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Original Articles

Olive leaves extract mediated zero-valent iron nanoparticles: synthesis, characterization, and assessment as adsorbent for nickel (II) ions in aqueous medium

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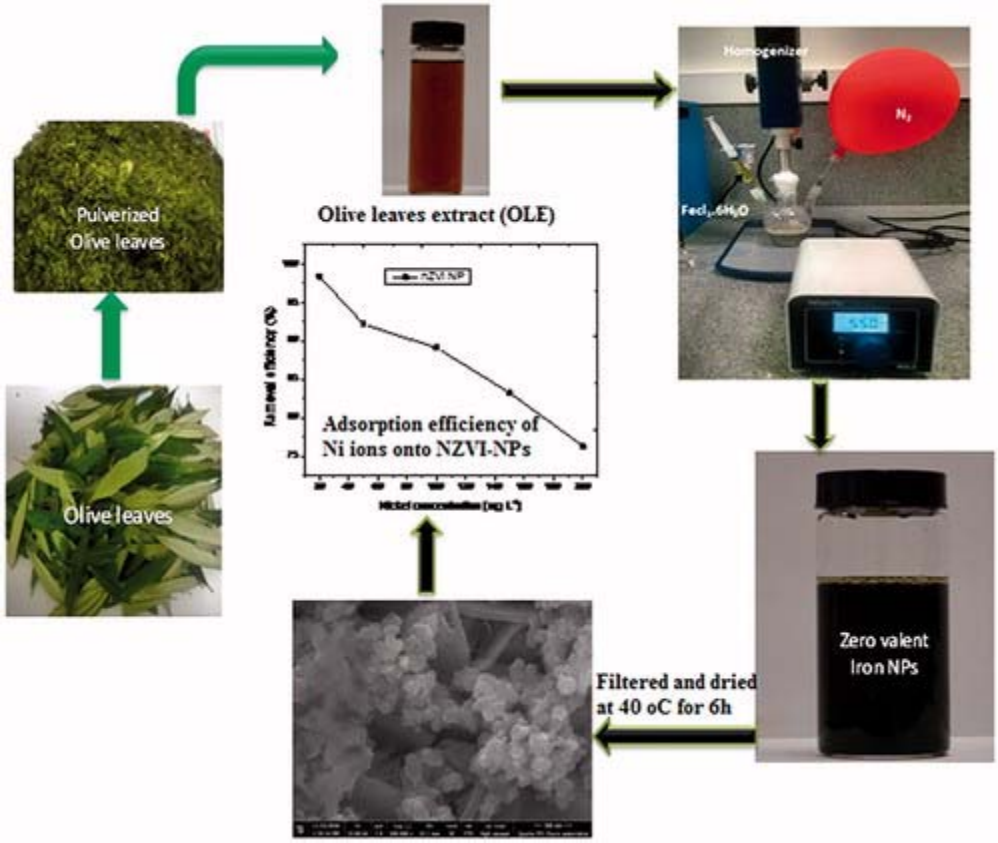
Abstract

Zero-valent iron nanoparticles (NZVI-NPs) possess significantly high surface area and volume ratio, and this unique surface characteristic has enhanced reactivity to their adsorption potential. In this work, a bio-matter (Olive leaves extract) is deployed as a nature-inspired reducing agent for the synthesis of NZVI-NPs. The particle size of NZVI-NPs has been determined using particle sizer. The NZVI-NPs are characterized using analytical and morphological techniques such as ultraviolet − visible spectroscopy (UV − vis), energy dispersive X-ray spectroscopy (EDS), X-ray diffraction spectroscopy (XRD), scanning electron microscope (SEM), Brunauer–Emmett–Teller (BET), and Fourier transform infrared (FTIR) spectroscopy. The average crystalline size of NZVI-NPs are around 30–60 nm while maximum adsorption is at 225 nm. XRD spectrum shows two distinctive diffraction peaks at 25.40° and 42.50° corresponding to lattice plane value indexed at (200) and (222) planes of faced centered cubic (FCC). At optimized experimental conditions, NZVI-NPs show 97% removal efficiency of Ni^{+2} ions from aqueous solution. The equilibrium time has been found to be 55 min and the monolayer maximum adsorption capacity is 139.5 mg/g. Kinetically, Ni^{+2} ions adsorption has been modelled using various physical isotherms and the data best fitted Freundlich isotherm model and pseudo-first-order kinetic; revealing a maximum adsorption capacity of 139.5 mg/g at 25 ± 3 °C and pH of 6.5. Desorption tests affirm the possibility of recovering reasonable amount of NZVI-NPs after used. The specific surface area of the NZVI-NPs sample measured by BET analysis is 21.9967 m^2/g indicating a high adsorption capacity.



Keywords:

- Application
- Characterization
- Green synthesis
- Recovery
- Zero-valent iron nanoparticles

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