

Mechanistic approach for Zinc ion removal by brick particles

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Removal of chemical species from polluted water, to produce relatively clean water, has become a crucial issue. Although chemical methods for water treatment are well established, environmentally friendliness of such methods is often debatable. Consequently, investigation on the use of natural substances and industrial byproducts for water and waste water treatment has become a logical alternative. Although it has been demonstrated that many types of heavy metal ions can easily be removed by above substances, mechanistic investigation of the ion removal process has not been given sufficient attention. It is the goal of this research to conduct a multi-technique approach for mechanistic investigation of the removal of zinc ions from aqueous solution by brick particles.

Atomic absorption measurements clearly indicate that small brick particles of 1-2 mm in diameter are able to reduce the zinc ion concentration in solution by more than 90% under optimized conditions, with a saturation limit beyond 10.0 ppm. Linearized Langmuir fit obtained for zinc ion solutions of different concentrations, after the brick particle treatment, suggests that this is a monolayer adsorption process. However, after the monolayer coverage, absorption of zinc ions into the brick particle matrix would probably continue until the saturation limit is reached. This was evidenced by X-ray diffraction patterns, where there were significant changes in spacings between atomic planes (d) upon treatment of zinc ion solutions with powdered brick particles. X-ray fluorescence measurements also indicated that the zinc levels of powdered brick samples were significantly enhanced after treatment of zinc ion solutions with brick particles. These observations suggest that both adsorption and absorption play a significant role for zinc ion removal by brick particles. In addition to the environmentally friendliness and cost effectiveness, value addition of this industrial byproduct for potential use in the field of industrial effluent treatment is a highly desirable aspect of this research.

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