FUNCTIONAL BREAD WITH IODINE

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Abstract: A research has been conducted concerning the fortification of bread with iodine by using iodinated salt and iodine compounds in industrial conditions. Experimental samples of bread were manufactured. Physical-chemical, microbiological and sensory parameters were examined, as well as the iodine preservation rates.
The developed technology of iodinated bread was patented and was awarded the silver medal at the International Exhibition "Infoinvent-2009" and also with the diploma of Great Mention "Invenția anului-2011".
The collected data were used as a basis for the development of technology and industrial manufacturing of bread with guaranteed iodine content.
Key-words: iodine, technology, bread, industrial production

Introduction

The deficit of iodine is one of the most frequent alimentary diseases. According to the data of the World Health Organization, around 2 billion people on the Earth suffer from various degrees of iodine deficiency. The iodine insufficiency is caused by the low content of this microelement in potable water and foodstuffs conditioned by the particularities of geochemical composition of soils and by the alimentary patterns of population.

The natural environment of the Republic of Moldova is characterized by low values of iodine content: 4,5-5,3 mg/kg in the soil, 40 mcg/l in water and 0,03-0,22 mg/kg in vegetable products (recalculated to dry substance) - all these being a favoring factor for thyroid gland diseases. The standard food allowance of the country's population composed of traditional nutrients and ready dishes of sufficient caloric contents can not fully satisfy the need for all vitamins and minerals. Small quantities of iodine may be found in natural products (non-frozen sea products – sea wand, sea fish, shrimps, squid). Additional iodine consumption is assured by iodination of cooking salt and its use in the food industry [1], as well as by inclusion of iodine compounds into foodstuffs. This approach to the solution of the problem is well acknowledged in the entire world and is recommended by competent international organizations.

For the overwhelming majority of the country's population bread is a traditional foodstuff of mass consumption. Bread and bakery products occupy an important place in the people's food allowance and in this manner the enrichment of these foodstuffs with iodine is considered to be as the most rational perspective allowing to cover the widest social strata.

Aim of research

Elaboration of a technology of production of bread enriched with iodine. Investigation of the possibility of using iodinated salt and other iodine compounds permitted by the health protection authorities of the Republic of Moldova for the creation of a functional product with guaranteed iodine content.

Research methods

Technological research methods

For the conduction of works related to the enrichment of bread and bakery products with iodine a systemic approach was used to include: selection of iodine compounds, determination of their dosage; determination of compatibility of iodine compounds with the product components; simplicity and convenience of usage; study of the impact of iodine compounds on the bread quality, dough properties; preservation of iodine during the technological production process and during the storage of finite products, as well as the economic aspects of enrichment of bakery products with iodine [1].

The enrichment of bread with iodine was effected based on the following rule: every 200 – 250 g of consumed bread shall contain 75 mcg of bound iodine (for adults aged 12 and above), that corresponds to a half daily requirement for iodine. As possible iodine compounds for enrichment were considered: iodinated cooking salt (with KJO_3 supplement) – as per GOST 13830 and the following iodine compounds: potassium iodide (KJ) – as per GOST 4232, potassium iodate (KJO_3) – as per GOST 4202, iodis-concentrate – ТУ У 14326060.003 (НПК «Йодис» Ukraine), iodine-casein – ТУ 9229-001-48363077-02 (НПП «Медбиофарм», Russia). The quantity of iodine containing supplement for the production of bread was determined based on the content of iodine in the compound itself minus the losses assumed during the production and storage of product.

The experimental samples of bread with use of iodinated salt and iodinated compounds based on the elaborated recipes and the reference samples of products were produced in industrial conditions on the bakery enterprise «ODIUS». The samples of finite products were packed into shrinkable film. Quality parameters were determined after baking as well as during 96 hours from production.

Physical-chemical and microbiological research methods

The physical-chemical parameters of bread and bakery products were determined in accordance with the following standardized methods: crumb humidity – as per GOST 21094; crumb acidity – as per GOST 5670; crumb porosity – as per GOST 5669; mass fraction of total iodine – as per IM 06.10/15.386 and GOST 13685; aerobic and elective anaerobe mesophilic organisms – as per GOST 10444.15; moulds – as per GOST 10444.12; potato disease of bread – as per SM 173;

Sensory evaluation

The sensory evaluation of finite products was performed by the Institute's Tasting Commission using a scale of 5 points.

Results and discussions

The content of iodine in the salt imported into the Republic of Moldova is at the level of 25 mgI/kg…35 mgI/kg of salt. Taking into consideration the salt consumption in the bread production prescribed by the respective recipes, the use of iodinated salt would provide a content of iodine in 200 g of bread at a level not exceeding 53% of the half-daily iodine requirement of an adult person. For this reason, in order to provide for a guaranteed half-daily requirement of iodine we have conducted a research of the possibility of combined use of iodinated salt and iodine supplements. The results of the said research are set out in the Tables.

The analysis of obtained data stipulates that the use of iodine preparations doesn't decrease the rated parameters of bread, including humidity, acidity and porosity of crumb compared to the reference alternative (see Table 1). Moreover, the use of potassium iodate improves considerably the properties of dough and gluten: thinning and smearing are reduced, a number of indicators is improved – specific volume, formation stability and porosity. In addition, the use of potassium iodide prevents the development of potato disease and moulds. During storage none of the samples displayed any signs of potato disease (table 2), that fully corresponds to the data provided in the literature [3].

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A high rate of iodine preservation was determined both in the bread production process with use of iodine supplements and during storage (70 to 95%). The content of iodine after three days of storage changes insignificantly compared to the initial values. The most evident loss of iodine was observed in the bread prepared with addition of bran where the crumb acidity was the highest (0,42% recalculated to lactic acid). This fact conforms to the data of iodine preservation in model systems where it was determined that the highest losses of iodine are observed in the system «iodine-casein - 1% acetic acid». The cooking salt exerts a protective action on the iodine preservation, while the organic acids tend to reduce it [4].

The use of iodine supplements increases the bread production costs somehow: use of potassium iodide or potassium iodate – by 1 bani, iodine-casein - by 4,5 bani, iodis-concentrate – by 41 bani.

Table 1. Results of microbiological analyses of bread performed during storage at temperatures 20-25ºC, packed

Bread description/ sample number	Iodine preparation	Parameters						
		After baking			96 hours after baking			Iodine preservation rate, % of
		crumb humidity, %	crumb acidity, deg	crumb porosity, %	crumb humidity, %	crumb acidity, deg	crumb porosity, %	
Top grade wheat flour bread, SM 173 / 1	-	33,0-46,0	2,5-3,5	min .65	33,0-46,0	2,5-3,5	Min. 65	-
Top grade wheat flour bread, control / 2	-	41,1	3,3	74,8	40,4	3,2	74,4	-
Top grade wheat flour bread / 3	KI	40,2	2,0	75,0	39,9	1,9	74,8	78
Top grade wheat flour bread / 4	KIO_3	40,8	2,3	76,2	40,0	2,2	76,0	80
Top grade wheat flour bread / 5	KIO_3	40,0	1,8	77,1	37,6	1,9	76,3	96
Top grade wheat flour and bran bread / 6	KIO_3	40,5	4,8	75,2	39,8	4,5	77,6	70
Top grade wheat flour bread / 7	Iodineasein	41,2	2,0	73,4	39,9	1,8	72,0	95
Top grade wheat flour bread / 8	Iodis-concentrate	40,9	1,8	72,9	39,9	1,8	71,8	96
Wheat and rye flour bread-GOST 28807/ 9	-	41,0-53,0	5,5-12,0	min.46	41,0-53,0	5,5-12,0	Min. 46	-
Rye and wheat flour bread experimental sample / 10	KI	41,1	6,0	66,7	41,0	6,0	66,4	91
Rye and wheat flour bread experimental sample / 11	KIO_3	41,1	5,5	67,4	41,0	5,5	65,8	94

Indicators	Norm by SANPiN 2.3.2.1078-01	Seeding value during storage				
		Backgroun	24 hours	48 hours	72 hours	96 hours
Coliforms, mesophilic, anaerobe and opportunistic anaerobe germs,	No more than $1x10^3$	-	-	-	-	-
Coliform group germs / 1g	Not allowed	not	not	not	not	not
Moulds, KOE/ cm^3	No more than 50	< 1x10	< 1x10	< 1x10	< 1x10	< 1x10
Potato disease	Not allowed	not	not	not	not	not
Coliforms, mesophilic, anaerobe and opportunistic anaerobe germs,	No more than $1x10^3$	-	$5,2x10^1$	$5,0x10^1$	$4,4x10^1$	$4,5x10^1$
Coliform group germs / 1g	Not allowed	not	not	not	not	not
Moulds, KOE/ cm^3	No more than 50	< 1x10	< 1x10	< 1x10	< 1x10	< 1x10
Potato disease	Not allowed	not	not	not	not	not
Coliforms, mesophilic, anaerobe and opportunistic anaerobe germs,	No more than $1x10^3$	$8,2x10^1$	$8,0x10^1$	$7,5x10^1$	$6,9x10^1$	$6,2x10^1$
Coliform group germs / 1g	Not allowed	not	not	not	not	not
Moulds, KOE/ cm^3	No more than 50	< 1x10	< 1x10	< 1x10	< 1x10	< 1x10
Potato disease	Not allowed	not	not	not	not	not

Table 2.

Product	Sample 3	Sample 6	Sample 10

The developed technology of iodinated bread was patented and was awarded the silver medal at the International Exhibition "Infoinvent-2009" and also with the diploma of Great Mention "Invenția anului-2011".

Conclusions

The obtained results allow us to make a conclusion that the use of iodine preparations doesn't alter the organoleptic quality parameters of the bread enriched with iodine compared to the reference samples, fully confirming the compatibility of iodine supplements with the components of dough and bread specified by the applicable recipes and the opportunity of their use in the industrial production of bread. The data obtained in the result of the performed research may be used as basis for the organization of industrial production of bread with a guaranteed iodine content in the Republic of Moldova.

Reference

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