

IRSTI 61.29.99

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## SORPTION CAPACITY OF MIXED SORBENT

**Abstract.** To date, the most pressing issue is water pollution, the need to make a decision on the processing of dangerous discharges that have entered the water in the process of use in the national economy. Due to the presence of a large number of obstacles in the process of preparing water for water use, a major problem is associated with the presence of man-made disasters, the consequences of natural phenomena. The active operation of production has more than doubled in recent years, which leads to an increase in the use of Water Resources. The total mass of water pollutants worldwide is fifteen billion tons per year, of which three million tons are heavy metals. In this regard, the mixed sorbent we are researching has high sorption capabilities, cost-effective properties, environmentally friendly.

**Keywords:** sorption, sorbent, combined, heavy metals, zeolite, goethite, pyrite.



Murzakassymova N.S., Sembek A., Sayabay A., Begenov A., Serikbayev Sh., Elamanova P.Zh. Sorption capacity of mixed sorbent // *Mechanics and Technology / Scientific journal.* – 2023. – No.4(82). – P.112-115. <https://doi.org/10.55956/KPVU5514>

**Introduction.** For mankind today, water purification is one of the main problems. It has been established that the water resources of some regions of our earth are contaminated with toxic substances, and groundwater is contaminated with heavy metals [1,2]. Wastewater from these heavy metal ions During the cleaning process, an absorption method was used to prevent recontamination. Absorption materials are obtained from high efficiency metal solutions [3,4]. Studies use combined absorption materials, both mineral and carbonaceous. Mineral sorbents include activated carbon, other silica gels and zeolites. Mixed sorbents have absorption capacity for each individual metal ion. Currently, activated carbon is widely used. Mixed sorbents have absorption capacity for each individual metal ion. Currently, activated carbon is widely used. Various sorbents made from wood, carbon, polymers or industrial waste are among the fibers that can be used as additives. This is harmful to the environment and the economy. In addition, purified coal and clay are commonly used to extract metal ions. Used to reduce the cost of biological treatment of industrial water using natural and other absorption materials [5].

Contamination of surface and groundwater by heavy metal ions is widespread when exposed to the human body. Heavy metal ions have a toxic, allergic and carcinogenic effect on all systems of the human body. Toxic metals include cadmium and lead. According to Sanpin Cd – 0.001 mg/dm<sup>3</sup> is concentrated in the bovine of lamellar Pb – 0.03 mg/dm<sup>3</sup> vessels [6].

**Conditions and methods of research.** The composition of the mixed mineral sorbent. During the study, the composition of water using effective methods using mineral sorbents

Problems of purification from Cd, Pb ions were considered. Based on the purpose of the work, in the process of removing Cd, Pb ions from artificial solutions involves obtaining mineral absorbers in the process of studying their chemical properties, as well as their absorption capacity.

The following combined sorbents were selected:

1. Zeolite.
2. Pyrite -is an iron disulfide of the chemical composition FeS<sub>2</sub> (46.6% Fe, 53.4% S). Impurities of Co, Ni, As are not uncommon, Cu, Au, Se, etc.
3. ( $\alpha$ -Fe<sup>3+</sup>O (OH)) sample.

**Research results.** Finding a mixed mineral sorbent. For further study of various properties of mineral sorbents, their preparation is done by grinding in agate solution, with further separation into fractions: less than 0.1 mm; 0.51 mm; 1.5-2.5 mm. for filtering, filters with cells of this type were taken: 0.1 mm; 0.5 mm; 1 mm; 1.5 mm; 2.5 mm. In own area, volume and the filtration properties of mineral suckers obtained in the extraction of cadmium and lead ions from artificial solutions were studied by mixed mineral suckers with a grain size of 0.51 mm, i.e. seolite-forty percent; pyrite-thirty percent; goethite – thirty percent.

*Physico-chemical properties of mixed isotopes.* Determination of the specific location and size of the combined isotopes is carried out using the best available methods. The following table shows the values for this area like many wizards and witches.

Table 1  
Specific surface area, pore area and volume of the studied sorbents

Sample	Particle size, mm	Specific surface area, m <sup>2</sup> /g	Specific volume pores, cm <sup>3</sup> /g
Zeolite	Less than 0.1	25.3	0.011
	0.5-1	21.1	0.009
	1,5-2,5	19.4	0.008
Goethite	Less than 0.1	4.1	0.002
	0.5-1	2.8	0.001
	1.5-2.5	2.2	0.001
Pyrite	Less than 0.1	0.765	0
	0.5-1	0.594	0
	1.5-2.5	0.136	0
Sample 1	0.5-1	9.4	0.0048

During the study, we can see that the surface area of pyrite is small, and the volume of its pores is zero. For sorbents, we can see an increase in the specific surface when the fractional composition of a given sample decreases.

**Discussion of research results.** Determination of adsorption capacity of mixed sorbent, the study of the sorption capacity of sorbents obtained from mineral sorbents was carried out on a multi-tab platform. According to Goso, we put 0.3 grams of the sorbent under study in a glass and add a solution of 30 cm<sup>3</sup> sample. As a model solution, metal ions are prepared in distilled water. The Model Solution contains cadmium ions with a concentration of 5.04 mg/dm<sup>3</sup>, and the initial concentration of lead ions is 10.12 mg/dm<sup>3</sup>, and mixing processes between 1,5 and 15 are carried out between 30-60 min.

After mixing, the filter is separated from the adsorbent in a "blue ribbon" paper filter. The content of Cd<sup>2+</sup> and Pb<sup>2+</sup> ions in the initial model solution and filtrate was analyzed by inverse voltammetry on the TA-07 analyzer device [7].

#### **Conclusion.**

1. Mixed sorbents were obtained on the basis of mineral sorbents.
2. To obtain mixed sorbents, the required amount of various minerals is selected.
3. Determine the actual surface area and actual pore volume in individual components and final sorption materials;
4. Conducting sorption studies of individual components and mixed sorbents while extracting Cd<sup>2+</sup> and Pb<sup>2+</sup> ions from sample solutions.
5. Based on the conducted research, it was concluded that the possibility of using mineral composite sorbents to purify water from heavy metal ions is very high.

#### **References**

1. Vladimirov, A.M., Lyakhin, Yu.I., Matveev, L.T., Orlov, V.G. Sreda bezopasnosti [Security environment]. – M.: Gidrometeoizdat, 1991. – 423 p. [in Russian].
2. Mosin O.V. Metody obnaruzheniya tyazhelykh metallov v vode [Methods of detection of heavy metals in water] / Kandidat khimicheskikh nauk [Candidate of Chemical Sciences]. // Electron. journal. – 2012. – 684 p [in Russian].
3. Chirkst D.E. Sorption of iron (2+) by ferromanganese nodules // Journal of Applied Chemistry, 2005. T. 78. Vol. 4, P. 599-605
4. Alykov N.M., Pavlova A.V., Nguyen Khanh Zui. Sorption removal of heavy metal ions from water // Life safety, 2010. No. 4. P. 17-20
5. Andreeva, N.P. Use of complex sorbents for cleaning wastewater from large molecular organic compounds and ions heavy metals / Andreeva Natalya Petrovna. – Moscow: – 2006.
6. SanPiN 2.2.4.548-96. Gigiyenicheskiye trebovaniya k mikroklimatu proizvodstvennykh pomeshcheniy (utv. Postanovleniyem Gossanepidnadzora RF ot 01.10.1996 N 21) [Hygienic requirements for the microclimate of industrial premises (approved Resolution of the State Sanitary and Epidemiological Supervision of the Russian Federation dated 01.10.1996 N 21)]. [in Russian].
7. Batueva, D.M. Gomboeva, S.V. Determination of the content of heavy metal ions in water by inversion voltammetry, – Ulan-Ude: 2003.

*Material received on 16.11.23.*

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#### АРАЛАС СОРБЕНТТИҢ СОРБЦИЯЛЫҚ ҚАБІЛЕТІ

**Аңдатпа.** Судың ластануы бүгінгі таңда өте күрделі мәселе болып отыр және су объектілеріне қауіпті төгінділерді тоқтату, оларды халық шаруашылығында пайдалану кезінде су орталарын тазарту туралы шешім қабылдау қажеттілігі туындайды. Қазіргі уақытта суды пайдалануға дайындау адамзаттың өндірістік қызметінің күшеюіне және техногендік апаттар мен табиғи құбылыстардың көбеюіне байланысты өте өткір мәселе. Адамзаттың өндірістік белсенділігінің күшеюі соңғы жарты ғасырда екі еседен астам өскен, су ресурстарын пайдаланудың артуына әкеледі. Қазіргі уақытта әлемде гидросфераны ластаушы заттардың жиынтық массасы жылына 15 млрд. т құрайды, оның ішінде ауыр металдар – жылына 3 млн.т. Осыған байланысты экономикалық тиімді, экологиялық зиянсыз аралас сорбенттердің сорбциялық тиімділігін зерттеу мақсатында тиімді сорбенттердің сорбциялық қабілеттерінің тиімділігін зерттедік.

**Тірек сөздер:** сорбция, сорбент, кешенді, ауыр металдар, цеолит, гетит, пирит.

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#### СОРБЦИОННАЯ СПОСОБНОСТЬ КОМБИНИРОВАННОГО СОРБЕНТА

**Аннотация.** Загрязнение воды на сегодняшний день является достаточно серьезной проблемой и возникает необходимость принятия решения о прекращении опасных сбросов в водные объекты, очистке водной среды при их использовании в народном хозяйстве. В настоящее время подготовка воды к водопользованию является достаточно острой проблемой, связанной с усилением производственной деятельности человечества и увеличением техногенных катастроф и природных явлений. Усиление производственной активности человечества приводит к увеличению использования водных ресурсов, которое за последние полвека увеличилось более чем вдвое. В настоящее время совокупная масса загрязняющих веществ гидросферы в мире составляет 15 млрд. т, в том числе тяжелых металлов – 3 млн. т/год. В связи с этим мы исследовали эффективность сорбционных способностей эффективных сорбентов с целью изучения сорбционной эффективности экономически эффективных, экологически безвредных комбинированных сорбентов.

**Ключевые слова:** сорбция, сорбент, комбинированный, тяжелые металлы, цеолит, гетит, пирит.