PREPARATION FROM SKINS OF STEAM PIGS TO PUT INTO THE PRODUCTION OF SAUSAGES

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ABSTRACT

A preparation from skins of steam pigs to put into the production of sausages and a production technology, has been developed. The influence of the factors : concentration of table-salt in skins salting brine, and the ratio of skins:flaky ice, in cutting - upon the indices : preparation stability regarding its ability to hold water, particles diameter and table-salt content in the preparation.

By means of a complete factor experiment with two factors (cutting time and concentration of sodium tripoliphosphate) on two levels, adequate mathematical models have been determined describing the ability of the preparation to hold water, and obtained so far, the mixture's cutting conditions have been optimized as regards its stability.

The general physical and chemical composition and the microbiological condition of the preparation have been determined.

INTRODUCTION

The Bulgarian meat industry annually produces about 500 tons of steam pigs skins which are not processed according to their purpose. In that way, economic, refrigeration, transport and other losses can be seen.

Some authors think (4,5) that when a right selection of protein-containing raw materials has been made, the meat products can contain up to 30 % of colagen from the total protein composition without decreasing significantly biological efficiency of the protein system. The purpose of this study is to investigate the possibilities for development of steam pigs skins preparation to be put into the production of sausages and meat cans from chopped meat and to work out a technological diagramme for its production.

MATERIALS AND METHODS

The investigations were carried out by using steam pigs skins, defatted, cooled down or frozen preliminarily. The skins were washed thrice under a shower and salted accoeding to the wet method by using 10, 12, and 14 % salt solution for 24 to 48 h, at a temperature of 0°C to 4°C.

After salting the skins should be drained away for 10 - 15 min and cut for 7 min in a cutter, with 8 cutting knives, at cutting shaft rotation speed of 1400 min^{-1} and cutter cup revolutions of 15 min^{-1}. During this process of cutting flaky ice should be added to the skins at a ratio of 2:1, 1:1, and 1:2, and 0,5 % o- sodium tripoliphosphate. The end temperature of the cutting preparation should be +14°C max.

By means of single-factor disperse analys-s, the influence of the following factors was determined : table-salt concentration in the brine and the ratio of the skins to flaky ice in the preparation production in the cutter, upon the rate of skins cutting, the content of sodium chloride in them, and the preparation stability as regards liquid phase delay.

In order to establish an optimum preparation stability, we carried out a complete factor experiment with two factors (cutting time and concentration of sodium tripoliphosphate), on two levels.

x_1 - cutting time, min;

x_2 - concentration of sodium tripoliphosphate, %.

Centre of the Plan	Levels of Factors		Interval of Variation
x_1^o = 7 min	x_1^- = 5 min	x_1^+ = 9 min	1 = 2 min
x_2 = 0,25 %	x_2^- = 0 %	x_2^+ = 0,5 %	2 = 0,25 %

The ratio skins to flaky ice during the cutting was 1:1.
Preparation stability was determined by centrofugation, after the method of Kozin, modified after Hutton & Campbell (2). For that purpose, we centrofugated a 4 g sample in a laboratory type centrofuge "Janetzki T 23", at 3000 min^{-1}.
We studied the preparation produced in order to determine the following indices :
- sodium chloride content - after the method of Auel (3);
- mean diameter of skins particles was measured by means of a caliper-gauge. We carried out 21 measurements and the results were averaged;
- water content of the preparation - by means of samples drying to a constant weight, at a temperature of 105°C;
- protein content - after the method of Kieldahl, and the fat content of the samples, by means of fats extraction by diethyl ether in the Soxllett apparatus;
- ash content - by means of samples mineralization in a muffle;
- microbiological conditions of the preparation was determined after standard methods by establishing the following indices : microbial number, colititre, presence of conditionally pathogenic organisms, presence of bacteria of sp.Salmonella and sp.Proteus, and also of molds.
The results obtained were worked out after the methods of mathematical statistics (1), at 7 repetitions of the experiments, with the exception of the experiments for the mean diameter measurements of skins particles in the mixture.

RESULTS AND DISCUSSION

The single-factor experiments results regarding the sodium content in the preparation at different ratios of skins and ice and at a different brine concentration for salting are presented on Fig.1, while those regarding the changes in skins particles mean diameter in the preparation depending on the ratio skins to ice and the brine salt content for salting - Fig. 2.
The content of rable-salt in the finished preparation increases, with the increase of skins quantity in the mixture, and with the salting solution concentration, as well (Fig.1). In all samples studied, the table-salt quantity does not surpass 2 %. This shows that in the preparation utilization in the form of an additive, in the production of sausages, the table-salt quantity would remain in the necessary required rates of 2,5 % max.
The average particled diameter in skins preparation from steam pigs varies from 10 to 31 mm different skins to flaky ice ratios (Fig.2). Statistically significant differences in particles diameter ($p \quad 0,01$) were not detected in the three investigated concentrations of table-salt in brine, for the ratios of skins to flaky ice - 2:1 and 1:1. At the same time, the mean diameter of the particles from skins in the preparation produced at a ratio of skins to flaky ice, equal to 1:2, is authentically greater than that produced at the other two ratios (2:1, 1:1). This effect is probably due to the better conditions of mixtures cutting at a greater viscosity (ratios of skins to flaky ice, equal to 2:1, 1:1), because of the lower water cont of the latter.
In the concentrations used by us, brine concentration for salting, it was determined that th preparation stability increases by decreasing the quantity of the flaky ice utilized (Fig.3). The least quantity of liquid phase was separated as regards skins to flaky ice ratio, equal 2:1, while the greatest - at skins to flaky ice ratio, equal to 1:2.
The quantity of the liquid phase separated varies at about 15 weight percents.
At skins to flaky ice ratio 2:1, the preparation stability salted with 12 to 14 % salt solutions, is an authentically smaller than that of the preparation prepared from skins salted with 10 % solution. At a ratio of 1:2 the most suitable turned to be the mixture containing skins salted with 12 % of salt solution.
The smallest mean diameter of the particles in the preparation was determined at a ratio of skins to flaky ice equal to 1:1. At the same ratio, the preparation stability does not depend on the concentration of table-salt in the brine, while at a ratio of 1:2, with the increase of the salt solution concentration, the stability of the preparation increases, as well.

Consequently, the most suitable thing is to apply wet salting of skins, at a salt solution concentration of 12 % and at a ratio of skins to flaky ice, equal to 1:1 in the cutter.

On the basis of the complete factor experiment carried out with two factors (x_1 - cutting time and x_2 - concentration of sodium tripoliphosphate), at two levels, adequate mathematical models were determined describing preparation stability change (Y - the quantity of liquid phase separated during centrofugation, weight percent), depending on the factors investigated, in 0 and 7 days of storage, at a temperature of 0 to +4°C. On the 0-th day :

$$Y = 34,45 - 4,63.X_1 - 1,78.X_2 + 1,57.X_1.X_2$$

On the 7-th day from the refrigeration storage :

$$Y = 17,44 - 3,84.X_1.$$

From the models presented so far, it becomes clear that immediately after the production, the preparation stability is directly proportionally influenced by both factors investigated. After 7 days of storage, at a temperature from 0 to +4°C, factor X_2 - concentration of the sodium tripoliphosphate (weight %) does not have any influence on preparation stability in the investigated by us range (0 to 0,5 %).

On the basis of the results obtained, the conditions of the mixtures cutting were optimized, as regards its stability (Fig. 4). Fig. 4 presents the change in the preparation stability after its production, depending on both factors investigated.

The preparation from steam pigs skins possesses the best stability at a ratio of skins to flaky ice, equal to 1:1, after cutting in the course of 9 min in the cutter, in the presence of sodium tripoliphosphate of 0,5 % (Fig. 4).

The results from the microbiological investigations of the preparation during its storage up to 7 days in refrigeration conditions (0 to +4°C) are presented on Table 1.

By increasing the storage life, the number of coliforms is increased, and the total number of microorganisms, as well, proteus bacteria and molds were determined. The analysis from the results obtained shows that the steam pigs skins preparation can be stired for 4 days max. at refrigeration conditions (temperature 0 to +4°C), without influence on its microbiological state.

Table 2 presents the results as regards the total physical and chemical composition of the preparation.

On the basis of the results obtained and their analysis, a technological diagramme for the production of steam pigs preparation was developed (Fig. 5).

Table 1. Microbial State of Steam Pigs Skins Preparation on the 4-th and 7-th Day of Its Refrigeration Storage at a Temperature of 0 to +4°C.

Index	Duration, days	
	4	7
Microbial number	$55,10^4$	10^5
Colititre	0.01	0.001
Salmonella	not found	not found
Proteus	not found	found
Molds	not isolated	not isolated

Table 2. Physical and Chemical Composition of Steam Pigs Skins Preparation

Index	Confidence intervals
Water contents, % of the total mass	67,6373 = 75,0060 = 82,3747
Dry matter, % of the total mass	17,6200 = 24,9940 = 32,3680
Total protein, % of the total mass	9,2090 = 11,3560 = 13,5030
Fat content, % of the dry matter	11,2428 = 33,8400 = 56,4372
Fat content, % of the total mass	1,9236 = 6,9400 = 11,9564
Ash content, % of the total mass	1,8291 = 2,0250 = 2.2209
Table-salt, % of the total mass	2,1518 = 2,3938 = 2,6358

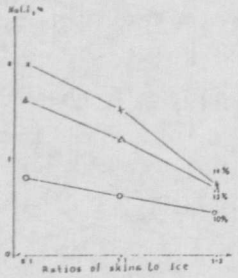


FIG. 1. Table-salt content in the preparation at different ratios of skins to ice and brine concentrations.

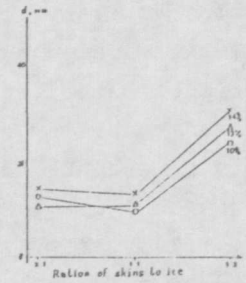


FIG. 2. Change of the mean diameter of the preparation particles, depending on the brine concentration and the ratio of skins to ice.

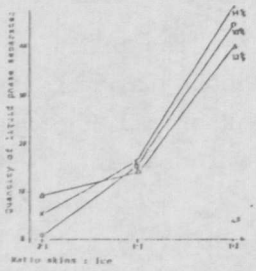


FIG. 3. Change of the preparation stability from skins of steam pigs, at a different ratio of skins to flaky ice, salted with salt solutions with concentrations of 10, 12 and 14 %.

- 10 % salt solution
- 12 % salt solution
- 14 % salt solution

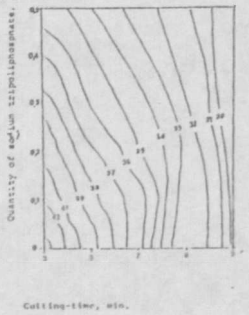
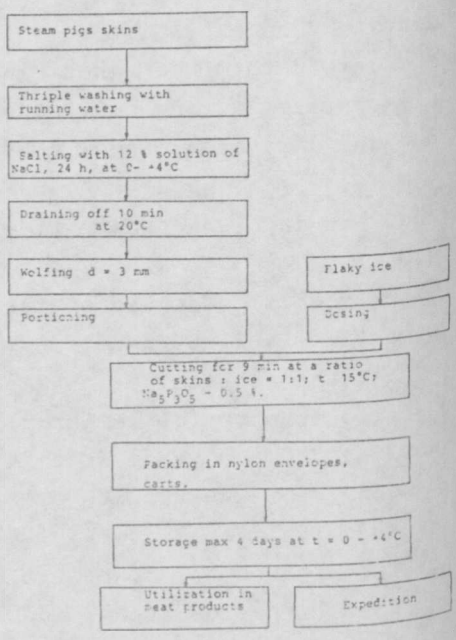


FIG. 4. Graphical expression of the change of stability of the preparation depending on the cutting-time and sodium tripolyphosphate concentration.

FIG. 5. Technological diagram for the production of a preparation from skins of steampigs to put into the production of meat products.



CONCLUSIONS

1. The optimum conditions for salting and cutting of pigs skins have been determined : concentration of salt solution - 12 %, ratio of skins to flaky ice - 1:1.
2. On the basis of the complete factor experiment, the following mathematical model describing the change of preparation stability has been determined :

$$Y = 34,45 - 4,63.X_1 - 1.78.X_2 + 1,57.X_1X_2$$

where : Y = the quantity of the liquid phase separated during centrofugation, %; cutting time, min; X_2 - concentration of sodium tripoliohosphate, %.
3. The preparation produced from steam pigs skins should be stired for 4 days max, at a temperature of 0 to +4°C.
4. On the basis of the investigations carried out a technological diagram for the production of the preparation has been developed.

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