

# Supporting Information

## **Copper(II)-Mediated Formation of oxazole-4-carbonitrile from Acetophenone and Coordinated Cyanide Anion via a Radical Coupling**

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# Supporting Information

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## Experimental Section

### 1. General Methods

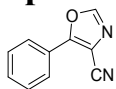
Unless otherwise specified, all melting points were obtained on a Büchi Melting Point B-540 apparatus (Büchi Labortechnik, Flawil, Switzerland) and were uncorrected. Mass spectra (MS) were taken in ESI mode on Agilent 1100 LC-MS (Agilent, Palo Alto, CA, USA.). <sup>1</sup>H NMR and <sup>13</sup>C NMR spectra were recorded on Bruker ARX-400, 400 MHz or Bruker ARX-600, 600 MHz spectrometers (BrukerBioscience, Billerica, MA, USA) with TMS as an internal standard. HRMS (ESI) was determined by using accurate-Mass Q-TOF HRMS/MS instrument (Agilent Technologies 6530). Column chromatography was run on silica gel (200e300 mesh) from Qingdao Ocean Chemicals (Qingdao, Shandong, China).

### 2. General Experimental Details

General procedure for the construction of **2a-2q**(**2a** as example).

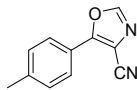
The mixture of acetophenone **1a** (120mg, 1.0 mmol), potassium ferricyanide (120.0 mg, 0.4mmol), CuBr<sub>2</sub>(222.2mg,1.0mmol) was added in DMF (3 mL). Then, the resulting mixture was stirred at 130°C for 12 h. After the reaction completed, and then added 10 mL water to the mixture, extracted with EtOAc three times (3 × 10 mL). Dried over anhydrous Na<sub>2</sub>SO<sub>4</sub> and concentrated under reduced pressure. The residue was purified by column chromatography on silica gel (petroleum ether/EtOAc = 7/3) to afford the desired product **2a**.

## Spectroscopic Data



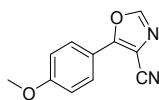
5-phenyloxazole-4-carbonitrile (**2a**)<sup>a</sup>:

Yield 75% (127.5 mg); white solid; m.p. 117–118 °C; <sup>1</sup>H NMR (400 MHz, CDCl<sub>3</sub>): δ (ppm) 7.93-7.96(m,3H),7.52(s,3H); <sup>13</sup>C NMR (100MHz, CDCl<sub>3</sub>): δ (ppm) 158.1, 150.0, 131.4, 129.4, 125.8, 124.8, 114.5, 108.1. calcd for C<sub>10</sub>H<sub>6</sub>N<sub>2</sub>O:170.0480; found: 170.0476.



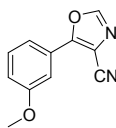
5-(p-tolyl)oxazole-4-carbonitrile(**2b**):

Yield 69% (127.7 mg); white solid; m.p. 119–120 °C; <sup>1</sup>H NMR (400 MHz, CDCl<sub>3</sub>): δ 7.89 (s, 1H), 7.85 (d, J = 8.3 Hz, 2H), 7.32 (d, J = 8.1 Hz, 2H), 2.43 (s, 3H). <sup>13</sup>C NMR (100MHz, CDCl<sub>3</sub>): δ (ppm) 158.46, 149.68, 142.11, 130.08, 125.83, 122.15, 113.66, 107.36, 21.64. calcd for C<sub>11</sub>H<sub>8</sub>N<sub>2</sub>O:184.0637; found: 184.0641.



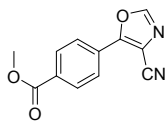
5-(4-methoxyphenyl)oxazole-4-carbonitrile(**2c**):

Yield 61% (121.3mg); white solid; m.p. 122-124 °C; <sup>1</sup>H NMR (400 MHz, CDCl<sub>3</sub>): δ 7.93- 7.87 (m, 2H), 7.85 (s, 1H), 7.04- 6.99 (m, 2H), 3.88 (s, 3H). <sup>13</sup>C NMR (100MHz, CDCl<sub>3</sub>): δ 161.96, 158.39, 149.32, 132.37, 130.60, 127.69, 117.51, 106.35, 55.53. calcd for C<sub>11</sub>H<sub>8</sub>N<sub>2</sub>O:200.0586; found: 200.0581.



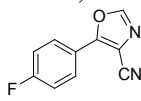
5-(3-methoxyphenyl)oxazole-4-carbonitrile(**2d**):

Yield 59% (117.1mg); white solid; m.p. 125-128 °C; <sup>1</sup>H NMR (400 MHz, CDCl<sub>3</sub>): δ 7.92 (s, 1H), 7.56 (d, J = 7.7 Hz, 1H), 7.45 (dd, J = 7.7, 5.3 Hz, 2H), 7.05 (dd, J = 8.3, 1.9 Hz, 1H). <sup>13</sup>C NMR (100MHz, CDCl<sub>3</sub>): δ 160.13, 158.07, 149.99, 130.60, 125.94, 118.27, 117.61, 113.47, 110.72, 108.29, 55.49. calcd for C<sub>11</sub>H<sub>8</sub>N<sub>2</sub>O:200.0586; found: 200.0589.



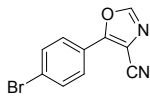
Methyl 4-(4-cyanooxazol-5-yl)benzoate(**2e**):

Yield 77%(174.9mg) : white solid; m.p. 117-119 °C; <sup>1</sup>H NMR (400 MHz, CDCl<sub>3</sub>): δ 8.21(d, 2H), 8.05(d,2H), 8.00(s,1H),3.97(s,3H). <sup>13</sup>C NMR (100MHz, CDCl<sub>3</sub>): 165.90, 156.92, 150.66, 132.46, 130.58, 128.55, 125.75, 113.07, 109.66, 52.56.calcd for C<sub>12</sub>H<sub>8</sub>N<sub>2</sub>O<sub>3</sub>:288.0535;found: 288.0531.



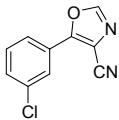
5-(4-fluorophenyl)oxazole-4-carbonitrile(**2f**):

Yield 82% (155.0mg); white solid; m.p. 120-124 °C; <sup>1</sup>H NMR (400 MHz, CDCl<sub>3</sub>): δ 8.00-7.94 (m, 2H),7.92 (s, 1H),7.23 (qd, J = 5.1, 2.6 Hz, 2H). <sup>13</sup>C NMR (100MHz, CDCl<sub>3</sub>): δ 164.27(d,*J*<sub>C-F</sub>=254.1 Hz), 157.32, 149.99, 128.21 (d, *J*<sub>C-F</sub>=8.8Hz), 121.25 (d, *J*<sub>C-F</sub>=3.4Hz), 116.82(d, *J*<sub>C-F</sub>=22.4Hz), 113.38, 107.82. calcd for C<sub>10</sub>H<sub>5</sub>FN<sub>2</sub>O:188.0386; found: 188.0389.



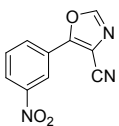
5-(4-bromophenyl)oxazole-4-carbonitrile(**2g**):

Yield 80% (197.7mg); yellow solid; m.p. 115-118 °C;  $^1\text{H NMR}$  (400 MHz,  $\text{CD}_3\text{SOCD}_3$ ):  $\delta$  8.79 (s, 1H), 7.82 (d,  $J = 6.8$  Hz, 4H).  $^{13}\text{C NMR}$  (400MHz,  $\text{CD}_3\text{SOCD}_3$ ):  $\delta$  156.96, 153.32, 133.19, 127.92, 125.47, 124.18, 114.05, 107.84. calcd for  $\text{C}_{10}\text{H}_5\text{BrN}_2\text{O}$ :247.9585; found: 247.9579.



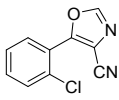
5-(3-chlorophenyl)oxazole-4-carbonitrile(**2h**):

Yield 86% (176.7mg); yellow solid; m.p. 127-128 °C;  $^1\text{H NMR}$  (400 MHz,  $\text{CDCl}_3$ ):  $\delta$  7.95 (s, 1H), 7.93-7.88 (m, 2H), 7.51-7.47 (m, 2H).  $^{13}\text{C NMR}$  (100MHz,  $\text{CDCl}_3$ ):  $\delta$  155.58, 149.33, 134.60, 130.44, 129.90, 129.76, 127.82, 125.40, 124.77, 122.92, 111.97. calcd for  $\text{C}_{10}\text{H}_5\text{ClN}_2\text{O}$ :204.0090; found: 204.0095.



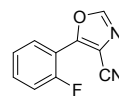
5-(3-nitrophenyl)oxazole-4-carbonitrile(**2i**):

Yield 54% (115.9mg); yellow solid; m.p. 165-167 °C;  $^1\text{H NMR}$  (400 MHz,  $\text{CDCl}_3$ ):  $\delta$  8.76 (s, 1H), 8.38 (dd,  $J = 9.4, 4.3$  Hz, 2H), 8.04 (s, 1H), 7.81-7.74 (m, 1H).  $^{13}\text{C NMR}$  (100MHz,  $\text{CDCl}_3$ ):  $\delta$  154.51, 149.89, 147.80, 130.11, 129.83, 125.39, 124.68, 119.74, 111.61, 109.09. calcd for  $\text{C}_{10}\text{H}_5\text{N}_3\text{O}_3$ :215.0331; found: 215.0338.



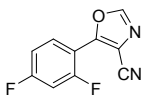
5-(3-chlorophenyl)oxazole-4-carbonitrile(**2k**):

Yield 70% (142.7mg); yellow solid; m.p. 115-117 °C;  $^1\text{H NMR}$  (400 MHz,  $\text{CDCl}_3$ ):  $\delta$  8.03 (s, 1H), 7.64 (dd,  $J = 7.6, 1.4$  Hz, 1H), 7.56 (dd,  $J = 8.0, 0.8$  Hz, 1H), 7.49 (td,  $J = 7.7, 1.6$  Hz, 1H), 7.43 (dd,  $J = 10.7, 4.3$  Hz, 1H).  $^{13}\text{C NMR}$  (100MHz,  $\text{CDCl}_3$ ):  $\delta$  155.58, 149.33, 134.60, 130.44, 129.76, 127.82, 124.77, 122.92, 111.97, 108.02. calcd for  $\text{C}_{10}\text{H}_5\text{ClN}_2\text{O}$ :204.0090; found: 204.0087.



5-(2-fluorophenyl)oxazole-4-carbonitrile(**2l**):

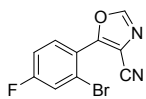
Yield 69% (129.7mg); yellow solid; m.p. 125-128 °C;  $^1\text{H NMR}$  (400 MHz,  $\text{CDCl}_3$ ):  $\delta$  8.01 (s, 1H), 7.80 (s, 1H), 7.53 (s, 1H), 7.30 (d,  $J = 11.7$  Hz, 1H).  $^{13}\text{C NMR}$  (100MHz,  $\text{CDCl}_3$ ):  $\delta$  159.29 (d,  $J_{\text{C-F}}=256.3\text{Hz}$ ), 153.45, 150.87, 133.41 (d,  $J_{\text{C-F}}=8.4\text{Hz}$ ), 128.78 (d,  $J_{\text{C-F}}=1.5\text{Hz}$ ), 124.99 (d,  $J_{\text{C-F}}=3.6\text{Hz}$ ), 116.97 (d,  $J_{\text{C-F}}=20.8\text{Hz}$ ), 113.42 (d,  $J_{\text{C-F}}=12.9\text{Hz}$ ), 112.47, 111.45. calcd for  $\text{C}_{10}\text{H}_5\text{FN}_2\text{O}$ :188.0386; found: 188.0379.



5-(2,4-difluorophenyl)oxazole-4-carbonitrile(**2m**):

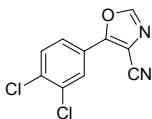
Yield 77% (159.7mg); yellow solid; m.p. 123-129 °C;  $^1\text{H NMR}$  (400 MHz,  $\text{CDCl}_3$ ):  $\delta$  8.01 (s, 1H), 7.81 (td,  $J=8.3, 6.3$  Hz, 1H), 7.11-7.05 (m, 1H), 7.05-6.99 (m, 1H).  $^{13}\text{C NMR}$  (100MHz,  $\text{CDCl}_3$ ):  $\delta$

164.83 (dd,  $J=11.7$  Hz,  $J=11.6$  Hz), 159.93 (dd,  $J=11.1$  Hz,  $J=12.3$  Hz), 152.67, 150.87, 130.15 (dd,  $J=3.2$  Hz,  $J=3.5$ Hz), 112.84 (dd,  $J=3.6$ Hz,  $J=3.6$ Hz), 112.30, 111.24, 110.05 (dd,  $J=3.8$ Hz,  $J=3.8$ Hz), 105.57 (t,  $J=25.3$  Hz). calcd for  $C_{10}H_4F_2N_2O$ :206.0292; found: 206.0298.



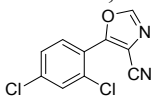
5-(2-bromo-4-fluorophenyl)oxazole-4-carbonitrile(**2n**):

Yield 74% (196.1mg); yellow solid; m.p. 114-118 °C;  $^1H$  NMR (400 MHz,  $CDCl_3$ ):  $\delta$  7.99-7.94 (m, 2H), 7.93 (s, 1H), 7.22 (t,  $J=8.5$  Hz, 2H).  $^{13}C$  NMR (100MHz,  $CDCl_3$ ):  $\delta$  164.24 (d,  $J_{C-F}=254.1$ Hz), 157.29, 150.04, 128.24, 128.15, 121.25(d,  $J_{C-F}=3.5$ Hz), 116.90, 116.68, 113.39, 107.78. calcd for  $C_{10}H_4BrFN_2O$ :265.9491; found: 265.9499.



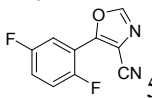
5-(3,4-dichlorophenyl)oxazole-4-carbonitrile(**2o**):

Yield 88% (208.5mg); yellow solid; m.p. 144-150 °C;  $^1H$  NMR (400 MHz,  $CDCl_3$ ):  $\delta$  8.01 (s, 1H), 7.97 (s, 1H), 7.86-7.81 (m, 1H), 7.61 (d,  $J=8.4$  Hz, 1H).  $^{13}C$  NMR (400MHz,  $CD_3SOCD_3$ ):  $\delta$  154.89, 154.41, 137.89, 133.53, 133.27, 130.85, 128.85, 123.02, 113.00, 112.23. calcd for  $C_{10}H_4Cl_2N_2O$ : 237.9701; found: 237.9710.



5-(2,4-dichlorophenyl)oxazole-4-carbonitrile(**2p**):

Yield 57% (135.7mg); yellow solid; m.p. 133-139 °C;  $^1H$  NMR (400 MHz,  $CD_3SOCD_3$ ):  $\delta$  8.99 (s, 1H), 8.03 (d,  $J=1.6$  Hz, 1H), 7.90 (d,  $J=8.4$  Hz, 1H), 7.81-7.75 (m, 1H).  $^{13}C$  NMR (100MHz,  $CDCl_3$ ):  $\delta$  155.77, 150.50, 135.89, 134.13, 131.59, 127.51, 124.82, 124.58, 112.87, 109.23. calcd for  $C_{10}H_4Cl_2N_2O$ : 237.9701; found: 237.9707.



5-(2,6-difluorophenyl)oxazole-4-carbonitrile(**2q**):

Yield 48% (99.8mg); yellow solid; m.p. 127-128 °C;  $^1H$  NMR (400 MHz,  $CDCl_3$ ):  $\delta$  8.03 (s, 1H), 7.48 (s, 1H), 7.24 (d,  $J=7.5$  Hz, 3H).  $^{13}C$  NMR (100MHz,  $CDCl_3$ ):  $\delta$  158.60(dd,  $J_{C-F}=245.5, 2.2$ Hz), 155.36(d,  $J_{C-F}=252.8, 2.4$ Hz), 151.93(t,  $J_{C-F}=2.5$ Hz), 151.11, 120.01(dd,  $J_{C-F}=24.2, 8.6$ Hz), 118.41(dd,  $J_{C-F}=24.0, 8.6$ Hz), 115.08(d,  $J_{C-F}=2.2$ Hz), 114.82(d,  $J_{C-F}=2.2$ Hz), 112.27(d,  $J_{C-F}=2.9$ Hz), 112.00. calcd for  $C_{10}H_4F_2N_2O$ :206.0292; found: 206.0298.

## References:

- (a) Xia, Q.; Ganem, B. *Synth.* **2002**. *14*.1969.

## 5. Appendix: spectral copies of $^1\text{H}$ NMR, and $^{13}\text{C}$ NMR

