 STUDY OF THE WATER BINDING IN THE GEL SYSTEMS OF PECTIN AND SODIUM ALGINATE (p. 4-11)

Iryna Sokolovska, Julya Kambulova, Nataliia Overchuk

One of the modern development trends of the confectionery industry is sugar reduction in products. Some sugar can be reduced in technological schemes of those confectionery masses in which structural stability is achieved by gelling. In such systems, hydrocolloids absorb and retain significant amounts of water, decrease its activity, which contributes to the microbiological stability of products during storage, and provides constant structural and mechanical properties.

Gel systems, which are the basis of many confectionery products form a strong structure with the comprehensive use of structure-forming agents. It is found that the combination of sodium alginate and pectin produces additional hydrogen bonds between chains of macromolecules, which increases the water binding energy in the system and the bound water portion. It is revealed that the adsorption-bound water has the largest share in the systems. Its amount in the complex gels is by 8–10 % higher than the amount of bound water in monocomponent samples. That is, water removal in these gels will be slower. This has a positive impact on the structural stability of gel-like confectionery products with reduced sugar in the formulation, provides microbiological safety of products during storage.

The development of this direction will find wide application, since the structure of a wide range of confectionery products is stabilized due to the developed gel-like properties of hydrocolloids. These are pastila and fruit jelly products, fillings for flour confectionery and candies, centers for sweets, etc.

Keywords: sugar reduction, pectin, alginate, polysaccharide complexes, synergy, thermogravimetric analysis of gels.

References
1. Guidance for Industry: A Food Labeling Guide (9. Appendix A: Definitions of Nutrient Content Claims) (2013). Food and Drug Administration, Office of Nutrition, Labeling and Nutrition, U.S. Department of Health and Human Services. Available at: http://www.fda.gov/Food/GuidanceRegulatoryInformation/LabelingNutrition/ucm2006828.htm
2. Nestle Policy on Sugars (2014). Corporate Wellness Unit, Nestle Research center. Nestle Ltd., Vevey, Switzerland. Available at: http://www.nestle.com/asset-library/documents/library/documents/about_us/nestle-policy-sugars.pdf
3. Li, J.-M., Nie, S.-P. (2016). The functional and nutritional aspects of hydrocolloids in foods. Food Hydrocolloids, 53, 46–61. doi: 10.1016/j.foodhyd.2015.01.035
4. Dorofovych, A., Obolhina, V., Gavva, O., Kiyantisya, S. (2005). Vykorystannia hidozoloidiv u kondyters’komu vyrobnyctvi. Khlibopetsk’ka t kondyters’ka promysovyist’ Ukrainy, 2, 9–11.
5. Mata, Y. N., Blázquez, M. L., Ballester, A., González, F., Muñoz, J. A. (2009). Sugar-beet pulp pectin gels as biosorbent for heavy metals: Preparation and determination of biosorption and desorption characteristics. Chemical Engineering Journal, 150 (2-3), 289–301. doi: 10.1016/j.cej.2009.01.001
6. Fuks, L., Filipiuk, D., Majdan, M. (2006). Transition metal complexes with alginate biosorbent. Journal of Molecular Structure, 792-793, 104–109. doi: 10.1016/j.molstruc.2005.12.053
7. Korzun, V. (2012). Zahody z minimalizacii dozy vnutrishnogo oprominennya naselennya. Invirotment and Health, 2, 23–29.
8. Ulrich-Merzenich, G., Panek, D., Zeitzler, H., Wagner, H., Vetter, H. (2009). New perspectives for synergy research with the “omic”-technologies. Phytomedicine, 16 (6-7), 495–508. doi: 10.1016/j.phymed.2009.04.001
9. Lima, A. M. F., Soldi, V., Borsali, R. (2009). Dynamic light scattering and viscosimetry of aqueous solutions of pectin, sodium alginate and their mixtures: effects of added salt, concentration, counterions, temperature and chelating agent. Journal of the Brazilian Chemical Society, 20 (9), 1705–1714. doi: 10.1590/s0103-50532009000900020
10. Gohil, R. M. (2010). Synergistic blends of natural polymers, pectin and sodium alginate. Journal of Applied Polymer Science, 120 (4), 2324–2336. doi: 10.1002/app.33422
11. Walkenström, P., Kidman, S., Hermansson, A.-M., Rasmussen, P. B., Hoegh, L. (2003). Microstructure and rheological behaviour of alginate/pectin mixed gels. Food Hydrocolloids, 17 (5), 393–393. doi: 10.1016/s0268-005x(02)00119-4
12. Madziva, H., Kailasapathy, K., Phillips, M. (2006). Evaluation of alginate–pectin capsules in Cheddar cheese as a food carrier for the delivery of folic acid. LWT – Food Science and Technology, 39 (2), 146–151. doi: 10.1016/j.lwt.2004.12.015
13. Young, N. W., Kappel, G., Bladt, T. (2003). A polyanuron blend giving novel synergetic effects and bake-stable functionality to high soluble solids fruit fillings. Food Hydrocolloids, 17 (4), 407–418. doi: 10.1016/s0268-005x(03)00032-8
14. Pestyna, A. A. (2011). Perspektivy vykorystannya system na osnovi alginatu natriyu ta pectyny v technologii harchovykh produktiv. Materiały V Mìghnarodnoyi konferentsii “Nuzkotemperaturna ta harchovi tehnologi u XXI stolitti”, 253–257.
15. Pytovarov, Ye. (2014). Vyvchennya procesu geleuvtorennya v obolonkah kapsuluvanych produktiv z pozicji kvantovo-himichnogo modeluvannya. Visnyk NTU “XPI”, Seriya: Novi rishennya v suchasnyh tehnologiyah, 17, 169–175.
16. Silva, M. A. da, Bierhalz, A. C. K., Kieckbusch, T. G. (2009). Alginate and pectin composite films crosslinked with Ca2+ ions: Effect of the plasticizer concentration. Carbohydrate Polymers, 77 (4), 736–742. doi: 10.1016/j.carbpol.2009.02.014
17. Nykytchyna, T. (2014). Zmina rozchynnosti pectynovych rechovyn za fermentatystvyno-gidrolizu pectynytetelyserazhy kartoplyanoi myazgy. Nauka i osvita: problemy ta perspectyvy, Part 1, 211–214.
18. Muhamedghanova, M. Yu., Filatova, A. V., Dghurbave, D., Turaev, A. S. (2012). Procesy geleuvtorennya ta reologichni vlastyvosti pomirno-koncentrovanykh vodyh rozchyniv cytrusovogo pectyny v prysutnosti ioniv polivalentnykh metali. Himiya rastitelnogo syrya, 1, 51–60.
THE RATIONALE OF SELECTING PASTRIES TO BE MADE WITH WAXY WHEAT FLOUR (p. 12-18)

Katerina Iorgachova, Olga Makarova, Kateryna Khvostenko

Analysis of the distinctive characteristics of various pastries has proved relevance of the differentiation approach (practiced outside Ukraine) to the technological properties of flour in producing specific product groups in Ukraine. The study shows the expediency of using non-amyllose waxy wheat flour to stabilize the quality of pastries. The study of the technological properties of waxy wheat flour and characteristics of its starch composition has predetermined the choice of pastries with different textures – yeast pastries and honeybread cookies compatible with this type of flour. It has been found that the use of waxy wheat flour in the technology of yeast cakes improves the quality of finished products. A non-amyllose type of flour instead of wheat flour in making low-sugar biscuits results in higher consumption characteristics in comparison with the standard, even when sugar is completely excluded from the recipe. The study of changes in the quality of no-bake and boiled honeybread cookies in storage shows that the use of non-amyllose flour facilitates preserving the honeybread cookies’ freshness, which is evidenced by a lower crystalinity of starch in no-bake honeybreads based on waxy wheat flour as well as less intensive weight loss in boiled honeybread cookies and higher crumbliness of the latter compared to the standard.

Keywords: waxy wheat, amylopectin, flour, technological properties of flour, yeast cakes, low-sugar biscuits, no-bake and boiled honeybread cookies.

References
1. Analiz rynda v Ukraini i v Mire. Available at: http://ar-group.kiev.ua
2. Dragilev, A. I., Marshalkin, G. A. (1999). Osnovy konditer-skogo proizvodstva. Moscow: Kolos, 448.
3. Manley, D. (2003). Technology of biscuits, crackers and cookies. Cambridge: Woodhead Publishing Limited, 558.

4. Lysjuk, G. M. (Ed.) (2009). Tehnologiya boroshnjanyh kondyters’kyh i hlibobulochnyh vyrobyv. Sumy: VTD «Universytets’ka knyga», 464.
5. Steele, R. (2004). Understanding and measuring the shelf-life of food. Woodhead Publishing, 448.
6. Olejnikova, A. A., Akensonova, L. M., Magomedov, G. O. (2010). Tehnologija konditerskich izdelij. Sph.: RAPP, 672.
7. Tehnologija hlebopechenjia. Available at: http://www.russ-bread.ru
8. Hlebinfo. Available at: http://hlebinfo.ru
9. Al-Dmoor, H. (2013). Correlation study between volume and overall acceptability of cake with properties of hard wheat flour. American Journal of Agricultural and Biological Sciences, 8 (2), 149–155. doi: 10.3844/ajabssp.2013.149.155
10. Zhigunov, D. A. (2011). Osobennosti klassifikacii i cel-evogo ispol’zovanija zerna pschenicy v Ukraine i zarubezhom. Zernovi produkty i kombikormi, 3, 4–9.
11. Zhigunov, D. A., Voloshenko, O. S., Broslavceva, I. V. (2013). Analiz kachestva pschenichnoj muki ucelovogo naznacheniia. Hranienie i pererabotka zerna, 3, 41–43.
12. Rybalka, O. I. (2011). Jakist’ pschenicy ta i’i polipshennja. Kyiv: Logos, 495.
13. Wang, S., Wang, J., Zhang, W., Li, C., Yu, J., & Wang, S. (2015). Molecular order and functional properties of starches from three waxy wheat varieties grown in China. Food Chemistry, 181. 43–50. doi: 10.1016/j.foodchem.2015.02.065
14. Zhang, H., Zhang, W., Xu, C., Zhou, X. (2013). Morphological features and physicochemical properties of waxy wheat starch. International Journal of Biological Macromolecules, 62, 304–309. doi: 10.1016/j.ijbiomac.2013.09.030
15. Yu, X. R., Zhou, L., Zhang, J., Yu, H., Gao, D. R., Zhang, B. Q. et. al. (2015). Comparison of Structural Development and Biochemical Accumulation of Waxy and Non-waxy Wheat Caryopses. Cereal Research Communications, 43 (2), 307–317. doi: 10.1556/crc.2014.0038
16. Yi, J., Johnson, J. W., Kerr, W. L. (2009). Properties of bread made from frozen dough containing waxy wheat flour. Journal of Cereal Science, 50 (3), 364–369. doi: 10.1016/j.jcs.2009.07.002
17. Choi, I., Kang, C.-S., Cheong, Y.-K., Hyun, J.-N., Kim, K.-J. (2012). Substituting Normal and Waxy-Type Whole Wheat Flour on Dough and Baking Properties. Preventive nutrition and food science, 17 (3), 197–202. doi: 10.3746/ jpnf.2012.17.3.197
18. Huang, Y.-C., Lai, H.-M. (2010). Noodle quality affected by different cereal starches. Journal of Food Engineering, 97 (2), 135–143. doi: 10.1016/j.jfoodeng.2009.10.002
19. Acosta, K., Cavender, G., Kerr, W. L. (2011). Sensory and physical properties of muffins made with waxy whole wheat flour. Journal of Food Quality, 34 (5), 343–351. doi: 10.1111/j.1745-457X.2011.00401.x
20. Lebedenko, T. Ye., Pshenyshnjuk, G. F., Sokolova, N. Ju. (2014). Tehnologija hlebopекars’koj vyrobnyctva. Praktykum. Odesa: Osvita Ukrainy, 392.
21. Iorgachova, K. G., Makarova, O. V., Gordijenko, L. V., Korkach G. V.; Iorgachova, K. G. (Ed.) (2011). Tehnologija kondyters’koj vyrobnyctva. Praktykum: navch. posibnyk. Odesa: OANAHT, 208.
22. Jorgacheva, E. G. et. al. (2013). Zavarnye prjaniki s pshenichnymi pryazhami. Kyiv: «Spektr», 565.
23. Jorgacheva, E. G. et. al. (2013). Zavarnye prjaniki s pshenichnymi pryazhami. Kyiv: «Spektr», 565.
RESEARCH OF RHEOLOGICAL PROPERTIES OF EGG SPONGE WITH EXTRUDED CORN FLOUR (p. 19-23)

Tetiana Lisovska, Nina Chorna, Alexander Dyakov

Addition of extruded corn flour affects the egg sponge stability. The dependence of the effective viscosity of egg sponge samples with different concentrations of extruded corn flour on the shear rate and stress is investigated. Viscosity index is closely associated with the water-containing capacity of the egg sponge. So, there is a need to study the state of free and bound water in the egg sponge depending on the content of extruded corn flour. The aim of the research was to identify the impact of extruded corn flour on the rheological properties of the egg sponge under mechanical impact, and study of the effect of extruded corn flour addition on the ratio of the state of free and bound water in it.

The most intensive decrease in viscosity with increasing shear rate is observed in the sponge based on the mixture with the content of extruded corn flour of 50 % at a shear rate of 2.4 s^{-1}. Further decrease in effective viscosity with increasing shear rate is less intense, and all the samples tend to approach a constant viscosity of 2.4 Pa\cdot s (for the control sample) and the viscosity of 4.2 Pa\cdot s in the sample with the content of extruded corn flour of 50 % at a shear rate of 11.65 s^{-1}.

Increased amount of extruded corn flour raises the spin-experiment time, indicating a decrease in the mobility of water molecules in solution. This suggests that increased amount of extruded corn flour in the egg sponge increases the amount of bound water, which contributes to retaining more moisture in the finished product.

The research shows the feasibility of extruded corn flour in the technology of semi-finished sponge cake that will improve the quality indicators of the finished product and extend its life.

Keywords: extruded corn flour, semi-finished sponge cake, rheological properties, nuclear magnetic resonance.

References
1. Kravchenko, M. F., Romanenko, R. P., Romanovska, O. L. (2015). Structural and mechanical properties of baked sponge semi-finished products with the addition of flour “zdrozovia” and carob powder. Journal of Food Science and Technology, 9 (4), 37–43. doi: 10.15073/2073-8684.4/2015.55869
2. De la Hera, E., Martinez, M., Oliete, B., Gómez, M. (2012). Influence of Flour Particle Size on Quality of Gluten-Free Rice Cakes. Food and Bioprocess Technology, 6 (9), 2280–2288. doi: 10.1007/s11947-012-0922-6
3. Iorhachova, K. H., Makarova, O. V., Kotuzaky O. M. (2010). Biskvitni napivfabrykately na osnovy boroshna z produktiv pererobky hrechky. Zernovi produkty i kombikormy, 4, 12–15.
4. Kuznetsova, L. S., Sydanova, M. Yu. (2008). Tekhnologiya prihotovleniy mukhnych kondyterskykh yzdeli. Moscow: Akademyia, 319.
5. Lozova, T. M., Syrokhman, I. V. (2009). Naukovyi osnovy formuvannia spozhuvnykh vlastyostei i zherhannya yakosti boroshnianyk kondyterskykh vyrobiv. Lviv: Vyd-vo LKA, 456.
6. Gómez, M., Doyagüe, M. J., dela Hera, E. (2012). Addition of pin-milled pea flour and air-classified fractions in layer and sponge cakes. LWT – Food Science and Technology, 46 (1), 142–147. doi: 10.1016/j.lwt.2011.10.014
7. Autio, K., Flander, L., Kinnunen, A., Heinonen, R. (2001). Bread Quality Relationship with Rheological Measurements of Wheat Flour Dough. Cereal Chemistry, 78 (6), 654–657. doi: 10.1094/chem.2001.78.6.654
8. Koruz J., Witzczak M., Ziobro R., Juszczak L. (2015). The influence of flour on rheological properties of gluten-free dough and physical characteristics of the bread. Eur Food Res Technol, 240, 1135–1143.
9. Gallagher, E. (Ed.) (2009). Gluten-free food science and technology. Blackwell Publishing Ltd, 240.
10. Sudha, M. L., Vetrimani, R., Leelavathi, K. (2007). Influence of fibre from different cereals on the rheological characteristics of wheat flour dough and on biscuit quality. Food Chemistry, 100 (4), 1365–1370. doi: 10.1016/j.foodchem.2005.12.013
11. Muratowa, E. I., Smolikhina, P. M. (2013). The use of regional raw materials for creating confectionery products for functional purposes In: Proceeding of international scientific and technical Conference after Leonardo da Vinci, 1, 177–185.
12. Pohozhykh, N. Y. et al. (2013). Voda v pyschevikh produktakh y dlia pyschevikh produktov. Kharkovskyi gosudarstvenyi universitet pytaniya i torgovli, 177.
13. Lisovska, T., Rybak, O., Kuhltn, M., Chorna, N. (2015). Investigation of water binding in sponge cake with extruded corn meal. Ukrainian food journal, 4 (3), 413–422.
14. Neronov, Yu. Y., Haralebkh, Z. (2003). Yadernii mahnytni rezonans v tomohrafii y v spektrolicheskih issledovaniyakh. SPb.: Sankt-Peterburshkyi hodsarstvenni ynstytut tochnoi mekhanyky u optyka (Tekhnichesky uniwersytet), 84.
15. Dunyleanko, O. F., Diakov, O. H., Torianyk, O. I. (2005). Avtomatyzovana systema vyniru YaMR spektrometra. Prohresyvni tekhnika ta teknolohiia kharchovykh vyrobnytstv recessanogo hospodarstva i torhivli, 2, 314–342.

STUDY OF THE PROTEIN-CARBOHYDRATE MIX EFFECT ON THE TECHNOLOGICAL PROPERTIES OF SHORT YEAST-LEAVENED DOUGH (p. 24-32)

Radion Nykyforov, Svitlana Popova, Alina Slashcheva, Yuri Korenets

The possibility of increasing the nutritional and biological value of bakery products through the use of a protein-carbohydrate mix (PCM) is considered. The main purpose of the research was to substantiate the effective concentration of PCM in terms of the technological properties of yeast-leavened dough.

The study was conducted on the model systems of short yeast-leavened dough by preactivation of yeast (Saccharomyces cerevisiae) in a culture medium consisting of water and dry additives produced from potato secondary products.

Investigations to determine the chemical and amino acid composition of PCM were carried out, high biological value of the mix was proved. The PCM effect on the gas-forming ability of dough, as well as indicators of active and titratable acidity of the yeast-leavened dough was examined. Improvement of the properties of flour protein-protease complex in the presence of PCM was revealed.

It is proved that the use of PCM in a concentration of 15 % by weight of flour improves the technological properties of yeast-leavened dough.
The results can be used in the baking industry to intensify the production of yeast-leavened baked products, as well as increase the biological value of the finished products.

**Keywords:** protein-carbohydrate mix, dry potato additive, yeast-leavened dough, gas-forming ability, active acidity.

**References**

1. Levin, R., Lang, K. W., Murphy, G. B., Dibble, J. W. (2007). Patent US 7225850 B2, MPK A21L 1/0534 (2006.01) High protein and high fiber food products. Applicant and patent holder Delavan LLC, Philadelphia, PA (US). № 10/4521026; declared 30.05.2003; published 07.08.2007, 8 p.

2. Popova, S. Ju., Nkyforov, R. P., Slashheva, A. V. (2015). Pro-activation optimization of the yeast. Technology audit and production reserves, 5/4(25), 29–35. doi: 10.15587/2312-8372.2015.51760

3. Sokol, N. V., Hrapko, O. P. (2010). Ispol'zovanie vtorichnyh syr'evyh resursov APK v proizvodstve hleba lecheno-profilakticheskogo naznachenija. Nauchnyj zhurnal «Univer- sitet. Nauka. Idei i reshenija», 1, 218–221.

4. Gelinas, P. (2010). Mapping early patents on baker's yeast manufacture. Comprehensive Reviewing in Food Science and Food Safety, 9 (5), 483–497. doi: 10.1111/j.1541-4337.2010.00122.x

5. Arsen'jeva, L. Ju., Arsynenko, N. O., Arsynenko, S. V. (2011). Patent 61737 Ukrai'na, MPK A21D 2/26 (2006.01): Sklad sumishi «Ideal». Zajavnyk ta patentovlasnyk Nacional'na akademija harchovyh tehnologij (Ukrai'na). № u201100602; declared 19.01.2011; published 25.07.2011, Bjul. № 14, 3.

6. Kalmina, I. V., Naumenko, N. V., Feklicheva, I. V. (2015). Isledovanie kachestva obogashhennyh vidov hleba v pro- cesse hranenija. Vestnik JuUrGU. Serija «Pishhevye i vyrobnyctva pshenychnogo hliba. № u201305454; declared 24.09.2014; published 25.07.2015, Bjul. № 10, 7.

7. Arsen'jeva, L. Ju., Arsynenko, N. O. (2009). Patent 46539 Ukrai'na, MPK A21D 2/10 (2009.01): Sklad kompozicijnoi' boroshnjano-zerновoi' sumishi sumishy dlja hlibobulochnych vyrobiv. Zajavnyk ta patentovlasnyk Nacional'nyj univer- sityet harchovyh tehnologij (Ukrai'na). № u200907178; declared 09.07.2009; published 25.12.2009, Bjul. № 24, 3.

8. Bortnichuk, O. V., Cyryl'nikova, V. V., Docenko, V. F., Pavlenko, A. A. (2015). Patent 99087 Ukrai'na, MPK A21D 8/00 (2015.01): Sposob vyrobykhvytnych hlibobulochnych vyrobiv. Zajavnyk ta patentovlasnyk Nacional'nyj univer- sityet harchovyh tehnologij (Ukrai'na). № a201410456; declared 24.09.2014; published 25.07.2015, Bjul. № 10, 7.

9. Nikiforov, R. P., Korshunova, A. F. (2012). Obosnovanie sposoba poluchenija polufabrikata na osno-ve belkov obezhi- rennogo moloka s povyshennyh poverhnostno-aktivnymi svojstvami. Sbornik nauchnyh trudov Sworld «Sovremen- nye problemy i puti ih reshenija v nauke, transporte, proiz-vodstve i obrazovanii 2012», 10, 65–72.

10. Bortnichuk, O. V., Gavrysh, A. V., Docenko, V. F. (2014). Patent 107283 Ukrai'na, MPK A21D 8/02 (2006.01): Sposob otrzymyvanja hlibobulochnych vyrobiv profilaktichkogo pryz- znachenija. Zajavnyk ta patentovlasnyk Nacionalnyj uni- versityet harchovyh tehnologij (Ukrai'na). № a201309446; declared 29.07.2013; published 10.12.2014, Bjul. № 23, 5.

11. Aghar, A. (2009). Effect of modified whey protein concentrates on physical, thermal and rheological properties of frozen dough dis...doctor of philosophy in food technology. National Institute of Food Science & Technology University of Agriculture. Faisalabad, Pakistan, 204.

12. Debujka, F., Gruje, N., Metr, J., Mjushembje, Zh.-Zh. (2012). Patent 98442 Ukrai'na, MPK A21D 8/06 (2006.01): Sposob prygotuvannja zamorozhenoi' tistovoi' zagotovki napivfabrykatu, zamorozhena tistovago zagotovka napivfab- rykatu ta sposob odezhranija vypechenogo hlibopekar'kogo vyrobu. Zajavnyk ta patentovlasnyk Lezafr E Kompani (Francija). № a200701198; declared 05.07.2005; published 25.05.2012, Bjul. № 10, 13.

13. Jooyandeh, R. (2009). Evaluation of physical and sensory properties of Iranian Lavash flat bread supplemented with precipitated whey protein (PWP). African Journal of Food Science, 3 (2), 28–34.

14. Bortnichuk, O. V., Gavrysh, A. V., Njemirich, O. V., Docenko, V. F. (2015). Features of technological properties and chemical composition of naked oats cultivar «Salomon». Journal of Food Science and Technology, 2 (31), 97–102. doi: 10.15673/2073-8684.2015.44282

15. Lebedenko, T. Je., Kananngychina, O. M., Sokolova, N. Ju., Miserzhy, M. D. (2011). Patent 66097 Ukrai'na, MPK A21D 8/02 (2006.01): Kompozicija ingredijentiv dlja pry- gotuvannja hliba psenychnogo. Zajavnyk ta patentovlas- nyk Odes'ka nacional'na akademija harchovyh tehnologij (Ukrai'na). № u201106371; declared 23.05.2011; published 26.12.2011, Bjul. № 24, 2.

16. Solonyc'ka, I. V., Pshenyshnjuk, G. F., Studentova, I. V. (2010). Patent 53020 Ukrai'na, MPK A21D 15/00 A61K 36/02; Sklad dlja vyroby hliboobulochnych vyrobiv iz zamorozhennyh hlibobulochnych vyrobiv iz masovhynnych napivfabrykativ likuval'no profilaktichkogo pryznachenija. Zajavnyk ta patentovlasnyk Odes'ka nacional'na akademija harchovyh tehnologij (Ukrai'na). № u201004849; declared 22.04.2010; published 11.10.2010, Bjul. № 19, 2.

17. Shenina, O. M., Gavrysh, T. V., Lobachova, N. L. (2013). Patent 84209 Ukrai'na, MPK A21D 8/02 (2006.01): Sposob vyrobykhvytnych hlibobulochnych vyrobiv iz zamorozhennyh hlibobulochnych vyrobiv iz masovhynnych napivfabrykativ likuval'no profilaktichkogo pryznachenija. Zajavnyk ta patentovlasnyk Odes'ka nacional'na akademija harchovyh tehnologij (Ukrai'na). № u201305454; declared 26.04.2013; published 10.10.2013, Bjul. № 9, 5.

18. Popova, S. Ju. (2015). Study of the fractional composition of sugars of the secondary products of potato processing. Eastern-European Journal of Enterprise Technologies, 5/6(77), 23–29. doi: 10.1585/1729-4061.2015.51551

19. Popova, S. Ju., Nkyforov, R. P., Slashheva, A. V. (2015). Analysis of amino acid composition and biological value of protein from buckwheat groats of different varieties. Tech- nology audit and production reserves, 4/4 (25), 29–35. doi: 10.15587/2312-8372.2015.51760

A STUDY OF THE EFFECT OF ENRICHED WHEY POWDER ON THE QUALITY OF A SPECIAL-PURPOSE BREAD (p. 32-40)

Anatoliy Ukrainets, Oksana Kochubei-Lytvynenko, Olena Bilyk, Valerij Zacharevich, Tetyana Vasilchenko

A topical problem of the bakery industry is to expand the range of bakery products for special purposes, especially for people over 60. The problem can be solved by using whey in the technology of bread-making. However, whey has a limited shelf life. We have made a comparative analysis of the chemical compositions as well as functional and technological properties of different types of whey powder existing on the market for Ukraine and innovative ones, developed at the National University of Food Technologies (Kyiv, Ukraine). The analysis was aimed at selecting dairy products capable of meeting the technological requirements of lability. Regarding the considerable practical interest, behaviour during processing, transportation and storage, an objective analysis and an accurate calculation of the
comprehensive quality index determined the choice of the following criteria: organoleptic characteristics, solubility, and storability. It has been found that the highest comprehensive index (98 %) characterizes whey with an enriched mineral composition, which has served as the basis for its use as a dairy ingredient in the recipes of wheat bread for people of older age groups. It has been specified that the optimal dose of whey to enrich the wheat bread and prolong its freshness is 5 % to the weight of flour. The study has proved the positive influence of whey powder enriched with Mg and Mn on the quality and freshness of bakery products. The findings ascertain the feasibility of introducing magnesium-enriched and manganese-enriched whey powder in the recipes of wheat bread to expand the assortment of bakery products for people of older age groups.

**Keywords:** whey powder, magnesium-enriched and manganese-enriched, wheat bread for special purposes.

**References**

1. Drewnowski, A., Evans, W. J. (2001). Nutrition, Physical Activity, and Quality of Life in Older Adults: Summary. The Journals of Gerontology Series A: Biological Sciences and Medical Sciences, 56 (2), 89–94. doi: 10.1093/gerona/56.suppl_2.89
2. Dubova N. F. (2014) Analiz zakonodavstva Ukrayini z pitan' obroblennya. Zbirnyk naukovykh prats' Vinnyts'koho skladu sukhoyi molochnoyi syrovatky za riznykh meto-
3. Korzun V. P. (2009) TeoretichnI osnovi stvorennya ta Anoshkina, G. (2006). Natural whey. Bakery products, 7, (80) 2016
4. Dubova N. F. (2014) Analiz zakonodavstva Ukrayini z pitan' obroblennya. Zbirnyk naukovykh prats' Vinnyts'koho skladu sukhoyi molochnoyi syrovatky za riznykh meto-
5. Wilmouth, J. M., Kennet, F. F. (2013). Gerontology: perspectives and issues. NY: Springer Publishing Company, 350.
6. Schuck, P., Blanchard, E., Dolivet, A., Mefore, S., Onillon, E., Jeantet, R. (2005). Water activity and glass transition in dairy ingredients. Le Lait, 85(4-5), 295–304. doi: 10.1051/laite:2005020
7. Roos, Y. H. (2002). Importance of glass transition and water activity to spray drying and stability of dairy powders. Le Lait, 82 (4), 478–484. doi: 10.1051/lait:20020225
8. Schwartzberg, H. G., Hartel, R. W. (1992). Physical chemistry of foods. NY: Marcel Dekker, 747.
9. Roos, Y. H. (2002). Importance of glass transition and water activity to spray drying and stability of dairy powders. Le Lait, 82 (4), 478–484. doi: 10.1051/lait:20020225
10. Roos, Y. H. (2002). Importance of glass transition and water activity to spray drying and stability of dairy powders. Le Lait, 82 (4), 478–484. doi: 10.1051/lait:20020225
11. Roos, Y. H. (2002). Importance of glass transition and water activity to spray drying and stability of dairy powders. Le Lait, 82 (4), 478–484. doi: 10.1051/lait:20020225

**QFD METHODOLOGY TO DEVELOP A NEW HEALTH-CONDUCTIVE GRAIN PRODUCT**

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The article describes using quality function deployment (QFD) methodology to develop a new grain product as healthy food. A questionnaire survey of consumer requirements for the new grain product was processed with the help of two techniques of quality management – an affinity diagram and a tree diagram – to generalise and structure consumer preferences. The elicited consumer requirements were further ranked according to the priorities, which made it possible to distinguish between imperative requirements and those that can be disregarded without significant effect on the resulting quality of the product.

The methodology of quality function deployment was used to transform requirements of potential customers for the quality of grain crackers into technical characteristics of a new health-conducive grain product to develop through priority optimisation. The study has determined that development of a grain product as healthy food should guarantee prophylactic effectiveness of the new product on the basis...
of natural enriching additives, increased BAS content, and, certainly, longer shelf life and safety parameters of grain crackers.

**Keywords**: quality, quality function deployment methodology, consumer requirements, grain crackers, “quality house”.

**References**

1. Aleshkov, A. V., Aleshkova, M. A. (2015). Os perspektvyakh QFD-analyza pri razrabotke ynnovatsonnyh produkty. Yezvystya Yrkutskoy stuzharsvennoy ekonomicheskoy akademeny (Baykal’skyy stuzharsvennoy universyset ekonomiky y prava), 6 (1). Available at: http://iezvystia.isea.ru/reader/article.aspx?id=19960.

2. Rusanova, S. V., Sabina, O. O., Kovalenko, S. M. (2009). Doslidzhennya rynku yak osnovna skladova razhortannya funktsyi yakosty (QFD). Upravlinnya, ekonomika ta zabezpechhnya yakosty v farmatsiyi, 6 (8), 51–58.

3. Matsyson, V. A., Demydova, N. A. (2012). Prymenyene metoda razvertivanyya funktsyi kachestva dlya konstruyrovannyya produkta v psychevoy promishlennosty. Psychevaya prom-t’, 4, 44–45.

4. Ponomarev, S. V., Myschenko, S. V., Belobryahn, V. Ya., Samorodov, V. A. et al. (2005). Upravlenye kachestvom produkty, Yzrumenty y metody medenzhmenta kachestva. Moscow: RYA «Standarty y kachestvo», 248.

5. Akaoy, Y. (1990). Quality Function Deployment (QFD). Integrating customer requirements into product design. Portland, OR: Productivity Press, 369.

6. Misuoo, S., Akaoy, Y. (1994). QFD. The customer-driven approach to quality planning and deployment. Tokyo, Japan, Asian Productivity Organization, 365.

7. Chan, L.-K., Wu, M.-L. (2002). Quality function deployment: A literature review. European Journal of Operational Research, 143 (3), 463–497. doi: 10.1016/s0377-2217(02)00178-9.

8. Benner, M., Linnemann, A. R., Jongen, W. M. E., Folstar, P. (2003). Quality Function Deployment (QFD)—can it be used to develop food products? Food Quality and Preference, 14 (4), 327–339. doi: 10.1016/s0950-3293(02)00129-5.

9. Cardoso, J. de F., Casarotto Filho, N., Cauchick Miguel, P. A. (2015). Application of Quality Function Deployment for the development of an organic product. Food Quality and Preference, 40, 180–190. doi: 10.1016/j.foodqual.2014.09.012.

10. De Pelsmaeker, S., Gellynx, X., Delbaere, C., Declercq, N., Dewettinck, K. (2015). Consumer-driven product development and improvement combined with sensory analysis: A case-study for European filled chocolates. Food Quality and Preference, 41, 20–29. doi: 10.1016/j.foodqual.2014.10.009.

11. Avstryevsyykh, A. N., Kantere, V. M., Surkov, Y. V., Ermoelaeva, E. O. (2007). Upravlenye kachestvom na predpriyatyakh psychevoy v yere-batavyansche promishlennosty. Syv. yyyy, yzd-o, 268.

12. Matsyson, V. A., Kantere, V. M. (2012) Kyvento-oryentlyrovannoe konstruyrovanye produktov pytanyya. Psychev. prom-st’, 2, 8–11.

13. Tarasova, E. Yu., (2014) Yysledovanye y razrabotka tekhhloshy fermentyrovannho molochno-zlakovovo produktu, OHAU, 192.

14. Mardar, M. R. (2013). Application of the method of quality functional deployment when developing a new extruded product. Meridian ingineresc, 2, 30–33.

15. Mardar, M. R., Zhyhyunov, D. O., Ustenko, I. A. (2015). Proektuannya novoho zernovovo produkdu u vidpovidnosti do spozhyvchykh perevah. Tekhnolohysheskyy audyt y rezervy proyzvodstva, 2/6 (22), 67–72. doi: 10.15587/2312-8372.2015.41755.

16. Havrylova, S. (2008). Model’ Kano. Upravlyenye kachestvom, 3, 10–12.

17. Ivanik, O. (2015). Analiz modelevy spryynyattya yakosti posluy na osonvi harmonizatsii interesiv zatsikavlenykh storin. Ekonomichnyyy chasopys Skhidnoyevropys’koho natsional’noho universysetu im. Lesi Ukrainyynk, 1, 24–29.

18. Suvorova, L. A., Tsyyvov, R. P. (2005). Prymenyene metodolohyy QFD y statystysheskykh metodov v upravlyeny kachestvom produkty v promyslshennom predpriyaty: Kachestvo, ynnovatssy, obrazovanye, 2, 72–78.
European Journal of Enterprise Technologies, 2/12 (68), 122–127. doi: 10.15587/1729-4061.2014.23380

7. Yang, Y., Zhang, G., Hong, Y., Gu, Z., Fang, F. (2013). Calcium cation triggers and accelerates the gelation of high methoxy pectin. Food Hydrocolloids, 32 (2), 228–234. doi: 10.1016/j.foodhyd.2013.01.003

8. Kaya, M., Sousa, A. G., Crepeau, M.-J., Sorensen, S. O., Ralet, M.-C. (2014). Characterization of citrus pectin samples extracted under different conditions: influence of acid type and pH of extraction. Annales of Botany, 114 (6), 1319–1326. doi: 10.1093/aob/mcu150

9. Zhang, X., Liu, X., Cao, M., Xia, K., Zhang, Y. (2015). Preparation of hydroxypropyl agar and their properties. Carbohydrate Polymers, 129, 87–91. doi: 10.1016/j.carbpol.2015.04.056

10. Schirmer, M., Jekle, M., Arendt, E., Becker, T. (2012). Physicochemical interactions of polydextrose for sucrose replacement in pound cake. Food Research International, 48 (1), 291–298. doi: 10.1016/j.foodres.2012.05.003

11. Yorgacheva, E. G., Tolstuh, V. Ju., Avetysjan, K. V. (2015). Strukturo-reologicheskie svojstva dyetycheskogo marmelada. ONAHT, 1 (36), 131–133.

12. Iorgachova, K. G., Makarova O. V., Gordijenko, L. V., Korkach, G. V. (2011). Tehnologija kondytny'kogo vyrobnyctva. Praktykum. Odesa: «Simeks-print», 204.

13. Krus', G. N., Shalygina, A. M., Volokitina, Z. V. (2000). Metodi issledovaniya melokha i melokhovyh produktov. Moscow: Kolos, 368.

14. Chugunova, O. V., Zavoronhina, N. V. (2010). Ispol'zovanie metodov degustacionnogo analiza pri modelirovanii receptur pishhevyh produktov s zadannymi potrebitel'skimi svojstvami. E.: UGU, 148.

15. Donchenko, L. V., Firsov, G. G. (2007). Pektin: osnovnye svojstva, proizvodstvo i primenenie. Moscow: DeLi print, 276.

16. Zubchenko A. V. (2001). Fiziko-himicheskie osnovy tehnologii konditerskih izdelii. 2nd edition. Voronezhskiy gosudarstvennaya tehnologicheskaya akademiya, 389.

17. Fennema, O. R. (1996). Food Chemistry. New York.: Marcel Dekker, 1088.

18. Ostapchuk, N. V., Kaminskij, V. D., Stankevich, G. N., Chucho, V. P. (1992). Matematicheskoe modelirovanie proessov pishhevyh proizvodstv. Kyiv: Visha shkola, 175.

19. Stabilnost' i srok godnosti. Hlebobulochnye i konditerskie izdeliya. 2nd edition. Voronezhskiy gosudarstvennaya tehnologicheskaya akademiya, 389.

20. Gnezdilova, A. I., Gnezdilova, A. I., Kurenkova, L. A. (2014). Stabil'nost' i srok godnosti. Hlebobulochnye i konditerskie izdeliya. 2nd edition. Voronezhskiy gosudarstvennaya tehnologicheskaya akademiya, 389.

21. Fat'janov, E. V., Tjo, R. E., Car'kov, I. V. (2011). Vlijanie gidreolaznykh rastvorov uglevodov na aktivnost' vody. Molochnaja Fat', 1088.

22. Gnezdilova, A. I., Gnezdilova, A. I., Kurenkova, L. A. (2014). Stabil'nost' i srok godnosti. Hlebobulochnye i konditerskie izdeliya. 2nd edition. Voronezhskiy gosudarstvennaya tehnologicheskaya akademiya, 389.

23. Krus', G. N., Shalygina, A. M., Volokitina, Z. V. (2000). Metody issledovaniya melokha i melokhovyh produktov. Moscow: Kolos, 368.

24. Chugunova, O. V., Zavoronhina, N. V. (2010). Ispol'zovanie metodov degustacionnogo analiza pri modelirovanii receptur pishhevyh produktov s zadannymi potrebitel'skimi svojstvami. E.: UGU, 148.

25. Donchenko, L. V., Firsov, G. G. (2007). Pektin: osnovnye svojstva, proizvodstvo i primenenie. Moscow: DeLi print, 276.

26. Zubchenko A. V. (2001). Fiziko-himicheskie osnovy tehnologii konditerskih izdelii. 2nd edition. Voronezhskiy gosudarstvennaya tehnologicheskaya akademiya, 389.
tween aerobic exercise and visceral fat reduction: systematic review of clinical trials. International Journal of Obesity, 31 (12), 1786–1797. doi: 10.1038/sj.ijo.0803683
7. Guire, M. M., Beerman, K. A. (2012). Nutritional Sciences: From Fundamentals to Food. 3rd edition. N.J., Wadsworth Cengage Learning, 736.
8. Mertens, I. L., van Gaal, L. F . (2000). Overweight, Obesity, and Blood Pressure: The Effects of Modest Weight Reduction. Obesity Research, 8 (3), 270–278. doi: 10.1038/oby:2000.32
9. Glazer, G. (2001). Long-term Pharmacotherapy of Obesity. Archives of Internal Medicine, 161 (15), 1814–1824. doi: 10.1001/archinte.161.15.1814
10. James, W. P. T., Caterson, I. D., Coutinho, W., Finer, N., Van Gaal, L. F., Maggioni, A. P. et. al. (2010). Effect of Sibutramine on Cardiovascular Outcomes in Overweight and Obese Subjects. New England Journal of Medicine, 363 (10), 905–917. doi: 10.1056/nejmoa1003114
11. Chanoine, J.-P., Hampl, S., Jensen, C., Boldrin, M., Hauptman, J. (2005). Effect of Orlistat on Weight and Body Composition in Obese Adolescents. JAMA, 293 (23), 2873–2883. doi: 10.1001/jama.293.23.2873
12. Maahs, D., Serna, D. G. de, Kolotkin, R. L., Ralston, S., Sandate, J., Qualls, C., Schade, D. S. (2006). Randomized, double-blind, placebo-controlled trial of orlistat for weight loss in adolescents. Endocrine Practice, 12 (1), 18–28. doi: 10.4158/ep.12.1.18
13. Grinevich, V. B., Sas, E. I., Kravtsov, Yu. A., Efimov, O. I. (2012). Abdominal obesity: clinical and social aspects of the problem. Farmateca, 16, 29–34.
14. Cherno, N. K., Krusir, G. V., Yashkina, V. V. (2004). Prospects for the use of certain types of vegetable raw materials as lipase inhibitors. Cereals and fodder, 3, 15–17.
15. Zhbankov, R. G. (1992). IR-spectra and carbohydrate structure. Minsk: Science, 456.
16. Cherno, N. K., Osolina, S. A., Nikitina, A. V. (2013). Chemical composition of Agaricus bisporus and Pleurotus ostreatus fruiting bodies and their morphological parts. Food and Environment Safety, 4, 291–299.
17. Chung, C., Nickerson, W. (1954). Poly saccharide synthesis in growing yeast. J. Biol. Chem., 208, 395–407.
18. Laine, R. A., Esselman, W. J., Sweely, C. C. (1972). Gas-liquid chromatography of carbohydrates. Complex Carbohydrates Part B, 18, 159–167. doi: 10.1016/0076-6879(72)28012-0
19. Smith, R. L., Gilkerson, E. (1979). Quantitation of glycosaminoglycan hexosamine using 3-methyl-2-benzothiazolone hydrazide hydrochloride. Analytical Biochemistry, 98 (2), 478–480. doi: 10.1016/0003-2697(79)90170-2
20. Selvakumar, P., Rajasekar, S., Periasamy, K., Raaman, N. (2008). Isolation and characterization of melanin pigment from Pleurotus cydidiiformis (telomorph of Antromycopsis macrocarpa). World Journal of Microbiology and Biotechnology, 24 (10), 2125–2131. doi: 10.1007/s12777-008-9718-2
21. Ofenbeher-Miletić, I., Stanimirović, D., Stanimirović, S. (1984). On determination of chitin content in mushrooms. Qualitas Plantarum Plant Foods for Human Nutrition, 34 (3), 197–201. doi: 10.1007/bf01091469
22. Ragazzi, E., Veronese, G. (1973). Quantitative analysis of phenolic compounds after thin-layer chromatographic separation. Journal of Chromatography A, 77 (2), 369–375. doi: 10.1016/s0021-9673(00)92204-0
23. Jagdish, P., Deepa, V., Rohan, G., Bhagat, R. D. (2013). Production of Microbial Lipases Isolated From Curd Using Waste Oil as a Substrate. Research J. Pharm., Bio. and Chem. Sci., 4 (3), 831–839.
24. Nikitina, O. V., Cherno, N. K., Osolina, S. A. (2015). Obtaining and characteritic of biopolymer complexes of Pleurotus ostreatus. Food Science and Technology, 9 (3), 19–25. doi: 10.15673/2073-8684.3/2015.50276

**RATIONALE FOR THE USE OF PROTEIN-CARBOHYDRATE MIX IN THE TECHNOLOGY OF DISPERSE PRODUCTS**

Alina Slashcheva, Radion Nykyforov, Svitlana Popova, Yuri Korenets

The possibility of using skim milk proteins and pectin of dogberries and sloes is considered.

The high-quality whipped system was obtained based on the protein-carbohydrate clot and berry puree. This was possible due to the activation of the functional components of the berry puree in their joint whipping, due to the presence of the surface-active sodium caseinate and stabilizing properties of pectin. As a result of the controlled interaction of these substances, calcium pectate, and protein-carbohydrate complexes are formed, which ultimately improves the system viscosity.

The content of essential ingredients in the mixes, including the protein-carbohydrate clot (PCC) with a concentration of 65...70 %; berry puree – 15...20 %, and sugar – 15 % was determined.

Based on the experimental data, the production process parameters of the protein-carbohydrate mix (PCM), including preparation of raw materials; solubilization of protein-carbohydrate clot proteins; solubilization of berry puree pectin; mixing of the protein-carbohydrate clot and modified berry puree; cooling of the system to 4±2 °C were determined.

It was found that the protein-carbohydrate mix (PCM) can be used in technologies of frozen dessert products under certain process conditions (temperature, pH).

The studies confirm the feasibility of the PCM use in technologies of frozen dessert products both in terms of effectiveness and nutritional value. The developed technology is low-waste, resource-saving and simple.

**Keywords:** protein-carbohydrate clot, dogberry, sloe, pumpkin, sea-buckthorn, frozen desserts, foaming capacity, foam stability, glycemic index.

**References**

1. Kilara, A., Chandan, R. (2013). Frozen dairy products // Milk and Dairy Products in Human Nutrition, Wiley-Blackwell Publishers, 435–457. doi: 10.1002/9781118534168.ch20
2. Polumbryk, M. O. (2008). Harchovi produkty z nyz'kym taryfom. Sb. nauch. trudov Sev.-Kavk. gos. tehn. un-ta. Serija «Prodovol'stvie», 2, 85–88.
3. Alizadeh, M., Azizi-Lalahadi, M., Kheirouri, S. (2014). Impact of Using Stevia on Physiochemical, Sensory, Rheology and Glycemic Index of Soft Ice Cream. Food and Nutrition Sciences, 5 (4), 390–396. doi: 10.4236/fns.2014.50407
4. Soukoulis, C., Lebesi, D., Tzia, C. (2009). Enrichment of ice cream with dietary fibre: Effects on rheological proper-
ties, ice crystallisation and glass transition phenomena. Food Chemistry, 115 (2), 665–671. doi: 10.1016/j.foodchem.2008.12.070
6. Carella, L., Salvaggio, P., Salvaggio, E., Salvaggio, V. (2011). Low carbohydrate, high protein, fiber enriched gelato formulation and method of manufacture: Pat. WO 2011069224 A1, MPK A 23 G 9/32; stoted 07.12.2009; published 16.06.2011, 7.
7. Raskin, L., Gradiose, R. (2013). Production of enriched products: Pat. WO 2013/036726 A1, MPK A 24 D 31/00. № US 2012/054096; stoted 07.09.2012; published 03.12.2013, 5.
8. Akbari, M., Eskandari, M. H., Niakosari, M., Bedeltavana, A. (2016). The effect of inulin on the physicochemical properties and sensory attributes of low-fat ice cream. International Dairy Journal, 57, 52–55. doi: 10.1016/j.idairyj.2016.02.040
9. Slashheva, A. V. (2008). Rozrobka tehnologii’ funkcional’nego napivfabrykatu z laktulozoju dlja m’jakogo morozyva ta solodkyh strav. Naukovyj zhurnal «Visnyk DonNUET». Serija: Tehnichni nauky, 1 (37), 53–57.
10. Medina, S., Segall, K. I. (2014). Frozen dessert mixes using protein products: Pat. WO 2014008580 A1, MPK A 23 G 9/42. the applicant and patent holder Burcon Nutrascience (Mb) Corp. Nр PCT/CA 2013/000626; stated 08.07.2013; published 16.01.2014, 6.
11. Grek, O. V., Os’mak, T. G., Turkova, T. M., Turkova, G. M. (2014). Morozyvo, zbogachene sojeju i chornyceju: Pat. UA 104954 C2, MPK A23 G9/04 (2006.01), MPK A23 G9/42 (2006.01). the applicant and patent holder Nacional’nyj universytet harchovyh tehnologij (Ukraj’na). Nр a201213583; stoted 27.11.2012; published 25.03.2014, Bjul. № 6, 3.
12. Skorenchenko, T. A., Fedchenko, T. G. (2006). Sry kysло-молочны – komponent diabetychnyh vyidv morozyva. Molochnoe delo, 2, 48–49.
13. McGhee, C. E., Gupta, B. P., Park, Y. W. (2015). Evaluation of Total Fatty Acid Profiles of Two Types of Low-Fat Goat Milk Ice Creams. Open Journal of Animal Sciences, 5 (1), 21–29. doi: 10.4236/ojas.2015.51003
14. Daw, E., Hartel, R. W. (2015). Fat destabilization and melt-down of ice creams with increased protein content. International Dairy Journal, 43, 33–41. doi: 10.1016/j.idairyj.2014.12.001
15. Pavlova, V. A., Gonchar, L. A., Holodova, O. Ju. (2014). Morozyvo «Sonjachne»: Pat. UA 87387 U, MPK A23 G9/32 (2006.01). Nр a201308932; stoted 04.07.2013; published 10.02.2014, Bjul. № 3, 5.
16. Ditrih, I. V., Molokanova, L. V., Jarysh, Ju. V. (2011). Morozyvo «Mauljeja»: Pat. UA 96136 C2, MPK A23 G9/42 (2006.01). the applicant and patent holder Donec’kyj nacional’nyj universytet ekonomiky i torgivli imeni My-hajla Tugan-Baranovskogo (Ukraj’na). Nр a200805670; stoted 30.04.2008; published 10.10.2011, Bjul. № 19, 3.
17. Raksha-Slusareva, O. A., Ghuho, O. Z., Cymbal, G. O., Kustova, O. K. et. al. (2014). Morozyvo «Brazil’jero»: Pat. UA 87825 U, MPK A23 G9/42 (2006.01), MPK A23 L1/221 (2006.01). the applicant and patent holder Raksha-Slusareva O. A. № a201308811; stated 15.07.2013; published 25.02.2014, Bjul. № 4, 3.
18. Jemec’, A. M., Matjusheko, R. V. (2013). Pat. 86292 «Sklad morozyva «Karambola», the applicant and patent holder Nacional’nyj universytet harchovyh tehnologij. №26043342; stoted 11.05.13; published 25.12.13, Bjul. № 6.
19. Bazhaj-Zhezerun, S. A. (2015). Morozyvo «Ozlorovche»: Pat. UA 108693 C2, MPK A23 G9/32 (2006.01). the applicant and patent holder Nacional’nyj universytet harchovyh tehnologij (Ukraj’na). Nр a201312600; stoted 28.10.2013; published 25.05.2015, Bjul. № 10, 2.
20. Os’mak, T. G. (2012). Rozroblennja tehnologii’ morozyva z cukrozaminnykamy. Nacional’nyj universytet harchovyh tehnologij, 18.
21. Nykyforov, R. P. (2009). Obg‘runtuvannja ta doslidzhennja umov otrymannja bilkovo-vuglevodnogo napivfabrykatu na osnovi bilkov znaehrenogo moloka ta dykoroslyh jagid dlja zbytyx desertnyh strav. DonNUET. Serija: Tehnichni nauky, 1 (41), 244–249.
22. Guinevych, V. A., Slashheva, A. V., Ivashhenko, M. V. (2014). Obg‘runtuvannja mozhlyvosti vykorystannja fermentnyh preparativ u tehnologijah roslynnyh napivfabrykativ z pidvyshhenym vmesost pektynovyh rechov. Visnyk DonNUET. Serija: Tehnichni nauky, 1 (58), 37–45.
23. Zhukova, L. P., Kanunnikova, N. E. Pat. 2204261 Rossija, MPK A23 G9/04. Sposob pragotovlenija morozhenogo nijakogo. № 200119687/13; stoted 24.07.2000; published 20.05.2003; Bjul. № 6, 5.