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Influence of oil of the Tengiz field and enterosorbents on hematologic indicators of blood of small mammals

The article presents the results of studying the influence of crude oil and chelators on hematological indices of blood in experimental animals. Found that crude oil raises nonspecific reaction of the organism small mammals pollution, which is stressful for the animals. It is shown that the use of chelators as a cleaner body from the toxic effects of oil significantly reduces the negative effects of oil on the homeostasis of the organism.

Keywords: pollution, crude oil, chronic intoxication, chelators, rats, hematological parameters of blood.

Introduction

In recent years, extensive pollution by harmful substances of different nature has led to a significant voltage ecosystem. The oil industry is now rightly belongs to the industries that are most responsible for the pollution of the environment. The imperfection of technology production, transportation and refining of oil leads to a systematic hit her in the environment [1].

For the purpose of early detection of abnormalities by the action of environmentally adverse factors, which include oil pollution, it is necessary to use an informative analysis methods. They allow you to quickly assess the activity of the protective functions of the organism, its back-up capability, the degree of response of different systems on the effect of extreme factors [2-6].

Now it is possible to consider established that the initial stage of extreme influences is accompanied by emergency mobilization of physiological mechanisms which doesn't depend by nature an irritant. It allowed to call such mechanisms nonspecific. The basis them is made by blood. The system of blood participates in integration of the organismal answer along with the central nervous system and humoral regulators. Blood interferes with violations power, structural, acid-base and other types of a homeostasis, provides resilience reactions to sudden shifts of a metabolism. Blood phagocytes together with fabric analogs clear an organism of toxic substances, of the damaged cages, their splinters and disintegration products. Marrow, erythrocytes and leukocytes gain value of organismal system of the homeostatic regulation defining ability of an organism to resist to impact of oil pollution and to be restored [7].

All called functions of blood at action of oil pollution on an organism of animals and the person are investigated very poorly. During the accidents connected with oil spill, there is no mass one-stage death of all flora and fauna around pollution, however, such technogenic catastrophes have very negative consequences in long-term prospect [3, 4]. From large-scale oil spills to count a loss rather difficult. It depends on several factors: like oil products, an ecological condition of the area in which there was a flood, weathers, a season, ocean and sea currents, a condition of fishery and tourism in the region and other reasons [4]. Investigating influence of oil pollution on mammals, it must be kept in mind that they have an impenetrable cover and breathe air therefore physiological effect of oil, its toxic components, is generally limited to their absorption when cleaning a wool cover, and also in the course of a food [5, 6].

Oil, getting to an organism of animals, can cause gastrointestinal bleedings, liver intoxication, kidney insufficiency and violations of a blood pressure. Besides, oil evaporations in a zone of big flood, or in close proximity to it as are pernicious for mammals

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[8-10]. For normalization of the broken exchange processes in an organism of the animals called by toxicant, very many various cure and methods (antagonists of heavy metals, adsorbents, premixes and feed additives) is offered. The effective remedy reducing negative consequences of action of ekotoksikant on an organism of animals, chelators are. Sorbtion practically has no contraindications, doesn't demand the special equipment, is applicable in any conditions.

In our researches along with absorbent carbon used a nanochelator "Ingo-2". This sorbent is received at institute of Problems of burning of the Kazakh national university named after al-Farabi, by carbonization and activation of vegetable raw materials (a rice peel).

This chelator possesses nanodimensional morphology and has specific properties [15-17].

Small mammals are model group of organisms in ecological researches as the important elements of ecosystems meeting demands, made to types to indicators (the high number, fast alternation of generations etc.). In this plan use of small mammals is of great importance in biotesting for experimental identification of responses of an organism [11-13].

The aim of our study is to determine the hematological parameters of blood at oil pollution and after detoxification.

Materials and methods.

Experiments are made on 84 laboratory rats of the line Wistar with an average weight of body of 150-200 g. Animals contained in conditions vivariums, with free to food, water and were one age.

Were formed four groups of rats: I-I group - control group (12 rats), II group - an experienced group of toxic poisoning (24 rats), III group - experimental group - toxic poisoning + adsorbent number 1 (24 rats) , IV group - experimental group - toxic poisoning + adsorbent number 2 (24 rats). To simulate the conditions which occur when the oil pollution in the second, third, fourth experiment animals groups received food and water with mild oil contamination.

In the experimental diet of white rats was part of Tengiz crude oil, the composition of which is shown in Table 1.

Table 1. Physico-chemical composition and properties of oil

№	Physico-chemical composition and properties of oil	Indicators
1.	Sulfur, %	0,65
2.	Resin, %	6,53
3.	Waxes, %	3,1-12,4
4.	Asphaltenes, %	0,1
5.	Methano-naphthenic hydrocarbons, %	75,82
6.	Aromatic hydrocarbons, %	17,55
7.	Pour oil, °C	6,0
8.	Temperature of paraffin melting, °C	55,0
9.	Oil density, g/cm^3 when 20°C	0,8529
10.	Molecular weight	246

The control group animals received the same feed, under the same amounts and proportions, but without added oil. In the experiment, the diet of the experimental groups of animals are systematically added daily crude oil.

Feed oil was stirred in a weight ratio of 1: 0.01 - oil concentration of about 1%. In drinking water to concentration of oil 0.001%. Thus, with the rats received a daily ration in a dosage crude - 5.85 g per day. Experimental animals, III, IV group received daily entorosorbenty with oil at a dose - 1g per kg. As enterosorbent activated carbon used for the experimental group III and nanoenterosorbent "Ingo-2" for the IV treatment group [14].

At the conclusion of experiments, all surviving animals were killed and subjected to detailed podnarkozom morpho-physiological, histological examination according to accepted procedures.

To determine the effect of oil on the morphological and physiological indicators organisms on blood parameters in laboratory animals used the following methods:

- The method of morphological indicators, which makes it possible to determine the relative body mass index (the ratio of body weight to the cube of its length);

- The method of the index major organs of rats. Indices of liver, kidney, heart, spleen, etc., which characterizes the state of the animals, depending on their habitat conditions [19-23];

- For the determination of hematological parameters of blood used Auto Hematology

Analyzer Abacus Junior Vet, production DIATRON (Austria). The experiments were performed using standard conventional techniques.

All data were expressed as mean ± SE and statistical analysis was made using the Statistical Package for Social Sciences (SPSS 11.0 software and Microsoft Excel 2010). For tests, analysis of differences between groups consisted on a one-way analysis of variance (ANOVA) with repeated measures, followed by post-hoc comparisons (LSD test). Differences were considered statistically significant at $p<0.05$ and marked as (*), highly significant at $p<0.01$ and marked as (**), and very highly significant at $p< 0.001$ and marked as (***) [18].

Results

The results of the study are shown in table 2. As a result of research the General was a decrease in the number of cells and a decrease in the concentration of hemoglobin in the peripheral blood of animals II experimental group.

Table 2. Influence of oil pollution of food and water on hematological parameters of blood (M ± m)

Indicators	Groups of animals			
	I (n=12)	II (n=24)	III (n=24)	IV (n=24)
Erythrocytes 10^{12}l	8,43±10,12	3,89±10,18*	7,65±10,19***	7,77±10,18**
The average concentration of hemoglobin in a mean corpuscular hemoglobin, g/mkg^3	0,33±0,005	0,19±0,005*	0,30±0,008**	0,31±0,004***
Retyculicytes, %	24,23±10,77	45,75±10,89*	22,07±11,01**	22,75±11,29***
Hematocryt, %	40,17±0,32	45,67±10,20**	37,88±10,41***	38,53±10,34*
Deposition rate erythrocytes, mm in hour	2,40±10,09	4,89±10,18*	1,93±10,06**	2,03±10,07***
The volume of erythrocytes mkm^3	48,03±0,74	125,57±15,17**	44,62±12,56*	45,75±12,42***
leukocytes, 10^9/l	4,42±0,11	6,14+0,22*	3,89±0,18***	3,97±0,13**
Eosinophiles, %	1,98±0,19	88,75±9,29**	1,88±0,83*	1,75±0,12***
Monocytes, , %	3,78±0,22	6,19±0,29**	2,65±0,11***	2,91±7,69*
Lymphocytes, %	73,32±0,72	78.35±1,73**	69,63±0,67*	70,9±11.80***

Note: n - the number of animals in the group; I - control group of animals II, III, IV - experimental groups of animals.

Reducing the number of red blood cells and hemoglobin concentration in the blood was due to hemolysis and was accompanied by a clear pattern of peripheral blood. The experiment studied and erythrocyte sedimentation rate (ESR). Significant increase in ESR II group from 2,4 ± 0,09 mm / h in the control to 4.89 + 0.18 mm / h was associated with the development erythropenia in peripheral blood. As a result of the activation of the germ of red blood in the blood washed out young red blood cells with a large diameter (macrocytes). The reason could be irritating toxic components of the oil on the bone marrow. We have checked the content of macrocytes increase in blood. The slowdown is due to the ESR erythropenia, characterized in comparison with the initial period of great content macrocytes

Quantity research reticulocytes in peripheral blood revealed existence reticulocytosis at all experimental animals. It indicated activation of a red sprout of marrow and formation of hypoxemic reaction of an organism. A certain role in activity increase erythropoietic could play and products of disintegration of erythrocytes as blood contained obvious traces of process of destruction of cages in experiences. Apparently from results, at all experimental rats the increase in volume of a single erythrocyte with increase of the average content of hemoglobin in one erythrocyte, a color indicator and decrease in average concentration of hemoglobin in an erythrocyte was observed. Experimental data showed that stay of rats on an oil diet led and to considerable changes of a picture of peripheral blood. At rats II groups on an oil diet statistically reliable increase in total of leukocytes to 6,14±0,22 109 l was observed. in comparison with control group (4,42±0,11 109 l.). And at animals

III, IV of group of quantity of leukocytes reached the following size 3,89±0,18 and 3,97±0,13. As a result research it is established that oil additives to food and water cause in white not purebred rats development of the hemolytic anemia, being accompanied poykilotsitoz, retikulotsitoz, increase of average volume of one erythrocyte, the average content of hemoglobin and a color indicator. Besides, oil pollution of food and water, along with number increase microcytes in peripheral blood, led to emergence of population macrocytes, on what the curve specifies the Price Jones at experimental animals. Oil pollution of food and water causes at early and late stages of experiment reorganization leukocytes, characteristic for a stress: neutrocytosis, to an eosinopenia and lymphopenia. Application of chelators sharply reduced negative effect of oil of the Tengiz field on hematologic indicators of blood of animals.

After giving a nanochelators physical and chemical and hematologic indicators of blood was restored by Ingo-2 better, than at absorbent carbon application though distinctions were insignificant.

The increase in lymph flow after giving chelator accelerates removal of oil from a microcirculation zone. Concentration of oil in blood and lymph nodes decreased to control sizes.

Chelators, adsorbing oil on the surface, reduce possibility of accumulation of oil in blood and organism fabrics.

Conclusion

During these researches influences of oil production on fauna and indicators of an organism of mammals were studied. In work the complex analysis of hematologic indicators of blood of small mammals was carried out at oil pollution and after desintoxication.

Thus, experimental influence caused in an organism of small mammals II groups noticeable deviations from norm. And blood indicators at III, were very close to IV of groups of animals with indicators of blood of control group of animals. It means that chelators as organism cleaners from toxicant positively influence blood indicators at chronic intoxications. Thus, application of chelators effectively reduces negative influence of oil on an organism homeostasis.

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