

ELECTRONIC SUPPLEMENTARY INFORMATION FOR

Cupredoxins Engineered Upconversion Nanoparticles for Ratiometric Luminescence Sensing of Cu²⁺

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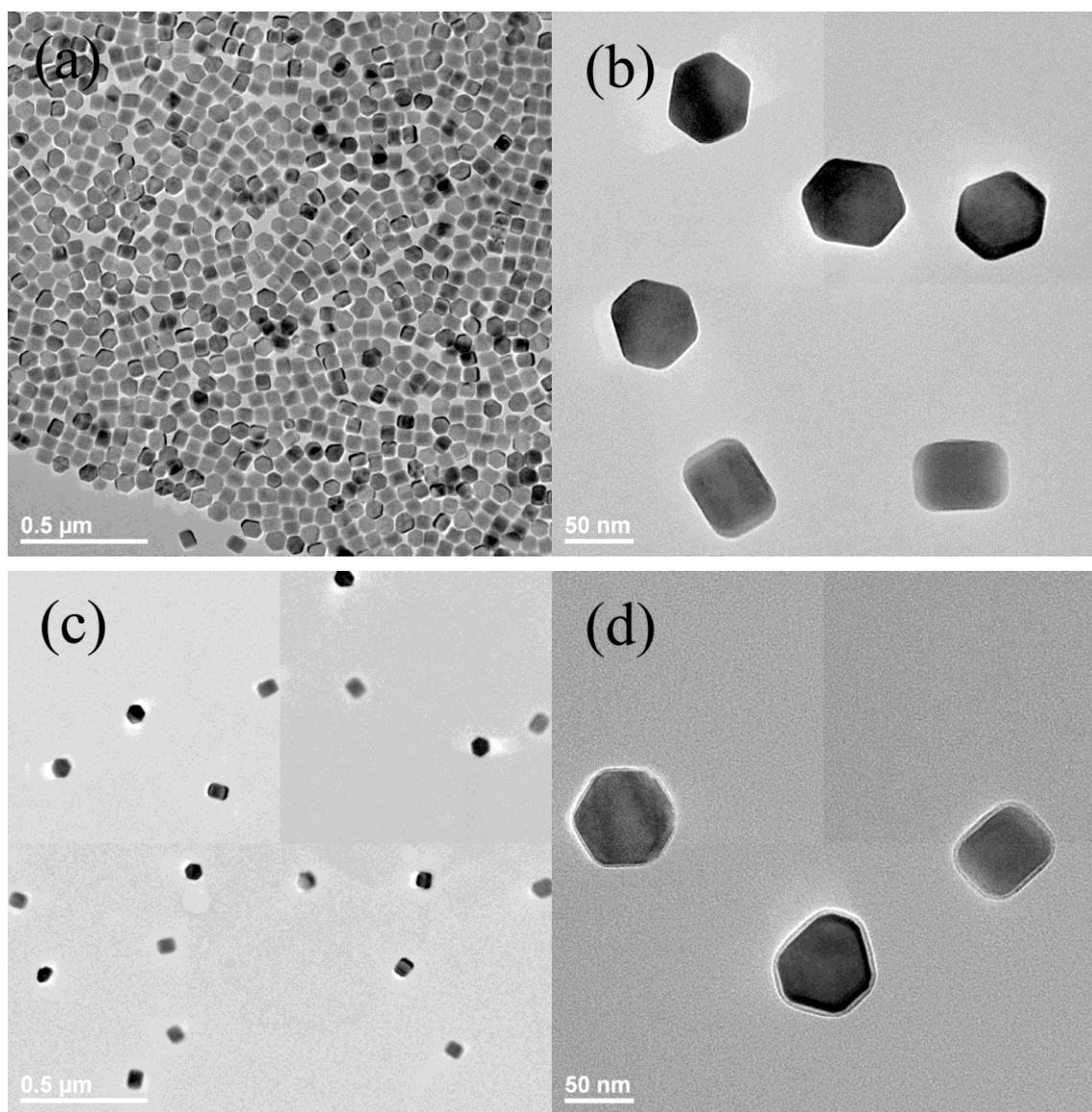


Figure S1. TEM images of the (a, b) as-prepared and (c, d) phospholipids DSPC coated UCNPs deposited on TEM grid from a drop of UCNPs cyclohexane solution and DSPC-UCNPs water solution, respectively.

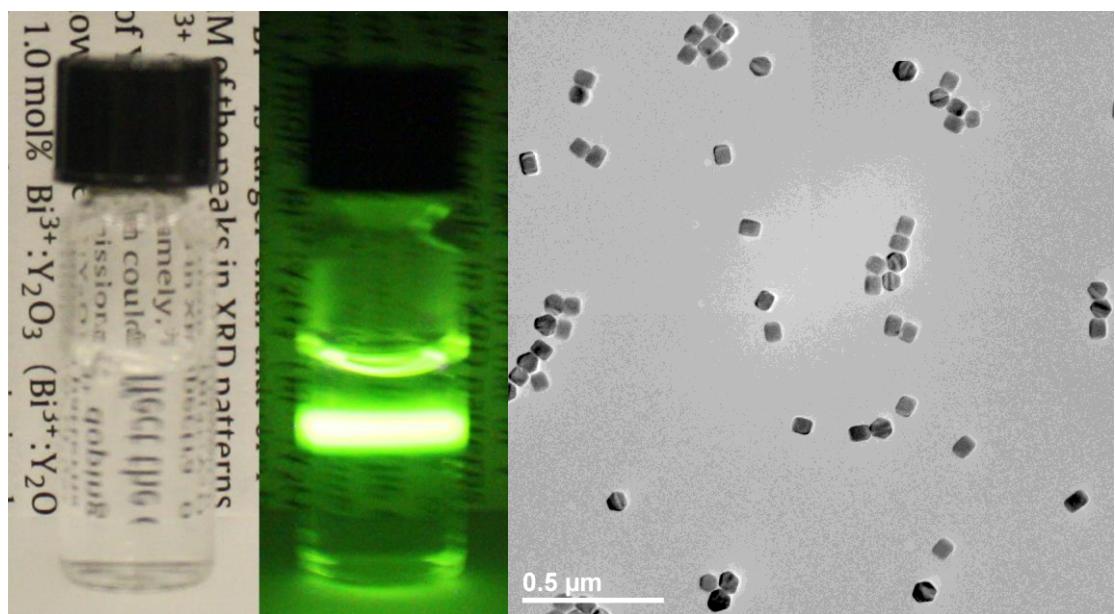


Figure S2. (Left) Photographs of the water solution of DSPC-UCNPs stored in water at room temperature for four months without laser illumination and the upconverted visible luminescence under continuous-wave 980 nm laser illumination. (Right) TEM images of the DSPC-UCNPs sample stored in water at room temperature for four months, indicating they remain monodisperse in size without aggregation.

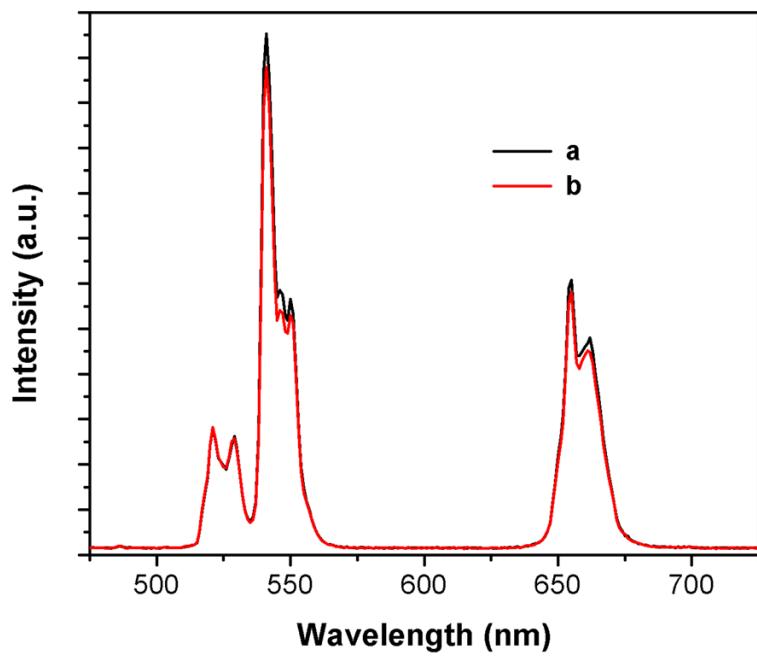


Figure S3. Upconversion luminescence spectra of the DSPC-UCNPs in aqueous solution in the absence (a) and presence (b) of $200 \mu\text{M} \text{ Cu}^{2+}$.

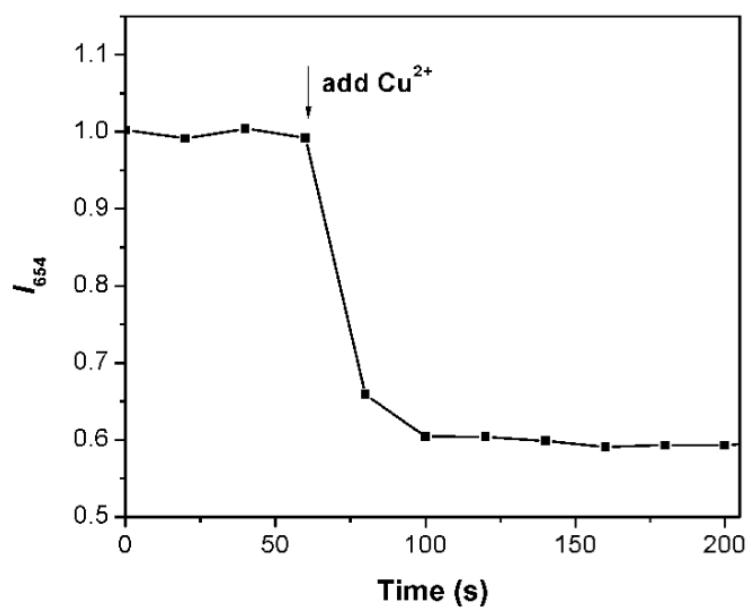


Figure S4. Time-dependent upconversion luminescence response of the sensor system with the adding of 70 μM Cu^{2+} .

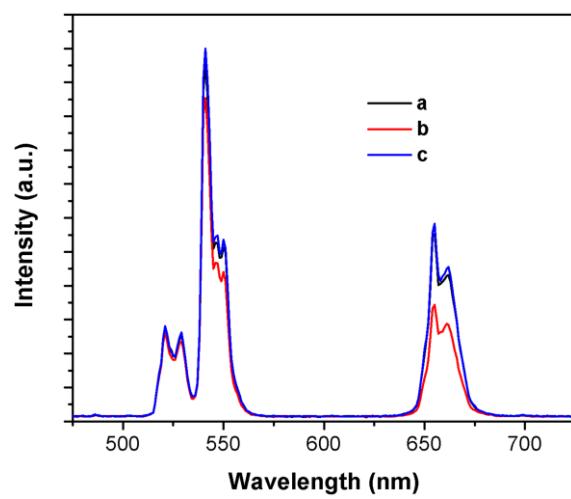


Figure S5. Upconversion luminescence spectra of the sensor system in the absence (blank line) and presence (red line) of Cu^{2+} , and Cu^{2+} -treated hybrid system upon addition of 10 equiv. L-ascorbate acid (blue line).