

HOW ARE MYCOTOXINS ANALYSED IN FOOD?

Mycotoxin analysis involves more than placing a sample into a laboratory instrument. The result depends on a sequence of steps: defining the batch to be tested, taking representative portions, preparing the material properly, choosing a suitable method and interpreting the findings in light of the food and the purpose of testing. An accurate analytical result on a poorly collected sample may describe that sample very well but the original batch very badly.

THE MOST DELICATE STEP: A TRULY REPRESENTATIVE SAMPLE

Many mycotoxins are unevenly distributed. In a batch of maize, wheat or tree nuts, some grains or nuts may be highly contaminated while many others have very low concentrations. This is often called a 'hot spot' distribution. Taking a single handful of product or selecting only the best-looking parts may therefore lead to misleading conclusions.

Representative sampling involves taking numerous incremental samples at different points in the batch and combining them into an aggregate sample according to procedures suited to the matrix and batch size. A laboratory sample is then obtained from it. The number, mass and distribution of increments are not arbitrary: specific procedures govern European official controls. A single retail pack, although analysable, does not automatically represent an entire production run.



FROM GRAIN TO TEST TUBE: GRINDING AND HOMOGENISATION

On arrival at the laboratory, the material must be prepared while avoiding losses, contamination and segregation. Cereals and tree nuts are normally ground and thoroughly homogenised so that the small portion actually extracted for analysis reflects the received sample as closely as possible. Particle size, mixing and proper subdivision are particularly important where contamination is heterogeneous.

The mycotoxin is then extracted from the matrix using solvents and procedures appropriate to the analyte. Where necessary, the extract is cleaned up to reduce interference from fats, pigments or other food components. Preparation may differ for cereals, spices, milk, wine or fruit juice. No single procedure is optimal for all combinations of mycotoxin and food.

PREVENTING MYCOTOXINS ALONG THE SUPPLY CHAIN

These measures reduce the risk of formation: they do not guarantee removal of toxins already present



Cooking is not a reliable decontamination treatment.

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SCREENING METHODS AND INSTRUMENTAL METHODS

Immunological tests, including ELISA and lateral-flow devices, are available for rapid testing and are often used for screening. They can identify samples requiring further examination, but reliability, scope, interference and the need for confirmation depend on the validated method and matrix. A screening result should not automatically be considered equivalent to a confirmatory quantitative determination.

Instrumental methods include high-performance liquid chromatography with fluorescence detection (HPLC-FLD), notably for certain mycotoxins, and liquid chromatography coupled with tandem mass spectrometry (LC-MS/MS). The latter often allows several mycotoxins to be determined in one analysis, provided every analyte and matrix falls

within the validated scope. The choice should be based on sensitivity, selectivity, reliability and testing purpose, not the prestige of the technology.

WHAT DO LOD, LOQ AND 'NOT DETECTED' MEAN?

Broadly, the limit of detection (LOD) describes the level at which a method can distinguish a signal from the blank response; the limit of quantification (LOQ) describes the level at which a quantity can be estimated with adequate analytical performance. Operational definitions and criteria depend on the method used. A report stating 'below LOQ' does not establish that a substance is entirely absent: it means that the substance was not quantified at the stated level under those analytical conditions.

Two laboratories may report different LOQs and both provide technically valid results. A method sensitive enough to check a statutory limit may not be sensitive enough to study exposure at much lower concentrations. Comparing two results therefore requires checking units, matrix, analyte, LOQ, method and the way values below the LOQ have been handled.

VALIDATION, RECOVERY AND MEASUREMENT UNCERTAINTY

A laboratory must demonstrate that its method is fit for its intended purpose. Relevant performance characteristics include selectivity, precision, trueness, recovery, measurement range and sensitivity. In simple terms, recovery describes how much of an analyte present in or added to a sample is recovered by the procedure. Measurement uncertainty expresses the uncertainty associated with a result: it is not evidence of incompetence but an essential property of scientific measurement.

For official controls, Implementing Regulation (EU) 2023/2782 establishes criteria for sampling, preparation and analytical methods. Where stipulated, assessment of compliance with applicable limits takes recovery correction and measurement uncertainty into account. A superficial comparison of just two numbers — the measured concentration and the statutory limit — may therefore be insufficient for the legal assessment of an official control.

THE EUROPEAN FRAMEWORK: TWO REGULATIONS WITH DIFFERENT PURPOSES

Regulation (EU) 2023/915, as amended, establishes maximum levels for several contaminants, including numerous mycotoxins, in specified food categories. There is therefore no single 'European mycotoxin limit': the exact substance, food, intended use and applicable legal version must be established.

Implementing Regulation (EU) 2023/2782 instead governs sampling and analysis for official mycotoxin controls, replacing Regulation (EC) 401/2006, and has applied since 1 April 2024. Its requirements are an important methodological reference, but this does not mean that every business's own-check programme must reproduce every official procedure. Such programmes must nevertheless use methods appropriate to the risk and purpose.

HOW TO READ A CERTIFICATE OF ANALYSIS

A useful report should identify the matrix, sample and originating lot, the sampling date where available, the analytes tested, method, units, result and any LOQ; where relevant, uncertainty and recovery information should also be reported. Knowing who took the sample and how is crucial: a laboratory certificate does not automatically establish sampling representativeness.

Accreditation to EN ISO/IEC 17025 provides assurance for activities covered by a laboratory's specific scope of accreditation; it is not a universal guarantee for every analysis performed there. Even a high-quality report must be interpreted with regard to the sampling plan and stated purpose.

FROM COMPLIANCE TO KNOWLEDGE

Food complying with European limits satisfies the applicable requirements for the regulated contaminants considered, but that does not show that every possible mycotoxin is absent. Conversely, simply detecting a mycotoxin does not automatically indicate a concrete health hazard: substance identity, concentration, quantity consumed and toxicological assessment all matter. Accurate testing thus requires three distinct questions: what was tested for, how much was measured, and how well does the sample represent the product being described?

SCIENTIFIC AND REGULATORY REFERENCES

[European Commission – Implementing Regulation \(EU\) 2023/2782: sampling and analysis methods for mycotoxins.](#)

[European Commission – Regulation \(EU\) 2023/915: maximum levels for certain contaminants in food.](#)

[European Parliament and Council – Regulation \(EU\) 2017/625: official controls.](#)

[ISO – ISO/IEC 17025:2017, General requirements for the competence of testing and calibration laboratories.](#)