USE OF UNCONVENTIONAL PRODUCTS OF RICE MEAL PROCESSING IN SAUSAGES PRODUCTION

A.B.Lisitsyn, L.S.Kudryashov, L.I.Lebedeva, I.G.Voitova
V.M.Gorbatov All-Russian meat research institute, Moscow, Russia

Background

A large range of vegetable ingredients, that appeared in recent time on Russian market, allows to use them purposefully and effectively for development of new recipes of meat products meeting the requirements of high quality foods. A possibility of use of cereals, subjected to different methods of modification, in meat products, is especially important because they have high food value and functional-technological properties. These cultures, being a source of food fibers (FF) largely help increase resistance of a human organism to unfavorable conditions of the environment. The grain contains almost all the main substances required for normal life of a human. Rice is one of the most popular cereal.

Objective

The objective of the work was to study the possibility of use of rice meal as modified by different methods in production of emulsion sausages.

Objects and methods of investigations

As the objects of investigations were used model samples of cooked sausages, sausage meat, rice meal treated by IR-radiation and rice meal obtained by the method of thermoplastic extrusion. Sample 1 – control; samples 2,3 and 4 – with the addition of IR- treated rice meal at 3,6 and 9%, respectively; samples 5,6 and 7 – with the addition of rice meal, obtained by the method thermoplastic extrusion at 3,6 and 9%, respectively (See Table).

Functional and technological properties of the sausage meat, yield and quality of sausages by their chemical composition, structural-mechanical properties and color characteristics were determined. Water-binding capacity was determined by press method according to Grau R. and Hamm R, as modified by Volovinskaya V.M. and Kelman B.Ya., the mass fraction of fat – by method of Soxhlet, protein – by the method of Kjeldahl. The study of the shear properties of the ground meat (effective viscosity and shear stress) were determined on rotary viscosimeter "Rheotest-2 " providing the change in shear stress in the range 0.1667 to 145.8 s^{-1} according to accepted procedure. pH level was measured by potentiometric method.

Results and discussion

The change in water content and water-binding capacity of the model of sausage meats depends upon the amount of the rice meal added and the method of its treatment. Results of the experiments suggest that with the increase of the amount of rice meal in the recipe of sausage meat, the quantity of water is decreased and the moisture-binding capacity of experimental sausage meat increases, as compared to the control one. Thus, in sample I the mass fraction of moisture was 72.8%, moisture-binding capacity – 89.64%; in sample 2 – 70.4% and 92.1%; in the sample 3 – 68.8% and 92.19%; in sample 4 – 68.9% and 93.3%; in sample 5 – 70.0% and 96.64%; in sample 6 – 70.4% and 96.85%; and in sample 7 – 68.2% and 97.60%.

The study of rheological characteristics (Fig.1) has shown that the samples of sausage meat, containing rice meal, subjected to IR-treatment, had the highest viscosity. In this case the highest increase of the effective viscosity value was marked in samples, containing 6 and 9% of rice meal, both subjected to IR treatment and thermoplastic extrusion.

It should be noted that the intensive destruction of the structure of the control and experimental samples of sausage meat with rice meal, as treated by thermoplastic extrusion, begins with at shear rate of 2.7 s^{-1} ,and for sausage meat samples with the IR- treated meal - at 4.5 s^{-1} (Fig.2).

It should be emphasized that the intensive destruction of the structure of the control and experimental sausage meat, containing rice meal treated with thermoplastic extrusion begins with the shear stress 2.7 s^{-1} and for samples of ground meat with IR-treated meal proceeds smoother what allows to suggest better stabilizing (structurizing) properties of this meal.

Stabilizing properties of rice meal prevent aggregating of the sausage meat particles and their sedimentation, the particles of meal decrease the surface tension on the particle-medium interface, binding a part of the dispersion medium and forming a hydrate coating around particles. Stability of dispersion system provides increase of resistance to shear stress (deformation).

It can be believed that the starch being in rice meal, plays the role of adsorbent and stabilizer at intensive mechanical treatment of the sausage meat in the process of its fine comminution.

Analysis of results of the investigations of sausage products (See Table) shows that the addition of rice meal of different kinds of treatment to the sausage meat doesn't lead to significant change of protein content in the products.

Table. Chemical composition of sausage products and their structural and mechanical characteristics

Indices	Sample number						
	1	2	3	4	5	6	7
Moisture Content, %	69.4	67.3	70.7	67.9	67.8	66.6	66.1
Protein Content, %	16.5	16.5	16.4	16.4	16.4	16.6	16.8
Fat content, %	9.2	9.0	8.8	9.4	9.1	8.2	8.9
Sodium Chloride Content, %	1.85	1.98	1.85	1.85	1.98	1.85	1.83
Sodium nitrite Content, %	2.52	2.58	2.63	2.66	2.61	2.65	2.70
Yield, %	118.0	120.4	123.1	121.5	120.6	121.3	121.7
Shear stress, kg/m^2	30.33	42.18	33.38	31.03	35.46	36.43	32.41
Shear work, J/m^2	182.03	210.03	208.07	188.44	185.53	167.90	140.41

The largest amount of moisture was found in Sample 3, containing 6% of rice meal treated with IR, and the least – in sample 7, to which was added 9% of rice meal subjected to thermoplastic extrusion.

As far as sodium chloride and sodium nitrite are concerned, all the investigated samples of sausage products practically did not differ from each other and met the requirements in force.

The largest yield of final products was obtained in the experiment 3, which by 4.1% exceeded the control sample. The rest of the samples had a relatively high yield as compared to the control one, but in the samples with 9% of rice meal, obtained by the method of thermoplastic extrusion, there were broth-fat pockets.

The sample, containing no rice meal, had the least shear stress and shear work. Close values of this index were for sample 4, where rice meal subjected to infrared treatment was added at 9%. Sample 2 of sausage products containing 3% of rice meal subjected to infrared treatment had the least strength characteristics.

The comparison of data on the change of pH of experimental and control samples of sausages allowed to make a conclusion, that rice meal doesn't change pH of the environment.

Analysis of color characteristics of sausages in the system CITLab-76 has shown that the incorporation of the rice meal into the recipe of cooked sausages did not have significant influence on the coefficient of lightness L* and yellowness b*. Simultaneously some increase in coefficient of redness a* and saturation S for samples of sausages, containing rice meal, subjected to thermoplastic extrusion was marked.

Results of sensory evaluation of sausages color have shown that the products, into the recipe of which IR-treated rice meal was added, had better preference as compared to sausages, containing rice meal subjected to thermoplastic extrusion.

Based on the data obtained one can make a conclusion that the incorporation of IR-treated rice meal into the sausage meat of cooked sausages stabilizes the structure of the sausage meat, slightly increases the strength properties of final products, doesn't have negative effect on color of the sausage and increases the yield of final products.

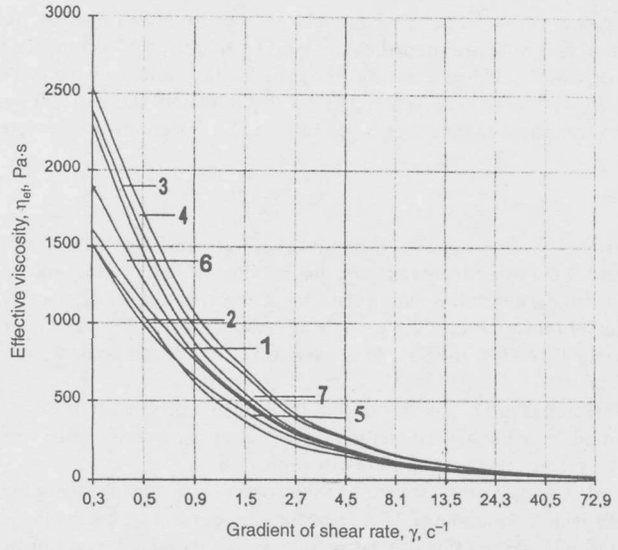

Fig. 1. Dependence of ground meat effective viscosity from gradient of shear rate

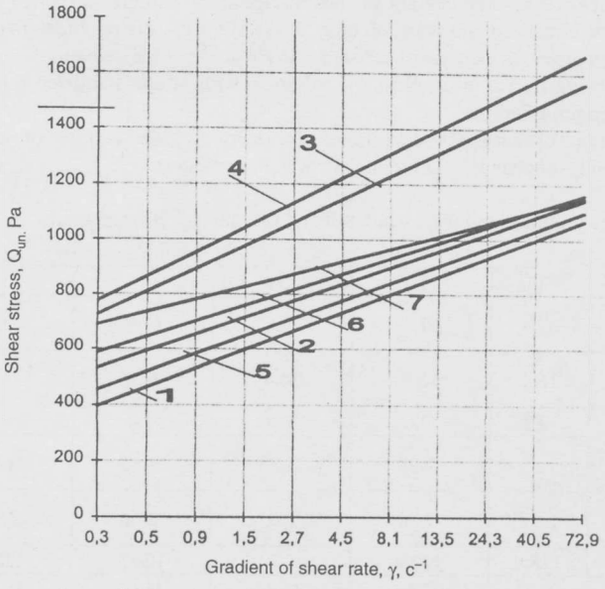

Fig. 2. Dependence of shear stress from gradient of shear rate