

Compounds names and spectral details

Spiro[pyrazolo(3,2-*c*)indeno[2,1-*b*]phthalazine-6,3'-indoline]-2',5,8,13-tetraone. (5a). M.p.218-220 °C, IR (KBr)cm⁻¹: 1344, 1365,1640-1670, 1680. ¹H NMR(300 MHz, CDCl₃, DMSO-*d*₆) δ(ppm): 7.30-7.56 (12H, m, H-Ar), 10.41 (1H,s,NH). ¹³C NMR (DMSO-*d*₆) δ(ppm): 75.9, 110.6, 120.1, 122.4, 124.5, 125.1, 125.6, 127.3, 127.6, 128..3, 129.8, 130.5, 136.6,138.9, 150.2, 151.3, 152.4, 156.7, 161.3, 188.4. Anal. calcd. (%) for C₂₅H₁₃N₃O₄ (419): C(71.59), H(3.10), N(10.02); found: C(71.51), H(3.02), N(9.98).

5'-bromo-Spiro[pyrazolo(3,2-*c*)indeno[2,1-*b*]phthalazine-6,3'-indoline]-2',5,8,13-tetraone. (5b). M.p.216-218°C, IR(KBr)cm⁻¹: 1340, 1365, 1640-1680, 1685. ¹H NMR(300 MHz, CDCl₃, DMSO-*d*₆) δ(ppm): 7.33-7.65 (11H, m, H-Ar), 10.40 (1H,s,NH). ¹³C NMR (DMSO-*d*₆) δ(ppm): 75.6, 111.4, 120.6, 123.3, 124.5,125.1, 126.2, 128.3, 128.8, 129.1, 129.8, 131.7,137.2, 139.4, 149.5, 152.1, 153.2, 156.5, 161.4,189.3. Anal. calcd. (%) for C₂₅H₁₂N₃O₄Br (498) : C(60.24), H(2.40), N(8.43); found: C(60.13), H(2.24), N(8.35).

5'-fluoro-Spiro[pyrazolo(3,2-*c*)indeno[2,1-*b*]phthalazine-6,3'-indoline]-2',5,8,13-tetraone. (5c). M.p. 221-223°C, IR(KBr) cm⁻¹: 1345,1360,1630-1670, 1675. ¹H NMR(300 MHz, CDCl₃, DMSO-*d*₆) δ(ppm): 7.35-7.72 (11H, m, H-Ar), 10.48 (1H,s,NH). ¹³C NMR (DMSO-*d*₆) δ(ppm): 74.9, 112.4, 119.2, 121.8, 124.4, 125.3, 126.1, 126.9, 127.6, 128.4, 130.1, 130.7, 135.4, 139.4, 148.7, 152.1, 152.5, 155.8, 161.7, 175.2, 189.3. Anal. calcd. (%) for C₂₅H₁₂N₃O₄F (437) :C(68.64), H(2.74), N(9.61); found: C(68.56), H(2.67), N(9.55).

5'-nitro-Spiro[pyrazolo(3,2-*c*)indeno[2,1-*b*]phthalazine-6,3'-indoline]-2',5,8,13-tetraone. (5d) . M.p.228-230°C, IR(KBr)cm⁻¹: 1340, 1370, 1670, 1640-1680. ¹H NMR(300 MHz, CDCl₃, DMSO-*d*₆) δ(ppm): 7.43-7.81 (11H, m, H-Ar), 10.45 (1H,s,NH). ¹³C NMR (DMSO-*d*₆) δ(ppm): 75.3, 112.8, 118.6, 120.9, 123.6, 125.8, 126.4, 127.8, 128.1, 128.9, 130.5, 131.2, 134.5,138.6, 150.4, 151.3, 152.6, 156.7, 161.8, 175.4, 189.6. Anal. calcd. (%) for C₂₅H₁₂N₄O₆ (464): C(64.65), H(2.58), N(12.06); found: C(64.55), H(2.53), N(12.00).

1,3-dimethylspiro[pyrazolo(3,4-*d*)pyrimido[2,1-*b*]phthalazine-5,3'-indoline]-2,2',4,7,12-pentaone. (7a). M.p.238-240 °C, IR(KBr)cm⁻¹: 1345, 1368,1630-1680, 2860, 2945. ¹H NMR(300 MHz, CDCl₃, DMSO-*d*₆) δ(ppm): 3.05 (3H, s, Me), 3.48 (3H, s,Me), 6.92-7.48 (8H ,m, H-Ar), 10.32 (1H,s,NH). ¹³C NMR (DMSO-*d*₆) δ(ppm): 40.1, 40.3, 75.2, 111.2, 120.4,123.6, 124.1, 125.8, 127.9, 128.3, 136.7, 137.7,148.9, 151.3,152.2, 153.7, 155.4, 159.6,165.8. Anal. calcd. (%) for C₂₂H₁₅N₅O₅ (429) : C(61.53), H(3.49), N(16.31); found: C(60.58), H(3.40), N(11.21).

5'-bromo-1,3-dimethylspiro[pyrazolo(3,4-*d*)pyrimido[2,1-*b*]phthalazine-5,3'-indoline]-2,2',4,7,12-pentaone. (7b). M.p.265-267°C, IR(KBr)cm⁻¹: 1340, 1365,1630-1680, 2860, 2950. ¹H NMR(300 MHz, CDCl₃, DMSO-*d*₆) δ(ppm): 3.02 (3H, s, Me), 3.42 (3H, s,Me) , 7.31-7.64 (7H ,m, H-Ar), 10.47 (1H,s,NH). ¹³C NMR (DMSO-*d*₆) δ(ppm): 40.4, 40.8, 75.5, 112.3, 118.6, 123.8, 124.2, 126.3, 128.4, 128.9, 136.5,138.3,150.2,151.6, 152.9, 154.1, 155.6, 159.1, 165.6. Anal. calcd. (%) for C₂₂H₁₄N₅O₅Br (508) : C(51.96), H(2.75), N(13.77); found: C(51.87), H(2.69), N(13.68).

5'-fluoro-1,3-dimethylspiro[pyrazolo(3,4-*d*)pyrimido[2,1-*b*]phthalazine-5,3'-indoline]-2,2',4,7,12-pentaone. (7c). M.p.248-250 °C, IR(KBr)cm⁻¹: 1370, 1375,1640-1680, 2865, 2940. ¹H NMR(300 MHz, CDCl₃, DMSO-*d*₆) δ(ppm): 3.04 (3H, s, Me), 3.47 (3H, s, Me) 7.37-7.73 (7H, m, H-Ar), 10.48 (1H,s,NH). ¹³C NMR (DMSO-*d*₆) δ(ppm): 40.4, 40.8, 74.8, 113.6, 119.2, 122.8,124.5, 125.6, 128.3, 130.1, 137.4, 138.9, 150.1, 151.6, 152.8, 154.1, 155.7, 158.9, 165.3. Anal. calcd.(%) for C₂₂H₁₄N₅O₅F (447): C(59.06), H(3.13), N(15.65); found: C(59.00), H(3.08), N(15.61).

1,3-dimethyl-5'-nitrospiro[pyrazolo(3,4-*d*)pyrimido[2,1-*b*]phthalazine-5,3'-indoline]-2,2',4,7,12-pentaone. (7d). M.p.225-227 °C, IR(KBr)cm⁻¹: 1340, 1366, 1640-1680, 2855,2945. ¹H NMR(300 MHz, CDCl₃, DMSO-*d*₆) δ(ppm): 3.01 (3H, s, Me), 3.47 (3H, s,Me), 7.41-7.83 (7H, m, H-Ar), 10.49 (1H,s,NH). ¹³C NMR (DMSO-*d*₆) δ(ppm): 40.4, 40.6, 75.5, 110.4, 118.6,122.5, 124.3, 126.4, 128.1, 128.3, 135.6, 138.2, 149.1, 151.6, 152.4, 154.1, 155.6, 160.3, 165.4. Anal. calcd.(%) for C₂₂H₁₄N₆O₇ (474): C(55.69), H(2.95), N(17.72); found: C(55.61), H(2.90), N(17.64).

Spiro[pyrazolo(3,4-*d*)pyrimido[2,1-*b*]phthalazine-5,3'-indoline]-2,2',4,7,12-pentaone. (7e). M.p.250-252 °C, IR(KBr)cm⁻¹: 1348, 1364,1630-1685. ¹H NMR(300 MHz, CDCl₃, DMSO-*d*₆) δ(ppm): 7.01-7.57 (8H, m, H-Ar), 10.57 (1H,s, NH), 11.18 (1H, s, NH), 11.44 (1H,s,NH). ¹³C NMR (DMSO-*d*₆) δ(ppm): 75.6, 113.4, 118.6, 122.5, 123.9, 125.3, 128.1, 128.3, 137.9, 139.6, 150.1, 151.9, 1526, 154.3, 155.6, 160.1, 165.1. Anal. calcd.(%) for C₂₀H₁₁N₅O₅ (401): C(59.85), H(2.56), N(17.45); found: C(59.60), H(2.54), N(17.23).

5'-bromospiro[pyrazolo(3,4-*d*)pyrimido[2,1-*b*]phthalazine-5,3'-indoline]-2,2',4,7,12-pentaone. (7f). M.p.233-235 °C, IR(KBr)cm⁻¹: 1340, 1370, 1630-1690. ¹H NMR(300 MHz, CDCl₃,DMSO-*d*₆) δ(ppm): 7.30-7.66 (7H, m, H-Ar), 10.42 (1H,s, NH), 11.14 (1H, s, NH), 11.43 (1H,s,NH). ¹³C NMR (DMSO-*d*₆) δ(ppm): 75.6, 114.2, 119.2, 122.7, 124.8, 125.9, 128.3, 128.8, 138.1, 139.6, 150.4, 151.9,153.1, 154.3, 155.8, 159.7, 165.5. Anal. calcd.(%) for C₂₀H₁₀N₅O₅Br (480): C(50.00), H(2.08), N(14.58); found: C(49.95), H(2.01), N(14.52).

5'-fluoro-Spiro[pyrazolo(3,4-*d*)pyrimido[2,1-*b*]phthalazine-5,3'-indoline]-2,2',4,7,12-pentaone. (7g). M.p.253-255 °C, IR(KBr)cm⁻¹: 1345, 1370, 1630-1690. ¹H NMR(300 MHz, CDCl₃, DMSO-*d*₆) δ(ppm): 7.36-7.74 (7H, m, H-Ar), 10.49 (1H,s, NH), 11.17 (1H, s, NH), 11.42 (1H,s,NH). ¹³C NMR (DMSO-*d*₆) δ(ppm): 75.5, 115.6, 118.9, 121.8, 124.1, 125.7, 128.8, 129.9, 138.1, 140.3, 150.6, 151.5, 152.7, 154.6, 155.6, 159.8, 165.4. Anal. calcd.(%) for C₂₀H₁₀N₅O₅F (419): C(57.27), H(2.38), N(16.70); found: C(57.19), H(2.33), N(16.63).

5'-nitrospiro[pyrazolo(3,4-*d*)pyrimido[2,1-*b*]phthalazine-5,3'-indoline]-2,2',4,7,12-pentaone. (7h). M.p.263-265 °C, IR(KBr)cm⁻¹: 1340, 1365,1630-1690. ¹H NMR(300 MHz, CDCl₃,DMSO-*d*₆) δ(ppm): 7.42-7.80 (7H, m, H-Ar), 10.47 (1H,s, NH), 11.15 (1H, s, NH), 11.48 (1H,s,NH). ¹³C NMR(DMSO-*d*₆) δ(ppm): 75.5, 114.4, 120.1, 122.5, 124.6, 126.4,

128.1, 128.4, 136.4, 139.5, 159.4, 151.7, 152.4, 155.1, 155.8, 160.2, 165.6. Anal. calcd.(%) for C₂₀H₁₀N₆O₇ (446): C(53.81), H(2.24), N(18.83); found: C(53.75), H(2.16), N(18.74).

Spiro[pyrazolo(4,3-*c*)chromeno[2,1-*b*]phthalazine-7,3'-indoline]-2',6,9,14-tetraone. (9a). M.p.198-200°C, IR(KBr)cm⁻¹: 1346, 1367, 1655, 1630-1695. ¹H NMR(300 MHz, CDCl₃, DMSO-*d*₆) δ(ppm): 7.05-7.62 (12H,m,H-Ar), 10.46 (1H,s,NH). ¹³C NMR (DMSO-*d*₆) δ(ppm): 76.1, 111.6, 117.2, 120.9, 123.4, 124.5, 125.4, 125.9, 126.6, 128.3, 128.9, 130.1, 133.5, 136.6, 138.7, 148.6, 151.6, 153.1, 156.8, 158.5, 166.1. Anal. calcd.(%) for C₂₄H₁₃N₃O₅ (423): C(68.08), H(3.07), N(9.92); found: C(67.95), H(2.98), N(9.85).

5'-bromospiro[pyrazolo(4,3-*c*)chromeno[2,1-*b*]phthalazine-7,3'-indoline]-2',6,9,14-tetraone. (9b). M.p.208-210°C, IR(KBr)cm⁻¹: 1350, 1365, 1660, 1630-1690. ¹H NMR(300 MHz, CDCl₃, DMSO-*d*₆) δ(ppm): 7.31-7.59 (11H,m,H-Ar), 10.41 (1H,s,NH). ¹³C NMR (DMSO-*d*₆) δ(ppm): 75.2, 112.4, 118.2, 121.3, 123.8, 124.4, 125.1, 125.8, 127.6, 128.7, 129.4, 131.2, 134.3, 136.6, 139.4, 149.6, 152.1, 153.4, 156.5, 158.9, 166.4. Anal. calcd.(%) for C₂₄H₁₂N₃O₅Br (502): C(57.37), H(2.39), N(8.36); found: C(57.30), H(2.32), N(8.27).

5'-fluoro-Spiro[pyrazolo(4,3-*c*)chromeno[2,1-*b*]phthalazine-7,3'-indoline]-2',6,9,14-tetraone. (9c). M.p.209-211°C, IR(KBr)cm⁻¹: 1340, 1365,1660,1630-1680. ¹H NMR(300 MHz, CDCl₃, DMSO-*d*₆) δ(ppm): 7.37-7.74 (11H,m,H-Ar), 10.48 (1H,s,NH). ¹³C NMR(DMSO-*d*₆) δ(ppm): 75.7, 112.4, 118.8, 121.2, 122.9, 124.6, 125.1, 125.7, 127.3, 128.1, 129.2, 130.1, 135.6, 137.8, 138.7, 149.4, 151.6, 154.2, 156.5, 157.2, 166.3. Anal. calcd.(%) for C₂₄H₁₂N₃O₅F (441): C(65.30), H(2.72), N(9.52); found: C(65.34), H(2.64), N(9.47).

5'-nitro-Spiro[pyrazolo(4,3-*c*)chromeno[2,1-*b*]phthalazine-7,3'-indoline]-2',6,9,14-tetraone. (9d). M.p.193-195°C, IR(KBr)cm⁻¹: 1355, 1385, 1660,1630-1680. ¹H NMR(300 MHz, CDCl₃, DMSO-*d*₆) δ(ppm): 7.41-7.82 (11H,m,H-Ar), 10.48 (1H,s,NH). ¹³C NMR (DMSO-*d*₆) δ(ppm): 74.8, 110.4, 116.3, 121.2, 122.8, 124.6, 125.4, 125.9, 127.6, 128.1, 128.8, 131.4, 134.5, 135.6, 138.8, 148.9, 151.7, 153.2, 156.4, 160.1, 165.6. Anal. calcd.(%) for C₂₄H₁₂N₃O₅NO₂ (468): C(61.53), H(2.56), N(8.97); found: C(61.46), H(2.51), N(8.92).

2,2-dimethyl-2,3-dihydro-1H-spiro[indazolo[2,1-*b*]phthalazine-5,3'-indoline]-2',4,7,12-tetraone. (11a). M.p. 253-255°C, IR(KBr)cm⁻¹ : 1350,1365,1630,1685, 2865,2950. ¹H NMR(300 MHz, CDCl₃, DMSO-*d*₆) δ(ppm): 1.24(6H,s,2Me), 2.34(2H,s,CH₂CO), 3.21&3.43(2H,ABsystemCH_aH_bCO),7.33-7.90(8H,m,H-Ar), 10.40(1H,s,NH). ¹³C NMR (DMSO-*d*₆) δ(ppm): 11.4, 18.7, 24.3, 27.2, 75.4, 110.4,122.1, 124.3,124.9, 125.4, 127.3,

128.3, 135.4, 138.6, 150.9, 151.4, 152.8, 156.3, 164.5, 179.4. Anal. calcd.(%) for $C_{24}H_{19}N_3O_4$ (413): C(69.73), H(4.60), N(10.16); found: C(69.70), H(3.95), N(10.11).

5'-bromo-2,2-dimethyl-2,3-dihydro-1H-spiro[indazolo[2,1-*b*]phthalazine-5,3'-indoline]-2',4,7,12-tetraone. (11b). M.p. 263-265 °C, IR(KBr) cm^{-1} : 1350, 1360, 1635, 1680, 2865, 2945. 1H NMR(300 MHz, $CDCl_3$, DMSO- d_6) δ (ppm): 1.28(6H,s,2Me), 2.38(2H,s, CH_2CO), 3.31&3.48(2H,ABsystem CH_aH_bCO), 7.32-7.68(7H,m,H-Ar), 10.48(1H,s,NH). ^{13}C NMR (DMSO- d_6) δ (ppm): 11.2, 18.6, 24.1, 28.3, 75.6, 110.9, 121.8, 124.5, 124.7, 125.6, 127.9, 129.1, 135.1, 137.8, 150.8, 151.6, 152.9, 156.2, 165.1, 180.2. Anal. calcd.(%) for $C_{24}H_{18}N_3O_4Br$ (492): C(58.53), H(3.65), N(8.53); found: C(58.32), H(3.47), N(8.48).

5'-fluoro-2,2-dimethyl-2,3-dihydro-1H-spiro[indazolo[2,1-*b*]phthalazine-5,3'-indoline]-2',4,7,12-tetraone. (11c). M.p. 248-250 °C, IR(KBr) cm^{-1} : 2955, 2860, 1645, 1685, 1340, 1370. 1H NMR(300 MHz, $CDCl_3$, DMSO- d_6) δ (ppm): 7.38-7.71(7H,m,H-Ar), 1.29(6H,s,2Me), 2.33(2H,s, CH_2CO), 3.20 & 3.44(2H,ABsystem CH_aH_bCO), 10.47(1H,s,NH). ^{13}C NMR (DMSO- d_6) δ (ppm): 11.9, 19.2, 25.5, 28.3, 75.8, 111.5, 123.4, 123.9, 124.8, 126.2, 127.1, 128.8, 134.9, 138.7, 150.8, 151.5, 153.7, 155.4, 165.1, 178.9. Anal. calcd.(%) for $C_{24}H_{18}N_3O_4F$ (431): C(66.82), H(4.17), N(9.74); found: C(66.78), H(4.11),

2,2-dimethyl-5'-nitro-2,3-dihydro-1H-spiro[indazolo[2,1-*b*]phthalazine-5,3'-indoline]-2',4,7,12-tetraone. (11d). M.p. 248-250 °C, IR(KBr) cm^{-1} : 1345, 1370, 1635, 1690, 2866, 2940. 1H NMR(300 MHz, $CDCl_3$, DMSO- d_6) δ (ppm): 1.30(6H,s,2Me), 2.32(2H,s, CH_2CO), 3.22 & 3.44(2H,ABsystem CH_aH_bCO) 7.40-7.81(7H,m,H-Ar), 10.46(1H,s,NH). ^{13}C NMR (DMSO- d_6) δ (ppm): 11.4, 19.3, 23.8, 28.4, 75.6, 111.2, 120.6, 130.3, 124.5, 125.6, 127.9, 129.6, 134.7, 138.5, 149.5, 151.6, 153.1, 156.4, 164.8, 180.2. Anal. calcd.(%) for $C_{24}H_{18}N_4O_6$ (458) C(62.88), H(3.93), N(12.22); found: C(62.79), H(3.86), N(12.17).