Mycotoxins are toxic metabolites produced by fungi or molds. They are associated with food poisoning outbreaks and can have significant adverse impacts on human health when consumed in small and large doses. This whitepaper provides basic technical data on mycotoxins and aflatoxins, and it can be used to support local HACCP plans.
1 INTRODUCTION

Following on from the whitepaper on chemical hazards, this paper takes a closer look at mycotoxins. Mycotoxins are a chemically diverse range of secondary metabolites (i.e. have no role in formal metabolism) and are produced by various fungal species especially *Aspergillus*, *Fusarium*, and *Penicillium*. They are toxic to humans and most are chemically stable and survive prolonged heat processing. Mycotoxins are responsible for outbreaks and fatalities across the world every year. Deaths have been associated with ergotism, Alimentary Toxic Aleukia (ATA), stachybotryotoxicosis and aflatoxicosis.

2 TOXIC EFFECTS OF MYCOTOXINS

The toxic effects of mycotoxins can be significant and varied depending on the toxin, dose, host and food matrix involved. These effects include:

- Carcinogenicity (cancer causing) especially in the liver
- Hepatotoxicoty (liver damage)
- Mutagenicity (changes to DNA)
- Other toxic effects include kidney disease, immumo-suppression and disturbance to the nervous and hormone systems

In order to define a toxin as a mycotoxin the following criteria must be met:

- Cause disease in humans and animals
- Occur in nature and be produced by a fungus
- Cause acute or chronic toxic effects, i.e. acute in high doses and carcinogenic in subclinical doses over long periods

3 MYCOTOXICOSIS OUTBREAKS

Mycotoxicosis is poisoning caused by the ingestion of a mycotoxin. It results in specific symptoms and other adverse effects. Mycotoxicosis is not transmissible and drug or antibiotic therapies have little or no effect on the disease. Outbreaks tend to be seasonal depending on the consumption of particular foodstuffs during the year. The degree of toxicity is often influenced by age, gender and nutritional status of the host.
4 MYCOTOXIN OCCURRENCE IN FOODS

Mycotoxins normally occur in the following foodstuffs:

- Mould damaged foodstuffs including agricultural products like cereals, oilseeds, fruits and consumer foods such as peanut butter
- Residues in animal tissues and products, e.g. milk, meat, dairy produce
- Mould ripened foods, e.g. cheeses, meats
- Fermentation products, e.g. microbial proteins and enzymes.
- Juices, e.g. apple juice

5 ROUTES OF CONTAMINATION

Mycotoxins can contaminate food products where mould growth occurs. Mould growth on raw production materials, such as spices and herbs, are a common cause of contamination. Mycotoxins can also be passed along the food chain in residual levels and are normally the subject of control programs such as GAP. High carbohydrate or high lipid (fatty) foods are most susceptible to mycotoxic migration. For instance, peanuts are a good example. Coffee beans, due to their lower oil content, would be less susceptible. The risk arises since mycotoxins can dissolve in fat and be carried along in the food chain.

6 METABOLISM OF MYCOTOXINS IN HUMANS

Mycotoxins are mainly metabolised by the liver. The skin and gastrointestinal tract (GI) also metabolise them to a lesser extent. Mycotoxins are not proteins and are not detected by the immune system. Therefore, they do not elicit an immune response in the host. No antibody is produced in response.
Table 1: Products of Metabolism

7 AFLATOXIN

Aflatoxins are naturally occurring mycotoxins that are produced by *Aspergillus flavus* and *Aspergillus parasiticus*, species of fungi. Aflatoxin B1 is the most common and most toxic.

Figure 1: Chemical structure of aflatoxin B1

The most common foods associated with aflatoxins are cereals, peanuts, milk, meat and meat products. Toxicity in humans includes liver carcinoma, especially in children. Liver damage is a common effect.

The toxin can also affect kidneys, intestine, blood, reproductive system and the immune system.

8 CONTROL MEASURES

There now exists a number of internationally recognized control programs which seek to control the safety of products and commodities associated with mycotoxic risks. Good Agricultural Practice (GAP) schemes are an example of such and some are approved under the Global Food Initiative (GFSI).

When it comes to controlling the risks the following are commonly used measures:

- Monitoring programs: Inspection and sampling of commodities intended for introduction into the food supply chain. Maximum levels are defined and often legally controlled in specific legislation. Rejection and removal of failed batches is a common control measure.
- Good Agricultural Practice: Contamination can occur in the field or at farm level during storage. Control measures can include use of fungus free seed, control of insects, prompt harvesting at maturity and prevention of damage to crops.
- Detection: Early detection of mould growth allowing early intervention and control measures to be implemented.
- Antifungal Agents: Antifungal agents can be used as controls and be applied at farm level.
- Deployment of Resistant crops through genetics.
- Mechanical removal of contaminated seeds/kernels.
- Inactivation of Toxins: This can be achieved through roasting of peanuts, heat and moisture control, chemical control, e.g. acids, H2O2, NH3, hypochorites.
Safefood 360° Food Safety Management Software

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- Stay up to date and fully compliant with software that updates automatically in line with changes to global food standards
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- Automatic audit log
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