Enhancing The Shelf-Life of Fruits from Irradiation

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Abstract

Irradiation technology is a recent technology that has proven to be effective in food safety however people remain cautious or even refuse this technology which is not yet very popular and popularized thinking that it is a toxic treatment. It is a non-thermal decontamination method that is substantially more flexible than other techniques. The irradiation technology was approved by the Food and Agriculture Organization, International Atomic Energy Agency, and World Health Organization (FAO/IAEA/WHO) joint committee on the wholesomeness of irradiated food in 1981. The irradiation of food at levels up to 10 kGy (the total average dose) was indicated to be safe and not to cause any particular nutritional issues. The positive results of this technology have been observed in many fruits such as strawberry, litchi, kinnow, guava, peach etc. Thus, helps in extending the shelf life of fruits. It is the most advanced minimum processing technique that has been extensively researched and examined.

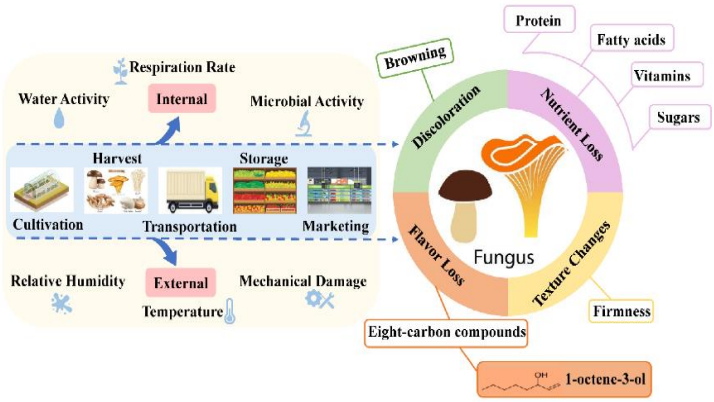
Introduction

Faced with the various technologies used today to preserve food, consumers are becoming more demanding on information relating to both the quality and the processing of food. Irradiation is a non-thermal decontamination method that is substantially more flexible than other techniques. It is the most advanced minimally processed technique for food. The irradiation technology was approved by the Food and Agriculture Organization, International Atomic Energy Agency, and World Health Organization (FAO/IAEA/WHO) joint committee on the wholesomeness of irradiated food in 1981. The irradiation of food at levels up to 10 kGy (the total average dose) was indicated to be safe and not to cause any particular nutritional issues. Using gamma, e-beam, and X-rays, several scientific research have examined the effects of ionizing radiation on a variety of foods, including fruits. The radiation damages the DNA of microorganisms, rendering them unable to reproduce and, thus, reducing their numbers. Among these, gamma irradiation is a type of ionizing radiation that uses short wavelength radiations, such as gamma rays, X-rays and accelerated electrons. Irradiation treatment can improve the antioxidant and sensory properties, along with microbiological quality while extending the shelf life of produce (Barkaoui *et al*., 2023). Various food products use gamma irradiation so as to reduce microbial growth and disinfestations. The severity of the damage caused by ionizing irradiation depends on several factors, including the type of radiation, the dose, and the duration of exposure (Barkaoui *et al*., 2021). It is one of the methods of preserving fruits by passing fruits through a radiation chamber. The radiation is emitted from radioactive forms of cobalt or cesium. The positive relationship between diet and health has raised shopper demand for more data on healthy eating, together with fruits and vegetables, with purposeful characteristics that facilitate delay aging processes and cut back risk of various diseases such as cardiovascular diseases and cancers.

With increasing consumer demand for healthier foods, the food business is searching for different technologies to keep up most of their recent attributes, safety, and storage stability. Different publications have emphasized the beneficial effects of irradiation technologies on fruit crops such as in case of berries, strawberry, guava, peach, kinnow etc. Research conducted on strawberries to study the effect of gamma radiation over a storage period of 14 days at 4°C and the results showed significant decrease in the proliferation of moulds and yeasts at 1, 2 and 3 kGy up to seven days of storage, the dose of 2 kGy was found to be the best dose to maintain the acceptance sensory quality of strawberries for the panel. The 2 kGy dose has contributed to the sensory acceptability of strawberries after 14 days of cold storage as well as to maintain the safety and global quality of strawberries with extended shelf-life (Barkaoui *et al*., 2021). Beneficial effects of gamma rays were also studied in berries in order to study its effect on bioactive components, such as anthocyanins, flavonols, procyanidins, phenolic acids, tannins and triterpenoids, vitamins and minerals (Barkaoui *et al*., 2023).

Radiation dose of 1 kGy was found to be the only effective dose in which enhanced shelf life was achieved without any deterioration of various quality attributes in litchi fruit var. rose scented (Pandey *et al*., 2013). Gamma irradiation has been successfully used as an alternative treatment for microbial disinfection (Usall *et al*., 2015). Microbial spoilage of fruits and vegetable is known as rot, which exhibits as change in texture, colour and most of the time off odour hence there is a dire need to develop methods to overcome the post-harvest losses of fruits and vegetables (Jeong and Jeon, 2018). The main problem of less shelf life as a result various microbe that may result in rotting of the fruit, the aim of the present work was to optimize a dose of gamma irradiation for fresh tomatoes that improved the shelf life of the tomato without altering its nutritional components (Munir *et al*., 2018). It was found that after 20 days of the storage period, 1.0 kGy treatment was most effective in reducing loss in weight and maintaining the fruit diameter, and was also beneficial for biochemical parameters like reducing sugar and taste of the fruits (Chandra *et al*., 2023).

Figure 1: The food system under irradiation technology



(γ, gamma radiation; e-beam, electron beam; UV, ultraviolet). (Source: Zhong *et al*., 2023)

Benefits of gamma irradiation in fruit crops

Delayed ripening

Gamma irradiation can delay ripening and senescence by suppressing the activity of respiratory enzymes, which reduces the release of carbon dioxide and ethylene.

Preservation: Gamma irradiation can prevent microbial spoilage and eliminate spoilage bacteria, insects, and parasites.

- It reduced the need for pesticides, preservatives, antioxidants, and other additives.
- It had also reduced the need for toxic chemical treatments to kill bacteria.

Conclusion

Thus, it can be concluded from the above article that by the use of irradiation technology in fruit crops, shelf life of fruits can be improved along with beneficial effects on antioxidant, microbial disinfection and sensory properties of fruit. There is no adverse effect on the nutritional parameters of the fruits due to irradiation. This method is economically and technically feasible and physically a safe technique.

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