Electronic Supplementary Information

A novel strategy for low level laser-induced plasmonic photothermal therapy: the efficient bactericidal effect of biocompatible AuNPs@ (PNIPAAM-co-PDMAEMA, PLGA and Chitosan)

Alireza Gharatape^{1,2}, Morteza Milani^{1,3}, Seyed Hossein Rasta^{4,5}, Mohammad Pourhassan-Moghaddam^{6,7}, Sohrab Ahmadi-Kandjani⁸, Soodabeh Davaran ⁹* and Roya Salehi ¹⁰**

¹Department of Medical Nanotechnology, School of Advanced Medical Science, Tabriz University of Medical Science, Tabriz, Iran

² Student Research Committee, Tabriz University of Medical Science, Tabriz, Iran

3 Infectious and Tropical Diseases Research Center, Tabriz University of Medical Science, Tabriz, Iran

4 School of Medical Sciences, University of Aberdeen, Aberdeen AB24 5DT, United Kingdom.

5 Department of Medical Bioengineering, Tabriz University of Medical Sciences, Tabriz, Iran

6 Department of Medical Biotechnology, School of Advanced Medical Science, Tabriz University of Medical Sciences, Tabriz, Iran.

7 Future Industries Institute, University of South Australia, Mawson Lakes Campus, Mawson Lakes, South Australia 5095, Australia

8 Research Institute for Applied Physics and Astronomy, University of Tabriz, Tabriz, Iran

9 Drug Applied Research Center and Department of Medicinal Chemistry, Faculty of Pharmacy, Tabriz University of Medical Science, Tabriz, Iran

10 Research Center for Pharmaceutical Nanotechnology and Department of Medical Nanotechnology, School of Advanced Medical Science, Tabriz University of Medical Science, Tabriz, Iran

(🖂) Corresponding author 1: Soodabeh Davaran, Drug Applied Research Center and Department of Medicinal Chemistry, Faculty of Pharmacy, Tabriz University of Medical Science, Tabriz, Iran E-mail: davaran@tbzmed.ac.ir

(⊠) Corresponding author 2: Roya Salehi, Research Center for Pharmaceutical Nanotechnology and Department of Medical Nanotechnology, School of Advanced Medical Science, Tabriz University of Medical Science, Tabriz, Iran, E-mail: <u>salehiro@tbzmed.ac.ir</u>

Supplementary Experimental Section



Figure 1: Au nanoparticles were synthesized by following a citrate reduction process. (a) Before citrate addition, (b) After citrate addition, (c), 1 minute after citrate addition, (d) 5 minute after citrate addition. Color solution was changed from golden to wine red.





Figure 2: FT-IR spectra of chitosan confirm the successful modification of AuNPs with medium MW chitosan. Unique absorption bands can be found at 1554 cm⁻¹ (-NH2 bending), 1081 cm⁻¹ (C-O), 2925 cm⁻¹ (CH2), and 1695 cm⁻¹ (Au-N), 3452 cm⁻¹ (symmetric NH2) and (OH) at 889 cm⁻¹.



Figure 3: zeta-potential of chitosan-AuNPs is about +17.8mv.





Figure 4: zeta-potential of PDMAEM-co-PNIPAM-AuNPs is nearby -0.66mv.



Figure 5: FT-IR spectroscopic analysis of PDMAEM-co-PNIPAM approves the successful polymerization on gold nanoparticles surface. Specific absorption bands in spectrum were found at: 1095 cm⁻¹ (C=O), 1454 cm⁻¹ (NH bending bond), 1556 cm⁻¹ (amide NH), 1650 cm⁻¹ (NH-C=O), 1731 cm⁻¹ (O=C-O), 2869 cm⁻¹ (symmetric stretching of the CH₂), 2920 cm⁻¹ (asymmetric stretching of the CH₂) and 3413 cm⁻¹ (NH).



Figure 6: FT-IR spectroscopic analysis of PLGA approves the successful polymerization on gold nanoparticles surface. Specific absorption bands in spectrum were found at: 1101 cm⁻¹ (C-O), 1731 cm⁻¹ (O=C-O), 2111 cm⁻¹ (SH), 2871 cm⁻¹ (asymmetric stretching of the CH) and 3519 cm⁻¹ (OH).



Figure 7. *P. aeruginosa* treated groups after 2h incubation with Chitosan + radiation (a-c). (a) Control with chitosan, (b) Chitosan+20J NIR radiation (c) Chitosan+50J NIR radiation. After 2h incubation with PNIPAAM-co-PDMAEMA + NIR radiation (d-f). (d) Control (e) PNIPAAM-co-PDMAEMA + 20J NIR radiation (f) PNIPAAM-co-PDMAEMA + 50J NIR radiation. After 2h incubation with PLGA+ NIR radiation (h-j). (h) Control (i) PLGA+ 30J NIR radiation (j) PLGA+ 50J NIR radiation.



Figure 8: A.baumannii. Treated groups after 2h incubation with Chitosan + NIR radiation. (a) Control W.O chitosan (b) control with chitosan (c) Chitosan+20J NIR radiation (d) Chitosan+50J NIR radiation. After 2h incubation with PNIPAAM-co-PDMAEMA + NIR radiation. (e) Control (f) PNIPAAM-co-PDMAEMA + 20J NIR radiation (g) PNIPAAM-co-PDMAEMA + 60J NIR radiation. After 2h incubation with PLGA+ NIR radiation. (h) Control (i) PLGA+ 10J NIR radiation (j) PLGA+ 30J NIR radiation (k) PLGA+ 70J NIR radiation.