Electronic Supplementary Information (ESI)

Doxorubicin loaded silica nanorattle actively homing to tumor with improved anti-tumor effect

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Carboxylation and PEGylation of silica nanorattle

For carboxylation, 100 mg SNs was mixed with 200 mg of glutaric anhydride (Sigma) in 20mL N,N-Dimethylformamide (DMF), The reaction was progressed in the dark overnight (12 hours). Then the reaction mixture was repeatedly washed with water and ethanol several times by centrifugation.

For PEGylation, 1 g of SNs was mixed with 200 mg of mPEG-SC (methoxypoly(ethylene glycol) succinimidyl carbonate) (5 KD, Kaizheng Biotech., Beijing) in 20mL deionized water and reacted for 24 h at room temperature, and then the unreacted molecules were removed by repeated centrifugation. and washing with deionized water.

Preparation of DOX-COOH-SNs and DOX-PEG-SNs and *In vitro* drug release

DOX loaded carboxyl (–COOH) (DOX-COOH-SNs) and poly(ethylene glycol) (PEG) modified SNs (DOX-PEG-SNs**)** and *In vitro* drug release were processed in the same way with the DOX-FA-SNs.

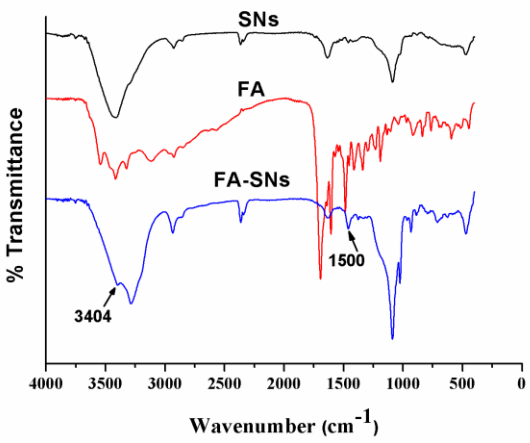

Fig. S1 FTIR spectra of SNs, folic acid (FA) and FA-SNs.

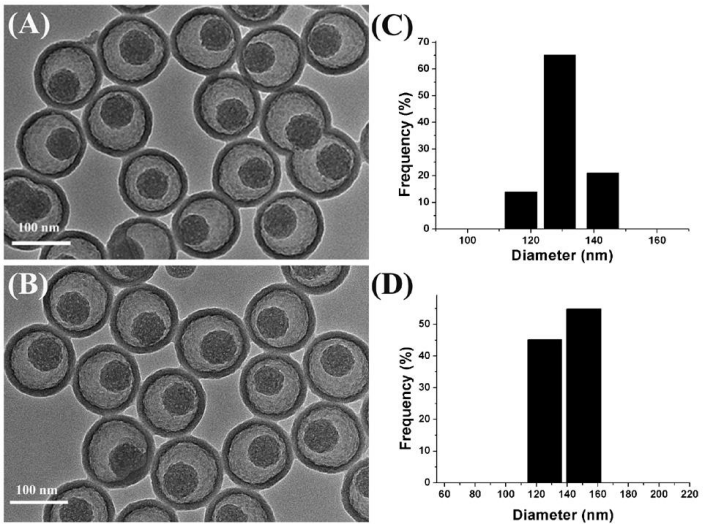

Fig. S2 TEM image of the COOH-SNs (A) and PEG-SNs (B) and their corresponding size distribution (C,D) by dynamic light scattering.

Table S1. Results obtained from samples used for loading DOX

Sample	Loading content (%)[a]	Entrapment efficiency (%)[b]
FA-SNs	15.0 ± 0.28	36.0 ± 0.45
COOH-SNs	16.0 ± 0.12	38.0 ± 0.64
PEG-SNs	14.4 ± 0.15	33.7 ± 0.50

[a](the weight of loading DOX / the weight of DOX loaded functionalized SNs)×100% (mean value) determined by UV method (n=3).
[b](the weight of loading DOX / feeding DOX)×100% (mean value) determined by UV method (n=3).

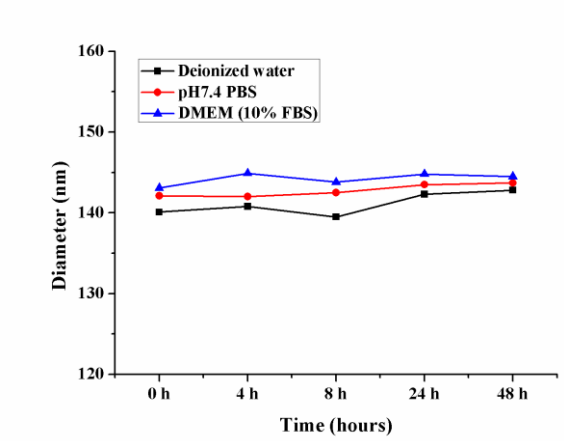

Fig. S3 The stability of DOX-FA-SNs in deionized water, pH7.4 PBS and DMEM (10% FBS) observed using DLS particle size analyzer.

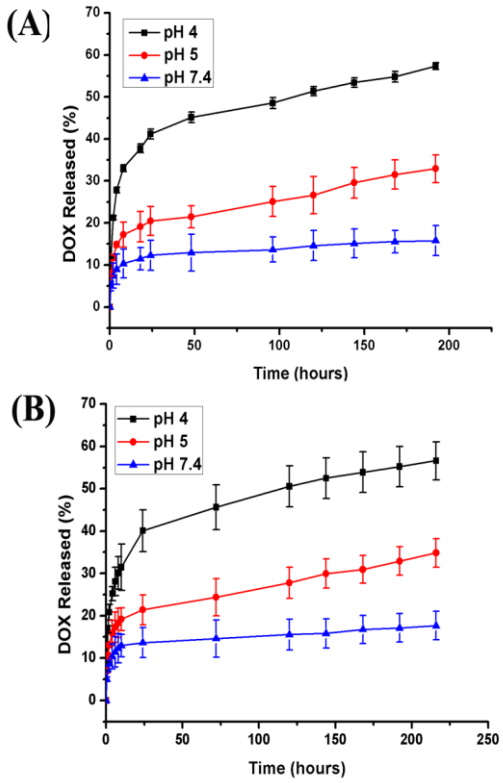

Fig. S4 Release behavior of DOX from (A) COOH-SNs and (B) PEG-SNs at different pH PBS.

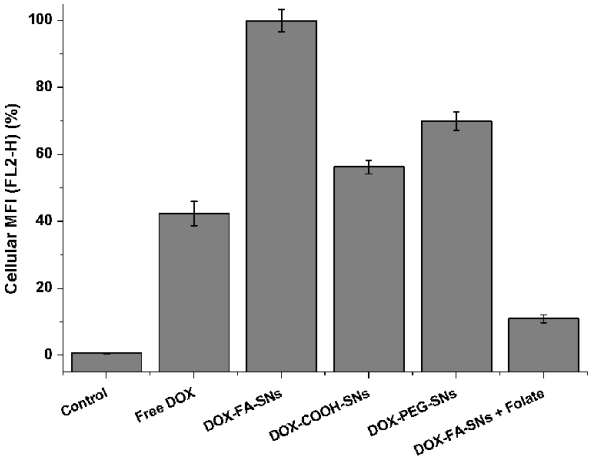

Fig. S5 Mean fluorescence intensity (MFI) of HeLa cells in the presence of different preparations of DOX. The values were normalized to the MFI of the cells incubated with DOX-FA-SNs.

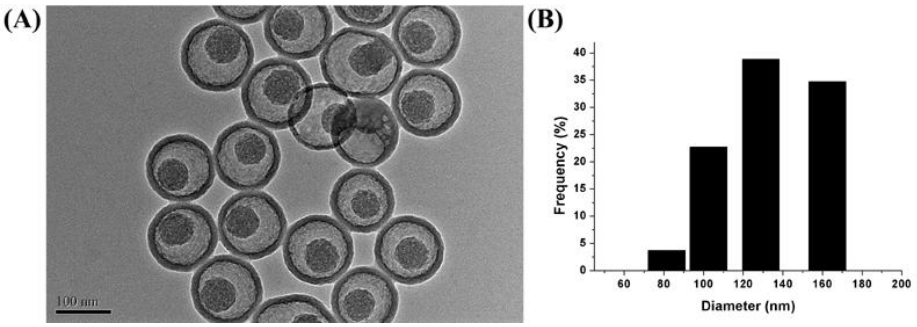

Fig. S6 TEM image (A) and size distribution (B) of the ICG-FA-SNs.

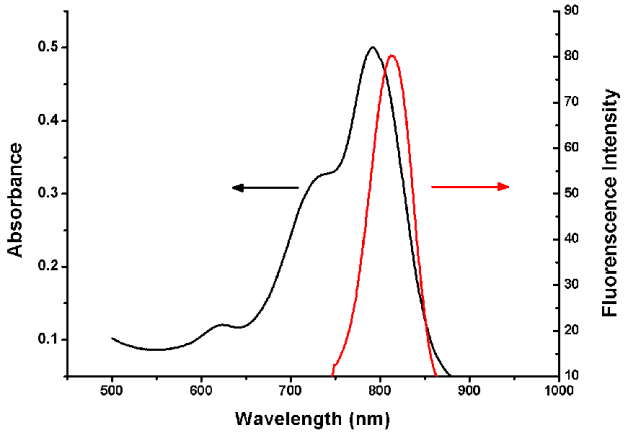

Fig. S7 UV absorption and fluorescence emission spectra of ICG-FA-SNs.