

Electronic Supplementary Material

A luminescent nanoswitch based on organic-phase copper nanoclusters for sensitive detection of trace amount of water in organic solvents

Yuanyuan Huang,[†] Weidong Liu,[†] Hui Feng, Yangting Ye, Cong Tang, Hang Ao, Meizhi Zhao, Guilin Chen, Jianrong Chen and Zhaosheng Qian*

College of Chemistry and Life Science, Zhejiang Normal University, Jinhua 321004, China

[†]Y. Huang and W. Liu contributed to this work equally.

- 1. Figure S1.** UV-visible spectra of CuNCs and GSH.
- 2. Figure S2.** X-ray photoelectron spectrum of Cu 2p electrons in CuNCs.
- 3. Figure S3** Representative electrospray ionization time-of-flight mass spectrometry (ESI-TOF MS) spectra of CuNCs in DMSO (A) and H₂O (B) in the negative-ion mode.
- 4. Figure S4.** (A) The time-resolved luminescence decay curve of CuNCs in DMSO. (B) The time-resolved luminescence decay curve of CuNCs powder.
- 5. Figure S5.** Luminescence spectra of CuNCs in dimethylsulfoxide (DMSO), N,N'-dimethyl formamide (DMF), tetrahydrofuran (THF) and acetonitrile (ACN), respectively. The luminescence spectra are recorded with (B) and without a cut-off filter of 395 nm (A), respectively.
- 6. Figure S6.** TEM image of CuNCs dispersed in water.
- 7. Figure S7.** Time-resolved decay curves of CuNCs in DMSO solution with varying amount of water.
- 8. Figure S8.** Luminescence intensity of CuNCs in DMSO in the presence of H₂O (0.25 % v/v) as a function of incubation time.
- 9. Figure S9.** (A) Luminescence spectra of higher concentration CuNCs (12.2 mg/mL) in DMSO in the presence of different content of water 0.00 to 0.67 v/v %. (B) The luminescence intensity of CuNCs as a function of water content in DMSO. Inset: The fitting curve between luminescence intensity and water content.
- 10. Figure S10.** (A) Luminescence spectra of lower concentration CuNCs (3.0 mg/mL) in DMSO in

the presence of different content of water 0.00 to 0.13 v/v %. (B) The luminescence intensity of CuNCs as a function of water content in DMSO. Inset: The fitting curve between luminescence intensity and water content.

11. Figure S11. (A) Luminescence spectra of unpurified CuNCs (6.1 mg/mL) in DMSO in the presence of different content of water 0.00 to 0.42 v/v %. (B) The luminescence intensity of CuNCs as a function of water content. Inset: The fitting curve between luminescence intensity and water content.

12. Figure S12. (A) Luminescence spectra of CuNCs in DMF in the presence of different content of water 0.00 to 0.33 % (v/v). (B) The luminescence intensity as a function of water content for DMF dispersion of CuNCs.

13. Figure S13. (A) Luminescence spectra of CuNCs in ACN in the presence of different content of water 0.00 to 0.37 % (v/v). (B) The luminescence intensity as a function of water content for ACN dispersion of CuNCs.

14. Figure S14. (A) Luminescence spectra of CuNCs in THF in the presence of different content of water 0.00 to 0.42 % (v/v). (B) The luminescence intensity as a function of water content for THF dispersion of CuNCs.

15. Figure S15. The reversibility of CuNCs in DMSO by introducing equivalent mole of H₂O and DCC (292.5 μmol).

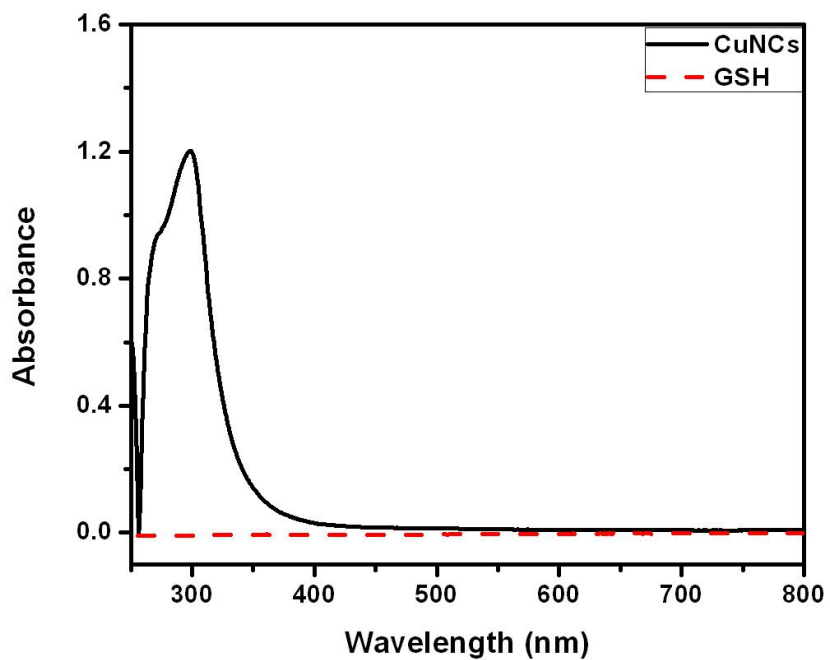


Figure S1. Absorption spectra of GSH-CuNCs and GSH.

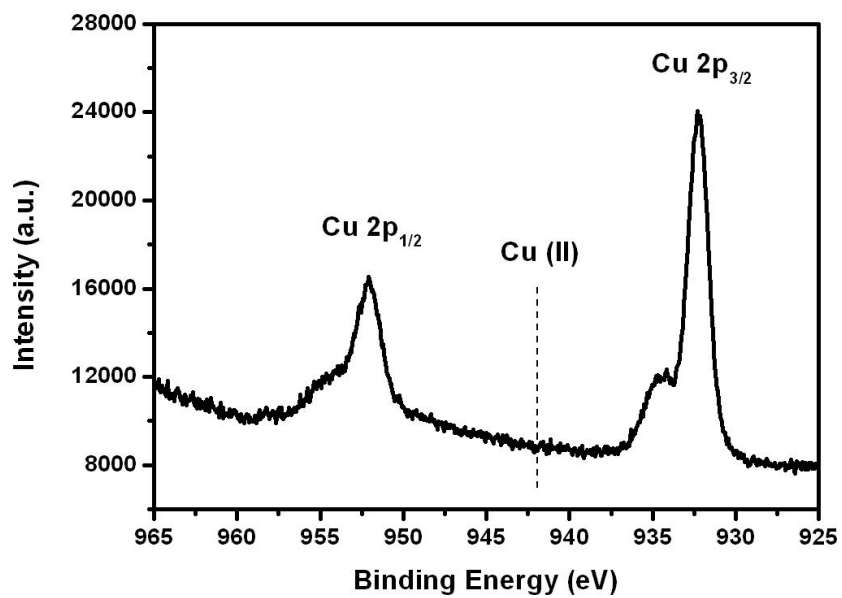


Figure S2. X-ray photoelectron spectrum of Cu 2p electrons in Cu NCs. The dashed line shows the binding energy position of Cu 2p electrons for Cu(II).

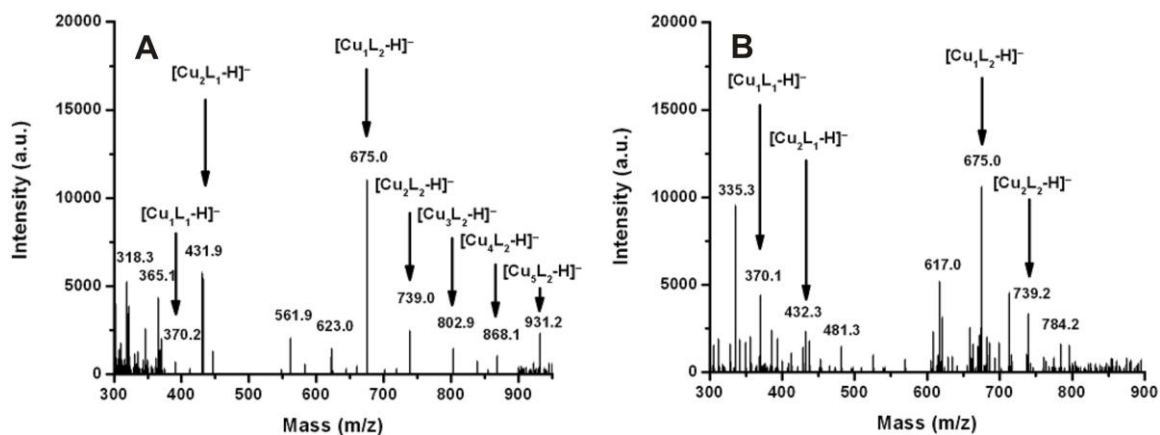


Figure S3 Representative electrospray ionization time-of-flight mass spectrometry (ESI-TOF MS) spectra of CuNCs in DMSO (A) and H₂O (B) in the negative-ion mode. L stands for C₁₀H₁₆O₆N₃S.

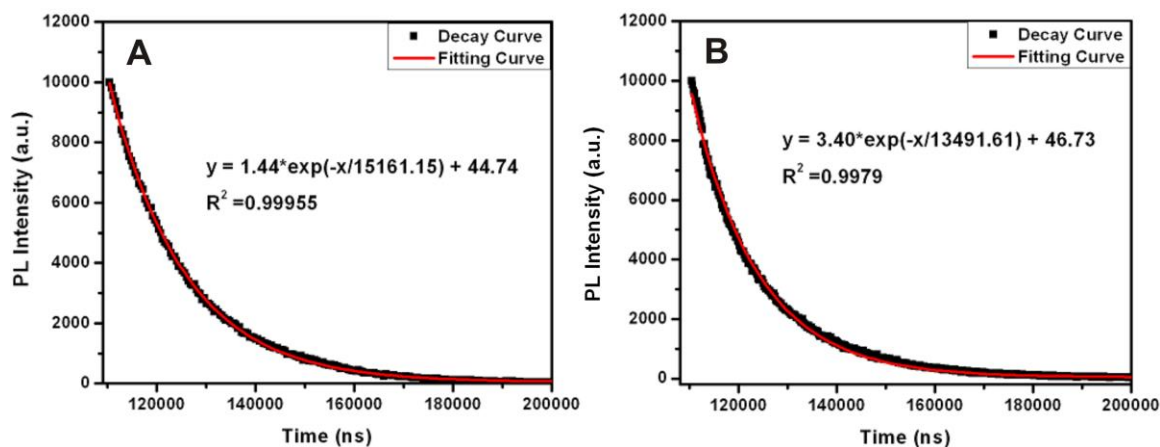


Figure S4. (A) The time-resolved luminescence decay curve of CuNCs in DMSO. The lifetime is calculated as 15.2 μ s. (B) The time-resolved luminescence decay curve of CuNCs powder. The lifetime is calculated as 13.5 μ s.

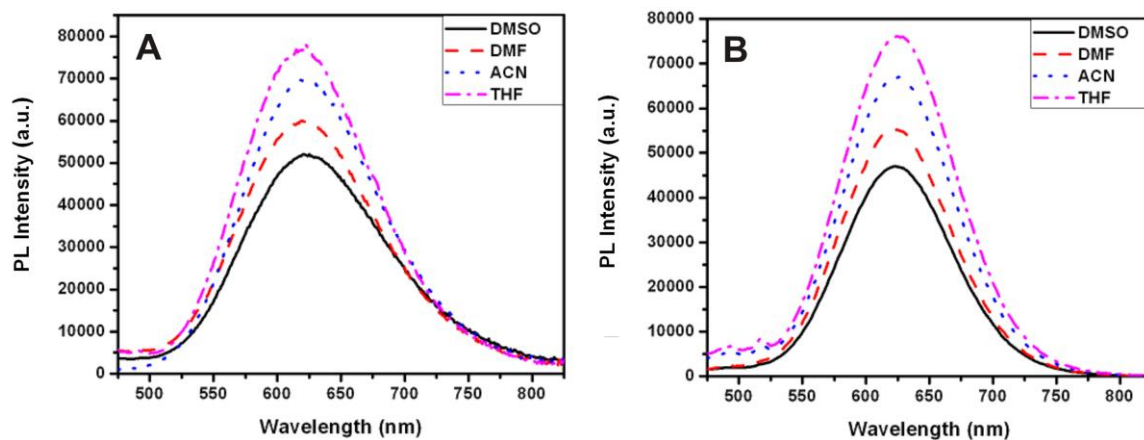


Figure S5. Luminescence spectra of CuNCs in dimethylsulfoxide (DMSO), N,N'-dimethyl formamide (DMF), tetrahydrofuran (THF) and acetonitrile (ACN), respectively. The luminescence spectra are recorded with (B) and without a cut-off filter of 395 nm (A), respectively.

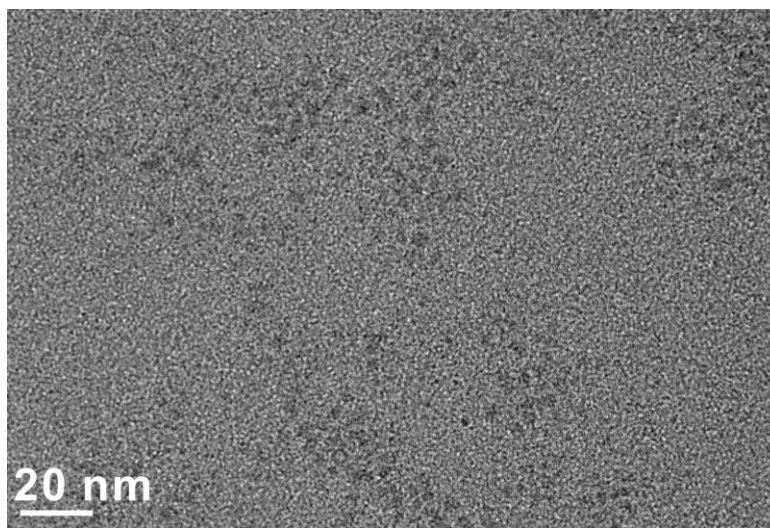


Figure S6. TEM image of CuNCs dispersed in water.

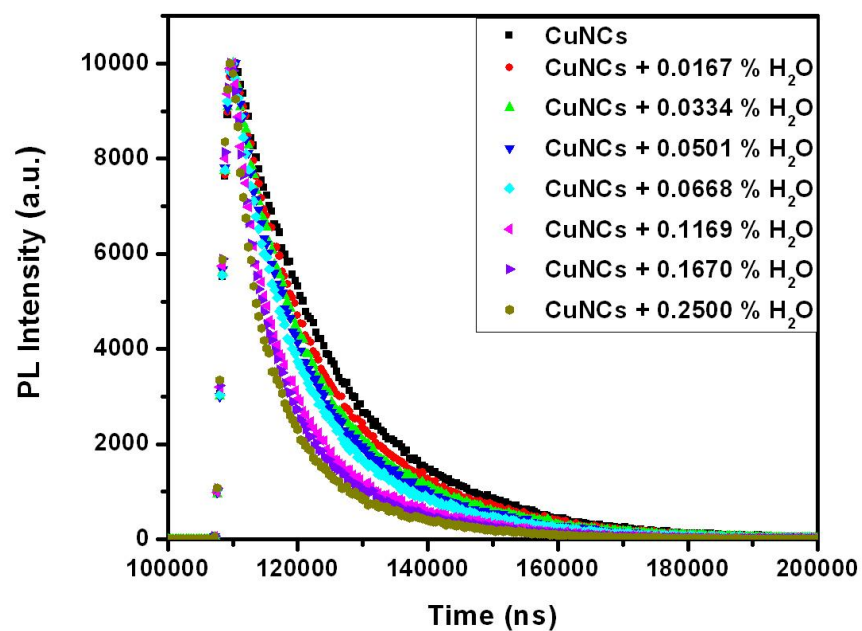


Figure S7. Time-resolved decay curves of CuNCs in DMSO solution with varying amount of water.

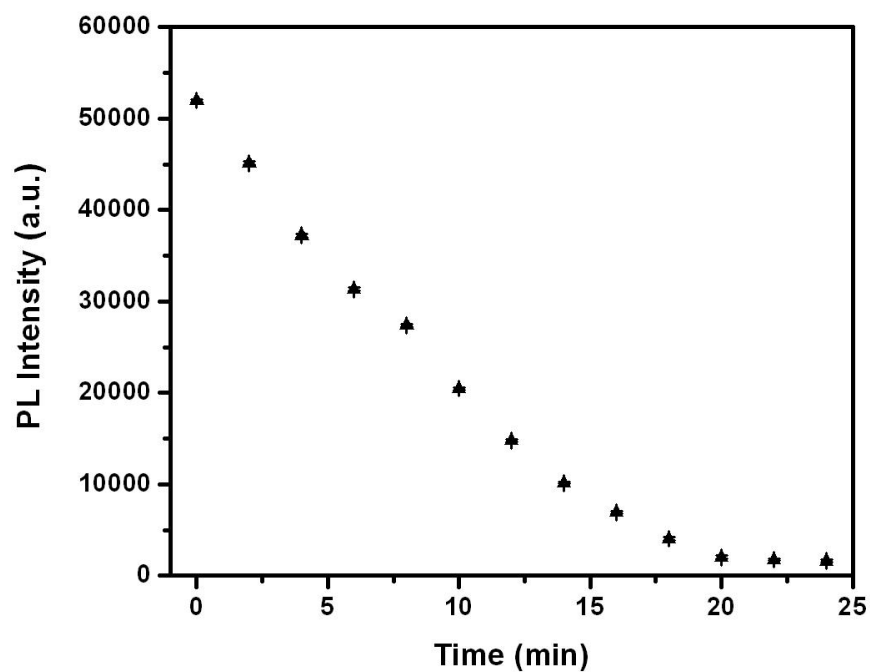


Figure S8. Luminescence intensity of CuNCs in the presence of H_2O (0.25 % v/v) as a function of incubation time.

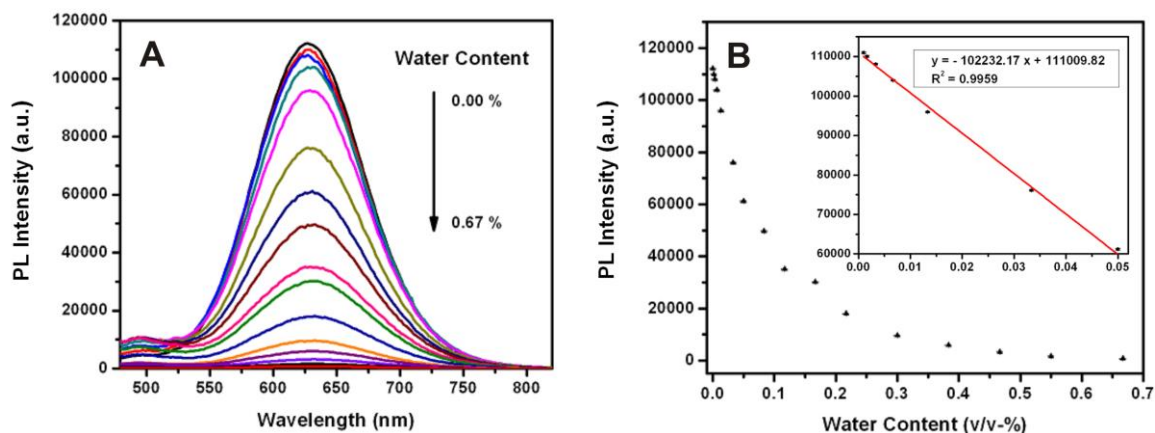


Figure S9. (A) Luminescence spectra of higher concentration CuNCs (12.2 mg/mL) in DMSO in the presence of different content of water 0.00 to 0.67 v/v %. (B) The luminescence intensity of CuNCs as a function of water content in DMSO. Inset: The fitting curve between luminescence intensity and water content. The detection limit is 3.0×10^{-4} % (v/v) with the linear range of 0.001% - 0.05% (v/v).

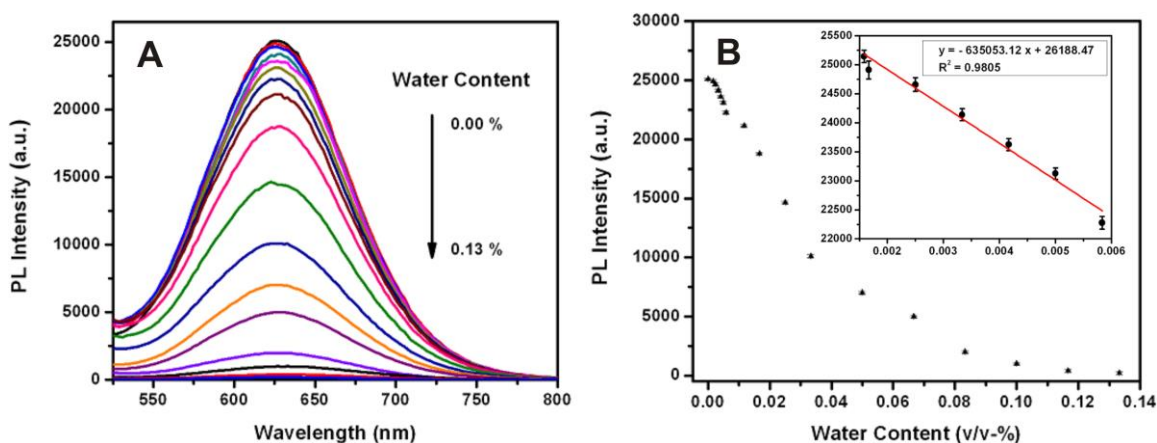


Figure S10. (A) Luminescence spectra of lower concentration CuNCs (3.0 mg/mL) in DMSO in the presence of different content of water 0.00 to 0.13 v/v %. (B) The luminescence intensity of CuNCs as a function of water content in DMSO. Inset: The fitting curve between luminescence intensity and water content. The detection limit is 4.8×10^{-4} % (v/v) with the linear range of 0.0016% - 0.0058% (v/v).

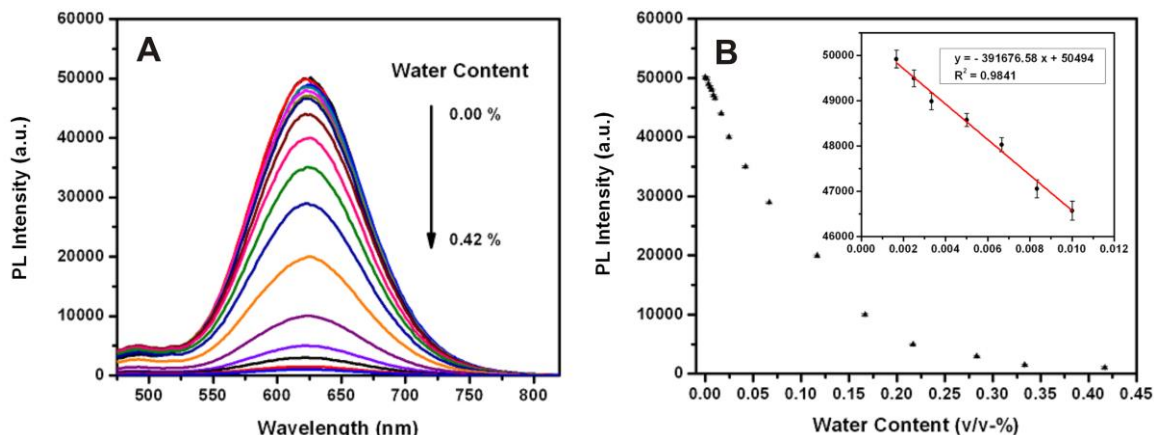


Figure S11. (A) Luminescence spectra of unpurified CuNCs (6.1 mg/mL) in DMSO in the presence of different content of water 0.00 to 0.42 v/v %. (B) The luminescence intensity of CuNCs as a function of water content. Inset: The fitting curve between luminescence intensity and water content. The detection limit is 7.5×10^{-4} % (v/v) with the linear range of 0.0017% - 0.01% (v/v).

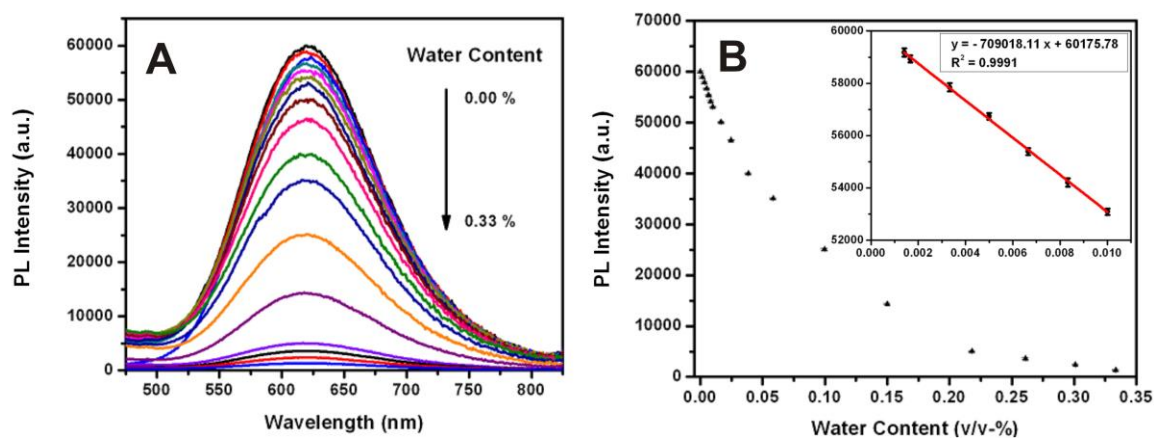


Figure S12. (A) Luminescence spectra of CuNCs in DMF in the presence of different content of water 0.00 to 0.33 v/v %. (B) The luminescence intensity as a function of water content for DMF dispersion of CuNCs. Inset: The fitting curve between luminescence intensity and water content. The detection limit is 4.2×10^{-4} % (v/v) with the linear range of 0.0014% - 0.01% (v/v).

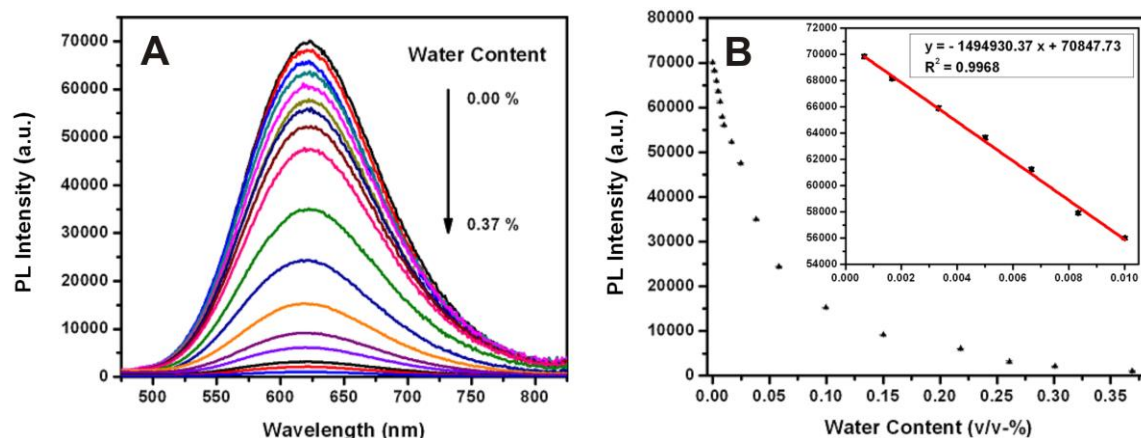


Figure S13. (A) Luminescence spectra of CuNCs in ACN in the presence of different content of water 0.00 to 0.37 v/v %. (B) The luminescence intensity as a function of water content for ACN dispersion of CuNCs. Inset: The fitting curve between luminescence intensity and water content. The detection limit is 2.0×10^{-4} % (v/v) with the linear range of 0.0007% - 0.01% (v/v).

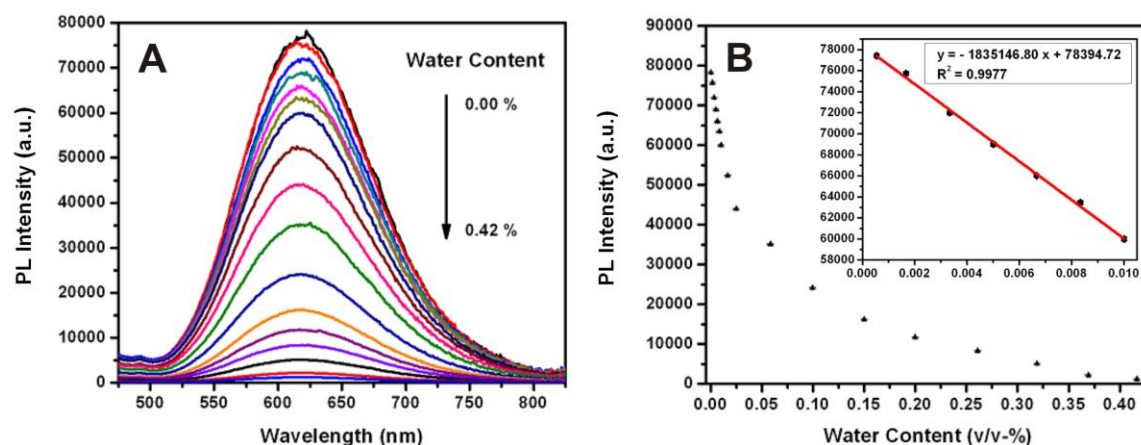


Figure S14. (A) Luminescence spectra of CuNCs in THF in the presence of different content of water 0.00 to 0.42 v/v %. (B) The luminescence intensity as a function of water content for THF dispersion of CuNCs. Inset: The fitting curve between luminescence intensity and water content. The detection limit is 1.6×10^{-4} % (v/v) with the linear range of 0.0005% - 0.01% (v/v).

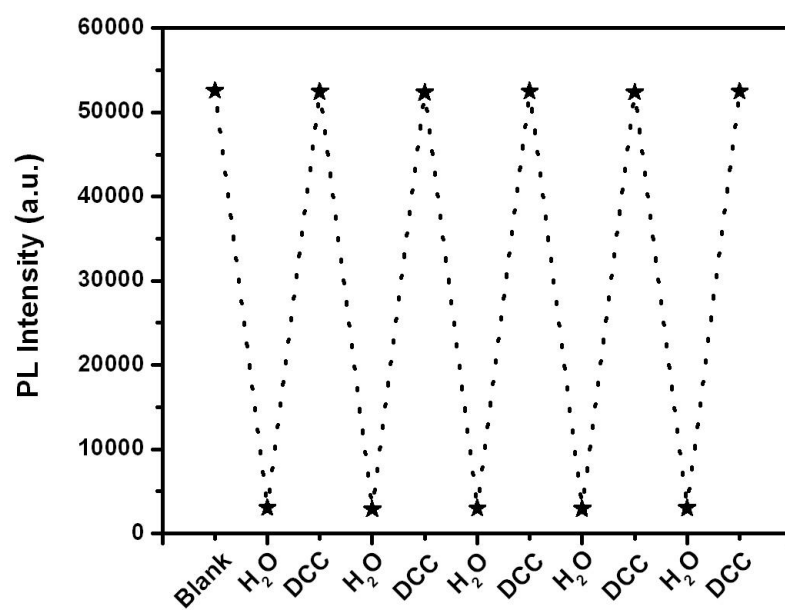


Figure S15. The reversibility of CuNCs in DMSO by introducing equivalent mole of H₂O and DCC (292.5 μ mol).