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EVALUATION OF TOXIOLOGICAL INDICATORS OF MONTHMORRILLONITE CLAY FOR THE PURPOSE OF USING THEM AS ALUMOSILICATE SOBENT AGAINST THE NEGATIVE EFFECT OF MYCOTOXINS ON THE BODY OF ANIMALS AND BIRDS

Abstract

The article presents the results of laboratory studies to assess the toxicological parameters of montmorillonite clay from the Pogadaevskoye deposit in the West Kazakhstan region in order to use them as an aluminosilicate sorbent in the composition of feeds that reduce the negative effects of mycotoxins on the body of animals and birds. The relevance of research is associated with the cultivation of healthy and highly productive animals and poultry in order to ensure the food security of the Republic of Kazakhstan.The studies carried out to assess the toxicological parameters of montmorillonite clay in order to use them as an aluminosilicate sorbent in experimental animals (rabbits and white rats) allowed the following results to be obtained: Visual study of the intensity of erythema when exposed to the test substance on the skin of rabbits showed their absence (0 points). The study of the intensity of edema (an increase in the thickness of the skin clutch of rabbits) when exposed to the test substance on the skin of rabbits showed no reaction (0 points). Studies evaluating the irritating effect of the test substances on the mucous membranes of the eyes of rabbits by symptoms of damage showed the absence of hyperemia (0 points). Weak eyelid edema (1 point), the minimum amount of discharge in the corner of the eye (1 point). The results of studies on the classification assessment of the test substance for the severity of the irritant effect on the eyes of rabbits showed that the average total score of the severity of the irritative effect corresponds to 1 point. A comprehensive analysis of the results obtained on the basis of scientific and experimental studies to assess the toxicological indicators of montmorillonite clay from the Pogadaevskoye deposit in relation to irritating effects on the skin and mucous membranes of experimental animals (rabbits) showed their harmlessness.

Keywords*: natural aluminosilicate sorbents, montmorillonite clay, sorption activity, toxicological characteristics, farm animals and birds, mycotoxins, food safety.*

Introduction. The relevance of raising healthy and highly productive animals and poultry is inextricably linked with food security and is of great global importance [1-5].One of the real threats to the health and productivity of animals and birds are the mycotoxins present in the feed.Mycotoxins are a group of chemicals that are produced by some molds (fungi), in particular many species of Aspergillus, Fusarium, Penicillium, Claviceps and Alternaria.The appearance of mycotoxins in finished feed can occur at different technological stages of feed production: in the field, during transportation, storage, or even after the final processing of the finished feed. In addition, toxic compound feed can be produced at a feed mill from quality raw materials.This is due to the fact that toxic products can accumulate in the processing equipment of production lines, since cleaning and sanitation of this equipment, as a rule, is rarely done. Thus, the content of toxins in the feed is always more or less present.To date, there are more than 140 identified mycotoxin types.Mycotoxins formed in feed are secondary metabolites of the vital activity of fungi and are rather stable substances that have teratogenic, mutagenic and carcinogenic effects that can disrupt protein, lipid and mineral metabolism and cause regression of the immune system.

Mycotoxicoses, depending on their nature, the concentration of mycotoxins in the diet, the type of animal, age, feeding conditions and the state of immunity, are manifested:

- a decrease in the productive parameters of animals and birds;
- a decrease in the efficiency of using feed for the production of products;
- violation of reproductive and reproductive functions;
- weakening of the body's immune system;
- increased susceptibility to diseases (coccidiosis, colibacillosis, etc.);
- an increase in material costs for treatment and preventive measures;
- lead to a weakening of the effect of vaccines and medicines;
- an increase in the frequency of infectious diseases.

The danger of mycotoxins, in addition to a decrease in productive qualities in animal husbandry and poultry farming, also lies in their transition in biotransformed or unchanged form into livestock and poultry products, which is a danger to human health. Therefore, it is necessary to take various veterinary and sanitary measures to prevent the diseases they cause. Today there are the following methods of dealing with the negative effect of mycotoxins on the animal body:

- physical (cleaning, soaking, washing, heating, dissolving, diluting);
- chemical (use of acids, alkalis, bisulfate, ammonia, formaldehyde, vitamin C,);
- biological (use of various enzymes);
- bonding with aluminosilicates (use of bentonites, zeolites, diatomites, activated carbon)

One of the most effective methods of reducing the negative effect of mycotoxins is the introduction of adsorbents into the diet. An effective adsorbent binds mycotoxins in the gastrointestinal tract of animals and birds into a durable complex that passes through the digestive system and is removed with feces, preventing or minimizing the effects of mycotoxins on the body of animals and birds.One of the strategic directions for achieving this global task is the prevention of diseases in animals and birds by creating non-carbon sorbents based on natural aluminosilicates. In this regard, the use of a number of agrominerals with a wide spectrum of biological action and availability has great prospects [6].

The main way in the prevention of many diseases is the use of natural and biosafety preparations and additives based on natural aluminosilicate minerals with sorption properties [7-9].

Natural minerals are capable of displacing pathogenic microflora from the intestinal tract, contribute to the normalization of digestion processes and the digestion of compound feed [10-12].

Therefore, the possibility of creating a favorable microbial background in the digestive tract with the help of natural minerals and rational feeding is an important point for improving the health of animals and poultry.

However, for the widespread use of various feed additives in the feeding of animals and poultry, detailed studies are required to assess toxicity to ensure safety and efficacy.

In addition, detailed studies of toxicological indicators is a prerequisite for the use of non-traditional natural sources of therapeutic and prophylactic action in the composition of animal and bird feed. The development of animal husbandry in European countries is also inextricably linked with the use of effective feed additives with an adsorbing effect. In the countries of the European Union (EU), feed additives with adsorbing action are classified as veterinary drugs subject to mandatory testing (Figure 1).

Figure - 1 Montmorillonite clay of the Pogodaevsky deposit, West Kazakhstan region in natural appearance and ground (powder)

In addition, it has been established that the montmorillonite clay of the Pogadaevskoye deposit has high plasticity, «fat content» to the touch, with an average density of 1450 kg / m^3, and is distinguished by good moisture capacity, high hydraulic and adsorption activity.

According to the results of X-ray phase analysis (XRF), it was found that the mineralogical composition of clay (Figure 2) is represented mainly by montmorillonite d / n = 5.06; 4.46; 3.79; 3.06; 2.455; 2.28; 2.127; 1,977; 1.817; 1,675 * 10-10m.

Figure 2 shows a model of the crystal structure of montmorillonite.

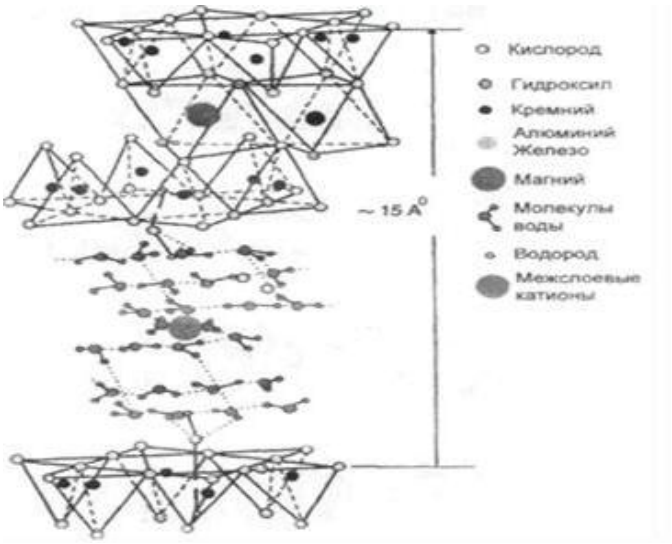

Figure - 2 Microscopic image of the montmorillonite mineral in the clay structure of the Pogodaevskoe deposit (magnification x 5000)

Results and discussion. At the initial stage, studies were carried out to assess the raw materials under study for local irritating and skin-resorptive properties, carried out on the organs of experimental animals.

The main task of the research at this stage was the study of the features of the epicutaneous effect of substances and the assessment of the degree of manifestation of their skin-irritating and skin-resorptive properties with single and repeated applications of experimental animals.

As a result of the experiments, it seems possible:

- to obtain data on the assessment of the real danger of acute and subacute manifestations of the effects of substances on the skin;

- upon detection of a real danger, substantiate the need for technological and special protective measures aimed at complete or maximum exclusion of contact with the skin of animals.

The study of local irritating and skin resorptive properties of substances was carried out by means of their single and repeated applications on the skin of the lateral surface of experimental animals. Rabbits were chosen as experimental animals. The number of selected animals in the group was 6 individuals. For the experiments, we selected rabbits with clean, healthy skin without mechanical damage.

Figure 4 - Preparation of experimental rabbits for testing

The area of application was 5% of the total surface of the skin of animals and in rabbits it corresponds to a size of 7 x 8 cm. To achieve the set task, one day before the experiment, the rabbits were carefully sheared off the wool on the side surface with an electric machine.To study the local effect, the wool was cut on symmetrical areas of the back on both sides of the spine, leaving a woolen cover between them 1-2 cm. The right side serves for the application of the studied substance, the left for control.

For the duration of the exposure, to exclude the licking of the substance from the skin and its entry through the respiratory organs, the animals were fixed in special individual houses.The test substance was applied to the skin of laboratory animals in its native form.The test substance was applied in an open way at an ambient temperature of 18-24 ^{0}C.When studying local action, the opposite skin area of the same animal served as a control. Studies assessing the local irritant properties of the test substance were carried out in single and repeated experiments. In repeated experiments, 20-fold applications were carried out 5 times a week. The test substance was evenly applied to the skin integuments of laboratory animals at a dose of 20 mg / cm^2. The period of observation of the clinical manifestations of intoxication and the condition of the skin, including instrumental studies, were carried out 1 and 16 hours after application and rinsing of the substance residues.

The calculation was carried out for each animal and then the average group indicator was calculated. Functional disorders of the skin were assessed by characteristic appearances of varying severity of erythema, edema, cracks, ulceration, changes in its temperature and a decrease in neutralizing ability.

The assessment in points of the functional state of the skin according to the severity of erythema and the magnitude of edema and the classification of the severity of the irritating properties of substances was carried out according to the data of special tables approved by scientific research (Tables 1-2).

Table 1 - Assessment of the degree of erythema

The intensity of erythema visually	Score in points
Lack of erythema	0
Weak (pink tone)	1
Moderately pronounced (pink-red tone)	2
Pronounced (red tone)	3
Strong (bright red tone)	4

Table 2 - Edema assessment of animal skin

The intensity of the edema (increase in the thickness of the skin masonry of animals, measured with a thickness gauge TR-1-10, compared to the background, mm)		Score in points
Gradation	Name experimental animal, rabbits	
Intensity	0-0,09	0
Lack of reaction	0,1-0,59	1
Weak reaction	0,6-1,0	2
Moderate reaction	1,1-2,01	3
Severe reaction	>2,1	4

The processing of the obtained data, the essence of which was to quantify the degree of induction of erythema and edema (in points) was summed up for each experimental animal separately, after which the average assessment of the severity of the local irritant properties of the substance for the group of experimental animals was calculated.The final results of the conducted studies on the study of toxicological indicators to assess the degree of erythema and the intensity of edema of the skin of animals are shown in Tables 3 and 4

Table 3 - Results of studies evaluating erythema

The intensity of erythema visually	Score in points
Lack of erythema	0

Table 4 - Results of studies on edema of animal skin

The intensity of the edema (the increase in the thickness of the skin masonry of animals, measured by the TP-1-10 thickness gauge, in comparison with the background, mm)	The name of the pilot, animal, rabbits	Edema assessment in points
Gradation intensity		
Lack of reaction	– 0,09	0

Conclusion.

The studies carried out to assess the toxicological parameters of montmorrillonite clay in order to use them as an aluminosilicate sorbent on experimental animals (rabbits and white rats) allowed the following results to be obtained:

1. Visual study of the intensity of erythema when exposed to the test substance on the skin of rabbits showed their absence (0 points);

2. Study of the intensity of edema (increase in the thickness of the skin masonry of rabbits) when exposed to the test substance on the skin of rabbits showed no reaction to them (0 points);

3. Studies evaluating the irritating effect of the test substances on the mucous membranes of the eyes of rabbits by the symptoms of damage showed the absence of hyperemia (0 points), slight edema of the eyelids (1 point), the minimum amount of discharge in the corner of the eye (1 point);

4. The results of studies on the classification assessment of the test substance for the severity of irritating effect on the eyes of rabbits showed that the average total score of the severity of irritative action corresponds to 1 point;

5. A comprehensive analysis of the results obtained on the basis of scientific and experimental studies to assess the toxicological parameters of montmorillonite clay from the Pogadaevskoye deposit in relation to irritating effects on the skin and mucous membranes of experimental animals (rabbits) showed their harmlessness;

6. As a result of a study of the acute toxicity of montmorillonite clay from the Pogadaevskoye deposit with intragastric administration on white rats, it was found that it can be classified as non-toxic and low-hazard compounds.

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ТҮЙІН

Мақалада Батыс Қазақстан облысындағы Погадаевское кен орнынан алынған монтмориллонит сазының токсикологиялық параметрлерін, оларды микотоксиндердің ағзасына теріс әсерін және азықтық құрамда алюминосиликатты сорбент ретінде қолдану мақсатында бағалауға арналған зертханалық зерттеулердің нәтижелері келтірілген. Зерттеулердің өзектілігі сау және өнімділігі жоғары жануарлар мен құстарды өсірумен Қазақстан Республикасының азық-түлік қауіпсіздігін қамтамасыз ету. Монтмориллонит сазының токсикологиялық параметрлерін эксперименталды жануарларда (қояндар мен ақ егеуқұйрықтарда) алюминосиликатты сорбент ретінде қолдану мақсатында бағалау үшін жүргізілген зерттеулер келесі нәтижелерді алуға мүмкіндік берді: сынаққа ұшыраған кезде эритеманың қарқындылығын визуалды зерттеу, қоянның терісіндегі зат олардың жоқтығын көрсетті (0 балл). Қояндардың терісіне зерттелетін зат әсер еткенде ісінудің интенсивтілігін зерттеу (қояндардың тері қалыңдығының артуы) реакция көрсеткен жоқ (0 балл). Зерттелетін заттардың қоянның көзінің шырышты қабығына зақымдану белгілері бойынша тітіркендіргіш әсерін бағалау бойынша зерттеулер гиперемияның жоқтығын көрсетті (0 балл). Қабақтың әлсіз ісінуі (1 балл), көздің бұрышындағы шығарудың минималды мөлшері (1 балл). Зерттелетін затты қояндардың көзіне тітіркендіргіш әсер ету дәрежесіне классификациялау бойынша жүргізілген зерттеулердің нәтижелері көрсеткендей, тітіркендіргіш әсердің ауырлық дәрежесінің орташа жалпы баллы 1 баллға сәйкес келеді. Погадаевское кен орнынан алынған монтмориллонит сазының токсикологиялық көрсеткіштерін эксперименталды жануарлардың (қояндардың) терісіне және шырышты қабаттарына тітіркендіргіш әсер етуіне байланысты бағалау үшін ғылыми-эксперименттік зерттеулер негізінде алынған нәтижелерге жан-жақты талдау жасау олардың зиянсыздығын көрсетті. Погадаевское кен орнынан монмориллонит сазының ақ уызға асқазан ішілік енгізумен өткір уыттылығын зерттеу нәтижесінде оны улы емес және қауіпті емес қосылыстарға жатқызуға болатындығы анықталды.

РЕЗЮМЕ

В статье представлены результаты лабораторных исследований по оценке токсикологических показателей монтмориллонитовой глины Погадаевского месторождения Западно-Казахстанской области с целью использования их в качестве алюмосиликатного сорбента в составе кормов снижающих негативные воздействия микотоксинов на организм животных и птиц. Актуальность исследований связано с выращиванием здоровых и высокопродуктивных животных и птицы с целью обеспечение продовольственной безопасности Республики Казахстан.Проведенные исследования по оценке токсикологических показателей монтмориллонитовой глины с целью использования их в качестве алюмосиликатного сорбента на экспериментальных животных (кролики и белые крысы) позволили получить следующие результаты: Визуальное изучение интенсивности эритемы при воздействии исследуемого вещества на кожу кроликов показали их отсутствие (0 балла).

Изучение интенсивности отека (нарастание толщины кожной кладки кроликов) при воздействии исследуемого вещества на кожу кроликов показали отсутствие на них реакции (0 балла). Исследования по оценке раздражающего действия исследуемого веществ на слизистые оболочки глаз кроликов по симптомам повреждения показали отсутствие гиперемии (0 балла). Слабый отек век (1 балл), минимальное количество выделения в углу глаза (1 балл). Результаты исследований по классификационной оценке исследуемого вещества на выраженность раздражающего действия на глаз кроликов показали, что средний суммарный балл выраженности ирритативного действия соответствует 1 баллу. Комплексный анализ полученных результатов на основе научно-экспериментальных исследований по оценке токсикологических показателей монтмориллонитовой глины Погадаевского месторождения по отношению раздражающих действии на кожу и слизистые оболочки экспериментальных животных (кроликов) показали их безвредность. В результате изучения острой токсичности монтмориллонитовой глины Погадаевского месторождения при внутрижелудочном введении на белых крысах было установлено, что его можно отнести к классу нетоксичных и малоопасных соединений.

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ВАЗОЭКТОМИЯ ЖАСАЛҒАН БҰҚАЛАРДЫҢ ГЕМАТОЛОГИЯЛЫҚ КӨРСЕТКІШТЕРІ
HAEMATOLOGICAL PARAMETERS OF STEERS AFTER VASECTOMY

Аннотация

Бұл мақалада вазоэктомиядан кейінгі қазақтың ақбас тұқымды бұқаларының қан көрсеткіштерін зерттеу нәтижелері көрсетілген. Ол үшін 12-14 айлық бұқалардан екі топ құрылды. Тәжірибелі топтағы бұқаларды «Айслу» қожалығында ен қосалқысының құйрығын «бұрау» арқылы вазоэктомия жасалды. 14-16 айлық кезінде екі топтан қан алынды. Нәтиже