Supporting Information for

Relying on the non-radical degradation of oxytetracycline by peroxymonosulfate activated with magnetic Cu/Fe composite: performance and mechanism

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Table S1

The BET surface area pore volume and pore size of the as-obtained catalysts.

Sample	BET surface area ($m^2\ g^{-1}$)	Pore volume (cm^3/g)	Pore size (nm)
Cu/Fe-1	26.090	0.06793	10.42
Cu/Fe-2	14.056	0.05118	14.57
Cu/Fe-0.5	31.363	0.06708	8.56

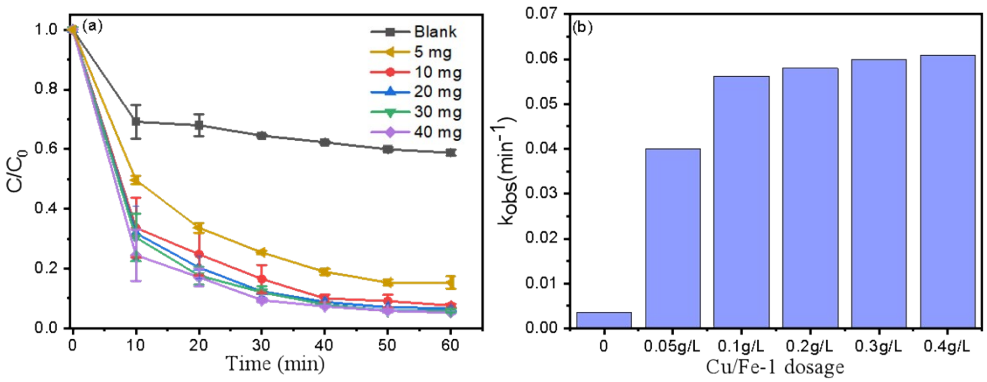

Fig. S1. Effect of catalyst dosage (a), kinetic rates of catalyst dosage (b) (Condition: [OTC]=20 mg/L, [PMS]=0.2 g/L, T=25℃, without pH adjustment).

The effect of catalyst dosage was investigated on OTC degradation. As shown in Fig. S1, 41.1% of OTC was degraded without catalyst. OTC removal significantly increased with the catalyst dosage of 0.05-0.1 mg/L from 81 % to 94%, the k_{obs} also increased from 0.040 min^{-1} to 0.056 min^{-1}. The increased amount of catalysts increased $SO_4^{\bullet-}$ production via PMS activation [1]. In the other words, the number of active sites increased with increasing catalyst dosage [2]. But the performance did not continue to improve as the catalyst dosage increased. This phenomenon could be attributed to the increased self-consumption of $SO_4^{\bullet-}$ (Eq. (1)) with the presence of excess catalysts in the system. Consequently, the generated $SO_4^{\bullet-}$ reacted with each other, thereby leading to inactivation. Therefore, the catalyst dosage of 0.1g/L was the most suitable for optimizing catalytic activity and economic cost.

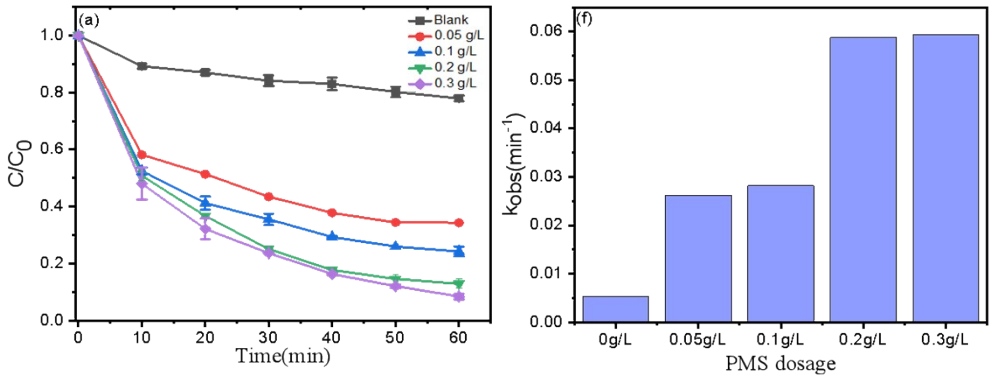

Fig. S2. Effect of PMS dosage (a), kinetic rates of PMS dosage (b) (Condition: [OTC]=20 mg/L, [catalyst] =0.1g/L, T=25℃, without pH adjustment).

To explore the optimal PMS dosage，the degradation of OTC at different PMS concentrations had been performed. As Fig. S2a clearly showed, less than 20% OTC was removed by catalyst. OTC removal significantly increased from 65% to 90% as the PMS concentration increased from 0.05g/L to 0.2g/L. The k_{obs} increased from 0.026min^{-1} to 0.053 min^{-1} (Fig. S2b). When PMS concentration exceeded 0.2 g/L, the degradation efficiency could barely increase, which could be explained by the radical interactions as a result of the excessive $SO_4^{\cdot-}$ generation [3]. Thus, the suitable concentration of PMS was 0.2 g/L.

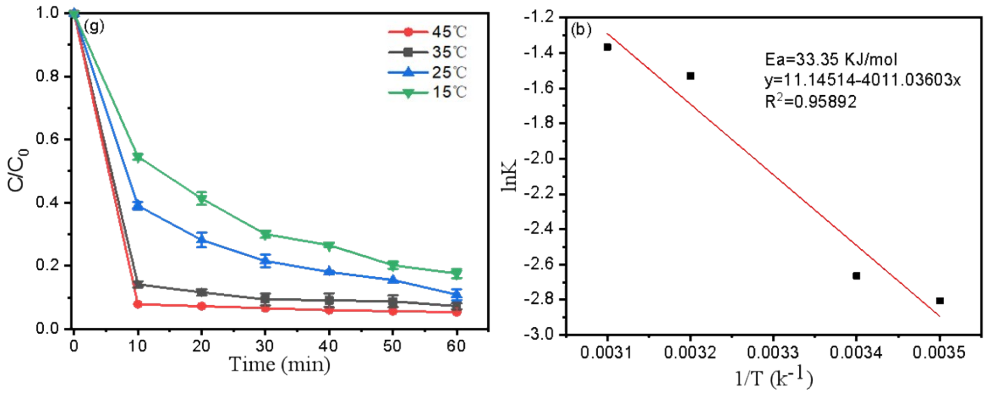

Fig. S3. Effect of reaction temperature (a), kinetic rates of reaction temperature (b) (Condition: [OTC]=20mg/L, [catalyst]=0.1g/L, [PMS]=0.2g/L, without pH adjustment).

The reaction temperature played important role in catalytic performance. As shown in Fig.S3 (a), higher temperature significantly accelerated OTC removal and reaction constant k. As shown in Eq.2, Fig. S3 (b) had fitted a plot of 1/T versus lnk. The reaction activation energy (Ea) of OTC degradation was 33.35 kJ mol^{-1}. The E_a was higher than the diffusion-controlled reactions (10^{-13} kJ/mol), indicating that the degradation process was mainly controlled by the intrinsic chemical reaction on catalyst surface instead of the mass transfer process [4].

References:

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