

Metallic and Magnetic Contaminations in Herbs and Spices – Risk Evaluation

Adopted at the ESA TC meeting 23 October 2013

Any metal contamination in food normally is regarded to be a potential hazard in accordance with the HACCP principles. A risk analysis has to be carried out and control measurements have to be implemented in order to reduce the hazard to an acceptable level so that consumer safety is managed for all herbs and spices.

As detection technology improves, in many fields, there is a move towards a “zero tolerance” for many different contaminants. In the case of metal fines and dust zero tolerance cannot be achieved and may not be necessary.

For a reasonable risk evaluation the sources of a possible metal contamination has to be considered. Sources of a metal contamination for herbs and spices can be

- natural metallic minerals from the soil, which are embedded in the plant materials
- metal pieces from harvesting and post-harvest processing steps
- metal from cutting machines, mills and other equipment.

Risk Analysis

The level of a possible hazard depends on the size and shape form of the metal pieces. Sharp splitters of a size of several millimetres can be significantly harmful. Metal dust of a size of less than one millimetre can be regarded as harmless for human consumption.

The likelihood of a contamination with metal pieces depends on the product itself (height, structure), the region the crop is grown in, the growth conditions (soil) and also on its harvest and post-harvest processing steps.

Products: During growth, plant materials such as root crops (ginger, turmeric etc.) might grow with embed minerals and metallic minerals from the soil. Bulbs like garlic, herbs with hairy leaves etc. may also get embedding of soil particles attaching to the crop.

Soil: Soil in some growing areas can contain metallic and magnetic minerals.

REM-studies show these effects (see annex). During drying the plants shrink and soil particles can be embedded.

Furthermore, black and white pepper can contain brownish, crumbly pieces of magnetic earth or clay which has a poor adherence to magnets and this mud can easily be crushed between two fingers. In size, weight, density and appearance they are quite similar to the pepper berries and therefore are very difficult to clean and sort out.

Such low contamination is within all the specified contractual quality parameters. Neither bulk density nor permissible extraneous matter <1 % or total acid insoluble (ash) content are affected.

The magnetic forces of the small clay pieces and also the resulting dust after grinding are sometimes too low to stick to normal magnets usually installed in the processes along the supply chain. The weight of the plant material itself limits the magnetic adherence.

These contaminations can only be found at the end of a very strong bar magnet of more than 10.000 Gauss moving slowly through the ground products. With such a manual search even dried whole pepper berries can be magnetic (see annex).

Another source for very small ferromagnetic dots can be sea salt.

Harvest: Metal pieces and abrasion from harvest machines or equipment can contaminate the plant materials, however as this material is usually made from mild steel it can normally be removed through the use of magnets.

Processing steps: Metal pieces and abrasion from processing machines or equipment like cutting machines, mills, pneumatic transport etc. can contaminate the plant materials. To ensure that fine metal particles are kept to a minimum it is usual to install magnets before and after any particle size reducing equipment.

Hazard Reduction Steps / Control Procedures

In order to reduce the hazard of a metal contamination mechanical and electronic cleaning steps like sieves, magnets, metal detectors, x-rays, etc. are implemented along the supply chain processes of the food industry.

Sieves loose foreign objects, including metal pieces, can be removed by a sieve if they are different in size to the product being processed. Sieves are often a significant step in a spice processing operation and thus their control is important.

Magnets can reduce magnetic metal pieces. Their effect is limited only for ferrous material such as iron. Non-ferrous or stainless steel metals cannot be removed by usual magnets. Magnetic particles embedded in the plant materials can only be removed partly

depending on the strength of the magnet and the weight of the plant material. For example heavy spices with a dusting of low magnetic contamination might not stick to the magnet. Similar to sieves, magnets are often a significant step in a spice processing operation and thus their control is important.

Metal Detector can control ferrous and non-ferrous metal pieces according to the sensitivity adjustment of the metal detector. Metal pieces below the specified sensitivity cannot be removed. Metal detectors can not only reject all metallic items above the specified sensitivity, they can also provide useful information that can drive preventative and corrective actions.

X-Ray can control ferrous and non-ferrous metal pieces according to the sensitivity adjustment of the X-Ray. As with metal detectors metal pieces below the units' sensitivity cannot be removed.

Conclusion

It is observed that natural minerals from the soil containing metals or magnetic material that can be embedded in or stick to the surface of dried plant materials. Also harvest and post harvest procedures can be a source of a metal contamination. Detection and reduction of these embedded metal particles is only partly possible by commonly used mechanical processing steps. Magnetic fines and dust below the limits of the technical equipments usually installed can only be found by moving very strong bar magnets slowly through the ground products.

Such "contaminations" cannot be guaranteed to be absent in any product for technical reasons. However, at the same time, they do not pose a health risk to the consumer ¹⁾.

Therefore, a general absence of single small magnetic pieces far below 1 mm or traces of metal dust in herbs and spices cannot be achieved with a reasonable technical effort.

The implemented risk evaluation and risk reduction processes can only reduce metal contaminations to the lowest possible and acceptable level.

¹⁾ A size of > 7 mm of hard and sharp particles is considered an unacceptable risk for the health of the consumer. For baby food a size of > 2 mm is considered potentially harmful.

Scientific publications about the "critical 7 mm size":

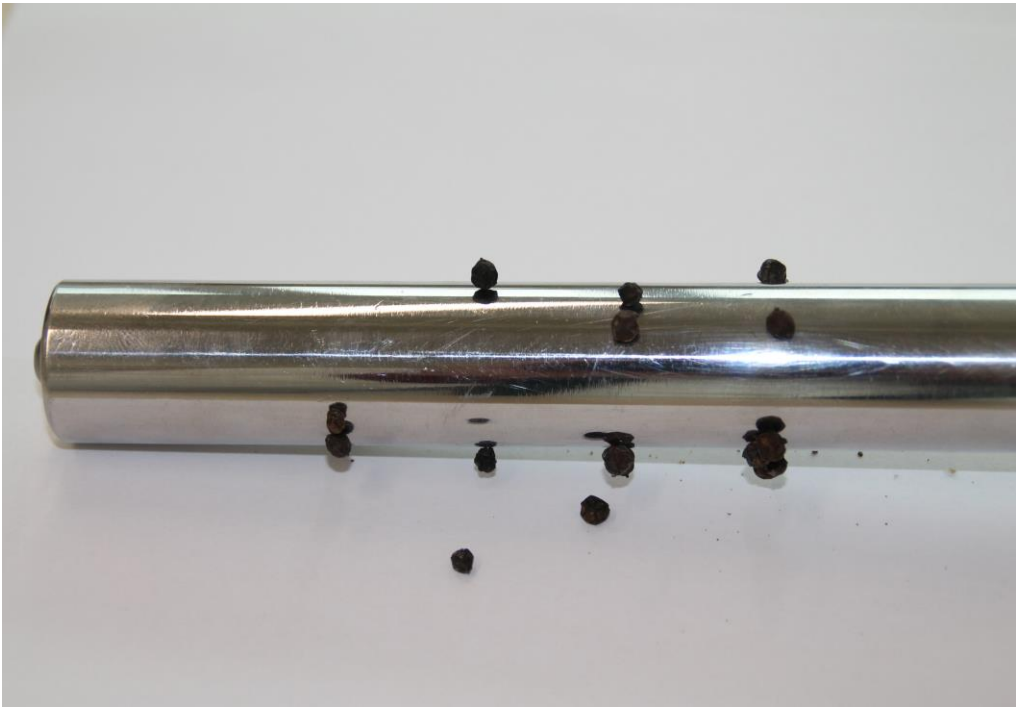
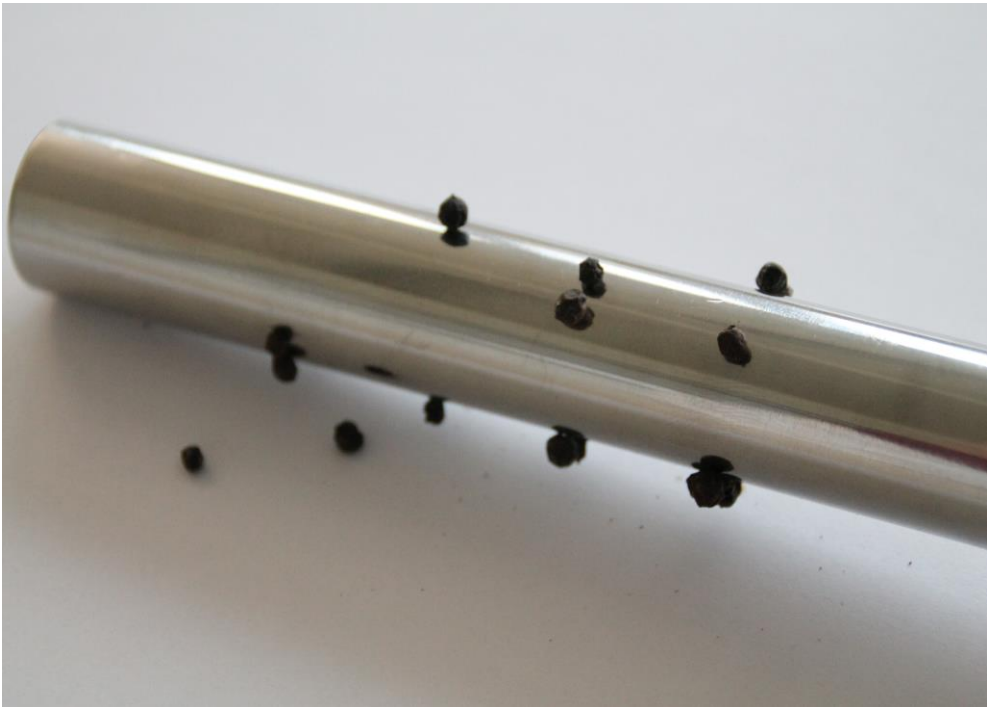
Olsen, A.R., 1998. Regulatory action criteria for filth and other extraneous materials. I. Review of hard or sharp foreign objects as physical hazards in food. *Regulatory toxicology and pharmacology* 28: 181-189

FDA. 2005. Foods - Adulteration Involving Hard or Sharp Foreign Objects. FDA/ORA Compliance Policy Guide, Chapter 5, Sub Chapter, 555, Section 555.425 (Issued: 3/23/1999, updated 29/11/2005). Department of Health and Human Services, Public Health Service, Food and Drug Administration, Washington, DC.

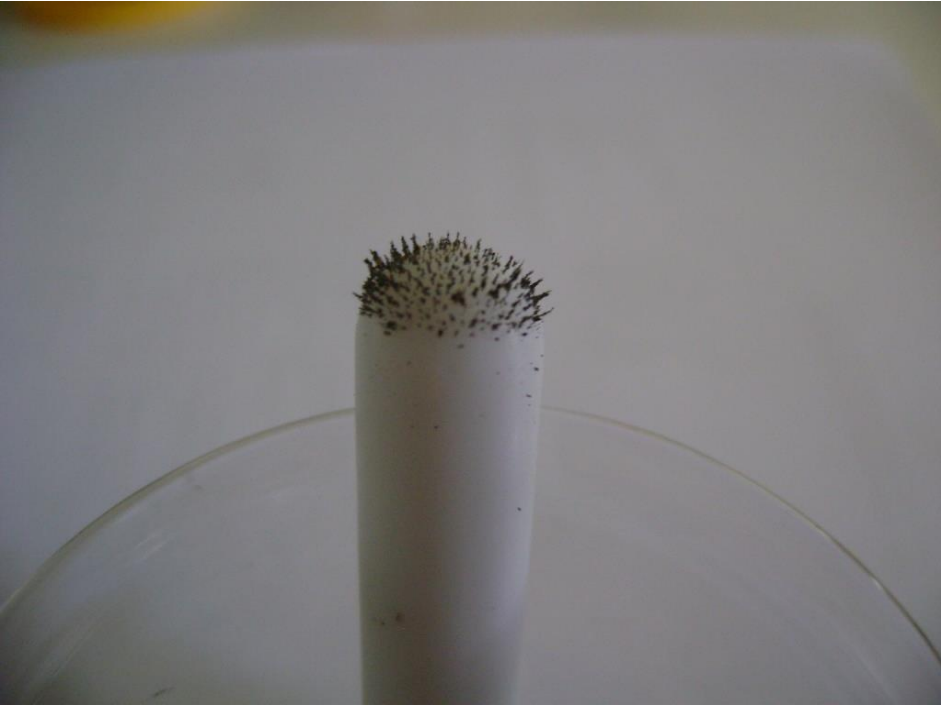
http://www.fda.gov/ora/compliance_ref/cpg/cpgfod/cpg555-425.htm, website, 24/1/09

Annex

Pictures from magnetic soil and magnetic pepper berries:

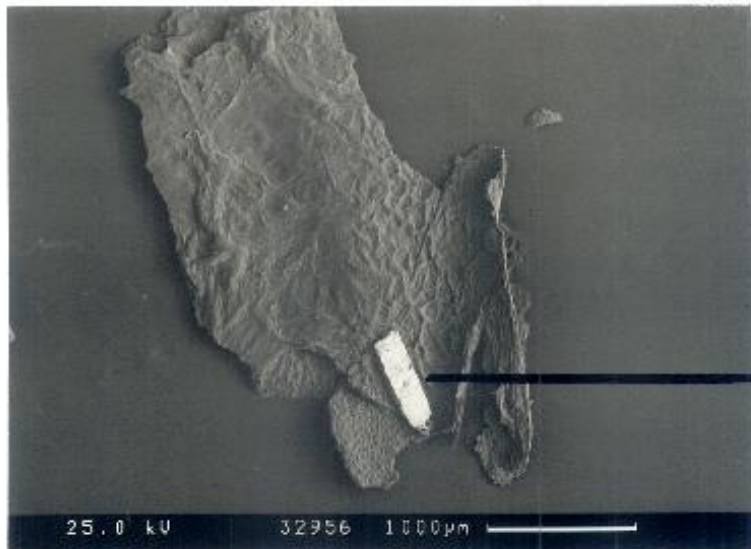
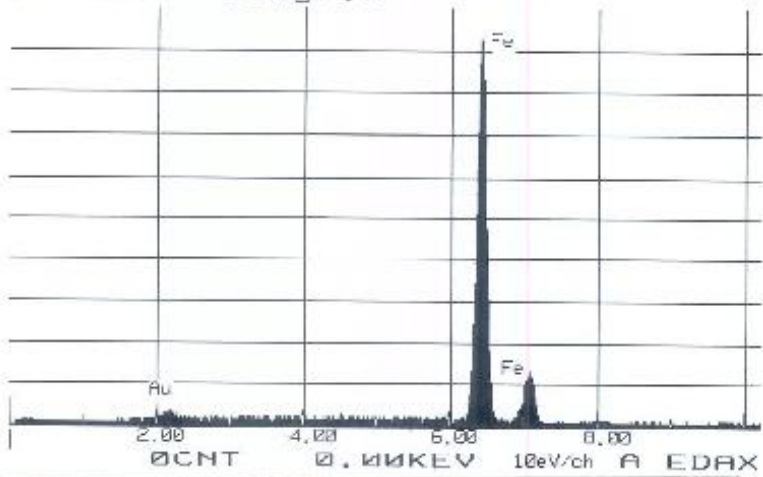


Magnetic dust:





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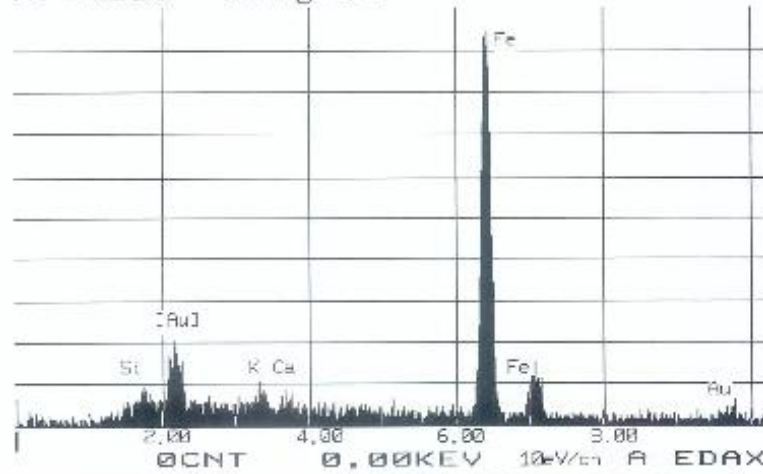
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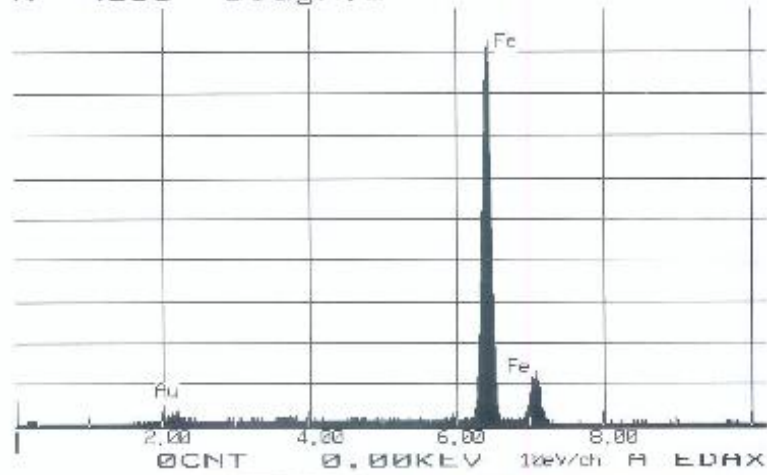
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21-JAN-99 10:39:57 EDAX READY
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