

Supplementing Information

Highly stable folic acid functionalized copper-nanocluster/silica nanoparticles for selective targeting of cancer cells

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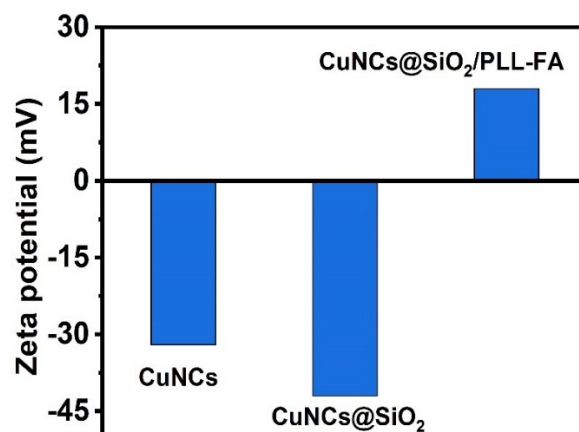


Fig. S1 Zeta potential histogram of CuNCs, CuNCs@SiO₂ and CuNCs@SiO₂/PLL-FA.

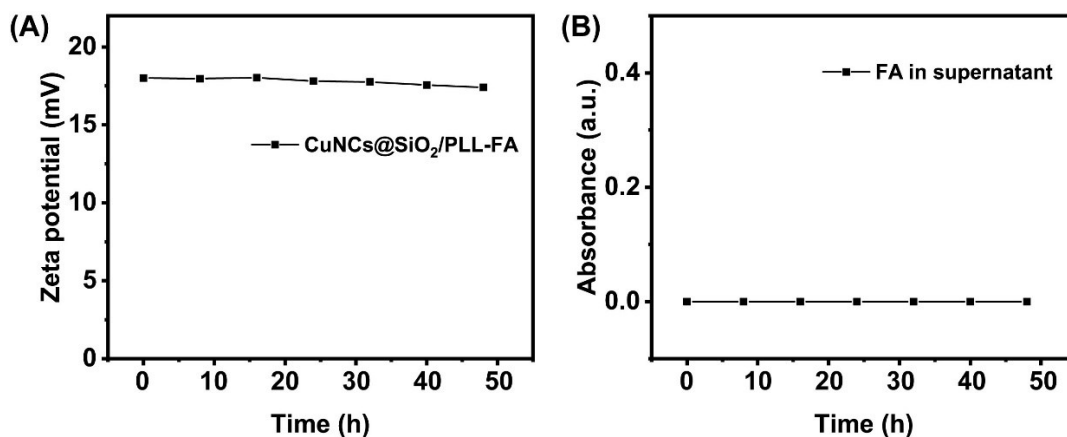


Fig. S2 (A) Variation of zeta potential of CuNCs@SiO₂/PLL-FA nanocomposites after incubated in PBS buffer (pH=7.4) for continuous 48 hours, which presents slight change at each 4 hours interval, demonstrating their excellent colloidal stability. (B) Absorbance at 360 nm of the supernatant separated from CuNCs@SiO₂/PLL-FA nanocomposites after incubated in PBS buffer for continuous 48 hours. The supernatant shows no obvious absorbance of FA indicating that the CuNCs@SiO₂/PLL-FA nanocomposites are stable in biological environment for cell detection contributed to the tough conjugation of FA on the surface.

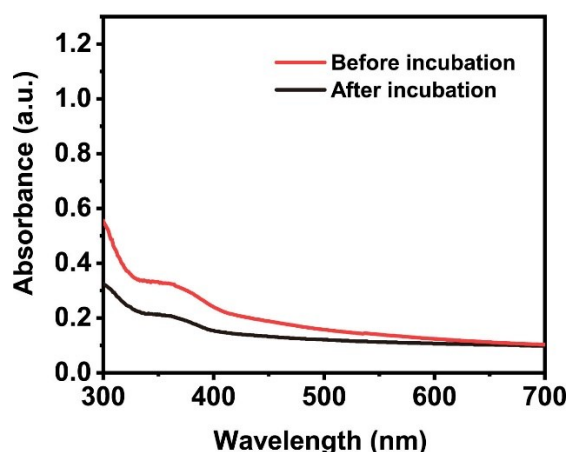


Fig. S3 UV-vis absorption spectra of PLL-FA before conjugated with CuNCs@SiO₂ (red line) and the supernatant separated from CuNCs@SiO₂/PLL-FA nanocomposites (black line).

Following the calculation of FA on each CuNCs@SiO₂/PLL-FA:

According to the Beer–Lambert law

$$A = Kbc \quad 1.$$

A is the absorbance

K is the molar attenuation coefficient

b is the optical path length

c is the concentration of the attenuating species

For pure FA, $A=0.5$, $c=1.9 \times 10^{-4}$ M (from UV-vis measurement), and Kb is 2.6×10^3 derived from 1.

From Fig. S3, the absorbance of PLL-FA at 360 nm before and after conjugated with CuNCs@SiO₂ is 0.33 and 0.21, respectively. Based on equation 1. and the value of Kb , the concentration of PLL-FA conjugated with CuNCs@SiO₂ is 0.46×10^{-4} M. The volume of the solution is 21 mL, thus the total quantity (N) of FA conjugated on CuNCs@SiO₂ is 9.66×10^{-7} M.

The weight (m) of CuNCs@SiO₂ is 23 mg (deducting the weight of CuNCs), the density (ρ) of SiO₂ is 2.2 g/cm^3 ,¹ and the diameter (d) of the CuNCs@SiO₂ is 52 nm.

$$m = n \times \rho \times \frac{4}{3} \pi \times (d/2)^3 \quad 2.$$

n is calculated ca. 1.42×10^{14} from equation 2.

The number of FA conjugated on each CuNCs@SiO₂ is calculated by the equation of $N \times N_A/n$ ($N_A=6.02 \times 10^{23}$), which is derived ca. 4095.

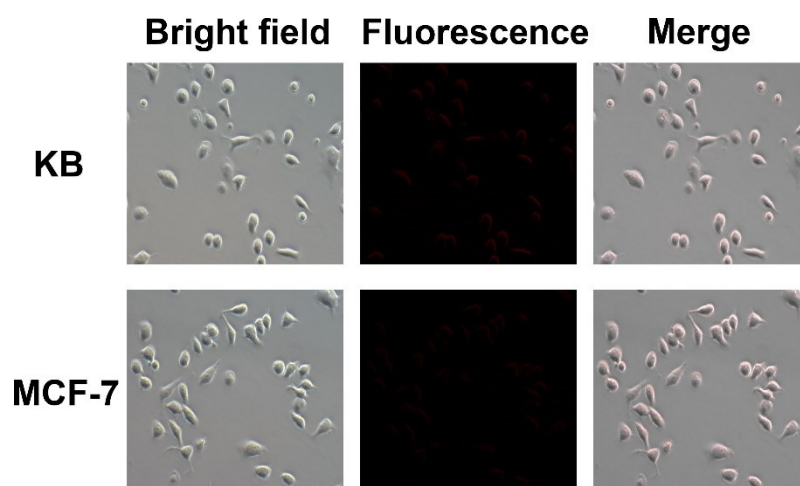


Fig. S4 Micrographs of KB cells (upper panel) and MCF-7 cells (lower panel) after incubated with CuNCs@SiO₂/PLL nanoparticles (50 µg/mL) for 12 h. Left: phase-contrast bright field images. Middle: fluorescence images. Right: the overlapped images of bright field and fluorescence images. For MCF-7 cells, the fluorescence signals are both weak after incubated with CuNCs@SiO₂/PLL and CuNCs@SiO₂/PLL-FA indicating that a few nanoprobos were internalized by MCF-7 cells. Compared with KB cells, the uptake of CuNCs@SiO₂/PLL-FA increased contributed to the high FR in KB cells.

References

1. T. Yu, A. Malugin and H. Ghandehari, *ACS Nano*, 2011, **5**, 5717-5728.