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Харчова хімія	Нанотехнології
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Фізичні властивості харчових продуктів	Автоматизація процесів
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Редакційна колегія

Contents

Using of low-value raw poultry materials

Tetiana Zmiievska, Nina Usatenko, Sergii Verbytskyi

Institute of Food Resources of National academy of agrarian science of Ukraine, Kyiv

Corresponding author:

Tetiana Zmiievska
E-mail:
tanja_sch@bk.ru

Abstract

Introduction. Considering immense yield of broiler chickens skin and its substantial content of protein, up to 3% of this being collagen, it is topical to determine expedience of the skin's use in formulations of meat products.

Materials and methods. Broiler chickens skin and restructured formed products on its base were studied. Active acidity, water binding, water holding and fat holding capacity, fat acids content and rheological parameters of meat products were determined using existing methods.

Results and discussion. Chemical composition of meat and skin of broiler chickens together with sensory, physical, chemical and rheological parameters of restructured formed products of broiler chickens meat with different fat contents were studied. As skin content was increasing from 6% to 15 %, the products' texture improved allowing for the decrease of hardness by 38 % and chewiness by 37 %, unsaturated fatty acids content also rose thus enhancing the biological value of the ready to eat product.

The best sensory and rheological resulting parameters were obtained for the product formulated with 12 % (to the raw meats used, by mass) of skin this complying with the anatomic constitution of carcasses of broiler chickens performed in a natural way. Addition of skin enhances the functional parameters (the value of water holding capacity bigger by 5.6 %, fat holding capacity bigger by 3%) and biological value (monounsaturated and polyunsaturated contents bigger by 2.4 % and by 5.8 % respectively) of the product compared to the control.

Conclusions. It is expedient that restructured formed products of chicken broilers meat are formulated with 12 % of skin.

Introduction

As for today specialists of meat processing industry pay more attention to low-value products of complex poultry processing. We consider such constituent of poultry meat as skin of birds deserving of our profound attention as the said skin's output reaches up to 15 % (of muscle tissue, by mass).

The content of protein in poultry skin is known [1] to be high (up to 21%), the vast part of the said protein being collagen capable to influence the functional properties of myofibril proteins while the concentration of collagen is high. Collagen can cause the decline in dimensions (shrinkage) of ground meat products – especially during high temperature processing, and also can influence binding capacity of meat pieces in formed products [2].

Literature sources [3 - 5] claim that poultry skin's principal use is being a raw material for production of fats. However, according to [6], the skin appeared to have rather high water binding, water holding and gel forming capacity, thus allowing stating it is valuable as raw food material. So taking the rapid development of poultry processing branch and the vast resources of the above said low value raw material into account, research of rational use of skin to manufacture restructured formed products of broiler chickens meat would be expedient.

Aim of the work – study and scientific substantiation of the expediency of broiler chickens skin as a basic raw material to manufacture restructured formed products.

Materials and methods

Contents (by mass) of water, protein and fat in raw broiler chickens meat determined according to standard methods adduced in [7].

Active acidity pH of samples measured by laboratorial ion meter I-160M.

Water binding capacity (WBC) determined by the method of Grau and Hamm modified by Volovinskaya and Kelman [7]

Water holding capacity (WHC) determined by the quantitative content of water held by an experimental sample after its thermal processing [7].

Fat holding capacity (FHC) determined as the difference of the fat content in ground meat and the quantity of fat exuded during the thermal processing [7].

Weighing portion mass values was measured with the use of laboratory scale Adventurer™ AR 3130-5400 of measuring error ±5 mg and«AXIS» AD 50 scale of measuring error ±0.5 mg.

Fatty acids content determined by the method of gas chromatography of methyl esters of fatty acids according to [7].

Sensory evaluation carried out by five-point scale [7].

Rheological parameters (cohesion, hardness, springiness) are measured in this work by electromechanical universal testing machine SANS CMT 2503 manufactured by Shenzhen SANS Testing Co. Ltd. with the use of complex instrumental method TPA (Texture Profile Analysis) [2] by the chart at Fig. 1.
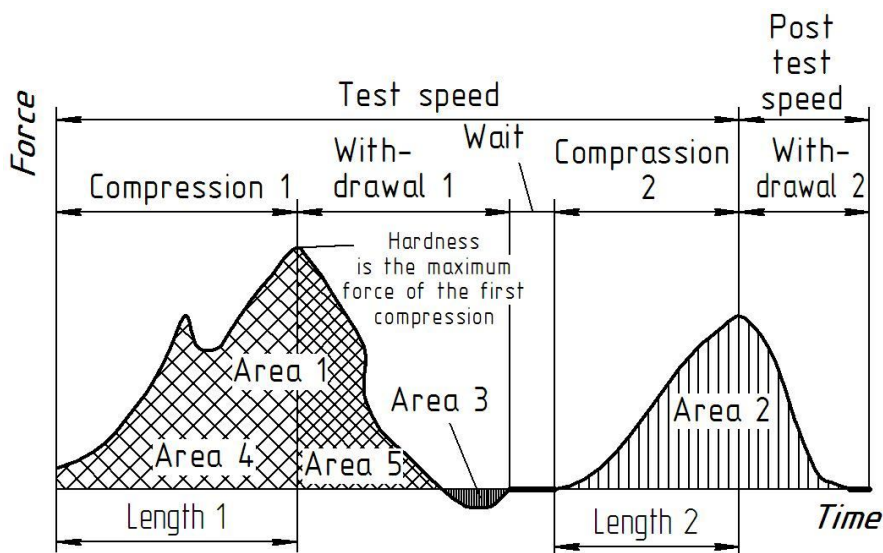
Fig. 1 Determination chart of rheological parameters of an object studied according to TPA method:

a - cohesion – deformation range of experimental sample of a product before its destruction calculated as ratio of the work (Area 2) during the second deformation to the work (Area 1) during the first deformation);

b - hardness, N – maximum force necessary to be applied to deform the product (force of the first compression of the product);

c - springiness – range of the product's recovery after the removal of deformation force – calculated as ratio of Length 2 to Length 1;

d - chewiness, N – work necessary to chew the product in order it is ready to be swallowed – calculated as product of three multipliers: cohesion * hardness * springiness.

Before fulfilling this work, chemical composition of broiler chickens meat and skin was studied (Table 1).

The formulations used to manufacture restructured formed products are adduced in Table 2. Control sample was formulated with the use of broiler chickens meat only according to the production instruction of chicken meat ham. From 6 % to 15 % of muscle tissue was replaced by skin in the experimental samples, this skin being preliminary frozen and comminuted to form a paste according to the novel technology.

Table 1

Chemical composition of broiler chickens meat and skin

Content, %, by mass	Raw materials of broiler chickens:	
	meat	skin
Protein(R)	19.54	11.13 (2.73 – collagen)
Fat(J)	7.07	41.98
Water(W)	72.26	47.37
Ash	0.97	0.78

Formulations of restructured formed products

Raw materials, spices and materials	Samples of restructured formed products				
	Control	**№1**	**№2**	**№3**	**№4**
Raw materials not salted, kg (for 100 kg)					
Broiler chickens meat (pieces)	90	84	81	78	75
Broiler chickens meat ground	10	10	10	10	10
Broiler chickens skin		6	9	12	15
Spices and materials, g (for 100 kg of raw materials not salted)					
Food table salt	2.5	2.5	2.5	2.5	2.5
"Biofos" phosphate	0.3	0.3	0.3	0.3	0.3
Sodium nitrite	0.005	0.005	0.005	0.005	0.005
Ascorbic acid	0.05	0.05	0.05	0.05	0.05
Black pepper ground	0.12	0.12	0.12	0.12	0.12
Fresh garlic ground	0.30	0.30	0.30	0.30	0.30
Water (for 30% brine)	27.0	27.0	27.0	27.0	27.0

Results and discussion

Results of sensory evaluation of ready to eat restructured formed products of broiler chickens meat by five-point scale are adduced in Table 3.

The results of sensory evaluation made it possible to determine that the use of broiler chickens skin in the technology of restructured formed products of broiler chickens meat enhances their texture, tenderness and juiciness. Sample № 3 formulated with the addition of 12 % gained the highest estimate of panelists. Bigger skin content (sample № 4 – 15 % of skin) caused unsatisfactory dense structure in areas, were meat pieces conjunct.

Sensory evaluation of ready to eat restructured formed products of broiler chickens meat by five-point scale

Samples	Sensory parameters					
	Cross-section pattern	**Color**	**Flavor**	**Taste**	**Texture**	**Overall impression**
Control	5.0	5.0	5.0	5.0	4.8	4.96
№1	5.0	5.0	5.0	5.0	4.8	4.96
№2	5.0	5.0	5.0	5.0	4.9	4.98
№3	5.0	5.0	5.0	5.0	5.0	5.00
№4	4.8	4.9	5.0	5.0	4.6	4.86

The results of sensory evaluation correlate with the results of rheological research illustrated by Fig. 2. Product № 3 is the most tender, its hardness being by 38 % and chewiness being by 37 % less compared to the control. The springiness of products, which correlate with the parameters of physical properties (WHC and FHC) studied (Table 4), vary for experimental samples and make, compared to the control: № 1 (– 12 %), № 2 (+ 2.1 %), № 3 (+ 9.6 %), №4 (– 4.7 %).
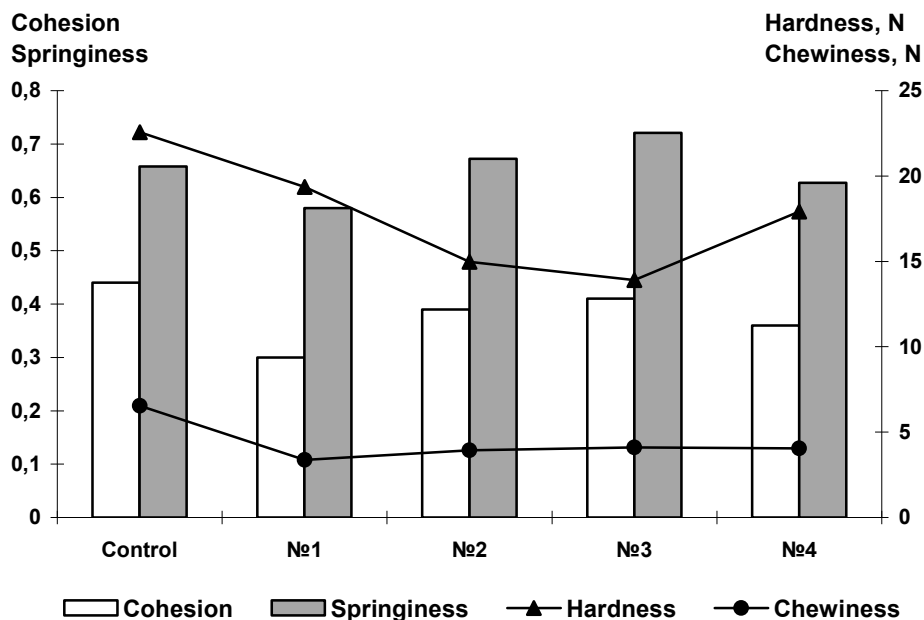
Fig. 2. **Rheological parameters of restructured formed products**

Table 4

Physical and chemical parameters of restructured formed products

Parameters	Samples of restructured formed products				
	Control	№1	№2	№3	№4
Protein content (R), %	16.76	16.16	15.80	15.62	15.42
Fat content (J), %	4.69	6.87	7.84	7.38	8.44
Water content (W), %	74.73	74.25	74.06	74.26	73.08
Water holding capacity, %					
– to product mass WHC_m	54.18	55.75	55.57	56.95	55.06
– to total water WHC_w	71.03	75.46	75.54	76.64	76.30
Fat holding capacity, %					
– to product mass FHC_m	3.22	5.10	5.50	5.29	6.02
– to total fat FHC_j	68.75	70.28	70.24	71.77	71.36
Output of products, %	115.5	115.5	115.6	115.8	114.1

Fatty acids composition of restructured formed products, this composition used to determine their biological value, is adduced in Table 5.

Table 5

Fatty acids composition of restructured formed products, g/100 g of fat

Fatty acids	**Control**	**№1**	**№2**	**№3**	**№4**
Total lipids, %	4.69	6.87	7.84	7.38	8.44
Saturated:	**26.602**	**24.562**	**24.24**	**24.103**	**23.965**
Caprinic ($C_{10:0}$)	0.063	0.044	0.046	0.045	0.037
Undecanic ($C_{11:0}$)	0.006	0.014	0.019	0.005	0.007
Lauric ($C_{12:0}$)	0.069	0.037	0.04	0.048	0.039
Miristic ($C_{14:0}$)	0.553	0.409	0.441	0.448	0.419
Palmitic ($C_{16:0}$)	19.869	17.351	17.59	17.271	17.397
Margarinic ($C_{17:0}$)	0.033	0.255	0.071	0.033	0.072
Stearic ($C_{18:0}$)	5.811	6.134	5.757	5.963	5.679
Arachic ($C_{20:0}$)	0.198	0.318	0.276	0.29	0.315
Monounsaturated:	**35.545**	**35.993**	**35.714**	**36.405**	**36.438**
Palmitoleic ($C_{16:1}$)	3.619	3.271	3.528	3.285	3.399
Oleic ($C_{18:1}$)	31.926	32.722	32.186	33.120	33.039
Polyunsaturated:	**34.306**	**35.808**	**35.511**	**36.284**	**36.458**
Linoleic ($C_{18:2}$) ω-6 т	33.997	35.391	35.103	35.884	36.043
Linolenic ($C_{18:3}$)	0.309	0.417	0.408	0.400	0.415
Other acids	3.54	3.64	4.54	3.25	3.14
Ratio PUFA/SFA	1.29	1.46	1.46	1.50	1.52

The results of the research of restructured formed products' fatty acids contents (Table 5) show that skin content increase from 6% to 15 % causes increase of unsaturated fatty acids, the latter content being an estimate of products' biological value. Thus the ratio of polyunsaturated fatty acids content to the content of saturated ones (≥ 0.3 according to FAO/WHO dietary recommendations for an adult) is 1.46; 1.46; 1.50; 1.52 for samples with skin № 1, № 2, № 3, № 4 respectively – by 15 % bigger than in the control (in average).

Biological value of experimental samples increased compared to the control, especially owing to higher content of such fatty acids as linoleic and linolenic – by 4.4 %, 3.5 %, 5.8 % and 6.3 % for samples № 1, № 2, № 3, № 4 referring to ω-6 fatty acids being of very important functions in human organism – according to [9]. The principal ones of them: promote growth and development of organism, assure functions of cell membranes associated with vitamins B_1 and B_6 exchange, promote immune-protective functions of organism and clearance of

cholesterol residues, prevent from gallstone formation, enhance transport of Na^+ through cell membranes and clearance out of organism.

Hereby the results of research let it assert that the use broiler chickens skin for manufacturing of meat products enhances their biological value, improves rheological characteristics and reduces prime costs.

Conclusions

As the result of the work fulfilled the expediency of the use of skin in the technology of manufacturing of restructured formed products of broiler chickens meat was scientifically grounded. It was determined that the best sensory and rheological resulting parameters were obtained for the product formulated with 12 % (to the raw meats used, by mass) of skin this complying with the anatomic constitution of broiler chickens carcasses performed in a natural way.

The above said technological procedure makes it possible to obtain a high quality meat product, its functional characteristics are better (WHCw values are by 5,6 % bigger, FHCj are by 3 % bigger) and are of higher biological value (the contents of monounsaturated and polyunsaturated fatty acids are bigger by 2,4 % and by 5,8 % correspondingly) than those of control sample.

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Enzymatic antioxidants in tomatoes and sweet bell pepper fruits under abiotic factors

Olesia Priss, Valentina Kalytka

Tavria State Agrotechnological University, Melitopol, Ukraine

Corresponding author:

Olesya Priss
E-mail:
olesyapriss@gmail.com

Abstract

Introduction. In order to maintain normal metabolism in the fruit separated from the mother plant and to protect plant tissues from oxidative damage the complex of high-molecular antioxidants is especially important.

Materials and methods. Fruits of tomatoes and sweet bell peppers grown under field conditions during the 2005-2012 years were studied. Catalase and peroxidase activity was determined by undecomposed rest titration of hydrogen peroxide. SOD activity was determined by its ability to inhibit the reaction of adrenaline auto-oxidation with a modification in the preparation of raw materials. The content of malondialdehyde was determined by thiobarbituric acid method.

Results and discussion. Activities of superoxide dismutase and catalase in both solanaceous vegetables are inversely correlated with the sum of temperatures of fruit development and ripening period. Rainfall induces activity of these enzymes in the pepper fruits, but do not affect on tomatoes.

Peroxidase activity inversely correlates with the sum of temperatures of fruit development and ripening period for both cultures (r=-0,63…-0,69). For tomatoes, from all of the above mentioned antioxidant enzymes, peroxidase is the most dependent upon weather factors. Peroxidase activity is directly dependent on the amount of rainfall during the development and ripening of the fruit for both cultures. Peroxidase activity is also dependent on rainfall of the whole vegetation period for pepper.

Conclusion. The sum of temperatures during fruit development and ripening has determining influence on the activity of antioxidant enzymes in tomatoes and pepper (r=-0,58…-0,76).

Introduction

Normal metabolism in living cells is represented by the set of the strongly connected biochemical processes. One of them is the reactive oxygen species (ROS) production. These short-lived radicals are involved in many physiological functions as well as in a number of pathological processes [1].To maintain the redox balance, the organism synthesizes a complex of high- and low-molecular bioantioxidants, which are able to stabilize the level of ROS. However, under the unfavorable conditions, dynamic balance between ROS and antioxidants (AO) may be perturbed. This leads to the oxidative stress, which is considered to be the root cause of many cardiac, cancer and other diseases. Epidemiological studies confirm that a diet rich in antioxidants is associated with a low incidence of degenerative diseases. Epidemiological studies confirm that a diet rich in antioxidants is associated with a low incidence of degenerative diseases [2]. Significant evidences of the effectiveness of food bioactive compounds in the maintenance of health and prevention of many diseases are the impetus for the antioxidant compounds in fruits and vegetables monitoring.

Complex of tissue antioxidants in solanaceous vegetables includes a strong system of low-molecular compounds [3, 4]. Low-molecular AO intercept free radicals, thus reducing ROS and products of oxidative modification. Formation of the complex of low-molecular antioxidants in solanaceous fruits under the influence of abiotic factors was investigated by many authors [5, 6]. However, to maintain normal metabolism in the fruit separated from the mother plant and to protect plant tissues from oxidative damage, the enzymatic complex of AO is especially important. It is known that resistance to low temperatures during storage and slowing senescence is closely related to the high-molecular antioxidants [7, 8]

Three main enzymes - superoxide dismutase (SOD), catalase (CAT) and peroxidase (PO) - ensure enzymatic system of tissues defense from oxidative damage [9].

SOD is a key enzyme of the first line of antioxidant defense in the cells of all aerobic organisms [10].That is why some authors propose to evaluate the antioxidant properties of plant material by determination of SOD activity [11]. SOD catalyzes dismutation of superoxide radicals. The result of superoxide anions dismutation is hydrogen peroxide. According to that, a group of enzymes, which can utilize hydrogen peroxide is a necessary element of antioxidant defense in plants. In the plant cell these enzymes are catalase and peroxidase that work in the second line of defense. Catalase catalyzes the conversion of H_2O_2 into two molecules of water and O_2 [12]. However, in some cell compartments catalase is almost absent, thus the functioning of other enzymes, which are involved in detoxification of hydrogen peroxide becomes necessary. Peroxidases react with hydrogen peroxide to form oxidation products of the enzyme and water [13].

The activity of antioxidant enzymes of raw fruits and vegetables varies widely and depends on many biotic and abiotic factors [7-10]. The formation of the enzymatic antioxidant complex in tissues of solanaceous fruits under the influence of abiotic factors remains open. Aim of this work was to determine the influence of hydrothermal conditions on the formation of complex of high-molecular antioxidants in fruits of tomato and pepper. To achieve this goal it is necessary to estimate the level of enzyme activity of SOD, CAT and PO for different weather conditions of vegetation period.

Materials and methods

Two cultivars of tomatoes Rio Grande Original (the Rio Grande) and Novachok and two cultivars of bell pepper fruits Nikita F1 and Hercules F1 grown under field conditions in Melitopol district during the 2005 - 2012 years were studied. The amount of temperatures during growing season, the sum of temperatures during fruit development and ripening (30 days before harvest for peppers and 40 for tomatoes), and the Seljanin's hydrothermic coefficient (HC) as an integrated index of hydrothermic parameters were calculated according to meteorological data collected in Melitopol.

Determination of peroxidase activity was conducted by titration of undecomposed rest of hydrogen peroxide in the reaction of pyrocatechol oxidation [Zemljanuhin, A. A. (1985) *Small workshop on Biochemistry* [*Malyj praktikum po biohimii*]]. Catalase activity was determined by titration of the undecomposed rest of hydrogen peroxide with sodium thiosulfate [Hrytsayenko, Z.M. et al. (2003) *Methods of biological and agrochemical research plants and soils* [*Metody biolohichnykh ta ahrokhimichnykh doslidzhen roslyn i gruntiv*]]. SOD activity was determined by estimation of its ability to inhibit the reaction of auto-oxidation of adrenaline in alkaline medium [Sirota T.V. (2000), *A method for determining the antioxidant activity of superoxide dismutase and chemical compounds* [*Sposob opredelenija antioksidantnoj aktivnosti superoksiddismutazy i himicheskih soedinenij*], Russian Federation Patent 2144674] (method was modified in the preparation of raw materials for research). For the measurement of SOD activity to 0,5 g of plant material 5 ml of phosphate buffer pH=7,8 was added and substance was triturated in a mortar with glass (on ice). Next, homogenate was transferred to the centrifuge tubes with 0,3 ml of chloroform and 0,6 ml of alcohol and centrifuged at 8000 rpm. 20 minutes. For spectrophotometric measurements supernatant was used. SOD activity was expressed in conventional units (CU), which show the percentage of inhibition of adrenaline auto-oxidation. The content of malondialdehyde (MDA) was determined by the thiobarbituric method [Musienko, M.M. et al. (2001) *Spectrophotometric methods in the practice of physiology, biochemistry and ecology of plants {ektrofotometrychni metody v praktytsi fiziolohiyi, biokhimiyi ta ekolohiyi roslyn}*].

Results and Discussion

Weather conditions of growing of solanaceous crops during the studies varied in a wide range (Fig 1).

There were hot and dry years (2005, 2007), as well as cool (2009) and moderately moist (2006). Three of the eight years of research (2007, 2009, 2012) can be characterized as a strictly dry as HC was below 0,5 (Tab. 1).

Table 1

Hydrothermic coefficients during growing period of solanaceous vegetables

Number	Fruit	Years of research							
		2005	2006	2007	2008	2009	2010	2011	2012
HC of growing season	pepper	0,87	0,90	0,23	0,34	0,41	0,67	0,58	0,16
	tomato	0,74	0,99	0,22	0,59	0,43	0,76	0,81	0,48
HC of fruit development and ripening period	pepper	0,00	0,80	0,11	0,12	0,41	0,21	0,46	0,07
	tomato	0,06	0,62	0,25	1,03	0,42	0,18	0,85	0,41
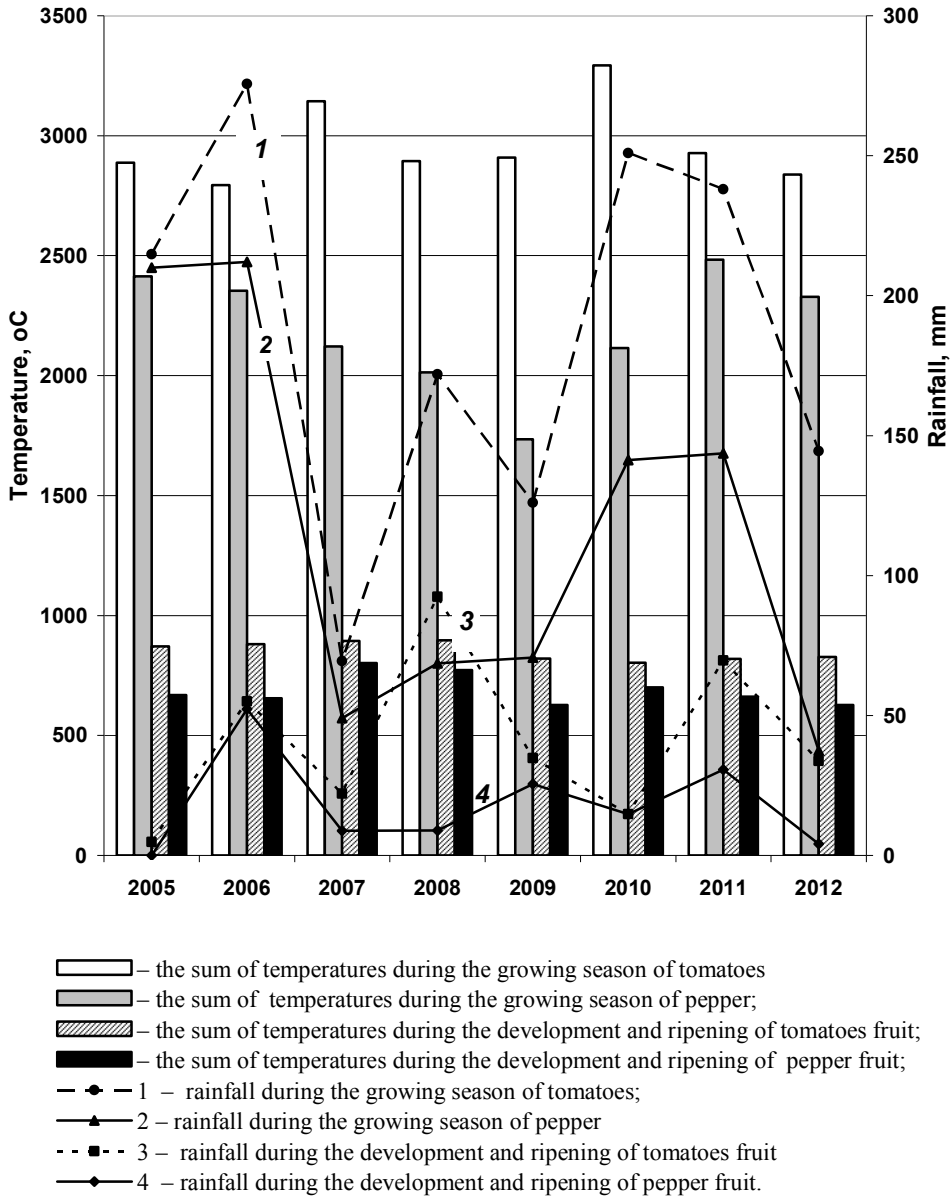
Fig. 1. Weather growing conditions of solanaceous fruits (2005 ... 2012)

HC of solanaceous growing season approached to the optimum only in 2006, reaching to 0,99 for tomatoes and 0,90 for peppers. Other years can be characterized from severely to moderately dry in terms of moistening. During fruit development and ripening it wasn't raining at all (2005 pepper), or it was raining very slightly.

SOD activity in both solanaceous crops during years of research ranged from 72 to 95 CU. Variability of SOD for both tomatoes and pepper was insignificant - variation coefficient didn't exceed 10%. A varietal difference in SOD activity is insignificant for both solanaceous fruit (Fig. 2).
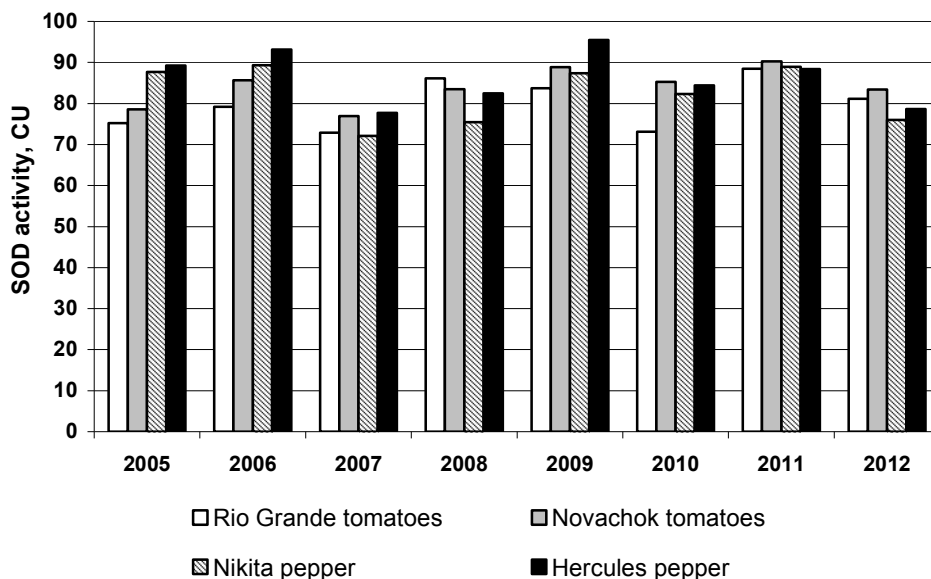
Fig. 2. SOD activity in solanaceous fruits, CU

Maximum of SOD activity was fixed in 2006 and 2009 for peppers and in 2011 for tomatoes. In the same years during fruit development and ripening the minimal sum of temperatures in combination with sufficiently large rainfall was observed. The lowest SOD activity was observed in 2007 in hot and arid conditions (HC = 0,22 ... 0,31).

The analysis of pair correlations confirms the inverse dependence of SOD activity on sum of temperatures during fruit development and ripening of solanaceous crops: r=-0,58; -0,60 (Fig. 3).

Unlike in tomatoes, in peppers SOD activity is closely dependent on other hydrothermal indicators. As shown in Fig. 3, weather factors associated with rainfall induce a SOD activity in fruits of pepper, but have no effect on this enzyme in tomatoes. This fact indicates higher tolerance of studied tomatoes to the lack of moisture and supports the idea of reduced SOD activity in response to drought in sensitive plants [14].

Variability of CAT activity in tomato in years of research was high: *V*=28,54; 28,74 %, while in the fruit of pepper it remained average: *V*= 18,32; 18,67 %. Varietal differences in CAT activity in the fruits of both cultures are insignificant. In the most dry years (2005, HC of fruit development and ripening period 0,06 (see tab. 1)) the activity of CAT in tomatoes is 2-3 times lower than in pepper. In years with sufficient moisture during the period of formation and ripening (in 2008, HC of the period of development and ripening is 1,03) catalase activity is lower than in pepper only by 32 ... 43% (Fig. 4).
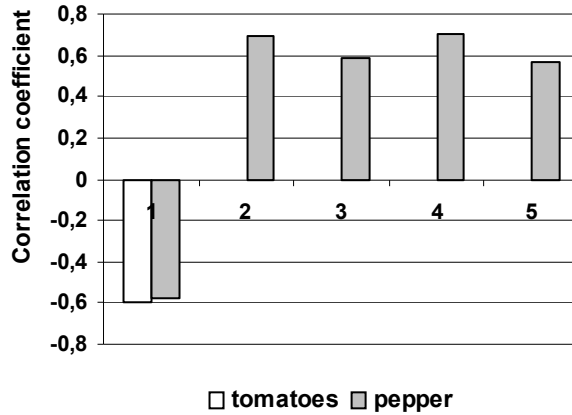
Fig. 3. Significant relationship between weather conditions and the SOD activity in solanaceous fruits, p<0,05:

1 – the sum of temperatures during fruit development and ripening;
2 – rainfall during the growing season;
3 – rainfall during fruit development and ripening;
4 – HC of growing season;
5 – HC of fruit development and ripening period.
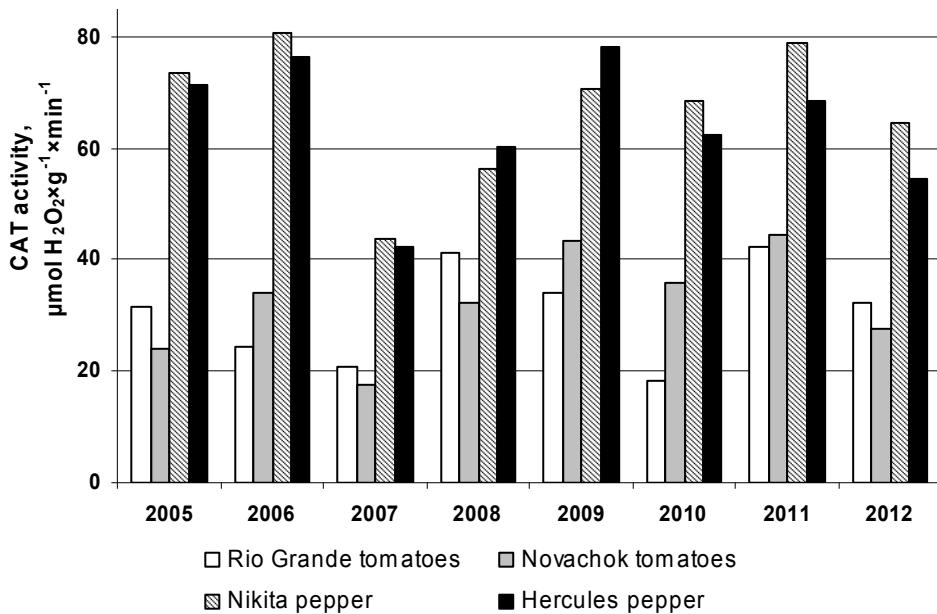
Fig. 4. CAT activity in solanaceous fruits

CAT activity remain low in both solanaceous vegetables in 2007, when HC of growing season and HC of fruit development and ripening period were low. Pepper shows high CAT activity in years with more rainfall during fruit development and ripening period (2006, 2009 and 2011). Maximum of catalase activity in tomato was recorded in 2011, when the sum of temperatures during fruit development and ripening was the lowest.

Analysis of pair correlation dependencies of CAT activity from weather factors allowed us to establish existence of the strong inverse correlation with the sum of temperatures during fruit development and ripening for both cultures: r=-0,65…-0,76 (Fig.5).
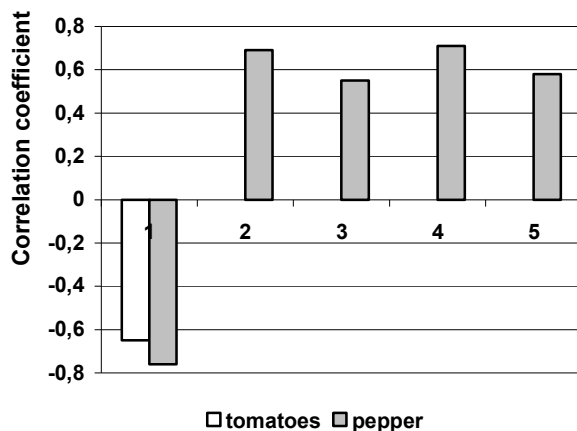
Fig.5. Significant relationship between weather conditions and the CAT activity in solanaceous fruits, p<0,05:
1 – the sum of temperatures during fruit development and ripening;
2 – rainfall during the growing season;
3 – rainfall during fruit development and ripening;
4 – HC of growing season;
5 – HC of fruit development and ripening period.

The CAT activity in pepper closely depends on factors related to the rainfall. Rainfall and HC directly influence the induction of CAT activity in fruits of pepper, but have no effect on this enzyme in tomatoes. As it was noted by some researchers, stress induced by drought causes a decrease in catalase activity in susceptible varieties, but increase in tolerant [15].

Peroxidase activity in solanaceous crops differs significantly. PO activity in tomato is approximately 2.5 times lower than in pepper. The variability of this enzyme is high in both solanaceous fruits (V = 33,73…51,41 %). However, especially significant differences are in Rio Grande tomato cultivar - more than 5 times over the years studies (Fig. 6).
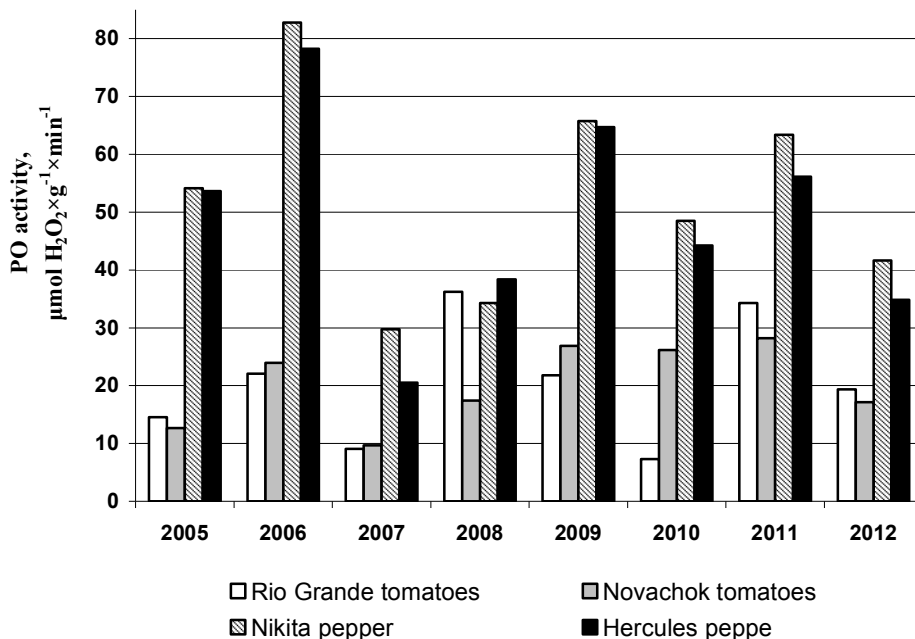
Fig. 6. PO activity in solanaceous fruits:

Maximum of PO activity in different varieties of tomatoes was fixed in different years. For tomatoes Rio Grande that was 2008, for Novachok - 2011. Both years could be characterized by high temperatures and rainfall during growing season and rainfall during the fruit development and ripening period (Fig.1). Peaks of PO activity in pepper fruits were observed when the highest rainfall fell out during the growing season (2006), and in 2009, while lowest temperatures of the growing season. Minimal PO activity was observed in 2007 for both species of solanaceous vegetables. The sum of temperatures during development and ripening of pepper fruit was the highest among other years and also growing season for tomatoes was characterized by high temperatures that year.

Analysis of pair correlations indicates the presence of a strong significant relation between peroxidase activity and the sum of temperature during fruit development and ripening for both cultures (r = -0,63; -0,69) (Fig. 7).

In tomatoes peroxidase is the most related to weather factors comparing to the other examined antioxidant enzymes. Peroxidase activity in fruits of both cultures shows a significant direct relationship with rainfall and HC of fruit development and ripening period. Activity of this enzyme in pepper is also dependent on rainfall and HC of growing season. It can be associated with a shorter vegetation period in pepper.

The level of malondialdehyde, which is a marker of oxidative stress [16], in peppers is 5-6 times higher than in tomatoes (Fig. 8).
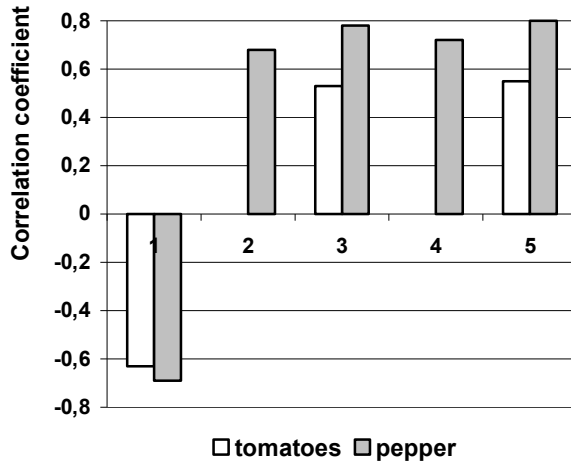
Fig.7. Significant relationship between weather conditions and the PO activity in solanaceous fruits, p<0,05:

1 – the sum of temperatures during fruit development and ripening;
2 – rainfall during the growing season;
3 – rainfall during fruit development and ripening;
4 – HC of growing season;
5 – HC of fruit development and ripening period.
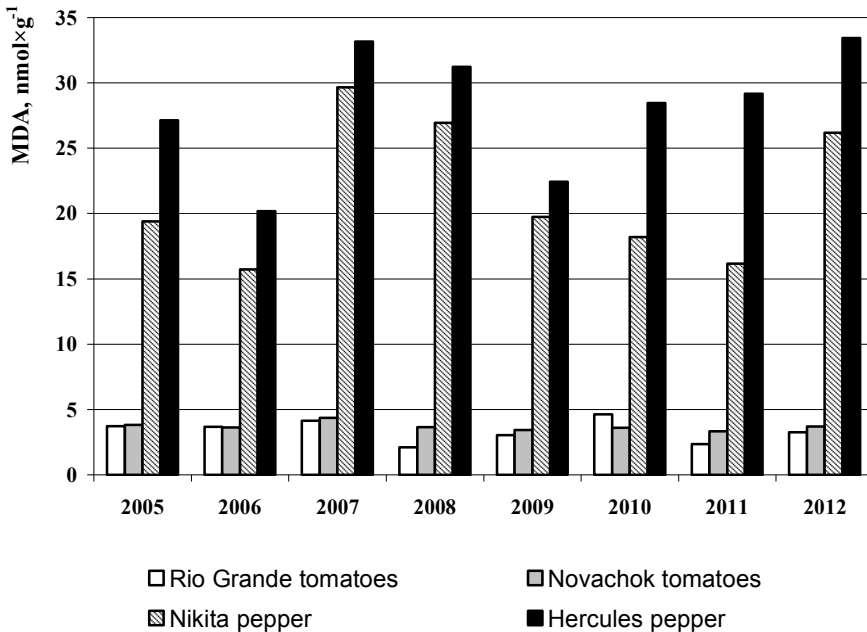
Fig. 8. Level of MDA in solanaceous fruits

Maximal levels of MDA in pepper fruits were fixed in dry years (2007, 2008, 2012). Maximum of MDA in tomato fruit was observed in 2007 and 2010, when the HC of fruit development and ripening period did not exceed 0,25.

Enzymatic antioxidants are very strongly dependent on each other and explicitly inversely correlated with the level of MDA (Tab. 2).

Table 2

Pair correlations of enzymatic antioxidants

Fruits	Enzyme	CAT	PO	MDA
	SOD	0,90	0,87	-0,71
Tomato	CAT	1	0,89	-0,80
	PO	0,89	1	-0,90
	SOD	0,86	0,85	-0,57
Pepper	CAT	1	0,92	-0,81
	PO	0,92	1	-0,80

Activity of SOD in tomatoes and peppers strongly directly correlated with activity of CAT and PO (r=0,85…0,90). The same strong correlation is also observed between CAT and PO: r=0,89; 0,92. Obviously the MDA level increases due to the dismutation of $O_2^{\cdot-}$ and harmful activity of produced H_2O_2, which is utilized by catalase and peroxidase. In tomatoes PO shows the highest correlation to the level of MDA, thus indicating its crucial role in the enzymatic antioxidant defense. In pepper correlations both between CAT and MDA and between PO and MDA are equally strong. This fact indicates the equal importance of these enzymes for protection of tissues from oxidative damage.

Conclusions

The sum of temperatures during fruit development and ripening period has the determining influence on the activity of antioxidant enzymes in tomatoes and pepper. (r = -0,58 ... -0,76). Rainfall induces activity of superoxide dismutase and catalase in fruit of pepper, but has no effect on these enzymes in tomatoes. Peroxidase activity in tomato fruit is the most related to the hydrothermal factors comparing to other investigated antioxidant enzymes.

Peroxidase activity in both cultures depends on rainfall and hydrothermic coefficient of the period of fruit development and ripening. Peroxidase activity in pepper fruit also depends on rainfall and hydrothermic coefficient of growing season. Enzymatic antioxidants of tomatoes and peppers dependent strongly one another (r = 0,85 ... 0,92) and are explicitly inversely correlated with level of MDA (r = -0,57 ... -0,90).

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The possibilities of using of essential oils in dairy products. 2. Dill (*Anethum Graveolens*)

Iliana Kostova[1], Dimitar Dimitrov[1], Mihaela Ivanova[2], Radka Vlaseva[2], Stanka Damyanova[1], Nastya Ivanova[1], Albena Stoyanova[2], Oleksii Gubenia[3]

1 - Ruse University „A. Kanchev", Branch - Razgrad, Bulgaria
2 - University of food technologies, Plovdiv, Bulgaria
3 – National university of food technologies, Kyiv, Ukraine

Abstract

Introduction. The possibility of using of the essential oil of dill (Anethum graveolens) in dairy products has been studied. The composition, antimicrobial properties and the effect of the essential oil of dill on the microorganisms of starter cultures for dairy products has been studied.

Materials and methods. The chemical composition of the oil is determined chromatographically. Antimicrobial effect of the essential oil of dill is determined against Gram-positive, Gram-negative bacteria, yeasts, fungi and two cultures for white brined cheese using the agar diffusion method.

Result and discussion. The analyses of the chemical composition of the essential oil of dill show that monoterpenes hydrocarbons (47.97%) dominate, followed by monoterpenes oxygen (37.52%). Considerably less is the quantity of sesquiterpenes, aliphatic and aromatic hydrocarbons.

The studies of the antimicrobial activity of the essential oil of dill show that there is weak antibacterial and high antifungal activity.

The antimicrobial effect of the oil against the lactic acid bacteria included in the composition of the starter culture is weak. The minimum inhibitory concentration is 0.05% and the minimum bactericidal concentration is 0.5%. These concentrations are higher than the concentrations that can be used in food products.

Conclusion. The essential oil of dill exhibits antimicrobial activity but does not inhibit the development of the lactic acid bacteria in the dairy starter cultures. It is a suitable natural addition to dairy products.

Introduction

Lactic acid products are food products rich in bioactive compounds in which can be added natural additions. Water and fats presence in them permits the inclusion of both water- and fat-soluble substances. It guarantees high absorption of the new product and hence their optimal functional effect in the organism [3, 13, 14].

It is known that spices and herbs with their rich composition improve the taste and quality of food products in which are used   [1, 2, 4]. Contained in them essential oils have antimicrobial effect which makes it possible to use them as natural preservatives [2, 9, 10, 11, 12].

Dill (A*nethum graveolens L.*) is an annual plant of the family *Apiaceae* (*Umbelliferae*), which is used to spice up dishes. Fresh dill is sweet and acrid taste. It is used to improve the taste of salads, milk and mayonnaise sauces, marinades and cheese [1, 6].

Essential oil of dill is widely used in the food industry - to flavor pickles, marinades, sauces, soups, meat, fish and other preserved food, cheeses, in medicine- in medicines for gastric diseases, in preparations against bronchitis and bronchial asthma, in cosmetics and less in the perfume industry [1, 4, 6].

The oil   has antiseptic and antispasmodic effect [1, 6, 13,15].

The purpose of this work is to explore the possibilities for using of essential oil of dill in dairy products by examining the composition, antimicrobial properties, and its effect on microorganisms of starter cultures for dairy products.

Materials and methods

1.Materials

1.1 Oil of dill has been used, provided by the company Vigalex Ltd, Sofia

1.2 *Test microorganisms*

To determine the antimicrobial activity of the oil of dill are used test cultures from NBIMCC - National Bank of Industrial Microorganisms and Cell Cultures, Sofia: Gram-positive: *Staphylococcus aureus* ATCC 6538, *Bacillus subtilis ATCC 6633;* Gram-negative: *Escherichia coli* ATCC 8739, *Pseudomonas aeruginosa ATCC 9027, Salmonella abony* NTCC 6017; Yeasts: *Saccharomyces cerevisiae* ATCC 9763, *Candida albicans* ATCC 10231; Fungi: *Aspergillus niger* ATCC 16404, *Penicillium chrysogenum, Fusarium moniliforme.*

1.3 *Starter cultures*

Two starter cultures have been used for white brined cheese: mikro MILK TBMC1, contains: *Streptococcus thermophilus, Lactobacillus delbrueckii subsp. bulgaricus, Lactococcus lactis subsp. lactis,   Lactobacillus lactis subsp. cremoris, Lactobacillus casei;*

„LB Bulgaricum" JSC LBB CM 310-40 with composition: *Lactobacillus delbrueckii subsp. bulgaricus, Streptococcus thermophilus, Lactobacillus casei, Lactobacillus helveticus, Lactococcus lactis.*

2. Methods

2.1   *Determination of the composition of the essential oil of dill*

The chemical composition of the oil was determined chromatographically. For GC analysis were used apparatus: GC 7890 A with MSD 5795 C; Temperature program 40°C

for 3 min then 5°C/min to 300°C for 5 min, run time 60 min; Column: HP-5MS (30 m x 250 µm x 0.25 µm); Gas: helium with a flow rate of 1 cm^3/min.

2.2 Determination of the antimicrobial activity of oil of dill by agar diffusion method

The experiments were conducted on Tryptic Soy agar (Biolife) – for bacteria and Sabourad- dextrose agar (Biolife) for the yeasts and fungi. The oil of dill was tested at concentrations 100; 50; 10; 5; 1; 0.5; 0.1; 0.05% in solvent 1% Tween 80.

The diameters of the zones of the growth inhibition were measured in mm with a digital caliper, such as up to 15 mm microbial culture is less sensitive; from 15 to 25 mm – sensitive and over 25 mm – highly sensitive.

The experiments were conducted in parallel with controls from the solvent, taking into account and   correct its effect.

2.3.Determination of the minimum inhibitory concentration (MIC) and minimum bactericidal concentration (MBC)

MIC and MBC were determined according to the methods describe by Andrews [7], Barros et al. [8] и Smith-Palmer et al. [16].

2.4 Determination of the minimum inhibitory concentration (MIC) and minimum bactericidal concentration (MBC) of the oil of dill on the microorganisms in starter cultures

The following concentrations of the oil were prepared: 1; 0,5 ; 0,1; 0,05 and 0,01 % in solvent sterile 1% solution of Tween 80.

The growth of the bacterial cultures was assessed by comparing the number of the lactic acid bacterial in each suspension with that one of the control (bacteria suspension without oil). Inhibition of the growth of the lactic acid bacteria is read at that concentration of the essential oil in which is established 90% reduction in the number of lactic acid bacteria compared to the control samples.

2.5 Studying of the influence of the oil of dill at concentrations suitable for the addition in food products on the microorganisms of the starter cultures

It is conducted according to the procedures for determining to the total number of lactic acid bacteria in starter cultures [5].

All results are presented as average of three parallel experiments.

Results and discussion

Table 1 presents the chemical composition of the essential oil. The data shows that the oil contained 31 components, of which the greatest amount are: carvone   (35,03 %), limonene (25,44 %) and phelandrene (20,45 %). From the identified 93,6% less than 6% are 28 components. The content of the main components of the oil is not different from the data in the literature [1, 13, 15].

Figure 1 shows the distribution of the components of the oil groups. The data shows that the monoterpenes hydrocarbon (47,97 %) dominate, followed by monoterpenes oxygen (37,52%). Significantly lower is the amount of sesquiterpenes, aliphatic and aromatic hydrocarbons.

The data from figure 2 shows that the dill oil acts weakly on the Gram- positive bacteria *Staphylococcus aureus* (13,6 mm diameter of the zone) and *Bacillus subtilis* (14,9 mm diameter of the zone). Gram-negative bacteria   *Pseudomonas aeruginosa* is sensitive to the oil (18,9 mm diameter of the zone of inhibition of the growth) while *Escherichia coli* (13,5 mm) and *Salmonella abony* (14,2 mm) are less sensitive.

With the exception of *Fusarium moniliforme*, which is insensitive to the effect of the oil, the growth of all tested fungi and yeasts is suppressed by the oil. Its antimicrobial

activity is highest against *Penicillium chrysogenum* (35,0 mm diameter of the zone), *Aspergillus niger* (25,9 mm diameter of the zone) and *Candida albicans* (21,2 mm diameter of the zone).

The results of the antimicrobial activity of the oil of dill are shown in Figure 2 and 3.

Table 1

Chemical composition of the essential oil of dill

Components	RI	%	Components	RI	%
α-Thujene	929	0,16	Bornyl acetate	1285	0,08
α-Pinene	939	1,04	α-Copaene	1378	0,11
Camphene	954	0,13	α-Cubebene	1385	0,17
β-Pinene	971	0,11	β-Caryophyllene	1419	0,16
α-Phelandrene	1003	20,45	β-Cubebene	1429	0,13
p-Cymene	1024	0,33	γ-Muurulene	1478	0,22
n-Heptacosane	2700	0,08	δ-Cadinene	1523	0,11
α-Limonene	1030	25,44	n-Nonadecane	1900	0,12
(Z)-β-Ocimene	1038	0,22	n-Eicosane	2000	0,07
γ-Terpinene	1060	0,19	n-Heneicosane	2100	0,08
trans-linalool oxide	1082	0,14	n-Docosane	2200	0,11
cis-Limonene oxide	1104	0,17	n-Tricosane	2300	0,06
3,6-Dimethyl-2,3,3a, 4, 5, 7a-hexahydrobenzofuran (Dill ether)	1185	6,22	n-Tetracosane	2400	0,13
cis-Dihydrocarvone	1198	0,39	n-Pentacosane	2500	0,15
trans-Dihydrocarvone	1205	1,71	n-Hexacosane	2600	0,09
Carvone	1248	35,03			

Contents of the components in the dill oil
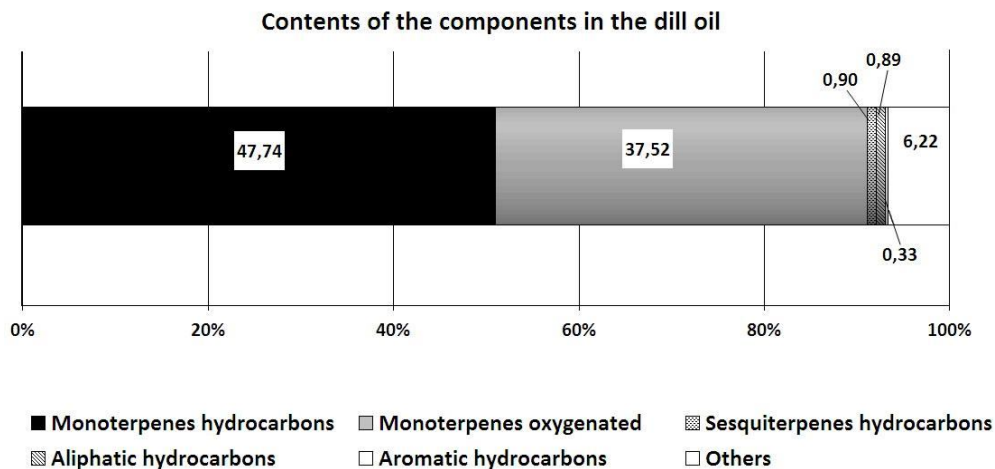
Figure 1. Distribution of the components of the dill oil
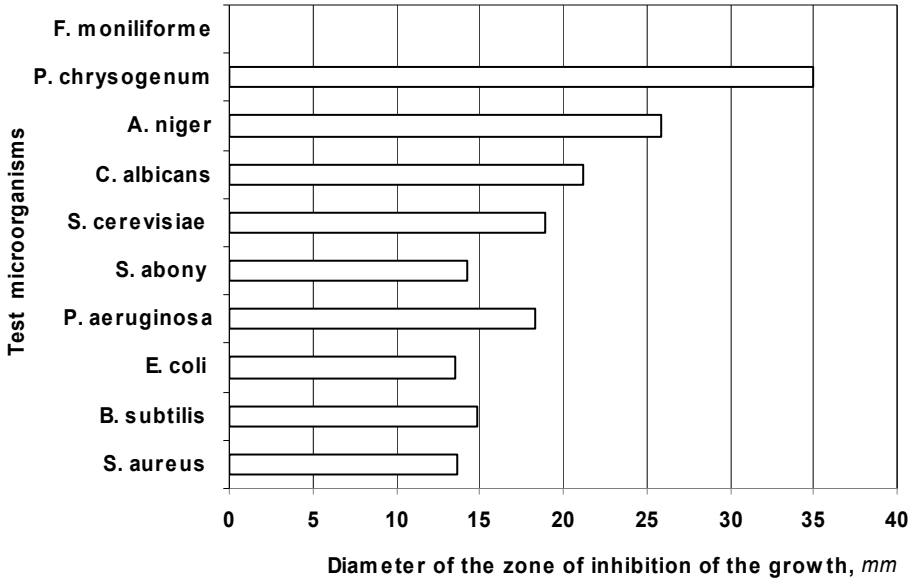
Figure 2. Antimicrobial activity of the dill oil
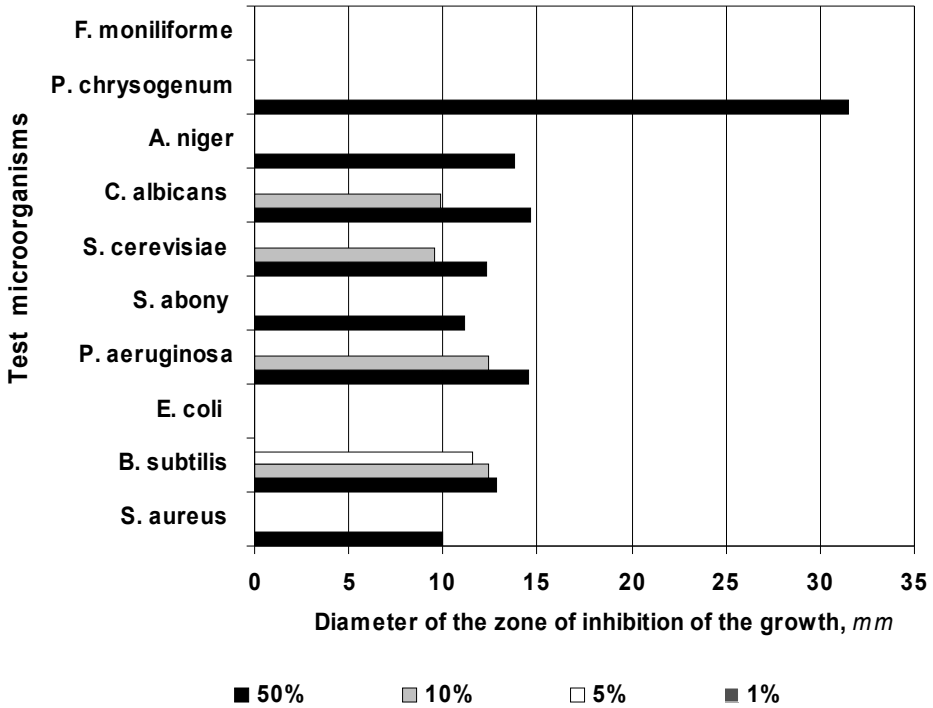
Figure 3. Antimicrobial effect of 50, 10, 5 and 1 % solutions of the dill oil

The both Gram-positive and Gram-negative bacteria are weak sensitive to the solutions of the dill oil (fig. 3). The growth of *Escherichia coli* is not inhibited even by 50% solution of the essential oil. With the exception of *Bacillus subtilis*, *Pseudomonas aeruginosa*, *Saccharomyces cerevisiae* and *Candida albicans* the other microorganisms are resistant to the effect of 10% solution of the oil. *Bacillus subtilis* is less sensitive to 5% solution of the oil. The growth of all tested microorganisms is not inhibited by 1% of the dill oil. Consequently, the oil has weak antibacterial and high antifungal activity.

To be used in dairy products the essential oil should not inhibit the development of the lactic acid bacteria contained in the dairy starter cultures. In this connection, the influence on the lactic acid bacteria from the two starter cultures is analyzed. The obtained results are shown in Table 2.

Table 2

Effect of solutions of essential oil of dill on the growth of lactic acid bacteria from starters for dairy products

Sample	Concentration of essential oil (%)	Total number of viable *Lactobacillus sp.* (cfu/ cm^3)		Total number of viable *S. thermophilus* and *L. lactis* (cfu/ cm^3)	
		LBB CM 310-40	TBMC1	LBB CM 310-40	TBMC1
Control	0	$3,1 \times 10^7$	$2,8 \times 10^7$	$1,4 \times 10^8$	$2,4 \times 10^8$
Dill oil	0,01	$2,2 \times 10^7$	$1,7 \times 10^7$	$9,1 \times 10^7$	$3,2 \times 10^7$
	0,05	$7,3 \times 10^3$	$1,2 \times 10^4$	$1,7 \times 10^5$	$4,5 \times 10^4$
	0,5	0	0	0	0
	1,0	0	0	0	0

The data shows that the growth of three species *Lactobacillus*, participating in the composition of the two starter cultures is not affected by the 0,01 % solution of the essential oil. 0,05 % solution of the oil substantially inhibit the growth of *Lactobacillus sp.*. The number of viable colony forming units decreases strongly with both starter cultures. By increasing the concentration of the oil over 0,5 % it does not observe growth of *Lactobacillus sp.* Therefore the MIC of the oil of dill against *Lactobacillus sp.* is 0,05%, and MBC is 0,5%.

The table also shows that the oil of dill affects analogically the growth of *Streptococcus thermophilus* and *Lactococcus lactis* – 0,01% weakly inhibits their development , 0,05% vastly inhibits them and completely killing them. Therefore MIC of the dill oil against *Streptococcus thermophilus* and *Lactococcus lactis* is 0,05 %, and MBC is 0,5 %.

The addition of essential oils in food products requires an appropriate amount so as not to deteriorate their quality. On the other hand, they must not have depressing effect on the specific microorganisms, involved in the preparation of the fermented milk product. In this connection, the influence of the dill oil is analyzed at concentrations 0,0008, 0,002 and 0,003 %, which can be used in food products [1]. The obtained results are shown in Table 3.

Table 3

Effect of the essential oil of dill on lactic acid bacteria from starter cultures for dairy products

Sample	Concentration of the essential oil (%)	Total number of viable *Lactobacillus* sp. (cfu/cm^3)		Total number of viable *S. thermophilus* and *L. lactis* (cfu/ cm^3)	
		LBB CM 310-40	TBMC1	LBB CM 310-40	TBMC1
Control		$3,3 \times 10^7$	$2,8 \times 10^7$	$2,3 \times 10^8$	$2,5 \times 10^8$
Dill oil	0,0008	$2,5 \times 10^7$	$2,9 \times 10^7$	$2,7 \times 10^8$	$2,8 \times 10^8$
	0,002	$3,0 \times 10^7$	$2,0 \times 10^7$	$2,2 \times 10^8$	$2,5 \times 10^8$
	0,003	$2,4 \times 10^7$	$2,5 \times 10^7$	$2,4 \times 10^8$	$2,6 \times 10^8$

The growth of *Lactobacillus* in the two starter cultures used is not affected by the presence of the essential oil of dill in concentrations which can be used in food products. The number of colony forming units with the addition of essential oil is approximately equals to the number of the colonies in the control samples. *S. thermophilus and L. lactis* is also not sensitive to the used concentrations of the dill oil in the tested starters: LBB CM 310-40 and TBMC1.

The used amounts of the essential oil of dill do not affect negatively on the development of the lactic acid bacteria in the tested starter cultures. Our results are confirmed by those of the literature [13].

Conclusion

The essential oil of dill exhibits antimicrobial activity but does not inhibit the development of the lactic acid bacteria in the dairy starter cultures. Minimum inhibitory concentration of the dill oil against *Lactobacillus sp., Lactococcus lactis* and *Streptococcus thermophilus* is 0,05 %, and minimum bactericidal concentration is 0,5 %. The essential oil of dill is suitable natural addition to dairy products.

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Effect of protein and mineral additive on consumer characteristics of meat emulsion products

**Inna Shurduk, Maksym Serik,
Svitlana Antonenko, Natalya Fedak**

Kharkiv State University of Food Technology and Trade, Ukraine

**Corresponding
author:**

Maksym Serik
E-mail:
serik_m@inbox.ru

Abstract

Introduction. The important task of contemporaneity is the search of multifunctional metabolically active additives that can improve the chemical composition and other consumer characteristics of meat emulsion products.

Materials and methods. Experimental studies were performed at semi-automatic penetrometer «Labor» for limiting shear stress measurement of sausages, rotational viscometer «Reotest-2» for viscosity measurement of pates. Optical microstructure analysis, determination of composition and digestibility of proteins were carried out by traditional methods.

Results and discussion. The influence of protein and mineral additive on the water binding, structure-mechanical, microstructural and consumer characteristics of sausages and pate products was determined. The use of additive in an amount of 7.5% allows to increase moisture-binding ability of sausages and pates to 4…9%, to decrease limiting shear stress of sausages at 2.5…6% and the viscosity of pates at 300…350 Pa×sec. and to improve microstructural product characteristics without deterioration of organoleptic properties.

The use of additive provides more even distribution of components in the sausages and pates structure, that stipulates the structure homogeneity and prevents the defects origin in the finished products. It was proved, that the additive use allows to increase the moist content at 0.7…1.1%, the protein content at 0.3…0.8% and the content of digestible calcium compounds in the finished product to the level 550-700 mg / 100g. The investigation of protein digestibility by proteolytic enzymes of the gastrointestinal tract showed the better protein hydrolysis degree of products at 11.5…13% compared to control. The additive use in sausages and pates composition on account of their chemical composition improvement and protein digestibility increase provides higher biological value of developed products. The obtained results were tested under industrial conditions.

Conclusions. The positive effect of protein and mineral additive on the water binding, structure-mechanical, organoleptic characteristics and biological value of meat emulsion products compared to existing market analogues was proved.

Introduction

An important task of the modern nutrition science is the improvement of food products' consumer characteristics. One of the main ways to solve this problem is the food products enrichment with digestible forms of deficient nutrients. Numerous studies convincingly argue that calcium is one of the most deficient mineral elements in the diet of modern man. This problem is primarily not in deficiency of calcium, but in deficiency of its digestible forms [1-4]. It's known that protein-binding calcium is the most metabolically active form of calcium. Exactly in this state the calcium is contained in dairy products, which are known to be the best source of it. However, the global shortage of raw milk necessitates the search of new sources of digestible calcium and development of new fortified foods.

Most modern technologies of food production enrichment with calcium include the use of such forms as citrate, lactate, chloride, gluconate, carbonate etc. However, these forms provide only maintenance of the calcium level in blood, preventing its "washout" from human bones, but this does not guarantee calcium assimilation and deposition in tissues [5-8].

Based on the above, the actual problem is the search new sources of digestible calcium compounds and new health products with their use.

Therefore, we proposed the use of developed in Kharkiv State University of Food Technology and Trade (KSUFTT) protein and mineral additive (PMA) which contains protein and mineral calcium and magnesium. The proposed additive is a complex where the protein component is represented by partially hydrolysed collagen structures which are used as a matrix for sorption of mineral elements (calcium and magnesium). The calcium content is possible to regulate by controlling sorption processes during the PMA obtaining. The mineral calcium compounds in the form of citrate, which can effectively maintain the level of calcium in the blood, and organic protein-binding form with high metabolic activity providing a deposition of calcium in the tissues are present in the composition of PMA. This additive is a powdery system with neutral organoleptic characteristics and high affinity for meat raw material. PMA contains 6…7% of moisture, 74...76% of protein, 8...9% of fat, 10.0...10.5% of ash, 7.0...7.5% of calcium [9–10].

We proposed the PMA use as a part of boiled, boiled-smoked sausages and pates, in technologies of which the use of functional additives based on hydrolyzed collagen is widespread. However, the use of PMA will allow not only to regulate the technical characteristics of systems and consumer properties of the final product, but also to give it expressed sanitary properties. Therefore, the study of PMA effect on consumer characteristics of the developed product is of current interest.

Materials and methods

Experimental studies were performed using traditional and generally known methods.

The moisture-binding ability (MBA) of systems was determined by pressing method [11]. On a glass plate 10×10 cm, covered with polyethylene wrap, filter paper was placed. In the center of the filter paper sample weighed with an accuracy of 0,001 g was placed, then it was covered with polyethylene wrap and glass plate. The upper glass plate in the middle was pressed with 1000 g weight. Weight was kept for (10×60) seconds.

After the required time the weight, glass plate and wrap were removed. A wet spot formed under the weight pressure on the sample was marked with pencil, and its area (R) was calculated.

The moisture-binding ability is determined by the formula:

$$S = \frac{Q - 8,4 \cdot R}{N} \cdot 100\% \, ,$$

where S – bound moisture content, %;

Q – general moisture content in sample, mg;

8,4 – moisture content in 1 cm^2 of wet spot, mg;

R – area of wet spot, cm^2;

N – sample weight, mg.

Limiting shear stress (LSS) of sausage products was performed on semiautomatic penetrometer «Labor» [12]. The conical indenter was used to determine the degree of penetration. The immersion of indenter into the sample under study for 0,1 mm was accepted as a unit of penetration. Limiting shear stress (LSS) was determined using the formula:

$$Q_0 = \frac{k \times m}{h^2} \, ,$$

where Q_0 – limiting shear stress, Pa;

k – constant of the cone, that depends on the angle α at the vertex ($\alpha = 60°$, k = 2,1);

m – mass of the cone, kg;

h – depth of immersion of the indenter, m.

Dynamic viscosity was determined on a rotary viscometer "Reotest 2" using cylindrical measuring device by Kuet [12].

Shear stress was determined by formula:

$$Q = 0,1 \cdot z \cdot \alpha \, ,$$

where z – constant of the cylinder;

α – indications on the scale of the device.

Coefficient of dynamic viscosity was determined using the formula:

$$\eta = \frac{Q}{\varepsilon} \, ,$$

On the basis of experimental data effective viscosity $\eta_{e\varphi}(\varepsilon)$ curves were built.

Microscopic studies of the structure of experimental and control samples of meat products were carried out by generally accepted methods [13]. Samples for histological examination of the size 10-15 mm×5-10×mm×2-4 mm were excised, wrapped in cheesecloth and subjected to fixation for 48 ... 72 hours in 10% neutral formalin aqueous solution. Further processing of the material was carried out by laundering fixator with tap water, dehydration in alcohols of increasing concentrations up to absolute and filling with paraffin by generally accepted methods.

Slices were prepared with a rotary microtome, moved and fixed on the slide and stained with hematoxylin-eosin after deparaffinization. Obtained micropreparations were viewed with the microscope «Granum».

Determination of the chemical composition was carried out by standardized methods [11].

The moisture content in the samples was determined by drying at 105…110°C. Ash content was determined by burning of the sample at 400…500°C. The content of calcium was determined titrimetric in a mineral residue. The content of total nitrogen was

determined by Kjeldahl method. The quantity of protein nitrogen was determined as the difference between quantities of total and non-protein nitrogen. Lipid content was determined gravimetrically with extraction by Bligh E. and Dyer W. [11]. Lipid content was calculated by the formula:

$$G = \left(\frac{l \cdot V_{tot}}{V_{al} \cdot a} \right) \cdot 100, \%$$

where l – amount of lipids in the aliquot, g;

V_{tot} – total volume of chloroform extract of lipids, ml;

V_{al} – volume of the aliquot, ml;

a – sample weight, g.

In vitro digestibility of finished meat products proteins by proteolytic enzymes of the gastrointestinal tract (pepsin and trypsin) was performed with the method of Pokrovsky and Ertanov [14]. Method consists of the gradual effect of the system of proteinases including crystalline pepsin and trypsin on the proteins of studied object.

Fermentation was held in two stages, lasting 60 minutes each. The first stage of fermentation by pepsin occurs at pH 2.0, the second stage of fermentation by trypsin occurs at pH 8.0.

Product samples, that contain 150 mg of protein, are placed in 2 test tubes. Into every tube 15 см³ of 0,02N HCl solution is added. In the experimental tube 15 mg of pepsin is added. The control tube does not contain enzyme. Samples are incubated at 38 ºC during 60 min with constant stirring. In order to determine soluble products of pepsinolysis 0.2 см³ of hydrolyzate is taken from each tube, then 2 см³ of 10% solution of trichloroacetic acid is added, mixtures are kept for 20 minutes at room temperature and then centrifuged for 10 min. at 6000 rev / min. The amount of soluble products of pepsinolysis of protein in pellets is determined by Lowry [11]. The degree of the protein break-up under the action of pepsin is calculated.

To provide trypsinolysis contents of experimental and control tubes are neutralized with alkali and added 15 см³ of 0.08 N solution of $NaHCO_3$. 30 mg of trypsin is added to the experimental tube. Trypsinolysis is held at 38 ºC during 60 min with constant stirring of tubes' content. In order to determine the total digestibility (the quantity of soluble protein hydrolysis products after sequential action of pepsin and trypsin) of samples 0.2 см³ of hydrolyzate is taken from tubes, then 2 см³ of 10% solution of trichloroacetic acid is added, tubes are kept for 20 minutes at room temperature and centrifuged for 10 min at 6000 rev / min. The amount of soluble protein hydrolysis products in pellets is determined by Lowry method [11]. The protein digestibility and the degree of the protein break-up under the action of trypsin is calculated.

Results and discussion

Moisture-binding and structure-mechanical properties are ones of the main physical and chemical parameters that characterize consumer characteristics of meat products with emulsion structure. Consider this we studied the moisture-binding ability *(S)*, limiting shear stress (LSS) *(Q)* and the viscosity *(ή)* of developed products depending on the additive contain in the system *(m)*. The results are shown in Fig. 1-3.
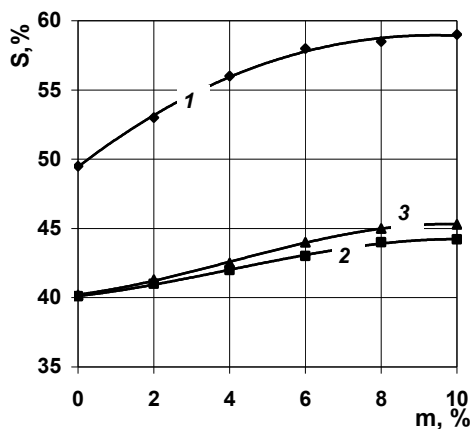
Fig. 1. Moisture-binding ability of meat products with emulsion structure:
1 – fine dispersed (boiled sausages); 2 – coarse dispersed (boiled-smoked sausages); 3 – pates.
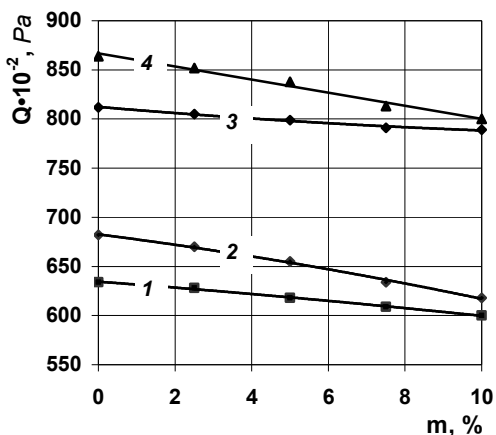
Fig. 2. Limiting shear stress of sausage products:
1 – boiled sausages; 2 – boiled sausages after storage (t = 1...6°C, τ = 15 days); 3 – boiled-smoked sausages; 4 – boiled-smoked sausages after storage (t = 1...6°C, τ = 30 days).

The graph shows that the PMA addition leads to MBA increase of systems. Considering the moisture-binding properties the most rational PMA content is at the level 7...9%, which provides MBA increase for 4.1...9.5%. At the increase of the PMA content to 10% MBA increase hardly occurs. In our opinion, MBA increase in experimental specimens with PMA addition is due to several factors. Firstly, due to the porous hydrolyzed collagen structure of additive moisture fixes in the pores and adsorbs on the surface of polymers. This moisture does not press out during the experiment. Secondly, binding of moisture is due to the calcium-donor properties of additive. A well-known fact is the improvement of moisture-fixing properties of calcium-binding proteins in the presence of Ca^{++} ions. In the composition of meat raw material there are myofibrillar proteins such as myosin and actin, which have expressed calcium-binding properties. Apparently, these proteins interact with ionic calcium of PMA, what leads to increase of moisture-binding properties of the system.

The results of LSS study show that the PMA addition results in reduction of it, while according to the Rebinder's classification all experimental samples of pates are classified as viscoplastic bodies with good ability to spreading and samples of sausage products as considerably solids. Herewith varying of the additive content from 2.5 to 10% leads to LSS changes at $(23...64) \times 10^2$ Pa in sausage products and at 35...59 Pa in pates. Some LSS changes are probably caused by increase of moisture-binding of the system and decrease of the part of raw meat proteins, which are the main structuring agents. This decrease in LSS would not adversely affect the quality of finished product.
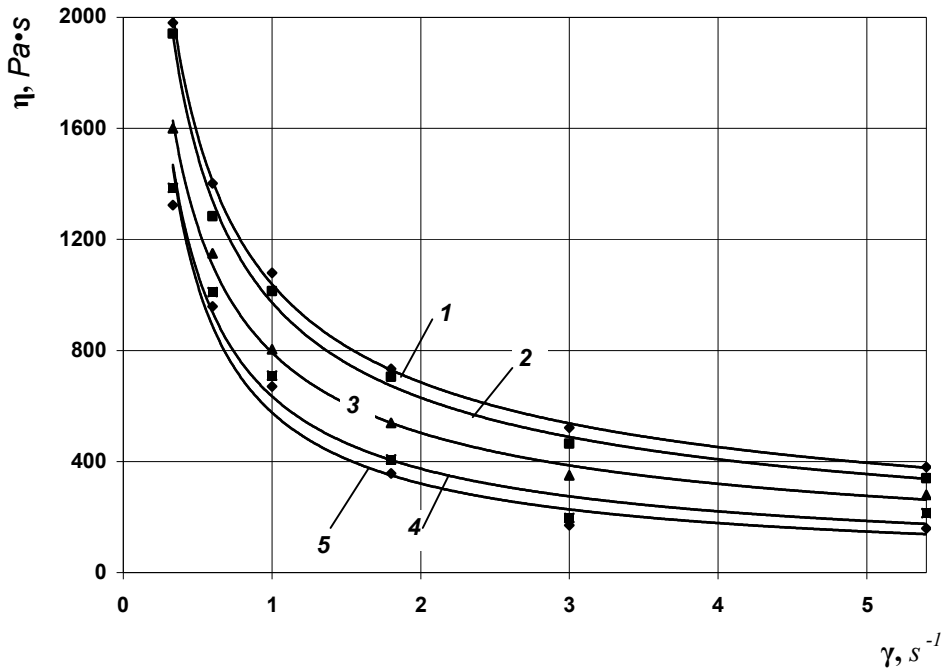
Fig. 3. The viscosity of freshly made pates:
1 – traditional recipe (control); 2 – pates with 2.5% of PMA; 3 – pates with 5% of PMA;
4 – pates with 7.5% of PMA; 5 – pates with 10% of PMA.

Analysis of the results shows the decrease of viscosity of pates with the addition of PMA, that is predictable because of reducing of raw meat part and consequently myofibrillar and sarcoplasmic proteins, which are the main structuring agents in meat systems. The viscosity fall with increase of shear rate is unsharp, that indicates nondesruption of the pate's structure. So there is a tendence to a sharp viscosity decrease with addition of PMA up to 7.5% and inhibition of viscosity decrease when PMA content approaches to 10%. It causes no need for PMA use in quantities more than 7.5%.

At the next stage the research of microstructure of experimental samples of sausage and pate products was carried out in order to determine the nature of interaction between the components of disperse systems. Photomicrographs of the samples structure are shown at Fig. 4-7.

Photomicrographs clearly show, that components of coarse dispersed meat and pate systems are uniformly distributed throughout the mass. Fat fraction tightly contacts with aquatic environment and system components. The impregnations of connective tissue proteins with tight contact with dispersed environment and muscle fragments of systems are expressed. Connective tissue proteins of PMA provide "structuring" of dispersed environment and moisture binding. We see a positive PMA influence on the mince structure. It looks like more homogeneous system with uniform distribution of fat, muscle and connective tissues. There are less expressed compared to control clusters of fat and connective tissues.
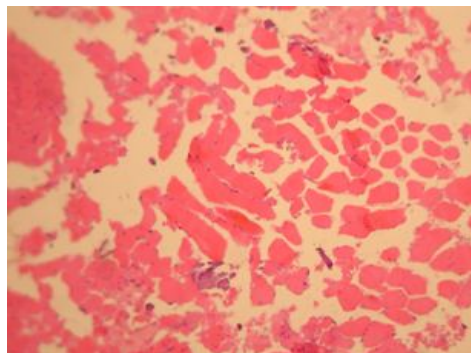
Fig. 4. Heat treated coarse dispersed sausage mince (control) (hematoxylin and eosin, ×240).
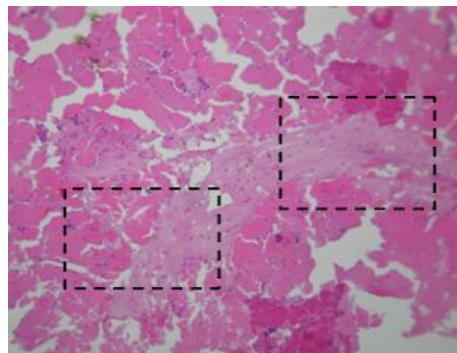
Fig. 5. Heat treated coarse dispersed sausage mince (7,5% of PMA) (hematoxylin and eosin, ×240).
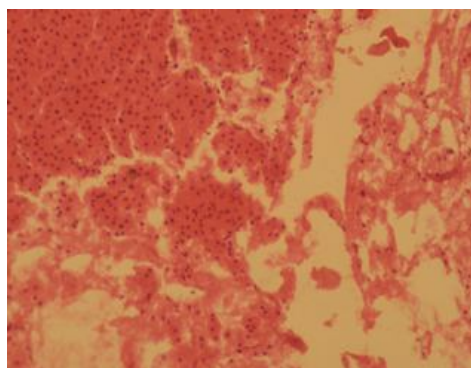
Fig. 6. Heat treated pate (control) (hematoxylin and eosin, ×240).
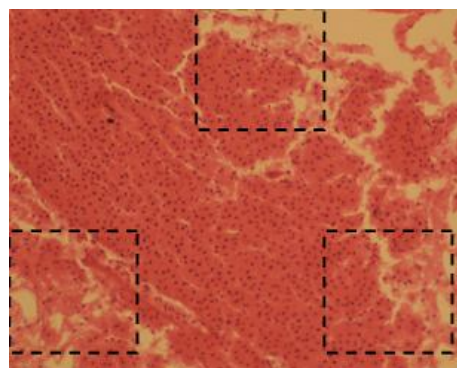
Fig. 7. Heat treated pate (7,5% of PMA) (hematoxylin and eosin, ×240).

Therefore, histological studies show structure-forming effect of PMA due to the forming of disperse phase, which has a high affinity for meat raw products, and disperse environment for interaction between liquid fraction and particles of meat systems.

Further investigation of organoleptic characteristics of the developed product showed PMA positive effect expressed in texture and colour characteristics improving due to the stabilizing colour influence of calcium citrate contained in the additive. PMA negative influence on taste and flavor characteristics of products was not found.

The studies of determination of the developed products chemical composition and digestibility of proteins by proteolytic enzymes of the gastrointestinal tract were performed. The research results are presented in Fig. 8 and Table 1.

It can be seen that the developed products are characterized by high content of protein and mineral compounds, particularly calcium. Herewith lipid content in the system slightly reduces. The other important aspect is the study of protein digestibility by enzymes. The research of digestibility of proteins *in vitro* convincingly proves that proteins of developed products are better digested by proteolytic enzymes of the gastrointestinal tract. The total digestibility of experimental boiled sausages is more at 12.6, pates – at 14.7 mg of tyrosine/g of protein compared to control products. The increase in digestibility occurs

during both stages: pepsinolysis and trypsinolysis. It is caused by thermal hydrolysis of collagen at the stage of PMA obtaining, which makes collagen digestibility better. Besides, larger moisture content makes proteins more accessible to the action of proteases.

Table 1

Chemical composition of sausage products

Sample name	Content, %				
	Moisture	**Protein**	**Fat**	**Ash**	**Calcium**
Boiled sausage extra (traditional technology)	65,1±1,5	14,7±0,5	18,5±0,5	1,7±0,1	0,017±0,005
Boiled sausage (7,5% PMA)	65,8±1,5	15,0±0,5	16,9±0,5	2,3±0,1	0,562±0,04
Pate extra (traditional technology)	51,2±1,5	15,5±0,5	22,8±0,5	1,8±0,1	0,012±0,005
Pate (7,5% PMA)	52,3±1,5	16,3±0,5	21,2±0,5	2,4±0,1	0,576±0,04
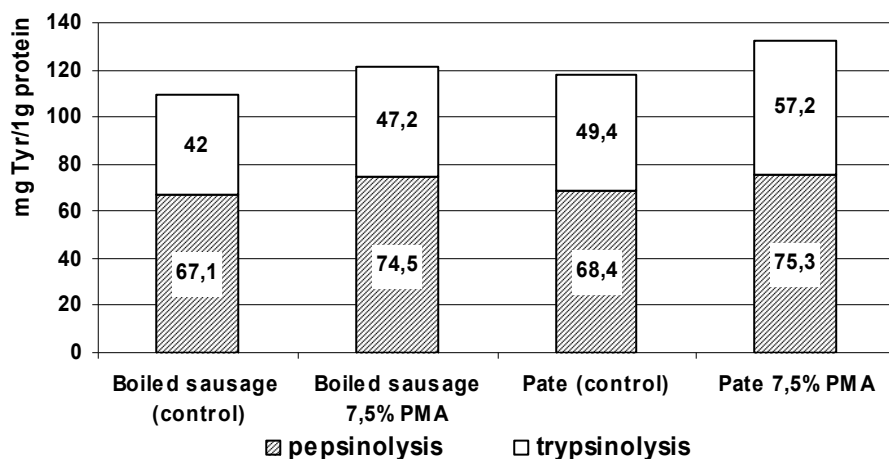
Fig. 8. The digestibility of proteins of boiled sausages and pates by proteolytic enzymes of the gastrointestinal tract.

Conclusions

1. PMA use in meat products with emulsion structure provides the preservation of traditional physical and chemical characteristics inherent to these products.
2. Moisture-binding ability increase on the background of limiting shear stress decrease of sausages and viscosity of pates indicates some changes in sensory products perception towards improving juiciness and tenderness.
3. Microstructural studies let to confirm the PMA structure-forming effect by interaction between dispersed environment and heterogeneous dispersed phase, components of

which have a high affinity for fatty and meat raw products. This allows to prevent fat-bouillon edemas during the production and to ensure homogeneous structure.

4. PMA use in the composition of meat emulsion products provides the improvement of nutitional and biological value of the finished products due to an increase of protein content at 0.3 ... 1.0% and digestible calcium compounds content to the level 562 ... 910 mg / 100 g of product. The moisture content increase at 0.6 ... 0.9%, the fat content decrease at 1.6 ... 2.5%, the carbohydrates content decrease in pates at 0.9% is also typical. The total increase of digestibility is 12.3 ... 14.7 mg of tyrosine / 1 g of protein is due to the considerable degree of hydrolysis and hydration of collagen fibers in the composition of PMA.

5. PMA use in the meat emulsion products composition provides the improvement of products consumer characteristics and ensures its competitive advantages over existing market analogues.

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The histological features of rat liver during refueling animals ethanol solution with additives

**Mykola Holovko[1], Galina Gubin-Vakulik[2],
Natalia Penkina[1], Victoria Kolesnyk[1]**

1 - Kharkiv State University of Food Technology and Trade, Kharkiv, Ukraine
2 – Kharkiv National Medical University, Kharkiv, Ukraine

Abstract

**Corresponding
author:**

Victoria Kolesnyk
E-mail:
vkol84@mail.ru

Introduction. The question of drawing new types of alcoholic beverages with reduced toxicity. The aim was to determine the histological characteristics of the structure of the liver when administered to Wistar rats of different types of alcoholic liquors with low toxicity.

Materials and Methods. The experiment used four groups of animals that used different types of liquors developed. Microscopy made on microscope Axiostar-plus, photography - the camera Progress C10. On the computer image micropreparations held kartometriya ("VideoTest").

Results and discussion. The degree of liver damage in rats of different groups in the use of experimental infusions. Determined that the area of intact nuclei hepetotsytiv an average of $32,70 \pm 0,78$ um2. In intact animals trabeculae level, the lumen of sinusoids is absent, the cytoplasm is compact (less enlightened) and contains little glycogen. In animals, the first main group (40% of long term use of water-alcohol mixture) revealed histological features of alcoholic liver disease with the formation of various animals in this group of chronic hepatitis varying degrees of activity. Hepatocytes have large nucleus, an area of $43,25 \pm 1,1$mkm2. In the second study group (40% of long term use of water-alcohol mixture with the addition of plant material) structure of the liver is preserved, distinct trabeculae, education sinusoids visible. The nuclei of hepatocytes have a slightly smaller footprint compared to the first main group $38,8 \pm 1,05$ um2. In the third main group (prolonged consumption of 40% alcohol mixture with the addition of vegetable and animal raw materials) histostructure liver preserved, trabeculae level, the presence of foci of cytolysis of hepatocytes were observed. The nuclei of hepatocytes have a minimum area of $33,57 \pm 0,91$ um2 compared to other major groups; value of this indicator unreliable different from the group of intact animals. It is proved that the addition of a mixture of plant and animal products improved morphofunctional state of the liver in the absence of background lesions cytolysis of hepatocytes and hepatocyte nuclei normalization value.

Conclusions. Developed alcohol tinctures reduce the toxic effects of alcohol on the liver.

Introduction

Nowadays in the world there is a spread of alcoholism. Parallel to this process is increasing concomitant somatic pathology with emphasis on the cardiovascular system and liver. According to available data, about 5% of the world population does not drink alcohol, 40% - almost 30% - moderate, 15% - take a lot of alcoholic beverages, and 10% of people who suffer from alcoholism [1]. According to the research company TNS Ukraine prefer hard alcohol prefer 58% compatriots. Today the level of alcohol consumption in Ukraine is among the highest in the world and is about 20 liters of absolute alcohol per capita per year, at a time when according to the World Health Organization alcohol consumption higher than 8 liters leads to the degradation of the nation [2]. Clearly expressed the need to saturate the market with quality alcohol. One of the promising areas of new alcoholic beverages is input to the formulation of appropriate plant and animal matter - alkoprotektoriv that reduce the toxic effects of ethanol and products of its transformation to internal organs [3-4]. The developed tools have combined the taste and aroma of the corresponding alcohol, produced from natural raw materials available and have a strong ability to weaken manifestations postintoksykatsiynoho alcohol syndrome and does not influence the effect of alcohol intoxication [5]. Background confirms a large number of as modern studies [6-9], and in previous years [10,11], indicating the great interest of scientists around the world to this problem.

The aim of our work was to determine the histological characteristics of the structure of the liver when administered to rats of different types of alcoholic liquors.

Materials and methods

The study was conducted on 20 Wistar rats weighing 200 ... 250 g, contained in standard vivarium conditions for 21 days. The experiment used the following groups of animals: one group (control) – intact rats in which alcohol is injected; the second group - rats injected water-alcohol solution (40% vol.) The third group – rats injected water-alcohol mixture (40% vol.) which includes prescription composition Echinacea purpurea root, Rhodiola rosea root, chokeberry; fourth group – rats injected alcohol mixture (40 vol.%) consisting of Echinacea purpurea root, Rhodiola rosea root, chokeberry, as a solvent - dairy (cottage cheese from under) with the addition of serum glucose. The animals were injected with alcohol in an amount of 5 mg/kg, intragastric.

After conducting the alcohol and fill in paraffin samples of liver tissue of experimental animals used for cooking micropreparations that stained with hematoxylin-eosin, by Van Hizonom pikrofuksynom, halotsianin-chrome alum in total nucleic acid set-Shik reaction to glycogen and neutral glycosaminoglycans. Microscopy made on microscope Axiostar-plus (Zeiss, FRG) photography - the camera Progress C10. On the computer image micropreparations held kartometriya ("VideoTest" - RF).

Results and discussion

In intact animals trabeculae level, the lumen of sinusoids absent, indicating a lack sklerotyzatsiyi their walls and consequently decrease of sinusoids after leakage of blood in the derivation of experimental animals. The nuclei of hepatocytes - rounded, moderately heterohromni. Area nuclei hepetotsytiv an average of $32,70\pm0,78$ mkm^2 (Table 1).

Table 1

Morphometry of liver hepatocytes biological objects

Group of laboratory rats	Control Intact rats (First group)	Hydro-alcoholic liquid, 40 vol. % (Second group)	Hydro-alcoholic Liquid 40 vol. % from plant material (third group)	Alcoholic liquid at 40. % Based on vegetable and animal products, (fourth group)
Core area hepatocytes (mkm^2)	$32{,}70\pm0{,}78$	$43{,}3\pm1{,}07$ $t_{2-1}=8{,}01$ $p_{2-1}<0{,}001$ $t_{2-3}=3{,}01$ $p_{2-3}<0{,}01$ $t_{2-4}=6{,}95$ $p_{2-4}<0{,}001$	$38{,}8\pm1{,}05$ $t_{3-1}=4{,}66$ $p_{3-1}<0{,}001$ $t_{3-4}=3{,}77$ $p_{3-4}<0{,}001$	$33{,}57\pm0{,}91$ $t_{4-1}=0{,}73$ $p_{4-1}>0{,}1$

The cytoplasm is compact (less enlightened) and contains little glycogen. The cytoplasm also marked a significant amount of RNAs. Around triads small macrophage-lymphocyte infiltration. Around the central veins and triads are small sclerosing stroma (Fig. 1).
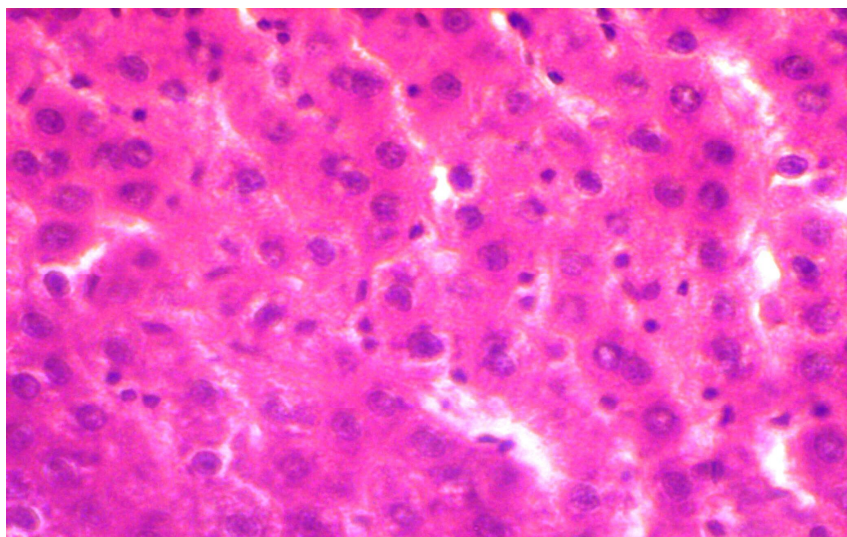
Fig. 1. Liver intact animal group. Liver trabeculae are well-preserved hepatocytes. Paint hematoxylin-eosin. Zagreb 400

In animals, the first main group (40% of long term use of water-alcohol mixture) revealed histological features of alcoholic liver disease with the formation of various animals in this group of chronic hepatitis varying degrees of activity as persestyruyuchoho and aggressive. According to two of the five animals in the liver parenchyma in the second region dolok observed the presence of foci of cytolysis, sometimes with abundant macrophage-lymphocytic infiltration. Collagen about triads and central it progresses. Macrophage-lymphocytic infiltrate at the triad - a multicellular. The first and the third zone

of hepatic lobules trabeculae clear, wide lumen of sinusoids, which can be explained by the appearance of collagen in the wall of sinusoids. Endeteliotsyty in places sinusoid killed, you will notice a dramatic increase in residual macrophages - Kupffer cells. Hepatocytes have large nucleus, an area of $43,25\pm1,1$mkm^2, t=8,01, p<0,001. In the cytoplasm, glycogen is absent, there are small rounded transparent vacuoles, lipid apparently, that starts in the liver parenchymal fatty degeneration (Fig. 2).
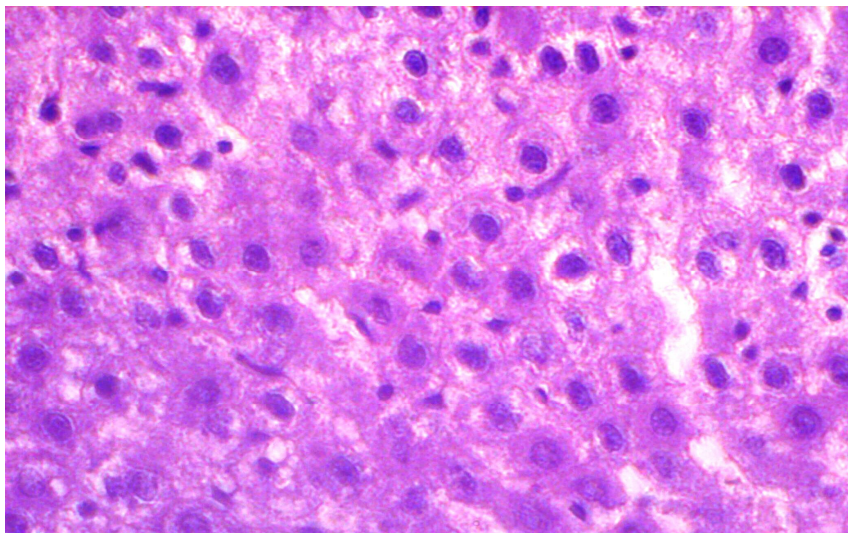
Fig. 2. Liver animals first main group. Trabekulyarnist somewhat broken. In the cytoplasm of hepatocytes contained numerous vacuoles. Refers areas cytolysis. Cytoplasm poorly painted RNA. Paint halotsianin-chrome alum. Zagreb 400

In the second study group (prolonged use of 40% water-alcohol mixture with the addition of plant material) preserved liver structure, distinct trabeculae, sinusoids visible gaps, the number of Kupffer cells in endothelial sinusoids vystiltsi increased compared with intact animals. In some animals of this group in the second region of hepatic lobules are cell cytolysis with small areas of macrophage-lymphocytic infiltration. However, compared to the first main group observed some signs of improvement hepatocytes. The nuclei of hepatocytes are slightly smaller area compared to the first main group ($38,8\pm1,05$ mkm^2, t=4,66, p<0,001), while comparing this measure intact group difference in the direction of increasing retained. Also in most animals in the cytoplasm of glycogen stored in small numbers, but equally fine crumbs. Parenhymatozna fatty less pronounced than in the previous group (see Fig. 3).

In the third main group (long-term consumption of 40% alcohol mixture with the addition of plant and animal materials) hystostructure liver preserved, trabeculae level, the presence of foci of cytolysis of hepatocytes were observed. The nuclei of hepatocytes with minimal area ($33,57\pm0,91$ mkm^2, t=0,73, p>0,1) compared to other major groups; value of this indicator unreliable different from the group of intact animals. The cytoplasm of hepatocytes is much less than in the preceding main groups has fat vacuoles, they look very small, pulverized. Glycogen represented various animals of this group in different ways, often mosaic. The endothelium of sinusoids is not damaged, although a slight increase in the number of Kupffer cells in endothelial sinusoids vystyltsi stored. Kolahenizatsiya walls

of sinusoids is virtually absent, which correlates with Low lumen sidusoyid. These signs of chronic hepatitis as macrophage-lymphocytic infiltration and periportal sclerosis - was pronounced (see Fig. 4).
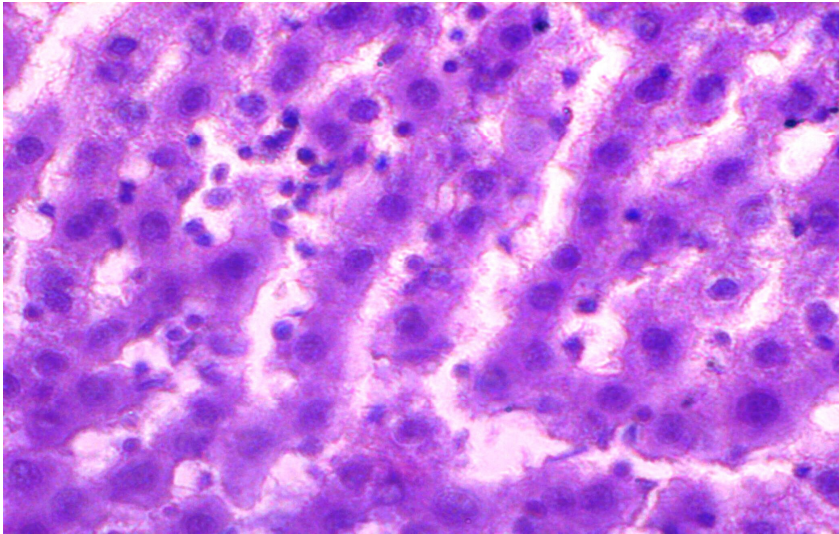
Fig. 3. Liver second main group of animals. Trabeculae liver saved. Vacuolization of the cytoplasm was expressed, but there are small pockets of apoptosis and cytolysis. Paint halotsianin-chrome alum. Zagreb 400
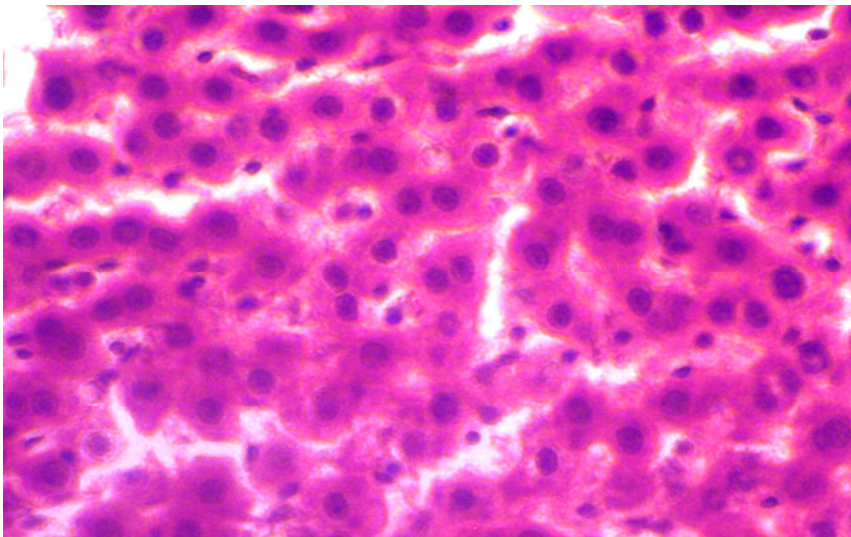
Fig. 4. Liver Animal third main group. Trabeculae are well defined. The nuclei of hepatocytes without evidence hybeli, Carpentry cytoplasm. Paint halotsianin-chrome alum. Zagreb 400

Conclusions

1. The use of water-alcohol mixture to enter Wistar rats for 21 days ended with the formation of chronic alcoholic hepatitis origin.
2. A significant increase in the area of hepatocyte nuclei indicates an increased load on existing hepatocytes, it may be due not only to an increase in toxic load on functional hepatocyte separate but death parts hepatocytes, ie the possible development of compensatory hypertrophy of the nuclei of hepatocytes.
3. The addition to the water-alcohol mixture plant material slightly reduced activity of chronic hepatitis.
4. The addition to the alcohol mixture of plant and animal products even more improved morphofunctional state of the liver in the absence of background lesions cytolysis of hepatocytes and hepatocyte nuclei normalization value.
5. Alcohol has developed a harmonious taste and aroma, made from natural ingredients available and have a pronounced ability to reduce the toxic effects on the body.

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Multi brines in the production of beef ham

Iryna Kyshenko[1], Yuliya Kryzhova[2], Maksym Gontovyi[1]

1 – National university of food technologies, Kyiv, Ukraine
2– National university of life and environmental sciences of Ukraine, Kyiv, Ukraine

Abstract

Introduction. It seems reasonable to develop a scientifically grounded manufacturing technology of whole- muscle products manufacturing that would provide an alternative to traditional technologies along with stability of quality indicators from raw materials with different biochemical properties.

Materials and methods. The pH of salted beef filtrate was determined by potentiometer-340 (pH meter) and the moisture content was obtained by drying the sample in an oven at a temperature of 103 - 105 °C to achieving the constant samples weight. The content of nitric oxide pigments was determined on a spectrophotometer at a wavelength of 540 nm relative to 80% aqueous solution of acetone, the residual amount of nitrite - by obtaining the colored solution due to the formation of isotopic color pigments, the specific shearing strength was determined with the help a installation MP-3, the value of moisture-retaining capacity (MRC) – using milk eleometer.

Results and discussion. The use of multi-functional brine colloidal systems (MFBCS) significantly affects the improvement the basic functional and technological properties of raw materials and finished products quality indicators. The elaboration of a whole-muscle beef products processing technology with the usage of multi-functional brine colloidal systems MFBCS was proved experimentally, precise calculations of the required quantity of brine were carried out and the corning schedules of various raw materials were determined. Massaging in the machine with 8 revolutions per minute mode: 15 minutes operation, 15 minutes break. The round and chuck parts of beef side treatment duration is 16 hours for NOR beef and 18 hours for DFD beef with the following ageing at a terms of maturation +4 ºC for 8 hours; neck and clod as well as loin strip – 14 hours for NOR beef and 16 hours for DFD beef with the following ageing at a terms of maturation +4 ºC for 10 hours; for sirloin and rib muscles – 9 hours for NOR beef and 10-11 hours for DFD beef with the following ageing at a terms of maturation +4 ºC for 12 hours. Efficiency of MFBCS implementation for the injections in 20%, 40%, 60%, 80% quantity shows the yield for DFD beef -104,8%; 123,9%; 143,7%; 162,5% and for NOR beef -102,6%; 123,5%; 142,9%; 161,7% respectively. The nitrate salt treatment in brine compositions reduces the permissible content of residual nitrite that is, mg/100g: for DFD beef is 2,34 - 2,91, and for NOR beef is 2,24 - 2,78.

Conclusions. The results are basis of the technology of new types of whole-muscle smoked and cooked beef products.

Introduction

The corned products of first-class meat like beef sirloin or balyk are considered to belong to the specialties group. These natural products are of high consumer demand, but are expensive and not available to the general population. Finished products, especially beef, often characterized by excessive rigidity, dry, crumbling texture, unexpressed taste. Therefore, existing technologies of beef specialties manufacturing need to be improved with a purpose of intensifying, increasing safety while maintaining high quality level of the finished product [1, 3, 8, 9].

The aim was to develop a scientifically based industrial technology of whole-muscle manufacturing of NOR and DFD beef products that would provide an alternative to traditional technologies along with keeping the stability of quality indicators from raw materials with different biochemical properties. But for all that these technological solutions should not affect the quality characteristics and cause adverse organoleptic changes in the product.

The usage of MFBCS at the whole-muscle specialties manufacturing allows to solve a significant part of problems mentioned [1, 3, 9]. As a result of experimental investigations it was found that the use of MFBCS significantly influences the improving of the basic functional and technological properties of raw materials and finished products quality indicators. The obtained results laid in the basis of the technology of new types of whole-muscle smoked and cooked beef products that we have developed.

Materials and methods

As an object of examination it was used a longitudinal rib muscle from which the pieces of 0.7…..1.0 kg were cut off, then they were separated from a small sirloin muscle, fat and connective tissues, keeping the tendons.

A distinctive feature of the developed technology was a implementation of a combination of three intensification factors:

1. MFBCS with a certain level of pH.
2. Structure-forming compositions, protein-containing additives and color-forming substances
3. Mechanical operations like injection and massaging.

Process flow sheet combines all of these factors and describes the sequence of their use in the operations applied.

Characteristics of raw materials and recipes of pumping pickle for the "Aromatniy" balyk manufacturing are presented in table1.

Quantitative combination of multi-functional brines components of various levels was evidented by extended studies of physical, chemical, functional and technological, structural and mechanical properties of finished products and is based on research data showing the definition of rational concentration by sensory evaluation of model samples and finished products.

A manufacturing beef was examined and its pH indicators determined its belonging to a particular group (NOR or DFD). As a raw material it was used a longitudinal rib muscle from which the pieces of 0.7…..1.0 kg were cut off, then they were separated from a small sirloin muscle, fat and connective tissues, keeping the tendons.

Components of multifunctional brine colloidal systems

Injection rate, % unsalted raw material weight	№ of brine	Brine composition	Quantity of ingredients, %	
			for chilled NOR beef	for chilled DFD beef
20	1	Nitrite salt	6,50	6,50
		Phosphate food additive E450iii, E 451i	2,50	2,55
		Compound of k- i j- carageen	–	0,15
		Isoascorbic Na	0,25	0,25
		Dextrose	1,50	1,50
40	2	Nitrite salt	5,8	5,8
		Phosphate food additive E450iii, E 451i	1,75	1,58
		Compound of k- i j- carageen	–	0,25
		Isoascorbic Na	0,18	0,18
		Dextrose	1,4	1,4
60	3	Nitrite salt	4,75	4,75
		Phosphate food additive E450iii, E 451i	1,45	1,30
		Compound of k- i j- carageen	0,16	0,16
		Isoascorbic Na	0,16	0,16
		Connecting tissue protein concentrate ProGel C 95	1,67	1,67
		Plasma proteins concentrate Vepro 75 PSC	0,7	0,7
		Dextrose	1,25	1,25
80	4	Nitrite salt	4,50	4,5
		Phosphate food additive E450iii, E 451i	1,13	1,02
		Compound of k- i j- carageen	0,13	0,13
		Isoascorbic Na		
		Connecting tissue protein concentrate ProGel C 95	0,13	0,13
		Plasma proteins concentrate Vepro 75 PSC	2,0	2,0
			0,8	0,8
		Haemoglobin –based colouring agent Vepro 70 Col P	0,45	0,35
		Dextrose	1,13	1,13

The preparation of MFBCS was carried out by adding of ingredients in water vigorously mixing it by hand or by mechanical devices according to the recipe MFBCS (Table 1) and in accordance with the recipe for each product. MFBCS is a suspension containing soluble and insoluble substances in the form of a solution or dispersion in water. MFBCS optimal temperature should be from - 2 to +2 °C. After a complete dissolution or dispersion of all additives required optimum the temperature of MFBCS is 0 °C and below.

The low temperature of MFBCS reduces the possibility of temperature rise in the process of massaging and mixing that, in its tern, reduces the risk of bacteria growth in injected meat. Such protection method is significantly important as the meat injected contains a lot of free water and nutrients that can provide bacterial growth (protein, sugars). In addition, the optimal fiber solubility of actin and myosin is especially observed in the temperature range from 0 to 3 °C.

The low temperature of MFBCS was supported by adding ice in a quantity, equal the half of its total amount (10 ... 15% of the total), in cold tap water at the beginning of the process before applying additives.

The preparing of MFBCS was carried out in a defined sequence. At first, a mixture of phosphates was taken into the cold water. After their complete dissolution in the brine such substances as sugar and mixture of proteins were added. Then this colloidal substance was again being mixed. On the next stage salt and carageen composition were added. Adding salt reduces the surface water tension and improves therefore carageen distribution.

For MFBCS with injection level of 20%...40% which contains mixture of phosphates, carageen composition and salt (without proteins) the sequence of applying the additives that is based on the level of solubility and dispersion, was the following: mixture of phosphates─›salt ─› carageen composition.

While adding proteins or protein compound the solutions should be carefully intermixed not less than 10…15 min. to ensure the complete animal protein hydration and therefore its complete functionality. It`s important to avoid prolonged mixing, it can lead to foam formation.

Some additives may me mixed in advance to improve their dispersion process and to ease the process of MFBCS preparation. Preliminary mixing sugar with carrageen and animal proteins significantly improves their solvability in water.

At the very end of the process nitrite salt was added and it all was intermixed to the complete dissolution. Then to reduce the temperature of the brine to 0…-4°C ice was added. The long-term storage of the brine is not recommended.

The process of injection was carried out on multineedle «Ruhle IR 56» injection machine in proportions 20%....80% to the weight of unsalted raw material, under the pressure of 2,8…3,2 atm. It can also be carried out by steam injection. The process can be repeated if proved necessary.

Massaging is conducted in massaging machines of various designs installed in refrigerated rooms with the temperature from 0 °C до 4 °C. Massager mode is chosen depending on the type of raw material, massager design (considering manufacturer`s recommendations), its capacity load (recommended massager load factor 0,6 - 0,7) and the number of revolutions per minute in the drum, with the introduction of the brine directly into a massager in a quantity of 5 % to the weight of raw material. Massaging is more effective at optimum capacity load of the massager at least 2/3 of the drum.

Depending on the massager configurations (internal diameter of the drum, the number of revolutions per minute) the rational mode of massaging is determined. It is recommended that the massager drum went through 10,000-12,000 meters (L • n • t) processing beef at vacuum pressure of 0.6-0.8 bar [1, 9]. Modes of processing of various raw materials are shown in Table 2. For the round, chuck, neck and clod as well as for loin strip parts of beef side the modes are instructed on the basis of practical experience.

Processing modes of each product item

Characteristics of raw material	Methods and modes of pickling
Round, chunk parts of a beef side	Massaging: the massager at 8 revolutions per minute mode: 15 minutes working →15 minutes break. Processing duration: 16 hours for NOR beef and 18 hours for DFD beef. Subsequent ageing – in terms of maturation at +4 ºC during 8 hours.
Neck&clod, loin strip of a beef side	Massaging: the massager at 8 revolutions per minute mode: 15 minutes working →15 minutes break. Processing duration: 14 hours for NOR beef and 16 hours for DFD beef. Subsequent ageing – in terms of maturation during -10 hours.
Rib and sirloin muscles of beef sides	Massaging: the massager at 8 revolutions per minute mode: 15 minutes working →15 minutes break. Processing duration: 9 hours for NOR beef and 10…11 hours for DFD beef with a subsequent ageing – in terms of maturation at +4 ºC during 12 hours.

After massaging salted prefabricated beef was cleaned out of cloth and tied with string and a loop for hanging on a stick was made. Heat treatment of a salted prefabricated product was conducted in three phases. Drying was carried out at 60 °C during 30 minutes (until moisture at the folds of muscle disappeared).

Smoking was carried out at 65 ... 70 °C (up to the appearance of redness and crusts on the surface of the product). The speed of a smoking environment was 0,125-0,250 m/s. A smoke density was determined by photoelectric smoke meter by light transmission ability or extinction E, the optimal value of quantity - 0.28. If there is no smoke meter the density of smoke is controlled by brightness of 40-watt bulb glow, its light must be visible through the smoke layer of at least 0.5 m.

Cooking was carried out at the temperature 75…80 °C during 2…4 hours considering 55 min for 1 kg of meat to its doneness (to the inner temperature of 70±2 °C). Product cooling was carried out to a temperature 30 ... 40 °C. After heat treatment the products were cooled in chambers to a temperature 0 ... 8 °C and the temperature inside the product was not above 8 ° C. For specific types of equipment installed at the meat processing plant heat treatment (cooling) can be carried out with implication of other possible modes of heat treatment of beef products in accordance with technical requirements for this type of product.

To determine the pH of salted beef sample with weight of $10,00 \pm 0,02$ was carefully chopped first in a meat grinder and then was homogenized. Then it was placed in a beaker with of 100 cm3 and extracted with distilled water at a ratio of 1:10 during 30 minutes at a temperature 20 ± 5 ° C, then was mixed and filtered through a paper filter. The pH of the filtrate was determined at a potentiometer-340 (pH- meter).

Mass fraction of moisture content was determined by drying the product sample with weight of 5 g, weighed to 0.0002 g, in an oven at a temperature of 103 - 105 °C for achieving a constant weight. Then drying was continued until the difference between the two weighings reaches 0,0001-0,0005g.

The specific cutting strenght was determined by measuring an effort required to

sample destruction by shearing it in the constant volume chamber. A shear load was indicated at PM-3 measuring device.

Value of moisture-retaining capacity (MRC) was indicated with the help of eleometer. A sample with of weight $5,00 \pm 0,01$ g was uniformly applied with a glass rod on the inner surface of the wider part of eleometer, then it was tightly closed with cork and placed on a water bath at a temperature of boiling down at a narrow part for15 minutes. The mass of water separated was calculated by the number of marks on eleometer scale.

Nitric oxide pigment content relatively to the total number of pigments was determined nitric oxide pigment extraction by an aqueous acetone, followed by determining the optical density of solutions on a spectrophotometer at a wavelength of 540 nm relative to 80% aqueous acetone solution. The residual amount of nitrite – by measuring the color intensity, formed in result of interaction of nitrite with sulfanilamide and N-ethilene diamine hydrochloride in protein-free filtrate.

Results and discussions

In the production of delicacy beef products there is a problem of rational use of brine components, which have to be injected into ham products. The problem lies in full consideration of brine quantity, injected in meat raw material for providing the technological process of ham products. This problem is particularly relevant to SMEs where the undercounting of production costs may lead to significant undercounting of brine components.

For the full consideration of brine amount, required for injection, the following formula was used:

$$M_p = (M_c \times I)/100 \qquad (1)$$

where M_p - a quantity of brine for injection, kg;

M_c - a quantity of raw material, kg.

So, injection ratio I is calculated with formula:

$$I = (m_2/m_1 \times 100 \%) - 100 \% \qquad (2)$$

where m_2 - weight of meat after the injection process, kg

m_1 - weight of meat before the injection process, kg

The degree of brine injection into raw meat shows percentage (%) of brine was directly injected in raw material. Knowing the percentage, if necessary, we can calculate the quantitative value for brine injection.

However, when calculating the cost price only the quantity of brine injected in raw meat is taken into account, without considering its quantity those, used for other purposes, discussed later.

In terms of production the leading technologists calculated the amount of brine required for injection, with the help of advanced formula:

$$M_p = (M_c \times I)/100 + M_i \qquad (3)$$

where M_i – quantity of brine required for filling in the injector system, kg.

Due to this calculation we obtained the much more accurate figures for the further calculations of production costs, because the brine that was kept in injector system also was considered in these calculations.

For the most accurate estimation of the brine quantity it is necessary to consider all the costs while injection process:

$$M_p = (M_c \times I)/100 + M_i + M_M + M_B \qquad (4)$$

where M_M – is an amount of brine that is added to the massager machine if necessary, kg;

M_B – brine losses, kg.

Brine losses M_B may occur for various reasons, for eg., because of inaccurate preparation of the brine, if the raw material is less than 100 kg. In this case, a standard amount of brine is prepared, and then has not been used fully. It is necessary to define precisely the given values M_i, M_M as well as to correct them depending on equipment type and production schemes.

For the facilitation of carrying out the calculations it is rational to add M_i, M_M, M_B to I and take out a new value – total brine losses:

$$M_p = I + M_i + M_M + M_B \qquad (5)$$

where M_p – total mass of brine losses.

Applying the recommendations given in formula 3, 4, 5, it appeared to be possible to take into account the entire amount of brine, which was used for raw meat injection. The result was the accurate calculating of brine amount for provision the technological process of manufacturing salted meat products and for price cost calculations.

With the technology developed in a production environment of "Meat –processing plant "Zorya" a pilot batch of smoked and cooked balyk "Aromatnyiy" was manufactured. Products have high quality characteristics, high product yield, as well as an attractive appearance. By organoleptic, physical, chemical and microbiological indicators products meet the requirements of State Ukrainian Standart 4671:2006 "Products from beef, lamb, cooked, smoked and cooked, raw smoked".

Qualitative figures of salted raw materials and finished product samples are represented in Table 3.

Thus, the developed technology of new kinds of smoked and cooked beef products with implementation of multifunctional brine colloidal systems and cyclic tumbling during the process of corning provides a high quality of a finished beef product with different biochemical properties and different levels of injection.

Qualitative characteristics of salted raw material and finished samples of smoked and cooked balyk "Aromatnyiy"

Characteristics	Brine composition			
	Balyk 1	Balyk 2	Balyk 3	Balyk 4
Salted DFD beef				
pH value	6,53±0,02	6,53±0,02	6,53±0,02	6,53±0,02
Moisture weight fraction, %	76,23±0,20	78,46±0,20	80,51±0,20	82,16±0,20
MRC, %	87,81±0,20	90,24±0,20	92,34±0,20	95,63±0,20
The penetration depth of the indenter needle, mm	6,9±0,10	7,0±0,10	7,0±0,10	7,2±0,10
Finished product				
Moisture weight fraction, %	68,35±0,20	69,14±0,20	73,4±0,20	75,3±0,20
pH value	6,28±0,02	6,24±0,02	6,22±0,02	6,15±0,02
MRC, %	75,46±0,20	78,50±0,20	80,13±0,20	82,16±0,20
The penetration depth of the indenter needle, mm	3,75±0,10	3,75±0,10	3,76±0,10	3,77±0,10
Specific shearing strength, H/m	145,58±2,0	145,14±2,0	144,82±2,0	144,67±2,0
Yield, %	104,8±1,1	123,9±1,1	143,7±1,1	162,5±1,1
Nitric oxide pigments concentration, % as to total quantity of pigments	65,20±0,20	63,76±0,20	62,41±0,20	60,65±0,20
Residual amount of nitrite, mg/100 g	2,34±0,02	2,65±0,02	2,28±0,02	2,91±0,02
Quantity of MAFAM, CFU in 1 g of product	$1,8 \times 10^2$	$1,8 \times 10^2$	$1,9 \times 10^2$	$1,9 \times 10^2$
Salted NOR beef				
pH value	6,13±0,02	6,13±0,02	6,13±0,02	6,13±0,02
Moisture weight fraction, %	73,14±0,20	75,19±0,20	77,61±0,20	79,06±0,20
MRC, %	84,12±0,20	86,35±0,20	87,92±0,20	90,15±0,20
The penetration depth of the indenter needle, mm	7,0±0,10	7,1±0,10	7,2±0,10	7,4±0,10
Finished product				
Moisture weight fraction, %	66,11±0,20	67,94±0,20	70,45±0,20	73,75±0,20
pH value	6,08±0,02	6,04±0,02	6,02±0,02	5,97±0,02
MRC, %	71,19±0,20	74,03±0,20	78,39±0,20	79,87±0,20
The penetration depth of the indenter needle, mm	3,77±0,10	3,77±0,10	3,78±0,10	3,79±0,10
Specific shearing strength, H/m	144,25±2,00	144,11±2,00	143,92±2,00	143,44±2,0
Yield, %	102,6±1,1	123,5±1,1	142,9±1,1	161,7±1,1
Nitric oxide pigments concentration, % as to total quantity of pigments	68,20±0,20	65,76±0,20	64,41±0,20	62,65±0,20
Residual amount of nitrite, mg/100 g	2,24±0,02	2,36±0,02	2,50±0,02	2,78±0,02
Quantity of MAFAM, CFU in 1 g of product	$1,6 \times 10^2$	$1,7 \times 10^2$	$1,7 \times 10^2$	$1,8 \times 10^2$

The obtained quantitative characteristics of smoked and cooked balyk "Aromatnyiy" demonstrated the efficiency of MFBCS- injection of beef.

The product showed rather high yield values, significant nutritional value and organoleptic properties.

In addition, the use of nitrite salt in brine composition for injection reduces the permissible content of residual nitrite [6, 7, 9].

Conclusions

- Developed scientifically-grounded manufacturing technology of NOR and DFD whole-muscle beef products lies in combining the three intensifying factors - MFBCS with a definite pH level, structure –forming agents, protein-containing additives and color-forming substances, as well as implementation of some mechanical operations like injection and massaging, which show stable and organoleptic characteristics, significant nutrition value and yield.
- The use of nitrite salt in brine composition for injection reduces the permissible content of residual nitrite, which is mg / 100 g: a salted DFD beef: 2,34 - 2,91, in salted NOR beef: 2,24-2,78 and influences significantly on the safety of salted beef products.
- The precise calculation of the brine quantity provides efficient conducting of technological process of salt products manufacturing as well as its economic validity.

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Technology specifics of heat-resistant milk contain stuffing that was frozen

Fedir Pertsovoy[1], Margarita Obozna[2], Galina Lyubenco[1]

1 – Kharkiv State University of Food Technology and Trade, Kharkiv, Ukraine
2 – Sumy National Agricultural University, Sumy, Ukraine

Corresponding author:

Galina Lyubenco
E-mail:
Galchonakluka@
ukr.net

Abstract

Introduction. Heat resistant stuffing was designed and investigated to improve and provide new features for confectionery and food products.

Materials and methods. Compatible impact on the change of prescription components was established by analyzing the scientific sources. A combination of components and stuffing structure formation were investigated by chemical interaction between substances. Expiration date was investigated by changes in microbiological and physico-chemical properties.

Results and discussion. Stuffing production technology consists of forth subsystems which are cooperate each other by common purpose operations that are: D it's a preparation constituents, C it's a mixing and heat treatment, B it's a pouring and structure formation, and A it's a getting heat resistant stuffing with milk contain. For better understanding heat resistant structure formation, presented the innovation strategy of obtaining heat resistant stuffing contain milk showing the influence, change and interaction constituents in the production process. So, in the first stage (subsystem D) are the combination of dry skimmed milk, modified corn starch and vegetable oil. During the recovering of dry skimmed milk, the lactose, protein and another components are go into solution. After heat treatment connects with starch. Presence of fat in dry dairy products complicates the process of dissolution, restoration and reduces expiration date due to its hydrophobic properties and the ability to interact with oxygen which leads to oxidation and decline of product quality. Therefore, vegetable oil is introduced after the swelling process, where fatty-protein complexes are formed. That is, around fatty molecule due to hydrophobic links the protein shell is distributed, which connects by hydrophilic bonds with starch and water environment, owing to orientation of hydrophobic and hydrophilic areas of protein manifests their ability to adsorb on the surface of phase distribution with the formation of cognate environment. Starch is intertwined with pectin molecules which are connected and form a grid through a Ca^{2+} which is in raw milk and calcium citrate that is all in order to fixation, providing structure and heat-resistant properties. Joint three-dimensional grid of pectin and starch keeps all prescription components together under high temperature.

Conclusion. Using the results during production of confectionery and food products lets simplify the technological process, provide high organoleptic properties, biological and nutritional value, low cost, competitiveness and prolonged expiration date.

Introduction

Food industry, for today, presents by government and private enterprises, which are producing fairly wide range of confectionery and food products. That provides them uninterrupted supply to domestic and foreign market not only in the form of finished products, but also semifinished, including stuffings. The last are complex multi-component systems, which consist of different kinds raw materials [3]. By set of properties their are combined into several groups::

– first group – fruity-berry stuff, honeyed, liqueur, dairy and «soft caramel»;
– second group – marzipan, chocolate, chocolate-nut, oil-nut and oil-sugar;
– third group – jelly;
– fourth group – fondant, creamy and scrambled.

Stuffings should have high organoleptic properties, constant physicochemical and rheologic parameters, maintain its quality during the whole shelf life. In the traditional technological process of production they require substantial costs of raw materials and long-term action of temperature, which leads to loss vitamins, flavor aromatic substances and formation hard absorbed sweetener aromatics complexes.

Recently, great attention is paid to mastering advanced and new production technologies of stuffing for culinary and confectionery, which withstand high temperature conditions.

It is known, that depending on the temperature action, stuffing are divided into three groups.

1. Heat-resistant stuffing, that characterized by high pillar ability to high temperatures in the range of $115…200^0$ C, it should not change the form, begin to boil and form bubbles on the surface called «craters».

2. Stuffing with limited heat resistant properties, which is defined by the temperature in the range of $115…200^0$ C, lightly change its form, surface with formation a brilliant layer.

3. Stuffing, which not have heat-resistant properties, characterized by the temperature lower than $115\ ^0$ C. At temperature baking $200\ ^0$C, stuffing is melted and completely changes the form [5].

Among of listed stuffings, widely used is heat-resistant stuffings, which satisfy the basic requirements of producer and consumer: they have a high organoleptic properties and manufacturing process is not laborious. So, heat-resistant stuffings have a high competitiveness in the market, shelf life is about 3 months.

A promising direction to save them quality for a long time is to use a low-temperature storage, it's meaning freezing. It predetermines a phase transition of water to ice, which is becoming not available for microbial growth, and brakes undesirables microbiological, biological and physico-chemical processes in product [1]. Physico-chemical, structural and mechanical, organoleptic, microbiological indicators which will not change after unfreezing should be maximally saved, during freezing.

Materials and methods

The object of research is a frozen heat-resistant stuffing with milk contain, which is presented like new technology. By the way, the subject of research were selected the prescription components that are consist of it's structure.
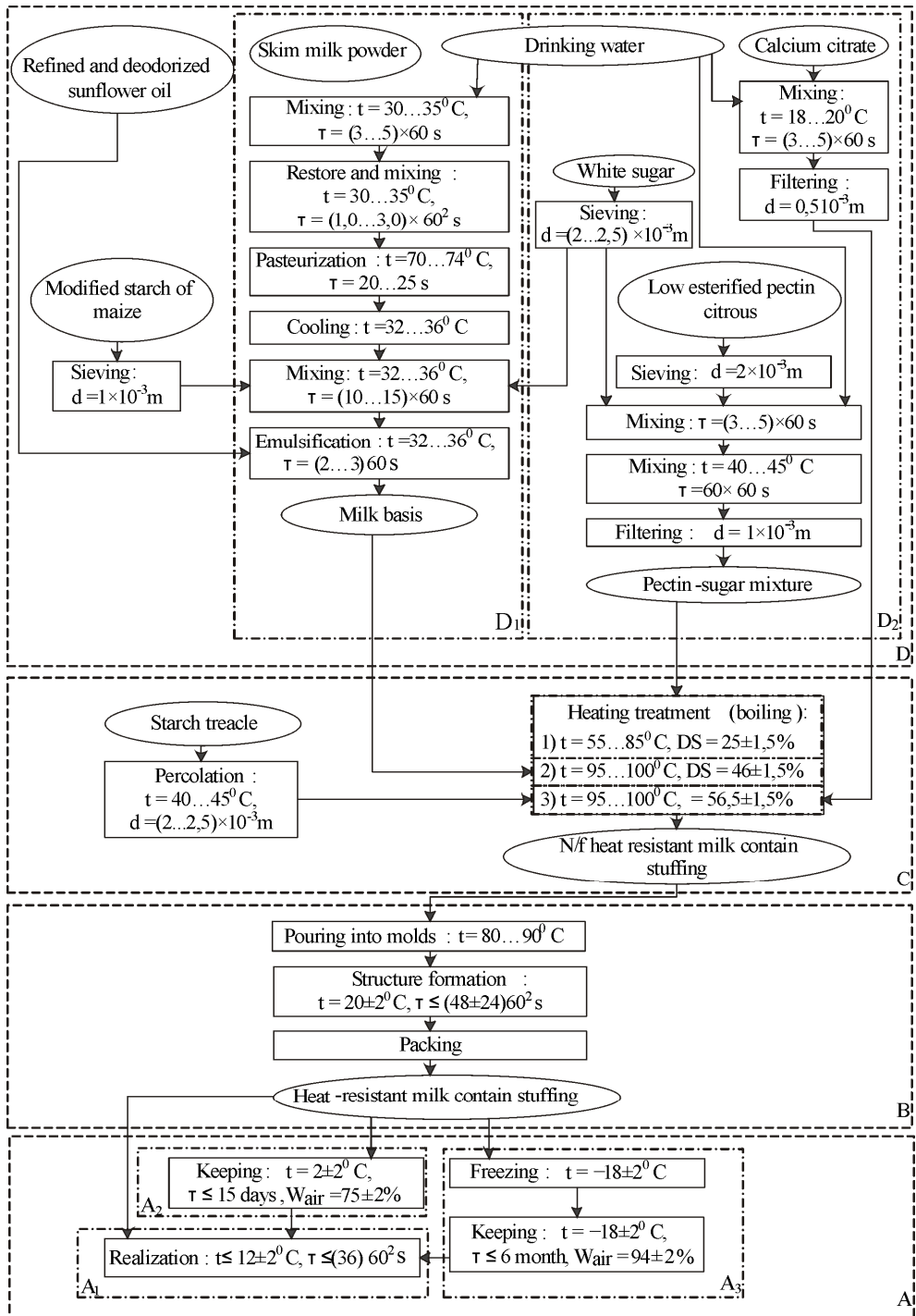
Based on the analytical data of scientific works of domestic and foreign scientists was investigated possible formation of intermolecular chemical bonds by means of presented

methods of chemical and physical interaction between the substance. Due to of theoretical analysis physical and chemical properties of the substance, were investigated and presented changes and new components creation of raw materials milk and vegetable origin that are used in a structure of heat-resistant stuffing containing milk, during its production [2, 6 – 9]. Given their functional characteristics are presented technological operations of their preparation with a view to provide the specified properties, which are in a future considering the overall objective, similar terms of influence mechanical and thermal actions are interrelated as subsystems, that collectively constitute the technological scheme for milk containing heat-resistant stuffing (pic. 1). During the preparation of dry components in order to remove any foreign matter and poorly dissolved components and poorly dissolved components using a sieve with diameter holes $(0,5…2,5)×10^{-3}$m. In order to provide uniform consistency during the process of: mixing and dissolution was involved a rotary mixer with 50 rp/m. Keeping at a specific temperature for a long time to obtain the characteristic properties of components is carried out using thermostat. Pasteurization and heat treatment are carried in containers with a shirt, which is served heat carrier (water or brine). The end of the heat treatment process is determined by using refract meter. After the heat treatment mixture is served in a syringe – dozator for bottling into molds, which then are placed in a thermostat, for structuring at room temperature. Stuffing takes some structural and mechanical, functional and technological, heat-resistant and organoleptic properties. Method of theoretical analysis physicochemical interactions is explained contrariety developed stuffing to high temperatures in the range of $200…230^0$ C during $(10…15)×60$s. By the Analytical method of functional properties used prescription components, their regrouping under the influence of various factors: temperature, mechanical impact, presence of chemical compounds (water, metals, salts, etc.) were investigated changes of the inner and intermolecular interactions in the sequence of their input, as shown in the model innovation strategy of obtaining milk containing heat-resistant stuffing (pic.2). Accordingly, conditions of formation structure stuffing, that characterized by heat resistant properties were found.

Results and discussion

Prospective direction of development heat resistant stuffings are presence in their structure as dairy and vegetable raw materials, which allows balance chemical structure and increase the biological and nutritive value. Heat-resistant stuffings are characterized by gel-like consistence and are able to maintain their physical and chemical properties (form, texture, maintenance of solids etc..) during the heat treatment in the range of $200…230^0$ C, within the limits $(10…15)×60$s. This is ensured by using hydrocolloids (pectin and starch), which have specific properties bind and hold water in the spatial structure of the gel [5, 8, 12]. The technological process of production heat resistant milk contain stuffing, as shown in pic. 1 includes four stages, that are consisting of subsystems.

The first stage is to prepare the prescription components (subsystem D), mixing citrus pectin low-esterified with ⅛ part of sugar and ⅓ part of drinking water, predicts temperatures $40…45^0$C, carefully mixed and leave for swelling within the limits $(20…24)×60^2$ s. Mixing dry skimmed milk with drinking water at a temperature $30…35^0$ C and withstand during $(1…3)×60^2$ s. Milk basis that you had got, pasteurized at a temperature $70…74^0$ C during 15…20s cooled to a temperature $32…36^0$ C, corn starch modified is added, share of sugar, that has remained and mixing within the limits of $(10…15)×60$s. After that oil refined, deodorized is added and emulsifies the temperature $32…36^0$ C during $(2…3)×60$s.

Refined and deodorized sunflower oil

Skim milk powder

Drinking water

Calcium citrate

Mixing : t = 30…35⁰ C,
τ = (3…5)×60 s

Mixing :
t = 18…20⁰ C
τ = (3…5)×60 s

Restore and mixing :
t = 30…35⁰ C,
τ = (1,0…3,0)× 60² s

White sugar

Filtering :
d = 0,5·10⁻³ m

Pasteurization : t =70…74⁰ C,
τ = 20…25 s

Sieving :
d =(2…2,5) ×10⁻³ m

Modified starch of maize

Cooling : t =32…36⁰ C

Low esterified pectin citrous

Sieving :
d =1×10⁻³ m

Mixing : t =32…36⁰ C,
τ = (10…15)×60 s

Sieving : d =2×10⁻³ m

Emulsification : t =32…36⁰ C,
τ = (2…3) 60 s

Mixing : τ =(3…5)×60 s

Mixing : t = 40…45⁰ C
τ =60× 60 s

Milk basis

Filtering : d = 1×10⁻³ m

Pectin -sugar mixture

D₁

D₂

D

Starch treacle

Percolation :
t = 40…45⁰ C,
d =(2...2,5)×10⁻³ m

Heating treatment (boiling):
1) t = 55…85⁰ C, DS = 25±1,5%
2) t = 95…100⁰ C, DS = 46±1,5%
3) t = 95…100⁰ C, = 56,5±1,5%

N/f heat resistant milk contain stuffing

C

Pouring into molds : t= 80…90⁰ C

Structure formation :
t = 20±2⁰ C, τ ≤ (48±24)60² s

Packing

Heat -resistant milk contain stuffing

B

Keeping : t = 2±2⁰ C,
τ ≤ 15 days , W_air =75±2%

Freezing : t = −18±2⁰ C

A₂

Keeping : t = −18±2⁰ C,
τ ≤ 6 month, W_air =94±2%

Realization : t≤ 12±2⁰ C, τ ≤(36) 60² s

A₁

A₃

A

Pic. 1. Technological process of production heat-resistant milk contain stuffing

Second stage consists of mixing and heat treatment (subsystem C). Pectinic mixture that was prepared, will be boil at the temperature within the limits $55…85^0$ C up to dry matter content $25\pm1,5\%$, emulsion that was received are introduced and continue to boil till total part of dry matter will be $46\pm1,5\%$, then starch syrup is added and continue to boil till dry matter will be $56,5\pm1,5\%$. $(2…3)\times60s$ before the boil end calcium citrate in a 1% solution is added.

Third stage consist of bottling and structure formation (subsystem B). A system that was received are mixed and poured in containers for structure formation during $(48…72)\times60^2s$, with direct implementation at the temperature 12 ± 2^0 C no more than 36×60^2s.

Fourth stage is characterized by getting heat resistant milk contain stuffing (subsystem A). Ready product is saved at the temperature $0…4^0$ C within the limits of 15 days, and a relative humidity of $75\pm2\%$ or at the temperature -18 ± 2^0 C no more than 6 month and relative humidity $94\pm2\%$, which has been frozen at the temperature $-18\pm2\ ^0$C before.

For best understanding processes, which are happened during production of heat resistant milk contain stuffing had been shown in a model innovation strategy and production (pic.2). The production of heat resistant milk contain stuffing includes stages, which are consist from consistent interaction of subsystems: D – preparing dry components (D_1 – milk bases: mixing, kipping, pasteurization, cooling, mixing, emulsification and D_2 – pectin-sugar mixture: sifting, mixing, mixing, swelling, filtering), C – mixing and heat treatment (percolation, heat treatment), B – pouring and structure formation (pouring in containers, structure formation, packing), A – getting heat resistant milk contain stuffing (A_1 – saving, A_2 – saving, A_3 – cooling, keeping).

Observed, that in the stuffing production process raw exposed to changes the physico-chemical level: bond formation between dairy, vegetable and fatty components, that leads to them regrouping and creation calcium bridges.

Production of heat resistant milk contain stuffing begins from preparing dry components with getting milk basis (D_1) and pectin-sugar mixture (D_2). Milk basis is getting by consistent mixing milk-starch mixture and emulsion systems.

Milk-starch mixture is formed by the interaction of restored milk, which had subject heat resistant before, scilicet recovery at a temperature $30…35^0$ C during $(1…3)\times60^2s$ and pasteurization at a temperature $70…74^0$ C during $20…25s$ with further entering modified starch of maize. In process keeping of nonfat dry milk the parts are moistened and increase in volume. Close interaction is established between components and them turning to solution: of lactose – from amorphous condition to crystalline, of protein – to colloidal condition (part size from 15 to 30 nm) and others, that are situated in ion-molecular condition (size nearly 1 nm and less). After the recovery process a difficult polydisperse system, for the purpose of disposal extraneous microflora and inactivation of the enzyme lipase, is exposed to pasteurization and freezing for entering starch. Starch shell be subject to swelling. In the middle of starch seed during heat treatment the void is formed where the water is coming, because some hydrogen bonds are weakened and destroyed. This helps to increase the starch seed in volume and occurrence of new hydrogen bonds [4, 8, 17, 19]. Milk-starch mixture that was formed, is characterized by difficult polydisperse environment with a viscous consistence.
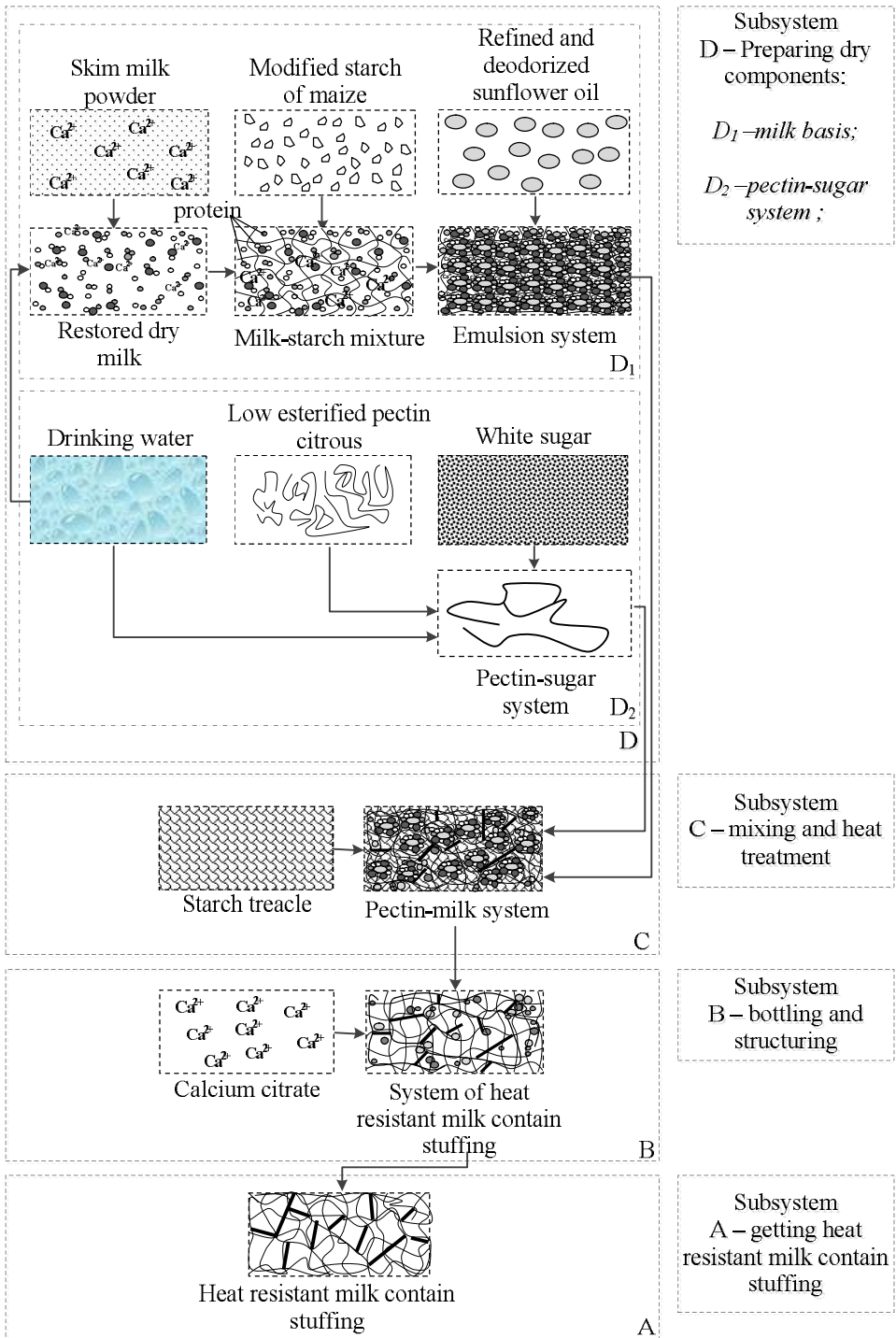
Pic. 2. Model of innovation strategy getting heat resistant milk contain stuffing

Emulsion system forms because in milk starch mixture putting refined deodorized oil at a temperature $32…36^0$C emulsifying during $(2…3)×60$s.

Known, that the presence of fat in the condition of powdered milk its swelling worsens forming protein to solution and dispersion of fat [2], that's why for getting restore milk with physic-chemical natural properties, vegetable oil entering after swelling process. During emulsification fat-milk components a redistribution between parts that are transformed to fat-protein complex are happened.

Casein micelle is one of the main structural proteins element, which consist of submitsels 10-15 nm in diameter, and they from of the subunits that are main factions of casein ($αs_1$, $αs_2$, β i χ) connected each other by hydrophobic, electrostatic, hydrogen connections and calcium bridges [9, 14, 22, 23, 25]. Polypeptide chains of casein fractions curling in such a way to submitseli, that in its inner part hydrophobic bonds are formed, and outside – hydrophilicity, which are presented like a negative charged by acid groups. The protein shell are distributed around the fat molecules due to hydrophobic connections, which are connected hydrophilic connections with starch and water environment, namely, due to the orientation of hydrophobic and hydrophilic parts of protein to appears them ability to be adsorbed on the surface phase distribution with the formation of cognate environment [11, 13, 22, 25].

For getting a pectin citrus mixture (D_2) you should mix sugar with pectin and add water a temperature $40…45^0$ C, mixing during $1×60^2$s and swelling within the limits $(20…24)×60^2$s. To prevent the formation of clots, also a uniformly and homogeneous allocation the particles pectin in mixture, shoul be previously mixed with sugar and than add water. Molecule of pectin has spiral shape [14 – 16, 18, 24]. When there are rapprochement voids are appear, where the carboxyl and hydroxyl groups are formed, that contribute appearance of hydrogen bonds as a result interaction with the hydroxy groups of sugars.

Next step is subsystem C – mixing and heat treatment, that characterizes by milk basis (D_1) and pectin-sugar mixture (D_2) connection. When it connect with water the pectin molecules dissociates with getting ions COO, as a result a molecule becomes a negative and repulsive power is arises between them, which is inhibited by adding divalent metal ions (Ca^{2+}), namely adding milk basis [7, 10, 14, 20, 21]. Owing to heat treatment starch grains starch grains absorb large amounts of water, increase in volume and form a flour paste, that is intertwined with pectin chains to form a three-dimensional, spatial grid. The gelation occurs in several stages: with little content of calcium ions happens rapprochement and orientation of molecule pectin owing to the connection carbonic groups of two adjacent molecules pectin ions of calcium [7, 10, 13, 16, 17, 19, 24].

Next step is subsystem B – bottling and structure formation are formed structural and mechanical properties of product by making add calcium citrate during $48…72×60^2$ s. Increasing the concentration of calcium ions in the system, promotes formation of complexes with calcium. Molecular interactions and calcium bridges interaction are happened, that crosslinking molecules of pectin interacting with them carboxyl groups and form a spatial grid that connecting all components of the system with heat-resistant milk contain stuffing together [7, 10, 12, 14, 19, 25].

Last step is subsystem A – getting heat resistant milk contain stuffing is characterized by getting structure product with established physicochemical and structural-mechanical properties. Its expiration date have 15 days, in normal storage conditions of $0…4^o$C . In order to prolong expiration date up to 6 months, was used rapid freezing at a temperature – $18±2$ ^{0}C, which promotes formation a large number of crystallization centers [1]. Thus

there are small ice crystals, that contribute to storage texture, physicochemical and biochemical properties of stuffing on molecular leve.

Conclusions

1. Frozen milk containing heat-resistant stuffing can satisfy the various range of consumers and widely be used not only as a standalone product, but also as part of culinary and confectionery.
2. It is characterized not labor intensive process of production and high biological and nutritional value, rather than its analogues. Due to the involvement of dairy and vegetable raw materials which are a valuable source of amino acids, vitamins, minerals and fiber.
3. The technology of production and synergistic effect of used hydrocolloids: citrus pectin low esterified and corn starch modified, due to consideration their interaction mechanism that is presented at model innovation strategy for obtaining milk containing heat-resistant stuffing.
4. Found that compatible using of citrus pectin low esterified and corn starch modified provides a structure stuffing and give it resistance to high temperatures, that is gets heat-resistant properties.

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Technological advancement of sorption water purification for alcoholic beverage industry

Svitlana Oliinyk, Vitalii Prybylskyi, Nataliya Chuprina, Iryna Dovgun

National University of Food Technologies, Kyiv, Ukraine

Abstract

Corresponding author:

Svitlana Oliinyk
E-mail: lana_ol@ukr.net

Introduction. The topicality of technological advancement of water conditioning by means of sorption water purification for alcoholic beverage industry is shown.

Materials and methods. Activated carbon Silcarbon K835spezial compared to Filtrasorb F300 is studied. During the studies standard methods of analysis for alcoholic beverage industry, theoretical generalizations and comparisons, systematic approach were used.

Results and discussion. The topicality of activated carbon Silcarbon K835spezial usage for alcoholic beverage industry is given scientific credence. Studied the efficacy of activated carbon brand Silcarbon K835 Spezial during conditioning of water for alcoholic the drinks. It is determined that in comparison to test samples the studied activated carbon brand Silcarbon K835spezial has a larger total volume of pores by water by 30%, adsorption activity by iodine by 38 %, and alkalinity of water infusion is twice as much that is supported by 35 % more of the number of basic oxides. During water conditioning activated charcoal Silcarbon K835spezial the mass concentration of iron, ammonium, nitrite decreases almost by 1,5 … 2 times, with that the permanganate oxidation improves by 40…50 % compared to the control sample Filtrasorb F300. Enhanced physicochemical and sorption properties of activated carbon Silcarbon K835spezial enable to increase the specific volume of prepared water by 38%.

Conclusion. Activated carbon Silcarbon K835spezial is promising to improve the quality of treated water and alcohol production with its use.

Introduction

Permanent increasing requirements to the quality of prepared water for the production of alcoholic beverages demand the use of the most effective ways to remove contaminants from the natural source water. Among the methods that have been successfully used to solve this problem is sorption purification. In this case the sorbents with developed or specific surface of natural or synthetic origin are used: resins and granular (crushed) active carbon (AC) [1 – 12].

Water filtration through a layer of granular coal is the most general method of removing dissolved organic substances of natural and unnatural origin from water. Deep purification of drinking water is achieved mainly through the adsorption capacity of AC, size of its particles, filtration velocity, size of concentration of pollutants and implementation of a process [1 – 12].

AB is a porous carbon adsorbent which is produced from raw materials of different degrees of metamorphism: bituminous coal and charcoal, coconut and other nutshells, and fruit pits.

In the process of carbonization of bituminous coal amorphous carbon is produced during an activation of which AC with advanced micromesoporous structure is received. AC from coconut shell is characterized by a greater proportion of micropores. AB from wood, which is characterized by a larger proportion of macropores, is not suitable for effective purification of drinking water.

At present such adsorbents as bituminous AC of Filtrasorb F-300 and F-500 brands produced by the firm "Chemviron Carbon" are widely used for water purification from organic contaminants at the enterprises of alcoholic beverage production. During the use of such brands organoleptic characteristics are improving, permanganate oxidation is reducing. Sorption capacity of AC Filtrasorb of the above brands is 1000 volumes of water to 1 volume of coal. However, while using AC of these brands the content of iron, manganese, nitrate, nitrite, hydrogen sulphide, ammonia hardly reduces, the adsorption activity is restored not more than 50% after the regeneration. AC of such brands is characterized by a higher ash content that requires an increase in the cost of its make-ready and reduction of the filter cycle [13 – 15].

AC from coconut and other nutshells, and fruit pits are not commonly used in water conditioning for the production of alcoholic beverages. However, this AC is promising to reduce the colour of water, remove some inorganic impurities and different surfactants due to its micro- and mesoporous structure and high adsorption capacity.

Materials and methods

During the laboratory tests AC of the brands Silcarbon K835spezial and Filtrasorb F-300 (control) were used as objects of research.

AC of the brand Silcarbon K835spezial is obtained from coconut shell and is specially prepared from ash minerals. It has a wide micromesoporous structure that provides the acquisitions of organic nitrogen compounds, organic and easily oxidable inorganic impurities which are present in water, and is repeatedly reactivated.

AC of the brand Filtrasorb F-300 is widely used in water sorption purification systems of alcoholic beverage companies in Ukraine.

AC of the brand Filtrasorb F300 is received with the help of the activation of special bituminous coal. It has micro- and mesoporous structure that provides the acquisitions of high and low molecular weight organic compounds found in water. AC Filtrasorb F300 is

moistened well with water and reactivated with little mass loss of 10 %. During water purification with sorbent Filtrasorb F300 the content of organic compounds reduces, taste and aroma of prepared water improve.

Input water (from municipal water supply) and prepared water were analyzed by organoleptic characteristics and hardness, alkalinity, dry residue, cationic, anionic composition.

During the studies of physical-mechanical and sorption characteristics of AC the methods adopted in chemical and technological control of alcoholic beverage production were used.

The study identified the main physical and mechanical properties of AC: moisture, bulk density, mechanical strength, ash content, particle size distribution.

Sorption properties of the AC samples were determined by the total volume of pores by water, activity by iodine, acid-base properties of coal by aqueous extract.

Water of Kyiv municipal water supply was used for the study.

The study was conducted in a dynamic mode at the facility which included: pressure water collection with the capacity of 10 dm^3, filter with AC with the capacity of 1,0 dm^3, and receiving collection with the capacity of 10 dm^3.

The process of water purification had a cyclic mode and consisted of the following sequential operations:

−AC preparation;

−filtering water through a layer of AC until the achievement of maximum allowable indices of organoleptic characteristics and permanganate oxidation;

−ripping the layer of the corresponding sorption material was carried out to prevent it from caking and to remove dirt. Input water was used for ripping in the upward flow and then it was dumped down the canalization. Monitoring was carried out in terms of water turbidity which was not supposed to exceed 0,5 mg/dm^3.

−AC regeneration.

−AC washing to remove dirt after the regeneration.

−after AC washing the filter was included again into the work.

Results and discussion

Sorption materials must provide the adsorption of both low and high molecular weight organic compounds, high effect of water purification from organic impurities, not to increase the hardness and alkalinity of prepared water.

Physical, mechanical and sorption properties of carbon AC of the brand Silcarbon K835spezial was investigated in order to improve the sorption method of water conditioning to produce alcoholic beverages.

Basic physical and mechanical characteristics of the studied AC are given in table 1.

It is determined that in comparison to test samples the studied AC has higher mechanical strength by 28% and lower ash content by 2,5%, which contributes to greater resistance to abrasion and service life, a slight dusting, increasing the number of regenerations and reduce of the start-up period.

Sorption characteristics of AC are shown in Table. 2.

Basic Physical and Mechanical Characteristics of AC

Index	Name of AC	
	Filtrasorb F300 (control)	Silcarbon K835spezial
Bulk density, g/dm^3	480	490
Humidity, %	4	4
Mechanical strength, %	70	98
Ash content, %	3,5	1,0
Particle size, mm	0,5 – 3,0	1,0 – 2,5

Main Sorption Characteristics of the Studied AC

Material	Sorption characteristics				
	Total volume of pores by water, cm^3/g	Number of basic oxides, mole/m^3	Number of acidic oxides, mole/m^3	Adsorption activity by iodine, %	Alkalinity of water infusion, 0,1 cm^3 hydrochloric acid c(HCl)= 0,01 mole/dm^3
F300 (control)	0,55	0,85	0,9	65	3,5
Silcarbon K835spezial	0,8	1,15	0,75	90	7,5

It is determined that in comparison to test samples the studied AC has a larger total volume of pores by water by 30%, adsorption activity by iodine by 38 %, and alkalinity of water infusion is twice as much that is supported by 35 % more of the number of basic oxides.

An optimal technological mode was set up during water conditioning with AC Silcarbon K835spezial that provides to get prepared water which quality meets the ukrainian standards SOU 15.9-37-237:2005 "Water prepared for alcoholic beverage production. Specifications".

The results of water conditioning with sorption method and optimal technological parameters are given in Tables 3, 4.

It is established that due to improved physical, mechanical and sorption characteristics of the studied AC compared to test samples water consumption for the preparation decreases by 1,5 times, for ripping and rapid washing – by 1,5 times, and the specific volume of prepared water increases by 38 %.

It was established that during the regeneration of the investigated AC compared to test samples the duration of steaming reduces by 1,5 times that makes possible to reduce steam consumption, with that the degree of regeneration increases by 1,3 times.

It is established that the studied AC provided water conditioning with such parameters: taste, aroma, colouring, turbidity. During water conditioning with AC the mass concentration of iron, ammonium, nitrite decreases almost by 1,5 – 2 times, with that the permanganate oxidation improves by 40 – 50 % compared to the control sample.

Table 3

Optimal Technological Parameters of Sorption Purification with the Studied AC

Name of technological operation	Linear speed, m/hour	Relative volume, v/v AC	
		F 300 (control)	Silcarbon K835spezial
AC preparation (washing)	5 – 10	10	5
Specific yield of water	8 – 12	800	1100
AC ripping of input water	10 – 12	6	4
Quick washing of AC	15	6	4
AC regeneration at temperatures 130 ^{o}C, hour.	-	6	4
Degree of regeneration, %		38 – 40	50 – 55
Number of possible regenerations, pcs.	-	2	4

Table 4

The Results of Water Conditioning with the Use of AC

Name of index, unit of measure	Requirements of SOU 15.9-37-237, no more	Input water	Prepared water with the use of AC	
			F 300 (control)	Silcarbon К835spezial
Organoleptic properties				
Taste at 20°C, points	0	2	0	0
Aroma at 20°C, points	0	2	0	0
Colouring, degrees	5	20	5	0
Turbidity, mg/dm^3	0,5	1,0	0,2	0
Physical and chemical properties				
Hardness, mole/m^3	0,1	3,8	4,2	3,8
Total alkalinity, mole/m^3	4,0	4,0	4,5	4,0
Free alkalinity, mole/m^3	not allowed[*]	not found[*]	0,4	not found[*]
Oxidation, mgO$_2$/dm^3	2,0	4,5	1,0 – 1,2	0,5 – 0,7
Contents, mg/dm^3				
- iron	0,1	0,15	0,1	0,07
- ammonium	0,05	0,10	0,07	0,05[1)]
- nitrite	0,1	0,2	0,15	0,05[1)]
- free residual chlorine	not allowed[*]	0,6	0,3[1)]	less than 0,3[*]
- bound residual chlorine	not allowed[*]	0,5	0,3[1)]	less than 0,3[*]
- hydrogen sulphide	not allowed[*]	0,2	0,15	less than 0,1[*]

[*]The results of testing of free alkalinity, ammonium, free residual chlorine and hydrogen sulphide within the sensitivity of the method

The topicality of activated carbon Silcarbon K835spezial usage for alcoholic beverage industry is given scientific credence. Enhanced physicochemical and sorption properties of activated carbon Silcarbon K835spezial enable to increase the specific volume of prepared water by 38 %.

Conclusion

Investigated microporous active carbon Silcarbon K835spezial is promising and allows not only to reduce significantly organic compounds in water content, but also iron, nitrogen-containing compounds, and to improve organoleptic properties of both water and alcoholic beverages with its use.

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Technological levers control of the properties of two-layer environment, the formation of thermostable capsules with the fat content

**Evgeniya Korotayeva, Olga Neklesa,
Pavel Pyvovarov, Tetiana Troshchyi**

Kharkiv State University of Food Technology and Trade, Ukraine

**Corresponding
author:**

Evgeniya Korotayeva
E-mail:
Korotayeva@yandex.ua

Abstract

Introduction. There are necessary the scientific justification of technological process parameters and components of technological systems to ensure industrial production of capsulated herbal oils.

Materials and methods. Capsule formation of model system «oil refined, deodorized - aqueous solution of sodium alginate» in two-layer receiving environment «oil - water», which contains free ions Ca^{2+} was investigated. The density of the receiving environment been adjusted by addition of ethanol. Surface tension of technology systems determined by the separation drops of capillary on a calibrated stalahmometrychnyy installation.

Results and discussion. There are experimental data of influence calcium chloride, ethanol, surfactants to determine the interfacial tension of two-layer receiving environment, forming thermostable capsules with fat, depending on the temperature in article. Composition of the system and working concentrations participants of the process, which provide a stable process of capsule formation are grounded. The obtained regularities allowed to carry out production of industrial innovation. Detected the influence temperature of component composition on capsulation technology system «oil refined, deodorized - aqueous solution of sodium alginate» through two-layer receiving environment by introducing a surfactant. Suggested working concentration of the prescription system components «Oil - water and alcohol (40% vol.) 1,0% solution of calcium chloride» using 0,3…0,5 % E322 (lecithin) or E432 (polyoxyethylene sorbitan monolaurate) will introduce a production capsulated herbal oils.

Conclusion. The conducted research is a research platform for the study of parameters of technological process of production of encapsulated vegetable oils.

Introduction

Systematic providing population of full foodstuffs, depends on the level efficiency of the food industry. Formation competitive production technology of Ukrainian goods and state food security with its export potential direction, depends on the level introduction the scientific innovations to the manufacture process.

Introduction technology of capsulated vegetable oils with heat-resistant ionotroFig. sheath into the industrial production, dictates the necessity substantiation the process parameters of capsule formation, processing system, which will provide to obtain a product with specified properties, indicators of quality and safety. The solution this problem is possible by evidence-based modeling of technology process system that will provide getting the physical capsule form.

Establishment the scientific bases capsule formation of adipose technology systems, in the author's opinion, allows to view the technological principles of obtaining foodstuffs, which include the adipose raw material and create a scientific and practical preconditions for obtaining foodstuffs with new organoleptic parameters.

The basis technology, is based on controlled using the chemical potentials of components, regulation sturdiness of interfacial layers using by the surfactants as levers to control the properties of two-layer receiving environment «oil - water».

By domestic [1] and foreign scientists [2 - 10] are conducted systematic investigations on stabilization two-phase systems, particular «oil - water», using surfactants. The method of stabilization, lies in the formation, projected, by strength of interfacial adsorption layers. Choice of surfactants and its concentration for stabilizing the complicated disperse systems should be based on its properties, values of the hydrophilic-lipophilic balance, type and concentration the third substance that is in one of phases system. Two-phase system durability and two extrusion process stability to obtaining oil capsule formation with the predicted organoleptic parameters are required experimental research, directed to determine the parameters reducing interfacial tension, that will provide two-phase system stabilization «oil - water-alcohol solution ions of Ca^{2+}» for the implementation industrial production of capsulated vegetable oils with thermostable resiliently - elastic sheath.

Materials and methods

There are used analytical, mathematical and applied research methods to substantiation the technology parameters capsulated vegetable oils and establishment regularities changes in interfacial tension (σ) stalahmometric method by volume drop, depending on the concentration each component of the prescription stuff by the temperatures 25°C and 40°C, that affect to the physical and chemical properties of two-layer receiving environment.

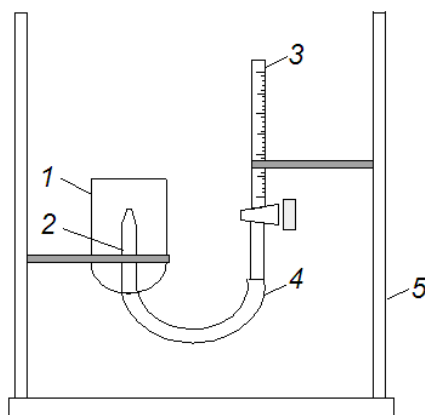Machine, which made measurements, shown schematically in Fig. 1.

Fig. 1. Stalahmometric installation:
1 – glass (for measuring the solution greater by density); 2 – capillary;
3 – microburette; 4 – connection hose; 5 – tripod

Stalahmometric installation consists of glass 1,5…2,0 mm diameter with soldered capillary, getting by connecting rubber hose with microburette. Capillary has polished horizontal cut. Microburette diameter is 5mm.

Before the measurements, carried out calibration, which includes defining constants device by liquids with known interfacial tension.

$$K = \frac{\sigma_{c/w}}{V \cdot (\rho_w - \rho_c)} \tag{1}$$

$\sigma_{c/w}$ - interfacial tension (cyclohexane/water) 50,9 мН/м;
V - volume for one drop;
ρ_w - density of distilled water at a temperature 20°C;
ρ_c - density of cyclohexane at a temperature 20°C.

For the measure are prepared a series solutions of different concentrations investigated system.

The further measurements are carried out as follows. Microburette, connecting rubber hose and capillary are filling with the investigated liquid that is less by density (oil). Glass is filling with liquid that is greater by density (water liquid) to 3/4 volume, watching that water don't put to capillary. Opening microburette's tap and measuring volume of 10 drops investigated liquid.

The physical system of drop formation and its throwing from capillary can be explain like involuntary accumulation on the breakdown cordon phase molecules of surfactant, which leads to a decrease in interfacial tension. Change σ achieved by the fact, that on the breakdown cordon molecules phase of surfactant, which have dyfilnu structure, always are oriented so that their interaction with two environments, leads to a maximum energy release - polar groups stands in polar liquid and non-polar radical refers to a non-polar phase.

Interfacial tension of two liquids is given by:

$$\sigma = K \cdot V \cdot (\rho_1 - \rho_2) \qquad (2)$$

σ - interfacial tension of investigated system, мН/м;
V - volume for one drop;
ρ_1 - density of water liquid at a measurements temperature;
ρ_2 - density of purified deodorized sunflower oil at a measurements temperature.

Results and discussion

Objective of scientific substantiation technology capsulated vegetable oils is investigation of the influence, integral prescription components (ethyl alcohol 96,0 %, calcium chloride) as technological levers to control the properties of two-layer receiving environment and scientific substantiation of prescription form.

Ethyl alcohol (ρ=0,78 g/sm^3) [11] in technology acts as a substance that reduces the density of drinking water, and calcium chloride, acts as bearer ions of Ca^{2+} - to realize the polysaccharide potentials solution of adipose capsule sheath.

To provide a transition for already formed quasi stable capsules, created in the top layer oil of two-layer receiving environment, to water-alcohol reaction environment is necessary to ensure the following:

- density of top oil layer should be approximately or equal to density of lower water-alcohol layer, two- layer receiving environment;
- water-alcohol layer receiving environment should contain Ca^{2+} ions;
- value of interfacial tension adsorption layers on the border «oil - water-alcohol solution Ca^{2+}» should provide a transition quasi stable capsules to water hydrophilic environment.

Process of transition capsules across the border phase system «oil - water-alcohol solution Ca^{2+}» is provided by using surfactants, that forming interfacial adsorption layers and providing reduction the Gibbs free energy at the interface phases. Introduction surfactants in one of two-layer environment is performed based on the nature dissolution at the stage preparation semifinished of two-layer receiving environment, which has a positive on stabilizing process coaxial extrusion technology mixture in two-layer receiving environment.

Considering, that system «oil - water-alcohol solution» can change the value of interfacial tension at higher temperatures, we investigated taking into account the thermal threshold, which cannot be exceeded due to spoilage the quality of the oil.

Nonionic, amphoteric surfactants with different values of hydrophilic-lipophilic balance (Table 1) for the solution of technological problem, been investigated.

Based on capsule formation process of technology capsulated vegetable oils, density of the oil layer and density of the water-alcohol layer two-layer receiving environment should be approximately or have a value 0,92 g/sm^3.

The influence of each prescription component system «oil - water» of two-layer environment to σ has the exploratory character in terms of justification concentrations, technology parameters, investigation physical and chemical properties of two-layer environment as a constant value of technology.

Surfactants characteristics to form a two layer receiving environment technologies capsulated vegetable oils

Name surfactants	Hydrophilic-lipophilic balance	Characteristics	Solubility	Micelle formation
E471 Mono- and diglycerides of higher carboxylic acids	3...4	Nonionic	Fat-soluble, alcohol-soluble, dispersible in water	Reverse micelles; Micelles
E322 lecithin	3…4	Amphoteric	Fat-soluble	Reverse micelles; Micelles
Polyoxyethylene sorbitan monolaurate E432	16,7	Nonionic	Fat-soluble, water-soluble, alcohol-soluble	Reverse micelles; Micelles

In this case technology can not exist without ions of Ca^{2+}, content which provides sheath structure-forming ability thermostable capsules. The specialists of Kharkiv State University of Food Technology and Trade have developed technology capsulated fat product with thermostable sheath and received a patent on an useful model № 90875 «Method of obtaining capsules with an inner content based on fat», the schematic diagram is shown in Fig. 3, fulfillment which allows for chemical potentials reactive capable substances of sodium alginate and calcium chloride to obtain a heat-resistant sheaths capsulating fats.

Experimentally established, that to obtain adipose capsule with specified elastic-plastic properties of the sheath, concentration $CaCl_2$ varies within the range 0,5…2,5 % (Fig. 4). Investigated effect of concentration $CaCl_2$ in two temperature lines 25°C and 40°C.

From Fig. 4 we can see, that with increase concentration of $CaCl_2$ from 0,5 % to 2,5 % at temperature 25°C and 40°C accurately not observed decrease the value σ and not influence to participant of two-layer receiving environment. That's why concluded, that injection of calcium chloride into the system can be choose by organoleptic evaluation sheath of the finished capsule. Working concentration is 1,0±0,05 % $CaCl_2$.

At the temperature 40°C interfacial tension have the meaning less than 25°C, which is obtained with comparison isothermal values of curves 1 and 2 (Fig. 4). This is probably due to increase the average distance between water molecules with temperature increasing, in consequence, the forces of interaction between them are decreased.
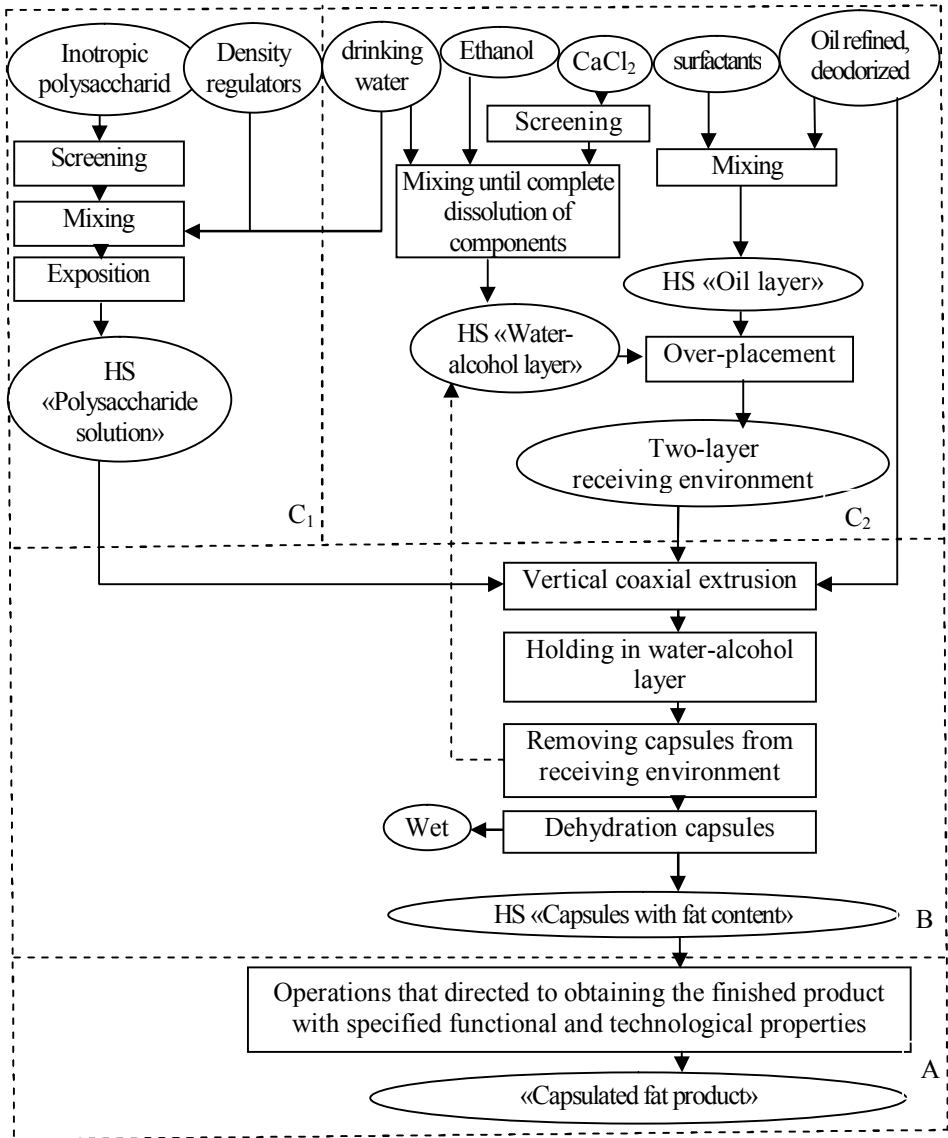
Fig. 3. Schematic diagram obtaining capsules with a heat-resistant sheath

Because of technological term dipping capsules - the density of two layer from doable layer receiving environment must be approximated to 0,92 г/см³ [11]. The concentration of ethanol (96,0 %) in the water-alcohol solution system $CaCl_2$ should be 40% vol., it was revealed. It was revealed also, that if alcohol volume concentration will higher the system will turn round. Influence of ethanol volume concentration to interfacial tension showed on Fig. 5.
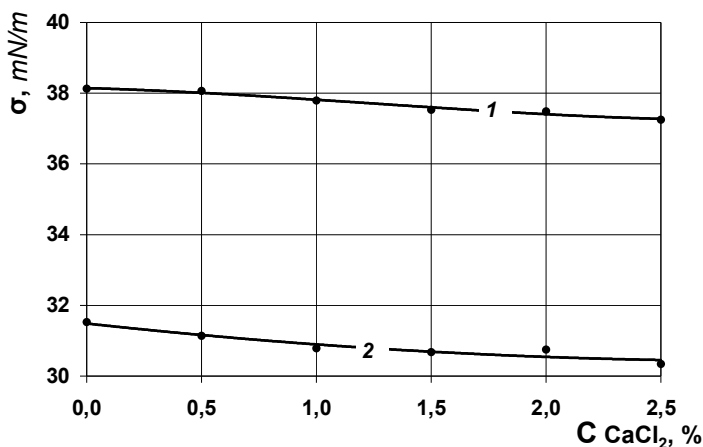
Fig. 4. The interfacial tension dependence of the system «oil - water solution CaCI₂» from concentration CaCI₂ according at temperature: 1, 2 - 25 °C; 40 °C
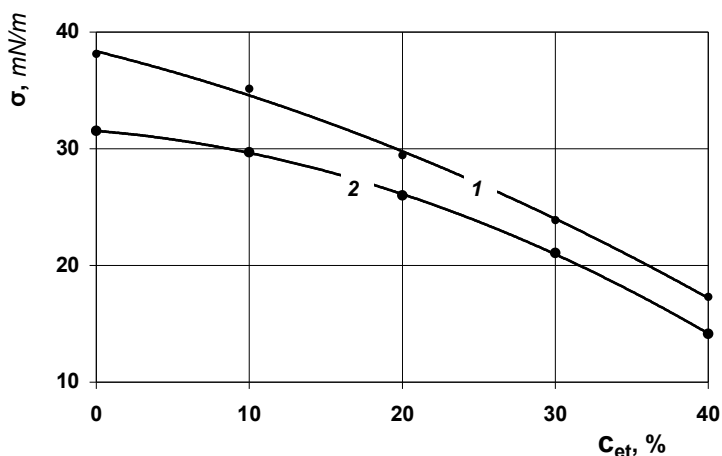

Fig. 5. The interfacial tension dependence of the system «oil - water alcohol solution» from ethanol concentration (% vol.) according at temperature:
1 - 25 °C; 2 - 40 °C

Descending character curves (Fig. 5) can be explained by nature of the polar organic compound (ethanol) and probably its ability in this technology mixes reduce the surface tension of water. Accepted density of water-alcohol layer does not satisfy the stable technological process of capsules formation since there is «hang-up» drops on the border of separation, that's why in following, modeling the two-layer receiving environment it was obtained surfactants influence to the «oil - water-alcohol with $c_{ethanol}$ = 40% vol., c_{CaCl2} = 1,0 %» system, which was introduced considering the nature of solubility.
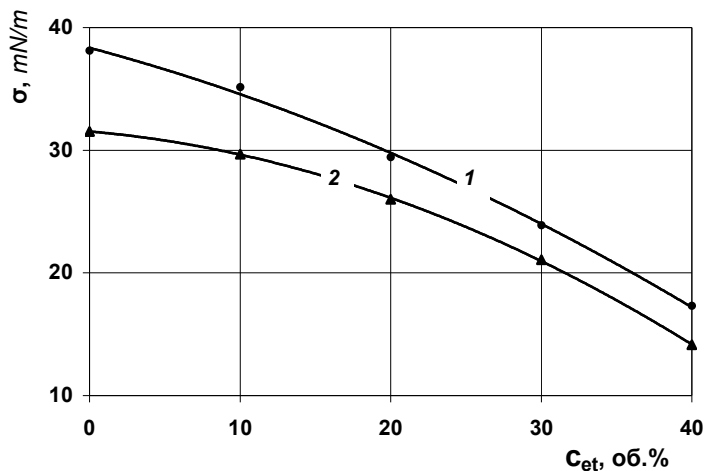
Fig. 5. The interfacial tension dependence of the system «oil - water alcohol solution» from ethanol concentration (% vol.) according at temperature:
1 - 25 °C; 2 - 40 °C

Established that injection (E432) polyoxyethylene sorbitan 0,1 % contributes to reducing σ system contenting ethanol 40,0 % vol. and 1,0 % $CaCl_2$ (Fig. 6), further increase in concentration leads to the formation and accumulation of surfactants molecules to interfacial adsorption layers.
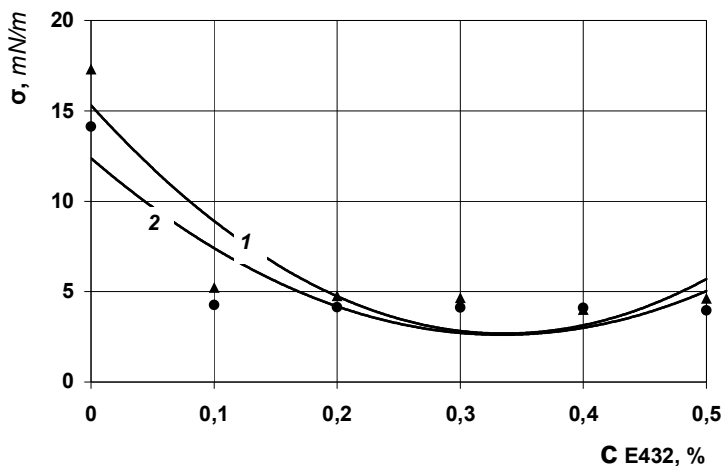

Fig. 6. The interfacial tension dependence of the system «oil - water alcohol solution 40 % vol. 1,0 % $CaCl_2$» from concentration E432 according at temperature:
1 - 25 °C; 2 - 40 °C

Established that mono- and diglycerides of higher carboxylic acids injection (E471) at a concentration of 0,1% to 0,5% contributes to a slight decrease σ in the system, but relying on the trend research such surfactants will not satisfy the stable technological process of capsules formation, which is confirmed by experiments in the laboratory (Fig. 7).

Fig. 7. The interfacial tension dependence of the system «oil - water alcohol solution 40 % vol. 1,0 % CaCl₂» from concentration E471 according at temperature:
1 - 25 °C; 2 - 40 °C

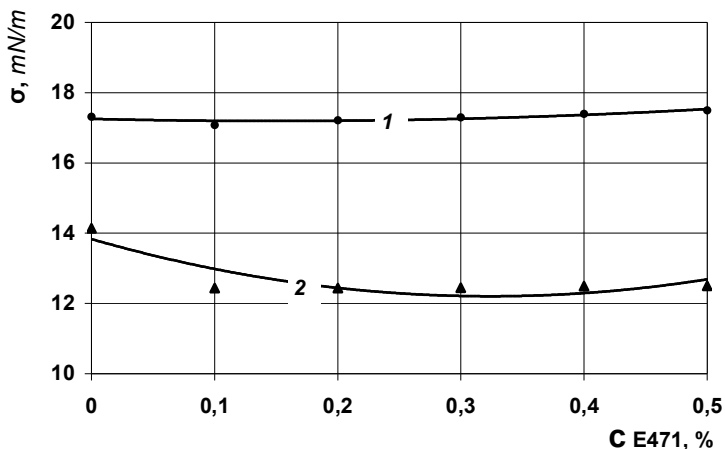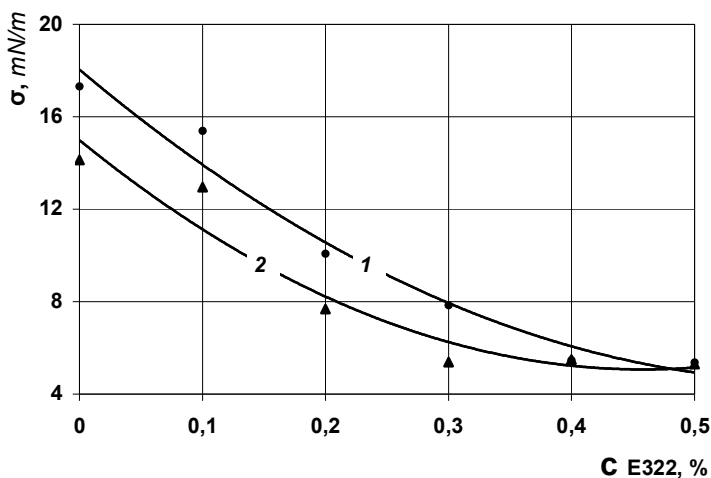**Fig. 8. The interfacial tension dependence of the system «oil - water alcohol solution 40 % vol. 1,0 % CaCl₂» from concentration E322 according at temperature:**
1 - 25 °C; 2 - 40 °C

Established that injection of lecithin (E322) in concentration 0,5 % (Fig. 8) provides lower meaning interfacial tension, that due by the accumulation surfactants molecules to interfacial adsorption layers, and of course compensate for the energy of two different liquids in nature.

Experimentally established, that using E432 and E322 surfactants in reasonable concentrations satisfy the stable technological process.

In this manner, it can be stated, that maximum power compensation of two layers, according minimum value of interfacial tension, and stable technological process formation, formation of capsulated vegetable oils, are satisfied technological questions, that was required by substantiation.

Conclusion

1. Injection $CaCl_2$ to model system «oil - water» two-layer receiving environment don't influence on the interfacial tension meaning.

2. Established, that injection of ethanol to the 40 % vol. due to increase interfacial tension receiving environment , same time aligning density approximately to the density of oil layer two-layer receiving environment.

3. Established, that type and surfactants concentration due to decrease interfacial tension. E432 under certain conditions satisfy the stable technological process of capsules formation.

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Food supplement with the adaptogenic activity on the basic of Agaricus bisporus biopolymers

Natalya Cherno[1], Leonid Shafran[2], Sophya Osolina[1], Olena Tretyakova[2], Oleksandra Nikitina[1]

1 - Odessa National Academy of food technologies, Ukraine
2 - State Enterprise Ukrainian Scientific and Research Institute of Transport Medicine, Odessa, Ukraine

Abstract

Introduction. It is necessary to use the food supplement with the adaptogenic activity for correcting and preventing human state suffered from stress effect.

Materials and methods. The samples were prepared by sequential treatment of mushrooms (*Agaricus bisporus*) with water, 3.7 % HCl and sodium hydroxide solutions, varying the alkaline agent concentration (3.0, 5.0 and 7.0%) and its contact time with the solid residue (60, 120, 180, 240 and 300 min). Adaptogenic activity was predicted by the whole complex of indexes: the antioxidant activity (AOA), bifidogenic effect (BGE), sorption of cholic acid (SCA). The food supplement in a dose of 200 mg/kg was administered to the diet of experimental animals. The plumbum acetate in a dose of 14.1 mg/kg was stressor. The morphometric indexes, behavioral responses, and the levels of total lipids, cholesterol, triglycerides, malondialdehyde (MDA), the activities of ALT, AST, glutathione peroxidase (GP), glutathione reductase (GR) and glucose-6-phosphate dehydrogenase (G-6-PDG) were determined.

Results. Correlation between the properties of samples of mushroom biopolymer complex and their preparation conditions (concentration of the alkaline agent, the treatment time) was investigated. It was shown that none of mushroom raw materials processing permitted to isolate the preparation that would show AOA, BGE, and SCA at the highest level. The sample that had AOA being equal to 90.0 %, SCA – 22.4 mg/g of the supplement, BGE corresponding to $1.5 \cdot 10^{12}$ CFU/cm^3 was chosen for research *in vivo* test. A nutritional intervention of the food supplement against stressor influence had a beneficial effect on laboratory animals. There were improvement of morphometric indexes and stabilization of animals' behavioral responses. Activities of GP, GR, G-6-PDG increased by 21.7, 26.0, and 20.0 % respectively compared to the animals group getting plumbum acetate. MDA, total lipids, triglycerides and cholesterol levels reduce by 14.8, 14.2, 26.6 and 18.9 % respectively. The indexes of ALT and AST activities are stabilized. These results suggest that food supplement obtained from *Agaricus bisporus* has the adaptogenic activity.

Conclusion. It is advisable to include this food supplement to the diet for correcting adaptative reactions of a human body.

Introduction

In the modern world a whole range of stress factors of different nature affect a human body. They bring about a cascade of nonspecific stress reactions. The long-term exposure of stressors causes the hyperlipidemia, disorder of the immune system functional activity, increasing the production of free radicals with the simultaneous shift of the system antioxidant-prooxidant towards the latter. It leads, as a consequence, to the development of the oxidative stress that is one of the main pathogenetic factors conducing to the reduction of compensatory-adaptive reactions of the organism, disruption of homeostasis and the development of pathological changes [1-3].

It is necessary to use preparations with the adaptogenic activity for correction and prevention such states [1-4]. Classic adaptogen preparations were prepared from *Panax ginseng*, *Eleutherococcus senticosus*, *Aralia mandshurica*, *Schisandra chinensis* that grow mainly in the Far East, Siberia and South-East Asia [3, 4]. These plants are very rare on the territory of Ukraine [4].

In this regard, it is important the search of new environmentally friendly and widely spread in nature sources of biologically active substances. The ones enhance a human body's resistance to adverse factors as well as prevent the development of pathological changes because they show antioxidant properties, ability to recuperate the immunological reactivity and positively influence on lipid metabolism [1-4].

Mushrooms are the important resource and potential source of these substances [5]. They contain β-glucan is one of the most active immune modulator of carbohydrate nature with pronounced prebiotic properties as well as aminopolysaccharide and melanin that show both enterosorbent and antioxidant activities (AOA) [5, 6]. For isolating these individual components it is necessary to use such treatment conditions of raw materials that lead to an uncontrolled modification of their properties. That is why it is effectually to obtain biopolymer complexes from mushrooms. These complexes have more expanded functional and physiological properties than the individual components [7].

It was found that biopolymer complexes obtained from *Agaricus bisporus* could show AOA, stimulate the growth of bifidobacteria that, in turn, reactivate immune response and enhance nonspecific resistance, sorb cholic acid – a product of cholesterol metabolism – and thus way they indirectly affect lipid metabolism [7, 8].

The aim of this work was to obtain the mushroom biopolymer complex that have the highest possible levels of AOA, bifidogenic effect (BGE) and sorption of cholic acid (SCA) – the food supplement with adaptogenic activity and to investigate its properties *in vivo* test.

Materials and methods

Biopolymer complex samples preparation and their properties.

The samples of the biopolymer complex were obtained by sequential treatment of raw materials (*Agaricus bisporus*) with hot water and 3.7 % HC1 solution at room temperature. The solid residue was treated with 3.0, 5.0 and 7.0 % NaOH solution at 98 °C, the time of treatment were varying in the range of 60 – 300 min.

AOA of samples was determined according to [9] with modification. 5 cm^3 of 0.1 % solution of sunflower oil in ethanol was added to 50 mg of sample. Oxidation was carried out at 90 °C for 90 min. After cooling, 0.5 cm^3 of 30 % $NH_4(CNS)$ solution and 0.5 cm^3 of 0.02 M $FeSO_4 \cdot 7H_2O$ solution were added to the reaction mixture. The colour intensity of the solution was measured at 500 nm. The control did not contain the sample. AOA was calculated by comparing the colour intensity of the test sample and control.

BGE of samples was estimated by their ability to intensify the growth of *Bifidobacterium bifidum* cells. For this 5 % suspension of *Bifidobacterium bifidum* cells from Biopharma and 2 % of the sample were added to the sterilized milk. Ripening was carried out at 37 °C. The viable count of *Bifidobacterium bifidum* was determined by plating the appropriate dilutions into thioglycollate medium. All plates were incubated anaerobically at 37 °C for 72 hours. The results were expressed as CFU/cm^3.

For determination SCA 2.5 cm^3 of cholic acid solution in phosphate buffer, pH 8.0 (1 mg of acid per 1 cm^3) was added to sample (0.1 g). The mixture was hold at 37 ºC for 2.5 hours. Then it was filtered. The cholic acid concentration in the filtrate was determined by spectrophotometrically. For this 0.4 cm^3 of 1 % fructose solution and 5 cm^3 of 67 % sulphuric acid solution were added to 1 cm^3 of filtrate. The mixture was being heated at 60 ºC for 15 minutes. Then it was rapidly cooled. The optical density of the solution was measured at 580 nm. A blank experiment was carried out in parallel. The cholic acid concentration in solution was determined using a calibration curve prepared for cholic acid (Sigma). SCA was evaluated by changing the cholic acid concentration in the solution before and after contact with sample.

Analysis of food supplement *in vivo* test.
The white male rats weighing 200-230 g were used in the test. The experiment continued for 4 weeks. The animals were maintained on a standard diet with free access to water and food according to the requirements [10-11]. Experimental animals were divided into 4 groups (8 animals each): the 1st group – control; the 2[d] group – received orally food supplement in a dose of 200 mg/kg [12]; the 3[d] group – received plumbum acetate in a dose of 14.1 mg/kg with drinking water; the 4th group – intragastrically received food supplement and plumbum acetate with drinking water in corresponding doses.

The dynamic of changes in body weight of animals was studied during the whole period of the experiment (body weight of the rats was measured before and after the experiment). Locomotor response, orienting-exploratory activity (horizontal and vertical activities, hole exploratory behaviour), the emotional state of animals (grooming and number of boluses) were investigated in the "open field" test [13] (before the experiment, at the second week and at the end of the experiment). After finish the experiment serum levels of total lipids, cholesterol, triglycerides were measured using commercial kits NPO "Felicit-Diagnostics" (Dnepropetrovsk, Ukraine). The activity of alanine (K.F.2.6.1.2-ALT) and aspartate aminotransferase (AST K.F.2.6.1.1) were determined using clinical kits PZ CORMAY, Poland. In liver tissue glutathione reductase (K.F.1.6.4.2-GR), glutathione peroxidase (K.F.1.11.1.7-GP), glucose-6-phosphate dehydrogenase (K.F.1.1.1.49-G-6-PDG)) activities were determined according to [14]. The malondialdehyde (MDA) level was measured according to [15].

Statistical analysis.
Statistical processing of research data was performed by variance, correlation analysis. Statistical differences were considered significant at $p < 0.05$. All calculations were performed using a standard software package application of Microsoft Office Excel 2003 (license № 74017-640-0000106-57490) [16].

Results and Discussion

Correlation between the properties of samples of mushroom biopolymer complex and their preparation conditions.

As it was shown in Fig. 1, treatment time of raw materials with the alkaline agent had a significant influence on AOA when the dilute sodium solution was used. Increasing exposure time brought enlarging the value of this index in 2.8 times. Its most rapid rise was observed during the first 180 minutes. Using more concentrated reagent solution also promoted growth of AOA with increasing the treatment time of raw materials, but its effect was markedly reduced with the rise of alkaline concentration.

According to the data shown in Fig. 2 for obtaining the samples that showed high level of BGE it was necessary to use the solution with a minimum concentration of extragent during the minimum time period. Processing raw materials with more concentrated solution led to the sharp decrease of this index in 1.5-3.4 times under the 60-minute treatment. More long-term contact of raw materials with more concentrated alkaline agent slightly impacted on BGE index. Besides samples, obtained under such treatment conditions, showed low level of BGE.

It should be noted that in contrast to the previous indexes SCA depended on changing conditions of the process to a lesser degree (Fig. 3). Its level varied in the range of 18.0 – 30.3 mg/g of the sample. The preparations isolated when more concentrated alkaline solution was used, regardless of the duration of exposure time, had the highest values of this index. The sample obtained by processing raw materials with the concentrated reagent solution during the minimum time period showed the maximum level of SCA.
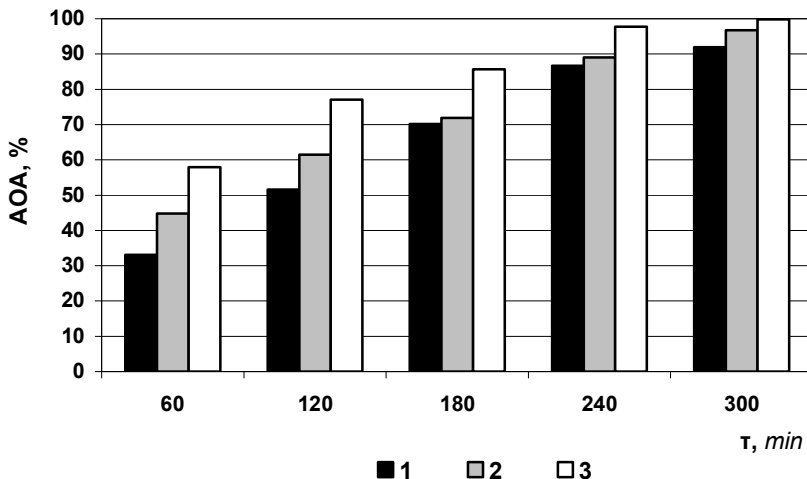

Fig. 1. The AOA of the biopolymer complex samples:
1 – biopolymer complex samples isolated in the processing of raw materials with 3 % NaOH solution;
2 – biopolymer complex samples isolated in the processing of raw materials with 5 % NaOH solution;
3 – biopolymer complex samples isolated in the processing of raw materials with 7 % NaOH solution.

Fig. 2. The BGE of the biopolymer complex samples:
1 – biopolymer complex samples isolated in the processing of raw materials with 3 % NaOH solution;
2 – biopolymer complex samples isolated in the processing of raw materials with 5 % NaOH solution;
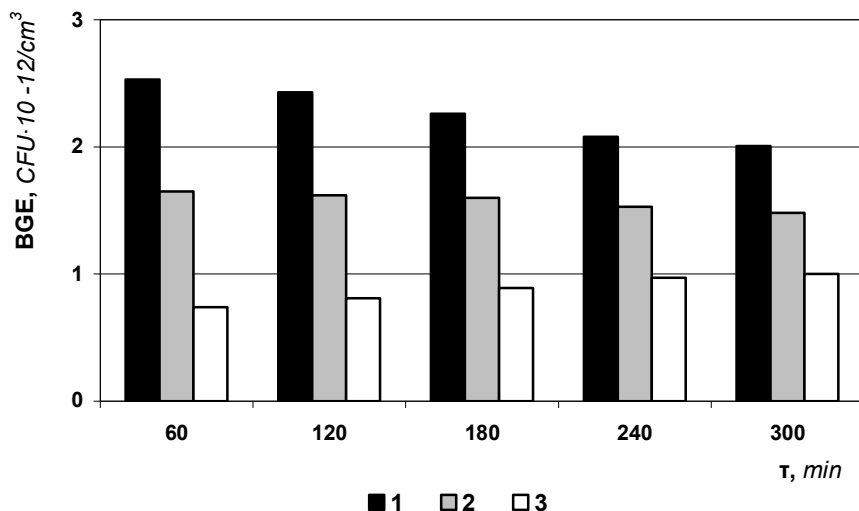3 – biopolymer complex samples isolated in the processing of raw materials with 7 % NaOH solution.

Fig. 3. The SCA by the biopolymer complex samples:
1 – biopolymer complex samples isolated in the processing of raw materials with 3 % NaOH solution;
2 – biopolymer complex samples isolated in the processing of raw materials with 5 % NaOH solution;
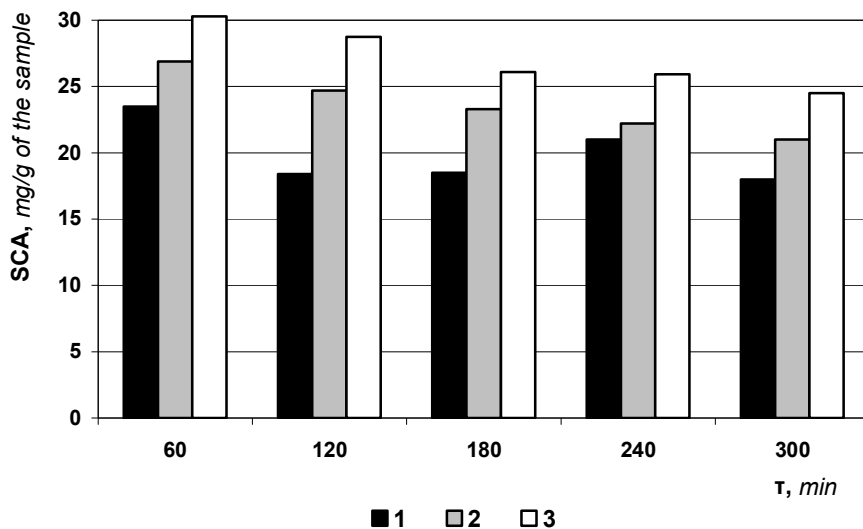3 – biopolymer complex samples isolated in the processing of raw materials with 7 % NaOH solution.

The above results point out that none of mushroom raw materials processing permited to isolate the biopolymer complex that would show the reported properties at the highest level. Therefore, the sample – food supplement – that had AOA being equal to 90.0 %, SCA – 22.4 mg/g of the supplement, BGE corresponding to $1.5 \cdot 10^{12}$ CFU/cm^3 was chosen for research *in vivo* test.

Estimation of food supplement properties *in vivo* test

For confirming the effectiveness of food supplement morphometric indexes, behavioral responses, lipid metabolism indexes, state of the hepatobiliary system, the state of the system of the antioxidant defence and lipid peroxidation level were investigated *in vivo* test.

It was found that the food supplement administration to the diet of laboratory animals that were not exposed to a stressor had a positive effect on the morphometric indexes (Table 1).

Thus, the dynamic of animals' body weight gain was 20.1 % (p<0.05) higher in the 2^d group than the control one. Ingestion of plumbum salt reduced the index of body weight gain by 24.3 % in the 3^d group and 14.2 % in the 4th group compared with 2^d group where animals were fed by the food supplement (p<0.001 and p<0.05 respectively). Such positive dynamic towards stabilization of this index in the group that was given plumbum acetate and biopolymer complex is probably due to the ability of this food supplement to increase nonspecific resistance of the organism, which in turn, allows restoring homeostasis.

Table 1

The dynamic of changes in animals' body weight during the experiment

Number of the group	Animals' body weight before the experiment, g	Animals body weight after the experiment, g	The weight gain, ΔM_{av}, g
1	213.70±1.90	246.75±1.46	32.9±1.95
2	218.70±3.40	258.25±3.40	39.5±1.32[*/1]
3	217.80±2.00	248.90±2.77	29.9±1.11[***/2]
4	218.80±2.50	252.75±3.19	33.9±1.68[*/2]

Note: */^{1} – indicates a significant difference compared to the 1th group (p <0.05);
 */^{2} – indicates a significant difference compared to the 2^d group (p<0.05);
 ***/^{2} – indicates a significant difference compared to the 2^d group (p<0.001);

The study of behavioral responses before the beginning of the experiment (Table 2) revealed significant differences in horizontal activity manifestation between animals of different groups. It was connected with individual and typological features of behavioral responses in various animals. Therefore, these indexes were compared in relation to their background for animals of each group.

There weren't observed any significant changes in the control group of animals after 2 weeks of the experiment compared with the beginning of the experiment. At the same time, a locomotor activity rose significantly in the 2^d group – a quantity of the animals' upright posture increased by 33.1 % in relation to the background indexes revealed in this group before the experiment. A tendency to depression of indexes of locomotor and exploratory activities was observed in the 3^d group. It indicates on probability of development of neurotoxic effects in animals exposed by plumbum acetate. Further intake of heavy metal

compound reduced significantly indexes of horizontal, vertical activities by 31.8 and 53.0 % respectively. Intake of both plumbum salt and food supplement stabilized indexes of animal behavioural responses. They characterize a functional state of nervous system that is the most sensitive to a stressor influence.

Thus, simultaneous improvement of morphometric indexes and stabilization of animal behavioral responses indicates the ability of food supplement to enhance a body's resistance to the influence of adverse factors.

Antioxidant properties of this food supplement were also investigated on the plumbum intoxication model. Reliable initiation of lipid peroxidation in liver was found in animals of the 3^d group exposed by plumbum acetate – by 35.0 % compared to the control group (p<0.05) (Table 3). In addition, an activation of the system of the antioxidant defence in liver tissue was observed: GP increased by 21.1 % (p<0.01), NADP·H_2 – dependent – by 17.1 % (p<0.05), G-6-PDG – by 33.1 %.

A nutritional intervention of the food supplement on the background stressor influence has a positive effect on the balance of pro-oxidant system in the body. Against heavy metal exposure an ingestion of the biopolymer complex reduces MDA level by 14.8 %, increased GP, GR, G-6-PDG activities by 21.7, 26.0 and 20.0 % respectively (p<0.05) compared with the 3^d group.

Table 2

The research of behavioral responses during the experiment

Number of the group	Horizontal activity	Vertical activity	Hole exploratory behaviour	Grooming	Emotion (number of boluses)
Before the experiment					
1	24.5±2.9	10.8±1.0	1.5±0.9	2.5±0.7	2.9±0.6
2	22.8±2.2**/[1]	13.9±1.0	1.6±0.3	2.1±0.4	1.9±0.3
3	21.4±1.8**/[1]	13.2±1.4	1.7±0.2	2.1±0.3	2.8±0.5
4	20.0±1.1**/[1]	10.2±0.9	1.8±0.2	2.7±0.3	2.2±0.4
After 2 weeks of the experiment					
1	24.6±2.3	10.2±1.3	2.0±0.3	2.1±0.3	2.1±0.3
2	24.5±2.7	18.5±0.9***/[1] **/b.e.	1.8±0.3	1.7±0.2	1.5±0.2
3	16.5±1.6	10.6±1.2	1.5±0.3	2.2±0.3	2.8±0.6
4	18.8±1.6	11.0±1.5	1.5±0.1	2.5±0.3	2.1±0.2
After 4 weeks of the experiment					
1	19.1±1.8	9.2±1.2	1.5±0.1	2.1±0.2	2.6±0.7
2	20.2±2.0	16.1±2.0	1.7±0.4	1.3±0.3	1.6±0.3
3	14.6±0.9 **/b.e.	6.2±0.2***/b.e.	2.0±0.2	1.6±0.1	2.9±0.3
4	20.2±1.0	10.8±0.9	2.0±0.3	2.3±0.4	3.0±0.4

Note: **/[1] – indicates a significant difference compared to the 1th group (p <0.01);
***/[1] – indicates a significant difference compared to the 1th group (p <0.001);
**/b.e. – indicates a significant difference compared to the background indexes of this group (beginning of the experiment (b.e.)) (p<0.01);
***/b.e. – indicates a significant difference compared to the to the background indexes of this group (beginning of the experiment (b.e.)) (p<0.001).

**Changes of MDA level and GP, GR, G-6-PDG activities
in liver tissue of animals**

Number of the group	MDA, nmol/mg	GP, μmol /mg protein·min	GR, nmol NADP·H$_2$/min· mg protein	G-6-PDG, nmol /mg protein
1	0.20±0.01	0.19±0.01	0.82±0.04	4.48±0.19
2	0.19±0.009	0.22±0.01	0.83±0.04	4.56±0.22
3	0.27[**/1]±0.01	0.23[*/1]±0.01	0.96[*/1]±0.05	5.96[**/1]±0.35
4	0.23[*/2]±0.01	0.28[*/1*/3]±0.02	1.21[**/1*/3]±0.07	7.15[*/1*/3]±0.34

Note: */[1] – indicates a significant difference compared to the 1th group (p<0.05);
   **/[1] – indicates a significant difference compared to the 1th group (p<0.01);
   */[3] – indicates a significant difference compared to the 3[d] group (p<0.05);

Thus, the intake of plumbum acetate causes both lipid peroxidation rise and activation of antiradical defence systems (GA and GR) in the rats. The preparation administration against plumbum exposure stabilizes indexes of lipid peroxidation and, at the same time, activates enzymes of antioxidant system. It indicates on high antioxidant activity of the food supplement. It's probably due to the substances in its composition that have antioxidant properties protecting the body from oxidative stress, inhibiting lipid peroxidation processes, as well as maintaining the structural characteristics of biological membranes [5, 6].

The food supplement influence on lipid metabolism was studied through changes of their main indexes. It was found that lipids level in animal blood did not change significantly in applying food supplement in the 2[d] group (Table 4). At the same time, their content increased by 52.4 % (p<0.001) in rats exposed by plumbum acetate in comparison with the control animals. There was significant reduction of lipids concentration by 14.2 % (p<0.01) in the 4th group compared to the 3[d] group.

**The total lipids, cholesterol, triglycerides, ALT and AST levels in blood serum of
animals after the experiment**

Number of the group	Total lipids (g/L)	Triglycerides (mmol/L)	Cholesterol (mmol/L)	AST, U/min	ALT, U/min
1	4.66±0.41	0.74±0.03	1.14±0.10	66.35±2.97	26.84±1.46
2	4.64±0.30	0.70±0.03	1.08±0005	62.42±4.41	27.28±1.73
3	7.10[**/1]± 0.36	1.09[**/1]±0.06	1.59[**/1]± 0.07	79.01±5.86	34.12[**/1]± 2.95
4	6.09[***/1,2**/3]±0.24	0.80[**/3]±0.04	1.29[**/3]± 0.07	66.06±5.57	28.81± 1.70

Note: **/[1] – indicates a significant difference compared to the 1th group (p <0.01);
   ***/[1,2] – indicates a significant difference compared to the 1th and 2[d] groups (p<0.001);
   **/[3] – indicates a significant difference compared to the 3[d] group (p<0.01);

A content of triglycerides in blood serum of the 2^d group had a tendency to decrease. Their level in blood of the 3^d group increased significantly in almost 1.5 times compared to the control animals. Enrichment of diet by the food supplement against heavy metal exposure reduced this index by 26.6 % ($p<0.01$) as compared to the 3^d group. There was a significant increase of cholesterol level by 39.5 % ($p<0.01$) in the 3^d group in comparison with control one. An ingestion of food supplement with simultaneous plumbum acetate intake reduced its level in serum by 18.9 % ($p<0.01$) compared to the 3^d group.

Thus, intake of both plumbum acetate and food supplement reduces significantly total lipids, triglyceride and cholesterol levels in comparison to the group getting only the plumbum. This might be due to the fact that components of the food supplement bind lipids and products of their metabolism in the intestinal lumen. It leads to the reducing their absorption. Furthermore, biopolymers being contained in the food supplement are fermented by the intestinal microbiota. As a result short chain fatty acids, in particular propionate, are generated. They show hypocholesteremic effects [12, 17].

Marker indicator of the functional state of hepatobiliary system that is responsible for processes of xenobiotic detoxification in the body is the activity of aminotransferases (AST and ALT) and their relationship [12, 14, 17]. It was found increased ALT activity in the 3^d animal group. It rose by 19.1 % ($p<0.01$). Ritis coefficient (the ratio of AST/ALT) decreased by 14.8 %. It indicated on the liver character of the index abnormal increase. AST and ALT in the 4th group were almost at the same level as that of the control group. This indicates on ability of the food supplement to limit the development of pathological processes that are developed due to xenobiotics intoxication.

Conclusion

It was studied the influence of treatment modes of mushrooms (*Agaricus bisporus*) on the biopolymer complex samples properties (antioxidant activity, bifidogenic effect, sorption activity). For research *in vivo* test the sample – food supplement – that had AOA being equal to 90.0 %, SCA – 22.4 mg/g, BGE corresponding to $1.5 \cdot 10^{12}$ CFU/cm^3 was chosen. It was shown that the use of the food supplement in the laboratory animal diet during the subchronic experiment did not lead to negative changes of the morphometric, physiological and biochemical indexes in comparison with the animal control group. Intake of the food supplement with the stressor (plumbum acetate) influence had a positive effect on the nervous system of experimental animals. It activated the system of antioxidant defence and stabilizes lipid metabolism. This suggests that food supplement obtained from available, non-seasonal, safety, local raw materials (*Agaricus bisporus*) shows high adaptogenic activity. It can be incorporated into the practice of the population sensible nutrition.

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Thermophilic methane digestion of chicken manure

Anatoliy Salyuk, Sergiy Zhadan, Evgen Shapovalov

National University of food technologies, Kyiv, Ukraine

Abstract

Corresponding author:

Sergiy Zhadan
E-mail: zhadan.nuft@
gmail.com

Introduction. The aim of our study was to investigate methanogenesis of chicken manure in the thermophilic mode with the low moisture content of the substrate.

Materials and methods. The study included periodic methane digestion of chicken manure with moisture content from 82 to 94% at 50 °C.

Results and discussion. Studies of anaerobic digestion of this waste product report that high nitrogen content often causes problems of ammonium toxicity for anaerobes. As the temperature increases, the larger amount of ammonia nitrogen turns into ammonia, which is considered a more toxic substance than ammonium ions.

A decrease of substrate moisture content resulted in a decrease of the process efficiency. Biogas yield ranged from 121 to 382 ml/g VS, and the proportion of methane in the produced gas varied from 39.6% to 57%. Methane production started from the first day of the experiment. From the very beginning of the experiment increase in its concentration in biogas content was faster at a higher moisture level of the substrate. Concentration of methane in biogas was not constant and ranged from 50% to 80% for all values of moisture content of the substrate. The maximum rate of methanogenesis increased with an increase of moisture content of the substrate from 2.8 ml / (g VS · day) to 24.7 ml / (g VS · day).

Conclusion. The obtained data prove that production of methane from chicken manure in the thermophilic mode is possible even at low moisture content of the substrate, despite the high content of ammonia nitrogen and ammonia.

Introduction

Poultry is one of the most intensive and mechanized agricultural sectors. Poultry manure is the main ecological problem of poultry farms and its poor management can cause serious environmental damage. Excessive manure generated at poultry farms negatively impacts atmosphere, soil, surface and groundwater. One of the ways of rational utilization of chicken manure is its anaerobic digestion, which provides production of biogas and high quality organic fertilizer. Methane digestion is an effective method of animal waste processing. However, anaerobic processing of poultry manure has not been widely investigated [1]. Studies of anaerobic digestion of chicken manure report that high nitrogen content in poultry manure often creates problems of ammonium toxicity for anaerobes. It is believed that concentration of ammonia nitrogen is the limiting factor for the dilution coefficient [8]. In its turn, the increase of influent concentration is economically valuable as it leads to reduction of reactor volume and lowers consumption of water and energy for its heating, the amount of effluent, the cost of transportation and storage. Most experiments have been carried out in the mesophilic regime [4]. As the temperature increases, larger amount of ammonia nitrogen turns into ammonia, which is considered a toxic substance. The aim of our study was to investigate methanogenesis of chicken manure in the thermophilic mode with the low moisture content of the substrate.

Materials and methods

The experiments were carried out in twenty one 60 ml syringes three times in a row. Moisture content of the substrate was 94%, 92%, 90%, 88%, 86%, 84% and 82%. Manure was diluted with tap water to get the desired moisture level. Each syringe contained 20 g of substrate. Mass fraction of anaerobic sludge was 10%. The syringes were placed in a dry-air thermostat TC 80 M2. The process was carried out in the thermophilic mode at the temperature of 50 °C. The amount of produced biogas was determined by deviation of the syringe piston. The concentration of carbon dioxide was measured by passing the biogas through 2% NaOH solution. The burnability of biogas was also checked. Chicken manure was obtained from Vasilkovska poultry farm where the egg-laying hens were kept in battery cages. Excessive anaerobic active sludge obtained from methane tanks of Bortnychi aeration station (where sludge from the primary clarifiers is processed) was used as inoculum. The sludge was clarified and the obtained liquid was decanted. Chicken manure and its anaerobic active sludge were stored in a refrigerator at 4 ° C.

The content of total solids (TS) was measured by drying the sample in a drying oven at 105 °C to constant weight. To determine the volatile solids (VS), dry residue was heated in a muffle furnace at 600 °C. The pH level was measured using a pH meter pH-150 МИ. Electric conductivity was determined using the conductivity meter PHYWE cobra4 mobile-link with module «Conductivity». The concentration of ammonia nitrogen and volatile fatty acids (VFA) was determined by distillation.

The content of free ammonia was calculated basing on concentration of ammonia nitrogen by the formula [4]:

$$NH_3 \ (mg/l) = \ NH_4^+ - N \ (1 + 10^{(pKw - pKb - pH)}) \ ^{-1},$$

where pK_w is a constant of water ionization at 50 ° C, that equals 13.262 [2], pK_b is a constant of ammonium dissociation at 50 ° C, that equals 4.723 [3].

The content of free VFA was calculated basing on the concentration of VFA by the formula [4]:

$$\text{Free VFA (mg/l)} = \text{VFA} \,(10^{(pK_a - pH)})/(1 + 10^{(pK_a - pH)}),$$

where pK_a is a constant of dissociation of acetic acid that is 4.787 at 50 ºC.

Results and discussion

Chicken manure obtained as a natural output of bird's vital activity has moisture level of 75%. In our study it equaled 72.2%. Chicken manure contains a larger proportion of organic matters, capable of biological decomposition, than other animal waste [5]. The content of VS in the manure was 70%. In the study of Webb and Hawkes (1985) [10] the content of VS varied from 60 to 70.59%, in the work of Huang and Shih (1981) [6] – 76%, Niu and al. (2013) – 73.84% [7].

The characteristics of substrate with different moisture values before methane digestion are given in Table 1 and after methane digestion – in Table 2.

Table 1

Characteristics of chicken manure before methane digestion

№	Primary moisture, %	General nitrogen, mg/l	$N-NH_4^+$, mg/l	NH_3, mg/l	VFA, mg/l	Nondissociated VFA, mg/l	pH	Electric conductivity, µS/cm
1	94	2652	796	2.05	831	53.44	5.95	4871
2	92	3536	1061	3.06	1140	65.78	6.00	5811
3	90	4420	1326	4.09	1449	78.33	6.03	6420
4	88	5304	1591	5.14	1757	90.93	6.05	8107
5	86	6188	1856	6.89	2066	93.75	6.11	7887
6	84	7072	2122	8.63	2374	98.64	6.15	8457
7	82	7956	2387	11.14	2683	97.62	6.21	8120

Table 2

Characteristics of chicken manure after methane digestion

№	Primary moisture, %	General nitrogen, mg/l	N-NH$_4^+$, mg/l	NH$_3$, mg/l	VFA, mg/l	Nondissociated VFA, mg/l	pH	Electric conductivity, µS/cm
1	94	2522	2522	1978.37	885	0.04	9.10	13244
2	92	3363	3222	2831.98	3210	0.08	9.40	15807
3	90	4199	3082	2608.43	7080	0.23	9.28	15160
4	88	5037	4483	3617.27	6840	0.29	9.16	20380
5	86	5879	3362	1229.79	8100	2.49	8.30	19840
6	84	6720	3642	2554.72	7140	0.54	8.91	28180
7	82	7558	4644	2404.84	14990	2.47	8.57	21480

It has been found that as manure moisture level decreases, biogas and methane yield from one unit of VS decreases as well. Thus, biogas production changed from 382 to 121 ml/g VS, and the production of methane – from 209 to 48 ml/g VS. Only during digestion of substrate with moisture content of 92% no decrease in the amount of produced biogas was observed.
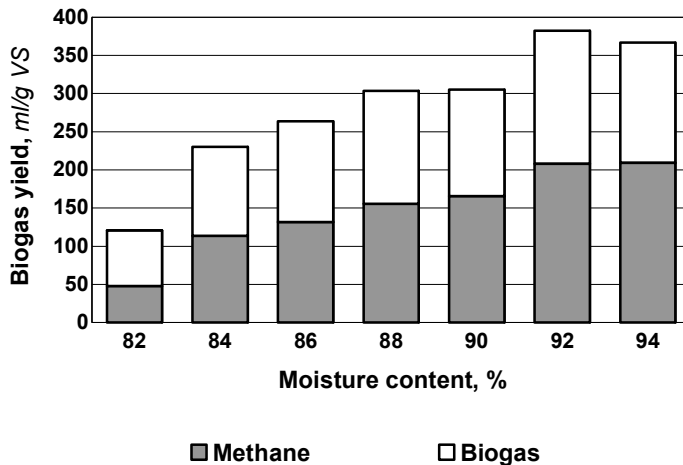
Fig. 1. Gas yield from VS with different moisture values of substrate

As moisture content of the substrate decreased, biogas and methane production increased from one unit of volume to moisture content of 82% – at that point decline started. Thus, production of gas at a moisture level of 84%, 86%, 88% and a moisture level of 90% and 92% was the same. Biogas yield varied from 15.2 ml/ml to 25.8 ml/ml, and methane yield – from 6 ml/ml to 12.9 ml/ml.
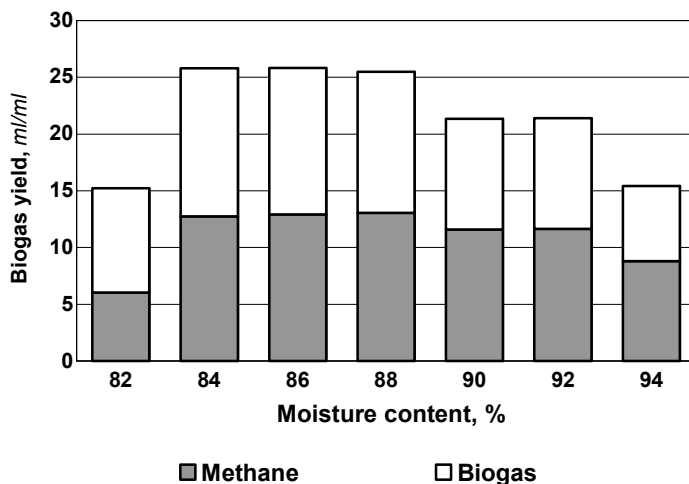
Fig. 2 Gas yield from the volume with different moisture values of substrate

Methane production started from the first day of the experiment. From the very beginning of the experiment increase in its concentration in biogas content was faster at a higher moisture level of the substrate. Biogas burned on the third day, when the methane concentration was higher or equaled 30%. Concentration of methane in biogas was not constant and ranged from 50% to 80% for all values of moisture content of the substrate.

Bujoczek and al. (2000) in their study, which was conducted in the mesophilic regime, reported a significant lag phase, which increased from 40 to 60 days with a decrease in moisture level from 90% to 84.3% [4]. In our study, basing on the kinetics of methane production, the duration of the lag phase for all values substrate moisture content was less than a day.

The proportion of methane in the produced biogas increased with an increase of moisture level in the range from 39.6% to 57% (Fig. 3). Pearson linear correlation coefficient was 0.91that shows a close relationship between the moisture content and the proportion of methane in biogas.

The maximum rate of methanogenesis increased with an increase of moisture content of the substrate from 2.8 ml / (g VS · day) to 24.7 ml / (g VS · day). The dependence is shown in Fig. 4. Pearson linear correlation coefficient was 0.96, showing a close relationship between the variables.
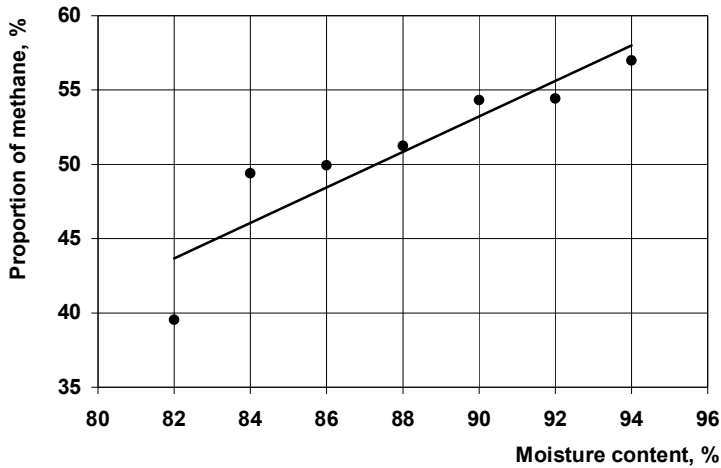
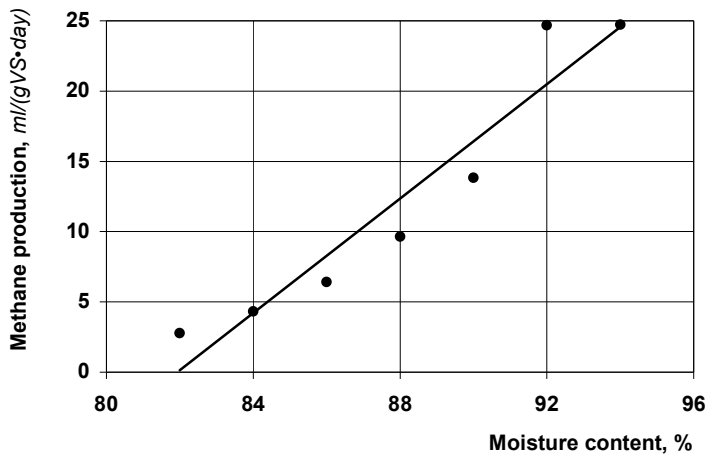**Fig. 3. The proportion methane/biogas with different moisture values of substrate**

Fig. 4. The maximum rate of methanogenesis with different moisture values of substrate

In our study decomposition of VS increased with an increase of moisture content and ranged from 41.87% to 96.55%. Webb and Hawkes (1985) reported that the decomposition of VS ranged from 48.97% to 66.5%, Huang and Shih (1981) – 66%, Safley (1987) – 53.1% [6, 9, 10].

Ammonia nitrogen content in chicken manure was 13.26 mg/g TS. Accordingly, its concentration increased from 796 mg/l to 2387 mg/l with a decrease of moisture content. After the methane digestion ammonium concentration ranged from 2522 mg/l to 4644 mg/l. Nondissociated ammonia is widely considered a toxic substance [8]. The concentration of

ammonia in the substrate ranged from 2.05 mg/l to 11.14 mg/l. After methane fermentation it increased and ranged from 1230 mg/l to 3617 mg/l.

In our investigation pH level of the substrate decreased with an increase of manure moisture content from 6.21 to 5.95, which corresponds to an increase in the content of ammonium nitrogen. After methane digestion pH increased and ranged 8.3-9.4. Safley and al. (1987) also noted an increase of pH from 7.2 to 8.05 as a result of anaerobic processing of poultry manure with moisture content of 94% in a continuous process at the temperature of 35 ºC and 22-day duration [9].

With an increase of moisture content, electric conductivity decreased from 8120 µS/cm to 4871 µS/cm. After methane digestion conductivity significantly increased due to mineralization of organic matter and ranged between 13244 µS/cm and 28180 µS/cm. Safley and al. (1987) noted an increase of electric conductivity from 22802 µS/cm to 26855 µS /cm [9].

Content of VFA increased with a decrease of moisture content from 831 mg/l to 2683 mg/l. After methane digestion VFA content increased and ranged from 885 mg/l to 14990 mg/l. Safley and al. (1987) reported a decrease of VFA content from 8447 mg/l to 3403 mg/l [9]. Pechan and Knappovfi (1987) reported an increase in the content of VFA up to 4600-9300 mg/l [8]. Content of nondissociated VFA before methane fermentation also increased with decrease of moisture content and ranged from 53.44 mg/l to 97.62 mg/l. After digestion it decreased due to an increase of the pH and ranged from 0.04 mg/l to 2.49 mg/l.

Conclusions

1. The investigation of periodic process of methane digestion of chicken manure in a wide range of moisture content values in the thermophilic mode was carried out for the first time.

2. The process was characterized by better results than those reported for the mesophilic regime, though as the temperature increases, the proportion of ammonia, which is considered more toxic than ammonium ions, also increases. The duration of lag phase was less than a day, and methane content in biogas ranged from 50 to 80% for all values of moisture content of raw materials.

3. Production of methane from chicken manure in the thermophilic mode at low moisture level of the substrate is possible, despite the high content of ammonia nitrogen and ammonia.

4. Further studies will be aimed at the study of the process at lower moisture values than were used in this investigation to determine the limits when methane production is still possible.

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Microbiological condition of premises, equipment, and air as an important factor in safe food production

Andrzej Baryga[1], Bozhenna Polec[1], Roksolana Chapovska[2]

1 - Institute of Agriculture and Food Biotechnology, Poland
2 - National University "Lviv Polytechnic", Ukraine

Abstract

Introduction. Keeping the proper microbiological status of production facilities and air is one of the most important problems, whose solution will guarantee food safety. To do this, in the food industry, the principles of quality systems providing the compliance with the stringent rules of process and food storage are applied. A large focus is on the selection of effective and safe chemicals and auxiliary materials for cleaning and disinfection.

Materials and methods. Using the methods of microbiological analysis, the bactericidal effect of the disinfectant "Higienizer" produced in Poland, whose active substance is hydrogen peroxide, was studied. The efficiency estimated by means of prints using agar plates and aspiration method, based on the principle of the current air shock on agar.

Results and discussions. Implementing HACCP system allows detecting these critical points of the process, in which the systematic monitoring hygiene standards ensure the appropriate quality and safety of the finished product. The detailed analysis of the process line, from the time of coming raw materials to the plant and up to the stage of packaging and storing the finished product allows finding a positive solution to eliminate the microbiological contamination, and make the process of the secondary contamination by microorganisms impossible. The complex of all these measures with using the environmental chemicals will allow producing safe food.

The studies on applying the disinfectant "Higienizer" showed its effectiveness in relation to sanitary and demonstration of gram-positive and gram-negative bacteria, including bacteria of E. coli, staphylococci, streptococci, Pseudomonas aeruginosa, Salmonella, yeast and molds etc. The lack of odor and complete biodegradation suggest that the disinfectants on the base of hydrogen peroxide are among the most optimal in the food industry.

Conclusions The systematic procedures of cleaning and disinfecting, using the ecological agents, following personal hygiene - all these activities assist the produced food to be safe and meet the requirements of the European standards.

Introduction

One of the main objectives of the food and processing industry is the food manufacture of not only high quality but also quite safe for life and the consumer's health. It can be achieved through applying the technological regimes, following the production process requirements, procedures, and guidelines at all the stages of production.

To ensure the proper quality of food, at the production they implement the principles of the appropriate quality systems, as follow:

- GMP – Good Manufacturing Practice
- GHP - Good Hygienic Practice
- HACCP – Hazard Analysis and Critical Control Point
- ISO – International Standards
- Codex Alimentarius - the international standards and food

HACCP system adjusted to the company guarantees to get the product safety for health. At that, a major condition of ensuring the sanitary food safety is the introduction and implement of the basic principles of GMP/GHP. They are the principles of good hygiene practice (GHP), which ensure the compliance with the sanitary standards that allow providing the product quality in terms of its microbiological purity.

GHP requirements relate to:

- Selection of the appropriate location of the food industry and analysis of the surrounding areas
- Location of food premises and equipment at the facility
- Selection of the appropriate technological equipment and the technical support provision
- Following the washing, disinfection, maintenance and conservation of machinery and equipment
- Ensuring the microbiological purity and quality of raw materials
- Following the appropriate processes and manufacturing operations
- Training the staff and following personal hygiene of workers

In manufacturing the safe food, the risk analysis and reduction of the threats occurring during their manufacture are very important.

As it is known [1], the threats in food production, which may affect the quality of the final product, are divided into three groups:

- *Physical* – the danger of getting the various foreign objects into the raw material or finished product as well as the danger of irradiating food
- *Chemical* – arise in a result of using a variety of hazardous chemicals and auxiliary materials at the production and during storage of the finished products
- *Biological* – the impact of microorganisms, fungi, mold, viruses, parasites, as well as pests that can infect both the raw materials and the finished product

Bacteria that are in a form of spores and are not destroyed during the production process, along with the microorganisms in the air contacting with the finished product, are the source of the secondary contamination. The microorganisms remaining in the products used as raw materials, can lead to harmful side effects, such as fermentation, feculence, gassiness, mucous formation etc. The biological contaminants in food are the greatest threat to health, because their influence is the most dangerous for the metabolic changes in the body.

To solve the issue of providing the adequate sanitary condition of the workplace the systematic research and finding the best methods to control the microbiological contamination are carried out.

The production processes associated with the food production are not in the sterile conditions. The presence of microbes in the environment is obvious, so both the raw materials and the production process, and the finished products shall be controlled.

The analysis of the production process is important to identify the places that could influence on the emergence of the secondary contaminations, because it significantly increases the microbial contamination of the final product. The main cause of this contamination is the air contacting with the finished product [2]. The type of microorganisms in the air depends on the nature of the environment, but there are some bacteria, which are always in it. The air environment itself does not promote the multiplication of microflora, but it acts as an excellent infection carrier. Bacteria get into the air from water, soil, open wounds of living organisms, their discharge, workplace etc.

The air surrounding the production line contains many microorganisms such as mold spores, cocci, aerobic bacteria etc. These microorganisms have a high degree of the organic material decomposition and are very dangerous. Therefore, the emphasis shall be made on the quality parameters of the air used for processing raw materials at the production stage and contacting with the finished product. The air directed for cooling and drying shall have the best microbiological quality. However, the clearness parameters of the air in the technologic rooms are very important.

The microflora in the air is characterized by saprophytic microorganisms, including:
• cocci of Micrococcus and Sarcina
• aerobic bacteria of Bacillus
• fungal spores of Clostridium, Penicillium, Aspergillus
• yeast Candida
• pathogenic bacteria such as aurococcus and streptococcus

Microbes are rarely in the Free State, they are often in the form of bioaerozols spreading in the air in three ways [3]:
- due to the dynamic projection of droplets due to the respiratory-muscle system reduction (e.g., coughing or sneezing)
- through the VAC system of the air in the workplace with ventdoors, elevators, etc.
- with convection air flows

The viability of microorganisms in the air depends mainly on the resistance of this species to drying and UV rays. The selection of the microorganisms in the air is made by destroying the vegetative forms that perish fastest whereas spore forms such as endospores of bacteria, mold conidia remain alive longest. The prolonged vital activity is characteristic for the microorganisms, whose cells are protected by a layer of mucus or the other organic compounds protecting bacteria from the external factors [4, 5, 6].

The fight against the microbiological contamination during food production is known to be often carried out using various chemicals. Thus, there may be a chemical threat, because disinfectants in the production process can form the dangerous compounds that remain in the finished product, or get inside it on the stage of storage. Therefore, the search and lockup of the safe chemicals that can be used in the food industry is one of the most important issues, the scientists of the whole world are working on.

Materials and methods

The scientists of the Sugar Production Department in the Institute of Agriculture and Food Biotechnology study for a long time the influence of different disinfectants on ensuring the microbiological purity of the food industry, particularly in the sugar factories. In the production process, the different chemical reactions are known to take place. Many

phases of the biological threats may arise due to the primary and secondary contamination caused by microorganisms, fungi, viruses, coming with raw materials or from the air. At the same time, the international quality requirements of sugar quality (including EU requirements) are quite high. Thus, disinfectants for the sugar industry, which would provide an appropriate level of the microbiological purity of the finished product and at the same time would be favorable to the environment, could find its application in the other areas of food and processing industries. In particular, the effectiveness of the disinfectant produced in Poland is studied for long.

The disinfectant is certified in Poland and authorized in the food industry. The microbiological and physical-chemical studies of the disinfectant carried out at the Institute of Fermentation Technology and Microbiology of the Łódź Technical University (Poland) and the State institution "L.V. Hromashevsky Institute of Epidemiology and Infectious Diseases" stated that the disinfectant is effective with respect to the sanitary-demonstrated gram-positive and gram-negative bacteria, including bacteria of E.coli, staphylococcus, streptococcus, Pseudomonas aeruginosa, Salmonella, yeastlike molds etc. If there is the organic contamination, the disinfection activity of the work solutions decreases. The work solutions are effective in cold disinfection and significantly increase its biocide activity with increasing the temperature to 40°C. They are watered fast and well.

The agent is without odor and quite biodegrative. The very properties are crucial in choosing the chemicals used in the food industry.

To test the effectiveness of the agent in the fight against the microbiological threats in the food industry, the research was carried out at the sugar factories. The treatment of the surfaces and equipment contacting with the finished product was made with the active solution, and the disinfection of the air used in the air conditioning silo systems (storage towers for sugar) was made.

With the concentrate of disinfectant "Higienizer" a 5% work solution is prepared and the air taken areas, floor, walls, waste channels, transporters of the finished products and semi-finished products, machinery and equipment are irrigated with it. The area treatment for air intake is made with a garden sprayer. To disinfect the air for drying and cooling sugar, the disinfection of inlets and filters was made.

It is known [7] that UV radiation significantly reduces the ability of bacteria to multiply, so the effectiveness of the disinfectant was studied in combination with UV irradiation.

The microbiological studies were carried out in accordance with the methodology approved in the laboratory of the Sugar Production Department in Institute of Agriculture and Food Biotechnology.

To investigate the microbiological status of the surfaces, the method of prints using agar plates was applied. The agar plate was attached to the dry surface under studying for 10 seconds. Then it was placed in an incubator and incubated under the conditions specific to a particular type of microorganisms (for mesophilic bacteria at 300°C for up to 3 days, for mold and yeast at 300°C for 5 - 7 days. After finishing the incubation, the number of colonies of microorganisms that emerged in the 25cm^2 plate was calculated.

The microbiological studies of the air samples were carried out by the aspiration method, which is based on the principle of the current air impact on an agar plate. To control the content of microorganisms in the air, the inertial samplers (impactors) were used. After collecting the samplers, the plates were incubated, using the appropriate conditions and culture media: mesophilic bacteria - 3 days at 300°C, mold and bacteria - 5 days at 300°C. Then, the number of colonies of microorganisms in 1 volume is calculated.

Results and discussion

Tables 1-4 show the results of the microbiological testing of the industrial surfaces and air before and after applying the disinfectant "Higienizer". These data suggest that the investigational agent was quite effective in dealing with the mesophilic bacteria and mold, which can significantly degrade the quality of the product.

Considering that the agent is completely safe for the finished product, such disinfection near the finished product is possible. The use of the means does not affect the taste, smell, texture, and purpose of the finished product. Therefore, this disinfectant is one of the few that can definitely be used at all the stages of preparation, production, and storage of food. Considering, the means contains a corrosion inhibitor, the corrosion danger of machinery and equipment reduces.

Note that in the study, the focus was on the production environment and the stages of the production, when there is a risk of the secondary contamination of the finished product.

The inadequate sanitary condition of machinery and equipment, not following the rules of the staff hygiene, a microbiological air pollution lead to the deterioration of the finished product quality. A large number of microorganisms being in the air are often the result of the poor sanitary condition of workplace and equipment, air ducts, and sometimes the lack of the staff hygiene.

Therefore, to ensure the proper microbiological purity of the finished product, it is necessary to:

- Maintain the proper sanitary condition of machinery and equipment contacting with the finished product

- Follow the staff hygiene

- Carry out the systematic monitoring of the microbiological condition of the air flowing into the workplace

Keeping cleanliness and order in the workplace, the systematic procedures for cleaning and disinfecting surfaces and equipment with the effective and safe agents, monitoring the staff health and hygiene allow minimizing the risks of the microbial contamination of food.

The workplace, in terms of the microbiological purity of the air, can be divided into three categories [3, 8]:

- areas with a low risk (the air quality does not affect the purity and quality of the finished product)

- areas with a medium risk (the air microbiology is an important element in producing certain kinds of food that shall not be sterile, but the use of the appropriate technological processes and principles of good sanitation practices reduce the microbial contamination affecting the finished product quality and safety)

- areas with a high risk (the air purity is one of the determining factors in the quality and safety of the finished product particularly susceptible to the microbial contamination). The production in the areas with a high risk involves the use of the special procedures and the regulatory compliance with the microbiological purity of the working environment. This is where the sanitary conditions of the production are important in preventing the secondary microbial contamination.

For each category of the workplace in accordance with the requirements of the HACCP system in enterprises the appropriate procedures for cleaning and disinfection, which determine the frequency of the preventive measures, a list of the chemicals recommended for that, as well as the responsible persons, are developed. The systematic undertaking of such procedures provides the adequate microbiological air quality.

In addition to processing the workplace and air with the disinfectants, the use of the ultraviolet lamps is provided as well. It should be noted that the presence of such lamps in the areas, where the air subjects to the pre-processing before drying or cooling, substantially reduces the risk of its contamination.

Measures reducing the risks associated with the negative impact of microorganisms on the finished products include:

- using the protective clothing by staff and visitors
- following the staff hygiene
- maintaining the cleanliness in the packing and warehouse, where the products are stored.

An important aspect of preventing the repeated contamination is to protect the finished product while transporting to the packing shops. At this stage, the final product is in contact with the environment, and thus, the risk of the repeated contamination increases significantly, whose outcome cannot be detected in time. In this case, the contaminated products go to the consumer and can be dangerous for his health. To prevent contaminating the products in this case, it is recommended to isolate the transporters of the finished products from the general areas of the production shops, or cover them. The effective protection is the fixing of UV lamps above the conveyor and the periodic surface treatment under the conveyor and the area around it by the disinfectants. This significantly reduces the risk of the microbiological contamination, which can be caused by the floor dust, which gets on the conveyor while its reversing.

To reduce the danger of the secondary contamination of the finished product, the air, flowing into the workplace, shall be passed through the filter. The specifics of each enterprise allow developing and implementing the optimal preparing scheme for the air. In particular, at the sugar factories a three-stage air purification is used [2, 4- 6]:

- the previous detention prevents the detaining of the dust particles with the fibrous filters;
- the main detention allows maximum separating bioaerozols from the air with flexible filters and detention inserts;
- the main detention, which is the site of direct air intake for the technological purposes

The air disinfection can be done in different ways:

- mechanical (applying the various filters)
- physical (heating the air, eliminating the dust particles with an electrostatic method or an ultraviolet radiation)
- chemical (using disinfectants).

The implementation of the new technologies in the food industry provides the more rigid requirements for the microbiological purity of the air, manufacturing space, machinery, and equipment, which are in the direct contact with the finished product. Much attention is focused on the cleanliness of floors, walls, and ramps in both a manufacturing site and a warehouse.

The results of the microbiological research of surfaces before and after applying disinfectant "Higienizer

Research area	Surface state	Mould (CFU)	Mesophilic bacteria (CFU)
Stores	without disinfection	0	58
	after disinfection	0	0
Walls in the production shop	without disinfection	∞	∞
	after disinfection	0	4
Floor in the production shop	without disinfection	23	188
	after disinfection	0	14
Surface near a waste channel	without disinfection	∞	∞
	after disinfection	4	10
Transporter of the finished product	without disinfection	∞	∞
	after disinfection	0	2
Floor around the transporter of the finished product	without disinfection	∞	∞
	after disinfection		

The results of the microbiologic research of the floor under the transporter of sugar

	The amount of microorganisms (CFU /25 cm^2 of the surface)		
	Total amount of mesophilic bacteria	Mould	Yeast
without disinfection	349	14	10
after UV-radiation	87	0	0
after disinfection with "Higienizer"	7	0	0

The results of the microbiologic research of the transporter of sugar

	The amount of microorganisms (CFU /25 cm^2 of the surface)		
	Mesophilic bacteria	Mould	Yeast
without disinfection	176	0	0
after disinfection with "Higienizer" and UV-radiation	2	0	0

Results of the microbiological testing of the air used for drying and cooling sugar

	The amount of microorganisms (CFU /1m^3 of air)		
	Mesophilic bacteria	Mould	Thermophilic bacteria
without disinfection	480	8	20
after UV-radiation	165	0	0
after the disinfection with "Higienizer" and UV-radiation	85	0	0

Conclusions

The need to develop the appropriate research methods, including the development of methods for sampling, identification of microflora sources and search for the effective methods of killing microorganisms coming from the air, waste produced in the manufacturing process, etc. are growing steadily. The prevention of the secondary contamination of the finished products is promoted by the proper sanitary condition of all the workplaces in manufacturing, as well as a hygienic state of the workers contacting with the finished product.

The presence of microorganisms in the air affects the shelf life of products; sometimes they are the main cause of the products' getting out of order. Using the adequate ventilation in the food industry, providing options of sterile air contacting with the finished product reduce the danger level of microbial contamination, condensation on the vapor in the areas of food, reducing odors that may affect the food quality. The direction of the airflow in the production areas is also important: the air movement shall be from "clean" areas to "dirty" ones. The conformity between the parameters of air directly contacting with the finished product and the microbiological standards of cleanliness prevents the secondary contamination.

The systematic procedures of cleaning and disinfection, the use of environmental agents, and following the personal hygiene - all these activities assist the produced food to be safe and meet the requirements of European standards.

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Theoretical requirements of orientation for shallow products that move under act of vibration

Oleksandr Gavva, Ludmyla Kryvoplyas-Volodina, Genadii Valiulin

National University of Food Technologies, Kyiv, Ukraine

Corresponding author:

Ludmyla Kryvoplyas-
Volodina
E-mail:
kaf_upak_tmm@bk.ua

Abstract

Introduction. For the increase of technological efficiency and productivity of vibrotray it is necessary to lower power charges. It is necessary to set the optimal value of corner of vibrations of working element of oscillation device.

Materials and methods. Experimental studies of process of vibromoving were undertaken on the electro-pneumatic setting adjusted on the different terms of vibration through a programmable logic controller. The mode of motion of separate products is described by the method of progressive approximations. For moving of finely-piece products on an oscillation tray, on condition of harmonic fluctuating motion, are used two methods of arrangement of oscillation tray on spring elements. A working tray that is placed under a certain corner to founding was investigation on certain office hours.

Results and discussion. The condition of symmetry of forces of resistance of relative motion and portable force of inertia is in-process used from harmoniousness of vibrations of working organ and symmetry in the location of directing. At the beginning of research harmonic motion of product is taken into account and the change of phase is not taken into account relative relatively vibrations. Assumption is amplitude of vibrations in absolute motion considerably less then, then amplitude of vibrations of working element. Mathematical models are built for description of phase corners of beginning and end of motion of unit of product, with the use of the preliminary found initial conditions, in every direction. Vibrations of surface of founding with an acceleration, allowed to set the modes of motion of unit of product between plates. An a surface of founding will have the identical moving, on an absolute value, in all directions axes of x. Vibromoving of unit of product will not be.The model of the experimental setting is collected with the use of electro-pneumatic drive. A model can be used for the small frequency vibrations of рабочого tray from 4-10 Hertzs, at a necessity a portage and division of fragile finely-piece products.

Conclusion. The results give an opportunity to estimate influence of speed and terms of power contact depending on direction of vibrations of surface of founding, intensification of motion of unit of product between directing.

Introduction

For the increase of technological efficiency and productivity of vibrotray it is necessary to lower power charges. For an oscillation device it is necessary to set the optimal value of corner of vibrations of working element of oscillation device. It is necessary to provide the rationale mode of the use of energy at oscillation and use of the generating system of the artificial mode of vibromoving.

Materials and methods

As research basis the process of the oscillation moving of product was accepted on the surface of tray at different terms work of drive. Experimental studies of process of vibromoving were undertaken on the electro-pneumatic setting adjusted on the different terms of vibration through a programmable logic controller. The mode of motion of separate products is described by the method of progressive approximations. For moving of finely-piece products on an oscillation tray, on condition of harmonic fluctuating motion, for use two methods of arrangement of oscillation tray on spring elements. The modes of fluctuating motion of surface are in-process investigation that is placed under a certain corner.Two methods exist today for creation of construction of devices, where a product moves under act of vibration. For this purpose use a surface that is on springs and under the corner of inclination to horizon. The first method consists of forming of pendant of support on rectilineal springs that set under a corner to horizon.

The second method consists of that some surface, located on cylindrical springs, not to set direction of vibrations (free pendant). Certain direction of vibrations of tray takes place under the action of a force force that has certain direction to horizon.

On condition that pendants are envisaged so that their projections on a horizontal basis will be perpendicular to the radius es in points their fastening, the corner of transferring to these points will be equal to the angle of slope of pendants.

Like rectilinear trays in bunkers giving of oscillation type, the directed pendants work. The vibrations of the system can be passed from the oscillation systems with different effort.

In a model use a free pendant, then tray of bunkers giving the spiral directing is envisaged in that, place on cylindrical springs. The vibrations of the system take place under act of one of a few oscillation engines. Many bunkers giving of oscillation type were working for principle of the first method.

Results and discussion

For the small and middle bunkers of feeder of oscillation type with frequency 50-100 Hertzs and by an engine from the electromagnetic oscillation systems, such method more effective. This the construction is of bunker of feeder is simple enough and reliable in exploitation. The constructions of feeder of oscillation type are today known with an inertia and electro-pneumatic drive. Such systems work by means of the programmable logic controller (PLC), on principle of free pendant. The general chart of the signal shaping in engines together with PLC is shown on fig. 1.

Signal on included in the sensor-based system

The signals of tension going in

| Buttons of including | Methods of reflection of information | Stand of operator |

Lamps and light-emitting diodes

Programmable Logic Controller

Data are in memory

| Devices of entrance | Data are in memory | Conversion of data in accordance with the program of management | Data are in memory | Devices of exit |

The signals of tension going out

Motion

| Sensor | | Pneumatic distributor | Spool of solenoid |

Motion

| Sensor | | Pneumatic distributor | Spool of solenoid |

P
t

0.45 bar   0.35-0.4 bar

X
t

A
t

Fig.1. General chart of transformation of signals in occasions from PLC for the system of harmonious vibrations

The law of motion of the last link (rod of pneumatic cylinder) can be changed by means of initial data of technological process.

It is necessary to use a discrete pneumatic apparatus and simple electric pneumatic elements for creation of effective oscillation inertias systems. Applying such charts of management and on the base of pilot plant of vibrofeeder of fig.2, it is possible to get next distribution of moving rod of pneumatic cylinders for time:

$$\frac{dx}{dt} = v_{uu} = \frac{f_1\sqrt{RT_M}}{F_1 P_1 \sqrt{\xi_1}} \cdot \sqrt{P_M^2 - P_1^2};$$

$$\frac{dx}{dt} = v_{uu} = \frac{f_2\sqrt{RT_M}}{F_2\sqrt{\xi_2}} \cdot \left(\frac{P_2}{P_M}\right)^{\frac{k-1}{2k}} \cdot \frac{\sqrt{P_2^2 - P_A^2}}{P_2},$$

(1)

$\frac{dx}{dt} = v_{uu} = const$ – it is speed of rod pneumatic cylinder, P_1 and P_2– permanent pressure in a piston and to the rods cavity pneumatic cylinder, P_M – main pressure of festering, P_A – atmospheric pressure, F_1 i F_2 – an area of piston is in piston and rods cavities, f_1 i f_2 – area of the communicating opening of pneumatic cylinder, ξ_1 i ξ_2 – coefficients of resistance of line of festering and upcast of air, x – coordinate of site of piston, S – maximal piston stroke, N – force of resistance is with taking into account coefficient of efficiency pneumatic cylinder, k – index adiabatics (coefficient of Poisson), R – gas constant, T_M – absolute temperature of gas. In a mathematical model does not take into account a coordinate x_{01} and x_{02}, what is characterized space volume for filling compressed air to the moving-off of piston of pneumatic cylinder.
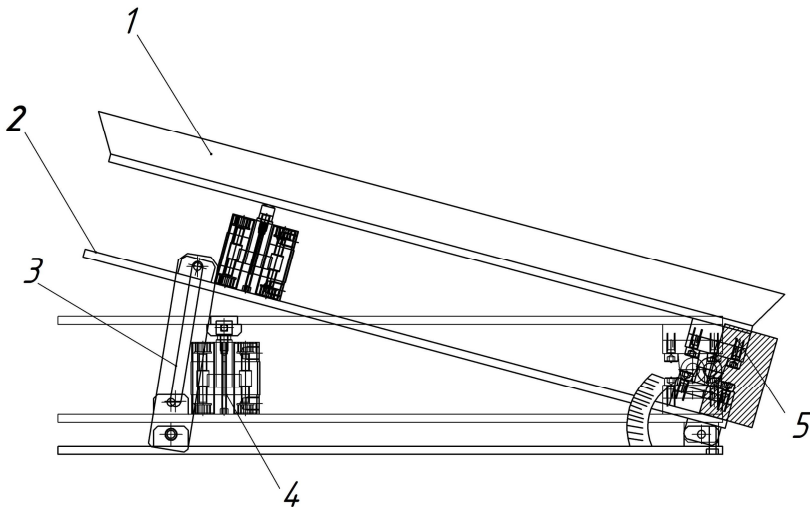
Fig. 2. Experimental setting with a pneumatic occasion:
1 - tray; 2 – directing vibrations; 3 – depreciation springs;
4 – pneumatic cylinder; 5 – mechanism of longitudinal vibrations.

Such vibrosystem creates force unidirectional vibrations in horizontal or vertical direction, depending on revolting force of pneumatic cylinder.

An aim undertaken studies is maintenance of integrity of unit finely - artificial product during realization of operation of division of her array on separate streams.

Will consider motion of unit of shallow products contiguous plates (fig. 3).
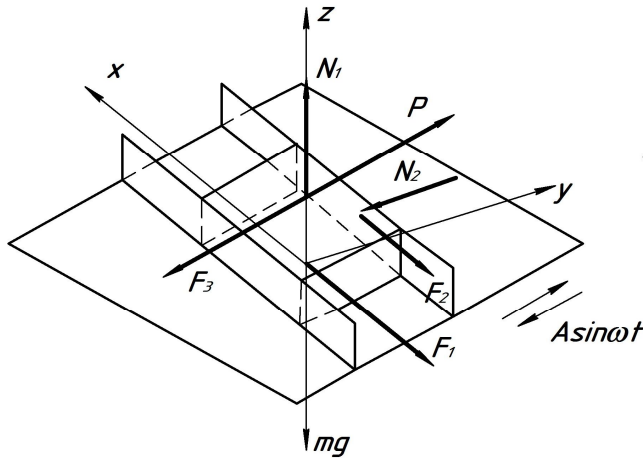
**Fig. 3. The system of forces, operating is on unit of shallow products,
that is on the surface of tray**

Let it a material point. Possibly, it is bound by forces of dry friction with the basic working surface of tray, with   the sides of directing plastins and   with other units of product.

The system of coordinates of xyz is hardly related to the surface of oscillation tray. The axes of xyz are located so, that the axis of x is directed along plastins, axis in - athwart to the plates, and axis of z - athwart to the plane of underlayment. Let there will be supposition, - the contact of unit of product with the sides of directing plastins takes place without gaps and without shots. A product at moving between plates has a variable power contact. Then, as a result of vibrations of working organ, it contacts both with one plate or with other.

Movement of unit of product will consider as a sum of portable motion (together with an underlayment) and relative motions along plates.

The underlayment of tray carries out harmonic forward vibrations:

$$\begin{cases} S_n = A\sin\omega t; \\ V_n = A\omega\cos\omega t; \\ a_n = -A\omega^2\sin\omega t, \end{cases} \quad (2)$$

S_n, V_n, a_n, - accordingly transferring, speed and acceleration to the portable moving.

Force of inertia that operates on a product determined as:

$$P = ma = mA\omega^2\sin\omega t$$

m – mass of product. On a material particle also operate: N_1 - normal reaction of underlayment of working organ; N_2 - normal reaction from the side of side of plate, with that finely, - an artificial product has a power contact; $F_1 = N_1 f_1$ - force of resistance of motion of particle on the bottom of working tray, where f_1 - the brought coefficient over of resistance of motion of shallow product on the bottom of working tray; $F_2 = N_2 f_2$ - force of

resistance of motion of particle is at a power contact with the side of plate, where f_2 - the brought coefficient over of resistance of motion of shallow product on the side of plate;
$F_3 = mgf_c$ - force of resistance from the side of directing that are above directing vertical plates, where f_c - the brought coefficient over of resistance of motion of shallow product that moves together with a working organ.

Force of friction F_3 directed against the relative rate of movement V shallow products (fig. 4). On fig. 4 represented projections of speed, where $\dot{x}$ - a portable rate of movement of shallow products is along plastins, V_p - resultant speed from V and $\dot{x}$. Direction of speed V depends on the terms of power contact and direction of vibrations of underlayment. Force of friction F_3 forms a corner with direction of vibrations of underlayment ε, and $\sin \varepsilon = \dfrac{\dot{x}}{V} \sin \gamma$. As a shallow product has the additional brake loading from the side of directing plastins and underlayment, then $V \gg \dot{x}$, it is thus possible to consider that $\sin \varepsilon = 0$, and $\varepsilon = 0$.
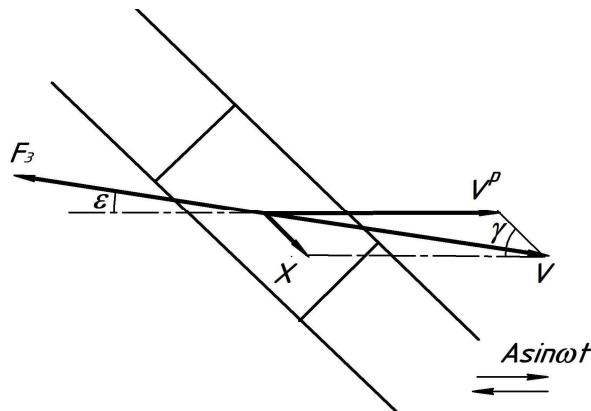
Fig.4. A chart is to determination straight of power action of force of resistance of F_3

In general case coefficients of resistance of unit finely - artificial products on a bottom and on the side of plate can be different, as a bottom and plates of working organ can be made from different materials and to have a different roughness. As a result of harmonic of vibrations of working organ and symmetry in the location of directing it is possible to use condition of symmetry of forces of resistance to relative motion and portable force of inertia.

In the first approaching set by that motion of product is harmonic and ignore the change of phase in relation to portable vibrations. Thus, it is possible to assume that amplitude of vibrations in absolute at moving substantially less than, than amplitude of vibrations of working organ. Thus, it is possible to take into account force of friction between units of product, that are simultaneously on a tray:$F_3 = mgf_c \ sin \ V_n$.

Ruh of product is possible in all modes of vibromoving, that is considered for the model of material particle [1, 2,7]. Next to it, for fragile shallow products more rational is the mode of the bilateral skidding with two instantaneous stops. As it gives an opportunity better to use time of stay of products that is oriented on the surface of worker to the tray, because processes of distribution of stream of shallow products on separate streams it takes place mainly at the relative moving.

Will consider motion of unit finely to the products between contiguous plates subject to condition horizontal vibrations of horizontal underlayment. Differential equalizations of relative motion of material point by mass of *m* in projections on wasp of coordinates for the case of power contact of material point with a right plate look like:

$$m\ddot{x} = mA\omega^2 \sin \omega t \cos \gamma - F_1 - F_2 + F_c \cos \gamma \; ; \tag{3}$$

$$m\ddot{z} = N_1 - mg \; ; \tag{4}$$

$$m\ddot{z} = N_1 - mg \; . \tag{5}$$

Will consider possible combinations straight of force of inertia of portable motion (a power contact is with a right or left plate), sign of function $signV_n = sign \cos \omega t$ (directions of force of friction) and straight relative motion of particle along an axis *x* (directions of forces of friction F_1 i F_2). At all possible combinations of directions of the indicated forces of equalization (5) it remains unchanging, and in equalizations (3) and (4) on the separate intervals of motion particles change signs before the projections of forces F_1, F_2, F_3 and N_2 on wasp of coordinates *x* and *y* [6].

Function $signV_n = sign \cos \omega t$ in the interval of change of phase corner $\delta = \omega t$ from a zero to equals $\sin \cos \omega t = 1$. Then in the interval of change of phase corner $0 \le \delta \le \dfrac{\pi}{2}$ and at a power contact with the right plate of equalization (3) and (4) will look like:

$$m\ddot{x} = mA\omega^2 \sin \omega t \cos \gamma - N_1 f_1 - N_2 f_2 + mgf_c \cos \gamma \; ; \tag{6}$$

$$m\ddot{y} = mA\omega^2 \sin \omega t \sin \gamma - N_2 + mgf_c \sin \gamma \; . \tag{7}$$

Ruh of unit of shallow products takes place without jumping up, as horizontal vibrations of horizontal underlayment take place.[8] Thus $z = const$, $\ddot{z} = 0$ and from equalization (5) get expression for determination of normal reaction N_1

$$N_1 = mg \tag{8}$$

As motion of particle is in direction, perpendicular plastins, impossible, then $y = const$, $\ddot{y} = 0$. Thus, from equalization (7) it is possible to get expression for determination of force of normal pressure N_2

$$N_2 = mA\omega^2 \sin \omega t \sin \gamma + mgf_c \sin \gamma \; . \tag{9}$$

Putting expressions N_1 and accordingly from equalizations (8) and (9) in equalization (6), with taking into account $f_2 = tg\mu$, where - corner of friction and after his transformations will get:

$$\ddot{x} = A\omega^2 \cdot \frac{\cos(\gamma + \mu)}{\cos \mu} \cdot \left[\sin \omega t - \frac{gf_1 \cos \mu}{A\omega^2 \cos(\gamma + \mu)} + \frac{gf_c}{A\omega^2} \right] \; . \tag{10}$$

Will designate:

$$a_0^n = A\omega^2 \cdot \frac{\cos(\gamma + \mu)}{\cos \mu} ; \qquad (11)$$

$$z_0^n = \frac{g}{A\omega^2} \cdot \left[\frac{f_1 \cos \mu}{\cos(\gamma + \mu)} - f_c \right] . \qquad (12)$$

Will get:

$$\ddot{x} = a_0^n \cdot \left(\sin \omega t - z_0^n \right), \qquad (13)$$

a_0^n and z_0^n - dimensionless parameter of resistance and parameter that has a dimension of acceleration and answer the power contact of unit of product with a right plate at her relative at moving in additional direction of axis x.

At $\delta = \dfrac{\pi}{2}$ - function $\sin V_n = \sin \cos \omega t$ transverses a sign, id est $\sin \cos \omega t = -1$ in the interval of change of phase corner δ from $\dfrac{\pi}{2}$ to $\dfrac{3}{2}\pi$.

Force of inertia of P here will save the direction to $\delta = \pi$, id est unit of product continues a power contact with a right plate. Thus, on the interval of change of phase corner $\dfrac{\pi}{2} \le \delta \le \pi$ differential equalizations (3) and (4) relative motion of particle in projections on wasp of x and in look like:

$$m\ddot{x} = mA\omega^2 \sin \omega t \cos \gamma - mgf_1 - N_2 f_2 - mgf_c \cos \gamma ; \qquad (14)$$

$$m\ddot{y} = mA\omega^2 \sin \omega t \sin \gamma - N_2 + mgf_c \sin \gamma . \qquad (15)$$

As $y = const$, $\ddot{y} = 0$, then from equalization (15) find expression for determination of force of normal pressure N_2 :

$$N_2 = mA\omega^2 \sin \omega t \sin \gamma + mgf_c \sin \gamma . \qquad (16)$$

Will put expression (16) in equalization (15) and after transformations will get:

$$\ddot{x} = A\omega^2 \cdot \frac{\cos(\gamma + \mu)}{\cos \mu} \cdot \left[\sin \omega t - \frac{gf_1 \cos \mu}{A\omega^2 \cos(\gamma + \mu)} + \frac{gf_c}{A\omega^2} \right] . \qquad (17)$$

Will designate:

$$a_1^n = A\omega^2 \cdot \frac{\cos(\gamma + \mu)}{\cos \mu} ; \qquad (18)$$

$$z_1^n = \frac{g}{A\omega^2} \cdot [\frac{f_1 \cos \mu}{\cos(\gamma + \mu)} - f_c] \ . \tag{19}$$

Will get:

$$\ddot{x} = a_1^n \cdot \left(\sin \omega t - z_1^n \right), \tag{20}$$

where z_1^n and a_1^n - dimensionless parameter of resistance and parameter, that has a dimension of acceleration, and answers the power contact of unit of products with a right plate at her relative transferring to positive direction of axis of x in the case when speeds of unit of products, that is for different parties of geometrical to the landmark of tray directed oppositely. Equalization (13) describes motion of unit of product in positive direction of axis of x at her power contact with a right plate in the interval of change of phase corner from δ_1^π to $\frac{\pi}{2}$, and (20) - in an interval $\frac{\pi}{2} \leq \delta \leq \pi$. In the turn-down of phase corner from π to 2π unit of product has a power contact with the left plate. If in an interval unit of product will not stop due to operating on his forces of friction from the side of other units of product, then it will continue motion in plus direction at a power contact with the left plate.

Differential equalizations of relative motion of unit for product are on an interval at skidding in positive direction of axis of x at a power contact with the left plate look like: in a projection on the axis of x like equalization (14), and in a projection on an axis in *y*.

$$m\ddot{y} = mA\omega^2 \sin \omega t \sin \gamma + N_2 - mgf_c \sin \gamma \ . \tag{21}$$

From equalization (21) will get expression for determination of normal reaction:

$$N_2 = -mA\omega^2 \sin \omega t \sin \gamma + mgf_c \sin \gamma \ . \tag{22}$$

Putting expressions (16) and (22) in equalization (14), and after transformations will get

$$\ddot{x} = A\omega^2 \cdot \frac{\cos\left(\gamma - \mu\right)}{\cos \mu} \cdot \left[\sin \omega t - \frac{gf_1 \cos \mu}{A\omega^2 \cos\left(\gamma - \mu\right)} + \frac{gf_c}{A\omega^2} \right]. \tag{23}$$

Will designate:

$$a_2^\pi = A\omega^2 \cdot \frac{\cos(\gamma - \mu)}{\cos \mu} \ ; \tag{24}$$

$$z_2^\pi = \frac{g}{A\omega^2} \cdot [\frac{f_1 \cos \mu}{\cos(\gamma - \mu)} - f_c]. \tag{25}$$

Will get:

$$\ddot{x} = a_2^\pi \cdot \left(\sin \omega t - z_2^\pi \right), \tag{26}$$

z_2^π and a_2^π - dimensionless parameter of resistance and parameter that has a dimension of acceleration, and answer the power contact of unit of shallow product, with the left plate at her relative a movement in positive direction of axis of x in the case when speeds of different units of product within the limits of directing are opposite. Equalization (26) describes motion of unit blown through in plus direction of axis of x at her power contact with the left plate in the turn-down of phase corner from to (-phase corner of completion of motion of particle in plus direction of axis of x at a power contact with the left plate).

After a stop the particle of product can begin motion in negative reverse direction of axis of x at a power contact with the left plate.

Differential equalizations of relative motion of unit of product in projections on wasp of x and y: in a projection on an axis in like equalization (13), and on the axis of x.

$$m\ddot{x} = mA\omega^2 \sin \omega t \cos \gamma + mgf_1 + N_2 f_2 - mgf_c \cos \gamma \qquad (27)$$

In this case normal reaction N_2 it is determined from equalization (14). Equalization (19), after a substitution for it N_2, but transformations and accepted denotations, it is possible to point in a kind:

$$\ddot{x} = a_3^\pi \cdot \left(\sin \omega t - z_3^\pi \right), \qquad (28)$$

when

$$a_3^\pi = A\omega^2 \cdot \frac{\cos(\gamma + \mu)}{\cos \mu} ; \qquad (29)$$

$$z_3^\pi = -\frac{g}{A\omega^2} \cdot \left[\frac{f_1 \cos \mu}{\cos(\gamma + \mu)} - f_c \right] \qquad (30)$$

z_3^π and a_3^π - dimensionless parameter of resistance and parameter that has a dimension of acceleration, and answer the power contact of unit of product, with the left plate at her relative at moving in negative direction of axis of x.

Equalization (30) describes motion of unit of product in negative direction of axis of x at her power contact with the left plate in the interval of change of phase corner from the beginning of skidding in negative direction to $\frac{3}{2}\pi$.

In the turn-down of phase corner δ from $\frac{3}{2}\pi$ to 2π differential equalizations of relative motion of unit of product in negative direction of axis of x look like:

$$m\ddot{x} = mA\omega^2 \sin \omega t \cos \gamma + mgf_1 + N_2 f_2 + mgf_c \cos \gamma ; \qquad (31)$$

$$m\ddot{y} = mA\omega^2 \sin \omega t \sin \gamma + N_2 + mgf_c \sin \gamma . \qquad (32)$$

Then $\ddot{y} = 0$ normal reaction N_2 can be certain from expression:

$$N_2 = -mgf_c \sin\gamma - mA\omega^2 \sin\omega t \sin\gamma \ . \tag{33}$$

Equalization (31), after a substitution for it expression (33) and transformations and accepted denotations, will look like:

$$\ddot{x} = a_4^\pi \cdot \left(\sin\omega t - z_4^\pi\right) \tag{34}$$

when

$$a_4^\pi = A\omega^2 \cdot \frac{\cos(\gamma+\mu)}{\cos\mu} \tag{35}$$

$$z_4^\pi = -\frac{g}{A\omega^2} \cdot \left[\frac{f_1\cos\mu}{\cos(\gamma+\mu)} + f_c\right] \tag{36}$$

z_4^π and a_4^π - dimensionless parameter of resistance and parameter that has a dimension of acceleration, and answer the power contact of unit of product with the left plate at her relative transferring to negative direction of axis of x in the case when speeds glowed overhead and lower directed in one side. Then $2\pi < \delta < \frac{5}{2}\pi$ unit of product will have a power contact with a right plate and can continue skidding in negative direction of axis of x.

Differential equalizations of relative motion of unit of product in projections on wasp of x and in look like accordingly: equalization (31) and equalization (7). The normal reaction of N_2 can be certain from expression (9). Equalization (31) is driven to the kind:

$$\ddot{x} = a_5^n \cdot \left(\sin\omega t - z_3^n\right) \tag{37}$$

$$a_5^n = A\omega^2 \cdot \frac{\cos(\gamma-\mu)}{\cos\mu} \tag{38}$$

$$z_5^n = -\frac{g}{A\omega^2} \cdot \left[\frac{f_1\cos\mu}{\cos(\gamma-\mu)} + f_c\right] \tag{39}$$

$z_5^n = a_5^n$ - dimensionless parameter of resistance and parameter that has a dimension of acceleration, and answer a power contact, unit of product, with a right plate at her relative transferring to negative direction of axis of x in the case when speeds are directed in one side.

The generalized equalization of relative motion of unit of product is along the axis of x (along plastins) at possible combinations straight of force of inertia of portable motion, sign of function $\sin V_n = \sin\cos\omega t$ but straight relative motion of unit of product it can be presented in a kind:

$$\ddot{x} = a \cdot \left(\sin\omega t - z\right), \tag{40}$$

$$a = \begin{cases} a_0^{\mathbf{n}} = A\omega^2 \cdot \dfrac{\cos(\gamma+\mu)}{\cos\mu} & for & \delta_0^n \leq \delta \leq \dfrac{\pi}{2}; \\[2mm] a_1^{n} = A\omega^2 \cdot \dfrac{\cos(\gamma+\mu)}{\cos\mu} & for & \dfrac{\pi}{2} \leq \delta \leq \pi; \\[2mm] a_2^{\pi} = A\omega^2 \cdot \dfrac{\cos(\gamma-\mu)}{\cos\mu} & for & \pi \leq \delta \leq \delta_2^{\pi}; \\[2mm] a_3^{\pi} = A\omega^2 \cdot \dfrac{\cos(\gamma+\mu)}{\cos\mu} & for & \delta_3^{\pi} \leq \delta \leq \dfrac{3}{2}\pi; \\[2mm] a_4^{\pi} = A\omega^2 \cdot \dfrac{\cos(\gamma+\mu)}{\cos\mu} & for & \dfrac{3}{2}\pi \leq \delta \leq 2\pi; \\[2mm] a_5^{n} = A\omega^2 \cdot \dfrac{\cos(\gamma+\mu)}{\cos\mu} & for & 2\pi \leq \delta_5^{n} \end{cases} \qquad (41)$$

$$z = \begin{cases} z_0^{n} = \dfrac{g}{A\omega^2} \cdot [\dfrac{f_1\cos\mu}{\cos(\gamma+\mu)} - f_c] & for & \delta_0^n \leq \delta \leq \dfrac{\pi}{2}; \\[2mm] \mathbf{z_1^n} = \dfrac{g}{A\omega^2} \cdot [\dfrac{f_1\cos\mu}{\cos(\gamma+\mu)} + f_c] & for & \dfrac{\pi}{2} \leq \delta \leq \pi; \\[2mm] z_2^{\pi} = \dfrac{g}{A\omega^2} \cdot [\dfrac{f_1\cos\mu}{\cos(\gamma-\mu)} + f_c] & for & \pi \leq \delta \leq \delta_2^{\pi}; \\[2mm] z_3^{\pi} = -\dfrac{g}{A\omega^2} \cdot [\dfrac{f_1\cos\mu}{\cos(\gamma+\mu)} - f_c] & for & \delta_3^{\pi} \leq \delta \leq \dfrac{3}{2}\pi; \\[2mm] z_4^{\pi} = -\dfrac{g}{A\omega^2} \cdot [\dfrac{f_1\cos\mu}{\cos(\gamma+\mu)} + f_c] & for & \dfrac{3}{2}\pi \leq \delta \leq 2\pi; \\[2mm] z_5^{n} = -\dfrac{g}{A\omega^2} \cdot [\dfrac{f_1\cos\mu}{\cos(\gamma-\mu)} + f_c] & for & 2\pi \leq \delta \leq \delta_5^{n}, \end{cases} \qquad (42)$$

δ_0^n - phase corner of beginning of skidding of unit of product in positive direction of axis of x at a power contact with a right plate;

δ_2^{π} - phase corner of completion of skidding of unit of product in positive direction of axis of x at a power contact with the left plate;

δ_3^{π} - phase corner of beginning of skidding of unit of product in negative direction of axis of x at a power contact with the left plate;

δ_5^n - phase corner of completion of motion of unit of product of part in negative direction of axis of x at a power contact with a right plate.

It is possible to draw conclusion from equalizations (42), that absolute values of dimensionless parameter in pairs equal each other on the different intervals of skidding of unit of product in positive and negative directions of axis of x at a power contact with right and left plates. Id est $2z_0^n = \left|z_3^{\pi}\right|$, $z_1^n = \left|z_4^{\pi}\right|$ та $\left|z_2^{\pi}\right| = \left|z_5^n\right|$. And also at equality of parameters appear even and parameters a_i. Thus, at the vibrations of underlayment with an acceleration sufficient for relative motion of unit of product between plates, the last will have the identical on an absolute value transferring to positive and negative directions of axis of x. Id est, vibromoving of unit of product directed in this case will not be.

On fig.5. presented dependence of dimensionless parameters Z_i from a corner options of plastins for parameters: $A = 10$ mm; $n = 10$ min^{-1}; $f_1 = 0,4$; $f_2 = 0,35$; $f_c = 0,5$. [1…3,7]
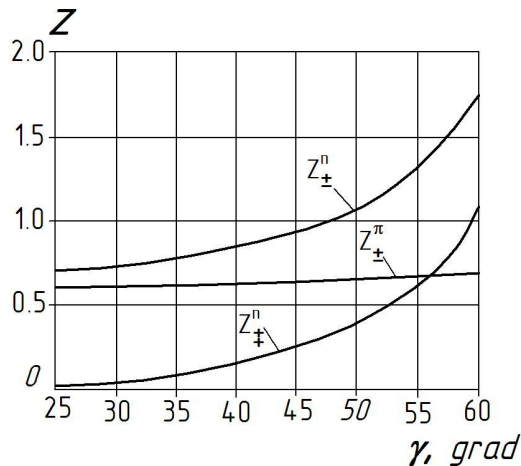
Fig. 5. Dependence of parameter z_i from the corner of setting of plastins γ

Such functional dependence is just for all values of corner establishment of plastins, and there is a betweenness by parameters z_0^n i z_1^n depends on a corner . In area of small values of corner of establishment of plastins $z_2^\pi > z_0^n$. With the increase of corner a difference is between the values of dimensionless parameters and z_0^n diminishes. There is an odomain of corner of establishment of plastins, at that $z_2^\pi < z_0^n$.

It costs to notice, that in this case, at the terms of beginning of skidding of unit of shallow products are not executed in each of directions, id est in this case absent motion of particle in relation to an underlayment between contiguous plates. An area that limits value of corner γ represented by the dotted line and responds to the condition $z_0^n = 1$.

At moving of unit of product in the mode of the bilateral skidding with two instantaneous stops unit of product has for three the subinterval skidding in each of directions of axis of x. At at a movement with stops unit of product can have for two or for three intervals of skidding in each of directions.

Ruh of particle can begin in plus direction of axis of x, if $\ddot{x} \geq 0$, id est for terms $z_0^n < 1$. Condition $z_0^n < 1$ it is the condition of existence of relative motion of unit of product between contiguous directing plates.

The mode of motion of particles of product is determined by the method of progressive approximations. For what, set by initial conditions, the phase corners of beginning and completion of motion of unit of product are determined in each of directions. Whereupon, by the correction of initial conditions, there is an exit on the mode that was set, or close to it with sufficient exactness.

Conclusion

1. The results of experiment give an opportunity to build the model of moving of products on the surface of tray on condition of the different speed modes. A decision of the put task is of interest from the point of view of further development of theory of the oscillation moving, for fragile shallow wares.
2. An equipment for moving of products under the action of vibration will have more operating conditions if to use a programmable logic controller in a management.

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Analysis of working parts for machines intended for fine meat raw material cutting

Aleksandr Zheludkov, Sergey Akulenko

Mogilev State Foodstuffs University, the Republic of Belarus

Abstract

Corresponding author:

Aleksandr Zheludkov
E-mail:
sheludkov@mail.ru

Introduction. A purpose of researches is a decline of power-hungryness of process of micronizing of meat raw material by the improvement of construction of cutter knives.

Materials and methods. 4 types of knives which differ in the type of cutting edge were investigated. Factors which influence on the process of micronizing of meat raw material in cutter, and the ways of improvement of micronizing process are certain on the basis of literary analysis of modern scientific paper of lider scientific journals.

Results and discussion. According to the design cutters can be divided into four groups: with rectilinear cutting edge; with continuous curve cutting edge; with dentate line cutting edge; with broken line cutting edge.

Cutting at micronizing process must be sliding, and a knife-blade is sloping. The increase of sliding coefficient results in the increase of length of cutting edge and side of knife, increases the losses of energy on a friction and intensively promotes the temperatures of raw material. At the change of coefficient of sliding of knife K from 1,06 to 1,94 the increase of temperature diminishes from 5 to to 4,66°C. The minimum increase of temperature at K=1,94. Specific power-hungryness at the increase of sliding coefficient from 1,06 to 2,17 diminishes. A minimum is observed at K=2,17, and for it further increase the specific power-hungryness rises. Surface of contact of cutting organ at K=3,7 increase by comparison to the case of the chopping cutting in several times. Effort of pinning of product to the side and coefficient of friction at the set speed of cutting are permanent, and principal reason of increase of specific power-hungryness is an increase of constituent of specific expense of energy on overcoming of knife surface friction at a product.The previous study in cutting process allowed to determine that the minimum temperature growth and specific energy intensity can be reached using the cutters with the broken line cutting edge and cutting angle γ=64°.

Conclusion. Given scientific developments allow to design the cutters with optimum cutting angle providing minimum specific energy intensity and temperature growth in comminuted raw material.

Introduction

The quality of sausage goods and their output depend on various factors. Among them the decisive role belongs to the fine meat mincing in the cutting machines, the shape of cutters influencing the mincing quality considerably.

A purpose of researches is a decline of power-hungryness of process of micronizing of meat raw material by the improvement of construction of cutter knives.

Materials and methods

Cutters of various designs and shapes are used as working parts in cutting machines at the meat-processing plants.

According to the design cutters can be divided into four groups:
1. cutter with rectilinear cutting edge;
2. cutter with continuous curve cutting edge (crescent cutter);
3. cutter with dentate line cutting edge;
4. cutter with broken line cutting edge.

The cutter with rectilinear cutting edge (fig. 1a) has two blades, one by one on both sides relative to its longitudinal axis which is its symmetry axis. The blades can be inclined at an angle of 15°…20° to the given axis (radius of rotation) [1].

a

b

c

d
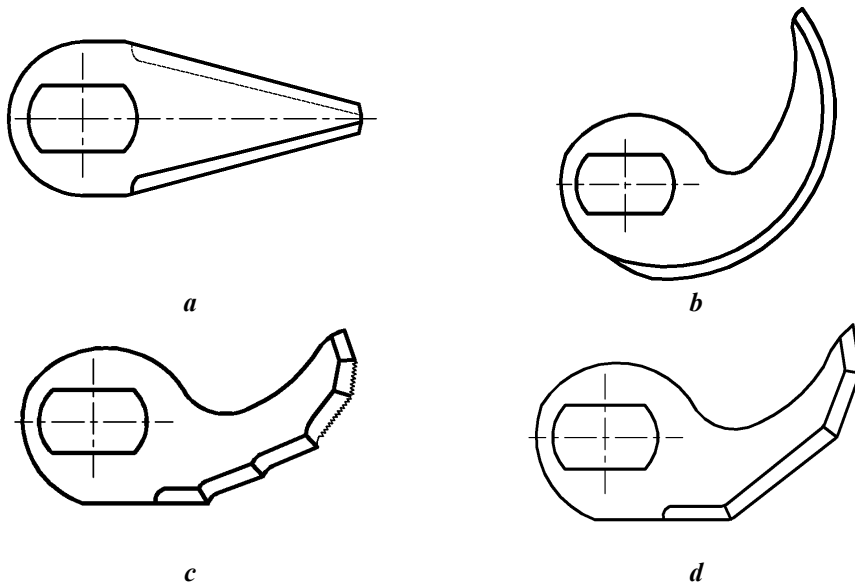
Figure 1. Cutter shapes:
a - cutter with rectilinear cutting edge;
b - cutter with continuous curve cutting edge;
c - cutter with dentate line cutting edge;
d - cutter with broken line cutting edge

Results and discussion

It should be noted that cutter with rectilinear cutting edge possesses less friction area with mince in comparison with that with continuous curve cutting edge, for central lateral surface of the former is less than that of the latter under the same conditions. The cutter with rectilinear cutting edge has clear advantages over that with continuous curve cutting edge. Metal wastes decrease owing to rational cutting. Its manufacturing is simplified considerably. Cutter operating life increases owing to two cutting edges. The cutter resharpening is made it easier.

However, while using such cutters chopping is prevalent. Because of its strength the connective tissue is cut worse than the muscle one. That is why the cutter with rectilinear cutting edge is advisable to be used for blending.

At the meat-processing plants crescent cutter is widely used (fig.1b). Its cutting edge is in the form of curve plotted on a definite spiral. The curves of the following types as Archimedean spiral, logarithmic spiral, evolvent and arc of a circle with displaced center are used for the cutter shaping.

M.N. Klimenko has carried out research to determine the most effective cutter shapes. Cutter operating efficiency was estimated by capacity value of the cutter shaft, comminution duration and mince quality. Studying has showed that minimum capacity value of the cutter shaft is reached while using the cutters in the form of Archimedean spiral or logarithmic spiral [1].

The cutter of the given shape allows attaining satisfied comminution quality owing to high slip coefficient. But crescent cutter has considerable disadvantages: high manufacturing cost, sophisticated sharpeners along with high manning level, metal overcharge.

To emulsify raw pig skin in the cutter machine it is recommended to use the cutter with dentate line cutting edge (fig. 1c) because of the high collagen strength. So it is necessary to employ a cutter for comminuting raw pig skin. For this purpose a saw-like cutter is used. Collagen fibers are sawn with its cogs increasing moisture retentive property sharply.

In the advanced cutting machines the cutter with the cutting edge in the form of broken line negotiated quadratic curve is widely used (fig.1d). Given cutter is all-purpose and ensures fine comminution and high emulsifying power. As a rule a broken line is divided into four or five segments of different length [3]. The points of the broken line like cogs exert additional cutting force. Given shape of the cutting edge ensures manufacturing and operation costs (resharpening) decreasing in comparison with cutters with continuous curve and dentate line cutting edges.

Analyzing design features of various cutters it should be considered both perforated ones and those with additional cutting edges and high emulsifying power (with forked end). The diagram of perforated cutter is shown in figure 2.

Estimating perforated cutter it should be noted that such a design application reduces both frontal resistance resulting from mince feeding and total force action [4]. The cutter perforation causes hydraulic disturbance in the comminuted raw material especially at the final cutting during liquid sausage meat making. It causes rising in energy expenditure related to heating and additional raw material blending. At the same time it should be noted that the cutter perforation is stress concentrator diminishing cutter strength and reducing dynamic stability.
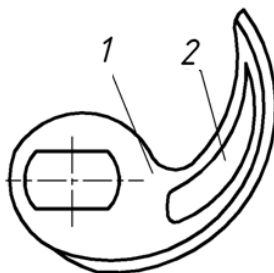
Figure 2 - The diagram of perforated cutter
1 – cutter; 2 – perforation

According to manufacturers' reports the cutters with additional cutting edges and forked end possess high emulsifying and fine comminution power. But the cutters of given design due to the reduced strength characteristics can be used only for cutting of precomminuted sausage meat. Slightly frozen raw material is not allowed to be cut.

The cutting edge angle of sharpening is of great importance to implement technological process of meat raw material comminution when sausage goods are made. At present it is recommended to use the following ways of cutter sharpening [5]:
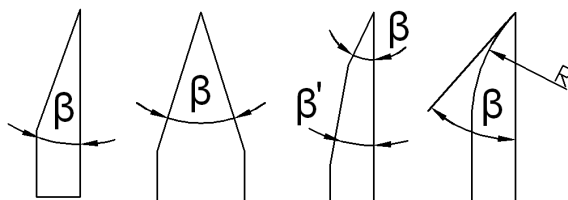
Figure 3. Shapes of cutter sharpening

In the advanced cutting machines cutting speed is more than 100 m/s. Taking into account both cutting edge strength characteristics and comminuted raw material properties the optimum range of cutting-point angle value is within the limits 15°…30° [6].On the one hand the less is cutting-point angle the better is cutting conditions. On the other hand cutting edge strength reduces. It results in cutter to be resharpened more frequently. The more is cutting-point angle the higher is cutting edge strength. However, resistance of cutter penetration into the comminuted raw material grows. It results in intensive mince heating. Meat fibers are torn without cutting. Energy is consumed on elastic meat and meat mass deformation increasingly.

When analyzing cutter designs it was found out there has been no common ways of working parts cutting edge shaping. A number of manufacturers produce slightly distinguished cutters. Their designs have no enough theoretical and experimental justifications. Owing to this optimization problem of working parts geometric parameters arises.

To make the cutting process more effective engineering solutions according to patents of the Republic of Belarus have been used (Patents 11597 and 11793)

In accordance with suggested engineering solution cutting edge was made in the form of broken line tangential to log spiral. It gives the opportunity to achieve the constancy of

cutting angle in the middle of every rectilinear part of cutting edge which, in its turn, results in the minced meat uniformity (Patents № 11597, Republic of Belarus).

When fibrous material cut it is necessary for the pressure in cutting edge and product contact zone not to reduce with the increasing of the distance from the axis of revolution to the cutting edge, but on the contrary grow. It could be achieved either to reduce the sharpening angle of the cutting edge as the distance from the axis of revolution to the cutting edge increases or to increase the cutting edge angle.

When the crescent cutter is used the latter is more practical. However, it results in the cutting edge length extension and loss of energy for friction and, in its turn, in the intensive increase in the temperature of minced meat during the process of cutting.

The use of cutter with the broken cutting edge allows reducing sharpening angle of the cutting edge as the distance from the axis of revolution to the cutting edge increases. Given constructive decision makes it possible to obtain required pressure in the cutting edge and product contact zone (Patents № 11793 the Republic of Belarus).

Thus advanced technologies in the field of cutter design have been offered. They make it possible to reduce both comminuted raw material temperature growth and expenditure of energy with the keeping of required mince quality.

To define specific cutter design factors (optimum cutting angle) it is necessary to carry out experimental studies taking into account the influence of the given parameter on the cutting. Specific energy intensity N_{sp} - temperature growth Δt - slip coefficient diagram is shown in figures 4 and 5.

$$\Delta t = 0{,}177Cs^2 - 0{,}688Cs + 5{,}53$$
$$R^2 = 0{,}993$$
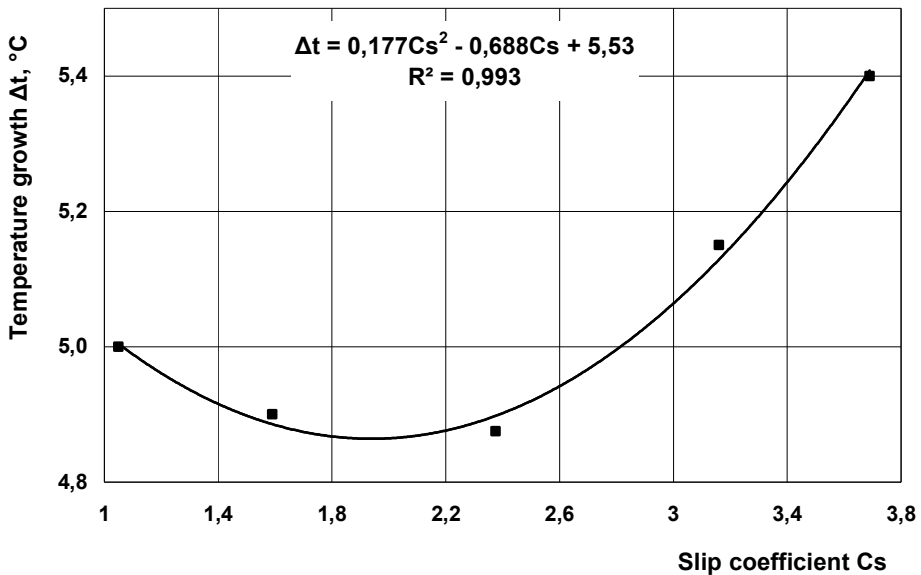
Figure 4. Dependence of Δt on C_s
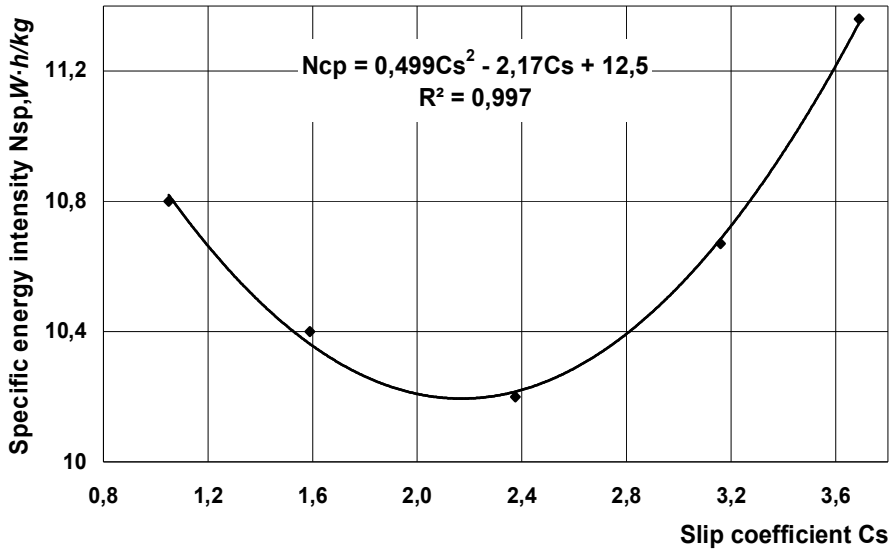
Figure 5. Dependence of N_{sp} on C_s

As follows from the diagram (figure 4) when slip coefficient C_s is increasing from 1.06 to 1.94 the temperature growth is decreasing from 5 °C to 4.66 °C. The minimum temperature growth is achieved when slip coefficient C_s is 1.94. The more is slip coefficient the more is temperature growth.

Minced meat cutting is accomplished with cutters at high speed. Energy is mainly spent to overcome adhesive and friction forces. Adhesive force is directly related to cutting blade and mince contact area. Therefore to reduce given force considerably cutter lateral surface should be cut with blade straightening.

Cutting should be accomplished at a glancing angle and blade cutter is inclined. It makes minced product possible to travel along a cutter blade. Slip coefficient increasing leads to the cutting edge length and cutter lateral surface extension and great loss of energy for friction and, in its turn, to the intensive increase in the temperature of minced raw material during the process of cutting.

When slip coefficient C_s is increasing from 1.06 to 2.17 specific energy intensity is decreasing (figure 5). The minimum specific energy intensity is achieved when slip coefficient C_s is 2.17. The further increasing in slip coefficient C_s causes the specific energy intensity N_{sp} increasing. The main reason for energy consumption growth is the increasing in N_{sp} component value which is important for friction force overcoming. When C_s is 3.7 the contact area of the cutting part is greater several times as much as in the case of chopping process. As product-lateral surface pressure and slip coefficient at the specified cutting speed are constant values it can be concluded that the main reason for specific energy intensity N_{sp} and slip coefficient C_s increasing is the growth of energy consumption component value to overcome cutter-product friction force.

Conclusion

The study allows determining that the minimum temperature growth and specific energy intensity are achieved when the cutter with slip coefficient C_s is 2.06 is used. As $Cs = \text{tg}\gamma$ then the given slip coefficient is complied with the cutting angle γ= 64° 11ʹ.

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Brand role in the conception of market positioning of goods on the consumer market

Sergii Sirobaba, Galyna Cherednichenko, Iryna Tiukha

National University of food technologies, Kyiv, Ukraine

Keywords:	Abstract

Corresponding author:

Galina
Cherednichenko
E-mail: gala-
office2006@ukr.net

Introduction. The article is devoted to the study and analysis of the concepts of «positioning» of goods on the market, «brand» and «trade mark» in the system of consumer behavior and development of practical recommendations for brand owners how to create a successful brand.

Materials and methods. Methods of scientific induction and deduction, comparative method and scientific abstraction method are used.

Results and discussion. The authors analyzed different views of Western and Ukrainian scientists as F. Kotler, J. Friedrich, M. Yanenko, F. Pankratov, P. Doyle on the concepts of «positioning» of goods on the market, «brand» and «trade mark» and gave their own vision. According to authors positioning is a set of specific marketing activities of a firm with the aim their products will take more favorable competitive position on the market relative to competitors' products. Fundamental differences between the concepts of «brand» and «trade mark» are disclosed. Authors determine that a trade mark represents a certain image of the product or the company which is created by the manufacturers to identify their products on the market among similar competitive products. A brand is widely known in the market, untwisted, legally registered trade mark, which is the expression of a positive image of the manufacturer and includes a set of specific emotional and functional characteristics. The history of brand development in Ukraine, its evolution caused by changes of the market and changes in tastes and preferences of final consumers is shown on practical examples of such brands as «Pervak», «Song» «Hetman», «Olympus», «Vdala», «Bilenka»; «SV», «Medoff», «Mernaia» and others. The following recommendations to Ukrainian manufacturers as to creating a brand are given. They are: provide increasing importance of positioning with a gradual saturation with goods and services on the market; use new technologies to promote brands on an increasing competitive market; refuse using «umbrella approach» to brand creation because its practical application in the conditions of a rigid competitive struggle is inefficient.

Conclusions. The original contribution of our exploration lies in determining mistakes which Ukrainian companies make in the process of their products promotion on the market and giving practical recommendations to avoid them.

Introduction

Different marketing techniques used by companies to promote their products on the market are being developed increasingly along with development of entrepreneurship in Ukraine. Such terms as «brand» and «trade mark» has already gone beyond the scope of marketing techniques, and nowadays they turned into intangible assets which are successfully used by enterprises not only with a purpose of their identification. They have become an integral component of a product, exactly product's name for which buyers are willing to pay money.

Market positioning in modern conditions is one of the most effective methods of competitive struggle on the consumer markets. To solve the problem of choice behavior in the market space is impossible without preliminary identification of strategic business positions and the corresponding business justification spectrum of appropriate marketing strategies.

At first the concept of positioning was examined by Jack Trout and Al Rice in 1972. In their opinion, positioning is a kind of operation in the minds of potential customers as a distinctive feature of a product in the minds of consumers [13, p.12-13]. Such authors as F. Kotler, P. Batra, K. Keller, J. Myers, J. Friedrich, J. Graham, A. Vovchak, M. Yanenko also studied the problem of market positioning on the consumer market. Their works cover basic theoretical principles of market positioning. They defined a possible basis for differentiating brands, highlighted a specific strategy for market positioning.

Materials and methods

In our article we used different methods: theoretical analysis of views and approaches of Western and Ukrainian scientist to the definition of the main terms of our study «positioning», «brand» and «trademark», comparative analysis of data, scientific induction and deduction, and abstraction to determin mistakes which Ukrainian companies make in the process of their products promotion on the market and give practical recommendations to avoid these mistakes.

Results and discussion

There were numerous attempts to define the concept of marketing positioning as a generalized category. F. Kotler defines «positioning» as actions from proposal of the company which wants its image take the isolated position in the minds of the target consumer group» [5, p. 369].

J. Friedrich understands «positioning» as product importance on the market, and how this product is perceived by appropriate customer group. This definition gives the necessary understanding of the problem [4].

However, it is worth to cite the definition of the concept of positioning in the M. Yanenko works. He writes «Positioning is management of customers' opinion about the place (position) of the brand among many different brands or a related commodity group» [15]. This positioning serves as a management tool to control consumer choice. According to M. Yanenko, the main purpose of positioning is the need to achieve sustainable idea in the minds of consumers about the brand as the best product for the specific conditions [4].

Having analyzed all previous opinions, we can conclude that positioning is a set of specific marketing activities of a firm with the aim their products will take more favorable competitive position on the market relative to competitors' products.

Thus, positioning plays the primary role in creating a brand. The life cycle of the brand combines four stages: design, creation, development and aging. Positioning occurs on the first stage of brand creation after development stage, that comes simultaneously with the definition of brand strategy, brand creation, logo and packaging. Actually, the concept of «positioning» is defined as the process of creation of the brand position on the market and in the minds of consumers, and along with creation of a brand name, brand image, service standards, warranties, packaging and method of delivery.

According to the definition of the American Marketing Association, «brand is a name, word, phrase, sign, symbol or design decision, or their combination to identify goods and services of a particular seller or group of sellers in order to be different from their competitors» [1]. In a broader sense brand includes a product or a service itself, together with all their parameters, a set of characteristics, expectations, associations perceived by the consumer and gives them the goods as well as promises all benefits that the brand owners give consumers. Thus, the brand is an «imaginary shortcut» that consumers «paste» on goods as well as to the content, which mean the actual creators [11].

Studying a brand, it is impossible not to mention such marketing concept as a «trademark», specialists are increasingly talking about importance of its use as one of the major factors of marketing that can ensure company's success on the market.

The terms «brand» and «trademark» are different in scope. According to F.G. Pankratov [8], the term «brand» has been used in the sense of «trademark» for a long time. However, trade mark, according to the author, has a wider meaning which the author compares and almost identifies with the meaning of the English term «brand» and which is not limited by the external attributes of the brand. Obviously, the concept of brand, brand name and trademark are closely interconnected, but not interchangeable. From the author's point of view the basis of «brand» is a trademark.

When we say «brand name» or «brand» we usually understand image and all that we know and think about the product, it is what consumers expect. The concept of «brand» is used by experts to characterize the level of information and the cost of the trade mark [8, 9]. From the economic point of view the brand differs from the trademark in that brand has a longer life cycle, brings additional income, allows to develop new market segments and expand the assortment of goods.

P. Doyle [2] notes that the trademark can be defined as a proper name, emblem or design, or a combination of both (messages). In addition, such combinations are the distinctive holders marks.

According to K. Keller [14], if consumers distinguish the brand from other ones and know something about it, they do not think about the choice of goods. Thus, they identify the right product easier and spend less time and effort to visit supermarkets. That is brands reduce the costs on searching goods. If consumers do not know anything about the brand, they make assumptions based on existing perceptions of the quality, characteristics of the goods and the like. Also K. Keller rightly points out that brands sometimes play the role of self-expression. Some of them are associated with a certain type of consumers that have their own values or features of consumption. Buying them, people define their position in society and inform the others about it [14].

It should also be noted that there are other scientific definitions of such concepts as «brand» and «trade mark». Different scientists understand them differently. However, we believe that:

• a trade mark represents a certain image of the product or the company which is created by the manufacturers to identify their products on the market among similar competitive products. In other words, the introduction of brands on the market is considered by manufacturers as a real event producers compete. First of all, it concerns enterprises operating in attractive for investment markets.

• a brand is widely known in the market, untwisted, legally registered trade mark, which is the expression of a positive image of the manufacturer and includes a set of specific emotional and functional characteristics. A brand is often an intangible asset of the company that brings marginal revenue.

One of the leading researchers of this problem T. Nilsson, describing the essence of brand positioning, follows the Reis-Trout approach. He argues that successful positioning is to find a key word or phrase for the brand and linking the expression with the important characteristics of the commodity to the buyer in which the brand has a chance to win [7, p. 125]. The position must be distinctive – otherwise it can't be called a position, besides, – buyers have to believe in it. Ideally, the position of the brand should be easily confirmed or displayed. The greatest value is the consistency of the selected item. The strong brand position means that the brand has unique, sustainable and valuable place in the minds of buyers. The positioning sets the direction necessary to guide the company in business and focus strategic efforts.

The positioning of the brand as a factor of innovativeness is influenced by external forces and certainly should not be done in isolation from the same brand. Brand positions should be different from competing brands, and they must be valuable for consumers. Policy formation of personal brand is a guarantee of the brand values, which makes it different from the rest of the brands. If the need for positioning is ignored, competitors define the place of the brand in the minds of consumers. The positioning of the brand is also the main source of internal and external growth of the company. It also defines the operational strategy.

Having done the analysis of the essence of market positioning, the specific positioning of the object and the object to which it is directed, positioning strategies can be classified according to the following criteria:

• the levels of positioning;
• the object against which is the differentiation;
• the brands of the competitors;
• the placement in the product category;
• the type of properties, which positioning are based on;
• the number of elected positions;
• the positioning stages;
• the existing market position.

In the mid 1990s, the first stage of brand creation in Ukraine was enough to learn how to make a quality product, to establish a distribution service – and national brand image is provided almost without advertising costs. It emerged as a brand of «Obolon» – the first Ukrainian strong brand that maintains and strengthens its leading position on the beer market. This brand came to the system of advertising and integrated brand promotion, when the Ukrainian beer market was powerfully attacked by «Interbrew» and «Sarmat».

Today these factors are necessary but not sufficient to create strong brands. In those markets where the brand did not exist, one could achieve significant results due to changing

consumption habits. The pioneer of this approach in Ukraine has become a brand «Oleyna» which, in essence, created a segment of bottled refined oil. The vast majority of consumers preferred bottling market oil. The creators of «Oleyna» told them the idea: this brand is deprived of essential shortcomings of the oil, which were sold on markets («do not burn, do not foam, do not burn up», «the taste of the food, not oil») [11]. In this way, their brand has become the market leader of sunflower oil. In 2002, a new technology has been taken as the basis for creating the brand «Nasha Ryaba». In a situation where the majority of Ukrainian consumers preferred to buy beef and pork and frozen chicken, this brand brilliantly demonstrated the benefits of chilled chicken meat and became the leader in our market [10].

It should be noted that at the first stage of brand creation in Ukraine was good enough–the brand in the eyes of consumers became very attractive. It becomes very important for the consumer to see and understand individual differences and the nature of brands now. This problem can be solved only by using brighter and more comprehensive advertising solutions.

There are several leading brands on many of markets that are competing with each other. This means that both producers and their partners must be always ready and provide a competitive advantage in both strategic and tactical terms. One example is the alcohol market. Historically, this market started with two companies and brands – Nemiroff and Soyuz-Victan (SV), which sold vodka in different price segments. Firstly, these brands have represented themselves as quality brands of vodka, and then they went through increasing the assortment positions in taste and price segments. «SV» brand weakened its positions and brand Nemiroff, on the contrary, strengthened. At the same time a new strong brand «Miagkov» was introduced on the market which was clearly positioned in very important rational (softness) and emotional (vodka for a soul company) benefits.

Since that time, the vodka market has entered a stage of brands portfolio, where one manufacturer produces and promotes various brands for different target groups. «Hetman» with its short-term projects «Pervak», «Song» and others left a big stage. They completely destroyed the reputation of the first Ukrainian premium brand of vodka «Hetman». Corporation «Olympus» successfully strengthened its position with the brands «Olympus», «Vdala», «Bilenka»; «SV» company with the brands «SV», «Medoff», «Mernaia»; the first Odessa distillery with the brand «Miagkov». Only some vodka producers remained true mono – branded approach using only one brand (Nemiroff, Shustov) [10].

All this examples show that the time of simple solutions in branding has expired. It is not necessary to talk about the stability of the position of brands in the conditions of growing competition and constant introduction of new technologies. Linear expansion of brands, the use of diverse sub-brands and using several different brands have become one of the major branding techniques, by which leadership is achieved and maintained in Ukraine. Experience of brand creation in Ukraine showed obvious advantages of these approaches over the «umbrella principle» of brand creating, when a variety of products were promoted under one brand. So the brand «Chumak» is more inclined to «mono-brand umbrella strategy», entered the market of Ukraine with a unique offer of ketchups and, in fact, formed this category. Then «Chumak» expanded in home canning, mayonnaise and oil. Mastering new category, «Chumak» received profits on new markets and thus weakened the previous one.

Today the brand «Chumak» has no share as the brand leader in any of the markets where it «works». Being everywhere in branding is to be nobody. «Umbrella approach» to brand creation can be used within the same category of products – even if it is very broad. A vivid example of this approach is the brand «Roshen», uniting under a production all

confectionery factories of the corporation [11]. Therefore, it is important to combine different branding technologies wherever possible.

Using products of different brands in one category for the economic segment and above average / segment or expensive is correct and very promising. «Sandora» and «Sadochok», «Olympus» and «Bilenka», «Maiskiy tea» and «Lisma» – these and many other brand «couples» allow their companies to maintain and develop positions in different terms of the ratio quality / price segments offering customers a variety of different, important values especially for them.

Conclusions

The concept of positioning is a powerful tool that allows introduce effectively to the consumer the main difference of the product from the mass of other products on the market. Positioning as a process is studied by many scientists and practitioners, as it is the base for creating a brand. Accordingly, we can suggest the following points to Ukrainian manufacturers:
• provide increasing importance of positioning with a gradual saturation with goods and services on the market;
• use new technologies to promote brands on an increasing competitive market;
• refuse using «umbrella approach» to brand creation because its practical application in the conditions of a rigid competitive struggle is inefficient.

It should also be noted hat every brand has its sectoral, functional and emotional limitations in the eyes of its consumers. To go beyond these limits means to put your business at risk aversion on the part of consumers and, consequently, the risk of loss of significant financial resources. A modern enterprise in such circumstances should pay special attention to the formation of brand positioning strategy of its trademark with the aim of having a strong position on the market.

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The impact of competitive environment on the raw material base development within diary industry of Ukraine

Viktor Yemtsev

National university of food technologies, Kyiv, Ukraine

Abstract

Introduction. The dairy industry in Ukraine is in the doldrums. The aim of research is analyzing the current state, problems and prospects of functioning and explore possible directions of dairy cattle development.

Materials and methods. The following methods were used in the research: a systematic and complex analysis, economic, mathematical and statistical, analytical and comparative methods, expert and rating estimation.

Result and discussion. Main problems and development tendencies in the native raw material sources for the enterprises of milk industry: reduction of number of cows, absence of selective and genetic work, low productivity of the cattle, price disparity, need of huge investments in the development of milk cattle, insufficient governmental support, low purchase ability of the milk product buyers, etc.

For revival of dairy industry in Ukraine, the priorities of the state regulation and support, in our opinion, should be: creation of cluster formations on market conditions beneficial to provide full cycle "selection and breeding - milk and meat - processing of raw materials - sales of finished products" and improve organization management based on specialization and cooperation; the development of selection and breeding, genetic work, increasing the role of breeding, breeding farms, better use of livestock breeding gene pool of the country; providing high-quality fodder, based on advanced technologies of harvesting and storage of fodder, protein solve priority problems and ensure the development of intensive and resource-saving technologies to manufacture high quality products and competitive farming.

Conclusion. Indicated directions of dairy cattle development are guarantee for ensuring sustainable milk base for processing plants in the existing competitive environment.

Introduction

The latest global trends in economic, social and political development, that are characterized by contradictions and strains of monopolar ambitions, are more and more accompanied by constant competitiveness between national and regional economies. The trend, in its turn, creates aggressive, contentious and competitive environment for national economies functioning that leads to significant global competition.

Therefore, at the present stage of market relations development at the gradually strengthening of risks and competitiveness within the markets of raw materials, when sales conditions and enterprises functioning become rather uncertain, ensuring the enterprise competitiveness is particularly important (including the development of the resource base) as the basis of economic system in conditions of dynamic competitive environment changes. That is why there is an objective need for comprehensive research to study the functioning of raw materials market for domestic processing plants, including the dairy industry. Because of such research, the producers of raw get the information about the dynamics and structure of supply and demand on the market of raw materials; and processing plants - about issues, trends and prospects of the market development.

The theoretical principles of sustainable provision of resource for processing enterprises and practical issues for creating and use efficiently the production capacity of enterprises, that are engaged in dairy cattle and milk processing, in the existing competitive environment are studied by of V. Ambrosov, V. Boiko, V. Vlasov, N. Golovin, M. Dem'yanenko, U. Luzan, V. Mesel-Veselyak, T. Mostenska, B. Pashaver, P.Sabluk, V. Sytnyk, Dorothee Flaig, Ofir Rubin, Marie Dervillé, Claudio Soregaroli, E.K. Miller-Cushon, M. Arych, Zhen Zhong, M.A.G. Keyserlingk and many others [1-26].

However, the system of forming, operation and development of raw materials market for milk processing plants exists in a dynamic context, as these issues remain relevant and require further research and scientific development.

The aim of research is analyzing of the current state, problems and prospects of functioning and explore possible directions of dairy cattle development as an aspect for ensuring sustainable milk base for processing plants in the existing competitive environment.

Materials and methods

The following methods were used in the research: a systematic and complex analysis, economic, mathematical and statistical, analytical and comparative methods, expert and rating estimation.

Result and discussion

AIC processing industries in 2014 brought the largest foreign exchange earnings for Ukraine. The significant place among processing industries is taken by the dairy industry that keeps high stable share and made approximately 14% in 2013 on food market (compared to the meat industry - 12.8% and confectionery - 6%).

During the economic crisis of the 90-ies, there were radical economic transformation in agriculture of Ukraine: the elimination of state centralized system of planning and management of agriculture, rural termination of state support, the rejection of state regulation and liberalization of pricing policies, changes in property that, ultimately led to a significant disparity in the prices for agricultural and industrial products, low competitiveness of most agricultural enterprises in domestic and foreign markets have resulted in the changes of structure and AIC

production. Thus, under the influence of these processes, the share of the livestock in total agricultural production has decreased from 48.8% in 1990 to 30.6% in 2013.

The most difficult case concerns dairy farming. The development and liberalization of the banking sector and destruction of livestock have taken the most barbaric swing when agricultural property, after the loans could not have been paid back on time, by facilitated procedure was given to lenders. As a result, banks confiscated the cattle and immediately put to the slaughter, including tens of thousands of heads of pedigree dairy herds. Because of that matters, many companies within the industry suffered and currently are trying to survive in unbalanced economic relations between the primary producers and processors, low quality of management and marketing, limited purchasing ability of consumers, which inhibits the formation of objective prices for milk and dairy products. Our studies show that in the period of1990-2013 the cattle decreased in 5.43 times and keep the overall downward trend (Table 1).

Table 1

Cattle: number and structure in 1980 - 2014
(end of the year; number of heads, thousands) [13,14]

Year	Cattle					Sheep and goats
	Total	Including cows	Density of cows per 100 hectares	Heifer up to 2 years old	Heifer above 2 years old	
1980	25367,6	9271,1	29,3	761,5	1507,2	9051,1
1990	24623,4	8378,2	28,2	667,5	1135,4	8418,7
1995	17557,3	7531,3	24,3	406,6	496,1	4098,6
2000	9423,7	4958,3	16,7	359,1	276,1	1875,1
2005	6514,1	3635,1	19,03	288,9	177,5	1629,5
2011	4425,8	2582,2	9,3	288,1	174,7	1739,4
2012	4645,9	2554,3	9,18	328,8	168,7	1738,2
2013	4534,0	2508,8	8,85	317,1	170,2	1735,2
2014	4248,2	2364,4	8,35	-	-	1473,8

Over the past ten years, the number of cattle in Ukraine was shrinking by 5% a year - every year the herds lost an average of 400 thousand heads. At the beginning of 2015, the meat and dairy cattle made about 4.248 million heads, which is 6.4% less than in 2013. In 2013, from 3 500 agricultural enterprises, engaged in dairy cattle farming, only 399 companies managed to have over 1000 heads, while the total livestock is equal to 458.4 thousand heads. The study results show that in 1990 the bulk (76.2%) amount of milk produced by agricultural (73.27% of the total volume of milk produced in the country) has been delivered to milk processing plants. It allowed controlling the production process, maintaining the quality and safety of raw materials and finished dairy products at all stages of its production.

In 2014, agricultural enterprises produced only 22,47% and processing enterprises received just 50.6% of milk produced in the country. The remaining milk was not supplied to the processing enterprises and thus sold, processed and consumed without completing all levels and types of quality control and safety of dairy products. This factor renders a significant negative impact on the competitiveness of products and dairy industry. It should also be noted that since independence, the domestic dairy industry significantly worsened its position in the global market: in 1990 milk production in Ukraine was on the fifth place in the world rankings, but is

number 14 now. The share of Ukraine in the world cattle number decreased from 1.7% in 1990 to 0, 32% in 2013, nearly by 6 times, and the proportion of milk produced in Ukraine in world milk production decreased from 4 51% in 1990 to 4.41% in 2014.

Table 2

Part of Ukraine in the world milk production, dynamics of change, % [13,14]

	1990	1995	2000	2005	2010	2011	2012	2013	2014
World production of milk, mln. tonnes	542,5	539,1	579,1	629,1	720,9	727,1	753,9	784	797
Milk production in Ukraine mln. tonnes	24,5	17,3	12,7	13,7	11,2	11,1	11,4	11,48	11,23
Part of Ukraine in the world production of milk, %	4,51	3,21	2,19	2,17	1,55	1,52	1,51	1,46	1,41

The above changes have led to the fact that milk production decreased and, per capita, in 2014 made 261.16 kg / cap (excluding the territory of Crimea and Sevastopol city) to 472 kg / cap a year - 1990 and 252.6 kg / cap - in 2013 while the scientific and reasonable rate of consumption is 380 kg / cap per year [14].

Table 3

Profitability of producing major types of livestock by agricultural companies (%) [13,14]

	1990	1995	2000	2005	2007	2009	2010	2011	2012	2013
Milk	32,2	-23,2	-6,0	-0,4	-3,7	1,4	17,9	18,5	2,3	13,6
Beef cattle	20,6	-19,8	-42,3	-25,0	-41,0	-32,9	-35,9	-24,8	-29,5	-43,3

On condition that that the situation with increasing costs and low milk prices will not change, we can predict that milk production in 2015 may be reduced by 1-1.5%. Taking into account the above mentioned trends and problems of dairy cattle in Ukraine, this trend has acquired the status of non-priority and low-profit, so domestic companies are not interested in doing business in the field of dairy and milk cattle farming.

Today in Ukraine there is relatively small number of companies specializing in dairy - in 2013 there were about 3 200 from the number of 3500 enterprises that kept cattle [13].

At the same time, almost half of large agricultural companies with an area of more than 3 thousand hectares do not keep the cattle. Following the results of 2013, only one third (1.1 thousand) from the number of companies working in the field of agricultural livestock, managed to increase the volumes compared to the last year [14]. This is because comparing all kinds of agricultural industries, the milk industry requires major investments that have the longest payback period.

Investing in one animal place is about ten thousand dollars and the return on investment is 7-9 years. At an unstable legislative framework and high interest rates on loans, it is really hard to find the investors wishing to finance the business as the payback period of investment in dairy cattle does not meet the expectations of investors. At the same time, keeping the herd and applying old technical and technological approaches is very ineffective. Many companies producing milk still have a yield lower than 4 thousand Kg / year per cow. Having this volume

of yields, it is difficult to make a profit, and therefore, stable business development. Therefore, significant costs related to the production of raw milk require state assistance in attracting investments and crucially important system changes for economic and legal stability for decades.

However, given that the state support of dairy farming is unwieldy for modern Ukraine budget, we should focus only on efficient use of the existing potential for the development of enterprises and providing strong incentives to their activities by the state.

In some countries, the stimulus is due to the grants, in others because cheap loans. In Ukraine, the only incentive for domestic companies that work in the field is the price that is formed on the market and encourages milk producers and processors to maintain and develop their business. However, the analysis of the current dynamics of prices for milk shows that dairy market is quite competitive, that is why the purchase prices for milk are constantly changed.

Lately, the prices in Ukraine were very close to the world trends, and in some periods even exceeded them. For example, in December 2013, prices paid for the first grade milk (3.4% fat and 3.0% protein) made on average 4.65 USD / Kg (or 0,43 € / kg), while in Germany the milk of 4.0% fat and 3.4% protein was 0,42 € / kg, in the US - 0,35 € / kg (3.7% fat), and in New Zealand - 0,39 € / kg (4, 2% 3% fat and protein).

The increase of purchasing prices for milk harmfully affects the efficiency of milk processing plants because the cost of dairy products is increased. However, even that occurrence did not make milk production a profitable business.

Currently, the profitability of milk production at half of the farms varies around zero. It should also be noted that the imports of cheap raw milk and finished products is opposed to creating growth for purchase prices in the domestic market. Thus, the import of milk in 2013 was equal to 548 thousand tons (5.5% of the consumption fund) and increased in comparison to year 2000 almost in 10 times. This is what is holding back the development of dairy cattle farming. Any stakeholder investing in the business wants to get the money back and to have a profit. Therefore, taking into account the need to ensure competitiveness, it should be noted that by stimulating potential price increases is not effective because for an industry, to be effective, it is a must to use better the existing technical and technological, human, organizational and managerial capacity.

By analyzing the factors of milk market sustainability, we should remember that the market demand for milk and milk products is influenced by natural and STEEPLE factors, which necessitates the use of a systematic approach in the study of its strategic priorities, features and operation problems. The proposal for raw milk business depends on technological factors (state and development of breeding and fodder, storage and transportation, technical and technological level of enterprises processing raw materials, etc.), environmental conditions and rigidity of environmental legislation, resources, organizational and economic (development of market infrastructure, the level of production, monetary and fiscal policy of the state) and the quality of relations between market actors (farmers, dairy companies and other market participants), ease of import procedures and so on. Nevertheless, the most important factor in ensuring milk, to date, is the number of animals and their performance. This low productivity of livestock is the major cause of low competitiveness of dairy farming industry in Ukraine. It is therefore important to continue the intensification of production, because it is providing competitive dairy enterprises. Otherwise, the country will lose not only external but also internal market.

In these conditions, the large processing companies (like "Danone Ukraine" company) started creating rural cooperatives sells of products by private farms. It is about production groups and associations of small 10-15 households that were created only for selling their products. Other companies create a vertically integrated association. These include agricultural holdings like "Ukrlandfarming", "Astarte", HarvEast, Kernel, "Egres-Agro" SE "Ylych-Agro

Donbass", "Agricultural farm Dovzhenko","Ukrainian dairy company "Company" Milkiland","RISE-Maksymko" and so on. Through these and other activities of leading 20 companies that hold a significant part of the dairy herd, on the contrary to the general trend, in 2013 the number of cows was increased by 5%. These companies hold 12.4% of the total number of cows in the country and produce 13.6% of the total amount of milk [15].

Of course, big companies are more competitive and therefore it is better to count on such companies at first. Nevertheless, government support is required for small farms and households, too. Now in rural areas of the country are more than 14 million of people that makes about 30% of the total population, and about 70% of adults are unemployed [13].

In modern conditions, the state really has no money to pay social benefits to the millions of unemployed rural people. Therefore, the cheapest way to solve it is just self-promotion of the population. In addition, for small producers gradually formed, there is a poorly developed niche - production of environmentally friendly and organic products. Therefore, in determining the forms and methods of state support, the dairy farming and dairy industry should understand that this assistance should provide appropriate conditions that will be a catalyst for growth in this area of business.

Conclusions

Based on the mentioned above, it becomes obvious that the dairy industry in Ukraine is in the doldrums. For its revival, the priorities of the state regulation and support, in our opinion, should be:
- Creation of cluster formations on market conditions beneficial to provide full cycle "selection and breeding - milk and meat - processing of raw materials - sales of finished products" and improve organization management based on specialization and cooperation;
- The development of selection and breeding, genetic work, increasing the role of breeding, breeding farms, better use of livestock breeding gene pool of the country;
- Providing high-quality fodder, based on advanced technologies of harvesting and storage of fodder, protein solve priority problems and ensure the development of intensive and resource-saving technologies to manufacture high quality products and competitive farming.

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Formation features of wine tourism destinations

Daria Basiuk, Kristina Udvorgeli

National university of food technologies

Abstract

Introduction. It was analyzed the structure of wine tourism destinations that serve strategic business units and tourist points of tourist demand crystallization.

Materials and methods. Analysis of the formation of wine travel destinations are based on the works of foreign and domestic scientists and experts in the field of tourism.

Results and discussion. Significant factors affecting the formation of wine tourism destinations are: the presence of industrial and cultural sites and attractions associated with wine and winemaking, transport and information accessibility, development of tourist infrastructure, cooperation between business and local communities for sustainable development of the tourist centre. Various kinds of wine tourism destinations of Ukraine were described. Ukrainian wine tourism destinations were outlined taking into account the macro-and micro-regions of winemaking and viticulture complex, and geospatial organization of tourism resources. Wine tourism destinations of different level of Crimean region, Transcarpathian region, Odessa and the Black Sea coasts, and area of the Azov Sea and steppes were described. "Shabo Wine Cultural Centre" is the first exclusive cultural centre of such level in Ukraine. It is an operating advanced enterprise with its own ancient wine cellars, degustation room, art expositions, and unique Wine and Winemaking Museum. The winery "Colonist" is an example of the formation of innovative destinations in wine tourism of Ukraine. It's a small family winery in the south of Odessa where you can visit wine tours, but also take part in an auction of their best vintage wine, in grape-harvest, and try dishes of Prydounayska Bessarabia cuisine. Wine tourism facilities become the factor for supporting tourist interest in destination. In such way wine routs of Transcarpathia (Zakarpattia) allow tourists to take part in tasting in about 50 family wineries, also in excursions and festivals.

Conclusions. Analysis of international practice of forming wine tourism destinations is of reasonable use for the further development of domestic wine tourism.

Introduction

The essence of tourism as a mobile form of consumption and recreation based on overcoming space is related to the nature of the environment, i.e., natural environment, socio-cultural environment and economic system. Unlike other industries where products are transported to the consumer, tourism leads to people migration to the concentration of tourist and recreational resources and tourism facilities. Consumption of tourist product takes place mainly in some tourist spot with certain territorial features. This place is usually interpreted as a tourist centre and a tourist destination.

Materials and methods

Scientific research of features of the formation and management of tourist destinations was made by foreign scientists N.Shmoll, V.Matiyenson, J.Suorbrok, O.Yorhensen, K.Kuper, D.Fletcher, I.Zorinyi, V.Kvartalnov, M.Kabushkin, K.Makarycheva, S.Nikolaev, T.Rumiantseva, Y.Alexandrova, V.Bogolyubov, V.Orlovska, V.Novikov and others. In Ukraine various aspects of the tourist centres were learned by O.Lyubitseva. T.Tkachenko, S.Melnychenko, H.Myhailichenko, M.Boyko and others. Traditional analysis of international practice of formation of wine tourism destinations was used for further development of domestic wine tourism market.

Results and discussion

The World Tourism Organization (UNWTO) believes that tourist destination is the key element of the tourism system and considers it as a leading factor in the system of development and delivery of tourism product [1].

The term "destination" comes from English. The concept of "tourist destination" was introduced in 1979 by N. Leyper, Prof. of Meissen University (Auckland, New Zealand) in the context of a comprehensive model of tourism industry. It includes three main geospatial elements: tourists, the place of origin of tourism product and region that generates tourist flows. He defined destination as a set of tourism products, concentrated in time in a particular area; a product that has use value [2].

The Russian scientific school (I.V. Zorin, V.I. Kvartalnov) treated destination as the facility of regional design of territorial recreation systems on such levels: country - region - landscape - centre - business - rout. Destinations differ in size and can be of: the territory of the country, city, town or village, a particular reservation or museum. According to I.V. Zorin any object which takes place in a positive image of the landscape, place or a country is a potential tourist destination and can become the base of the tourist route and enter the directory of tour operators [3]. These authors also differentiate the idea of a tourist centre, a centre of tourism and a tourist destination, which is not appropriate to our opinion.

According T.Tkachenko, destination is an object (city, region, area, locality, place, establishment) which has tourist and recreational resources (unique or specific) that are attractive for travellers, accessible due to availability of necessary infrastructure (facilities and services), and brought to the consumer as a ready for sale tourist product by means of marketing communications (with logo, brand, etc.) in the system of levers of integrated management for business entities [4; 30].

Noteworthy is the model of tourist destination by Danish tourism experts O.Yorhensen, K.Kuper, and D.Fletcher. They determine six interrelated elements that can be conditionally named as "6A" (Fig.1):

-Attraction (tourism resources, entertainment facilities);
-Access (transport and information availability);
-Amenities (infrastructure of tourist services);
-Ancillary services (attendant services);
-Activities (organization of tourist activities);
-Available packages (formation of the tourism product) [5].
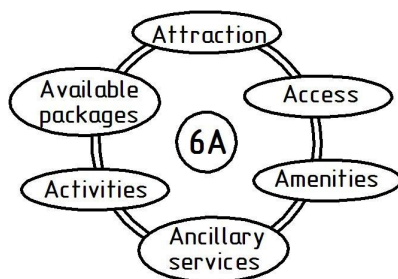
Fig. 1. Structure of tourist destination

Summarizing different points of view, we suggest considering tourist destination as area, where natural and anthropogenic, cultural and historical, recreational and tourist resources are concentrated. This area has required transport infrastructure and an adequate level of tourism industry development to form a complex competitive tourist product.

Frequently tourist centres appear in different areas spontaneously without special effort from tourism specialists and local authorities. Usually these are picturesque areas like mountain landscapes, plains, woodlands, river shores and seas coasts, regions which are rich in mineral and thermal springs or therapeutic mud that become spa resorts. Destinations are developed if unique natural features are available: waterfalls, caves, flora and fauna objects, favourable conditions for different types of recreational activities.

Traditional tourist destinations are the places which are highly valued for a long time due to their unique artistic or spiritual heritage and were visiting centres even before the modern phenomenon of tourism. Sometimes small and not popular towns and villages become tourist centres due to relation with some religious or political events that quickly attract public attention.

Under current conditions industrial facilities often become tourist centres. They usually demonstrate human achievement in science and technology (high-tech enterprises in machine building, nuclear and alternative energy, metallurgy, aircraft and space industries), specialities of technology of manufacturing food or products of mass demand (confectioneries, bakeries, wineries, breweries and soft drink companies), handcraft businesses (pottery, weaving, glass blowing, etc.). Sometimes places of technological disaster (e.g., NPP Chernobyl) become objects of tourist interest.

International practice shows a lot of examples of successful use of industrial facilities for tourism purposes. Experts of UNWTO state that industrial heritage with its various industrial and technological monuments of different sectors of the economy is an excellent resource for tourism development aiming to diversification and stability. Visitors together with local residents can participate in cultural events organized under the influence of industrial heritage. It encourages social integration, enhances the sense of belonging to the community and facilitates intercultural dialogue and understanding [5]. For example, the city of Rovaniemi in the northern Finland was a town of Finnish lumberjacks and gold

diggers in the past; nowadays it is a tourist centre of Lapland. Egyptian resort Hurghada appeared on the place of village of British gas prospectors. Industrial projects often turn into museums and are demonstrated to tourists. There is an ethnographic museum (a reservation) of coal mining industry in Zabrze near Katowice (Poland). In the old mine "Queen Louise" you can learn about coal mining in the areas of Sudet and Silesia. In the town of Wieliczka near Krakow (Poland) a salt mine of XIII century was made a museum and listed on the UNESCO World Heritage List. In the former salt chambers a great exposure of the history of salt production was made. There you can see sculptures made of salt, unique bas-reliefs, and a huge hall of salt with the altar carved inside.

Therefore the tourism industry nowadays can be as effective and profitable for development of particular area as other traditional industries. In many cases tourism can be a "substitute branch", which leads to changes in the economic specialization of the territory, diversification of the local economy, creation of new niches for small and medium businesses.

Wineries which offer visiting vineyards, tasting local grape varieties, exploring manufacturing technologies for various types of alcoholic beverages, introducing the history of local winemaking, visiting specialized museums, exhibitions, enoteks are traditionally attractive tourist places. They also offer tasting in special tasting rooms and cellars. In other words wineries create necessary conditions for the formation of wine tourism destinations. Wine tourism destination is an area or locality that offers tourists a range of services related to the introduction to the history, technology and culture of alcohol beverages in a particular region and further tasting of alcoholic beverages directly from the manufacturer. The best and most recognized worldwide destinations of wine tourism are the regions of Tuscany (Italy), Bordeaux (France), Jerez de la Frontera (Spain), Napa Valley (California, USA). Promising wine tourism centres are Eger and Tokaj (Hungary), the Rhine Valley (Germany), Cape wine region (South Africa), Kakheti (Georgia), Cricovo (Moldova), Mendoza (Argentina) and others with a well-developed network of wine industry, wine routes, museums, enoteks, tasting cellars and specialized hotels etc.

In Ukraine wine tourism destinations of different levels are formed actively in the traditional areas of viticulture and winemaking. Taking into account the macro-and micro-regions of winemaking and viticulture complex, and geospatial organization of tourism resources, the main areas of wine tourism in Ukraine can be clearly outlined (Fig.2):
- Crimean (Southern Coast of Crimea, South-western Crimea);
- Transcarpathian (districts of Berehovo, Vynogradiv, Irshava, Mukachevo, Uzhgorod in Transcarpathian region);
- Odessa and the Black Sea coasts;
- Area of the Azov Sea and steppes.

Some of the best tourist destination in the south of Ukraine are "Shabo Wine Cultural Centre" (Shabo Belgorod of Dniester district in Odessa region), tasting room "The house of vintage cognacs "Tavria" (Nova Kahovka in Kherson region) and village of Kobleve (Mykolaiv region).

"Shabo Wine Cultural Centre" is the first exclusive cultural centre in Ukraine and still the only one. It is located on the territory of the industrial complex of "Shabo" company in one of the oldest wine regions of Europe with traditions from ancient times. The centre combines operating advanced enterprise, ancient wine cellars, degustation room, expositions of modern sculptures and architecture, and unique Wine and Winemaking Museum. Tourists can find there all necessary information materials, professional guides (sommelier), degustation of sparkling and still wines, also cognac and vermouth of local production, a company store, organized marketing communications and transport routes.

"Shabo Wine Cultural Centre" is included to the tourist map of European wine routes by the Commission of the Council of Europe [6].
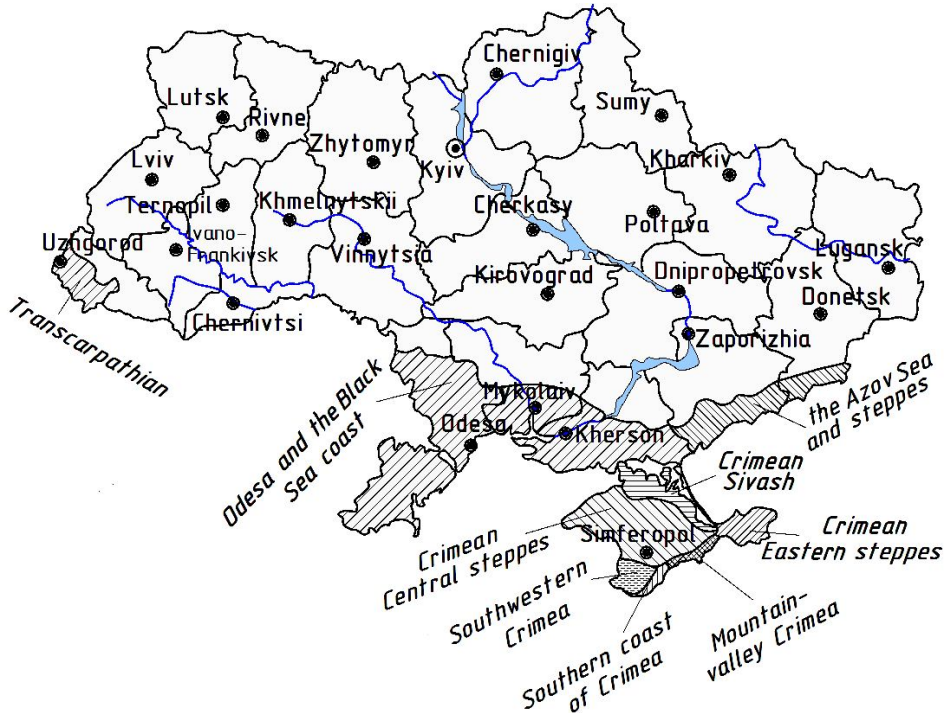
Fig. 2. The map of the main areas of wine tourism in Ukraine

The house of vintage cognacs "Tavria" is a leading manufacturer of authentic vintage cognacs in Ukraine. These cognacs are made of grapes grown in the Ukraine on the enterprises of complete cycle of cognac production. This cycle begins in their vineyards and finishes in oak barrels that are kept for at least six years. The line of cognacs MQM "Tavria" includes ordinary, vintage and collection cognac brands "Tavria", "Georgiivskyi", "Jatone" and "AleXX" which are known not only in Ukraine, but also abroad. From 1970 till 2013 the production of company got 138 gold, 106 silver and 44 bronze medals, 36 special awards and 11 awards of the Grand Prix at the international tasting competitions and exhibitions. Visitors are offered tours to the company and Museum of MQM "Tavria" where they can learn the history of the company since 1889. DMK "Tavria" organized three types of degustation: "Classics of cognac barrels", "Harmony of elements" and "The Renaissance of taste" to try bouquet and flavour of taurine wines and cognacs [7].

The resort is located in Kobleve of Berezan district in Mykolayivska region. Kobleve is situated in a picturesque corner between the Black Sea and Tylihulsky estuary, which is known for its therapeutic mud. Climate is unique there due to to the combination of sea breeze and phytoncides of pine forest. The village is surrounded by vineyards; most of them belong to one big winery - CJSC "Koblevo".

Wine connoisseurs are offered a degustation tour which includes an excursion round the factory with exploring all stages of modern manufacturing, tasting the best wines

followed by explanation of the basics of enohastronomy, visiting a unique art gallery with opportunity of purchasing wine and accessories in the company store [8].

An example of the formation of innovative destinations in wine tourism is a winery "Colonist". It's a small family winery which was founded in 2005 by Ivan Plachkov in his native village Krynychne in the south of Odessa. The company produces about 140 000 bottles of premium dry wine a year. It allows to focus more on the quality of wine and to implement new technologies and innovations. Company of TM "Colonist" together with their partner travel agency offer various wine tours. For example, in addition to tours in the vineyards, exploring production capacities, wine tasting in the tasting hall with fireplace, company organizes seasonal events. In spring TM "Colonist" holds an auction of their best vintage wine and makes a theatrical show of a Bulgarian national holiday with traditional dinner of national cuisine. If you visit this winery in August or September, you can take part in the grape-harvest and press grapes barefoot, and also try fresh grape juice. All this activities are accompanied by passionate music of foreign artists. To complete this experience, tourists try wine of TM "Colonist" in the vineyards and have dinner of Prydounayska Bessarabia cuisine [9].

Traditional wine region of Transcarpathia (Zakarpatska region) offers a unique tourist product: wine routs of Transcarpathia. The program offers a tour in the "microregions" that are related to the culture of growing grapes and producing wine. It includes sightseeing historical places of winemaking and viticulture with its numerous legends and artefacts, staying in the country estate, participation in the picturesque and colourful celebration of grape-harvest, tasting in tasting rooms of about 50 family wineries and further buying wine.

Tours to the biggest wineries of the region are of great demand: "Leanka", "Chizay", Uzhgorod cognac company with wine degustation of their wine branded products: "Traminer", "Troyanda Zakarpatia", "Rhine riesling", "Italian riesling", "Leanka", "Muller Thurgau" and also cognacs "Uzhgorod" and "Tysa".

In recent years numerous wine festivals began and are still held in Transcarpathian region: "Chervone vyno" (Mukachevo, January), "Bile vyno" (Berehove, April), "Sonyachnyi napiy" (Berehove, May), the festival of vin de primeur "Transcarpathian Beaujolais" (Uzhgorod, October) and the festival "Uhochaska loza" (Vynogradiv, June).

Conclusions

Based on the analysis we can identify key conditions of formation of wine tourism destinations:

1. Presence of objects which are of great interest for tourists, wine lovers and connoisseurs: vineyards, wineries, tasting rooms, wine cellars, wine shops, specialized exhibitions, wine fairs and auctions etc. Moreover destination becomes more attractive and complete, if there are natural and recreational, cultural and social tourism resources: mountains, forest landscapes, ponds, natural, cultural, historical, and architectural monuments and so on. Wine tourism facilities is the highlight for attracting tourists to the territory of destination and the factor for supporting tourist interest that makes them stay longer.

2. Presence of developed tourist infrastructure: accommodation, catering, entertainment, and also retail trade and services. Other important indicator of tourist destination development is a variety of high quality services of different categories. It is essential that infrastructure should include specialized facilities: wine hotels and resorts with wine SPA, and restaurants with premium wine cards.

3. Accessibility of destinations for different kinds of tourists, i.e., presence of developed transportation system. Distance from tourist market to destination makes it vulnerable, as it creates difficulties in travel. Therefore development and support of convenient transport links with tourist markets is an essential requirement for the tourist centre to succeed. Not only external transport links are important for tourists, but also developed internal transport links and services, car rentals, local transportation for sightseeing tours and transfers to accommodation and places of wine presentation.

4. The development of information and communication systems that provide informing the tourist market about the destination and become an important tool for forming tourist demand. In particular, the use of global information systems for tourists ("Amadeus", "Galileo", and "Worldspan") provides distribution of information about tourism infrastructure facilities all over the world. It is important to publish information on specialized wine portals, such as wineverity, vinotag etc. Support of information and communication systems is necessary to create an attractive tourist destination brand.

5. Management of wine tourism destination requires a concerted effort from government, business and local communities to support winemaking and viticulture industries as a budget refund industry. Formation of wine tourist facilities, specialized attractions and events will attract the attention of domestic and international tourists, as well as private and public partnership in promoting local tourism product and activation of marketing communications system.

6. Sustainable development of wine tourism has specific benefits for locals and residents of tourism destinations. These are support of local producers of grapes and wine, market expansion and brands promotion. Due to multiplier effect of tourism, other sectors of the local economy are stimulated (production of food, souvenirs, restaurant and hotel industry, transport). Social benefits include the development of transport and IT infrastructure, support for culture, education, science establishments, organizing celebrations and festivals etc.

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Анотації

Харчові технології

Застосування малоцінної сировини з птиці

Тетяна Змієвська, Ніна Усатенко, Сергій Вербицький

Інститут продовольчих ресурсів Національної академії аграрних наук України

Вступ. Враховуючи значний вихід шкіри курчат-бройлерів, значний вміст у ній білка, в якому до 3 % колагену, актуально встановити доцільність її використання у складі м'ясопродуктів.

Методи досліджень. Досліджувались шкіра курчат-бройлерів і реструктуровані формовані продукти з її використанням. Активну кислотність, вологозв'язуючу, вологоутримуючу, жироутримуючу здатність, вміст жирних кислот та структурно-механічні показники м'ясопродуктів визначали за відомими методиками.

Результати і обговорення. Визначено хімічний склад м'яса та шкіри курчат-бройлерів, а також органолептичні, фізико-хімічні й структурно-механічні показники реструктурованих формованих продуктів із м'яса курчат-бройлерів з різним вмістом шкіри. Зі збільшенням вмісту шкіри (від 6% до 15 %) покращується структура продуктів за рахунок зменшення міцності на 38 % і жувальної твердості на 37 %, а також підвищується вміст ненасичених жирних кислот, що, у свою чергу, підвищує біологічну цінність готового продукту.

Кращі результати за органолептичними та структурно-механічними показниками були отримані відповідно до рецептури, яка передбачала внесення 12 % шкіри до маси м'ясної сировини, що відповідає анатомічному приросту тушки курчати-бройлера. Застосування шкіри покращує функціональні показники (значення вологоутримуючої здатності збільшується на 5,6 %, жироутримуючої здатності – на 3%) та підвищує біологічну цінність продукту (вміст мононенасичених і поліненасичених жирних кислот збільшується, відповідно, на 2,4 % та 5,8 %) порівняно з контрольним зразком.

Висновки. При виготовленні реструктурованих формованих продуктів із м'яса курчат-бройлерів у рецептуру доцільно вносити 12 % шкіри.

Ключові слова: курчата бройлерів, шкіра, м'ясо, АТП.

Ферментативні антиоксиданти томатів і перцю залежно від абіотичних факторів

Олеся Прісс, Валентина Калитка

Таврійський державний агротехнологічний університет, м. Мелітополь, Україна

Вступ. Для підтримання нормального метаболізму в плодах, відділених від материнської рослини, захисту рослинних тканин від окисного пошкодження. Особливо важливим є комплекс високомолекулярних антиоксидантів.

Матеріали і методи. Досліджували плоди томатів і перцю, вирощені протягом 2005-2012 рр. в умовах відкритого ґрунту. Активність пероксидази та каталази визначали титруванням нерозкладеного залишку пероксиду водню. Активність супероксиддисмутази визначали за її здатністю інгібувати реакцію автоокислення

адреналіну з модифікацією при підготовці сировини. Вміст малонового діальдегіду визначали тіобарбітуровим методом.

Результати і обговорення. Активність супероксиддисмутази та каталази в обох пасльонових овочах обернено залежить від температур періоду формування і дозрівання плодів. Опади індукують активність ферментів у плодах перцю, але не мають впливу на ці ензими у томатів. Активність пероксидази обернено корелює з сумою температур періоду формування і дозрівання плодів для обох культур (r = -0,63…-0,69). Для томатів, із усіх розглянутих антиоксидантних ферментів, пероксидаза найбільш пов'язана з погодними факторами. Активність пероксидази безпосередньо залежить від кількості опадів у період формування і дозрівання плодів для обох культур. У перцю активність пероксидази також залежить від кількості опадів у період вегетації.

Висновки. Визначальний вплив на активність антиоксидантних ферментів томатів і перцю має сума температур періоду формування й дозрівання плодів.

Ключові слова: томати, перець, супероксиддисмутаза, каталаза, пероксидаза.

Застосування ефірних олій у молочних продуктах. 1. Кріп (*Anethum graveolens*)

Іліана Костова[1], Дімітар Дімітров[1], Міхаела Іванова[2], Радка Власева[2], Станка Дамянова[1], Настя Іванова[1], Албена Стоянова[2], Олексій Губеня[3]

1 - Русенський університет «Ангел Кънчев», філія в м. Разгад, Болгарія
2 - Університет харчових технологій, Пловдив, Болгарія
3 - Національний університет харчових технологій, Київ, Україна

Вступ. Доведена доцільність використання ефірної олії кропу (*Anethum graveolens L.*) в молочних продуктах. Досліджено склад, антимікробні властивості та вплив ефірної олії кропу (*Anethum graveolens L.*) на мікроорганізми в заквасках молочних продуктів.

Матеріали і методи. Хімічний склад ефірної олії визначено хромотографічним методом. Антимікробна дія на ефірну олію кропу визначена для грам-позитивних, грам-негативних бактерій, дріжджів, пліснєвих грибів і двох заквасок для білого розсільного сиру методом дифузії в агарі.

Результати і обговорення. Аналіз хімічного складу ефірної олії кропу показує, що в ньому переважають монотерпенові вуглеводні (47,97 %), монотерпенові кисневмісні вуглеводні складають 37,52 %, сесквітерпенові та аліфатичні вуглеводні: близько 0,9 %, ароматичні - 0.33 %, інші – 6,22 %. Дослідження антимікробної активності ефірних олій з кропу показують, що існує слабо виражена антибактеріальна та висока антигрибкова активність.

Антимікробна дія олії безпосередньо на молочнокислі бактерії, що входять до складу закваски, виражена слабко. Мінімальна інгібіторна концентрація складає 0,05 %, а мінімальна бактерицидна концентрація – 0,5 %. Такі концентрації вищі від тих, що можуть додаватись у харчові продукти.

Висновки. Ефірна олія з кропу проявляє антимікробну активність, та не пригнічує розвиток молочнокислих бактерій у молочних заквасках. Її доцільно використовувати як натуральну добавку в молочних продуктах.

Ключові слова: кріп, ефірна олія, молоко, мікрооганізм.

───── *Abstracts* ─────

Вплив добавки білково-мінеральної на споживчі характеристики м'ясних емульсійних виробів

Інна Шурдук, Максим Серік, Світлана Антоненко, Наталя Федак
Харківський державний університет харчування та торгівлі, Харків
є Україна

Вступ. Актуальним завданням сьогодення є пошук поліфункціональних метаболічно активних добавок, здатних покращувати хімічний склад та інші споживні характеристики м'ясних емульсійних виробів.

Матеріали і методи. Експериментальні дослідження виконані з використанням напівавтоматичного пенетрометра «Labor» для вимірювання граничного напруження зсуву ковбас, ротаційного віскозиметра «Реотест-2» для вимірювання в'язкості паштетів. Оптичний мікроструктурний аналіз, дослідження вологозв'язуючої здатності, визначення хімічного складу та перетравлюваності білків проводили за традиційними методиками.

Результати. Визначено вплив добавки білково-мінеральної на вологозв'язуючі, структурно-механічні, мікроструктурні та споживні властивості ковбасних виробів і паштетної продукції. Використання добавки в кількості 7,5% дає змогу підвищити вологозв'язуючу здатність ковбасної продукції та паштетів на 4…9%, знизити граничне напруження зсуву ковбасних виробів на 2,5…6%, в'язкість паштетів – на 300…350 Па×с та покращити мікроструктурні характеристики продукції без погіршення органолептичних властивостей. Використання добавки забезпечує більш рівномірний розподіл компонентів у структурі ковбас і паштетів, що зумовлює однорідність структури та запобігає виникненню дефектів у готовій продукції.

Використання добавки дозволяє збільшити вміст вологи на 0,7…1,1%, білка – на 0,3…0,8%, засвоюваних сполук кальцію в готовому продукті – до рівня 550…700 мг/на 100 г. Дослідження перетравлюваності білків продукції протеолітичними ферментами шлунково-кишкового тракту виявили вищій ступінь гідролізу білків дослідної продукції на 11,5…13% порівняно з контрольними виробами. Використання добавки в складі ковбасної продукції й паштетів за рахунок удосконалення їх хімічного складу й підвищення перетравлюваності білків забезпечує більшу біологічну цінність розробленої продукції. Результати апробовано у виробничих умовах.

Висновки. Добавка білково-мінеральна позитивно впливає на вологозв'язуючі, структурно-механічні, органолептичні характеристики та біологічну цінність м'ясних емульсійних виробів порівняно з існуючими на ринку аналогами.

Ключові слова: ковбаса, паштет, м'ясо, кальцій, якість.

Гістологічні особливості печінки щурів при затравці тварин розчином етанолу з добавками

Микола Головко[1], Галина Губіна-Вакулік[2], Наталія Пенкіна[1], Вікторія Колесник[1]
[1]Харківський державний університет харчування та торгівлі, Харків, Україна
[2]Харківський національний медичний університет, Харків, Україна

Вступ. Актуальним є питання розробки нових видів алкогольної продукції зі зниженим токсичним ефектом. Метою дослідження полягала у визначенні

гістологічних особливостей будови печінки при введенні щурам лінії Вістар різних видів спиртових настоянок зі зниженим токсичним ефектом.

Матеріали і методи. В експерименті використано чотири групи тварин, які вживали різні види розроблених настоянок. Мікроскопіювання здійснено на мікроскопі Axiostar-plus (Zeiss, ФРГ), фотографування – з використанням фотокамери Progress C10. Картометрію проведено на комп'ютерному зображенні мікропрепаратів («ВідеоТест»).

Результати. Визначено ступінь ураження печінки щурів різних груп під час вживання експериментальних настоянок. Визначено, що площа ядер гепетоцитів інтактної групи в середньому становить $32{,}70{\pm}0{,}78$ мкм^2. В інтактних тварин трабекули рівні, просвіт синусоїд відсутній, цитоплазма компактна (трохи просвітлена) та містить незначну кількість глікогену. У тварин першої основної групи (тривале вживання 40% водно-спиртової суміші) виявлено гістологічні ознаки алкогольного ураження печінки з формуванням хронічного гепатиту різного ступеня активності. Гепатоцити мають крупне ядро, площа якого складає $43{,}25{\pm}1{,}1$мкм^2. У другій основній групі (тривале вживання 40% водно-спиртової суміші з додаванням рослинної сировини) структура печінки збережена, чітко виражені трабекули, просвіти синусоїд проглядаються. Ядра гепатоцитів мають дещо меншу площу порівняно з першою основною групою ($38{,}8{\pm}1{,}05$ мкм^2). У третьої основної групи (тривале споживання 40% спиртової суміші з додаванням рослинної і тваринної сировини) гістоструктура печінки збережена, трабекули рівні, наявність вогнищ цитолізу гепатоцитів не відзначено. Ядра гепатоцитів мають мінімальну площу ($33{,}57{\pm}0{,}91$ мкм^2), порівняно з іншими основними групами значення цього показника несуттєво відрізняється від групи інтактних тварин. Експериментально доведено, що добавка суміші з рослинної і тваринної сировини поліпшила морфофункціональний стан печінки на тлі відсутності вогнищ цитолізу гепатоцитів та нормалізації величини ядер.

Висновки. Розроблені спиртові настянки знижують токсичну дію алкоголю на печінку.

Ключові слова: щур, етанол, печінка, гепатоцит, цитоплазма.

Використання багатокомпонентних розсолів у виробництві шинок з яловичини

Ірина Кишенько[1], Юлія Крижова[2], Максим Гонтовий[1]
1 - Національний університет харчових технологій, Київ, Україна
2 - Національний університет біоресурсів і природокористування України, Київ, Україна

Вступ. Доцільною є розробка науково обгрунтованих промислових технологій виробництва цільном'язових виробів, які були б альтернативою традиційним і забезпечували стабільність якісних показників з сировини з різними біохімічними властивостями.

Матеріали і методи. Величину pH фільтрату із посоленої яловичини визначали на потенціометрі-340 (pH-метрі), масову частку вмісту вологи - висушуванням наважки у сушильній шафі за температури 103 – 105 °C до досягнення постійної маси зразків. Вміст нітрозопігментів визначали на спектрофотометрі при довжині хвилі 540 нм відносно 80-відсоткового водного розчину ацетону, залишкову кількість

нітриту – отриманням забарвленого розчину в результаті утворення ізофарби, питоме зусилля різання – на лабораторній установці ПМ-3, значення вологоутримуючої здатності (ВУЗ) - за допомогою молочного жироміра.

Результати. Використання багатофункціональних розсільних колоїдних систем (БФРКС) здійснює суттєвий вплив на покращення основних функціонально-технологічних властивостей сировини і якісних показників готових виробів.

Обгрунтовано розроблення технології виробництва цільном'язових виробів з яловичини з використанням багатофункціональних розсільних колоїдних систем (БФРКС) з проведенням точного розрахунку необхідної кількості розсолу, встановлено способи та режими соління різних видів сировини. Масажування в масажері при 8 обертах за хвилину (15 хвилин робота, 15 хвилин пауза). Тривалість оброблення тазостегнової, лопаткової частини яловичих напівтуш – 16 год для яловичини NOR та 18 год – для яловичини DFD з подальшою витримкою в умовах дозрівання за температури +4 ℃ протягом 8 год; шийно-підлопаткової частини, покромки – 14 год для яловичини NOR та 16 год для яловичини DFD з подальшою витримкою в умовах дозрівання за температури +4 ℃ протягом 10 год; спинних і поперекових м'язів – 9 год для яловичини NOR та 10…11 год для яловичини DFD з подальшою витримкою в умовах дозрівання за температури +4 ℃ протягом 12 год. Ефективність використання БФРКС для ін'єктування в кількості 20%, 40%, 60%, 80% дає вихід для яловичини DFD 104,8%; 123,9%; 143,7%; 162,5%, для яловичини NOR – 102,6%; 123,5%; 142,9%; 161,7%. Використання нітритної солі в складі розсолів знижує допустимий вміст залишкового нітриту, який становить, мг/100г: для яловичини DFD – 2,34 – 2,91, для яловичини NOR – 2,24 – 2,78.

Висновки. Результати є основою технології нових видів цільном'язових копчено-варених виробів з яловичини.

Ключові слова: розсіл, яловичина, структуроутворення, ін'єктування, масажування.

Характеристика технології термостійкої молоковмісної начинки замороженої

Федір Перцевой[1], Маргарита Обозна[2], Галина Любенко[1]

1 – Харківський державний університет харчування і торгівлі, Харків, Україна
2 – Сумський національний аграрний університет, Суми, Україна

Вступ. Розроблено та досліджено термостійку начинку з метою поліпшення та надання нових властивостей кондитерським кулінарним виробам.

Матеріали і методи. Сумісний вплив і зміну рецептурних компонентів термостійкої молоковмісної начинки встановлено на основі аналізу наукових джерел. Поєднання компонентів та утворення структури начинки досліджено методом хімічної взаємодії між речовинами. Терміни зберігання – методом зміни мікробіологічних і фізико-хімічних властивостей.

Результати і обговорення. Технологія виробництва начинки передбачає чотири підсистеми, які взаємопов'язані між собою спільною метою операцій, а саме: підсистема D – підготовка рецептурних компонентів, підсистема C – змішування й теплової обробки; підсистема B – розлив і структуроутворення; підсистема A – отримання термостійкої молоковмісної начинки. Наведена інноваційна стратегія отримання термостійкої молоковмісної начинки показує вплив, зміну та взаємодію рецептурних компонентів у процесі виробництва. На першому етапі (підсистема D) відбувається поєднання молока сухого знежиреного, крохмалю кукурудзяного

модифікованого і олії рослинної. Під час відновлення сухого знежиреного молока лактоза, білок та інші складові частинки переходять у розчині, і після теплової обробки з'єднується з крохмалем. Наявність жиру у сухих молочних продуктах ускладнює процес розчинення й відновлення та зменшує терміни зберігання через його гідрофобні властивості й здатність взаємодіяти з киснем, що призводить до окислення і зниження якості продукту. Зважаючи на це, рослинну олію додають після процесу набрякання, при якому утворюються жирно-білкові комплекси. Тобто навколо жирової молекули завдяки гідрофобним зв'язкам розподіляється білкова оболонка, яка з'єднується гідрофільними зв'язками з крохмалем і водним середовищем, внаслідок орієнтації гідрофобних і гідрофільних ділянок білка проявляється їхня здатність адсорбуватися на поверхні розподілу фаз з утворенням спорідненого середовища. З метою фіксації, надання структури і термостійких властивостей крохмаль переплітається з пектиновими молекулами, які з'єднуються й утворюють сітку завдяки Ca^{2+}, що знаходиться в молочній сировині та цитраті кальцію. Отримана тримірна спільна сітка пектину і крохмалю утримує всі рецептурні компоненти разом під дією високої температури.

Висновок. Застосування результатів під час виробництва кондитерських і кулінарних виробів надає можливість спростити технологічний процес, забезпечити високі органолептичні властивості, біологічну і харчову цінність, низьку собівартість, конкурентоспроможність та подовжений термін зберігання.

Ключові слова: начинка, молоко, гідроколоїд, термостійкість, клейстеризація.

Удосконалення технології сорбційного очищення води для виробництва алкогольних напоїв

Світлана Олійник, Віталій Прибильський, Наталія Чупріна, Ірина Довгун

Національний університет харчових технологій, Київ, Україна

Вступ. Показано актуальність удосконалення технології кондиціювання води шляхом сорбційного очищення води для виробництва алкогольної продукції.

Матеріали і методи. Порівнювалось активне вугілля марки Silcarbon K835spezial з Фільтрасорб F300. У дослідженнях використовували органолептичні, капілярнофоретичні і титрометричні методи аналізу, теоретичне узагальнення і порівняння, системний підхід.

Результати. Проведена порівняльна оцінка фізико-хімічних і сорбційних характеристик активного вугілля марок Silcarbon K835spezial та Фільтрасорб F300. Вивчена ефективність застосування активного вугілля марки Silcarbon K835spezial під час кондиціювання води для алкогольних напоїв. Досліджуване активне вугілля порівняно з активним вугіллям Фільтрасорб F300 має більший загальний сумарний об'єм пор за водою – на 30 %, адсорбційну активність за йодом - на 38 %, та лужність водного настою більш ніж 2 рази, що підтверджується більшою (на 35 %) кількістю основних оксидів.

Під час кондиціювання води активним вугіллям Silcarbon K835spezial масова концентрація заліза, амонію, нітритів зменшувалась майже у 1,5 - 2 рази, при цьому перманганатна окислюваність покращувалась на 40…50 % порівняно з контрольним зразком Фільтрасорб F300. Покращені фізико-хімічні та сорбційні характеристики активного вугілля Silcarbon K835spezial дають змогу збільшити питомий об'єм підготовленої води на 38 %.

Висновок. Активне вугілля Silcarbon K835spezial є перспективним для підвищення якості підготовленої води й алкогольної продукції з її використанням.

Ключові слова: *вода, алкоголь, вугілля, очищення, кондиціювання.*

Технологічні важелі керування властивостями двошарового середовища формування термостабільних капсул із жировим умістом

Євгенія Коротаєва, Ольга Неклеса, Павло Пивоваров, Тетяна Трощий

Харківський державний університет харчування та торгівлі, Харків, Україна

Вступ. Для забезпечення промислового виробництва олій рослинних капсульованих необхідним є наукове обгрунтування параметрів технологічного процесу та складу технологічної системи.

Матеріали і методи. Досліджувалось капсулоутворення модельної системи «олія рафінована дезодорована - водний розчин альгінату натрію» в двошаровому прийомному середовищі «олія - вода», яке містить вільні іони Ca^{2+}. Густина прийомного середовища корегувалася додаванням етилового спирту. Поверхневий натяг технологічних систем визначали методом відриву краплі від капіляра на каліброваній сталогмометричній установці.

Результати і обговорення. Представлені експериментальні дані впливу хлориду кальцію, етанолу, поверхнево-активних речовин на значення міжфазного натягу двошарового прийомного середовища формування термостабільних капсул з жировим умістом залежно від температури. Обгрунтовано склад системи та робочі концентрації складових технологічного процесу, які забезпечують стабільний процес капсулоутворення. Отримані закономірності дозволили здійснити індустріальне виробництво інноваційного продукту. Визначено вплив температури компонентного складу на капсулювання технологічної системи «олія рафінована дезодорована - водний розчин альгінату натрію» через двошарове прийомне середовище шляхом введення поверхнево-активної речовини. Запропоновані робочі концентрації рецептурних компонентів системи «олія - водно-спиртовий (40 об.%) розчин 1,0 % хлориду кальцію» з використанням 0,3…0,5 % E322 (лецитин) або E432 (поліоксиетиленсорбітанмонолаурат) дозволять запровадити виробництво капсульованих рослинних олій.

Висновки. Результати досліджень є науковою платформою для обгрунтування параметрів технологічного процесу виробництва капсульованих рослинних олій.

Ключові слова: капсула, жир, хлорид кальцію, етанол, олія.

Дієтична добавка з адаптогенною активністю на основі біополімерів печериці двоспорової (*Agaricus bisporus*)

Наталія Черно[1], Леонід Шафран[2], Софія Озоліна[1],
Олена Третьякова[2], Олександра Нікітіна[1]

1- Одеська національна академія харчових технологій, Одеса, Україна
2- Державне підприємство "Український науково-дослідний інститут медицини транспорту МОЗ України", Одеса, Україна

Вступ. Для корекції та профілактики станів, спричинених дією стресогенних факторів різної природи на організм людини, необхідно застосовувати препарати з адаптогенною активністю.

Матеріали і методи. Зразки отримували послідовною обробкою печериць (*Agaricus bisporus*) водою, розчинами 3,7 % HCl і натрій гідроксиду, варіюючи концентрацію лужного агента (3,0, 5,0 і 7,0 %) і тривалість його контакту з твердою фазою (60, 120, 180, 240 і 300 хв). Адаптогенну активність прогнозували за сукупністю показників: антиоксидантна активність (АОА), біфідогенний ефект (БГЕ), сорбція холевої кислоти (СХК). Дієтичну добавку вводили в раціон харчування експериментальних тварин у дозі 200 мг/кг. Стресогенним чинником був плюмбум ацетат у дозі 14,1 мг/кг. При цьому контролювали показники морфометрії, поведінкові реакції, вміст загальних ліпідів, холестеролу, тригліцеридів, рівень малонового діальдегіду, активності АЛТ, АСТ, глутатіонпероксидази (ГП), глутатіонредуктази (ГР) і глюкозо-6-фосфатдегідрогенази (Г-6-ФДГ).

Результати. Вивчено вплив режимів отримання зразків біополімерних комплексів грибів (концентрація лужного агента, тривалість обробки) на їх властивості. Показано, що жоден із розглянутих режимів обробки грибної сировини не дозволяє виділити препарат, який виявляв би АОА, БГЕ, СХК на максимально високому рівні. Для дослідження в умовах *in vivo* був обраний зразок – дієтична добавка, АОА якої становила 90,0 %, СХК – 22,4 мг/г добавки, БГЕ відповідав 1,5 10^{12} КУО/см^3. При дії стресогенного фактора прийом дієтичної добавки позитивно впливав на стан лабораторних тварин. Так, поліпшилися показники морфометрії та стабілізувалися поведінкові реакції тварин. Підвищилися активності ГП, ГР, Г-6-ФДГ на 21,7, 26,0, 20,0 % порівняно з групою тварин, що одержувала плюмбум ацетат. Спостерігалося зниження вмісту МДА на 14,8 %, загальних ліпідів – на 14,2 %, тригліцеридів – на 26,6 %, холестеролу – на 18,9 % відповідно. Також стабілізувалися показники активності АЛТ і АСТ. Дані результати підтверджують наявність адаптогенної активності у дієтичній добавці, отриманій з печериці двоспорової (*Agaricus bisporus*).

Висновки. Доцільним є включення даної дієтичної добавки в раціони харчування з метою корекції адаптаційних реакцій організму людини.

Ключові слова: дієта, добавка, адаптоген, гриб, *Agaricus bisporus*.

Біотехнологія, мікробіологія

Термофільне метанове бродіння курячого посліду

Анатолій Салюк, Сергій Жадан, Євген Шаповалов

Національний університет харчових технологій, Київ, Україна

Вступ. Мета дослідження полягала у вивченні метаногенезу курячого посліду в термофільному режимі при низькій вологості субстрату.

Матеріали і методи. У дослідженні проведено періодичне метанове бродіння курячого посліду з вологістю від 82 до 94% за температури 50 °C.

Результати і обговорення. Високий вміст азоту часто викликає проблеми токсичності амонію для анаеробів. При збільшенні температури більша кількість амонійного азоту переходить в аміак, який вважають більш токсичною речовиною, ніж йони амонію. Зменшення вологості субстрату призводило до зниження ефективності процесу. Вихід біогазу варіювався від 121 до 382 мл / г СОР, а частка

метану у виробленому газі – від 39,6% до 57%. Виробництво метану почалося з першого дня проведення експерименту. Збільшення його концентрації в біогазі з початку експерименту відбувалось швидше при вищій вологості субстрату. Концентрація метану в біогазі не була постійною і коливалася в межах від 50% до 80% при всіх значеннях вологості субстрату. Максимальна швидкість метаногенезу зростала при збільшенні вологості субстрату від 2,8 мл / (г СОР · день) до 24,7 мл / (г СОР · день).

Висновок. Виробництво метану з курячого посліду у термофільному режимі є можливим навіть за низької вологості субстрату, незважаючи на високий вміст амонійного азоту й аміаку.

Ключові слова: курячий послід, анаеробне бродіння, біогаз, аміак, інгібування.

Мікробіологічний стан приміщень, обладнання і повітря як важливий чинник виробництва безпечних харчових продуктів

Анджей Барига[1], Боженна Полець[1], Роксоляна Чаповська[2]

1 - Інститут біотехнології сільського господарства і харчової промисловості, Польща
2 - Національний університет «Львівська політехніка», Львів, Україна

Вступ. Для дотримання належного мікробіологічного стану виробничих приміщень і повітря на підприємствах харчової промисловості впроваджують принципи систем якості, які передбачають дотримання жорстких правил ведення технологічного процесу. Увага зосереджується на пошуку ефективних і безпечних хімічних засобів і допоміжних матеріалів для миття та дезінфекції.

Матеріали і методи. Методами мікробіологічного аналізу проведено дослідження бактерицидної дії дезінфекційного засобу польського виробництва "Гігієнізер", активною речовиною якого є перекис водню. Ефективність засобу оцінювали методом відбитків із застосуванням агарових пластинок та аспіраційним методом, що базується на принципі ударної дії струму повітря на агарову пластину.

Результати і обговорення. Впровадження системи НАССР дозволяє виявити ті критичні точки технологічного процесу, в яких систематичний контроль санітарно-гігієнічних норм забезпечить належну якість і безпечність готового продукту. Детальний аналіз технологічної лінії, від моменту надходження сировини на підприємство і аж до етапу упаковки та зберігання готового продукту дають змогу знайти ефективні шляхи усунення мікробіологічного забруднення, а також унеможливить процес вторинного зараження мікроорганізмами. Комплекс усіх цих заходів у поєднанні з використанням екологічних хімічних засобів дозволить виробляти безпечне продовольство. Результати досліджень дезінфекційного засобу «Гігієнізер» показали його ефективність щодо до санітарно-показових грампозитивних і грамнегативних бактерій, в тому числі бактерій групи кишкових паличок, стафілококів, стрептококів, синьогнійної палички, сальмонел, дріжджоподібних та пліснявих грибів тощо. Відсутність запаху та повна біодеградація надає можливість стверджувати, що дезінфікуючі засоби на основі перекису водню є найбільш оптимальними в харчовій промисловості.

Висновки. Систематичне проведення процедур миття та дезінфекції, використання екологічних засобів, дотримання правил особистої гігієни – це заходи, які сприяють тому, що вироблені продукти харчування будуть безпечними і відповідатимуть сучасним вимогам європейських стандартів.

Ключові слова: мікробіологія, зараження, дезінфекція, безпека, продовольство.

Процеси та обладнання харчових виробництв

Теоретичні аспекти орієнтування дрібної штучної продукції при вібропереміщенні

Олександр Гавва, Людмила Кривопляс-Володіна, Генадій Валіулін

Національний університет харчових технологій, Київ, Україна

Вступ. Підвищення технологічної ефективності і продуктивності вібролотка при мінімальних енергетичних витратах можливо забезпечити при встановленому оптимальному куті спрямованості коливань робочого органу вібраційного пристрою, раціональному режимі енергозбереження, введенні генеруючої системи штучного режиму вібропереміщення.

Матеріали і методи. Експериментальні дослідження процесу вібропереміщення проведені на електропневматичній установці, налаштованій на різні умови вібрації програмованим логічним контролером. Режим руху частинок продукту описано методом послідовних наближень. Для здійснення руху дрібно-штучної продукції по вібраційному лотку, за умови гармонійного коливального руху, використовується два методи компонування вібраційного лотка на пружних підвісах для реалізації коливального руху під певним кутом з опорною поверхнею.

Результати і обговорення. З урахуванням гармонічності коливань робочого органа й симетрії в розташуванні напрямних застосована умова симетрії сил опору відносного руху і переносної сили інерції. У першому наближенні враховано гармонічний рух продукту і не враховано зрушення фази стосовно переносних коливань. Припущення: амплітуда коливань в абсолютному русі істотно менша, ніж амплітуда коливань робочого органу. На основі попередньо заданих початкових умов побудовані математичні моделі визначення фазових кутів початку і закінчення руху одиниці продукту в кожному з напрямів. При коливаннях опорної поверхні з прискоренням, достатнім для відносного руху одиниці продукту між пластинами, остання матиме однакові за абсолютною величиною переміщення в додатньому і від'ємному напрямах осі *x,* вібропереміщення одиниці продукту не відбуватиметься. Створена модель експериментальної установки з використанням електропневматичного приводу, яка може використовуватись при невеликих частотних коливаннях робочого лотка від 4-10 Гц, за необхідності транспортування і розділення крихкої дрібно-штучної продукції.

Висновок. Отримані результати цінні для подальшого розвитку теорії вібраційного переміщення крихких дрібноштучних виробів і надають можливість оцінити вплив швидкості й умов силового контакту від напряму коливань опорної поверхні, а також інтенсифікації руху одиниці продукту між напрямними пластинами.

Ключові слова: електропневмопривід, вібрація, транспортування.

Аналіз робочих органів машин для тонкого подрібнення м'ясної сировини

Алєксандр Желудков, Сєргєй Акуленко

Могильовський державний університет продовольства, Республіка Бєларусь

Вступ. Мета досліджень - зниження енергоємності процесу тонкого подрібнення м'ясної сировини шляхом удосконалення конструкції кутерних ножів.

Матеріали і методи. Досліджувалися чотири види ножів, які відрізняються за типом різальної кромки. Чинники, які впливають на процес тонкого подрібнення м'ясної сировини в кутерах, і шляхи удосконалення процесу подрібнення визначені на основі аналізу сучасних наукових статей, передових надрукованих в наукових журналах.

Результати і обговорення. За конструкцією кутерні ножі можна розділити на чотири групи: з прямолінійною різальною кромкою; з різальною кромкою у вигляді безперервної кривої лінії (серповидний); з різальною кромкою у вигляді зубчастої лінії; з різальною кромкою у вигляді ламаної лінії. Різання при кутеруванні має бути ковзальне, а лезо ножа - похиле. Збільшення коефіцієнта ковзання призводить до зростання довжини різальної кромки і бічної поверхні ножа та втрат енергії на тертя, інтенсивно підвищує температуру сировини. При зміні коефіцієнта ковзання ножа K від 1,06 до 1,94 приріст температури зменшується від 5 °З до 4,66 °С. Мінімальний приріст температури - за K=1,94. Питома енергоємність із збільшенням коефіцієнта ковзання від 1,06 до 2,17 зменшується. Мінімум спостерігається за K=2,17, і за подальшого збільшення питома енергоємність підвищується. Поверхня контакту різального органу за K=3,7 більша порівняно з випадком нормального різання у декілька разів. Зусилля притиснення продукту до бічної поверхні й коефіцієнт тертя за заданої швидкості різання є постійними, і основною причиною підвищення питомої енергоємності є збільшення складової питомої витрати енергії на подолання сил тертя поверхні ножа по продукту. Мінімальні приріст температури і питома енергоємність процесу досягаються за використання ножів із різальною кромкою у вигляді ламаної лінії і кутом різання 64°.

Висновок. Запропоновані наукові розробки дозволяють конструювати ножі з оптимальним кутом різання, використання яких забезпечує мінімальні питому енергоємність процесу і приріст температури сировини.

Ключові слова: м'ясо, кутер, різання, ніж.

Економіка і управління

Сутність і роль бренду в концепції ринкового позиціонування товару на споживчому ринку

Сергій Сіробаба, Галина Чередніченко, Ірина Тюха

Національний університет харчових технологій, Київ, Україна

Вступ. Проаналізовано зміст таких термінів, як «позиціонування» товарів на ринку, «бренд» і «торгова марка» в системі споживчої поведінки, та розроблено практичні рекомендації для власників зі створення успішних брендів.

Матеріали і методи. Використовуються методи наукової індукції та дедукції, порівняльний метод і наукової абстракції.

Результати. Проаналізовано різні погляди західних та українських науковців, таких як Ф.Котлер (F. Kotler), Дж.Фрідерік (J. Friedrich), П. Доуль(P. Doyle), М. Яненко, Ф. Панкратов на поняття «позиціонування товарів на ринку», «бренд» і «торгова марка» та запропоновано їхнє власне бачення. Автори вважають, що позиціонування – це набір певних маркетингових дій фірми для того щоб зайняти більш сприятливе конкурентне місце на ринку порівняно з конкурентами. Розкрито

основні відмінності між поняттями «бренд» і «торгова марка». З'ясовано, що торгова марка являє собою певний образ продукту або компанії, яка створюється виробниками, щоб вирізнити свою продукцію на ринку серед аналогічних конкуруючих продуктів. Бренд - широко відома на ринку, розкручена, юридично зареєстрована торгова марка, яка є відображенням позитивного іміджу виробника і включає в себе ряд конкретних емоційних і функціональних характеристик. Історія розвитку бренду в Україні, його еволюція, що викликана змінами на ринку і змінами у смаках і перевагах кінцевих споживачів, показані на практичних прикладах таких брендів, як «Первак», «Пісня» «Гетьман». «Олімп», «Вдала», «Біленька», «СВ», «Medoff», «Мерная» тощо.

Розроблено рекомендації для українських виробників щодо створення бренду, а саме: надавати більшого значення позиціонуванню з поступовим насиченням ринку товарами і послугами; використовувати нові технології для просування брендів на більш конкурентному ринку; відмовитися від використання комплексного підходу (umbrella approach) до створення брендів, тому що його практичне застосування в умовах жорсткої конкурентної боротьби є неефективним.

Висновки. Новизна дослідження полягає в аналізі помилок, яких припускаються українські фірми при просуванні своїх товарів на ринок, а також запропоновано практичні рекомендації щодо їх уникнення.

Ключові слова: позиціонування, концепція, стратегія, бренд, торгова марка.

Вплив конкурентного середовища на розвиток ресурсної бази підприємств молочної промисловості України

Віктор Ємцев

Національний університет харчових технологій, Київ, Україна

Вступ. Галузь молочного скотарства в Україні знаходиться в депресивному стані. Мета досліджень - проаналізувати стан, проблеми функціонування та перспективи розвитку молочного скотарства, дослідити напрями його розвитку.

Матеріали і методи. Використані такі методи: систематичний і комплексний аналіз, економічні, математичні та статистичні, аналітичні і порівняльні методи, експертна та рейтингова оцінка.

Результати і обговорення. Основні проблеми й тенденції розвитку вітчизняних джерел сировини для підприємств молочної промисловості: зниження поголів'я корів, відсутність селективної та генетичної роботи, низький рівень продуктивності великої рогатої худоби, диспаритет цін, необхідність значних інвестицій у розвиток молочного скотарства, недостатність державної підтримки, низька купівельна здатність населення тощо. Для відродження галузі молочного скотарства в Україні пріоритетними напрямами державного регулювання і підтримки є: створення кластерних формувань на ринкових взаємовигідних умовах для забезпечення повного циклу «селекційно-племінна справа - виробництво молока та м'яса - переробка сировини - реалізація готової продукції» та підвищення рівня організації управління ними на основі спеціалізації і кооперації; розвиток селекційно-племінної, генетичної роботи, підвищення ролі племінних заводів, племінних господарств, племінних ферм, краще використовування генофонду племінного тваринництва країни; забезпечення високоякісної кормової бази на основі прогресивних технологій заготівлі і зберігання кормів з пріоритетом вирішення білкової проблеми, розвитку інтенсивних і

ресурсозберігаючих технологій, спрямованих на виробництво якісної і конкуренто-спроможності продукції скотарства.

Висновок. Вказані напрями розвитку молочного скотарства є гарантією стабільного забезпечення молокопереробних підприємств сировиною.

Ключові слова: молоко, скотарство, конкуренція, реструктуризація, кластер.

Харчування і туризм

Особливості формування дестинацій винного туризму

Дарія Басюк, Крістіна Удворгелі
Національний університет харчових технологій, Київ, Україна

Вступ. Проаналізовано структуру дестинацій винного туризму, які виступають стратегічними одиницями туристичного бізнесу і точками кристалізації туристичного попиту.

Матеріали і методи. Аналіз формування винних туристичних дестинацій здійснений на основі праць зарубіжних і вітчизняних вчених та фахівців у сфері туризму.

Результати і обговорення. Суттєві фактори, які впливають на формування винних дестинацій: наявність промислових і культурних об'єктів та атракцій, пов'язаних з вином і виноробством, транспортна та інформаційна доступність, розвиток туристичної інфраструктури, співпраця бізнесу та місцевої громади для сталого розвитку туристичного центру. Окреслено основні райони винного туризму в Україні з урахуванням макро- і мікрорайонування виноградно-виноробного комплексу та геопросторової організації туристичних ресурсів. Описані дестинації винного туризму різного рівня у Кримському, Закарпатському, Одеському причорноморському й приазово-степовому районах. Серед них варто виділити єдиний в Україні «Центр культури вина Шабо» - діюче підприємство з власними винними підвалами, дегустаційними залами, мистецькими експозиціями і музеєм вина та виноробства. Як приклад становлення інноваційної дестинації винного туризму наведено виноробне господарство «Колоніст» - невелику сімейну виноробню в Одеській області, де, крім винних турів, також проводяться аукціони вінтажних вин ТМ «Колоніст», збір винограду, дегустація страв кухні Придунайської Бессарабії. Об'єкти винного туризму виступають фактором підтримки туристичного інтересу до дестинації. Так, винний шлях Закарпаття надає можливість відвідати дегустації у близько 50 дегустаційних залах сімейних виноробних підприємств, екскурсії та фестивалі.

Висновки. Аналіз міжнародної практики формування винних туристичних дестинацій підтвердив доцільність її використання для подальшого розвитку вітчизняного винного туризму.

Ключові слова: вино, туризм, дестинація, виноробство, атракція.

Аннотации

Пищевые технологии

Применение малоценного сырья из птицы

Татьяна Змиевская, Нина Усатенко, Сергей Вербицкий

Институт продовольственных ресурсов Национальной академии аграрных наук Украины

Введение. Учитывая значительный выход кожи цыплят-бройлеров, высокий уровень содержания в ней белка, в котором до 3% коллагена, актуально подтвердить целесообразность ее использования в составе мясопродуктов.

Методы исследований. Исследовались кожа цыплят-бройлеров и реструктурированные формованные продукты с ее применением. Активную кислотность, влагосвязывающую, влагоудерживающую, жироудерживающую способность, содержание жирных кислот и структурно-механические показатели мясопродуктов определяли по общепринятым методикам.

Результаты и обсуждение. Определены химический состав мяса и кожи цыплят-бройлеров, а также органолептические, физико-химические и структурно-механические показатели реструктурированных формованных продуктов из мяса цыплят-бройлеров с разным содержанием кожи. По мере увеличения содержания кожи (от 6% до 15%) улучшается структура продуктов за счет уменьшения прочности на 38% и жевательной твердости на 37%, а также повышается содержание ненасыщенных жирных кислот, которые, в свою очередь, повышают биологическую ценность готового продукта.

Лучшие результаты по органолептическим и структурно-механическим показателям были получены в соответствии с рецептурой, которая предусматривала внесение 12% кожи к массе мясного сырья, что соответствует анатомическому приросту тушки цыпленка-бройлера. Применение кожи улучшает функциональные показатели (значение влагоудерживающей способности увеличивается на 5,6%, жироудерживающей способности – на 3%) и повышает биологическую ценность продукта (содержание мононенасыщенных и полиненасыщенных жирных кислот увеличивается соответственно, на 2,4% и 5,8%) по сравнению с контрольным образцом.

Выводы. При изготовлении реструктурированных формованных продуктов из мяса цыплят-бройлеров в рецептуру целесообразно вносить 12% кожи.

Ключевые слова: цыплёнок бройлеров, кожа, мясо, АТП.

Ферментативные антиоксиданты томатов и перца в зависимости от абиотических факторов

Олеся Присс, Валентина Калитка

Таврический государственный агротехнологический университет, г. Мелитополь, Украина

Введение. Для поддержания нормального метаболизма в плодах, отделенных от материнского растения, защиты растительных тканей от окислительного повреждения, особенно важным является комплекс высокомолекулярных антиоксидантов.

Материалы и методы. Исследовали плоды томатов и перца выращенные в течение 2005—2012 гг. в условиях открытого грунта. Активность пероксидазы и каталазы определяли титрованием неразложеного остатка пероксида водорода. Активность супероксиддисмутазы определяли по ее способности ингибировать реакцию аутоокисления адреналина с модификацией в части подготовки сырья. Содержание малонового диальдегида определяли тиобарбитуровым методом.

Результаты и обсуждение. Активность супероксиддисмутазы и каталазы в обеих пасленовых овощах обратно зависит от температур периода формирования и созревания плодов. Осадки индуцируют активность этих ферментов в плодах перца, но не оказывают влияния на них у томатов. Активность пероксидазы обратно коррелирует с суммой температур периода формирования и созревания плодов для обеих культур (r=-0,63…-0,69). Для томатов, из всех рассмотренных антиоксидантных ферментов, пероксидаза наиболее связана с погодными факторами. Активность пероксидазы прямо зависит от количества осадков в период формирования и созревания плодов для обеих культур. У перца активность пероксидазы также зависит от количества осадков в период вегетации.

Выводы. Определяющее влияние на активность антиоксидантных ферментов томатов и перца имеет сумма температур периода формирования и созревания плодов (r=-0,58…-0,76).

Ключевые слова: томаты, перец, супероксиддисмутаза, каталаза, пероксидаза.

Применение эфирных масел в молочных продуктах.
1. Укроп *(Anethum graveolens)*

Илиана Костова[1], Димитър Димитров[1], Михаела Иванова[2], Радка Власева[2], Станка Дамянова[1], Настя Иванова[1], Албена Стоянова[2], Алексей Губеня[3]

1 - Русенский университет «Ангел Кънчев», филиал в г. Разград, Болгария
2 - Университет пищевых технологий, Пловдив, Болгария
3 - Национальный университет пищевых технологий, Киев, Украина

Введение. Доказана целесообразность использования эфирного масла укропа (Anethum graveolens L.) в молочных продуктах. Исследован состав, антимикробные свойства и влияние эфирного масла укропа (Anethum graveolens L.) на микроорганизмы в заквасках молочных продуктов.

Материалы и методы. Химический состав єфирного масла определён хромотографическим методом. Антимикробное действие на эфирное масло укропа определено для грамм-положительных, грамм-отрицательных бактерий, дрожжей, плесневых грибов и двух заквасок для белого рассольного сыра методом диффузии в агаре.

Результаты и обсуждение. Анализ химического состава эфирного масла укропа показывает, что в нем преобладают монотерпеновые углеводороды (47,97%), монотерпеновые кислородосодержащие углеводороды составляют 37,52%,

сесквитерпеновые и алифатические углеводороды - около 0,9%, ароматические - 0,33%, другие – 6.22 %.

Исследования антимикробной активности эфирных масел укропа показывают, что существует слабо выраженная антибактериальная и высокая антигрибковая активность. Антимикробное действие масла непосредственно на молочнокислые бактерии, входящие в состав закваски, является слабо выраженным. Минимальная ингибиторная концентрация составляет 0,05%, а минимальная бактерицидная концентрация составляет 0,5%. Такие концентрации является выше тех, которые могут добавляться в пищевые продукты.

Выводы. Эфирное масло укропа проявляет антимикробную активность и не угнетает развитие молочнокислых бактерий в молочных заквасках. Его целесообразно использовать как натуральную добавку в молочных продуктах.

Ключевые слова: укроп, эфирное масло, молоко, микрооганизм.

Влияние добавки белково-минеральной на потребительские характеристики мясных эмульсионных изделий

Инна Шурдук, Максим Серик, Светлана Антоненко, Наталья Федак

Харьковский государственный университет питания и торговли, Харьков, Украина

Введение. Актуальной задачей является поиск полифункциональных метаболически активных добавок, способных совершенствовать химический состав и другие потребительские характеристики мясных эмульсионных изделий.

Материалы и методы. Экспериментальные исследования выполнены с использованием полуавтоматической пенетрометры «Labor» для измерения предельного напряжения сдвига колбас, ротационного вискозиметра «Реотест-2» для измерения вязкости паштетов. Оптический микроструктурных анализ, исследования водосвязывающей способности, определение химического состава и перевариваемости белков проводили по традиционным методикам.

Результаты. Определено влияние добавки белково-минеральной на водосвязывающие, структурно-механические, микроструктурные и потребительские свойства колбасных изделий и паштетной продукции. Использование добавки в количестве 7,5% позволяет повысить водосвязывающую способность колбасной продукции и паштетов на 4...9%, снизить предельное напряжение сдвига колбасных изделий на 2,5...6%, вязкость паштетов - на 300.. 350 Па×с и улучшить микроструктурные характеристики продукции без ухудшения органолептических свойств. Определено, что использование добавки обеспечивает более равномерное распределение компонентов в структуре колбас и паштетов, что обуславливает однородность структуры и предупреждает возникновение дефектов в готовой продукции.

Использование добавки позволяет увеличить содержание влаги на 0,7 ... 1,1%, белка - на 0,3 ... 0,8%, усваиваемых соединений кальция в готовом продукте – до уровня 550 ... 700 мг / 100 г. Исследование перевариместости белков продукции протеолитическими ферментами желудочно-кишечного тракта выявили лучшую степень гидролиза белков исследуемой продукции на 11,5 ... 13% по сравнению с контрольными изделиями. Использование добавки в составе колбасных изделий и паштетов за счет совершенствования их химического состава и повышения перевариместости белков обеспечивает большую биологическую ценность разработанной продукции. Результаты апробированы в производственных условиях.

Выводы. Добавка белково-минеральная положительно влияет на водосвязывающие, структурно-механические, органолептические характеристиками и биологическую ценность мясных емульсионных изделий по сравнению с существующими на рынке аналогами.

Ключевые слова: колбаса, паштет, мясо, кальций, качество.

Гистологические особенности печени крыс при затравке животных раствором этанола с добавками

Николай Головко[1], Галина Губина-Вакулик[2],
Наталья Пенкина[1], Виктория Колесник[1]

[1] *Харкивський государственный университет питания и торговли, Харьков, Украина*
[2] *Харкивський национальный медицинский университет, Харьков, Украина*

Введение. Актуальным является вопрос разработки новых видов алкогольной продукции с пониженным токсическим эффектом. Цель исследования состояла в определении гистологических особенностей строения печени при введении крысам линии Вистар разных видов спиртовых настоек с пониженным токсическим эффектом.

Материалы и методы. В эксперименте использовали четыре группы животных, которые употребляли различные виды разработанных настоек. Микроскопирование осуществлено на микроскопе Axiostar-plus, фотографирование - с использованием фотокамеры Progress C10. На компьютерном изображении микропрепаратов проведена картометрия («Видеотест»).

Результаты. Определена степень поражения печени крыс разных групп при употреблении экспериментальных настоек. Определено, что площадь ядер гепетоцитив интактной группы в среднем составляет $32{,}70 \pm 0{,}78$ мкм^2. У интактных животных трабекулы ровные, просвет синусоид отсутствует, цитоплазма компактная (непросветленная) и содержит немного гликогена. У животных первой основной группы (длительное употребление 40% водно-спиртовой смеси) обнаружены гистологические признаки алкогольного поражения печени с формированием у разных животных этой группы хронического гепатита разной степени активности. Гепатоциты имеют крупное ядро, площадь которого составляет $43{,}25 \pm 1{,}1$мкм^2. Во второй основной группе (длительное употребление 40% водно-спиртовой смеси с добавлением растительного сырья) структура печени сохранена, четко выражены трабекулы, просвещения синусоид просматриваются. Ядра гепатоцитов имеют несколько меньшую площадь по сравнению с первой основной группой ($38{,}8 \pm 1{,}05$ мкм^2). У третьей основной группы (длительное потребление 40% спиртовой смеси с добавлением растительного и животного сырья) гистоструктура печени сохранена, трабекулы ровные, наличие очагов цитолиза гепатоцитов не отмечено. Ядра гепатоцитов имеют минимальную площадь ($33{,}57 \pm 0{,}91$ мкм^2), по сравнению с другими основными группами значение этого показателя несущественно отличается от группы интактных животных. Экспериментально доказано, что добавка смеси из растительного и животного сырья улучшила морфофункциональное состояние печени на фоне отсутствия очагов цитолиза гепатоцитов и нормализации величины ядер гепатоцитов.

Выводы. Разработанные спиртовые настойки снижают токсическое действие алкоголя на печень.

Ключевые слова: крыса, этанол, печень, гепатоцит, цитоплазма.

Использование многокомпонентных рассолов в производстве ветчин из говядины

Ирина Кишенько[1], Юлия Крыжова[2], Максим Гонтовый[1]

1 – Национальный университет пищевых технологий, Киев, Украина
2 – Национальный университет биоресурсов и природоиспользования Украины, Киев

Вступ. Представляется целесообразной разработка научно-обоснованных промышленных технологий производства цельномышечных изделий , которые были бы альтернативой традиционным и обеспечивали стабильность качественных показателей из сырья з различными биохимическими свойствами.

Материалы и методы. Значение pH фильтрата из соленой говядины определяли на потенциометре-340 (pH-метре), массовую часть содержания влаги - высушуванием навески в сушильном шкафу при температуре 103 – 105 °С до достижения постоянной массы образцов. Содержание нитрозопигментов определяли на спектрофотометре при длине волны 540 нм относительно 80-процентного водного раствора ацетона, остаточное количество нитрита – получением окрашенного раствора в результате образования изокраски, удельное усилие резания – на лабораторной установке ПМ-3, значение влагоудерживающей способности (ВУС) – с помощью молочного жиромера.

Результаты. Использование многофункциональных рассольных коллоидных систем (МФРКС) оказывает существенное влияние на улучшение основных функционально-технологических свойств сырья и качественных показателей готовых изделий.

Обоснована разработка технологии производства цельномышечных изделий с говядины с использованием многофункциональных рассольных коллоидных систем (МФРКС) с проведением точного расчета необходимого количества рассола, установлены способы и режимы посола разных видов сырья: массирование в масажоре при 8 оборотах за минуту (15 минут робота, 15 минут пауза). Длительность обработки тазобедренной, лопаточной частей говяжьих полутуш – 16 часов для говядины NOR и 18 часов для говядины DFD с последующей выдержкой в условиях созревания при температуре +4 ºС на протяжении 8 часов; шейно-подлопаточной части, покромки – 14 часов для говядины NOR и 16 часов для говядины DFD с последующей выдержкой в условиях созревания при температуре +4 ºС на протяжении 10 часов; спинных и поясничных мышц – 9 часов для говядины NOR и 10…11 часов для говядины DFD с последующей выдержкой в условиях созревания при температуре +4 ºС на протяжении 12 часов. Эффективность использования МФРКС для инъектирования в количестве 20%, 40%, 60%, 80% обеспечивает выход для говядины DFD 104,8%; 123,9%; 143,7%; 162,5%, для говядины – NOR 102,6%; 123,5%; 142,9%; 161,7%. Использование нитратной соли в составе рассолов снижает допустимое содержание остаточного нитрита, который составляет, мг/100г: для говядины – DFD – 2,34 – 2,91, для говядины NOR – 2,24 – 2,78.

Выводы. Результаты являются основой технологии новых видов цельномышечных копчено-вареных изделий из говядины.

Ключевые слова: рассол, говядина, структурообразование, инъектирование, массирование.

Характеристика технологии термостойкой молокосодержащей начинки замороженной

Фёдор Перцевой[1], Маргарита Обозна[2], Галина Любенко[1]

1 – Харьковский государственный университет питания и торговли, Украина
2 – Сумской национальный аграрный университет, Украина

Введение. Разработано и исследовано термостойкую начинку с целью улучшения та получения новых свойств для кондитерских и кулинарных изделий.

Материалы и методы. Совместное влияние и смену рецептурных компонентов термостойкой молокосодержащей начинки установлено на основе анализа научных источников. Соединение компонентов и образование структуры начинки исследовано методом химического взаимодействия между веществами. Срок хранения – методом изменения микробиологических и физико-химических свойств.

Результаты и обсуждение. Технология производства начинки предусматривает четыре подсистемы, которые взаимосвязаны между собой общей целью операций, а именно: подсистема D – подготовка рецептурных компонентов; подсистема C – смешивание и тепловая обработка; подсистема B – розлив и структурообразование; подсистема A – получение термостойкой молокосодержащей начинки. Приведена инновационная стратегия получения термостойкой молокосодержащей начинки, которая показывает влияние, изменение и взаимодействие рецептурных компонентов в процессе производства. На первом этапе (подсистема D) происходит сочетание молока сухого обезжиреного, крахмала модифицированного кукурузного и растительного масла. Во время восстановления сухого обезжиреного молока лактоза, белок и другие составные частицы переходят в раствор и после тепловой обработки соединяется с крахмалом. Наличие жира в сухих молочных продуктах затрудняет процесс растворения и восстановления и уменьшает срок хранения в связи с его гидрофобными свойствами и способностью взаимодействовать с кислородом, что приводит к окислению и снижению качества продукта. Растительное масло вводят после процесса набухания, при котором образуются жиро-белковые комплексы. То есть вокруг жировой молекулы благодаря гидрофобным связям распределяется белковая оболочка, которая соединяется гидрофильными связями с крахмалом и водной средой, вследствие ориентации гидрофобных и гидрофильных участков белка проявляется их способность адсорбироваться на поверхности раздела фаз с образованием однородной среды. С целью фиксации, придания структуры и термостойких свойств крахмал переплетается с пектиновыми молекулами, которые соединяются и образуют сетку благодаря Ca^{2+}, что находится в молочном сырье и цитрате кальция. Полученная трехмерная общая сетка пектина и крахмала удерживает все рецептурные компоненты вместе под действием высокой температуры.

Вывод. Применения результатов во время производства кондитерских и кулинарных изделий позволяет упростить технологический процесс, обеспечить высокие органолептические свойства, биологическую и пищевую ценность, низкую себестоимость, конкурентоспособность и увеличить срок хранения.

Ключевые слова: начинка, молоко, гидроколоид, термостойкость, клейстеризация.

— Abstracts —

Усовершенствование технологии сорбционной очистки воды для производства алкогольных изделий

Светлана Олейник, Виталий Прибыльський, Наталия Чуприна, Ирина Довгун
Национальный университет пищевых технологий, Киев, Украина

Введение. Показана актуальность усовершенствования технологии кондиционирования воды путем сорбционной очистки воды для производства алкогольной продукции.

Материалы и методы. Сравнивали активированный уголь марки Silcarbon K835spezial с Фильтрасорб F300. Во время исследований использовали органолептические, капиллярнофоретические и титриметрические методы анализа, теоретическое обобщение и сравнение результатов, системный подход.

Результаты и обсуждение. Проведена сравнительна оценка физико-химических и сорбционных характеристик активированного угля марок Silcarbon K835spezial и Фильтрасорб F300. Изучена эффективность использования активированного угля марки Silcarbon K835spezial при кондиционировании воды для алкогольных изделий. Исследуемый активированный уголь в сравнении з активированным углем Фильтрасорб F300 имеет больший общий суммарный объем пор по воде – на 30 %, адсорбционную активность по йоду - на 38 % и щелочность водного настоя более чем в 2 раза, что подтверждается большим (на 35 %) колличеством основных оксидов.

При кондиционировании воды активированным углем Silcarbon K835spezial массовая концентрация железа, аммония, нитритов уменьшалась в 1,5 - 2 раза, при этом перманганатная окисляемость улучшалась на 40…50 % в сравнении с контрольным образцом Фильтрасорб F300.

Улучшенные физико-химические и сорбционные характеристики активированного угля Silcarbon K835spezial дают возможность увеличить удельный объем подготовленной воды для ликероводочных изделий на 38 %.

Вывод. Активированный уголь Silcarbon K835spezial является перспективным для улучшения качества подготовленной воды и алкогольной продукции с ее использованием.

Ключевые слова: *вода, алкоголь, уголь, очистка, кондиционирование.*

Технологические рычаги управления свойствами двухслойной среды формирования термостабильных капсул с жировым содержимым

Евгения Коротаева, Ольга Неклеса, Павел Пивоваров, Татьяна Трощий
Харьковский государственный университет питания и торговли, Харьков, Украина

Введение. Для обеспечения промышленного производства масел растительных капсулированных является необходимым научное обоснование параметров технологического процесса и состава технологической системы.

Материалы и методы. Исследовалось капсулообразование модельной системы «масло рафинированное дезодорированное - водный раствор альгината натрия» в двухслойной приёмной среде «масло - вода», которое содержит свободные ионы Ca^{2+}. Плотность приёмной среды корректировалась добавлением этилового спирта. Поверхностное натяжение технологических систем определяли методом отрыва капли от капилляра на калиброванной сталогмометрической установке.

Результаты и обсуждение. Представлены экспериментальные данные влияния хлорида кальция, этанола, поверхностно-активных веществ на значение межфазного натяжения двухслойной приемной среды формирования термостабильных капсул с жировым содержанием в зависимости от температуры. Обоснован состав системы и рабочие концентрации участников технологического процесса, которые обеспечивают стабильный процесс капсулообразования. Полученные закономерности позволили осуществить индустриальное производство инновационного продукта.

Определено влияние температуры компонентного состава на капсулирование технологической системы «масло рафинированное дезодорированное - водный раствор альгината натрия» через двухслойную приёмную среду путем введения поверхностно-активного вещества. Предложенные рабочие концентрации рецептурных компонентов системы «масло - водно-спиртовой (40 об.%) раствор 1,0 % хлорида кальция» с использованием 0,3…0,5 % Е322 (лецитин) или Е432 (полиоксиэтиленсорбитанмонолаурат) позволяют внедрить производство капсулированных растительных масел.

Выводы. Результаты исследований являются научной платформой для обоснования параметров технологического процесса производства капсулированных растительных масел.

Ключевые слова: капсула, масло, жир, хлорид кальция, этанол.

Диетическая добавка с адаптогенной активностью на основе биополимеров шампиньона двуспорового (*Agaricus bisporus*)

Наталия Черно[1], Леонид Шафран[2], София Озолина[1],
Елена Третьякова[2], Александра Никитина[1]

1 - Одесская национальная академия пищевых технологий, Одесса, Украина
2 - Государственное предприятие "Украинский научно-исследовательский институт медицины транспорта МОЗ Украины", Одесса, Украина

Введение. Для коррекции и профилактики состояний, вызванных действием стрессогенных факторов различной природы на организм человека, необходимо применять препараты с адаптогенной активностью.

Материалы и методы. Образцы получали последовательной обработкой шампиньонов (*Agaricus bisporus*) водой, растворами 3,7 % HCl и натрий гидроксида, варьируя концентрацию щелочного агента (3,0, 5,0 и 7,0 %) и продолжительность его контакта с твердой фазой (60, 120, 180, 240 и 300 мин). Адаптогенную активность прогнозировали по совокупности показателей: антиоксидантная активность (АОА), бифидогенный эффект (БГЭ), сорбция холевой кислоты (СХК). Диетическую добавку вводили в рацион питания экспериментальных животных в дозе 200 мг/кг. Стрессогенным фактором являлся ацетат свинца в дозе 14,1 мг/кг. При этом контролировали показатели морфометрии, поведенческие реакции, содержание общих липидов, холестерола, триглицеридов, уровень малонового диальдегида, активность АЛТ, АСТ, глутатионпероксидазы (ГП), глутатионредуктазы (ГР) и глюкозо-6-фосфатдегидрогеназы (Г-6-ФДГ).

Результаты. Изучено влияние режимов получения образцов биополимерных комплексов грибов (концентрация щелочного агента, продолжительность обработки) на их свойства. Показано, что ни один из рассматриваемых режимов обработки грибного сырья не позволяет выделить препарат, который проявлял бы АОА, БГЭ,

СХК на максимально высоком уровне. Для исследования в условиях *in vivo* был выбран образец – диетическая добавка, АОА которой составляла 90,0 %, СХК – 22,4 мг/г добавки, БГЭ соответствовал $1,5 \cdot 10^{12}$ КОЕ/см^3. При действии стрессогенного фактора прием диетической добавки положительно влиял на состояние лабораторных животных. Так, улучшились показатели морфометрии и стабилизировались поведенческие реакции животных. Повысились активности ГП, ГР, Г-6-ФДГ на 21,7, 26,0, 20,0 % соответственно по отношению к группе, получавшей ацетат свинца. Наблюдалось снижение содержания МДА на 14,8 %, общих липидов на 14,2 %, триглицеридов на 26,6 %, холестерина на 18,9 % соответственно. Также стабилизировались показатели активности АЛТ и АСТ. Данные результаты подтверждают наличие адаптогенной активности у диетической добавки, полученной из шампиньона двуспорового (*Agaricus bisporus*).

Выводы. Целесообразно включение данной диетической добавки в рационы питания с целью коррекции адаптационных реакций организма человека.

Ключевые слова: диета, добавка, адаптоген, гриб, *Agaricus bisporus*.

Микробиология, биотехнология

Термофильное метановое брожение куриного помета

Анатолий Салюк, Сергей Жадан, Евгений Шаповалов

Национальный университет пищевых технологий, Киев, Украина

Введение. Цель исследования состояла в изучении метаногенеза куриного помета в термофильном режиме при низкой влажности субстрата.

Материалы и методы. В исследовании было проведено периодическое метановое брожение куриного помета с влажностью от 82 до 94% при температуре 50 °C.

Результаты и обсуждение. Высокое содержание азота часто вызывает проблемы токсичности аммония для анаэробов. При увеличении температуры большее количество аммонийного азота переходит в аммиак, который считается более токсичным веществом чем ионы аммония.

Уменьшение влажности субстрата приводило к снижению эффективности процесса. Выход биогаза варьировался от 121 до 382 мл / г СОР, а доля метана в выработанном газе – от 39,6% до 57%. Производство метана началось с первого дня проведения эксперимента. Увеличение его концентрации в биогазе с начала эксперимента происходило быстрее при большей влажности субстрата. Концентрация метана в биогазе не была постоянной и колебалась в пределах от 50% до 80% при всех значениях влажности субстрата. Максимальная скорость метаногенеза возрастала при увеличении влажности субстрата от 2,8 мл / (г СОР · день) до 24,7 мл / (г СОР · день).

Вывод. Производство метана из куриного помета в термофильном режиме возможно даже при низкой влажности субстрата, несмотря на высокое содержание аммонийного азота и аммиака.

Ключевые слова: помет, брожение, биогаз, аммиак, ингибирование.

Микробиологическое состояние помещений, оборудования и воздуха как важный фактор производства безопасных пищевых продуктов

Анджей Барыга[1], Боженна Полец[1], Роксоляна Чаповска[2]

1 - Институт биотехнологии сельского хозяйства и пищевой промышленности, Польша,
2 - Национальный университет «Львовская политехника», Украина

Введение. Для надлежащего микробиологического состояния производственных помещений и воздуха на предприятиях пищевой промышленности внедряют принципы систем качества, которые предусматривают соблюдение жестких правил ведения технологического процесса. Особое внимание сосредоточивается на подборе эффективных и безопасных химических средств и вспомогательных материалов для мытья и дезинфекции.

Материалы и методы. С помощью методов микробиологического анализа проведено исследование бактерицидного действия дезинфицирующего средства польского производства "Гигиенизер", активным веществом которого является перекись водорода. Эффективность средства оценивали методом отпечатков с применением агаровых пластинок и аспирационным методом, который базируется на принципе ударного действия тока воздуха на агаровую пластину.

Результаты и обсуждение. Внедрение системы HACCP позволяет выявить те критические точки технологического процесса, в которых систематический контроль санитарно-гигиенических норм обеспечит надлежащее качество и безопасность готового продукта. Анализ технологической линии от момента поступления сырья на предприятие до этапа упаковки и хранения готового продукта позволяет найти эффективные пути устранения микробиологического загрязнения, а также сделает невозможным процесс вторичного заражения микроорганизмами. Комплекс всех этих мероприятий в сочетании с использованием экологических химических средств позволит производить безопасное продовольствие.

Результаты исследований дезинфицирующего средства «Гигиенизер» показали его эффективность в отношении санитарно-показательных грамположительных и грамотрицательных бактерий, в том числе бактерий группы кишечных палочек, стафилококков, стрептококков, синегнойной палочки, сальмонелл, дрожжеподобные и плесневых грибов и т.п. Отсутствие запаха и полная биодеградация позволяет утверждать, что дезинфицирующие средства такого типа являются одними из самых оптимальных в пищевой промышленности.

Выводы. Систематическое проведение процедур мытья и дезинфекции, использование экологических средств, соблюдения правил личной гигиены – это меры, способствующие тому, что производимые продукты питания будут безопасными и отвечать современным требованиям европейских стандартов.

Ключевые слова: микробиология, заражение, дезинфекция, безопасность, продовольствие.

Процессы и оборудование пищевых производств

Теоретические аспекты ориентирования мелко-штучной продукции при виброперемещении

Александр Гавва, Людмила Кривопляс-Володина, Генадий Валиулин

Национальный университет пищевых технологий, Киев, Украина

Введение. Повышение технологической эффективности и продуктивности вибролотка при минимальных энергетических расходах зависит от установленного оптимального значения угла колебаний рабочего органа вибрационного устройства, обеспечения рационального режима энергосбережения при колебании, наличия генерирующей системы искуственного режима виброперемещения.

Материалы и методы. Экспериментальные исследования процесса виброперемещения проведены на электропневматической установке, настроенной на разные условия вибрации с помощью програмируемого логического контролера. Режим движения продукта описывается методом последовательных приближений. Для осуществления движения мелко-штучной продукции по вибрационному лотку, при условии гармонического колебательного движения, используется два метода компоновки вибрационного лотка на пружинных подвесах.

Результаты и обсуждения. С учетом гармоничности колебаний рабочего органа и симметрии в расположении направляющих используется условие симметрии сил сопротивления относительного движения и переносной силы инерции. В первом приближении учитывается гармоническое движение продукта и не учитывается изменение фазы относительно относительно переносных колебаний. Допущение: амплитуда колебаний в абсолютном движении значительно меньше, чем амплитуда колебаний рабочего органа. С использованием предварительно найденных начальних условий построены математические модели по определению фазовых углов начала и конца движения единицы продукта в каждом направлении. При колебаниях опорной поверхности с ускорением, достаточным для относительного движения единицы продукта между пластинами, последняя будет иметь одинаковые по абсолютной величине перемещения во всех направлениях оси *x,* виброперемещения единицы продукта не будет. Созданная модель экспериментальной установки с использованием электропневматического привода может использоваться при небольших частотных колебаниях рабочего лотка от 4-10 Гц при необходимости транспортирования и разделения хрупкой мелко-штучной продукции.

Вывод. Результаты позволяют оценить влияние скорости и условий силового контакта от направления колебаний опорной поверхности, интенсификации движения единицы продукта между направляющими.

Ключевые слова: электропневмопривод, вибрация, транспортирование.

Анализ рабочих органов машин для тонкого измельчения мясного сырья

Александр Желудков, Сергей Акуленко

Могилёвский государственный университет продовольствия, Республика Беларусь

Введение. Цель исследований – снижение энергоёмкости процесса тонкого измельчения мясного сырья путём усовершенствования конструкции кутерных ножей.

Материалы и методы. Исследовались четыре вида ножей, которые отличаются типом режущей кромки. Факторы, которые влияют на процесс тонкого измельчения мясного сырья в куттерах, и пути усовершенствования процесса измельчения определены на основании анализа современных научных статей, напечатанных в передовых научных журналов.

Результаты и обсуждение. По конструкции куттерные ножи можно разделить на четыре группы: с прямолинейной режущей кромкой; с режущей кромкой, образованной непрерывной кривой линией (серповидный); с режущей кромкой в виде зубчатой линии; с режущей кромкой в виде ломаной линии.

Резание при куттеровании должно быть скользящее, а лезвие ножа – наклонное. Увеличение коэффициента скольжения приводит к возрастанию длины режущей кромки и боковой поверхности ножа, потерь энергии на трение, интенсивно повышает температуру сырья. При изменении коэффициента скольжения ножа K от 1,06 до 1,94 прирост температуры уменьшается от 5 °C до 4,66 °C. Минимальный прирост температуры - при $K = 1,94$. Удельная энергоемкость с увеличением коэффициента скольжения от 1,06 до 2,17 уменьшается. Минимум наблюдается при $K = 2,17$, при дальнейшем его увеличении удельная энергоемкость повышается. Поверхность контакта режущего органа при $K = 3,7$ больше в сравнении со случаем рубящего резания в несколько раз. Усилие прижатия продукта к боковой поверхности и коэффициент трения при заданной скорости резания являются постоянными, и основной причиной повышения удельной энергоемкости является увеличение составляющей удельного расхода энергии на преодоление сил трения поверхности ножа о продукт. Минимальные прирост температуры и удельная энергоемкость процесса достигаются с использованием ножей с режущей кромкой в виде ломаной линии и углом резания 64°.

Вывод. Предложенные научные разработки позволяют конструировать ножи с оптимальным углом резания, использование которых обеспечивает минимальную удельную энергоемкость процесса и прирост температуры измельчаемого сырья.

Ключевые слова: мясо, куттер, нож, резание.

Экономика и управление

Сущность и роль бренда в концепции рыночного позиционирования товара на потребительском рынке

Сергей Серобаба, Галина Чередниченко, Ирина Тюха

Национальный университет пищевых технологий, Киев, Украина

Введение. Статья посвящена изучению и анализу таких понятий, как позиционирование товаров на "рынке", "бренд", "торговая марка" в системе "потребительского поведения", и разработке практических рекомендаций для владельцев по созданию успешных брендов.

Материалы и методы. Используются методы научной индукции и дедукции, сравнительный и метод научной абстракции.

Результаты. Проанализированы различные взгляды западных и украинских ученых, таких как Ф. Котлер (F. Kotler), Дж.Фридерик (J. Friedrich), П. Доул (P. Doyle), М. Яненко, Ф. Панкратов на понятие «позиционирование товаров на рынке», «бренд» и «торговая марка» и предложено их собственное видение. Авторы считают, что позиционирование - это набор определенных маркетинговых действий фирмы для того, чтобы занять более благоприятное конкурентное место на рынке относительно конкурентов.

Раскрыты основные различия между понятиями «бренд» и «торговая марка». Определено, что торговая марка - это определенный образ продукта или компании, который создается производителями, чтобы выделить свою продукцию на рынке среди аналогичных конкурирующих продуктов. Бренд - широко известная на рынке, раскрученная, юридически зарегистрированная торговая марка, которая является отражением положительного имиджа производителя и включает в себя ряд конкретных эмоциональных и функциональных характеристик.

Историю развития бренда в Украине, его эволюцию, которая вызвана изменениями на рынке и изменениями во вкусах и предпочтениях конечных потребителей, показано на практических примерах таких брендов, как «Первак», «Песня» «Гетман». «Олимп», «Вдала», «Беленькая»; «СВ», «Medoff», «Мерная» и других. Предложены следующие рекомендации для украинских производителей по созданию бренда, а именно: придавать большее значение позиционированию с постепенным насыщением рынка товарами и услугами; использовать новые технологии для продвижения брендов на более конкурентные рынки; отказаться от использования комплексного подхода (umbrella approach) к созданию брендов, так как его практическое применение в условиях жесткой конкурентной борьбы является неэффективным.

Выводы. Новизна исследования заключается в том, что рассмотрены ошибки, которые допускают украинские фирмы при продвижении своих товаров на рынок, а также предложены практические рекомендации по их устранению.

Ключевые слова: позиционирование, концепция, стратегия, бренд, торговая марка.

Влияние конкурентной среды на развитие ресурсной базы предприятий молочной промышленности Украины

Виктор Емцев

Национальный университет пищевых технологий, Киев, Украина

Введение. Отрасль молочного скотоводства в Украине находится в депрессивном состоянии. Цель исследования - проанализировать состояние, проблемы функционирования и перспективы развития молочного скотоводства и исследовать возможные направления его развития.

Материалы и методы. Использованные следующие методы: систематический и комплексный анализ, экономические, математические и статистические, аналитические и сравнительные методы, экспертная и рейтинговая оценка.

Результаты и обсуждения. Основные проблемы и тенденции развития отечественных источников сырья для предприятий молочной промышленности: снижение поголовья коров, отсутствие селективной и генетической работы, низкий уровень производительности крупного рогатого скота, диспаритет цен, необходимость значительных инвестиций в развитие молочного скотоводства,

недостаточность государственной поддержки, низкая покупательная способность населения.

Для возрождения отрасли молочного скотоводства в Украине приоритетными направлениями государственной регуляции и поддержки являются: создание кластерных формирований на рыночных взаимовыгодных условиях для обеспечения полного цикла "селекционно-племенное дело - производство молока и мяса - переработка сырья - реализация готовой продукции" и повышение уровня организации управления ими на основе специализации и кооперации; развитие селекционно-племенной, генетической работы, повышения роли племенных заводов, племенных хозяйств, племенных ферм, лучшее использование генофонда племенного животноводства страны; обеспечение высококачественной кормовой базы, на основе прогрессивных технологий заготовки и хранение кормов с приоритетом решения белковой проблемы, развития интенсивных и ресурсосберегающих технологий, направленных на производство качественной и конкурентоспособной продукции скотоводства.

Вывод. Указаны направления развития молочного скотоводства являются гарантией стабильного обеспечения молокоперерабатывающих предприятий сырьем.

Ключевые слова: молоко, скотоводство, конкуренция, реструктуризация, кластер.

Питание и туризм

Особенности формирования дестинаций винного туризма

Дарья Басюк, Кристина Удворгели

Национальный университет пищевых технологий, Киев, Украина

Введение. Проанализирована структура дестинаций винного туризма, которые выступают стратегическими единицами туристического бизнеса и точками кристаллизации туристического спроса.

Материалы и методы. Анализ формирования винных туристических дестинаций основан на трудах зарубежных и отечественных ученых и специалистов в сфере туризма.

Результаты и обсуждение. Существенные факторы, которые влияют на формирование винных дестинаций: наличие промышленных и культурных объектов и достопримечательностей, связанных с вином и виноделием, транспортная и информационная доступность, развитие туристической инфраструктуры, сотрудничество бизнеса и местной общины для устойчивого развития туристического центра. Очерчено основные районы винного туризма в Украине, учитывая макро- и микрорайонирование виноградно-винодельного комплекса и геопространственной организации туристических ресурсов. Описаны дестинации винного туризма разного уровня в Крымском, Закарпатском, Одесском причерноморском и приазово-степном районах. Среди них стоит выделить единственный в Украине «Центр культуры вина Шабо» - действующее предприятие с собственными винными подвалами, дегустационными залами, художественными экспозициями и музеем вина та виноделия. Как пример становления инновационной дестинации винного туризма приведено винодельное хозяйство «Колонист» - небольшую семейную винодельню в Одесской области, где кроме винных туров

также проводятся аукционы винтажных вин ТМ «Колонист», сбор винограда, дегустация блюд кухни Придунайской Бессарабии. Объекты винного туризма выступают фактором поддержки туристического интереса к дестинации. Так, винный путь Закарпатья разрешает продегустировать вино около 50 семейных винодельных предприятий, экскурсии и фестивали.

Выводы. Анализ международной практики формирования винных туристических дестинаций подтвердил целесообразность ее использования для дальнейшего развития отечественного винного туризма.

Ключевые слова: вино, туризм, дестинация, виноделие, аттракция.

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1.   The title of the article
2.   Authors (full name and surname)
3.   Institution, where the work performed.
4.   Abstract (2/3 of page). The structure of the abstract should correspond to the structure of the article (Introduction, Materials and methods, Results and discussion, Conclusion).
5.   Key words.
Points from 1 to 5 should be in English, Ukrainian and Russian.
6.   The main body of the article should contain the following obligatory parts:
   • Introduction
   • Materials and methods
   • Results and discussing
   • Conclusion
   • References
   If you need you can add another parts and divide them into subparts.
7. The information about the author (Name, surname, scientific degree, place of work, email and contact phone number).

All figures should be made in graphic editor, the font size 14.

The background of the graphs and charts should be only in white color. The color of the figure elements (lines, grid, text) - in black color.
Figures and EXCEL format files with graphs additionally should submit in separate files.
Photos are not appropriate to use.

Website of Ukrainian Food Journal: www.ufj.ho.ua

Extended articles should be sent by email to: ufj_nuft@meta.ua

Шановні колеги!

Редакційна колегія наукового періодичного видання «**Ukrainian Food Journal**» запрошує Вас до публікації результатів наукових досліджень.

Вимоги до оформлення статей

Мови статей – англійська, українська, російська
Рекомендований обсяг статті – **8-15 сторінок** формату А4**.**
Стаття виконується в текстовому редакторі Microsoft Word 2003, в форматі *.doc.
Для всіх елементів статті шрифт – **Times New Roman**, кегль – **14**, інтервал – 1.
Всі поля сторінки – по 2 см.

Структура статті:

1**.** УДК**.**
2. **Назва статті.**
3. Автори статті (ім'я та прізвище повністю, приклад: Денис Озерянко).
4. *Установа, в якій виконана робота.*
5. Анотація. Рекомендований обсяг анотації – 2/3 сторінки. Анотація повинна відповідати структурі статті та містити розділи Вступ, Матеріали і методи, Результати та обговорення, Висновки.
6. Ключові слова (3-5 слів, але не словосполучень).
    Пункти 2-6 виконати англійською, українською та російською мовами.
7. Основний текст статті. Має включати такі обов'язкові розділи:
- Вступ
- Матеріали та методи
- Результати та обговорення
- Висновки
- Література.
За необхідності можна додавати інші розділи та розбивати їх на підрозділи.
8. Авторська довідка (Прізвище, ім'я та по батькові, вчений ступінь та звання, місце роботи, електронна адреса або телефон).
9. Контактні дані автора, до якого за необхідності буде звертатись редакція журналу.

Рисунки виконуються якісно. Сковані рисунки не приймаються. Розмір тексту на рисунках повинен бути **співрозмірним** (!) тексту статті. **Фотографії бажано не використовувати.**
Фон графіків, діаграм – лише білий. Колір елементів рисунку (лінії, сітка, текст) – чорний (не сірий).
Рисунки та графіки EXCEL з графіками додатково подаються в окремих файлах.
Скорочені назви фізичних величин в тексті та на графіках позначаються латинськими літерами відповідно до системи СІ.
В списку літератури повинні переважати статті та монографії іноземних авторів, які опубліковані після 2000 року.

Додаткова інформація та приклад оформлення статті – на сайті
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Оформлення списку літератури

Наукометричні бази визначають рейтинг як журналу, так і окремих авторів за кількістю посилань на статті. Електронні системи опрацьовують кожен елемент списку – авторів, назву статті та видання, номер, рік та інші елементи.

Українські стандарти передбачають складні вимоги до оформлення посилань на літературу. Такі посилання не можуть опрацьовуватись наукометричними базами (Scopus, Index Copernicus, EBSCO, Google Scholar, Web of Science та ін.). Ці бази сприймають просте оформлення списку, без косих ліній та зайвих елементів.

В світі відсутні єдині правила оформлення посилань. Наукові видання розроблюють власні вимоги оформлення посилань, але зазвичай узгоджують їх із загальноприйнятими вимогами American Psychological Association, Council of Biology Editors, Citation-Sequence, Chicago 16th Edition, Harvard, Harvard - British Standard, NLM - National Library of Medicine та іншими.

Всі визнані світові стандарти передбачають оформлення списку літератури лише латинськими символами. При оформленні посилань на джерела, написані кирилицею, необхідно проводити транслітерацію. Користуючись програмами транслітерації, слід уважно вказувати, з якої мови проводиться транслітерація – української чи російської. Застосовуючи спеціальне програмне забезпечення для транслітерації з української мови використовуємо лише **Паспортний (КМУ 2010)** тип транслітерації, а з російської – тип **МВД,** в яких використовуються лише символи англійського алфавіту.

Для задоволення вимог як українських стандартів, так і визнаних в науковому середовищі наукометричих баз, редакційна колегія просить авторів оформлювати **два списки літератури** – згідно українського стандарту, та згідно вимог, описаних нижче.

1.   Посилання на статтю.

Автори (рік видання), Назва статті, *Назва журналу (курсивом)*, том (номер), сторінки.
Всі елементи після року видання розділяються комами.

Приклад:

Український стандарт	Стандарт Harvard
Пирог Т.П. Використання мікробних поверхнево-активних речовин у біології та медицині / Т.П. Пирог, А.Д. Конон, А.Б. Скочко // Біотехнологія. – 2011. – Т. 4, № 2. – С. 24–38.	Pyroh T.P., Konon A.D., Skochko A.B. (2011), Vykorystannia mikrobnykh poverkhnevo-aktyvnykh rechovyn u biolohii ta medytsyni*, Biotekhnolohiia*, 4(2), pp. 24-38.

2.   Посилання на книгу.
Автори (рік), *Назва книги (курсивом)*, Видавництво, Місто.
Всі елементи після року видання розділяються комами.

Український стандарт	Стандарт Harvard
Раєвнєва О.В. Управління розвитком підприємства: методологія, механізми, моделі: монографія / О.В. Раєвнєва. – Харків, 2006. – 496 с.	Raievnieva O.V. (2006), *Upravlinnia rozvytkom pidpryiemstva: metodolohiia, mekhanizmy, modeli,* Kharkiv.

3. Посилання на електронний ресурс.

Виконується аналогічно посиланню на книгу або статтю. Після оформлення даних про публікацію пишуться слова **available at:** та вказується електронна адреса.

Приклад посилання на статтю із електронного видання:
Barbara Chmielewska (2012), Differentiation of the standard of living of families in countries of the European Union, *Ukrainian Food Journal*, 2(2), pp. 230-241, available at: http://ufj.ho.ua/Archiv/UKRAINIAN%20FOOD%20JOURNAL%202013%20V.2%20Is.2.pdf

Приклад посилання на публікацію із електронного видання:
(2013), *Svitovi naukovometrychni bazy*, available at:
http://www1.nas.gov.ua/publications/q_a/Pages/scopus.aspx

Приклад оформлення списку літератури:

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