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MATHEMATICAL MODELING OF FOOD QUALITY

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The quality of the food is a set of characteristics that determine its ability to ensure the stability of the composition and useful properties during shelf life. Mathematical model that describes the quality, includes optimization option ($y(t)$ - dependent parameter), which varies with time t , and independent factors characterizing formulation, technological features of production, storage conditions and so on. Second order differential equations can reveal the kinetics of the parameter optimization by chemical, biological, and rheological changes in the product better than any lower-order equations.

Model of meat and meat products quality can be written as an equation:

$$K_1 V \rho \frac{d^2 y}{dt^2} + K_2 \frac{dy}{dt} = \tau, \quad (1)$$

K_1 and K_2 - characteristics of biochemical changes and structural and mechanical properties of the product, τ - the driving force (generalized factorial influence on the product), V - volume, ρ - density.

For the practical application of the model it is necessary to find the coefficients K_1 and K_2 . The sequence of their location next follows. Let's obtain the solution of equation (1) with initial conditions $y(0) = 0 \Rightarrow$ (Cauchy

problem).

$$y(t) = \frac{\tau}{K_2^2} (K_1 V \rho e^{\frac{K_2 t}{K_1 V \rho}}) + K_2 t - \rho K_1 V \quad (2)$$

Then we will find the speed with which the parameter optimization changes

$$\frac{dy}{dt} = \frac{\tau}{K_2} (1 - e^{-\frac{K_2 t}{K_1 V \rho}}) \quad (3)$$

Based on the analytical and experimental studies of the preservation product selected term t_1 , we find the value of $y(t_1)$, $\frac{dy(t_1)}{dt}$ and substitute it into the left side of the equations (2) and (3). Solving the system of equa-

tions $y=f(t)$ and $V = f_2(\frac{dy}{dt})$, we find the coefficients K_1 and K_2 . Substituting them into (1) a mathematical model of changing the quality of the product is obtained which to determine the duration of its storage.

The considered way of determining the coefficients of mathematical models based on differential equations of the second order is applied in modeling the kinetics of quality change, in the study of structural and mechanical properties of cutting food, centrifugation of fluid disperse systems. Given optimization parameter, temperature control, we calculated the coefficients K_1 , K_2 and kinetics of weight loss in meat products and containing meat



products with specified formulat.

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