UNIVERSITEIT GENT

FACULTEIT DIERGENEESKUNDE
approved by EAEVE

Field study to identify frequently used mycotoxin detoxifiers in Belgium

T. De Mil[1], M. Eeckhout[2], E. Van Ranst[3], P. De Backer[1] and S. Croubels[1]

[1]Department of Pharmacology, Toxicology and Biochemistry, Faculty of Veterinary Medicine, Ghent University, Salisburylaan 133, 9820 Merelbeke, Belgium. [2]Department of Food Science and Technology, Faculty of Applied Bioscience Engineering, Ghent University College, Valentin Vaerwyckweg 1, 9000 Ghent, Belgium. [3]Department of Geology and Soil science, Faculty of Science, Ghent University, Krijgslaan 281, S8, 9000 Ghent, Belgium

Products on the European market*

*results of internet research conducted May 2013

Active MOS
Adfimax
Agrabond
Agrabond
Fuzion
Agrabond Zea
AgriMOS
Agrotox
AlphaTox
Ammomin
andSORB
andSORB MOS
andTOTAL
Animasanum
Antaferm H25
MOS
Antaferm MT
Antaferm MT80
Ascogen
Astra Ben 20
Astri-PeC
ATOX
Bentonites
Betasacc
bgMOS
Biocell
Biolex MB40
Bionit S
Biosecure MP 362
Calibrin A
Calibrin Z
Captex
Captex Fusa
Captex T2
Detoxa plus
Elitox
Escent
Exal
F1- Natural
Fibosel
Fixar Bios
Fixar S
Fixar Viv
FloBond
Fra Bind
Fra MaxiBind
Freetox
Globafeed ap
Globafix
Grainsure E
Klinofeed
Klinosan
Klinosorb
Magnet
Mareguard plus
Mastersorb
Mastersorb fm
Mastersorb gold
Mastersorb premium
Mia Myco fit
Mia Myco bond
Microsafe max
Milbond TX
Min-a-zel plus
MMi.S
MT X+
MT.x+
Myco-Ad A-Z
Tox Free
CoBind AZ
Mycoad ZT
Mycobond
Mycofix plus
Mycogen
Mycosal
Mycosorb
Mycotec
Mycozym
Neofeed
Neutox
Neutox
Novasil plus
Nutricell polysorb
Ocra-tox
Oligos
Plusbind
Plusbind bio
Prosid TB
Protease A-DS
Resindox
Rheintox
Safe
Safmannan
Solis
Solis MOS
Sorbatox
Sorbatox
Sorb-it
SPLF Elite
Starbind
Stop tox
T5X Bind
T5X Premium
T5X SD
Tonilys
Toxfin
Toxinor
Toxiroak Gold
Toxisorb
Toxo-MX
Toxtrap
Toxynil plus dry
Ultrabond
Ultrasorb
Ultrasorb
Ultrasorb
Unike plus
UT aflatrol
Vilocym z
Volclay
XPls Myco Bind
Zagribind
Zeofarm
Zeolex
Zeolita natural
Nutrica
Zeolite

Introduction

Contamination of feed with mycotoxins is a difficult problem to resolve. Application of good agricultural practices or the disposal of heavy contaminated lots is not always sufficient to guarantee feed safety since effects can occur even with very low levels of contamination. Therefore, other solutions are explored and the most popular is mixing special additives in feed. The additives used for this purpose can be divided into two groups: binders and modifiers. Binders aim to prevent the uptake of toxic compounds by adsorbing the toxins, binders are often clay minerals or yeast derived products. Modifiers aim to alter the chemistry of the toxins to reduce their toxicity and are often of microbiological origin. They comprise whole cultures of bacteria or yeasts, as well as specifically extracted enzymes.

The procedure for registration is only a minor threshold to market these products as they are registered as technical additives, feedstuff or digestibility enhancer. Furthermore, these products gain popularity because they are relatively cheap compared with other options such as replacing the feed reserves. The increasing popularity attracts new entrants to this market and results in many new materials, combinations and rebranded products, contributing to the complexity of this industry. In addition, Belgian and European legislation does not require full transparency with regard to the content of the additives. Registers of the use and content of these products are not available, which makes it difficult to identify the most used compounds. However, identifying and characterizing these compounds is necessary to ensure quality and transparency in the food chain (EFSA, 2010).

In addition to the regulatory and economic hurdles, chemical ambiguities also contribute to the problem of identifying and characterizing mycotoxin binders and –modifiers. This is especially the case when clays are used as an ingredient, which is often the case in the available products. Literature on clays used as feed additive indeed suggests a large variability in the composition of the material, resulting in vague specification and misunderstandings, this results in difficulties in identification and comparing results with literature data. This study will identify and characterize the most relevant products used to prevent problems caused by mycotoxin contamination.

Materials and methods

Mycotoxin binders and modifiers on the European market were identified using internet and literature research, experts indicated the most popular products in Belgium. Cation exchange capacity was determined using the ammonium acetate (pH=7) displacement method, exchangeable cations were quantified using Inductively Coupled Plasma analysis. Mineral and moisture fraction was determined gravimetrically with the aid of a muffle furnace. XRD diffractograms were made of dry powder-, oriented- and glycolysed samples of the different products.

Results

Products available on the European market are listed in the table on the left. As the market situations changes constantly, the exclusiveness cannot be guaranteed. Chemical and physical properties of the most popular products on the Belgian market are presented in the table below.

sample ID	commercial name	XRD result	HCl	CEC (meq/100g)	pH	Ca (ppm)	K (ppm)	Mg (ppm)	Na (ppm)	MF (%)	RH (%)
13-1633	Z	Zeolite	+	172,91	8,33	6748,97	40026,70	208,60	5652,64	94,40	4,58
13-1634	S	Sepiolite, smectite	+	31,87	7,73	2937,91		2448,29	293,90	96,01	8,65
13-1635	C	Clinoptilolite	-	120,32	7,65	3365,45		301,53	2347,45	97,69	4,93
13-1636	Z	Zeolite	-	413,51	10,31		13848,05	14,38	83531,71	93,78	7,13
13-1637	L	Humic substance, quartz	-	185,88	4,19	2877,02		861,93	4406,99	15,77	10,64
13-1638	B	Mixed layer montmorilloniet, Quartz	-	51,00	7,70	3996,71	4173,13	940,39	5018,19	78,62	3,37
13-1639	B	Montmorillonite	++	82,91	9,76	5000,96		994,58	14662,98	97,14	10,06
13-1640	B	Montmorillonite	-	100,47	3,72	7710,53	710,11	752,32	185,54	95,94	13,32
13-1641	H	Sepiolite, Montmorillonite, Quartz (t), Dolomite (t), Albite (t)	+	39,33	8,24	3300,90	234,95	2554,22	138,44	96,30	5,36
13-1642	F	Montmorillonite, Sepiolite, Quartz (t), Calcite (t)	++	56,72	8,45	6755,45	218,16	1993,62	6174,33	96,93	9,08
13-1643	B	Montmorillonite, Quartz (t), Calcite (t), Feldspars (t)	++	64,14	9,31	7860,67	1179,16	1670,62	12489,22	98,27	11,87
13-1644	H	Humic substance, quartz	-	166,35	4,39	514,42	4486,25	232,29	4237,77	5,95	12,40
13-1645	H	Sepiolite, montmorillonite, calcite (t), Quartz (t)	+	22,06	7,10	7107,06		2312,04	1002,91	80,30	6,73
13-1646	S	Montmorillonite	-	109,37	5,59	8707,81	6708,32	472,89	969,43	92,77	7,23
13-1647	M	Calcite, Dolomite, organic material	++	12,61	5,68	14212,53	7455,43	1037,69	5979,68	38,88	5,07
13-1648	C	Thenardite, Montmorillonite, Quartz, organic material		7,80	4,10	918,19	10183,13	1744,38	30301,18	27,35	6,39
13-1649	G	Montmorillonite	-	71,76	8,04	3813,56		681,18	11368,87	90,16	9,84
13-1650	N	Clinoptilolite	-	176,64	7,42	6073,69	17486,22	496,33	1377,93	96,27	4,72
13-1651	T	Quartz, Mica, Montmorillonite, kaolin	-	59,73	7,90	7252,38	732,00	2240,45	63,08	95,38	7,95
13-1652	T	Mica, Kaolin, Quartz, Montmorillonite	+	59,59	7,93	5757,73	968,51	2184,41	129,94	97,02	9,01
13-1653	A	Multi layered Smectite	+	23,66	9,86	5321,73		4791,38	10973,20	97,47	7,54
13-1654	N	Mica, Calcite, Smectite	+	77,95	7,98	13577,18	701,85	1029,19	200,29	88,65	11,35
13-1655	T	Montmorillonite, Sepiolite, calcite (t)	++	46,51	7,88	9696,29	543,24	1184,16	12698,21	92,66	7,34
13-1656	M	Montmorillonite, Mica, Feldspars	-	7,01	6,18	3245,97		823,59	1117,61	94,79	5,21
13-1657	M	Calcite, Montmorillonite (t)	++	26,08	6,62	22360,42	4170,13	601,16	2665,14	97,05	2,95
13-1658	M	Multi layered montmorillonite, Quartz, Feldspars	-	27,87	7,73	3726,40	558,62	646,02	1125,50	98,02	1,98
13-1659	N	Montmorillonite	-	111,74	9,50	3486,06	525,57	1007,28	15973,57	86,75	13,25

Characteristics of the most relevant mycotoxin binders and –modifiers on the Belgian market. 'HCl' indicates presence of chalc, 'CEC' is the Cation Exchange Capacity, 'pH' indicates the degree of acidity, 'Ca', 'K', 'Mg' and 'Na' indicate the amount of exchangeable ions of resp. calcium, potassium, magnesium and sodium, 'MF' indicates the fraction of mineral content, 'RH' stands for Relative Humidity, '(t)' indicate trace amounts of the compound.

Future outlook

Chemical and physical properties of the mycotoxin binders and modifiers will be linked to literature data on the efficacy and safety of these products in a review study. Factorial analysis will be used to identify the main properties indicative for binding or modifying mycotoxins as well as veterinary drugs.

References

[EFSA]European Food Safety Authority. 2010. Statement on the establishment of guidelines for the assessment of additives from the functional group 'substances for reduction of the contamination of feed by mycotoxins'. EFSA J.8:1693

Acknowledgements

The financial support of the Federal Public Service Public Health and Food chain safety is gratefully acknowledged

MYTOX www.mytox.be