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EFFICIENCY OF MYCOTOXIN SORPTION IN VITRO

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It was found that in vitro Alfasorb and Alfasorb Ultra in the amount of 0,5% showed a high sorption capacity (75-100%) regarding aflatoxin B1, patulin, zearalenone, sterigmatocystin and lower sorption of deoxynivalenol and T-2 toxin (40 and 55%). The inclusion of a complex of mananoligosaccharides into the composition of Alfasorba-KMOS contributed to an increase in the level of sorption steritmatocystin from 75 to 95%, deoxynivalenol from 40 to 90% and T-2 toxin from 55 to 65%.

***Key words**: mycotoxin, mycotoxicosis, sorbents, Alfasorb.*

The problem. The problem of mycotoxin contamination of feed needs special attention in pig production. This is due to the fact that grains constitute more than 80 % of pigs diets which are a fertile ground for the growth and development of molds under certain conditions and are capable of producing mycotoxins. When mycotoxins enter the gastrointestinal canal with food, they negatively affect the intestinal normal flora, causes changes in microbiological homeostasis, promotes an increase in aerobic bacteria and increases the toxic effect of pathogenic microflora [10]. All these changes lead to the development of mycotoxicosis in animals, which are difficult to diagnose, cause huge economic losses due to a decrease in productivity and death of animals [1, p. 46; 3, p. 15].

Mycotoxins accumulate in meat, lard, by-products, then migrate to pork processing products. Therefore, the problem of mycotoxicosis goes far beyond the pig farms, where the last link in this sequence of negative impact is human health [2].

As the problem is global, to implement sanitary and preventive measures for preventing the development of mycotoxicosis is of great importance [5, p. 5].

Analysis of current research. It has been proven that mycotoxins are thermostable compounds that are resistant to the effects of chemicals. Existing preventive measures for mycotoxicosis (grain processing with various chemicals, cooking, steaming, granulating, extruding, autoclaving) do not give the expected results as usual [6, p. 134-136].

Currently, the most widespread in animals' practice is mycotoxicosis prevention which is based on the use of a contaminated feed with feed sorbents [4, p. 279]. Sorbents reduce the biological activity of mycotoxins, they are able to bind and remove them from the gastrointestinal tract.

Today sorbents used in pig breeding are divided into three groups - inorganic, represented by a group of aluminosilicates of natural origin (bentonites, zeolites, etc.), organic (lignins, yeast wall components, activated charcoals) and combined (mixtures of inorganic and organic adsorbents in various ratios with indifferent excipients). At the present stage, preference is given to combined sorbents that combine the effective aspects of organic and inorganic components in a single preparation [9].

LLC NPP "Ariadna" (Odessa) produces a number of feed additives – Alfasorb, Alfasorb Ultra and Alfasorb-KMOS to prevent the development of mycotoxicosis in animals and poultry. A characteristic feature of Alfasorb is that it is obtained by isolating cellulosic biopolymers (cellulose, hemicellulose, pectin, lignin) from plant dietary fibers that have been subjected to multilevel processing. As a result, biotransformation of polymer carbohydrate chains occurred and many active centers were formed for the effective binding of mycotoxins.

Alfasorb Ultra, in addition to cellulose biopolymers, additionally contains the mineral zeolite, and Alfasorb-KMOS contains a complex of mannano-oligo saccharides.

In this regard, the **purpose** of our research was to study in model experiments in vitro the sorption properties of Alfasorb, Alfasorb Ultra and Alfasorb-KMOS when they interact with mycotoxins – patulin, aflatoxin B_1, sterigmatocystin, zearalenone, DON and T-2 toxin.

Materials and methods. For the research, the recommended amount of 500 mg / kg was taken as the initial amount of the sorbent under study.

To prepare an experimental sample, a 5 g sample was taken, which was introduced into a flask with water, after which a solution of a mixture of mycotoxins was added with constant stirring. The solution contained a mixture of mycotoxins in accordance with the maximum permissible levels (MRL) of mycotoxins established in Ukraine in animal feed: aflatoxin B1 at the rate of 0.1 mg / l; zearalenone – 2.0 mg / l; sterigmatocystin – 0.6 mg / l; patulin – 0.5 mg / l; deoxynivalenol – 1 mg / l and T-2 toxin, respectively, 0.2 mg / l [8].

Experimental samples were kept for 30 min at a temperature of 38 ± 1 ° C and pH 6.0 in the incubation medium, after which they were centrifuged at 8000 rpm for 15 min and the supernatant was taken, which was used to determine mycotoxins [7] using TLC plates of ASK "Silufol" UV-254 and "Sorbfil" types.

The adsorption activity of the sorbents with respect to mycotoxins was calculated from the concentration of mycotoxins in the experimental sample in 30 minutes after the introduction of the weighed portion of the sample according to generally accepted formulas. The average value was determined from the results of two parallel studies.

A control sample was considered a solution of a mixture of mycotoxins with the corresponding content of mycotoxins as in the experimental samples, only without adding a sorbent. The control sample was processed according to the scheme similar to the experimental sample.

Basic material. As a result of the studies, it was found that sorbents in the amount of 0.5 % after 30 minutes of incubation with a mixture of mycotoxins showed some differences in the sorption.

Thus, during a 30-minute exposure, Alfasorb and Alfasorb Ultra sorbed aflatoxin B_1, patulin and zearalenone by 100 %, sterigmatocystin by 75 %, and T-2 toxin and DON, by 55 % and 40 %, respectively. During the same incubation time, Alfasorb-KMOS absorbed aflatoxin B_1, patulin and zearalenone by 100%, sterigmatocystin by 95 %, DON by 90 % and T2 toxin by 65 %.

Table 1. **The sorption capacity of sorbents in vitro, %**

Name of the sorbent	Aflatoxin B_1	Patulin	Sterigma-tocystine	Zeara-lenon	T2 toxin	DON
Alfasorb	100	100	75	100	55	40
Alfasorb Ultra	100	100	75	100	55	40
Alfasorb-KMOS	100	100	95	100	65	90
μ	100	100	81,7	100	58.3	56.7

Our in vitro studies showed a higher sorption capacity of Alfasorb-KMOS compared to Alfasorb and Alfasorb Ultra relative to sterigmatocystin and T-2 toxin - 95 and 90 %, respectively, versus 75 and 40 %.

When the effectiveness of sorbents in vitro was studied, the lowest sorption activity was revealed in relation to DON and T-2 toxin. Thus, the average sorption activity of the Alfasorb line of sorbents during a 30-minute exposure relative to DON was 56.7 %, T-2 toxin – 58.3 %, sterigmatocystin – 81.7 % (Fig. 1).

The revealed low sorption capacity of the studied sorbents of DON and T-2 toxin in comparison with other mycotoxins is explained by their structural features - the presence of an epoxy ring (12,13 – epoxy – Δ9 – trichothecene), which is the main target for the successful neutralization of mycotoxins. At the same time, it was established [7] that the epoxy ring of trichothecenes is well protected from the action of various reagents, and therefore they are able to persist for a long time without any changes.

It was determined that the inclusion of zeolite in Alfasorb Ultra did not increase its sorption capacity relative to trichothecene group mycotoxins. At the same time, the inclusion of a complex of mannano-oligosaccharides isolated from the cell walls of yeast into the Alfasorb-KMOS composition increased the sorption level of sterigmatocystin from 75 to 95 %, deoxynivalenol from 40 to 90 % and T-2 toxin from 55 to 65 %.

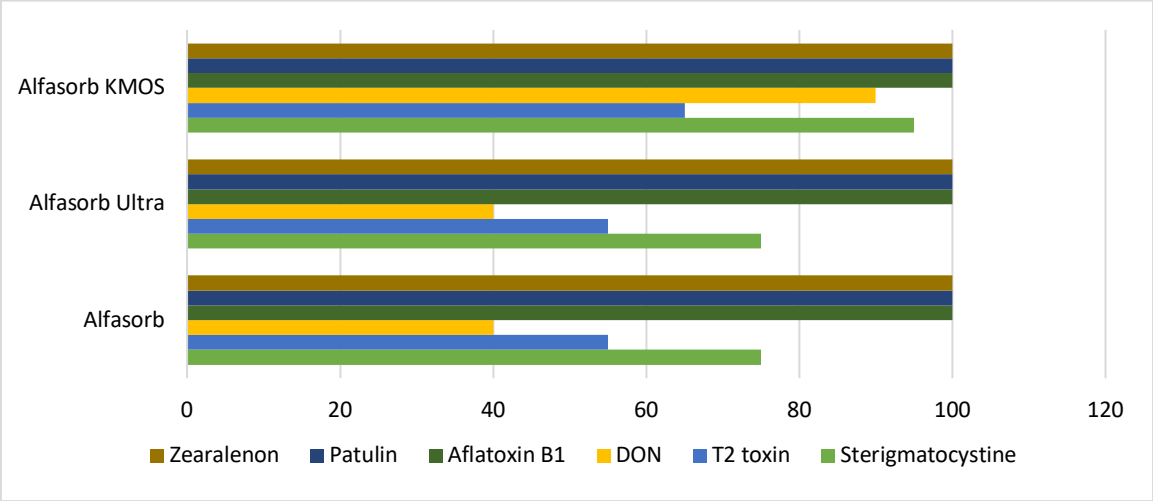

Fig. 1. Comparative sorption activity of sorbents relative to the studied mycotoxins

Conclusions

1. In vitro Alfasorb and Alfasorb Ultra in the amount of 0.5 % showed a high sorption capacity (75–100 %) relative to aflatoxin B_1, patulin, zearalenone, sterigmatocystin and lower sorption – deoxynivalenol and T-2 toxin (40 and 55 %).

2. The inclusion of Alfasorb Ultra zeolite did not increase its sorption capacity against mycotoxins of the trichothecene group.

3. The inclusion in the composition of Alfasorb-KMOS complex of mannan- oligosaccharides increased the level of sorption of sterigmatocystin from 75 to 95 %, deoxynivalenol from 40 to 90 % and T-2 toxin – from 55 to 65 %.

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ЭФФЕКТИВНОСТЬ СОРБЦИИ МИКОТОКСИНОВ *IN VITRO*

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Установлено, что в условиях in vitro Альфасорб и Альфасорб Ультра в количестве 0,5 % показали высокую сорбционную способность (75–100 %) относительно афлатоксина B_1, патулина, зеараленона, стеригматоцистина и более низкую сорбцию – дезоксиниваленола и Т-2 токсина (40 и 55 %). Включение комплекса манannоолигосахаридов в состав Альфасорба-КМОС способствовало повышению уровня сорбции стеригматоцистина с 75 до 95 %, дезоксиниваленола с 40 до 90 % и Т-2 токсина с 55 до 65%.

Ключевые слова: *микотоксин, микотоксикозы, сорбенты, Альфасорб.*

ЕФЕКТИВНІСТЬ СОРБЦІЇ МІКОТОКСИНІВ *IN VITRO*

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Встановлено, що в умовах in vitro Альфасорб і Альфасорб Ультра в кількості 0,5 % показали високу сорбційну здатність (75-100 %) щодо афлатоксину B_1, патуліну, зеараленону, стеригматоцистину і нижчу – відносно дезоксиніваленолу і Т-2 токсину (40 і 55%). Включення комплексу манannоолігосахаридів до складу Альфасорба-КМОС сприяло підвищенню рівня сорбції стеригматоцистину з 75 до 95 %, дезоксиніваленолу з 40 до 90 % і Т-2 токсину – з 55 до 65%.

Ключові слова: *микотоксин, мікотоксикозів, сорбенти, Альфасорб.*