Supporting information

Palladium-Catalyzed Synthesis of 2-Aminobenzothiazoles through Tandem Reaction

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As for the reaction mechanism of this work, we believe the reaction proceed via a tandem manner. By performing the control experiments, the key intermediate (N-(2-chloro)arylthiourea) was obtained (isolated yield: 91%). The further adding of Pd catalyst drove the subsequent cyclization reaction smoothly.

1. Base promoted synthesis of N-(2-chloro)arylthiourea (key intermediate): A dried tube, equipped with a magnetic stirrer and a septum, anilines (1.0 mmol) was dissolved in DMSO (3 mL), and t-BuOK (3 mmol) was added. The mixture was stirred for 5 minutes, and then dithiocarbamate (1.5 mmol) was added, the reaction mixture was then heated at 100 °C and checked by TLC until the starting material was finished. The reaction was cooled down to room temperature, and then quenched with sat. NH₄Cl solution (5 mL) and extracted with ethyl acetate, dried over anhydrous MgSO₄ and evaporated under vacuum. The residue was purified by flash column chromatography to afford the desired N-(2-chloro)arylthiourea with an isolation yield of 91 %. Aqueous phase was treated with 3N HCl for further GCMS detection of thiophenol.

1.1. Physical and Spectra parameters of N-(2-chloro)arylthiourea: White solid, mp: 171-173 °C, ¹H NMR: (400 MHz, CDCl₃) δ: 7.92 (d, J = 4.0 Hz, 1H), 7.38 (d, J = 4.0 Hz, 1H), 7.29-7.20 (m, 2H), 3.88 (s, 6H). ¹³C NMR: (100 MHz, CDCl₃) δ: 181.31, 136.50, 129.22, 126.90, 126.55, 126.04, 41.20. HRMS (ESI) Calcd for C₉H₁₁ClN₂S (214.0331), found: 214.0349.

**The first control experiment**
2. The detection of thiophenol: The aqueous phase was treated with 3N HCl (pH<3), then extracted with ethyl acetate, and the crude oil phase was submitted for GC-MS check, the thiophenol peak was detected (RT: 8.24 min, M=110).
3. Further cyclization: the synthesis of target molecule. Palladium catalyst was added when the generation of (2-chloro)arylthiourea was finished (checked by TLC, within 4 h). The reaction mixture was then heated at 100 °C and checked by TLC until the intermediate spot was finished (checked by TLC, within 5 h). The reaction was cooled down to room temperature, and then quenched with sat. NH₄Cl solution (5 mL) and extracted with ethyl acetate, dried over anhydrous MgSO₄ and evaporated under vacuum. The residue was purified by flash column chromatography to afford the desired 2-aminobenzothiazole with an isolation yield of 74%.

**The second control experiment**

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\begin{align*}
\text{NH}_2 \quad \text{Cl} & \quad + \quad \text{S} \quad \text{N} \\
\text{1a} & \quad \text{KOt-Bu, DMSO} & \quad 100 ^\circ \text{C}, \ 4h & \quad \text{crude intermediate} \\
\text{S} \quad \text{N} & \quad \text{add Pd(PPh)}_3 & \quad 100 ^\circ \text{C}, \ 5h & \quad \text{Isolation yield: 74%}
\end{align*}
\]
Spectra of the products:

*N,N*-Dimethylenzo[d]thiazol-2-amine (3a)
6-Bromo-N,N-dimethylbenzo[d]thiazol-2-amine (3b)

\[
\begin{align*}
\text{Br} & \quad \text{N} \\
\text{N} & \quad \text{B} \\
\end{align*}
\]
N,N-6-Trimethylenzo[d]thiazol-2-amine (3c)
6-Chlro-N, N-dimethybenzo[d]thiazol-2-amine (3d)
$N,N$-5-Trimethylbenzo[\textit{d}]thiazol-2-amine (3e)

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5-Chloro-N,N-dimethylbenzo[d]thiazol-2-amine (3f)
5-Methoxy-\(\text{N,N-dimethybenzo}[d]\text{thiazol-2-amine (3g)}\)
2-(Dimethylamino)benzo[d]thiazole-6-carbonitrile (3h)
$\text{N,N-Diethylbenzo[\text{d}]}\text{thiazol-2-amine (3i)}$

$\text{N,N-Diethylbenzo[\text{d}]}\text{thiazol-2-amine (3i)}$
6-Bromo-\(N,N\)-diethylbenzo[\(d\)]thiazol-2-amine (3j)
6-Methyl-N,N-diethybenzodthiazol-2-amine (3k)
6-Chloro-N, N-diethylbenzo[d]thiazol-2-amine (3l)
5-Methyl-\(\text{N,N-diethylenzo}[d]\text{thiazol-2-amine}\) (3m)
5-Chloro-N,N-diethylenzo[d]thiazol-2-amine (3n)
5-Methoxy-\(N,N\)-diethylenzo[d]thiazol-2-amine (3o)
N,N-Dimethylthiazolo [5,4-b]pyridin-2-amine (3p)

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