

Supporting information

Enhanced Activation of Peroxymonosulfate by Multivariate Zn_xCo_y -ZIF for Efficient Pharmaceutical Degradation in Water

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Table S1 The pore structure and properties of synthesized Zn_xCo_y -ZIF

Zn_xCo_y -ZIF	S_{BET} ($m^2 g^{-1}$)	V_{total} ($cm^3 g^{-1}$)	Pore size (nm)
ZIF-8	1377	1.713	0.852
$Zn_{0.75}Co_{0.25}$ -ZIF	1100	1.478	0.852
$Zn_{0.50}Co_{0.50}$ -ZIF	1306	1.648	0.852
$Zn_{0.25}Co_{0.75}$ -ZIF	1063	1.366	0.852
ZIF-67	950	1.120	0.926

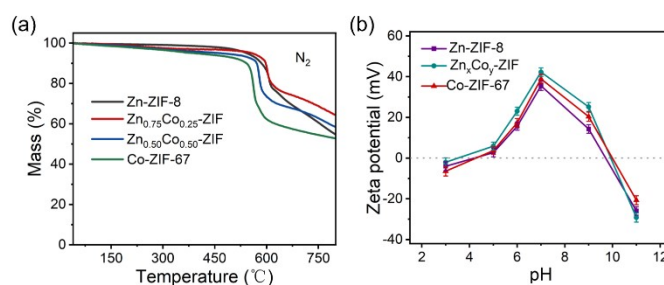


Fig. S1 (a) The TGA curves and (b) Zeta potential of as-synthesized Zn_xCo_y -ZIF.

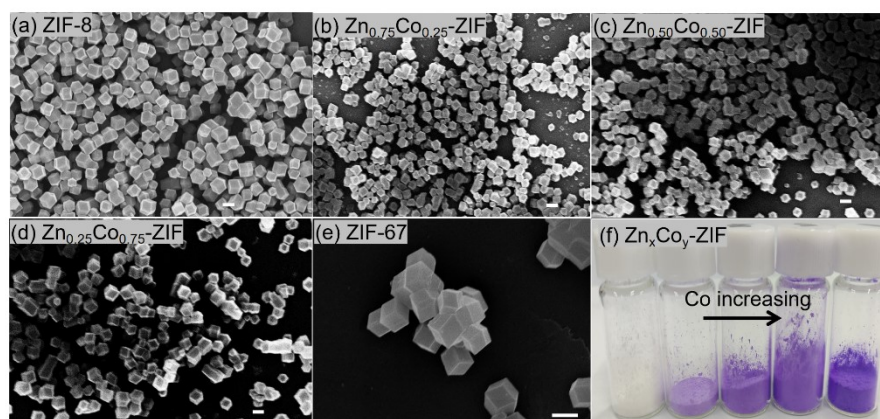


Fig. S2 (a-e) SEM images (scale bar:100 nm) and (f) digital photos of a series of Zn_xCo_y -ZIF materials.

Table S2 Determination of Zn/Co contents of as-synthesized Zn_xCo_y -ZIF by TEM and EDS mapping.

Zn_xCo_y -ZIF	Zn (%)	Co (%)	Zn/Co (Measured)	Zn/Co (Theoretical)
$Zn_{0.75}Co_{0.25}$ -ZIF	7.74	2.26	3.42/1	3/1
$Zn_{0.50}Co_{0.50}$ -ZIF	5.18	4.98	1.04/1	1/1
$Zn_{0.25}Co_{0.75}$ -ZIF	2.45	7.34	0.33/1	1/3

Table S3 Metal element analysis of as-synthesized Zn_xCo_y -ZIF by ICP-OES.

Zn_xCo_y -ZIF	Zn (%)	Co (%)	Zn/Co (Measured value)	Zn/Co (Theoretical value)
ZIF-8	31.67%	—	—	—
$Zn_{0.75}Co_{0.25}$ -ZIF	27.70%	5.45%	5.1/1	3/1
$Zn_{0.50}Co_{0.50}$ -ZIF	17.50%	13.60%	1.29/1	1/1
$Zn_{0.25}Co_{0.75}$ -ZIF	9.20%	22.92%	1/2.49	1/3
ZIF-67	—	30.01%	—	—

Table S4 Fitting by pseudo-first order kinetics model in Zn_xCo_y -ZIF/PMS system with different Zn/Co ratio

Zn/Co ratio	k_{obs} (min ⁻¹)	R ²
ZIF-8	0.0014	0.980
$Zn_{0.75}Co_{0.25}$ -ZIF	0.0040	0.967
$Zn_{0.50}Co_{0.50}$ -ZIF	0.0173	0.990
$Zn_{0.25}Co_{0.75}$ -ZIF	0.1112	0.962
ZIF-67	0.0521	0.979

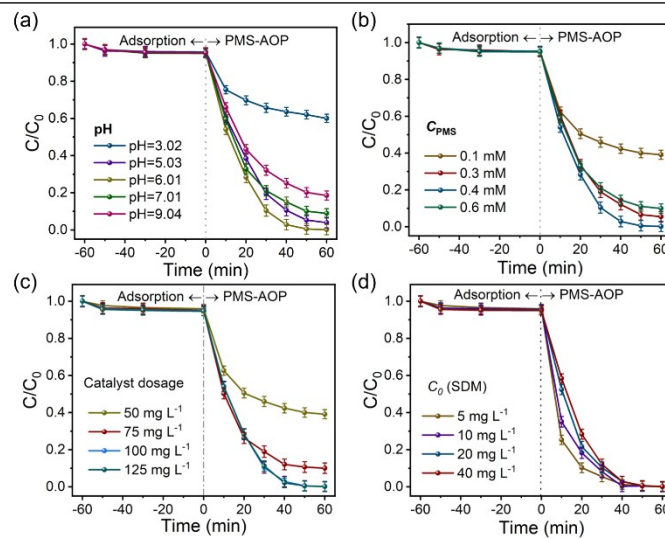


Fig. S3 The effects of various experimental conditions on SDM removal: (a) Acidity of the solution, (b) PMS concentration, (c) Catalyst dosage, (d) Initial SDM concentration. (Unless otherwise specified, reaction conditions:

initial pH = 6.2, [Catalyst] = 0.10 g L⁻¹, [PMS] = 0.4 mM, [SDM] = 10 mg L⁻¹)

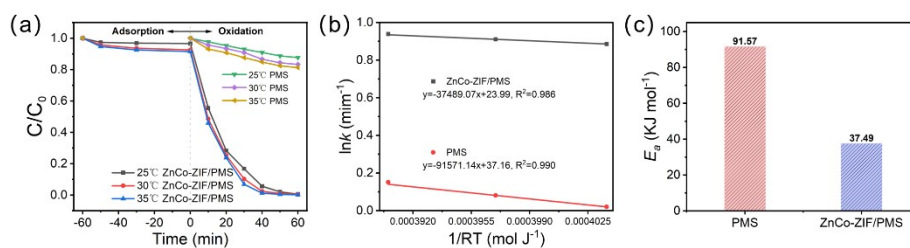


Fig. S4 (a) The effects of reaction temperature; (b-c) The activation energy demanded in the absence/presence of $Zn_{0.25}Co_{0.75}$ -ZIF. (Unless otherwise specified, reaction conditions: initial pH = 6.2, [Catalyst] = 0.10 g L⁻¹, [PMS] = 0.4 mM, [SDM] = 10 mg L⁻¹)

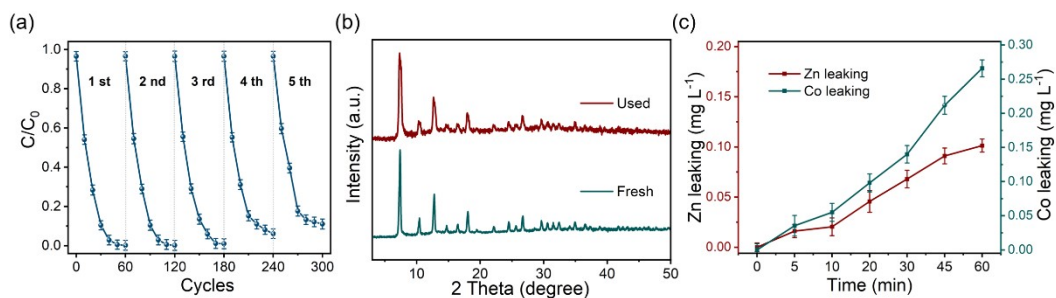


Fig. S5 (a) SDM degradation experiments with recycled catalyst in Zn_xCo_y -ZIF/PMS system, (b) The PXRD pattern of Zn_xCo_y -ZIF before and after cycling experiments, (c) The leaking experiment of metal ion after degradation reaction cycles.