Federation of Malysia

EDICT OF GOVERNMENT

In order to promote public education and public safety, equal justice for all, a better informed citizenry, the rule of law, world trade and world peace, this legal document is hereby made available on a noncommercial basis, as it is the right of all humans to know and speak the laws that govern them.

MS 1265-7 (2007) (English): CODE OF GOOD IRRADIATION PRACTICE – PART 7: FISH, SHRIMPS AND FROG LEGS FOR THE CONTROL OF MICROFLORA (FIRST REVISION)

BLANK PAGE

MALAYSIAN STANDARD

MS 1265: PART 7:2007

CODE OF GOOD IRRADIATION PRACTICE – PART 7: FISH, SHRIMPS AND FROG LEGS FOR THE CONTROL OF MICROFLORA (FIRST REVISION)

ICS: 67.020

Descriptors: fish, shrimp, frog legs, fresh, refrigeration, frozen, irradiation, ionising, radiation treatment, guideline, microflora control

DEPARTMENT OF STANDARDS MALAYSIA

DEVELOPMENT OF MALAYSIAN STANDARDS

The **Department of Standards Malaysia (STANDARDS MALAYSIA)** is the national standards and accreditation body of Malaysia.

The main function of STANDARDS MALAYSIA is to foster and promote standards, standardisation and accreditation as a means of advancing the national economy, promoting industrial efficiency and development, benefiting the health and safety of the public, protecting the consumers, facilitating domestic and international trade and furthering international cooperation in relation to standards and standardisation.

Malaysian Standards (MS) are developed through consensus by committees which comprise balanced representation of producers, users, consumers and others with relevant interests, as may be appropriate to the subject at hand. To the greatest extent possible, Malaysian Standards are aligned to or are adoption of international standards. Approval of a standard as a Malaysian Standard is governed by the Standards of Malaysia Act 1996 [Act 549]. Malaysian Standards are reviewed periodically. The use of Malaysian Standards is voluntary except in so far as they are made mandatory by regulatory authorities by means of regulations, local by-laws or any other similar ways.

STANDARDS MALAYSIA has appointed **SIRIM Berhad** as the agent to develop, distribute and sell the Malaysian Standards.

For further information on Malaysian Standards, please contact:

Department of Standards Malaysia
Ministry of Science, Technology and Innovation
Level 1 & 2, Block 2300, Century Square
Jalan Usahawan
63000 Cyberjaya
Selangor Darul Ehsan
MALAYSIA

Tel: 60 3 8318 0002
Fax: 60 3 8319 3131
http://www.standardsmalaysia.gov.my

E-mail: central@standardsmalaysia.gov.my

OR

SIRIM Berhad
(Company No. 367474 - V)
1, Persiaran Dato' Menteri
Section 2
40000 Shah Alam
Selangor Darul Ehsan
MALAYSIA

Tel: 60 3 5544 6000
Fax: 60 3 5510 8095
http://www.sirim.my

E-mail: msonline@sirim.my

CONTENTS

Committee representation

The Food and Food Products Industry Standard Committee (ISC J) under whose authority this Malaysian Standard was developed comprises representatives from the following organizations:

Department of Agriculture Malaysia
Department of Chemistry Malaysia
Department of Standards Malaysia
Federal Agricultural Marketing Authority
Federation of Malaysian Manufacturers
Malaysian Agricultural Research and Development Institute
Malaysian Association of Standards Users
Malaysian Institute of Food Technology
Malaysian Palm Oil Association
Malaysian Palm Oil Board
Ministry of Agriculture and Agro-Based Industry
Ministry of Health Malaysia
Ministry of International, Trade and Industry
National Biotechnology Division, Ministry of Science, Technology and Innovation
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 Nuclear Agency

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 Food Products Industry Standards Committee.

This Malaysia standard 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, shrimps and frog legs 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 meat and dried salted meat of animal origin for insect disinfestation, control of moulds and reduction of pathogenic micro organisms*

This Malaysian Standard is the first revision of MS 1265: Part 7, *Guidelines for irradiation of foods: Part 7: Irradiation of fresh fish and shrimps stored under refrigeration and for frozen frog legs and shrimps (to control microflora).*

Major modifications in this revision are as follows:

a) microbiological criteria have been added in the pre-irradiation treatment;

b) new radiation source has been added;

c) the labelling requirements have been revised; and

d) guidance for sampling has been removed.

This Malaysian Standard cancels and replaces MS 1265: Part 7:1992.

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

CODE OF GOOD IRRADIATION PRACTICE - PART 7: FISH, SHRIMPS AND FROG LEGS FOR THE CONTROL OF MICROFLORA (FIRST REVISION)

1. Scope

1.1 This Malaysian Standard describes a code of good irradiation practice for refrigerated fresh or frozen; fish, shrimps or prawns[1] and frozen frog legs.

1.2 This standard excludes requirements for other animal foods of marine or freshwater origin.

1.3 The microbial contamination of concern in this standard is mainly bacterial. As referred to in this standard, irradiation is not used to treat contamination with other organisms, such as moulds, yeasts and insects. However, when irradiating fresh fish for bacterial reduction, any parasites present are rendered non-infective.

1.4 Frozen frog legs, fish and shrimps may be contaminated with pathogenic bacteria such as *Salmonella, Shigella, Vibrio, Listeria* and *Yersinia*. The irradiation of these foods is for the purpose of inactivating such pathogenic vegetative bacteria and not for the purpose of their preservation, which is achieved through freezing.

1.5 Bacterial contamination of fresh fish and shrimps can lead to their spoilage. The irradiation of these products is for the purpose of reducing the bacterial contamination, but not eliminating it completely, so as to extend the shelf-life of these foods when kept under refrigeration. Irradiation accomplishes a reduction of the numbers of both spoilage and pathogenic organisms initially present. The use of irradiation to control pathogenic bacteria which can grow at refrigeration temperature (e.g. *Listeria, Vibrio*) is highly significant.

2. Normative references

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 *Malaysian Food Act 1983 and Malaysian Food Regulations 1985*

[1] Hereafter referred to as shripms

3. Pre-irradiation treatment

3.1 Fresh fish and shrimps

3.1.1 General

The amount and kind of bacterial contamination of fresh fish and shrimps vary with the locality of their origin, the nature of the catching, processing, transport and storage technology, the facilities employed, the time period the product is held after catching and before irradiation. It is recommended that the fresh fish and shrimp shall be properly chilled or iced to bring its temperature down to as close as possible to 0 °C without delay as specified in the "Recommended International Code of Practice for Fresh Fish" (CAC/RCP 9-1976)[1] to prevent deterioration, histamine formation, spoilage and bacterial growth prior to irradiation.

3.1.2 Fish

3.1.2.1 After catching, gutting (if done) and/or bleeding (if done), and washing with clean water, the fish should be iced or refrigerated without delay. Storage aboard the catching vessel should maintain good refrigeration not add bacterial contamination.

3.1.2.2 During unloading on shore, mixing of catches of fish from different days and damaged fish should be avoided. On-shore storage should maintain proper refrigeration. Fish requiring gutting on-shore should be handled properly. Fillets should be handled so as to minimise bacterial contamination. Handling for detection and removal of fish containing parasites, blood spots, skin pieces, etc. may be needed. Food additives should be used properly and in accordance with the Malaysian Food Act 1983 and Malaysian Food Regulations 1985.

3.1.2.3 Any products intended for further processing (e.g. by irradiation) should be produced under conditions of good manufacturing practices and should meet the following criteria; Aerobic Plate Count (20 °C): $n = 5$, $c = 3$, $m = 5 \times 10^5$, $M = 10^7$.

3.1.3 Shrimps

3.1.3.1 After sorting, removing of heads and washing, the shrimps should be iced promptly and placed in a fish hold and kept appropriately. After landing, the shrimps should be transferred promptly to the processing plant.

3.1.3.2 If sorting, removing of heads and washing not done on board ship, the shrimps should be washed with water containing 25 ppm - 50 ppm of chlorine upon arrival at the processing plant. Inspection to enable removal of defective shrimps and grading for size is done. deveining, if done, follows and finally packing

3.1.3.3 Any product intended for further processing (e.g. by irradiation) should meet the following criteria; Aerobic Plate Count (20 °C): $n = 5$, $c = 3$, $m = 5 \times 10^5$, $M = 10^7$.

The proposed draft code of practice, when finalised, will replace all current Codes of Practice for Fish and Fishery Products

3.2 Frozen frog legs

3.2.1 Applicable codes of practice for the processing of frog legs and standards of good manufacturing practice should be followed in maintaining the initial quality of the frog legs before processing and during pre-irradiation handling.

3.2.2 The legs are packaged individually or overwrapped and quick frozen. Legs frozen unwrapped should be glazed with ice to prevent desiccation during storage.

3.3 Frozen shrimps

3.3.1 After sorting, removal of heads and washing, the shrimps should be iced promptly and placed below deck. After landing, the shrimps should be transferred promptly to the processing plant. If not done on board ship, the shrimps are headed, after which they are washed with pressurised water containing 25 ppm - 50 ppm of chlorine. Inspection to enable removal of defective shrimps and grading for size is done. Peeling, deveining and pre-cooking, if done, follows.

3.3.2 Quick freezing of individual shrimps may be done prior to packaging or freezing may be done after placing in waxboard cartons. Glazing with ice after freezing, to prevent desiccation, is customary.

3.3.3 Any product intended for further processing (e.g. by irradiation) should be produced under conditions of good manufacturing practices and should meet the following criteria; Aerobic Plate Count (20 °C): $n = 5$, $c = 3$, $m = 5 \times 10^5$, $M = 10^7$.

4. Packaging

4.1 General

4.1.1 Packaging should be done prior to irradiation. Generally, at the doses considered in this standard commonly used packaging materials are satisfactory. They should be functionally and adequately protective. However, if irradiation significantly alters functional properties of a particular packaging material or may 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 If product containers (e.g., boxes) are repeatedly used in the handling, of the fish, and as a consequence are subject to repeated irradiation, consideration shall be given to their composition. Containers made of certain plastics or of metals should be used. Boxes made of wood or similar cellulosic material are not recommended since they will be sources of bacterial contamination and gradually damaged by successive irradiation thus becoming unusable.

4.1.3 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 the irradiation source, as they relate to the dose distribution obtained within the container (see Clause 6).

4.1.4 The irradiation procedure will, therefore, be facilitated if the product packages are geometrically well-defined and uniform. With certain irradiation facilities, it may be necessary to limit the use to particular packages, shapes and sizes.

4.2 Fresh fish and shrimps

4.2.1 Containers or packages customarily employed for fresh fish or shrimps are satisfactory, except as noted below.

Fish may be considered of two types: (i) lean fish (with less than 3% fat) and (ii) fatty fish (with more than 3% fat). For the latter, vacuum packaging or flushing with nitrogen (to exclude oxygen) may be needed to maintain suitable sensory quality over the radiation-extended life of these fish.

4.2.2 Irradiation, similar to other sub-sterilisation methods of food processing, e.g. thermal pasteurisation, modified atmosphere packaging, may increase the potential hazard of *Clostridium botulinum*, even if good manufacturing practices have been adhered to *Clostridium botulinum* type E is of special significance to fish and seafood as it has been isolated from fish and shellfish and can grow and produce toxin under favourable conditions even at refrigeration temperature.

4.3 Frozen frog legs and shrimps

Containers or packages customarily employed for these foods are satisfactory.

5. Pre-irradiation storage and transport

5.1 Fresh fish and shrimps

5.1.1 During transport to the irradiation facility and during storage prior to irradiation, measures to keep these foods, it is recommended that the products shall be properly chilled or iced to bring its temperature down to as close as possible to 0 °C without delay. Packaging to avoid product contact with ice or melt-water should be used.

5.2 Frozen frog legs and shrimps

Product temperatures normal for the handling of these frozen foods should be maintained at -18 °C or lower.

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 employed in irradiating marine and freshwater animal food 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 In selecting one or another of the sources, the limitations of the use of electrons, due to their poor penetration, should be considered.

6.1.4 It is not possible to distinguish irradiated from non-irradiated product by inspection, and, therefore, it is important that, in the operation of an irradiation facility appropriate means, such as physical barriers, be employed for keeping the irradiated and non-irradiated product separate.

6.1.5 Indicator devices commercially available at present 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 radiosterilisation industry, 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, therefore, important that adequate records of the operation of the irradiation facility be kept. Foods that have been irradiated should be identified by lot numbers or other suitable means. Such measures to enable verification of the irradiation treatment 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 Of the irradiation process parameters, the most important 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) and 1 Gy is equal to the absorbtion of 1 J/kg. The dose employed is determined by the purpose of the treatment and the kind of organisms. It is important that the food should receive the minimum absorbed dose required to achieve the desired effect and that uniformity ratio be maintained at an appropriate level.

6.2.1.2 The control of the irradiation procedure so as to deliver a prescribed dose entails a number of considerations, important among which is the technology for measuring dose, which is termed 'dosimetry'. It is recommended that manuals on dosimetry procedures be consulted. Refer to bibliography for the list of references on dosimetry procedures.

6.2.2 Fresh fish and shrimps

6.2.2.1 For many fresh fish and shrimps the optimum absorbed dose is in the range of 1 kGy to 1.5 kGy. However, it is recommended that the absorbed dose be determined for each species. Apart from this determination, the desired product life-extension which is related to the level of bacterial contamination that exists following irradiation should also be considered. A larger life extension requires a lower post-irradiation level of bacteria and, therefore, a larger absorbed dose.

6.2.3 Frozen frog legs

A minimum absorbed dose of 2 kGy, obtained with the product temperature during irradiation not exceeding -18 °C, reduces the *Salmonella* contamination to below the level of detection.

6.2.4 Frozen shrimps

A minimum absorbed dose of 2 kGy, obtained with the product temperature during irradiation not exceeding -12 °C, reduces the *Salmonella* contamination to below the level of detection.

6.3 Irradiation conditions

6.3.1 Fresh fish and shrimps

The temperature of these foods during irradiation should be maintained close to 0 °C.

6.3.3 Frozen frog legs and shrimps

The temperature normal for the handling of these frozen foods (i.e. below -18 °C) should be maintained during irradiation. At no time should they be allowed to thaw.

7. Post-irradiation handling and storage

7.1 Fresh fish and shrimps

At all times following irradiation, the product temperature shall be close to 0 °C.

7.2 Frozen frog legs and shrimps

The normal temperature for these products (i.e. at -18 °C) is satisfactory.

8. Labelling

8.1 Foods that have been irradiated should be labelled and labelling shall be in accordance to 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

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

10. Quality of irradiated products

10.1 Quality of irradiated fresh fish and shrimps

10.1.1 In general, the quality of these foods is not adversely affected by irradiation, provided that the quality before irradiation is good. Irradiation controls only the bacterial contamination and reduces the microflora present, resulting in shelf-life extension. However, the surviving flora which eventually grows will yield normal spoilage characteristics (objectionable odour). Other mechanisms for spoilage, such as chemical changes due to enzymes (with some possible exceptions) or atmospheric oxygen are not controlled by irradiation. Therefore, the need to irradiate fish of initial good quality is essential in securing good quality through the period of shelf-life extension provided by irradiation. Irradiation cannot be used to improve deteriorated quality which exists prior to irradiation.

10.1.2 With very fresh shrimps irradiation reduces melanosis (black spots) during refrigerated storage. With shrimps which are not fresh at the time of irradiation, irradiation enhances melanosis.

10.1.3 Fish with pigmented flesh, such as salmon or lake trout, may undergo colour loss upon irradiation. With some fish, darkening of the flesh or textural changes may occur. The intensity of these changes increases with dose. For most fish and for shrimps in the dose range of 1 kGy to 1.5 kGy (see 6.2.2) these changes are either slight or non-existent.

10.1.4 In order to avoid any quality changes associated with irradiation, it is considered to be good practice to employ the minimum dose that is effective in securing the desired product shelf-life extension.

10.1.5 As in the case of other pasteurisation treatments, the microflora population distribution, subsequent to irradiation and storage, may differ from that prior to treatment. Attention, should therefore be given only to the eventual significance of such a change in the case of fresh fish and shrimps, which, similar to all seafood regardless of irradiation or not, have to be kept at a temperature close to 0 °C to avoid possible bacterial growth and toxin productions

10.2 Quality of irradiated frozen frog legs and shrimps

10.2.1 Irradiation, as specified in 6.2.3 and 6.2.4 of this standard, does not alter the quality of frozen frog legs and shrimps, nor does it affect their storage characteristics.

11. Final product specification

11.1 Fresh fish and shrimps

The criterion should be that the irradiated product be non infectious with regard to the 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.

11.2 Frozen frog legs and shrimps

The following specifications are recommended: *Salmonella*: n = 10, c = 0, m = 0. The usual acceptable sample size taken from a lot is 10 × 25 g. Definitions of n, c and m are specified in annex A.

Annex A

The definitions of sample size for microbiological testing

DEFINITIONS

A.1 Lot: A lot, in the commercial sense, is a quantity of food supposedly produced under identical conditions, all packages of which would normally bear a lot number that identifies the production during a particular time interval, and usually from a particular 'line,' retort or other critical processing unit. Statistically, a lot is considered as a collection of sample units of a product from which a sample is to be drawn to determine acceptability of the lot.

A.2 Sampling plan: * A statement of the criteria of acceptance to be applied to a lot, based on examination of a required number of sample units by defined analytical methods. The sampling plans referred herewith require specification as follows:

(I) if a 2-class plan - n,c,m;
(ii) if a 3-class plan - n,c,m,M.

A.3 Defective sample: A sample is defective if it contains any of certain dangerous microorganisms, or more than some chosen number of other microorganisms.

c : The maximum allowable number of defective sample units. When more than this number are found, the lot is rejected.

m : A microbiological criterion which, in a 2-class plan separates good quality from defective quality; or, in a 3-class plan separates good quality from marginally acceptable quality. In general m represents an acceptable level and values above it are marginally acceptable or unacceptable.

*usual acceptable sample size for *Salmonella* determination in frozen frog legs and shrimps would be 10 x 25 g.

M : A microbiological criterion which, in a 3-class plan, separates marginally acceptable quality from defective quality. Values at or above M are unacceptable.

n : The number of sample units which must be examined from a lot of food to satisfy the requirements of a particular sampling plan.

SPC : Standard plate count - the numbers of aerobic mesophilic microorganisms present per gram in the test food sample as determined by the standard method.

Bibliography

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

[2] MS ISO/ASTM 51261:2005, *Guide for selection and calibration of dosimetry systems for radiation processing*

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

[4] CAC/RCP 30-1983, Code of hygienic practice for the processing of frog legs

[5] CAC/RCP 52- 2003, Revision 2 –2005 Code of practice for fish and fishery products

[6] ICMSF, 1986. Methods for microbiological examination

Acknowledgements

Members of Working Group on Food Irradiation

Dr Muhamad Lebai Juri (Chairman)/ Dr Ahmad Zainuri Mohd Dzomir (Vice Chairman)	Malaysian Nuclear Agency
Ms Irma Munirah Alias (Secretary)	SIRIM Berhad
Mr Ahmad Hazizi Aziz	Department of Fisheries Malaysia
Dr Noraini Mohd Khalid	Malaysian Agricultural Research and Development Institute
Ms Shamsinar Abdul Talib	Ministry of Health Malaysia
Assoc Prof Dr Russly Abdul Rahman/ Dr Noranizan Mohd Adzahan	Universiti Putra Malaysia

Printed by: Jabatan Percetakan, SIRIM Berhad (1389/2009-N)