

**Biodistribution, Excretion, and Toxicity of Polyethyleneimine Modified  
NaYF<sub>4</sub>:Yb,Er Upconversion Nanoparticles in Mice *via* Different Administration  
Routes**

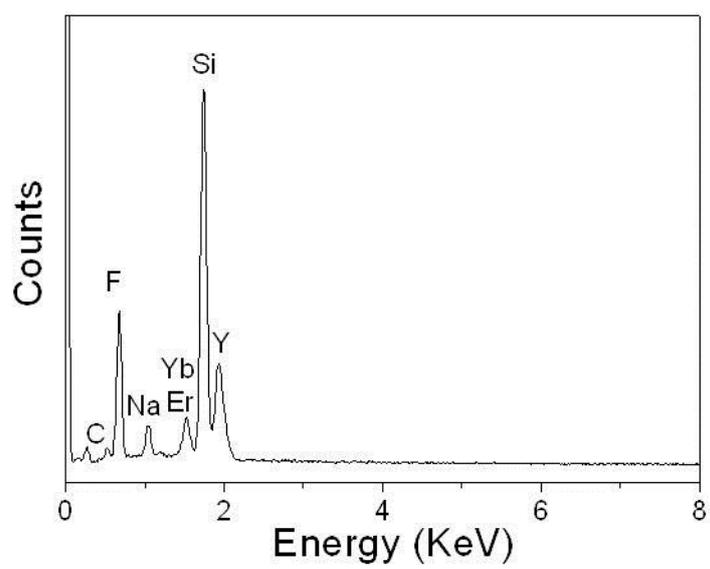
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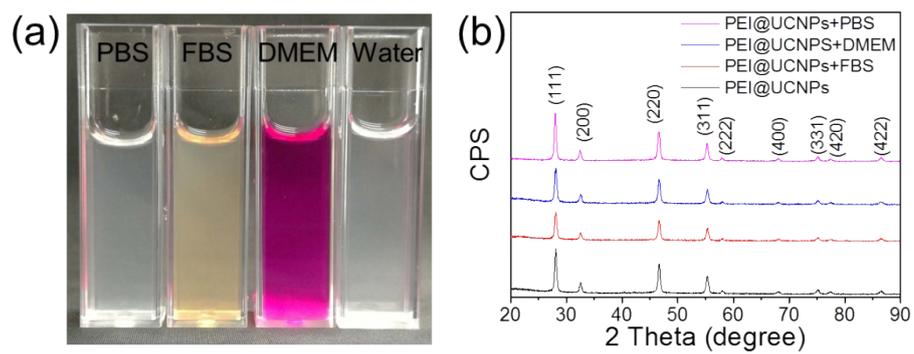
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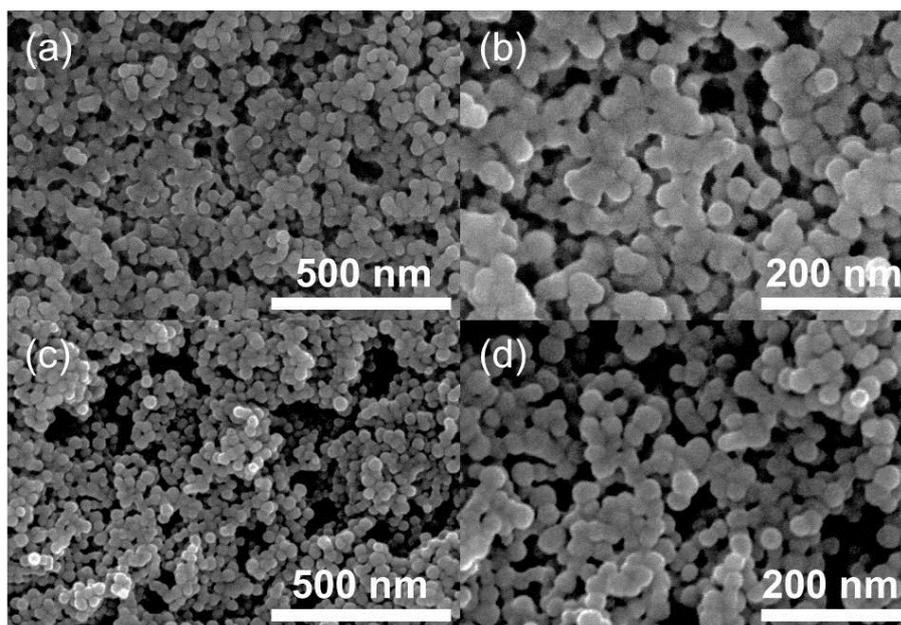
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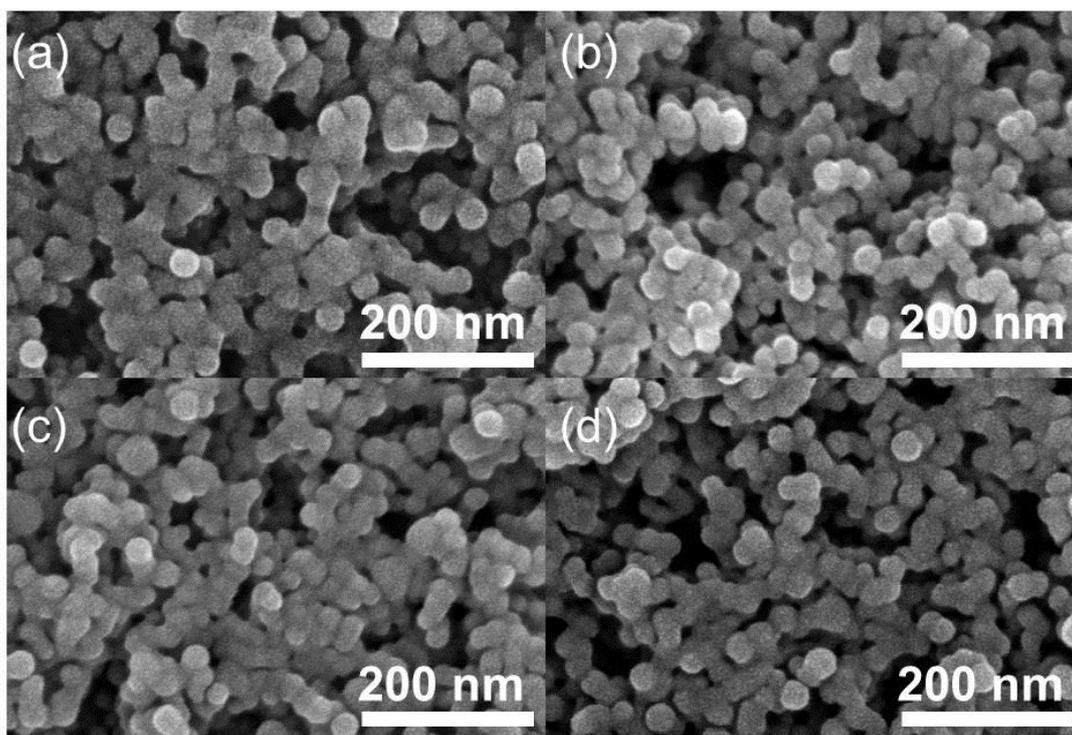
**Figure S1.** EDX spectrum of PEI@UCNPs. The Si element comes from the silicon substrate.



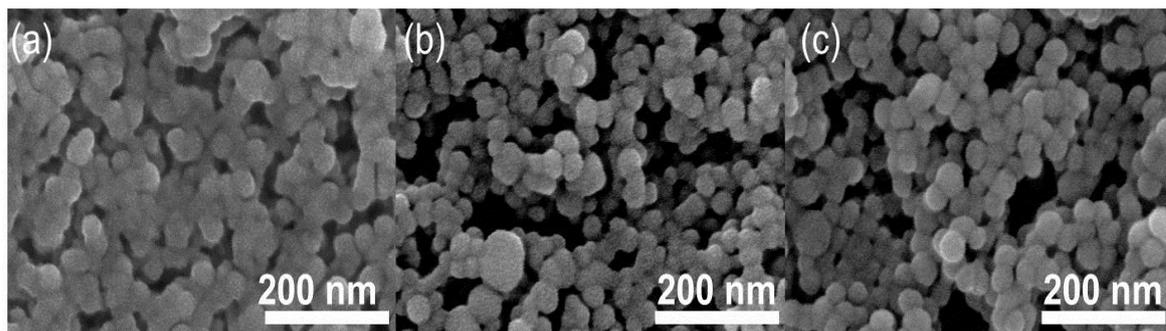
**Figure S2.** (a) Stability tests of PEI@UCNPs in PBS, FBS, DMEM, and water dispersions (concentration:  $500 \mu\text{g mL}^{-1}$ ). (b) XRD patterns of PEI@UCNPs incubated with PBS, FBS, DMEM, and water solutions for 24 h, respectively.



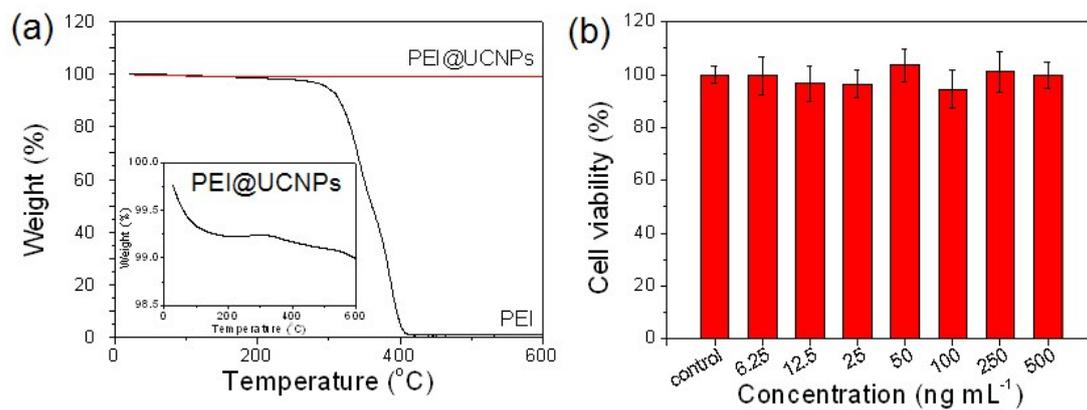
**Figure S3.** PEI@UCNPs synthesized by adding different amount of water: (a,b) 2 mL of water , and (c,d) 3 mL of water.



**Figure S4.** PEI@UCNPs synthesized by different solvothermal reaction time: (a) 6, (b) 12, (c) 24, and (d) 48 h.



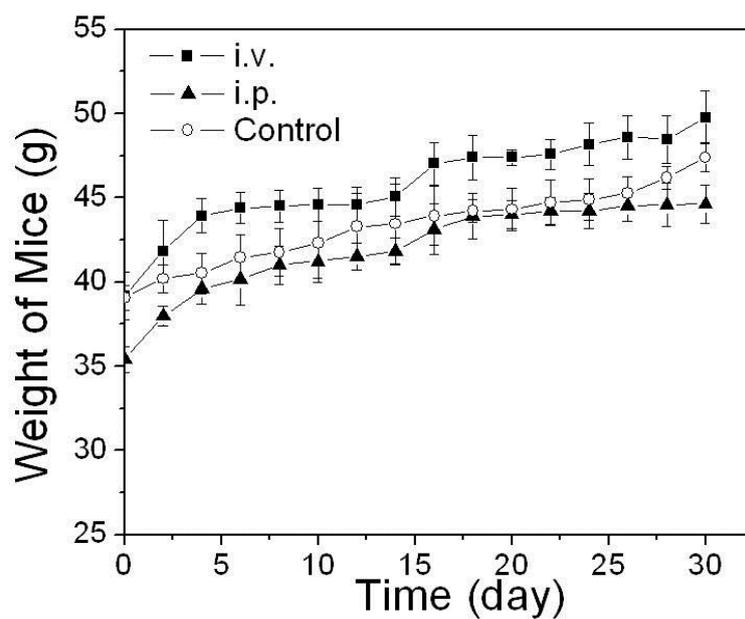
**Figure S5.** PEI@UCNPs synthesized by adding different amount of precursors: (a) 0.4 mmol of  $\text{Er}^{3+}$ , (b) 0.1 mmol of  $\text{Yb}^{3+}$ , and (c) 0.4 mmol of  $\text{Y}^{3+}$ .



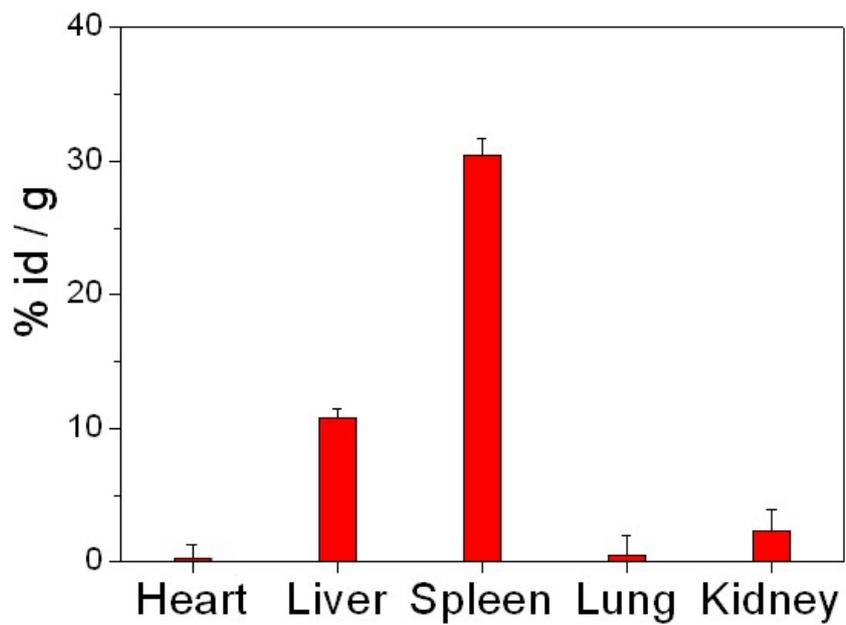
**Figure S6.** (a) TGA plot of PEI@UCNPs. Inset in (a) shows the magnified TGA plot of PEI@UCNPs. (b) Relative cell viability of BEL-7402 cells after incubation with different concentrations of PEI for 24 h.



**Figure S7.** Cell imaging under (a) bright field and (b) 980 nm laser irradiation after being incubated with PEI@UCNPs ( $10 \mu\text{g mL}^{-1}$ ) for 24 h.



**Figure S8.** Changes in body weight of mice *via i.p.* and *i.v.* injected with PEI@UCNPs within 30 days. Error bars represent standard deviation calculated from three mice.



**Figure S9.** Organ biodistribution of  $^{64}\text{Cu}$ -NOTA-PEI@UCNPs at 24 h after *i.v.* injection, determined by  $\gamma$ -counter (n=3). (% ID/g organ)