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**Removal of norfloxacin by surface Fenton system (MnFe₂O₄/H₂O₂): Kinetics,
mechanism and degradation pathway**

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Abstract

Magnetic MnFe₂O₄ particles were prepared by sol-gel method and used to activate H₂O₂ for norfloxacin removal from water. The results of hydrodynamic particle size distribution and Zeta potential analyses show that the particle size ranged from 100 nm to 500 nm, and Zeta potential from -76 mV to -25 mV at pH_{initial} = 7.0. The MnFe₂O₄/H₂O₂ system was able to remove 90.6% of norfloxacin at neutral pH, and the spent material can be reused in multiple cycles of operations. Fluorescence detection and DMPO capture analyses indicated that ·OH was the main free radicals, which played a primary role in degradation of norfloxacin. The valence variations of Mn and Fe were analyzed by XPS, and the results showed that coupled transformations of Mn²⁺/Mn³⁺ and Fe²⁺/Fe³⁺ were involved in generation of ·OH. Moreover, the removal rate in the MnFe₂O₄/H₂O₂ system showed a positive correlation with the adsorption efficiency of NOR by MnFe₂O₄. Eight degradation intermediates were detected by LC-QToF-MS/MS, and consequently, three degradation pathways were proposed, including

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