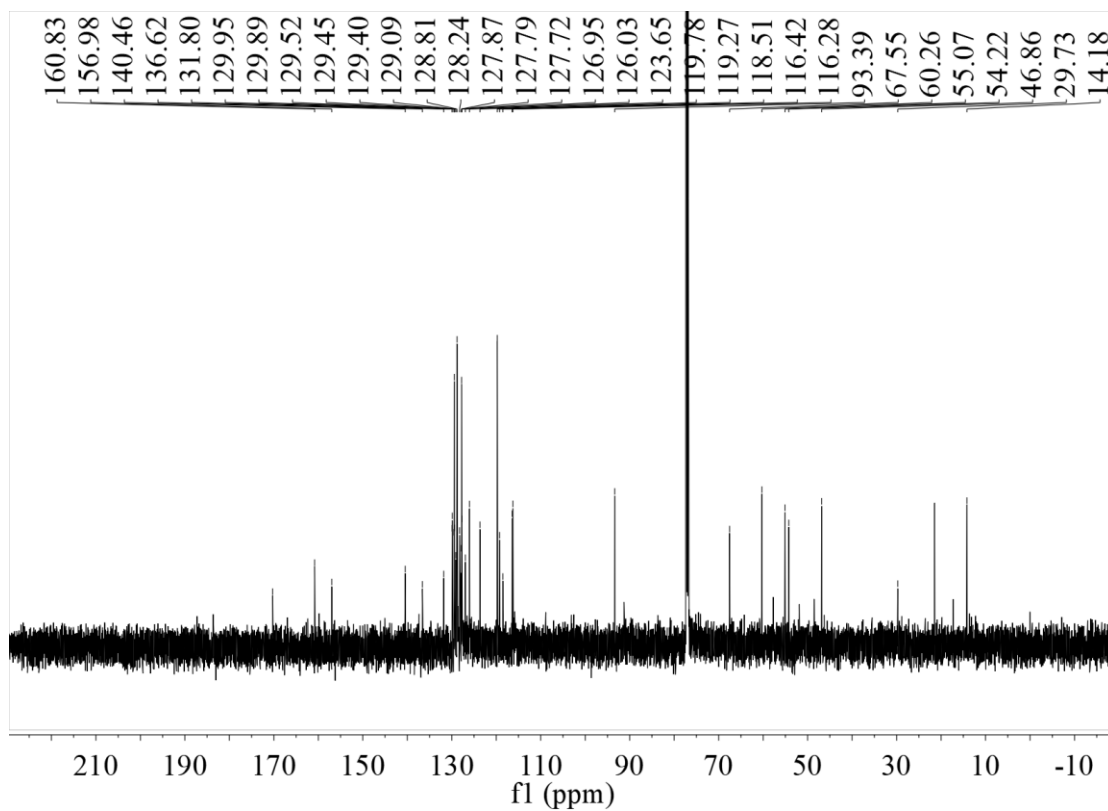
3'-methyl-5'-oxo-1'-phenyl-3,9-di-p-tolyl-1',3a,5',9,10,11a-hexahydro-7bH-spiro[isoxazolo[5,4-c]pyrrolo[2,1-a]isoquinoline-8,4'-pyrazole]-10-carbonitrile (3c) : white solid, 58 %, m.p. 203-205 °C; ¹H NMR (400 MHz, CDCl₃) δ: 7.49 (d, *J* = 6.8 Hz, 2H, ArH), 7.28 (s, 1H, ArH), 7.24 (s, 2H, ArH), 7.19 (d, *J* = 8.4 Hz, 5H, ArH), 7.09 (d, *J* = 8.4 Hz, 4H, ArH), 7.03 (s, 2H, ArH), 6.73-6.72 (m, 1H, ArH), 6.18 (d, *J* = 7.6 Hz, 1H, CH), 5.26 (s, 1H, CH), 5.22 (d, *J* = 10.8 Hz, 1H, CH), 4.78 (d, *J* = 7.6 Hz, 1H, CH), 4.19 (d, *J* = 10.4 Hz, 1H, CH), 2.45 (s, 3H, CH₃), 2.37 (s, 3H, CH₃), 2.27 (s, 3H, CH₃); ¹³C NMR (100 MHz, CDCl₃) δ: 229.5, 173.1, 163.6, 159.8, 143.0, 142.0, 139.4, 134.3, 132.5, 132.0, 131.6, 131.3, 130.8, 130.5, 130.4, 130.2, 129.8, 128.4, 126.4, 122.5, 121.4, 96.3, 70.3, 63.1, 57.8, 57.3, 49.1, 24.1, 23.7, 16.8; IR(KBr) ν: 3704, 3032, 2918, 2851, 1704, 1594, 1497, 1432, 1405, 1373, 1313, 1290, 1201, 1159, 1130, 927, 856, 817, 758 cm⁻¹; MS (*m/z*): HRMS (ESI) Calcd. For C₃₇H₃₁N₅NaO₂ ([M+Na]⁺): 600.2359, found: 600.2370.



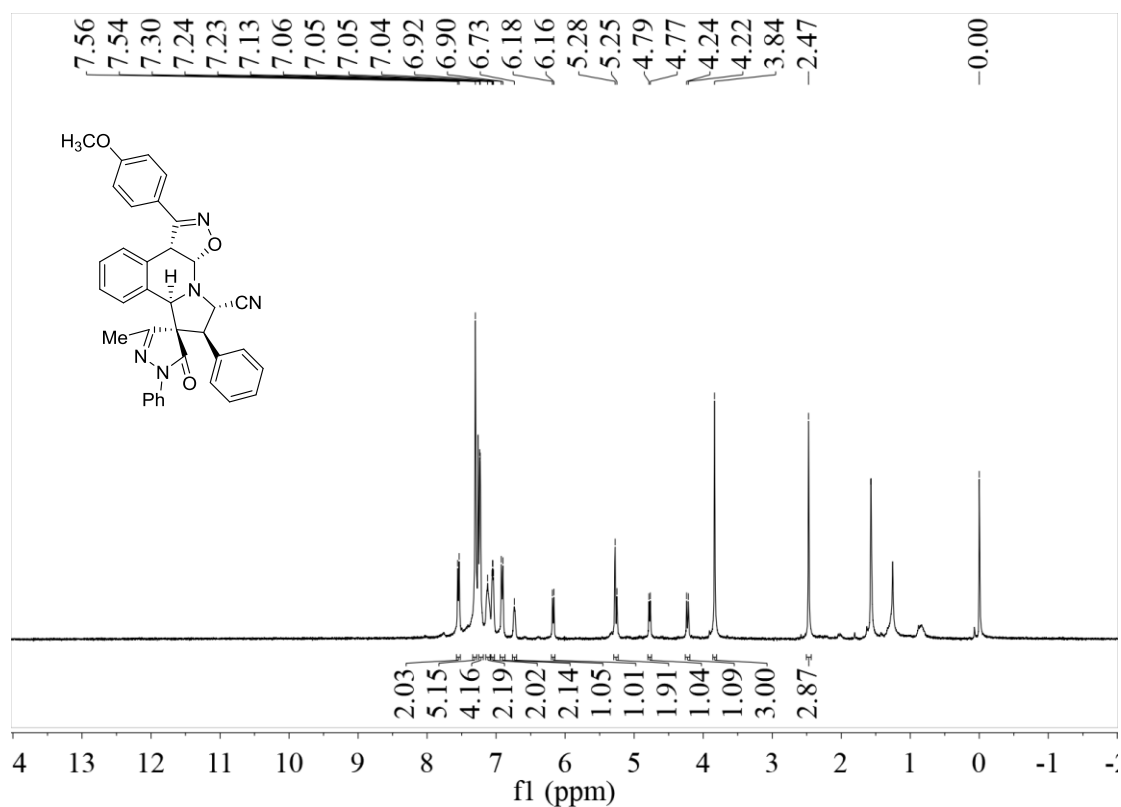


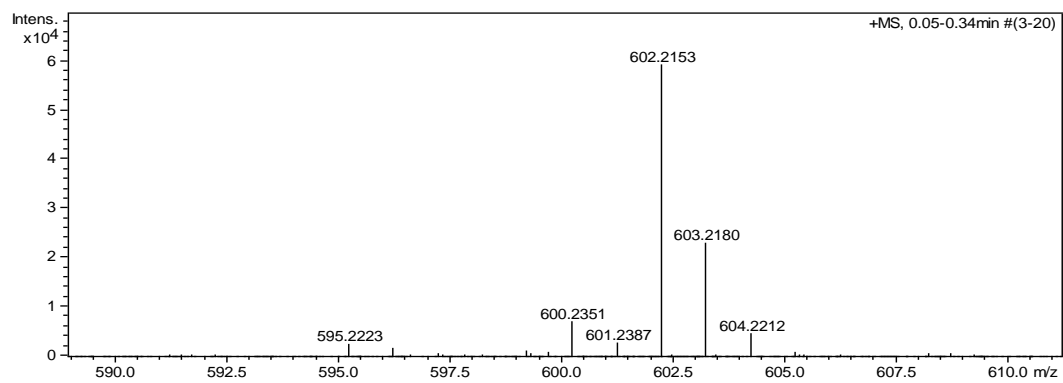
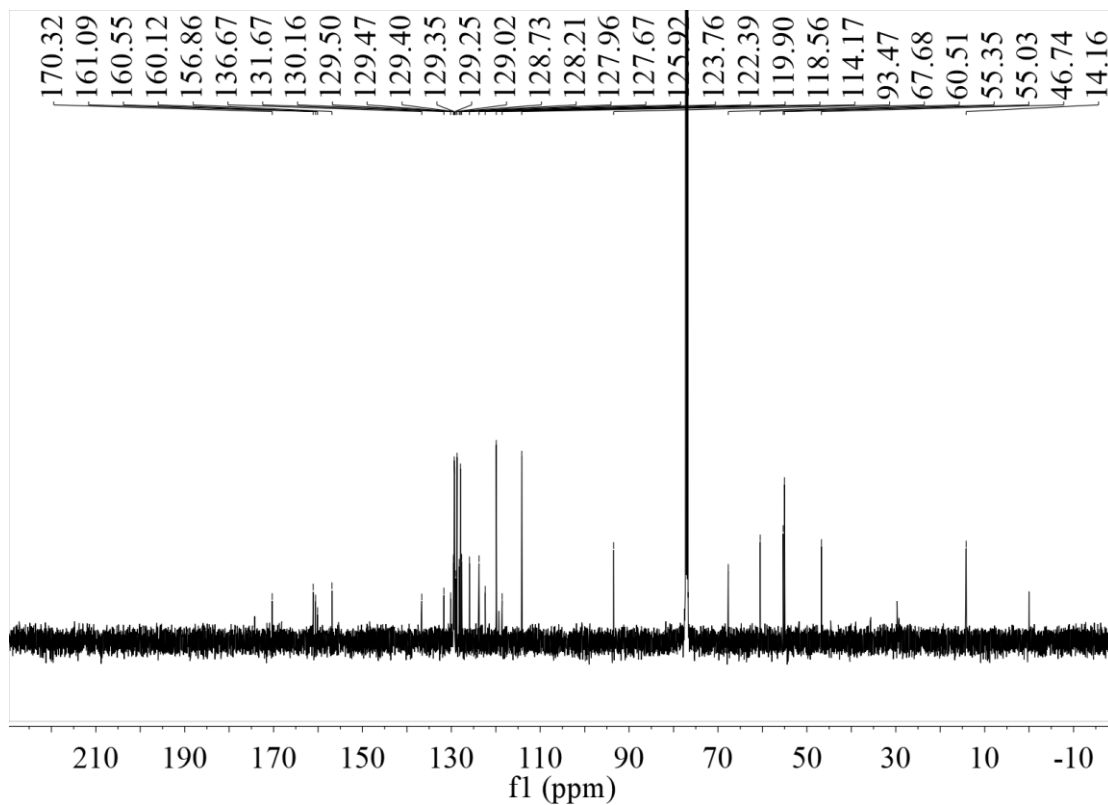
9-(4-fluorophenyl)-3'-methyl-5'-oxo-1'-phenyl-3-(*p*-tolyl)-1',3a,5',9,10,11a-hexahydro-7bH-spiro[isoxazolo[5,4-c]pyrrolo[2,1-a]isoquinoline-8,4'-pyrazole]-10-carbonitrile (3d) : white solid, 50 %, m.p. 197-199 °C; ¹H NMR (400 MHz, CDCl₃) δ: 7.47 (d, *J* = 8.0 Hz, 2H, ArH), 7.32-7.29 (m, 4H, ArH), 7.12 (s, 2H, ArH), 7.04-6.97 (m, 5H, ArH), 6.71 (s, 1H, ArH), 6.20 (d, *J* = 7.6 Hz, 1H, CH), 5.27 (s, 1H, CH), 5.21 (d, *J* = 10.0 Hz, 1H, CH), 4.81 (d, *J* = 8.0 Hz, 1H, CH), 4.24 (d, *J* = 10.8 Hz, 1H, CH), 2.46 (s, 3H, CH₃), 2.37 (s, 3H, CH₃); ¹³C NMR (100 MHz, CDCl₃) δ: 170.2, 160.8, 156.9, 140.4, 136.6, 131.7, 129.9, 129.8, 129.5, 129.4, 129.9 (d, *J* = 21.6 Hz), 128.8, 128.2, 127.8, 127.7, 127.7, 126.9, 126.0, 123.6, 119.7, 119.2, 118.5, 116.4 (d, *J* = 58 Hz), 93.3, 67.5, 60.2, 55.0, 54.2, 46.8, 29.7, 14.1; IR(KBr) ν: 3684, 3063, 3015, 2901, 2840, 1704, 1608, 1514, 1457, 1416, 1367, 1314, 1261, 1232, 1203, 1167, 1135, 1112, 1046, 1025, 982, 920, 839, 783, 751 cm⁻¹; MS (*m/z*): HRMS (ESI) Calcd. For C₃₆H₂₈FN₅NaO₂ ([M+Na]⁺): 604.2104, found: 604.2119.



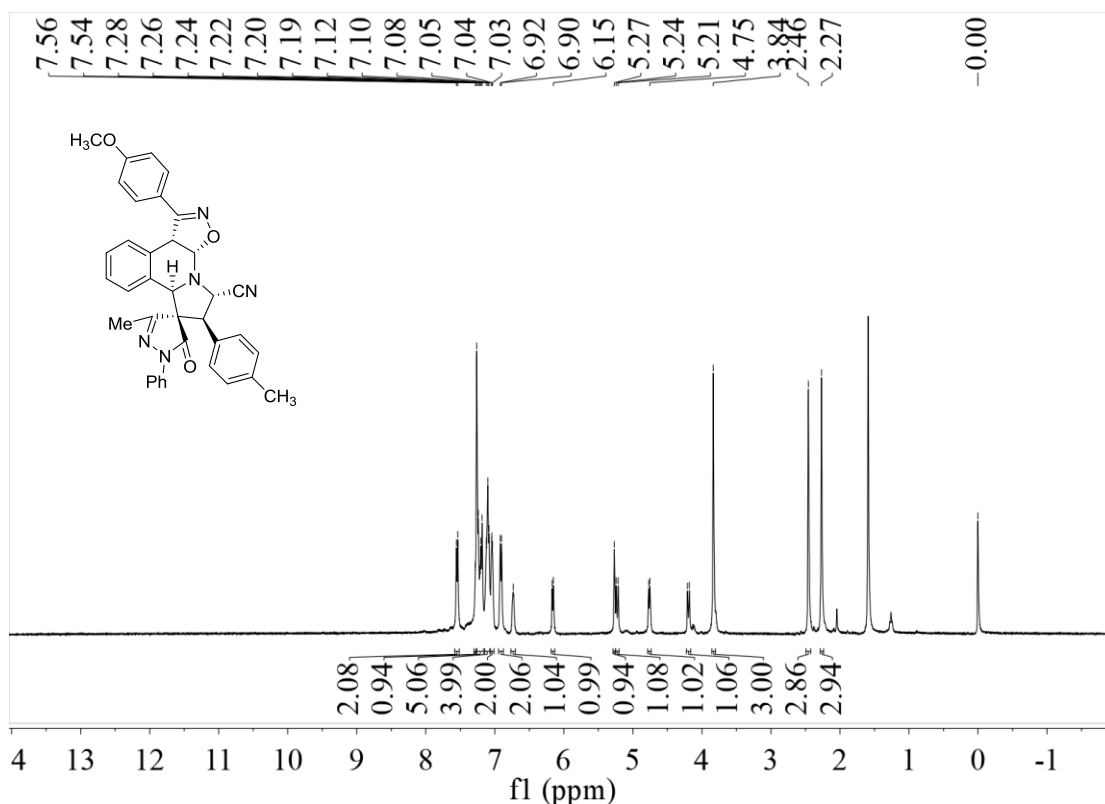


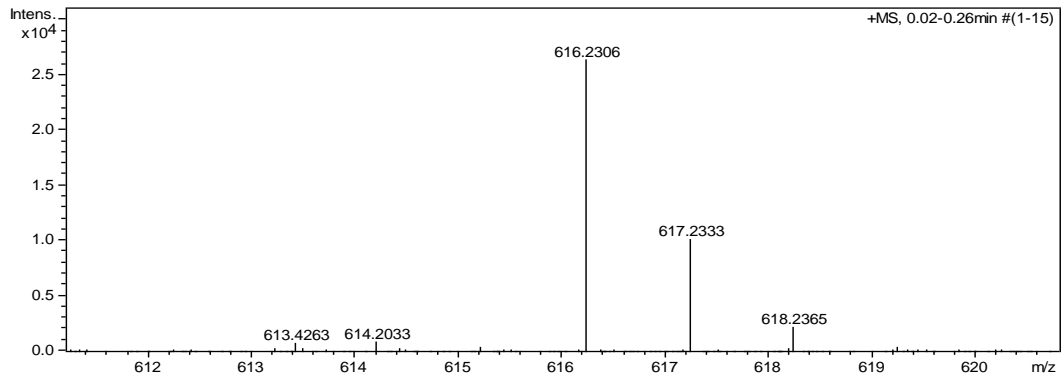
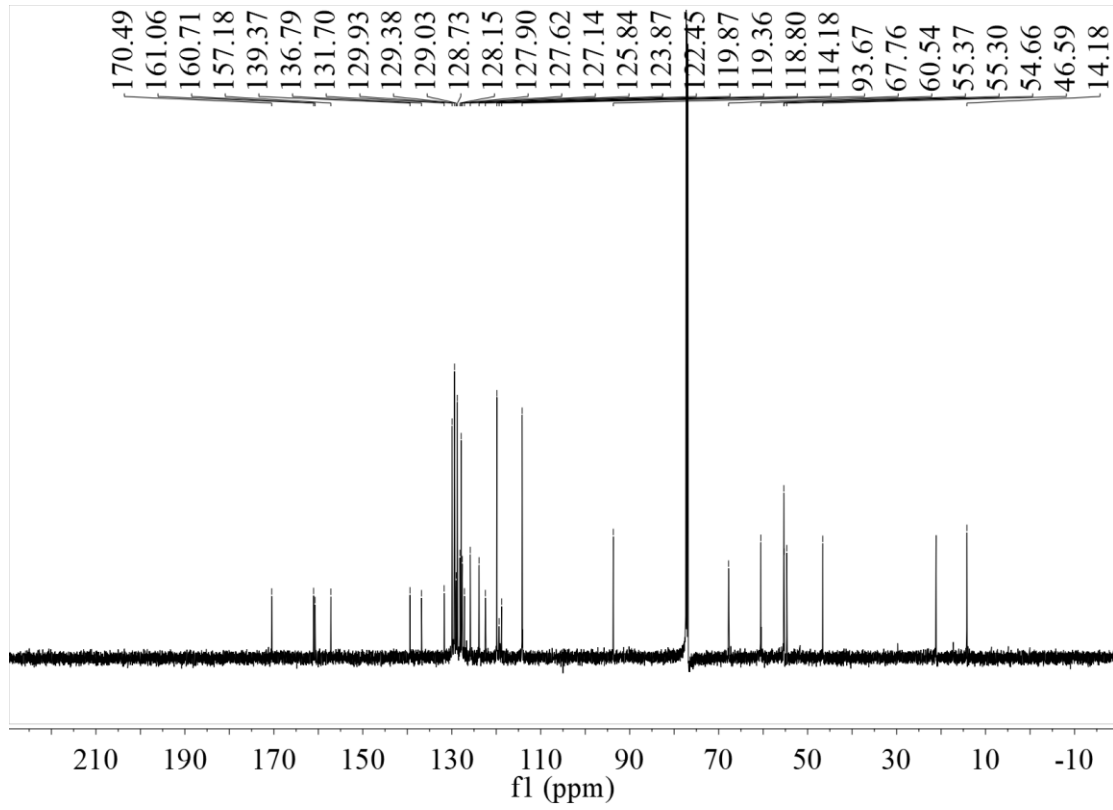
3-(4-methoxyphenyl)-3'-methyl-5'-oxo-1',9-diphenyl-1',3a,5',9,10,11a-hexahydro-7bH-spiro[isoxazolo[5,4-c]pyrrolo[2,1-a]isoquinoline-8,4'-pyrazole]-10-carbonitrile (3e) : white solid, 51 %, m.p. 134-136 °C; ¹H NMR (400 MHz, CDCl₃) δ: 7.55 (d, J = 8.8 Hz, 2H, ArH), 7.30 (s, 5H, ArH), 7.23 (d, J = 3.2 Hz, 4H, ArH), 7.13 (s, 2H, ArH), 7.06-7.04 (m, 2H, ArH), 6.91 (d, J = 9.2 Hz, 2H, ArH), 6.73 (s, 1H, ArH), 6.17 (d, J = 7.6 Hz, 1H, CH), 5.26 (d, J = 8.4 Hz, 2H, CH), 4.78 (d, J = 5.2 Hz, 1H, CH), 4.23 (d, J = 6.0 Hz, 1H, CH), 3.84 (s, 3H, OCH₃), 2.48 (s, 3H, CH₃); ¹³C NMR (100 MHz, CDCl₃) δ: 170.3, 161.0, 160.5, 160.1, 156.8, 136.6, 131.6, 130.1, 129.4, 129.4, 129.3, 129.2, 129.0, 128.7, 128.2, 127.9, 127.6, 125.9, 123.7, 122.3, 119.8, 118.5, 114.1, 93.4, 67.6, 60.5, 55.3, 55.0, 46.7, 14.1; IR(KBr) ν: 3654, 3065, 3036, 2919, 2839, 2217, 1703, 1602, 1498, 1456, 1407, 1369, 1341, 1306, 1255, 1213, 1175, 1132., 1025, 952, 910, 838, 811, 748 cm⁻¹; MS (m/z): HRMS (ESI) Calcd. For C₃₆H₂₉N₅NaO₃ ([M+Na]⁺): 602.2153, found:602.2163.



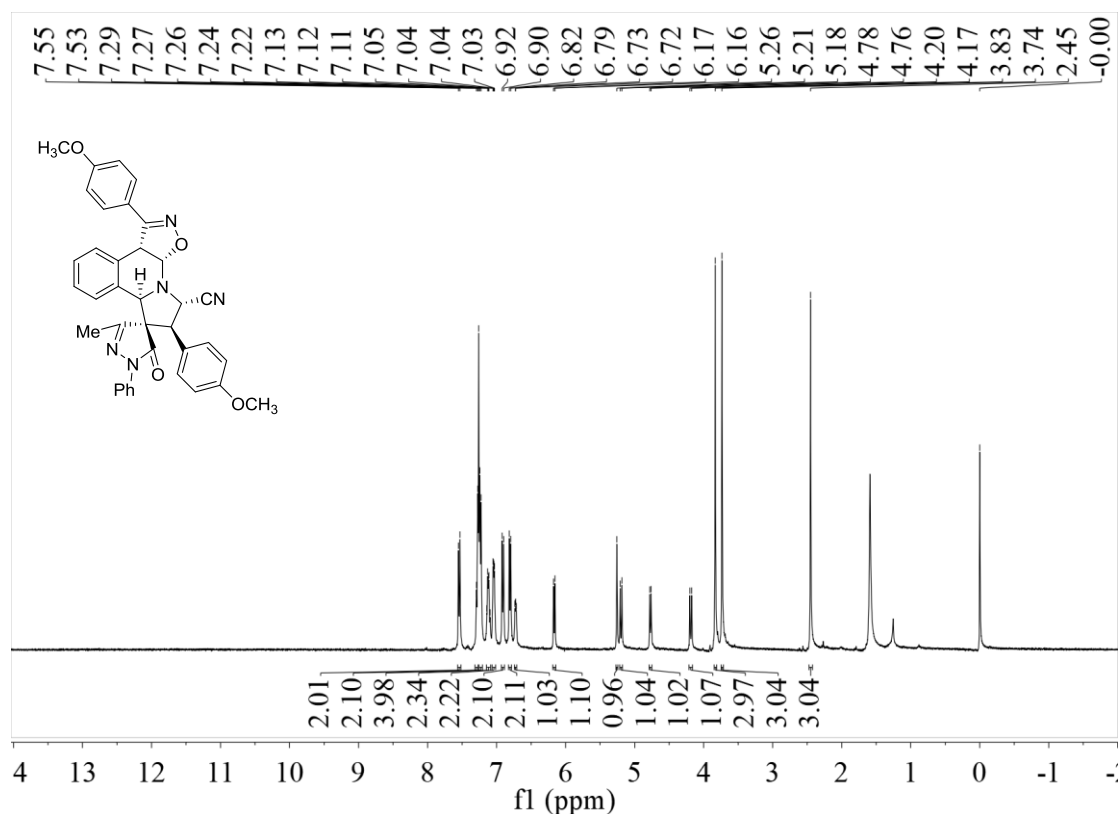


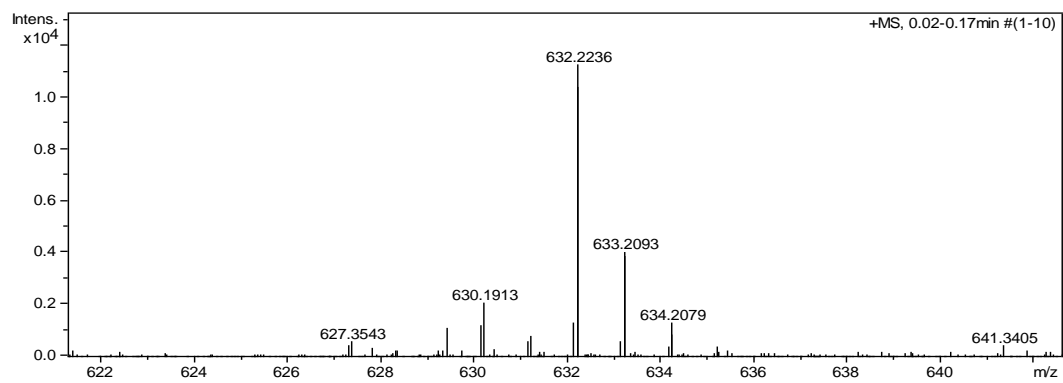
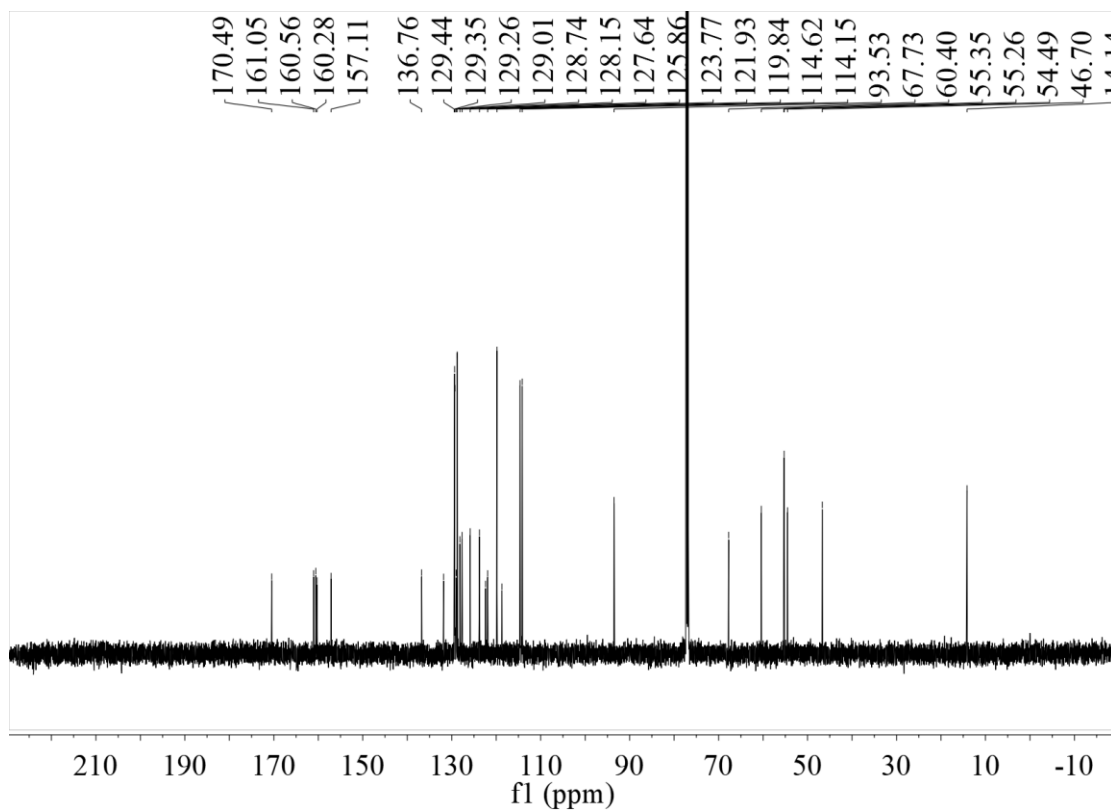
3-(4-methoxyphenyl)-3'-methyl-5'-oxo-1'-phenyl-9-(*p*-tolyl)-1',3a,5',9,10,11a-hexahydro-7bH-spiro[isoxazolo[5,4-c]pyrrolo[2,1-a]isoquinoline-8,4'-pyrazole]-10-carbonitrile (3f): white solid, 61 %, m.p. 226-228 °C; ¹H NMR (400 MHz, CDCl₃) δ: 7.55 (d, *J* = 7.2 Hz, 2H, ArH), 7.28 (s, 1H, ArH), 7.24-7.19 (m, 5H, ArH), 7.05-7.03 (m, 2H, ArH), 6.91 (d, *J* = 7.2 Hz, 2H, ArH), 6.73 (s, 1H, ArH), 6.16 (d, *J* = 7.2 Hz, 1H, CH), 5.27 (s, 1H, CH), 5.23 (d, *J* = 10.4 Hz, 1H, CH), 4.76 (d, *J* = 7.2 Hz, 1H, CH), 4.19 (d, *J* = 10.0 Hz, 1H, CH), 3.83 (s, 3H, OCH₃), 2.46 (s, 3H, CH₃), 2.27 (s, 3H, CH₃); ¹³C NMR (100 MHz, CDCl₃) δ: 170.4, 161.0, 160.7, 157.1, 139.3, 136.7, 131.7, 129.9, 129.3, 129.0, 128.7, 128.1, 127.9, 127.6, 127.1, 125.8, 123.8, 122.4, 119.8, 119.3, 118.7, 114.1, 93.6, 67.7, 60.5, 55.3, 55.3, 54.6, 46.5, 14.1; IR(KBr) ν: 3062, 3013, 2921, 2838, 2235, 1704, 1608, 1512, 1457, 1414, 1376, 1313, 1254, 1221, 1204, 1175, 1156, 1134, 1110, 1043, 1020, 990, 925, 834, 778, 754 cm⁻¹; MS (*m/z*): HRMS (ESI) Calcd. For C₃₇H₃₁N₅NaO₃ ([M+Na]⁺): 616.2306, found: 616.2319.





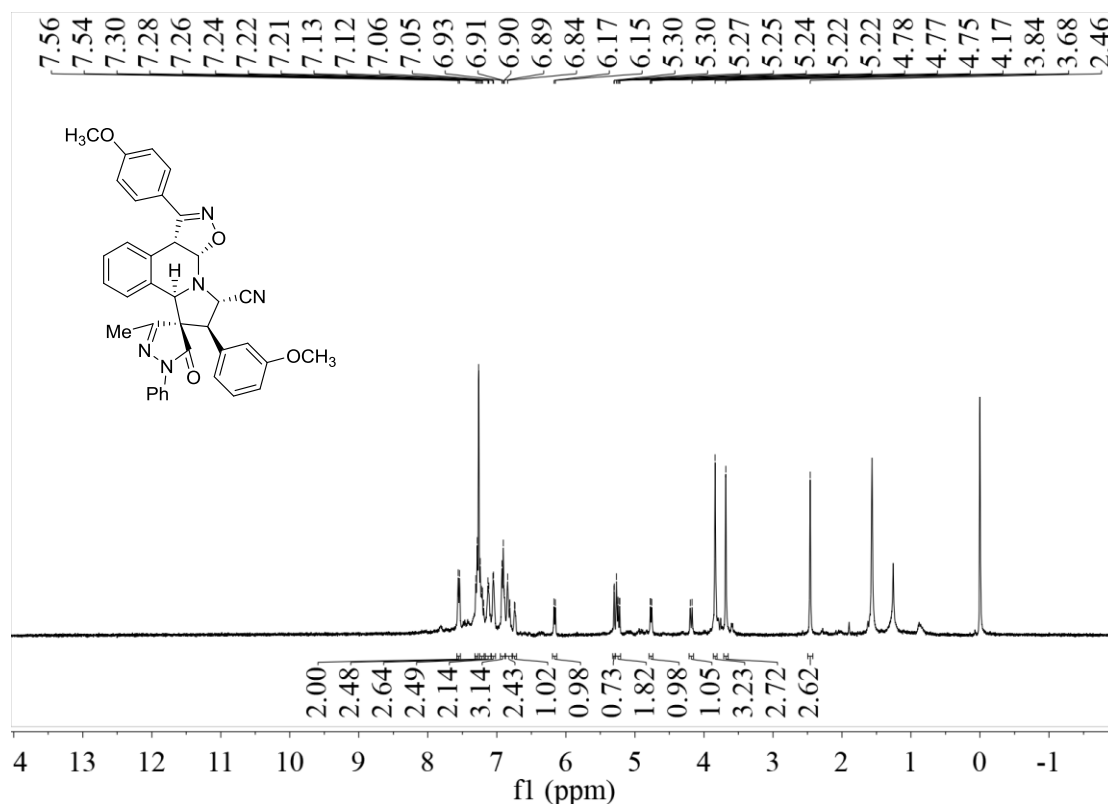
3,9-bis(4-methoxyphenyl)-3'-methyl-5'-oxo-1'-phenyl-1',3a,5',9,10,11a-hexahydro-7bH-spir
o[isoxazolo[5,4-c]pyrrolo[2,1-a]isoquinoline-8,4'-pyrazole]-10-carbonitrile (3g): white solid,
 52 %, m.p. 213-215 °C; ¹H NMR (400 MHz, CDCl₃) δ: 7.54 (d, *J* = 8.8 Hz, 2H, ArH), 7.28 (d, *J* =
 7.6 Hz, 2H, ArH), 7.23 (d, *J* = 6.8 Hz, 4H, ArH), 7.14-7.09 (m, 2H, ArH), 7.05-7.03 (m, 2H, ArH),
 6.91 (d, *J* = 8.8 Hz, 2H, ArH), 6.81 (d, *J* = 8.4 Hz, 2H, ArH), 6.74-6.71 (m, 1H, ArH), 6.17 (d, *J* =
 8.0 Hz, 1H, CH), 5.26 (s, 1H, CH), 5.20 (d, *J* = 10.4 Hz, 1H, CH), 4.77 (d, *J* = 7.6 Hz, 1H, CH),
 4.19 (d, *J* = 10.0 Hz, 1H, CH), 3.83 (s, 3H, OCH₃), 3.74 (s, 3H, OCH₃), 2.45 (s, 3H, CH₃); ¹³C
 NMR (100 MHz, CDCl₃) δ: 170.4, 161.0, 160.5, 160.2, 157.1, 136.7, 131.8, 129.4, 129.3, 129.2,
 129.0, 128.7, 128.1, 127.6, 125.8, 123.7, 122.4, 121.9, 119.8, 118.7, 114.6, 114.1, 93.5, 67.7, 60.4,
 55.3, 55.2, 54.4, 46.6, 14.1; IR(KBr) ν: 3690, 3080, 2913, 2838, 1706, 1612, 1595, 1518, 1494,
 1459, 1401, 1374, 1314, 1262, 1211, 1176, 1132, 1112, 1051, 1023, 994, 904, 838, 799, 756 cm⁻¹;
 MS (*m/z*): HRMS (ESI) Calcd. For C₃₇H₃₁N₅NaO₄ ([M+Na]⁺): 632.2236, found: 632.2268.

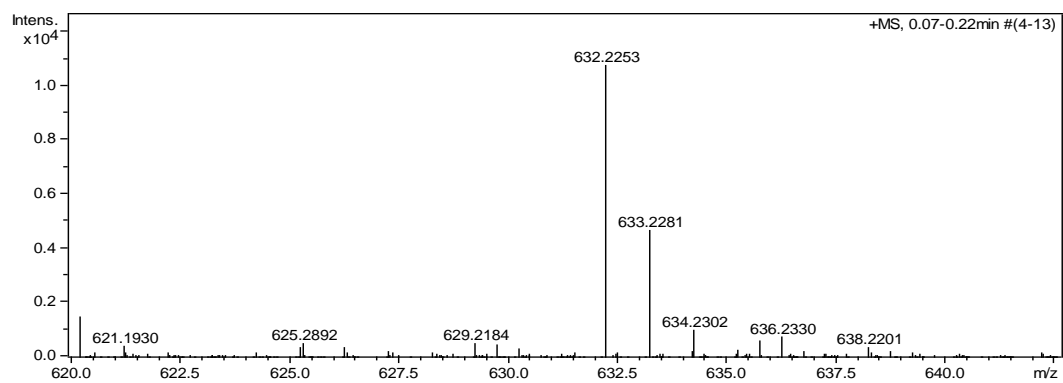
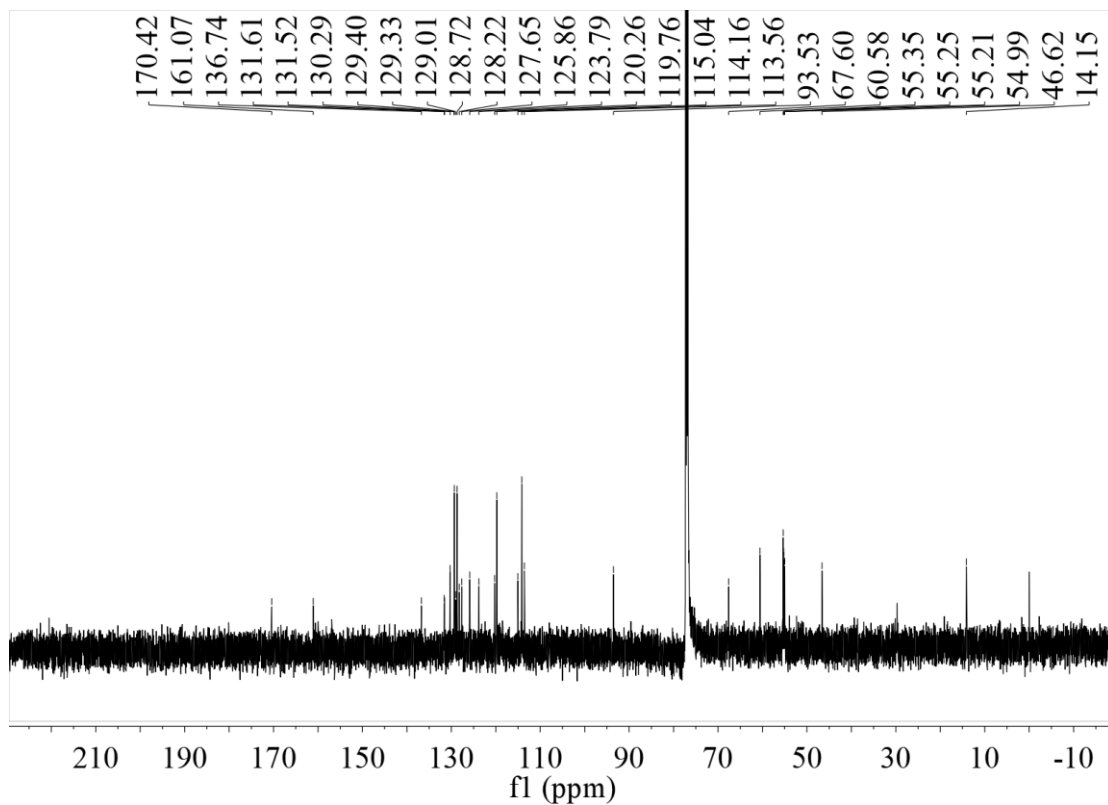




9-(3-methoxyphenyl)-3-(4-methoxyphenyl)-3'-methyl-5'-oxo-1'-phenyl-1',3a,5',9,10,11a-hexahydro-7bH-spiro[isoxazolo[5,4-c]pyrrolo[2,1-a]isoquinoline-8,4'-pyrazole]-10-carbonitrile

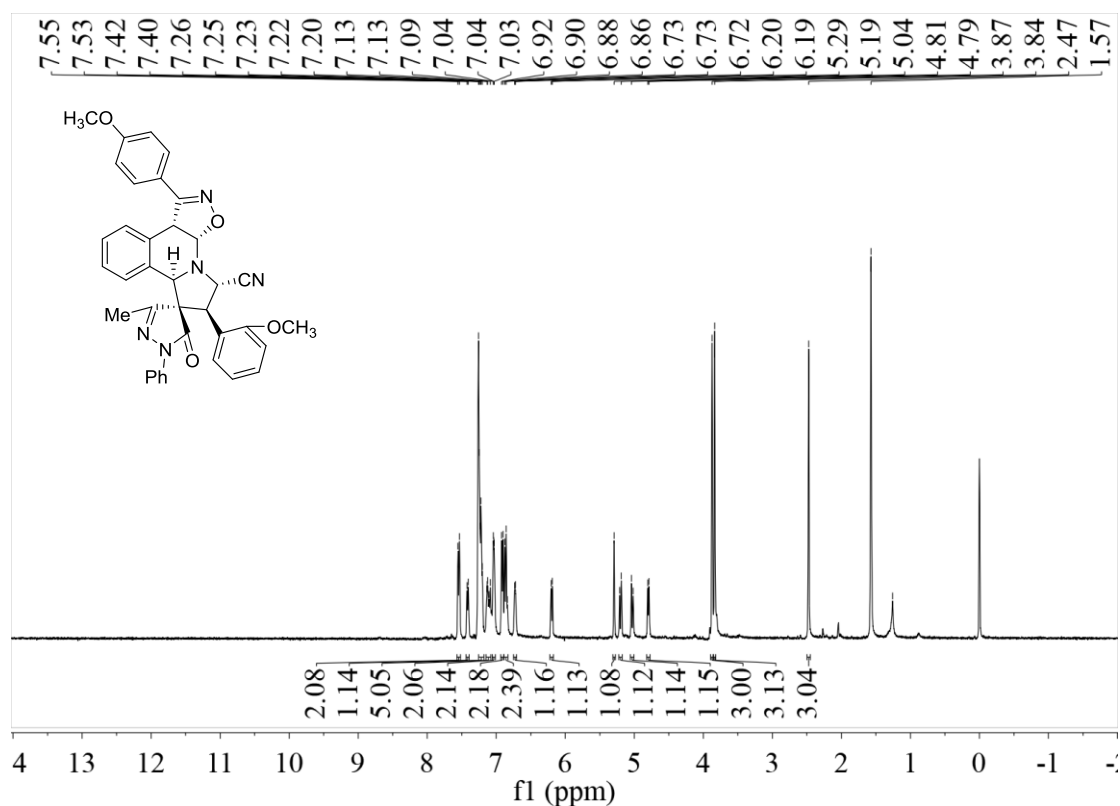
(3h) : white solid, 50 %, m.p. 172-174 °C; ¹H NMR (400 MHz, CDCl₃) δ: 7.55 (d, *J* = 7.2 Hz, 2H, ArH), 7.29 (d, *J* = 7.6 Hz, 2H, ArH), 7.24-7.19 (m, 3H, ArH), 7.12 (d, *J* = 5.6 Hz, 2H, ArH), 7.05 (d, *J* = 3.6 Hz, 2H, ArH), 6.93-6.89 (m, 3H, ArH), 6.83 (t, *J* = 13.2 Hz, 2H, ArH), 6.75-6.74 (m, 1H, ArH), 6.16 (d, *J* = 8.0 Hz, 1H, CH), 5.30-5.22 (m, 2H, CH), 4.77 (d, *J* = 8.0 Hz, 1H, CH), 4.18 (d, *J* = 10.4 Hz, 1H, CH), 3.84 (s., 3H, OCH₃), 3.68 (s., 3H, OCH₃), 2.46 (s, 3H, CH₃); ¹³C NMR (100 MHz, CDCl₃) δ: 170.4, 161.0, 160.0, 136.7, 131.6, 131.5, 130.2, 129.4, 129.3, 129.0, 128.8, 128.7, 128.2, 127.6, 125.8, 123.7, 120.2, 119.7, 115.0, 114.1, 113.5, 93.5, 67.5, 60.5, 55.3, 55.2, 55.2, 54.9, 46.6, 14.1; IR(KBr) ν: 3696, 3079, 2924, 2839, 2374, 1706, 1600, 1518, 1494, 1458, 1434, 1371, 1312, 1258, 1204, 1170, 1132, 1045, 992, 902, 840, 753 cm⁻¹; MS (*m/z*): HRMS (ESI) Calcd. For C₃₇H₃₁N₅NaO₄ ([M+Na]⁺): 632.2253, found: 632.2268.

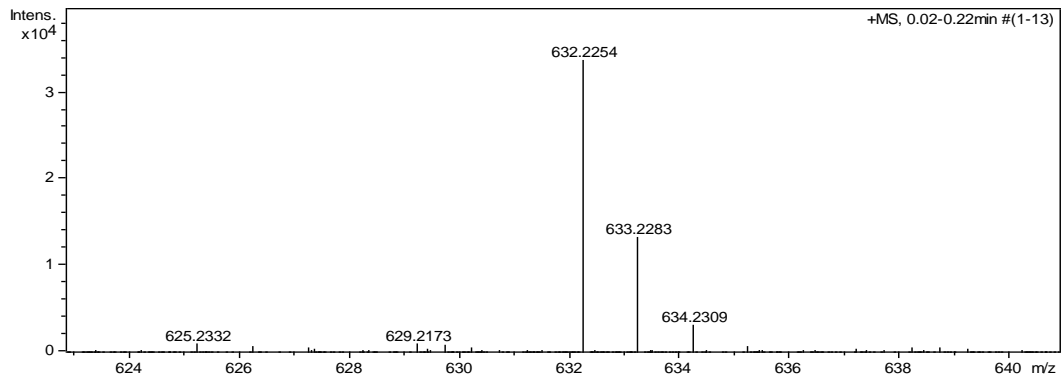
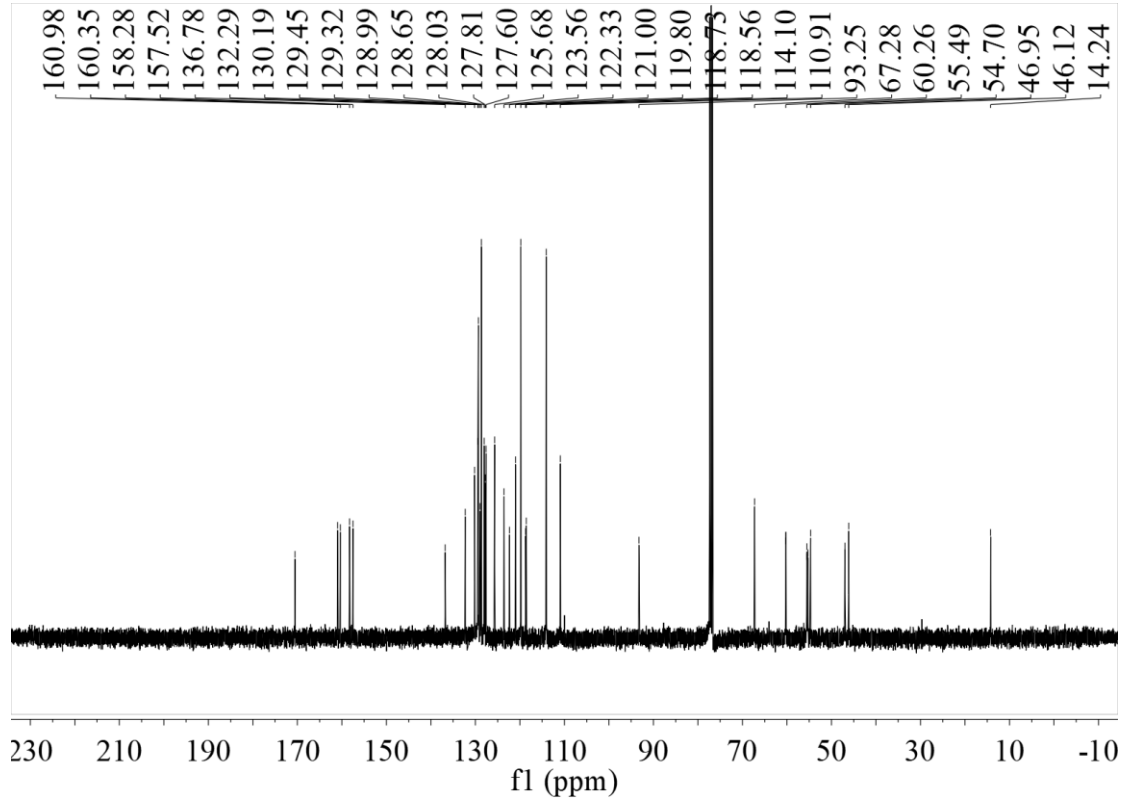




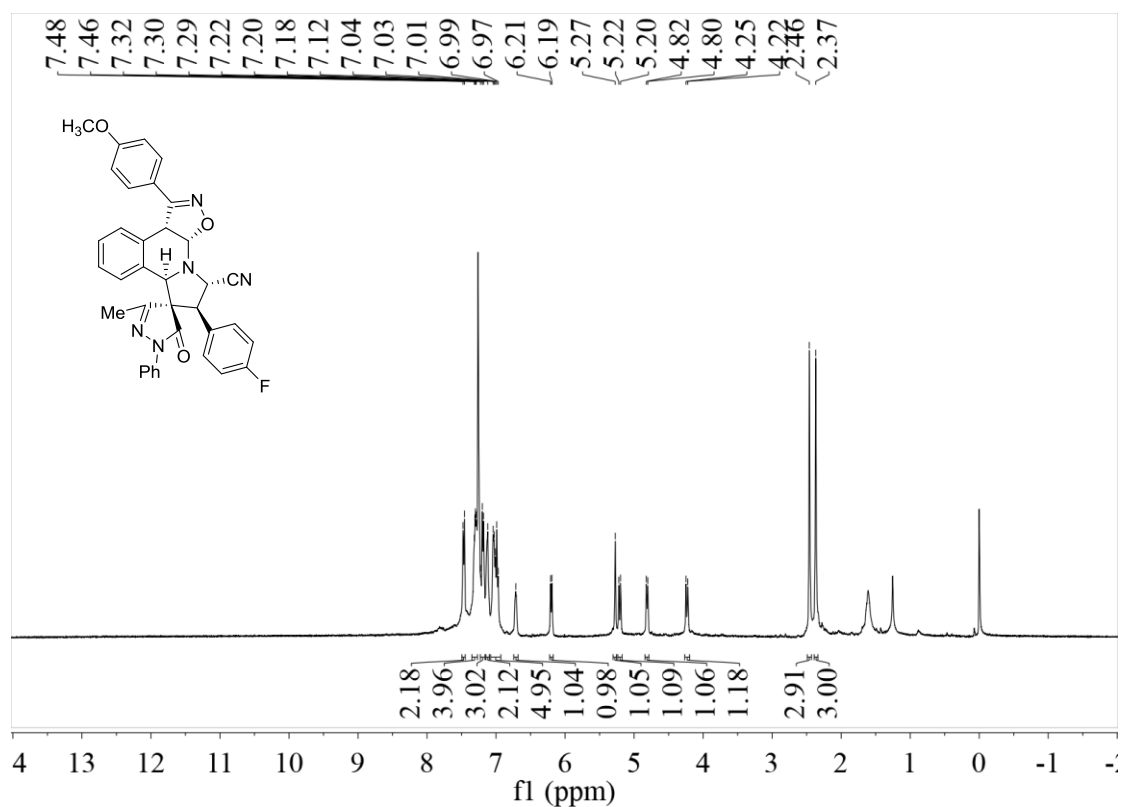
9-(2-methoxyphenyl)-3-(4-methoxyphenyl)-3'-methyl-5'-oxo-1'-phenyl-1',3a,5',9,10,11a-hexahydro-7*b*H-spiro[isoxazolo[5,4-*c*]pyrrolo[2,1-*a*]isoquinoline-8,4'-pyrazole]-10-carbonitrile

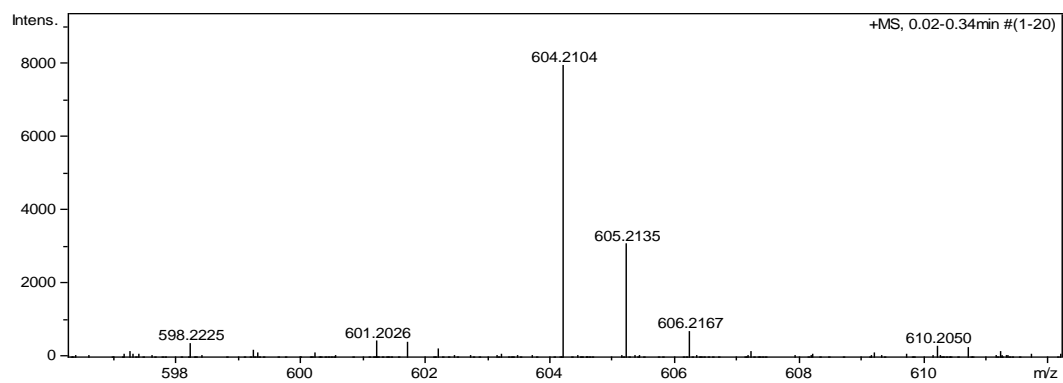
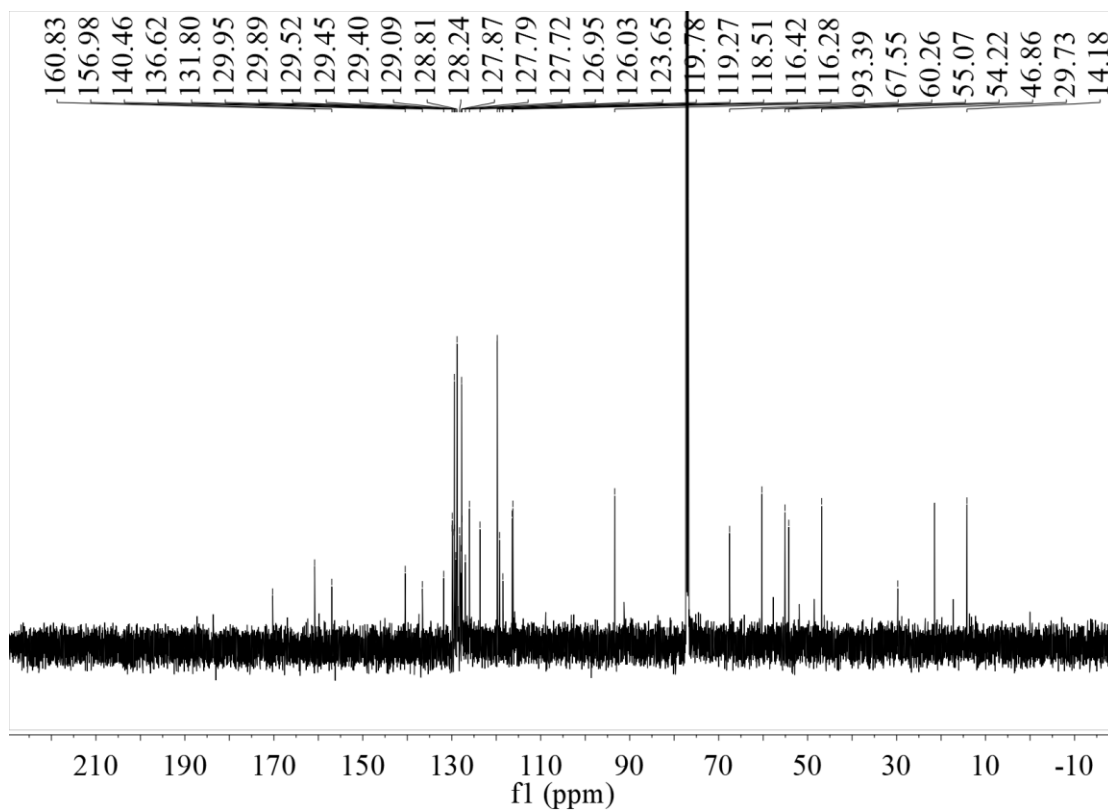
(3i) : white solid, 65 %, m.p. 232-234 °C; ¹H NMR (400 MHz, CDCl₃) δ: 7.54 (d, *J* = 8.0 Hz, 2H, ArH), 7.41 (d, *J* = 7.6 Hz, 1H, ArH), 7.25-7.20 (m, 5H, ArH), 7.14-7.09 (m, 2H, ArH), 7.04-7.03 (m, 2H, ArH), 6.91 (d, *J* = 8.4 Hz, 2H, ArH), 6.88-6.84 (m, 2H, ArH), 6.73-6.72 (m, 1H, ArH), 6.19 (d, *J* = 7.2 Hz, 1H, CH), 5.29 (s, 1H, CH), 5.20 (d, *J* = 10.0 Hz, 1H, CH), 5.03 (d, *J* = 10.0 Hz, 1H, CH), 4.80 (d, *J* = 7.2 Hz, 1H, CH), 3.87 (s., 3H, OCH₃), 3.84 (s., 3H, OCH₃), 2.47 (s, 3H, CH₃); ¹³C NMR (100 MHz, CDCl₃) δ: 170.5, 160.9, 160.3, 158.2, 157.5, 136.7, 132.2, 130.1, 129.4, 129.3, 128.9, 128.6, 128.0, 127.8, 127.6, 125.6, 123.5, 122.3, 121.0, 119.8, 118.7, 118.5, 114.0, 110.9, 93.2, 67.2, 60.2, 55.5, 55.3, 54.6, 46.9, 46.1, 14.2; IR(KBr) ν: 3757, 3656, 3078, 3014, 2943, 2894, 2840, 2373, 1707, 1689, 1601, 1521, 1494, 1462, 1420, 1372, 1344, 1308, 1255, 1202, 1167, 1115, 1060, 1023, 992, 906, 841, 783, 755 cm⁻¹; MS (*m/z*): HRMS (ESI) Calcd. For C₃₇H₃₁N₅NaO₄ ([M+Na]⁺): 632.2254, found: 632.2268.



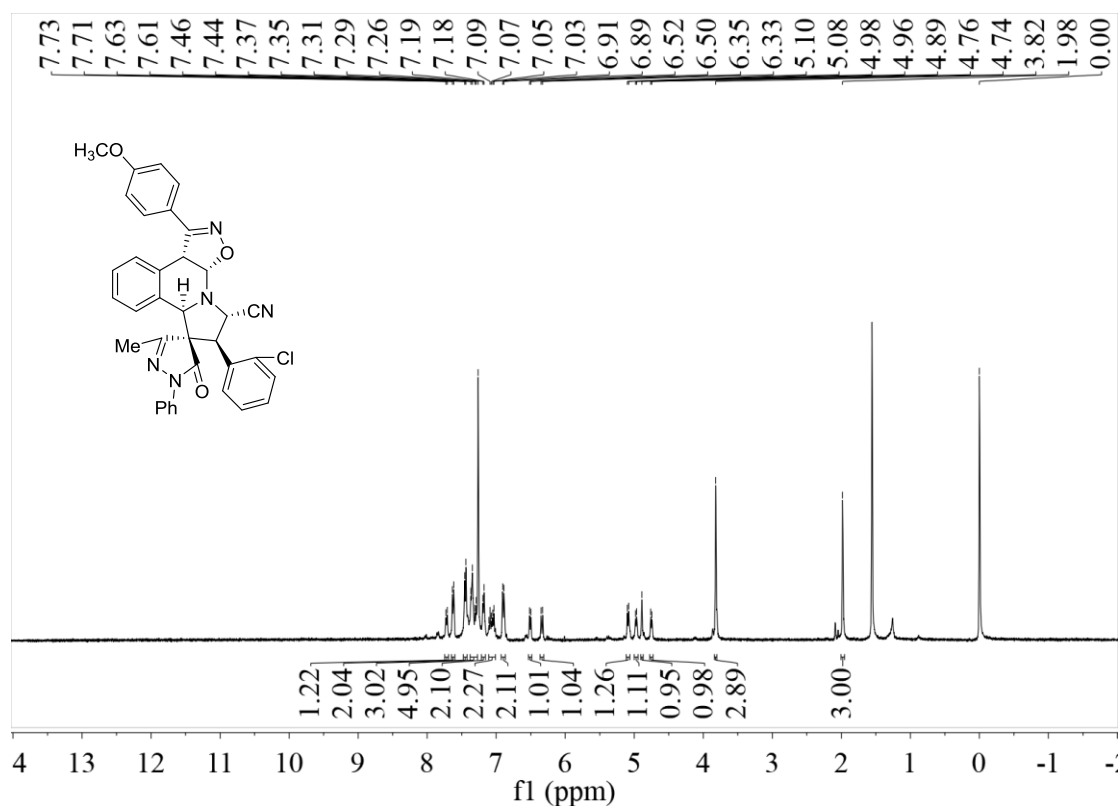


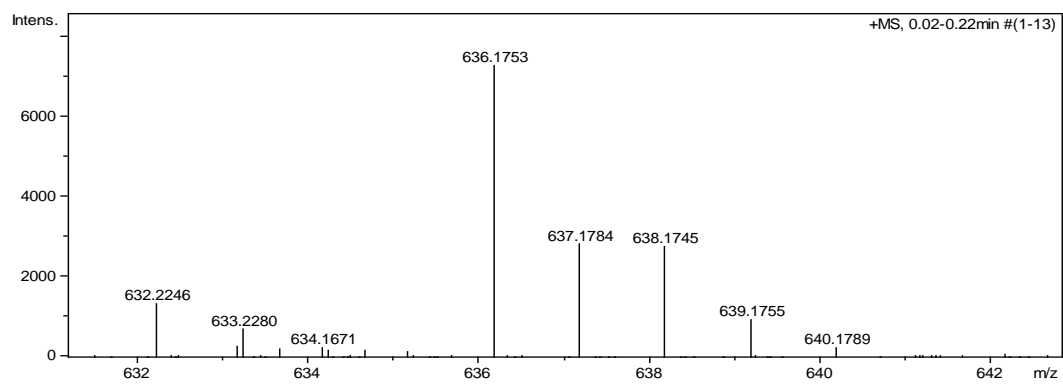
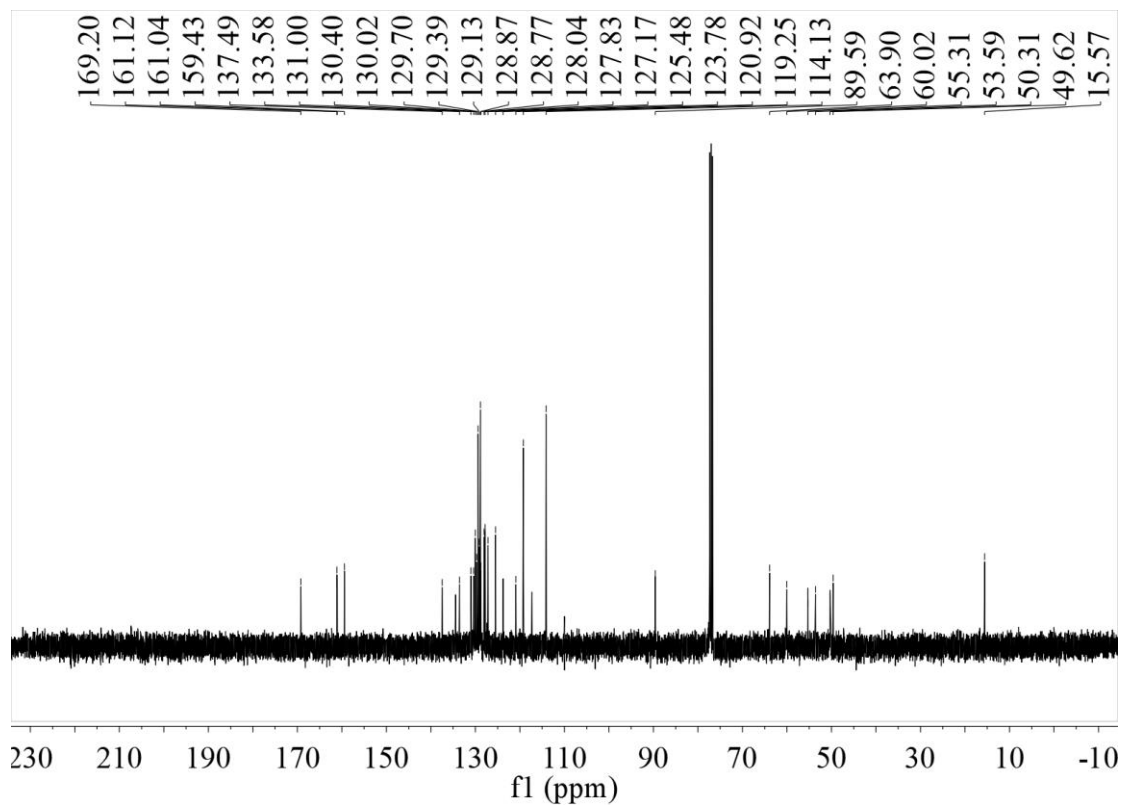
9-(4-fluorophenyl)-3'-methyl-5'-oxo-1'-phenyl-3-(*p*-tolyl)-1',3a,5',9,10,11a-hexahydro-7b*H*-spiro[isoxazolo[5,4-*c*]pyrrolo[2,1-*a*]isoquinoline-8,4'-pyrazole]-10-carbonitrile (3j) : white solid, 56 %, m.p. 197-199 °C; ¹H NMR (400 MHz, CDCl₃) δ: 7.47 (d, *J* = 8.0 Hz, 2H, ArH), 7.32-7.29 (m, 4H, ArH), 7.12 (s, 2H, ArH), 7.04-6.97 (m, 5H, ArH), 6.71 (s, 1H, ArH), 6.20 (d, *J* = 7.6 Hz, 1H, CH), 5.27 (s, 1H, CH), 5.21 (d, *J* = 10.0 Hz, 1H, CH), 4.81 (d, *J* = 8.0 Hz, 1H, CH), 4.24 (d, *J* = 10.8 Hz, 1H, CH), 2.46 (s, 3H, CH₃), 2.37 (s, 3H, CH₃); ¹³C NMR (100 MHz, CDCl₃) δ: 170.2, 160.8, 156.9, 140.4, 136.6, 131.7, 129.9, 129.8, 129.5, 129.4, 129.9 (d, *J* = 21.6 Hz), 128.8, 128.2, 127.8, 127.7, 127.7, 126.9, 126.0, 123.6, 119.7, 119.2, 118.5, 116.4 (d, *J* = 58 Hz), 93.3, 67.5, 60.2, 55.0, 54.2, 46.8, 29.7, 14.1; IR(KBr) ν: 3684, 3063, 3015, 2901, 2840, 1704, 1608, 1514, 1457, 1416, 1367, 1314, 1261, 1232, 1203, 1167, 1135, 1112, 1046, 1025, 982, 920, 839, 783, 751 cm⁻¹; MS (*m/z*): HRMS (ESI) Calcd. For C₃₆H₂₈FN₅NaO₂ ([M+Na]⁺): 604.2104, found: 604.2119.



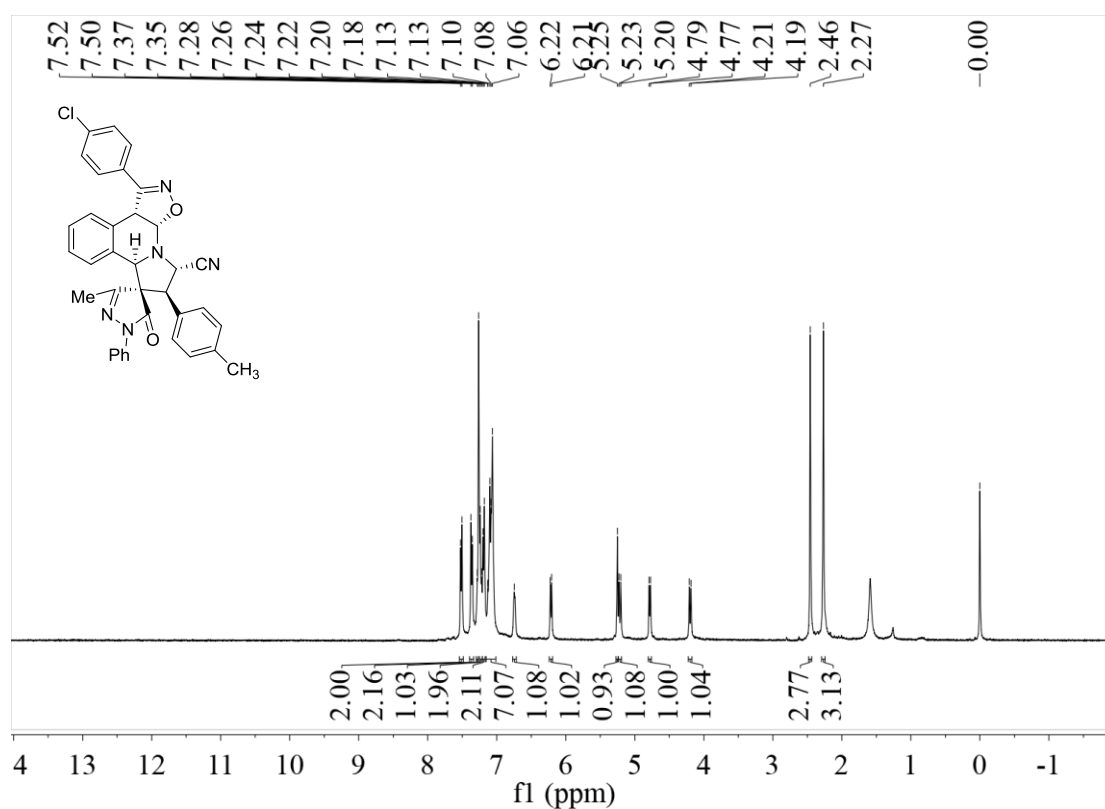


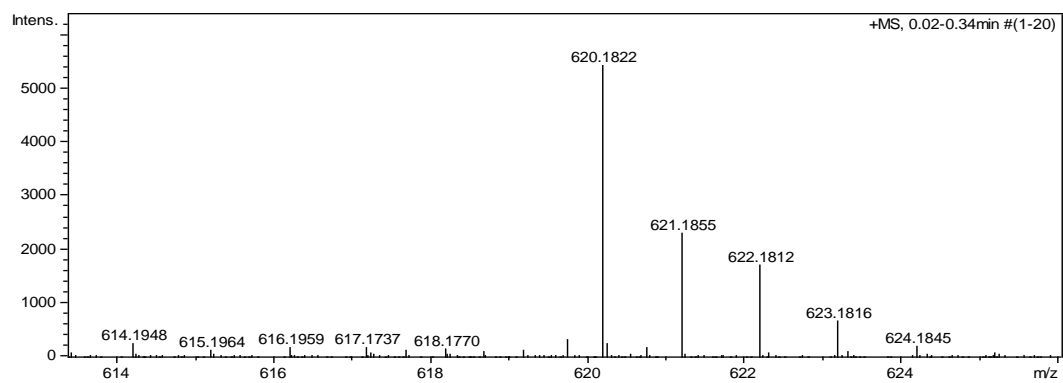
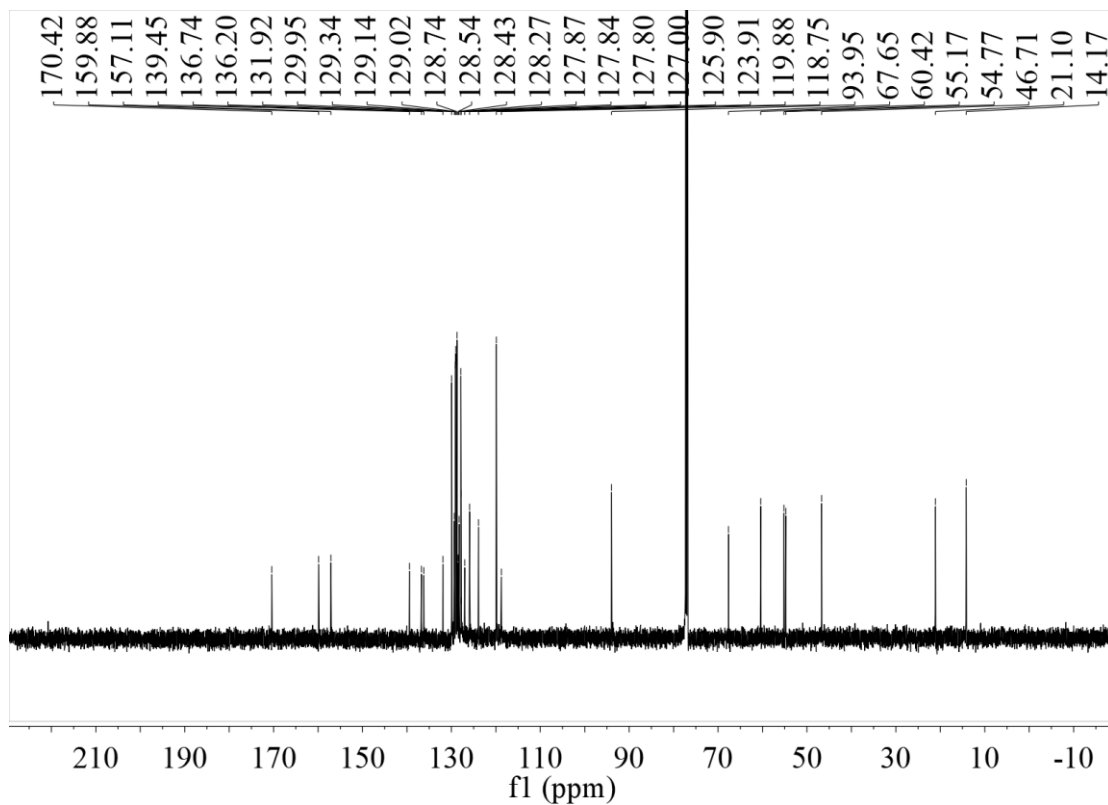
9-(2-chlorophenyl)-3-(4-methoxyphenyl)-3'-methyl-5'-oxo-1'-phenyl-1',3a,5',9,10,11a-hexahydro-7bH-spiro[isoxazolo[5,4-c]pyrrolo[2,1-a]isoquinoline-8,4'-pyrazole]-10-carbonitrile (3k) :
white solid, 68 %, m.p. 186-188 °C; ¹H NMR (400 MHz, CDCl₃) δ: 7.72 (d, *J* = 7.6 Hz, 1H, ArH), 7.63 (d, *J* = 8.0 Hz, 2H, ArH), 7.45 (d, *J* = 7.2 Hz, 3H, ArH), 7.37-7.29 (m, 5H, ArH), 7.18 (d, *J* = 6.8 Hz, 2H, ArH), 7.11-7.03 (m, 2H, ArH), 6.90 (d, *J* = 7.6 Hz, 2H, ArH), 6.51 (d, *J* = 6.4 Hz, 1H, CH), 6.34 (d, *J* = 9.6 Hz, 1H, CH), 5.09 (d, *J* = 8.8 Hz, 1H, CH), 4.97 (d, *J* = 7.2 Hz, 1H, CH), 4.89 (s, 1H, CH), 4.75 (d, *J* = 7.2 Hz, 1H, CH), 3.82 (s, 3H, OCH₃), 1.96 (s, 3H, CH₃); ¹³C NMR (100 MHz, CDCl₃) δ: 169.2, 161.1, 161.0, 159.4, 137.4, 134.4, 133.5, 130.9, 130.3, 130.0, 129.7, 129.3, 129.1, 128.8, 128.7, 128.0, 127.8, 127.1, 125.4, 123.7, 120.9, 119.2, 117.2, 114.1, 89.5, 63.8, 60.0, 55.3, 53.5, 50.3, 49.6, 15.5; IR(KBr) ν: 3672, 3067, 2997, 2956, 2912, 2835, 1707, 1602, 1502, 1439, 1414, 1370, 1342, 1292, 1257, 1219, 1178, 1154, 1134, 1112, 1040, 900, 845, 820, 763, 746 cm⁻¹; MS (*m/z*): HRMS (ESI) Calcd. For C₃₆H₂₈ClN₅NaO₃ ([M+Na]⁺): 636.1753, found: 636.1773.





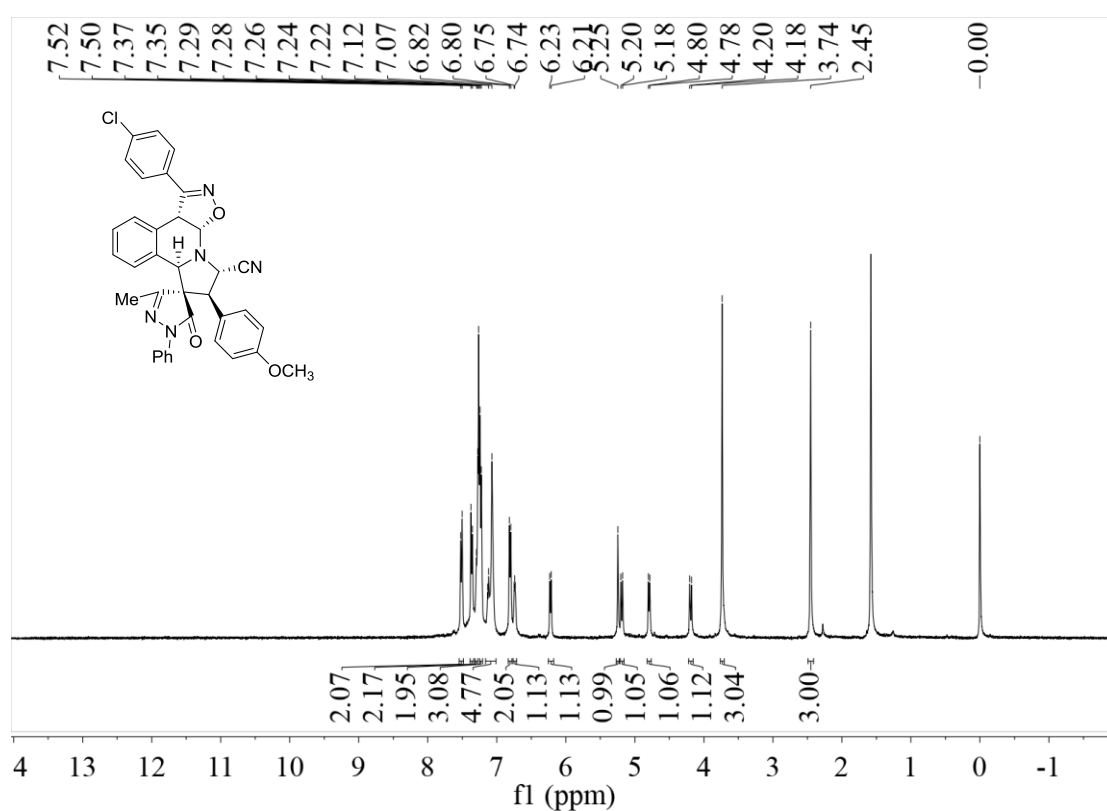
3-(4-chlorophenyl)-3'-methyl-5'-oxo-1'-phenyl-9-(*p*-tolyl)-1',3a,5',9,10,11a-hexahydro-7b*H*-spiro[isoxazolo[5,4-*c*]pyrrolo[2,1-*a*]isoquinoline-8,4'-pyrazole]-10-carbonitrile (3l) : white solid, 57 %, m.p. 213-215 °C; ¹H NMR (400 MHz, CDCl₃) δ: 7.51 (d, *J* = 7.6 Hz, 2H, ArH), 7.36 (d, *J* = 7.2 Hz, 2H, ArH), 7.28 (s, 1H, ArH), 7.23 (d, *J* = 8.0 Hz, 2H, ArH), 7.19 (d, *J* = 7.2 Hz, 2H, ArH), 7.13-7.06 (m, 7H, ArH), 6.74 (s, 1H, ArH), 6.22 (d, *J* = 8.0 Hz, 1H, CH), 5.25 (s, 1H, CH), 5.22 (d, *J* = 10.4 Hz, 1H, CH), 4.78 (d, *J* = 8.0 Hz, 1H, CH), 4.20 (d, *J* = 10.0 Hz, 1H, CH), 2.46 (s, 3H, CH₃), 2.27 (s, 3H, CH₃); ¹³C NMR (100 MHz, CDCl₃) δ: 170.4, 159.8, 157.1, 139.4, 136.7, 136.2, 131.9, 129.9, 129.3, 129.1, 129.0, 128.7, 128.5, 128.4, 128.2, 127.8, 127.8, 127.0, 125.9, 123.9, 119.8, 118.7, 93.9, 67.6, 60.4, 55.1, 54.7, 46.7, 21.0, 14.1; IR(KBr) ν: 3667, 3031, 2907, 2856, 2237, 1706, 1624, 1595, 1495, 1454, 1429, 1403, 1368, 1344, 1311, 1202, 1159, 1128, 1093, 1011, 944, 896, 851, 821, 793, 750 cm⁻¹; MS (*m/z*): HRMS (ESI) Calcd. For C₃₆H₂₈ClN₅NaO₂ ([M+Na]⁺): 620.1822, found: 620.1824.

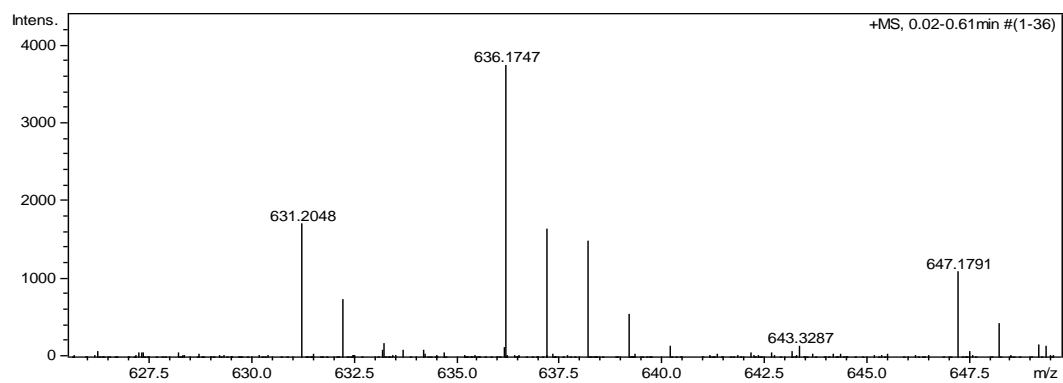
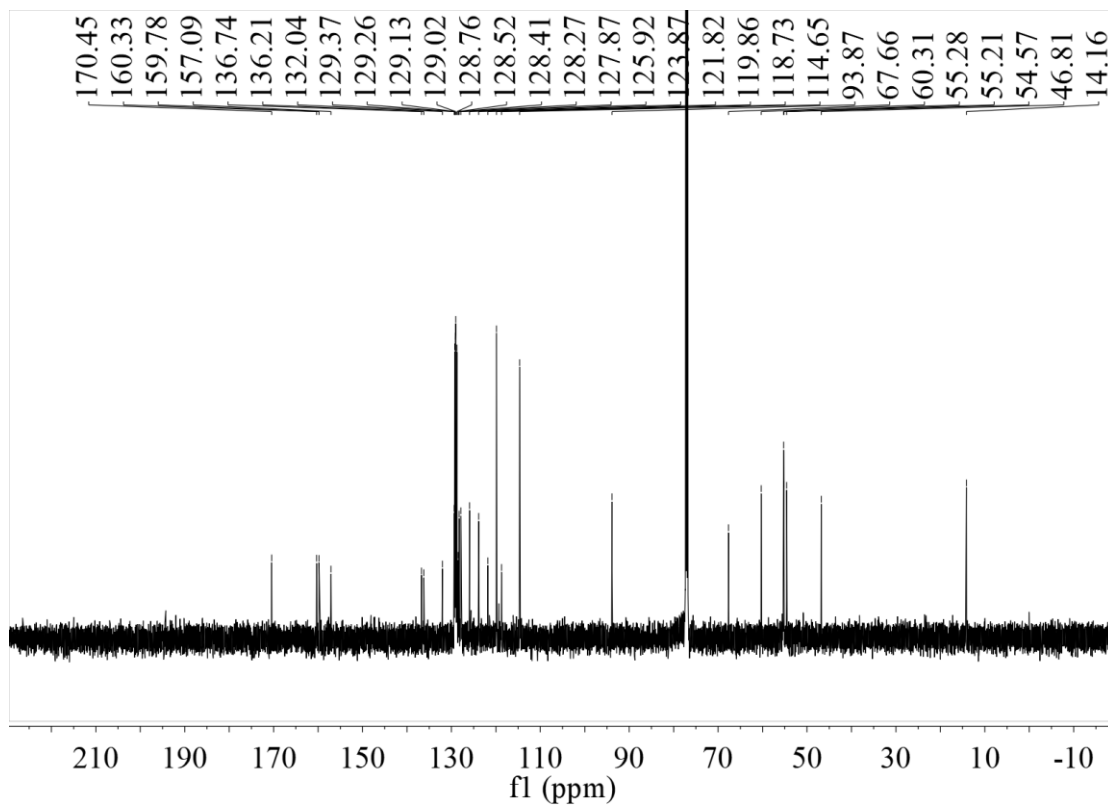




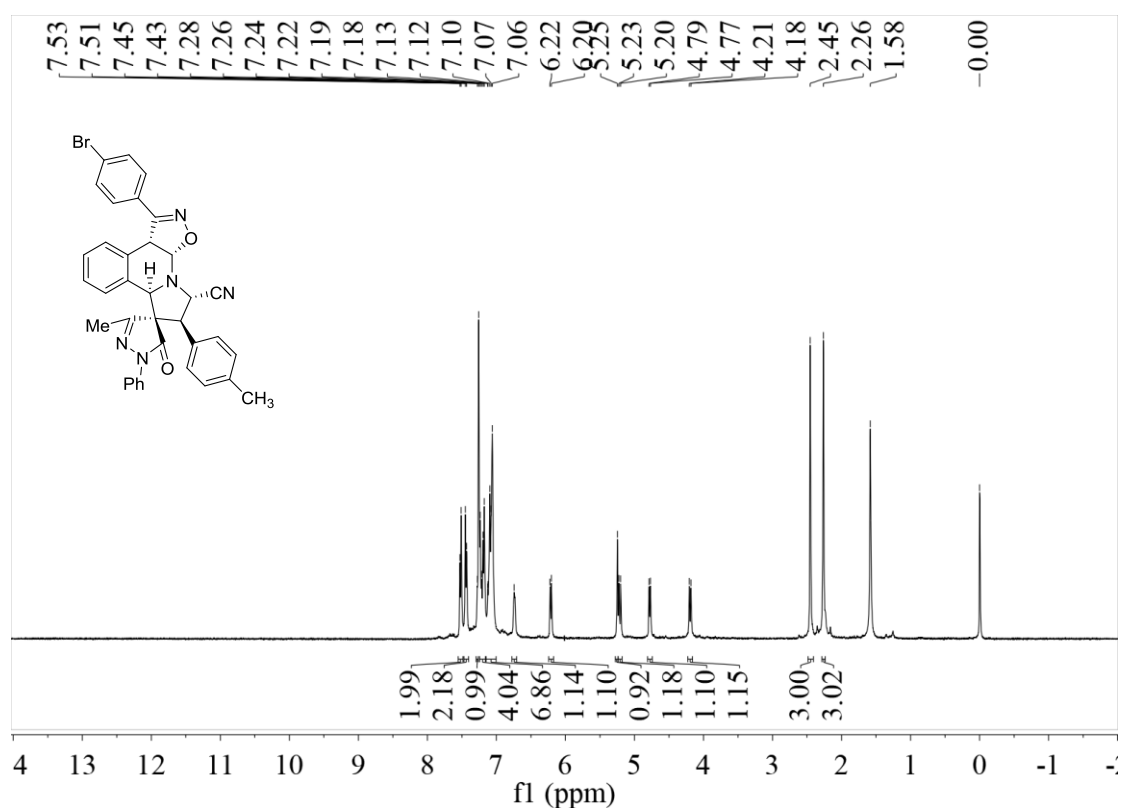
4-(4-chlorophenyl)-9-(4-methoxyphenyl)-3'-methyl-5'-oxo-1'-phenyl-1',3a,5',9,10,11a-hexahydro-7bH-spiro[isoxazolo[5,4-c]pyrrolo[2,1-a]isoquinoline-8,4'-pyrazole]-10-carbonitrile

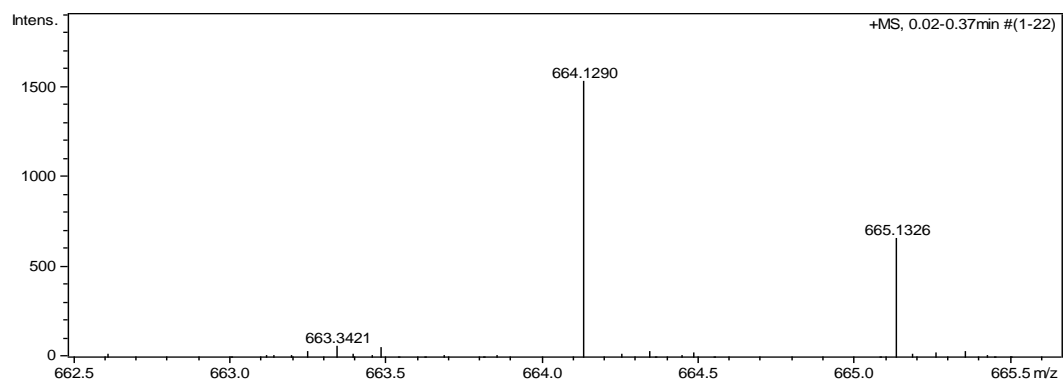
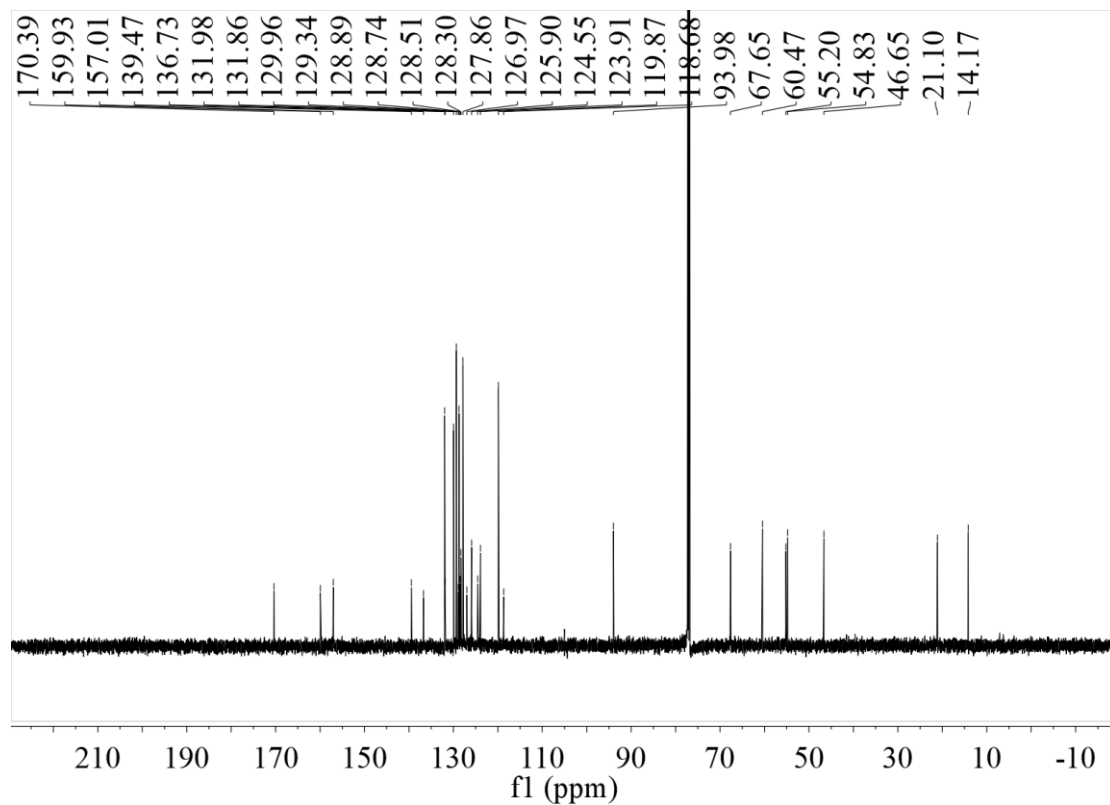
(3m) : white solid, 58 %, m.p. 217-219 °C; ^1H NMR (400 MHz, CDCl_3) δ : 7.51 (d, $J = 8.0$ Hz, 2H, ArH), 7.36 (d, $J = 7.6$ Hz, 2H, ArH), 7.28 (d, $J = 7.6$ Hz, 2H, ArH), 7.23 (d, $J = 8.0$ Hz, 3H, ArH), 7.13-7.07 (m, 5H, ArH), 6.81 (d, $J = 8.0$ Hz, 2H, ArH), 6.75-6.73 (m, 1H, ArH), 6.22 (d, $J = 8.0$ Hz, 1H, CH), 5.25 (s, 1H, CH), 5.19 (d, $J = 10.4$ Hz, 1H, CH), 4.79 (d, $J = 7.6$ Hz, 1H, CH), 4.19 (d, $J = 10.4$ Hz, 1H, CH), 3.74 (s, 3H, OCH_3), 2.45 (s, 3H, CH_3); ^{13}C NMR (100 MHz, CDCl_3) δ : 170.4, 160.3, 159.7, 157.0, 136.7, 136.2, 132.0, 129.3, 129.2, 129.1, 129.0, 128.7, 128.5, 128.4, 128.2, 127.8, 125.9, 123.8, 121.8, 119.8, 118.7, 114.6, 93.8, 67.6, 60.3, 55.2, 55.2, 54.5, 46.8, 14.1; IR(KBr) ν : 3667, 3069, 2906, 2836, 2238, 1705, 1596, 1518, 1496, 1456, 1403, 1369, 1343, 1308, 1255, 1208, 1180, 1158, 1130, 1094, 1030, 947, 894, 826, 799, 752 cm^{-1} ; MS (m/z): HRMS (ESI) Calcd. For $\text{C}_{36}\text{H}_{28}\text{ClN}_5\text{NaO}_3$ ($[\text{M}+\text{Na}]^+$): 636.1747, found: 636.1773.





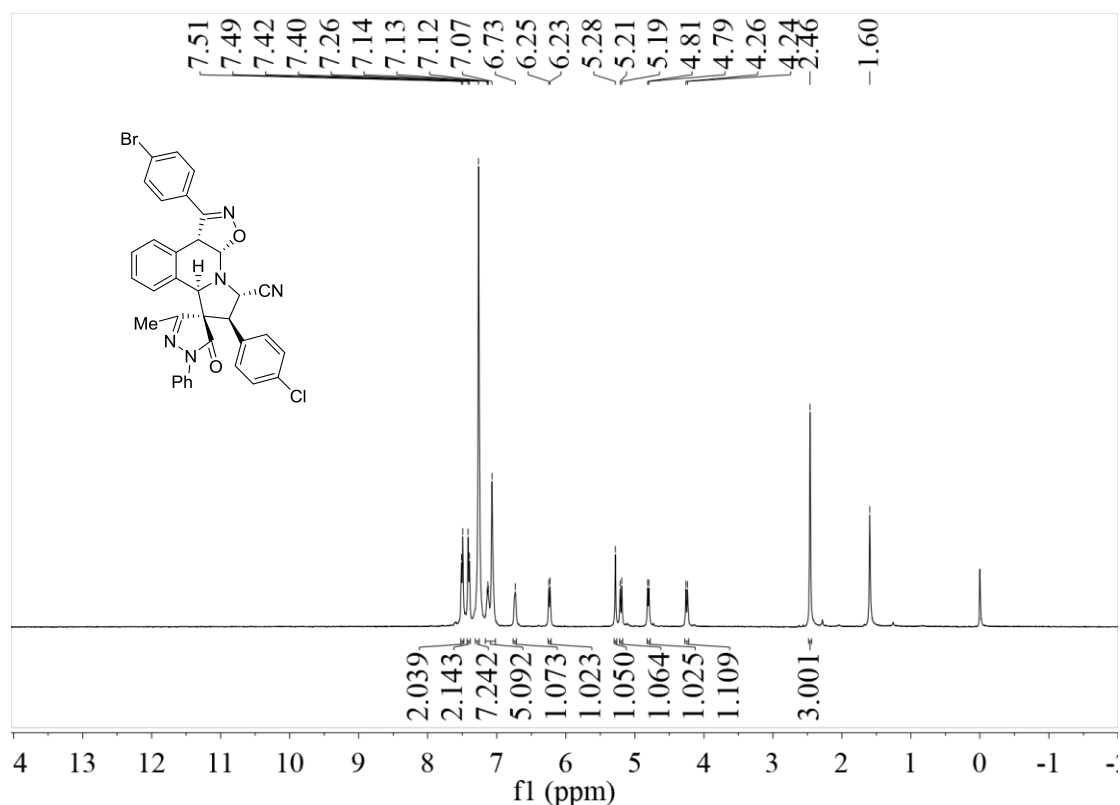
3-(4-bromophenyl)-3'-methyl-5'-oxo-1'-phenyl-9-(*p*-tolyl)-1',3a,5',9,10,11a-hexahydro-7*b*H-s piro[isoxazolo[5,4-*c*]pyrrolo[2,1-*a*]isoquinoline-8,4'-pyrazole]-10-carbonitrile (3n) : white solid, 52 %, m.p. 178-180 °C; ¹H NMR (400 MHz, CDCl₃) δ: 7.52 (d, *J* = 7.2 Hz, 2H, ArH), 7.44 (d, *J* = 7.2 Hz, 2H, ArH), 7.28 (s, 1H, ArH), 7.24-7.18 (m, 4H, ArH), 7.13-7.06 (m, 7H, ArH), 6.74 (s, 1H, ArH), 6.21 (d, *J* = 8.0 Hz, 1H, CH), 5.25 (s, 1H, CH), 5.22 (d, *J* = 10.4 Hz, 1H, CH), 4.78 (d, *J* = 7.6 Hz, 1H, CH), 4.19 (d, *J* = 9.6 Hz, 1H, CH), 2.46 (s, 3H, CH₃), 2.26 (s, 3H, CH₃); ¹³C NMR (100 MHz, CDCl₃) δ: 170.3, 159.9, 157.0, 139.4, 136.7, 131.9, 131.8, 129.9, 129.3, 128.8, 128.7, 128.5, 128.3, 127.8, 126.9, 125.9, 124.5, 123.9, 119.8, 118.6, 93.9, 67.6, 60.4, 55.1, 54.8, 46.6, 21.0, 14.1; IR(KBr) ν: 3667, 3031, 2914, 1704, 1593, 1525, 1496, 1402, 1371, 1310, 1200, 1158, 1131, 1073, 1008, 923, 753 cm⁻¹; MS (*m/z*): HRMS (ESI) Calcd. For C₃₆H₂₈BrN₅NaO₂ ([M+Na]⁺): 664.1290, found: 664.1319.

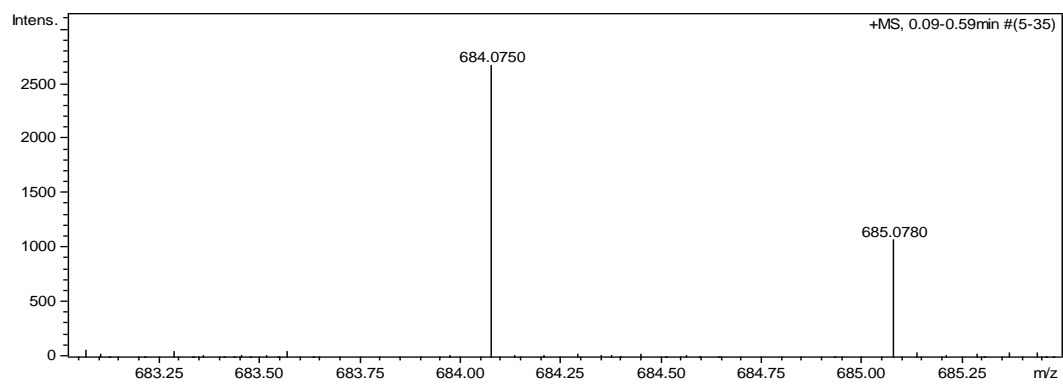
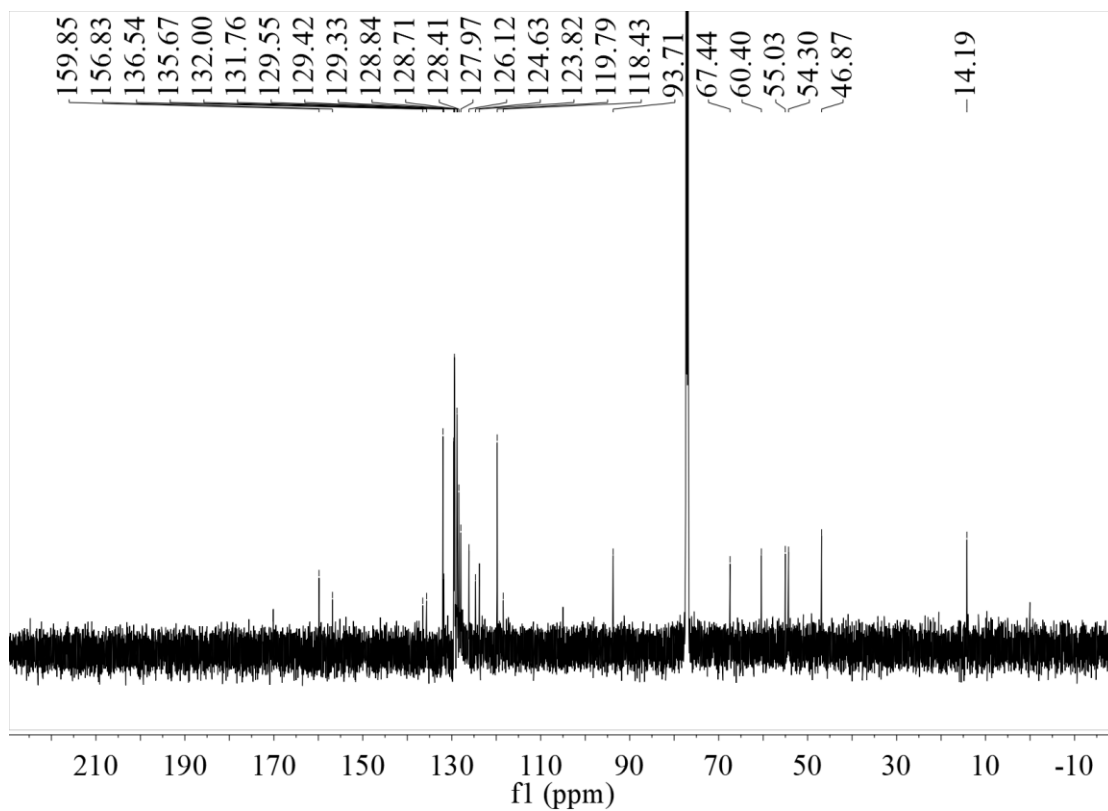




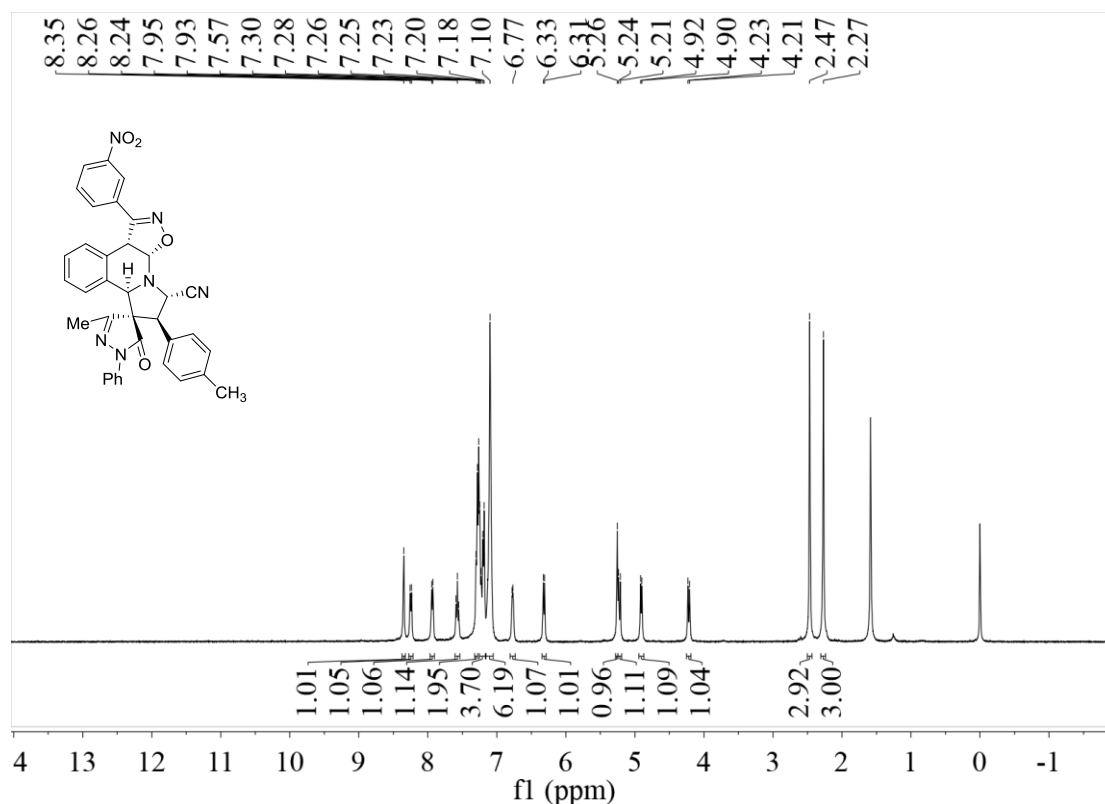
4-(4-bromophenyl)-9-(4-chlorophenyl)-3'-methyl-5'-oxo-1'-phenyl-1',3a,5',9,10,11a-hexahydro-7bH-spiro[isoxazolo[5,4-c]pyrrolo[2,1-a]isoquinoline-8,4'-pyrazole]-10-carbonitrile (3o) :

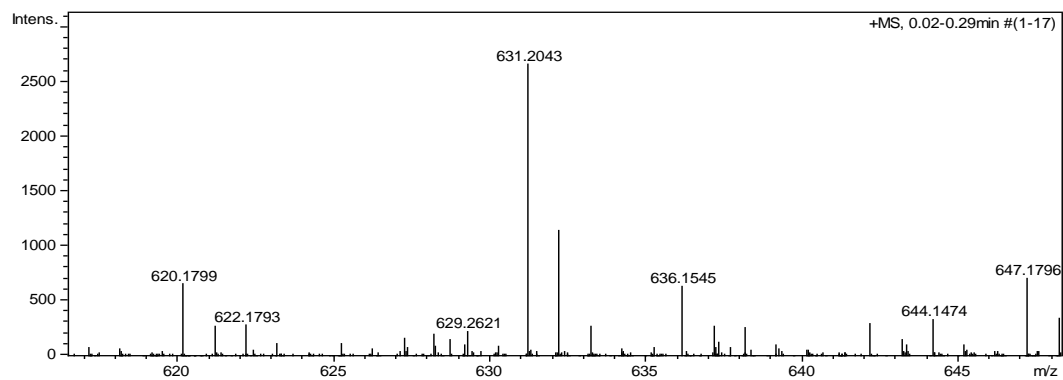
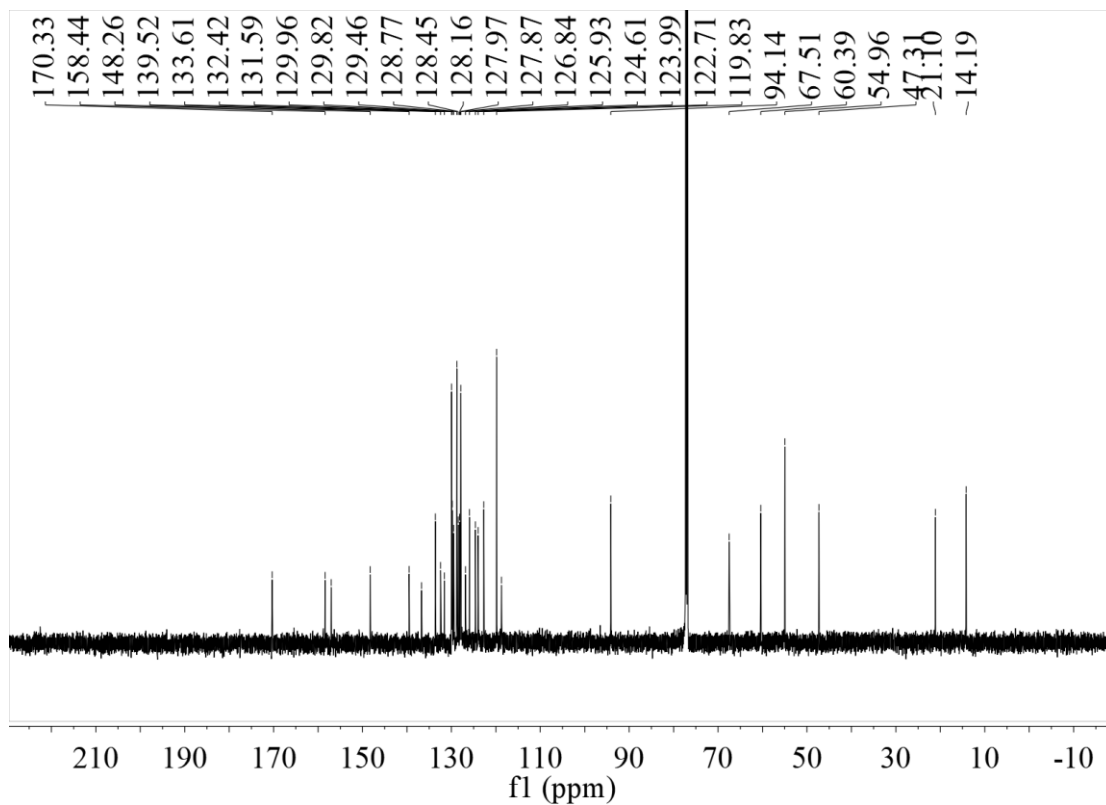
white solid, 50 %, m.p. 188-190 °C; ¹H NMR (400 MHz, CDCl₃) δ: 7.50 (d, *J* = 7.6 Hz, 2H, ArH), 7.41 (d, *J* = 7.6 Hz, 2H, ArH), 7.26 (s, 7H, ArH), 7.14-7.03 (m, 5H, ArH), 6.73 (s, 1H, ArH), 6.24 (d, *J* = 7.6 Hz, 1H, CH), 5.28 (s, 1H, CH), 5.20 (d, *J* = 8.8 Hz, 1H, CH), 4.80 (d, *J* = 7.6 Hz, 1H, CH), 4.25 (d, *J* = 10.0 Hz, 1H, CH), 2.46 (s, 3H, CH₃); ¹³C NMR (100 MHz, CDCl₃) δ: 159.8, 156.8, 136.5, 135.6, 131.9, 131.7, 129.5, 129.4, 129.3, 128.8, 128.7, 128.4, 127.9, 126.1, 124.6, 123.8, 119.7, 118.4, 93.7, 67.4, 60.4, 55.0, 54.3, 46.8, 14.1; IR(KBr) ν: 3756, 3678, 3081, 2909, 2372, 1704, 1594, 1496, 1456, 1403, 1369, 1311, 1209, 1160, 1131, 1095, 1073, 1011, 899, 849, 818, 793, 752, 713 cm⁻¹; MS (*m/z*): HRMS (ESI) Calcd. For C₃₅H₂₅BrClN₅NaO₂ ([M+Na]⁺): 684.0750, found: 684.0772.



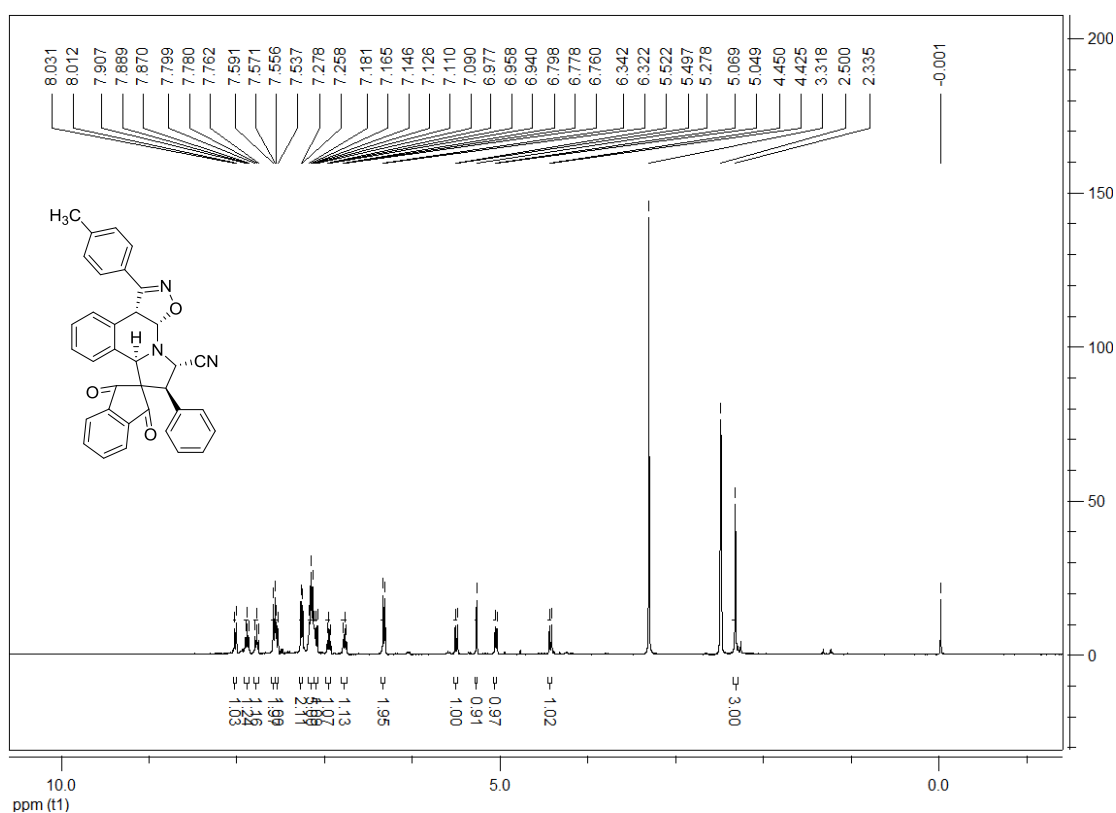


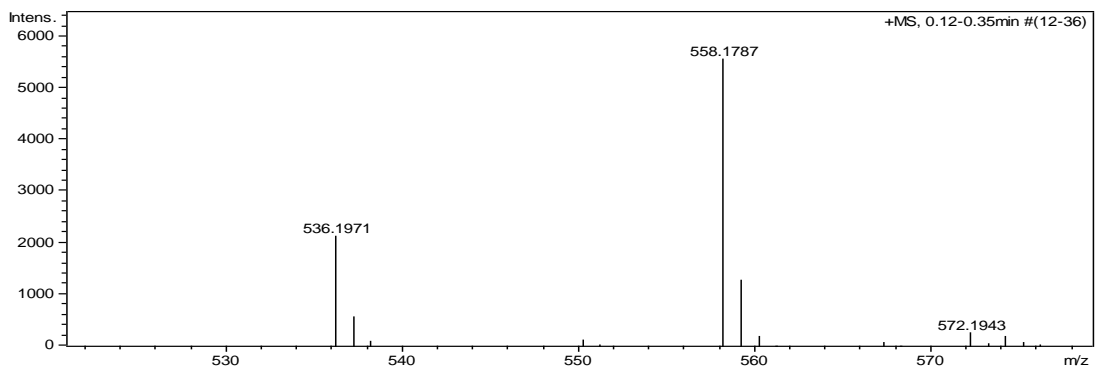
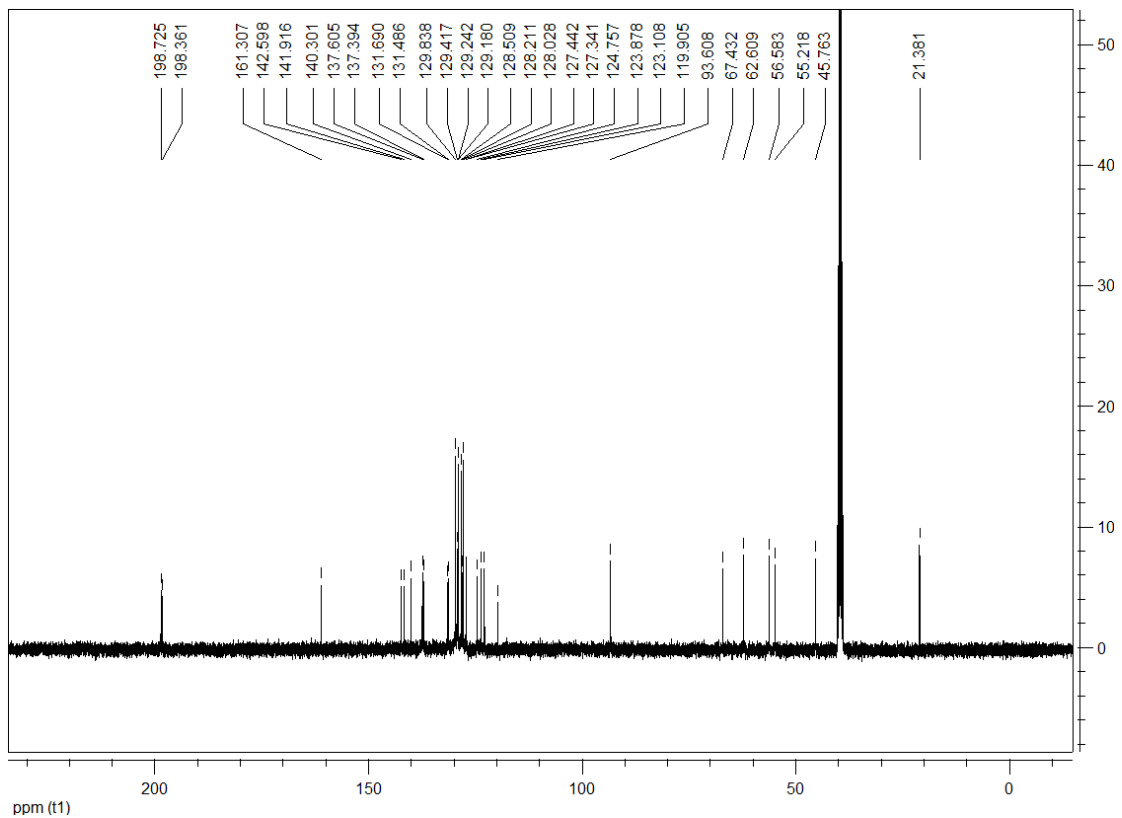
3'-methyl-3-(3-nitrophenyl)-5'-oxo-1'-phenyl-9-(*p*-tolyl)-1',3a,5',9,10,11a-hexahydro-7*b*H-spiro[isoxazolo[5,4-*c*]pyrrolo[2,1-*a*]isoquinoline-8,4'-pyrazole]-10-carbonitrile (3p) : white solid, 60 %, m.p. 224-226 °C; ¹H NMR (400 MHz, CDCl₃) δ: 8.35 (s, 1H, ArH), 8.25 (d, *J* = 8.0 Hz, 1H, ArH), 7.94 (d, *J* = 7.6 Hz, 1H, ArH), 7.57 (t, *J* = 7.6 Hz, 1H, ArH), 7.29 (d, *J* = 8.0 Hz, 2H, ArH), 7.25-7.18 (m, 4H, ArH), 7.10 (s, 6H, ArH), 6.78-6.77 (m, 1H, ArH), 6.32 (d, *J* = 8.0 Hz, 1H, CH), 5.26 (s, 1H, CH), 5.22 (d, *J* = 10.4 Hz, 1H, CH), 4.91 (d, *J* = 7.6 Hz, 1H, CH), 4.22 (d, *J* = 10.0 Hz, 1H, CH), 2.47 (s, 3H, CH₃), 2.27 (s, 3H, CH₃); ¹³C NMR (100 MHz, CDCl₃) δ: 170.3, 158.4, 157.0, 148.2, 139.5, 136.7, 133.6, 132.4, 131.5, 129.9, 129.8, 129.4, 128.7, 128.4, 128.1, 127.9, 127.8, 126.8, 125.9, 124.6, 123.9, 122.7, 119.8, 118.7, 94.1, 67.5, 60.3, 54.9, 47.3, 21.1, 14.1; IR(KBr) ν: 3667, 3092, 2920, 2237, 1705, 1596, 1531, 1497, 1455, 1428, 1405, 1351, 1308, 1218, 1159, 1131, 1022, 990, 905, 864, 774, 752 cm⁻¹; MS (*m/z*): HRMS (ESI) Calcd. For C₃₆H₂₈N₆NaO₄ ([M+Na]⁺): 631.2043, found: 631.2064.



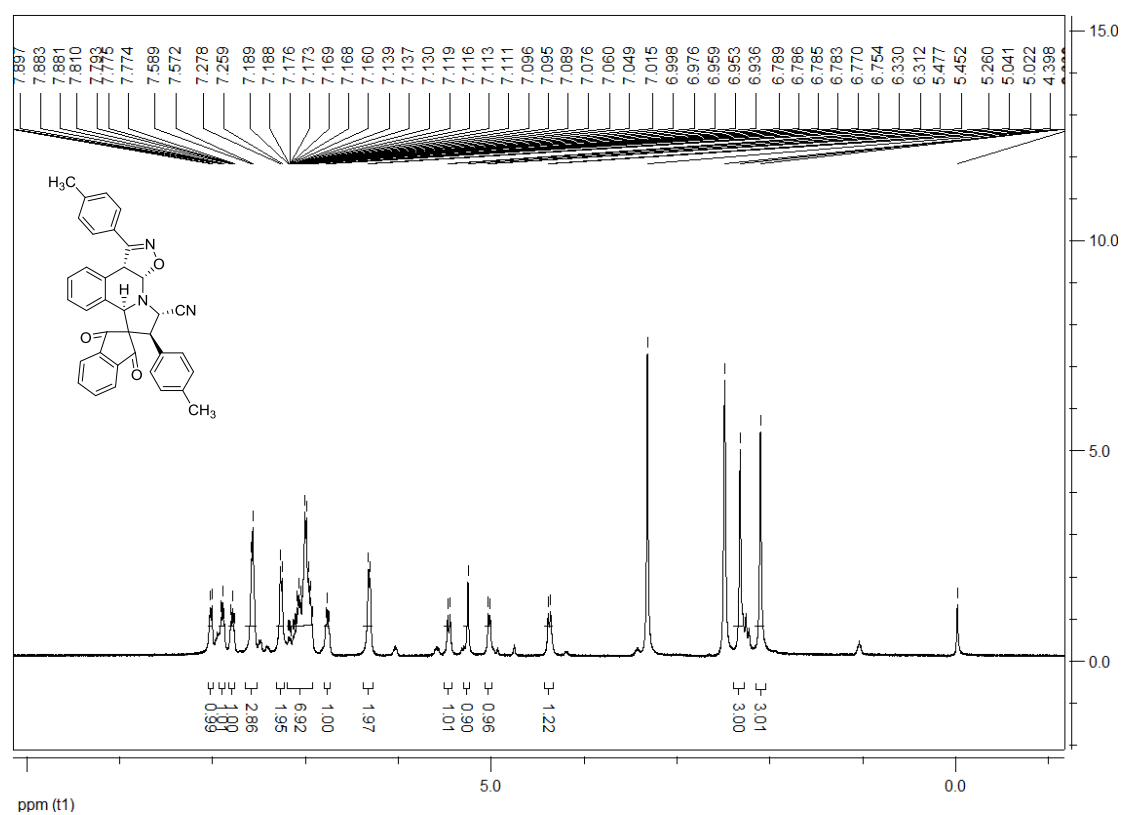


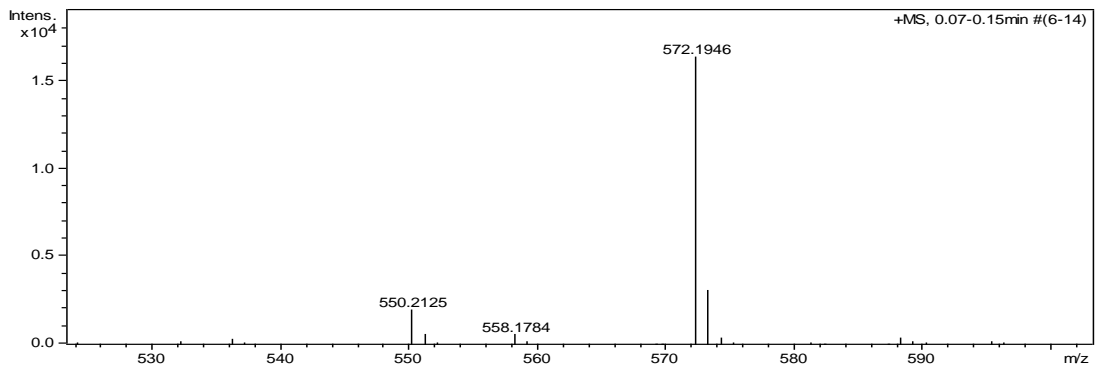
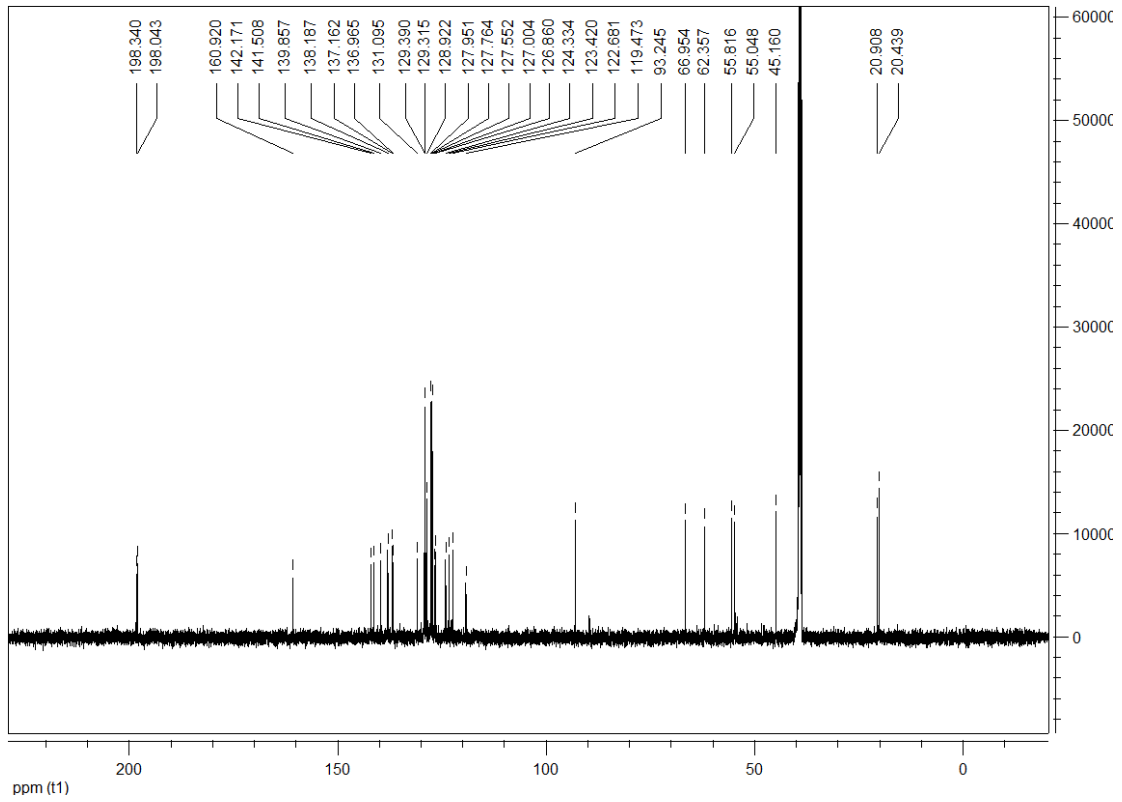
1,3-dioxo-9'-phenyl-3'-(*p*-tolyl)-1,3,3a',9',10',11a'-hexahydro-7b'*H*-spiro[indene-2,8'-isoxazolo[5,4-*c*]pyrrolo[2,1-*a*]isoquinoline]-10'-carbonitrile (4a): white solid, 55%, m.p. 226-228 °C; ¹H NMR (400 MHz, DMSO-*d*₆) δ: 8.02 (d, *J* = 7.6 Hz, 1H, ArH), 7.91-7.87 (m, 1H, ArH), 7.80-7.76 (m, 1H, ArH), 7.58 (d, *J* = 8.0 Hz, 2H, ArH), 7.55 (d, *J* = 7.6 Hz, 1H, ArH), 7.27 (d, *J* = 8.0 Hz, 2H, ArH), 7.18-7.13 (m, 5H, ArH), 7.10 (d, *J* = 8.0 Hz, 1H, ArH), 6.98-6.94 (m, 1H, ArH), 6.80-6.76 (m, 1H, ArH), 6.33 (d, *J* = 8.0 Hz, 2H, ArH, CH), 5.51 (d, *J* = 10.0 Hz, 1H, CH), 5.28 (s, 1H, CH), 5.06 (d, *J* = 8.0 Hz, 1H, CH), 4.44 (d, *J* = 10.0 Hz, 1H, CH), 2.34 (s, 3H, CH₃); ¹³C NMR (100 MHz, DMSO-*d*₆) δ: 198.7, 198.3, 161.3, 142.5, 141.9, 140.3, 137.6, 137.3, 131.6, 131.4, 129.8, 129.4, 129.2, 129.1, 128.5, 128.2, 128.0, 127.4, 127.3, 124.7, 123.8, 123.1, 119.9, 93.6, 67.4, 62.6, 56.5, 55.2, 45.7, 21.3; IR (KBr) ν: 3032, 2918, 1730, 1692, 1590, 1496, 1426, 1345, 1253, 1013, 905, 870, 839, 754, 721 cm⁻¹; MS (*m/z*): HRMS (ESI) Calcd. for C₃₅H₂₅NaN₃O₃ ([M+Na]⁺): 558.1788, found: 558.1787.



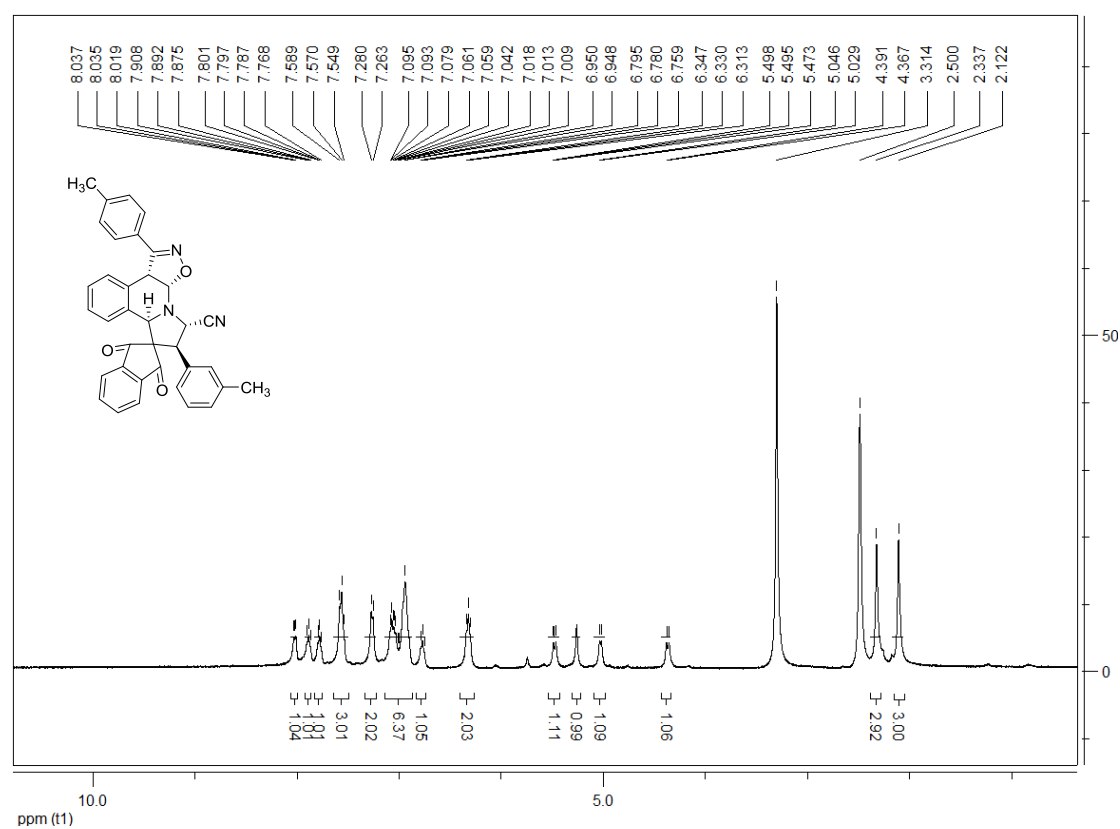


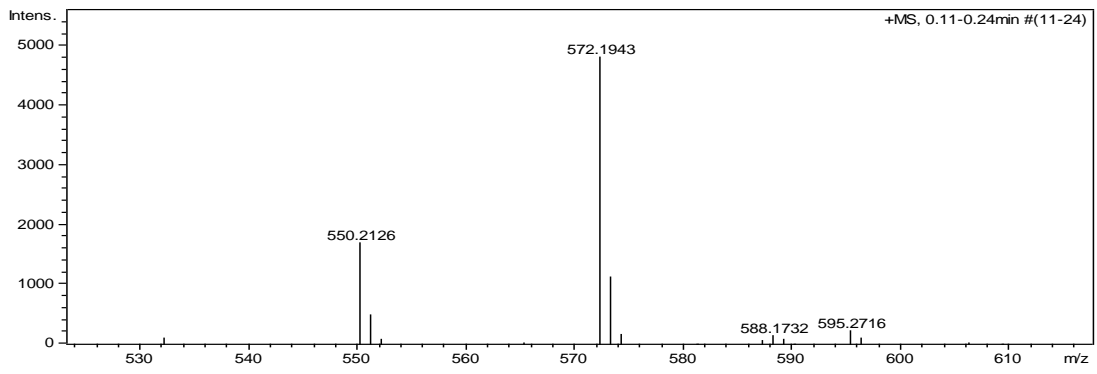
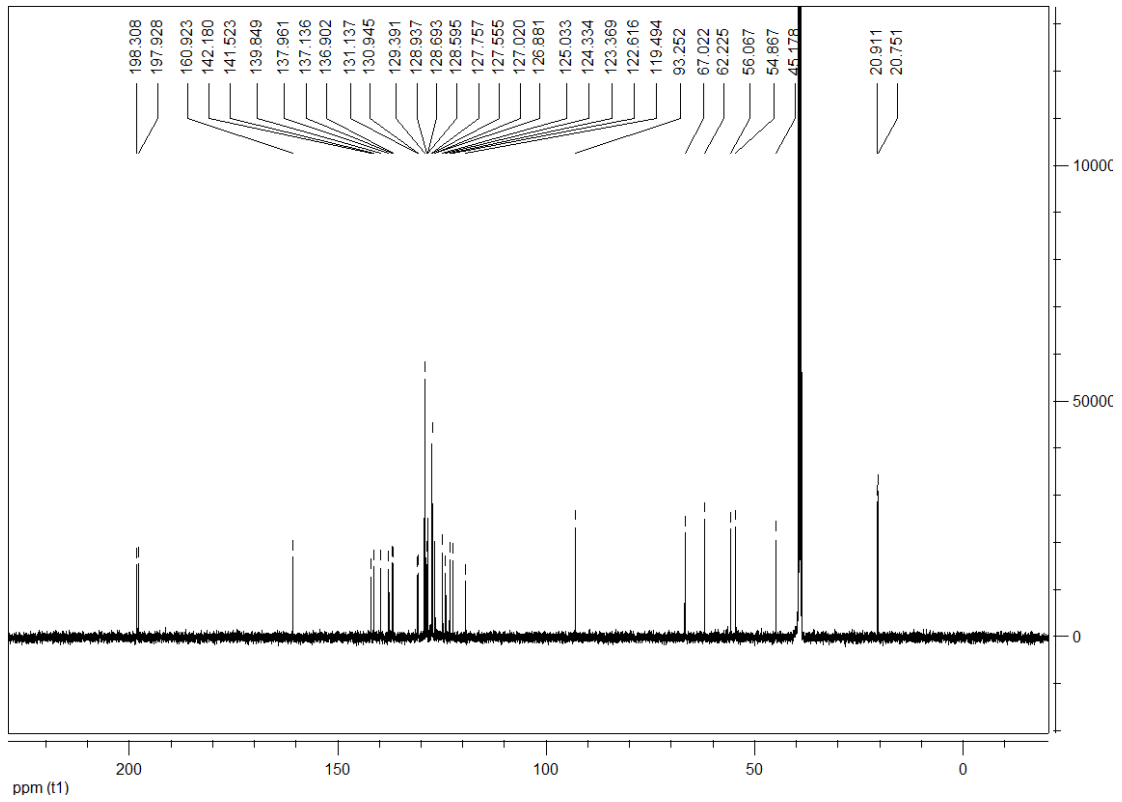
1,3-dioxo-3',9'-di-p-tolyl-1,3,3a',9',10',11a'-hexahydro-7b'H-spiro[indene-2,8'-isoxazolo[5,4-c]pyrrolo[2,1-a]isoquinoline]-10'-carbonitrile (4b): white solid, 60%, m.p. 231-233°C; ¹H NMR (400 MHz, DMSO-*d*₆) δ: 8.03-8.01 (m, 1H, ArH), 7.91-7.88 (m, 1H, ArH), 7.81-7.77 (m, 1H, ArH), 7.59-7.57 (m, 3H, ArH), 7.27 (d, *J* = 7.6 Hz, 2H, ArH), 7.19-6.94 (m, 7H, ArH), 6.79-6.75 (m, 1H, ArH), 6.33-6.31 (m, 2H, ArH, CH), 5.46 (d, *J* = 10.0 Hz, 1H, CH), 5.26 (s, 1H, CH), 5.03 (d, *J* = 7.6 Hz, 1H, CH), 4.38 (d, *J* = 10.0 Hz, 1H, CH), 2.33 (s, 3H, CH₃), 2.12 (s, 3H, CH₃); ¹³C NMR (100 MHz, DMSO-*d*₆) δ: 198.3, 198.0, 160.9, 142.1, 141.5, 139.8, 138.1, 137.1, 136.9, 131.0, 129.3, 129.3, 128.9, 127.9, 127.7, 127.5, 127.0, 126.8, 124.3, 123.4, 122.6, 119.4, 93.2, 66.9, 62.3, 55.8, 55.0, 45.1, 20.9, 20.4; IR (KBr) ν: 3033, 1740, 1706, 1591, 1497, 1455, 1355, 1257, 1150, 1071, 1009, 911, 838, 764 cm⁻¹; MS (*m/z*): HRMS (ESI) Calcd. for C₃₆H₂₇NaN₃O₃ ([M+Na]⁺): 572.1945, found: 572.1946.



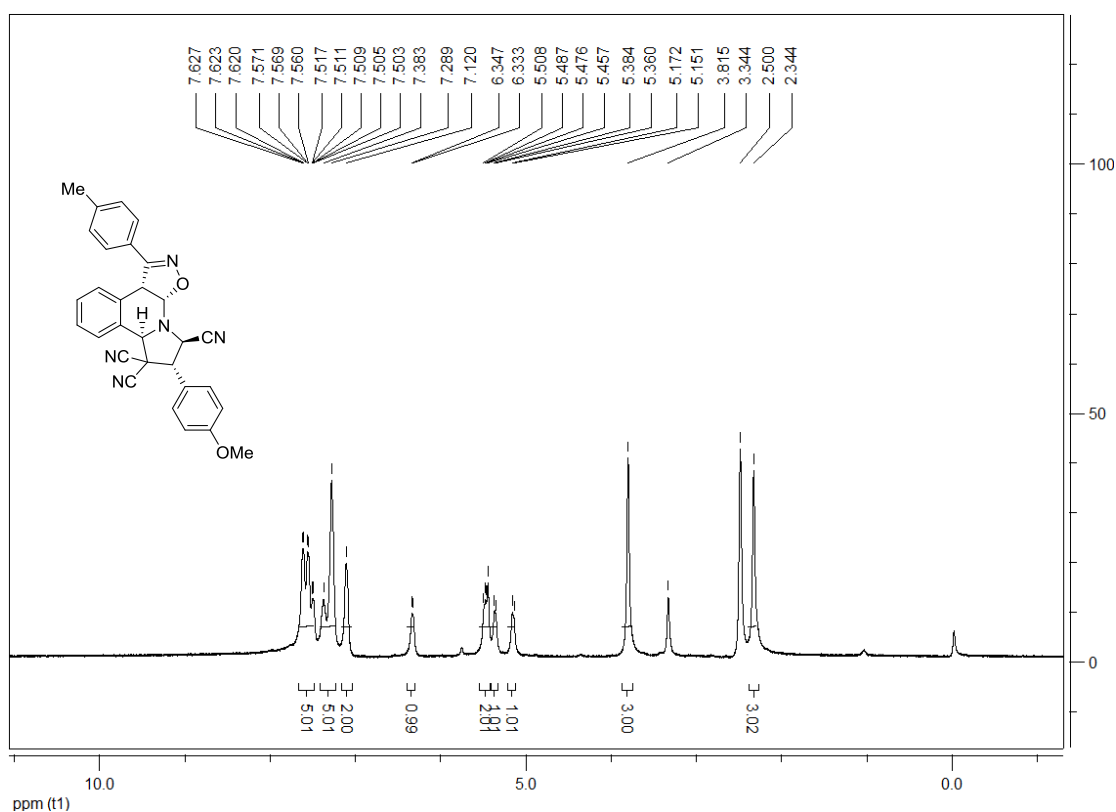


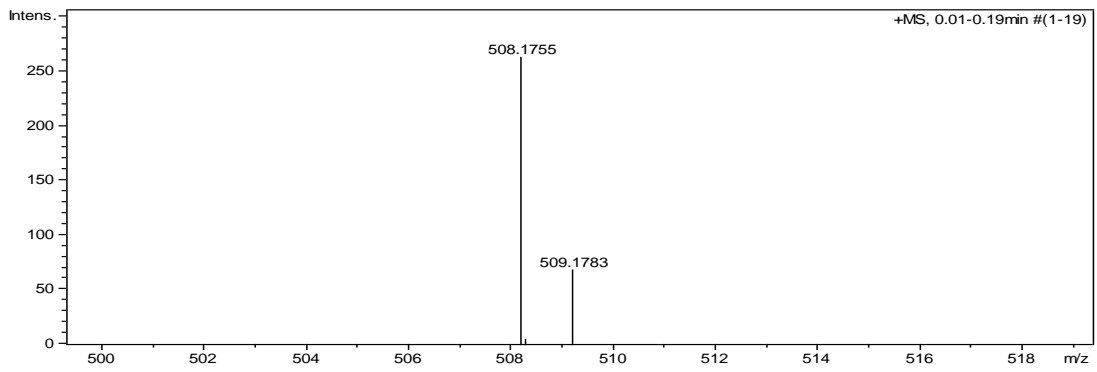
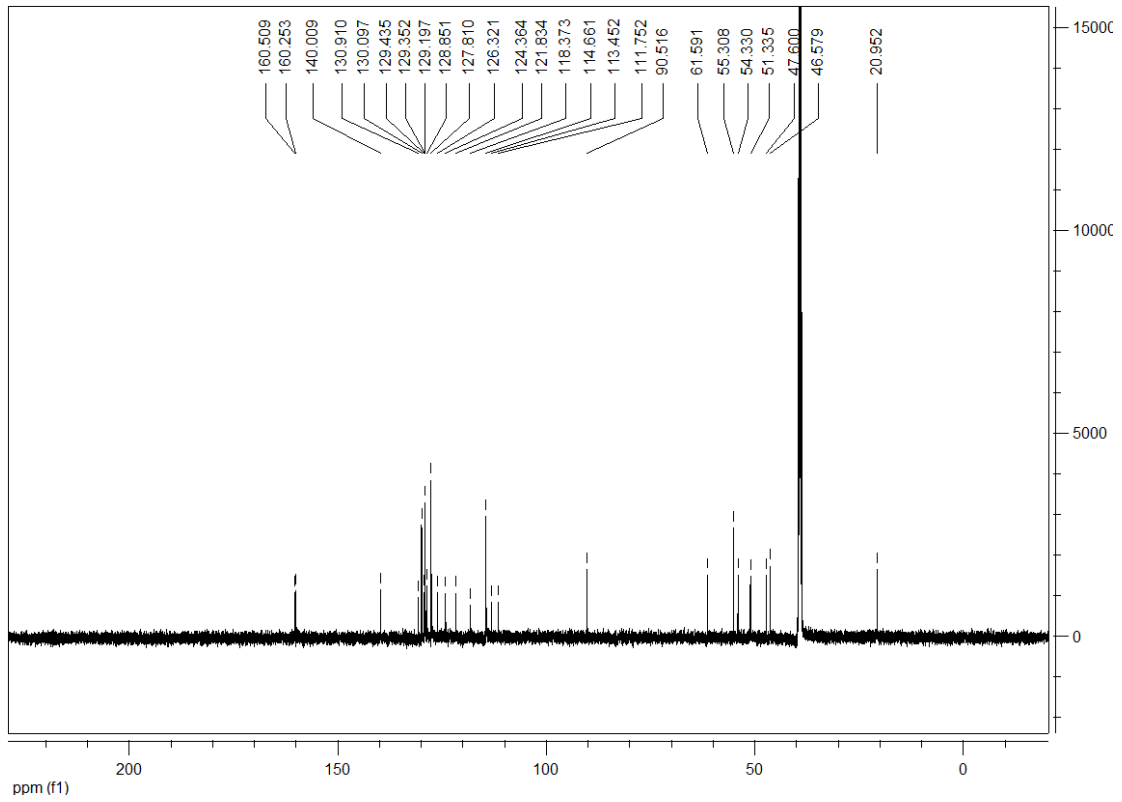
1,3-dioxo-9'-(*m*-tolyl)-3'-(*p*-tolyl)-1,3,3a',9',10',11a'-hexahydro-7b'*H*-spiro[indene-2,8'-isoxazolo[5,4-*c*]pyrrolo[2,1-*a*]isoquinoline]-10'-carbonitrile (4c): white solid, 63%, m.p. 223-225°C; ¹H NMR (400 MHz, DMSO-*d*₆) δ: 8.04-8.02 (m, 1H, ArH), 7.91-7.88 (m, 1H, ArH), 7.80-7.77 (m, 1H, ArH), 7.59-7.55 (m, 3H, ArH), 7.28-7.26 (m, 2H, ArH), 7.10-6.95 (m, 6H, ArH), 6.80-6.76 (m, 1H, ArH), 6.35-6.31 (m, 2H, ArH, CH), 5.48 (d, *J* = 10.0 Hz, 1H, CH), 5.27 (s, 1H, CH), 5.03 (d, *J* = 6.8 Hz, 1H, CH), 4.38 (d, *J* = 9.6 Hz, 1H, CH), 2.34 (s, 3H, CH₃), 2.12 (s, 3H, CH₃); ¹³C NMR (100 MHz, DMSO-*d*₆) δ: 198.3, 197.9, 160.9, 142.1, 141.5, 139.8, 137.9, 137.1, 136.9, 131.1, 130.9, 129.3, 128.9, 128.6, 128.5, 127.7, 127.5, 127.0, 126.8, 125.0, 124.3, 123.3, 122.6, 119.4, 93.2, 67.0, 62.2, 56.0, 54.8, 45.1, 20.9, 20.7; IR (KBr) ν: 3049, 2920, 2846, 1735, 1696, 1591, 1493, 1375, 1316, 1254, 1215, 1203, 1014, 955, 917, 895, 876, 772, 734, 718 cm⁻¹; MS (*m/z*): HRMS (ESI) Calcd. for C₃₆H₂₇NaN₃O₃ ([M+Na]⁺): 572.1945, found: 572.1943.



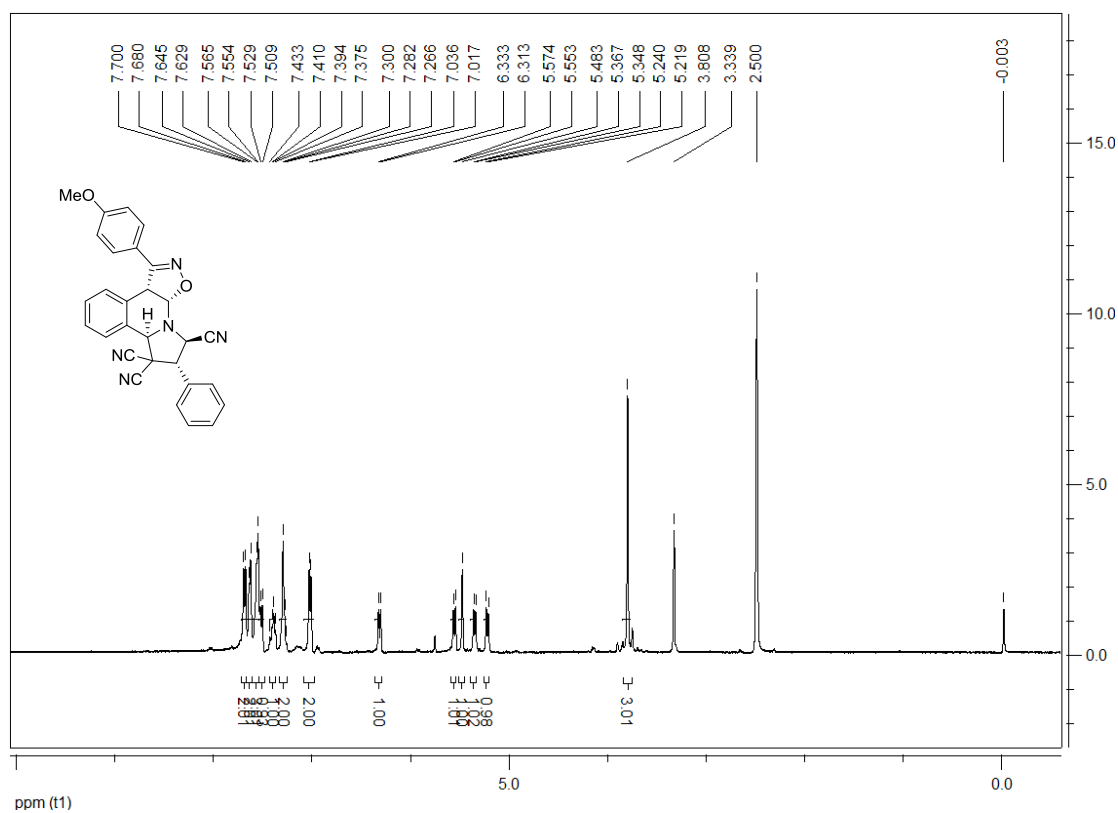


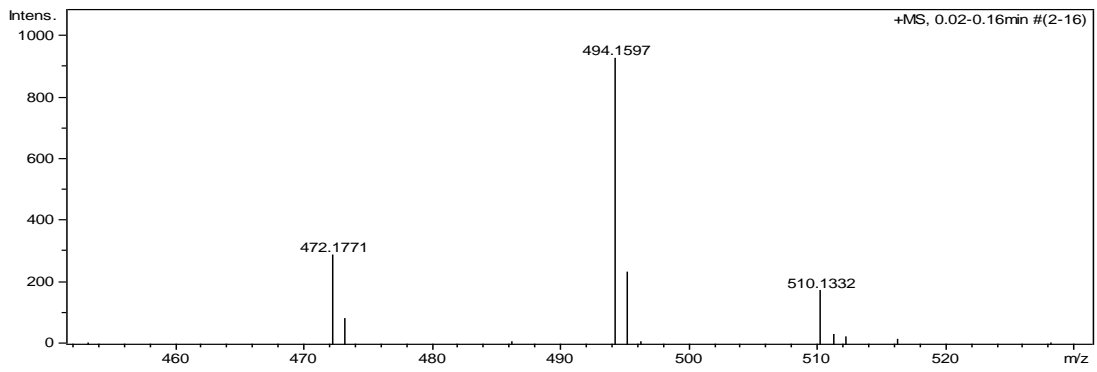
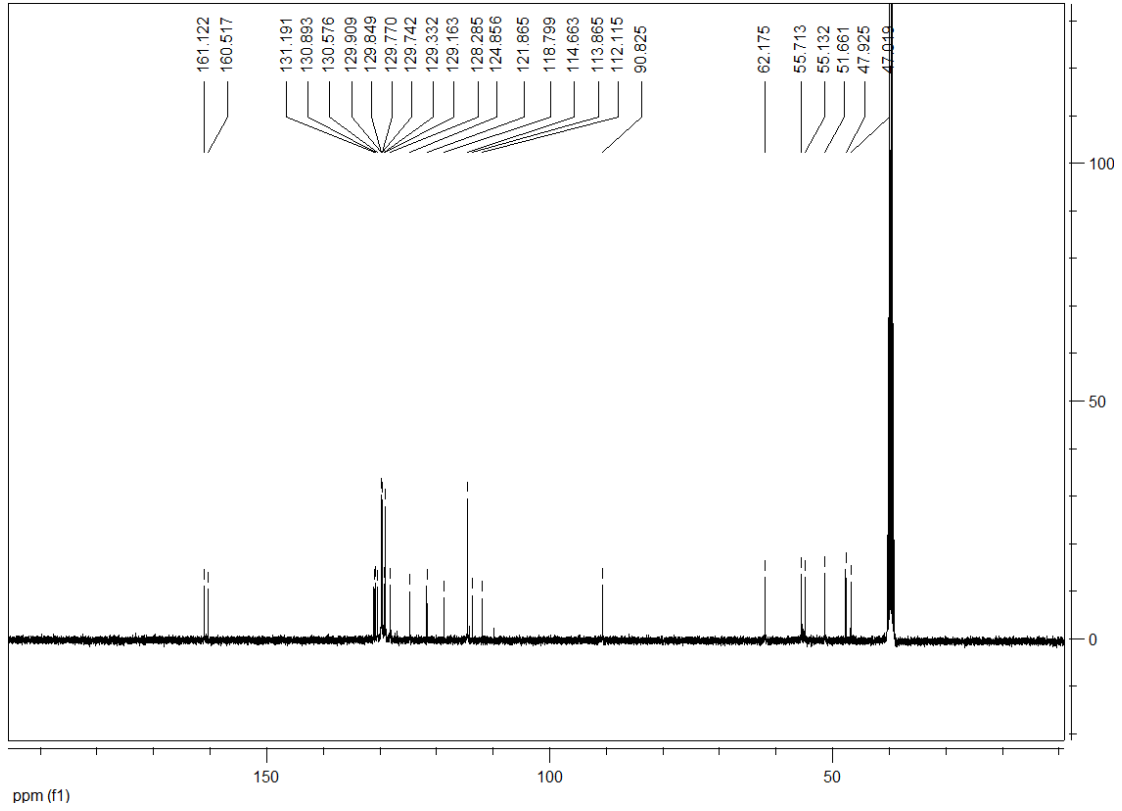
9-(4-methoxyphenyl)-3-(*p*-tolyl)-3a,9,10,11a-tetrahydroisoxazolo[5,4-*c*]pyrrolo[2,1-*a*]isoquinoline-8,8,10(7*bH*)-tricarbonitrile (5a): yellow solid, 65%, m.p. 249-251 °C; ¹H NMR (400 MHz, DMSO-*d*₆) δ: 7.63-7.50 (m, 5H, ArH), 7.38-7.29 (m, 5H, ArH), 7.12 (s, 2H, ArH), 6.35-6.33 (m, 1H, CH), 5.51-5.46 (m, 2H, CH), 5.37 (d, *J* = 9.6 Hz, 1H, CH), 5.16 (d, *J* = 8.4 Hz, 1H, CH), 3.82 (s, 3H, OCH₃), 2.34 (s, 3H, CH₃); ¹³C NMR (150 MHz, DMSO-*d*₆) δ: 160.5, 160.2, 140.0, 130.9, 130.0, 129.4, 129.3, 129.1, 128.8, 127.8, 126.3, 124.3, 121.8, 118.3, 114.6, 113.4, 111.7, 90.5, 61.5, 55.3, 54.3, 51.3, 47.6, 46.5, 20.9; IR (KBr) ν: 2958, 2188, 1732, 1676, 1618, 1489, 1458, 1449, 1376, 1308, 1304, 1276, 1248, 1175, 1105, 1050, 954, 878, 861, 847, 761, 728 cm⁻¹; MS (*m/z*): HRMS (ESI) Calcd. for C₃₀H₂₃NaN₅O₂ ([M+Na]⁺): 508.1744, found: 508.1755.



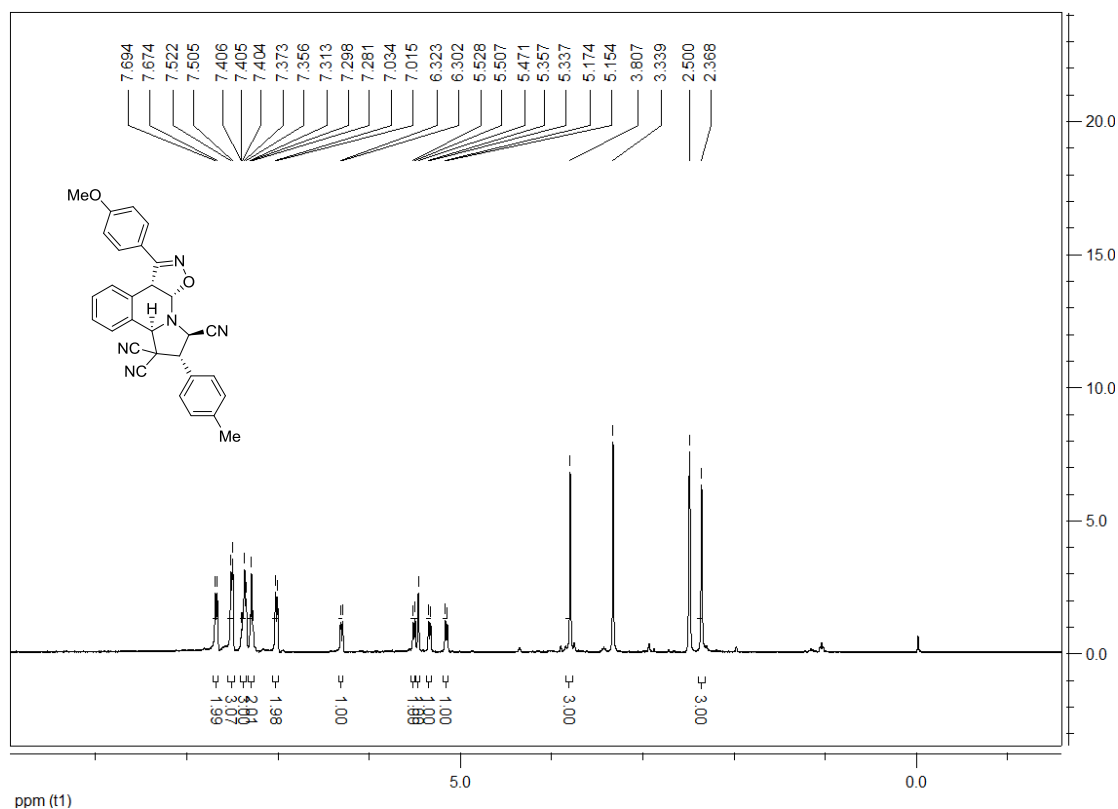


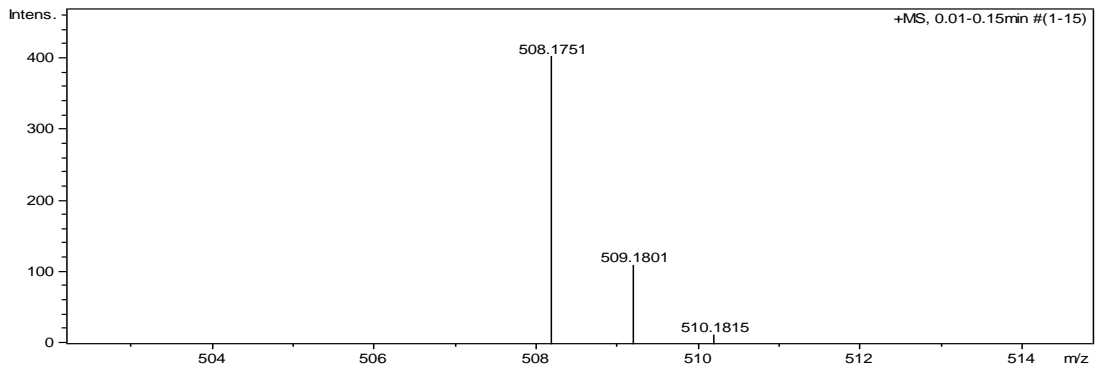
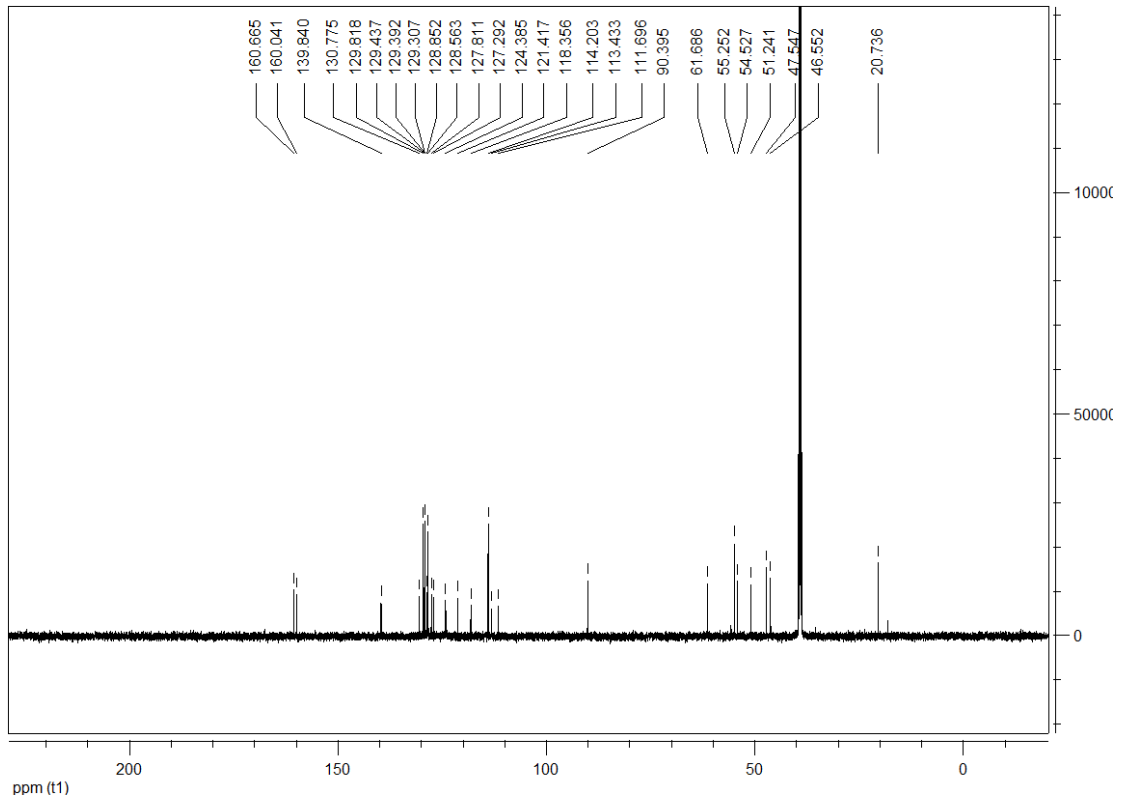
3-(4-methoxyphenyl)-9-phenyl-3a,9,10,11a-tetrahydroisoxazolo[5,4-c]pyrrolo[2,1-a]isoquinoline-8,8,10(7bH)-tricarbonitrile (2b): yellow solid, 60%, m.p. 256-258 °C; ¹H NMR (400 MHz, DMSO-*d*₆) δ: 7.70-7.68 (m, 2H, ArH), 7.65-7.62 (m, 2H, ArH), 7.57-7.55 (m, 3H, ArH), 7.53-7.51 (m, 1H, ArH), 7.43-7.38 (m, 1H, ArH), 7.30-7.26 (m, 2H, ArH), 7.03 (d, *J* = 7.6 Hz, 2H, ArH), 6.32 (d, *J* = 8.0 Hz, 1H, CH), 5.56 (d, *J* = 8.4 Hz, 1H, CH), 5.48 (s, 1H, CH), 5.36 (d, *J* = 7.6 Hz, 1H, CH), 5.23 (d, *J* = 8.4 Hz, 1H, CH), 3.81 (s, 3H, OCH₃); ¹³C NMR (100 MHz, DMSO-*d*₆) δ: 161.1, 160.5, 131.1, 130.8, 130.5, 129.9, 129.8, 129.7, 129.7, 129.3, 129.1, 128.2, 124.8, 121.8, 118.7, 114.6, 113.8, 112.1, 90.8, 62.1, 55.7, 55.1, 51.6, 47.9, 47.0; IR (KBr) ν: 2975, 2934, 2198, 1729, 1676, 1608, 1498, 1478, 1457, 1376, 1328, 1304, 1256, 1208, 1175, 1111, 1050, 954, 902, 880, 861, 837, 761, 730 cm⁻¹; MS (*m/z*): HRMS (ESI) Calcd. for C₂₉H₂₁NaN₅O₂ ([M+Na]⁺): 494.1587, found: 494.1597.



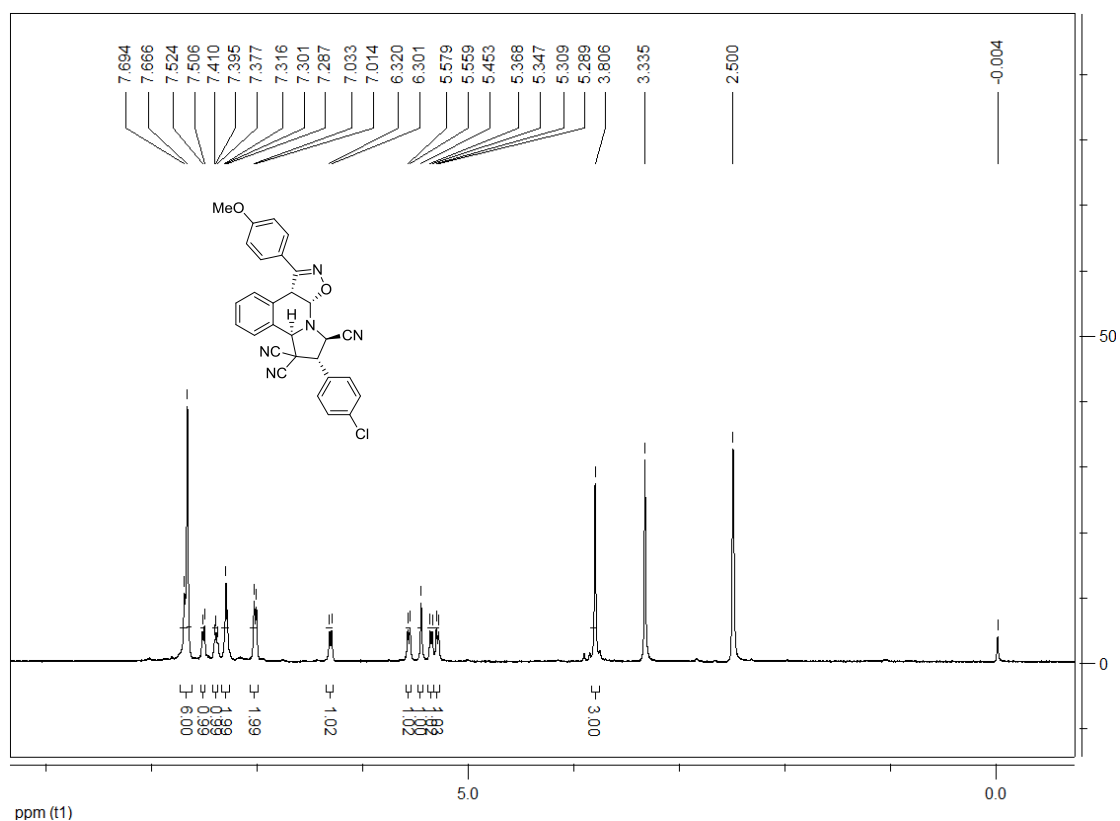


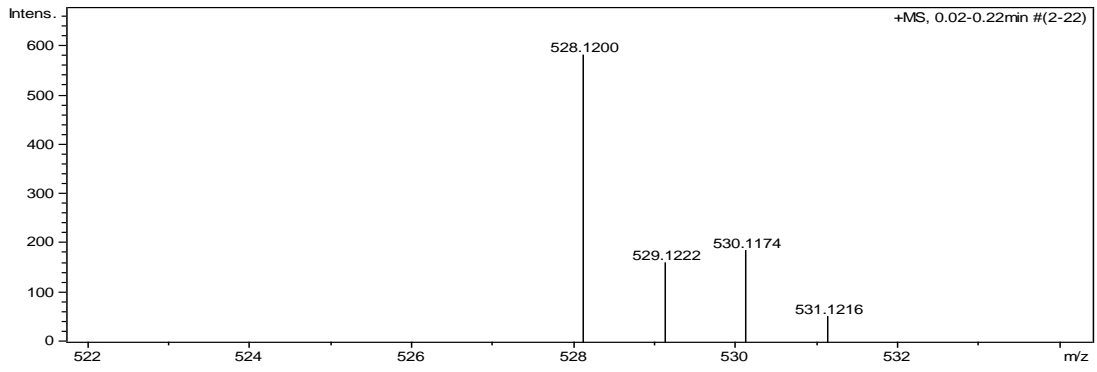
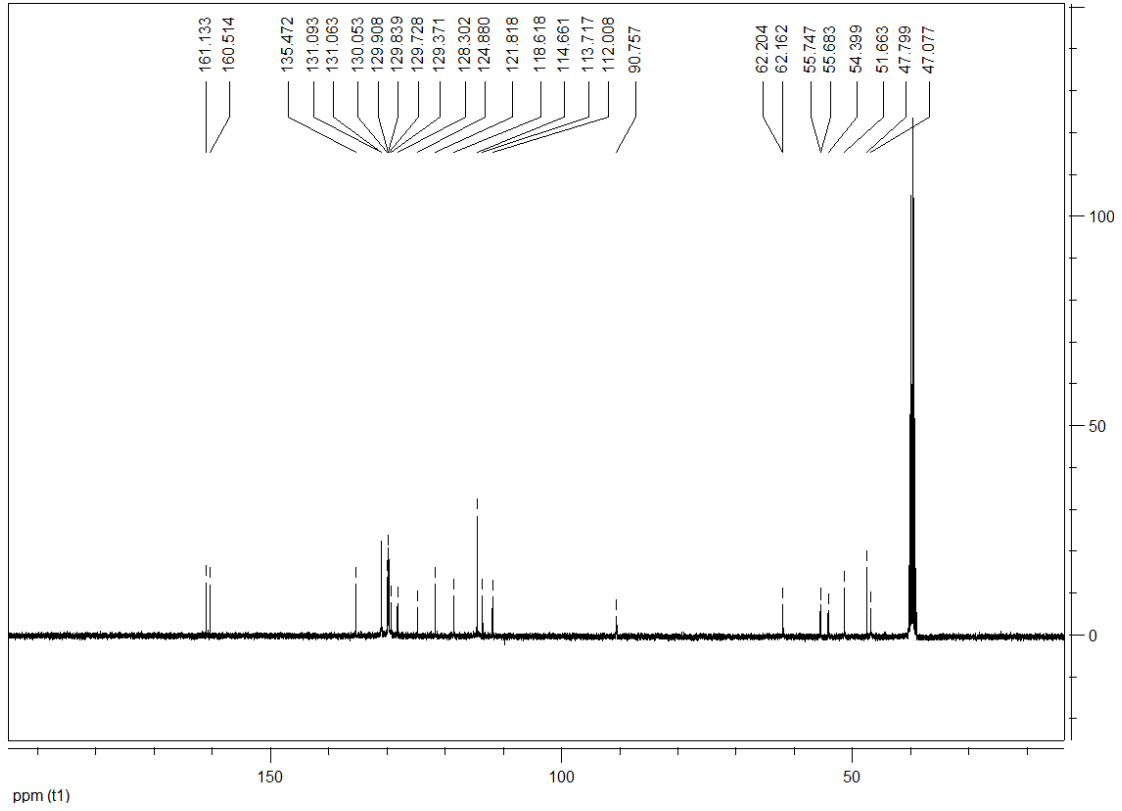
3-(4-methoxyphenyl)-9-(*p*-tolyl)-3a,9,10,11a-tetrahydroisoxazolo[5,4-*c*]pyrrolo[2,1-*a*]isoquinoline-8,8,10(7*bH*)-tricarbonitrile (5c)**: yellow solid, 63%, m.p. 254-256°C; ¹H NMR (400 MHz, DMSO-*d*₆) δ: 7.68 (d, *J* = 8.0 Hz, 2H, ArH), 7.51 (d, *J* = 6.8 Hz, 3H, ArH), 7.41-7.36 (m, 3H, ArH), 7.31-7.28 (m, 2H, ArH), 7.02 (d, *J* = 7.6 Hz, 2H, ArH), 6.31 (d, *J* = 8.4 Hz, 1H, CH), 5.52 (d, *J* = 8.4 Hz, 1H, CH), 5.47 (s, 1H, CH), 5.35 (d, *J* = 8.0 Hz, 1H, CH), 5.16 (d, *J* = 8.0 Hz, 1H, CH), 3.81 (s, 3H, OCH₃), 2.37 (s, 3H, CH₃); ¹³C NMR (150 MHz, DMSO-*d*₆) δ: 160.6, 160.0, 139.8, 130.7, 129.8, 129.4, 129.3, 129.3, 128.8, 128.5, 127.8, 127.2, 124.3, 121.4, 118.3, 114.2, 113.4, 111.6, 90.3, 61.6, 55.2, 54.5, 51.2, 47.5, 46.5, 20.7; IR (KBr) ν: 2937, 1720, 1610, 1516, 1460, 1405, 1336, 1303, 1258, 1177, 1113, 1041, 1023, 942, 903, 833, 810, 786, 756, 739 cm⁻¹; MS (*m/z*): HRMS (ESI) Calcd. for C₃₀H₂₃NaN₅O₂ ([M+Na]⁺): 508.1744, found: 508.1751.



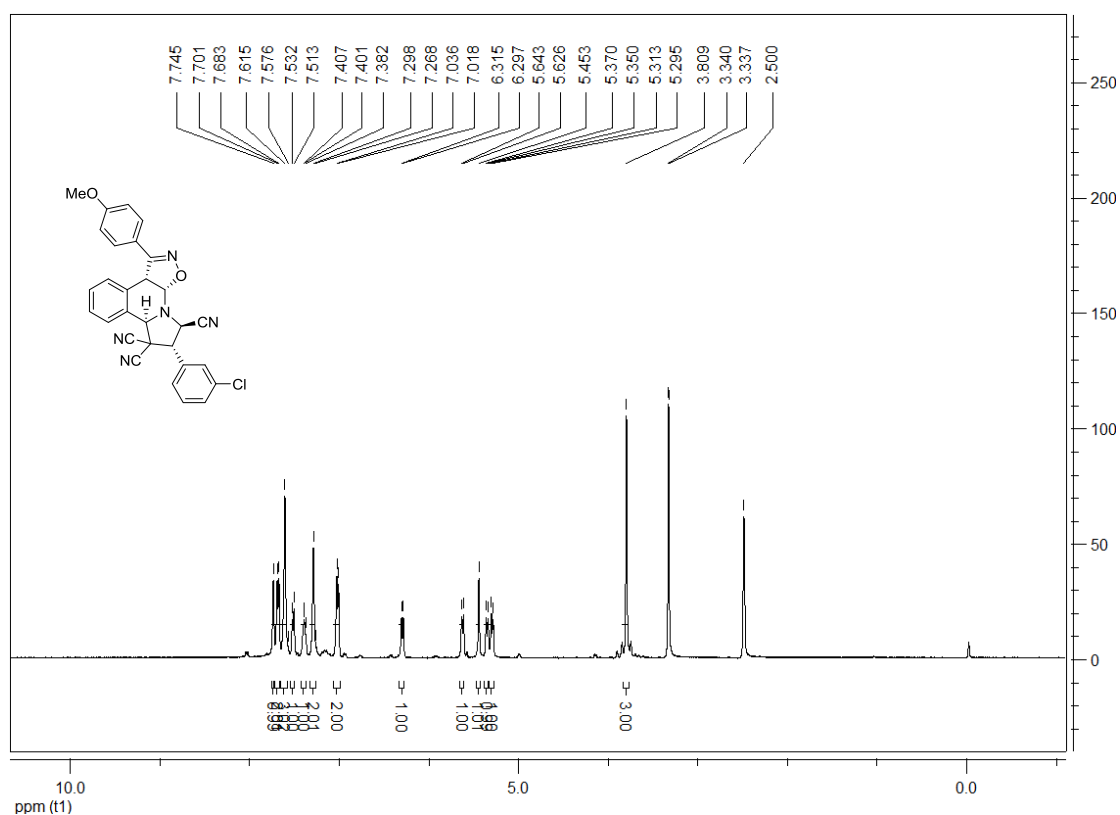


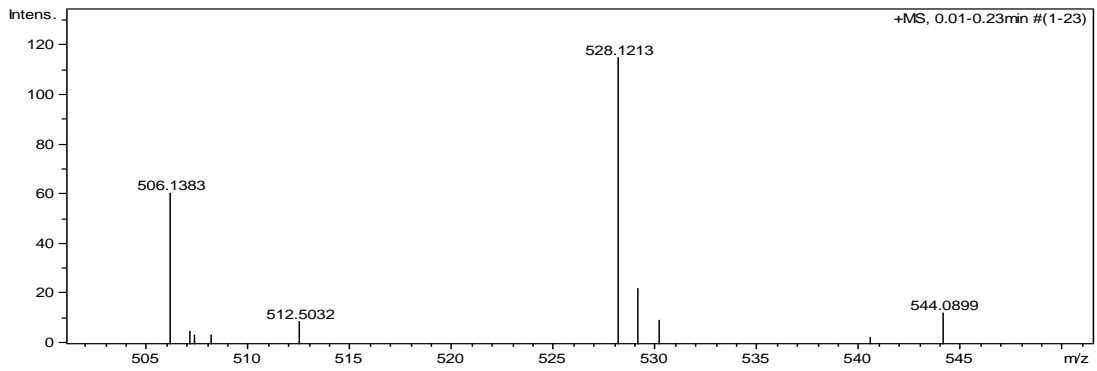
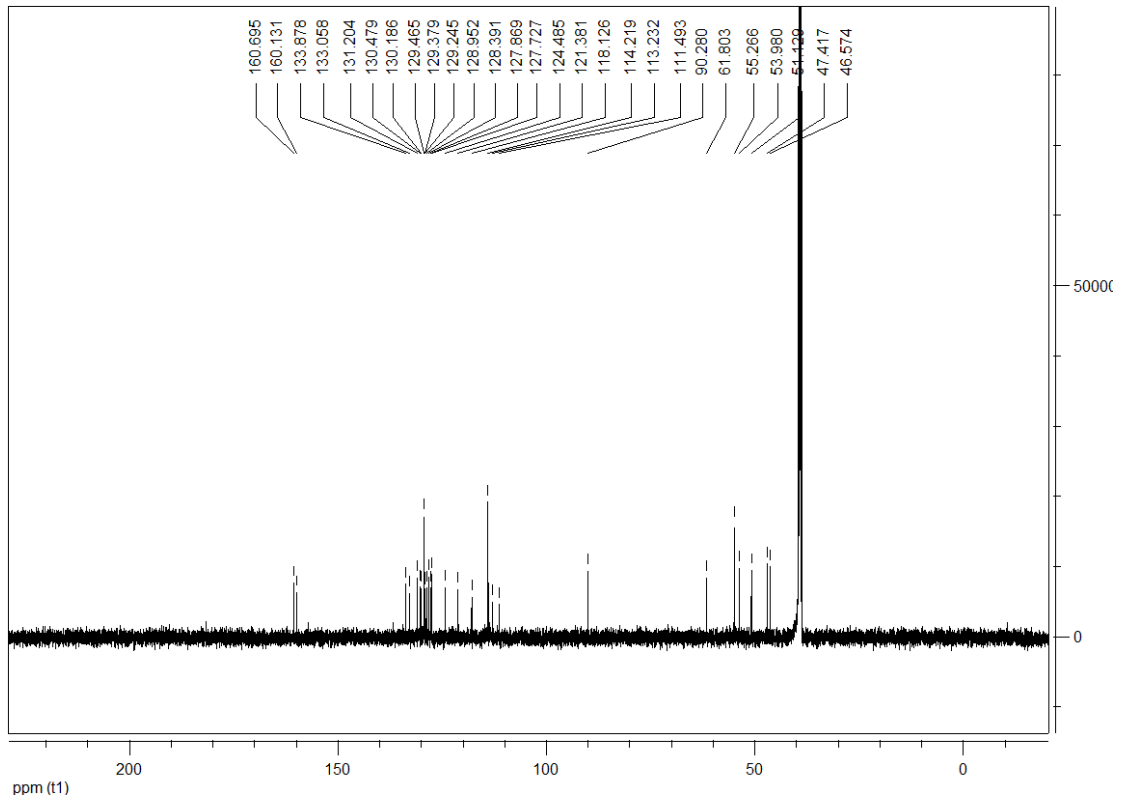
9-(4-chlorophenyl)-3-(4-methoxyphenyl)-3a,9,10,11a-tetrahydroisoxazolo[5,4-c]pyrrolo[2,1-a]isoquinoline-8,8,10(7bH)-tricarbonitrile (5d): yellow solid, 70%, m.p. 256-258°C; ¹H NMR (400 MHz, DMSO-*d*₆) δ: 7.69-7.67 (m, 6H, ArH), 7.51 (d, *J* = 7.2 Hz, 1H, ArH), 7.41-7.37 (m, 1H, ArH), 7.32-7.28 (m, 2H, ArH), 7.02 (d, *J* = 7.6 Hz, 2H, ArH), 6.31 (d, *J* = 7.6 Hz, 1H, CH), 5.57 (d, *J* = 8.0 Hz, 1H, CH), 5.45 (s, 1H, CH), 5.36 (d, *J* = 8.4 Hz, 1H, CH), 5.30 (d, *J* = 8.0 Hz, 1H, CH), 3.81 (s, 3H, OCH₃); ¹³C NMR (100 MHz, DMSO-*d*₆) δ: 161.1, 160.5, 135.4, 131.0, 131.0, 130.0, 129.9, 129.8, 129.7, 129.3, 128.3, 124.8, 121.8, 118.6, 114.6, 113.7, 112.0, 90.7, 62.2, 62.1, 55.7, 55.6, 54.3, 51.6, 47.7, 47.0; IR (KBr) ν: 3213, 2967, 2839, 1716, 1608, 1515, 1470, 1395, 1332, 1259, 1227, 1177, 1137, 1120, 1043, 911, 875, 835, 810, 787, 747, 727 cm⁻¹; MS (*m/z*): HRMS (ESI) Calcd. for C₂₉H₂₀ClN₅O₂ ([M+Na]⁺): 528.1198, found: 528.1200.



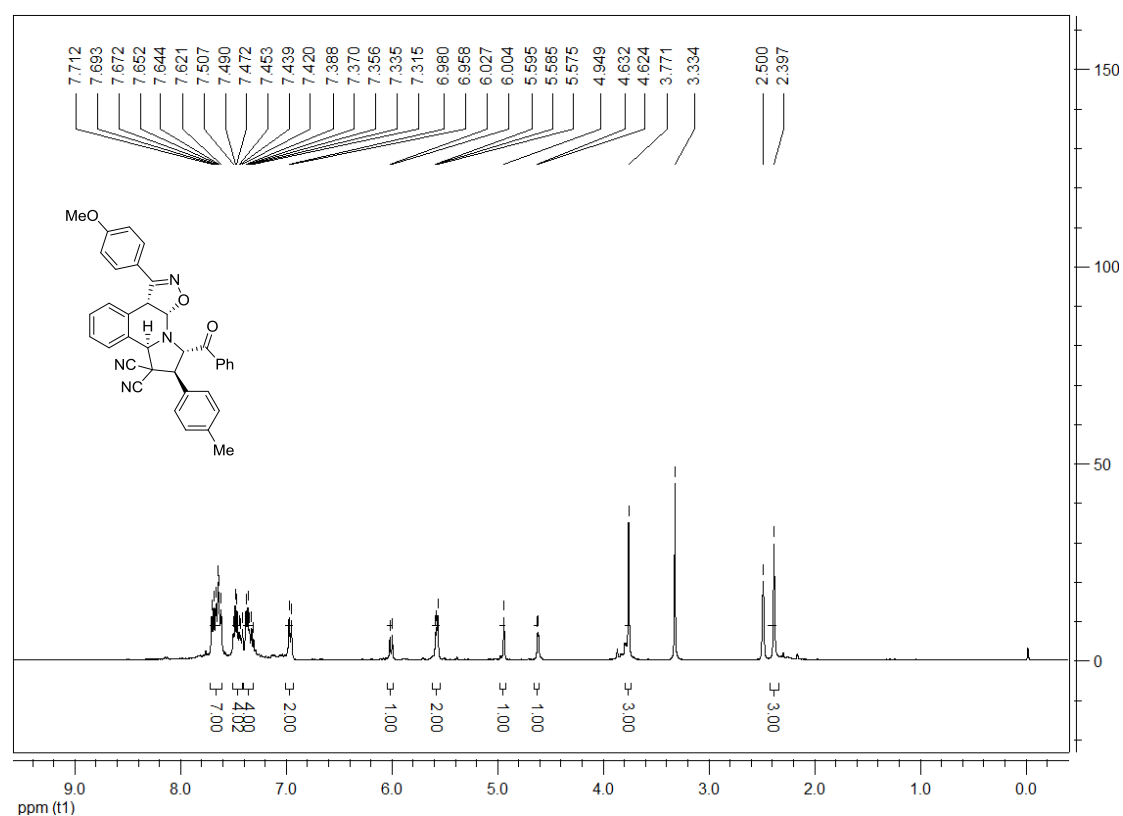


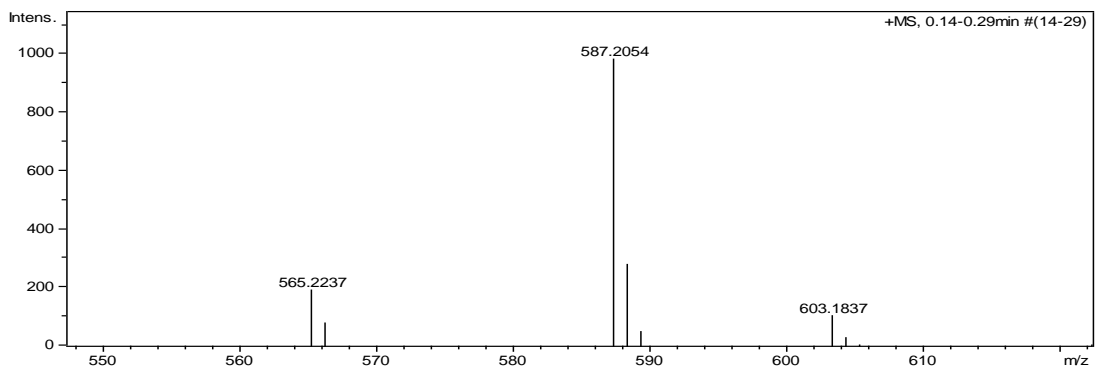
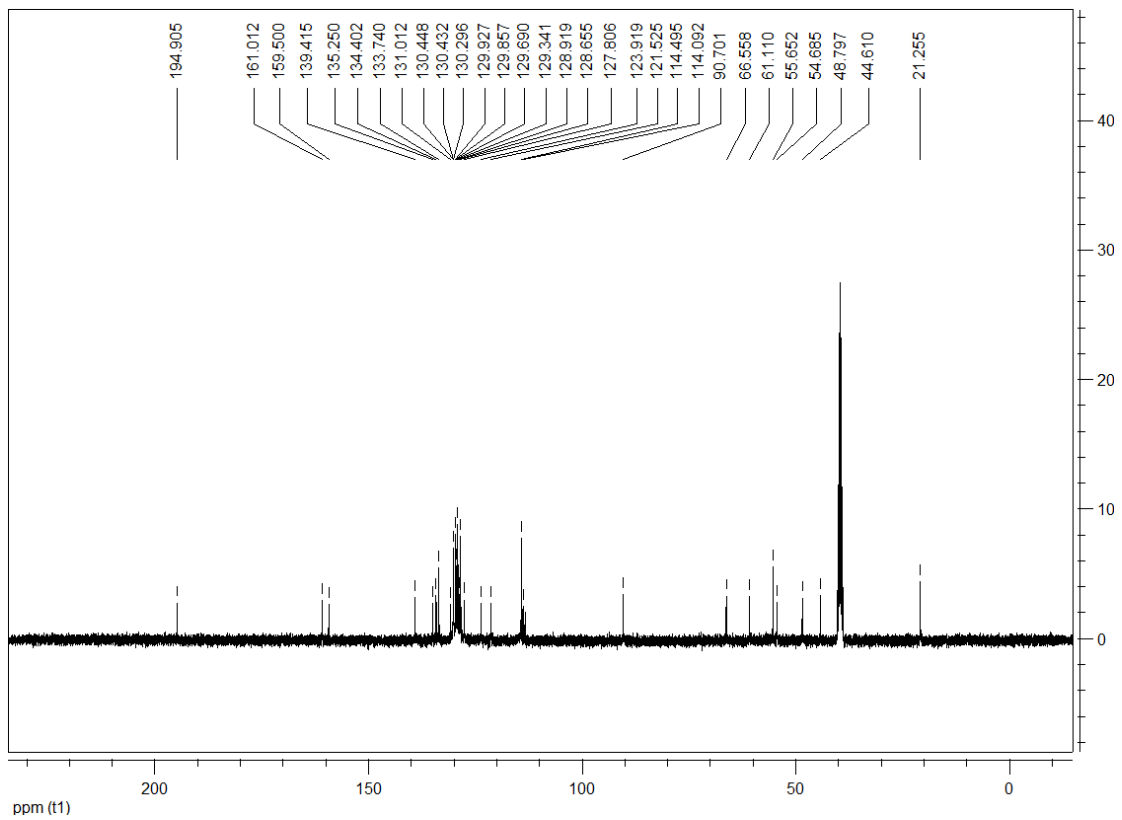
9-(3-chlorophenyl)-3-(4-methoxyphenyl)-3a,9,10,11a-tetrahydroisoxazolo[5,4-c]pyrrolo[2,1-a]isoquinoline-8,8,10(7bH)-tricarbonitrile (5e): yellow solid, 68%, m.p. 249-251 °C; ¹H NMR (400 MHz, DMSO-*d*₆) δ: 7.75 (s, 1H, ArH), 7.69 (d, *J* = 7.6 Hz, 2H, ArH), 7.63-7.56 (m, 3H, ArH), 7.52 (d, *J* = 7.6 Hz, 1H, ArH), 7.41-7.38 (m, 1H, ArH), 7.30-7.26 (m, 2H, ArH), 7.02 (d, *J* = 7.2 Hz, 2H, ArH), 6.30 (d, *J* = 7.2 Hz, 1H, CH), 5.63 (d, *J* = 6.8 Hz, 1H, CH), 5.45 (s, 1H, CH), 5.36 (d, *J* = 8.0 Hz, 1H, CH), 5.30 (d, *J* = 7.2 Hz, 1H, CH), 3.81 (s, 3H, OCH₃); ¹³C NMR (150 MHz, DMSO-*d*₆) δ: 160.6, 160.1, 133.8, 133.0, 131.2, 130.4, 130.1, 129.4, 129.3, 129.2, 128.9, 128.3, 127.8, 127.7, 124.4, 121.3, 118.1, 114.2, 113.2, 111.4, 90.2, 61.8, 55.2, 53.9, 51.1, 47.4, 46.5; IR (KBr) ν: 2961, 2837, 1714, 1610, 1595, 1576, 1515, 1480, 1464, 1405, 1335, 1322, 1299, 1256, 1199, 1176, 1112, 1086, 1043, 1023, 945, 908 cm⁻¹; MS (*m/z*): HRMS (ESI) Calcd. for C₂₉H₂₀ClN₅O₂ ([M+Na]⁺): 528.1198, found: 528.1213.

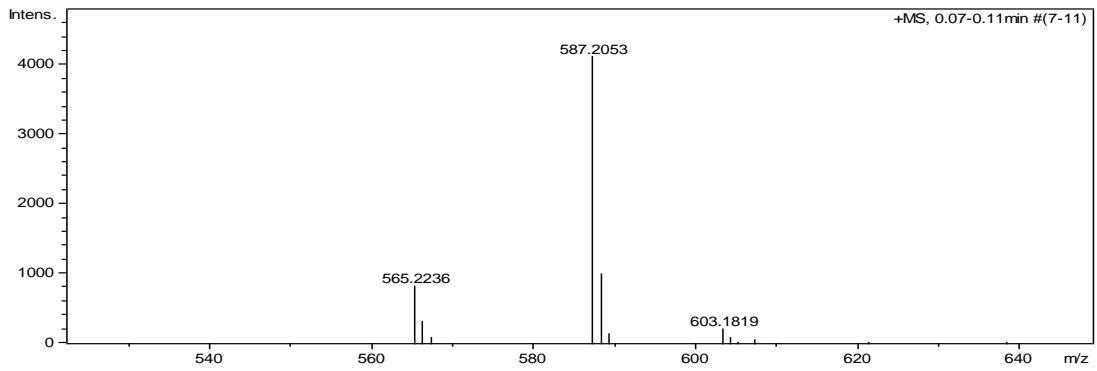
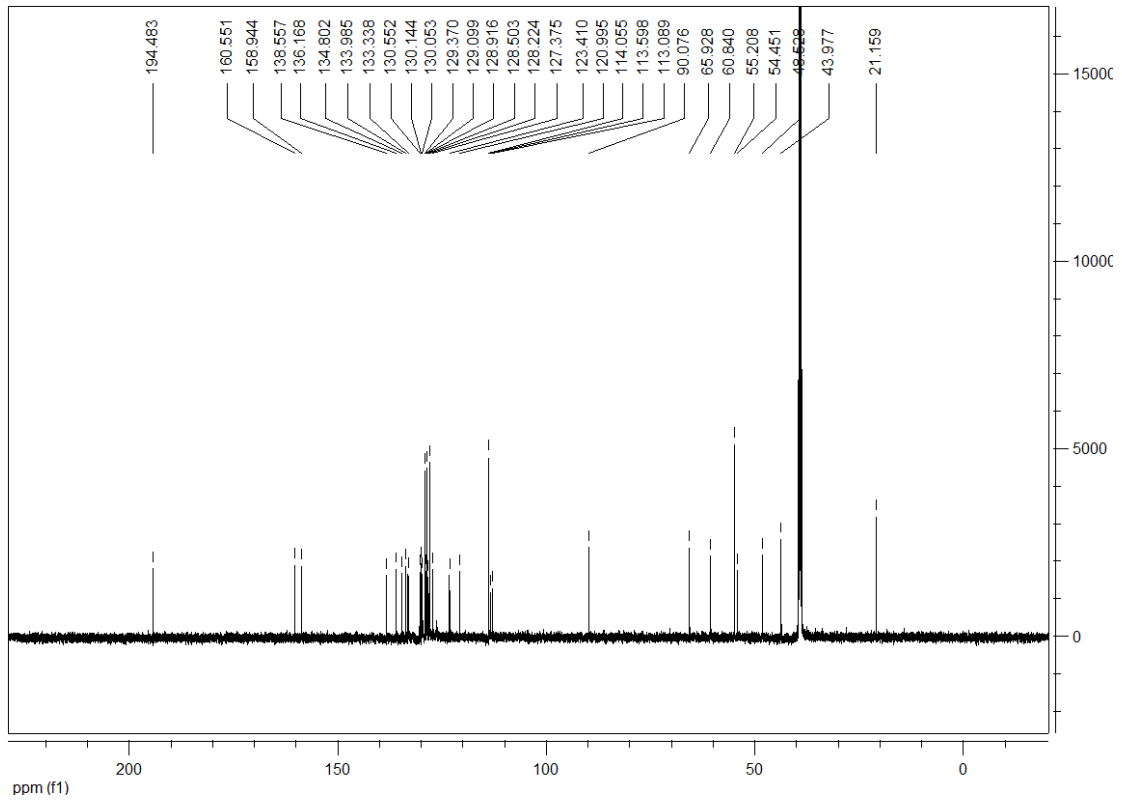


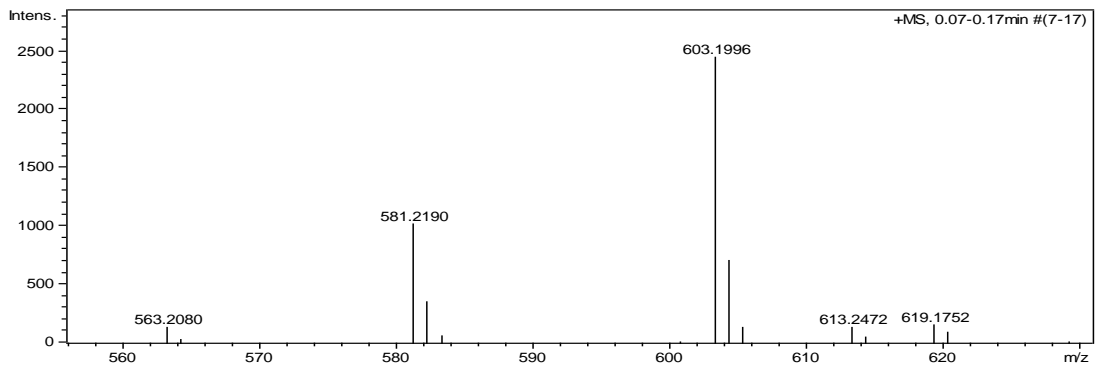
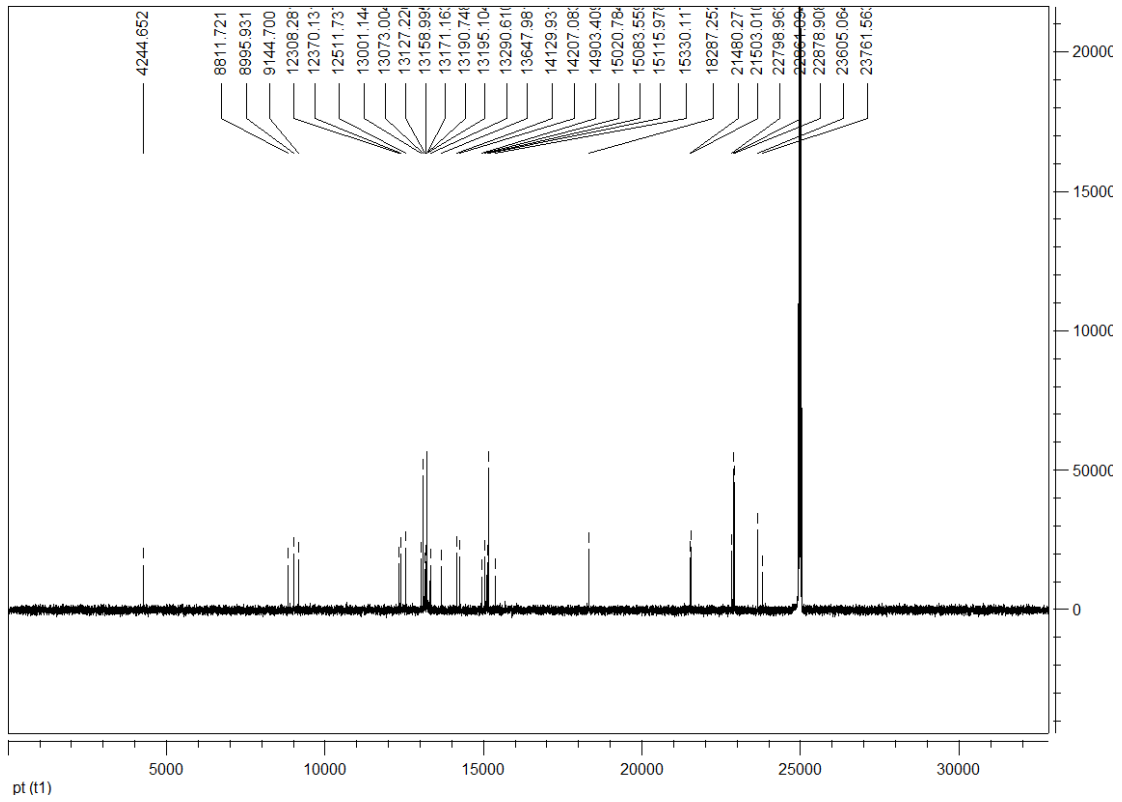


10-benzoyl-3-(4-methoxyphenyl)-9-(*p*-tolyl)-3a,9,10,11a-tetrahydroisoxazolo[5,4-*c*]pyrrolo[2,1-*a*]isoquinoline-8,8(7*bH*)-dicarbonitrile (5f)**: yellow solid, 62%, m.p. 216-218°C; ¹H NMR (400 MHz, DMSO-*d*₆) δ: 7.71-7.62 (m, 7H, ArH), 7.51-7.44 (m, 4H, ArH), 7.39-7.32 (m, 4H, ArH), 6.97 (d, *J* = 8.8 Hz, 2H, ArH), 6.01 (d, *J* = 9.2 Hz, 1H, CH), 5.60-5.58 (m, 2H, CH), 4.95 (s, 1H, CH), 4.63 (d, *J* = 3.2 Hz, 1H, CH), 3.77 (s, 3H, OCH₃); ¹³C NMR (100 MHz, DMSO-*d*₆) δ: 194.9, 161.0, 159.4, 139.4, 135.2, 134.4, 133.7, 131.0, 130.4, 130.4, 130.2, 129.9, 129.8, 129.6, 129.3, 128.9, 128.6, 127.8, 123.9, 121.5, 114.4, 114.0, 90.7, 66.5, 61.1, 55.6, 54.6, 48.7, 44.6, 21.2; IR (KBr) ν: 2919, 2850, 1738, 1697, 1591, 1490, 1456, 1395, 1356, 1291, 1255, 1157, 1118, 1074, 1052, 1009, 955, 896, 855, 819, 786, 773, 745 cm⁻¹; MS (*m/z*): HRMS (ESI) Calcd. for C₃₆H₂₈NaN₄O₃ ([M+Na]⁺): 587.2054, found: 587.2054.

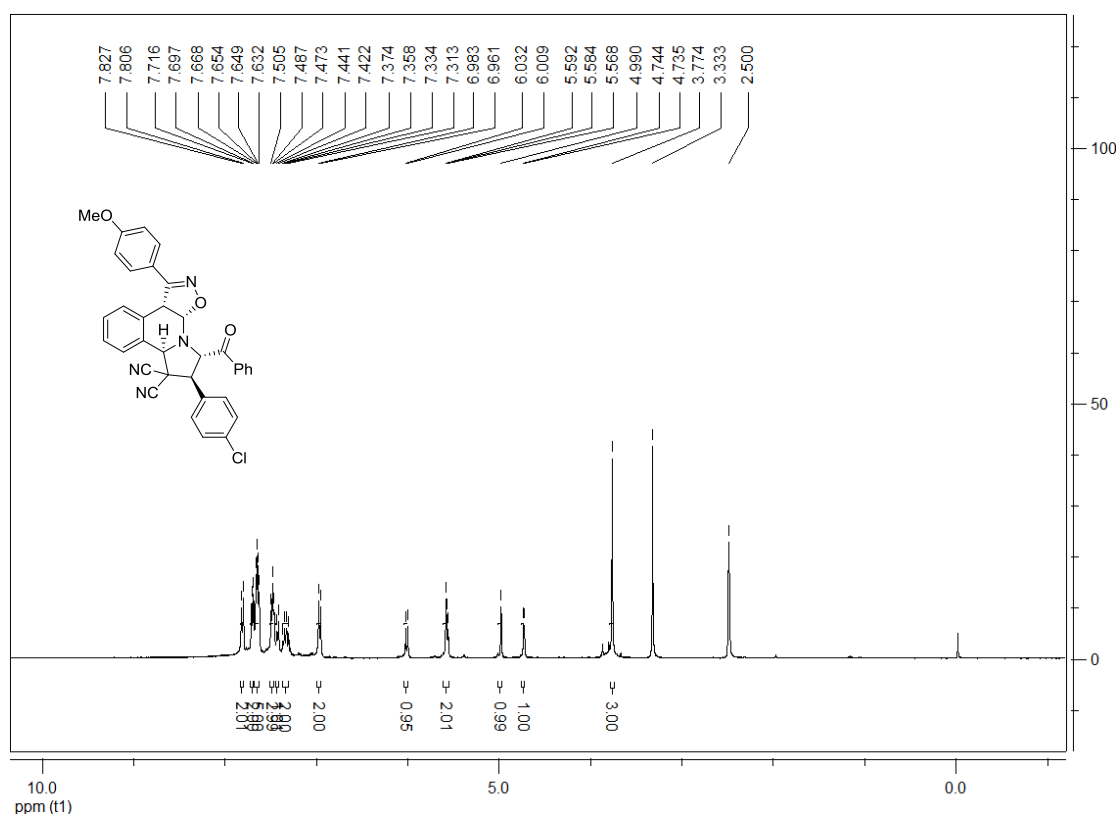


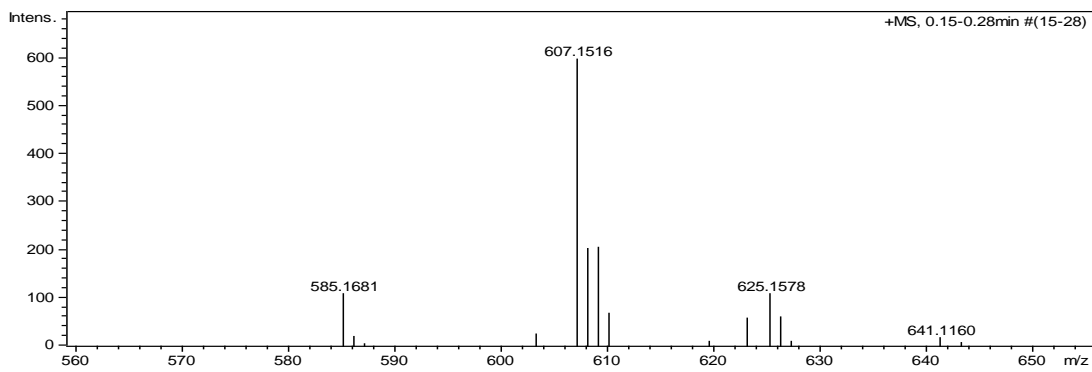
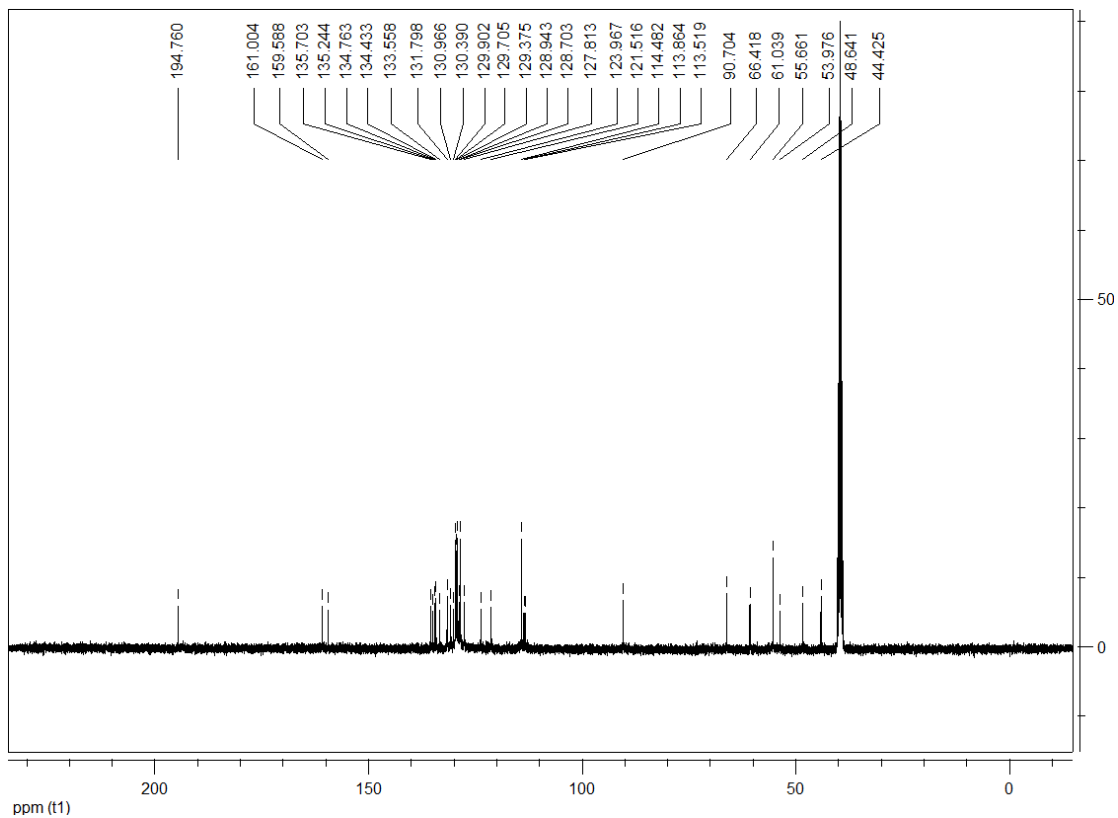






10-benzoyl-9-(4-chlorophenyl)-3-(4-methoxyphenyl)-3a,9,10,11a-tetrahydroisoxazolo[5,4-c]pyrrolo[2,1-a]isoquinoline-8,8(7bH)-dicarbonitrile (5i): yellow solid, 73%, m.p. 223-225°C; ^1H NMR (400 MHz, DMSO- d_6) δ : 7.82 (d, J = 8.4 Hz, 2H, ArH), 7.71 (d, J = 7.6 Hz, 2H, ArH), 7.67-7.63 (m, 5H, ArH), 7.51-7.47 (m, 3H, ArH), 7.43 (d, J = 7.6 Hz, 1H, ArH), 7.37-7.31 (m, 2H, ArH), 6.97 (d, J = 8.4 Hz, 2H, ArH), 6.02 (d, J = 9.2 Hz, 1H, CH), 5.59-5.57 (m, 2H, CH), 4.99 (s, 1H, CH), 4.74 (d, J = 3.6 Hz, 1H, CH), 3.77 (s, 3H, OCH₃); ^{13}C NMR (100 MHz, DMSO- d_6) δ : 194.7, 161.0, 159.5, 135.7, 135.2, 134.7, 134.4, 133.5, 131.7, 130.9, 130.3, 129.9, 129.7, 129.3, 128.9, 128.7, 127.8, 123.9, 121.5, 114.4, 113.8, 113.5, 90.7, 66.4, 61.0, 55.6, 53.9, 48.6, 44.4; IR (KBr) ν : 3049, 2920, 2846, 1735, 1696, 1591, 1493, 1454, 1375, 1353, 1316, 1291, 1254, 1215, 1203, 1157, 1120, 1014, 955, 939, 917, 895, 876, 852, 816, 786, 772, 734, 718, 700 cm^{-1} ; MS (m/z): HRMS (ESI) Calcd. for C₃₅H₂₅ClN₄O₃ ([M+Na]⁺): 607.1507, found: 607.1516.





10-benzoyl-9-(4-bromophenyl)-3-(4-methoxyphenyl)-3a,9,10,11a-tetrahydroisoxazolo[5,4-c]pyrrolo[2,1-a]isoquinoline-8,8(7bH)-dicarbonitrile (5j): yellow solid, 72%, m.p. 228-230°C; ¹H NMR (400 MHz, DMSO-*d*₆) δ: 7.80-7.70 (m, 6H, ArH), 7.64 (d, *J* = 8.0 Hz, 3H, ArH), 7.51-7.43 (m, 4H, ArH), 7.38-7.30 (m, 2H, ArH), 6.97 (d, *J* = 8.0 Hz, 2H, ArH), 6.01 (d, *J* = 8.8 Hz, 1H, CH), 5.58-5.56 (m, 2H, CH), 4.99 (s, 1H, CH), 4.72-4.71 (m, 1H, CH), 3.78 (s, 3H, OCH₃); ¹³C NMR (150 MHz, DMSO-*d*₆) δ: 194.3, 160.5, 159.1, 135.6, 134.7, 133.9, 133.0, 132.1, 131.5, 130.5, 129.9, 129.4, 128.9, 128.4, 128.2, 127.3, 123.5, 123.0, 121.0, 114.0, 113.3, 113.0, 90.2, 65.8, 60.5, 55.2, 53.5, 48.1, 43.8; IR (KBr) ν: 3065, 2932, 2838, 1686, 1608, 1513, 1491, 1449, 1414, 1305, 1254, 1177, 1113, 1075, 1011, 971, 910, 836, 786, 738, 699 cm⁻¹; MS (*m/z*): HRMS (ESI) Calcd. for C₃₅H₂₅BrNaN₄O₃ ([M+Na]⁺): 651.1002, found: 651.0999.

