

SYNTHESIS OF NEW MULTIFUNCTIONAL IONITES AND THEIR APPLICATION IN SORPTION OF SOME METALS

¹Haydarov Bekzod, ²Mamirov Akmal, ³Pardaboyeva Shakhlo

¹Assistant teacher of Yangiyer branch of Tashkent Institute of Chemical Technology

^{2,3}Students of Yangiyer branch of Tashkent Institute of Chemical Technology

<https://doi.org/10.5281/zenodo.8200095>

Abstract. This article presents information on the synthesis of new multifunctional ionites and their use in the sorption of certain metals, dewatering of clay-salt suspensions, desilting, condensation and washing technologies of clay-carbonate sludges.

Keywords: ionite, reagent, oil-gas, metallurgy, perfumery, macromolecule, NH₂ group, copper and nickel sulfate, polyelectrolyte-ionite.

In recent years, extensive scientific and research work has been carried out on obtaining nitrogen and sulfur-containing ionites, and several types of ionites are known according to the field of use and raw material sources. Ionites obtained from polymers and copolymers containing carboxyl and amino groups are characterized by high flexibility and mechanical strength. The degree of solubility of the resulting ionites varies depending on many physicochemical factors, such as the ratio of functional groups, amount, degree of coagulation, reaction temperature, coagulation reagent and concentration of the main substance.

Synthesized ionites have mechanical strength, so in practice they can be used in various forms in the form of powder, granules. Also, the obtained ionites are successfully used in agriculture, oil and gas, construction, engineering, metallurgy, perfumery, medicine and many other fields [1].

Currently, the synthesis of polyelectrolyte-ionites with ionization activity, water solubility and high physico-mechanical properties is in the focus of basic research.

In this work, the synthesis of new effective ionites containing a large amount of functional groups, soluble in water and salt solutions, and their complex formation with metal ions in solutions of metal salts were studied. Hydrolyzed polyacrylonitrile and 37% solutions of formalin were used as starting products. The physico-chemical properties of polymer ionites formed from cross-linking of initial substances at different ratios and temperatures were studied. As a result of studies, the optimal indicator between the degree of ionization ($m-m_0 / m_0$) and the amount of binding reagent was determined. According to it, the highest level of binding was recorded when the amount of binding reagent was 0.3% [2].

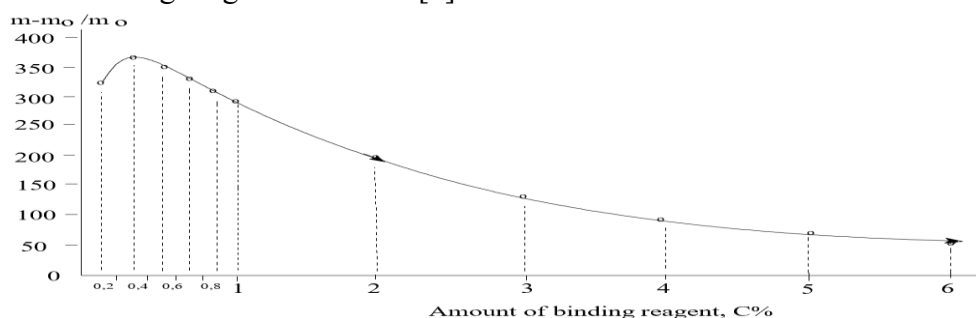


Figure 1. The graph of the relationship between the amount of the synthesized ionites and the amount of binding reagent. (200 - 400 C).

The given table shows the bond and link ratio, or rather the degree of friction. This ratio curve can vary along the same curve as the absorbance curve of ions in solution passing through pores at the molecular level into ionites.

Among the ionites synthesized at different temperatures and concentrations, those with low solubility and higher absorption properties of metal ions were selected and their sorption properties were studied (Table 1) [3].

Table 1.

Degradation rates of ionites obtained at different ratios and temperatures.

№	ГИПАН, C %	Amount of binding reagent, C %	Reaction temperature.				
			20 °C	40 °C	60 °C	80 °C	100 °C
			Stuttering level. m-m ₀ / m ₀				
1	99,0	1,0	295	250	170	60	28
2	98,0	2,0	198	145	105	45	22
3	97,0	3,0	133	95	70	25	15
4	96,0	4,0	96	60	45	12	8
5	95,0	5,0	85	20	14	8	2

The use of ionites as ionites in the production of rare and rare elements and in the treatment of waste water from various metal ions can be of great benefit.

The use of ionites as ionites has several advantages. First of all

- recommended ionites were synthesized on the basis of local raw materials. Therefore, its cost is much cheaper than imported ionites of this type.

- no toxic effect.

- most ionites sorb ions on their surface, and due to the flexibility of ionites, ions penetrate into the interior of the macromolecule.

- It is easy to separate it from the solution because it can keep its aggregate state well.

- Such polymer compounds are effective as sorbents in the sorption process due to the presence of positively charged nitrogen and hydroxyl groups.

The sorption properties of these obtained ionites, metal ions in solution, were studied. During the sorption process, ions were placed in a conical flask with a capacity of 500 ml and 0.1 n. A solution of CuSO₂, NiSO₄ and SoSO₄ salts was added. As a result of the inspection, it was found that the ionites are saturated with ions. The following formula was used for this.

$$\alpha = \frac{C_{\text{бoишл}} - C_{\text{мyвoз}} \cdot V}{m_c}$$

Here α is the sorption value, mg/l.

C_{start} - the initial concentration of the substance to be determined, mg/ml.

C_{balance} - the concentration of the substance to be determined after sorption, mg/ml, V - solution volume, ml, m_c - ionite weight, g.

The table below shows that ionites have good sorption properties (Table 2).

Table 2

Results of comparison of sorption parameters of the obtained substances.

Vsol ит, ml	Sorbent mass, g	pH bal.	Amount of MeSO4 before sorption, mg/l					Sorption rate, %				
			Cu	Zn	Ni	Co	NaCl	Cu	Zn	Ni	Co	NaCl
Cationite KB – 2												
250	6,5	4,43	200	201	194	19 4	146	99	93	98	65	66
Cationite KB – 4												
250	5,2	4,30	200	201	194	19 4	146	97	97	89	98	97
Amberlight IRC-50												
200	8,0	4,45	200	201	194	19 4	146	10 0	100	94	98	98
Ionite												
250	3,5	4,45	200	201	194	19 4	146	10 0	99	98	99	97

It was found that the synthesized ionites have good sorption of intermediate metal ions. The studied ions can be placed in the following series according to the degree of sorption in the ionite:



It was found that the product of ionites obtained on the basis of GIPAN and caustic reagent (96:4 ratio, T=100°C) has a low solubility compared to other ionites, but the level of sorption of copper, nickel and other ions is high. To determine the copper ion saturation of each ionite over time, the saturation factor was calculated from the kinetic curve of sorption of all ionites and the maximum exchange volume. According to him, the ionite, which is saturated with copper ions faster than others, is obtained on the basis of GIPAN and binding reagent (96:4 ratio T=100°C) and is saturated by 87% for 1.5 minutes (Fig. 2).

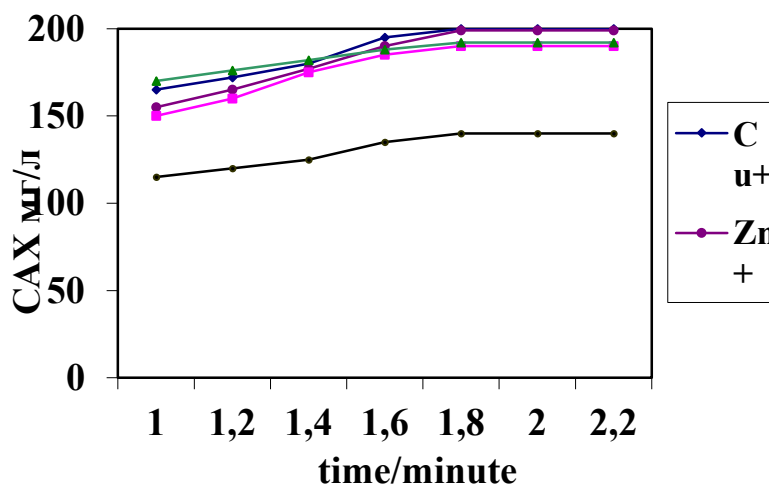


Figure 2. Kinetics of sorption of some metal ions on ionite obtained on the basis of GIPAN and binding reagent (96:4 T=100°C).

IR-absorption spectra of ionite and complex compounds of copper and nickel (II) obtained on their basis are shown in figures 3, 4 and 5. When the obtained spectra were compared with the data obtained from the literature, it was found that the main vibrational frequencies are identical. Only in the $\nu(\text{CONH})$ 3400-3450 cm^{-1} valence vibration region, several broad and slightly shifted bands are observed, which are characteristic of associated groups and adsorbed additives. Absorption lines in the region of 1070 and 1150 cm^{-1} indicate simple ether bonds formed after quenching with a coupling reagent. According to the information in the literature, absorption lines in the region of 1638 - 1625 cm^{-1} indicate the presence of $\delta(-\text{COOH})$ and $\delta(-\text{COONa})$ functional groups. Intramolecular and intermolecular hydrogen bonding through the NH -group appears at several shifted vibrational frequencies.

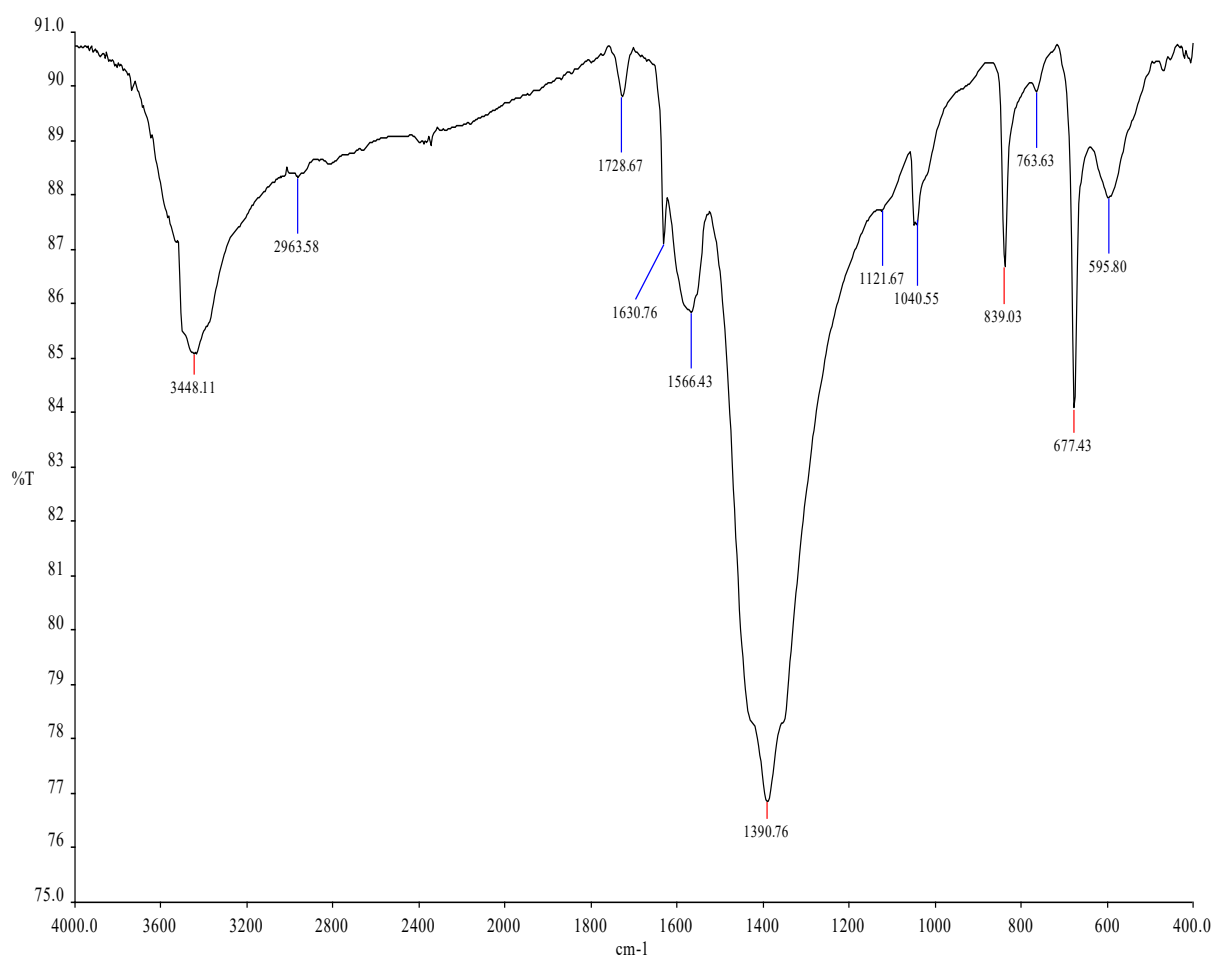


Figure 3. IR-absorption spectrum of the complex formed by ionite with CuSO_4 salt.

When the vibration spectra of the obtained ionite and complex compounds were compared, it was found that the valence vibration of the $-\text{CONH}-$ and $-\text{COOH}$ groups shifted from 1640-1620 to 1630-1600 cm^{-1} and 1560-1350 cm^{-1} in the short-wave range. Such a shift of the fundamental vibrational frequencies of $\nu(\text{CONH})$ and $\nu(\text{COOH})$ indicates the formation of a donor-acceptor bond with the complex-forming ion in the ligand through the oxygen in the carboxyl group and the nitrogen atom in the amino group.

Compared with the spectrum of free ions, a shift of the carboxyl and amino group lines to a slightly lower frequency region was observed as a result of the association of adjacent oxygen atoms through hydrogen bonds. The deformation vibration lines of the NH_2 group in the complex compound are shifted to a higher frequency.

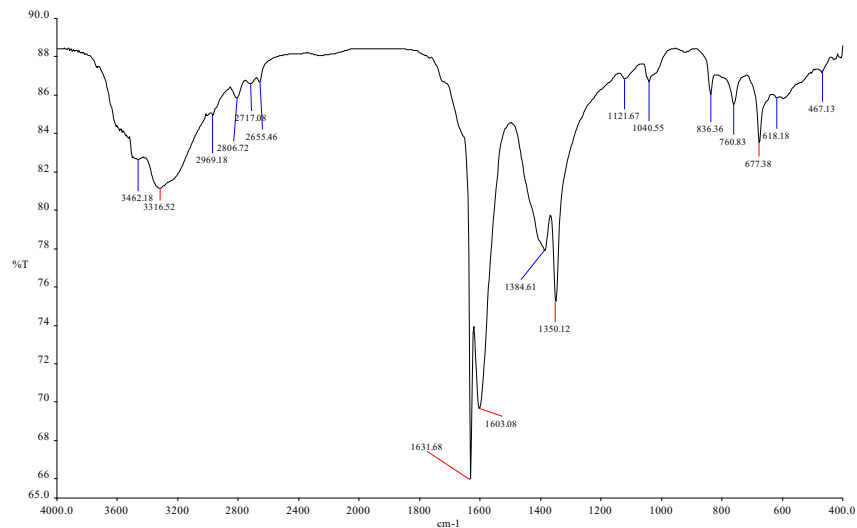


Figure 4. IR-absorption spectrum of the complex formed by ionite with AgNO_3 salt.

When studying the IR-absorption spectra of complex compounds of copper and nickel sulfates obtained with ionite, it was found that they have a flat square structure. The shift of $\nu(\text{CONH})$ from 1350 to 1570 cm^{-1} and $\nu(\text{COOH})$ from 1600 to 1650 cm^{-1} in the high-frequency region indicates that these complexes are formed due to coordination of the ligands through the oxygen of the carboxyl group and the nitrogen atom of the amino group. Absorption lines characteristic of $\nu(\text{SO}_4)$ in all complexes were obtained in the region of 1040-1130 cm^{-1} .

According to the results of studying the IR-absorption spectra of the obtained complex compounds, it can be concluded that the metal ion in these compounds is coordinated with oxygen in the carboxyl group and nitrogen in the amide group. The ionite molecule acts as a bidentate ligand. As a result of the conducted research, it is of great practical importance that some of these ionites based on ionite have a strong sorption property of metal ions.

REFERENCES

1. Масленицкий И.Н, Чугаев Л.В, Стрижко Л.Е «Металлургия благородных металлов» М, Metallurgy 1987
2. Разумов К.А, Перов В.А, «Проектирование обогатительных фабрик» М. Недра. 1982
3. Кучерский Н. И «Золото кызылкумов» Ташкент. 1998
4. Зеленев В.А Методические исследование золотосеребро содержащих руд.М. Недра 1989 г
5. Журнал Цветные металлы №7 1999 г
6. Гидрометаллургия золота М. наука 1980
7. Горный журнал «ахборотнома» №8 1998г
8. Польшкин И.С «Обогащения руд и россыпей редких и благородных металлов» М. Недра 1987г
9. Шохин В.Н, Лопатин Л.Г «Гравитационные методы обогащения» М. Недра 1993г
10. Поленко Г.С «Минерология золото чертвтертычных россыпей Узбекистана» Ташкент. Фан 1982г
11. Стрижко Л.С. Абдурахманов С.А «Металлургия золото и серебра» Навоий 2000 (рукопись), переден в печать
12. Стрижко Л.С , Абдуравхманов С.А , Аскарлов М.А «Металлургия благородных металлов» (технологические расчеты) рукпись на кафедре готовится к печати