

Understanding Challenging Applications for Improved Metal Detection

In food and pharmaceutical industries, certain products act like metal contaminants - a phenomenon known as 'Product Effect'. This Rapid Read is a quick reference guide to understanding Product Effect and how it can be overcome.

Factors influencing absence or presence of Product Effect

- i. Salt content
- ii. Moisture content
- iii. Temperature
- iv. Product size and shape
- v. Product position and orientation through detector
- vi. Product consistency and density
- vii. Packaging material – especially metallised film,
- viii. whether product is 'wet' or 'dry'

Dealing with Product Effect

Metal detectors operate at many frequencies, from 25 kHz to 900 kHz. At low frequencies, aperture magnetic field is strong, but product currents and magnetic field are low, so product signal is low. However, the metal contaminant signal is also low - so electric and electromagnetic noise become dominant sensitivity factors. At high frequencies, aperture magnetic field is low, but product and contaminant current amplitude

are high, making it hard to detect metal contaminant. The metal detector is easily saturated by high Product Effect applications, so sensitivity is compromised.

There is always a trade-off between Product Effect, maximum operating frequency and metal detector sensitivity. The rule is: the higher the Product Effect (i.e. the wetter the product), the lower the optimal frequency and detector sensitivity.

By comparison, the lower the Product Effect, the higher the operating frequency and detection sensitivity. Dry products with low Product Effect have little impact on the metal detector at high frequencies, so it can easily detect small metal contaminants.

Phase Discrimination

Operating frequency alone is not sufficient to deal with Product Effect, so the most common additional technique for tiny metal contaminant detection is 'phase

discrimination', which reduces product signal and amplifies metal signal, improving sensitivity performance. Sophisticated metal detectors have a dedicated Digital Signal Processor (DSP) to handle phase discrimination and other advanced signal processing techniques, allowing detection of even smaller metal contaminants.

Multi-Simultaneous-Frequency Metal Detectors

Multi-Simultaneous-Frequency (MSF) detectors are the most sensitive, tackling Product Effect by operating at high and low frequencies simultaneously. The most sophisticated detectors use Product Signal Suppression (PSS) technology, with 2 stages of discrimination: frequency and phase.

This cancels information from high-and-low frequency combinations, removing product signal to allow detection of much smaller metal contaminants. PSS can also handle product variations, adjusting to different Product Effect in each product. This increases small metal contaminant detection, even compensating for simultaneous inspection of several of the same products.

Operating to factory detection standards

Improvement in detector performance (changing from single-frequency to MSF) is as much as 50% in Product Effect for

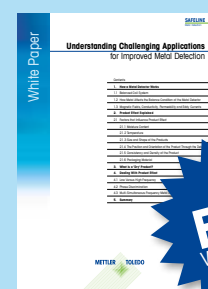
metallised film; in more challenging applications, operating to factory detection standards can be difficult, with sensitivity level increases to a point where detector set-up is unstable, causing 'false rejection' of good product. High false reject rates can be costly, requiring a concession to factory detection standards - though MSF and PSS technology now ensure factory detection standards can be met without generating false rejects.

What to expect from a competent metal detector supplier

- i. A range of products offering top sensitivity (single-frequency detectors for dry products, multi-simultaneous-frequency detectors for Product Effect & metallised film applications);
- ii. good-quality, stable detectors protected from electromagnetic and other interference;
- iii. reliable global service
- iv. understanding of detection programmes that meet food safety standards;
- v. easy detector set-up and use;
- vi. future-proof solutions which can grow with a business.

Rapid Read – Further Reading

Our FREE white paper "**Understanding Challenging Applications For Improved Metal Detection**" examines Product Effect in more detail by showing how a metal detector works, identifying the types of product to exhibit this phenomenon and what the latest solution available is to limit the effect.



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