Bulletin of the *Transilvania* University of Braşov
Series II: Forestry • Wood Industry • Agricultural Food Engineering • Vol. 10 (59) No.2 – 2017

DEVELOPMENT OF «BORODINSKY» BREAD PRODUCTION TECHNOLOGY USING SCALDED SEMI-FINISHED PRODUCT «EIVA ESTONIA»

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Abstract: *The aim of this research is to study the feasibility of using scalded semi-finished product «Eiva Estonia» in «Borodinsky» bread production. A method of production of «Borodinsky» bread with improved organoleptic and physical-chemical indicators was developed. A formula of a new type of a product was presented. Operational conditions of the bread were considered in depth. The ingredients of the scalded semi-finished product «Eiva Estonia» were described. The physical-chemical and organoleptic indicators of the end product were studied.*

Key words: *bread, scalded semi-finished product, production process, formula, quality indicators.*

1. Introduction

Nowadays, bakery products, made, using rye flour, pregelatinized flour and ferments in a range of European countries belong to a group of healthy and dietary products [20]. The improvement of technology, the use of new types of unconventional vegetable and mineral raw materials is an urgent problem with these positions for this branch, the solution of which will allow not only to expand the assortment of bakery products for healthy nutrition, but also to increase their nutritional value [6]. This direction is of special importance for the food industry since bakery products as they are daily, mass-market ones and they belong to socially important food items [7], [9].

Malt bread is a pan loaf that consists of dark rye flower, water, salt, yeast, fermented malt with a possible addition of caraway and other spices. A formula peculiarity of malt bread is in the use of pregelatinized flour – the mixture with flower with white or red malt and brewing with boiling water during its production. This method of production helps the malt

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bread remain fresh longer and it gives the bread a special taste with the addition of spices [11], [19]. The malt rye bread has five times more fiber than the wheat one. Fiber relaxes the bowels and removes harmful chemical substances and toxins. A large number of minerals - calcium, iron, phosphorus, magnesium, potassium, and also vitamins of group B make the malt bread a healthy part of an everyday menu [3], [4].

Scalded semi-finished products are a natural fermented pregelatinized flour (pregelatinized flour + ferment = "two-in-one"). In this case the rye flour is used to make pregelatinized flour. There are different types of pregelatinized flours, but they all have similar effect, they all increase the amount of sugar in the dough to a certain extent and improve physical features of the bread [2]. There is always some sugar in the flour (1–3 %), but the starch makes its main mass (about 70 %). In addition, there is some diastatic enzyme in the flower, which can transform flour starch into sugar. The diastanic value (power), that is the ability of the flour to create normal dough and bread, is determined by the presence of the formed sugar [5]. Flour baking qualities are determined, mainly, by the quality and the quantity of gluten and flour's diastanic value. The average flour's diastanic value with a normal amount of sugar in the flour conduces sufficient generation of gas while dough fermentation, and good gluten helps to keep this gas in the dough. As a result, the best bread can be produced. Since the pregelatinized flour is used to increase the amount of sugar in the dough, quantity of the pregelatinized flour depends on the diastanic value of the flour. The higher the flour's diastanic value, the less pregelatinized flour should be used and vice versa. The dark has a greater diastanic value than the top-grade flour [15], [16].

The essence of brewing is that when the flower is brewed with hot water, the starch in it starts gelatinizing and saccharifying under the influence of amylase ferment (diastatic enzyme). The optimum saccharification temperature of the amylase gelatinized starch is about 63 °C.

Using the brewing gives the following advantages:

– increases the amount of sugar in the dough;
– improves of flour's baking qualities;
– improves of the bread's flavor;
– increases of yield of bread (stuffing) due to a greater binding of water to gelatinized starch (up to 3-5 %);
– slows down the firming of bread [12], [14].

2. Material and Methods

The basis for the production of "Borodinsky" bread is a unifying recipe with the use of scalded semi-finished product "Eiva Estonia" (TS 9113-001-31058817-2014) [8]. The recipe for "Borodinsky" bread with scalded semi-finished product "Eiva Estonia" is shown in Table 1.

The moisture content was identified by drying the analyzed sample of the product at a certain temperature and calculating the weight loss with respect to the mass of the sample analyzed before drying.

The acidity of the crumb was identified by titrating the filtrate, obtained from bread crumbs by an accelerated method. The porosity of the product was determined using a Zhuravlev probe. From a piece of crumb at a distance of at least 1 cm from the crusts some grooves are made with the cylinder of the device.

The recipe for "Borodinsky" bread with scalded semi-finished product "Eiva Estonia" Table 1

Name of raw materials and semi-finished products	Raw materials consumption for 100 kg
Wheat flour	37,140
Rye flour	24,860
Scalded semi-finished product "Eiva Estonia"	11,430
Rye malt	1,140
Sand sugar	1,430
Kosher salt	0,570
Compressed yeast	0,570
Ground coriander	0,430
Water	37,430
Total	115,0
Yields	100,0

The sharp edge of the cylinder, previously lubricated with vegetable oil, is inserted by rotational movement into the crumb of the piece. The cylinder filled with crumb is placed on the tray so that its rim tightly enters the slot on the tray. Then the bread crumb is pushed out of the cylinder by the plug, for about 1 cm, and cut it off at the edge of the cylinder with a sharp knife. The cut off part of the crumb is removed. The remaining piece of crumb in the cylinder is pushed out by the plug to the wall of the tray and is also cut off at the edge of the cylinder [18].

The porosity is the ratio of the pore volume of the crumb to the total volume of the crumb, expressed as a percentage.

The weight fraction of sugar was determined by the accelerated method of hot titration. The method is based on the ability of reducing sugars to reduce the cupric copper to the cuprous one in an alkaline solution. The weight fraction of sugar is determined by titrating the copper-alkaline solution with the studied sugar solution. The weight fraction of fat was determined by the extraction-weight method.

The method is based on the extraction of fat from the analyzed sample of the product with a solvent and determining the mass fraction of fat after removing the solvent [10].

All measurements were repeated three times. Statistical analysis was performed using the following software packages: Microsoft Excel XP, Statistica 8.0. Statistical error did not exceed 5% (with a 95% confidence level).

3. Results and Discussion

The method of preparing of Scalded semi-finished products consists of several stages.

The first stage is to prepare a thick fermentation starter with a moisture content of 48-50% and acidity content of 13-16 degrees [17]. A small amount of rye flour and water is mixed with a small amount of ferment that was made previously. After several hours of fermentation of this first ferment, it is refreshed, and additionally increased by adding more flour. The second ferment obtained that way after several hours of fermentation is refreshed and replenished with the addition of flour and water. This third ferment, after several hours of fermentation, is a bulk starter, which is ready for use in the production run. The second stage is to prepare a brew. It is prepared from flour, water and fermented rye malt in a ratio of 1:3 by heating the

water-flour mixture to the temperature of the starch (62–65 °C), the duration of saccharification is 2-4 h. The third stage is mixing ferment and brewing with the addition of some extra raw materials - salt, vegetable oil and spices. After that we gradually cool the derived semi-finished product to a temperature of 10 ° C during 4 hours [1].

Operational conditions are shown in Table 2.

Operational conditions Table 2

Schedule	Characteristics
Kneading time	On the 1st speed – 8 min., On the 2nd speed – 3 min.
Dough temperature, °C	26–28
Fermentation time, min	40
Final proofing, min	60
Baking time, min	45
Baking temperature, ° C	230–190–180

The dough for «Borodinsky» bread with scalded semi-finished product “Eiva Estonia” is prepared in an accelerated, straight dough procedure. The water is fed through a water doser-mixer or other water portioning devices at a temperature of 34-35 ° C in the container of the kneading machine MAG80 or other types. Next, the raw materials are added in accordance with the recipe and kneaded to a homogenous consistency (Fig. 1).

Fig. 1. *Mixing of ingredients for “Borodinsky” bread with scalded semi-finished product “Eiva Estonia”*

The description of the scalded semi-finished product "Eiva Estonia" is represented in Table 3.

The dough kneading is done at the 1st speed – 8 min, at the 2nd speed – 3 min. The duration of the dough kneading depends on the amount of the dough and it can be changed. The temperature of the kneaded dough is 26-28 °C (Fig. 2).

Characteristic of scalded semi-finished product "Eiva Estonia" Table 3

Nomination of the raw material	Description	Ingredients
Scalded semi-finished product for bread baking "Eiva Estonia"	Rye fermented brewing on a dark rye malt with the addition of dark barley malt flour	Water, rye flour, fermented rye malt, ground barley malt, salt, rye unfermented malt, vegetable oil, spices, barley malt extract

Fig. 2. *The dough kneading for "Borodinsky" bread with scalded semi-finished product "Eiva Estonia"*

Dough fermentation takes 40 min. Then the dough handling and its forming begins. Ready fermented dough is worked either with hands or in a dough dividing machine «DISVAL» with dough pieces of the weight prescribed in the recipe. The proofing of bakery products is carried out in a proofer at a temperature of 34-37 ° C, with humidity of 75-85%. The proofing time is 60 minutes.

Bread making is done in the ovens of any type in a humidified baking chamber.

Estimated duration of baking of molds weighing 0,390 kg is 45 minutes at a temperature of 230–190–180 °C (it is recommended to open the gate 5 minutes before the end of baking) [21].

The indicated parameters of proofing and baking can vary depending on the quality of raw materials, production conditions, and type of equipment, design features and the conditions of its use.Bread, taken out of the oven, should be immediately placed in trays. Cooled products can be cut into slices of the same shape and approximately the same thickness, avoiding deformation and excessive crumbling before being packed. Finished products are put into cargo containers or packed and then put unto cargo containers [5].

At the next stage of the research, the physical-chemical and organoleptic researches of the finished product (Tables 4 and 5).

Preparation of "Borodinsky" bread using scalded semi-finished product “Eiva Estonia” –is, first of all, a reduction of technological production process of bread by half the time. It also allows producing the bread with high organoleptic and physical-chemical indicators.

Physical-chemical quality indicators of “Borodinsky” bread with scalded semi-finished product “Eiva Estonia” Table 4

Indicator name	Study outcomes
Moisture of the crumb, %,	45±0,8
Acidity of the crumb, deg.	3,9±0,35
Porosity, %	50±1,0
The weight fraction of sugar (on the dried basis), %	11,02
The weight fraction of fat (on the dried basis), %	0,93

Organoleptic indicators of “Borodinsky” bread with scalded semi-finished product “Eiva Estonia” Table 5

Indicator name	Characteristic
Shape	Corresponding to the baking dish in which the baking was made, with no side extensions
Surface	Without major erosion, with gloss
Colour	Dark brown
Getting baked thoroughly	Thoroughly bakes , with a slight stickiness, elastic
Being stirred thoroughly	Without lumps and traces of undermixing
Porosity	strong, the crumb is slightly densified
Flavour	Sweet
Smell	With a light aroma of coriander

4. Conclusions

While preparing the rye dough it is necessary to provide helpful activating agents to lactic-fermentation bacteria. To do this, we should provide conditions when the number of acid-forming bacteria would exceed (usually 60-80 times) the number of yeast cells in the rye dough. The necessary ratio of yeast to acid-forming bacteria is achieved when preparing rye dough with brewing.

The technology of “Borodinsky” bread production was developed on the basis of optimization. It was identified that adding scalded semi-finished product “Eiva Estonia” to the recipe, improves not only sensory attributes of the bread but also

improves its texture, physical - chemical properties and shortens the preparation time of bread.

The use of accelerated technologies makes it possible to organize the production of bakery products in limited areas. The technological process is much simpler, which allows renewing the range of products quick and easy, depending on the requirements of the market. Bread that is produced with the accelerated technology has nice marketable appearance, light-coloured crumb, low acidity and fluffy volume.

Acknowledgments

The work was supported by Act 211 of the Government of the Russian Federation, contract № 02.A03.21.0011.

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