Electronic Supplementary Material (ESI) for Nanoscale.

Supporting information

NIR absorbing Prussian Blue Nanoparticles for transarterial infusion photothermal therapy of VX2 tumor implanted in rabbit

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Calculation of Photothermal Conversion Efficiency

The photothermal conversion efficiency for PB NPs was calculated by measuring the temperature change of PB NPs aqueous dispersion as a function of time under the continuous irradiation of 808 nm laser (2.0 W/cm^2) for 600 s (t) till the temperature of solution reached a steady-state case. The photothermal conversion efficiency (η) was calculated by Equation. (1),

$$\eta = [hA(T_{max} - T_{surr}) - Q_{Dis}]/[I(1 - 10^{-A_\lambda})] \quad (1)$$

where h is the heat transfer coefficient, A the area of the container, T_{max} the maximum steady-state temperature (80.5 °C), T_{Surr} the ambient temperature of the environment (30.0°C), Q_{Dis} represents the heat dissipation from the light absorbed by the solvent and the sample cell, I is the incident laser power (2.0W/cm^2), and A_λ is the absorbance of the sample at 808 nm (0.51196). The value of hA was calculated by Equation. (2),

$$hA = m_D c_D/\tau_s \quad (2)$$

whereτs is the time constant for the heat transfer in the system, which was accessed based on the measurements in Figure S (τs = 316 s); and m_D and c_D is the mass (1 g) and heat capacity (4.2 J/g) of the DI water used to disperse PTM NPs, respectively. The photothermal conversion efficiency of PB NPs was calculated to be 47.01%.

Cell Culture

PB NPs were diluted with culture medium to prepare a working solution for cellular experiments. HepG2 cells were cultured in 1640 culture medium with 10% fetal bovine serum and 1% penicillin–streptomycin in 5% CO_2 incubator at 37 °C.

In vitro Cytotoxicity Assay

HepG2 cells were seeded into 96-well plates at a density of 1×10^4 cells/well and maintained in 1640 supplemented with 10% FBS and 1% penicillin-streptomycin at 37 °C in a humidified atmosphere containing 5 % CO_2. After overnight incubation, the cell culture medium was replaced with 100 μL of fresh culture medium different concentrations of PB NPs and incubated for other 24 h. The viability of cells was measured by the CCK-8 assay. The absorbance at 450 nm was recorded on a microplate reader (BioTek Synergy HT, USA). All experiments were conducted in triplicate and presented as mean ± SD compared to the OD values of untreated cells.

In vitro Photothermal Ablation

HepG2 cells (1×10^4 cells/well) were seeded on 96-well plates and incubated overnight at 37 °C container. The cells were incubated with PB NPs for 4 h at 37 °C, and then irradiated with the 808 nm laser (1.5 W/cm^2) for 8 min. After irradiation, the treated cells were incubated for another 3 h and rinsed with PBS for further cytotoxicity assay. The standard CCK-8 assay was employed to determine the relative viabilities of treated cells. To further confirm the photothermal effect, after various treatment, HepG2 cells were incubated with a mixture of calcein AM (calcein acetoxymethyl ester) and PI (propidium iodide) for further live/dead cell double staining. After rinsed by PBS, the cell samples were observed with a fluorescence microscopy (FV1200-IX83, Olympus, Japan) and FACS Calibur flow cytometer using 488 nm laser for Annexin V-FITC and 561 nm laser for PI excitation.

Follow Up

The examination of leukocyte (WBC), hemoglobin (HGB), platelet (PLT), creatinine (Cr), glutamic-pyruvic transaminase (ALT), glutamic-oxaloacetic transaminase (AST) had been done before and 7 days after treatment.

Ultrasound Imaging

Ultrasound images (M7, Mindray, Shenzhen, China) were captured at 0 day, 1 day, 3 day, 7 day after treatment.

Histological Examination

Rabbit was intravenously injected with 50 mL of PB NPs (5.0 mg/mL in 1× PBS), and major organs including kidney, lung, spleen, liver, and heart were collected and stained with hematoxylin and eosin (H&E) after seven days administration. The images were taken by an upright microscope (Olympus BX43) with a 100× oil objective (UPlanSApo, NA: 1.40).

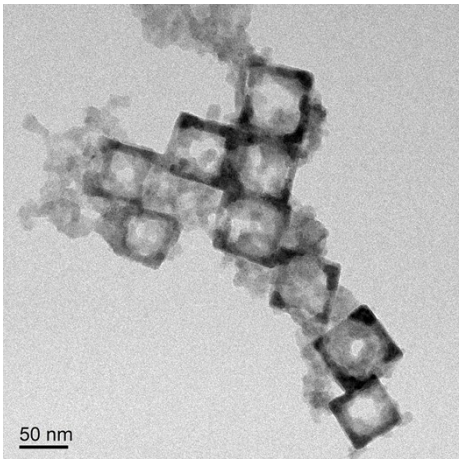

Fig S1 TEM of PB NPs.

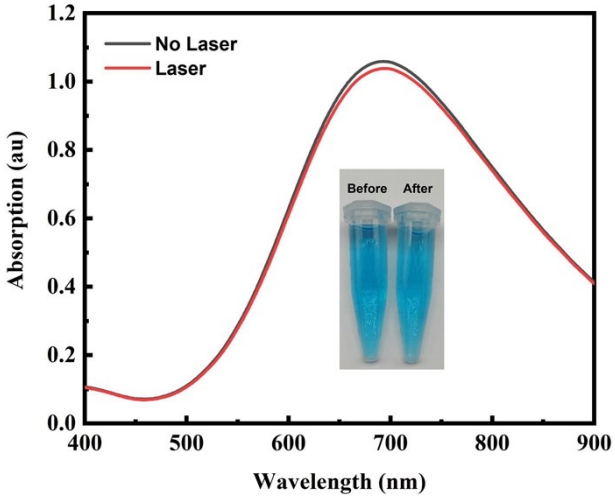

Fig. S2 The UV spectrum of PB NPs after 808nm laser irradiation for 10min

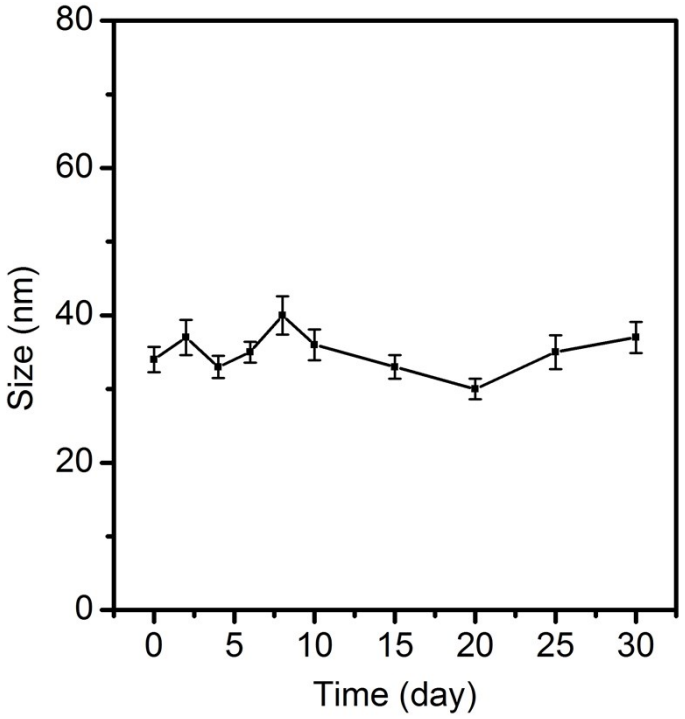

Fig. S3 Changes of hydrodynamic diameters of PB NPs in PBS.

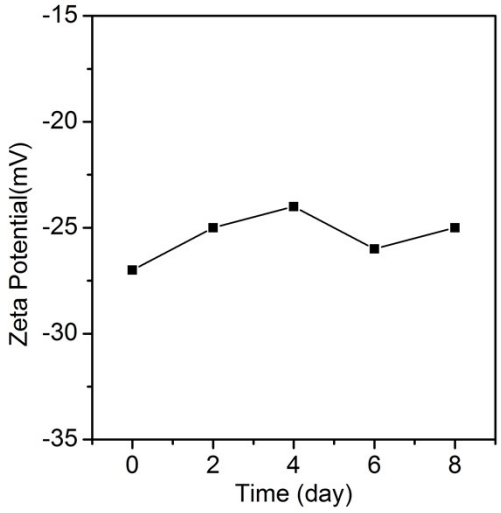

Fig. S4 Changes of Zeta Potential of PB NPs in PBS.

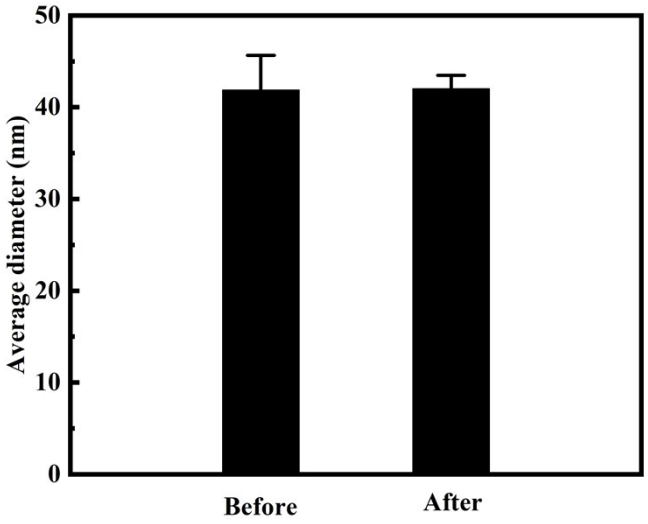

Fig S5 The DLS of NPs after NIR irradiation (808nm, 2.0W/cm^2, 10min).

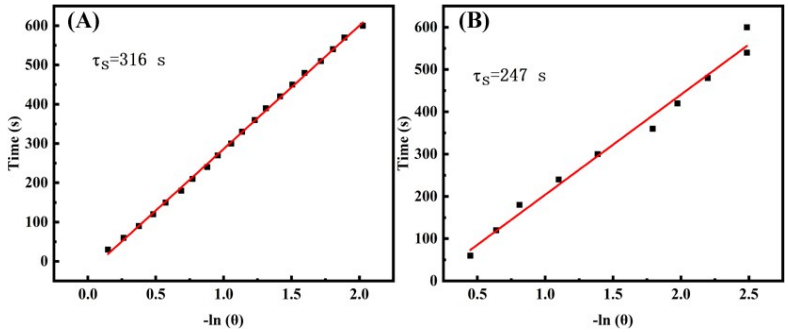

Fig. S6 the time constant for the heat transfer (A) PB NPs. (B) DI water.

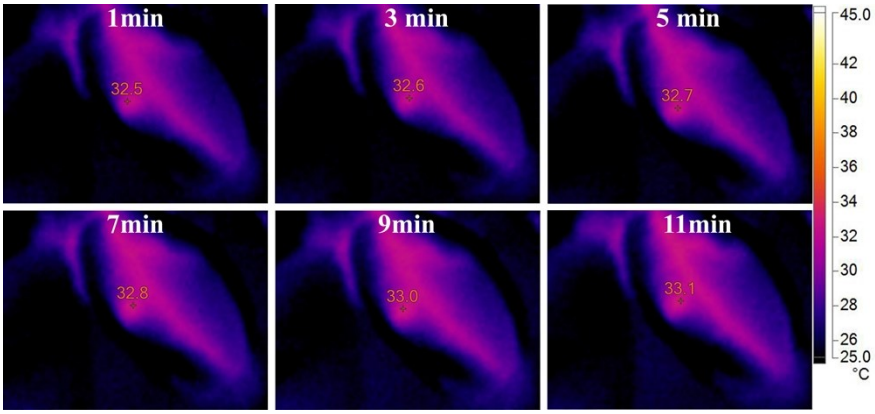

Fig. S7 Infrared thermal images of the tumor-bearing rabbit transarterial infusion of PBS before and after NIR laser light irradiation (1.5 W/cm^2, 11 min).

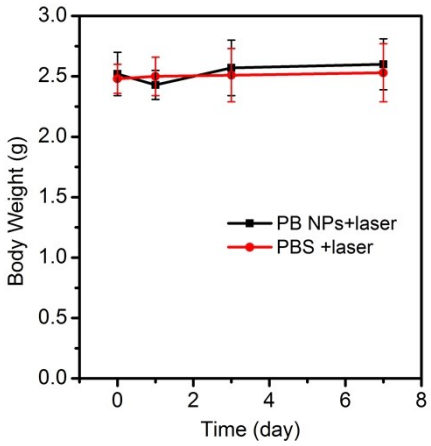

Fig. S8 Body weight of Rabbit after different treatment

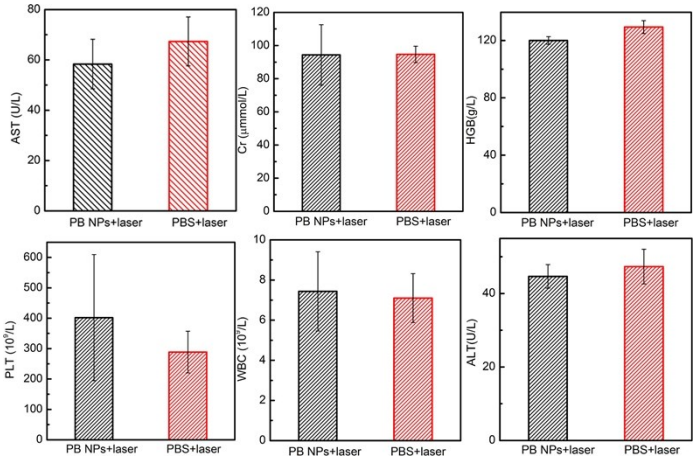

Fig. S9 The influence of PB NPs on hematopoietic system of rabbit.

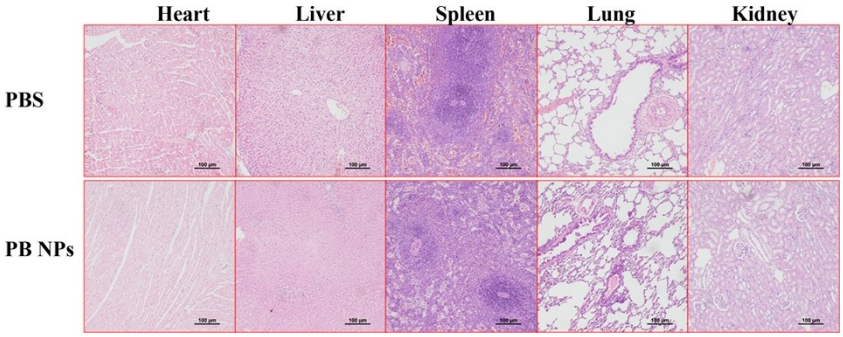

Fig. S10 H&E staining images of major organs in the rabbit.