Novel nano-architectonic carbon quantum dots (CQDs) with phosphorous acid tags as an efficient catalyst for the synthesis multisubstituted 4*H*-pyran with indole moieties under mild condition

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2-Amino-4-(4-methoxyphenyl)-6-(2-methyl-1H-indol-3-yl)-4H-pyran-3,5-dicarbonitrile(L1)

White solid; Mp:263-265 ˚C; FT-IR (KBr, cm^{-1}): 3459, 3304, 2209, 2194, 16667; ^{1}H NMR (500 MHz, DMSO-d_6) δ 11.76 (s, 1H), 7.48 (d, *J* = 7.4 Hz, 1H), 7.39 (d, *J* = 7.6 Hz, 1H), 7.31 (d, *J* = 8.0 Hz, 2H), 7.22 – 7.07 (m, 4H), 7.01 (d, *J* = 8.0 Hz, 2H), 4.43 (s, 1H), 3.79 (s, 3H), 2.44 (s, 3H). ^{13}C NMR (126 MHz, DMSO) δ 159.4, 155.8, 139.5, 135.8, 135.6, 129.3, 126.5, 122.3, 120.8, 120.0, 119.7, 118.4, 114.9, 111.8, 103.8, 91.4, 56.8, 55.7, 14.0.

2-Amino-4-(4-chlorophenyl)-6-(2-methyl-1H-indol-3-yl)-4H-pyran-3,5-dicarbonitrile(L2)

White solid; Mp:268-270 ˚C; FT-IR (KBr, cm^{-1}): 3487, 3322, 2217, 2200, 1663; ^{1}H NMR (400 MHz, DMSO-d_6) δ 11.79 (s, 1H), 7.53 (d, *J* = 8.4 Hz, 2H), 7.49 – 7.40 (m, 3H), 7.38 (d, *J* = 7.8 Hz, 1H), 7.29 (s, 2H), 7.15 (t, *J* = 7.4 Hz, 1H), 7.10 (t, *J* = 7.9 Hz, 1H), 4.55 (s, 1H), 2.42 (s, 3H). ^{13}C NMR (151 MHz, DMSO) δ 159.8, 156.7, 139.6, 139.5, 135.4, 133.0, 131.5, 130.7, 130.2, 128.6, 126.3, 122.2, 120.7, 119.6, 119.5, 117.9, 111.7, 103.5, 88.7, 54.5, 38.6, 13.9.

2-Amino-4-(2-chlorophenyl)-6-(2-methyl-1H-indol-3-yl)-4H-pyran-3,5-dicarbonitrile(L3)

White solid; Mp:236-238 ˚C; FT-IR (KBr, cm^{-1}): 3456, 3321, 2215, 2199, 1667; ^{1}H NMR (600 MHz, DMSO-d_6) δ 11.78 (s, 1H), 7.52 (t, *J* = 8.0 Hz, 2H), 7.49 – 7.43 (m, 2H), 7.42 – 7.36 (m, 2H), 7.27 (s, 2H), 7.14 (t, *J* = 7.5 Hz, 1H), 7.10 (t, *J* = 7.4 Hz, 1H), 4.95 (s, 1H), 2.43 (s, 3H). ^{13}C NMR (151 MHz, DMSO) δ 154.4, 151.1, 137.1, 136.8, 136.0, 132.4, 131.8, 130.8, 129.7, 129.3, 125.6, 123.8, 122.8, 121.8, 121.5, 116.9, 114.9, 112.9, 112.6, 88.7, 40.5, 29.9.

2-Amino-6-(2-methyl-1H-indol-3-yl)-4-(4-nitrophenyl)-4H-pyran-3,5-dicarbonitrile(L4)

Yellow solid; Mp:284-286 ˚C; FT-IR (KBr, cm^{-1}): 3645, 3485,2216,2201,1664; ^{1}H NMR (600 MHz, DMSO-d_6) δ 11.82 (s, 1H), 8.33 (d, *J* = 8.8 Hz, 2H), 7.71 (d, *J* = 8.8 Hz, 2H), 7.47 (d, *J* = 7.8 Hz, 1H), 7.41 – 7.37 (m, 3H), 7.15 (t, *J* = 7.5 Hz, 1H), 7.10 (t, *J* = 7.5 Hz, 1H), 4.76 (s, 1H),

2.43 (s, 3H). ^{13}C NMR (151 MHz, DMSO) δ 159.6, 156.7, 150.8, 147.6, 139.8, 135.4, 129.5, 126.3, 124.8, 122.3, 120.8, 120.8, 119.7, 119.5, 118.0, 111.8, 103.4, 89.3, 56.5, 55.0, 14.0.

2-Amino-6-(2-methyl-1H-indol-3-yl)-4-(3-nitrophenyl)-4H-pyran-3,5-dicarbonitrile(L5)

Yellow solid; Mp: 252-254 ˚C; FT-IR (KBr, cm^{-1}): 3475, 3335, 2199, 1669; ^{1}H NMR (600 MHz, DMSO-d_6) δ 11.78 (s, 1H), 7.52 (t, J = 8.5 Hz, 2H), 7.49 – 7.43 (m, 2H), 7.41 – 7.36 (m, 2H), 7.27 (s, 2H), 7.14 (t, J = 7.5 Hz, 1H), 7.10 (t, J = 7.4 Hz, 1H), 4.95 (s, 1H), 2.43 (s, 3H). ^{13}C NMR (151 MHz, DMSO) δ 159.8, 156.7, 139.6, 139.5, 135.4, 133.0, 131.5, 130.7, 130.2, 128.6, 126.3, 122.2, 120.7, 119.6, 119.5, 117.9, 111.7, 103.5, 88.7, 54.5, 38.5, 13.9.

2-Amino-4-(4-bromophenyl)-6-(2-methyl-1H-indol-3-yl)-4H-pyran-3,5-dicarbonitrile(L6)

White solid; Mp:267-269 ˚C; FT-IR (KBr, cm^{-1}): 3845, 3331, 2216, 2199, 1662; ^{1}H NMR (600 MHz, DMSO-d_6) δ 11.78 (s, 1H), 7.65 (d, J = 8.3 Hz, 2H), 7.46 (d, J = 7.9 Hz, 1H), 7.39 – 7.34 (m, 3H), 7.28 (s, 2H), 7.14 (t, J = 7.5 Hz, 1H), 7.10 (t, J = 7.5 Hz, 1H), 4.53 (s, 1H), 2.42 (s, 3H). ^{13}C NMR (151 MHz, DMSO) δ 159.4, 156.1, 143.0, 139.6, 135.4, 132.4, 130.3, 126.3, 126.3, 122.2, 121.5, 121.4, 120.7, 119.7, 119.6, 118.1, 111.7, 103.5, 90.2, 55.6, 40.5, 13.9.

2-Amino-4-(3,4-dimethoxyphenyl)-6-(2-methyl-1H-indol-3-yl)-4H-pyran-3,5-dicarbonitrile(L7)

White solid; Mp:205-207 ˚C; FT-IR (KBr, cm^{-1}): 3478, 3463, 3334, 2206, 1664; ^{1}H NMR (500 MHz, DMSO-d_6) δ 11.75 (s, 1H), 7.47 (d, J = 7.6 Hz, 1H), 7.38 (d, J = 7.9 Hz, 1H), 7.19 – 7.06 (m, 4H), 7.02 (d, J = 8.1 Hz, 1H), 6.96 – 6.87 (m, 2H), 4.42 (s, 1H), 3.84 – 3.73 (m, 6H), 2.44 (s, 3H).^{13}C NMR (126 MHz, DMSO) δ 158.7, 155.2, 149.0, 145.4, 138.9, 135.5, 134.9, 125.9, 125.9, 121.7, 120.2, 119.7, 119.0, 117.8, 112.1, 111.2, 111.1, 105.3, 103.2, 90.6, 83.1, 56.1, 55.5, 13.3.

2-Amino-6-(2-methyl-1H-indol-3-yl)-4-(pyridin-4-yl)-4H-pyran-3,5-dicarbonitrile(L8)

yellow solid; Mp:226-228 ˚C; FT-IR (KBr, cm^{-1}): 3451, 3342, 2203, 1665; ^{1}H NMR (500 MHz, DMSO-d_6) δ 11.80 (s, 1H), 8.70 – 8.62 (m, 2H), 7.48 (d, *J* = 7.6 Hz, 1H), 7.45 – 7.41 (m, 2H), 7.41 – 7.34 (m, 3H), 7.16 (t, *J* = 7.2 Hz, 1H), 7.11 (t, *J* = 7.1 Hz, 1H), 4.59 (s, 1H), 2.43 (s, 3H). ^{13}C NMR (126 MHz, DMSO) δ 159.2, 156.4, 151.3, 150.4, 139.3, 135.0, 125.8, 122.7, 121.8, 120.3, 119.2, 118.9, 117.4, 111.3, 102.9, 88.6, 60.0, 54.3, 13.4

2-Amino-4-(4-cyanophenyl)-6-(2-methyl-1H-indol-3-yl)-4H-pyran-3,5-dicarbonitrile(L9)

White solid; Mp:257-259 ˚C; FT-IR (KBr, cm^{-1}): 3459, 3323, 3364, 2231, 2218, 2197; ^{1}H NMR (500 MHz, DMSO-d_6) δ 11.79 (s, 1H), 7.94 (d, *J* = 7.8 Hz, 2H), 7.63 (d, *J* = 7.8 Hz, 2H), 7.47 (d, *J* = 7.6 Hz, 1H), 7.39 (d, *J* = 7.8 Hz, 1H), 7.34 (s, 2H), 7.16 (t, *J* = 7.1 Hz, 1H), 7.11 (t, *J* = 7.3 Hz, 1H), 4.68 (s, 1H), 2.43 (s, 3H). ^{13}C NMR (126 MHz, DMSO) δ 159.1, 156.2, 148.4, 139.3, 135.0, 133.0, 128.7, 125.8, 121.8, 120.3, 119.2, 118.9, 118.6, 117.5, 111.3, 110.7, 103.0, 89.0, 54.7, 13.4.

2-Amino-6-(2-methyl-1H-indol-3-yl)-4-(pyridin-3-yl)-4H-pyran-3,5-dicarbonitrile(L10)

Yellow solid; Mp:220-222 ˚C; FT-IR (KBr, cm^{-1}): 3449, 3316, 2199, 1662; ^{1}H NMR (500 MHz, DMSO-d_6) δ 11.79 (s, 1H), 8.61 (d, *J* = 16.9 Hz, 2H), 7.85 (d, *J* = 7.5 Hz, 1H), 7.55 – 7.45 (m, 2H), 7.39 (d, *J* = 7.7 Hz, 1H), 7.32 (s, 2H), 7.19 – 7.04 (m, 2H), 4.64 (s, 1H), 2.44 (s, 3H). ^{13}C NMR (126 MHz, DMSO) δ 159.1, 156.0, 149.1, 148.8, 139.1, 138.4, 135.4, 134.9, 125.8, 124.3, 121.8, 120.2, 119.1, 119.0, 117.5, 111.2, 103.0, 89.3, 54.8, 37.6, 13.4.

2-Amino-4-(4-chlorophenyl)-6-(1H-indol-3-yl)-4H-pyran-3,5-dicarbonitrile(I1)

White solid; Mp:254-256 ˚C; FT-IR (KBr, cm^{-1}): 3459, 3306, 2203, 2153, 1674; ^{1}H NMR (600 MHz, DMSO-d_6) δ 12.01 (s, 1H), 8.14 (d, *J* = 2.9 Hz, 1H), 7.95 (d, *J* = 8.0 Hz, 1H), 7.52 – 7.48 (m, 3H), 7.40 – 7.34 (m, 4H), 7.24 (t, *J* = 7.6 Hz, 1H), 7.16 (t, *J* = 7.5 Hz, 1H), 4.50 (s, 1H). ^{13}C NMR (151 MHz, DMSO) δ 159.1, 156.3, 142.5, 136.4, 132.8, 130.1, 129.9, 129.4, 124.9, 123.1, 122.0, 121.4, 119.6, 119.3, 119.3, 112.8, 105.7, 105.7, 84.0, 55.8, 39.4.

2-Amino-4-(4-bromophenyl)-6-(1H-indol-3-yl)-4H-pyran-3,5-dicarbonitrile(I2)

White solid; Mp:210-212 ˚C; FT-IR (KBr, cm^{-1}): 3457, 3306, 2201, 2151, 1672; ^{1}H NMR (500 MHz, DMSO-d_6) δ 11.99 (s, 1H), 8.04 (d, J = 97.6 Hz, 2H), 7.75 – 7.44 (m, 3H), 7.42 – 7.08 (m, 6H), 4.49 (s, 1H). ^{13}C NMR (126 MHz, DMSO) δ 158.7, 155.8, 142.4, 135.9, 131.8, 129.9, 129.4, 124.4, 122.6, 122.6, 121.5, 120.9, 119.0, 118.7, 112.3, 105.2, 83.5, 70.1, 55.4.

2-Amino-6-(1H-indol-3-yl)-4-(3-nitrophenyl)-4H-pyran-3,5-dicarbonitrile(I3)

Yellow solid; Mp:248-250 ˚C; FT-IR (KBr, cm^{-1}): 3457, 3357, 3253, 2201, 1663; ^{1}H NMR (500 MHz, DMSO-d_6) δ 12.02 (s, 1H), 8.43 – 8.07 (m, 3H), 8.07 – 7.67 (m, 3H), 7.62 – 7.40 (m, 3H), 7.21 (d, 2H), 4.76 (s, 1H). ^{13}C NMR (126 MHz, DMSO) δ 158.9, 156.3, 148.1, 145.2, 135.9, 134.5, 130.7, 129.6, 122.8, 122.7, 122.1, 121.5, 121.0, 118.6, 118.6, 112.3, 107.3, 73.2, 64.6, 39.0.

2-Amino-6-(1H-indol-3-yl)-4-(4-nitrophenyl)-4H-pyran-3,5-dicarbonitrile(I4)

Yellow solid; Mp:239-241 ˚C; FT-IR (KBr, cm^{-1}): 3435, 3332, 3272, 2209, 2194, 1666; ^{1}H NMR (500 MHz, DMSO-d_6) δ 12.02 (s, 1H), 8.30 (s, 2H), 8.06 (d, J = 94.3 Hz, 2H), 7.66 (s, 2H), 7.58 – 7.35 (m, 3H), 7.20 (d, J = 31.8 Hz, 2H), 4.70 (s, 1H). ^{13}C NMR (126 MHz, DMSO) δ 158.8, 156.4, 150.2, 147.1, 135.9, 129.6, 129.1, 124.4, 124.2, 122.7, 121.5, 121.0, 118.8, 118.6, 112.3, 105.2, 82.6, 54.8.

2-Amino-6-(1H-indol-3-yl)-4-(naphthalen-2-yl)-4H-pyran-3,5-dicarbonitrile(I5)

Yellow solid; Mp:205-207 ˚C; FT-IR (KBr, cm^{-1}): 3478, 3310, 2204, 1675; ^{1}H NMR (500 MHz, DMSO-d_6) δ 11.98 (s, 1H), 8.14 (s, 1H), 8.07 – 7.81 (m, 5H), 7.62 – 7.42 (m, 4H), 7.38 – 7.13 (m, 4H), 4.61 (s, 1H). ^{13}C NMR (126 MHz, DMSO) δ 158.6, 155.7, 140.3, 135.4, 132.9, 132.5, 129.3, 128.9, 127.9, 127.5, 126.5, 126.2, 125.5, 122.6, 122.4, 121.5, 121.5, 120.9, 119.2, 118.9, 112.2, 72.2, 64.4, 55.8.

2-Amino-6-(1H-indol-3-yl)-4-(pyridin-4-yl)-4H-pyran-3,5-dicarbonitrile(I6)

Yellow solid; Mp:220-222 ˚C; FT-IR (KBr, cm^{-1}): 3374, 3252, 2205, 2194, 1659; ^{1}H NMR (500 MHz, DMSO-d_6) δ 12.03 (s, 1H), 8.63 (s, 2H), 8.07 (d, *J* = 106.3 Hz, 2H), 7.69 – 7.32 (m, 5H), 7.21 (d, *J* = 29.4 Hz, 2H), 4.53 (s, 1H). ^{13}C NMR (126 MHz, DMSO) δ 158.9, 156.5, 151.3, 150.3, 135.9, 129.6, 124.4, 122.7, 122.7, 121.5, 121.0, 118.9, 118.6, 112.3, 105.1, 82.4, 54.5, 39.0.

2-Amino-6-(1H-indol-3-yl)-4-(4-methoxyphenyl)-4H-pyran-3,5-dicarbonitrile(I7)

White solid; Mp:246-248 ˚C; FT-IR (KBr, cm^{-1}): 3425, 3337, 3182, 2198, 1665; ^{1}H NMR (500 MHz, DMSO-d_6) δ 11.95 (s, 1H), 8.03 (d, *J* = 81.3 Hz, 2H), 7.51 (s, 1H), 7.33 – 7.12 (m, 6H), 6.98 (s, 2H), 4.37 (s, 1H), 3.77 (s, 3H). ^{13}C NMR (126 MHz, DMSO) δ 158.7, 158.5, 155.3, 135.9, 135.1, 129.1, 128.7, 124.5, 122.6, 121.4, 120.9, 119.2, 118.9, 114.2, 112.2, 105.4, 84.5, 56.3, 55.1, 39.0.

2-Amino-4-(4-cyanophenyl)-6-(1H-indol-3-yl)-4H-pyran-3,5-dicarbonitrile(I8)

White solid; Mp:260-262 ˚C; FT-IR (KBr, cm^{-1}): 3456, 3316, 3353, 2225, 2202, 1665; ^{1}H NMR (500 MHz, DMSO-d_6) δ 12.02 (s, 1H), 8.15 (s, 1H), 8.04 – 7.83 (m, 3H), 7.70 – 7.33 (m, 5H), 7.20 (d, *J* = 34.7 Hz, 2H), 4.62 (s, 1H). ^{13}C NMR (126 MHz, DMSO) δ 158.8, 156.3, 148.3, 135.9, 133.0, 129.6, 128.7, 124.4, 124.4, 122.7, 121.5, 121.0, 118.9, 118.6, 112.3, 110.6, 105.2, 82.7, 54.9.

2-Amino-4-(2,6-dichlorophenyl)-6-(1H-indol-3-yl)-4H-pyran-3,5-dicarbonitrile(I9)

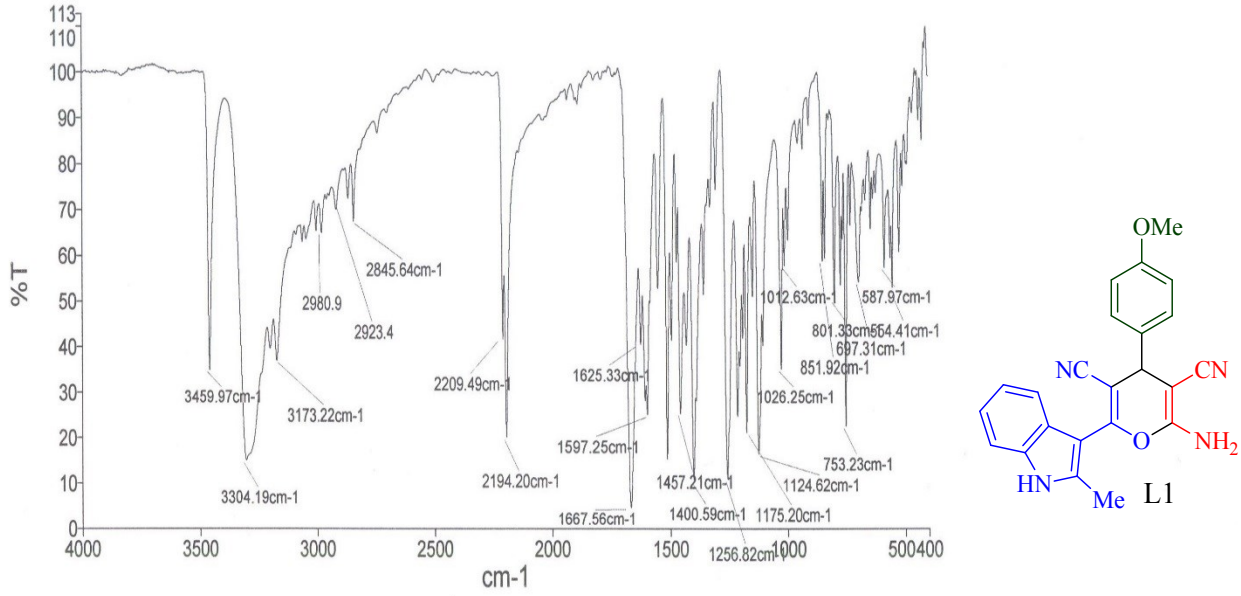
White solid; Mp:238-240 ˚C; FT-IR (KBr, cm^{-1}): 3444, 3314, 3187, 2199, 1675; ^{1}H NMR (500 MHz, DMSO-d_6) δ 11.98 (s, 1H), 8.02 (d, *J* = 91.9 Hz, 2H), 7.61 – 7.47 (m, 3H), 7.45 – 7.33 (m, 3H), 7.20 (d, *J* = 34.4 Hz, 2H), 5.49 (s, 1H). ^{13}C NMR (126 MHz, DMSO) δ 159.5, 157.2, 135.9, 134.3, 131.0, 130.5, 129.2, 128.9, 124.5, 124.4, 122.6, 121.4, 120.9, 118.6, 118.2, 112.3, 105.2, 79.9, 51.8, 36.2.

2-Amino-6-(1H-indol-3-yl)-4-(pyridin-3-yl)-4H-pyran-3,5-dicarbonitrile(I10)

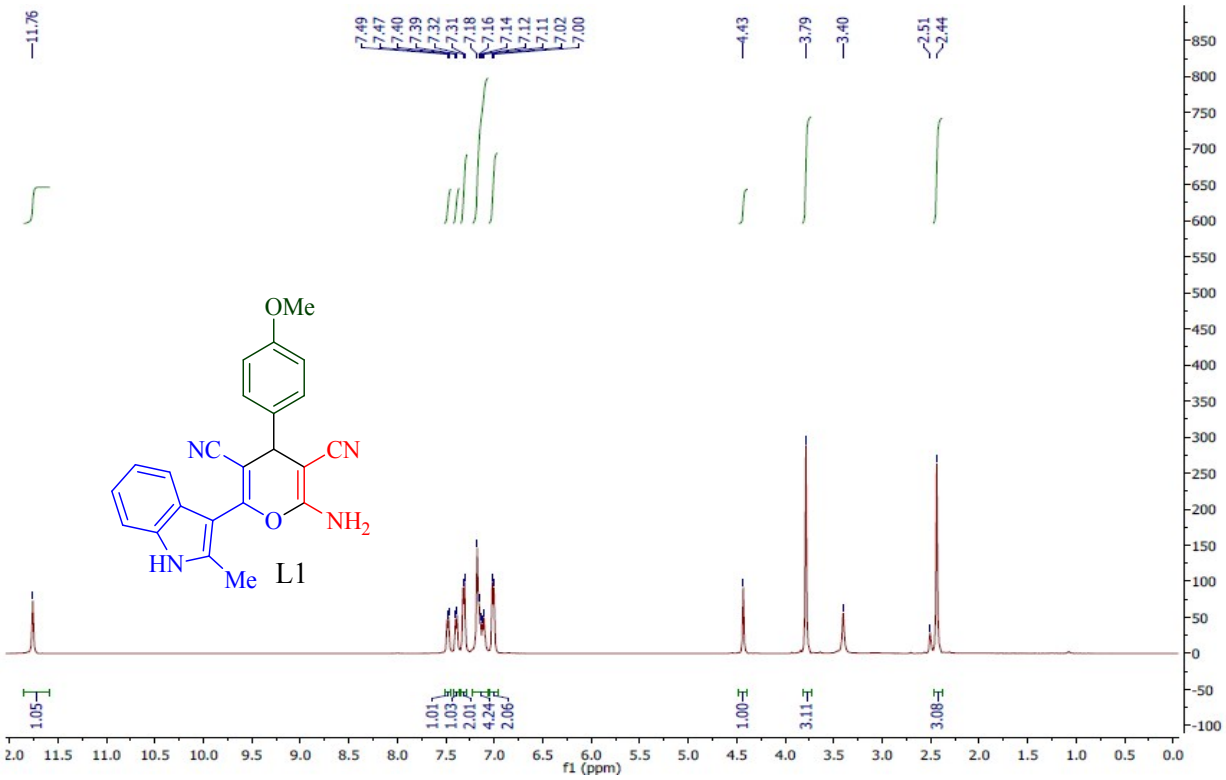
Yellow solid; Mp:238-240 ˚C; FT-IR (KBr, cm^{-1}): 3372, 3296, 3115, 2204, 2191, 1672; ^{1}H NMR (500 MHz, DMSO-d_6) δ 12.00 (s, 1H), 8.58 (s, 2H), 8.27 – 7.72 (m, 3H), 7.60 – 7.31 (m, 4H), 7.20 (d, J = 33.7 Hz, 2H), 4.57 (s, 1H). ^{13}C NMR (126 MHz, DMSO) δ 158.8, 156.2, 149.0, 148.8, 138.3, 135.9, 135.4, 129.5, 124.4, 124.2, 122.6, 121.5, 120.9, 118.9, 118.7, 112.3, 105.2, 83.1, 55.0, 37.2.

2-Amino-4-(3,4-dimethoxyphenyl)-6-(1H-indol-3-yl)-4H-pyran-3,5-dicarbonitrile(I11)

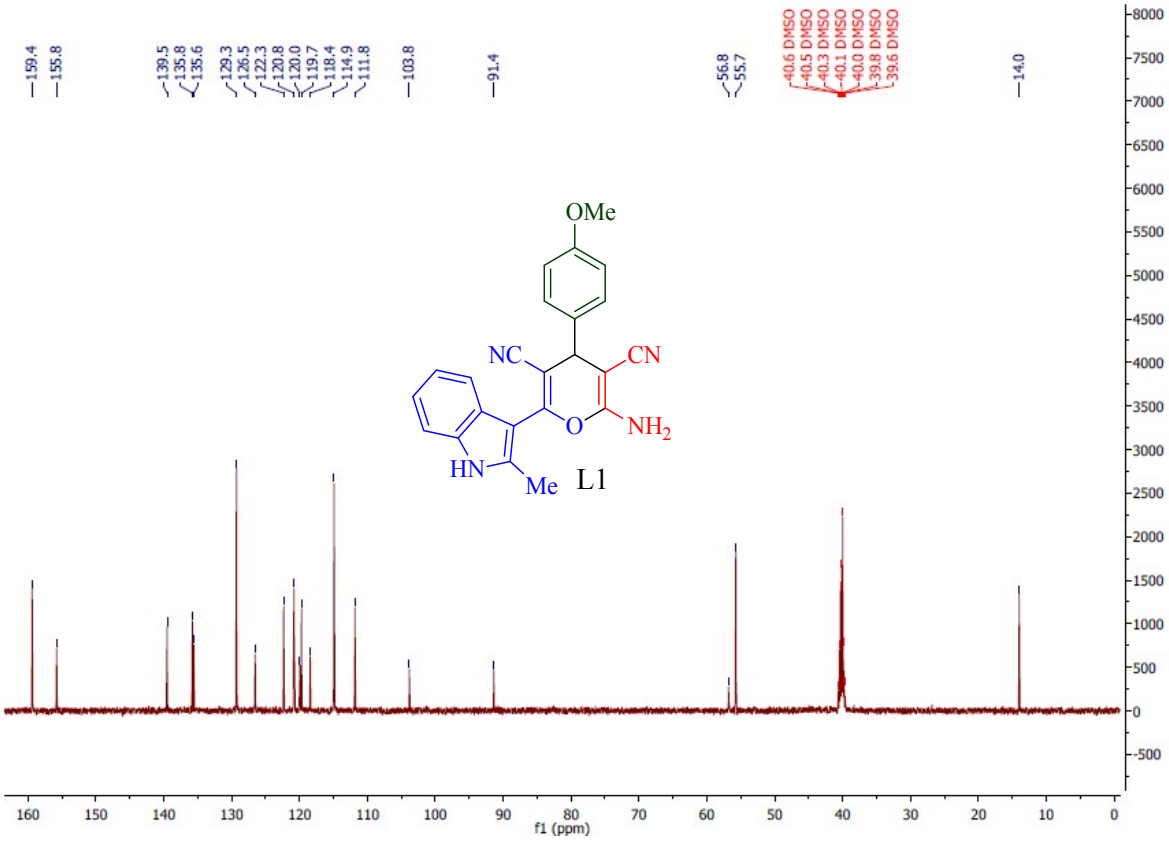
Yellow solid; Mp*:228-230* ˚C; FT-IR (KBr, cm^{-1}): 3426, 3342, 3205, 2203, 1667; ^{1}H NMR (500 MHz, DMSO-d_6) δ 11.89 (s, 1H), 7.97 (d, J = 86.3 Hz, 2H), 7.59 – 6.58 (m, 8H), 4.38 (s, 1H), 3.73 (s, 6H). ^{13}C NMR (126 MHz, DMSO) δ 158.5, 155.3, 148.8, 148.3, 135.9, 135.4, 129.1, 122.6, 122.5, 121.4, 120.8, 119.7, 119.7, 119.2, 118.8, 112.1, 111.3, 105.4, 104.8, 55.7, 55.5, 39.0.



FT-IR spectrum of 2-amino-4-(4-methoxyphenyl)-6-(2-methyl-1H-indol-3-yl)-4H-pyran-3,5-dicarbonitrile



[1]H-NMR spectrum of 2-amino-4-(4-methoxyphenyl)-6-(2-methyl-1H-indol-3-yl)-4H-pyran-3,5-dicarbonitrile



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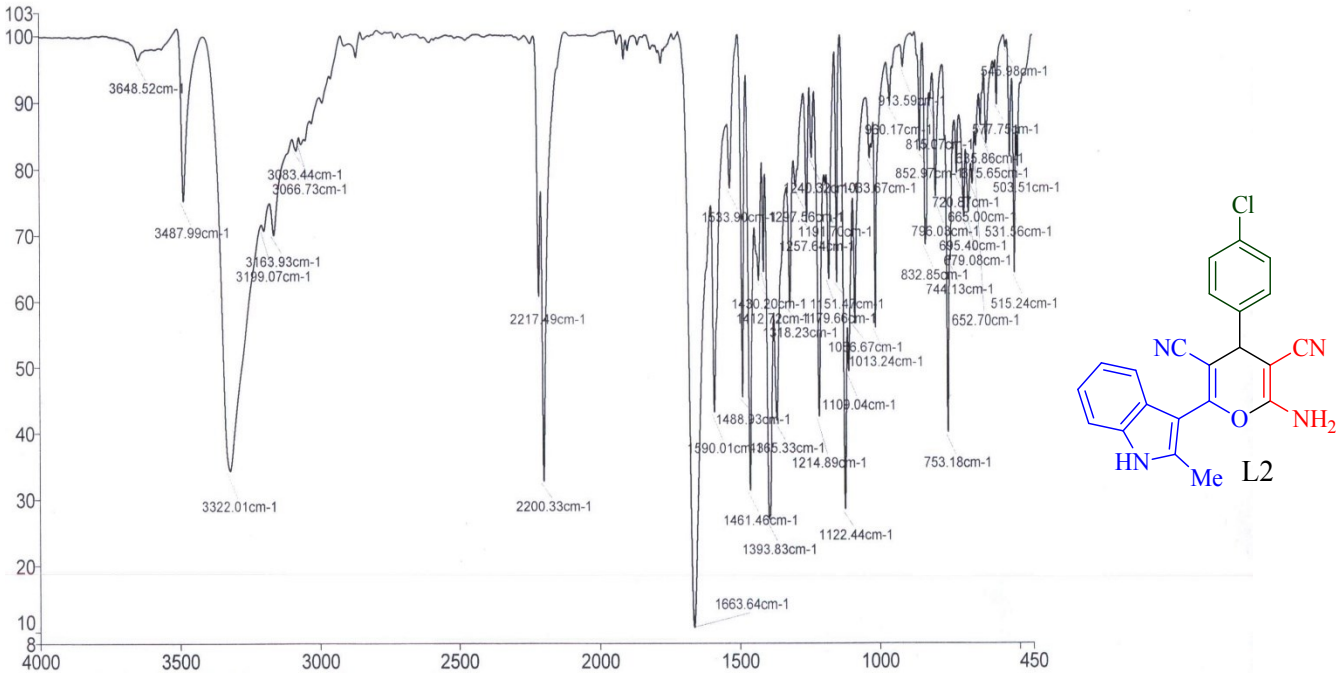
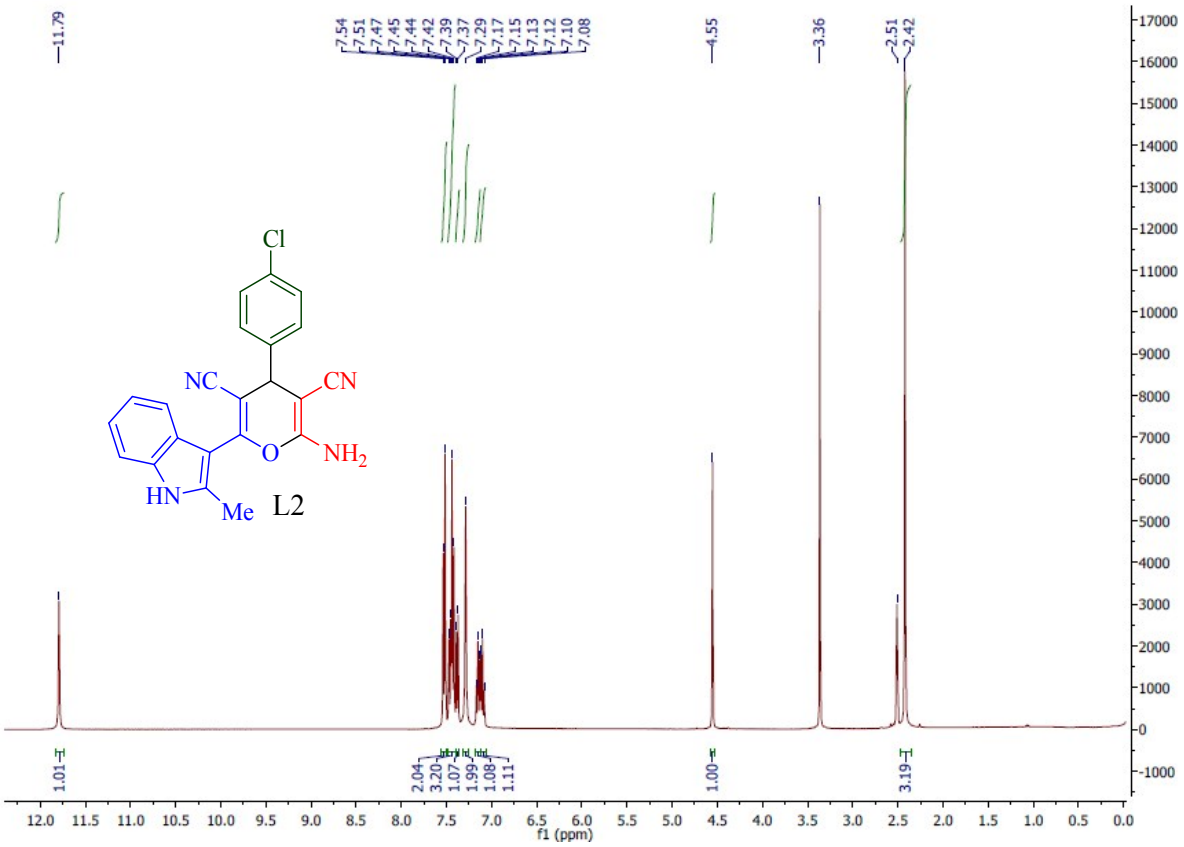


FT-IR spectrum of 2-amino-4-(4-chlorophenyl)-6-(2-methyl-1H-indol-3-yl)-4H-pyran-3,5-dicarbonitrile



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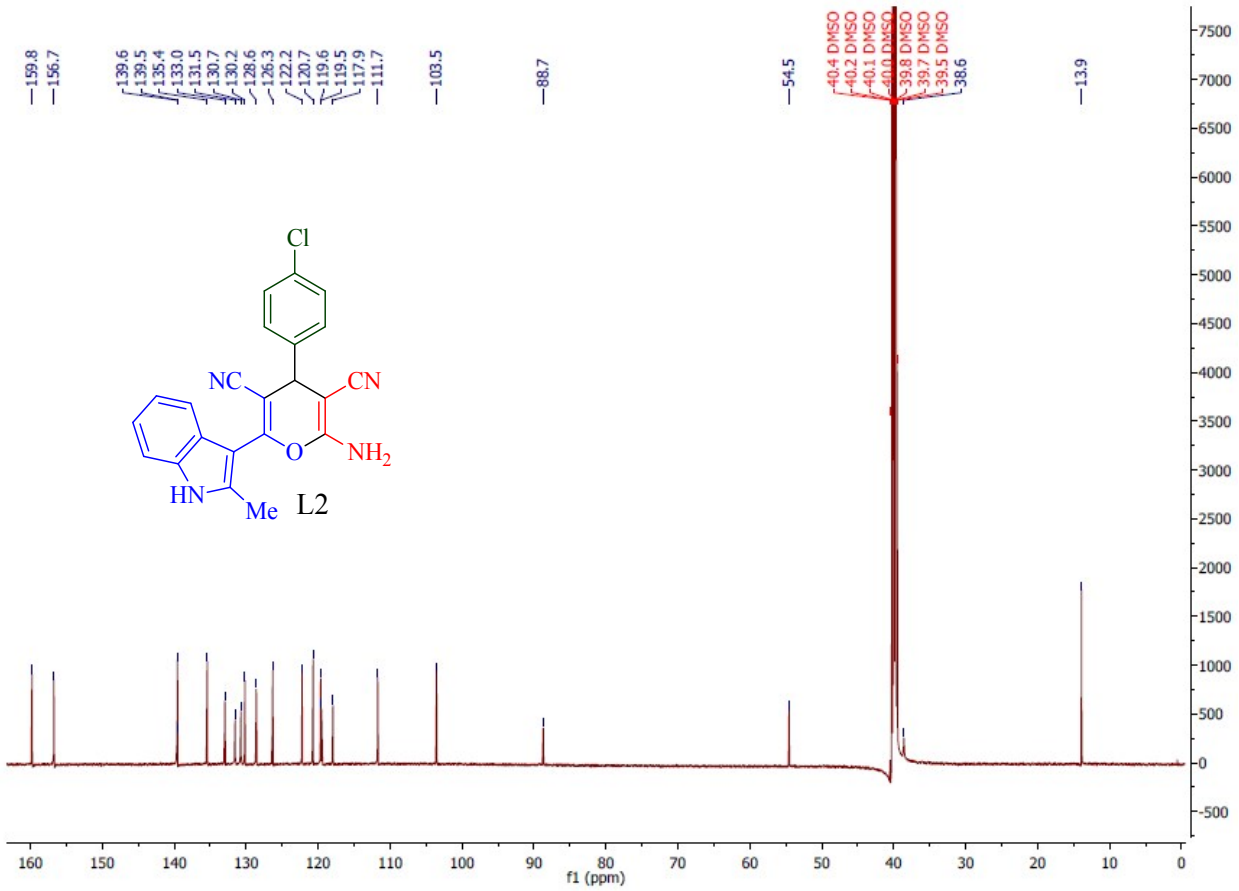
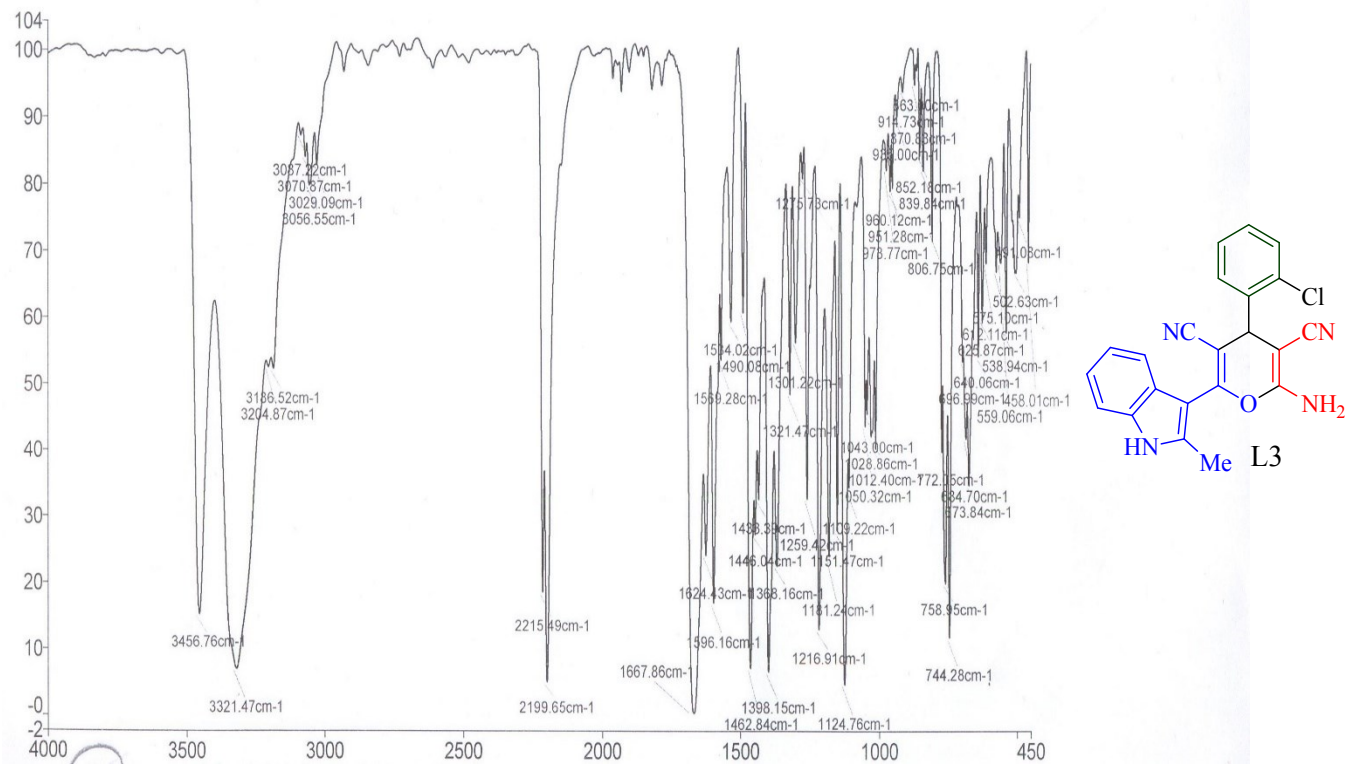
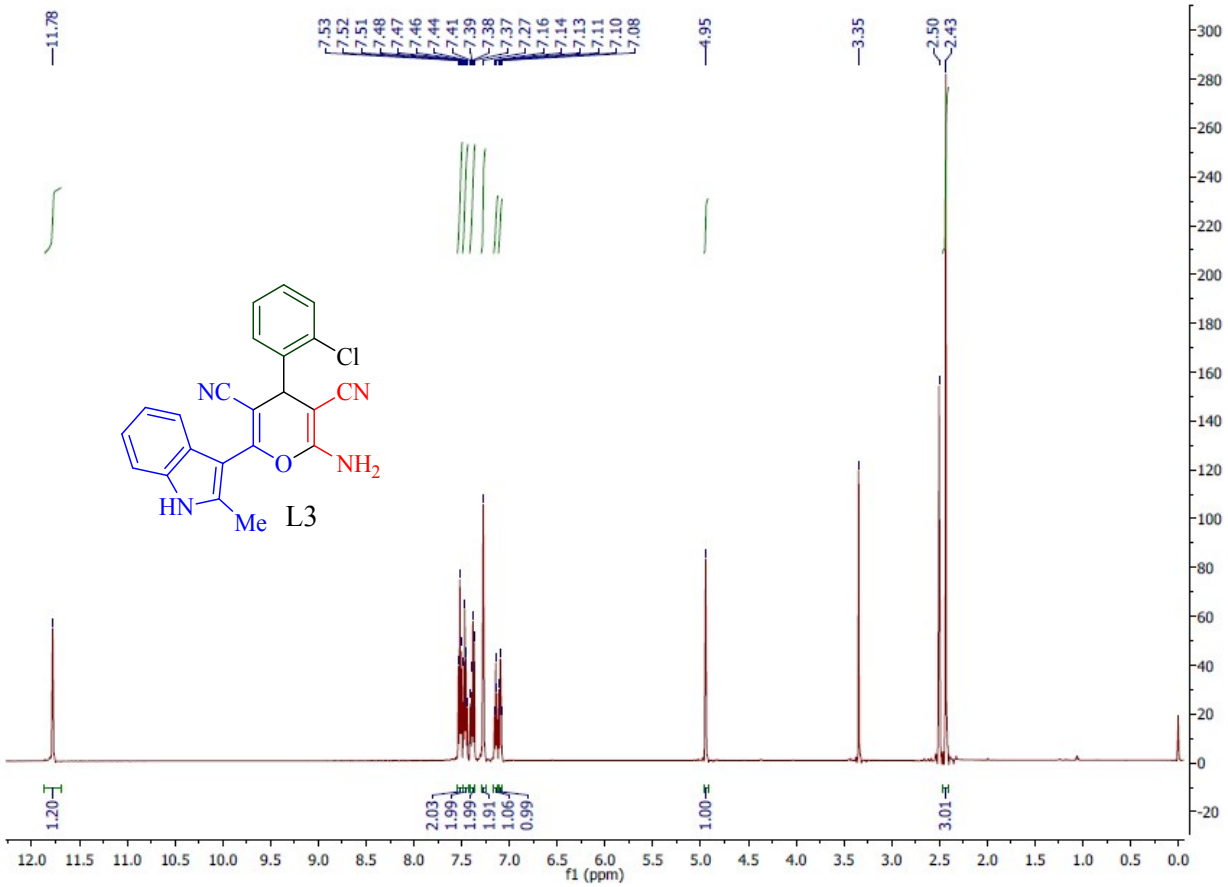


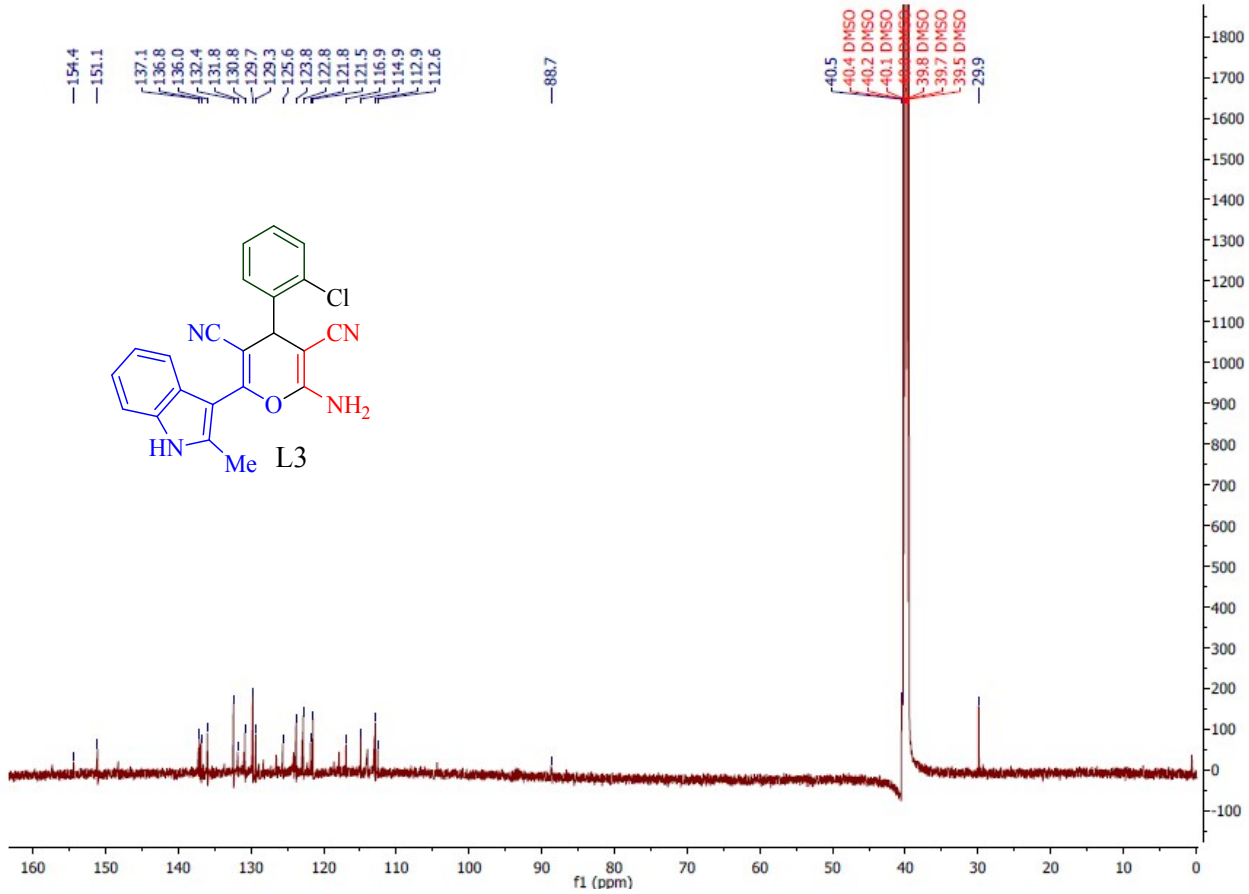
^{13}C-NMR spectrum of 2-amino-4-(4-chlorophenyl)-6-(2-methyl-1H-indol-3-yl)-4H-pyran-3,5-dicarbonitrile



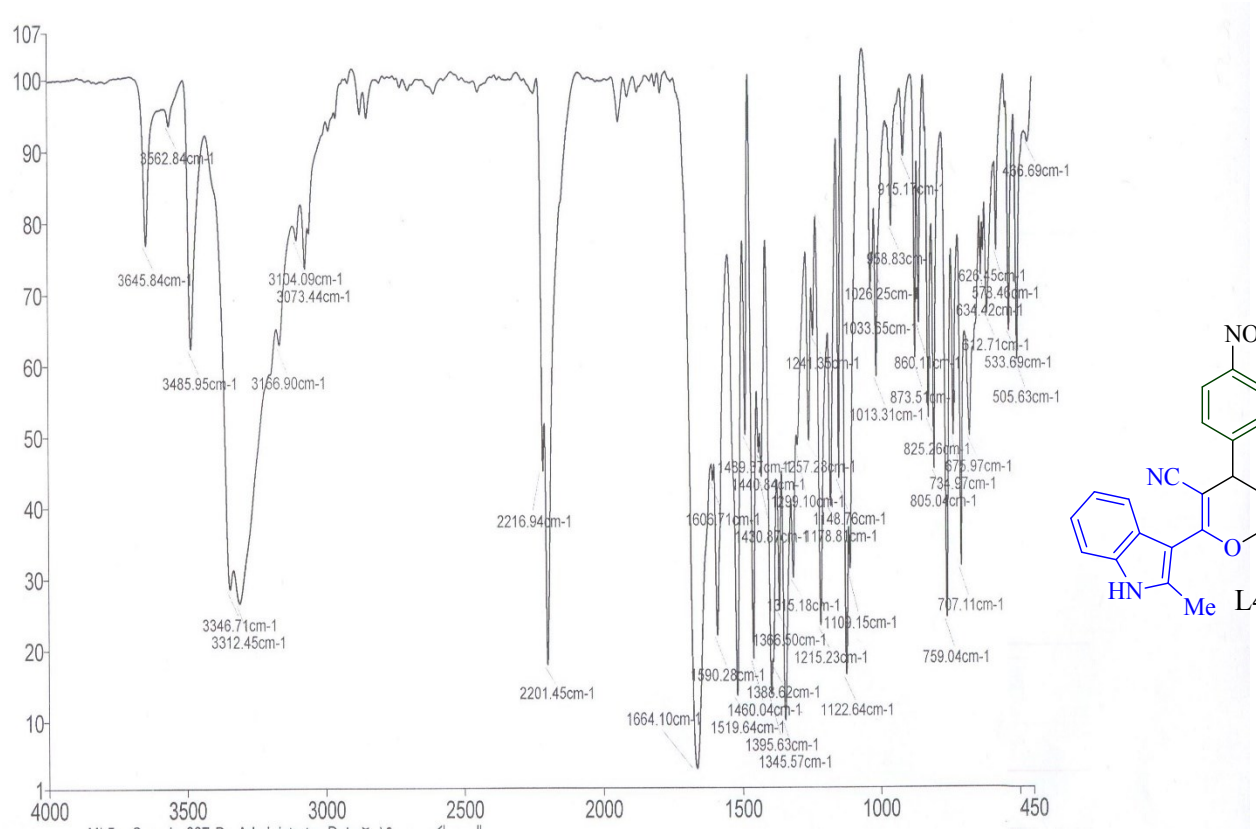
FT-IR spectrum of 2-amino-4-(2-chlorophenyl)-6-(2-methyl-1H-indol-3-yl)-4H-pyran-3,5-dicarbonitrile



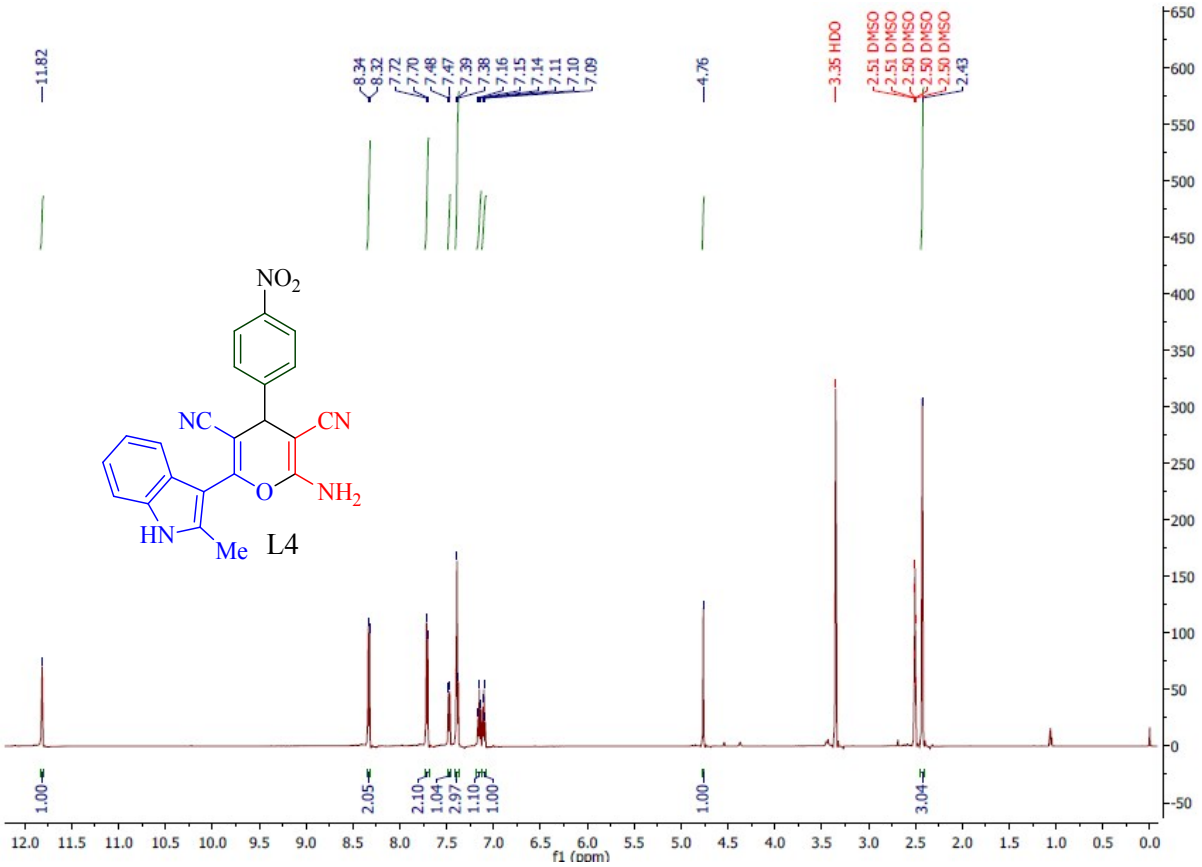
[1]H-NMR spectrum of 2-amino-4-(2-chlorophenyl)-6-(2-methyl-1H-indol-3-yl)-4H-pyran-3,5-dicarbonitrile



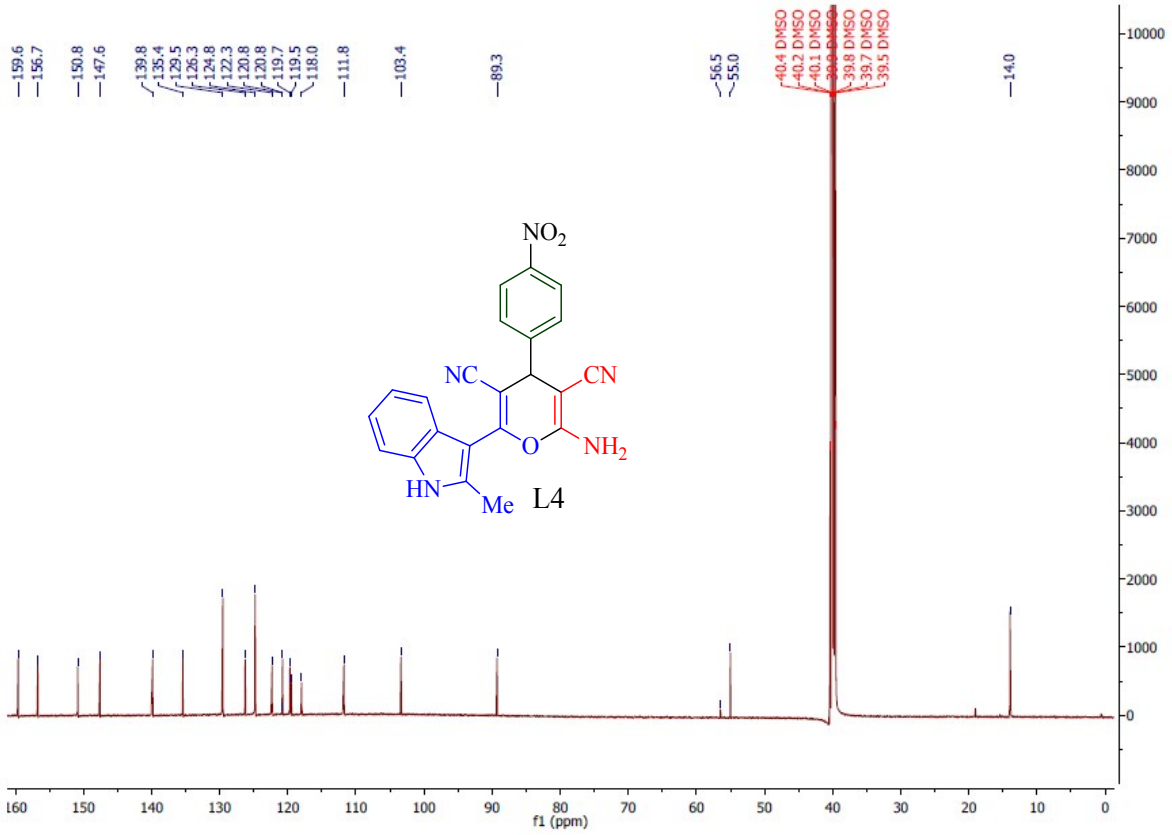
^{13}C-NMR spectrum of 2-amino-4-(2-chlorophenyl)-6-(2-methyl-1H-indol-3-yl)-4H-pyran-3,5-dicarbonitrile



FT-IR spectrum of 2-amino-6-(2-methyl-1H-indol-3-yl)-4-(4-nitrophenyl)-4H-pyran-3,5-dicarbonitrile



[1]H-NMR spectrum of 2-amino-6-(2-methyl-1H-indol-3-yl)-4-(4-nitrophenyl)-4H-pyran-3,5-dicarbonitrile



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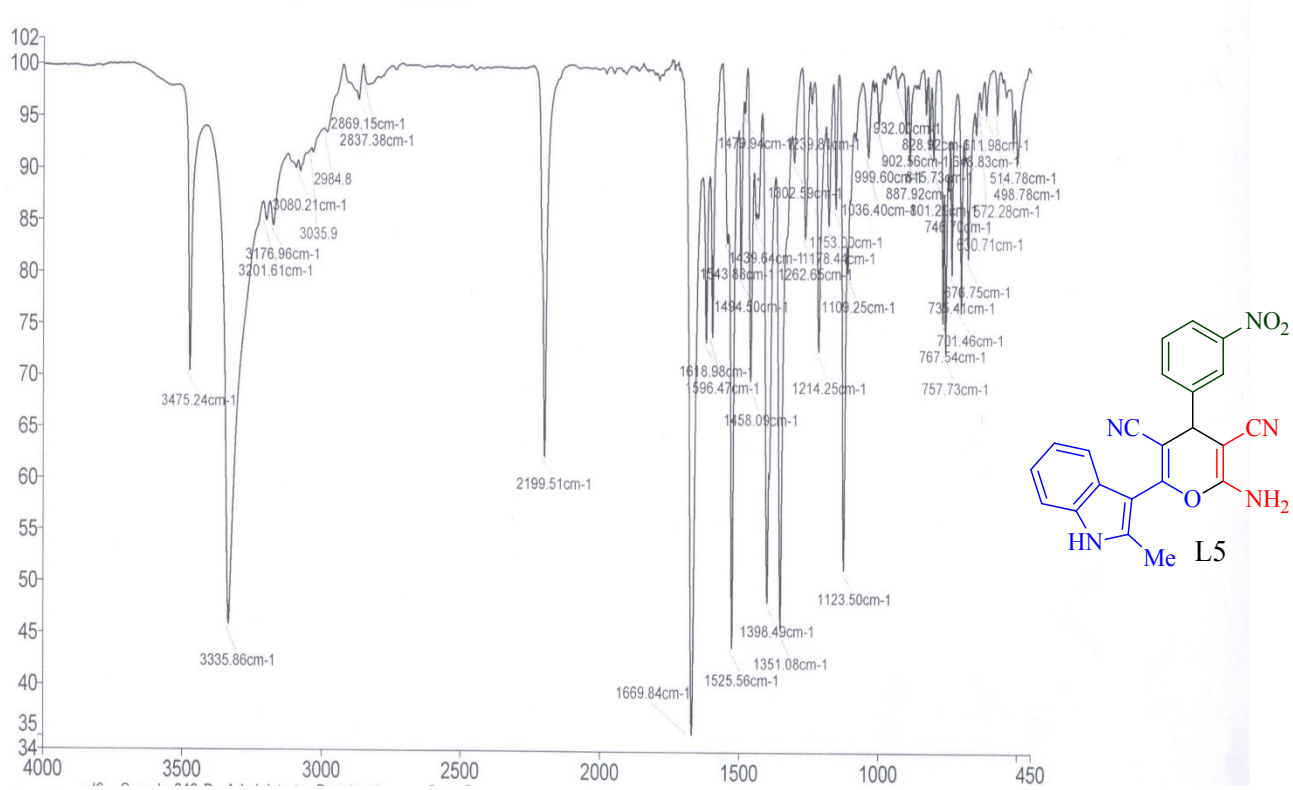
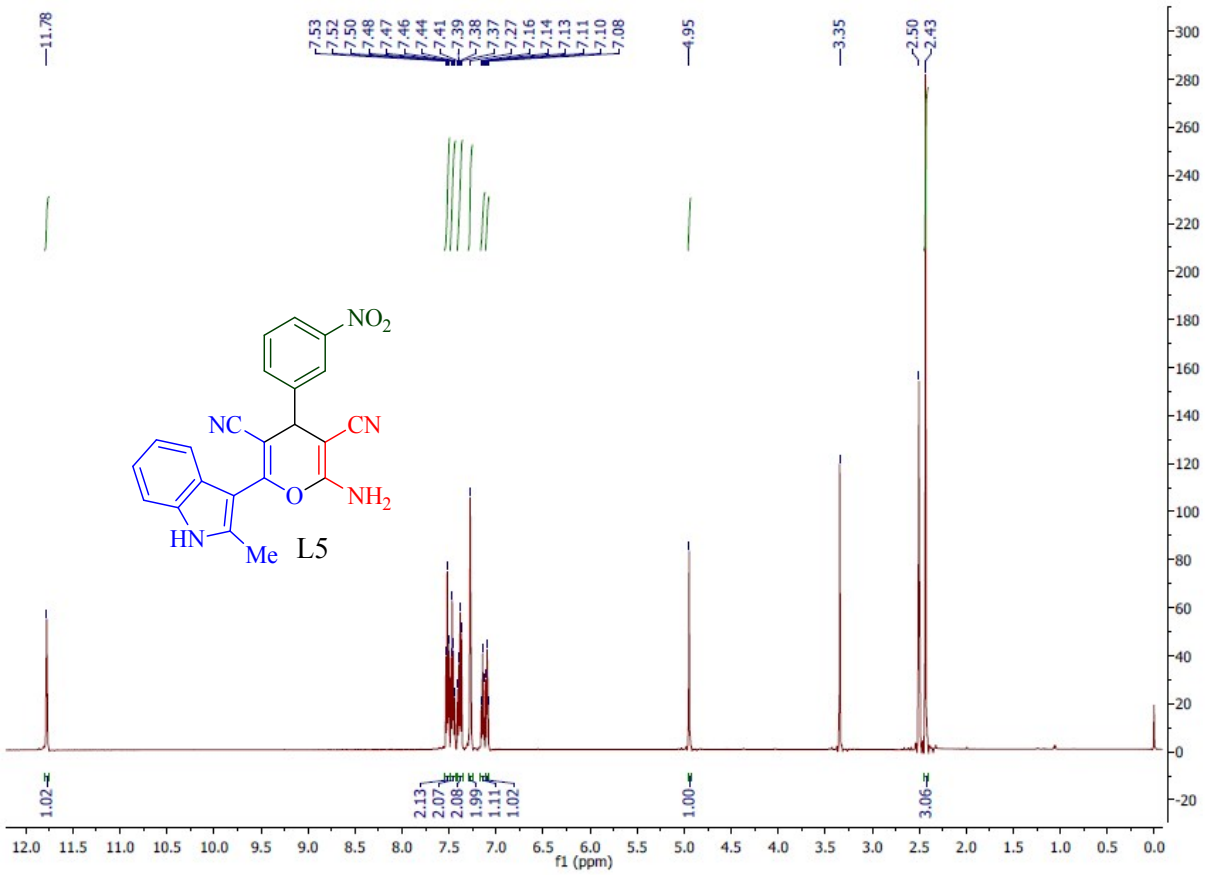


FT-IR spectrum of 2-amino-6-(2-methyl-1H-indol-3-yl)-4-(3-nitrophenyl)-4H-pyran-3,5-dicarbonitrile



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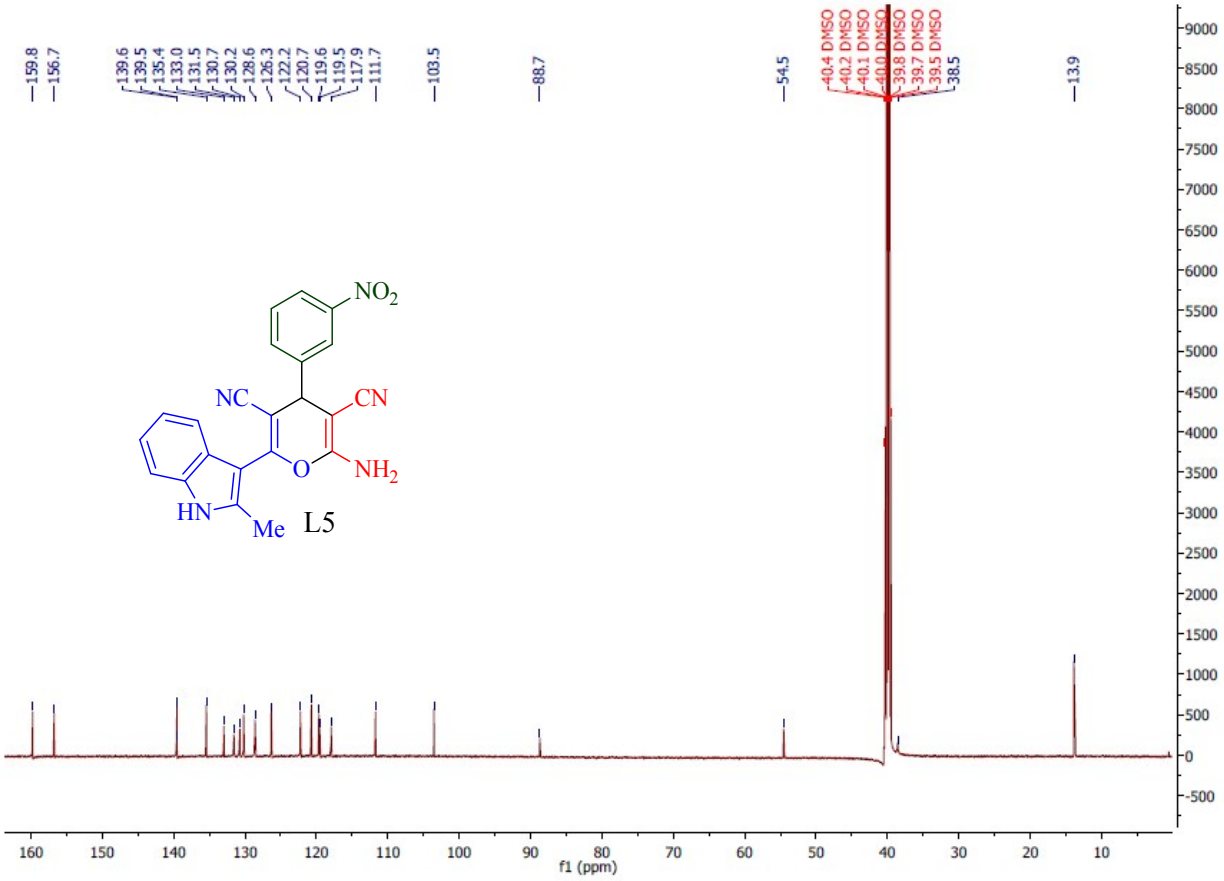

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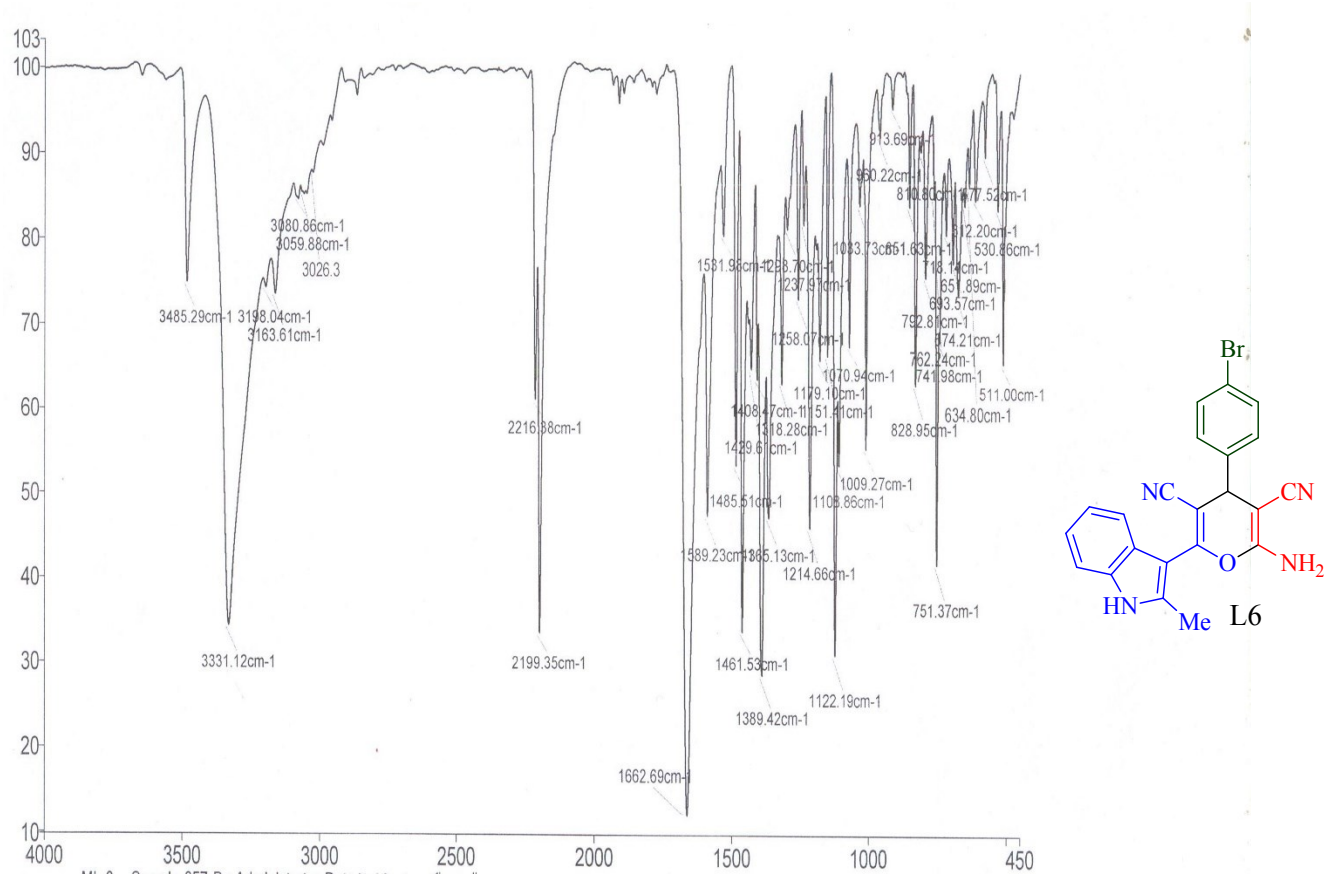
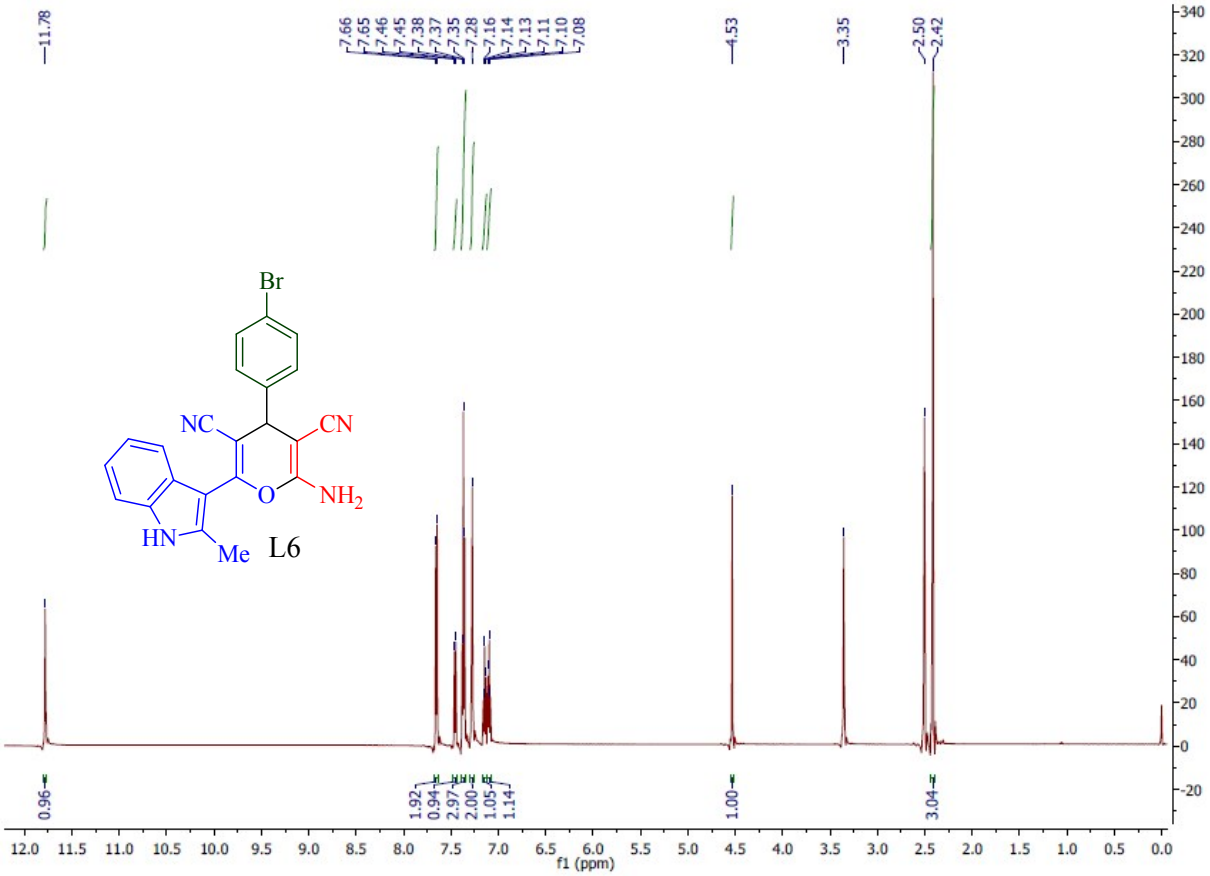


FT-IR spectrum of 2-amino-4-(4-bromophenyl)-6-(2-methyl-1H-indol-3-yl)-4H-pyran-3,5-dicarbonitrile



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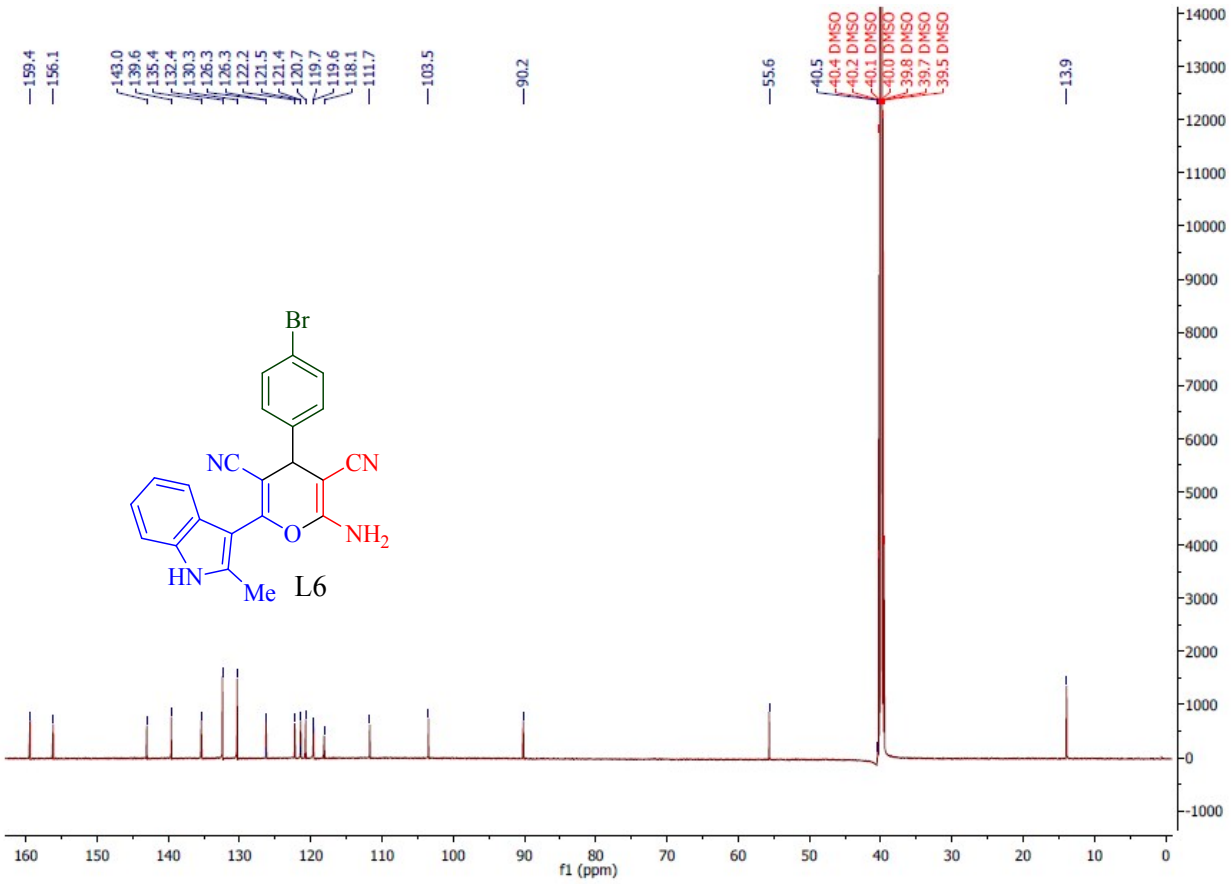

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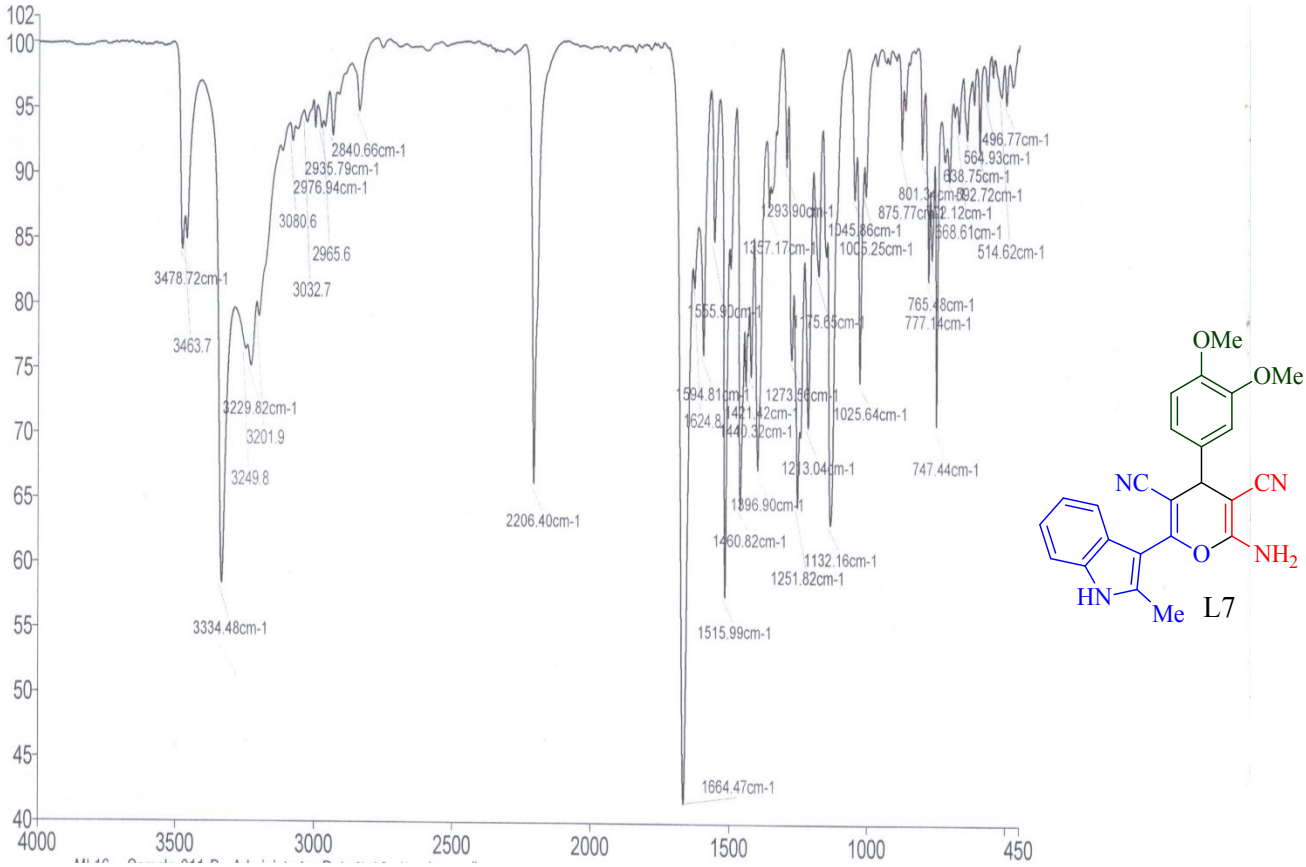
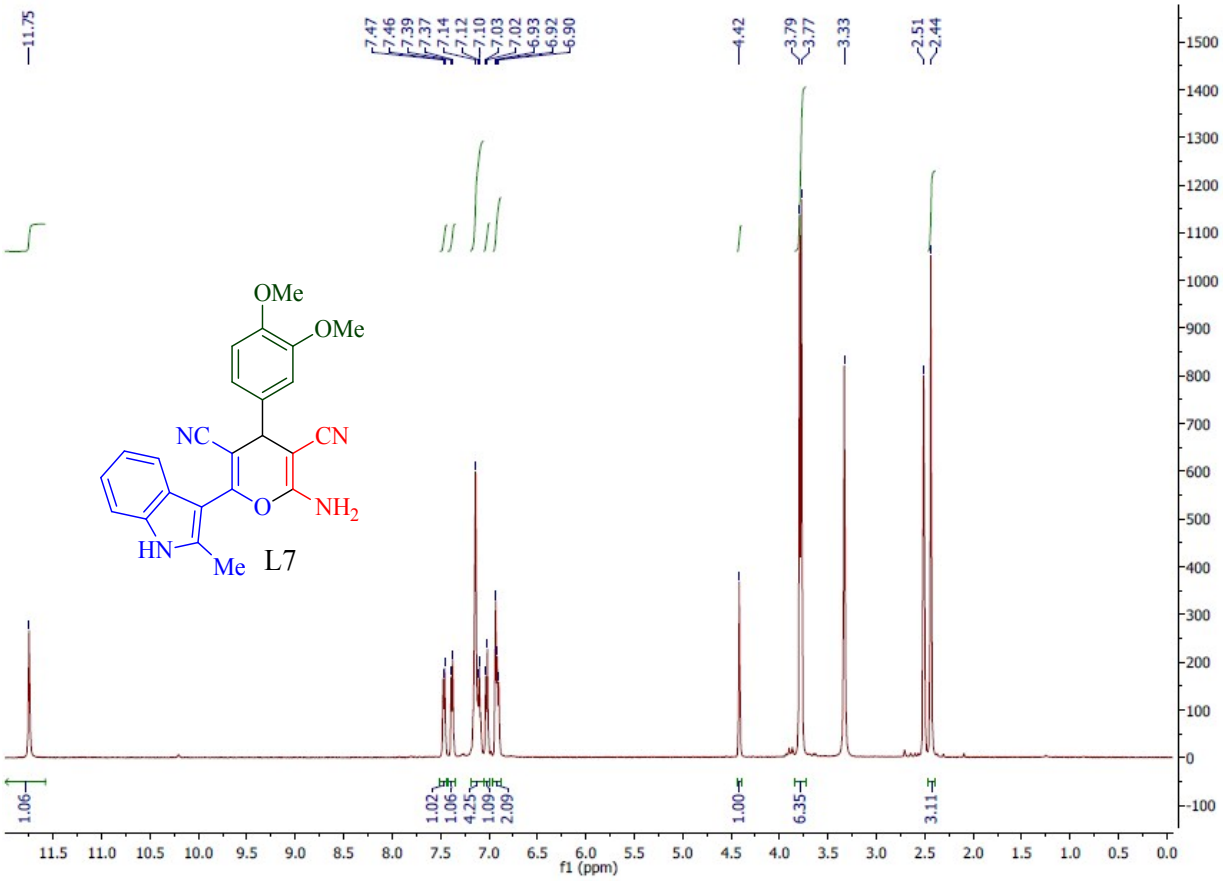


FT-IR spectrum of 2-amino-4-(3,4-dimethoxyphenyl)-6-(2-methyl-1H-indol-3-yl)-4H-pyran-3,5-dicarbonitrile



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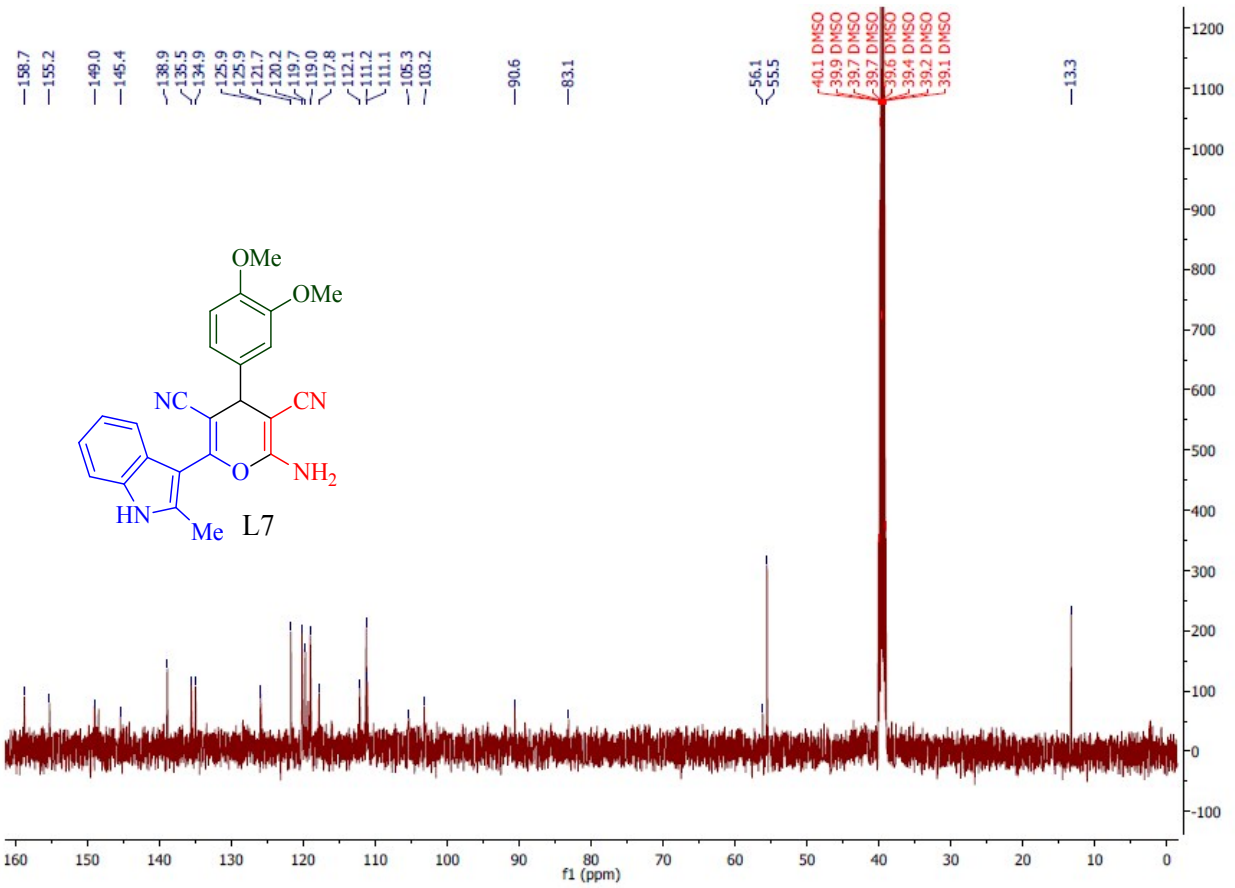
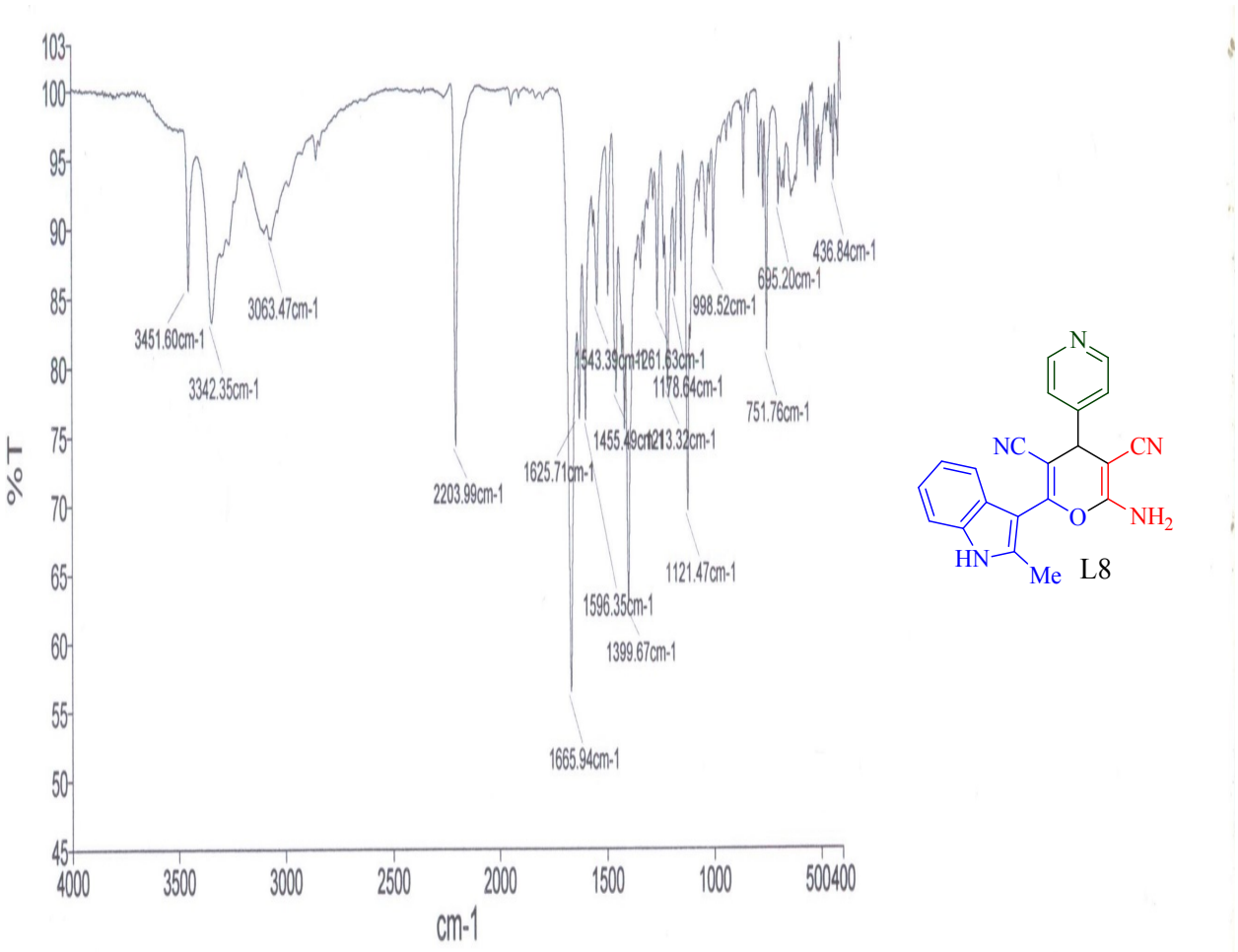
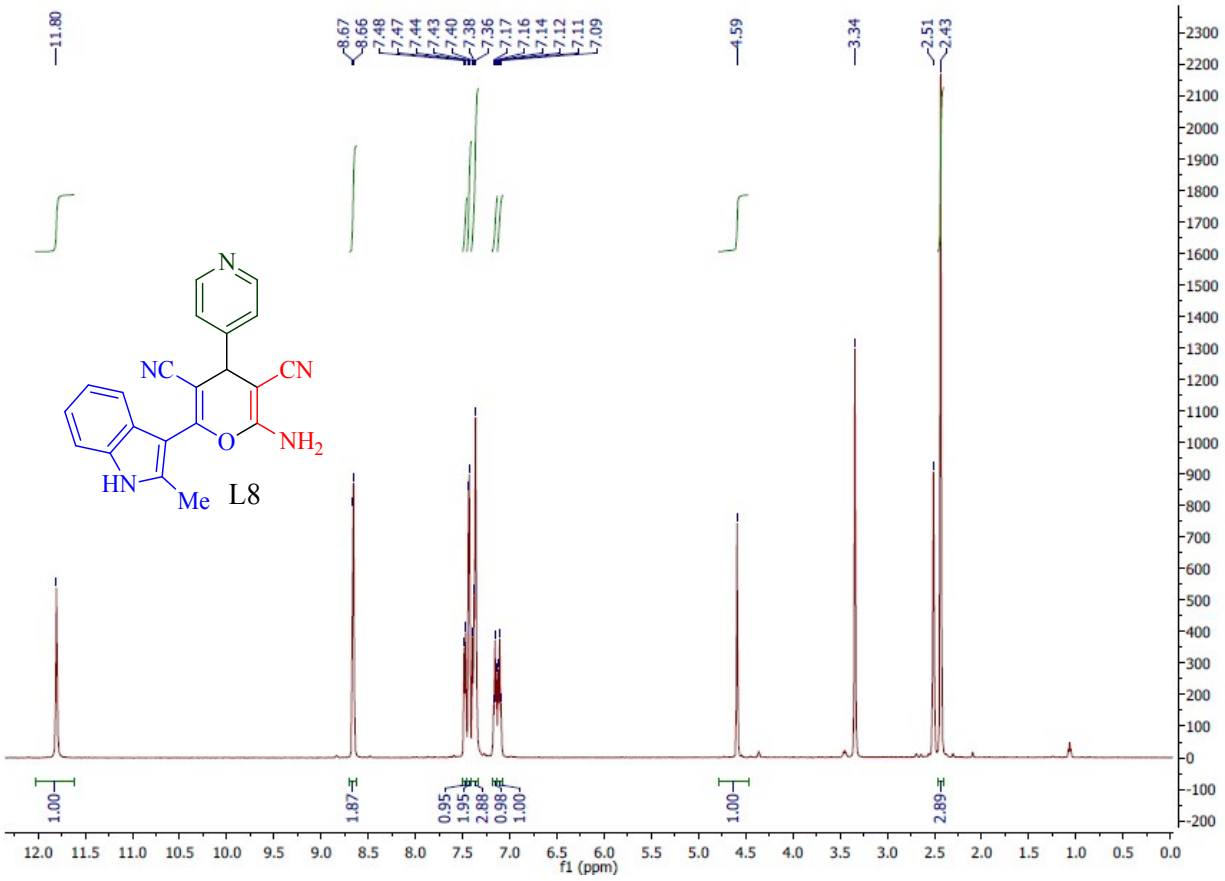


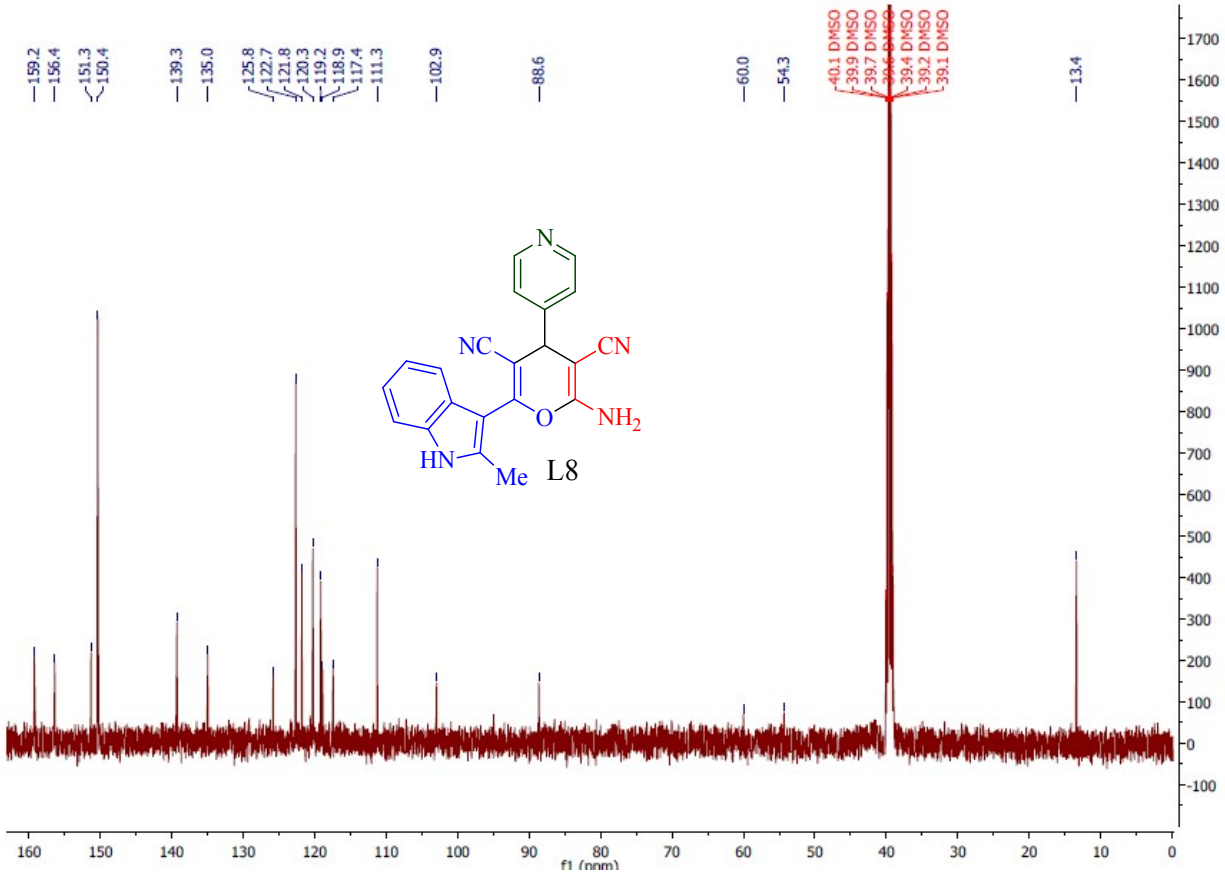
^{13}C-NMR spectrum of 2-amino-4-(3,4-dimethoxyphenyl)-6-(2-methyl-1H-indol-3-yl)-4H-pyran-3,5-dicarbonitrile



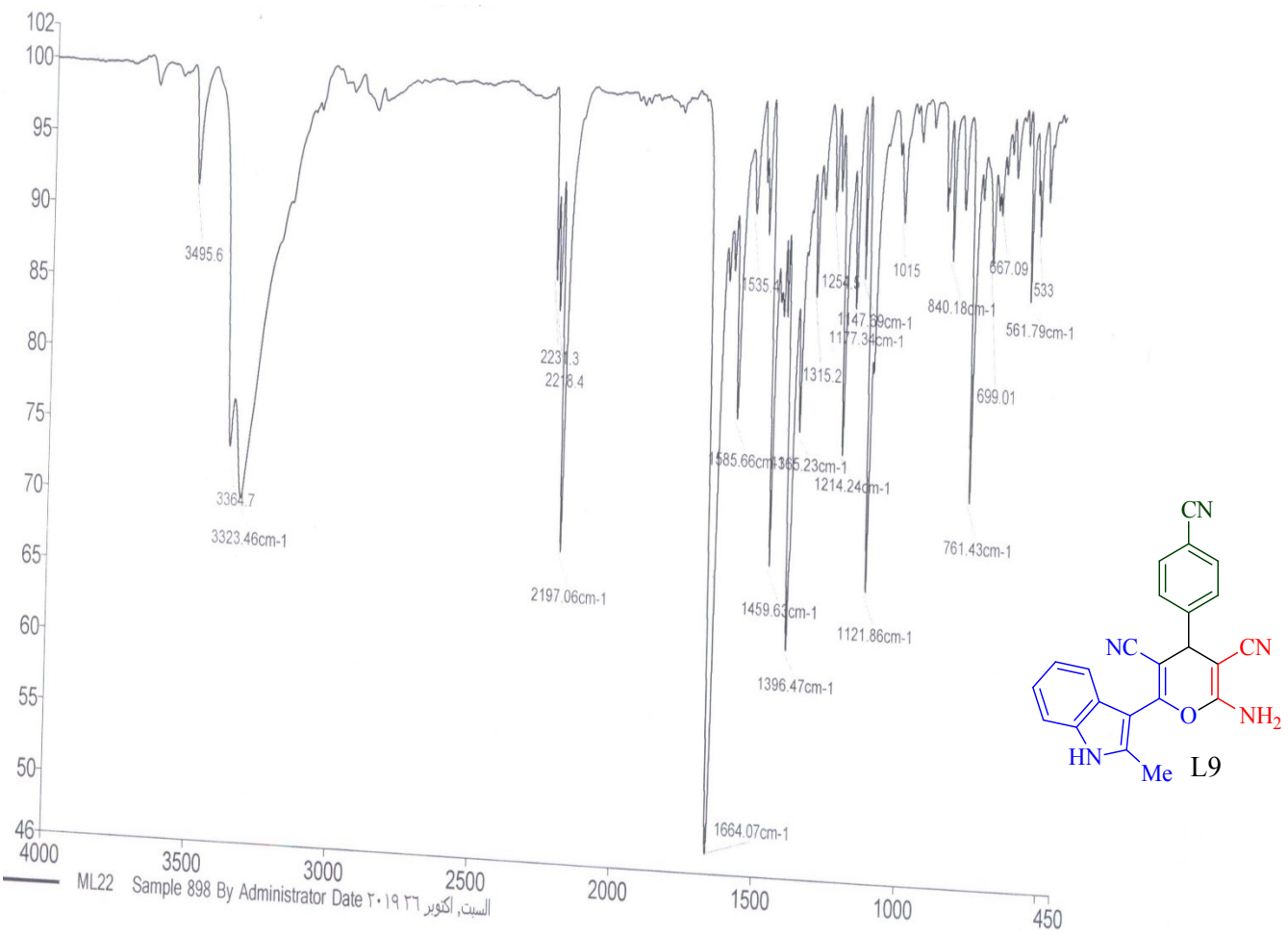
FT-IR spectrum of 2-amino-6-(2-methyl-1H-indol-3-yl)-4-(pyridin-4-yl)-4H-pyran-3,5-dicarbonitrile



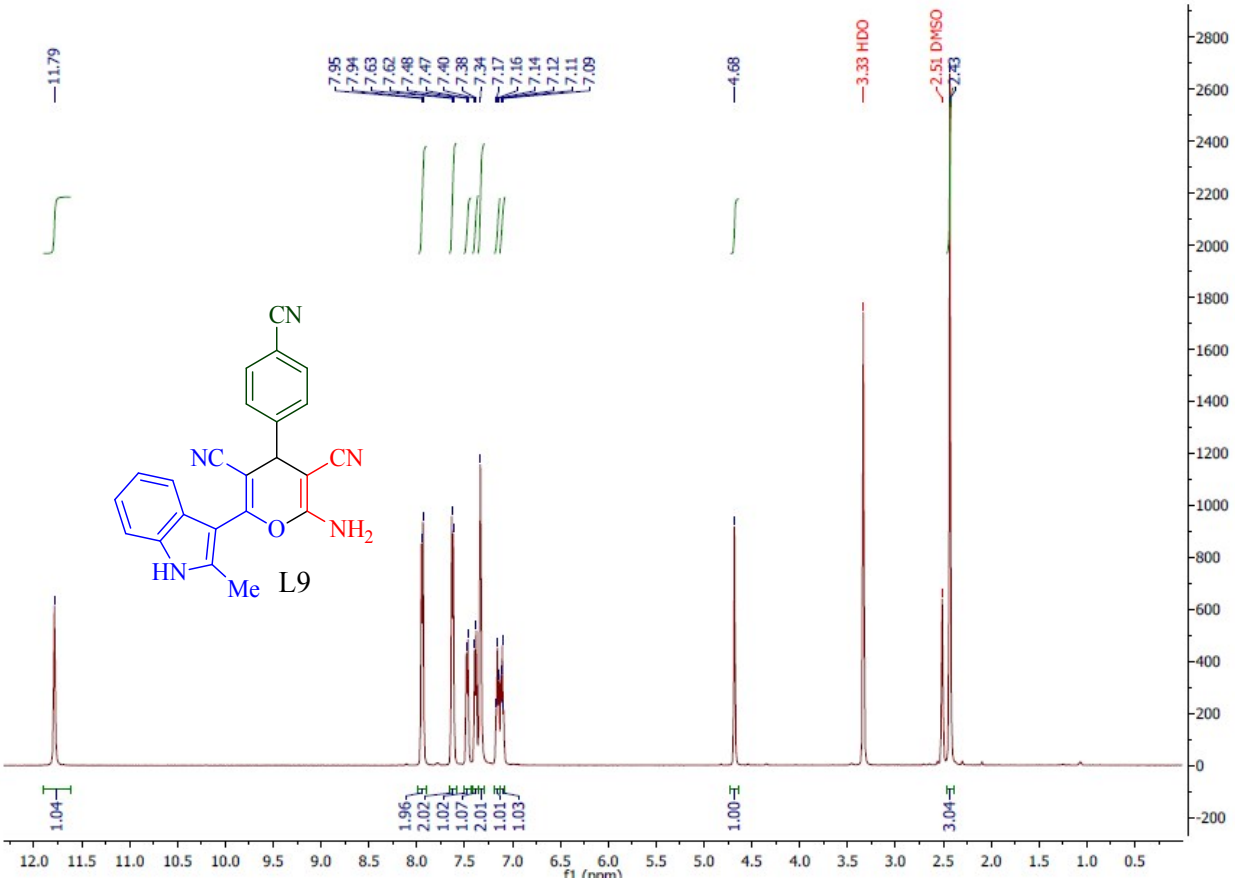
[1]H-NMR spectrum of 2-amino-6-(2-methyl-1H-indol-3-yl)-4-(pyridin-4-yl)-4H-pyran-3,5-dicarbonitrile



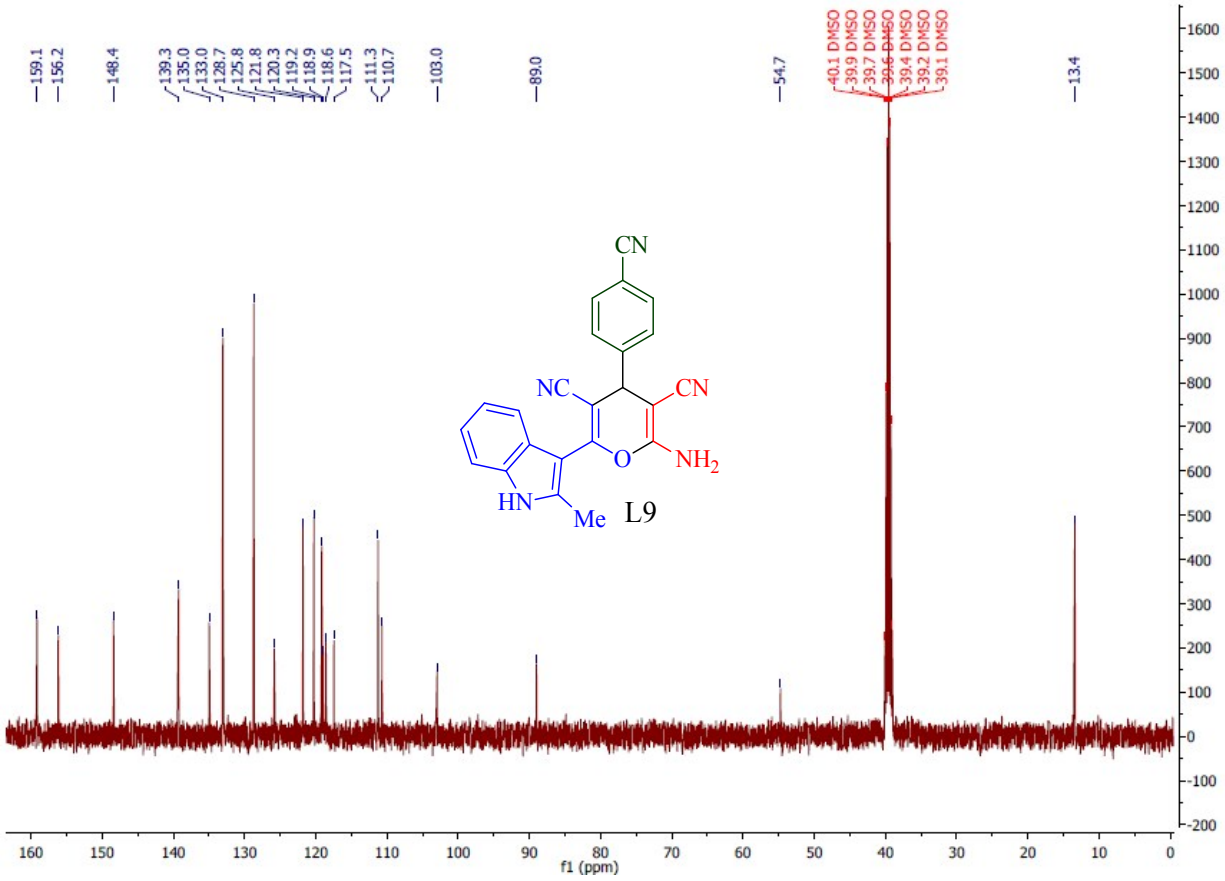
^{13}C-NMR spectrum of 2-amino-6-(2-methyl-1H-indol-3-yl)-4-(pyridin-4-yl)-4H-pyran-3,5-dicarbonitrile



FT-IR spectrum of 2-amino-4-(4-cyanophenyl)-6-(2-methyl-1H-indol-3-yl)-4H-pyran-3,5-dicarbonitrile



[1]H-NMR spectrum of 2-amino-4-(4-cyanophenyl)-6-(2-methyl-1H-indol-3-yl)-4H-pyran-3,5-dicarbonitrile



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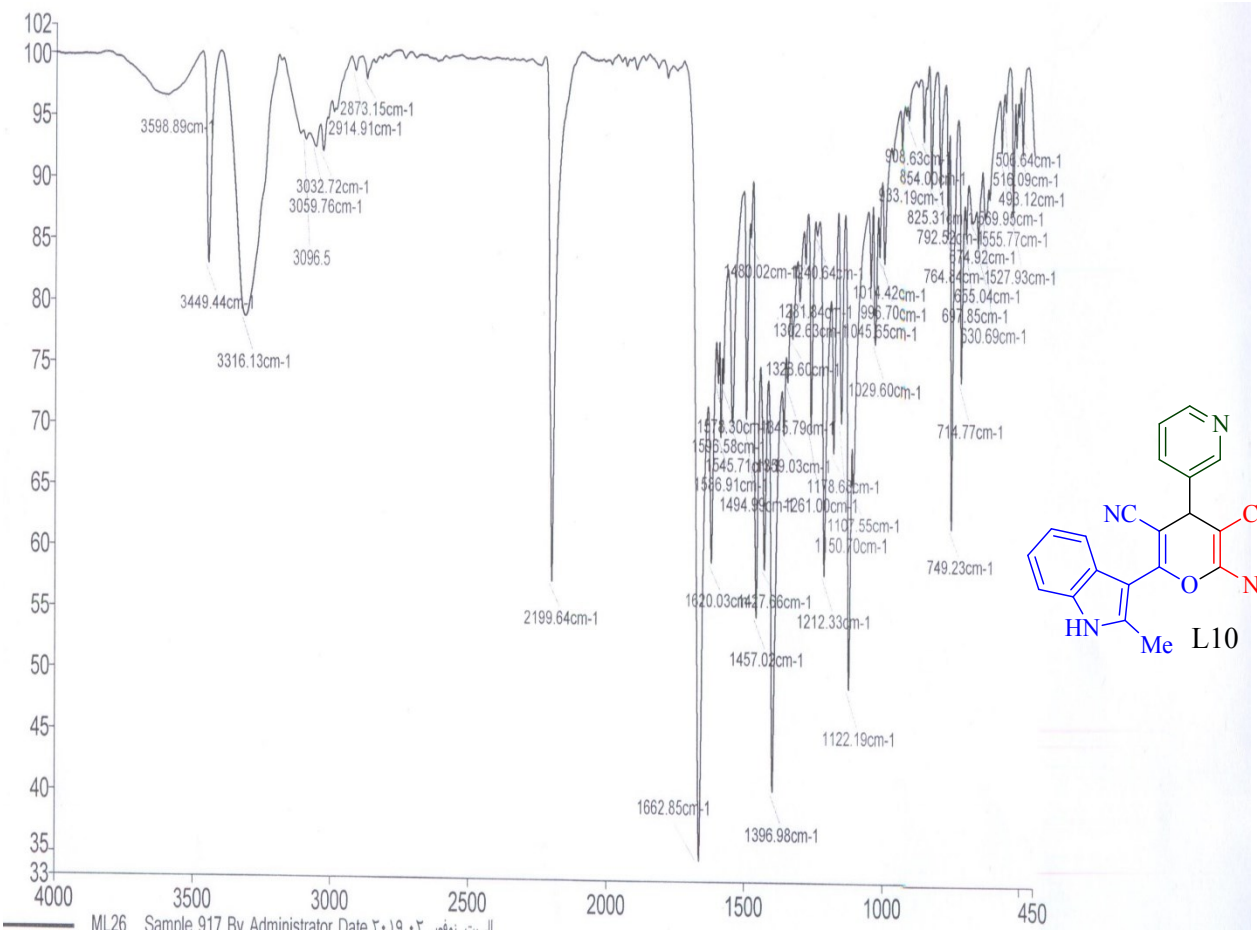
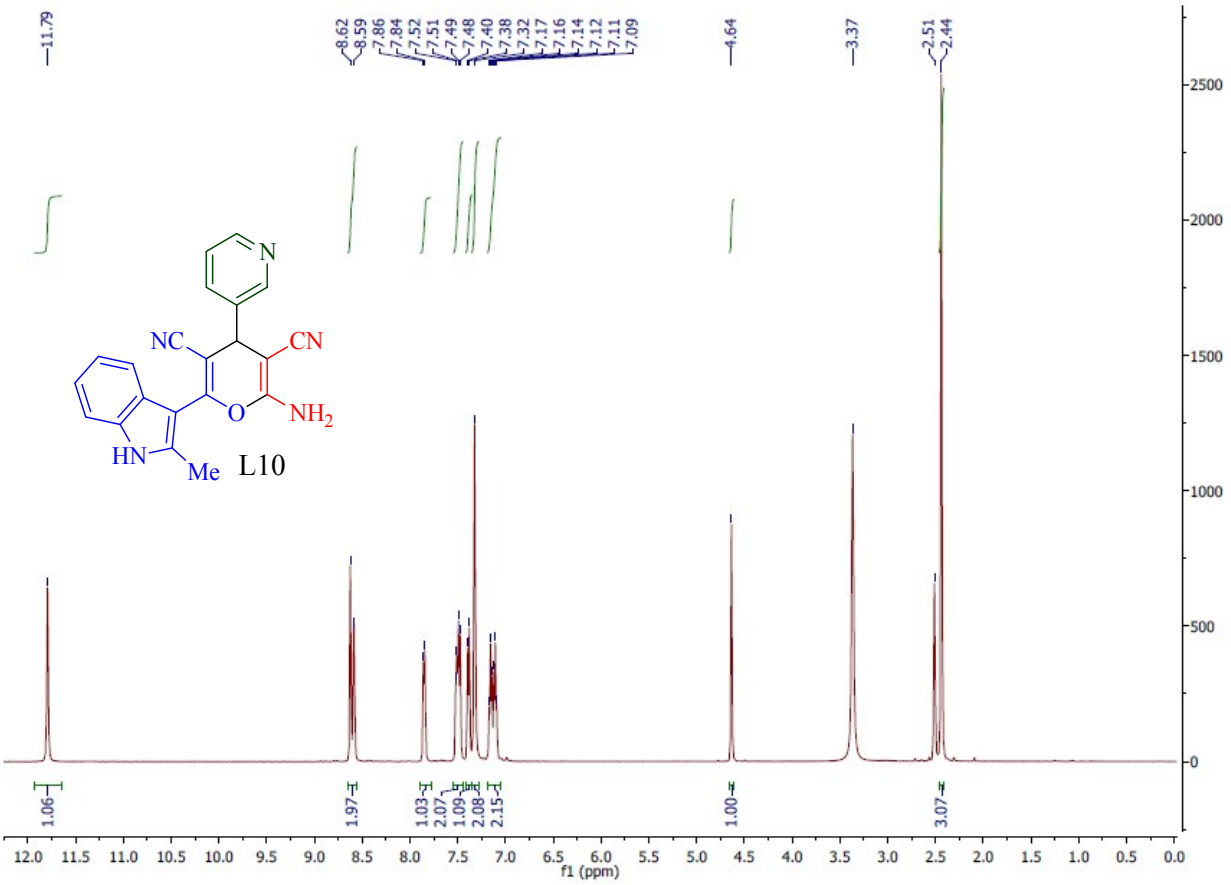


FT-IR spectrum of 2-amino-6-(2-methyl-1H-indol-3-yl)-4-(pyridin-3-yl)-4H-pyran-3,5-dicarbonitrile



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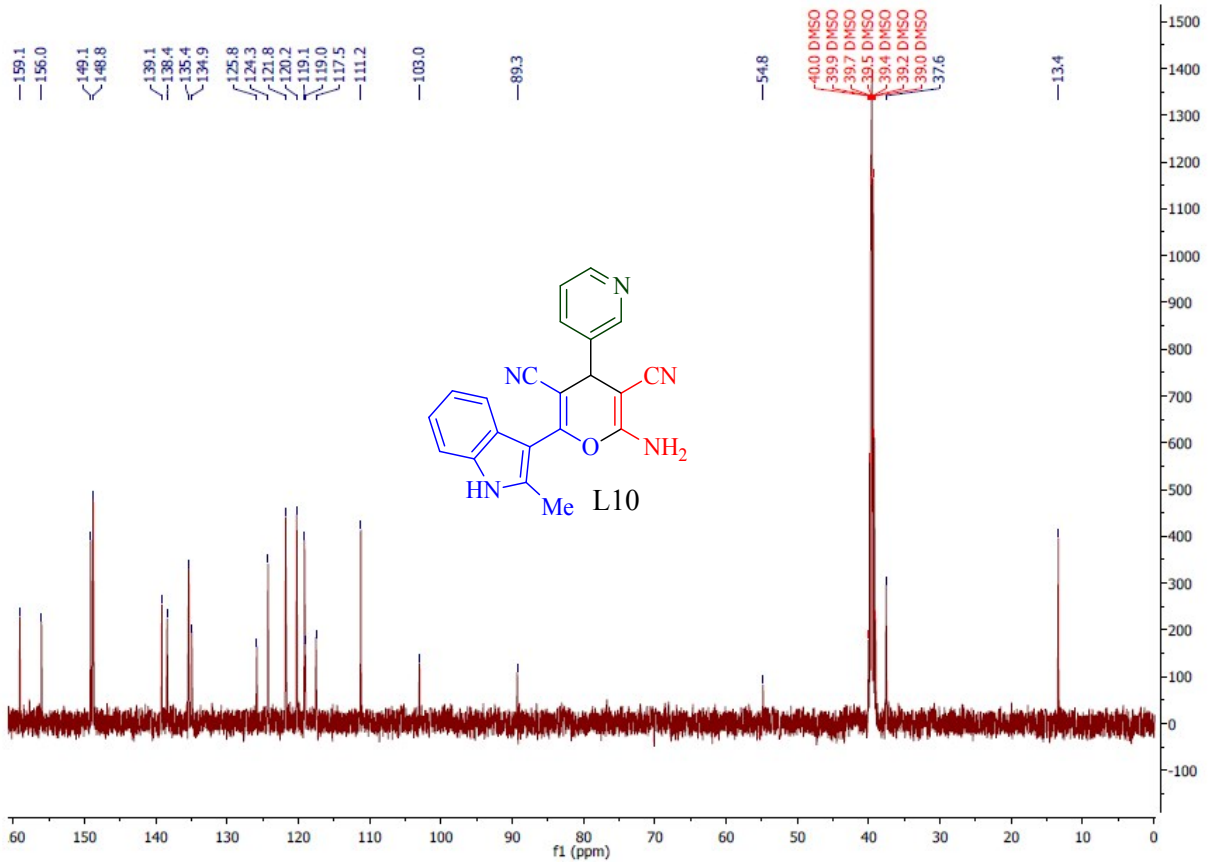
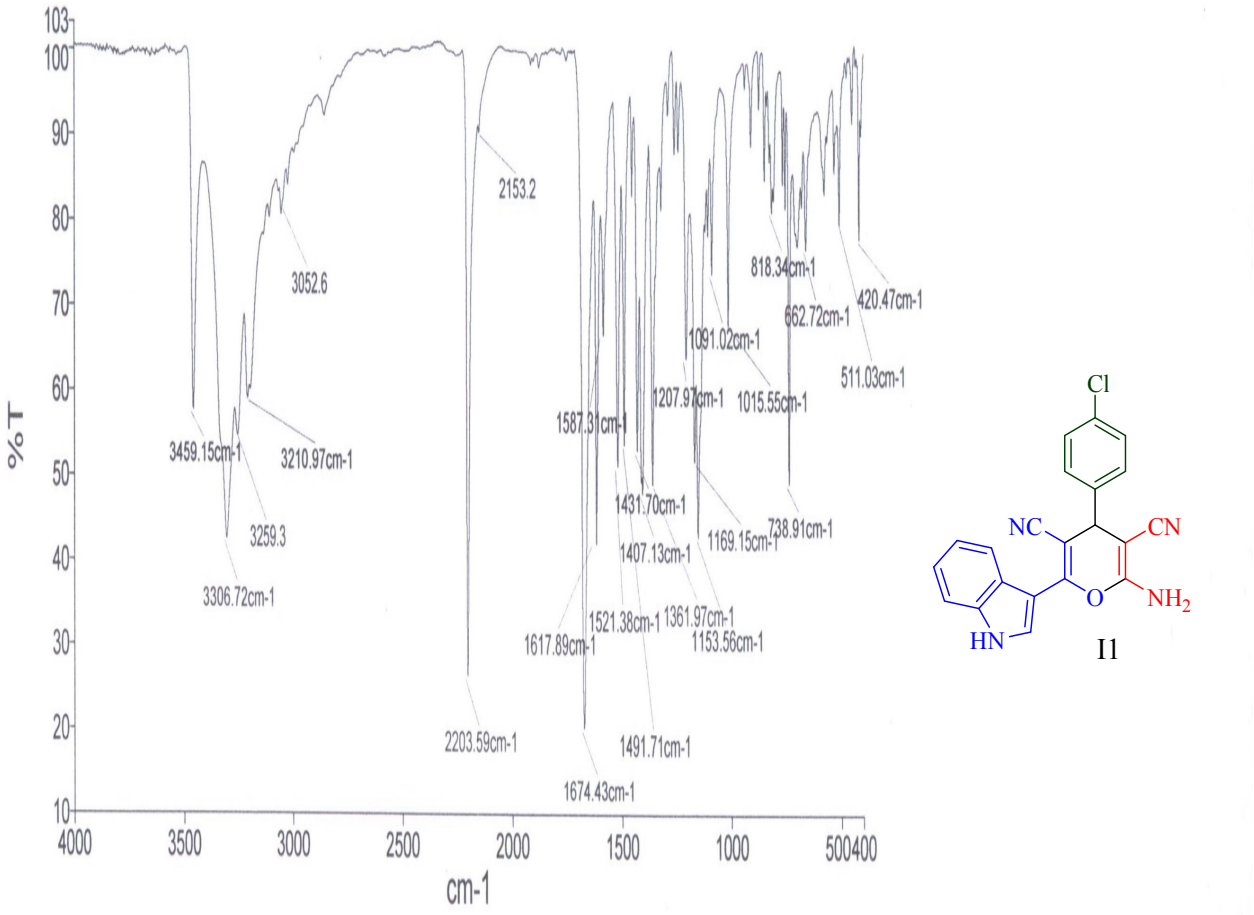
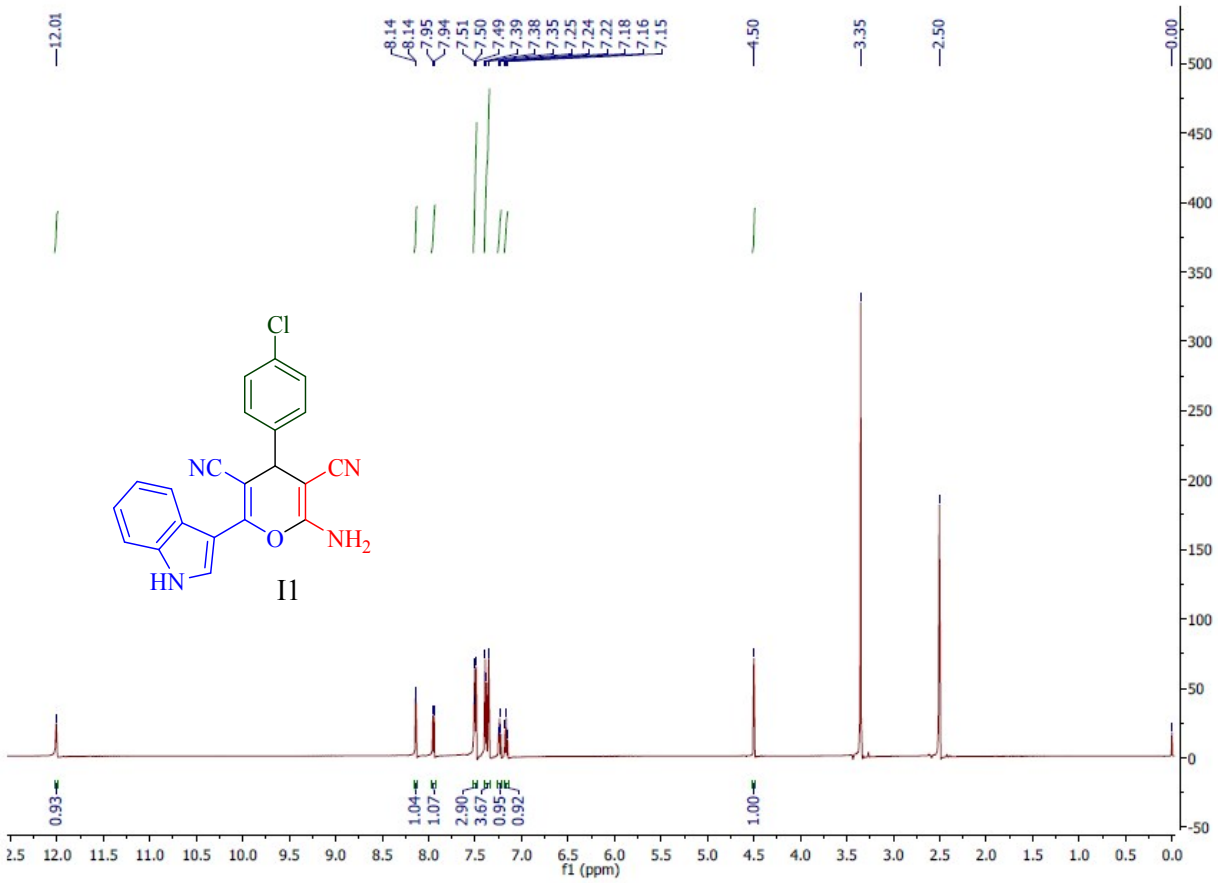


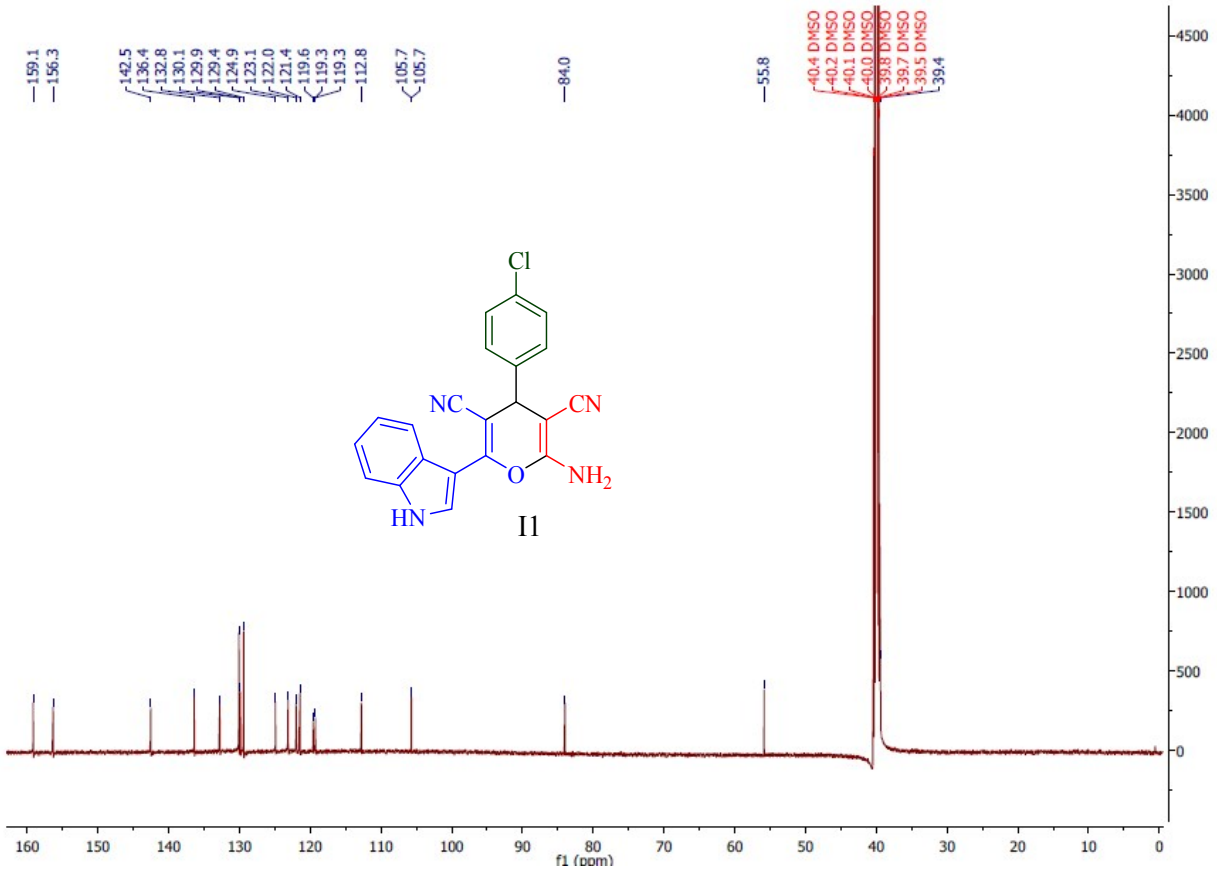
^{13}C-NMR spectrum of 2-amino-6-(2-methyl-1H-indol-3-yl)-4-(pyridin-3-yl)-4H-pyran-3,5-dicarbonitrile



FT-IR spectrum of 2-amino-4-(4-chlorophenyl)-6-(1H-indol-3-yl)-4H-pyran-3,5-dicarbonitrile



[1]H-NMR spectrum of 2-amino-4-(4-chlorophenyl)-6-(1H-indol-3-yl)-4H-pyran-3,5-dicarbonitrile



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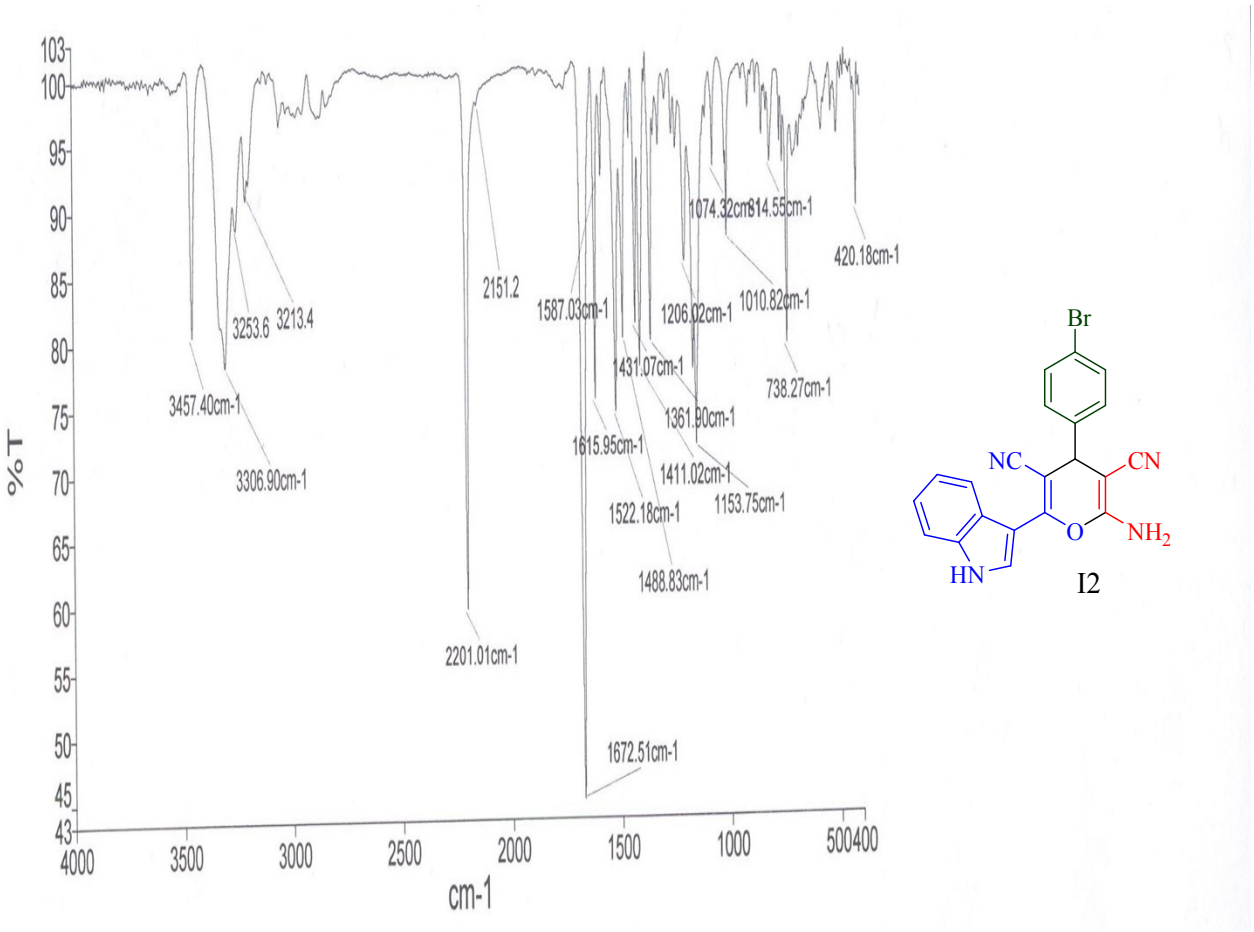
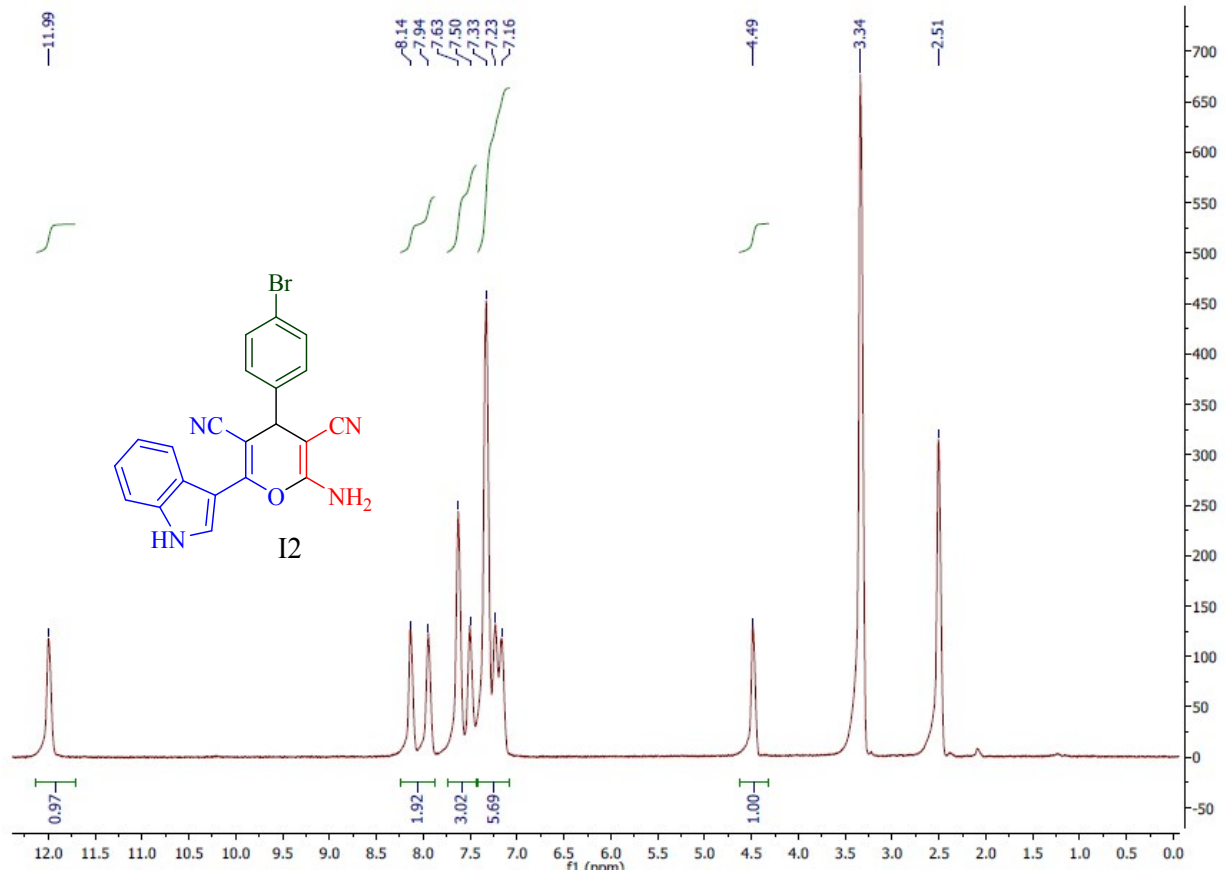


FT-IR spectrum of 2-amino-4-(4-bromophenyl)-6-(1H-indol-3-yl)-4H-pyran-3,5-dicarbonitrile



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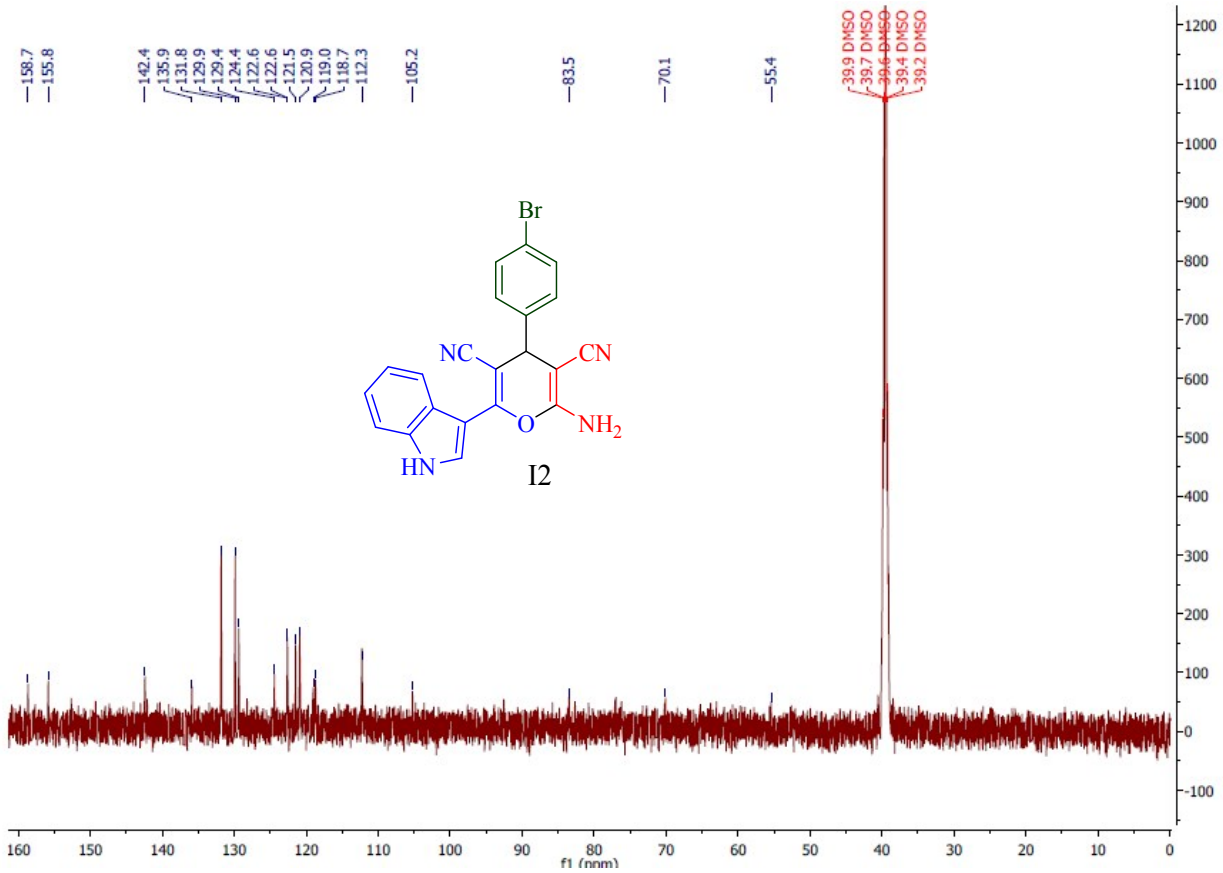
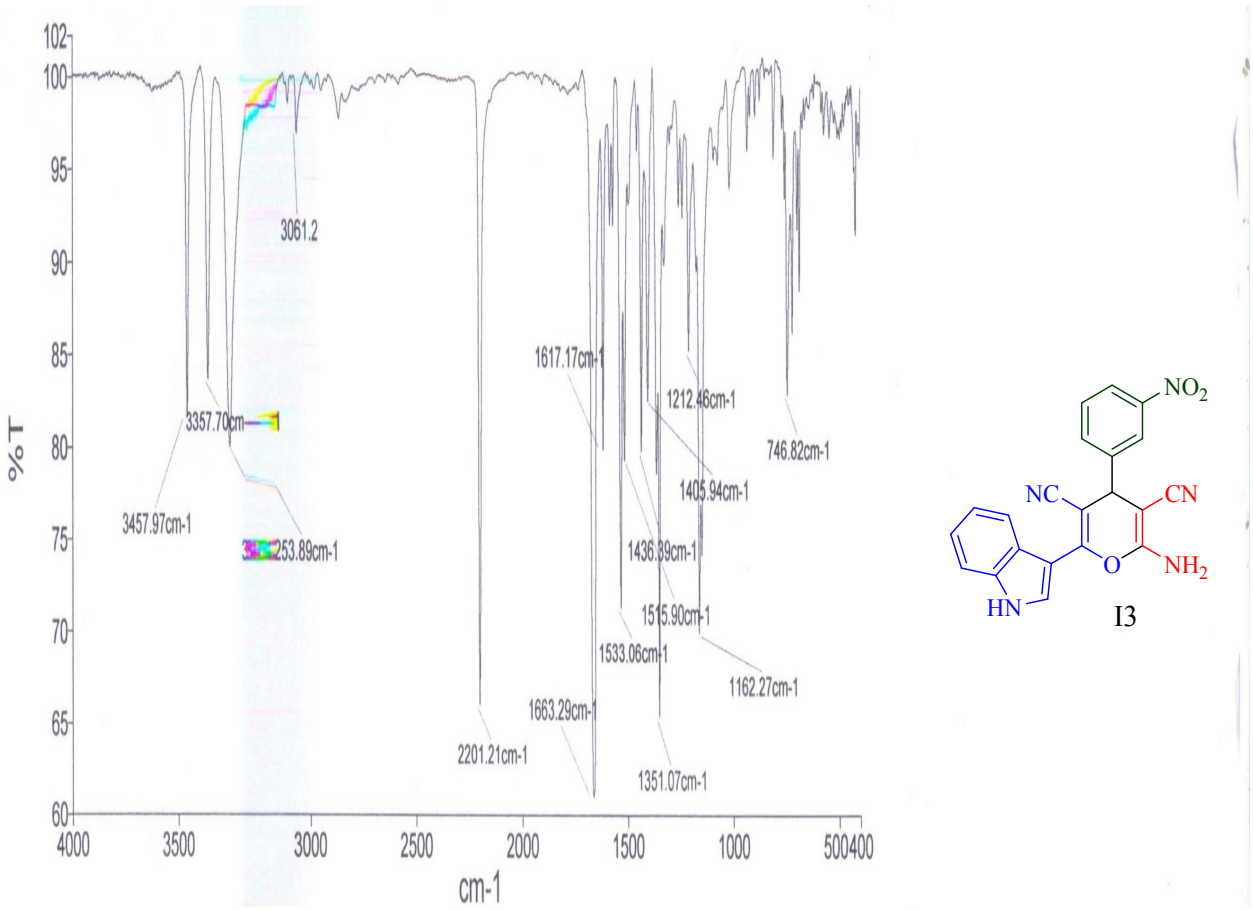
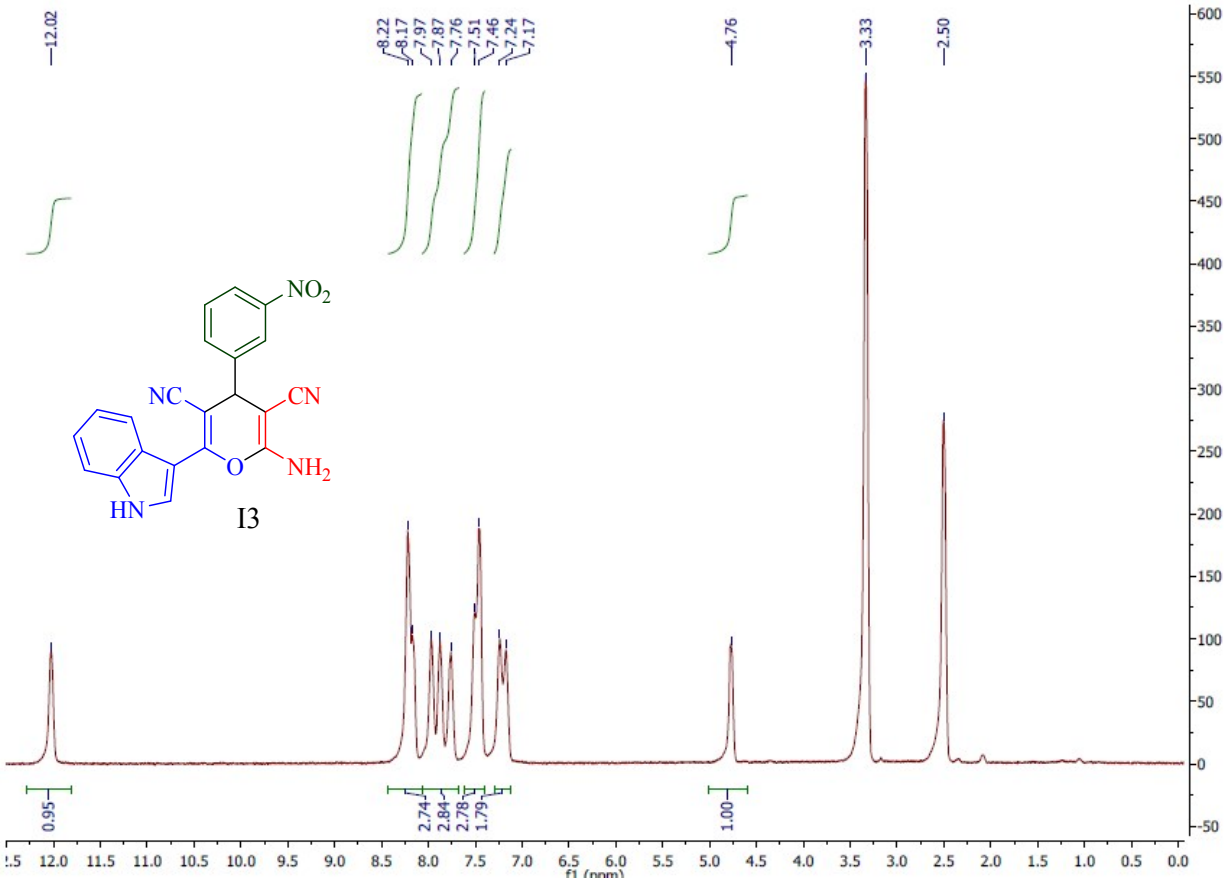


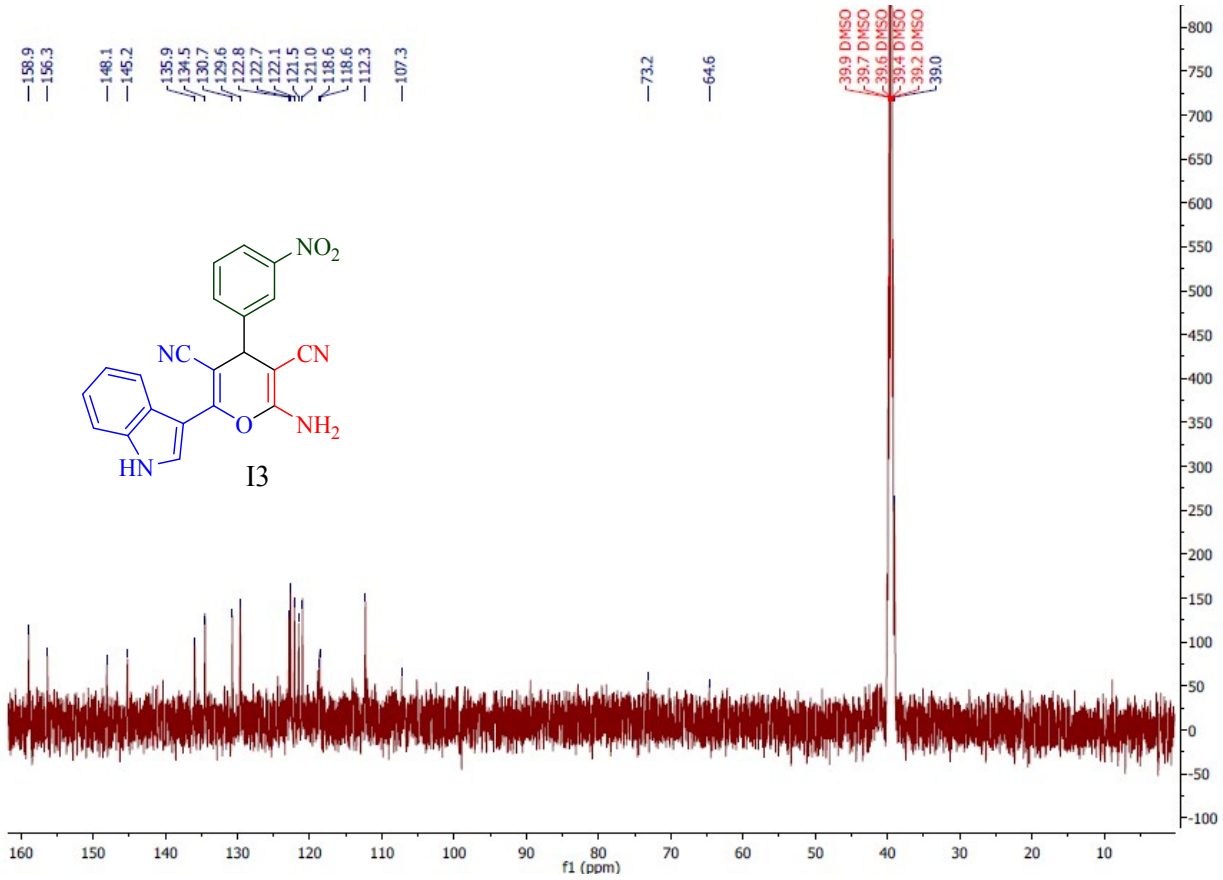
^{13}C-NMR spectrum of 2-amino-4-(4-bromophenyl)-6-(1H-indol-3-yl)-4H-pyran-3,5-dicarbonitrile



FT-IR spectrum of 2-amino-6-(1H-indol-3-yl)-4-(3-nitrophenyl)-4H-pyran-3,5-dicarbonitrile



[1]H-NMR spectrum of 2-amino-6-(1H-indol-3-yl)-4-(3-nitrophenyl)-4H-pyran-3,5-dicarbonitrile



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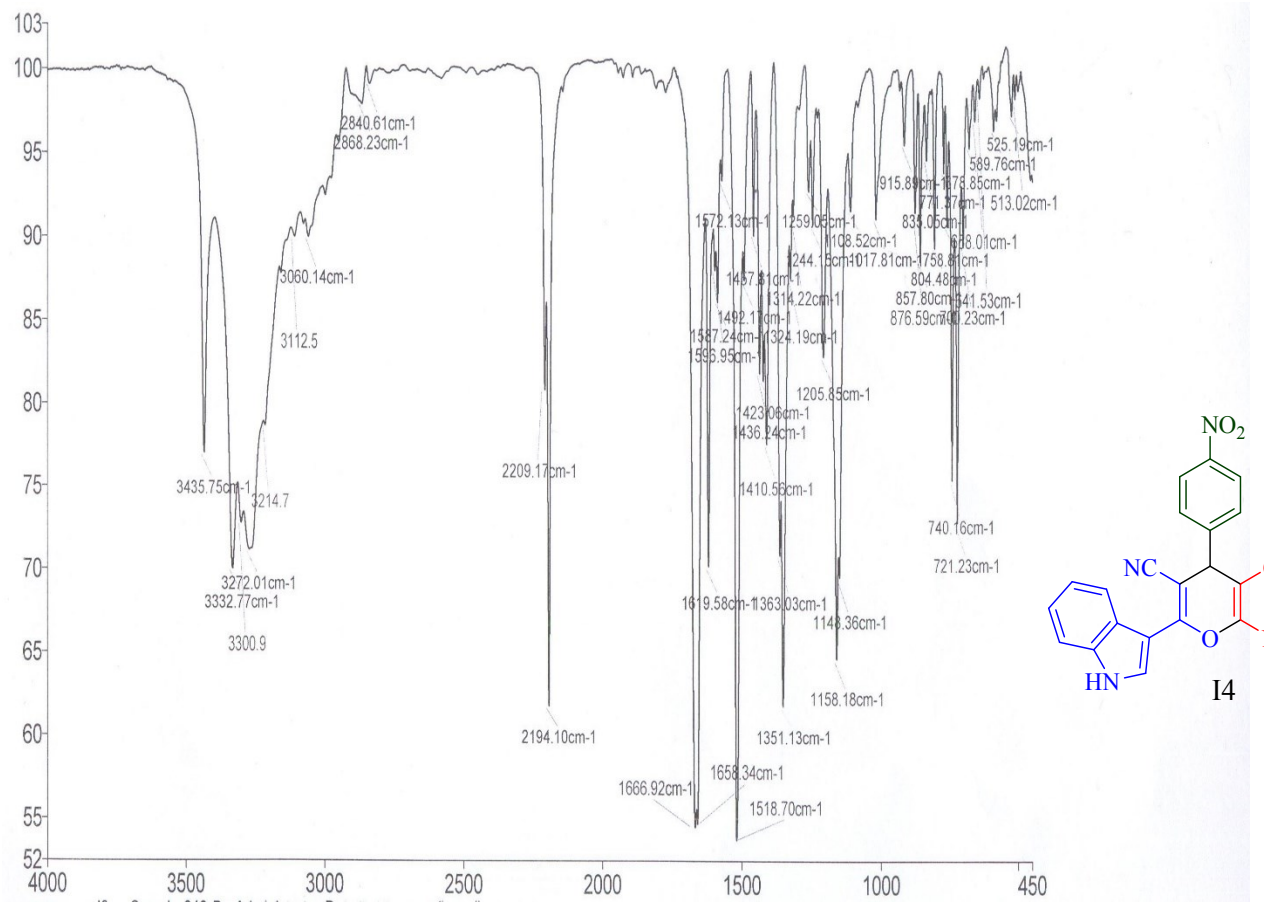
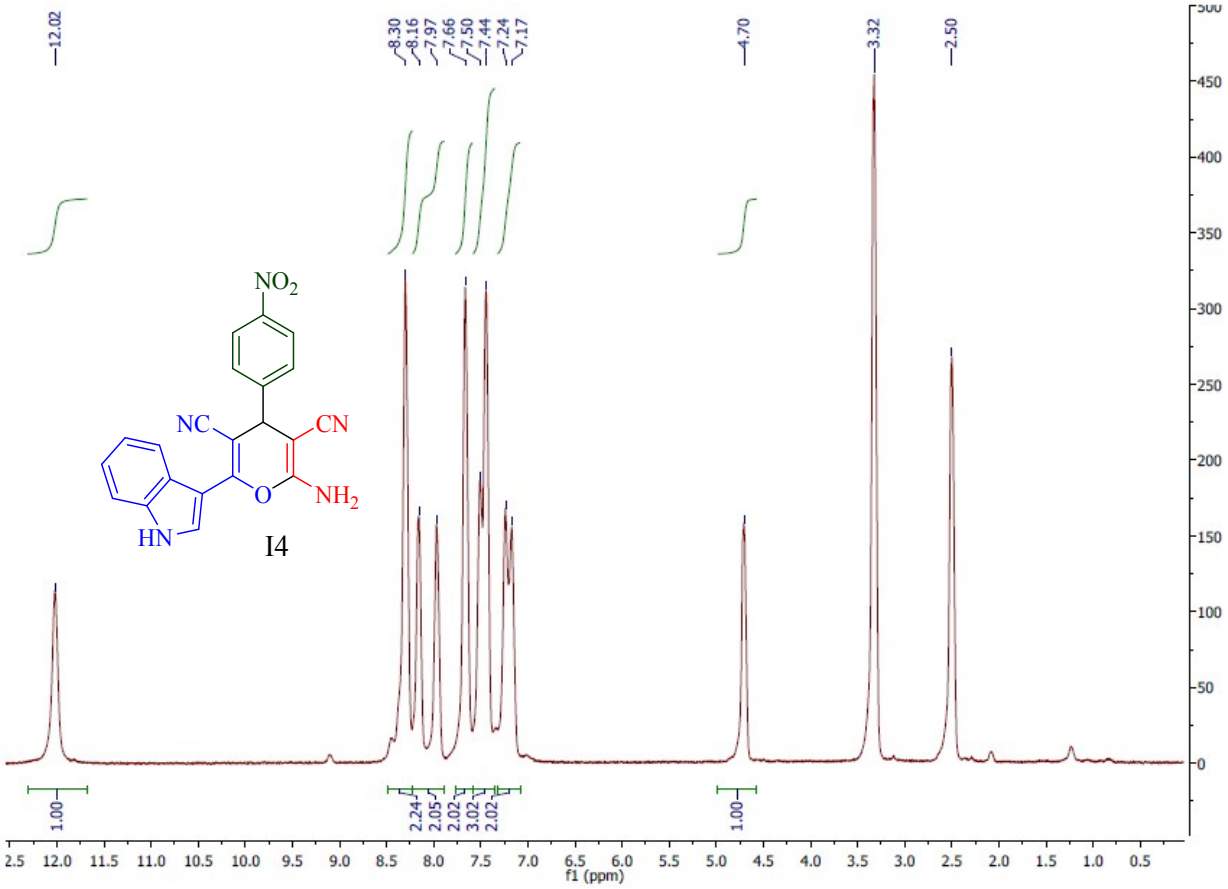


FT-IR spectrum of 2-amino-6-(1H-indol-3-yl)-4-(4-nitrophenyl)-4H-pyran-3,5-dicarbonitrile



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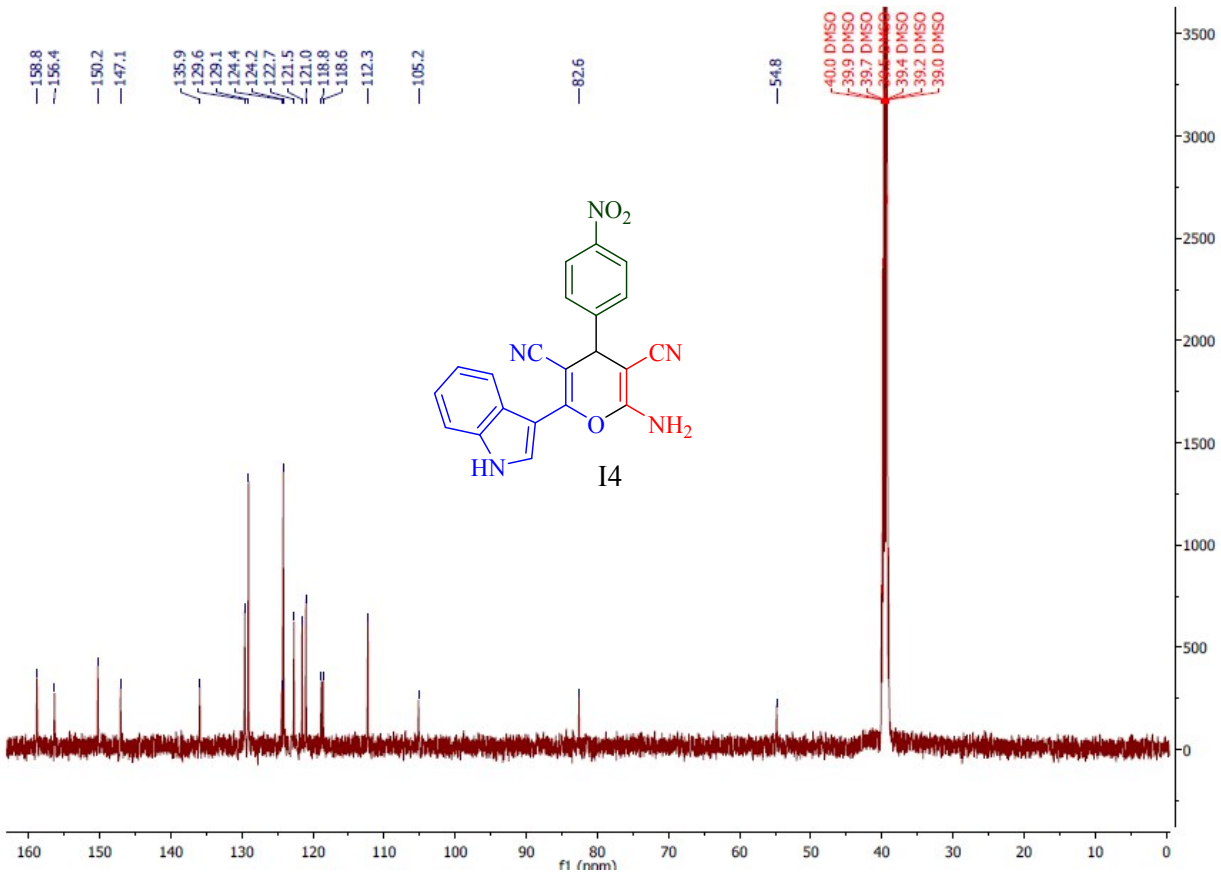
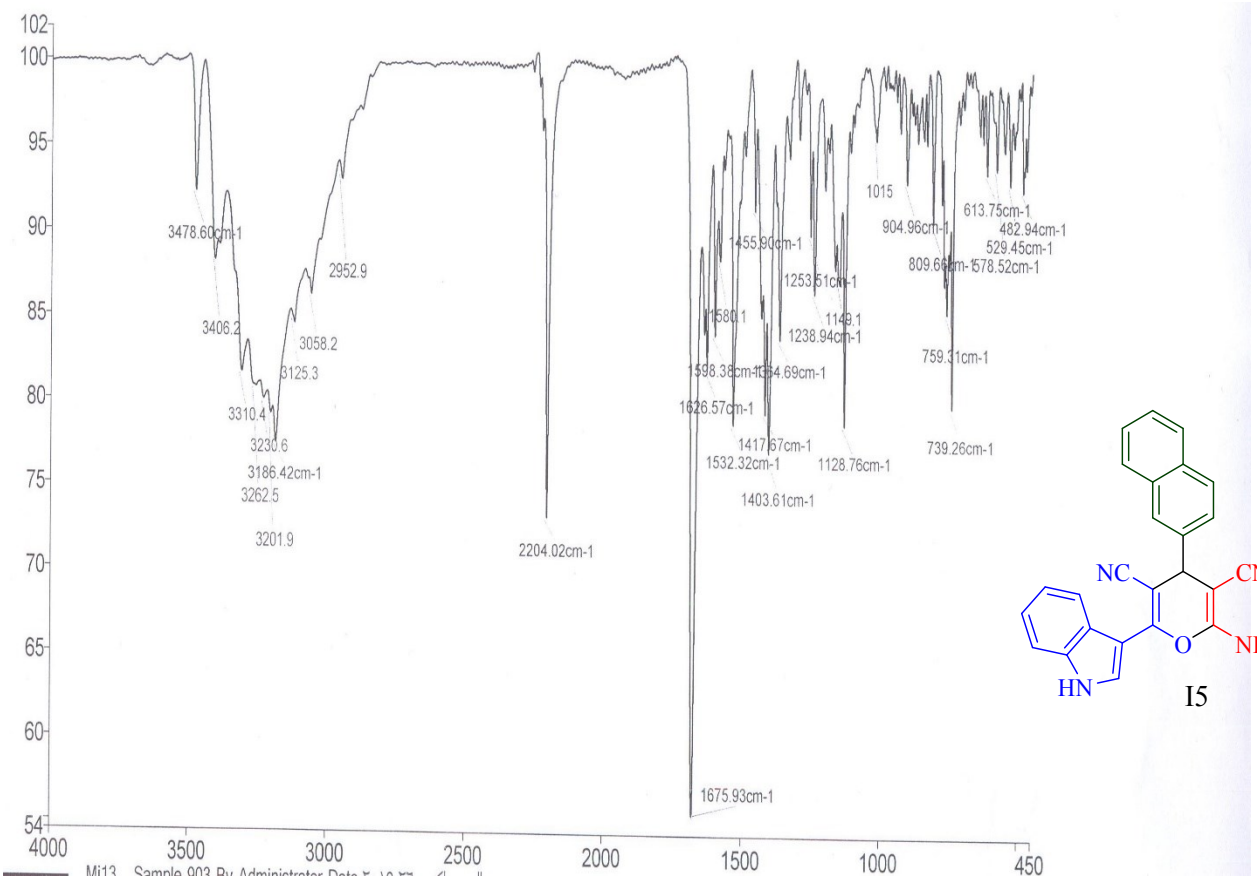
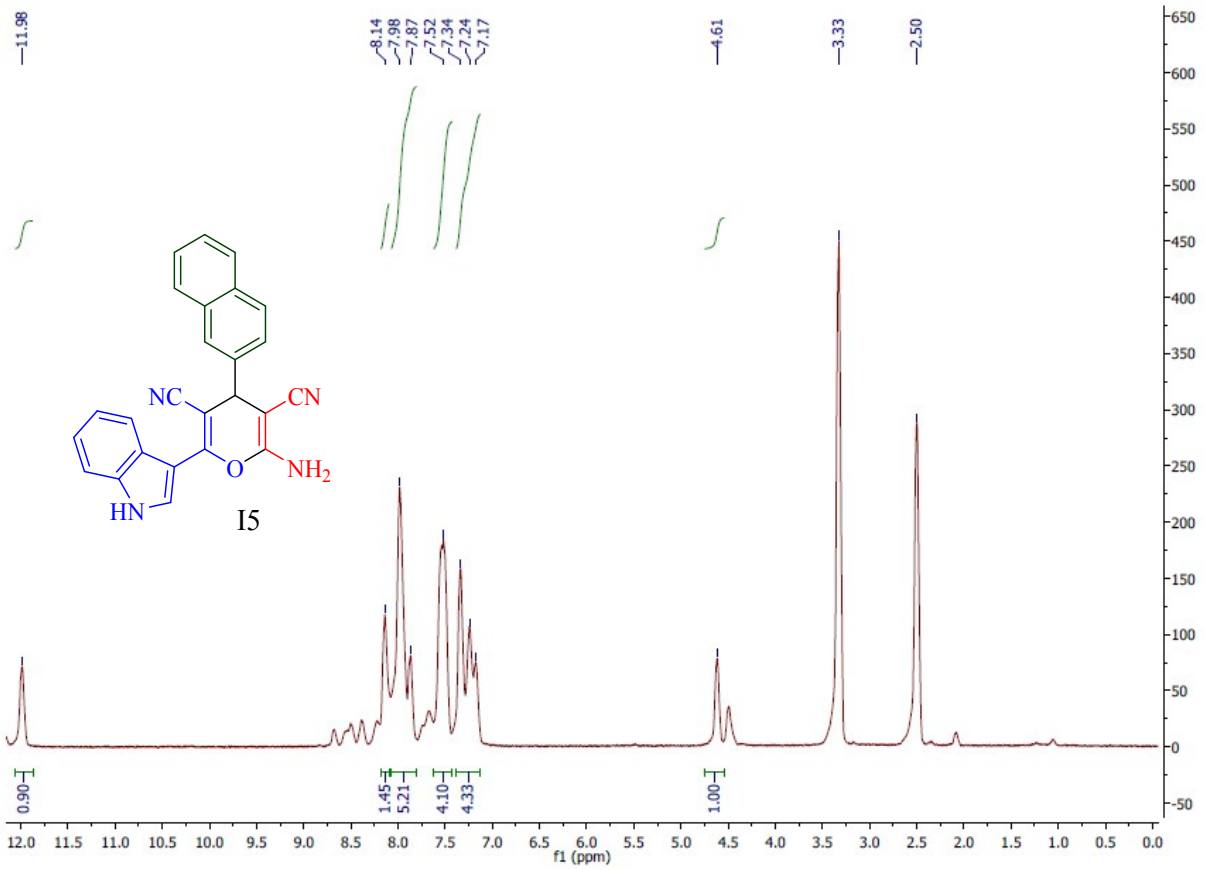


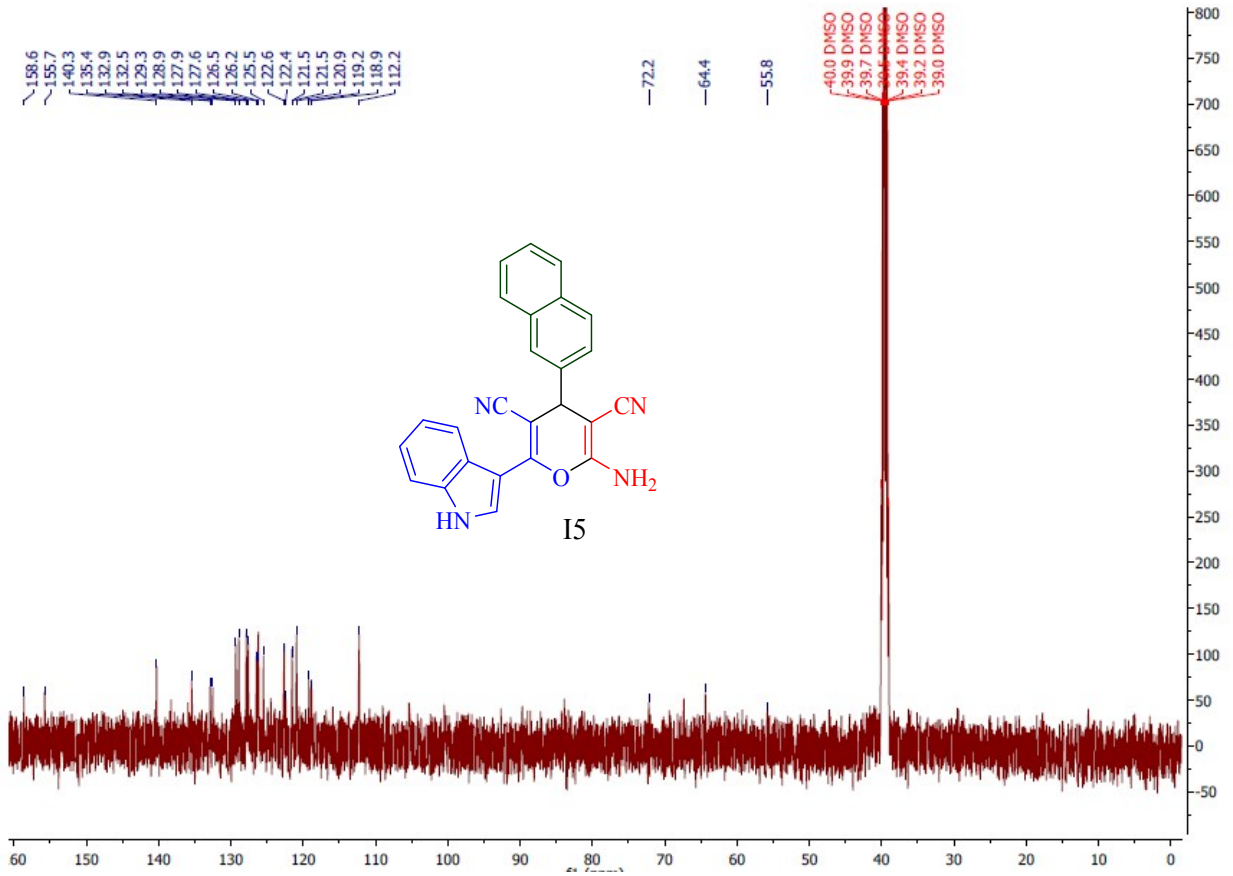
^{13}C-NMR spectrum of 2-amino-6-(1H-indol-3-yl)-4-(4-nitrophenyl)-4H-pyran-3,5-dicarbonitrile



FT-IR spectrum of 2-amino-6-(1H-indol-3-yl)-4-(naphthalen-2-yl)-4H-pyran-3,5-dicarbonitrile



[1]H-NMR spectrum of 2-amino-6-(1H-indol-3-yl)-4-(naphthalen-2-yl)-4H-pyran-3,5-dicarbonitrile



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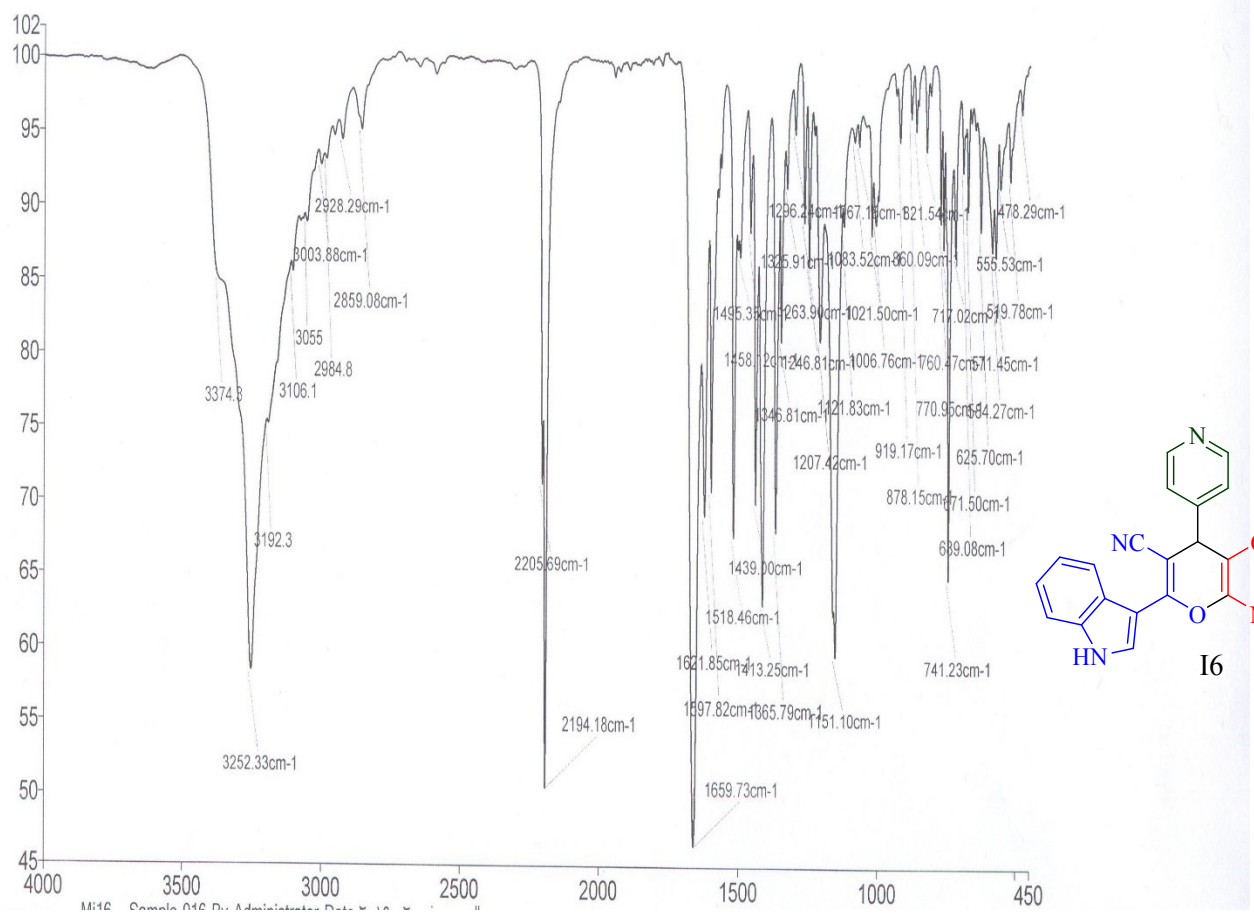
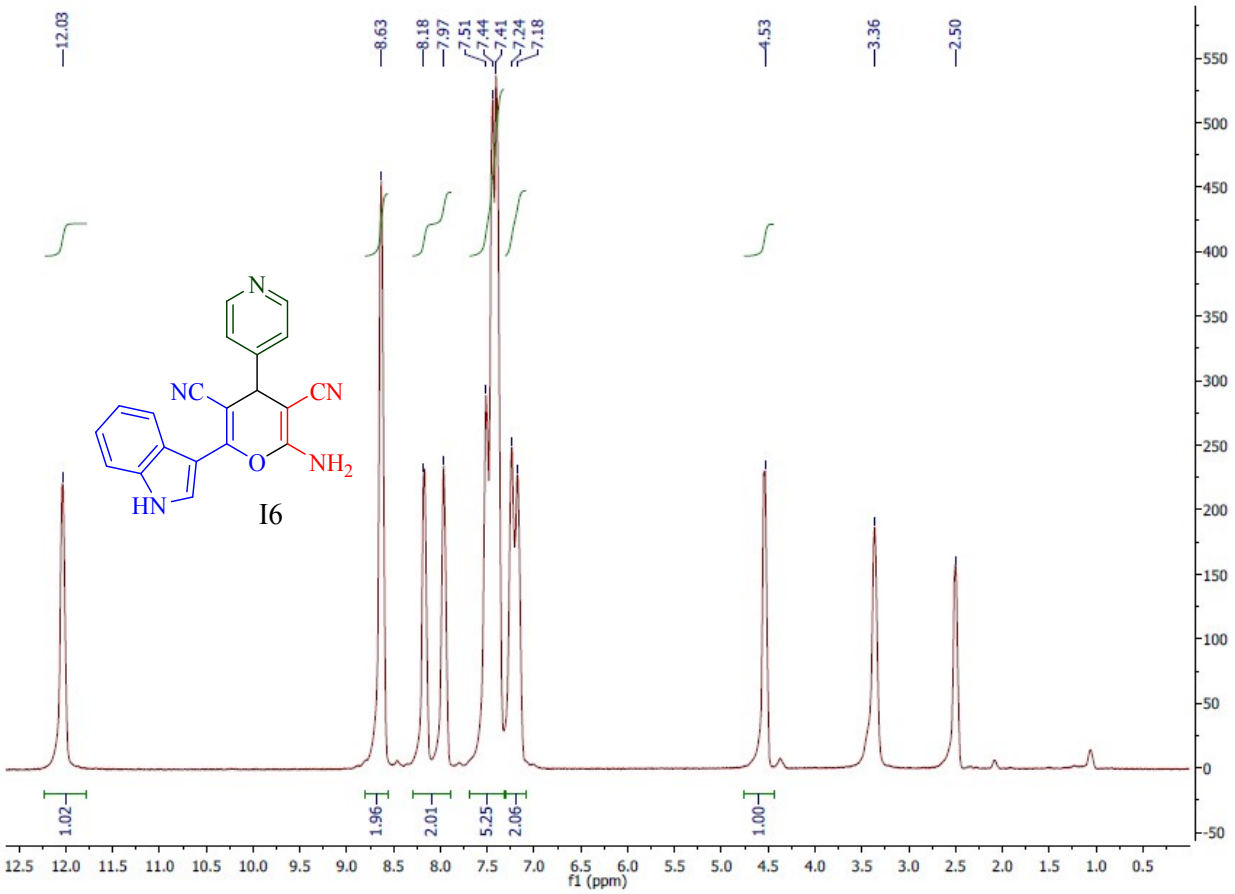


FT-IR spectrum of 2-amino-6-(1H-indol-3-yl)-4-(pyridin-4-yl)-4H-pyran-3,5-dicarbonitrile



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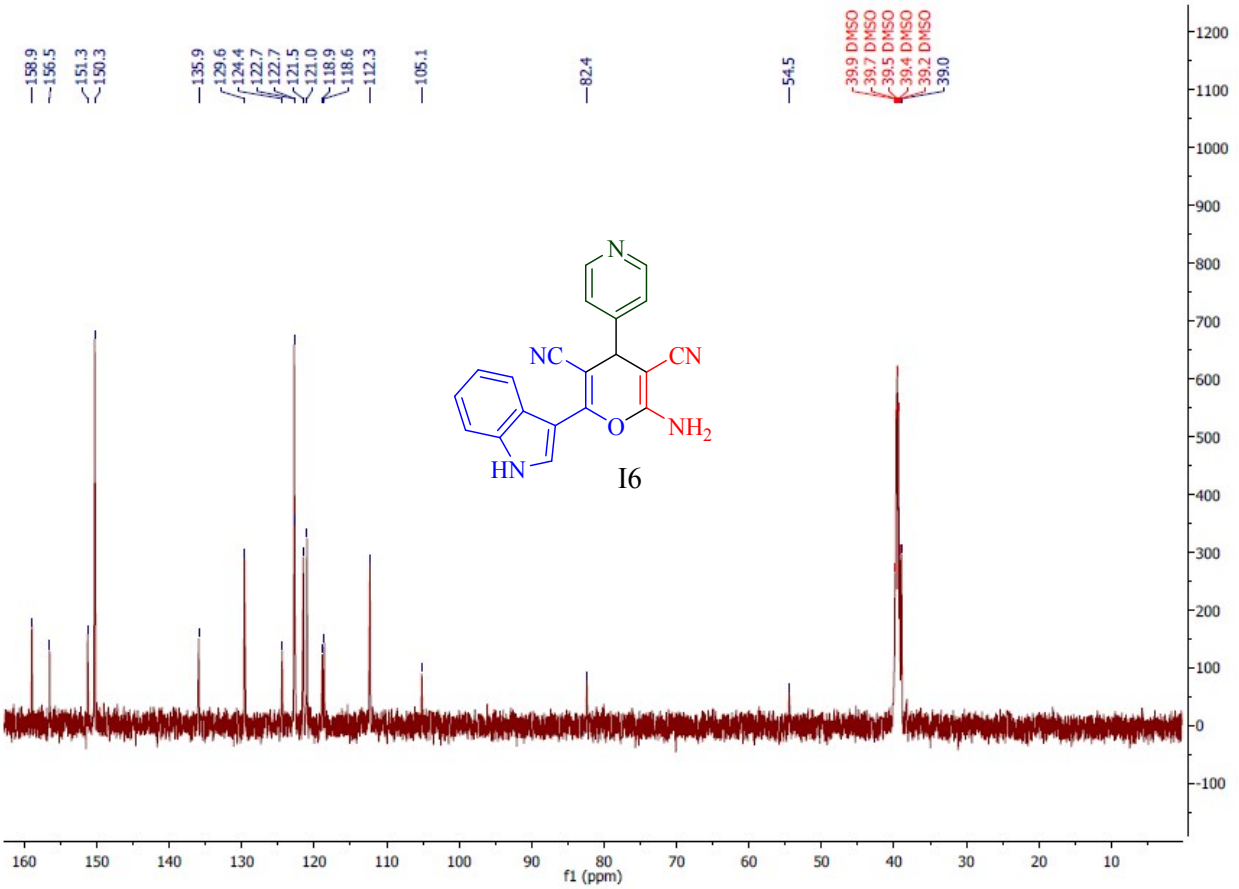
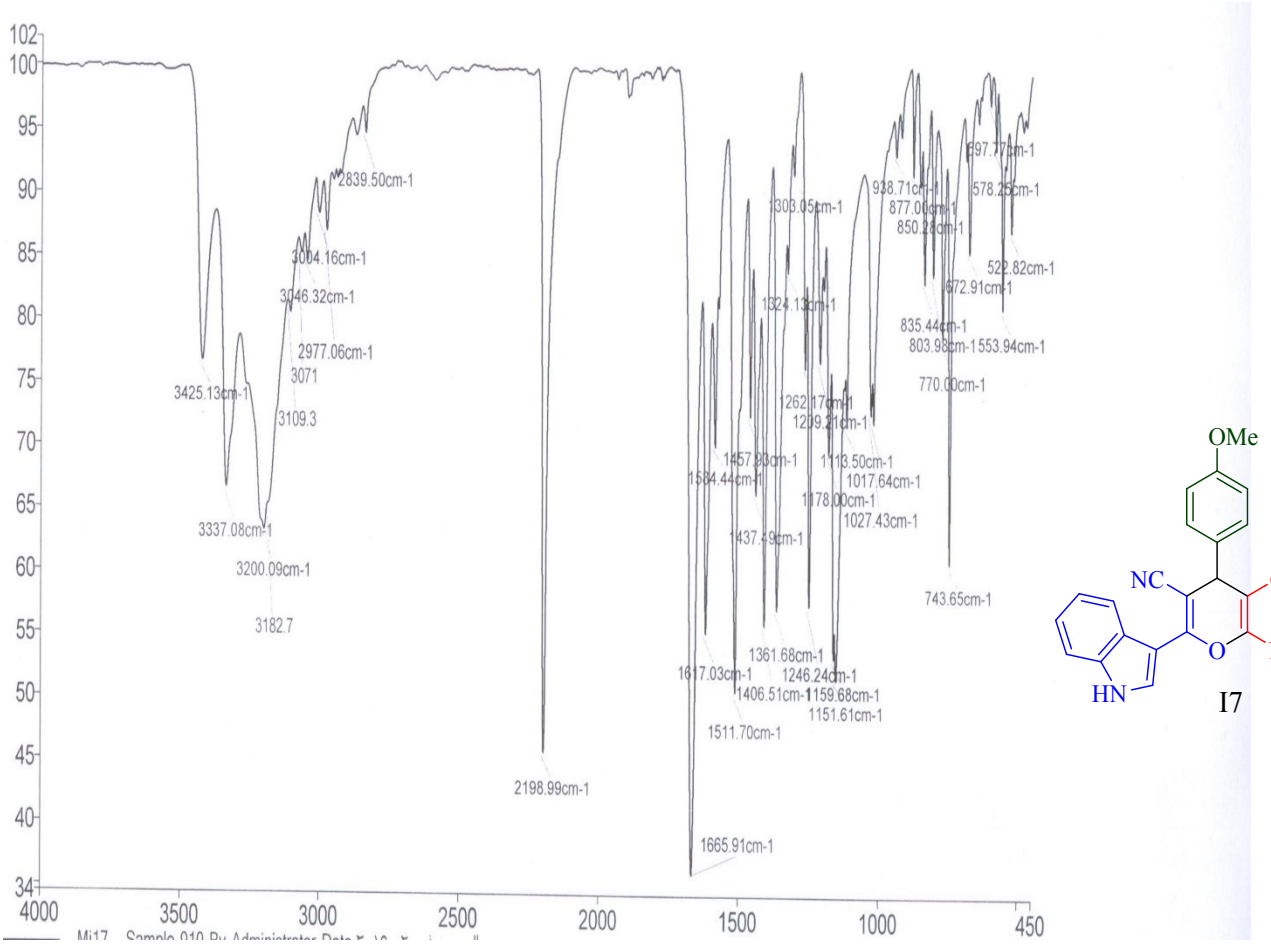
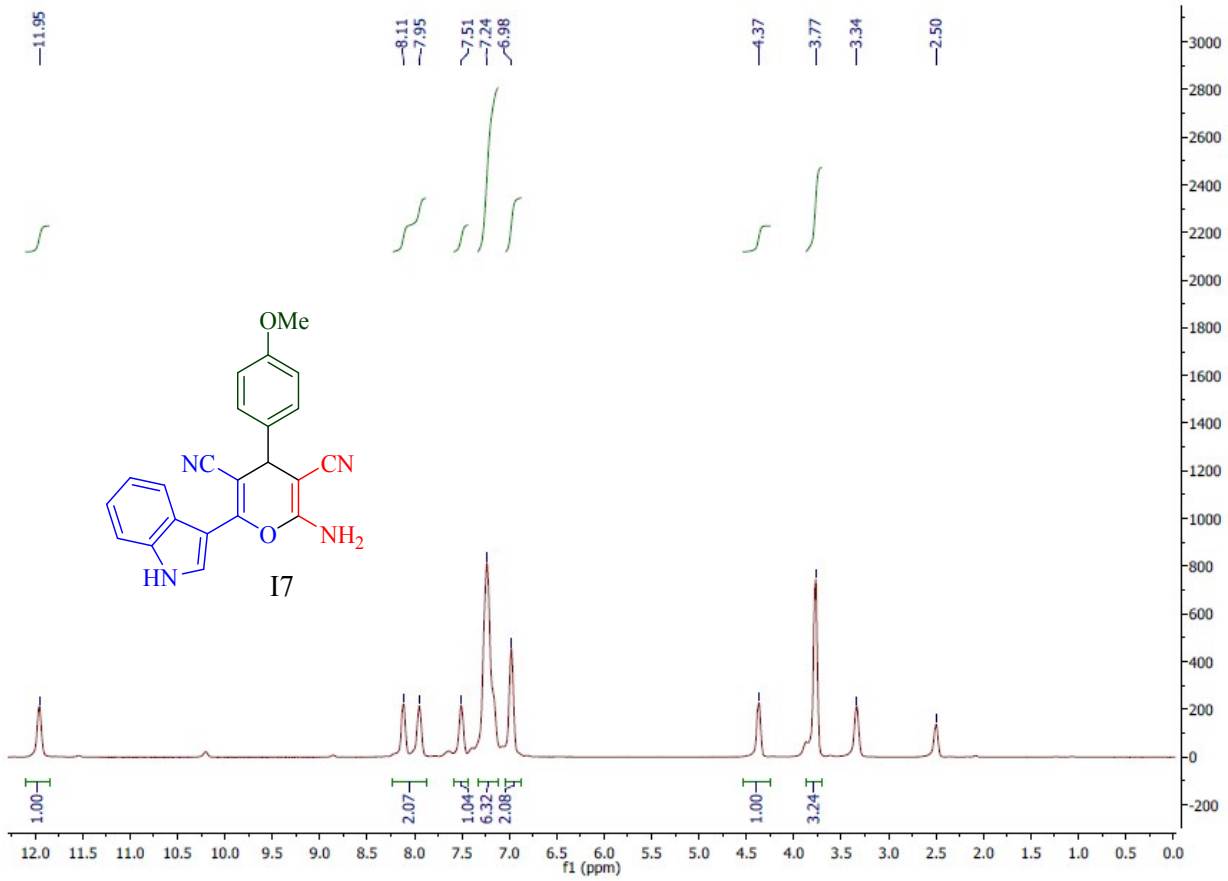


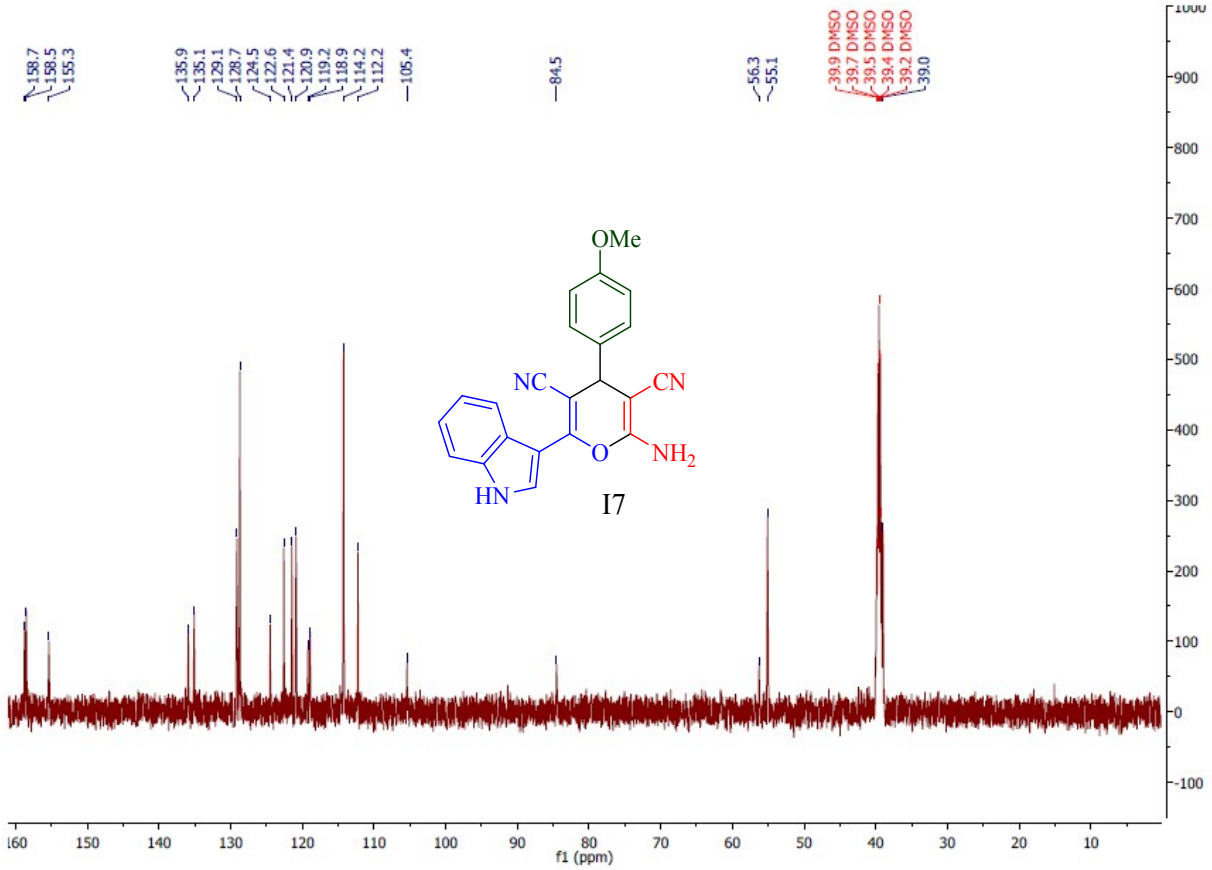
^{13}C-NMR spectrum of 2-amino-6-(1H-indol-3-yl)-4-(pyridin-4-yl)-4H-pyran-3,5-dicarbonitrile



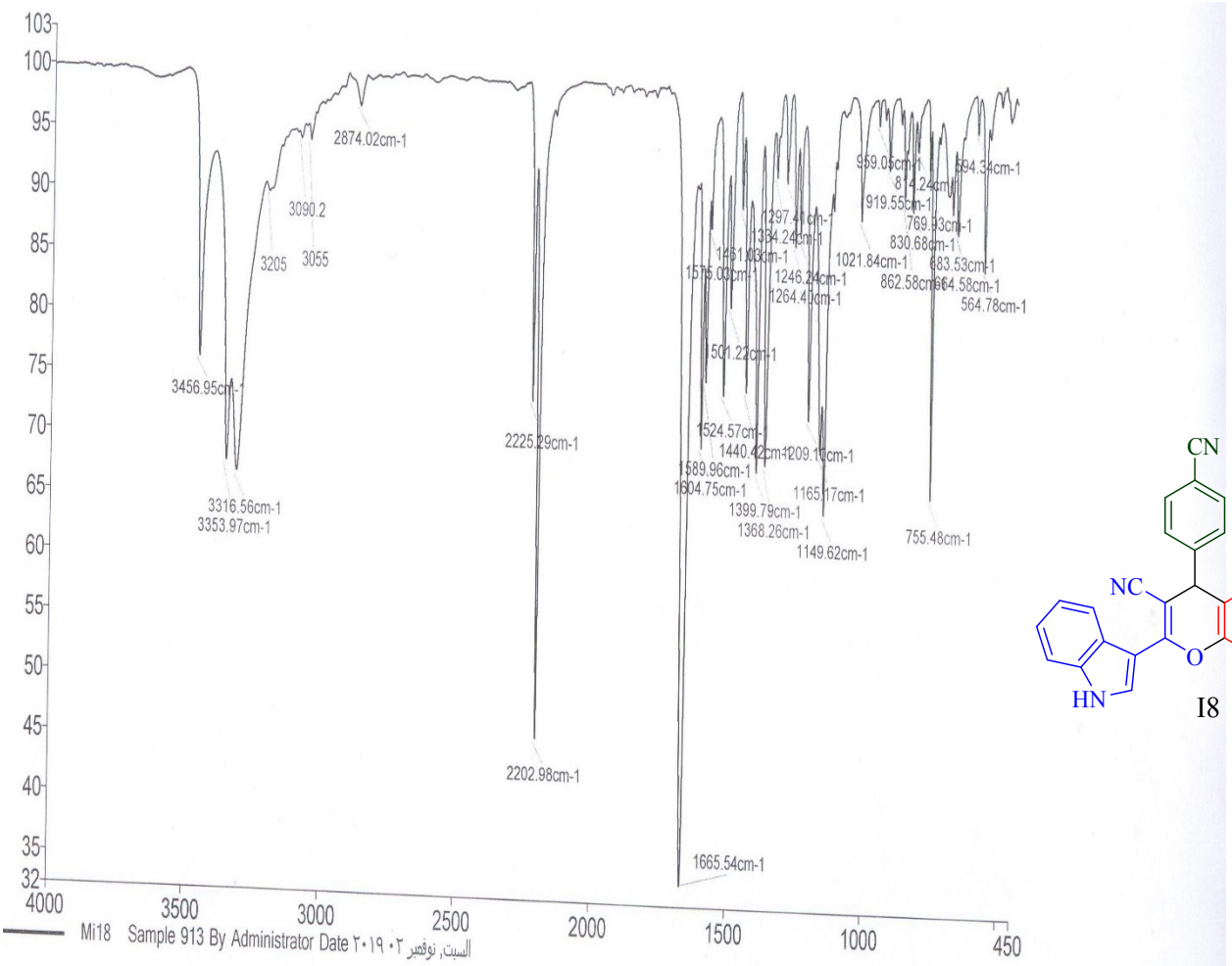
FT-IR spectrum of 2-amino-6-(1H-indol-3-yl)-4-(4-methoxyphenyl)-4H-pyran-3,5-dicarbonitrile



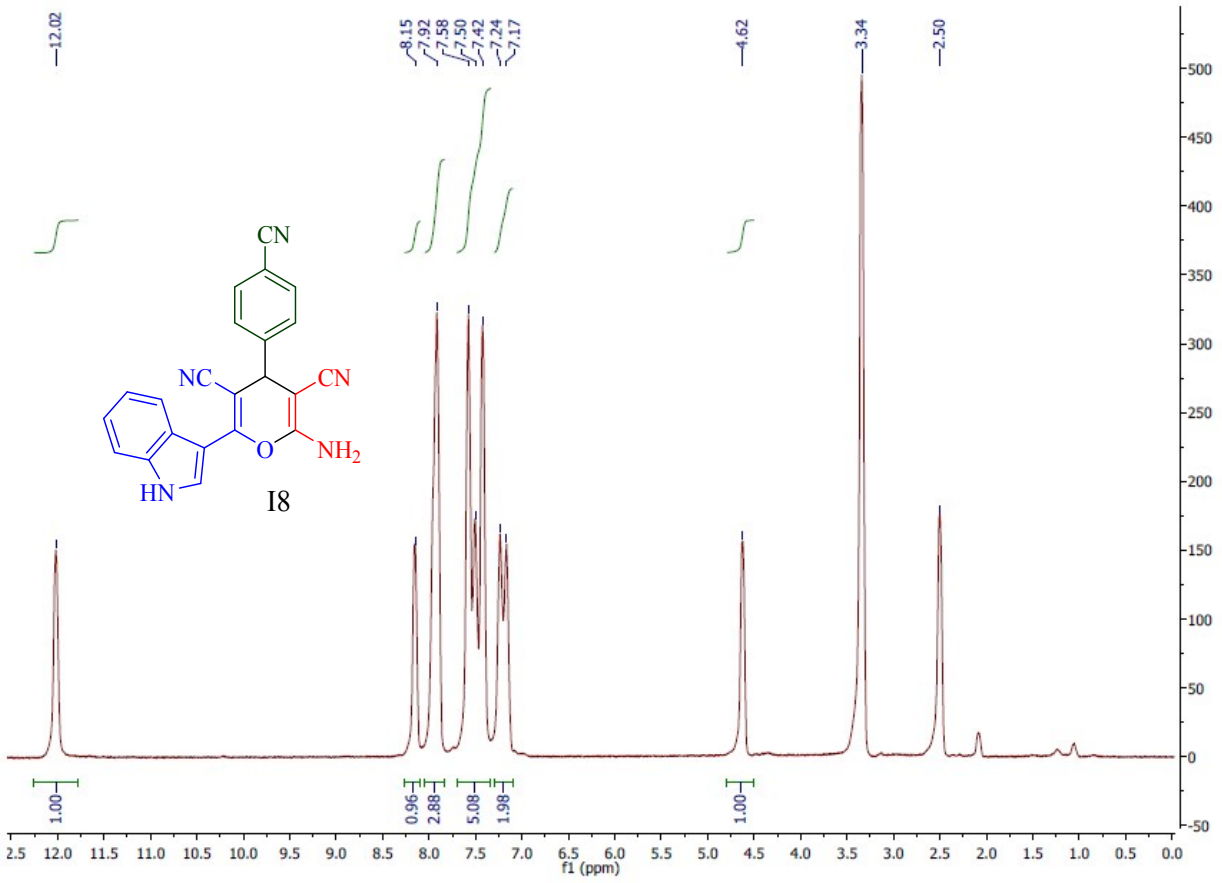
[1]H-NMR spectrum of 2-amino-6-(1H-indol-3-yl)-4-(4-methoxyphenyl)-4H-pyran-3,5-dicarbonitrile



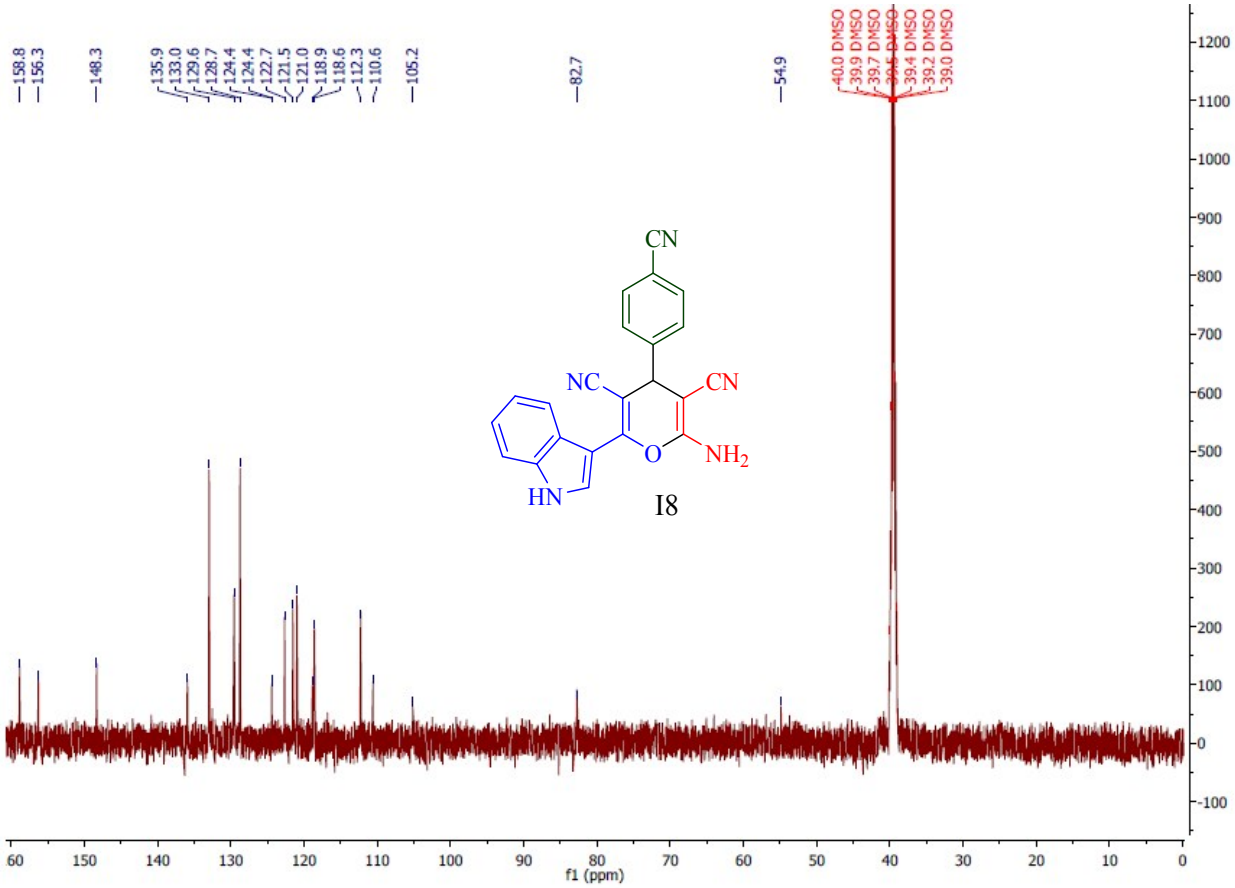
^{13}C-NMR spectrum of 2-amino-6-(1H-indol-3-yl)-4-(4-methoxyphenyl)-4H-pyran-3,5-dicarbonitrile



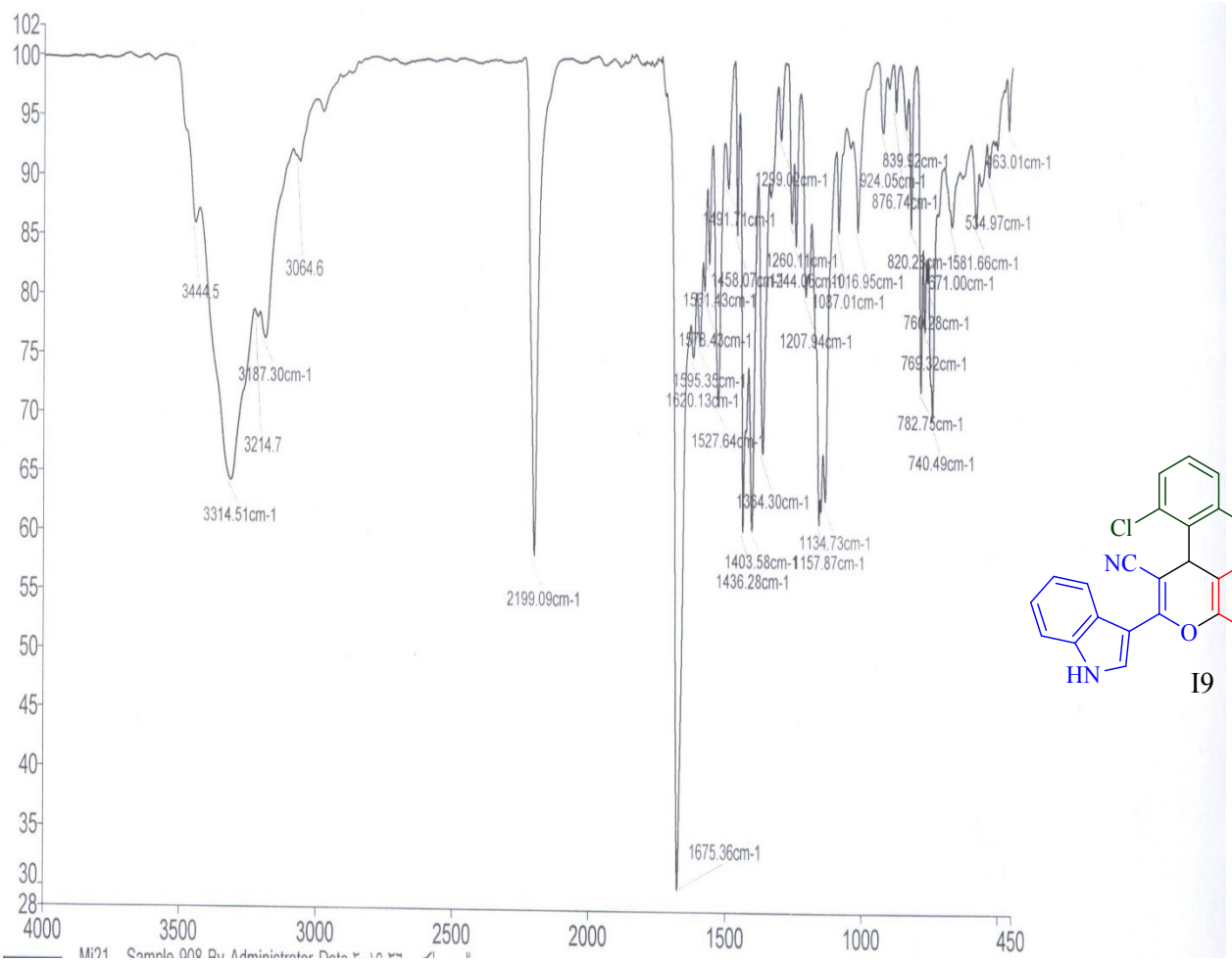
FT-IR spectrum of 2-amino-4-(4-cyanophenyl)-6-(1H-indol-3-yl)-4H-pyran-3,5-dicarbonitrile



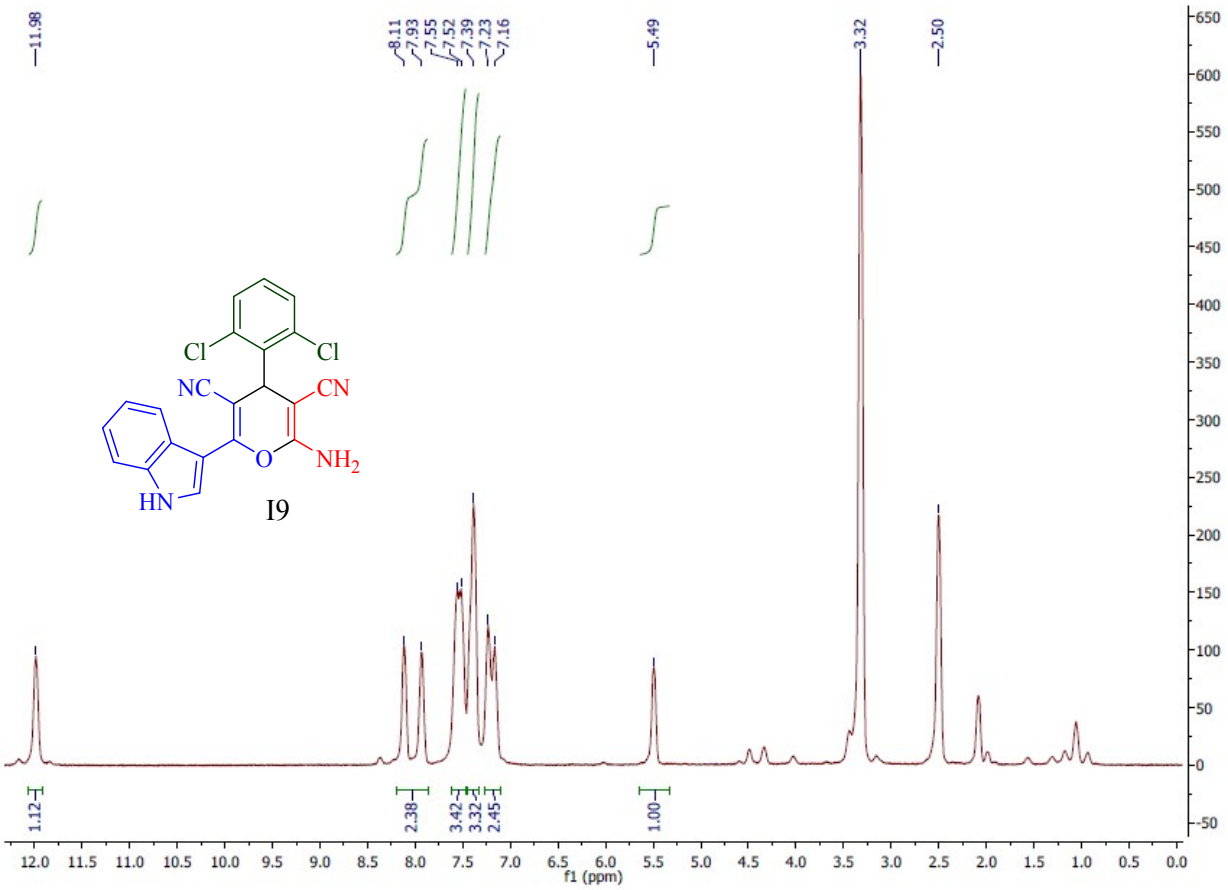
[1]H-NMR spectrum of 2-amino-4-(4-cyanophenyl)-6-(1H-indol-3-yl)-4H-pyran-3,5-dicarbonitrile



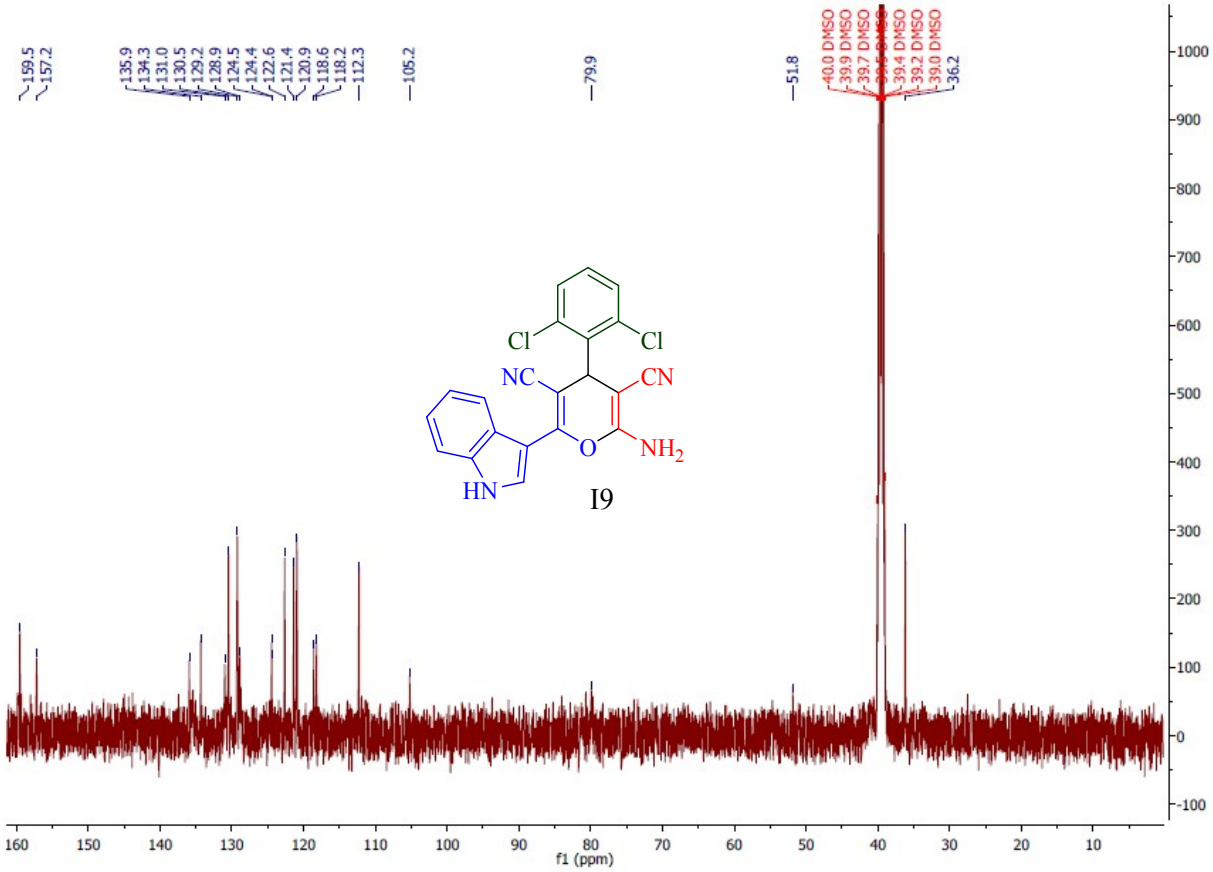
^{13}C-NMR spectrum of 2-amino-4-(4-cyanophenyl)-6-(1H-indol-3-yl)-4H-pyran-3,5-dicarbonitrile



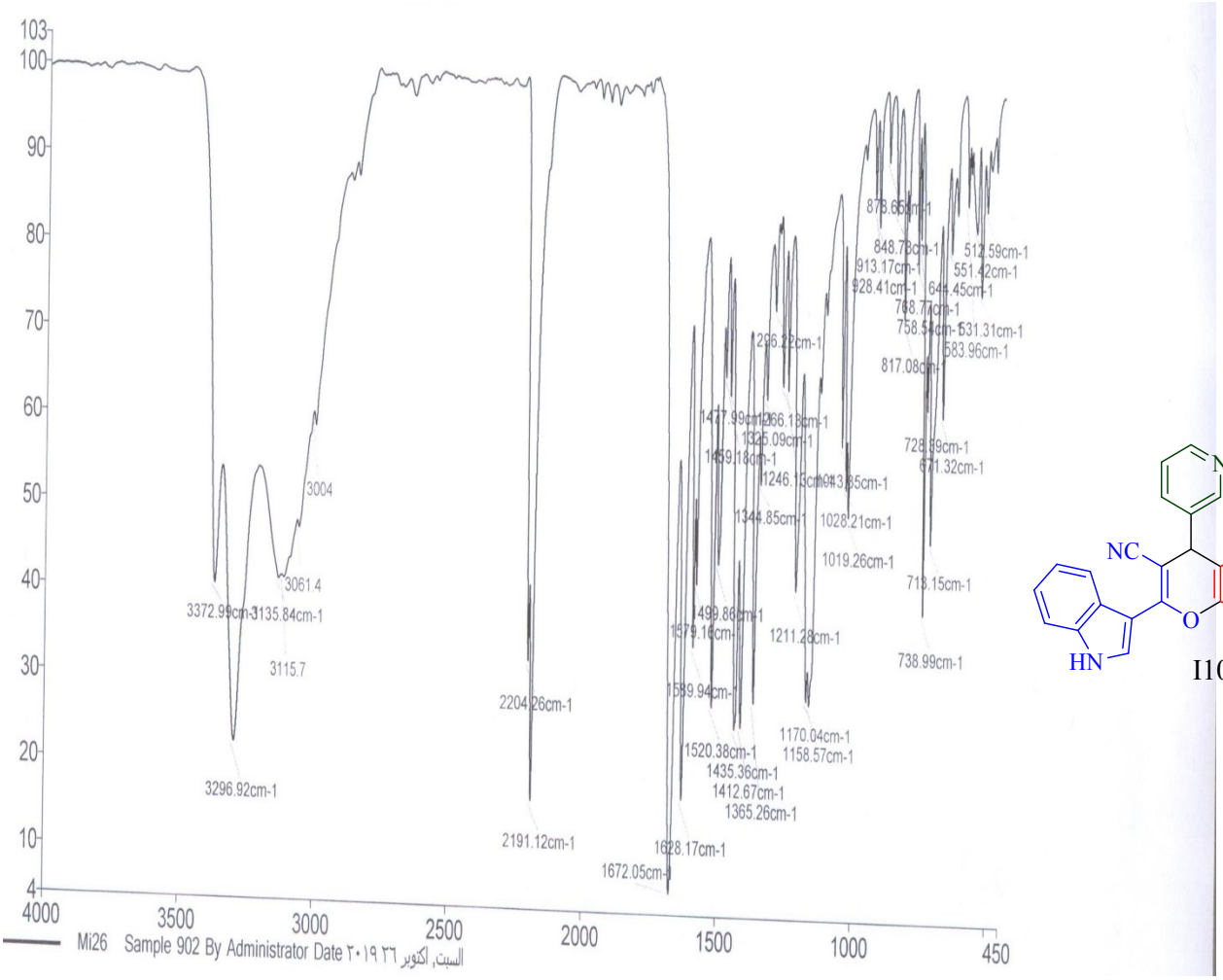
FT-IR spectrum of 2-amino-4-(2,6-dichlorophenyl)-6-(1H-indol-3-yl)-4H-pyran-3,5-dicarbonitrile



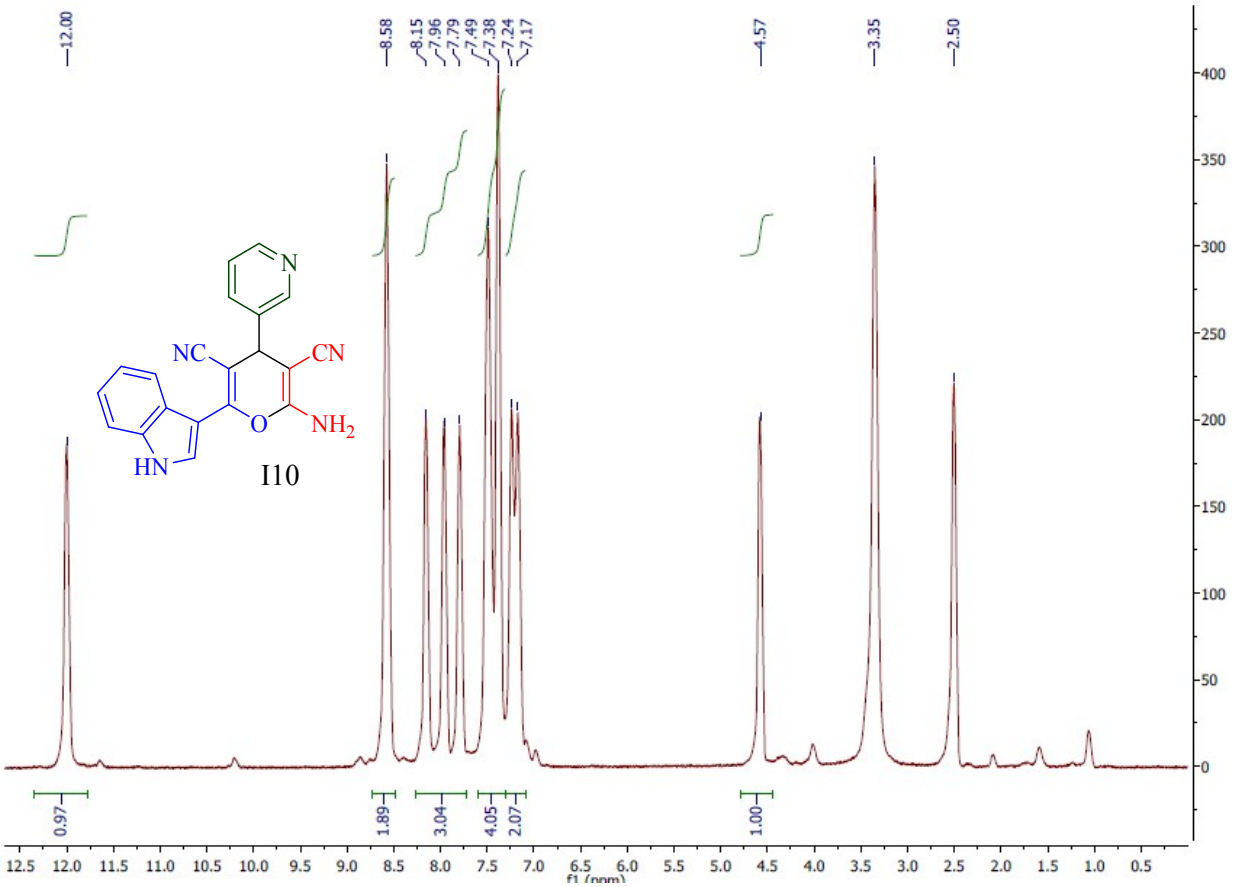
[1]H-NMR spectrum of 2-amino-4-(2,6-dichlorophenyl)-6-(1H-indol-3-yl)-4H-pyran-3,5-dicarbonitrile



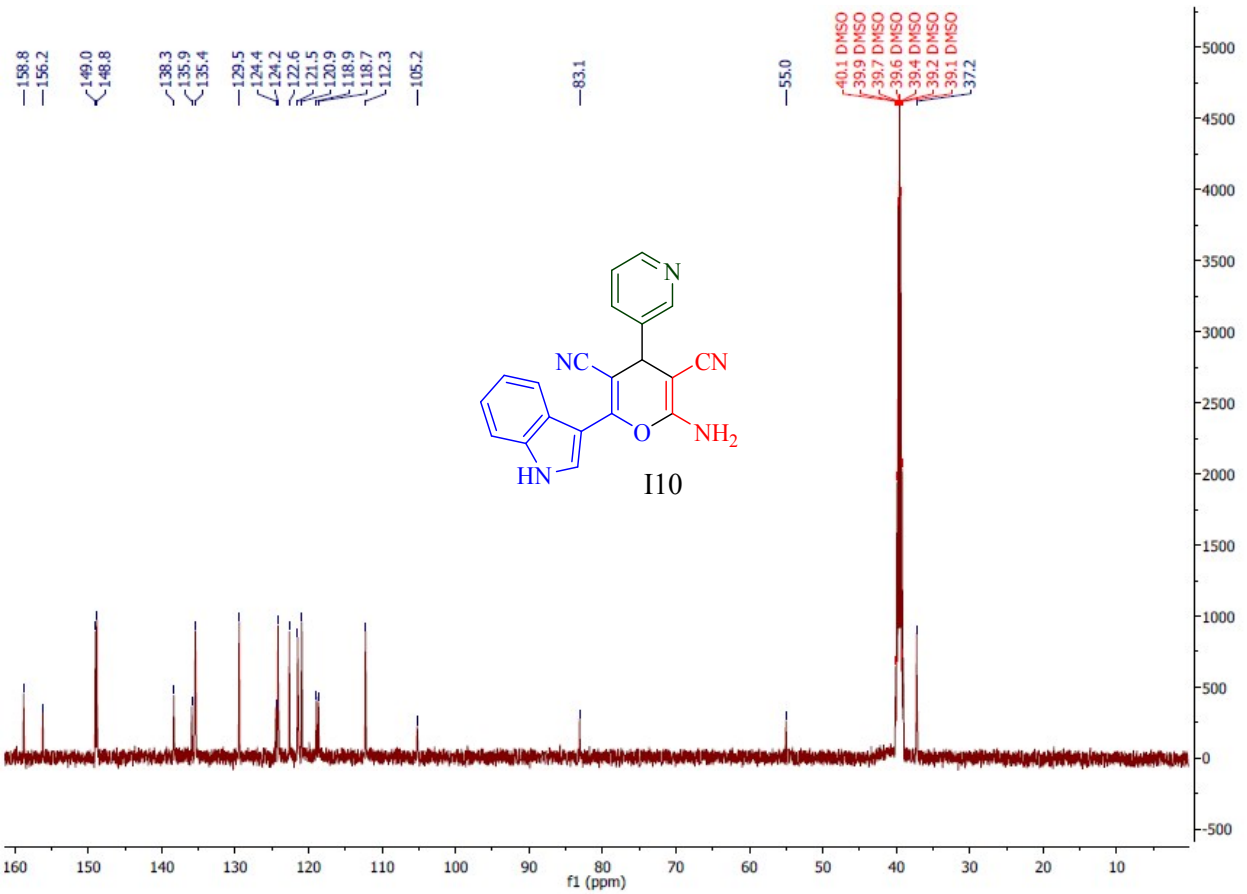
^{13}C-NMR spectrum of 2-amino-4-(2,6-dichlorophenyl)-6-(1H-indol-3-yl)-4H-pyran-3,5-dicarbonitrile



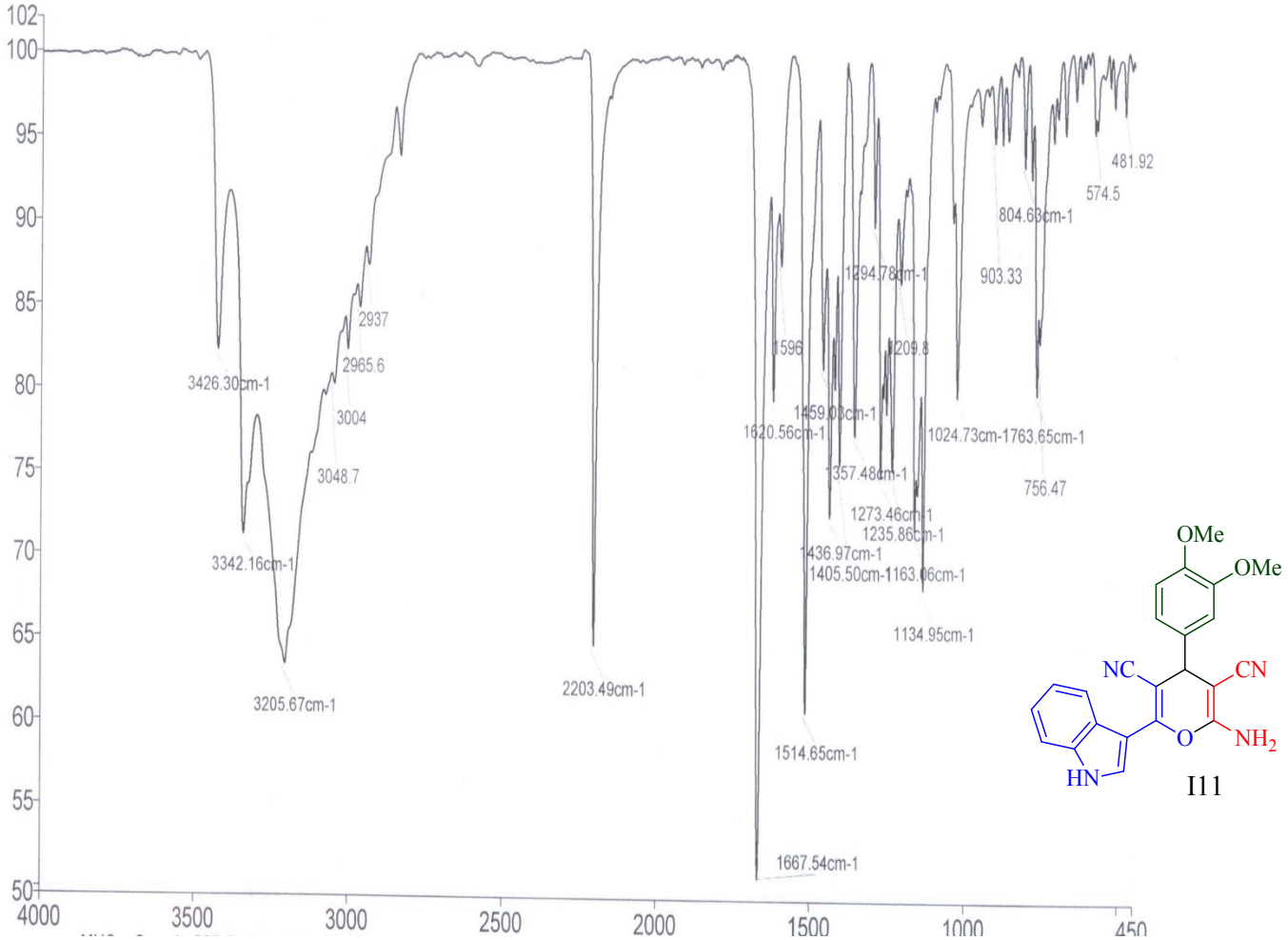
FT-IR spectrum of 2-amino-6-(1H-indol-3-yl)-4-(pyridin-3-yl)-4H-pyran-3,5-dicarbonitrile



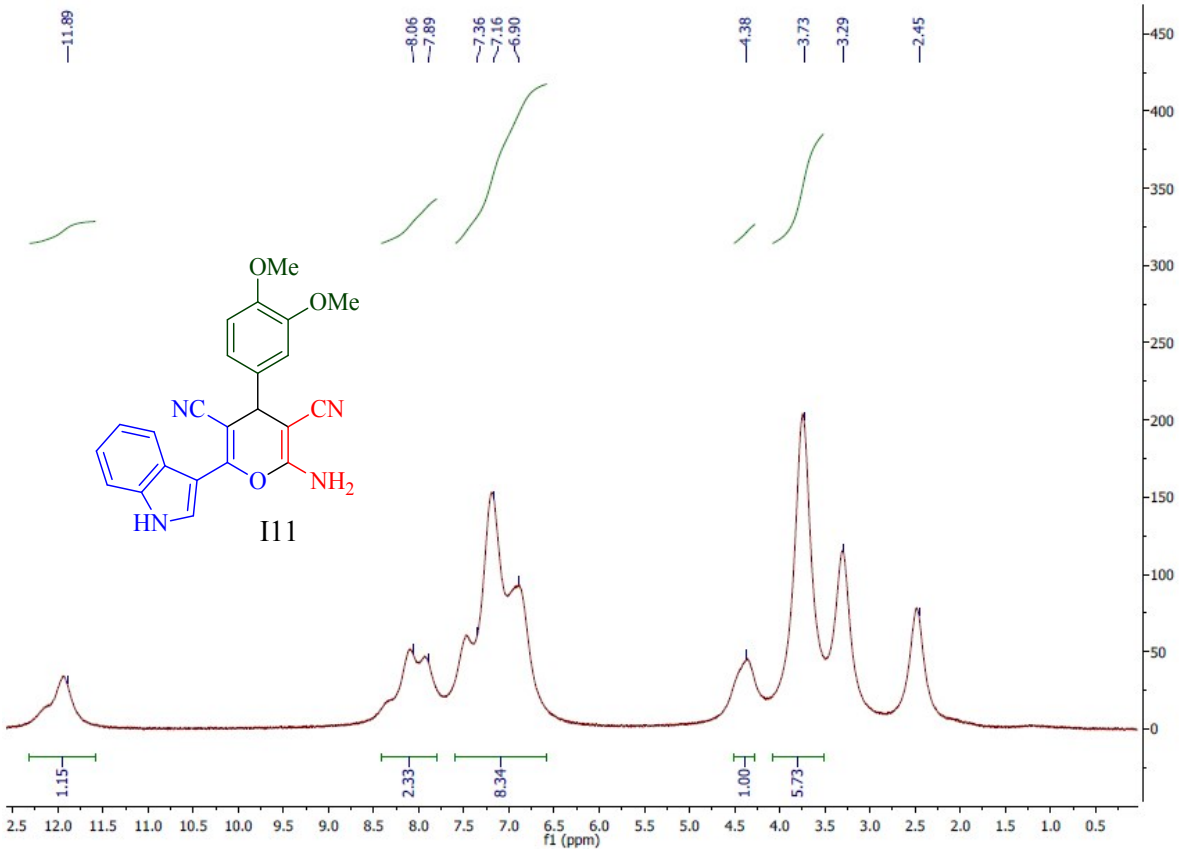
[1]H-NMR spectrum of 2-amino-6-(1H-indol-3-yl)-4-(pyridin-3-yl)-4H-pyran-3,5-dicarbonitrile



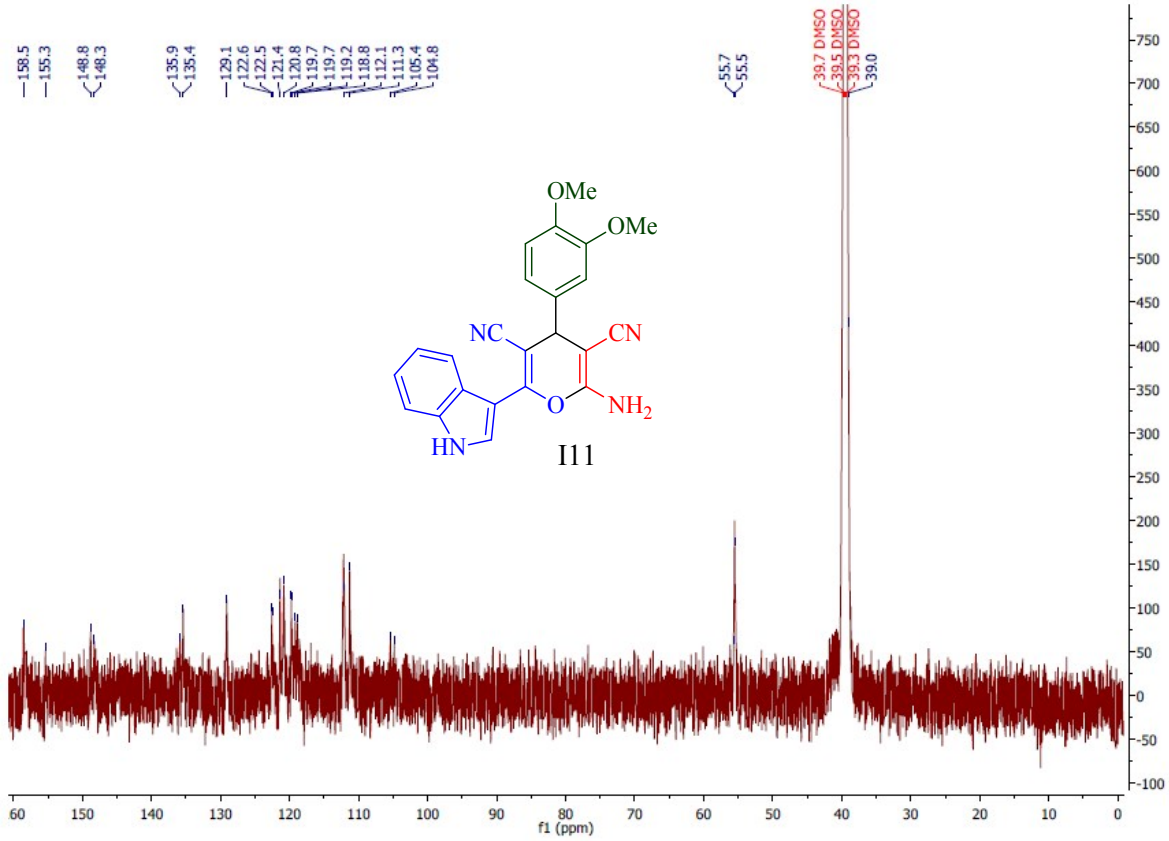
^{13}C-NMR spectrum of 2-amino-6-(1H-indol-3-yl)-4-(pyridin-3-yl)-4H-pyran-3,5-dicarbonitrile



FT-IR spectrum of 2-amino-4-(3,4-dimethoxyphenyl)-6-(1H-indol-3-yl)-4H-pyran-3,5-dicarbonitrile



[1]H-NMR spectrum of 2-amino-4-(3,4-dimethoxyphenyl)-6-(1H-indol-3-yl)-4H-pyran-3,5-dicarbonitrile



^{13}C-NMR spectrum of 2-amino-4-(3,4-dimethoxyphenyl)-6-(1H-indol-3-yl)-4H-pyran-3,5-dicarbonitrile