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Multiple imaging and excellent anticancer efficiency of an upconverting nanocarrier mediated by a single near infrared light

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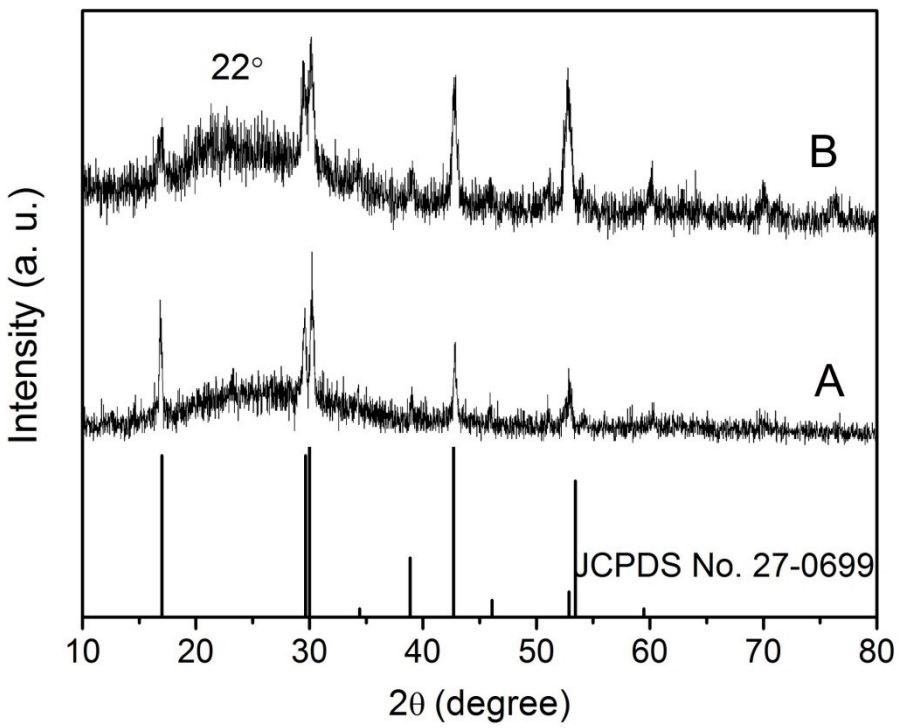

Fig. S1 XRD patterns of (A) $NaGdF_4$:Yb,Er,Mn,Co, and (B) $NaGdF_4$:Yb,Er,Mn,Co@SiO_2. The vertical bars show the peak positions and intensities for pure $NaGdF_4$ (JCPDS No. 27-0699).

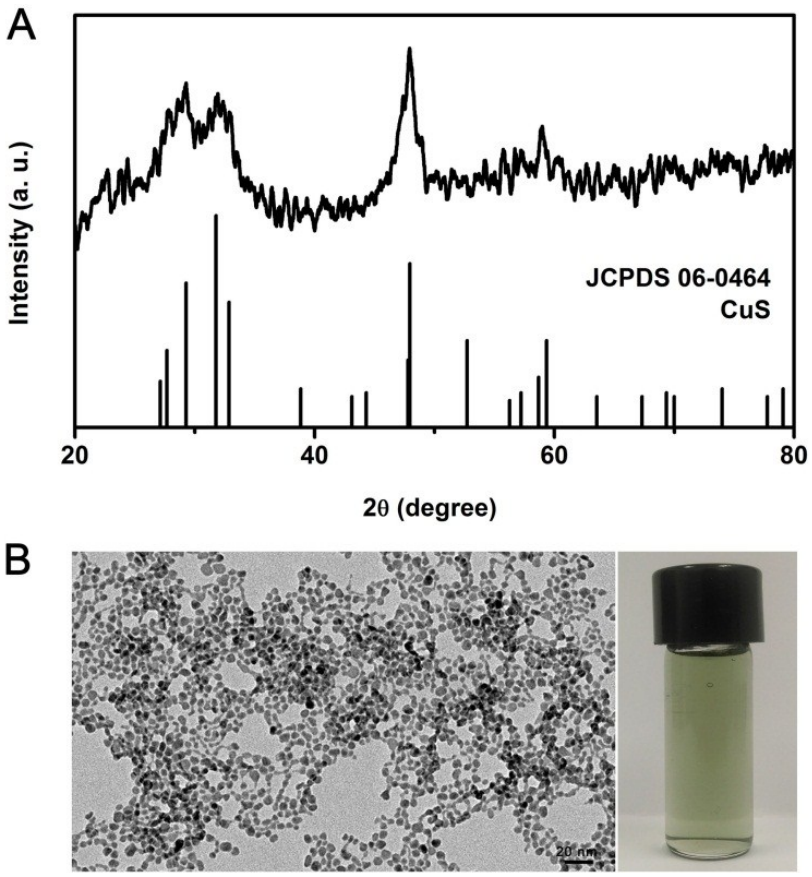

Fig. S2 (A) XRD pattern and (B) TEM image of CuS nanoparticles. Inset in panel B is the digital photograph of CuS nanoparticles dispersed in water.

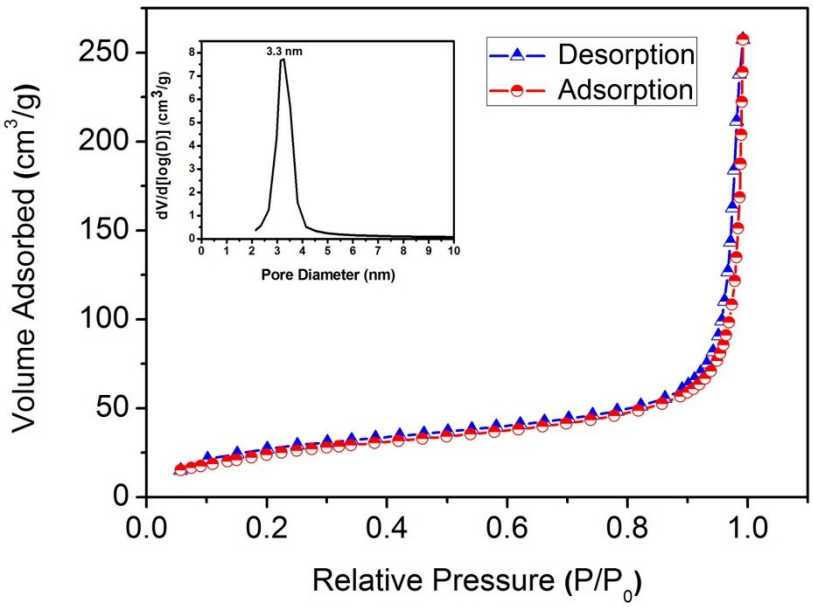

Fig. S3 N_2 adsorption/desorption isotherm and pore size distribution (inset) of as-synthesized UCNPs@SiO_2-CuS.

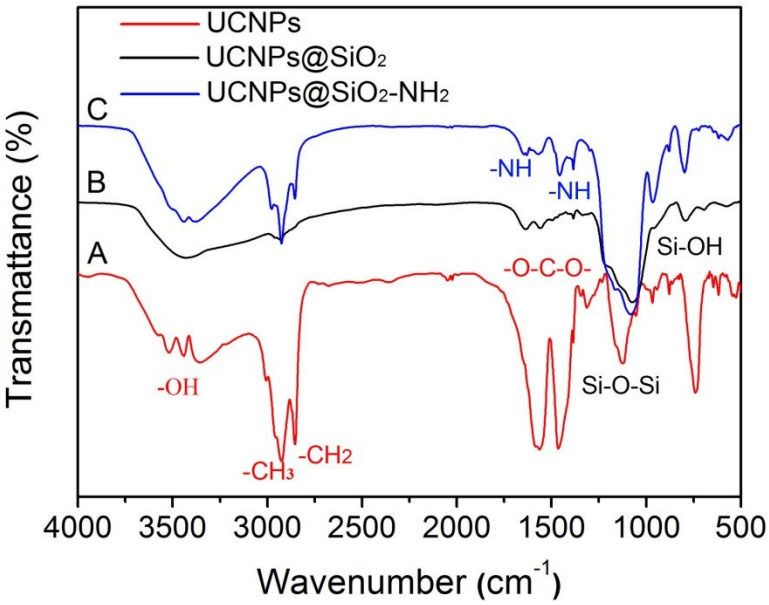

Fig. S4 FT-IR spectra of UCNPs, UCNPs@SiO_2 and UCNPs@SiO_2-NH_2.

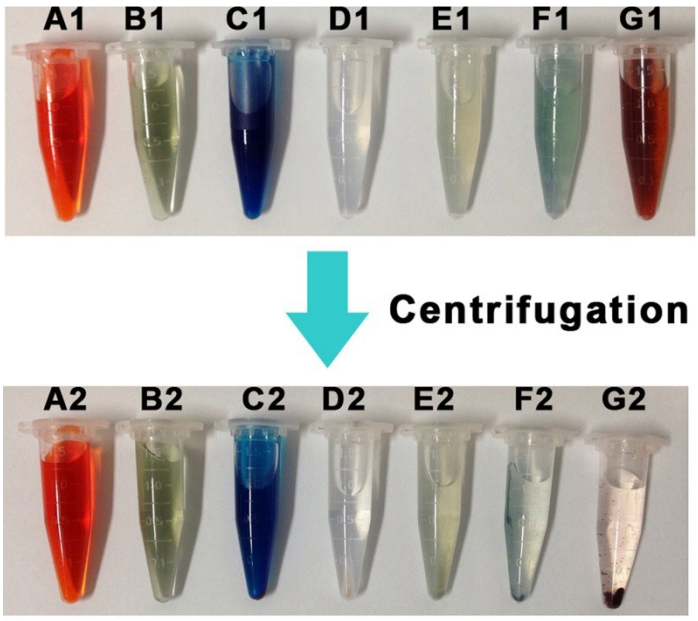

Fig. S5 Digital photographs of the tubes containing free DOX, CuS, ZnPc, UCNPs@SiO_2, UCNPs@SiO_2-CuS, UCNPs@SiO_2-ZnPc, and UMCZ-DOX (from left to right) dispersed in water (top) before and (down) after centrifugation treatment.

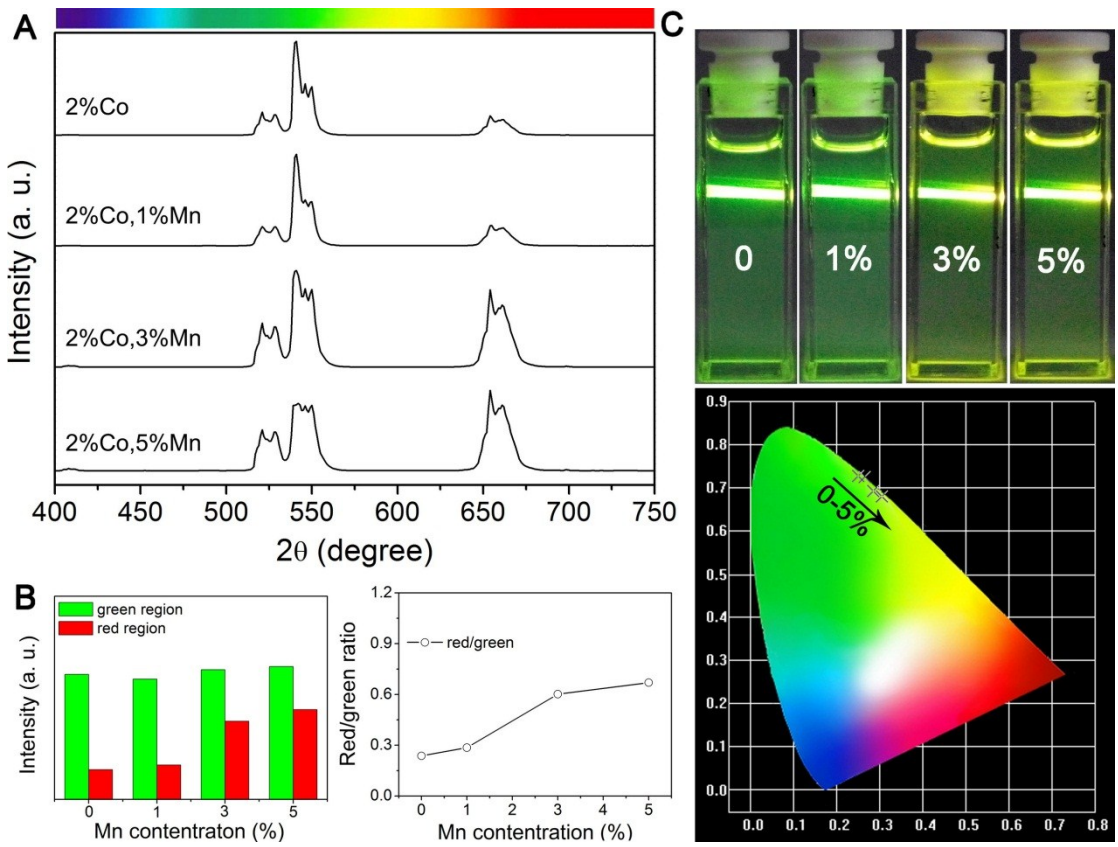

Fig. S6 (A) UC emission spectra of $NaGdF_4$:Yb,Er,2%Co, x%Mn (x = 0, 1, 3, and 5) under 980 nm excitation. (B) Integrated intensity of red and the red/green ratio with different Mn concentration. (C) Photographs of $NaGdF_4$:Yb,Er,2%Co, x%Mn (x = 0, 1, 3, and 5) under 980 nm irradiation and the corresponding CIE chromaticity.