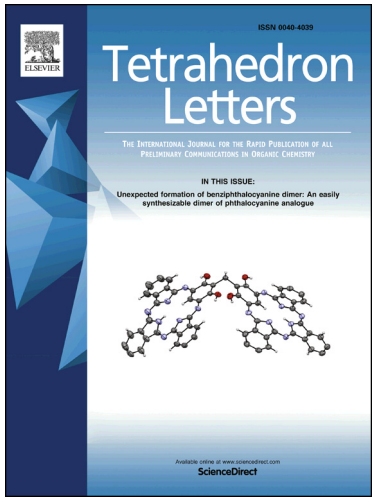

Copper catalyzed synthesis of benzoxazoles and benzothiazoles *via* tandem manner

Wan Xu, Meng-Tian Zeng, Sha-Sha Liu, Yue-Sheng Li, Zhi-Bing Dong

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Copper calyzed synthesis of benzoxazoles and benzothiazoles *via* tandem manner

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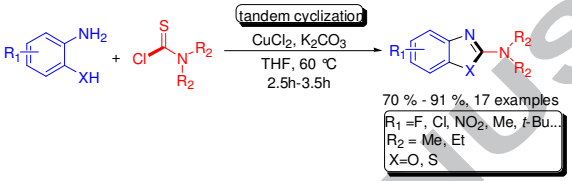

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Copper catalyzed synthesis of benzoxazoles and benzothiazoles *via* tandem manner

Wan Xu[a], Meng-Tian Zeng[a], Sha-Sha Liu[a], Yue-Sheng Li[b], Zhi-Bing Dong[a,] *

Dedicated to Prof. Herbert Mayr at Ludwig-Maximilians-Universität on the occasion of his 70th birthday

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ABSTRACT

A useful protocol for the preparation of substituted 2-aminobenzoxazoles and 2-aminobenzothiazoles was presented. Under the catalysis of copper, 2-aminophenols or 2-aminothiophenols reacted with thiocarbamoyl chlorides *via* a tandem manner, furnishing a series of 17 benzoheterocycles smoothly with good to excellent yields (70-91%). The broad substrate scope, short reaction time, mild react conditions, easy performance and nice yields make this approach attractive, showing its practical synthetic value for the preparation of some biologically or pharmaceutically active compounds.

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1. Introduction

N-containing heterocyclic compounds are generally biocompatible, which could be widely used as pharmaceutical and agrochemical agents.[1] The scaffolds of benzazoles, such as benzoxazoles and benzothiazoles are typical *N*-containing heterocyclics that represent core structure of many trade drugs. Benzothiazoles have been found to possess interesting biological activities like anti-inflammatory,[2] antibacterial.[3-6] They are also popular construction units in fatty acid amide hydrolase inhibitors[7] and antitumor agents (**Figure 1**). Moreover, benzothiazole-based compounds have been applied in other fields, for example as ratiometric fluorescent pH indicators.[8] The benzoxazole derivatives are significant targets in drug discovery,[9] and also find applications in material chemistry as photochromic agents.[10]

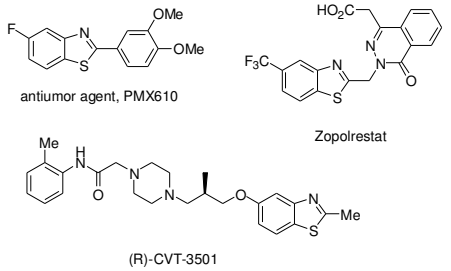


Figure 1. Examples of bioactive benzothiazoles

Instead, the benzoxazole scaffold is found in a varied spectrum of biologically active compounds.[11-14] Further important significant physiological activities related with benzoxazoles are HIV-1 protease inhibitors,[15-16] butyrylcholinesterase inhibitors[17-18], topoisomerase II inhibitors[19] (**Figure 2**).

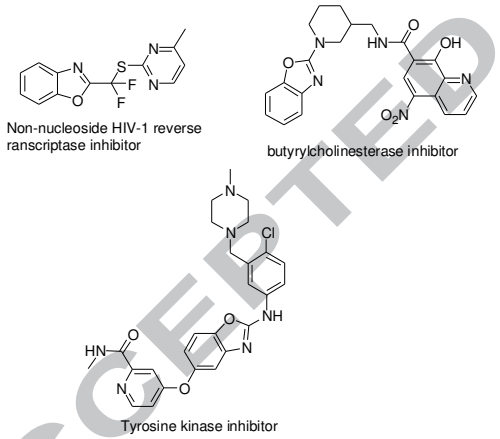


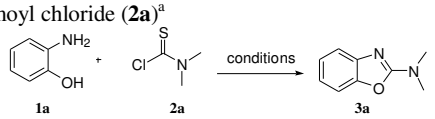
Figure 2. Benzoxazole derivatives with biological activities

A variety of synthetic routes for these compounds have been developed due to their great importance. Generally, the traditional approaches for the preparation of these compounds mostly based on the condensation of *o*-aminophenol (or *o*-aminothiophenol) with aldehydes, derivatives of carboxylic acids, and ester[20-22] or the oxidative intramolecular cyclization of thiobenzanilides.[23] Other protocols such as transition metal catalyzed cross coupling reaction of *o*-haloanilides or their analogues through intramolecular or intermolecular cyclization, were also studied.[24] Among these, to treat with 2-aminophenols and CS_2 furnishing 2-aminobenzoxazoles is mostly often reported.[25] However, most of the reported methods suffer from expensive metal catalysts, ligands and amount of toxic reagent, strong acid and high temperature conditions, and multistep reactions, which limit their applications. Thus, more attentions have been devoted to the one-pot synthetic methods. As part of our longstanding interests in developing phenylthioureas and the relevant applications,[26] we hereby report a facile, mild and efficient preparation of benzoxazoles and benzothiazoles catalyzed by copper *via* one-pot manner.

2. Results and Discussion

For our initial studies, 2-aminophenol (**1a**) and thiocarbamoyl chloride (**2a**) were chosen as starting materials to optimize the reaction conditions (Table 1). We are pleased to find that *N,N*-dimethyl-2-benzoxazolamine (**3a**) could be obtained in 31 % yield in the presence of NaH/THF at 60°C for 2.5 h (Table 1, entry 1). Subsequently, the effect of base was evaluated and the results showed that K_2CO_3 was proved to be the appropriate base affording the desired product in 46% yield (Table 1, entries 2-7). Furthermore, various catalysts were examined. Copper and nickel catalysts all displayed nice results (Table 1, entries 8-15), and $CuCl_2$ was turned to be the most suitable for the model reaction. In addition, solvents, temperature, and the loading of base were further investigated. The screening of solvents showed that THF was the best (Table 1, entries 11, 16-20), and the temperature screening showed that 60 °C was the optimal reaction temperature (Table 1, entries 11, 21-22). As for the loading of base, the isolation yield was not improved obviously when the loading of K_2CO_3 was 2 equiv (85%, Table 1, entry 23). The further screening of base loading (Table 1, entries 11, 24-25) indicated that the optimal base loading was 1 equiv. The control experiments for the substrate ratio showed that the excess of thiocarbamoyl chloride was crucial for full conversion of *o*-aminophenol (Table 1, entries 26-27). The optimal reaction conditions were summarized in entry 11.

Table 1. Screening reaction conditions for 2-aminophenol (**1a**) with thiocarbamoyl chloride (**2a**)[a]



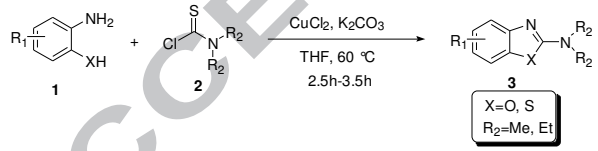
Entry	Catalyst	Base	Solvent	Temp (°C)	Yield[b] (%)
1	-	NaH	THF	60	31
2	-	*t*-BuOK	THF	60	19
3	-	CH_3ONa	THF	60	25
4	-	KOH	THF	60	27
5	-	NEt_3	THF	60	36
6	-	K_2CO_3	THF	60	46
7	-	Na_2CO_3	THF	60	21
8	CuBr	K_2CO_3	THF	60	80
9	CuI	K_2CO_3	THF	60	81
10	CuO	K_2CO_3	THF	60	72
11	**$CuCl_2$**	**K_2CO_3**	**THF**	**60**	**86**
12	$Cu(OTf)_2$	K_2CO_3	THF	60	74
13	$Cu(OAc)_2$	K_2CO_3	THF	60	70
14	$NiCl_2$	K_2CO_3	THF	60	77
15	$NiBr_2$	K_2CO_3	THF	60	73
16	$CuCl_2$	K_2CO_3	DMSO	60	27
17	$CuCl_2$	K_2CO_3	DMF	60	39

18	$CuCl_2$	K_2CO_3	DMAC	60	68
19	$CuCl_2$	K_2CO_3	CH_3CN	60	46
20	$CuCl_2$	K_2CO_3	CH_2Cl_2	60	53
21	$CuCl_2$	K_2CO_3	THF	40	63
22	$CuCl_2$	K_2CO_3	THF	r.t	30
23[c]	$CuCl_2$	K_2CO_3	THF	60	85
24[d]	$CuCl_2$	K_2CO_3	THF	60	73
25	$CuCl_2$	--	THF	60	71
26[e]	$CuCl_2$	K_2CO_3	THF	60	47
27[f]	$CuCl_2$	K_2CO_3	THF	60	63

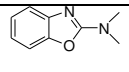
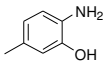
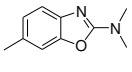
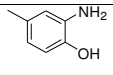
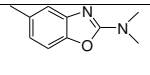
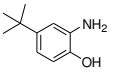
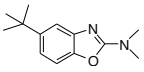
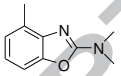
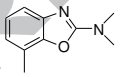
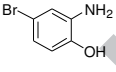
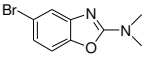
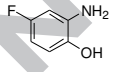
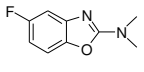
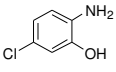
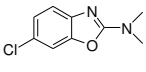
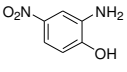
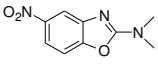
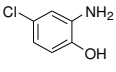
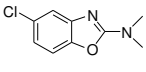
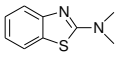
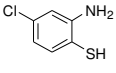
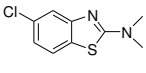
[a]Reaction conditions: **1a** (1.0 mmol), **2a** (3.0 mmol), [Cat.] (5 mol%), base loading (1 equiv), solvent (2.5 mL) for 2.5 h. [b]Isolation yields. [c]base loading (2 equiv). [d]base loading (0.5 equiv). [e]**1a** (1.0 mmol), **2a** (1.5 mmol), [f]**1a**(1.0 mmol), **2a** (2.0 mmol).

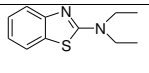
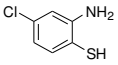
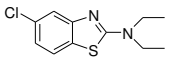
Under the optimal conditions, various functionalized 2-aminophenol or 2-aminothiophenol derivatives reacting with thiocarbamoyl chloride furnished desired benzoxazoles or benzothiazoles smoothly (Table 2, entries 1-17). Substrates **1b, 1c** and **1d**, having electron-donating group on the *para* or *meta position* of amino group, cyclized with thiocarbamoyl chloride successfully to give the desired products in 83%, 82% and 82% yields, respectively (entries 2-4). However, substrates **1e** and **1f**, bearing the same type functional group *ortho* to the amino or hydroxyl group afforded **3e** and **3f** in relatively lower yields (77% for **3e**, 74% for **3f**, entries 5-6), this might be caused by the stereo hinderance. The electron-withdrawing groups on the *para* or *meta position* of amino group promoted the reaction slightly, yielding the corresponding products **3g**-**3k** ranging from 84%–91% (Table 2, entries 7-11). In addition, 2-aminothiophenols could react with thiocarbamoyl chloride well under the optimal conditions to give **3l** in 73 % yield (entry 12) and **3m** in 70 % yield (entry 13). Furthermore, the substrate diethylthiocarbamoyl chloride (**2b**) was also investigated. The results revealed that **2b** was a good reacting partner with 2-aminophenols and 2-aminothiophenols, affording cyclization products in good yields (72-88%, entries 14–17).

Table 2. $CuCl_2$-catalyzed synthesis of benzoxazoles and benzothiazoles[a]



1 2 3

Entry	Aminophenol / Aminothiophenol	Thiocarbamoyl chloride	Product	Yield[b] (%)
1	 **1a**	 **2a**	 **3a**	86
2	 **1b**	 **2a**	 **3b**	83
3	 **1c**	 **2a**	 **3c**	82
4	 **1d**	 **2a**	 **3d**	82
5	 **1e**	 **2a**	 **3e**	77
6	 **1f**	 **2a**	 **3f**	74
7	 **1g**	 **2a**	 **3g**	84
8	 **1h**	 **2a**	 **3h**	85
9	 **1i**	 **2a**	 **3i**	87
10	 **1j**	 **2a**	 **3j**	89
11	 **1k**	 **2a**	 **3k**	91
12	 **1l**	 **2a**	 **3l**	73
13	 **1m**	 **2a**	 **3m**	70
14	**1n**	**2b**	**3n**	83
15	**1o**	**2b**	**3o**	88

16				72
	1p	**2b**	**3p**	
17				74
	1q	**2b**	**3q**	

[a]Reaction conditions: **1** (1.0 mmol), **2** (3.0 mmol), $CuCl_2$ (5 mol%), K_2CO_3 (1 eq), THF (2.5 mL), 60 °C for 2.5 h. [b]Isolation yield.

Though the reaction mechanism is not clear at this stage, we speculate the reaction goes through a tandem manner.[26f] The first step is the formation of *o*-hydroxy arylthiourea, which is subsequently transformed to *o*-hydroxy arylisothiourea in the presence of base. The second step is the copper-catalyzed C-O coupling to give the final cyclization product.

3. Conclusion

In summary, we presented a useful protocol for the preparation of various substituted 2-aminobenzoxazoles and 2-aminobenzothiazoles. Under the catalysis of copper, 2-aminophenol or 2-aminothiophenol derivatives reacting with thiocarbamoyl chloride furnished the desired benzoheterocycles smoothly with good to excellent yields (70-91%). The broad substrate scope, short reaction time, mild react conditions, and nice yields make this approach attractive, showing its practical synthetic value for the preparation of some biologically or pharmaceutically active compounds. Further investigation of this protocol and the related applications are under studied in our laboratory.

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References and notes

(1) (a) Yuan, J.; Liu, C.; Lei, A. *Chem. Commun.* **2015**, *51*, 1394. (b) Candeias, N. R.; Branco, L. C.; Gois, P. M. P.; Afonso, C. A. M. *Chem. Rev*. **2009**, *109*, 2703. (c) Wu, X. F.; Neumann, H.; Beller, M. *Chem. Rev*. **2013**, *113*, 1.
(2) Kamlesh, N.; Kale, M. *Pharma. Lett*. **2011**, *3*, 276.
(3) Kale, M.; Mene, D. *Int. J. Pharma Bio Sci*. **2013**, *4*, 503.
(4) Weeks, A. A.; Westwell, A. D. *Curr. Med. Chem*. **2009**, *16*, 2430.
(5) Alaves, S.; Vantipalli, M. C.; Zucker, D. J. S.; Klang, I. M.; Lithgow, G. J. *Nature*, **2011**, *472*, 226.
(6) Konig, J.; Wyllie, S.; Wells, G.; Stevens, M. F.; Wyatt, P. G.; Fairlamb, A. H. *J. Med. Chem*. **2008**, *52*, 170.
(7) Wang, X.; Sarris, K.; Kage, K.; Zhang, D.; Brown, S. P.; Kolasa, T.; Surowy, C.; Kouhen, O. F. E.; Muchmore, S. W.; Brioni, J. D.; Stewart, A. O. *J. Med. Chem*. **2009**, *52*, 170.
(8) Yao, S.; Schafer, K. J.; Belfield, K. D. *Org. Lett*. **2007**, *9*, 5645.
(9) Brown, R. N.; Cameron, R.; Chalmers, D. K.; Hamilton, S.; Luttick, A.; Krippner, G. Y.; McConnell, D. B.; Nearn, R.; Stanislawski, P. C.; Tucker, S. P. Waston, K. G. *Bioorg. Med. Chem. Lett*. **2005**, *15*, 205.
(10) Heynderickx, A.; Guglielmetti, R.; Dubest, R.; Aubard, J.; Samant, A. *Synthesis* **2003**, 1112.
(11) Ertan, T.; Yildiz, I.; Tekiner-Gulbas, B.; Bolelli, K.; Temiz-Arpaci, O.; Ozcan, S.; Kaynak, F.; Yalcin, I.; Aki, E. *Eur. J. Med. Chem*. **2009**, *44*, 501.
(12) Kumar, D.; Jacob, M. R.; Reynolds, M. B.; Kerwin, S. M. *Bioorg. Med. Chem*. **2002**, *10*, 3997.
(13) (a) Terzioglu, N.; Van Rijn, R.; Bakker, R. A.; De Esch, I. J. P.; Leurs, R. *Bioorg. Med. Chem. Lett*. **2004**, *14*, 5251. (b) Mortimer, C. G.; Wells, G.; Crochard, J. P.; Stone, E. L.; Bradshaw, T. D.; Stevens, M. F.; Westwell, A. D. *J. Med. Chem*. **2006**, *49*, 179.
(14) (a) Evans, D. A.; Sacks, C. E.; Kleschick, W. A.; Taber, T. R. *J. Am. Chem. Soc*.**1979**, *101*, 6789. (b) Yildiz-Oren, I.; Yalcin, I.; Aki-Sener, E.; Ucarturk, N. *Eur. J. Med. Chem*. **2004**, *39*, 291.
(15) Surleraux, D. L. N. G.; A.de Kock, H.; Verschueren, W. G.; Pille, G. M. E.; Maes, L. J. R.; Peeters, A.; Vendeville, S.; Meyer, S. D.; Azijn, H.; Pauwels, R.; de Bethune, M. P.; King, N. M.; Prabu-Jeyabalan, M.; Schiffer, C. A.; Wigerinck, P. B. T. P. *J. Med. Chem*. **2005**, *48*, 1965.
(16) Boyer, J.; Arnoult, E.; Médebielle, M.; Guillemont, J.; Unge, J.; Jochmans, D. *J. Med. Chem*. **2011**, *54*, 7974.
(17) Knez, D.; Brus, B.; Coquelle, N.; Sosič, I.; Šink, R.; Brazzolotto, X.; Mravljak, J.; Colletier, J. P.; Gobec, S. *Bioorg. Med. Chem*. **2015**, *23*, 4442.
(18) Matsumura, K.; Ono, M.; Kitada, A.; Watanabe, H.; Yoshimura, M.; Iikuni, S.; Kimura, H.; Okamoto, Y.; Ihara, M.; Saji, H. *J. Med. Chem*. **2015**, *58*, 7241.
(19) Li, P. H.; Zeng, P.; Chen, S. B.; Yao, P. F.; Mai, Y. W.; Tan, J. H.; Ou, T. M.; Huang, S. L.; Li, D.; Gu, L. Q.; Huang, Z. S. *J. Med. Chem*. **2016**, *59*, 238
(20) (a) Zhang, G. D.; Wang, P.; Yang, F.; Wu, Y. J. *Tetrahedron* **2015**, *71*, 57.(b) Chen, Y. X.; Qian, L. F.; Zhang, W.; Han, B. *Angew. Chem. Int. Ed*. **2008**, *47*, 9330. (c) Bahrami, K.; Khodaei, M. M.; Naali, F. *J. Org. Chem*. **2008**, *73*, 6835. (d) Moghaddam, F. M.; Ismaili, H.; Bardajee, G. R. *Heteroat. Chem*. **2006**, *17*, 136. (e) Chakraborti, A. K.; Rudrawar, S.; Jadhav, K. B.; Kaur, G.; Chankeshwara, S. V. *Green. Chem*. **2007**, *9*, 1335. (f) Mali, J. R.; Jawale, D. V.; Londhe, B. S.; Mane, R. A. *Green. Chem. Lett. Rev*. **2010**, *3*, 209. (g) Riadi, Y.; Mamouni, R.; Azzalou, R.; Haddad, M. E.; Routier, S.; Guillaumet, G.; Lazar, S. *Tetrahedron Lett.* **2011**, *52*, 3492. (h) Li, Y.; Wang, Y. L.; Wang. J. Y. *Chem. Lett*. **2006**, *35*, 460. (i) Jin, H. L.; Cheng, T. X.; Chen, J. X. *Appl. Organomet. Chem*. **2011**, *25*, 238.
(21) (a) Chen, C.; Chen. Y. J. *Tetrahedron Lett*. **2004**, *45*, 113. (b) Mourtas, S.; Gatos, D.; Barlos, K. *Tetrahedron. Lett*. **2001**, *42*, 2201. (c) Ranu, B. C.; Jana, R.; Dey, S. *Chem. Lett*. **2004**, *33*, 274. (c) Wang, Y.; Sarris, K.; Sauer, K.; Djuric, S. W. *Tetrahedron Lett*. **2006**, *47*, 4823.
(22) (a) Matsushita, H.; Lee, S. H.; Joung, M. Clapham, B.; Janda, K. M. *Tetrahedron. Lett*. **2004**, *45*, 313. (b) Chakraborti, A. K.; Selvam, C.; Kaur, G.; Bhagat, S.

Synlett. **2004**, *5*, 851.

(23) (a) Itoh, T.; Mase, T. *Org. Lett*. **2007**, *9*, 3687. (b) Joyce, L. L.; Evindar, G.; Batey, R. A. *Chem. Commun*. **2004**, 446. (c) Moghaddam, F. M.; Boeini, H. Z. *Synlett* **2005**, 1612.

(24) (a) Miao, D. Z.; Shi, X. S.; He, G. Z.; Tong, Y.; Jiang, Z. Q.; Han, S. Q. *Tetrahedron*. **2015**, *71*, 431. (b) Viirre, R. D.; Evindar, G.; Batey, R. A. *J. Org. Chem*. **2008**, *73*, 3452. (c) Zou, B.; Yuan, Q.; Ma, D. *Angew. Chem., Int. Ed*. **2007**, *46*, 2598. (d) Bonnamour, J.; Bolm, C. *Org. Lett*. **2008**, *10*, 2665. (e) Ueda, S.; Nagasawa, H. *Angew. Chem. Int. Ed*., **2008**, *47*, 6411. (f) Saha, P.; Ali, M. A.; Ghosh, P.; Punniyamurthy, T. *Org. Biomol. Chem*. **2010**, *8*, 5692. (g) Saha, P.; Ramana, T.; Purkait, N.; Ali, M. A.; Paul, R. Punniyamurthy, T. *J. Org. Chem.* **2009**, *74*, 8719. (h) Ma, D.; Xie, S. W.; Xue, P.; Zhang, X. J.; Dong, J. H.; Jiang, Y. W. *Angew. Chem. Int. Ed.* **2009**, *121*, 4286. (i) Sasmal, S.; Sen, I.; Hall, R. G.; Pal, S. *Tetrahedron Lett*. **2015**, *56*, 1374. (j) Benedi, C.; Bravo, F.; Uriz, P.; Fernandez, E.; Claver, C.; Castillon, S. *Tetrahedron Lett*. **2003**, *44*, 6073.

(25) (a) Yan, S.; Zhang, C.; Wang, Y. H.; Cao, Z.; Zheng, Z.; Hu, X. P. *Tetrahedron Lett*. **2013**, *54*, 3669. (b) Guntreddi, T.; Allam, B. K.; Singh. K. N. *RSC Adv.*, **2013**, *3*, 9875. (c) Raju, G. N.; Prasanna, T. S. K. T.; Surekha, M. K. L.; Suneetha, M.; Nadendla, R. R. *World J. Pharm. Pharma. Sci.* **2015**, *4*, 1082 (d) Venkatachalam, T. K.; Pierens, G. K.; Reutens, D. C. *Lett. Org. Chem.* **2010**, *7*, 519.

(26) (a) Xu W.; Zeng M. T.; Liu M.; Liu S. S.; Li Y. S.; Dong Z. B. *Synthesis* **2017**, *49*, 3084. (b) Xu W.; Zeng M. T.; Liu M.; Liu X.; Chang C. Z.; Zhu H.; Li Y. S.; Dong Z. B. *Chem. Lett.* **2017**, *46*, 641. (c) Zeng M. T.; Xu W.; Liu M.; Liu X.; Chang C. Z.; Zhu H.; Dong Z. B. *SynOpen* **2017**, *1*, 1. (d) Chang C. Z.; Xu W.; Zeng M. T.; Liu M.; Liu X.; Zhu H.; Dong Z. B. *Synthetic. Commun.* **2017**, *47*, 1262. (e) Cao Q.; Liu F.; Wang M.; Xu W.; Zeng M. T.; Liu M.; Li Y. S.; Dong Z. B. *J. Chem. Res.* **2017**, *41*, 301. (f) Liu M.; Zeng M. T.; Xu W.; Chang C. Z.; Liu X.; Zhu H.; Li Y. S.; Dong Z. B. *J. Chem. Res.* **2017**, *41*, 165.

Highlights:

- **17 benzoheterocycles (2-aminobenzoxazoles and 2-aminobenzothiazoles) were smoothly synthesized *via* tandem manner.**
- **The excess of thiocarbamoyl chloride (3 equiv.) is crucial for full conversion of o-aminophenol.**
- **The addition of Coppper ($CuCl_2$) was found to be crucial for the full conversion of o-aminophenol.**