Dendritic Copper Catalysts for Homogeneous Click Chemistry in Water

**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-CuI (4–200 ppm CuI), prepared from CuSO₄·5H₂O 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 ¹H NMR shifts and a NOESY spectrum. The micelle nanoreactor 1 was recycled ten times (10th reuse: 2a, 91% yield).

Selected examples:

- **2a** R¹ = H, R² = Ph
  - Conditions A: 91% yield (4 ppm CuI)
  - Conditions B: 99% yield (4 ppm CuI)

- **2b** R¹ = H, R² = TMS
  - Conditions A: 89% yield (4 ppm CuI)
  - Conditions B: 91% yield (20 ppm CuI)
  - Conditions C: 81% yield (20 ppm CuI)

- **2c** R¹ = Me, R² = Ph
  - Conditions A: 90% yield
  - Conditions B: 88% yield (20 ppm CuI)

- **2d** R¹ = CN, R² = Ph
  - Conditions A: 90% yield
  - Conditions B: 90% yield (50 ppm CuI)

- **2e** R¹ = Br, R² = Ph
  - Conditions A: 96% yield
  - Conditions B: 89% yield (50 ppm CuI)

**Conditions:**

- **A:** dendrimer 1 (1 mol%), [hexabenzyltren-Cu]Br 3 (0.1 mol%), H₂O, 25 °C, 3 h
- **B:** catalyst 1-CuI (4–50 ppm CuI), H₂O, 30 °C, 24 h
- **C:** catalyst 1-CuI (4–50 ppm CuI), H₂O, 35 °C, 24 h

**Chemical Structures:**

- **2a**
- **2b**
- **2c**
- **2d**
- **2e**