Adsorption of Co(II) ions using Zr-Ca-Mg and Ti-Ca-Mg phosphates: adsorpti…

Adsorption of Co(II) ions using Zr-Ca-Mg and Ti-Ca-Mg phosphates: adsorption modeling and mechanistic aspects

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ENVIRONMENTAL SCIENCE AND POLLUTION RESEARCH

Том: 29 **Выпуск:** 50 **Страница:** 75989-76002

DOI: 10.1007/s11356-022-20764-3

Опубликовано: OCT 2022

Ранний доступ: JUN 2022

Дата индексации: 2022-06-20

Тип документа: Article

Аннотация

The environmental pollution by toxic Co(II) ions had a negative impact on living organisms and water resources. The amorphous Zr-Ca-Mg and Ti-Ca-Mg phosphates with varied Zr and Ti content with the mesoporous structure (A(BET) = 19-232 m(2)/g, V-des. = 0.075-0.370 cm(3)/g, D-des. = 6.2-10.9 nm) were synthesized. The effect of adsorbent chemical composition, the presence of competing ions (0.1-1.0 M NaCl and 0.01-0.1 M CaCl2 backgrounds), and pH (3.0-7.0) of aqueous solution on adsorption removal of Co(II) ions by Zr-Ca-Mg and Ti-Ca-Mg phosphates was studied. The highest adsorption capacity of Zr-Ca-Mg-1 and Ti-Ca-Mg-1 samples reached 253.3 and 212.8 mg/g. The prepared adsorbents demonstrated high efficiency at pH in the range of 3.0-7.0 and the presence of 0.1-1.0 M NaCl and seawater with a salinity of 35.0 g/L backgrounds. The chemisorption and ion-exchange mechanisms of Co(II) ions removal for Zr-Ca-Mg and Ti-Ca-Mg phosphates were proposed. The adsorption isotherms were well fitted with Sips and Langmuir models that proved the heterogeneous nature of adsorption sites as well as assumed the monolayer adsorption that occurs at specific homogeneous sites within the adsorbent without

any interaction between the adsorbed substances. The kinetic data was well described by the pseudo-second-order model that is suitable for chemisorption processes as liming adsorption stage. The presented results shown the prospects of developed adsorbents for the investigation of real wastewater treatment from heavy metal ions and liquid radioactive waste purification.

Ключевые слова

Ключевые слова автора: Zr-Ca-Mg phosphates; Ti-Ca-Mg phosphates; Co(II) ions adsorption; Isotherms and kinetic modeling; Water treatment

Keywords Plus: AQUEOUS-SOLUTIONS; COBALT IONS; METAL-IONS; REMOVAL; CO2+; SORBENT; CALCIUM; WATER

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Категории/классификация

Области исследования: Environmental Sciences & Ecology

Темы цитирования : 2 Chemistry › 2.22 Inorganic & Nuclear Chemistry › 2.22.1989 Metal Phosphonates

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