DEVELOPMENT AND INVESTIGATION OF THE NEW EXPRESS - METHOD ANALYSIS OF MEAT AND MILK COMPONENTS' CONCENTRATION.

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The analysis of literary sources, patent and technical documents, showed that control means, which are based on optical, electrical and chemical methods of analysis, have well-developed theory and wide practical application for determination of meat and milk products' concentration. In the USSR chemical laboratory methods of analysis are often used for control of meat and milk products' concentration in industrial conditions. But grave shortcomings of these methods (such as duration, discreteness, necessity of preparation of samples) do not let to ensure efficient control of the finished production's compounds. The most perfect analysers, which are based on optical methods of analysis (e.g. Milk-Tester devices of the firm Foss-Electric, Denmark) carry out analysing operation of multicomponent substances' concentration (such as the majiority of meat and milk products) after their preliminary putting into two-component homogeneous solutions. The analyses of functionig methods of other known designs of concentration-meter showd that in most cases they also require the additional operations to be carried out. It makes their using in automatic systems of control and regulation of technological proceses very problematic. The principal aim of present researt work is working out new direct express-methods of analysis of multicomponent meat and milk products components' concentration without shortcomings of methods mentioned above. Preliminary searching studies showed that solving the problem of direct measuring analysed multicomponent substances components concentration in automatic express-rate may be working out the multiparametric method of analysis. Multiparametric calculating method of multicomponent mixtures analyses is based on integral and electoral parameters measuring. These parameters are bounded up functionally with the concentration of analysed I's components.

Multparametric calculating method was approved by means of differential electrophysical method while determining heterogeneous systems' concentration of the type: gaseous dispersive surroundings - hard particles of different nature 2. The amplitude of impulse tension was determined as parameter's integral. The duration of sygnal impulse from the particle was determined as electoral parameter. As it showed in work 2, the impulse amplitude is proportional to dielectrical permeaqbility and particle's diameter

to the 3d power:

$$U = f(\varepsilon, d^3) \quad (1)$$

where ε - dielectrical permeability, determined by its physical nature;
d - particle's diameter.

At the same time the duration of impulse was determined only by its diameter.

$$\tau = Kd \quad (2)$$

where K - coefficient of proportionality, dependent on particle's velocity and geometric parameters of primary element.

According to formulae 1 and 2 amplitude's ratio to the impulse duration in the third power is determined inly by dielectrical permeability of the particle, i.e. depends on material's nature. The selection of impulses with identical quantity of this ration allows to isolate particles with identical electrophysical properties from the compound and thus measure the concentration of particles of the same physical nature. The mentioned experimental investigations of the method with model particles of dielectrical nature (glass) and conductors (steel) gave the following values of these quantities

$$0{,}77 \pm 0{,}3\ ;\ 1{,}39 \pm 0{,}2$$

At present we are developing multiparametric calculating method of analysis of multicomponent mixtures on the basis of using integral electrophysical method. This method is intended for determining the concentration of both heterogeneous dispersive system and homogeneous multicomponent solutions. In this case module of the complex quantity of dielectrical permeability and electrical conductivity may be used as integral parameters. The same is true for active and reactive components of these physical characteristics.

Thus measuring of the three above mentioned electrophysical characteristics of compounds functionally associated with analysed components' concentrations allows to obtain three-equation system. One or two equations which express measuring scheme dependence on the concentration of electrical parameters may be added to this system. The whole amount of equations is enough taking into account the amount of analysed components in meat and milk industry does not exceed 3 - 5. These compounds are: humidity, fattiness, protein, salt. To calculate the concentration of any component of the equation's system, it's enough to solve the following equations:

$$\begin{aligned} C_1 &= f(x_1, x_2, x_3, x_4) \\ C_2 &= f(x_1, x_2, x_3, x_4) \\ C_3 &= f(x_1, x_2, x_3, x_4) \\ C_4 &= f(x_1, x_2, x_3, x_4) \end{aligned} \quad (3)$$

It makes the task of calculating much easier.

The result of searching and experimental studying of functional possibilities of different measuring schemes of analyser as applied to the given task was working out the measuring scheme, which expresses electoral parameters:

$$Y_k = F_k(C_k) \qquad (4)$$

where Y_k - meaning of measuring parameter
C_k - concentration of the component.

Experimental investigations showed that electrical parameters of measuring scheme should be used as electoral parameters.

Tables 1, 2, 3 show experimental meanings of relative changes of measuring scheme's electrical parameters as functions of the model solution concentration. The solutions of salt, nitrates and soda were used as model solutions.

Table 1.

Solution NaCl

concentration	impedance quantity on the initial transformer's resistance at 10 Om
1	44
2	50
3	56
4	62
5	68
6	73
7	79
8	88

Table 2.

Solution $NaHCO_3$

concentration	impedance quantity on the initial transformer's resistance at 100m
1	64
3	64
5	68

Profound investigating the meanings of resulting quantity as functions of component's concentration in the three-component solution (H_2O, NaCl, $Na\ HCO_3$), showed that measured electrical characteristic of the measuring scheme possesses the properties of electoral parameter for the three-component substance.

Table 3.

Solution Na Cl+ $Na\ HCO_3$

concentration : NaCl	impedance quantity on the initial transformer's : resistance at 10 Om
7.6	83
6.6	78
5.0	68
4.0	61
3.0	56
2.8	54
3% NaCl + 3% $NaHCO_3$	
7.6	84
6.6	77
5.0	68
4.0	62
3.0	56
2.8	54
8% NaCl + 5% $NaHCO_3$	
7.6	82
6.6	77
5.0	69
4.0	63
3.0	55
2.8	53

References:

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