RESEARCH OF SEDIMENTATION STABILITY OF LIPID-MAGNETITE SUSPENSIONS BY THE METHOD OF SPECTROPHOTOMETRY (p. 4-11)

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A spectrophotometric method of the assessment of stability and determining of the morphological characteristics of lipid-magnetite suspensions (LMS) was studied. The sizes of the particles of magnetite with a surface-active substance (SAS) were defined. The diameter of the particles is 78 nm. The concentration of the particles of magnetite stabilized by a surface-active substance was determined – the concentration (number in 1 cm³) equals N=1.33·10¹⁵ cm⁻³ when obtaining a suspension. A slight decrease in the number of particles of magnetite with SAS in 1 cm³ of suspension was observed over time: during 48 hours, the concentration in 1 cm³ decreased from 1.33·10¹⁵ down to 1.13·10¹⁵ cm⁻³. The concentration decreases by approximately 2.25 % per 1 hour. Different LMS were obtained. The optimum ratios of the components were selected in the suspensions: magnetite, stabilizer and dispersion medium.

It was established that LMS can be used as biological–active additives, which possess comprehensive action: lipid-magnetite suspensions (LMS) on the basis of magnetite during oral introduction into human organism render beneficial biological effect with the period of action within the range of 3–4 hours: when entering LMS into human organism, the iron concentration in blood rises, which brings about:

– a short-term decrease in intracranial CSF pressure;
– activation of gastric and duodenum performance;
– increase in urination.

Due to bivalent iron and its ability to form transition complexes with oxygen and peroxide radicals (and hydro peroxides), magnetite also manifests antioxidant activity, which makes it possible to recommend it as an antioxidant, which facilitates improvement of the quality and prolongation of the period of storage of fat-containing products. Furthermore, LMS contain magnetite (which means digestible Fe²⁺); therefore they can be recommended as anti-anemic agent due to easily digestible bivalent iron. Thus, introduction of LMS into food products increases their quality, nutritional and biological value.

Therefore the studies of LMS are actual and they represent significant theoretical and practical interest.

Keywords: magnetite, suspension, method, SAS, sedimentation, stability, spectrophotometry, particle size, stabilization.

References

1. Chapa Gonzalez, C., Martinez Perez, C. A., Martinez Martinez, A., Olivas Armendáriz, I., Zavala Tapia, O., Martel-Estrada, A., Garcia-Casilas, P. E. (2014). Development of Antibody-Coated Magnetic Nanoparticles for Biomarker Immobilization. Journal of Nanomaterials. 2014, 1–7. doi: 10.1155/2014/978284
2. Unterweger, H., Tietze, R., Janko, C., Zaloga, J., Lyer, S., Taccardi, N. et. al. (2014). Development and characterization of magnetic iron oxide nanoparticles with a cisplatin-bearing polymer coating for targeted drug delivery. International Journal of Nanomedicine, 1, 3659–3676. doi: 10.2147/ijn.s36433
3. Cárdenas, W. H. Z., Mamani, J. B., Sibov, T., Caous, C. A., Amaro Jr., E., & Gamarra, L. F. (2012). Particokinetics: computational analysis of the superparamagnetic iron oxide nanoparticles deposition process. International Journal of Nanomedicine, 2099–2712. doi: 10.2147/ijn.s30074
4. Cihanovskaja, I. V., Onoprienko, T. A., Kovalenko, V. A., Onoprienko, V. I. (2009). O perspektivah ispol’zovaniya magnetita v kachestve biologicheski aktivnykh doobavok. Himija i tehnologija zhirov. Perspektivy razvitija maslo-zhirovoj otrasi. Kharkiv, NII masel i zhirov, 33–34.
5. Iluha, N. G., Barsova, Z. V., Kovalenko, V. A., Cihanovskaja, I. V. (2010). Tehnologija proizvodstva i pokazateli kachestva pishchevoj doobavki na osnovie magnetita. Eastern-European Journal of Enterprise Technologies, 6 (10 (48)), 32–35. Available at: http://journals.uran.ua/eejet/article/view/5847/5271
6. Denysova, A. Ju., Cyhanovskaja, Y. V., Skorodumova, O. B., Gonchar, Ja. M., Pryjmak, G. O., Shevechenko, I. V. (2013). Doslidzhennya vplyvu zhiro-magnetytovoi’ suspensyi’ na termin zберiгання tvarynych zhyriv. Part I. Progresyvna tehnika ta tehnologi’ hарчових виробів, restorannogo ta goot’el’nogo gospodarstv i torgivli. Ekonomichna strategiya i perspektyvy rozv’ytku sfery torgivli ta poslug. Kharkiv, 71–72.
7. Cho, J., Koo, S. (2015). Characterization of particle aggregation in a colloidal suspension of magnetite particles. Journal of Industrial and Engineering Chemistry, 27, 218–222. doi: 10.1016/j.jiec.2014.12.038
8. Lou, W., Charalambopoulos, T. T. (1994). On the Electromagnetic Scattering and Ab-sorption of Agglomerated Small Spherical Particles. Journal of Physics D: Applied Physics, 27 (11), 2258–2270. doi: 10.1088/0022-377X/27/11/004
9. Xu, R. (2001). Particle Characterization: Light Scattering Methods. N.Y.: Kluwer Academic Publishers, 410.
10. Di Stasio, S. (2000). Feasibility of an optical experimental method for the sizing of primary spheres in sub-micron agglomerates by polarized light scattering. Applied Physics B: Lasers and Optics, 70 (4), 635–643. doi: 10.1007/s0034000508572
11. Mulholland, G. W., Donnelly, M. K., Hagwood, C. R., Kuckuck, S. R., Hackley, V. A., Pui, D. Y. H. (2006). Measurement of 100 nm and 60 nm Particle Standards by Differential Mobility Analysis. Journal of Research of the National Institute of Standards and Technology, 111 (4), 257–312. doi: 10.6028/jres.111.022
12. Ivanov, L. A., Kizevettet, D. V., Kiselev, N. N. et. al. (2006). Izmenenie svetovozvrazhshenia ot steklannyh mikrosharikov i progon kachestva sveto-vozvrazhajushhix pokrytij. Opt. zhurn., 73 (1), 35–40.
13. Kizevettet, D. V., Maljugin, V. I. (2009). Odnovremennoe izmenenie razmerov i skorosti dvizhenija chastic. Zhurn. tehn. fiziki, 79(2), 90–95.
14. Ershov, A. E., Isaev, I. L., Semina, P. N., Markel, V. A., Karpov, S. V. (2012). Effects of size polydispersity on the extinction spectra of colloidal nanoparticle aggregates. Physical Review B, 85 (4), doi: 10.1103/physrevb.85.043421
15. Karpov, S. V., Isaev, I. L., Gavrilyuk, A. P. (2009). Opticheskie spektry kolloidov sereba s pozicii fiziki fraktalov. Kolloid. zhurn., 71 (5), 314.
16. van de Hjulst, G. (1961). Rassejanie sveta malymi chasticami. Moscov. IL, 536.
17. Kerker, M. (1969). The scattering of light and other electromagnetic radiation. N.Y., London, Academic Press, 666.
18. Xu, R. (2001). Particle Characterization: Light Scattering Methods. N.Y.: Kluwer Academic Publishers, 410.
19. Di Stasio, S. (2000). Feasibility of an optical experimental method for the sizing of primary spheres in sub-micron agglomerates by polarized light scattering. Applied Physics B: Lasers and Optics, 70 (4), 635–643. doi: 10.1007/s0034000508572
20. Kizevettet, D. V., Maljugin, V. I. (2009). Odnovremennoe izmenenie razmerov i skorosti dvizhenija chastic. Zhurn. tehn. fiziki, 79(2), 90–95.
DEVELOPING A MODEL OF THE FOAM EMULSION SYSTEM AND CONFIRMING THE ROLE OF THE YIELD STRESS SHEAR OF INTERFACIAL ADSORPTION LAYERS TO PROVIDE ITS FORMATION AND STABILITY (p. 11-19)

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The model of the formation of the foam emulsion by the emulsion whipping was developed. It was experimentally proved that the yield stress shear of interfacial adsorption layers can be used as a criterion for evaluating the stability of foams, emulsions and foam-emulsion systems. It was found that the introduction of DATEM to the reconstituted skimmed milk increases the yield stress shear of interfacial adsorption layers and stability of foams and emulsions. The introduction of lecithin’s or DATEM reduces the yield stress shear of interfacial adsorption layers and stability of foams and emulsions accordingly. Simultaneous use of milk proteins, LACTEM, lecithin’s and DATEM provides 1.3 times higher yield stress shear of interfacial adsorption layers at the water-air interface than at the water-oil interface, which is a thermodynamic condition for the formation of the foam emulsion by the emulsion whipping. It was proved that homogenization of the emulsion based on cocoa butter, milk proteins and surfactants provides destabilization of the emulsion and creates conditions for the flotation of destabilized fat particles.

The results allow justifying the parameters of the technology of the whipped semi-finished product based on cocoa butter, which is the emulsion whipping of which provides the foaming capacity of 450±22 %, the mechanical strength of the foam emulsion of 3200±160 Pa. It was confirmed that the whipping process can be divided into three stages: foaming, emulsion destabilization and adhesion of fat particles to air bubbles, providing high mechanical strength of the foam emulsion.

Keywords: interfacial adsorption layer, yield stress shear, whipped emulsion, foaming capacity.

References

1. Carr, N. O., Hogg, W. F. (2005). A manufacturer’s perspective on selected palm-based products. Asia Pac J Clin Nutr. 14 (4), 381–386.
2. Allen, K. E., Murray, B. S., Dickinson, E. (2008). Development of a model whipped cream: Effects of emulsion droplet liquid/solid character and added hydrocolloid. Food Hydrocolloids, 22 (4), 690–699. doi: 10.1016/j.foodhyd.2007.01.017
3. Hotrum, E. N., Cohen Stuart, M. A., van Vliet, T., van Aken, G. A. (2004). Spreading of partially crystallized oil droplets on an air/water interface. Colloids and Surfaces A: Physicochemical and Engineering Aspects, 240 (1-3), 83–92. doi: 10.1016/s0927-7757(04)00172-4
4. Brun, M., Delamere, M., Harte, E., Lecomte, S., Leal-Calderon, F. (2015). Stabilization of air bubbles in oil by surfactant crystals: A route to produce air-in-oil foams and air-in-oil-in-water emulsions. Food Research International, 67, 366–375. doi: 10.1016/j.foodres.2014.11.044
5. Fainerman, V. B., Aksenenko, E. V., Lyubk, S. V., Lotfi, M., Miller, R. (2015). Adsorption of Proteins at the Solution/Air Interface Influenced by Added Nonionic Surfactants at Very Low Concentrations for Both Components. 3. Dilatational Surface Rheology. J. Phys. Chem. B, 119 (9), 3768–3775. doi: 10.1021/jacs.5b05036
6. Burke, J., Cox, A., Petkov, J., Murray, B. S. (2014). Interfacial rheology and stability of air bubbles stabilized by mixtures of hydrophobin and β-casein. Food Hydrocolloids, 34, 119–127. doi: 10.1016/j.foodhyd.2012.11.026
7. López-Castejón, M. L., de la Fuente, J., Ruiz, M., Guerrero, A. (2012). Influence of the presence of monoglyceride on the interfacial properties of soy protein isolate. Journal of the Science of Food and Agriculture, 92 (15), 2618–2623. doi: 10.1002/jsfa.5674
8. Fredrick, E., Heyman, B., Moens, K., Fischer, S., Verwijlen, T., Moldenaers, P. et al. (2013). Monoacylglycerols in dairy recombined cream: II. The effect on partial coalescence and whipping properties. Food Research International, 51 (2), 936–945. doi: 10.1016/j.foodres.2013.02.006
9. Phan, T. T. Q., Asaduzzaman, M., Le, T. T., Fredrick, E., Van der Meeren, P., Dewettinck, K. (2013). Composition and emulsifying properties of a milk fat globule membrane enriched material. International Dairy Journal, 29 (2), 99–106. doi: 10.1016/j.idj.2012.10.014
10. Kotlyar, O., Gorachuk, A., Grinchenko, O. (2014). The Study of Surface-Active Agents’ Impact on the Strength of Interfacial Adsorption Layers: The Advanced Science Journal, 2014 (10), 37–42. doi: 10.15550/asj.2014.10.037
11. Esner, M. D., Jeehani, S. A. K., Bernhard, L., Windhab, E. J. (2007). Stability of foams containing proteins, fat particles and nonionic surfactants. Chemical Engineering Science, 62 (7), 1974–1987. doi: 10.1016/j.ces.2006.12.036
12. Petkov, J. T., Gurkov, T. D., Campbell, B. E. (2001). Measurement of the Yield Stress of Gel-like Protein Layers on Liquid Surfaces by Means of an Attached Particle. Langmuir, 17 (15), 4556–4563. doi: 10.1021/la001347i
13. Karbaschi, M., Lotfi, M., Kr gel, J., Javadi, A., Bastani, D., Miller, R. (2014). Rheology of interfacial layers. Current Opinion in Colloid & Interface Science, 19 (6), 514–519. doi: 10.1016/j.cocis.2014.08.003
14. Langevin, D. (2000). Influence of interfacial rheology on foam and emulsion properties. Advances in Colloid and Interface Science, 88 (1-2), 299–222. doi: 10.1016/s0001-8686(00)00457-5
15. Langevin, D., Marquez-Beltran, C., Delacote, J. (2011). Surface force measurements on freely suspended liquid films. Advances in Colloid and Interface Science, 168 (1-2), 124–134. doi: 10.1016/j.ccis.2011.03.007
16. Santini, E., Ravera, F., Ferrari, M., Stubenrauch, C., Makievsky, A., Kriigel, J. (2007). A surface rheological study of non-ionic surfactants at the water–air interface and the stability of the corresponding thin foam films. Colloids and Surfaces A: Physicochemical and Engineering Aspects, 298 (1-2), 12–21. doi: 10.1016/j.colsurfa.2006.12.004
17. Lexis, M., Willenbacher, N. (2014). Yield stress and elasticity of aqueous foams from protein and surfactant solutions – The role of continuous phase viscosity and interfacial properties. Colloids and Surfaces A: Physicochemical and Engineering Aspects, 459, 177–185. doi: 10.1016/j.colsurfa.2014.06.030
18. Maldonado-Vallerrama, J., Martin-Rodriguez, A., Galvez-Ruiz, M. J., Miller, R., Langevin, D., Cabrerizo-Vilchez, M. A. (2008). Foams and emulsions of β-casein examined by interfacial rheology. Colloids and Surfaces A: Physicochemical and Engineering Aspects, 323 (1-3), 116–122. doi: 10.1016/j.colsurfa.2007.11.003
19. Aksenenko, E. V., Kovalchuk, V. I., Fainerman, V. B., Miller, R. (2006). Surface dilational rheology of mixed adsorption layers at liq-
uid interfaces. Advances in Colloid and Interface Science, 122 (1-3), 57–66. doi: 10.1016/j.cis.2006.06.012
20. Derkach, S. R., Kräigel, J., Miller, R. (2009). Methods of measuring rheological properties of interfacial layers (Experimental methods of 2D rheology). Colloid Journal, 71 (1), 1–17. doi: 10.1134/s1061933009010013
21. Pellepén, J., Kristl, J., Rošič, R., Baumgartner, S., Kocbek, P. (2012). Interfacial rheology: An overview of measuring techniques and its role in dispersions and electropinning. Acta Pharmaceutica, 62 (2), 123–140. doi: 10.2478/v10007-012-0018-x
22. Danov, K. D., Kalchevsky, P. A., Radulova, G. M., Basheva, E. S., Stoyanov, S. D., Pelen, E. G. (2015). Shear rheology of mixed protein adsorption layers vs their structure studied by surface force measurements. Advances in Colloid and Interface Science, 222, 148–161. doi: 10.1016/j.cis.2014.04.009
23. Martin, A., Bos, M., Cohen Stuart, M., van Vliet, T. (2002). Stress-Strain Curves of Adsorbed Protein Layers at the Air/Water Interface Measured with Surface Shear Rheology. Langmuir, 18 (4), 1238–1243. doi: 10.1021/la011176x
24. Izmajlova, V. N., Jampol’skaja, G. P., Summ, B. D. (1988). Poverhnostnye javlenija v belkovyh sistemah. Moscow: Hi-mija, 240. Available at: https://books.google.com.ua/books?id=rPOWtwAACAJ
25. Denkov, N. D., Marinova, K. G., Tcholakova, S. S. (2014). Mechanistic understanding of the modes of action of foam control agents. Advances in Colloid and Interface Science, 206, 57–67. doi: 10.1016/j.cis.2013.08.004
26. Osmelchenko, S., Horalchuk, A., Hryshchenko, O. (2014). Argumentation of Emulsifier Part in the Recipe of Foam and Emulsion Dairy Products Containing Vegetable Fats. The Advanced Science Journal, 2014 (7), 28–32. doi: 10.15530/asj.2014.07.028

OPTIMIZATION OF FORMULATION OF THE LOW–CALORIE EMULSION FAT SYSTEMS

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Among the promising food products of oil-and-fat industry, special place is held by emulsion fat products, in which vegetable oil is in the dispersed state that increases its assimilation. High taste and nutritional properties, due to the specific character of their structure, are inherent in emulsion fat systems. Therefore, water-fat emulsions are the promising systems, on the basis of which it is possible to create mayonnaises, sauces, dressings, oil pastes, spreads and other food products, including low fat ones, with the balanced composition and health-improving properties.

The work substantiated the optimum content of the concentrate of Jerusalem artichoke “Noteo” and the stabilizing system “Hamulsion QNA” – 10.06 and 0.42 % respectively, as the components of low calorie emulsion fat basis for the production of low fat oil-and-fat products.

It is shown that a low calorie emulsion fat system, produced with the use of raw components in the optimal ratio, possesses standardized physical-chemical and microbiological indicators, high organoleptic characteristics and can be used as the raw material for the production of low calorie mayonnaises, sauces and dressings for healthy nutrition.

The recommendations are provided regarding the design of the technologies of the two groups of low calorie mayonnaises, sauces, dressings, enriched with food fibers and prebiotics (or the complexes of synbiotics), on the basis of the developed emulsion fat systems.

Keywords: low calorie emulsion system, Jerusalem artichoke, viscosity, organoleptic indicators, optimization, the response surface.

References
1. Smoljar, V. I. (2012). Stan faktychnogho kharchuvannia naselennia nezalezhnoi Ukrainy. Problemy kharchuvannia, 1-2, 5–9.
2. Betoret, E., Betoret, N., Vidal, D., Fito, P. (2011). Functional foods development: Trends and technologies. Trends in Food Science & Technology, 22 (9), 498–508. doi: 10.1016/j.tifs.2011.05.004
3. Fahimtdanesh, M., Mohammadi, N., Ahari, H., Khosravi, M. A., Zanjani, F. Zh. et al. (2012). Effect of microencapsulation plus resistant starch on survival of Lactobacillus casei and Bifidobacterium bifidum in mayonnaise sauce. African Journal of Microbiology Research. 6 (40). 6683–6688. doi: 10.5897/ajmr12.1240
4. Mantar, M. R., Tkachenko, N. A., Lovozska, G. M., Makovska, T. V. (2016) Marketnyhovyi doslidzhennya pry pozicionuvanni ta vyvedenni na rynek nyzykokaloriynoho majonenu, zhagache- nogho kompleksom synbiotykiv. Kharchova nauka i tekhnikhija, 1 (26), 3–10.
5. Ghazaei, S., Mizani, M., Piravi-Vanak, Z., Alimi, M. (2015). Particle size and cholesterol content of a mayonnaise formulated by OSA-modified potato starch. Food Science and Technology (Campinas), 35 (1), 150–156. doi: 10.1590/1678-457x.6555
6. Kuo, S.-M., Merhige, P. M., Hagey, L. R. (2013). The Effect of Dietary Prebiotics and Probiotics on Body Weight, Large Intestine Indices, and Fecal Bile Acid Profile in Wild Type and IL10−/− Mice. PLoS ONE, 8 (3), e60270. doi: 10.1371/journal.pone.0060270
7. Harris, W. S., Miller, M., Tighe, A. P., Davidson, M. H., Schaefer, E. J. (2008). Omega-3 fatty acids and coronary heart disease risk: Clinical and mechanistic perspectives. Atherosclerosis, 197 (1), 12–24. doi: 10.1016/j.atherosclerosis.2007.11.008
8. Tkachenko, N. A., Sevastjanova, O. V., Makovska, T. V. (2016) Zhyrozaminnyky vughlevodnoji ta bilkovoji pryrody v nyzjkokalori- nykh majonezakh. Prodovoljcha industrija APK, 1-2, 18–22.
9. Mitchell, C. M., Davy, B. M., Halliday, T. M., Hulver, M. W., Neul- son, A. P., Ponder, M. A., Davy, K. P. (2015). The effect of prebiotic supplementation with inulin on cardiometabolic health: Rationale, design, and methods of a controlled feeding efficacy trial in adults at risk of type 2 diabetes. Contemporary Clinical Trials, 45, 328–337. doi: 10.1016/j.cct.2015.10.012
10. Azizi, A., Homayouni, A., Payahoo, L. (2012). Effects of Probiotics on Lipid Profile: A Review. American Journal of Food Technology, 7 (5), 251–265. doi: 10.3923/ajft.2012.251.265
11. Mogilvii, M. P., Shaltumaev, T. Sh., Galukova, M. K. (2013). Sovremennie napravleniiia ispolzovaniia pshechevyh volokon v kacheste functionalnih ingredientei. Novije tehnologii, 1, 27–31.
12. Han, G. K. & Ko. (2006). Istoria uspева. Stabilizacionniie sistemi dlia idealnogo produkta. Pshechevaya promishlennost, 8, 34.
13. Chatsivili, N. T., Avmiosridi, I., Kiosseoglou, V. (2012). Physico-chemical properties of a dressing-type o/w emulsion as influenced by orange pulp fiber incorporation. LWT – Food Science and Technolog, 46 (1), 335–340. doi: 10.1016/j.lwt.2011.08.019
14. Myers, R., Montgomery, D., Anderson-Cook, C. (2016). Respon- se surface methodology: process and product optimization using designed experiments. Hoboken, New Jersey: John Wiley & Sons, 825.
15. Tkachenko, N. A., Makovska, T. V. (2015) Low-calorie mayonnaise production technology enriched with synbiotic complex by using batch method. Journal of Food Science and Technology, 4 (33), 74–81. doi: 10.15673/2073-8684-4.2015.55876
16. Rahulari, M., Aalami, M., Kashaninejad, M., Maghsoudlou, Y., Agh- daei, S. S. A. (2014). A mixture design approach to optimizing low cholesterol mayonnaise formulation prepared with wheat germ protein isolate. Journal of Food Science and Technology, 52 (6), 3383–3393. doi: 10.1007/s13197-014-1389-4
17. Kish, Y. F. M., Elsheshatwy, H. E. (2013). Effect of ginger powder on the mayonnaise oxidative stability, rheological measurements,
and sensory characteristics. Annals of Agricultural Sciences, 58 (2), 213–220. doi: 10.1016/j.aoas.2013.07.016

18. Mardar, M. R., Valevskia, L. O. (2010). Kompleksna tovaroznavcha ocinka jakosti novykh vydiv ekstrudovanych zernovykh produktiv pidvyshheniho kharchovyi cinnosti. Zernovi produkty i kom-bikormy, 1 (37), 19–22.

19. Makovesja, T. V., Tkachenko, N. A. (2015). Bifidobacterium activation in technologies of health-improving mayonnaise. Technology auditt and production reserves, 6 (4(26)), 40–44. doi: 10.15587/2312-8372.2015.56209

## TECHNOLOGY OF SPECIALTY FATS BASED ON PALM STEARIN (p. 27-33)

Ekaterina Kunitsa, Aleksey Uduvenko, Elena Litvinenko, Fedor Gladkiy, Irina Levchuk

New technology of modification of fats was developed, which allows, by fermentative ethanolysis, obtaining a new type of specialty fats for use in the food industry (culinary, bakery and dairy products). We proposed, for the modification of fatty raw materials, restructuring of the fats, namely, their active parts (acyl groups) with obtaining of derivatives of fatty acids that have functional properties. Obtained fats meet the requirements of normative documentation by the indicators of quality, and are additionally enriched with physiologically–active ingredients – ethyl esters of fatty acids, which are better digested and reduce the resynthesis of fat in a human body. The influence of conditions of fermentative alcoholysis of palm stearin by ethyl alcohol on the degree of its conversion to ethyl esters of fatty acids was defined.

It was established that when using ethyl alcohol as a reagent in the presence of lipolytic enzyme, ethyl esters and incomplete acylglycerols accumulate that causes the change of physical and chemical indicators (including the melting temperature decrease), the composition of the reaction mixture, and allows obtaining fats with given composition and properties. Thus, using this method, selecting necessary raw materials and varying the conditions of the reaction, one can obtain a whole range of specialty fats.

**Keywords**: alcoholysis, palm stearin, ethyl alcohol, enzyme, ethyl esters, specialty fat.

### References

1. Sultanovych, Yu. A., Duxu, T. A. (2015). Problemy pry prymenenyy byodyzelya. Yzvestyya Sankt-Peterburgskogo universyteta, 320.
2. Lysyczkaya, T. V. (2010). Osnovnye aspekty yspolzovanyya lypazids, 34 (S1), 281–285. doi: 10.1007/bf02562318
3. Tems, R. E. (2005). Fractional crystallisation - the fat modification process for the 21st century. European Journal of Lipid Science and Technology, 107 (1), 48–57. doi: 10.1002/ejlt.200401075
4. Nospin, K., Kumar, S. (2014). Optimization of ethyl ester production from palm oil. Petroiuel & Coal, 36 (3), 249–256.
5. Korus, R. A., Hoffman, D. S., Bam, N., Peterson, C. L., Drown, D. C. (1995). Transesterification process to manufacture ethyl ester of rape oil. First Biomass Conference of the Americas: Energy, Environment, Agriculture, and Industry, 2, 815–826.
6. Latip, R. A., Lee, Y.-Y., Tang, T.-K., Fruhr, E., Tan, C., Lai, I.-M. (2013). Physicochemical properties and crystallisation behaviour of bakery shortening produced from stearin fraction of palm-based diacylglycerol blended with various vegetable oils. Food Chemistry, 141 (4), 3938–3946.
7. Abd. Rashid, N., Chiew Let, C., Chong Seng, C., Omar, Z. (2012). Crystallisation kinetics of palm stearin, palm kernel olein and their blends. LWT - Food Science and Technology, 46 (2), 571–573. doi: 10.1016/j.lwt.2011.11.001
8. Barison, Dr. Y., Sundram, Dr. K. (Eds.) (2014). Palmovoe maslo (p. 27-33)
9. Nekrasov, P. A., Podlynsa, O. V., Gopkalov, V. G. (2014). Yssledo vanye pyshevye cennosty dacylglycerinoynovo masla. Masla y zhryy, 3–4, 7–9.
10. Xarkeyvych, D. A. (2006). Farmokologyya. Moscow: GEOTAR-Medlya, 560.
11. Korenskaya, Y. M., Yvanovskaya, N. P., Kolosova, O. A. (2008). Lekarstvennye rastenya y lekarstvennoe rastytelnoe syre, sooder-zhshhie vytamyny, polysaxarydy, zhyrnye masla. Voronezh, Vza-telsko-polygraficheskij centor Voronezheskogo gosudarstvennogo unversyteta, 320.
12. Kapryelance, L. Z., Iorgachova, K. G. (2003). Funkcionalni produkty. Odesa: Druk, 312.
13. Laposata, M. (1999). Fatty acid ethyl esters: Nonoxidative ethanol metabolites with emerging biological and clinical significance. Lipids, 34 (S1), 281–285. doi: 10.1007/bf02562318
14. Tereshlik, L. V., Mamonov, A. S., Starovoytova, K. V. (2014). Produkty frakcyonyrovannya ypalovomo masla v proyzvodstve spredov. Texnnya y teknologiya pyshevhey proyszvodstv, 3, 79–83.
15. Tyutyunnikov, B. N., Buhshtab, Z. I., Gladkiy F. F et. al. (1992). Hi-myia zhirov. Moscow: Koslos, 448.
16. Garabadzhyu, A. V., Galynkyn, V. A., Karasev, M. M., Kozlov, G. V., Lysyczkaya, T. V. (2010). Osnovnye aspekty yspolzovanyya lypaz dlya poluchenyya byodyzelya. Yzvestyya Sankt-Peterburgskogo gosudarstvennogo tekhnyologicheskogo yn-ta (textnycheskogo un-ta), 7, 63–67.

### THE INFLUENCE OF MECHANOLYSIS ON THE ACTIVATION OF NANOCOMPLEXES OF HETEROPOLYSACCHARIDES AND PROTEINS OF PLANT BIOSYSTEMS IN DEVELOPING OF NANOTECHNOLOGIES (p. 33-40)

Raisa Pavlyuk, Viktoryiya Pogarska, Tatyana Kotuyk, Aleksey Pogarskiy, Svitlana Loseva

A nanotechnology of protein plant supplements in the form of puree of peas was developed that is based on the processes of deep processing of raw materials. Finely dispersed grinding and steam and thermal processing were used in this work as the innovation. When using traditional methods of raw materials processing, biological potential is not used in full.

It was found that during deep processing of plant raw materials (dried peas), which is based on comprehensive effect of steam and thermal processing and finely dispersed grinding on the raw material in obtaining nanostructured puree, the processes of mechanical destruction and mechanical chemistry occur. These processes are accompanied by non–enzymatic biocatalysis – mechanolysis (destruction) of hard soluble biopolymers and nanocomplexes of biopolymers (proteins, heteropolysaccharides, namely, pectins, cellulose, starch) with their transformation to monomers (35...55 %) into soluble easily absorbed form (almost 2 times higher compared to the original raw material in a hidden form). The mechanism of protein mechanical destruction and its nanocomplexes, which is associated with the mechanical cracking, was discovered. It was found that the steam and thermal processing and finely dispersed grinding of peas, while obtaining finely dispersed puree, leads to the destruction of polysaccharides by the non–enzymatic catalysis, namely cellulose and starch (30...35 %), proptectin (50 %), to separate monomers. It is shown that in parallel there is an increase of glucose in nanopuree of peas (1.0 g ...10.0 g/100 g, i. e. by 10 times).

Integrated application of these processes is accompanied by mechanical destruction, mechanical activation and mechanolysis of

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**Keywords**: alcoholysis, palm stearin, ethyl alcohol, enzyme, ethyl esters, specialty fat.
biopolymers of nanocomplexes (protein, heteropolysaccharides, etc.) to e-amino acids, glucose, etc. (48...55 %).

Keywords: nanotechnologies, finely dispersed grinding, mechanoysis, nanocomplexes, biopolymers, heteropolysaccharides.

References

1. FAO/WHO/UNU. Dietary protein quality evaluation in human nutrition (2013). Report of an FAO Expert Consultation. Food and agriculture organization of the united nations Rome, 92, 57.
2. Kaprelyan, L. V. (2015). Prebiotiki: himija, tehnologija, primenenie. Kyiv: EnterPrint, 252.
3. Gibson, G., Roberfroid, M. (2008). Handbook of Prebiotics. Vol. 4. CRS Press, London, 22–42.
4. Sousa, V. M. C. de, Santos, E. F. dos, Sgarbieri, V. C. (2011). The Importance of Prebiotics in Functional Foods and Clinical Practice. Food and Nutrition Sciences, 02 (02), 133–144. doi: 10.4236/12.2011.22019
5. Roberfroid, M. B. (2000). Fructo-oligosaccharide malabsorption: benefit for gastrointestinal functions. Current Opinion in Gastroenterology, 16 (2), 173–177. doi: 10.1097/00001574-200003000-00013
6. Pavljuk, R., Ju, Pogarskaja, V. V., Pavljuk, V. A., Radchenko, L. A., Jur'eva, O. A., Maksimova, N. F. (2015). Krio-i mehanohimija v pishevyh tehnologijah. Har'kovskij gosudarstvennyh universitet pitanja i torgovli; Har'kovskij torgovo-ekonomicheskij institut; Kievskij nacional'nyh torgovo-ekonomicheskij universitet, 253.
7. Galland, L. (2014). Functional Foods: Health Effects and Clinical Applications. 3rd edition. Reference Module in Biomedical Sciences, from Encyclopedia of Human Nutrition, 366–371.
8. Tur, J. A., Bibiloni, M. M. (2015). Functional Foods. Reference Module in Food Science: Encyclopedia of Food and Health, 157–161.
9. Tu, J., Zhang, M., Xu, B., Liu, H. (2015). Effects of different freezing methods on the quality and microstructure of lotus (Nelumbo nucifera) root. International Journal of Refrigeration, 52, 59–65. doi: 10.1016/j.ijrefrig.2014.12.015
10. Goñi, I., Serrano, J., Saura-Calixto, F. (2006). Bioaccessibility of β-Carotene, Lutein, and Lycopene from Fruits and Vegetables. Journal of Agricultural and Food Chemistry, 54 (15), 5382–5387. doi: 10.1021/jf0609835
11. Bernstein, P. S., Khachik, F., Carvalho, L. S., Muir, G. J., Zhao, D.-Y., Katz, N. B. (2001). Identification and Quantitation of Carotenoids and their Metabolites in the Tissues of the Human Eye. Experimental Eye Research, 72 (3), 215–223. doi: 10.1016/exer.2000.0954
12. Dherani, M., Murthy, G. V. S., Gupta, S. K., Young, I. S., Mariani, G., Camparini, M. et. al. (2008). Blood Levels of Vitamin C, Carotenoids and Retinol Are Inversely Associated with Cataract in a North Indian Population. Investigative Ophthalmology & Visual Science, 49 (8), 3328–3335. doi: 10.1167/iovs.07-1202
13. Goñi, I., Serrano, J., Saura-Calixto, F. (2006). Bioaccessibility of β-Carotene, Lutein, and Lycopene from Fruits and Vegetables. Journal of Agricultural and Food Chemistry, 54 (15), 5382–5387. doi: 10.1021/jf0609835
14. Bernstein, P. S., Khachik, F., Carvalho, L. S., Muir, G. J., Zhao, D.-Y., Katz, N. B. (2001). Identification and Quantitation of Carotenoids and their Metabolites in the Tissues of the Human Eye. Experimental Eye Research, 72 (3), 215–223. doi: 10.1016/exer.2000.0954
15. Gerasimenko, S. S., Gerasimenko, V. S. (2013). Statystichnaхарактерystyka spodzhyvannya produktiv harchuvannya naselenniam Ukraina'ny. Statystyka Ukrainy, 2, 28–33.
16. Dejneko, L. V., Shul’d’ko, E. I. (2013). Harchova promyslovist’ Ukrainy’ny: efektivnost’ vykorystannya vyrobnych resursiv ta kadrovogo potenciyalhu. NAN Ukrainy’ny, DU “In-t ekon. ta prognoz. NAN Ukrainy’ny”, 120.
17. James, S. J., James, C. (2014). Chilling and Freezing. Food Safety Management, 481–510. doi: 10.1016/b978-0-12-381504-0.00020-2
18. Shi, L., Li, W., Sun, J., Qiu, Y., Wei, X., Luon, G. et. al. (2016). Gridding of maize: The effects of fine grinding on compositional, functional and physicochemical properties of maize flour. Journal of Cereal Sci, 68, 25–30. doi: 10.1016/j.jcs.2015.11.004
19. Balaz, P. (2010). Mechanochemistry in Nanoscience and Minerals Engineering. Woodhead Publishing Limited, 400.
20. Baláž, P., Baláž, M., Bujáková, Z. (2014). Mechanochemistry in Technology: From Minerals to Nanomaterials and Drugs. Chemical Engineering & Technology, 37 (5), 747–756. doi: 10.1002/ceat.201300669
21. Boldyrev, V. V. (2004). Mechanochemical modification and synthesis of drugs. Journal of Materials Science, 39 (16/17), 5117–5120. doi: 10.1023/b:jmsc.0000039193.69784.1d

STUDYING THE ACCUMULATION OF NITROGENOUS SUBSTANCES IN BIOFORTIFIED PUMPKIN VEGETABLES (p. 40-46)

Gregory Deinychenko, Olha Yudicheva

The main purpose of biofortification is obtaining plant products with improved nutritional properties. Plant products are biofortified by means of the classic selection, genetic modification, or with the use of special fertilizers. Food plants have traditionally been enriched with vital minerals and vitamins; lately, they have also been bioenriched with amino acids and proteins. Vegetable protein consumed with the animal one enhances the value of protein nutrition due to the formed biologically active amino acid complexes. The value of vegetable protein increases in vegetarian nutrition, especially hard food, and nutrition of people suffering from celiac disease. We have studied the peculiarities of nitrogenous substances’ accumulation in biofortified pumpkin vegetables grown with the use of the liquid, organic, environment-friendly Riverm fertilizer. The objects of study are biofortified pumpkin vegetables: pumpkins of Oleshkivskiyi and Svitennyi varieties, melons of Olvia and Fortuna varieties, and watermelons of Orphei and Atlant varieties. The reference samples are vegetables grown by the standard technology, without the above mentioned fertilizer. The research findings show that biofortified pumpkin vegetables are characterized by higher contents of total nitrogen and protein nitrogen, as well as contain more protein in comparison with the reference samples: pumpkins – by 15.0–17.6 %, melons – by 6.5–16.4 %, and watermelons – by 8.9–10.1 %. The highest amount of essential amino acids is contained in the protein of biofortified pumpkins, a bit lower – in biofortified melons and watermelons. The protein of biofortified pumpkins is characterized by the content of leucine, valine, and lysine. Biofortified melons and watermelons are dominated by lysine and phenylalanine. The largest shares of replaceable amino acids in all the samples are those of aspartic acid and glutamic acid. Bioenriched with nitrogenous substances (in particular, protein and amino acids) pumpkin vegetables cannot fully satisfy human needs of proteins and essential amino acids, although they can perfectly supplement nutrition with the latter. Such vegetables can be recommended to be used in balanced diets of animal and vegetable proteins, glutenless diets, and vegetarian diets.

Keywords: biofortification, fertilizers, Riverm, protein, nitrogenous substances, amino acids, pumpkin vegetables, micronutrients.

References

1. Dunaevskiy, G. A., Popik, S. Y. (1990). Ovoschki i fruktvy v pitanii zdorovogo i bolnogo chełoveka. Kyiv: Zdorove, 160.
2. Hirsch, K. D. (2009). Nutrient Biofortification of Food Crops. Annual Review of Nutrition, 29 (1), 401–421. doi: 10.1146/annurev-nutr-080508-141143
3. Burlaka, O. M., Sorochynskyi B. V. (2010) Roslymn biotekhnolohii: biofortyfikatsiia kharchovyh roslyv. Kyiv: DIA, 88.
4. Welch, R. M. (2005). Biotechnology, Biofortification, and Global Health. Food and Nutrition Bulletin, 26 (4), 304–306. doi: 10.1177/15648265050264309

5. Fageria, N. K., Moraes, M. F., Ferreira, E. P. B., Knupp, A. M. (2012). Biofortification of Trace Elements in Food Crops for Human Health. Communications in Soil Science and Plant Analysis, 43 (3), 556–570. doi: 10.1080/00103624.2012.639831

6. Murgia, I., De Gara, L., Gruvac, M. A. (2013). Biofortification: how can we exploit plant science and biotechnology to reduce micronutrient deficiencies? Frontiers in Plant Science, 4. doi: 10.3389/fpls.2013.00429

7. Chojnacka, K., Mikuliewicz, M., Cieplik, J. (2011). Biofortification of Food with Microelements. American Journal of Agricultural and Biological Sciences, 6 (4), 544–548. doi: 10.3844/ajabss.2011.544.548

8. Mayer, J. E., Pfeiffer, W. H., Beyer, P. (2008). Biofortified crops to alleviate micronutrient malnutrition. Current Opinion in Plant Biology, 11 (2), 166–170. doi: 10.1016/j.pbi.2008.01.007

9. Gilligan, D. O. (2012). Biofortification, Agricultural Technology Adoption, and Nutrition Policy: Some Lessons and Emerging Challenges*. CESifo Economic Studies, 58 (2), 405–421. doi: 10.1093/cesifo/isf020

10. Leyva-Guerrero, E., Narayan, N. N., Ihemere, U., Sayre, R. T. (2012). Iron and protein biofortification of cassava: lessons learned. Current Opinion in Biotechnology, 23 (2), 257–264. doi: 10.1016/j.copbio.2011.12.009

11. DellaValle, D. M., Thavarajah, D., Thavarajah, P., Vandenberg, A., Glahn, R. P. (2013). Lentil (Lens culinaris L.) as a candidate crop for iron biofortification: Is there genetic potential for iron bioavailability? Field Crops Research, 144, 119–125. doi: 10.1016/j.fcr.2013.01.002

12. Nair, R. M., Yang, R.-Y., Easdown, W. J., Thavarajah, D., Thavarajah, P., Hughes, J. d’A., Keatinge, J. D. (2013). Biofortification of mungbean (Vigna radiata) as a whole food to enhance human health. Journal of the Science of Food and Agriculture, 93 (8), 1805–1813. doi: 10.1002/jsfa.6110

13. McGrath, S. P., Chambers, B. J., Taylor, M. J., Carlton-Smith, C. H. (2012). Biofortification of zinc in wheat grain by the application of sewage sludge. Plant and Soil, 361 (1-2), 97–108. doi: 10.1007/s11104-012-1381-6

14. Aciksoz, S. B., Yazici, A., Ozturk, L., Cakmak, I. (2011). Biofortification of wheat with iron through soil and foliar application of nitrogen and iron fertilizers. Plant and Soil, 349 (1-2), 215–225. doi: 10.1007/s11104-011-1063-2

15. Hussain, S., Sampoold, M. A., Rengel, Z., Aziz, T. (2012). Biofortification and estimated human bioavailability of zinc in wheat grains as influenced by methods of zinc application. Plant and Soil, 361 (1-2), 279–290. doi: 10.1007/s11104-012-1238-z

16. Zhang, Y.-Q., Deng, Y., Chen, R.-Y., Cui, Z.-L., Chen, X.-P., Yost, R. et al. (2012). The reduction in zinc concentration of wheat grain upon increased phosphorus-fertilization and its mitigation by foliar zinc application. Plant and Soil, 361 (1-2), 143–152. doi: 10.1007/s11104-012-1238-z

17. Ajiboye, B., Cakmak, I., Paterson, D., de Jonge, M. D., Howard, D. L., Stacey, S. P. et al. (2013). X-ray fluorescence microscopy of zinc localization in wheat grains biofortified through foliar zinc applications at different growth stages under field conditions. Plant and Soil, 392 (1-2), 357–370. doi: 10.1007/s11104-015-2467-8

18. Zou, C. Q., Zhang, Y. Q., Rashid, A., Ram, H., Savasli, E., Arisoy, R. Z. et al. (2012). Biofortification of wheat with zinc through zinc fertilization in seven countries. Plant and Soil, 361 (1-2), 119–130. doi: 10.1007/s11104-012-1369-2

19. Poblaciones, M. J., Rodrigo, S. M., Santamaria, O. (2012). Evaluation of the Potential of Peas (Pisum sativum L.) to Be Used in Selenium Biofortification Programs Under Mediterranean Conditions. Biological Trace Element Research, 151 (1), 132–137. doi: 10.1007/s12011-012-9539-x

20. Rahmani, M. M., Erskine, W., Zaman, M. S., Thavarajah, P., Thavarajah, D., Siddique, K. H. M. (2013). Selenium biofortification in lentil (Lens culinaris Medikus subsp. culinaris): Farmers’ field survey and genotype × environment effect. Food Research International, 54 (2), 1596–1604. doi: 10.1016/j.foodres.2013.09.008

21. Seppänen, M. M., Kontturi, J., Heras, I. L., Madrid, Y., Cámara, C., Hartikainen, H. (2010). Agronomic biofortification of Brassica with selenium – enrichment of SeMet and its identification in Brassica seeds and meal. Plant and Soil, 337 (1-2), 273–283. doi: 10.1007/s11104-010-0523-y

22. Landini, M., Gonaldi, S., Penati, P. (2011). Iodine biofortification in tomato. Journal of Plant Nutrition and Soil Science, 174 (3), 480–486. doi: 10.1002/jpln.201000395

23. Blasco, B., Rios, J. J., Leyva, R., Cervilla, L. M., Sánchez-Rodríguez, E., Rubio-Wilhelmi, M. M. et al. (2010). Does Iodine Biofortification Affect Oxidative Metabolism in Lettuce Plants? Biological Trace Element Research, 142 (3), 831–842. doi: 10.1007/s12011-010-0816-9

24. Voogt, W., Holwerda, H. T., Khodabaks, R. (2010). Biofortification of lettuce (Lactuca sativa L.) with iodine: the effect of iodine form and concentration in the nutrient solution on growth, development and iodine uptake of lettuce grown in water culture. Journal of the Science of Food and Agriculture, 90 (5), 906–913. doi: 10.1002/jsfa.3902

25. Jin, Z., Minyan, W., Lianghuan, W., Jiangguo, W., Chunhai, S. (2008). Impacts of Combination of Foliar Iron and Boron Application on Biofortification and Nutritional Quality of Rice Grain. Journal of Plant Nutrition, 31 (9), 1599–1611. doi: 10.1080/01904160802244883

26. Jekol, P. et al. (2011). Effect of foliar application of selenium on the content of selected amino acids in potato tubers (Solanium tuberosum L.). Plant soil environ, 57 (7), 315–320.

27. Kozak, V. V. (2009). Printsipy ekologicheski bezopasnogo zemleupravleniya: Prakticheskoe Rukovodstvo. Moscow: Arxipov. 400 p.

RESEARCH INTO THE IMPACT OF ENZYME PREPARATIONS ON THE PROCESSES OF GRAIN DOUGH FERMENTATION AND BREAD QUALITY (p. 46-53)

Svitlana Oliinyk, Olga Samokhvalova, Anna Zapareko, Elena Shidakova-Kamenyuka, Nocola Chekanov

The important issue of improvement in the technology of grain bread is the development of measures to improve the rheological properties of dough and bread. With this aim we proposed the use of cellulosases, hemicellulases and oxidoreductases at the stage of dough mixing. It is shown that the application of the studied enzymes for grain emmer and wheat dough contributes to the intensification of non-starch polysaccharides hydrolysis, namely reduction of the content of cellulose by 11 %, hemicelluloses – by 14.3 and 13.0 %, and increase in the content of water-soluble fraction of hemicelluloses.
Additionally, the presence of enzyme preparations in the grain dough promotes slowing down of the processes of gluten proteolysis and improvement of its rheological properties that predetermines increase of gas-retaining capacity of the studied system. It was discovered that adding the studied enzyme preparations to grain dough contributes to the intensification of acid and gas generation in it. The resulting effect of biochemical and microbiological changes in grain dough under the influence of enzyme preparations of cellulase, xylanase and glucose oxidase is the improvement in the quality of grain bread compared to the samples without their addition.

**Keywords:** enzymes, grain bread, dough preparation, cellulase, xylanase, glucose oxidase.

**References**

1. Mofti, A., Ferraro, Z. M., Stewart, K. A., Tulk, H. M. F., Robinson, L. E., Duncan, A. M., Graham, T. E. (2012). The Acute Impact of Ingestion of Sourdough and Whole-Grain Breads on Blood Glucose, Insulin, and Incretins in Overweight and Obese Men. Journal of Nutrition and Metabolism, 12, 1–9. doi: 10.1155/2012/184710
2. Shkapov, E. I. (2002). Sovershenstvovanie technologii dispersirovaniya zerna dla proizvodstva khlебobulochnych izdeliy. Moskovskij gosudarstvennyj universitet pishhevyh proizvodstv, 18.
3. Koriachkina, S. Ya., Kuznetsova, E. A., Cherepnina, O. M. (2006). Vliyaniye vlagoteplovoy obrabotki pshenitsy na pokazateli kachestva zernovogo khleba. Kharchova nauka i technologiya, 1, 73–77.
4. Koriachkina, S. Ya., Kuznetsova, E. A., Fragarina, O. M. (2006). Povysheniye mikrobiologicheskoy chistoty rastitelnykh obyektov. Khimiya rastitelnogo syrya, 4, 29–33.
5. Ivanova, G. S., Leschuk, O. V. (2012). Vplyv sposobiv tisoprygotuvannia na yakist zernovogo khliba na osnovi sumishhi. Naukovyi zavadnyk, 25–28.
6. Doven, H., Schols, H. A. (1999). Baking Performance, Rheology, and Chemical Composition of Wheat Dough and Gluten Affected by Xylanase and Oxidative Enzymes. Journal of the Science of Food and Agriculture, 79 (1), 304–306.
7. Pogozhykh, M. I., Pak, A. O., Chekanov, M. A., Ishtvan, Ye. O., Pavliuk, I. M. (2014). Researches of system water of food raw materials by thermodynamic and molecular-kinetic methods. Eastern-European Journal of Enterprise Technologies, 5 (11 (71)), 42–46. doi: 10.15587/1729-4061.2014.27790
8. Drohot V. I. (2015). Tekhnokhimichniy control syrovyny ta khlibbulochnykh zernovykh produktiv. Kyiv : Knyha-Vydavnytstvo, 972 p.

**CONSUMER PROPERTIES IMPROVEMENT OF SUGAR COOKIES WITH FILLINGS WITH NON-TRADITIONAL RAW MATERIALS WITH HIGH BIOLOGICAL VALUE (p. 54-61)**

Alina Tkachenko, Inna Pakhomova

According to the study of experimental data, the feasibility of unconventional raw materials with increased biological value (powdered apples, dried apricots; sea-buckthorn and calendula officinalis syrups, fat-free whey powder, whey protein concentrate, preparation of eggsbells with lemon juice, cherry plums and zucchini jam, sea-buckthorn jam) and unconventional oils (sea-buckthorn) to be used in food production is established.
in the sugar cookies production has been proved. The study indicates the increased content of essential amino acids by 34.83% in the cookies “Dachne” and in the cookies “Vasyne sonochno” by 32.54% as compared with the check sample. The content of polysaturated fatty acids and minerals has increased. Especially, the content of calcium has increased by 2.8–3 times. The total fraction of carbohydrates and fats has decreased; the fraction of proteins has increased. The new cookies samples have been evaluated by the parameters of taste and smell higher than the check sample especially according to the organoleptic evaluation. The developed samples meet the standard by the physical-chemical parameters and safety parameters. The results can be used for implementation in the confectionery companies for the diversification of products with high nutritional value. 

**Keywords:** pastry products, unconventional raw material, consumer properties, nutrition value, sugar cookies with fillings.

**References**

1. Galushko, O. S. (2009). The trends of development market of confectionery and features of transformation in the system of values it’s participants. Actualni problemy ekonomici, 8, 17–25.

2. Tkachenko, A. S., Syrokhman, I. V. (2015). The improvement of consumer properties of sugar cookies. Kharchova nauka i tekhnologiya, 3, 82–87.

3. Bodak, M. P. (2014). The usage of non-traditional raw-materials for bakery. Visniki Lvivskoi comercyymaci, 14, 113–116.

4. Hadeeva, S. O., Svidlo, K. V. (2010). The determination potential risks of technology of baked biscuit semi with dietary supplements. Zbirnik naukovih prats’ NTU “KhPI”, 46, 270–283.

5. Tkachenko, A. S. (2015). The improvement of fat-acid contents of sugar cookies. Visniki Lvivskoi courtichymaci, 15, 114–119.

6. Tkachenko, A. S. (2015). The sugar cookies with enriched protein contents. Torgrilla, comercia, marketing, 18, 118–122.

7. Shemanskaia, E. I., Oseiko, N. I. (2012). The phospholipid fat-containing products of functional appointment. The food science, 1, 28–30.

8. Sincik, M., Goksoy, A. T. (2014). Investigation of Correlation between Traits and Path Analysis of Confectionary Sunflower Genotypes. Notulae Botanicae Horti Agrobotanici Cluj-Napoca, 42 (1), 227–231. doi: 10.15835/nhba4219429

9. Ajay, B. C., Gowda, M. V. R., Rathnakumar, A. L., Kusuma, V. P., Fiyaz, R. A., Holajjer, P. et. al. (2011). Improving Genetic Attributes of Confectionary Traits in Peanut (Arachis hypogaea L.) Using Multivariate Analytical Tools. Journal of Agricultural Science, 4 (3), 247–258. doi: 10.5539/jas.v4n3p247

10. Kulichenko, A. I. (2013). The usage of products with a milk raw material for confectionery products. Molodoy ucheniy, 4, 675–77.

11. Nikiforova, T. A., Sevireno, S. M., Kulikov, D. A. et. al. (2009). The prospects of usage secondary raw-materials of cereals productions. Khleboprodukti, 7, 59–51.

12. Assel, K., Izmabaysheva, Merwet P. Bayisbayeva, Bayan Z., Muldabezheva H. (2014). Non–Traditional Raw Materials in Production of Sugar Cookies. American– Eurasian J. Agric. & Environ. Sci., 3, 358–362.

13. Maximova, A. A. (2010). Innovation technology of production of the oat cookies. Khleboprodukti, 7, 38–39.

14. Eckerson, J. M., Lieb, A. E., Mullen, K. A., Allen, N. O. (2015). The Effect of a Protein–Rich Egg White Breakfast and an Isocaloric Toast Pastry Breakfast on Satiety and Dietary Intake in Normal–Weight College–Age Women. Journal of the Academy of Nutrition and Dietetics, 115 (9), A17. doi: 10.1016/j.jand.2015.06.048

15. Roslikov, I. F., Gonchar, V. V., Shulvinskaia, I. V. (2007). The usage of the Siberian pine nut kernel (pinus sibirica) in the production of pastry for functional appointment. Fundamental research, 7, 89–90.

16. Ruhilan, M., Gutierrez, C., Verdugo, M., Shen, C., Cneiro, J. (2010). Flaxseed as a source of functional ingredients. Journal of soil science and plant nutrition, 10 (3), 373–377. doi: 10.4067/s0718-9516201000010010

17. Li, S.-W., Sang, L.-S., Shu, Q.-Y., Wu, J., Chen, L.-G., Shao, S., Yin, D.-D. (2015). Fatty acid composition of developing tree peony (Paeonia section Moutan DC.) seeds and transcriptome analysis during seed development. BMC Genomics, 16 (1), doi: 10.1186/s12864-015-1429-0

18. Fatima, T., Snyder, C. L., Schroeder, W. R., Crum, D., Datla, R., Wishart, D. et. al. (2012). Fatty Acid Composition of Developing Sea Buckthorn ( Hippophae rhamnoides L.) Berry and the Transcriptome of the Mature Seed. PLoS ONE, 7 (4), e34099. doi: 10.1371/journal.pone.0034099

19. Dorokhovich, A. M., Soloviova, O. L., Dorokhovich, V. V. (2011). Fortification of the confectionery Productu & ingrediyentsy, 3, 26–28.

20. Bogatirov, A. (2011). Scientific principles of fortification nutrition products. Khliboperekarska i kondyterska promyslovist Ukrayini, 5, 44–47.

21. Magomedov, O. G., Plotnikova, I. V., Magomedov, N. G. (2014). Beet feelings for bakery. Khleboprodukti, 8, 44–47.

22. Alekseenko, E. V., Dikareva, I. M. (2014). The usage of see button concentrate in the cakes products. Kondytersko i khleboperekarskoe proizvodstvo, 5-6, 6–8.

23. Ivanova, V. D., Khlebutina, M. S., Ivchuk, N. P. (2011). The researching of the cake functional properties. Naukovi pratsi ONAKHT, 40 (1), 82–86.

24. Poliakova, A. V. (2011). Technology of the puff pastry with berries dry-powders supplements for puff pastry. Visnyk Donetskoho natsionalnoho universtyentu ekonomiky i torhivli imeni Mykhayla Tihui–Baranovskoho. Ser. Tekhnichni nauky, 1, 55–60.

25. Pop, A., Muste S., Man, S. (2013). Study of Valorification of Lycium barbarum (Goji) in Pastry Products / Anamaria Pop, Sevastita Munte, Simona Man. Bulletin UASVM Food Science and Technology, 70 (2), 93–98.

26. Zucco, F., Borsuk, Y., Arntfield, S. D. (2011). Physical and nutritional evaluation of wheat cookies supplemented with pulse flowers of different particle sizes. LWT – Food Science and Technology, 44 (10), 2070–2076. doi: 10.1016/j.lwt.2011.06.007

27. Pérez, S., Matta, E., Osetta, C., de la Torre, M., Sánchez, H. D. (2013). Effect of soy flour and whey protein concentrate on cookie color. LWT – Food Science and Technology, 50 (1), 120–125. doi: 10.1016/j.lwt.2012.06.015

28. Gedrovica, P., Karklina D. (2013). Influence of Jerusalem Artichoke Powder on the Nutritional Value of Pastry Products. Biomolecular, Agricultural, Food and Biotechnological Engineering, 6, 7

29. Aller, M. C., Villarlin, M. D., Pascual, P. R. L. (2015). Product Development of Malunggay (Morippugia Oleifera) and Sweet Potato (Ipo–mea Batatas) for Pastry and Fillings. Tropical Technology Journal, 19 (1), 5. doi: 10.7603/s40934-015-0005-1

30. Recipes of the cookie (1987). Moscow: Vsesoyuznyi nauchno-issle dovatechnyi institut kondytersky promyslusheni, 248.

31. Krutovo, Z. A., Zakharenko, G. V., Kaulova, L. O. et. al. (2013). Matematyche modelyvannya retsepturnyi kompozitytsiyi kexk su pidvysuhchonyi kharchovoyi tsinnosti. Nauka ta innovatsiyi, 5 (9), 5–9.

32. Regulation (EU) Nº 854 of the European Parliament and of the Council. Laying down specific rules for the organisation of official controls on products of animal origin intended for human consumption (2004). Official Journal of the European Union, 45.

33. Ovchinnikova, I. A. (1974). New methods of analysis of amino acids, proteins and peptidov. Moscow: Myr, 120.
THE EFFECT OF GRAPE SEED POWDER ON THE QUALITY OF BUTTER BISCUITS (p. 61-68)

Olga Samohvalova, Natalya Gvretseva, Tatiana Brykova, Anjelika Grigorenko

Butter biscuits that enjoy stable great demand in all segments of population traditionally contain a lot of fats and carbohydrates versus small amounts of biologically active substances. Enriching butter biscuits with dietary fibre, polyphenolic compounds, minerals and vitamins has a beneficial effect on the human body. These components are abundant in raw plant materials, primarily in powdered grape pomace. Grape pomace is a secondary product of wine manufacturing that is output in large quantities at wineries in Ukraine; it is an available and inexpensive raw stuff with a rich chemical composition.

We have studied the possibility of using grape seed powder in the technology of butter biscuits, in order to increase their biological value. We have found that in comparison with wheat flour, the powder is characterized by a higher water absorption capacity, and adding grape seed powder makes gluten less tense and more elastic. The study has proved a positive effect of grape seed powder on physicochemical and organoleptic parameters of the quality of butter biscuits that become biologically more valuable.

Keywords: grape pomace, grape seed, powder, gluten, water absorption ability, butter biscuits.

References

1. Ljusjuk, G. M., Vereshko, N. V., Chujko, A. M. (2011). Novi napravmi vikoristannya vtorinnykh produktiv pererobki vinogradu u virobnictvi boroshihanui virov. Kharkiv: HDUHT, 175.
2. Bareeva, N. N., Donchenko, L. V. Vinogradnі vyzhivky – perspektyvi pro rybolovnі. Available at: http://calebka.ru/2006/04/30/
3. Bačkova, I. A., Jashina, I. A., Makarova, N. V., Novikova, M. N., Smirnova, N. V. (2014). Vlijanie temperatury sushki na himicheskij skład pisochnogo pechyva «Aronija». Zajavnyk ta patentovlasnyk Nacional’nyj universytet ekonomiky i torgivli im. M. Tugan-Baranovs’kogo, 30, 75–80.
4. Holcombe, R. F., Nguyen, A. V., Martinez, M., Stamos, M. J., Moyer, M. P., Planusit, K. et al. (2009). Results of a phase I pilot clinical trial examining the effect of plant-derived resveratrol and grape powder on Wt pathway target gene expression in colonic mucosa and colon cancer. Cancer Management and Research, 25–37. doi: 10.2147/cmr.s4544
5. Suwannaphet, W., Meeprom, A., Yibchok-Anun, S., Adisakwattana, S. (2010). Preventive effect of grape seed extract against high-fructose diet-induced insulin resistance and oxidative stress in rats. Food and Chemical Toxicology, 48 (7), 1853–1857. doi: 10.1016/j.fct.2010.04.021
6. Salim, S., Patki, G., Jannise, B. (2015). The Role of Grape Powder in Emotional Well-Being and Memory Improvement. Diet and Nutrition in Dementia and Cognitive Decline, 925–934. doi: 10.1016/b978-0-12-407824-6-00085-9
7. Tkachenko, A. I. (2009). Vinograd – venec tvorenija prirody. Nauchno-metodicheskoe posobie dlja vrazhie i shirokogo kruga chitateljov. Kharkiv: Nauchno-lechebnij fitocenter «Avicenna», 28.
8. Sagiydikova, B. A., Tihonov, A. I., Isabekova, D. S. (2011). Razrabotka tabletkov s suhim jekstraktom semjan vinograda s modificirovanym vysvobozhdeniem. Vismik farmacij, 1 (65), 16–19.
9. Voronina, L. M., Zagajko, A. L., Samohin, A. S., Aljeksjejeva, L. M. (2004). Polifenol'ni ekstrakty vynograd kul'turnogo na zahyst pechyvka za umov oksydatyvnogo stresu. Klinichna farmacija, 8 (2), 36–37.
10. Grape Extracts May Be Effective Against Harmful Gut Bacteria. Available at: https://www.sciencedaily.com/releases/2009/03/090304132621.htm
11. Orczyk, G. M., Vereshko, N. V., Chujko, A. M. (2011). Novi napravmi vikoristannya vtorinnykh produktiv pererobki vinogradu. Viti siniyeho sorta “Izabella” dlja kosmetiki i izuchenie ih svojstv. Moscov, 26.
12. Bondakova, M. V. (2014). Razrabotka receptury i tehnologii proizvodstva glichkosti i izuchenie ih svojstv. Moscov, 23.
13. Sant’Anna, V., Christiano, F. D. P., Marczak, L. D. F., Tessaro, I. C., Thys, R. C. S. (2014). The effect of the incorporation of grape marc powder in fettuccine pasta properties. JWF – Food Science and Technology, 58 (2), 497–501. doi: 10.1016/j.jwt.2014.04.008
14. Cagdas, E., Kumcuoglu, S. (2014). Effect of grape seed powder on oxidative stability of precooked chicken nuggets during frozen storage. Journal of Food Science and Technology, 52 (5), 2918–2925. doi: 10.1007/s13197-014-3337-7
15. Aksoylu, Z., Çagını, Ö., Kése, E. (2015). Effects of Blueberry, Grape Seed Powder and Poppy Seed Incorporation on Physicochemical and Sensory Properties of Biscuit. Journal of Food Quality, 38 (3), 164–174. doi: 10.1111/j.fq.12153
16. Kalinovs’ka, T. V., Krpyvnyc’ja, I. O., Obolkina, V. L., Ivjanyts’ja, S. G. (2013). Vykorystannja vtorinnyh produktiv pererobky vynograd pid chas rozrobu innovatsijnych tehnologij kondyter’kyh vyrobyv. Obladnannya ta tehnologij harchovyh vyrobyv. Don’c’ky na nacional’nyj universitet ekonomiky i torgivli im. M. Tugan-Baranovs’koga, 30, 75–80.
17. Obolkina, V. I., Kyrpichenkova, O. M., Bukshyna, L. S., Krpyvnyc’ka, I. O. (2012). Pat. 72163 Ukrai’na, MPK (2012.01) A 23 G 3/00. Sposib vyrobynictva biskvitnogo zdobnogo pechyva «Shantine». Zajavnyk ta patentovlasnyk Nacional’nyj universytet harchovyh tehnologij. Ne u201200701; zajav. 23.01.2012; opubl. 10.08.2012. Bull. № 15, 3.
18. Zadorozhnya, O. S., Gavrysh, A. V., Docenok, V. F. (2014). Pat. 89005 Ukrai’na, MPK (2014.01) A 21 D 2/00. Pishchevo pechyvo «Sonechko». Zajavnyk ta patentovlasnyk Nacional’nyj universytet harchovyh tehnologij. Ne u201312347; zajav. 21.10.2013; opubl. 10.04.2014. Bull. № 7, 2.
19. Korečka, I. L., Lytvyn, G. V., Bandurens’k, G. M., Lyvkivs’ka, T. M., Zinchenko, T. V. (2014). Pat. 57628 Ukrai’na, MPK (2011.01) A 23 G 3/36. Zdobne pechyvo. Zajavnyk ta patentovlasnyk Nacional’nyj universytet harchovyh tehnologij. Ne u201312347; zajav. 21.10.2013; opubl. 10.04.2014. Bull. № 7, 2.
20. Jablonys’ka, I. O., Myroshyn, Ju. A., Gavrysh, A. V., Docenok, V. F. (2014). Pat. 94940 Ukrai’na, MPK (2006.01) A 21 D 13/08. Sposib vyrobnyctva biskvitno-zbyvnogo zdobnogo pechyva. Zajavnyk ta patentovlasnyk Nacional’nyj universytet harchovyh tehnologij. Ne u201312347; zajav. 21.10.2013; opubl. 10.04.2014. Bull. № 7, 2.
21. Syrohman, I. V., Turchynjak, M. K. (2008). Pat. 33281 Ukrai’na, MPK (2006) A 21 D 13/00. Zdobne pechyvo «Spokusa». Zajavnyk ta patentovlasnyk Syrohman I. V., Turchynjak M. K. Ne u200804704; zajav. 11.04.2008; opubl. 10.09.2008. Bull. № 17, 3.
22. Syrohman, I. V., Lebedyns’v. V. T. (2009). Asortiment i jakist kondyter’kyh vyrobyv. Kyiv: Centr uchbovoi’ literatury, 636.
23. Kalinovskaya, T. V., Obolkin, V. I. (2014). Substantiation of using wine-making secondary products as alternative raw material for confectionery industry. Nauka i Studia, 14 (124), 59–62.

24. Sidorenko, A. V., Vershinina, O. L., Derevenko, V. V., Shapovalova, D. V. (2011). Tehnologicheskie osobennosti prigotovleniya hlebobulochnyh izdelij obogashhennyh poroshkom iz kozhicy vinogradnyh vyzhimok. Izvestija vuzov. Pishhevaja tehnologija, 4, 26–28.

25. Drobot, V. I.,Docenko, V. F., Arsen'eva, L. Ju., Ustinov, Ju. V., Pereguda, N. A. (1987). Issledovanie vozmozhnosti primenenija produktov iz vinograda v hlebopechenii. Kyiv, 10.

26. Davidov-Pardo, G., Moreno, M., Arozarena, I., Marin-Arroyo, M. R., Bleibaum, R. N., Bruhn, C. M. (2012). Sensory and Consumer Perception of the Addition of Grape Seed Extracts in Cookies. Journal of Food Science, 77 (12), 430–438. doi: 10.1111/j.1750-3841.2012.02991.x

27. Chukho, A. M., Chukho, M. M., Orlova, O. S., Jer’omenko, S. O. (2014). Research of quality of yeast-leavened dough products and shortbread using cryopowders made of herbal raw materials. Eastern-European Journal of Enterprise Technologies, 2 (12 (68)), 133–137. doi: 10.15587/1729-4061.2014.22416

28. Maner, S., Sharma, A. K., Banerjee, K. (2015). Wheat Flour Replacement by Wine Grape Pomace Powder Positively Affects Physical, Functional and Sensory Properties of Cookies. Proceedings of the National Academy of Sciences, India – Section B: Biological Sciences. doi: 10.1007/s40011-015-0570-5

29. Drobot, V. I. (2006). Laboratornyj praktykum z tehnologii hlibopekar'skogo ta makaronnogo vyrobnyctv. Kyiv: Centr nавчальної литератури, 341.

30. Lur’e, I. S. (1981). Tehnologija i tehnohimicheskij kontrol’ konditerskogo proizvodstva. Moscow: Ljogkaja i pishhevaja promyshlennost’, 328.