Supporting Information

for

A one-pot electrochemical synthesis of 2-aminothiazoles from active methylene ketones and thioureas mediated by NH₄I

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Experimental procedures, characterization data and copies of spectra of the all synthesized compounds (¹H NMR, ¹³C NMR and HRMS)
1. General information
Starting materials and solvents were obtained from commercial sources and used without further purification. Chromatographic purification of products was accomplished by flash chromatography on silica gel (petroleum ether/EtOAc). The product spots on the thin layer chromatography (TLC) were identified/visualized by fluorescence quenching or by potassium permanganate. NMR spectra were recorded with a 300 MHz spectrometer (300 MHz \( ^1\)H frequency, 75 MHz \( ^{13}\)C frequency). Chemical shifts were referenced to residual undeuterated solvent peaks (note: DMSO-\(d_6\): 2.50 ppm \( ^1\)H NMR, 40 ppm \( ^{13}\)C NMR). Coupling constants are reported in Hz. High resolution mass spectra (HRMS) were obtained on a SolariX mass spectrometer.

2. General procedure for the one-pot electrochemically synthesis of 2-aminothiazoles from active methylene ketones and thioureas

A 50 mL undivided cell was equipped with a graphite plate cathode and a graphite plate anode (each about 2 × 2 cm\(^2\)) which were connected to a DC regulated power supply. To the cell was added active methylene ketone 1 (2 mmol), thiourea 2 (1 mmol), NH\(_4\)I (0.1 mmol), DL-alanine (1 mmol) and LiClO\(_4\) (0.5 mmol) dissolved in a mixed solvent of DMSO (1 mL) and H\(_2\)O (14 mL). The mixture was electrolyzed under constant current conditions at 5 mA/cm\(^2\) at 30 °C while stirring. The electrolysis was terminated when 6 F/mol of charge had been consumed. After the electrolysis, the reaction mixture was washed with a saturated aqueous Na\(_2\)S\(_2\)O\(_3\) and the product was then extracted with DCM (3 × 10 mL), dried over MgSO\(_4\), and concentrated in vacuum. The residue was purified by column chromatography on silica gel using a mixture of petroleum ether/EtOAc as eluent.
3. Compounds characterization

| Compound | Yield | Characteristics | Physical Properties | Spectroscopic Data |
|----------|-------|-----------------|---------------------|-------------------|
| Ethyl 2-amino-4-methylthiazole-5-carboxylate (3a)<sup>[1]</sup> | 140 mg, 75%; white solid | M.P.: 173-174 °C | 1H NMR (300 MHz, DMSO-d<sub>6</sub>) δ (ppm): 1.22 (t, J = 7.2 Hz, 3H), 2.37 (s, 3H), 4.14 (q, J = 7.2 Hz, 2H), 7.72 (br, 2H); 13C NMR (75 MHz, DMSO-d<sub>6</sub>) δ (ppm): 14.8, 17.6, 60.2, 107.9, 159.8, 162.5, 170.7. |
| Methyl 2-amino-4-methylthiazole-5-carboxylate (3b)<sup>[2]</sup> | 138 mg, 80%; light yellow solid | M.P.: 218-220 °C | 1H NMR (300 MHz, DMSO-d<sub>6</sub>) δ (ppm): 2.37 (s, 3H), 3.67 (s, 3H), 7.74 (br, 2H); 13C NMR (75 MHz, DMSO-d<sub>6</sub>) δ (ppm): 17.6, 51.7, 107.3, 160.1, 162.8, 170.8. |
| tert-Butyl 2-amino-4-methylthiazole-5-carboxylate (3c)<sup>[1]</sup> | 109 mg, 51%; yellow solid | M.P.: 162-163 °C | 1H NMR (300 MHz, DMSO-d<sub>6</sub>) δ (ppm): 1.45 (s, 9H), 2.33 (s, 3H), 7.74 (br, 2H); 13C NMR (75 MHz, DMSO-d<sub>6</sub>) δ (ppm): 17.6, 28.5, 80.6, 109.7, 158.8, 162.0, 170.8. |
| Pentyl 2-amino-4-methylthiazole-5-carboxylate (3d)<sup>[2]</sup> | 52 mg, 30%; yellow waxy solid | | 1H NMR (300 MHz, DMSO-d<sub>6</sub>) δ (ppm): 0.87 (t, J = 6.6 Hz, 3H), 1.23-1.32 (m, 4H), 1.54-1.64 (m, 2H), 2.37 (s, 3H), 4.09 (t, J = 6.6 Hz, 2H), 7.74 (br, 2H); 13C NMR (75 MHz, DMSO-d<sub>6</sub>) δ (ppm): 14.4, 17.7, 22.3, 28.3, 28.5, 64.3, 107.9, 159.8, 162.5, 170.8. |
| Allyl 2-amino-4-methylthiazole-5-carboxylate (3e)<sup>[2]</sup> | 155 mg, 78%; white solid | M.P.: 151-154 °C | 1H NMR (300 MHz, DMSO-d<sub>6</sub>) δ (ppm): 2.38 (s, 3H), 4.63-4.64 (m, 2H), 5.2-5.33 (m, 2H), 5.91-6.01 (m, 1H), 7.79 (br, 2H); 13C NMR (75 MHz, DMSO-d<sub>6</sub>) δ (ppm): 17.7, 64.6, 107.3, |
benzyl 2-amino-4-methylthiazole-5-carboxylate (3f)
Yield: 130 mg, 52%; light yellow solid; M.P.: 135-138 °C.
\(^1\)H NMR (300 MHz, DMSO-\(d_6\)) \(\delta\) (ppm): 2.38 (s, 3H), 5.19 (s, 2H), 7.31-7.39 (m, 5H), 7.78 (br, 2H);
\(^13\)C NMR (75 MHz, DMSO-\(d_6\)) \(\delta\) (ppm): 17.7, 65.6, 107.3, 128.2, 128.4, 129.0, 137.0, 160.5, 162.2, 171.0;
HRMS (ESI) calcd for C\(_{12}\)H\(_{13}\)N\(_2\)O\(_2\)S (M+H\(^+\)) 249.06914, found 249.06923.

ethyl 2-amino-4-ethylthiazole-5-carboxylate (3g)
Yield: 127 mg, 65%; yellow solid; M.P.: 174-178 °C.
\(^1\)H NMR (300 MHz, DMSO-\(d_6\)) \(\delta\) (ppm): 1.11 (t, \(J = 7.5\) Hz, 3H), 1.21 (t, \(J = 7.2\) Hz, 3H), 2.82 (q, \(J = 6.3\) Hz, 2H), 4.13 (q, \(J = 7.2\) Hz, 2H), 7.75 (br, 2H);
\(^13\)C NMR (75 MHz, DMSO-\(d_6\)) \(\delta\) (ppm): 13.9, 14.9, 24.2, 60.3, 107.2, 162.3, 165.5, 171.1;
HRMS (ESI) calcd for C\(_8\)H\(_{13}\)N\(_2\)O\(_2\)S (M+H\(^+\)) 201.06921, found 201.06923.

ethyl 2-amino-4-propylthiazole-5-carboxylate (3h)[1]
Yield: 130 mg, 61%; yellow solid; M.P.: 134-135 °C.
\(^1\)H NMR (300 MHz, DMSO-\(d_6\)) \(\delta\) (ppm): 0.87 (t, \(J = 7.5\) Hz, 3H), 1.22 (t, \(J = 7.2\) Hz, 3H), 1.52-1.62 (m, 2H), 2.80 (t, \(J = 7.5\) Hz, 2H), 4.13 (q, \(J = 7.2\) Hz, 2H), 7.73 (br, 2H);
\(^13\)C NMR (75 MHz, DMSO-\(d_6\)) \(\delta\) (ppm): 14.3, 14.8, 22.4, 60.2, 60.3, 108.0, 162.3, 164.1, 170.9.

ethyl 2-amino-4-isopropylthiazole-5-carboxylate (3i)[3]
Yield: 114 mg, 58%; yellow solid; M.P.: 171-173 °C.
\(^1\)H NMR (300 MHz, DMSO-\(d_6\)) \(\delta\) (ppm): 1.120 (d, \(J = 6.6\) Hz, 6H), 1.213 (t, \(J = 6.9\) Hz, 3H), 3.745-3.900 (m, 1H), 4.136 (q, \(J = 6.9\) Hz, 2H), 7.776 (br s, 2H);
\(^13\)C NMR (75 MHz, DMSO-\(d_6\)) \(\delta\) (ppm): 14.8, 22.4, 28.7, 60.2, 106.5, 162.2, 169.4, 171.2.

ethyl 2-amino-4-butylthiazole-5-carboxylate (3j)
Yield: 95 mg, 41%; yellow solid; M.P.: 118-119 °C.
\(^1\)H NMR (300 MHz, DMSO-\(d_6\)) \(\delta\) (ppm): 0.87 (t, \(J = 7.5\) Hz, 3H), 1.22 (t, \(J = 7.2\) Hz, 3H), 1.24-1.34 (m, 2H), 1.49-1.59 (m, 2H), 2.82 (t, \(J = 7.2\) Hz, 2H), 4.13 (q, \(J = 7.2\) Hz, 2H), 7.73 (br, 2H);
\(^13\)C NMR (75 MHz, DMSO-\(d_6\)) \(\delta\) (ppm): 14.3, 14.8, 22.4, 30.2, 31.2, 60.2, 107.8, 162., 164.3, 170.9;
HRMS (ESI) calcd for C\(_{10}\)H\(_{13}\)N\(_2\)O\(_2\)S (M+H\(^+\)) 229.10046, found 229.10053.

ethyl 2-amino-4-(tert-butyl)thiazole-5-carboxylate (3k)
Yield: 51 mg, 24%; yellow waxy solid.
\(^1\)H NMR (300 MHz, DMSO-\(d_6\)) \(\delta\) (ppm): 1.21 (t, \(J = 6.9\) Hz, 3H), 1.34 (s, 9H), 4.12 (q, \(J = 6.9\) Hz, 2H), 7.67 (br, 2H);
\(^13\)C NMR (75 MHz, DMSO-\(d_6\)) \(\delta\) (ppm): 14.8, 29.6, 36.4, 60.4, 107.0, 161.6, 169.4, 170.7;
HRMS (ESI) calcd for C\(_{10}\)H\(_{13}\)N\(_2\)O\(_2\)S (M+H\(^+\)) 229.10036, found 229.10053.

ethyl 2-amino-4-cyclohexylthiazole-5-carboxylate (3l)
Yield: 84 mg, 33%; yellow solid; M.P.: 179-182 °C.
| Yield | Description |
|-------|-------------|
| 130 mg, 52% | Yellow solid; M.P.: 147-149 °C. |
| 107 mg, 41% | Yellow solid; M.P.: 178-181 °C. |
| 51 mg, 18% | Yellow solid; M.P.: 241 °C. |
| 147 mg, 53% | Yellow solid; M.P.: 286-304 °C. |
| 50 mg, 17% | Yellow waxy solid. |
| 79 mg, 30% | Yellow solid; M.P.: 187-190 °C |

**ethyl 2-amino-4-phenylthiazole-5-carboxylate (3m)**

Yield: 130 mg, 52%; yellow solid; M.P.: 147-149 °C.

**ethyl 2-amino-4-(p-tolyl) thiazole-5-carboxylate (3n)**

Yield: 107 mg, 41%; yellow solid; M.P.: 178-181 °C.

**ethyl 2-amino-4-(4-methoxyphenyl) thiazole-5-carboxylate (3o)**

Yield: 51 mg, 18%; yellow solid; M.P.: 241-244 °C.

**ethyl 2-amino-4-(3-methoxyphenyl) thiazole-5-carboxylate (3p)**

Yield: 147 mg, 53%; yellow solid; M.P.: 286-304 °C.

**ethyl 2-amino-4-(2-methoxyphenyl) thiazole-5-carboxylate (3q)**

Yield: 50 mg, 17%; yellow waxy solid.

**ethyl 2-amino-4-(4-fluorophenyl) thiazole-5-carboxylate (3r)**

Yield: 79 mg, 30%; yellow solid; M.P.: 187-190 °C.

**ethyl 2-amino-4-phenylthiazole-5-carboxylate (3m)**

Yield: 107 mg, 41%; yellow solid; M.P.: 178-181 °C.

**ethyl 2-amino-4-(p-tolyl) thiazole-5-carboxylate (3n)**

Yield: 147 mg, 53%; yellow solid; M.P.: 286-304 °C.

**ethyl 2-amino-4-(4-methoxyphenyl) thiazole-5-carboxylate (3o)**

Yield: 51 mg, 18%; yellow solid; M.P.: 241-244 °C.

**ethyl 2-amino-4-(3-methoxyphenyl) thiazole-5-carboxylate (3p)**

Yield: 147 mg, 53%; yellow solid; M.P.: 286-304 °C.

**ethyl 2-amino-4-(2-methoxyphenyl) thiazole-5-carboxylate (3q)**

Yield: 50 mg, 17%; yellow waxy solid.

**ethyl 2-amino-4-(4-fluorophenyl) thiazole-5-carboxylate (3r)**

Yield: 79 mg, 30%; yellow solid; M.P.: 187-190 °C.
ethyl 2-amino-4-(4-chlorophenyl)thiazole-5-carboxylate (3s)[6]

Yield: 112 mg, 40%; light yellow solid; M.P.: 188-193 °C

1H NMR (300 MHz, DMSO-d6) δ (ppm): 1.49 (t, J = 7.0 Hz, 3H), 4.089 (q, J = 7.1 Hz, 2H), 7.198 (t, J = 8.9 Hz, 2H), 7.671-7.719 (m, 2H), 7.881 (br, 2H);

13C NMR (75 MHz, DMSO-d6) δ (ppm): 14.6, 60.6, 108.7, 114.6 and 114.9 (d, J(C,F) = 22.5 Hz), 131.42 and 131.46 (d, J(C,F) = 3.0 Hz), 132.4 and 132.5 (d, J(C,F) = 7.5 Hz), 158.1, 161.1 and 164.4 (d, J(C,F) = 247.5 Hz), 161.6, 170.4;

HRMS (ESI) calcd for C13H12ClF2O2S (M+H)⁺ 267.0598, found 267.05980.

ethyl 2-amino-4-(4-bromophenyl)thiazole-5-carboxylate (3t)[6]

Yield: 62 mg, 19%; light yellow solid; M.P.: 187-202° C

1H NMR (300 MHz, DMSO-d6) δ (ppm): 1.15 (t, J = 6.9 Hz, 3H), 4.09 (q, J = 6.9 Hz, 2H), 7.44 (d, J = 8.4 Hz, 2H), 7.67 (d, J = 8.7 Hz, 2H), 7.90 (br, 2H);

13C NMR (75 MHz, DMSO-d6) δ (ppm): 14.6, 60.7, 109.1, 127.9, 132.0, 133.8, 133.8, 157.8, 161.6, 170.5.

ethyl 2-amino-4-(4-nitrophenyl)thiazole-5-carboxylate (3u)[6]

Yield: 155 mg, 53%; yellow waxy solid.

1H NMR (300 MHz, DMSO-d6) δ (ppm): 1.15 (t, J = 6.9 Hz, 3H), 4.11 (q, J = 6.9 Hz, 2H), 7.90 (d, J = 8.7 Hz, 2H), 7.99 (br, 2H);

13C NMR (75 MHz, DMSO-d6) δ (ppm): 14.5, 60.9, 113.0, 121.3, 131.5, 141.4, 147.7, 156.4, 161.4, 170.7.

ethyl 2-amino-4-(4-furan-2-yl)thiazole-5-carboxylate (3v)[6]

Yield: 55 mg, 23%; yellow waxy solid.

1H NMR (300 MHz, DMSO-d6) δ (ppm): 1.23 (t, J = 6.9 Hz, 3H), 4.18 (q, J = 6.9 Hz, 2H), 6.60-6.62 (m, 1H), 7.48 (d, J = 3.3 Hz, 1H), 7.75 (s, 1H), 7.90 (br, 2H);

13C NMR (75 MHz, DMSO-d6) δ (ppm): 14.7, 60.8, 107.6, 112.2, 114.6, 144.0, 147.8, 148.5, 161.3, 170.2.

2-amino-N,N-diethyl-4-methylthiazole-5-carboxamide (3w)[6]

Yield: 51 mg, 24%; light yellow solid; M.P.: 148-154 °C.

1H NMR (300 MHz, DMSO-d6) δ (ppm): 1.07 (t, J = 7.2 Hz, 3H), 2.05 (s, 3H), 3.31-3.38 (m, 4H), 7.19 (br, 2H);

13C NMR (75 MHz, DMSO-d6) δ (ppm): 14.1, 16.9, 41.4, 111.4, 149.5, 163.7, 167.8.

2-amino-4-phenylthiazole-5-carboxamide (3x)[5]

Yield: 95 mg, 48%; light yellow waxy solid.

1H NMR (300 MHz, DMSO-d6) δ (ppm): 7.50-7.52 (m, 3H), 7.92 (d, J = 6.9 Hz, 2H), 8.26 (br, 2H);

13C NMR (75 MHz, DMSO-d6) δ (ppm): 84.1, 115.8, 127.9, 129.3, 130.5, 133.0, 161.5, 171.1.

4-phenyl-5-(phenylsulfonyl)thiazol-2-amine (3y)

Yield: 67 mg, 22%; white solid; M.P.: 169-175 °C.

1H NMR (300 MHz, DMSO-d6) δ (ppm): 7.37-7.56 (m, 10H), 8.05 (br, 2H);

13C NMR (75 MHz, DMSO-d6) δ (ppm): 117.8, 127.0, 128.6, 130.2, 130.4, 133.7, 134.2, 143.0, 158.3, 171.6.
HRMS (ESI) calcd for C₁₅H₁₁N₂O₃S₂ (M+H)+ 317.04087, found 317.04130.

(2-amino-4-phenylthiazol-5-yl) (phenyl)methanone (3z) [6]

![Chemical structure of 3z](image)

Yield: 12 mg, 4%; light yellow solid; M.P.: 157-161 °C.

1H NMR (300 MHz, DMSO-d₆) δ (ppm): 7.04-7.14 (m, 5H), 7.22-7.29 (m, 3H), 7.35-7.37 (m, 2H), 8.06 (br, 2H);
13C NMR (75 MHz, DMSO-d₆) δ (ppm): 121.0, 127.8, 128.1, 128.8, 129.0, 130.0, 131.6, 135.3, 139.0, 159.4, 171.4, 188.0.

1-(2-amino-4-methylthiazol-5-yl)ethan-1-one (3aa) [5]

![Chemical structure of 3aa](image)

Yield: 39 mg, 25%; light yellow waxy solid.

1H NMR (300 MHz, DMSO-d₆) δ (ppm): 2.32 (s, 3H), 2.40 (s, 3H), 7.84 (br, 2H);
13C NMR (75 MHz, DMSO-d₆) δ (ppm): 18.8, 30.0, 121.8, 158.1, 171.0, 188.8.

Ethyl 4-methyl-2-(methylamino)thiazole-5-carboxylate (3bb) [1]

![Chemical structure of 3bb](image)

Yield: 154 mg, 77%; light yellow solid; M.P.: 149-151 °C.

1H NMR (300 MHz, DMSO-d₆) δ (ppm): 1.22 (t, J = 6.9 Hz, 3H), 2.41 (s, 3H), 2.82 (d, J = 4.8 Hz, 3H), 4.14 (q, J = 6.9 Hz, 2H), 8.28 (d, J = 4.2 Hz, 1H);
13C NMR (75 MHz, DMSO-d₆) δ (ppm): 14.9, 17.8, 31.3, 60.3, 107.5, 160.2, 162.5, 171.2.

Ethyl 4-methyl-2-(phenethylamino) thiazole-5-carboxylate (3cc)

![Chemical structure of 3cc](image)

Yield: 128 mg, 44%; yellow solid; M.P.: 100-102 °C.

1H NMR (300 MHz, DMSO-d₆) δ (ppm): 1.22 (t, J = 6.9 Hz, 3H), 2.40 (s, 3H), 2.85 (t, J = 6.9 Hz, 2H), 3.45 (q, J = 6.6 Hz, 2H), 4.14 (q, J = 6.9 Hz, 2H), 7.23-7.30 (m, 5H), 8.44 (br, 1H);
13C NMR (75 MHz, DMSO-d₆) δ (ppm): 14.9, 17.9, 34.9, 46.2, 60.3, 107.4, 126.8, 128.9, 129.2, 139.5, 160.0, 162.5, 170.1;
HRMS (ESI) calcd for C₁₅H₁₅N₂O₃S (M+H)+ 291.11602, found 291.11618.

4. References

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5. Spectra of prepared compounds

$^1$H NMR of ethyl 2-amino-4-methylthiazole-5-carboxylate (3a)

$^{13}$C NMR of ethyl 2-amino-4-methylthiazole-5-carboxylate (3a)
$^1$H NMR of methyl 2-amino-4-methylthiazole-5-carboxylate (3b)

$^{13}$C NMR of methyl 2-amino-4-methylthiazole-5-carboxylate (3b)
$^1$H NMR of tert-butyl 2-amino-4-methylthiazole-5-carboxylate (3c)

$^{13}$C NMR of tert-butyl 2-amino-4-methylthiazole-5-carboxylate (3c)
$^1$H NMR of pentyl 2-amino-4-methylthiazole-5-carboxylate (3d)

$^{13}$C NMR of pentyl 2-amino-4-methylthiazole-5-carboxylate (3d)
$^1$H NMR of allyl 2-amino-4-methylthiazole-5-carboxylate (3e)

$^{13}$C NMR of allyl 2-amino-4-methylthiazole-5-carboxylate (3e)
$^1$H NMR of benzyl 2-amino-4-methylthiazole-5-carboxylate (3f)

$^{13}$C NMR of benzyl 2-amino-4-methylthiazole-5-carboxylate (3f)
HRMS of benzyl 2-amino-4-methylthiazole-5-carboxylate (3f)

1H NMR of ethyl 2-amino-4-ethylthiazole-5-carboxylate (3g)
$^{13}$C NMR of ethyl 2-amino-4-ethylthiazole-5-carboxylate (3g)

HRMS of ethyl 2-amino-4-ethylthiazole-5-carboxylate (3g)
$^1$H NMR of ethyl 2-amino-4-propylthiazole-5-carboxylate (3h)

$^{13}$C NMR of ethyl 2-amino-4-propylthiazole-5-carboxylate (3h)
$^1$H NMR of ethyl 2-amino-4-isopropylthiazole-5-carboxylate (3i)

$^{13}$C NMR of ethyl 2-amino-4-isopropylthiazole-5-carboxylate (3i)
$^1$H NMR of ethyl 2-amino-4-butylthiazole-5-carboxylate (3j)

$^{13}$C NMR of ethyl 2-amino-4-butylthiazole-5-carboxylate (3j)
HRMS of ethyl 2-amino-4-butylthiazole-5-carboxylate (3j)

[Image of HRMS graph]

$^{1}H$ NMR of ethyl 2-amino-4-(tert-butyl) thiazole-5-carboxylate (3k)

[Image of NMR spectrum]
$^{13}$C NMR of ethyl 2-amino-4-(tert-butyl) thiazole-5-carboxylate (3k)

HRMS of ethyl 2-amino-4-(tert-butyl) thiazole-5-carboxylate (3k)
$^1$H NMR of ethyl 2-amino-4-cyclohexylthiazole-5-carboxylate (3l)

$^{13}$C NMR of ethyl 2-amino-4-cyclohexylthiazole-5-carboxylate (3l)
HRMS of ethyl 2-amino-4-cyclohexylthiazole-5-carboxylate (3l)

\[ \text{HRMS of ethyl } 2\text{-amino-4-cyclohexylthiazole-5-carboxylate (3l)} \]

\[ \text{1H NMR of ethyl 2-amino-4-phenylthiazole-5-carboxylate (3m)} \]

\[ \text{1H NMR of ethyl 2-amino-4-phenylthiazole-5-carboxylate (3m)} \]
$^{13}\text{C}$ NMR of ethyl 2-amino-4-phenylthiazole-5-carboxylate (3m)

$^1\text{H}$ NMR of ethyl 2-amino-4-(p-tolyl) thiazole-5-carboxylate (3n)
$^{13}$C NMR of ethyl 2-amino-4-\((p\text{-}toly)}\) thiazole-5-carboxylate (3n)

HRMS of ethyl 2-amino-4-\((p\text{-}toly)}\) thiazole-5-carboxylate (3n)
$^1$H NMR of ethyl 2-amino-4-(4-methoxyphenyl) thiazole-5-carboxylate (3o)

$^{13}$C NMR of ethyl 2-amino-4-(4-methoxyphenyl) thiazole-5-carboxylate (3o)
HRMS of ethyl 2-amino-4-(4-methoxyphenyl) thiazole-5-carboxylate (3o)

\[\text{Molecular Structure Image} \]

\[\text{HRMS Image} \]

\[\text{1H NMR of ethyl 2-amino-4-(3-methoxyphenyl) thiazole-5-carboxylate (3p)} \]

\[\text{NMR Image} \]
$^{13}$C NMR of ethyl 2-amino-4-(3-methoxyphenyl) thiazole-5-carboxylate (3p)

HRMS of ethyl 2-amino-4-(3-methoxyphenyl) thiazole-5-carboxylate (3p)
$^1$H NMR of ethyl 2-amino-4-(2-methoxyphenyl) thiazole-5-carboxylate (3q)

$^{13}$C NMR of ethyl 2-amino-4-(2-methoxyphenyl) thiazole-5-carboxylate (3q)
HRMS of ethyl 2-amino-4-(2-methoxyphenyl) thiazole-5-carboxylate (3q)

$^1$H NMR of ethyl 2-amino-4-(4-fluorophenyl) thiazole-5-carboxylate (3r)
$^{13}$C NMR of ethyl 2-amino-4-(4-fluorophenyl) thiazole-5-carboxylate (3r)

HRMS of ethyl 2-amino-4-(4-fluorophenyl) thiazole-5-carboxylate (3r)
$^1$H NMR of ethyl 2-amino-4-(4-chlorophenyl) thiazole-5-carboxylate (3s)

$^{13}$C NMR of ethyl 2-amino-4-(4-chlorophenyl) thiazole-5-carboxylate (3s)
$^1$H NMR of ethyl 2-amino-4-(4-bromophenyl) thiazole-5-carboxylate (3t)

$^{13}$C NMR of ethyl 2-amino-4-(4-bromophenyl) thiazole-5-carboxylate (3t)
$^1$H NMR of ethyl 2-amino-4-(4-nitrophenyl) thiazole-5-carboxylate (3u)

$^{13}$C NMR of ethyl 2-amino-4-(4-nitrophenyl) thiazole-5-carboxylate (3u)
$^1$H NMR of ethyl 2-amino-4-(furan-2-yl) thiazole-5-carboxylate (3v)

$^{13}$C NMR of ethyl 2-amino-4-(furan-2-yl) thiazole-5-carboxylate (3v)
$^1$H NMR of 2-amino-N, N-diethyl-4-methylthiazole-5-carboxamide (3w)

$^{13}$C NMR of 2-amino-N, N-diethyl-4-methylthiazole-5-carboxamide (3w)
$^1$H NMR of 2-amino-4-phenylthiazole-5-carbonitrile (3x)

$^{13}$C NMR of 2-amino-4-phenylthiazole-5-carbonitrile (3x)
$^1$H NMR of 4-phenyl-5-(phenylsulfonyl) thiazol-2-amine (3y)

$^{13}$C NMR of 4-phenyl-5-(phenylsulfonyl) thiazol-2-amine (3y)
HRMS of 4-phenyl-5-(phenylsulfonyl) thiazol-2-amine (3y)

1H NMR of (2-aminophenylthiazol-5-yl) (phenyl)methanone (3z)
$^{13}$C NMR of (2-amino-4-phenylthiazol-5-yl) (phenyl)methanone (3z)

$^1$H NMR of 1-(2-amino-4-methylthiazol-5-yl)ethan-1-one (3aa)
$^{13}$C NMR of 1-(2-amino-4-methylthiazol-5-yl)ethan-1-one (3aa)

$^1$H NMR of ethyl 4-methyl-2-(methylamino) thiazole-5-carboxylate (3bb)
$^{13}$C NMR of ethyl 4-methyl-2-(methylamino) thiazole-5-carboxylate (3bb)

$^1$H NMR of ethyl 4-methyl-2-(phenethylamino) thiazole-5-carboxylate (3cc)
$^{13}$C NMR of ethyl 4-methyl-2-(phenethylamino) thiazole-5-carboxylate (3cc)

HRMS of ethyl 4-methyl-2-(phenethylamino) thiazole-5-carboxylate (3cc)