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STUDY OF PHYSICOCHEMICAL PROPERTIES OF CREMNESOL-BASED COMPOSITE IONITES

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ИССЛЕДОВАНИЕ ФИЗИКО-ХИМИЧЕСКИХ СВОЙСТВ КОМПОЗИЦИОННЫХ ИОНИТОВ НА ОСНОВЕ КРЕМНЕЗОЛА

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ABSTRACT

In this article, it is explained in detail that a copolymer is obtained based on the copolymerization reaction of N-vinylmorpholine and acrylic acid, and it is treated with the help of colloidal silica to obtain a composite ionite. The thermal and mechanical strength of the obtained composite was also studied.

АННОТАЦИЯ

В данной статье подробно объясняется, что на основе реакции сополимеризации N-винилморфолина и акриловой кислоты получают сополимер и обрабатывают его с помощью коллоидного кремнезема для получения композиционного ионита. Также были исследованы термическая и механическая прочность полученного композита.

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Ключевые слова: динитрил азобисизомасляной кислоты, температура разложения, N-винилморфолин акриловой кислоты, механическая прочность, сополимеризация.

Introduction

Today, ionites are the latest modern and promising method of extracting non-ferrous metals from wastewater and are widely used in industry. Selective cations are widely used for the selective extraction of metal ions from solutions. Extraction of d-metal ions in the solution is carried out with the help of ionites, which have the property of metal sorption at the expense of donor-acceptor bonds. Such ions sorb metals as a result of interacting with molecules and ions holding empty orbitals to form a complex[1-3].

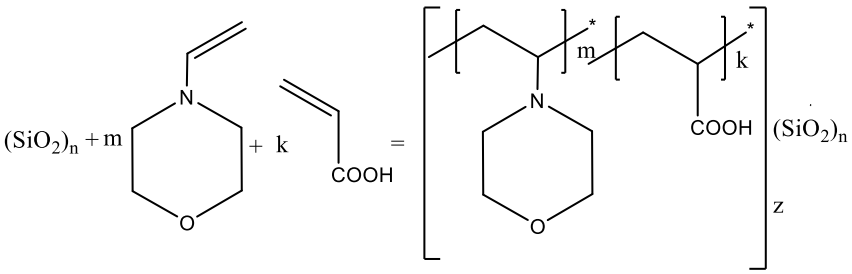
The main indicators of such ionites are selective sorption of ions (selectivity), sorption capacity, mechanical strength, stability constants of the complex, extraction of metals from the ionite, and the structure of the ionite. Currently, there are many ways to introduce electron-donor atoms that retain a free electron pair into the composition of ionites. Synthesis of inorganic and organic matrix sorbent materials by sol-gel method allows to easily influence their composition, structure and properties[4-6]. Compounds obtained by the sol-gel synthesis method are characterized by thermal stability, glass transition temperature and high mechanical strength[7-9]. Hybrid ionites, which contain nitrogen, sulfur and oxygen atoms in the macromolecule of polymer compounds, allow not only to increase the high efficiency of metal separation, but also to improve the technical properties of materials [9-12].

The fact that the molecules of the hybrid polymer structure form three-dimensional structures in space further increases their mechanical strength. Branched structures can be formed by polymerization of selected monomers or macromolecules. Three-dimensional structured meshes can be obtained by welding or solidification and vulcanization processes[13-15]. It is formed as a result of binding of active groups in each monomer in the crosslinking of monomers. The formation of macromolecules in these ways increases their mechanical strength. In addition to the active functional groups in the hybrid ionites, its period of use, number of uses and selective sorption of metal ions largely depend on the structure of the ionite and the active groups in it[16-19].

Methods and results

The process of copolymerization of N-vinylmorpholine (N-VM) and acrylic acids (AA) was carried out in solution with the presence of DAA initiator. After the copolymerization process, the product was treated with colloidal silica (CS) by two precipitations and then dried under vacuum to a constant mass[20-22].

The interaction of selected compounds can be represented by the following general scheme.



The structure and properties of the synthesized composite were investigated.

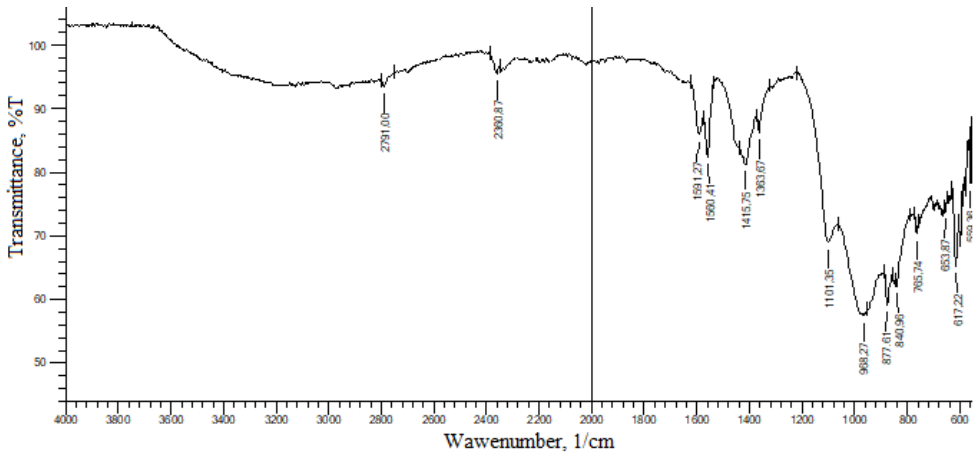


Figure 1. IR spectrum of VM-AA-CS composite

The mechanical strength of ionite was determined by the method of vibration in a vibration apparatus. Cationite dissolved in 50 ml of water is placed in a 150 ml measuring cylinder, filled with 100 ml of distilled water and closed with a stopper. The cylinder was shaken horizontally in a vibrating apparatus for 10 hours (100 sh/min) [23]. After the partial boiling process, it was sieved through a 0.5 cm sieve and the size of the cationite remaining in the sieve was determined. The mechanical strength of the cation was found by the ratio of the volume remaining after shaking to the initial volume (Table 1).

Table 1.

Characteristics of composites based on nitrogen-retaining polycompounds

Composite	Amount, % wt.		Amount of SiO_2, % wt.	Yield, %	$T_{dec.}$, °C	Mechanical strength, %
	N	Si				
N-VM-AA-CS	6,4 5,9 4,2	7 9,8 20,5	15 21 44	60 56 71	258 276 329	97 98 99

Ionite's sorption of ions was determined by its sorption of ions in basic water. In this case, a model solution was prepared and the sorption capacity of ionite was determined by the method of serial titration [24-26].

In addition to functional groups, the operational properties of adsorbents also depend on the structure of the sorbent material. The nature of the organopolymer or inorganic matrix mainly determines the chemical and mechanical stability of the sorbents, as well as the kinetics of the adsorption process. From this point of view, hybrid sorption materials with desired structural and chemical properties have a great advantage.

Table 2.

Sorption of some metal ions by carboxyl cation exchanger

№	The initial concentration of the studied ions, C = 1 g /l	Type R-H	Type R- Na
1.	Nickel (II) sulfate	1,81 – 2,09	2,23 – 2,48
2.	Copper (II) sulfate	2,28 – 2,65	3,3 – 3,71

Conclusion

An increase in the glass transition temperature and decomposition with an increase in the amount of colloidal kremnizol in the system was determined, which ensures their high thermal and chemical stability due to the formation of organic copolymers from three-dimensional silicon dioxide, which is strongly associated with the structure of the composites.

The changes in the mechanism of adsorption of metal ions of composites based on copolymers VM-MMA-CS and VM-AA-CSwith temperature, when tested in the "Central Scientific Research Laboratory of the State Enterprise Navoi Mining and Metallurgical Plant" of high mechanical strength and the sorption absorption of ions such as copper, nickel, and is also characterized by inertia in active media.

References:

1. Сипкина Е.И. Гибридные композиты на основе азотсодержащих гетероциклических низко- и высокомолекулярных соединений и диоксида кремния. Авто. Дисс. Иркутск – 2017 г.
2. Ostonov Firuz, Akhmedov Vohid SYNTHESIS OF IONITES BASED ON CREMNISOLE // Universum: технические науки. 2022. № 4-13 (97).
3. Ostonov Firuz, Akhmedov Vokhid SYNTHESIS AND PROPERTIES OF COMPLEX FORMING IONITES // Universum: технические науки. 2023. №2-6 (107).
4. Остонов Ф.И., Ахмедов В.Н. Гибридные композиты на основе морфолина. // Меж. Конф.-Руминия, Бухарест. 20.11.2020 г. С. 38-42.
5. Ахмедов В.Н., Назаров Ш.К. Электронная структура и квантово-химические расчёты виниловых эфиров фенолов.
6. Olimov B.B., Akhmedov V.N., Gafurova G.A. Application of derivatives of diatomic phenols as corrosion inhibitors // Euro Asian Conference on Analytical Research (Germany. – 2021. – T. 15. – C. 136-138.
7. Olimov B., Akhmedov V., Gafurova G. Production and use of corrosion inhibitors on the basis of two-atomic phenols and local raw materials //environment. – T. 7. – C. 11.

8. Олимов Б.Б., Ахмедов В.Н. Винилацетилен асосида феноларнинг винил эфирлари синтези.“ // Замонавий ишлаб чикаришнинг мухандислик ва технологик муаммоларини инновацион ечимлари” Халкаро илмий анжуман материаллари Бухоро. – 2019. – С. 37-39.
9. Olimov B.B., Yoldosheva N.J. Gravimetric study of the mechanism of action of corrosion inhibitors used in the oil and gas industry //Международный научно-образовательный электронный журнал «Образование и наука в XXI веке». Выпуск. – №. 19.
10. Olimov B.B., Ahmedov V.N., Hayitov S. Ikki atomli fenollar asosida vinilli efirlarni olish usullari //Fan va texnologiyalar taraqqiyoti ilmiy-texnikaviy jurnal. – 2020. – №. 1.
11. Олимов Б.Б., Гафурова Г.А., Кудратов О.Х. Production and properties of corrosion inhibitors in the oil and gas industry // Universum: химия и биология: электрон. научн. журн. – 2022. – Т. 2. – С. 92.
12. Olimov B.B., M.I. Sadiqova, and I.A. Beshimov. "Technology of obtaining effective corrosion inhibitors in the oil and gas industry." Universum: технические науки: электрон. научн. журн 1 (2022): 94.
13. Ахмедов В., Олимов Б., Гафурова Г. Винилачетилен иштирокида винил эфирлар олиш //НамДУ илмий ахборотномаси-Научный вестник НамГУ. – 2021. – С. 37-43.
14. Shomurod N., Vokhid A., Bobir O. Preliminary quantum chemical analysis of synthesized monomers with the participation of vinylacetylene //International journal of progressive sciences and technologies. – 2020. – Т. 22. – №. 2. – С. 50-56.
15. Паноев Э.Р., Дустов Х.Б., Ахмедов В.Н. Проблемы коррозии в кислых компонентных системах и способы ее уменьшения // Universum: технические науки. – 2021. – №. 12-5 (93). – С. 47-50.
16. Olimov B., Akhmedov V. The effect of reaction duration and catalyst on the synthesis of arylvinyl esters // Збірник наукових праць ΛΌГОΣ. – 2020. – С. 33-37.
17. Bahodirovich O.B. et al. Synthesis of Resorcinol Vinyl Ether in the Mono-position, Influence of the Catalyst, Temperature and Solvent on the Reaction Yield //JournalNX. – 2020. – С. 44-51.
18. Ахмедов В.Н., Олимов Б.Б. Способ получения виниловых эфиров на основе винилацетилена // Gaydar Aliyevning. – 2020. – Т. 97.
19. Назаров Ш. и др. Синтез мономеров при участии винилацетилена из одноатомных фенолов содержащих ариловую группу //Universum: химия и биология. – 2020. – №. 11-2 (77). – С. 11-15.
20. Ганиев Б.Ш., Олимов Б.Б. Влияние температуры синтеза на абсорбционные свойства сополимерных композитов содержащих навбахорского бентонита // Химия и химическая технология: достижения и перспективы. – 2018. – С. 304.1-304.2.
21. Olimov B.B., Akhmedov V.N., Gafurova G.A. Application of derivatives of diatomic phenols as corrosion inhibitors. Euro Asian Conference on Analytical Research (Germany).
22. Sh, Ganiev B. "Olimov BB influence of the temperature of synthesis on the absorption properties of copolymer composites containing navbahor bentonite." chemistry and chemical technology: achievements and prospects.-2018.--S: 304-1.
23. Nazarov S.K., Olimov B.B., Akhmedov V.N. Electronic structure and quantum-chemical calculations of vinyl esters of phenols //Austrian Journal of Technical and Natural Sciences. – 2020. – №. 3-4. – С. 46-51.
24. Остонов Ф.И., Ахмедов В.Н. Винилморфолин иштирокида гибрид полимер композит олиш //Рес. Конф. Бухара. 4-5 декабр. 2020 г. С.406-406.
25. Ахмедов В.Н., Остонов Ф.И., Дўстов Ҳ.Б. Получение модифицированных акриловых соединений на основе соединений кремния // Развитие науки и технологий. 2021. № 2. С. 24-30.
26. Остонов Ф.И., Ахмедов В.Н. Производство новых видов гибридных композитов // Научный вестник Наманганского государственного университета. 2021 № 9. С. 44-49.