



Investigation of the Application of Zeolites in the Adsorption Mechanism

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ABSTRACT

Zeolites are a group of hydrated aluminosilicates crystallized with fine pores that contain equilibrium cations of alkaline and alkaline earth metals (Na⁺, K⁺, Mg²⁺ and Ca²⁺) and reversibly absorb and release water. One of their characteristics is that they are able to reabsorb and re-release water and exchange some of their own building cations without major changes in their building. The presence of metals in the water of rivers and seawater poses a serious threat to the health of the aquatic community, the most common of which is damage to the gills of fish. Metals such as lead, cadmium, copper, arsenic, nickel, chromium, zinc, mercury, iron are known as heavy metals. These metals tend to accumulate in environmental systems and seriously contaminate soil and water, which can be harmful to humans, animals and plants even in low concentrations. Unlike biodegradable organic matter, metal ions are not removed from aquatic ecosystems by natural processes, which encourages scientists to develop new methods for removing heavy metal ions from water. As a result, in many countries, laws have been introduced to control water pollution. Various regulatory bodies have set maximum limits for the discharge of toxic heavy metals into aquatic systems. However, metal ions with a much higher concentration than usual are discharged into the water by industrial activities, leading to health hazards and environmental degradation.

1. Introduction

The human body and many other living organisms need small amounts of these heavy metals, but mainly consuming small amounts of them for humans and other living organisms can be pathogenic and cause many problems for the consumer. Heavy metals in the field of bio absorption are divided into three groups, the first category of toxic metals including: nickel-cobalt-zinc-lead and mercury. The second category includes: precious metals such as palladium-platinum-silver-gold and finally the third category includes: radionuclides Such as radium-uranium-ammerium, which typically weigh more than 5 grams per cubic centimeter. Biologists use the term heavy metal for metals that cause a variety of diseases and are harmful to humans [1, 2].

If the amount of these essential metals entering the body is too much, they can cause poisoning. In addition to carbohydrates, lipids, amino acids, and vitamins, some heavy metals are essential for the biological activity of cells, some metals, such as chromium and iron, are vital to life, and others, such as copper, zinc, and lead, are

essential for activity enzymes are essential. Maleki et al. studied the uptake of cadmium and copper by wheat straw modified with sodium bicarbonate from the aqueous medium. The adsorption process was intermittently studied in vitro with emphasis on the effects of various parameters such as PH, contact time, arsenic concentration and the amount of adsorbent on the adsorption efficiency. In order to better understand the adsorption process, equilibrium isotherms were determined [3-5].

The results showed that the adsorption of cadmium and copper is affected by factors such as initial concentration, amount of adsorbent and pH of the aqueous medium. The amount of adsorbed metal ions increased with increasing PH. Among the three isotherm models studied, including Langmuir, Freundlich and Dubinin-Radushkovich, two models, Langmuir and Freundlich, described the adsorption of cadmium and copper well. The average free adsorption energy (11.1 kJ/mol for cadmium and 11.4 kJ/mol for copper) indicates the mechanism of chemical adsorption of both metals on the adsorbent. Based on the results of this study, it can be stated that the adsorption

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