Review Article

BIOMEDICAL Journal of Scientific & Technical Research

ISSN: 2574 -1241

DOI: 10.26717/BJSTR.2022.44.007055

The Use of Fruit and Berry Raw Materials in the Technology of Production of Bakery Products from Frozen Semi-Finished Products

Roman Kh Kandrokov*, Danila Y Antropov and Artem N Anurov

FGBOU VO "Moscow State University of Food Production", Russia

***Corresponding author:** Roman Kh Kandrokov, FGBOU VO "Moscow State University of Food Production", Moscow, Volokolamskoe shosse, 11, 125080, Russia

ARTICLE INFO

Received: June 01, 2022

Published: June 09, 2022

Citation: Roman Kh Kandrokov, Danila Y Antropov, Artem N Anurov. The Use of Fruit and Berry Raw Materials in the Technology of Production of Bakery Products from Frozen Semi-Finished Products. Biomed J Sci & Tech Res 44(3)-2022. BJSTR. MS.ID.007055.

Keywords: Fruit and Berry Raw Materials; Bakery Products; Frozen Semi-Finished Products

ANNOTATION

Currently, in the Russian Federation, the market for the consumption of flour bakery products and rye-wheat bread is increasing due to an increase in both the number of consumers due to the general population growth and due to the lower cost of such products. In this regard, there is a problem of delivery of fresh bakery products to the points of their sale, far from the place of production of products. It should be noted that it is necessary to bind a larger amount of moisture in the test, leaving only a small amount of water in the free state, which causes the course of the necessary chemical, biochemical, physical and colloidal processes. To achieve this goal, the most promising and justified use of substances that chemically bind moisture, which in this case will act as cryo protectors. It is necessary to transfer moisture into a chemically bound state. This effect is achieved due to the binding of moisture by molecules of various components of raw materials. However, the binding capacity of its own raw materials used in the production of wheat and rye-wheat types of bread. Various polysaccharides bind water most actively. Basically, the raw materials of the bakery industry, the availability of such substances is very small, which means that they must be introduced by adding unconventional plant raw materials rich in such compounds. Dietary fibers of pears, apples and black currants can be used in the production of wheat and rye-wheat bread from frozen semi-finished products as cryoprotectants.

Introduction

Currently, in the Russian Federation, the market for the consumption of flour bakery products and rye-wheat bread is increasing due to an increase in both the number of consumers due to the general population growth and due to the lower cost of such products. In this regard, there is a problem of delivery of fresh bakery products to the points of their sale, remote from the place of production of products [1-4]. Bread and bakery products belong to the category of goods that quickly become stale and, therefore, lose their attractiveness to the consumer. Also, at present, the consumer pays attention to the production time and chooses a fresher product. This makes it impossible for bakery products produced at a distance from the point of sale to compete with locally produced products. The solution to this problem may lie in the production of final products from frozen semi-finished products. This approach will make it possible to produce the most fresh bakery products with high quality indicators of finished products, expand the range of products produced without increasing production and complicating technological lines [5-8]. However, when using the freezing method to preserve semi-finished products, a number of reasons have been identified that lead to a decrease in the quality of the products produced, which is due to the peculiarities of the process of freezing the dough, storage in frozen form and the process

of defrosting. If the stages of the above-mentioned processes are observed, it is necessary to ensure the preservation of the quality of both the semi-finished products themselves and the finished products produced from them in the form of bakery products. The solution to this problem may lie in the use of special substances that can protect semi-finished products, and, consequently, finished products from the negative effects of cold.

The main problems in the production of bread from frozen semi-finished products according to classical technology. Currently, the market presents a wide variety of bakery products produced from frozen semi-finished products, but at the same time they are mainly produced from wheat flour, and the diversity is due to the taste preferences of the population and the raw material base. [9-11]. Many different formulations and technologies are used to produce frozen semi-finished products. Most of them are aimed at preserving the baking properties of the dough after the stages of freezing, storage in frozen form and further defrosting. The main problems when using this technology are the speed of freezing and defrosting [12-14]. At an excessively high rate of freezing and defrosting, water does not form ice crystals that lead to damage to the structure of the test mass, but at the same time yeast and lactic acid bacteria do not have time to adapt to environmental conditions and die. This, in turn, leads to the impossibility of fermentation and proofing after defrosting, and hence the impossibility of obtaining high-quality bakery products [15-19]. Studies have been conducted on the study of freezing water and modeling ice crystals With too slow a freezing rate of the dough blank, the following is observed: the microbiota of the dough has time to adapt to low temperature, but at the same time there is an intensive growth of ice crystals with a pronounced peculiar shape, which leads to the destruction of the gluten structure and to the disruption of the membranes of microorganisms and, consequently, to their death, which also makes it impossible to obtain high-quality bread [19-22]. In this regard, the production of bakery products using low-temperature processing according to the traditional recipe becomes impossible, which has also been experimentally confirmed by a number of domestic and foreign studies [23-25].

Properties of Water, as One of the Main Factors Determining the Quality of Finished Products in the Technology of Bakery

In the technology of baking water is one of the most important recipe components. Water performs a number of different technological functions. It is a solvent of various substances, creates an environment for microbiological, chemical and biochemical processes, participates in physical and colloidal processes at all stages of bread production, starting from the process of kneading dough and ending with the process of storing finished products. It should be noted that the water in the test is divided into free and bound [26-30].

Free and Coherent Moisture

Water is one of the simplest substances, but at the same time irreplaceable, which consists of two hydrogen atoms and one oxygen atom. Despite its simplest structure, it is part of a larger number of organic and inorganic systems. Starting from solutions and suspensions, ending with such complex coherent structures as dough, protozoa, infusoria, flagellar and complex forms of life, animals and humans. Water is the medium of various chemical, biological and physico-chemical processes, this is due to a number of its unique properties, dissolve polar substances and bind to high-molecular structures such as protein and starch, the ability to carry out phase transitions at sufficiently low and easily achievable temperatures (from 0 ° C to 100 ° C). In the technology of baking, water can be both in a bound and free state, this is its important property, which is explained by a number of technological functions performed by water. It is part of absolutely all recipes of bread and bakery products, while it participates in the formation of both the structure of the dough and the quality of the final product. According to the form of the moisture bond, the following types can be distinguished: mechanically bound moisture, which is retained due to the internal structure of colloidal systems in the capillaries or between large particles of the dough. Capillaries are divided into macro- and micro-, as a result of which there is a different retention of free moisture and its absorption and, therefore, this explains the unevenness of moisture binding. The peculiarity of such moisture, despite the coherent nature of compliance with external influences, such as changes in temperature, pressure, osmotic pressure difference, arising on the surface of the membranes of the microbiota cells of test semi-finished products.

But despite all this, this type of moisture, due to its low strength of bonds, is practically indistinguishable from free moisture, so in the process of freezing, storing and subsequent defrosting of text semi-finished products, a positive effect is practically not observed. The growth of ice crystals remains free, and due to their proximity to other components of the test, the probability of their destruction may even increase to some extent. Firmly bound moisture is at the atomic level with other components of test semi-finished products, this type of bond is called adsorption. Water binding is carried out due to the molecular force field, which always arises due to the noncompensation of molecular forces in the interphase surface layer, which, however, occurs only when solid incredibly small and homogeneous test particles are very close to each other. Thus, an increase in the percentage of bound moisture by this method will have a positive effect on the resistance of the test to negative consequences in the process of freezing, storage and subsequent

defrosting, in test masses and finished products. But despite this, it is quite difficult to reproduce this method of connecting moisture throughout the volume of the test mass for a number of objective reasons, as well as the transition of moisture to an inert state occurs, which does not allow to develop a dough for bakery products with normal rheological properties, and, consequently, the use of this method in the technology of baking is not justified. The third type of water is a chemically bound moisture, which reflects a strong bond of moisture and material, which is usually not removed even when drying, due to a chemical reaction and crystal hydrates, while water loses its nativeness, becoming, in fact, only a structural unit of a new substance. Chemically bonded moisture becomes inert to the processes occurring during the production of finished bakery products, only to a certain extent.

Moisture becomes almost immune to cold treatment when using shock freezing temperatures (from -35 ^{0} C to -40 ^{0} C). The temperature at which the characteristic needle-like structure of ice bound in this manner is formed is significantly lower than the specified range. However, the complete binding of free moisture is unacceptable, since the rheological properties inherent in the test semi-finished product will not be of proper quality due to the impossibility of the underlying processes that determine the unique properties of the final product. At the same time, binding the entire volume of water is impossible, as a result of the hydrolysis of the carbohydrate and protein complexes of flour, the product of which is water. Summing up the preliminary results, it should be noted that it is necessary to bind a larger amount of moisture in the test, leaving only a small amount of water in the free state, which determines the course of the necessary chemical, biochemical, physical and colloidal processes. To achieve this goal, the most promising and justified use of substances that chemically bind moisture, which in this case will act as cryo protectors.

The Process of Ice Formation from Free Moisture

If the chemically cohesive moisture does not form a solid phase when processed at low temperatures, then it is safe for the structure of the dough and its microbiota and the transition of free moisture to the frozen state is often accompanied by the formation of a kind of needle-like crystal structure, which can have a negative impact on the quality of both the test mass and the quality of the finished product. A number of studies have revealed a large number of different structures formed during freezing. Among these forms, a form without a pronounced structure called amorphous was revealed. The formation of such ice is highly desirable in the production of bread, since the absence of an ice structure eliminates the possibility of damage to both the structure of the dough and the microorganisms involved in the fermentation process. Thus, it is necessary to ensure the formation of amorphous ice from free moisture. This problem was solved by developing a special technology for freezing semi-finished products. When the technology is observed, free moisture passes into the state of amorphous ice, and the coherent moisture remains in the native state.

Vegetable Raw Materials as a Source of Cryoprotectants

As noted earlier, it is necessary to transfer moisture into a chemically bound state. This effect is achieved due to the binding of moisture by molecules of various components of raw materials. However, the binding capacity of its own raw materials used in the production of wheat and rye-wheat types of bread. Various polysaccharides bind water most actively. Basically, the raw materials of the bakery industry, the availability of such substances is very small, which means that they must be introduced by adding processing products of unconventional plant raw materials rich in such compounds.

Apple Dietary Fiber

The most well-known and common polysaccharide capable of retaining large amounts of water is pectin. The substance itself can be isolated from many types of plant raw materials, but it is apple raw materials that are most rich. On average, apple raw materials contain from 0.38% to 0.45% of pectin in terms of dry matter, and protoctin from 0.33% to 0.40% in terms of dry matter. As it was found, pectin is able to bind a large amount of moisture, exceeding many times its mass. As a result, jelly is formed, preventing the consolidated redistribution and freezing of moisture. In a number of studies, it was found that when pectin is added to the dough, the water absorption capacity increases, and the absorption of moisture itself is much more intense. This indicates the binding of the dough's own moisture with polysaccharides, therefore, when freezing, this moisture will not go into a crystalline state, which will positively affect the quality of both semi-finished products and the quality of finished products. It should be noted that, in turn, it allows us to consider pectin and other polysaccharides capable of binding moisture to cryo protectors. However, the cost of pure pectin and other polysaccharides is very expensive, as an alternative, you can use food fiber obtained during the processing of apple raw materials.

Dietary Fiber of Pear Fruits

The second most common fruit, as a source of pectin in our country, is a pear. Pear raw materials contain a kind of set of macro and microcomponents characteristic of this type of raw material, among which pectin substances were found. When determining the quantitative composition of pectin substances, it was found that the pear fruit contains 5.8% in terms of dry matter. This significantly exceeds the content of similar substances in apple raw materials and, therefore, when using dietary fiber of pear, it is necessary to make a smaller amount of this raw material in the test mass to

achieve an effect similar to that observed when introducing apple raw materials. Based on the foregoing, it follows that the dietary fiber of pear can be considered in the production of wheat and rye-wheat bread from frozen semi-finished products as cryoprotectants.

Dietary Fiber of Black Currant

Among the berry raw materials, black currants can be distinguished as a raw material with the greatest gel and gelatin forming ability. This indicates a significant content of polysaccharides capable of binding moisture and, in particular, pectin substances, the content of which, according to studies, is up to 3.4%. Thus, the intensity of moisture binding is quite high, which allows you to keep a constant amount of free moisture throughout the entire process of producing bread from frozen semi-finished products. Separately, it should be noted that gels and gels formed due to the fruits of black currant differ more in thermal stability compared to gels and gels formed when using apple and pear raw materials. This allows the use of these dietary fibers in the technologies of bread production with high dough moisture and increased activity of flour enzymes.

Conclusion

- Summing up, it should be noted that the share of bakery products produced from frozen semi-finished products in the world and Russian markets is growing. This is due to a number of different factors, analyzing which it can be assumed that in the near future the share of bakery products produced using freezing technology will become equal to the share of products produced by classical technologies, and possibly will become predominant.
- It has been established that the use of chemically created specific cryoprotectants is not justified and does not give the required results due to the complexity of the processes occurring during freezing and defrosting of both semi-finished and finished products. The most important of the unsolved problems is new ingredients, mainly of plant origin, with cryoprotective properties.
- One of the promising areas for solving this problem is the use of natural components, or rather a set of components that make up various plant raw materials. It is the totality of native components with cryoprotective properties that shows the most promising results than the development and synthesis of specialized chemicals, since these natural components of plant raw materials are in sufficient quantities in the waste of processing fruit and vegetable and fruit raw materials.
- Another advantage of using vegetable dietary fiber is the presence in them, in addition to the content of substances with cryoprotective ability, a wide variety of micro- and macroelements necessary for the human body, which will also increase the nutritional value of bread produced from frozen wheat and rye-wheat semi-finished products.

References

1. Bogatyreva TG, Labutina NV, Belyavskaya IG, Yudina TA (2016) Technology of rye-wheat bread based on grain starter cultures. Khleboprodukty 9: 49-51.
2. Vershinina OL, Gonchar VV, Roslyakov YuF, Tychina AV (2019) The use of gluten-free buckwheat flour in the production of bread from a mixture of rye and wheat flour. News of higher educational institutions. Food Technology 5-6(371-372): 35-38.
3. Gerasimova EO, Labutina NV, Maklyukov VI, Rogozkin EN (2020) Study of the heating process of rye-wheat dough pieces by the electro-contact method. Khleboprodukty 4: 60-61.
4. Gerasimova EO, Influence of adding fatty products of vegetable origin and flour from chia seeds on the heating process when baking rye-wheat pan bread from frozen semi-finished products of a high degree of readiness.
5. Danilina AS, Danilin SI (2020) Development of recipes and parameters of the technological process for the production of rye-wheat bread using lupine flour. Science and Education 3(3): 8.
6. Dorn GA, Moskvin VI (2020) Development of a recipe for rye-wheat bread with buckwheat flour and the addition of powders from non-traditional vegetable raw materials. Agro-food policy of Russia 4: 12-16.
7. Labutina NV (2004) "Technology for the production of bakery products from frozen semi-finished products", M, "Universum", pp. 236.
8. Lapteva NK, Mitkinykh LV (2020) Rye-wheat bread "noble": nutritional value. Agrarian science of the Euro-North-East 21(3): 293-300.
9. Loktionova AO, Markin EM, Labutina NV, Gerasimova EO (2020) Efficiency of the technology of rye-wheat bread from frozen semi-finished products using grain starter cultures of a high degree of readiness for preventive nutrition. News of higher educational institutions. Food Technology 2-3(374-375): 17-20.
10. Kitaevskaya SV, Romanova NK, Popova EV, Kamartdinova DR (2019) Optimization of the recipe composition of rye-wheat bread produced on the basis of frozen semi-finished products. XXI century: results of the past and problems of the present plus 8(4)(48): 171-176.
11. Kozlovskaya AE, Labutina NV, Yudina TA, Karaseva EV (2016) The use of chia flour in the technology of rye-wheat bread from frozen semi-finished products of a high degree of readiness. Food Industry 8: C62-65.
12. Naumova NL, Burmistrova OM, Makaeva OA, Eremina YuA (2019) Change in the nutritional value of rye-wheat bread when using flour from non-traditional raw materials. Technology and Commodity Research of Innovative Food Products 2(55): 39-43.
13. Chizhikova OG, Samchenko ON, Korshenko LO, Nizhelskaya KV, Smertina ES (2016) Development of meat-and-cereal semi-finished products tailored to the specificity of the gerodietetic nutrition. Research Journal of Pharmaceutical, Biological and Chemical Sciences 7(4): 2448-2457.
14. Guzhel YA, Dotsenko SM, Kovaleva LA, Agafonov IV (2021) Substantiation of technological approaches to the creation of innovative concentrated food semi-finished flour products. IOP Conference Series: Earth and Environmental Science. Ser. "International Conference on Production and Processing of Agricultural Raw Materials - Technology of Processing, Storage and Recycling of Plant Crops" P. 022020.

15. Hramova VN, Gorlov IF, Slozhenkina MI, Timofeeva AD, Hramova YaI, et al. (2020) Development of enriched meat and vegetable semi-finished products chopped in a shell. IOP Conference Series: Earth and Environmental Science. III International Scientific Conference: AGRITECH-III-2020: Agribusiness, Environmental Engineering and Biotechnologies. Krasnoyarsk Science and Technology City Hall of the Russian Union of Scientific and Engineering Associations S. 82072.

16. Kryuchkov SV, Malinin VG, Bogdanov NP, Konovalov MN, Malukhina OA, et al. (2020) A method of processing semi-finished products from an alloy of titanium nickelide tn-1. IOP conference series: materials science and engineering. The conference proceedings Ispciet'2020 S. 012038.

17. Kulishov B, Kulishova K, Rudometova N, Fedorov A, Novoselov A, et al. (2020) Advantages of electric resistance method for baking bread and flour confectionery products of functional purpose. Agronomy Research 18(4): 2449-2464.

18. Kulishov B, Kulishova K, Rudometova N, Fedorov A, Novoselov A (2020) Advantages of electric resistance method for baking bread and flour confectionery products of functional purpose. Agronomy Research 18(4): 2449-2464.

19. Nazimova EV, Markov AS, Sergeeva IYu, Romanov AS (2021) Changes in the biochemical properties of yeast during oxygen saturation of semi-finished bakery products. IOP Conference Series: Earth and Environmental Science. Cep. "International Conference on Production and Processing of Agricultural Raw Materials - Technology of Processing, Storage and Recycling of Plant Crops" C. 022005.

20. Woinet B, Andrieu J, Laurent M, Min SG (1998) Experemental and Theoretical Study of Model Food Freezing. Part 11. Characterization and Modeling of the Ice Cristal Size. Journal of Food Engineering 35(4): 395-407.

21. Sapozhnikov AN, Kopylova AV, Krainov SA, Krainova YO (2021) Enrichment of choux pastry semi-finished products by local plant raw material. Conference on Production and Processing of Agricultural Raw Materials - Technology of Processing, Storage and Recycling of Plant Crops" C. 022048.

22. Spicher G (1961) Die Erreger des Sauerteiggarung: vergleichende Untersuchungen liber den Einflup von kochsalz auf das Sanerungsvermogen: der Milchsa-nebacterien des Sauerteiges. Brot und Geback 15(6): 113-119.

23. Taranova ES, Kuznetsova EA, Efremova EN, Zenina EA, Labutina NV, et al. (2021) The peculiarities of the technology of bread production from frozen semi-finished products of a high degree of readiness with the use of functional components. IOP Conference Series: Earth and Environmental Science. Cep."International Conference on Agricultural Science and Engineering" C. 012113.

24. Tsykhanovska I, Evlash V, Alexandrov A, Lazareva T, Svidlo K, et al. (2017) Research into technological indicators of a rye-wheat dough semi-finished product with the addition of the polyfunctional food supplement "magnetofood". Eureka: Life Sciences 6: C. 43-50.

25. Salzmann CG, Radaelli PG, Hallbrucker A, Mayer E and Finney JL. The Preparation and Structures of Hydrogen Ordered Phases of Ice. Science 311: 1758-1761.

26. Vasyleva NS, Slozhenkina MI, Khramova VN, Shinkareva SV, Chekhova EA, et al. (2021) Research of the effect of spinach on the quality indicators of chopped poultry semi-finished products. IOP Conference Series: Earth and Environmental Science. Krasnoyarsk Science and Technology City Hall. Krasnoyarsk, Russian Federation. C. 32004.

27. Steel MI (2015) Comparative analysis of apple pectin. International scientific journal "Symbol of Science" 6: 34-36.

28. Gusakova GS, Evstafiev SN (2015) Prospects for the use of Ussuri pear fruits in winemaking. Chemistry of vegetable raw materials 3: 173-178.

29. Golub OV, Stepanova EN, Tyapkina EV (2017) Nutritional value and quality of red currant berries. Technique and technology of food production 44(1): 105-110.

30. Shmalko NA (2021) Modern technologies of rye-wheat bread using amaranth flour. News of higher educational institutions. Food Technology 2-3(380-381): 6-9.

ISSN: 2574-1241

DOI: 10.26717/BJSTR.2022.44.007055

Roman Kh Kandrokov. Biomed J Sci & Tech Res

Submission Link: https://biomedres.us/submit-manuscript.php