Electronic Supplementary Material

Photochemical Eco-Friendly Synthesis of Emissive Copper Nanoclusters in Water: Towards Sustainable Nanomaterials

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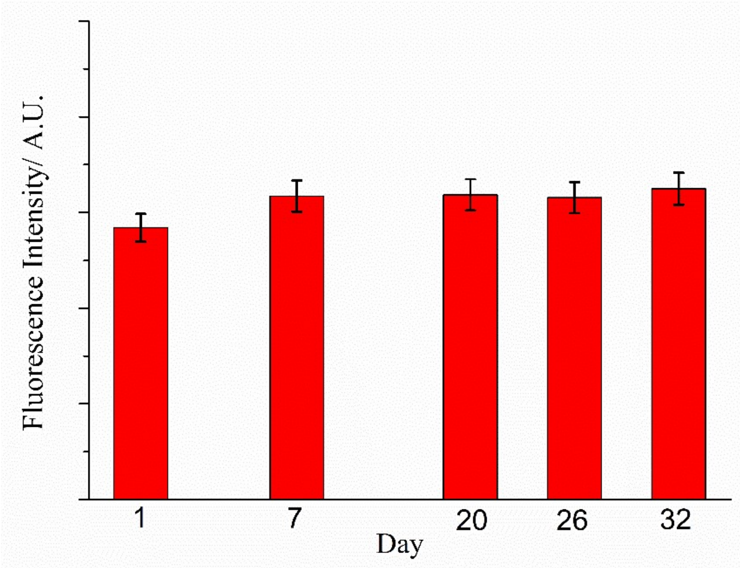

Figure S1. Luminescence emission stability of the final Cu NCs solution after 24 h from the end of irradiation and after a volume reduction to 6 mL measured after 1, 7, 20, 26, and 32 days at a λ_{exc} = 390 nm (relative standard deviation RSD=5.13%).

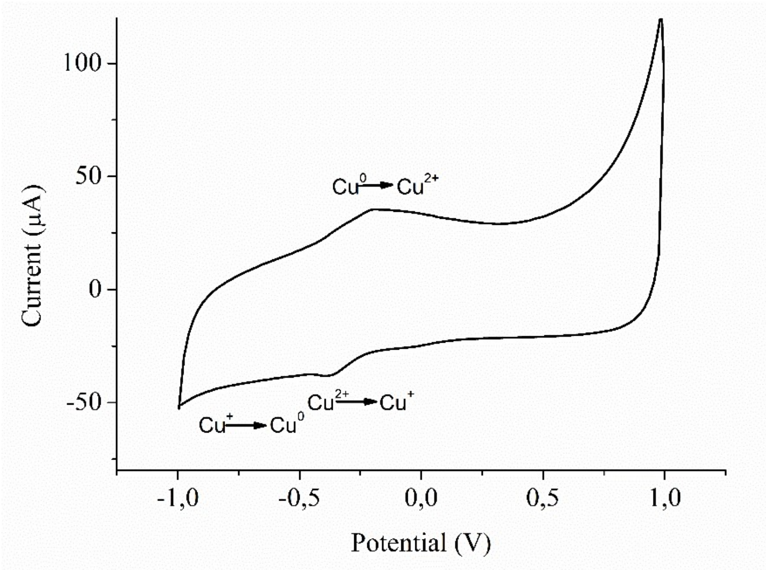

Figure S2. CV of final Cu NCs solution after a volume reduction to 6 mL, recorded 5 months after the synthesis.

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A CV analysis of Cu NCs synthesised 5 months earlier was conducted to confirm their excellent long-term stability. The data indicate an anodic oxidation peak (Ipa) of 35.41 μA and a cathodic reduction peak (Ipc) of 38.88 μA. These two values continue to show that the redox reaction is completely reversible and that the highlighted difference of 3.47 μA, measured between Ipa and Ipc, is consistent with what was already observed of the presence of about 9 % Cu^{2+} with respect to the total copper content, as evidenced by CV and magnetic analyses carried out 5 months earlier.

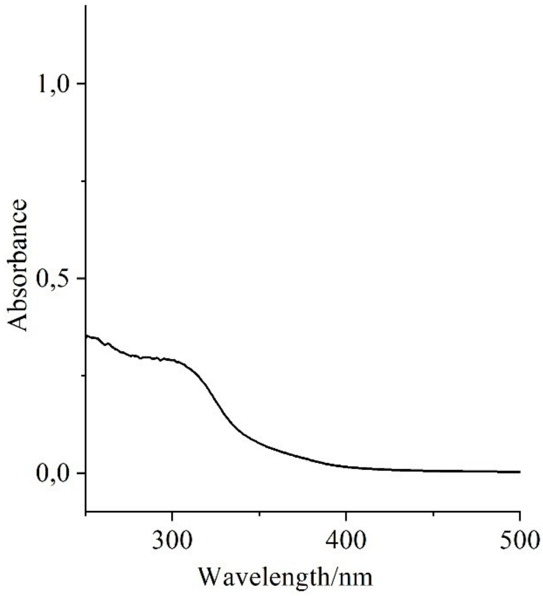

Figure S3. UV-vis spectrum of the final Cu NCs solution eight months after the synthesis. The band at 303.9 nm remains unaltered and this observation confirms the excellent stability of these Cu NCs.

Photothermal conversion efficiency (η).

Photothermal measurements were performed irradiating a volume of 100 μL of Cu NCs dispersion for 10 minutes in a glass tube (diameter 3 mm), using a continuous wave Laser 405 nm (power 210 mW). A standard infrared thermal imaging camera was used to measure the temperature of solution every 20 seconds, during the heating and cooling processes. The photothermal conversion efficiency (η) was calculated according to equation (1) introduced by Roper.[1]

$$\eta = \frac{hA\,(T_{max} - T_{surr}) - Q_{Dis}}{I(1 - 10^{-A})} \qquad (1)$$

Where T_{max} (30.1 °C) and T_{surr} (21.0 °C) represents the max photothermal temperature and

the ambient temperature respectively, I is the incident laser power (210 mW). The absorbance (A = 0.36) of Cu NCs at 405 nm. The equations (2) and (3) were introduced to calculate the parameter hA.

$$\theta = \frac{T - T_{surr}}{T_{max} - T_{surr}} \quad (2)$$

$$\tau = \frac{M_D C_D}{hA} \quad (3)$$

where MD and CD are the mass (0.1 g) and heat capacity (4.2 J g^{-1}) of water respectively, and τ_s is the time constant, calculated by the equation (4).

$$t = -\tau(ln\theta) \ (4)$$

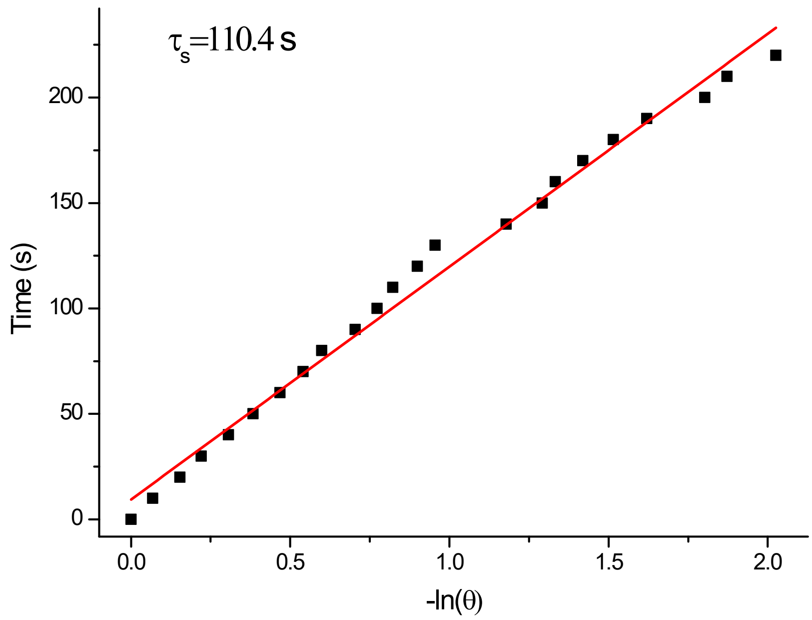

Figure S4. Linear relationship between time (sec) and -ln(θ), the slope is the time constant (τ_s).

1. D. K. Roper, W. Ahn, M. Hoepfner, *J. Phys. Chem. C*, 2007, **111**, 3636-3641.