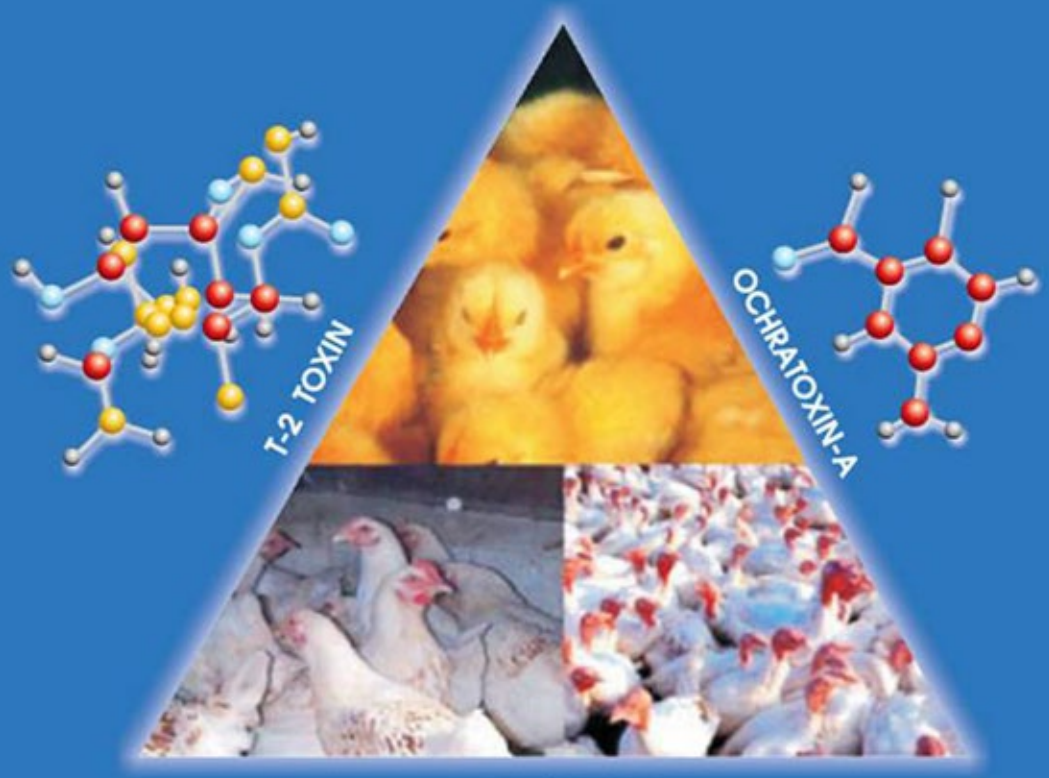
MYCO-AD®



Poultry Technical Manual

SPECIAL NUTRIENTS
THE MYCOTOXINS SPECIALIST

MYCO-AD®

The first, unique mycotoxin adsorbent in the world with a commercial dose (2.5 kg per metric ton of feed) identical to that used in scientific tests. Statistically-significant data show that **MYCO-AD®** has the ability to effectively protect birds against the deleterious effects of the following mycotoxins:

Aflatoxin	**7500 ppb**
Ochratoxin	**2000 ppb**
T-2 Toxin	**1000 and 1250 ppb**

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INTRODUCTION

Fungal contamination of agricultural products is often unavoidable and of worldwide concern, because the products frequently contain toxic metabolites known as mycotoxins. Mycotoxin contamination can occur in the crop, during harvest, at storage, or even after feed manufacturing. Mycotoxins are fairly stable compounds that cause a wide variety of deleterious effects in poultry and other animal species, depending on the nature and concentration of toxins in the diet, animal species, age, and nutritional and health status at the time of exposure to contaminated feed. Several factors have an influence on the development of molds, including the moisture content of the grain or feed, environmental humidity and/ temperature, oxygen concentration, pH, and storage length. Mycotoxins cause toxic, teratogenic, mutagenic, and carcinogenic effects, and/or depression of the immune system. Clinical immunosuppressive conditions can be confused with those caused by other pathogens. This is why it is frequently difficult to establish a precise differential diagnosis. The fact that a great variety of mycotoxins affect different organs in the urinary, digestive, and reproductive tracts, or the nervous and immune systems, among others, makes recognizing a mycotoxicosis condition even harder.

For many years, mycotoxins were studied individually in each species, without considering that under field conditions contamination with only one mycotoxin normally does not occur. Only recently the combination effect of several mycotoxins started to be evaluated.

The scientific community is concerned about the fact that mycotoxin levels that used to be considered as safe in the past, currently have shown their ability to cause problems when combined with "low" levels of other mycotoxins. This potentiation of mycotoxin effects is due to the synergy that occurs when several mycotoxins are combined in the feed. One example of combined contamination in grains and feeds is the aflatoxin-fumonisin combination. Another example is vomitoxin and zearalenone, which are naturally found in combination in the same grain or oil seeds/meals.

It has been consistently shown that the immune system is an important target of mycotoxins, causing adverse effects on the normal immune response, resulting in suppression of one or more immune functions. These immune failures predispose animals to severe vaccine reactions, low humoral/local antibody levels, and the presentation of diseases that are typically controlled with normal vaccination programs. In many occasions these effects cannot be seen, so that only lack of uniformity and poor productive parameters are reported. Mycotoxins with the strongest effect on birds' immune system include aflatoxins, ochratoxins, and the Trichothecenes group.

Figure 1. Bursal atrophy in 28-day-old broilers affected by mycotoxins. This indicates damage to the immune system.

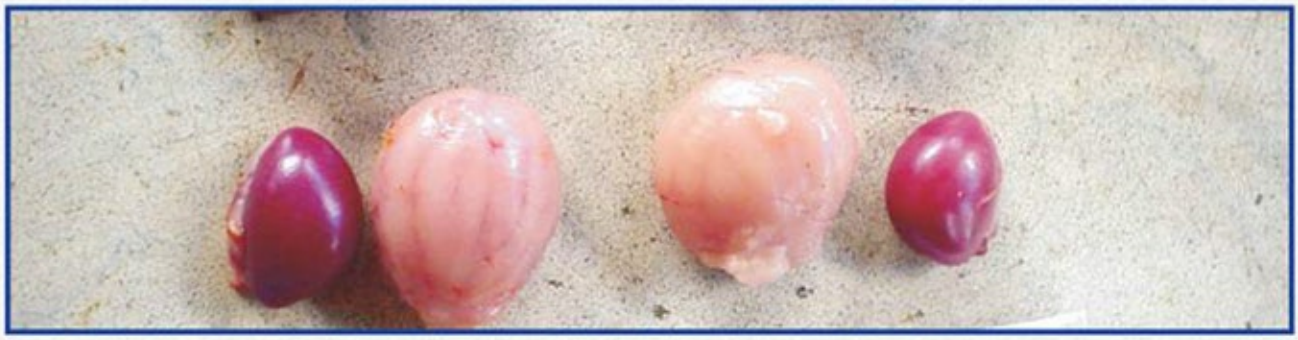


Figure 2. Normal bursae and spleens of 28-day-old commercial broilers. At this age, bursal size should be 2- 2.5 times that of the spleen.

IN VIVO SCIENTIFIC TESTS

Some scientific studies showing the efficacy of **MYCO-AD®** in the control of the most important mycotoxins affecting commercial birds are shown below.

EVALUATION OF MYCO-AD® EFFICACY IN REDUCING THE TOXICITY CAUSED BY FEEDING SYNTHETIC OCHRATOXIN AND AFLATOXIN IN COMMERCIAL BROILERS

Facilities: International Animal Research Institution, Querétaro, Mexico.

Type of Birds: Broilers.

MYCO-AD® inclusion rate: 2.5 kg per metric ton of feed.

Synthetic mycotoxin concentration in the feed: Aflatoxin = 7500 ppb plus Ochratoxin = 2000 ppb. High levels were used in order to show the damage caused by these mycotoxins. Under field conditions, lower levels of natural mycotoxins can cause damage more readily.

Reference: A. Casarin, M. Forat, E. Soto, M. Contreras and D. Zaviezo. Evaluation of the efficacy of a commercial HSCAS to reduce toxicity of T 2 toxin in broiler chicks. 2005 International Poultry Scientific Forum. Atlanta, GA, USA.

Table 1. Effect of **MYCO-AD®** on daily feed intake (DFI), average daily gain (ADG), feed conversion rate (FCR) and initial/final body weight of aflatoxin-fed, 24-day-old broilers.

TREATMENT	DFI g	ADG g	FCR	BW 4 days g	BW 24 days g
Control	45.90 a	28.03 a	1.637 a	78.87 a	639.47 a
MYCO-AD®	47.82 a	27.83 a	1.717 a	78.35 a	634.95 a
Aflatoxin (7.5 ppm)	35.42 b	18.49 b	1.915 b	76.71 a	446.51 b
MYCO-AD® + Aflatoxin (7.5 ppm)	43.01 c	26.48 a	1.623 a	78.90 a	608.50 a

a, b, c Values within one column with different letters are significantly different ($P < 0.05$).

Table 2. Effect of **MYCO-AD®** on liver size and lesions, and mortality rate of aflatoxin fed 24-day-old broilers .

TREATMENT	Liver weight/ 100g BW	Liver gross lesions	Mortality (%)
Control	3.54 a	Negative	0
MYCO-AD®	3.18 a	Negative	0
Aflatoxin (7.5 ppm)	6.14 b	100% Severe	8.3
MYCO-AD® + Aflatoxin (7.5 ppm)	3.83 a	25% negative 40% mild 25% moderate 10% severe	0

a, b Values within one column with different letters are significantly different (P< 0.05).

Table 3. Effect of **MYCO-AD®** on daily feed intake (DFI), average daily gain (ADG), feed conversion rate (FCR), and initial and final body weight (BW) of ochratoxin-fed 28-day-old broilers.

TREATMENT	DFI g	ADG g	FCR	7 day BW g	28 day BW g
Control	53.87 a	31.05 a	1.734 a	82.45 a	734.50 a
MYCO-AD®	54.85 a	31.12 a	1.762 a	85.36 a	738.80 a
Ochratoxin (2.0 ppm)	52.91 a	29.67 b	1.783 a	82.63 a	705.70 a
MYCO-AD® + Ochratoxin (2.0 ppm)	53.89 a	32.63 a	1.651 b	85.19 a	770.04 a

a, b Values within one column with different letters are significantly different (P< 0.05).

Table 4. **MYCO-AD®** effect on liver and kidney size, as well as lesions in ochratoxin fed 28-day-old broilers.

TREATMENT	Liver weight/ 100g BW	Liver gross lesions	kidney weight/ 100g BW	kidney gross lesions
Control	4.90	Negative	1.09 a	Negative
MYCO-AD®	4.96	Negative	1.19 a	Negative
Ochratoxin (2.0 ppm)	4.89	19% mild 63% moderate 18% severe	1.37 b	88% severe 6% mild 6% moderate
MYCO-AD® + Ochratoxin (2.0 ppm)	4.81	44% negative 19% mild 31% moderate 6% severe	1.33 b	62% negative 19% mild 6% moderate 13% severe

a, b Values within one column with different letters are significantly different (P< 0.05).

Conclusions

Effect on aflatoxin and ochratoxin

MYCO-AD® controlled the deleterious effects caused by both mycotoxins, showing a statistically significant difference in favor of **MYCO-AD®** + mycotoxin fed group when compared with the group that received only mycotoxins.

Nutrients absorption

No negative effects were seen on productive parameters of birds treated only with **MYCO AD®**. Results were statistically similar to those of the controls.

EVALUATION OF MYCO-AD® EFFICACY IN DECREASING THE TOXICITY OF T-2 TOXIN IN COMMERCIAL BROILERS

Facilities: Veterinary Medicine Institute, Debrecen, Hungry, & International Animal Research Institute, Querétaro, Mexico.

Type of Birds: Broilers

MYCO-AD® Inclusion rate: 2.5 kg per metric ton of feed.

Concentration of natural and synthetic mycotoxins in the feed:
T-2 Toxin = 1.0 and 1.25 ppm, respectively. High levels were used in order to show the damage caused by these mycotoxins. Under field conditions, lower levels of natural mycotoxins can cause damage more readily.

Reference: A. Casarin, M. Forat, E. Soto, B. Fazekas, J. Tanyi, and D. Zaviezo. Evaluation of the efficacy of a commercial HSCAS to reduce toxicity of T-2 toxin in broiler chicks. 2005 International Poultry Scientific Forum. Atlanta, GA, USA.

Table 5. Effects of MYCO-AD® on body weight, feed intake, feed conversion rate (FCR), and organs development of broilers fed T-2 toxin at 40 days of age.

TREATMENT	Body weight g	Feed Intake g	FCR	Spleen weight/ 100g BW	Liver weight/ 100g BW	Heart weight/ 100g BW
Control	1791 a	3690 a	2.06 a	0.12 a	2.5 a	0.6 a
Control + T-2 (1 ppm)	1381 b	2928 b	2.12 b	0.09 b	2.5 a	0.6 a
Control + T-2 + MYCO-AD®	1840 a	3717 a	2.02 a	0.12 a	2.4 a	0.6 a

a, b Values within one column with different letters are significantly different (P< 0.05).

Table 6. Effects of **MYCO-AD®** on body weight (BW), oral lesions, and bursal development of broiler chickens fed T-2 toxin at different ages.

	21 Days			28 Days			35 Days	
TREATAMENT	BW g	Oral lesion	Bursal weight/ 100g BW	BW g	Oral lesion	Bursal weight/ 100g BW	BW g	Oral lesion
Control	538 a	0 a	0.30 a	932 a	0 a	0.45 a	1446 a	0 a
Control + T2 (1 ppm)	463 b	1.84 b	0.20 b	788 b	1.63 b	0.20 b	1148 a	0.96 b
Control + T2 +MYCO-AD®	543 a	0.36 a	0.28 a	938 a	0.21 a	0.40 a	1451 a	0.04 a

a, b Values within one column with different letters are significantly different (P< 0.05).

Graph 1. Incidence and severity of oral lesions in broilers fed the control diet, the T- 2 toxin contaminated diet, and the T-2 toxin contaminated diet treated with **MYCO-AD®** during the entire test.

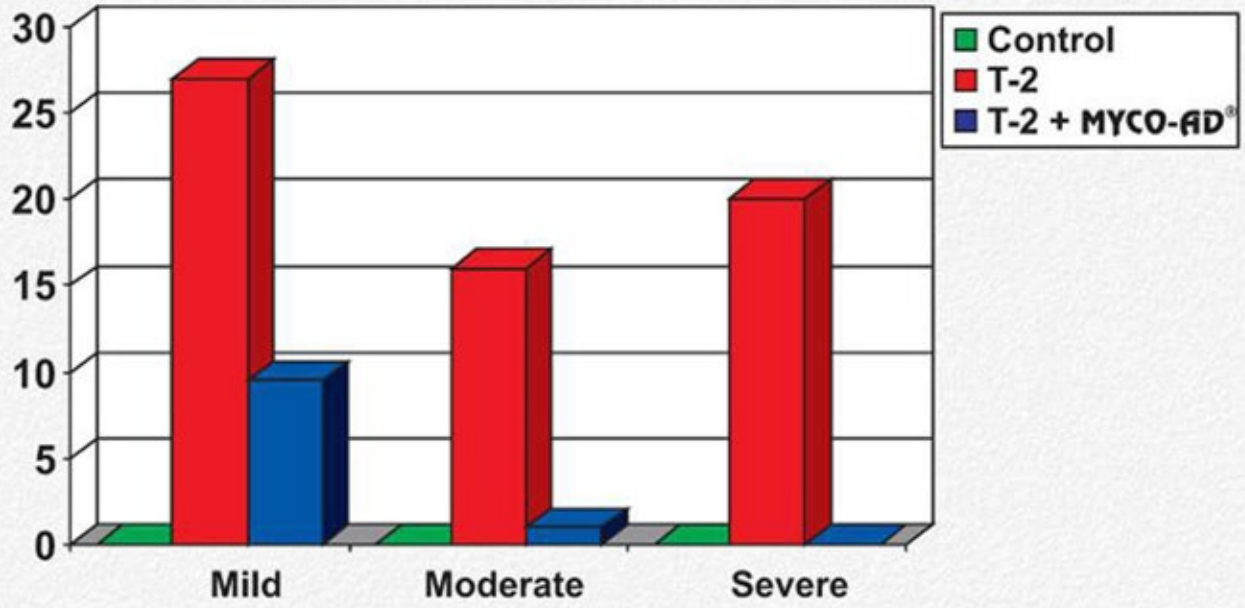


Table 7. Effects of **MYCO-AD®** on average daily gain (ADG), daily feed intake (DFI), feed conversion rate (FCR), oral lesions, and bone mineralization of 38 day-old broilers exposed to test diets for 33 days.

TREATAMENT	ADG g	DFI g	FCR	Oral lesion	Bone ash %
Control	54.8 a	105.3 a	1.92 a	0.25 a	45.95 a
MYCO-AD®	51.3 a	103.0 a	2.01 a	0.25 a	45.65 a
Toxin T-2 (1.25 ppm)	44.9 b	98.4 a	2.19 b	2.75 c	--
MYCO-AD® + Toxin T-2 (1.25 ppm)	53.5 a	101.4 a	1.90 a	1.75 b	--

a, b Values within one column with different letters are significantly different ($P < 0.05$).

Conclusions

Effect on T-2 Toxin

MYCO-AD® controlled in a statistically significant manner the deleterious effects caused by T-2 toxin on broiler performance. In the presence of the mycotoxin, **MYCO-AD®** prevented bursal atrophy and significantly decreased the level of oral lesions in birds.

Nutrients absorption

No negative effects were seen on the productive parameters of **MYCO AD®** treated birds. Results were statistically similar to those of the controls. Similarly, no statistically significant differences were observed when bone mineralization was determined at trial completion.

EVALUATION OF THE EFFICACY OF MYCO-AD® TO DECREASE THE TOXICITY CAUSED BY NATURAL MYCOTOXIN CONTAMINATION IN COMMERCIAL LAYERS

Type of birds: Commercial Layers (Babcock B-300).

MYCO AD® Inclusion rate: 2.5 kg per metric ton of feed.

Toxins used: Toxins were present naturally in the feed (15% moisture grain).

Mycotoxicosis lesions were reported in the birds. Analyzed mycotoxin levels ranged from 100 to 140 ppb of aflatoxin, and from 100 to 150 ppb of T-2 toxin.

Facilities: a commercial farm in Puebla, Mexico.

Table 8. Effect of **MYCO-AD®** on feed conversion rate, egg production, egg weight, and egg mass of 30-week-old commercial layers fed a naturally mycotoxin-contaminated feed for 19 days.

TREATAMENT	Egg production %	Egg weight g	Egg mass kg	Feed conversion rate
Control + mycotoxins	88.4 a	56.9 a	95.5 a	2.16 a
Control + mycotoxins + MYCO-AD®	93.2 b	58.4 b	103.4 b	2.00 b

a, b Values within one column with different letters are significantly different (P< 0.05).

Conclusions

MYCO-AD® prevented, in a statistically-significant manner, the deleterious effects caused by the natural aflatoxin/T-2 Toxin combination in the layer feed.

The addition of 2.5 Kg **MYCO-AD®** per metric ton of contaminated feed allowed to significantly recover egg production, egg weight, and egg mass. Feed conversion rate was also improved.

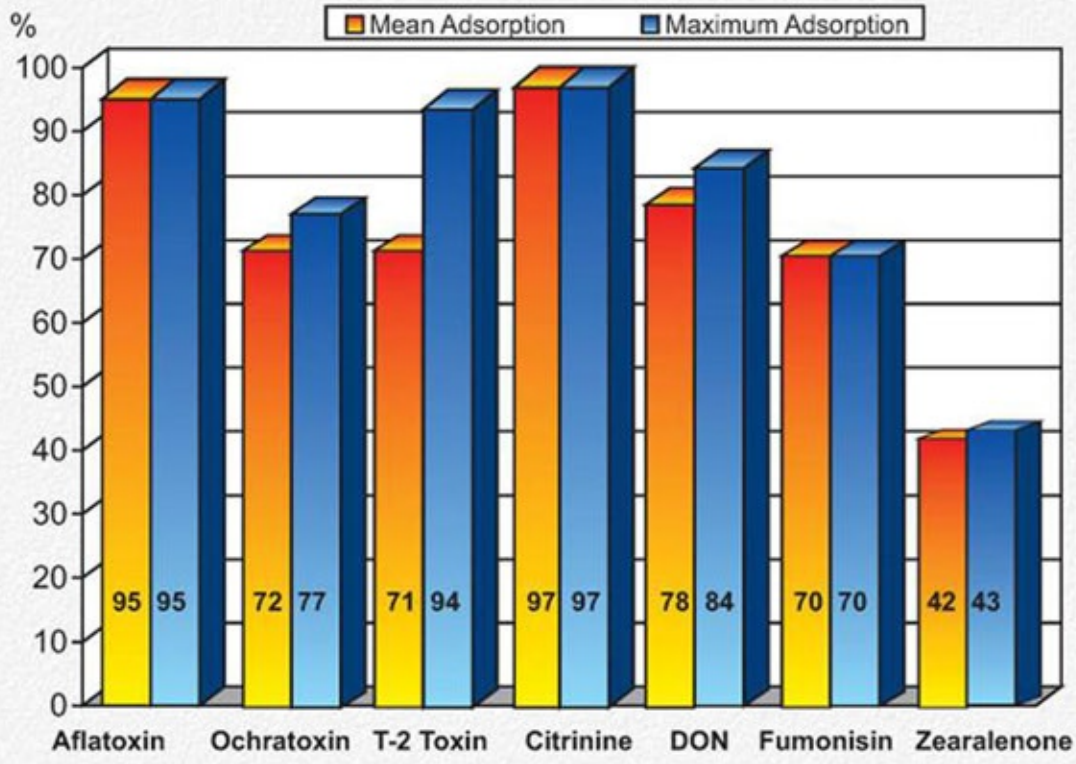
IN VITRO EVALUATION

In vitro evaluation is the first step that must be taken for the identification of a mycotoxin binder. This is so important that many researchers consider that if the product does not work ***in vitro***, it will hardly work when used in animals (***in vivo***).

Generally, it is considered that a product with 80% absorption capacity ***in vitro*** can potentially do a good job ***in vivo***.

It is important that ***in vitro*** results represent the net adsorption of the product, meaning that both the adsorption and desorption process has occurred, through a pH change, mimicking what occurs in the gastrointestinal tract of animals. Adsorption results from tests performed only at a low pH do not assure that the product can retain the mycotoxin when the pH rises.

Graph 2. Mean and maximum net adsorption capacity of **MYCO-AD®** in the high performance liquid chromatography (HPLC) test using 5 ppm (5000 ppb) of all 7 mycotoxins tested, with a **MYCO-AD®** level of 2.5 kg/metric ton (commercially-recommended dose).



History of Mycotoxins Absorbants.

For the last 20 years hydrated sodium and calcium aluminosilicates (HSCAS) have been used for the control of the deleterious effects of mycotoxins. During 1987 Phillips and several collaborators analyzed the adsorption capacity of several adsorbents, demonstrating their aflatoxin adsorbing effectiveness. Numerous myths have risen throughout the years about the use of clays for the control of mycotoxins. In some regions, people believe that all clays are polar, so that they only absorb aflatoxin. Some producers consider that most or all clays absorb nutrients, and they also believe that high inclusion levels (5 - 20 kg per metric ton) are needed for these clays to be effective. About the idea that all clays are similar, and that they only absorb aflatoxin, a scientific mineralogy literature review will show the existence of several types of bipolar clays, which can adsorb more than one mycotoxin. Regarding nutrient absorption, we can argue that many poultry studies demonstrated that several clays that adsorbed mycotoxins did not affect nutrient absorption whatsoever.

Clay Chemistry Applied to Nutrition.

The terms clay and HSCAS are synonyms. They represent a great variety of minerals, including many types of clay with a wide variety of physicochemical traits. To show this wide diversity, we should state that no two equal clays exist in the world, since in one same mine, clay characteristics can change, and even minor variations that do not seem to affect the end product, can vary its mycotoxin adsorption ability, as well as the types of mycotoxins adsorbed. Each clay type has a function in animal agriculture. Some of them are used to absorb water, and they are excellent for pelleting purposes, while others absorb ammonia in the GI tract of ruminants, or in the litter of poultry or pets. But those types of clays have a limited action as mycotoxin adsorbents since if any they adsorb only aflatoxin. The most important characteristics that should be taken into account at the time of evaluating a clay as a potential candidate for mycotoxin adsorbent in the GI tract of animals are described below.

CLAYS. PHYSICOCHEMICAL CHARACTERISTICS

Electric Charges

The adsorption of mycotoxins through the utilization of mycotoxin binders basically consists of the neutralization of electric charges. When the electric charges of the mycotoxin and those of the adsorbent neutralize each other, the toxin will be adsorbed on the surface of the adsorbent. This process is similar to the mechanism by which a magnet attracts a metal. In other words, attraction occurs as a result of the electric charge difference. For a clay particle to adsorb or bind organic molecules, such as mycotoxins in feeds, opposite electric charges attracting each other must exist.

Clay electric charges can be either polar or bipolar. Polar clays only contain negative charges, so that they can only adsorb mycotoxins with a strong positive charge (i.e.: aflatoxins). Bentonites are a good example of clays that only adsorb aflatoxins, because of the type of charge contained in bentonite. On the contrary, bipolar clays have both positive and negative charges, allowing them to adsorb not only aflatoxin, but also other types of mycotoxins.

Cationic Exchange Capacity (CEC)

Cationic Exchange capacity is a measure of the amount of cations (positively-charged ions) that a clay can catch. CEC is important since, for irreversible mycotoxin retention to be performed by the absorbent, it is necessary that after the initial attraction occurs between opposite electric charges in the intestine, the presence of multiple electric sites is required for mycotoxin molecules to be retained, even if the adequate electric charges are present. A milliequivalent (mEq) is the unit used to measure CEC. It is considered that clays with >60 mEq have a high CEC, and this might interfere with nutrient absorption, particularly minerals. Bentonites are included in this clay group. Clays with <19 mEq (saturation point) make the clay to have a neutral charge, which results in a limited mycotoxin absorption capacity. Coalinites and zeolite are included in this category.

pH

pH is one of the factors with the strongest impact on the mycotoxin retention ability of a clay, after adherence has occurred. During the mycotoxin adsorption process, binding is not permanent and it can be reversible. A low (acidic) pH means excess positive charges, as a result of the presence of acidic protons (H^+). On the other hand, a high (basic or alkaline) pH stands for the presence of more negative charges (OH^-). pH can alter the electric charges present in both the mycotoxins and in the absorbent, resulting in alterations in the link that maintains both molecules together. This effect can apparently occur in the GI tract, so that a low pH can promote mycotoxin adsorption, while the presence of a higher pH can result in mycotoxin release. Numerous scientists consider that clays should have a slightly basic pH for them to work in the stomach, before mycotoxins are absorbed to the bloodstream. Clays with an acidic pH tend to work better at the end of the GI tract, where the adsorption effect is no longer important, since mycotoxins have already been absorbed by the animal.

Composition

Clays are constituted by 2 or more layers of mineral oxide. These layers are parallel units piled up in silica and alumina lamellae. Silica forms tetrahedral lamellae, while alumina forms octahedral sheets. Some of these clay particles have the ability of absorbing moisture and expand; others do not. Some of the bonds are weaker, so that they allow for layer expansion. Other bonds are stronger and prevent layers from being separated by water among them. Sodium bentonite a montmorillonite is an example of a clay that expands when water is added. On the other hand, caolinite is a non-expandable clay. Caolinite has units of layers strongly bound by hydrogen bonds. Depending on the type of clay, and on the differences in their constitution, pore size can vary from 0.26 nm to 100 nm in diameter, a trait that can have an effect on binding the organic molecules (i.e. mycotoxins) as well as the surface bond.

Drying Temperature

Temperature can have an effect on cationic exchange, because of the interaction between the solubility and temperature. A 100 150 °C drying temperature allows for a better activation of the clay and improved CEC. In addition to the clay activation effect, drying temperature eliminates the contamination with pathogens that could infect animals. Currently, this topic is extremely important, considering the potential risk of avian influenza virus spread among commercial birds.

Expansibility

Expansibility is the opening ability of the layers that constitute the clay, depending on their chemical composition. Non expansible clays have fixed layers so that they cannot absorb water or nutrients, and they have a low CEC (<60 mEq). This group includes but is not limited to caolinites, ilites, and chlorites. Expansible clays have the trait that they can absorb water and nutrients, and they have a high CEC (>60 mEq.)

Particle Size

Ideally, a mycotoxin adsorbent particle size should be 35 to 50 microns (300 - 400 mesh.) If particle size is >50 microns, the binder will not have enough exposure surface area to act on mycotoxins. On the contrary, if particle size is too small, the product will be too dusty, making it difficult to use in the feed mill.

Graph 3. CEC based classification of various minerals used as commercial binders and identified with different letters. The CEC value is on the right of each mineral. Products with 35 - 60 mEq typically belong to the HSCAS group.

INCLUSION LEVEL PER TON IN *IN VIVO* SCIENTIFIC STUDIES

10 kg | 5 kg | 2.5 kg | 5 kg | 10 kg | 20 kg

CATIONIC EXCHANGE CAPACITY, mEq

0 | 20 | 40 | 60 | 100 +

CAOLINITES		ILLITES and CHLORITES		BENTONITES – ZEOLITES	
S - - - - - - X	3.52	D - - - - - -D	22.73	C - - - - - - - N A - E	62.32
M- - - O B- - D	12.15	M - - - - - X P - - S	24.08	A - - - - 0	63.05
S - - - - T	17.24	Z - - - - X	29.28	Z - - - - N	64.76
		MYCO-AD®	39.89	D - - - X	66.27
		M - - - - - D (Old)	45.00	F - X A T - X	70.53
		Z - - - - N	48.40	C - - - - - - - - E	75.10
		N - - - - - - L	59.28	F - - - - X	75.75
		M - - - - - D (New)	59.42	D - - - - - X	105.94
				M - - - - - - B	105.94
				T - - i N – L	185.51

mEq = Milliequivalents per 100 g clay.

Results in this chart are based on analyses performed by Perry Agricultural Laboratories, USA, using their own equipment calibration standard.

QUESTIONS AND ANSWERS

What mycotoxin levels can cause damage in chickens?

The following chart includes different mycotoxin concentrations that can damage birds, causing negative effects on the immune system under field conditions. It should be taken into account that the levels regulated or recommended in the chart are based on studies performed with only one synthetic mycotoxin. Synthetic mycotoxins are less toxic than natural mycotoxins. Therefore, this chart is only a guideline for the levels that can result in field problems.

One important limitation of these studies is that they do not consider the synergy of different mycotoxins, the interactions with other dietary noxious compounds, bacterial contamination, or the presence of bird stressors such as poor ventilation, heat stress and poor management.

Mycotoxin	Regulation or Recommendation USA & EU	Levels that can result in immunosuppression
Aflatoxin	‹ 20 ppb	‹ 5 ppb
T-2 Toxin	‹ 500 ppb	‹ 100 ppb
Ochratoxin	‹ 20 ppb	‹ 5 ppb

Where samples should be obtained from in order to detect mycotoxin contamination?

Establishing a sound feedstuff quality control program is crucial. Both, raw materials and finished feeds should be sampled. Obtaining representative samples for mycotoxin analysis is not an easy task, since mycotoxins are found in some areas inside the bins. They are not evenly spread in the feed ingredients or in the ration. In order to reduce errors, samples should be obtained from moving ground grain. Finished feed samples should be obtained directly from the farm feeders, so that they represent what the animals are actually eating. Even if ideal sampling recommendations are observed, in many cases it is not possible to detect high mycotoxin levels. This is why many practitioners use laboratory analyses such as histopathology, to reconfirm the diagnosis of mycotoxicosis observed in the field.

Do mycotoxins affect only feed conversion and mortality rates?

Mycotoxins first affect the immune system. This results in secondary problems that are typically misdiagnosed/confused with other pathologic conditions. The effect on the immune system results in stronger respiratory live vaccine reactions. Antibiotic use must be increased in order to control associated bacterial infections. In the case of enteric problems, increased susceptibility to salmonellosis and colibacillosis occurs.

When a mycotoxin binder is used, should a mold inhibitor be also added?

It is important to remember that mold inhibitors cannot destroy mycotoxins. They inhibit the growth of the mycotoxin-producing molds. This means that if mycotoxins are already present in the feed, the effect of the mold inhibitor will have only limited value. Ideally, both mold inhibitors and mycotoxin binders should be used. But if you have to choose, use only the mycotoxin binder, since the effect of mycotoxins on animals is much worse that that of molds.

Do mycotoxin binders have the ability to absorb essential nutrients for animal development?

This depends on the type of binder. Some of them can affect the absorption of certain nutrients in the GI tract, mainly those with a high CEC and that are also expansible. They retain water together with certain water-soluble nutrients. This group includes several bentonites and zeolites. This is why it is important to review the results of *in vivo* trials, in order to determine if the product has the ability to absorb some nutrient types.

What is the advantage of using a low inclusion level mycotoxin binder in the feed?

Traditionally, nutritionists refuse to use high inclusion level mycotoxin binders since these products use valuable space within the feed formulation without contributing with any nutritional value. This is a lot more critical in broiler diets, where high energy/amino acid density should exist in order to fulfill the requirements of genetically rapid growing broiler strains.
One additional advantage is that using low inclusion rate mycotoxin binders reduces their possibilities to absorb essential nutrients such as vitamins and minerals. Also, the cost of the product inclusion into the feed is decreased when compared with other similarly-priced binders.

Numerous technical manuals recommend a lower commercial dose rate than the significantly effective dose shown in the scientific studies that appear in the same manual, why?

This is done to show that the addition of the binder has little incidence in the final cost of the feed. In the poultry industry, the cost of the mycotoxin binder inclusion is very important, since the production cost of feed is consistently questioned. Feed typically represents in excess of 2/3 of the production cost of one pound of meat. If a low dose rate is recommended, inclusion will be less expensive, making it more attractive to be used in the feed. However, a reduced dose will not provide effective protection in the presence of mycotoxins.

Are the mycotoxin binders containing bacteria, yeasts, or enzymes of any value to degrade mycotoxins?

So far, no mycotoxin binders exist that do not contain clays, since clays are the only products *per se* that have shown efficacious, consistent results.

Detoxification with enzymes, bacteria or yeasts should result in a fairly rapid mycotoxin biotransformation, prior absorption occurs in the small intestine.

One additional concern about their mode of action is that biotransformation sometimes results in secondary metabolites that are more toxic than the original mycotoxin.

Enzymes. The main disadvantage of using enzymes is that their activity greatly depends on the conditions existing in the GI tract, especially acidity, and the presence of other dietary enzymes/ingredients. Most mycotoxins are denatured when subjected to pelleting/extrusion processes. Therefore, a simple analytical method should exist to determine enzyme levels prior to and after feed manufacturing.

Bacteria. Other biotransformation mechanism, that occurs naturally, is through the action of anaerobic bacteria present in the distal GI tract. Successful colonization of the GI tract with foreign bacteria greatly depends on the microflora already established and on the conditions existing in the GI tract. When bacteria are used in the feed, it is important to avoid the use of antibiotics either as growth promoters or for therapeutic purposes. Antibiotics have shown potential to destroy beneficial microflora. In addition, high pelleting/extrusion temperatures are very likely to destroy the bacteria present in the feed.

MYCO-AD® CHARACTERISTICS

MYCO-AD® is a natural, broad spectrum mycotoxin adsorbent. **MYCO-AD®** is a combination product of 2 bipolar silica clays (HSCAS), belonging to the ilite/chlorite group, within the non-hydrated mica group. This positive/negative charge combination allows for more effective mycotoxin retention, and for a broader spectrum of action. After mycotoxin binding, the complex resulting from the reaction of both substances passes with the feces, therefore decreasing or eliminating their toxicity.

CHARACTERISTIC	MYCO-AD®	ADVENTAGES
Cationic Exchange Capacity (CEC)	34.58 - 39.89 mEq	Improved mycotoxin retention after entering the small intestine.
pH	7.4 - 7.9	Improved mycotoxin retention in the stomach (acidic pH).
Drying temperature	115 – 120° C for 25 - 30 minutes	Clay activation. Pasteurization destroys pathogens, thus preventing any potential contamination.
Expansibility	No	Does not absorb nutrients or water.
Electric charge	Positive & Negative	Adsorbs both polar and bipolar mycotoxins (broader spectrum).
Clay type	Phyllosilicate	More surface area / more space for mycotoxin binding.
Particle size	35 a 50 microns (300-400 mesh)	Allows for a larger mycotoxin binding surface area.

LESIONS CAUSED BY DIFFERENT MYCOTOXINS IN CHICKENS

Photo 1. Oral ulcers in a hen caused by T-2 Toxin.

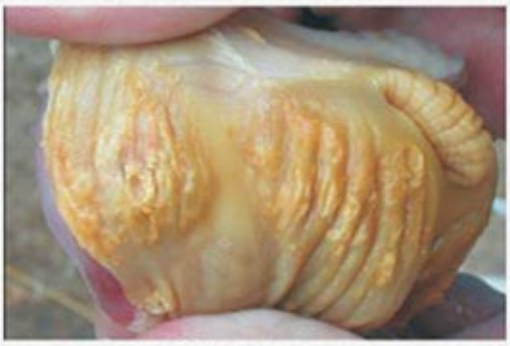


Photo 2. Gizzard erosion caused by T-2 Toxin, DAS or MAS (Trichothecenes).

Photo 3. Enteritis caused by T-2 Toxin.

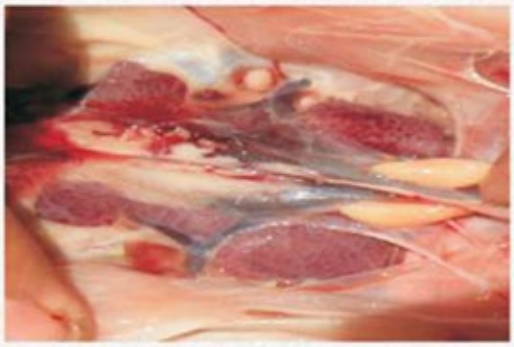


Photo 4. Hemorrhagic and swollen kidneys caused by Ochratoxin.

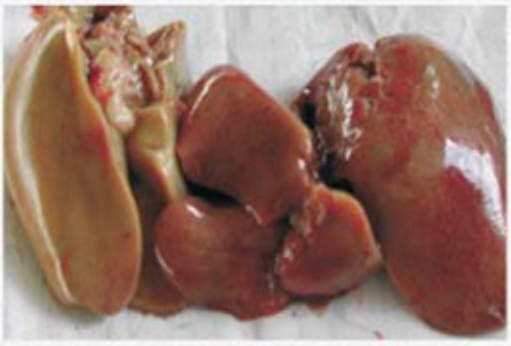


Photo 5. Pale liver affected by Aflatoxin (left). Normal liver (right).

Photo 6. Capillary fragility caused by Aflatoxin.

MYCO-AD®

DESCRIPTION

MYCO-AD® is an activated, broad spectrum, hydrated, sodium/calcium aluminosilicate (HSCAS), specially formulated to adsorb and retain all major mycotoxins affecting poultry health and productivity.

COMPATIBILITY

MYCO-AD® is compatible with all feed ingredients. **MYCO-AD® does not affect or adsorb** any of the feed components (amino acids, vitamins, minerals, antibiotics, coccidiostats).

DOSE RATE

2.5 kg per metric ton of feed.

CHARACTERISTICS

Cream-colored, fine powder.

APLICATION

Add **MYCO-AD®** to the mixer, together with all other feed ingredients. Mix homogeneously.

PACKAGING

25 kg bag. Four-ply bags (three paper plies and one inner plastic ply).

MYCO-AD®

The effective solution
to control the
immunosuppressive
effects of mycotoxins

Scientific Dose = **2.5 Kg / TM** = Commercial Dose

All over the world

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THE MYCOTOXINS SPECIALIST

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