Foreign bodies risk management in RUTF/RUSF/LNS

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Foreign bodies risk management

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Definition

“Foreign material is defined as foreign bodies that may cause illness or injury to the consumer, or are perceived by the consumer to be alien to the food. While not all foreign material is harmful, it is a physical hazard and its potential to cause injury or illness must be considered.”

By Beth Driscoll (Ryerson University), Getting a Handle on Foreign Materials August 6, 2013
Foreign bodies risk management

Context

Regulation

**U.S. Food and Drug Administration (FDA) Regulations on Adulteration Involving Hard or Sharp Foreign Objects**

“The Board found that foreign objects that are less than 7 mm, maximum dimension, rarely cause trauma or serious injury except in special risk groups such as infants, surgery patients, and the elderly.”

**European Regulation n°852/2004** “[...]official controls should be in place to check food business operators' compliance and food business operators should establish and operate food safety programs and procedures based on the HACCP principles.”

Regulation main outputs

- No defined acceptable size for the RUF/LNS beneficiaries (infants of <5 years old)
- Supplier responsibility involved
- HACCP approach to be used for this physical risk
### Foreign bodies risk management

The major existing technologies

#### Magnets
*(For raw materials or Finished product)*

<table>
<thead>
<tr>
<th>Strength</th>
<th>Weakness / limit</th>
<th>Good practices</th>
</tr>
</thead>
</table>
| • Minor product loss  
  • Low price  
  • Easy maintenance  
  • Easy implementation  
  • **High efficiency for iron fillings** | • *Not used on packed Finished Products*  
  • Not adapted to viscous product flow  
  • Flow efficiency dependent  
  • **Only for ferrous metals**  
  • Temperatures Sensitive | • Magnet shape to be adapted  
  • Regular cleaning |
Foreign bodies risk management

The major existing technologies

Optical sorting

<table>
<thead>
<tr>
<th>Strength</th>
<th>Weakness / limit</th>
<th>Good practices</th>
</tr>
</thead>
<tbody>
<tr>
<td>• High efficiency on bulky materials</td>
<td>• No use on the finished product</td>
<td>• Rejection and false positives management training</td>
</tr>
<tr>
<td></td>
<td>• Surface detection only</td>
<td>• Frequent maintenance (light and temperature)</td>
</tr>
<tr>
<td></td>
<td>• False positive rate (1 to 5% loss)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• No detection of the uncolored foreign materials</td>
<td></td>
</tr>
</tbody>
</table>

And other technologies for bulky materials (ultrasounds for instance)
# Foreign bodies risk management

The major existing technologies

## Sieves / Filters

<table>
<thead>
<tr>
<th>Strength</th>
<th>Weakness / limit</th>
<th>Good practices</th>
</tr>
</thead>
</table>
| • All foreign materials caught (> mesh size)  
• Minor product loss  
• Can be used at different process stages | • No use for the packed FP  
• Quite cumbersome / large  
• Rejection of long/thin foreign materials  
• Non adapted to crumbly material | • Take care of sieve/filter material vibration resistance  
• Good Hygiene practices for maintenance/cleaning  
• Frequent required monitoring/cleaning |
Foreign bodies risk management
The major existing technologies

X-Ray

<table>
<thead>
<tr>
<th>Strength</th>
<th>Weakness / limit</th>
<th>Good practices</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Use on several materials (stone, high density glass or plastic, metals)</td>
<td>• Foreign material density dependent</td>
<td>• Management of false positives to be considered for trainings</td>
</tr>
<tr>
<td>• Use with packed products</td>
<td>• Belt speed dependent</td>
<td>• Safety risks to be monitored</td>
</tr>
<tr>
<td>• High efficiency on low density products</td>
<td>• FP homogeneity (ingredients) dependent</td>
<td>• Highly trained technician to radioprotection (PCR training) required</td>
</tr>
</tbody>
</table>

- Management of false positives to be considered for trainings
- Safety risks to be monitored
- Highly trained technician to radioprotection (PCR training) required
Foreign bodies risk management

The major existing technologies

Metal detector

<table>
<thead>
<tr>
<th>Strength</th>
<th>Weakness / limit</th>
<th>Good practices</th>
</tr>
</thead>
<tbody>
<tr>
<td>• High efficiency for ferrous metals</td>
<td>• Non-metal materials not detected</td>
<td>• Training for management of false positives</td>
</tr>
<tr>
<td>• High speed capacity</td>
<td>• Sachet overlapping dependent</td>
<td>• Regular calibration</td>
</tr>
<tr>
<td>• Use with packed products</td>
<td>• Metalized packaging dependent</td>
<td>• One dedicated person for maintenance and calibration</td>
</tr>
<tr>
<td>• Detects all foreign body orientation</td>
<td>• Position and shape dependent</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Sensitive to vibrations / electromagnetic interferences</td>
<td></td>
</tr>
</tbody>
</table>
## Detection/rejection capacity

<table>
<thead>
<tr>
<th>Material</th>
<th>Magnets / Magnetic grid</th>
<th>Optical sorter</th>
<th>Sieve / Filter</th>
<th>X-Ray</th>
<th>Metal detector</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ferrous metal</td>
<td>++</td>
<td>~</td>
<td>++</td>
<td>+</td>
<td>++</td>
</tr>
<tr>
<td>Non-ferrous metal</td>
<td>--</td>
<td>~</td>
<td>++</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Stainless steel</td>
<td>--</td>
<td>~</td>
<td>++</td>
<td>+</td>
<td>~</td>
</tr>
<tr>
<td>PE / PET (low density plastics)</td>
<td>--</td>
<td>~</td>
<td>++</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>Stone</td>
<td>--</td>
<td>~</td>
<td>++</td>
<td>++</td>
<td>--</td>
</tr>
<tr>
<td>Glass</td>
<td>--</td>
<td>~</td>
<td>++</td>
<td>~</td>
<td>--</td>
</tr>
<tr>
<td>Wood</td>
<td>--</td>
<td>~</td>
<td>++</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>Cardboard / Paper</td>
<td>--</td>
<td>--</td>
<td>+</td>
<td>--</td>
<td>--</td>
</tr>
</tbody>
</table>

**Legend:**
- ++ High sensitivity
- + Good sensitivity
- ~ Medium sensitive
- - Low sensitivity
- -- Not detected

## Implementation and use

<table>
<thead>
<tr>
<th>Material</th>
<th>Magnets / Magnetic grid</th>
<th>Optical sorter</th>
<th>Sieve / Filter</th>
<th>X-Ray</th>
<th>Metal detector</th>
</tr>
</thead>
<tbody>
<tr>
<td>Use on packed FP</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Safety ease</td>
<td>Easy</td>
<td>Medium</td>
<td>Easy</td>
<td>Difficult</td>
<td>Medium</td>
</tr>
<tr>
<td>Maintenance / cleaning</td>
<td>Easy</td>
<td>Medium</td>
<td>Easy</td>
<td>Medium</td>
<td>Medium</td>
</tr>
</tbody>
</table>
Foreign bodies risk management

The product characteristics

Plumpy’Nut® characteristics

- High density (1.1 - 1.2)
- Packaging aluminum foil surfaced
- High viscosity
- Very few overlapped sachets on conveyors
- High conveyor speed

Identified potential foreign materials

- In raw materials: stones, wood, metals, low density glass or plastic
- In production area (prior to packing): low density plastics, metals
- In production area (packing area): metals
Which solution takes all these technology and product characteristics into account?
Foreign bodies risk management

Nutriset chosen solution
Foreign bodies risk management

Nutriset chosen solution

**Magnetic grid**
for bulky raw material hoppers (retention measure)

**Vibrating sieve / filter**
for finished product flow (retention measure)

**Metal detector**
on the packed finished product (detection measure)
Foreign bodies risk management

Nutriset chosen solution

Retention performance

• All ferrous metal foreign bodies caught at the incorporation stage (magnetic grid)
• All material foreign bodies <1-2 mm (sieve/filter) at non-packed finished product stage

Detection performance

• Metal foreign bodies detected after the packing stage (metal detector)

Expected characteristics

• Iron filing: \( \geq 0.3 \text{mm} \)
• Mesh size: 1-2 mm
• Easy to clean/maintain

Sensitivity on Plumpy’Nut®

• Ferrous: \( \geq 1.5-2 \text{mm} \)
• Non-ferrous: \( \geq 2.5-3.5 \text{mm} \)
• Stainless steel: \( \geq 3.5-4.5 \text{mm} \)