Supporting Information

Metal-Free, Visible-Light-Mediated Desulfurization and Aromatization of Dihydropyrimidin-2-thiones for Synthesis of 2-Unsubstituted Pyrimidines

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1. General

$^1$H NMR and $^{13}$C NMR data analyses were performed with a Varian Mercury plus-400 instrument and plus-600 instrument unless otherwise specified. Dual-beam infrared spectrophotometer CDCl$_3$ as solvent and tetramethylsilane (TMS) as the internal standard were employed. Chemical shifts were reported in units (ppm) by assigning TMS resonance in the 1H NMR spectrum as 0.00 ppm. The data of 1H NMR was reported as follows: chemical shift, multiplicity ($s =$ singlet, $d =$ doublet, $t =$ triplet, $m =$multiplet and $br =$ broad), coupling constant ($J$ values) in Hz and integration. Chemical shift for $^{13}$C NMR spectra were recorded in ppm from TMS using the central peak of CDCl$_3$ (77.0 ppm) as the internal standard. Flash chromatography was performed using 200-300 mesh silica gel with the indicated solvent system according to standard techniques. Analytical thin-layer chromatography (TLC) was performed on pre-coated, glass-backed silica gel plates. Melting points were measured with an XT-4 apparatus. High-resolution mass spectra (HRMS) (ESI) were obtained with a Bruker Daltonics APEX II 47e and Orbitrap Elite mass spectrometer. Column chromatography was generally performed on silica gel (200–300 mesh) and TLC analyses were conducted on silica gel GF254 plates.
2. Experimental details and characterization data for all compounds.

2.1 General procedures for preparation of substrates 1a (Scheme 1).
To the mixture of Benzaldehyde (6.3672 g, 60 mmol), Ethyl acetoacetate (7.8084 g, 60 mmol), thiocarbamide (5.480g, 72 mmol) in CH$_3$CH$_2$OH (15.0 mL) was added 20 drops 98% H$_2$SO$_4$ in 100mL round-bottom flask. The reaction mixture was heated to 80 °C and stirred for 8 h. Extracting by Buchner funnel and dried white solid (Scheme 1).

![Scheme 1: Synthesis of intermediate product 1a.](image)

2.2 General procedure for the synthesis of 3a (Scheme 2).
6-methyl-4-phenyl-2-thioxo-1,2,3,4-tetrahydropyrimidine-5-carboxylate 1a (0.276g, 1 mmol), eosin B 2 (0.012g, 0.02 mmol) , DMF (3mL) was added to an oven-dried tube. The reaction mixture at room temperature with 15W blue light and stirred for 12 h and the reaction was monitored by TLC analysis. Then, the reaction mixture was quenched with saturated aqueous NH$_4$Cl solution (3mL) and extracted with ethyl acetate (3×15 mL). The organic layers were combined, washed with brine, and dried over MgSO$_4$. The crude product was purified via silica gel column using Petroleum Ether/EtOAc (v/v 1:15) as eluent to give the corresponding product 3a.

![Scheme 2. Synthesis of desulfurization aromatization derivative 3a.](image)
2.3 Characterization Data for the Isolated Products.

**Ethyl 4-methyl-6-phenylpyrimidine-5-carboxylate (3a).** Yellow oil. (194mg, 0.80mmol, yield 80%). $^1$H NMR (600 MHz, CDCl$_3$) $\delta$ 9.15 (s, 1H), 7.65 (d, $J$ = 7.6 Hz, 2H), 7.46 (d, $J$ = 7.4 Hz, 2H), 4.20 (q, $J$ = 7.2 Hz, 2H), 2.63 (s, 3H), 1.08 (t, $J$ = 7.2 Hz, 3H). $^{13}$C NMR (100 MHz, CDCl$_3$) $\delta$ 167.67, 164.95, 163.20, 158.06, 137.53, 130.13, 128.58, 128.26, 125.95, 61.93, 22.56, 13.62. HRMS (ESI$^+$) m/z: Calcd for C$_{14}$H$_{14}$N$_2$O$_2$ 243.1128 [M+H]$^+$, Found 243.1123.

**Ethyl 4-methyl-6-(o-tolyl)pyrimidine-5-carboxylate (3b).** Brown oil. (211mg, 0.82mmol, yield: 82%). $^1$H NMR (600 MHz, CDCl$_3$) $\delta$ 9.15 (s, 1H), 7.29 (d, $J$ = 7.6 Hz, 2H), 7.23 – 7.09 (m, 2H), 4.04 (q, $J$ = 7.2 Hz, 2H), 2.66 (s, 3H), 2.22 (s, 3H), 0.90 (t, $J$ = 7.2 Hz, 3H). $^{13}$C NMR (150 MHz, CDCl$_3$) $\delta$ 166.72, 165.44, 165.09, 157.75, 137.25, 135.77, 130.38, 129.18, 128.01, 127.26, 125.48, 61.61, 22.75, 19.51, 13.40. HRMS (ESI$^+$) m/z: Calcd for C$_{15}$H$_{16}$N$_2$O$_2$ 257.1285 [M+H]$^+$, Found 257.1283.

**Ethyl 4-methyl-6-(m-tolyl)pyrimidine-5-carboxylate (3c).** Yellow oil. (198mg, 0.77mmol, yield: 77%). $^1$H NMR (600 MHz, CDCl$_3$) $\delta$ 9.14 (s, 1H), 7.52 – 7.45 (m, 1H), 7.44 – 7.39 (m, 1H), 7.33 (t, $J$ = 7.6 Hz, 1H), 7.30 – 7.27 (m, 1H), 4.22 (q, $J$ = 7.1 Hz, 2H), 2.62 (s, 3H), 2.42 – 2.38 (m, 3H), 1.10 (t, $J$ = 7.2 Hz, 2H). $^{13}$C NMR (150 MHz, CDCl$_3$) $\delta$ 167.72, 164.84, 163.33, 158.01, 138.40, 137.42, 130.91, 128.90, 128.45, 125.96, 125.33, 61.90, 22.55, 21.36, 13.64. HRMS (ESI$^+$) m/z: Calcd for C$_{15}$H$_{16}$N$_2$O$_2$ 257.1285 [M+H]$^+$, Found 257.1288.
Ethyl 4-methyl-6-(p-tolyl)pyrimidine-5-carboxylate (3d). Green oil. (195mg, 0.76mmol, yield: 76%). \(^1\)H NMR (600 MHz, CDCl\(_3\)) \(\delta\) 9.13 (s, 1H), 7.57 (d, \(J = 8.2\) Hz, 2H), 7.27 – 7.24 (m, 2H), 4.24 (q, \(J = 7.2\) Hz, 2H), 2.61 (s, 3H), 2.41 (s, 3H), 1.13 (t, \(J = 7.2\) Hz, 3H). \(^{13}\)C NMR (150 MHz, CDCl\(_3\)) \(\delta\) 167.89, 164.72, 163.02, 158.01, 140.49, 134.62, 129.31, 128.25, 125.75, 61.90, 22.53, 21.37, 13.70. HRMS (ESI\(^+\)) m/z: Calcd for C\(_{15}\)H\(_{16}\)N\(_2\)O\(_2\) 257.1285 [M+H]\(^+\), Found 257.1280.

![Ethyl 4-methyl-6-(p-tolyl)pyrimidine-5-carboxylate (3d).](image)

Ethyl 4-(4-fluorophenyl)-6-methylpyrimidine-5-carboxylate (3e). Bright yellow oil. (178mg, 0.68mmol, yield: 68%). \(^1\)H NMR (400 MHz, CDCl\(_3\)) \(\delta\) 9.14 (s, 1H), 7.69-7.66 (m, 2H), 7.16 (t, \(J = 8.6\) Hz, 2H), 4.24 (q, \(J = 7.2\) Hz, 2H), 2.63 (s, 3H), 1.14 (t, \(J = 7.2\) Hz, 3H). \(^{13}\)C NMR (150 MHz, CDCl\(_3\)) \(\delta\) 167.62, 165.05, 161.92, 158.04, 130.47, 115.68, 115.66, 109.99, 62.05, 22.57, 13.72. HRMS (ESI\(^+\)) m/z: Calcd for C\(_{14}\)H\(_{13}\)FNO\(_2\) 261.1034 [M+H]\(^+\), Found 261.1036.

![Ethyl 4-(4-fluorophenyl)-6-methylpyrimidine-5-carboxylate (3e).](image)

Ethyl 4-(4-chlorophenyl)-6-methylpyrimidine-5-carboxylate (3f). Bright yellow oil. (208mg, 0.75mmol, yield: 75%). \(^1\)H NMR (600 MHz, CDCl\(_3\)) \(\delta\) 9.14 (s, 1H), 7.61 (d, \(J = 7.8\) Hz, 2H), 7.44 (d, \(J = 8.4\) Hz, 2H), 4.24 (q, \(J = 7.2\) Hz, 2H), 2.63 (s, 3H), 1.15 (t, \(J = 7.2\) Hz, 3H). \(^{13}\)C NMR (150 MHz, CDCl\(_3\)) \(\delta\) 167.49, 165.05, 161.92, 158.04, 130.47, 115.68, 115.70, 62.09, 22.57, 13.72. HRMS (ESI\(^+\)) m/z: Calcd for C\(_{14}\)H\(_{13}\)ClNO\(_2\) 277.0738 [M+H]\(^+\), Found 277.0742.

![Ethyl 4-(4-chlorophenyl)-6-methylpyrimidine-5-carboxylate (3f).](image)

Ethyl 4-(3-chlorophenyl)-6-methylpyrimidine-5-carboxylate (3g). Yellow oil. (211mg, 0.76mmol, yield: 76%). \(^1\)H NMR (600 MHz, CDCl\(_3\)) \(\delta\) 9.14 (s, 1H), 7.58 (d, \(J = 9.0\) Hz, 1H), 7.49 – 7.31 (m, 2H), 4.24 (q, \(J = 7.2\) Hz, 2H), 2.62 (s, 3H), 1.13 (t, \(J = 7.2\) Hz, 3H). \(^{13}\)C NMR (150 MHz, CDCl\(_3\)) \(\delta\) 167.26, 165.28, 161.61, 158.11, 139.14, 134.67, 130.17, 129.84, 128.47, 126.44, 125.96, 62.13, 22.60, 13.68. HRMS (ESI\(^+\)) m/z: Calcd for C\(_{14}\)H\(_{13}\)ClNO\(_2\) 277.0738 [M+H]\(^+\), Found 277.0741.
**Ethyl 4-(4-bromophenyl)-6-methylpyrimidine-5-carboxylate (3h).** Yellow oil. (234mg, 0.73mmol, yield: 73%). $^1$H NMR (600 MHz, CDCl$_3$) δ 9.14 (s, 1H), 7.59 (d, $J = 8.4$ Hz, 2H), 7.53 (d, $J = 8.4$ Hz, 2H), 4.23 (q, $J = 7.2$ Hz, 2H), 2.62 (s, 3H), 1.14 (t, $J = 7.2$ Hz, 3H).$^{13}$C NMR (150 MHz, CDCl$_3$) δ 167.46, 165.19, 161.89, 158.11, 136.36, 131.82, 129.91, 125.78, 124.93, 62.11, 22.59, 13.72. HRMS (ESI$^+$) m/z: Calcd for C$_{14}$H$_{13}$BrN$_2$O$_2$ 321.0233 [M+H]$^+$, Found 321.0229.

**Ethyl 4-(2-methoxyphenyl)-6-methylpyrimidine-5-carboxylate (3i).** Yellow oil. (123mg, 0.45mmol, yield: 45%).$^1$H NMR (600 MHz, CDCl$_3$) δ 9.14 (s, 1H), 7.52 – 7.37 (m, 2H), 7.08 – 6.87 (m, 2H), 4.11 – 4.07 (m, 2H), 3.74 – 3.73 (m, 3H), 2.69 – 2.67 (m, 3H), 1.06 – 0.95 (m, 3H).$^{13}$C NMR (150 MHz, CDCl$_3$) δ 166.60, 165.23, 162.69, 158.23, 156.27, 131.11, 130.49, 127.31, 126.68, 120.93, 110.30, 61.18, 55.12, 23.27, 13.53. HRMS (ESI$^+$) m/z: Calcd for C$_{15}$H$_{16}$N$_2$O$_3$ 273.1234 [M+H]$^+$, Found 273.1229.

**Ethyl 4-(3-methoxyphenyl)-6-methylpyrimidine-5-carboxylate (3j).** Yellow oil. (120mg, 0.44mol, yield: 44%). $^1$H NMR (600 MHz, CDCl$_3$) δ 9.14 (s, 1H), 7.35 (d, $J = 7.6$ Hz, 1H), 7.24 – 7.17 (m, 2H), 7.02 (s, 1H), 4.24- 4.21 (m, 2H), 3.84 (d, $J = 6.0$ Hz, 3H), 2.65 – 2.59 (m, 3H), 1.11 (d, $J = 6.0$ Hz, 3H).$^{13}$C NMR (150 MHz, CDCl$_3$) δ 167.64, 164.89, 162.97, 159.77, 158.01, 138.78, 129.63, 126.04, 120.60, 116.41, 113.28, 61.97, 55.35, 22.54, 13.66. HRMS (ESI$^+$) m/z: Calcd for C$_{15}$H$_{16}$N$_2$O$_3$ 273.1234 [M+H]$^+$, Found 273.1237.
**Ethyl 4-(4-methoxyphenyl)-6-methylpyrimidine-5-carboxylate (3k).** Yellow oil. (109mg, 0.40mmol, yield: 40%). \(^1^H\)NMR (600 MHz, CDCl\(_3\)) \(\delta\) 9.09 (s, 1H), 7.64 (d, \(J = 8.6\) Hz, 2H), 6.95 (d, \(J = 8.6\) Hz, 2H), 4.24 (q, \(J = 7.1\) Hz, 2H), 3.84 (s, 3H), 2.58 (s, 3H), 1.15 (t, \(J = 7.2\) Hz, 3H). \(^{13}\)C NMR (150MHz, CDCl\(_3\)) \(\delta\) 168.07 , 164.62 , 162.34 , 161.39 , 157.93 , 129.97 , 129.76 , 125.36, 114.05 , 61.91 , 55.35 , 22.50 , 13.78 .HRMS (ESI\(^*\))m/z: Calcd for C\(_{15}\)H\(_{16}\)N\(_2\)O\(_3\) 273.1234 [M+H]\(^+\), Found 273.1231.

**1-(4-methyl-6-phenylpyrimidin-5-yl)ethanone (3l).** Yellow oil. (188mg, 0.88mmol, yield: 88%). \(^1^H\)NMR (600 MHz, CDCl\(_3\)) \(\delta\) 9.13 (s, 1H), 7.61 (d, \(J = 7.2\) Hz, 2H), 7.50-7.49 (m, 2H), 2.53 (s, 3H), 2.06 (s, 3H). \(^{13}\)C NMR (150MHz,CDCl\(_3\)) \(\delta\) 204.18 , 163.61, 161.67 , 157.82 , 137.18 , 133.12 , 130.61 , 129.00 , 128.91 , 31.80 , 22.40. HRMS (ESI\(^*\)) m/z: Calcd for C\(_{13}\)H\(_{12}\)N\(_2\)O 213.1022 [M+H]\(^+\), Found 213.1018.

**isopropyl 4-methyl-6-phenylpyrimidine-5-carboxylate (3m).** Yellow oil. (185mg, 0.72mmol, yield: 72%). \(^1^H\)NMR (600 MHz, CDCl\(_3\)) \(\delta\) 9.13 (s, 1H), 7.63-7.63(m, 2H), 7.45-7.30 (m, 3H), 5.09 (t, \(J = 6.0\) Hz ,1H), 2.61 (s, 3H), 1.08 (d, \(J = 6.0\) Hz, 6H). \(^{13}\)C NMR (150 MHz,CDCl\(_3\)) \(\delta\) 167.09 , 164.66 , 163.06 , 157.94 , 137.52 , 130.03 , 128.53 , 128.32 , 126.37 , 69.87 , 22.45 , 21.26. HRMS (ESI\(^*\)) m/z: Calcd for C\(_{15}\)H\(_{16}\)N\(_2\)O 257.1285 [M+H]\(^+\), Found 257.1287.

**Methyl 4-methyl-6-phenylpyrimidine-5-carboxylate (3n).** Yellow oil. (195mg, 0.85mmol, yield: 85%). \(^1^H\)NMR (600 MHz, CDCl\(_3\)) \(\delta\) 9.15 (s, 1H), 7.65-7.64 (m, 2H), 7.47 – 7.45 (m, 3H), 3.72 (s, 3H), 2.61 (s, 3H). \(^{13}\)C NMR (150 MHz,CDCl\(_3\)) \(\delta\) 168.25 , 165.02 , 163.06 , 158.16 , 137.41 , 130.25 , 128.57 , 128.16 , 52.65 , 22.60. HRMS (ESI\(^*\)) m/z: Calcd for C\(_{13}\)H\(_{12}\)N\(_2\)O 229.0972 [M+H]\(^+\), Found 229.0975.
Methyl 4-(4-chlorophenyl)-6-methylpyrimidine-5-carboxylate (3o). Yellow oil. (181mg, 0.69mmol, yield: 69%). $^1$H NMR (600 MHz, CDCl$_3$) $\delta$ 9.15 (s, 1H), 7.61 (d, $J = 8.4$ Hz, 2H), 7.45 (d, $J = 9.0$ Hz, 2H), 3.76 (s, 3H), 2.62 (s, 3H). $^{13}$C NMR (150 MHz, CDCl$_3$) $\delta$ 168.07, 165.27, 161.79, 158.21, 136.71, 135.82, 129.59, 128.98, 125.47, 52.81, 22.63. HRMS (ESI$^+$) m/z: Calcd for C$_{13}$H$_{11}$ClN$_2$O$_2$ 263.0582 [M+H]$^+$, Found 263.0577.

Methyl 4-(4-fluorophenyl)-6-methylpyrimidine-5-carboxylate (3o). Yellow oil. (183mg, 0.74mmol, yield: 74%). $^1$H NMR (600 MHz, CDCl$_3$) $\delta$ 9.14 (s, 1H), 7.68 – 7.66 (m, 2H), 7.17 – 7.14 (m, 2H), 3.76 (s, 3H), 2.61 (s, 3H). $^{13}$C NMR (150 MHz, CDCl$_3$) $\delta$ 168.19, 166.49, 165.15, 161.86, 158.15, 130.37, 130.32, 115.93, 115.78, 52.76, 22.62. HRMS (ESI$^+$) m/z: Calcd for C$_{13}$H$_{11}$FNN$_2$O$_2$ 247.0877 [M+H]$^+$, Found 247.0874.

Methyl 4-(4-bromophenyl)-6-methylpyrimidine-5-carboxylate (3q). Yellow oil. (233mg, 0.76mmol, yield: 76%). $^1$H NMR (600 MHz, CDCl$_3$) $\delta$ 9.14 (s, 1H), 7.60 (d, $J = 8.4$ Hz, 2H), 7.53 (d, $J = 8.4$ Hz, 2H), 3.75 (s, 3H), 2.61 (s, 3H). $^{13}$C NMR (150 MHz, CDCl$_3$) $\delta$ 168.05, 165.30, 161.84, 158.22, 136.26, 131.94, 129.80, 125.43, 125.10, 52.84, 22.64. HRMS (ESI$^+$) m/z: Calcd for C$_{13}$H$_{11}$BrN$_2$O$_2$ 307.0077 [M+H]$^+$, Found 307.0082.
**Methyl 4-methyl-6-(p-tolyl)pyrimidine-5-carboxylate (3r).** Yellow oil. (201mg, 0.83mmol, yield: 83%). ¹H NMR (600 MHz, CDCl₃) δ 9.12 (s, 1H), 7.56 (d, J = 8.4 Hz, 2H), 7.26 (d, J = 8.4 Hz, 2H), 3.74 (s, 3H), 2.59 (s, 3H), 2.40 (s, 3H). ¹³C NMR (150 MHz,CDCl₃) δ 168.48, 164.83, 162.91, 158.11, 140.63, 134.51, 129.43, 128.15, 125.37, 52.67, 22.58, 21.39. HRMS (ESI⁺) m/z: Calcd for C₁₄H₁₄N₂O₂ 242.1055 [M+H]⁺, Found 242.1051.

![Methyl 4-methyl-6-(p-tolyl)pyrimidine-5-carboxylate (3r)](image)

**Ethyl 4-isopropyl-6-phenylpyrimidine-5-carboxylate (3s).** Yellow oil. (184mg, 0.68mmol, yield: 68%). ¹H NMR (600 MHz, CDCl₃) δ 9.23 (s, 1H), 7.53 – 7.51 (m, 2H), 7.46 – 7.42 (m, 3H), 4.20 (q, J = 7.2 Hz, 2H), 3.23-3.18 (m, 1H), 1.34 (d, J = 7.2 Hz, 6H), 1.08 (t, J = 7.2 Hz, 3H). ¹³C NMR (150 MHz,CDCl₃) δ 172.68, 167.78, 163.12, 158.42, 130.13, 128.55, 128.45, 128.30, 128.26, 61.90, 33.21, 21.72, 13.63. HRMS (ESI⁺) m/z: Calcd for C₁₆H₁₈N₂O₂ 271.1441 [M+H]⁺, Found 271.1436.

![Ethyl 4-isopropyl-6-phenylpyrimidine-5-carboxylate (3s)](image)

**Ethyl 4-isopropyl-6-(p-tolyl)pyrimidine-5-carboxylate (3t).** Yellow oil. (200mg, 0.70mmol, yield: 70%). ¹H NMR (600 MHz, CDCl₃) δ 9.20 (s, 1H), 7.57 (d, J = 8.4 Hz, 2H), 7.25 (d, J = 7.2 Hz, 2H), 4.23 (q, J = 7.2 Hz, 2H), 3.2-3.16 (m, 1H), 2.40 (s, 3H), 1.34 (s, 3H), 1.33 (s, 3H), 1.13 (t, J = 7.2 Hz, 3H). ¹³C NMR (150 MHz,CDCl₃) δ 172.48, 168.00, 162.97, 158.38, 140.31, 134.83, 129.28, 128.23, 125.06, 61.87, 33.20, 21.72, 21.36, 13.71. HRMS (ESI⁺) m/z: Calcd for C₁₇H₂₀N₂O₂ 285.1598 [M+H]⁺, Found 285.1596.

![Ethyl 4-isopropyl-6-(p-tolyl)pyrimidine-5-carboxylate (3t)](image)
3. References.


\(^1\)H and \(^{13}\)C Spectra of compound 3a (CDCl\(_3\), 600 MHz)

\(^1\)H NMR spectrum of compound 3a in CDCl\(_3\), 600 MHz

\(^{13}\)C NMR spectrum of compound 3a in CDCl\(_3\), 100 MHz.
$^1$H NMR spectrum of compound 3b in CDCl$_3$, 600 MHz

$^{13}$C NMR spectrum of compound 3b in CDCl$_3$, 150 MHz.
$^{13}$C NMR spectrum of compound 3c in CDCl$_3$, 150 MHz.

$^1$H NMR spectrum of compound 3c in CDCl$_3$, 600 MHz.
\(^1\)H NMR spectrum of compound 3d in CDCl\(_3\), 600 MHz.

\(^{13}\)C NMR spectrum of compound 3d in CDCl\(_3\), 150 MHz.
\(^1\)H NMR spectrum of compound 3e in CDCl\(_3\), 400 MHz.

\(^{13}\)C NMR spectrum of compound 3e in CDCl\(_3\), 150 MHz.
$^1$H NMR spectrum of compound 3f in CDCl$_3$, 600 MHz.

$^{13}$C NMR spectrum of compound 3f in CDCl$_3$, 150 MHz.
$^1$H NMR spectrum of compound 3g in CDCl$_3$, 600 MHz.

$^{13}$C NMR spectrum of compound 3g in CDCl$_3$, 150 MHz.
$^1$H NMR spectrum of compound 3h in CDCl$_3$, 600 MHz.

$^{13}$C NMR spectrum of compound 3h in CDCl$_3$, 150 MHz.
$^1$H NMR spectrum of compound 3i in CDCl$_3$, 600 MHz.

$^{13}$C NMR spectrum of compound 3i in CDCl$_3$, 150 MHz.
$^1$H NMR spectrum of compound 3j in CDCl$_3$, 600 MHz.

$^{13}$C NMR spectrum of compound 3j in CDCl$_3$, 150 MHz.
$^1$H NMR spectrum of compound 3k in CDCl$_3$, 600 MHz.

$^{13}$C NMR spectrum of compound 3k in CDCl$_3$, 150 MHz.
$^1$H NMR spectrum of compound 3l in CDCl$_3$, 600 MHz.

$^{13}$C NMR spectrum of compound 3l in CDCl$_3$, 150 MHz.
$^1$H NMR spectrum of compound 3m in CDCl$_3$, 600 MHz.

$^{13}$C NMR spectrum of compound 3m in CDCl$_3$, 150 MHz.
$^1$H NMR spectrum of compound 3n in CDCl$_3$, 600 MHz.

$^{13}$C NMR spectrum of compound 3n in CDCl$_3$, 150 MHz.
$^1$H NMR spectrum of compound 3o in CDCl$_3$, 600 MHz.

$^{13}$C NMR spectrum of compound 3o in CDCl$_3$, 150 MHz.
$^1$H NMR spectrum of compound 3p in CDCl$_3$, 600 MHz.

$^{13}$C NMR spectrum of compound 3p in CDCl$_3$, 150 MHz.
\[ ^1H \text{ NMR spectrum of compound 3q in CDCl}_3, 600 \text{ MHz}. \]

\[ ^{13}C \text{ NMR spectrum of compound 3q in CDCl}_3, 150 \text{ MHz}. \]
$^1$H NMR spectrum of compound 3r in CDCl$_3$, 600 MHz.

$^{13}$C NMR spectrum of compound 3r in CDCl$_3$, 150 MHz.
$^1$H NMR spectrum of compound 3s in CDCl$_3$, 600 MHz.

$^{13}$C NMR spectrum of compound 3s in CDCl$_3$, 150 MHz.
$^1$H NMR spectrum of compound 3t in CDCl$_3$, 600 MHz.

$^{13}$C NMR spectrum of compound 3t in CDCl$_3$, 150 MHz.