

INFLUENCE OF VACUUM SMOKING AND DEHYDRATION OF MINCED MEAT DURING SMOKED SAUSAGES PRODUCTION

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There is substantiated the purposefulness of a study and introduction of smoked sausages production with minced meat vacuum smoking and dehydration. The main advantages of this process are determined: a decrease of smoking period by 25-30%; an increase of products quality and organisation of ecologically clean production.

A pilot unit is developed. It consists of a modified vacuum mixer with vacuum locks and a system of smoke-air mixture inlet and outlet.

There is shown a possibility of smoked sausages production with minced meat vacuum smoking and dehydration. As the result smoking time decreases as well as total processing time; product structure improves due to the use of vacuum with the residual pressure of $0.1-0.15 \cdot 10^4 \text{Pa}$; cancerogenic substances content significantly decreases (1.5-4 times).

The purposefulness of a study and introduction of smoked sausages manufacturing with minced meat vacuum smoking and dehydration is substantiated; the main advantages of the process are determined; a pilot unit, consisting of a vacuum mixer with locks, smoke-air mixture inlet and outlet systems, is developed.

Smoked sausages due to their quality characteristics, conditions of storage and transporting are popular. Analysis of semi-smoked and cooked-&-smoked sausages technological processes shows that they are time- and working place-consuming.

Smoked sausages production from pre-smoked and dehydrated minced meat is one of the ways of its intensification. Meat changes during smoking are being brought to water content decrease, acidity change and accumulation of volatile substances in smoke gases. Smoking consists in a simultaneous treatment of a product with smoke and heat. A correct combination of these two factors stipulates an efficient smoking, product quality and its prolonged storage without significant changes of quality.

The process of smoked sausages manufacturing with minced meat pre-smoking and dehydration, in contrast to a traditional one, means a transfer of smoking and partial dehydration from thermal treatment stage to the stage of raw material (minced meat) preparation.

The modified process has the following peculiarity: a non-significant change of thermophoresis and thermodiffusion because the difference between the temperature of surface sausage meat particles and of smoke components in the range of 20-30 m is no more than 2-3°C. The process of smoke components transfer (phenolic fractions, flavouring aldehydes, other carbonylic compounds, organic acid and etc.) is not complicated by particles size as well as by casing from the surface of which the smoking is directed into the product.

Minced meat was pre-smoked and dehydrated in a vacuum mixer with smoke-air mixture inlet and outlet through a

receiver that purified the mixture, stabilised temperature and humidity at 2030°C and various levels of residual pressure ($0.1-0.6 \cdot 10^4 \text{Pa}$).

During the study physico-chemical, organoleptical and histological parameters were determined according to the common procedures as well as cancerogenic substances content by thermoluminescent and fluorescent methods.

Dehydration process was comparable at various stages for the test (an improved technology) and control (a traditional technology) samples. However water content for the test samples, at the stage of raw material preparation, was by 6-8% lower than for the controls. Thermal treatment, drying and storage also caused water content decrease. The rate of decrease consistently lowered. Evaluating product readiness by water content it is possible to conclude that test samples met the normative requirements 2-3 days earlier.

The level of vacuuming had a greater influence upon the degree of minced meat dehydration. A characteristic peculiarity is that while forming a definite vacuum value air inclusions are being extracted from micropores and various large and small spaces of minced meat. And at smoke-air mixture treatment smoke components, due to the thermophoresis, actively sorb on minced meat surface. Sausage microstructure significantly changes as related to raw material quality and technological regimes. This is expressed in the degree of aggregation and interaction between muscle fibres particles and other components, in distribution and size of fat drops infiltrating minced meat.

The microstructural investigations show that "Tallinskaya" (semi-smoked) and "Servelat" (cooked-&-smoked) sausages made from pre-treated (smoking and vacuuming) minced meat differ from traditionally made sausages by their microstructure characteristics.

We think that vacuuming causes the destruction of lipocyties surface cell membranes. An it is more efficient while using a technology of breaking and alteration of sausage meat vacuuming and mixing. This leads to fat particles mincing to the drops with the size cup to 2 microm and to their more uniform distribution among muscle fibres and in a fine-grainy protein mass of sausage meat. The degree of fat cells destruction depends on vacuuming time but does not submit to the linear law of growth. The process of fat drops destruction is more intensive at vacuuming up to 15 min. A further increase in treatment time does not cause a corresponding improvement of fat drops distribution and their mincing. So, it is not justified. Besides, there exists a relation between samples structure and vacuum depth. At vacuum depth of $0.6 \cdot 10^4 \text{Pa}$ sausage meat is significantly loose and contains a moderate amount of small fat drops. The highest effect is being achieved at a lower pressure ($0.25-0.30 \cdot 10^4 \text{Pa}$). Vacuum treatment at the end of smoking allows to get a product with a more uniform structure and to increase sausage meat compactness.

Test samples have a more uniform structure: structure elements are close to each other; fine-grainy protein mass is pierced with small and medium vacuoles; fat is uniformly distributed in the form of smallest drops (Fig. 1,2). So, the use of vacuum treatment improves product tenderness and its taste characteristics.

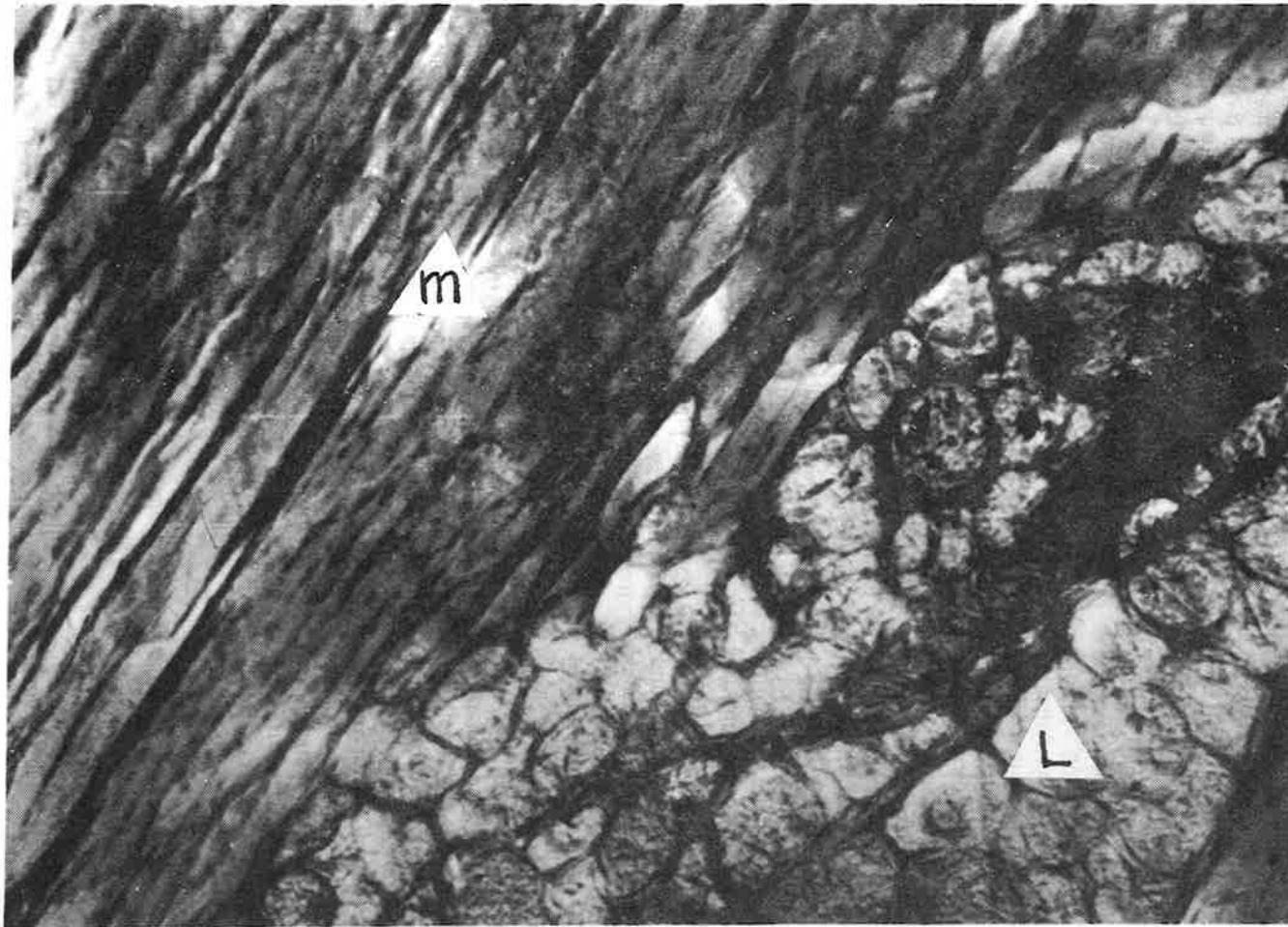


Fig.1. Structure of sausage made according to a traditional technology
m - muscle tissue; L - lipid drops. Magnification - 500 times.

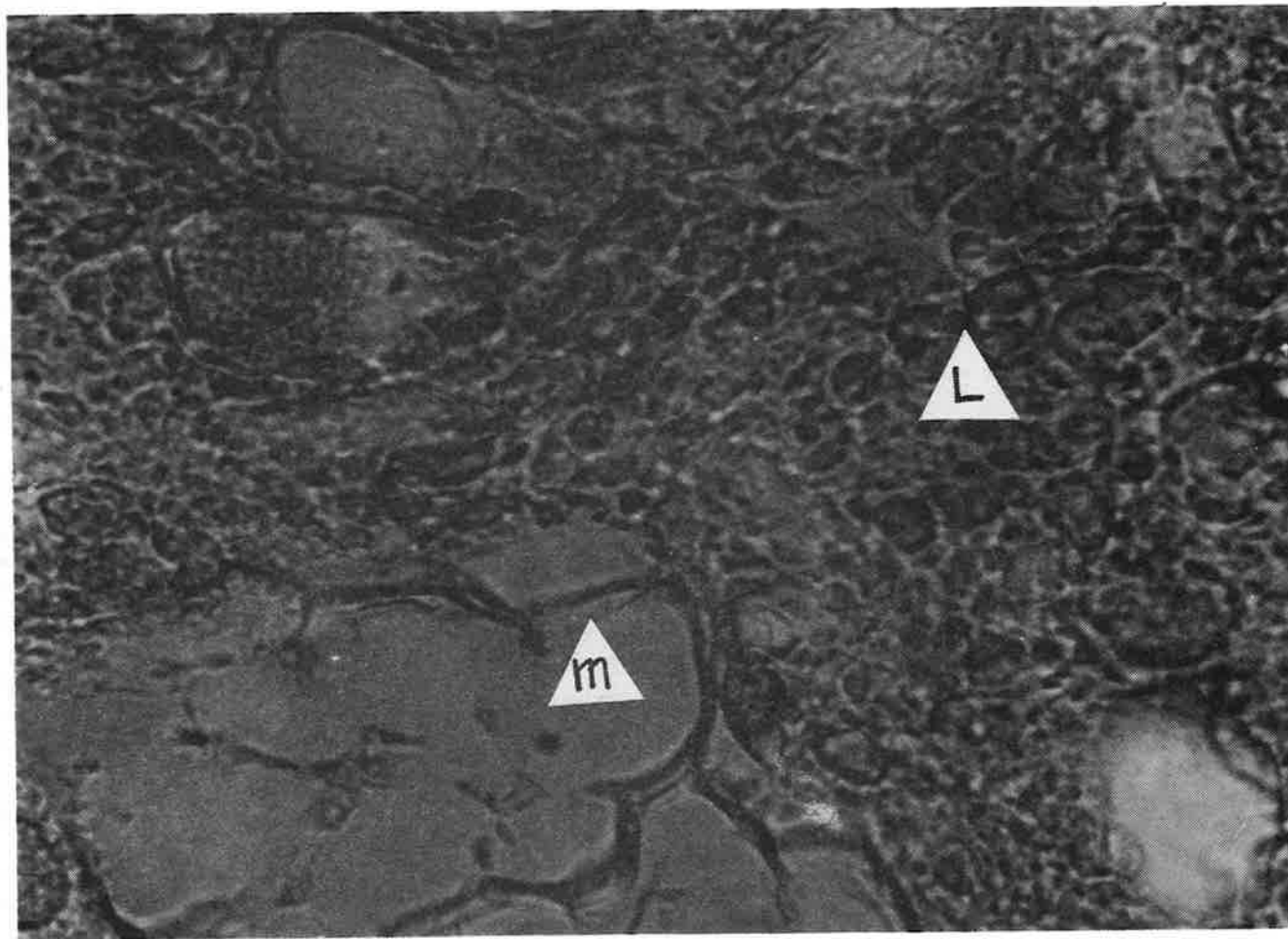


Fig.2. Structure of smoked sausage made using vacuum treatment for 15 min.
m - muscle tissue; L - lipid drops. Magnification - 500 times.

Parallel with technological, physico-chemical and histological characteristics a study into the presence of cancerogenic compounds in samples is very significant. Literature data testify to the fact that meat products with nitrite added and smoke-air mixture treated contain nitroso-di-methylamine and benz- α -pyrine.

The results of test and traditional sausage samples investigations are given in Table.

Table

Sausage	Benz- α -pyrine, mkg/kg	Nitroso- dimethylami- ne, mkg/kg
Tallinskaya(control)	0.197	2.0
Tallinskaya(test)	0.068	0.50
Servelat (control)	0.028	1.4
Servelat (test)	0.019	0.8

It is seen from the given results that test samples were the best from oncological point of view. Content of benz- α -pyrine is 2-3 times and of nitroso-di-methylamine - 1.5-4 times lower as compared to the controls. Apparently, cancerogenic compounds content decreases as the result of vacuuming.

Investigation results showed the possibility of smoked sausages production from pre-treated (smoking and dehydration under vacuum) minced meat. The new technology allowed to reduce smoking time as well as total processing time; to improve product structure due to vacuum use of 0.25-0.30 \cdot 10⁴Pa; to decrease (1.5-4 times) cancerogenic compounds content in smoked sausages and to improve their flavour and taste.