

INSPECTION

LATEST SYSTEMS FOR CONTAMINANT DETECTION, PRODUCT SORTING AND CONTAINER AND LABEL MONITORING

CONTAMINANT DETECTION

X-ray and metal detection come to terms

X-ray systems and metal detectors have been battling it out in the contaminant detection arena for several years now. But as the limitations and strengths of each technology become increasingly apparent, it seems there is room in the food industry for both.

Metallised film and foil are becoming increasingly popular packaging materials, owing to a combination of aesthetic appeal and the barrier qualities required to keep product fresher for longer.

This trend is almost single-handedly driving the adoption of X-ray technology on UK food and packaging lines. Indeed machinery manufacturer Thermo Electron estimates that over half of the enquiries it receives for X-ray systems are for foil or metallised film applications.

Finding metal in foil clearly presents problems for a metal detector. Metal detection equipment suppliers have gone some way to addressing the issue by developing ferrous-in-foil detectors that satisfy 'due diligence' requirements. But the problem is that they will only find ferrous metals and will tend to overlook stainless steel – which is the most common contaminant on food production lines.

The performance of X-ray, on the other hand, is not compromised by metallic packaging. The case for deploying X-ray where metallic packaging is present has been further strengthened by changes in retailer codes of practice. Two of the UK's largest retailers are now encouraging suppliers of products packaged in metallised film or foil to use X-ray inspection.

A second factor driving the uptake of X-ray is the detection of non-metallic contaminants, such as bones and stones. Thermo Electron says it has sold quite a few systems recently for isolating bones in boneless chicken meat. "It's a specialised application where it's best to put meat through a pipeline and pump it into the

X-ray machine so you get an homogenous image," explains Bob Ries, contaminant detection product manager at Thermo Electron.

But X-ray's potential extends beyond contamination detection. For example, Smiths Detection's dual energy X-ray technology allows meat processors to conduct on-line fat analysis. So as well as inspecting for contaminants, the company's Eagle FA system will measure the fat content of bulk boxed meat to calculate and monitor the CL (Chemical Lean) value of all kinds of meat products. "These systems will achieve a considerably higher precision with regard to fat analysis than can be achieved through random tests," says Terry Woolford, Smiths Detection PID manager, UK and Ireland.

X-ray inspection systems can also verify the weight of packaged product – in effect carrying out the job traditionally done by a checkweigher – but offering the additional benefit of being able to identify missing product or components.

Calculate weights

For example, Loma Systems' mass measurement image processing software can calculate individual weights in multi-compartment products, such as twin-pot yogurts or lunch packs. This allows 'zonal' weighing of each compartment rather than a general reading of the entire tray, minimising the risk of underweight segments not being detected.

While X-ray offers clear advantages in certain applications, it is not without its issues. Certainly, cost is still a major obstacle to its widespread adoption. Prohibitively high costs in the past deterred many manufacturers from investing in X-ray technology, although there are now signs that the gap in price between metal detection and X-ray systems is closing – albeit slowly. Bob Ries reckons that the cost of X-ray has come down to about two or three times that of metal detection. But he admits that is still a sizeable premium to pay and that the downwards trend in pricing is not open-ended. "Metal detectors will always be the

lower cost inspection solution due to the inner workings of the machines," he says.

Recognising price as a potential barrier to sales, several inspection equipment suppliers are marketing systems on their affordability. Indeed, at the PPMA Show in September Thermo Electron staged the UK launch of the Goring Kerr EZx X-ray system. The company says the new unit offers the simplicity of a metal detector, a low total cost of ownership and the enhanced detection capability and sensitivity of an X-ray system.



Low cost X-ray: The EZx from Thermo Electron was launched in the UK at the PPMA Show

The EZx also eliminates risk of unscanned areas, particularly when larger items such as cases fill the aperture. The X-ray source is mounted beneath the conveyor and, rather than operate with a single sensor array at the top of the aperture, the machine employs additional sensor arrays down the two sides. This means the full width and height of the aperture is scanned, leaving no blind spots.

Earlier this year, Mettler-Toledo Safeline introduced an X-ray system which costs less than its existing system and offers bolt-on functions such as mass measurement, seal integrity verification and counting. Cintex – now part of



Combination X-ray machine: Eagle Combo from Smiths Detection incorporates a checkweigher



Faster image processing: Heuft Reflexx X-ray contaminant detector

the Spectis Group which also includes Loma Systems – has had a low cost X-ray option for the past two years. The Sentry XR costs less than £20,000.

One of the reasons that the cost of X-ray has fallen is that there are more players in the market than a few years ago, creating fiercer competition. But even if price does continue to fall, there are still limitations with the technology itself. While some issues are gradually being overcome, others are subject to the universal laws of physics.

According to Alan Johnson, product marketing manager with Loma Systems, advances in

PC and image processing technology, faster scan rates and the introduction of high gain sensors have all helped improve sensitivity, speed, reliability and user-friendliness.

Indeed, German inspection equipment specialist Heuft points out that although standard computers have become increasingly faster, their performance is not high enough for use in the image processing systems of X-ray inspection devices and has developed its own card for this application.

However, X-ray systems are not as sturdily constructed as metal detectors – nor can they hope to match the 10-15 year lifespan of many metal detectors.

“The nature of X-ray tubes mean that X-ray will never be as rugged as coils potted in epoxy and sealed in a metal detector,” says Bob Ries at Thermo Electron. There is also the issue of products which ‘fool’ an X-ray system into thinking they are contaminants, such as pips in apples and seeds on crackers. One of the methods X-ray systems use to find contaminants is edge-recognition, which means they may mistake surface texture for contamination.

Main limitation

But the main limitation of X-ray technology lies in the fact that it works on a density differentiation basis. So while it can easily detect contaminants which are heavier than the surrounding product, it has difficulty finding lighter contaminants such as insects, rubber and aluminium. Also, the thicker and denser the product, the more X-ray will struggle to detect contaminants.

Alan Johnson believes there is unlikely to be a sea-change in the types of contaminants X-ray machines can detect. “The boundary between detectable and non-detectable contaminants is unlikely to change to any significant degree,” he says.

So while X-ray offers clear benefits for the detection of metal in metal and softer contaminants or where product or weight analysis can add value, metal detection can still reliably protect against contamination in many applications – for a fraction of the cost. That metal detection equipment suppliers are forging ahead with technological advancement certainly suggests they are confident that metal detectors will be around for some time to come.

Indeed, a novel approach to improving sensitivity to stainless steel contaminants within aluminium foil packaging was launched at Sep-

tember’s PPMA Show by Selo-Bollans, UK representative of the Japanese manufacturer Anritsu.

The M Series metal detector incorporates a system to magnetise the small ferrous element within certain stainless steels, enhancing the signal available for detection and diminishing the effects of moisture or high salinity within the product. It also means that the orientation of contaminants such as fine wire to the search head is far less critical.

Multi-frequency inspection

However, one of the key drivers of developments in metal detection technology is the ongoing quest for the holy grail of true multi-frequency inspection.

The general rule with operating frequency is ‘the higher the better’. However, when inspecting at high frequency, the metal detector becomes less tolerant to variations in product or packaging characteristics and performance is compromised in certain applications.

Historically, metal detectors were built to operate at a single frequency – calculated as the optimum setting for the product in question. However, in recent years, food manufacturers have shifted away from running lines dedicated to one product, creating demand for multi-frequency metal detectors which can screen several different products.

Lock Inspection Systems has responded to this trend by developing the MET 30+ 3f, a metal detector which operates at three frequencies: low, medium and high. Lock says the detector’s automatic frequency selection facility will choose the optimum application for the product being inspected.

Aimia Foods, formerly known as Nichols Foods, is one of several UK companies to use Lock’s MET 30+ 3f. The detector forms part of a twin-head system – comprising a FeroChek ferrous-in-foil detector and a MET 30+ 3f detector mounted on one conveyor – at the company’s Haydock site in Lancashire.

According to Mike Randall, chairman of Lock Inspection Systems, such twin-head configurations are finding increasing favour with manufacturers, owing to their flexibility and ability to detect in different materials on the same line.

“In the last three years we have seen steady growth in the number of twin-head systems we’ve been asked to supply,” he says. “There is an overall trend within the food industry towards running several products on one line,



Twin head: Lock Inspection system at Aimia Foods

rather than having dedicated lines. This obviously places greater demands on metal detection equipment, as machines must be able to handle a broader range of products and packaging, yet still be able to meet the ever more exacting sensitivity standards set by retailers."

Aimia Foods produces vending packs of condiments and beverages for major supermarkets and vending companies. Many of its products are supplied in foil-lined packaging to preserve freshness and flavour, for example drinking chocolate,



Monitoring tablets: CEA THS/PH21 metal detector meets CFR 21 part 11 requirements

tea and coffee in individual vending packs or jars with peel-off lids. Lock's FeroChek overlooks the aluminium foil packaging and detects smaller particles of ferrous metals inside the packaging, allowing Aimia Foods to achieve 'due diligence'.

For other types of packaging, the MET 30+3f selects the optimum frequency for the application in hand. So when inspecting hot chocolate powder in non-metallised packaging, the detector will automatically select high frequency, whereas for condiments in metallised sachets, it will operate at a lower frequency.

At the PPMA Show, Mettler-Toledo Safeline launched the Safeline R Series Profile detector, which features a multi-frequency detection coil system and failsafe condition monitoring. This means that key elements of the machine are under constant surveillance, with performance trended against pre-set tolerances to provide

allows 100 frequencies to be 'dialed in' from the control panel. A 'sweet spot' can then be located that maximises sensitivity for the product in hand. Cintex has achieved multi-frequency capability by developing one set of electronics which can handle every frequency, rather than having a different set of electronics for each frequency.

Looking to the future though, Alan Johnson at Loma believes further developments in sensitivity will be incremental. "There's nothing out



Checking bigger bags: Large aperture metal detector from Fortress Technology

early warning of any corrective maintenance required. This can be relayed via a network to a production office if required.

there that's suddenly going to make a metal detector ten times more sensitive."

Rather, he expects advancements to focus on making equipment easier to use and more flexible. "Inspection manufacturers are tending to invest in software that will make metal detectors easy to set up because operating staff don't have time to fiddle around on the production line to get it right and skill levels are not necessarily as good as they used to be. So anything that can help ease of use and maintenance of performance is going to sell."

Higher levels of plant integration, without the need for expensive network cabling, is something he thinks will increasingly be required by larger customers. "There are all sorts of issues with running cabling on a factory floor, which is why we are seeing growth in demand for wireless networking. The trend started in the USA and is reaching the UK too."

Outside the food arena meanwhile, Fortress Technology claims to have made progress in sensitivity for bulk and multi-packs. The company has developed a range of high performance, large aperture detectors for inspection of goods such as disposable nappies and toilet

There is also a 'change free running' mode that allows numerous product types that exhibit a product effect to be inspected with no need to change detector settings or programs, eliminating the "fiddle problem" that leads to a high proportion of service calls.

Helping with validation

The colour touch screen Windows-style control panel gives access to a series of new features to help in validation and performance monitoring. Real time histograms display data on product characteristics while the Profile's memory stores data on every individual product that passes through the machine, providing a complete record for QA and performance qualification purposes.

Cintex claims to be the only company to have developed a 'true' multi-frequency detector. The Sentry VF's digital frequency system

paper. The apertures typically measure about 500mm wide and 325mm high to accommodate the bulk packs and are capable of detecting 0.9-1.5mm ferrous and 1.2-2.0mm stainless steel in a 'real life production environment'.

Fortress recognises that this level of performance can be easily achieved in ideal conditions, but points out that when machines are moved into the production area, electrical noise and vibration can compromise detector performance. Therefore the company says it has used a combination of technology – mechanical, electrical and software – to enable these machines to achieve high sensitivity.

Constant Instruments has introduced a metal detector which enables compliance with the CFR 21 Part 11 requirements in the pharmaceutical industry. Constant claims that the THS/PH21 has reduced the size of detectable particles by 30 per cent for some manufacturers of tablets and capsules. Nineteen of the systems have now been installed at a major UK manufacturer.

For further information:

Cintex

T: 01908 629221
E: sales@cintex.co.uk

Constant Instruments

T: 01903 739333
E: sales@constant-ceia.com

Fortress Technology (Europe)

T: 01295 256266
E: europe@fortresstechnology.com

Heuft

T: 01827 716541
E: sales@heuft.co.uk

Lock Inspection Systems

T: 0161 624 0333
E: marketing@lockinspection.co.uk

Loma Systems

T: 01252 893300
E: sales@loma.co.uk

Mettler-Toledo Safeline

T: 0161 848 8636
E: sales@safeline.co.uk

Selo Bollans

T: 0151 644 9393
E: info@selo-bollans.co.uk

Smiths Detection

T: 01923 294400
E: terry.woolford@smithsdetection.com

Thermo Electron

T: 01788 820300
E: sales.wi.uk@thermo.com

SORTING

Vision systems look out for product defects

Contaminants are not the only threat to product integrity. In some cases, manufacturers also need to screen product for defects and so vision sorting systems are becoming an increasingly common sight on food lines, for inspecting and sorting ingredients and unpacked products such as nuts, snacks and biscuits.

Vision systems don't come cheap – Radix estimates the cost at £50-150,000, depending on complexity. But they can detect a number of contaminants, such as wood, insects, plastic and metal, which cannot reliably be detected by X-ray or metal detection systems. And Milan Fuchs, the company's managing director, reckons the systems pay for themselves by reducing labour costs and customer complaints.

Vision systems not only safeguard product quality, but as Mr Fuchs points out, they can reduce downtime and waste in packaging lines. "These systems remove mis-shapen or broken items that would otherwise jam automatic packaging machines," he says.

Double sided inspection

Radix launched a new vision system at this year's PPMA Show. Called the Autosort MC-D, the sorter offers double-sided inspection to detect defects that can be seen on one side of the product only, for example, the green top of a sliced carrot, a mouldy peanut or a bad crisp buried in the product. A new ejector configuration combined with fast acting pneumatic valves also promises to ensure accurate removal of defects and contaminants with minimal wastage of good material.

A purpose designed 'Snapshot' processing engine capable of inspecting up to 100,000 items a minute lies at the heart of the sorter technology, according to Radix, while higher speed line-scan cameras allow detection of defects as small as 0.5mm. Using four specific wavelengths for illumination is said to give a wealth of information, including high speed analysis of spectral signature. This enables detection of subtle colour differences and even contaminants that are the same colour as the product.

In addition to colour, the Autosort MC-D can



Two-side inspection: Discoloured dried carrot is removed from good product by the Autosort MC-D

detect and remove size or shape defects in products such as snacks, nuts, biscuits, and rice cakes.

In the pharmaceutical industry, Philippe Rincel, director of the pharmaceutical business unit at French manufacturer Proditex, says there is a gradual shift towards using automated vision systems to check tablets for visual defects – whether variations in colour, chips in the coating or irregular embossing.

Entry level for tablets

Most systems on the market are designed to carry out high-speed, high-output, systematic inspection, with infrequent product changeovers. However, when it comes to reworking defective batches, such systems are simply not suitable and manufacturers are often forced to inspect tablets manually.

With this in mind, Proditex has developed an entry-level system specifically for inspecting defective batches. Called the Inspectab 100, the system is said to offer easy set-up and rapid changeover from one tablet to another. Further inspection systems from Proditex, represented in the UK by FJ Pistol, are available to give speeds in excess of 200,000 tablets an hour.

Since October, Logic TPS has been distribut-

ing the Sortomat visual inspection systems from Maschinpex. The Sortomat measures and sorts tablets, hard candies, chewing gum and other confectionery products, according to length, diameter and thickness.

For further information:

Logic TPS
T: 01344 750101
E: sales@logictps.com

FJ Pistol
T: 01727 823461
E: info@pistol-mach.co.uk

Radix Systems
T: 01794 830240
E: info@radixsystems.co.uk

CONTAINERS AND LABELS

Maintaining product integrity

It's not just the product itself where vision technology can help maintain product integrity – the packaging is just as crucial.

For example, verifying that the right lid has been put on the right container is one area where vision technology can be of assistance. Dimaco's Veri-iD system checks the identity of lid and container using either a colour camera to analyse the print decoration or a mono camera to verify the text or code – or a combination of both. Dimaco says the system will check the identity in any orientation, which is particularly important for round containers.

The use of vision systems for checking label data, positioning and orientation is well established. However, as David Bragg, sales director with Inex Inspection Systems, explains, inspecting labels on round containers has historically been fraught with difficulties. "The entire production process had to be slowed down to enable the operator to position the label in front of the camera or you had to put the camera inside the labeller, which is never ideal," he says.

When Inex was asked by one of its customers, a US wine producer, to design a system capable of inspecting label quality on a round container, its solution to the problem came in the form of the Gemini 3D. This takes four images around the circumference of the container and

'stitches' them together into a single strip before carrying out a precise inspection of the label.

Meanwhile, Heuft has introduced the FinalView camera-based container inspection system, which inspects the label and closure for presence, position, alignment, damage, raised corners and tightness as well as checking that the correct label has been applied. In addition, the system will check that best before dates and codes – even embossed codes – are in place and legible.

A further vision system is also now available from German end-of-line packaging machinery specialist ETT, represented in the UK by Eng-sol. Mounted at the infeed to ETT's machinery the system will detect label presence and position, check that the correct label has been applied and check the closure is in place.

The colours of the container can also be checked which, says ETT opens up the possibility of packing an assortment of colours, even where a variety of products are presented at random. Speed is up to 200 bottles a minute.

The prospect of being hit with heavy retailer fines for incorrect or illegible barcoding and 2D coding is driving the use of vision technology for barcode verification, too.

Codeway has broadened the inspection capabilities of its CheckRite barcode verification system to include 2D coding as well as conven-



Mini-Smart camera: Monitors print quality and checks codes on pharmaceuticals

INSPECTION



Checking lid against container: Dimaco Veri-ID vision system establishes the identity of both

tional linear bar coding. In a recent installation, the Checkrite was linked to a Pals label applicator and an Open Date thermal transfer printer to ensure that high resolution DataMatrix 2D coding printed on Denny Brothers multi-form labels is to specification.

The pharmaceutical industry is also harnessing vision technology to maintain rigorous labelling and coding standards. PCE's new Mini-Smart camera, available from Logic TPS, monitors print quality and checks for missing DataMatrix 2D codes on vials, ampoules, tubes, steel cylinders and blisters. Packaging can be either stamp-printed, thermo-transfer printed or laser printed. The camera can also check pharma codes, which enables remaining packaging material to be used up when changing from pharma-coded to 2D coded packaging.

Sessions of York has developed a print-apply

labeller which incorporates a camera inspection system. Installing a camera system capable of recognising the text on labels printed by the SPA 924 print-apply labeller enables incorrect print to be identified and rejected. The camera can also verify that the label has been applied to the correct item. ■

For further information:

Codeway
T: 01206 751300
E: identify@codeway.com

Dimaco
T: 01234 851515
E: sales@dimaco.co.uk

Engsol
T: 01502 470812
E: enquiries@engsol.uk.com

Heuft
T: 01827 716541
E: sales@heuft.co.uk

Inex Inspection Systems
T: 0161 876 1700
E: david.bragg@inexinspection.com

Logic TPS
T: 01344 750101
E: sales@logictps.com

Sessions of York
T: 01904 659224
E: machine.info@sessionsofyork.co.uk

For full details of all PPMA members able to supply inspection equipment, consult the PPMA machinery finder service, tel: 020 8773 8111, or visit www.ppma.co.uk

Testing blisters in-line for leaks

Sepha has made progress in an area which has long eluded in-line leak testing systems – the inspection of finished cold-form pharmaceutical blister packs.

Branded Oracle, the company's new in-line technology is said to represent a significant breakthrough for pharmaceutical quality assurance departments looking for an 'early warning' system of quality failures in finished blister packs.

Existing systems identified pinholes in lidding foil using vision systems, but could not check quality after the sealing process. The new Oracle system is reckoned to be the first system to achieve 100 per cent testing of thermoformed or cold-formed blisters for pin holes, weak seals and capillaries.

The in-line quality assurance test can



Early warning: Sepha Oracle tests blisters in-line

inspect up to 300 sealed blisters a minute, giving a 'pass/fail' result for each pocket and identifying the types of leak present.

T: 028 9182 4252
E: sales@sepha.com