



## A comparative study of nitrate removal from aqueous solutions using zeolite, nZVI–zeolite, nZVI and iron powder adsorbents

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### ABSTRACT

Nitrate is one of the most important pollutants causing some problems in the environment, particularly in water bodies. In this study, batch adsorption experiments were performed to investigate the feasibility of the adsorbents: zeolite, nano zero-valent iron (nZVI)–zeolite, nZVI and iron powder for nitrate removal from aqueous solutions. Also, the effects of different operating parameters like pH, temperature, contact time, adsorbent dosage and initial nitrate concentration were investigated. Results indicated that nitrate removal was strongly pH dependent. The maximum removal (96.5%) occurred at pH = 3 for nZVI–zeolite. Experimental equilibrium data were fitted to the pseudo-second-order and Langmuir isotherm models and the adsorption capacities of zeolite, nZVI–zeolite, nZVI and iron powder for nitrate were 12.804, 18.939, 17.064 and 9.671 mg/g, respectively. Total nitrogen loss was obtained at 13, 10 and 8% for nZVI–zeolite, nZVI and iron powder, respectively. The reduction of nitrate to ammonium, and nitrate adsorption by the adsorbents were main mechanisms in nitrate removal. Thermodynamic studies indicated that the adsorption process was spontaneous and exothermic and the adsorption capacity slightly dropped with increasing temperature. It can be concluded that the adsorbents, especially nZVI–zeolite, could decrease nitrate to meet standard limits.

**Keywords:** Nitrate removal; Zeolite; nZVI–zeolite; nZVI; Iron powder

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