Taking due diligence to a new level

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There is an increasing awareness amongst food manufacturers across Europe and the United States, of the need for careful planning and documentation of systems and methods that enhance food quality and safety.

Traceability and accountability are highly important throughout the supply chain; HACCP is here to stay and due diligence continues to be the watchword.

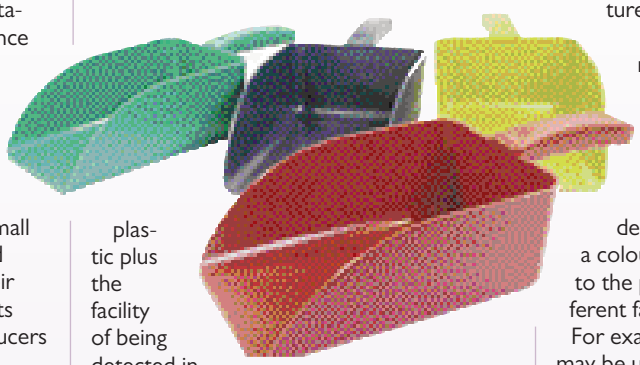
So, it is important when a relatively small niche product manufacturer like Harold Moore announces the expansion of their detectable range of hand tools, products which a few years ago many food producers would have thought eccentric.

Most food production lines now employ an in line metal detection system at some point. Hand tools, either for cleaning or in the production process itself, will also be employed somewhere along most food production lines.

These hand tools are often not of metal but of plastic. Plastic is often preferred for reasons of durability, lower weight, ease of cleaning, flexibility and so on. However, if a piece of it should break off in use and fall into the food being produced will it be found?

Whilst an in-line detector is likely to pick up a metal contaminant, it is obviously not going to detect plastic. Therefore, how does one benefit from the advantages of plastic tools without increasing the chance of contamination going undetected?

The answer lies in a special formulation of detectable plastic. That is, a metal fill is added to the plastic during the manufacturing process, to produce a material that displays all of the properties associated with plastic plus the facility of being detected in a standard metal detector. Then it is essential to get the metal fill to mix consistently throughout the plastic, so that any piece of the product can be detected, should it ever break off. This is not easy to achieve and has taken some years to perfect.



We are not just talking about a metal strip or button somewhere on the product. It is a physical feature of the entire material from which the tool is made – a truly detectable plastic. Furthermore, having the product certified as suitable for contact with food materials also takes some time and investment.

Safety and colour coding

Hygiene does not depend upon the tools and machinery used in a food factory. It depends upon the system that employs them. Good hygiene is underpinned by good training, organisation, application of best practice and discipline. These ensure that any hygiene tools are used to best effect and any time and money saving features are fully utilised.

For example, a green shovel offers no advantages on its own.

However, colour coding is now widely accepted as significant and a simple method of cutting the risks of cross contamination.

Areas within a factory are zoned depending on their use and allocated a colour. These zones can vary according to the premises and processes within different factories.

For example, in one factory green coding may be used for the cooked foods area and yellow for the raw and red for cleaning materials used in the toilet areas.

Any tools used in these areas carry these colours so that they may be quickly identified if they stray into the wrong area. Then, a green shovel becomes part of a hygiene system and carries an advantage to the user in helping to reduce cross contamination.

In another premises colours may be used to identify shifts and when all tools are cleared for cleaning and sterilising the presence of a red scraper during the green shift's production time will be easily seen.

Therefore, to enhance their usefulness where such systems are in place, any detectable products should also be coloured. However, until recently, the number of colours in which detectable products could be produced was limited, since the metal fill substantially darkens the colour of the plastic.

This problem has now been overcome and it is possible to provide clearly recognisable colours of blue, red, green and yellow.

Therefore, there is no more need to compromise between detectability and colour coding – the two features are now available within one product. However, are these products still safe in contact with food?

Product certification

Any plastic article that comes into contact with food must not itself provide a source of contamination. Have you ever been out on

Continued on page 7

Table 1. Comparison of detection sensitivity at wet setting.

Shape	Size (mm)	Approximate mass of plastic (g)	Approximate equivalent ferrous (mm)	Machine sensitivity
Cube	8	0.52	3.5	0
	6	0.22	2.5	30
	4	0.06	1.8	70
	2	0.01	0.8	170
Sphere	10	0.53	3.5	0
	6	0.11	2.2	40
	3	0.01	1.0	150

Material: Harold Moore detectable plastic (all colours). Machine: Safeline Signature IS. Settings: 25kHz frequency, 90; phase (typical wet material setting).

Continued from page 5
hot days and drunk sun-warmed water from a plastic bottle? Did it taste faintly of plastic? This is caused by molecules from the plastic leaching out into the water.

Under European Union (2002/72/EC) and United States FDA (21 CFR 177.1520) regulations, there are fixed limits to this molecular migration.

All plastic articles used in the production and storage of foodstuffs must be tested, approved and certified that they do not cause contamination outside of the set limits laid down in the regulations.

Materials that go into the production of most plastics for food use are certified to these standards – that is both the base polymer itself and the dye used to colour it. Any other additives must also be approved for food contact, which normally excludes any fibrous material or ferrous metals.

However, it is important to know that any process that applies heat and pressure to a material is likely to affect the properties of that material. When plastics are moulded the raw polymer and dye are mixed and subjected to high pressure and temperature, which changes its form into the finished product.

This means that although food approved materials are used at the start of the process it does not guarantee that the finished product is also food approved. There is a good likelihood, but no guarantee.

Therefore, any good manufacturer will test the finished article also and be able to provide appropriate certification that the completed product also meets the accepted migration levels.

Such is the case too with detectable plastic products – an injection moulded plastic with a metal fill has been through a lot of processing and the manufacturer ought to be able to provide proof that their products do meet the regulations.

This should be for peace of mind if nothing else, leaving nothing to chance.

How does it work?

This article is not intended to discuss the whole body of physics around metal detection or the working of metal detectors. Nevertheless, the basic outline is as follows.

A metal detector produces an electromagnetic field of a fixed orientation, power and frequency. If a metal article passes through this field at the right speed and orientation and there is no other interference, the field is effectively broken and this break can be detected and measured. The result can be used to trigger an alarm to indicate the presence of metal within another material.

What even this brief paragraph should reveal is that detection relies upon many factors, including the phase, power and frequency of the field generated by the machine, its sensitivity and the orientation, speed and make-up of the product passing through it.

Shape	Size (mm)	Approximate mass of plastic (g)	Approximate equivalent ferrous (mm)	Machine sensitivity
Cube	8	0.52	1.5	109
	6	0.22	1.2	139
	4	0.06	0.8	199
	2	0.01	Not detected	199
Sphere	10	0.53	1.5	109
	6	0.11	1.0	149
	3	0.01	Not detected	199

Material: Harold Moore detectable plastic (all colours). Machine: Safeline Signature IS. Settings: 300kHz frequency, 0; phase (typical dry material setting).

Table 2. Comparison of detection sensitivity at dry setting.

This means that it is again down to a system of risk assessment, calibration and inspection to ensure that the most is made from such equipment.

How much is detectable?

As outlined above, a metal detector can be set up in many different ways, depending upon the requirements of the manufacturer and the attributes of both machinery and product to be examined. This means that the answer to the question, 'How much is detectable?' is: 'It depends.'

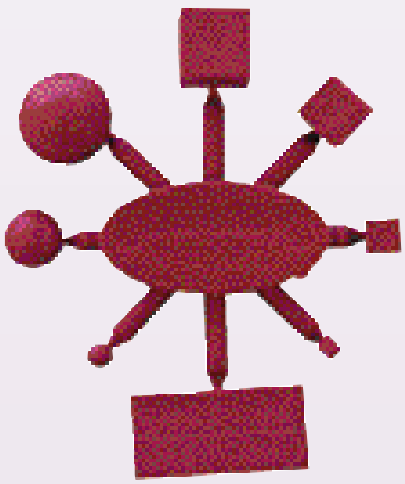
However, the key lies in the calibration of the detector. This is normally done by passing a ferrous ball bearing of known diameter through the detector.

The alarm is then set to ring as soon as an object larger than this is detected. For example, a company may select, in its HACCP system, a setting that will detect a 0.8mm diameter ball bearing and the system is said to be 'set at 0.8mm ferrous.'

The same can now be done with detectable plastic. Harold Moore has produced a set of spheres and cubes of different sizes that will facilitate a comparative calibration.

To show how this might work, Tables 1 and 2 show the results of tests on the detectability of their formula compared to standard ferrous ball bearings.

The test pieces for use in checking the metal detectors.



These results imply the following, for example:

If a factory runs an in-line metal detector for a dry food product, such as biscuits, set at 300kHz at 0° and sensitive enough that a 0.8mm diameter ferrous ball bearing will trigger an alarm, then a 4mm cube (or 0.06g) of Harold Moore's metal detectable plastic may be needed to set off the alarm.

= 4mm actual size

Another factory running a similar detection system set for a wet product, such as a microwave meal, set at 25kHz at 90° and sensitive enough that a 0.8mm ferrous ball bearing will trigger an alarm, should detect a 2mm cube (or 0.01g) of material.

= 2mm actual size

Another tool in the box

As part of an integrated hygiene and quality system, detectable plastic products have much to offer.

Well made, high grade plastic products do not wear down or break easily in normal use and provide advantages in weight and durability, making them less tiring for the staff to use and kinder to the surfaces of more expensive machinery.

Couple this with the ability to integrate them into a colour coding system and with the added assurance of fragment detection by the production line sensors, detectable plastic now offers powerful evidence of using all due diligence in the production of foods.

This is one of those rare occasions where a little planning and a minimum of investment go a very long way indeed and detectable products provide another valuable tool for the food manufacturer.

Not only is there a range of existing tools made from detectable plastic but the material is also available for manufacturers to specify or produce their own items, such as containers used to transport food along the production line or machine parts. n

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