Supporting Information

Enhanced Ultrasonically-Assisted Heterogeneous Fenton Degradation of Organic Pollutants over a New Copper Magnetite (Cu-Fe_3O_4/Cu/C) Nanohybrid Catalyst

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[1] Equally contributed to the present work.

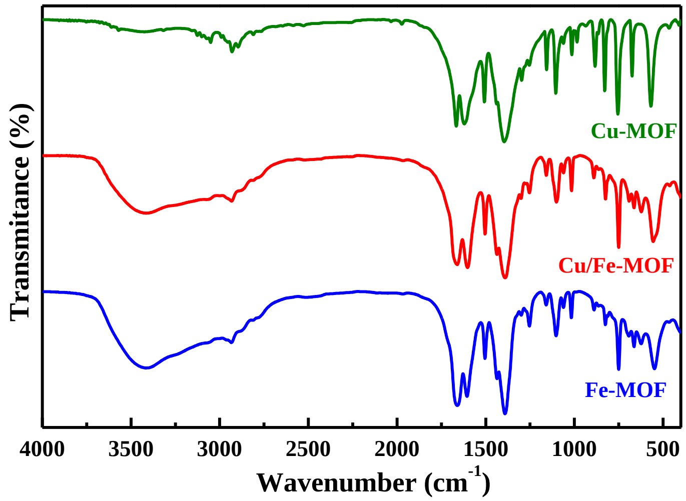

Figure S1. FTIR spectra of the as-synthesized MOFs.

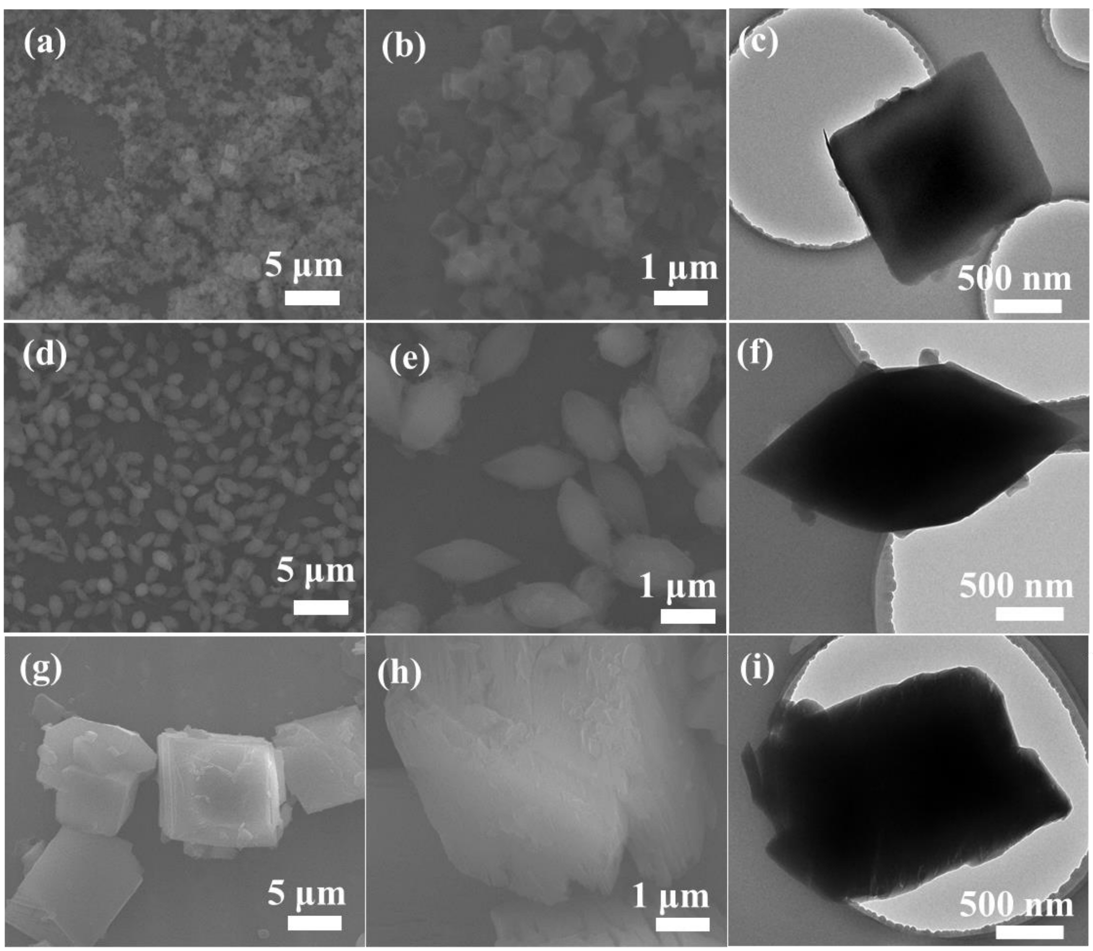

Figure S2. (a ,b ,d, e, g, h) Different magnification SEM and (c, f, i) TEM images of (a,b,c) Fe-MOF, (d, e, f) Cu/Fe-MOF and (g,h, i) Cu-MOF.

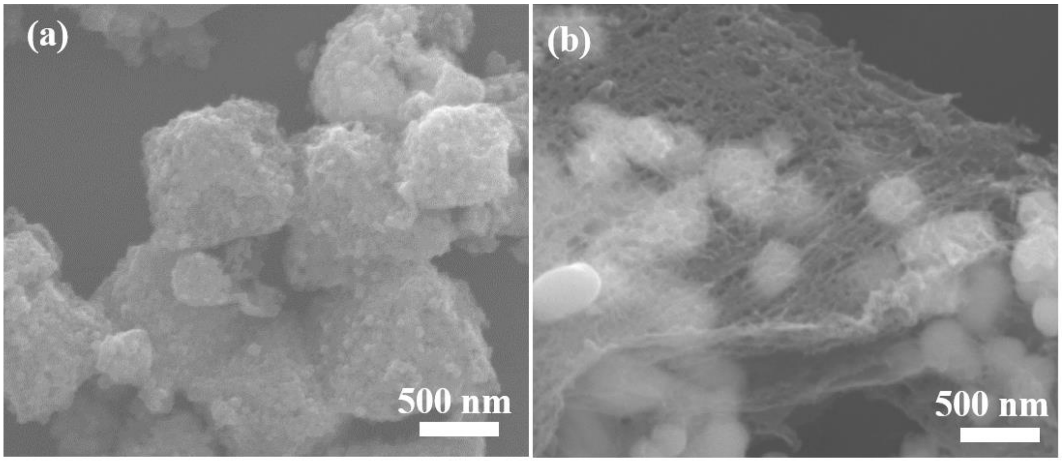

Figure S3. SEM images of (a) Fe_3O_4/C and (b) Cu/C.

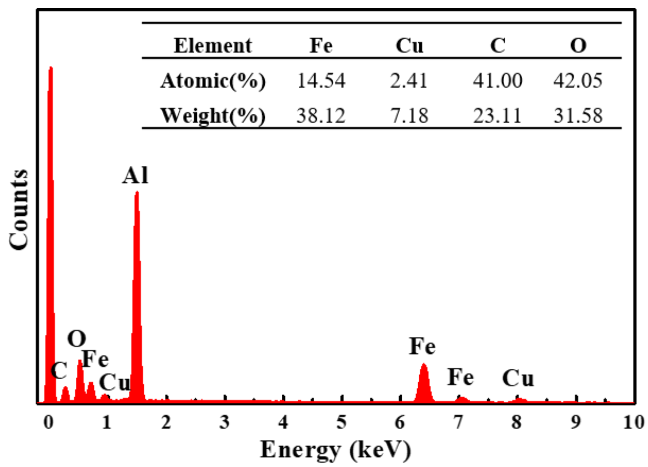

Figure S4. EDX spectra of Cu-Fe_3O_4/Cu/C along with the corresponding Element content in inset view.

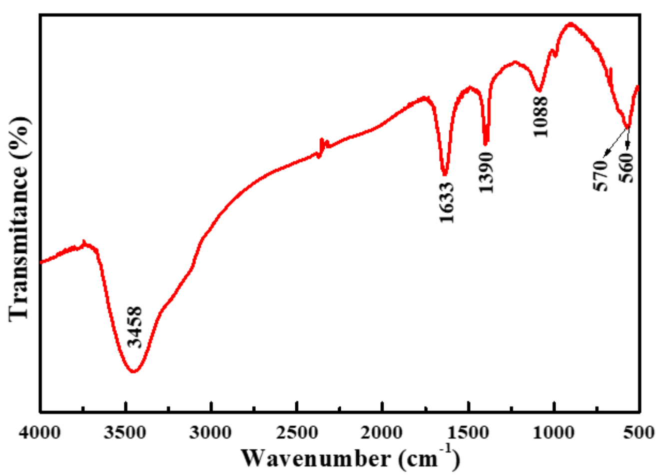

Figure S5. FTIR spectrum of the as-prepared Cu-Fe_3O_4/Cu/C.

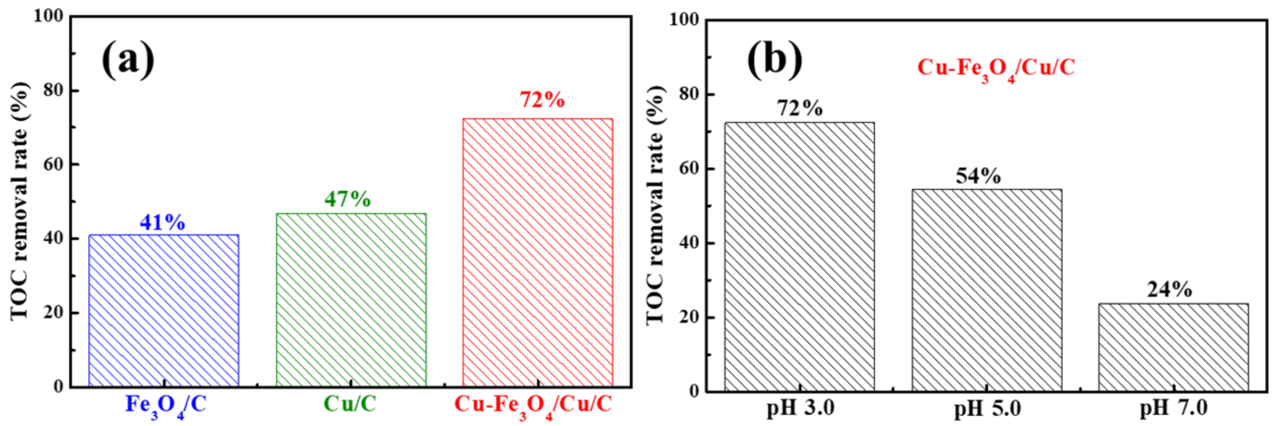

Figure S6. TOC removal rate in different (a) catalyst (b) pH systems and for US/H-Fenton degradation of RhB at 3 h of reaction time. Experimental conditions: [Fe_3O_4/C] = [Cu/C] = [Cu-Fe_3O_4/Cu/C] = 0.1 g/L, [H_2O_2] = 10.0 mmol/L, [RhB] = 10.0 mg/L, pH 3.0.

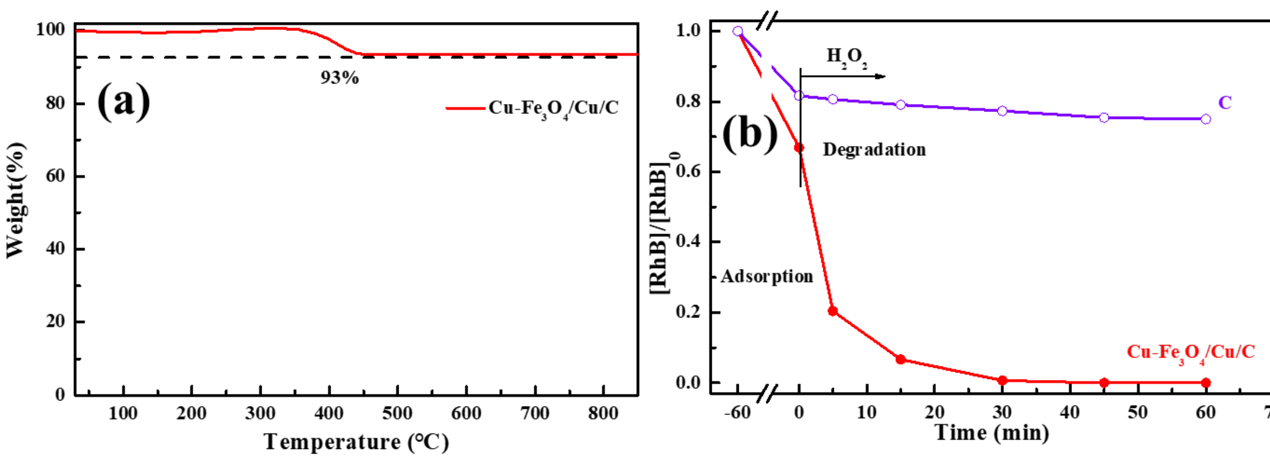

Figure S7. (a) TGA curve of Cu-Fe_3O_4/Cu/C catalyst in the air atmosphere. (b) RhB degradation efficiency of US/H-Fenton reaction by using C and Cu-Fe_3O_4/Cu/C catalysts at pH 3.0. Experimental conditions: [C] = 0.01 g/L, [Cu-Fe_3O_4/Cu/C] = 0.1 g/L, [H_2O_2] = 10.0 mmol/L, [RhB] = 10.0 mg/L.

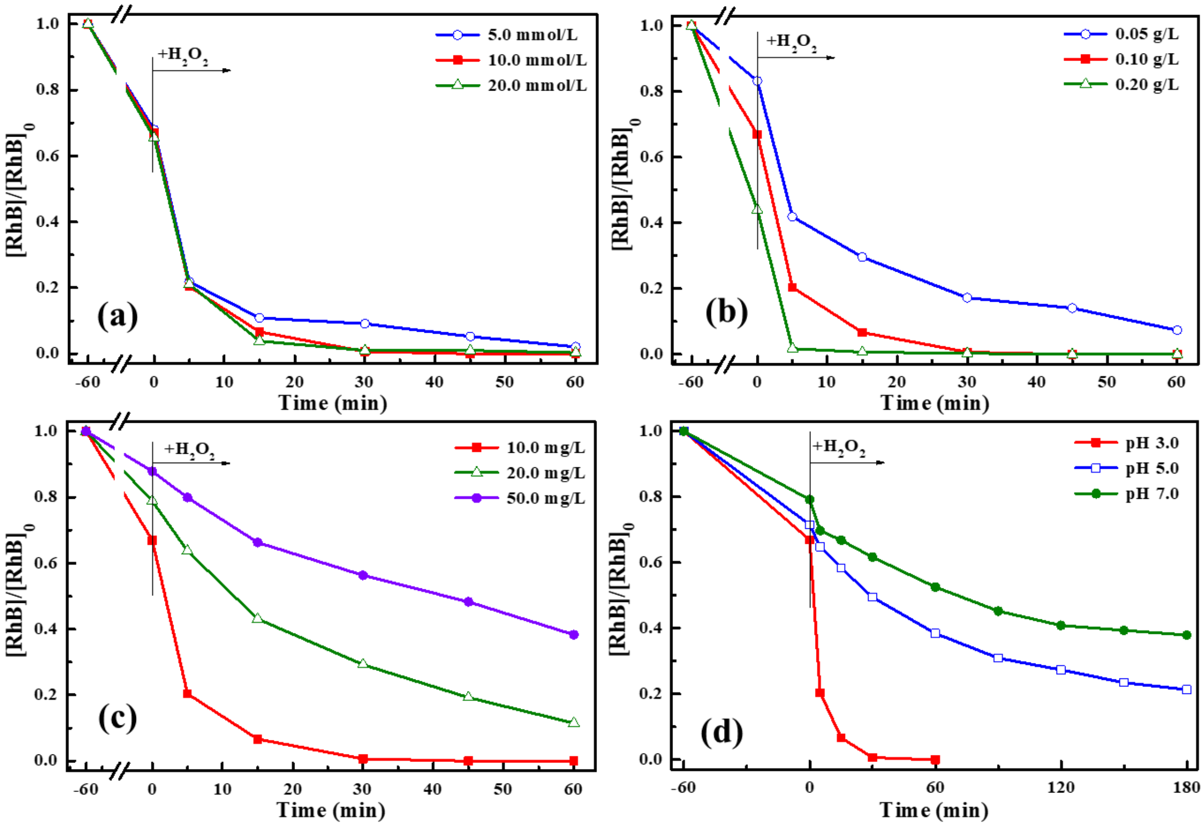

Figure S8. Effect of (a) H_2O_2 dosage, (b) Cu-Fe_3O_4/Cu/C dosage, (c) RhB concentration and (d) pH value on RhB degradation during US/H-Fenton process. Other reaction parameters were fixed at [Cu-Fe_3O_4/Cu/C] = 0.1 g/L, [H_2O_2] = 10.0 mmol/L, [RhB]= 10.0 mg/L, pH 3.0.

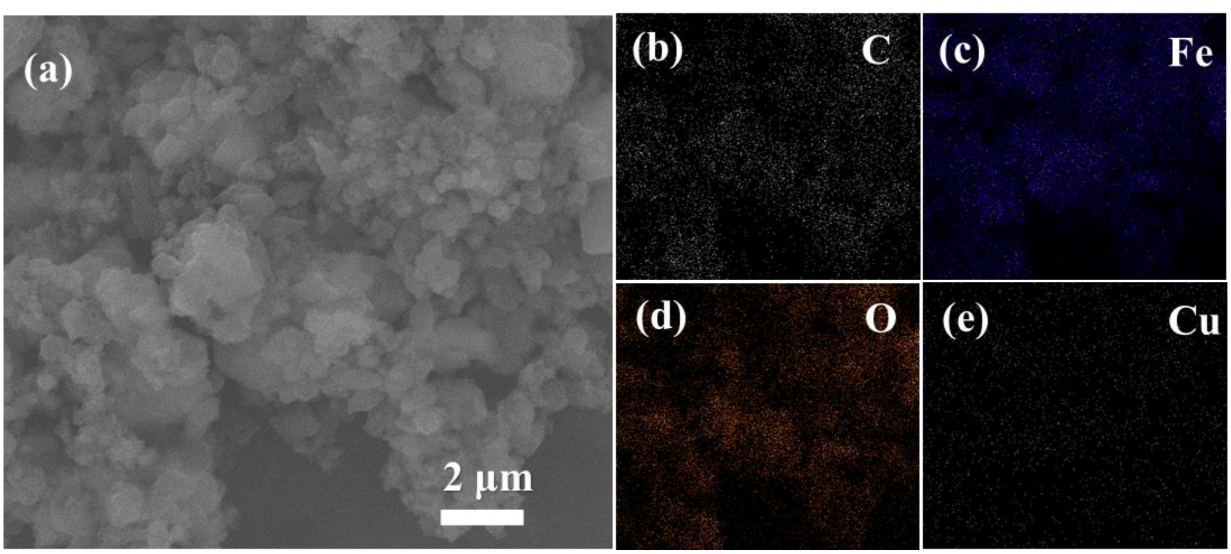

Figure S9. (a) SEM image and (b-e) EDS elemental mapping of the used Cu-Fe_3O_4/Cu/C.

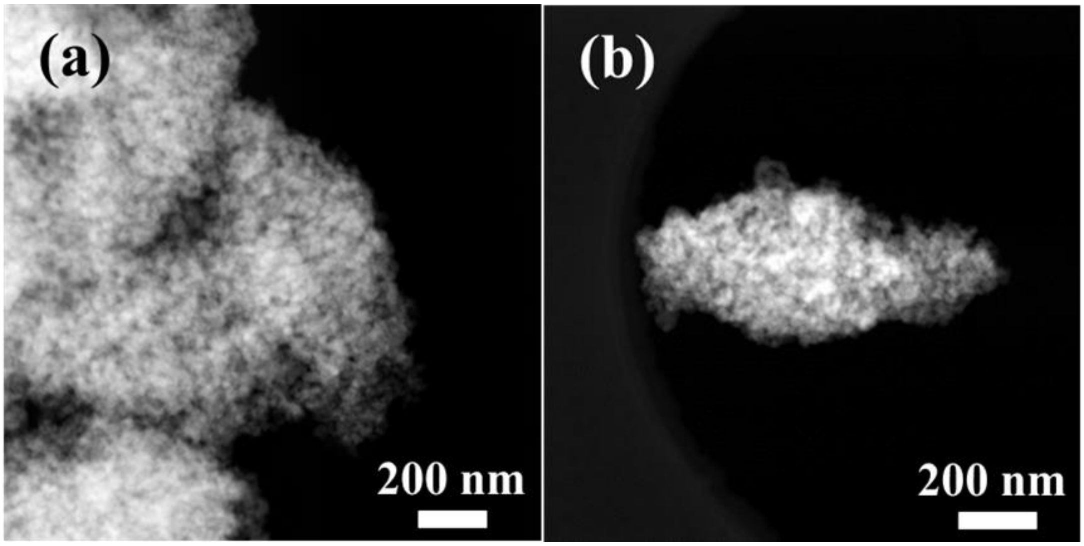

Figure S10. HAADF-STEM images of used Cu-Fe_3O_4/Cu/C.

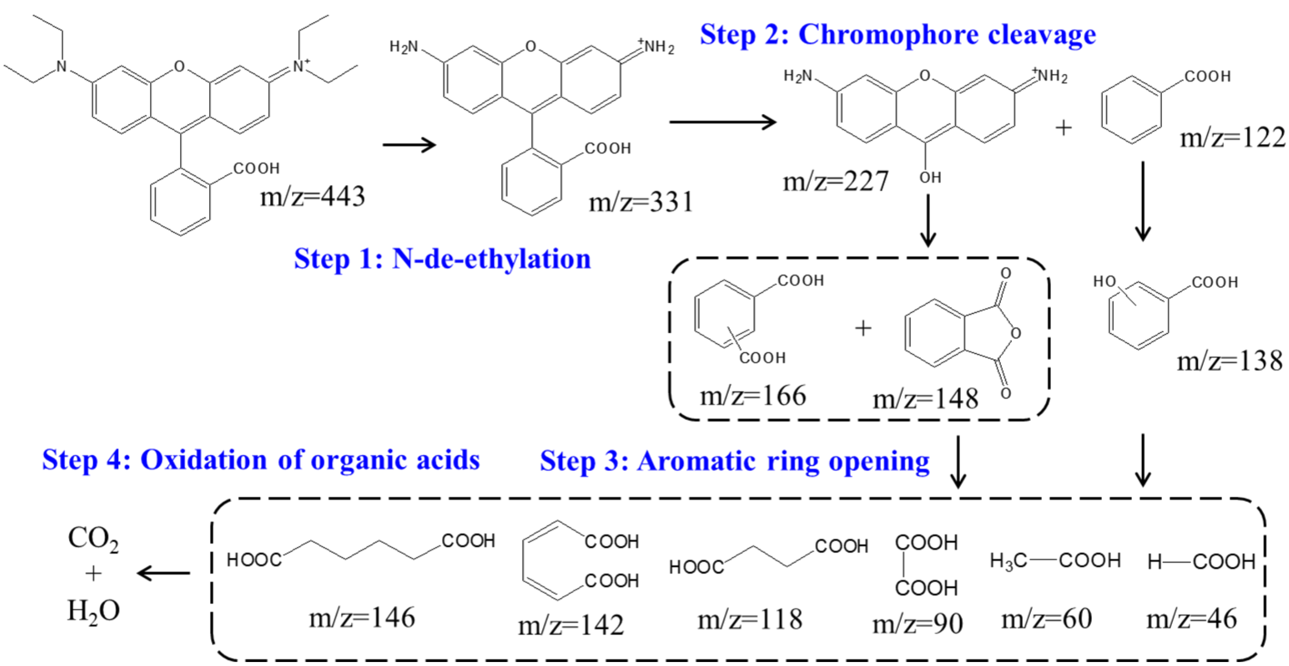

Figure S11. Possible degradation pathway of RhB in US/H-Fenton reaction.

Table S1. The comparison on RhB removal rate of Cu-Fe_3O_4/Cu/C with other reported heterogeneous catalysts.

Catalysts	Reaction conditions	Removal rate	Reference
α-Fe_2O_3/Graphene	pH = 2.9, [cat.] = 0.5 g/L, [H_2O_2] = 6.0 mL/L, [RhB] = 10.0 mg/L, UV irradiation	~90% (60 min)	(1)
Fe_2O_3	pH = 2.9, [cat.] = 0.5 g/L, [H_2O_2] = 5.0 mL/L, [RhB] = 10.0 mg/L, UV irradiation	100% (30 min)	(2)
$CoFe_2O_4$@PPy	pH = 7.0, [cat.] = 0.2 g/L, [H_2O_2] = 4.0 mL/L, [RhB] = 10.0 mg/L, UV irradiation	~100% (30 min)	(3)
Cu/C	pH = 3.9, [cat.] = 0.5 g/L, [H_2O_2] = 1.0 mL/L, [RhB] = 10.0 mg/L, US (40 kHz)	~60% (70 min)	(4)
Fe_3O_4	pH = 5.0, 55 °C, [cat.] = 0.5 g/L, [H_2O_2] = 3.7 mL/L, [RhB] = 4.8 mg/L	~84% (60 min)	(5)
FeS_2	pH = 3.0, [cat.] = 1.0 g/L, [H_2O_2] = 0.6 mL/L, [RhB] = 19.2 mg/L	~90% (60 min)	(6)
$MgFe_2O_4$	pH = 3.0, 45 °C, [cat.] = 1.0 g/L, [H_2O_2] = 10.0 mL/L, [RhB] = 10.0 mg/L	~40% (60 min)	(7)
MIL-88A(Fe)	[cat.] = 0.2 g/L, [H_2O_2] = 2.0 mL/L, [RhB] = 10.0 mg/L, UV irradiation	100% (60 min)	(8)
$Fe_4[Fe(CN)_6]_3$	pH = 3.5, 35 °C, [cat.] = 0.6 g/L, [H_2O_2] = 1.0 mL/L, [RhB] = 25.0 mg/L, UV irradiation	97% (60 min)	(9)
$ZnFe_2O_4$/C	35 °C, [cat.] = 1.0 g/L, [H_2O_2] = 20.0 mL/L, [RhB] = 5.0 mg/L, UV irradiation	100% (60 min)	(10)
$LuFeO_3$	pH = 3.0, 40 °C, [cat.] = 1.0 g/L, [RhB] = 5.0 mg/L, US (40 kHz)	~60% (90 min)	(11)
$FePO_4$/N-CNTs	pH = 4.1, [cat.] = 2.0 g/L, [H_2O_2] = 0.9 mL/L, [RhB] = 15.0 mg/L	100% (60 min)	(12)
CuO/Fe_2O_3/kaolin	pH = 3.0, [cat.] = 30.0 g/L, voltage = 10.0 V, aeration rate = 0.8 L/min, [RhB] = 20.0 mg/L	97% (60 min)	(13)
Cu-Fe_3O_4/Cu/C	pH = 3.0, 30 °C, [cat.] = 0.1 g/L, [H_2O_2] = 0.9 mL/L, [RhB] = 10.0 mg/L, US (40 kHz)	~100% (30 min)	This work

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