Electronic Supplementary Material (ESI) for Environmental Science: Nano.

Robust Degradation of Tetracycline Antibiotic through Recyclable Fe_3S_4/Ti_3C_2MXene Composites

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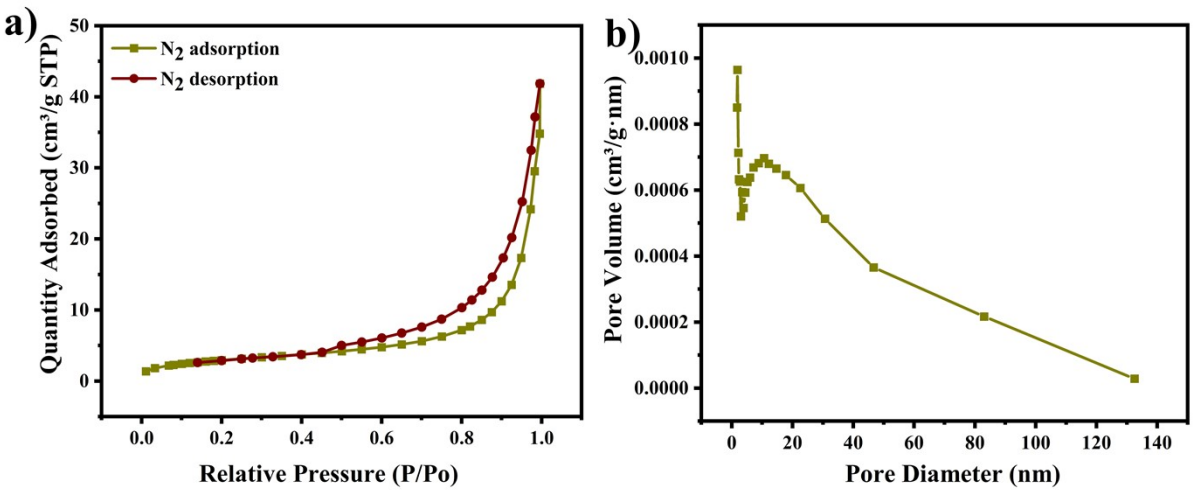

Fig. S1. a) N_2 adsorption-desorption isotherms and b) pore size distribution of Fe_3S_4/Ti_3C_2MXene composite.

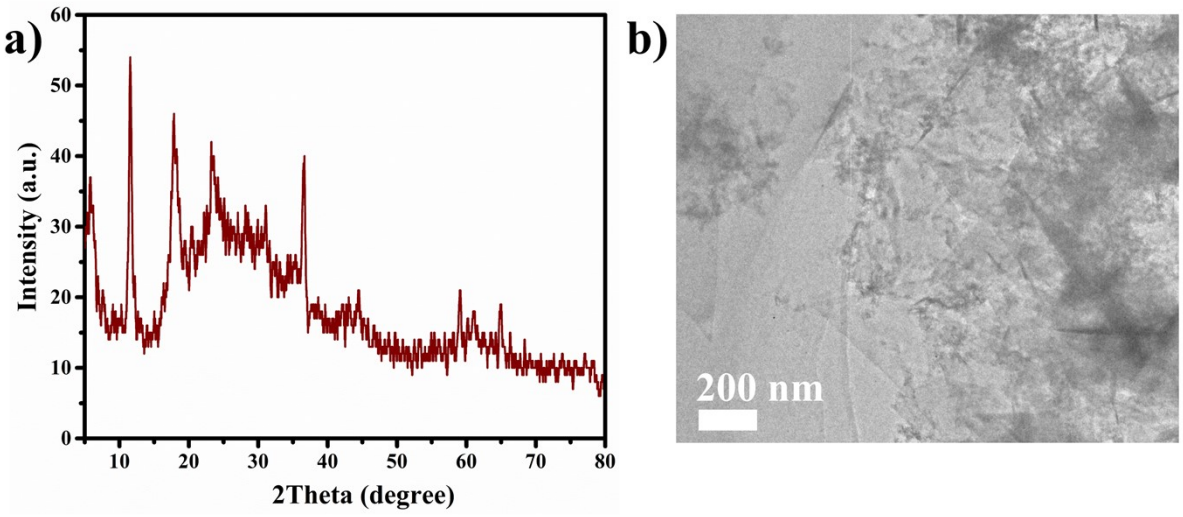

Fig. S2. a) XRD and b) TEM of the prepared material using Water instead of DES.

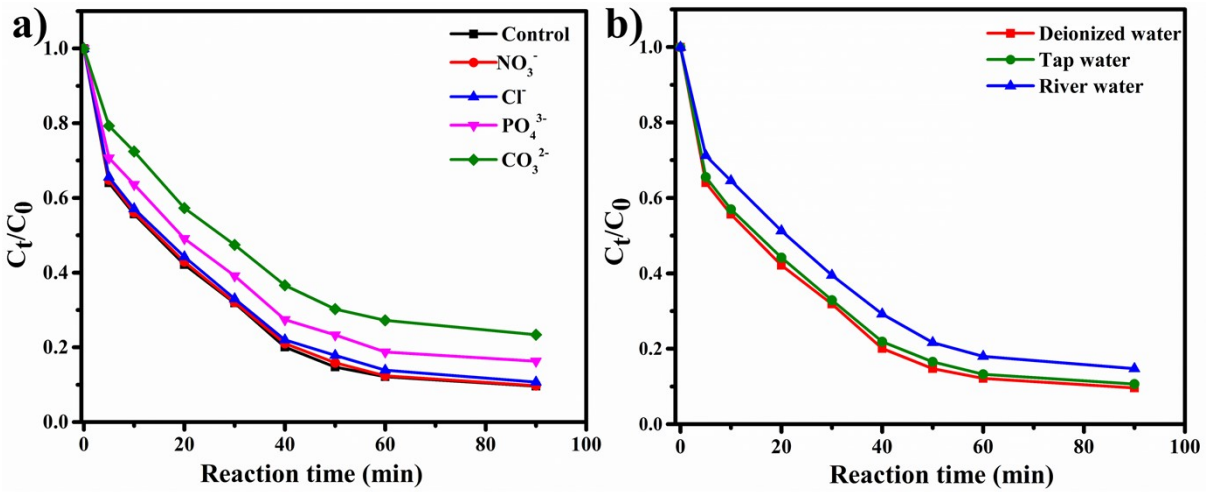

Fig. S3. a) Effect of various ions on TC degradation and b) The application of Fe_3S_4/Ti_3C_2MXene+H_2O_2 system with the actual water body. Reaction conditions: [H_2O_2]:1 mM, solution pH:3, [Fe3S4/Ti_3C_2MXene]:1 g/L, [TC]:100 mg/L, and the reaction time: 90 min at 25 °C.

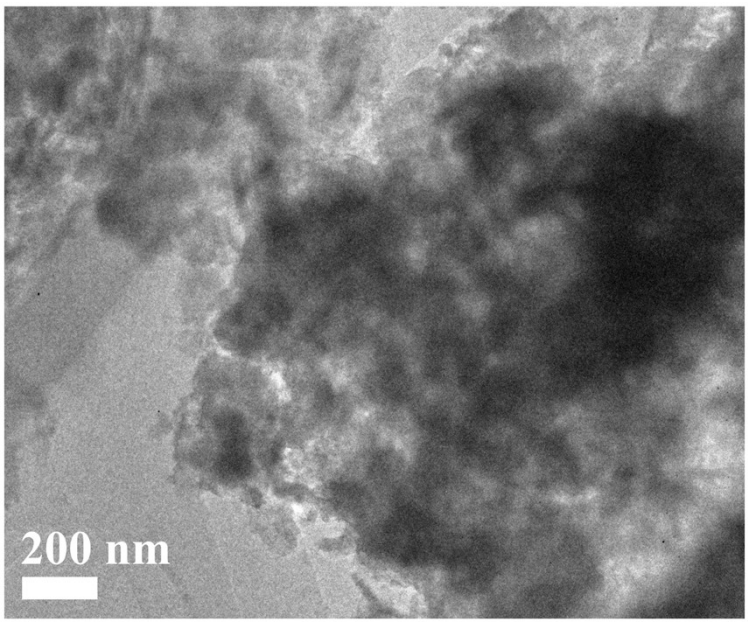

Fig. S4. TEM image after 4 cycles of reuse

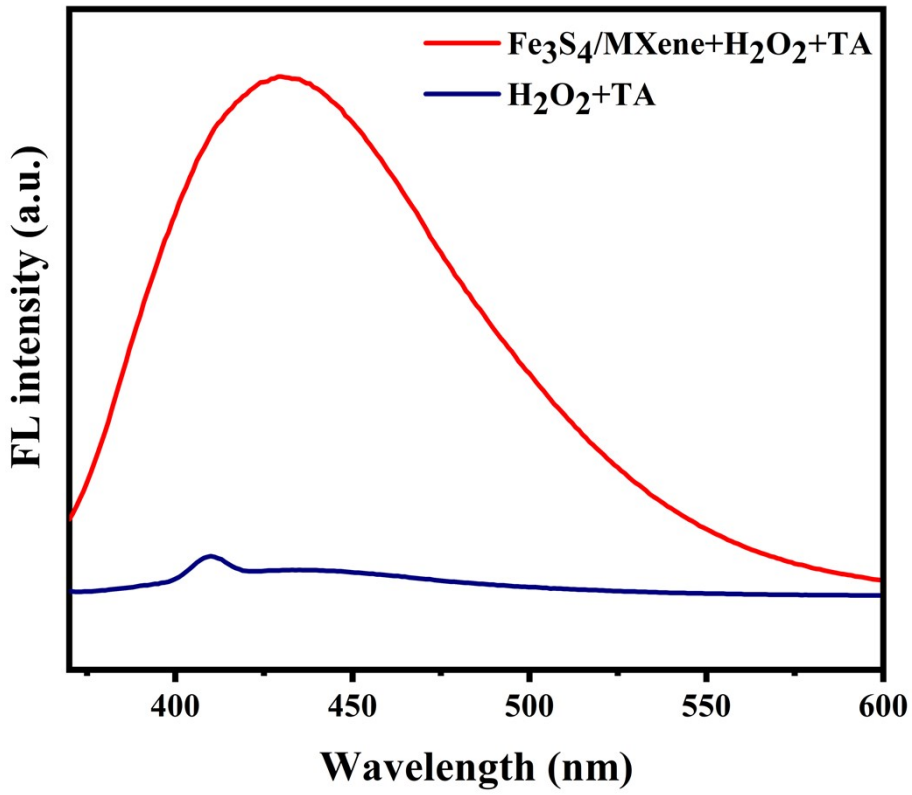

Fig. S5. Fluorescence essay in terephthalic acid.

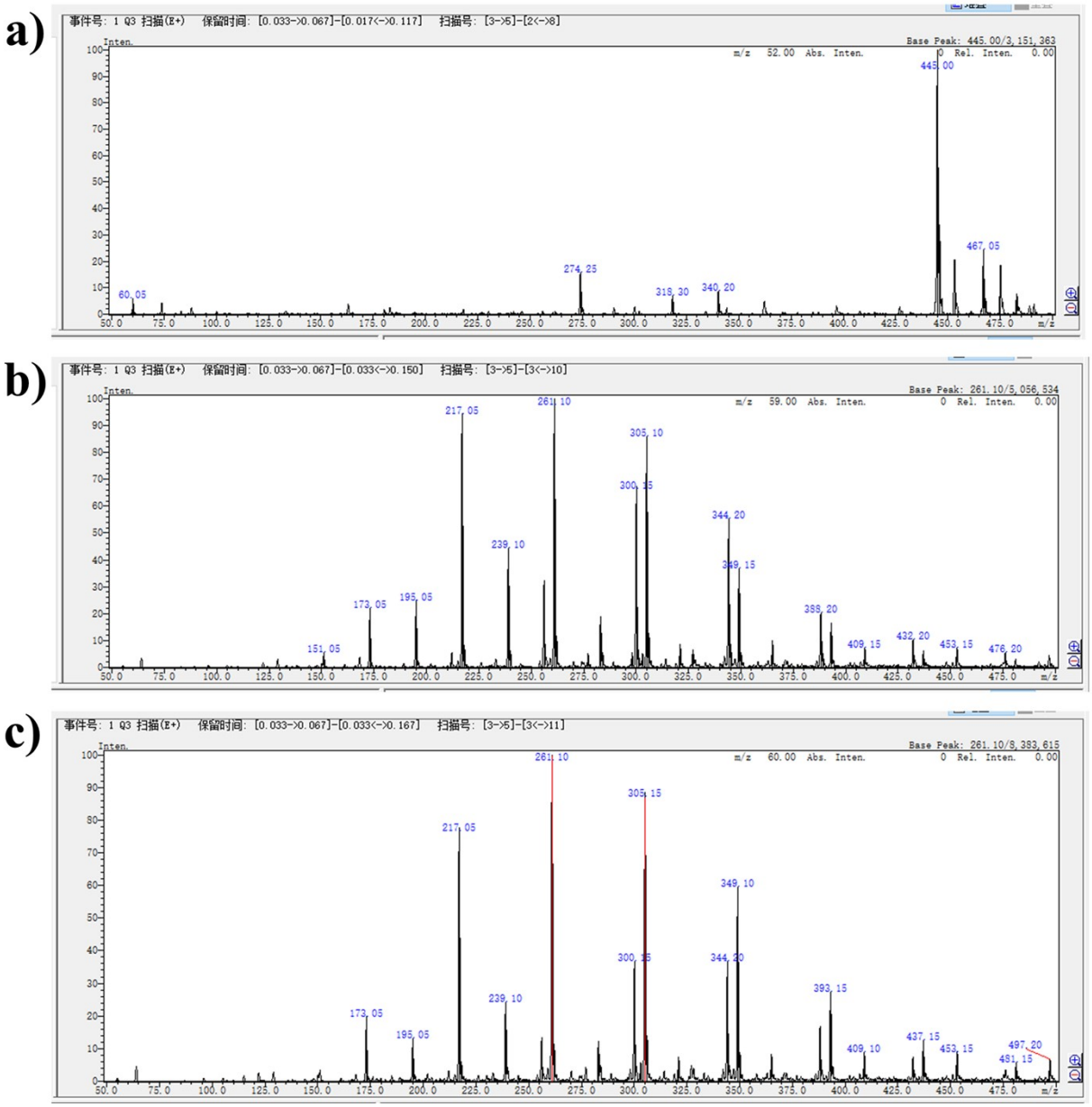

Fig. S6. GC/LC-MS spectra of TC a) before degradation b) and c) after degradation in 30 and 90 min respectively in Fe_3S_4/MXene+H_2O_2 system.

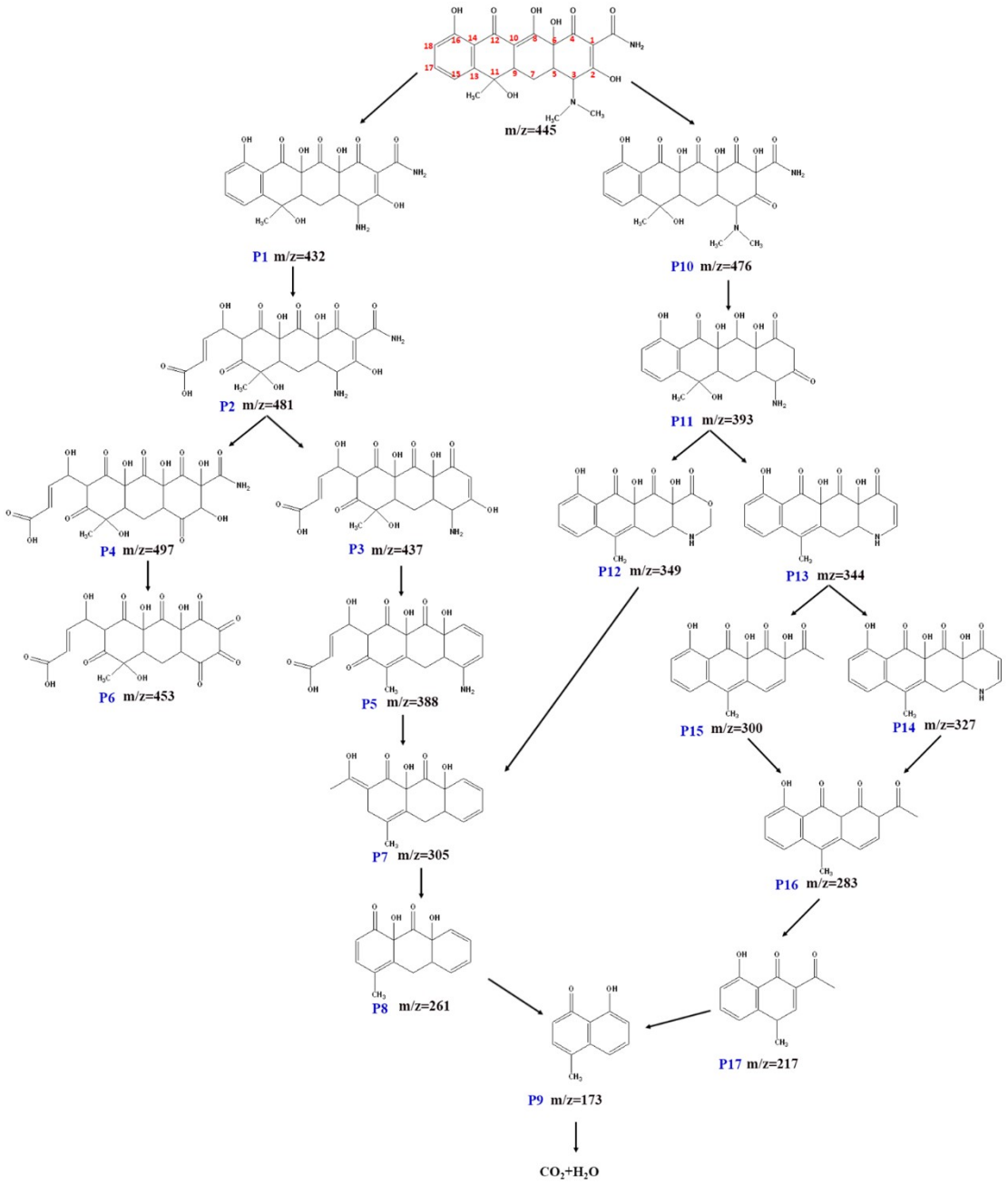

Fig. S7. TC degradation pathway in Fe_3S_4/MXene+H_2O_2 system.

compounds	Mobile phase	Flow rate (mL/min)	Wavelength (nm)
Ibuprofen	Acetonitrile: 40% 0.1% Acetic acid: 60%	0.5	222
Sulfamethoxazole	Methanol: 70% 0.2% Acetic acid: 30%	1	264
Bisphenol A	Water:70% Acetonitrile: 30%	1	280

Table S1: HPLC conditions for different compounds

Table S2. Surface area, pore volume, and pore size of prepared materials.

Materials	Surface area (m^2/g)	Pore volume (cm^3/g)	Pore size (nm)
MXene	6.92	0.03	16.40
Fe_3S_4	27.44	0.12	17.30
Fe_3S_4/MXene	10.88	0.05	19.81

Table S3. Fitted parameters of pseudo-first-order model for TC degradation in different systems.

Pseudo-first-order model		
System	**R^2**	**k (min^{-1})**
Fe_3S_4/MXene+H_2O_2	0.9815	0.0338
Fe_3S_4+H_2O_2	0.9566	0.0155
Fe_3S_4/MXene	0.9834	0.0090
MXene+H_2O_2	0.9466	0.0060
Fe_3S_4	0.9715	0.0055
MXene	0.9442	0.0037
H_2O_2	0.9166	0.0018

Table S4: Comparison of different catalysts for H_2O_2 activation in TC removal

Catalyst	Reaction conditions	Degradation rate	Time	References
Fe_3O_4 nanospheres	$[H_2O_2]$: 50 mM Fe_3O_4 nanospheres: 0.5 g/L [TC]: 25 mg/L pH: 7	82%	110 min	[1]
micro-nano bubble	$[H_2O_2]$: 30 mM air intakes: 30 mL/min [TC]: 20 mg/L pH: 3	92.43%	150 min	[2]
ZIF-67	$[H_2O_2]$: 20 eq vs mol TC ZIF-67: 0.2g/l [TC]:50 mg/L	69%	35 min	[3]
Meso-Fe/Co	$[H_2O_2]$: 30 mM Fe/Co: 0.6 g/L [TC]: 30 mg/L pH: 7	86%	3h	[4]
Fe_3S_4/Ti_3C_2MXene	$[H_2O_2]$: 1 mM Fe_3S_4/Ti_3C_2MXene: 1g/L [TC]: 100 mg/L pH: 3	90.40%	90 min	This work

References

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