Electronic Supplementary Material (ESI) for Biomaterials Science.

Yolk-structured Multifunctional Up-conversion Nanoparticles For Synergistic Photodynamic-Sonodynamic Antibacterial Resistance Therapy

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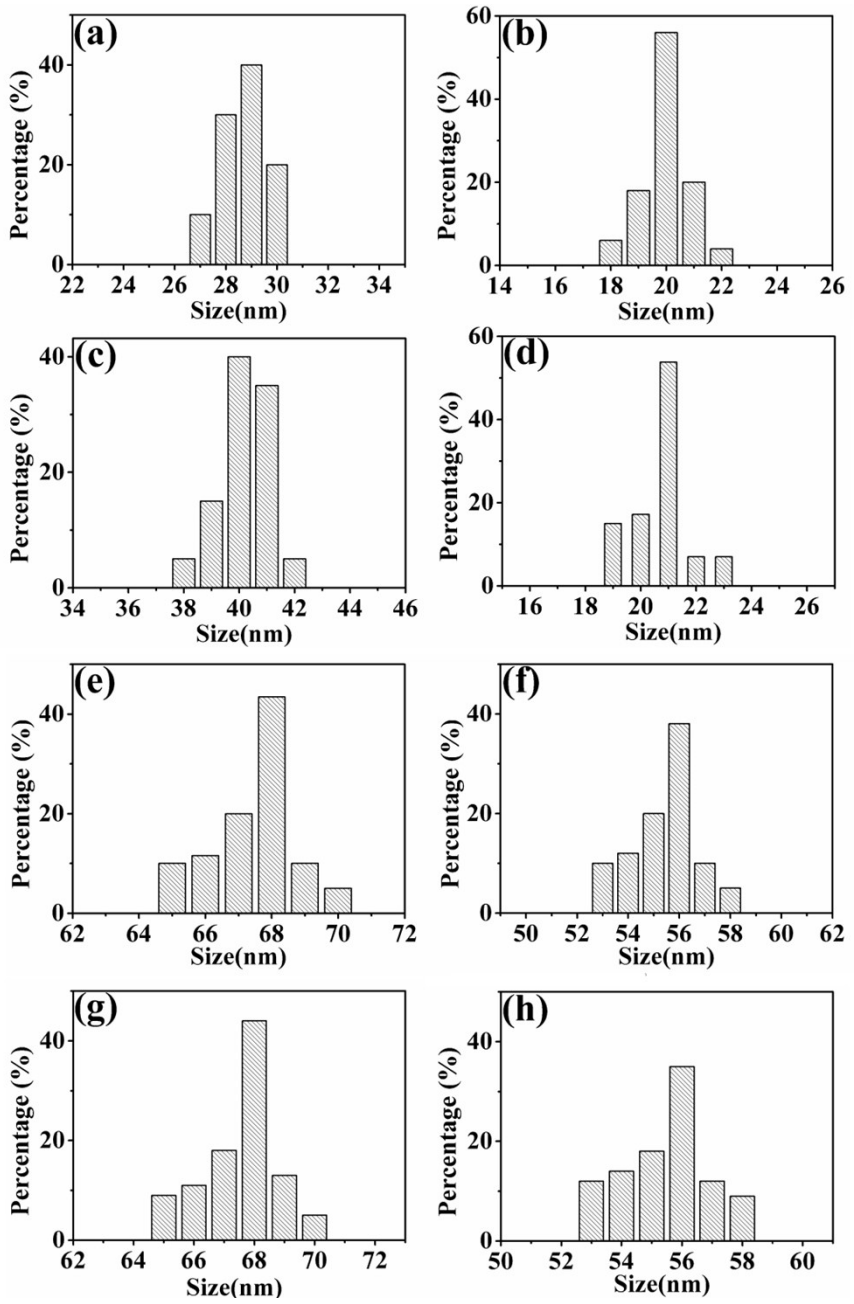

Fig. S1. Size distributions of the (a, b) $NaYF_4$: Yb, Er; (c, d) $NaYF_4$: Yb, Er @ $NaGdF_4$: Nd; (e, f) UCNP@SiO_2-RB; (g, h) yolk-structured UCNP@SiO_2-RB and size of (a, c, e, g) was in length and (b, d, f, h) was in width.

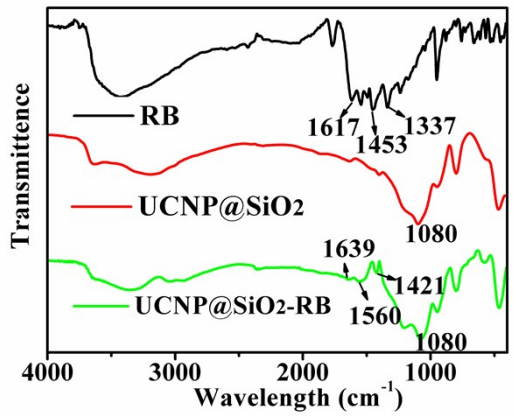

Fig. S2. Fourier-transform infrared (FTIR) spectra of RB, UCNP@SiO_2 and UCNP@SiO_2-RB.

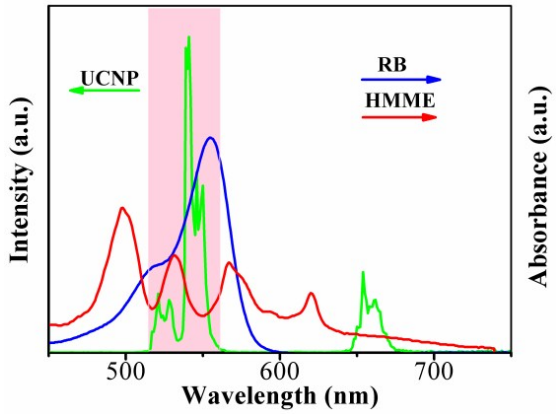

Fig. S3. UC emission spectrum of the UCNP NPs in cyclohexane (green line), and absorption spectra of RB molecules (blue line) and HMME (red line) in Deionized water.

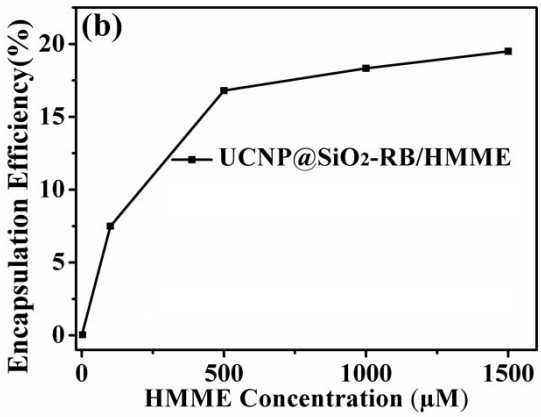

Fig. S4. The drug encapsulation efficiency (%) of HMME as a function of HMME concentration.

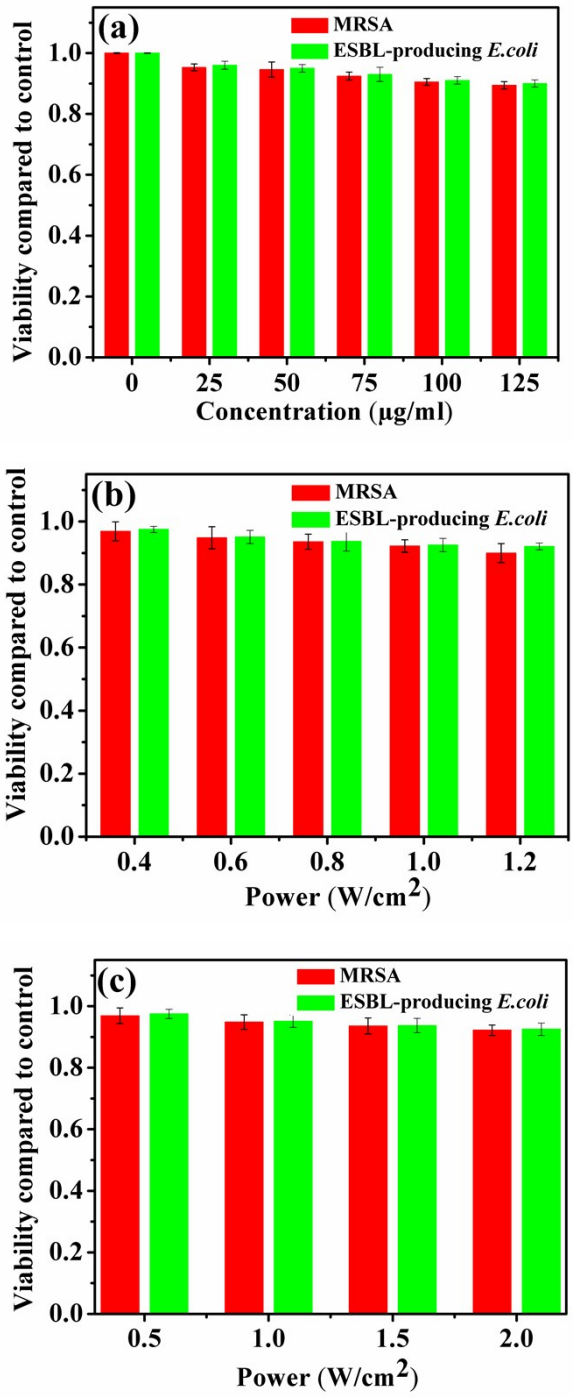

Fig. S5. Cytotoxicity assay of MRSA and ESBL-producing *E.coli* treated with (a) UCNP@SiO_2-RB/HMME at different concentrations (no irradiation); (b) 980 nm laser for 30min; (c) ultrasonication for 10min.

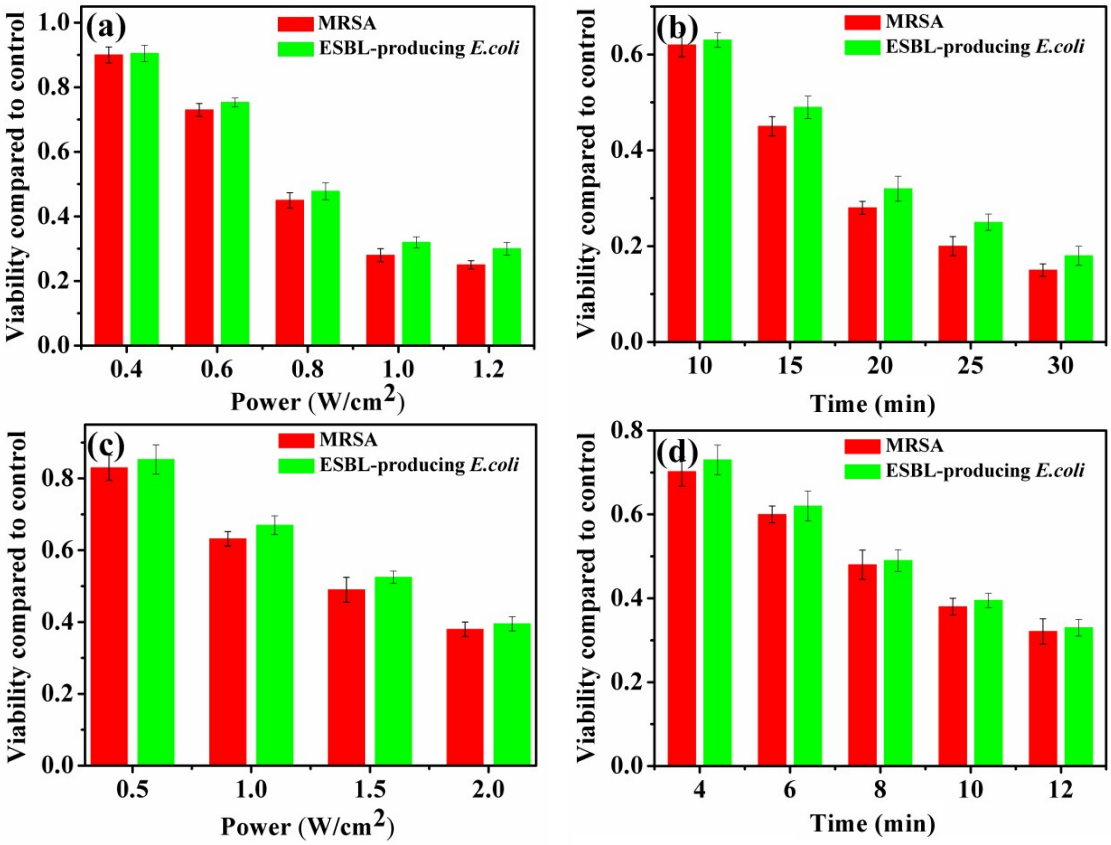

Fig. S6. Cytotoxicity assay of MRSA and ESBL-producing *E.coli* incubated with 100μg/ml UCNP@SiO_2-RB/HMME under 980nm laser with (a) different power intensity (irradiation time = 30 min); (b) different illumination time (1.0 W/cm^2); with ultrasonication for (c) different power intensity (10 min);(d) different illumination time (2.0 W/cm^2).