Sustainable Bacterial Inactivation in Agrochemical Industrial Wastewater Using Magnetic Nanoparticles

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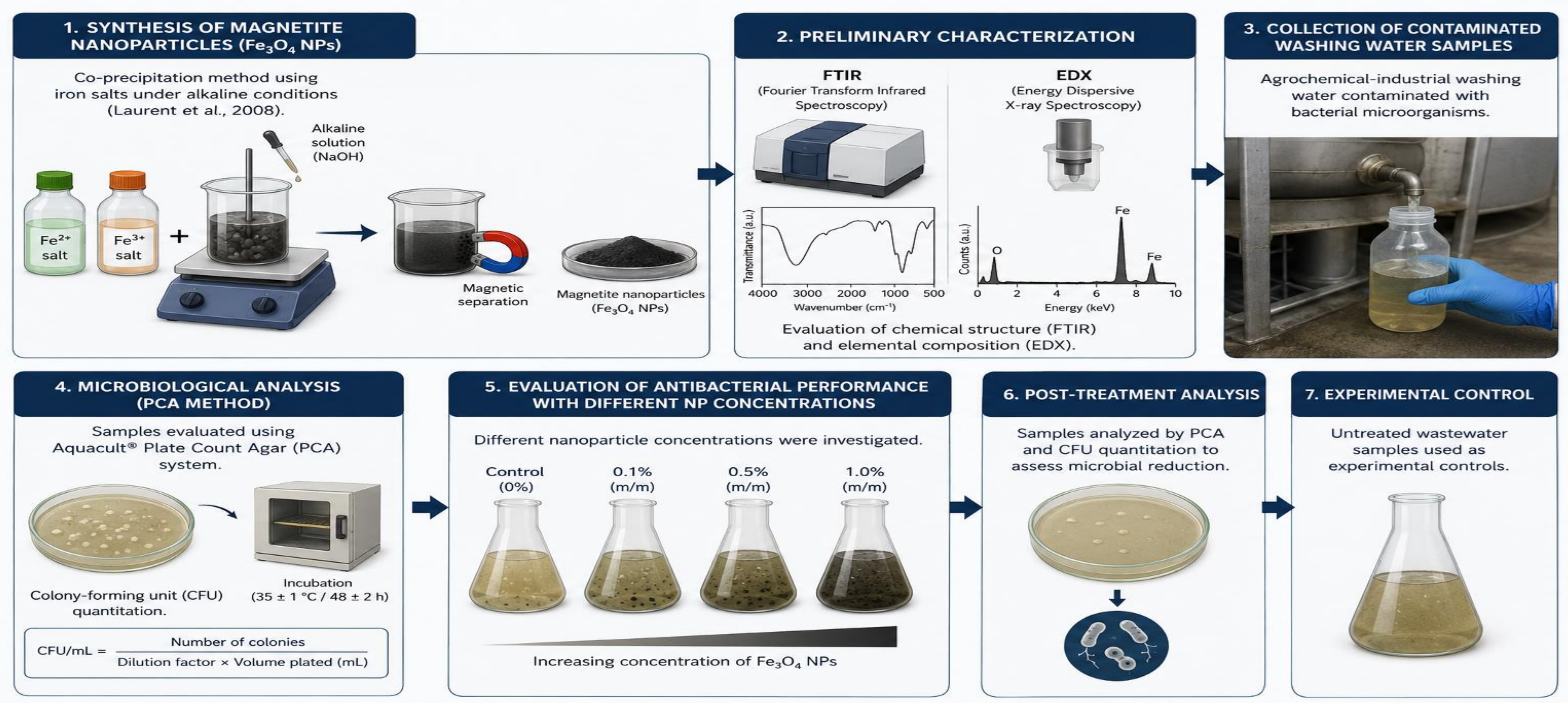
Introduction

Contamination of agrochemical-industrial wastewater by bacterial microorganisms represents an important environmental and operational challenge, particularly in tank-cleaning and formulation systems. Residual microbial contamination may lead to biofilm formation, deterioration of agrochemical formulations, and contamination of industrial equipment and disposal systems. Conventional disinfection methods often require high chemical consumption and may generate secondary residues, highlighting the need for alternative and sustainable water treatment technologies. Magnetite nanoparticles (Fe_3O_4) have attracted considerable interest due to their antimicrobial potential, magnetic properties, high surface area, and chemical stability. In addition, their magnetic behavior enables rapid recovery and reuse after.

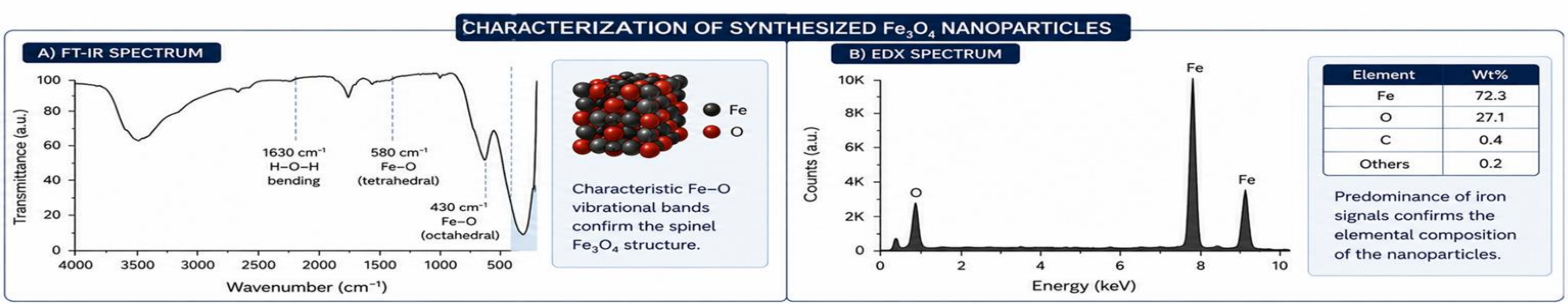
Goals

The present study aimed to synthesize and characterize magnetite nanoparticles and evaluate in a preliminary approach their bactericidal activity against contaminated agrochemical-industrial washing water.

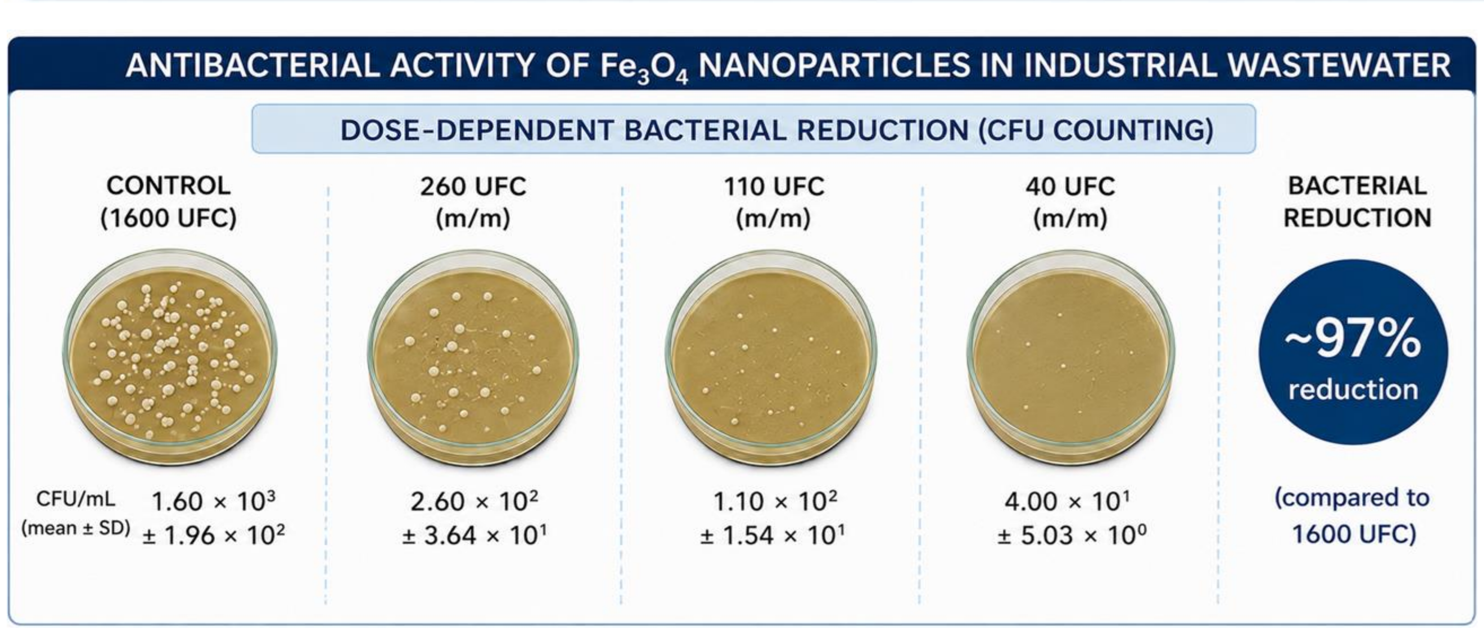
Material and Methods

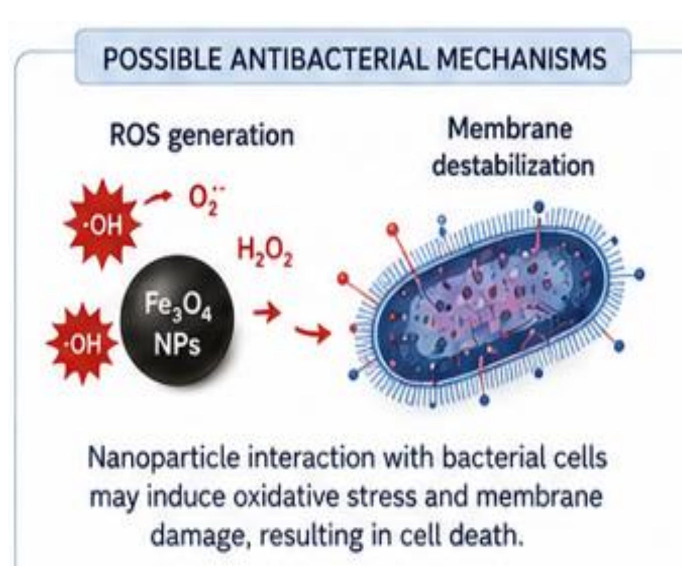


Results and Discussion



Element	Wt%
Fe	72.3
O	27.1
C	0.4
Others	0.2





Bactericidal assays demonstrated important bacterial reduction estimated around 97 % after treatment with 1.0% m/m Fe_3O_4 nanoparticles .

Conclusions

Synthesized Fe_3O_4 nanostructures showed promising antimicrobial activity against contaminated agrochemical-industrial washing water while maintaining magnetic recoverability. FTIR and EDX analyses confirmed the successful synthesis of the nanomaterial, highlighting its potential as a sustainable alternative for industrial wastewater treatment and reuse applications.

Acknowledgements

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