



“Gheorghe Asachi” Technical University of Iasi, Romania



DYE REMOVAL PERFORMANCE AND BIOLOGICAL ACTIVITIES OF IRON OXIDE NANOPARTICLES SYNTHESIZED FROM *Cotoneaster* sp. FRUIT EXTRACT

Bülent Akar^{1*}, Cemalettin Baltacı¹, Azer Özad Düzgün², Omer Karpuz³,
Volkan Karakullukçu⁴, Esma Gülbahar Erdoğan⁴

¹Department of Food Engineering, Faculty of Engineering and Natural Sciences,
Gümüşhane University, Gümüşhane 29000, Türkiye

²Department of Occupational Health and Safety, Faculty of Health Sciences, Gümüşhane University, Gümüşhane 29000, Türkiye

³Department of Genetic and Bioengineering, Faculty of Engineering and Natural Sciences,
Gümüşhane University, Gümüşhane 29000, Türkiye

⁴Department of Biotechnology, Graduate Education Institute, Gümüşhane University, Gümüşhane 29000, Türkiye

Abstract

This work aimed to study the antioxidant, antibacterial, and dye adsorption capabilities of the aqueous extract of *Cotoneaster* sp. fruits (CFE) and iron oxide nanoparticles (CF-FeONP) green-synthesized from the CFE. CF-FeONPs were characterized using Fourier transform infrared spectroscopy (FTIR), scanning electron microscopy (SEM), and X-ray diffraction (XRD) analyses. The antioxidant activity of CFE and CF-FeONPs was assessed through various tests, including ABTS radical scavenging activity, DPPH radical scavenging activity, iron-reducing antioxidant power (FRAP), total phenolic content (TPC), total flavonoid content (TFC), and total antioxidant content (TAC). The CF-FeONPs had superior antibacterial and antioxidant activity compared to the CFEs. Furthermore, CF-FeONPs suppressed the growth of Gram-negative bacteria such as *Yersinia pseudotuberculosis* ATCC 911, *Escherichia coli* ATCC 25922, *Proteus vulgaris* ATCC 13315, and *Pseudomonas aeruginosa* ATCC 43288, as well as by Gram-positive bacteria like *Streptococcus pyogenes* ATCC 19615, *Staphylococcus aureus* ATCC 25923, and *Bacillus subtilis* ATCC 6633. The microdilution medium technique was used to determine the minimum inhibitory concentration (MIC) of CFE and CF-FeONPs against these bacteria strains. The adsorption rates of CF-FeONPs exhibited variability based on the quantity of adsorbent used and the specific dye type, whereas the lowest adsorption rate was 250 mg/L. CF-FeONPs demonstrated higher adsorption capacities for malachite green (MG) dye compared to methylene blue (MB) and phenol red (PR).

Key words: antioxidant, antimicrobial, cotoneaster, dye removal, iron oxide nanoparticle

Received: February, 2024; Revised final: August, 2024; Accepted: October, 2024; Published in final edited form: May, 2025

* Author to whom all correspondence should be addressed: e-mail: akarblnt@gmail.com; Phone:904562331000; Fax: 904562301075