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Food Irradiation

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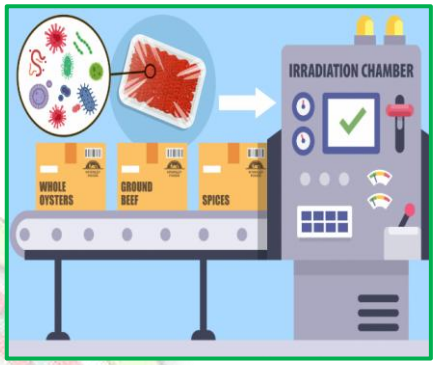

In order to prevent food poisoning (also known as a food borne sickness), food is exposed to radiation as part of a food safety process. Irradiating food is safe, and a number of federal authorities and international organizations have endorsed it for its effectiveness. Food is not rendered radioactive, nor does it change in texture or appearance. Irradiation is the method of preparing food by using electromagnetic waves to lessen deterioration and damage. Insect control and food shelf life extension are two other uses for food irradiation. Food products are exposed to ionizing radiation as part of the food irradiation process. Irradiating food is a cold technique; therefore it doesn't use heat to destroy microorganisms. Heat is used in other food safety procedures like pasteurization and canning, which you may be more familiar with. By inactivating microorganisms, food irradiation extends the shelf life of foods (Ravindran and Jaiswal, 2019). Ionizing radiation contains high energy particles, which causes chemical bonds to rupture (Hallman, 2011).Irradiation dose is measured in Grays which is the amount of energy per unit mass. The amount of energy to which a food is exposed is expressed as the "radiation absorbed dose" (rad). 1 kGy raises food by <0.5°F (Brewer, 2009).

History of Irradiation in Food Preservation

With the discovery of radioactivity in 1895, the concept of irradiation was first proposed as a way to eliminate pathogenic bacteria (Mittendorfer, 2016). The FAO/IAEA/WHO joint committee on the wholesomeness of irradiation food authorised this technology in 1981.The period of irradiated food starts in 1905. 1980 regarded food irradiation up to 10 kGy as secure and healthy. Irradiation dosages up to 10 kGy were deemed safe for food and to present no nutritional issues. More than 26 countries already employ irradiation for commercial purposes (Diehl, 2002).

Types of Radiation sources

Three principal types of irradiation source can be used in food irradiation according to the Codex Alimentarius General Standard (Food and agriculture organization, world health organization, 1984):

a) Gamma radiation from radionuclides such as 60 ˚C or 137 ˚C.
b) Machine sources of bremsstrahlung (X rays) with electron energies up to 5 MeV.
c) Machine sources of electron beams with energies up to 10 MeV.

Because of their greater penetrating capacity, ɣ rays and X rays may be used for processing of relatively thick or dense products. For situation where only a shallow penetration is needed and where rapid conveyor speeds can be used, high power electron beams may provide a higher output at lower cost per unit of product when large amounts of product are involved.

Gamma rays –The Gamma rays used in food processing are obtained from large 60 C radionuclide sources. This type of radiation is essentially monoenergetic (60 C emits simultaneously two photons per disintegration with energies of 1.17 and 1.33 MeV). Using analytical techniques such as the point kernel or monte Carlo method, it is possible to compute the dose distribution in irradiated food products.

X-rays –X-rays are produced by reflecting a high energy stream of electrons of a target substance (usually one of the heavy metals) into food. X-rays are also widely used in medicine and industry to produce images of internal structures.

Electron Beam (e-beam) –Electron beam is similar to x-rays and is a stream of high-energy electrons propelled from an electron accelerator into food.

Why irradiate food

1. Prevention of foodborne illness – Effectively eliminate microbes: salmonella and E. Coli
2. Preservation – Destroy/ inactivate organisms that cause spoilage and decomposition.
3. Control of insect – Destroys insecte.g., imported fruits
4. Delay of sprouting and ripening – Lengthen the longevity of product e.g., potatoes.
5. Sterilization- Useful for patients in the hospital especially with impaired immunity.

Dose and dose rate –Ionizing energy processes create enough of an absorbed dose to destroy microbes. Unit of absorbed dose in in food in kGy (kilograys). One of the requirements for food irradiation is the dose used. It is because each dose of irradiation has different purpose. Dose can be divided into three categories –

- Radicidation
- Radurization
- Raddapperization

➢ **Low dose < 1 kGy (Radicidation) –**

Controls insect in grain and fruits and inhibits sprouting in tubers. Delay the ripening of some fruits and vegetables. Reduce the problem of parasite in products of animal origin.

➢ **Medium Dose (1to 10 kGy) (Radurization) –**

Control salmonella, singella, Campylobacter, yersinia Listeria and E.Coli in meat poultry and fish. Delay mold growth on strawberries and other fruits.

➢ **High dose (> than 10 kGy) (Radapperization) –**

Kill microorganisms and insect in spices. Commercially sterilize foods, destroying all microorganisms of public health concern.

Limitation

- It cannot destroy already present pesticides and toxins in foods.
- Compliance of a particular food commodity to radiation processing has to be tested first in a laboratory.

- Only those foods for which specific benefits are achieved by applying appropriate doses and those duly permitted under the PFA Rules, (1955) and now FSSA regulations (2011) can be processed by radiation.

Conclusion

One of the best methods for food preservation that inactivates microorganisms and eradicates insect pests is irradiation. An efficient packaging material, which performs all the technical duties of packaging and is radiation resistant, is linked to an effective irradiation treatment on food. The advantages of food irradiation and its ability to lower the incidence of food borne illness are becoming more and more known to consumers.

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