Preparation of some chromeno[4,3-d]pyrido[1,2-a]pyrimidine derivatives by ultrasonic irradiation using NiFe2O4@SiO2 grafted di(3-propylsulfonic acid) nanoparticles

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Experimental

Chemicals including, NiCl₂.6H₂O, FeCl₃.6H₂O, Si(OEt)₄, and organic materials were purchased from Merck and Aldrich companies.

The following instruments were used for the catalyst characterizations and organic materials analysis:

X-ray diffraction pattern (XRD): X-Ray diffractometer (Philips, D5000, Cu-Kα irradiation)

NMR spectra: Bruker Avance DPX 400 MHz instrument. The spectra were measured in DMSO-d₆ relative to TMS (0.00 ppm).

Elemental analysis: Heraeus CHN-O-Rapid analyzer

Selected spectral data:

7-Phenyl-6H,7H-chromeno[4,3-d]pyrido[1,2-a]pyrimidin-6-one (Table 2, Product d₁):

White powder, m.p.: 212-214 °C; ¹H-NMR (400 MHz, DMSO-d₆): δ = 6.29 (s, 1H, CH), 6.86-

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7.32 (m, 9H), 7.52 (t, J = 8.4 Hz, 1H), 7.81 (t, J = 8.4 Hz, 1H), 7.88-7.92 (m, 2H) ppm; $^{13}$C-NMR (100 MHz, DMSO-d$_6$): δ = 168.3, 165.3, 153.7, 152.3, 145.1, 142.5, 136.1, 130.9, 127.4, 126.4, 124.8, 124.4, 123.0, 120.0, 116.0, 113.7, 112.8, 104.0, 36.6 ppm; MS: m/z (%) = 326 (M$^+$), 325 (100%); Found: C, 77.18; H, 4.23; N, 8.47% C$_{21}$H$_{14}$N$_2$O$_2$; requires: C, 77.29; H, 4.32; N, 8.58%.

7-(p-tolyl)-6H,7H-chromeno[4,3-d]pyrido[1,2-a]pyrimidin-6-one (Table 2, Product d$_2$):
White powder, m.p.: 231-233 °C; $^1$H-NMR (400 MHz, DMSO-d$_6$): δ = 2.20 (s, 3H, CH$_3$), 6.23 (s, 1H, CH), 6.86-7.22 (m, 8H), 7.52 (t, J = 8.4 Hz, 1H), 7.79-7.93 (m, 3H) ppm; $^{13}$C-NMR (100 MHz, DMSO-d$_6$): δ = 167.9, 165.1, 153.7, 152.2, 144.9, 139.6, 136.0, 133.3, 130.4, 128.1, 126.6, 124.5, 123.3, 119.2, 115.9, 113.0, 112.5, 103.6, 35.9, 21.2 ppm; MS: m/z (%) = 340 (M$^+$), 339 (100%); Found: C, 77.55; H, 4.68; N, 8.14% C$_{22}$H$_{16}$N$_2$O$_2$; requires: C, 77.63; H, 4.74; N, 8.23%.

7-(4-methoxyphenyl)-6H,7H-chromeno[4,3-d]pyrido[1,2-a]pyrimidin-6-one (Table 2, Product d$_3$):
White powder, m.p.: 239-241 °C; $^1$H-NMR (400 MHz, DMSO-d$_6$): δ = 3.68 (s, 3H, OCH$_3$), 6.19 (s, 1H, CH), 6.85-7.93 (m, 12H) ppm; $^{13}$C-NMR (100 MHz, DMSO-d$_6$): δ = 167.6, 164.8, 156.2, 153.6, 152.2, 144.7, 136.1, 133.6, 130.7, 127.4, 124.5, 123.1, 119.0, 115.7, 114.2, 113.2, 112.3, 103.4, 55.3, 35.4 ppm; MS: m/z (%) = 356 (M$^+$), 355 (100%); Found: C, 74.06; H, 4.44; N, 7.83% C$_{22}$H$_{16}$N$_2$O$_3$; requires: C, 74.15; H, 4.53; N, 7.86%.

7-(3,4,5-trimethoxyphenyl)-6H,7H-chromeno[4,3-d]pyrido[1,2-a]pyrimidin-6-one (Table 2, Product d$_4$):
White powder, m.p.: 278-279 °C; $^1$H-NMR (400 MHz, DMSO-d$_6$): δ = 3.58 (s, 6H, OCH$_3$), 3.66 (s, 3H, OCH$_3$), 6.14 (s, 1H, CH), 6.34 (s, 2H), 6.85-7.15 (m, 4H), 7.52 (t, J = 8.3 Hz, 1H), 7.80-7.93 (m, 3H) ppm; $^{13}$C-NMR (100 MHz, DMSO-d$_6$): δ = 167.3, 164.6, 158.3, 155.4, 153.7, 152.3, 144.6, 136.2, 133.7, 130.2, 127.3, 123.2, 119.1, 114.2, 113.3, 112.2, 109.4,
105.7, 56.7, 55.1, 35.9 ppm; MS: m/z (%) = 416 (M<sup>+</sup>), 415 (100%); Found: C, 69.15; H, 4.78; N, 6.69% C<sub>24</sub>H<sub>20</sub>N<sub>2</sub>O<sub>5</sub>; requires: C, 69.22; H, 4.84; N, 6.73%.

7-(2-fluorophenyl)-6H,7H-chromeno[4,3-d]pyrido[1,2-a]pyrimidin-6-one (Table 2, Product d<sub>5</sub>): White powder, m.p.: 222-224 °C; <sup>1</sup>H-NMR (400 MHz, DMSO-d<sub>6</sub>): δ = 6.35 (s, 1H), 6.85-7.95 (m, 12H) ppm; <sup>13</sup>C-NMR (100 MHz, DMSO-d<sub>6</sub>): δ = 168.0, 163., 160.2, 154.1, 152.5, 144.4, 136.2, 130.7, 130.3, 130.2, 128.8, 128.6, 127.4, 127.3, 124.3, 123.4, 123.2, 120.1, 115.8, 114.4, 114.2, 113.5, 112.6, 103.2, 35.6 ppm; MS: m/z (%) = 344 (M<sup>+</sup>), 343 (100%); Found: C, 73.18; H, 3.76; N, 8.08% C<sub>21</sub>H<sub>13</sub>FN<sub>2</sub>O<sub>2</sub>; requires: C, 73.25; H, 3.81; N, 8.14%.

7-(2-methoxyphenyl)-6H,7H-chromeno[4,3-d]pyrido[1,2-a]pyrimidin-6-one (Table 2, Product d<sub>6</sub>): White powder, m.p.: 231-233 °C; <sup>1</sup>H-NMR (400 MHz, DMSO-d<sub>6</sub>): δ = 3.71 (s, 3H, OCH<sub>3</sub>), 5.93 (s, 1H, CH), 6.86-7.94 (m, 12H) ppm; <sup>13</sup>C-NMR (100 MHz, DMSO-d<sub>6</sub>): δ = 167.3, 164.4, 156.6, 153.4, 152.0, 144.5, 136.0, 133.6, 129.9, 128.2, 125.4, 124.5, 123.1, 119.0, 115.7, 114.2, 113.2, 112.3, 108.2, 103.3, 55.6, 34.0 ppm; MS: m/z (%) = 356 (M<sup>+</sup>), 355 (100%); Found: C, 74.08; H, 4.42; N, 7.79% C<sub>22</sub>H<sub>16</sub>N<sub>2</sub>O<sub>3</sub>; requires: C, 74.15; H, 4.53; N, 7.86%.

2,3-dimethoxy-11-methyl-7-(3,4,5-trimethoxyphenyl)-6H,7H-chromeno[4,3-d]pyrido[1,2-a]pyrimidin-6-one (Table 2, Product d<sub>12</sub>): White powder, m.p.: >300 °C; <sup>1</sup>H-NMR (400 MHz, DMSO-d<sub>6</sub>): δ = 2.32 (s, 3H, CH<sub>3</sub>), 3.55 (s, 6H, OCH<sub>3</sub>), 3.63 (s, 3H, OCH<sub>3</sub>), 3.65 (s, 3H, OCH<sub>3</sub>), 3.76 (s, 3H, OCH<sub>3</sub>), 6.03 (s, 1H, CH), 6.39 (s, 2H), 6.64 (s, 1H), 6.74 (s, 1H), 7.07 (d, J = 8.4 Hz, 1H), 7.32 (s, 1H), 7.85 (d, J = 8.4 Hz, 1H) ppm; <sup>13</sup>C-NMR (100 MHz, DMSO-d<sub>6</sub>): δ = 167.0, 161.3, 158.0, 155.7, 153.6, 152.3, 150.1, 148.9, 144.2, 132.8, 130.3, 123.2, 114.3, 112.2, 109.0, 103.7, 98.7, 92.5, 56.7, 55.8, 55.4, 54.5, 34.8, 21.1 ppm; MS: m/z (%) = 490 (M<sup>+</sup>), 489 (100%); Found: C, 66.03; H, 5.25; N, 5.66% C<sub>27</sub>H<sub>26</sub>N<sub>2</sub>O<sub>7</sub>; requires: C, 66.11; H, 5.34; N, 5.71%. 
2,3-dimethoxy-11-methyl-7-phenyl-6H,7H-chromeno[4,3-d]pyrido[1,2-a]pyrimidin-6-one

(Table 2, Product d13): White powder, m.p.: >300 °C; ¹H-NMR (400 MHz, DMSO-d₆): δ = 2.32 (s, 3H, CH₃), 3.62 (s, 3H, OCH₃), 3.73 (s, 3H, OCH₃), 6.14 (s, 1H, CH), 6.59 (s, 1H), 6.73 (s, 1H), 7.04 (d, J = 8.2 Hz, 1H), 7.14 (t, J = 7.8 Hz, 2H), 7.21 (t, J = 7.8 Hz, 1H), 7.27 (s, 1H), 7.35 (d, J = 8.2 Hz, 2H), 7.82 (d, J = 8.2 Hz, 1H) ppm; ¹³C-NMR (100 MHz, DMSO-d₆): δ = 166.3, 160.3, 153.4, 152.7, 150.7, 148.3, 144.3, 132.6, 130.7, 128.4, 127.2, 126.6, 123.7, 114.0, 109.0, 103.6, 97.8, 91.8, 55.9, 54.8, 34.6, 21.1 ppm; MS: m/z (%)= 400 (100%); Found: C, 72.07; H, 5.09; N, 6.94% C₂₄H₂₀N₂O₄; requires: C, 71.99; H, 5.03; N, 7.00%.

2,3-dimethoxy-11-methyl-7-(p-tolyl)-6H,7H-chromeno[4,3-d]pyrido[1,2-a]pyrimidin-6-one

(Table 2, Product d14): White powder, m.p.: >300 °C; ¹H-NMR (400 MHz, DMSO-d₆): δ = 2.21 (s, 3H, CH₃), 2.33 (s, 3H, CH₃), 3.63 (s, 3H, OCH₃), 3.75 (s, 3H, OCH₃), 5.98 (s, 1H, CH), 6.61 (s, 1H), 6.74 (s, 1H), 7.02-7.06 (m, 3H), 7.23 (d, J = 7.8 Hz, 2H), 7.29 (s, 1H), 7.83 (d, J = 8.4 Hz, 1H) ppm; ¹³C-NMR (100 MHz, DMSO-d₆): δ = 166.2, 159.9, 153.2, 152.8, 150.3, 148.6, 144.1, 139.1, 132.4, 130.5, 125.6, 123.6, 123.2, 114.2, 108.6, 103.8, 98.3, 91.9, 55.8, 54.8, 34.4, 21.4, 21.2 ppm; MS: m/z (%)= 414 (M⁺), (100%); Found: C, 72.53; H, 5.44; N, 6.68% C₂₅H₂₂N₂O₄; requires: C, 72.45; H, 5.35; N, 6.76%.

2,3-dimethoxy-7-(4-methoxyphenyl)-11-methyl-6H,7H-chromeno[4,3-d]pyrido[1,2-a]pyrimidin-6-one (Table 2, Product d15): White powder, m.p.: >300 °C; ¹H-NMR (400 MHz, DMSO-d₆): δ = 2.31 (s, 3H, CH₃), 3.64 (s, 3H, OCH₃), 3.70 (s, 3H, OCH₃), 3.74 (s, 3H, OCH₃), 5.89 (s, 1H, CH), 6.60 (s, 1H), 6.74 (s, 1H), 6.91 (d, J = 7.8 Hz, 2H), 7.04 (d, J = 8.4 Hz, 1H),
7.25 (d, $J = 7.8$ Hz, 2H), 7.28 (s, 1H), 7.81 (d, $J = 8.4$ Hz, 1H) ppm; $^{13}$C-NMR (100 MHz, DMSO-$d_6$): $\delta = 166.6, 160.3, 156.2, 153.4, 152.6, 150.1, 148.8, 144.3, 132.5, 129.3, 124.6, 123.2, 115.6, 114.3, 109.0, 103.9, 98.8, 92.1, 55.8, 55.3, 54.6, 34.1, 21.1 ppm; MS: $m/z$ (%) = 430 (M$^+$), 429 (100%); Found: C, 69.68; H, 5.07; N, 6.44% C$_{25}$H$_{22}$N$_2$O$_5$; requires: C, 69.76; H, 5.15; N, 6.51%.

7-(4-chlorophenyl)-2,3-dimethoxy-11-methyl-6H,7H-chromeno[4,3-d]pyrido[1,2-a]pyrimidin-6-one (Table 2, Product d$_{16}$): White powder, m.p.: $>300$ °C; $^1$H-NMR (400 MHz, DMSO-$d_6$): $\delta = 2.31$ (s, 3H), 3.65 (s, 3H, OCH$_3$), 3.76 (s, 3H, OCH$_3$), 6.03 (s, 1H, CH), 6.61 (s, 1H), 6.76 (s, 1H), 7.89 (d, $J = 8.0$ Hz, 2H), 7.07 (d, $J = 8.5$ Hz, 1H), 7.48 (d, $J = 8.0$ Hz, 2H), 7.32 (s, 1H), 7.86 (d, $J = 8.5$ Hz, 1H) ppm; $^{13}$C-NMR (100 MHz, DMSO-$d_6$): $\delta = 166.9, 162.3, 153.7, 152.6, 150.3, 148.9, 147.0, 144.4, 135.7, 132.6, 128.6, 127.3, 123.3, 114.4, 109.3, 103.7, 100.1, 93.2, 55.7, 54.6, 36.0, 21.2 ppm; MS: $m/z$ (%) = 434 (M$^+$), 433 (100%); Found: C, 66.22; H, 4.37; N, 6.33% C$_{24}$H$_{19}$ClN$_2$O$_4$; requires: C, 66.29; H, 4.40; N, 6.44%.

7-(4-bromophenyl)-2,3-dimethoxy-11-methyl-6H,7H-chromeno[4,3-d]pyrido[1,2-a]pyrimidin-6-one (Table 2, Product d$_{17}$): White powder, m.p.: $>300$ °C; $^1$H-NMR (400 MHz, DMSO-$d_6$): $\delta = 2.32$ (s, 3H), 3.65 (s, 3H, OCH$_3$), 3.77 (s, 3H, OCH$_3$), 6.07 (s, 1H, CH), 6.62 (s, 1H), 6.75 (s, 1H), 7.93 (d, $J = 8.0$ Hz, 2H), 7.08 (d, $J = 8.5$ Hz, 1H), 7.54 (d, $J = 8.0$ Hz, 2H), 7.31 (s, 1H), 7.85 (d, $J = 8.5$ Hz, 1H) ppm; $^{13}$C-NMR (100 MHz, DMSO-$d_6$): $\delta = 166.5, 162.4, 153.6, 152.5, 151.8, 151.3, 149.5, 144.6, 134.3, 133.8, 128.7, 127.1, 123.2, 114.7, 109.5, 104.1, 100.3, 93.1, 55.6, 54.4, 36.1, 21.2 ppm; MS: $m/z$ (%) = 479 (M$^+$), 478 (100%); Found: C, 60.06; H, 3.91; N, 5.77% C$_{24}$H$_{19}$BrN$_2$O$_4$; requires: C, 60.14; H, 4.00; N, 5.84%.

2,3-dimethoxy-11-methyl-7-(4-nitrophenyl)-6H,7H-chromeno[4,3-d]pyrido[1,2-a]pyrimidin-6-one (Table 2, Product d$_{18}$): Pale yellow powder, m.p.: $>300$ °C; $^1$H-NMR (400 MHz, DMSO-$d_6$): $\delta = 2.33$ (s, 3H), 3.65 (s, 3H, OCH$_3$), 3.77 (s, 3H, OCH$_3$), 6.07 (s, 1H, CH), 6.63 (s, 1H), 6.76 (s, 1H), 7.86 (d, $J = 8.0$ Hz, 2H), 7.08 (d, $J = 8.5$ Hz, 1H), 7.54 (d, $J = 8.0$ Hz, 2H), 7.31 (s, 1H), 7.85 (d, $J = 8.5$ Hz, 1H) ppm; $^{13}$C-NMR (100 MHz, DMSO-$d_6$): $\delta = 166.5, 162.4, 153.6, 152.5, 151.8, 151.3, 149.5, 144.6, 134.3, 133.8, 128.7, 127.1, 123.2, 114.7, 109.5, 104.1, 100.3, 93.1, 55.6, 54.4, 36.1, 21.2 ppm; MS: $m/z$ (%) = 479 (M$^+$), 478 (100%); Found: C, 60.06; H, 3.91; N, 5.77% C$_{24}$H$_{19}$BrN$_2$O$_4$; requires: C, 60.14; H, 4.00; N, 5.84%.
MHz, DMSO-d$_6$): δ = 2.33 (s, 3H), 3.67 (s, 3H, OCH$_3$), 3.78 (s, 3H, OCH$_3$), 6.27 (s, 1H, CH), 6.64 (s, 1H), 6.76 (s, 1H), 8.14 (d, $J$ = 7.8 Hz, 2H), 7.08 (d, $J$ = 8.4 Hz, 1H), 7.94 (d, $J$ = 7.8 Hz, 2H), 7.32 (s, 1H), 7.86 (d, $J$ = 8.4 Hz, 1H) ppm; $^{13}$C-NMR (100 MHz, DMSO-d$_6$): δ = 168.5, 164.4, 154.1, 153.0, 151.5, 146.3, 144.5, 134.7, 131.8, 130.7, 128.1, 123.3, 115.1, 110.5, 104.0, 99.9, 94.1, 55.7, 54.6, 37.3, 21.1 ppm; MS: $m/z$ (%)= 445 (M$^+$, 100%); Found: C, 64.83; H, 4.38; N, 9.36% C$_{24}$H$_{19}$N$_3$O$_6$; requires: C, 64.72; H, 4.30; N, 9.43%.

7-(3,4-dichlorophenyl)-2,3-dimethoxy-11-methyl-6H,7H-chromeno[4,3-d]pyrido[1,2-a]pyrimidin-6-one (Table 2, Product d$_{19}$): White powder, m.p.: >300 ºC; $^1$H-NMR (400 MHz, DMSO-d$_6$): δ = 2.33 (s, 3H), 3.66 (s, 3H, OCH$_3$), 3.77 (s, 3H, OCH$_3$), 6.19 (s, 1H, CH), 6.63 (s, 1H), 6.76 (s, 1H), 7.07 (d, $J$ = 8.4 Hz, 1H), 7.31 (s, 1H), 7.63 (d, $J$ = 7.8 Hz, 1H), 7.84 (d, $J$ = 8.4 Hz, 1H), 8.01-8.05 (m, 2H) ppm; $^{13}$C-NMR (100 MHz, DMSO-d$_6$): δ = 166.5, 161.3, 153.0, 152.2, 151.4, 150.3, 149.3, 148.6, 144.2, 134.8, 131.3, 128.7, 128.1, 127.7, 123.2, 114.2, 109.0, 102.7, 100.2, 93.4, 55.6, 54.4, 35.6, 21.2 ppm; MS: $m/z$ (%)= 469 (M$^+$, 100%); Found: C, 61.33; H, 3.81; N, 5.88% C$_{24}$H$_{18}$Cl$_2$N$_2$O$_4$; requires: C, 61.42; H, 3.87; N, 5.97%.

7-(3,4-dimethoxyphenyl)-2,3-dimethoxy-11-methyl-6H,7H-chromeno[4,3-d]pyrido[1,2-a]pyrimidin-6-one (Table 2, Product d$_{20}$): White powder, m.p.: >300 ºC; $^1$H-NMR (400 MHz, DMSO-d$_6$): δ = 2.32 (s, 3H, CH$_3$), 3.66 (s, 3H, OCH$_3$), 3.76 (s, 3H, OCH$_3$), 3.73 (s, 3H, OCH$_3$), 3.81 (s, 3H, OCH$_3$), 6.07 (s, 1H, CH), 6.63 (s, 1H), 6.75 (s, 1H), 6.84 (d, $J$ = 7.8 Hz, 1H), 6.97 (d, $J$ = 7.8 Hz, 1H), 7.04 (s, 1H), 7.07 (d, $J$ = 8.4 Hz, 1H), 7.31 (s, 1H), 7.83 (d, $J$ = 8.4 Hz, 1H) ppm; $^{13}$C-NMR (100 MHz, DMSO-d$_6$): δ = 166.9, 161.1, 157.2, 156.5, 153.2, 152.4, 150.0, 148.7, 144.1, 132.7, 127.3, 124.4, 115.4, 114.1, 112.3, 111.4, 109.2, 103.7, 98.7, 92.2, 56.1, 55.8, 55.4, 54.7, 34.3, 21.1 ppm; MS: $m/z$ (%)= 460 (M$^+$), 459 (100%); Found: C, 67.74; H, 5.16; N, 6.03% C$_{26}$H$_{24}$N$_2$O$_6$; requires: C, 67.82; H, 5.25; N, 6.08%.
7-(3,5-dimethoxyphenyl)-2,3-dimethoxy-11-methyl-6H,7H-chromeno[4,3-d]pyrido[1,2-a]pyrimidin-6-one (Table 2, Product d21): White powder, m.p.: >300 °C; $^1$H-NMR (400 MHz, DMSO-$d_6$): $\delta = 2.32$ (s, 3H, CH$_3$), 3.68 (s, 3H, OCH$_3$), 3.75 (s, 3H, OCH$_3$), 3.88 (s, 6H, OCH$_3$), 6.14 (s, 1H, CH), 6.53 (s, 1H), 6.64 (s, 1H), 6.67 (s, 2H), 6.76 (s, 1H), 6.84 (d, $J = 7.8$ Hz, 1H), 6.97 (d, $J = 7.8$ Hz, 1H), 7.04 (s, 1H), 7.07 (d, $J = 8.4$ Hz, 1H), 7.32 (s, 1H), 7.84 (d, $J = 8.4$ Hz, 1H) ppm; $^{13}$C-NMR (100 MHz, DMSO-$d_6$): $\delta = 166.1, 161.0, 158.1, 153.3, 152.2, 150.1, 148.9, 144.0, 133.7, 124.4, 115.5, 114.7, 114.3, 109.2, 103.9, 102.2, 98.8, 92.1, 56.8, 55.7, 54.5, 35.7, 21.1$ ppm; MS: $m/z$ (%)= 460 (M$^+$), 459 (100%); Found: C, 67.72; H, 5.17; N, 5.98% C$_{26}$H$_{24}$N$_2$O$_6$; requires: C, 67.82; H, 5.25; N, 6.08%.
Figure S1: $^1$H-NMR spectra of 7-Phenyl-6H,7H-chromeno[4,3-d]pyrido[1,2-a]pyrimidin-6-one
Figure S2: $^{13}$C-NMR spectra of 7-Phenyl-6H,7H-chromeno[4,3-d]pyrido[1,2-a]pyrimidin-6-one
**Figure S3:** MASS spectra of 7-Phenyl-6H,7H-chromeno[4,3-d]pyrido[1,2-a]pyrimidin-6-one
**Figure S4:** $^1$H-NMR spectra of 7-(p-tolyl)-6H,7H-chromeno[4,3-d]pyrido[1,2-a]pyrimidin-6-one

**Figure S5:** $^{13}$C-NMR spectra of 7-(p-tolyl)-6H,7H-chromeno[4,3-d]pyrido[1,2-a]pyrimidin-6-one
Figure S6: MASS spectra of 7-(p-tolyl)-6H,7H-chromeno[4,3-d]pyrido[1,2-a]pyrimidin-6-one
Figure S7: $^1$H-NMR spectra of 7-(4-methoxyphenyl)-6H,7H-chromeno[4,3-d]pyrido[1,2-a]pyrimidin-6-one
Figure S8: $^{13}$C-NMR spectra of 7-(4-methoxyphenyl)-6H,7H-chromeno[4,3-d]pyrido[1,2-a]pyrimidin-6-one
**Figure S9**: MASS spectra of 7-(4-methoxyphenyl)-6H,7H-chromeno[4,3-d]pyrido[1,2-a]pyrimidin-6-one
Figure S10: $^1$H-NMR spectra of 7-(3,4,5-trimethoxyphenyl)-6H,7H-chromeno[4,3-d]pyrido[1,2-a]pyrimidin-6-one
Figure S11: $^{13}$C-NMR spectra of 7-(3,4,5-trimethoxyphenyl)-6H,7H-chromeno[4,3-d]pyrido[1,2-a]pyrimidin-6-one
Figure S12: MASS spectra of 7-(3,4,5-trimethoxyphenyl)-6H,7H-chromeno[4,3-d]pyrido[1,2-a]pyrimidin-6-one
Figure S13: $^1$H-NMR spectra of 7-(2-fluorophenyl)-6H,7H-chromeno[4,3-d]pyrido[1,2-a]pyrimidin-6-one
Figure S14: $^{13}$C-NMR spectra of 7-(2-fluorophenyl)-6H,7H-chromeno[4,3-d]pyrido[1,2-a]pyrimidin-6-one
Figure S15: MASS spectra of 7-(2-fluorophenyl)-6H,7H-chromeno[4,3-d]pyrido[1,2-a]pyrimidin-6-one
Figure S16: $^1$H-NMR spectra of 7-(2-methoxyphenyl)-6H,7H-chromeno[4,3-d]pyrido[1,2-a]pyrimidin-6-one
Figure S17: $^{13}$C-NMR spectra of 7-(2-methoxyphenyl)-6H,7H-chromeno[4,3-d]pyrido[1,2-a]pyrimidin-6-one
Figure S18: MASS spectra of 7-(2-methoxyphenyl)-6H,7H-chromeno[4,3-d]pyrido[1,2-a]pyrimidin-6-one
Figure S37: $^1$H-NMR spectra of 2,3-dimethoxy-11-methyl-7-phenyl-6H,7H-chromeno[4,3-d]pyrido[1,2-a]pyrimidin-6-one
Figure S₃₈: $^{13}$C-NMR spectra of 2,3-dimethoxy-11-methyl-7-phenyl-6H,7H-chromeno[4,3-d]pyrido[1,2-a]pyrimidin-6-one
**Figure S39:** MASS spectra of 2,3-dimethoxy-11-methyl-7-phenyl-6H,7H-chromeno[4,3-d]pyrido[1,2-a]pyrimidin-6-one
Figure S40: $^1$H-NMR spectra of 2,3-dimethoxy-11-methyl-7-(p-tolyl)-6H,7H-chromeno[4,3-d]pyrido[1,2-a]pyrimidin-6-one
Figure S41: $^{13}$C-NMR spectra of 2,3-dimethoxy-11-methyl-7-(p-tolyl)-6H,7H-chromeno[4,3-d]pyrido[1,2-a]pyrimidin-6-one
Figure S42: MASS spectra of 2,3-dimethoxy-11-methyl-7-(p-tolyl)-6H,7H-chromeno[4,3-d]pyrido[1,2-a]pyrimidin-6-one
Figure S43: $^1$H-NMR spectra of 2,3-dimethoxy-7-(4-methoxyphenyl)-11-methyl-6H,7H-chromeno[4,3-d]pyrido[1,2-a]pyrimidin-6-one
Figure S44: $^{13}$C-NMR spectra of 2,3-dimethoxy-7-(4-methoxyphenyl)-11-methyl-6H,7H-chromeno[4,3-d]pyrido[1,2-a]pyrimidin-6-one
Figure S45: MASS spectra of 2,3-dimethoxy-7-(4-methoxyphenyl)-11-methyl-6H,7H-chromeno[4,3-d]pyrido[1,2-a]pyrimidin-6-one
Figure S46: $^1$H-NMR spectra of 7-(4-chlorophenyl)-2,3-dimethoxy-11-methyl-6H,7H-chromeno[4,3-d]pyrido[1,2-a]pyrimidin-6-one
Figure S47: $^{13}$C-NMR spectra of 7-(4-chlorophenyl)-2,3-dimethoxy-11-methyl-6H,7H-chromeno[4,3-d]pyrido[1,2-a]pyrimidin-6-one
Figure S48: MASS spectra of 7-(4-chlorophenyl)-2,3-dimethoxy-11-methyl-6H,7H-chromeno[4,3-d]pyrido[1,2-a]pyrimidin-6-one
Figure S49: $^1$H-NMR spectra of 7-(4-bromophenyl)-2,3-dimethoxy-11-methyl-6H,7H-chromeno[4,3-d]pyrido[1,2-a]pyrimidin-6-one
Figure S50: $^{13}$C-NMR spectra of 7-(4-bromophenyl)-2,3-dimethoxy-11-methyl-6H,7H-chromeno[4,3-d]pyrido[1,2-a]pyrimidin-6-one
Figure S51: MASS spectra of 7-(4-bromophenyl)-2,3-dimethoxy-11-methyl-6H,7H-chromeno[4,3-d]pyrido[1,2-a]pyrimidin-6-one
**Figure S52:** $^1$H-NMR spectra of 2,3-dimethoxy-11-methyl-7-(4-nitrophenyl)-6H,7H-chromeno[4,3-d]pyrido[1,2-a]pyrimidin-6-one
Figure S53: $^{13}$C-NMR spectra of 2,3-dimethoxy-11-methyl-7-(4-nitrophenyl)-6H,7H-chromeno[4,3-d]pyrido[1,2-a]pyrimidin-6-one
**Figure S54:** MASS spectra of 2,3-dimethoxy-11-methyl-7-(4-nitrophenyl)-6H,7H-chromeno[4,3-d]pyrido[1,2-a]pyrimidin-6-one
Figure S55: $^1$H-NMR spectra of 7-(3,4-dichlorophenyl)-2,3-dimethoxy-11-methyl-6H,7H-chromeno[4,3-d]pyrido[1,2-a]pyrimidin-6-one
Figure S56: $^{13}$C-NMR spectra of 7-(3,4-dichlorophenyl)-2,3-dimethoxy-11-methyl-6H,7H-chromeno[4,3-d]pyrido[1,2-a]pyrimidin-6-one
Figure S57: MASS spectra of 7-(3,4-dichlorophenyl)-2,3-dimethoxy-11-methyl-6H,7H-chromeno[4,3-d]pyrido[1,2-a]pyrimidin-6-one
Figure S58: $^1$H-NMR spectra of 7-(3,4-dimethoxyphenyl)-2,3-dimethoxy-11-methyl-6H,7H-chromeno[4,3-d]pyrido[1,2-a]pyrimidin-6-one
Figure S59: $^{13}$C-NMR spectra of 7-(3,4-dimethoxyphenyl)-2,3-dimethoxy-11-methyl-6H,7H-chromeno[4,3-d]pyrido[1,2-a]pyrimidin-6-one
Figure S60: MASS spectra of 7-(3,4-dimethoxyphenyl)-2,3-dimethoxy-11-methyl-6H,7H-chromeno[4,3-d]pyrido[1,2-a]pyrimidin-6-one
Figure S61: $^1$H-NMR spectra of 7-(3,5-dimethoxyphenyl)-2,3-dimethoxy-11-methyl-6H,7H-chromeno[4,3-d]pyrido[1,2-a]pyrimidin-6-one
Figure S62: $^{13}$C-NMR spectra of 7-(3,5-dimethoxyphenyl)-2,3-dimethoxy-11-methyl-6H,7H-chromeno[4,3-d]pyrido[1,2-a]pyrimidin-6-one
Figure S63: MASS spectra of 7-(3,5-dimethoxyphenyl)-2,3-dimethoxy-11-methyl-6H,7H-chromeno[4,3-d]pyrido[1,2-a]pyrimidin-6-one
Figure S64: $^1$H-NMR spectra of 2,3-dimethoxy-11-methyl-7-(3,4,5-trimethoxyphenyl)-6H,7H-chromeno[4,3-d]pyrido[1,2-a]pyrimidin-6-one
Figure S65: $^{13}$C-NMR spectra of 2,3-dimethoxy-11-methyl-7-(3,4,5-trimethoxyphenyl)-6H,7H-chromeno[4,3-d]pyrido[1,2-a]pyrimidin-6-one
Figure S66: MASS spectra of 2,3-dimethoxy-11-methyl-7-(3,4,5-trimethoxyphenyl)-6H,7H-chromeno[4,3-d]pyrido[1,2-a]pyrimidin-6-one