

# 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  $\text{NH}_4$  adsorption without any other ion presence, the  $\text{NH}_4$  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  $\text{NH}_4$  is one of the main pollutants which causes eutrophication and algal blooms in this region. For preparing a high removal efficiency of  $\text{NH}_4$  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.  $\text{NH}_4$  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  $\text{NH}_4$  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  $\text{NH}_4$  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  $\text{NH}_4$  sorption potential for aquaculture farm waste water. The peak value for  $\text{NH}_4$  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  $\text{NH}_4$  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  $\text{NH}_4$  adsorption, in which removal efficiency for initial concentration of  $2\text{mg.l}^{-1}$  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  $\text{NH}_4$  adsorption occurred between 1 and  $5\text{mg.l}^{-1}$ , on the other side for  $10\text{mg.l}^{-1}$  of  $\text{NH}_4$  concentration a drastic decreasing was shown in removal process within 15 min.  $\text{NH}_4$  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.