POSSIBILITIES OF MICROBE-ORIGIN COLLAGENASES USE IN MEAT INDUSTRY

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Background

Rational use of low-grade meat raw materials is very urgent for the meat industry.

One of the perspective trends in solving the above problem is usage of enzyme preparations. Works of Soloviev V.I., Mitsyk V.E., Rogov I.A., Bolshakov A.S., Khorolsky V.V., Boreskov V.G., Kudryashov L.S., Bataeva D.S., Muller H., Blakmore H. and other researchers are devoted to it.

Optimal activity of the majority of enzymes manifests itself at 20-40 °C.

Utilization of enzyme preparations active at low positive temperatures and having primary influence over the connective tissue is very urgent.

The FPM-MP collagenolytic microbe-origin enzyme preparation, whose producer is *Serratia proteamaculans*-94, was jointly developed by specialists from GNU VNIIMP named after V.M. Gorbatov, Institute of Molecular Genetics of RAN and Institute of Biochemistry and Physiology of Microorganisms named after G.K. Skryabin of RAN. The above strain is non-pathogenic, and the enzyme has no toxic effect, is intended to actively affect connective tissue for improvement of quality properties, and is effectively active at 4-18 °C, pH 5.8-6.0. Inactivation of the enzyme being produced by this microorganism takes place at thermal processing regimes (65-70) °C.

Objectives

Study of quality indices (physicochemical, microstructural, microbiological, organoleptic) taking place in low-grade meat raw materials during manufacture of meat products with the usage of collagenolytic microbe-origin enzyme preparation.

Methods

The indices given below were determined according to the standard methods accepted in Russia:

- pH value
- moisture mass share
- fat mass share
- ash mass share
- sodium chloride mass share
- meat moisture-binding capacity
- microstructural investigations
- effective viscosity
- collagen cooking properties
- hydroxyproline content in collagen
- collagenolytic activity
- during microbiological investigations the content of microorganisms, availability of coliform bacteria, sulfite-reducing clostridia, salmonella, pathogenic staphylococcus were studied

Samples of ground beef, grade II, and finished meat product manufactured from it served as an object of investigations

The enzyme preparation was used as an aqueous solution. The aqueous solution of the enzyme preparation was prepared 30-60 minutes before usage. To make it ready, the preparation : water ratio of 1:50 g/ml was used. The preparation was solved in cold water with addition of 1% white salt.

The brine was prepared at a rate of 25% introduction into the raw material. It was prepared as follows: in 25 l of water (per 100 kg of raw material) were consequently solved: phosphates, white salt, ice (water), sodium nitrite, sugar, sodium ascorbinate. Then the enzyme preparation (0.05-0.1%) was introduced, and everything was carefully mixed.

Brine with FPM-MP was injected into the thickness of raw material (into the connective tissue) using a one-needle or multi-needle injector.

After forcing out the raw material was continuously massaged during 10 h at 8 rpm . Both test and control samples were cured in salt at 0-4 °C during 48-72 h.

After curing the raw material was rubbed with spices (garlic, black pepper) and put into metal moulds preliminarily covered with cellophane film to prevent burning of the product. Laurel leaf and sweet pepper were put on their bottom. Then moulds were covered, and the raw material was pressed, after what it was cooked until the temperature in the center of the product reached 76-78 °C.

The finished products were cooled.

Results and Discussion

Investigations of physicochemical properties of meat raw materials using various concentrations of the enzyme preparation resulted in increase of moisture-binding capacity in the process of curing, as compared with the control (without treatment of the enzyme preparation).

Influence of the preparation over the connective tissue was determined by the cooking property of collagen.

Change in the cooking capacity of meat raw material collagen under the action of different concentrations of the microbe-origin collagenolytic enzyme preparation is given in the table below.

Sample	Collagen cooking property , %		
	0 h	48 h	72 h
Control (without enzyme)	10.82	12.16	13.47
Test 1 (0.05 % of enzyme)	10.82	14.55	16.51
Test 2 (0.1 % of enzyme)	10.82	15.22	18.40

Data given in the Table above show that the collagen cooking property index in test samples was 16-27 % higher, as compared to control ones.

Microstructural investigations carried out showed that muscular tissue of the test samples of the final product, as compared to the control ones, kept a higher degree of swelling and was characterized by more expressed destructive changes in the form of multiple microfissures and cross-fissury disturbances of their integrity.

The above physicochemical and microstructural changes in the finished product correspond to higher organoleptic indices (juiciness, consistency) in relation to the control samples.

Microbiological indices of the finished product corresponded to standards for meat products set in Russia.

Conclusions

The findings may serve as a basis for development of modern meat products technologies using microbe-origin collagenolytic enzyme preparation.

References

Zhuravskaya N.K., Alekhina L.T., Otryashenkova L.M. Investigation and control of meat and meat products quality. – M.: Agropromizdat, 1985.- 296 p.

Khvylya S.I., Kuznetsova T.G., Avilov V.V. Histological methods and meat products quality assessment. 43rd ICoMST, New Zealand,1997/-P. 405-407.

Fedonin M.Yu. Development of technology for formed beef products using enzyme preparation. Diss. PhD(tech.).- M.: MGUPB, 2000.

Diaz O., Gonldsworthy A.M., Leaver J. Identification of peptide released from casein muselles by limited trypsinolysis.- J.Agr. Food Chem., 1996, v.44, No. 9, p. 2517-2522.