Technological factors effect to quality indices of moulded sausages

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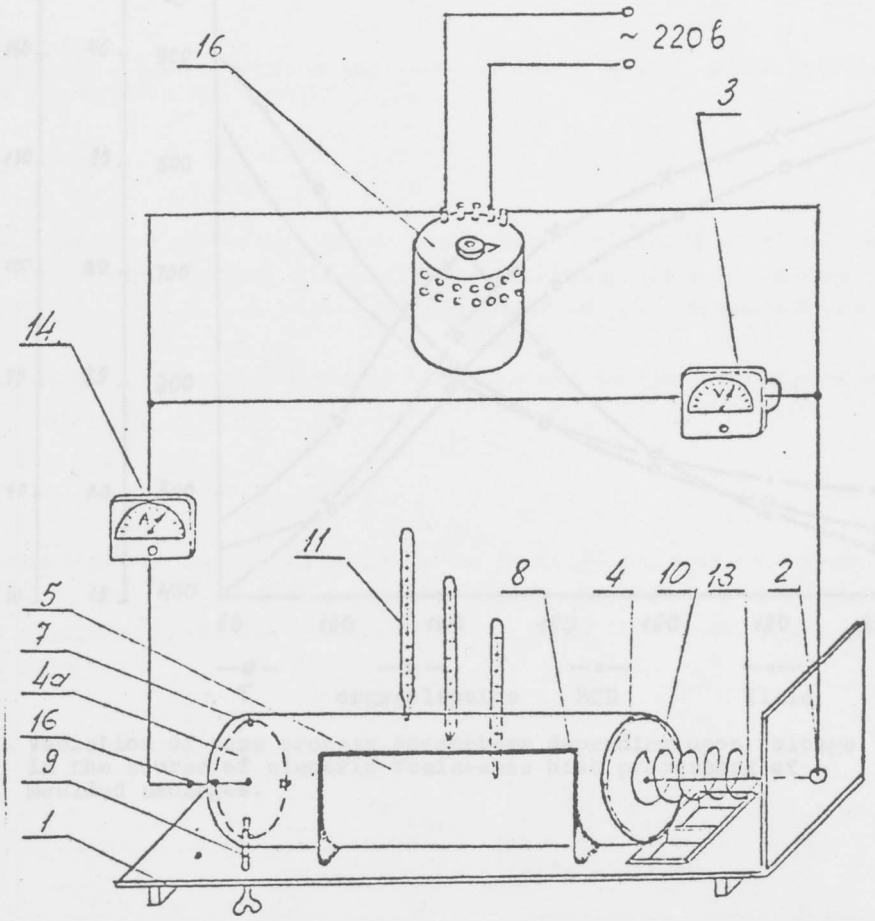
One of the most perspective efforts directed towards improving and intensifying meat-products production process was to extendedly integrate the electrical engineering methods for processing of raw materials. This can be first of all, explained by the fact that all products of biological origin are, in terms of physics, of electric nature, and the most efficient effect to electrically charged particles can be gained by directed action to their transpormation by electric, magnetic and electromagnetic fields. Until the present time the most developed electric engineering processes in food-making industry have been effected by electrostatic, electric resistance, high-frequency and superhigh-frequency infra-red, pulse and ultrasonic techniques. Each of them has distinct advantages, which are progressively realized in production of some meat products. The electric resistance method can be described as follows: electric current passes through product and releases heat, which increases the product's temperature. Fast heating (within 15-60 s) of chopped-up meat up to 50-70°C makes for intensification of process. The electric resistance heating is favourably noted for simple implementation, high efficiency, simple control of power.parameters. The object of study was to find out some technological factors of production of boiled moulded sausages by electric resistance heat processing, the factors, which effect to quality of finished product. The study has been carried out at experimental plant which comprises a basis with a mould fastened to it. The mould is made of polymeric material - polytetrafluorethylene, and has a shape of cylinder with length of 400 mm, diameter of 100 mm. Stainless steel electrodes of appropriate diameter and with power supply terminals are installed at end sides of the mould. There were three openings at the upper part of the mould, they were used for thermometers with different tips, which indicated distribution of temperature fields along the loaf. In addition, the plant is equipped with instrumentation, which indicates circuit voltage and strength of current. Readings of ammeter and voltmeter were controlled by rheostat. General view of experimental plant can be seen in Fig.1. The object of investigation was sausage meat for high-quality boiled sausage "Lyubitelskaya". The sausage meat was stuffed into moulds which were fixed to the basis as per diagram in Figure. Then the sausage meat was processed by electric resistance heating technique, voltage variated from 80 to 220 V. Heat processing was considered to be completed when the temperature in centre of loaf was 72°C. In the course of investigation the following parameters have been determined: duration of heat processing was controlled both from the point of view of thermometry and degree of product readiness, which was determined by phosphatase residue; amount of broth extracted; loaf deformation degree; finished product yield; colour intensity as well as organoleptic mark according to five-mark grading system. As you can see, Fig.2 shows a reverse relationship between heat processing term and voltage. In this case the highest degree of indirect correlation (r = -0,90) is noted at voltage variated from 80 to 100 V. Loaf deformation degree and amount of broth extraction are in direct correlation (r = 0.95), their significance therewith is more neglectable, the shorter duration of electrotechnological processing (r = - 0.78). As seen from Fig.2, the most optimal voltage is 120 V. In this case, duration of electrotechnical processing is 600 s max., loaf deformation degree is at the level of 26 mm, amout of broth extracted is 2.7% as related to weight of

sausage meat stuffed into mould, colour intensity at λ = 5 85nm is =0.45u of optical density, total organoleptic mark is 4.1 as compared to 4.0 in controls, which have been produced of the same sausage meat, under traditional conditions of heat processing, in cellulosic packing film. Loaf diameter was 80 mm, finished product yield was 108.8 as compared to 108.0 in controls.

Examination of finished product yield also showed that highest yield can be achieved with products processed by electrotechnological technique at 80 V during 900 s, it amounts 116.8% as compared to 108.0 in controls. However, in the course of organoleptic examination of finished products it has been found out that samples in this case (and in the case when voltage was 100 V) has bad marketable look. Due to the fact that there was no colour formation reaction, colour intensity at λ = 585 nm, 80 V was 0.18 max. and at 100 V it was 0.25, loaf colour of uneven, weak pink with brown spots around fats. Besides, a completely undyed ellipse-shaped surface as a halo has been formed at upper part of the loaf. In addition, unusual for meat products smell of iron was identified. Total organoleptic mark for finished products was 1.5 at 80 V and 2.1 at 100 V. In the process of estimation of marketable look no attention was paid to loaf-shape parameters as methods of loaf formation principally differed. Organoleptic mark for quality of samples produced at voltage of more than 120 V and results of comparison with samples produced at given technological parameters can be adopted as grounds for the following conclusion: when voltage is higher than 120 V and amount of broth extracted and loaf deformation degree increase, finished product yield decreases and total organoleptic mark becomes lower. When industrial voltage is 220 V, quality of product is too low, i.e. too much broth extracts, high degree of loaf deformation, which caused cracks at the whole surface of loaf, structure is friable and unsatisfactory, moisture-adheaiveness of sausage meat is practically absent - 25-30% from total moisture content, total organoleptic mark is 1.0.

On the basis of results of investigations conducted the following conclusion has been made: the most optimal voltage is 120 V when electrotechnological technique, the electric resistance technique, in particular, is used for boiled sausages production. In this case the sausage loafs look satisfactory (average mark is 4.0), have smooth and even surface, intensive pink colour (4,2), resilient body and normal succulence, good taste and smell, no strange touches and smells. When voltage is lower than 120 V, required quality can't be guaranteed as the voltage is unsufficient (though we observed a relatively high yield and low degree of deformation). When voltage is higher than 120 V, this irreversibly affects to properties of meat raw materials in the course of electrotechnological processing and the result is worse quality of finished products.



1. Basis, which forms a right angle. 2. Opening. 3. Voltmeter.
4. Electrodes. 5. Mould. 6. Chopped up meat. 7. Screws fixed.
8. Saddle-shaped support. 9. Supporting pin. 10. Thermometer.
11. Vessel. 12. Electrode axle with terminal. 14. Ammeter.
15. Rheostat. 16. Terminal

Fig. 1. Experimental plant for production of moulded boiled sausages in the course of electric resistance heat processing.

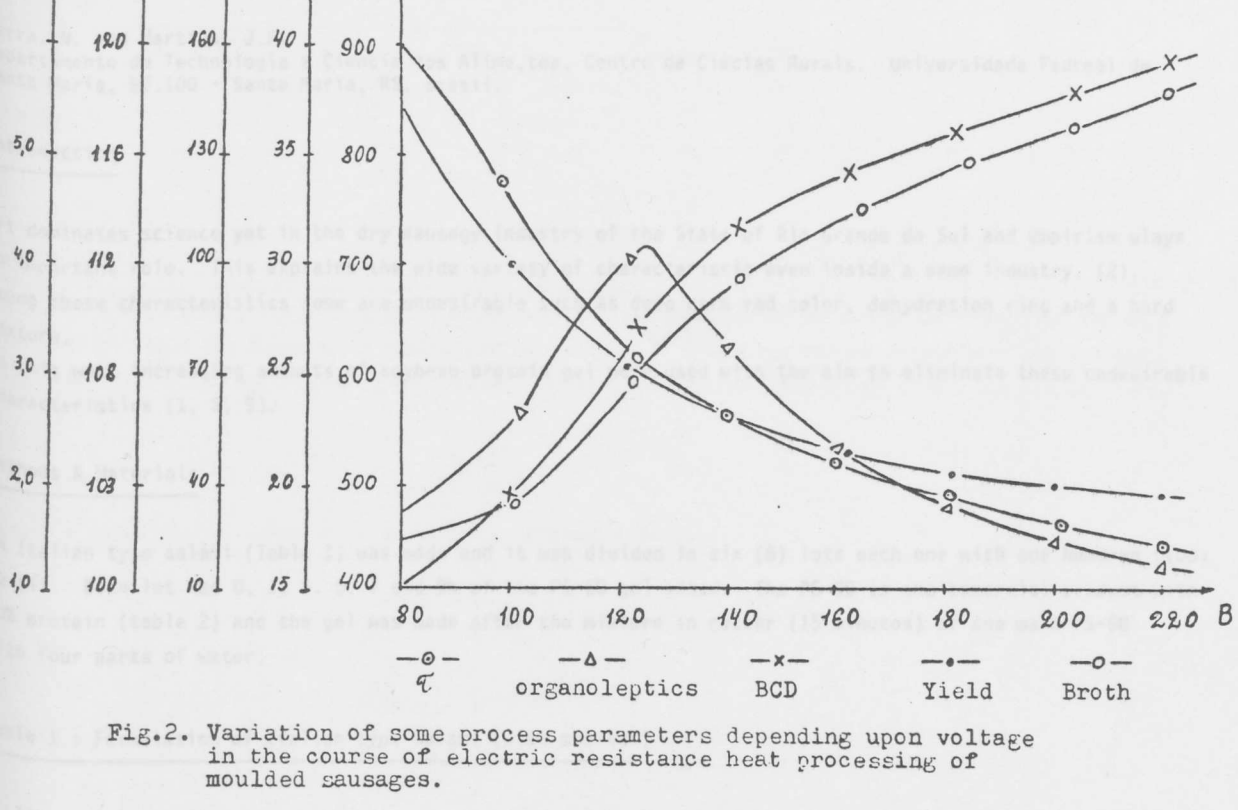


Fig.2. Variation of some process parameters depending upon voltage in the course of electric resistance heat processing of moulded sausages.