Looking where it matters

François Bourdichon discusses the importance of process sampling in tracking deviations in microbial monitoring, and where and how one can implement meaningful preventative actions.

"Sampling is always a passionate topic of debate among those working in QA/QC"

WHEN IT COMES to microbial monitoring of a food production process, one is tempted to blindly follow the regulation and only look where required: that is, finished product testing, processing environment monitoring with surface swabbing, and, in due course, raw materials and ingredients analysis.

But what about sampling along the production process? To do this, one requires a rationale and, indeed, the awareness and capability to test where it really matters.

Finding a purpose

Sampling is always a passionate topic of debate among those working in QA/QC; most specifically when mathematics, ie, statistics, is discussed. In a previous article for *New Food*, I addressed the limitations of finished product testing and the relevance of processing environment monitoring;[1,2] so you may question if there is any more to add. Yes – there always is.

Presently, the EU Regulation 2073/2005 outlines where attention should be placed, considering the hygiene criteria of '*E. coli*' and 'Coagulase positive *staphylococci*' for milk and milk products. It states: "At the time during the manufacturing process when the number [...] is expected to be highest".

The purpose of sampling and microbial monitoring is not compliance with regulation (both EU 2073/2005 and its updated version EU 178/2002), although that is a legal requirement, but rather a recognition of your responsibility as a manufacturer to ensure safe food production.

A rationale is expected when it comes to implementing a testing scheme – at least a relevant one. As such, a dedicated microbial

risk assessment/hazard analysis is required. For this, you should evaluate the following:

- Which hazard should be considered
- Where it could be introduced in the process
- How the sampling can be carried out to assess and monitor the microbial contamination at the earliest stage.

This aspect of microbial monitoring has been embedded in the update definition of the microbiological criterion in the Codex Alimentarius Guidelines GL21/1997 update 2013:[3] "A microbiological criterion is a risk management metric which indicates the acceptability of a food, or the performance of either a process or a food safety control system".

Root cause analysis

One of the pitfalls of relying solely on finished product testing is that a monitoring system with a fail/pass approach fails to provide clear evidence of where/when the problem originated.

Recent and ongoing outbreaks (infant formulations with *Cronobacter* spp. and/or *Salmonella* spp.; frozen corn, deli meat and smoked salmon with *Listeria monocytogenes*) have reaffirmed the necessity of processing environment monitoring to track harbourage niches of resident strains. But while this is essential, it's not always sufficient.

While critical control points (CCP) are monitored through the defined critical limits, some contamination episodes - for example, thermophilic bacteria in liquid-heated processes such as UHT milk - require a detailed view of global process to identify the weak point(s) where a biofilm may be present or a control measure is not working sufficiently.

These investigations are classically carried out afterwards, once problems have occurred and finished products are already contaminated. Learning from these experiences is key to guard against future issues; and there will certainly be future issues if nothing is done to address the present one/s. Implementing an appropriate and thorough monitoring scheme is part of such preventative measures.

A process is rarely linear; it requires stages where it can be paused and analysed. Stepping back and reflecting is indeed costly, but never as much as a recall or scenario that results in brand damage, if not closure of a business.

Everyone has a plan, until they get punched in the mouth

Anticipation is key and identifying the potential source of deviation to track an issue to its source is certainly the most efficient (but not the easiest) way to monitor food production along the process chain.

The sampling process is rarely linear; it requires stages where it can be put on hold and analysed

This requires preparedness, and when it comes to microbial contamination (and eventually other adulterants) one must address the PIGS: prevalence, introduction, growth and survival. The processing environment itself can be a source of contamination, the raw materials and ingredients as well – particularly in the absence of microbial critical control points along the process. Different stages of the process should also be separately monitored to identify any deviations at the earliest step; this prevents the problem spreading and halting production. This sentiment is stipulated in the Codex guidelines under microbiological criterion: have a look where it matters, with a defined rationale.

Sampling is expensive, so it has to be worth it. Speaking about return of investment for process sampling might seem callous but it is worth considering.

Doing it right: aseptic sampling

It is of utmost importance to trust the sample and therefore the sampler.[4] While this issue is highly monitored in water microbiology, due to the interaction of competitive flora (*Micrococci*, *Staphylococci*) of the skin flora and the sensitivity of the sample, it is unfortunately often overlooked in the area of food microbiology. So far, only the ISO 18593:2018 standard has provided guidelines for surface swabbing, while ISO 7218:2007 focuses on laboratory samples rather than production samples.

The sampler needs to have a minimum background in microbiology and analytical chemistry in order to carry out the task accurately and avoid any cross-contamination. It is also worth bearing in mind that your analytical workflow is only as strong as its weakest link – and it starts in the production zone, not in the laboratory. »

"The more you look, the more you find. Be prepared to open Pandora's box"

François Bourdichon

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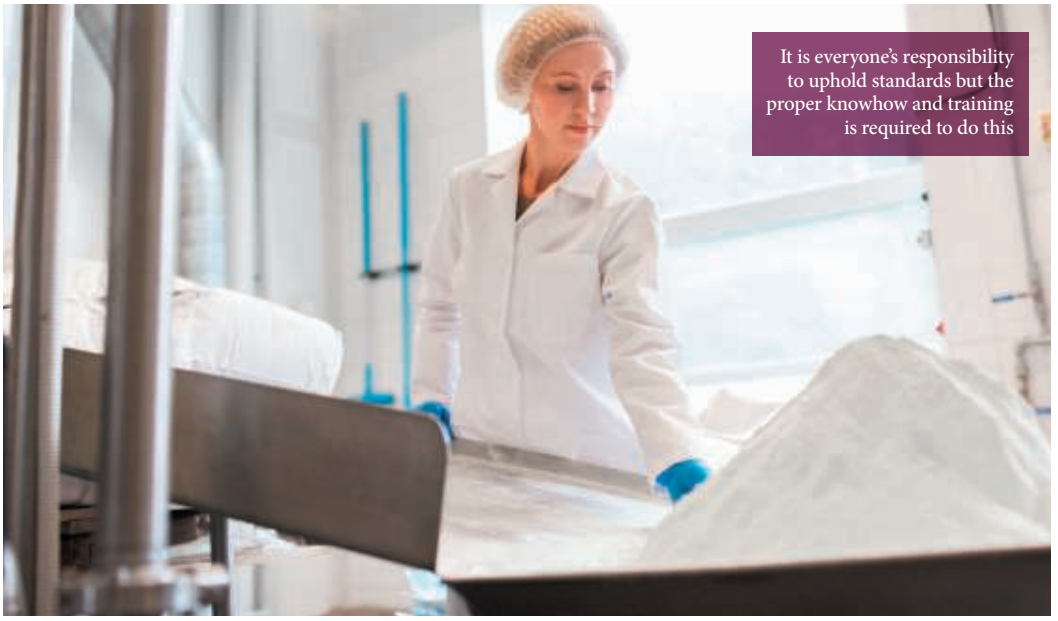

It is everyone's responsibility to uphold standards but the proper knowhow and training is required to do this

Hygienic design is mandatory

Process sampling, if not implemented from the initial design of the production equipment, will require technical modifications with a permanent solution in place: septa, faucet, automatic sampler, online analyser, for example.

Regardless of the solution, its implementation must be carried out in accordance with professional standards of hygienic design, hence 3A (North America) or EHEDG (Europe, at least). Do-it-yourself solutions can be tempting but are rarely effective. There are always specificities of the equipment and process that will require the expertise of engineers. Do not create solutions that will end up generating new problems.

Start with the why

While process sampling is relevant to monitor the conformance of your production, it will always raise discussions once deviation is identified. Start with the 'why'; if one samples and analyses, one must also be prepared for the two (at least) potential outcomes.

The more you look, the more you find. Be prepared to open Pandora's box.

References

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On-site testing: Goodbye patulin

Patulin contamination has become a matter of concern for public health authorities who have recognised its largely unnoticed presence in food products on many supermarket shelves. Here, Jim Donovan describes a new technique which can more quickly identify this mycotoxin.

Patulin is a harmful mycotoxin that is commonly found in commercial fruit juices and apple products. Although fruits, specifically apples, are sorted to meet quality criteria before being processed into juice, patulin contamination is not always visible and some contaminated fruit may make its way into processing.

For juice producers, identifying and preventing patulin contamination in their supply chain and production process is key to brand protection and regulatory compliance, preventing costly product recalls and ensuring consumer confidence.

Regulatory bodies across the world have put maximum allowable levels of patulin in place. To comply with these limits, juice producers and retailers need effective analytical tools. Although instrumental techniques such as HPLC have traditionally been the industry standard for patulin testing, there is a need for new analytical techniques that can provide large-scale testing capacity with shorter turnaround times and at lower cost. Antibody-based tests (ELISAs) provide all these advantages and may be used on site within juice companies or by independent laboratories.

Eurofins Abraxis has developed a rapid, robust and sensitive immuno-analytical kit for the determination of patulin. This immunoassay method, based on monoclonal antibodies, includes a simple and speedy sample preparation step, which is then analysed in the ELISA. The test enables the detection and quantification of patulin in apple juice, apple sauce, apple cider and orange juice for a test range of 7.0 to 300 ppb. Results for up to 41 samples, including sample preparation, can be performed and obtained in approximately three hours.

The assay has demonstrated good recovery and reproducibility, allowing for the rapid detection of this mycotoxin in a variety of samples. Evaluation of other sample matrices, including mango, pear and plum, will be performed and reported on in the future.