MS 1265-4 (2005) (English): CODE OF GOOD IRRADIATION PRACTICE – PART 4: CEREAL GRAINS FOR INSECT DISINFESTATIONS (FIRST REVISION)

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MALAYSIAN STANDARD

MS 1265: PART 4:2005

CODE OF GOOD IRRADIATION PRACTICE – PART 4: CEREAL GRAINS FOR INSECT DISINFESTATIONS (FIRST REVISION)

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Committee representation

The Food and Agricultural Industry Standards Committee (ISC A) under whose authority this Malaysian Standard was developed, comprises representatives from the following organisations:

Department of Agriculture

Department of Standards Malaysia

Federal Agricultural Marketing Authority

Federation of Malaysian Manufacturers

Malaysia Palm Oil Association

Malaysian Agricultural Research and Development Institute

Malaysian Association of Standards Users

Ministry of Agriculture and Agro-based Industry

Ministry of Health Malaysia

Ministry of International Trade and Industry

Universiti Kebangsaan Malaysia

Universiti Putra Malaysia

The Working Group on Food Irradiation which developed this Malaysian Standard consists of representatives from the following organisations:

Department of Fisheries Malaysia

Department of Veterinary Services Malaysia

Federation of Malaysian Consumers Associations

Malaysian Agricultural Research and Development Institute

Malaysian Institute for Nuclear Technology Research

Ministry of Health, Malaysia

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FOREWORD

This Malaysian Standard was developed by the Working Group on Food Irradiation under the authority of the Food and Agricultural Industry Standards Committee.

MS 1265 consists of the following parts, under the general title *Code of good irradiation practice*:

- *Part 1: General*

- *Part 2: Bulb and tuber crops for sprout inhibition*

- *Part 3: Fresh fruits and vegetables for insect disinfestations and as quarantine treatment*

- *Part 4: Cereal grains for insect disinfestations*

- *Part 5: Dried fish and dried salted fish for insect disinfestations*

- *Part 6: Bananas, mangoes and papayas for shelf-life extension*

- *Part 7: Fish, frog legs and shrimps for the control of microflora*

- *Part 8: Prepackaged meat and poultry for the control of pathogens and/or to extend shelf-life*

- *Part 9: Spices, herbs and vegetable seasonings for the control of pathogens and microflora*

- *Part 10: Dried and dried salted meat of animal origin for insect disinfestations, control of moulds and reduction of pathogenic microorganisms.*

This Malaysian Standard is the first revision of MS 1265: Part 4, *Guidelines for irradiation of foods: Part 4: Irradiation of cereal grains for insect disinfestation.*

Major modifications in this revision are as follows:

a) the scope of the standard has been amended to indicate that the irradiation treatment will also reduce the microbial load of cereal grains; and

b) new radiation source has been added.

This Malaysian Standard cancels and replaces MS 1265: Part 4: 1992, *Guidelines for irradiation of foods: Part 4: Irradiation of cereal grains for insect disinfestation.*

Compliance with a Malaysian Standard does not of itself confer immunity from legal obligations.

CODE OF GOOD IRRADIATION PRACTICE - PART 4: CEREAL GRAINS FOR INSECT DISINFESTATIONS (FIRST REVISION)

0. Introduction

Dry cereal grains can be infested with insects. Feeding insects proliferating exponentially and this may cause severe damage to grains. Insect activity can also cause an increase in the moisture content of stored grains; resulting in microbial growth which can produce further damage to the grain. Additionally, the presence of insects in grains is objectionable for aesthetic reasons.

1. Scope

This Malaysian Standard describes a code of good irradiation practice for insect disinfestations of cereal grains, and which to a certain extent reduces the microbial load. However the contamination of concern in this standard is exclusively insects.

2. Normative reference

The following normative reference is indispensable for the application of this standard. For dated reference, only the edition cited applies. For undated reference, the latest edition of the normative reference (including any amendments) applies.

MS 1265: Part 1, *Code of good irradiation practice - Part 1: General*

3. Pre-irradiation treatment of cereal grains

The harvested grains are dried to a moisture level sufficiently low to secure preservation, usually below 14 %. Drying procedures are controlled so as to prevent "case hardening" and resultant cracking of the kernels.

4. Packaging

4.1 Grains may be handled as bulk products, without any form of packaging.

4.2 In some circumstances, the grains may be packed in containers such as bags (sacks). Such packaging should be done prior to irradiation. Irradiation provides no lasting disinfestations effect; therefore, where possible, packaging materials that cannot be penetrated by insects should be used to avoid post irradiation infestation.

5. Pre-irradiation storage and transport

Normal practice of transport and storage of the grains are satisfactory. Maintenance of the required low moisture content; the prevention of heating; and minimisation of insect contamination are necessary.

6. Irradiation

6.1 Facility requirements and operations; process parameters and critical operational control points; ionising radiation sources employed

6.1.1 The requirements and guidance regarding certain irradiation process parameters and irradiation facilities and their operation should be referred to MS 1265: Part 1.

6.1.2 The ionising radiation which may be employed in irradiating dry cereal grains is limited to:

a) Gamma rays from the radionuclide Cobalt-60 or Caesium-137;

b) X-rays generated from machine sources operated at or below an energy level of 5 MeV (Million Electron Volts); and

c) Electrons generated from machine sources operated at or below an energy level of 10 MeV.

6.1.3 Grains may be irradiated using a general-purpose irradiation facility. However, bulk grains can be irradiated with better overall process efficiency and with lower costs if the irradiators are designed and constructed specifically for grain irradiation. It is likely that most requirements will necessitate the handling of large volumes of grains and this should economically justify using a single-purpose irradiator. The handling procedures for bulk grains may not be applicable to other foods.

6.1.4 Bulk grains can be treated as fluids and may be handled by a gravitational flow through a radiation field. Such flow can be aided in various ways, including electromechanical propelling devices or blending of an air stream with the flowing grain. A number of grain irradiators have been built using such methods of transport.

6.1.5 The radiation treatment shall penetrate the depth of the grain stream. If the radiation is sourced from either X-ray or gamma ray, an adequate penetration is likely to be secured without difficulty. Electron radiation, having less penetrability, requires that the grain stream have a depth commensurate with the electron beam penetration, as determined by the electron energy employed, the upper limit for which is 10 MeV. This will require the appropriate design and construction of the grain transport system, since even minor variations of both parameters may result in considerable over- or under- exposure.

6.1.6 The capacity of the irradiator shall be adequate to provide the required quantity of radiation in the course of the period of exposure, which in a flow-type irradiator may be short.

6.1.7 Consideration should be given to carrying out the irradiation treatment when the grain is needed to be transported for other purpose, such as moving the grains into bins or, loading or unloading a consignment. The extra handling avoided in this manner may result in cost reduction, provided post-irradiation infestation can be effectively minimised.

6.1.8 For grains which are not irradiated as bulk products, but in containers such as bags or sacks, the conventional irradiators, including batch irradiators may be used. The operation of such facilities is in accordance with normal practices. Due to the penetration requirements, problems may be encountered when using electron radiation and containers of certain dimensions (however, this will depend on electron energy emitted).

6.1.9 It is not possible to distinguish irradiated products from non-irradiated products by inspection. Therefore, it is important that, in the operation of an irradiation facility, any appropriate means, such as physical barriers, be used for keeping the irradiated and non-irradiated products separate.

6.1.10 Indicators which will change colour or which otherwise undergo an easily determined and time-stable change when exposed to radiation at the dose required are commercially available. Such device is common in the radiation-sterilisation industry and is used as a paper sticker (or equivalent) is attached to each product unit which could assist the operator in identifying irradiated product.

6.1.11 It is important to keep adequate records of the operation of the irradiation facility. The grains which have been irradiated should be identified by lot numbers or by other suitable means. Such measures which enable verification of the irradiation treatment carried out are likely to be required by the regulatory agencies.

6.2 Amount of radiation used (absorbed dose)

6.2.1 General

6.2.1.1 The most important process parameter in irradiation treatment of food, is the amount of ionising energy absorbed by the target material. This is termed "absorbed dose". The unit of absorbed dose is known as Gray (Gy). One Gy is equal to the absorption of one joule per kg. The dose employed will depend on the type of insect, the stages present and the purpose of the treatment.

NOTE. It is recommended that no food should receive the overall coverage absorbed dose above 10 kGy (Refer MS 1265: Part 1).

6.2.1.2 The irradiation procedure is controlled to deliver prescribed doses which involve a number of considerations. Among which is important, is the technology for measuring dose, given the termed "dosimetry". The manuals on dosimetry procedures should be consulted. Refer to bibliography for the list of references on dosimetry procedures.

6.2.2 Cereal grains

6.2.2.1 Cereal grain pests include:

a) *Coleoptera* (Beetles);

b) *Lepidoptera* (Moths); and

c) *Arachimida* (Mites).

6.2.2.2 The radiation resistance of each type of pests varies fairly and increases in the following order:

Beetles < Mites < Moths

6.2.2.3 The absorbed doses of 3 kGy to 5 kGy are needed to secure lethality within 24 h. This short-time effect is common with the use of chemical pesticides, however, it has been accepted that it is not a necessary requirement. The absorbed dose of 0.5 kGy is needed for the radiation disinfestations of cereal grains. This absorbed dose produces sterility and death within a few weeks, and generally is considered to be an adequate treatment, since this absorbed dose also reduces the insect's ability to feed.

6.2.2.4 The use of a low absorbed dose avoids the eventual radiation-induced damage on the functional properties of grains (e.g. the baking quality of wheat) and also reduces the processing cost.

6.2.2.5 An absorbed doses lower that 0.5 kGy may be used if only the radiation-sensitive beetles are present. An absorbed dose of 0.5 kGy is necessary if more radiation-resistant beetles, mites or moths are present. The absorbed dose of 0.5 kGy may not render adult moths to be infertile, but the number of their progeny will be greatly reduced and they will also be steriled.

6.3 Irradiation conditions

The conditions usually practiced for irradiating materials at ambient temperatures may be employed. The irradiation area should be well ventilated to minimize ozone build-up, particularly in electron accelerator installations where a hazard may potentially result from the formation of an explosive mixture with dust.

7. Post-irradiation storage and transport

Generally there are no special requirements for post-irradiation storage and handling of cereal grains, other than customary practice (e.g. storage in dry and cool conditions to avoid growth of moulds). However, since the irradiation treatment provides no lasting protection against subsequent insect infestation, effective and appropriate measures to prevent re-infestation are necessary, which could include the proper choice on the point of irradiation (in the handling and storage chain).

8. Labelling

8.1 Foods that have been irradiated shall be labelled and labelling shall be in accordance with the current national legislation requirements.

8.2 Labelling should not only identify the food as irradiated, but also serve to inform the purchaser as to the purpose and benefits of the treatment.

8.3 Each package containing the food treated by ionising radiation may bear on it the international food irradiation symbol given in MS 1265: Part 1.

8.4 Generally, labelling as referred to the above, applies to pre-packaged foods. Cereal grains irradiated as bulk products which cannot be labelled in the ordinary means should have records of the irradiation treatment in the shipping documents which accompany the commercial movement of each lot or unit of the bulk product.

9. Re-irradiation

Generally, irradiation of the same product more than once is not recommended. Where allowed, the total of the absorbed dose shall not exceed the maximum dose permitted and shall not be so high as to impair the functional properties. Since the radiation doses for cereal grain disinfestations are very low, re-irradiation to control subsequent infestation may not cause any damage to the product, or impair its functional properties. (Refer to MS 1265: Part 1 for more guidance on re-irradiation of products)

10. Quality of cereal grains irradiated for insect disinfestations

The cereal grains which have been irradiated with doses adequate for insect disinfestations (e.g. 0.5 kGy) as described in this standard undergo no loss of functional properties or other qualities. However, higher doses may cause impairment to the cereal grains functional properties.

11. Final product specification

Pre-irradiation populations of insects present in cereal grains as pupae or adults would be steriled after irradiation. Eggs and larvae present before irradiation do not develop into normal adults after irradiation.

Bibliography

MS ISO ASTM 51204: 2005, *Practice for dosimetry in gamma irradiation facilities for food processing*

MS ISO ASTM 51261: 2005, *Guide for selection and calibration of dosimetry systems for radiation*

MS ISO ASTM 51431: 2005, *Practice for dosimetry in electron and bremsstrahlung irradiation facilities for food processing*

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