

Supporting Information

Copper Promoted One Pot Approach: Synthesis of Benzimidazoles

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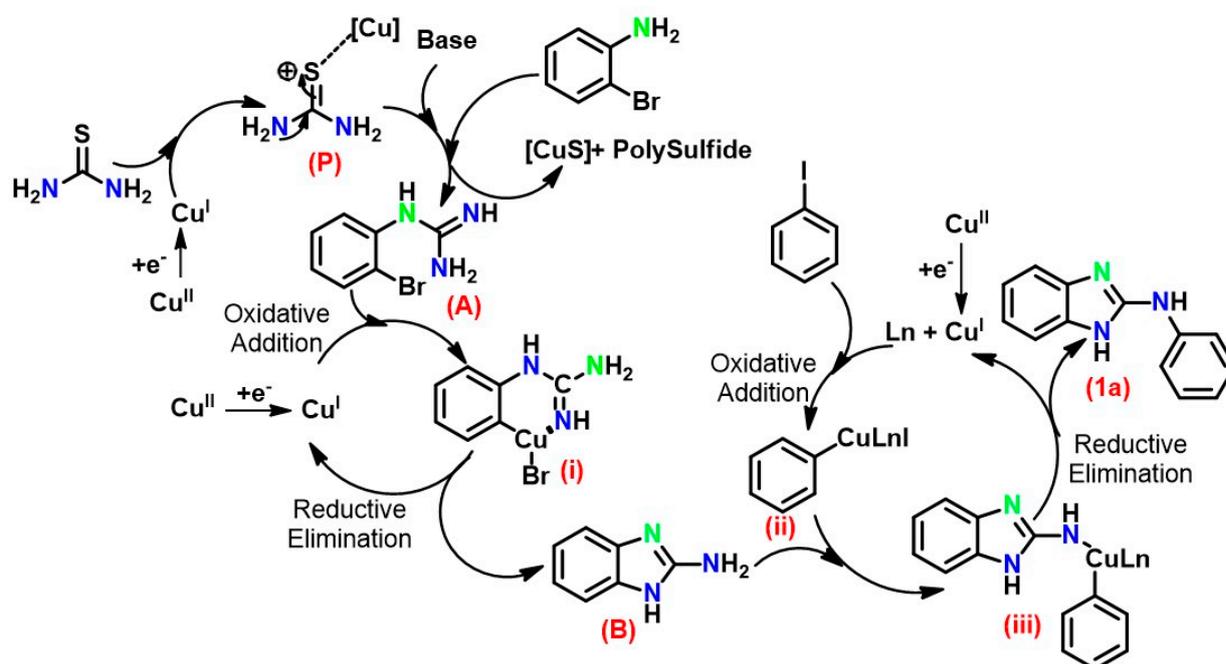
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Mechanism

Based on the experimental evidences and literature reports [1, 2-12] the proposed mechanism for the formation of final product 2-aminophenylbenzimidazole **1a** is as follows.



Scheme S1. Proposed mechanism [1]

Initially, the reduction of copper(II) salt with thiourea led to the *in situ* generation of copper(I) species [5], which can coordinate with thiourea to afford intermediate **P**. Next, the intermediate **P** on deprotonation with base followed by reaction with 2-bromoaniline may provide N-(2-bromophenyl)-guanidine **A** along with by-products CuS and polysulphide [2] *via* desulphurization/substitution reactions[3,4]. Oxidative addition of **A** with copper (I) species (it could be generated from copper (II) species [5]) can afford intermediate **(i)**, that may lead to the

formation of intramolecular C-N cyclised product 2-aminobenzimidazole **B**[6,7] using base. On the other hand, oxidative addition of iodobenzene with copper (I) species lead to the formation of intermediate **(ii)**, which can undergo an intermolecular C-N cross-coupling reaction[8-12] with intermediate **B** to afford the intermediate **(iii)** that can complete the catalytic cycle by reductive elimination of final product 2-aminophenylbenzimidazole **1a**.

References

1. Kondraganti, L.; Manabolu, S.b.; Dittakavi, R. Synthesis of Benzimidazoles via Domino Intra and Intermolecular C-N Cross-Coupling Reaction. *ChemistrySelect* **2018**, *3*, 11744-11748.
2. Ramana, T.; Punniyamurthy, T. Preparation of 2-Azido-1-Substituted-1 H-Benzo [d] imidazoles Using a Copper-Promoted Three-Component Reaction and Their Further Conversion into 2-Amino and 2-Triazolyl Derivatives. *Chemistry—A European Journal* **2012**, *18*, 13279-13283.
3. Guin, S.; Rout, S.K.; Gogoi, A.; Nandi, S.; Ghara, K.K.; Patel, B.K. Desulfurization strategy in the construction of azoles possessing additional nitrogen, oxygen or sulfur using a copper (I) catalyst. *Advanced Synthesis & Catalysis* **2012**, *354*, 2757-2770.
4. Yella, R.; Khatun, N.; Rout, S.K.; Patel, B.K. Tandem regioselective synthesis of tetrazoles and related heterocycles using iodine. *Organic & biomolecular chemistry* **2011**, *9*, 3235-3245.
5. For the reduction of copper (II) salts to copper (I) species using thiourea, see: Bowmaker, G.A.; Hanna, J.V.; Pakawatchai, C.; Skelton, B.W.; Thanyasirikul, Y.; White, A.H. Crystal structures and vibrational spectroscopy of copper (I) thiourea complexes. *Inorg. Chem.* **2009**, *48*, 350-368.
6. Wang, X.; Kuang, C.; Yang, Q. Copper-Catalyzed Synthesis of 4-Aryl-1H-1, 2, 3-triazoles from 1, 1-Dibromoalkenes and Sodium Azide. *Eur. J. Org. Chem.* **2012**, *2012*, 424-428.
7. Chiba, S.; Zhang, L.; Ang, G.Y.; Hui, B.W.-Q. Generation of iminyl copper species from α -azido carbonyl compounds and their catalytic C-C bond cleavage under an oxygen atmosphere. *Org. Lett.* **2010**, *12*, 2052-2055.
8. Tan, B.Y.-H.; Teo, Y.-C. Efficient cobalt-catalyzed C-N cross-coupling reaction between benzamide and aryl iodide in water. *Organic & biomolecular chemistry* **2014**, *12*, 7478-7481.
9. Ma, D.; Lu, X.; Shi, L.; Zhang, H.; Jiang, Y.; Liu, X. Domino Condensation/S-Arylation/Heterocyclization Reactions: Copper-Catalyzed Three-Component Synthesis of 2-N-Substituted Benzothiazoles. *Angew. Chem. Int. Ed.* **2011**, *50*, 1118-1121.
10. Cahiez, G.; Moyeux, A. Cobalt-catalyzed cross-coupling reactions. *Chem. Rev.* **2010**, *110*, 1435-1462.
11. Boddapati, S.N.M.; Polam, N.; Mutchu, B.R.; Bollikolla, H.B. The synthesis of arylcyanamides: a copper catalyzed consecutive desulfurization and C-N cross coupling strategy. *New J. Chem.* **2018**, *42*, 918-922.
12. Boddapati, S.N.M.; Saketi, J.M.R.; Mutchu, B.R.; Bollikolla, H.B.; Adil, S.F.; Khan, M. Copper promoted desulfurization and C-N cross coupling reactions: Simple approach to the synthesis of substituted 2-aminobenzoxazoles and 2,5-disubstituted tetrazole amines. *Arabian Journal of Chemistry*, **2020**, *13*, 4477-4494.