Supporting Information

Spacer Intercalated Disassembly and Photodynamic Activity of Zinc Phthalocyanine inside Nano-Channels of Mesoporous Silica Nanoparticles

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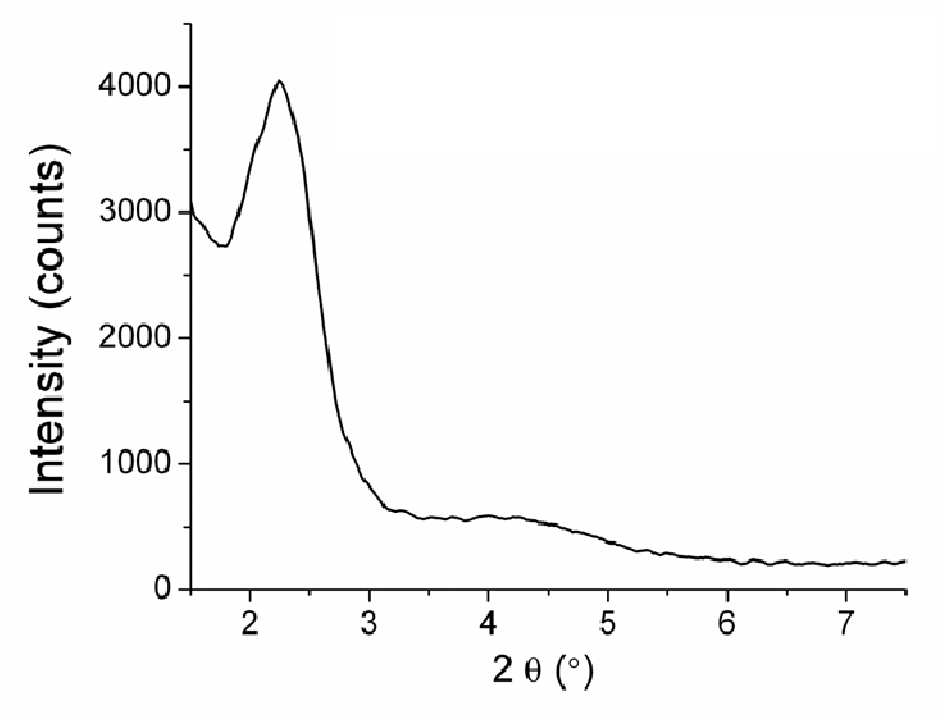

Figure S1. X-ray diffraction pattern of MSNP-Ad.

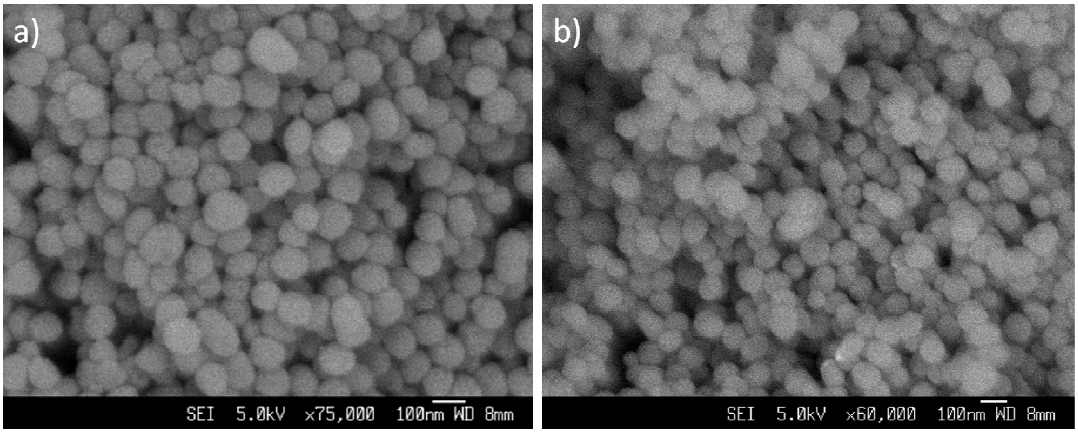

Figure S2. FE-SEM images of a) MSNP-Ad and b) ZnPc loaded MSNP-Ad (MSNP-Ad+ZnPc).

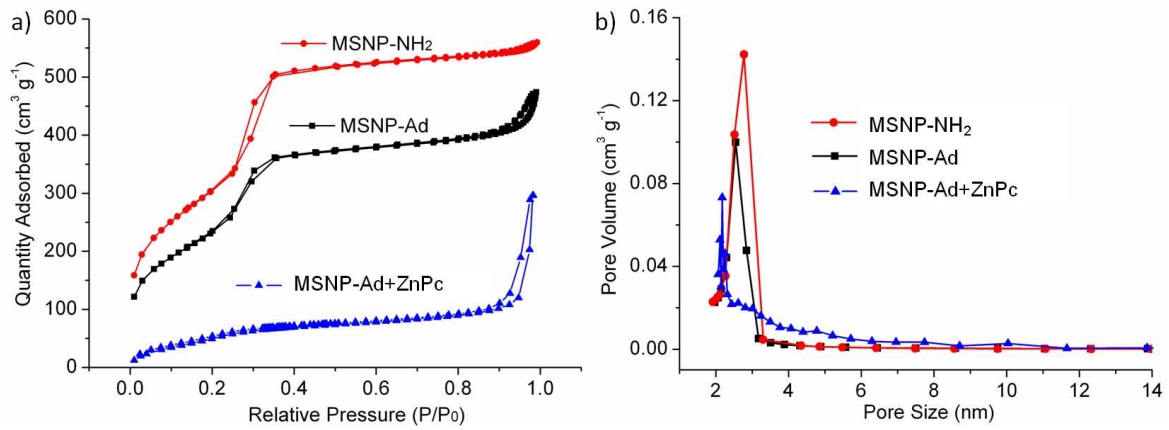

Figure S3. a) N_2 adsorption/desorption isotherms and b) BJH pore size distributions of MSNP-NH_2, MSNP-Ad, and MSNP-Ad+ZnPc.

Table S1. BET surface area, BJH pore size and pore volume of MSNP-NH_2, MSNP-Ad, and MSNP-Ad+ZnPc.

	Surface area (m^2 g^{-1})	Pore size (nm)	Pore volume (cm^3 g^{-1})
MSNP-NH_2	1116.63	2.81	0.98
MSNP-Ad	852.58	2.52	0.83
MSNP-Ad+ZnPc	238.89	2.13	0.38

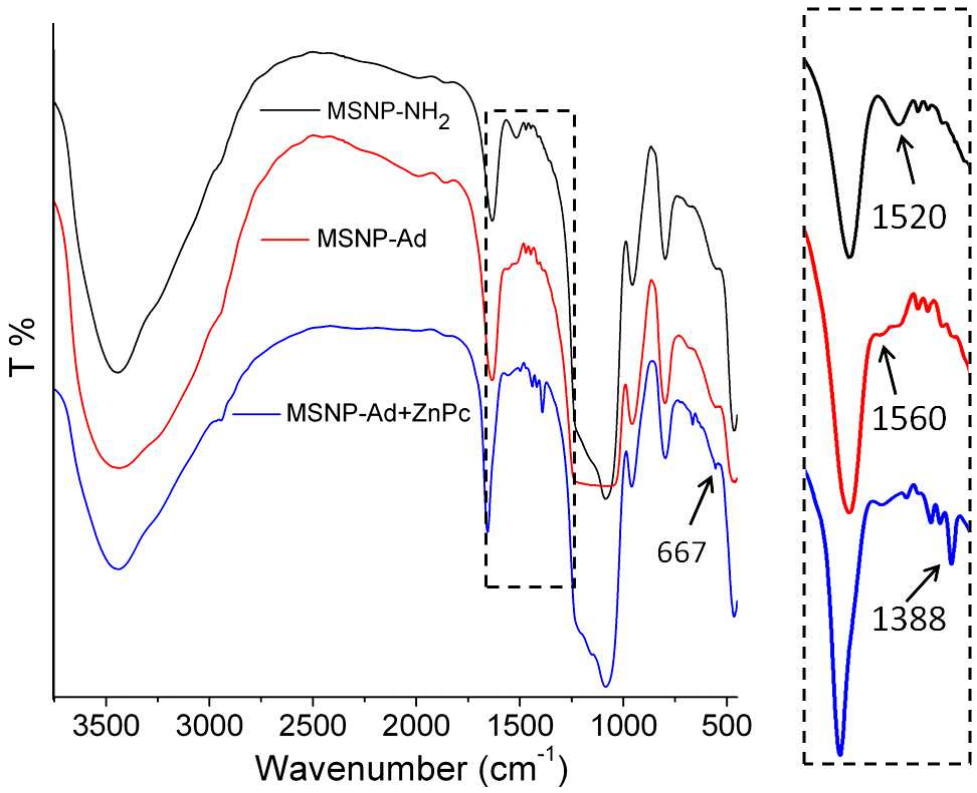

Figure S4. a) FT-IR spectra of MSNP-NH_2 (black curve), MSNP-Ad (red curve) and MSNP-Ad+ZnPc (blue curve). The presence of ZnPc in MSNP-Ad+ZnPc was evidenced by the new peaks at 667 cm^{-1} and 1388 cm^{-1}.

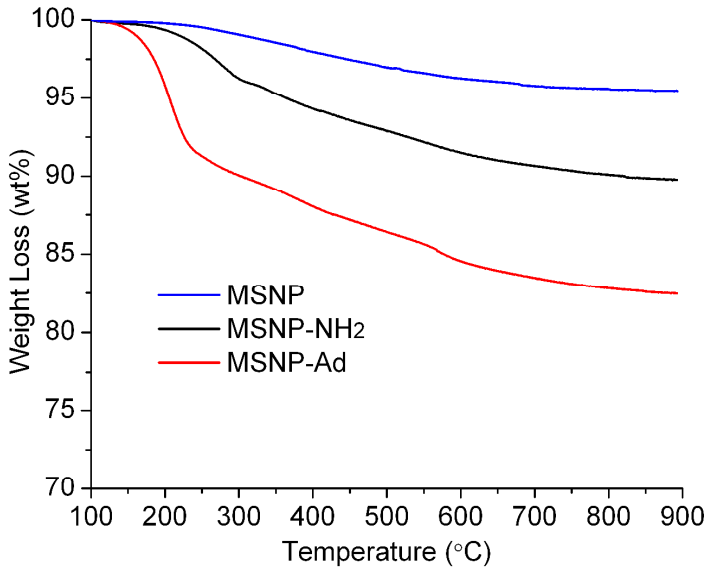

Figure S5. TGA curves of MSNPs, MSNP-NH_2, and MSNP-Ad.

Table S2. Zeta-potential value and DLS size measurements.

Samples	ζ-potential (mV)	Size in H_2O (20μg mL^{-1}) (nm (PDI))	Size in DMEM (20μg mL^{-1}) (nm (PDI))
MSNP-NH_2	24.0±1.9	257 (0.391)	167 (0.242)
MSNP-Ad	7.8±0.7	830 (0.455)	743 (0.752)
MSNP-Ad+CD-2NH_2	25.2±1.9	223 (0.233)	236 (0.214)
MSNP-Ad+ZnPc	6.7±0.5	634 (0.752)	332 (0.610)
MSNP-Ad+ZnPc+CD-2NH_2	23.3±1.8	277 (0.351)	181 (0.263)
Solid SiO_2	-49.2±8.9	NA	NA
Solid SiO_2-NH_2	12.1±2.3	NA	NA
Solid SiO_2-Ad	-24±3.2	NA	NA

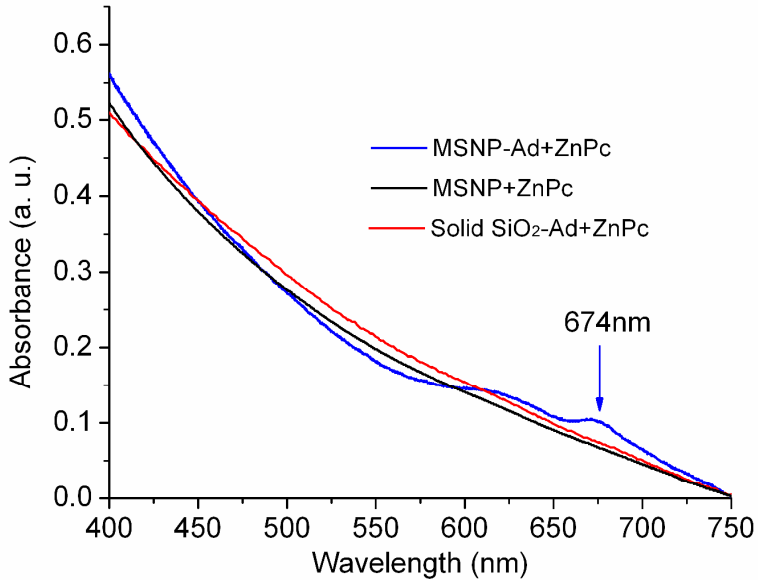

Figure S6. UV-vis spectra of MSNP+ZnPc (black curve), MSNP-Ad+ZnPc (blue curve), and solid SiO_2-Ad+ZnPc (red curve).

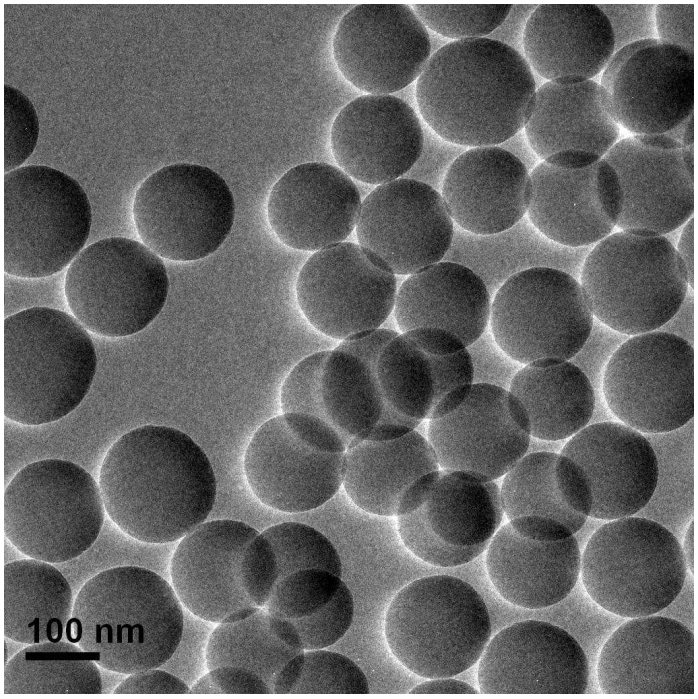

Figure S7. TEM image of solid SiO_2-Ad.

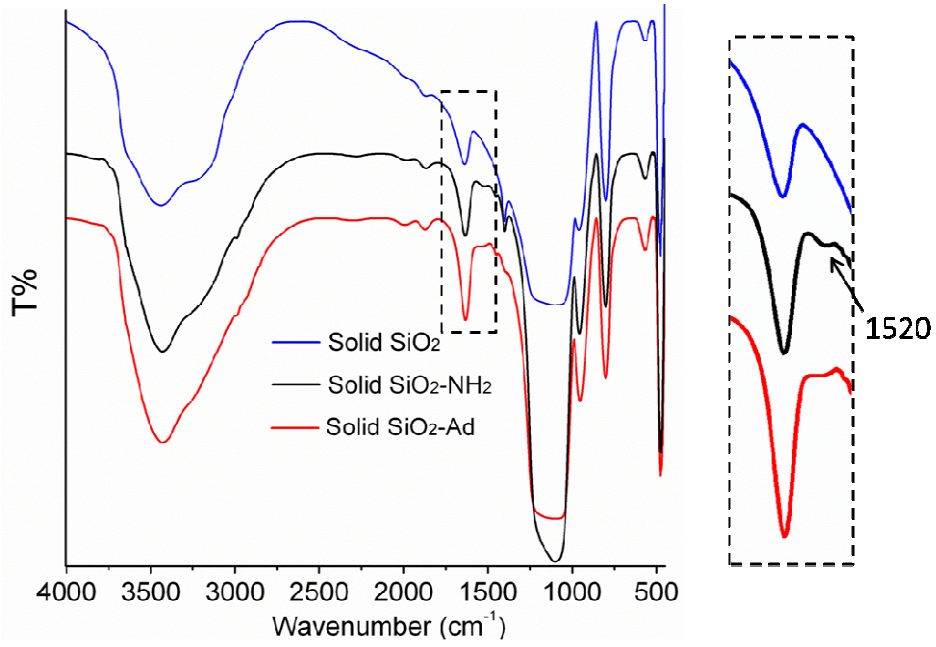

Figure S8. a) FT-IR spectra of solid SiO_2 (blue curve), solid SiO_2-NH_2 (black curve), and solid SiO_2-Ad (red curve).

Table S3. ZnPc loading capacity of MSNPs, MSNP-Ad, and solid SiO_2-Ad.

Samples	Loading capacity (wt%)
MSNPs	0.5wt%
MSNP-Ad	0.6wt%
Solid SiO_2-Ad	<0.1wt%

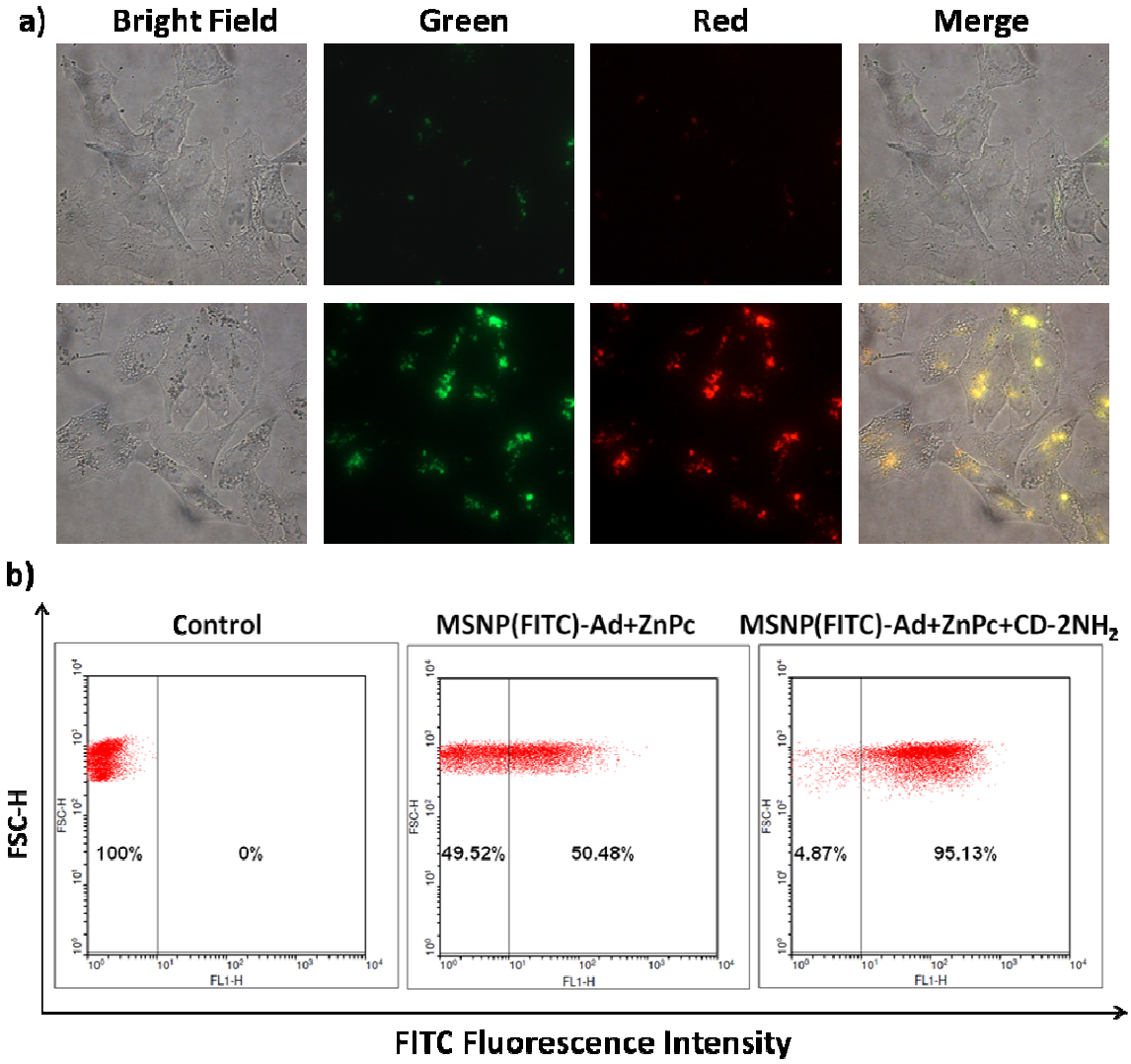

Figure S9. a) Fluorescence microscopy images of HeLa cancer cell lines incubated with MSNP(FITC)-Ad+ZnPc (20μg mL^{-1}) (row 1) and MSNP(FITC)-Ad+ZnPc+CD-$2NH_2$ (20μg mL^{-1}) (row 2). b) Flow cytometry analysis of HeLa cell lines incubated with MSNP(FITC)-Ad+ZnPc (20μg mL^{-1}) and MSNP(FITC)-Ad+ZnPc+CD-$2NH_2$ (20μg mL^{-1}) for 24h. HeLa cells without any treatment were used as control.

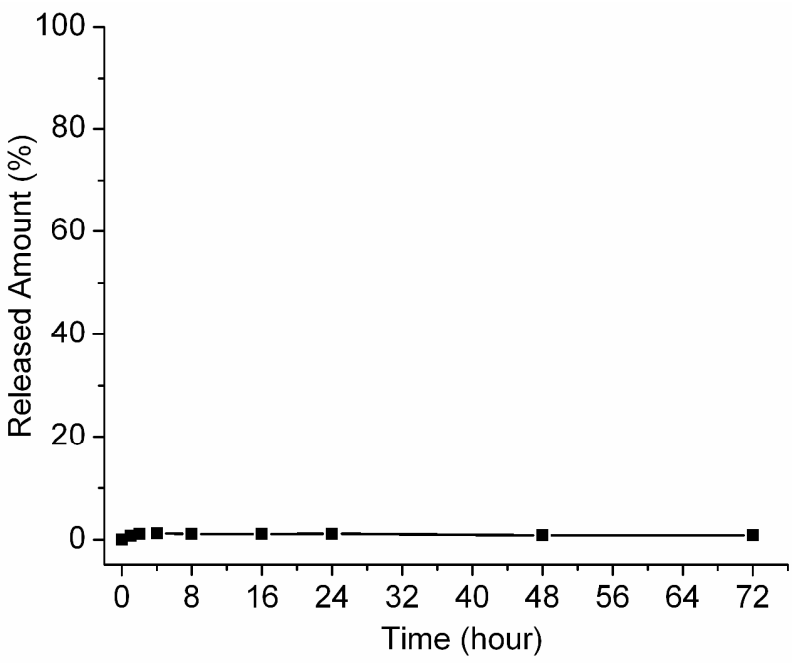

Figure S10. Release profile of ZnPc from MSNP-Ad+ZnPc+CD-2NH_2 in PBS buffer at pH 7.2. MSNP-Ad+ZnPc+CD-2NH_2 (1 mg) was suspended in PBS buffer (1 mL), and after certain time intervals, the sample was centrifuged and the UV-vis absorption spectrum of the supernatant was recorded in order to trace the release of ZnPc from the hybrid.

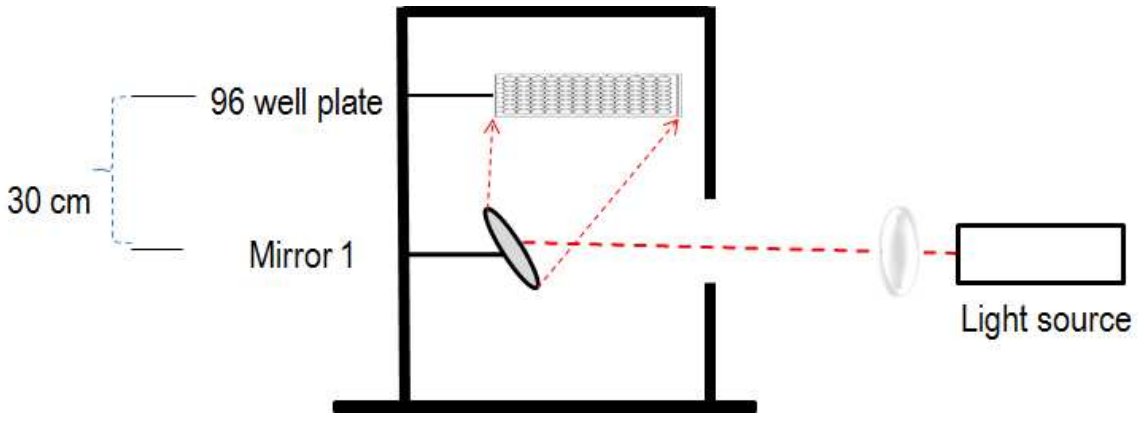

Figure S11. Schematic diagram showing the PDT experimental setup for light irradiation.

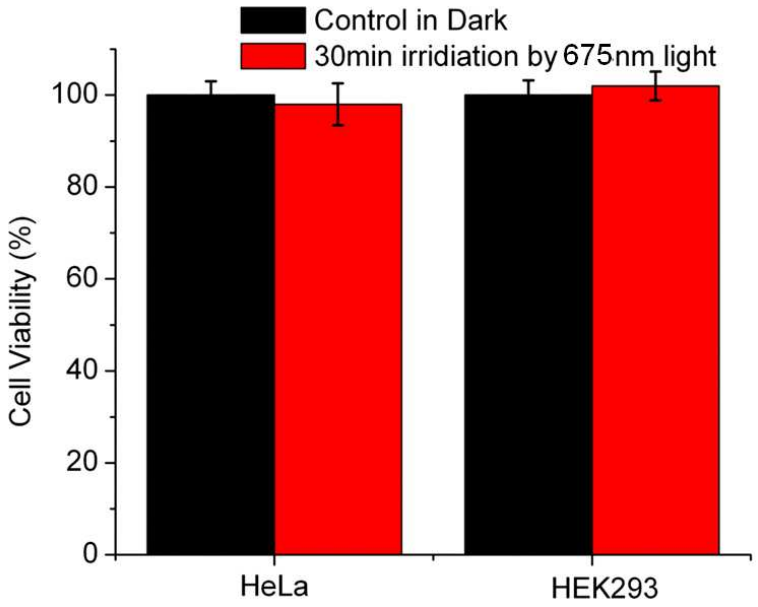

Figure S12. MTT cytotoxicity assay of HeLa and HEK293 cells incubated in the dark (control) and after irradiation by 675nm light for 30min without any nanoparticle treatment.

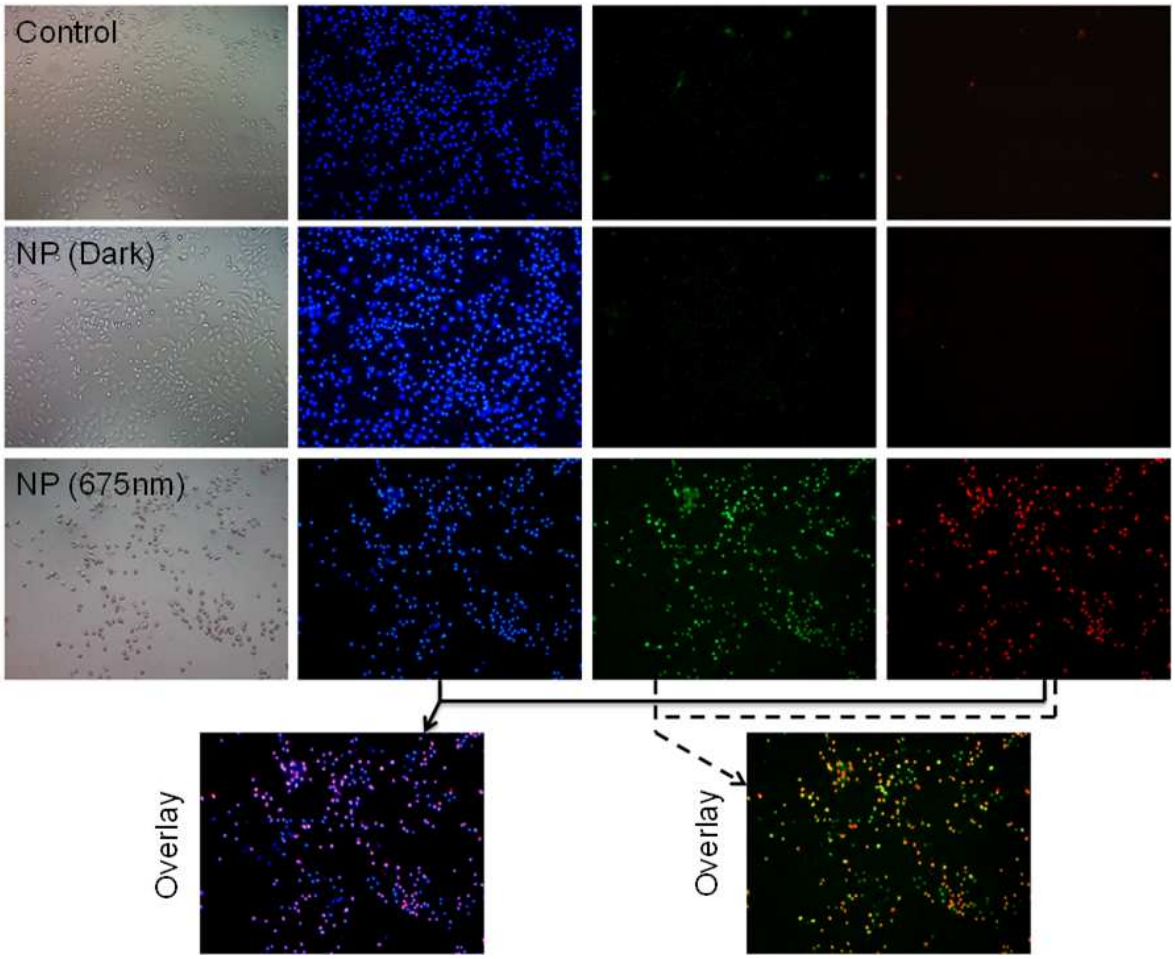

Figure S13. Fluorescence microscopy images of stained apoptosis/death cells using HeLa cells. Row 1: cells without any treatment. Row 2: cells treated with MSNP(FITC)-Ad+ZnPc+CD-2NH_2 (20μg mL^{-1}) in the dark. Row 3: cells treated with MSNP(FITC)-Ad+ZnPc+CD-2NH_2 (20μg mL^{-1}) followed by 675 nm light irradiation for 20min. From left to right: bright field channel, DAPI channel, annexin V channel, and propidium iodide channel, respectively.

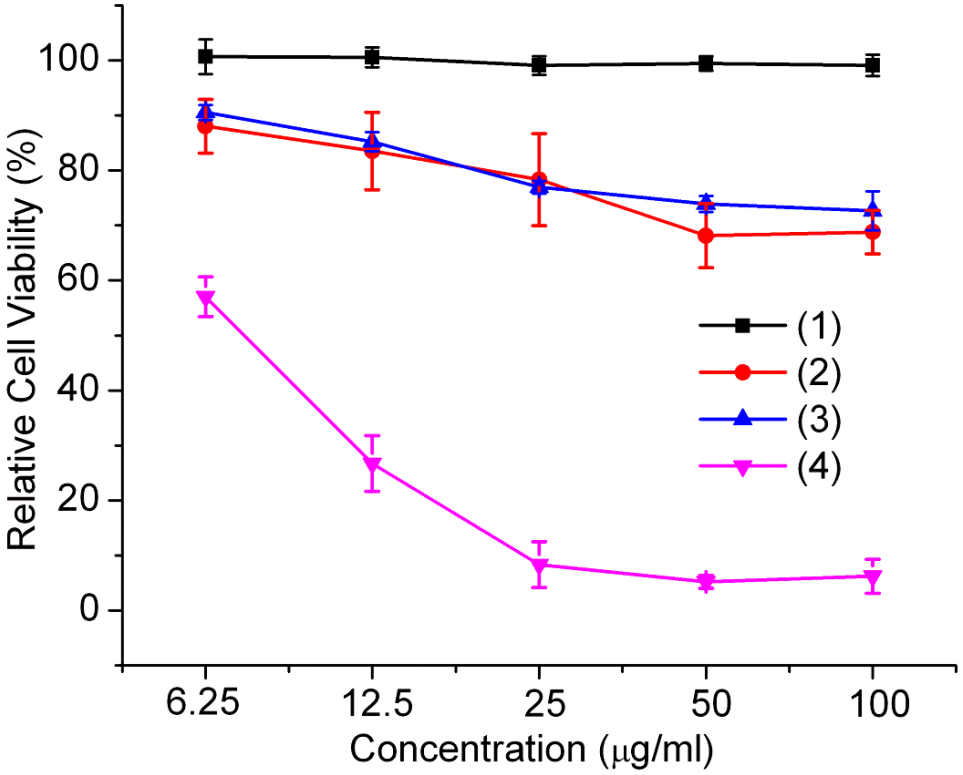

Figure S14. MTT viability assay of HeLa cells treated with (1) H_2O+DMSO (9:1), (2) H_2O+DMSO (9:1) mixture solution containing ZnPc kept in the dark, (3) H_2O+DMSO (9:1) mixture solution containing ZnPc under 675nm light irradiation for 30min, and (4) MSNP-Ad+ZnPc+CD-2NH_2 under 675nm light irradiation for 30min. The concentrations used refer to the amount of MSNP-Ad. For (2) and (3), equivalent amount of ZnPc was used when compared to (4). For (1), equivalent amount of H_2O+DMSO (9:1) mixture solution was used when compared to others. For photodynamic cytotoxicity determined by MTT assay, the same procedure was employed.

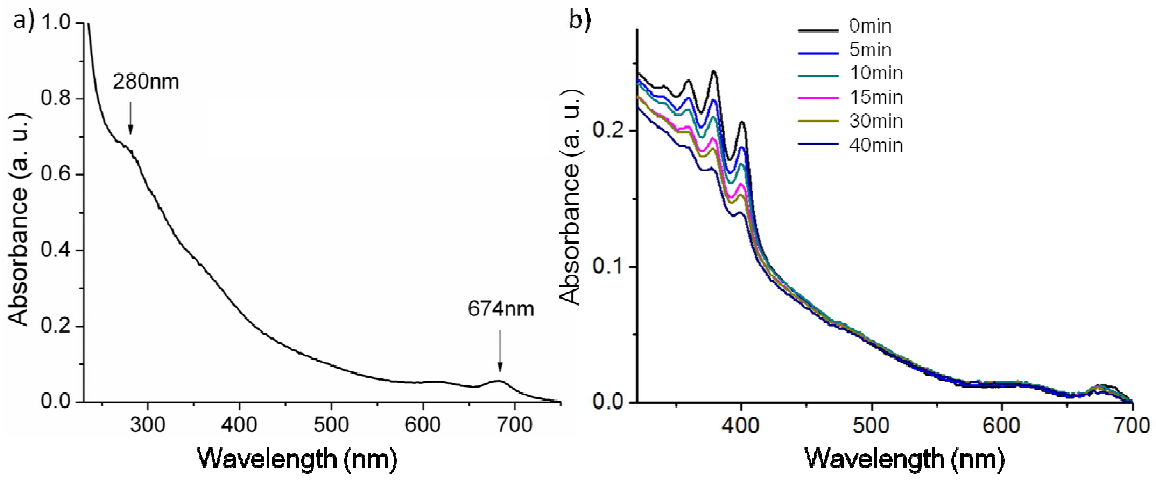

Figure S15. UV-vis spectra of a) MSNP-Ad+ZnPc+CD-FA, and b) ADMA mixed with MSNP-Ad+ZnPc+CD-FA upon 675 nm light irradiation for 40 min.

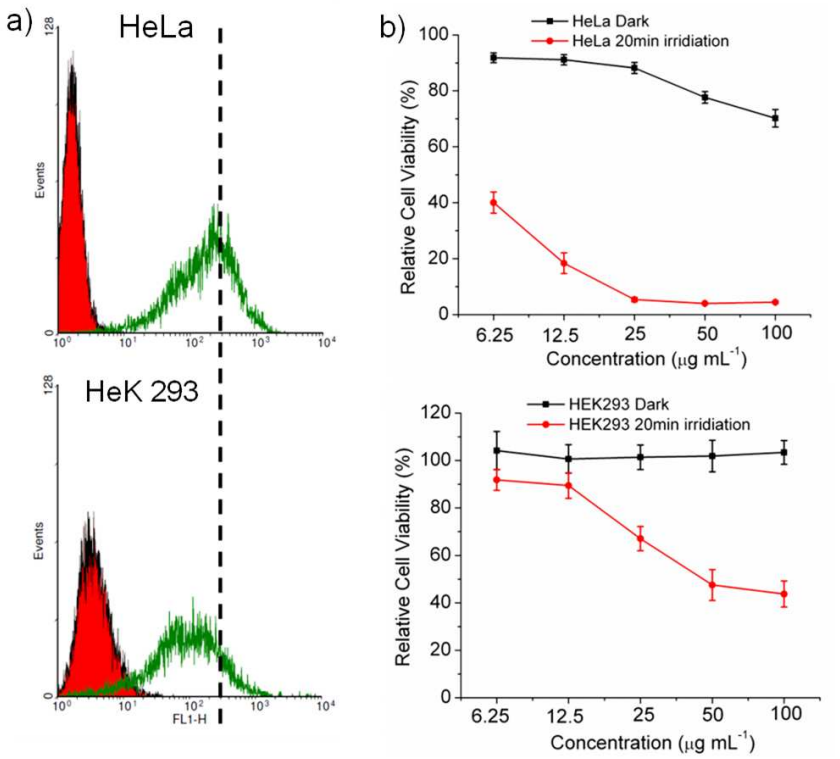

Figure S16. a) Flow cytometry analysis of HeLa (up) and HEK293 (bottom) cells without any treatment (red) or treated with MSNP(FITC)-Ad+ZnPc+CD-FA (20μg mL^{-1}) for 24h (green); b) MTT cytotoxicity assay of HeLa (up) and HEK293 (bottom) cells treated with MSNP-Ad+ZnPc+CD-FA followed by 675nm light irradiation for 20min.