ABSTRACT AND REFERENCES

ECOLOGY. TECHNOLOGY AND EQUIPMENT OF FOOD PRODUCTION

ELECTRIC CONDENSATION AND DEHYDRATION OF RED SLUDGE (p. 4-7)

Olesya Razghonova, Vladimir Sokolnik

Red sludge is a mixture resulting from production of aluminum with high content of iron and aluminum oxides. Through lack of effective technologies for processing and high moisture, a bulk of red sludge is not utilized. Instead, it is stocked in huge sludge fields with an obvious alkaline environment, which is fatal to anything living on earth. There are methods of processing red sludge, such as sedimentation, filtering, drying, pyrometallurgical processing, magnetic separation, recuperative melting, hydrometallurgical schemes, etc. Most of these methods, however, are not really used because of their being economically and technically inefficient.

The study is focused on the method of condensation and dehydration of red sludge in the electric field. The method does not require huge investments and allows using dehydrated red sludge as a valuable raw material in various industries. The researched red sludge suspension was taken from the sludge storage at Zaporizhzhya Aluminum Plant. The research was conducted in on the designed laboratory equipment consisting of two cylinders. One of the cylinders was equipped with electrodes supplying electric voltage from 0 V to 175 V, while the other showed gravitational sedimentation. The obtained graphical dependence proved that the smallest fraction of 28 % of sludge sediment was received with electric voltage of 150 V, whereas the fraction of sludge sediment without exposure to electricity was 45 %. Voltage supply of 25 V resulted in the longest 260-minute condensation, and with supply of 175 V the condensation process was the shortest—90 minutes.

The obtained findings showed that electric-field condensation and dehydration of red sludge can facilitate condensation and reduce the volume fraction of sludge sediment. The advantage of the method is condensation and dehydration of red sludge within short time with reduced energy costs. Application of the suggested method in aluminum production will reduce the production pressure on the environment.

Keywords: red sludge, condensation, dehydration, electric charge, sediment, electric voltage.

References

1. Satish, C. (2013). Waste Materials Used in Concrete Manufacturing. Elsevier, 292–295.
2. The danger of «red mud» to human health. Available at: http://ria.ru/ecoinfogr/20101011/284454555.html
3. Stentiford, E. (1995). Sludge composting - trends and opportunities. Water and Waste treat, 38 (11), 44–47.
4. Gupta, V. K., Sharma, G. (2002). Using Red Mud, Environ. Sci Technol, 36, 3612–3617.
5. Laskorin, B. N., Gromov, B. V., Tzygankov, A. P., Senin, V. N. (2000). Problems of waste production. Moscow: Stroyizdat, 566.
6. Liu, Y., Lin, C., Wu, Y., Hazard, J. (2007). Characterization of red mud derived from a combined Bayer Process and bauxite calcination method. Mater, 146 (1-2), 255–261. doi: 10.1016/j.jhazmat.2006.12.015
7. Ruyters, S., Mertens, J., Vassilieva, E., Dehandschutte, R. B., Poffijn, A., Smolders, E. (2011). The red mud accident in Ajka (Hungary): Plant toxicity and trace metal bioavailability in red mud contaminated soil. Environ Sci. Technol, 45 (4), 1616–1622. doi: 10.1021/es104000m
8. Savitsky, V. M., Hilchevsky, V. K., Chunarev, O. V., Yatsyuk, M. V., (2007). Waste production and consumption and their impact on soils and natural waters: a manual. Kiev: publishing center «Kyiv University», 152
9. Korneev, V. I., Sousse, A. G., Tsehovoy, A. I. (1991). Red sludge - properties, storage and application. Moscow: Metallurgy, 144
10. Jiang, Y., Ning, P. (2003). Comprehensive utilization of red mud from alumina plant. Environ. Sci.Technol., 26, 40–44.
11. Shmorgunenko, N. S., Korneev, V. I. (1982) Complex processing and utilization of red mud in alumina production. Moscow: Metallurgy, 128.
12. Materials based on metallurgical sludges. Available at: http://www.bibliotekar.ru/spravochnik-110-stroitelnye-materialy/11.htm
13. Yalcin, N., Sevinc, V. (2000). Utilization of bauxite waste in ceramic glazes. Ceram. Int., 26 (5), 485–493. doi: 10.1016/s0272-8842(99)00083-8
14. Ovcharova, O. V., Sokolnik, V. I., Atamanyuk, O. A. (2013). Intensification of gravitational sedimentation and compaction of iron sludge in an electric field. Municipal economy of cities, 107, 291–295.
15. Grigorov, O. N. (1973). Electrokinetic phenomena. Lviv: Ed. LSU, 199.

DEVELOPMENT OF BIOCENTRIC-NETWORK STRUCTURE OF VINNYTSIA ENVIRONMENTAL NETWORK USING GEOINFORMATIONAL TECHNOLOGIES (p. 8-12)

Yevgeniyy Kryzhanovskiy, Anastasiy Nagorna

Approach to developing a generalized scheme of the Vinnytsia city ecological network, which, unlike the existing one provides a connectivity evaluation of the biocentric - network structure of the developed ecological network scheme that allows to quantify the quality of the proposed ecological network has got further development. The main structural elements of Vinnytsia city ecological network project were determined.

According to the research tasks:

– the development of a general algorithm of the city ecological scheme, which details the design process and the connectivity evaluation of the ecological network was performed;

– the method of analysis of the connectivity evaluation of the biocentric - network structure of the developed ecological network scheme was proposed;

– the approbation of the developed algorithm and the proposed evaluation method on the example of the Vinnytsia city ecological network was carried out.

A project of the generalized Vinnytsia city ecological network scheme using geoinformation package "Panorama" was developed. The developed ecological network project was presented at a meeting with Mayor of Vinnytsia at the participation of heads of departments and offices of the City Council.

For the specification, implementation and effective use of the developed project of the generalized ecological network scheme, it is necessary:

1) to improve and detail the general schemes of the Vinnytsia city ecological network;

2) to agree the project with the corresponding government authorities;

3) to develop recommendations for the proper functioning of the city ecological network.

Specified and detailed city ecological network can be used when developing management decisions on saving biodiversity and protection of the city environment.

Keywords: ecological network, GIS, remote sensing, structure, evaluation, city, ecology, Vinnytsia, scheme, connectivity.

References

1. Marushevsky, G. B., Melnychuk V. P., Kostyushin, V. A. (2008). Biodiversity and econet. Kiev: Wetlands International Black Sea Programme, 169.
2. Law of Ukraine «On Ecological Network of Ukraine». The official website of the Verkhovna Rada of Ukraine. Available at: http://zakon.rada.gov.ua/cgi-bin//laws/main.cgi?nreg=1864-15
3. The Law of Ukraine On the State program of national ecological network of Ukraine for 2000 - 2015. The official website of the Verkhovna Rada of Ukraine. Available at: http://zakon.rada.gov.ua/cgi-bin//laws/main.cgi?nreg=1989-14
4. Movchan, Y. I. (1997). Econet Ukraine: study of the structure and the realization [Convention on Biological Diversity: public awareness and participation], 98–110.

5. Movchan, Y. I., Shelyag-Sosonko, J. R. (1999). Ways to implement an ecological network of Ukraine. Building an ecological network in Ukraine, 104–111.
6. Shelyag-Sosonko, J. R., Tkachenko, V. S., Andrienko, T. L., Movchan, Y. I. (2005). Econet Ukraine and its natural nucleus. Ukr. Botan. Zh.. 62 (2), 142–158.
7. Vakarenko, L. P., Dubin, D. V., Shelyag-Sosonko, J. R. (2005). Econet Ukraine: Ideology and create ways of creating. Chernomor. Botan. Zh., 1 (1), 60–65.
8. Coucil of Europe, UNEP & European Centre for Nature Conservation. The Pan European Biological and Landscape Diversity Strategy, a vision for Europe's natural heritage (1996)., 45.
9. Demyna, A. N. (2011). Designing econets in the steppe zone and measures for the protection of plant communities. Geographic Fundamentals Formation ecologically networks in Russia and of Eastern Europe, 1, 81–85.
10. Procenko, L. D. (2012). Econet Azov-Chernomorskoho Natural Corridor, 60.
11. Yurchuk, L. (2011). Econet Biosphere Reserve "West Polesie" (mapshema and its legend). Bulletin of Lviv University. Biology Series, 56, 141–147.
12. Popovic, S., Vasilenko, V. (2009). Econet steppes of Ukraine: kartoshema and its legend. Reserve management in Ukraine, 15 (1), 1–5.
13. Mokin, V. B., Gavenko, O. V., Kryzhanovskiy, E. M, Belenkov, V. V. (2013). Geographic information system for monitoring the environment of the city Krivoy Rog. Heoprofy, 2, 23–25. Available at: http://www.gisinfo.ru/item/99.pdf
14. Grodzinsky, M. D., Shischenko, P. G. (1998). Preservation and reproduction of landscape diversity in the context of sustainable development. Reserve business in Ukraine, 4 (1), 3–8.

PULSE INFRASOUND SIGNAL PRODUCED BY A WIND TURBINE. PRINCIPLES OF ASSESSMENT (p. 13-19)

Nadiia Afanasieva, Leonid Pljatsuk, Lev Filatov, Inna Trunova

Analysis of the literature that most completely reflects the nature of the occurrence and propagation of the sound emission of wind power engineering facilities is presented. A literature review of studies of pulse sound emission in the geological and air environments has allowed to reduce the concept of emission to the concept of signal, the general theory of signals. Based on the analyzed literature data, the basic principles of assessment of pulse infrasound signal of the wind turbine are formed. Approach in terms of the theory of signals is aimed at the future implementation of the highlighted principles in the mathematical model. The concept of pulse sound signal is applicable to any field of the natural environment around the wind turbine. This is the principle of the signal uniformity in the fields of the natural environment on the one hand and the principle of signal separation in these areas on the other. Evaluation of the amplitude of the biosphere response to the impact of the sound signal of the wind turbine is reduced to the corresponding amplitude-frequency analysis of the action signal. As a result, the calculation of the spectrum of probable and dominant harmonics for the model of FL 2500-100 wind turbine, the application of which is the most relevant in Ukraine is given.

Keywords: wind turbine, pulse infrasound emission, spectrum.

References

1. Saccorotti, G., Piccinini, D., Cauchie, L., Fiori, I. (2011). Seismic noise by wind farms: A case study from the Virgo gravitational wave observatory. Italy. Bull. of the Seism. Soc. of America, 101 (2), 568–578. doi: 10.1785/0120100203
2. Devins, D. (1985). Energiya, [Energy: its physical impact on the environment john wiley and sons]. Moscow, Russia, 108.
3. Salt, A., Lichtenhan, J. (2014). How Does Wind Turbine Noise Affect People? Acoustics Today, Winter, 10 (1), 20–28. doi: 10.1121/1.4870173
4. Schofield, R. (2001). Seismic Measurements at the Stateline Wind Project. LIGO T020104-00-Z.
5. Snow, D. J., Styles, P. (1997). Low frequency noise and vibration measurements at a modern wind farm, ETSU W/13/00392/REP.
6. Styles, P., England, R., Stimpson, I. G., Toon, S. M., Bowers, D., Hayes, M. (2005). Microseismic and Infrasound Monitoring of Low Frequency Noise and Vibrations from Windfarms: Recommendations on the Siting of Windfarms in the Vicinity of Eskdalemuir, Scotland, Report to MOD/FT/BWEA, 125.
7. Xolodov, Yu. A. Reakcii biologicheskix sistem na magnitnye polya (1978). Moscow, Russia, 216.
8. Murzamadieva, Z. A. (1996). Morfologicheskie izmeneniya vo vnutrennix organax i golovnom mozge pri vozdejstvii proizvodstvennogo infrazvuka. RGB OD, Almaty', Russia, 24.
9. Xashxozheva D. A. (2008). Dinamika integral'ny'x pokazatelej serdechno-sosudistoj sistemy' pod vliyaniem nejroakusticheskix signalov. RGB OD, Nal'chik, Russia, 152.
10. Kuralesin, N. A. (1997). Nauchny'e osnovy' reglamentacii infrazvuka v medicine truda : Mediko-biologicheskie aspekty'. NII mediciny' truda, Moskva, Russia, 48.
11. Moskalionov, P. P. (2008). E'kologo-fiziologicheskaya ocenka vliyaniya akusticheskix signalov na adaptaciyu cheloveka. RGB OD, Moskva, Russia, 125.
12. Plexanov, A. G., Kartasheva, G. F. (1990). Osnovny'e zakonomernosti nizkochastotnoj e'lektromagnitobiologii, Izd-vo Tom. un-ta, Tomsk, Russia, 188.
13. Plexanov, G. F. (1982). E'kologicheskaya rol' vneshnix e'lektromagnitny'x polej, Problemy' solnechno-zemny'x svyazej, Novosibirsk, Russia, 10–16.
14. 5 vetroturbin vvedeno v ekspluataciyu na Lutuginsky VES, [5 wind turbines were put into operation at wind farm Lutuginsky], Vetryanye parki Ukrainy. Available at: http://wpu.com.ua/ru/news/ (Last accessed: 12.16.2013)
15. FL 2500 – die Multimegawatt Wind Turbine for all Sites: Fuhrländer. Available at: http://www.fuhrlaender.de/en/fl-2500-gb

INVESTIGATION OF NITRATE POLLUTION OF THE HYDROSPHERE IN THE TRANSBOUNDARY AREA OF SEVERSKY DONETS RIVER BASIN (p. 20-27)

Yuliya Vystavna, Valeriy Yakovlev, Dmytro Diadin, Yuri Vergeles, Anna Chystykova, Iryna Zhydkykh

The aim of the research was to determine the distribution patterns of dissolved substances, in particular nitrates in surface and ground water. Water sampling was carried out on the Udy, Lopan, Oskol and Seversky Donets rivers and groundwater on the left and right banks of rivers. The results have shown that water-rock interaction and evaporation are predominant natural factors that affect the macroelement composition of natural water. Nitrates had high spatial and temporal variations in surface and ground water. The average nitrate content in groundwater was 26.7 mg/l, and in river water – 6.9 mg/l. Annual nitrate removal from groundwater into rivers was 3 tons/km^2. About 1/5 spring water samples were characterized by a higher nitrate content than the standards, recommended by the World Health Organization and national water quality standards.

Keywords: water quality assessment, groundwater classification, environmental assessment, nitrate removal, agricultural land use, Ukraine.

References

1. Shnyukov, E. F., Shestopalov, V. M., Jakovlev, E. A. (1993). Ekologicheskaya geologiya Ukraini. Spravochnoe posobie. Naukova dumka, 407.
2. Prymushko, S. Y., Byloshapska, T. D., Velychko, V. F. (2011). Stan pydzemnikh vod Ukraini. Derzhavne naukovo – vyrobniche pidpryemstvo 'Derzhavniy informaciyniy geologichniy fond Ukraini', 120.
3. Shestopalov, V. M. (1991). Vodoobmyn v gydrogeologicheskikh structurakh Ukraini. Vodoobmin v porushemikh umovakh. Kiev. Naukova dumka, 203.
4. Vasenko, O. G., Grycenko, A. V., Karabash, G. O., Stankevich, P. P. (2006). Seversky Donets. Vodniy y ekologichesky atlas. Kharkiv: "Rayder", 188.
5. Vasenko, O. G. (2006). Complexny expediciyni doslydzhennya ekologichnogo stanu vodnikh objectov baseynu reky Udy. Kharkiv: "Rayder", 174.
6. Yakovlev, V. V. (2009). Stan gruntovikh vod na priklady Kharkivskoy oblasty ta zakhody shodo polypshennya putnykh ta kolodyaznikh vod. Vesnyk Kharkivskogo Universitetu 882. Seriia Geologia – Geographia – Ekologia, 31, 216–222.
7. Zagalnogerzhavna programa "Pytna voda Ukraini" na 2006–2020 roki zatverdzhena zakonom Ukraini vid 3 bereznya 2005 roku 2455 – IV.

8. Dmytrenko, T. V. (2005). Povyshenie ekologicheskoy bezopasnosti yspolzovaniya rodnykovikh vod na primere Kharkovskogo regiona. Dissertasia na soiskanie uchenoy stepeny kandidata tekhnychnikh nauk. Kharkiv, 157.
9. Iqbal, M. Z. (2002). Nitrate flux from aquifer storage in excess of baseflow contribution during a rain event. Water Research, 36, 788–792. doi: 10.1016/S0043-1354(01)00246-9
10. Jahangir, M. M. R., Johnston, P., Khalil, M. J., Richards, K. G. (2012). Linking hydrogeochemistry to nitrate abundance in groundwater in agricultural settings in Ireland. Journal of Hydrology, 448-449, 212–222. doi: 10.1016/j.jhydrol.2012.04.054
11. Vystavna, Y. Huneau, F., Motelica-Heino, M., Le Coustumer, P., Vergeles, Y., Stolberg F. (2012). Monitoring and flux determination of trace metals in rivers of the Seversky Donets basin (Ukraine) using DGT passive samplers. Environmental Earth Sciences, 65, 1715–1725. doi: 10.1007/s12665-011-1151-4
12. Vystavna, Y. Le Coustumer, P., Huneau, F. (2013). Monitoring of trace metals and pharmaceuticals as anthropogenic and socio-economic indicators of urban and industrial impact on surface waters. Environmental Monitoring and Assessment, 185, 3581–3601. doi: 10.007/s10661-012-2811-x
13. Katz, B. G., Bohlke, J. L., Hornsby, H. D. (2001). Timescales for nitrate contamination of spring water northern Florida use. Chemical Geology, 179 (14), 167–186. doi: 10.1016/S0009-2541(01)00321-7
14. Katz, B. G., Chelette, A. R., Pratt, T. R. (2004). Use of chemical and isotopic tracers to access nitrate contamination and groundwater age, Woodville karst Plain, USA. Journal of Hydrology, 289 (1-4), 36–61. doi: 10.1016/j.jhydrol.2003.11.001

SAFE USE OF POLYETHYLENE TEREPHTHALATE (PET) PACKAGING IN THE PRODUCTION OF VEGETABLE OILS (p. 27-31)

Irina Levchuk, Vladimir Kishchenko, Nikolai Oseyko, Valentina Timchenko, Ekaterina Kunitsa

The need to control vegetable oils, packaged in PET on the content of phthalates, features of determining phthalates in vegetable oils is shown in the paper. The data on the migration of phthalates from packaging material is given, the need to monitor the content of phthalates in vegetable oils that come into contact with plastic packaging is shown. The procedure of purifying contaminated samples was developed and introduced. Adsorption purification of sunflower oil samples using inorganic adsorbent floricil was used. It is shown that the effectiveness of the proposed solid-phase purification of samples is caused by the need to control "internal laboratory contamination". Principle possibility of determining phthalates and their derivatives by gas-liquid chromato-mass spectroscopy was experimentally confirmed. Based on the research and analysis of scientific and technical literature, necessity to monitor the content of phthalates in vegetable oils for the purpose of food safety and specifying the appropriate control critical points of oil and fat production was proved.

Keywords: polyethylene terephthalate, migration, phthalates, food safety, vegetable oils.

References

1. ISO 22000:2005 NACCR Systemy menedzhmentabezopesnosty pyshchevykh produktov. Trebovanyia ko vsem orhanyzatsyiam v tsepy prouzvodstva y potreblenyia pyshchevykh produktov, 32.
2. DSP 4.4.4.090-2002 Derzhavni sanitarni pravyla dlia pidpryemstv, yaki vyrobliaiut roslynni olii: Postanova MOZ Ukrainy vid 31.05.2002, 21.
3. Dzhailz, D., Bruks, D., Sabsai, O. Yu. (2006). Proyzvodstvo upakovky yz PET, Moscow: Professyia, 368.
4. Podrushniak, A. E., Prodanchuk, N. H., Hortseva, L. V., Shunova, T. V. (2004). Bezopasnost yspolzovanyia polymernykh materyalov dlia upakovky pushchevykh produktov, produkty y ynhredyenty, 54–55.
5. Report on Packaging Materials (2000). Polyethylene Terephthalat (PET) for food Packaging Application, International Life Sciences, 12.
6. Diethylhexyl phthalate (1992). Environmental Health Criteria, 131.
7. Hubert, W. W., Grasl-Kraupp, B., Schulte-Hermann, R. (1996). Hepatocarcinogenic potential of di(2-ethylhexyl)phthalate in rodents and its implications on human health, Critical Reviews in Toxicology, 26 (4), 365–481. doi: 10.3109/10408449609048302
8. Yakist vody. Vyznachennia pevnykh ftalativ metodamy hazovoi khromatografii ta mas-spectrometrii (2012). DSTU ISO 18856 [Chynnyi vid 2013-07-01]. Kyiv: Derzhspozhyvstandart Ukrainy, 37
9. Mu 4259-87 (1987). Ynstruktsyia po sanytarnitarno-khymycheskomu yssledovanyiu yzdelyi yz polymernykh materyalov, dlia yspolzovanyia v khoziaistvenno-putevom vodosnabzhenyy y vodnom khoziaistve, Moscow, 35–36.
10. Levchuk, Y. V., Kyshchenko, V. A., Tymchenko, V. K. (2013). Optymyzatsyia uslovyi opredelenyia ftalatov metodom hazozhydkostnoi khromatomass-spektroskopyy – put k reshenyiu ekolohotekhnologycheskoi problemy maslozhyrovoi otrasly, Maslozhyrovoi kompleks, Dnepropetrovsk: YA «Ekspert-Ahro», 4 (43), 40–43.
11. Levchuk, Y. V., Kyshchenko, V. A., Oseyko, M. I. (2014). Obosnovanye metodolohyy vyiavlenyia ftalatov metodom hazozhydkostnoi khromatomass-spektroskopyy, Maslozhyrovaia otrasl: Tekhnolohyy y rynok: materyaly VII mazhdunarodnoi nauchno-tekhnycheskoi konferentsyy, Kyev, Kharkov: UkrNYYMZh NAAN, 42.

DYNAMIC BAYESIAN MODELLING FOR RADIONUCLIDE SOIL-TO-PLANT TRANSFER (p. 32-37)

Iryna Zagirska, Petro Bidyuk, Dmytro Levin

The study is aimed at estimating and forecasting the transfer coefficient of radionuclides from soil to agricultural plants based on the real data collected in the areas affece by the Chornobyl disaster. The model was developed using a dynamic Bayesian network, which is an element of novelty, since the use of this tool for radio-ecological modelling was not previously carried out. The problem considered in this study is of a high priority, since the human body internal exposure is mainly caused by the presence of contaminated plants on the lower level of the food chain, and mathematical modeling of the process is not common in general. The factors affecting the radionuclide transfer coefficient were analyzed, and the dependencies transfer level change were identified, depending on the humidity, acidity, soil type, depth of the root system, the content of K + and 2Ca +. Dynamic approach allows tracking changes of plant contamination over 80 months with a time step equal to 1 month. Junction tree algorithm was used for inference, as the network consists both of continuous and discrete nodes. The results obtained demonstrate the high accuracy in accordance with general criteria: the standard deviation does not exceed 10^{-3}, mean absolute percentage error does not exceed 5 % for all measurements, the variance is close to zero, that justifies the use of dynamic Bayesian network to solve this problem.

Also the possibility of this approach usage while solving problems of the same calss in general was considered. The model allows creating long-term scenarios to identify the possible ways of agriculture development over the areas affected by the Chornobyl disaster and similar anthropogene disasters.

Keywords: radionuclide contamination, dynamic Bayesian network, probabilistic inference.

References

1. De Cort, M., Dubois, G., Fridman, S. D. et al. (1998). Atlas on the caesium deposition across Europe after the Chernobyl accident. Office for Official Publications of the European Communites, Brussels, Belgium & Luxembourg.
2. Hrabovskyy, V. A., Dzendzelyuk, O. S., Kushnir, O. S. (2009). Monitoring of radionuclide contamination of plants in the western part of Volyn Polissya (Ukraine) during 1994–2007. Radioprotection, 44 (5), 639–645. doi: 10.1051/radiopro/20095118
3. Environmental protection in Ukraine 1994-1995 (1997). Kyiv, Rayevsky publishing, 95.
4. Baryakhtar, V. G. (Ed.) (1995). Chornobyl disaster. Kyiv, Naukova dumka, 560.
5. Ciuffo, L., Belli, M., Velasco, H., Sansone, U. (2003). 137Cs and 40K soil-to-plant transfer Process in Semi-natural: Grassland. Assessment of its Impact on Human Food Chain. Journal of Radiation Research, 44 (3), 277–283. doi: 10.1269/jrr.44.277
6. Priester, B. S., Omelyanenko, N. P., Perepelyatnykova, L. V. (1990). Radionuclide migration in the soils and transfer of them to plants in Chornobyl accident area. Soil science, 10, 51–60.
7. Rahman, M. M., Rahman, M., Koddus, A., Ahmad, G. U. (2007). Transfer of radiocaesium from soil to plant by field experiment. Journal of Biological Sciences, 7 (4), 673–676. doi: 10.3923/jbs.2007.673.676
8. Prister, B. S., Perepelyatnikova, L. V., Ivanova, T. N., Vynogradskaya, V. D., Kalinenko, L. V., Grytsjuk, N. R., Rudenko, V. A., Perepelyat-

nikov, G. P., Pojarkov, V. A. (2003). The Classification of Ukrainian soil systems on the basis of transfer factors of radionuclides from soil to reference plants. Classification of soil systems on the basis of transfer factors of radionuclides from soil to reference plants. Proceedings of a final research coordination meeting organized by the Joint FAO/IAEA Programme of Nuclear Techniques in Food and Agriculture and held in Chania, Crete.
9. Handl, J., Sachse, R., Jakob, D., Michel, R., Evangelista, H., Gonçalves, A. C., de Freitas, A. C. (2008). Accumulation of (137)Cs in Brazilian soils and its transfer to plants under different climatic conditions. Journal of Environmental Radioactivity, 99 (2), 271–287. doi: 10.1016/j.jenvrad.2007.07.017
10. Sanzharova, N., Spiridonov, S., Kuznetzov, V., Isamov, N., Fesenko, S., Belova, N. (2003). The classification of Russian soil systems on the basis of transfer factors of radionuclides from soil to reference plants. Classification of soil systems on the basis of transfer factors of radionuclides from soil to reference plants. Proceedings of a final research coordination meeting organized by the Joint FAO/IAEA Programme of Nuclear Techniques in Food and Agriculture and held in Chania, Crete, 139–144.
11. Djingova, R. (2003). Influence of soil acidity on the transfer od caesium 137 and other radionuclides from soil to reference plants. Classification of soil systems on the basis of transfer factors of radionuclides from soil to reference plants. Proceedings of a final research coordination meeting organized by the Joint FAO/IAEA Programme of Nuclear Techniques in Food and Agriculture and held in Chania, Crete, 51–58.
12. Orlov, O. O., Korotkova, O. Z. (2000). Peculiarities of the season dynamics of ^{137}Cs accumulation by the phytomass of blackberry (Vaccinium murtillus L.) and cowberry (Vaccinium vitis-idaea L.). Naukovi visti, Lviv, UkrDLTU, 10.2, 34–43.
13. Zarubina, N. (2002). Peculiarities of accumulation of gamma-radiation radionuclides by the macromycetes on the territory of the alienation zone and the "southern trace" after Chornobyl disaster. Kyiv, KNU, 20.
14. Krasnov, V. P. (1998). Radioecology of Ukrainian Polissya. Zhytomyr. Volyn, 112.
15. Murphy, K. A Brief Introduction to Graphical Models and Bayesian Networks. University of British Columbia, Faculty of Science. Available at: http://www.cs.ubc.ca/~murphyk/Bayes/bayes.html/ (Last accessed: 07.07.2007).
16. Zgurovskyi, M. Z., Bidyuk, P. I., Terentyev, O. M. (2007). System methodics of designing BN. Kyiv, Naukovi visti NTUU "KPI", 4, 47–61.

RESEARCH ON THE AMINO ACID COMPOSITION IN SEMI-SMOKED SAUSAGES CONTAINING LENTILS, JUNIPER AND THYME (p. 38-43)

Irina Markovych

The paper deals with the possibilities of using vegetable raw materials in the meat processing industry. The study presents recipes of smoked sausages, specifies the amino acid composition, analyzes the amino acid score, and reveals the indicators of the biological value of proteins in new types of semi-smoked sausages that contain the flour of lentil sprouts and non-germinated lentils as well as spicy and aromatic plants with the aim of putting them into production.

Semi-smoked sausages show an increase in the amount of essential amino acids by 2.146 mg/100 g (sample 1) and by 1.217 mg/100 g (sample 1.1) in comparison with the reference sample. An increase in the amount of essential amino acids is observed in all the samples: 2.216 mg/100 g (sample 2), 0.728 mg/100 g (sample 2.1), 2.766 mg/100 g (sample 3), and 1.722 mg/100 g (sample 3.1) in comparison with the reference sample.

Semi-smoked sausages also demonstrate a significant increase in the use of the limited amino acid valine: by 2.81 % in sample 1, by 5.63 % in sample 1.1, sample 2, and sample 3.1, and by 4.22 % in sample 3. The amino acid score of the majority of amino acids in semi-smoked sausages is optimal. All products also contain a significant amount of lysine. In semi-smoked sausages with the use of non-germinated lentil flour, the amino acid score of methionine+ cystine grows from 1.73 % to 7.82 % in comparison with the reference sample. In semi-smoked sausages with the use of lentil sprouts flour, the amino acid score of fenilalanin + tyrosine grows from 7.29 % to 10.94 % in comparison with the reference sample.

Amino acids contained in semi-smoked sausages are readily absorbed by the body: the KRAS of samples 1.1-3.1 is 14.38 %, 16.72 %, and 8.63 % lower than that of samples 1–3. The biological value of such sausages is also higher than of the reference sample—by 0.5 % in sample 1.1 and by 1.2 % in sample 2.1. The highest rate of comparable redundancy was found in the reference sample, which is 1.78 %. In semi-smoked sausages with lentil sprouts flour, it is by 4.73 % and 9.46 % lower in comparison with sample 1; it is by 5.05 %, 9.5 %, and 14.04 % lower in the research samples than in the reference sample. In semi-smoked sausages with non-germinated lentil flour, this indicator is also lower than in the reference sample—by 10.6 % (sample 2.1.).

It has been found that the substitution of raw meat with lentil sprouts flour in an amount of 1.5 to 2.0 kilos per 100 kilos of raw meat is expedient and it raises the energy value of the new types of semi-smoked sausages.

Keywords: raw product, plant, lentil, juniper, thyme, recipes, sausages, composition, amino acids, value.

References

1. Konovalov, K. L., Shulbaeva, M. T. (2008). Rastitel'nye pishhevye kompozity dlja proizvodstva kombinirovannyh produktov. Pishhevaja promyshlennost', 7, 8–10.
2. Maksimov, I. A., Kurchaeva, E. E., Manzhesov, V. I. (2009). Puti racional'nogo ispol'zovanija rastitel'nogo syr'ja pri proizvodstve funkcional'nyh produktov. Sovrem. naukoemk. tehnol, 4, 20–22.
3. Komissarova, V. V. (2009). Novye vidy pishhevyh volokon dlja mjasnyh produktov. Mjas. industrija, 5, 54–55.
4. Bruno, Zh. (2007). Gorohovyj belok: luchshe, chem prosto funkcional'naja dobavka. Mjas. industrija, 10, 40–41.
5. Beljakina, N. E., Ustinoa, A. V., Morozkina, I. K., Surnina, A. I., Prjanishnikova, V. V., Il'tjakov, A. V. (2007). Strukturno-mehanicheskie i sorbcionnye svojstva nerstvorimyh pishhevyh volokon. Mjas.industrija, 10, 71–75.
6. Mikulovich, T. P. (Ed.) (1991). Rastitel'nyj belok. Moscow: Agropromizdat, 684.
7. Pietrasic, Z. Janz, J. A. M. (2010). Utilization of pea flour, starch-rich and fiber-rich in low fat bologna. Food Res. Int., 2, 602–608. doi: 10.1016/j.foodres.2009.07.017
8. Lisicyn, A. B., Krylova, V. B., Gustova, T. V., Novikova, O. N. (2007). Tehnologija poluchenija rastitel'-mjasnyh jekstrudatov. Mjas. tehnol., 12, 36–38.
9. Pasichnij, V. N. (2010). Rozshirenija primenenija bobovyh v proizvodstve kombinirovannyh mjasoproduktov. Mjasnoe delo, 4, 26–27.
10. Antipova, L. V., Glotova, I. A., Astanina, V. Ju., Kiljakova, O. B. (1998). Fiziko-himicheskie i funkcional'nye svojstva chechevichnoj muki v mjasnyh produktah. Izvestija vuzov. Pishhevaja tehnologija, 5-6, 11–13.
11. Paska, M. Z., Markovich, I. I. (2013). Mozhlivist' vikoristannja prjano-aromatichnih roslin u tehnologiï napivkopchenih kovbas jak al'ternativi harchovim dobavkami. Jakist' i bezpeka harchovih produktiv». Kiev, 124–126.
12. Paska, M. Z., Markovich, I. I. (2013). Doslidzhennja vmistu toksichnih elementiv v sochevici i prjano-aromatichnih roslinah ta u viroblenih napivkopchenih kovbasah z ïh dodavannjam. Naukovi praci ONAHT, 44 (2), 185–189.
13. Mielnik, Maria B., Signe, Sem, Bjorg, Egalandsdal (2008). By-products from herbs essential oil production as ingredient in marinade for turkey thighs. Skrede Grete LWT-Food Sci. and Technol, 41 (1), 93–100. doi: 10.1016/j.lwt.2007.01.014
14. Patent Rosijs'koï Federacië na vinahid № 12487578 A23L1/317 (2006). Data prioritetu 17.01.2012, opublikovano 20.07.2013, Federal'noe gosudarstvennoe obrazovatel'noe uchrezhdenie vysshego professional'nogo obrazovanija "Gorskij gosudarstvennyj agrarnyj universitet" Sposob proizvodstva syrokopchenyh kolbas.
15. Molochnikov, V. V., Trubina, I. A., Sadovoj, V. V., Shhlykov, S. N. (2008). Ispol'zovanie fitopreparatov v recepturnyh kompozicijah mjasnyh produktov. Pishh. Prom-st', 6, 64, 89.

THE USE OF EMULSIFIERS IN THE TECHNOLOGIES OF MEAT PRODUCTS (p. 44-49)

Natalia Murlykina, Marina Yancheva

The role of emulsifiers in the formation of stable meat emulsions is theoretically grounded. An analytical review of the Ukrainian market of food emulsifiers for meat products is done and a background for the development of domestic emulsifiers with the improved properties and composition is determined.

The authors obtained new domestic emulsifiers of acylglycerine origin as the oil phase with mono- and diacylglycerines of fatty acids according to the scientifically grounded process of variables of transesterification of sunflower oil in the hexane-isopropanol system at a temperature of 35...40 °C.

The regularities in formation of functional and technological properties of forcemeats under the influence of emulsifiers of acylglycerine origin were determined. The improvement of these properties allows ensuring a high level of structural and mechanical, organoleptic properties, yield of ready products.

It was experimentally proved that the developed emulsifiers of acylglycerine origin allowed ensuring high consumer properties of the new products satisfying the needs of business in the branch with domestic MAG, DAG in which the essential biologically active components were conserved and thermal-oxidative processes were decelerated.

Application of the developed emulsifiers opens the possibilities of rational use of raw materials and involvement of raw meats with an increased content of fat and moisture, poor functional and technological properties into technological process.

Keywords: meat emulsion, emulsion structure, stability, emulsifiers of acylglycerine origin, competitive adsorption.

References

1. Nollet, L. M. L., Toldrá F. (2006). Advanced technologies for meat processing. CRC Press, Cambridge England, 483. doi: 10.1201/9781420017311
2. Kerry, J., Kerry, J., Ledward, D. (2002). Meat processing: Improving quality. CRC Press, Cambridge England, 435. doi: 10.1201/9781439823163
3. Nollet, L. M. L., Toldra, F. (2009). Handbook of Muscle Foods Analysis. CRC Press, 743–745.
4. Sagalowicz, L., Leser, M. E., Watzke, H. J., Michel, M. (2006). Monoglyceride self-assembly structures as delivery vehicles. Trends in Food Science & Technology, 17 (5), 204–214. doi:10.1016/j.tifs.2005.12.012.
5. McKenna, B. M. (2003). Texture in food. Vol. 1: Semi-solid foods. Woodhead Publishing Limited, Cambridge England, 425. doi: 10.1201/9780203501276
6. Akoh, C. C., Min, D. B. (2008). Food lipids: Chemistry, Nutrition, and Biotechnology. CRC Press, 700, 726–728.
7. Murlykina, N. V., Yancheva, M. O., Upatova, O. I. (2012). Rehuliuvannia parametriv pereesteryfikatsii soniashnykovoi olii z metoiu oderzhannia emulhatoriv dlia miasnykh vyrobiv emulsiinoi struktury, Progresyvni technica ta technologii harchovyh vyrobnytstv: zbirnik naukovyh prats KhDUKhT, 2(16), 34–42.
8. Antipova, L. V. (2001). Metody issledovaniya myasa i myasnykh produktov. Kolos, Moscow, 236–237.
9. Horalchuk, A. B., Pyvovarov, P. P., Hrynchenko, O. O. (Eds.) (2006). Reolohichni metody doslidzhennia syrovyny ta kharchovykh produktiv ta avtomatyzatsiia rozrakhunkiv reolohichnykh kharakterystyk: metod. Posibnyk, KhDUKhT, Kharkiv, 63.
10. Hasenhuettl, G. L., Hartel, R. W. (2008). Food Emulsifiers and Their Applications. Professiya, Sankt-Peterburg, 156–169.
11. Sarafanova, L. A. (2007). Primenenie pishchevykh dobavok v pererabotke myasa i ryby. Professiya, Sankt-Peterburg, 35, 107.
12. Shubina, G. (2008). Mirovoy rynok ingredientov dlya myasnoy promyshlennosti, Products & Ingredients, 1, 63.
13. Demidov, I. N., Belous, O. V. (2010). Poluchenie poverkhnostno-aktivnykh veshchestv metodom pereeterifikatsii etilovykh efirov molochnoy kisloty s podsolnechnym maslom, Visnyk Natsionalnoho tekhnichnoho universytetu "Kharkivskyi politekhnichnyi instytut", 44, 42–48.
14. Yong-Ching, Y., Vali, S. R., Yi-Hsu, Ju. (2003). A Process for Synthesizing High Purity Monoglyceride, J. Chin. Inst. Chem. Engrs., 34 (6), 617–623.
15. Chetpattananondh, P., Tongurai, C. (2008). Synthesis of high purity monoglycerides from crude glycerol and palm stearin, Songklanakarin J. Sci. Technol, 30 (4), 515–521.

DEVELOPMENT OF PROTECTIVE PROTEIN EMULSION TECHNOLOGY FOR MECHANICALLY DEBONED POULTRY MEAT (p. 50-54)

Vyacheslav Onishchenko, Nataliya Grynchenko, Viktoria Bolshakova

Using mechanically deboned poultry meat (MPMO) to sell as mincemeat or recipe ingredient has a number of negative aspects that lie in the oxidation and microbiological stability reduction, caused by production factors and biochemical properties of such raw product as a result of the transition of bone marrow lipids and hemoproteins. On this basis, the paper is aimed at using protective protein emulsions (PPE) that contain mostly natural components and allow to some extent eliminate the negative impact of phospholipid compounds, heme pigments and so on. The results of the design and scientific substantiation of technological solutions that allow to increase the functional and technological and improve consumer properties of mechanically deboned poultry meat (chicken) by adding the PPE, protein preparation from pork skin ScangelA95, sodium ascorbyl palmitate antioxidant are given in the paper. It was found that introducing the proposed PPE leads to increased shear stress limit, reduced intensity of a specific dirty red color of MDPM towards pale red and pink, approximating color to characteristic for minced chicken from shin muscles, loss of gloss and matte appearance, improved mincemeat stability, which lies in reduced oxidation product formation intensity.

Keywords: mechanically deboned poultry meat, protective protein emulsion, functional and technological properties.

References

1. Antipova, L. V., Poljanskih, S. V., Kalachev, A. A. (2009). Tehnologija i oborudovanie pticepererabatyvajushhego proizvodstva. SPb.: GIORD, 512.
2. Mitrofanov, M. S., Shumkov, E. G. (1990). Pererabotka pticy. Moscow: Agropromizdat, 272.
3. Sjems, R. A. (2007). Pererabotka mjasa pticy. SPb.: Professija, 432.
4. Nikitchenko, D. V., Jacjuta, M. A., Nikitchenko, V. E., Perevozchikova, V. N. (2012). Ocenka kachestvennyh pokazatelej mjasa pticy mehanicheskoj obvalki. Mjasnaja industrija, 4, 62–63.
5. Gonockij, V. A., Fedina, L. P., Hvylja, S. I.; Davleeva, A. D. (Ed.) (2004). Mjaso pticy mehanicheskoj obvalki. Moscow: DeLiprint, 200.
6. Semenysheva, A. I. (2010). Tehnologija rublenyh polufabrikatov s ispol'zovaniem mjasa pticy mehanicheskoj obvalki. Mjasnaja industrija, 10, 21–23.
7. Alehina, L. T., Bol'shakov, A. S., Boreskov, V. G.; Rogova, I. A. (Ed.) (1988). Tehnologija mjasa i mjasoproduktov. Moscow: Agropromizdat, 576.
8. Abaldova, V. A. (2010). Povyshenie gigienicheskoj bezopasnosti mjasa pticy mehanicheskoj obvalki. Mjasnaja industrija, 9, 72–74.
9. Clark, E. M., Mahoney, A. W., Carpenter, C. E. (1997). Haem and total iron in ready-to-et chicken. Journal of Agricultural and Food Chemistry, 45 (1), 124–126. doi: 10.1021/jf960054l
10. Igene, J. O., Yamauchi, K., Pearson, A., Groxy, J. (1985). Mechanism by which nitrite inhibits the development of warmed over flavour in cured meat. Food Chemistry, 18, 1–18. doi: 10.1016/0308-8146(85)90099-8
11. Jancheva, M. O., Krajnjuk, L. M., Skurihina, L. A., Dromenko, O. B. (2010). Vykorystannja kolagenomistkoi' syrovyny m'jasnoi' promyslovosti: monografijz. Kharkiv: Hark. derzh. un-t harchuvannja ta torgivli, 148.
12. Goral'chuk, A. B., Pyvovarov, P. P., Grynchenko, O. O., Pogozhyh, M. I., Polevych, V. V., Gurs'kyj, V. P. (2006). Reologichni metody doslidzhennja syrovyny i harchovyh produktiv ta avtomatyzacija rozrahunkiv reologichnyh harakterystyk. Kharkiv: Hark. derzh. un-t harchuvannja ta torgivli, 63.
13. Abdrahmanov, R. N., Gurinovch, G. V., Kudrjashov, L. S. (2011). Izmenenie kachestva mjasa pticy mehanicheskoj obvalki pri holodil'nom hranenii. Mjasnaja industrija, 9, 42–45.
14. Krzywicki, K. (1982). The determination of haem pigment in meat. Meat Science, 7 (1), 29–36. doi: 10.1016/0309-1740(82)90095-x

DEVELOPMENT OF NANOTECHNOLOGY OF FINE-DISPERSED ADDITIVES WITH THE USE OF CRYOGENIC MECHANICAL MODIFICATION (p. 54-58)

Raisa Pavlyuk, Viktoriya Pogarska, Olexandr Bessarab, Katerina Balabai, Alina Borysova, Svitlana Loseva

Nanotechnologies of fine-dispersed additives based on topinambour in the form of frozen puree and freeze-dried powder with the use of cryogenic mechanical modification particularly cryogenic «shock» freezing and low-temperature mechanical grinding

is proposed and developed. A unique new technology allows to get additives and food products containing record amount of fructose in free condition: 50–55 % of inulin is transformed into easily digestible fructose in free condition that reduces glycemic index and the immune system reinforcement. Simultaneously cellulose and protein destruction and degradation occur: 50 % of cellulose is transformed into its monomers – glucose and 50 % of protein is destroyed to separate free amino acids. It is also established that mechanical and cryogenic destruction, accompanying «shock» freezing and fine-dispersed grinding of topinambour, allows both to save all biologically active supplements such as phenolic compounds, ascorbic acid, tannins etc. and free-out them from the bound complexes with biopolymers or associates transforming them to free condition (their amount increases 1,7–2,2 times comparing with the original raw materials). It allows to cook product with new chemical composition and excellent consumer properties.

Keywords: nanotechnologies, «shock» freezing, low-temperature grinding, cryogenic destruction, mechanical activation, topinambour, inulin, additives.

References

1. Pavlyuk, R. Yu. (1994). Development of technology of canned vitaminous phytonutrients and their use in food products of preventive action [Razrabotka technologii konservirovannih vitaminnih fitodobavok i ih ispolzovanie v produktah pitaniya profilakticheskogo deistviya], Odessa, ONAFT, 446.
2. Kochnev, N. K., Kalinichenko, M. V. (2002). Topinambur – biojenergeticheskaja kul'tura HHI veka. Moscow: Ares, 150.
3. Pavlyuk, R., Pogarskaya, V., Janickiy, V., Pavlyuk, V., Sokolova, L., Korobets, N., Maximova, N. (2013). Merchandizing and innovative technologies for processing of drug-technical herbal raw materials. Kharkov State University of Food Technology and Trade; Kharkov Trade and Economic Institute of Kyiv National Trade and Economic University Kharkov, 429.
4. Pavlyuk, R., Pogarskaya, V., Timofeeva, N., Maximova, N., Berestova, A., Borisenko, T. (2013). Nanotechnologies of frozen puree based on citrus fruits with unique features. Progressive technique and technologies of food production in trade and catering industry: Collected papers. Kharkov State University of Food Technology and Trade. Kh., 1 (17), 27–35.
5. Reshetnik, L. A., Ladodo, K. S., Prokop'eva, O. V., Kochnev, N. K. (1998). Topinambur – vozmozhnosti ego ispol'zovanija v lechebnom pitanii detej. Voprosy pitanija, 1, 18–21.
6. Chernenko, A. V., Altun'jan, M. K., Kubyshkina, N. A. (2010). Perspektivnye napravlenija v tehnologii pererabotki topinambura. Izvestija vuzov. Pishhevaja tehnologija, 5-6, 39–41.
7. Kauhcheshvili, Je. I. (1980). Sublimacija, kriobiologija, primenenie holoda v medicine. Obzor dokladov na zasedanii komissii MIH "Holodil'naja tehnika", 6, 58–60.
8. Almashi, Je., Jerdeli, L., Sharoj, T. (1981). Bystroe zamorazhivanie pishhevyh produktov. Moscow: Legkaja i pishhevaja prom-st', 408.
9. Barambojm, N. K. (1978). Mehanohimija vysokomolekuljarnyh soedinenij. Moscow: Himija, 384.
10. Dubinskaja, A. N. (1989). Mehanohimija lekarstvennyh veshhestv. Him.-farm. zhurnal, 6, 755–764.

DEVELOPMENT OF FUNCTIONAL HEALTH NANODRINKS BASED ON MILK WHEY (p. 59-64)

Raisa Pavlyuk, Viktoriya Pogarska, Tatyana Abramova, Adelina Berestovaya, Svitlana Loseva

The aim of scientific work is the development of the recipe, experimental objectivation of technological regimes, process flowsheet and technology of new drinks based on whey with the use of fine-dispersed frozen additives containing pumpkin, sea buckthorn, bananas in the nanostructured puree form, and also phytoextracts based on natural spices; studying the content of biologically active substances in the new drinks in comparison with analogues; studying quality of the drinks during the storage; development of regulatory documentation; approbation of the new drinks in industrial environment.

Technology and technological process regimes of new types of milk-herbal drinks based on whey are developed and scientifically explained. The new drinks differ from the traditional ones by the addition of frozen fine-dispersed fruit and vegetable additives into the boiling sugar syrup.

Simultaneously defrostation and thermal processing of fruit and vegetable raw materials occur which guarantee the fullest preservation of biologically active and aromatic substances, conservation of natural flavor.

It is found that the drinks have stable homogeneous consistency which does not separate due to the fact that the introduction of additives from pumpkin, buckthorn and bananas have the properties of structurants and thickeners. The results were confirmed by IR spectroscopic analysis, which demonstrated that new lactic herbal drinks are 2 times longer stored and the content of BAS such as ascorbic acid, phenol compounds, tannins, pectin, essential amino acids, etc. Exceed the known analogues and possess potential immunomodulatory properties. Thus, they can be referred to as health products recommended for healthy diet.

On the basis of the results was made possible development of the Scientific Research Project on nanostructured frozen puree. New types of drinks were degustated and approbated in industrial environment of Kharkov (Ukraine): Ltd "Bogodukhov milk factory" Ltd SUIS "Polyus Ltd".

Keywords: milk whey, nanostructured additive, cryogenic puree, phytoextract, pumpkin, sea buckthorn, nanodrinks, thickener.

References

1. Pavljuk, R. (2003). The new generation of dairy products for increasing immunity [Nove pokolinnja molochnih produktiv u pidvishhenni imunitetu] Advanced energy saving technologies and economic justification in food service. The economic problems of trade, Part 1 (2), 93–99. [in Ukraine]
2. Kaprel'janc, L., Iorgachova, K. (2003). Functional Foods [Funkcional'nye produkty]. Odesa: Druk, Ukraine, 312. [in Ukraine]
3. FAO/WHO (1992). Nutrition 21. Global problems. International Conference on Nutrition, 3.
4. FAO/WHO (2012). Policy measures to ensure food security in the region: problems and prospects – Food Forecast to 2050. Twenty-eighth FAO Regional Conference for Europe, 25.
5. Tutelyan, V. (2004). Food and health [Pitanie i zdorov'e], Food Processing Industry, 6–7. [in Ruussian]
6. Osipova, L. (2007). Scientific and practical substantiation and development of technology of canned functional beverages [Nauchno-prakticheskoe obosnovanie i razrabotka tehnologi konservirovannyh funkcional'nyh napitkov], 377. [in Ruussian]
7. Pavljuk, R., Pogarskaya, V., Loseva S., Glubokij D., Matsipura A., Berestovaya, A., Maximova, N. (2010). Nanotechnology of frozen cryopastes of fruit and vegetables with unique characteristics – additives for functional dairy products [Nanotehnologiї zamorozhenih kriopast iz plodiv ta ovochiv z unikal'nimi harakteristikami – dobavok dlja funkcional'nih molochnih produktiv]. MOLOKOpererobka, 1, 24–30. [in Ukraine]
8. Dyakova, T. (1998). Merchandise estimate and investigation of the antioxidant properties of medicinal plant phytonutrients and their use in products of preventive actions [Tovarovednaja ocenka i issledovanie antioksidantnyh svojstv fitodobavok iz lekarstvennogo syr'ja i ih ispol'zovanie v produktah profilakticheskogo dejstvija], 250. [in Ruussian]
9. Sergeev, V. (2001). Biologically active plant material in the food industry [Biologicheski aktivnoe rastitel'noe syr'e v pishhevoj promyshlennosti], Pishhevaja promyshlennost', 6, 28–30. [in Ruussian]
10. Yanitckiy, V. (2000). Merchandise estimate of dietary herbal supplements and their use in products radioprotective effect [Tovarovednaja ocenka biologicheski aktivnyh rastitel'nyh dobavok i ih ispol'zovanie v produktah radiozashhitnogo dejstvija], 255. [in Ruussian]