

## ***Aflatoxin in Coffee***

The aflatoxins are a large group of closely related compounds representing what is probably the most prominent fungal toxin concern in food and feed. They are hepatotoxic carcinogens with a genotoxic mechanism of action. In fact, the native compound is not active but it is converted into one of the most carcinogenic substances known, by the action of a common enzyme system found in the microsomal fraction of cell-free preparations of liver cells.

Biosynthetically they are poly-ketides rearranged into five rings. There are two principal families as produced (and others as metabolised by animal systems). Both have a bis-furan ring system at one end and this is where the molecule is activated. Aflatoxin B derivatives have a five membered ring at the other end while aflatoxin G derivatives have a six membered ring. Immunological methods for the purification of these compounds can exploit both this commonality and difference by using one end or the other in preparing the antigen, thus directing the specificity of the anti-body.

Aflatoxin is produced by some strains of three species of *Aspergillus*: the very common *A. flavus* and *A. parasiticus* and the less common *A. wentii*. Interestingly, many species, including species in other genera, produce sterigmatocystin, an aflatoxin pre-cursor which is also toxic and carcinogenic. About 20–30% of *A. flavus* isolates produce aflatoxin, typically B-type only, while some 80% of *A. parasiticus* isolates produce B and G-type aflatoxin. The two species are difficult to distinguish from each other but *A. flavus* is widely isolated from coffee<sup>1</sup>.

Both are fast growing in a similar water activity and  $A_w$  range as *A. ochraceus*. Ecologically these fungi were originally thought of as classic 'storage fungi' but this less than useful term is particularly unfortunate in this case, since these fungi are known to have very specific interactions with several crop plants in the field.

Interest in the presence of aflatoxin in coffee was perhaps diverted by early laboratory studies that seemed to show that caffeine prevented aflatoxin production. Later work has shown aflatoxin to occur in coffee samples both at retail and from traders in amounts and frequency as high as or higher than ochratoxin. In other foods, aflatoxin is considered to be heat stable surviving the roasting and cooking of nuts and maize - two commodities with which it is closely associated. The effect of roasting coffee on aflatoxin levels in naturally contaminated coffee is not known though one study showed a loss of about  $\frac{3}{4}$  of spiked aflatoxin (at 1880 ppb) after 12 minutes at 200-205°C.

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<sup>1</sup> Nakajima, M., Tsubouchi, H., Miyabe, M., & Ueno, Y. 1997. Food and Ag Immunol. 9:77-83. *Survey of aflatoxin B1 and ochratoxin A in commercial green coffee beans by HPLC linked with immunoaffinity chromatography.*

Tsubouti, H., Yamamoto, K., Hisada, K., & Sakabe, T. 1984. Pro Japn Ass Mycotoxicol, 19: 16-21. *A survey of the occurrence of mycotoxins and toxigenic fungi in imported green coffee beans.*

