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MS 1265-8 (2005) (English): CODE OF GOOD IRRADIATION PRACTICE - PART 8: PREPACKAGED MEATS AND POULTRY FOR THE CONTROL OF PATHOGENS AND/OR TO EXTEND SHELF-LIFE (FIRST REVISION)

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MALAYSIAN STANDARD

MS 1265: PART 8:2005

CODE OF GOOD IRRADIATION PRACTICE - PART 8: PREPACKAGED MEATS AND POULTRY FOR THE CONTROL OF PATHOGENS AND/OR TO EXTEND SHELF-LIFE (FIRST REVISION)

ICS: 67.020

Descriptors: code of practice, irradiation, ionising, radiation treatment, prepackaged, meat, poultry, control of pathogens, shelf-life extension

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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

Malaysian Agricultural Research and Development Institute

Malaysian Association of Standards Users

Malaysian Palm Oil Association

Ministry of Agriculture and Agro-based Industry

Ministry of Health Malaysia

Ministry of International 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

SIRIM Berhad (Secretariat)

Universiti Putra Malaysia

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 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, frogs and shrimps for the control microflora*

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

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

- *Part 10: Dried meat 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 8, *Guidelines for irradiation of foods: Part 8: Irradiation of fresh and frozen red meats and poultry (to control pathogens).*

Major modifications in this revision are as follows:

a) the requirements and guidance for the irradiation process parameters and facilities have been amended;

b) recommended manuals on dosimetry procedures have been updated; and

c) labelling requirements have been amended.

This Malaysian Standard cancels and replaces MS 1265: Part 8, *Guidelines for irradiation of foods: Part 8: Irradiation of fresh and frozen red meats and poultry (to control pathogens).*

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

CODE OF GOOD IRRADIATION PRACTICE - PART 8: PREPACKAGED MEATS AND POULTRY FOR THE CONTROL OF PATHOGENS AND/OR TO EXTEND SHELF-LIFE (FIRST REVISION)

1. Scope

1.1 This Malaysian Standard describes the code of good irradiation practice for fresh and frozen red meats, of the bovine (beef and veal), porcine and ovine species. This standard also applies to fresh and frozen poultry meat. This standard includes raw meat products, such as chopped or comminuted meat, mechanically deboned meat and poultry meat, whether fresh or frozen.

1.2 This standard does not include processed meat or poultry products, such as sausages and cured meats or dried or canned meat or poultry.

1.3 The purposes of irradiation are given as follows:

a) to eliminate or otherwise inactivate, pathogenic microorganisms present in fresh or frozen meats and poultry and, thereby, to make these foods safer for human consumption. These pathogenic microorganisms may, be either certain bacteria such as *Salmonella* or *Campylobacter* or parasites such as *Trichinella spiralls*; and

b) to extend the shelf-life of the fresh meats by reducing their microbial population, primarily vegetative forms of bacteria, which are the cause of spoilage.

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

3.1 Applicable codes of hygienic practices and good manufacturing practices should be followed in maintaining the initial quality of the fresh meat and poultry, before processing and during pre-irradiation handling, as reflected by the microbiological criteria for food to be further processed including by irradiation. This includes slaughtering of only healthy animals, sanitary dressing operations, prompt and effective reduction of product temperature at 4 °C or below, and appropriate cutting, trimming and de-boning (if done) and grinding (if done) operations. Meats should be chilled promptly and maintained at 4 °C or below, during storage. During transport of the chilled product to another location, the indicated low product temperatures should be maintained. Generally, necessary measures should be taken at all times to minimise microbial contamination and growth.

3.2 It is recommended that meat should be frozen after the primary chill and not subjected to unnecessary storage. A final product temperature of below -18 °C should be obtained and maintained.

3.3 Meats that have been handled differently from above, especially those that have been held under refrigeration for an unduly long time should not be irradiated. Irradiation does not effectively extend product shelf-life if the bacterial population is large. Irradiation should not be used to replace good and proper handling meat and meat products.

4. Packaging

4.1 General

4.1.1 Packaging should be done prior to irradiation. Generally, at the doses considered in this standard, the commonly used packaging materials are suitable. They should be functionally and adequately protective. However, if irradiation significantly alters functional properties of a particular packaging material or result in the formation of toxic substances which can be transferred by contact to the foods, this packaging material cannot be used.

4.1.2 The size and shape of containers which may be used for irradiation are determined in part by certain aspects of the irradiation facility. The critical aspects include the characteristics of product transport systems and of the irradiation source, as they relate to the dose distribution obtained within the container (see Clause 6).

4.1.3 The irradiation procedure will, therefore, be facilitated if the product packages are geometrically well-defined, especially if they are flat-sided rather than round. With certain irradiation facilities, it may be necessary to limit use to particular package shapes and sizes.

4.2 Fresh red meats and poultry

4.2.1 The nature of the material used for packaging fresh meats is highly critical and is partly determined by what is allowable for the particular product under the national legislation.

4.2.2 Fresh red meats, especially the more highly pigmented ones such as beef, ordinarily require the presence of oxygen in order to maintain their normal red colour. The use of an oxygen-impermeable film causes the meat to be dark in the package, although the normal red colour will return when the package is opened. The colour changes resulting from vacuum packaging is less significant in marketing the less pigmented red meats and poultry.

4.2.3 Ordinarily a red colour rather than a dark colour is demanded by consumers in the retail marketing of fresh meats. For wholesale cuts, however, and in some localities for retail package of ground red meats, vacuum packaging is acceptable. Replacement of the air in the package with a gas mixture is capable of extending the shelf-life and maintaining the oxygenated state of pigment.

4.2.4 In addition to properties related to its oxygen and carbon dioxide permeabilities, the packaging material shall be a moisture barrier to prevent drying of the meats. The use of absorbing material, especially when plastic trays are used, may also be useful.

4.2.5 Irradiation can improve the shelf-life of meats and poultry only through its action on their microbial content. There are mechanisms other than bacterial action which cause meat spoilage. These are largely chemical and generally involve the action of atmospheric oxygen in contact with the meat to cause discolourations and lipid oxidation, and may require measures in addition to irradiation in order to obtain a satisfactory product. Where it can be used, a package that provides an oxygen free condition (e.g. vacuum packaging) prevents such effects. It may be advisable, therefore to use a double packaging system. In this system access of oxygen to the meat is prevented through vacuum packaging, or its equivalent, for most of the handling period. In the last part of the period (about three days) access of, oxygen to the product is provided in order to obtain the normal red colour needed for marketing.

4.2.6 Irradiation, similar to other microbial control agents, e.g. heat pasteurisation, modified atmosphere packaging, may increase the potential hazard of *C. botulinum* in vacuum packaged fresh meat and poultry. To avoid the risk from this hazard, packaged red meat and poultry regardless of irradiation or treated by other means, shall be stored at a temperature of 10 °C or below. (See 10.1.1)

4.3 Frozen red meats and poultry

For frozen meats the packaging material should be in total, unbroken contact with the meat surface for maximum heat transfer efficiency. Frozen storage of unwrapped meat, or meat in damaged packaging results in a form of desiccation as 'freezer burn'. Packaging materials normally used for frozen meats generally are, satisfactory.

5. Pre-irradiation storage and transport

5.1 For fresh meats and poultry, the principal requirement for pre-irradiation storage is maintenance of product temperatures below 4 °C, without freezing. A second requirement is that the storage period be short. For chicken meat this should, preferably less than one day.

5.2 Under normal commercial conditions, the relatively short duration frozen storage prior to irradiation is not particularly critical. However, normally freezing does not provide an unlimited product life without loss of quality and, therefore, the pre-irradiation storage period should be minimised.

6. Irradiation

6.1 Facility requirements and operation; 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 operations should be referred to MS 1265: Part 1.

6.1.2 The ionising radiation which may be used for the irradiation of red meats and poultry is limited to:

a) Gamma rays from the radionuclides Cobalt-60 and 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 The selection of the irradiation source to be employed in the treatment should be appropriately considered, for example the use of electrons has its limitations due to their poor penetration ability.

6.1.4 It is not possible to distinguish irradiated from non-irradiated product 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 product separate.

6.1.5 Indicators which change colour or which otherwise undergo some easily determined and time-stable change when exposed to radiation at the doses required are commercially available. Such devices, common in the radiation-sterilisation industry which is used as a paper sticker (or equivalent) and attached to each product unit, such as a carton, could assist the operator in identifying irradiated product.

6.1.6 It is important to keep adequate records of the operation of the irradiation facility. Fish which have been irradiated should be identified by lot numbers or 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 parameters in the 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 the Gray (Gy). One Gy is equal to the absorbtion of one joule per kg. The dose employed is determined by the level of the initial contamination (number of insects), the kind of insects, and the purpose of the treatment.

6.2.1.2 The irradiation procedure is controlled to deliver a prescribed dose involves 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.

6.2.1.3 The failure to meet criteria of hygienic quality required under national legislations should direct attention to the manufacturing process and the re-establishment, if necessary, of Good Manufacturing Practices. The Hazard Analysis and Critical Control Point (HACCP) system should be applied to the entire processing and distribution chain. Microbiological sampling at critical control points is most effective as a preventive measure for bacterial control. A bacteriological examination of the irradiated product should reveal a significant reduction in relevant bacterial counts as compared with the unirradiated product.

6.2.2 Absorbed dose for the inactivation of pathogenic bacteria in frozen red meats (not processed) and in frozen poultry

A number of pathogenic bacteria may be present in these foods, including *Salmonella, Campylobacter, Yersinia, Escherichia coli, Staphylococcus* and *Listeria monocytogenes.* The absorbed dose required to reduce the number of these bacteria to levels commensurate with product safe for consumption depends upon the initial level of contamination and the radiation sensitivity of the bacteria present. A precise absorbed dose, therefore, cannot be given without knowing the specific conditions that exist. It is recommended that the absorbed dose be determined for the conditions that exist locally. Experience obtained up to the present suggests that a minimum dose of 3 kGy should be adequate for product irradiated in the frozen state.

6.2.3 Absorbed dose for irradiation of the parasite *Trichinella spiralis* in pork

The absorbed dose which renders this helminth non-infectious in fresh, non-frozen pork is 0.3 kGy. This dose is to be regarded as the minimum effective absorbed dose.

6.2.4 Absorbed dose for shelf-life extension of fresh red meats and poultry stored at refrigeration temperature

6.2.4.1 The absorbed dose which produces shelf-life extension of these foods falls in the range of 1 kGy to 2.50 kGy. In general, the smallest absorbed dose that is deemed effective under appropriate local conditions should be used.

6.2.4.2 Too large an absorbed dose may cause the formation of an "off" flavour in the meat. The sensitivity to this flavour formation varies with the species of the meat for the threshold doses for "irradiated" flavour formation in several species. However, it will also depend very much on temperature, gaseous environment, type of cut, and other factors, and should be considered as indicative only. In addition, large absorbed doses may cause discolouration In some meats. Care shall therefore, be taken on dose uniformity of products treated in certain size and shape of containers and by certain types of irradiators. The minimum absorbed dose should be sufficient to achieve the technological purpose and the maximum should not exceed the tolerance limit of the product.

7. Post-irradiation handling and storage

7.1 Fresh red meats and poultry

7.1.1 Irradiation for shelf-life extension

7.1.1.1 The product temperature should not exceed 4 °C (without causing freezing) and package integrity shall be maintained.

7.1.1.2 Care should be exercised not to exceed the period of shelf-life extension which has been established for the product. If vacuum-packaging is not employed during part or all of this period, attention should be given to all aspects of product deterioration not associated with microbial content, e.g., pigment changes causing product discolouration and lipid oxidation, which can affect flavour. If vacuum-packing or oxygen-free packaging is employed, particular care shall be taken to ensure that the storage temperature does not exceed 4 °C, to prevent abuse of the product.

7.1.2 Irradiation of pork for inactivation of *Trichinella spiralis*

No changes in post-irradiation handling from the usual are required.

7.2 Frozen red meats and poultry

No changes in post-irradiation handling from the usual are required.

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.

9. Re-irradiation

Irradiation of the same product more than once generally is not recommended. MS 1265: Part 1 may be referred for provisions for irradiation of certain foods.

10. Final product specification

10.1 Fresh red meats and poultry

10.1.1 Irradiation for control of pathogenic bacteria

The criterion should be that the irradiated product be non-infectious with regard to pathogenic bacteria to be controlled. The numbers of pathogenic bacteria that can result in an infectious product vary with the specific bacterium and the susceptibility of the consumers involved.

10.1.2 Irradiation for shelf-life extension

It is not considered appropriate to irradiate fresh red meat and poultry with the sole objective of shelf-life extension as this can be achieved by applying Good Manufacturing Practice at slaughter, chilling, cutting/boning and packaging, coupled with control of distribution and storage temperature. Irradiation could give added assurance of safety to these products after processing by Good Manufacturing Practice and to retain the organoleptic qualities of raw foods.

10.1.3 Irradiation of pork for inactivation of *Trinchinella spiralis*

In terms of this standard, the associated specification is that the irradiated pork, uncooked, be non-infectious with regard to *Trihinella spirafis.* (This does not require the parasite to be killed by the 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*

Acknowledgement

Dr Muhamad Lebai Juri (Chairman)/	Malaysian Institute for Nuclear Technology Research
Mohd Sidek Othman	
Puan Seri Azalina Mohd Ghazalli (Secretary)	SIRIM Berhad
Encik Ahmad Hazizi Aziz	Department of Fisheries Malaysia
Dr Maznah Ahmad	Department of Veterinary Services Malaysia
Dr Noraini Mohd Khalid	Malaysian Agricultural Research and Development Institute
Puan Shamsinar bt Abdul Talib	Ministry of Health Malaysia
Prof Madya Dr Russly Abdul Rahman	Universiti Putra Malaysia