

Supporting information

A novel colorimetric sensor for naked-eye detection of cysteine and Hg^{2+} based on "on-off" strategy using Co/Zn-Grafted Mesoporous Silica Nanoparticles

M. Aghayan^a, A.Mahmoudi^{a,*}, M. Reza Sazegar^a, F. Adhami^b

^aDept. of Chemistry, Faculty of science, Islamic Azad University, North Tehran Branch, Tehran, Iran

^bDep. of chemistry, Faculty of science, Islamic Azad University, Yadegar-e-Imam Khomeini (RAH), Shahre rey Branch, Tehran, Iran.

* Corresponding Authors

E-mail: mahmoudiali.ac@gmail.com

Tel.: +98 9123377127

E-mail: m_r_sazegar@yahoo.com

Tel.: +98 9120335814

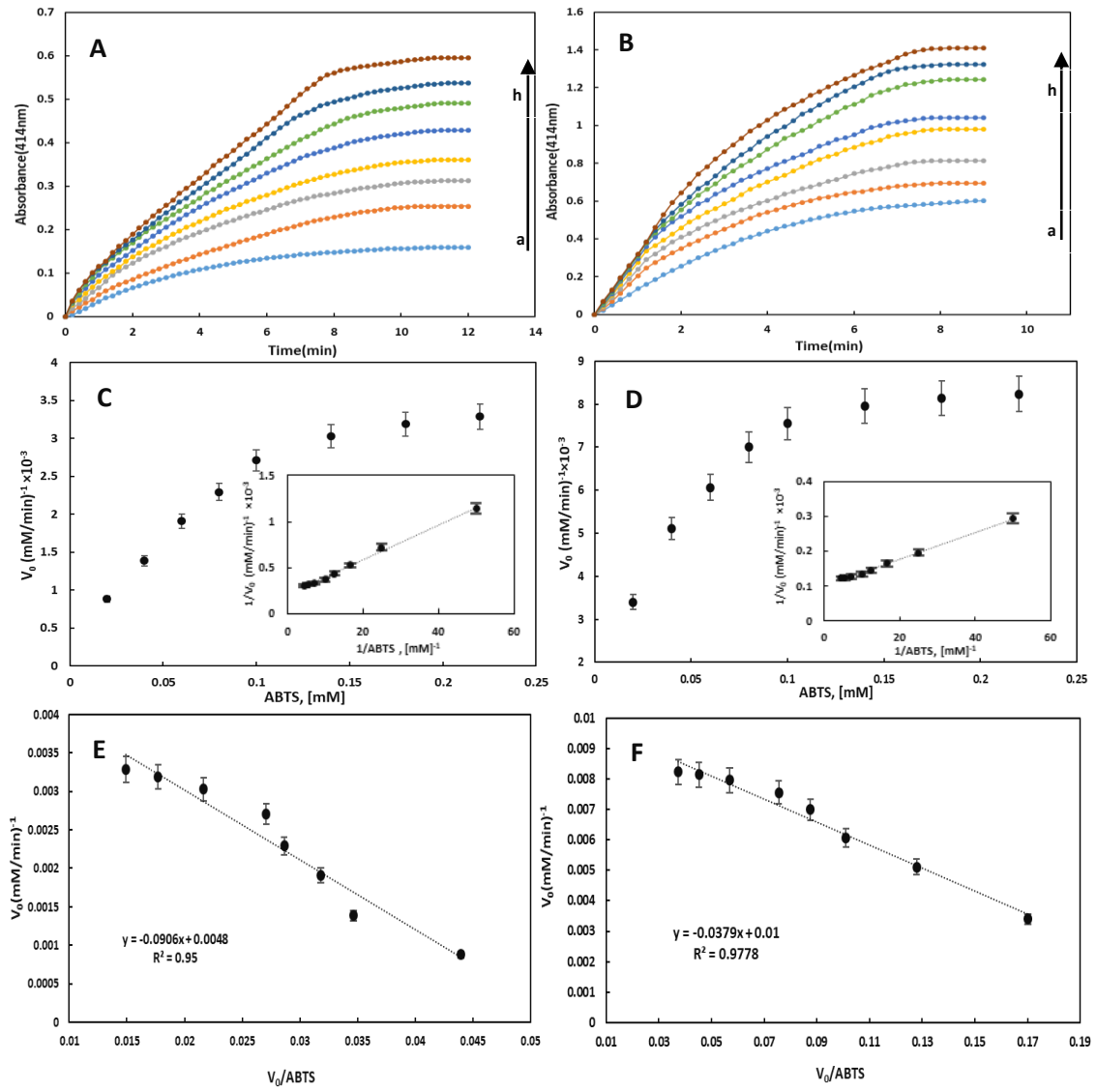


Fig. S1 Absorbance of $ABTS_{ox}$ versus time by Zn-MSN and Co/Zn-MSN with different concentration of ABTS a-h: 0.02, 0.04, 0.06, 0.08, 0.1, 0.14, 0.18, 0.22 Mm respectively. (C-D) Michaelis-Menten plot, Lineweaver-Burk plot of the double reciprocal of the Michaelis-Menten equation (inset) and (E-F) Eadie-Hofstee plot for Zn-MSN and Co/Zn-MSN respectively. Experiments were carried out in 1 mL 0.05 M HAC–NaAc buffer and concentration of H_2O_2 was kept at 0.5 mM . The error bars demonstrate the standard deviation of four measurements.

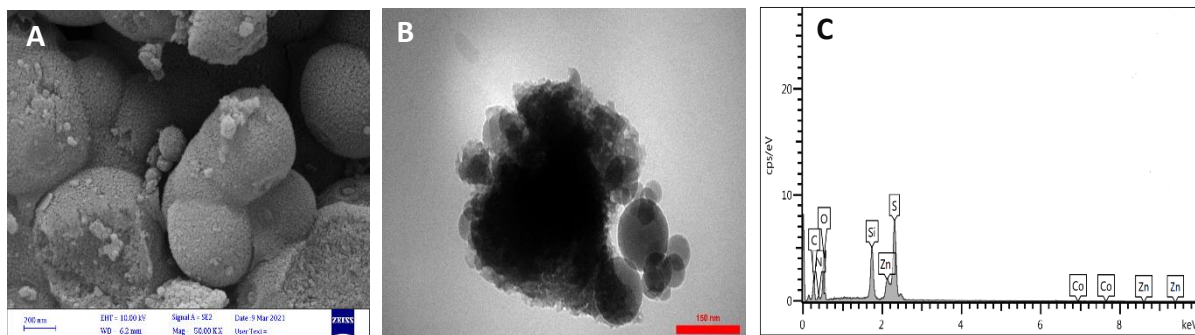


Fig. S2 (A) SEM image, (B) TEM images, and (C) the result of EDX for CZMC-500

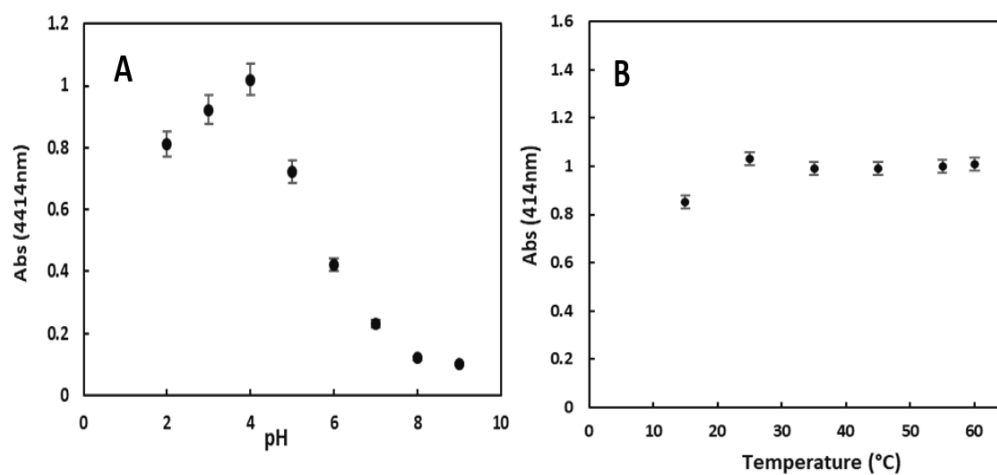


Fig. S3. Effect of (A) pH and (B) temperature on the activity of the Co/Zn-MSN in the oxidation of ABTS in sensing procedure. Error bars illustrated standard error derived from five repeated experiments.

Table S1. Comparison of the kinetic parameters of various nanoparticles

Nanoparticle	k_m (mM)		V_{max} (mM.s ⁻¹)		k_{cat} (s ⁻¹)		k_{cat}/k_m (mM.s ⁻¹)		Reference
	ABTS	H ₂ O ₂	ABTS	H ₂ O ₂	ABTS	H ₂ O ₂	ABTS	H ₂ O ₂	
Zn-MSN	0.0906	0.285	8×10^{-5}	3.5×10^{-2}	1.5×10^{-1}	6.72	1.6×10^{-1}	2.3×10^1	This work
Co/Zn-MSN	0.0392	0.0871	1.6×10^{-4}	1.4×10^{-1}	1.05×10^2	2.6×10^{-1}	2.68×10^2	3×10^2	This work
HRP ^a	0.0174	-	7.16×10^{-5}	-	2.9×10^2	-	1.6×10^4	-	31
Co-MSN	0.07	0.34	33×10^{-5}	13.2×10^{-5}	1.62×10^{-2}	-	2.22×10^{-1}	-	30
Zn-CNT ^b	0.5	0.6	1.5×10^{-6}	5×10^{-5}	-	-	-	-	45
Pd@Fe ₂ O ₃	0.049	0.254	1.02×10^{-4}	1.28×10^{-4}	7.5×10^{-3}	9.4×10^{-2}	-	-	46
Fe ^{II} Fe ^{III} LDHNS ^c	0.68	3.46	3.29×10^{-5}	7.19×10^{-5}	-	-	-	-	47

^aHRP: horseradish peroxidase, ^bZn-CNT: zinc oxide incorporated carbon nanotubes, ^cFe^{II}Fe^{III}LDHNS: Fe^{II}Fe^{III} layered double hydroxide nanosheets

Table S2. Comparison of available methods for H₂O₂ detection based on enzyme mimics.

Enzyme mimic	Methods	Linear range (μM)	LOD (μM)	Reaction time (min)	References
Zn-MSN	Colorimetry	66-500	19	12	This work
Co/Zn-MSN	Colorimetry	2.4-100	0.73	9	This work
Co-MSN	Colorimetry	22.5-200	6.7	11	30
Fe ₃ O ₄ MNPs	Colorimetry	5-100	3	10	51
Au@Ag NRs ^b	Colorimetry	10-1000	6	10	50
Pt-ZnO	Electrochemistry	20-5000	1.5	-	52
Mb-ZnO ^c	Electrochemistry	4.8-200	2	-	53

^aFe₃O₄ MNPs: Fe₃O₄ magnetic nanoparticles. ^bAu@Ag NRs: Au@Ag heterogeneous nanorods.
^cMb-ZnO: Myoglobin-ZnO

Table S3 Determination results of Hg²⁺ in real sample using the proposed method

Samples	Original amount (μM)	Added (μM)	Found (μM)	Recovery (%)	RSD(%)
River water	N.D. ^a	0.5	0.498±0.006	99.6	1.64
		1	0.986±0.011	98.6	1.40
		2	1.993±0.012	99.6	0.73
		4	3.996±0.008	99.9	0.31
^a N.D.: not detected					