Supporting Information

In situ generation of peroxynitrite ($ONOO^-$) for enhanced antibacterial photodynamic therapy

Tao Yue[a,‡], Baoxuan Huang[a,‡], Lei Xia[a], Jia Tian[a], Qu Liu[b,c,*], Weian Zhang[a,*]

[a]Shanghai Key Laboratory of Functional Materials Chemistry, East China University of Science and Technology, Meilong Road No. 130, Shanghai 200237, PR China
[b]Faculty of Hepatopancreatobiliary Surgery, the First Medical Center of Chinese People's Liberation Army (PLA) General Hospital, Beijing, China
[c]Department of Organ Transplantation, the Third Medical Center of Chinese People's Liberation Army (PLA) General Hospital, Beijing, China
E-mail: leonliu52@163.com; wazhang@ecust.edu.cn;

Synthesis of poly(2-(dimethylamino)ethyl methacrylate) (PDMAEMA)

In a typical polymerization experiment, DMAEMA (1.0 g, 2.1 mmol), CEPA (0.027 g, 0.103 mmol), AIBN (0.0056 mg, 34.1 μmol) and 2 mL THF were added into a dry glass tube equipped with a magnetic stirring bar. The degassed solute on was immersed into an oil bath at 70 °C. After stirred for 12 h, the polymerization was quenched by plunging the reaction flask into liquid nitrogen, opened, and diluted with THF. The mixture was then precipitated into an excess amount of diethyl ether three times, and then the product was dried in vacuum oven at room temperature. The product was characterized by ^{1}H NMR as shown **Figure S1.**

Synthesis of Porphyrin-based monomer (TPP6CMA)

5,10,15-Triphenyl-20-(4-hydroxyphenyl)porphyrin (73 mg, 1 mmol) and triethylamine (1200 mg, 1.2 mmol) were dissolved in anhydrous THF (40 mL) in flask and chilled to 0 °C. Subsequently, methacryloyl chloride (124 mg, 1.2 mmol) was added into the solution. The mixture solution was filtered and evaporated after stirring overnight.

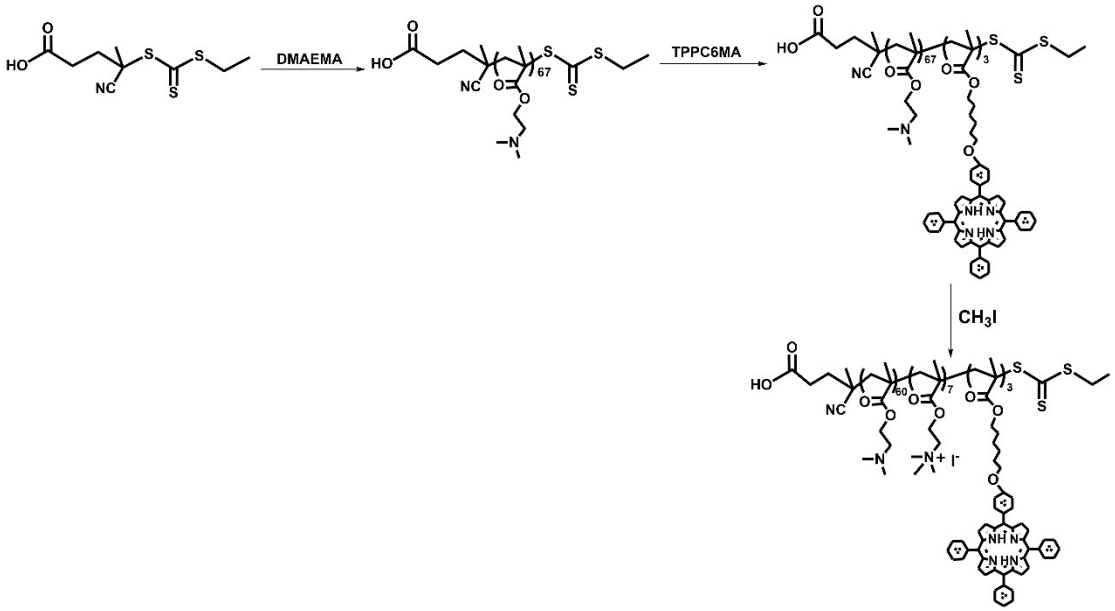
Finally, the pure product TPP6CMA was obtained through column chromatography DCM/PE (3:1, v/v).

Synthesis of 6-bromo-2-butyl-1*H*-benzo[de]isoquinoline-1,3(2*H*)-dione (BNA)

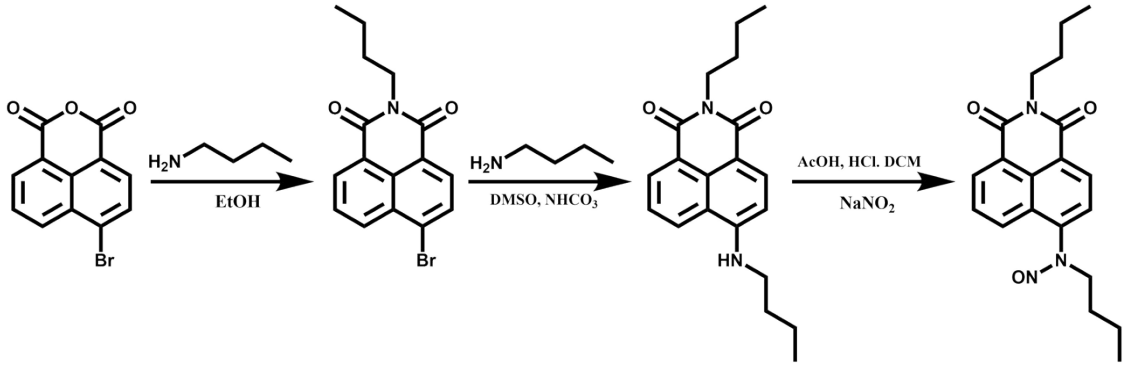
BNA was synthesized according to the previous literature. 4-Bromo-1,8-naphthalic anhydride (10 g, 31.2 mmol) and butylamine (3.2 g, 43.3 mmol) were dissolved with 250 mL ethanol. The mixture was stirred for 8 h under refluxing, and then was filtered and washed with ethanol to afford a crude product. And then it was purified by recrystallization in the mixed solvent of ethanol and water to obtain BNA (Yield: 70%). ^{1}H NMR (400 MHZ, $CDCl_3$): δ 1.00 (t, 3H, CH_3), 1.40-1.50 (m, 2H, CH_2CH_3), 1.68-1.76 (m, 2H, CH_2CH_2), 4.17 (t, 2H, NCH_2), 7.85 (t, 1H, CH), 8.04 (d, 1H, CH), 8.41 (d, 1H, CH), 8.57 (d, 1H, CH), 8.66 (d, 1H, CH).

Synthesis of 2-butyl-6-(butylamino)-1*H*-benzo[de]isoquinoline-1,3(2*H*)-dione (MOEANA)

BNA (5 g, 15.0 mmol), butylamine (1.6 g, 22.7 mmol) and $NaHCO_3$ (3.80 g, 45.18 mmol) were dissolved with 300 mL DMSO. The mixture was heated to 110 °C and then stirred for 12 h. After the mixture was cooled to room temperature, the solvent was evaporated under reduced pressure. The resulting residue was transferred into water, and then extracted with CH_2Cl_2 three times. The organic layer was dried with Na_2SO_4, and filtered, and evaporated under reduced pressure to obtain the crude product. The product was further purified with a column chromatography with DCM/PE (1:1.5, v/v) as the eluent to obtain the MOEANA (Yield: 75%).^{1}H NMR (400 MHZ, $CDCl_3$): δ 0.97 (t, 3H, CH_3), 1.03 (t, 3H, CH_3), 1.40-1.50 (m, 2H, CH_2), 1.50-1.60 (m, 2H, CH_2)1.67-1.75 (m, 2H, CH_2), 1.77-1.84 (m, 2H, CH_2), 3.38-3.44 (m, 2H, CH_2), 4.16 (t, 2H, CH_2) 6.72 (d, 1H, CH), 7.61 (d, 1H, CH), 8.07 (d, 1H, CH), 8.46 (d, 1H, CH), 8.58 (d, 1H, CH).



Scheme S1. Synthesis of PDP.



Scheme S2. Synthetic route of NORM.

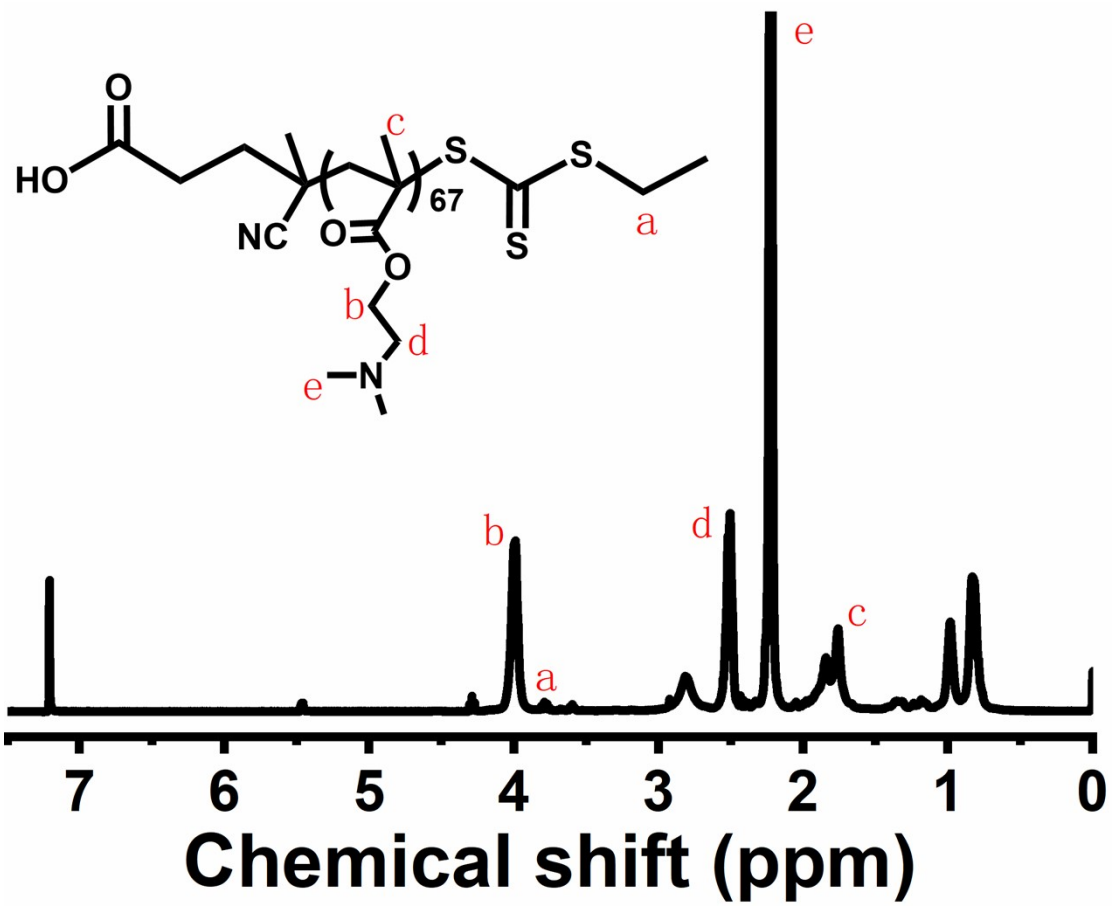


Figure S1. ^{1}H NMR of PDMAEMA.

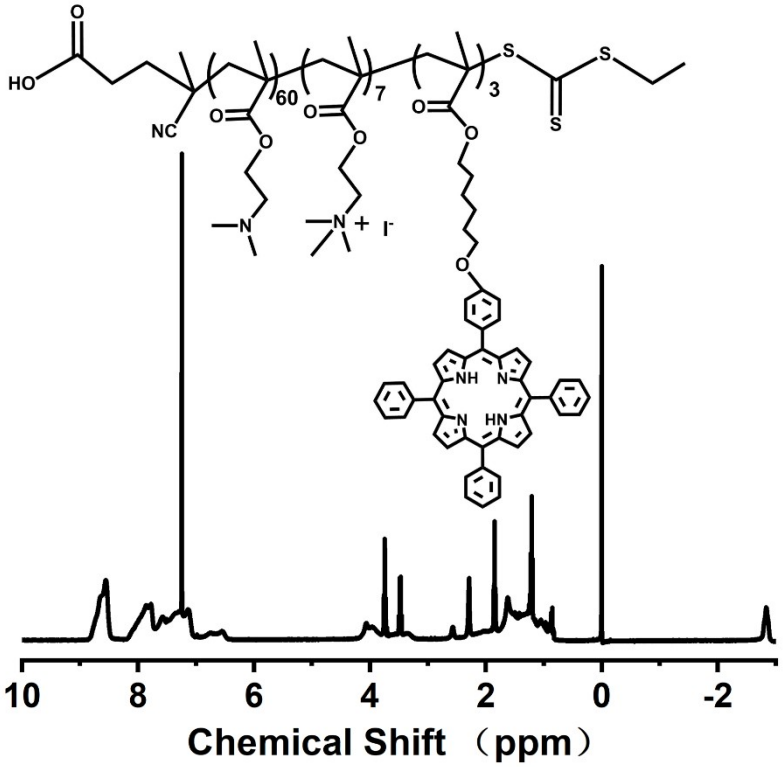


Figure S2. ^{1}H NMR of PDP.

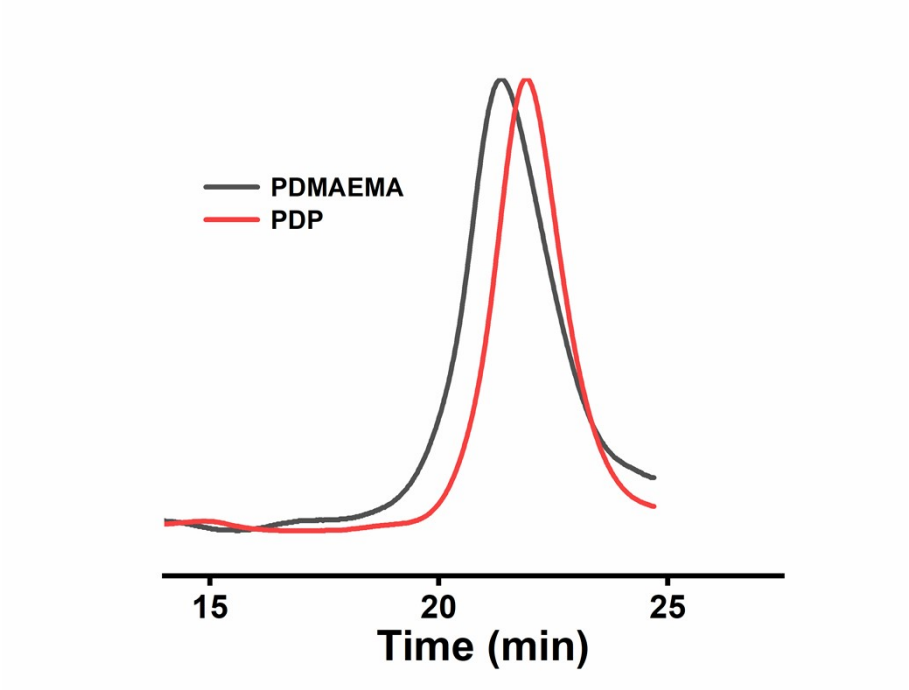


Figure S3. GPC traces of PDMAEMA and PDP.

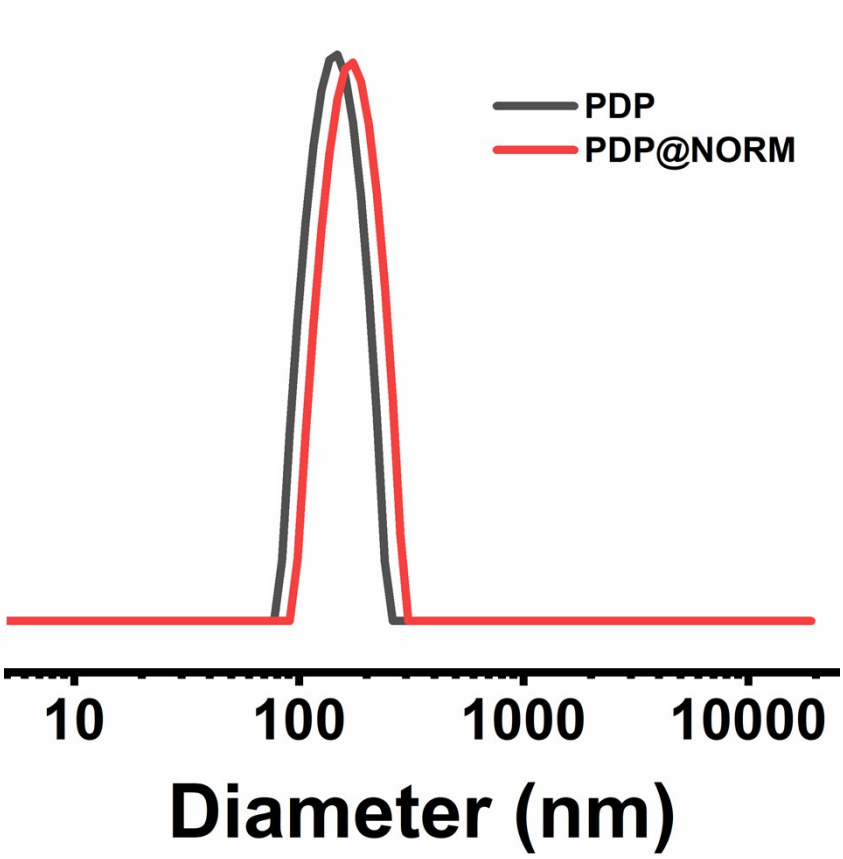


Figure S4. DLS of PDP and PDP@NORM.

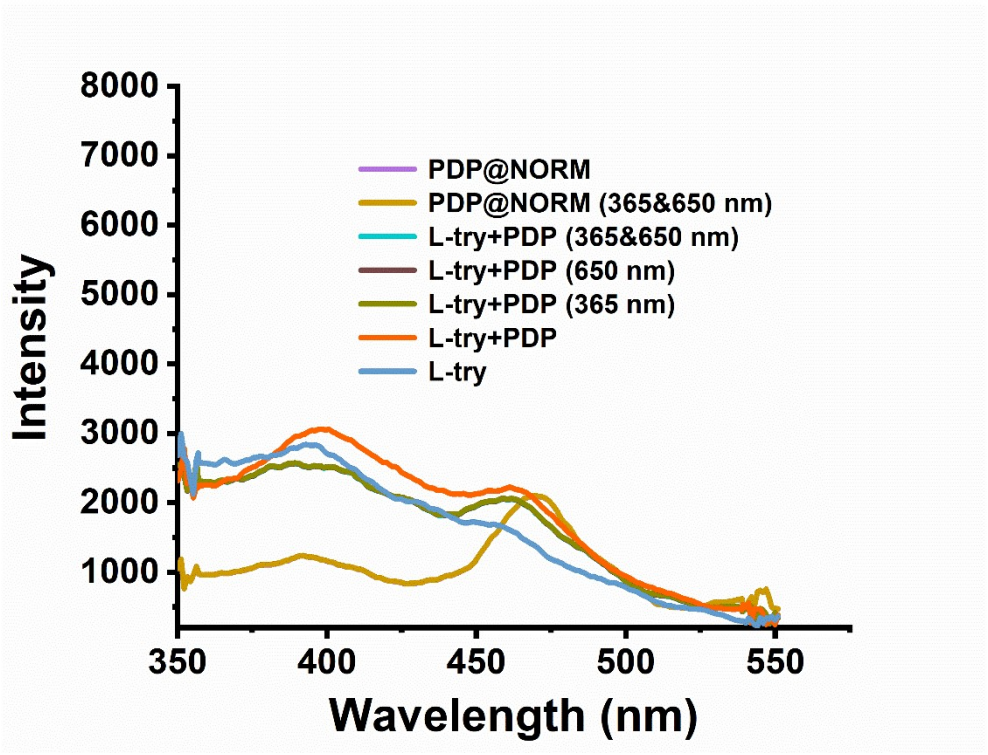


Figure S5. Detection of $ONOO^-$ with L-tyrosine by a fluorescence spectrophotometer (λ_{ex} = 313 nm).

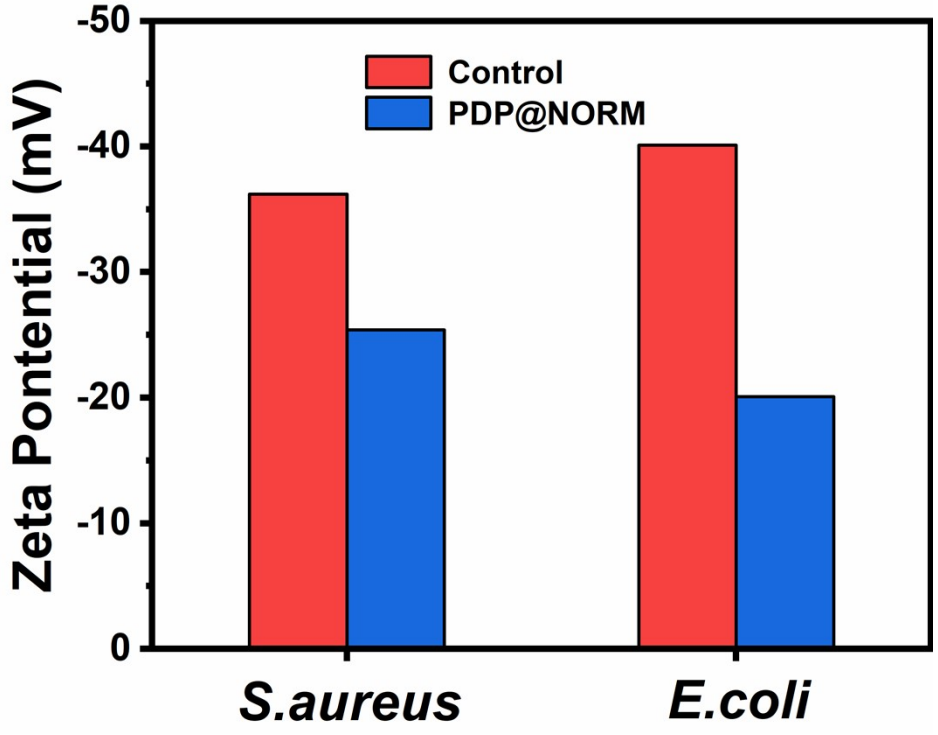


Figure S6. ζ-potentials of *S. aureus* and *E. coli* before and after PDP@NORM nanoparticles.

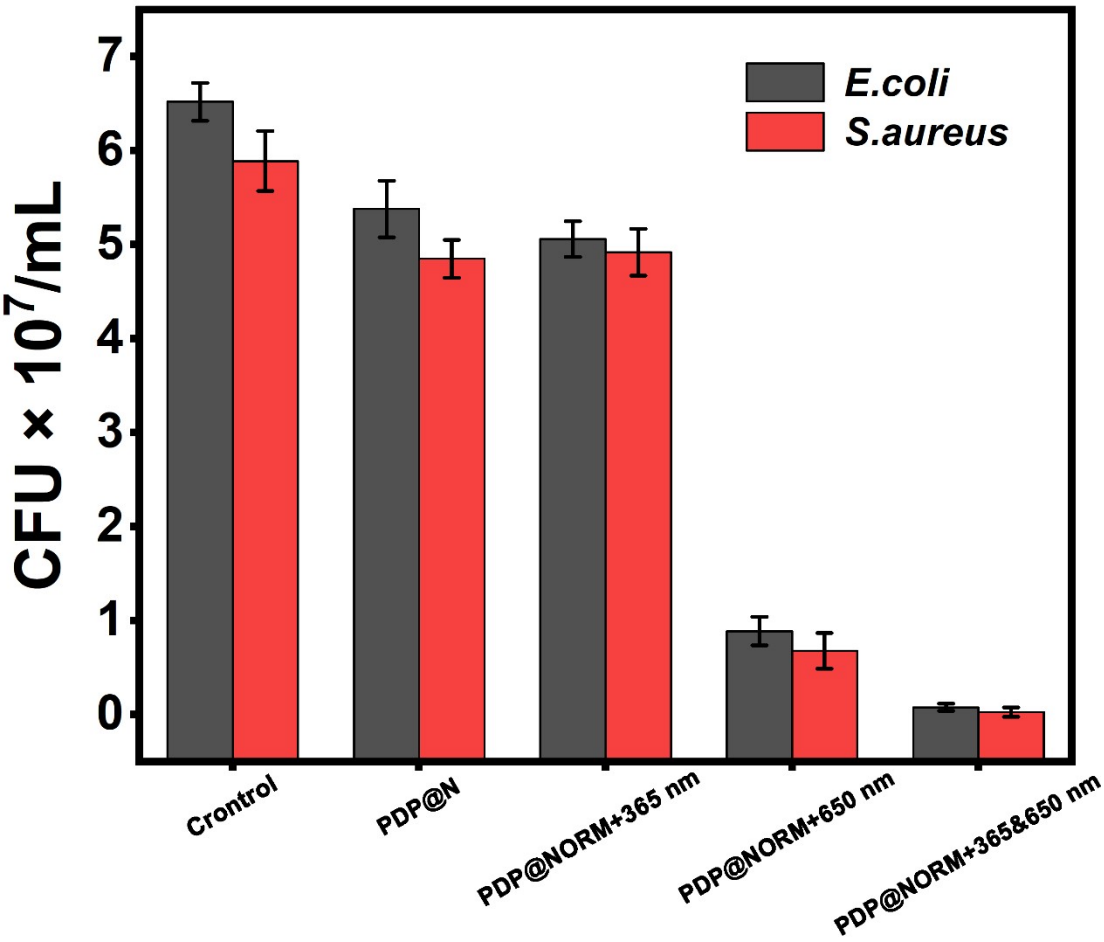


Figure S7. Relative bacterial number of *E. coli* and *S. aureus*.

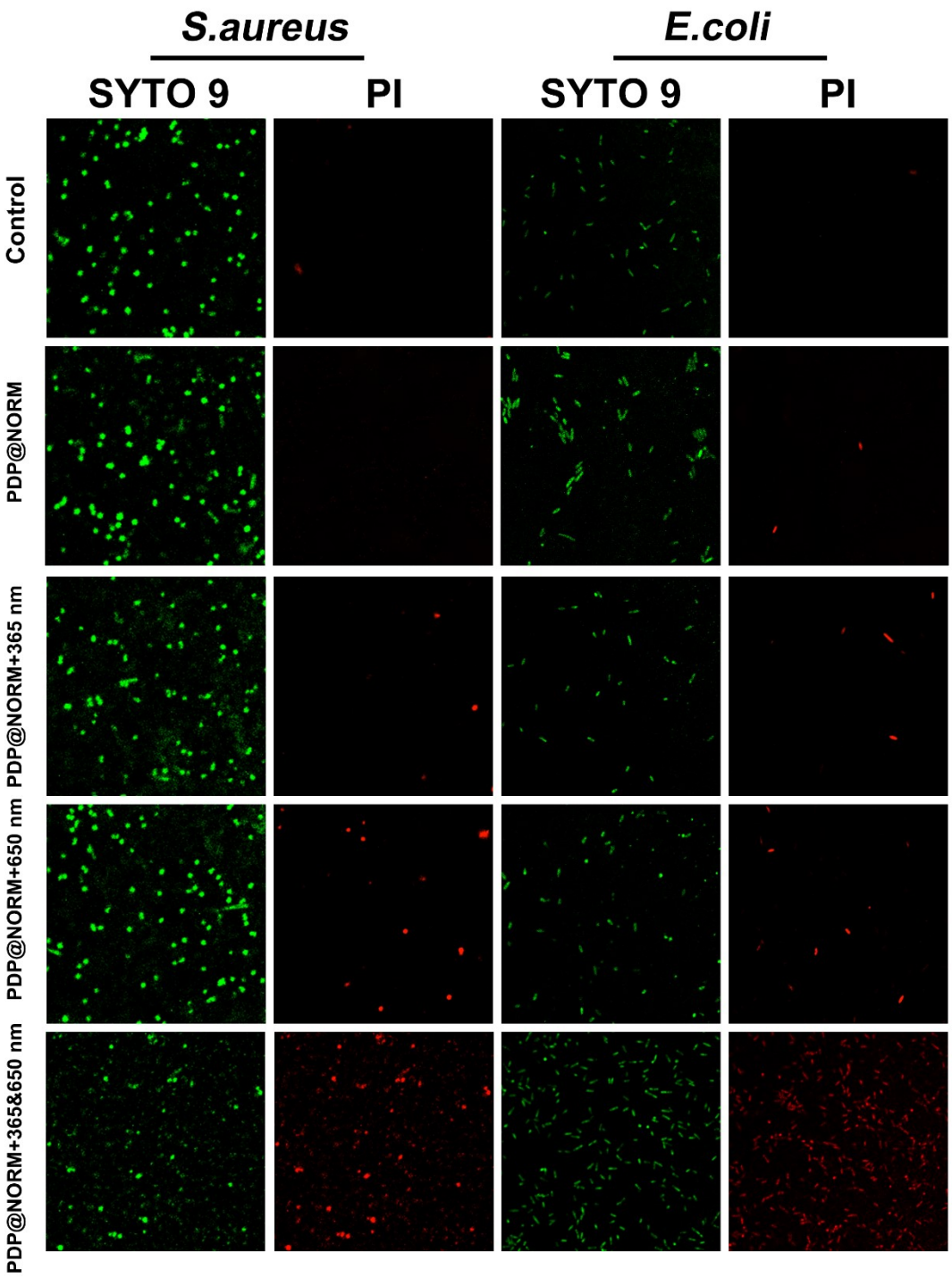


Figure S8. Live/dead bacterial cell observation of *E. coli* and *S. aureus* after treated with PDP@NORM nanoparticles with or without light irradiation.

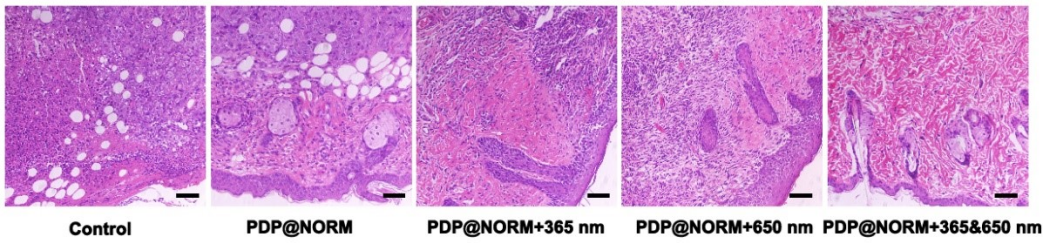


Figure S9. Histological studies of skin tissues by hematoxylin and eosin (H&E) staining with different treatments. Scale bar = 100 μm.