

## Nickel ion removal from aqueous solution using recyclable zeolitic imidazolate framework-8 (ZIF-8) nano adsorbent: a kinetic and equilibrium study

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### ABSTRACT

The adsorption of nickel ions in an aqueous solution system was measured using zeolitic imidazolate framework-8 (ZIF-8) nanoadsorbent. ZIF-8 crystals were synthesized using the hydrothermal method. Nanoadsorbent was characterized by FTIR, XRD, SEM and N<sub>2</sub> adsorption analysis. ZIF-8 crystals showed a high surface area of 1303 m<sup>2</sup>/g and particle size 100–150 nm. The Langmuir and Freundlich isotherms model were used to analyze the data. The sufficiently high R<sup>2</sup> value of 0.996 resulted from the Langmuir isotherm model demonstrated the perfect performance of this model. The kinetic data were analyzed using the pseudo-first-order and pseudo-second-order models of types 1–4. Kinetic studies of the adsorption showed that the adsorption process followed the pseudo-second-order kinetics model of type 2. Experimental data showed that the maximal adsorption capacity of nickel by ZIF-8 adsorbent was 69.36 mg/g at initial metal ions concentration 25 mg/L at T = 25°C and pH 7.0. Desorption of nickel from spent ZIF-8 was carried out using 0.1 M EDTA solution effectively and recycled at least four times. No reduction in adsorption efficiency was observed up to 3 cycles of adsorption–desorption. The results confirmed the applicability of ZIF-8 as an effective nanoadsorbent for the removal of nickel ions from aqueous solutions.

*Keywords:* Adsorption; Isotherm; Kinetic; Zeolitic imidazolate framework-8 (ZIF-8); Nickel removal, Aqueous solution

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