CREATION OF MECHANICAL PROPERTIES OF FORMED PORK HAM. PHYSICO-CHEMICAL PROCESSES INVOLVED

Irena Tyszkiewicz, Michał Olkiewicz and Andrzej Borys

Meat and Fat Research Institute, 36, Rakowiecka Street, 02-532 Warsaw, Poland

Introduction

Experimental studies on mechanical tenderizing and tumbling of pork meat in relation to product mechanical properties have be carried on for several years. The aim of the study was to find out and explain the mechanism of meat softening and rise of slice strenge caused by the two unit plasticization processes.

Experimental

Samples of tenderized pork meat, taken from ham muscles 48 hours post mortem, were observed under electron microsoft (Tyszkiewicz and Jakubiec-Puka, 1995) and examined for water and brine-holding capacity, protein extractability (Tyszkiewicz et al, ¹⁹⁹⁷ myofibril fragmentation index, proteolytic activity (Drobisz, 1994) and protein fractions pattern (SDS-page electrophoresis). Sticky exult formed in course of tumbling was examined for total protein content, myofibril protein content and myofibril fragmentation index (Olkiewice et al 1995/1996). Cooked sticky exudate used as a model of ham join junction was examined for its rheological properties: yield point elasticity and fluidity. Cooked formed ham as a final product was examined for its shear value and slice strength (Olkiewicz, 1997).

Results

Mechanical tenderization caused sever damage of muscle fibres and of the contractile structure. It was observed under electronic microscope as fractures of myofibrils at the Z-line region, expansion of myofibrils with preserved continuity or with lost connection betwee A- and I-band, total disorganization of the contractile structure (Tyszkiewicz and Jakubiec-Puka, 1995). Swelling of the fibres and separation of myofibrils were also noticed. It was accompanied by the increase of brine-holding capacity of the muscle and rise of the amount extractable proteins (Tyszkiewicz et al, 1997), increase of proteolytic activity of tissue (calpain and B+L cathepsines) and rise of the amount of low-molecular protein fractions. Troponine presence in the muscle extract was an additional marker of Z-line damage (Drobisz, 1994).

Tumbling was mainly responsible for continuous rise of total protein content, myofibril protein content and myofibril fragmentation index of the sticky exudate formed at the surface of meat pieces. The higher myofibril protein content and myofibril fragmentation index in higher the strength of product slice (Olkiewicz and Tyszkiewicz,1995). The strength of slice was closely related to rheological parameters the model join junction of formed ham (Olkiewicz, 1997). The rise of yield point and decrease of elastisicity and fluidity caused by the increase of myofibril protein content and myofibril fragmentation index is the sticky exudate, resulted in higher resistance of ham slice break.

Construction of the model

The proposed model of interrelationships among various physico- and bio-chemical processes responsible for formation mechanical properties of formed pork ham is graphically presented. The two main points are as follows:

- increase of slice strength results from opening of the meat tissue structure and its damage facilitating brine absorption, protein extractive protein solubilization, fragmentation and dispersion of myofibrils in brine and formation of sticky exudate. The exudate under cooline develops a strong join junction characterized by high yield point; all those processes are induced by and developed in course of tumbling
- increase of tenderness (softening) of ham muscles results from tissue damage, enhanced proteolysis due to the rise of proteolytic activity the tissue and proteins swelling caused by brine absorption; those processes, excluding swelling of proteins resulting mainly from tumbling, are caused by mechanical tenderization.
 - Literature

Tyszkiewicz I, Jakubiec-Puka A. (1995) Meat Sci, <u>41</u>, 3, 273-282

Tyszkiewicz I., Kłossowska B.M., Wieczorek U., Jakubiec-Puka A. (1997) J.Sci.Food Agric. 73, 2, 179-185

Olkiewicz M., Tyszkiewicz I., Senik I.(1995/1996) Roczniki IPMiT, 32/33, 171-180

Olkiewicz M., Tyszkiewicz I. (1995) Pork meat tumbling. Binding ability of exudate. XLI ICoMST, San Antonio, paper No D-34 Olkiewicz M. (1997) Roczniki IPMiT, <u>34</u> (in press)

Drobisz D. (1994) Effect of ultrastructure damage on proteolytic activity of pork muscle. XL ICoMST Haga, paper No S-IVB.33

43rd ICOMST 1997



bee

engl

scop

997) udati

ewic

poin

ctra

Wel

ratil

nt (

ation the ers of y the ce to

1 1

ction okint ling ity o fron Model of mechanically induced physico-chemical processes and their qualitative effects in pork meat

magnification 6.2 X. 40 X of light microscope "lendium" with the telecamera "Bood", that were the part of a complex control "Magiscan-2A" (loyce Loeble) Larger components of the ground must were mudied on a macro viewing mustitution. Chi autoropictures were photographed in studying the histographitations under the light microscope "leneval" with a photo extended with the purpose of demonstration of microstructural peculiatities of samples of ground must and final products. The results of foll histographical and morphometric investigations of the samples of annels used must and final products made it possible to the strategized and morphometric investigations of the samples of canned ground must and final products made it possible to the dynamic of strategized in strategized of the samples of canned ground mass and ready products made it possible to the dynamic of structure formation of the samples of grander and colloidal mill, had the best microstructure formation and degree of granding morphometric investigations of the lengther and colloidal mill, had the best microstructure formation and degree the dynamic of structure formation with the help of gradet and colloidal mill, had the best microstructure formation and the ground mass (Fig. 1) with uniformity distributed statch, purples of gradet and colloidal mill, had the best microstructure formation and degree of fat drops), components of the average was 500 nem, and during microscopic really as 255 mm (Fig. 2), with the avthan the standardized 1.5 mm and on the average was 500 nem, and during microscopic really as 255 mm (Fig. 2), with the arthan the standardized 1.5 mm and on the average was 500 nem, and during microscopic really as 555 mm (Fig. 2), with the ardue drops), components of adding confirmed by recological investigations. All that resulted bother between its compoated must components was reached and a dense and rabie microtaric of mineed mest with stable interior bonds between its created which facintared water binding, confirmed by recol

Approximation of the interaction in the hold together with image analysis has clearly shown a microstructure of products and presented in a product and presented in the mathematical products and presented in the mathematical state interaction of history and the could be obtained using the mathematical state of server, or extra bing the communited mean through the dim seconding to approved techniques. 2. Complex application of history and instance and intrage analysis has helped to obtain optimum raflox of structural complex complex, application of history and here are the structural complex application of history and the structural complex in the here the seconding to the best advantage distinguished the developed and integers to those prescribed. Which to the best advantage distinguished the developed regers bit of the incurrence of the mathematical and biological requirements to purce-type ment and vegetable canned the structure of the products from the most foreign by based out, medical and biological requirements to purce-type ment and vegetable canned the structure of the product and formulation were setemifically based and biological requirements to purce-type ment and vegetable canned the structure of the product and formulation were setemifically be and biological requirements to purce-type ment and vegetable canned the structure of the product and formulation were setemifically based and biological requirements to purce-type ment and vegetable canned to the structure of the product and to be the set of t

noscourt bee

• Accommander and analysis of data about microstructural characteristics of the products for child nutrition with the use of comparison analysis allowed to come to forming of qualifative characteristics of the objects of investigations by their morphometric indices.