ISSN: 0975-8585

Research Journal of Pharmaceutical, Biological and Chemical Sciences

Formation of the Physico-Chemical Parameters of Meat Products in the Processing Of Ultrasonic Acoustic Field.

Shaliko Zhorayevich Gabriyelyan, Igor Nikolaevich Vorotnikov, Maxim Alekseevich Mastepanenko, Ruslan Saferbegovich Omarov, and Sergei Nikolayevich Shlykov*.

Stavropol State Agrarian University, Technological Management Department, Zootekhnicheskiy lane 12, Stavropol 355017, Russia.

ABSTRACT

The aim of the study to determine the effect of ultrasonic field on the qualitative characteristics of model systems with dairy protein-carbohydrate concentrates, and to establish the possibility of using the defrosted meat without salting stage the output of meat products. The experiment to conducted according to the plan Greco-Latin squares. For processing minced ultrasonic field was developed ultrasonic parametric generator. To effectively analyze the results of research were studied functional and technological properties of raw minced meat and the end products, treated and not treated with ultrasound. The data analysis showed a positive effect of ultrasound.

Keywords: ultrasonic field, meat, defrosted meat, salting stage, functional and technological properties.

Corresponding author

ISSN: 0975-8585

INTRODUCTION

Dispersing and emulsifying ability ultrasound is valuable for food technology, because to using this phenomenon to manage to get any homogenates and stable emulsions with particle size 1 micron [1]. In the meat industry has a number of developments of using ultrasonic waves to produce fat emulsions in sausage production. The established to supplement of fat emulsion in the stuffing sausages and frankfurters increased its capacity for retaining moisture and it is possible to process meat products defrosted meat without salting stage.

Determination the effect of ultrasonic waves on the qualitative characteristics of model systems with dairy protein-carbohydrate concentrates, and to establish feasibility of using defrosted meat without salting stage the output of meat products was the purpose of this study. For prototyping used: beef of the premium, 1 and 2 grades, lean pork, bacon, soy concentrate Arkon-S, bifidogenic concentrates «Lactobel» and «CPC-Rs», SMP, lactose and lactulose. The amount of added water in excess of the formulation was 40%. Salting stage defrosted meat it wasn't made [2].

METHODS

The experiment was conducted according to plan Greco-Latin squares. For processing model minced ultrasonic waves was developed ultrasonic parametric generator. Structure of ultrasonic parametric generator is shown in Fig. 1 [3]. To the power supply single phase flows c frequency of 50 Hz, which is regulated by the output voltage in the range of 150-400 V. The required voltage is supplied to the generator for converting DC to AC and to adjust the resonant frequency. One output wire directly connected to the ultrasonic head, and the other consecutively with the shunt through the oscilloscope. The shunt is used to control the current, reflected on the oscilloscope [4, 5].

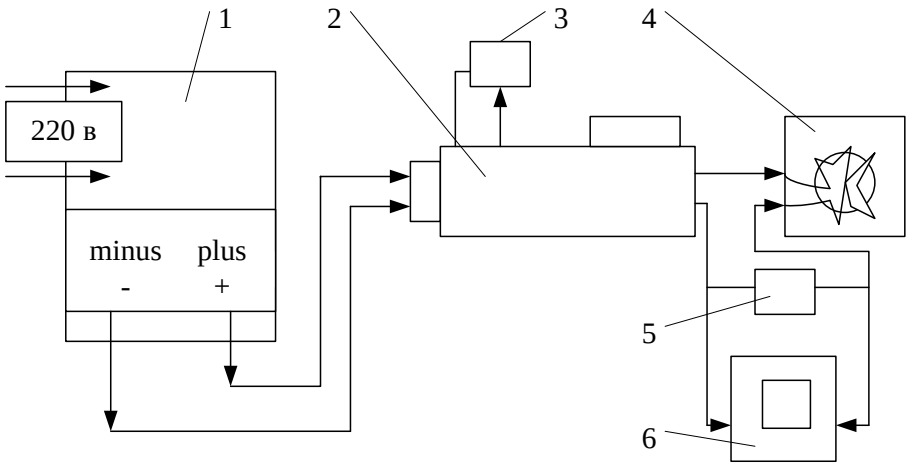
To effectively analyze the results of research were studied functional and technological properties of raw minced meat and finished products (Table. 1).

Table 1: Functional and technological properties of multicomponent model meat systems EPC<0,05

№ of experiment	The pattern with the effect of ultrasonic					The pattern without the effect of ultrasonic				
	The yield, % (y_1)	CSS[1], Pa (y_2)	SE[2], % (y_3)	WBC[3], % (y_4)	DP[4], мм (y_5)	The yield, % (y_1)	CSS[1], Pa (y_2)	SE[2], % (y_3)	WBC[3], % (y_4)	DP[4], мм (y_5)
1	130	563	37,5	81,8	9,7	121	637	8	79,1	6,9
2	136	538	31,5	91,5	6,5	129	566	16	85,4	7,7
3	136	515	26,5	86,2	5,0	127	621	16	84,1	6,1
4	135	385	24,3	83,8	3,6	128	461	17	83,0	6,6
5	139	508	48,0	82,1	6,0	127	408	16	79,3	6,0
6	135	495	25,0	90,1	8,0	126	510	14	90,0	9,5
7	137	412	42,5	87,1	4,0	126	434	14	85,7	5,8
8	137	358	35,0	85,0	7,6	127	531	16	83,2	8,3
9	134	486	40,0	84,8	6,5	125	490	16	79,5	8,3
10	134	450	23,5	88,7	7,0	127	501	16	86,6	9,1
11	135	385	50,0	85,4	5,0	126	548	15	84,3	7,0
12	135	320	40,0	86,2	6,0	127	468	16	84,9	7,0
13	134	465	47,0	86,0	1,4	127	412	15	84,8	6,2
14	132	423	49,0	92,9	7,1	129	603	15	87,0	8,3
15	135	373	27,5	93,4	5,4	128	523	16	88,4	8,7
16	133	302	24,0	86,3	4,2	127	493	16	84,1	8,0
17	129	475	19,0	80,0	9,0	126	473	14	80,0	9,0
18	124	523	11,5	81,3	6,0	128	493	12	86,5	8,8
19	128	465	14,0	81,8	7,0	126	473	14	86,9	7,0
20	128	413	19,0	81,0	5,0	128	435	14	86,6	5,0
21	129	425	17,5	78,6	8,0	126	527	16	81,5	9,7
22	125	456	11,5	83,2	8,0	126	452	14	86,2	8,0
23	128	418	17,0	78,6	8,0	126	408	14	88,6	8,0
24	119	410	18,5	80,6	7,0	128	420	14	90,6	7,0
25	117	440	14,5	82,5	7,0	129	491	14	82,3	7,3

[1]critical shear stress, [2]the stability of emulsion, [3]water-binding capacity, [4]the degree of penetration

ISSN: 0975-8585



1 – power supply, 2 – ultrasonic generator, 3 – frequency control,
4 – capacity with ultrasonic head, 5 – shunt, 6 – oscilloscope

Figure 1: Structure of ultrasonic parametric generator

MAIN PART

Analysis of the data (Table. 1) showed a positive effect of ultrasound. The yield and stability of emulsion of the patterns with the effect of ultrasonic significantly higher than non-irradiated a patterns.

Using the application the Neural Network to developed a complex neural network to based on perceptrons and neurons with radial basis function (Fig. 2).

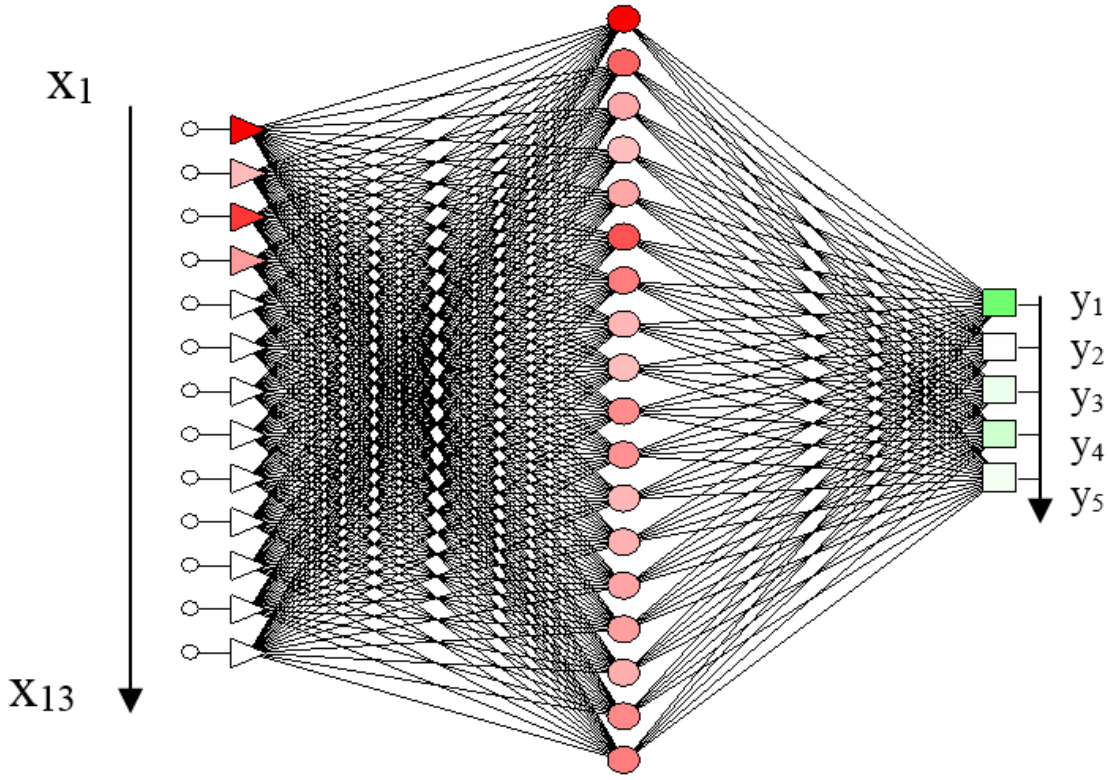


Figure 2: A neural network with input and output signals

ISSN: 0975-8585

Analysis of experimental data the neural network (Fig. 2) to get the surface response to changes each functional indicates initial the frequency and time of ultrasonic treatment (Fig. 3 - 5).

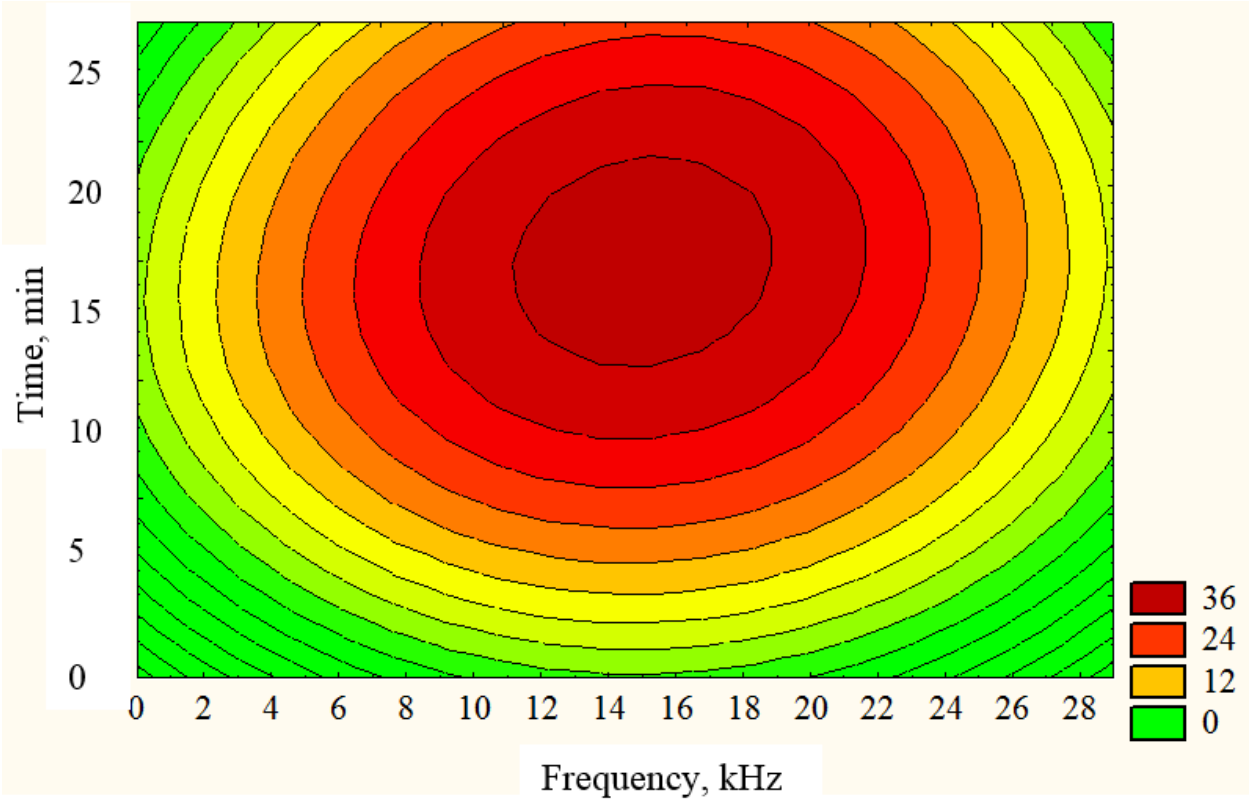


Figure 3: The surface response to changes the stability of emulsion initial the frequency and time of ultrasonic treatment

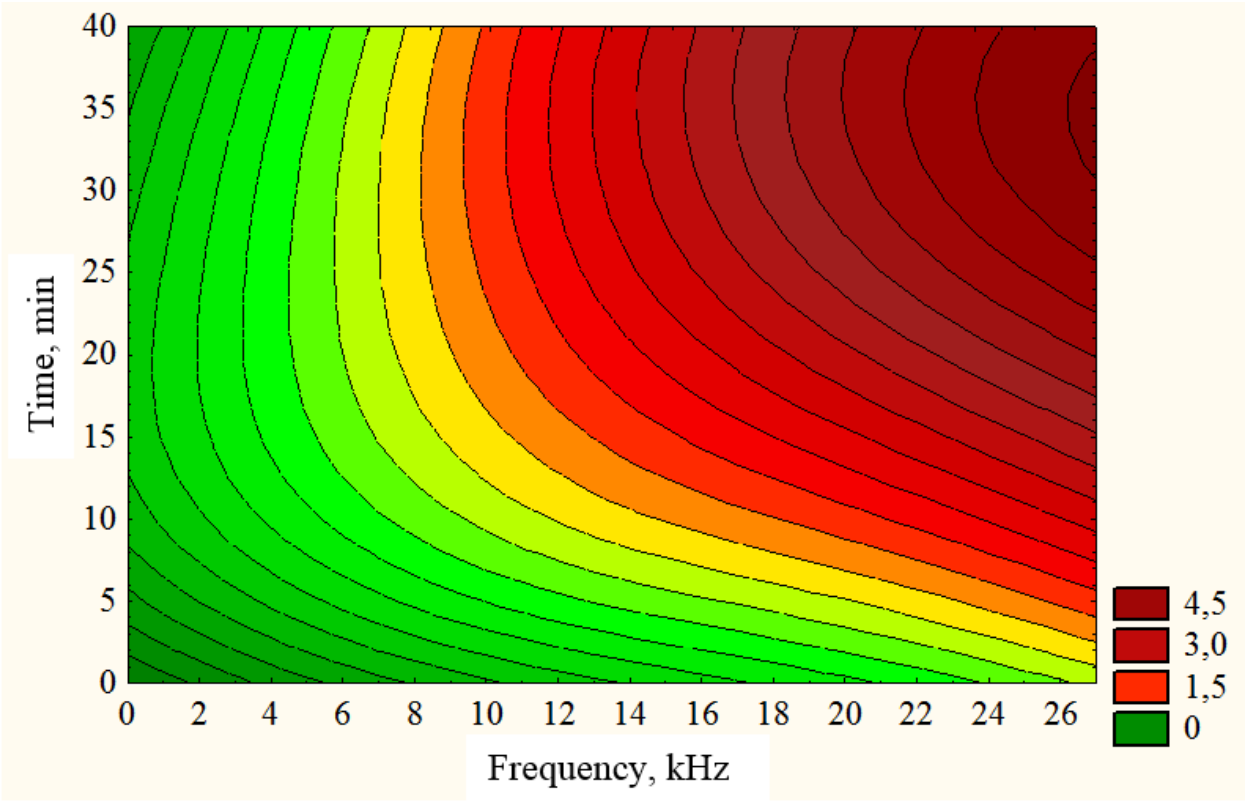


Figure 4: The surface response to changes the water-binding capacity initial the frequency and time of ultrasonic treatment

ISSN: 0975-8585

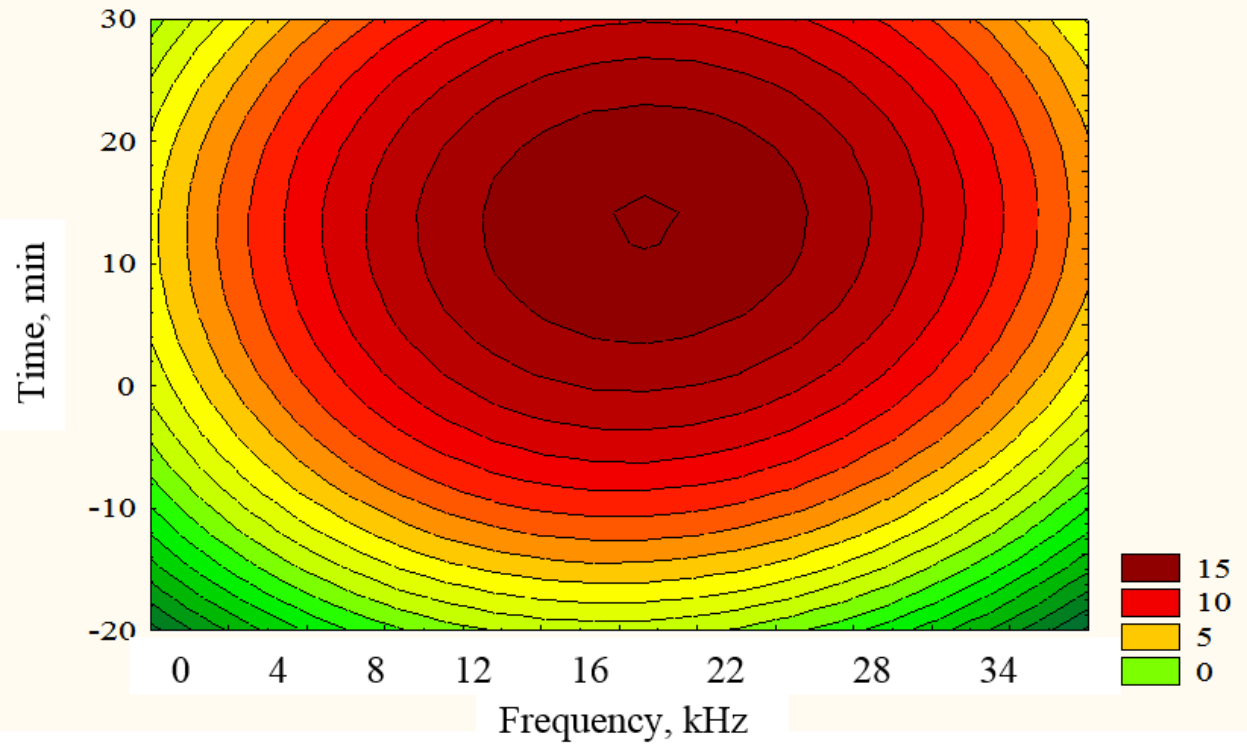


Figure 5: The surface response to changes the yield initial the frequency and time of ultrasonic treatment

Surface response (Fig. 3) to displays the maximum difference the stability of emulsion to get a time range of 13 to 20 min. and a frequency range of 12 to 18 kHz. In this interval, the change in the stability of emulsion reaches 36% or more. This results of the effect of ultrasonic to fulfil with published data, which indicate that ultrasound promotes vigorous stretching of the droplets of the dispersed phase to unstable liquid cylinders critical length and interfaceraise the disintegration this cylinders by very small droplets, i.e. the mechanical destruction the molecules of fat and to dispersion of the system that create stable emulsions with a particle size close to 1 µm.

On the different parts the molecules of protein the ultrasound to affects is differently, according to the different length of the wave.

This phenomenon may lead to change in the properties of the original protein molecules, i.e. the ultrasound to leads at beginning stage of denaturation, accompanied by change in the spatial structure of the protein globule, without breaking covalent bonds, to formed hydrophilic zone, which leads to increase the WBC cell systems (Fig. 4).

The yield is an important indicator of minced meat, the figure 5 is showing that the optimal parameters to get to the time from 16 to 19 min. and the frequency 18 - 20 kHz. In this interval, it reaches a maximum difference at 15%. The WBC and the stability of emulsion is an important for the yield, and as well the effect of ultrasound to shows the growth of these indicators, the result is appropriate.

Analyzing the surface response, to shows the rise the ultrasound frequency to leads to a decrease the CSS. Perhaps the optimal range is dominated by the hydrolysis of collagen fibers of muscle tissue, the meat becomes more tender and soft.

The degree of penetration is characterized by the consistency of the end product. It is significant the maximum the degree of penetration to get to the time 13 to 20 min. and the frequency 16 to 23 kHz. In this range the degree of penetration has the largest difference -9 mm. Perhaps a boiling to led to form more dense gels minced due to change the conformation of molecules.

SPECULATION

Studies the effect of ultrasonic on the functional, technological, structural, and mechanical properties of minced model systems to giving positive results. The optimum parameters of ultrasonic treatment to get to the time 16-19 minutes and the frequency of 18-20 kHz. In this range, the growth of water-binding capacity (from 78.6 to 93.4%) yield of end products (from 117 to 139% by weight of raw materials), the stability of emulsion (with 11.5 to 50%). Decreased critical shear stress (563 to 302) and the degree of penetration (from 9.7 to 1.4 mm).

CONCLUSION

Summarizing this section, we can conclude the feasibility of using an ultrasonic acoustic field in the production of rational meat products with milk protein-carbohydrate concentrates. It was found that ultrasonic treatment to facilitate the growth of functional and technological properties and reduces microbial contamination compared to products made of raw meat with a salting stage.

REFERENCES

[1] Olga Evgenyevna Zheleznikova*, and Svetlana Anatolyevna Amelkina. Res J Pharm Biol Chem Sci 2015; 6(2):94-100.
[2] Vladimir Vsevolodovich Sadovoy, Sergei Nikolayevich Shlykov, Ruslan Saferbegovich Omarov, and Tatiana Viktorovna Shchedrina. Res J Pharm Biol Chem Sci 2014;5(5):1530-1537.
[3] Omarov RS et al. Food Industry 2011;12:56-57.
[4] Murcia M, et al. J Agr Food Chem 2004;52:1872–1881.
[5] Vladimir Ivanovich Trukhachev, Vladimir Vsevolodovich Sadovoy, Sergei Nikolayevich Shlykov, and Ruslan Saferbegovich Omarov. Res J Pharm Biol Chem Sci 2015;6(2):1347-1352.