ABOUT A NEW WAY OF BAKING OF BREAD AND BAKERY PRODUCTS WITH A LONG PERIOD OF STORAGE

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Received on 08-06-2016
Accepted on 29-06-2016

Abstract

The offered production technology of bread and bakery products with a long period of storage is developed on the basis of a new way of baking of bread and the bakery products packed into a "heat-resistant" cover. Contact of food products with working bodies of the equipment and the service personnel in the course of baking, transportations and storages is as a result excluded; and also moisture losses in a bread crumb that promotes preservation of freshness of bakery production more long, than usually decrease.

Keywords: bread and bakery products, grain bread, production method, baking method, heat-resistant cover with micropores, storage life.

Introduction

Bread and bakery products are one of the basic foods taking their leading place in the human being's diet. The range of products made by bakeries is very wide. The existing technology allows making products of different weights, types, moistures and based on various recipes. Various types of bakery products are produced according to recipes and technological instructions.

Scientific researches and practices confirm that freshly baked bread and bakery products become dry with the course of time (after 2 days) and their weight is reduced due to drying and firming. These two processes and independent, but interrelated. Due to the fact that such processes take place and have an influence the storage life of bakery products is reduced [1-8].

Since bread is an everyday product, extending its storage life to have it fresh and of good quality condition is a topical issue. Therefore, the purpose of our research is to develop a technology of production of bread and bakery products that ensure a long period of storage and freshness.
products based on a new method of making long-term storage bakery products.

The results given in article are received during performance of research works on a subject "A new strategic-purpose hearth bread baking method" (# the state registration 0112PK02604) on grant financing of scientific researches of Committee of science of the Ministry of Education and Science of RK.

Materials and Methods

Despite the small range of bakery products in the Republic of Kazakhstan there is no shortage of bread. However, the quantities of specialized, functional and medical-and-preventive types of bread to be produced are not sufficient. As the ecological situation worsens in settlements and as the packing material production technologies develop there arises the issue of improving the aesthetic and sanitary purity of bakery products.

Moreover, the baking technologists are worried about the problems of creating and practically using the substances that provide a separating effect in the interface between the food and the industrial equipment surface. In particular, during the baking process any lubricants not contacting the dough piece burn up and build up combustion products on the equipment surface. Any further heating of them may result in complicated multiphase chemical reactions that may cause the formation of different aromatic compounds having a carcinogenic effect [2-7].

In view of this there is possibility of improving technologies and extending the range of bakery products by producing bread packed in "pre-fabricated" cover that will eliminate contact with food products during processing operations, transportation and storage. This is confirmed by many experimental investigations and research works by domestic and foreign ones, which are dedicated to intensifying production technologies, improving the feed to be used, identifying its alternative sources of supply and applying new types of feed.

On the other side, producing bakery products packed in pre-fabricated cover will extend their storage life and allow delivering bread to locations difficult to access, for example, from the air, by plane, to military locations.

Baking is the most important final phase of bread production, which determines the quality of finished products. During the baking process the proved dough is heated, which determines its transition into the condition of bread. Both increasing and decreasing the bread baking period has a substantial effect on its quality. When the baking period is not sufficient the bread's crumb is under baked, its crust is light and it hardens when stored. An excessing baking period results in an increase in baking losses and worsening technical-and-economic indexes when bread production capacity is reduced. Once baked, it undergoes a number of processes (cooling down, drying up and hardening) that lead to a change in bread quality subject to certain baking conditions [2-6].
Many researches have been studying the baking process, developing its theoretical bases and formulating its main regularities: L. Auerman, A. Ginzburg, A. Lykov, I. Maklyukov, V. Maklyukov, N. Gogoberidze, V. Bryazun, A. Lissovenko, A. Mikhelev, C. Walker, B. Dobraszczyk etc. According to their investigations when bread is baked its dough undergoes complicated processes such as: thermophysical, biochemical, microbiological and colloidal, which together determine the product's quality.

For example, when bakery products are traditionally baked, the colloidal processes [1, 2] taking place in the dough are the gelatization of starch and denaturation of proteins. Full starch gelatinization requires 2-3 times as much moisture as in the dough. Therefore, the process is slow and stops when the central layers of the dough is heated to 95-97 °C. The bread crust formation at the end of the second baking phase facilitates the process where moisture movement and evaporation from the deep layers of the dough being baked are accompanied by the non-steady heat exchange process. An increase in dough volume during the baking process provides the necessary porosity of bread, improves its appearance and enhances its digestibility. And the bread crust, as it is baked, by the end of the second phase starts to lose its ability to expand and is dehydrated. Therefore, on the other side, it serves as a growing obstacle preventing the dough volume from further increasing. When stored for a long period the baked bread dries out and its mass decreases because of moisture loss (moisture evaporation from the crust surface into the environment) and hardening.

This problem can be solved through improving the production processes, in particular, bakery food making, which consists in the following [9].

It is known that the baking processes consists of three periods. The first baking period is characterized by an intensive external heat and mass exchange resulting in dough heating and an increase of its mass due to the steam condensation. In the second baking period the evaporation zone becomes deeper, which is accompanies by an increase in temperature of the dough and crust formation. In the third baking period the crust and crumb structure prevent the dough volume from further increasing in which case the evaporation rate becomes stables.

Results and Discussion

In this connection the novelty of our investigation is the fact that after the second baking period, that is after the crust formation, the processes is suspended, half-baked bread mass is wrapped into heat-resistant cover with micropores and then sent again for final baking. That is, in the third period, the half-baked bread mass wrapped in heat-resistant cover with micropores is baked. At that, the bread crust that is, in most cases, thinner than that during the traditional
baking, is formed separately. Further, the sole bread baked in heat-resistant cover is subject to fast cooling (figure 1).

Fig. 1: Samples of the ready grain bread baked in a heat-resistant cover.

As known from the literature sources, the decrease in dough mass is known as baking losses. It may vary from 6 to 14% subject to grade, form, mass of products, baking mode, baking method and moisture content etc. Domestic and foreign scientists have proved that the higher the relative humidity of the baking chamber's steam-air medium and the higher the humidity of the dough surface layer the later crust is formed, the less it is dehydrated and the less the mass loss. According to domestic and foreign literature there is no full practical fulfillment of this proof.

Our proposed baking method allows achieving it quite successfully. This takes place as follows. During the baking process there is formed a relatively humid steam-air medium in the cavity between the surface of the half-baked bread and the wrapped heat-resistant cover with micropores, which facilitates the process where during a certain period of time (when the steam-air medium spreads in the oven through the cover micropores) the surface layer of the dough is maintained more humid. In turn, it facilitates a better formation and less dehydration of the bread crust and the latter facilitates the decrease in mass loss (figure 2 and 3).

Fig. 2: The grain bread baked without cover (at the left) and in a cover (on the right)

Fig. 3: The grain bread in a section baked without cover (1) and in a cover (2)
We have carried out an organoleptic quality assessment of the grain bread baked according to the new technology.

The assessment has been carried out according to the requirements posed by regulatory documentation using special rating scales.

Tastings have been carried out first on a whole product then on a cut one. The following samples of grain sole-bread have been presented for tasting: Sample 1 – grain bread baked traditionally. Sample 2 – grain bread baked using PTFE heat-resistant cover with micropores. The table shows a quality rating of grain bread.

According to the organoleptic assessment of grain bread the most rated bread is the one baked using the heat-resistant cover (Sample 2). This bread rating is 27.3, which is the maximum score. With that, the dough's gas-retaining capacity has increased and the product's appearance meets the standard. The baked product had a good volume without any cracks and undercuts. The crust is thin and has gained a smooth glossy surface.

Table: Quality rating of grain bread.

<table>
<thead>
<tr>
<th>Name of indexes</th>
<th>Scale of quality rating, points</th>
<th>Taster's rating, points</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>excellent</td>
<td>good</td>
</tr>
<tr>
<td>Form:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- volume sufficiency</td>
<td>6-5</td>
<td>4-3</td>
</tr>
<tr>
<td>- regularity of configuration</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Surface:</td>
<td>7.5-6</td>
<td>5-3.5</td>
</tr>
<tr>
<td>- evenness</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- glossiness</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- color</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Condition of crumb:</td>
<td>9-7</td>
<td>6-4</td>
</tr>
<tr>
<td>- degree of bakedness</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- degree of blendedness</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- porosity</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- elasticity</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Taste: appropriate to standard characteristics without any foreign flavor</td>
<td>4.5-4</td>
<td>3-2.5</td>
</tr>
<tr>
<td>Flavor: appropriate to standard characteristics without any foreign flavor</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>TOTAL</td>
<td>30-25</td>
<td>20-15</td>
</tr>
</tbody>
</table>

The tasting of Sample 1 (traditionally baked grain bread) has scored 26.7 points. The bread had a hummocky surface and a light-brown crust resulting in a reduced rating.

Therefore, our separate bread crust formation method we propose contributes to some increase in bread mass volume,
in which case the colloidal processes (gelatinization of starch and denaturation of proteins) will be of quite good quality, which ensures high quality of finished bakery products. According to our baking method as compared with the traditional one, some increase in bread mass, will allow the bread mass to take up the whole cavity formed between the half-baked bread surface and the wrapped heat-resistant cover. Moreover, there is formed an air-free and absolutely dense and dry contact between the baked bread surface and the heat-resistant cover. In turn, after rapid cooling, it helps extend the storage period of bread preventing it from drying up and hardening.

The bread preserves its freshness for 8 days for grain bread without leaven (baking in laboratory conditions) and for 10 days for wheat bran bread with leaven (baking in industrial conditions).

It is known [1, 2, 7, 8], which during storage of bread its taste and flavor change with the rheological properties of the crumb. Bread staling process becomes hard and brittle as a result of gradual drying. Based on the above studies, bread baked in heat-resistant cover, I had the best indicators of quality. Determination of the dynamics of moisture loss during storage of bread samples 1 and 2 were performed after 0, 12, 24, 36, 48 and 60 hours after baking. The results of these studies are presented in figure 4.

![Figure 4: Dynamics of changes in moisture content of grain in storage.](image)

1 – bread baked without the cover (control); 2 – bread baked in cover

In sensory evaluation of bread crumb compressibility, it was observed that the film slows the loss of bread freshness.

Keeping bread in packaged form and reduces the loss of their volatile flavor compounds.

**Conclusion**

According to the investigations it is confirmed that it is possible to use heat-resistant cover with micropores when
baking sole-bread with a long-term storage life. A technology of production of bread and bakery products has been
developed based on a new method of baking bread and bakery products packed in a "heat-resistant" cover with
micropores. Moreover, it is expected to have social (purity and ecological suitability of finished products) and
economic (selling high-quality baked foods with a long-term storage life and an added value) effects.

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