Chicken sausage is one of the very popular meat products. In order to change the nutritional composition of chicken sausage and increase the content of dietary fiber, we add bran, but it affects the textural properties of chicken sausage. Pork rind is rich in collagen and is a natural and safe food gel. Pork rind content affects the cooking loss, color, TPA, moisture distribution and sensory evaluation results of cooked sausage products. In this study, six different pigskin content treatment experiments were set up: 0 %, 5 %, 10 %, 15 %, 20 %, and 25 %. This research shows that adding pork rind can reduce cooking loss during the sausage heating process. As more pork rind was added, the L* and b* values of minced meat and chicken sausage gradually increased, while the a* value gradually decreased. The chewiness of the sausages in the test group was significantly reduced (p<0.05), except for T1, while the elasticity, recovery, and cohesiveness did not change significantly (p>0.05), and the hardness value increased significantly (p<0.05). The hardness of the sausages increased significantly (except in T5). Compared with the control group, the relaxation times of hydrated water and immobilized water in the treatment group became shorter, while the relaxation times of free water shifted to a longer direction. Sensory evaluation revealed that the hardness score of the T5 group was significantly lower than that of the control group. Based on these results, the sausage quality of the T3 group (pork rind 15 %) was the highest.

This study improves the gel properties of bran chicken sausage, provides scientific data support for the application of pork rind in chicken sausage, improving the application value of pork rind.

**Keywords:** pig skin, quality improvement, physico-chemical property, gel properties, sensory evaluation.

**References**

1. Choi, Y.-S., Kim, H.-W., Hwang, K.-E., Song, D.-H., Jeong, T.-J., Kim, Y.-B. et. al. (2015). Effects of fat levels and rice bran fiber on the chemical, textural, and sensory properties of frankfurters. Food Science and Biotechnology, 24 (2), 489–495. doi: https://doi.org/10.1007/s10068-015-0064-5

2. Zaini, H. B. M., Sintang, M. D. B., Pindi, W. (2020). The roles of banana peel powders to alter technological functionality, sensory and nutritional quality of chicken sausage. Food Science & Nutrition, 8 (10), 5497–5507. doi: https://doi.org/10.1002/fsn3.1847

3. Ma, M., Mu, T. (2016). Anti-diabetic effects of soluble and insoluble dietary fibre from deoiled cumin in low-dose streptozotocin and high-glucose-fat diet-induced type 2 diabetic rats. Journal of Functional Foods, 25, 186–196. doi: https://doi.org/10.1016/j.jff.2016.05.011

4. Lu, M., Mou, D. H., Feng, S., Wang, S. J., Gao, X. G. (2021). Application and Research Progress of Cereal Dietary Fiber in Meat Processing Products. Food Research and Development, 4, 209–214. Available at: https://caod.oriprobe.com/articles/60724485/Application_and_Research_Progress_of_Cereal_Dietary.htm

5. Devi, P. B., Vijayabharathi, R., Sathyabama, S., Mallesh, N. G., Priyadarisini, V. B. (2011). Health benefits of finger millet (Eleusine coracana L.) polyphenols and dietary fiber: a review. Journal of Food Science and Technology, 51 (6), 1021–1040. doi: https://doi.org/10.1007/s13197-011-0458-9

6. Yi, S. M., Yang, L., Zhao, J. Z., Li, X. P., Mu, W. L., Li, J. R. et. al. (2020). Comparison of Gelation Properties on Different proportions of Chicken - Nemipterus-virgatus Surimi Mixture Sausage. Modern Food Science and Technology, 36, 207–213. doi: https://doi.org/10.13982/j.mfst.1673-9078.2020.5.028

7. Zhao, Y. P., Bu, J. Z., Yu, L. M. (2016). Nutrition composition and texture properties of chicken. Journal of Food Safety and Quality, 7, 4096–4100. doi: https://doi.org/10.1016/j.jfqs.2015.07.006

8. Ignatieva, N., Zakharkina, O. (2008). The role of in situ tissue constraint in collagen stability under non- and homogeneous heating. Journal of Biomechanics, 102 (4), 1187–1191. doi: https://doi.org/10.1016/j.jbiomech.2006.07.006

9. Baur, J. L., Harbaum-Piayda, B., Stöckmann, H., Schwarz, K. (2013). Antioxidant activities of corn fiber and wheat bran and derived extracts. LWT - Food Science and Technology, 50 (1), 132–138. doi: https://doi.org/10.1016/j.lwt.2012.06.012

10. Tang, L., Li, C. B., Hu, Y. X., Dong, Y. Y., Shi, X. Y., Xu, X. L. (2008). Effects of technology conditions on texture properties and microstructure of pork skin extracts. Transactions of the CSAE, 24, 269–274. Available at: https://kns.cnki.net/kcms/detail/detail.aspx?FileName=NYGU200812056&DbName=CJFQ2008

11. Feng, X., Dai, H., Zhu, J., Ma, L., Yu, Y., Zhu, H. et. al. (2021). Improved solubility and interface properties of pigskin gelatin by microwave irradiation. International Journal of Biological Macromolecules, 171, 1–9. doi: https://doi.org/10.1016/j.ijbiomac.2020.12.215

12. Wang, W., Wang, X., Zhao, W., Gao, G., Zhang, X., Wang, Y., Wang, Y. (2017). Impact of pork collagen superfine powder on rheological and texture properties of Harbin red sausage. Journal of Texture Studies, 49 (3), 300–308. doi: https://doi.org/10.1111/jtxs.12300

13. Zhou, T., Zhao, Y., Fu, S., Wang, W., Liu, A. (2018). Effects of Pig Skin and Coconut Powder Mixture on Gelling and Rheological Properties of Composite Gel Prepared with Squid Myofibrillar Pro-
tein and Lard: International Journal of Food Engineering, 14 (1). doi: https://doi.org/10.1515/ijfe-2017-0265
15. Choe, J.-H., Kim, H.-Y. (2016). Effects of swelled pig skin with various natural vinegars on quality characteristics of traditional Korean blood sausages (Sundae). Food Science and Biotechnology, 25 (6), 1605–1611. doi: https://doi.org/10.1007/s10068-016-0247-8
16. Sha, X. M., Wang, G. Y., Hu, Z. Z., Hu, W. Y., Tu, Z. C. (2021). The influence of winter and summer on the properties and traceability of gelatin prepared from pigskin. Food and Fermentation Industries, 47, 31–39. doi: https://doi.org/10.3995/j.fci.2011-1802/2021.062536
17. Choe, J.-H., Kim, H.-Y., Lee, J.-M., Kim, Y.-J., Kim, C.-J. (2013). Quality of frankfurter-type sausages with added pig skin and wheat fiber mixture as fat replacers. Meat Science, 93 (4), 849–854. doi: https://doi.org/10.1016/j.meatsci.2012.11.054
18. Xiong, Y., Zhang, P., Warner, R. D., Hossain, M. N., Leonard, W., Fang, Z. (2022). Effect of sorghum bran incorporation on the physicochemical and microbial properties of beef sausage during cold storage. Food Control, 132, 108344. doi: https://doi.org/10.1016/j.foodcont.2021.108544
19. Kellet, U., Pagter, M., Aslayng, M. D., Raben, A. (2017). Meatballs with 3% and 6% dietary fibre from rye bran or pea fibre - Effects on sensory quality and subjective appetite sensations. Meat Science, 125, 66–75. doi: https://doi.org/10.1016/j.meatsci.2016.11.007
20. Petersson, K., Godard, O., Eliasson, A.-C., Tornberg, E. (2014). The effects of cereal additives in low-fat sausages and meatballs. Part 2: Rye bran, oat bran and barley fibre. Meat Science, 96 (1), 503–508. doi: https://doi.org/10.1016/j.meatsci.2013.08.019
21. Chen, Y. C., Jiang, S., Cao, C. A., Chen, J. X., Kong, B. H., Liu, Q. (2019). Evaluation of the Quality of Frankfurters Prepared with Highly Stable Vegetable Oil-in-Water Pre-Emulsion as a Partial Replacer of Pork Back Fat. Shipin Kexue / Food Science, 40 (24), 86–93. doi: https://doi.org/10.7506/spxk1002-6630-20180906-060
22. Kim, D. H., Shin, D. M., Seo, H. G., Han, S. G. (2019). Effects of konjac gel with vegetable powders as fat replacers in frankfurter-type sausage. Asian-Australasian Journal of Animal Sciences, 32 (8), 1195–1204. doi: https://doi.org/10.5713/ajas.18.0781
23. Lao, H., Guo, C., Lin, L., Si, Y., Gao, X., Xu, D. et al. (2020). Combined Use of Rheology, LF-NMR, and MRI for Characterizing the Gel Properties of Hairtail Surimi with Potato Starch. Food and Bioprocess Technology, 13 (4), 637–647. doi: https://doi.org/10.1007/s11947-020-02423-y
24. Cheng, S., Wang, X., Yang, H., Lin, R., Wang, H., Tan, M. (2020). Characterization of moisture migration of beef during refrigeration storage by low-field NMR and its relationship to beef quality. Journal of the Science of Food and Agriculture, 100 (5), 1940–1948. doi: https://doi.org/10.1002/jsfa.10206
25. Eim, V. S., Simal, S., Rossello, C., Femenia, A. (2008). Effects of addition of carrot dietary fibre on the ripening process of a dry fermented sausage (sobrasada). Meat Science, 80 (2), 173–182. doi: https://doi.org/10.1016/j.meatsci.2007.11.017
26. Zhao, Y., Hao, L. J. (2019). Application of pork collagen in simulated cured meat products. China Food Additives, 30, 96–100. Available at: https://kns.cnki.net/kcms/detail/detail.aspx?FileName=ZSTJ201905012&DbName=CJFQ2019
27. Li, H. J., Chen, T., Yang, B. R., Li, Y. Q., Bian, J. K., Shu, G. T. (2020). Relationship of Intra- and Extracellular Spaces of Myocytes with Water-Holding Capacity and Water Status in Fresh Pork. Shipin Kexue / Food Science, 41, 1–6. doi: https://doi.org/10.7506/spxk1002-6630-20191029-323
28. Hu, N., Qiao, M. L., Liu, Y., Ma, C. W. (2010). Functional Properties of Emulsion-Type Pigskin Collagen. Meat Research, 6, 10–14. Available at: https://kns.cnki.net/kcms/detail/detail.aspx?FileName=RLYJ201006008&DbName=CJFQ2010
29. Dong, Y. V., Tang, L., Hu, Y. X., Li, C. B. (2012). Effect of Pork Skin Extract on the Texture of Pork Surimi Products. Meat research, 26, 14–19. Available at: https://kns.cnki.net/kcms/detail/detail.aspx?FileName=RLYJ201208007&DbName=CJFQ2012
30. Ni, N., Wang, Y. J., Li, Z. H., Xu, L. Y., Li, H. (2011). Effects of Acorn Starch, Pigskin Homogenate and Fats on the Quality of Pork Sausage. China Condiment, 46 (1), 45–50. Available at: https://coleditor.com/articles/64017287/Effects_of_Acorn_Starch___Pigskin_Homogenate_and_Fat.htm
31. Liu, Z. M. (2013). Research on different preparation methods of emulsifying pigskin and its effect on low temperature meat products. Meat Industry, 11, 35–37. Available at: https://kns.cnki.net/kcms/detail/detail.aspx?FileName=RLGY201311011&DbName=CJFQ2013
32. Gai, S. M., You, J. W., Zhang, X. J., Zhang, Z. H., Liu, D. Y. (2020). Discrimination of Water-injected Ground Meat Using Low-field Nuclear Magnetic Resonance and Magnetic Resonance Imaging. Shipin Kexue / Food Science, 41, 289–294. doi: https://doi.org/10.7506/spxk1002-6630-20190709-129

DOI: 10.15587/1729-4061.2022.262102
IMPROVING ELECTROMAGNETIC FIELD EXPOSURE REGIMES IN THE PRODUCTION OF FLATTENED SPELT GROATS (p. 15–22)

Vitalii Liubych
Uman National University of Horticulture, Uman, Ukraine
ORCID: https://orcid.org/0000-0003-1408-9063

Ivan Mostovyi
Uman National University of Horticulture, Uman, Ukraine
ORCID: https://orcid.org/0000-0003-5458-3480

Volodymyr Novikov
Uman National University of Horticulture, Uman, Ukraine
ORCID: https://orcid.org/0000-0003-3052-8407

Ivan Leschenko
Uman National University of Horticulture, Uman, Ukraine
ORCID: https://orcid.org/0000-0002-0937-6739

Svitlana Belinska
State University of Trade and Economics / Kyiv National University of Trade and Economics, Kyiv, Ukraine
ORCID: https://orcid.org/0000-0002-1984-5797

Viktor Kirian
Ustymivka Experimental Station of Plant Production, Ustymivka vill., Poltava reg., Ukraine
ORCID: https://orcid.org/0000-0001-9739-8507

Oleh Tryhub
Ustymivka Experimental Station of Plant Production, Ustymivka vill., Poltava reg., Ukraine
ORCID: https://orcid.org/0000-0003-3346-9828

Serhii Pykalo
The V. M. Remeslo Myronivka Institute of Wheat of National Academy of Agrarian Sciences of Ukraine, Tsentralne vill., Obukhiv dist., Kyiv reg., Ukraine
ORCID: https://orcid.org/0000-0002-3158-3830
Abstract and References. Technology and equipment of food production

Vasyl Petrenko
Laboratory of Grain Milling and Bakery Technology
Institute of Food Resources of National Academy of Agrarian Sciences of Ukraine, Kyiv, Ukraine
ORCID: https://orcid.org/0000-0002-5849-0589

Olena Tverdokhlib
H. S. Skovoroda Kharkiv National Pedagogical University; Kharkiv, Ukraine
ORCID: https://orcid.org/0000-0002-7209-1808

The modes to produce flattened spelt groats using an electromagnetic field of ultrahigh frequency have been scientifically substantiated. The influence of the duration of irradiation by the field of ultrahigh frequency and water heat treatment on the temperature, yield, and duration of flattened spelt groats cooking was investigated.

When irradiated with a field of ultrahigh frequency from 20 to 180 s, the minimum temperature of the product is 27–128 °C, and the maximum temperature is 43–159 °C. Treatment with a field of ultrahigh frequency from 20 to 100 s does not significantly affect the total yield of groats from spelt. The total yield, in this case, is 94–97 %. At the irradiation with a field of ultrahigh frequency from 120 to 180 s, the total yield of groats is significantly reduced to 83–90 %. Treating with a field of ultrahigh frequency for 100–180 s significantly reduces the duration of flattened groats cooking. The duration of cooking groats, in this case, is 14.0–15.8 minutes. It should be noted that water-heat treatment reliably reduces the duration of cooking flattened groats compared to the option without moistening.

The peculiarity of the technology to produce flattened groats from spelt wheat using the field of ultrahigh frequency is that whole groats must be irradiated for 60–80 s with moistening by 1.0–1.5 %. Under this mode, the total yield of groats is 94–97 %, and the duration of cooking groats is 14.3–15.9 minutes. Subject to the production of flattened groats of the highest grade, it is necessary to irradiate with a field of ultrahigh frequency for 80 s without water-heat treatment. Under such a mode, the yield of flattened groats of the highest grade is 80 %, and that of the first grade is 13 %. The duration of cooking such groats is 16.8 minutes.

The recommendations from this study could be used by small-scale grain processing enterprises in order to produce flattened groats.

Keywords: electromagnetic field, groats, wheat spelt, culinary quality, water-heat treatment.

References
1. Mefleh, M., Conte, P., Fadda, C., Giunta, F., Piga, A., Hassoun, G., Motzo, R. (2018). From ancient to old and modern durum wheat varieties: interaction among cultivar traits, management, and technological quality. Journal of the Science of Food and Agriculture, 99 (5), 2059–2067. doi: https://doi.org/10.1002/jsfa.9388
2. Ma, F., Balk, B.K. (2021). Influences of grain and protein characteristics on in vitro protein digestibility of modern and ancient wheat species. Journal of the Science of Food and Agriculture, 101 (11), 4578–4584. doi: https://doi.org/10.1002/jsfa.11100
3. Petrenko, V., Liubich, V., Bondar, V. (2017). Baking quality of wheat grain as influenced by agriculture systems, weather and storing conditions. Romanian Agricultural Research, 34, 69–76. URL: https://www.cabdirect.org/cabdirect/abstract/20180008263
4. Shewry, P. R. (2009). Wheat. Journal of Experimental Botany, 60 (6), 1537–1553. doi: https://doi.org/10.1093/jxb/erp058
5. Lindfors, K., Ciacci, C., Kurppa, K., Lundin, K. E. A., Mahkaria, G. K., Mearin, M. L. et. al. (2019). Coeliac disease: Nat Rev Dis Primers, 5 (1). doi: https://doi.org/10.1038/s41572-018-0054-z
6. Dubois, B., Bertin, P., Mahovski, V., Escarnot, E., Mingot, D. (2017). Development of TaoMan probes targeting the four major celiac disease epitopes found in α-gliadin sequences of spelt (Triticum aestivum ssp. spelta) and bread wheat (Triticum aestivum ssp. aestivum). Plant Methods, 13 (1). doi: https://10.1186/s13007-017-0222-2
7. Liubych, V., Novikov, V., Zholkova, V., Pirykhodko, V., Petrenko, V., Khomenko, S. et. al. (2020). Improving the process of hydrothermal treatment and dehulling of different triticate grain fractions in the production of groats. Eastern-European Journal of Enterprise Technologies, 3(11 (105)), 55–65. doi: https://doi.org/10.15587/1729-4061.2020.203737
8. Osokina, N., Liubych, V., Volodymyr, N., Leshchenko, I., Petrenko, V., Khomenko, S. et. al. (2020). Effect of electromagnetic irradiation of emmer wheat grain on the yield of flattened wholegrain cereal. Eastern-European Journal of Enterprise Technologies, 6 (11 (108)), 17–26. doi: https://doi.org/10.15587/1729-4061.2020.217018
9. Águilar, C. N., Ruiz, H. A., Rubio Rios, A., Chávez-González, M., Sepúlveda, L., Rodríguez-Jasso, R. M. et. al. (2019). Emerging strategies for the development of food industries. Bioengineered, 10 (1), 522–537. doi: https://doi.org/10.1080/21655979.2019.1682109
10. De Sousa, T., Ribeiro, M., Sabenga, C., Igrejas, G. (2021). The 10,000-Year Success Story of Wheat! Foods, 10 (9), 2124. doi: https://doi.org/10.3390/foods10092124
11. Arzani, A. (2011). Emmer (Triticum turgidum ssp. dicoccum) Flour and Breads. Flour and Breads and Their Fortification in Health and Disease Prevention, 69–78. doi: https://doi.org/10.1016/j.978-0-12-380886-8.10007-8
12. Boukid, F., Folliot, S., Sforza, S., Vittadini, E., Prandi, B. (2017). Current Trends in Ancient Grains-Based Foodstuffs: Insights into Nutritional Aspects and Technological Applications. Comprehensive Reviews in Food Science and Food Safety, 17 (1), 123–136. doi: https://doi.org/10.1111/1541-4337.12315
13. Silletti, S., Morello, L., Gavazzi, F., Giani, S., Braglia, L., Breviario, D. (2019). Untargeted DNA-based methods for the authentication of wheat species and related cereals in food products. Food Chemistry, 271, 410–418. doi: https://doi.org/10.1016/j.foodchem.2018.07.178
14. Zhang, L., Du, L., Shi, T., Xie, M., Liu, X., Yu, M. (2022). Effects of pulsed light on germination and gamma-aminobutyric acid synthesis in brown rice. Journal of Food Science, 87 (4), 1601–1609. doi: https://doi.org/10.1111/1750-3841.16087
15. Wang, S., Wang, J., Guo, Y. (2018). Microwave Irradiation Enhances the Germination Rate of Tartary Buckwheat and Content of Some Compounds in Its Sprouts. Polish Journal of Food and Nutrition Sciences, 68 (3), 195–205. doi: https://doi.org/10.1515/pjfnfs-2017-0025
16. Wu, X. H., Luo, G. Q., Feng, J. M. (2017). Effects of microwave treatment on the nitrogen metabolism of oat seedlings under NaCl stress. J. Microwaves, 33, 91–96.
17. Qin, Z.-B., Guo, J.-L., Zhang, M.-M., Lei, M.-Y., Li, Z.-L. (2012) Nitric oxide acts as a signal molecule in microwave pretreatment induced cadmium tolerance in wheat seedlings. Acta Physiologiae Plantarum, 35 (1), 65–73. doi: https://doi.org/10.1007/s11738-012-1048-1
18. Chen, Y.-P., Jia, J.-F., Han, X.-L. (2008). Weak microwave can alleviate water deficit induced by osmotic stress in wheat seedlings. Planta, 229 (2), 291–298. doi: https://doi.org/10.1007/s00425-008-0828-8
The object of research reported in this paper is grain and leguminous crops of Republic of Kazakhstan.

Grains and leguminous crops, as well as products that are made from them, are of great importance in human nutrition because they are sources of protein, fat, carbohydrates, some vitamins, and macro and microelements. They contain plant fibers, as well as a number of biologically active substances necessary for the normal functioning of the entire human body. At the same time, modern technologies for processing and manufacturing products from cereals are associated with significant losses of nutrients embedded in them by nature when producing refined products. The problem that needs to be solved is to study the impact exerted on grain crops by various processing techniques and to propose the most optimal ones that make it possible to maximally preserve the nutrients of grain raw materials laid down by nature.

A comparative study of the following grain processing techniques was carried out: micronization, extrusion, germination, and fine grinding. Processing modes have been proposed, which could significantly reduce the loss of useful substances of the grain.

The chemical and vitamin composition of processed products has been studied. It was established that fine grinding and extrusion processing are the most acceptable because they allowed the use of grain without separating the shells containing the main nutrients of the grain.

The suggested processing modes contribute to the production of grain bases and additives with the most optimal vitamin-mineral formulation.

This study’s results contributed to a better understanding of the impact of the examined techniques for processing grains and legumes on the vitamin-mineral complex of the resulting products. Grain processing modes can be recommended for practical application.

Keywords: grain crops, fine grinding, extrusion, micronization, germination, vitamin composition, mineral complex.

References

1. Shaimerdenova, D. A., Chakanova, J. M., Malahemetova, A. A., Isakova, D. M., Yesmambetov, A. A. (2019). Methods for obtaining grain bases for food. Proceedings of the Voronezh State Uni-
Abstract and References. Technology and equipment of food production

2. Shaimerenova, D. A., Chakanova, Zh. M., Sultanova, M. Zh., Borovsky, A. Yu., Shaimerenova, P. R., Abdrakhmanov, Kh. A. (2018). Instant cereals enriched with carboxylates. International Journal of Engineering & Technology, 7(2.13), 140. doi: https://doi.org/10.14419/ijet.v7i2.13.11628

3. Sarwar, H. (2013). The importance of cereals (Poaceae: Gramineae) nutrition in human health: A review. Journal of Cereals and Oilseeds, 4 (3), 32–35. doi: https://doi.org/10.897/jcn.v4i1.023

4. Shaimerenova, D. A., Chakanova, Zh. M., Isakova, D. M., Sarbashova, G. T., Bekbolatova, M. B., Yesmambetov, A. A. (2020). JT Effective method of grain processing using in grain bases for foods: Methods of grain bases’ production. Eurasian Journal of Biosciences, 14 (2), 6291–6302.

5. Moreno, C. R., Fernández, P. C. R., Rodríguez, E. O. C., Carrillo, J. M., Rochín, S. M. (2018). Changes in Nutritional Properties and Bioactive Compounds in Cereals During Extrusion Cooking. Extrusion of Metals, Polymers and Food Products. doi: https://doi.org/10.5772/intechopen.68753

6. Koehler, P., Wieser, H. (2012). Chemistry of Cereal Grains. Handbook on Sourdough Biotechnology, 11–45. doi: https://doi.org/10.1007/978-1-4614-5425-0_2

7. Garg, M., Sharma, A., Vats, S., Tiwari, V., Kummari, A., Mishra, V., Krishania, M. (2021). Vitamins in Cereals: A Critical Review of Content, Health Effects, Processing Losses, Bioaccessibility, Fortification, and Biofortification Strategies for Their Improvement. Frontiers in Nutrition, 8. doi: https://doi.org/10.3389/fnstr.2021.56815

8. Oghbamei, M., Prakash, J. (2016). Effect of primary processing of cereals and legumes on its nutritional quality: A comprehensive review. Cogent Food & Agriculture, 2 (1). doi: https://doi.org/10.1080/23311932.2015.1136015

9. Reddy, M. R., Love, M. (1999). The Impact of Food Processing on the Nutritional Quality of Vitamins and Minerals. Impact of Processing on Food Safety, 90–106. doi: https://doi.org/10.1007/978-1-4615-4853-9_7

10. Ahmed, J. (2021). Emerging technologies for pulse processing. Pulse Foods, 265–293. doi: https://doi.org/10.1016/j.978-0-12-818184-3.00011-8

11. Nayak, B., Liu, R. H., Tang, J. (2015). Effect of Processing on Phenolic Antioxidants of Fruits, Vegetables, and Grains – A Review. Critical Reviews in Food Science and Nutrition, 55 (7), 887–918. doi: https://doi.org/10.1080/10408388.2011.653142

12. Gustinovich, V. G. (2020). Sovremenstvovanie tehnologii i razrabotka novogo assortimenta funktsional’nykh muchnykh konditerskih izdeliy s ispol’zovaniem tonkodispersnykh rastitel’nykh poroshkov. Voronezh, 18.

13. Nikolaev, N. A., Yaichkin, V. N., Gulyanov, Yu. A. (2013). Praktikum po tehnologii pererabotki produktov rastenieiedvostva (po kursu «Tehnologiya khraneniya, pererabotki i standartizatsii rastenieiedvostva»). Orenburg: Izdatel’skiy tsentr OGAU, 70.

14. Gouldstein, Dzh., Yakovitsa, Kh. (Eds.) (1978). Prakticheskaya rasstroevaya mikroskopiya. Moscow: Mir, 656.

15. Rzbekova tehnologiy poluchenya gotovykh zernovykh osnov dlya produktov pitaniya. Orotch v NIR (promzhezhotch.). No. GR 0118RRK00544. Inv. No. 0218RRK00489. Astana, 138.

16. Pongrac, P., Aréon, L, Castillo-Michel, H., Vogel-Mikúš, K. (2020). Mineral Element Composition in Grain of Awned and Awnletted Wheat (Triticum aestivum L.) Cultivars: Tissue-Specific Iron Speciation and Phytate and Non-Phytate Ligand Ratio. Plants, 9 (1). 79. doi: https://doi.org/10.3390/plants9010079

17. Li, B., Yang, W., Nie, Y., Kang, F., Goff, H. D., Cui, S. W. (2019). Effect of steam explosion on dietary fiber, polysaccharide, protein and physicochemical properties of okara. Food Hydrocolloids, 94, 48–56. doi: https://doi.org/10.1016/j.foodhyd.2019.02.042

18. Saldanha do Carmo, C., Varela, P., Poudroux, C., Dessev, T., Myhrer, K., Rieder, A. et. al. (2019). The impact of extrusion parameters on physicochemical, nutritional and sensorial properties of expanded snacks from pea and oat fractions. LWT, 112, 108232. doi: https://doi.org/10.1016/j.lwt.2019.108232

19. Suyanjali, S., Ying, D., Sangunusri, L., Buckow, R., Augustin, M. A., Gras, S. L. (2017). The effect of extrusion on the functional properties of oat fibre. LWT, 84, 106–113. doi: https://doi.org/10.1016/j.lwt.2017.05.025

20. Arribas, C., Cabellos, B., Sánchez, C., Cuadrado, R., Guillamón, E., Pedrosa, M. M. (2017). The impact of extrusion on the nutritional composition, dietary fiber and in vitro digestibility of gluten-free snacks based on rice, pea and carob flour blends. Food & Function, 8 (10), 3654–3663. doi: https://doi.org/10.1039/c7fo00910k

21. Beck, S. M., Knoerzer, K., Foerster, M., Mayo, S., Philipp, C., Aricot, J. (2018). Low moisture extrusion of pea protein and pea fibre fortified rice starch bars. Journal of Food Engineering, 231, 61–71. doi: https://doi.org/10.1016/j.jfoodeng.2018.03.004

22. Jacques-Fajardo, G. E., Prado-Ramirez, R., Arriola-Guevara, E., Pérez Carrillo, E., Espinoza-Arends, H., Guatemala Morales, G. M. (2017). Physical and hydration properties of expanded extrudates from a blue corn, yellow pea and oat bran blend. LWT, 84, 804–814. doi: https://doi.org/10.1016/j.lwt.2017.06.046

23. Ramos Diaz, J. M., Sundarrajan, L., Kariluoto, S., Lampi, A.-M., Tenitz, S., Jouppila, K. (2016). Effect of Extrusion Cooking on Physical Properties and Chemical Composition of Corn-Based Snacks Containing Amaranth and Quinoa: Application of Partial Least Squares Regression. Journal of Food Process Engineering, 40 (1), e12320. doi: https://doi.org/10.1111/jfpe.12320

24. Kaman, E. H., Nikhata, S. G., Ayna, E. O. (2020). Extrusion and mixothermal conditions influence the magnitude of change in the nutrients and bioactive components of cereals and legumes. Food Science & Nutrition, 8 (4), 1753–1765. doi: https://doi.org/10.1002/fsn3.1473

25. Thachil, M. T., Chouksey, M. K., Gudipati, V. (2013). Amylose–lipid complex formation during extrusion cooking: effect of added lipid type and amylose level on corn-based puffed snacks. International Journal of Food Science & Technology, 49 (2), 309–316. doi: https://doi.org/10.1111/ijfs.12333

26. Nikmaram, N., Leong, S. Y., Koutbaa, M., Zhu, Z., Barba, F. J., Greiner, R. et. al. (2017). Effect of extrusion on the anti-nutritional factors of food products: An overview. Food Control, 79, 62–73. doi: https://doi.org/10.1016/j.foodcont.2017.03.027

27. Koksel, F., Masatcioglu, M. T. (2018). Physical properties of puffed yellow pea snacks produced by nitrogen gas assisted extrusion cooking. LWT, 93, 592–598. doi: https://doi.org/10.1016/j.lwt.2018.04.011

28. Korkerd, S., Wanlapa, S., Puttanek, C., Uttapap, D., Rungrasardthong, V. (2015). Expansion and functional properties of extruded snacks enriched with nutrition sources from food processing by-products. Journal of Food Science and Technology, 53 (1), 561–570. doi: https://doi.org/10.1007/s13197-015-2039-1
The object of this study is the influence of technological parameters on the extraction process from walnut shells.

The main practical application of walnut is associated with the use of a kernel placed inside the shell. The kernel isolated after processing is used in confectionery, fat-and-oil, flour milling, pharmaceutical, and other industries. The walnut shell that remains after cleaning is waste and is usually disposed of. Analysis of studies reveals that walnut shells are rich in phenolic acids and related polyphenols, which are essentially a natural antibiotic with numerous healing effects. Along with this, crushed walnut shell is a universal organic, biodegradable, environmentally friendly, and valuable raw material with unique physical characteristics and chemical properties used in various sectors of the economy. Walnut shell is 52.3 % lignin, for comparison – almond shell contains 28.9 %, pine nut – 40 % lignin. Studies show that lignin characterizes the level of strength of the shell, and in its chemical composition is a source of antioxidants. Various methods of extraction of biologically active substances from walnut shells are used. However, the results obtained by different methods have a wide range of data. Optimization of extraction processes has been carried out and its regularity was established. By the method of mathematical modeling, optimal extraction modes were revealed under which the most complete extraction of biologically active substances from walnut shells is observed. Optimal extraction modes have been developed.

Keywords: antioxidants walnut, biological activity, lignin, catechins, quercetin, optimization of extraction.

References
1. Queirós, C. S. G. P., Cardoso, S., Lourenço, A., Ferreira, J., Miranda, I., Lourenço, M. J. V., Pereira, H. (2019). Characterization of walnut, almond, and pine nut shells regarding chemical composition and extract composition. Biomass Conversion and Biorefinery, 10 (1), 175–188. doi: https://doi.org/10.1016/j.bcb.2019.04.025
2. Soto-Maldonado, C., Caballero-Valdés, E., Santos-Bernal, J., Jara-Quezada, J., Fuentes-Viveros, L., Zúñiga-Hansen, M. E. (2022). Potential of solid wastes from the walnut industry: Extraction conditions to evaluate the antioxidant and bioherbicidal activities. Electronic Journal of Biotechnology, 58, 25–36. doi: https://doi.org/10.1016/j.ejbt.2022.04.005
3. Andrade, T. de J. A. dos S., Araújo, B. Q., Citéo, A. M. das G. L., da Silva, J., Safi, J., Richter, M. F., Ferraz, A. de B. F. (2011). Antioxidant properties and chemical composition of technical Cashew Nut Shell Liquid (cNSL). Food Chemistry, 126 (3), 1044–1048. doi: https://doi.org/10.1016/j.foodchem.2010.11.122
4. Wang, S., Fu, W., Han, H., Rakita, M., Han, Q., Xu, Q. (2020). Optimization of ultrasound-assisted extraction of phenolic compounds from walnut shells and characterization of their antioxidant activities. Journal of Food and Nutrition Research, 8 (1), 50–57.
5. Tultabayev, M., Zhumanova, U., Borovski, A., Kizatova, M. (2021). Simulation of the Extrusion Process Oil Crops Waste, on the Example of Flax. Chemistry and Chemical Engineering, 2021 (1). Available at: https://papers.ssrn.com/sol3/papers.cfm?abstract_id=4112988
6. Mourtzinos, I., Gouda, A. (2019). Polyphenols in Agricultural Byproducts and Food Waste. Polyphenols in Plants, 23–44. doi: https://dx.doi.org/10.1016/b978-0-12-813768-0.00002-5
7. Pereira, J. A., Oliveira, I., Sousa, A., Ferreira, I. C. F. R., Bento, A., Estevinho, L. (2008). Bioactive properties and chemical composi-
Abstract and References. Technology and equipment of food production

tion of six walnut (Juglans regia L.) cultivars. Food and Chemical Toxicology, 46 (6), 2103–2111. doi: https://doi.org/10.1016/j.fct.2008.02.002
8. Zhang, Z., Liao, L., Moore, J., Wu, T., Wang, Z. (2009). Antioxidant phenolic compounds from walnut kernels (Juglans regia L.). Food Chemistry, 113 (1), 160–165. doi: https://doi.org/10.1016/j.foodchem.2008.07.061
9. Zhumaliyeva, G., Chomanov, U., Tultabaeva, T., Tultabayev, M., Kasymbek, R. (2020). Formation of Processes of Intensification of Crop Growth For The Formation of Business Structures. SSRN Electronic Journal. doi: https://doi.org/10.2139/ssrn.4128701
10. Balasundrum, N., Sundram, K., Samman, S. (2006). Phenolic compounds in plants and agri-industrial by-products: Antioxidant activity, occurrence, and potential uses. Food Chemistry, 99 (1), 191–203. doi: https://doi.org/10.1016/j.foodchem.2005.07.042
11. Tultabayev, M., Chomanov, U., Tultabaeva, T., Shoman, A., Dodaev, K., Azimov, U., Zhumanoova, U. (2022). Identifying patterns in the fatty-acid composition of safflower depending on agroclimatic conditions. Eastern-European Journal of Enterprise Technologies, 2 (11 (16)), 23–28. doi: https://doi.org/10.15587/1729-4061.2022.255336
12. Contini, M., Baccelloni, S., Massantini, R., Anelli, G. (2008). Extraction of natural antioxidants from hazelnut (Corylus avellana L.) shell and skin wastes by long maceration at room temperature. Food Chemistry, 110 (3), 659–669. doi: https://doi.org/10.1016/j.foodchem.2008.02.060
13. Fernández-Agulló, A., Pereira, E., Freire, M. S., Valenťano, P., Andrade, P. B., González-Álvarez, J., Pereira, J. A. (2013). Influence of solvent on the antioxidant and antimicrobial properties of walnut (Juglans regia L.) green husk extracts. Industrial Crops and Products, 42, 126–132. doi: https://doi.org/10.1016/j.indcrop.2012.05.021
14. Sultana, B., Anwar, F., Ashraf, M. (2009). Effect of Extraction Solvent/Technique on the Antioxidant Activity of Selected Medicinal Plant Extracts. Molecules, 14 (6), 2167–2180. doi: https://doi.org/10.3390/molecules14062167
15. Yang, J., Chen, C., Zhao, S., Ge, F., Liu, D. (2014). Effect of Solvents on the Antioxidant Activity of Walnut (Juglans regia L.) Shell Extracts. Journal of Food and Nutrition Research, 2 (9), 621–626. doi: https://doi.org/10.1326/jfrn-2.9-2-15
16. Akkol, E. K., Orhan, I. E., Yegład, A. (2012). Anticholinesterase and antioxidant effects of the ethanol extract, ethanol fractions and isolated flavonoids from Cistus laurifolius L. leaves. Food Chemistry, 131 (2), 626–631. doi: https://doi.org/10.1016/j.foodchem.2011.09.041
17. Zakaria, Z. A., Mohamed, A. M., Jamil, N. M., Roifie, M. S., Somchit, M. N., Zuraini, A. et. al. (2011). In vitro cytotoxic and antioxidant properties of the aqueous, chloroform and methanol extracts of Dicanthopetalus linearis leaves. African journal of Biotechnology, 10 (2), 273–282. Available at: https://www.researchgate.net/publication/266884212_In_vivo_cytotoxic_and_antioxidant_properties_of_the_aqueous_chloroform_and_methanol_extracts_of_Dicanthopetalus_linearis_leaves
18. Perveen, S., El-Shafar, A. M., Al-Taweel, A., Fawzy, G. A., Malik, A., Afza, N. et. al. (2011). Antioxidant and urease inhibitory C-glycosylflavonoids from Celtis africana. Journal of Asian Natural Products Research, 13 (9), 799–804. doi: https://doi.org/10.1080/10286020.2011.593171
19. Kurian, G. A., Suryanarayanan, S., Raman, A., Padikkala, J. (2010). Antioxidant effects of ethyl acetate extract of Desmodium gangeticum root on myocardial ischemia reperfusion injury in rat hearts. Chinese Medicine, 5 (1), 3. doi: https://doi.org/10.1186/1749-8546-5-3
20. Moure, A., Cruz, J. M., Franco, D., Domínguez, J. M., Sineiro, J., Domínguez, H. et. al. (2001). Natural antioxidants from residual sources. Food Chemistry, 72 (2), 145–171. doi: https://doi.org/10.1016/s0308-8146(00)00223-5
21. Al-Farsi, M. A., Lee, C. Y. (2008). Optimization of phenolics and dietary fibre extraction from date seeds. Food Chemistry, 108 (3), 977–985. doi: https://doi.org/10.1016/j.foodchem.2007.12.009
22. Jahanban-Esfahlan, A., Jahanban-Esfahlan, R., Tabibiazar, M., Roufegarnejad, L., Amarowicz, R. (2020). Recent advances in the use of walnut (Juglans regia L.) shell as a valuable plant-based bio-sorbent for the removal of hazardous materials. RSC Advances, 10 (12), 7026–7047. doi: https://doi.org/10.1039/c9ra0088a
23. Sheng, F., Hu, B., Jin, Q., Wang, J., Wu, C., Luo, Z. (2021). The Analysis of Phenolic Compounds in Walnut Husk and Pellicle by UPLC-Q-Orbitrap HRMS and HPLC. Molecules, 26 (10), 3013. doi: https://doi.org/10.3390/molecules26103013
24. Ostriok, A. N., Gorbatova, A. V., Filipovs, P. V. (2016). Analysis of fatty acid composition of peanut and walnut oil. Tekhnologii pischevykh i perefabratyvatychushey promyshlennosti APK - produkty zdrovogo pitanija, 4 (12), 37–42. Available at: https://cyberleninka.ru/article/n/analiz-zhirnokislotnogo-sostava-maselei-arasha-i-gretskego-oreha
25. Medic, A., Jakopic, J., Solar, A., Hudina, M., Veberic, R. (2021). Walnut (J. regia) Agro-Residues as a Rich Source of Phenolic Compounds. Biology, 10 (6), 535. doi: https://doi.org/10.3390/biology10060535
26. Gutiérrez Ortuz, A. L., Berti, F., Navarini, L., Crisafulli, P., Colombar, S., Forzato, C. (2018). Aqueous extracts of walnut (Juglans regia L.) leaves: quantitative analyses of hydroxycinnamic and chlorogenic acids. Journal of Chromatographic Science, 56 (8), 753–760. doi: https://doi.org/10.1093/chromsci/bmy041
27. Pang, X., Zhong, Z., Jiang, F., Yang, J., Nie, H. (2022). Juglans regia L. extract promotes osteogenesis of human bone marrow mesenchymal stem cells through BMP2/Smad/Runx2 and Wnt/β-catenin pathways. Journal of Orthopaedic Surgery and Research, 17 (1). doi: https://doi.org/101186/s13018-022-02949-1
28. Jahanban-Esfahlan, A., Ostadrashahi, A., Tabibiazar, M., Amarowicz, R. (2019). A Comparative Review on the Extraction, Antioxidant Content and Antioxidant Potential of Different Parts of Walnut (Juglans regia L.) Fruit and Tree. Molecules, 24 (11), 2133. doi: https://doi.org/10.3390/molecules24112133
29. Schwindt, S., Kraus, B., Heilmann, J. (2017). Phytochemical study of Juglans regia L. leaves. Phytochemistry, 144, 58–70. doi: https://doi.org/10.1016/j.phytochem.2017.08.012
30. Soto-Maldonado, C., Vergara-Castro, M., Jara-Quezada, J., Caballero-Valdés, E., Müller-Pavek, A., Zúñiga-Hansen, M. E., Altamirano, C. (2019). Polyphenolic extracts of walnut (Juglans regia) green husk containing juglone inhibit the growth of HL-60 cells and induce apoptosis. Electronic Journal of Biotechnology, 39, 1–7. doi: https://doi.org/10.1016/j.ejbt.2019.02.001
31. Vieira, V., Pereira, C., Abreu, R. M. V., Calhelha, R. C., Alves, M. J., Coutinho, J. A. P. et. al. (2020). Hydroethanolic extract of Juglans regia L. green husks: A source of bioactive phytochemicals. Food and Chemical Toxicology, 137, 111189. doi: https://doi.org/10.1016/j.fct.2020.111189
32. Jakopić, J., Veberič, R., Stampar, F. (2009). Extraction of phenolic compounds from green walnut fruits in different solvents. Acta Agriculturae Slovenica, 93 (1). doi: https://doi.org/10.2478/v10014-009-0002-4

33. Bamberger, C., Rossmeyer, A., Lechner, K., Wu, L., Waldmann, E., Fischer, S et. al. (2018). A Walnut-Enriched Diet Affects Gut Microbiome in Healthy Caucasian Subjects: A Randomized, Controlled Trial. Nutrients, 10 (2), 244. doi: https://doi.org/10.3390/nu10020244

34. Rock, C. L., Flatt, S. W., Barkai, H.-S., Pakiz, B., Heath, D. D. (2017). Walnut consumption in a weight reduction intervention: effects on body weight, biological measures, blood pressure and satiety. Nutrition Journal, 16 (1). doi: https://doi.org/10.1186/s12957-017-0304-2

35. Bamberger, C., Rossmeyer, A., Lechner, K., Wu, L., Waldmann, E., Stark, R. et. al. (2017). A Walnut-Enriched Diet Reduces Lipids in Healthy Caucasian Subjects, Independent of Recommended Macronutrient Replacement and Time Point of Consumption: A Prospective, Randomized, Controlled Trial. Nutrients, 9 (10), 1097. doi: https://doi.org/10.3390/nu9101097

36. Bhardwaj, R., Dod, H., Sandhu, M. S., Bedi, R., Dod, S., Konat, G. et. al. (2018). Acute effects of diets rich in almonds and walnuts on endothelial function. Indian Heart Journal, 70 (4), 497–501. doi: https://doi.org/10.1016/j.ihj.2018.01.030

37. Mohammadi, J., Delaviz, H., Ghalamfarsa, G., Mohammadi, B., Farhadi, N. (2017). A review study on phytochemistry and pharmacology applications of Juglans Regia plant. Pharmacognosy Reviews, 11 (22), 145. doi: https://doi.org/10.4103/phrev.phrev_10_17

38. Farr, O. M., Tuccinardi, D., Upadhyay, J., Oussaada, S. M., Mantzuros, C. S. (2017). Walnut consumption increases activation of the insula to highly desirable food cues: A randomized, double-blind, placebo-controlled, cross-over fMRI study. Diabetes, Obesity and Metabolism, 20 (1), 173–177. doi: https://doi.org/10.1111/dom.13060

39. Scott, N., Ellmers, L., Pilbrow, A., Thomsen, L., Richards, A., Frampton, C., Cameron, V. (2017). Metabolic and Blood Pressure Effects of Walnut Supplementation in a Mouse Model of the Metabolic Syndrome. Nutrients, 9 (7), 722. doi: https://doi.org/10.3390/nu9070722

40. Wang, D., Mu, Y., Dong, H., Yan, H., Hao, C., Wang, X., Zhang, L. (2017). Chemical Constituents of the Ethyl Acetate Extract from Diaphragma juglandis Fructus and Their Inhibitory Activity on Nitric Oxide Production In Vitro. Molecules, 23 (1), 72. doi: https://doi.org/10.3390/molecules23010072

41. Zibaeezehdad, M. J., Farhadi, P., Attar, A., Mosleh, A., Anirmoeezi, F., Azimi, A. (2017). Effects of walnut oil on lipid profiles in hyperlipidemic type 2 diabetic patients: a randomized, double-blind, placebo-controlled trial. Nutrition & Diabetes, 7 (4), e259–e259. doi: https://doi.org/10.1038/nu10020244

DOI: 10.15587/1729-4061.2022.262924

IMPROVING THE PRODUCTION TECHNOLOGY OF FUNCTIONAL PASTE-LIKE FRUIT-AND-BERRY SEMI-FINISHED PRODUCTS (p. 43–52)

Aleksey Zagorulko
State Biotechnological University, Kharkiv, Ukraine
ORCID: https://orcid.org/0000-0003-1186-3832

Andrii Zahorulko
State Biotechnological University, Kharkiv, Ukraine
ORCID: https://orcid.org/0000-0001-7768-6571

Kateryna Kasabova
State Biotechnological University, Kharkiv, Ukraine
ORCID: https://orcid.org/0000-0001-5827-1768

Lyudmila Chukov
State Biotechnological University, Kharkiv, Ukraine
ORCID: https://orcid.org/0000-0003-2377-7501

Lyudmila Yakovets
Vinnytsia National Agrarian University, Vinnytsia, Ukraine
ORCID: https://orcid.org/0000-0001-5283-7169

Andrii Pugach
Dnipro State Agrarian and Economic University, Dnipro, Ukraine
ORCID: https://orcid.org/0000-0002-5586-424X

Olha Barabolica
Poltava State Agrarian University, Poltava, Ukraine
ORCID: https://orcid.org/0000-0002-5663-8443

Vladyslav Lavruk
State Biotechnological University, Kharkiv, Ukraine
ORCID: https://orcid.org/0000-0002-0943-7351

The object of this study is a functional fruit-and-berry paste for health purposes with the selection of components (apples, Ziziphus jujuba, blueberries), which are sources of dietary fiber, vitamin C, low molecular weight polyphenolic compounds and phytosterols, which are used as an immunostimulant to create products with cholesterol-lowering effect. The task to increase the content of these substances is solved by concentrating in a rotary film evaporator (RFE) under mild regime parameters (60...65 °С) to a dry matter (DM) content of 30...32 % for 45...50 s and by the pasteurization of concentrated paste in a scraper heat exchanger (SHE) at a temperature of 95...98 °С followed by packing.

The effective viscosity (Pas) of the mixtures of the original purées (DM 16...17 %) and resulting pastes (30...32 %) has been determined and its increase was found in the pastes compared to puree, by 1.65...1.85 times. The obtained data indicate a strengthening of the structure of the resulting functional paste, which, compared to control, has an effective viscosity of 3.6 times more. A significant advantage has a paste containing 45 % of apple; 35 % of Ziziphus jujuba; 20 % of blueberries. It is characterized by an enhanced content of dietary fiber; by 3.6 times; vitamin C, by 2.25 times; low-molecular polyphenolic compounds and tannins, phytosterols. Therefore, it can be used as an immunostimulant to manufacture products with cholesterol-lowering effect.

It was established that in order to effectively conduct the process of concentration in RFE and subsequent pasteurization in SHE, it is rational to grind puree to a particle size within 0.1...0.5 mm. The heat transfer coefficient when concentrating samples with a particle size of 0.5 mm has a higher rate, by 6 %, compared to the sample with a particle size of 1.5 mm. The technology could be introduced at the enterprises of the canning and confectionery industries.

Keywords: paste (apple, Ziziphus jujuba, blueberry), effective viscosity, heat transfer coefficient, dispersion, pectin, vitamins, phytosterols.

References
1. Galanakis, C. M., Rizou, M., Aldawoud, T. M. S., Ucak, I., Rowan, N. J. (2021). Innovations and technology disruptions in the food sector within the COVID-19 pandemic and post-lockdown era. Trends in Food Science & Technology, 110, 193–200. doi: https://doi.org/10.1016/j.tifs.2021.02.002
Abstract and References. Technology and equipment of food production

2. Pap, N. Fidelis, M., Azevedo, L., do Carmo, M. A. V., Wang, D., Mocan, A. et. al. (2021). Berry polyphenols and human health evidence of antioxidant, anti-inflammatory, microbiota modulation, and cell-protecting effects. Current Opinion in Food Science, 42, 167–186. doi: https://doi.org/10.1016/j.coFS.2021.06.003

3. Bucher, T., van der Horst, K., Siegrist, M. (2013). Fruit for dessert. How people compose healthier meals. Appetite, 60, 74–80. doi: https://doi.org/10.1016/j.appet.2012.10.003

4. König, L. M., Renner, B. (2019). Boosting healthy food choices by meal colour variety: results from two experiments and a just-in-time Ecological Momentary Intervention. BMC Public Health, 19 (1). doi: https://doi.org/10.1186/s12889-019-7306-x

5. Ruiz Rodríguez, J. G., Zamora Gasga, V. M., Pescuma, M., Van Nieuwenhove, C., Mozz F., Sánchez Burgos, J. A. (2021). Fruits and fruits by-products as sources of bioactive compounds. Benefits and trends of lactic acid fermentation in the development of novel fruit-based functional beverages. Food Research International, 140, 109854. doi: https://doi.org/10.1016/j.foodres.2020.109854

6. Hubbermann, E. M. (2016). Coloring of Low-Moisture and Gelatinized Food Products. Handbook on Natural Pigments in Food and Beverages, 179–196. doi: https://doi.org/10.1016/b978-0-8100371-8.00008-7

7. Mykhailov, V., Zahorulko, A., Zagorulko, A., Liashenko, B., Dudnyk, S. (2021). Method for producing fruit paste using innovative equipment. Acta Innovations, 39, 15–21. doi: https://doi.org/10.32933/actainnovations.39.2

8. De Laurentiis, V., Corrado, S., Sala, S. (2018). Quantifying household waste of fresh fruit and vegetables in the EU. Waste Management, 77, 238–251. doi: https://doi.org/10.1016/j.wasman.2018.04.001

9. Silveira, A. C. P. (2015). Thermodynamic and hydrodynamic characterization of the vacuum evaporation process during concentration of dairy products in a falling film evaporator. Food and Nutrition. Available at: https://tel.archives-ouvertes.fr/tel-01342521

10. Cherevko, O., Mykhaylov, V., Zagorulko, A., Zahorulko, A. (2018). Improvement of a rotor film device for the production of high-quality multicomponent natural pastes. Eastern-European Journal of Enterprise Technologies, 2 (11 (92)), 11–17. doi: https://doi.org/10.15587/1729-4061.2018.126400

11. Crespi-Llorens, D., Vicente, P., Viedma, A. (2018). Experimental study of heat transfer to non-Newtonian fluids inside a scraped surface heat exchanger using a generalization method. International Journal of Heat and Mass Transfer, 118, 75–87. doi: https://doi.org/10.1016/j.ijheatmasstransfer.2017.10.115

12. Kasabova, K., Sabadash, S., Mohutova, V., Volokh, V., Poliakov, A., Lazarieva, T. et. al. (2020). Improvement of a scraper heat exchanger for pre-heating plant-based raw materials before concentration. Eastern-European Journal of Enterprise Technologies, 3 (11 (105)), 6–12. doi: https://doi.org/10.15587/1729-4061.2020.202501

13. Cherevko, O., Mykhaylov, V., Zahorulko, A., Zagorulko, A., Gordienko, I. (2021). Development of a thermal-radiation single-drum roll dryer for concentrated food stuff. Eastern-European Journal of Enterprise Technologies, 1 (11 (109)), 25–32. doi: https://doi.org/10.15587/1729-4061.2021.220990

14. Silva, L. B. da, Queiroz, M. B., Fadini, A. L., Fonseca, R. C. C. da, Germer, S. P. M., Efrain, P. (2016). Chewy candy as a model system to study the influence of polyols and fruit pulp (apricot) on texture and sensorial properties. IWT - Food Science and Technology, 65, 268–274. doi: https://doi.org/10.1016/j.jwt.2015.08.006

15. Kaprelyants, L. V. (2016). Functional foods and nutraceuticals – modern approach to food science. Visnyk of Lviv University. Series Biology, 73, 441.

16. Kasabova, K., Zagorulko, A., Zahorulko, A., Shmatchenko, N., Simakova, O., Gorainova, I. et. al. (2021). Improving pastille manufacturing technology using the developed multicomponent fruit and berry paste. Eastern-European Journal of Enterprise Technologies, 3 (11 (111)), 49–56 doi: https://doi.org/10.15587/1729-4061.2021.231730

17. Bashita, A. O., Kovalchuk, V. V. (2014). Rozroblennia sposobu otrzymywania zefiru ozdorovcholoho pryzmachennia. Kharkova prosperisty, 16, 37–41. Available at: http://nbuv.gov.ua/UKRN/Khp_2014_16_10

18. Dolores Alvarez, M., Canet, W. (2013). Time-independent and time-dependent rheological characterization of vegetable-based infant purées. Journal of Food Engineering, 114 (4), 449–464. doi: https://doi.org/10.1016/j.jfoodeng.2012.08.034

19. Zahorulko, A., Zagorulko, A., Yancheva, M., Serik, M., Sabadash, S., Savchenko-Pererva, M. (2019). Development of the plant for low-temperature treatment of meat products using ir-radiation. Eastern-European Journal of Enterprise Technologies, 1 (11 (97)), 17–22. doi: https://doi.org/10.15587/1729-4061.2019.154950

20. Cherevko, A., Mayak, O., Kostenko, S., Sardarov, A. (2019). Experimental and simulation modeling of the heat exchange process while boiling vegetable juice. Prohresyvni tekhnika ta tehknologiyi kharchovykh vyrobnyctsvrestorannoho hospodarstva i torhivli, 1 (29), 75–85. Available at: https://repo.btu.khar.kz/handle/123456789/298

21. Burkhatovna, A. A., Abbelbaevich, B. T., Kulkeldievna, A. G., Rahm edovna, Ch. E. (2015). Primeneenie innovatsionnykh tehnologiy v proizvodstve muchnykh konditerskih izdeliy. Evraziyskiy Soyuz uchenych, 11 (20). Available at: https://cyberleninka.ru/article/n/primenienie-innovatsionnyh-tehnologiy-v-proizvodstve-muchnykh-konditerskih-izdeliy

DOI: 10.15587/1729-4061.2022.261574
DEVELOPMENT OF PROBIOTIC YOGURT FROM SMALL CATTLE MILK (p. 53–59)

Assan Ospanov
Kazakh Research Institute of Processing and Food Industry, Almaty, Republic of Kazakhstan
ORCID: https://orcid.org/0000-0003-2396-3419

Shukhrat Velyamov
Kazakh Research Institute of Processing and Food Industry, Almaty, Republic of Kazakhstan
ORCID: https://orcid.org/0000-0002-5997-5182

Raushan Makeeva
Kazakh Research Institute of Processing and Food Industry, Almaty, Republic of Kazakhstan
ORCID: https://orcid.org/0000-0001-6344-4301

Dinara Tleveslova
Almaty Technological University, Almaty, Republic of Kazakhstan
ORCID: https://orcid.org/0000-0002-5084-6587

Raushan Tastanova
Kazakh Research Institute of Processing and Food Industry, Almaty, Republic of Kazakhstan
ORCID: https://orcid.org/0000-0003-1995-0332

This paper considers the physicochemical parameters of sheep’s and goat’s milk as raw materials to produce live yogurt. Sheep’s

121
milk of 12 breeds (14 samples per breed) and goat’s milk of 4 breeds (10 samples per breed) were examined. Milk was selected to produce yogurt from cow’s, sheep’s, goat’s milk and combined mixtures of cow’s and sheep’s milk in different ratios. The milk was selected for the purpose of producing yogurt with long-term viability of dairy bacteria, thereby obtaining live yogurt without the addition of synthetic preservation agents. The viability of probiotics (Bifidobacterium and Lactobacterium) in the composition of yogurts from cow’s, sheep’s, goat’s milk, and mixtures: cow’s and sheep’s milk in various ratios, cow’s and goat’s in similar ratios has been investigated. For consumer preference, organoleptic analyses are very important, according to the results of which yoghurt was selected in a ratio of 3:1 cow’s milk and sheep’s milk, respectively. An equally important indicator is the safety of the product, so microbiological and biochemical analyses were carried out on day 1 and during storage (day 28 at 4 °C). Producing yogurt using sheep’s milk is an interesting approach because of the improved nutritional value compared to cow’s and goat’s milk. Yogurt with the best indicators and a rational ratio of 2 types of milk was also identified. The physicochemical parameters of all types of yogurts were studied, the rational number of added starter cultures was selected. At the same time, yogurt from cow’s milk received low marks on organoleptic analysis, the rest of the samples showed a good result. The best in terms of the organoleptic analysis are yogurts with the addition of sheep’s milk. Yogurts have the ability to increase the body’s resistance to harmful environmental factors, subject to the consumption of live yogurt.

Keywords: viability of bacteria, sheep’s milk, combined milk, and goat’s milk’s nutritional value, shelf life.

References

1. World milk production will grow by about 1.7% per year until 2030. DairyNews.today. Available at: https://dairynews.today/news/proizvodstvo-moloka-v-mire-rasti-primerno-na.html
2. Yuan, G.-F., Chen, X.-E., Li, D. (2014). Conjugated linoleic acids and their bioactivities: a review. Food & Function, 5 (7), 1360. doi: https://doi.org/10.1039/c4fo0037d
3. Khorasvi, A., Safari, M., Khodaiyan, F., Gharibzahedi, S. M. T. (2015). Bioconversion enhancement of conjugated linoleic acid by Lactobacillus plantarum using the culture media manipulation and numerical optimization. Journal of Food Science and Technology, 52 (9), 5781–5789. doi: https://doi.org/10.1007/s13197-014-1699-6
4. Wang, T., Lee, H. G. (2014). Advances in Research oncis-9, trans-11 Conjugated Linoleic Acid: A Major Functional Conjugated Linoleic Acid Isomer. Critical Reviews in Food Science and Nutrition, 55 (5), 720–731. doi: https://doi.org/10.1080/10408398.2012.674071
5. Kanushina, J. A., Kister, I. V., Lisin, P. A. (2011). Computer modeling of a compounding cottage cheese Product «Kislinka» with vegetative components. Vestnik Omskogo gosudarstvennogo agrarnogo universiteta. Available at: https://cyberleninka.ru/article/n/kompyuternoe-modelirovanie-reseptury-tvorozhnoho-produkta-kislinka-s-rastitelnymi-komponentami
6. Dikhanbayeva, F., Zhaxybayeva, E., Dimitrov, Z., Baiysbayeva, M., Yessirkep, G., Bansal, N. (2021). Studying the effect of the developed technology on the chemical composition of yogurt made from camel milk. Eastern-European Journal of Enterprise Technologies, 3 (11(11)), 36–48. doi: https://doi.org/10.15587/1729-4061.2021.235831
7. Alimardanova, M., Tlevlessova, D., Akpanov, Z. (2021). Biotechnological processes for production of yoghurt containing conjugated linoleic acid isomer. Critical Reviews in Food Science and Nutrition, 55 (5), 720–731. doi: https://doi.org/10.1080/10408398.2012.674071
8. Ospanov, A., Toxanbayeva, B. (2020). Switching to sheep’s milk industry: problems and prospective. Eurasian Journal of Biosciences, 14 (1), 1263–1271.
9. Wang, K. Y., Li, S. N., Liu, C. S., Perng, D. S., Yu, Y. C., Wu, D. C. et al. (2004). Effects of ingesting Lactobacillus- and Bifidobacterium-containing yoghurt in subjects with colonized Helicobacter pylori. The American journal of clinical nutrition, 80 (3), 737–741. Available at: https://pubmed.ncbi.nlm.nih.gov/15321816/
10. Vargas, M., Chafer, M., Albors, A., Gonzalez-Martinez, C. (2008). Phychochemical and sensory characteristics of yoghurt produced from mixtures of cows’ and goats’ milk. International Dairy Journal, 18 (12), 1146–1152. doi: https://doi.org/10.1016/j.idairyj.2008.06.007
11. Kılıçk coûtan, A., Demir, M., Aşı, A., Çomak, E. M. (2011). Graininess and roughness of stirred yoghurt made with goat’s, cow’s or a mixture of goat’s and cow’s milk. Small Ruminant Research, 96 (2-3), 173–177. doi: https://doi.org/10.1016/j.smallruminres.2010.12.003
12. Güler, Z., Gürsöylale, A. C. (2011). Evaluation of volatile compounds and free fatty acids in set types yogurts made of ewes’, goats’ milk and their mixture using two different commercial starter cultures during refrigerated storage. Food Chemistry, 127 (3), 1065–1071. doi: https://doi.org/10.1016/j.foodchem.2011.01.090
13. Matos, S., Pinto, A., Castilho, C., Correia, P. R., Monteiro, A. C. (2013). Mix goat and sheep yoghurt: development and product characterization. World Academy of Science, Engineering and Technology International Journal of Nutrition and Food Engineering, 7 (7), 596–599. Available at: https://publications.waset.org/v13642/mix-goat-and-sheep-yoghurt-development-and-product-characterization
14. Wang, W., Bao, Y., Hendricks, G. M., Gao, M. (2012). Consistency, microstructure and probiotic survivability of goats’ milk yoghurt using polymerized whey protein as a co-thickening agent. International Dairy Journal, 24 (2), 113–119. doi: https://doi.org/10.1016/j.idairyj.2011.09.007
15. Ng, E. W., Yeung, M., Tong, P. S. (2011). Effects of yoghurt starter cultures on the survival of Lactobacillus acidophilus. International Journal of Food Microbiology, 145 (1), 169–175. doi: https://doi.org/10.1016/j.ijfoodmicro.2010.12.006
16. Kallasapathy, K., Chin, J. (2000). Survival and therapeutic potential of probiotic organisms with reference to Lactobacillus acidophilus and Bifidobacterium spp. Immunology and Cell Biology, 78 (1), 80–88. doi: https://doi.org/10.1046/j.1440-1711.2000.00886.x
17. Vianna, F. S., Canto, A. C. V. C. S., da Costa-Lima, B. R. C., Salim, A. P. A. A., Costa, M. P., Balthazar, C. F. et. al. (2017). Development of new probiotic yoghurt with a mixture of cow and sheep milk: effects on phycochemical, textural and sensory analysis. Small Ruminant Research, 149, 154–162. doi: https://doi.org/10.1016/j.smallrumres.2017.02.013
DETERMINATION OF OPTIMAL TECHNOLOGICAL PARAMETERS OF OBTAINING STEVIA EXTRACT IN TECHNOLOGY OF SOUR DAIRY DESSERTS (p. 60–67)

Tatiana Belemets
National University of Food Technologies, Kyiv, Ukraine
ORCID: https://orcid.org/0000-0002-6701-1711

In order to determine the optimal technological parameters for obtaining stevia leaf sweet extract, the dependence of the extractives' yield on the temperature and extraction process duration was investigated. A mathematical model has been built that makes it possible to determine and predict the extraction process at different technological parameters in order to effectively obtain extractive substances.

The expediency of using whey from the production of fermented milk cheese as an extractant for obtaining stevia extract has been substantiated. It was experimentally established and mathematically confirmed that the use of whey makes it possible to increase the yield of extractives by 12.1 %, as opposed to the use of an aqueous solution.

In order to intensify the extraction process, it is proposed to use a rotary-pulse apparatus. It was found that the application of a rotary-pulse apparatus makes it possible to increase the yield of extractive substances from sweet grass by 0.1–0.4 % compared to maceration.

The optimal technological parameters for obtaining stevia extract have been determined: hydro module, 1:15; extractant, whey; extraction temperature, 85±5 °C; process duration, 20–25 min. The use of graphic and mathematical modeling in the environments "Mathcad" and "Statistica" helped construct 3D-graphic models to illustrate the dependence of the degree of extraction of extractive substances from dry stevia leaves on the technological parameters for obtaining extracts.

The improved technology of obtaining stevia leaf sweet extract will significantly expand the range of “healthy foods” through the partial or complete replacement of sugar. The production of such dietary products will have a social effect and economic attractiveness for food industry enterprises.

Keywords: fermented milk product, stevia leaf extract, sweet extract, rotary pulse apparatus, extractives.

References
1. Belemets, T., Radziyevskaya, I., Yushchenko, N., Kuzmyk, U. (2020). Determining the efficiency of using egg products for the stabilization of emulsion when making milk-containing curds-based products. Eastern-European Journal of Enterprise Technologies, 4 (11 (106)), 14–23. doi: https://doi.org/10.15587/1729-4061.2020.210006
2. Kalmykova, Y., Kalmykov, S., Bismak, H., Bezizychna, O., Okun, D. (2020). Results of the use of physical therapy for metabolic syndrome according to anthropometric studies. Journal of Human Sport and Exercise, 16 (2). doi: https://doi.org/10.14198/jhse.2021.162.09
3. Kalmykova, Y., Kalmykov, S., Bismak, H. (2018). Dynamics of anthropometric and hemodynamic indicators on the condition of young women with alimentary obesity in the application of a comprehensive program of physical therapy. Journal of Physical Education and Sport, 18 (4), 2417–2427. doi: https://doi.org/10.7752/jpess.2018.04364
4. Farhat, G., Berzet, V., Moore, L. (2019). Effects of Stevia Extract on Postprandial Glucose Response, Satiety and Energy Intake: A Three-Arm Crossover Trial. Nutrients, 11 (12), 3036. doi: https://doi.org/10.3390/nu11123036
5. McCain, H. R., Kaliappan, S., Drake, M. A. (2018). Invited review: Sugar reduction in dairy products. Journal of Dairy Science, 101 (10), 8619–8640. doi: https://doi.org/10.3168/jds.2017-14347
6. Singh, D. P., Kumari, M., Prakash, H. G., Rao, G. P., Solomon, S. (2019). Physicochemical and Pharmacological Importance of Stevia: A Calorie-Free Natural Sweetener. Sugar Tech, 21 (2), 227–234. doi: https://doi.org/10.1007/s12355-019-00784-1
7. Saraiva, A., Carrascosa, C., Rahrem, D., Ramos, F., Raposo, A. (2020). Natural Sweeteners: The Relevance of Food Naturalness for Consumers, Food Security Aspects, Sustainability and Health Impacts. International Journal of Environmental Research and Public Health, 17 (17), 6285. doi: https://doi.org/10.3390/ijerph17176285
8. Samuel, P., Ayoob, K. T., Magnusson, B. A., Wälwer-Rieck, U., Jeppesen, P. B., Rogers, P. J. et. al. (2018). Stevia Leaf to Stevia Sweetener: Exploring Its Science, Benefits, and Future Potential. The Journal of Nutrition, 148 (7), 1186S–1205S. doi: https://doi.org/10.1093/jn/nxy102
9. Marcinek, K., Krejpcio, Z. (2016). Stevia rebaudiana Bertoni: health promoting properties and therapeutic applications Journal Für Verbraucherschutz Und Lebensmittelsicherheit, 11 (1), 3–8. doi: https://doi.org/10.1007/s00003-015-0068-2
10. Yushchenko, N., Belemets, T. (2015). Use of milk whey for obtaining extracts based on stevia leaves. Prohresyvni tekhnika ta tekhnolohiyi kharchovykh vyrobnytstv restorannoho hospodarstva i torhivli, 2 (22), 214–221. Available at: http://dspace.muft.edu.ua/pspui/handle/123456789/26187
11. Belemets, T., Radziyevska, I., Yushchenko, N., Kuzmyk, U., Pasichnyi, V., Kochubei-Lytvynenko, O. et. al. (2021). Impact of vegetable oils on the fatty acid composition of a milk-containing curd product. Journal of Hygiene Engineering and Design, 34, 150–160. Available at: https://keypublishing.org/jhed/wp-content/uploads/2021/04/18-JHED-Volume-34-FFP-Full-paper-Tatiana-Belemets.pdf
12. De Carvalho, M. W., Arriola, N. D. A., Pinto, S. S., Verruck, S., Fritzen-Freira, C. B., Prudêncio, E. S., Amboni, R. D. de M. C. (2018). Stevia-fortified yoghurt: Stability, antioxidant activity and in vitro digestion behaviour. International Journal of Dairy Technology, 72 (1), 57–64. doi: https://doi.org/10.1111/1471-0307.12559
13. Abou-Arab, A. E., Abou-Arab, A. A., Abu-Salem, M. F. (2010). Physico-chemical assessment of natural sweeteners stevioides produced from Stevia rebaudiana Bertoni plant. African Journal of Food Science, 4 (5), 269–281. Available at: https://academicjournals.org/article/article1380729967_About-Arab%20et%20al.pdf
14. Lisak, K., Lenc, M., Jeličić, I., Božanić, R. (2012). Sensory evaluation of the strawberry flavored yoghurt with stevia and sucrose addition. Hrvatski časopis za prehrambenu tehnologiju, biotehnologiju i nutricionizam, 7, 39–43. Available at: https://hrcak.srce.hr/file/123163

15. Velotto, S., Parafati, L., Ariano, A., Palmeri, R., Pesce, F., Planeta, D. et al. (2021). Use of stevia and chia seeds for the formulation of traditional and vegan artisanal ice cream. International Journal of Gastronomy and Food Science, 26, 100441. doi: https://doi.org/10.1016/j.ijgfs.2021.100441

16. Pereira, C. T. M., Pereira, D. M., de Medeiros, A. C., Hirakata, S. E. Y., Ventura, M. B., Bolini, H. M. A. (2021). Skyr yoghurt with mango pulp, fructooligosaccharide and natural sweeteners: Physical aspects and drivers of liking. LWT, 150, 112054. doi: https://doi.org/10.1016/j.lwt.2021.112054

17. Trukhachev, V., Sycheva, O., Starodubtseva, G., Veselova, M., Putrina, A. (2011). The combined dairy and vegetable dessert with stevia extract. Agricultural Bulletin of Stavropol Region, 2, 36–39. Available at: http://www.vapk26.ru/journals/06.pdf

18. Buchilina, A., Ariyana, K. (2021). Physicochemical and microbiological characteristics of camel milk yoghurt as influenced by monk fruit sweetener. Journal of Dairy Science, 104 (2), 1484–1493. doi: https://doi.org/10.3168/jds.2020-18842

19. Mahato, D. K., Keast, R., Liem, D. G., Russell, C. G., Ciceral, S., Gamlath, S. (2021). Optimisation of natural sweeteners for sugar reduction in chocolate flavoured milk and their impact on sensory attributes. International Dairy Journal, 115, 104922. doi: https://doi.org/10.1016/j.idj.2020.104922

20. Esmerino, E. A., Cruz, A. G., Pereira, E. P. R., Rodrigues, J. B., Faria, J. A. F., Bolini, H. M. A. (2013). The influence of sweeteners in probiotic Petit Suisse cheese in concentrations equivalent to that of sucrose. Journal of Dairy Science, 96 (9), 5512–5521. doi: https://doi.org/10.3168/jds.20136616

21. Granato, D., Santos, J. S., Salem, R. D., Mortazavian, A. M., Roche, R. S., Cruz, A. G. (2018). Effects of herbal extracts on quality traits of yogurts, cheeses, fermented milks, and ice creams: a technological perspective. Current Opinion in Food Science, 19, 1–7. doi: https://doi.org/10.1016/j.cofs.2017.11.013

22. Gamboa, F., Chaves, M. (2012). Antimicrobial potential of extracts from Stevia rebaudiana leaves against bacteria of importance in dental caries. Acta Odontologica Latinoamericana, 25 (2), 171–175. Available at: https://www.researchgate.net/publication/233899208_Antimicrobial_potential_of extracts_from_Stevia_rebaudiana_leaves_against bacteria_of importedance_in_dental_caries/citations

23. Milani, P. G., Formigoni, M., Dacome, A. S., Benossi, L., Costa, C. E. M. D., Costa, S. C. D. (2017). New seminal variety of Stevia rebaudiana: Obtaining fractions with high antiobacterial potential of leaves. Anais Da Academia Brasileira de Ciências, 89 (3), 1841–1850. doi: https://doi.org/10.1590/0001-3765201720170174

24. Roik, M. V., Kuznetsova, I. V. (2018). Technology of manufacture concern- trate from dried leaves of Stevia. Bulletin of Agricultural Culture, 96 (4), 48–54. doi: https://doi.org/10.31073/agrovisnyk201804-08

25. Menchik, P., Zubler, T., Zubler, A., Moraru, C. I. (2019). Short communication: Composition of coproduct streams from dairy processing: Acid whey and milk permeate. Journal of Dairy Science, 102 (5), 3978–3984. doi: https://doi.org/10.3168/jds.2018-15951

26. Yushchenko, N., Grabova, T., Kuzmyk, U., Pasichnyi, V. (2017). Determining the technological parameters of obtaining extraction of sucumac for further use in the technology of sour-milk paste. Scientific Works of National University of Food Technologies, 23 (4), 177–182. doi: https://doi.org/10.24263/2225-2924-2017-23-4-23

27. Jia, F., Chawhuaymak, J., Riley, M. R., Zimmt, W., Ogden, K. L. (2013). Efficient extraction method to collect sugar from sweet sorghum. Journal of Biological Engineering, 7 (1). doi: https://doi.org/10.1186/1754-1611-7-1

DOI: 10.15587/1729-4061.2022.263111
IDENTIFICATION OF THE INFLUENCE OF TECHNOLOGICAL FACTORS ON THE GROWTH AND DEVELOPMENT OF LACTIC ACID MICROORGANISMS IN PASTILLE MARMALADE PRODUCTS ENRICHED WITH LACTIC ACID STARTERS (p. 68–78)

Yuliya Pronina
Almaty Technological University, Almaty, Republic of Kazakhstan
ORCID: https://orcid.org/0000-0003-0395-3379

Zhanar Nabiyeva
Almaty Technological University, Almaty, Republic of Kazakhstan
ORCID: https://orcid.org/0000-0001-7258-746X

Olga Belozertseva
Almaty Technological University, Almaty, Republic of Kazakhstan
ORCID: https://orcid.org/0000-0002-2149-9811

Saule Shukesheva
Almaty Technological University, Almaty, Republic of Kazakhstan
ORCID: https://orcid.org/0000-0002-7275-8385

Abdysemat Samodun
Almaty Technological University, Almaty, Republic of Kazakhstan
ORCID: https://orcid.org/0000-0002-5286-5175

Prototypes of pastille marmalade products with starters of lactic acid microorganisms have been developed. Pastille marmalade products that contain live cells of probiotic culture (from 1 to 3 CFU/g) help strengthen and maintain immunity. The macro and micromorphology of the probiotic culture were investigated, which confirmed the belonging of microorganisms to lactic acid. The studies reported here were scientifically substantiated by the method of mathematic modeling. Based on the regression equation, it was revealed that the growth of lactic acid microorganisms in the product is affected by the volume of whey (250 ml), the volume (0.02 g) and the time of revival of the starter culture (6 hours). A more significant factor was the volume of application of lactic acid microorganisms, from 0.01 to 0.02 g, which affects the growth of lactic acid microorganisms (increases) in the product. The antimicrobial activity of isolated crops in relation to E. coli was studied. The zones of illumination of the isolated colonies in relation to E. coli range from 0.1 mm to 0.5 mm. The results show that antagonistic properties affect pathogenic and conditionally pathogenic microorganisms in the gastrointestinal tract.

The antioxidant properties of pastille marmalade products have been established. When applying starters of lactic acid cultures, the volume of antioxidants increased by 1.7 and 2.2 times compared with control.

In this regard, the development of pastille marmalade products with starters of lactic acid microorganisms is a relevant and promising task because they are natural, have an immunostimulating effect, and expand the range of confectionery products.
Keywords: starters of lactic acid microorganisms, whey, antimicrobial activity, antioxidant properties, immunity.

References

1. Pronina, Yu. G., Bazykhanova, E. Ch., Nabiieva, Zh. S., Belozerts'eva, O. D., Kazhymurat, A. T., Samadun, A. I. (2021). Sovremennoe sostoyanie isledovaniy i proizvodstva dieticheskikh immunostimulyatsionnykh konditsionerskikh izdeliy na osnove rastitel'nogo svyra'ya. Mat. IX mezhdunar. nauch.-prakt. konf. «Nauka i obrazovanie v sovremennom mire: vyzovy XXI veka», 54–58.

2. Stroshkova, A. V., Titova, I. M., Massalina, I. P. (2021). Justification of the functional marmalade recipe. Youth science reporter, 3 (30). doi: https://doi.org/10.46845/2541-8254-2021-3(30)-5-5

3. Shegeda, V. A., Demisova, O. N. (2020). Zameniteli sakhara: pol'za i vred. Mater. XV mezhd. mol. nauch. konf. po estestvenno-nauch. i tekhn. distsiplinam «Nauchnomu progressu – tvorchestvo molodykh», PGTU. Ch. 1. Yoshkar-Ola, 170–173.

4. Belozerts'eva, O., Baibolova, L., Pronina, Y., Cepeda, A., Tvelessova, D. (2021). The study and scientific substantiation of critical control points in the life cycle of immunostimulating products such as pastila and marmalade. Eastern-European Journal of Enterprise Technologies, 5 (11 (113)), 20–28. doi: https://doi.org/10.15587/1729-4061.2021.241526

5. Pronina, Yu. G., Nabiieva, Zh. S., Shukesheva, S. E. (2021). Perspektivy ispol'zovaniya mochnokislykh mikroorganizmov v proizvodstve marmelad. Integration of Education, Science and Business in Modern Environment: Summer Debates: abstracts of the 3rd International Scientific and Practical Internet Conference. Dnipro, 413–415. Available at: http://www.wayscience.com/wp-content/uploads/2021/08/Materials-of-conference-11-12-08-2021-1.pdf

6. Samedie, L., Charles, A. L. (2019). Functional Activity of Four Autochthonous Strains L. paraplanterium AB362736.1, L. plantarum MF369875.1, W. paraacentroides CP023501.1, and E. faecalis HQ892261.1 in a Probiotic Grape Marmalade during Storage. Antioxidants, 8 (6), 165. doi: https://doi.org/10.3390/antiox8060165

7. Yang, Y., Babich, O., Sukhikh, S., Zimina, M., Milentyeva, I. (2020). Antibiotic activity and resistance of lactic acid bacteria and other antagonistic bacteriocin-producing microorganisms. Foods and Raw Materials, 8 (2), 377–384. doi: https://doi.org/10.21603/2038-4075-2020-2-377-384

8. Zhel'dybaeva, A. Kh. (2020). Razrabotka funktsional'nogo produkta: marmelad. Aktual'nye isledovaniya, 21 (24), 22–27. Available at: https://apni.ru/article/1384-razrabotka-funktsionalnogo-produkta-marmelad

9. Kashina, E. D. (2021). Rol' mochnokislykh mikroorganizmov v proizvodstve kislomolochnykh produktov i syrov. Molohnaya promyshlennost', 32–33.

10. Markova, Yu. M., Stetsenko, V. V., Polyanyina, A. S. (2021). A Method of Direct Quantification of Lactobacillus spp. in Intestinal Contents Based on Real-Time PCR. Bulletin of Experimental Biology and Medicine, 171 (6), 794–797. doi: https://doi.org/10.1007/s10517-021-0318-w

11. Zabasht, N. N., Grin, V. A., Semenenko, M. P., Kuzminova, E. V. (2018). Possibilities of using a complex of probiotics with microelements for the production of functional nutrition. Research Journal of Pharmaceutical, Biological and Chemical Sciences, 9 (6), 1703–1708.

12. Kondratenko, V., Posokina, N., Kolokolova, A., Zakharova, A. (2021). Development of Lactic acid Microorganisms during Fermentation of Substrate with an Increased Concentration of Carbohydrates. Food Processing: Technologies and Techniques, 51 (3), 584–592. doi: https://doi.org/10.21603/2074-9414-2021-3-584-592

13. Sorokina, E. V., Stoyanov, I. A., Abdullaeva, A. M., Stoyanova, L. G. (2002). Multifunctional properties of probiotic strains Lactococcus lactis ssp. lactis. Uspekhi sovremennoy biologii, 142 (1), 25–36. doi: https://doi.org/10.31857/s0042173220106070

14. Artiiukhova, S. I., Tolstoguzova, T. T. (2014). Biotechnology bioproducts "Healing-1". Vestnik Voronezhskogo gosudarstvennogo universiteta inzhenernykh tehnologiy, 4, 183–186. Available at: https://cyberleninka.ru/article/n/biotehnologiya-bioproduktov-tezelebnyy-1

15. Perez, R., Ancuelo, A. E., Zendo, T. (2022). Genotypic and phenotypic characterization of bacteriocinogenic lactic acid bacterial strains for possible beneficial, virulence, and antibiotic resistance traits. Journal of Microbiology, Biotechnology and Food Sciences, 11 (5), e990. doi: https://doi.org/10.55251/jmbfs.990

16. Poluyanova, M. A., Popov, V. G. (2022). Biotechnological Aspects of the Functional Marmalade Development Using Whey for the Gastrointestinal Diseases Prevention. Food Industry, 7 (2), 72–79. doi: https://doi.org/10.29141/2500-1922-2022-7-2-8

17. Tret'yak, L. N., Vorob'ev, A. L. (2022). Osnovy teorii i praktiki obrabotki eksperimental'nykh dannyh. Moscow: Izdatel'stvo Yuryat, 237. Available at: https://library.yurayt.ru/files/156389/

18. Krass, M. S., Chuprynyov, B. P. (2019). Matematika v ekonomike: matematicheskie metody i modeli. Moscow: Izdatel'stvo Yuryat, 541.

19. Aprelev, A. V., Davydova, E. V., Smirnov, V. A. (2018). Antibiosyndity kak kriteriy bezopasnosti pischevykh produktov. Al'manakh sovremennoy metrologii, 16, 120–128.

20. Kizatova, M. Zh., Nabiieva, Zh. S., Kosherbaeva, L. M., Abchaeva, Sh. A. (2012). Oprodelenie antibiosyndiantovii aktivnosti v syr'ye i produktakh proroschennoy kykyryzy. Mezhdynarodnaya naychno-prakticheskaya konferentsiya «Innovatsionnnoe razvitie pischevykh, legkoy promyshlennosti i industrii gosteprinimstva» posvyashchennoy 55-letiyu ATY. Almaty, 136–138.

21. Boyarinaeva, I. V. (2020). Probiotiki v funktsional'nom pitanii. Vestnik Khabarovskogo gosudarstvennogo universiteta ekonomiki i prava, 3 (104), 160–163. doi: https://doi.org/10.38161/2618-9526-2020-3-03

DOI: 10.15587/1729-0461.2022.263032

EFFECT OF ENTEROSORBING DIETARY FIBERS ON THE QUALITY AND SAFETY OF FERMENTED MILK PRODUCTS (p. 79–87)

Mariam Alimardanova
Almaty Technological University, Almaty, Republic of Kazakhstan
ORCID: https://orcid.org/0000-0003-4861-7862

Venera Bakiyeva
Almaty Technological University, Almaty, Republic of Kazakhstan
ORCID: https://orcid.org/0000-0002-4801-7173

This paper considers the possibility of using rice husks as enteroxabsorbing dietary fibers in the production of fermented milk products. The results of studying the fermented milk product using L. diacetylactis, L. helveticus and Bacteriumbifidum microflora with the introduction of enterosorbing dietary fibers (ESDF) are reported. The
technology of processing and preparation for the introduction of rice husks is described. Rice husks were studied for different particle sizes, the optimal option in the form of powder was selected. The behavior, influence on the shelf life, and viability of lactic acid bacteria in the finished product were investigated. The study of the chemical composition showed that in the examined samples the protein content increased by 25 %, carbohydrates – by 1.6 %, and dry matter – by 18 %; the content of dietary fiber (2.3 g) is 9 % of the daily value. An organoleptic assessment was also analyzed, based on which it was revealed that the rational dose of rice husks is 12 %. The dose of ESDF introduction varied from 0 to 5 %, in increments of 1 %. The optimization method revealed the area of the optimum, based on which repeated studies of the fermented milk product, produced according to the optimal formulation, were carried out. To assess safety, such indicators as QMAF AnM (the quantity of mesophilic aerobic and facultative anaerobic microorganisms), titrated acidity and pH, as well as the content of heavy metals in the resulting samples were investigated. Enriching the fermented milk product with dietary fiber has made it possible to obtain a product with higher organoleptic properties and increased nutritional value while maintaining the consumer properties of the product.

**Keywords:** fermented milk product, rice husks, lactic acid bacteria, shelf life, safety.

**References**

1. Nigam, D. (2018). Probiotics as Functional Foods in Enhancing Gut Immunity. Functional Food and Human Health, 59–82. doi: https://doi.org/10.1007/978-981-13-1123-9_4

2. Alkhaiti, A. (2020). Antiviral Functional Foods and Exercise Lifestyle Prevention of Coronavirus. Nutrients, 12 (9), 2633. doi: https://doi.org/10.3907/nutrients12092633

3. Bozhkova, S. E., Pogorelets, T. P., Gaivoronskaya, N. S., Pilenko, D. N., Surkova, S. A. (2019). Technology of production of granulated cottage cheese with usage of dietary fiber. Agrarian-And-Food Innovations, 5 (1), 77–83. doi: https://doi.org/10.31208/2618-7333-2019-5-77-83

4. Stambeleva, A. K., Elenesova, A. A., Bayakhan, A. A., Almardanova, M. K., Petchenko, V. I., Levochkina, N. A. (2022). Development of the recipe, technology of a functional fermented milk product with dill greens and “Dzhusay.” BIO Web of Conferences, 43, 03043. doi: https://doi.org/10.1051/bioconf/20224303043

5. Cronin, P., Joyce, S. A., O’Toole, P. W., O’Connor, E. M. (2021). Dietary Fibre Modulates the Gut Microbiota. Nutrients, 13 (5), 1635. doi: https://doi.org/10.3390/nu13051635

6. Orisova, M. Z., Kuzieva, Z. N., Oshepekova, Y. I., Salikhov, S. I. (2022). Obtaining Chitosan from Artemia Cysts and Studying its Sorption Properties. Pharmaceutical Chemistry Journal, 55 (11), 1234–1239. doi: https://doi.org/10.11099-022-02563-9

7. Fatullayeva, S., Tagiyev, D., Zeynalov, N. (2021). A review on enterosorbents and their application in clinical practice: Removal of toxic metals. Colloid and Interface Science Communications, 45, 100545. doi: https://doi.org/10.1016/j.ciscom.2020.100545

8. Sarratskaya, V., Mikhailenko, V., Prokopenko, I., Gerashchenko, B. I., Shevchuk, O., Yushko, L. et. al. (2020). The effect of two formulations of carbon enterosorbents on oxidative stress indexes and molecular conformation of serum albumin in experimental animals exposed to CCl4. Heliyon, 6 (1), e01326. doi: https://doi.org/10.1016/j.heliyon.2019.e01326

9. Kucher, S. V., Lototska, O. V. (2021). Inclusion of enterosorvents in anti-inflammatory therapy improve treatment effectiveness in copd patients during exacerbations. The Ukrainian Biochemical Journal, 93 (2), 107–114. doi: https://doi.org/10.15407/ubj93.02.107

10. Tuskano, V. V., Vasyutin, A. V., Tonikh, J. L., Gorchilova, E. G., Rzhavicheva, O. S., Borisov, A. G. (2020). Possibilities of application of enterosorbent in combined therapy of opisthorchiasis patients with skin syndrome. Meditsinskij Sovet – Medical Council, 5, 70–76. doi: https://doi.org/10.21518/2079-701x-2020-5-70-76

11. Budnyak, T. M., Vlasova, N. N., Golovkina, L. P., Slabon, A., Ter-tykh, V. A. (2019). Bile acids adsorption by chitoan-fumed silica enterosorbent. Colloid and Interface Science Communications, 32, 100194. doi: https://doi.org/10.1016/j.colcom.2019.100194

12. He, Y., Wang, B., Wen, L., Wang, F., Yu, H., Chen, D. et. al. (2022). Effects of dietary fiber on human health. Food Science and Human Wellness, 11 (1), 1–10. doi: https://doi.org/10.1016/j.fshw.2021.07.001

13. Almardanova, M. K., Baybolova, L. K., Dzhetpsiabaeva, B. Sh., Bakieva, V. M., Bayyshbaeva, M. P., Mutushev, A. Zh. et. al. (2019). Pat. No. 406 RK. Sposob proizvodstva yogurta. No. 2019/0316.2.

14. Shunkeeyeva, A. A., Alimardanova, M., Albertovich, M. A. (2021). Chemical Composition, Texture and Sensory Evaluation of Yogurts Supplemented with Amaranth Flower. American Journal of Animal and Veterinary Sciences, 16 (2), 136–143. doi: https://doi.org/10.3844/ajavsp.2021.136.143

15. Tavakoli, M., Habibi Najafi, M. B., Mohelbi, M. (2019). Effect of the milk fat content and starter culture selection on proteolysis and antioxidant activity of probiotic yogurt. Heliyon, 5 (2), e01204. doi: https://doi.org/10.1016/j.heliyon.2019.e01204

16. Irvine, S. L., Hummelen, R., Hekmat, S. (2011). Probiotic yogurt consumption may improve gastrointestinal symptoms, productivity, and nutritional intake of people living with human immunodeficiency virus in Mwanza, Tanzania. Nutrition Research, 31 (12), 875–881. doi: https://doi.org/10.1016/j.nutres.2011.10.005

17. Sarangi, M., Bhattacharyya, S., Behera, R. C. (2009). Effect of temperature on morphology and phase transformations of nanocrystalline silica obtained from rice husk. Phase Transitions, 82 (5), 377–386. doi: https://doi.org/10.1080/01411590902578302

18. Munothar, A. S. (2002). Utilization of uncontrolled burnt rice husk ash in soil improvement. Dimensi Teknik Sipil, 4 (2), 100–105. Available at: https://tekniksipil.unsyiah.ac.id/wp-content/uploads/2011/06/CIV-0204207.pdf

19. Sapei, L., Suseno, N., Riadi, L., Padmawijaya, K. S., Wurarah, T. S., Dewi, V. (2018). Biosilica recovery from pulped rice husk by acid precipitation. In: Chemeca 2018: Chemical Engineering in Australasia. Available at: http://repository.ubaya.ac.id/34069/

20. Todkar, B. S., Deorukhkar, O. A., Deshmukh, S. M. (2016). Extraction of Silica from Rice Husk. International Journal of Engineering Research and Development, 12 (3), 69–74. Available at: http://www.wjerd.com/paper/vol12-issue3/Version-2/H12326974.pdf

21. Karavay, L. V., Levochkina, L. V. (2008). Gidrozilozovannaya risovaya sheluhka dlya proizvodstva muchnykh izdeliy. Psichevaya promyshlennost’, 11, 53. Available at: https://cyberleninka.ru/article/n/gidrozilozovannaya-risovaya-sheluhka-dlya-proizvodstva-muchnykh-izdeliy

22. Kruglova, A. S., Selina, A. A., Minakova, P. S. (2020). Issledovanie aktivnogo kremnya v otkhodakh plodovykh obolochek risa i solomy.
Eurasian Scientific Association, 9-3 (67), 168–170. Available at: https://www.elibrary.ru/item.asp?id=44122569

23. Galchenko, A. V. Sherstneva, A. A., Levina, M. M. (2021). Conditionally essential trace elements in nutrition of vegetarians and vegans: fluoride, silicon, bromine, boron. Trace elements in medicine, 22 (1), 32–43. doi: https://doi.org/10.19112/2413-6174-2021-22-1-32-43

24. Alimardanova, M., Tlevlessova, D., Bakiyeva, V., Akpanov, Z. (2021). Revealing the features of the formation of the properties of processed cheese with wild onions. Eastern-European Journal of Enterprise Technologies, 4 (11 (112)), 73–81. doi: https://doi.org/10.15587/1729-4061.2021.239120

DOI: 10.15587/1729-4061.2022.263177

DEFINING QUALITY INDICATORS FOR SUGAR PASTES WITH DEMINERALIZED WHEY DURING STORAGE (p. 88–96)

Larysa Rybchuk
State University of Trade and Economics/Kyiv National University of Trade and Economics, Kyiv, Ukraine
ORCID: https://orcid.org/0000-0002-6282-7295

Anatoliy Vdovichen
Chernivtsi Institute of Trade and Economics of State University of Trade and Economics, Chernivtsi, Ukraine
ORCID: https://orcid.org/0000-0002-4496-6435

Olima Romanovska
Chernivtsi Institute of Trade and Economics of State University of Trade and Economics, Chernivtsi, Ukraine
ORCID: https://orcid.org/0000-0003-4027-560X

Inna Danyliuk
Chernivtsi Institute of Trade and Economics of State University of Trade and Economics, Chernivtsi, Ukraine
ORCID: https://orcid.org/0000-0002-3407-8813

Vladimir Piddubnyi
National Academy of Agrarian Sciences of Ukraine, Kyiv, Ukraine
ORCID: https://orcid.org/0000-0002-0596-7478

Iryna Losheniuk
Chernivtsi Institute of Trade and Economics of State University of Trade and Economics, Chernivtsi, Ukraine
ORCID: https://orcid.org/0000-0002-0692-9318

Mihailo Kravchenko
State University of Trade and Economics/Kyiv National University of Trade and Economics, Kyiv, Ukraine
ORCID: https://orcid.org/0000-0002-0093-2786

Tatiana Yudina
State University of Trade and Economics/Kyiv National University of Trade and Economics, Kyiv, Ukraine
ORCID: https://orcid.org/0000-0001-9803-978X

Roman Romanenko
State University of Trade and Economics / Kyiv National University of Trade and Economics, Kyiv, Ukraine
ORCID: https://orcid.org/0000-0003-3090-9250

This paper considers the changes in quality indicators of sugar pastes with dry demineralized whey and glycerin during storage in order to establish their technological shelf life.

Based on the results of studying changes in the mass fraction of moisture of sugar pastes over 30 days, a decrease in this indicator in the control sample was established, by 80 %, and in the experimental one - by 30 %.

Examining the sensory characteristics of consistency according to the devised descriptors has made it possible to establish that the control sample of sugar pastes on day 10 of storage is technologically unsuitable. Its consistency is characterized as too dense, hard, brittle, not uniform, with lumps. Accordingly, the molding ability, which received 3.45 points, decreases. The prototype, even on day 30 of storage, has acceptable consistency characteristics: moderately hard and dense, softish, homogeneous with the presence of barely perceptible small inclusions. A high molding ability is retained, which received 4.3 points.

Experimental studies of the fractional composition of the solid phase and the dispersion of sugar pastes are consistent with studies into the sensory characteristics of the consistency. It was established that on day 10 of storage, in the control sample the fractional composition of particles with a size of 21 to 30 µm prevails, the content of which is 62 %, which characterizes the structure as coarse crystalline. In the prototype on day 30 of storage, the content of particles the size of 11 to 20 µm was 72 %, which preserves the quality of the paste and characterizes its structure as finely crystalline.

The results of the study made it possible to establish a tendency to slow down the build-up of solid particles of the developed sugar pastes, and their growth to a critical size of 22.6 µm. The data obtained have made it possible to establish the technological shelf life of the developed sugar pastes, which was 30 days, which is 3 times more than that of the control.

Consequently, the introduction into the formulation composition of sugar pastes of demineralized whey at a concentration of 50 % and glycerin at a concentration of 5 % makes it possible to extend their technological shelf life. This is important from a practical point of view and solves the problem set.

Keywords: sugar paste, demineralized whey, glycerin, technological suitability, consistency, particle size.

References

1. Yuliati, K., Hamzah, R. S., Hamzah, B. (2022). Feasibility study of indigenous confectionery business - the case of gulo puan industries. Economia Agro-Alimentare, 1, 1–30. doi: https://doi.org/10.3280/eca2022oa12375

2. Mafra, R., José, S. A. (2015). Application of lean manufacturing concepts in the Bakery and Confectionery industry: Case small bakery company in Joinville, Brazil. Espacios, 36 (1). Available at: http://www.revistaespacios.com/a15v36n01/15360110.html

3. Akesowan, A., Choonhahirun, A. (2013). Quality Assessment of Reduced-calorie Thai Mung Bean Marzipan Made with Erythritol-Sucralose Blend and Soy Milk. Life Science Journal, 10 (2), 2129–2134. Available at: http://www.lifesciencesite.com/lsj/life1002_2134. Available at: http://www.revistaespacios.com/a15v36n01/15360110.html

4. Akesowan, A., Choonhahirun, A. (2017). Quality characteristics and storage stability of reduced-calorie mung bean marzipan incorporating konjac flour and pumpkin. International Food Research Journal, 24 (6), 2474–2481. Available at: http://www.ifrj.ump.edu.my/24%20(06)%202017/(28).pdf

5. Brüning, P., Haase, I., Matisek, R., Fischer, M. (2011). Marzipan: Polymerase Chain Reaction-Driven Methods for Authenticity Control. Journal of Agricultural and Food Chemistry, 59 (22), 11910–11917. doi: https://doi.org/10.1021/jf202484a
6. Sadohara, R. (2019). Quality characteristics of bean paste as a confectionery ingredient and recent breeding efforts of common beans in Japan. Journal of the Science of Food and Agriculture, 100 (1), 10–15. doi: https://doi.org/10.1002/jsfa.10013

7. Inoue, Y., Kato, S., Saito, M., Suzuki, C., Otsubo, Y., Tanaka, Y. et al. (2016). Analysis of the cooked aroma and odorants that contribute to umami aftertaste of soy miso (Japanese soybean paste). Food Chemistry, 213, 521–528. doi: https://doi.org/10.1016/j.foodchem.2016.06.106

8. Talebi, S., Chen, G. Q., Freeman, B., Suarez, F., Freckleton, A., Bathurst, K., Kentish, S. E. (2019). Fouling and in-situ cleaning of ion-exchange membranes during the electrodialysis of fresh acid and sweet whey. Journal of Food Engineering, 246, 192–199. doi: https://doi.org/10.1016/j.jfoodeng.2018.11.010

9. Chen, G. Q., Eschbach, F. I., Weeks, M., Gras, S. L., Kentish, S. E. (2016). Removal of lactic acid from acid whey using electrodialysis. Separation and Purification Technology, 158, 230–237. doi: https://doi.org/10.1016/j.seppur.2015.12.016

10. Ortiz Quezada, A. G., Castilla Asaf, A., Sacks, G. L. (2021). Optimization of conditions for Greek style yogurt whey demineralization and its effects on filterability. International Dairy Journal, 123, 105163. doi: https://doi.org/10.1016/j.idairyj.2021.105163

11. Romanchuk, I., Minorova, A., Krushelnynska, N. (2018). Physical-chemical composition and technological properties of demineralized milk whey received by membrane methods. Agricultural Science and Practice, 5 (3), 33–39. doi: https://doi.org/10.15407/agrbsp.03.033

12. Merkel, A., Voropaeva, D., Ondrušek, M. (2021). The impact of integrated nanofiltration and electrodialytic processes on the chemical composition of sweet and acid whey streams. Journal of Food Engineering, 298, 110500. doi: https://doi.org/10.1016/j.jfoodeng.2021.110500

13. Kravchenko, M., Rybchuk, L. (2019). New types of apparatus confectionery fragrances. Pratsi Tarvisykoho derzhavnoho ahlrotekh- nolohichnogo universytetu, 1 (19), 255–261. Available at: http://nbuv.gov.ua/UJRN/Ptdau_2019_19_1_35

14. Kravchenko, M., Rybchuk, L. (2018). Structural and mechanical properties of sugar paste. Commodities and markets, 3, 77–90. Available at: http://nbuv.gov.ua/UJRN/tovary_2018_3_10

15. Kravchenko, M., Shapoval, S., Rybchuk, L. (2018). Properties of sugar paste surface. Commodities and markets, 4, 124–131. doi: https://doi.org/10.31617/tr.knute.2018(28)12

16. Polevoda, Y. (2020). Research of glycerol-containing surfactants in food and processing industries. Vibrations in engineering and technology, 1 (96), 141–148. doi: https://doi.org/10.37128/2306-8744-2020-1-15

17. Kravchenko, M., Rybchuk, L. (2019). Confectionery mastics with glycerin: rheological characteristics. Commodities and markets, 2, 87–97. Available at: http://trkmite.edu.ua/files/2019/02/30/2019_10.pdf

18. Tomchyk, O. M., Savin, S. M., Kochetov, V. P. (2015). Pat. No. 100447 UA. Sposob zberihannia silskohospodarskykh kharchovykh produktiv abo syrovyny. No. u201501050; declareted: 10.02.2015; published: 27.07.2015, Bul. No. 14. Available at: https: //uapatents.com/5-100447-sposob-zberigannya-silskohospodarskikh-kharchovykh-produktiv-abo-syrovini.html

19. Obolkina, V., Zalevskaya, N., Gureeva, V., Kishko, E. (2011). Izdeliakh Khlibopetsarska i kondyterska promyslovst Ukrainy, 5 (78), 11–12.

20. Horalchuk, A. B., Pyyovarov, P. P., Bryuchenko, O. O., Pohozhykh, M. I., Polevych, V. V., Hrusky, P. V. (2006). Reolohichni metody doslidzhen-nia syrynvy i kharchovykh produktiv ta avtomatyzatsiav rozakhunkiv reolohichnykh kharakterystyk. Kharkiv: KhDUKhT, 63.

DOI: 10.15587/1729-4061.2022.262850

DETERMINING CRITICAL CONTROL POINTS FOR PROCESSING MELON FRUITS (p. 97–104)

Zaira Uikassova
Almaty Technological University, Almaty, Republic of Kazakhstan
ORCID: https://orcid.org/0000-0001-5530-4907

Sanavar Azimova
Almaty Technological University, Almaty, Republic of Kazakhstan
ORCID: https://orcid.org/0000-0002-8992-8889

Dinara Tlevelessova
Almaty Technological University, Almaty, Republic of Kazakhstan
ORCID: https://orcid.org/0000-0002-5804-516X

Ruta Galoburda
Latvia University of Life Sciences and Technologies, Jelgava, Latvia
ORCID: https://orcid.org/0000-0002-5804-516X

To properly ensure the quality of products from melon fruits, it is necessary to develop a production technology with the introduction of the HACCP (Hazard Analysis and Critical Control Points) system. Methods for prolonging the shelf life of freshly cut melon have been considered in this paper. The stages of processing technology and risks were considered; methods for improving the quality of melon processing products have been proposed.

The objects of this study were melon fruits. Melon is a low-calorie fragrant fruit, with juicy pulp and thin skin; it is a seasonal product. Consequently, its shelf life is short. Due to its juiciness, melon perfectly quenches thirst, supports work of the nervous system.

A study has been conducted to determine the level of microbial contamination and establish critical control points associated with melon processing. Samples were collected in the Southern regions of the Republic of Kazakhstan. Selected samples of melons were subjected to microbiological analysis. Microbiological parameters are affected by the temperature and duration of treatment. Thus, it is determined that when processing melon without refrigeration, it is not possible to save the product. A condition for the storage of the product is the preconditioning of melon fruits before processing to refrigeration temperature.

The results were used to assess the relevant critical control points, in relation to raw materials, contamination, process requirements and contact of ingredients with equipment. The observed contaminants common to all specimens and regardless of products were staphylococci aureus, Salmonella spp, Bacillus spp. and Aspergillus fumigatus. The study has found that the monitoring and control of critical control points (CCP) ensures the quality of melon products. The measures taken were effective; based on the studies carried out, a technological scheme for processing melon fruits was developed.

A relevant issue is to ensure the availability of melon products all year round; ensuring the safety of these products is the most important task and the goal of the study. The most important risk
to human health when eating melon and processed products from it is poisoning caused by microorganisms, therefore, the greatest risk is microbiological contamination of fruits during processing. The results can be used in the production of long-term storage products from melon fruits, to better ensure the quality and safety of the finished product and are recommended in canning and juice production.

**Keywords:** control critical points, melon microbiology, processing technology, heat treatment of melon, HACCP.

**References**

1. Uazhanova, R., Mannino, S., Tungyshbaeva, U., Kazhymurat, A. (2018). Evaluation of the effectiveness of internal training of personnel in the HACCP system at the bakery enterprise. Acta Technica, 63 (1), 1–8. Available at: http://journal.tut.az/63(2018)-1B-Paper%20ID-17%20Uazhanova.pdf

2. Chernova, E. V., Bychenkova, V. V. (2018). Obespechenie i kontrol` printsipov NASSR pri proektirovani i funktsionirovani predpriyatiiy. Sankt-Peterburg: Izd-vo Politekhi, un-ta, 196.

3. Anandappa, A. (2013). Evaluating Food Safety Systems Development and Implementation by Quantifying HACCP Training Dura

4. Castillo, A., Mercado, I., Lucia, L. M., Martínez-Ruiz, Y., De León, J. P., Murano, E. A., Acuff, G. R. (2004). Salmonella Contamination during Production of Cantaloupe: A Binational Study Journal of Food Protection, 67 (4), 713–720. doi: https://doi.org/10.4315/JFFP-04-0713

5. Heaton, J. C., Jones, K. (2008). Microbial contamination of fruit and vegetables and the behaviour of enteropathogens in the phyllo-

6. Belozertseva, O., Baibolova, L., Pronina, Y., Cepeda, A., Tlevlessova, D., Akhmedov, A., Poladjan, A., Trchounian, K. (2022). Growth and hydrogen production by Escherichia coli during utilization of sole and mixture of sugar beet, alcohol, and beer production waste. Biomass Conversion and Biofermery. doi: https://doi.org/10.1007/s13399-022-02692-x

7. Ulukay, D. O., Bari, M. L., Kawamoto, S., Isshiki, K. (2005). Use of hydrogen peroxide in combination with nisin, sodium lactate and citric acid for reducing transfer of bacterial pathogens from whole melon surfaces to fresh-cut pieces. International Journal of Food Microbiology, 104 (2), 225–233. doi: https://doi.org/10.1016/j.ijfoodmicro.2005.01.016

8. Ulukay, D. O., Fett, W. F., Sapers, G. M. (2004). Inhibition of listeria monocytogenes by native microflora of whole cantaloupe. Journal of Food Safety, 24 (2), 129–146. doi: https://doi.org/10.1111/j.1117-4565.2004.tb00380.x

9. Ulukay, D. O., Geveke, D. J., Chau, L., Bigley, A., Niemira, B. A. (2017). Appearance and overall acceptability of fresh-cut cantaloupe pieces from whole melon treated with wet steam process. LWT - Food Science and Technology, 82, 235–242. doi: https://doi.org/10.1016/j.lwt.2017.04.033

10. Raybaudimassila, R., Mosquedamelgar, J., Martinbellos, O. (2008). Edible alginate-based coating as carrier of antimicrobials to improve shelf-life and safety of fresh-cut melon. International Journal of Food Microbiology, 121 (3), 313–327. doi: https://doi.org/10.1016/j.ijfoodmicro.2007.11.010

11. Lamikanra, O., Watson, M. (2006). Effect of Calcium Treatment Temperature on Fresh-cut Cantaloupe Melon during Stora

12. Fan, X., Annous, B. A., Beaulieu, J. C., Sites, J. E. (2008). Effect of Hot Water Surface Pasteurization of Whole Fruit on Shelf Life and Quality of Fresh-Cut Cantaloupe. Journal of Food Science, 73 (3), M91–M98. doi: https://doi.org/10.1111/j.1750-3841.2008.00695.x

13. Burt, S. (2004). Essential oils: their antibacterial properties and potential applications in foods – a review. International Journal of Food Microbiology, 94 (3), 223–253. doi: https://doi.org/10.1016/j.ijfoodmicro.2004.03.022

14. Langeveld, W. T., Veldhuizen, E. J. A., Burt, S. A. (2014). Synergy between essential oil components and antibiotics: a review. Critical Reviews in Microbiology, 40 (1), 76–94. doi: https://doi.org/10.3109/1040841x.2013.763219

15. Kim, M., Sowndhararajan, K., Kim, S. (2022). The Chemical Composition and Biological Activities of Essential Oil from Korean Native Thyme Bak-Ri-Hyang (Thymus quinquecostatus Celak.). Molecules, 27 (13), 4251. doi: https://doi.org/10.3390/molecules27134251

16. Belozertseva, O., Baibolova, L., Pronina, Y., Cepeda, A., Tlevlessova, D. (2021). The study and scientific substantiation of critical control points in the life cycle of immunostimulating products such as pastila and marmalade. Eastern-European Journal of Enterprise Technologies, 5 (11 (113)), 20–28. doi: https://doi.org/10.15587/1729-4061.2021.241526

17. Almaty, Republic of Kazakhstan

18. Moon, K. M., Kwon, E.-B., Lee, B., Kim, C. Y. (2020). Recent Trends in Controlling the Enzymatic Browning of Fruit and Vegetable Products. Molecules, 25 (12), 2734. doi: https://doi.org/10.3390/molecules25122754

19. Arias, E., González, J., Oria, R., Lopez-Buesa, P. (2007). Ascorbic Acid and 4-Hexylresorcinol Effects on Pear PPO and PPO Catalyzed Browning Reaction. Journal of Food Science, 72 (8), C422–C429. doi: https://doi.org/10.1111/j.1750-3841.2007.00484.x

**DOI:** 10.15587/1729-4061.2022.263130

**ANALYSIS OF RISKS AND SAFETY INDICATORS OF RAW MATERIALS AND PRODUCTS OF THE SUGAR INDUSTRY OF KAZAKHSTAN (p. 105–112)**

Nurlan Dautkanov

Kazakhstan Research Institute of Processing and Food Industry, Almaty, Republic of Kazakhstan
The objects of research are the process of sugar beet processing, sugar beet, sugar and molasses.

The problem of determining critical control points in sugar beet processing and safety indicators of raw materials and products of the sugar industry was solved.

The results were obtained based on the risk analysis and the system of control points for sugar beet processing, five critical control points were identified according to the criteria of physical, chemical and biological contamination. It was also found that in terms of safety indicators, raw materials – sugar beet, and finished products meet the requirements of regulatory documents for microbiological indicators and heavy metal content.

The safety indicators of sugar beet, white sugar, molasses and beet pulp were studied. Microbiological indicators: CGB (coliforms), pathogens and S.aureus were not found in sugar beet samples. Microbiological indicators of QMAFAnm and yeast of white sugar, molasses and pulp 1–5*10², 6–7*10², 5–8*10² and 2–3*10³, 1–3*10⁴, 1*10⁵ CFU/cm³, respectively, are within acceptable limits. The content of toxic elements did not exceed the permissible limits.

For Republic of Kazakhstan sugar factories, no studies on hazard analysis and critical control points in the sugar industry have been conducted before, so the results of the study will fill this gap.

The scope and conditions for the practical use of the results obtained are the possibilities of raising the quality of finished products and improving the safety of raw materials and finished products, increasing the shelf life of by-products (molasses, beet pulp) of sugar beet production. These opportunities are based on the hazard analysis and critical control points (HACCP) in sugar beet processing.

Keywords: HACCP, sugar industry, safety, beet pulp, molasses, risks, microbiological indicators, toxic elements.

References

1. Bugaenko, I. F. (1994). Analiz poter’ sakhara v sakharnom proizvodstve i puti ikh snizheniya. Kursk: AP «Kursk», 128.
2. Astakhova, N. V., Ermolaeva, E. O., Trofimova, N. B. (2020). Development of a food safety management system based on HACCP principles in the production of chocolate wafers. Food processing industry = Pischevaya promyshlennost’, 5, 39-43. doi: https://doi.org/10.24411/0235-2486-2020-10053
3. Varivoda, A. A., Oveharova, G. P. (2013). Tekhnologiya khraneniya i pererabotki meloka i molochnykh produktov. Saarbryukken: Palmarium Academic Publishing, 256.
4. Tungushbayeva, U., Mannino, S., Uazhanova, R., Adilbekov, M., Yakiiyeva, M., Kachymurat, A. (2021). Development of a methodology for determining the critical limits of the critical control points of the production of bakery products in the Republic of Kazakhstan. Eastern-European Journal of Enterprise Technologies, 3 (11 (111)), 57–69. doi: https://doi.org/10.15587/1729-4061.2021.234969
5. Liu, Y., Sabadash, S., Duan, Z., Deng, C. (2022). The influence of different drying methods on the quality attributes of beetroot. Eastern-European Journal of Enterprise Technologies, 3 (11 (117)), 60–68. doi: https://doi.org/10.15587/1729-4061.2022.258049
6. Sadovnikova, M. A., Makarova, L. V. (2018). Analiz poter’ pri proizvodstve sakhar (na primere OMO «Atmir-sakhur» g. Kamenki). Molodoy ucheniy, 49 (235), 52–53. URL: https://moluch.ru/archive/235/54712/
7. Pusik, L., Pusik, V., Bondarenko, V., Gaevaya, L., Kyruchina, N., Kuts, O. et. al. (2022). Determining carrot preservation depending on the root quality and size, as well as on storage techniques. Eastern-European Journal of Enterprise Technologies, 1 (11 (115)), 26–32. doi: https://doi.org/10.15387/1729-4061.2022.251785
8. Gharib-Bibalan, S., Keramat, J., Hamdami, N., Hojjatoleslamy, M. (2012). Traceability for Food Safety: the case of a sugar factory and alcohol distillery plant. International conference on Industrial Engineering and Operation Management. Guimarães. Available at: https://abeupro.org.br/biblioteca/iciem2012_submission_145.pdf
9. Rohles-Gancedo, S., López-Díaz, T. M., Otero, A. (2009). Microbiological Counts during Beet Sugar Extraction. Journal of Food Protection, 72 (6), 1332–1337. doi: https://doi.org/10.4315/0362-028x-72.6.1332
10. Kuts, O. et. al. (2022). Determining carrot preservation depending on the root quality and size, as well as on storage techniques. Eastern-European Journal of Enterprise Technologies, 3 (11 (117)), 60–68. doi: https://doi.org/10.15587/1729-4061.2022.258049
Abstract and References. Technology and equipment of food production

17. Kupriyanov, A. V. (2013). Razrabotka i vnedrenie sistemy KhASPP na predpriyatiyah pischeyov promyshlennosti. Orenburg, 89.

18. Gharib-Bibalov, S., Keramot, J., Hamsami, N., Hojjatoleslame, M. (2016). Optimization of the oxidation process for the degradation of color precursors in raw sugar beet juice. Sugar Tech, 18 (3), 273–284. doi: https://doi.org/10.1007/s12355-015-0398-6

19. Grigorenko, V. R. (2017). Puti sokhraneniya urozhaya korneplodov sakharnoy svekly i sakharistosti pri ugroze nalichiiya korneykh gnily. Materialy IX Mezhdunarodnogo studencheskogo nauchnogo konferentsii «Studencheskiy nauchnyy forum». Available at: https://scienceforum.ru/2017/article/2017038968

20. Iztaev, A. I., Yakiyeva, M. A., Arynova, R. A. et al. (2020). Innovatsionnye tekhnologii dlitel’nogo khraneniya sakharnoy svekly. Almaty: TOO Izdatel’stvo “Fortuny Poligraf”, 480.

21. Stognienko, O. I. (2014). Izmeneniya v patogennom komplekse kagatnoy gnili, proizoshedshie za 80 let. Priemy i sredstva povysheniya produktivnosti sakharnoy svekly i drugikh kul’tur sevooborota. Voronezh, 92–96.

17. Kupriyanov, A. V. (2013). Razrabotka i vnedrenie sistemy KhASPP na predpriyatiyah pischeyov promyshlennosti. Orenburg, 89.

18. Gharib-Bibalov, S., Keramot, J., Hamsami, N., Hojjatoleslame, M. (2016). Optimization of the oxidation process for the degradation of color precursors in raw sugar beet juice. Sugar Tech, 18 (3), 273–284. doi: https://doi.org/10.1007/s12355-015-0398-6

19. Grigorenko, V. R. (2017). Puti sokhraneniya urozhaya korneplodov sakharnoy svekly i sakharistosti pri ugroze nalichiiya korneykh gnily. Materialy IX Mezhdunarodnogo studencheskoy nauchnogo konferentsii «Studencheskiy nauchnyy forum». Available at: https://scienceforum.ru/2017/article/2017038968

20. Iztaev, A. I., Yakiyeva, M. A., Arynova, R. A. et al. (2020). Innovatsionnye tekhnologii dlitel’nogo khraneniya sakharnoy svekly. Almaty: TOO Izdatel’stvo “Fortuny Poligraf”, 480.
АНОТАЦIЯ

ТЕХНОЛОГІЯ І РОЗРОБКА ТЕХНОЛОГІЙ ОТРИМАННЯ ЗЕРНОВИХ ОСНОВ ТА СПЕЦІАЛЬНИХ ДОБАВОК З МІСЦЕВОЇ ЗЕРНОВОЇ СИРОВИНИ ДЛЯ ВИРОБНИЦТВА ПРОДУКТІВ ПІД ЧАС ВИРОБНИЦТВА КРУПИ ПЛЮЩЕНОЇ ПОЛБ’ЯНОЇ (с. 15–22)

Б. В. Любич, І. І. Мостов’ян, В. Б. Новіков, І. А. Лещенко, В. М. Кір’ян, В. В. Петренко, О. В. Твердохліб

Проведено наукове обґрунтування режимів виробництва крупи плющеної полб’яної з використанням електромагнітного поля надвисокої частоти. Досліджено вплив тривалості опромінення полем надвисокої частоти і водо теплового оброблення на температуру, вихід і тривалість варіння крупи плющеної.

За опромінення полем надвисокої частоти від 20 до 180 с мінімальна температура продукту становить 27–128 °С, а максимальна – 43–159 °С. Оброблення полем надвисокої частоти від 20 до 100 с достовірно не впливає на загальний вихід крупи з пшениці полби. Загальний вихід при цьому становить 94–97 %. За опромінення полем надвисокої частоти від 120 до 180 с загальний вихід крупи достовірно знижується до 83–90 %. Достовірно зменшує тривалість варіння крупи плющеної оброблення полем надвисокої частоти упродовж 100–180 с. Тривалість варіння крупи при цьому становить 14,0–15,8 хв. Слід відзначити, що водотеплове оброблення достовірно зменшує тривалість варіння крупи з плющеної вищого сорту порівняно з варіантом без зволожування.

Особливість технології виробництва плющеної крупи з пшениці полби з використанням електромагнітного поля полягає в тому, що цілу крупу необхідно опромінювати впродовж 80 с без водотеплового оброблення. За такого режиму вихід крупи становить 94–97 %, тривалість варіння крупи – 14,3–15,9 хв. За умови виробництва крупи плющеної вищого сорту необхідно проводити опромінення полем надвисокої частоти упродовж 80 с без водотеплового оброблення. За такого режиму вихід крупи золотистої вищого сорту становить 80 %, а першого – 13 %.

Розроблені рекомендації можуть бути використані зернопереробними підприємствами низької продуктивності за виробництва крупи плющеної.

Ключові слова: електромагнітне поле, крупа, пшениця полба, кулінарна якість, водотеплове оброблення.

DOI: 10.15587/1729-4061.2022.261747
Зернові та зернобобові культури та продукти з них мають велике значення в харчуванні людини, так як є джерелами біль, жиру, вуглеводів, деяких вітамінів, макро- та мікро- елементів. Вони мають рослинні волокна, і навіть ряд біологічно активних речовин, котрі необхідні для нормальної роботи всього організму людини. У той же час, сучасні технології обробки та виробництва продуктів із зерен призводять до значних втрат закладених у них природою поживних речовин, виробляючи рафіновані продукти. Проблемою, яка потребує вирішення, є вивчення впливу на зернові культури різних способів обробки та пропозиція найбільш оптимальних, що дозволяють максимально зберегти корисні речовини зернової сировини, закладені природою.

Проведено порівняльне вивчення таких способів обробки зерна: мікросфіксації, екструдування, тонкосперсного подрібнення. Запропоновано режими обробки, що дають змогу значно зменшити втрати корисних речовин зерна.

Досліджено хімічні та вітамінний склад обробленних продуктів. Встановлено, що тонкосперсне подрібнення та екструдійна обробка є найприйнятнішими, так як дозволили використовувати зерно без відділення оболонок, які містять основні поживні речовини зерна.

Запропоновані режими обробки сприяють отриманню зернових основ та добавок з найбільш оптимальним вітамінно-мінеральним комплексом.

Результати дослідження сприяли кращому розумінню впливу вивчених способів обробки зернових та бобових культур на вітамінно-мінеральний комплекс одержаних продуктів. Режими обробки зерна можуть бути рекомендовані для практичного застосування.

Ключові слова: зернові культури, тонкосперсне подрібнення, екструдування, мікрофіксація, мікро- та макро- елементи.

DOI: 10.15587/1729-4061.2022.264173

ОБ’єКТОМ ДОСЛІДЖЕННЯ Є ЗЕРНОВІ КУЛЬТУРИ ЧИ СЕРНИКИ, ЗАПРОПОНОВАНО РЕЖИМИ ОБРОБКИ, ЩО ДАЮТЬ ЗМОГУ ЗАЙНЯТИ ВІТЯМАНІ ПОЖИВНІ РЕЧОВИНИ ЗЕРНА.

Запропоновані режими обробки сприяють отриманню зернових основ та добавок з найбільш оптимальним вітамінно-мінеральним комплексом.

Результати дослідження сприяли кращому розумінню впливу вивчених способів обробки зернових та бобових культур на вітамінно-мінеральний комплекс одержаних продуктів. Режими обробки зерна можуть бути рекомендовані для практичного застосування.

Ключові слова: зернові культури, тонкосперсне подрібнення, екструдування, мікроловолітат, вітамінний склад, мінеральний комплекс.

DOI: 10.15587/1729-4061.2022.262924

ОБ’ЄКТОМ ДОСЛІДЖЕННЯ Є ФУНКЦІОНАЛЬНА ПАСТОПОДІБНА ПЛОДОВО-ЯГІДНА ПАСТА ОДНОРОДНОГО ПРИЗНАННЯ, ЩО ДАЄ ЗАБЕЗПЕЧИТИ ЗАЙНЯТИ БІЛКОВИ, ЖИРНІ, ВІТАМІННІ ТА МІНЕРАЛЬНІ РЕЧОВИНИ, ЗАКЛАДЕНІ ПРИРОДОЮ, ЩО Дозволяє здійснити біологічно активний ефект.

Результати дослідження сприяли кращому розумінню впливу вивчених способів обробки зернових та бобових культур на вітамінно-мінеральний комплекс одержаних продуктів. Режими обробки зерна можуть бути рекомендовані для практичного застосування.

Ключові слова: антиоксиданти волоського горіха, біологічна активність, лігнін, катехіни, кверцетин, оптимізація екстракції.
має більший на 6 % показник порівняно зі зразком з розміром часток 1,5 мм. Технологія може бути впроваджена на підприємства консервної та кондитерської промисловості.

Ключові слова: паста (яблуко, зізіфус, чорниця), ефективна в’язкість, коефіцієнт тепловіддачі, дисперсність, пектин, вітаміни, фітостероли.

DOI: 10.15587/1729-4061.2022.261574
РОЗРОБКА ПРОБІОТИЧНОГО ЙОГУРТУ З МОЛОКА ДРІБНОЇ РОГАТОЇ ХУДОБИ (c. 53–59)
Assan Osanopov, Shukhrat Velyamov, Raushan Makeeva, Dinara Tlevlessova, Raushan Tastanova

Розглянуто фізико-хімічні показники овечого та козячого молока як сировини для живого йогурту. Було досліджено овече молоко 12 порід (14 зразків на кожну породу), та козяче молоко 4 порід (10 зразків на кожну породу). Відібрано молоко для виробництва йогурту з коров’ячого, овечого, козячого молока та комбінованих сумішей з коров’ячого та овечого молока у різних співвідношеннях. Молоко відбиралися з метою виробництва йогурту із тривалою життєздатністю молочних бактерій, тим самим отримуючи живий йогурт без досягнення синтетичних засобів консервації. Досліджено життєздатність пробіотиків (Bifidobacterium та Lactobacterium) у складі йогуртів з коров’ячого, овечого, козячого молока та сумішей: коров’ячого та овечого у різних співвідношеннях, коров’ячого та козиного в аналогічних співвідношениях. Для споживчої переваги дуже важливими є органолептичні аналізи, за результатами якого відібрано йогурт у співвідношенні 3:1 коров’ячого молока та молока овець, відповідно. Не менш важливим показником є безпека продукту, тому мікробіологічні та біохімічні аналізи проводили на 1 добу та при зберіганні (28 день при 4 °С). Виробництво йогурту з використанням овечого молока – цікавий підхід через покращення харчової цінності порівняно з коров’ячим та козячим молоком. Також було виявлено йогурт з найкращими показниками: життєздатність бактерій, овече, комбіноване та козяче молоко, харчова цінність, термін зберігання.

Ключові слова: життєздатність бактерій, овече, комбіноване та козяче молоко, харчова цінність, термін зберігання.

DOI: 10.15587/1729-4061.2022.263530
ВИЗНАЧЕННЯ ОПТИМАЛЬНИХ ТЕХНОЛОГІЧНИХ ПАРАМЕТРІВ ОТРИМАННЯ ЕКСТРАКТУ СТЕВІЇ В ТЕХНОЛОГІЇ КИСЛОМОЛОЧНИХ ДЕСЕРТІВ (c. 60–67)
Т. О. Белемець, У. Г. Кузьмик, Р. В. Грищенко, Т. Г. Осьмак

З метою виявлення оптимальних технологічних параметрів отримання солодкого екстракту стевії досліджено залежність виходу екстрактивних речовин від температури та тривалості процесу екстрагування. Розроблено математичну модель, що дає можливість визначити та прогнозувати процес екстрагування за різних технологічних параметрів з метою ефективного вилучення екстрактивних речовин.

Аргументовано доцільність використання сироватки з-під виробництва сиру кисломолочного у якості екстрагенту для отримання екстракту стевії. Експериментально встановлено та математичним шляхом підтверджено, що застосування молочної сироватки до збільшити вихід екстрактивних речовин на 12,1 %, в порівнянні з використанням водного розчину.

Удосконалення технологій отримання солодкого екстракту стевії дозволить суттєво розширити лінійку «здорових продуктів харчування» за рахунок часткової або повної заміни цукру. Виробництво такої дієтичної продукції матиме соціальний ефект та економічну привабливість для підприємств харчової галузі.

Ключові слова: кисломолочний продукт, екстракт стевії, солодкий екстракт, роторно-імпульсний апарат, екстрактивні речовини.

DOI: 10.15587/1729-4061.2022.263111
ВИЯВЛЕННЯ ЗАКОНОМІРНОСТЕЙ ВПЛИВУ ТЕХНОЛОГІЧНИХ ФАКТОРІВ НА ЗРОСТАННЯ ТА РОЗВИТОК МОЛОЧНОКИСЛИХ МІКРООРГАНІЗМІВ У ПАСТИЛОМАРМЕЛАДНИХ ВИРОБАХ, ЗБАГАЧЕНИХ МОЛОЧНОКИСЛИМИ ЗАКВАСКАМИ (с. 68–78)
Yuliya Pronina, Zhanar Nabiyeva, Olga Belozertseva, Saule Shukesheva, Abdysemat Samodun

З метою визначення оптимальних технологічних параметрів отримання солодного екстракту стевії досліджено залежність виходу екстрактивних речовин від температури та тривалості процесу екстрагування. Зроблено математичну модель, що дає можливість визначати та прогнозувати процес екстрагування за різних технологічних параметрів з метою ефективного вилучення екстрактивних речовин.

Аргументовано доцільність використання сироватки з-під виробництва сиру кисломолочного у якості екстрагенту для отримання екстракту стевії. Експериментально встановлено та математичним шляхом підтверджено, що застосування молочної сироватки дозволяє збільшити вихід екстрактивних речовин на 12,1 %, на противагу використанню водного розчину.

З метою інтенсифікації процесу екстрагування запропоновано застосувати роторно-імпульсний апарат. Встановлено, що застосування роторно-імпульсного апарату дозволяє збільшити вихід екстрактивних речовин на 0,1–0,4 % в порівнянні з мацерацією.

Удосконалення технологій отримання солодкого екстракту стевії дозволить суттєво розширити лінійку «здорових продуктів харчування» за рахунок часткової або повної заміни цукру. Виробництво такої дієтичної продукції матиме соціальний ефект та економічну привабливість для підприємств харчової галузі.

Ключові слова: кисломолочний продукт, екстракт стевії, солодкий екстракт, роторно-імпульсний апарат, екстрактивні речовини.
макро- та мікроморфологію пробіотичної культури, яка підтвердила належність мікроорганізмів до молочнокислих. Отримані до-
слідження було наукою обґрунтовано методом математичного моделювання. На підставі рівняння регресії виявлено, що на ріст молочнокислих мікроорганізмів у продукті впливає кількість молочної сироватки (250 мл), кількість (0,02 г) та час пожвавлення за-
кваски (6 год). Найбільш значимим чинником стала кількість внесення закваски молочнокислих мікроорганізмів від 0,01 до 0,02 г, яка впливає на зростання молочнокислих мікроорганізмів (збільшує) у продукті. Вивчені антимікробну активність виділених культур по відношенню до E. coli. Зони просвічених колоній відношення до E. coli становлять від 0,1 мм до 0,5 мм.
Дані результати показують антагоністичні властивості, що впливають на хвороботворні та умовно-патогенні мікроорганізми
шлунково-кишкового тракту.

Експериментальне обстежування фракційного складу та дисперсності цукрових паст узгоджується з дослідженнями сен-
сорних характеристик консистенції згідно розроблених дескрипторів дозволили встановити, що контрольний зміна масової частки вологи цукрових паст протягом 30 діб встановлено зниження даного показника в контрольному зразку на 80 %, в дослідному на 30 %.

Дослідження сенсорних характеристик консистенції згідно розроблених дескрипторів дозволили встановити, що контрольний зміна масової частки вологи цукрових паст протягом 30 діб встановлено зниження даного показника в контрольному зразку на 80 %, в дослідному на 30 %.
Дослідження сенсорних характеристик консистенції згідно розроблених дескрипторів дозволили встановити, що контрольний зміна масової частки вологи цукрових паст протягом 30 діб встановлено зниження даного показника в контрольному зразку на 80 %, в дослідному на 30 %.
Дослідження сенсорних характеристик консистенції згідно розроблених дескрипторів дозволили встановити, що контрольний зміна масової частки вологи цукрових паст протягом 30 діб встановлено зниження даного показника в контрольному зразку на 80 %, в дослідному на 30 %.
Дослідження сенсорних характеристик консистенції згідно розроблених дескрипторів дозволили встановити, що контрольний зміна масової частки вологи цукрових паст протягом 30 діб встановлено зниження даного показника в контрольному зразку на 80 %, в дослідному на 30 %.
Дослідження сенсорних характеристик консистенції згідно розроблених дескрипторів дозволили встановити, що контрольний зміна масової частки вологи цукрових паст протягом 30 діб встановлено зниження даного показника в контрольному зразку на 80 %, в дослідному на 30 %.
Дослідження сенсорних характеристик консистенції згідно розроблених дескрипторів дозволили встановити, що контрольний зміна масової частки вологи цукрових паст протягом 30 діб встановлено зниження даного показника в контрольному зразку на 80 %, в дослідному на 30 %.
Дослідження сенсорних характеристик консистенції згідно розроблених дескрипторів дозволили встановити, що контрольний зміна масової частки вологи цукрових паст протягом 30 діб встановлено зниження даного показника в контрольному зразку на 80 %, в дослідному на 30 %.
Дослідження сенсорних характеристик консистенції згідно розроблених дескрипторів дозволили встановити, що контрольний зміна масової частки вологи цукрових паст протягом 30 діб встановлено зниження даного показника в контрольному зразку на 80 %, в дослідному на 30 %.
Дослідження сенсорних характеристик консистенції згідно розроблених дескрипторів дозволили встановити, що контрольний зміна масової частки вологи цукрових паст протягом 30 діб встановлено зниження даного показника в контрольному зразку на 80 %, в дослідному на 30 %.
Дослідження сенсорних характеристик консистенції згідно розроблених дескрипторів дозволили встановити, що контрольний зміна масової частки вологи цукрових паст протягом 30 діб встановлено зниження даного показника в контрольному зразку на 80 %, в дослідному на 30 %.
Дослідження сенсорних характеристик консистенції згідно розроблених дескрипторів дозволили встановити, що контрольний зміна масової частки вологи цукрових паст протягом 30 діб встановлено зниження даного показника в контрольному зразку на 80 %, в дослідному на 30 %.
Отже, внесення в рецептурний склад цукрових пасти сироватки демінералізованої у концентрації 50 % та гліцерину у концентрації 5 % дозволяє продовжити термін їх технологічної придатності. Це є важливим з практичної точки зору та вирішує поставлену задачу.

Ключові слова: цукрові пасти, сироватка демінералізованая, гліцерин, технологічна придатність, консистенція, розмір частинок.

DOI: 10.15587/1729-4061.2022.262850

ВИЗНАЧЕННЯ КОНТРОЛЬНИХ КРИТИЧНИХ ТОЧОК ПРИ ПЕРЕРОБЦІ ПЛОДІВ ДІНИ (с. 97‒104)

Zaira Uikassova, Sanavar Azimova, Dinara Tlevlessova, Ruta Galoburda

Для належного забезпечення якості продуктів із плодів дині необхідно розробити технологію виробництва із впровадженням системи HACCP (Hazard Analysis and Critical Control Points). Розглянуті методи продовження термінів зберігання свіжозрізаної дині. Розглянуто етапи технології переробки та ризики, запропоновано методи підвищення якості продуктів переробкою дині.

Розглянуто етапи технології переробки та ризики, запропоновано методи підвищення якості продуктів переробкою дині.

Об’єктами дослідження були плоди дині. Диня – низькокалорійний ароматний фрукт, із соковитою м’якоттю та тонкою шкіркою, є сезонним продуктом. Отже, термін зберігання у неї нетривалий. За рахунок своєї соковитості, диня чудово вгамовує спрагу, підтримує роботу нервової системи.

Було проведено дослідження для визначення рівня мікробного забруднення та встановлення критичних контрольних точок, пов’язаних із переробкою дині. Зразки були зібрані у Південних регіонах Республіки Казахстан. Відібрані зразки динь зазнали мікробіологічного аналізу. На мікробіологічні показники впливають температура та тривалість обробки. Так, визначено, що при переробці дині без охолодження немає можливості зберегти продукт. Умовою зберігання продукту є попереднє охолодження плодів дині перед переробкою до холодильної температури.

Результати були використані для оцінювання відповідних критичних контрольних точок за критеріями: фізичне, хімічне та біологічне забруднення. Також встановлено, що за показниками безпеки сировина – цукровий буряк, та готова продукція відповідають вимогам нормативних документів за показниками – мікробіологічними та вмістом важких металів.

Аналізовані показники безпеки цукрових буряків, цукру-піску, меляси та бурякового жому. Мікробіологічні показники: БГКП (коліформи), патогені та S.aureus у різних зразках цукрових буряків не виявлені. Мікробіологічні показники КМАФАнМ та дріжджі цукру-піску, меляси та жому 1–5*10^2, 6–7*10^2, 5–8*10^2 і 2–3*10^1, 1–3*10^1, 1*10^1 КУО/см^3 відповідно, знаходяться в допустимих межах. Вміст токсичних елементів не перевищував допустимих норм.

Для цукрових заводів Казахстану раніше не проводилися дослідження з визначення аналізу ризиків та контрольних критичних точок в цукровій галузі, отримані результати досліджень заповнять цей недолік.

Областю та умовами практичного використання отриманих результатів є можливість підвищення якості готової продукції та поліпшення показників безпеки продукції, збільшення термінів зберігання побічних продуктів (меляса, буряковий жом) бурякоцукрового виробництва. Досягнення зазначених можливостей ґрунтується на аналізі ризиків та контрольних критичних точок (HACCP) при переробці цукрових буряків.

Ключові слова: HACCP, цукрова промисловість, безпека, буряковий жом, меляса, ризики, мікробіологічні показники, токсичні елементи.

DOI: 10.15587/1729-4061.2022.263130

АНАЛІЗ РИЗИКІВ І ПОКАЗНИКІВ БЕЗПЕКИ СИРОВИНИ ТА ПРОДУКЦІЇ ЦУКРОВОЇ ПРОМИСЛОВОСТІ КАЗАХСТАНУ (с. 105‒112)

Nurlan Dautkanov, Dina Dautkanova, Saltanat Mussayeva

Об’єктами дослідження є процес переробки цукрових буряків, цукрові буряки, цукор, меляса. Вирішено задачу визначення контрольних критичних точок при переробці цукрових буряків і показників безпеки сировини та продукції цукрової промисловості.

Результати отримані на підставі аналізу ризиків та системи контрольних точок при переробці цукрових буряків і показників безпеки сировини та продукції цукрової промисловості.

Аналізовано показники безпеки цукрових буряків, цукру-піску, меляси та бурякового жому. Мікробіологічні показники: БГКП (коліформи), патогені та S.aureus у різних зразках цукрових буряків не виявлені. Мікробіологічні показники КМАФАнМ та дріжджі цукру-піску, меляси та жому 1–5*10^2, 6–7*10^2, 5–8*10^2 і 2–3*10^1, 1–3*10^1, 1*10^1 КУО/см^3 відповідно, знаходяться в допустимих межах. Вміст токсичних елементів не перевищував допустимих норм.

Для цукрових заводів Казахстану раніше не проводилися дослідження з визначення аналізу ризиків та контрольних критичних точок в цукровій галузі, отримані результати досліджень заповнять цей недолік.

Областью та умовами практичного використання отриманих результатів є можливість підвищення якості готової продукції та поліпшення показників безпеки продукції, збільшення термінів зберігання побічних продуктів (меляса, буряковий жом) бурякоцукрового виробництва. Досягнення зазначених можливостей ґрунтується на аналізі ризиків та контрольних критичних точок (ХАССП) при переробці цукрових буряків.

Ключові слова: ХАССП, цукрова промисловість, безпека, буряковий жом, меляса, ризики, мікробіологічні показники, токсичні елементи.

DOI: 10.15587/1729-4061.2022.263130