

3.1.3. Food Microbiology

Decontamination of spices by gamma irradiation

The contamination of spices occurs during harvesting, handling, transportation and storage. Spices with a high bio-burden used in food industries, cause spoilage of food products. There have been many reports that radiation treatment is a suitable method for the decontamination of the spices. However, the work on spices in Pakistan has only recently been initiated. Many spices also show losses to some degree in their volatile oils and other important constituents. Radiation treatment was, therefore, used in these studies and the results are reported as under:

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1. Influence of storage on fungal infestation in spices

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A survey, conducted during the past year, had revealed considerable fungal spoilage of spices. It was, therefore, considered worthwhile to study the influence of storage and gamma radiation on fungal control in spices. The results relating fungal count and fungal infestation during initial 6 months storage of irradiated and unirradiated caraway and black pepper have already been presented earlier. Table 1 shows the effect of irradiation on total fungal counts and fungal infestation during the entire storage period. The spices such as caraway and black pepper were irradiated with 5.0, 7.5 and 10.0 kGy and stored under ambient conditions for 12 months. The initial fungal counts were 4.3×10^2 in the caraway and 3.0×10^2 in black pepper and the initial infestation was observed 60 and 70% in caraway and black pepper respectively.

The fungal count and fungal infestation decreased to almost undetectable levels upon irradiation especially at 7.5 and 10 kGy radiation doses. The fungal counts increased considerably after each successive storage interval. The increase in fungal contamination was faster in the unirradiated samples and the rate decreased with increasing level of irradiation dose from 5 to 10 kGy. At the expiry of 12 months storage, the fungal counts ranged from 1.0×10^5 to 1.0×10^7 in caraway and 4.6×10^5 to 8.7×10^7 in black pepper. Similarly, fungal infestation

TABLE 1: THE EFFECT OF GAMMA RADIATION ON THE FUNGAL COUNT AND FUNGAL INFESTATION IN SPICES.

Fungal count/gm and fungal infestation (%)

Spices	Dose (kGy)	Storage period - Months											
		2		4		6		8		10		12	
		F. count	Inf. F. count	Inf. F. count	F. count	Inf. F. count	F. count	Inf. F. count	Inf. F. count	F. count	Inf. F. count	Inf. F. count	Inf. F. count
Caraway	0	5.4×10^2	50	6.9×10^2	68	9×10^2	70	1.6×10^4	70	9.6×10^5	75	1.0×10^7	80
	5.0	3.0×10^2	22	3.9×10^2	25	4.6×10^2	26	8.9×10^3	25	4.6×10^4	30	5.2×10^6	35
	7.5	2.4×10^2	20	2.9×10^2	25	3.6×10^2	25	4.5×10^3	25	4.0×10^4	30	4.0×10^5	32
	10.0	1.0×10^2	10	1.6×10^2	15	2.6×10^2	16	3.6×10^3	20	1.0×10^4	20	2.7×10^5	24
Black pepper	0	2.4×10^3	65	4.9×10^3	70	4.6×10^4	75	2.5×10^5	72	3.6×10^6	75	8.7×10^7	84
	5.0	3.9×10^2	24	4.6×10^2	27	5.9×10^2	28	2.7×10^3	30	7.9×10^4	30	6.6×10^5	40
	7.5	2.8×10^2	22	3.6×10^2	24	4.6×10^2	26	1.8×10^3	28	4.6×10^4	30	6.5×10^5	36
	10.0	1.8×10^2	12	2.9×10^2	15	2.9×10^2	16	1.2×10^3	22	2.3×10^4	25	4.6×10^5	30

Initial values: Fungal count - caraway 4.3×10^2 ; Black pepper 3.0×10^2

Infestation - caraway 60%; Black pepper 70%

decreased to undetectable levels upon irradiation of these spices especially at higher doses. However, infestation increased with advanced storage period in both the irradiated and unirradiated samples, and the increased was considerably higher in the untreated than treated samples.

In caraway, the fungal infestation was found to vary from 24 to 80% after 12 months at ambient conditions depending upon the irradiation dose. In the case of black pepper, the infestation values were between 30 and 84% after 12 months of storage depending upon the dose level. The fungi associated with different spices consist mainly of the Aspergillus glaucus, A. restrictus, A. flavus, A. fumigatus and A. niger groups, and Penicillium and Rhizopus and lower frequencies of A. ochraceus and A. wentii groups. Some of these strains are aflatoxins producing.

2. Biochemical and Microbiological quality of spices

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The spoilage of spices is generally due to microbial contamination as well as development of off-flavours due to oxidation of oils. In view of wide utilization of spices in Pakistan, research studies were conducted to investigate the influence of irradiation doses (2-10 kGy) on bacterial and fungal contamination as well as colour and volatile components during storage of spices. The spices included in this study were black pepper, chillies, coriander, cumin and turmeric. The colour evaluation of spices immediately after irradiation treatment (4-8 kGy) is shown in Table 2. The L, a and b values denote a specific colour and are hence used to determine the extent of change in the colour of many food materials. The L values indicate the lightness of the sample, a value redness and b value yellowness. The L, a and b values were obtained using colour difference computer. The data indicated that radiation treatment had slight effect on these values. However, L and a values increased with increasing radiation dose in coriander whereas b values increased in the black pepper. In other cases, no significant differences were observed.