Selecting the right product inspection system for your application

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Recent updates to the International Featured Standards (IFS) in Europe, as well as other Global Food Safety Initiative (GFSI) approved guidelines worldwide, have shifted the emphasis of the food industry from contamination response to contamination prevention.

Today, product inspection is more critical than ever in the global food supply chain and new technologies are making inspection more speedy and accurate.

In addition to constant concerns regarding organic contaminants from dangerous microbes to bone fragments, food processors must be concerned with inspecting packaged products for foreign objects such as stones, glass, metals and other materials. There is also a desire from a large and growing number of manufacturers to ensure that products are not damaged, misshapen, or absent from packages. After all, that pack of broken biscuits can crumble a brand's reputation.

For decades, product inspection has incorporated two main technologies: Metal Detection (MD) and X-Ray (XR). Both technologies have been integrated into quality control protocols for numerous food manufacturers. Through the years there have been enhancements to both technologies to improve performance and meet increasingly robust regulations.

When selecting the most appropriate inspection technology for an application, one question is obvious: Is one technology superior to the other? The truth is that comparing these technologies is like comparing apples and oranges. Both offer advanced solutions for thorough product inspection, yet the technologies are very different and provide specific advantages depending on a manufacturer's needs. The better question should be: Which technology is better suited to my application?

Mettler-Toledo Safeline Profile Metal Detectors with enhanced metal detection software takes the sting out of product changeovers.

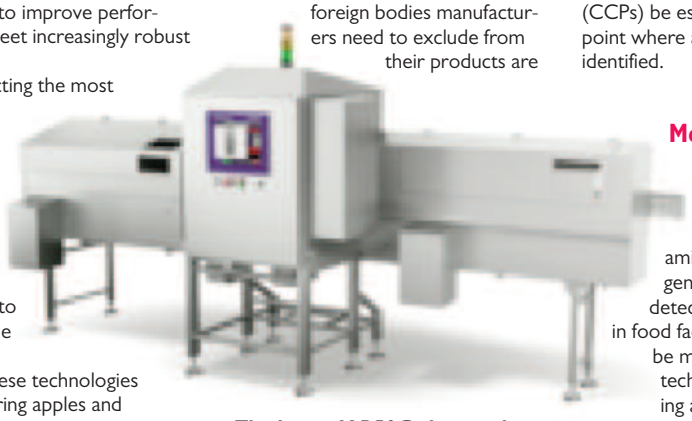
Product inspection

Practically all food and beverage products are subject to the risk of some type of unwanted contamination, beginning from the time food is picked in the field, processed, packaged and shipped to consumers.

Many of these contaminants and foreign objects are very difficult to detect. Some of the most common foreign bodies manufacturers need to exclude from their products are metal, rubber, glass, plastic and stones. Processed meat is just one of many examples of a food product that is subject to metal contaminants. This is because there is a risk that the equipment used in processing, such as grinders and cutting blades may break during manufacture, resulting in small metal shards making their way into the production stream.

Food manufacturers typically use the Hazard Analysis Critical Control Point (HACCP) guidelines to determine how best to safeguard products from contamination.

The procedure typically requires that all production processes be fully audited and critical control points (CCPs) be established after each point where a contamination risk is identified.



The InspireX R50G glass in glass X-ray system.

Metal detection

Metal detectors are the popular workhorses for metal contaminant detection. They generally outnumber x-ray detection systems installed in food factories and also tend to be more cost effective. MD technology works by creating a detection field from an electronic detection coil system within a search head.

Very small disturbances are created when metal contaminants pass through the field of detection. The tiny electrical signals generated are received, amplified and analysed by sophisticated software. The technology works with any type of metal including ferrous, non-ferrous and stainless steel.

As a well established inspection technology, there is a wide array of MD options available to manufacturers to suit their application.

For example, gravity fall MD systems have been designed for bulk powders, granules and other dry products in 'free-falling' applications. Pipeline systems are available to inspect liquids, pastes and slurries as they are pumped through process pipelines. All systems can be engineered to enable them to operate comfortably in harsh environments where they need to withstand frequent wash-downs or high humidity.

One potential challenge with this type of technology is that some conductive or wet products can create electrical signals when passing through the detection field in the search head. These signals cause a phenomenon known as 'product effect' which can in some cases mask signals of any contaminants within the package.

To overcome this, developments in MD systems have led to the use of variable frequency technology, which allows the software to select the most suitable frequency for each application, in increments of 1kHz, with an automatic function that determines the optimum frequency for the product being inspected.

This enables the most challenging products to be inspected successfully including those with high moisture content as well as those packaged in metallised film.

MD technologies have also been developed to meet the needs of specific markets. One example is the sausage industry, which has a host of inspection challenges. Grinding equipment used to process sausages and metal clips used to seal sausage ends can result in tiny metal particles making their way into the end product.

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A metal detector introduced to the market has been specifically designed for sausage processing operations and can be easily integrated with widely-used vacuum fillers and sausage processing equipment.

The technology uses short throughput tubes and is constructed from stainless steel with high sealing standards certified to Ingress Protection Rating IP69K that can withstand harsh environments and wash-down regimes.

X-ray technology

X-ray detection is an entirely different technology from MD. It uses an invisible form of short-wave electromagnetic radiation to capture grey-scale images of objects. As it scans the product, it analyses the images generated to detect contaminants which have a higher density than the surrounding product.

The sophisticated software used to analyse the image is also able to calculate product length, width, area and volume, enabling it to carry out mass measurement calculations. It can also identify missing, broken or misshapen products, monitor fill levels of liquids, and detect compromised seals and other irregularities. Because of this, XR is seen not only as a tool to detect contaminants but also as a brand-enhancing method of checking to make sure a product will look exactly as a customer expects it to look.

XR systems are typically deployed at the end of the production process after the product is packed, but they can also be used in some processing environments too. XR technology is able to detect glass, bone, stones and high density plastics as well as metal contaminants. If a HACCP audit conducted by a food manufacturer identifies the risk of multiple contaminant types (more than just metals) then XR is likely to be a more suitable choice than MD.

XR technology also has the ability to inspect metal packaging, such as tin cans or aluminium foil trays, for foreign bodies and out-of-place products. MD technology can be used to inspect some products packed in metallised films (where metal contamination is the risk) but only XR technology can inspect and identify contamination in food or beverage cans and aluminium trays. In addition, the technology can be used to identify products that are deformed, out of place, as well as missing components.

For example, XR scans can quickly detect a missing or misshapen praline in a premium box of chocolates which includes aluminium foil wrapped products.

In the same way that certain products challenge MD sensors, some product characteristics can also be challenging to XR technology. An example is salty products with free salt crystals. These crystals might be analysed as dense particles by XR sensors and mistakenly considered product defects. Because XR is based on density calculations, detecting products of similar densities is difficult; however advances to XR technology are being developed to overcome these challenges.

Some recent technology advancements with XR have also improved detection of products within glass containers.

Due to the varying thickness of glass walls and bases of jars and bottles, detecting foreign bodies can be difficult and can result in the rejection of good products.

New XR technology has been designed to scan with one vertical and three horizontal X-ray beams simultaneously, reducing blind spots in the base, sidewalls and necks of glass containers.

Making the right choice

When it comes to choosing MD or XR technology, food safety regulations and retailers are largely leaving the decision to manufacturers. Leading standards have not weighed in on preferences regarding MD or XR technology, and the most recent updates to the most common standards such as the BRC Global Standards Version 6 and the IFS Version 6 do not favour one over the other.

Neither technology is considered superior to the other in terms of product inspection. Instead, manufacturers must evaluate their production process and decide which technology makes sense for their own products and specific contamination threats. Such decisions can only be established after a comprehensive HACCP audit that identifies critical control points and the best method for risk mitigation.

The most successful product inspection system in some cases might be to incorporate both technologies at critical control points throughout a production line. It is important that manufacturers understand the individual needs of their production lines and the food quality legislation that they need to comply with before implementing a product inspection system.

By making use of MD and XR technologies, food manufacturers can ensure they meet and exceed regulatory requirements and retailer food safety guidelines. At the same time they will be protecting brand reputation and guaranteeing consumer welfare.

Ultimately, as with any important decision, manufacturers should seek guidance from professionals. Making the right choice is important, and asking for expert help is the safest way to select the right solution. ■