Nano zero-valent iron particles (nZVI) supported on granular activated carbon (GAC) (nZVI/GAC) were synthesized and its feasibility was explored for the treatment of pyridine-bearing wastewater. nZVI/GAC was synthesized by the borohydride reduction method under ethanol atmosphere. The synthesized nZVI/GAC was characterized by scanning electron microscopy (SEM), X-ray diffraction, Fourier transform infrared spectroscopy, and N₂ adsorption-desorption study. Results indicated that the nZVI was well dispersed on the surface of GAC. The presence of support material apparently decreased the extent of aggregation and size of the nZVI and thus, facilitated in increasing the pyridine removal efficiency. Batch studies were carried out in order to evaluate the effect of operating parameters such as pH (2 ≤ pH ≤ 9), dose (m) (5 ≤ m ≤ 15 g/l), initial concentration (C₀) (50 ≤ C₀ ≤ 1000 mg/l), and temperature (T) (288 ≤ T ≤ 318 K). At optimum condition, maximum removal of pyridine was found to be ~86% at m = 15 g/l, pH = 6, C₀ = 100 mg/l, and T = 303 K. The degradation kinetics has been investigated, and pseudo-first-order kinetic model was found to be suitable fit for the experimental data kinetic model. The apparent activation energy (Eₐ) of this process was found to be ~22.46 (kJ/mol). The nZVI/GAC showed stable performance for the degradation of pyridine-bearing wastewater until five consecutive cycles.

Keywords: Nano zero-valent iron; Granular activated carbon; Pyridine; NZVI/GAC; Kinetic study