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INFLUENCE AND CHARACTERISTICS OF DRYING MECHANISMS IN LEATHER PRODUCTION ON THE DERMA LAYER

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Abstract:

Objective. The article is devoted to the description of the drying method of liquid liquid vehicles produced on the basis of a joint solution of heat generated by the authors. The number of leather layers, thermophiles properties and sizes. The content of the dried product is focused on the appearance of dried structures with the emergence of communication. The influence of structures that appear on the surface of thermopam of dry drying is noted. When studying the drying processes of various products, the understanding of the physical essence of the process and the possibility of its mathematical dispersion of products and the quality indicators of the finished product are mainly determined by specific structural and rheological changes. For example, in the process of drying heat-resistant materials, chemical and structural deformation changes determine the quality indicators of a dry product [18].

Any phenomena that occur during drying (for example, the formation of structure on the surface, chemical reactions, changes in the shape and size of the dried material, the formation of mass flows in the main part of the material, etc.) will lead to the appearance of some "non-classical" points or areas on drying thermogram (for example, turning points or the fate of a monotonic asymptotic increase or decrease in temperature) [2]. As a result, the shape of the drying thermogram changes significantly.

The kinetics of material heating during drying is often more important than the kinetics of moisture loss for determining the properties of the process and describing its mechanism [1, 6]. Therefore, the type of thermogram is often the most informative in terms of understanding the physics of the process.

When liquid-dispersed systems are dried, a certain structure (for example, a film) is formed on the surface, which leads to a change in the thermophysical properties of the surface of the drying material and, as a result, has a limiting effect. evaporation process, which is clearly reflected in the nature of the thermogram.

Sheep and cattle skins were chosen as the studied leather materials for drying on substrates [2, 3]. The main thermophysical properties of the studied materials are identified.

Figure 1 shows the drying of skins under uniform conditions, which allows for the expansion of the drying area of the skins with the help of steam and wind

Methods. For materials with similar basic thermophysical properties, the nature of thermograms is fundamentally different. The process of drying the skin is very similar to the classical drying of a simple capillary-porous body in terms of thermograms. During the drying process, things get more complicated.

There is no clear area of wet skin on the thermogram. The temperature rises continuously during the first drying period. The thermogram has a characteristic inflection point in the wet bulb field [2, 9].

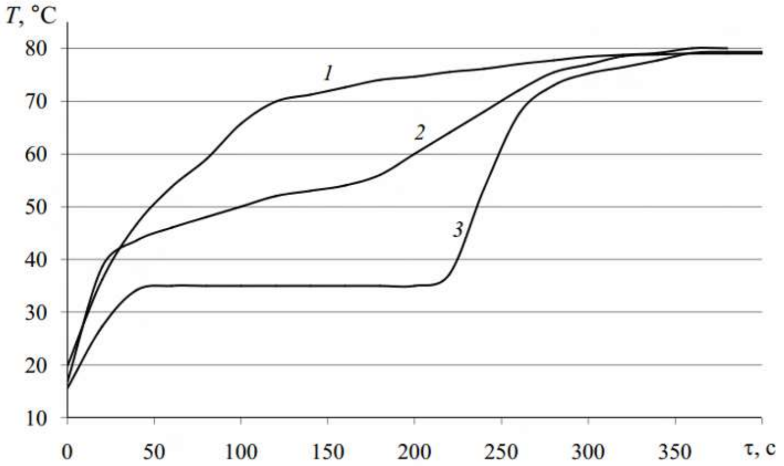

Figure 2. Shows the characteristic thermograms of the desiccant plasticizer (1), distillation stillage (2), and skin moisture (3). Substrate - aluminum, T=80°C, w=3 m/s, layer thickness 0.5 mm

The liquid plasticizer (1) behaves in the distillation of the liquid during the drying process. In this case, the wet bulb area on the thermogram is almost destroyed. At the same time, the thermogram in the wet bulb zone in the first period also has a characteristic fracture [10].

A similar nature of thermograms is associated with the mechanism of formation of certain structures on the surface of the drying product. During the drying process, structures (films, agglomerates, crusts, etc.) are not formed on the entire surface of the body and in the volume of the skin. When the alembic is dried, a thin film immediately begins to form on the surface of the dried product, which eventually turns into a much harder crust.

When the plasticizer layer dries, some time after the start of the process, an elastic film forms on the surface, and a liquid pulsation phenomenon is observed under the film. During the drying process, moisture is removed due to the formation of an air gap under the film. The surface film (in the mode of fixing the contact line to the substrate) rises, falls, and deforms in different ways, forming a surface of a complex geometric shape [2, 3, 9].

Results. The nature of the appearance of surface and cast structures is associated with the fractional composition of the dried product and the shape of the particles that make up the dispersed phase. The description of the phenomena of self-organization of such structures is very difficult, therefore, in relation to our problems, it is of practical importance to search for a criterion for assessing the possibility of self-organization of particles of a given product. conditions [11–13].

For a mathematical description of the drying kinetics of such materials, it is proposed to use a joint solution of heat transfer and diffusion problems in a material with a dynamically changing number of layers, thermophysical properties, and layer sizes. In the general case, multilayer systems are used not only to describe heat transfer (diffusion) processes in physical multilayer bodies, but can also be used to describe the process in a physical single-layer body if its properties vary greatly along . or more coordinates.

The drying kinetics of fibrous materials and liquid dispersed systems on substrates is ensured by taking into account the most complete physical approximation of the problem to real conditions, as shown by the experience of studies carried out in the department of processes and apparatuses. Multilayer (usually two-four-layer) investigated body [10]. In this case, layers can also appear and collapse during the calculation.

An algorithm for the formation/degeneration of multilayer problems in the calculation of the drying kinetics of the studied materials is presented [10].

The task of calculating the kinetics of skin drying can be considered as twofold. The first layer is a non-diffusion substrate. The second layer is a liquid layer that changes thickness during the first drying period. In the second period, the thickness of the residual layer does not change. The calculation of the evaporation rate in the first period, the equations for calculating the critical humidity are presented in [1-4].

We divide the drying process into separate stages. At the first stage (at the initial moment of time), before the formation of a film on the liquid surface, a two-layer problem is considered in the calculation. The first layer is a non-diffusion substrate and the second layer is a fluid layer that changes thickness as it dries.

At the second stage, with the formation of a film on the surface of the liquid, one more layer is added to the problem - a film one. The task is threefold. The moment of appearance of this layer can be estimated from the equations obtained in [2]. At the same time, a characteristic inflection point is noted on the thermogram during the first drying period, and the first critical humidity corresponding to this point is distinguished. As mentioned above, when drying, the film layer turns into a hard shell, under which the lower layer remains, similar to the film layer [2, 4,]. The kinetics of the formation of a layer of the earth's crust was studied in [2, 4], and it is possible to calculate the moment of its formation. Thus, another layer is formed - the shell layer, and the problem becomes a four-layer one. During the drying process, the liquid phase evaporates, the liquid layer decreases until it disappears completely. So one layer is broken. The task is threefold. Further processing leads to the degeneration of the film layer into a shell layer. The task is two-layer: one layer is the substrate, and the second layer is the layer of the dried material [8–10].

The process of drying a liquid plasticizer can, with some assumptions, be considered similar to the process of drying an alembic. However, due to the lack of a correct mathematical description of such phenomena as pulsations similar to self-oscillating reactions in the drying layer, the accuracy of describing such a process will be low [12].

Having decided on the algorithm for the formation or degeneration of layers, taking certain correlation dependences for the thermophysical properties of these layers, they jointly solve the problems of heat conduction and diffusion in the classical formulation by the interval method.

The main idea of the interval method is that the process is divided into certain time intervals. The duration of each interval is determined by the nature of the change in the boundary conditions, the characteristics of the drying product, the geometric dimensions of the body, temperature, concentration, or the appearance of certain structures depending on the process time. To solve the problem, the first, previous and next intervals are distinguished. For each interval, according to previously obtained relations, variable coefficients are taken as piecewise constants. Thus, the problem of heat and mass transfer for each interval is linear. For the first interval, the problem is solved taking into account the initial conditions specified at the zero moment of time. Accordingly, at the moment of time in the solution we obtain the temperature distribution given as a function. For the next time interval, the temperature distribution obtained in the previous time interval (ie, actually at the end of the previous interval) is taken as the initial condition at an equal time.

In the formula under consideration, the main feature of applying solutions to problems of diffusion of heat conduction is the mathematical description (or at least a numerical estimate) of the properties of the resulting surface structures. In the first period, it is necessary to evaluate the coefficient of reduction in the intensity of evaporation from the surface and a possible analytical calculation of the thermophysical properties of the structures formed in the drying product.

Conclusion. To date, one of the promising approaches to solving such problems is the use of fractal analysis and the determination of the correlation between fractal parameters and actually observed phenomena [14–15]. The main feature of drying is self-similarity, which allows you to create a curve or surface according to a given algorithm with given parameters. Practice shows that many natural objects created as a result of evolution are also self-similar and therefore resemble fractals. This also applies to dispersed products [16]. Consequently, the use of fractal structures gives a certain possibility of modeling real objects.

At present, the authors are solving the problem of comparing the structures formed on the drying surface of liquid disperse products with certain types of fractal lines or surfaces, as well as linking the properties of real surface structures with fractal parameters.

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