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SORPTION SUCTION OF LANTHANUM ION WITH NEW MODIFIED SORBENTS

Abstract. In this article, a new modified synthetic high-molecular organic ionite is proposed for the sorption of rare-earth metal ions from water bodies. Concentrated citric acid (C₆H₈O₇) is used as a modifier. The article shows an increase in the volume of La³⁺ extraction from the concentration of the C₆H₈O₇ modifier. During the sorption extraction experiment, the concentration of La³⁺ extraction increases at 90 min. heating. AB-17-8 is referred to as strongly basic anionites, which work effectively at pH 2-14. Rare earth metals (REM) are widely used in various industries: electrical engineering, catalysts, permanent magnets and phosphors. All this causes anthropogenic pollution of the environment, living organisms, so it is necessary to study potential threats. To do this, we must be able to detect small amounts of REM in the environment and water. REM in wastewater is often determined by separation and concentration methods, such as co-precipitation, ion exchange, liquid-liquid extraction, electrolysis, etc. However, these methods have disadvantages, such as the duration and complexity of the study, as well as material costs.

Keywords: anion resin, sorption, rare earth metals, citric acid, concentration, temperature.



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Introduction. Nowadays, rare earth metals (REMs) occupy a strong position as one of the important resources for many high-tech processes. REMs are used for the production of microelectronic products, optics, structural materials, green energy elements, hybrid car engines and much more [1-3].

REMs have almost the same structure of the outer electronic levels of their atoms, which explains the similarity of their physical and chemical properties. Despite the fact that their total occurrence on earth is tens of times greater than that of metals such as molybdenum and tungsten, the capital costs of their extraction are quite high [4,5].

Currently, there are many methods for extracting sparingly soluble compounds of various metals: ferrous, non-ferrous, rare earth from aqueous solutions. We chose the cheapest, more accessible sorption method.

Conditions and methods of research. 65% -vertical HNO₃ solution, 25%-NH₃ solution, 96% -CH₃COOH, 38% HCl, 95% ethanol ("Ch.d.a.", "IREA 2000",

Russia). Acetate-ammonium buffer solution (2m, pH 4) is prepared from ammonium acetate and uxic acid. We prepared Lantana solution (1mg/mL) $\text{La}(\text{NO}_3)_3 \cdot 6\text{H}_2\text{O}$ ("Ch.D.A.") in a solution of 0.1 m HNO_3 directly from the measured one. The necessary solutions for the work were prepared by mixing with distilled water and acetate-ammonyl buffer solutions. We used the following sorbents: AB-17-8 grade anionite, AB-17-8: $\text{C}_6\text{H}_8\text{O}_7$ modified anionite. For photometric studies of lanthanum, we used arsenan solution III (0.01%) ("Ch.d.a.", "Reachim", Russia). To prepare the solution, we mixed dry metered 0.3 m of HCl solution.

Research results and discussions. In the article, the multiprotector MultiBioRS-24 (firm Biosan) was used. We shot the spectrum on the Shimadzu UV-1800 (Japan company) spectrometer [6]. Studies have been carried out with a maximum optically dense 650nm with a thickness of cuvettes of 1 cm. depending on the pH and time, the sorption of the La Ion was carried out with AB-17-8 and its modified form AB-17-8: $\text{C}_6\text{H}_8\text{O}_7$. We poured La solution into a test tube in a volume of 0.5 ml, added 1.5 ml of acetate-ammonium buffer solution (2m, pH 4) and arsenazo in the calculation of 1ml of ionizer. We supplement the solution with distilled water to a line of 3 ml.

As a result of experiments, the modifier has a good effect, as shown. Under the influence of the modifier, the sorbent was well sorbing La^{3+} ions (Fig. 1). The volume of La^{3+} ion suction increased due to the modifier concentration, as shown in the Figure 2. Increasing the concentration of the modifier by 3mol will not lead to an increase in volume in the future.

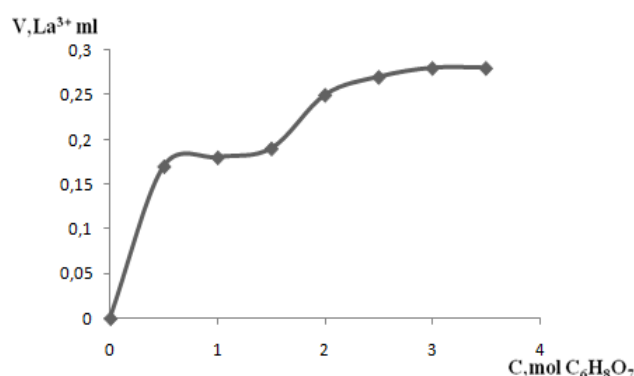
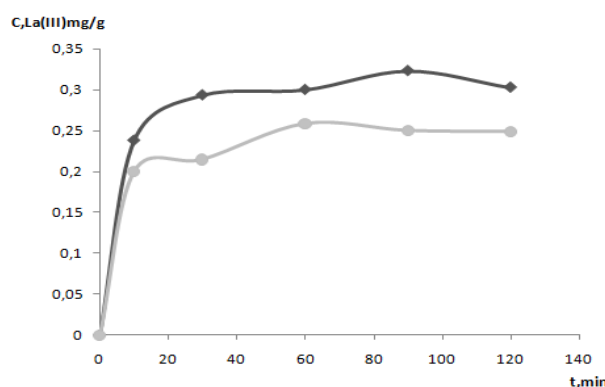


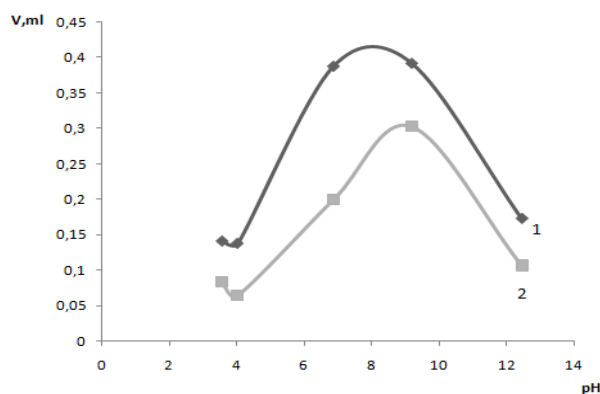
Figure 1. La^{3+} ion of the modifier concentration



1 – AB-17-8: $\text{C}_6\text{H}_8\text{O}_7$ swallows 0.32 mg/g in the 90-minute interval, as shown in Figure; 2 – AB-17-8 90-swallows 0.25 mg/g at intervals of minutes.

Figure 2. Dependence of La^{3+} ion concentration on heating time

Judging by the curved corset in the picture, the solution is a strong base ash, which works effectively at a pH of 2-14. As a result, high sorption capacity (Fig. 3) AB-17-8: C₆H₈O₇ in a neutral environment, the sorption of the La³⁺ ion showed 0.38 mg/g, and the result of the sorption of the AB-17-8 sorbent showed 0.30 mg/g. That is, modification of anionite with concentrated citric acid increases the sorption capacity of the sorbent by 8 times.



1 – AB-17-8:C₆H₈O₇; 2 – AB-17-8.

Figure 3. Dependence of sorption of La³⁺ on PH

Conclusion. With us, a new modified AB-17-8:C₆H₈O₇ sorben was studied, which has the ability to SORB the Lantana (III) ion. The work selected optimal states: modifier concentration, ph, lanthanum ion sorption time with modified sorbents. As a result, anionite of the AB-17-8 brand, modified with concentrated citric acid, highly effectively removes lanthanum ions from model waters. Sorbent can be recommended for use in wastewater treatment.

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ЖАҢА МОДИФИКАЦИЯЛАНҒАН СОРБЕНТТЕРМЕН ЛАНТАН ИОНДАРЫНЫҢ СОРБЦИЯСЫ

Аңдатпа. Мақалада су объектілерінен сирек жер металдарының иондарын сорбциялау үшін жаңа модификацияланған синтетикалық жоғары молекулалық органикалық ионит ұсынылған. Модификатор ретінде концентрацияланған лимон қышқылы (C₆H₈O₇) қолданылады. Зерттеуде C₆H₈O₇ модификаторының концентрациясынан La³⁺ экстракция көлемінің ұлғаюы көрсетілген. Сорбциялық экстракция эксперименті кезінде La³⁺ экстракциясының концентрациясы 90 минуттан кейін артады. АВ-17-8 рН 2-14-те тиімді жұмыс істейтін күшті негізді аниониттерге жатады. Сирек жер металдары әртүрлі салаларда кеңінен қолданылады: электротехника, катализаторлар, тұрақты магниттер және фосфорлар. Мұның бәрі қоршаған ортаның, тірі организмдердің антропогендік ластануын тудырады, сондықтан ықтимал қауіптерді зерттеу қажет. Мұны істеу үшін біз қоршаған орта мен судағы аз мөлшердегі сирек жер металдарын анықтай алуымыз керек. Ағынды сулардағы сирек жер металдарының мөлшері көбінесе тұндыру, ион алмасу, экстракция, электролиз және т.б. бөлу және шоғырландыру әдістерімен анықталады. Алайда, бұл әдістердің кемшіліктері бар, мысалы, зерттеудің ұзақтығы мен күрделілігі, сондай-ақ материалдық шығындар.

Тірек сөздер: анионды шайыр, сорбция, сирек жер металдары, лимон қышқылы, концентрация, температура.

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СОРБЦИЯ ИОНОВ ЛАНТАНА НОВЫМИ МОДИФИЦИРОВАННЫМИ СОРБЕНТАМИ

Аннотация. В данной статье предложен новый модифицированный синтетический высокомолекулярный органический ионит для сорбции ионов редкоземельных металлов из водных объектов. В качестве модификатора используется концентрированная лимонная кислота (C₆H₈O₇). В статье показано увеличение объема экстракции La³⁺ от концентрации модификатора C₆H₈O₇. В ходе эксперимента по сорбционной экстракции концентрация экстракции La³⁺ увеличивается через 90 мин. отопление. АВ-17-8 относится к сильноосновным анионитам, которые эффективно работают при рН 2-14. Редкоземельные металлы (РЗМ) широко используются в различных отраслях промышленности: электротехнике, катализаторах, постоянных магнитах и люминофорах. Все это вызывает антропогенное загрязнение окружающей среды, живых организмов, поэтому необходимо изучать потенциальные угрозы. Чтобы сделать это, мы должны быть способны обнаруживать небольшие количества РЗМ в окружающей среде и воде. Содержание РЗМ в сточных водах часто определяется методами разделения и концентрирования, такими как совместное осаждение, ионный обмен, жидкостно-жидкостная экстракция, электролиз и т.д. Однако эти методы имеют недостатки, такие как продолжительность и сложность исследования, а также материальные затраты.

Ключевые слова: Анионная смола, сорбция, редкоземельные металлы, лимонная кислота, концентрация, температура.