Supplementary Information

**An efficient multicomponent synthesis and *in vitro* anticancer activity of dihydropyranochromene and chromenopyrimidine-2,5-diones**

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**EXPERIMENTAL**

**General:** All the chemicals used were of laboratory grade. Melting points of all the synthesized compounds were determined in open capillary tubes and are uncorrected. 1H NMR spectra were recorded with a Bruker Avance 400 spectrometer operating at 400 MHz using CDCl3 solvent and tetramethylsilane (TMS) as the internal standard and chemical shift in δ ppm Mass spectra were recorded on a Sciex, Model; API 3000 LCMS/MS Instrument. The purity of each compound was checked by TLC using silica-gel, 60F254 aluminum sheets as adsorbent and visualization was accomplished by iodine/ultraviolet light.

**General Procedure for the synthesis of 2-amino-4,5-dihydro-5-oxo-4-(substitutedphenyl)pyrano[3,2-c]chromene-3-carbonitriles (4a-o)**

A mixture of substituted benzaldehydes (**1a-j**) (4 mmol), malononitrile (**2**) (4 mmol), 4-hydroxy coumarin (4 mmol) and β-Cyclodextrin (10 mol%) in water (15 ml) was subjected to stirr at 60-65 ºC. Progress of the reaction was monitored by thin layer chromatography. After 60 min, reaction mixture was cooled to room temperature, filtered and washed with hot water. Obtained solid was crystallized by ethanol:DMF. Synthesized compounds characterized by IR, 1H NMR and are in good agreement with those reported in the literature.[1,2]

**General Procedure for the synthesis of 3,4-dihydro-4-(substituted phenyl)-1H-chromeno[4,3-d]pyrimidine-2,5-dione (6a-g)**

A mixture of substituted benzaldehydes (**1a-g**) (4 mmol), urea (**5**) (4 mmol), 4-hydroxy coumarin (**3**) (4 mmol) and β-Cyclodextrin (10 mol%) in water (15 ml) was subjected to stirr at 60-65 ºC. Progress of the reaction was monitored by thin layer chromatography. After 2 h, reaction mixture was cooled to room temperature, filtered and washed with hot water. Obtained solid was crystallized by ethanol:DMF. Synthesized compounds characterized by IR, 1H NMR and are in good agreement with those reported in the literature.[1,2]

**Experimental procedure for MTT assays**

The stock solutions of test compounds were prepared in DMSO. After 24 h incubation, different concentrations (2, 4, 6, 8 µM) of compounds, made by serial dilution in culture medium, were added in 48 h incubation. The final concentration of DMSO was 0.01% in each well. A separate well containing 0.01 % DMSO only was run as DMSO control, which was found inactive under applied conditions. The cell growth was determined using MTT (3-(4,5-dimethylthiazol-2-yl)-2,5-diphenyl tetrazolium bromide (Sigma) reduction assay, which is based on ability of viable cells to reduce a soluble yellow tetrazolium salt to blue farmazan crystal.[46] Briefly, after 48 h of treatments, the10µl of MTT dye, prepared in phosphate buffered saline (PBS) were added to all wells. The plates were then incubated for 4h at 37oC. Supernatant from each well was carefully removed, formazon crystals were dissolved in 100µL of DMSO and absorbance at 540 nm wavelength was recorded and each concentration was tested in threefold. The IC50 values were determined as concentration of compounds that inhibited cancer cell growth by 50%.

**Spectral Analysis of compounds as follow[1,2]**

**2-Amino-4,5-dihydro-5-oxo-4-phenyl-pyrano[3,2-c]chromene-3-carbonitrile (4a)**



White solid mp: 258-260 °C (lit. 258-260 °C) [ref. 1,2]; IR (ATR υ cm-1**)** Characteristic absorptions: 3265 (N-H stretching), 2890 (C-H stretching), 1172 (C-O-C stretching), 1646 (C=O stretching). 1H NMR (400 MHz, CDCl3, δ ppm): 6.05 (s, 1H, CH), 7.13-7.32 (m, 4H, Ar-H), 7.39-7.47 (m, 5H, Ar-H), 11.17-11.26 (m, 2H, NH2). 13C NMR (100 MHz, DMSO-*d*6 δ ppm): 159.95, 158.32, 153.87, 152.56, 143.78, 133.36, 128.93 (2C), 128.07 (2C), 127.54, 125.01, 122.88, 119.66, 116.98, 113.34, 104.38, 58.39, 37.35. Mass (LC-MS): m/z 317 [M+H]+. Anal. calcd. For C19H12N2O3: N: 8.86; C: 72.15; H: 3.82; Found: N: 8.82; C: 72.69; H: 4.25%.

**2-Amino-4,5-dihydro-5-oxo-4- (4-methoxy phenyl)pyrano[3,2-c]chromene-3-carbonitrile (4b)**



White solid mp: 231-233 °C (lit. 232-234 °C) [ref. 1,2]; IR (ATR υ cm-1**)** Characteristic absorptions: 3278 (N-H stretching), 2885 (C-H stretching), 1177 (C-O-C stretching), 1637 (C=O stretching). 1H NMR (400 MHz, CDCl3, δ ppm): 3.58 (s, 3H, OCH3), 6.06 (s, 1H, CH), 7.27-7.39 (m, 4H, Ar-H), 7.42-7.49 (m, 4H, Ar-H), 11.42-11.45 (m, 2H, NH2). 13C NMR (100 MHz, DMSO-*d*6 δ ppm): 160.12, 157.45, 156.31, 153.57, 143.43, 141.23, 134.23, 128.07 (2C), 127.89 (2C), 127.37, 124.20, 122.67, 120.13, 118.70, 116.31, 104.45, 58.85, 56.73, 37.46. Mass (LC-MS): m/z 347 [M+H]+. Anal. calcd. For C20H14N2O4: N: 8.09; C: 69.36; H: 4.07; Found: N: 8.08; C: 69.39; H: 4.04%.

**2-Amino-4,5-dihydro-5-oxo-4- (4-methyl phenyl)pyrano[3,2-c]chromene-3-carbonitrile (4c)**



White solid mp: 258-259 °C (lit. 258-260 °C) [ref. 1,2]; IR (ATR υ cm-1**)** Characteristic absorptions: 3291 (N-H stretching), 2884 (C-H stretching), 1187 (C-O-C stretching), 1680 (C=O stretching). 1H NMR (400 MHz, CDCl3, δ ppm): 2.15 (s, 3H, CH3), 6.03 (s, 1H, CH), 7.09-7.37 (m, 6H, Ar-H), 7.49-7.54 (m, 2H, Ar-H), 11.21-11.49 (m, 2H, NH2). 13C NMR (100 MHz, DMSO-*d*6 δ ppm): 160.49, 158.37, 153.66, 152.57, 140.82, 136.74, 133.36, 129.47 (2C), 127.91 (2C), 125.08, 122.87, 119.68, 116.97, 113.36, 104.56, 58.54, 36.97, 21.04. Mass (LC-MS): m/z 331 [M+H]+. Anal. calcd. For C20H14N2O3: N: 8.48; C: 72.72; H: 4.27; Found: N: 8.50; C: 72.69; H: 4.25%.

**2-Amino-4,5-dihydro-5-oxo-4- (4-chloro phenyl)pyrano[3,2-c]chromene-3-carbonitrile (4d)**



White solid mp: 263-265 °C (lit. 264-266 °C) [ref. 1,2]; IR **(**ATR υ cm-1**)** Characteristic absorptions: 3807 (N-H stretching), 1142 (C-O-C stretching), 1657(C=O stretching); 1H NMR (400 MHz, CDCl3, δ ppm): 6.07 (s, 1H, CH), 7.24-7.41 (m, 4H, Ar-H), 7.47-7.54 (m, 4H, Ar-H), 11.28-11.37 (m, 2H, NH2). 13C NMR (100 MHz, DMSO-*d*6 δ ppm): 159.94, 158.38, 153.94, 152.58, 142.74, 133.45, 132.13, 130.08, 130.04, 128.87 (2C), 125.07, 122.93, 119.50, 116.97, 113.33, 103.87, 57.96, 36.88. Mass (LC-MS): m/z 351 [M+H]+. Anal. calcd. For C19H11ClN2O3: N: 7.99; C: 65.06; H: 3.16; Found: N: 8.00; C: 65.07; H: 3.15%.

**2-Amino-4,5-dihydro-5-oxo-4- (3-chloro phenyl)pyrano[3,2-c]chromene-3-carbonitrile (4e)**



White solid mp: 259-261 °C (lit. 259-261 °C) [ref. 1,2]; IR **(**ATR υ cm-1**)** Characteristic absorptions: 3832 (N-H stretching), 1146 (C-O-C stretching), 1645 (C=O stretching); 1H NMR (400 MHz, CDCl3, δ ppm): 6.04 (s, 1H, CH), 7.19-7.32 (m, 4H, Ar-H), 7.39-7.49 (m, 4H, Ar-H), 11.29-11.35 (m, 2H, NH2). 13C NMR (100 MHz, DMSO-*d*6 δ ppm): 162.84, 160.4, 159.96, 158.36, 153.84, 152.56, 139.94, 139.92, 133.31, 130.07, 130.05, 125.04, 122.94, 119.57, 116.91, 115.73, 115.54, 113.28, 104.15, 58.27, 36.66. Mass (LC-MS): m/z 351 [M+H]+. Anal. calcd. For C19H11ClN2O3: N: 7.99; C: 65.06; H: 3.16; Found: N: 7.97; C: 65.07; H: 3.15%.

**2-Amino-4,5-dihydro-5-oxo-4- (4-bromophenyl)pyrano[3,2-c]chromene-3-carbonitrile (4f)**



White solid mp: 230-232 °C (lit. 233-235 °C) [ref. 1,2]; IR **(**ATR υ cm-1**)** Characteristic absorptions: 3837 (N-H stretching), 1164 (C-O-C stretching), 1627 (C=O stretching); 1H NMR (400 MHz, CDCl3, δ ppm): 6.05 (s, 1H, CH), 7.27-7.36 (m, 4H, Ar-H), 7.41-7.45 (m, 4H, Ar-H), 11.14-11.26 (m, 2H, NH2). 13C NMR (100 MHz, DMSO-*d*6 δ ppm): 160.02, 158.45, 154.25, 152.67, 148.31, 133.53, 129.07 (2C), 125.87 (2C), 125.16, 123.28, 122.989, 119.46, 117.05 (2C), 113.34, 103.56, 57.57, 37.26. Mass (LC-MS): m/z 396 [M+H]+. Anal. calcd. For C19H11BrN2O3: N: 7.09; C: 57.74; H, 2.81; Found: N: 7.03; C: 57.77; H: 2.80%.

**2-Amino-4,5-dihydro-5-oxo-4- (4-hydroxy phenyl)pyrano[3,2-c] chromene-3-carbonitrile (4g)**



White solid mp: 260-262 °C (lit. 261-263 °C) [ref. 1,2]; IR **(**ATR υ cm-1**)** Characteristic absorptions: 3854 (N-H stretching), 1139 (C-O-C stretching), 1651 (C=O stretching); 1H NMR (400 MHz, CDCl3, δ ppm): 6.02 (s, 1H, CH), 7.19-7.26 (m, 4H, Ar-H), 7.32-7.41 (m, 4H, Ar-H), 11.19-11.27 (m, 2H, NH2). 13C NMR (100 MHz, DMSO-*d*6 δ ppm): 160.04, 158.57, 154.31, 152.66, 148.27, 145.98, 135.16, 133.57, 130.48, 125.13, 123.00, 122.86, 122.68, 119.38, 117.01, 113.34, 103.27, 57.35, 37.04. Mass (LC-MS): m/z 333 [M+H]+. Anal. calcd. For C19H12N2O4: N: 8.43; C: 68.67; H: 3.64; Found: N: 8.42; C: 68.64; H: 3.64%.

**2-Amino-4,5-dihydro-5-oxo-4-(4-hydroxy-3-methoxyphenyl)pyrano[3,2-c]chromene-3-carbonitrile (4i)**



White solid mp: 255-257 °C (lit. 257-259 °C) [ref. 1,2]; IR **(**ATR υ cm-1**)** Characteristic absorptions: 3412 (OH stretching), 3833 (N-H stretching), 1148 (C-O-C stretching), 1637 (C=O stretching); 1H NMR (400 MHz, CDCl3, δ ppm): 6.05 (s, 1H, CH), 7.15-7.29 (m, 3H, Ar-H), 7.32-7.39 (m, 4H, Ar-H), 11.25-11.32 (m, 2H, NH2). 13C NMR (100 MHz, DMSO-*d*6 δ ppm): 160.05, 158.54, 154.35, 152.66, 148.27, 145.93, 135.17, 133.55, 130.48, 125.14, 123.06, 122.84, 122.69, 119.38, 117.02, 113.35, 103.27, 57.38, 56.36, 37.04. Mass (LC-MS): m/z 363 [M+H]+. Anal. calcd. For C20H14N2O5: N: 7.73; C: 66.30; H: 3.89; Found: N: 7.73; C: 66.32; H: 3.81%.

**2-Amino-4,5-dihydro-5-oxo-4- (3,4-dimethoxy phenyl)pyrano[3,2-c]chromene-3-carbonitrile (4j)**



White solid mp: 228-230 °C (lit. 225-227 °C) [ref. 1,2]; IR **(**ATR υ cm-1**)** Characteristic absorptions: 2832 (N-H stretching), 1138 (C-O-C stretching), 1656 (C=O stretching); 1H NMR (400 MHz, CDCl3, δ ppm): 6.05 (s, 1H, CH), 7.17-7.24 (m, 4H, Ar-H), 7.27-7.39 (m, 4H, Ar-H), 11.21-11.33 (m, 2H, NH2). 13C NMR (100 MHz, DMSO-*d*6 δ ppm): 159.85, 158.56, 154.57, 152.66, 139.83, 133.79, 133.53, 132.80, 132.55, 129.26, 128.28, 125.14, 122.94, 119.07, 117.05, 113.23, 102.93, 56.56, 56.41, 34.32. Mass (LC-MS): m/z 377 [M+H]+. Anal. calcd. For C21H16N2O5: N: 7.44; C: 67.02; H: 4.28; Found: N: 7.47; C: 67.05; H: 4.24%.

**2-Amino-4,5-dihydro-5-oxo-4- (N,N dimethyl phenyl)pyrano[3,2-c]chromene-3-carbonitrile (4k)**



White solid mp: 225-227°C (lit. 224-226°C) [ref. 1,2]; IR (ATR υ cm-1**)** Characteristic absorptions: 3378 (N-H stretching), 3184 (Ar-H stretching), 2817(C-H stretching), 2188 (CN stretching), 1102 (C-O-C stretching), 1670(C=O stretching); 1H NMR (400 MHz, CDCl3, δ ppm): 2.33 (s, 3H, CH3), 2.45 (s, 3H, CH3), 6.06 (s, 1H, CH), 7.11-7.26 (m, 4H, Ar-H), 7.32-7.42 (m, 2H, Ar-H), 7.61-7.82 (m, 2H, Ar-H), 11.29-11.51 (m, 2H, NH2); 13C NMR (100 MHz, DMSO-*d*6 δ ppm): 161.20, 160.47, 154.96, 152.48, 133.15, 125.01, 122.54, 121.07, 116.93, 113.39, 105.24, 51.87, 37.53, 33.17, 20.58, 16.88. Mass (LC-MS): m/z 360 [M+H]+. Anal. calcd. For C21H17N3O3: N: 11.69; C: 70.18; H: 4.77; Found: N: 11.75; C: 70.20; H: 4.71%.

**2-Amino-4,5-dihydro-5-oxo-4- (4-nitro phenyl)pyrano[3,2-c]chromene-3-carbonitrile (4l)**



White solid mp: 258-260 °C (lit. 255-257°C) [ref. 1,2]; IR (ATR υ cm-1**)** Characteristic absorptions: 3365 (N-H stretching), 3174 (Ar-H stretching), 2815(C-H stretching), 2181 (CN stretching), 1107 (C-O-C stretching), 1669 (C=O stretching); 1H NMR (400 MHz, CDCl3, δ ppm): 6.05 (s, 1H, CH), 7.16-7.23 (m, 4H, Ar-H), 7.29-7.32 (m, 2H, Ar-H), 7.42-7.55 (m, 2H, Ar-H), 11.27-11.43 (m, 2H, NH2); 13C NMR (100 MHz, DMSO-*d*6 δ ppm): 160.02, 158.46, 154.38, 152.66, 151.18, 147.05, 133.67, 129.56 (2C), 125.17, 124.15 (2C), 123.01, 119.37, 117.05, 113.29, 103.18, 57.17, 37.23. Mass (LC-MS): m/z 362 [M+H]+. Anal. calcd. For C19H11N3O5: N: 11.63; C: 63.16; H: 3.07; Found: N: 11.65; C: 63.20; H: 3.10%.

**2-Amino-4-butyl-4,5-dihydro-5-oxopyrano[3,2-c]chromene-3-carbonitrile (4n)**



White solid mp: 270-272 °C (lit. 265-267°C) [ref. 1,2]; IR (ATR υ cm-1**)** Characteristic absorptions: 3370 (N-H stretching), 2813 (C-H stretching), 2180 (CN stretching), 1143 (C-O-C stretching), 1634 (C=O stretching); 1H NMR (400 MHz, CDCl3, δ ppm): 1.12 (m, 3H, CH3), 1.26 (m, 4H, CH2), 1.35 (m, 2H, CH2), 3.27 (s, 1H, CH), 7.24-7.29 (m, 4H, Ar-H), 11.21-11.31 (m, 2H, NH2); 13C NMR (100 MHz, DMSO-*d*6 δ ppm): 160.36, 159.84, 154.54, 133.12, 124.96, 122.55, 120.11, 116.93, 113.36, 104.75, 55.56, 36.58, 31.16, 19.46, 18.05, 14.27. Mass (LC-MS): m/z 297 [M+H]+. Anal. calcd. For C17H16N2O3: N: 9.45; C: 68.91; H: 5.44; Found: N: 9.41; C: 68.91; H: 5.45%.

**2-Amino-4-benzyl-4,5-dihydro-5-oxopyrano[3,2-c]chromene-3-carbonitrile (4o)**



White solid mp: 120-122 °C (lit. 121-123 °C) [ref. 1,2]; IR (ATR υ cm-1**)** Characteristic absorptions: 3370 (N-H stretching), 3169 (Ar-H stretching), 2831 (C-H stretching), 2148 (CN stretching), 1121 (C-O-C stretching), 1640 (C=O stretching); 1H NMR (400 MHz, CDCl3, δ ppm): 2.91-3.05 (m, 2H, CH2), 3.43 (s, 1H, CH), 7.19-7.21 (m, 5H, Ar-H), 7.26-7.31 (m, 2H, Ar-H), 7.38-7.45 (m, 2H, Ar-H), 11.24-11.31 (m, 2H, NH2); Mass (LC-MS): m/z 331 [M+H]+. Anal. calcd. For C20H14N2O3: N: 8.48; C: 72.72; H: 4.27; Found: N: 8.48; C: 72.73; H: 4.24%.

**3,4-Dihydro-4-phenyl-1H-chromeno[4,3-d]pyrimidine-2,5-dione (6a)**



White solid mp: 238-240 °C (lit. 237-239 °C) [ref. 1,2]; IR (ATR υ cm-1) Characteristic absorptions: 3282 (N-H stretching), 2882 (C-H stretching), 1181 and 1208 (C-O-C stretching); 1H-NMR (400 MHz, CDCl3, δ ppm): 6.04 (s, 1H, CH), 7.15-7.17 (d, 2H, *J* = 8Hz, Ar-H), 7.26-7.30 (d, 2H, *J* = 8Hz, Ar-H), 7.41-7.43 (m, 2H, Ar-H), 7.99-8.09 (m, 3H, Ar-H ), 11.31 (s, 1H, NH) and 11.54 (s, 1H, NH); 13C NMR (100 MHz, DMSO-*d*6 δ ppm): 162.87, 158.00, 152.86, 149.96, 149.48, 141.56, 131.79, 129.68 (2C), 128.66 (2C), 127.34, 125.69, 119.89, 119.46, 88.43, 58.67. Mass (LC-MS): m/z 292 [M+H]+. Anal. calcd. For C17H12N2O3: N: 9.58; C: 69.86; H: 4.14; Found: N: 9.60; C: 70.00; H: 4.27%.

**4-(4-Chlorophenyl)-3,4-dihydro-1H-chromeno[4,3-d]pyrimidine-2,5-dione (6b)**



White solid mp: 163-165 °C (lit. 165-167 °C) [ref. 1,2]; IR (ATR υ cm-1) Characteristic absorptions: 3276 (N-H stretching), 2876 (C-H stretching), 1146 and 1256 (C-O-C stretching); 1H-NMR (400 MHz, CDCl3, δ ppm): 6.05 (s, 1H, CH), 7.16-7.29 (m, 4H, Ar-H), 7.49-7.53 (m, 2H, Ar-H), 7.61-7.65 (d, 2H, *J = 7.8 Hz*, Ar-H), 11.29 (s, 1H, NH) and 11.47 (s, 1H, NH); Mass (LC-MS): m/z 327 [M+H]+. Anal. calcd. For C17H11ClN2O3: N: 8.57; C: 62.49; H: 3.39; Found: N: 8.60; C: 62.50; H: 3.36%.

**4-(4-Bromophenyl)-3,4-dihydro-1H-chromeno[4,3-d]pyrimidine-2,5-dione (6c)**



White solid mp: 194-196 °C (lit. 195-196 °C) [ref. 1,2]; IR (ATR υ cm-1) Characteristic absorptions: 3254 (N-H stretching), 2879 (C-H stretching), 1180 and 1224 (C-O-C stretching); 1H-NMR (400 MHz, CDCl3, δ ppm): 6.07 (s, 1H, CH), 7.21-7.26 (d, 2H, *J* = 8Hz, Ar-H), 7.39-7.41 (m, 2H, Ar-H), 7.59-7.65 (d, 2H, *J* = 7.9 Hz, Ar-H), 7.97-8.04 (m, 2H, Ar-H ), 11.30 (s, 1H, NH) and 11.53 (s, 1H, NH); Mass (LC-MS): m/z 372 [M+H]+. Anal. calcd. For C17H11BrN2O3: N: 7.55; C: 55.01; H: 2.99; Found: N: 7.55; C: 55.05; H: 3.00%.

**4-(4-Hydroxyphenyl)-3,4-dihydro-1H-chromeno[4,3-d]pyrimidine-2,5-dione (6d)**



White solid mp: 174-176 °C (lit. 172-174 °C) [ref. 1,2]; IR (ATR υ cm-1) Characteristic absorptions: 3279 (N-H stretching), 2889 (C-H stretching), 1176 and 1198 (C-O-C stretching); 1H-NMR (400 MHz, CDCl3, δ ppm): 6.05 (s, 1H, CH), 7.17-7.19 (d, 2H, *J* = 7.9 Hz, Ar-H), 7.29-7.35 (d, 2H, *J* = 8Hz, Ar-H), 7.41-7.43 (m, 2H, Ar-H), 7.79-7.85 (m, 2H, Ar-H ), 11.37 (s, 1H, NH) and 11.52 (s, 1H, NH); Mass (LC-MS): m/z 309 [M+H]+. Anal. calcd. For C17H12N2O4: N, 9.09; C, 66.23; H, 3.92; Found: N: 9.07; C: 66.25; H: 3.95%.

**4-(3-Hydroxyphenyl)-3,4-dihydro-1H-chromeno[4,3-d]pyrimidine-2,5-dione (6e)**



White solid mp: 203-206 °C (lit. 201-203 °C) [ref. 1,2]; IR (ATR υ cm-1) Characteristic absorptions: 3287 (N-H stretching), 2892 (C-H stretching), 1173 and 1193 (C-O-C stretching); 1H-NMR (400 MHz, CDCl3, δ ppm): 6.04 (s, 1H, CH), 7.19-7.21 (m, 2H, Ar-H), 7.25-7.31 (d, 2H, *J* = 8Hz, Ar-H), 7.46-7.49 (m, 2H, Ar-H), 7.89-8.00 (m, 2H, Ar-H ), 11.35 (s, 1H, NH) and 11.51 (s, 1H, NH); Mass (LC-MS): m/z 309 [M+H]+. Anal. calcd. For C17H12N2O4: N, 9.09; C, 66.23; H, 3.92; Found: N: 9.10; C: 66.24; H: 3.93%.

**3,4-Dihydro-4-(3,4-dimethoxyphenyl)-1H-chromeno[4,3-d]pyrimidine-2,5-dione (6g)**



White solid mp: 260-262 °C (lit. 263-265 °C) [ref. 1,2]; IR (ATR υ cm-1) Characteristic absorptions: 3289 (N-H stretching), 2878 (C-H stretching), 1180 and 1207 (C-O-C stretching); 1H-NMR (400 MHz, CDCl3, δ ppm): 3.18 (s, 3H, OCH3), 3.23 (s, 3H, OCH3), 6.06 (s, 1H, CH), 7.11-7.16 (m, 2H, Ar-H), 7.21-7.29 (m, 2H, Ar-H), 7.76-7.79 (m, 3H, Ar-H), 11.37 (s, 1H, NH) and 11.58 (s, 1H, NH); Mass (LC-MS): m/z 353 [M+H]+. Anal. calcd. For C19H16N2O5: N: 7.95; C: 64.77; H: 4.58; Found: N: 7.95; C: 64.79; H: 4.57%.

**IR of Compound (4k)**



**1H NMR of Compound (4k)**



**IR of Compound (4c)**



**IR of Compound (4d)**



**IR of Compound (6a)**



**1H NMR of Compound (6a)**



**IR of Compound (6b)**



**REFERENCES**

1. (a) Kiyani, H.; Ghorbani, F. *Res. Chem. Intermed*., **2015**, *41*, 4031-4046;(b) Niknam, K.; Jamali, A. *Chin. J. Catal*., **2012**, *33*, 1840-1849;
2. (a) Tiwari, J.; Saquib, M.; Singh, S.; Tufail, F.; Singh, M.; Singh, J.; Singh, J. *Green Chem*., **2016**, *18*, 3221-3231; (b) Wang, H.-J.; Lu, J.; Zhang, Z.-H. *Monatsh. Chem*., **2010**, *141*, 1107-1112; (c) Kidwai, M.; Sapra, P. *Synt Comm*, **2002**, *32(11)*, 1639-1645.