Zwitterion-Functionalized Hollow Mesoporous Prussian Blue Nanoparticles for Targeted and Synergetic Chemo-Photothermal Treatment of Acute Myeloid Leukemia

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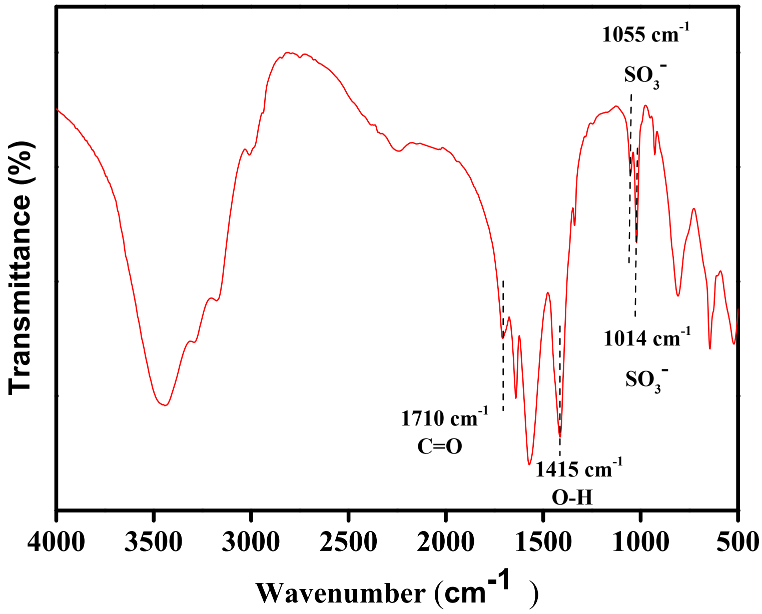

Fig. S1 FTIR spectrum of sulfobetaine zwitterion. The FT-IR spectrum showed characteristic absorption peaks at 1710 and 1415 cm^{-1}, which are assigned to the C=O stretching vibration and the O-H flexure vibration in AA, respectively. The characteristic peaks at 1055 and 1014 cm^{-1} are assigned to SO_3^- group in DMAPS.

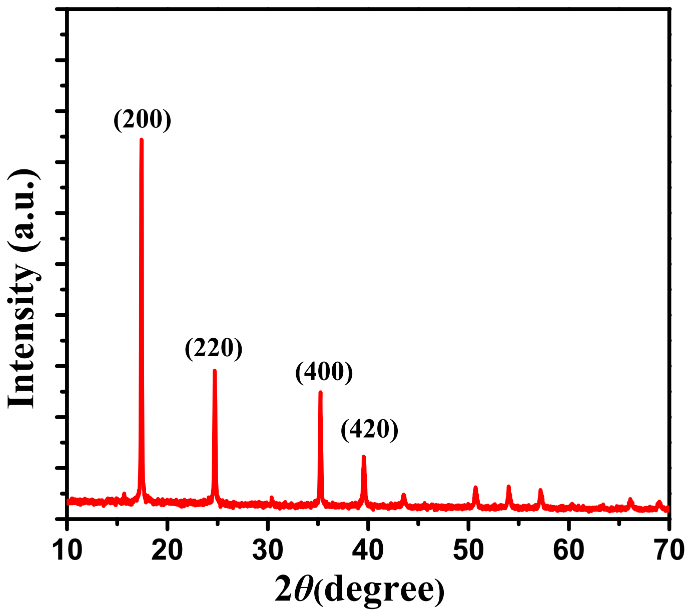

Fig. S2 XRD analysis of HMPBs@PEI-ZS-E5.

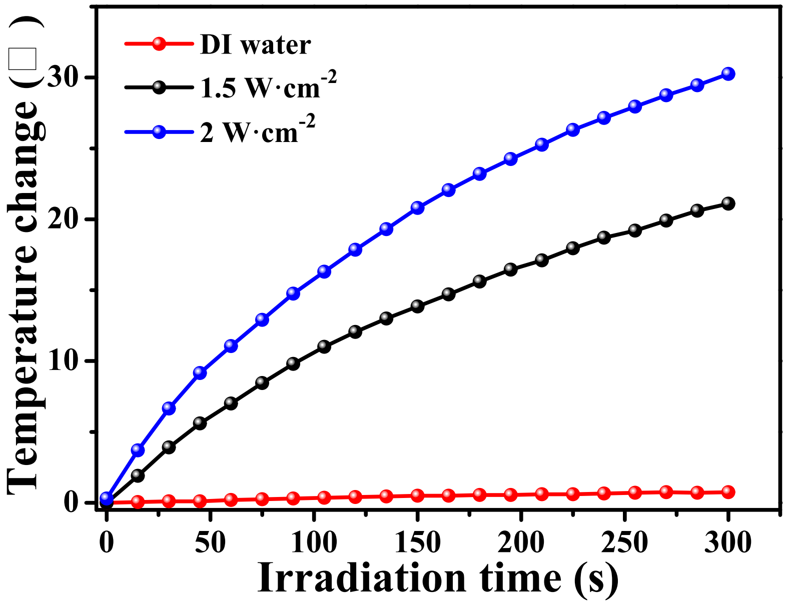

Fig. S3 Temperature change of the HMPBs@PEI-ZS-E5 dispersion upon laser exposure at a power density of b) 1.5 and c) 2 W cm^{-2}.

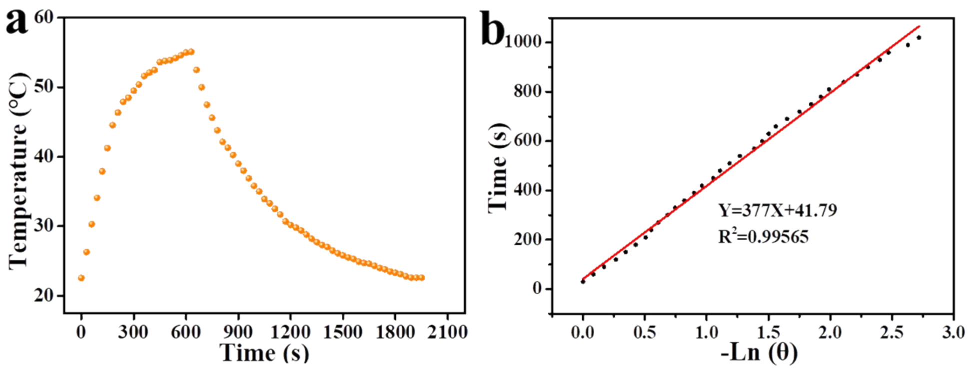

Fig. S4 (a) The aqueous dispersion of HMPBs@PEI-ZS-E5 (100 μg mL^{-1}) was irradiated with 808 nm laser (2 W/cm^2). After the temperature reach steady state, the laser was shut off, and the temperature of the dispersion was recorded. (b) τ_s is determined to be *377* s by using the time data from the cooling period versus negative logarithm of driving force temperature. $R^2 = 0.995$.

The photothermal conversion efficiency of HMPBs@PEI-ZS-E5 was calculated according to Korgel's report.[1]

$$\eta = \frac{hA(T_{max} - T_{surr}) - Q_{dis}}{I(1 - 10^{-A(\lambda)})} \tag{1}$$

In Equation (1), h, A, T_{max}, T_{surr}, Q_{dis}, I, A(λ) and η represent heat transfer coefficient, surface area of the container, the maximum steady-state temperature, ambient temperature of the surroundings, heat loss for the light absorbed by the container, the laser power (in units of mW), the absorbance at 808 nm and the photothermal conversion efficiency, respectively.

$$hA = {}^{mc}/\tau_s \tag{2}$$

In Equation (2), m, c and τ_s represent the mass of the solvent (water), heat capacity of the water and time constant for heat transfer from the system, respectively.

$$t = - \tau_s In\theta$$

$$\theta = \frac{T - T_{surr}}{T_{max} - T_{surr}} \tag{4}$$

$$Q_{dis} = hA(T_{max,water} - T_{surr,water}) \tag{5}$$

The τ_s is determined to be 377 s by applying the linear time data from the cooling period *vs* negative natural logarithm of driving force temperature (Fig. S4b). The *m* is 1.5 g and the *c* is 4.2 J/(g • ℃). Thus, according to Equation 2, the *hA* is deduced to be 16.7 mW/°C. Since $T_{max,water}$ minus $T_{surr,\ water}$ is 1.85, Q_{dis} was calculated to be 30.9 mW via Equation 5. In addition, the absorbance at 808 nm is 0.45, T_{max} minus T_{surr} is

32.45 and I is 2 W/cm^2. Therefore, according to Equation 1, η of HMPBs@PEI-ZS-E5 can be calculated to be 39.6%.

1. X. Cai, X. Jia, W. Gao, K. Zhang, M. Ma, S. Wang, Y. Zheng, J. Shi and H. Chen, Advanced Functional Materials, 2015, 25, 2520-2529.

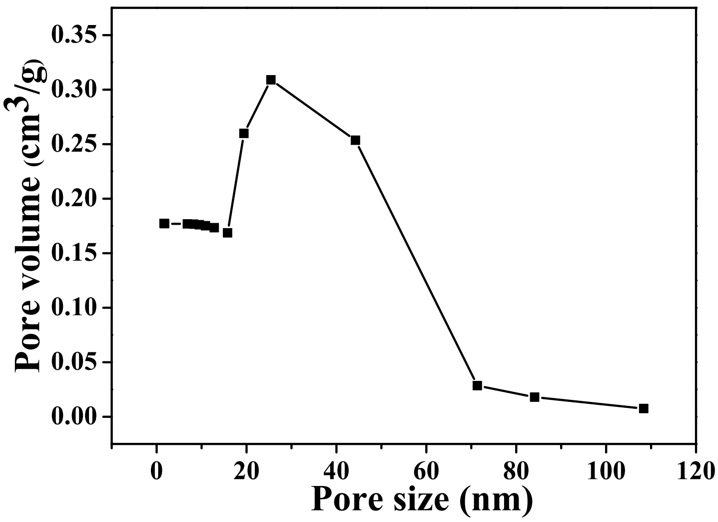

Fig. S5 Pore size distributions of HMPBs.

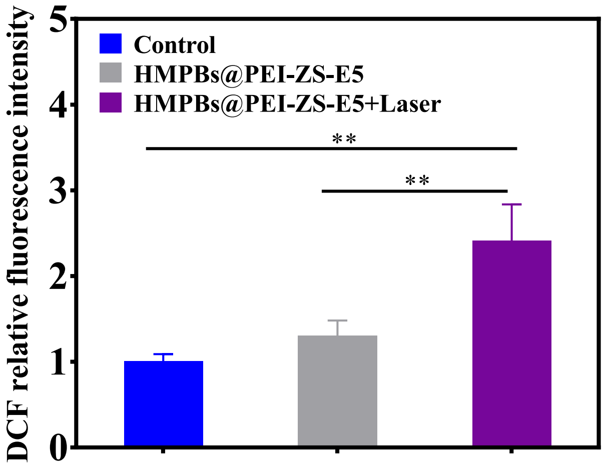

Fig. S6 DCF relative fluorescence intensity of HL60 cells treated with 50 μg mL^{-1} HMPBs@PEI-ZS-E5 with or without laser irradation was measured by fluorescence spectrophotometer.

Table 1 Primer sequences for qRT-PCR to assess the expression of Caspase3 and GAPDH genes in HL60 cells

Gene name	Primer sequences (5′ to ′3)
Caspase3	F: 5′-AGAACTGGACTGTGGCATTGAG-3′ R: 5′-CACAAAGCGACTGGATGAACC-3′
GAPDH	F:5′-GGAAGCTTGTCATCAATGGAAATC-3′ R: 5′-TGATGACCCTTTTGGCTCCC-3′

Table 2 The drug loading efficiency of different HMPBs

drug name	HMPBs(DNR+AraC)	HMPBs(DNR+AraC) PEI-ZS	(DNR+AraC) @PEI-ZS-E5
DNR	16.41±2.1%	15.88±1.31%	16.2±1.17%
AraC	11.89±1.02%	12.1±1.87%	12.4±1.32%