Supporting Information

Palladium-catalyzed Synthesis of Benzoxazoles by the Cleavage Reaction of Carbon-carbon Triple Bond with \( \sigma \)-Aminophenol

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S2-S8 Experimental and spectral data of compounds
S9-S22 Copies of \(^1\)H and \(^{13}\)C NMR spectra of all compounds.

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Experimental

1 General methods and materials Melting points were uncorrected. NMR spectra were in CDCl₃ (¹H at 500 MHz or 400 MHz and ¹³C at 125 MHz or 100 MHz). Column chromatography was performed on silica gel (300-400 mesh). Unless otherwise noted, all reagents were obtained commercially and used without further purification.

2 General procedure for the formation of benzoxazoles

The reaction mixture of o-aminophenol (1a, 109.1 mg 1.0 mmol), diphenylacetylene (2a, 89 mg, 0.5 mmol), PdCl₂ (4.4 mg, 0.0025 mmol), PhCl (1 mL) in a 10 mL flask was stirred at reflux and monitored periodically by TLC. Upon completion, chlorobenzene was removed under reduced pressure using an aspirator, and then the residue was purified by flash chromatography (hexane/ethyl acetate = 40:1) on silica gel to yield the desired product 3aa as white solid (167.8 mg, 86% yield), mp 101.7-103.5 °C.

2-Phenylbenzo[d]oxazole (3aa, CAS: 833-50-1)¹

[Figures and chemical structures]

¹H NMR (400 MHz, CDCl₃) δ 8.29-8.24 (m, 2H), 7.81-7.76 (m, 1H), 7.62-7.57 (m, 1H), 7.56-7.51 (m, 3H), 7.38-7.33 (m, 2H). ¹³C NMR (100 MHz, CDCl₃) δ 163.05, 150.78, 142.13, 131.50, 128.90, 127.63, 127.20, 125.09, 124.56, 120.02, 110.57. m/z (MS): 196 [M+H]+.

2-(4-Methylphenyl)benzo[d]oxazole (3ab, CAS: 835-71-2)¹

[Figures and chemical structures]
The reaction was conducted with α-aminophenol (1a, 109.1 mg, 1.0 mmol), 1,2-bis(4-methylphenyl)acetylene (2b, 103.1 mg, 0.5 mmol). The residue was purified by flash chromatography (hexane/ethyl acetate = 40:1) on silica gel to yield the desired product 3ab as colorless solid (163.1 mg, 78% yield), mp 110.2-111.7 °C.

$^1$H NMR (500 MHz, CDCl$_3$) δ 8.14 (d, $J = 8.1$ Hz, 2H), 7.77-7.76 (m, 1H), 7.55-7.74 (m, 1H), 7.35-7.31 (m, 4H), 2.41 (s, 3H). $^{13}$C NMR (125 MHz, CDCl$_3$) δ 163.18, 150.59, 142.12, 141.89, 129.51, 127.49, 124.74, 124.35, 119.74, 110.37, 21.50. m/z (MS): 210 [M+H]$^+$. 

**2-(4-Methoxyphenyl)benzo[d]oxazole (3ac, CAS: 838-34-6)$^{[1]}$**

![Image of 2-(4-Methoxyphenyl)benzo[d]oxazole](image)

The reaction was conducted with α-aminophenol (1a, 109.1 mg, 1.0 mmol), 1,2-bis(4-methoxyphenyl)acetylene (2c, 119.1 mg, 0.5 mmol). The residue was purified by flash chromatography (hexane/ethyl acetate = 40:1) on silica gel to yield the desired product 3ac as colorless solid (164.3 mg, 73% yield), mp 101.2-102.5 °C.

$^1$H NMR (500 MHz, CDCl$_3$) δ 8.24-8.18 (m, 2H), 7.74 (dd, $J = 5.5$, 2.1 Hz, 1H), 7.56 (d, $J = 6.8$ Hz, 1H), 7.36-7.29 (m, 2H), 7.06-7.01 (m, 2H), 3.90 (s, 3H). $^{13}$C NMR (125 MHz, CDCl$_3$) δ 163.15, 162.35, 150.70, 142.33, 129.36, 124.53, 124.36, 119.76, 119.61, 114.34, 110.31, 55.37. m/z (MS): 226 [M+H]$^+$. 

**2-(4-Bromophenyl)benzo[d]oxazole (3ad, CAS: 3164-13-4)$^{[2]}$**

![Image of 2-(4-Bromophenyl)benzo[d]oxazole](image)

The reaction was conducted with α-aminophenol (1a, 109.1 mg, 1.0 mmol), 1,2-bis(4-bromophenyl)acetylene (2d, 167 mg, 0.5 mmol). The residue was purified by flash chromatography (hexane/ethyl acetate = 40:1) on silica gel to yield the desired product 3ad as white solid (240.2 mg, 88% yield), mp 157.3-158.1 °C.

$^1$H NMR (500 MHz, CDCl$_3$) δ 8.12 (d, $J = 8.8$ Hz, 2H), 7.70 (d, $J = 7.3$ Hz, 1H), 7.53 (d, $J = 7.7$ Hz, 1H), 7.37-7.27(m, 2H), 6.78 (d, $J = 8.7$ Hz, 2H), 3.08 (s, 6H). $^{13}$C
NMR (125 MHz, CDCl$_3$) $\delta$ 162.16, 150.81, 142.07, 132.24, 129.02, 126.22, 125.38, 124.75, 120.14, 110.62. $m/z$ (MS): 274, 276 [M+H]$^+$. 

4-(Benzo[d]oxazol-2-yl)-N,N-dimethylaniline (3ag, CAS: 840-57-3)$^{[3]}$

![Image of the structure of 4-(Benzo[d]oxazol-2-yl)-N,N-dimethylaniline]

The reaction was conducted with o-aminophenol (1a, 109.1 mg, 1.0 mmol), 4-(phenylethynyl)-N,N-dimethylaminobenzene (2g, 110.6 mg, 0.5 mmol). The residue was purified by flash chromatography (hexane/ethyl acetate = 20:1) on silica gel to yield the desired product 3ag as white solid (43 mg, 36% yield), mp 182.3-183.7 °C.

$^1$H NMR (500 MHz, CDCl$_3$) $\delta$ 8.14 (d, $J$ = 8.7 Hz, 2H), 7.72 (d, $J$ = 7.5 Hz, 1H), 7.54 (d, $J$ = 7.8 Hz, 1H), 7.28-7.34 (m, 2H), 6.79 (d, $J$ = 8.5 Hz, 2H), 3.09 (s, 6H). $^{13}$C NMR (125 MHz, CDCl$_3$) $\delta$ 164.21, 152.42, 150.60, 142.64, 129.09, 124.14, 123.88, 119.12, 111.59, 110.09, 40.11. $m/z$ (MS): 239 [M+H]$^+$. 

2-(4-Fluorophenyl)benzo[d]oxazole (3ai, CAS: 397-54-6)$^{[4]}$

![Image of the structure of 2-(4-Fluorophenyl)benzo[d]oxazole]

The reaction was conducted with o-aminophenol (1a, 109.1 mg, 1.0 mmol), 1-(4-fluorophenyl)-2-phenylethyne (2i, 98 mg, 0.5 mmol). The residue was purified by flash chromatography (hexane/ethyl acetate = 40:1) on silica gel to yield the desired product 3ai as pale yellow solid (48 mg, 45% yield), mp 93-94 °C.

$^1$H NMR (400 MHz, CDCl$_3$) $\delta$ 8.27-8.23 (m, 2H), 7.78-7.74 (m, 1H), 7.58-7.54 (m, 1H), 7.37-7.33 (m, 2H), 7.20 (t, $J$ = 8.6 Hz, 2H). $^{13}$C NMR (100 MHz, CDCl$_3$) $\delta$ 166.00, 163.49, 162.10, 150.69, 141.98, 129.82, 129.73, 125.10, 124.62, 123.43, 119.93, 116.26, 116.04, 110.53. $m/z$ (MS): 214 [M+H]$^+$. 

4-(Benzo[d]oxazol-2-yl)benzonitril (3aj, CAS: 838-33-5)$^{[2]}$

![Image of the structure of 4-(Benzo[d]oxazol-2-yl)benzonitril]
The reaction was conducted with o-aminophenol (1a, 109.1 mg, 1.0 mmol), 1-(4-cyanophenyl)-2-phenylethynyl (2j, 101.5 mg, 0.5 mmol). The residue was purified by flash chromatography (hexane/ethyl acetate = 30:1) on silica gel to yield the desired product 3aj as white solid (51 mg, 46.5% yield), mp 202-204 °C.

$^1$H NMR (500 MHz, CDCl₃) δ 8.41-8.35 (m, 2H), 7.81 (d, $J = 6.1$ Hz, 3H), 7.61 (s, 1H), 7.41 (s, 2H). $^{13}$C NMR (125 MHz, CDCl₃) δ 160.95, 150.98, 141.96, 132.66, 131.20, 127.99, 126.14, 125.11, 120.61, 118.09, 114.83, 110.85. m/z (MS): 221 [M+H]$^+$.

2-(Naphthalen-2-yl)benzo[d]oxazole (3ak, CAS: 14625-56-0)$^5$

The reaction was conducted with o-aminophenol (1a, 109.1 mg, 1.0 mmol), 2-(2-phenylethynyl)naphthalene (2k, 114 mg, 0.5 mmol). The residue was purified by flash chromatography (hexane/ethyl acetate = 40:1) on silica gel to yield the desired product 3ak as white solid (49 mg, 40% yield), mp 115.3-116.7 °C.

$^1$H NMR (500 MHz, CDCl₃) δ 9.51 (d, $J = 8.7$ Hz, 1H), 8.44 (d, $J = 7.3$ Hz, 1H), 8.03 (d, $J = 8.2$ Hz, 1H), 7.95-7.90 (m, 2H), 7.73 (t, $J = 7.7$ Hz, 1H), 7.66-7.64 (m, 1H), 7.62-7.59 (m, 2H), 7.42-7.40 (m, 2H). $^{13}$C NMR (125 MHz, CDCl₃) δ 162.79, 150.17, 142.33, 133.96, 132.24, 130.70, 129.27, 128.62, 127.85, 126.40, 126.30, 125.22, 124.88, 124.45, 123.61, 120.26, 110.45. m/z (MS): 246 [M+H]$^+$.


The reaction was conducted with o-aminophenol (1a, 109.1 mg, 1.0 mmol), 1-(2-pyridyl)-2-phenylethynyl (2l, 89.5 mg, 0.5 mmol). The residue was purified by flash chromatography (hexane/ethyl acetate = 20:1) on silica gel to yield the desired product 3al as white solid (40 mg, 40.5% yield), mp 108-109 °C.

$^1$H NMR (500 MHz, CDCl₃) δ 8.82 (d, $J = 4.6$ Hz, 1H), 8.37 (d, $J = 7.9$ Hz, 1H), 7.89
(t, J = 7.7 Hz, 1H), 7.83 (d, J = 7.3 Hz, 1H), 7.67 (d, J = 7.7 Hz, 1H), 7.47-7.38 (m, 3H). $^{13}$C NMR (125 MHz, CDCl$_3$) $\delta$ 161.47, 151.09, 150.29, 146.14, 141.81, 137.05, 126.02, 125.52, 124.91, 123.45, 120.65, 111.22. m/z (MS): 197 [M+H]$^+$. 

2-(Thiophenyl)benzoxazole (3am, CAS: 23999-63-5)$^5$

![Image of 2-(Thiophenyl)benzoxazole](image)

The reaction was conducted with o-aminophenol (1a, 109.1 mg, 1.0 mmol), 2-(2-phenylethynyl)thiophene (2m, 92 mg, 0.5 mmol). The residue was purified by flash chromatography (hexane/ethyl acetate = 40:1) on silica gel to yield the desired product 3am as white solid (41 mg, 41% yield), mp 81-83 °C. 

$^1$H NMR (500 MHz; CDCl$_3$) $\delta$ 7.92 (d, J = 3.3 Hz, 1H), 7.74-7.73 (m, 1H), 7.57-7.54 (m, 2H), 7.35-7.33 (m, 2H), 7.20-7.18 (m, 1H). $^{13}$C NMR (125 MHz, CDCl$_3$) $\delta$ 159.07, 150.48, 142.06, 130.21, 129.94, 129.71, 128.23, 125.07, 124.72, 119.83, 110.42. m/z (MS): 202 [M+H]$^+$. 

6-Methyl-2-phenylbenzo[d]oxazole (3bn, CAS: 14016-00-3)$^6$

![Image of 6-Methyl-2-phenylbenzo[d]oxazole](image)

The reaction was conducted with 2-amino-5-methylphenol (1b, 123.1 mg, 1.0 mmol), diphenylacetylene (2n, 89 mg, 0.5 mmol). The residue was purified by flash chromatography (hexane/ethyl acetate = 40:1) on silica gel to yield the desired product 3bn as pale yellow solid (177.7 mg, 85% yield), mp 91-92 °C. 

$^1$H NMR (500 MHz, CDCl$_3$) $\delta$ 8.25-8.21 (m, 2H), 7.64 (d, J = 8.1 Hz, 1H), 7.52-7.49 (m, 3H), 7.37-7.36 (m, 1H), 7.17-7.14 (m, 1H). $^{13}$C NMR (125 MHz, CDCl$_3$) $\delta$ 162.50, 151.01, 139.88, 135.49, 131.19, 128.79, 127.40, 127.32, 125.74, 119.28, 110.69, 21.71. m/z (MS): 210 [M+H]$^+$. 

6-Chloro-2-phenylbenzo[d]oxazole (3co, CAS: 15952-20-2)$^7$

![Image of 6-Chloro-2-phenylbenzo[d]oxazole](image)
The reaction was conducted with 3-chloro-6-aminophenol (1c, 143 mg, 1.0 mmol),
diphenylacetylene (2o, 89 mg, 0.5 mmol). The residue was purified by flash
chromatography (hexane/ethyl acetate = 40:1) on silica gel to yield the desired product
3co as yellow solid (190.1 mg, 83% yield), mp 107-108 °C.

\[ \text{1H NMR (500 MHz, CDCl}_3 \text{) } \delta 8.21-8.19 (m, 2H), 7.65 (d, J = 8.4 Hz, 1H), 7.56 (d, J = 1.8 Hz, 1H), 7.54-7.49 (t, J = 7.5 Hz, 3H), 7.33-7.31 (m, 1H).} \]

\[ \text{13C NMR (125 MHz, CDCl}_3 \text{) } \delta 163.59, 150.80, 140.78, 131.74, 131.45, 128.90, 128.84, 127.56, 125.21, 120.38, 111.17.} \]

\[ m/z \text{ (MS): 230 [M+H]^+}. \]

2-Propylbenzo[d]oxazole (3ap, CAS: 2008-05-1)[8]

The reaction was conducted with o-aminophenol (1a, 109.1 mg, 1.0 mmol),
pent-1-ynyl-benzene (2p, 72 mg, 0.5 mmol). The residue was purified by flash
chromatography (hexane/ethyl acetate = 40:1) on silica gel to yield the desired product
3ap as pale yellow oil (29 mg, 36.5% yield).

\[ \text{1H NMR (500 MHz, CDCl}_3 \text{) } \delta 7.65-7.68 (m, 1H), 7.45-7.48 (m, 1H), 7.27-7.30 (m, 2H), 2.92 (t, J = 5.1 Hz, 2H), 1.85-1.91 (m, 2H), 0.89 (t, J = 5.1 Hz, 3H).} \]

\[ \text{13C NMR (125 MHz, CDCl}_3 \text{) } \delta 167.32, 150.59, 141.42, 124.34, 123.99, 119.49, 110.17, 31.37, 22.43, 13.97.} \]

\[ m/z \text{ (MS): 162 [M+H]^+}. \]

Benzo[d]oxazole (3aq, CAS: 273-53-0)[9]

The reaction was conducted with o-aminophenol (1a, 109.1 mg, 1.0 mmol),
phenylacetylene (2r, 80.5 mg, 0.5 mmol). The residue was purified by flash
chromatography (hexane/ethyl acetate = 40:1) on silica gel to yield the desired product
3aq as colorless oil (25 mg, 41.5% yield).
$^1$H NMR (400 MHz, CDCl$_3$) $\delta$ 8.09 (s, 1H), 7.80-7.77 (m, 1H), 7.59-7.56 (m, 1H), 7.39-7.35 (m, 2H). $^{13}$C NMR (100 MHz, CDCl$_3$) $\delta$ 152.44, 149.88, 139.94, 125.53, 124.52, 120.53, 112.22. m/z (MS): 120 [M+H]$^+$.

References


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