



EMAN BULLETIN

Winter 2011

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BIOMIN:

BIOMIN's Mycotoxin Survey – Quarterly Report

by Karin Nährer

BIOMIN, the leader in Mycotoxin Risk Management, is proud to present to you the results of mycotoxin analyses for the third quarter of 2011.

This data will enable you to assess the risk level incurred by the use of commodities from certain regions. In the period between July and September 2011, a total of 1360 samples were analyzed and 4774 analyzes were carried out for the most important mycotoxins in terms of agriculture and animal production – aflatoxins (Afla), zearalenone (ZON), deoxynivalenol (DON), fumonisins (FUM) and ochratoxin A (OTA). Samples were originated from different regions: America (North and South), Asia (South-East, South and North), Oceania and Europe (Northern, Central and Southern) and Middle East and Africa.

Samples tested were diverse, ranging from cereals such as corn, wheat, barley and rice to processing by-products, namely soybean meal, corn gluten meal, dried distillers grains with soluble (DDGS) and other fodder such as straw, silage and finished feed. This is the third of 4 reports to be released this year. If this information is useful for you, make sure you do not miss the others: register and subscribe to the quarterly Mycotoxin Survey Report at <http://www.biomin.net/en/register/>.

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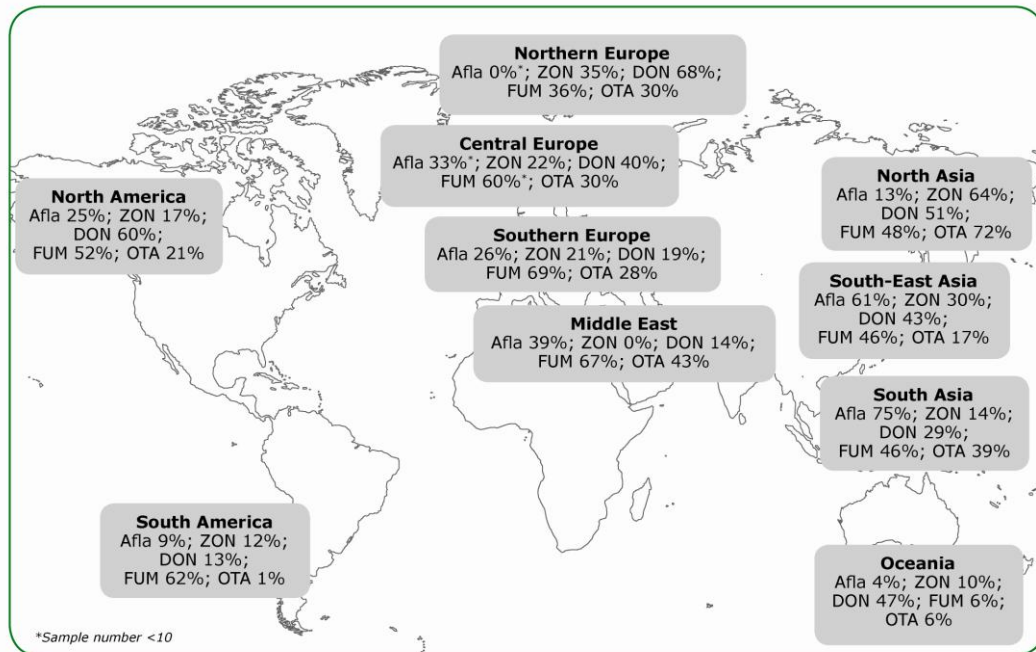


Figure 1: Prevalence of mycotoxins in different geographic regions according to percentage of positive samples

As can be observed in Figure 2, from the 804 survey samples analyzed 24%, 31%, 48%, 50% and 18% tested positive for contamination with Afla, ZON, DON, FUM and OTA, respectively.

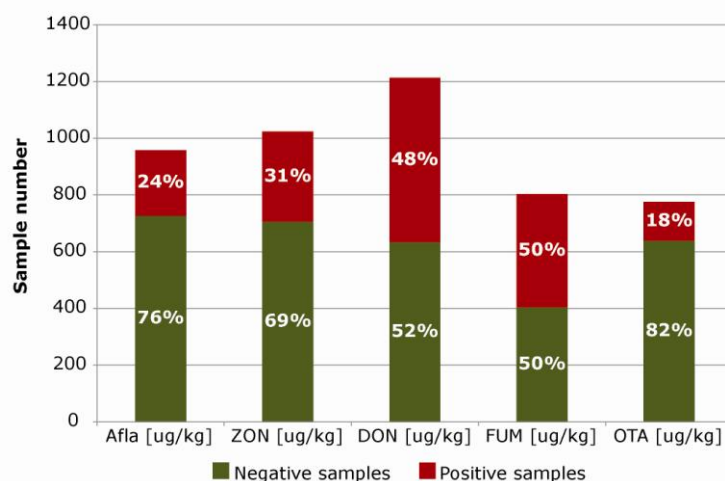


Figure 2: Global occurrence of mycotoxins between July and September 2011 in the analysed samples

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From Figure 3, it is obvious that mycotoxins are a ubiquitous problem as 89 % of the analyzed samples show the presence of, at least, one mycotoxin. The presence of more than one mycotoxin in 35 % of the samples raises the attention to the problem of synergistic effects caused by multiple mycotoxins in animal feeds.

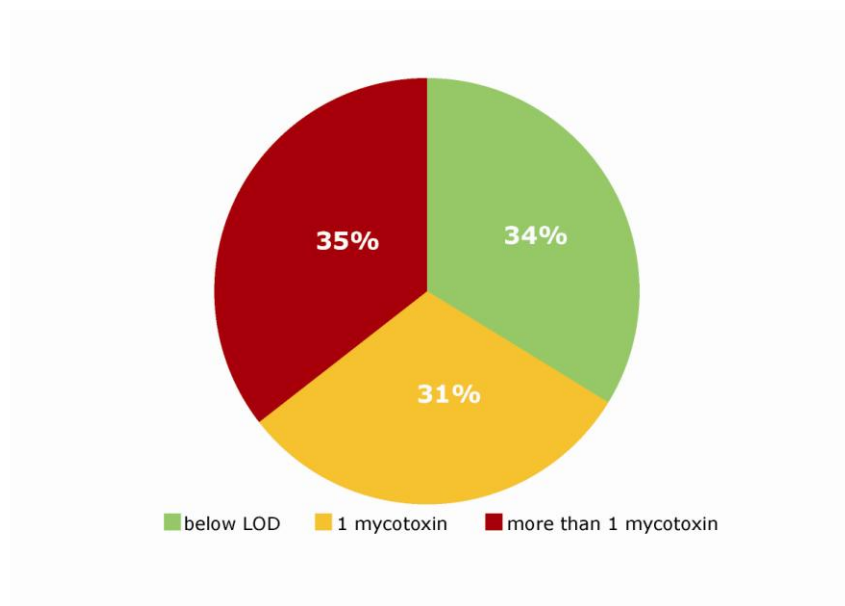


Figure 3: Global co-occurrence of mycotoxins

Tables 1 to 5 present an overview of the survey with details on analyzed samples. Number of samples tested, percentage of positive samples, average of positive, 75th percentile and maximum levels found are shown. 25 % of the tested samples fall at levels equal to or above those represented by the 75th percentile figure.

Table 1 - 5: Mycotoxin analysis results by different regions

Asia Total	Afla	ZON	DON	FUM	OTA
Number samples tested	497	504	511	448	451
Positive [%]	29	45	64	43	22
Average [µg/kg]	19	139	644	721	1
Maximum [µg/kg]	2230	7446	41439	18503	85
75 th percentile [µg/kg]	40	232	875	1618	3

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Europe Total	Afla	ZON	DON	FUM	OTA
Number samples tested	32	217	375	53	45
Positive [%]	25	24	42	55	29
Average [$\mu\text{g}/\text{kg}$]	1	35	505	435	2
Maximum [$\mu\text{g}/\text{kg}$]	6.6	1546	25759	3558	31
75 th percentile [$\mu\text{g}/\text{kg}$]	5	126	1337	1307	9

North America	Afla	ZON	DON	FUM	OTA
Number samples tested	206	88	113	89	65
Positive [%]	25	17	60	52	22
Average [$\mu\text{g}/\text{kg}$]	17	14	499	555	1
Maximum [$\mu\text{g}/\text{kg}$]	416	152	19919	12900	18
75 th percentile [$\mu\text{g}/\text{kg}$]	87	99	300	700	3

South America	Afla	ZON	DON	FUM	OTA
Number samples tested	191	167	165	191	151
Positive [%]	9	13	15	62	1
Average [$\mu\text{g}/\text{kg}$]	0	17	40	843	0
Maximum [$\mu\text{g}/\text{kg}$]	3	534	782	6920	10
75 th percentile [$\mu\text{g}/\text{kg}$]	1	166	363	1922	10

Middle East	Afla	ZON	DON	FUM	OTA
Number of samples tested	31	21	21	21	21
Positive [%]	39	0	14	67	43
Average of positive [$\mu\text{g}/\text{kg}$]	1	0	46	298	2
Maximum [$\mu\text{g}/\text{kg}$]	16	0	408	3727	18
75 th percentile [$\mu\text{g}/\text{kg}$]	2	0	357	256	8

BIOMIN GmbH and the authors had no influence on the sampling process of the investigated samples. Therefore, the contamination levels found in the samples do not necessarily reflect the actual contamination level of these regions / commodities. However, the samples provide more insight into the range and levels of mycotoxins which can be found in diverse commodities of various regions.



ALLTECH:

Low Levels of Vomitoxin Can Affect Gene Expression in Poultry

Swamy Haladi, DVM., PhD

Global Technical Manager

Mycotoxin Management Team, Alltech

Vomitoxin (Deoxynivalenol, DON) is by far the most common mycotoxin detected in animal feeds and feed ingredients on a global scale. This is particularly true for European and North American regions due to cooler growing seasons. DON is one of several trichothecene *Fusarium* mycotoxins found in feedstuffs and its presence can indicate that several other mycotoxins may be in attendance. These can include 3-acetyl DON, 15-acetyl DON, T-2 toxin etc. For this reason it is more logical to carry out animal research using natural DON-contaminated feed rather than purified DON.

Commercial broiler chickens, laying hens, turkeys, and breeding hens have been studied for their susceptibility to the feeding of DON-contaminated grains. The EU guidance value for maximum DON concentration in poultry feed is 5ppm.

Turkeys: This is the most sensitive poultry species to DON-contamination. The feeding of lower concentrations of *Fusarium* mycotoxins (2.2 ppm DON) reduced growth rates, elevated blood uric acid levels and caused immunosuppression (Girish et al., 2008a, 2010). This was coupled with morphological changes in the small intestine (Girish and Smith, 2008) and changes in brain neurochemistry (Girish et al., 2008b). Under commercial conditions turkeys can be sensitive to DON even at levels lower than 2ppm.

Commercial laying hens: Layers are susceptible to the feeding of DON-contaminated grains due to their chronic exposure as well as for the increased use of byproducts in their diets (Chowdhury and Smith, 2004). Their subsequent study also revealed a reduction in liver protein synthesis in laying hens exposed to DON. An increased serum uric acid concentration was the hallmark of DON toxicity in all poultry species tested.

Broiler Breeders: The feeding of DON-contaminated feed to broiler breeders significantly reduced hatchability due to reduced shell thickness of fertile eggs (Yegani et al., 2006a). Changes in brain neurochemistry were also observed (Yegani et al., 2006b). In a parallel study with broiler breeder pullets, immunosuppression (Girgis et al., 2008) and delayed coccidiosis recovery (Girgis et al., 2010) was noted when birds were fed *Fusarium* mycotoxins.

Broiler chickens: Broilers tend to tolerate higher concentrations of DON. This may be due to short duration of exposure, poor bioavailability of DON and rapid elimination from the body. Unlike many of the research papers, Swamy et al. (2002) reported linear decrease in feed intake and weight gains in broiler chickens fed low (6ppm) and high (9.5ppm) levels of DON from contaminated grains. Alterations in biliary immunoglobulin concentrations were also reported. The researchers concluded that although it takes higher concentrations of DON to cause performance losses in broilers, the stress of commercial conditions may make them susceptible to even lower levels of DON in the field.

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Gene Expression Study on DON in Poultry (Dietrich et al., 2011):

Why it is needed?

It is very well known that DON affects cellular function at different levels. At the molecular level, it binds to the 60S ribosomal unit and subsequently inhibits protein synthesis at the translational level. However, very little is known about its impact at the transcriptional level, especially in production animals. Microarray analysis will assist in analyzing thousands of transcripts (mRNAs) in one experiment.

The evaluation of gene expressions in the liver and intestines gives the indications of functional mechanism of mycotoxins. Using these gene expressions, genes related to altered cellular uptake of nutrients, detoxification, altered protein synthesis rate, and DNA repair mechanisms could be detected. With the description of new pathways, a better understanding of the effects of DON on the metabolism of broiler chicks can be expected.

Objectives: Scientists from the Swiss Federal Institute of Technology evaluated the effects of feeding DON-contaminated wheat on the gene expressions of liver and jejunum in broiler chickens.

Key findings:

1. This *in vivo* animal study on the effects of DON on gene expression confirmed the results of several cell culture studies.
2. **DON affected genes related to nutrient absorption:**
 - a. Reduced passive D-fructose transporter (SLC2A5) expression in liver (2.5ppm) and jejunum (2.5/5ppm). The numerical decrease in AME (5.9%) may support this further.
 - b. Increased amino acid transporter (SLC7A10) expression in liver (5ppm) and jejunum (5ppm). The numerical decrease in nitrogen retention (9%) further supports increased amino acid uptake.
 - c. Nutrients affected: D-glucose/D-fructose, palmitic acid, monocarboxylates, L-serine, leucine and other amino acids.
3. **DON affected genes related to protein synthesis and growth:**
 - a. DON altered translation initiation-related genes (EIF2AK3 and DNAJC3) and mRNA stabilization genes
4. **DON affected genes related to detoxification:**
 - a. DON decreased detoxification genes (AKR1B1) expression in liver (2.5/5ppm) and jejunum (5ppm).
 - b. Indicated that 2.21ppm DON may be enough to cause cytotoxic (cell damage) effects.
5. **DON affected genes related to immune response:**
 - a. DON down-regulated the expression of MIA2 gene which can ultimately reduce the amount of IL-6 in the liver. The end effect is imbalance in pro- and anti-inflammatory cytokines leading to unnecessary immune stimulation.
6. **DON affected genes that can induce mutagenicity:**
 - a. DON up-regulated DNA repair genes indicating its possible mutagenic effects.

Conclusions:

The genes related to growth, feed efficiency, immunity, detoxification, and mutagenicity can be significantly affected by feeding DON-contaminated grains to poultry. Some of those effects can be noticed at DON levels as low as 2.21ppm, which is lower than the EU guidance value of 5ppm limit for poultry. Moreover, under field conditions other nutritional, management and production-related stress factors may reduce the tolerance threshold of poultry to DON. Therefore, it is recommended to observe animals closely for the potential toxic signals rather than purely depend on the mycotoxin analysis results. The gene expression profiles of DON exposure may one day serve as biomarker for DON toxicity in livestock and poultry.

References are available upon request

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MERIDEN ANIMAL HEALTH LIMITED:



FUSION

Three pronged approach to Feed Safety

Mycotoxins are secondary metabolites produced by fungi. According to the FAO 25% of the world's grain crop is contaminated by mycotoxins. The impact of the mycotoxins will depend upon a number of factors including species, age, multiple mycotoxin contamination, stress factors affecting the animals and of course the intensity and frequency of contamination.

The Fusion Feed Safety range comprises of three cost effective products designed to suit individual circumstances. A blend of premium mineral binder, Beta-Glucan complex and Orego-Stim®, these products provide superior mycotoxin binding with additional benefits. The below products are all available in 25kg packs, for administration into the feed.



Fusion +OS is a unique combination product designed to reduce the negative impact of feed borne mycotoxins and maintain the animal's immune system integrity. It has strong antifungal, ammonia binding, anticaking properties and is a superior source of essential amino acids, vitamins and other fundamental nutrients.



Fusion Dyad is a product designed to minimise the negative effects of feed borne mycotoxins. It has excellent immunity boosting properties and will also bind pathogenic bacteria such as *Salmonella* and *E-coli*.



FUSIONMBX contains an extremely pure form of clinoptilolite, a naturally formed zeolite. It binds ammonia and aflatoxins efficiently without affecting vitamins, minerals or other nutrients in the feed.

Contact sales@meriden-ah.com for more information



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ANIMAL HEALTH



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Several countries have instituted Zearalenone and Fumonisin B1+B2 restrictions in foodstuffs. Member countries of the European Union have set maximum allowable levels of Zearalenone at 350µg/kg in unprocessed maize, 100µg/kg in maize for human consumption and 20µg/kg in maize based food for infants and young children and Fumonisin (B1+B2) at 4000µg/kg in unprocessed maize, 1000µg/kg in maize for human consumption, and 200µg/kg in maize based food for infants and young children (European Commission Regulation (EC) 1126/2007 [1]).

Several analytical methods have been developed for the determination of either Zearalenone or the Fumonisin. However, no method exists for the specific clean-up of Fumonisin **AND** Zearalenone prior to quantification. POLYINTELL has developed such a method.

To do so, we have developed a new class of intelligent polymers based on molecularly imprinted polymers specific to Zearalenone and Fumonisin. Molecularly Imprinted Polymer (MIP) is a synthetic material with artificially generated three-dimensional network able to specifically rebind a target molecule. MIP has the advantage to be not only highly selective and specific but also chemically and thermally stable, compatible with all solvents and cost-effective. This polymer is used as a powerful technique for clean-up and pre-concentration applications of Zearalenone and Fumonisin. This study describes the solid phase extraction of Zearalenone and Fumonisin from maize and maize-based baby food using a Molecularly Imprinted Polymer (MIP) SPE cartridge: [AFFINIMIP® SPE FumoZON](#).

Experimental conditions

Materials

All reagents and chemicals were ACS grade quality or better. Zearalenone was obtained from Sigma Aldrich (Fluka). Fumonisin B1 was obtained from CFM Oscar Tropitzsch and Fumonisin B2 was obtained from LGC. Fumonisin B1 and B2 in Maize flour were obtained from Sigma Aldrich (Oekanal). Zearalenone in Maize was obtained from Sigma Aldrich (ERM-BC717). Cereal-based samples were purchased in supermarket.

Preparation of samples prior to SPE with AFFINIMIP® SPE FumoZON Cartridge

25g of ground samples were extracted with 100 mL of Acetonitrile/Methanol/deionized Water (25/25/50, v/v/v) for 3 min using a blender. The extract was filtered through a folded filter paper and 10 mL of the filtrate were diluted with 10 mL of deionized water. Then, this solution was filtered through a filter paper.

This solution was used as the loading solution.

Solid phase extraction (SPE) protocol

The SPE procedure used a 3mL [AFFINIMIP® SPE FumoZON](#) Cartridge. The details of each step are as follows:

- Condition the SPE cartridge with 2mL of Acetonitrile (ACN), then with 2mL of deionized Water
- Load 8mL of the loading solution
- Wash the cartridge with 8mL of deionized Water /Acetonitrile (60/40, v/v)
- Elute Zearalenone and Fumonisin with 2mL of Methanol containing 2% of Acetic Acid

The SPE procedure lasted approximately 30 minutes.

The elution fraction was then evaporated and dissolved in the mobile phase.

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Analysis

HPLC was performed on a ThermoFinnigan Surveyor Plus with a Thermo Hypersil Gold C18 column (50mm x 2.1mm). The separation was carried out at a flow rate of 0.2mL/min using a mobile phase of deionized Water-0.1% Formic acid/Acetonitrile (73/27, v/v) for Fumonisin B1 and Zearalenone and with a mobile phase of deionized Water-0.1% Formic acid/Acetonitrile (65/35, v/v) for Fumonisin B2. The detection system was a ThermoFinnigan MSQ Plus with an electrospray source (ESI).

The injection volume was 20µL. The quantification was done in selected ion monitoring at m/z 722 for Fumonisin B1 (ESI⁺), m/z 705 for fumonisin B2 (ESI⁺) and m/z 317 for Zearalenone (ESI).

Choice of the extraction solvent

The composition of the solvent applied for extraction is a crucial parameter particularly when you have molecules with different properties. Several mixtures were tested on maize contaminated with Zearalenone or Fumonisins to determine the best extraction solvent. The best result was obtained with a mixture Acetonitrile/Methanol/deionized Water (25/25/50, v/v/v).

Ion Suppression

Ion suppression is caused by interferents that co-elute with the analyte of interest during analysis. This phenomenon can induce suppression or enhancement of the signal. The quantification is so erroneous. To evaluate the ion-suppression, blank maize-based baby food samples were cleaned up with AFFINIMIP® SPE FumoZON. The SPE extracts were spiked with a mixture of Fumonisin B1 and Zearalenone at 2 different concentrations. The standard calibration curves were compared to the matrix SPE extracts. The signal responses for the SPE extracts are very close to the signal responses obtained from the calibration sample (see Table 3). The use of AFFINIMIP® SPE FumoZON strongly reduces ion-suppression phenomena with a maximum of 15% observed for Fumonisins.

Results

Table 1. Recovery of Zearalenone, Fumonisins B1 and B2 in maize flour after AFFINIMIP® SPE FumoZON clean-up and relative standard deviation calculated from results generated under reproducibility conditions.

Sample	C° µg/kg	Mean µg/kg	Recoverie s %	% RSD R
Zearalenone	38	39.2	103.2	8.5 (n=8)
Fumonisin B1	2408	2002.2	83.1	10.3 (n=8)
Fumonisin B1	400	401.0	100.2	- (n=2)
Fumonisin B2	630	684.6	108.7	11.5 (n=3)

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Table 2. Recovery of Zearalenone, Fumonisin B1 and B2 in maize-based baby food after AFFINIMIP® SPE FumoZON clean-up and relative standard deviation calculated from results generated under reproducibility conditions.

Sample	C° µg/kg	Mean µg/kg	Recovery s %	% RSD _R
Zearalenone	20	16.9	84.4	1.6 (n=4)
Fumonisin B1	200	168.6	84.3	1.4 (n=3)
Fumonisin B2	200	185.6	92.8	1.9 (n=3)

Table 3. Ion suppression percentage obtained in Maize-based baby food (tested twice).

Analyte	C° µg/kg	Ion suppression n %
Zearalenone	10	1% 5%
Zearalenone	50	0% 5%
Fumonisin B1	100	8% 11%
Fumonisin B1	500	12% 14%

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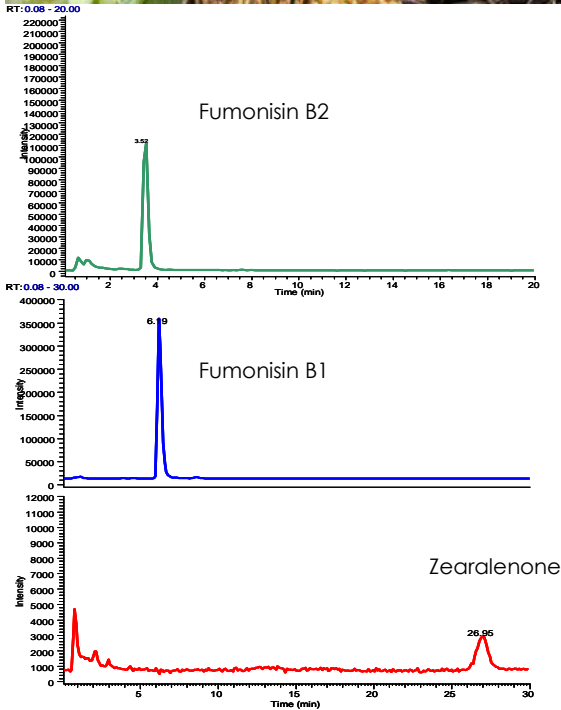


Figure 4. Chromatograms obtained after **AFFINIMIP® SPE FumoZON** Clean-up of a maize flour spiked at 38µg/kg with Zearalenone, 2408µg/kg with Fumonisin B1 and 630µg/kg with Fumonisin B2.

Conclusion

The use of an **AFFINIMIP® SPE FumoZON** SPE cartridge is a simple, fast, sensitive and selective tool for the extraction of Fumonisin and Zearalenone from Maize products.

This method complies with the performance criteria for Fumonisin and Zearalenone established by the European Commission Regulation (EC) 401/2006 [2]. This regulation requires recovery values for Zearalenone higher than 60% for analysis done below 50µg/kg and for Fumonisin higher than 60% for analysis done below 500µg/kg and 70% for analysis done above 500µg/kg.

The use of **AFFINIMIP® SPE** Fumonisin and Zearalenone enables to obtain recoveries higher than 80% with low ion suppression. This method is well-suited for the analysis in maize products.

References

- [1] Commission Regulation (EC) No. 1126/2007 of 28 September 2007, Official Journal of the European Union.
- [2] Commission Regulation (EC) No. 401/2006 of 23 February 2006, Official Journal of the European Union.

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Related products

- **AFFINIMIP® SPE FumoZON**

Catalog number: FS109-02 for 25 columns

FS109-03 for 50 columns

- **AFFINIMIP® SPE Zearalenone**

Catalog number: FS100-02 for 25 columns

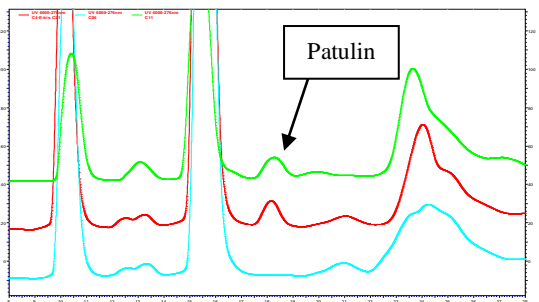
Please follow the link to [Application note AFFINIMIP® SPE Zearalenone](#) – Automated protocol (GILSON GX271 ASPEC™)

- **AFFINIMIP® SPE Patulin**

Catalog number: FS102-02 for 25 columns

Please follow the link to [Application note - AFFINIMIP® SPE Patulin Apple Juice and Apple Puree](#)

Perfect cleanup method with **AFFINIMIP®SPE Patulin**



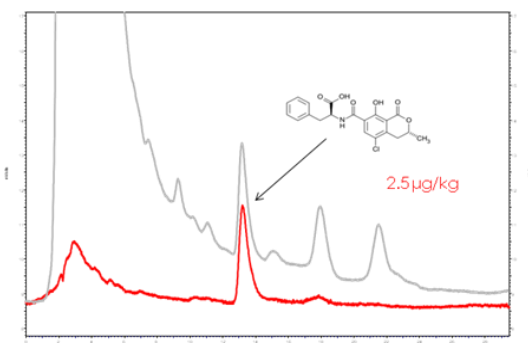
Chromatograms of apple puree containing 0µg/kg (blue) or 20µg/kg (tested twice, green and red) of Patulin after **AFFINIMIP®SPE Patulin** Clean-up

- **AFFINIMIP® SPE Ochratoxin A**

Catalog number: FS101-02 for 25 columns

Please follow the link to [Application note AFFINIMIP® SPE Ochratoxin A](#) – Automated protocol (GILSON GX271 ASPEC™)

Perfect cleanup method with **AFFINIMIP®SPE Ochratoxin A**



Chromatograms obtained after purification with **AFFINIMIP®SPE Ochratoxin A** (2.5µg/kg) of a cereal sample

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About POLYINTELL

Founded in 2004, POLYINTELL develops, manufactures and markets innovative products based on intelligent polymers for sample preparation, selective extraction, purification and detection of specific target analytes.

POLYINTELL maintains cutting-edge R&D activities in analytical and diagnostic fields. The company has fully integrated technology platform with specialized teams in:

- Organic chemistry
- Polymer chemistry
- Analytical and bioanalytical chemistry

For more information or ordering: contact@polyintell.com

Website: www.polyintell.com

Events in 2012

<p>14-16 May 2012</p> <p>34th Mycotoxin Workshop Braunschweig, Germany http://www.mykotoxin.de/docs/public/tmp/lt_article.asp?CntID=60&PCat_ID=3&Lang=EN</p>	<p>28 May – 1 June 2012</p> <p>ISM – MycoRed Training Course 2012 Bari, Italy http://www.mycored.eu/page/upcoming_events/68/ism-mycored_workshop-training_course:_detection_techniques_for_mycotoxins_in_the_food_chain/</p>
<p>3-8 June 2012</p> <p>Fusarium Laboratory Workshop Bari, Italy http://www.mycored.eu/page/upcoming_events/67/fusarium_laboratory_workshop_june_2012/</p>	<p>24-28 June 2012</p> <p>MycoRed North America 2012 http://www.mycored.eu/page/upcoming_events/65/mycored_north_america_2012/</p>
<p>5-9 November 2012</p> <p>WMF meets IUPAC – 7th World Mycotoxin Forum and 13th International Symposium on Mycotoxins and Phycotoxins Rotterdam, the Netherlands http://www.wfmeetsiupac.org/html/welcome.asp</p>	



Abstracts

Compiled and edited by *Leatherhead Food Research*
Abstracts from *Leatherhead Food Research's Foodline Science database*
(<http://services.leatherheadfood.com/foodline/index.aspx>).

(Abstracts of published papers on mycotoxins, which are selected from peer-reviewed journals. Major areas of mycotoxin research and analysis are covered, with an emphasis on mycotoxin occurrence in food).

Quantification of Tri5 gene, expression, and deoxynivalenol production during the malting of barley.

Vegi A., Schwarz P., Wolf-Hall C.E.

International Journal of Food Microbiology (ISSN: 0168-1605) 2011 (November 1), 150 (2-3), 150-156 (24 ref.) En:en (saan: 828337)

This study investigated levels of deoxynivalenol during malting of *Fusarium*-contaminated barley. It was found that levels of *Fusarium* increased during the germination stage, and temperatures in excess of 60 C were required to reduce *Fusarium* levels in inoculated samples. In naturally infected barley, strong gene expression (Tri5) for deoxynivalenol production was observed during the third day of germination and, for these samples, a kilning temperature of 49 C or more was effective in reducing levels of *Fusarium* but not the heat-stable deoxynivalenol. The authors highlight the significance of enhanced *Fusarium* growth, high Tri5 production and expression, and deoxynivalenol production during the last 2 days of germination and initial stages of kilning during malting of barley.

Influence of noodle processing (industrial protocol) on deoxynivalenol.

Farahany E.M., Takoy L.L.

Food Control (ISSN: 0956-7135) 2011 (November), 22 (11), 1765-1769 (27 ref.) En:en (saan: 828352)

This paper considers the effects of processing on deoxynivalenol, a potential contaminant in flour derived from fungus-contaminated cereals. Noodles were prepared using wheat flour spiked with deoxynivalenol. Mixing had no effect on mycotoxin levels, whereas significant

reductions in deoxynivalenol levels were observed as a result of cooking and frying of yellow alkaline and instant noodles. A greater reduction was observed during the processing of instant noodles. This was attributed to heat degradation, and a leaching of deoxynivalenol into the cooking medium.

Development of a sensitive competitive indirect ELISA method for determination of ochratoxin A levels in cereals originating from Nanjing, China.

Zhang A., Ma Y., Feng L., Wang Y., He C., Wang X., Zhang H.

Food Control (ISSN: 0956-7135) 2011 (November), 22 (11), 1723-1728 (36 ref.) En:en (saan: 828346)

The presence of ochratoxin A in cereals has significant consequences for the safety of cereal-based foods and feeds. This paper reports on the development of a competitive indirect ELISA method for the detection of this mycotoxin, based on the use of a monoclonal antibody specific for ochratoxin A. The method was found to be simple and reliable, capable of detecting ochratoxin A in the range 0.55-6.75 ng/ml. Use of the method for the analysis of 65 cereal samples from Nanjing, China, found 26.15% to contain levels of ochratoxin A in the range 2.604-23.021 ng/g.

Natural occurrence of aflatoxin B1 in peanut collected from Kinshasa, Democratic Republic of Congo.

Kamika I., Takoy L.L.

Food Control (ISSN: 0956-7135) 2011 (November), 22 (11), 1760-1764 (56 ref.) En:en (saan: 828351)

Peanut is described as a suitable substrate for fungal growth, and the growth of mycotoxin-producing fungi, and the presence of aflatoxins in peanuts can have a significant effect on product safety. It is observed that, in the Democratic Republic of Congo, the risk of consuming aflatoxin-contaminated peanuts is very high. The results of this study showed that aflatoxin levels exceeded the maximum limit of 5 mcg/kg in 70% of peanut samples; and that aflatoxin levels were likely to increase in the rainy season. A potential link between aflatoxin-contaminated peanuts and the high rate of liver cancer in the Congo is highlighted.

Development of an oligosorbent for detection of ochratoxin A.

Rhouati A., Paniel N., Meraihi Z., Marty J.-L.

Food Control (ISSN : 0956-7135) 2011 (November), 22 (11), 1790-1796 (40 ref.) En:en (saan: 828356)

This paper reports on an oligosorbent for use with solid-phase extraction columns for the selective extraction of ochratoxin A from beer samples. This was achieved by grafting a DNA aptamer with high affinity and specificity for ochratoxin A to cyanogen bromide-activated sepharose. The performance of the oligosorbent was compared to that of a commercial immunoaffinity column. An average recovery of 96% and a limit of detection of 0.2 ng/ml was obtained; and it was found that the column could be re-used more than three times without loss of performance.

Optimisation and validation of a fluorescence polarisation immunoassay for rapid detection of zearalenone in corn.

Choi E.H., Kim D.M., Choi S.-W., Eremin S.A., Chun H.S.

International Journal of Food Science and Technology (ISSN : 0950-5423) 2011 (October), 46 (10), 2173-2181 En:en (saan: 828158)

A fluorescence polarisation immunoassay (FPIA) was optimised in this study for the detection of zearalenone (ZEN). The method was validated using tracers mimicking ZEN and synthesised from different fluorescence labels and chemicals. The tracer selected was 4-(aminomethyl) fluorescein-labelled ZEN tracer.

Extraction conditions were optimised, and detection limit, recovery, trueness and ruggedness values for the method tested on a corn matrix were determined. Advantages of the current FPIA for the detection of ZEN, and its potential as a rapid screening tool for ZEN and its analogues in corn are discussed.

Impact of aggressiveness of Fusarium graminearum and Fusarium culmorum isolates on yield parameters and mycotoxin production in wheat.

Korn U., Muller T., Ulrich A., Muller M.E.H.

Mycotoxin Research (ISSN : 0178-7888) 2011 (August), 27 (3), 195-206 En:en (saan: 827969)

Field experiments over two years, involving the inoculation on wheat with plant-associated isolates from *Fusarium graminearum* and *Fusarium culmorum*, were carried out, and the influence of these isolates on fungal colonisation of the ears was determined. In addition, the production of trichothecene mycotoxins (deoxynivalenol, nivalenol and zearalenone) was correlated to fungal contamination in this study. Indicators of fungal infection and detection of mycotoxins were used to assign isolates into one of four groups based on level of aggressiveness. *Fusarium* DNA was monitored and increased levels in wheat ears correlated with increased deoxynivalenol content in wheat kernels. The influence of weather conditions at different stages of grain development was studied, and it was observed that when weather conditions were dry during the period of anthesis and ripening there was no fungal growth or mycotoxin contamination.

Aflatoxins in peanut butter in Khartoum State, Sudan.

Elzupir A.O., Salih A.O.A., Suliman S.A., Adam A.A., Elhussein A.M.

Mycotoxin Research (ISSN : 0178-7888) 2011 (August), 27 (3), 183-186 En:en (saan: 827967)

The determination of aflatoxins in peanut butter samples (n=43) from Khartoum State, Sudan is reported in this study. Samples were extracted with methanol:water (8:1) and cleaned up using chloroform prior to analysis by HPLC with fluorescence detection. Aflatoxins were detected in all samples at levels of between 26.7 and 853 mcg/kg. A total of 28 samples were contaminated with aflatoxin B1 at levels up to 534 mcg/kg, and aflatoxin G1 was detected in all samples at levels up to 401 mcg/kg. The authors propose that as the levels of aflatoxins that were detected in these

samples were so much greater that maximum regulation levels an intervention strategy to manage aflatoxins in peanut butter from the Khartoum area was necessary.

New strategies in sample clean-up for mycotoxin analysis.

Cichna-Markl M.

World Mycotoxin Journal (ISSN : 1875-0710) 2011 (August), 4 (3), 203-215 En:en (saan: 827973)

A review of the principles and the application of different approaches to the clean-up of samples for mycotoxin analysis is presented in this paper. The most commonly used techniques for sample cleanup in mycotoxin methods are solid-phase extraction, immunoaffinity chromatography and MycoSep columns. Immunoaffinity columns, prepared using antibodies covalently bound to a solid support material, are highly selective and extremely effective in reducing matrix interferences. Innovations in immunoaffinity chromatographic separations are presented in the review: sol-gel immunoaffinity chromatography, immuno-ultrafiltration, molecularly imprinted polymers (MIPs) and immunoaffinity chromatography using aptamers as selective ligands.

Silibinin pretreatment protects against ochratoxin A-mediated apoptosis in primary rat hepatocytes.

Essid E., Petzinger E.

Mycotoxin Research (ISSN : 0178-7888) 2011 (August), 27 (3), 167-176 En:en (saan: 827965)

Silibinin, the main structural component of silymarin, found in the seeds, fruit and leaves of milk thistle, has been reported to have hepatoprotective properties. The aim of this study was to use an in vitro technique to evaluate the inhibitory effect of silibinin on hepatocyte apoptosis induced by ochratoxin A (OTA). An enzymic digestion method and a new EDTA-perfusion method were used to prepare rat hepatocytes. Hepatocytes prepared by the EDTA-perfusion method were found to be more stable than the enzymically prepared cells. OTA-mediated apoptosis was inhibited by treatment with 130 $\mu\text{mol/l}$ silibinin. The MTT-test and Live/Dead kit was used to evaluate viability of cells following OTA administration, and cell viability was moderately decreased 24 hours following administration but cytotoxic effects were observed for over 36 hours, in contrast to lipopolysaccharide (LPS) which did not cause apoptosis.

Tools for investigating workplace-related risks from mycotoxin exposure.

Degen G.H.

World Mycotoxin Journal (ISSN : 1875-0710) 2011 (August), 4 (3), 315-327 En:en (saan: 827979)

The problem of mycotoxin contamination in the workplace, such as agricultural and food processing facilities, greenhouses and waste management facilities, is considered in this paper. Mycotoxins may be present as a result of dust from raw materials or processed products and can be considered a health hazard through inhalation of airborne contaminated material or dermal absorption. The difficulties involved in assessing workplace contamination, and the use of human biomonitoring studies to overcome these difficulties are discussed. Methods for the determination of mycotoxins and their metabolites in blood or urine need to be sensitive.

Detection of deoxynivalenol using biolayer interferometry.

Maragos C.M.

Mycotoxin Research (ISSN : 0178-7888) 2011 (August), 27 (3), 157-165 En:en (saan: 827964)

Molecular interactions can be monitored in real time using biolayer interferometry, based on differences in the interference patterns of reflected light from optical fibres on the binding of different molecules to the fibre tip. The aim of this study was to develop a aminopropylsilane sensor with immobilised deoxynivalenol-bovine serum albumin (DON-BSA). The change in interference pattern on the binding of deoxynivalenol-specific antibodies was determined, and the principle of the assay is the competition between deoxynivalenol and immobilised DON-BSA for binding to the antibody. A detection limit of 0.10 mg/kg is reported with the use of matrix-matched standards to overcome the problem of matrix interferences. In addition the conditioning of sensors to remove loosely attached DON-BSA was found to give superior results (recovery: 101.4% and RSD: 13.2%). The method was successfully applied to the determination of deoxynivalenol in spiked whole wheat flour samples, and the authors recommend this technology for development as an assay for mycotoxin determination.

Exposure assessment and risk characterization of aflatoxin B1 in Malaysia.

Leong Y.-H., Rosma A., Latiff A.A., Ahmad N.I. *Mycotoxin Research* (ISSN : 0178-7888) 2011 (August), 27 (3), 207-214 En:en (saan: 827970)
Liquid chromatography tandem mass spectrometry (LC-MS/MS) was used in this study for the determination of aflatoxin B1 in nut and nut products (n=128) in Penang, Malaysia. Aflatoxin B1 was detected in 57% of samples at levels of between 0.4 and 222 mcg/kg; 13.3% of samples contained levels above 2 mcg/kg. Dietary exposure to aflatoxin B1 in nut and nut products was estimated at between 0.36 and 8.89 ng/kg body. The benchmark dose lower confidence limit was determined by dose-response modelling as 0.305 ng/kg body weight/day. The authors conclude that aflatoxin B1 should be considered a public health concern and a high priority for risk management actions.

The current state of mycotoxin biomarker development in humans and animals and their potential for application to plant systems.

Baldwin T.T., Riley R.T., Zitomer N.C., Voss K.A., Coulombe R.A., Pestka J.J., Williams D.E., Glenn A.E. *World Mycotoxin Journal* (ISSN: 1875-0710) 2011 (August), 4 (3), 257-270 En:en (saan: 827976)

A review of the development of biomarkers for certain mycotoxins, in particular aflatoxins, for the identification of links between exposure to disease risk is presented in this paper. Aflatoxin biomarkers are either exposure or mechanism-based biomarkers indicating the potential of aflatoxins to cause disease in humans. Disease associated with fumonisin contamination in animals has been studied by employing biomarkers. Mycotoxin biomarker development in humans and animals and the possibility of transference of this development to the study of effects of mycotoxins on plant systems is considered. The use of mechanism-based biomarkers for the evaluation of infection of maize seed by *Fusarium verticillioides* is discussed.

Substances for reduction of the contamination of feed by mycotoxins: a review.

Kolosova A., Stroka J. *World Mycotoxin Journal* (ISSN: 1875-0710) 2011 (August), 4 (3), 225-256 En:en (saan: 827975)

A review of the current knowledge and use of mycotoxin binders, products added to animal feeds to reduce levels of mycotoxin contamination, is presented. Mycotoxin binders can have different modes of action when added to the diet: either adsorption (binding mycotoxins to their surface) or biotransformation (degradation or creation of less toxic metabolites). Adsorbent agents include hydrated sodium calcium aluminosilicate, zeolites, bentonites, clays, activated carbons, yeast cell wall components, synthetic polymers (cholestyramine, polyvinylpyrrolidone), humic substances and dietary fibres, and biotransformation agents can be either mycotoxin-degrading enzymes or microorganisms that produce enzymes with this activity. The review includes details of the most important types of mycotoxin binders and their mode of action, including in vitro and in vivo effectiveness.

Network analysis of the RASFF database: a mycotoxin perspective.

Petroczi A., Nepusz T., Taylor G., Naughton D.P. *World Mycotoxin Journal* (ISSN: 1875-0710) 2011 (August), 4 (3), 329-338 En:en (saan: 827980)

The Rapid Alert System for Food and Feed (RASFF) is a tool established by the European Union to allow information exchange on the steps taken by Member States to respond to serious food- or feed-related risks. An analysis of the RASFF portal using descriptive statistics coupled to network analysis, is presented in this paper, identifying different approaches by countries and the seasonal variations in contamination. A total of 30% of notifications of all notifications have been for mycotoxins, in particular aflatoxins. The leading countries for mycotoxin contamination incidences between January 2008 and October 2010 were, in order, Turkey, China, Iran and the US. The use of network analysis to identify leading detecting and transgressing nations is described. The technique was able to identify a greater improvement in the trend of mycotoxin contamination incidences in Iran than in Turkey or China. In addition network analysis can provide weekly updates for the identification of emerging issues in nations or contaminant type.

Fumonisin elimination and prospects for detoxification by enzymatic transformation.

Hartinger D., Moll W.-D.

World Mycotoxin Journal (ISSN: 1875-0710) 2011 (August), 4 (3), 271-283 En:en (saan: 827977)

The aim of this study was to investigate the establishment of a novel technique involving the application of enzymes to animal feed for the detoxification of fumonisins in the gastrointestinal tract of animals. The elimination of fumonisins and the chemical reactions of fumonisins in processing and decontamination processes are discussed. Traditional methods of maize processing, nixtamalisation and enzymic biotransformation can result in the formation of hydrolysed fumonisins, and the toxicity of these compounds is considered. The potential of genes from an alphaproteobacterium, enzymes and genes from the black yeast *Exophiala spinifera*, and from the bacterium ATCC 55552 for the detoxification of fumonisins and their application of these enzymes in feed or food is discussed.

Mushrooms versus fungi: natural compounds from *Lentinula edodes* inhibit aflatoxin biosynthesis by *Aspergillus parasiticus*.

Reverberi M., Zialic A., di Meo C., Scarpari M., Fanelli C., Fabbri A.A.

World Mycotoxin Journal (ISSN : 1875-0710) 2011 (August), 4 (3), 217-224 En:en (saan: 827974)

Previous studies have identified the ability of certain compounds naturally occurring in the basidiomycete *Lentinula edodes* (polysaccharides and glycoproteins, in particular beta-glucans) to inhibit the production of aflatoxins. The aim of this study was to stimulate synthesis of beta-glucans through paraquat-induced oxidative stress in *Lentinula edodes*. In addition the effect of these oxidative-stress-induced polysaccharides on the inhibition of aflatoxin production in two different strains of *Aflatoxin parasiticus* was demonstrated to be enhanced in comparison with non-induced polysaccharides.

***Fusarium* species (section *Liseola*) occurrence and natural incidence of beauvericin, fusaproliferin and fumonisins in maize hybrids harvested in Mexico.**

Reyes-Velazquez W.P., Figueroa-Gomez R.M., Barberis M., Reynoso M.M., Rojo F.G.A.

Mycotoxin Research (ISSN : 0178-7888) 2011 (August), 27 (3), 187-194 En:en (saan: 827968)

The occurrence of *Fusarium* species in different maize hybrids (28 samples from seven different hybrids) in Mexico was investigated in this study. In addition the ability of *Fusarium* isolates to produce beauvericin, fusaproliferin and moniliformin and their natural occurrence in maize were investigated. The dominant species was identified as *Fusarium verticillioides* with less frequent occurrence of *Fusarium subglutinans* and *Fusarium proliferatum*. Three different hybrids were contaminated with beauvericin (300-400 ng/g) but only one hybrid was contaminated with fusaproliferin (200 ng/g). Fumonisin B1 and B2 were detected in all samples at levels of 606 and 277 ng/g respectively. *Fusarium verticillioides* isolates were all able to produce fumonisin B1 and co-production of fumonisin B1, B2 and fusaproliferin was observed with some isolates. Beauvericin, fusaproliferin, fumonisin B1 and B2 were produced by several isolates.

Transcript profiling of the phytotoxic response of wheat to the *Fusarium* mycotoxin deoxynivalenol.

Walter S., Doohan F.

Mycotoxin Research (ISSN : 0178-7888) 2011 (August), 27 (3), 221-230 En:en (saan: 827972)

Cereal plants, such as wheat and barley, are susceptible to contamination with deoxynivalenol, a secondary metabolite of *Fusarium graminearum* or *Fusarium culmorum*. The aim of this study was to use wheat cDNA arrays in the analysis of the effect of deoxynivalenol in a wheat cultivar sensitive to deoxynivalenol. Modulation of jasmonate biosynthesis and signalling and other cellular functions by deoxynivalenol was demonstrated. The authors conclude that resistance to deoxynivalenol is related to the rapidity and magnitude of the response of the plant.

Mycotoxin co-contamination of food and feed: meta-analysis of publications describing toxicological interactions.

Grenier B., Oswald I.P.

World Mycotoxin Journal (ISSN : 1875-0710) 2011 (August), 4 (3), 285-313 En:en (saan: 827978)

A review of animal studies examining the effects of mycotoxin co-occurrence in farm animals is presented. A total of 112 studies (employing a 2x2 factorial design with individual and combined mycotoxin effects) are reported in which animals were exposed to more than one mycotoxin and the type of interaction observed was determined for each parameter. Interactions varied according to animal species,

toxin dose, length of exposure and the parameters measured. Co-occurrence of aflatoxins with other mycotoxins, in particular fumonisins, ochratoxin A and trichothecenes is considered in the majority of the studies, but interactions between ochratoxin A and citrinin or between toxins produced by *Fusarium* species are also reported. Four different categories of interactions of mycotoxins were identified: synergistic, additive, less than additive or antagonistic.

Co-occurrence of mycotoxins in swine feed produced in Portugal.

Almeida I., Martins H.M., Santos S., Costa J.M., Bernardo F.

Mycotoxin Research (ISSN : 0178-7888) 2011 (August), 27 (3), 177-181 En:en (saan: 827966)

HPLC was used in this study for the determination of mycotoxins (ochratoxin A, zearalenone, deoxynivalenol and fumonisins) in commercial swine feed for fattening pigs (n=277) and sows (n=127). A total of 7.6% of fattening pig feeds were contaminated with ochratoxin A, 24.9% were contaminated with zearalenone and 16.9% were contaminated with deoxynivalenol. A total of 29.9% of sow feeds were contaminated with zearalenone and 8.7% were contaminated with fumonisins B1 and B2. Maximum levels of mycotoxins were 6.8 mcg/kg (ochratoxin A), 73 mcg/kg (zearalenone), 864 mcg/kg (deoxynivalenol) and 391.4 mcg/kg (fumonisins B1 and B2). Co-occurrence of the toxins was observed, in particular co-occurrence of deoxynivalenol and zearalenone.

Contribution of the endogeic earthworm species *Aporrectodea caliginosa* to the degradation of deoxynivalenol and *Fusarium* biomass in wheat straw.

Wolfarth F., Schrader S., Oldenburg E., Weinart J.

Mycotoxin Research (ISSN : 0178-7888) 2011 (August), 27 (3), 215-220 En:en (saan: 827971)

The aim of this study was to evaluate the efficacy of the endogeic geophageous earthworm species *Aporrectodea caliginosa* in the reduction of *Fusarium culmorum* and deoxynivalenol in wheat straw residues. *Fusarium* biomass and deoxynivalenol concentration were determined after 5 weeks both above ground and in the wheat straw buried in soil by the earthworm. Reduction of *Fusarium* biomass and deoxynivalenol concentration were unaffected by the presence of the earthworm species *Aporrectodea caliginosa*.

Non-destructive measurement of deoxynivalenol in wheat flour using fluorescence fingerprinting.

Fujita K., Tsuta M., Sugiyama J., Kushiro M., Shibata M.

Nippon Shokuhin Kagaku Kogaku Kaishi (Journal of the Japanese Society for Food Science and Technology) (ISSN : 1341-027X) 2011 58 (8), 375-381 En:en (saan: 827705)

A non-destructive method for predicting deoxynivalenol (DON) concentrations in wheat flour using fluorescence fingerprinting (FF) was developed. FF values determined at different wavelengths were used to construct a partial least square (PLS) regression model, and reference values for DON concentrations were determined by chemical analysis. The proposed model showed good fit with the validation dataset. Absolute values of regression coefficients for the calibration model were high for excitation wavelengths of 240-400 nm and emission wavelengths of 500-600 nm. To reduce numbers of wavelengths for shorter measurement time, PLS regression was applied to FF values at these limited wavelengths. Fitting of the acquired model to the validation dataset did not differ significantly from that for the original model. Results indicated that rapid and non-destructive prediction of DON concentration in wheat flour was achieved using FF.

Cytotoxic effects of mycotoxin combinations in mammalian kidney cells.

Ruiz M.-J., Macakova P., Juan-Garcia A., Font G.

Food and Chemical Toxicology (ISSN : 0278-6915) 2011 (October), 49 (10), 2718-2724 En:en (saan: 827552)

The cytotoxicity of beauvericin, deoxynivalenol (DON) and T2 toxin produced by *Fusarium* was examined in this study. The effect of a combination of mycotoxins was determined in Vero cells, and interactions involved were investigated. Combination index values for different combinations of the mycotoxins are discussed. Toxicological effects on Vero cells were increased by mycotoxin combinations, and the binary DON and T2 toxin mixture produced the highest antagonistic effect.

Lactic acid bacteria in the inhibition of *Fusarium graminearum* and deoxynivalenol detoxification.

Franco T.S., Garcia S., Hirooka E.Y., Ono Y.S., dos Santos J.S.

Journal of Applied Microbiology (ISSN : 1364-5072) 2011 (September), 111 (3), 739-748 En:en (saan: 827438)

The ability of different lactic acid bacteria (LAB) strains to inhibit the development of *Fusarium graminearum* and remove deoxynivalenol (DON) was examined in this study in vitro, using the agar diffusion method. The effect of the culture media, pH and lactic and acetic acids was also investigated. Growth of *Fusarium graminearum* was inhibited by isolated strains and commercial cultures, and DON was removed. Heat affected the ability of the bacteria to remove DON. The potential application of the isolated LAB strains is highlighted.

A fluorescence-LC method with NDA pre-column derivatization for fumonisin B2 determination in black aspergilli cultures.

Abrunhosa L., Calado T., Resende T., Venancio A.

Journal of Liquid Chromatography and Related Technologies 2011 (34 (15), 1594-1603) En:en (saan: 827197)

Aspergillus niger is responsible for a black mould on fruit and vegetables and has been recently identified as a fumonisin producer. The development and validation of a sensitive LC-fluorescence method for the identification of fumonisin B2 in black aspergilli cultures is reported in this study. Precolumn derivatization using naphthalene-2,3-dicarboxaldehyde (NDA) and elution of derivatives with an isocratic solution of acetonitrile/water/acetic acid on a polar C18 reverse phase ODS column are described. Fumonisin B2 was detected by fluorescence detection with excitation and emission wavelengths of 420 and 500 nm respectively. Fumonisin B2 was detected in black aspergilli with a limit of detection of 2 and a limit of quantification of 6 mcg/kg respectively.

Evaluation of genetic markers for identifying isolates of the species of the genus *Fusarium*.

Watanabe M., Yonezawa T., Lee K.-I., Kumagai S., Sugita-Konishi Y., Goto K., Hara-Kudo Y.

Journal of the Science of Food and Agriculture (ISSN : 0022-5142) 2011 (October), 91 (13), 2500-2504 En:en (saan: 827126)

A rapid and accurate system for identifying members of the genus *Fusarium*, which are

important plant pathogens, is required. This study identified isolates of *Fusarium* species by sequencing specific genes and calculating nucleotide sequence homology of tested strains against reference sequences. The most appropriate genetic marker was *lys2*, which had high resolution for identifying isolates of the genus *Fusarium* among the genes examined.

Isolation and characterization of a new less-toxic derivative of the *Fusarium* mycotoxin diacetoxyscirpenol after thermal treatment.

Shams M., Mitterbauer R., Corradini R., Wiesenberger G., dall'Asta C., Schuhmacher R., Krska R., Adam G., Berthiller F.

Journal of Agricultural and Food Chemistry (ISSN : 0021-8561) 2011 (September 14), 59 (17), 9709-9714 En:en (saan: 826651)

Potatoes are prone to contamination with the trichothecene, 4,15-diacetoxyscirpenol, after infection with *Fusarium sambucinum*, and this study examined the reduction of this mycotoxin during thermal treatment in aqueous solution. A new derivative (DAS-M1) was detected, isolated and characterised. Cooking potatoes inoculated with *Fusarium sambucinum* reduced the content of 4,15-diacetoxyscirpenol; effects of pH value are discussed. Compared with 4,15-diacetoxyscirpenol, the inhibitory effect of DAS-M1 on yeast growth and inhibition of protein synthesis was lower.

Effects of milling and baking technologies on levels of deoxynivalenol and its masked form deoxynivalenol-3-glucoside.

Kostelanska M., Dzuman Z., Malachova A., Capouchova I., Prokinova E., Skerikova A., Hajslova J.

Journal of Agricultural and Food Chemistry (ISSN : 0021-8561) 2011 (September 14), 59 (17), 9303-9312 En:en (saan: 826589)

Deoxynivalenol (DON) and its conjugate deoxynivalenol-3-glucoside (DON-3-Glc) have been found in infected wheat, and this study examined the fate of DON and DON-3-Glc in milling and baking processes. Both analytes showed no substantial changes during dough preparation, but DON-3-Glc was increased in fermented dough when bakery improvers were used. During baking, DON-3-Glc and DON were reduced, and thermal degradation products were detected in roasted wheat samples and baked bread samples. Degradation products were identified; most were located in the crust of experimental breads.

Quantitative analysis of mycoflora on commercial domestic fruits in Japan.

Watanabe M., Tsutsumi F., Konuma R., Lee K.-I., Kawarada K., Sugita-Konishi Y., Kumagai S., Takatori K., Konuma H., Hara-Kudo Y.
Journal of Food Protection (ISSN : 0362-028X) 2011 (September), 74 (9), 1488-1499 En:en (saan: 826549)

Counts of fungi, total yeast and moulds on the surface of fruit grown in Japan were determined in this study. The most frequent fungus was *Cladosporium*, which was found in samples of all fruit examined, followed by *Penicillium*. Different fungi and fruit combinations showing the highest total counts are listed. Common pre- and postharvest fungi were found on the surfaces of the fruit; those producing mycotoxins or causing diseases were not prominent on healthy fruit. The need to handle fruit carefully to control the quality of fruit and processed fruit products is highlighted.

Multiplex PCR assay for the detection of aflatoxigenic and non-aflatoxigenic fungi in meju, a Korean fermented soybean food starter.

Kim D.M., Chung S.H., Chun H.S.
Food Microbiology (ISSN : 0740-0020) 2011 (October), 28 (7), 1402-1408 En:en (saan: 826537)

This paper describes the development of a multiplex PCR method for the detection of aflatoxigenic fungi in the Korean fermented soya food meju. Two different sets of three primers were designed for the *omtB*, *ver-1*, *afIR* and *omtA* genes. It was demonstrated that only fungi that produced aflatoxins gave complete amplification in both sets of primers. It is concluded that the method provides an accurate and specific method for the detection of aflatoxigenic *Aspergillus* in meju.

Deoxynivalenol transport across the human placental barrier.

Nielsen J.K.S., Vikstrom A.C., Turner P., Knudsen L.E.
Food and Chemical Toxicology (ISSN : 0278-6915) 2011 (September), 49 (9), 2046-2052 En:en (saan: 826412)

Deoxynivalenol (DON) can pass through to the foetus of animals and cause foetal abnormalities, and this study examined DON transfer across the human placenta. Transfer of DON through a cell monolayer was found *in vitro*, and placentas were used to study DON transfer with a dual perfusion model. Results showed the transfer of DON to the foetal side.

Comparative cytotoxicity study of enniatins A, A1, A2, B, B1, B4 and J3 on Caco-2 cells, Hep-G2 and HT-29.

Meca G., Font G., Ruiz M.J.
Food and Chemical Toxicology (ISSN : 0278-6915) 2011 (September), 49 (9), 2464-2469 En:en (saan: 826440)

The cytotoxicity of enniatins (ENs) produced by strains of *Fusarium* spp was examined in this study in Caco-2, human colon carcinoma (HT-29), and human liver carcinoma (Hep-G2) cell lines. The enniatins examined showed toxic activity at low micromolar concentrations in mammalian cells. Pronounced cytotoxic effects in the cell lines tested were found for enniatins A, A1, B1 and B4.

Comparison of different exposure assessment methods to estimate the long-term dietary exposure to dioxins and ochratoxin A.

Boon P.E., Bonthuis M., van der Voet H., van Klaveren J.D.
Food and Chemical Toxicology (ISSN : 0278-6915) 2011 (September), 49 (9), 1979-1988 En:en (saan: 826410)

European food consumption data and national concentration data for the Netherlands were used in this study to calculate long-term exposures to dioxins and ochratoxin A. Advantages of different long-term models are discussed; the contribution of major sources of exposure differed for the models and the concise database. The need to use models that correct the variation in long-term exposure for within person variation, together with food consumption data and national concentration data is highlighted. The use of the beta-binomial-normal (BBN) model, which can model exposure distributions that depend on covariates, is suggested.

Kidney and liver distribution of ochratoxin A in male and female F344 rats.

Vettorazzi A., de Troconiz I.F., Gonzalez-Penas E., Arbillaga L., Corcuera L.-A., Gil A.G., de Cerain A.L.
Food and Chemical Toxicology (ISSN : 0278-6915) 2011 (September), 49 (9), 1935-1942 En:en (saan: 826407)

The effect of age and gender on the distribution of ochratoxin A (OTA) in rat kidney and liver was examined in this study. Compared with other groups, male rats that were fed and fasted showed a reduction and an increase in relative bioavailability, respectively. Concentrations of OTA were similar between liver and kidney. Models considering the distribution of OTA from

the central compartment and elimination from the liver compartment are discussed. Results showed that the differences between male and female rats in organs were a result of differences in bioavailability.

Quantification of ochratoxin A-producing molds in food products by SYBR Green and TaqMan real-time PCR methods.

Rodriguez A., Rodriguez M., Luque M.I., Justesen A.F., Cordoba J.J.

International Journal of Food Microbiology (ISSN : 0168-1605) 2011 (October 3), 149 (3), 226-235 En:en (saan: 826362)

The sensitivity and specificity of two real-time quantitative PCR methods based on SYBR Green and TaqMan were investigated. Seventy five fungal strains representing ochratoxin A (OTA) producers and non-producers of different species, usually reported in food products, were tested for OTA production using micellar electrokinetic capillary electrophoresis and HPLC-mass spectrometry. Optimised qPCR protocols were used to determine OTA-producing fungi in different artificially inoculated foods. A good linear correlation was obtained for all qPCR assays in cooked and cured products and fruits. Detection limits in all inoculated foods were 1 to 10 conidia/g for SYBR Green assay and TaqMan. Levels of conidia detected by both qPCR methods were close to inoculated amounts for most foods, indicating that the proposed method might have potential for detection and determination of OTA-producing fungi in foods.

Ochratoxin A in cocoa and chocolate products from the Italian market: occurrence and exposure assessment.

Brera C., Debegnach F., de Santis B., lafrate E., Pannunzi E., Berdini C., Prantera E., Gregori E., Miraglia M.

Food Control (ISSN : 0956-7135) 2011 (October), 22 (10), 1663-1667 En:en (saan: 826353)

The occurrence of ochratoxin A (OTA) in cocoa and chocolate products available in Italy was investigated, together with exposure assessment. A total of 179 of 300 samples of cocoa and chocolate-based products were found to be positive for OTA contamination, representing 60% of purchased products, with all 40 cocoa samples showing OTA contamination. Mean OTA concentrations for cocoa and chocolate products were well below Italian legal limits. The highest consumers of cocoa powder were teenage males, while the highest weekly OTA intake was seen for infants

and children. The highest daily consumption and highest intake of chocolate products were reported for children. Results indicated that exposure to OTA owing to consumption of cocoa and chocolate products in Italy was not a major health concern.

Species of Agave induces morphological changes in *Aspergillus parasiticus* Speare and *Aspergillus flavus* Link ex Fries.

Lozano-Muniz S., Garcia S., Heredia N., Castro-Franco R.

International Journal of Food, Agriculture and Environment (JFAE) (ISSN : 1459-0255) 2011 9 (2), 768-771 En:en (saan: 826282)

Extracts of the plant species agave have been reported to inhibit the growth of toxigenic *Aspergillus* species and could be used as biocontrol measures to reduce the risks of fungal infection and aflatoxin production. This work shows that extracts of agave (*Agave asperrima*) inhibited the growth of aflatoxigenic *Aspergillus parasiticus* and *Aspergillus flavus*. The extracts affected the morphology and development of the aflatoxigenic fungi and this was correlated with a reduction in aflatoxin biosynthesis.

Development of real-time PCR methods to quantify patulin-producing molds in food products.

Rodriguez A., Luque M.I., Andrade M.J., Rodriguez M., Asensio M.A., Cordoba J.J.

Food Microbiology (ISSN : 0740-0020) 2011 (September), 28 (6), 1190-1199 En:en (saan: 826229)

The presence of patulin-producing moulds in foods needs to be quantified to improve food safety and, in this study, two real-time PCR protocols based on SYBR Green and TaqMan were developed. Patulin production was tested using micellar electrokinetic capillary electrophoresis (MECE) and HPLC-MS. The isoeopoxydon dehydrogenase gene involved in patulin biosynthesis was used to design a primer pair and probe. Use of the real-time PCR protocols for quantifying patulin-producing moulds in foods is suggested.

Salting of dry-cured meat - a potential cause of contamination with the ochratoxin A-producing species *Penicillium nordicum*.

Sonjak S., Licen M., Frisvad J.C., Gunde-Cimerman N.

Food Microbiology (ISSN : 0740-0020) 2011 (September), 28 (6), 1111-1116 En:en (saan: 826218)

Penicillium nordicum, found on dry-cured meat products, is a producer of ochratoxin A (OTA), which has toxic activities. This study examined the contamination by *Penicillium nordicum* of meat products, air in the meat-processing plant, and sea salt used for salting. Using amplified fragment length polymorphism (AFLP) analyses of isolates, contamination of meat products via salt was found to be possible. Selected isolates produced OTA, and the need to consider salt as a potential source of contamination in dry-cured meat products is highlighted.

Emerging risk of infestation and contamination of dried fruits by mites in the Czech Republic.

Hubert J., Erban T., Nesvorna M., Stejskal V. Food Additives and Contaminants: Part A (ISSN : 0265-203X) 2011 28 (9), 1129-1135 En:en (saan: 826183)

Frequent infestation of dried fruit imported from the Mediterranean region by the mite, *Carpoglyphus lactis* L., has been reported, and this study examined samples taken from supermarkets in the Czech Republic. Dried apricots, figs, plums and raisins were contaminated, and the growth rate of *Carpoglyphus* and risk level were estimated under laboratory conditions. Mites were able to enter dried fruit packing material, including polypropylene and aluminium foil, indicating that they move between packages in supermarkets. The increased risk of *Carpoglyphus* contamination in dried fruit, and the potential of mites to produce allergens and acts as vectors of mycotoxin-producing fungi are highlighted.

Aflatoxins and ochratoxin A in stored barley grain in Spain and impact of PCR-based strategies to assess the occurrence of aflatoxigenic and ochratoxigenic *Aspergillus* spp.

Mateo E.M., Gil-Serna J., Patino B., Jimenez M. Journal of Food Microbiology (ISSN : 0168-1605) 2011 (September 15), 149 (2), 118-126 En:en (saan: 826167)

PCR assays were used in this study to detect *Aspergillus* species in mycotoxin-positive barley samples, together with classical enumeration techniques in different culture media. Barley kernel samples collected from Spanish grain stores were analysed using an optimised method. Mycotoxins detected and their levels are listed. High levels of natural contamination of barley with the species of *Aspergillus* examined were found with PCR assays.

Influence of water activity and temperature on growth and mycotoxin production by *Alternaria alternata* on irradiated soya beans.

Oviedo M.S., Ramirez M.L., Barros G.G., Chulze S.N.

International Journal of Food Microbiology (ISSN : 0168-1605) (September 15), 149 (2), 127-132 En:en (saan: 826168)

The production of alternariol (AOH) and alternariol monomethyl ether (AME) by *Alternaria alternata* on irradiated soya beans, as affected by water activity, temperature and their interactions, was examined in this study. Conditions for maximum growth of *Alternaria alternata* and maximum AOH and AME production were determined. Areas where conditions indicated a risk of accumulation of AOH and AME accumulation on soya bean were identified using profiles of water activity and temperature. The impact on storage conditions and potential hazards to human health are highlighted.

Phylogenetic characterization and ochratoxin A: fumonisin profile of black *Aspergillus* isolated from grapes in Argentina.

Chiotta M.L., Susca A., Stea G., Mule G., Perrone G., Logrieco A., Chulze S.N.

International Journal of Food Microbiology (ISSN : 0168-1605) 2011 (September 15), 149 (2), 171-176 En:en (saan: 826172)

Aspergillus species responsible for the production of ochratoxin A (OTA) and fumonisins were identified in this study by gene sequencing of *Aspergillus* section Nigri populations isolated from grapes in Argentina. Six lineages were found as a result of phylogenetic analysis and were grouped into four main clusters. *Aspergillus homomorphus* was identified from vineyards for the first time; *Aspergillus carbonarius* was the main ochratoxigenic species isolated. Only strains belonging to the *Aspergillus niger* cluster were able to produce OTA and fumonisins B2-B4.

A biomarker survey of urinary deoxynivalenol in China: the Shanghai Women's Health Study.

Turner P.C., Ji B.T., Shu X.O., Zheng W., Chow W.H., Gao Y.T., Hardie L.J.

Food Additives and Contaminants: Part A (ISSN : 0265-203X) 2011 28 (9), 1220-1223 En:en (saan: 826191)

Deoxynivalenol (DON) and other trichothecenes have been implicated in acute poisoning and oesophageal cancer, and this study examined

exposure patterns for women in China. Urinary unmetabolised or free DON and its glucuronide metabolite were determined. Detection of free DON plus glucuronide metabolite was found for 96.7% of samples. Results indicated that DON contamination of wheat might be higher in Shanghai than in the UK, and that humans have a more restricted detoxification capacity than animals.

Potential of an in vitro toolbox combined with exposure data as a first step for the risk assessment of dietary chemical contaminants.

Ribonnet L., van der Heiden E., Nobels I., Chaumont A., Remacle A.-S., de Saeger S., Schneider Y.-J., Scippo M.-L., Blust R., Pussemier L., Larondelle Y.
Food Additives and Contaminants: Part A (ISSN : 0265-203X) 2011 28 (9), 1136-1158 En:en (saan: 826184)

An in vitro approach using different complementary tools was used in this study to improve the assessment of the toxicological impact of dietary contaminants. Stress gene induction in transgenic strains of *Escherichia coli*, modulation of enzymic activity in a human intestinal cell line, and activation of genes in agonistic and antagonistic assays were applied to ochratoxin A, deoxynivalenol, imazalil and benomyl. Assays were performed at realistic intestinal concentration. Results showed that imazalil caused induction of cytochrome CYP1A1 activity, and inhibition of CYP3A4 activity occurred in Caco-2 cells. Exposure to deoxynivalenol and imazalil also induced some bacterial stress genes, and benomyl caused an oestrogen receptor agonistic activity in a human oestrogen sensitive reporter cell line. The use of complementary tools for obtaining a fingerprint of dietary contaminants is discussed.

Determination of aflatoxin risk components for in-shell Brazil nuts.

Vargas E.A., dos Santos E.A., Whitaker T.B., Slate A.B.
Food Additives and Contaminants: Part A (ISSN : 0265-203X) 2011 28 (9), 1242-1260 En:en (saan: 826192)

Samples of kernels and shells of Brazil nuts collected from processing plants in Amazonia, Brazil, were analysed for aflatoxin risk. Kernels and shells were sorted into good and rotten kernels/shells. The Brazil nut shell was contaminated with aflatoxin, and rotten nuts were a high-risk fraction for aflatoxin in in-shell Brazil nuts. Aflatoxin concentration in good kernels and nuts was estimated by measuring

aflatoxin concentration in the in-shell test sample and in all kernels, respectively.

Multitoxin analysis. Application to determine the aflatoxin and ochratoxin A in pepper, nutmeg, ginger and curry.

Barricelli M., Borner B.
Deutsche Lebensmittel-Rundschau (ISSN : 0012-0413) 2011 (September), 107 (9), 414-420 De (saan: 826073)

This paper discusses the potential for certain spices to contain high levels of aflatoxins and ochratoxin A. In the EU, pepper, nutmeg, ginger and curry are likely to have the highest contents. Each of these is discussed separately, with details of sourcing and composition. A multitoxin method to identify the presence of different toxins is described and the results of different tests on each of the spices are presented. For example, in 25 tests on nutmeg, 36% found aflatoxins but not in determinable quantities, while 8% showed levels above the maximum content. The same tests also showed 24% of the samples contained ochratoxin A but not in determinable quantities, while 4% showed levels above the maximum.

New mycotoxin reference materials. Quality assurance in food analysis.

Koch M., Koppen R., Nehls I.
Deutsche Lebensmittel-Rundschau (ISSN : 0012-0413) 2011 (September), 107 (9), 434-439 De (saan: 826075)

Mycotoxin limits are now a key part of food safety and consumer protection and as this kind of quality assurance increases in importance, so too does demand for Certified Reference Materials (CRMs) but there remains only a limited range of such controls or standards in place. A European project was undertaken to set new CRMs for certain mycotoxins and this has now been successfully completed for three types: ochratoxin A in coffee, ochratoxin A in wine and fusarium toxins in wheat. Factors such as homogeneity and stability were tested and new certified contents were set.

Chemical composition of *Ocimum basilicum* L. essential oil and its efficacy as a preservative against fungal and aflatoxin contamination of dry fruits.

Kumar A., Shukla R., Singh P., Prakash B., Dubey N.K.
International Journal of Food Science and Technology (ISSN : 0950-5423) 2011

(September), 46 (9), 1840-1846 En:en (saan: 825802)

Fungal and aflatoxin contamination of dried fruit, as affected by *Ocimum basilicum* essential oil, was investigated in this study. Of fungal isolates from dried fruit, 40% of isolates of *Aspergillus flavus* were toxigenic, and the essential oil was fungitoxic against the toxigenic strain of *Aspergillus flavus*. Production of aflatoxin B1 was inhibited by the oil, which showed broad fungitoxic spectrum, and reduced *Aspergillus flavus* isolates from dried fruit when used as a fumigant. GC-MS analysis was used to determine the chemical profile of the essential oil. The use of *Ocimum basilicum* essential oil as a preservative for enhancing the shelf life of dried fruit during storage is suggested.

Characterization of deoxynivalenol-induced anorexia using mouse bioassay.

Flannery B.M., Wu W., Pestka J.J.

Food and Chemical Toxicology (ISSN : 0278-6915) 2011 (August), 49 (8), 1863-1869 En:en (saan: 825669)

The induction of food refusal caused by deoxynivalenol (DON) was examined in this study using a short-term mouse model. Anorexia was induced as a result of DON exposure, and the no-observed-adverse-effect and lowest-observed-adverse-effect levels were set. Effects on food intake were transient, and a dose-dependent orexigenic response was found. Use of the short-term mouse bioassay to determine the adverse nutritional effect of DON is suggested.

Modeling the effect of temperature and water activity on the growth rate and lag phase of *Aspergillus flavus* during rice drying.

Yue X., Sui J., Niu T., Liu Y., Liu X.

Drying Technology (ISSN : 0737-3937) 2011 29 (11), 1306-1312 En:en (saan: 825675)

Models describing the effect of storage temperature and water activity on the growth rate and lag phase of *Aspergillus flavus* in rice were validated in this study. An adequate predictor of growth was the linear Arrhenius-Davey model, which described the effects of temperature on colony growth rate or lag phase. A quadratic polynomial function was validated for rice, and results showed that the model was suitable for describing the combined effect of water activity and temperature on the colony growth rate and lag phase. The use of the models developed in the preservation of rice is suggested.

Recognising food safety hazards.

Wallace C.A., Sperber W.H., Mortimore S.E. *Food safety for the 21st century*. Wallace C.A., Sperber W.H., Mortimore S.E. Wiley-Blackwell Singapore, 2011 (ISBN : 978-1-4051-8911-8) 65-86 (many ref on pp235-243) En:en (saan: 825403)

This chapter discusses what constitutes a food safety hazard, including biological hazards; the characteristics of foodborne illnesses; the major types of foodborne pathogens, including bacteria, viruses, prions and protozoa; chemical hazards, including allergens, mycotoxins, marine toxins, GM foods, antibiotics, persistent organic pollutants and heavy metals; and physical hazards.

A method for the detoxification of food products and food raw materials contaminated with aflatoxins.

Valida Srl, Gilli G., Tartaro D. *European Patent Application 2 361 020* En:en (saan: 825321)

An improved method of detoxifying food products or food raw materials that are contaminated with aflatoxins, such as cereals and pistachios and other tree nuts, is disclosed. The invention is claimed to eliminate or reduce the level of aflatoxins both inside and outside of the products. It allows for flexibility of application, is inexpensive and has high effectiveness without altering the visual, sensory and nutritional characteristics of the treated products. The method reduces the risk of operators being exposed to toxins, the risk of contaminating other food products, the damages to end-users' health and the waste of material and related costs. The invention involves atomising or nebulising hydrogen peroxide at a predetermined concentration on food products or raw materials to be detoxified.

Reduction of fumonisin B1 in corn grits by twin-screw extrusion.

Jackson L.S., Jablonski J., Bullerman L.B., Bianchini A., Hanna M.A., Voss K.A., Hollub A.D., Ryu D.

Journal of Food Science (ISSN : 0022-1147) 2011 (August), 76 (6), T150-T155 En:en (saan: 825174)

Fumonisin B1 and its analogues were determined in this study in flaking corn grits during twin-screw extrusion, using food-grade corn grits and grits contaminated with fumonisin B1 by *Fusarium verticillioides* M-2552. Fumonisin B1, B2 and B3 were reduced in contaminated grits by extrusion. The hydrolysed form of fumonisin B1 was a minor species in extruded corn grits, with or without added

glucose. The need to identify the reaction products resulting from extrusion processing of corn products contaminated with fumonisin is highlighted.

Volatile trans-2-hexenal, a soybean aldehyde, inhibits *Aspergillus flavus* growth and aflatoxin production in corn.

de Lucca A.J., Carter-Wientjes C.H., Boue S., Bhatnagar D.

Journal of Food Science (ISSN : 0022-1147) 2011 (August), 76 (6), M381-M386 En:en (saan: 825200)

Trans-2-hexenal produced by soya bean and other plants has been shown to reduce the viability of *Aspergillus flavus* germinating conidia, without affecting the viability of non-germinated conidia. This study examined the effect of trans-2-hexenal for preventing the growth of *Aspergillus flavus* on stored corn. The volatile compound was intermittently pumped through corn kernels inoculated with conidia of *Aspergillus flavus*, and aflatoxin B1, viability counts, and aldehyde concentration in the headspace were determined. Results showed that growth of *Aspergillus flavus* and aflatoxin B1 production were prevented by intermittent pumping of volatile trans-2-hexenal.

Natural occurrence of fumonisins B1 and B2 in corn from three main production provinces in China.

Feng Y.Z., Lu X.H., Tao B., Pang M.H., Liu Y.C., Dong J.G.

Journal of Food protection (ISSN : 0362-028X) 2011 (August), 74 (8), 1374-1378 (31 ref.) En (saan: 824987)

This study of the fumonisin content of Chinese corn found that the incidence of fumonisins B1 and B2 was significantly higher in samples from Liaoning, compared with those from Shandong and Henan. It was found that 80% of the Liaoning samples were contaminated, with a mean total fumonisin concentration of 3,990 ng/g. The mean total fumonisin concentration of samples from Shandong was 845 ng/g and that from Henan was 665 ng/g. It is proposed that, based on the provisional tolerable daily intake of 2.0 mcg/kg body weight, the corn samples do not pose a risk to health.

Incidence, phylogeny and mycotoxigenic potentials of fungi isolated from rice in Niger State, Nigeria.

Makun H.A., Dutton M.F., Njobeh P.B., Phoku J.Z., Yah C.S.

Journal of Food Safety (ISSN : 0149-6085) 2011 (August), 31 (3), 334-349 En:en (saan: 824903)

The results from a small survey of fungal contamination in 21 samples of rice (stored and field) from Nigeria are presented. A total of 357 fungal isolates including *Aspergillus*, *Fusarium*, *Sarocladium*, *Acremonium*, *Curvularia*, *Botryosphaeria*, *Penicillium*, *Alternaria* and *Ascomycota* were identified. *Aspergillus flavus*, *Aspergillus parasiticus*, *Aspergillus ochraceus*, *Fusarium proliferatum* and *Fusarium verticillioides* were identified as mycotoxigenic species and could potentially cause contamination with aflatoxins, ochratoxin A and fumonisins.

An immunoassay for the simultaneous detection of two mycotoxins, ochratoxin A and fumonisin B1.

Wang X., Zhang H., Liu H., He C., Zhang A., Ma J., Ma Y., Wu W., Zheng H.

Journal of Food Safety (ISSN : 0149-6085) 2011 (August), 31 (3), 408-416 En:en (saan: 824912)

The development and performance of an immunoarray ELISA for the simultaneous determination of ochratoxin A and fumonisin B1 are discussed. Limits of detection were around 5 and 109 ng/ml for ochratoxin A and fumonisin B1, respectively. This rapid determination method could be an alternative to more time-consuming chromatography techniques for screening foods.

Effects of the essential oil of *Zataria multiflora* Boiss, a thyme-like medicinal plant from Iran on the growth and sporulation of *Aspergillus niger* both in vitro and on lime fruits.

Abdollahi M., Hamzehzarghani H., Saharkhiz M.J.

Journal of Food Safety (ISSN : 0149-6085) 2011 (August), 31 (3), 424-432 En:en (saan: 824914)

The antifungal activity of essential oil from *Zataria multiflora* Boiss (a herb similar to thyme) on *Aspergillus niger* induced fruit rot in key lime is described. Essential oil concentrations around 400 ppm reduced the risk of fruit rot during cold storage of limes. Concentrations greater than 1,500 ppm inhibited *Aspergillus niger* sporulation. The natural preservative is considered to be a useful alternative to fungicides for preventing fruit rot during storage.

Analysis of patulin in pear- and apple-based foodstuffs by liquid chromatography electrospray ionization tandem mass spectrometry.

Desmarchelier A., Mujahid C., Racault L., Perring L., Lancova K.

Journal of Agricultural and Food Chemistry (ISSN : 0021-8561) 2011 (July 27), 59 (14), 7659-7665 En:en (saan: 824646)

Patulin was determined in apple- and pear-based foods in this study using a liquid chromatography electrospray ionisation-MS-MS method. Sample preparation and clean-up are described. Isotope dilution was used for quantification of patulin, and the method was validated in baby food products, pear concentrate, raw apples, apple flakes, dried apples, and yoghurt. Limits of detection and quantification are presented. The performance, recovery, repeatability and reproducibility of the method are discussed.

Immunoassay based on monoclonal antibodies versus LC-MS: deoxynivalenol in wheat and flour in southern Brazil.

Sifuentes dos Santos J., Takabayashi C.R., Ono E.Y.S., Itano E.N., Mallmann C.A., Kawamura O., Hirooka E.Y.

Food Additives and Contaminants: Part A (ISSN : 0265-203X) 2011 28 (8), 1083-1090 En:en (saan: 824594)

Deoxynivalenol (DON) was detected in wheat and flour using an indirect competitive ELISA (ic-ELISA) method with a monoclonal antibody, compared with liquid chromatography-MS (LC-MS). DON was detected in more samples using the ic-ELISA, compared with LC-MS. The reliability, efficiency and suitability of the ic-ELISA for DON screening in wheat samples are discussed.

Distribution of aflatoxins in shelling and milling fractions of naturally contaminated rice.

Trucksess M.W., Abbas H.K., Weaver C.M., Shier W.T.

Food Additives and Contaminants: Part A (ISSN : 0265-203X) 2011 28 (8), 1076-1082 En:en (saan: 824593)

The distribution of aflatoxins in rice milling fractions was examined in this study. Paddy (seeds) rice was collected and stored under humid conditions, and samples milled into hulls, brown rice, bran and white rice fractions were analysed for aflatoxins B1, B2, G1 and G2. Contamination with aflatoxins B1 and B2 was found for seeds stored under poor conditions. Total levels of aflatoxin B1 and aflatoxin B2 in

stored paddy rice, hulls, brown rice, bran and white rice are presented. Results showed that brown rice contained more aflatoxins than white rice.

Quantitative dietary exposure assessment of the Catalonian population (Spain) to the mycotoxin deoxynivalenol.

Cano-Sancho G., Gauchi J.-P., Sanchis V., Marin S., Ramos A.J.

Food Additives and Contaminants: Part A (ISSN : 0265-203X) 2011 28 (8), 1098-1109 En:en (saan: 824596)

The exposure of the Catalonian population to deoxynivalenol (DON) as a result of food consumption was examined in this study. A parametric method was used to combine contamination and consumption data, and related confidence intervals were built using a pseudo-parametric bootstrap method, to quantify the accuracy and reliability of the estimates. Results indicated that the Catalonian population are exposed to moderate levels of DON, with the most exposed population groups being infants and individuals with ethnic dietary patterns.

Occurrence of toxigenic fungi in ochratoxin A contaminated liquorice root.

Chen A.J., Huang L.F., Wang L.Z., Tang D., Cai F., Gao W.W.

Food Additives and Contaminants: Part A (ISSN : 0265-203X) 2011 28 (8), 1091-1097 En:en (saan: 824595)

Mouldy liquorice materials from herbal markets in areas of China were examined for the fungi associated with ochratoxin A (OTA) contamination and their ability to produce OTA. Fungal species isolated are listed; *Penicillium polonicum* was predominant. *Aspergillus* and *Eurotium* were dominant in samples with lower OTA contents, and liquid chromatography-MS-MS detected representative strains on rice media. *Penicillium polonicum* isolates and a *Penicillium chrysogenum* were ochratoxigenic. The health risks of mouldy liquorice root are highlighted.

Comparison of manual and automatic sampling for monitoring ochratoxin A in barley grain.

Andersson M.G., Reiter E.V., Lindqvist P.-A., Razzazi-Fazeli E., Haggblom P.

Food Additives and Contaminants: Part A (ISSN : 0265-203X) 2011 28 (8), 1066-1075 En:en (saan: 824592)

Ochratoxin A was analysed in barley grain in this study using automatic and manual sampling methods. Barley grains inoculated with *Penicillium verrucosum* were incubated and sampled once the OTA concentration reached a certain level. Manual sampling gave a high sampling uncertainty, but when aggregate samples were formed by automatic sampling, the uncertainty was eliminated; the advantages of automatic sampling for monitoring low levels of mycotoxins in grain are discussed. The need for appropriate subsampling to prevent segregation of particles is highlighted.

Mould growth and mycotoxin production as affected by *Equisetum arvense* and *Stevia rebaudiana* extracts.

Garcia D., Garcia-Cela E., Ramos A.J., Sanchis V., Marin S.

Food Control (ISSN : 0956-7135) 2011 (August), 22 (8), 1378-1384 En:en (saan: 824553)

Natural ways to inhibit or destroy the growth, and, hence, mycotoxin production among toxigenic fungi would be helpful to the food industry. This work shows that an extract of *Equisetum arvense* inhibited the growth of a mixture of six toxigenic fungi. In contrast, an extract of *Stevia rebaudiana* had no significant effect on fungal growth. However, the effects of the extracts on mycotoxin production were not conclusive.

Effect of two different roasting techniques on the ochratoxin A (OTA) reduction in coffee beans (*Coffea arabica*).

Castellanos-Onorio O., Gonzalez-Rios O., Guyot B., Fontana T.A., Guiraud J.P., Schorr-Galindo S., Durand N., Suarez-Quiroz M.

Food Control (ISSN : 0956-7135) 2011 (August), 22 (8), 1184-1188 En:en (saan: 824526)

There are maximum limits for the mycotoxin ochratoxin A (OTA) in coffee. This work describes the effects of roasting techniques (rotating cylinder and fluidised bed) on the content of OTA in green coffee deliberately contaminated with *Aspergillus westerdijkiae*. Complete degradation of OTA was not achieved but a reduction of 88% was obtained using a rotating cylinder roasting during the production of commercial dark roast coffee.

Fusarium mycotoxins in wheat samples harvested in Serbia: a preliminary survey.

Skrbic B., Malachova A., Zivancev J., Veprikova Z., Hajslova J.

Food Control (ISSN : 0956-7135) 2011 (August), 22 (8), 1261-1267 En:en (saan: 824537)

Fusarium contamination of wheat can lead to the production of various mycotoxins. The risks of fungal infection, and, hence mycotoxin production are affected by species, wheat growth stage and climatic factors. The results from a survey of the deoxynivalenol-3-glucoside, 3- and 15-acetyldeoxynivalenol, fusarenon-X, zearalenone, deoxynivalenol, HT-2 toxin, T2-toxin and nivalenol contamination in 54 samples of Serbian wheat harvested in 2007 are presented. Deoxynivalenol was the most common with a maximum level of 309 mcg/kg. Nivalenol, T2-toxin and zearalenone were not detected. The levels are in compliance with EU legislation concerning maximum limits of certain Fusarium toxins in cereals.

Simultaneous determination of type-A and type-B trichothecenes in barley samples by GC-MS.

Ibanez-Vea M., Lizarraga E., Gonzalez-Penas E.

Food Control (ISSN : 0956-7135) 2011 (August), 22 (8), 1428-1434 En:en (saan: 824562)

The development and performance validation of a simultaneous determination method for type-A and type-B Fusarium mycotoxins is presented. The toxins were extracted using acetonitrile/water, cleaned-up on a Multiep column, derivatised and analysed using GC-MS. Recoveries of target analytes were in the range 63 to 102% and limits of quantification were between 10 and 20 mcg/kg. Eighty-nine percent of 44 samples of barley harvested in Spain in 2007 contained deoxynivalenol. However, the authors consider that the dietary intakes of deoxynivalenol, HT-2 toxin, T-2 toxin and nivalenol are within the tolerable daily intakes. Two or more trichothecenes were present in 41% of samples and the human health risk posed by this needs to be assessed.

A preliminary study of T-2 and HT-2 toxins in cereals sold in traditional market in South Korea.

Kassim N., Kim K., Mtenga A.B., Song J.E., Liu Q., Shim W.B., Chung D.H.

Food Control (ISSN : 0956-7135) 2011 (August), 22 (8), 1408-1412 En:en (saan: 824558)

The results from a survey of the occurrence and content of the Fusarium mycotoxins T-2 toxin and HT-2-toxin in cereals sold in traditional markets in Gyeongnam Province, South Korea

are presented. Of the 75 samples analysed, 13 were contaminated with T-2 toxin (35.2-431 ng/g) and 25 with HT-2 toxin (21.1-442.7 ng/g). Four samples contained both toxins.

Mycotoxin management in the European cereal trading sector.

Siegel D., Babuscio T.

Food Control (ISSN : 0956-7135) 2011 (August), 22 (8), 1145-1153 En:en (saan: 824520)

Growing and stored grain is at risk of fungal infection and mycotoxin contamination. The EU has maximum limits for mycotoxins in cereals and cereal products to minimise human exposure. Additionally, the economic value of mycotoxin contaminated cereals is reduced. This survey of European cereal traders examines the key issues in commercial mycotoxin management. Prevention, sampling, access to appropriate methods of analysis and issues relating to variations in regulatory limits and commercial standards are discussed.

Development of a real time PCR system for detection of ochratoxin A-producing strains of the *Aspergillus niger* aggregate.

Castella G., Cabanes F.J.

Food Control (ISSN : 0956-7135) 2011 (August), 22 (8), 1367-1372 En:en (saan: 824551)

This is thought to be the first report of a real-time PCR for the simultaneous detection of ochratoxin A (OTA)-producing strains of the *Aspergillus niger* aggregate. The ability to detect potentially OTA producing strains can alert food operators to the risks associated with food batches. Two specific primers and a probe were designed to detect gene sequences in a polyketide synthase (PKS) from *Aspergillus niger* CBS 513.88. This target has high homology with a PKS in *Aspergillus ochraceus* involved in OTA biosynthesis. Specificity for only OTA-producing strains of the *Aspergillus niger* aggregate was demonstrated.

Determination of *Fusarium* mycotoxins enniatins, beauvericin and fusaproliferin in cereals and derived products from Tunisia.

Oueslati S., Meca G., Mliki A., Ghorbel A., Manes J.

Food Control (ISSN : 0956-7135) 2011 (August), 22 (8), 1373-1377 En:en (saan: 824552)

The results from a survey of the occurrence of various *Fusarium* mycotoxins in wheat, barley, maize, sorghum, pasta and couscous

purchased from retailers in Tunisia are presented. Enniatin A1 was detected in 92% of samples (11-480 mg/kg), enniatin B was detected in about 70% of samples (1.5-295 mg/kg), enniatin A1 in about 30% of samples (19.6-121.3 mg/kg) and enniatin B1 in about 40% of samples (4.8-120.1 mg/kg). Beauvericin and fusaproliferin were not detected in any of the samples. This is thought to be the first report of the occurrence of these emerging *Fusarium* toxins in Tunisian cereals and cereal products.

Detection of potentially mycotoxigenic *Aspergillus* species in Capsicum powder by a highly-sensitive PCR-based detection method.

Sardinas N., Gil-Serna J., Santos L., Ramos A.J., Gonzalez-Jaen M.T., Patino B., Vazquez C.

Food Control (ISSN : 0956-7135) 2011 (August), 22 (8), 1363-1366 En:en (saan: 824550)

The results from a survey of the occurrence of mycotoxigenic fungi in retail samples of paprika and chilli from Spain are presented. Detection of mycotoxigenic potential was made using PCR. About 84% of paprika and 65% of chilli samples contained toxigenic *Aspergillus* species, predominantly *Aspergillus niger* and *Aspergillus flavus*. The high co-occurrence of *Aspergillus* species with the potential to produce aflatoxins and ochratoxin A (OTA) highlights the need to reduce fungal contamination to improve the safety of these spices.

Influence of different coffee drink preparations on ochratoxin A content and evaluation of the antioxidant activity and caffeine variations.

Santini A., Ferracane R., Mikusova P., Eged S., Srobarova A., Meca G., Manes J., Ritieni A.

Food Control (ISSN : 0956-7135) 2011 (August), 22 (8), 1240-1245 En:en (saan: 824534)

Ochratoxin A (OTA) is a mycotoxin that may be found in coffee beans. However, the content of OTA in coffee beverages will be affected by the brewing process. This work compared the changes in OTA and caffeine contents and antioxidative activity in coffee (American, moka, Italian espresso, Neapolitan and Turkish) made from roasted coffee beans contaminated with OTA. Brewed coffee had much lower content than beans and the OTA content varied by brewing method.

Verification of the effectiveness of SCAR (sequence characterized amplified region) primers for the identification of Polish strains of *Fusarium culmorum* and their potential ability to produce B-trichothecenes and zearalenone.

Baturo-Ciesniewska A., Suchorzynska M. International Journal of Food Microbiology (ISSN : 0168-1605) 2011 (August 15), 148 (3), 168-176 En:en (saan: 824330)

The evaluation of the efficacy of primers for species identification of *Fusarium culmorum* and basic mycotoxin-producing genes is reported in this study. Isolates (n=68) were collected from Polish-grown cereals and potatoes over 3 years. Four primer pairs were evaluated but only primers Fc01F/Fc01R was fully effective in the identification of Polish strains of *Fusarium culmorum*. The Tri5 gene, responsible for trichothecene production, was effectively identified by use of three pairs of primer (tox5-1/tox5-2, HATriF/HATriR and Tri5F/Tri5R). Primer pairs MinusTri7F/MinusTri7F, Tri7F/Tri7DON and Tri13F/Tri13DONR were suitable for the identification of strains of *Fusarium culmorum* with potential for producing deoxynivalenol, primer pairs Tri7F/Tri7R, Tri7F/Tri7NIV and Tri13NIVF/Tri13R were suitable for the identification of nivalenol-producing strains, and assay with PKS4-PS.1/PKS4-PS.2 and F1/R1 was suitable for the identification of zearalenone-producing isolates.

Molecular survey of trichothecene genotypes of *Fusarium graminearum* species complex from barley in Southern Brazil.

Astolfi P., dos Santos J., Schneider L., Gomes L.B., Silva C.N., Tessmann D.J., del Ponte E.M. International Journal of Food Microbiology (ISSN : 0168-1605) 2011 (August 15), 148 (3), 197-201 En:en (saan: 824334)

Small-grain cereals of Brazil can be contaminated with mycotoxins, such as deoxynivalenol and nivalenol, and acetylated derivatives of deoxynivalenol: 3-acetyl-deoxynivalenol and 15-acetyl-deoxynivalenol, as a result of infection with *Fusarium graminearum* that can also cause *Fusarium* head blight. In this study, isolates (n=92) were collected from barley grain grown in cereal production regions of Brazil over three years. Trichothecene genotypes were identified using PCR based on amplification of portions of Tri3 and Tri12. Growing region and year had no effect on the proportion of trichothecene genotype which were 66% 15-acetyl-deoxynivalenol, 29.3% nivalenol and 4.4% 3-

acetyl-deoxynivalenol. The strains were identified based on trichothecene genotypes as *Fusarium graminearum sensu stricto*, *Fusarium meridionale* and *Fusarium austroamericanum*.

Determining mycotoxins and mycotoxigenic fungi in food and feed.

de Saeger S. Woodhead, Cambridge 2011 (ISBN : 978-1-84569-674-0) 427pp En (saan: 824309)

This edition comprises five sections. Part 1 on determining mycotoxins in food and feed contains chapters on sampling strategies to control mycotoxins; sample preparation and clean up in mycotoxin analysis - principles, applications and recent developments; chromatographic separation techniques for determination of mycotoxins in food and feed; mass spectrometry in multi-mycotoxin and fungal spore analysis; immunochemical methods for rapid mycotoxin detection in food and feed. Part 2 on quality assurance and official methods for determining mycotoxins in food and feed contains chapters on official methods and performance criteria for determining mycotoxins in food and feed; ensuring the quality of results from food control laboratories: laboratory accreditation, method validation and measurement uncertainty. Part 3 on development and analysis of biomarkers for mycotoxins contains chapters on developing biomarkers of human exposure to mycotoxins; developing mechanism-based and exposure biomarkers for mycotoxins in animals. Part 4 on determining mycotoxigenic fungi in food and feed contains chapters on rationale for a polyphasic approach in the identification of mycotoxigenic fungi; molecular identification of mycotoxigenic fungi in food and feed; identification of genes and gene clusters involved in mycotoxin synthesis; DNA barcoding of toxigenic fungi - a perspective. Part 5 on emerging methods for mycotoxin analysis in food and feed contains chapters on emerging biosensing methods for mycotoxin analysis; masked mycotoxins in food and feed - challenges and analytical approaches; spectroscopic techniques for fungi and mycotoxins detected.

Development and analysis of biomarkers for mycotoxins.

Routledge M.N., Gong Y.Y., Riley R.T., Voss K.A., Pestka J.J., Williams D.E. Determining mycotoxins and mycotoxigenic fungi in food and feed. de Saeger S. Woodhead, Cambridge 2011 (ISBN : 978-1-84569-674-0) 223-275 (many ref.) En (saan: 824312)

The two chapters in this section are: 'Developing biomarkers of human exposure to mycotoxins', by M.N. Routledge and Y.Y. Gong; and 'Developing mechanism-based and exposure biomarkers for mycotoxins in animals', by R.T. Riley, K.A. Voss, J.J. Pestka and D.E. Williams.

Determining mycotoxins in food and feed.

Various authors Determining mycotoxins and mycotoxigenic fungi in food and feed. de Saeger S.

Woodhead, Cambridge 2011 (ISBN : 978-1-84569-674-0) 3-167 (many ref.) En (saan: 824310)

This section contains the following papers: 'Sampling strategies to control mycotoxins', by B. Maestroni and A. Cannavan; 'Sample preparation and clean up in mycotoxin analysis: principles, applications and recent developments', by E. Razzazi-Fazeli and E.V. Reiter; 'Chromatographic separation techniques for determination of mycotoxins in food and feed', by G.S. Shephard; 'Mass spectrometry in multi-mycotoxin and fungal spore analysis', by M.C. Spanjer; and 'Immunochemical methods for rapid mycotoxin detection in food and feed', by I.Y. Goryacheva and S. de Saeger.

Determining mycotoxigenic fungi in food and feed.

Frisvad J., Munaut F., van Hove F., Moretti A., Brown D.W., Butchko R.A.E., Proctor R.H., Santamaria M. Determining mycotoxins and mycotoxigenic fungi in food and feed. de Saeger S. Woodhead, Cambridge 2011 (ISBN : 978-1-84569-674-0) 277-356 (many ref.) En (saan: 824313)

The following papers are presented in this section: 'Rationale for a polyphasic approach in the identification of mycotoxigenic fungi', by J.C. Frisvad; 'Molecular identification of mycotoxigenic fungi in food and feed', by F. Munaut, F. van Hove and A. Moretti; 'Identification of genes and gene clusters involved in mycotoxin synthesis', by D.W. Brown, R.A.E. Butchko and R.H. Proctor; and 'DNA barcoding of toxigenic fungi - a perspective', by M. Santamaria.

Emerging methods for mycotoxin analysis in food and feed.

Tohill I.E., di Mavungu J.D., de Saeger S., Singh C.B., Jayas D.S. Determining mycotoxins and mycotoxigenic fungi in food and feed. de Saeger S. . Woodhead, Cambridge

2011 (ISBN : 978-1-84569-674-0) 357-414 (many ref.) En (saan: 824314)

The following papers are presented in this section: 'Emerging bio-sensing methods for mycotoxin analysis', by I.E. Tohill; 'Masked mycotoxins in food and feed - challenges and analytical approaches', by J.D. di Mavungu and S. de Saeger; and 'Spectroscopic techniques for fungi and mycotoxins detection', by C.B. Singh and D.S. Jayas.

Quality assurance and official methods for determining mycotoxins in food and feed.

Senyuva H.Z., Gilbert J., de Beer J.O., van Poucke C., Routledge M.N., Gong Y.Y., Riley R.T., Voss K.A., Pestka J.J. Determining mycotoxins and mycotoxigenic fungi in food and feed. de Saeger S. Woodhead, Cambridge 2011 (ISBN : 978-1-84569-674-0) 169-276 (many ref.) En (saan: 824311)

mycotoxins in food and feed', by H.Z. Senyuva; and 'Ensuring the quality of results from food control laboratories: laboratory accreditation, method validation and measurement uncertainty', by J.O. de Beer and C. van Poucke.

Apparatus and method for treating stored crops infected with toxins.

Pureline Treatment Systems LLC, O'Connell T.W. PCT Patent Application WO 2011/100165 En:en (saan: 824291)

An improved method of treating stored crops infected with mycotoxins and other toxins using chlorine dioxide is disclosed. The invention is claimed to ensure treatment of both the toxins themselves and their source. It can be used in grain storage areas, grain silos and fermentation plants, such as beverage and ethanol plants. The method is suitable for use in treating various products, including fermentation products (e.g. beer, wine and distilled spirits), therapeutic compositions, fortified foods, bakery products, nutraceuticals, nutraceutical intermediates, dietary supplements and enzymes. The mycotoxins can be aflatoxins, fumonisin, vomitoxin, ochratoxin, zearalenone, T-2 toxin, patulin, fusarochromanone and citrinin.

Concentrations of ergosterol and trichothecenes in the grains of three Triticum species.

Wiwart M., Perkowski J., Budzynski W., Suchowilska E., Busko M., Matysiak A.

Czech Journal of Food Sciences (ISSN : 1212-1800) 2011 29 (4), 430-440 En:en (saan: 824148)

Concentrations of ergosterol, HT-2 toxin, T-2 tetraol, scirpentriol, deoxynivalenol, 3-acetyldeoxynivalenol, 15-acetyldeoxynivalenol, nivalenol and fusarenone X in different wheat cultivars were determined in this study. The grain of *Triticum durum* contained the highest concentrations of ergosterol and deoxynivalenol; fungicide application did not reduce ergosterol concentrations. A predominance of pathogenic *Fusarium* fungi was found in the wheat grain.

Changes in baking quality of winter wheat with different intensity of *Fusarium* spp. contamination detected by means of new rheological system.

Papouskova L., Capouchova I., Kostelanska M., Skerikova A., Prokinova E., Hajslova J. Czech Journal of Food Sciences (ISSN : 1212-1800) 2011 29 (4), 420-429 En:en (saan: 824147)

A new rheological Mixolab was used in this study to detect changes in the baking quality of winter wheat with different levels of *Fusarium* spp contamination. Correlations between Mixolab properties and other quality parameters of wheat flour and grain were also examined. The rheological quality was adversely affected by increasing intensity of *Fusarium* spp contamination, and Mixolab curves demonstrated its negative effects on protein and the starch part of the grain. Mixolab characteristics and technological parameters, and Mixolab parameters and loaf volume were correlated.

Determination of ochratoxin A in wheat after clean-up through a DNA aptamer-based solid phase extraction column.

de Girolamo A., McKeague M., Miller J.D., DeRosa M.C., Visconti A.

Food Chemistry (ISSN : 0308-8146) 2011 (August 1), 127 (3), 1378-1384 En:en (saan: 824120)

Solid-phase extraction (SPE) columns were prepared in this study using a DNA aptamer with high affinity and specificity to ochratoxin A (OTA) conjugated to a coupling gel. The extraction step was optimised, and SPE columns were used for clean-up of OTA from wheat prior to HPLC analysis with fluorescence detection. Naturally contaminated durum wheat samples were analysed, and samples cleaned up on aptamer SPE and immunoaffinity columns showed a good correlation.

Widespread occurrence of low levels of alternariol in apple and tomato products as determined by comparative immunochemical assessment using monoclonal and polyclonal antibodies.

Ackermann Y., Curtui V., Dietrich R., Gross M., Latif H., Martibauer E., Usleber E.

Journal of Agricultural and Food Chemistry (ISSN : 0021-8561) 2011 (June 22), 59 (12), 6360-6368 En:en (saan: 823975)

The production of monoclonal and polyclonal antibodies against the mycotoxin alternariol was investigated, together with their application in an enzyme immunoassay for rapid determination of alternariol in food samples. Both enzyme immunoassays were shown to be sensitive, with detection limits of around 35 pg/ml using monoclonal antibodies and 59 mg/ml using polyclonal antibodies. The proposed method was used to analyse apple and tomato products and white wine from retail outlets in Germany. Alternariol was found at levels of 1 to 13 mcg/kg in 67% of apple products and 93% of tomato products. Tomatoes with visible signs of *Alternaria* infection that were stored at room temperature for up to 4 weeks contained up to 50 mg/kg of alternariol as determined by enzyme immunoassay and HPLC with fluorescence detection.