Polyaniline/banana peel composite: an eco-friendly adsorbent for removal of dihydrogen phosphate from groundwater

Abstract

A low-cost polyaniline/banana peel (PAni/BP) composite was prepared by oxidative polymerization of aniline in the presence of agricultural waste BP powder and characterized by Fourier-transform infrared spectroscopy, scanning electron microscopy, X-ray diffraction, thermogravimetric analysis, and Brunauer–Emmett–Teller. The surface area and average pore width were 5.65 m2·g–1 and 61.2 nm, respectively. A maximum adsorption capacity of 56.8 mg·g–1 and more than 90% removal of 5.0 mg·L–1 phosphate, were achieved under optimized conditions. Phosphate adsorption is best# described by the pseudo-second-order and Langmuir isotherm models. The Temkin isotherm gave an 8.2 J·mol–1 B constant, while the Dubinin–Radushkevich isotherm produced 14.1 kJ·mol–1 adsorption energy; both of them supported the chemisorption process. Thermodynamic parameters showed that the phosphate adsorption process was endothermic and spontaneous. For spiked groundwater, removal ranged between 90% and 95%, while desorbed phosphate removal ranged from 83% to 100%, with a relative standard deviation ranging from 2.0% to 7.4%.