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Reduction of cadmium contaminated groundwater pollution by using mineral adsorbents and industrial sorbents

Saeid Sotoodeh Nia¹, Seyedeh Mohaddeseh Taheri², Ali Mahdavi Mazdeh^{1,2}, and Stefan Wornlich¹

¹Applied Geology (Hydrogeology), Ruhr University Bochum, Bochum, Germany (saeid.sotoodehnia@rub.de)

²Water Eng. Dept., Imam Khomeini International University, Qazvin, Iran

Iron nanoparticles are capable of removing heavy metals due to their significant specific surface relative to their weight. Iron nano powders with an average particle size of 50 nm and very high reactivity are suitable for groundwater purification and industrial wastewater treatment. In fact, the very high ability of iron nanoparticles of zero valences in its reduction and high reactivity makes this material a good choice in achieving the above goals. Due to its small size, after injection, these particles can be spaced and transferred easily. On the other hand, natural zeolites are important aluminosilicates in adsorption processes due to their low cost. In this research activity, a comparison was made between the adsorption percentage of zero iron nanoparticles as an industrial adsorbent with the minerals, calcite, and zeolite. By adding 1 gram of adsorbent powder to a solution of 10 ppm cadmium, decreased cadmium concentrations at different time intervals in three experiments with two replications was measured by an atomic absorption spectrometer. The results showed that 38.4% of cadmium was adsorbed by nanoparticles after 3 hours, which was 8.53% and 5.5%, respectively for the usage of calcite and zeolite mineral adsorbents. This indicates an increase of 29.86 and 32.9% in adsorption of nanoparticle adsorbent compared to calcite and zeolite. To investigate the effect of adsorption percentage in a saturated porous medium, 100 ml of 10 ppm cadmium solution in the presence of 50 g of soil with an average diameter of 1.11 mm saturated with 50 ml of cadmium solution with the same concentration in reaction with 1 g of adsorbent powder was used 22 hours after the start of the experiment, 51.55% of the total cadmium was removed from the environment by soil and industrial adsorbent, and the adsorption percentages for calcite and zeolite in the porous medium were 17.5% and 7.75%, respectively.

Keywords: Cadmium, Zero iron nanoparticles, Calcite, Zeolite.