

GAMMA IRRADIATION INDUCED CONTROL OF EPIPHYTIC MICROFLORA ON GARLIC TO ENHANCE THE SHELF LIFE

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Abstract

Gamma irradiation was used to reduce the microflora of desi garlic. The garlic samples were irradiated at different doses (0.25, 0.50 and 0.75 kGy). The results revealed that gamma irradiation significantly reduced the microflora without affecting the organoleptic qualities of desi garlic at 0.5 kGy and enhanced shelf life for one month as compared to non-irradiated garlic.

Garlic is an important spice in Asian and European countries. There are different factors responsible for garlic damage. Abiotic factors include mechanical injury during transport, packaging and storing of bulb. Physiological factors include processes like sprouting, ripening and dehydration. Sprouting is most common in garlic. This type of injury provides good substrate for the growth of bacteria and fungi. There are several methods of prevention from the microbial flora and enhance the garlic shelf life. Conventional physical methods include refrigeration, and heated air. Physical methods are comparatively cost effective but may pose risk of fungal contamination. Chemicals methods are not preferred because chemical residues on garlic may cause health risks for consumers (Sharma 2004). Radiation is safe and cost effective method used worldwide to minimize the surface micro flora and enhance shelf life of fruits and vegetable. The aim of this study was to improve the market export value which is decreasing due to post harvest losses.

“Desi” garlic bulbs of uniform size and good quality were selected, packed into perforated plastic bags and irradiated (0.5, 0.7 and 1 kGy) at Pakistan Radiation services, (PARAS) Lahore. The control and irradiated samples were stored at ambient temperature (27 - 35°C) and examined periodically every month (Farak 1991). Epiphytic microflora of garlic samples were isolated counted and identified. No surface decay was observed in case of control and 0.5 kGy irradiated garlic samples till the 2nd month after irradiation. Afterwards control sample showed sprout growth; while 0.5kGy irradiated sample’s texture turned brown slightly and showed sprouting on 5th month of irradiation. In contrast, 0.25 kGy irradiated garlic showed golden brown texture on 3rd month of gamma irradiation and incidence of sprouting was seen after four months. Those garlic samples which were treated with 0.75 kGy showed texture damaging. Hence, 0.5 kGy seemed more effective for reducing the percentage decay and sprout inhibition.

Garlic bulbs irradiated at doses of 0.25 and 0.5 kGy showed reduction in micro flora flourishing on them immediately after irradiation at room temperature storage (Fig. 1a,b,c) Perhaps it was due to the reason that gamma rays either directly damage the DNA to inactivate the microorganisms or indirectly interact with the radiolytic products of food water molecules that changes biomolecules. This hinder microbes to reproduce and ultimately food surface becomes

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pathogen free (Chauhan *et al.* 2009, Sharma 2004). Viable count of bacteria on 0.25 kGy irradiated garlic was more as compared to 0.5 kGy irradiated sample. It might be due to the reason that at low doses some microbes may become dormant for some time due to improper breakdown of DNA strands and after ligation process can be able to attack the commodity again (da Silva 2012). At 0.5 kGy irradiated samples total bacterial count was appreciably reduced as compared to fungal count.

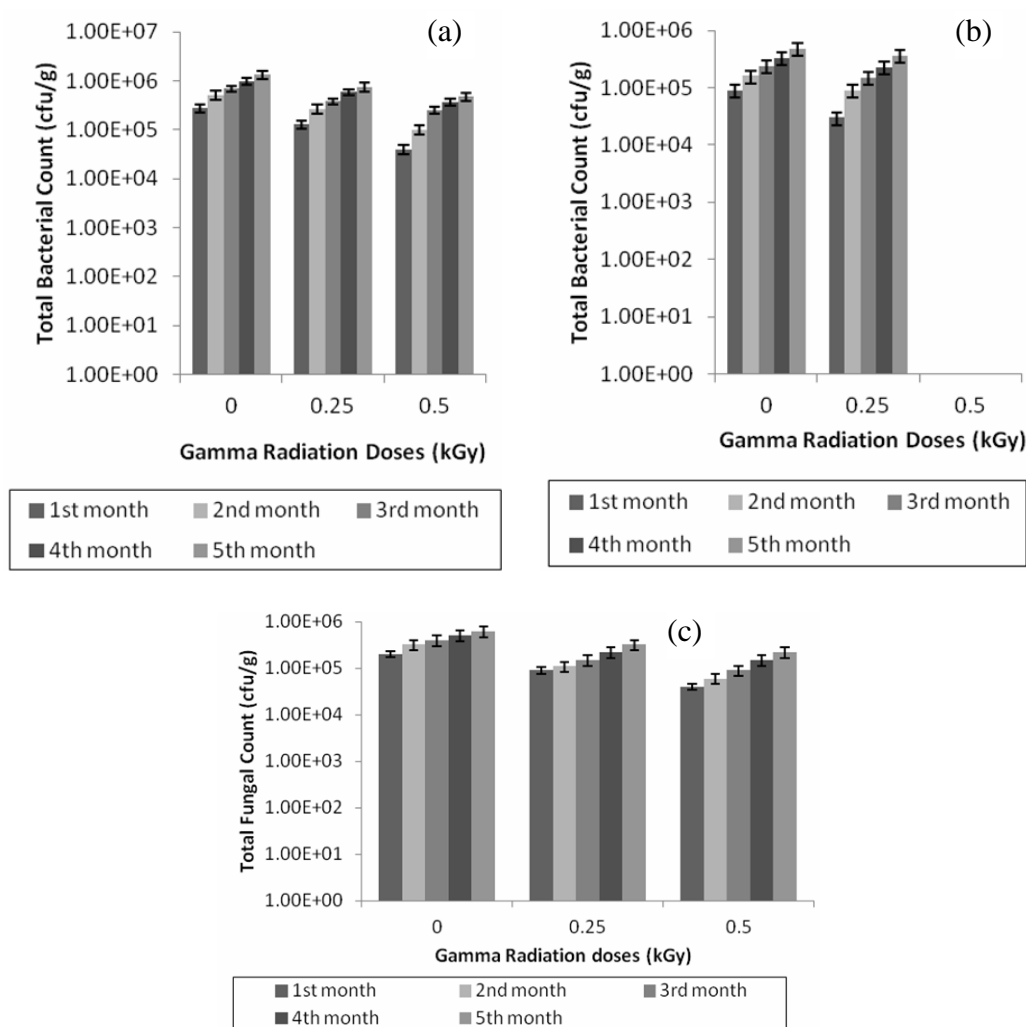


Fig. 1. Influence of different doses of gamma irradiation on epiphytic bacteria of garlic using (a) nutrient agar, (b) MacConkey agar and (c) potato dextrose agar. Each value is the mean of three parallel replicates. The error bars indicate the mean difference is significant at $p \leq 0.05$.

Gamma irradiation proved to be efficient in eliminating *Escherichia coli*, *Clostridium perfringens*, and *Bacillus cereus*. More fungal species was present on non-irradiated samples as compared to irradiated samples. Our findings were in accordance to Fuselli *et al.* (2003) and Pezzutti *et al.* (2005) who isolated bacterial and fungal species from different varieties of garlic.

Low doses of gamma radiation 0.25, 0.5 kGy showed no harm to the bulb color up to 3 months at room temperature storage (Sharma 2004). Texture softening was observed in control garlic bulbs after 3 months of storage that was possibly due to microbial attack on the garlic cell wall which brought biochemical changes to cell wall fractions resulting in breakdown of polymers like hemicelluloses, cellulose and pectin.

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