13-06-18

TEST REPORT

X-ray inspection of frozen consumer fish products (ready meal)

Problem description

X-ray systems are ideal for inspection of packaged products and detection inside the parcel of a variety of possible foreign objects.

A few selected products have been provided. These are kept in frozen condition. The parcels have been opened and a variety of possible foreign objects have been placed atop the product.

The objects considered are:

- Fish bones 30-40 mm long and 0.2 – 0.6 mm thick
- A wire of brass, approximately 0.3 x 15 mm
- Small stones (silicate), 2-4 mm long/wide and 0.3- 2 mm thick
- Shims and washers of stainless steel
- Selected rubber pieces (O-ring and a rubber sheet), 0.6 to 1.5 mm thick.

Inspection method

The products with and without impurities/foreign objects have been placed on a low-energy X-ray system and imaged at a speed of 20 m/min. The X-ray energy is 25 kV. The system has been operated in off-line (manual) mode, facilitating the acquisition of images. No specific sorting and/or automatic detection has been accomplished.

The X-ray system is ultra compact, and based on the newest and most effective X-ray detection technology. This involves high stability, long life metal ceramic X-ray source, closed water cooling system, high sensitivity detector with 0.1 mm resolution, optional PLC master configuration, bar code reader etc. Maximum conveyor speed at optimal detection settings is about 0.5 m/s. In the present set-up, a detector width of 150 mm has been used. This is just at the limit relative to the product dimensions.

Results

Below are provided images of the products with foreign objects as described above. No specific image processing has been attempted, the pictures are solely converted from 16-bit TIFF to 8-bit JPEG format.

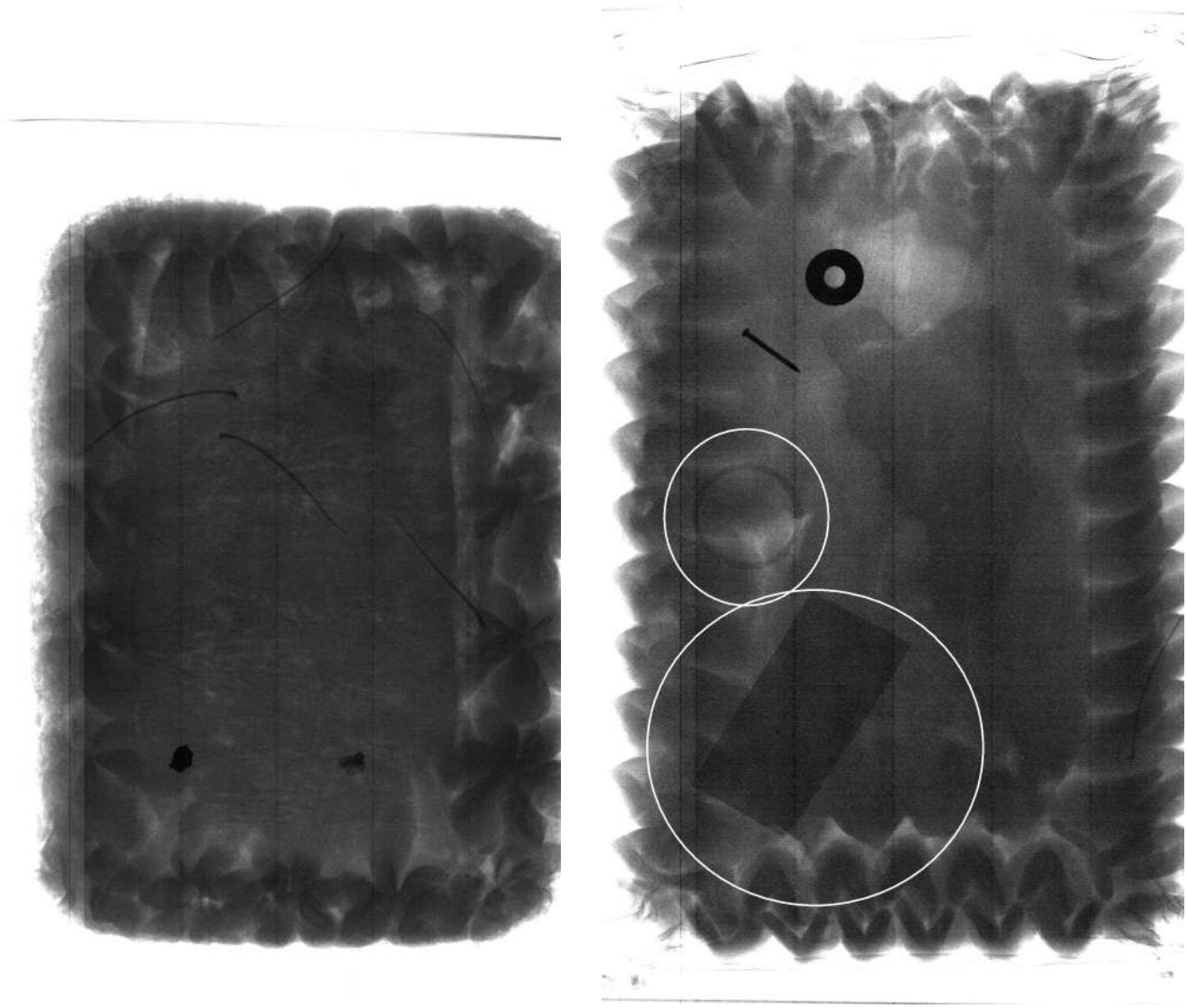

Fig. 2. Fiskgratin citron (left) with fish bones and small stones. Fiskgratin dill (right) with small rubber pieces, a brass nail and a stainless steel washer.

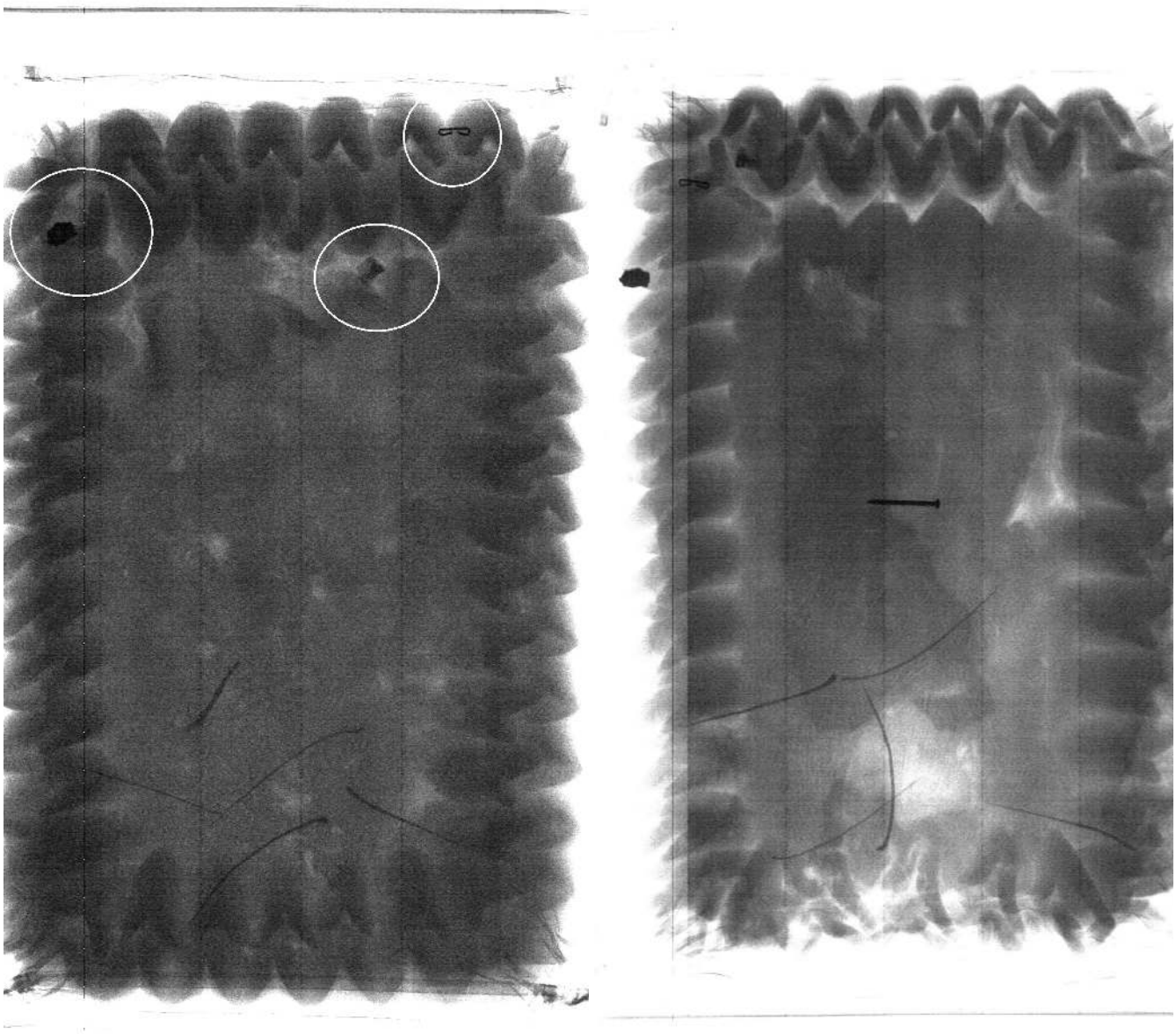

Fig. 3. Fiskgratin with fishbones, small stones and a clips (from the packaging) (left) and fiskgratin dill with brass nail, small stones and fish bones (right).

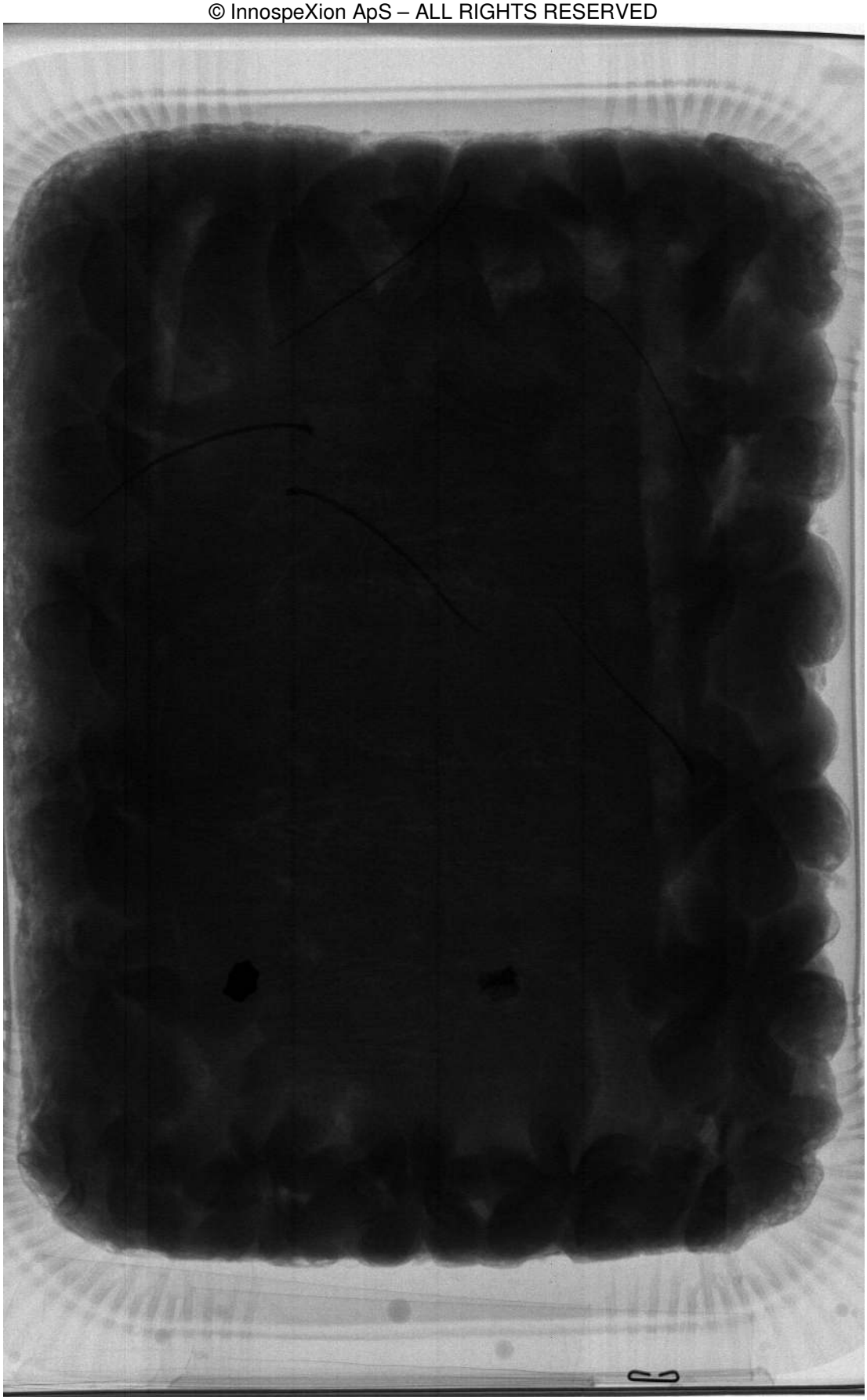

Fig. 4. Fiskgratin dill with the grey level of the images adjusted so the human vision better perceives the **details of the packaging**. Low energy X-rays enables BOTH the product AND the packaging to be quality controlled. This is unlike ordinary X-ray systems which cannot inspect the packaging

Discussion

The results unveils the capability of the low X-ray energy technology to detect even small and thin foreign objects in the considered range of products. It also allow the assessment of the packaging around the product, i.e. its integrity, splash overs, etc. If the product is enclosed in plastics which may have welds, the welds may in most cases be assessed as well.

Low energy X-rays stipulate much smaller radiation levels are intrinsicaly safer than conventional X-ray systems. They use less power and does not include any lead.

Conclusions & Notes

The InnospeXion low energy X-ray scanner is available in a number of tailored versions, specifically suited to specific tasks concerning overall interfacing, design of conveyor, conveyor attachment to existing production line and integrated software with TTL-based triggering for ejection and sorting. The system is available as stand alone units or as completely integrated PLC controlled systems operating in automatic, self-regulating mode.

Please contact InnospeXion por your local representative for further information.