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Food preservation by using irradiation process

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ABSTRACT *Biotechnology has commendable role in converting relatively bulky, perishable and typically inedible raw materials into more useful shelf-stable and palatable foods or potable beverages. This technology makes use of microbial inoculants to enhance properties such as the taste, aroma, shelf-life, texture and nutritional value of foods. A range of technologies is applied at different levels in food processing. Conventional or low level food processing technologies include drying, fermentation, salting, and various forms of cooking, including roasting, frying, smoking, steaming, and oven baking. Medium levels of processing technologies include canning, oven drying, spray drying, freeze drying, freezing, pasteurization, vacuum packing, osmotic dehydration and sugar crystallization. Higher-level, food-processing technologies include high-temperature short-time pasteurization and high-pressure low-temperature food processing. Almost All food preservation methods change the composition taste, appearance, texture, composition or nutritional value of the food. However, research has shown that in the case of irradiation, the change in the chemical composition of the food is minimal.*

Food is irradiated to provide the same benefits as when it is processed by other conventional techniques such as heat, refrigeration, and freezing or treated with chemicals. This process destroys bacteria including the parasites, moulds and yeasts that spoil food, salmonella and campylobactor that cause illness. Irradiation can treat insect infestation, microbiological contamination and extend the shelf-life of food. Irradiation of food involves exposing the food to a radiation electron beam and X-ray technologies which allow the energy source to be switched on and off. The food is moved into the radiation field via a conveyor belt. The gamma or X-rays irradiating the food kills bacteria, insects and pathogens and makes them biologically inactive. The irradiation process is carefully monitored to get the desired outcome without harming the food. The food itself does not become radioactive and the radiation used in the process does not have enough energy to alter the molecular structure of any of the atoms in the food.

The irradiation process does not increase the normal radioactivity level of the food, it can prevent the division of microorganisms which cause food spoilage, by changing their molecular structure. It can also slow down ripening of fruits and vegetables by modifying the physiological processes of the plant tissues.

Macronutrients (eg. protein, carbohydrates and fat) and essential minerals are not affected by irradiation of foods. But as vitamins vary in their sensitivity to heat, they also vary in their sensitivity to radiation. Vitamins A, B1 (thiamine), C, E and K in foods are relatively sensitive to radiation; while some other B vitamins such as riboflavin, niacin and vitamin D are not. The losses in nutrition value of food less and are comparable to those seen with other forms of food preservation, such as thermal processing, and drying.

Frog legs can be heavily contaminated by Salmonella and other pathogens, and irradiation can take care of this contamination. Eggs and egg products are also contaminated with Salmonella and irradiated at doses of up to 5 kGy without quality loss and that this dose provided sufficient hygienic protection. More recent work suggests 2 kGy as the most suitable dose for inactivation of Salmonella in egg powder.

Seafood, especially shellfish, is affected by Salmonella, Vibrio parahaemolyticus, and Shigella. Consumption of raw and inadequately cooked shellfish is injurious for health. But still, many people eat raw shellfish such as oysters and clams. In frozen shrimp, reduction of pathogens to a safe level requires a dose of about 3 kGy for inactivating Vibrio spp., Salmonella spp. and Aeromonas hydrophila.

Pork meat must be cooked thoroughly because it may contain Trichinella spiralis, a parasite which may cause illness and death. The larvae of this parasite can be made non-infective by irradiation with a minimum dose of 0.3 kGy. This pork in market is labelled as "trichina-safe".

Decontamination; Spices, herbs and vegetable are often contaminated with microorganisms because of the environmental and processing conditions under which they are produced. Therefore, before using as food products, the microbial load should be reduced it has been observed that heat treatment can cause significant loss of flavour and aroma, so irradiation process can be helpful. Until recently, most spices and herbs were fumigated, usually with sterilizing gases such as ethylene oxide.

Extension of shelf-life; The shelf-life of food products can be considerably prolonged by irradiations that do not alter flavour or texture. irridiation can slow down the ripening of some fruits, control fungal rot in some others and maturation in certain vegetables, thereby extending their shelf-life. For example, ripening in bananas, mangoes,and papayas can be delayed by irradiation . Strawberries are frequently spoiled by Botrytis mould. Irradiations can result in a shelf-life of up to 14 days. Shelf-life extension can be increased at least two-fold by irradiation followed by storage at 10°C, and even longer when stored at a lower temperature compared with non-irradiated mushrooms.

Disinfestation;Insect (beetles, moths, weevils and others) infestation of preserved grains can be controlled by Irra-

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diations. Methyl bromide, the most widely used fumigant for insect control, is being replaced by irradiations globally because of its ozone depleting properties, irradiation is a fast treatment and its efficacy is not temperature dependent.

Inhibition of sprouting

Sprout inhibitors such as maleic hydrazide, propham, or chloropropham are used for preventing sprouting in sprouting plant foods such as potato tubers, onion bulbs, yams. These chemicals, however, are not effective under tropical conditions or leave residues in the produce, and are considered to be harmful for health. Irradiating by low radiation inhibits sprouting of products and leaves no residues and allows storage at higher temperatures.

The limitation of irradiation process is that it cannot regenerate rotten food. Also Irradiation does not kill all bacteria. It also does not kill viruses or bacteria toxins, bacteria that cause botulism remain unaffected by radiations.

CONCLUSION

Irradiation can be one of the effective way to help reduce food-borne hazards. Irradiation is not a substitute for proper food manufacturing and handling procedures. But the process, especially when used to treat meat and poultry products, can kill harmful bacteria, greatly reducing potential hazards. Irradiation also reduces, insects, spoilage bacteria, parasites, and it inhibits sprouting and delays ripening.

Irradiated foods are safe; Irradiation process does not make foods radioactive. It may cause a small loss of nutrients, but such loss is also inevitable by other methods of preservation such as cooking, canning, or heat pasteurization.

Irradiated foods have cost slightly more than their conventional counterparts. But these costs may be offset by advantages.

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