What are mycotoxins?

Which products does LCTech offer for the analysis of mycotoxins?

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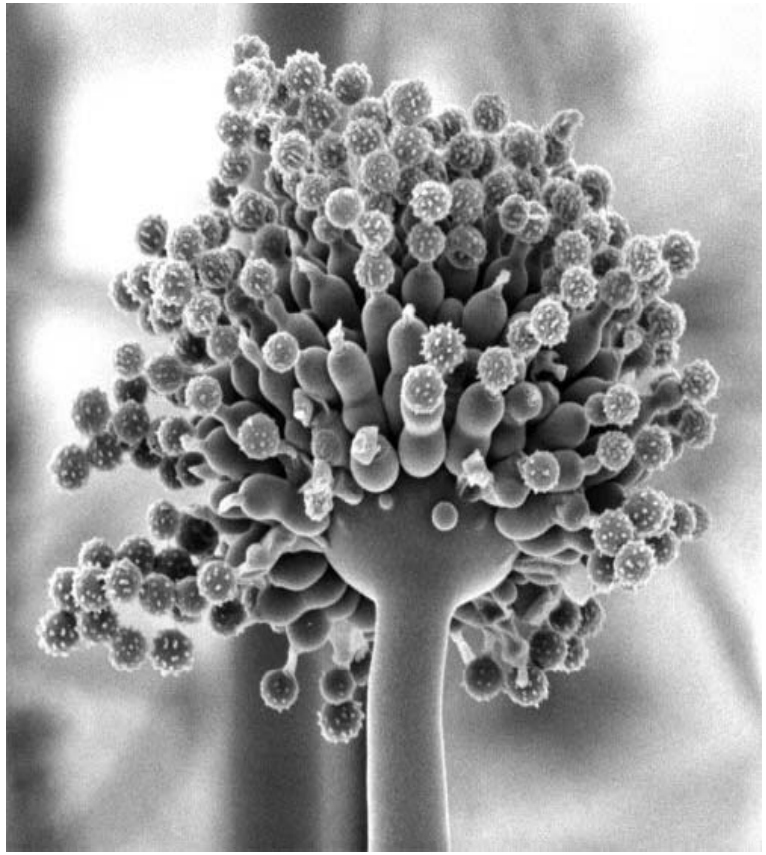
What are mycotoxins?



Aspergillus flavus: a fungi, which produces mycotoxins

- **Mycotoxins =**
  secondary metabolites produced by fungi like *Fusarium, Penicillium, Aspergillus*
- more than 300 toxins known

What are mycotoxins?

- very resistant against heat or acid, not destroyed while processed (boiling, roasting, baking)
- All molded food can contain mycotoxins (above all cereals, seeds, fruits)
- Different contaminations
  - Primary contamination: corn is already contaminated on the field
  - Secondary contamination: Stored food is contaminated
  - Carry over: animals take up mycotoxins with feed and transfer them to milk, eggs or meat.

Mycotoxins - worldwide problem

- FAO estimates that in about 25 % of the world food production mycotoxins can be found.
- About 20% of the corn in the EU contain measurable amounts of mycotoxins.
- Production of mykotoxins is enhanced by
  - high temperatures and humidity
  - bad storage and transport conditions
- High contaminations in the tropics and subtropics

Health threats for men

- Acute effects of mycotoxins to man
  - Damages to the central nervous system
  - Damages to skin and mucosa
  - allergic reactions
  - Damages to organs
  - …

- Chronic effects of myctoxins to man
  - enhanced cancer risk, above all liver cancer
  - impaired immune system
  - inhibited or disturbed metabolic processes
  - Damages to genetic material
  - …

The curse of the pharaoh

Howard Carter (at the left) with Lord Carnarvon in the entrance to Tutanchamun's coffin chamber

- The legend:

  "Death shall come on swift wings to him that toucheth the tomb of the pharaoh."

  - that's the inscription to the grave of the Egyptian pharaoh Tutanchamun

  The archaeologist Howard Carter and his team open the coffin chamber in 1922.

  During the following weeks the curse becomes true: Some of the researchers, their family members and visitors to the grave die.

- The facts:

  The fungi *Aspergillus flavus* outlives the centuries in the coffin chamber, its toxins are the reason for some of the deaths.

Health treats to animals

- Toxin contents (trichothecene) in feed and observed symptoms for different animals

animal	conent mg/kg feed	symptom
dairy cow	more than 5	reduced feed uptake and milk performance
	more than 10	carry-over to milk
sheep	more than 10	less leukocytes enhanced susceptibility to diseases
fish	more than 1	necrosis, inflammations
hens	more than 5	residues in eggs

Source: Schimmelpilze und Mykotoxine in Futtermitteln, Landesanstalt für Landwirtschaft Bayern

The investigaiton of mycotoxins

- The beginning:

  In 1960 more than 100,000 turkeys die in England due to a new disease called "turkey x disease".

  Mass mortality spreads to ducks and pheasants.

  Using an electron microscope the fungi Aspergillus flavus is discovered.

  Accurate investigations show that the disease resulted from Brazilian peanut feed, which was contaminated with mycotoxins.

- Ever since:

  Mycotoxins are intensively investigated all over the world.

  In more than 100 countries maximum contents in food are stricly regulated.

Legal reglementations

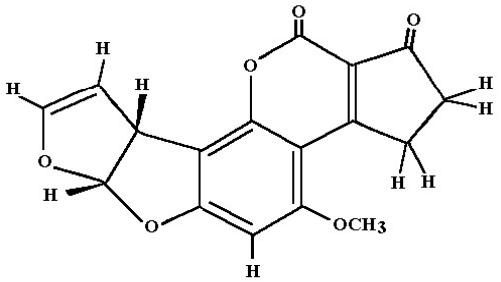
- Legal maximum contents for aflatoxins in food in the EU, exemplary

product	max. cont. aflatoxin B1	max. cont. ∑ aflatoxins
peanuts, ready to eat	2.0	4.0
paprika, chili, nutmeg, pepper	5.0	10.0
corn and cereals	2.0	4.0
baby food	0.1	-

Source: COMMISSION Regulation (EC) No 1881/2006 setting maximum levels for certain contaminants in foodstuffs

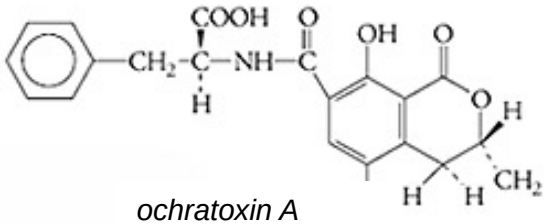
The most important mycotoxins

- Aflatoxins
  - produced by *Aspergillus spec.*, …
  - acutely toxic
  - found in maize in the USA or in the tropical countries, fungi affects corn already on the fields
  - but also in oily seeds, peanuts, hazelnuts, Brazil nuts, almonds, pistachios, poppy seeds, sesame, rice, sorghum, field beans, dried fruits, chili, paprika, pepper, nutmegs, ginger, curcuma, milk, …



aflatoxin B1

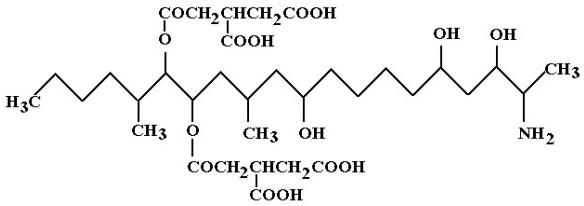
- Ochratoxins
  - produced by *Aspergillus spec., Penicillium spec.*, …
  - maize, oat, barley, wheat, rye, rice, sorghum, soy beans, peanuts, Brazil nuts, pepper, …
  - coffee, beer, wine, ….



ochratoxin A

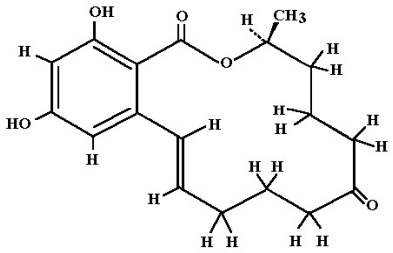
The most important mycotoxins

- Fumonsins
  - produced by *Fusarium spec*, …
  - above all in maize
  - probable reason for cumulative gullet cancer in South Africa, China and Italy



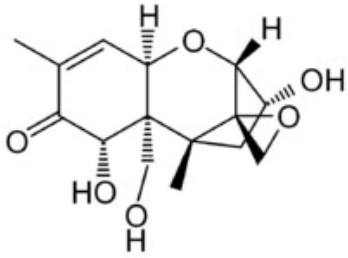
fumonisin B1

- Zearalenone (ZEA)
  - produced by *Fusarium spec*, …
  - above all in corn and nuts
  - high estrogen and anabolic effects



zearalenone

- Trichothecene
  - produced by *Fusarium spec*, …
  - corn, potatoes, bananas, …
  - inhibite protein sythesis



deoxynivalenol

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Analysis of mycotoxins

Sampling

▼

Homogenization

▼

Extraction

▼

Cleaning up

▼

Chromatography

▼

Detection

▼

Interpretation

LCTech products for mycotoxin analysis

Cleaning up

- Immunoaffinity columns for sample preparation for the analysis of aflatoxin B1, B2, G1 and G2
  - maxium load capacity 100 ng aflatoxin B1
  - convenient 3 mL polypropylen format
  - LCTech checks each charge and documents the result with a certificate
  - excellent recoveries
- sucessfully used for matrices like corn, nuts and spices
- also suitable for the analysis of feed
- More at www.Lctech/e/AflaCLEAN

LCTech products for mycotoxin analysis

Cleaning up

OtaCLEAN

- Immunoaffinity columns for sample preparation for the analysis of ochratoxin A
  - maximum load capacity 200 ng ochratoxin A
  - recoveries for standards ≥ 90 % following LCTech protocol
  - high matrix tolerance: corn, coffee, raisins, wine, beer, malt, liquorice, …
  - LCTech checks each charge and documents the result with a certificate
- best results for the analysis of coffee
- More at www.Lctech/e/OtaCLEAN

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LCTech products for mycotoxin analysis

Cleaning up

Afla-OtaCLEAN™

- Immunoaffinity columns for simultaneously cleaning up aflatoxins and ochratoxin A
  - maximum load capacity 200 ng ochratoxin A and 150 ng aflatoxin B1
  - recoveries for standards ≥ 90 % following LCTech protocol
  - LCTech checks each charge and documents the result with a certificate
- Guaranteed recoveries for aflatoxin standard
  - aflatoxin B1 ≥ 90%
  - aflatoxin G1 > 90%
  - aflatoxin B2 ≥ 85%
  - aflatoxin G2 > 60%
- More at www.Lctech/e/Afla-OtaCLEAN

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LCTech products for mycotoxin analysis

Cleaning up

EluVac™

- SPE vacuum manifold for simultaneous handling of up to 20 samples
  - sample preparation under vacuum
  - robust and chemically resistant design
  - rack for large volume reservoirs
  - most comfortable: from "waste" to "collect" by simply turning the lid.
- saves time and money
- More at www.Lctech/e/EluVac

www.LCTech.de

LCTech products for mycotoxin analysis

Cleaning up

- Automated sample preparation for immunoaffinity columns
  - cleans up extacts of various matrices
  - 3 samples simultaneously and 30 in a run
  - enhanced sample throughput
  - works totally autonomously
- simplifies and accelerates sample preparation
- More at www.Lctech.de/e/AcceCLEAN

www.LCTech.de

Analysis of aflatoxins

Sampling

▼

Homogenization

▼

Extraction

▼

Cleaning up

▼

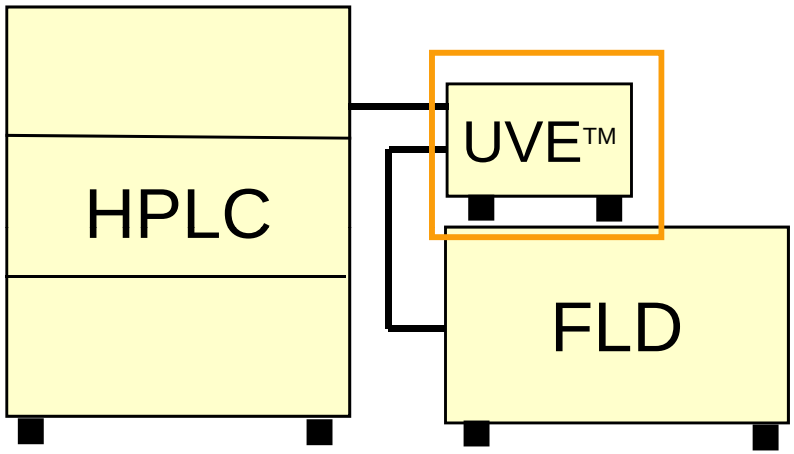
Chromatography

Derivatization

Detection

▼

Interpretation



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LCTech products for mycotoxin analysis

Derivatization

UVE

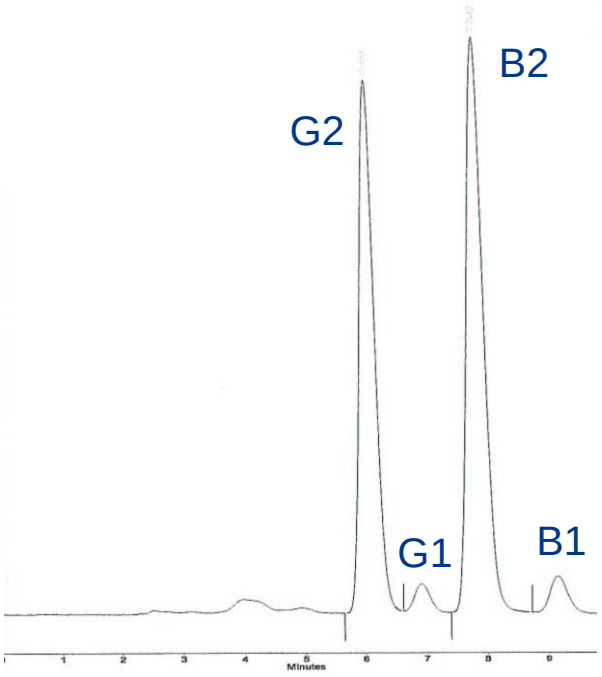
- UV derivatization module for the analysis of aflatoxins with HPLC
  - uncomplicated handling: put it between the HPLC and the fluorescence detector, switch on, ready to use
  - robust and long-living system
  - HPLC device remains cleans, no rinsing needed
- Exact analysis of aflatoxins possible
- More at www.Lctech/e/UVE

LCTech products for mycotoxin analysis

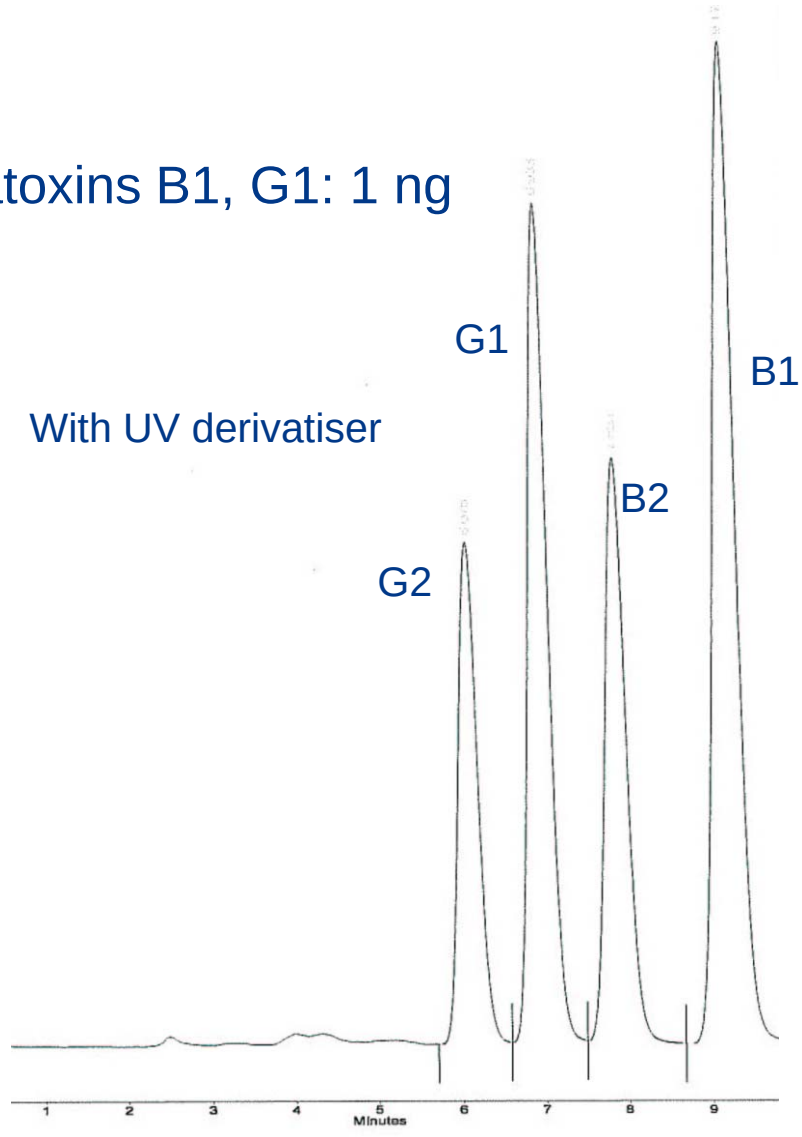
Derivatization

- Aflatoxins B2, G2: 0,25 ng; aflatoxins B1, G1: 1 ng

Without UV derivatiser



With UV derivatiser



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LCTech products for mycotoxin analysis

Derivatization

PINNACLE PCX

- Post-column derivatization system for the analysis of myctoxins with HPLC
  - DON, fumonisins, ochratoxin A, aflatoxins
  - automatic system rinsing
  - can be connected to every HPLC system
  - pulse-free
- More at www.lctech.de/e/Pinnacle_mycotoxins

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LCTech products for mycotoxin analysis

Quick test

AflaREAD™

- ELISA Kit for the Detection of Aflatoxin B1 in food and feed
  - ready-to-use screening test for extracts
  - only two extraction methods for all kinds of solid matrices
  - no prior clean-up needed
  - 96-well ELISA plate with 8-well stripes
  - evaluated with certified reference material
  - excellent batch-to-batch reproducibility
- More at www.Lctech/e/AflaREAD

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LCTech products for mycotoxin analysis

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