Supporting information

Iodine-Mediated Multicomponent Synthesis of 3-Sulfenylimidazo[1,2-a]pyridines from 2-Aminopyridines, Ketones, and Sulfonyl Hydrazides

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General Unless otherwise stated, all reactions were performed under air in a flame-dried reaction flask. Toluene, DCE, 1,4-Dioxane, CH$_3$CN and DMF were dried by calcium hydride and freshly distilled. DMSO and EtOH and were used without further purification. The other materials and solvents were purchased from Adamas-beta and other commercial suppliers, and used without additional purification. For chromatography, 200-300 mesh silica gel (Qingdao, China) was employed. $^1$NMR spectra were recorded on a Bruker Avance operating at for $^1$H NMR at 400 MHz, and $^{13}$C NMR at 100 MHz using TMS as internal standard. Mass spectroscopy data of the products were collected on an HRMS-TOF instrument or Waters TOFMS GCT Premier using EI or ESI ionization. Melting points were measured with WRR digital point apparatus and not corrected.

Typical Procedure for the Synthesis of 3-Sulfenylimidazo[1,2-a]pyridines

$$\begin{align*}
\text{R}^1\text{N} & + \text{R}^2\text{C} & + \text{R}^3\text{S} \text{NH}_2 & \xrightarrow{\text{I}_2 \text{ (0.5 equiv)}} & \text{R}^1\text{N} \text{R}^2\text{S} \text{NH}_2 & \xrightarrow{\text{PPh}_3 \text{ (2.0 equiv)}} & \text{DMSO, 100 °C, 12 h} & \text{R}^1\text{N} \text{R}^2\text{S} \text{NH}_2
\end{align*}$$

PPh$_3$ (157.4 mg, 0.6 mmol) and I$_2$ (38.1 mg, 0.15 mmol) were added to a solution of substrate 1 (0.3 mmol), 2 (0.42 mmol) and 3 (0.6 mmol) in DMSO (1 mL). The mixture was stirred at 100 °C under air for 12 h. After the completion of the reaction (monitored by TLC), the reaction mixture was cooled to ambient temperature, quenched by water and extracted with ethyl acetate (3 x 15 mL). The extract was washed with 10% Na$_2$S$_2$O$_3$ solution (w/w) (2 x 15 mL), dried over anhydrous Na$_2$SO$_4$ and the solvent was removed in vacuo to provide a crude product, which was purified by column chromatography on silica gel with petroleum ether/EtOAc as eluent to afford the product 4 or 5.

Synthesis of Compound 6

$$\begin{align*}
\text{N} & + \text{O} \xrightarrow{\text{NaHCO}_3 \text{ (1.5 equiv)}} & \text{EtOH, 80 °C} & \text{N}
\end{align*}$$

An oven-dried flask was charged with 2-aminopyridine (13 mmol), the 2-bromo-1-phenylethanone (10 mmol), NaHCO$_3$ (15 mmol), and EtOH (20 mL). The mixture was stirred at 80 °C under air for 3–4 h. After the completion of the reaction (monitored by TLC), the reaction mixture was cooled to ambient
temperature and 15 mL water was added to the mixture, then extracted by EtOAc for 3 times (3 × 30 mL). The combined extracts were washed with brine, dried over Na₂SO₄, and the solvent was removed in vacuo to provide a crude product, which was purified by column chromatography on silica gel with petroleum ether/EtOAc (3/1) as eluent to afford pure product.

**Radical Trapping Experiments**

![Radical trapping reaction scheme](image)

PPh₃ (157.4 mg, 0.6 mmol) and I₂ (38.1 mg, 0.15 mmol) were added to a solution of substrate 1a (28.2 mg, 0.3 mmol), 2a (50.4 mg, 0.42 mmol) and 3a (111.6 mg, 0.6 mmol) in DMSO (1 mL). The radical scavenger TEMPO (93.6 mg, 0.6 mmol) or BHT (132 mg, 0.6 mmol) or BQ (64.8 mg, 0.6 mmol) or 1,1-diphenylethylene (108 mg, 0.6 mmol) was added into the reaction, respectively. The mixture was stirred at 100 °C under air for 12 h. After the completion of the reaction (monitored by TLC), the reaction mixture was cooled to ambient temperature, quenched by water and extracted with ethyl acetate (3 x 15 mL). The extract was washed with 10% Na₂S₂O₃ solution (w/w) (2 x 15 mL), dried over anhydrous Na₂SO₄ and the solvent was removed in vacuo to provide a crude product, which was purified by column chromatography on silica gel with petroleum ether/EtOAc as eluent to afford the product in 0% or 69% or 71% or 64% yield, respectively.

**The Control Experiment**

![Control reaction scheme](image)

PPh₃ (157.4 mg, 0.6 mmol) and I₂ (38.1 mg, 0.15 mmol) were added to a solution of compound 6 (58.2 mg, 0.3 mmol) and 3a (111.6 mg, 0.6 mmol) in DMSO (1 mL). The mixture was stirred at 100 °C under air for 12 h. After the completion of the reaction (monitored by TLC), the reaction mixture was cooled to ambient temperature, quenched by water and extracted with ethyl acetate (3 x 15 mL). The extract was
washed with 10% Na₂S₂O₃ solution (w/w) (2 x 15 mL), dried over anhydrous Na₂SO₄ and the solvent was removed in vacuo to provide a crude product, which was purified by column chromatography on silica gel with petroleum ether/EtOAc as eluent to afford the product 4a in 89% yield.

**Characterization Data of the Corresponding Products**

2-phenyl-3-(p-tolylthio)imidazo[1,2-a]pyridine (4a)

Yield: 81%; 77.1 mg, white solid; m.p = 136-138 °C; ¹H NMR (CDCl₃, 400 MHz) δ (ppm) 8.28 (d, 1H, J = 6.8 Hz), 8.22 (d, 2H, J = 7.6 Hz), 7.72 (d, 1H, J = 9.2 Hz), 7.44 (t, 2H, J = 7.4 Hz), 7.38 (d, 1H, J = 7.2 Hz), 7.32 (t, 1H, J = 8 Hz), 7.02 (d, 2H, J = 8 Hz), 6.91 (d, 2H, J = 8 Hz), 6.86 (t, 1H, J = 6.8 Hz), 2.26 (s, 3H). ¹³C NMR (CDCl₃, 100 MHz) δ (ppm) 151.2, 147.0, 136.0, 133.4, 131.5, 130.2, 128.5, 128.4, 126.5, 124.5, 117.6, 113.0, 106.9, 20.9. HRMS (ES⁻-TOF) calcd for C₂₀H₁₈N₂S⁺ (M+H⁺): 317.1107, found: 317.1116.

8-methyl-2-phenyl-3-(p-tolylthio)imidazo[1,2-a]pyridine (4b)

Yield: 78%; 76.9 mg, white solid; m.p = 100-101 °C; ¹H NMR (CDCl₃, 400 MHz) δ (ppm) 8.20 (d, 2H, J = 7.6 Hz), 8.15 (d, 1H, J = 6.8 Hz), 7.43 (m, 2H), 7.37 (t, 1H, J = 6.6 Hz), 7.10 (d, 1H, J = 6.8 Hz), 7.02 (d, 2H, J = 7.6 Hz), 6.91 (m, 2H), 6.77 (t, 1H, J = 6.8 Hz), 2.27 (s, 3H), 2.26 (s, 3H). ¹³C NMR (CDCl₃, 100 MHz) δ (ppm) 150.8, 147.3, 135.9, 133.8, 131.9, 130.1, 128.5, 128.3, 127.7, 125.8, 125.3, 122.3, 112.9, 107.0, 20.9, 16.8. HRMS (ES⁻-TOF) calcd for C₂₁H₁₉N₂S⁺ (M+H⁺): 331.1263, found: 331.1274.
7-methyl-2-phenyl-3-(p-tolylthio)imidazo[1,2-a]pyridine (4c)

Yield: 65%; 64.7 mg, white solid; m.p = 130-131 °C; $^1$H NMR (CDCl$_3$, 400 MHz) δ (ppm) 8.20 (d, 2H, $J$ = 7.2 Hz), 8.14 (d, 1H, $J$ = 7.2 Hz), 7.48 (s, 1H), 7.43 (t, 2H, $J$ = 7.4 Hz), 7.36 (t, 1H, $J$ = 7.2 Hz), 7.02 (d, 2H, $J$ = 8.4 Hz), 6.90 (d, 2H, $J$ = 8.4 Hz), 6.68 (dd, 1H, $J_1$ = 7 Hz, $J_2$ = 1.4 Hz), 2.43 (s, 3H), 2.26 (s, 3H). $^{13}$C NMR (CDCl$_3$, 100 MHz) δ (ppm) 151.1, 147.4, 137.7, 135.9, 133.6, 131.8, 130.1, 128.4, 128.3, 128.2, 125.7, 123.7, 116.2, 115.5, 106.0, 21.4, 20.8. HRMS (ES$^+$-TOF) calcd for C$_{21}$H$_{19}$N$_2$S$^+$ (M+H$^+$): 331.1263, found: 331.1270.

6-methyl-2-phenyl-3-(p-tolylthio)imidazo[1,2-a]pyridine (4d)

Yield: 76%; 75.5 mg, white solid; m.p = 126-128 °C; $^1$H NMR (CDCl$_3$, 400 MHz) δ (ppm) 8.19 (d, 2H, $J$ = 6.4 Hz), 8.08 (s, 1H), 7.62 (d, 1H, $J$ = 8.4 Hz), 7.43 (m, 3H), 7.17 (d, 1H, $J$ = 8.4 Hz), 7.03 (d, 2H, $J$ = 6.4 Hz), 6.91 (d, 2H, $J$ = 6.4 Hz), 2.31 (s, 3H), 2.26 (s, 3H). $^{13}$C NMR (CDCl$_3$, 100 MHz) δ (ppm) 151.1, 146.1, 135.8, 133.6, 131.9, 130.2, 129.6, 128.3, 128.2, 125.6, 122.8, 122.2, 116.9, 106.2, 20.8, 18.4. HRMS (ES$^+$-TOF) calcd for C$_{21}$H$_{19}$N$_2$S$^+$ (M+H$^+$): 331.1263, found: 331.1274.

6-chloro-2-phenyl-3-(p-tolylthio)-2,3-dihydroimidazo[1,2-a]pyridine (4f)

Yield: 87%; 91.3 mg, white solid; m.p = 159-160 °C; $^1$H NMR (CDCl$_3$, 400 MHz) δ (ppm) 8.33 (d, 1H, $J$ =
1.2 Hz), 8.21 (d, 2H, \( J = 7.2 \) Hz), 7.66 (d, 1H, \( J = 9.6 \) Hz), 7.44 (t, 2H, \( J = 7.4 \) Hz), 7.39 (d, 1H, \( J = 7.2 \) Hz), 7.28 (dd, 1H, \( J_1 = 9.2 \) Hz, \( J_2 = 2 \) Hz), 7.04 (d, 2H, \( J = 8 \) Hz), 6.92 (d, 2H, \( J = 8.4 \) Hz), 2.27 (s, 3H). \(^{13}\)C NMR (CDCl₃, 100 MHz) \( \delta \) (ppm) 151.9, 145.3, 136.4, 133.0, 130.9, 130.3, 128.8, 128.5, 128.3, 127.9, 126.0, 122.5, 121.5, 118.0, 107.9, 20.9. HRMS (ES\(^+\)-TOF) calcd for \( \text{C}_{20}\text{H}_{16}\text{ClN}_2\text{S}^+ \) (M+H\(^+\)): 351.0717, found: 351.0725.

![Image of 6-iodo-2-phenyl-3-(p-tolylthio)-2,3-dihydroimidazo[1,2-a]pyridine (4g)]

6-iodo-2-phenyl-3-(p-tolylthio)-2,3-dihydroimidazo[1,2-a]pyridine (4g)

Yield: 92%; 122.3 mg, white solid; m.p = 163-164 °C; \(^1\)H NMR (CDCl₃, 400 MHz) \( \delta \) (ppm) 8.54 (s, 1H), 8.21 (d, 2H, \( J = 7.6 \) Hz), 7.49 (s, 2H), 7.44 (t, 2H, \( J = 7.4 \) Hz), 7.38 (d, 1H, \( J = 7.2 \) Hz), 7.04 (d, 2H, \( J = 8 \) Hz), 6.92 (d, 2H, \( J = 8 \) Hz), 2.28 (s, 3H). \(^{13}\)C NMR (CDCl₃, 100 MHz) \( \delta \) (ppm) 151.3, 145.6, 136.2, 134.5, 132.9, 131.0, 130.3, 129.5, 128.8, 128.4, 128.3, 126.0, 118.6, 107.2, 76.0, 20.9. HRMS (ES\(^+\)-TOF) calcd for \( \text{C}_{20}\text{H}_{16}\text{IN}_2\text{S}^+ \) (M+H\(^+\)): 443.0073, found: 443.0072.

![Image of 2-phenyl-3-(p-tolylthio)-6-(trifluoromethyl)imidazo[1,2-a]pyridine (4h)]

2-phenyl-3-(p-tolylthio)-6-(trifluoromethyl)imidazo[1,2-a]pyridine (4h)

Yield: 86%; 99.3 mg, white solid; m.p = 154-156 °C; \(^1\)H NMR (CDCl₃, 400 MHz) \( \delta \) (ppm) 8.67 (s, 1H), 8.27 (d, 2H, \( J = 7.2 \) Hz), 7.81 (d, 1H, \( J = 9.2 \) Hz), 7.46 (m, 3H), 7.42 (d, 1H, \( J = 7.2 \) Hz), 7.05 (d, 2H, \( J = 8 \) Hz), 6.95 (d, 2H, \( J = 8 \) Hz), 2.27 (s, 3H). \(^{13}\)C NMR (CDCl₃, 100 MHz) \( \delta \) (ppm) 152.6, 146.7, 136.7, 132.7, 130.4, 130.3, 129.0, 128.5, 128.4, 126.3, 123.4 (q, \( J_{C-CF3} = 269.5 \) Hz), 123.4 (q, \( J_{C-CF3} = 5.6 \) Hz), 122.4, 118.3, 117.3 (q, \( J_{C-CF3} = 34.0 \) Hz), 109.2, 20.8. HRMS (ES\(^+\)-TOF) calcd for \( \text{C}_{21}\text{H}_{16}\text{F}_{3}\text{N}_2\text{S}^+ \) (M+H\(^+\)): 385.0981, found: 385.0984.
6-nitro-2-phenyl-3-(p-tolylthio)imidazo[1,2-a]pyridine (4i)

Yield: 73%; 78.8 mg, yellow solid; m.p = 219-220 °C; \(^1\)H NMR (CDCl\(_3\), 400 MHz) \(\delta\) (ppm) 9.36 (d, 1H, \(J = 1.6\) Hz), 8.28 (d, 2H, \(J = 6.8\) Hz), 8.07 (dd, 1H, \(J_1 = 9.8\) Hz, \(J_2 = 2.2\) Hz), 7.75 (d, 1H, \(J = 10\) Hz), 7.45 (m, 3H), 7.05 (d, 2H, \(J = 8\) Hz), 6.97 (d, 2H, \(J = 8\) Hz), 2.27 (s, 3H). \(^{13}\)C NMR (CDCl\(_3\), 100 MHz) \(\delta\) (ppm) 154.0, 146.9, 137.7, 137.1, 132.3, 130.5, 129.8, 129.5, 128.6, 128.4, 126.7, 124.4, 120.7, 117.2, 110.9, 20.9. HRMS (ES\(^+\)-TOF) calcd for C\(_{20}\)H\(_{16}\)N\(_3\)O\(_2\)S\(^+\) (M+H\(^+\)): 362.0958, found: 362.0973.

2-phenyl-3-(p-tolylthio)imidazo[1,2-a]pyridine-8-carbonitrile (4j)

Yield: 78%; 79.7 mg, light yellow solid; m.p = 155-157 °C; \(^1\)H NMR (CDCl\(_3\), 400 MHz) \(\delta\) (ppm) 8.46 (d, 1H, \(J = 6.8\) Hz), 8.33 (d, 2H, \(J = 7.2\) Hz), 7.74 (d, 1H, \(J = 6.8\) Hz), 7.43 (m, 3H), 7.03 (d, 2H, \(J = 8\) Hz), 7.03 (m, 3H), 2.27 (s, 3H). \(^{13}\)C NMR (CDCl\(_3\), 100 MHz) \(\delta\) (ppm) 152.4, 144.5, 136.7, 133.0, 132.4, 130.4, 130.2, 129.2, 128.6, 128.5, 128.4, 126.2, 114.8, 111.9, 109.4, 102.6, 20.9. HRMS (ES\(^+\)-TOF) calcd for C\(_{21}\)H\(_{16}\)N\(_3\)S\(^+\) (M+H\(^+\)): 342.1059, found: 342.1067.

2-phenyl-3-(p-tolylthio)benzo[d]imidazo[2,1-b]thiazole (4k)
Yield: 75%; 83.6 mg, white solid; m.p = 113-115 °C; \(^1\)H NMR (CDCl\(_3\), 400 MHz) \(\delta\) (ppm) 8.36 (d, 1H, \(J = 8\) Hz), 8.12 (d, 2H, \(J = 7.2\) Hz), 7.68 (d, 1H, \(J = 7.2\) Hz), 7.42 (t, 2H, \(J = 7.4\) Hz), 7.33 (m, 3H), 7.07 (t, 4H, \(J = 9.2\) Hz), 2.26 (s, 3H). \(^{13}\)C NMR (CDCl\(_3\), 100 MHz) \(\delta\) (ppm) 153.4, 150.6, 136.0, 133.5, 133.2, 132.9, 130.3, 130.1, 128.3, 128.2, 127.8, 126.3, 125.8, 124.8, 123.9, 114.4, 110.5, 20.9. HRMS (ES\(^+\)-TOF) calcd for C\(_{22}\)H\(_{17}\)N\(_2\)S\(_2\)\(^{+}\) (M+H\(^+\)): 373.0828, found: 373.0840.

![Chemical Structure of 2-(p-tolyl)-3-(p-tolylthio)imidazo[1,2-a]pyridine (5a)](image)

2-(p-tolyl)-3-(p-tolylthio)imidazo[1,2-a]pyridine (5a)

Yield: 71%; 69.9 mg, white solid; m.p = 142-143 °C; \(^1\)H NMR (CDCl\(_3\), 400 MHz) \(\delta\) (ppm) 8.26 (d, 1H, \(J = 6.8\) Hz), 8.11 (d, 2H, \(J = 7.6\) Hz), 7.71 (d, 1H, \(J = 9.2\) Hz), 7.31 (t, 1H, \(J = 7.8\) Hz), 7.24 (d, 2H, \(J = 8.4\) Hz), 7.01 (d, 2H, \(J = 7.6\) Hz), 6.90 (d, 2H, \(J = 7.6\) Hz), 6.84 (t, 1H, \(J = 6.6\) Hz), 2.38 (s, 3H), 2.25 (s, 3H). \(^{13}\)C NMR (CDCl\(_3\), 100 MHz) \(\delta\) (ppm) 151.3, 147.0, 138.4, 135.9, 131.6, 130.5, 130.1, 129.1, 128.2, 126.4, 125.8, 124.4, 117.5, 112.8, 106.5, 21.3, 20.8. HRMS (ES\(^+\)-TOF) calcd for C\(_{21}\)H\(_{19}\)N\(_2\)S\(^+\) (M+H\(^+\)): 331.1263, found: 331.1270.

![Chemical Structure of 2-(m-tolyl)-3-(p-tolylthio)imidazo[1,2-a]pyridine (5b)](image)

2-(m-tolyl)-3-(p-tolylthio)imidazo[1,2-a]pyridine (5b)

Yield: 74%; 73.4 mg, white solid; m.p = 115-116 °C; \(^1\)H NMR (CDCl\(_3\), 400 MHz) \(\delta\) (ppm) 8.28 (d, 1H, \(J = 6.8\) Hz), 8.03 (d, 2H, \(J = 12.4\) Hz), 7.72 (d, 1H, \(J = 8.8\) Hz), 7.31 (t, 2H, \(J = 7.6\) Hz), 7.19 (d, 1H, \(J = 7.6\) Hz), 7.01 (d, 2H, \(J = 7.6\) Hz), 6.91 (d, 2H, \(J = 7.6\) Hz), 6.85 (t, 1H, \(J = 6.6\) Hz), 2.41 (s, 3H), 2.26 (s, 3H). \(^{13}\)C NMR (CDCl\(_3\), 100 MHz) \(\delta\) (ppm) 151.3, 147.0, 138.0, 136.0, 133.3, 131.6, 130.2, 129.3, 129.1, 128.2, 126.5, 125.9, 125.5, 124.5, 117.6, 112.9, 107.0, 21.5, 20.9. HRMS (ES\(^+\)-TOF) calcd for C\(_{21}\)H\(_{19}\)N\(_2\)S\(^+\) (M+H\(^+\)): 331.1263, found: 331.1273.
2-(o-tolyl)-3-(p-tolylthio)imidazo[1,2-a]pyridine (5c)

Yield: 58%; 57.8 mg, white solid; m.p = 115-117 °C; \(^1\)H NMR (CDCl\(_3\), 400 MHz) \(\delta\) (ppm) 8.26 (d, 1H, \(J = 6.8\) Hz), 8.11 (d, 2H, \(J = 7.6\) Hz), 7.71 (d, 1H, \(J = 9.2\) Hz), 7.31 (t, 1H, \(J = 7.8\) Hz), 7.24 (d, 2H, \(J = 8.4\) Hz), 7.01 (d, 2H, \(J = 7.6\) Hz), 6.90 (d, 2H, \(J = 7.6\) Hz), 6.84 (t, 1H, \(J = 6.6\) Hz), 2.38 (s, 3H), 2.25 (s, 3H). 13C NMR (CDCl\(_3\), 100 MHz) \(\delta\) (ppm) 151.3, 147.0, 138.4, 135.9, 133.3, 131.6, 130.5, 130.1, 129.1, 128.2, 126.4, 125.8, 124.4, 117.5, 112.8, 106.5, 21.3, 20.8. HRMS (ES\(^{+}\)-TOF) calcd for C\(_{21}\)H\(_{19}\)N\(_2\)S\(^{+}\) (M+H\(^{+}\)): 331.1263, found: 331.1273.

2-(4-methoxyphenyl)-3-(p-tolylthio)imidazo[1,2-a]pyridine (5d)

Yield: 76%; 79.1 mg, white solid; m.p = 138-140 °C; \(^1\)H NMR (CDCl\(_3\), 400 MHz) \(\delta\) (ppm) 8.26 (d, 1H, \(J = 6.8\) Hz), 8.18 (d, 2H, \(J = 8.8\) Hz), 7.69 (d, 1H, \(J = 8.8\) Hz), 7.31 (t, 1H, \(J = 7.8\) Hz), 7.02 (d, 2H, \(J = 8.4\) Hz), 6.97 (d, 2H, \(J = 8.8\) Hz), 6.91 (d, 2H, \(J = 8.8\) Hz), 6.84 (t, 1H, \(J = 6.6\) Hz), 3.84 (s, 3H), 2.26 (s, 3H). 13C NMR (CDCl\(_3\), 100 MHz) \(\delta\) (ppm) 160.0, 151.1, 147.0, 135.9, 131.7, 130.2, 129.6, 126.4, 126.1, 125.8, 124.4, 117.4, 113.8, 112.8, 105.9, 55.3, 20.8. HRMS (ES\(^{+}\)-TOF) calcd for C\(_{21}\)H\(_{19}\)N\(_2\)OS\(^{+}\) (M+H\(^{+}\)): 347.1213, found: 347.1228.
2-(4-fluorophenyl)-3-(p-tolylthio)imidazo[1,2-a]pyridine (5e)

Yield: 56%; 56.1 mg, white solid; m.p = 86-87 °C; 1H NMR (CDCl₃, 400 MHz) δ (ppm) 8.28 (d, 1H, J = 6.8 Hz), 8.21 (m, 2H), 7.71 (d, 1H, J = 9.2 Hz), 7.33 (t, 1H, J = 8.4 Hz), 7.12 (t, 2H, J = 8.8 Hz), 7.02 (d, 2H, J = 8 Hz), 6.90 (d, 2H, J = 8 Hz), 6.86 (d, 1H, J = 7.6 Hz), 2.26 (s, 3H). 13C NMR (CDCl₃, 100 MHz) δ (ppm) 163.1 (d, J_C-F = 246.6 Hz), 150.3, 147.0, 136.2, 131.3, 130.2, 130.1 (d, J_C-F = 8.5 Hz), 129.6 (d, J_C-F = 2.8 Hz), 126.6, 125.8, 124.5, 117.6, 115.3 (d, J_C-F = 22.5 Hz), 113.0, 106.6, 20.8. HRMS (ES⁺-TOF) calcd for C₂₀H₁₆FN₂S⁺ (M+H⁺): 335.1013, found: 335.1018.

2-(4-chlorophenyl)-3-(p-tolylthio)imidazo[1,2-a]pyridine (5f)

Yield: 74%; 78.0 mg, white solid; m.p = 124-126 °C; 1H NMR (CDCl₃, 400 MHz) δ (ppm) 8.28 (d, 1H, J = 6.8 Hz), 8.19 (d, 2H, J = 8.4 Hz), 7.70 (d, 1H, J = 8.8 Hz), 7.40 (d, 2H, J = 8.8 Hz), 7.33 (t, 1H, J = 7.8 Hz), 7.02 (d, 2H, J = 8 Hz), 6.89 (d, 2H, J = 8.4 Hz), 6.85 (d, 1H, J = 6.8 Hz), 2.26 (s, 3H). 13C NMR (CDCl₃, 100 MHz) δ (ppm) 149.9, 147.0, 136.2, 134.5, 132.0, 131.2, 130.2, 129.6, 128.6, 126.7, 125.8, 124.5, 117.6, 113.0, 107.1, 20.8. HRMS (ES⁺-TOF) calcd for C₂₀H₁₆ClN₂S⁺ (M+H⁺): 351.0717, found: 351.0722.
2-(4-bromophenyl)-3-(p-tolylthio)imidazo[1,2-a]pyridine (5g)

Yield: 69%; 81.8 mg, light yellow solid; m.p = 135-137 °C; $^1$H NMR (CDCl$_3$, 400 MHz) $\delta$ (ppm) 8.28 (d, 1H, $J = 6.8$ Hz), 8.12 (d, 2H, $J = 8.4$ Hz), 7.72 (d, 1H, $J = 8.8$ Hz), 7.56 (d, 2H, $J = 8.4$ Hz), 7.34 (t, 1H, $J = 8.4$ Hz), 7.02 (d, 2H, $J = 8$ Hz), 6.88 (m, 3H), 2.26 (s, 3H). $^{13}$C NMR (CDCl$_3$, 100 MHz) $\delta$ (ppm) 149.9, 147.0, 136.2, 132.3, 131.5, 131.1, 130.2, 129.9, 126.8, 125.9, 124.5, 122.9, 117.6, 113.2, 107.2, 20.9. HRMS (ES$^+$-TOF) calcd for C$_{20}$H$_{16}$BrN$_2$S$^+$ (M+H$^+$): 395.0212, found: 395.0227.

![Structure of 2-(4-bromophenyl)-3-(p-tolylthio)imidazo[1,2-a]pyridine](image)

2-(4-(methylsulfonyl)phenyl)-3-(p-tolylthio)imidazo[1,2-a]pyridine (5h)

Yield: 88%; 103.7 mg, light white solid; m.p = 184-185 °C; $^1$H NMR (CDCl$_3$, 400 MHz) $\delta$ (ppm) 8.47 (d, 2H, $J = 8.4$ Hz), 8.32 (d, 1H, $J = 6.8$ Hz), 7.99 (d, 2H, $J = 8.4$ Hz), 7.74 (d, 1H, $J = 9.2$ Hz), 7.38 (t, 1H, $J = 7.8$ Hz), 7.03 (d, 2H, $J = 8$ Hz), 6.90 (q, 3H, $J = 7.6$ Hz), 3.07 (s, 3H), 2.26 (s, 3H). $^{13}$C NMR (CDCl$_3$, 100 MHz) $\delta$ (ppm) 148.7, 147.2, 139.9, 138.9, 136.6, 130.7, 130.4, 129.0, 127.5, 127.2, 126.0, 124.6, 117.9, 113.6, 106.7, 44.6, 20.9. HRMS (ES$^+$-TOF) calcd for C$_{21}$H$_{19}$N$_2$O$_2$S$_2$$^+$ (M+H$^+$): 395.0882, found: 395.0889.

![Structure of 2-(4-(methylsulfonyl)phenyl)-3-(p-tolylthio)imidazo[1,2-a]pyridine](image)

2-(naphthalen-2-yl)-3-(p-tolylthio)imidazo[1,2-a]pyridine (5i)

Yield: 78%; 85.3 mg, white solid; m.p = 124-126 °C; $^1$H NMR (CDCl$_3$, 400 MHz) $\delta$ (ppm) 8.76 (s, 1H), 8.42 (d, 1H, $J = 8.8$ Hz), 8.32 (d, 1H, $J = 6.8$ Hz), 7.91 (d, 2H, $J = 8$ Hz), 7.84 (s, 1H), 7.76 (d, 1H, $J = 8.8$ Hz), 7.47 (m, 2H), 7.33 (t, 1H, $J = 7.8$ Hz), 7.02 (d, 2H, $J = 7.2$ Hz), 6.97 (d, 2H, $J = 7.2$ Hz), 6.86(t, 1H, $J = 6.6$ Hz), 2.25 (s, 3H). $^{13}$C NMR (CDCl$_3$, 100 MHz) $\delta$ (ppm) 150.9, 147.0, 136.1, 133.34, 133.32, 131.5, 130.9, 130.2, 128.6, 127.9, 127.8, 127.6, 126.6, 126.3, 126.1, 126.0, 125.9, 124.5, 117.6, 113.0, 107.4, 20.8.
HRMS (ES\(^+\)-TOF) calcd for C\(_{24}\)H\(_{19}\)N\(_2\)S\(^+\) (M+H\(^+\)): 367.1263, found: 367.1267.

2-(thiophen-2-yl)-3-(p-tolylthio)imidazo[1,2-a]pyridine (5j)

Yield: 47%; 45.3 mg, white solid; m.p = 140-142 °C; \(^1\)H NMR (CDCl\(_3\), 400 MHz) \(\delta\) (ppm) 8.27 (d, 1H, \(J = 6.8\) Hz), 8.00 (d, 1H, \(J = 3.6\) Hz), 7.68 (d, 1H, \(J = 8.8\) Hz), 7.37 (d, 1H, \(J = 5.2\) Hz), 7.31 (t, 1H, \(J = 7.8\) Hz), 7.10 (t, 1H, \(J = 4.2\) Hz), 7.01 (d, 2H, \(J = 8.4\) Hz), 6.96 (d, 2H, \(J = 8.4\) Hz), 6.85 (t, 1H, \(J = 6.8\) Hz), 2.25 (s, 3H). 13C NMR (CDCl\(_3\), 100 MHz) \(\delta\) (ppm) 147.0, 146.6, 136.3, 136.2, 131.0, 130.2, 127.7, 126.7, 126.6, 126.3, 124.4, 117.4, 113.0, 20.9. HRMS (ES\(^+\)-TOF) calcd for C\(_{18}\)H\(_{15}\)N\(_2\)S\(_2\)^+ (M+H\(^+\)): 323.0671, found: 323.0681.

2-ferrocenyl-3-(p-tolylthio)imidazo[1,2-a]pyridine (5k)

Yield: 81%; 104.0 mg, red solid; m.p = 96-98 °C; \(^1\)H NMR (CDCl\(_3\), 400 MHz) \(\delta\) (ppm) 8.24 (d, 1H, \(J = 6.4\) Hz), 7.67 (d, 1H, \(J = 8.8\) Hz), 7.29 (d, 1H, \(J = 8\) Hz), 7.05 (d, 2H, \(J = 7.6\) Hz), 6.95 (d, 2H, \(J = 7.6\) Hz), 6.83 (t, 1H, \(J = 6.6\) Hz), 5.24 (s, 2H), 4.35 (s, 2H), 4.02 (s, 5H), 2.27 (s, 3H). 13C NMR (CDCl\(_3\), 100 MHz) \(\delta\) (ppm) 152.0, 147.0, 135.9, 131.9, 130.1, 126.2, 125.8, 124.0, 116.9, 112.6, 105.4, 69.5, 69.3, 66.2, 20.9. HRMS (ES\(^+\)-TOF) calcd for C\(_{24}\)H\(_{21}\)FeN\(_2\)S\(^+\) (M+H\(^+\)): 425.0769, found: 425.0780.
2-phenyl-3-(phenylthio)imidazo[1,2-a]pyridine (5m)

Yield: 61%; 55.4 mg, white solid; m.p = 90-91 ºC; \(^1\)H NMR (CDCl\(_3\), 400 MHz) \(\delta\) (ppm) 8.26 (d, 1H, \(J = 6.8\) Hz), 8.20 (d, 2H, \(J = 7.6\) Hz), 7.72 (d, 1H, \(J = 9.2\) Hz), 7.43 (t, 2H, \(J = 7.6\) Hz), 7.37 (d, 1H, \(J = 7.2\) Hz), 7.31 (t, 1H, \(J = 8\) Hz), 7.19 (t, 2H, \(J = 7.6\) Hz), 7.12 (t, 1H, \(J = 7.4\) Hz), 6.99 (d, 2H, \(J = 7.6\) Hz), 6.84 (t, 1H, \(J = 6.8\) Hz). \(^{13}\)C NMR (CDCl\(_3\), 100 MHz) \(\delta\) (ppm) 151.4, 147.1, 135.2, 133.3, 129.4, 128.5, 128.4, 126.0, 125.6, 124.4, 117.6, 113.0, 106.3. HRMS (ES\(^+\)-TOF) calcd for C\(_{19}\)H\(_{15}\)N\(_2\)S\(^+\) (M+H\(^+\)): 303.0950, found: 303.0965.

\[ \text{O}\begin{array}{c} \text{S} \\ \text{N} \\ \text{N} \end{array}\text{O} \]

3-((4-methoxyphenyl)thio)-2-phenylimidazo[1,2-a]pyridine (5n)

Yield: 70%; 69.4 mg, white solid; m.p = 110-112 ºC; \(^1\)H NMR (CDCl\(_3\), 400 MHz) \(\delta\) (ppm) 8.30 (d, 1H, \(J = 6\) Hz), 8.25 (d, 2H, \(J = 8\) Hz), 7.70 (d, 1H, \(J = 8.8\) Hz), 7.42 (m, 2H), 7.37 (t, 1H, \(J = 5.8\) Hz), 7.30 (m, 1H), 6.99 (d, 2H, \(J = 8.4\) Hz), 6.84 (t, 1H, \(J = 5.8\) Hz), 6.74 (d, 2H, \(J = 8.4\) Hz), 3.70 (d, 3H, \(J = 4.4\) Hz). \(^{13}\)C NMR (CDCl\(_3\), 100 MHz) \(\delta\) (ppm) 158.5, 150.8, 146.8, 133.5, 128.5, 128.4, 128.3, 128.0, 126.4, 125.5, 124.4, 117.6, 115.1, 112.9, 107.8, 55.3. HRMS (ES\(^+\)-TOF) calcd for C\(_{20}\)H\(_{17}\)N\(_2\)OS\(^+\) (M+H\(^+\)): 333.1056, found: 333.1063.

\[ \text{F}\begin{array}{c} \text{S} \\ \text{N} \\ \text{N} \end{array}\text{F} \]

3-((4-fluorophenyl)thio)-2-phenylimidazo[1,2-a]pyridine (5o)

Yield: 72%; 69.5 mg, white solid; m.p = 157-159 ºC; \(^1\)H NMR (CDCl\(_3\), 400 MHz) \(\delta\) (ppm) 8.27 (d, 1H, \(J = 6.8\) Hz), 8.21 (d, 2H, \(J = 7.6\) Hz), 7.73 (d, 1H, \(J = 8.8\) Hz), 7.45 (t, 2H, \(J = 7.4\) Hz), 7.38 (t, 1H, \(J = 7.2\) Hz), 7.33 (t, 1H, \(J = 8\) Hz), 6.98 (m, 2H), 6.88 (m, 3H). \(^{13}\)C NMR (CDCl\(_3\), 100 MHz) \(\delta\) (ppm) 161.5 (d, \(J_{C-F} =

S13
244.6 Hz), 151.3, 147.1, 133.2, 130.1, 128.6, 128.4 (d, $J_{CF} = 9.5$ Hz), 127.6 (d, $J_{CF} = 7.7$ Hz), 126.7, 124.3, 117.7, 116.5 (d, $J_{CF} = 22.3$ Hz), 113.1, 106.6. HRMS (ES$^+$-TOF) calcd for C$_{19}$H$_{14}$FN$_2$S$^+$ (M+H$^+$): 321.0856, found: 321.0862.

![Image of molecule](image)

**3-((4-chlorophenyl)thio)-2-phenylimidazo[1,2-a]pyridine (5p)**

Yield: 74%; 74.4 mg, light yellow solid; m.p = 164-166 °C; $^1$H NMR (CDCl$_3$, 400 MHz) δ (ppm) 8.25 (d, 1H, $J = 6.8$ Hz), 8.18 (d, 2H, $J = 7.2$ Hz), 7.74 (d, 1H, $J = 8.8$ Hz), 7.44 (t, 2H, $J = 7.4$ Hz), 7.36 (m, 2H), 7.18 (d, 2H, $J = 8.4$ Hz), 6.91 (m, 3H). $^{13}$C NMR (CDCl$_3$, 100 MHz) δ (ppm) 151.7, 147.2, 133.8, 133.2, 132.1, 129.6, 128.7, 128.5, 128.3, 126.7, 126.8, 124.3, 117.8, 113.2, 105.8. HRMS (ES$^+$-TOF) calcd for C$_{19}$H$_{14}$ClN$_2$S$^+$ (M+H$^+$): 337.0561, found: 337.0568.

![Image of molecule](image)

**3-((4-bromophenyl)thio)-2-phenylimidazo[1,2-a]pyridine (5q)**

Yield: 63%; 72.5 mg, light white solid; m.p = 188-190 °C; $^1$H NMR (CDCl$_3$, 400 MHz) δ (ppm) 8.24 (d, 1H, $J = 6.8$ Hz), 8.17 (d, 2H, $J = 8$ Hz), 7.74 (d, 1H, $J = 8.8$ Hz), 7.44 (t, 2H, $J = 7.4$ Hz), 7.37 (m, 2H), 7.32 (d, 2H, $J = 8.4$ Hz), 6.87 (m, 3H). $^{13}$C NMR (CDCl$_3$, 100 MHz) δ (ppm) 151.7, 147.2, 134.5, 133.1, 132.4, 128.7, 128.4, 128.3, 127.1, 126.8, 124.3, 119.8, 117.8, 113.2, 105.5. HRMS (ES$^+$-TOF) calcd for C$_{19}$H$_{14}$BrN$_2$S$^+$ (M+H$^+$): 381.0056, found: 381.0065.
2-phenyl-3-(4-(trifluoromethyl)phenyl)thio)imidazo[1,2-a]pyridine (5r)

Yield: 77%; 85.2 mg, white solid; m.p = 180-181 °C; $^1$H NMR (CDCl$_3$, 400 MHz) δ (ppm) 8.23 (d, 1H, $J = 6.8$ Hz), 8.15 (d, 2H, $J = 7.6$ Hz), 7.77 (d, 1H, $J = 8.8$ Hz), 7.44 (m, 4H), 7.38 (t, 2H, $J = 8.6$ Hz), 7.06 (d, 2H, $J = 8$ Hz), 6.91 (t, 1H, $J = 6.8$ Hz). $^{13}$C NMR (CDCl$_3$, 100 MHz) δ (ppm) 152.1, 147.5, 140.5, 133.1, 128.8, 128.5, 128.3, 128.1, 126.3 (q, $J_{C\text{-CF}_3} = 3.5$ Hz), 125.6 (q, $J_{C\text{-CF}_3} = 273.0$ Hz), 125.3, 122.6, 117.9, 113.4, 104.6. HRMS (ES$^+$-TOF) calcd for C$_{20}$H$_{14}$F$_3$N$_2$S$^+$ (M$^+$): 371.0824, found:371.0833.
$^1$H and $^{13}$C NMR Spectra of Products

![NMR Spectra](image)

4a
4i

hsp-2-41c-CDC13-400M

hsp-2-41c-CDC13-100M
hsp-2-5d-H-CDCl3-400M

hsp-2-5d-C-CDCl3-100M

5g