Phosphate Removal from Wastewater by Fe-Zeolite-A Adsorbent

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1. Introduction - Conventional phosphate removal by chemical addition in water treatment has been performed by rapid mixing for complete contact of the chemical with the wastewater, slowing it down to make larger suspended solid and finally settling down as chemically treated sludge. The chemical treatment has disadvantage of high production of chemical sludge and their treatment cost is also high. Recently, to overcome the problems of the chemical treatment, many scientists have studied on phosphate absorbents, which mean no production of sludge, based on iron such as iron ores, slag, slap and NZVI (nano zerovalent iron). However, the results showed that the removal efficiencies was very low and the reaction time was longer or more than 4 h [1]. In this study, the Fe-Zeolite-A (FZA) was synthesized by incorporating iron into the tetra-hedral frame of aluminosilicate [2]. Batch type experiments were performed to assess the adsorption as well as desorption capability of FZA. It was synthesized by sol-gel method under the following reaction conditions: aging time 12 hrs at room temperature; reaction time 24 h at 150 °C temp in an autoclave. The molar composition of the synthesis mixture was 3Na2O : 2SiO2 : 1Al2O3 : 0.1Fe : 400H2O. The source of iron was AIC (ammonium iron citrate) which acted as chelating iron complex in this reaction and it prohibited the formation of flocs from the alkaline solution.

2. Results and Discussion - From the adsorption experiments, it was confirmed that the phosphate removal efficiency was 99% with a residual phosphate concentration less than 0.1 mg/L after 10 minutes of reaction time (as shown in Image. 1). The adsorbed phosphate was subjected to acidic treatment for the desorption test. About 80 % of the adsorbed was phosphate was desorbed within 20 minutes of reaction time (as shown in in
2). The chemical species considered contributing to the phosphate removal were the positively charged ionic compounds: NaH+, Al(OH)+++ and Fe(OH)+++. 3. Conclusions – The synthesized FZA adsorbent showed significant adsorption as well as desorption capabilities, which makes this material a sustainable one for further use. The mechanism behind adsorption and desorption of phosphate is also propose