

Electronic Supplementary Information

Atomically dispersed Fe-Zn dual-site nanozymes with synergistic catalytic effects for the simultaneous detection of Cr(VI) and 8-hydroxyquinoline

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Table S1 Comparison of the kinetic parameters of different single-atom nanozymes and HRP.

Catalyst	Substrate	V_{max} (10^{-8} M·s ⁻¹)	W (mg/L)	K_m (mM)	Ref.
FeSNC	TMB	201	16	2.46	[2]
	H ₂ O ₂	261		25.44	
Fe ₅₅ -NC	TMB	27	1	0.37	[3]
	H ₂ O ₂	23		4.90	
BiSA@Au-200	TMB	92	33.3	1.54	[4]
	H ₂ O ₂	79.6		59.6	
Fe-NC-800NTs	TMB	65	5	0.08	[5]
	H ₂ O ₂	15.7		2.47	
HRP	TMB	10	0.001	0.43	[6]
	H ₂ O ₂	8.71		3.70	
FeZn-NC	TMB	3.1	3.25	0.05	This work
	H ₂ O ₂	2.5		0.07	
MWCN/FeZn-NC	TMB	4.3	3.25	0.04	This work
	H ₂ O ₂	6.9		1.34	

Table S2 Comparison of the proposed method with other methods for the detection of Cr(VI).

No.	Method	Materials	Linear Rang (μM)	LOD (μM)	Ref.
1	Colorimetry	PNPG-PEG	0.01-12.5	0.012	[7]
2	Colorimetry	GO	0.07-0.43	0.0058	[8]
3	Colorimetry	AuNR@Ag	5-35	1	[9]
4	Colorimetry	CeO ₂ NRs-MOF	0.03-5	0.02	[10]
5	Colorimetry	CoFe ₂ O ₄ /H ₂ PPOP	0.6-100	0.026	[11]
6	Fluorescence	NH ₂ -CuMOFs	0.1-20	0.018	[12]
7	Fluorescence	CQDS	1.5-30	0.023	[13]
8	Fluorescence	GCPF	0-50	0.22	[14]
9	Colorimetry	FeZn-NC	1-10	0.56	This work
10	Colorimetry	MWCN/FeZn-NC	0.1-15	0.040	This work

Table S3 Comparison of the proposed method with other methods for the detection of 8-HQ.

No.	Method	Materials	Linear Rang (μM)	LOD (μM)	Ref.
1	Electrochemical	CoPc-SPCE	10-250	0.89	[15]
2	Electrochemical	ANSA-GC	0.5-425	0.16	[16]
3	Electrochemical	SLSMCNTPE	0.2-1000	0.11	[17]
4	Colorimetry	FeZn-NC	0.4-50	0.18	This work
5	Colorimetry	MWCN/FeZn-NC	0.15-50	0.055	This work

Table S4 Analytical results of the 8-HQ determination in samples.

Sample	Initial (μM)	Added (μM)	Found (μM)	Recovery (%)	RSD (% , n=5)
Hair oil	-	5.0	5.27 ± 0.12	105.4	2.4
		25.0	26.43 ± 0.36	105.7	1.4
		45.0	46.13 ± 0.28	102.5	0.6
Conditioner	-	5.0	4.86 ± 0.10	97.2	2.0
		25.0	25.78 ± 0.37	103.1	1.4
		45	45.59 ± 0.14	101.3	0.3

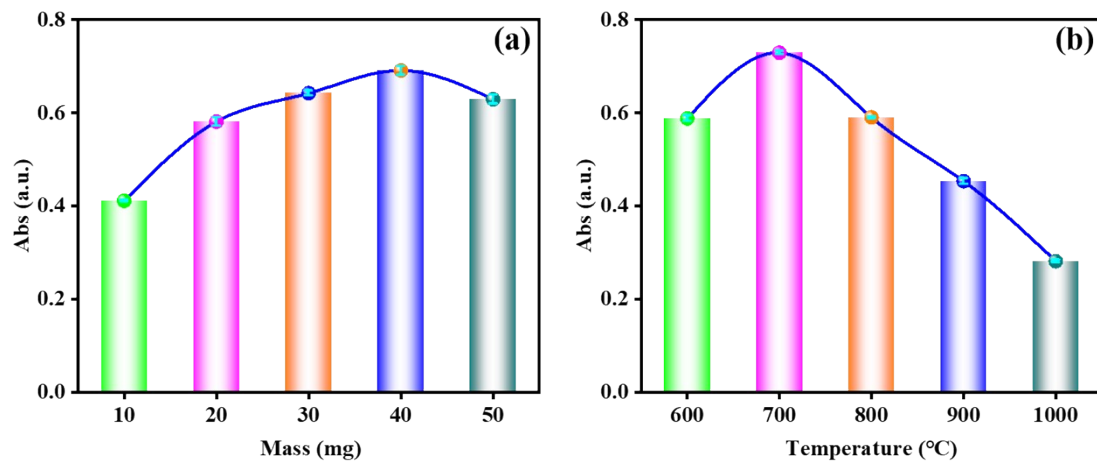


Fig. S1 Effect of MWCN (a) and temperature (b) on the catalytic activity of MWCN/FeZn-NC.

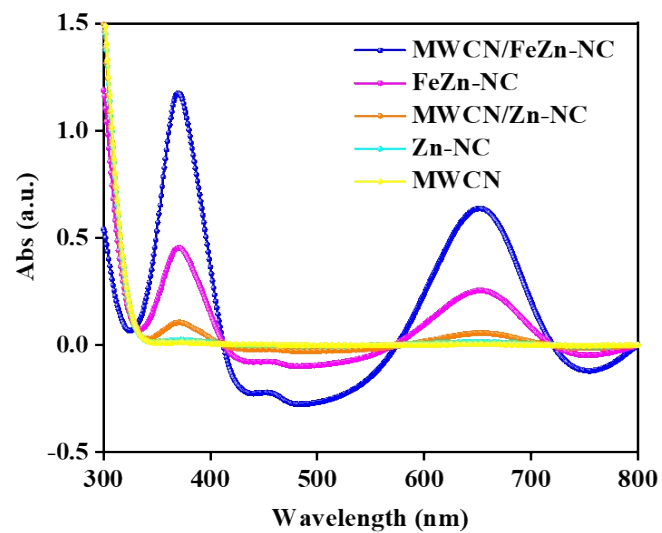


Fig. S2 UV-vis spectra of different materials in the H_2O_2/TMB solution.

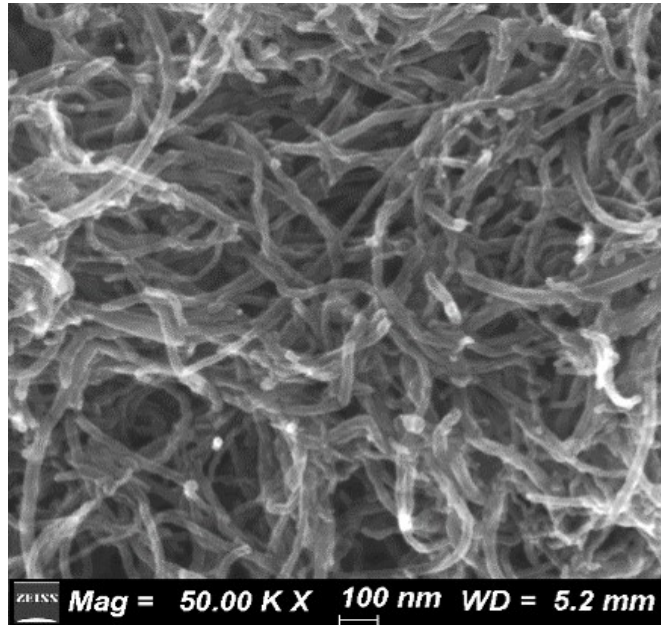


Fig. S3 SEM images of the MWCN.

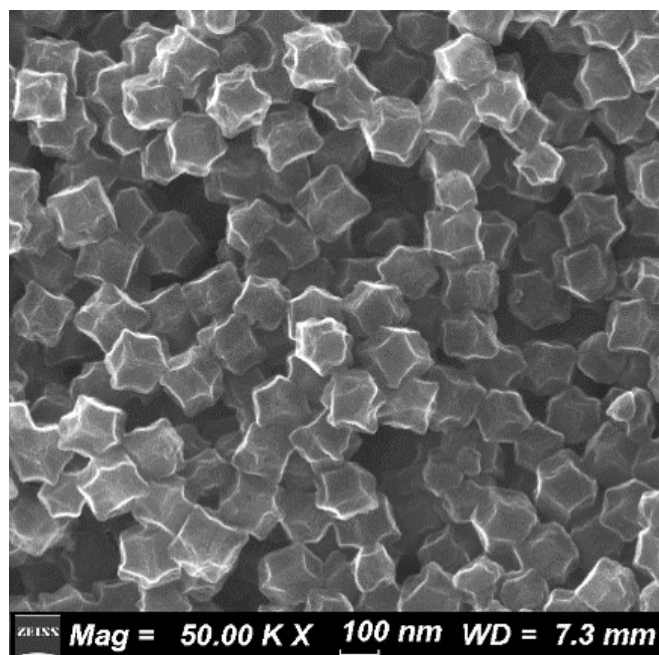


Fig. S4 SEM images of the FeZn-NC.

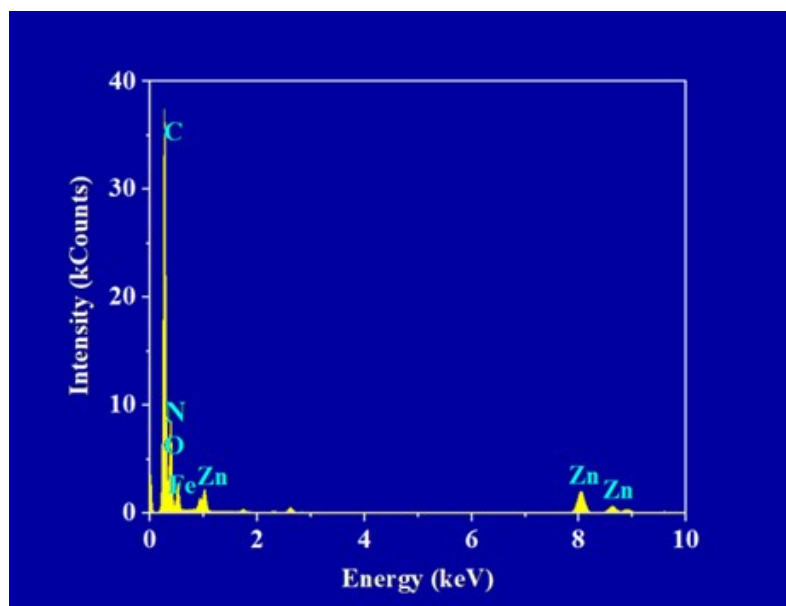


Fig. S5 EDS images of the MWCN/FeZn-NC.

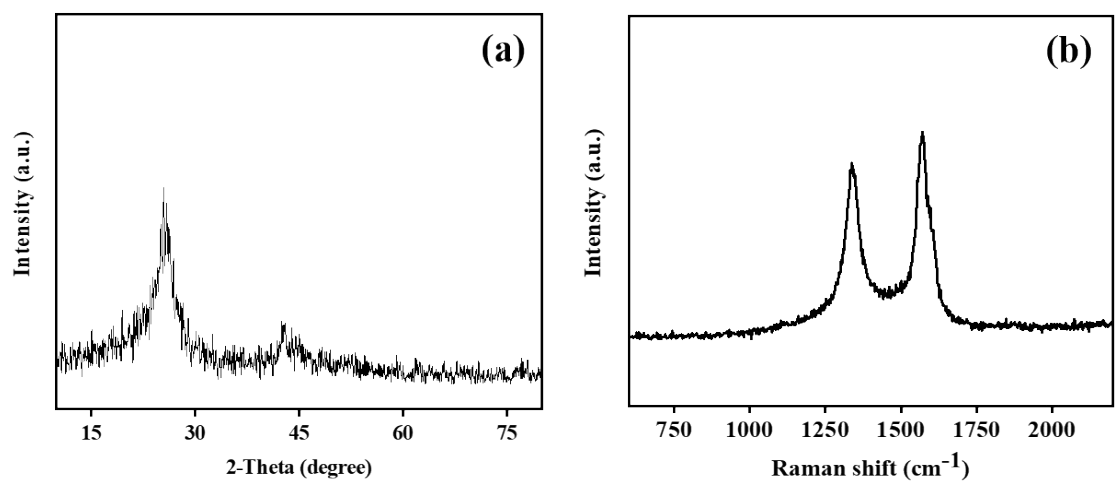


Fig. S6 XRD (a) and Raman (b) images of the MWCN/FeZn-NC.

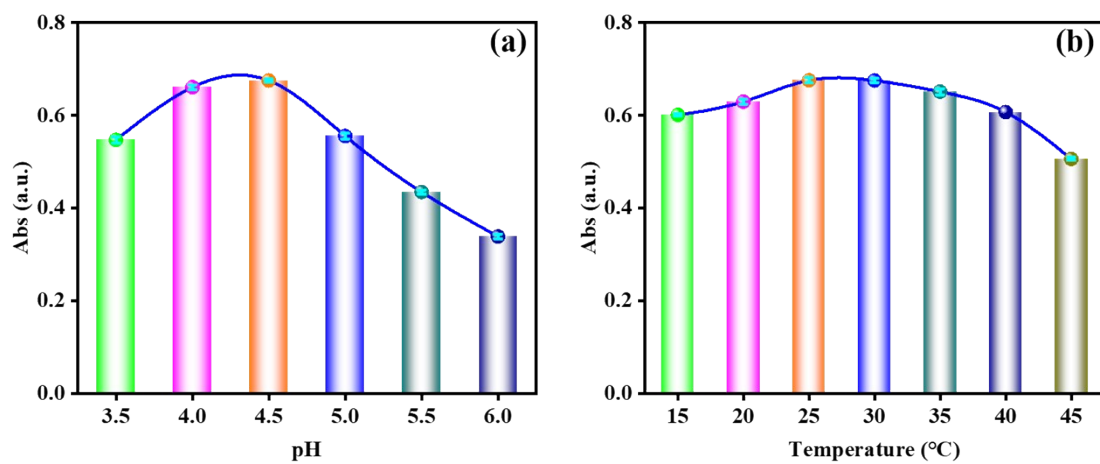


Fig. S7 Effect of pH (a) and temperature (b) on the catalytic activity of MWCN/FeZn-NC.

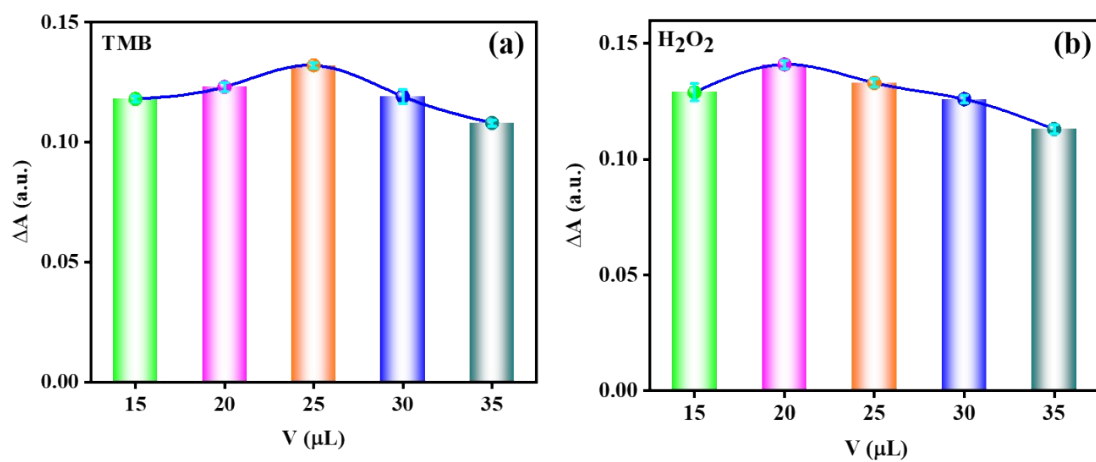


Fig. S8 Effect of the amount of TMB (a) and H₂O₂ (b) on the detection of Cr(VI).

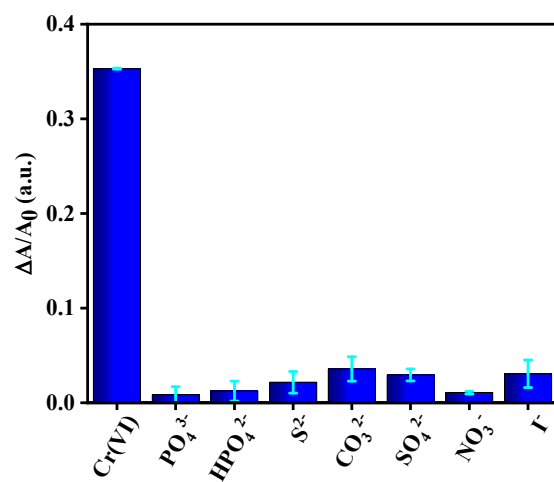


Fig. S9 Effect of anions on the chromogenic system of Cr(VI).

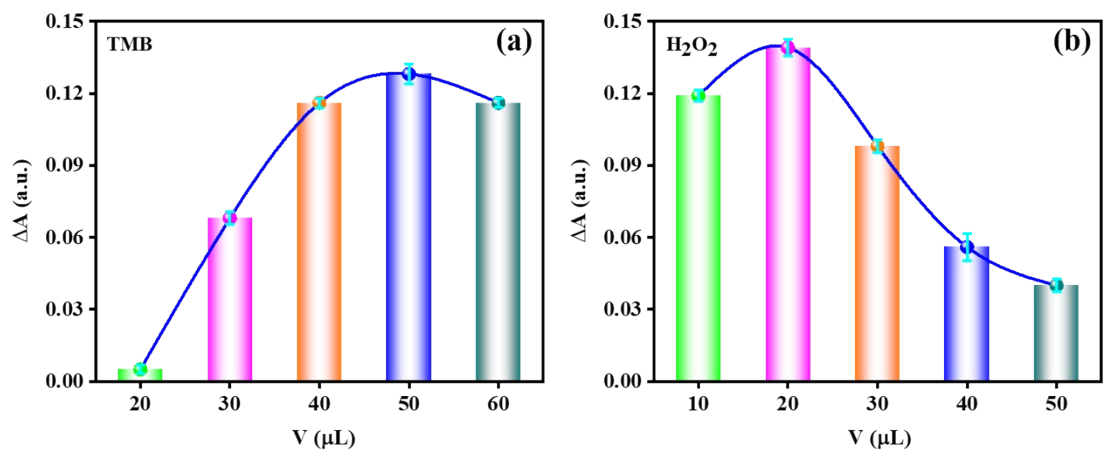


Fig. S10 Effect of the amount of TMB (a) and H₂O₂ (b) on the detection of 8-HQ.

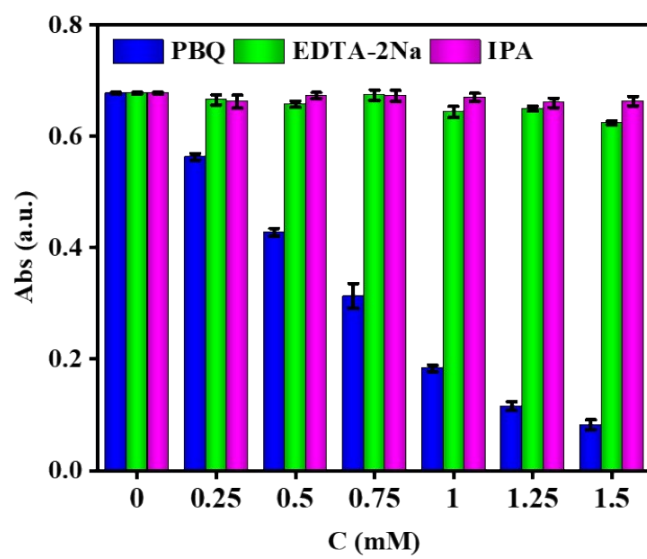


Fig. S11 Relationship between the Abs and different concentration of free radical scavengers.

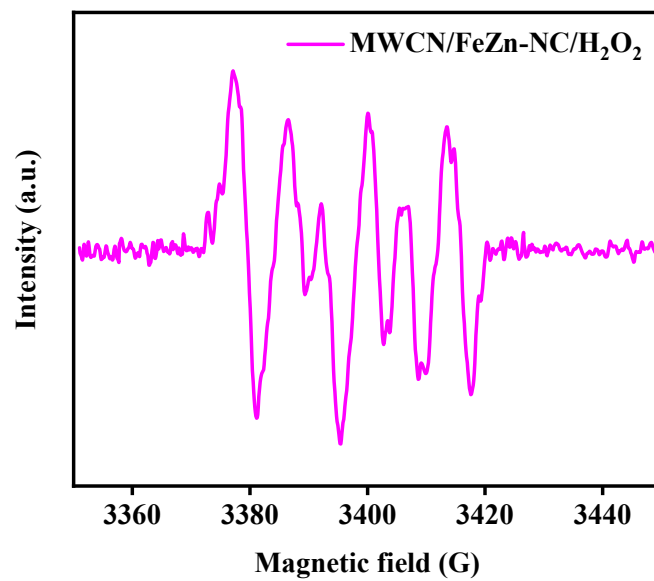


Fig. S12 ESR spectra of the DMPO/ \cdot O₂⁻ spin adduct of MWCN/FeZn-NC/H₂O₂.

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