

DAIRY
INNOVATION

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Advanced plant automation in Vietnam

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Foreign body detection

Keeping products safe

Technology is developing rapidly to ensure that dairy products reach consumers safe and free from contaminants, as **Dairy Innovation** reports.

Microwave detection in dairy

Food Radar specialises in the use of microwave technology to detect foreign objects in a food flow and has completed several successful pilot tests on processed cheese and yogurts. Claire Rowan discovered more.

Companies such as **Emmi** and **Heinz** are already benefiting from the Food Radar system to ensure the food safety of their products.

"We have carried out extensive work in dairy and detection of hard pieces such as metal, stone and glass, as well as more difficult objects such as soft plastic, fruit stones, and wood related objects can be successfully detected by our microwave technology at product flow rates," said vice president, sales & marketing Mikael Reimers. "Even difficult to detect objects such as dried insects, which cannot easily be detected by x-ray because of their low density, can be spotted by the Food Radar."

At one dairy, trials on fruit yogurt illustrated the accurate results the Food Radar system can produce for yogurt and

fruit preparations pumped at a load of approximately 25kg of product, around a yogurt pilot plant. Various contaminants such as wood, cherry pits, rubber, soft plastic, aluminium foil, leaves and stones, were added at intervals.

"Effectively, each foreign object will generate a peak in the background noise of the product due to the difference in dielectric properties between the product and the object," explained Mikael. "If the peak is high enough to intersect a threshold, the foreign object will be rejected through the reject valve."

The volume of product flowing through the sensor head is scanned by eight microwave channels at ten different frequencies simultaneously to cover the complete dimension of the pipe and to allow for temperature and product differences. All this is repeated

500 times per second and hence the food is sampled 40,000 times per second to handle high process flow. Food Radar uses two sensor sizes, either 2.5" or 1.5".

Detection efficiency was high in the pure yogurt, although a prerequisite for the detection of foreign objects is a product flow without air, according to Mikael, who highlighted that in the test in the pilot plant foam and air bubbles were created as a result of the circulation of the product, which decreased the detection level. In addition, it was noted that as the yogurt flowed through the pilot plant its viscosity decreased, which influenced the flow speed of the foreign objects

in the pipe, with wood pieces, for example, travelling slower than in a standard production line. Tests in a new batch of yogurt saw the products flow better in the more viscous product.

"In any installation, the Food Radar is adapted to the conditions of a specific processing plant," said Mikael, who confirmed that the results demonstrated that the detection efficiency in premixed fruit yogurt is very high (see table 1, 2 and 3).

In other tests on a processed cheese, the Food Radar system was found to be highly efficient in detecting even very small pieces of soft plastic in the plain product, which was made up of fat (15-17%), protein (15-17%),

Table 1. Natural yogurt 3% fat

Objects	Total amount of passages	Rejects	Comments
Wood 10x10x10	1	1	
Wood 10x5x5	2	1	
Soft plastic 15x15	1	1	
Aseptic bag foil 13x13	1	1	
Cherry pit, whole	1	1	
Rubber 13x5x5	2	1	
Leaf 50x10	1	1	
Stone 9x5x5	1	1	
Stone 10x8x7	1	1	New batch of yogurt

Natural yogurt 3% fat mixed with raspberry preparation (12% fruit content) During the test the signal noise from the product was very uneven due to air bubbles and probably also due to incomplete mixing. A more stable situation was achieved by decreasing the speed of the pump

Table 2. Natural yogurt 3% fat mixed with raspberry preparation (12% fruit content)

Objects	Total amount of passages	Rejects	Comments
Wood 10x5x5	1	1	
Soft plastic 15x15	3	1	
Soft plastic 15x15	1	1	80% pump speed
Leaf 50x10	1	1	80% pump speed
Leaf 25x10	1	1	80% pump speed

Fruit yogurt 2% fat 8% fruit. With this product the flow was much better and this test shows high detection efficiency in yoghurt. Even a small piece of rubber gasket 5x5x5mm was detected and rejected (see Table 3)

Table 3. Yoggi fruit yogurt 2% fat 8% fruit

Objects	Total amount of passages	Rejects	Comments
Rubber 10x5x5	1	1	
Rubber 5x5x5	1	1	
Leaf 22x10	1	1	
Plexiglas 11x11x1	1	1	
Cherry pit, half	1	1	
Cherry pit, quarter	1	0	

Trends in foreign body detection

by Kyle Thomas, strategic business unit manager at Eagle Product Inspection

What are the trends in foreign body detection in dairy?

Cost-conscious consumers are increasingly demanding that their dairy products, including milk and cheese, last as long as possible in their refrigerators before spoiling. In response, dairy producers have begun to introduce 'fresher for longer' product ranges, which have not only been treated to extend lifespan, but, in the case of cheese products, are also packaged in formats designed to minimise the risk of spoilage from contact with air or sunlight, such as aluminum foil and metalised film.

This has led to growth in the use of x-ray technology, due to its ability to penetrate foil and metalised formats, which are traditionally challenging to inspect. Advanced x-ray solutions capable of identifying metal fragments in metal packaging, as well as glass shards, plastics, rubber and stones, are also becoming more widely used to maximise detection sensitivity.

What are the most challenging products for foreign body detection for dairy processors, and why?

Traditionally, products with complex and varying density levels, including unprocessed cheese, multi-layered desserts and multi-component snacks, have presented a challenge for sensitive product inspection. This is due to the fact that multiple densities can mask foreign bodies from standard product inspection systems, making it harder to discriminate between conforming product of a different density and particles of foreign body contaminant.

However, advanced x-ray solutions, such as the Eagle Pack 550 PRO combined with Material Discrimination X-ray (MDX) technology, are capable of sensitive contaminant detection, even in products of varying density or traditionally difficult to inspect with standard x-ray technology, such as shredded cheese or split pot yogurt combinations which

can generate busy and thus confusing x-ray images. Material Discrimination X-ray (MDX) allows for the identification of a products' chemical composition, easily distinguishing between a product of a different density and foreign body contamination.

What solutions has Eagle developed recently to overcome these product challenges?

In addition to the Eagle Pack 550 PRO, Eagle Product Inspection has developed its QuadView, an innovative x-ray contaminant detection system specifically designed for glass in glass detection. This makes it ideal for the inspection of milk and other dairy products in traditional glass bottles and jars.

Featuring four x-ray beams, angled at 45° across the conveyor, the QuadView allows each pack to be inspected from multiple angles simultaneously, eliminating blind spots in the side wall. They can be easily adjusted to be directed at the dome at the base of the bottle,



where contaminants are most likely to congregate, maximising detection rates.

In addition to contaminant detection, the QuadView can perform other in-line quality checks, including fill level inspection and mass measurement for portion control, inspection for seal integrity and can also count components. This can enable dairy manufacturers to ensure product quality, as well as safety, to safeguard consumer satisfaction.

It can offer high detection sensitivity at rates of up to 1,000 packs per minute (ppm), allowing much greater line speeds than traditional technology, and is suitable for the inspection of tall, rigid containers, including glass, metal and ceramic, as well as plastic packaging and cartons. ■

Table 4. Detection of foreign objects in processed cheese

Foreign Bodies (mm)	Number of passages through the sensor	Number of rejections
Metal film 20x20)	4	4
Soft plastic (20x20)	1	1
Soft plastic (15x15)	3	2
Soft plastic (10x10)	3	2
Wood (10x10x5)	2	2



salt (ca 4%) and water. The cheese was kept at 80 to 85°C while being pumped through a test loop with a 32mm pipe.

More recently, trials on cheese spread containing shrimp, which was ground or whole, showed that the Food Radar system had no trouble detecting foil at a size of 20x20mm, as well as hard plastic (see table 4).

"We were very pleased with these results, and see no reason why the addition of spices, or small pieces of food, to the food matrix would have any major negative impact on the detection efficiency, provided that we use a small diameter sensor head," said Mr Reimers, who explained that the microwave attenuation was high

when the test team used a 63mm diameter antenna head, but reduced significantly when a smaller 30mm antenna head was used making the background noise of the processed cheese very low. ■

