

Evaluation of ion exchange capacity of acid activated, thermally treated Iranian Na-Bentonite as a cheap alternative for ammonium removal in aquaculture farms of Iran and comparison with H-zeolite synthesis

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The absorption $\text{NH}_4\text{-N}$ from aqueous solution was investigated onto H form of both Iranian Na-Bentonite and zeolite synthesis. After determination of parameters affecting the NH_4 adsorption without any other ion presence, the NH_4 was removed from aquaculture wastewater with a high efficiency too. Wastewater samples were collected from Ardabil region located in north-west of Iran as a case study, regarding to environmental impacts. Nutrient parameters mainly NH_4 is one of the main pollutants which causes eutrophication and algal blooms in this region. For preparing a high removal efficiency of NH_4 in low concentrations, the H form of Bentonite From the industrial point of view, in present study was therefore carried out in two main steps: first for decreasing the Na-Bentonite swelling and increasing some special characteristics i.e. surface acidities, specific surface areas (A) and specific pore volumes (V) a wide range of thermal treatments were applied to Bentonite samples (between 150 to 500 °C) and second, bentonites samples were activated by different HCl dosage up to 7 M. NH_4 removal was tested by different H form of Bentonite in pure water and the best H-Bentonite samples were selected for further experiments. In a next step the contact time, optimum pH, initial concentration and above all the NH_4 removal efficiency from real waste water was performed too. Also some of these steps including effects of pH, adsorbent dosage, initial concentration, and ion presence in real waste water for determination of NH_4 removal efficiency in low concentration were studied with synthesis H-zeolite.

The results were enough abundant, fit the expectations, and the best and optimum data brought out some creative responses. Equilibrium isotherm data was fitted to the Langmuir isotherm model and the regression result had comparatively high precision with linear form. The low amounts of H-Bentonite exhibit good NH_4 sorption potential for aquaculture farm waste water. The peak value for NH_4 adsorption without any ion presence appears at 7 M of HCl dosage which was heated in 100 and 200 °C of thermal pre-treatment. In applying 5g H-Bentonite in 100mL, around 80% sorption occurred in different affective aspects within prior 15 min for NH_4 and equilibrium was attained at 40 min for low concentrations. Results indicate an optimal contact time of 15 min in different pH range of solution for NH_4 adsorption, in which removal efficiency for initial concentration of 2mg.l⁻¹ were closed to 80 percent for most of pH ranges after 15 min contact time. There are significant decreasing for removing affinity in very low (pH= 2.5) and very high (pH=10) pH ranges. The best result for NH_4 adsorption occurred between 1 and 5mg.l⁻¹, on the other side for 10mg.l⁻¹ of NH_4 concentration a drastic decreasing was shown in removal process within 15 min. NH_4 removal efficiency in real waste water of aquaculture effluents in the presence of interfering materials of anions and cations was not significant. The cost effective of H-Bentonite and abundant beside others advantages can justify whole of results in comparative of H-Zeolite.

Keywords: H-Bentonite; H-Zeolite; acid activation; preheating; ammonium removal; aquaculture; wastewater treatment; Langmuir isotherm.