Electronic Supplementary Material (ESI) for Nanoscale.

Supporting Information

Fe_3N Decorated Porous Carbon Frameworks from Wheat Flour with Dual Enzyme-mimicking Activities for Organic Pollutants Degradation

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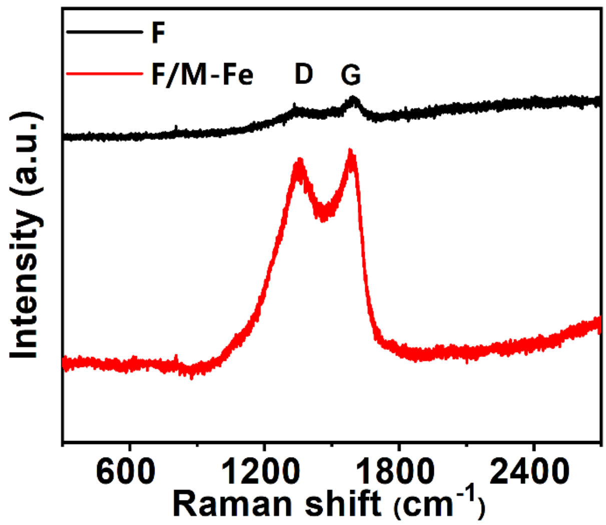

Figure S1. Raman spectra of F and F/M-Fe.

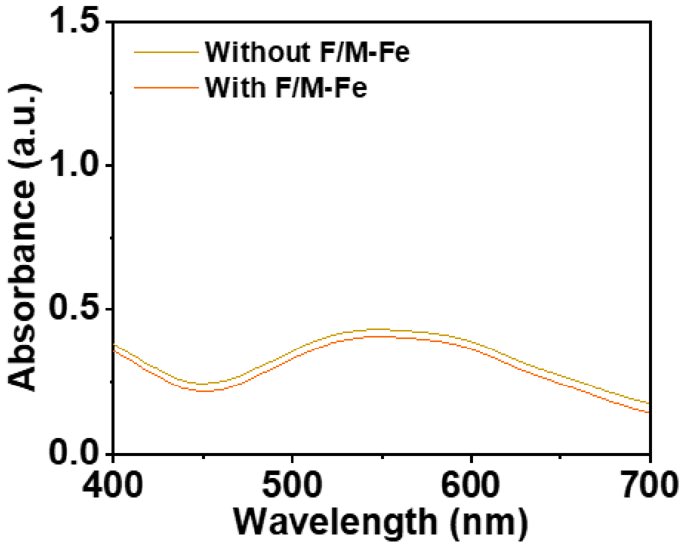

Figure S2. SOD-like activity assay of F/M-Fe using NBT probe as indicator.

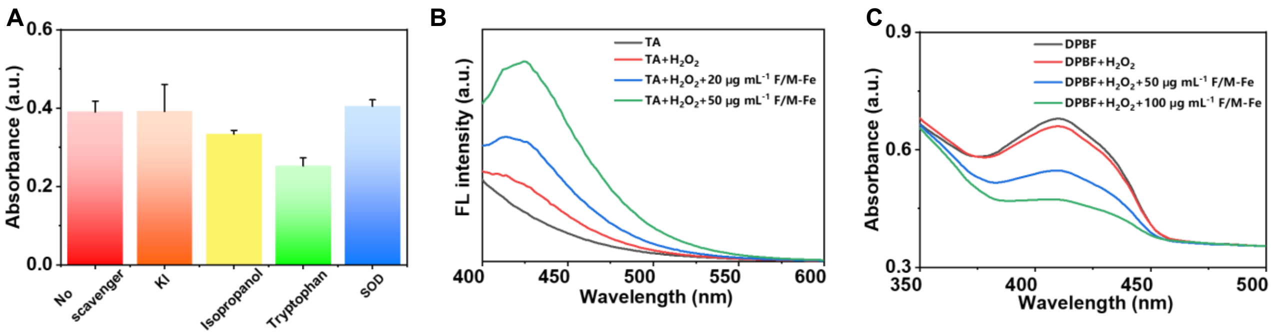

Figure S3. (A) Effect of different scavengers on the catalytic oxidation of TMB by F/M-Fe. (B) Fluorescence spectra of produced hydroxyl radicals (·OH) by using TA assay. (C) UV-Vis absorption spectra of produced singlet oxygen ($^1O_2$) by using DPBF assay.

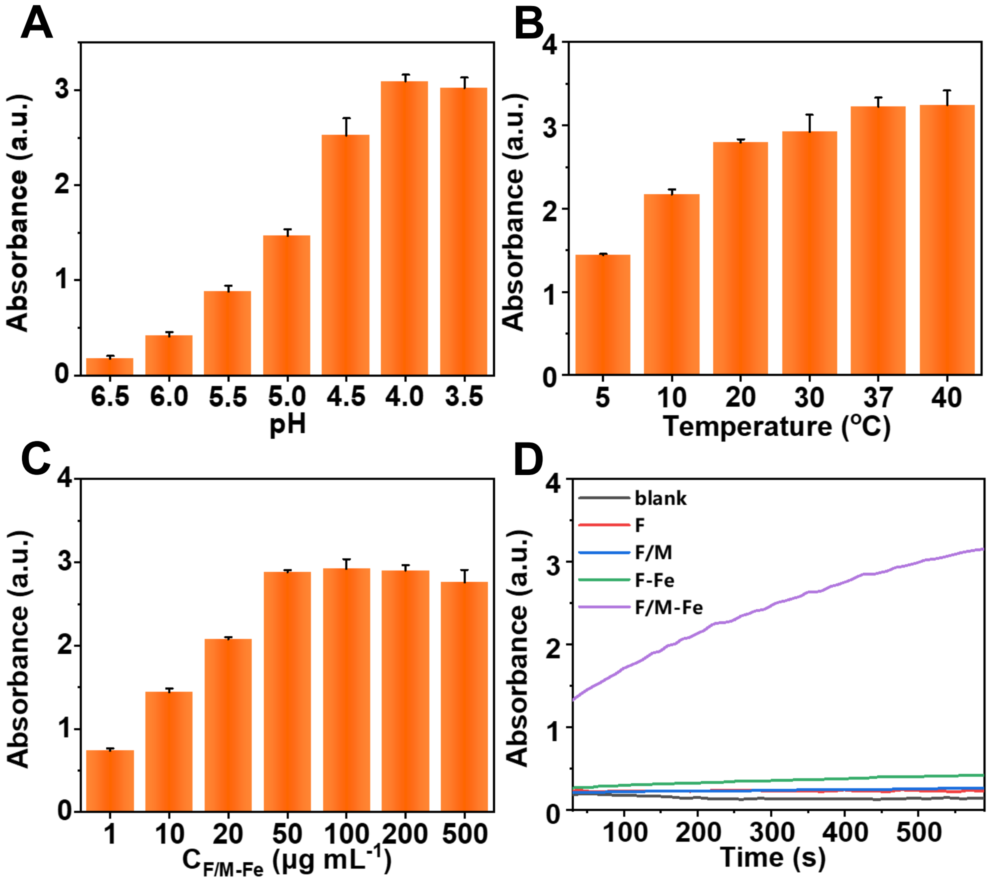

Figure S4. The optimization for (A) pH, (B) temperature and (C) the concentration of F/M-Fe. (D) Time-dependent absorbance of TMB at 652 nm with carbon-based nanozymes.

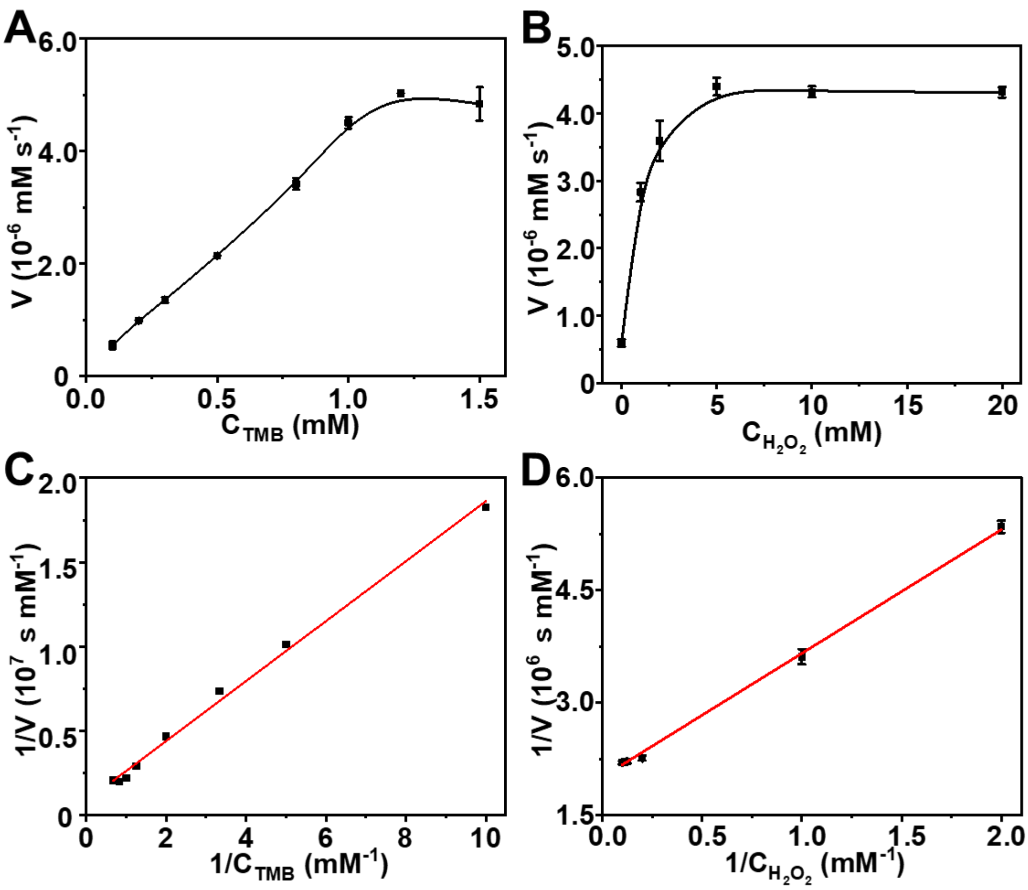

Figure S5. Steady-state kinetic study of the reaction between TMB and H_2O_2 catalyzed by F/M-Fe. The well-fitted Michaelis-Menten curve while varying the concentrations of (A) TMB (0.1, 0.2, 0.3, 0.5, 0.8, 1, 1.2, 1.5 mM) and (B) H_2O_2 (0, 0.5, 1, 2, 5, 8, 10, 20 mM). (C-D) The double reciprocal plots obtained from (A) and (B).

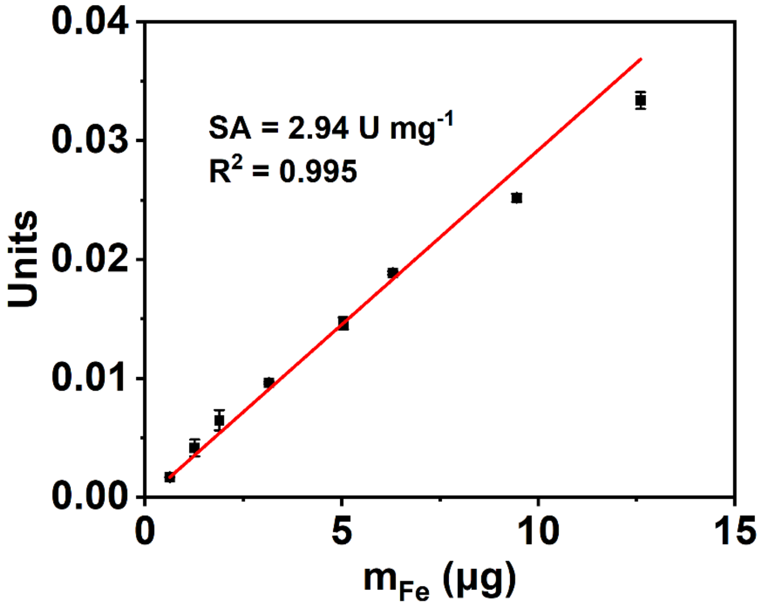

Figure S6. The specific activity value of F/M-Fe. m_{Fe} is mass of Fe in F/M-Fe.

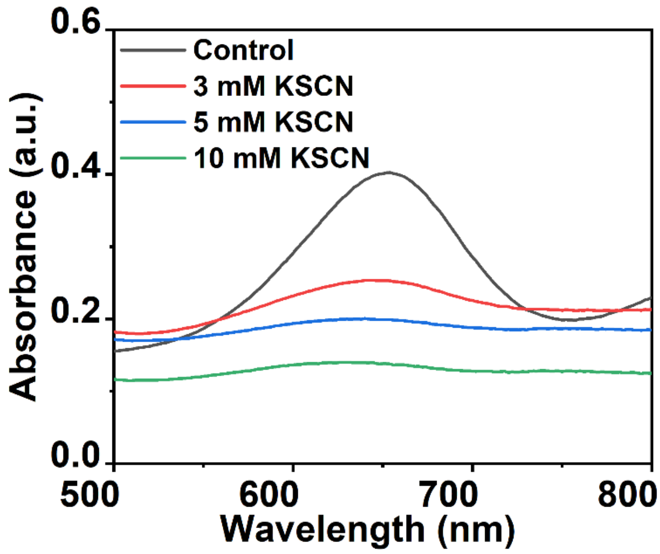

Figure S7. UV-vis absorption spectra of H_2O_2/TMB/ F/M-Fe solution upon the addition of various concentrations of KSCN.

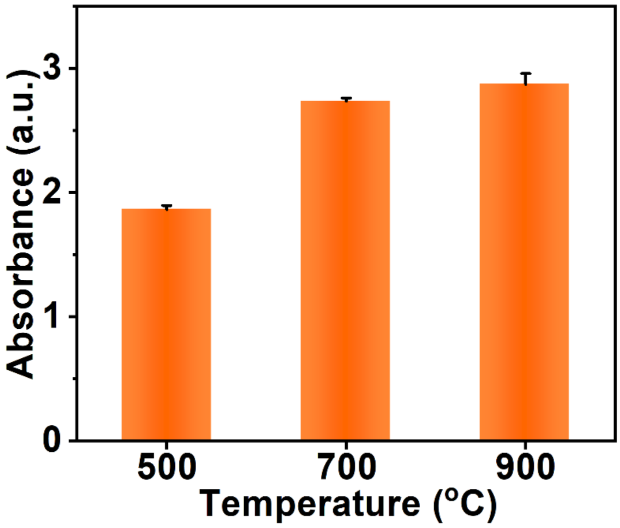

Figure S8. Optimization of the calcination temperature during pyrolysis.

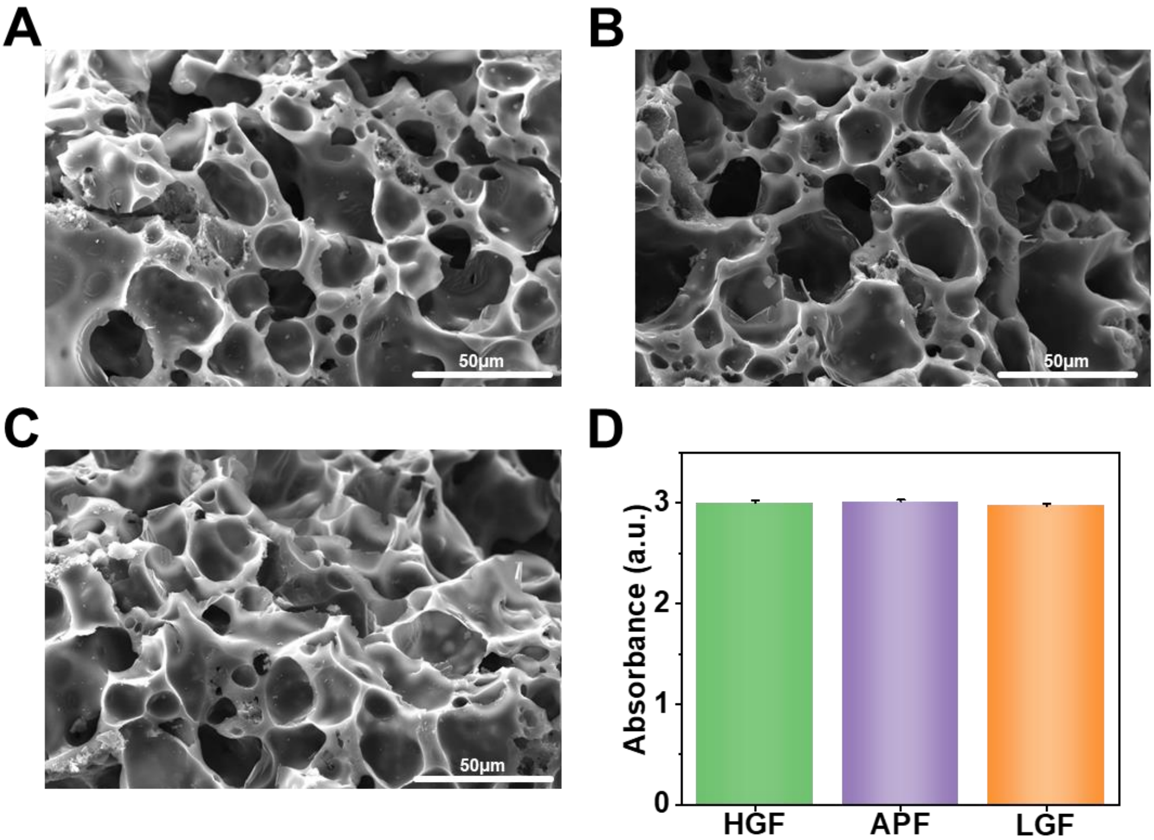

Figure S9. The SEM images of F/M-Fe with different types of wheat flour as precursors: (A) high-gluten flour (HGF); (B) all-purpose flour (APF); (C) low-gluten flour (LGF), and (D) the comparison for the respective peroxidase-like activity of each sample.

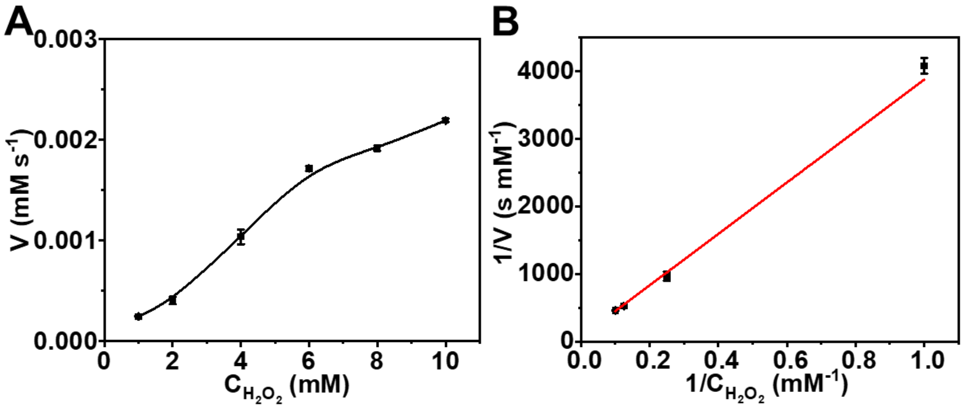

Figure S10. (A) Michaelis-Menten curve fit and (B) Lineweaver-Burk double reciprocal plot of CAT-like activity of F/M-Fe.

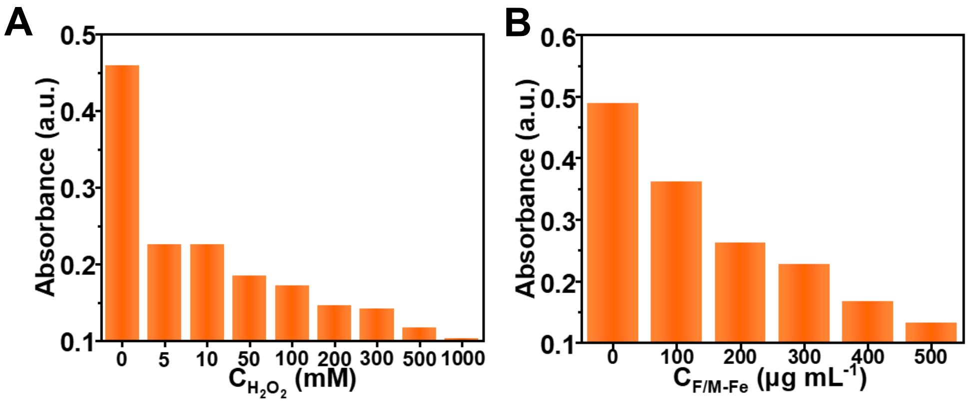

Figure S11. Optimization for the concentration of H_2O_2 (A) and F/M-Fe (B) for MB degradation.

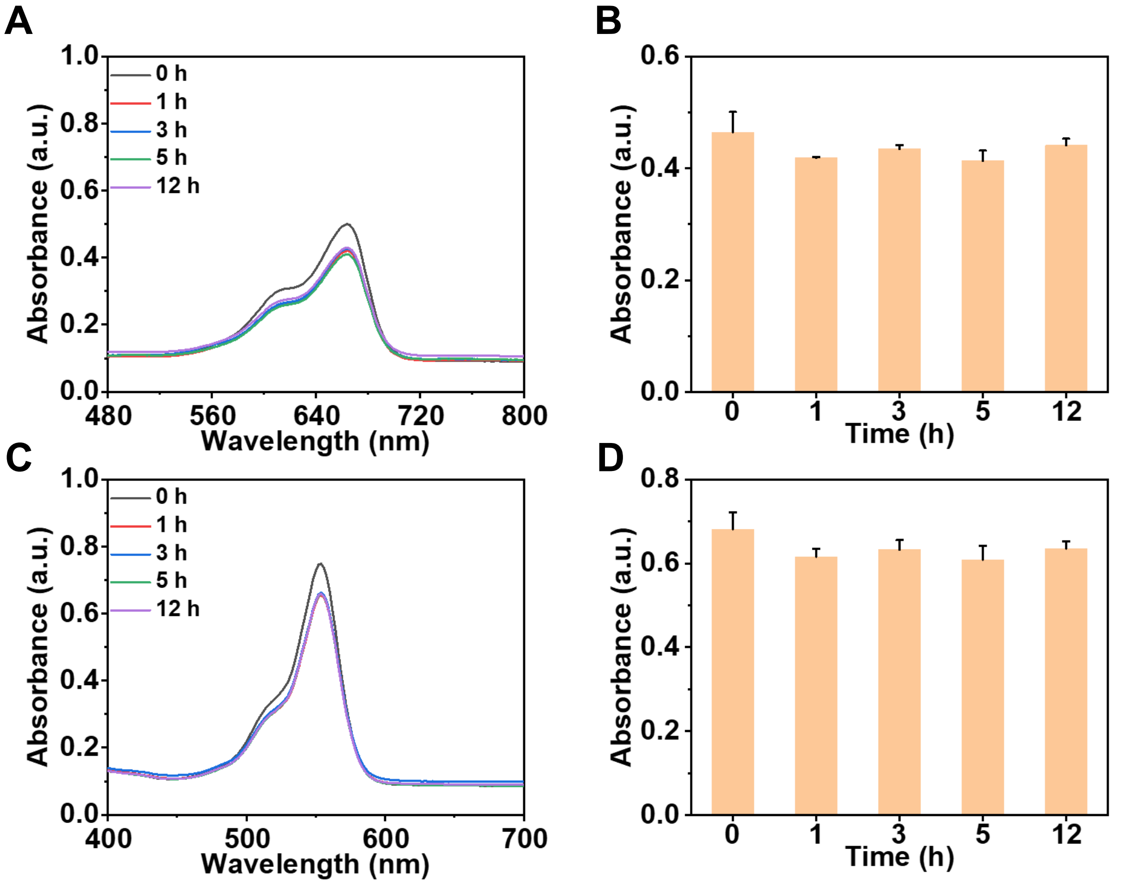

Figure S12. (A) UV-vis absorption spectra of MB subjected to F/M-Fe with different incubation time; (B) Comparison of the absorbance at 664 nm of MB; (C) UV-vis absorption spectra of RhB subjected to F/M-Fe with different incubation time; (D) Comparison of the absorbance at 550 nm of RhB.

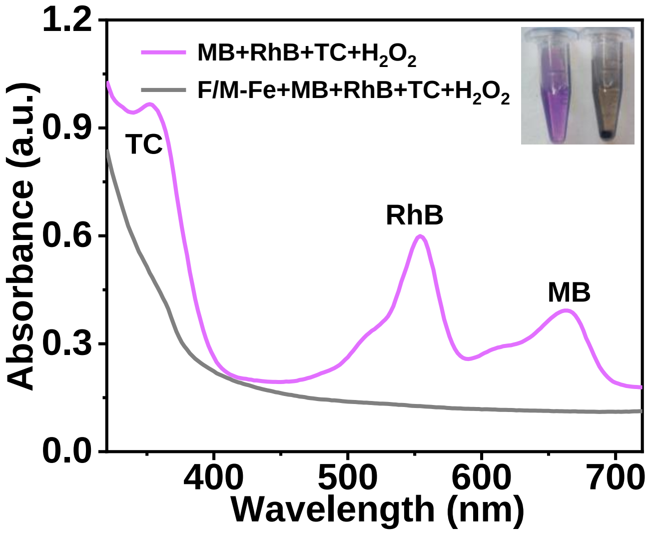

Figure S13. UV-Vis spectra of the pollutant mixture solution (10 μM MB + 10 μM RhB + 0.05 mg mL^{-1} TC) before and after degradation with F/M-Fe in the presence of 1 M H_2O_2. (The inset picture is the color change of mixture solution before and after degradation)

Table S1. Comparison of kinetic parameters (POD) of F/M-Fe, HRP and other carbon-based enzyme mimics.

	Substance	K_m (mM)	V_{max} (10^{-8} mM/s)	Reference
F/M-Fe	TMB	2.07	113	This work
	H_2O_2	0.82	49.7	
HRP	TMB	0.434	10	1
	H_2O_2	3.7	8.71	
GO-COOH	TMB	0.0237	3.45	2
	H_2O_2	3.99	3.85	
CQDs	TMB	0.039	3.61	3
	H_2O_2	26.77	3.06	
GQDs	H_2O_2	0.49	2.62	4
Carbon nanohorn	H_2O_2	49.8	2.07	5
$C_{60}[C(COOH)_2]_2$	H_2O_2	24.58	4.01	6

Table S2. Comparison for the kinetic parameters (CAT) of F/M-Fe, catalase and other enzyme mimics.

	K_m (mM)	V_{max} (mM/min)	Reference
F/M-Fe	54.4	0.87	This work
Catalase	294.4	0.18	[7]
Fe^{3+}/AMP CPs	112.2	0.144	
DMSN@AuPtCo	5.9	0.34	[8]
L-QDs	432.7	0.08	[9]
Fe-SANzyme	18.8	0.559	[10]
PCNSs	678.9	0.007	[11]

Table S3. Comparison of different catalysts in previous studies and this study.

Catalyst	Reaction condition	Substrate	Degradation efficiency	Time (h)	Reference
F/M-Fe	\	MB	99.72%	1	This work
		RhB	93.43%	1	
		TC	82.01%	1	
V_2O_5/g-C_3N_4	Visible light irradiation	RhB	95.5%	1	12
		TC	75.7%	2	
$CuCr_2O_4/CeO_2$	\	MB	99%	0.75	13
		RhB	85%	0.75	
Bi_2WO_6/Nb_2CT_x	Visible light irradiation	MB	92.7%	1.5	14
		RhB	99.8%	1.5	
		TC	83.1%	2	
ZnO_2/Fe^{3+}	\	TC	90%	1	15
GOQD-MPS	\	RhB	92%	6	16

Reference

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