Designation: F 1885 – 98

Standard Guide for Irradiation of Dried Spices, Herbs, and Vegetable Seasonings to Control Pathogens and Other Microorganisms[1]

This standard is issued under the fixed designation F 1885; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ϵ) indicates an editorial change since the last revision or reapproval.

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, nor 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 a 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 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the 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 Standards:*

E 170 Terminology Relating to Radiation Measurements and Dosimetry[3]
E 1204 Practice for Dosimetry in Gamma Irradiation Facilities for Food Processing[3]
E 1261 Guide for the Selection and Calibration of Dosimetry Systems for Radiation Processing[3]
E 1431 Practice for Dosimetry in Electron and Bremsstrahlung Irradiation Facilities for Food Processing[3]
E 1539 Guide for Use of Radiation Sensitive Indicators[3]
F 1640 Guide for Packaging Materials for Foods to be Irradiated[4]

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

STAN 1-1985 General Standard for the Labeling of Prepackaged Foods[5]
STAN 106-1983 General Standard for Irradiated Food[5]
CAC/RCP19-1979 (Rev. 1) Recommended International Code of Practice for the Operation of Irradiation Facilities for the Treatment of Food[5]

2.3 *U.S. Food and Drug Administration, Code of Federal Regulations:*[6]

[1] This guide is under the jurisdiction of ASTM Committee E-10 on Nuclear Technology and Applications and is the direct responsibility of Subcommittee E10.06 on Food Irradiation Processing and Packaging.

Current edition approved May 10, 1998. Published December 1998.

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

[3] *Annual Book of ASTM Standards*, Vol 12.02.

[4] *Annual Book of ASTM Standards*, Vol 15.09

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

[6] Available from the U.S. Government Printing Office, Superintendent of Documents, Washington, DC 20402–9328.

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*—Other terms used in this guide may be defined in Terminology E 170.

3.1.1 *absorbed dose*—the quantity of energy from ionizing radiation imparted to a unit mass of a specified material (food). The special name of the unit for absorbed dose is the gray (Gy). One Gy is equal to one joule of absorbed energy per kilogram. Formerly, the unit of absorbed dose was the rad (1 rad = 0.01 Gy).

3.1.1.1 *Discussion*—A commonly used definition of absorbed dose appears in Terminology E 170.

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

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

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

3.1.5 *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)**.

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

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

6.1.1 Use packaging materials suitable to the product considering any planned processing (including irradiation) and consistent with any regulatory requirements (see Guide F 1640).

6.1.2 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 Practices E 1204 and E 1431).

6.2 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. Minimum and maximum dose limits may also affect the size, shape, or product loading configuration of the process load (see 7.3).

7. Irradiation

7.1 *Scheduled Process*—Irradiation of food should conform to a scheduled process. A scheduled process for food irradiation is a written procedure that is used to ensure that the absorbed dose range and irradiation conditions selected by the radiation processor are adequate under commercial processing conditions to achieve the intended effect on a specific product in a specific facility. The scheduled process should be established by qualified persons having expert knowledge in irradiation requirements specific for the food and the processor's irradiation facility (21 CFR 179.25).

7.2 *Radiation Sources*—The sources of ionizing radiation that may be employed in irradiating spices are limited to the following: (see CAC STAN 106-1983)

7.2.1 Gamma rays from radionuclides cobalt-60 (^{60}Co) or cesium-137 (^{137}Cs),

7.2.2 X-rays (bremsstrahlung) generated from machine sources at or below an energy of 5 MeV, and

7.2.3 Electrons generated from machine sources at or below an energy of 10 MeV.

7.3 *Absorbed Dose*— Food irradiation specifications from the owner of the spice should include minimum and maximum absorbed dose limits (see 7.3.2): a minimum necessary to ensure the intended effect and a maximum to prevent product degradation. One or both of these limits may be prescribed by regulation for a given application. See for example 21 CFR 179.26. It is necessary to configure irradiation parameters to ensure processing is carried out within these limits. Once this capability is established, it is necessary to monitor and record absorbed dose values during routine processing. (See 11.1.3.)

7.3.1 Routine dosimetry is part of a verification process for establishing that the irradiation process is under control.

7.3.1.1 Select a dosimetry system appropriate to the radiation source being used and the range of absorbed doses required (see Guide E 1261).

7.3.1.2 Verify that the product receives the required absorbed dose by using proper dosimetric measurement procedures, with appropriate statistical controls and documentation. Place dosimeters in or on the process load at locations of