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# Magnetic Core–Shell-Structured FeO<sub>x</sub>/CN Catalyst Mediated Peroxymonosulfate Activation for Degradation of 2,4-Dichlorophenol via Non-Radical Pathway

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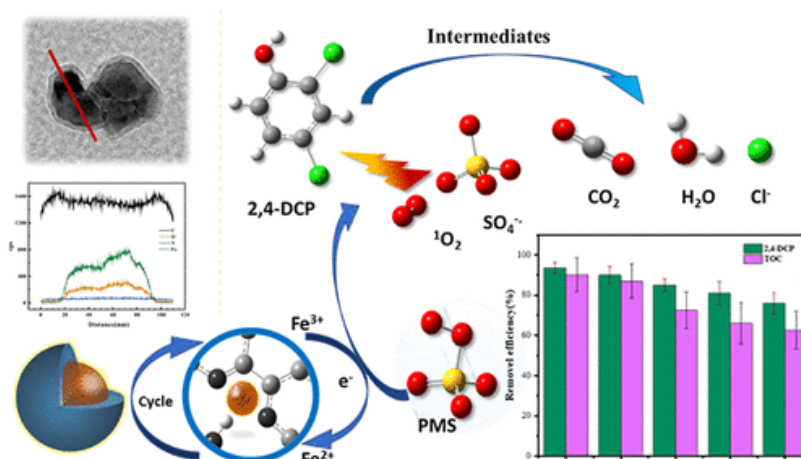
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## Abstract



In this study, a magnetic nano-FeO<sub>x</sub>/CN core–shell-structured catalyst with a high operating stability was successfully prepared by a coordinating polymer pyrolysis strategy. It exhibited high catalytic activity in peroxymonosulfate (PMS)-based advanced oxidation processes. Under neutral and room temperature conditions, the removal efficiency of 2,4-dichlorophenol (2,4-DCP) via FeO<sub>x</sub>/CN/PMS system reached more than 90% within 60 min, and the removal of total organic carbon reached 89% within 90 min. The key operating parameters were evaluated and analyzed. Besides, in five consecutive degradation experiments, Fe-3/CN showed high stability, low iron ion loss, and excellent magnetic separation and recovery performance, demonstrating its potential as a practical Fenton-like catalyst. The abundant and orderly N pores in the CN structure provided key conditions for the anchoring and dispersion of nano-FeO<sub>x</sub> particles. Electron paramagnetic resonance and free radical scavenging experiments proved that <sup>1</sup>O<sub>2</sub> is the main reactive oxygen species (ROS) that causes 2,4-DCP degradation (about 76.4% of the total contribution). Combined with density functional theory, the degradation pathway of 2,4-DCP was reasonably predicted. This study provides new ideas for the design and synthesis of Fenton-like catalysts with high stability and high activity.

**KEYWORDS:** heterogeneous Fenton-like catalyst, non-radical pathway, iron oxide, peroxymonosulfate

## Supporting Information

Procedures of chemical tests and details for the probe experiments, tables of HPLC analysis conditions, degradation intermediate of 2,4-DCP detected by GC–MS, iron contents, and comparison of catalytic activities, and figures of schematic illustration for the synthesis FeO<sub>x</sub>/CN catalyst, SEM and TEM images, XRD spectra, XPS spectra, N 1s, C 1s, O 1s, and Fe 2p peaks, nitrogen adsorption–desorption isotherms, adsorption–desorption equilibrium diagram, consumption of PMS under different systems, electrochemical impedance spectra, effect of Fe dosage on 2,4-DCP removal,  $\zeta$  potentials and  $k$  values at different pHs, concentration of Fe leaching, relative concentration of sulfate radical and hydroxyl radical, effect of different doses of TBA and MeOH on 2,4-DCP degradation, magnetization curves, Fukui function isosurface, and GC–MS spectra ([PDF](#))

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Supplementary Material

for

**A Magnetic Core-shell-structured FeO<sub>x</sub>/CN Catalyst Mediated Peroxymonosulfate Activation Degradation of 2,4-Dichlorophenol via Nonradical Pathway**



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