Laboratory of Chemistry of Polysaccharides

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Following the dissolution of the Scientific-Research Institute of Chemistry and Technology of the Cotton Cellulose, the Laboratory of Cellulose joined the Institute of Bioorganic Chemistry, Uzbekistan Academy of Sciences in 1993. Headed by Professor Turaev A.S., Academician, Uzbekistan Academy of Sciences, the laboratory conducted studies on peculiarities of chemical transformations of polysaccharides and their derivatives, molecular and supramolecular structures, synthetic hydrophilic polymers, on generation of novel effective medications with the preset properties for medical practice and agriculture. In a short time, the laboratory enlarged; number of the Candidates and Doctors of Sciences increased. In 2012 the laboratory was renamed to “Chemistry of polysaccharides”.
Today there are more than 20 workers, 1 Academician, 2 Doctors of Sciences, 8 Candidate of Sciences among them. The training of personnel is paid special attention. Thus, there are 2 external PhD candidates and 4 base-type PhD candidates.

Principle directions of research include

- Study on peculiarities of isolation and chemical transformations of polysaccharides and their derivatives, molecular and supramolecular structures, synthetic hydrophilic polymers, on generation of novel effective medications for medical practice and agriculture.
- Study and development of the scientific basis for macromolecular systems based on polysaccharides and their derivatives, synthetic water-soluble polymers for medicine, biology and agriculture
- Generation of gel systems and development of highly efficient soft drug forms of external use based on polysaccharides and their derivatives, synthetic water-soluble polymers for dentistry, dermatology, surgery cosmetics
- Isolation of collagen from the cattle raw leather with preservation of their basal fibrous structure and their modification with the water-soluble polysaccharides; production of medications and surgical products for medicine and cosmetics
- Chemical modification of polysaccharides and development of macromolecular medications of targeting and prolonging effect
- Generation of polymer compositions for problems of the agriculture to be solved



ПОЛИСАХАРИДЛАР КИМЁСИ ЛАБОРАТОРИЯСИ ХОДИМЛАРИ

Main achievements include

Basic

- isolation of polysaccharides from various sources by well-known methods and those developed at the laboratory. Structures and compositions of polysaccharides. Isolated by means of various methods were determined by chromatography-mass spectroscopy, ^{3}C-NMR and IR-spectroscopy, spectrophotometry, polarimetry and photometric titration
- establishment of regularities in reactions of carboxymethylation, sulphatation and nitration of polysaccharides of various origins. We demonstrated possibility to obtain carboxymethyl-polysaccharides and sulfate polysaccharides with the preset properties (for example, carboxymethyl-polysaccharides with the polymerization degree ranging from 30 to 550 and substitution degree by the –CH_2COOH groups ranging from 0.1 to 1.0; sulfate polysaccharides with the polymerization degree ranging from 50 to 400 and substitution degree ranging from 0.5 to 2.86 and nitrate polysaccharides with the polymerization degree ranging from 25 to 450 and substitution degree ranging from 0.6 to 2.75). Optimal conditions of etherification of polysaccharides directly and selectively
- study on chemical transformation of polysaccharides by chemical cross-linking with bifunctional compounds (formaldehyde, dimethylol ethylene urea, dimethylol diethylene urea and others) in heterogeneous and homogenous media
- establishment of possibility to cross-link sodium carboxy methyl cellulose in the aqueous solution by Al^{3+}, Mg^{2+}, Co^{2+}, Ca^{2+} ions in the presence of the polybasic acids, resulting in transformation of the system from the free-flowing to no-flowing condition and increase in its viscosity from 3.5 to 1585 Pa·s. Methods for production of gel compositions for ultrasonic diagnosis and soft drug form were developed
- biological testing of a large set of the modified (polyanionic) polysaccharides with wound healing, anti-microbial, anti-coagulation, immune-modulating and anti-tumor effects. The interrelations between their activities and structures were established.

Applied

- Improvement of production procedure and construction of surgical braided thread. The threads produced on the basis of polyamide, polyether and natural silk are characterized with improved anti-traumatic and physical-mechanical features
- Development of production procedure for an effective antimicrobial debonder from carboxy methyl cellulose to tablet medications. The debonder makes possible the increase in the rate of the active substance isolation by 8 and more times
- Development of production procedure for effective antimicrobial medication to improve fixation and early adaptation to removable dentures
- Development of "Thymogel", an effective wound-healing gel for therapy of the infected wounds and burns
- Development of production procedure for "Fludgel", an anti-allergic and anti-fungal gel
- Development of "Biomairin", the combined anti-tuberculosis medication with prolonged action
- Development of "Bioplant", a microimplant to increase the volume and supplement of the soft tissues deficit, to treat chronic persistent wounds, burned tissues and those infected upon surgery, disorders of the skin and soft tissues
- Development of "Hemosponge", a medication to be used as a local hemostatic to stop capillary and parenchymal hemorrhages
- Development of "Biosulfocel", an antiviral medication with inhibiting effect to mosaic viruses on the plant leaves, as well as stimulating protective functions to viral infections in the green crops and gourds
- Development of production procedure for "Biosolvent", a polymer composition with the surface active features providing easy and quick removal of toxic sparingly soluble salts from the soil depth with low volumes of wash waters

Practical value of the results

For the first time, original medications and surgical products were developed and approved for use, to name

- "Kacelon", an absorbable surgical thread on the basis of carboxy methyl polysaccharides to suture inner organs wounds
- "Biolon", a non-absorbable surgical thread on the basis of polyether and polyamide to suture wounds
- "Gelecel", a draining sorbent on the basis of chemically cross-linked carboxy methyl polysaccharides for therapy of purulent wounds
- "Polygel", a gel on the basis of carboxy methyl polysaccharides used as a contact medium in ultrasound diagnosis

- An embolic polymer material on the basis of copolymers of metacryl acid for endovascular surgery
- “Hemocel”, an absorbable surgical drape on the basis of carboxy methyl polysaccharides to stop hemorrhages in the close wounds
- An effective antimicrobial debonder from carboxy methyl cellulose to tablet medications
- “Biodent”, an effective antimicrobial medication to improve fixation and early adaptation to removable dentures
- Thymogel”, an effective wound-healing gel for therapy of the infected wounds and burns

Research results

Patent № IAP 02100 Twisting torsional device
Patent № I AP 02099 Melting-molding assembly to the device for surgery threads production
Patent № I AP 02217 “Cardiogel”, an electrical conducting gel composition
Patent № I AP 02311 Method for production of surgical suture filament
Patent № I AP 02435 Surgical suture filament
Patent № I AP 02506 Method for production of matrix from collagen fibers
Patent № I AP 02561 Method for production of collagen powder
Patent № I AP 02592 Surgical suture filament
Patent № I AP 02724 Adhesive composition
Patent № I AP 03204 Adhesive powder for fixation of movable dentures
Patent № I AP 03207 Composition for tableting
Patent № I AP 03503 Method for production of surgical filament
Patent № I AP 04589 Injection solution of collagen for therapy of connective tissue disorders
Patent № I AP 04588 Injection solution of collagen for endoprosthetics
Patent № I AP 04587 Injection solution of collagen for endoprosthetics
Patent № I AP 04603 Inhibitor for tobacco mosaic virus on the plant leaves
Patent № I AP 04608 Anti-inflammation wound-healing medication
Patent №IAP 04665 Injection solution of collagen to treat connective tissue disorders
Patent № I AP 04736 Method for production of collagen substance
Patent № I AP 05125 Method for production of collagen spongy material
Patent № I AP 05207 Wound-healing medication
Patent № IAP 05327 Gel with anti-allergic, anti-fungal, immune-modulating and anesthetic effects

Patent applications

- Patent application No. IAP 20160219. The combined anti-tuberculosis medications of the prolonged effect
- Patent application No. IAP 20160219. Medication from local raw material with laxative effect
- Patent application No. IAP 20160348. Method for production of applicator

Registration Certificates

- TB/M 00086/09/06 “Polygel ultra” a polymer gel for ultrasound diagnosis
- DV/M 01574/06/17 “Thymogel”, a wound-healing medication
- TB/M 00104/12/16 Collagen “Hemosponge” Гемогубка коллагеновая;
- № 1 A 1730 “Biosolvent”, a liquid

Prospects include

- Study on complementary interactions of beta-D-glucans, galactomannanes and their modified analogues with the cell lectins aiming at generation of anti-tumor medications with the targeted action
- Task-orientated synthesis of polyanionic and polycationic polysaccharides and their derivatives, generation of anti-viral, anti-bacterial, anticancer medications on their basis
- Clinical trials of “Biomairan” anti-tubeculosis medication
- Development of production procedure for protein-rich fodder concentrate based on the collagen and natural water-soluble polysaccharides
- Generation of gel systems for highly efficient soft pharmaceutical forms
- Development of antiseptic and wound healing medications based on the derivatives of polysaccharides with guanidine groups
- Development of external use medication for therapy of allergy complicated with the fungal infection
- Development of the absorbable wound healing film based on the collagen generated from the untanned raw hide

Scientific ties

Scientific-Research Institute of Epidemiology, Microbiology and Infectious Diseases, Uzbekistan Public Healthcare Ministry

- Scientific-Research Institute of Veterinary, Uzbekistan Ministry of Agriculture and Water Management
- Institute of Virology, Uzbekistan Public Healthcare Ministry
- Tashkent Medical Academy
- Tashkent Pharmaceutical Institute
- Institute of Microbiology, Uzbekistan Academy of Sciences
- Scientific Institute of Irrigation and Water Problems, Uzbekistan Ministry of Agriculture and Water Management
- Tertiary Center of Oncology, Uzbekistan Public Healthcare Ministry
- Tertiary Center of Phthisology and Pulmonology, Uzbekistan Public Healthcare Ministry
- National University of Uzbekistan
- Research and Development Institute of Soil Science and Agrochemistry, Uzbekistan Ministry of Agriculture
- Tashkent Chemical-Technological University
- Namangan National University
- Bukhara National University
- Andijan State University
- Tashkent State Agricultural University
- Moscow State University, the Russian Federation
- V.A. Engelhardt Institute of Molecular Biology, Russian Academy of Sciences, the Russian Federation
- Tulane University, Tulane, USA
- Institute of Organic Chemistry at Rostock University, Rostock, Germany
- Kumamoto University, Kumamoto province, Japan
- Shanghai Institute of Materia Medica, Shanghai, PRC
- University of Siegen, Siegen, Germany
- Friedrich Schiller University of Jena, Germany

Publications

1. Filatova A.V., Djurabaev D.T., Turaev A.S. Technological aspects of “Fludigel”, a combined medication production. Uzbek chemical journal, 2015, No.4, 60-63
2. Filatova A.V., Djurabaev D.T., Turaev A.S Filatova A.V., Djurabaev D.T., Turaev A.S. Study on pharmaco-toxicological properties of “Fludigel”, an anti-allergic medication of external action. Pharmaceutical Bulletin of Uzbekistan, 2015
3. Boimirzaev A.S., Turaev A.S. Study on molecular-mass characteristics of derivatives of carboxy methyl cellulose and polygalacturonic acid. Bulletin of K. Jubanov Aqtobe State

Regional University, 2015, No.1, 41-44
4. Akhmedov O.R., Muidinov N.T., Turaev A.S. Study on chemical effect of iodized polysaccharides of guanidine. Bulletin of K. Jubanov Aqtobe State Regional University, 2015. No.1, 99-102.
5. Akhmedov O.R., Muidinov N.T., Turaev A.S. Chemical modification of norsulfazol and streptocide with polygalacturonic acid. Uzbek chemical journal, 2015, No.3, 48-52
6. Muidinov N.T., Akhmedov O.R., Boimirzaev A.S., Turaev A.S. Study on molecular-mass characteristics of carboxy methyl cellulose and polygalacturonic acid upon hydrolytic . Uzbek chemical journal, 2015, No.4 15-18.
7. Shomuratov Sh.A., Turaev A.S. Synthesis and study on biological activity of sulfonyl derivatives of polysaccharides. Chemistry of Plant Raw Materials. No.3, 18-23.
8. Khodoinazarov I.A., Filatova A.V., Normakhamatov N.S., Azimboev S.A., Turaev A.S. Increase of productivity of the salinized soils upon use of a polymer composition. Uzbek chemical journal, 2015, No.6
9. Shomurotov Sh.A., Muidinov N.T., Vaili A., Turaev A.S. Synthesis and study on antimicrobial activity of sulfamin derivatives of pectin. Chemistry for benefits of stable progress, 2-15, No.4, 79-85.
10. Shomurotov Sh.A., Muidinov N.T., Turaev A.S. Synthesis and antibacterial activity of derivatives of polygalacturonic acid. Chemical-pharmaceutical journal, 2015, No.4, 67-72
11. Shomurotov Sh.A., Mamadullaev G., Turaev A.S. Medical-biological properties of polysaccharide complexes of ioniaside and etambutol. Journal of biomedical chemistry, Moscow, 2016, No.1, 45-49
12. Ахмедов О.Р., Shomurotov Sh.A., Turaev A.S. Qualitative determination of active substances in “Biomairan” anti-tuberculosis medication. Pharmaceutical Bulletin of Uzbekistan, 2016, No.1, 45-50
13. Shomurotov Sh.A., Muidinov N.T., Rakhmanova G.G., Turaev A.S. Synthesis of xanthan gum dialdehyde. Chemistry and chemical technology, 2016
14. Shomurotov Sh.A., Baratov K., Turaev A.S. Carboxy methylation of guar gum. Chemistry and chemical technology, 2016
15. Khudoianazarov I.A., Normakhamatov N.S., Boysunov N.B., Shirokova Yu.I., Azimova L.B., Turaev A.S. Study on water washing of the salinized soils with “Biosolvent” polymer composition. Chemistry and chemical technology, 2016
16. Wondraczek H., Normakhamatov N., Heinze Th., Turaev A.S. Preparation and estimation of the viscosimetric constants for sodium cellulose sulfates in varying molecular parameters // Carbohydrate polymers, 2016.
17. Khaitmetova S.B., Turaev A.S. Hydrolytic degradation of cellulose derivatives with the preset molecular parameters. Uzbek chemical journal, 2016, No.4, 70-75
18. Khudoianazarov I.A., Filatova A.V., Normakhamatov N.S., Azimboev S.A., Turaev A.S. Study on effect of “Biosolvent” polymer composition on germination capacity and development of the crops. Uzbek chemical journal, 2016, No.1
19. Khaitmetova S.B., Shomurotov Sh.A., Turaev A.S. Synthesis and study on properties of polymer complexes of etacizin with carboxy methyl cellulose. Chemistry of plant raw materials, 2017, No.4, 23-30

20. Shomurotov Sh.A., Akhmedov O.R., Mamatmusaeva N.E., Sagdullaev B.T., Turaev A.S. Modified derivatives of polysaccharides having antituberculosis activity // Austrian Journal of Technical and Natural Sciences. 2017. №1-2. p.134-138.
21. Shomurotov Sh.A., Saifutdinov Z.A., Allamuratova D.A., Turaev A.S. Comparative study on *m. Tubersulosis* sensitivity to "Biomairan" medication and other anti-tuberculosis medications *in vitro*. Pharmaceutical Bulletin of Uzbekistan, 2017, No.1, 24-28
22. Akhmedov O.R., Sokhibnazarov Kh.A., Shomurotov Sh.A., Turaev A.S. Guanidin-containing derivatives of polysaccharides and their antibacterial activity. Pharmaceutical Bulletin of Uzbekistan, 2017, No.1
23. Akhmedov O.R., Shomurotov Sh.A., Vaili A., Turaev A.S. Synthesis and study on antimicrobial activity of sulfamin derivatives of pectin. Chemistry for the benefit of stable progress, 2017, Vol.25, 141-145
24. Akhmedov O.R., Shomurotov Sh.A., Talipov Kh.S., Turaev A.S. Peculiarities of synthesis of dialdehyde derivatives of carboxy methyl guar gum and nitrogen-containing compounds on their basis. Uzbek Chemical Journal. 2017, No.2
25. B. Muhitdinov, Th. Heinze, N. Normakhamatov, Turaev A.S. Preparation of sodium cellulose sulfate oligomers by free-radical depolymerization // Carbohydrate Polymers, 2017. Vol. 173. pp. 631-637.
26. Khodoinazarov I.A., Poluashova G.K., Shirokova Yu.I., Filatova A.V., Azimova L.B., Turaev A.S. Study on water washing of the salinized soils with "Biosolvent" polymer composition. Int.Sci.Jour. «The Way of Science», 2017.
27. Akhmedov O.R., Shomurotov Sh.A., Izotova L.Yu., Turaev A.S. Derivatives of xanthan gum. Synthesis, study, fungicide activity. Journal of Siberian Federal University (Chemistry series), 2017, No.2, 14-16.
28. Abdullaev Sh.V., Normakhamatov Sh.V., Turaboev A.A., Tojiboev B. Galacomannanes from *Saphora Japonica L.* growing in Uzbekistan. Scientific News of Namangan State University, 2017, No.1 4-7
29. Khaitmetova S.B., Shomurotov Sh.A., Turaev A.S. Synthesis and study on properties of polymer complexes of etacizin with carboxy methyl cellulose. Chemistry of plant raw materials, 2017, No.4, 23-30
30. Khaitmetova S.B., Turaev A.S. Development of production procedure of anti-arrhythmic medication based on the modified carboxy methyl cellulose. Uzbek chemical journal. 2017, No.5, 15-32
31. Filatova A.V., Djurabaev D.T., Turaev A.S. Development of composition and technology for the combined medication for therapy of the gums. Uzbek chemical journal, 2017
32. Gulyamov T., Radjabov O.I., Atajanov A.Yu., Muidinov N.T., Khalilova G.A., Turaev A.S. Method for isolation of collagen and production of medications on its basis.
Гулямов Т., Раджабов О.И., Атажанов А.Ю., Муйдинов Н.Т., Халилова Г.А., Тураев А.С. Способ выделения коллагена и создание препаратов на его основе. Dokladi Akademii Nauk, 2017, No 6, 62-64.
33. Muidinov N.T., Radjabov O.I., Khalilova G.A., Gulyamov T., Atajanov A.Yu., Turaev A.S. Biopolymer composition for medical films. Dokladi Akademii Nauk, 2017, No. 6,.52-56
34. A.R.Leach, V.J.Jillet "Introduction to chemoinformatics", Ed. By Prof. F.T. Adylov

(Institute of Mathematics) and Normakhamatov N.S.
Ф.Т.Адылова (Институт математики) и реценз. с.н.с. Нормахаматова Н.С (ИБОХ).
35. Ахмедов О.Р., Shomurotov Sh.A., Turaev A.S., Talipova Kh.S. Physical-chemical methods for study on guanidine cellulose. Uzbek Chemical Journal, 2018, No.1, 47-53
36. Muidinov N.T., Radjabov O.I., Khalilova G.A., Gylyamov T., Atajanov A.Yu., Turaev A.S. Коллаген асосида олинган плёнкаларнинг структурасини ва реологик хоссаларини ўрганиш .Pharmaceutical Journal, 2018, No3, 62-65.
37. Muidinov N.T., Shomurotov Sh.A., Radjabov O.I., Gulyamov T., Turaev A.S. Коллагенни диальдегид карбоксиметилцеллюлоза билан модификациялаш. Ёш олимлар ахборотномаси, 2018, No.2(1),.52-53.
38. Khudoinazarov I.A., Normakhamatov N.S., Azimova L.B., Filatova A.V., Turaev A.S. Testing of "Biosolvent" polymer composition on the salinized soils. Ўзбекистон Республикаси Фанлар Академияси Ёш олимлар кенгаши. Ёш олимлар ахборотномаси. 2018, No.2 (1), 129-131.
39. Khudoianazarov I.A., Normakhamatov N.S., Shirokova Yu.I., Filatova A.V., Turaev A.S., Mamasolieva M.A. Study on water washing of the salinized soils with "Biosolvent" polymer composition. Universum: chemistry and biology, Moscow, 2018, 6(48), 26-32
40. Khaitmetova S.B., Azimova L.B., Turaev A.S. Physical-chemical characteristics of pectin isolated from apple scraps by non-conventional method. The News of Young Scientists, 2018, No. 2(1), 110-111
41. Khalilova G.A., Normakhamatov N.S., Turaev A.S. Замбуруглардан сувда эрувчан полисахаридларни ажратиб олиш ва уларнинг физик-кимёвий хоссаларини урганиш // Ўзбекистон Республикаси Фанлар Академияси Ёш олимлар кенгаши. Ёш олимлар ахборотномаси, 2018 No.2 (1),129-131; 120-121.
42. Filatova A.V., Djurabaev D.T., Vypova N.L., Azimova L.B., Turaev A.S. Pharmaco-toxicological studies on medication for topical therapy of allergy. Infection, immunity and pharmacology, 2018, No.1, 64-68
43. Sagdullaeva D.S., Turaev A.S., Filatova A.V., Pardaev G.E., Abdurakhimov A.A. Study on effect of method for production of the cotton phospholipids on their fat acid composition. Chemistry and Chemical Technology, 2018, No.4, 60-64.
44. Filatova A.V., Turaev A.S., Djurabaev D.T. Development of production procedure for "Polygel ultra" gel for ultrasound diagnosis. Uzbek Chemical Journal, 2019, No.1
45. Filatova A.V., Turaev A.S., Djurabaev D.T. Study on physical-chemical properties of "Polygel ultra" gel. Uzbek chemical journal, 2019, No.1
46. Akramova R.R., Sagdullaeva D.S., Turaev A.S., Abdurakhimov S.A. Khodjaev S.F., Umarov F.A. Hydration of saflor oil with microwave radiation. Universum: technical sciences. Moscow, 2018, 2 (59), 26-32
47. Muidinov N.T., Khalilova G.A., Radjabov O.I., Gulyamov T., Turaev A.S. Study on production procedure for water-soluble compositions based on collagen and natural biomaterials. Uzbek chemical journal, 2019 (in press)
48. Shomurotov Sh.A., Sultanova E.M., Salakhutdinov M.K., Ishimov U.J., Ziavitdinov J.F., Veshkurova O.N., Turaev A.S. Study on pharmacokinetics of "Biomairan", an anti-tuberculosis medication. Pharmacokinetics and pharmacodynamics. Moscow, 2018, No.4,

50-55
49. Shomuratov Sh.A., Turaev A.S., Mamatmusaeva N.E., Sagdullaev B.T. “Pre-clinical studies of the anti-tuberculosis drug “Biomairin”// World journal of pharmacy and pharmaceutical sciences. 2019, Volume 8. Issue 5. Pp. 1697-1707.
50. Khalilova G.A., Mulhitdinov B.I., Khaitmetova S.B., Azimova L.B., Normakhamatova N.S. Turaev A.S. Ўзбекистонда учрайдиган базидиал замбуруғларни полисахарид таркибини ўрганиш. Uzbek Chemical Journal, 2019, No.2, 48-55.
51. Azimova K.B., Normakhametov N.S., Khaitmetova S.B., Mukhitdinov B.I., Amonova D.M., Khalilova G.A., Kyrgizbaev Kh.Kh., Turaev A. S. Isolation and study on physical-chemical properties of galactomannanes from the plant raw materials. Chemistry of plant raw materials (Barnaul, Russian Federation), 2019, 35-41 DOI: https://doi.org/10.14258/jcprm.2019024491.
52. Bahtiyor Muhitdinov, Thomas Heinze, AbbaskhanTuraev, Andreas Koschella, Nodirali Normakhamatov. Homogenous synthesis of sodium cellulose sulfates with regulable low and high degree of substitutions with SO_3/Py in N,N-dimethylacetamide/LiCl // European Polymer Journal (Elsevier). 2019, Vol. 119, pp. 181-188.
DOI: https://doi.org/10.1016/j.eurpolymj.2019.07.030.