The New Uzbekistan Journal of Medicine (NUJM)

Available online at: https://ijournal.uz/index.php/nujm/index
Volume I, Issue II, 2025
ISSN: 2181-2675

THE MEDICAL SIGNIFICANCE OF THE COMPLEX COMPOUND OF PECTIN WITH ZINC METAL

Soliha Bobonazarova[1]
Marg'uba Abdullayeva[2]
Tashkent Medical Academy,
Tashkent, Uzbekistan

[1]Student, Tashkent Medical Academy;

DOI: **10.5281/zenodo.15274507**

Article History	Abstract
Received: 15.03.2025 Accepted: 24.04.2025	Fundamental scientific research is being actively conducted in the world today on the synthesis of polymer-metal complexes and the creation of promising drugs for different purposes. In this regard, it is an urgent task to obtain polymer-metal complexes with biological activity, to determine their physico-chemical properties and possible areas of their application. The purpose of the research: to obtain complexes of pectin with some metals and to study their physical and chemical properties.

Keywords: Pectin, metal complexes, viscometry, process of calcium, magnesium, zinc metals.

The New Uzbekistan Journal of Medicine (NUJM)

Available online at: https://ijournal.uz/index.php/nujm/index
Volume I, Issue II, 2025
ISSN: 2181-2675

PEKTINNING RUX METALLI BILAN MURAKKAB BIRIKMASINING TIBBIY AHAMIYATI

Annotatsiya/ Аннотация

Bugungi kunda dunyoda polimer-metall komplekslarni sintez qilish va turli maqsadlarda istiqbolli dori vositalari yaratish bo‘yicha fundamental ilmiy tadqiqotlar faol olib borilmoqda. Shu munosabat bilan biologik faollikka ega bo'lgan polimer-metall komplekslarni olish, ularning fizik-kimyoviy xossalari va qo'llanilishi mumkin bo'lgan sohalarini aniqlash dolzarb vazifadir. Tadqiqot maqsadi: ba'zi metallar bilan pektin komplekslarini olish va ularning fizik-kimyoviy xususiyatlarini o'rganish.

Kalit so‘zlar/ Ключевые слова: pektin, metall komplekslari, viskometriya, kaltsiy, magniy, rux metallari jarayoni.

1. INTRODUCTION.

The study of the processes of complex formation of natural polymers with metals in the world attracts special attention of researchers. The problem of creating new effective drugs for agriculture and medicine is a prerequisite for obtaining new knowledge on the synthesis and prediction of the properties of metal complexes. The transition of the polymer complex form to drugs reduces their toxicity, gives them new biological activity, and acquires prolongation properties. The water solubility of polymer metal complexes is of great importance in this, which helps to increase the biodegradability of drugs and increase the possibility of their wider application in practice. In the human body, as well as in farm animals, microelements are of great importance, for example, calcium regulates intracellular processes, regulates the permeability of cell membranes, regulates the processes of conduction and contraction in the nerve, stabilizes heart activity, forms bone tissue, and mineralizes teeth. Calcium deficiency in the body leads to diseases such as osteoporosis, heart disease, rickets.

Today, fundamental scientific research is actively being conducted in the world on the synthesis of polymer-metal complexes and the creation of promising drugs for various purposes. In this regard, it is an urgent task to obtain polymer-metal complexes with biological activity, determine their physicochemical properties and possible areas of their application

Authors [5]. It was shown that the acetyl number of various pectins is in a wide range: from 0.01 to 2.5%. The authors also noted that the higher the acetyl groups in the pectin, the lower the gel-forming properties of pectin. For pectins used as gelling agents, the content of acetyl groups should not exceed 1%.

Pectins are characterized by a difference in the distribution of carboxyl groups along the entire length of the pectin molecule, in particular, in apple pectins the carboxyl groups are evenly distributed along the length of the pectin molecule, but in citrus pectins this distribution is uneven.

With an increase in the degree of esterification of pectin molecules and a decrease in their molecular weight, their water solubility increases, therefore, low-methoxyl pectins are less

The New Uzbekistan Journal of Medicine (NUJM)

Available online at: https://ijournal.uz/index.php/nujm/index
Volume I, Issue II, 2025
ISSN: 2181-2675

soluble in water than high-methoxyl pectins. Molecules of pectic acids that do not contain methoxyl groups, although their molecular weight is insignificant, are insoluble in water. With vigorous stirring and at room temperature, 4-8 g of pectin dissolve in 100 ml of water, when the temperature rises to 60-80 ° C, the solubility of pectin increases slightly and amounts to 10 g of pectin in 100 ml of water. . Thus, the maximum concentration of aqueous solutions of various pectins does not exceed 10%. To increase the solubility of pectins, sugar can be added to water. This tendency can be explained by the dissociation of free carboxyl groups in pectin molecules and the pH of their aqueous solutions close to 3.5, i.e., the formation of an acidic environment in pectin molecules in water. Consequently, pectins are more soluble in water, the more methoxyl groups in their molecules, the more significantly the ability of pectins to form complexes decreases. Pectin solutions were characterized by significant viscosity. This is an important indicator, since there is a clear relationship between the viscosity of pectin and its gel-forming ability [6]. In this work [35], a polysaccharide-metal complex of a ruthenium compound was synthesized (Scheme 2). it showed a certain inhibition specificity towards the human renal cell adenocarcinoma cell line 786-O cells and reduced the toxic effects of the Ruthenium complex on normal cell lines, such as human normal kidney [35].

2. RESEARCH METHODOLOGY

Polymer-metal complexes are synthesized by various methods, such as electro, photo, free radical polymerization (atactic polymers are synthesized), reflux, homopolymerization, copolymerization, and living and controlled polymerization (stereoregular polymers are obtained), polycondensation, synthesis of dendrimers and hyperbranched polymers-physical vapor deposition polymerization, radiation-stimulated welding method, polycondensation, emulsion polymerization, etc. [65]. Coordination polymers are materials with high surface area, porosity, and are widely used in ion exchange processes, adsorption, sensor technologies, heterogeneous catalysis, luminescence, and proton conductivity [66,67,68]. Coordination polymerization involving metal chelate compounds is the most preferred method for the development of polymer-metal complexes. Coordination polymers are composed of metal ions and bridging ligands that link them to solid-state structures that extend in one, two, and three dimensions. Two- and three-dimensional coordination polymers with potential voids are often called metal-organic frameworks or porous coordination polymers. They are obtained by the following methods:

1. Conventional method
2. Diffusion synthesis
3. Solvents
4. Microwave synthesis
5. Sonochemical synthesis
6. Electrochemical synthesis
7. Ion-thermal synthesis

3. ANALYSIS AND RESULTS

As a result of processing the integral curves of Fig. 1, differential curves were obtained for the distribution of the pore volume by effective radii, which are shown in Fig. 2;

The New Uzbekistan Journal of Medicine (NUJM)

Available online at: https://ijournal.uz/index.php/nujm/index
Volume I, Issue II, 2025
ISSN: 2181-2675

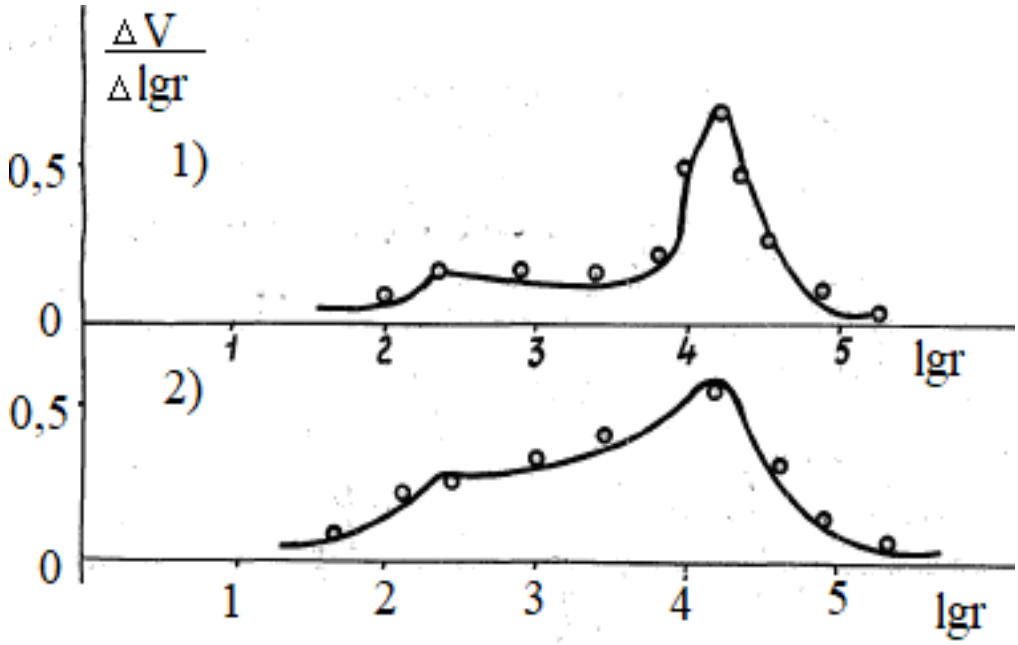

Figure 2. Differential curves of pore size distribution by effective radii of plant residue coals

1-charcoal obtained from the roots of licorice, 2-modified sodium carbonate charcoal

Benzene sorption-desorption isotherms for all samples were also obtained at 20°C in the range of R/Rs relative pressure from 1*10-5 to 0.95. The isotherms are depicted in Figure 3. The isotherms are S-shaped and have a clear hysteresis loop, indicating the presence of capillary condensation in the transition pores. All the experimental points in the relative pressure range from 1*10-5 to 0.2÷0.3 fit well on a straight line, which shows that this equation is applicable for processing experimental data.

As can be seen from Table 1, when changing coal, the total volume of pore space decreases, but this decrease occurs in different ways. When impregnated with an aqueous solution of Na2CO3, the decrease in total volume occurs mainly due to the decrease in the volume of macropores and partly due to micropores. Since the aqueous solution of the modifier cannot enter the micropores due to the negative capillary pressure, a slight decrease in their volume may be associated with the "blackening" of the entrances to the micropores.

Table-1

Soaking conditions and porous structure of activated carbon

Sample	Metal content in coal mg/g	Total porosity П%	Volume pore sm^3/g			Dubinin-Radushkevich		Energy classification is cal/mol	distribution, n
			V mak	Vn	V mik	10^{-9}	W_0		
Activated carbon	-	63	0,28	0,17	0,48	0,75	0,50	5220	1,95
Sodium charcoal	28	60	0,25	0,18	0,45	0,7	0,47	5340	2,04

The New Uzbekistan Journal of Medicine (NUJM)

Available online at: https://ijournal.uz/index.php/nujm/index
Volume I, Issue II, 2025
ISSN: 2181-2675

In addition, the wetting nature of the porous layers in activated carbon may differ from the wetting properties of graphite, and at least part of the micropores are wetted, for example, due to oxidation.

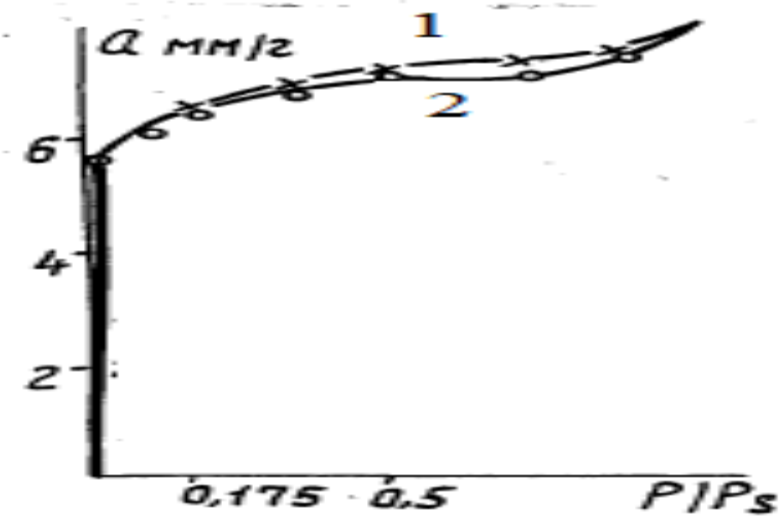

Figure 3. Isotherm of benzene adsorption onto the obtained coal samples

1-charcoal obtained from the roots of licorice, 2-modified sodium carbonate charcoal

A different picture is observed when activated carbon is impregnated with carbonate solutions containing alcohol. Here, in all cases, the decrease in total pore volume is associated with a decrease in the volume of pores of all sizes, which indicates a more uniform distribution of the modifier in the pore space of the coal.

It is worth noting that when the alcohol content rises to 75% and 95%. the concentration of sodium carbonate in the solution and its content in coal decreases, and the volume of micropores does not increase and even slightly decreases, which indicates that they are more fully filled.

As can be seen from the table, the value of the constant in the Dubinin-Radushkevich equation decreases for modified coal, which indicates an increase in the adsorption potential in micropores. Since benzene was used as a sorbate in the recording of sorption-desorption isotherms, the increase in adsorption potential when modified with sodium carbonate can be explained only by the decrease in the average size of micropores. The value of the constant in the range of 0.76÷0.6 indicates the presence of micropores up to 5 - 7 A in the corner, the effective radii of other pores also decrease, which is confirmed by differential porograms for macropores (Fig. 2).).

The maximum volume of the sorption area Wo calculated using this equation corresponds practically to the volume of micropores and decreases with increasing alcohol content in the absorbent solution.

The processing of the results showed that the isotherms of all samples of coal modified with sodium carbonate are characterized by the thermal adsorption equation with the degree of distribution n approximately equal to two, which corresponds to the data for unmodified coal. and modified by other substances. The characteristic adsorption energy of the studied samples

The New Uzbekistan Journal of Medicine (NUJM)

Available online at: https://ijournal.uz/index.php/nujm/index
Volume I, Issue II, 2025
ISSN: 2181-2675

increases from 5250 to 5850 cal/mol; an increase in this parameter allows us to expect an increase in their sorption activity towards carbon dioxide.

Table 1 summarizes the composition of the samples and their pore structure, obtained by numerical processing of porograms and isotherms.

As can be seen from Table 1, the limiting concentration of sodium carbonate was used in water-alcohol mixtures, first of all, the amount of alcohol in the absorbent solution increases, increases. experiments with a constant content of the modifier reach the greatest value when impregnated with a 50% alcohol solution and then decrease. A sample soaked in a 10% aqueous solution of Na2CO3 has a lower carbonate concentration (6.47%). As can be seen from the table, due to the use of aqueous-alcohol solutions, the maximum amount of sodium carbonate in coal can increase to 130 mg / g, while when using aqueous solutions, feces are four times less (32 mg/g) . If necessary, the content of the modifier can be increased to 220 mg / g by reabsorption with a solution of Na_2CO_3 in 50% ethanol.

The table also shows that the porosity of the samples during soaking changes depending on the amount of carbonate in the coal: with an increase in the amount of K_2CO_3, the porosity decreases, and when it is weakened, the diffusion of sodium carbonate into the pores increases.

Summary. Preparation of samples modified with sodium carbonate was carried out by impregnation with solutions of non-constant Na_2CO_3 content. This is explained by the desire to obtain sorbents with the highest modifier content. Unmodified coal has a higher sorption than modified coal. This is the basis for the use of cationic coals in medicine.

Conclusion

In all countries, the generation of large amounts of medicinal plant processing waste causes a number of negative economic and ecological consequences. It is necessary to produce industrially useful materials and practical application by purposeful use of licorice root extract residues. In this regard, it is very important for theory and practice to justify the rational use of these medicinal plant residues. The rationale for this solution is particularly relevant for the global scale. As a result of mechanical processing of plant residues, the issues of effective disposal of very large amounts of waste are solved. Carbon sorbent was obtained by thermal treatment of plant extract residues at 800-900^{0}C. The sorption of benzene molecules to the obtained carbonization and activated carbon and their distribution into the pores were theoretically studied. The results of the study revealed that the sorption laws of thermodynamics correspond. If the heat of adsorption is higher than 50 kJ/mol, ion-molecular p-complexes are formed in the pores. The use of activated substances for the proposed coal, that is, the use of the modification method, allows for uniform distribution in the pores of the coal, increasing the absorption depth.

References

[1] Masakatsu M. Rapid microwave pyrolysis of wood / M. Masakatsu, J. Chem. Most. Jap. - 2000. - vol. 33, iss. 2. - RP. 299-302.

[2] Uraki Y. Preparation of activated carbon from peat / Y. Uraki, Y. // BioResources. – 2009. - No. 4 (1) – PP. 205-213.

[3] Viswanathan, B. Methods of activation and specific applications of carbon materials // Indian Institute of Technology Madras. - 2009. - p. 160.

The New Uzbekistan Journal of Medicine (NUJM)

Available online at: https://ijournal.uz/index.php/nujm/index
Volume I, Issue II, 2025
ISSN: 2181-2675

[4] Mingbo Wu. Preparation of porous carbons from petroleum coke by different activation methods / Wu Mingbo, Qingfang Zha, Jieshan Qiu, Xia Han, Yansheng Guo, Zhaofeng Li, Aijun Yuan, Xin Sun // Fuel. - 2005. - 84, 14-15. - p. 1992-1997.

[5] Juma M. Pyrolysis and combustion of scrap tire / M. Juma, Z. Koreňovb, J. // Petroleum & Coal. - 2006. - 48(1). - p. 15-26.

[6] Chesnokov N.V. Carbon adsorbents from hydrolyzable lignin for cleaning waste water ot organic primesey // Journal of Siberian Federal University; Chemistry. – 2011. – No. 1 (4) – p. 100-107.

[7] Medvedev A.V. Razabotka metoda elektrodugovoy pyroliznoi utilizatsii osadkov stochnykh vod gorodskih chishtnykh uchrejdenii: autoref. dissertation. nor soiskanie three. St. sugar tech. Nauk (25.00.36) // Tyumen State Neftegazovy University. - Tyumen, 2003. – 24 p.

[8] Kuznetsova L.N. Pyrolysis osadkov stochnyx vod TsBP s polucheniem organomineralnyx adsorbentov dlya ochistki promyshlennyx stokov: avtoref. dissertation. nor soiskanie three. St. sugar tech. nauk (05.21.03)//- Arkhangelsk, 2000. – 20 p.

[9] Bogdanovich N. I. Pyrolysis osadkov, soderzhashchikh active il, s polucheniem organomineralnyx adsorbentov dlya ochistki jdkikh i gazovykh vybrosov/Management ecology. Mat-ly conf. "Ecology-99". - Vologda, Vologda GTU. - 1999. – S. 50-53.

[10] Weisman Ya.I. Issledovaniya physiko-khimicheskikh svoystv i termicheskoi destruktsii otkhodov neftepererabatyvayushchikh predpriyatiy / Ya.I.Vaisman, I.S.Glushankova, L.V.Rudakova, M.S.Dyakov // Nauchnye issledovaniya i innovatsii. 2010. - T. 4, No. 3 – P.21-24.

[11] Kuznetsov B.N. Synthesis and application of carbon sorbents // Sorosovsky obrazovatelny journal. -1999. – No. 12. - S. 29-34.

[12] Yatsevskaya M.I. Aktivnye ugli na slujbe u cheloveka // Minsk: o-vo "Znanie" BSSR, 1983. – 21 p.

[13] Olontsev V.F. Aktivnye ugli (poluchenie i primenenie) / V.F.Olontsev, V.V.Olontsev. // Perm: GU Perm. center nauch.-techn. inform., 2005. – 88 p.

[14] Moreno-Castilla C. Adsorption of organic molecules from aqueous solutions on carbon materials // 2004. - №42. – p.83–94.

[15] Khudayberganova N., Rizaev A., Abduraxmonov E.B. Adsorption properties of benzene vapors on activated carbon from coke //E3S Web of Conferences 264, 01022 (2021) CON– 2021 https://doi.org/10.1051/e3sconf /202126401022

[16] M.Khudoyberganov, F.Rakhmatkarieva, E.Abdurakhmonov, I.Tojiboeva, Kh.Tadjieva, Thermodynamics of water adsorption on local kaolin modified microporous sorbents//The 1st international conference on problems and perspectives of Modern science, ICPPMS, 10-11 June, 2021, Tashkent, Uzbekistan (2021), AIP Conference Proceedings 2432, 050001 (2022); https://doi.org/10.1063/5.0090736

[17] F.Rakhmatkarieva, O.Ergashev, O.Davlatova, M.Kokhkharov, M.Khudoyberganov, E.Abdurakhmonov, T.Abdulkhaev, NalTA energy in molecular sieve guest-guest interactions energetics of host-guest interactions in NalTA molecular electrics// Journal of Physics: Conference Series, IV International Conference on Applied Physics, Information Technologies and Engineering 2022 (APITECH-IV 2022) 05-08 October, Bukhara, Uzbekistan (2022), J.Phys.: Conf. Ser. 2388 012175, https://doi:10.1088/1742-6596/2388/1/012175

The New Uzbekistan Journal of Medicine (NUJM)

Available online at: https://ijournal.uz/index.php/nujm/index
Volume I, Issue II, 2025
ISSN: 2181-2675

[18] E. Abdurakhmonov, I.B. Sapaev, B. Abdullaeva, F. Rakhmatkarieva, N.N. Dekhkanova. Thermodynamics of hydrogen sulfide adsorption in Zeolite LiX// E3S Web of Conferences 383, 04018 (2023) TT21C-2023 https://doi.org/10.1051/e3sconf/202338304018

[19] Firuza Rakhmatkarieva, Mansur Xudoyberganov, Sergei Lyapin, Eldor Abdurakhmonov, Mirzakhid Kokharov, and Tolib Abdulkhaev. Energy, structure and localization of H_2O-Ba^{2+} and H_2O- Na^+ complexes in BaNaY molecular sieve// AIP conference proceedings «Problems in the Textile and Light Industry in the Context of Integration of Science and Industry and Ways to Solve Them (PTLICISIWS-2022)» AIP Conference Proceedings 2789, 020022 (2023) https://doi.org/10.1063/5.0145638

[20] Nigora Dekhkanova, Eldor Abdurakhmonov, Feruza Rakhmatkarieva and Nodirabegim Jamoliddinova Thermodynamics of hydrogen sulfide adsorption in NaX zeolite // E3S Web of Conferences 402, 14037 (2023) TransSiberia 2023 https://doi.org/10.1051/e3sconf/202340214037

[21] Ziyada Djumanova, Eldor Abdurakhmonov. Adsorption energetics of benzene vapors on activated adsorbent based on glycyrrhiza glabra root extract residues// E3S Web of Conferences 413, 04005 (2023) INTERAGROMASH 2023 https://doi.org/10.1051/e3sconf/202341304005

[22] Muxlis Oydinov, Tolibjon Abdulxayev, Mirzohid Kokhkharov, Eldor Abdurakhmonov, Firuza Rakhmatkarieva Thermodynamics of Carbon (IV)-Oxide adsorption on NaA Zeolite obtained by modification of angren kaolin// E3S Web of Conferences 413, 04007 (2023) INTERAGROMASH 2023 https://doi.org/10.1051/e3sconf/202341304007

[23] Muminjon Ismoilov, Bosit Khamidov, G. Yakubova, Eldor Abdurakhmonov and Shavkat Khamidov Oil production from local oil// BIO Web of Conferences 65, 03003 (2023) EBWFF-2023 https://doi.org/10.1051/bioconf/20236503003

[24] Firuza Rakhmatkarieva, Odina Davlatova, Mirzokhid Kokhkharov, Mansur Xudoyberganov, Oybek Ergashev, Eldor Abdurakhmonov, Tolib Abdulkhaev. Mechanism of H_2O Vapor Adsorption in A Type Zeolites: A Model Based on Adsorption Calorimetry// E3S Web of Conferences 434, 03032 (2023) ICECAE 2023 https://doi.org/10.1051/e3sconf/202343403032

[25] M.X.Oydinov, B.D. Igamov, I.R. Bekpulatov, E.B. Abduraxmonov, G.T. Imanova. Analysis of Na-A zeolite based on kaolin using an X-ray diffractometer. Chem Bull Kaz Nat Univ 1-2:28-36. (2024) IRSTI 621.362 https://doi.org/10.15328/cb1371

[26] Kh. Bakhronov, O. Ergashev, Kh. Karimov, N. Akhmedova, I. Absalyamova1, Sh. Abdullayeva Differential heats, isotherm and entropies of n- pentane adsorption on LiZSM-5 and CsZSM-5 zeolites, E3S Web of Conferences, 458, 02008 (2023), https://doi.org/10.1051/e3sconf/202345802008

[27] Khayot Bakhronov, Oybek Ergashev, Nazirahon Esonkulova, Ilmira Absalyamova1, Majidjon Ahkmadov, Basic thermodynamic characteristics of toluene adsorption in Cu^{2+}ZSM-5 Zeolite, E3S Web of Conferences 402, 14004 (2023), https://doi.org/10.1051/e3sconf/202340214004

[28] O. Ergashev, Kh. Bakhronov, N. Akhmedova, Sh. Abdullayeva, S. Khalilov, K. Kholikov, Calorimetric study of methanol adsorption in LiZSM-5 and CsZSM-5 zeolites, E3S Web of Conferences, 401, 02023 (2023), https://doi.org/10.1051/e3sconf/202340102023

The New Uzbekistan Journal of Medicine (NUJM)

Available online at: https://ijournal.uz/index.php/nujm/index
Volume I, Issue II, 2025
ISSN: 2181-2675

[29] Kh. Bakhronov, O. Ergashev, A. Sultonov, H. Kholmedov, A. Ganiev, M. Asfandiyorov, Basic thermodynamic characteristics and isotherm of ammonia adsorption in NaZSM-5 and LiZSM-5 zeolites, E3S Web of Conferences 401, 02025 (2023), https://doi.org/10.1051/e3sconf/202340102025

[30] Kh. Bakhronov, O. Ergashev, Kh. Kholmedov, A. Ganiev, M. Kokhkharov, N. Akhmedova, Adsorption of Carbon Dioxide in Zeolite LiZSM-5, AIP Conference Proceedings 2432, 050050 (2022), https://doi.org/10.1063/5.0090037

[31] Kh. Bakhronov, O. Ergashev, Kh. Karimov, T. Abdulkhaev, Y. Yakubov, A. Karimov, Thermodynamic Characteristics of Paraxylene Adsorption in LiZSM-5 and CsZSM-5 Zeolites, AIP Conference Proceedings 2432, 050056 (2022), https://doi.org/10.1063/5.0090039

[32] Kiselyov A.V. Udelnaya poverkhnost adsorbentov different structure. - V sb.: Metody issledovaniya structure vysokodispersnyx i poristyx tel, M,: Izd. AN USSR, 1953, pp. 86-113.