Supporting Information

Supermagnetic Mn-substituted $ZnFe_2O_4$ in AB-sites Hybridization for Ultra-effective catalytic degradation of azoxystrobin

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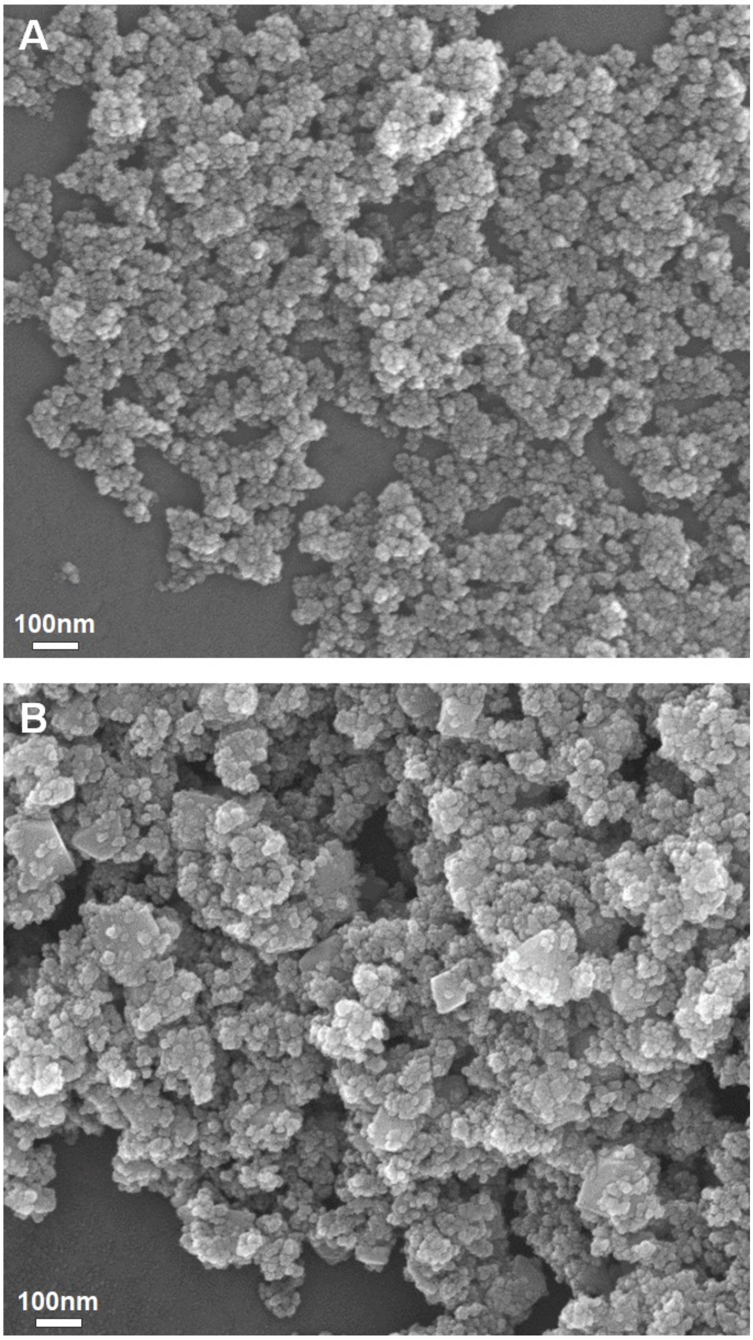

Figure S1. SEM images of the ZF and MF catalysts.

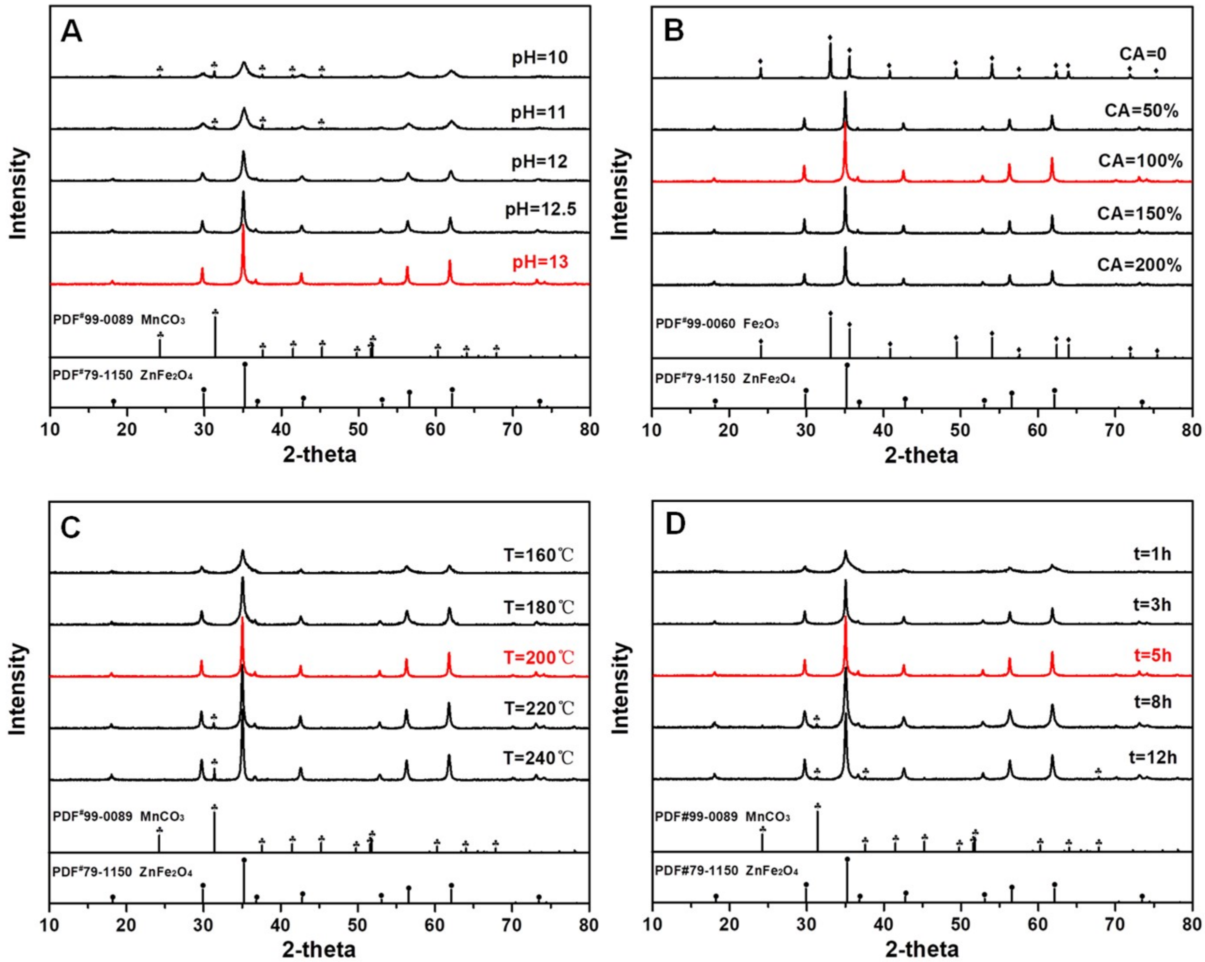

Figure S2. XRD patterns for the prepared Mn-substituted $ZnFe_2O_4$ samples ($ZMF_{0.75}$) at different pH value (A), citric acid addition (B), temperature (C) and reaction time (D) in hydrothermal reaction. Experimental conditions: (A) [CA] = 100%, T = 200 °C, t = 5 h; (B) pH = 13, T = 200 °C, t = 5 h; (C) pH = 13, [CA] = 100%, t = 5 h; (D) pH = 13, [CA] = 100%, T = 200 °C.

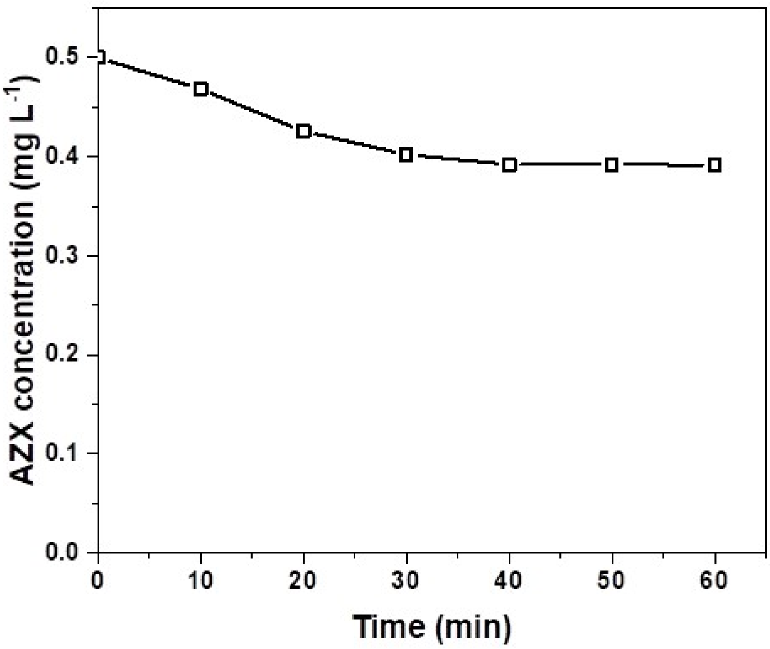

Figure S3. AZX removal efficiency by ZMF0.75 adsorption at the control experimental conditions of [AZX] = 0.5 mg L^{-1}, [$ZMF_{0.75}$] = 0.2 g L^{-1}, and pH = 4.5 ± 0.2.

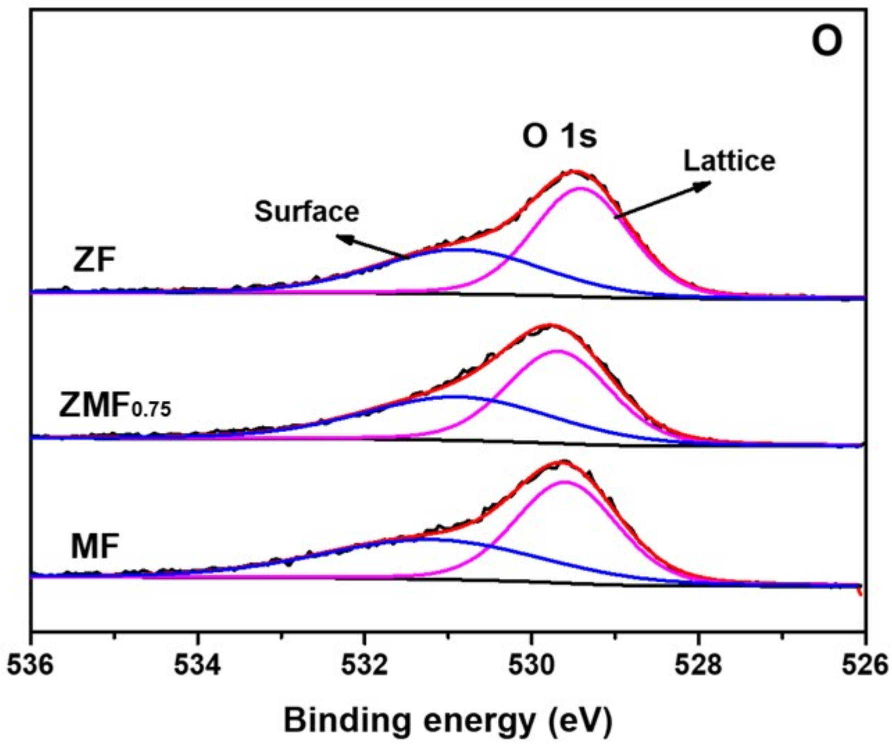

Figure S4. High resolution XPS spectra of O 1s for ZF, $ZMF_{0.75}$ and MF, respectively.

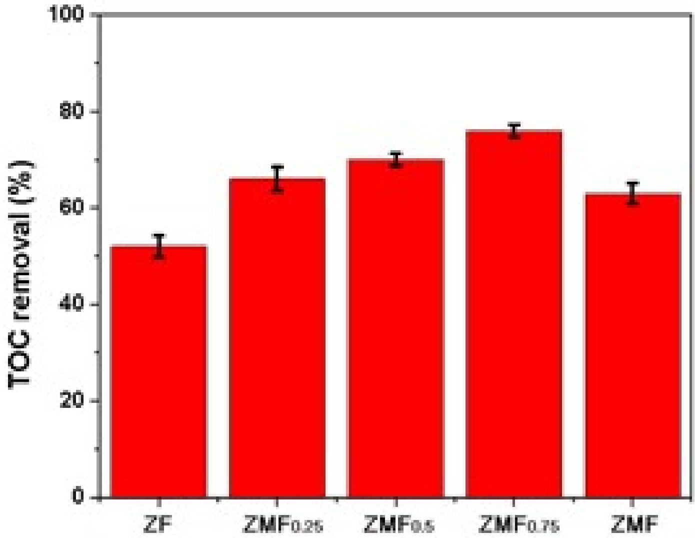

Figure S5. TOC removal based on the as-prepared catalysts in Fenton-like system at 10 hours. The experimental conditions are [AZX] = 0.5 mg L^{-1}, [catalyst] = 0.2 g L^{-1}, pH = 4.5 ± 0.2, [H_2O_2] = 100 mM.

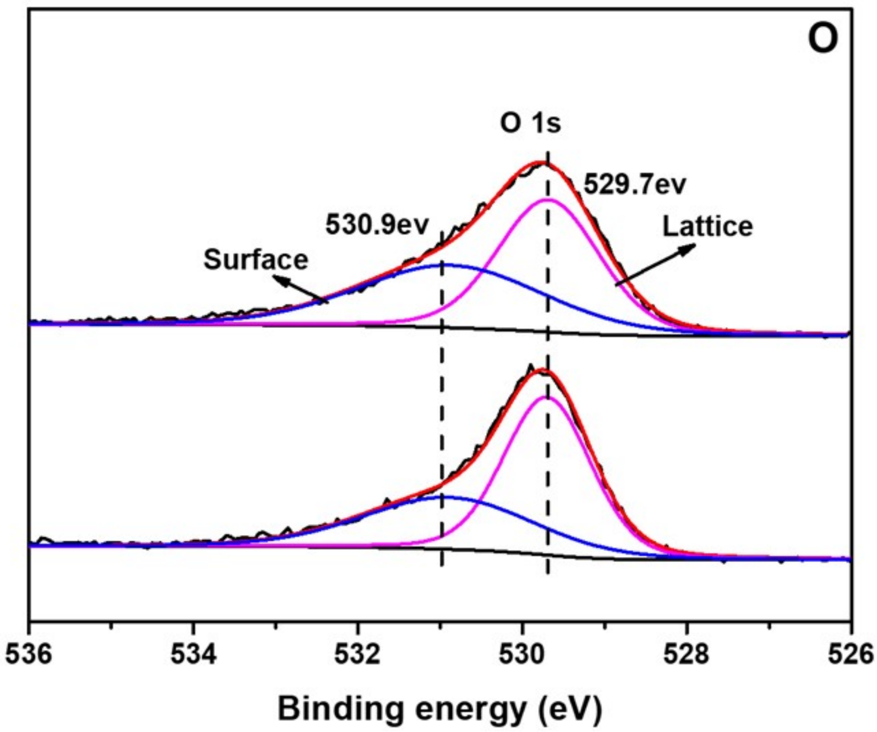

Figure S6. High resolution XPS spectra of O 1s for used $ZMF_{0.75}$ compared with its fresh.

Table S1. Characteristics summary of the as-prepared catalysts on crystal lattice parameters and crystal size

Catalyst	Crystal structure				[a] Crystallite size (nm)
	a [Å]	a [Å]	a [Å]	V [$Å^3$]	
ZF	8.441	8.441	8.441	602.26	9.4
$ZMF_{0.25}$	8.449	8.449	8.449	603.46	13.9
$ZMF_{0.5}$	8.467	8.467	8.467	606.94	21.2
$ZMF_{0.75}$	8.483	8.483	8.483	610.22	20.9
MF	8.505	8.505	8.505	614.14	19.8

[a] Calculation by the Scherrer equation based on the facet (311).

Table S2. A brief of Fenton-like system driven by varied spinel ferrites for organic pollutants degradation

Catalyst	Synthesis method	Morphology/ nanostructure	System conditions	Degradation rate	Radical species	Ref.
$ZMF_{0.75}$	Hydrothermal way	Nanocluster with nanoparticle size of 5~10 nm	[AZX] = 0.5 mg L^{-1}, [catalyst] = 0.2 g L^{-1}, $[H_2O_2]$ = 100 mM, pH = 4.5 ± 0.2	99% in 300 min	$HO^{\bullet}$, $HO_2^{\bullet}$	This report
Fe_3O_4	Chemical coprecipitation method	Qusi-spherical particles	[4-chlorocatechol] = 1 mmol L^{-1}, [catalyst] = 1 g L^{-1}, $[H_2O_2]$ = 50 mM, pH = 6.5 ± 0.2	~99% in 180 min	$HO^{\bullet}$, $HO_2^{\bullet}$, $O_2^{\bullet -}$	1
$MnFe_2O_4$	Sol-gel method	Near-nubby morphology	[norfloxacin] = 10 mg L^{-1}, [catalyst] = 0.6 g L^{-1}, $[H_2O_2]$ = 200 mM, pH = 6.6	90.6% in 180 min	$HO^{\bullet}$	2
$Mn_{1.07}Fe_{1.93}O_4$	Solvothermal way	Sphere-like morphology	[methylene blue] = 400 mg L^{-1}, [catalyst] = 0.5 g L^{-1}, $[H_2O_2]$ = 1323 mM, pH at acidic	98.2% in 360 min	$HO^{\bullet}$, $HO_2^{\bullet}$	3

References:

[1] J. He, X. Yang, B. Men, Z. Bi, Y. Pu, D. Wang, Heterogeneous Fenton oxidation of catechol and 4-chlorocatechol catalyzed by nano-Fe_3O_4: Role of the interface, *Chemical Engineering Journal*, 2014, 258, 433-441.

[2] G.Wang, D. Zhao, F. Kou, Q. Ouyang, J. Chen, Z. Fang, Removal of norfloxacin by surface Fenton system ($MnFe_2O_4/H_2O_2$): Kinetics, mechanism and degradation pathway, *Chemical Engineering Journal*, 2018, 351, 747-755.

[3] M., Li, Q. Gao, T. Wang, Y.S., Gong, B. Han, K.S., Xia, C.G., Zhou, Solvothermal synthesis of $Mn_xFe_{3-x}O_4$ nanoparticles with interesting physicochemical characteristics and good catalytic degradation activity, *Materials & Design*, 2016, 97, 341-348.