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RATIONALE OF CHEESE FILLING TECHNOLOGY FOR THE MEAT INDUSTRY

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Abstract: *Oneof the priority tasks of the food industry is the production of products that are competitive and complete in terms of biological value. In today's market, there is a certain interdependence between different sectors of the food industry. In meat production, a fairly large amount of milk processing products is used. Powdered milk, whey, protein concentrates have long been included in the classic recipes for sausages, sausages and other meat products. The use of ready-made cheeses or cheese fillings in sausage recipes can significantly expand the range and increase the overall nutritional value. When making curd fillers, which will later be introduced into recipes for meat products, it is necessary to take into account a number of factors, in particular, resistance to temperatures, both high during heat treatment and low during storage and freezing.*

The work reflects the development of the technology of cheese fillers for further use in the composition of sausages. Model samples of cheese fillers based on protein concentrates were made using a stabilization system, dyes and flavor mixtures. The main organoleptic and physical-technological indicators of the developed products have been investigated. An instrumental and technological production scheme has been developed, taking into account the minimum production area and equipment of equipment for the direct manufacture of this product at meat processing plants.

The use of the developed mixture for the production of cheese fillers will make it possible to produce a wide range of products in regions with a shortage of traditional raw materials. The production of cheese fillers based on protein concentrates allows at the initial level to control the content of milk protein in the finished product.

Keywords**:** *cheese, cheese fillers, milk, protein concentrates*

INTRODUCTION

Cheese is one of the most ancient foods known to mankind. Each country has specific features of the manufacture and consumption of products produced by the coagulation of milk proteins (Licitra, G., 2010). During the development of world trade, cheeses, which were recently produced and consumed only by residents of certain regions, have closely entered the diet of other peoples and countries. The main product for making cheese is milk from different types of farm animals: cows, goats, sheep (Gobbetti, M., Neviani, E., & Fox P., 2018).

Cheese is often used to make products for various food industries. Used as a filling for bakery and confectionery products, for making sauces and in meat products (Mandl, K., Hartel, R. W., & Wendorff, W., 2009). In addition to classical cheese production technologies, there are options for the manufacture of similar cheese products with milk fat substitutes. Separately, there are technologies for the reconstituted milk components (Lawrence, R. C., Heap, H. A., & Gilles, J., 1984). This is true for regions with a remote source of raw materials and regions with an unsuitable climate for fattening and keeping animals for obtaining raw milk (Paredes-Belmar, G., Lüer-Villagra, A., Marianov, V., Cortés, CE, & Bronfman, A., 2017). The use of mixtures based on reconstituted dairy components for the manufacture of cheese products can significantly increase

the ability to produce cheese with limited or irregular milk supplies for cheese factories (Moiseev, N., Suchkova, E., & Iakovchenko, N., 2017).

In the meat processing industry, there are many sausage recipes using dairy products and structure-forming meat substitutes (Pasichnyi, V. & Yastreba, Yu. 2013). Recipes using cheese as fillings are quite popular and highly appreciated by consumers (Xiang, C., Ruiz-Carrascal, J., Petersen, M. A., & Karlsson, A. H., 2017). In general, we use ready-made cheeses and cheese products made at specialized enterprises. The use of finished products in formulations involves finding an appropriate supplier, logistics costs and risks, and the use of refrigerated storage areas (Fancello, G., Paddeu, D., & Fadda, P., 2017). When choosing or making a cheese product for use in recipes for meat products, its thermal stability is important; using it in recipes for sausages that do not involve reheating, it is important to preserve the cut pattern. Leakage and deformation of the filler during heat treatment should be minimized (Schenkel, P., Samudrala, R., & Hinrichs, J. 2013).

A technological solution is proposed that will allow the production of cheese fillers directly at the meat processing plant. The technology assumes the use of existing equipment at enterprises with minimal retrofitting. It is based on dry milk concentrates and replaceable milk fat. The manufacture of such a product will allow you to control the final quality at the stage of input raw materials. Raw materials do not require special storage and refrigeration equipment (Nasser, S., Moreau, A., Jeantet, R., Hédoux, A., & Delaplace, G., 2017). The introduction of this technology will make it possible to produce the required amount of product for a certain production period with a certain protein-fat balance.

EXPOSITION

After conducting a preliminary study of the heat resistance of cheeses and cheese products on the market, it was concluded that the effect of the protein-fat balance of the product on its resistance to temperatures.

Based on the results of preliminary studies and the analysis carried out, it was revealed that to improve the thermal stability of the product under development, an additional stabilization system is required, which will improve the product's resistance to temperature (Rudiuk, V. & Pasichnyi, V., 2020).

Recipes for cheese filling based on dry milk concentrates are shown in Table 1.

Table 1 Formulations of model samples of mixtures for cheese filling

№	Components of	Content in the recipe, kg		
		Sample 1	Sample 2	Sample 3
1	Water	45	40	50
2	Milk fat substitute	10	15	5
3	Dry whey	20	10	-
4	Micellar casein	15	20	30
5	*FOODGARD® CHEESE	10	15	15
6	**FOODGARD® «CHEESE FLAVOR»	0,8	1,0	1,2
7	Salt	1,5	1,5	1,5
8	Citric acid	-	0,1	0,1
9	Dye "Anato"	0,04	0,04	0,04
Total, kg		102,34	102,64	102,84

*- Complex stabilizing mix

**- The mixture is flavorful

Technological scheme of cheese filling production, introduced in Fig. 1

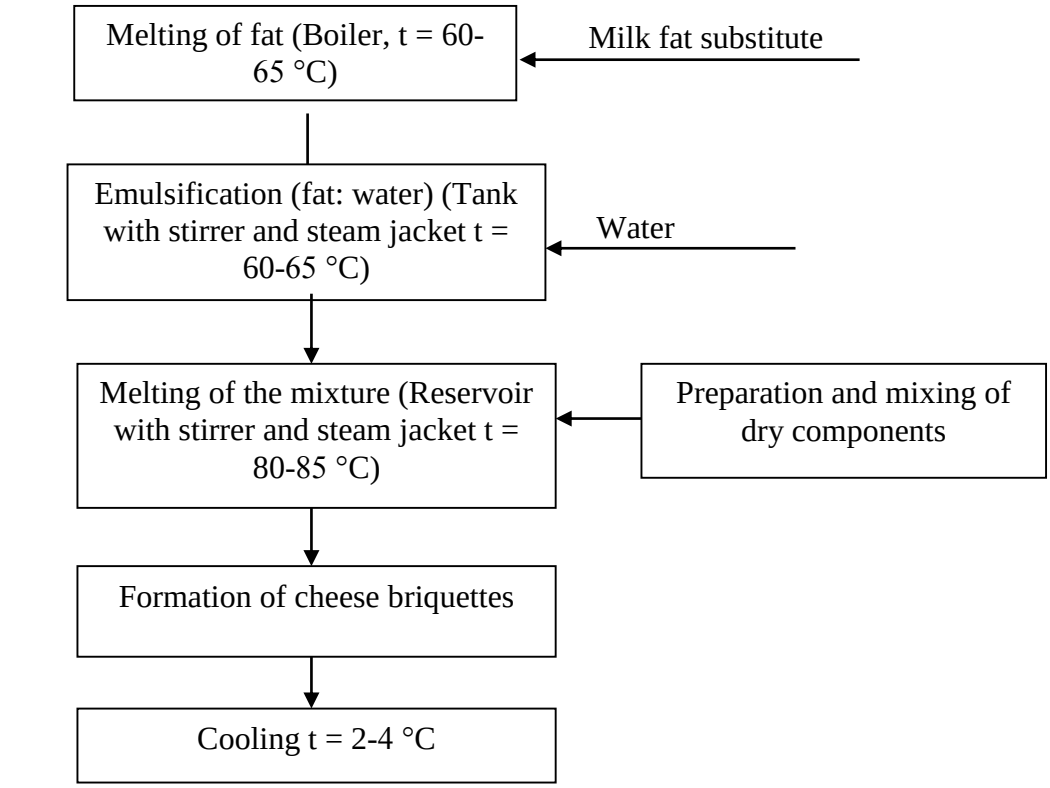

Fig. 1 Technological scheme of cheese filling

The process of making a cheese filling (after weighing the ingredients) begins in the boiler melter (I), in which a substitute for milk fat is introduced and melts (t = 60-65 °C).

The molten fat is transferred to a tank with a stirrer and a steam jacket (III), part of the water is added to the fat, the mixture is heated with constant stirring. Bulk components are introduced into the mixer (II) and mixed with each other. The mixture of dry components is fed to the tank (III) and with constant stirring with water and fat, the temperature is brought to 85 °C, with a holding time of 5-7 minutes. The finished melted cheese mixture is poured into molds and sent for cooling.

The hardware-technological scheme of cheese filling production is shown in Fig. 2

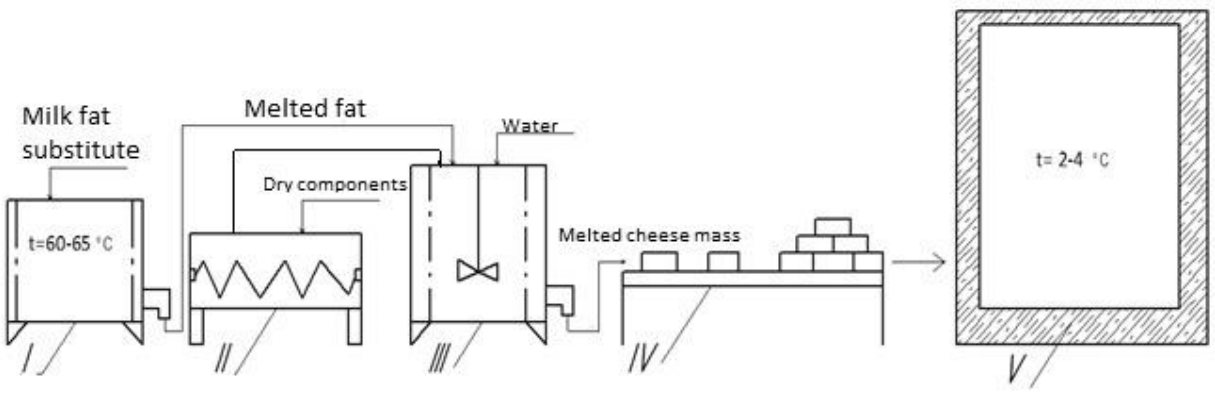

Fig. 2 Apparatus-technological scheme of cheese filling
I - Boiler , II - Mixer for dry components, III - Tank with steam circuit and stirrer, IV - Forming table, V- Refrigerator

The model samples were made in the laboratory using a Thermomix TM6 thermal cutter. A milk fat substitute was added to the cutter bowl and melted at 60 °C. Parts of water were added to the melted fat and stirred at high knife speeds. Strong components, dye and the rest of the water were added to the prepared mixture (water: fat). With constant operation of the stirrer, the

temperature in the circuit was raised, reached 85 °C in the product. Exposure was performed for 5 minutes Before forming the pH of the mixture was 5.9 to 6.0. At higher values, the pH is balanced by a solution of citric acid. The molten mixture was poured into a mold. After complete fixation, the product was ready for use. The process of preparation of raw materials and preparation of cheese product is shown in Fig 3.

1 **2** **3** **4**

Fig. 3 The process of cheese filling in the laboratory

1 - Melted milk fat substitute, 2 - Introduction of dry components, 3 - Partial melting of the cheese mass, 4 - The product is ready for molding

The finished melted cheese mass was poured into molds aimed at solidification for 6-8 hours at a temperature of 2-4 ºC.

The finished product is shown in Fig. 4

Fig. 4 Visualization of the finished cheese filling after cooling.

A preliminary visual assessment of the product was performed. According to the appearance, color, consistency, the presence of cells (formed during molding, and its own classic bulk rennet cheese), we can conclude that the product is made, visually on the classic rennet cheese or cheese product.

Sensory evaluation and research of technological and functional indicators of model samples were carried out.

Sensory evaluation was performed on a 5-point scale, taking into account such indicators as taste, odor, appearance, consistency.

The results of sensory analysis are shown in Fig. 5.

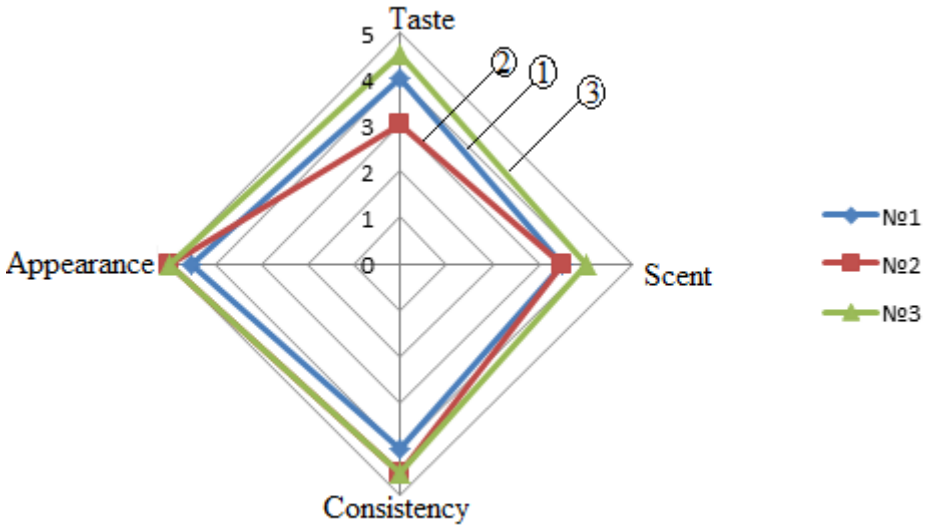

Fig. 5 Schedule of sensory evaluation

Sensory evaluation, it is understood that samples №2 and №3 in consistency and appearance, have an advantage over sample №1. Sample №3 (with more flavor and aroma mixture) has the best score in terms of taste and smell. From the data of organoleptic evaluation, it can be concluded that the formulation №2 is more balanced in consistency and appearance, but to improve the taste, you need to make more flavor mixture.

Functional - technological indicators of cheese products are given in Table 2.

Table 2 Functional and technological properties samples after cooling

№	Indexes	pH	Moisture content,%	The fat content in the dry residue., %	Plasticity, g/см²	Moisture binding ability,%
1	Sample №1	6,5	47,2±0,12	19,3±0,05	14,4±0,04	94,5±0,2
2	Sample №2	6,0	42,1±0,12	23,4±0,04	15,8±0,04	98,1±0,3
3	Sample №3	5,9	51,9±0,12	11,2±0,03	16,1±0,04	97,6±0,2

From the data of table №2, it is seen that the manufactured products have good moisture binding ability indicators, there is no visible separation of moisture, the product is stable and homogeneous. As the amount of moisture increases, the plasticity of the product increases. The fat content depends on the amount of milk introduced, in №2 it is optimal, and has a good effect on organoleptic properties.

An experiment on the effect of temperature on experimental samples was performed. Samples of cubic shape (size 15*15*15mm) were placed in a thermal chamber at an initial temperature of 70 °C (temperature of readiness of sausages), every 3 min the temperature in the chamber was increased by 5 °C. When the temperature reached 85 °C, the experiment was completed. The product remained in its original form, melting did not occur. These data give an understanding of the fundamental difference between the manufactured cheese product and the cheese products presented on the market. Such high heat resistance will allow to use this product in recipes of meat products, with preservation of the initial form of the entered product, without visible deformation at thermal processing.

CONCLUSIONS

The technology of thermostable sulfur filler on the basis of dry milk concentrates, for the further use in recipes of half-smoked sausages is developed.

It is experimentally possible to manufacture a thermostable whey filler according to the developed technological scheme and set in the new technological modes.

The developed cheese fillings have rather high organoleptic and technological properties, and they can be used as the main raw material for the production of meat and meat-containing sausages.

Further research will be aimed at determining the possibility of increasing the biological value of sausages using these types of cheese fillings.

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