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Physiological and morphological changes of internal organs in rats of their poisoning by lead on the background of use the nanoenterosorbent "Ingo-2"

In this research work the first time conducted research on the effect of lead on the animal organism. It was shown that lead adversely affects the quality and quantity of blood and organs of animals, and also found that a high-performance carbon "Ingo-2" nanostructured nanoenterosorbent has good corrective properties, restores homeostasis and contributes to the compensatory-adaptive reactions. The paper was also investigated effects of lead on the morphology of the internal organs of the animal organism. When comparing the actions identified reversible pathological changes observed and lead to signs of hydropic, and then the protein dystrophy plethora of vessels, the appearance of certain inflammatory infiltrates. However, these changes are reversible, are compensatory-adaptive nature and disappear after a single exposure nanoenterosorbent "Ingo-2." A study that nanoenterosorbent "Ingo-2" has a strong universal sorption properties. In the lumen of the gastrointestinal tract it can bind and excrete coming from outside and formed inside the toxic substances of different nature, including lead. The studies we were first identified particular mechanisms of action nanoenterosorbenta "Ingo-2" on the morphological and physiological performance of internal organs in animals. Based on the data obtained proved that nanoenterosorbent "Ingo-2" with a single fed to rats causes the tissues in the esophagus, stomach, heart, kidneys and liver minor changes morphophysiological compensatory and adaptive nature, which are short and completely reversible.

Key words: chemical pollutants, enterosorption, ecological crisis, hematology, human ecology, heavy metals, industrial waste, lead, morphology, neinteresant "Ingo-2".

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«Инго-2» наноэнтеросорбент аясында қорғасынмен уланды-руда егеуқұйрықтардың ішкі мүшелерінің физиологиялық және морфологиялық өзгерістері

Бұл ғылыми жұмыста қорғасынның жануарлар ағзасына әсері зерттелген. Қорғасынның жануар ағзасында қан сандық және сапалық көрсеткіштеріне кері әсері байқалған, сонымен қатар жоғары әсерлі көміртекті наноқұрылымды «Инго-2» наноэнтеросорбенті жақсы түзетушілік қасиетке ие екендігі және ағзаның гомеостазын қалпына келтіріп, компенсациялық бейімділік реакциясын жоғарлатуға қабілетті екендігі бекітілді. Ғылыми еңбекте, сонымен қатар қорғасынның ішкі мүшелердің морфологиялық көрсеткіштеріне әсері де зерттелді. Тәжірибелік топ жануарларында қайтымды патоморфологиялық өзгерістер: гидропиялық белгілерінің пайда болуымен, белокты дистрофиямен, тамырлардың қанға толуымен және жекелеген қабыну инфильтраттарымен байқалды. Бірақ бұлар компенсациялық бейімділік сипаттағы қайтымды процестертер және бір реттік «Инго-2» наноэнтеросорбентін қабылданғаннан кейін жоғалулары байқалды. «Инго-2» наноэнтеросорбент айрықша әмбебапты сорбциялық қасиеттке ие екендігі зерттелді. Асқазанішек жолдарында «Инго-2» наноэнтеросорбент сырттан түскен әртүрлі тектегі токсикалық заттармен, әсіресе қорғасынмен байланысып және оны ағзадан сыртқа шығарады. Жүргізілген зерттеулеріміздің нәтижесінде «Инго-2» наноэнтеросорбентт жануарлардың ішкі мүшелерінің морфологиялық және физиологиялық көрсеткіштеріне әсер ету механизмінің ерекшеліктері алғаш рет анықталды. Зерттеуден алынған нәтижелердің негізінде, егеуқұйрықтарға «Инго-2» наноэнтеросорбентпен бір реттік пероральді енгізуден кейін ұзаққа созылмайтын және толық қайтымды түрдегі өңештің, асқазанның, жүректің, бүйректің және бауырдың компенсациялық бейімділік сипаттағы морфологиялық өзгерісітерді тудыратындығы дәлелденді.

Түйін сөздер: адам экологиясы, гематология, «Инго-2» наноэнтеросорбенті, қорғасын, морфология, химиялық улағыштар, энтеросорбция, экологиялық дағдарыс.

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PHYSIOLOGICAL AND MORPHOLOGICAL CHANGES OF INTERNAL ORGANS IN RATS OF THEIR POISONING BY LEAD ON THE BACKGROUND OF USE THE NANOENTEROSORBENT "INGO-2"

Introduction

In recent years, the environment is polluted various toxic substances, as a result worsening environmental situation, accumulation of toxic substances in the soil, water and plants. One of the most common pollutants of the biosphere are heavy metals, a large amount of them entering the food chain dangerous for human and animal health. Among heavy metalls pollutants prevail elements with high eco-toxicity, which applies primarily lead [1,2]. Recently pollution of foodstuff by several representatives of heavy metals meet more often. At the same time toxic effect of metals at receipt them in an organism of animals and the person is insufficiently studied, effectiveness of enterosorbents at the mixed toxicoses is not defined. Therefore there is a need of more deep studying of questions of effect of heavy metals and research of efficient enterosorbents at simultaneous impact on animals of several toksikantov [3, 4, 5]. Today actively the certain area of medicine – an enterosorbtion develops, and interest in it grows, the environmental environment is strongly polluted, delivery products we often consume a stale and artificial – harmful and unnecessary substances comes to our organism enough. Generally the enterosorbtion is used in those cases when in an organism the excess quantity of the metabolites which are characterized by toxic impact on bodies and systems [6, 7] collects. However some enterosorbents possess also the cytoprotective action thanks to ability to protect a surface of a mucosa of internal bodies, from aggressive mechanical and chemical influences, an also from influence of a pathogenic microflora. Sorbents are enough much, they rapid are also applied not only in a case of toxic poisoning. Considering importance of enterosorbents us it was synthesized high performance carbon nanostrukturirovanny nanoenterosorbent "Ingo-2", under the leadership of the academician Z. A. Mansurova in RGP on a PVC "Institute of problems of combustion" (Almaty, Kazakhstan) on a basis of vegetable raw materials which has the expressed universal getter property, good correctional properties restores the homeostasis of an organism also promotes increase in compensatory-adaptive reactions, removal toxic and toxicants, absorbs these harmful substances in itself when are in a stomach or intestines, then having

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Физиологические и морфологические изменения внутренних органов у крыс при отравлении их свинцом на фоне использования наноэнтеросорбента «Инго-2»

В данной научной работе впервые проведены исследования о влиянии свинца на организм животных. Показано, что свинец отрицательно влияет на количественные и качественные показатели крови и органы животных, а также установлено, что высокоэффективный углеродный наноструктурированный наноэнтеросорбент «Инго-2» обладает хорошими коррекционными свойствами, востанавливает гомеостаз организма и способствует повышению компенсаторно-приспособительных реакций. В работе также было исследовано действие свинца на морфологию внутренних органов организма животных. При сравнении действия обнаружены обратимые патоморфологические изменения, наблюдающиеся и выражающиеся в появлении признаков гидропической, а затем белковой дистрофии, полнокровия сосудов, появлении отдельных воспалительных инфильтратов. Однако эти изменения обратимы, носят компенсаторно-приспособительный характер и исчезают после однократного воздействия наноэнтеросорбент «Инго-2». Изучено, что наноэнтеросорбент «Инго-2» обладает выраженным универсальным сорбционным свойством. В просвете желудочно-кишечного тракта он может связывать и выводить из организма поступающие извне и образующиеся внутри токсические вещества различной природы, в том числе свинец. В результате проведенных исследований нами были впервые выявлены особенности механизмов действия наноэнтеросорбента «Инго-2» на морфологические и физиологичекие показатели внутренних органов у животных. На основании полученных данных доказано, что наноэнтеросорбент «Инго-2» при однократном скармливании его крысам вызывает в тканях пищевода, желудка, сердца, почки и печени незначительные морфологические изменения компенсаторно-приспособительного характера, которые непродолжительны и полностью обратимы.

Ключевые слова: гематология, морфология, наноэнтеросорбент «Инго-2», промышленные отходы, химические загрязнители, свинец, тяжелые металлы, энтеросорбция, экологически кризис, экология человека.

neutralized poisons, is brought out of an organism in the reference way.

Objective: study of the mechanisms of action of neinteresanta "Ingo-2" at the hematologic, biochemical and morphological indicators of animal organism on the background of lead poisoning.

Materials and methods of a research

30 white not purebred laboratory rats of a trimensual age weighing 200-220 grams were an object of a research. Animals contained in the vivarnykh conditions. Experiments were made according to the planned schedule in laboratory of ecological physiology and a hronobiologiya at scientific research institute of problems of biology and biotechnology of Al-Farabi Kazakh National University. The animals selected for experience met all requirements imposed to statement of an experiment (Good Laboratory of nursery). Rats were divided into 3 groups in the 2 and 3 group on 12 animals, and in control 6 pieces. 1 group – intact group No. 1(6 of rats); The 2nd group – experienced group No. 2 – lead poisoning in a dose of 25 mg/kg (12 rats); The 3rd group – experienced group No. 4 – poisoning within 30 days with lead in a dose of 25 mg/kg + a nanoenterosorbent of "Ingo-2" in a dose of 1 g/kg. (12 rats);

During the experiment conditions of chronic lead poisoning were created. Entered a diet of experienced white rats lead. Control group of animals received the same forages, in the same quantities and proportions, but without addition of heavy metals. During the experiment in a diet of experimental groups of animals systematically daily within 30 days it was leaded. At the first stage of an experiment 2 groups received daily lead in a dose of 25 mg/kg, within 30 days; At the second stage of an experiment animal 3 groups received daily 30 days lead in a dose of 25 mg/kg + a nanoenterosorbent of "Ingo-2". Animals contained in conditions vivariums, the free access to food, water and were one age. The experimental works on this technique 30 days lasted. Experiments were made according to the reference practical standards. Upon completion of experiences all survivors animals were hammered and subjected to a hematological and morphological research on the accepted techniques. For definition of hematological indexes of blood (amount of hemoglobin, erythrocytes, thrombocytes and leukocytes, a so an ESR and speed blood folding) the automatic hematological Abacus Junior Vet analyzer, productions DIATRON (Austria) was used. Histologic processing of material were carried out by a traditional method of microscopic technology of preparation of thin cuts (Volkova, Yelets, 1982). For the morphological analysis the decapitation of animals was made in strictly particular fixed time between 9-10 o'clock in the morning. As an object of a research served the main populations of cells of a myocardium, kidneys, a liver, a stomach of rats. Capture and fixing of material of bodies of control and experimental animals with after-treatment is made for the comparative histologic and morphological analysis.

Results of researches

Of hematological and biochemical indexes of blood of white laboratory rats at poisoning with lead and at correction nanoenterosorbenta "Ingo-2" by 30 days of change of blood were characterized by decrease of maintenance of erythrocytes and a hemoglobin by 25 and 17,6% respectively. The maintenance of lymphocytes by 30th day was 15% less than initial values. Kolichestvosegmentoyadernykh neutrophils had a tendency to increase and by 30 days it was 24,7% higher posravneniyu with background indexes. Soderzhaniyeobshchego protein on an extent vsegoopytasushchestvenno did not change. Content of calcium by 30 days decreased by 16,3%. Researches of blood of white rats, otravlennykhsolyami lead and receiving nanoentersorbent "Ingo-2" testify o less expressed changes of hematological and biochemical indexes, than at control groups of animals is (figure 1).

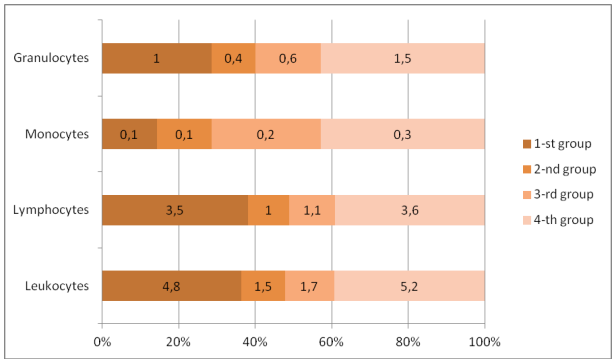

Figure 1 – A leukocytic formula of peripheral blood at poisoning heavy metals and correction nanoenterosorbentom "Ingo-2"

So, the maintenance of erythrocytes went down on an experience extent for 12,5%, a hemoglobin – for 8%. In structure of a leukocytic formula of change of quantity of lymphocytes, neutrophils, an also of eosinocytes and monocytes were unessential (table 1, the figure 2).

Table 1 – Changes in a leukocytic formula of peripheral blood at poisoning with lead and cadmium and after its correction nanoenterosorbentom "Ingo-2"

Index	Group of animals		
	the first group control group – 12 rats	the second group (otravleniyesvintsom) – 12 rats	the third group poisoning with lead + nanoenterosorbent «Ingo 2») – 12 rats
Leukocytes, 10^9/л	4,8±0,02	1,5±0,01***	5,0±0,01**
Lymphocytes, 10^9/л	3,5±0,04	1,0±0,01***	3,4±0,03**
Monocytes,10^9/л	0,1±0,01	0,1±0,01**	0,1±0,03*
Granulocytes, 10^9/л	1,0±0,03	0,4±0,01**	1,3±0,05*
Note: * – P< 0,05; ** – P< 0,01; *** – P< 0,001 – reliability of distinctions between control and experienced groups			

In the content of the common protein and proteinaceous fractions statistically reliable changes undetected. The amount of calcium decreased by 30 days by 16,5%. Keeping of sulfhydryl groups to this term decreased by 15,8% in comparison with background values. When feeding rats decrease in phagocytic activity of neutrophils on 16 happened lead sterns for the 30th days; 27 and 38%, a phagocytic index – for 13, 16 and 42%; phagocytic number – for 27, 40 and 64%, phagocytic capacity – for 8, 20, and 48% respectively. Activity of a lysozyme on an extent of experience went down for 13,9 – 36%. The number of T – lymphocytes decreased for the 30th days by 18,3 and 24,7%; B – lymphocytes – for 17 and 28% respectively. B – lymphocytes remained in limits of background sizes. At poisoning of rats with lead and application nonoenterosorbenta «Ingo-2» indexes of a phagocytosis significantly did not change, activity for the 30th days approached tentative values. The maintenance of T – and B – lymphocytes fluctuated in limits of background sizes. The experimental data showed that stay of rats at poisoning with lead led also to the considerable changes of a leukocytic picture of peripheral blood. After poisoning of rats it was observed statistically reliable (P<0,001) decrease in the common quantity of leukocytes to (1,5±0,01) 10^9/l., in comparison with control group – (4,8±0,02) 10^9/l. It is impossible to exclude emergence of a leukocytosis in our experiments and at the expense of mobilization of cages from mural pool in circulatory. After deintoxication the quantity of leukocytes increased to 5,2±0,02, the leukocytic formula was considerably restored.

In the course of researches it was established what at the rats receiving compounds of lead amount of the common protein in serum of blood decreases posravneniyu with monitoring by 1,3 times and makes 53,4 ± 0,5 g/l (P<0,001). The quantity of albumins in serum of blood of this group also decreases at intake of lead – by 1,2 times, the level of globulins in too time increases, at receipt in a lead organism – by 1,4 times.

For the account of increase in quantity of a globulin and decrease of an albumin in serum of blood also A/G coefficient decreases. If in control group it made 1,70, then in 2-oy group it is equal 1,02 and in 3-oy to group – 1,04.

The researches on definition of indexes of anazotic organic components conducted by us showed that in serum of blood of the rats receiving compound of lead, the level of a cholesterin increased by 1,1 times and made 12,20 ± 0,33 μmol/l (P<0,01).. Violation of normal functioning of ferment processes is the reason or a consequence of various pathological states. In the course of researches activity of the following enzymes was defined: aspartic aminotransferase (ACAT), alaninic aminotransferase (ALAT) and alkaline phosphatase. At receipt in an organism kryssoyedineny lead there is an increase in indexes of enzymes of serum of blood: alkaline phosphatase by 2,86 times, ACAT – by 1,56 times, the ALAT – by 1,98 times also makes 3,09 ± 0,04 mmol/l, 1,76 ± 0,09 mmol/l, 1,09 ± 0,08 mmol/l according to (P<0,001). Thus the coefficient de– Ritis also decreased and equaled 1,61.

Therefore, at receipt in an organism of rats of compounds of lead protein level in serum of blood decreases by 1,3 time, an albumin – by 1,2 times, a quantity of a globulin increases in 1,4 respectively. After deintoxication all indexes of blood it was considerably restored.

Histologic structure of internals showed that the most expressed morphological changes at impact of lead on an organism of animals happen in bodies for the 30th days of experience. At rats, the receiving CdCl2 in a dose of 25 mg/kg within

30 days revealed pathomorphologic changes which were expressed in inhomogeneity of structure of a liver. In a parenchyma of a liver the centers with the expressed granular dystrophy are revealed. Processes of a dystrophic obesity and places sites of a necrosis which are most expressed in segments with the broken girder structure are observed, swelled (figure 2). In structure of kidneys granular dystrophy of a proximal and distal crimp canaliculus, the collective tubules is revealed. The focal necrosis of an epithelium of a canaliculus is strongly expressed. The change of interstitial fabric, the numerous centers scattered among normal fabric is revealed. The expressed interstitial swelled. An epithelium of a canaliculus indistinct washed away, the core is kept. Balls with a legible endothelium of vessels. Basal membranes are legiblly expressed, contours are well reflected. Epitheliocytes of the capsule have the flattened form. Balls of a routine structure, capsule thin (figure 2).

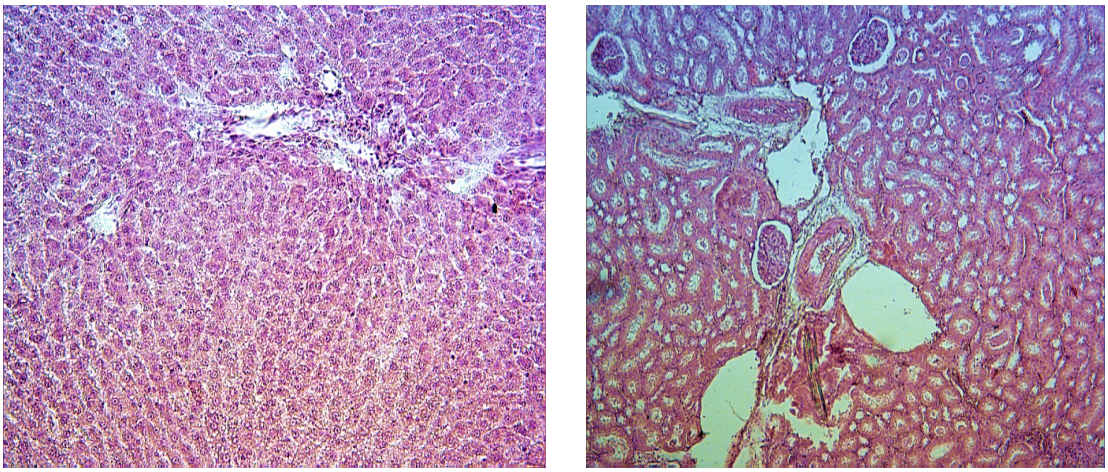

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Figure 2. A) Liver hypostasis; B) interstitial hypostasis in kidneys
Coloring a hematoxylin – eosine. Increase x 200. Semi-thin section.

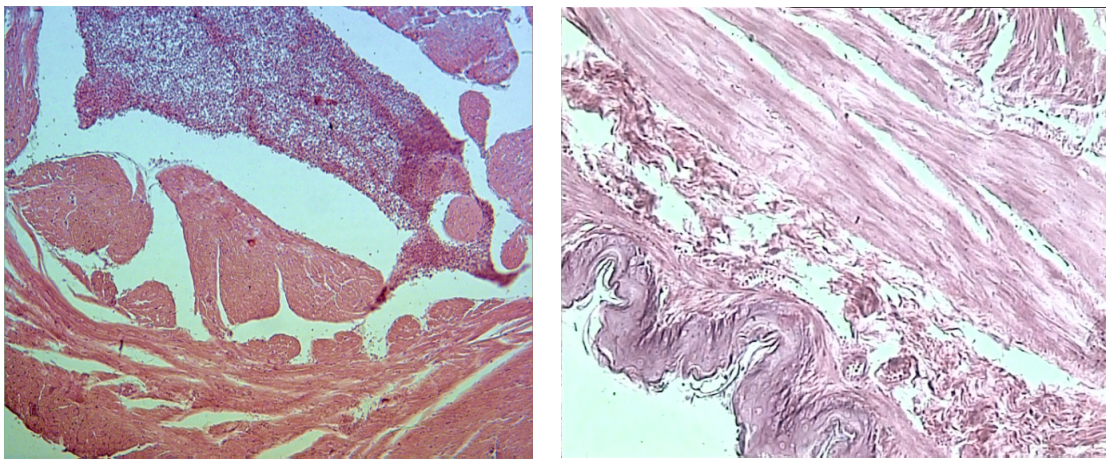

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Figure 3. A) It is noted expressed intermuscular swelled a myocardium;
B) Puffiness of a mucosa of a gullet. Coloring a hematoxylin – eosine.
Increase x 210. Semi-thin section.

In a myocardium existence of hemorrhages, a hyperemia of vessels, moderate focal granular dystrophy is noted, the structure of a structure of body is not kept, it is noted expressed intermuscular swelled. Walls of vessels are thickened, an endothelium the turgent, the partial convergence

in places is visible. In certain sites muscle fibers are fragmented. Around them a congestion of the spherical and extended cages in the form of the centers (figure 3).

In a gullet mucosa at animals showed the strong puffiness. In an epithelium the exfoliating of a horn layer, in the form of continuous layer began. The horn layer remained only in certain places, but it was visible that process of a casting-off accrues (figure 3).

When studying a mucosa of a stomach it was revealed that in certain places a part is hyperemic, turgent, in a condition of a catarrh with existence of dot hemorrhages and the necrotic phenomena, a thickening of cages of the surface epithelium, in characteristic plate of a mucosa was defined by places a leukocytic infiltration (figure 4).

Thus, daily poisoning within 30 days of animals with lead in a dose of 25 mg/kg of a forage led to accumulation of metal in an organism, at the same time its largest content was noted in a liver. By 30 days of researches the content of lead in a liver exceeded background indicators in 4,5; 6,5.

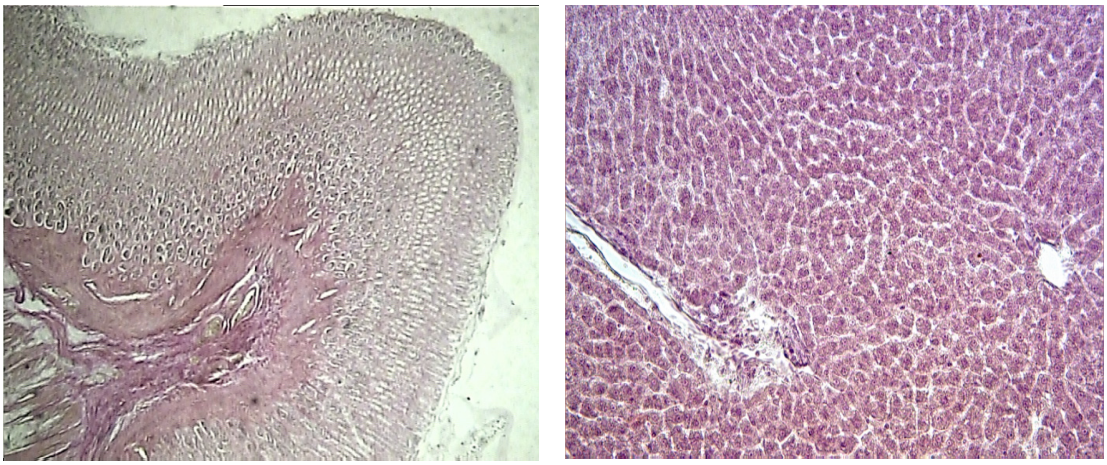

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Figure 4. A) Thickening of cages of the surface epithelium of a stomach;
B) Hepatocytes slightly turgent with rather turbid cytoplasm.
Coloring a hematoxylin – eosine. Increase x 210. Semi-thin section.

Morphological studying at poisoning of rats with lead + a nanoenterosorbent of "Ingo-2", showed manifestation of histologic change of intoxication, the events in later terms. Changes of morphological indexes at animals were less essential and to the end of a research, they approached background values. It is revealed that in a liver hepatocytes in a condition of moderate focal granular dystrophy, the girder structure of segments of a liver is kept, venous sine are slightly expanded, hepatocytes slightly turgent with rather turbid cytoplasm, cores are kept, their contours are maleficiated. In separate segments groups of cages in which cytoplasm shallow fatty drops of various size (figure 4) come to light are found.

The morphological research at the rats poisoned with their lead and receiving a nanoenterosorbent of «Ingo-2» in kidneys and heart showed that the histologic structure was without special changes. In the macroscopic analysis of a kidney it is visible that cortical substance is formed generally of renal little bodies and a crimp canaliculus and looks on medicine more dark.

The brain substance disposed closer to the center of body is painted is lighter. Stroma hypostasis, small parenchymatous proteinaceous dystrophy of an epithelium of a canaliculus was observed. On heart medicines transversal ischerchenny fibers of a layer of the friable connecting fabric containing a large number of vessels legiblly came to light. Fibers of a myocardium are focused in various directions longitudinal, circular and slanting (figures 5).

In a stomach slight puffiness of a mucosa and violation of a wholeness of an epithelium which in some sites under the influence of use of a naoenterosorbent of «Ingo-2» came to an end with the complete recovery was observed. Minor changes in a histological structure of bodies of rats are completely reversible and have compensatory and adaptive character (figure 6).

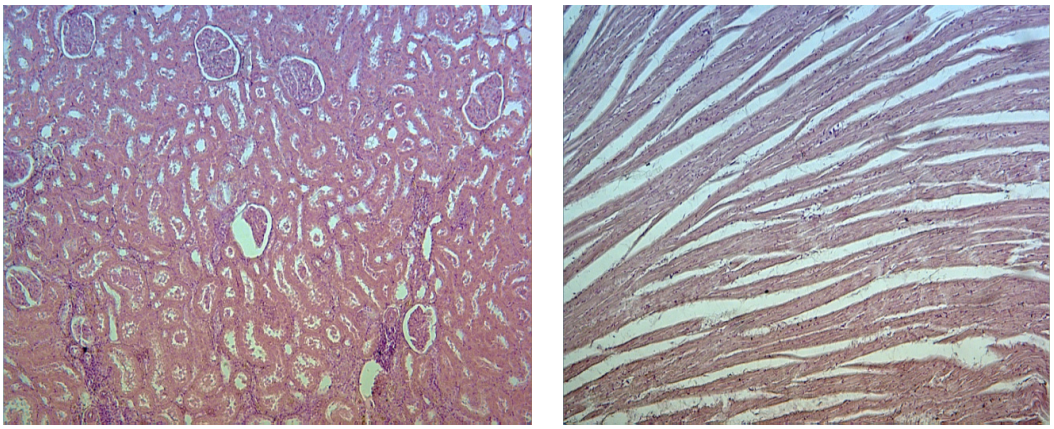

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Figure 5. A) Stroma hypostasis, parenchymatous proteinaceous dystrophy of an epithelium of a canaliculus; B) Transversal ischerchenny fibers of a layer of friable connecting fabric. Coloring a hematoxylin – eosine. Increase x 400. Semi-thin section.

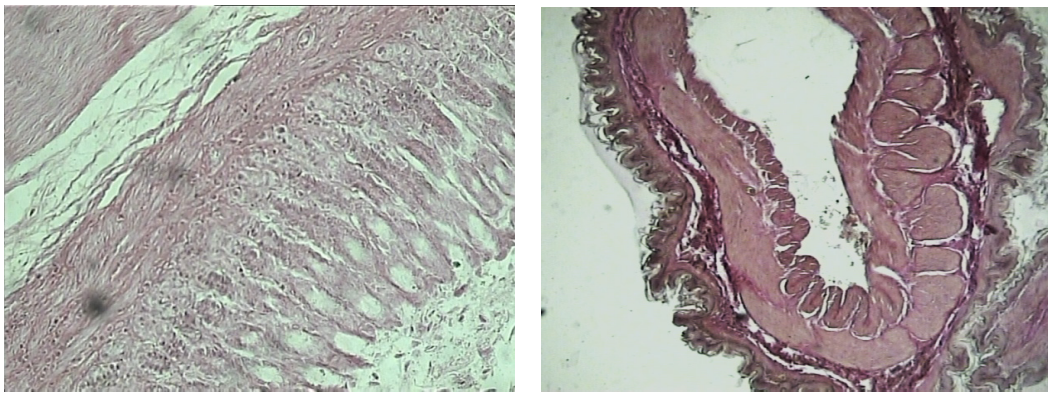

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Figure 6. A) Puffiness of a mucosa, violation of a wholeness of an epithelium; B) Esophageal glands with proteinaceous mucous glands of a typical structure. Coloring a hematoxylin – eosine. Increase x 210. Semi-thin section.

The mucosa of an epithelium of a gullet of rats is less subject, irreversible destructive changes were not noted, esophageal glands are presented by proteinaceous and mucous glands of a typical structure. The structures reminding intestinal cryptás with a set of enterocytes, various on structure, including endocrine cages (figure 6).

Therefore, as a result of a research it was found out that at influence of heavy metals the content of lead in bodies high what is caused probably by potentsirovanny effect of this metal. Poisoning of animals with lead showed in an organism of animals of the phenomenon of fatty dystrophy, a necrosis of hepatocytes, puffiness, violation of a wholeness of cages, the strong destructive changes. Addition of a nanoenterosorbent of "Ingo-2" had significant effect on decrease in toxiferous elements in internals of animals, to cell regeneration, restoration of bodies to full functioning.

Conclusion

Today it is impossible to present any human activity, directly or indirectly not the bound to influence on live organisms of chemicals which quantity continues to grow. Among them there is a large number of toxiferous elements which influence leads to increase in diseases of people and animals [8, 9, 10]. Among these connections one of leading places is occupied by the heavy metals coming generally to a surrounding medium as a result of activity of the person. A wastage and by-products of productions, toxic chemicals, tail waters, slags, ashes and gases, a wastage of

transport, the enterprises of the heavy industry, mechanical engineering, instrument making, warm and power plants, contain a large amount of heavy metals among which the most toxiferous are lead and cadmium. Special attention to negative impact of lead and cadmium on the person is caused now by the fact that from the narrow section of professional pathology and medicine of work the question of lead poisoning and cadmium developed into global ecologically pathological problem [11]. At various pathologies change of maintenance of minerals in an organism takes place. Toxicity of "metal poisons" is explained by their linkng with the corresponding functional groups of proteinaceous and other vital connections in an organism. Normal functions of the corresponding cages and fabrics in an organism are as a result broken, and there comes poisoning which in a row a case in comes to an end with death. Chronic lead poisoning gradually leads to violations of functions of kidneys, nervous system, anemia. Toxicity of lead increases at a lack of an organism of calcium and iron.

Received by us nanoenterosorbent "Ingo-2" is an efficient enterosorbent of lead with the "weak" action for the regular and prolonged preventive use. Medicine renders the adsorbing and disintoxication action, plays an essential role in biological prophylaxis of pollution of the environment of dwelling of the person heavy metals.

In the course of this research it was studied influences of lead on indicators of an organism of animals. In work the complex analysis of hematological indexes of blood, morphological studying of bodies at shallow mammals at poisoning are carried out and after deintoxication. Experimental influence caused in an organism of animals of the second group noticeable deviations from norm, pathomorphologic changes in animals in bodies of a liver, kidneys, hearts, a stomach and a gullet. At poisoning of rats with lead there is more essential accumulation in bodies of animals of each of toxins, in communication with it concentration of lead was higher in a liver, lungs for 17%. The received experimental data of the third group demonstrate o the fact that at poisoning and after its correction nanoenterosorbentom "Ingo-2" to the current of month at rats is followed decrease of damage of internal bodies. In a gleam of a gastrointestinal path nanoenterosorbent "Ingo-2" connects and brings out of an organism endogenic and exogenetic toxic substances of various nature, in that number, microbes and microbial toxins, food allergens, medicinal medicines, poisons, alkaloids, salts of heavy metals, gases. Nanoenterosorbent "Ingo-2" it is capable to soak up from a GIT, to an absorption in a blood bed gases, alkaloids, other hypnotic drugs and narcotic tools, salts of heavy metals, nitrates and other chemical connections. On a passing measure for intestines the components connected by it are not exposed to a desorption and do not change pH of the environment [12, 13]. The results received in the course of a research demonstrate that the enterosorbent promoting with different effectiveness is found to occlude cations of lead.

Therefore, on the basis of the conducted researches it is shown that nanoenterosorbent "Ingo-2" has the expressed universal getter property. In a gleam of a gastrointestinal path it can connect and bring out of an organism the toxic substances of various nature entering from the outside and formed inside, including microorganisms and microbial toxins, antigens, food allergens, immune complexes, medicinal medicines and poisons, salts of heavy metals, radionuclides, alcohol [14]. Nanoenterosorbent "Ingo-2" except that, it can occlude also the excess of bilirubin, cholesterin and lipide complexes, metabolites of nitrogenous exchange, substances of "the average molecular weight" responsible for development of metabolic toxicosis. "Ingo-2" can have antioxidatic, blocking action of aggressive free radicals and adaptogennye properties, increasing the resilience of an organism to infections, adverse ecological factors, capable with high effectiveness to sorb and bring lead and cadmium out of an organism.

The conducted researches at rats allowed to make the following the preliminary conclusion feeding of rats lead leads to the strong destructive violations of bodies of lungs, hearts, kidneys, a stomach, a liver, an after its correction nanoenterosorbentom "Ingo-2" was observed decrease of dystrophic processes and increase in compensatory adaptive reactions.

In such way, on the basis of the conducted researches when performing works for 2016 it is possible to make the following conclusions:

1) The nanoenterosorbent of "Ingo-2" causes statistically reliable ($R<0,001$) increase of level of leukocytes, erythrocytes, a hemoglobin and hematocrit, and also total number of lymphocytes, eosinocytes and basophiles. Against the background of statistically reliable (R 0,001) decrease in level the polimorfnykhyadernykh of neutrophils, increase of lymphocytes is noted.

2) The experimental influence of lead caused in an organism of rats of the second group noticeable deviations from norm, in a type of anemia and the destructive changes of internal bodies of animals, an obesity of parenchymatous cells of

a liver, the structure of kidneys is characterized by necrobiotic changes in an epithelium of a renal canaliculus and granular regeneration of cardiomyocytes of heart.

3) Use of an enterosorbent of "Ingo-2" in ekperimente does not call 3 groups in the studied bodies of rats of special changes of the destructive character. Slight changes in histologic structure are completely reversible and carry compensatory adaptive character.

4) It is established that nanoenterosorbent "Ingo-2" has the expressed universal getter property, has antioxidatic properties, blocks action of aggressive free radicals and adaptogen properties, increases the resilience of an organism to infections, adverse ecological factors, plays an important correctional role.

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