Understanding listeria detection – the importance of patterns

Food manufacturers should be encouraged to trend their microbial product and environmental sampling data with time to establish any pointers to the potential presence of pathogens.

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As a minimum, results should be trended for a year to establish any seasonal effects, both in terms of the supply of raw materials and environmental effects. Ideally, results should be trended for several years.

A classic trend for listeria in the environment in the UK is shown in Fig. 1. As an environmental micro-organism, it is suggested that listeria will multiply in the environment as temperatures increase, will become a potential risk in the early summer and be most prevalent in late summer/early autumn.

Listeria then becomes a challenge to the factory envelope and can be introduced into the factory both via soil (on footwear, transport wheels, containers etc) or via airborne dust. If the summer is particularly dry (as for 2019), the challenge of airborne listeria could be high. Factory environmental and product sample detections would mirror the environmental challenge and would be detected as a multi-species event. For example a detection pattern of:

L. innocua (Li), L. monocytogenes (Lm), Li, L. welshimeri (Lw), Lm, Li, Lw, Li, L. seeligeri (Ls), Li, Li, Lm, Lw, Ls etc

The listeria species is random and is dependent on which species has entered the factory at a given time. If this pattern is prevalent in the environment, then attention should be placed on the high hygiene area barriers to stop the further entrance of the organism. This pattern of listeria can also be found on raw materials that have been grown in the environment and detected in raw materials from fresh produce to salmon. In this case raw material samples would mirror the environmental levels and, again, a multi-species pattern would be found. A more complex pattern can be seen where ingredients are sourced from different geographical regions throughout the year.

For example, Fig. 2 shows a pattern of product detection which corresponds to the use of a raw material supplied from two different regions. It is suggested that listeria levels rise in the environment and are most prevalent towards the end of that region's growing season.

Raw material supply is then stopped from this region and switched to a different or (in Fig. 2) a local UK supply where listeria peaks in early autumn. Management of listeria in product is thus related to the quality of the supplied raw material and the timing between switching suppliers (to avoid potential late season contamination risks). A very different pattern of listeria isolation is shown in Fig. 3, where detection in the product or environment is irrespective of season. This is also usually associated with a listeria detection pattern of:

Li, Li, Li, Li, Li, Li, Lg, Li, Li, Li or Lm, Lm, Lm, Lm, Lm, Lm, Lm

Where one listeria species (or predominantly one species) is found, irrespective of season, this may be indicative of a persistent strain which is being harboured in the food processing environment and either has not, or cannot, be targeted by the current cleaning programme.

The organism is also present in product due to cross-contamination from the environment. In this situation the source of the listeria needs to be found and techniques such as in-production product testing to determine when the product first becomes contaminated on the process line can be useful.

The reality, however, is that most factories will undertake periodic deep cleans and the pattern in Fig. 3 will more likely be represented by that in Fig. 4. The source of the listeria still needs to be found, though the cleaning undertaken every three months is effective at controlling the source (for a limited time period). Genetic fingerprinting of the predominant species may also help establish whether it is indeed, the same strain, though this will require liaison with the contract laboratory to ensure that isolates are held by the laboratory for subsequent identification. If a persistent strain source is detected, the manufacturing infrastructure should be modified to remove the source, or the cleaning programme intensified to affect control.

Annual trending of pathogen detections is thus useful to determine the potential source of the pathogen contamination incident and to help determine the next steps in its control. ■

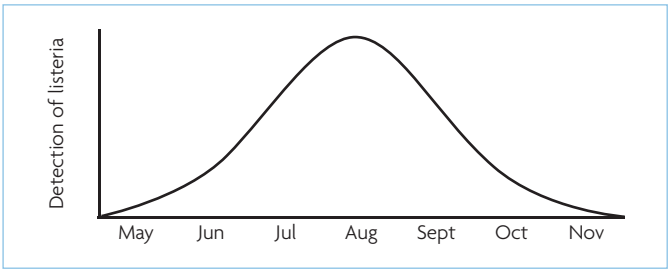

Fig. 1. Environmental detection of listeria.

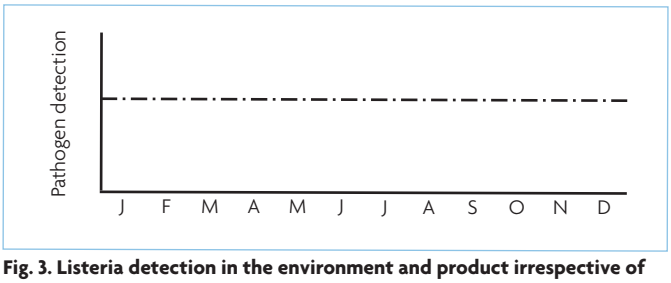

Fig. 3. Listeria detection in the environment and product irrespective of season.

Fig. 2. Listeria detection in two different ingredients.

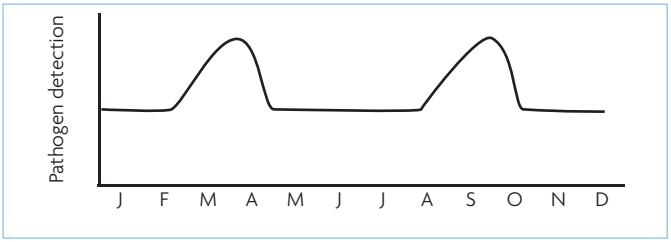

Fig. 4. Listeria detection associated with periodic deep cleans.