

# Dendritic Copper Catalysts for Homogeneous Click Chemistry in Water

Category

Polymer-Supported  
Synthesis

Key words

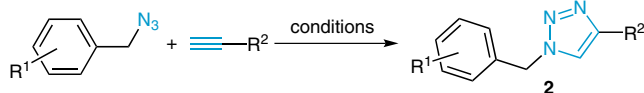
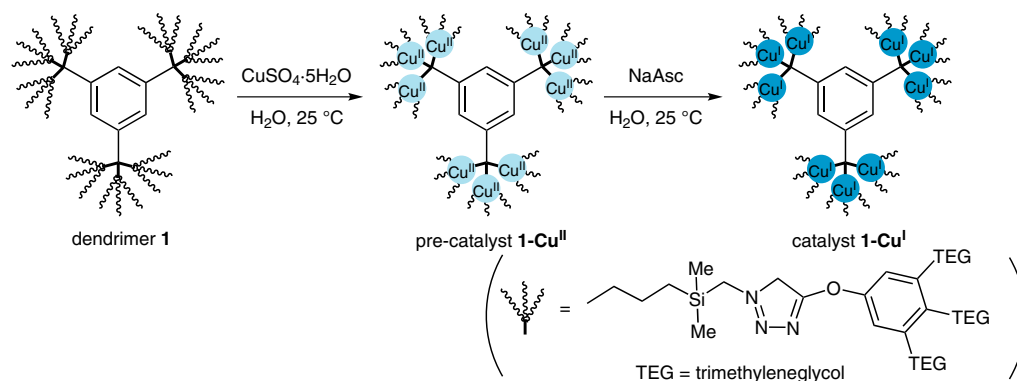
dendrimers

Huisgen  
cycloaddition

click chemistry

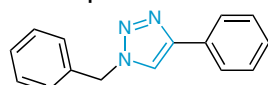
copper catalysis

**SYNFACT**  
of the month

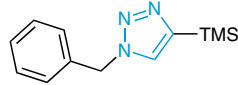


conditions A: dendrimer **1** (1 mol%), [hexabenzyltren-Cu]Br **3** (0.1 mol%), H<sub>2</sub>O, 25 °C, 3 h  
 conditions B: catalyst **1-Cu<sup>I</sup>** (4–50 ppm Cu<sup>I</sup>), H<sub>2</sub>O, 30 °C, 24 h  
 conditions C: catalyst **1-Cu<sup>I</sup>** (4–50 ppm Cu<sup>I</sup>), H<sub>2</sub>O, 35 °C, 24 h

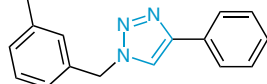
## Selected examples:



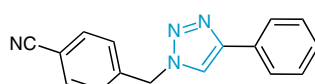
**2a** R<sup>1</sup> = H, R<sup>2</sup> = Ph  
 conditions A: 91% yield  
 conditions B: 99% yield (4 ppm Cu<sup>I</sup>)



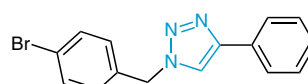
**2b** R<sup>1</sup> = H, R<sup>2</sup> = TMS  
 conditions A: 89% yield  
 conditions C: 81% yield (20 ppm Cu<sup>I</sup>)



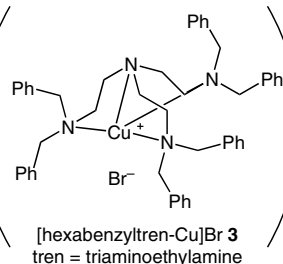
**2c** R<sup>1</sup> = Me, R<sup>2</sup> = Ph  
 conditions A: 90% yield  
 conditions B: 89% yield (20 ppm Cu<sup>I</sup>)



**2d** R<sup>1</sup> = CN, R<sup>2</sup> = Ph  
 conditions A: 90% yield  
 conditions B: 90% yield (50 ppm Cu<sup>I</sup>)



**2e** R<sup>1</sup> = Br, R<sup>2</sup> = Ph  
 conditions A: 96% yield  
 conditions C: 89% yield (50 ppm Cu<sup>I</sup>)



**Significance:** The dendrimer **1** consists of water/organic compatible 27 triethyleneglycol (TEG) termini and a hydrophobic core (for the preparation of **1**, see: *Chem. Commun.* **2013**, 49, 8169). [Hexabenzyltren-Cu]Br **3** and **1** promote the click reaction of benzyl azides and phenyl acetylenes in water to give the corresponding triazoles in 89–96% yield. The catalyst **1-Cu<sup>I</sup>** (4–200 ppm Cu<sup>I</sup>), prepared from CuSO<sub>4</sub>·5H<sub>2</sub>O and NaAsc, also catalyzed the click reaction in 81–99% yield.

**Comment:** The TEG termini render the dendrimer **1** water-soluble, and the hydrophobic core allows solubilization of the hydrophobic compound **3** and the substrates in water. The interaction between **1** and **3** was shown by selective <sup>1</sup>H NMR shifts and a NOESY spectrum. The micelle nanoreactor **1** was recycled ten times (10<sup>th</sup> reuse: **2a**, 91% yield). The click reaction was performed with 1 ppm **1-Cu<sup>I</sup>** to give **2a** in 50% yield, whose turnover number (TON) and turnover frequency (TOF) were 510000 and 21200 h<sup>−1</sup>, respectively.

**SYNFACTS Contributors:** Yasuhiro Uozumi, Yoichi M. A. Yamada, Rikako Ishii  
 Synfacts 2014, 10(12), 1331 Published online: 18.11.2014  
 DOI: 10.1055/s-0034-1379574; Reg-No.: Y13214SF