RSC Advances

ARTICLE

Electronic Supplementary Material (ESI) for RSC Advances.

Introduction of Taurine (2-aminoethanesulfonic acid) as a green bio-organic catalyst for the promotion of some of the organic reactions under green conditions

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Supporting information

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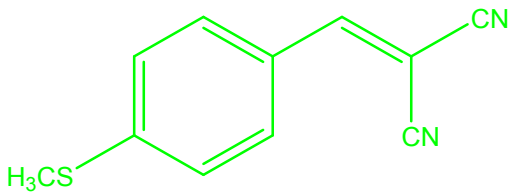
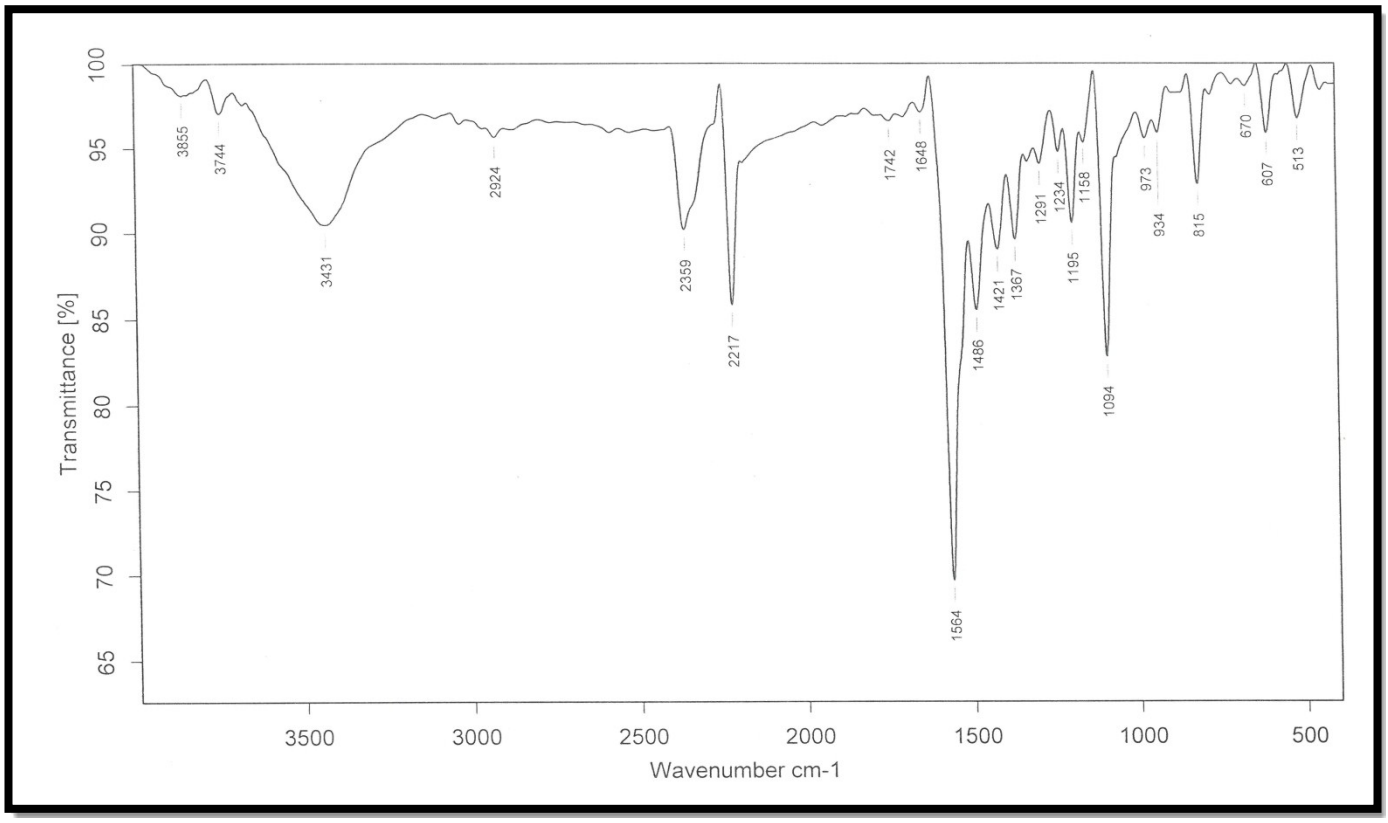
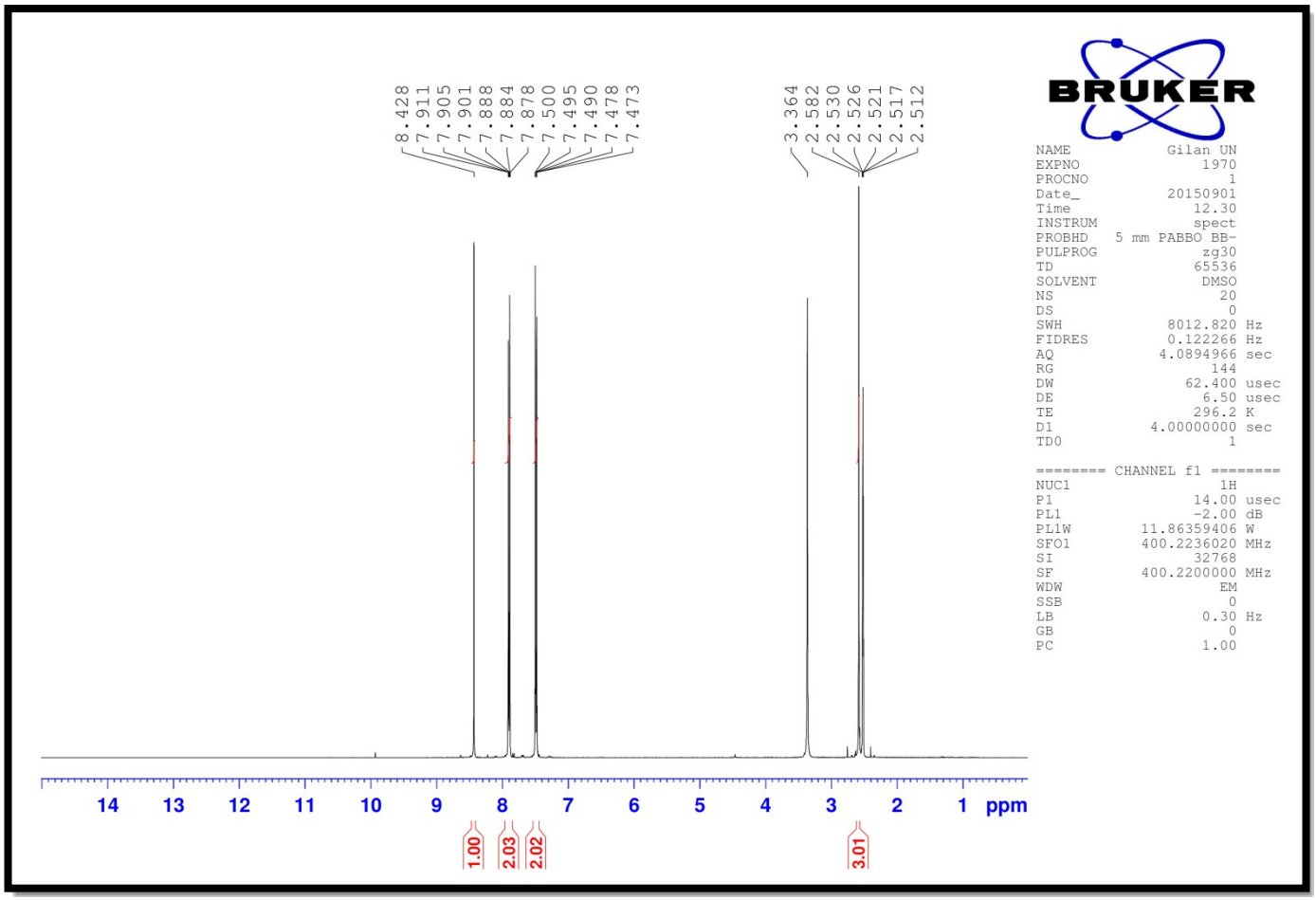
Spectral data of the new compounds:

1p) 2-(4-(methylthio)benzylidene)malononitrile (Table 2, entry 16). IR (KBr, cm^{-1}): 3040, 2217, 1648, 1564, 1094; ^{1}H NMR (400 MHz, DMSO-d_6): δ= 2.58 (s, 3H), 7.48 (d, J= 8.4 Hz, 2H), 7.89 (d, J= 8.4 Hz, 2H), 8.42 (s, 1H) ppm; ^{13}C NMR (100 MHz, DMSO-d_6): δ= 14.30, 79.10, 114.14, 115.10, 125.87, 127.75, 131.41, 148,92, 160.86 ppm.

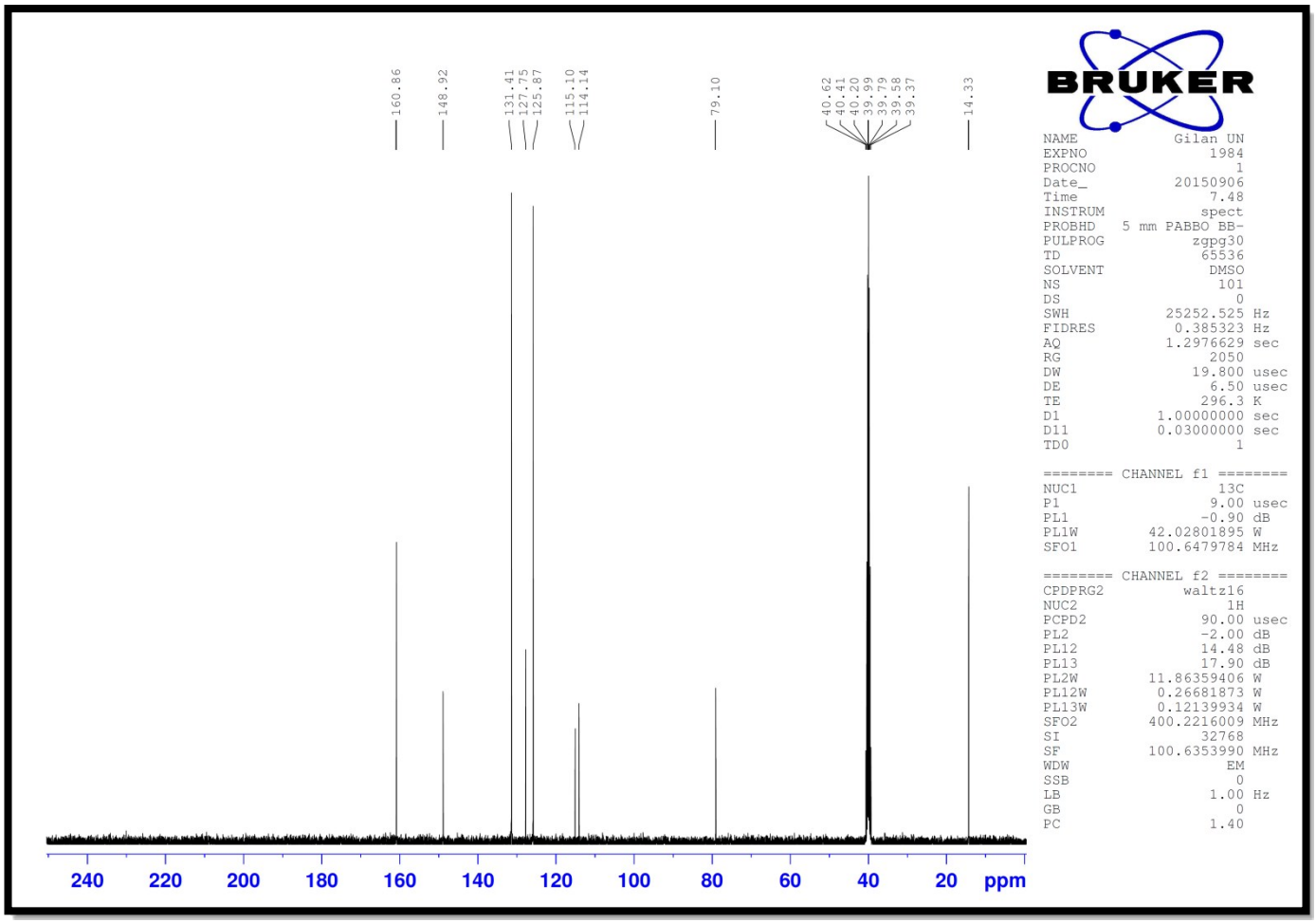




FT-IR of spectra 2-(4-(methylthio)benzylidene)malononitrile

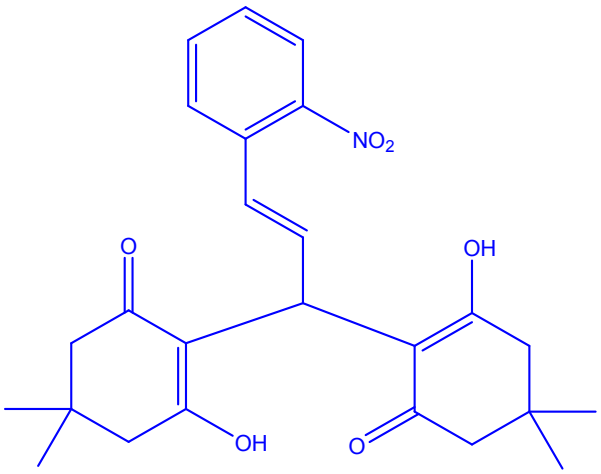


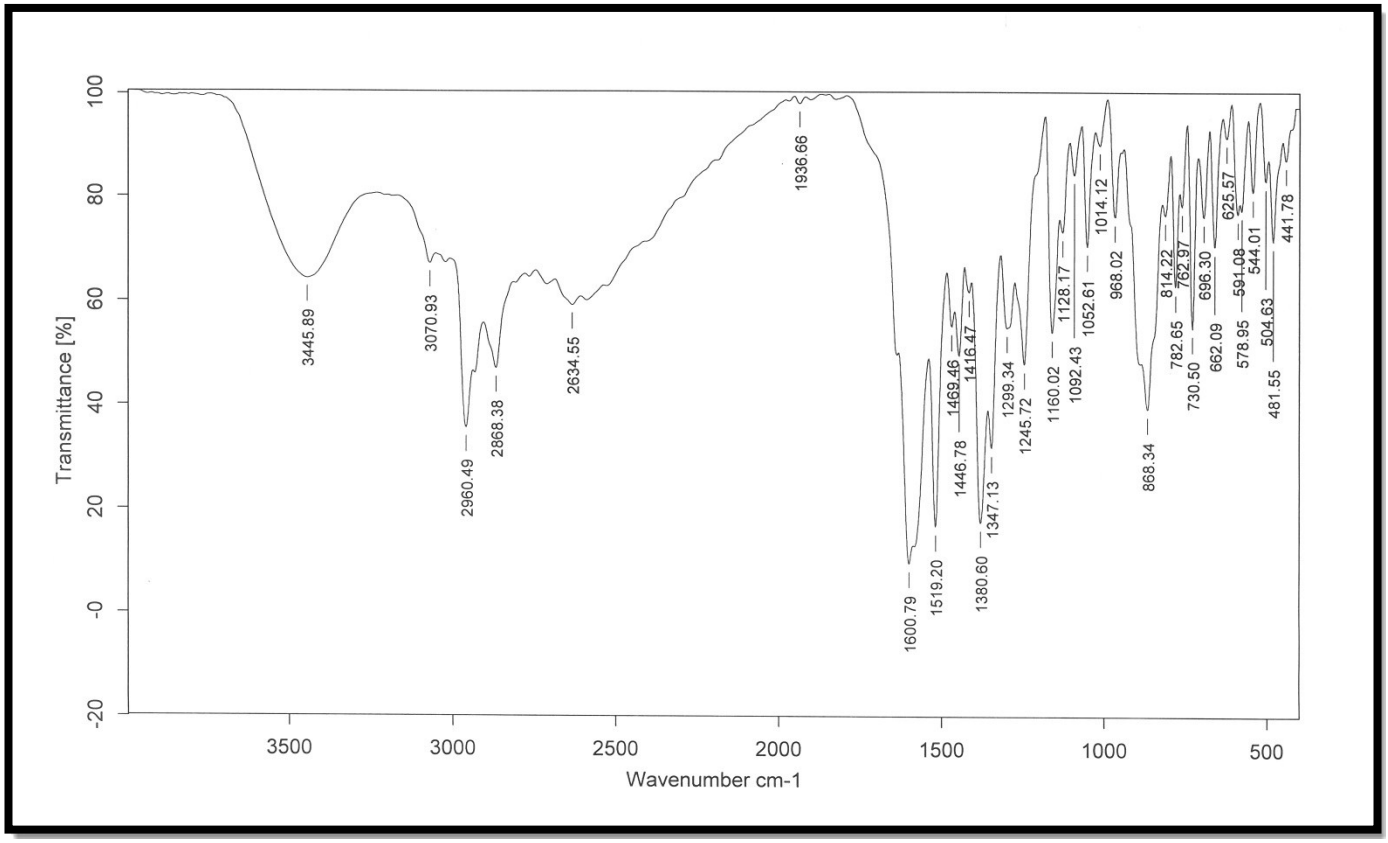
^{1}H NMR spectra of 2-(4-(methylthio)benzylidene)malononitrile



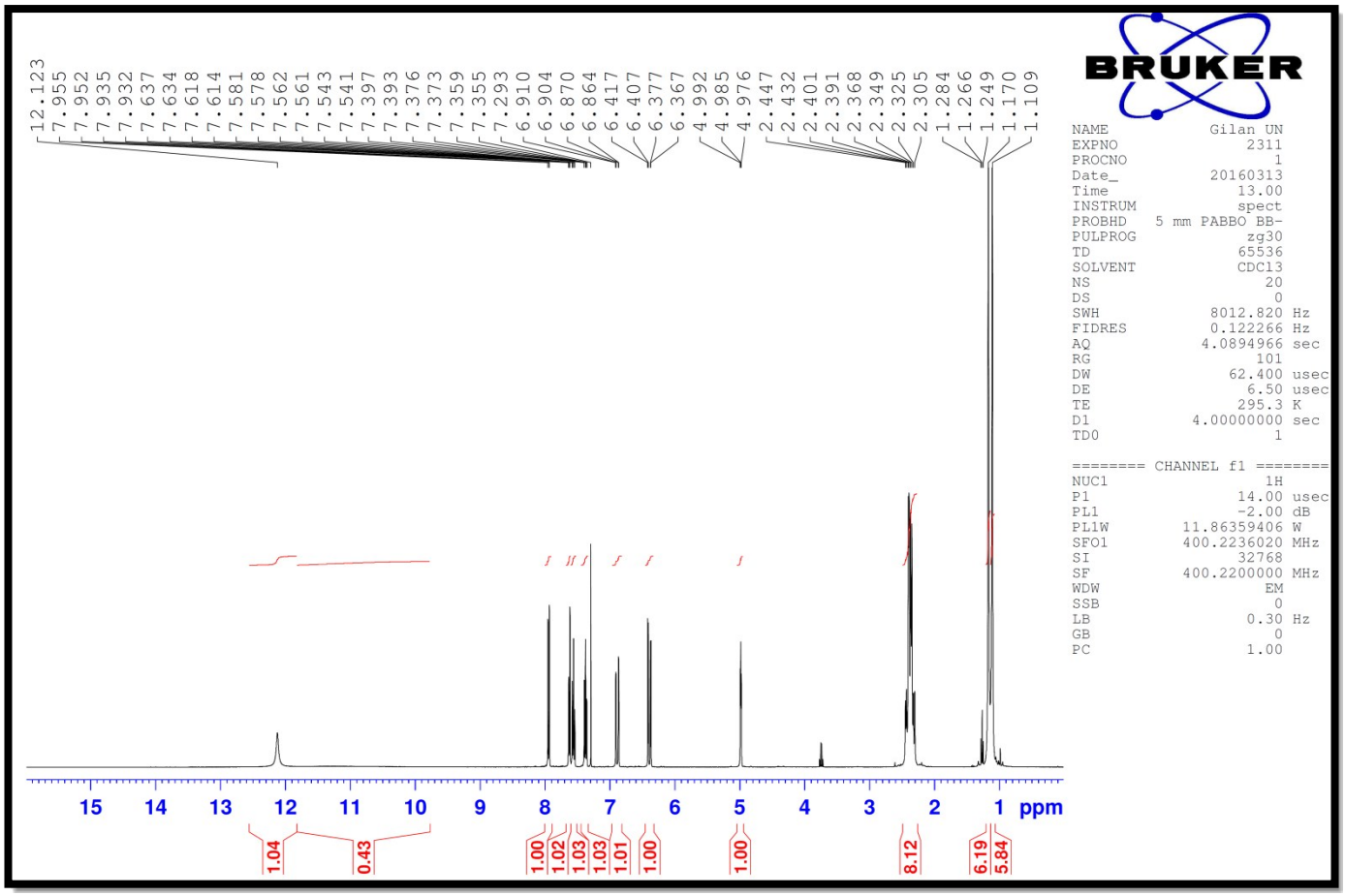
^{13}C NMR spectra of 2-(4-(methylthio)benzylidene)malononitrile

2q) 2,2'-(3-(2-nitrophenyl)prop-2-ene-1,1-diyl)bis(3-hydroxy-5,5-dimethylcyclohex-2-en-1-one)(Table 4, entry 17). IR (KBr, cm^{-1}): 3445, 3070, 2960, 2868, 1600, 1590, 1519, 1380. ^1H NMR (400 MHz, $CDCl_3$,): δ= 1.10 (s, 6H), 1.17 (s, 6H), 2.30-244 (m, 8H), 4.98 (m, 1H), 6.39 (dd, *J*= 16.0, 4.0 Hz, 1H), 6.89 (dd, *J*= 16.0, 2.4 Hz, 1H), 7.35 (dt, *J*= 8.0, 1.6 Hz, 1H), 7.56 (dt, *J*= 8.0, 1.2 Hz, 1H), 7.94 (dd, *J*= 8.0, 1.2 Hz, 1H), 11.27 (br, 1H), 12.12 (s, 1H) ppm; ^{13}C NMR (100 MHz, $CDCl_3$,): δ= 20.86, 29.73, 31.42, 31.44, 46.20, 46.83, 115.96, 124.53, 125.37, 127.72, 128.80, 133.12, 133.16, 134.64, 147.34, 189.43, 190.05 ppm.

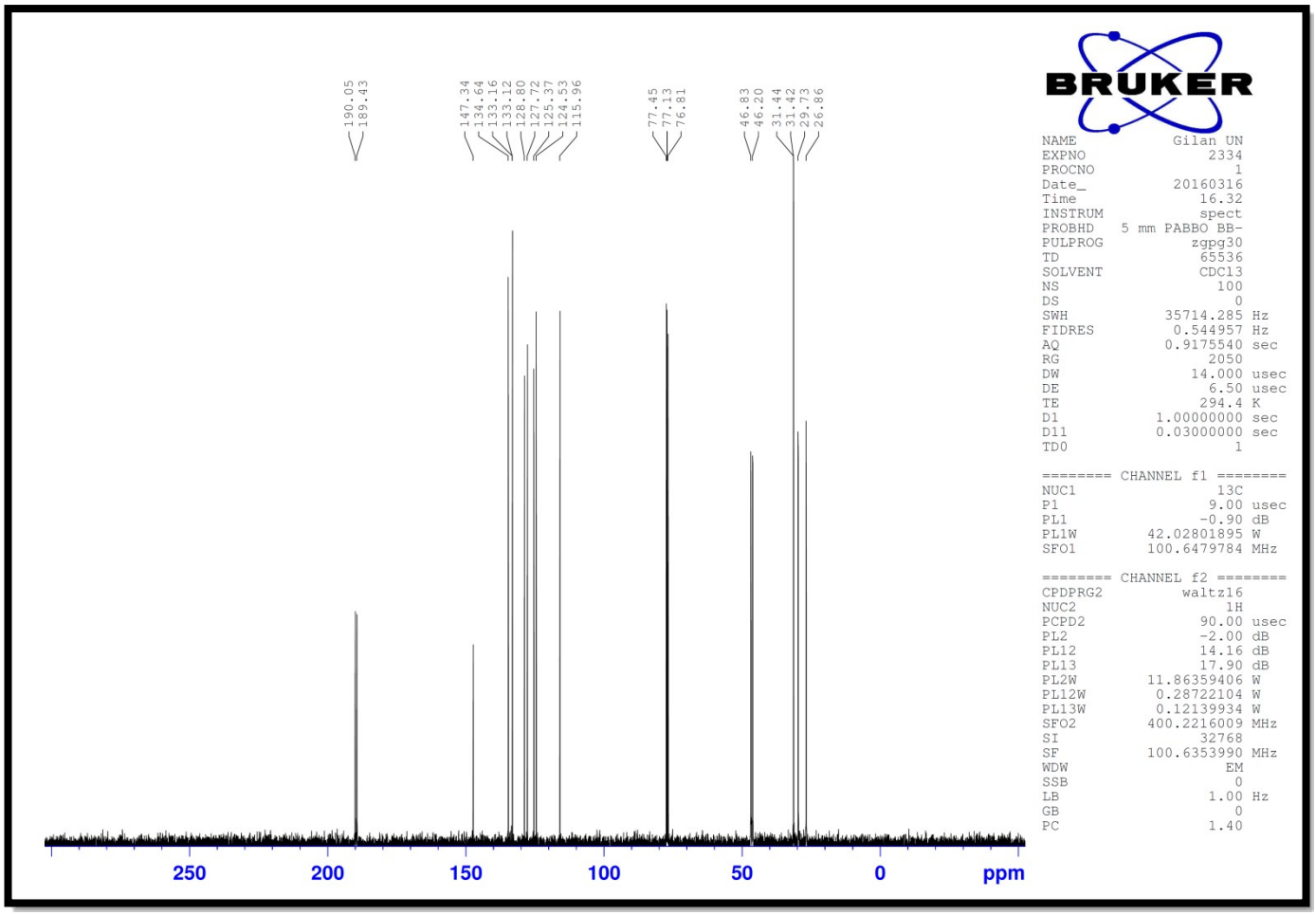




FT-IR spectra of 2,2'-(3-(2-nitrophenyl)prop-2-ene-1,1-diyl)bis(3-hydroxy-5,5-dimethylcyclohex-2-en-1-one)

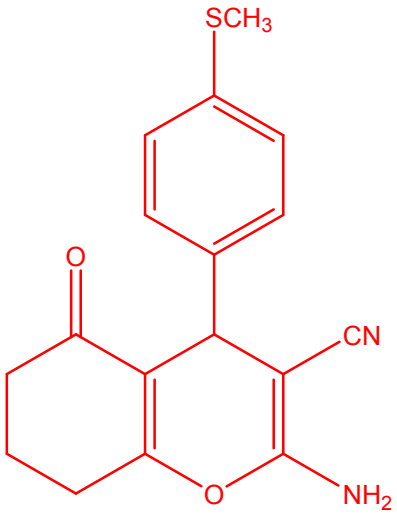


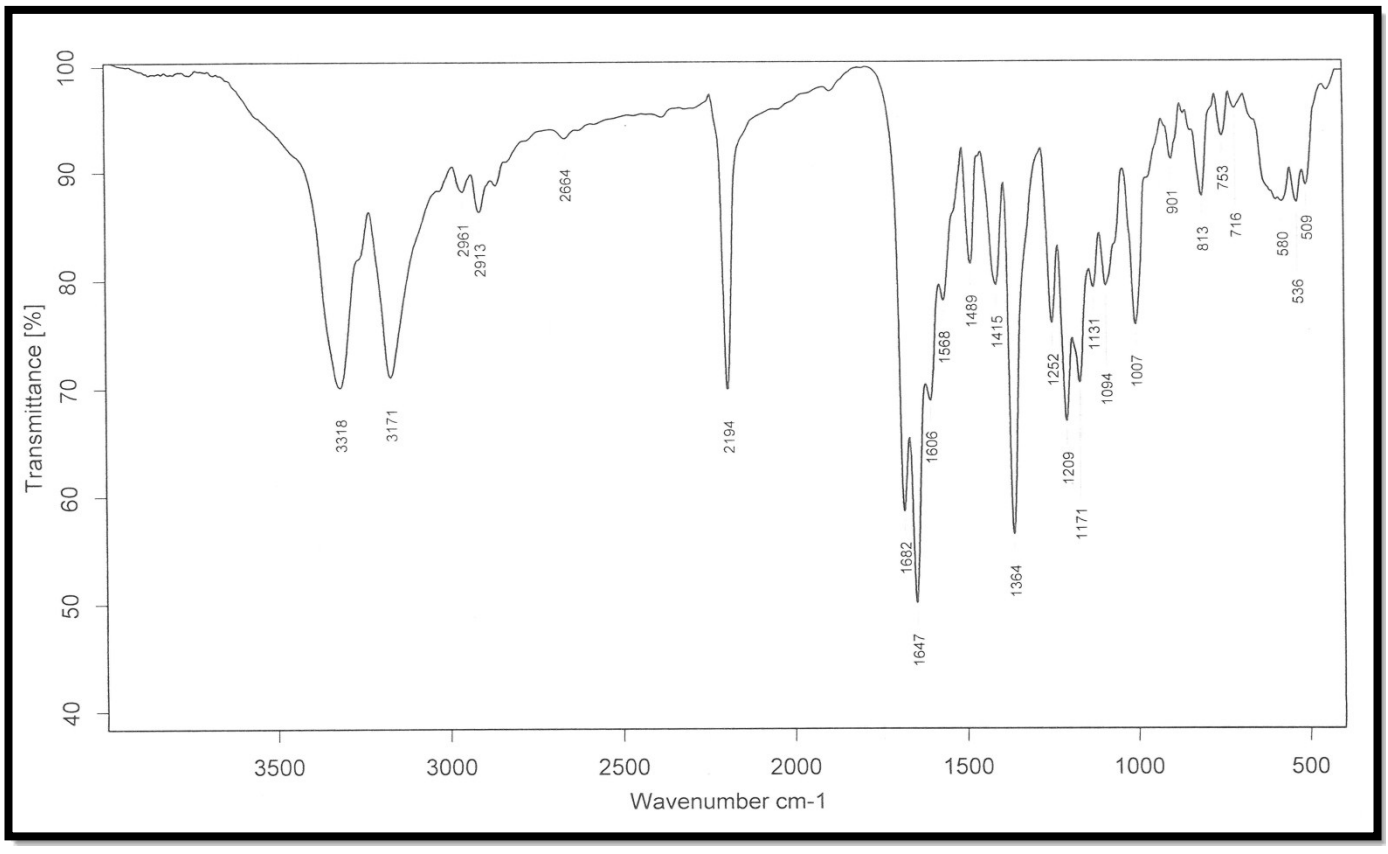
^{13}H NMR spectra of 2,2'-(3-(2-nitrophenyl)prop-2-ene-1,1-diyl)bis(3-hydroxy-5,5-dimethylcyclohex-2-en-1-one)



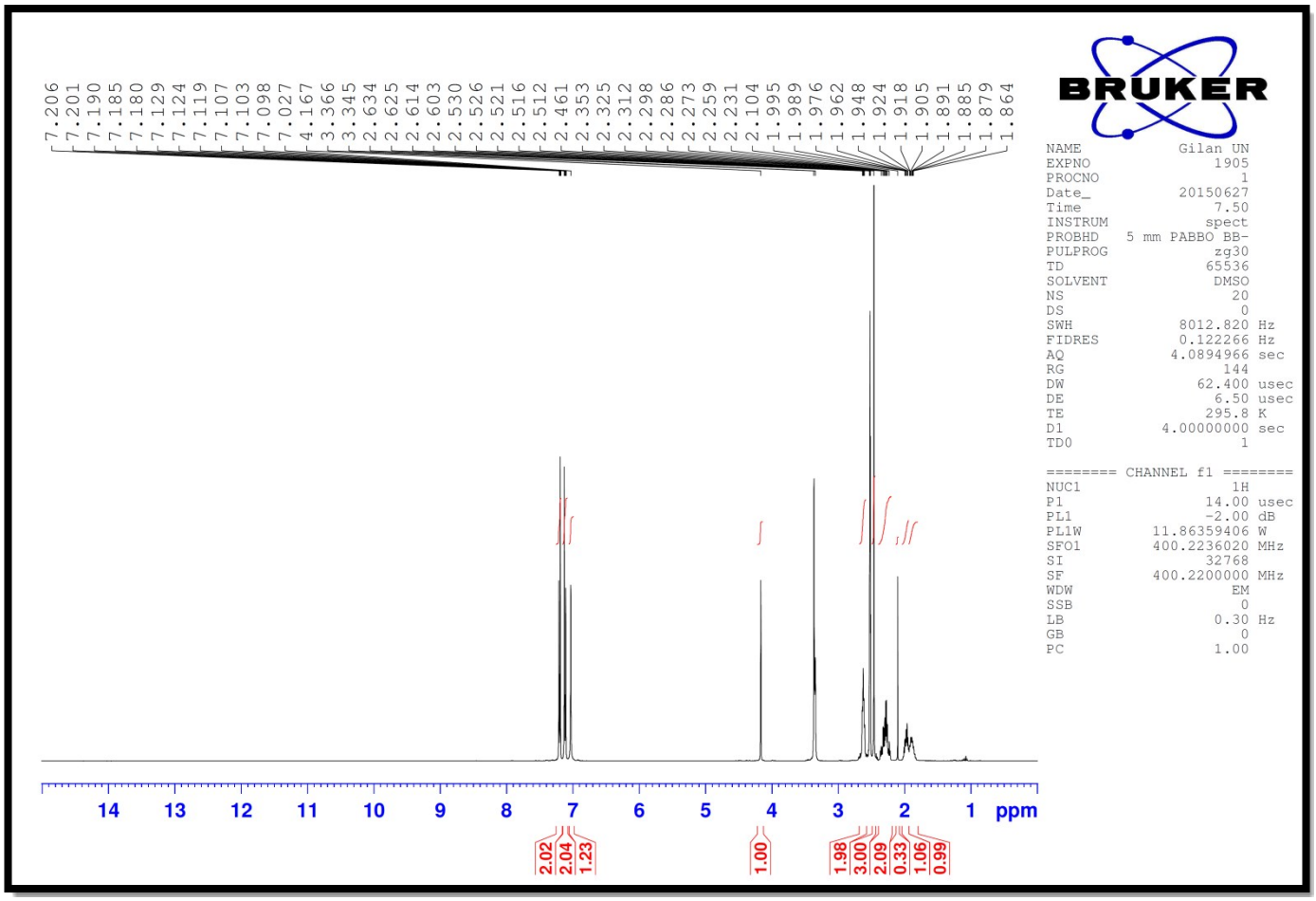
^{13}C NMR spectra of 2,2'-(3-(2-nitrophenyl)prop-2-ene-1,1-diyl)bis(3-hydroxy-5,5-dimethylcyclohex-2-en-1-one)

3y) 2-amino-4-(4-(methylthio)phenyl)-5-oxo-5,6,7,8-tetrahydro-4H-chromene-3-carbonitrile (table 4, Entry 26). IR (KBr, cm^{-1}): 3318, 3171, 2961, 2913, 2194, 1682, 1647, 1364; ^{1}H NMR (400 MHz, DMSO-d_6): δ= 1.92-2.00 (m,2H), 2.24-2.34 (m, 2H), 2.35(s,1H), 2.61-2.63 (m,2H), 4.16 (s,1H), 7.08 (s,2H), 7.02 (d, J= 8.4 Hz, 2H), 7.10 (d, J= 8.4 Hz, 2H) ppm; ^{13}C NMR (100 MHz, DMSO-d_6): δ= 15.29, 20.29, 26.95, 35.46, 36.81, 58.50, 114.17, 120.23, 126.53, 128.31, 136.53, 142.09, 158.88, 158.92, 164.87, 196,35 ppm.

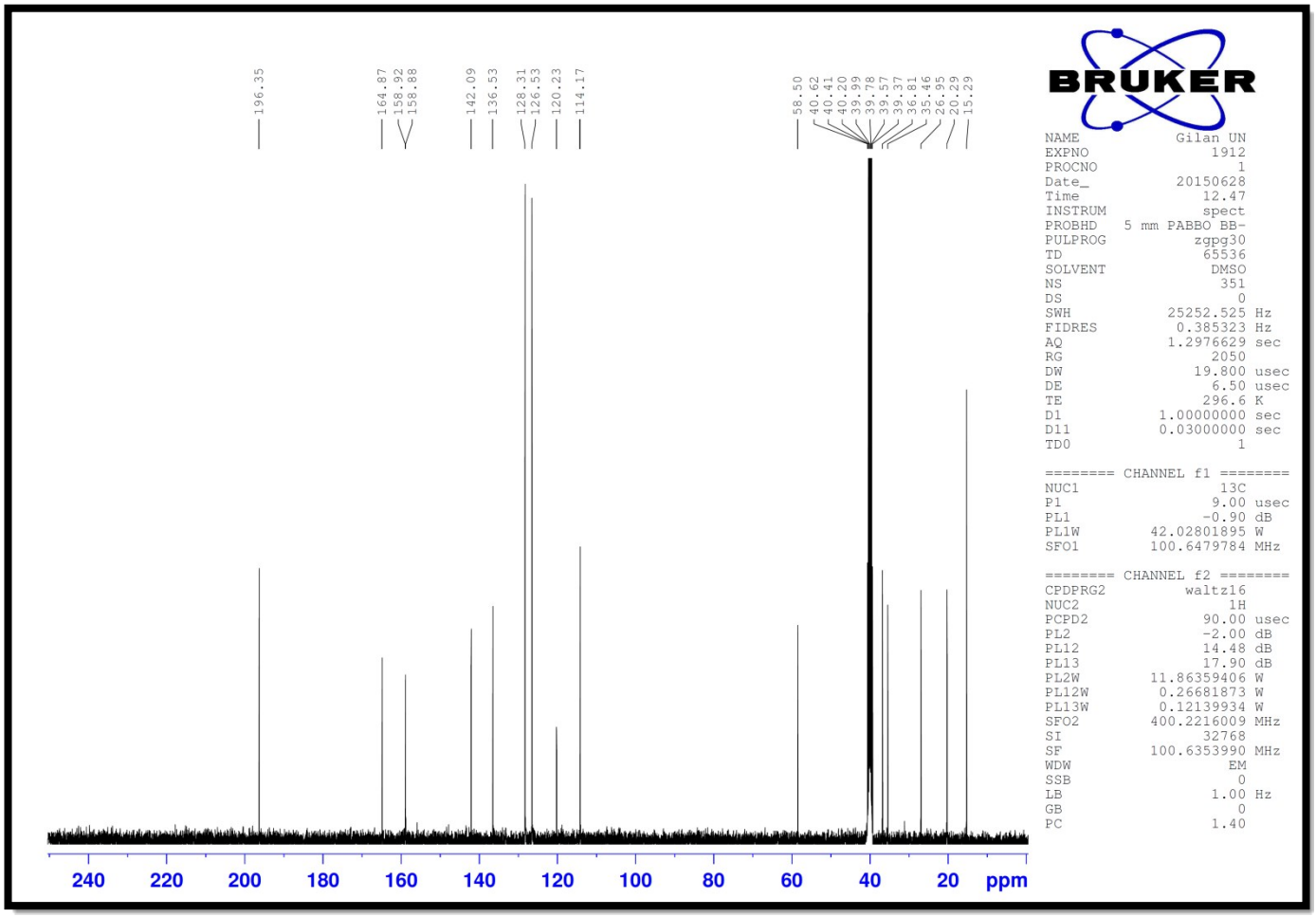




^{1}H NMR spectra 2-amino-4-(4-(methylthio)phenyl)-5-oxo-5,6,7,8-tetrahydro-4H-chromene-3-carbonitrile

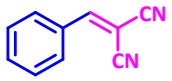


^{1}H NMR spectra of 2-amino-4-(4-(methylthio)phenyl)-5-oxo-5,6,7,8-tetrahydro-4H-chromene-3-carbonitrile.

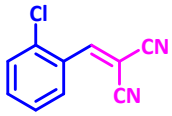


^{13}C NMR spectra of 2-amino-4-(4-(methylthio)phenyl)-5-oxo-5,6,7,8-tetrahydro-4H-chromene-3-carbonitrile.

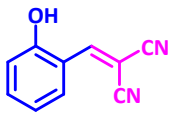
Spectral data of Benzylidene malononitriles:



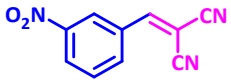
^{1}H NMR (300 MHz, $CDCl_3$, ppm): δ=7.54 (t, J=7.5 Hz, 2H), 7.64 (t, J= 7.5 Hz, 1H), 7.78 (s, 1H), 7.91 (d, 7.6 Hz, 2H).



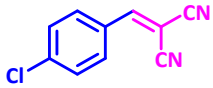
IR (KBr) *v* /cm: 3047, 2221, 1638, 1583, 1129, 755; ^{1}H NMR (300 MHz, $CDCl_3$, ppm): δ= 8.56 (s, 1H), 8.06-7.52 (m, 4H).



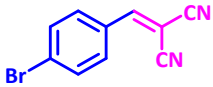
^{1}H NMR (300 MHz, $CDCl_3$, ppm): 5.57 (s, 1H), 6.97 (d, J= 8.6 Hz, 2H), 7.66 (s, 1H), 7.89 (d, J= 8.6 Hz, 2H).



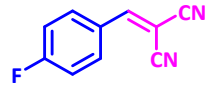
^{1}H NMR (300 MHz, $CDCl_3$, ppm): δ= 7.79 (t, J= 8.1 Hz, 1H), 7.88 (s, 1H), 8.47 (d, 1H, J= 8.3 Hz), 8.66 (s, 1H), 8.32 (d, 1H, J= 7.8 Hz).



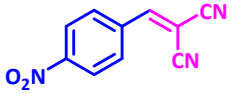
^{1}H NMR (300 MHz, $CDCl_3$, ppm): δ= 7.53 (d, J=8.3 Hz, 2H), 7.74 (s, 1H), 7.86 (d, J = 8.3 Hz).



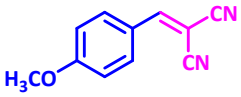
^{1}H NMR (500 MHz, $CDCl_3$, ppm): δ= 7.68–7.70 (d, J = 9.0 Hz, 2H), 7.71 (s, 1H), 7.76–7.78 (d, J = 9.0 Hz, 2H).



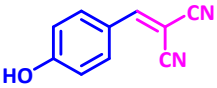
IR (KBr) *v* /cm: IR: 3048, 2231, 1600, 1512; ^{1}H NMR (300 MHz, $CDCl_3$, ppm): δ= 7.95-7.99 (m, 2H), 7.76 (s,1H), 7.22-7.27 (m, 2H)



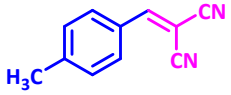
IR (KBr) *v* /cm: 3038, 2230, 1636, 1579, 1070, 831; ^{1}H NMR (300 MHz, $CDCl_3$, ppm): δ= 8.71 (s, 1H), 8.41-8.16 (m, 4H).



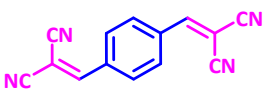
^{1}H NMR (300 MHz, $CDCl_3$, ppm): δ= 3.91 (s, 3H),7.01 (d, J= 8.6 Hz, 2H), 7.65 (s, 2H), 7.91 (d, J= 8.6 Hz, 2H)



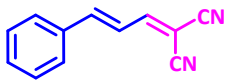
^{1}H NMR (500 MHz, $CDCl_3$, ppm): δ= 6.95–6.97 (d, J = 9.0 Hz, 2H), 7.64 (s, 1H), 7.87–7.89 (2H, d, J = 9.0 Hz).



^{1}H NMR (400 MHz, $CDCl_3$, ppm): δ= 2.46 (, s, CH3, 2H), 7.34 (2H, d, *J* = 8.0 Hz), 7.22 (s, 1H), 7.81 (d, *J* = 8.0 Hz, 2H).

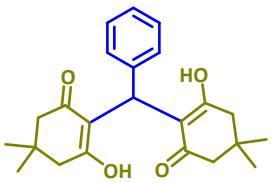


^{1}H NMR (300 MHz, DMSO-d_6, ppm): δ= 8.63 (s, 2H), 8.09 (s, 4H).

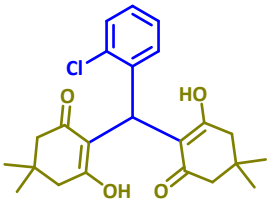


^{1}H NMR (300 MHz, DMSO-d_6, ppm): δ= 7.28 (dd, J =11.5 Hz, 15.2 Hz, 1H), 7.47–7.51 (m, 3H), 7.62 (d, J= 15.2 Hz, 1H), 7.77–7.79 (m, 2H), 8.31 (d, J= 11.4 Hz, 1H).

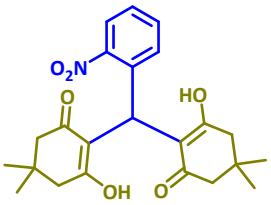
Spectral data of tetraketone derivatives:



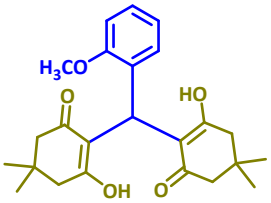
IR (KBr) *v* /cm: 3400, 2962, 1610, 1448, 1373, 1298, 1249, 1163, 1045, 869, 842, 777, 694, 11.89;; ^{1}H NMR (300 MHz, $CDCl_3$, ppm): δ= (1H, s), 7.27-7.06 (5H, m), 5.52 (1H, s), 2.41-2.26 (8H, m), 1.21 (6H, s), 1.08 (6H, s); ^{13}CNMR (75 MHz, $CDCl_3$, ppm): δ= 190.4, 189.4, 138.1, 128.2, 126.7, 125.8, 115.5, 47.0, 46.4, 32.7, 31.4, 29.6, 27.4.



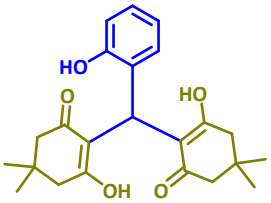
IR (KBr) *v* /cm: 3000–2500, 2956, 2929, 1610, 1470, 1380, 1289, 1230, 1140, 1070, 987, 745; ^{1}H NMR (300 MHz, $CDCl_3$, ppm): δ= 1.06(s, 6H), 1.17 (s, 6H), 2.25–2.51 (m, 8H), 5.63 (s, 1H), 7.09–7.39 (m, 4H), 9.76 (s, 1H), 11.88 (s, 1H).



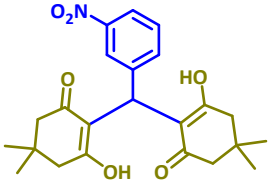
IR (KBr) *v* /cm: 3261, 2955, 1719, 1616, 1524, 1449, 1388, 1291, 1234, 1071, 985, 839, 747, 696, 570; ^{1}H NMR (300 MHz, $CDCl_3$, ppm): δ= 11.56 (s, 1H), 7.49(d, J = 8.1 Hz, 1H), 7.41 (t, J = 7.8 Hz,1H), 7.28 (t, J = 8.1 Hz, 1H), 7.19 (1H, d, J = 8.1 Hz), 5.98 (s, 1H), 2.39-2.28 (m, 8H), 1.07 (s, 6H), 0.97 (s, 6H); ^{13}C NMR (75 MHz, $CDCl_3$, ppm): δ= 189.6, 149.4, 132.1, 131.2, 129.3, 126.9, 124.0, 114.3, 46.4, 31.6, 29.7, 28.1.



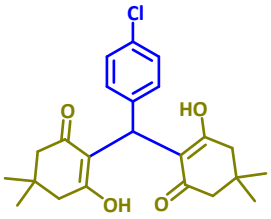
IR (KBr) *v* /cm: 3123, 1613, 1601, 1517, 1461, 1339, 841; ^{1}H NMR (400 MHz, $CDCl_3$, ppm): δ= 7.15–7.24 (m, 2H), 6.87 (td, J = 7.9 Hz, J = 1.8 Hz, 1H), 6.77 (d, J = 7.9 Hz, 1H), 5.33–5.50 (m, 1H), 3.70 (s,3H), 3.72–3.80 (m, 2H), 2.13–2.45(m, 8H), 1.14 (s, 6H), 1.08 (s, 6H).



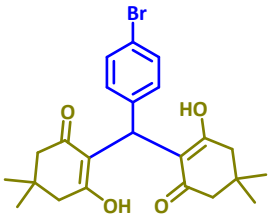
IR (KBr) *v* /cm 3101, 1611, 1602, 1518, 1462, 1340, 848cm21; ^{1}H NMR (400MHz, ppm): δ= CD_3OD): 6.81-7.14 (m, 4H), 5.15-5.26 (m, 1H), 2.44-2.54 (m, 2H) 2.15-2.27 (8H, m) 1.06 (s, 6H), 1.01 (s, 6H).



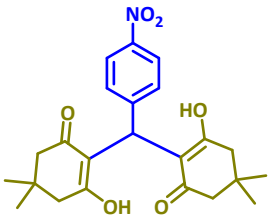
IR (KBr) *v* /cm: 3123, 1655, 1616, 1595, 1366, 841; 1H NMR (400 MHz, CD_3OD, ppm): δ= 8.12 (d, J = 8.4 Hz, 1H),7.27 (d, J = 1.8 Hz), 6.87 (dd, J = 1.8 Hz, J = 8.4 Hz, 1H), 4.91–5.01 (m, 1H), 2.05–2.40 (m, 8H), 1.10 (s, 6H), 1.00 (s, 6H).



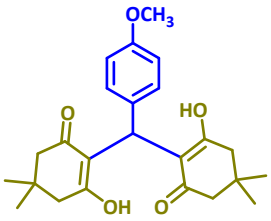
IR (KBr) *v* /cm: 3427, 2958, 1590, 1489, 1374, 1253, 1158, 1124, 1043, 885, 680, 585, 495; ^{1}H NMR (300 MHz, $CDCl_3$, ppm): δ= 11.83 (1H, s), 7.21(d, J = 8.0 Hz, 2H), 6.99 (d, J = 8.0 Hz, 2H), 5.45 (s, 1H), 2.47- 2.25 (m, 8H), 1.19 (s, 6H), 1.08 (s, 6H); ^{13}C NMR (75 MHz, $CDCl_3$, ppm): δ= 190.5, 189.3, 136.6, 131.4, 128.2, 128.1, 115.1, 46.9, 46.3, 32.3, 31.3, 29.4, 27.3.



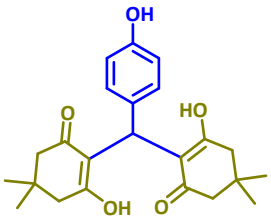
IR (KBr) *v* /cm: 3053, 2959, 2873, 1723, 1594. ^{1}H NMR (300 MHz, $CDCl_3$, ppm): δ=1.13 (s, 6H), 1.23 (s, 6H), 2.20–2.53 (m, 8H), 5.47 (s, 1H), 6.96(d, 2H, J = 6.6 Hz), 7.38 (d, 2H, J = 6.6 Hz), 11.93 (brs, 1H).



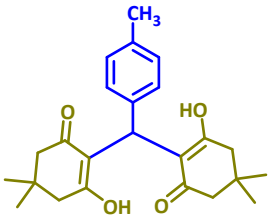
IR (KBr) *v* /cm: 3422, 2956, 1591, 1513, 1374, 1248, 1157, 1115, 1042, 850, 732, 585, 489; ^{1}H NMR (300 MHz, $CDCl_3$, ppm): δ=11.76 (s, 1H), 8.11 (d, J = 8.4 Hz, 2H), 7.23 (d, J = 8.4 Hz, 2H), 5.53 (s, 1H), 2.51-2.28 (m, 8H), 1.21 (s, 6H), 1.09 (s, 6H); ^{13}C NMR (75 MHz, $CDCl_3$, ppm): δ= 191.1, 189.3, 145.9, 127.5, 123.3, 114.8, 46.7, 32.9, 31.3, 29.2, 27.4.



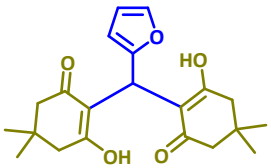
IR (KBr) *v* /cm: 3016, 2959, 1795, 1589, 1510, 1452, 1365, 1246, 1178, 1165, 1033, 918, 829, 661; ^{1}H NMR (300 MHz, $CDCl_3$, ppm): δ=6.98 (2H, d, J = 8.4 Hz), 6.78 (2H, d, J = 8.4 Hz), 5.46 (1H, s), 3.72 (3H, s), 2.46-2.23 (8H, m), 1.19 (6H, s), 1.06 (6H, s); ^{13}C NMR (75 MHz, CDCl3, ppm): δ= 190.0, 189.0, 161.8, 157.3, 129.6, 129.0, 127.5, 115.5, 113.4, 54.9, 50.5, 46.8, 46.2, 40.5, 31.8, 31.1, 29.3, 27.0.



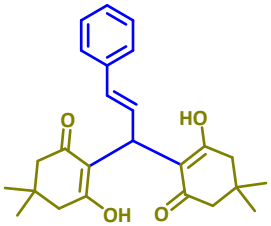
IR (KBr) *v* /cm: 3100, 1606,1600, 1512, 1465, 1344, 848; (400 MHz, $CDCl_3$, ppm): 7.32 (d, J = 8.4 Hz, 2H), 6.72 (d, J = 8.4 Hz, 2H), 5.06–5.10 (m, 1H), 3.68–3.80 (m, 2H), 2.15–2.27 (m, 8H), 1.04 (s, 6H), 0.99 (s, 6H).



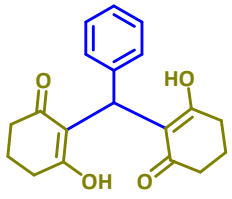
IR (KBr) *v* /cm: 3111, 1616, 1603, 1513, 1475, 843; ^{1}H NMR (400 MHz, CD_3OD, ppm): δ=7.01(d, J= 8.0Hz, 2H), 6.92 (d, J =8.0 Hz, 2H), 5.55-5.67 (m, 1H), 2.48-2.54 (m, 2H), 2.32-2.41 (m, 8H), 2.26 (s, 3H), 1.11 (s, 12H).



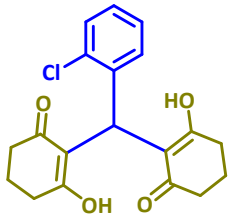
IR (KBr) *v* /cm: 3112, 1612, 1615, 1312, 841; 1H NMR (400MHz,CD_3OD): δ= 7.26 (d, J= 1.9 Hz, 1H), 6.26 (dd, J= 3.1, J= 1.9 Hz, 1H), 5.87 (1H, d, J= 3.1 Hz), 5.43-5.59 (m, 1H), 2.55-2.61 (m,2H), 2.29-2.38 (8H, m), 1.09 (s 12H).



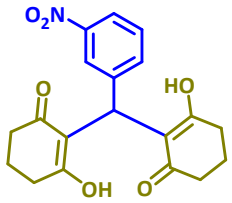
IR (KBr) *v*/cm: 3110, 1615, 1605, 1510, 1470, 840; ^{1}H NMR (400MHz, CD3OD, ppm): δ=7.24 (t,2H, J= 7.1 Hz, H-300/H-500), 7.14 (d, J= 7.1 Hz 3H), 5.75 (d, J= 11.5 Hz, 1H), 5.60 (d, J=11.5 Hz, 1H), 5.10-5.22 (m, 1H) , 2.42-2.48 (m, 2H), 2.19-2.32 (m, 8H), 1.02 (s,12H,).



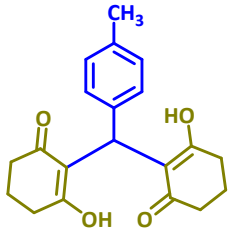
IR (KBr) *v* /cm: 2951, 1660, 1515, 1343, 1453, 843; ^{1}H NMR (400 MHz, CD_3OD, ppm): δ=7.05–7.25 (m, 5H), 4.17(m, 1H) 2.33–2.60 (m, 2H) 2.09–2.32 (m, 8H).



IR (KBr) *v* /cm: 3145, 2951, 1719, 1515, 1343, 1453, 843; ^{1}H NMR (400 MHz, $CDCl_3$, ppm): δ=7.26 (1.2 Hz), 7.12 (td, J = 7.4 Hz, J = 1.2 Hz), 6.98 (d, J = 7.8 Hz), 4.17 (m, 1H), 2.33–2.60 (m, 2H), 2.09–2.32 (m, 8H), 1.97–2.0 (m, 4H).

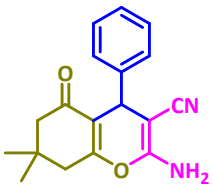


IR (KBr) *v* /cm: 3145, 2951, 1719, 1515, 1343, 1453, 843; ^{1}H NMR (400 MHz, CD_3OD, ppm): δ= 8.13 (d, J = 8.3 Hz), 7.97 (d, J = 1.8 Hz,1H), 7.68 (td, J = 8.3 Hz, J = 1.8 Hz), 7.39 (dd, J= 8.3 Hz, J = 1.8 Hz, 2H), 4.17 (m, 1H), 2.33–2.60 (m, 2H), 2.09–2.32 (m, 8H), 1.97–2.0 (m, 4H).

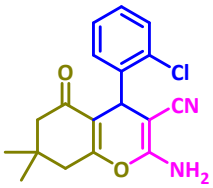


IR (KBr) *v* /cm: 3138, 3048, 2996, 1591, 1487, 1368, 1302, 1250, 716; ^{1}H NMR (400 MHz, $CDCl_3$, ppm): δ= 2.34-2.38 (m, 4H), 2.45-2.47 (m, 8H), 2.69 (s, 3H), 5.82 (s, 1H), 7.38-7.36 (m, 1H), 7.46-7.49 (m, 4H), 7.60-7.58 (m, 1H).

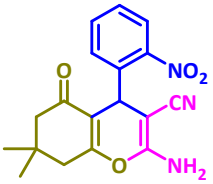
Spectral data of 2-amino-4*H*-pyran derivatives:



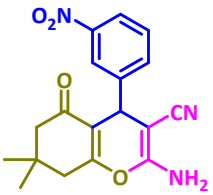
IR (KBr) *v* /cm: 3393, 3317, 3185, 2958, 2196, 1687, 1652, 1367; ^{1}H NMR (300 MHz, DMSO-d_6, ppm): δ= 0.94 (3H, s), 1.04 (s, 3H), 2.08 (d, J = 16.0 Hz, 1H), 2.23 (d, J = 16.0 Hz, 1H), 2.50 (m, 2H), 4.11 (s, 1H), 7.06 (2H, br s), 7.19 (m, 3H), 7.33 (m, 2H) ppm; ^{13}C NMR (75 MHz, DMSO-d_6, ppm): δ=26.33, 27.62, 31.27, 35.04, 39.83, 49.91, 60.33, 113.07, 118.41, 126.11, 126.65, 127.52, 143.21, 157.73, 161.37, 195.17.



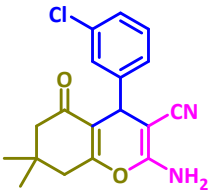
^{1}H NMR (400 MHz, DMSO-d_6, ppm): δ= 7.36 (d, J = 8.0 Hz, 1H) 7.27 (t, J = 6.8 Hz), 7.16–7.22 (m, 2H), 7.03 (s, 2H) 4.70 (s, 1H) 2.52 (AB quartet, J = 17.2 Hz, 2H), 2.25 (d, J = 16.0 Hz, 1H), 2.08 (d, J = 16.0 Hz, 1H, 1.04 (s, 3H), 0.98 (s, 3H); ^{13}C NMR (100 MHz, DMSO-d_6, ppm): δ= 195.4, 163.0, 158.6, 141.5, 132.0, 129.9, 129.3, 128.1, 127.3, 119.2, 111.7, 56.8, 49.9, 39.6, 32.8, 31.7, 28.3, 26.8.



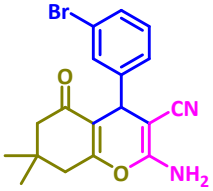
IR (KBr) *v* /cm: 3470, 3334, 2193, 1663, 1364 cm^{-1}; ^{1}H NMR (500 MHz, DMSO-d_6, ppm): δ = 1.2 (s, 3H), 1.3 (s, 3H), (1H, d) 2.2 (1H, d) 2.6 (1H, d) 2.7 (d, 1H), 4.9 (s,1H) 7.2 (s, 2H) 7.4 (1H, d) 7.5 (1H, d), 7.6 (1H, d), 7.8 (1H, d)



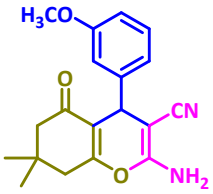
^{1}H NMR (500 MHz, DMSO-d_6, ppm): δ= 8.09-8.03 (m, 1H), 7.96 (s, 1H), 7.64 (dt, J=10.3, 5.2 Hz, 1H), 7.59 (dd, J=12.1, 4.4 Hz, 1H), 7.16 (s, 2H), 4.40 (s, 1H), 2.54-2.48 (m, 2H), 2.25 (d, J=16.1 Hz, 1H), 2.08 (d, J=17.8, Hz, 1H), 1.00 (s, 3H), 0.95 (s, 3H); ^{13}C NMR (125 MHz, DMSO-d_6, ppm): δ= 196.2, 163.6, 159.1, 148.2, 147.4, 134.6, 130.4, 129.0, 122.2, 119.8, 112.2, 57.6, 50.3, 35.8, 32.3, 28.8, 27.2.



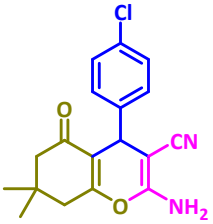
^{1}H NMR (500 MHz, DMSO-d_6, ppm): δ= 7.31 (t, J=7.8 Hz, 1H), 7.24 (ddd, J=8.0, 2.1, 1.1 Hz, 1H), 7.14 (t, J=1.9 Hz, 1H), 7.12-7.07 (m, 1H), 7.06 (s, 2H), 4.19 (s, 1H), 2.51 (s, 2H), 2.23 (d, J=16.1 Hz, 1H), 2.11 (d, J=16.0 Hz, 1H), 1.01 (s, 3H), 0.94 (s, 3H); ^{13}C NMR (125 MHz, DMSO-d_6, ppm): δ= 196.1, 163.3, 159.0, 147.7, 133.3, 130.7, 127.5, 127.1, 126.4, 119.9, 112.5, 58.1, 50.4, 35.8, 32.3, 28.7, 27.3.



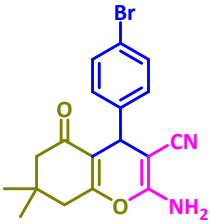
IR (KBr) *v* /cm: 3343, 2962,2191, 1687, 1657, 1603; ^{1}H NMR (500 MHz, DMSO-d_6, ppm): δ= 7.38-7.41 (m, 1H), 7.30-7.31 (m, 1H), 7.26-7.29 (m, 1H,), 7.15-7.17 (m, 1H), 7.09 (s, 2H), 4.20 (s, 1H), 2.53 (s, 2H), 2.24 (d, 1H), 2.11 (d, 1H),1.03 (s, 3H), 0.96 (s, 3H); ^{13}C NMR (125 MHz, DMSO-d_6, ppm): δ=196.2, 163.3 159.0, 147.9, 131.1, 129.9, 126.8, 119.6, 112.5, 58.1, 50.3, 40.5, 39.4, 32.3, 28.7, 27.2.



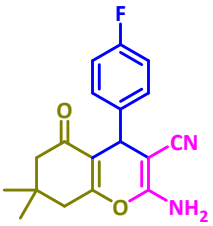
^{1}H NMR (500 MHz, DMSO-d_6, ppm): δ= 7.16 (t, J=7.9 Hz, 1H), 6.94 (s, 2H), 6.71 (d, J=8.1Hz, 1H), 6.66 (d, J=7.6 Hz, 1H), 6.60 (s, 1H), 4.09 (s, 1H), 3.64 (s, 3H), 2.55-2.40 (m, 2H), 2.21 (d, J=16.0 Hz, 1H), 2.07 (d, J=16.1 Hz, 1H), 0.99 (s, 3H), 0.92 (s, 3H); ^{13}C NMR (125 MHz, DMSO-d_6, ppm): δ=164.9, 159.6, 158.9, 146.8, 129.9, 128.3, 120.2, 119.7, 114.1, 113.3, 111.8, 58.5, 55.3, 35.9, 32.2, 27.3, 26.3.



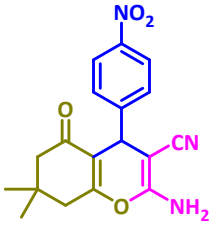
IR (KBr) *v* /cm: 3359, 3204, 2198, 1674; ^{1}H NMR (500 MHz, DMSO-d_6, ppm): δ= 7.37-7.29 (m, 2H), 7.19-7.12 (m, 2H), 7.03 (s, 2H),4.18 (s, 1H), 2.49 (t, J=3.4 Hz, 2H), 2.23 (d, J=16.1Hz, 1H), 2.09 (d, J=16.0 Hz, 1H), 1.02 (s, 3H), 0.93 (s, 3H); ^{13}C NMR (125 MHz, DMSO-d_6, ppm): δ=196.1, 163.0, 158.9, 144.2, 131.6, 129.5, 128.7, 120.0, 112.8, 58.2, 50.4, 35.5, 32.2, 28.8, 27.3.



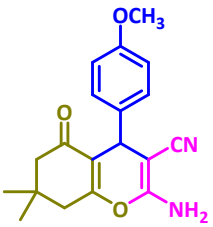
IR (KBr) *v* /cm : 3389, 3277, 2112, 1688; ^{1}H NMR (400 MHz, $CDCl_3$): δ= 0.98 (s, 3H), 1.14 (s, 3H), 2.12 (d, 1H, *J* = 16 Hz), 2.25(d, 1H, *J* = 16 Hz) 2.44 (s, 2H), 4.43 (s, 1H), 6.12 (s, 2H), 7.32-7.52 (m, 4H); ^{13}C NMR (100 MHz, DMSO-d_6, ppm): δ =27.8, 29.1, 32.4, 35.6, 40.5, 50.9, 60.8, 113.7, 119.5, 120.9, 129.7, 131.7, 143.3, 158.7,162.3, 196.2.



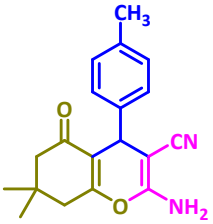
IR (KBr) *v* /cm: 3358, 3206, 2211, 1683, ^{1}H NMR (400 MHz, $CDCl_3$, ppm): δ=0.97 (s, 3H), 1.10 (s, 3H), 2.21 (d, 1H, *J* = 16 Hz), 2.03 (d, 1H, *J* = 16 Hz), 2.62 (s, 2H), 4.20 (s, 1H), 5.48 (s, 2H), 7.15-7.29 (m, 4H).



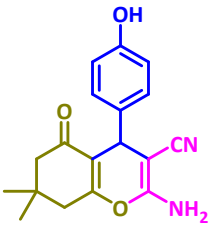
^{1}H NMR (400 MHz, DMSO-d_6): δ = 8.16 (d, J = 8.4 Hz, 2H), 7.47 (d, J = 8.4 Hz, 2H), 7.18 (s, 2H), 4.37 (s, 1H), 2.64 (s, 2H), 2.23–2.37 (m, 2H), 1.91–1.99 (m, 2H) ppm; ^{13}C NMR (100 MHz, DMSO-d_6): d = 195.8, 165.0, 158.5, 152.2, 146.1, 128.5, 123.5, 119.3, 112.7, 56.9, 36.1, 35.5, 26.5, 19.7.



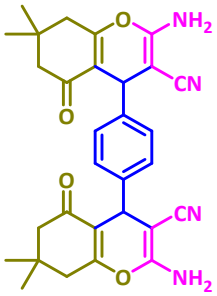
IR (KBr) *v* /cm: 3450, 3417, 3336, 3209, 3055, 2931, 2835, 2193, 1633, 1602, 1571, 1398, 1236, 1176, 1103, 1026; ^{1}H NMR (400 MHz, DMSO-d_6): δ 3.69 (s, 3H), 4.81 (s,1H), 6.99 (m, 7H), 7.82 (m, 5H); ^{13}C NMR (DMSO-d6, 100MHz): δ= 40.4, 55.8, 57.4, 114.9, 119.0, 121.4, 121.5, 123.6, 124.6, 127.1, 127.4, 127.5, 128.5, 129.6, 133.5, 138.7, 143.4, 159.0, 160.8.



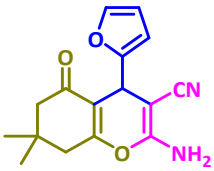
^{1}H NMR (400 MHz, DMSO-d_6): δ = 7.08 (d, J = 8.0 Hz, 2H), 7.02 (d, J = 8.0 Hz, 2H), 6.96 (s, 2H,) 4.12 (s, 1H), 2.50 (AB quartet, J = 17.2 Hz, 2H), 2.22–2.26 (m, 3H), 2.08 (d, J = 16.4 Hz, 1H), 1.03 (s, 3H), 0.95 (s, 3H);. ^{13}C NMR (100 MHz, DMSO-d_6): δ= 195.5, 162.2, 158.3, 141.7, 135.5, 128.8, 127.0, 119.6, 112.8, 58.4, 49.9, 39.6, 35.1, 31.7, 28.3, 26.7, 20.5.



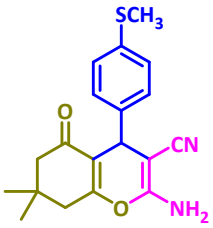
IR (KBr) *v*/cm: 3454, 3313, 3184, 3020, 2860, 2808, 2679, 2592, 2200, 1653, 1629, 1600, 1570, 1508, 1375, 1244, 1186, 1101, 1018; ^{1}H NMR (400 MHz, DMSO-d_6): δ= 4.74 (s, 1H), 6.86 (m,7H), 7.88 (m, 5H), 9.25 (s, 1H); ^{13}C NMR (DMSO-d_6, 100 MHz): 40.4, 57.6, 116.2, 119.3, 121.5, 121.6, 123.6, 124.6, 127.2, 127.4, 127.5, 128.5, 129.5, 133.4, 137.0, 143.4, 157.1, 160.8.



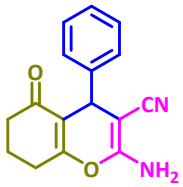
IR (KBr) *v*/cm: 3394, 2961, 2199, 1660, 1604; ^{1}HNMR (300 MHz, DMSO-d_6, ppm): δ= 7.02 (s, 4H), 6.42 (bs, 4H), 4.16 (s,2H), 2.42 (s, 4H), 2.15 (s, 4H), 1.05 (s, 6H) 1.01 (s, 6H); ^{13}C NMR (75 MHz, DMSO-d6, ppm) δ= 195.56 162.4, 158.81, 142.91, 128.75,127.30, 120.20, 113.55, 59.84, 50.61, 35.26,28.26, 27.95;(75 MHz, DMSO-d_6, ppm): δ=127.29, 50.59, 40.59, 35.26, 28.84, 27.95.



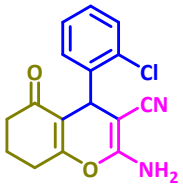
IR (KBr) *v*/cm:3370, 3142, 2241 1683; ^{1}HNMR (300 MHz, $CDCl_3$, ppm): δ= 1.05 (s, 3H), 1.12 (s, 3H), 2.19 (d, 1H, JAB = 16 Hz) 2.32 (d, 1H, J=16 Hz), 2.47 (s, 2H), 4.60 (s, 1H), 4.82 (s, 2H), 6.21-7.29 (m, 3H).



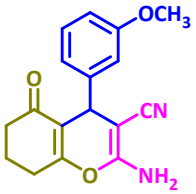
IR (KBr) *v*/cm: 3465, 3395, 3327, 2195, 1680, 1650, 1602, 1450, 1436, 1360; ^{1}H NMR (300 MHz, DMSO-d_6, ppm): δ=0.96 (s, 3H), 1.04 (s, 3H), 2.07 (d, J = 16.2 Hz, 1H), 2.18 (d, J = 16.2 Hz, 1H), 2.38 (s, 3H), 2.45 (s, 2H), 4.16 (s, 1H), 6.50 (s, 2H), 7.04-7.09 (m, 4H); ^{13}C NMR (75 MHz, DMSO-d6, ppm): δ= 13.8, 25.8, 27.3, 30.5, 33.8, 38.8,49.0, 57.5, 114.7, 118.4, 124.7 (2C), 126.5 (2C),134.9, 139.9, 157.2, 161.0, 194.7.



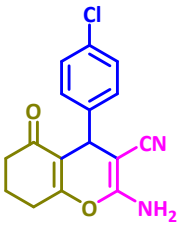
^{1}HNMR (400 MHz, DMSO-d_6, ppm): δ= 7.28 (t, J = 7.2 Hz, 2H), 7.14–7.19 (m, 3H), 6.99 (s, 2H), 4.19 (s, 1H), 2.62 (s, 2H), 2.21–2.31 (m, 2H), 1.87–1.98 (m, 2H); ^{13}C NMR (100 MHz, DMSO-d_6, ppm): δ= 195.8, 164.4, 158.4, 144.7, 128.2, 127.0, 126.4, 119.7, 113.7, 58.2, 36.3, 35.4, 26.4, 19.7.



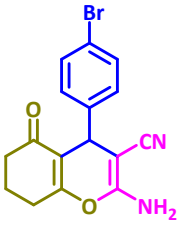
^{1}HNMR (400 MHz, DMSO-d_6, ppm): δ=7.36 (d, J = 7.2 Hz, 1H), 7.26 (t, 1H, J = 7.0 Hz, 1H), 7.19 (t, J = 6.8 Hz, 2H), 7.01(s, 2H), 4.71 (s, 1H), 2.55–2.67 (m, 2H), 2.19–2.32 (m, 2H), 1.90–1.97 (m, 2H); ^{13}C NMR (100 MHz, DMSO-d_6, ppm) δ=195.6, 165.0, 158.5, 141.7, 132.0, 129.7, 129.2, 128.0, 127.4, 119.2, 112.8, 56.8, 36.2, 32.6, 26.4, 19.8.



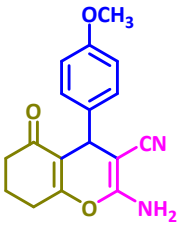
^{1}HNMR (500 MHz, DMSO-d_6, ppm): δ=7.18 (td, J=8.2, 1.5 Hz, 1H), 6.97 (s, 2H), 6.83-6.59 (m, 3H), 4.14 (s, 1H), 3.71 (s, 3H), 2.70-2.51 (m, 2H), 2.34-2.17 (m, 2H), 2.04-1.77 (m, 2H); ^{13}C NMR (125 MHz, DMSO-d_6, ppm): δ= 196.3, 165.0, 159.6, 158.9, 146.8, 129.9, 120.2, 119.7, 114.1, 113.7, 111.8, 58.5, 55.3, 36.8, 35.7, 26.9, 20.3



^{1}H NMR (500 MHz, DMSO-d_6, ppm): δ=7.32 (d, J=8.2 Hz, 2H), 7.17 (d, J=8.3 Hz, 2H), 7.03(s, 2H), 4.19 (s, 1H), 2.62-2.56 (m, 2H), 2.33-2.19 (m,2H), 1.94 (dt, J=11.0, 5.5 Hz, 1H), 1.86 (dt, J=13.1,7.8 Hz, 1H); ^{13}C NMR (125 MHz, DMSO-d_6): δ=196.9, 165.0, 158.9, 144.2, 131.5, 129.5, 128.7, 120.0, 113.8, 58.1, 36.7, 35.4, 26.9, 20.2;



^{1}H NMR (400 MHz, DMSO-d_6) δ = 7.47 (d, J = 8.0 Hz, 2H), 7.13 (d, J= 8.0 Hz, 2H), 7.05 (s, 2H), 4.19 (s, 1H), 2.61 (s, 2H), 2.22–2.33 (m, 2H), 1.88–1.96 (m, 2H); ^{13}C NMR (100 MHz, DMSO-d6): δ= 195.7, 164.5, 158.4, 144.1, 131.1, 129.4, 119.5, 113.2, 57.5,36.2, 35.0, 26.4, 19.7.



^{1}H NMR (500 MHz, DMSO-d_6, ppm): δ=7.04 (d, J=8.3 Hz, 2H), 6.92 (s, 2H), 6.81 (d, J=8.3 Hz, 2H), 4.11 (s, 1H), 3.69 (s, 3H), 2.62-2.51 (m, 2H), 2.36-2.13 (m, 2H), 2.01-1.74 (m, 2H); ^{13}C NMR (125 MHz, DMSO-d6):δ= 196.3, 164.5, 158.3, 142.3, 136.1, 128.6, 127.4, 120.1, 114.1, 58.9, 55.4, 35.1, 35.5, 26.9, 20.3;