Ce-MOF with intrinsic haloperoxidase-like activity for ratiometric colorimetric detection of hydrogen peroxide

Supplementary Material

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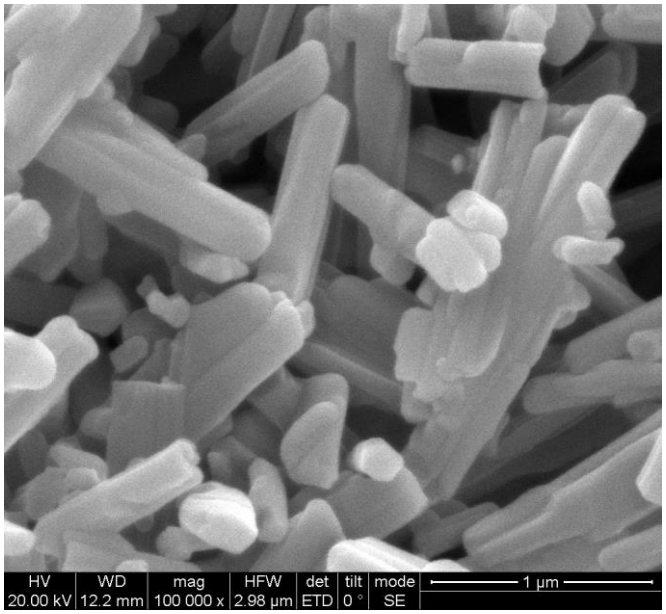

Figure S1 SEM image of the original Ce-MOF.

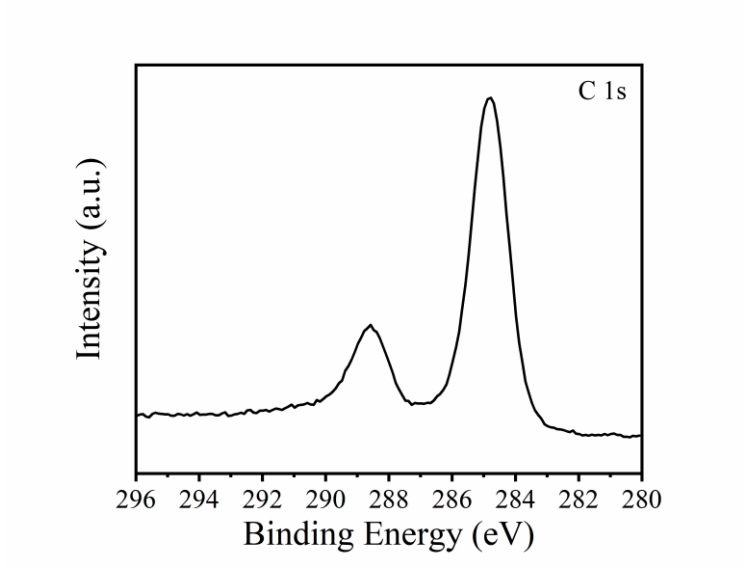

Figure S2 C1s XPS high-resolution spectra of MVCM.

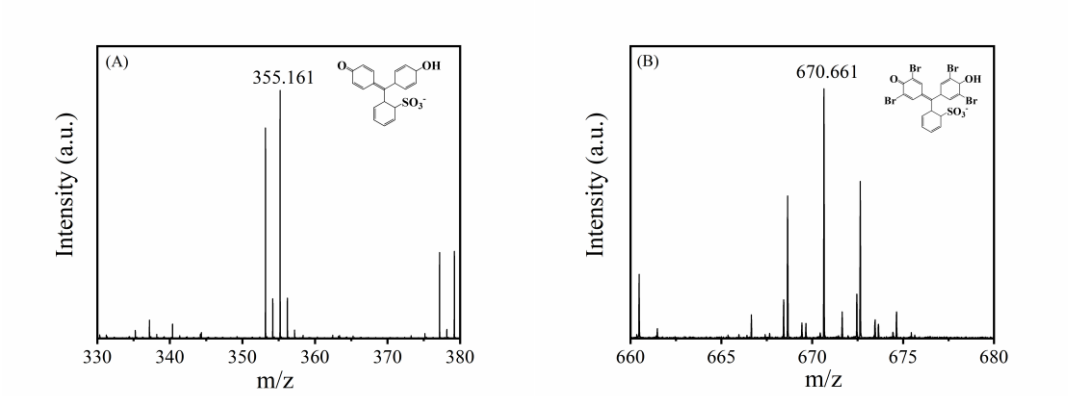

Figure S3 MALDI-TOF MS spectra (positive ion modes) of (A) phenol red and (B) bromophenol blue.

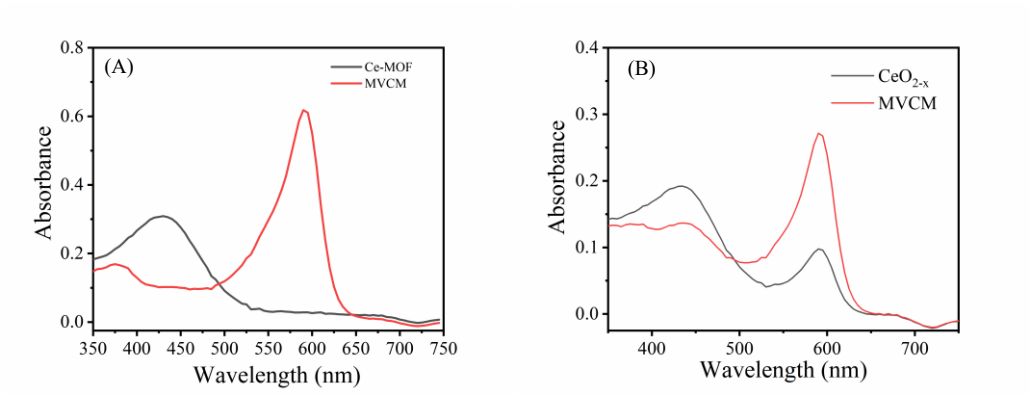

Figure S4 The absorption spectrum of MVCM and original Ce-MOF (A), CeO_{2-x} and MVCM (B) under the same reaction condition.

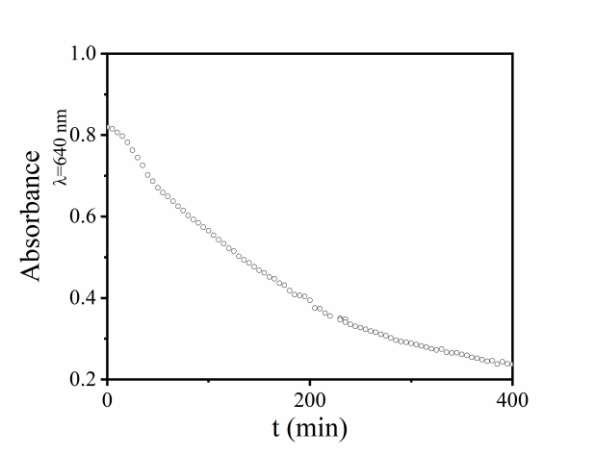

Figure S5 The bleaching of celestine blue (CB) at 640 nm indicates the formation of oxidized bromine species (e.g., OBr^-).

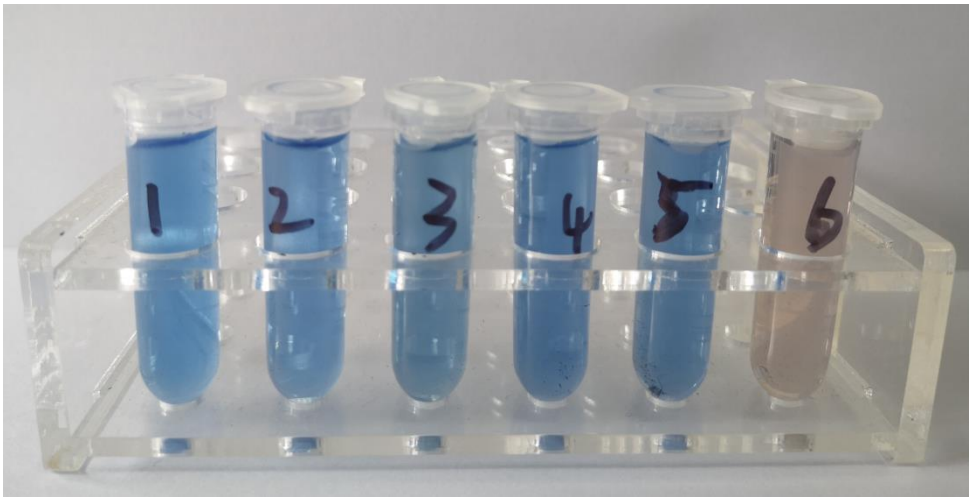

Figure S6 Celestine blue (CB) reacts in different systems. (1. MVCM+NH_4Br+CB; 2.H_2O_2+NH_4Br+CB; 3. MVCM+H_2O_2+CB; 4. MVCM+CB; 5. H_2O_2+CB; 6. MVCM+NH_4Br+H_2O_2+CB).

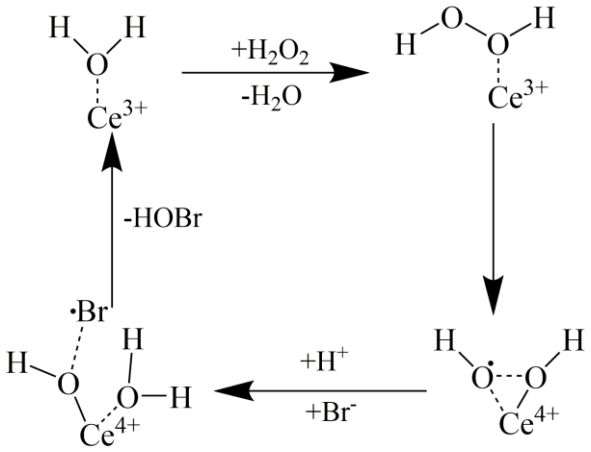

Figure S7 Probable catalytic mechanism of the MVCM as haloperoxidase mimic.

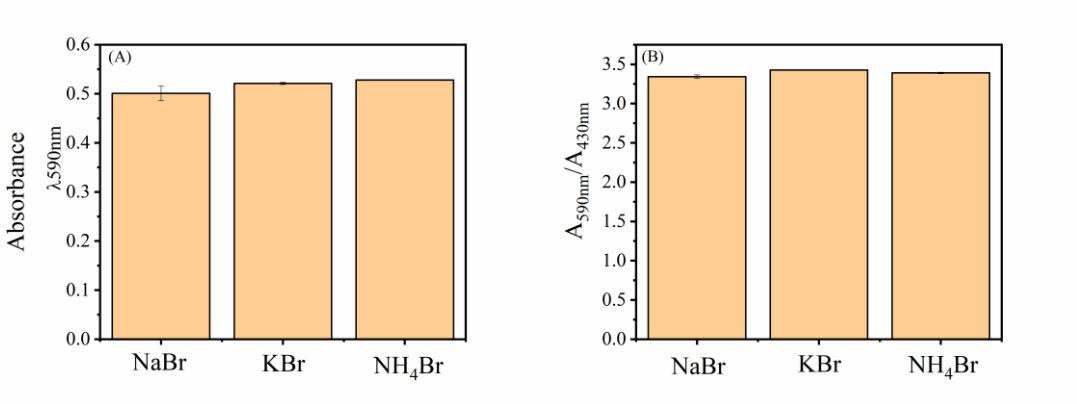

Figure S8 Dependence on the bromine source.

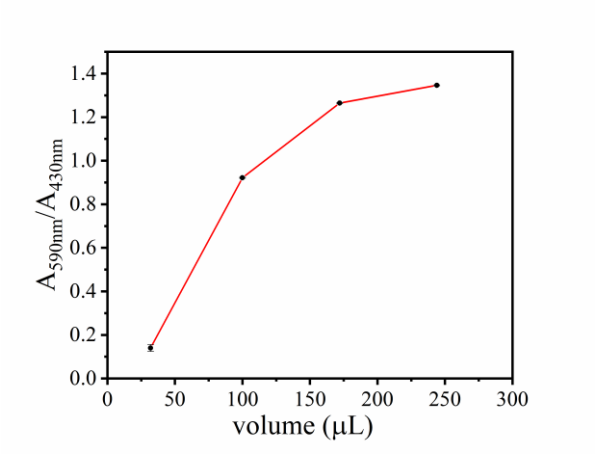

Figure S9 Ce-MOF was treated with different NaOH/H_2O_2 volume.

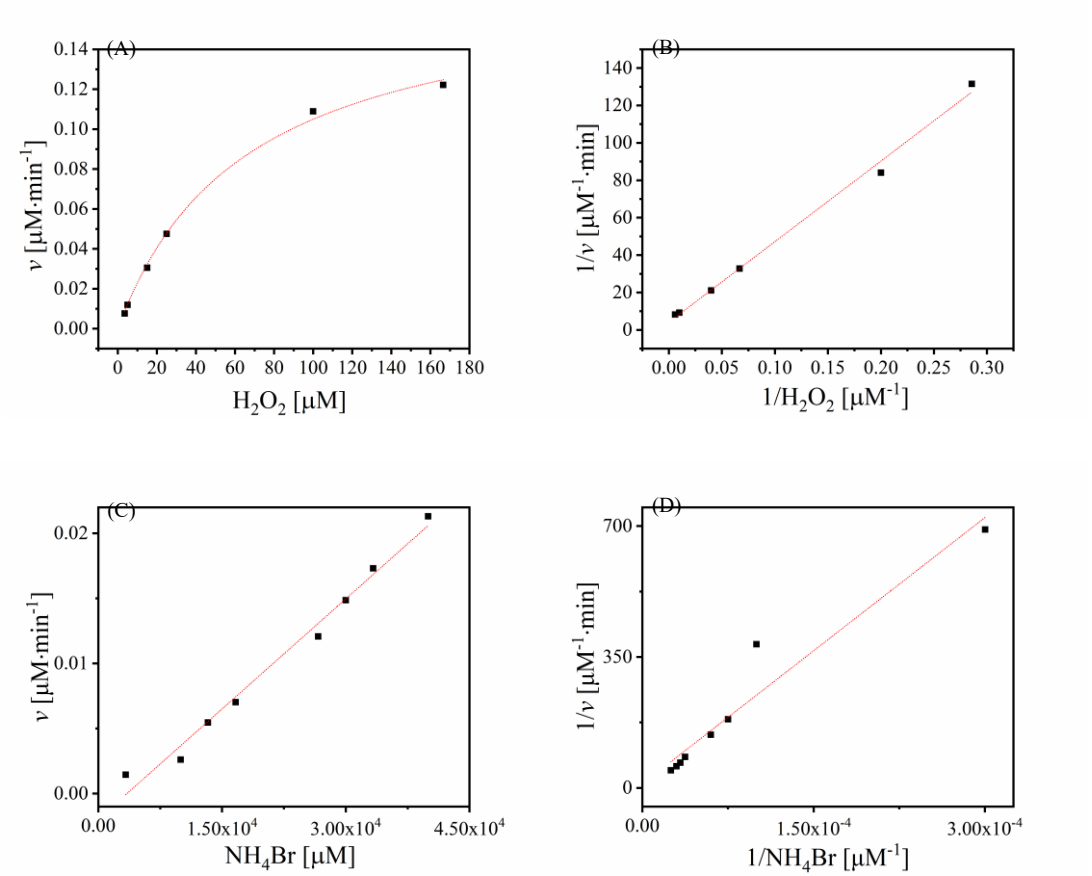

Figure S10 Steady-state kinetic assays of MVCM. The H_2O_2 concentration was varied, the concentration of NH_4Br and PR was fixed (A); the NH_4Br concentration was varied, the concentration of H_2O_2 and PR was fixed (C); and the double-reciprocal plots of haloperoxidase-like activity of MVCM with a fixed concentration of one substrate relative to varying concentration of the other substrate (B and D).

Table S1. A comparison of K_m value for materials-based haloperoxidase mimics.

Materials	Substrate	K_m(M)	Ref.
CeO_2@C	H_2O_2	2.1×10^{-3}	[1]
	Br^-	0.5	
CeO_{2-x} nanorod	H_2O_2	2.6×10^{-4}	[2]
	Br^-	0.35	
MVCM	H_2O_2	1.0×10^{-4}	This work
	Br^-	0.22	

Table S2. Comparison detection limit in different catalyst systems by means of different methods.

Materials	Method	Detection limit (μM)	Ref.
flake-like Cu_2O	Electrochemistry	90.5	[3]
$ZnCrCoO_4$/NCNTs	Electrochemistry	1	[4]
rGO/Ag NPs	Electrochemistry	31.3	[5]
Ce-MOF	Fluorescence	10	[6]
CuO nanoparticles	Fluorescence	0.34	[7][7]
NiFe LDH	Colorimetry	4.4	[8]
Ni^0 nanoparticle	Colorimetry	120	[9]
VS_4	Colorimetry	5	[10]
MVCM	Colorimetry	3.25	This work

Note:

$ZnCrCoO_4$/NCNTs: $ZnCrCoO_4$ and nitrogen-doped carbon nanotubes composite

rGO/Ag NPs: reduced graphene oxide/Ag nanoparticles

NiFe LDH: NiFe layered double hydroxide nanosheets

References

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