Copper fumarate with high-bifunctional nanozyme activities at different pH for glucose and epinephrine colorimetric detection in human serum

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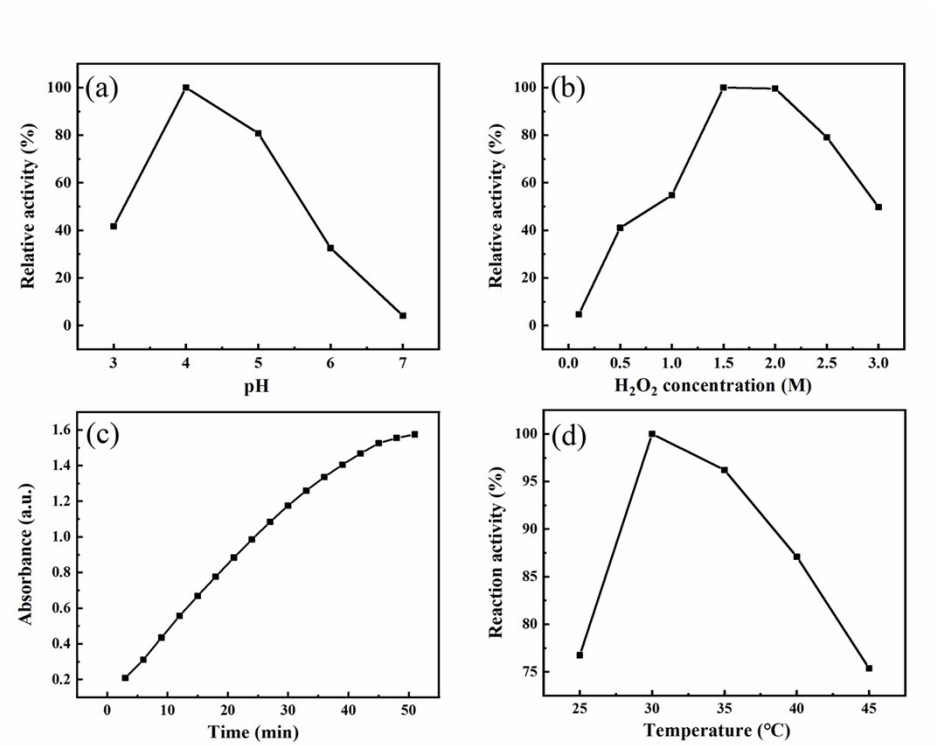

Figure S1 Effect of (a) pH, (b) H_2O_2 concentration, (c) time-dependent absorbance behavior at 652 nm of TMB+H_2O_2 system, and (d) effect of temperature on the peroxidase-like property of Cu FMA. All maximum points in each curve (a, b and d) are set as 100% in H_2O.

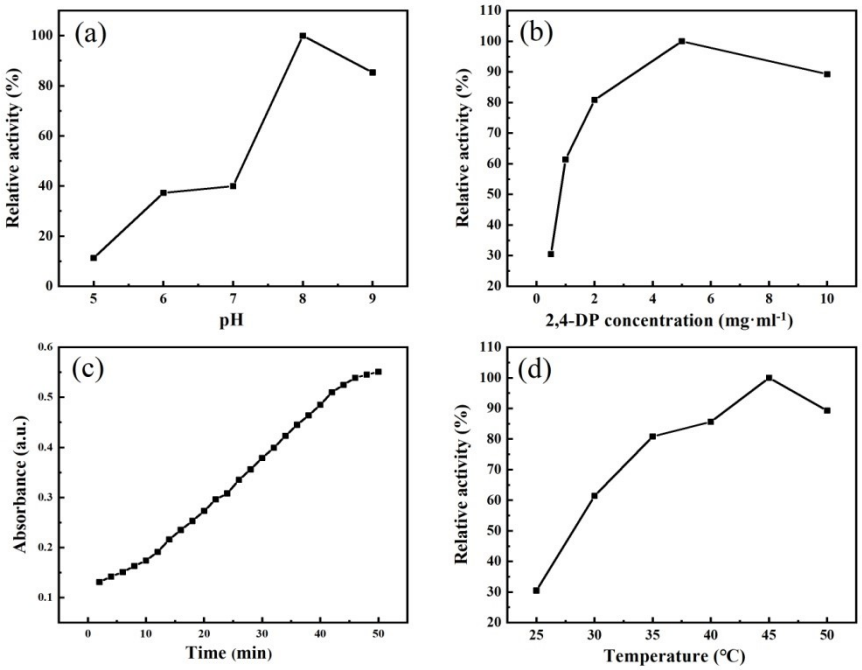

Figure S2 (a) Effect of pH on the laccase-like activity of Cu FMA, (b) effect of 2,4-DP concentration on the laccase-like activity of Cu FMA, (c) time-dependent absorbance behaviour at 510 nm of 2,4-DP+4-AAP system catalyzed by Cu FMA, and (d) effect of temperature on the laccase-like property of Cu FMA. All maximum points in each curve (a, b and d) are set as 100% in H_2O.

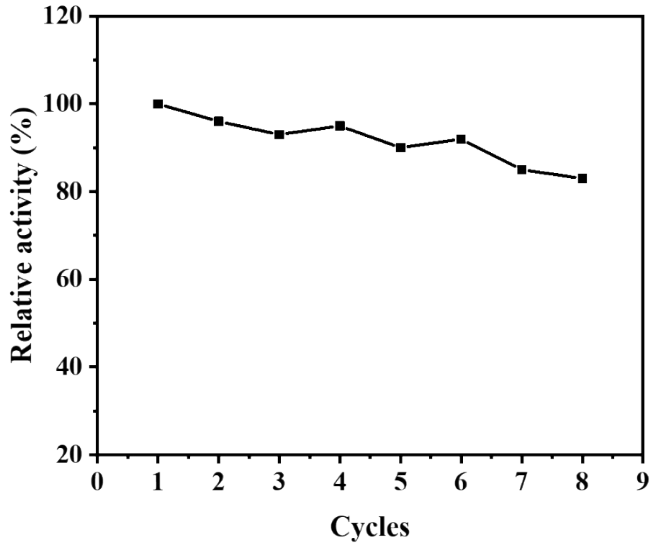

Figure S3 Relative activity of Cu FMA in the colorimetric reaction during the recycling and reuse process. The condition for recycling experiments: 5 mg/mL Cu FMA, 5 mM TMB, 1.5 M H_2O_2, pH 4, 30°C, 45 min.

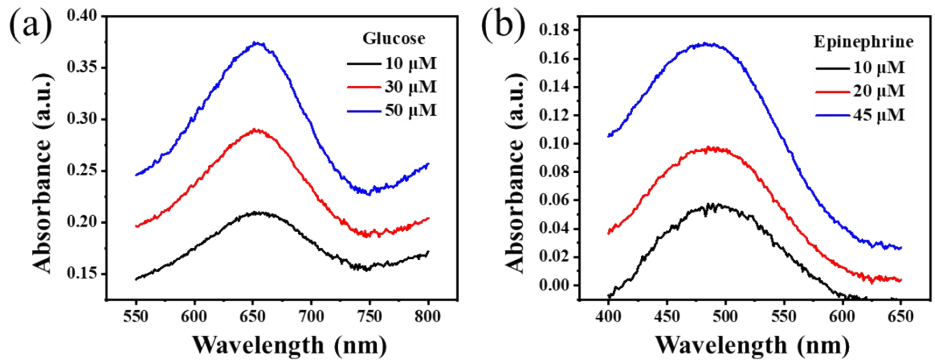

Figure S4 The UV-Vis spectra of different concentrations for (a) glucose and (b) epinephrine in human serum.

Table S1 Comparison of kinetic parameters of Cu FMA with HRP and laccase. K_m is the Michaelis-Menten constant, V_{max} is the maximal reaction velocity, and k_{cat} is the catalytic constant.

Catalyst	Substrate	K_m (mM)	V_{max} (10^{-8} M s^{-1})	k_{cat} (s^{-1})
Cu FMA	TMB	1.10	1.79	9.04×10^{3}
	H_2O_2	0.34	1.43	7.23×10^{3}
	2,4-DP	0.45	5.72	2.89×10^{4}
HRP[1]	TMB	0.43	10.00	4.00×10^{3}
	H_2O_2	3.7	8.71	3.48×10^{3}
Laccase[2]	2,4-DP	0.41	10.68	6.89×10^{-2}

Table S2 Comparative table of colorimetric detection for glucose and epinephrine

	Sensing probe	Linear range (μM)	Detection limit (μM)	Reference
Glucose	Cu-Ag/rGO	1-30	3.8	[3]
	CuS	5–200	7.2	[4]
	Cu	500-15000	450	[5]
	Cu-MOF	8-140	2.7	[6]
	Cu FMA	10-300	0.2	This work
Epinephrine	CH-Cu	27-270	1.6	[2]
	CuO NRs	0.6−18	0.6	[7]
	CTNs	4.5-90	3.4	[8]
	Cu-Cys NLs	9–455	2.7	[9]
	Cu FMA	2.7-54.6	1.1	This work

Table S3 Determination of glucose and epinephrine added in diluted human blood serum with proposed Cu FMA colorimetric method.

	Added (μM)	Absorbance (a.u.)	Found (μM)
Glucose	10.00	0.2076	10.24
	30.00	0.2879	30.02
	50.00	0.3726	50.88
Epinephrine	10.00	0.0577	9.19
	20.00	0.0979	21.75
	45.00	0.1694	44.09

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