A Dual-Modal Therapeutic Role of Lactate Oxidase-Embedded Hierarchical Porous Zeolitic Imidazolate Framework as Nanocatalyst for Effective Tumor Suppression

Xi Zhou, † Wen Zhao, † Muxue Wang, † Shuai Zhang, † Yunhong Li, ‡ Wenxin Hu, † Lei Ren, †
Shenglin Luo, *, # Zhiwei Chen*, §

§ Department of Electronic Science, Fujian Provincial Key Laboratory of Plasma and Magnetic Resonance Research, School of Electronic Science and Engineering, Xiamen University, Xiamen, Fujian 361005, P. R. China.

† Department of Biomaterials, College of Materials, Xiamen University, Xiamen, Fujian 361005, P. R. China.

# State Key Laboratory of Trauma Burns and Combined Injury, Institute of Combined Injury, Chongqing Engineering Research Center for Nanomedicine, College of Preventive Medicine, Third Military Medical University, Chongqing 400038, P. R. China.

‡ Harvard College, Harvard University, 209 Dunster Mail Center, 945 Memorial Drive, Cambridge MA 02138, USA.

*Corresponding author:

chenzhiwei@xmu.edu.cn (Zhiwei Chen), luosl@tmmu.edu.cn (Shenglin Luo).
**Figure S1.** The TEM imaging of Au (a), Fe$_3$O$_4$ (c) and ZIF-8 (d) nanoparticles. (b) The UV-Vis-NIR absorption spectra of Au nanoparticles before and after modification.

**Figure S2.** The hydrodynamic diameters of Au&Fe$_3$O$_4$@ZIF-8, meso-Fe$_3$O$_4$@ZIF-8, and LFZ NPs in methanol solution respectively.
Figure S3. T$_2$-weighted MRI images of LFZ NPs (a) and plot of 1/T$_2$ of LFZ NPs (b) with different concentrations of Fe$_3$O$_4$.

Figure S4. The T$_2$-weighted MRI images of tumor-bearing mice before and after the injection of LFZ NPs in vivo (The tumor site is circled by the red rectangle).
Figure S5. The comparison of the catalytic performances of Fe$_3$O$_4$@ZIF-8 NPs with Fe$_3$O$_4$ NPs (a), and the comparison of the catalytic performances of LOD immobilized by ZIF-8 NPs with free LOD (b).

Figure S6. (a) The cell viability of MCF-7 incubated with ZIF-8, FZ, LZ, and LFZ NPs without lactic acid. (b) The cell viability of MCF-7 incubated with ZIF-8, FZ, LZ and LFZ NPs with lactic acid. (c) L-ascorbic acid-assisted cell rescue profiles of MCF-7 cells’ cytotoxicity induced by LFZ NPs.