Electronic Supplementary Information

Construction of mPt/ICG-αA nanoparticles with enhanced phototherapeutic activities for multidrug-resistant bacteria eradication and wound healing

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Experiment Section

Characterization

Utilizing an FEI Tecnai G2 S-Twin with a field emission gun operating at 200 kV, TEM images were captured. A D8 Focus diffractometer (Bruker) was used to test the X-ray diffraction (XRD) patterns. The UV-vis spectrophotometer UH5300 was used to test the UV-vis absorption spectra. A FLIR T420 thermal camera captured the photos in the thermal range. The cell viability was tested with a Microplate reader (Bio Tek-Elx800). The zeta potential was measured using a Zetasizer (NZS, Zetasizer Nano ZS). The fluorescence images were pictured through an inverted fluorescence microscope (MF53-N, China). The oxygen concentration was measured by a portable oxygen dissolver (JPB-607A).

Bacterial culture

The monoclonal bacteria (*E. coli*, ATCC25922), Staphylococcus aureus (*S. aureus*, ATCC2923) on the Luria–Bertani (LB) solid medium was transferred to a 5 mL LB liquid medium and cultured at 37 ℃ at 200 rpm for 8 h to reach the logarithmic growth period.

In vitro cytotoxicity

L929 cells purchased from Procell were seeded in DMEM medium supplemented with 10% FBS, penicillin (100 units mL^{-1}), and streptomycin (100 μg mL^{-1}) in 5% CO_2 at 37 °C. In 96-well plates, L929 cells were seeded and incubated overnight. Then, the culture medium was replaced with fresh medium containing mPIA and incubated for 24 h. MTT solution (10 μL) was applied to each well and incubated at 37 °C for 4 h. Finally, DMSO (0.2 mL) was added to each well, and the absorbance at 450 nm was determined using a microplate reader.

Calculation of the photothermal conversion efficiency

The photothermal conversion efficiency was calculated by Eq. (1):

$$\eta = \frac{hS\left(T_{max,NP} - T_{surr}\right) - Q_{dis}}{I\left(1 - 10^{-A_{808}}\right)} \quad (1)$$

where h is the heat transfer coefficient, S is the surface area of the vessel, T_{max} is the maximum temperature of the solution, T_{surr} is the ambient temperature, Q_{dis} is the heat generated by the absorption of light by water, I is the laser power density, A_{808} is the absorption value of the materials at 808 nm. hS can be calculated by Eq. (2) and (3):

$$Q_{dis} = hS(T_{max,H_2O} - T_{surr}) \quad (2)$$

$$\tau_s = \frac{m_D C_D}{hS} \quad (3)$$

where m_D is the mass of H_2O and C_D is the heat capacity of H_2O, τ_s is the fitted time constant, calculated by Eq. (4) and (5):

$$t = -\tau_s ln\theta \quad (4)$$

$$\theta = \frac{T_{surr} - T}{T_{surr} - T_{max}} \quad (5)$$

where t is the cooling time, T is the temperature at cooling t_s, and θ is a dimensionless dynamic temperature introduced to calculate τ_s.

Statistical Analysis

Experiments were performed at least three times and results were expressed as means ± SD. Statistical significances were analyzed using the student's t-test and one-way analysis of variance (*$p < 0.05$, **$p < 0.01$, ***$p < 0.001$).

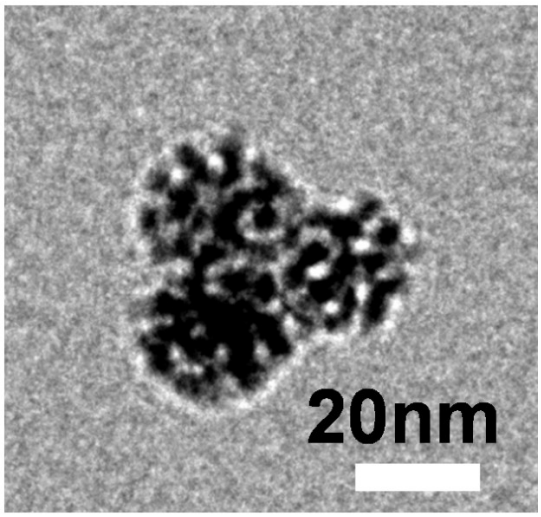

Fig. S1 TEM image of mPt

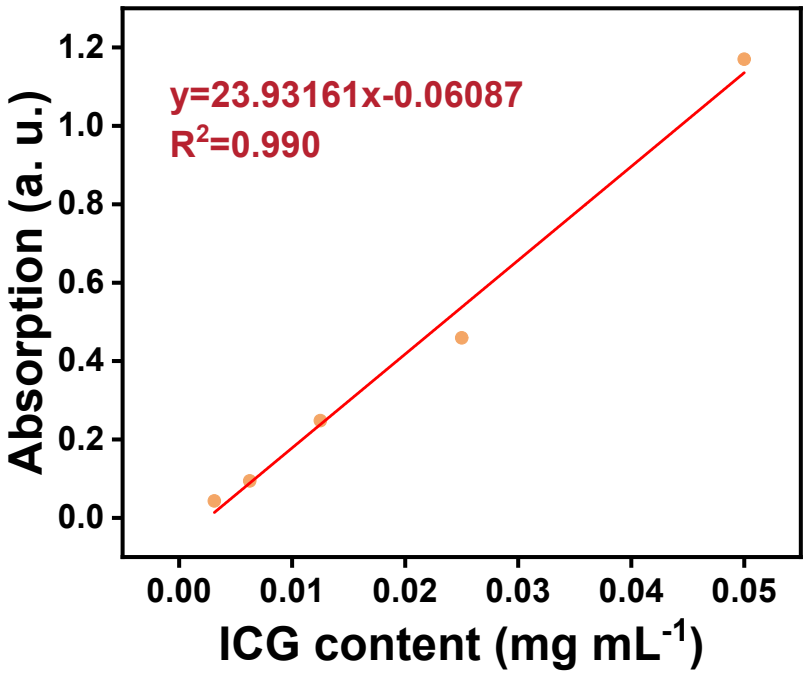

Fig. S2 The standard curve of ICG.

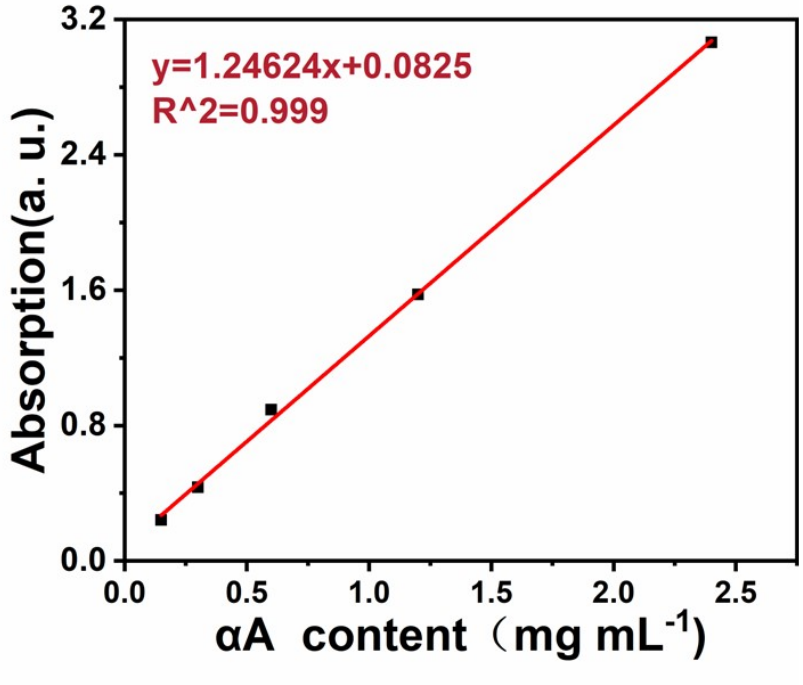

Fig. S3 The standard curve of Bradford protein assay kit for calculating the encapsulation rate of αA.

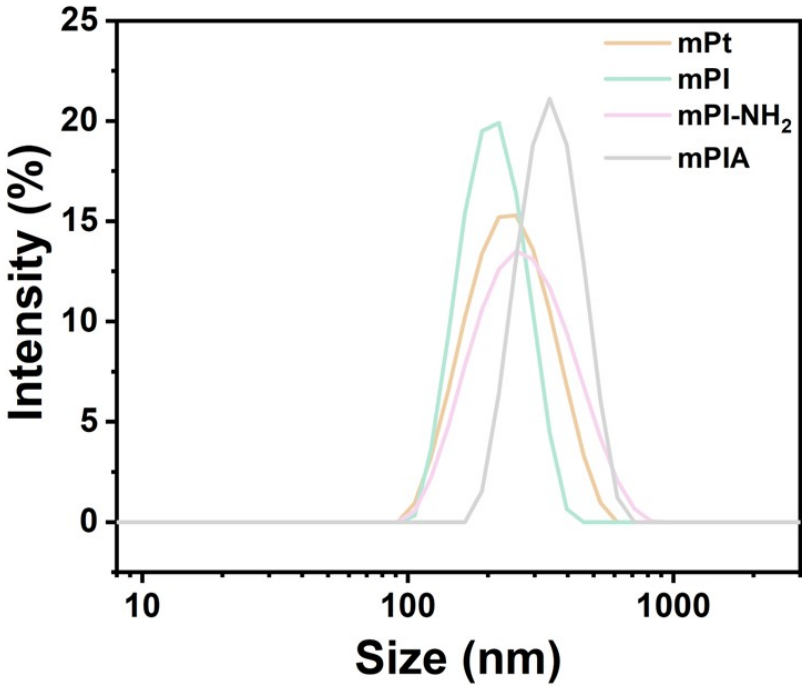

Fig. S4 The DLS data of mPt NPs, mPI NPs, mPI-NH_2, and mPIA NPs.

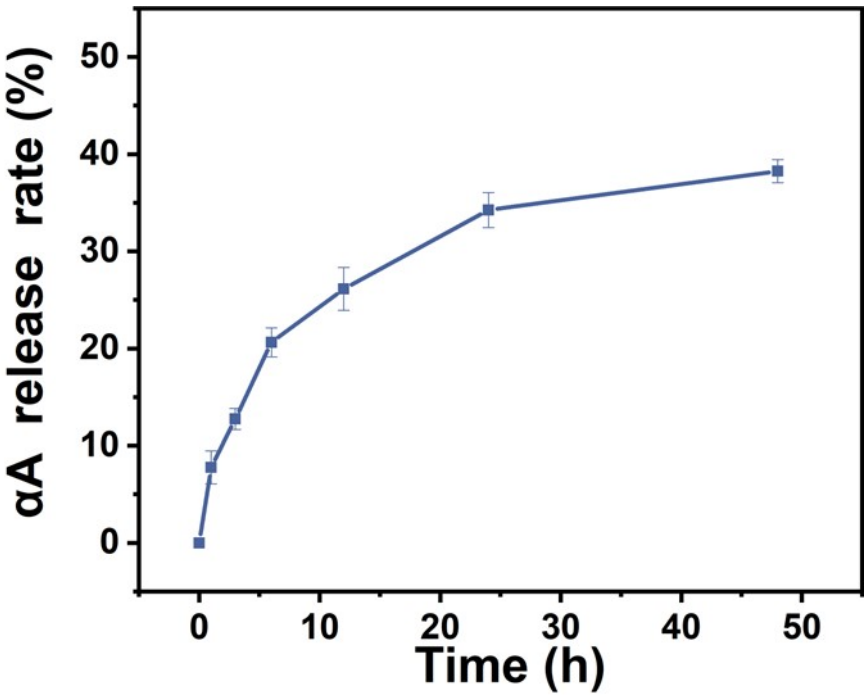

Fig. S5 The release rate of α-amylase.

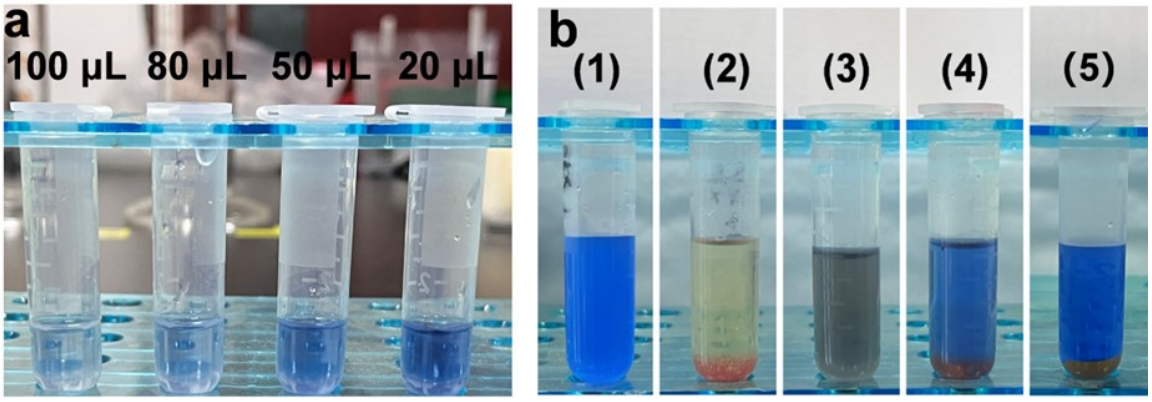

Fig. S6 (a) Iodine solution combined with starch solution with different amounts of α-amylase. (b) Starch solution with Fehling's reagent (1) Fehling's reagent and α-amylase (2) mPIA (3) Fehling's reagent, α-amylase and mPIA (4) Fehling's reagent and mPIA two days after release (5)

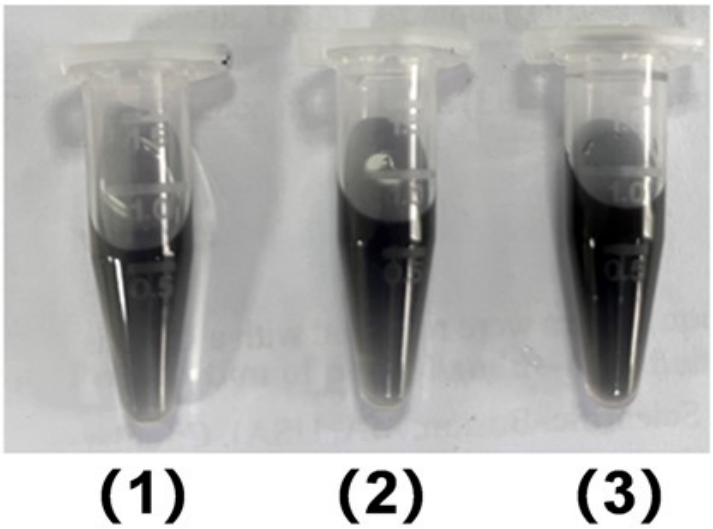

Fig. S7 The photograph of mPIA dispersed in H_2O(1), PBS(2) Luria-Bertani (LB) medium (3).

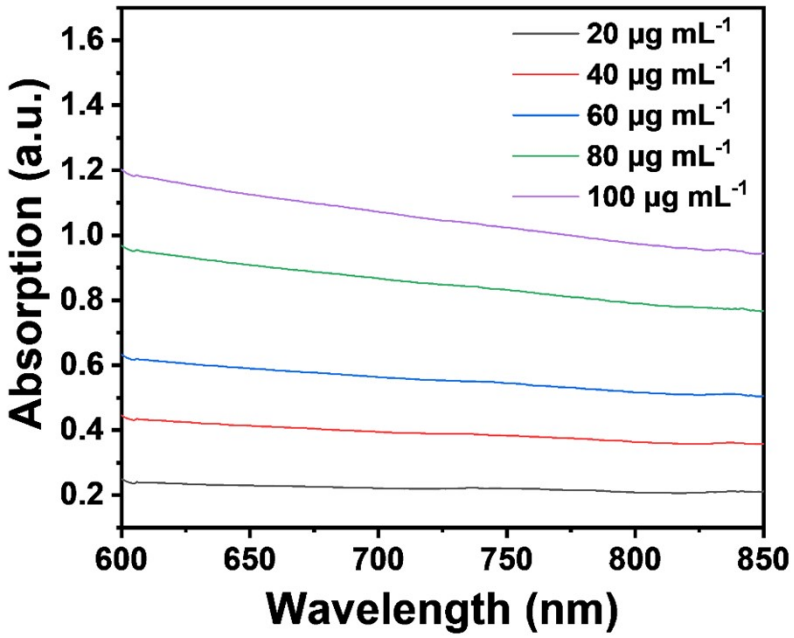

Fig. S8 Absorbance spectra of mPIA NPs solution with different concentrations.

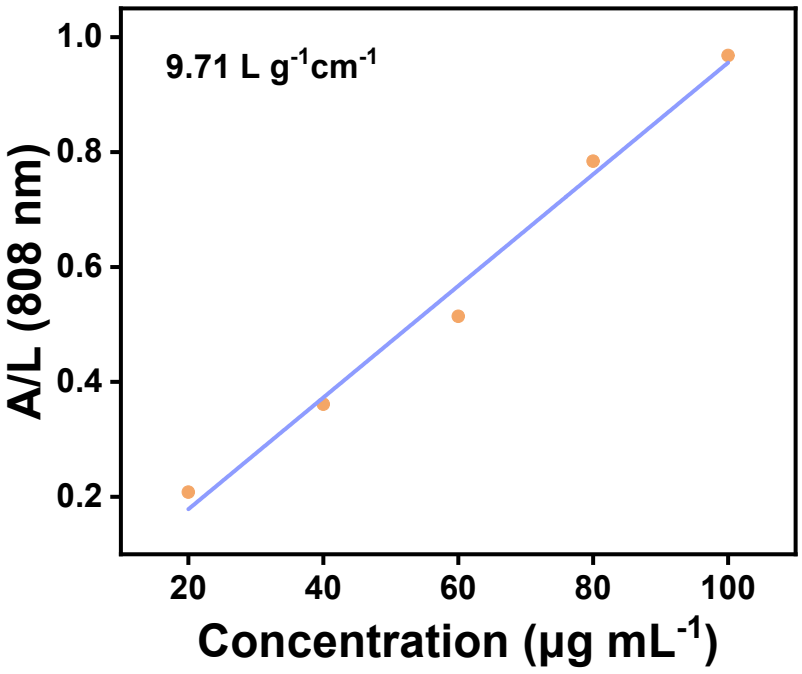

Fig. S9 The mass extinction coefficient of mPIA NPs.

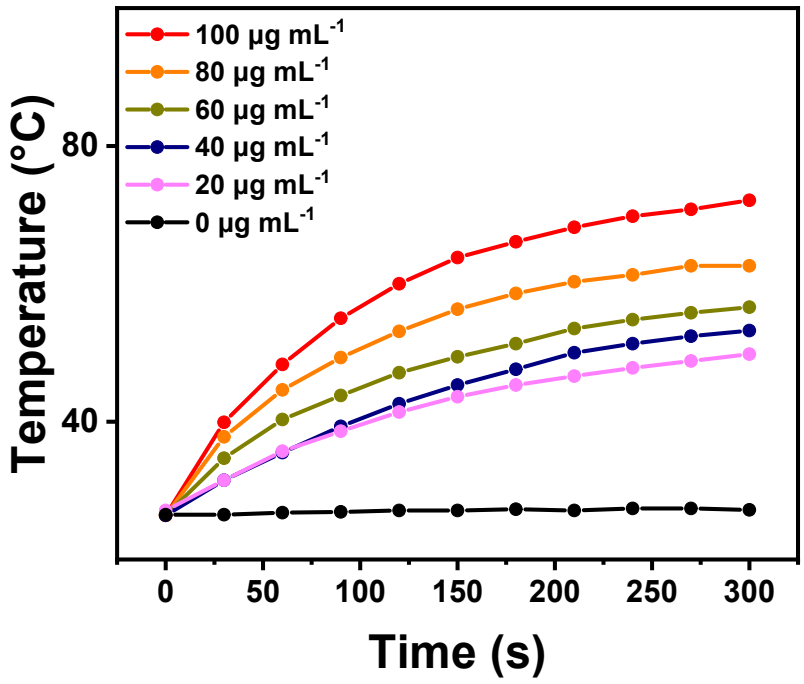

Fig. S10 Temperature changes of mPt NPs with various concentrations under the laser power density of 1.0 W cm^{-2} (808 nm laser for 5 min).

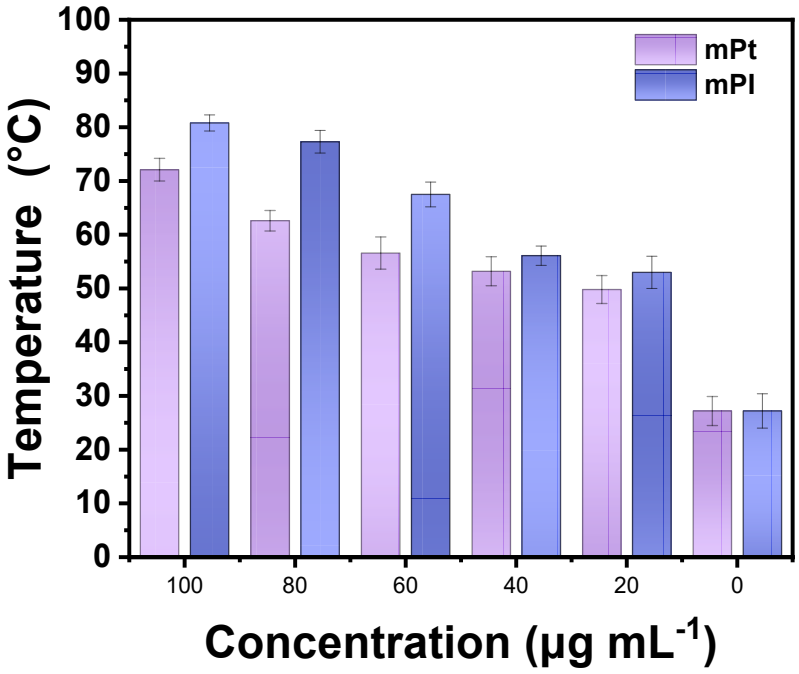

Fig. S11 Comparison of the maximum temperature of mPt NPs and mPI NPs at different concentrations after irradiation at 808 nm for 5 min.

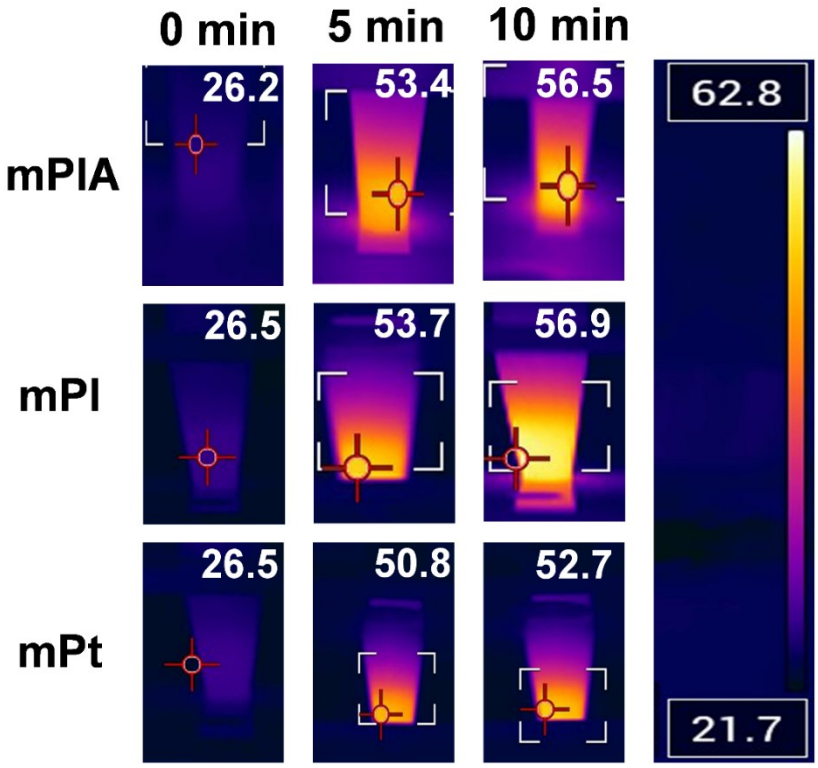

Fig. S12 Temperature generated by mPt/mPI/mPIA (25μg mL^{-1}) after exposure to 808nm laser with 1.0 W cm^{-2} for10 min.

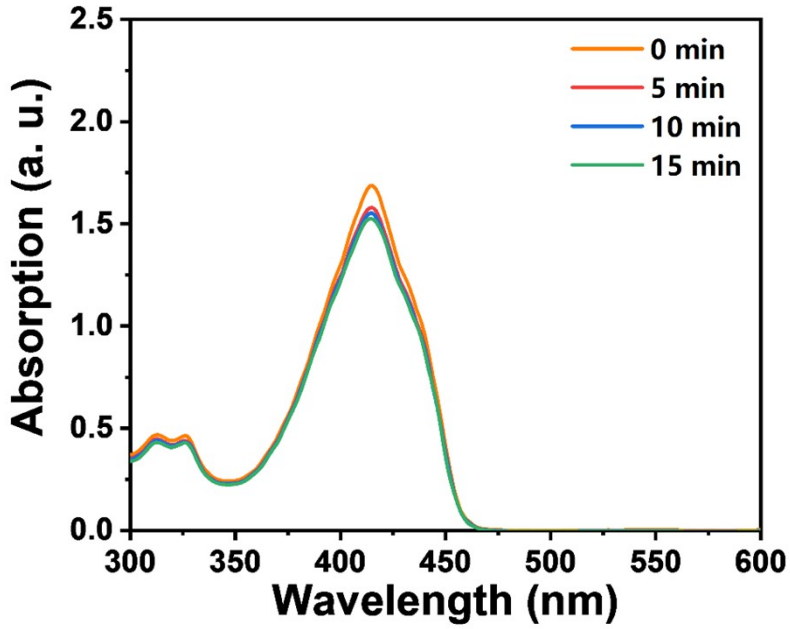

Fig. S13 The UV-vis absorption spectra of DPBF under 808 nm laser irradiation for different time.

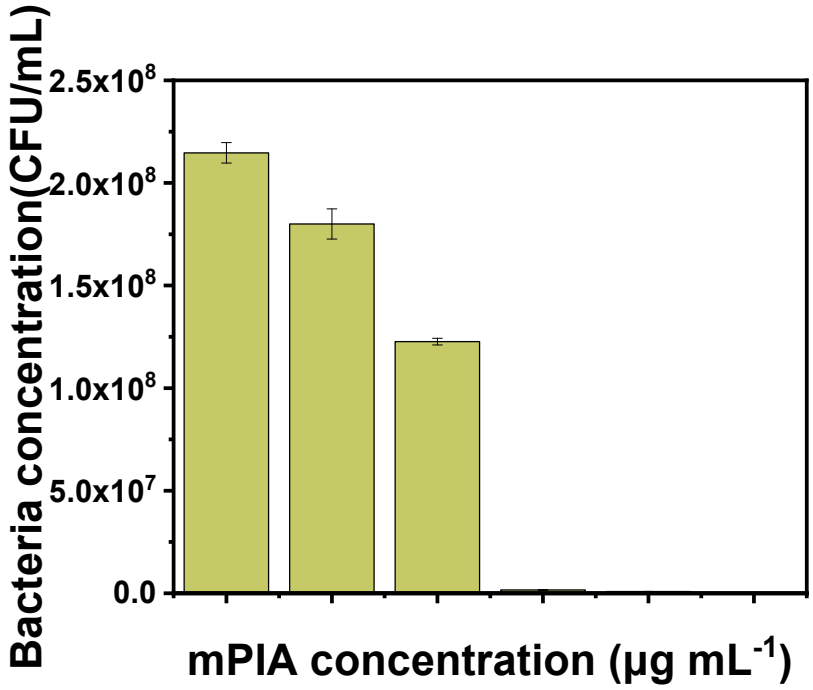

Fig. S14 Colony counting assays of Escherichia coli exposed to different concentrations of mPIA. The results were expressed as mean ± SD (n = 3, ***p < 0.001, **p < 0.01).

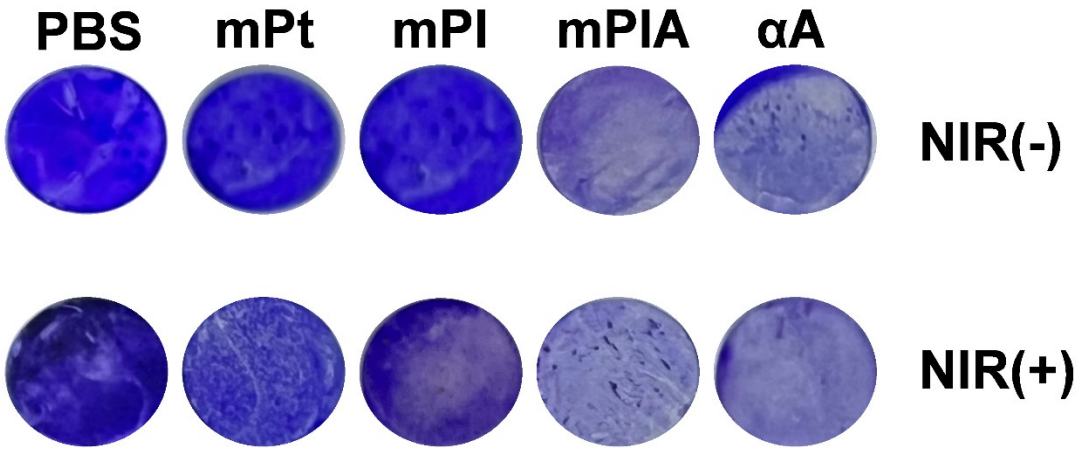

Fig. S15 The hole plate images of the biofilms stained with crystal violet.

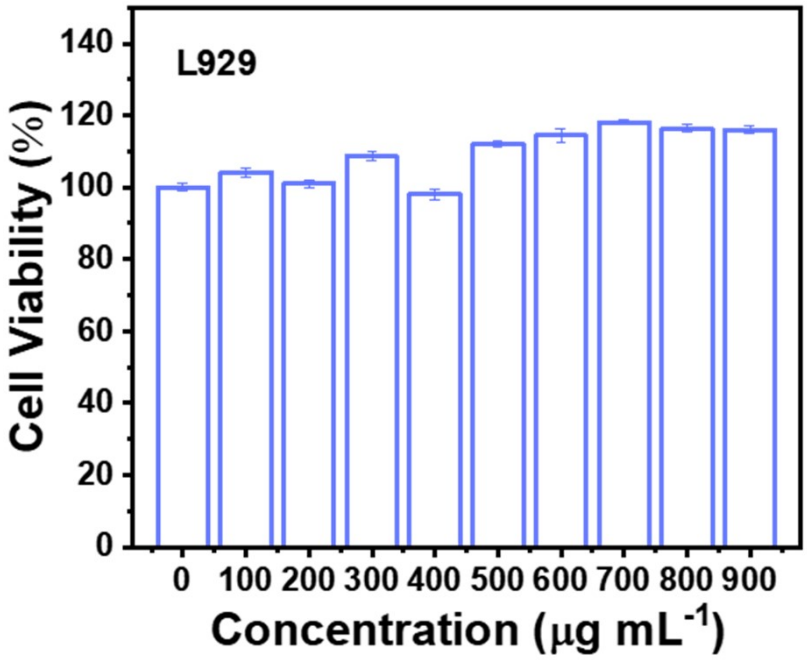

Fig. S16 Cell viability of L929 cells after incubated with mPIA NPs for 24 h.

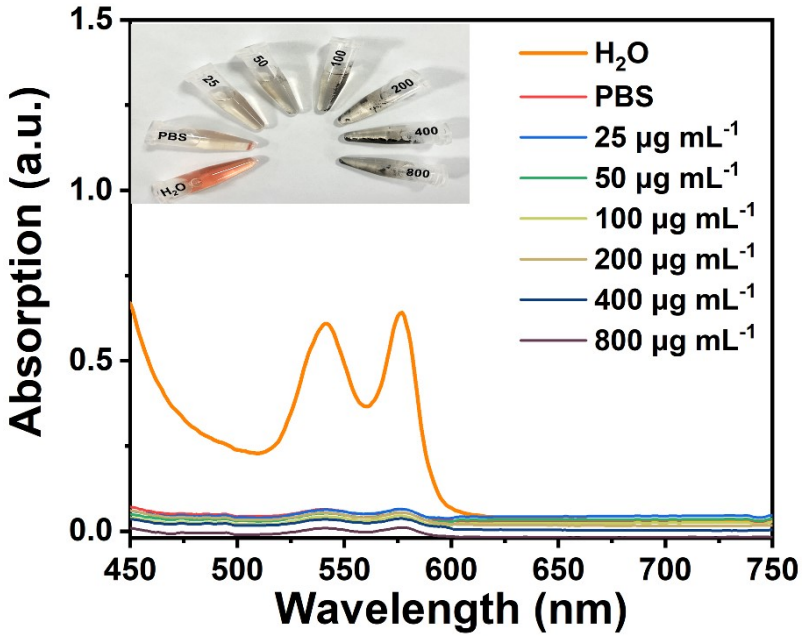

Fig. S17 Hemolytic tests of mPIA NPs at different concentrations.

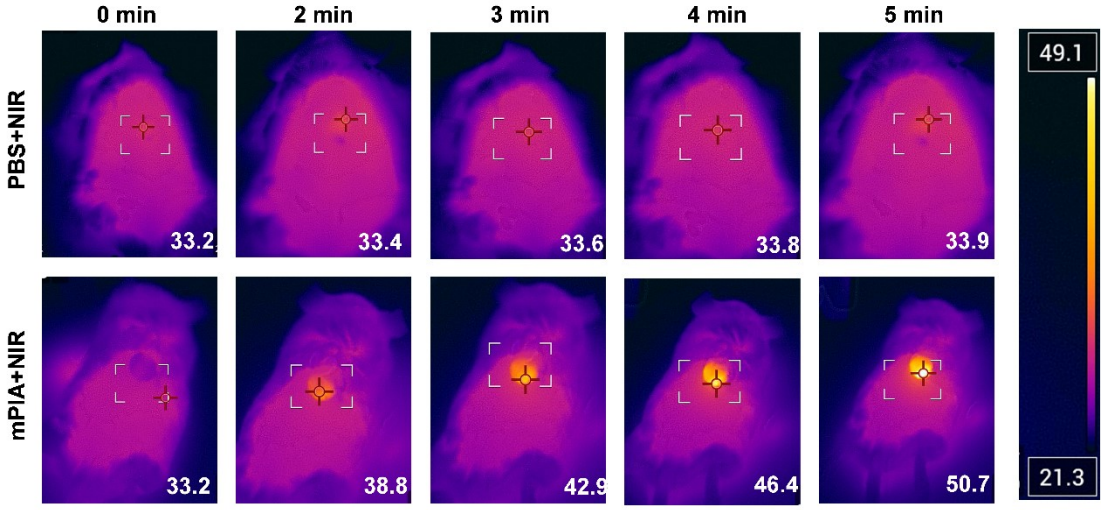

Fig. S18 Thermal images of mice injected with PBS (0.01 M, pH 7.4, 100 μL) and mPIA NPs (25 μg mL^{-1}, 100 μL) under 808 nm NIR irradiation (0.5 W cm^{-2}) for 5 min.

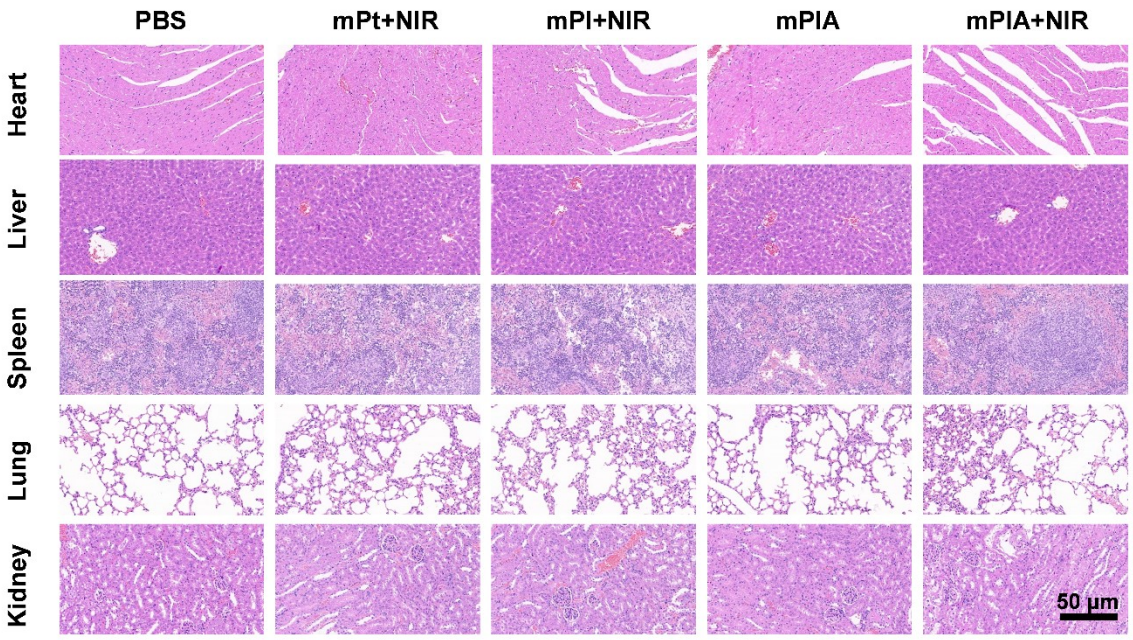

Fig. S19 The H&E stained images of mice major organs under the different treatments.