

Supplement information

Tartaric acid stabilized iridium nanoparticles with excellent laccase-like activity

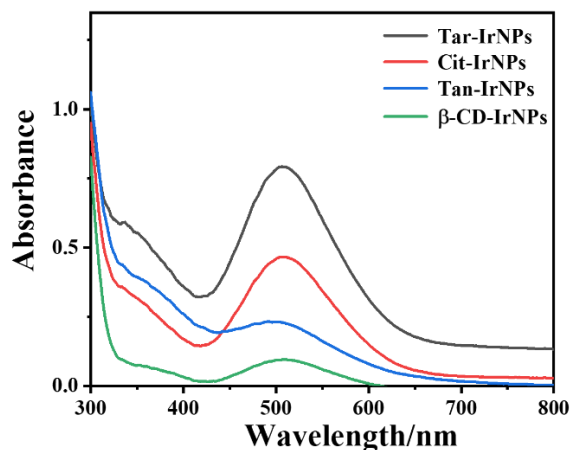


Fig. S1 Comparison of the laccase-like activity of iridium nanoparticles. Reaction conditions: 260 μM 2,4-DP, 210 μM 4-AP, 43 $\mu\text{g/ml}$ IrNPs, 2 mL 0.1 M acetate buffer solution (pH=7.0).

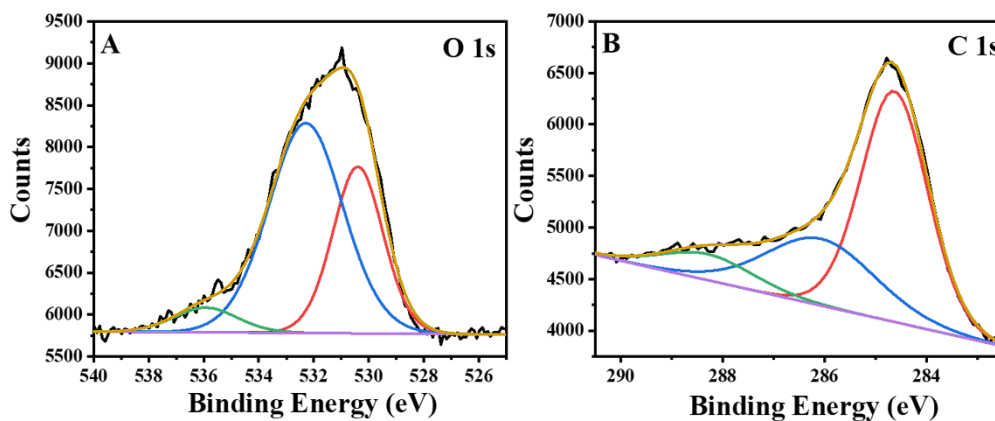


Fig. S2 (A) XPS spectrum in the O 1s region of Tar-IrNPs. (B) XPS spectrum in the C 1s region of Tar-IrNPs.

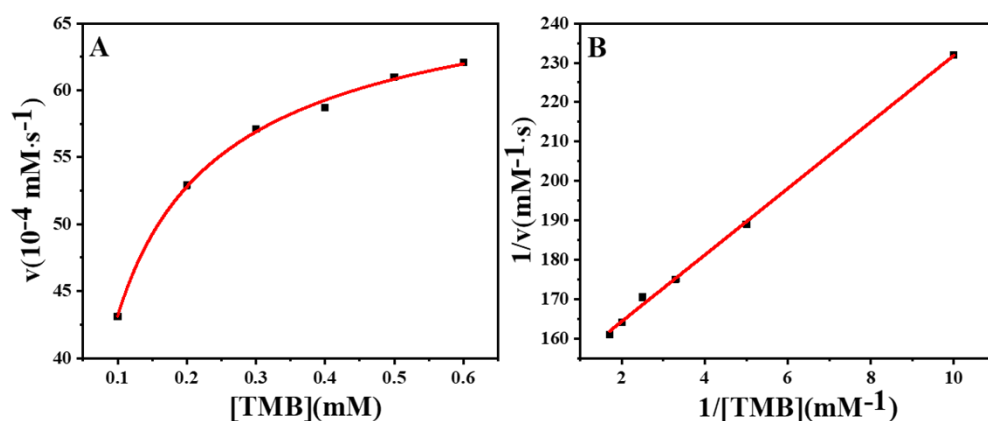


Fig. S3 (A) Steady state kinetic assay of oxidase-like activity of Tar-IrNPs at room temperature. (B) Double-reciprocal plots of oxidase-like activity of Tar-IrNPs. Reaction conditions: 0.1 M acetate buffer solution (pH 4.0) in the presence of $10 \mu\text{g/mL}$ Tar-IrNPs. The kinetic constants were determined in the presence of different concentrations of TMB (0.1-0.6 mM).

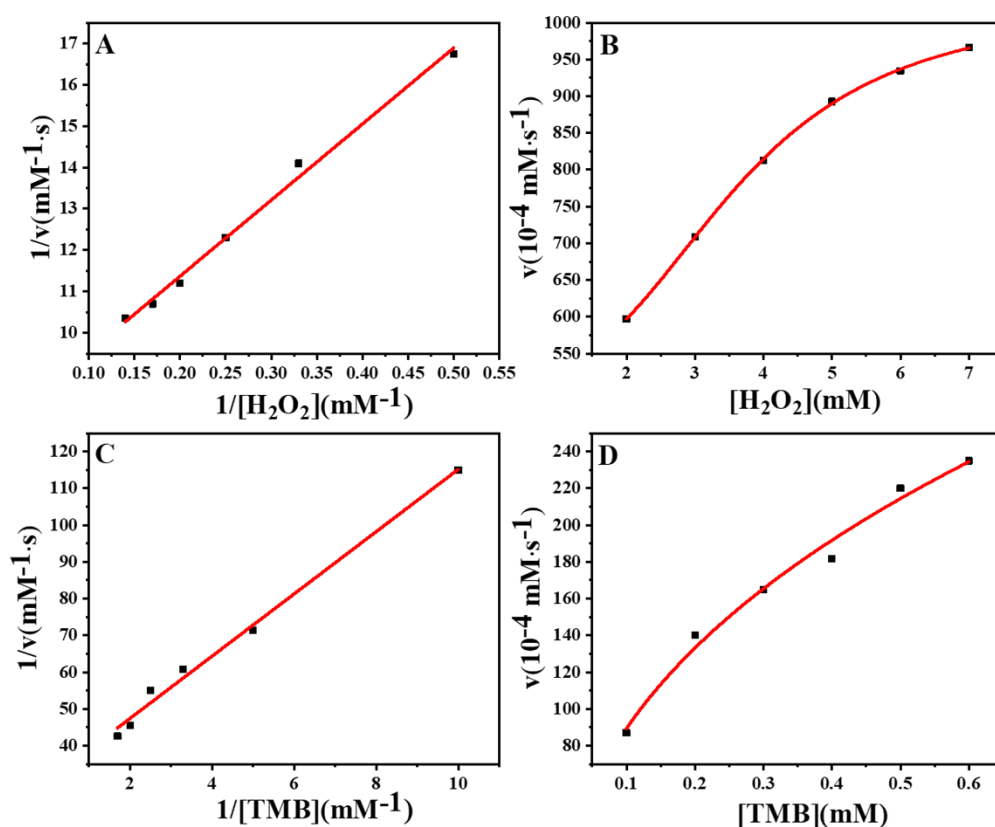


Fig. S4 Steady-state kinetic assay of peroxidase-like activity of the TA-IrNPs. The Lineweaver-Burk curves obtained from (A) H_2O_2 and (C) TMB. The dependence of the catalytic reaction rates on the concentration of the substrate (B) H_2O_2 and (D) TMB.

Table S1.**Kinetic parameters of peroxidase-like activities of Tar-IrNPs and other reported nanozymes.**

enzyme	[E] (M)	substrate	K _m (mM)	V _m (10 ⁻³ mM·s ⁻¹)	K _{cat} (10 ⁻³ s ⁻¹)	ref
Cit-IrNPs	3.4×10 ⁻⁷	TMB	0.0906	1.7	0.5	[1]
		H ₂ O ₂	0.27	1.5	0.44	
HRP	2.5×10 ⁻¹¹	TMB	0.434	0.1	0.4	[2]
		H ₂ O ₂	3.7	0.871	0.348	
PVP-IrNPs	1.97×10 ⁻⁹	TMB	0.02	0.108	0.055	[3]
		H ₂ O ₂	266	0.385	0.196	
Tar-IrNPs	3.17×10 ⁻⁷	TMB	0.278	2.2	0.69	This work
		H ₂ O ₂	0.43	1.8	0.56	

Table S2.**Kinetic parameters of laccase-like activities of Tar-IrNPs and Natural laccase.**

Catalyst	K _m (mM)	V _m (10 ⁻³ mM·s ⁻¹)
Natural Laccase	0.41	0.122
Tar-IrNPs	0.204	5.4

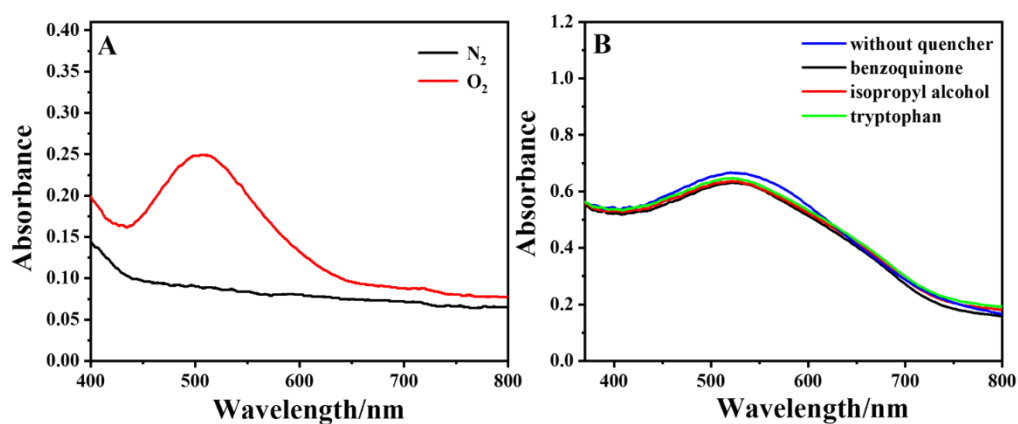


Fig. S5. (A) The effect of different atmospheric conditions on the activity of Tar-IrNPs. (B) The UV-vis absorption spectra of the oxidized product of PPD in the presence of Tar-IrNPs and different ROS scavengers.

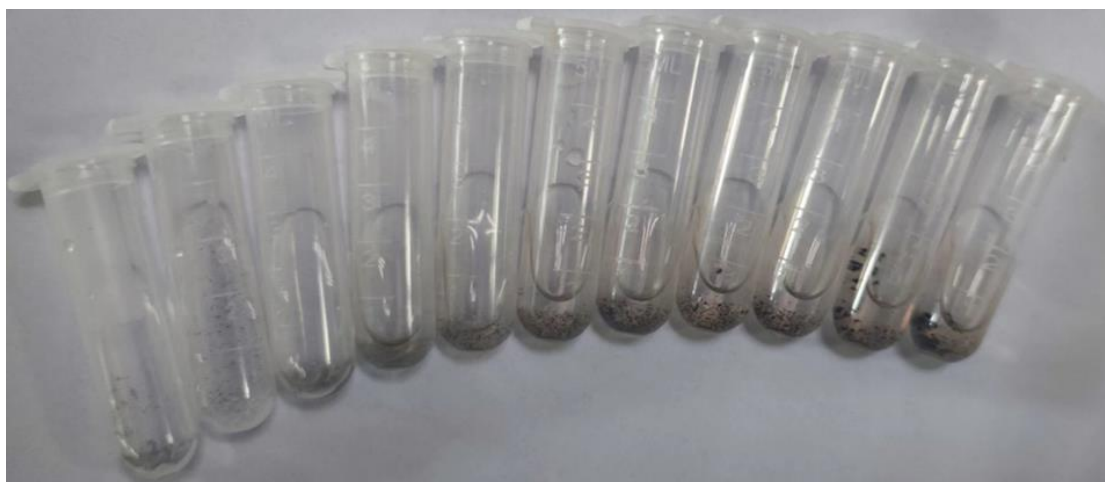


Fig. S6. Adding Tar-IrNPs to the PPD solution after a period of reaction (The PPD concentration increases from left to right).

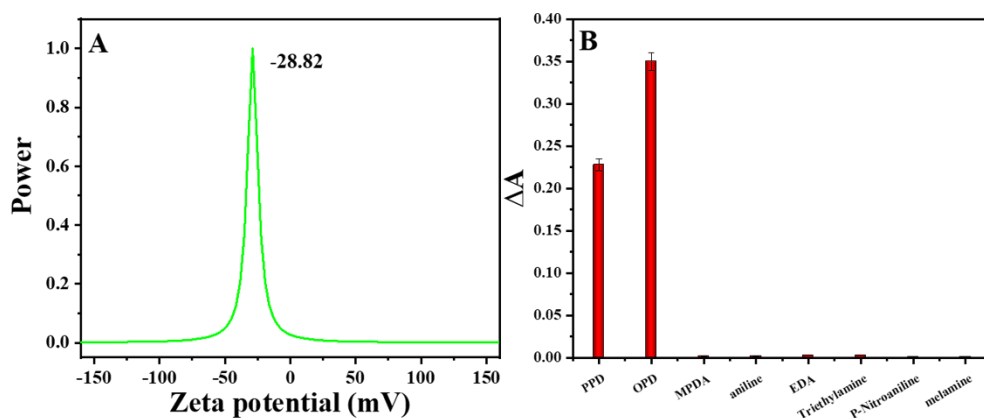


Fig. S7. (A) The zeta potential of Tar-IrNPs. (B) Effect of other molecules on the chromogenic reaction.

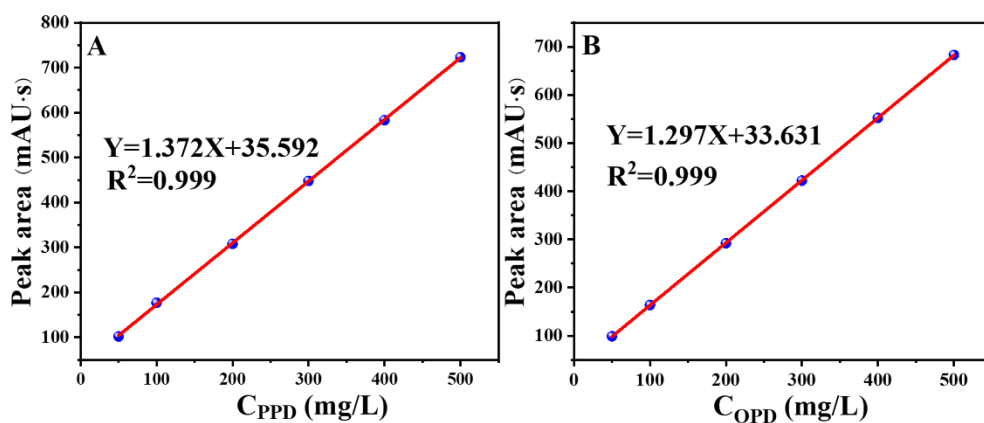


Fig. S8. The calibration curve for PPD and OPD analysis by HPLC method.

References

- [1] G. Jin, J. Liu, C. Wang, W. Gu, G. Ran, B. Liu, Q. Song, Ir nanoparticles with multi-enzyme activities and its application in the selective oxidation of aromatic alcohols, *Applied Catalysis B: Environmental*, 267 (2020).
- [2] J.L. Dong, L.N. Song, J.J. Yin, W.W. He, Y.H. Wu, N. Gu, Y. Zhang, Co₃O₄ Nanoparticles with Multi-Enzyme Activities and Their Application in Immunohistochemical Assay, *Acs Applied Materials & Interfaces*, 6 (2014) 1959-1970.
- [3] H. Su, D.D. Liu, M. Zhao, W.L. Hu, S.S. Xue, Q. Cao, X.Y. Le, L.N. Ji, Z.W. Mao, Dual-Enzyme Characteristics of Polyvinylpyrrolidone-Capped Iridium Nanoparticles and Their Cellular Protective Effect against H₂O₂-Induced Oxidative Damage, *ACS Appl Mater Interfaces*, 7 (2015) 8233-8242.