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The Efficiency of Radiation Processing by the Tunisian 60Co Industrial Irradiator after 16 Years of Use

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Background of the study:

Since its commissioning at 1999, The Tunisian 60-Co irradiator has been mainly used for sterilization of single use medical devices and decontamination of agro-food products. At third half life, the irradiator has a low source activity. This activity leads to a very low dose rate and requires a very long processing time. Therefore, it becomes judicious to study the absorbed dose distribution in the processed product.
In this study, evaluation of the irradiator performance was carried out by placing multiple Fricke dosimeters. Dose mapping in the front and back planes of the irradiated product has been carried out and microbiological analysis has been established.

Methodology:

Taking into account its huge virtue in different diseases (cancer, heart-vascular, Cholesterol-lowering effect…) and the short time required for their irradiation, garlic 'Allium sativum L' was considered in this study. Boxes containing garlic, with dimension of (24x20.6x15.5) cm3, were irradiated with 50, 100 and 150 Gy during 7, 18 and 29 min, respectively. The determination of radiation doses measured by Fricke dosimeters are performed using UV-visible spectrophotometer. Thus, yeast, mould and mesophilic bacteria were quantified at different doses.

Results:

Isodose distribution:
The cartography performed using Fricke dosimeters allowed the determination of the dose uniformity ratio (Dmax/Dmin). Two-sided (front and back) irradiation resulted in a dose uniformity ratio of about 1.5 for garlic and 1.13 for rock wood (used for carthograpy).
For the front and back planes, the results showed a symmetrical distribution relatively to the horizontal XY plane. The maps showed that the absorbed dose reached the maximum in the center and decreased slightly keeping the same order of magnitude. Statistical uncertainty of Fricke dosimeters is about 2% and systematic error related to the source activity is below 10%.

Microbiological analysis:
Results obtained for the microbiological analysis of the irradiated and non irradiated garlic showed that irradiated garlic with known absorbed doses harbored bacteria. The high dose irradiated samples (150 Gy) were free of viable bacteria. According to the FAO permissible limits, irradiated garlic never exceeded these permissible counts.
Considerable number of yeast and mold (20000 cfu/g) were detected only in non irradiated samples. After 50 Gy irradiation dose, the number of these microorganisms decreased to (61 cfu/g) and continue to be absent for all other doses. The number of total aerobic mesophilic bacteria decreased by the irradiation. This is in agreement with literature for different food commodities.

Conclusion:

Performed studies showed that the irradiation facility at third half life gave an uniform absorbed dose rate distribution. however the processing efficacy of the actual source to preserve fresh food (fruits, vegetables,

salads and meat products) in terms of microbiological safety is not reliable regarding the very low absorbed dose rate and the required long time of irradiation. However, preserving low needed irradiation time food (garlic, oignon ...) is possible at actual activity and waiting for the 60-Co source pencils reloading.

Country/Organization invited to participate

Tunisia

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