Supplementary Information

A core-shell structural catalyst with graphitic carbon encapsulating Fe_3C and Fe_3N used for H_2O_2 activation to degrade norfloxacin

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1 Chemicals and materials

Norfloxacin (NOR) and furfuryl alcohol (FFA) were supplied by Aladdin Co., Ltd (Shanghai， China). Ferric nitrate ($Fe(NO_3)_3·9H_2O$), glucose, urea ($CO(NH_2)_2$), *p*-benzoquinone (*p*-BQ, 97%), *tert*-butyl alcohol (TBA,), and hydrogen peroxide (H_2O_2) were purchased from Chengdu Kelong reagent Co. (Chengdou, China). Sodium hydroxide (NaOH), hydrochloric acid (HCl), Sodium chloride (NaCl), sodium sulfate anhydrous (Na_2SO_4), sodium carbonate anhydrous (Na_2CO_3), Sodium nitrate ($NaNO_3$), were gained from Macklin Reagent Co. Ltd (Shanghai, China).

2 Characterization techniques

X-ray diffraction (XRD) analysis was performed with a Haoyuan DX-2700BH diffractometer. Copper Kα radiation (1.54 Å) was generated with a tube voltage of 40 kV and a tube current of 30 mA. BrunauerEmmett-Teller (BET) was analyzed by an SSA-4200 automatic surface analyzer (Beijing Builder Electronic Technology Co., LTD, China). Scanning electron microscopy (SEM) and energy dispersive X-ray (EDX) elemental mapping images were collected on a Gemini SEM 300 scanning electron microscope (ZEISS, Germany) at an accelerating voltage of 5 kV. XPS measurements were performed on an ESCALABMK II X-ray photoelectron spectrometer using Mg as the exciting source.

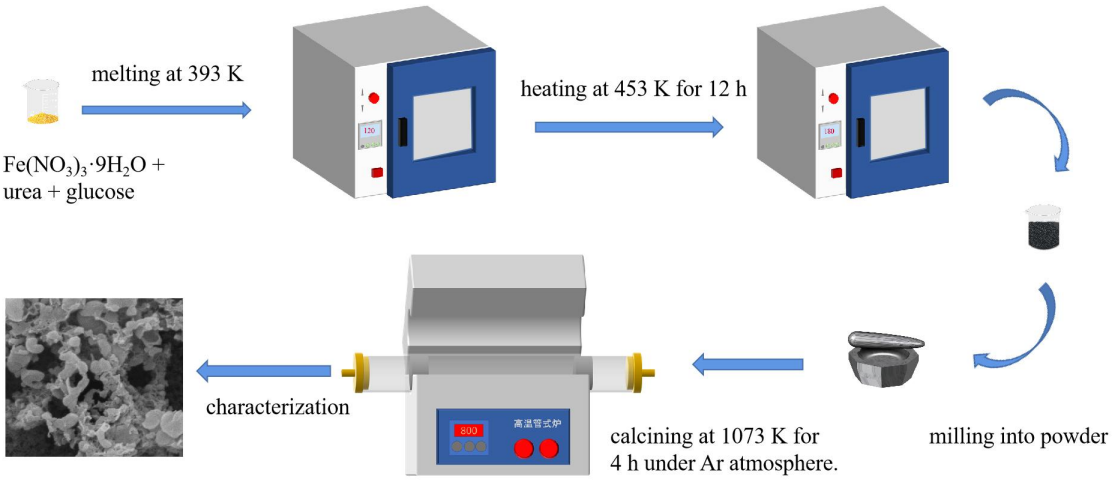

Fig. S1. Schematic diagram of FeNC@C preparation process.

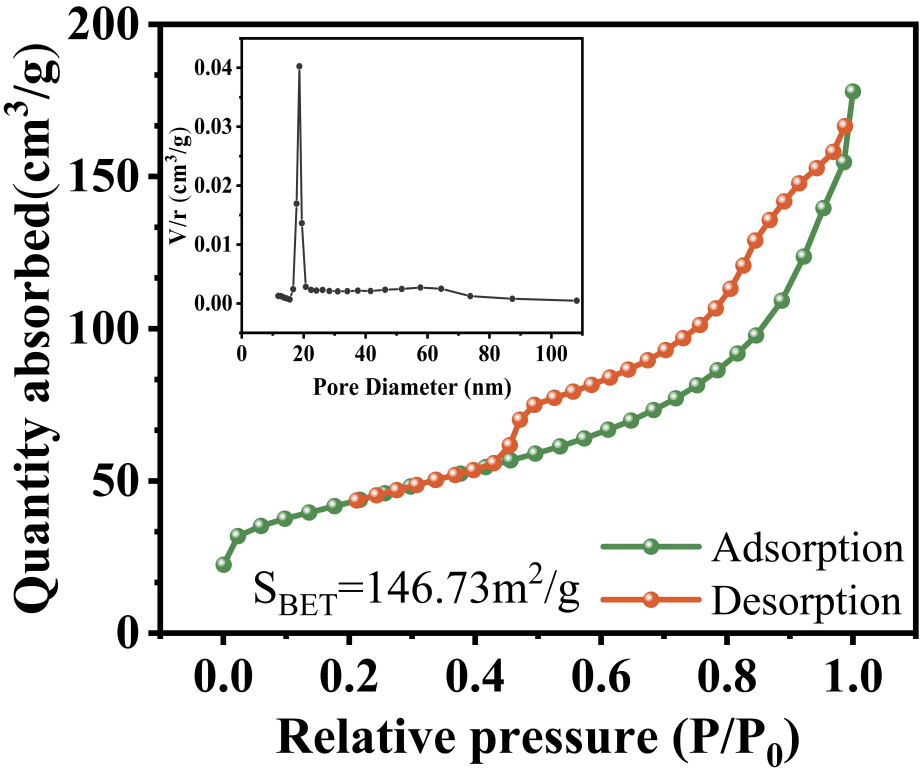

Fig. S2. N_2 adsorption-desorption isotherm and pore size distribution plot (inset) of FeNC@C.

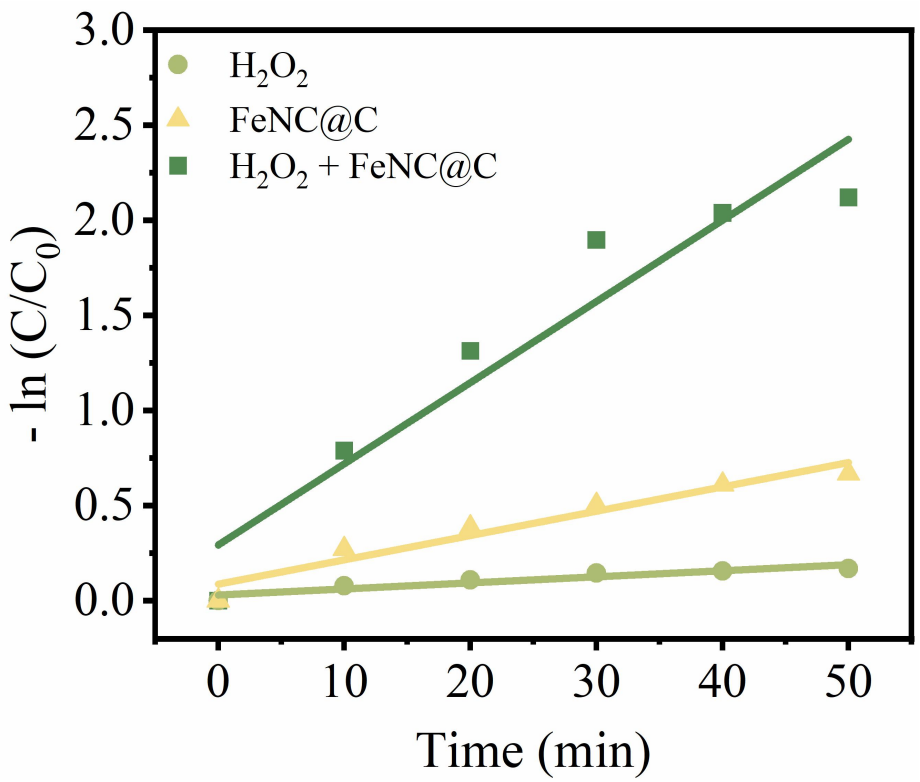

Fig. S3. The pseudo-first-order kinetic curves in different reaction systems.

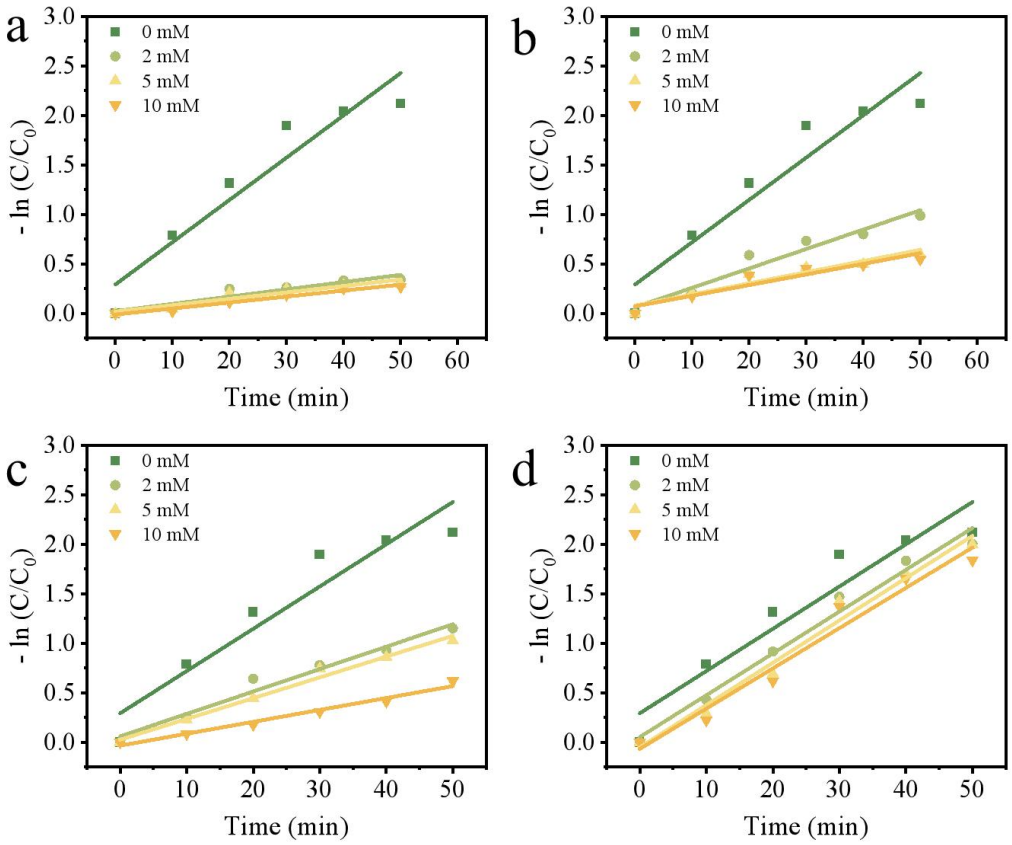

Fig. S4. The corresponding kinetic fitting curves of (a) Cl^- concentration, (b) SO_4^{2-} concentration, (c) CO_3^{2-} concentration, (d) NO_3^- concentration on NOR degradation in FeNC@C/H_2O_2 system.

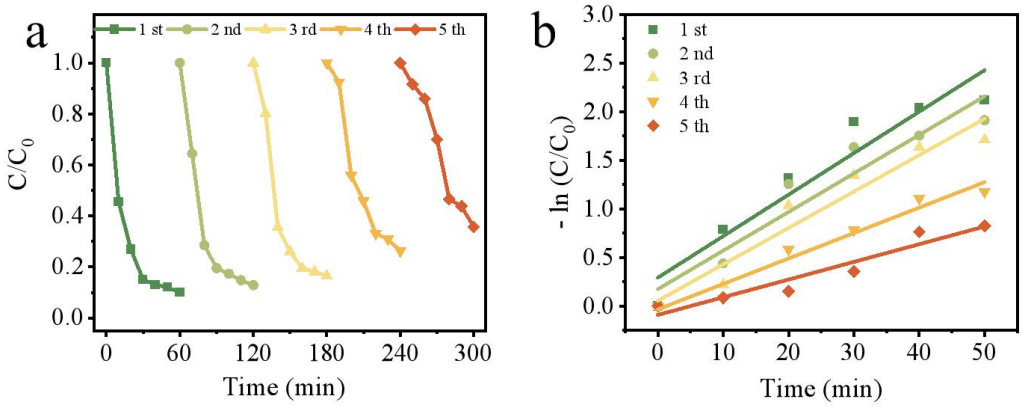

Fig. S5. (a) NOR degradation with recycled FeNC@C. (b) The corresponding kinetic fitting curves.([NOR] = 20 mg/L (100 mL), [catalyst] = 0.3 g/L, [H_2O_2] = 20 mM, pH = 5).

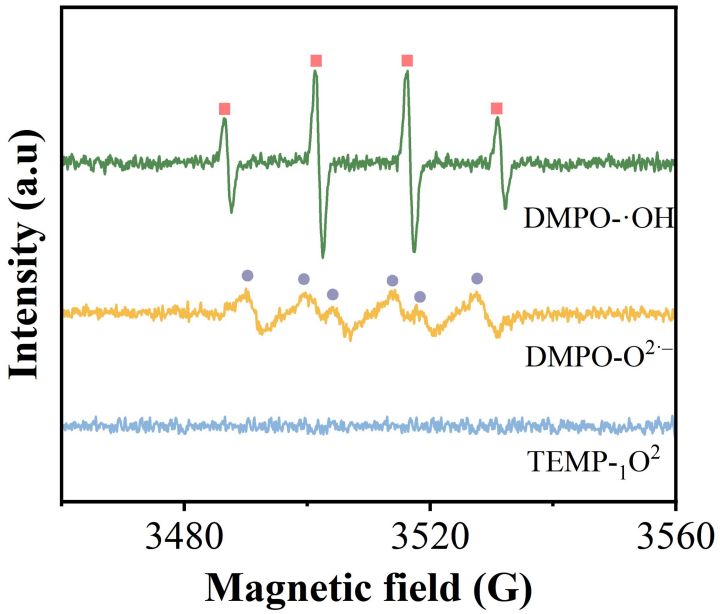

Fig. S6. EPR spectra of DMPO-·OH , DMPO-$O_2^{\cdot -}$ and TEMP-$^1O_2$.

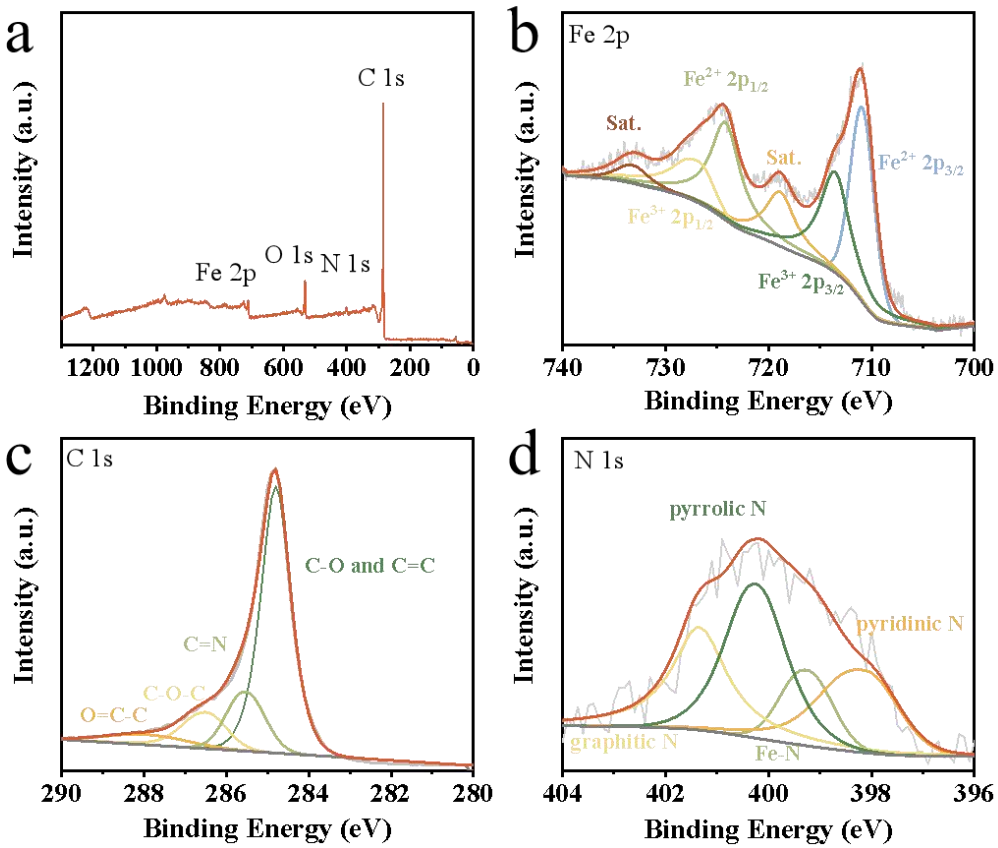

Fig. S7. (a) XPS survey spectrum of used FeNC@C. High-resolution spectra of FeNC@C in the (b) Fe 2p, (c) C 1s, and (d) N 1s regions.

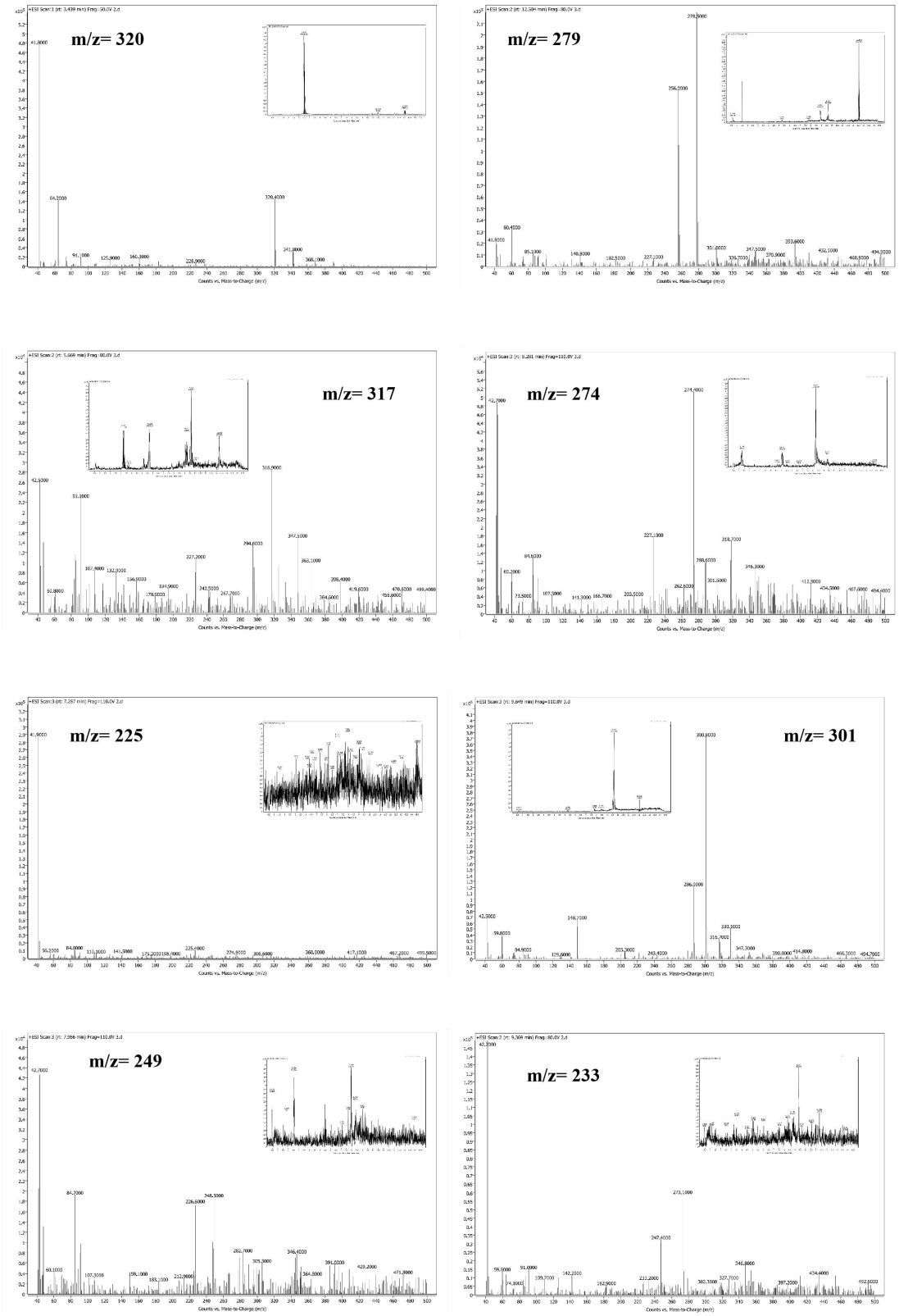

Fig. S8. The results of HPLC-MS chromatographic of NOR degradation products in the EIS (+) mode.

Table S1. Comparison of NOR degradation efficiency with different catalysts.

Catalyst	NOR degradation efficiency (%)	Reactive time (min)	Condition	Ref.
FeNC@C	90	60	[NOR] = 20 mg/L [catalyst] = 300 mg/L $[H_2O_2]$ = 20 mM	This work
Fe_3O_4/MWCNTs	90	120	[NOR] = 0.5 mg/L [catalyst] = 1000 mg/L $[H_2O_2]$ = 100 mM Xenon lamp (300 W)	[1]
RM-PB	90	60	[NOR] = 20 mg/L [catalyst] = 2000 mg/L $[H_2O_2]$ = 9.79 mM	[2]
TiO_2/BiOCl	84	180	[NOR] = 10 mg/L [catalyst] = 500 mg/L Xe lamp (300 W)	[3]
Fe/Ce-MIL-101	94	60	[NOR] = 10 mg/L [catalyst] = 300 mg/L $[H_2O_2]$ = 20 mM	[4]
$MnFe_2O_4$	90	180	[NOR] = 10 mg/L [catalyst] = 300 mg/L $[H_2O_2]$ = 200 mM	[5]

References

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