Metal Detection - An Overview with Food Safety Implications

Earlier this year, it was reported that a Trinidadian mother wanted to find out how a metal screw ended up inside the chocolate bar she was eating. The bar had been offered to her by her daughter and she had already consumed half when she bit down on the hard metal hidden inside.

The local producer of the bar is a leading manufacturer and distributor of snack foods, confectionery, biscuits and cereals in the Caribbean. The company's managing director had stated that they were concerned about where the object came from since metal detectors were installed on all lines at the chocolate factory and the company met all requirements of the United States Food and Drug Administration (USFDA).

Understandably, there may be many questions associated with this case, but firstly, how does metal find itself in a food product? The possibilities are, quite frankly, endless. At all points in the farm to table chain of activities such as at harvest, storage, transport, processing, packaging, distribution, retail and preparation for consumption, the product is at risk for contamination by physical objects. At these points, the food material may come into contact (either intentionally or not) with a variety of potential hazards, such as harvesting equipment, wooden crates and pallets held together with nails, corroded storage sheds, cutting blades, injection needles, metallic conveyor belts, equipment nuts, bolts, bearings, maintenance parts and tools, to name a few.

The USFDA Health Hazard Evaluation Board supports regulatory action against products with metal fragments 7mm to 25mm in length. Further, the Food and Drugs Act of Trinidad and Tobago states that any person who sells an item of food which is adulterated, is guilty of an offence. Metal detection is therefore crucial to food safety and overall quality assurance.

Thus, companies invest heavily in metal detection systems. These systems are capable of detecting both ferrous (with iron) and non-ferrous metals, e.g. brass, bronze, aluminium etc. The reliability of metal detectors, however, is affected by several factors, such as the size of the detector aperture (greater detection area to be covered), position of metal in the aperture (metal furthest away from sensor may be missed), type of material (stainless steel is more difficult to detect), shape and orientation of the metal, type of food product, product packaging material (e.g. foil may be a source of interference), operating frequency (better sensitivity at higher frequencies), processing speed and environmental conditions (vibrations, temperature fluctuations etc.).

Metal detectors usually require calibration for these influencing factors which sets the ranges for detection. Hence, if a metal contaminant falls outside of the calibrated specifications of the detector, it can find its way to the consumer. For instance, if a detector is set to detect metallic

spheres 2mm or greater in diameter, it may fail to detect a wire that is smaller in diameter but considerably longer (1 inch) in length.

In addition, the point in processing at which metal detection is implemented is critical. Too early, and metal may be introduced further down in the process. Too late, and interference from packaging materials may prevent detection altogether or the investment of resources is so high that the manufacturer suffers substantial losses.

It is clear that metal detectors as a standalone solution to the hazard of metal inclusion are not failure proof. They should be used in conjunction with measures such as in-process separators and periodic visual inspections of equipment for damage where the risk may be high. The development and implementation of a HACCP (Hazard Analysis Critical Control Points) plan will therefore always remain of great importance to the food safety management system and hence, cannot be stressed enough.

References

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