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## INFLUENCE OF THAWING REGIMES ON QUALITATIVE CHARACTERISTICS OF MEAT

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### Background

Reduction of meat and meat products consumption, change-over to low-waste processing of raw materials, economic aspects of development of the meat industry and other reasons predetermine the necessity of manufacturing high-quality meat products, satisfying physiological human needs. The problems of furnishing the population with high-quality foodstuffs are strongly connected with development of progressive technologies of storage and processing of raw materials and finished products, taking into account the latest achievements of fundamental and applied investigations. Manufacture of high-quality products depends on the condition of raw materials. The basic raw material for manufacturing meat products is meat subjected to low-temperature treatment and refrigerated storage, that is why the process of meat thawing and development of the most effective procedure for its realization are of great importance.

### Objective

The objective of the present study was to investigate dependences of physico-chemical characteristics of meat quality on regime parameters of the process of microwave energy thawing.

### Object and Methods

First-category beef without bone tissue (model system) was used for carrying out of investigations. Experimental samples consisted of meat pieces approximately of the same mass (about 4 kg), cut out from the upper part of hindleg muscles. These samples were frozen, and their temperature before thawing was minus 17 °C. To obtain maximum information about processes under investigation at considerable reduction of the number of experiments, we practised the method of optimal experiment planning, permitting to use the mathematical apparatus not only at the stage of measurement results processing, but also during preparation and making of definitions. Moreover, in case of employment of the above procedure, investigations become logical and regulated.

In this paper the following characteristics for definition of meat quality in the initial state and after the freezing-thawing process were investigated: total moistute (**Yw**) and fat (**Yg**) content, total nitrogen (**Ya**) and volatile fatty acids (**Ygk**) content, water-retaining capacity (**Ys**), active acidity (**YpH**), fat acid (**Yk**) and peroxide (**Yp**) numbers, average-volume meat temperature (**Yt**), variability of temperatures by the sample volume (**Ytq**), and loss of mass (**Ym**). Procedures for definition of these characteristics are commonly known.

Based on investigations of microwave thawing of meat carried out earlier, the following process regime parameters and their variation ranges were chosen: wave specific capacity (**X1**) - from 0.5 to 1.0 kW/kg; durability of microwave action (**X2**) - from 30 to 60 s; pause duration (**X3**) - from 60 to 90 s; number of cycles (**X4**) - from 3 to 5.

### Results and their Discussion

When analysing observations made in the course of experiment, one can say that samples under investigation after thawing had good appearance, colour and odour characteristic of fresh meat. As a result of thawing, secretion of cell fluid whose amount changed depending on the process operation regimes from 0.2 to 6.7 mass%, was observed. It led, respectively, to a certain loss of mass of the thawed meat, but for the dominant majority of samples it didn't exceed or was equal to 1 % from the frozen meat mass. Such great range of mass loss values is explained by the fact, that thawing regimes for some samples were very rigid by specific capacity and the period of microwave effect, while for the others, those regimes were considerably softer. Changes of **Yw, Ys, YpH** values are closely and those of **Ya** value indirectly connected with meat juice losses. When making experimental definitions after thawing of meat, **Yw** values varied in the range from 63.56 to 73.30 %; **Ys** - from 31.59 to 59.98 %; **YpH** - from 5.45 to 7.65; **Ya** - from 2.17 to 3.55 %; **Yg** - from 1.35 to 16.70 %; **Yk** - from 0.23 to 2.15 mg KOH; **Yp** - from 0.0042 to 0.0729 %J; **Yt** - from minus 2.6 to plus 15.0 °C, and **Ytg** - from 0.3 to 9.3 °C.

Proceeding from investigations carried out, it is possible to note, that some qualitative characteristics to a large extent depend on the chosen regime parameters, while the others depend to a lesser degree or don't depend at all. Such characteristics as moisture content, water-retaining capacity, pH, mass loss, the final average-volume temperature and temperature variability by volume after thawing can be attributed to the first group. Such characteristics as the total fat and nitrogen content, fat acid and peroxide numbers weakly depend on thawing regimes. Their variations in some or other limits sooner depend on the initial properties of the sample itself, correlation of tissues in it and numerical value of the above indices before freezing, as well as, at the most, on the period and conditions of storage, than on defrosting regimes. The same one can say about the content of volatile fatty acids, proving it by the fact, that their accumulation during such a short period of time as microwave treatment, even in case of the most prolonged thawing regime (12.5 min), can't lead to sufficient deterioration of meat freshness, though affects it to a certain extent. Certain conversion of protein nitrogen into the non-protein one can take place as a result of the freezing-thawing process, but the amount of total nitrogen practically doesn't change in this connection and depends on correlation of tissues in the sample.

Based on mathematical processing of experimental results, regression equations, describing the correlation of qualitative characteristics with the regime parameters of microwave thawing of meat, were obtained.

$$Y_w = 68.87 - 0.86X_1 - 1.04X_4 - 0.45X_1X_2 - 0.46X_1X_3 - 0.68X_2X_3;$$
$$Y_s = 46.77 - 1.06X_1 + 1.80X_3 - 7.15X_4 - 3.36X_2X_3 - 1.61X_2X_4;$$
$$Y_{pH} = 6.54 + 0.13X_2 + 0.19X_1X_2 - 0.18X_1X_4 + 0.40X_2X_4 - 0.32X_3X_4;$$
$$Y_{gk} = 3.88 + 0.53X_1X_2 + 0.29X_1X_4 - 0.59X_2X_4 - 0.32X_3X_4;$$
$$Y_a = 3.11 - 0.22X_1 + 0.20X_1X_2 + 0.25X_1X_4 + 0.30X_2X_3 + 0.31X_3X_4;$$
$$Y_g = 6.59 - 1.42X_1 + 1.77X_4 + 2.03X_2X_3 - 1.19X_2X_4;$$
$$Y_k = 0.83 - 0.27X_4 + 0.3X_2X_3;$$
$$Y_p = 0.02 + 0.009X_4 + 0.005X_1X_2;$$
$$Y_t = 0.53 + 1.54X_1 + 1.62X_2 + 1.65X_4 - 0.88X_1X_2 - 1.08X_2X_3 + 1.23X_2X_4;$$
$$Y_{tq} = 1.85 + 0.60X_1 + 1.11X_2 + 1.07X_4 + 0.55X_1X_2 + 0.61X_1X_4 + 1.01X_2X_4;$$
$$Y_m = 1.43 + 0.66X_1 = 0.68X_2 + 0.37X_1X_2 - 0.34X_1X_3 - 0.39X_1X_4 + 0.39X_2X_3 + 0.30X_2X_4 + 0.53X_3X_4.$$

Evaluating the adequacy of regression equations according to Fisher criterion, we found that changes of the investigated meat quality characteristics under the action of regime parameters of microwave energy thawing were described with an accuracy of higher than 0.95, besides **Ya** and **Yg** values. Consequently, the developed system of regression equations may be evaluated as a mathematical model describing change of meat quality during thawing..

**Conclusion**

Dependences of physic-chemical meat characteristics on regime parameters of microwave energy thawing were studied, what creates prerequisites for scientific forecast of the process management. Dependences obtained permit to quantitatively predict the change of meat quality after thawing and facilitate the choice of optimal regimes of its realizatioin.