The importance of early detection of mycotoxins in poultry feed

Mycotoxins, first identified in the 1960s, have become a concern for poultry feed and meat producers worldwide. There are said to be between 300 and 400 toxins in existence, many of which present a number of direct health challenges to poultry, which can vary depending on age, sex, diet and environment, amongst other elements.

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Even with excellent management, low levels of mycotoxins may still exist in poultry feed and can affect the immune system, liver and, in extreme cases, even cause mortality. In order to avoid this, early detection of toxins is essential.

Serious risk to poultry health

Aflatoxins present the highest acute and chronic toxicity to poultry of all mycotoxins. Aflatoxin compounds were discovered due to the outbreak of Turkey X disease in 1962, which resulted in around 100,000 turkey poult deaths in England due to meal contaminated with the fungus Aspergillus flavus.

Further research soon revealed that the serious effects produced by the ingestion of contaminated feed had resulted from the presence of quantities of four secondary metabolites in the mould, named B1, B2, G1 and G2. Aflatoxin B1 remains the most potent, with acute toxicity varying from decreased weight gain to poor feed efficiency, reduced egg production and liver damage.

It is clear that the presence of mycotoxins in poultry feed can result in significant economic losses for the poultry producer. In order to prevent this, the European Commission has introduced maximum levels for aflatoxin, limiting the acceptable amount in poultry feeds. Additionally, guidance values have been recommended by the EC for a further five mycotoxins under Commission Recommendation 2006/376/EC: zearalenone, ochratoxin A and fumonisins B1 and B2. These mycotoxins pose a risk to poultry health and production, but the risk to public health is considered low; in all cases, food of animal origin only contributes marginally to the total human exposure to these toxins. The legislation applies to the specified foods whether they are imported into the UK or produced in the UK.

Another toxin that is set to be added to this list in early 2017 is ergot alkaloids. Produced by the Claviceps spp, the fungus that attacks cereal grains, ergot alkaloids can affect poultry in a number of ways, including damage to the nervous, vascular and endocrine systems. Other toxins such as T-2 toxin and diacetoxyscirpenol, despite not appearing under Commission recommendation, also have adverse effects on poultry.

For example, T-2 toxin, the most toxic type A trichothecene mycotoxin, affects the immune, nervous and digestive systems, as well as poultry production performance (for example, decreased weight gain, egg production and hatchability). Globally, the requirement for mycotoxin screening is varied. In an attempt to safeguard consumers, there are a number of special import conditions currently in place for some foods from certain third world countries (Africa in particular), where the risk from aflatoxin contamination is increased.

Compliance with internationally acceptable limits for mycotoxins (TDL) can be challenging for the food industry, requiring good plant protection, adequate storage and good manufacturing practices in order to keep levels below the limits.

Extensive research over the last few decades has highlighted that a number of different mycotoxins are often present as a wide range of feed ingredients. Producers must be aware that if one toxin is identified in a sample, the chance that other toxins are present is highly likely.

The need to monitor multiple toxins simultaneously has created a demand for rapid, reliable and sensitive screening methods that fit expeditiously into the production process. Until now, testers have had no choice but to prepare separate samples for each mycotoxin to be tested, which leads to an extremely time consuming process.

Currently chromatographic, spectrometric and immunoassay-based techniques are used for the detection of these toxins. Advancing technologies now allow for multiple toxins to be tested from a single sample extract, without the need to repeat the sample preparation process. One such example is Biochip Array Technology (BAT) from Randox Food Diagnostics; simultaneous quantitative determination of multiple analytes from a single sample reducing the time it takes to result.

How are they detected?

Using BAT from Randox Food Diagnostics gives the user the ability to screen multiple mycotoxins from a single feed sample. Multiple immunoassays take place at the same time in discrete test sites on the biochip surface, thus increasing the output of test results. Common cereal grains used in poultry feed, including maize, millet, wheat, barley, oats and rice, alongside 20 other matrices, can all be tested using the Randox Food Diagnostics Biochip Array Technology.

The multi-analyte biochip technology uses micro spotting techniques to simultaneously detect and provide quantitative results for up to 10 mycotoxins from a single sample, including all of the most prevalent toxins: aflatoxin B1/B2 and G1/G2, ergot alkaloids, aflatoxin A, fumonisins, deoxynivalenol, diacetoxyscirpenol, T2 toxin, zearalenone and paxilline.

This offers major benefits in comparison to traditional methods, including minimal sample preparation and significant cost savings. Biochip Array Technology is used in conjunction with the Evidence Investigator, the multi-analyte residue screening analyser used worldwide to provide simultaneous, rapid testing without compromising quality.

Furthermore, this methodology is flexible with the selection of the ‘Mycoflex’ option. This allows the user to customise the mycotoxins to be screened according to a particular preference, for example, the most common toxins in a specific geographical region. Randox Food also offer aflatoxin B1 and ergot alkaloid ELISAs, produced to the highest standard, offering excellent reliability and limits of detection in line with regulatory requirements.

Conclusion

Even with excellent management, low levels of mycotoxins may still exist in poultry feed and can affect the immune system, liver and, in extreme cases, may even cause mortality. Having the right technology is key to ensure that mycotoxins are detected quickly and levels are adequately monitored.

One such option is market-leading Biochip Array Technology, which provides quantitative analysis of 10 of the most prevalent toxins in order to safely comply with global regulations and maintain poultry health worldwide.

References are available from the author on request