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Turning Detective to Identify Foreign Bodies

Tips for Conducting Foreign Body Analysis

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A Leatherhead Food Research white paper

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Turning Detective to Identify Foreign Bodies

Frogs in salads? Glass in burgers? Foreign bodies found in food and beverages appear in the media on a regular basis alongside images of disgruntled complainants, but how do foreign bodies get into our products? In this white paper, Gemma Cambray explains the detective work which goes into identifying the contaminant and discovering who is responsible.

A foreign body, or physical contaminant, is 'an object which can be seen by the unaided eye or felt in the mouth, and which the consumer perceives as being alien to the food'[1]. The key to this definition is that the consumer only has to *perceive* an object to be alien, for it to cause concern.

A foreign body can enter the product at any point, from the raw ingredient growing phase right up to when the product is inside the consumer's mouth. The two most common places of contamination are during manufacture, or in the consumer's home. In both cases, foreign bodies may be introduced accidentally, or maliciously.

Foreign bodies range from fragments of glass, metal and plastic, to teeth, stones, insects and, quite commonly, ingredients that may be irregular in shape/size or overcooked, for example large granules of salt or sugar. Sometimes the appearance of the product may cause a consumer concern, for example a haze present in usually clear beverages. Another common concern is the presence of meat in vegetarian dishes. No matter the type of complaint, identifying the object and concluding where and how it became incorporated into the product is the top priority.

Investigating the source of the needle in the haystack

Leatherhead uses a combination of microscopy techniques to analyse and identify foreign bodies. Light microscopy, as well as Scanning Electron Microscopy (SEM), combined with analysis of elements present are typically used for most contaminants. Other techniques include Fourier Transform Infra-red spectroscopy (FT-IR).

As with any form of detection work, analysts look for clues to identify the possible origins and causes of foreign body incorporation. These are some lines of enquiry which our analysts investigate as part of their analysis:

- **What has the foreign body come into contact with?** Examination of extraneous material present on foreign body samples can show what the sample has touched and give all important clues to help identification. Presumptive testing for saliva and blood, for example, will confirm whether the foreign body has been inside or cut a consumer's mouth (if alleged).

[1] Guidelines for the Identification of Foreign bodies reported from Food (Second Edition) 2006 M.C Edwards

- **What do marks on the foreign body indicate?** Observations of the condition of the foreign body give insight into its history. It can, for example, show mechanical damage/scraping from machinery. It can indicate if the sample has been chewed, and even give clues as to how it may have been stored before ending up in the product. Scratches on a piece of glass found in a product helped Leatherhead successfully identify it as a fragment of a domestic drinking glass. The scratches on the foreign body were the clue; they were consistent with drinking glasses which had been stored upside down.

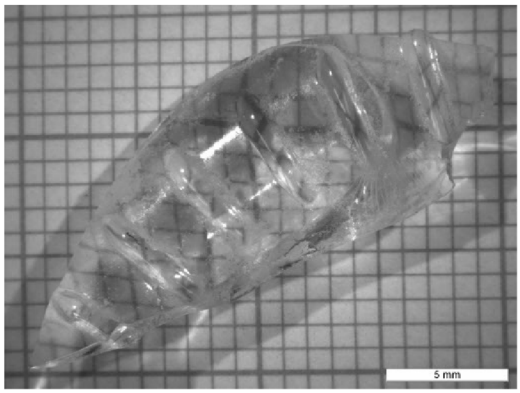

Fig. 1: Micrograph of a fragment of glass, the appearance of which is typical of the bottom of a bottle/jar

- **Can we find a sample match?** Detailed results from the SEM and FT-IR allow matches to be made to comparison samples. As an example, if a piece of machinery has broken down and fragments of metal have been found in the product, comparison samples from the machinery can be analysed alongside the foreign body sample. This will confirm the source and give the manufacturer confidence that once the machine is fixed, the issue will be resolved.

- **What manufacturing processes has the foreign body undergone?** A phosphatase test can indicate if a biological foreign body, such as an insect, has undergone heat treatment above approximately 60°; this can suggest at what point the biological foreign body, entered the product. This can be a particularly useful line of enquiry if the foreign body is found within a product that have undergone pasteurisation, or has been cooked (either in the factory or in the home). This method can also be used successfully to test whether meat has been adequately cooked.

Further testing of some samples requires additional analysis after microscopy. In cases where meat, bone, insects or mould are identified, we can use our in-house expertise in DNA analysis to identify the species. We can also subcontract insects to expert entomologists who can provide detailed information on country of origin. They can also supply additional information about the eating and nesting habits of specific species, which can support hypotheses about how the foreign body entered the product.

Fig. 2: Micrograph of a suspected cat claw from coleslaw. Analysis revealed plant material consistent with cabbage, i.e. a dried out ingredient of the product.

Knowledge is power

Detailed analysis of foreign bodies is vital to prevent contamination from re-occurring. Precautions can be put in place to prevent a reoccurrence if results indicate the issue is during manufacture.

Analysis can also help when results indicate the foreign body entered the product in the consumer's home, or after manufacture. This information can potentially prevent product recall, and reassure customers that products are safe. As an example, a piece of glass was found in a frozen dessert by a customer. The manufacturer held the rest of the batch of the dessert in frozen storage until the glass was tested. Analysis showed it was domestic glass, probably from a small bowl of the sort used to serve desserts. The Environmental Health Officer (EHO) returned to the customer's kitchen and with permission searched the cupboards and found two small pieces of glass. These were analysed and found to match the original piece. The customer remembered he had broken a bowl some months before and it was concluded that small shards of glass from the breakage had found their way into the dessert product.

In some cases, where a foreign body has been maliciously planted by the consumer on more than one occasion, repeat complainants' details are recorded by the Inter Company Consumer Affairs Association (ICCA); this is a database which can be accessed by its members in order to identify reoccurring malicious claims.

Foreign bodies can enter a product at any point during the product lifecycle, whether through intention or accidental actions.

Leatherhead analysts deploy a range of techniques to identify what the foreign body actually is and piece together the clues to identify how it got incorporated into the product. Armed with this vital intelligence, manufacturers can perform the necessary actions to ensure the integrity of the product is upheld and, where possible, prevent contamination from happening again. Contact safety@leatherheadfood.com to find out more.

How Leatherhead can help

Leatherhead offers a UKAS accredited foreign body service with expertise in foreign body analysis using multiple microscopy techniques to analyse materials and identify likely sources. We correspond closely with clients at each stage to understand possible areas of issue if reported from the factory, comparing reported materials with known samples, as well as determining contaminants that may have entered the product after manufacture. This allows clients to show due diligence and give customers confidence in the products that they purchase.

About the author

Gemma graduated from the University of Staffordshire with a BSc (Hons) in Forensic Science and Criminology. She has three years' experience analysing foreign bodies reported from food, and in chemical testing in alcoholic beverages, including Ion Chromatography. At Leatherhead, Gemma works as a Principal Scientist within Science and Microscopy Solutions working on confidential projects in food structure, in addition to routine analysis of foreign bodies. Gemma is a member of the Royal Microscopical Society and the Institute of Food Science & Technology.

About Leatherhead Food Research

Leatherhead Food Research provides expertise and support to the global food and drink sector with practical solutions that cover all stages of a product's life cycle from consumer insight, ingredient innovation and sensory testing to food safety consultancy and global regulatory advice. Leatherhead operates a membership programme which represents a who's who of the global food and drinks industry. Supporting all members and clients, large or small, Leatherhead provides consultancy and advice, as well as training, market news, published reports and bespoke projects. Alongside the Member support and project work, our world-renowned experts deliver cutting-edge research in areas that drive long term commercial benefit for the food and drink industry.

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