Supplementary Data

Enhanced sulfamethoxazole ozonation based on magnetic Fe$_3$O$_4$ nanoparticles by noble-metal-free catalysis：Catalytic performance and degradation mechanism

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Chromatography condition

SMX concentration was determined by HPLC (Waters, C$_{18}$, λ=270nm). The mobile phase was a mixture of acetonitrile and 0.2% acetic acid with the volume ratio 40:60. A 10μL volume was injected using the auto sampler. FA concentration was also determined by HPLC (λ=210nm). The mobile phase was a mixture of acetonitrile and 0.5% phosphoric acid with the volume ratio 5:95. The intermediates of SMX degradation were measured by HPLC–MS/MS (Finnigan, LCQ-DECA-XP-MAX), which was equipped with a Zorbax SB-C$_{18}$ HPLC column (150 mm×2.1 mm ×3.5 μm, Agilent). The mobile phase was a mixture of acetonitrile and acetic acid. A 10μL volume was injected using the auto sampler. In MS analysis, the ionization for MS was operated at APCI mode with negative ion mode.

Kinetic methods

The method applied in kinetics was based on the comparison reaction between the degradation rate of SMX and that of the reference compound. In this research, the reference compound was the fumaric acid (FA).

Considering that the kinetic of both SMX and FA follow the equations:

$$\frac{d[SMX]}{dt} = - k_{SMX} \cdot [O_3] \cdot [SMX]$$

(1)

$$\frac{d[FA]}{dt} = - k_{FA} \cdot [O_3] \cdot [FA]$$

(2)

Dividing Eq. (1) by Eq. (2) and solving the resulting integration, Eq. (3) is obtained:

$$ln\frac{[FA]}{[FA]_0} = - \frac{K_{FA}}{K_{SMX}} ln\frac{[SMX]}{[SMX]_0}$$

(3)

To calculate the ratio k$_{FA}$/k$_{SMX}$, the Nigerian logarithm of the normalized concentration of both compounds was plotted thus obtaining a straight line. As the k$_{FA}$ for the studied pH values are collected from the literature, the k$_{SMX}$ can be calculated. In Table 1, calculated values of k$_{SMX}$ are presented along with the values of the ratio k$_{FA}$ /k$_{SMX}$ recorded from the experimental data and the k$_{FA}$ found in literature.
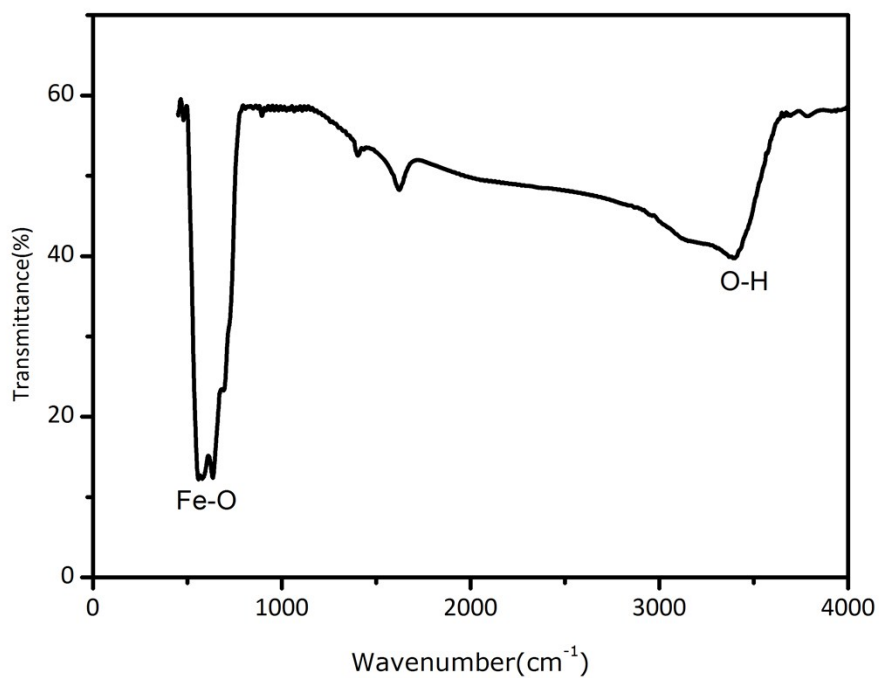
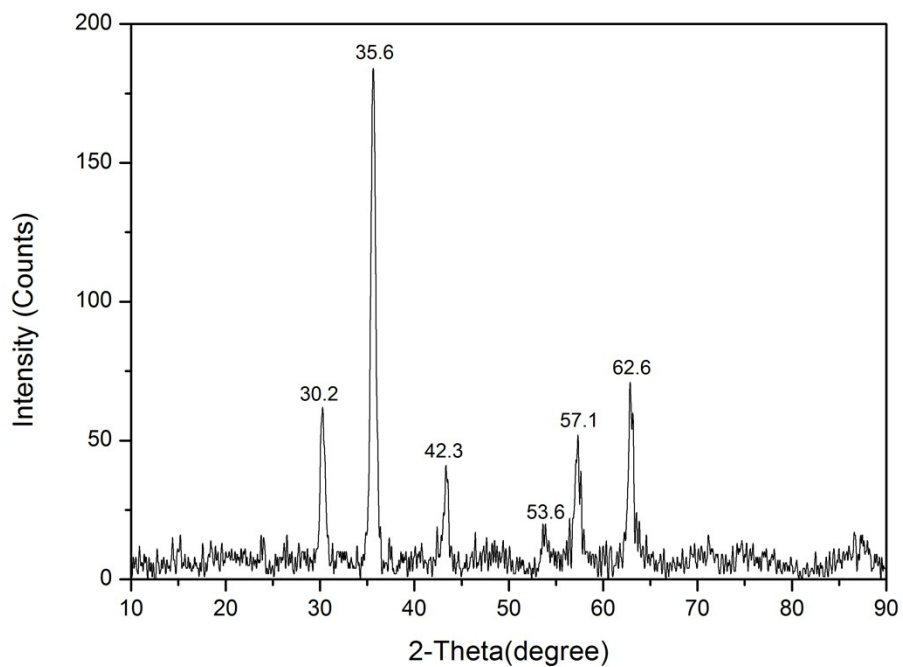Fig. S1 FTIR image of Fe_3O_4 employed in this study

Fig. S2 XRD image of Fe_3O_4 employed in this study
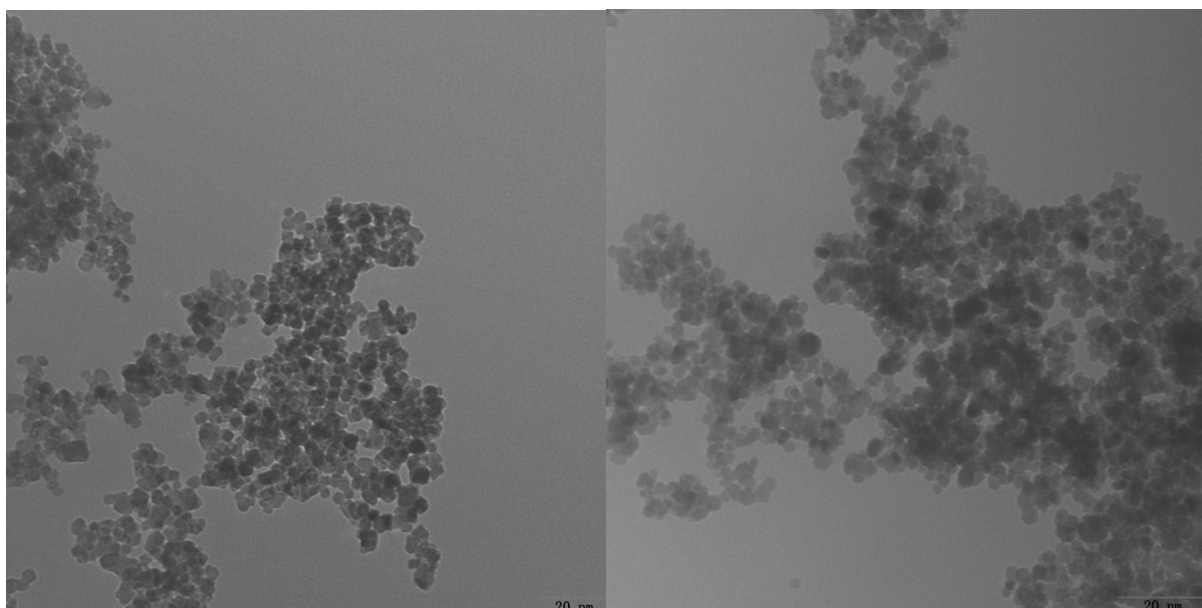
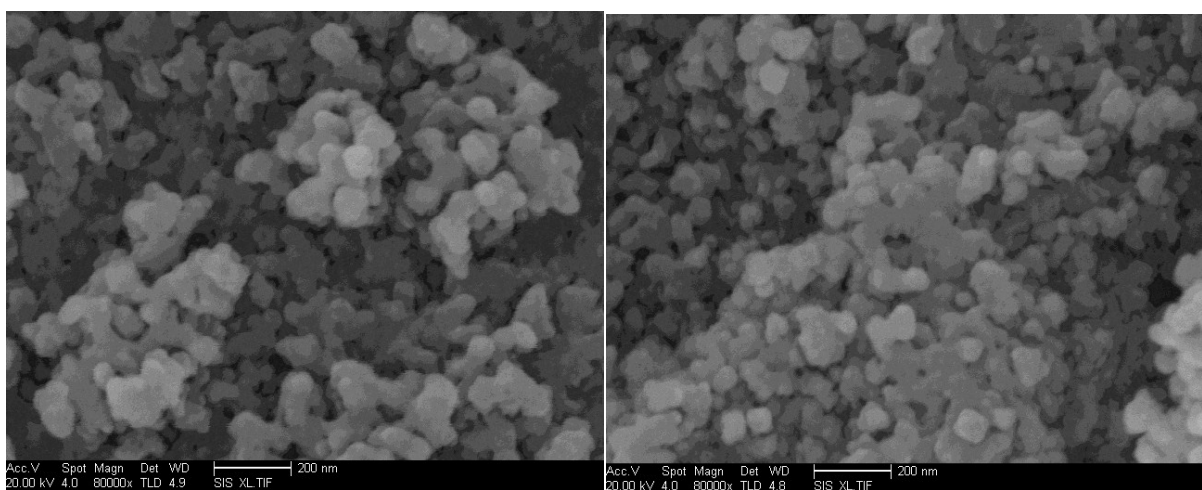Fig. S3 TEM image of Fe$_3$O$_4$ before (left) and after (right) the catalytic ozonation

Fig. S4 SEM image of Fe$_3$O$_4$ before (left) and after (right) the catalytic ozonation

Table S1. The result of element from the sample on SEM/EDS

Element	Wt%	At%
OK	28.01	57.60
FeL	71.99	42.40
Matrix	Correction	ZAF