

PROLONGATION OF THE STORAGE AND QUALITY PRESERVATION OF POTATO SEMI-FINISHED FOODS BY SPECIFIC TECHNOLOGICAL TREATMENT

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Abstract

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In the food industry are applied modern methods for processing and storage of products of animal and plant origin. In contrast to the past when more attention was paid to productivity, now the requirements are moving towards searching of technologies which guarantee the obtaining as end product of foods with high purity and preserved nutritious value. One of the approved technologies in this field is the gamma-ray sterilization, the so called cold sterilization. According to many years researches of IAAE and FAO the consumption of foods irradiated with doses up to 10 kGy is absolutely harmless for the human organism. During the study was investigated the effect of gamma irradiation on potato semi-finished foods. The samples were irradiated a single time with doses 100, 150 and 200 Gy. They were stored at temperature 0-4°C for three months term and prolongation of the preservation of the irradiated samples with 30 days was established. The results have shown that the applying of the traditional technology is an appropriate method for obtaining of harmless and with preserved taste qualities foods.

Key words: food quality, potato semi-finished foods, gamma-ray sterilization

Introduction

Each technological process should be characterized by an optimum effect in order to avoid to a maximum degree product spoilage which could lead to worsening of the quality and decrease of its biological value. This is especially true for irradiation as a method of preservation, having in mind its many-sided effect on the aroma, the structure, the color, the appearance, the biochemical changes, etc.

The ionizing radiations are a powerful means for inactivation of microorganisms and other pests in food industry. Their penetrating capacity allows the treatment of products with considerable thickness, complex form and various packaging. For this reason irradiation is applicable for prolongation of the storage term of different food kinds, spices, products subjected to culinary treatment and others. During

irradiation of foodstuff in their components occur considerable changes. In case of a correct process of radiation treatment the nutritious qualities of the products are preserved, the same as with the traditional ways of food preservation (Diehl, 1995).

Today the frozen potato semi-finished products are a mass commodity all over the world (Delibeev, 2003), hence the problem for the safe storage of these products in view of the increasing on a global scale of the diseased caused by contaminated foods. The using of ionizing radiations as a method of cold sterilization can ensure a reduction and elimination of the pathogens in foodstuff (Kaloyanov et al., 1991; Radomyski et al., 1994). It has been established that the irradiation of potatoes with low gamma-ray doses leads to a prolongation of the shelf life without affecting their gustatory qualities (Antonov and Tzvetkova, 1998; Codex Alimentarius, 1983).

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Main objective: To study the effect of gamma irradiation on the quality and shelf life of potato semi-finished products.

Materials and Methods

Comparative analyses were carried out with blanched potatoes of two companies on the Bulgarian market “Vita Foods Ltd.” and company “Degustos”. For the sake of brevity we marked the samples as type A from the first company and type B from the second company. The irradiation was carried out on gamm and 200 Gy, respectively. The experimental and control samples were stored at -18°C . The microbiological analyses were carried out according to the requirements for purity of processed potatoes— Total number of aerobic microorganisms, Salmonella in 25 g, Coliform and Proteus bacteria in 1 g, coagulase-positive Staphylococci in 1 g, sulphide reducing Clostridia 0.1 g, Yeasts and Fungi.

The taste assessment was carried out by a nine grade scale from the methodology of Institute for Storage and Processing of Agriculture Products (Benkenn and Van Der Zaag, 1990). The assessment of the culinary qualities was made of 8 main qualities and properties of potatoes: color, taste, mealiness, wateriness, view, texture, structure, suitability and braising.

Results and Discussion

The results from the microbiological investigations in relation to total number aerobic mesophyll microorganisms are presented in Table 1.

The initial number aerobic microorganisms was not great $1,38 \cdot 10^3$ CFU/g for the samples type A and $1,49 \cdot 10^3$ CFU/g for the samples type B. During the storage of the non-irradiated potatoes at temperature -18°C , the number of micro-

organisms decreased to $4 \cdot 10^2$ CFU/g for the first variant and $3 \cdot 10^2$ CFU/g for the second variant on the 38th day of storage.

On 0 days the potatoes irradiated with the three gamma-ray doses didn't contain any microorganisms. This demonstrates the reducing effect of the applied low doses – 100, 150 и 200 Gy. On the 10th day of storage an insignificant growth was observed in the experimental potato groups. In the fourth group again there was no growth of microorganisms, which shows that the dose of 200 Gy is appropriate for longer storage. For the potato semi-finished products of type A at this dose a microbial purity was kept till the 24th day of storage. For the remaining experimental groups was established a minimum number aerobic mesophyll microorganisms till the 38th day. Differences between the potato semi-finished products irradiated with different gamma-ray doses were not established.

In the composition of the total number aerobic microorganisms have been established *St. albus*, *St. citreus*, *Bacillus*, *micrococci*.

The results from the microbiological analyses by the other characteristics showed a lack of Salmonella bacteria, coagulase-positive Staphylococci, Coliform and Proteus bacteria, as well as sulphide-reducing Clostridia, for the whole storage period.

The results of the physical-chemical analysis are presented in Table 2.

The dry substance in the potatoes was not influenced by the applied gamma-ray doses, as it was kept in the range 27-29% till the 38th day of storage. The content of proteins was around 6% of the dry substance and remained unchanged during storage. The change in the pH value – 5.77 - 5.91 was also not recorded, which shows a stability in the quality of potatoes as food.

An assessment was made of the culinary qualities of the two types semi-finished products, irradiated with different

Table 1
Total number of aerobic and mesophyll microorganisms (average values CFU/g) in non-irradiated and irradiated potato semi-finished foods stored at -18°C

Storage	First group non irradiated potatoes		Second group irradiated with 100 Gy		Third group irradiated with 150 Gy		Fourth group irradiated with 200 Gy	
	Type A	Type B	Type A	Type B	Type A	Type B	Type A	Type B
1. for 0 days	$1,38 \cdot 10^3$	$1,49 \cdot 10^3$	0	0	0	0	0	0
2. for 10 days	2.102	$2,28 \cdot 10^2$	6.102	$1,3 \cdot 10^3$	1.102	1.102	0	0
3. for 24 days	3.102	2.102	2.102	2.102	1.102	1.102	0	1.102
4. for 38 days	4.102	3.102	2.102	2.102	1.102	1.102	1.102	1.102

Table 2

Results from the comparative physical-chemical analyses during storage of two type (A and B) potato semi-finished product, supplied from the commercial network

Storage	Dry substance in %		Fats in % of dry substance		Protein in % of dry substance		Ash in % of dry substance		pH - value	
Non irradiated										
Type	A	B	A	B	A	B	A	B	A	B
0 days	28.82	27.7	13.8	14.02	6.8	6.66	8.74	7.8	5.82	5.83
10 days	28.88	27.8	13.14	13.9	5.99	6.32	7.44	7.65	5.78	5.8
24 days	29.07	28.8	13.63	14.55	6.06	6.4	6.19	7.2	5.82	5.78
38 days	29.09	28	13.71	14.9	6.7	6.5	5.12	6.96	5.91	5.95
Irradiated with 100 Gy										
0 days	28.56	27.5	12.6	13.8	6.61	6.8	7.11	7.2	5.83	5.85
10 days	30.72	28.02	14.09	13.63	6.27	6.75	6.96	7.15	5.8	5.87
24 days	29.72	28.5	12.17	13	6.02	6.7	8.81	7.57	5.89	5.9
38 days	29.46	29.2	14.05	14.95	6.41	6.8	8.11	7.9	5.88	5.87
Irradiated with 150 Gy										
0 days	28.7	28.35	12.58	12.17	6.8	6.7	7.14	8.13	5.83	5.9
10 days	29.71	28.52	13.28	13.71	6.05	6.55	5.95	7.11	5.78	5.88
24 days	27.6	27.59	14.05	13.92	6.3	5.76	8.4	7.97	5.83	5.82
38 days	28.62	28.2	12.68	14.97	5.52	5.68	7.37	8.1	5.89	5.87
Irradiated with 200 Gy										
0 days	28.7	28.3	12.43	12.1	6.27	6.65	7.1	7.13	5.77	5.6
10 days	29.71	28.6	12.92	12.58	5.95	6.8	4.74	6.96	5.85	5.89
24 days	28.64	28.2	11.9	13.05	6.52	6.57	7.82	7.54	5.8	5.67
38 days	29.77	28.8	13.13	14	6.18	5.97	7.15	7.8	5.82	5.84

Table 3

Assessment of the gastronomical qualities of the two types potato semi-finished products irradiated with different gamma-ray doses

Type	Dose Gy	Fitness	Softness	Appearance	Consistency	Mealiness	Wateriness	Structure	Taste	Color
A	K	8	9	7	8	7	7	8	8	9
	100	8	9	7	6	8	6	7	7	9
	150	8	9	7	7	8	6	6	9	8
	200	8	9	7	6	8	5	6	8	6
B	K	9	9	8	6	7	8	6	9	9
	100	8	9	7	6	6	6	6	9	9
	150	8	9	7	6	7	6	6	8	7
	200	8	9	7	6	7	8	6	7	6

gamma-ray doses. The results from the investigations are presented in Table 3.

In the most of the studied parameters was no significant difference in scores between irradiated and non-irradiated potato semi-finished products during long storage.

It was established that for the samples of type A, which are with an increased concentration of potassium and starch there was no sweetish taste, i.e. the level of sugars is low. For type B, in whom the sugars content is increased, sweetish taste for all variants was established.

Conclusion

The applied gamma-ray doses prolong the storage term with 30 days compared to the control of the analyzed potato semi-finished products. An increase of the seeding with microorganisms is not observed and their gustatory qualities are preserved. The obtained results prove that the applying of the radiation technology is modern and safe for human health. The dose of 200 Gy is appropriate for a longer storage for the variants of type B.

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