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SORPTION MATERIALS BASED ON ZEOLITE AND CHITOSANE FOR THE DISCHARGE OF IONS OF TOXIC METALS

Annotation. The authors of the article studied the influence of various factors on the sorption of Cu^{2+} and Pb^{2+} ions. And also the optimal values of sorption parameters are determined: sorbent mass - 1g per 100 cm3 solution for copper and lead, T = 298K

In the course of studying the sorption of Cr6 + ions, it was determined that the modification of the sorbent increases the recovery rate, which increases to 100%.

New composite materials based on zeolite and chitosan have been obtained. Their sorption characteristics (extraction, adsorption, equilibrium time) with respect to heavy metal ions (Cr^{6+}, Cu^{2+}, Pb^{2+}) in aqueous solutions are determined. To study the physicochemical and sorption properties of materials, the following methods were used: atomic absorption spectroscopy (spectrophotometer "Shimadzu 6200" and spectrophotometer SPECORD 200 Analytic Jena, Germany).

Keywords: sorption, heavy metals, zeolite, chitosan, Cr (VI), Cu (II), Pb (II).

Introduction. It is known that heavy metals, as well as their salts, enter the human body from the environment - with inhaled air, tap water, food. It is generally believed that there is no element of the chemical table of Mendeleyev, which is harmful to humans if it does not exceed a certain number. But this amount for some of them, including heavy metals, is very insignificant. But, unfortunately, now more and more people suffer from the fact that heavy metals that enter the body in multiple amounts exceed the permissible norm. Cleaning the body of metal ions is one of the important environmental problems in modern life. Consequently, sorption methods of purification of the body are considered effective as a solution to this problem, so the search for modern available sorbents is an urgent topic for research. One of the available sorbents are natural sorbents, and modification with various substances makes it possible to increase their efficiency.

Methods of research. The purpose of this work is to create a polymer composition-sorbent, which has a high sorption capacity for ions of heavy metals.

The process of sorption of heavy metals, as well as the influence on the process of such factors as the concentration of the modifier in the sorbent composition, temperature, mass of the sorbent was studied.

Objects of the research: Zeolite (Chankanai deposit), Chitosan, Unithiol. When studying the adsorption kinetics from physiological solutions of heavy metals in concentrations above permissible standards for the human body, the following salts were used: $CuCl^2 * 5H^2O$, $K2Cr^2O^7$, Pb (NO^3).

The discussion of the results. Copper influences the function of endocrine glands and is a catalyst for cellular oxidative processes. It accumulates in the liver and in the cellular nuclei of tissues. Causes hemolysis and acute kidney failure.

Hexavalent chromium Cr (VI) is highly toxic - this intracellular reduction to the third valence underlies critical toxic effects. Cumulated in the liver, lungs and kidneys, and is excreted mainly by excretion through the kidneys.

Lead is cumulated mainly in the bones, brain and liver. Penetrates into the body by contact - through the skin and respiratory tract or through the digestive system.

Investigation of the effect of the modifier concentration in the sorbent composition. Five grams were placed 1 g of sorbent and filled 100 cm^3 of solutions containing Pb^{2+}, Cu^{2+} ions at concentrations of 12-36 ini / ml at room temperature (25 ± 5) °C until equilibrium was established.

The adsorption value for all the sorbents was calculated by the equation:

$$A = \frac{c_{ini} - c_{res}}{m} * V,$$

where Cini and Cres are, respectively, the initial and residual sorbate concentration, initial / cm^3; V is the volume of the sorbate solution, cm3; m is the sorbent mass, g.

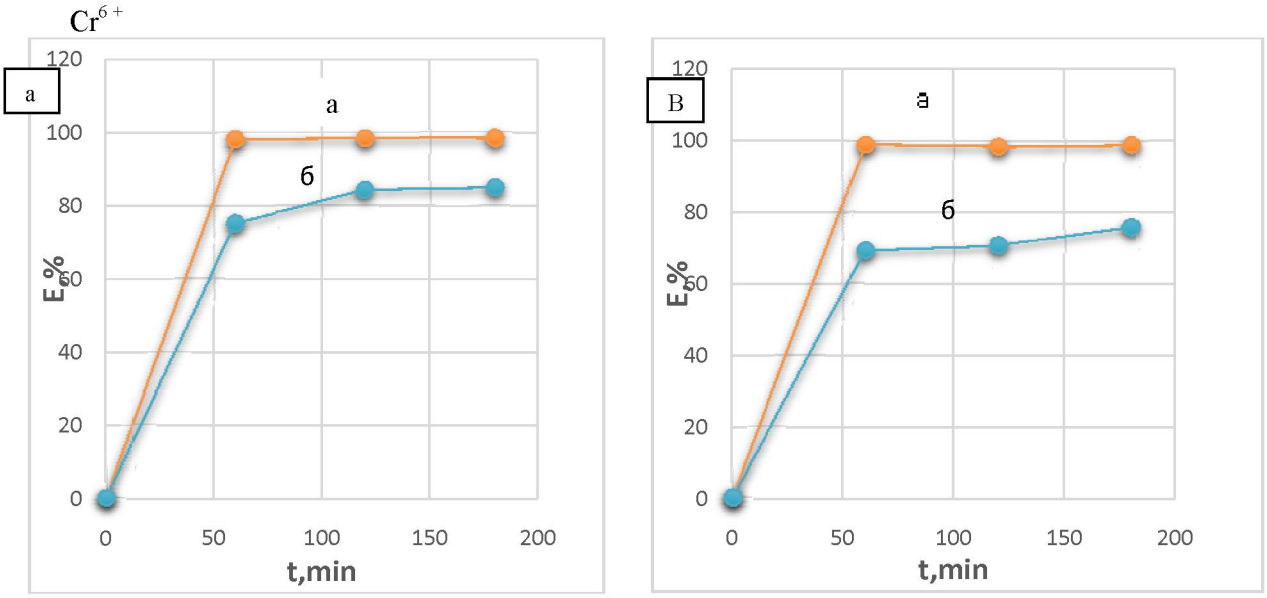
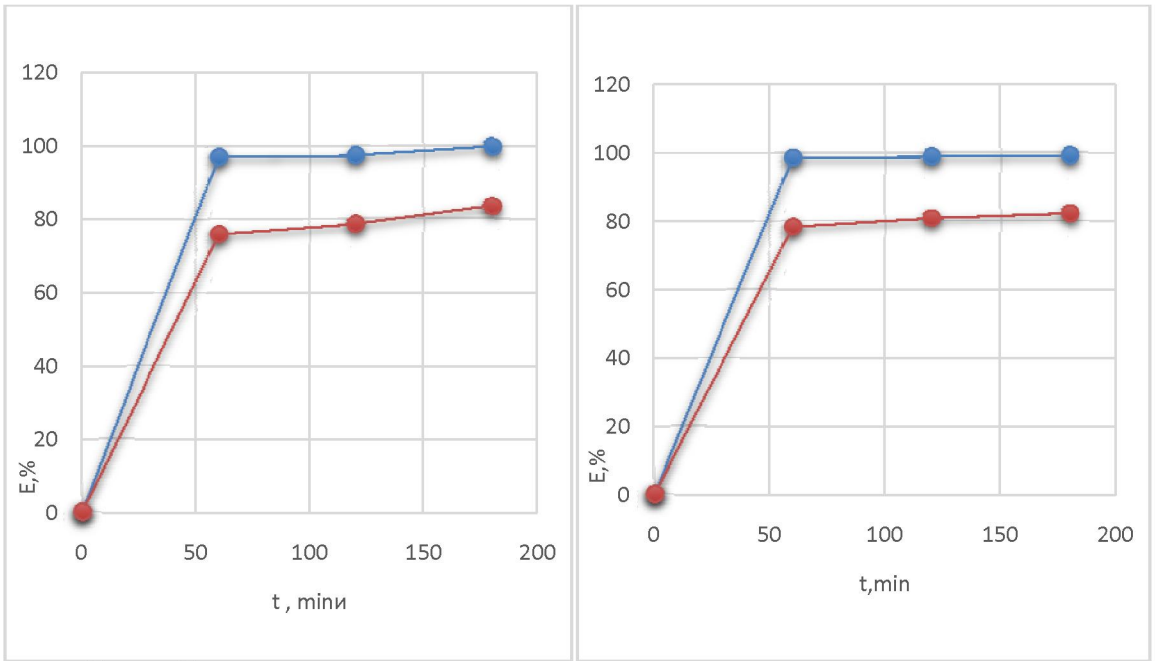


Figure 1 - Dependence of the degree of extraction of ions Pb^{2+} (a) and Cu^{2+} (b) by chitosan, modified unithiol (a) and initial chitosan (b) against time (T = 298K, pH = 6, Cini = 36 ini / ml)



Red - Pb^{2+} and Cu^{2+}
Blue - Pb^{2+}

Figure 2 - Dependence of the degree of extraction of Pb^{2+} and Cu^{2+} ions by a sorbent modified with unitiol of concentrations of 1 mg / ml versus time (T = 298 K, pH = 6, Cini = 36 ini / ml)

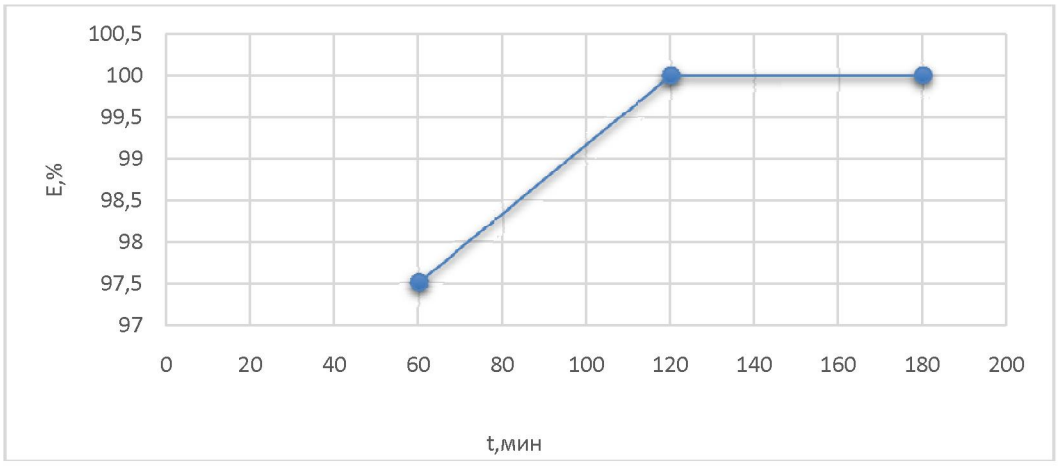


Figure 3 - Dependence of the degree of extraction of Cr^{6+} ions by a sorbent modified with unitiol of concentrations of 1 mg / ml versus time (T = 298 K, pH = 6, Cini = 2 ini / ml)

The initial and residual concentrations of cadmium and lead were determined by the AAS method using a Shimadzu 6200 atomic absorption spectrophotometer. The results were processed using the ORIGIN 5 software.

The study of the change in the sorption capacity of the sorbent from sorbate concentration was carried out for a period of time necessary for the onset of Investigation of the effect of temperature on the sorption process. Five grams were placed on 1 g of sorbent and filled with 100 cm^3 of solutions containing ions of Pb^{2+}, Cu^{2+} concentrations of 100-500 initial / ml at temperatures of 298, 309.6 K. The temperature regime was created and regulated by means of a thermostat. The processing of the results was carried out in the same way as in §1.

Investigation of the effect of sorbent mass on the sorption process. The experiment was carried out in the same way as in item 1 with the use of sorbents of 0.1 mass; 0.5; 1 g, modified with 1mg / ml of unithiol.

Influence of the concentration of the modifier (unitiol) on the process of sorption of ions Cu^{2+}, Pb^{2+},

Study of the sorption of Cr^{6+} ions. Sorption of Cr^{6+} ions was carried out from solutions of $K^2Cr^2O^7$ concentration of 2 ini / ml-8 ini / ml with sorbent containing 1 mg / ml unitiol. 1 g of sorbent was poured into 100 cm^3 of a salt solution and aliquots were taken at regular intervals. The initial and residual metal concentrations were measured on a spectrophotometer SPECORD 200 Analytic Jena, Germany.

Conclusions. The optimal concentration of the modifier (Unitiol) in the sorbent composition was determined, which was 1 mg / ml

Modification of the sorbent Unitiol increases the sorption activity of chitosan zeolite with respect to Cu^{2+} and Pb^{2+} ions, the recovery rate of which increases to (96 ± 4). The effect of various factors on the sorption of Cu^{2+} and Pb^{2+} ions was studied. Optimum values of sorption parameters are determined: sorbent mass - 1g per 100 cm^3 solution for copper and lead, T = 298K

In the course of studying the sorption of Cr^{6+} ions, it was determined that the modification of the sorbent increases the recovery rate, which increases to 100%.

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ТОКСИКАЛЫҚ МЕТАЛДАРДЫҢ ИОН ЖӘНЕ ТИІСТІК МЕТАЛДАРДЫҢ ТОҚТАТУҒА АРНАЛҒАН ЗОЛОТЕЛЬ ЖӘНЕ ЧИТОСАНҒА НЕГІЗДІ ТЫЙЫМДАР

Аннотация. Авторлар иондарының Cu^{2+} және Pb^{2+} туралы сорбция процесінің әр түрлі факторлардың әсерін зерттеді. Сондай-ақ сорбциялық параметрлерін оңтайлы маңызы: сорбент бұқаралық - мыс пен қорғасын 1D na100sm3 шешім, T = 298K.

Ол 100% арттырады сорбент өндіру, түрлендіру дәрежесі арттырады, зерттеу сорбциялық Cr^{6+} иондарының барысында анықталды.

Цеолиттен және хитозана негізделген жаңа композициялық материалдар алу. су ерітінділеріндегі ауыр металл иондарының қатысты өз сорбциялық сипаттамалары (өндірудің дәрежесі, адсорбция тепе уақыты) (Cr^{6+}, Cu^{2+}, Pb^{2+}) арқылы анықталған. атомдық-абсорбциялық спектроскопия (спектрофотометр «Shimadzu 6200» және спектрофотометр 200 Specord Аналитикалық Jena, Германия): пайдаланылған материалдардың физикалық-химиялық және сорбциялық қасиеттерін зерттеу үшін келесі әдістері.

Түйін сөздер: сорбция, ауыр металдар, цеолит, хитозан, Cr (VI), Cu (II), Pb (II).

УДК 54.058

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СОРБЦИОННЫЕ МАТЕРИАЛЫ НА ОСНОВЕ ЦЕОЛИТА И ХИТОЗАНА ДЛЯ ОБЕЗВРЕЖИВАНИЯ ИОНОВ ТОКСИЧНЫХ МЕТАЛЛОВ

Аннотация. Авторами статьи изучено влияние различных факторов на процесс сорбции ионов Cu^{2+} и Pb^{2+}. А так же определены оптимальные значения параметров проведения сорбции: масса сорбента – 1г на100см^3 раствора для меди и свинца, T =298K.

В ходе исследования сорбции ионов Cr^{6+} было определено, что модифицирование сорбента увеличивает степень извлечения, которое повышается до 100%.

Получены новые композиционные материалы на основе цеолита и хитозана. Определены их сорбционные характеристики (степень извлечения, адсорбция, равновесное время) по отношению к ионам тяжелых металлов (Cr^{6+}, Cu^{2+}, Pb^{2+}) в водных растворах. Для изучения физико-химических и сорбционных свойств материалов использованы следующие методы: атомно-абсорбционная спектроскопия (спектрофотометр «Shimadzu 6200» и спектрофотометр SPECORD 200 Analytic Jena, Германия).

Ключевые слова: сорбция, тяжелые металлы, цеолит, хитозан, Cr(VI), Cu (II), Pb (II).

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