

Seeing is Believing

A look at X-ray inspection

By Erik Brainard

X-ray systems dedicated to food inspection have been around for more than 20 years. Within the past decade, significant advancements in detection accuracy, speed, pricing and, most importantly, reliability have allowed this technology to become a proven warrior against physical contaminant concerns.

Metal, glass, stones and bones are introduced to the food chain in various ways. Glass can be introduced when a beer bottle is tossed from a car into a farm field and picked up by harvesting equipment. Bolts and other metals can enter during the raw material transportation process. Hypodermic needles may break inside an animal when veterinarians are administering medications. Small metal shavings or sieve wires may be introduced when processing equipment fails. And, of course, bones from pork, beef or chicken can be introduced during processing.

X-ray systems provide additional benefits beyond contaminant detection. They are designed to automatically analyze for underweight conditions, broken product and product trapped within a flow wrap or meat packaging seal. Additionally, they can count the number of units within a package, inspect through metallic packaging without any degradation to contaminant accuracy and analyze fill levels.

X-ray technology can be classified into two categories: entry-level and advanced. Entry-level systems are priced and built to improve upon the standard metal detection technology most food processors use today. These systems are low-priced, provide moderately increased accuracy over metal detection systems as well as the ability to inspect through metallic packaging. Advanced-level systems are designed to maximize results. Offering significant value, they provide a huge accuracy improvement over metal detection and entry-level X-ray systems as well as benefits beyond contaminant detection.

X-Ray Inspection versus Metal Detection

For many, the initial investment in an X-ray system is avoidable as a metal detector can “do the job” that is required to meet a HACCP (Hazard Analysis Critical Control Points) specification, such as 1.5 millimetres ferrous metal. But while the metal detector carries with it a price point advantage, the online disadvantages far outweigh the initial cost of the more advanced X-ray detection solution.

Drawbacks include:

- Metal detection technology is affected by changes in environmental conditions.
- The accuracy of a metal detector is affected by the variability of a product’s ingredients and temperature, known as the “product effect.”
- Vibration or noise from frequency drives can cause “head instability” and “false detection.”
- Metal detectors are prone to missing metal wire of a significant length depending on the angle. This is known as the “orientation effect.” The

aperture size and often the frequency are designed specifically for the application, which limits a metal detector’s effectiveness.

- When a metal detector rejects product there is no visual indication of the location and actual physicality of the contaminant.

Applications do exist where a metal detector is the proper choice alone or in tandem with X-ray technology. For example, if dealing with free falling product from a scale, a metal detector is the appropriate solution. However, installation of X-ray technology should be considered after the scale and bag-packaging process to inspect the final product to ensure no additional contaminants were added and detect product conglomerates, such as salt clumping. Further, metal detectors provide more accurate detection than X-ray technology for small and thin ferrous metals and metallic film materials within a product, such as gum wrappers and metallic dust. These items produce a significant and cumulative signal that is detected by the metal detector but do not create a significant density change visible by X-ray technology. For these reasons, the food processing industry in North America should consider using both metal detection and X-ray technology as a complete solution.

Vision System Integration

Vision systems provide additional and complementary benefits to X-ray technology. They inspect bulk-harvested products, such as raisins and nuts, and processed items like potato chips for various quality issues detectable based on colour, size and shape. Twigs, leaves, bugs, stones and glass can be rejected in nuts at high speeds. And colour problems resulting from overcooked chips or French fries can be detected and rejected as well. This is not a full-proof solution for contaminant detection as items such as stones may look and ‘act’ like nuts and green glass may be present in green vegetables. However, these contaminants are detectable by X-ray technology as they are denser than the product. For this reason, it is recommended vision systems and X-ray technology work in tandem to maximize a company’s quality control program.

X-Ray inspection technology is gaining a footing within the industry. With recent technological advancements that have improved the system’s ability to detect hidden and not previously seen contaminants inside product as well as within packaging, investment in this detection solution is now justified and potentially a marketing advantage for companies. ●●

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