Electronic Supplementary Information

An efficient photothermal-chemotherapy platform based on polyacrylamide/phytic acid/polydopamine hydrogel

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1 Additional experimental section

1.1 Synthesis of the PAAM/PA/PDA hydrogel

The PAAM/PA/PDA conductive hybrid hydrogel was prepared according to the literature.[S1] In brief, 667 μL AAM (6.0 mol L^{-1}), 250 μL PA (pH 7.5, 0.54 mol L^{-1}), 250 μL MBA (0.02 mol L^{-1}, chemical cross-linker) and 250 μL water were mixed with agitating. After de-aired by Ar gas for 10 min, 410 μL DA (0.17 mol L^{-1}) was added to the mixture and ultrasonicated for 5 min. Subsequently, 85.2 mg potassium peroxodisulfate (KPS, initiator) was added to the mixture. After ultrasonicated for 15 min, 0.3 μL TEMED (accelerator) was added, and then the mixture were immediately injected into a mode with a thickness of 0.8 mm for further experiments.

1.2 MTT assay

The effects of PAAM/PA/PDA hydrogel with or without 808 nm NIR laser irradiation on cell viability were first studied. DMEM supplemented with 10% (v/v) FBS and 100 U mL^{-1} penicillin/streptomycin was used for culturing C6 cells while L-15 supplemented with 10% (v/v) FBS and 100 U mL^{-1} penicillin/streptomycin was employed for culturing SW620 cells. The cells were propagated in fresh culture medium using a fully humidified incubator containing 5% CO_2 at 37 °C. The SW620 and C6 cells (1×10^4 cells per well) were seeded in the PAAM/PA/PDA disk coated 96-well plates and cultured for 24 h as previously described. Then, the cells with or without 808 nm NIR laser irradiation were washed with PBS (100 μL, three times), and treated with MTT (10 μL, 5 mg mL^{-1}) for 4 h. Subsequently, the supernatant was

discharged, and purple formazan product was dissolved by DMSO (100 μL per well) with gentle shaking for 10 min. Finally, the solution of each well was collect to a new 96-well plates and the absorbance was read on a Power Wave XS 2 Microplate Spectrophotometer at 490 nm. The relative cell viabilities (%) were calculated by using the optical densities with respect to the control value. The cells cultured in blank 96-well plates were used as control samples.

Moreover, the effects of PAAM/PA/PDA-DOX with or without 808 nm NIR laser irradiation on cell viability were also studied by MTT assay. The 1×10^4 cells were dispersed in 100 μL culture medium and cultured in PAAM/PA/PDA-DOX coated 96-well plates with or without 808 nm NIR laser irradiation as previously described. Subsequently, the cells were collected by centrifugation (1000 rpm for 5 min), and cultured in blank 96-well plates for 24 h as previously described. The viabilities of cells were measured as previously described.

1.3 Hemolysis Assay

The fresh sodium heparin stabilized human whole blood was obtained from the First Hospital of Jilin University. Blood sample (1 mL) was diluted with PBS (2 mL, pH 7.4). The blood solution was centrifuged at 8000 rpm for 10 min (five times), and the supernatant was discharged. Then, the purified red blood cells (RBCs) were resuspended in PBS (10 mL). Subsequently, the resultant suspension (200 μL) was mixed with PBS (800 μL) containing various amounts of PAAM/PA/PDA hydrogel ranging from 0-864 mg under gently shaking and kept at room temperature for 12 h.

The resultant suspension (200 μL) mixed with PBS (800 μL) and H_2O (800 μL) were served as negative control and positive control, respectively. Finally, the specimens were centrifuged under 12000 rpm for 5 min, the absorbance values of supernatants at 541 nm were determined. The hemolysis percentage of RBCs was calculated based on the following formula: Hemolysis percentage = [(sample absorbance – negative control absorbance)/(positive control absorbance – negative control absorbance)] × 100%.

2 Additional Figures and Tables

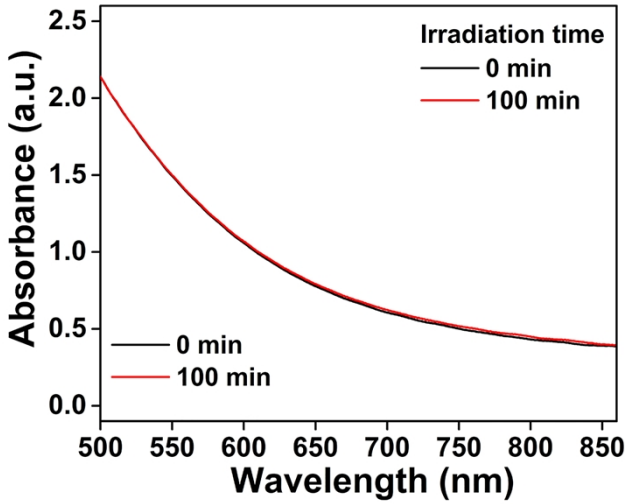

Fig. S1 UV-visible spectra of PAAM/PA/PDA hydrogel before (black line) and after (red line) irradiated by 808 nm NIR laser (1.0 W cm^{-2}) for 100 min, respectively.

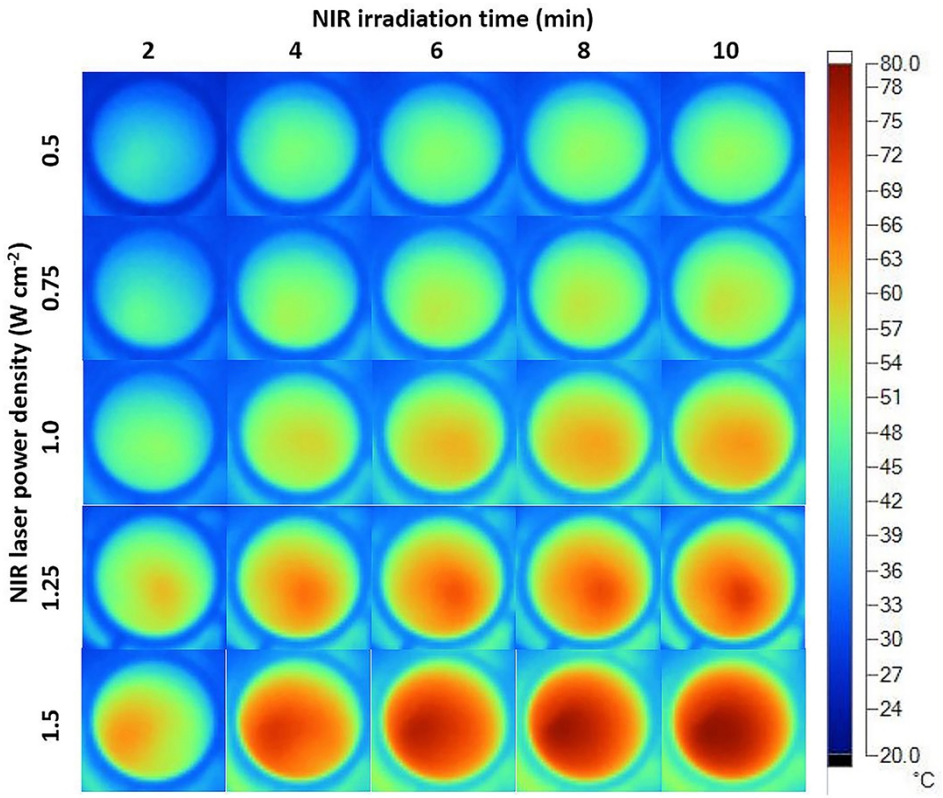

Fig. S2 Infrared thermal images of 45 mg PAAM/PA/PDA hydrogel in 100 μL PBS under irradiation of 808 nm NIR laser with various power intensities (0.5, 0.75, 1.0, 1.25 and 1.5 W cm^{-2}) over a period of 10 min. The temperature is measured by a Fluke Ti9 thermal imager.

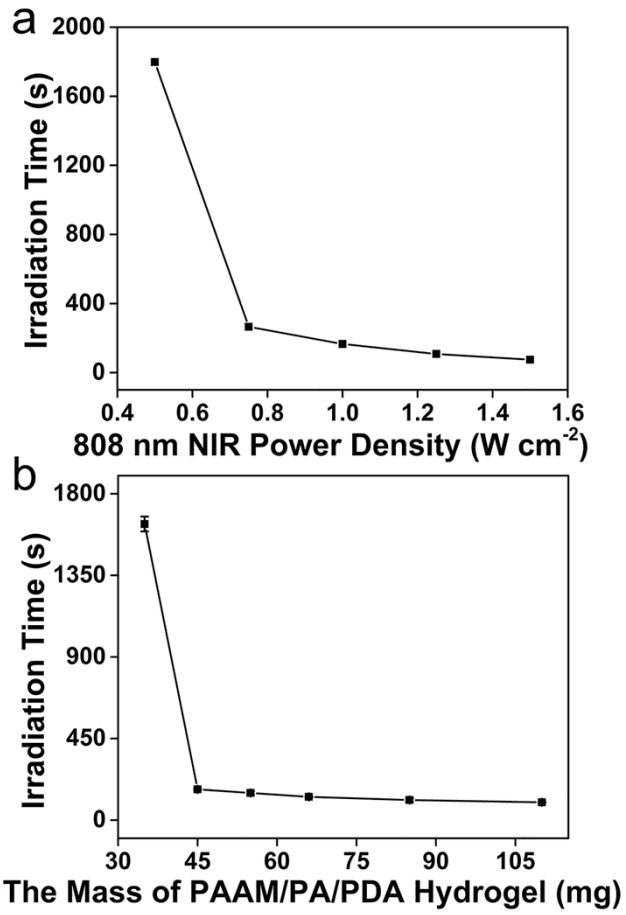

Fig. S3 Effects of (a) the power density of 808 nm NIR laser and (b) the mass of PAAM/PA/PDA hydrogel on the photothermal conversion capability of PAAM/PA/PDA hydrogel. The irradiation time refers to the time required to reach eventual steady state temperature of the mixture. Error bars mean standard deviations (n = 3).

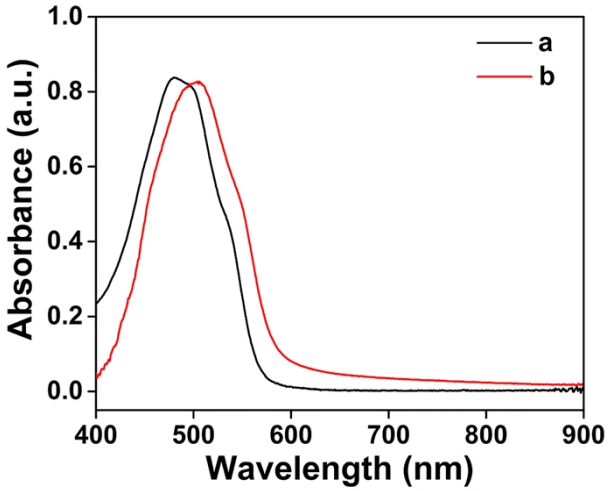

Fig. S4 Absorption spectra of (a) 0.1 mg mL^{-1} DOX in PBS and (b) PAAM/PA/PDA-DOX (loading capacity 170 mg g^{-1}) deducting the PAAM/PA/PDA hydrogel background.

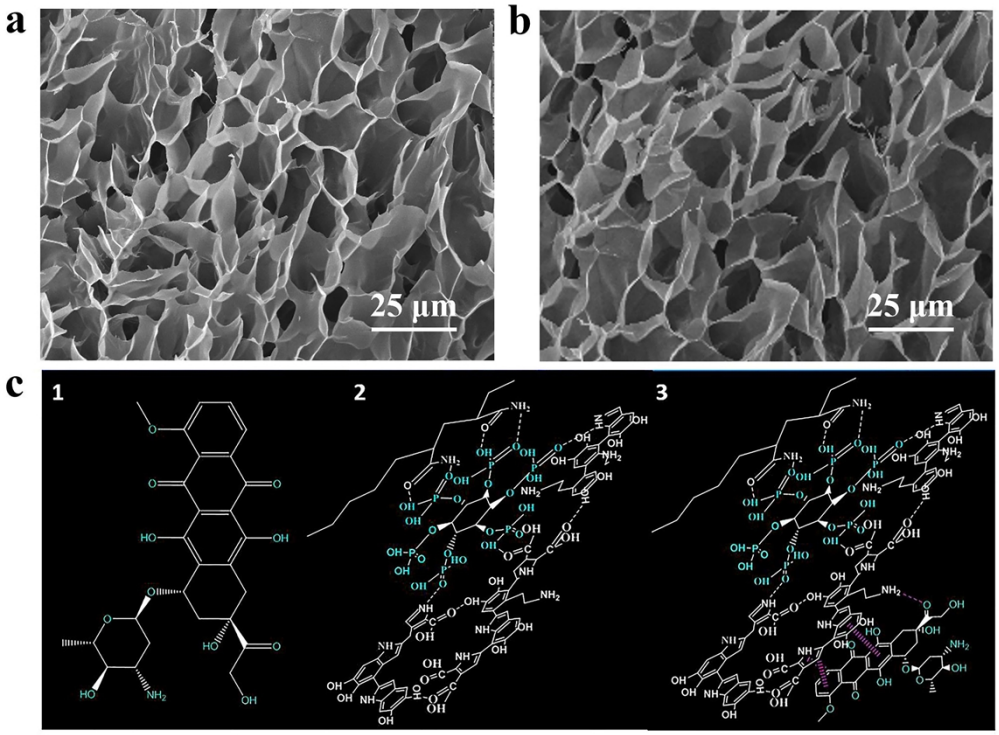

Fig. S5 The SEM of (a) PAAM/PA/PDA hydrogels and (b) PAAM/PA/PDA-DOX, (c) the molecular structures of (1) DOX, (2) PAAM/PA/PDA hydrogels and (3) PAAM/PA/PDA-DOX,.

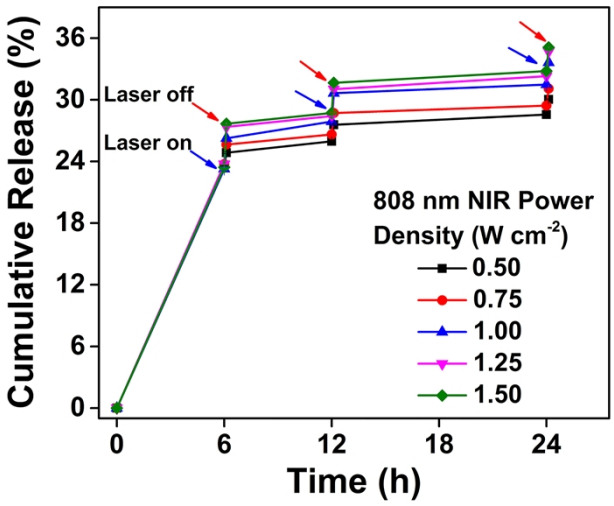

Fig. S6 The effect of the power density of 808 nm NIR laser at different time points on the releasing rate of DOX from PAAM/PA/PDA-DOX in PBS (pH 5.0). Error bars mean standard deviations (n = 3).

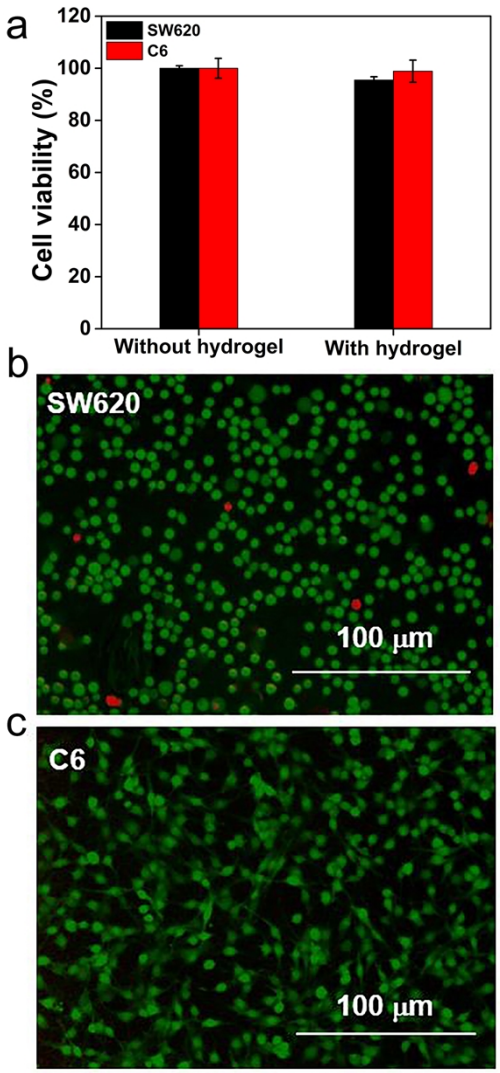

Fig. S7 (a) In vitro cell viabilities of SW620 and C6 cells cultured in the 96-well plates coated with or without PAAM/PA/PDA hydrogel for 24 h. Error bars mean standard deviations (n = 3). The corresponding microscopic images of (b) SW620 cells and (c) C6 cells cultured in 96-well plates coated with PAAM/PA/PDA hydrogel for 24 h. The cells were co-stained by Calcein AM/PI. Living cells are indicated as green and dead cells are indicated as red.

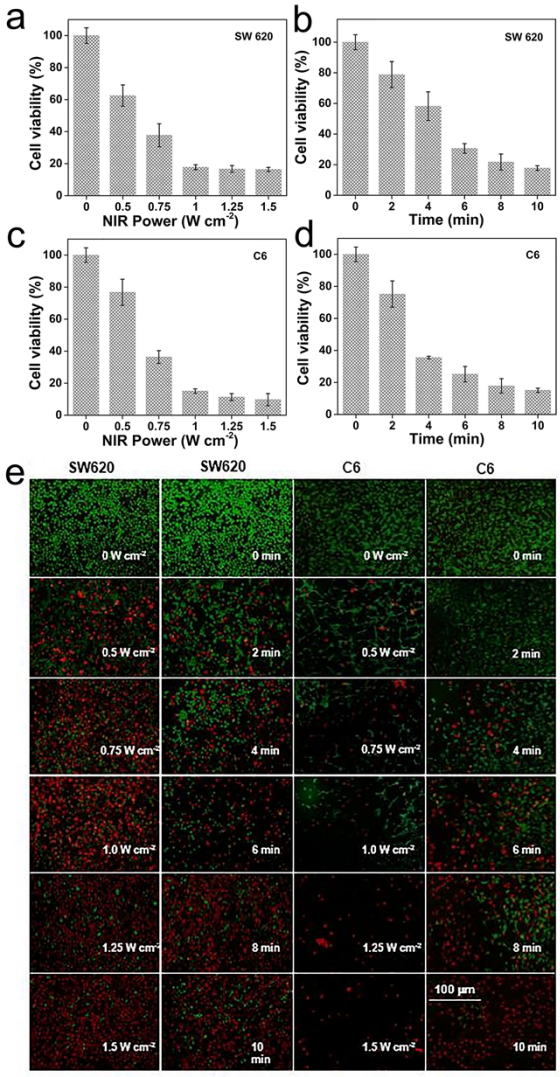

Fig. S8 The cell viabilities of SW620 and C6 cells after irradiated by 808 nm NIR laser with (a, c) different laser power densities (0, 0.5, 0.75, 1.0, 1.25 and 1.5 W cm^{-2}) for 10 min and (b, d) different irradiation time (0, 2, 4, 6, 8 and 10 min) with power intensity 1.0 W cm^{-2}, respectively. Error bars mean standard deviations (n = 3). (e) The corresponding fluorescence microscopic images of SW620 and C6 cells. The cells were co-stained by Calcein AM/PI. Living cells are indicated as green and dead cells are indicated as red.

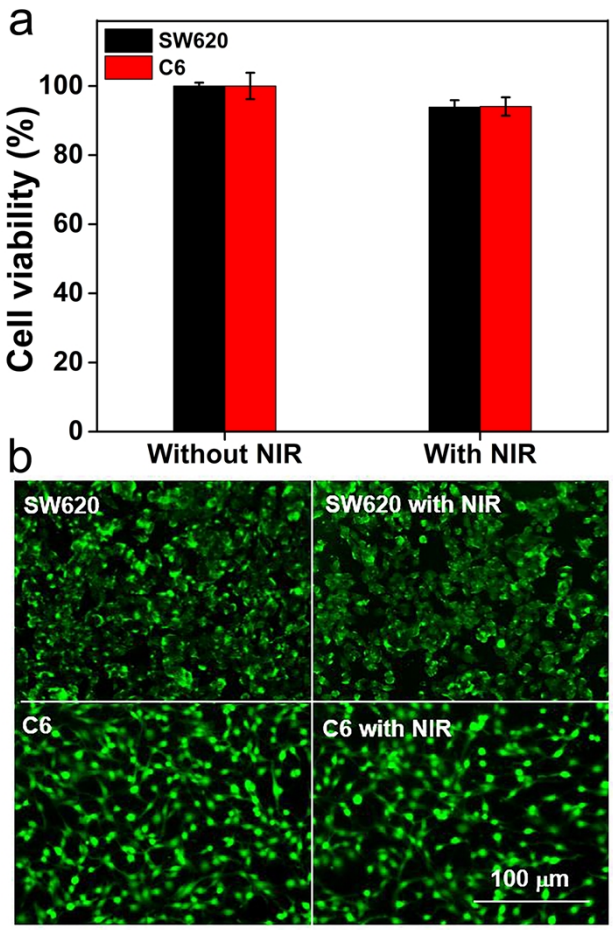

Fig. S9 (a) In vitro cell viabilities and (b) the corresponding fluorescence microscopic images of SW620 and C6 cells cultured in the blank 96-well plates for 24 h with or without 808 nm NIR laser irradiation (1.0 W cm^{-2} and 10 min). Error bars mean standard deviations (n = 3). The cells were co-stained by Calcein AM/PI. Living cells are indicated as green and dead cells are indicated as red.

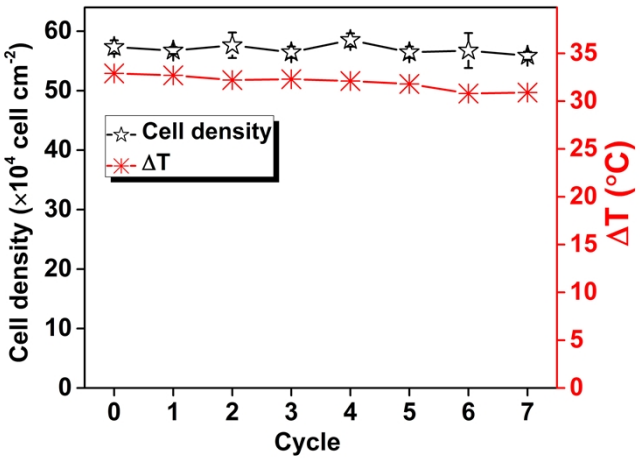

Fig. S10 The cell densities of C6 cells cultured on PAAM/PA/PDA hydrogel surface and the changes of PAAM/PA/PDA hydrogel temperature after irradiated by 808 nm NIR laser (0.75 W cm^{-2} and 6 min). The PAAM/PA/PDA hydrogel was washed and reused for culturing C6 cells after 808 nm NIR irradiation. 0 means control experiment. Error bars mean standard deviations (n = 3).

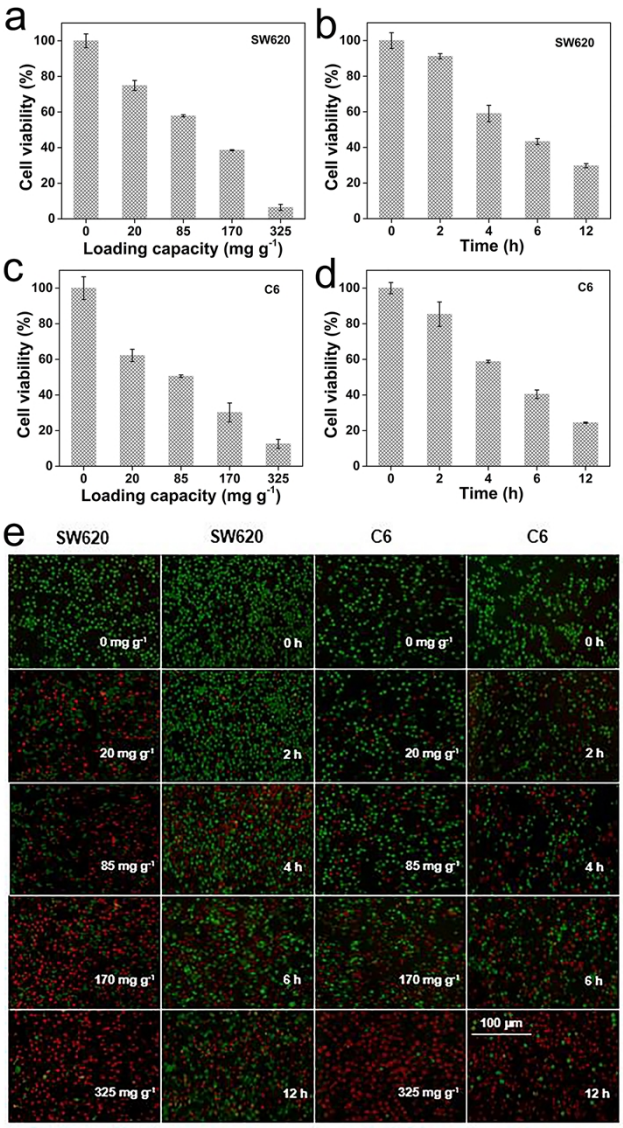

Fig. S11 In vitro cell viabilities of SW620 and C6 cells cultured on the PAAM/PA/PDA hydrogel surface with (a, c) different DOX loading capacities (0, 20, 85, 170, 325 mg g^{-1}) for 6 h, and (b, d) for different times (0, 2, 4, 6 and 12 h) with 85 mg g^{-1} DOX loading capacity, respectively. Error bars mean standard deviations (n = 3). (e) The corresponding fluorescence microscopy images of SW620 and C6 cells. The cells were co-stained by Calcein AM/PI. Living cells are indicated as green and dead cells are indicated as red.

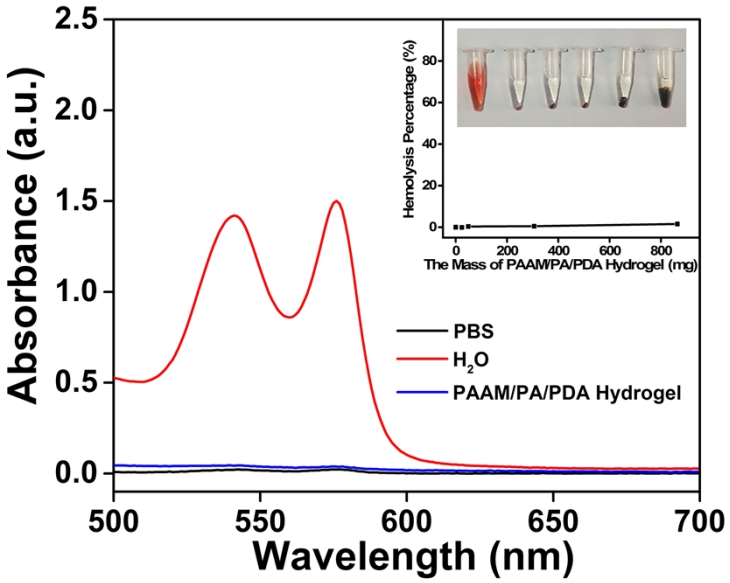

Fig. S12 UV-visible spectra of the blood sample supernatants including plasma and lysed erythrocytes, treated by PBS, H_2O and PAAM/PA/PDA hydrogel, respectively. Inset, the hemolysis percentage as a function of the mass of PAAM/PA/PDA hydrogel.

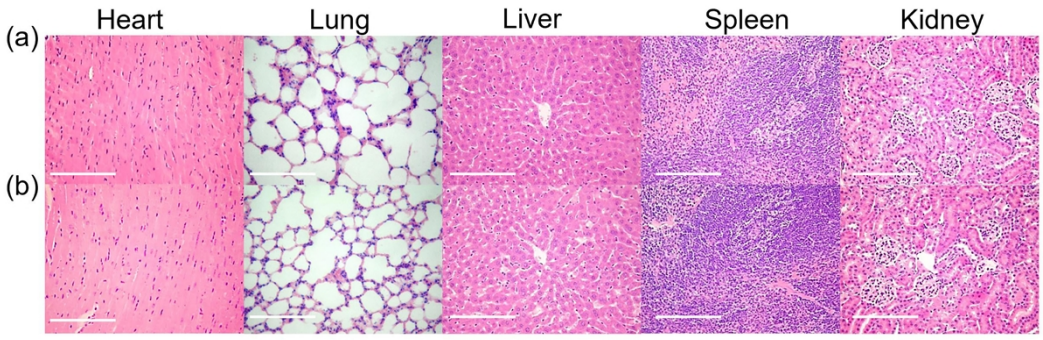

Fig. S13 Histological changes (H&E staining) of (a) healthy mouse without injection of PAAM/PA/PDA hydrogel and (b) the mouse after 21 days post-injection of PAAM/PA/PDA hydrogel, respectively. All of scale bars are 100 μm.

Table S1 Hematology analysis of healthy mice treated with or without PAAM/PA/PDA hydrogel.

Hematological	Units	Control	Treatment
WBC	$\times 10^9$/L	13.9	13.5
RBC	$\times 10^{12}$/L	9.48	8.74
HGB	g/L	142.00	132.00
MCV	fL	46.60	48.10
MCH	pg	15.00	15.10
MCHC	g/L	321.00	314.00
PLT	$\times 10^9$/L	1264.00	1046.00
PDW	fL	9.32	10.50

3 Additional Reference

S1. Zhao Z, Chen H, Zhang H, et al. *Biosens. Bioelectron.*, 2017, 91, 306-312.