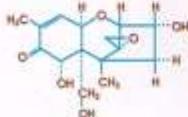


MINGFIX

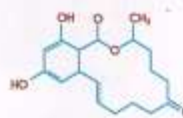
The Proven Mycotoxin Adsorbent
that binds and diminishes the adverse effects of mycotoxins



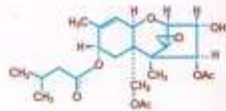
Aflatoxin B1



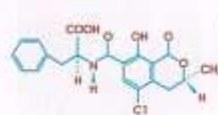
Vomitoxin



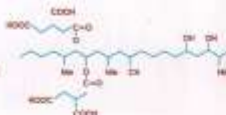
Zearalenone



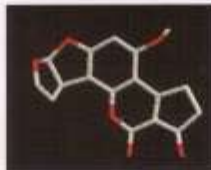
T-2 Toxin



Ochratoxin A



Fumonisin



Aflatoxin B1



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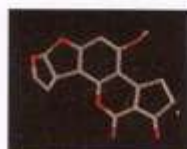
MINGFIX

A Multi-Modular Approach To Overcome Mycotoxin Problems

MYCOTOXINS-----A GLOBAL PROBLEM

Mycotoxins are toxic secondary metabolites produced by actively growing molds. The occurrence of mycotoxins in cereal grains and animal feeds has become a major health concern for livestock and poultry on a worldwide basis. Mycotoxins can be found all along the food chain. Mycotoxins in contaminated feeds are ingested by animals, and can be carried over to milk, egg and edible animal tissues. Other fungal associated toxins have been identified in forages such as endophytes fungal infections in dairy and beef cattles grazing on tall fescue or ergot alkaloid in sorghum.

The most prevalent mycotoxins are aflatoxin, fumonisin, citrinin, vomitoxin (DON), T-2 Toxin, zearalenone, ochratoxin, etc.



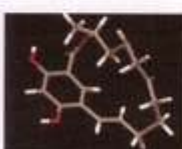
Aflatoxin B1



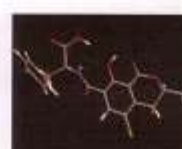
Vomitoxin (DON)



T-2 Toxin



Zearalenone



Ochratoxin



Fumonisin

ECONOMIC IMPACT OF MYCOTOXINS

Mycotoxins have significant economic and commercial impact. Firstly, nutritive value of ingested cereals and forages is affected—crude protein, crude fat and metabolizable energy of the contaminated feeds are reduced. In farm animals, including lactating and growing cattle, pigs and poultry, mycotoxins reduce feed intake, depress growth rate, reproductive rate, growth efficiency, immunological defences and promote diarrhea and permanent damages to the liver and kidney.

All levels of mycotoxins should be considered dangerous since even small amounts of mycotoxins have a detrimental effect on the immune system and metabolism, thus posing a continuous threat to human and animal health.

GENERAL SYMPTOMS OF MYCOTOXICOSIS AND DIAGNOSIS TIPS:

- * Many symptoms are vague, eg. low efficiency in vaccines, antibiotics and other therapeutics.
- * Increased variation in a group (some animals greatly affected, some unaffected)
- * Non-transmittance through herd.
- * Symptoms build gradually.
- * Depressed feed intake and feed rejection.
- * Poor growth rate and milk production.
- * Antibodies cannot be passed on from breeder and sow to offspring.
- * Diarrhea/bloody diarrhea without fever.
- * Increased incidence of miscarriage in various stages of gestation.
- * Immuno-suppression and impaired immune function.
- * Jaundiced animals (check eyes for yellow tint)
- * Rough-looking coats, especially in young pigs.
- * Pigmentation of egg yolk and skin is affected.



SYMPTOMS OF MYCOTOXICOSIS

POULTRY

A. By Aflatoxin :



Hepato - Nephrosis of kidneys and liver.



Acute Nephrosis-enlarged kidney in chick.



Enlarged and inflamed liver with lesion



Discolored pale kidneys and liver.



Acutely inflamed duodenum



Nervous syndrome

B. By Ochratoxin :

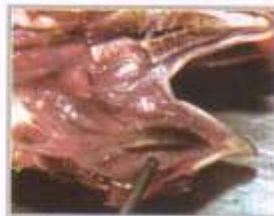


Haemorrhages of kidney

C. By T-2 Toxin :



Oral lesions



Oral lesions



Impeded Growth

D. By Sterigmatocystin :



Impaired feathering

SWINE

A. By Zearalenone :



Edema of vulva



Vulvovaginitis

B. By T-2 Toxin :



Dermal lesions



Subcutaneous petechial haemorrhages.

HOW DOES MINGFIX WORK ?

Biofeed Ras has developed **MINGFIX** with advanced biotechnology which provides a multi-modular system to effectively overcome mycotoxin problems: *By effectively binding and lessening the effects of mycotoxins.*

MODULE 1

1. MYCOTOXIN BINDING :

The two key ingredients are **Clinoptilolite** and **Esterified Glucomannan** extracted from cell wall of *Saccharomyces cerevisiae* Yeast. The synergistic blending of these 2 mycotoxin binders provides the most effective and broad spectrum adsorption of all prevalent mycotoxins.

A. CLINOPTILOLITE :

Effective in adsorbing polar mycotoxins –eg. aflatoxins

Clinoptilolite is a hydrated aluminosilicate of volcanic origin possessing a tridimensional structure of silicon tetrahedra. It is one of the most useful natural zeolites. Clinoptilolite is well suited to bind mycotoxins due to its large amount of pore space, high resistance to extreme temperatures and

SPECIAL FEATURES OF MICROBOND'S CLINOPTILOLITE :

i. INCREASED ADSORPTION CAPACITY :

The clinoptilolite in **MINGFIX** has undergone a special patented activation manufacturing process. The clinoptilolite is purified by extracting essentially all the non-clay fractions that interfere in the adsorption of mycotoxins. By eliminating these non-essential fractions, the individual layers are more exposed, therefore, the purified clinoptilolite has a high total surface area (45-60 m²/g) and a large internal pore volume (0.34 cm³/g) to bind the mycotoxins in the 3 to 6 microns size.

ii. INCREASED ADSORPTION EFFICIENCY :

The purified clinoptilolite also has more angles where the electrical charges of clinoptilolite can coincide with electrical charges of mycotoxins. Thus the mycotoxins be effectively and tightly bound. The large inner surface and pore sizes of appropriate pore diameter are specially adapted to bind mycotoxins with dipolar functional groups, such as aflatoxins, thus not only the adsorption capacity is increased, but also the efficiency of the adsorption is improved.

The adsorption process for mycotoxins is irreversible, once the mycotoxins are adsorbed by clinoptilolite in MINGFIX they are excreted through the feces, therefore the mycotoxins do not affect the animals.

iii. BINDING OF AMMONIA:

The porous structure of clinoptilolite (pore volume 0.34 cm³/cm³) and its high Cation Exchange Capacity for ammonia (CEC= 150 meq/100 g) allow clinoptilolite to heavily bind ammonia. The incorporation of clinoptilolite in animal feeds binds excess ammonia and favor an optimisation of the performance of intestinal beneficial microflora. This reduces ammonia gas levels and other odors in the organic waste of animal and the environment.



Mycelium producing fungi

iv. PREVENTING FORMATION OF WET SPOTS AND MOISTURE MIGRATION IN FEED SILO AND BINS:

Clinoptilolite's superior flow and anti-caking properties prevents the interruption of feed in bulk handling system, therefore pockets of wet spot which favor mold growth are not formed.

MINGFIX 'S' clinoptilolite selectively binds mycotoxins but does not bind drugs, vitamins and minerals, including phosphorus. This is because clinoptilolite is a non-expandable clay. The electrical charges are more exposed on the surface and clinoptilolite reacts with extreme reactive/radical dipolar substances, such as mycotoxins. Other substances in feed such as vitamins, minerals, etc. have electrical dipolar charges but these molecules are not as reactive/radical as mycotoxins, that is why they are more difficult to be adsorbed by clinoptilolite.



Electron microscope picture of clinoptilolite.



Clinoptilolite has large amount of pore space.



Clinoptilolite has superior flow and anti-caking properties.

B. ESTERIFIED GLUCOMANNAN EXTRACTED FROM CELL WALL OF SACCHAROMYCES CEREVISIAE YEAST.

Broad spectrum: Effective in adsorbing both polar and less polar mycotoxins--eg. zearalenone.

Glucomannan is a functional carbohydrate extracted from the cell wall of *Saccharomyces cerevisiae* Yeast. The structure of esterified glucomannan consists of large surface containing pores of many different sizes that physically trap or adsorb many types of mycotoxin, irrespective of their polarity. Therefore it is a broad spectrum mycotoxin binder. It can bind polar aflatoxin, less polar zearalenone, vomitoxin, ochratoxin, fumonisin, T-2 toxin, etc.

* 1 g Esterified Glucomannan contains 3 x 10¹⁰ particles of esterified glucomannan.

SPECIAL FEATURES OF ESTERIFIED GLUCOMANNAN :

- Broad spectrum - bind all mycotoxins.
- Will not bind drugs, vitamins and minerals.
- Much larger surface area than other varieties of common clay and zeolitic minerals, inclusion is only 1/8 of these common clay minerals.
- Not affected by pH range in the G-I tract.



MODULE 2

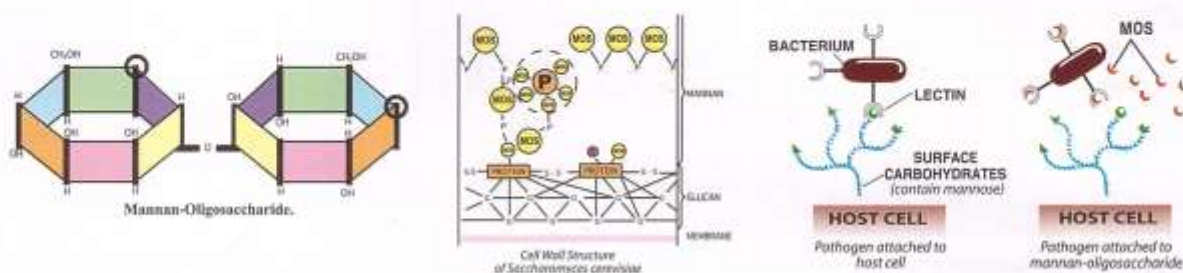
2. ENHANCING IMMUNE SUPPORT

Mycotoxins can cause immune suppression, the inclusion of the following immuno-stimulants in **MINGFIX** effectively enhances immune support.

A. Mannan-Oligosaccharides :

Mannan-Oligosaccharides are natural complex carbohydrates. They serve as a substrate for selectively enhancing the growth of specific beneficial lactic-acid producing bacteria that out-compete and suppress the colonization of pathogens. Pathogens lack the enzymes that can digest mannan-oligosaccharides, they cannot multiply and are starved to death.

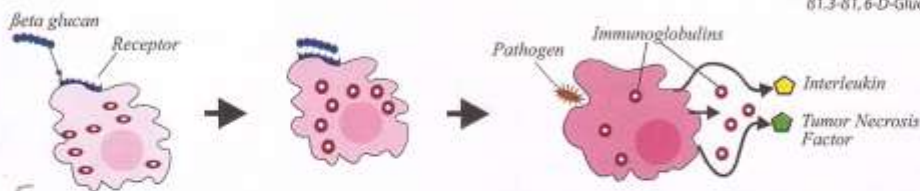
Mannan-Oligosaccharides can prevent pathogens from binding to the mucosal wall of the G-I tract, they will be flushed out of the animal.



B. β 1,3- β 1,6-D-Glucans :

These natural immune cell activator polysaccharides have a broad spectrum of immunopharmacological activities. By activating the large immune system cells called macrophages, these beta-glucans can increase non-specific host resistance to a variety of bacterial, fungal, parasitic infections due to mycotoxicosis.

* Both Mannan-Oligosaccharides and Beta-Glucans are derived from the fermentation of three beneficial micro-organisms: *Paecilomyces* sp., *Saccharomyces cerevisiae* yeast and *Ganoderma lucidum* (reishi mushroom). Mannan-Oligosaccharides are extracted from the outer cell wall and beta-glucans are extracted from the inner cell wall.



Paecilomyces sp.: Beneficial fungus which can produce β 1,3- β 1,6-D-Glucan.



Macrophage trapping & engulfing viruses.



Fermenter: For the production and extraction of β 1,3- β 1,6-D-Glucan.



Macrophage communicating with T-cell



Macrophage attacking bacteria.

C. Colostrum :

Colostrum is the first milk secreted by the cows for the few hours after calving and is very rich in powerful immune factors (Immunoglobulins, Lactoferrin, Leucocytes, Cytokines, Interferon, Lactalbumin, Lysozyme, etc). These important immune and growth factors help to promote healing and prevent pathogenic infections due to mycotoxicosis.

These three natural ingredients strengthen the animal's natural immune responses and compensate the immuno-suppressive effects of mycotoxins.

* Colostrum is not added to **MINGFIX** formulated for poultry diets.



Colostrum

MODULE 3

3. PROLIFERATING BENEFICIAL MICRO-ORGANISMS :

Saccharomyces cerevisiae Yeast, micro-encapsulated *Lactobacillus acidophilus*, *Lactobacillus casei*, *Bacillus subtilis*, *Bacillus licheniformis* and *Streptococcus faecium* are included in **MINGFIX** at effective levels to replenish essential microflora and decrease the incidence of gastrointestinal disorders. These beneficial micro-organisms can actively prevent pathogenic bacteria from settling in the intestinal tract by competitive exclusion. By doing so, **MINGFIX** reduces the number of negative interactants which increase the adverse effects of mycotoxins and creates a growth promoting effect even in the absence of mycotoxins.

Beneficial bacteria that can feed on mannan-oligosaccharides.



Saccharomyces cerevisiae yeast



Lactobacillus acidophilus



Lactobacillus within the gut



Bacillus subtilis



Bacillus subtilis form stable endospores



Microencapsulated *Streptococcus faecium*



MODULE 4

4. MAXIMIZING FEED UTILIZATION AND REDUCING ANIMAL WASTE :

MINGFIX includes a high potency of multiple digestive enzymes. Feed digestion is the key to successful animal performance.

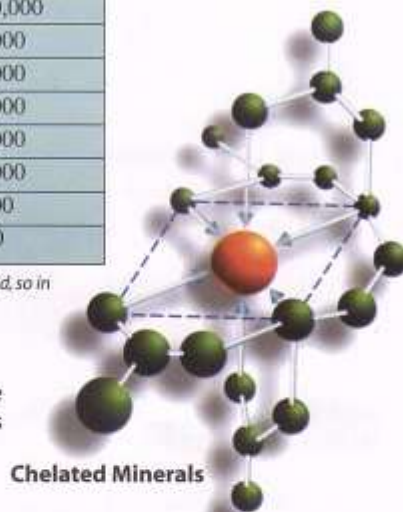
A. DIGESTIVE ENZYMES :

ENZYME	SUBSTRATES	AVAILABLE NUTRIENT	UNITS / KG
Amylase	starch, glycol	sugar	min. 10,500,000
Protease	protein	amino acids	min. 1,000,000
Cellulase	cellulose	sugar	min. 480,000
Lipase	fat	fatty acid, glycerol	min. 300,000
Pectinase	pectin	galacturonic acid	min. 200,000
Xylanase	pentosan	sugar	min. 140,000
β -glucanase	β -glucan	sugar	min. 140,000
Lactase	lactose	sugar	min. 10,000
Phytase	phytic acid	inositol, phosphorus	min. 0 - 70

* The use of phytase in ruminant diets is not warranted since rumen microbes are capable of hydrolyzing phytic acid, so in ruminant formulation, no phytase is added but extra cellulase is incorporated.

B. CHELATED AND ORGANICALLY BOUND MINERALS :

Chelated minerals are more bioavailable enabling the highest possible digestive efficiency. Minerals are linked to an amino acid carrier where they are 'escorted' across the stomach with great efficiency.



SPECIAL FEATURES OF Biofeed Ras' CHELATED MINERALS :

- Glycine is the organic chelating agent for the minerals. Glycine is the smallest amino acid with a molecular weight of 75, this ensures fast and complete absorption by the animals.
- Biofeed Ras'** chelated minerals contain a high percentage of simple amino acid complexes and has less insoluble proteins than found in other products. Together with a lower average molecular weight, it features a higher dispersion plus consistent blending and uniformity throughout the feed.

IRON:	immune function, vitamin formation & reproduction.
COPPER:	enzyme activation, blood formation, reproduction, gestation & lactation.
ZINC:	boosts immune and enzyme function, cell formation & wound repair.
MANGANESE:	essential for healthy bone and cartilage formation, growth & fertility.

MINGFIX vs. MTB-100

* MTB-100 is also known as MYCOSORB

The data below dramatically demonstrated the superior performance of **MINGFIX** when compared to MTB-100 in binding Aflatoxin B1.

* Aflatoxins are the most prevalent and economically the most important mycotoxins in the world. Aflatoxin B1 (Afb1) is the most acutely toxic and hepatocarcinogenic of the 16 naturally occurring aflatoxins. In the United States, aflatoxins are the only mycotoxins that are formally and specifically regulated.

In Vitro Percent Toxin Bound				
	MINGFIX	MTB-100	MINGFIX	MTB-100
Aflatoxin B1	pH As Is		pH 7	
Mixed overnight	87.0	3.8	89.4	38.0
Mixed 2 hours	78.4	34.0	-	-

This trial was performed in August, 2003 by Dr. Winston M. Hagler, Jr., Ph.D, Professor and Mycotoxin Laboratory Director, Department of Poultry Science, College of Agriculture and Life Science, North Carolina State University, Raleigh, North Carolina, U.S.A.

MINGFIX'S BINDING ABILITY FOR VARIOUS MYCOTOXINS

MINGFIX has been shown in-vitro to have a high adsorbency for various mycotoxins. The following tests show the binding of **MINGFIX** in contaminated feeds.

MYCOTOXIN	Percent Bound	Level
Aflatoxin B ₁	100%	3.5 ppm
Fumonisin B ₁	100%	2.4 ppm
Fumonisin B ₂	88%	2.4 ppm
Citrinin	99%	2.5ppm

MYCOTOXIN	Percent Bound	Level
Vomitoxin (DON)	80%	7.0 ppm
T-2 Toxin	75%	2.5 ppm
Zearalenone	65%	4.5 ppm
Ochratoxin	80%	0.125 ppm

SPECIAL FEATURES OF MINGFIX:

- Provides a multi-modular system to deactivate mycotoxins.
- A unique combination of clinoptilolite and esterified glucomannans, provides a broad spectrum mycotoxin binder from aflatoxin to zearalenone.
- Low inclusion rate in feed will not tie up other nutrients and additives.
- Rapid and uniform dispersion in the feed during mixing.
- Heat stability during pelleting, extrusion and during storage.
- No affinity for vitamins, minerals or other nutrients.
- High stability over a wide pH range.
- More bio-degradable than other clay-based mycotoxin binders.
- Contains unique blend of prebiotics and probiotics to strengthen the animal's immune response and compensate the immuno-suppressive effect of mycotoxins, fight back before illness develops.

BENEFITS OF MINGFIX :

- Enhances immunity
- Eliminates Feed Rejection
- Improves Feed Efficiency



POULTRY :

- Improvement of egg shell quality—weight, yolk color and shell thickness.
- Increased egg production and hatchability.
- Improved shank and skin color.
- Reduced mortality.
- Lower incidence of bruises and haemorrhages. healthier day old chick.
- Decreases immuno-suppressive problems.

SWINE :

- Improved feed intake and weight gain.
- Cure for fertility problems.
- Prevention of reduced litter size.
- Higher birth weights and better survival rate.
- Prevention of diarrhea.
- Improved feed intake.



RECOMMENDED RATE OF USE



Level of Feed Contamination	Per Ton Of Feed
High	1.0 - 2.0 kg
Medium	0.7 - 1.5 kg
Low	0.5 - 1.0 kg



High	1.0 - 2.0 kg
Medium	0.4 - 0.8 kg
Low	0.2 - 0.5 kg



Total Mixed Ration (TMR)

High	1.0 - 2.0 kg
Medium	0.7 - 1.0 kg
Low	0.5 kg

(or 10 - 15 g /head /day.)

For contaminated feed, a low fat and high quality protein ration containing 30 - 40% methionine above NRC value and higher vitamin C inclusion can effectively reduce mycotoxin damages to livers and kidneys of animals.



MINGFIX is carefully researched and formulated to avoid any ingredient which will negate the effect of others. We use organically bound chelated minerals to avoid reducing the viability of microbials. All ingredients are included at effective levels with the animal's needs and requirement evaluated. **MINGFIX** is targeted to improve the farm's profitability through optimization of digestion and reproductive functions.

MINGFIX is university tested, veterinarian recommended and used by animal nutritionists. All ingredients used are non-toxic and generally regarded as safe. The ingredients meet all requirements of the American Association of Feed Control Officials, Inc. (AAFCO) as listed in their current edition.



BIOFEED RAS' Natural Products Guide

- | | |
|-------------|------------------------|
| 1. LIVEBIOS | 6. RASMOS |
| 2. MINGFIX | 7. RASACID-WAY |
| 3. BIOLAC | 8. BIOFLEX4-MIX |
| 4. BIOODOR | 9. BIOSE |
| 5. RASZYME | 10. RAS PHOSZ YME 1000 |

All **BIOFEED RAS** products comply with GMP specifications and strict QC/QA regulations. **BIOFEED RAS** products' field efficacy is proven day after day in more than forty countries.

Physical and Chemical Characteristics

Appearance	: light to medium brown powder
Odor	: strong pleasant yeast aroma
Characteristics	: slightly hygroscopic with a solubility of approximately 8 - 9 grams per 100ml of water.
Packaging	: Are packed in 25 kg net weights multi-layer paper bags with inner polyethylene lining.
Storage	: Store in dry cool place away from heat and direct sunlight. Keep partially opened bags tightly closed when not in use.
Stability	: 18 month in original factory package.

