Instant Coffee Packaging:

Award-winning Glass in Glass detection technology based on high contrast X-ray imaging

SYNOPSIS

Glass splinters constitutes a major problem in the production of food products packaged in glass jars, bottles and containers. The splinters may have very hazardous consequences upon swallowing, and therefore there is a major concern not to supply products to the market where a health risk may exist.

X-ray technology has been used for years for the inspection of filled glass packaging with food products.

The problem is, that the normal technology is inadequate for the revelation of critical glass splinters. This is due to the fact that the contrast between the glass pieces and the product inside the glass jar has to be relatively large in order for automated image analysis algorithms to detect and correctly reject a faulty product. In addition, the resolution of the image acquisition sensor has to be high in order for as many pixels as possible to represent a defect. Unfortunately, high resolution and high contrast is in contradiction. High resolution implies small pixels, and hence a small “count number” due to a very small detection area. This makes noise be relatively high compared to a (small) “count” difference between a defect and a neighbor area without a defect.

New technology, used for some years to disclose sealing imperfections in food packaging, has proven viable for the revelation of glass fragments in filled glass jars.

The Technology was presented at the Scandinavian FoodTech2016 show 1-3. November 2016, and awarded the Innovation Prize by his Royal Highness, Prince Joachim of Denmark.

Fig. 0. His Royal Highness Prince Joachim of Denmark (to the left) presenting the FoodTech Innovation Award 2016 to CEO of InnospeXion, Dr. Joergen Rheinlaender. Photo courtesy of MCH.

STATE OF THE ART

X-ray systems used for food inspection, especially for contaminants detection, are very much similar in terms of the fundamental techical basis for the acquisition of the X-ray images. The technology is thus based on using 0.4 or 0.8 mm pixels, which detects the electrical or optical signal from a scintillator that converts the X-ray photon image. The scintillator used in general is based on Gadox, a robust, cheap and well known material for X-ray imaging.

New developments have brought in new scintillation materials. Among others, CdTe has proven very attractive due to a very high efficiency in converting the X-ray photon image, and a very good efficiency also at energies below 25 keV, where Gadox is ineffective. Due to this, the CdTe provides very high contrast images. At the same time, a very small pixel size is possible without excessive noise, due to the high conversion efficiency.

The above is testified by current X-ray systems used for glass detection not being able to detect glass pieces below approximately 4 x 4 x 4 mm3, or a minimum extension in the direction of the X-ray beam of approximately 4 mm.

As also shown, the current technology, in some cases, makes it difficult or impossible to detect glass fragments close to the walls of the jar. In fact, in some cases 40 % of the volume remains un-inspected.

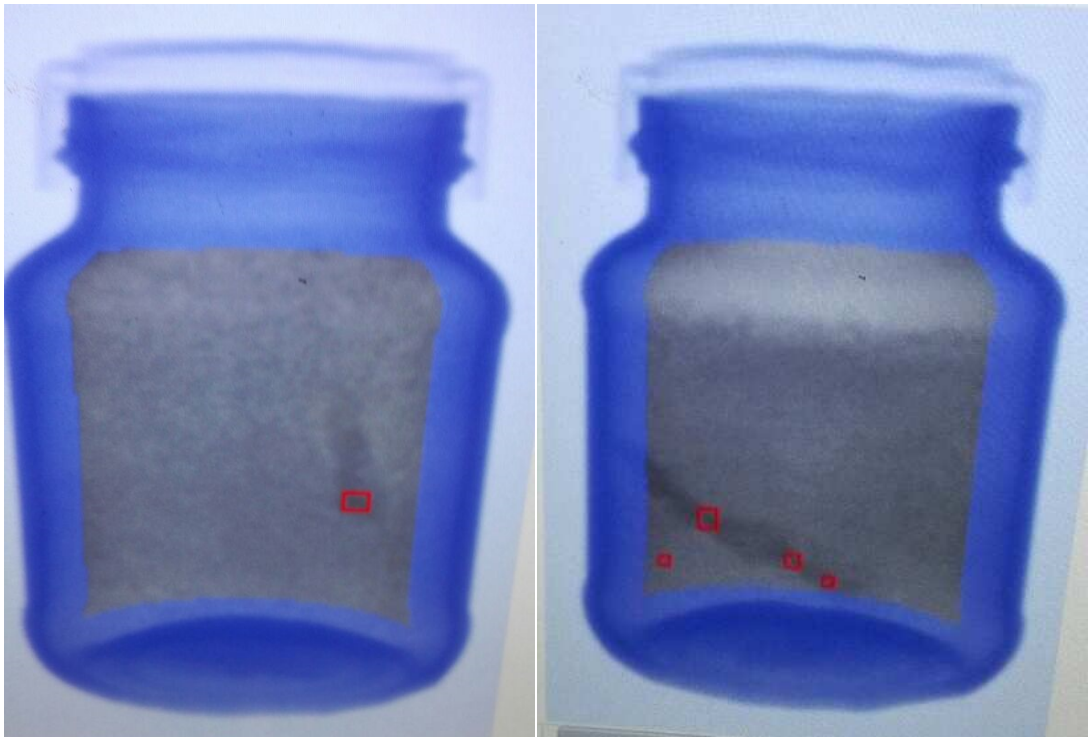

Fig. 1. Example of detection capability of a standard system. Identified large glass pieces are indicated. Note the large dimension of detected objects, and cutting off of about 40% of the jar volume (blue region).

Fig. 2. Less than 2 mm glass piece detected using the novel high sensitivity technology. Note the position of the glass piece close to the bottom

CAPABILITY OF NOVEL TECHNOLOGY

The high contrast, high resolution imaging made possible integrating new CdTe-CMOS detection technology is in the new InnospeXion glass-in-glass detection system integrated with a novel, fast and very robuist and reliable automatic glass splinter detection algorithm. This enables even the tinniest glass fragments to be detected, even when placed next to the glass wall.

This is a truly novelty, and responds to a strong demand from both consumer safety as well as the production quality control procedures. In effect, present technology does not detect the really critical glass objects that compromises food safety. The new technology pushes the detection level that relates to the real need – to detect what is critical for the consumer.

THE EXPERIENCES FROM THE FIRST USERS

New technology often finds very tough ways to the market. However, in this case the innovation lies in the combination of a developed and well-proven technology with a new application opportunity. Therefore, the traditional child diseases and long term testing for revealing the value created, has been generally non-existing.

The first system has been implemented in Asia, in a factory that experienced important quality problems and real concerns on the possible presence of potentially lethal glass splinters in food product. Since end of July 2016, the system has been in continuous 24/7 usage.

CONCLUSION

Detection of glass pieces in glass jars with food products is a high priority area due to the risk of severe hazards, by intake of a contaminated product. Traditional X-ray technology provides a false safety, in as much the real critical glass pieces remain undetectable by present state of the art. New, high contrast and high resolution imaging combined with intelligent, fast and robust image processing methods, has proven viable to provide the necessary level of confidence in the market.