Metal detectable plastics used in cleaning tools and utensils

Foreign body contamination of foods can be a safety or quality issue, or both. Regardless, if a food is contaminated by a foreign body, the repercussions for the food business can be expensive and damaging.

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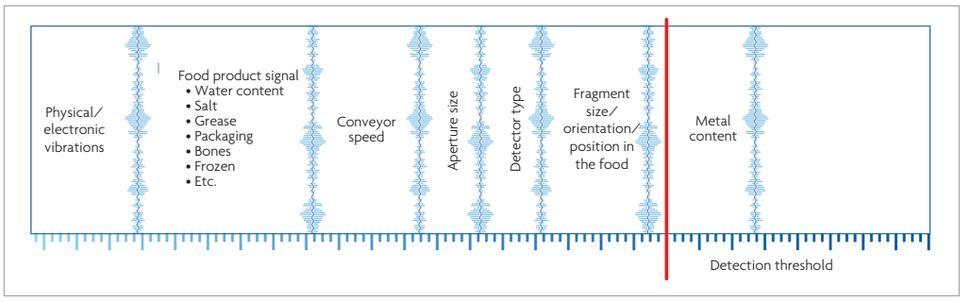


Fig. 1. Factors affecting the metal detectable threshold.

Metal detection is well established as a method for reducing the risk of metal fragments in commercial food products. Control of plastic foreign bodies is more difficult.

Metal detectable plastics have been developed with the intention that metal detectors can also be used for their detection, but how detectable are these plastics?

Many food manufacturers are unaware that the metal detectability of any metal containing foreign body will depend on a number of things, including the:

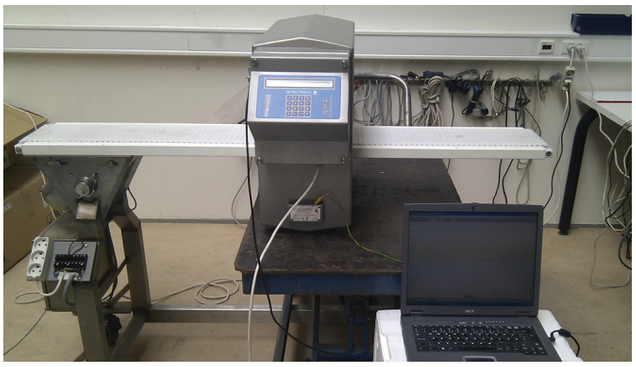
- Vibrations (physical and electronic).
- Metal content of the contaminant, both the quantity and type of metal.
- Size of the metal containing contaminant.
- Orientation of the metal containing contaminant.
- Food packaging.
- Food product – size, composition.
- Speed of the conveyor belt.
- Detector used.
- Detector calibration.

Each of these interfering factors has an effect on the detectability of the metal containing contaminant and the interferences are often cumulative, as illustrated in Fig. 1.

Consequently, metal detection systems do not give 100% security, even with regard to the detection of totally ferrous metal objects. Metal detection systems cannot detect non-metallic items such as bone, glass or wood. The metal detectable plastics used in the construction of food industry standard utensils and cleaning equipment only contain a small percentage of metal detectable material.

Consequently, metal detection systems only work if the fragments of this equipment are large enough to detect (given other detector limitations).

The Detectronic metal detector (Model No .606-250) used during the study.



Most manufacturers of metal detection equipment will provide 'calibration test pieces' to check the function of the detector against ferrous (iron) and non-ferrous metals. These are regularly used by the food manufacturer to verify the performance of their metal detection system.

Some manufacturers of metal detectable plastic equipment will also provide a test kit that enables the food manufacturer to find out what size of metal detectable plastic can be detected by their detector/in their product.

However, very few do this and, worryingly, research undertaken by Vikan, Denmark, to determine the metal detectability of a range of metal detectable plastics available to the food industry, showed that not all are sufficiently detectable.

Investigating detectability

Initial investigations were conducted in collaboration with Detectronic, a Danish based metal detection system manufacturer. The detector was calibrated for optimal detection of a 1.5mm diameter iron ball. These settings were then used to assess the detectability of each different sized piece of metal detectable plastic in each supplier test kit.

The results (Fig. 2) showed that even without the additional interferences of product and packaging, the detectability of metal detectable plastics varies greatly.

None of the samples from Supplier two were detectable and even the best detected metal detectable plastics (Vikan) needed to be over nine times the size of the iron sample to generate a similar reading. ie, an 11mm round piece of metal detectable plastic was required to generate a similar detection signal to a 1.5mm round piece of iron.

Consequently, if the use of metal detectable plastic equipment is deemed necessary, the selection of appropriately metal detectable plastic equipment is essential to minimise the foreign body risk from this source. As an alternative, it is suggested that tools and utensils are regularly inspected and replaced, in order to minimise the risk of foreign body contamination from this source, and that equipment of a contrasting colour to the food product is used, to enable the plastic fragments to be seen more easily.

An example of a metal detectable plastic test kit (Vikan).

Continued on page 12

Continued from page 11

The most recent addition to the metal detectable plastic product range offered to the meat industry by some cleaning equipment manufacturers is the metal detectable plastic brush, incorporating metal detectable plastic bristles.

Investigations by Vikan sought to determine their metal detectability as well as their durability and functionality, in terms of how well they clean.

In collaboration with Mettler Toledo, a manufacturer of food industry metal detection systems, food industry standard metal detectable bristles were investigated with regard to their detectability using a Profile Advantage multi-frequency metal detector, with and without the presence of a wet packed fresh chicken breast.

Metal detectable plastic bristles were not detectable in the presence of food and packaging. To achieve a similar detection to that of a ferrous ball with a spherical diameter of 1.5mm, metal wire lengths of between 3mm and 9mm would be required.

Currently brushes with metal detectable plastic bristles are only available with bristle diameters of 0.35mm, 0.50mm and 0.60mm, i.e. much thinner than the metal wires assessed. It can be concluded therefore that even longer lengths of metal detectable plastic bristles would be required to achieve the same level of detection.

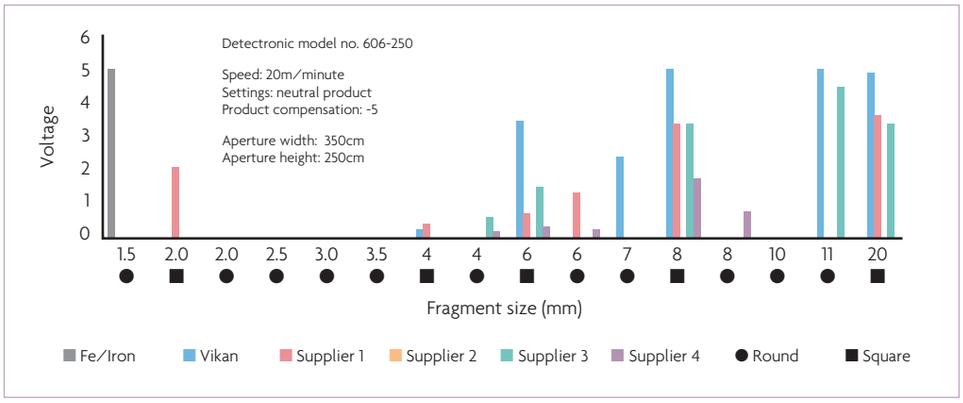


Fig. 2. The results of an investigation to assess the metal detectability of different metal detectable plastic fragments provided by different suppliers to the food industry of metal detectable plastic equipment.

Tests to assess the break strength and elasticity of metal detectable and plastic bristles were performed by Zwick Roell, Germany, using a Zwicki 5kN bristle pull test apparatus.

Plastic (PBT) bristles were 68% stronger and more than twice as elastic as metal detectable bristles.

The use of metal detectable plastic bristled brushes may increase the risk of bristle contamination of food, due to their reduced strength and elasticity, and a perception that any metal detectable bristles will be controlled via the metal detector.

Metal detectable plastic bristled brushware offers no advantage over plastic bristled brushes with regard to cleaning efficacy.

Based on the findings of these investigations it seems unlikely that metal detectable plastic bristles would be detectable in a food product, especially given previously mentioned detector and product accumulative variances, and that the plastic fragments are likely to be small. To detect these small fragments the metal detector sensitivity would need to be set so high that most products would be rejected.

As an alternative, use of a brush of a contrasting colour and that minimises bristle loss through good construction is adviseable. Ultimately, the decision on whether to use metal detectable plastic cleaning tools and utensils should be based on risk assessment. ■

Vikan would like to thank Detectronic, Mettler Toledo and Zwick Roell for their collaboration during these studies.