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Standard Guide for Irradiation of Dried Spices, Herbs, and Vegetable Seasonings to Control Pathogens and Other Microorganisms¹

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INTRODUCTION

The purpose of this guide is to present information on the use of ionizing energy (radiation) in treating dried spices, herbs, and vegetable seasonings to reduce pathogens and spoilage microorganisms. Information on handling these commodities before and after irradiation is also provided.

This guide should be followed when using irradiation technology where approved by an appropriate regulatory control authority. It is not to be construed as a requirement for the use of irradiation, or as a rigid code of practice. While the use of irradiation involves certain essential requirements to attain the objectives of the treatment, some parameters can be varied in optimizing the process.

This guide has been prepared from a code of good irradiation practice, published by the International Consultative Group on Food Irradiation (ICGFI) under the auspices of the Joint Food and Agriculture Organization/International Atomic Energy Agency Division of Nuclear Techniques in Food and Agriculture, which serves as the Secretariat to ICGFI (1).²

1. Scope

1.1 This guide covers procedures for irradiation of dried spices, herbs, and vegetable seasonings for microbiological control. Generally, these items have moisture content of 4.5 to 12 % and are available in whole, ground, chopped, or other finely divided forms, or as blends. The blends may contain sodium chloride and minor amounts of dry food materials ordinarily used in such blends.

1.2 This guide covers absorbed doses ranging from 3 to 30 kiloGray (kGy).

NOTE 1—U.S. regulations permit a maximum dose of 30 kGy. (See 21CFR 179.26 Irradiation in the Production, Processing and Handling of Food.)

1.3 The values stated in SI units are to be regarded as standard. No other units of measurement are included in this standard.

1.4 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the*

¹ This guide is under the jurisdiction of ASTM Committee E61 on Radiation Processing and is the direct responsibility of Subcommittee E61.05 on Food Irradiation.

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² The boldface numbers given in parentheses refer to a list of references at the end of the text.

responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.

2. Referenced Documents

2.1 ASTM Standards³

E170 Terminology Relating to Radiation Measurements and Dosimetry

F1640 Guide for Selection and Use of Packaging Materials for Foods to Be Irradiated

2.2 ISO/ASTM Standards³

ISO/ASTM 51204 Practice for Dosimetry in Gamma Irradiation Facilities for Food Processing

ISO/ASTM 51261 Guide for the Selection and Calibration of Dosimetry Systems for Radiation Processing

ISO/ASTM 51431 Practice for Dosimetry in Electron and X-ray (Bremsstrahlung) Irradiation Facilities for Food Processing

ISO/ASTM 51539 Guide for Use of Radiation Sensitive Indicators

³ For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

2.3 *Codex Alimentarius Commission (CAC) Recommended International Codes and Standards:*

[STAN 1-1985 General Standard for the Labeling of Prepackaged Foods](#)⁴

[STAN 106-1983 General Standard for Irradiated Food](#)⁴

[CAC/RCP19-1979 \(Rev. 1\) Recommended International Code of Practice for the Operation of Irradiation Facilities for the Treatment of Food](#)⁴

2.4 *U.S. Food and Drug Administration, Code of Federal Regulations:*⁵

[CFR Title 21, Part 110 Current Good Manufacturing Practices in Manufacturing, Packaging, or Handling Human Food](#)

[CFR Title 21, Section 179.25 General Provisions for Food Irradiation](#)

[CFR Title 21, Section 179.26 Irradiation in the Production, Processing and Handling of Food](#)

3. Terminology

3.1 Definitions:

3.1.1 Other terms used in this guide may be defined in Terminology [E170](#).

3.1.2 *absorbed dose*—quantity of ionizing radiation imparted per unit mass of a specified material. The SI unit of absorbed dose is the gray (Gy), where one Gray is equivalent to the absorption of one joule per kilogram of the specified material (1 Gy = 1 J/kg).

3.1.2.1 *Discussion*—A commonly used definition of absorbed dose appears in Terminology [E170](#).

3.1.3 *absorbed dose mapping*—measurement of absorbed dose within a process load using dosimeters placed at specified locations to produce a one, two, or three-dimensional distribution of absorbed dose, thus rendering a map of absorbed dose values.

3.1.4 *dose distribution*—the variation in absorbed dose within a process load exposed to ionizing radiation.

3.1.5 *dosimetry system*—a system used for determining absorbed dose, consisting of dosimeters, measurement instruments and their associated reference standards, and procedures from the system's use.

3.1.6 *Good manufacturing practice (GMP)*—procedure established and exercised throughout the production, manufacturing processing, packing, and distribution of foods, encompassing maintenance of sanitation system, quality control and assurance, qualification of personnel and other relevant activities, to ensure the delivery of commercially acceptable and safe product.

3.1.7 *process load*—one or more containers of product collectively transported through the irradiator as a whole, for example, a box, tote, pallet, or carrier.

3.1.8 *spices*—includes dried spices, herbs, and vegetable seasonings.

⁴ Available from Joint FAO/WHO Food Standards Program, Joint Office, FAO, Via delle Terme di Caracalla, 00100, Rome, Italy.

⁵ Available from the U.S. Government Printing Office, Superintendent of Documents, Washington, DC 20402-9328.

3.1.9 *transport system*—the conveyor or other mechanical system used to move the process load through the irradiator.

4. Significance and Use

4.1 The purpose of irradiation to decontaminate spices, as referred to in this guide, is to reduce the population of pathogens, other bacteria, molds, and yeasts present in the products ([2,3,4,5,6, 7](#)).

4.2 The process will also kill any insects present, at all stages of development.

5. Pre-Irradiation Product Handling

5.1 Upon receipt at the irradiation facility, inspect packages and containers of spices according to relevant Good Manufacturing Practices (GMPs) to ensure that their integrity has not been compromised. See for example 21 CFR 110.

5.2 Irradiation can be applied to spices as they are prepared for processing in-line, in bulk or in commercial packages.

5.3 Handling of spices in an irradiation facility should be in accordance with relevant and current GMPs. There are no special requirements for handling of spices prior to irradiation except for providing control measures to prevent post-irradiation re-contamination in storage facilities and for assuring separation of irradiated and non-irradiated product.

5.3.1 *Product Separation*—It may not be possible to distinguish irradiated from non-irradiated product by inspection. It is therefore important that appropriate means, such as physical barriers, or clearly defined staging areas, be used to maintain non-irradiated product separate from irradiated product.

6. Packaging and Product Loading Configuration

6.1 Packaging Materials.

6.1.1 Packaging spices prior to irradiation is one means of preventing post-irradiation contamination.

6.1.2 Use packaging materials suitable to the product considering any planned processing (including irradiation) and consistent with any regulatory requirements (see Guide [F1640](#)).

6.2 Product Loading Configuration.

6.2.1 Irradiation will be facilitated if the product packages are geometrically well defined and uniform. With certain irradiation facilities, it may be necessary to limit use to particular package shapes and sizes based on the density of the product and validation testing at known product densities in the irradiation facility (see [ISO/ASTM 51204](#) and [ISO/ASTM 51431](#)).

6.2.2 The size, shape, and loading configuration of a process load for spices to be irradiated should be determined primarily by considering design parameters of the irradiation facility. Critical design parameters include the characteristics of product transport systems and of the radiation source as they relate to the dose distribution obtained within the process load. The design parameters of the irradiation facility and product dose specifications should be taken into account in determining the size, shape and loading configuration of a process load ([7.3](#)).