Experimental Investigation of Arsenic Removal by Using Fe Nano Particles in Batch Experiment

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Introduction: Toxic and dangerous pollution in groundwater is enormous. This assenic pollution is concentrated more than its permissible limits. It can be observed in different countries like India, Nepa l,Bangladesh, Pakistan, Taiwan, Thailand, Vietnam, Argentina, Brazil, Chili and Mexico. In some places in Iran like Hashtgerd and Kordestan the arsenic pollution has been observed more than the permissible concentration. As the arsenic pollution is increasing, many studies have been done to find different treatment options. Due to rapid removing of the As (V) and As (III) by using Iron Nano particles, this method have recently been considered useful. In this paper arsenic removal process was investigated by using nanoparticles. Based on batch experiments, the influence of Zero-valent iron nanoparticles concentration, tem perature, pH, time, and arsenic initial concentration were observed in arsenic removal process. The results of this study indicated that the Iron nanoparticles have high performance in arsenic pollution removal. Experimental Method The purpose of the current experimental study was to investigate the arsenic remediation process by using iron nanoparticles in batch experiment. Specific concentration of iron nanoparticles produced by PNF Corporation along with the arsenite sodium salt was used. In the first test, the solution containing 0.5 gr/lit arsenic and 1 gr/lit nanoparticles reacted after 1 hour and the results showed that arsenic concentration reduced to below the allowable concentration by using Fe nanoparticles in this time interval (Fig. 1 and 2). In pH test, alkaline, acidic and natural environments were investigated and the result indicated that the reaction rate increased withdecreasing of pH. The results also indicated that pH increased during the test (Fig4) and this result was one reason for decreasing reaction rate with time. For studying the temperature effect, two similar tests were done in 60□C and 30□C temperatures. In these tests, the reaction rate increased with increasing the temperature. Initial arsenic concentration and injection iron concentration affected the reaction rate significantly. Consequently, the experiments were conducted by considering different concentration of iron nanoparticles and arsenic thawt ere for arsenic concentration 5 and 0.5 ppm and for iron nanoparticles of 2 and o.5 gr/lit (Table 3). After that, the results indicated that the reaction rate increased with increasing the arsenic or iron nanoparticles concentration (Fig. 3) because of the increase in the contact between arsenic pollution and iron nanoparticles as reactive. Finally, the results revealed that iron nanoparticles could effectively been used to eliminate the arsenic pollution.
Conclusion: Nowadays, arsenic remediation as a toxic and widespread pollution is important in groundwater studies. One of the methods for the arsenic remediation is using the iron nano particles. This method involves lower costs with high performance and can be used for in-site pollutant remediation in aquifers. The result of this investigation indicated that the reaction between iron nanoparticles and arsenic lasts only about several minutes. Increase in the temperature and decrease in pH reduced the reaction rate. Investigation of arsenic concentration com pared with iron nanoparticles injection concentration revealed that the arsenic removal rate is increased by an increase in the ratio of nanoparticles to arsenic. For removing 500 ppb of arsenic concentration by using 1 gr/lit of iron nanoparticles, an exponential decreasing process was observed so that the arsenic concentration was reached to less than the arsenic permissible concentration during two hours. Finally it can be concluded that the capability of the Zero-valent Fe nanoparticles is a useful tool for removing the arsenic pollution in the groundwater.

arsenic pollution removal, batch experiment, iron nanoparticles, remediation water

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