Supporting Information

A Smart Theranostic Platform for Photoacoustic and Magnetic Resonance Dual-imaging-guided Photothermal-Enhanced Chemodynamic therapy

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Figures

Figure S1. Stability of Au@MnO$_2$ dispersed in different physiological solutions within one week and corresponding photograph (inset) after one week. (a) water, (b) PBS, (c) DMEM and (d) FBS.
Figure S2. Hydrodynamic diameter of prepared Au nanoparticles dispersed in water over one week, indicating a good stability.

Figure S3. (a) Absorption and photograph (inset) of the Au nanosphere water dispersion. (b) Transmission electron microscopy (TEM) image of the Au nanospheres.
Figure S4. The preparation of Au@MnO₂ and the color change before and after reaction.

Figure S5. (a) The size distribution of the gold (Au) core. (b) The thickness of the manganese dioxide (MnO₂) shell.

Figure S6. The Hydrodynamic diameter of prepared Au@MnO₂ collected by dynamic light scattering.
**Figure S7.** EDS spectrum of Au@MnO₂ nanoparticles.

**Figure S8.** UV-Vis-NIR absorption spectra of Au@MnO₂ at different times after addition of (a) 6 mM, (b) 8 mM and (c) 10 mM GSH.
Figure S9 (a) Absorption spectra of Au@MnO₂ in the presence of GSH and H₂O₂ with different ratio (100:1, 50:1, 10:1, 5:1 and 1:1); (b) TEM image of the Au@MnO₂ in the presence of GSH and H₂O₂ with ratio of 1:1.

Figure S10. Thermal images of (a) water (control), gold (Au), gold@manganese dioxide (Au@MnO₂), Au+GSH, Au@MnO₂+GSH, Au@MnO₂+GSH +H₂O₂ and (b) an Au@MnO₂ aqueous dispersion with different concentrations (30, 60, 90, 120, and 150 µg/mL) in the presence of GSH after 15 min of 808 nm laser (1W/cm²) irradiation. Here, the Au is a nanosphere and GSH concentration is 10 mM and H₂O₂ concentration is 1 mM.

Figure S11. The time constant obtained for (a) gold@manganese dioxide (Au@MnO₂) and (b) Au@MnO₂ in the presence of glutathione (GSH).
Figure S12. (a) The absorption and (b) corresponding photograph of the methylene blue (MB) solution after a 30 min incubation under different conditions.

Figure S13. The methylene blue (MB) content after a 30 min incubation with (a) gold@manganese dioxide (Au@MnO₂) in the presence of 1 mM H₂O₂ with different glutathione (GSH) concentrations and (b) Au@MnO₂ in the presence of 10 mM GSH with different H₂O₂ concentrations.

Figure S14. The fluorescence intensity of TPA solution mixed with different concentration of GSH or H₂O₂: (a) GSH concentration changed from 0 to 2, 4, 6, 8 and 10 mM and kept H₂O₂ (1.0 mM); (b) H₂O₂ concentration changed from 0 to 0.125, 0.25, 0.5, 0.75 and 1.0 mM and kept GSH (10 mM).
Figure S15. The absorption of the red blood cells (RBCs) supernate after being treated by different concentrations of Au@MnO$_2$, PBS and water.

Figure S16 (a) MR imaging and (b) corresponding MR signal of normal organs and tumors in mice without (control) and with intravenous injection of Au@MnO$_2$ nanoparticles after 8 h; (c) Photoacoustic imaging and (d) corresponding photoacoustic signal values of normal tissue and tumors after intravenous injection of A@MnO$_2$ and Au nanoparticles for 8 h.
Figure S17. Confocal laser scanning microscopy images of the cell treated by different condition, which the live and dead cells are dyed by calcein-AM (green fluorescence) and propidium iodide (PI, red fluorescence) respectively. The incubation concentration of the Au@MnO₂, GSH, H₂O₂ are 75 ug/mL, 1 mM and 0.1 mM respectively. The laser is 808 nm with the density of 1 W/cm² and the irradiation time is 10 mins.

Figure S18. (a) The necrosis rate and (b) apoptosis rate obtained from tumor sections stained by hematoxylin and eosin (H&E) and terminal deoxynucleotidyl transferase dUTP nick end labeling (TUNEL), respectively.
Figure S19. Photograph of the tumors taken from the mouse for each group after 16 days treatment.