THE USE OF PHYSICAL EFFECT METHODS FOR SALT CURING OF HORSEFLESH

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Introduction

Traditional technology of manufacturing salted products of horseflesh is characterized by large duration and labour costs. It makes impossible to get the product with high enough organoleptic indices. The finished products are distinguished by toughness inadequate juiciness and low output (7). On the other hand it is caused by the large amount of intramuscular connective tissue in horseflesh. In order to intensify and improve the technology of manufacturing salted meat products at present much attention is paid to the problems connected with the use of new physico-chemical and other effect methods making it possible to get the products with high quality indices and output at the same time reducing the process duration (6). Numerous investigations have proved the expediency of the use of electrical effect on fresh-killed injected with curing brine half carcasses of butchers for accelerating ageing injected-electrical massaging (EM). For this the energy of muscles contraction and relaxation under the action of electric current was used to redistribute the brine in muscles tissue (Bolshakov A.S. and Madagajev T.A., 1983). It was also determined that the mechanical treatment (MT) in cyclic conditions contributes to the more complete distribution of salting substances in meat and increasing flavour and aroma formation. The output and the quality of finished products were also improved (Bolshakov A.S. and Uzhakhova M.K., 1984). EM and further MT effects on the qualitative indices of salted meat products have also been

investigated. A number of researchers have used MT with administration of different flavour additives, vegetable proteins and vacuum-mechanical treatment (3, 4, 2, 1). Researchers from PPR have studied the influence of electric stimulation with constant electric current on horseflesh properties. They have determined that electric stimulation influences the tenderness, color and flavour of horseflesh (5). During the manufacture of salted meat products of fresh-killed meat cuts it is possible to stabilize meat properties using brine injecting that ensures macrodistribution of salting substances. For their further redistribution EM and subsequent MT may be used. Electric stimulation of fresh-killed half-carcasses muscles causes mechanical pulsating resulting in filtrational transfer of salting substances. After boning salted cuts were subjected to additional MT in cyclic conditions.

Materials and methods

The object of this work was longissimus dorsi of horses of average fattiness taken during an hour after slaughtering. The muscle of the 1st half carcass was used as the check sample and that of the 2nd half carcass was used as the experimental one. Experimental and check muscles in the fresh-killed state were injected with brine containing 18% of NaCl, 2.5% of sugar, 0.05% of sodium nitrite. The ratio was 15% of the total mass of raw material. Then experimental samples were subjected to the impulse electric current fed in impulses with frequency of 50 cps and voltage of 220 V. The duration of impulses was 0.5 s, the interval between impulses was 0.5 s, the total duration of ET was 120-180 s. ET was held till the stop of contraction and relaxation of muscles. Feeding of a.c. was made by means of two separate electrodes put into the upper and lower parts of the muscle. Experimental samples were subjected to MT on the horizontal barrel-type unit in cyclic conditions during 6 hours: rotation - 1 hour, holding in rest - 0.5 hours.

The corner speed of drum rotation was 4.12 rod/s. Loading coefficient was 0.5. Check samples were held at the temperature of 0°- 4°C during 120 h.

While studying salted samples there were determined pH value by the portable instrument "pH-150"; water binding capacity - by the method of Gray and Hamm, the depth of indentor inculation - on the penetrometer PP-3 by means of 4-needle indentor; NaCl content - by the method of Mor, shear stress - by the plunger attachment and shear-press "Cramer" on the general-purpose testing machine "Instron"; microbiological indices - by standard methods; NaCl distribution - by the method of per-layer determination (Bolshakov A.S. and Madagajev F.A., 1983).

Results and Discussion

The data received have shown that as a result of electric current effect, pH value, water binding capacity (WBC), penetration rate and shear stress of experimental samples varied significantly from similar indices of check ones. In experimental samples there was the marked decrease of pH value that was connected with the acceleration of autolytic processes in muscle tissue. Reducing pH value was also observed after stopping EM during first hours of MT. Decreasing WBC of meat after EM results from the change of pH value for isoelectrical point of proteins which accelerates post-mortem rigidity (table 1). The depth of indentor inculation in experimental samples after EM increases as a result of wholeness break of muscle fibres under the action of electric current. However, short-term EM does not provide the complete distribution of salting substances in meat and consequently does not suppress ATF activity of myozin. That is why additional MT of experimental samples was held in cyclic conditions. MT of meat after EM provides further distribution of salting substances due to shock energy. Destructive changes during EM and MT provide the increased penetrability of muscle tissue. The results presented in table 3

show that in the process of MT concentration of NaCl has increased at distances of 2.10^{-2}m and 3.10^{-2} from the place of brine injection. As a result of MT the intensive suppression of glycolysis process by chloride and sodium ions takes place. pH value in experimental samples has been stabilized on a higher level compared to check ones (Table 1). Decreasing WBC continued at the initial stage of MT and then after 4 h of MT its gradual increase was observed. WBC of experimental samples at the beginning of MT was lower due to the decrease of pH value after EM and reducing the number of hydrophyll centres of proteins because of actomyozin complex formation. At the end of MT WBC of experimental samples stabilized on a higher level compared to check ones. During MT of check samples not subjected to EM firming of meat consistency was observed. It was caused by the process of rigidity that is seen from lowering pH value and WBC. Penetration rate was lowered from 21.4×10^{-2}m to 20.7×10^{-2}m. In about 6 h of MT there was no marked reducing of these indices observed. Changes of shear stress and penetration rate are shown in table 2. The data of microbiological studies show that the total microbial seeding of experimental samples is much lower than that of check ones. It was determined that the use of physical effects doesn't influence the qualitative composition of microflora. Thus, the use of electric and mechanical effects significantly influences the character of changes of physico-chemical and structural--mechanical indices, smoothes out the development of autolythic processes and accelerates meat ageing.

Table I.

Control			Experiment		
time of holding, h	pH	W B C	duration of treatment MT, h	pH	W B C
0	6,67	70,16	1,5	6,45	70,5
24	6,45	67,10	3	6,31	70,1
48	6,24	65,30	4,5	6,21	69,9
96	6,18	64,10	6	6,28	70,3
120	6,12	64,0			

Table 2.

Control			Experiment		
time of holding, h	depth of indentor incylation: 10^{-3} m	shear stress, 10^5 Pa	duration of treatment MT, h	depth of indentor incylation: 10^{-3} m	shear stress, 10^5 Pa
0	20,3	3,5	1,5	21,4	3,3
24	20,0	3,6			
48	19,4	3,7	3	20,7	3,5
72	19,0	3,7	4,5	21,0	3,5
96	19,5	3,6	6	21,8	3,3
120	20,2	3,4			

Salt content in various layers of samples depending on salting conditions. Table 3.

Distance from the place of brine injection 10^{-2} m	Salt content, %				
	check sample		experimental sample		
	after injecting	after holding	after inj-g	after MT	after EM
0	3,01	2,81	3,1	2,64	2,81
1	2,07	2,38	2,11	2,47	2,34
2	1,41	2,12	1,38	2,21	1,63
3	0,58	1,32	0,47	1,87	0,65
	1,77	2,13	1,76	2,29	1,83

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