Supplementary Material

Mo-doped ZnO NPs with NIR light enhanced peroxidase-like nanozyme as photocatalytic and antimicrobial applications

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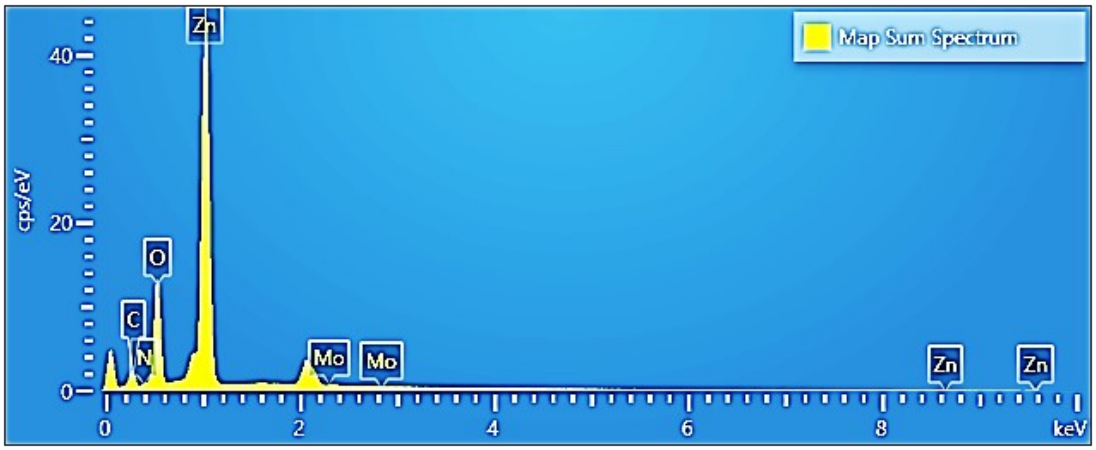
1. Materials

Sodium molybdate ($Na_2MoO_4 \cdot 7H_2O$), zinc nitrate ($ZnNO_3 \cdot 6H_2O$), Sodium hydroxide (NaOH), Acetic acid and Sodium acetate were obtained from Tianjin Zhiyuan Reagent Co. Ltd. Hexamethylene tetramine was obtained from Guangzhou Pharmaceuticals Co. Ltd. 3,3',5,5'-Tetramethylbenzidine (TMB) 3,3',5,5'-Tetramethylbenzidine (TMB) were purchased from Tianjin Hiens Biochemical Technology Co., Ltd. Ethanol, hydrogen peroxide (H_2O_2, 30 wt%) was bought from Sigma-Aldrich (Shanghai, China). *Staphylococcus aureus* (*S. aureus*, ATCC-6538), *Escherichia coli* (*E. coli*, ATCC-8099), *Ampicillin-resistant Escherichia coli* (AREC, SHBCC D25148) and *Methicillin-resistant Staphylococcus aureus* (MRSA, ATCC 43300) were received from Shanghai Bioresource Collection Center. All aqueous solutions used in the experiments were prepared with deionized water (18.2 MΩ ·cm, Millipore).

2. Characterization

Using a 200 kV accelerating voltage, the TecnaiG2 TF20 transmission electron microscopy (TEM) was used to examine the morphology and microstructure of the Mo/ZnO NPs. Therma Scientific K-Alpha Nessa X-ray photoelectron spectroscopy (XPS) fitted with Al X-ray source analysis was used to examine the molecular states of the Mo/ZnO NPs. Additional verification of the its composition was conducted using a Bruker Tensor 27 spectrometer that was connected to the Hyperion microscope. The spectrometer had an MCT (HgCdTe) detector that was cooled using liquid nitrogen. Using a Beijing General Analysis Instrument Co. Ltd. TU-1901 Double beam UV-visible spectrophotometer, UV-vis absorption spectra were measured.

Figures:



Map Sum Spectrum		
Element	Wt%	Wt% Sigma
C	10.41	0.26
N	0.33	0.19
O	20.33	0.13
Zn	68.76	0.28
Mo	0.16	0.14
Total:	100.00	

Fig. S1 The EDS spectrum of the Mo/ZnO NPs microstructures.

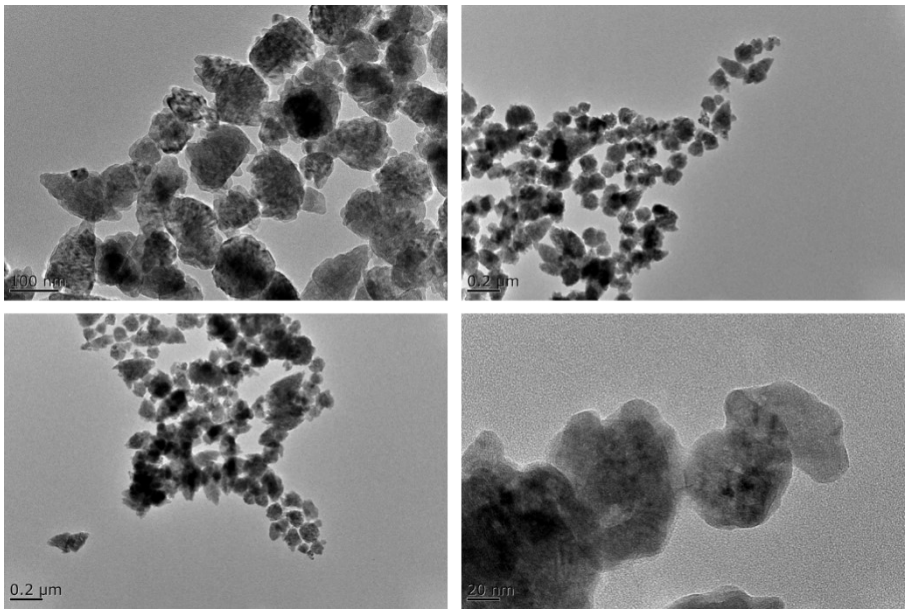


Fig. S2 TEM image of Mo/ZnO

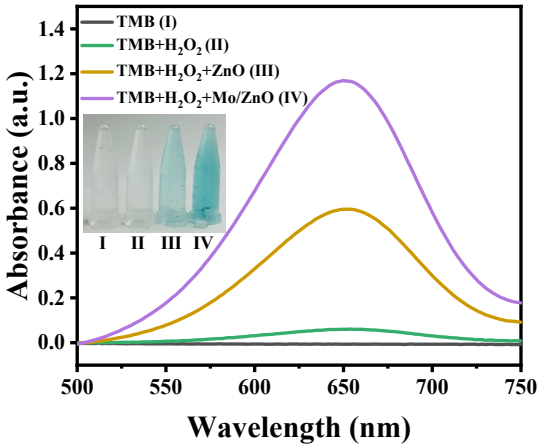
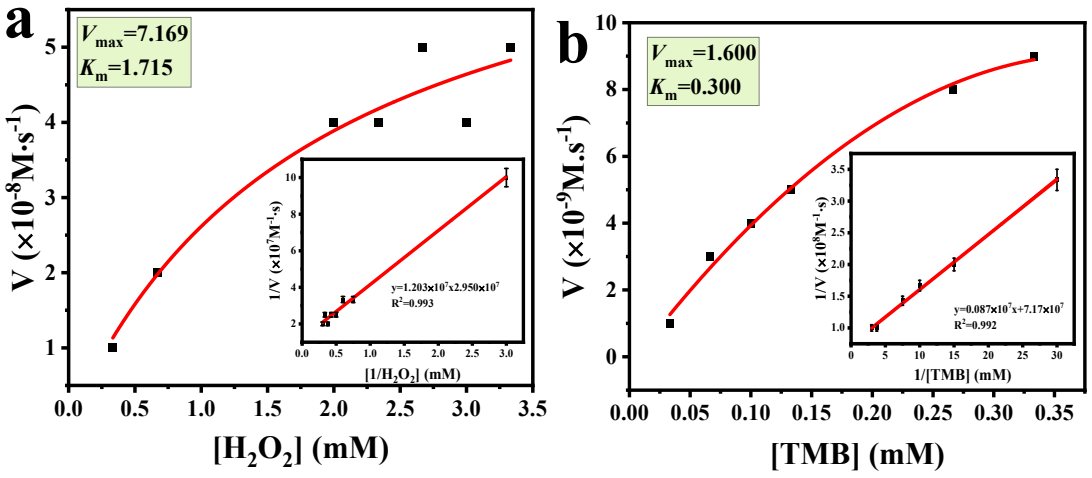


Fig.S3 Comparison of POD-like activity of ZnO and ZnO@Mo



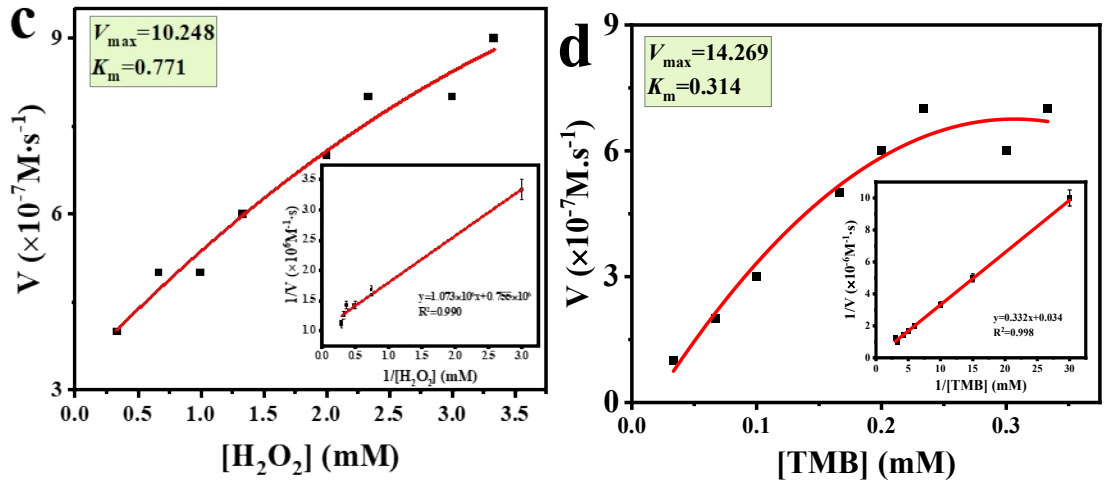


Fig. S4 Steady-state kinetic analysis of Mo/ZnO NPs (a) H_2O_2, (b) TMB; Mo/ZnO NPs (c) H_2O_2+NIR, (d) TMB+NIR;

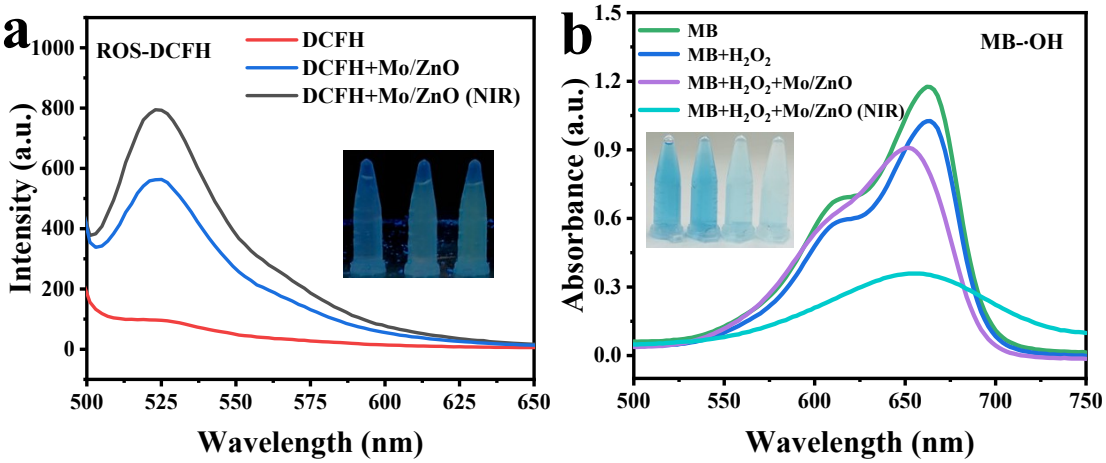


Fig. S5 (a)The DCFH validation of ROS. (b) The MB validation of ·OH.

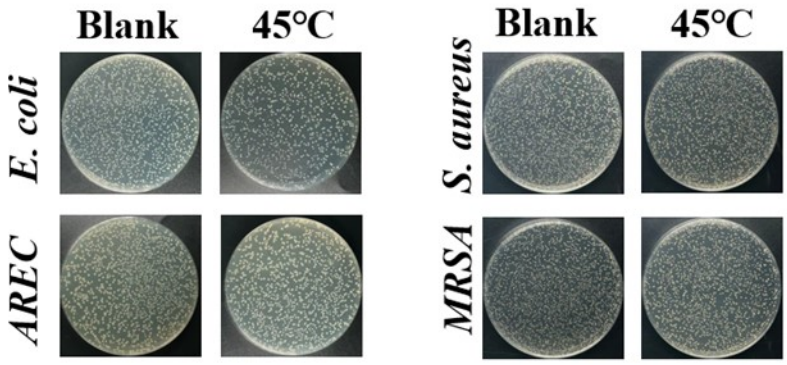


Fig. S6 The influence of temperature on *E. coli*, AREC, *S. aureus* and MRSA.

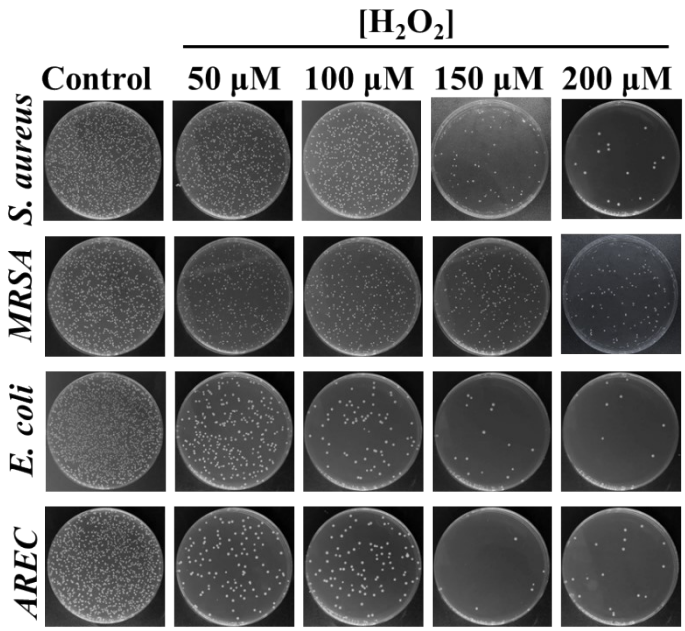
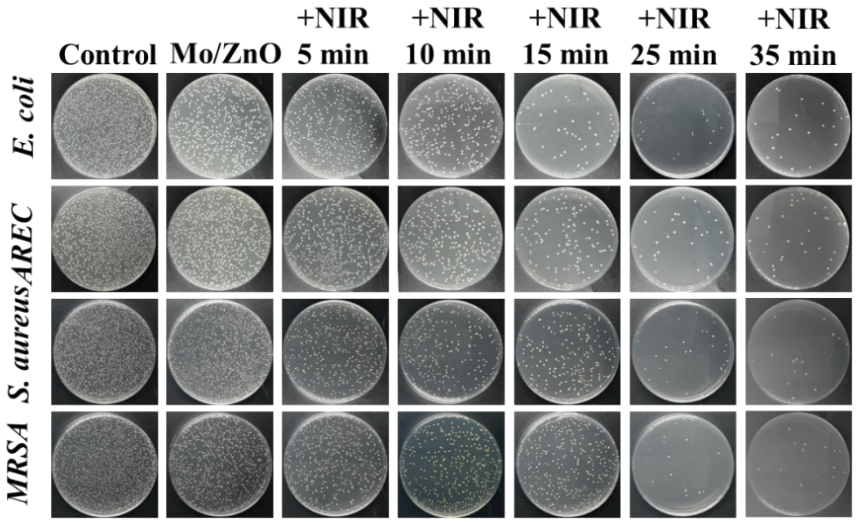


Fig. S7 The effect of H_2O_2 concentration on the antibacterial activity of Mo/ZnO NPs.



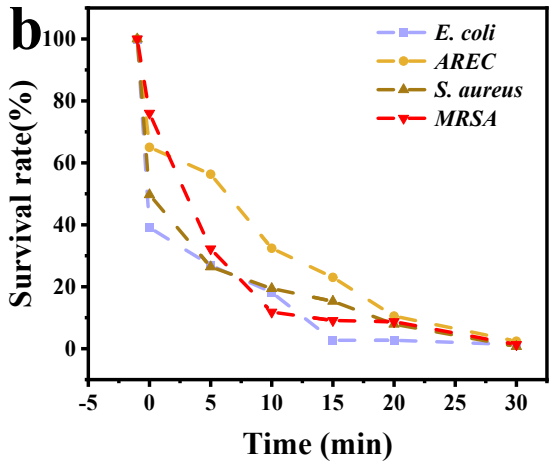
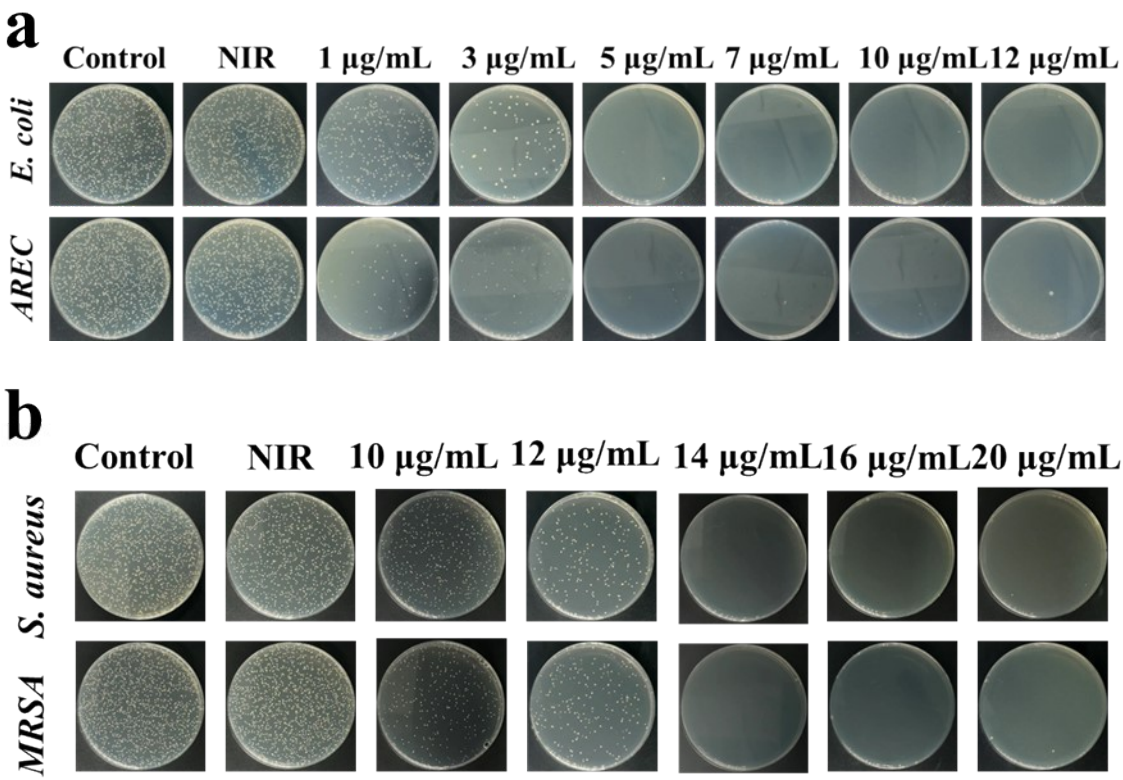


Fig. S8 The effect of reaction time on the antibacterial activity of Mo/ZnO NPs.



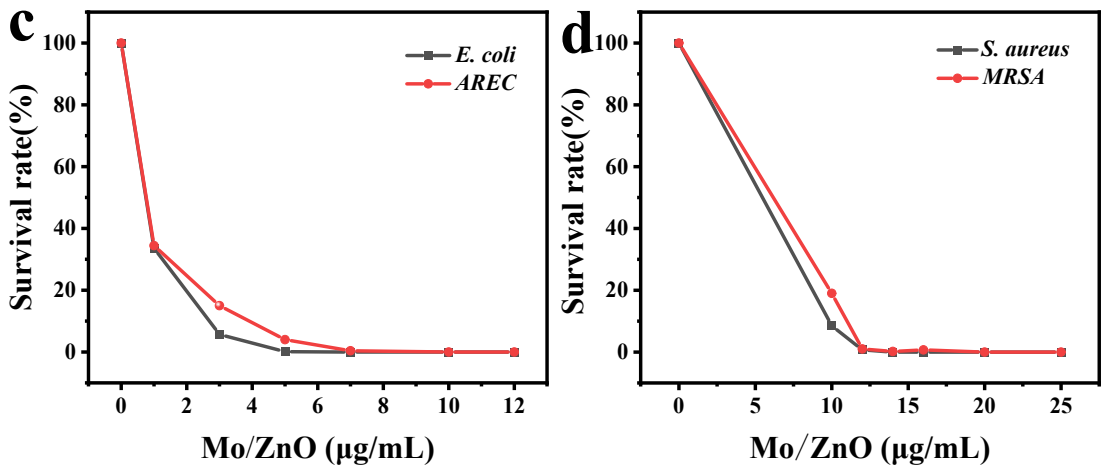


Fig. S9 Effect of antimicrobial activity of Mo/ZnO NPs concentration.

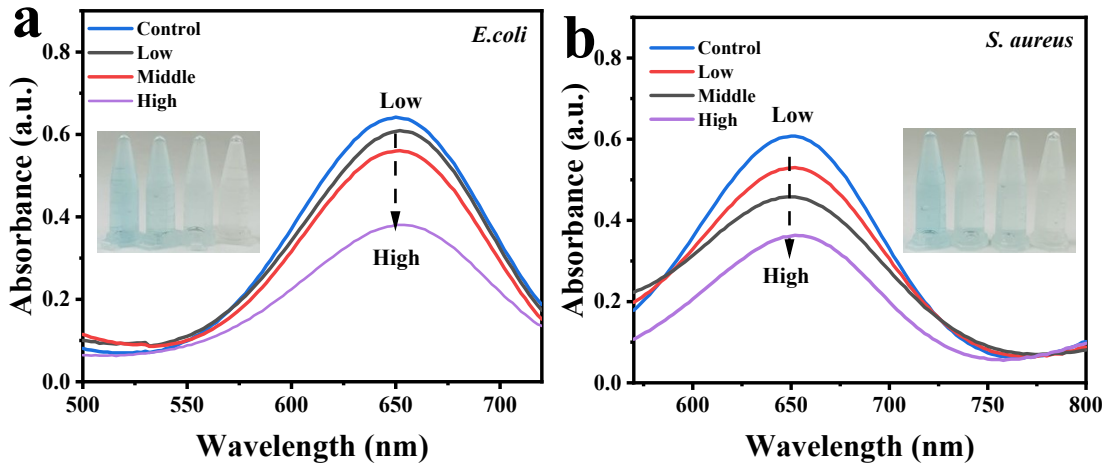


Fig. S10 ROS generated by Mo/ZnO NPs and the H_2O_2 system are absorbed by bacteria.

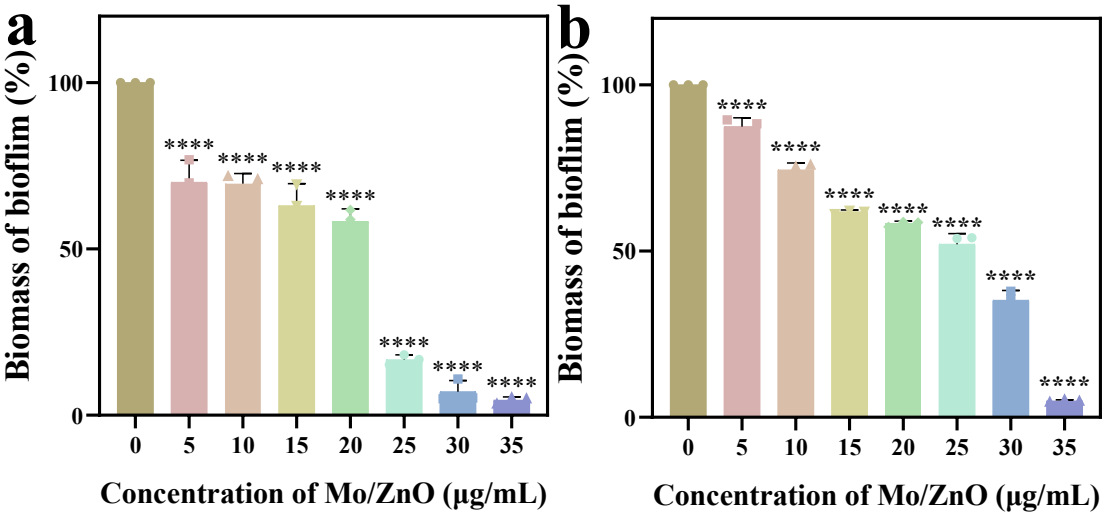


Fig. S11 Performance of Mo/ZnO NPs in inhibiting biofilm production by AREC,

MRSA.

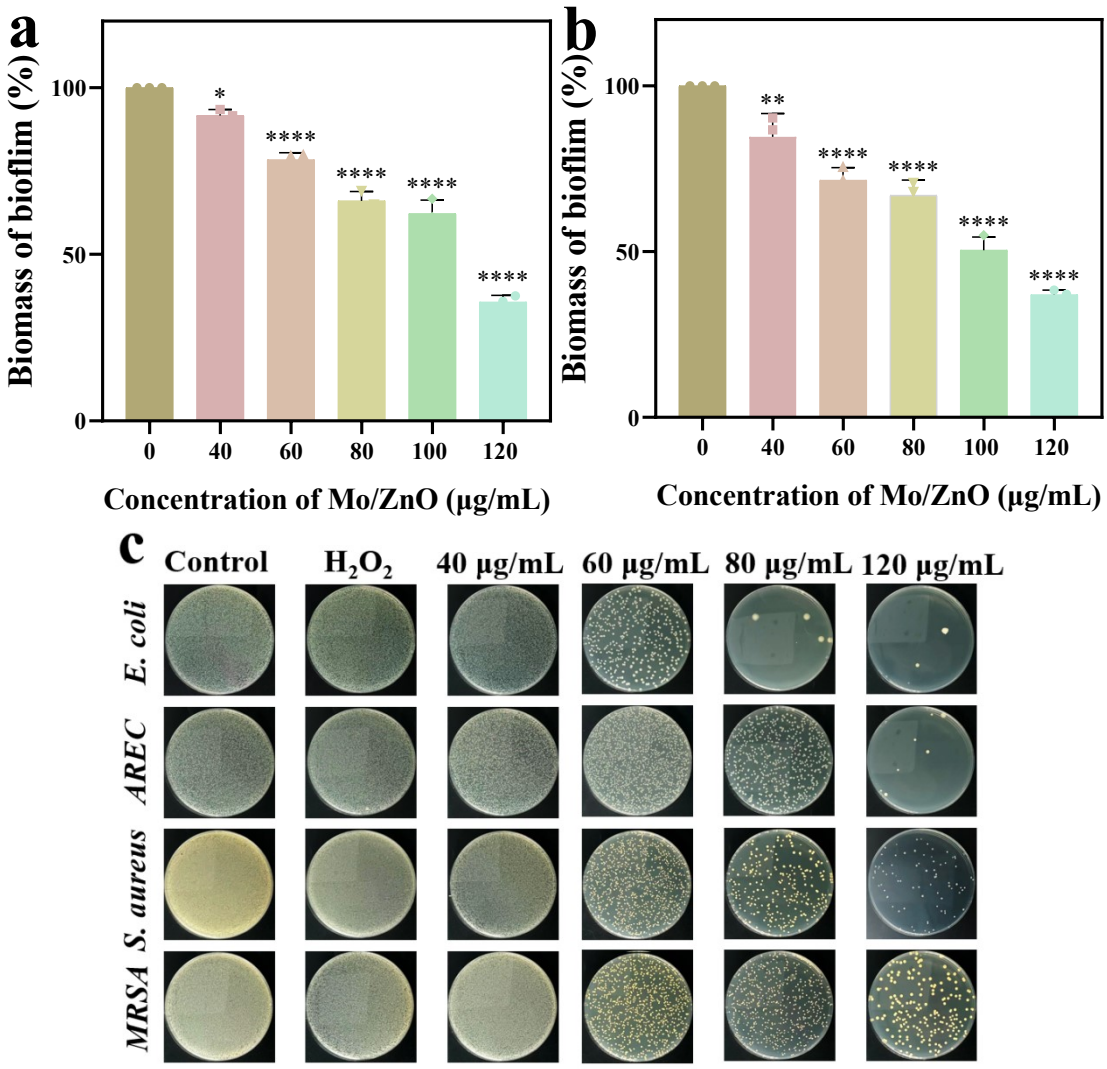


Fig. S12 (a-b) Performance of Mo/ZnO NPs in eliminating mature biofilms of AREC, MRSA. (c)The formed biofilm was beaten into PBS and mixed well before coating the plate.

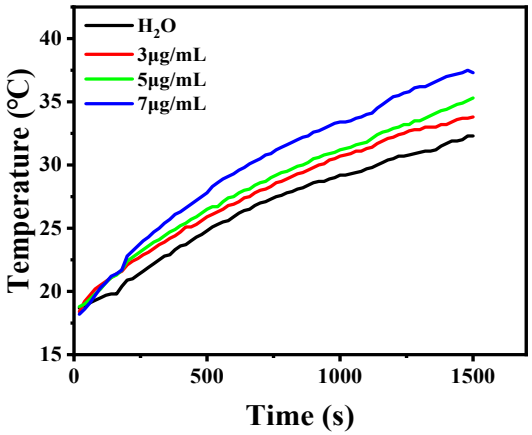


Fig. S13 Temperature elevation curves of Mo/ZnO NPs at the different concentrations irradiated by 808 nm laser