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EXPERIMENTAL STUDIES OF THE PROCESS OF EXTRACTION OF THE FIXED LAYER OF MATERIAL TREBERSPURG

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In the course of analytical studies have identified several factors affecting the rate of mass transfer processes during the extraction process. One of the most important is the determination of the coefficient of mass transfer coefficients, which is characterized by the similarity of Sh and Pe expressed in the criterion equation. In addition, to determine the intensity of mass transfer, it is necessary to carry out the following experimental studies the results of which are necessary for the further calculation of the coefficient of mass transfer.

Keywords: extracting, by mass, experiment, factor.

Introduction. Extraction from solids is the process of equalization of the concentrations of the solutions inside and outside of the particles, i.e. the achievement of the so-called phase equilibrium. The duration of the equalization of concentrations is an important criterion for assessing its effectiveness.

In this regard, studies have been conducted to determine the conditions of phase equilibrium when changing dermatologo and temperature.

Problem. The article considers the problem of determining the mode of carrying out the process of the extraction of fine solid substances of plant origin, which is the highest oil yield, and possible development of calculation methods of extraction apparatuses column type.

Analysis of recent researches and publications. The process of extracting soluble substances from solid bodies are among the most common in food technology. With the number of 20-25 basic processes of food production, its distribution and importance in food technology extraction immediately after the process of heating, drying, evaporation and getting cold. It is the main process in the oil - extraction industry.

In the process of extraction of solid or quasitoric bodies, which are most of the materials of vegetable origin, with a liquid solvent extracted components that are used in primary production to the final product or of secondary importance, but providing a closed technological cycle - waste-free production.
Raw food industry is subjected to extraction, differs a great variety of shapes, sizes, mechanical, thermal and physico-chemical properties that vary greatly in the extraction process. Therefore, attempts to use devices which have proved themselves to one type of production to another, without sufficient scientific evidence does not lead to the desired results.

The development of fundamental science and especially the theory of mass - and heat transfer has created an opportunity for more in-depth analysis of the extraction process, the development of modern methods of engineering calculation and finding ways its intensification and optimization. Mastering these techniques will allow you to more deeply analyze the work of extractors and optimize operation in accordance with the actual state of the raw material received for processing.

Purpose of research: The development process of extraction of the fixed layer treberspurg material.

The main material: To study the kinetics of the process, and in particular for determining the characteristics describe the patterns of inter-phase transition following studies were conducted. In the first stage, the influence of the nature of the extractant on the coffee sludge. To determine this type of extractant, which has the best ability to separate the target component. In the study used extractants three species. First - ethyl alcohol, second - hexane, third - nefras.

Conditions of the extraction process were as follows: water ratio was 1:2, the temperature of extraction was 20 , the flow velocity of the extractant 0.52 m/C. the dependences of the yield of the target component from the extract below.

The second phase of the study of the influence of operational factors were determining tomodule ratios, i.e. the ratio of the weight of the extractant to the weight of raw materials (coffee sludge). The range of research in this area, i.e. the change of attitude of the masses raw - extractant in accordance ranged from 1:1 to 1:4.

The test conditions were as follows: as extractant was used nefras, the temperature of extraction was 20 , the speed of the extractant was 0.52 m/s
The most important factors affecting the extraction process is temperature and speed modes. Due to the fact that these modal parameters are the main variables that depend on two kinetic - diffusion coefficient and the coefficient Masoud. And they, in turn, are the most important criteria for assessing the effectiveness of the extraction process.

In accordance with this third stage of the research was to study the effect of temperature regime of the process, depends on the magnitude of the diffusion coefficient .

Temperature of extraction varied with increments of 10 in the range from 10 to 50 . The conditions of the experiment were as follows: as extractant was used nefras, the rate of passage of the extractant was 5.2 m/s, tomodule first, the ratio was 1:1. This experiment was conducted for raw materials two types of coffee sludge and grain amaranth. According to the obtained results, we constructed the dependence of the concentration of the target component in the extract from the temperature of extraction. In the future, similar dependencies were obtained for different tomodel: 1:2 to 1:4.

In addition, experiments were conducted with different combinations of raw material and extractant, i.e., obtained during the extraction, the extract was applied to a fresh product, or pure extractant was served on a product that had previously been defatted. The conditions of the experiment remained the same, except that the water ratio did not change and amounted to a ratio of 1:2. The results are shown in table (1.1).

Table 1.1. The concentration of the coffee oils and amaranth at different temperature of extraction.

Indicators	Units	Value				
Temperature	^0C	10	20	30	40	50
Speed	m/s	5,2*10^{-4}				
The water ratio	kg/kg	1:2				
The concentration of oils in the coffee extract	%	$\frac{15,6}{5,2}$	$\frac{18,2}{4,1}$	$\frac{19,5}{3,2}$	$\frac{20,3}{1,9}$	$\frac{21,7}{0,9}$

In the numerator of the last column are the values of concentration, subject to the presentation of the extract to a new not fat-free product, a kind of equilibrium concentration at different temperatures of extraction. Comparing the obtained results with the data given in section (3.2) it is easy to see the practical similarity of results. This in turn confirms the reliability of the obtained data.

The denominator is the concentration when applying pure extractant, with zero concentration of the target component on the pre-fat solids.

The fourth stage of the investigation of kinetic regularities, is the definition of high-speed modes of the process. For these studies we conducted an experiment by changing the speed of the extractant through the fixed layer of the raw material within 0,052 m/s to 52 m/C. Other operational parameters consisted of the following: as extractant was used nefras, the water ratio was 1:1, the temperature of extraction was set to 50. Such experiments were conducted for different ratios of expenses masses of solid and liquid phases, which in turn ranged from 1:2 to 1:4 respectively.

The data obtained was based graphical dependence of the concentration of the target component in the extract from the rate of passage of a solvent through a layer of raw material.

Also by analogy with the study of the temperature dependency, an experiment was conducted with different combinations of raw material and extractant. The results are shown in table (1.2).

Table 1.2. The concentration of the coffee oils and amaranth at different speeds the passage of solvent through the layer of product.

Indicators	Units	Value			
Temperature	^0C	50			
Speed	m/s	0,052 10^{-4}	0,52 10^{-4}	5,2 10^{-4}	52 10^{-4}
The water ratio	kg/kg	1:2			
The concentration of oils in the coffee extract	%	$\frac{11,2}{6,1}$	$\frac{17,7}{4,2}$	$\frac{21,9}{0,8}$	$\frac{21,8}{1}$

The last column has the same value of the table (1.2). They show that the rate of flow of the extractant has a greater influence on mass transfer processes during extraction. There has been a sharp increase in the concentration of a target component to increase the flow speed of the extractant. From this we can judge about the direct relationship between the speed factor and coefficient Masoud.

Research results: Based on the analysis of the dimensions of the analytical description of the process of extraction of the fixed layer of finely dispersed material in the course, which was defined General appearance criteria according to the calculation of the coefficient Masoud. Was calculated depletion solid phase under certain operating parameters of the process of extraction of coffee sludge and grain amaranth.

Following the obtained results, the possibility of a theoretical calculation of the coefficient of mass transfer coefficients at different speeds extractant through the layer of raw materials and various temperature regimes. By using this formula:

$$\beta = \frac{dM}{dF(c_n - c_1)d\tau}, \qquad (3.1)$$

where: - the concentration of the target component in the boundary layer, the concentration of the target component in the extract stream.

The results are shown in table (1.3).

In the future, was held computer experiment, which was conducted processing results in the form of dependencies:

$$Sh = APe^n, \qquad (3.2)$$

With the aim of obtaining the constants of this criterion equations, and comparing the calculated mass transfer number Sherwood and experimental to evaluate the discrepancies in the data values.

After conducting this experiment criterial equation takes the form:

$$Sh = 8{,}07\, Pe^{0{,}41}, \qquad (3.3)$$

Other details of the calculation are given in table 1.4.

Table 1.3. The value of the coefficient of mass transfer at different speed and temperature regimes.

Indicators	Units	Value			
Temperature	^0C	50			
Speed	m/s	0,052 10^{-4}	0,52 10^{-4}	5,2 10^{-4}	52 10^{-4}
The coefficient Masoud	m/s	0,7*10^{-5}	1,7*10^{-5}	5,5*10^{-5}	5,44*10^{-4}
Temperature	^0C	30			
The coefficient Masoud	m/s	1,6*10^{-5}	2*10^{-5}	9,2*10^{-5}	3,32*10^{-4}
Temperature	^0C	20			
The coefficient Masoud	m/s	1,6*10^{-5}	1,7*10^{-5}	3,6*10^{-5}	1,11*10^{-4}

As can be seen from table (1.3) coefficient Masoud tends to increase with increasing flow rate of the extractant, which confirms previously expressed our assumption. A noticeable trend growth factor Masoud with increasing temperature, but it is mild and does not have a decisive role, which in turn confirms the weak effect of changing temperature regimes in the extraction process.

Table 1.4. Experimental and theoretical comparison of numbers of similarity.

Pe	Sh (experiment)	The calculation according to the formula (3.3)	Absolute error
25	76	31	45
250	81	80	1

2500	171	207	36
25000	520	536	16
4,7	14	15	1
47	18	40	22
470	84	103	19
4700	300	268	32
2,7	4	12	8
27	9	32	23
270	29	82	53
2700	280	213	67

Conclusions: Analyzing the results in table (1.4) it can be noted the relatively small discrepancy between the experimental and theoretical results. The largest deviation is observed at low speeds the flow of extractant, this is due to the error of the experiment. Because in these conditions, the time of extraction is increased, and thereby increase the loss of extractant due to vapor leakage that when determining the concentration of the target component in the liquid phase increases its value. And thus introduces error in further calculations, but as the results masonn processes are more intense at high speeds, this difference is not decisive.

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Summary

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