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Short Communication

Development of Biologically Active Polymers

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Biologically active polymers are high molecular weight compounds with the ability to influence physiological processes. The physiological response can manifest itself in a change in the general state of the body or its individual biological systems (cells, tissues, fluids, organs). This can be the result of the effect of a polymeric substance directly on specific receptors, on membranes or organelles of cells, water-salt or hydrophilic-lipophilic balance of fluids (blood, lymph), microbial flora present in a healthy or infected organism, etc. The biological activity of high molecular weight compounds began to be actively studied from the end of the 50s. 20th century the terms physiological activity and pharmacological activity are sometimes used as synonyms for physiological activity [1,2].

Biologically active polymers can be classified by source of production and by functional (physiological) activity. Natural biologically active polymers (biopolymers) include proteins, nucleic acids, polysaccharides, lipoproteins and other high molecular weight products of animal and plant organisms [3].

According to their functional activity, that is, according to properties that allow the use of polymers in medicine, veterinary medicine and biology, physiologically active polymers should be divided into:

- Blood substitutes and plasma substitutes,
- Medicinal (pharmacologically active),
- Auxiliary polymers.

This division is arbitrary, since due to the variety of properties, some of the BAPs can be attributed not to one, but to several groups. In some cases, belonging to a particular group is determined by the molecular weight of the polymer, its state of aggregation, the concentration of the solution, or even the method of its application (externally, injection, etc.).

In the manifestation of physiological activity, an essential role is played by the ability of polymeric substances for complementary conformational transformations and cooperative binding, for sorption, donor-acceptor, Van-der-Waals and hydrophobic interactions with natural macromolecules involved in the maintenance of the body's vital activity. These features provide quantitatively and sometimes qualitatively new (in comparison with low molecular weight substances) methods of binding of polymers to biological objects (membranes and cell components, bio receptors, etc.).

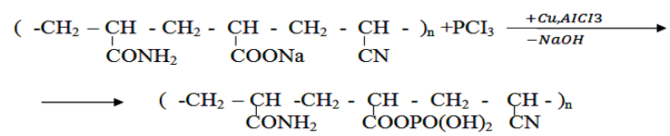
In this aspect, one of the urgent problems of modern chemistry of macromolecular compounds is the study of the foundations of the synthesis of polyfunctional polymers with biologically active and complexing properties. Fibrous materials based on anion-exchange and complexing compounds have a high specific surface area, which provides a high possibility of sorption of toxic impurities. They are especially effective in removing toxic substances even at very low levels from polluted air, water and living organisms.

At the same time, the acrylic fiber "GIPAN" produced by OJSC "Navoiazot" (Uzbekistan) is of particular interest. The Academy of Sciences of the Republic of Uzbekistan conducted research on the development of fibrous ion-exchange materials based on acrylic fiber "GIPAN", but they were never brought to their logical conclusion. In addition, these studies neglected the study of the physiological aspects of the preparation of these materials. When developing the foundations for the preparation of ion-exchange materials, much attention was paid to the study of the physical and chemical aspects of the synthesis and properties of these high-molecular compounds. These studies due to the fact that they allow you to adjust the processes of synthesis and, therefore, necessary to obtain polymers with required composition and with complex specific properties.

As noted above, to date, no attention has been paid to the study of the physiological bases of anionits and polycomplexones due to the applied research carried out to date in this area of research. In this regard, the study of the physiological foundations of creation, the properties of anionites and biologically active polymers based on acrylic fiber "GIPAN" is relevant both from a theoretical and practical point of view. These technologies mainly use granular sorbents, while fibrous sorbents make up only 2-3% of the ion-exchange materials used. Using technology employing ion exchange material from algae and natural brine deposits of oil and gas recovered to 90% of iodine and bromine. Iodine-containing sorbents are used for disinfection of drinking water from microorganisms and extraction of mercury from wastewater and gas emissions. They can be used for concentrating the processing solutions and biologically active substances in the preparation of catalyst systems nanoparticles metals. It should also be noted that Uzbekistan hitherto not been established as industrial manufacture granular and fibrous sorbents, although such polymers are widely used in industry.

To eliminate the above-mentioned gaps, we carried out research on the creation of phosphorus-containing ion exchangers of the "GIPAN" fiber. Therefore, in the future, for the modification reaction, activated "GIPAN" was used, which was obtained by partial treatment with phosphorus trichloride.

In this case, the fiber modified by GIPAN had an ion-exchange capacity of up to 1 mg-eq/g according to HCI. Further reaction was carried out within 5 hours at a temperature of 373K. the modified polymer with 1.1 –PCI3 under these conditions had an HCl COE of 3.2 mg-eq/g, and this COE value corresponds to approximately 36% conversion of CN-groups to phosphate. Potentiometric titration curves of products phosphorylation, two jumps are observed from pKα acidity 5.3 and 3.3. In the IR-spectra of samples modified with the Friedel-Crafts reaction, a decrease in the intensity of the absorption band at 2240 cm^{-1} corresponding to stretching vibrations of the nitrile group is observed, new absorption bands appear in the region of 3200-3500 cm^{-1} and 1580 cm^{-1}, which are related to stretching and bending vibrations of >PO groups, an absorption band with a frequency of 1640cm^{-1} is observed, belonging to the



stretching vibrations of the C = N groups. Based on the results of the physicochemical analysis of the product, the scheme of the HIPAN phosphorylation reaction can be represented as follows:

For bactericidal materials, having a high hydrophility and the combined action proved promising modification iodide anion complex of fibrous materials based on fibers "GIPAN» natural polymer chitosan (HZ). The iodine content in the samples ranged from 5% to 20%. Processing chitosan significantly enhances the sorption properties of samples (at 55% relative humidity sorption is 1.50% compared to 0.55% for the sorption capacity of acrylic fibers without treatment solution HZ).

When this water absorbing capacity of impregnated samples HZ increases almost 3 times, which is very important when they are used as dressings in the treatment of necrotic diseases. Based on these studies compiled laboratory regulations and technical specifications to produce bactericidal halogenated materials and in laboratory regulations drawn up by the combined iodine containing dressings having chitosan. With a view to recommending sorbents AGR-1 and AGR-5 for sewage treatment of chromium ions was studied by dynamic sorption of chromium ions from artificial and waste processing solutions. In this dynamic exchange capacity (DEC) for the SMA-1 sorbent by dichromate ions reached 390mg/g of artificial solutions at pH 4.2 and 213mg/g sorbent for SMA-5 from spent process solutions at pH 4.5. Studies show that sorbents SMA-1 and SMA-5 on its sorption properties exceeds the known ion exchangers. For example, anion exchange resins Amberlite IRA96 and Dowex 18 have DOE-100 and 117mg/g, respectively, and extract reaches 93% at pH=3, whereas the SMA-1 extracts the ion chromium (VI) solutions of almost 100%. These results allowed us to develop laboratory regulations and technological scheme of wastewater from chromium ions (VI). Studies have shown that the ions DEC sorbents $[Cu\ (NH_3)_4]^{2+}$ at pH-12 reached 375mg/g (hydrolyzed SMA-1) and 113mg/g (SMA-1+MA). For SMA-1 hydrolyzed sorbent adsorption of copper is observed even in acidic environments (pH-4.2 at DOE power 53mg/g) with no ionization of the carboxyl groups.

Therefore, in these conditions the sorption of copper occurs primarily by complexing with amines sorbent SMA-1. To identify the possibility of creating dressings for sterilizing wounds, the bactericidal properties of the combined dressings were tested. Biomedical research was carried out at the Department of "Microbiology and Epidemiology" at the Tashkent Medical Academy, under the guidance of prof. Z. Nuruzova. Material for microbiological studies served exudate taken from the wounds of experimental animals. In analyzing the dynamics of morphological studies showed a significant improvement in wound healing process of skin wounds developed under the influence of combined dressings. Studies in human volunteers have shown that the combined antibacterial dressings based on GIPAN has a pronounced anti -inflammatory and antibacterial effect, has an absorbent action during the second stage of wound healing process and are effective for the treatment of necrotic soft tissue diseases. Thus, we have developed combined phosphorus-and iodine-containing anion-exchange materials based on the GIPAN fiber. The introduction of chitosan into the composition of iodine-containing materials leads to an increase in their water-absorbing capacity. Combined bactericidal dressings have a pronounced anti-inflammatory and antibacterial effect, are effective for the treatment of purulent-necrotic soft tissue diseases.

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