ABSTRACT Lack of domestic raw materials, a significant portion of imported high-cost ingredients and increasing competitiveness make manufacturers look for new technological solutions in order to improve the consumer properties of marmalade products. A promising trend in the field of jelly and marmalade products is the creation of products with high quality and long shelf life. For this purpose various food additives, i.e. improvers, are used in jelly marmalade technology. As an improver of shaped jelly marmalade, we have developed and proposed “Magnetofood” food additive, which is nanopowder with a particle size of (70–80) nm. “Magnetofood” is a food additive with high functional and technological potential. “Magnetofood” additive can independently generate structural and mechanical properties of jelly masses, and also it can influence the gelling agent by entering into chemical and electrostatic interactions with it. Therefore the “Magnetofood” food additive can simultaneously affect several technological properties in the food jelly system: to be a stabilizer, a thickener and a gelling agent. Due to Fe (II), nanosize, developed active surface, bacteriostatic character, high thermal stability, “Magnetofood” has reducing, antioxidant, antimicrobial, sorbing, complexable, emulsifying, moisture-retaining, fat-retaining, water-binding, stabilizing, and structuring properties. It makes possible to recommend “Magnetofood” as an additive of complex action to improve the quality and extend the shelf life of shaped jelly marmalade. The influence of “Magnetofood” food additive on organoleptic, physical and chemical, microbiological parameters of test samples of agar- and pectin-based shaped jelly marmalade has been studied.

Keywords: technology; “Magnetofood” food additive; shaped jelly marmalade; quality indicators.

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INTRODUCTION

The range of marmalade on the market today is represented mainly by a group of jelly marmalade, which has an attractive appearance, a variety of shapes, a pleasant smell and taste, is quite simple to manufacture. That is why it is popular among the population and manufacturers. The effectiveness of technologies for the production of molded jelly marmalade in a market economy is determined by the introduction of competitive resource-saving technologies, the achievement of high technical and economic indicators of production, the possibility of processing raw materials with different properties while ensuring the stable quality of marmalade products and extending their shelf life. The range of jelly marmalade produced today, its composition and technological production process is a reflection of innovative technologies aimed at improving the technical and technological level of production, improving the
quality and increasing the range of marmalade products [1–3].

Among the priority areas for expanding the range by improving the technology of molded jelly marmalade are the following: the use of new raw materials, that provide an opportunity to change or adjust the functional and technological properties of jelly masses, as well as texture, quality indicators and increase the shelf life of marmalade products [4–11].

Market trends in forming a range of molded jelly marmalade are due to innovations in its recipe composition, aimed at reducing its cost, improving its quality and shelf life.

It is especially important to note that the prices for raw materials rise every year. Unfortunately, pectin and agar, the two main gelling agents, traditionally used in molded jelly marmalade technology, are expensive imported raw materials. So, from the beginning of 2014 and at the end of 2016, the prices for agar and the food pectin increased on average by (3,5–4,0) times; the search for new raw materials of domestic production that reduces the cost price while maintaining the quality is an urgent task for the production of molded jelly marmalade [5–8].

Thus, one of the possibilities for creating competitively priced products is the economical and efficient use of expensive raw materials, including gelling. There are various ways to solve this issue, but the main one is the introduction of competitive resource-saving technologies.

Many specialists, in particular, scientists of NUHT, KDUKhT, ONAKhT (A. M. Dorokhovich, V. F. Pertsev, V. I. Obolkina, G. A. Magomedova, V. V. Rumyantseva, Yu. V. Kambulova, Tung-Shan Chen, Yoslyn MA, A. Lee, D. Storey and others) are actively developing modern technologies of jelly marmalade using new types or modifications by gelling agents, thickeners, mixtures of unconventional substances capable of jelly formation (agar and gelatin, agar and alginate, agar and xampana, agaroid, furcellaran and sodium carboxymethylcellulose, pectin and alginate, locust bean gum, tara gum, etc.), allowing to reduce the costs of the main gelling agents, and thereby reduce the cost of production. For the extraction of artificial dyes and flavors from the recipe composition, the introduction of krias-powders, cryo-pastes, extracts of medicinal plants, etc. is proposed. [8-16]. However, with regard to research on the effects of nanopowder additives, in particular, the food additive “Magnetofood” [Patent UA No. 126502, MPK A 23L 13/40, A23L 33/10. Food supplement “Magnetofood”] on the processes of structure formation of jelly masses during jelly marmalade production and on the indicators of the quality of the finished product, there is no any data and more research is needed.

“Magnetofood” is a food additive, it has a certain functional and technological potential and can independently form the structural and mechanical properties of jelly masses and also affect the gelling agents, entering into chemical and electrostatic interactions with it. Therefore, the food additive “Magnetofood” can perform several technological functions in the system at once: act as a stabilizer, at the same time increasing the viscosity of the system or forming a gel. That is, it can perform the functions of both a thickener and gelling agents. Although the food additive “Magnetofood” is not a surfactant, it can stabilize disperse systems (emulsions, suspensions) due to its thickening and thixotropic properties, preventing their division. Changing the fluid properties of a liquid disperse system in the presence of the food additive “Magnetofood” leads not only to the stabilization of the system, but also to the formation of a certain consistency. Functional and technological properties of the additive "Magnetofood" in food systems include: water-binding and water-holding ability; stabilization of emulsions and suspensions; regulation of fluid properties; formation of stable gels at room temperature. The thixotropic properties of gels with the use of the food additive "Magnetofood" are manifested in reversible changes in the structure of the gel during its deformation and subsequent removal of the mechanical load [17–22].

Thus, the use of the food additive "Magnetofood" as a thickener and stabilizer of jelly-marmalade products will allow to solve the following tasks: to improve the consumer properties of the finished product: compaction of the consistency, cutting improvement (glossy cut) and provision of elasticity; reduce syneresis during storage of products.

In this regard, the study of the functional and technological potential of natural mineral resources, in particular, nanopowder food additives, from the point of view of the impact on the quality, shelf life and economic efficiency of the production of jelly confectionery masses and marmalade products made from them is relevant.

To solve this urgent problem, an integrated approach to the development of technological solutions for the production of jelly marmalade products is needed, which should be based, on the one hand, on the study of the influence of nanopowder mineral additives on the structural and mechanical properties of jelly masses to substantiate their functional and technological potential, that is important to ensure the quality characteristics of molded jelly marmalade in terms of physical and chemical, organoleptic and safety indicators, on the other hand, on the technological process of jelly marmalade products, that affects the economic efficiency of the production.

Within the work considered, it was of interest to substantiate the expediency of improving the technology of molded jelly marmalade using the food additive "Magnetofood".

**Literature data analysis and problem formulation**

The confectionery industry is one of the active users of food additives, improvers in the manufacture of products. The use of food additives in the industry of sweets, in particular jelly marmalade, is caused by a number of circumstances; reasons and directions of use of
food additives by the confectionery industry. Recently, there have been numerous studies on search for new low-cost gel-forming components, improving structural and mechanical, physical and chemical, and organoleptic indicators of jelly masses and finished products, as well as partial or full replacement of traditional gelling agents, in particular, agar and pectin — imported products with high cost price [8-12,22-46].

In order to improve the structural and mechanical properties of jelly masses, it is proposed to use pectic substances obtained from non-traditional raw materials, such as food industry waste (canning, wine-making, sugar-beet industries) and agriculture (seed-growing state farms, cotton growing, melon-growing) [9,23,24]; as well as alternative raw materials: chitosan, herbal, vegetable and fruit-vegetable products [14,25-27].

Some scientists have developed combined systems with gelling agents to control the rheological and structural and mechanical properties of jelly semi-finished products and products, in particular the combination of gelatin with pectin, with sulfated polysaccharides, gelatin – k-carrageenan, gelatin – LM pectin [28-30]; pectin with hydrocolloids (Herbagel SW-010, ricogel 8100), LM pectin – k-carrageenan [30-32]; agar with the concentrate of animal proteins "Scanpro" [30].

To improve the plastic strength of the jelly and the texture of jelly products in the production of marmalade, various hydrogels are widely used, showing the properties of thickeners, a gelling agent and stabilizers — carrageenan and its sodium, potassium, ammonium salts, including furcellaran; xanthan, tara gum, guar gum, locust bean gum, xanthan gum and others [32–35].

Numerous studies have been carried out to study the influence of modifying additives on the structural and mechanical properties of jellies: sodium carboxymethylcellulose (Na-CMC) and ferric chloride to increase the gel-forming ability of sulfate polysaccharides [29, 26]; sodium lactate, sodium citrate and glycerin in the amount of (0,1–0,2) % of the total mass to increase the gel-forming ability of red seaweed polysaccharides and, as a result, to reduce their content by (35–40)% [36,37]; mannitol or sodium alginate in the amount of (0,08-0,09)% to increase the strength of the jelly to (40–60)% and reduce the amount of agar (agaroid, furcellaran) [38–40].

Analysis of information sources [4–12,22–46] shows the lack of data on jelly marmalade technologies using nanopowder additives that have thickening, gel-forming, stabilizing abilities; improve structural and mechanical properties of jelly masses and quality indicators and shelf life of finished products. As an additive improver for food systems, we have developed and proposed the food additive “Magnetofood” [TU U 10.8-2023017824-001: 2018]. It is an ultra-fine powder with a large specific and highly active surface.

In food systems, “Magnetofood” exhibits reconstructive, antioxidant, sorption, bacteriostatic, complexing, emulsifying, water-holding, fat-holding, water-binding, stabilizing, structuring properties [17-22].

In this regard, it is relevant to improve the recipe composition and the existing technology of molded jelly marmalade with the introduction to the recipe composition the food additive “Magnetofood”.

**Purpose and objectives of research**

The aim of the work is to improve the technology of molded jelly marmalade using the food additive "Magnetofood".

To achieve the main goal, the following tasks were set:

- to study the influence of the food additive “Magnetofood” on the physical and chemical properties (mass fraction of moisture, total acidity) of test samples of the molded jelly marmalade on agar and pectin;
- to study the influence of the food additive “Magnetofood” on the organoleptic indicators (taste, smell, color, consistency, form) of test samples of molded jelly marmalade on agar and pectin;
- to study the effect of the food additive “Magnetofood” on the sorption properties of test samples of molded jelly marmalade on agar and pectin during a regulated shelf life;
- to study the effect of the food additive “Magnetofood” on the microbiological indicators of test samples of molded jelly marmalade on agar and pectin during a regulated shelf life;
- to establish a rational mass fraction of the food additive "Magnetofood" in the compositions of molded jelly marmalade on agar and pectin;
- to develop a technological scheme for the production of molded jelly marmalade using the food additive “Magnetofood”.

**Statement of basic materials**

The object of the research is the technology of molded jelly marmalade on agar and pectin. The subject of the research is the model samples of jelly marmalade on agar and pectin, which are based on the basic compositions № 11 and № 49 [47] and are shown respectively in Tables 1 and 2.

Preparation of test samples of marmalade was carried out according to the traditional technology of molded jelly marmalade according to the classical composition [15, 47], Table 1 and 2.

Organoleptic evaluation of the quality of jelly marmalade test samples was carried out according to DSTU 4683:2006 on a 5-point scale using weighting factors that take into account the significance of each indicator: shape, consistency, color were determined by inspection of controlled marmalade products.

In assessing the smell of marmalade, attention was paid to the presence or absence of foreign, unusual odors. The acidity of the finished products was determined by the titrimetric method using phenolphthalein according to DSTU 5024: 2008.
Table 1 – The compositions of jelly marmalade on agar (control) and with different mass fraction of the food additive "Magnetofood"

| Raw material                      | Raw material consumption per 1 ton of finished products, kg |
|-----------------------------------|-------------------------------------------------------------|
|                                   | Sample 1 – control  | Sample 2  | Sample 3  | Sample 4  |
| Sanding sugar for sprinkling      | 86,6               | 86,6      | 86,6      | 86,6      |
| Sanding sugar in jelly            | 525,6              | 525,6     | 525,6     | 525,6     |
| Molasses                          | 262,7              | 262,7     | 262,7     | 262,7     |
| Agar                              | 10,5               | 10,5      | 10,5      | 10,5      |
| Citric acid                       | 11,8               | 11,8      | 11,8      | 11,8      |
| Various essences                  | 1,6                | 1,6       | 1,6       | 1,6       |
| Various dyes                      | 0,5                | 0,5       | 0,5       | 0,5       |
| Food additive "Magnetofood"       | -                  | 1,0       | 1,5       | 2,0       |

Table 2 – The compositions of jelly marmalade on pectin and with different mass fraction of food additive "Magnetofood"

| Raw material                      | Raw material consumption per 1 ton of finished products, kg |
|-----------------------------------|-------------------------------------------------------------|
|                                   | Sample 5 – control  | Sample 6  | Sample 7  | Sample 8  |
| Sanding sugar for sprinkling      | 86,6               | 86,6      | 86,6      | 86,6      |
| Sanding sugar in jelly            | 718,9              | 718,9     | 718,9     | 718,9     |
| Molasses                          | 262,7              | 262,7     | 262,7     | 262,7     |
| Pectin                            | 18,0               | 18,0      | 18,0      | 18,0      |
| Citric acid                       | 12,0               | 12,0      | 12,0      | 12,0      |
| Sodium lactate                    | 10,0               | 10,0      | 10,0      | 10,0      |
| Various essences                  | 1,6                | 1,6       | 1,6       | 1,6       |
| Various dyes                      | 0,6                | 0,6       | 0,6       | 0,6       |
| Food additive "Magnetofood"       | -                  | 1,0       | 1,5       | 2,0       |

To simulate the storage of marmalade the polyethylene film (PND, 15 micron) was used as a packaging material in the work. Test samples of jelly marmalade 18 hours after casting and cooling were wrapped in film and stored in the dark at a temperature of (18 ± 3) °C and a relative air humidity of ≤ 75% for 90 days.

At the same time, the sorption properties of the test samples were determined by the strain gauge method [48,49] immediately after sample preparation and during 110 days with an interval of 10 days. When selecting the optimal storage mode, the constancy of the moisture content of jelly marmalade (the moisture content of molded jelly marmalade after production is 0,179-0,181 kg/kg), which depends on the humidity of the environment and the shelf life of jelly marmalade (days), was chosen as a criterion. The proposed criterion is as follows (1):

$$Q_p = \sum_{i=1}^{N} |W_i - \bar{W}|_{\text{norm}} \rightarrow \min$$  \hspace{1cm} (1)

where N is the amount of tests during storage, pcs; \(W_i\) is the normative moisture content equal to 0,18 kg/kg; \(\bar{W}\) is the current value of moisture content, kg/kg; \(\varphi\) is the humidity of the environment, %.

The list of microbiological indicators, which were used to control the quality of the finished marmalade products, was established in accordance with the requirements of the DSP 4.4.5.078; MBT № 5061-89 and DSTU 4683: 2006.

Research results

Table 3 shows the results of organoleptic analysis of jelly marmalade test samples with various gelling agents.

From the data of Table 3, it was found that marmalade with the content of the food additive “Magnetofood” 0.15% by weight of the raw material is the best according to the organoleptic quality indicators compared with other samples. The average score for organoleptic indicators is increased by (1,3-1,4) points compared with the control.

The main physical and chemical characteristics of molded jelly marmalade is acidity and humidity. Data on the effect of the food additive "Magnetofood" on acidity and moisture loss during molding and cooling of marmalade products are presented in Table 4.

The data in Table 4 show that the introduction of the food additive "Magnetofood" in the amount of (0,10-0,20) % by weight of the raw material contributes to the improvement of the physical and chemical indicators of the marmalade test samples: the humidity increases by (4,8-6,2) % in the samples on agar and (5,2–6,2) % in the samples on pectin – due to the water-binding and water-holding ability of nanoparticles of the additive “Magnetofood”. That is, the presence of the additive "Magnetofood" in the composition contributes to less moisture loss when cooling products after casting marmalade mass into a mold; total acidity decreases by (5,9–7,4) ° in samples on agar and (6,1–7,6) ° in samples on pectin – due to the amphoteric character of the additive “Magnetofood” and its ability to interact with acidic substances of jelly-marmalade masses. As a consequence, the gel-forming component (agar, pectin, etc.) is less subject to acid hydrolysis. At the same time, a decrease in acidity (Table 4) has practically no effect on the process of gel-formation. It also becomes possible to produce low acidity jelly marmalade, which can be recommended in therapeutic and preventive nutrition.
| Marmalade test samples | Consistency | Aroma | Color | Taste | Form and surface |
|------------------------|-------------|-------|-------|-------|------------------|
| Sample 1 (control)     | Jelly-like with brittle structure, vitreous fracture | unexpressed | transparent with slight spotting | slightly empty | distorted fuzzy contour |
| Sample 2               | slightly puffy, jelly-like with a homogeneous structure, transparent vitreous fracture | pleasant, characteristic of marmalade | transparent, smooth, with a brown cognac shade, without spotting | pleasant, characteristic of marmalade | correct, with a fuzzy contour, not elastic enough dry surface |
| Sample 3               | vitreous, elastic with a homogeneous structure, transparent vitreous fracture | pleasant, characteristic of marmalade | transparent, smooth, with a brown cognac shade, with slight spotting | smooth, without deformation, with a clear contour, smooth elastic dry surface | correct, without deformation, with a clear contour, smooth elastic dry surface |
| Sample 4               | vitreous, slightly elastic with a homogeneous structure, transparent vitreous fracture | unexpressed | transparent, smooth, light with slight spotting | sourish | with overlaps, fuzzy contour, matte elastic dry surface |
| Sample 5 (control)     | soft, jelly-like with homogeneous structure, uneven cleavage at fracture | unexpressed | transparent, smooth, light with slight spotting | sourish | with overlaps, fuzzy contour, matte elastic dry surface |
| Sample 6               | jelly-like, with smooth transparent cleavage at fracture | pleasant, characteristic of marmalade | transparent, smooth, with a brown cognac shade, without spotting | pleasant, characteristic of marmalade | correct, with burrs, fuzzy contour, glossy elastic dry surface |
| Sample 7               | slightly puffy, with a smooth transparent cleavage at fracture | pleasant, characteristic of marmalade | transparent, smooth, with a brown cognac shade, without spotting | pleasant, characteristic of marmalade | correct, without deformation, with a clear contour, glossy elastic dry surface |
| Sample 8               | dense puffy, with a smooth opaque cleavage at fracture | pleasant, characteristic of marmalade | transparent, smooth, with a brown cognac shade, without spotting | pleasant, characteristic of marmalade | correct, without deformation, with a clear contour, glossy elastic dry surface |

Studies have allowed to scientifically substantiate the composition (Tables 1 and 2) and the technological parameters of the production of molded jelly marmalade.Fig. 1 shows the flow chart of molded jelly marmalade on agar with the addition of the food additive “Magnetofood”. A distinctive feature of the new technology is the preliminary mixing of the food additive “Magnetofood” with gelling agents, which is used before the technological operation of soaking of gelling agents in cold water. The production technology of jelly marmalade on pectin with the addition of the food additive “Magnetofood” includes the same steps, but has some differences in technological regimes. The technological process of production of molded jelly marmalade involves the following stages: selection and preparation of prescribed components – loose components are sieved, essence, citric acid, the dye are dissolved, starch syrup is heated and filtered; getting a dry mixture of gelling agents with the food additive “Magnetofood” followed by soaking in cold water at a temperature of (18±2) °C for (50–80) *60 s for agar and (3,5–4,0)*3600 s – for pectin, thus it happens the solvation of the food additive “Magnetofood” and swelling of the gelling agents with its partial structuring under the action of the nanoparticles of the additive “Magnetofood”, which promote water penetration into the most organized parts of the chain of the gelling agents.

Next, the solution of the mixture of the gelling agents with additive “Magnetofood” is heated to a temperature of (95–100) °C for agar and (85–87) °C for pectin and kept for (20–25)*60 s for agar and (10–15) *60s for pectin. At this stage, the additive “Magnetofood” increases solubility of gelling agents due to its water-holding ability and the interaction of its ionized nanoparticles with polarized agar and pectin groups, which leads to branching of the main chains of polysaccharide molecules, which contributes to their cover and better penetration of water molecules.
Preparation of jelly-marmalade mass. After the builder completely dissolves, the recipe amount of sugar and starch syrup needed to obtain the jelly mass is added, and mixed thoroughly for (20–25)×60s for agar and (10–15)×60s for pectin, when heated to a temperature (100–105) °C; at the same time, sodium lactate is additionally added to the pectin-sugar-molasses syrup. After a uniform distribution, the syrup is boiled down to a mass fraction of dry substances (75,0 ± 1)% for agar and (76,5 ± 1)% for pectin; cooled to (55–60) °C for agar and (80–85) °C for pectin and the tempering is carried out, adding diluted dyes, citric acid and essence, according to the composition, with thorough mixing for (5–7)×60s.

Fig. 1 – Technological scheme of molded jelly marmalade on agar with the addition of the food additive "Magnetofood": A, B, C1, C2, C3, C4, C5 – subsystems of the technological scheme of marmalade production

Cooling and structuring jelly-marmalade mass. The resulting marmalade mass is poured into molds and cooled to a temperature of (25–30) °C for structure formation.

Drying jelly marmalade is carried out at a temperature of (52,5±2,5) °C for (6–8)×3600s – for agar and (4–6)×3600s – for pectin.

Packing, packaging, labeling and storage. Ready molded jelly marmalade is packed and stored in storage conditions at relative air humidity (75±2)%.

Microbiological indicators of the quality of test samples of molded jelly marmalade were studied. Table 5 shows the microbial contamination of the marmalade surface immediately after manufacture and after storage for 90 days at a relative air humidity φ= (90±2)%.

From the data in Table 5 it follows that the introduction of the food additive "Magnetofood" suppresses the contamination of the surface of marmalade products test samples:

| Name of indicators | Standard | Test samples of jelly marmalade at φ= (90±2)% |
|--------------------|----------|-----------------------------------------------|
|                    | Control  | Sample 3 | Sample 7 |
| Yeast KUO/g         | not found | not found | not found |
|                     | /1,0×10¹ | /1,0×10¹ | /1,0×10¹ |
| BGKP (coliforms), in 0,1 g. immediately after 90 days | not dosed | not found | not found |
| Pathogenic m/o, including bacteria of the genus Salmonella, in 25g, immediately after 90 days | not dosed | not found | not found |
| Mold fungi KUO/g, not more than, immediately after 90 days | not found | not found | not found |

During storage of marmalade test samples at air humidity (90±2)% for 75 days in samples 3, 7 decreases: KMAFAnM 10 times, yeast – 3 times, mold fungi – 2 times compared with the control;

during storage of marmalade test samples at air humidity (90±2)% for 90 days in samples 3, 7 decreases: KMAFAnM 10 times, yeast – 2,5 times, mold fungi – 2 times compared with the control.

This is due to the bacteriostatic action of the food additive "Magnetofood" [18].

Table 5 – The influence of the food additive "Magnetofood" on the microbiological indicators of test samples of molded jelly marmalade compared with the control samples during storage

In order to determine the storage conditions, the sorption kinetics of jelly marmalade test samples was studied. The research results are shown in Fig. 2, a, b, c, d.
The analysis of curves given in Fig. 2 shows that at relative air humidity (70–80) % during recommended shelf lifes (3 months) in all test samples of jelly marmalade the change in moisture content occurs slowly, as can be seen on the corresponding sorption curves. It is established that when the air humidity is (75±2) %, the samples of jelly marmalade will be characterized by a constant moisture content during the entire shelf life. Fig. 2 also shows that when the air humidity is (90±2) %, the moisture content of the marmalade gradually increases, that is externally characterized by the development of mold fungi on control samples of marmalade after 90 days of storage (see Table 5). When air humidity is less than (70±2)%, the sorption curves are directed downwards, which characterizes a decrease in moisture content, gradual drying of the product and leads to loss of organoleptic properties: changes in the shape, structure, hardening of the consistence. When comparing with the control samples (Fig. 2, a, c), it can be seen that the rate of change of moisture content in the test samples of marmalade (Fig. 2, b, d) decreases, which is due to the water-holding and stabilizing ability of the food additive "Magnetofood", namely creation of solvatocomplexes and supramolecular assemblies of nanoparticles “Magnetofood” with macromolecules of polysaccharides, in particular agar, pectin [21].

The results of the criterion Q calculation (see formula 1) for test samples of jelly marmalade are given in Table 6.

| Environmental moisture content, φ, % | The value of the criterion Q for test samples of molded jelly marmalade |
|--------------------------------------|-------------------------------------------------------------------------|
|                                      | Sample 1 | Sample 3 | Sample 5 | Sample 7 |
| 40                                   | 1,405    | 1,257    | 1,422    | 1,407    |
| 50                                   | 1,304    | 1,139    | 1,359    | 1,309    |
| 60                                   | 1,1079   | 0,990    | 1,236    | 1,189    |
| 70                                   | 0,490    | 0,480    | 0,521    | 0,319    |
| 80                                   | 0,876    | 0,492    | 0,879    | 0,824    |
| 90                                   | 1,679    | 1,378    | 1,744    | 1,400    |

The analysis of criterion Q (Table 6) sets the smallest total deviation of moisture content (W_i) of test samples of molded jelly marmalade from the standard value W_3 = 0,180 kg/kg – at φ=(70±2) %, which is an additional confirmation of the optimal temperature and humidity conditions for storage of molded jelly marmalade, found from the kinetic sorption curves (Fig. 2): air humidity φ=(75±2) %, temperature (18±2) °C.

Conclusions

The investigation results of the influence of the food additive "Magnetofood" on the quality indicators of molded jelly marmalade showed that the addition of the
food additive in the amount of (0.10–0.20) % has a positive effect on the organoleptic, physical and chemical, and microbiological properties of jelly marmalade on agar and pectin, particularly there is an improvement in the following:
- shape, consistency, smell and color on average by 0.1–0.4 points;
- humidity increases by (4.8–6.2) % in samples on agar and by (5.2–6.2)% in samples on pectin due to the water-binding and water-holding ability of the nanoparticles of the additive "Magnetofood";
- total acidity decreases by (5.9–7.4) % in samples on agar and by (6.1–7.6) % in samples on pectin due to the amphoteric nature of the additive "Magnetofood" and its ability to interact with acidic substances of jelly-marmalade masses;
- rational content of the food additive "Magnetofood" was established – 0.15% by weight of raw materials;
- technological scheme for the production of molded jelly marmalade with the introduction of the food additive "Magnetofood" was developed;
- it has been proven the suppression of microbial surface contamination of jelly marmalade products samples with the food additive "Magnetofood". When stored at ϕ = (90±2) % for 75 days in samples 3, 7 compared with the control, the following decreases: KMAFAnM 10 times, yeast – 3 times, mold fungi – 2 times; and when stored for 90 days – KMAFAnM 10 times, yeast – 2.5 times, mold fungi – 2 times;
- optimal conditions for temperature and humidity conditions were established during storage of molded jelly marmalade: air humidity ϕ = (75±2) %, temperature (18±2) °C.

The results obtained suggest that food additive "Magnetofood" is recommended as a stabilizer, structurant and improver for food jelly systems.

**Список литератури**

1. Стаценевич, С. А. Ринок кондитерських виробів України: пропозиції та підходи / С. А. Стаценевич, С. М. Валявський // Продукти & інгредієнти. – 2013. – № 1. – С. 14–17.
2. Гарбі, Е. Желейно-желатинова сладкість для українця / Е. Гарбі // Продукти & інгредієнти. – 2011. – № 2. – С. 40–42.
3. Сегмент пастило-марамеладних інгредієнтів і восточних сладостей. Кто домовиться тенденції: cost: С. Контеева [i dr.]. – URL: http://myki.ru/articles.php (дата звернення 30.08.2019).
4. Бочковская, Е. Мармелад и желе: или здоровье, или доступно накупуло? / Е. Бочковская // Продукты & ингредиенты. – 2013. – № 2. – С. 14–17.
5. Иоргачева, Е. Г. Желейные и желейные мрамелады / Е. Г. Иоргачева // Кондитерское и хлебопекарное производство. – 2010. – № 1. – С. 54–55.
6. Васькина, В. А. Сравнительная характеристика технологий желейного мармелада / В. А. Васькина // Кондитерское и хлебопекарное производство. – 2004. – Т. 6. – № 34. – С. 1–4.
7. Иоргачева, Е. Г. Регулирование качества желейного мармелада с измененным углеводным составом / Е. Г. Иоргачева, К. В. Аветисян // Восточно-европейский журнал передовых технологий. – 2016. – Т. 2. – № 11(80). – С. 28–38. – doi: 10.15587/1729-4061.2016.65768.
8. Иоргачева, Е. Г. Регулирование структурно-реологических свойств желейных и сливных масс для двухслойного мармелада / Е. Г. Иоргачева, О. В. Макарова, К. В. Аветисян // Восточно-европейский журнал передовых технологий. – 2014. – Т. 2. – № 12 (68). – С. 122–127. – doi: 10.15587/1729-4061.2014.23380.
9. Salieva, A. Pectin substances from sea and freshwater grasses as stabilizers at manufacturing of canned food of type confiture / A. Salieva // Vestnik of Astrakhann State Technical University. – 2013. – 1. – Р. 194–200.
10. Yang, Y. Calcium cation triggers and accelerates the gelation of high methoxy pectin / Y. Yang, G. Zhang, Y. Hong, Z.Gu, F. Fang // Food Hydrocolloids. – 2013. – Vol. 32. – P. 228–234. – doi: 10.1016/j.foodhyd.2013.01.003.
11. Kaya, M. Characterization of citrus pectin samples extracted under different conditions: Influence of acid type and pH of extraction / M. Kaya, A. G. Sousa, M. J. Crepeau, S. O. Sorensen, M. C. Ralet // Annals of Botany. – 2014. – Vol. 114. – 6. – Р. 1319–1326. – doi: 10.1093/aob/mcu150.
12. Zhang, X. Preparation of hydroxypropyl agar and their properties / X. Zhang, X. Liu, M. Cao, K. Xia, Y. Zhang // Carbohydr. Polym. – 2015. – 129. – Р. 87–91. – doi: 10.1016/j.carbpol.2015.04.056.
13. Schirmer, M. Physicochemical interactions of polydextrose for sucrose replacement in pound cake / M. Schirmer, M. Jekle, E. Arendt, T. Becker // Food Research International. – 2012. – Vol. 48. – 1. – Р. 291–298. – doi: 10.1016/j.foodres.2012.05.003.
14. Артамонова, М. В. Технология мармелада желейного с використанням края-порошкі рослинного походження: монографія / М. В. Артамонова, Г. М. Лисюк, Н. Ф. Тух. – Харків: ХДУХТ. – 2015. – 184 с.
15. Драгилев, А. И. Технология кондитерских изделий / А. И. Драгилев, А. Н. Лурье. – М.: Дель-принт. – 2001. – 483 с.
16. Сарапанова, Л. А. Применение пищевых добавок в кондитерской промышленности / Л. А. Сарапанова. – СПб: Профессия. – 2005. – 304 с.
17. Tsykhanovska, I. V. Investigation of magnetite nanoparticles of lipid-magnetite suspensions by methods of photometry and electron microscopy / I. V. Tsykhanovska, O. V. Aleksandrov, T. B. Gontar, Z. V. Barsova, M. G. Kokodyi // East European Journal of Advanced Technologies. – 2016. – Vol.6/3. – P. 28–38. – doi: 10.15587/1729-4061.2016.69826.
18. Ilyukh, N. G. Production technology and quality indices of a food additive based on magnetite / N. G. Ilyukh, I. V. Tsykhanovska, Z. V. Barsova, V. A. Kovalenko // East European Journal of Advanced Technologies. – 2010. – Vol. 6. – 48. – P. 32–35.
19. Tsykhanovska, I. V. Development of technology of rye-wheat bread "Kharkiv Rodnichek" with the addition of a multifunctional nutritional supplement "Magnetofood" / I. V. Tsykhanovska, O. V.
РІШЕННЯ
СУЧАСНИХ ТЕХНОЛОГІЙ

26. 20. mekanizm between the lipo- and glucoproteids of rye- 

48. №  

97. mechnizm of interaction of carbohydrates of rye-wheat flour and nanoparticles of the functional food additive 

“Magnetofood” / I. Tsykhanska, A. Alexandrov, V. Evlash, T. Lazareva, O. Bryzytska // European Journal of Advanced Technologies. – 2018. – Vol. 4 /11/. – Р. 61–68. – doi: 10.15587/1729-4061.2018.140048.

21. Tslyhanska, I. Substantiation of the mechanism of interaction of carbohydrates of rye-wheat flour and nanoparticles of the functional food additive “Magnetofood” / I. Tslyhanska, A. Alexandrov, V. Evlash, T. Lazareva, T. Yevlash // European Journal of Advanced Technologies. – 2018. – Vol. 3 /11/. – Р. 59–68. – doi: 10.15587/1729-4061.2018.133373.

22. Tslyhanska, I. Formation of the functional and technological properties of the beef minced meat by using the food additive on the nanopowder basis of double oxide of two- and trivalent iron / I. Tslyhanska, L. Skurikhina, V. Evlash, L. Pavlotska // Ukrainian food journal. – 2018. – Vol. 7. – 3. – Р. 379–396. – doi: 10.24263/2304-974X-2018-7-3-4.

23. Bабаходжаев, С. Ф. Мармелад на хлопковом пектине / С. Ф. Bабаходжаев // Пищевая промышленность. – 1991. – № 2. – С. 54.

24. Призарова, У. Пищевые вещества из отходов пищевых производстv / У. Призарова, А. Х. Арифходжаев, Х. Т. Салов / Пищевая промышленность. – 1991. – № 2. – С. 55.

25. Крапивницкая, И. А. Основные и функционально-суспензирующие пищевые компоненты для отделочного производства желирующих материалов / И. А. Крапивницкая, В. И. Оболенская, У. С. Йоббак // Кондитерское производство. – 2014. – № 5. – С. 33–34.

26. Иоргачева, Е. Г. Альтернативные виды сырья в технологии получения пасто-мармеладных изделий / Е. Г. Иоргачева, К. В. Автенис, А. В. Куз // Хлебопекарная і кондитерська промисловість України. – 2009. – № 1. – С. 14–16.

27. Гурьянов, И. Д. Хитозан в производстве желейного мармелада / И. Д. Гурьянов, З. И. Фанрихманова, Д. И. Фанрихманова // Вестник Казанского технологического университета. – 2014. – № 7. – С. 205–208.

28. Донченко, Л. В. Пектин: основные свойства, производство и применение / Л. В. Донченко, Г. Г. Фирсов. – М.: Дели-принт. – 2007. – 276 с.

29. Фошан, А. Л. Регуляция реологических и структурно-механических свойств желейных виробів та напіфабрикатів на основі комбінованих систем драге утворювачів / А. Л. Фошан // Хлібопекарська і кондитерська промисловість України. – 2010. – № 2. – С. 29–30.

30. Гриненко, И. Г. Некоторые закономерности образования инулиновых гелей / И. Г. Гриненко, Р. И. Грушецкий, Л. М. Хомич// Сахар: Научно-технический и производственный журнал. – 2014. – № 11. – С. 54–55.

31. Щебершина, Н. Н. Использование рикугеля 8100 в производстве желейного мармелада / Н. Н. Щебершина // Кондитерское производство. – 2013. – № 6. – С. 15–16.

32. Игнатова, Т. А. Использование гидрогелей каррагинанов в технологии желейных продуктов / Т. А. Игнатова, А. В. Подкорытова // Актуальные проблемы охлаждения биологических ресурсов мирового океана: материалы III Междунар. науч.-техн. конф. в 2 частях. Владивосток: Дальрыбвтуз. – 2014. – С. 58–63.

33. Теймурова, А. Т. Розробка технології желейної продукції з використанням концентратів тваринних білків: автореф. дис… кан. техн. наук: 05.18.16 / НАН України. –Харків: Харківський державний університет харчування та торгівлі, 2010. – 18 с.

34. Осипов, А. Пектинов и каррагинаны для кондитерских изделий. Новые возможности традиционных ингредиентов / А. Осипов // Кондитерское производство. – 2012. – № 5. – С. 18–19.

35. Маренкова, Т. И. Способ отмирания мармелада желейного формового на каппа-каррагинане с яконо эмениными функционально-технологическими возможностями. Патент 94598 UA. МПК A23L 1/00. –2014. – Бюл. № 22. – 4 с.

36. Фошан, А. Л., Григоренко, А. М. Способ підвищення міцності драглісусофіатних полісахаридів. Патент 61370 UA. МПК A 33 L 1/06. – 2014. – Бюл. № 14. – 4 с.

37. Овсинникова, Л. Г. Использование кислых полисахаридов для сокращения расхода студеобразователей из красных морских водорослей / Л. Г. Овсинникова // Сборник материалов науч. техн. конференции «Прогрессивные технологии и оборудование пищевых производств». – СПб: ГАХПТ. – 1999. – С. 183.

38. Евделяев, Б. В. Лактатсодержащие пищеве добавки и мармелад функционального назначения / Б. В. Евделяев, Т. М. Черпилова, А. Т. Никифорова // Кондитерское производство. – 2013. – № 6. – С. 13–16.

39. Свиридов, В. В. Влияние природы студеобразователя на свойства пищевых студней / В. В. Свиридов, А. В. Банинюк, Н. М. Пичкина // Известия вузов. Пищевая технология. – 2012. – № 1. – С. 59–61.

40. Шехонцова, Т. Г. Развитие технологии желейного мармелада с заданными потребительскими свойствами / Т. Г. Шехонцова, Ю. И. Сидренко // Хранение и переработка сельхозпродуктов. – 2008. – № 8. – С. 65–67.

41. Золотарева, Л. А. Структурообразователи и прочностные свойства желейных изделий / Л. А. Золотарева, К. В. Автенис // Хлебопекарская і кондитерська промисловість України. – 2007. – № 4. – С. 40–41.

42. Крапивницька, І. О. Наукові та практичні аспекти пектину та пектинопродуктів: монографія / І. О. Крапивницька, Ф. В. Перцевй, Є. О. Омельчук. – Суми: Сумський національний аграрний університет. – 2015. – 314 с.

43. Аймесон, А. Пищевые загустители, стабилизаторы, гелеобразователи / пер. С. В. Макарова. – СПб.: ИД «Профессия». – 2012. – 408 с.
44. Голубев, В. Н. Функциональные свойства пектинов и крахмала / В. Н. Голубев, С. Ю. Белов, А. В. Подюх // Пищевые ингредиенты. Сырые и добавки. – 2000. – № 1. – С. 14–18.
45. Мазур, Л. М. Физико-химические процессы гелеобразования пектинов в пищевых технологиях / Л. М. Мазур, А. А. Олехнович // Сахар. – 2014. – № 1. – С. 2–5.
46. Карнаушенко, Л. И. Рецептуры желеобразных масс / Л. И. Карнаушенко, Э. И. Погоцева, Э. И. Чмарь // Кондитерская и хлебобулочная промышленность. – 1981. – № 3. – С. 41–42.
47. Иванушко, Л. С. Сахар в пастилу и заливку / Л. С. Иванушко. – М.: Пищевая промышленность. – 1974. – 208 с.
48. Штайдер, Р. Многокритериальная оптимизация. Теория, вычисления и приложения: [пер. с английского] / Р. Штайдер. – М.: Радио и связь. – 1992. – 504 с.
49. Євлаш, В. В. Наукові аспекти формування якості дітичних добавок; що містять гемове залізо, та кондитерських виробів із їх використанням: монографія / В. В. Євлаш, В. О. Акмін. – Харків: ХДУХТ. – 2015. – 183 с.

References (transliterated)
1. Stasinev'ch, S. A., Vyalys'ky'j, S. M. Ry' nok kondy'ts'ky'x ry' rovub Ukrainy'ny': propozyi'cyia i pop'y't. Produkty & ingrediyenty, 2013, 1, 14–17.
2. Garbi, E. Zhelezno-zhevatel'naja sladost' dlia ukrainca. Produkty & ingrediyenty, 2011, 2, 40–42.
3. Segment pastilo-marmeladnyx izdelij i vostochnyx sladostej. Kto opredeljaet tendencii: sost. Kopteeva S. [i dr.]. Available at: http://my-ki.ru/articles.php. (data zvernennia 30.08.2019).
4. Bochkovskaya, E. Marmelad i zehe: ili zdorovo, ili dostupno pokupatel'yu? Produkty & ingrediyenty, 2013, 2, 14–17.
5. Iorgacheva, E. G. Zhevat'nye i zheleznnye marmelady. Konditerskie i hlebopekarnye proizvodstvo, 2010, 1, 54–55.
6. Vas'kina, V. A. Srravnitel'naja harakteristika tehnologij zheleznogo marmelada. Konditerskie i hlebopekarnye proizvodstvo, 2004, 6 (34), 1–4.
7. Iorgacheva, E. G., Avetisjan, K. V. Regulirovanie kachestva zheleznogo marmelada s izmenennym uglovodnym sostavom. Vostochno-evropejskija zhurnal peredovixh tehnologij, 2016, 2, 11 (80), 28–38, doi: 10.15587/1729-4061.2016.65768.
8. Iorgacheva, E. G., Makarova, O. V., Avetisjan, K. V. Regulirovannyie strukturno-reologicheskih svoistv zheleznih i svisnyih mass dlja duvishlogogo marmelada. Vostochno-evropejskij zhurnal peredovyxh tehnologij, 2014, 2, 12 (68), 122–127, doi: 10.15587/1729-4061.2014.23380.
9. Salieva, A. Pectin substances from sea and freshwater grasses as stabilizers at manufacturing of canned food of type confiture. Vestnik of Astrakhan State Technical University, 2013, 1, 194–200.
10. Yang, Y., Zhang, G., Hong, Y., Gu, Z., Fang, F. Calcium cation tigation and accelerates the gelation of high methoxy pectin. Food Hydrocolloids, 2013, 32 (2), 228–234, doi: 10.1016/j.foodhyd.2013.01.003.
11. Kaya, M., Sousa, A. G., Crepeau, M. J., Sorensen, S. O., Ralet, M. C. Characterization of citrus pectin samples extracted under different conditions: Influence of acid type and pH of extraction. Annals of Botany, 2014, 114 (6), 1319–1326, doi: 10.1093/aob/mcu150.
12. Zhang, X., Liu, X., Cao, M., Xia, K., Zhang, Y. Preparation of hydroxypyrrol agars and their properties. Carbohydr. Polym., 2015, 129, 87–91, doi: 10.1016/j.carbpol.2015.04.056.
13. Schirmer, M., Jekle, M., Arendt, E., Becker, T. Physicochemical interactions of polydextrose for sucrose replacement in pound cake. Food Research International, 2012, 48 (1), 291–298, doi: 10.1016/j.foodres.2012.05.003.
14. Artamonova, M. V., Lisjuk, G. M., Tuz, N. F. Tehnologija marmeladu zheleznego z vikoristanniam krias-poroshkiv roslinnogo pohodzhennja: monografija. Harkiv: HDUHT, 2015, 184.
15. Dragilev, A. I., Lur'e, A. I. Tehnologija konditerskih izdelij. Moskva: DeLi-print, 2001, 483.
16. Sarafanova, L. A. Primenenie pishevyxh dovobkov v konditerskoj promyshlennosti. SPb: Professija, 2005, 304.
17. Tsykhanovska, I. V., Aleksandrov, O. V., Gontar, T. B., Barsova, Z. V., Kokodyi, M. G. Investigation of magnetite nanoparticles of lipid-magnetite suspensions by methods of photometry and electron microscopy. East European Journal of Advanced Technologies, 2016, 6/3 (81), 28 – 38, doi: 10.15587/1729-4061.2016.69826.
18. Ilyukh, N. G., Tsykhanovska, I. V., Barsova, Z. V., Kovalenko, V. A. Production technology and quality indices of a food additive based on magnetite. East European Journal of Advanced Technologies, 2010, 6 (48), 32 – 35, doi: 10.15587/1729-4061.2010.48697.
19. Tsykhanovska, I. V., Aleksandrov, O. V., Evlash, V. V., Lazareva, T. A., Svidlo, K. V., Gontar, T. B. Development of technology of rye-wheat bread "Kharkiv Rodnichok" with the addition of a multifunctional nutritional supplement "Magnetofood". East European Journal of Advanced Technologies, 2017, 6/11 (90), 48 – 58.
20. Tsykhanovska, I., Alexandrov, A., Evlash, V., Lazareva, T., Bryzhtsa O. Substantiation of the interaction mechanism between the lipo- and glucoproteids of rye-wheat flour and nanoparticles of the food additive “Magnetofood”. East European Journal of Advanced Technologies, 2018, 4/11 (94), 61–68, doi: 10.15587/1729-4061.2018.140048.
21. Tsykhanovska, I., Alexandrov, A., Evlash, V., Lazareva, T., Yevlash, V., Lazareva, T. A., Svidlo, K. V., Gontar, T. B. Substantiation of the mechanism of interaction of carbohydrates of rye-wheat flour and nanoparticles of the polyfunctional food additive “Magnetofood”. East European Journal of Advanced Technologies, 2018, 3/11 (93), 59–68, doi: 10.15587/1729-4061.2018.133373.
22. Tsykhanovska, I., Skurikhina, L., Evlash, V., Pavlotska, L. Formation of the functional and technological properties of the beef minced meat by using the food ad-ditive on the nanopowder basis of double oxide of two- and trivalent iron. Ukrainian food journal, 2018, 7 (3), 379–396, doi: 10.24263/2304-974X-2018-7-3-4.
23. Babahodzhaev, S. F. Marmelad na hlopkovom pektine. Pishheva promyshlennost'. 1991, 2, 54.
24. Prnazarova, U., Arifходzhәев, A. H., Salomov, H. T. Pektинове вешества из отходов пищевых производств. Pishcheva promyslennost', 1991, 2, 55.

25. Krapivnickaja, I. A., Obolkin, V. I., Jovbak, U. S. Овощи и фруктово-овощные пектиноводерзшзее продукты в отдельных полифабrikатах с зеленой структурой. Konditersкoe proizводство, 2014, 5, 33–34.

26. Iorgacheva, E. G., Avetisjan, K. V., Kue, A. V. A.ftermatynye vidy sy'rya v tehnologii poluchenia pastilo-marmeladnyx izdeli. Hilipoepekar'ska i konditers'ka promoslivost' України, 2009, 1–16.

27. Gur'janov, I. D., Faizrahmanova, Z. I., Faizrahmanova, D. I. Hitozan v proizводстве зеленого мармелада. Vestnik Kazanskago tehnologicheskago universiteta, 2014, 7, 205–208.

28. Donchenko, L. V. Pektin: osnovnye svojstva, proizводство i primenenie. M.: Deli-print, 2007, 276.

29. Foshhan, A. L. Regulyuvannya reologichnyx ta strukturno-mechanichnyx vlasty'v stеl'nych' x vy'robiv ta napivfabrykativu na osnovi kombinovanych' x sy'stem dragle utvoryuvachiv. Xlibipoepekar'ska i kondy'ters'ka promyslivost' Ukrayini, 2010, 2, 29–30.

30. Grinenko, I. G., Grusheckij, R. I., Homichak, L. M. Nekotorye zakonomernosti obrazovanija inulinovyh gelej. Funkcional'nogo naznachenija. Xlibipoepekar'ska i konditers'ka promyslivost' Ukrayini, 2007, 4, 40–41.

31. Grinenko, I. G., Grusheckij, R. I., Homichak, L. M. Estimasyon karraginany вы'кор'ystanniam: monografiya. Xarkiv: XDUHT, 2013, 41–56.

32. Tejmurova, A. T. Rozrobka tehnologij зелененькій продукції зи v'y'kory'stanniam koncentrativ tvary'n'x bilikiv: avtoref. dy's. kand. tehn. nauk. Karkiv: Xar'kivs'kyj derzhavnyj universy't tet xarchuvannya ta torgivlia, 2018.

33. Osi̇pov, A. Pektẏn i karraginany dlja konditerskih izdeli. Novye vozmoznosti tradicionnyh ingredienctv. Konditersкoe proizводство, 2013, 6, 15–16.

34. Ignatova, T. A., Podkorytova, A. V. Ispol'zovanie gidrogelej karraginov v tehnologii zhelejnyh produktov. Aktual'nye svojstva biologicheskikh resarsov mirovoego okoea: materialy III Mezhdunar. nauch.-tehn. konf. v 2 chastjah. Vladivostok: Dal'rybvytna, 2014, 58–63.

35. Tejmurova, A. T. Rozrobka tehnologij зелененькій продукції зи v'y'kory'stanniam koncentrativ tvary'n'x bilikiv: avtoref. dy's. kand. tehn. nauk. Karkiv: Xar'kivs'kyj derzhavnyj universy't tet xarchuvannya ta torgivlia, 2018.

36. Osi̇pov, A. Pektẏn i karraginany dlja konditerskih izdeli. Novye vozmoznosti tradicionnyh ingredienctv. Konditersкoe proizводство, 2012, 5, 18–19.

37. Osvjannikova, L. G. Ispo'l'zovanie kislyx polisaharidov dlja sokrashhenija rashod sudeoobrazovatelей iz krasnych'x morskih'x vodorostej. Sbornik materialov nauch-tveh. konferencii «Progressivnye tehnologii i oborudovanie pishchevyh proizvodstv», SPb: GAHTP, 1999, 183.

38. Evaleva, V. V., Chepalkova, T. M., Nikiforova, T. A. Laktsadorszhzee Pistheveye dobavki i marmelad funkcionaľ'nogo naznachenija. Konditersкoe proizводство, 2013, 6, 13–16.

39. Svirdov, V. V., Bannikova, A. V., Ptichkina, N. M. Vlijanie prirody studneobrazovatelja na svojstva pishchevyh studnej. Izvestia vuzov. Pishchevaja tehnologija, 2012, 1, 59–61.

40. Shehovcova, T. G., Sidorenko, J. Razrabotka tehnologii зелененького мармелада с заданными потребител'скими svojstvami. Hranenie i pererabotka sel'hozvyrya, 2008, 8, 65–67.

41. Zolotareva, L. A., Avetisjan, K. V. Strukturoobrazovateli i prochnostnye svojstva зеленького izdeli. Xlibipoepekar'ska i kondy'ters'ka promyslivost' Ukrayini, 2007, 4, 40–41.

42. Ignatova, T. A., Podkorytova, A. V. Ispol'zovanie karraginany v tehnologii zhelejnyh marmelad s zadannymi svojstvami. Pishchevye zagustiteli, stabilizatory, geobrazovateli: pr. Makarova SV. SPb.: ID «Professija», 2012, 408.

43. Golubev, V. N., Beglov, S. Ju., Podzhuev, A. V. Funkcional'nye svojstva pishtevyh i krahmalno. Pishchevye ingrediencty. Sy're i dobavki, 2000, 1, 14–18.

44. Mazur, L. M., Olehnovicz, A. A. Fiziko-himicheskie processy geobrazovaniya pektinov v pisshchevyh tehnologijah. Sahar, 2014, 1, 2–5.

45. Kernauwenko, L. L., Pogonceva, Ye. O. Naukovyi aspekty' aspekty' formuvannya potrebitel'skimi svojstvami. Konditerska i klebopekar'na promyslennost', 1981, 3, 41–42.

46. Ivanushko, I. S. Receptury нa мarmelad, pastilu i zefir. M.: Pishcheva promyslennost', 1974, 208.

47. Shtajer, R. Mnogokriterial'naja optimizacija. Teorija, vychisljenija i prilozhenija: [per. s anglijskogo]. M.: DeLi-print, 2015, 183.
Будь ласка, посилайтеся на цю статтю наступним чином:

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АННОТАЦИЯ
Дефицит отечественного сырья, значительная часть импортных ингредиентов с высокой стоимостью, растущая конкурентоспособность заставляют производителей искать новые технологические решения для повышения потребительских свойств мармеладной продукции. Перспективным направлением в области желейно-мармеладных изделий является создание продукции, которая имеет высокие показатели качества и длительный срок хранения. С этой целью в технологии желейного мармелада используются различные пищевые добавки – улучшители. В качестве улучшителя формового желейного мармелада нами разработана и предложена пищевая добавка “Магнетофуд” – нанопорошок с размером частиц (70–80) нм. “Магнетофуд” – пищевая добавка с высоким функционально-технологическим потенциалом. Добавка “Магнетофуд” может как самостоятельно формировать структурно-механические свойства желейных масс, так и влиять на гелеобразователь, вступая с ним в химические и электростатические взаимодействия. Поэтому, пищевая добавка “Магнетофуд” может влиять сразу на несколько технологических свойств в пищевой желейной системе: быть стабилизатором, загустителем, студнеобразователем. За счет Fe (II), наноразмеров, развитой активной поверхности, бактериостатичности, высокой термостабильности “Магнетофуд” имеет восстановительные, антиоксидантные, антимикробные, сорбционные, комплексообразующие, эмульгирующие, жироудерживающие, водосвязывающие, стабилизирующие, структурирующие свойства. Это позволяет рекомендовать “Магнетофуд” как добавку комплексного действия для повышения качества и продления срока хранения формового желейного мармелада. Исследовано влияние пищевой добавки “Магнетофуд” на органолептические, физико-химические, микробиологические показатели опытных образцов формового желейного мармелада на агаре и пектине.

Ключевые слова: технология; пищевая добавка “Магнетофуд”; формовой желейный мармелад; показатели качества.

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