# MEAT PRODUCTS OF NON-COMMINUTED MEAT WITH NATURAL PROTEIN COATING

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ABSTRACT: A technology for production of specialties from non-comminuted pork with natural protein coating is described. Fine meat emulsion, coagulated in the process of cooking is used. The microstructure of this coating is studied on cooked pork chops. With photo micrographs is demonstrated the fine coating of coagulated muscle proteins, constructing the coating. There is shown also the location of the coating on the cooked chops surface. The comparative investigations are carried out regarding the oxygen peroxide and malonaldehyde level in cooked pork loins with and without above mentioned natural protein coating in the process of storage at 4°C to 6°C on second, 15th and 23d days. The results are statistically significant and are presented graphically. On the base of the conducted investigations a protective action of the protein coating is established regarding the fat oxidation in the cooked specialties from non-comminuted pork during storage.

INTRODUCTION: During storage of meat products, the oxidative processes are carried out in fats, leading to the appearence of peroxides, aldehydes, ketones, lowmolecular acids, oxiacids etc. As a result fats reduce their nutrition value and become toxic. When the meat is cured, the rancidity stability increases, but at the same time fats become more susceptible to oxidation /Zajas, 1981/. The same author indicates that the main factors for the fat susceptability to oxidation are: the fat composition, in particular - the level of unsaturated fat acids; catalysts level; the partial oxygen pressure, surfaces that are in contact with the oxygen; the storage conditions - temperature, light and moisture. The oxidation development is inhibited when are used any type of packages, decreasing the fat contacts with the air oxygen. Many authors /Bliznakova et al., 1987, Iochle, 1984;.Bartels, 1973/ recommend the use of coatings for the meat products, but from synthetic materials, monoglycerides and saturated fat acids, which is received with reservations from the consumers and do not improve the product appearence. One of the main functions of these coatings is to retain the oxidative processes in fats of meat products. Velinov et al.,/1985/ itensify the curing of heated trimmed from fat and sinew pork specialties by the process of tumbling. When such a treatment is used, on the meat surface appears a fine coating of small quantity salt soluble myofibrillar proteins, coagulated in the form of thin dark red natural coating /till 1-2 mm/ during the process of cooking. This natural protein coating has a number of advantages: stable red colour of the product, Higher yield, protection from air contact, drying and contamination. In order to carry out this treatment expensive specialized equipments are necessary /massarators or tumblers/, orientated mainly at ham production, that restricts within narrow limits the possibility of their use. Velinov et al. /1987/ use an

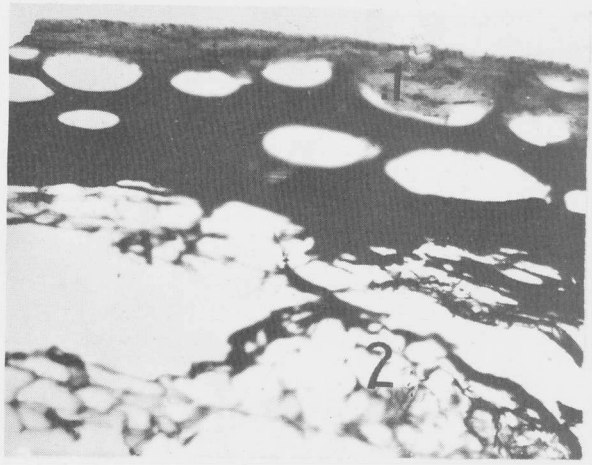
accessible method for receiving similar protein coating on the surfaces of specialties from non-comminuted pork without the use of specialized equipments. The objective of the present study is to investigate the protective action of the coating against the fat oxidation of heated specialties from non-comminuted meat.

MATERIALS AND METHODS: In order to create natural protein coating, we grind lean pork through 2 mm plate, then cured the pork in 1:0,5 ratio with the following salt solution: 96 l water, 3,6 kg salt, 0,6 kg sugar, 0,2 kg sodium tripolyphosphate and 0,01 kg sodium nitrite. So cured meat remained 24 h at 4°C to 6°C, after that we regrinded the meat by cutter with addition of double quantity of ice till receiving of meat emulsion. For the purpose of studying the properties of the natural protein coating, we separated, trimmed and stamped pairs of right and left outer loins from 6 pork carcasses with pH - 6,1 to 6,3 at 45 min, measured in m. Longissimus dorsi. Then we cured the trimmed and stamped meat raw material by muscle injection of 10% salt solution with density 16° according to Bohme /100 l water, 20,5 kg salt, 0,5 kg sugar, 0,2 kg sodium nitrate and 0,1 kg sodium nitrite/. After pumping we immersed the loins into salt solution with density 14° according to Bohme /100 l water, 17,3 kg salt, 0,5 kg sugar, 0,1 kg sodium nitrate, 0,05 kg sodium nitrite/ in 1:1 ratio for 48 to 72 h. The cured loins were suspended to drain away during 10 h. The loins from the left pork sides were immersed into fresh prepared meat emulsion till their complete immersion and immediately were placed to dry in warm to 75°C vapour-boiled cabin Reich. In the same cabin we placed also the right cured loins but without coating /control samples/. After 25 min drying we smoked and heated the loins at 95°C till receiving a compact elastic red cover on the loin surface and internal temperature 72°C. Then we chilled the loins in chillers at 4°C to 6°C for 10 to 12 h. From the surface of the loins with coating we took material for microstructure examination in the form of cubes /0,5x0,5x 0,5 sm/. We freezed the cubes in isopentan, cooled in liquid nitrogen to -196°C. Then fixed with 10% formalin and coloured with Ponseau S slices thick 10 μm, prepared on cryostat Minotome and firmed on cover glasses. The coloured preparations we observed and photographed on microscope Docuval-Karl Zeis. We carried out the investigation of fat oxidation during the loin storage on second, fifteenth and twentythird days of storage in chillers of the products at 4°C to 6°C. For this purpose we determined the variation of peroxide and thiobarbituric number according to Pearson /1975/. The peroxide number characterizes the peroxide oxygen level in fats. The thiobarbituric number is an index of malonaldehyde level in fats, as a residue from fat oxidation. The results from the investigations were variational statistically framed also by two-factor analysis according to Bozhanov and Vuchkov /1983/ and Scheffe /1959/.

RESULTS AND DISCUSSION: On fig. 1 is represented the surface layer of heated pork loins with natural protein coating. The meat emulsion of cured lean pork is coagulated

in the process of cooking and is transformed into compact protein coating. There is observed very thick zone of smoking, where the fat globules are disposed, received at the emulsifying of the material for the protein coating. The compact and homogeneous structure of the natural protein coating contributes to isolating of the liable fat tissue from the air oxygen and light irradiation, thus the oxidative process in fats is delayed during the storage of the studied meat products.

Fig. 1. Microstructure of the surface layer of heated pork loin with natural protein coating. Protein coating /1/. Liable fat tissue /2/. Microscope enlargement x 25. Photographic enlargement.




The variation of the peroxide number in miliequivalents active oxygen per 1 kg product during the loin storage with and without natural protein coating, is shown on fig. 2 and table 1. On the second day of the storage, almost similar quantity active oxygen in the two types of the product was established. On the fifteenth day the peroxide number in the loins without coating was increased and continue to increase till twentythird day, with 25,5% more than the quantity on the second day. The same index in the loins with protein coating decreased on the fifteenth day with 11,7%, after that it retained nearly at the same level till twentythird day. The two-factor analysis showed expressed influence of the factor "protein coating" on the peroxide number level: F calculated /15,5607/ > F critical /7,56/ and joined influence of the two factors - "protein coating" and "storage time": F calculated /8,1875/ >F critical /5,39/; the factor "storage time" had not influence on this index: F calculated /0,3661/ < F critical /5,39/. We determined F critical by the distribution table according to Fisher at significance level /$\alpha$/ = 0,99. On fig. 3 and table 2 the malonaldehyde level is shown in the loins with and without natural protein coating during the process of storage. On the second day aproximately equal quantity malonaldehyde is observed, that increased weakly on the fifteenth day, but more in loins without coating - 12,5% than in loins with coating - 5,5%. On the twentythird day is observed dramatical increasing of malonaldehyde level in loins without coating with 100%, than in loins with coating - 13,9%.

Table 1.- Variation of the peroxide number during the process of storage of heated pork loins with and without natural protein coating

n = 6

| Product under examination | Days of storage | mequiv/kg | The coefficient of variation % |
|---|---|---|---|
| Heated pork loin without natural protein coating | 2 | 3.41±0.16 | 11.18 |
| | 15 | 3.78±0.19 | 12.19 |
| | 23 | 4.28±0.08 | 3.78 |
| Heated pork loin with natural protein coating | 2 | 3.57±0.36 | 24.70 |
| | 15 | 3.15±0.04 | 3.01 |
| | 23 | 3.08±0.04 | 2.69 |

Fig. 2

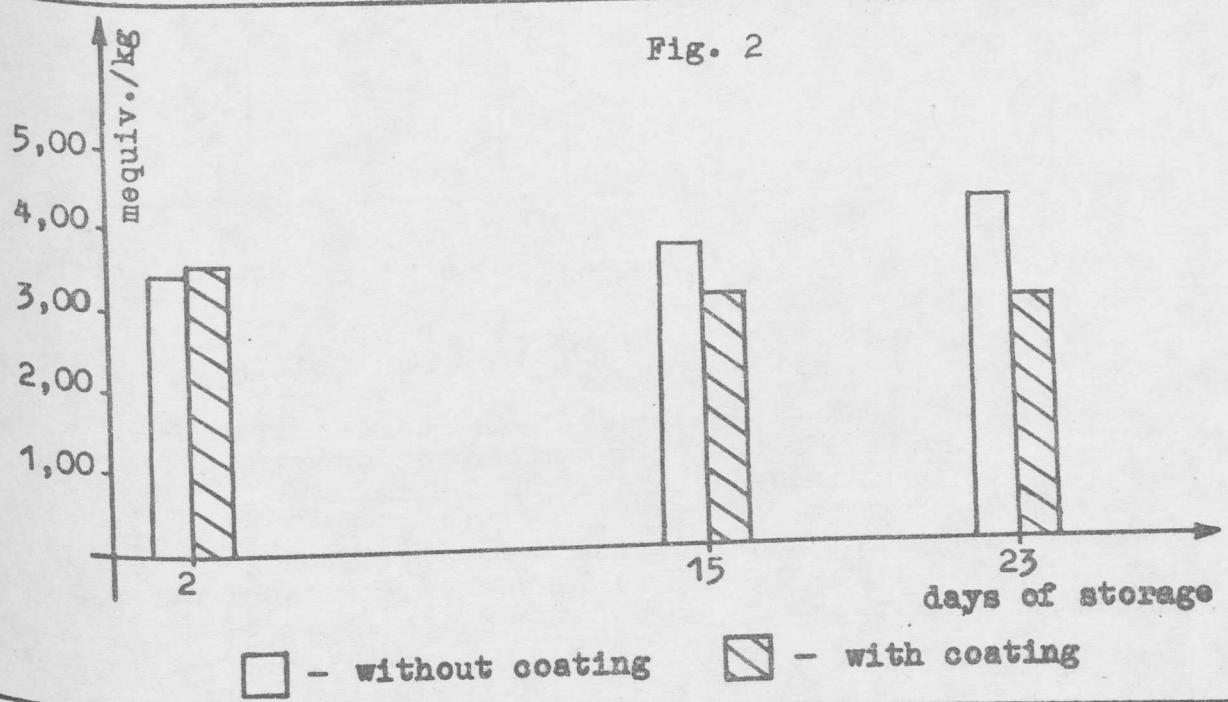
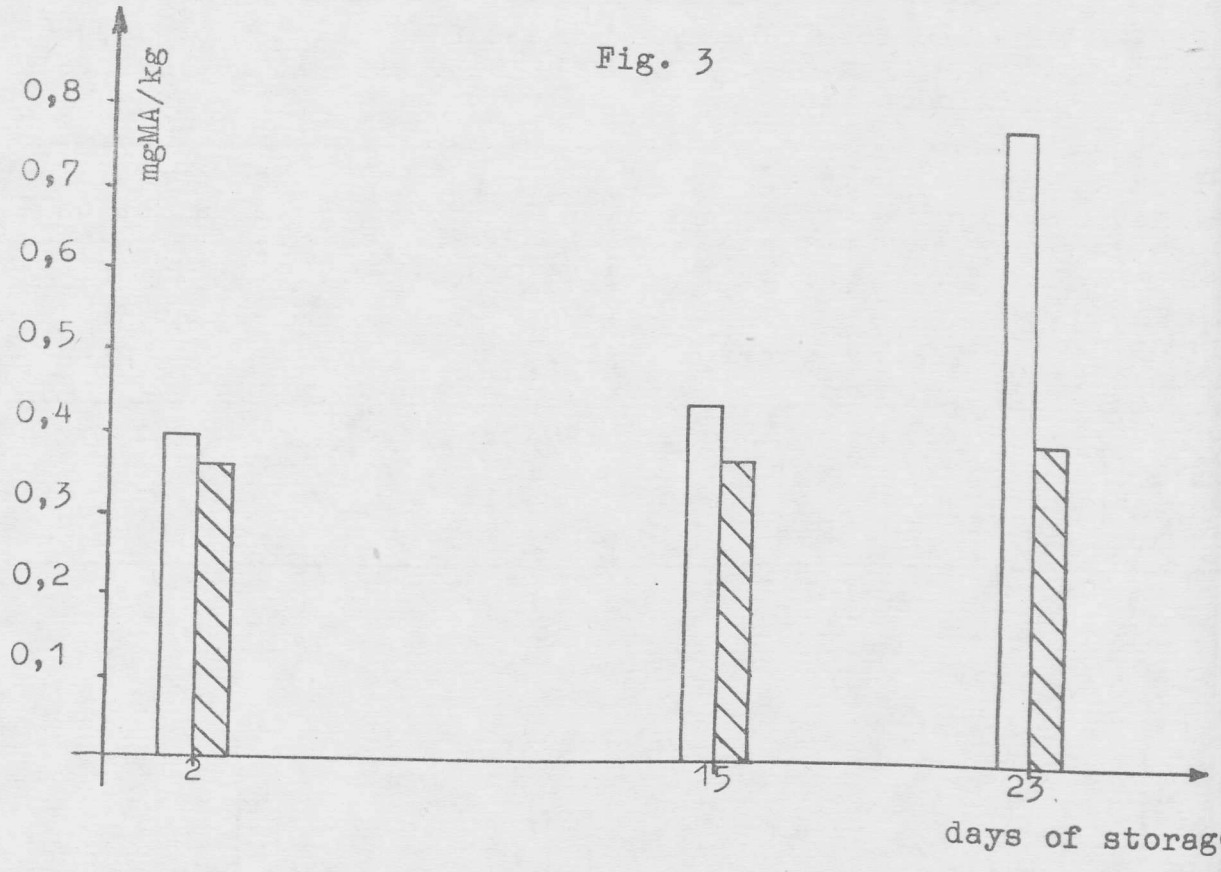



Table 2.- Variation of the thiobarbituric number during the process of storage of heated pork loins with and without natural protein coating

n = 6

| Product under examination | Days of storage | mgMA/kg | The coefficient of variation % |
|---|---|---|---|
| Heated pork loin without natural protein coating | 2 | 0.40±0.03 | 17.40 |
| | 15 | 0.45±0.01 | 7.76 |
| | 23 | 0.08±0.02 | 6.88 |
| Heated pork loin with natural protein coating | 2 | 0.36±0.02 | 13.86 |
| | 15 | 0.38±0.01 | 8.66 |
| | 23 | 0.41±0.01 | 7.63 |

Fig. 3




Regarding the malonaldehyde level in the loins under examination, the two-factor analysis showed strong influence of the factor "protein coating": F calculated /101.8653/ > F critical /7.56/. On the development of this index had influence the factor "storage time": F calculated /76.5513/ > F critical /5.39/. The joined influence of the two factors is proved also: F calculated /48.7439/ > F critical /5.39/.

CONCLUSIONS: Our investigations show, that the meat emulsion of cured lean pork coagulates during the process of cooking and the received natural protein coating is identical with the coating, depicted from Velinov /1987/ from extracted myofibrillar proteins at the process of tumbling. The studied protein coating protects the fats in the finished product from oxidation during storage, which is a good index for the reliability and success of our method.

REFERENCES:

- Bliznakova, L.T., Dimitrova, N.Hr., Mangarudov, A.R. and Ivanov, A.I. (1987) A.C. 40338, PRB.
- Bozhanov, E.S., Vechkov, I. (1983) Statistical methods for modelling and optimizing of poly-factor objects. Ed. Tehnika, Sofia, p. 423.
- Velinov, P.D., Zhikov, M.V. and Todorov, N. (1985) A.C. 39326, PRB.
- Velinov, P.D. (1987) Doctor's Thesis, TZNIVMI, p. 305, Sofia.
- Velinov, P.D., Zhikov, M.V. and Todorov, N. (1987) A.C. 43724, PRB.

- Zajas, Y.F. (1981) Meat and Meat Products Quality. Ed. Light Food Industry, Moscow, p. 479.
- Bartels, P., Krole, H.I. (1973) Fleischwirtschaft 53:816.
- Iochle, W. (1984) Meat Processing 23:32.
- Pearson, D. (1975) Laboratory Techniques in Food Analysis, Buttorworths, London, 127-129.
- Seffe, H. (1953) Annals Math.Stat. 27:251.