Electronic Supplementary Information (ESI)

Mannose modified zwitterionic polyester conjugated second near-infrared organic fluorophore for targeted photothermal therapy†

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TABLE OF CONTENTS

1. Experimental supplement

1.1. Instruments

^{1}H, ^{13}C and ^{19}F NMR spectra were measured using Bruker AVANCE AV400 NMR spectrometer. Fourier transform infrared spectroscopy (FT-IR) spectra were recorded on a Nicolet 6700 spectrometer. Electrospray mass spectrometry (ESI-MS) measurements were performed on Q-TOF Ultima Global liquid chromatography/time-of-flight tandem mass spectrometer (Waters) combined electrospray source (ESI), matrix-assisted laser dissociation source (MALDI), mass lock (LOCK-SPRAY) and quadrupole selective ion transmission. Nanoparticles size and polydispersity were determined using dynamic light scattering (DLS) at 25 ^{o}C by a Malvern Zetasizer Nano ZS90 equipped with a 633 nm vertically polarized He-Ne laser using back-scattering detection. The diffraction angle is 90^{o}. Measurements were done in triplicate at 25 ^{o}C. Transmission electron microscopy (TEM) was performed using a JEM-1011 TEM operated at the accelerating voltage of 100 kV. The samples were prepared by dropping 7 μL of nanoparticles suspension on the copper grid followed by staining with 7 μL of phosphotungstic acid (20 mg mL^{-1}). UV-vis absorption spectra of M and PM/M2 were obtained using a UV-vis spectrophotometer (Shimadzu UV-2600), and UV-vis spectra of dye IR1048, IR1048-COOH and PM/M2-IR were recorded on the UV-vis spectrophotometer (Shimadzu UV-2600) with integrating sphere

accessories. The NIR II fluorescence spectra were obtained on an Edinburgh FLS980 steady state transient fluorescence spectrometer, which is equipped with xenon lamp, picosecond pulse laser light source, microsecond flash lamp and integrating sphere accessories. The excitation laser is the 980 nm laser diode. Fluorescence emission signal is collected through a 1000 nm long pass filter. The laser irradiation source was a continuous high stability infrared semiconductor laser (MIL-N-1064 nm, Changchun New Industries Optoelectronics Technology Co., Ltd., China). The characters of laser are perfect beam quality and long-term stability <1% and M^2 factor <3.0, and the maximum output power of laser is 5 W. The detection of temperature and IR thermal imaging were measured by Fotric 225s thermal imager and recorded by AnalyzIR software. Fluorescence images were captured with Confocal Laser Scanning Biological Microscope LSM880 (ZEISS, Germany) with 405, 488 and 633 nm laser as the excitation sources, and FV1000-IX81 (Olympus, Japan) with 405, 488 and 559 nm laser as the excitation sources.

1.2. Cell culture

A2780DDP cells and HUVEC cells were grown in RPMI 1640 (HyClone) supplemented with 10% fetal bovine serum, 0.03% L-glutamine and 1% penicillin/streptomycin in 5% CO_2 at 37 ^oC.

2. Supplementary figures

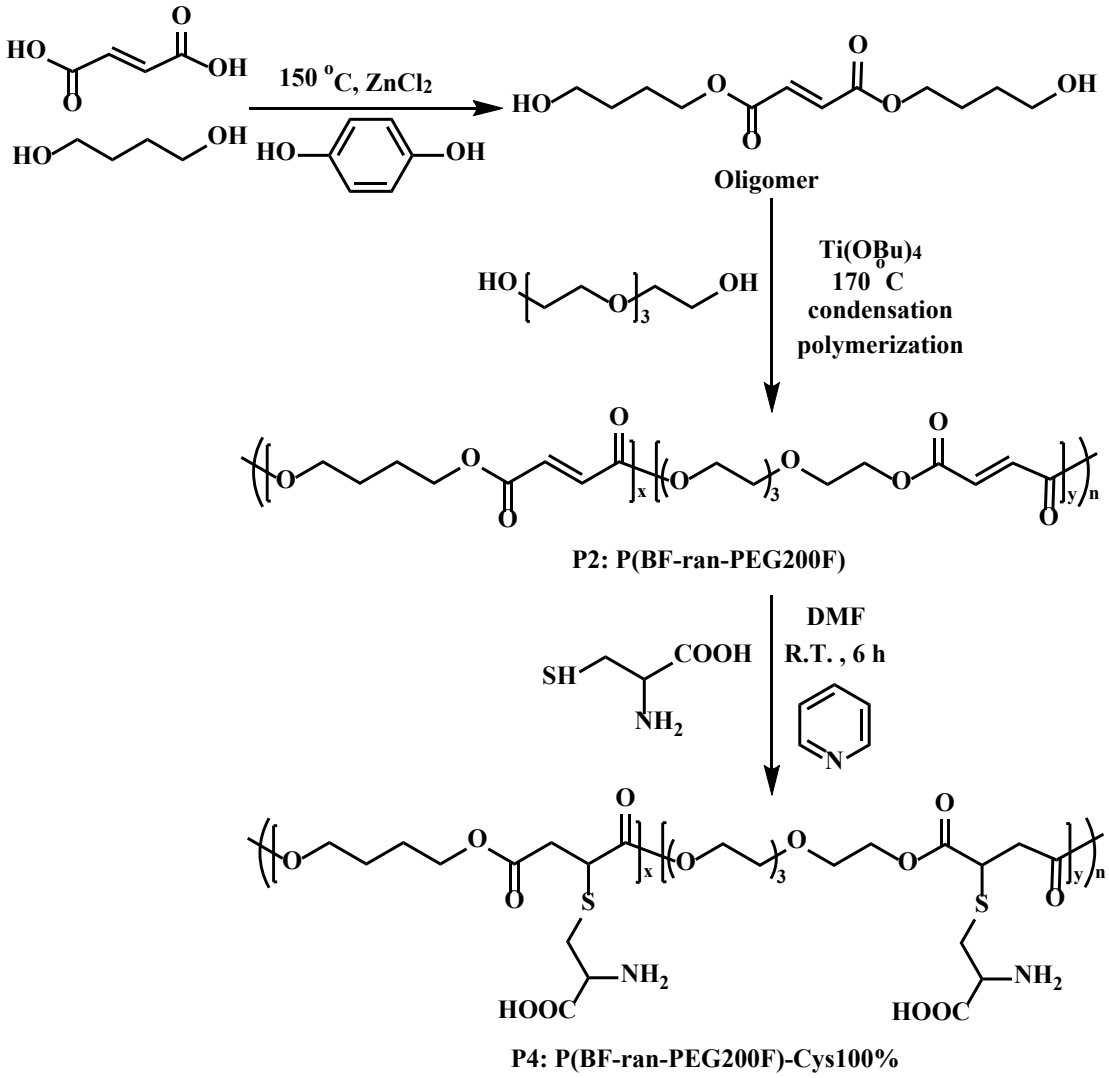


Figure S1. The synthesis of zwitterionic polyester P4.[1]

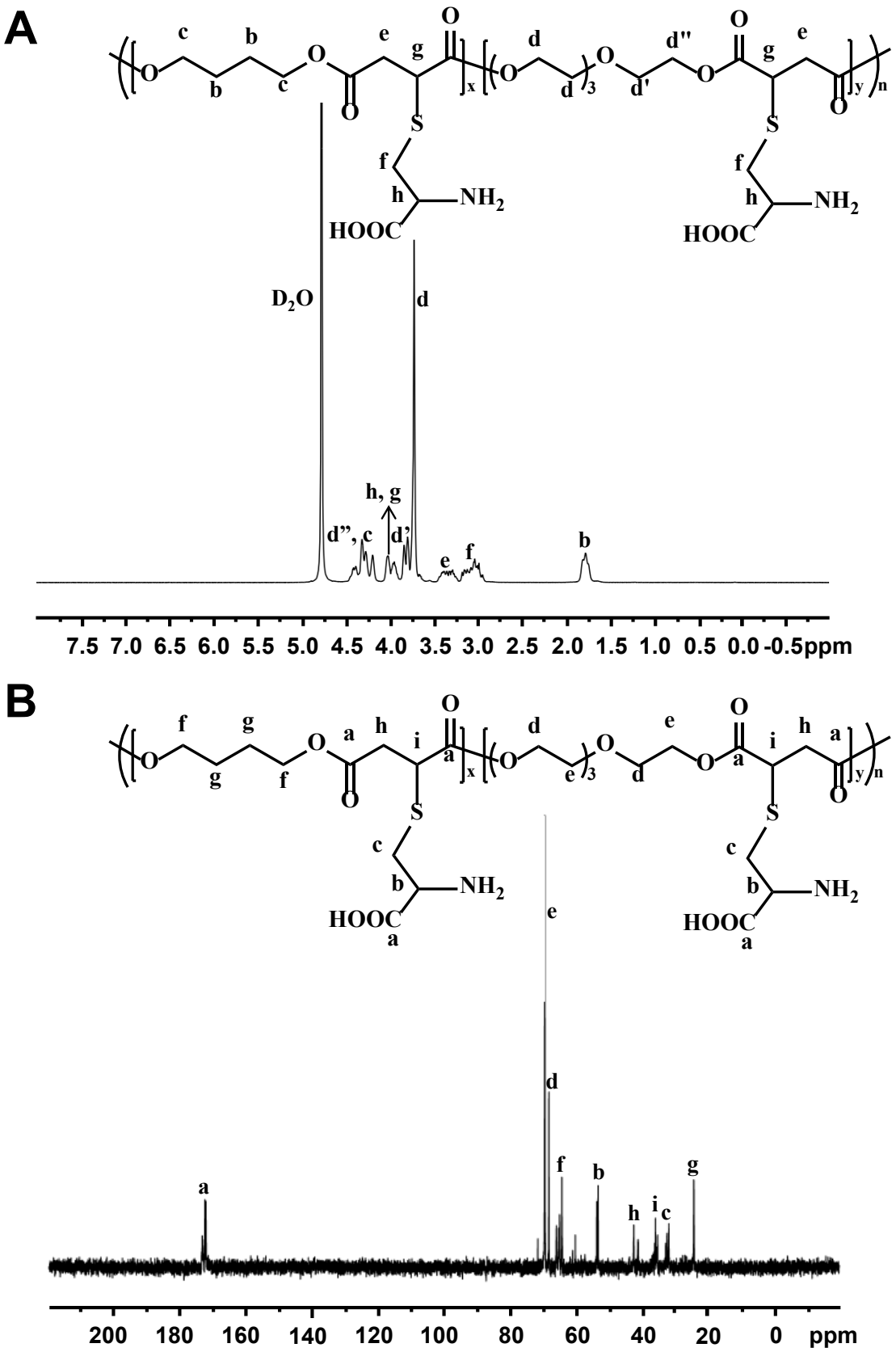


Figure S2. A) ^{1}H-NMR spectra and B) ^{13}C-NMR spectra of the zwitterionic polyester P4.[1]

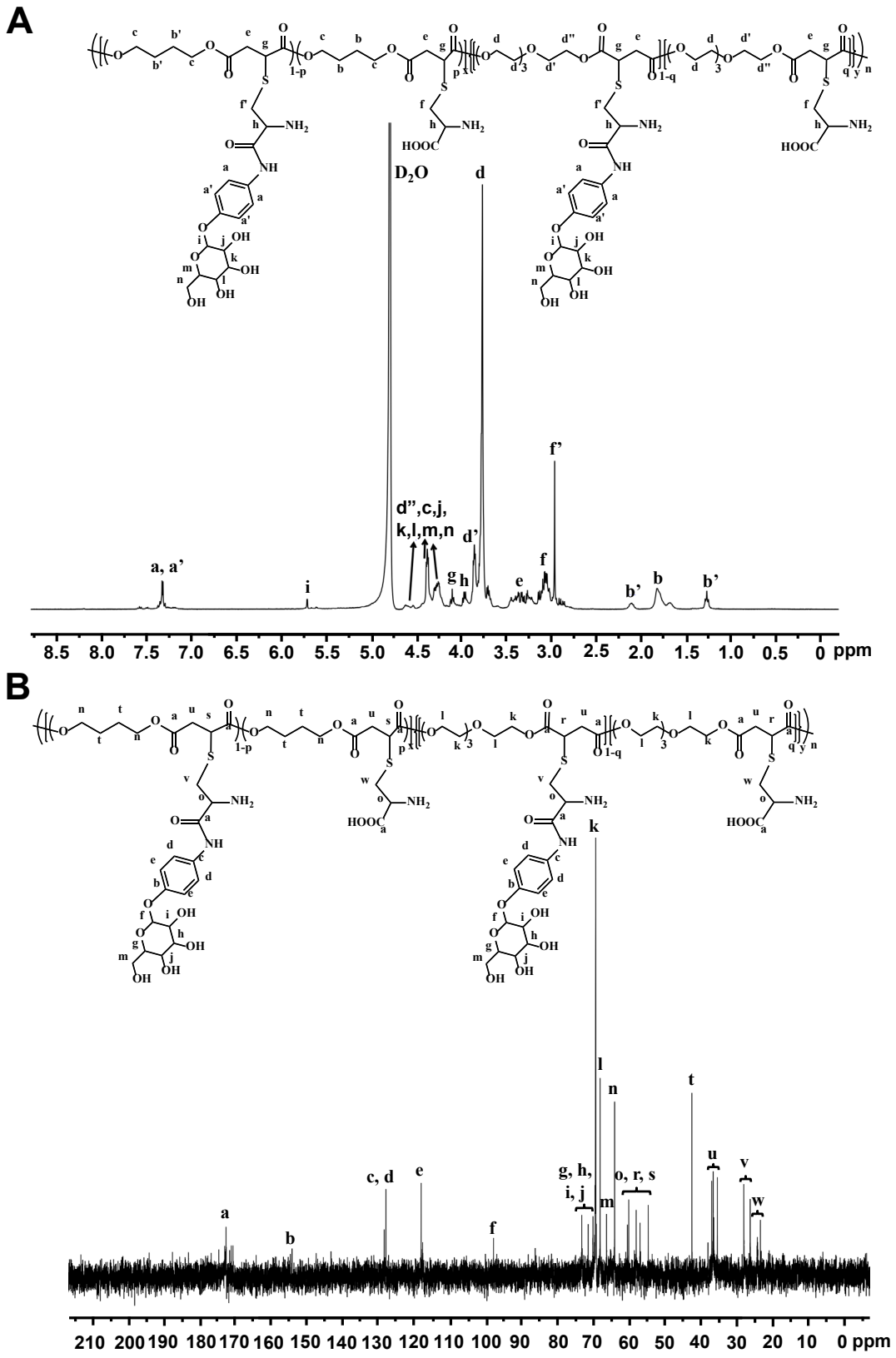


Figure S3. A) ^{1}H-NMR spectra and B) ^{13}C-NMR spectra of the zwitterionic polyesters PM2.

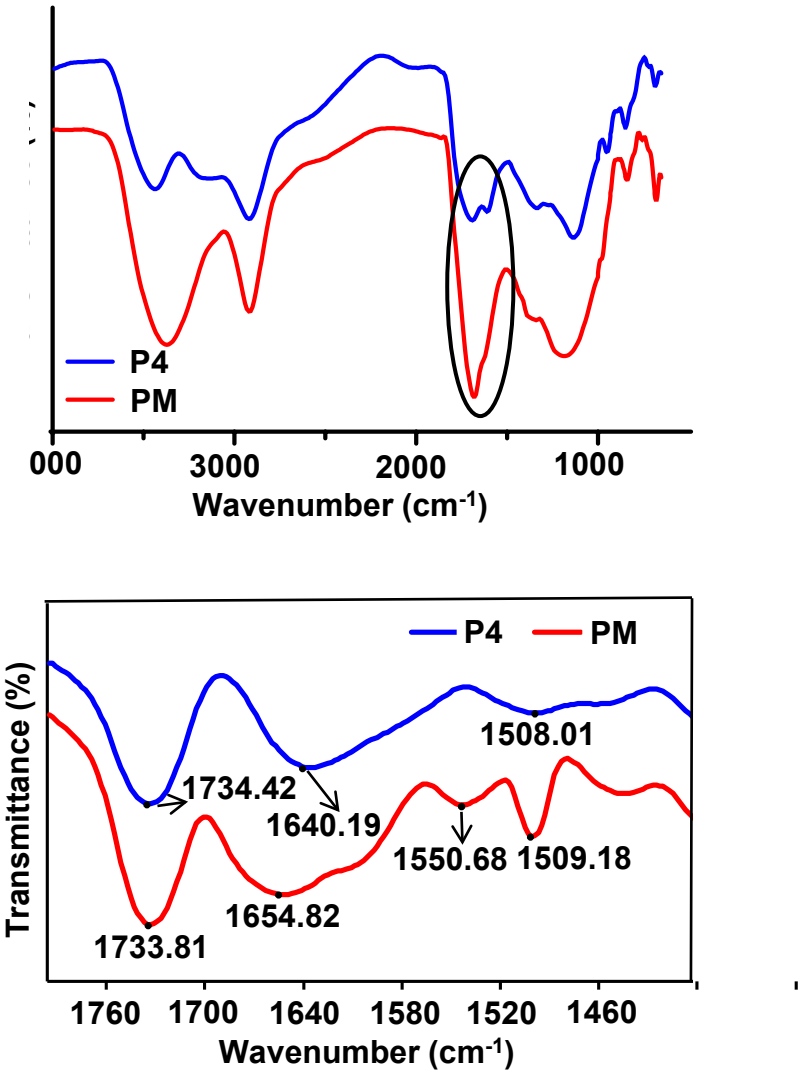


Figure S4. FT-IR of the zwitterionic polyesters P4 and PM. The figure B) is amplified partially of the figure A).

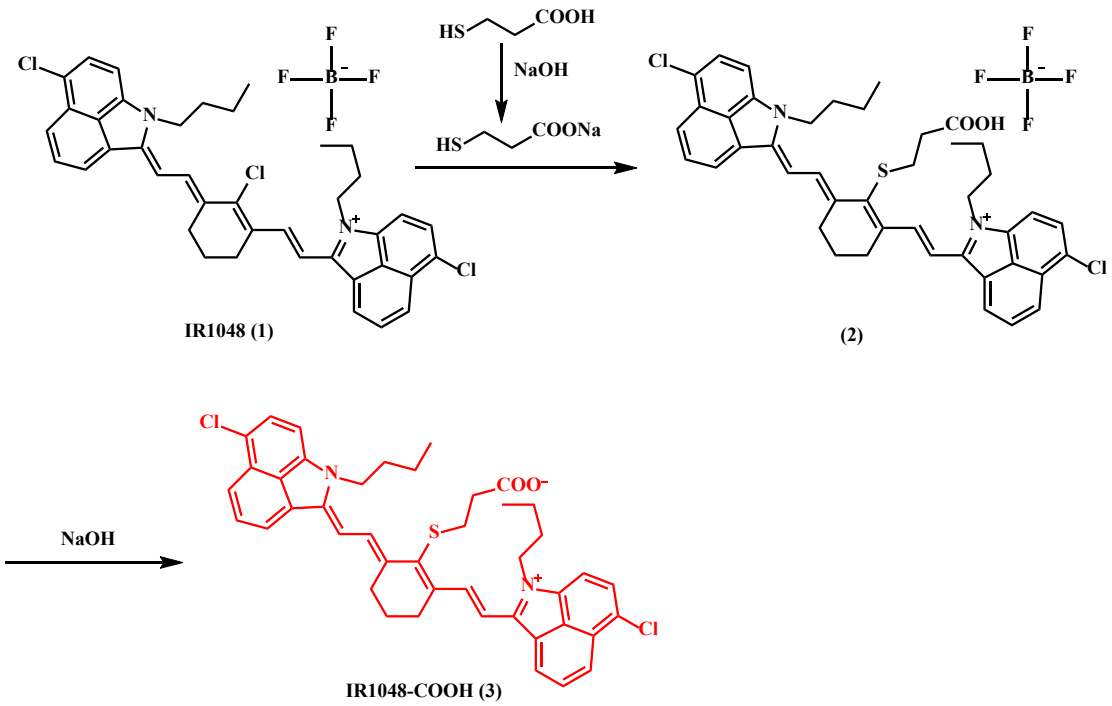
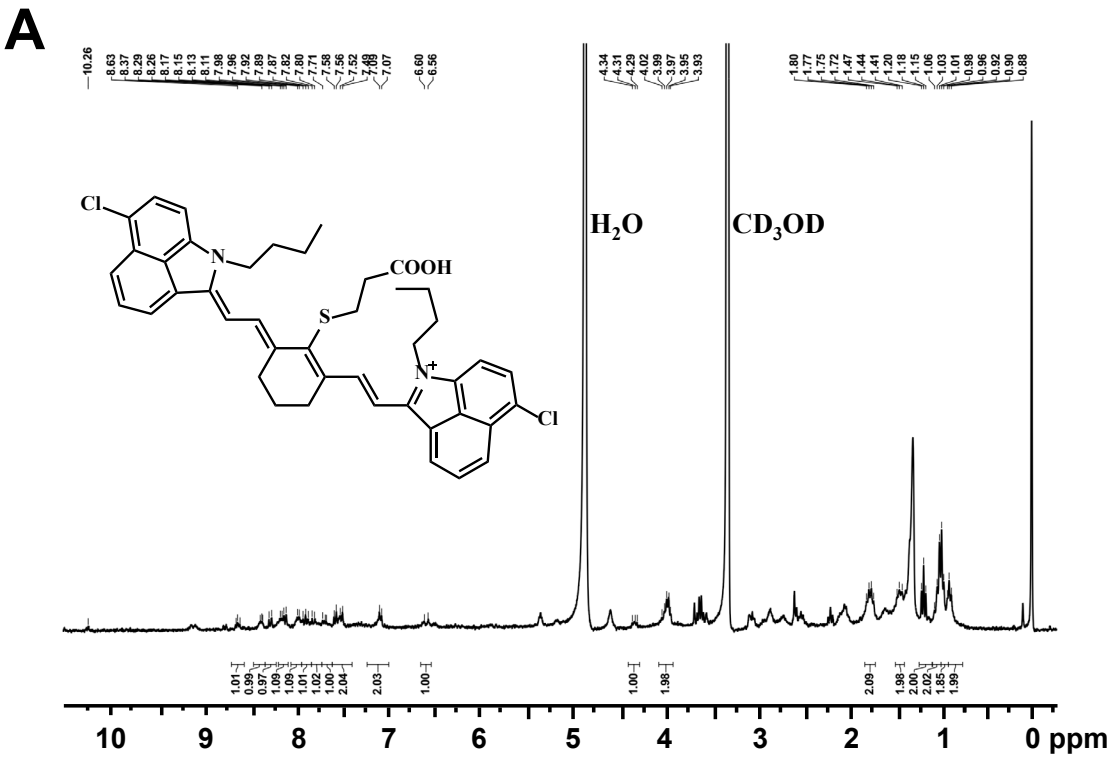
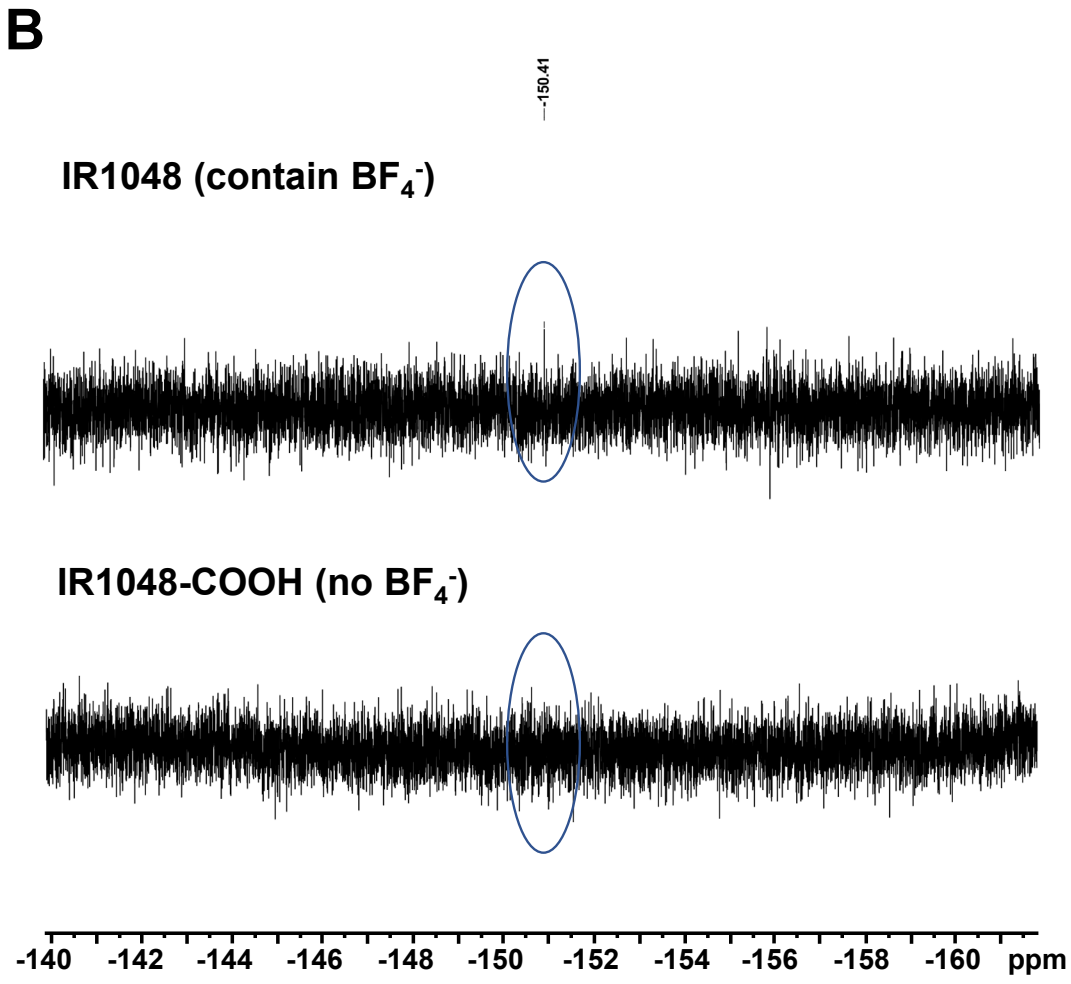


Figure S5. The modification of the hyperthermal near-infrared fluorescent dyes, IR1048-COOH.


A
Cl
N
COOH
S
N+
Cl
H2O
CD3OD
10
9
8
7
6
5
4
3
2
1
0 ppm


B
-150.41
IR1048 (contain BF4-)
IR1048-COOH (no BF4-)
-140
-142
-144
-146
-148
-150
-152
-154
-156
-158
-160
ppm

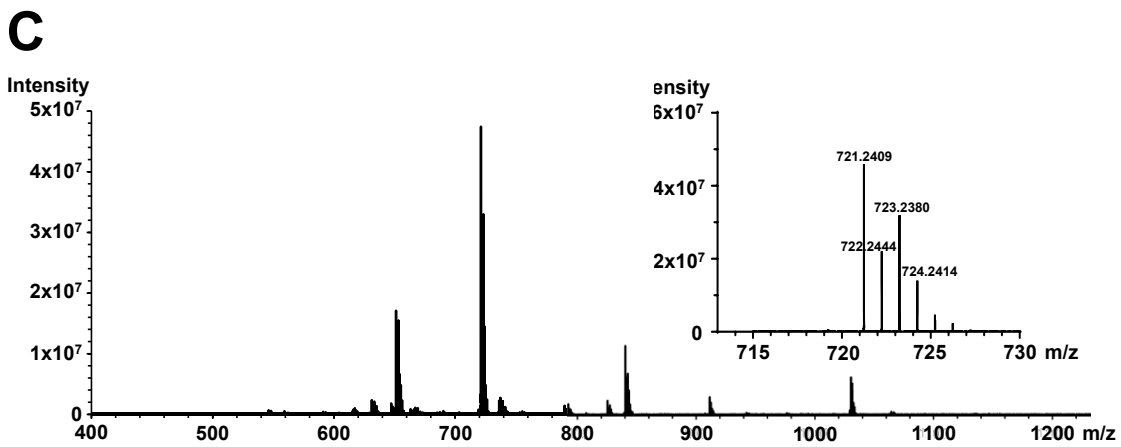


Figure S6. The characterization of the synthesized dyes, IR1048-COOH. A) ^{1}H-NMR spectrum. B) ^{19}F-NMR spectrum. C) The HRMS (TOF-MS).

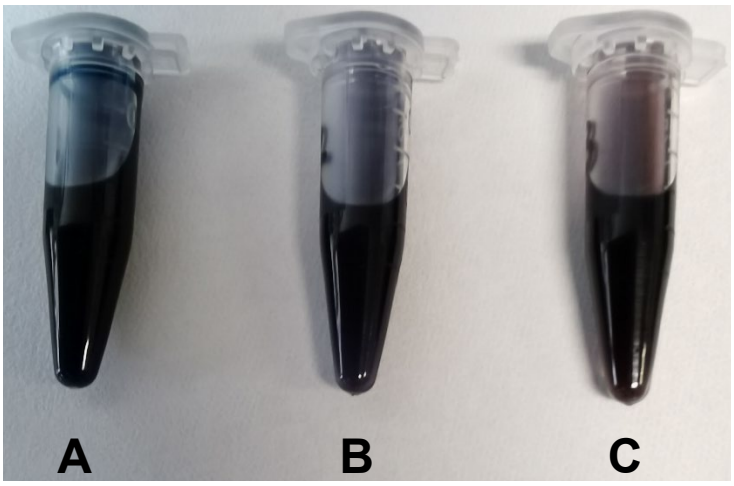


Figure S7. Digital images of A) PM-IR (1.2 mg mL^{-1}), B) PM2-IR (2.4 mg mL^{-1}) and C) PM2-IR2 (0.96 mg mL^{-1}) in DMF.

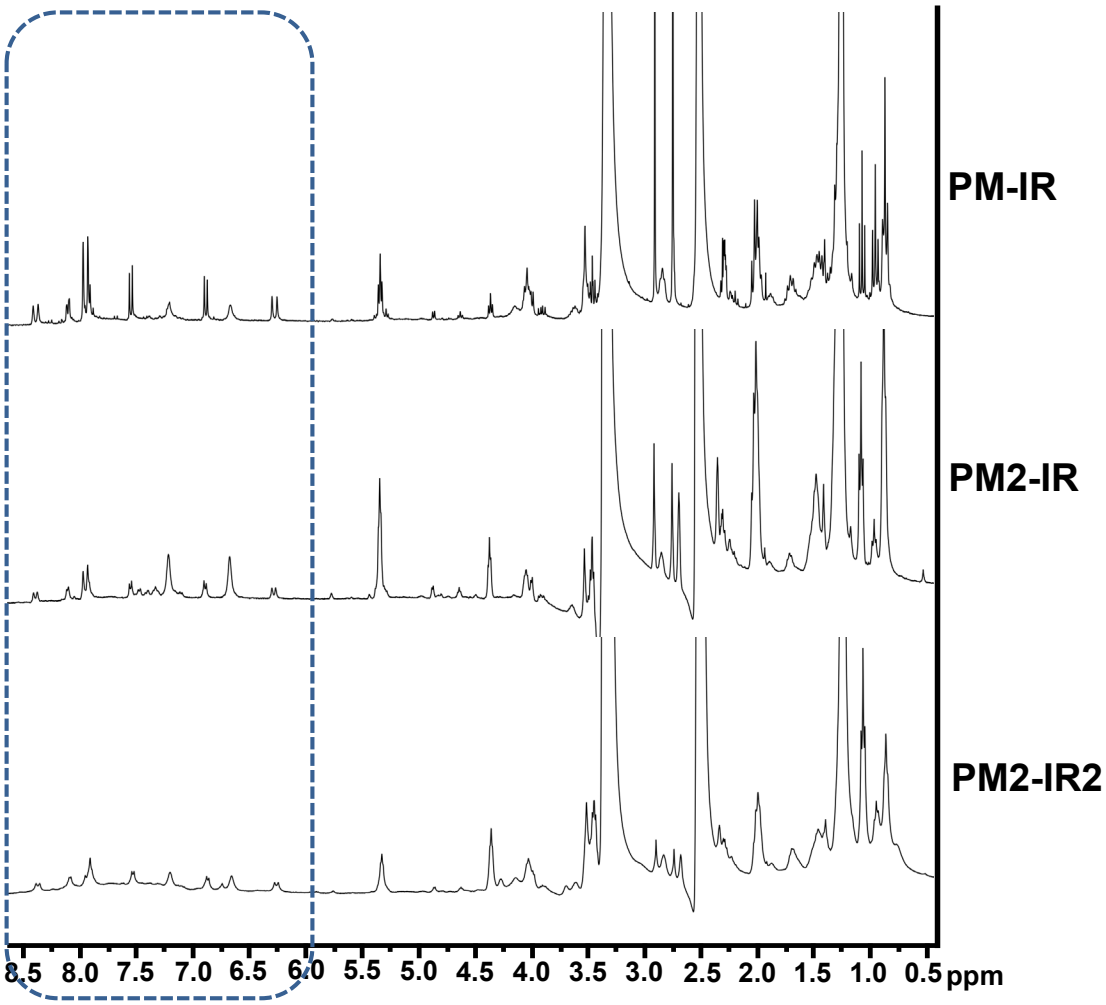


Figure S8. ^{1}H-NMR of PM-IR, PM2-IR and PM2-IR2 in *d*-DMSO. The IR1048 dye-related NMR peaks are shown in the dotted box.

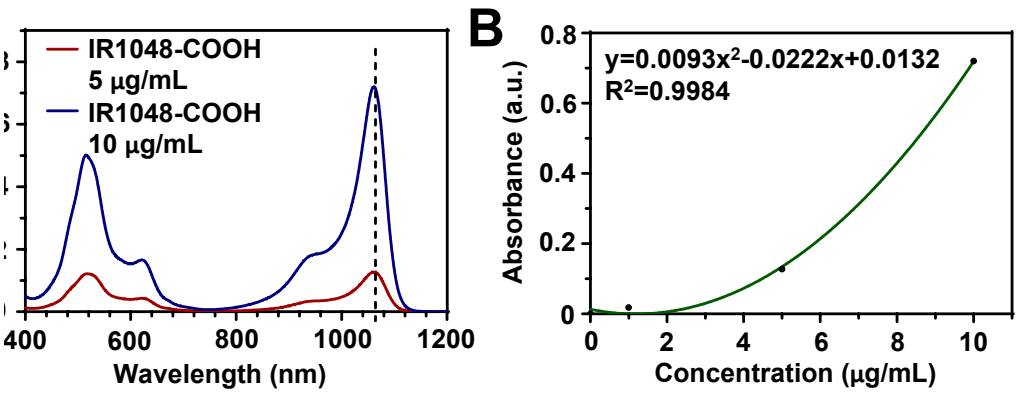


Figure S9. A) The UV-vis absorbance spectra of dye IR1048-COOH in DMF. B) Concentration absorbance at 1061.2 nm gradient of IR1048-COOH in DMF was used to determine the content of IR1048 dye in PM/M2-IR.

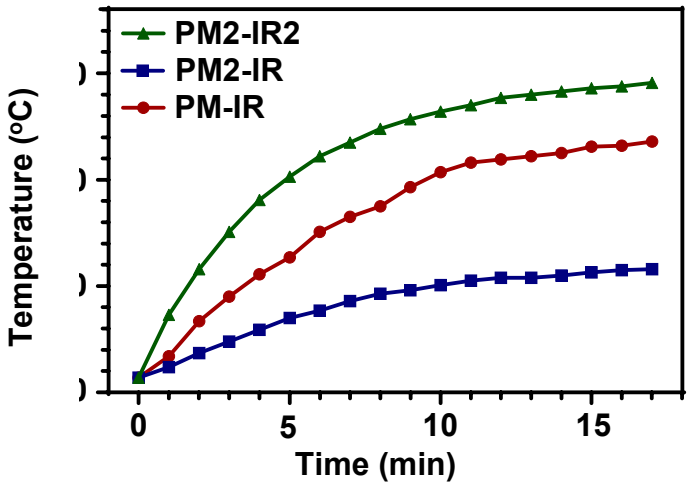


Figure S10. The curves of temperature elevation of different nanoparticles (0.312 mg mL^{-1} PM-IR, 0.2 mg mL^{-1} PM2-IR and 0.25 mg mL^{-1} PM2-IR2) upon illumination (1064 nm laser) with power densities 3.82 W cm^{-2}.

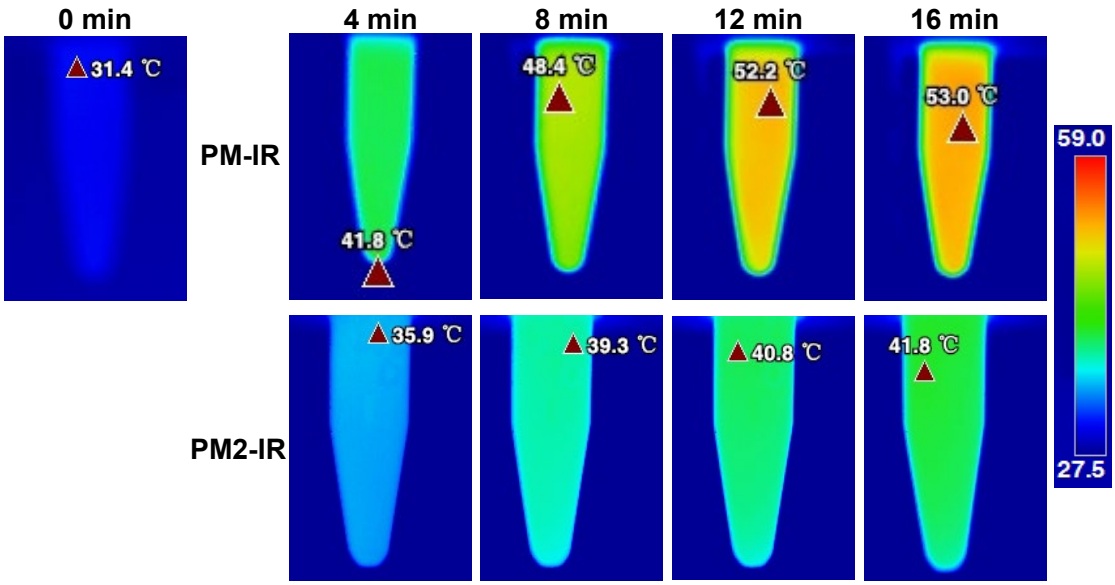


Figure S11. Infrared thermal images to record the changed temperature of PM-IR solution (0.312 mg mL^{-1}) and PM2-IR nanoparticles solution (0.2 mg mL^{-1}) upon 1064 nm NIR-II laser (3.82 W cm^{-2}) irradiation at different durations.

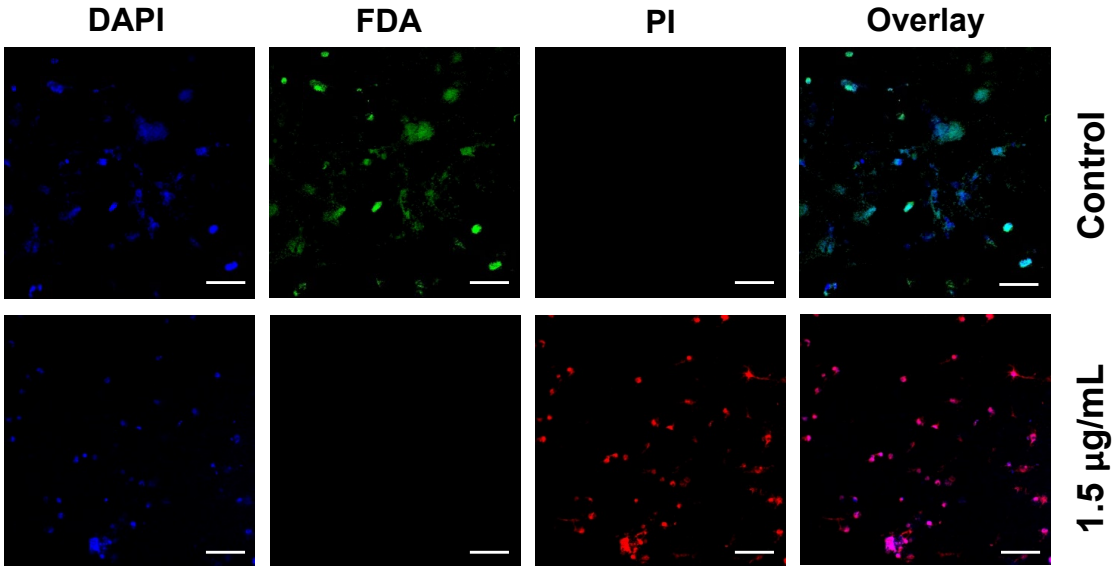


Figure S12. Laser confocal microscopy imaging of A2780DDP stained with DAPI, FDA and PI. A2780DDP cells with PM2-IR2 nanoparticles (0 and 1.5 μg mL^{-1} on basis of dye IR1048) after photothermal treatment (1064 nm, 3.82 W cm^{-2}), were stained by using DAPI (for cell nucleus, blue), FDA (for live cells, green) and PI (for dead cells, red). Scale bars represent 100 μm.

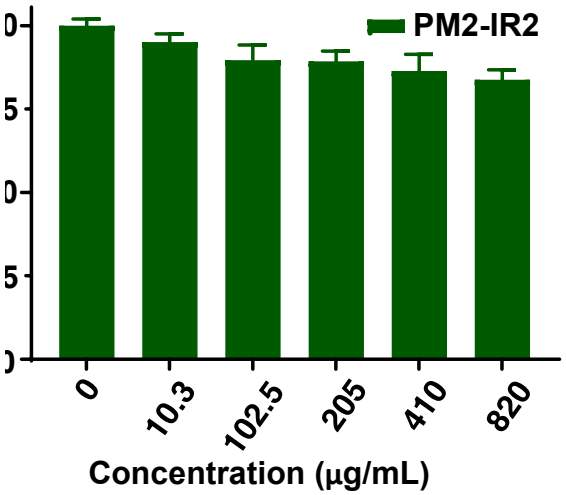


Figure S13. Cytotoxicity of PM2-IR2 nanoparticles via HUVEC cell assays without laser irradiation for 48 h.

References

[1] J. Li, L. Zheng, H. Xiao, C. Li, S. Wu, Y. Xiao, J. Liu, B. Zhang, *Polym. Chem.*, 2019, **10**, 5353-5363.