Vaginal delivery of mucus-penetrating organic nanoparticles for photothermal therapy against cervical intraepithelial neoplasia in mice

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EXPERIMENT SECTION

Calculation of photothermal conversion efficiency (*η*). The photothermal conversion efficiency (*η*) was calculated according to the equation (Eq) as follows

$$\eta = \frac{hA\Delta T_{max} - Q_s}{I(1 - 10^{-A_\lambda})}$$

according to previous work[5]: (1), where h is the heat transfer coefficient, A is the surface area of the container, ΔT_{max}-is the maximum temperature change, I is the laser power, A_λ is the absorbance at 604 nm, Q_s is the heat associated with the light absorbance of the solvent. In to get the hA, θ defined as the ratio of ΔT to ΔT_{max} was introduced: $\theta = \frac{\Delta T}{\Delta T_{max}}$.

Based on the total energy balance for this system: $\Sigma_i m_i C_{p,i} \frac{dT}{dt} = Q_{NPs} + Q_s - Q_{loss}$ (2), where Q_{NPs} is the photothermal energy input by PEG_{800}-BDP/NPs, Q_s is the heat associated with the light absorbance of the solvent, Q_{loss} is thermal energy lost to the surroundings. At the maximum steady-state temperature, the heat input is equal to the heat output: $Q_{NPs} + Q_s = Q_{loss} = hA\Delta T_{max}$.

Substituting θ into Eq.2 and rearranging: $\frac{d\theta}{dt} = \frac{hA}{\Sigma_i m_i C_{p,i}}(\frac{Q_{NPs} + Q_s}{hA\Delta T_{max}} - \theta)$ (3),

When the laser was shut off, the $Q_{NPs} + Q_s = 0$, Eq.3 changed to: $dt = -\frac{\Sigma_i m_i C_{p,i}}{hA}\frac{d\theta}{\theta}$ (4).

Integrating Eq.4 gives the expression: $t = -\frac{\Sigma_i m_i C_{p,i}}{hA}\theta$. Then hA can be determined by applying the linear time data from the cooling period versus $-\boldsymbol{Ln\theta}$.

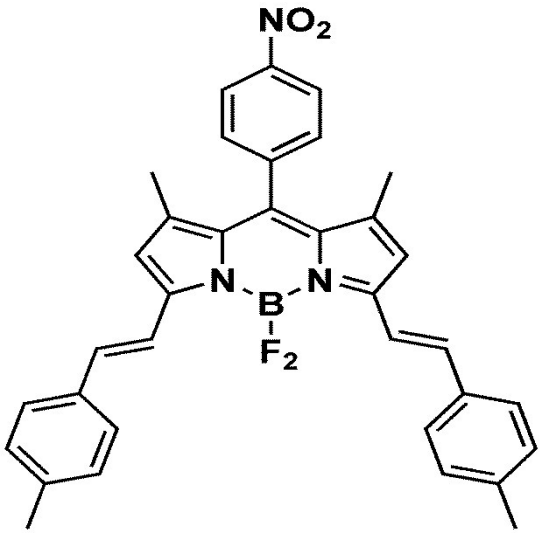


Fig.S1 Structure of BDP without the two alkane chains.

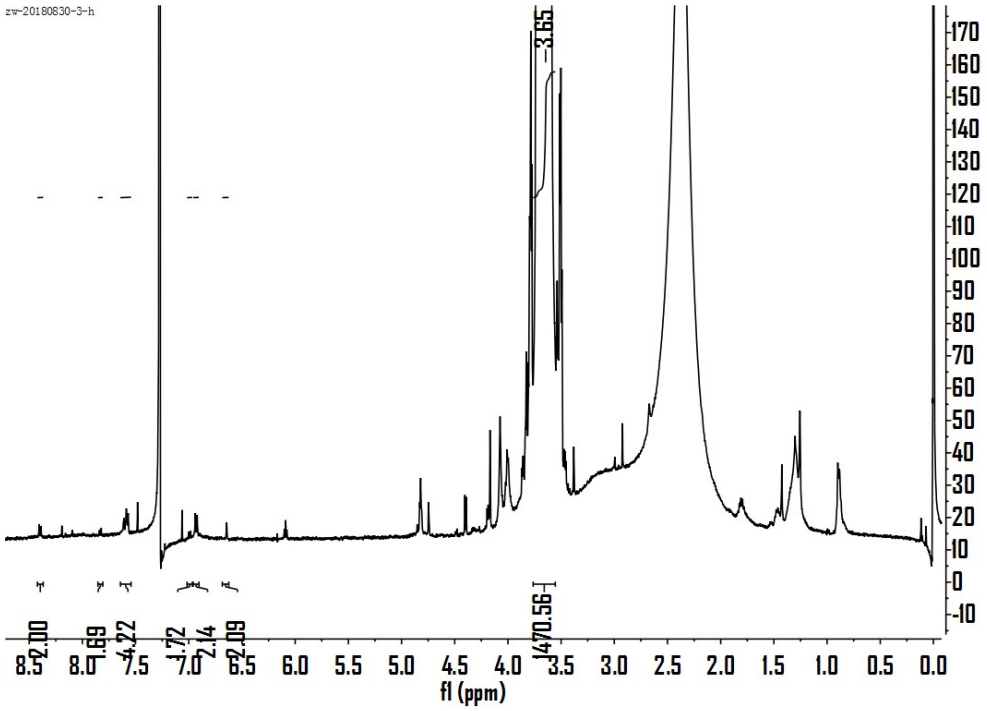


Fig.S2 ^{1}H NMR spectra of PEG800-BDP/NPs.

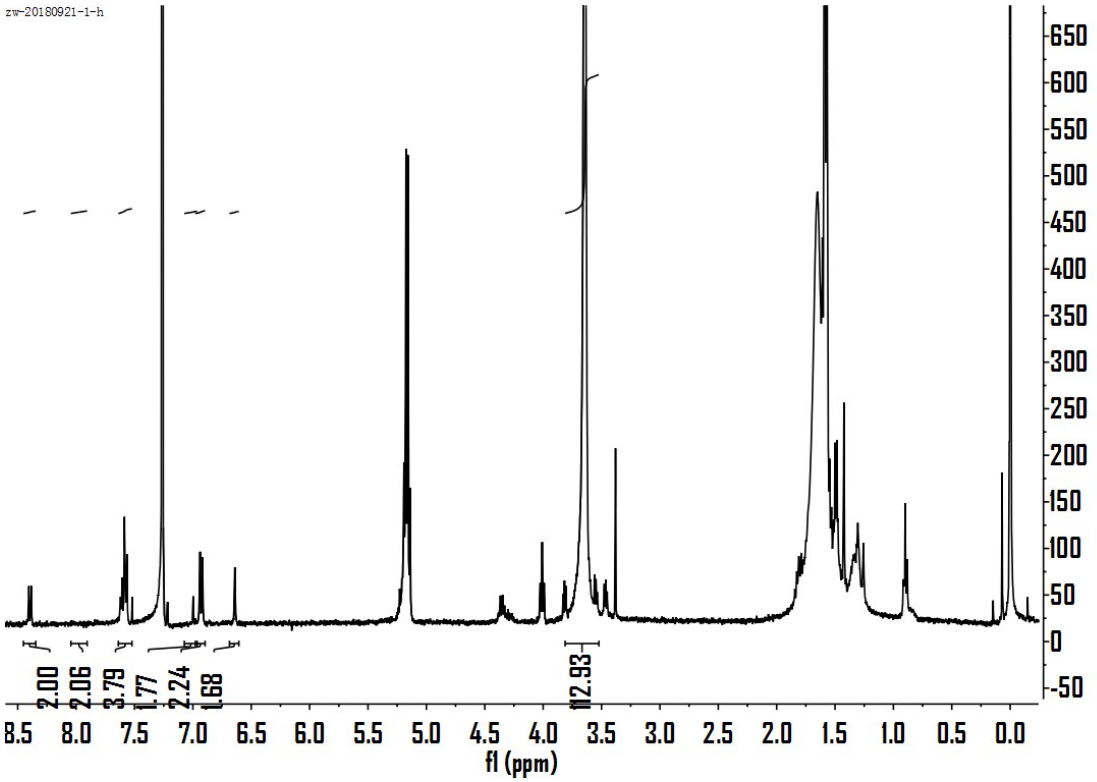


Fig.S3 ^{1}H NMR spectra of BDP/M.

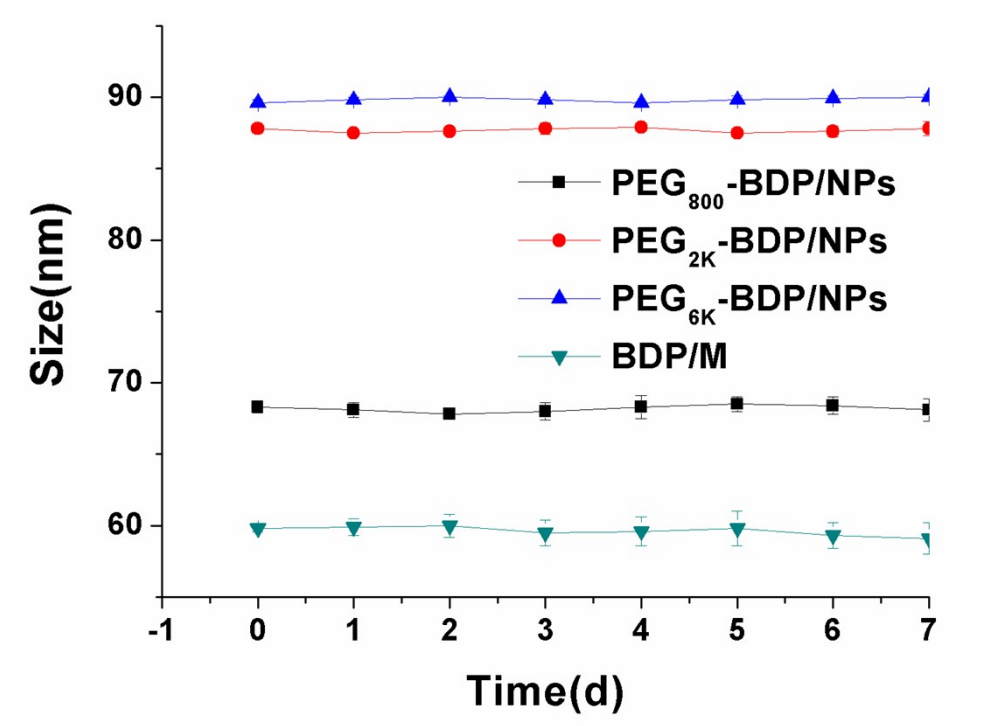


Figure S4. Size changes of PEG_{800}-BDP/NPs, PEG_{2K}-BDP/NPs, PEG_{6K}-BDP/NPs and BDP/M in acetate buffer (pH 5) solutions..

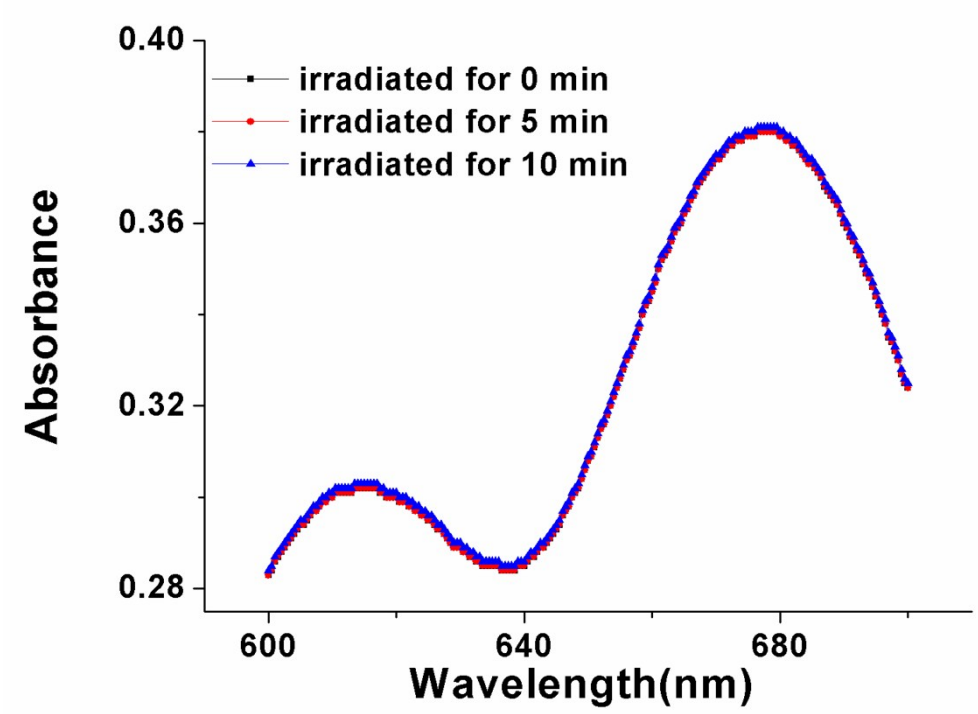
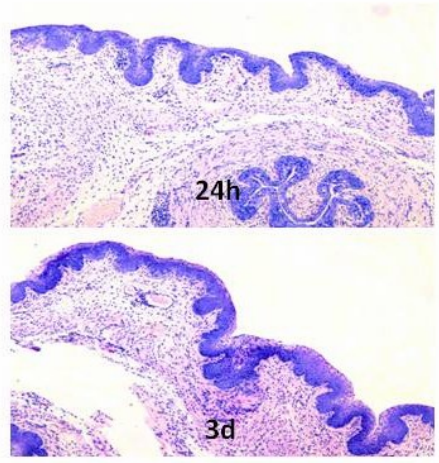


Figure S5. Absorption spectra of PEG_{800}-BDP/NPs solutions before and after 650 nm laser irradiation at a power density of 1W/cm^2 for 10 min.



	24h	3d
Epithelial disruption	0	0
Leukocyte infiltration	0	0
Vascular congestion	0	0
Edema	0	0
Vaginal irritation index	0	0

Fig.S6 Local irritation evaluation: (A) histological microscopy of vaginal mucosa of mice in PTT group or PEG_{800}-BDP/NPs group; (B) Histopathological examination of vaginal tissues. Individual score: 0 = absence, 1 = minimal, 2 = mild, 3 = moderate, 4 = severe irritation. The cumulative score were correlated to human vaginal irritation potential as follows: vaginal irritation index $\leqslant$8: acceptable; 9–10: borderline; $\geqslant$11: unacceptable.

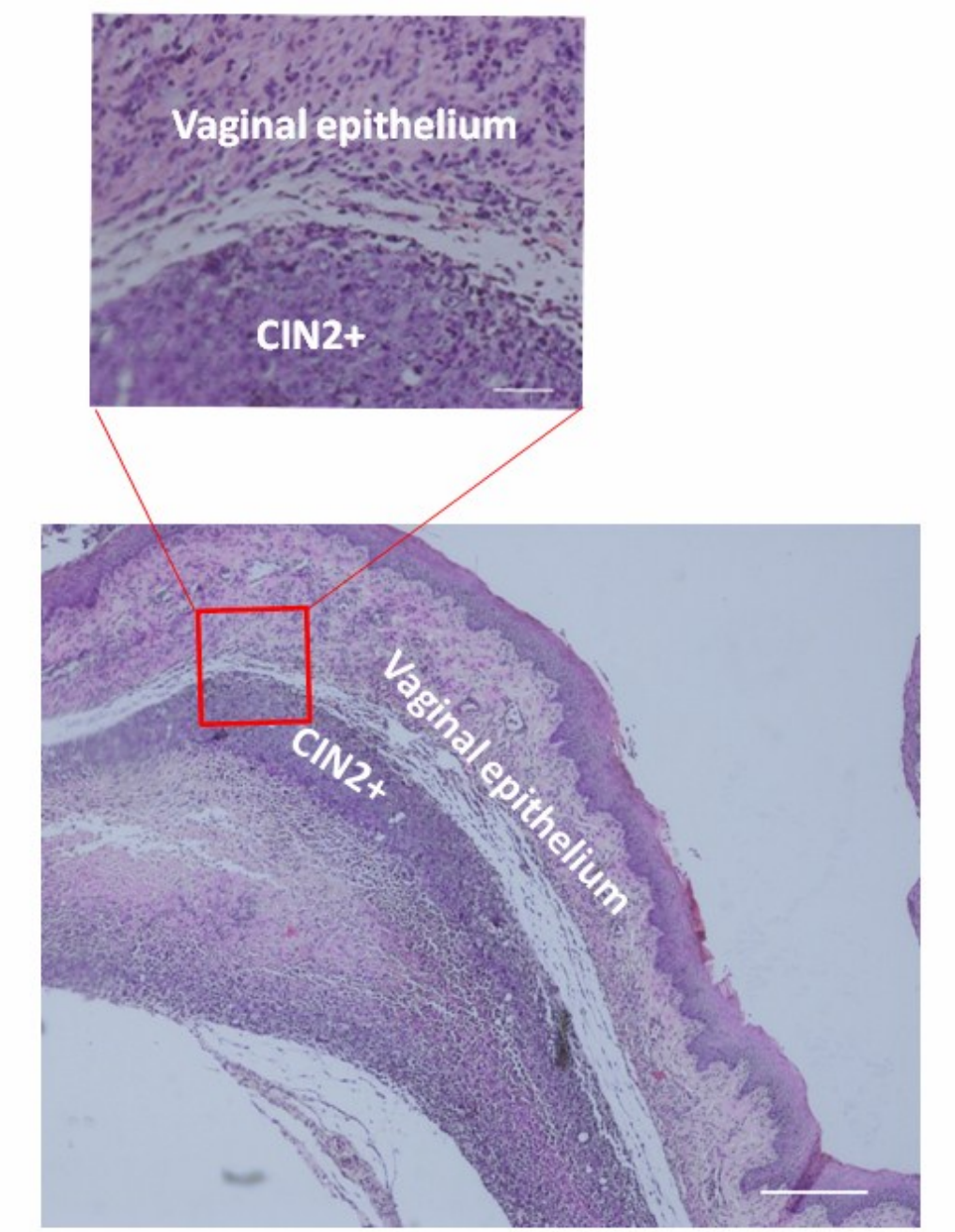


Figure S7. H&E picture of CIN2+. Bar=100 μ m

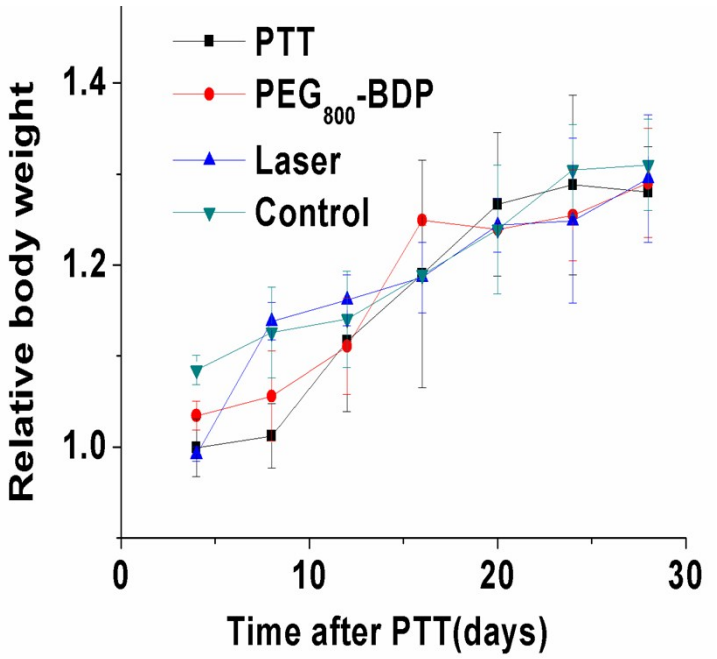


Figure S8. Changes in body weight of mice in mice after PTT.

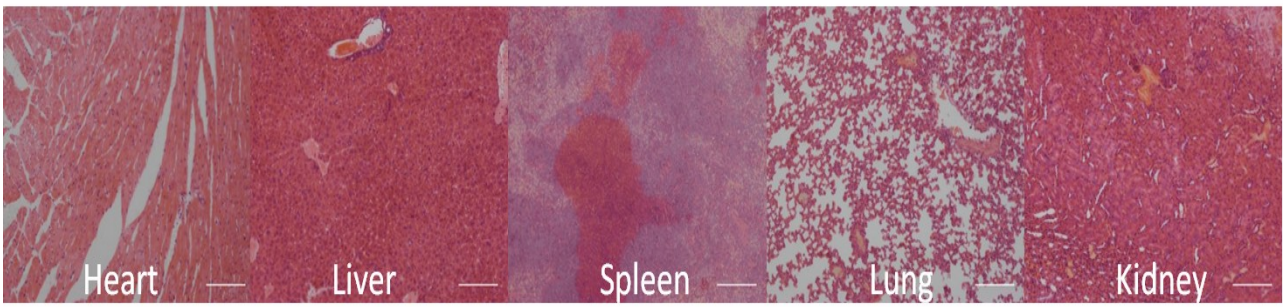


Figure S9. Histological analysis of main organs of mice 33 days after PTT.