The importance of rapid foreign body identification

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Any foreign body incident is likely to prove distressing for both a consumer and a food manufacturer. At the very least, a foreign body incident could undermine the loyalty of an individual customer. At worst, it could point to serious lapses in quality control systems that need to be addressed before a more serious incident occurs, or indeed, be the first indication that a serious contamination incident has already happened.

It is important therefore to address every foreign body complaint that occurs. This will serve to assure customers that their complaint has been taken seriously, and should provide vital information that helps the manufacturer to decide what else must be done to prevent a recurrence.

Using the confocal laser scanning microscope to look at foreign bodies.

Common problem

A quick analysis of the recall incidents published by the Food Standards Agency and its international counterparts indicates that approximately 10% of recall incidents are prompted by foreign bodies. However, this figure probably underestimates the scale of the problem for the food industry. Many foreign body incidents affect individual products, causing isolated events of distress for individual consumers, but do not necessarily require a full-scale product withdrawal.

Indeed, RSSL's own experience of identifying foreign bodies on behalf of food industry clients would suggest that the vast majority of foreign body incidents affect a handful of products at most, at any one time. That said, it must be noted that when an incident is first reported, one cannot know whether it will prove to be an isolated incident, or whether it will prove to be the first of a stream of complaints.

Hence, the one thing that is common in every case is that rapid identification allows the manufacturer or retailer to assess the appropriate response to a reported incident.

It is always dangerous to assume that the foreign body is obvious. Customer reports are notoriously unreliable. So, it is important to see and analyse the contaminant properly rather than rely on a customer's evaluation. After all, a small, hard, white 'bit' in a product could easily be a bone, a stone, a crystallised ingredient, a fragment of ceramic or plastic, and eyesight alone may not be enough to say for sure what it is.

Clearly, the implications of bone or ingredient are very different, so it matters to know what it is. An immediate investigation of a foreign body incident will help a company to decide the best course of action to protect its customers and the reputation of its brands.

Experienced laboratory staff using modern analytical equipment should have little problem in distinguishing between the various foreign body options given above. To distinguish between different types of glass, or different types of plastic, for example, takes more time and more investigative skill.

In all cases, the first stage of a rapid, routine identification is close examination of the foreign body by stereo or compound light microscopy.

The techniques used are generally non-destructive and are applicable to very small samples.

In some cases, microscopy will be sufficient on its own to identify the contaminant. If necessary, spectroscopic techniques might also be applied, which can give some idea of elemental composition, and hence help to distinguish between different materials.

In a well resourced laboratory with experienced staff, this routine identification of foreign bodies should be relatively inexpensive and relatively rapid (within five working days from receipt of sample).

Complex investigations

Sometimes it may be enough to know that the foreign body is bone rather than stone, or plastic rather than glass, or animal hair rather than synthetic fibre. At other times, it may be important to investigate further, to understand where the foreign body came from, and if it was processed along with the product or perhaps introduced by the customer. At this point, the laboratory must bring into play a full barrage of high-tech equipment.

Microscopy of any original surfaces of a glass fragment can provide important information on its mode of manufacture,

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whether for example the original glass article was moulded (milk bottle) or spun manufactured (light bulb).

Surface interferometry gives information on the curvature of a fragment, distinguishing between flat glass (window) or curved glass (tumbler, milk bottle).

More information is available from X-ray Fluorescence (XRF), a technique that can provide detail on the elemental composition of samples. Using this technique, and our database of 400+ samples, it is possible to differentiate between many different types of glass.

The origin of a tiny metal fragment or dust can only be determined once its elemental composition is known. This is achieved by X-ray microanalysis, which allows distinctions to be made between different base metals, steels and other alloys. The same analysis can be used to determine any match between samples and reference materials supplied from the factory.

A combination of microscopy and spectroscopy techniques can be used to identify these materials.

Fourier Transform Infra-Red (FT-IR) spectroscopy or microspectroscopy can be used to characterise the chemical structure of the sample.

The spectrum obtained by FT-IR can be compared with reference spectra from RSSL's own plastics database, or an extensive polymer library. A second technique, known as Differential Scanning Calorimetry (DSC) can also be used to help differentiate between different forms of the same polymer.

X-ray microfluorescence spectrometry is another powerful technique for elemental analysis of all kinds of solid fragments, and is especially valuable in the analysis of coatings, paint flakes etc.

The technique is non-destructive and permits fast, simultaneous, multi-element detection for all elements in increasing atomic number from sodium to uranium. It also permits the gathering of qualitative, quantitative and spatial distribution information.

There are many other potential foreign bodies, such as hairs and fibres, insect parts, animal droppings, all of which can be investigated using a combination of microscopy, microbiology and chemistry techniques.

Deposits and hazes, for example, often arise from natural deposition or settling out of ingredients, breakdown of filtration systems, or by chemical contamination causing precipitation of ingredients (for example, the accidental addition of cleaning fluids to milk). Occasionally they develop post-manufacture as a result of microbiological or enzymatic activity.

With insect foreign bodies, it is usually possible to determine the species or family, giving a good clue as to its country of origin and association with specific raw materials.

From the manufacturer's point of view, it is worth knowing whether the infestation occurred in the raw materials, during processing, or after processing.

Conclusion

Any consumers finding a foreign body in food are bound to be suspicious of the quality and hygiene standards of the manufacturer, and possibly, with every justification. Similarly, any manufacturer finding foreign bodies in their ingredients will probably suspect the standards of their suppliers.

RSSL's own experience is that consumers expect an explanation from the manufacturer as to the cause of a foreign body, and are not satisfied merely with a refund of the purchase price of the affected goods.

It is also clear that manufacturers need to respond quickly to foreign body incidents, at the very least identifying the contaminant, and possibly investigating its source and cause.

Procedures and resources to achieve both these aims must be in place before an incident occurs, or else the initiative will be lost, and an irritating problem might rapidly develop into an uncontrollable crisis.

Hence, well before any incident occurs, manufacturers would be well advised to recruit a partner laboratory capable of providing a rapid, routine foreign body identification service, as well as a more elaborate investigation. ■