



The future of mycotoxin analysis

IN MYCOTOXIN ANALYSIS, WELL ESTABLISHED METHODS BASED ON CHROMATOGRAPHIC PRINCIPLES ARE HOLDING THEIR GROUND, BUT A TRANSITION TO MULTITOXIN AND RAPID METHODS CAN BE OBSERVED. ALSO, A NUMBER OF NEW TECHNIQUES SUCH AS BIOSENSORS ARE RAPIDLY EMERGING SAY RUDOLF KRSKA AND ELVIRA WELZIG.

For close surveillance of mycotoxins in the food chain, analytical methods have been developed and refined since the 1960s¹. Because mycotoxins are compounds of different chemical structure and physicochemical properties, specific detection methods have evolved using well established techniques on the basis of liquid (LC) or gas chromatography (GC) with appropriate detectors such as fluorescence detection (FLD), UV detection, flame ionisation detection (FID), electron capture detection (ECD) and mass spectrometry (MS). Although the methods are usually optimised for one target mycotoxin, or at best a group of closely related mycotoxins as for instance the B-trichothecenes, multimycotoxin methods are highly desired. Because LC with tandem mass spectrometry (LC-MS/MS) has been progressing strongly, the simultaneous determination of up to 40 different mycotoxins is now feasible². Sophisticated LC-MS/MS equipment does not require sample clean-up especially when isotope labelled internal standards are used. However, the conditions during sample preparation and chromatographic separation are often a compromise, and even LC-MS/MS is not completely devoid of matrix interferences in the form of signal suppression. In spite of its immense potential, it will take some time for LC-MS/MS to be implemented in routine analysis because of the high investment costs. Apart from new chromatographic columns that are frequently introduced to mycotoxin analysis, clean-up has undergone considerable development. Nowadays, immunoaffinity columns, SPE material in disposable plastic cartridges and MycoSep® columns are available commercially for all major mycotoxins.

ELISA AND DIPSTICKS

A number of rapid methods, based on immunochemical techniques, mostly do not require any clean-up or analyte enrichment. Enzyme linked immunosorbent assays (ELISA) have become one of the most useful tools for the rapid monitoring of mycotoxins, especially for the screening of raw materials. The great advantages are speed, sensitivity, specificity, easy operation, and high sample throughput achieved by full automation by means of robots. A list of commercial immunological test kits (and specifications) for the analysis of mycotoxins is compiled by the European Mycotoxin

Awareness Network (EMAN, www.mycotoxins.org). Overestimation can sometime be a drawback, and ELISA's may be influenced by matrix composition. In the past several years, test kits based on the mostly indirect competitive principle for field use have emerged. First, dipsticks were developed, but the consecutive dipping of the small strip into several solutions was soon found impractical and they were replaced by lateral flow devices (LFD). These are also often, wrongly, named dipsticks, but they are based on competitive test principles using stained antibodies with either latex particles or colloidal gold as the label. LFDs are available for aflatoxins and deoxynivalenol (DON).

EMERGING TECHNIQUES

In order to further cut down costs and time, new analytical techniques are enthusiastically incorporated into mycotoxin analysis. However, it is often a long way from the bench to commercially available products. Both fluorescence polarisation immunoassay (FPI) and surface plasmon resonance (SPR) have reached this point. Some of the most interesting emerging techniques for the detection of mycotoxins in grains are non-invasive methods such as Fourier Transform mid-infrared spectroscopy with attenuated total reflection (ATR) or near infrared transmission spectroscopy, reducing sample preparation to an absolute minimum. However, major restrictions of spectroscopic techniques include high matrix dependence and lack of appropriate calibration material. This already alludes to the topic of quality assurance in laboratories dealing with mycotoxin analysis. Several measures are now available including the regular participation in proficiency testing organised by, for example, FAPAS (www.fapas.com) and, although not complete by far, a good range of (certified) reference materials (CRM). Both matrix RM and calibrant CRM are offered especially for aflatoxins and *Fusarium* toxins. A complete list of available CRMs is available from COMAR (www.comar.bam.de) enabling traceability and comparability of analytical results in mycotoxin analysis.

References 1-2 are available on request.

Photo: USDA



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