

Ammonium ion removal using activated zeolite and chitosan

ABSTRACT

Studies have previously been done on efficacies of chitosan and zeolite in ammonium ion (NH_4^+) removal. However, no study compares the adsorption performance of natural zeolite (NZ) and activated NZ (ANZ) with high molecular weight chitosan (HMWC) and low molecular weight chitosan (LMWC). Hence, this study investigates the potentials of NZ, ANZ, LMWC, and HMWC in NH_4^+ removal. The characteristics of NZ, ANZ, LMWC, and HMWC such as functional groups, surface morphology, elemental composition, zeta potential, and particle size was also investigated. The deposition of NH_4^+ on the surface of NZ and ANZ was confirmed with the absence of nitrogen by the adsorption spectrum of energy dispersive X-ray (EDX) and supported by the presence of an Fourier transform infrared (FTIR) stretching band at $\sim 3,500\text{--}3,300\text{ cm}^{-1}$, as well as broader and less intense bands $\sim 1,600\text{ cm}^{-1}$ after the adsorption for all the adsorbents. The particle size of LMWC, HMWC, NZ, and ANZ were 98, 813, 22,354, and 9,826 nm, respectively. Meanwhile, after the activation process, the composition of O, Si, Al, Fe, Ca, and Na was reduced. NH_4^+ batch adsorption was also studied. HMWC, NZ, and ANZ reached adsorption equilibrium at 15 h, meanwhile for LMWC, the equilibrium reached at $t = 20$ h. The adsorption capacity of LMWC, HMWC, NZ, and ANZ at an initial concentration of 50 mg/L was 0.769, 0.331, 2.162, and 2.937 mg/g, respectively.