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DEVELOPMENT OF TECHNOLOGY AND TECHNOLOGY FOR CARRIAGE AND DRYING OF COCONS OF HERE

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The article describes the technique and technology for carrots and high-quality drying of silkworm cocoons using low temperature using infrared radiation, elastic waves and convective heat supply. The process of processing silkworm cocoons is characterized by a number of parameters: the quality and quantity of raw materials and the finished product, the temperature and relative humidity of the environment, the residence time of the product in the installation. Using this technique and technology, the process of accelerating carrots and drying, as well as improving the quality of the resulting silk, is provided.

Key words: drying, elastic waves, silkworm cocoons, infrared radiation.

The relevance of the proposed development - in order to expand the ongoing research work, the relevant adopted Decrees of the President of the Republic of Uzbekistan dated March 29, 2017 No. 2856 "On measures for organizing the activities of the Uzbekipaksanoat Association" [1] were issued.

As noted in the Decree of the President of the Republic of Uzbekistan, the mulberry plantations existing in the country are not used efficiently enough, and in the winter, the yield of mulberries is significantly reduced. Due to the insufficient production of cocoon raw materials, the production capacities of silk-winding and silk-weaving enterprises are not fully utilized.

Today, more than 80 million linear plantations and 51 thousand hectares of mulberry plantations provide for the feeding of 450 moth silkworm caterpillars and the production of about 26 thousand tons of silkworm cocoons. To cover the deficit, 230-250 thousand boxes of silkworm grena are imported annually - up to 50% of the needs of the industry.

Particular attention in the decree was paid to the production of grain and cocoons, their preparation and primary processing through the introduction of highly productive breeds and hybrids of silkworm, modernization of existing and creation of new capacities for the production of raw silk, as well as the organization of deep processing of cocoons.

It is expected that by 2021 the total share of processing volumes of silkworm cocoons will be increased to 50%, with the creation of new jobs and an increase in the flow of foreign exchange funds due to export of products [1].

The goal - the development of machinery and technology for carrots and high-quality drying of silkworm cocoons using low temperature using infrared radiation, elastic waves, vibration and convective heat supply.

Natural silk is in great demand in many countries. In terms of consumer properties, it is higher than other textile fibers. Great strength, high elasticity, hygroscopicity, original design of fabrics, and the irreplaceability of silk fiber in some technical industries - make natural silk unique. Sericulture around the world to date remains one of the most poorly mechanized sectors of agriculture.

One of the important ways to increase the level of agriculture, the importance of the industry in the economy of the republic, we consider the improvement of the technology for the production of silkworms and cocoons of silkworms based on the comprehensive mechanization of the main processes in sericulture.

In Japan (also one of the leading silkworm countries), there is currently a sharp decline in the production of cocoons and, as a result, raw silk. The reason is the same - the high complexity of production,

the departure of workers to other more popular industries. Although the processes are somewhat better mechanized than in other countries. But this is mainly small artisanalization and it is also far from enough. The great demand for natural silk has led Japan to import cocoons and raw silk from Korea, China, partly from the CIS, and negotiations are underway to establish joint ventures [2].

A number of foreign and domestic works of scientists and practitioners are devoted to solving scientific and practical issues on increasing the production of cocoon raw materials and improving their quality based on the improvement of technological processes.

Work aimed at improving the technique and technology for processing silkworm cocoons, the corresponding processes through the widespread introduction of complex mechanization will reduce labor costs and improve product quality. More attractive mechanized labor will reduce staff turnover and give an impetus to more efficient use of the achievements of scientists in sericulture. Therefore, these research and development are of theoretical and practical interest.

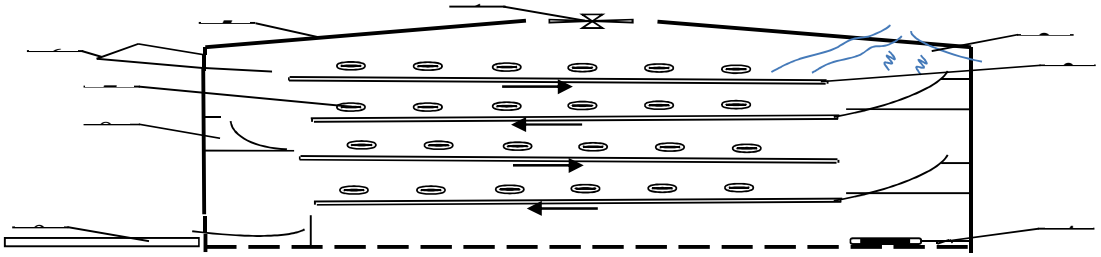
Drying is a thermal process of dehydration of products by evaporation of moisture and removal of generated vapors. In this case, heat transfer and diffusion movement of moisture occur in the substance. The drying process is used in many industries. The proposed technology for drying silkworm cocoons using low temperature using infrared radiation, elastic waves, vibration and convective heat supply is one of the most innovative and more suitable drying methods. The development of such equipment is quite a promising direction. Technological features of this process allow achieving effective carrots and high-quality drying of silkworm cocoons. Additionally, the task is to obtain new qualities in the finished product. To achieve these goals, it is necessary to use appropriate efficient energy-saving equipment using low temperature at which the raw materials obtained for the textile industry retain their quality and appearance [3-6].

The process of processing silkworm cocoons is characterized by a number of parameters: the quality and quantity of raw materials and the finished product, the temperature and relative humidity of the environment, the residence time of the product in the installation.

The advantages associated with the excitation of waves in an elastic system of cocoons are to obtain a low resonant frequency suitable for practical purposes, i.e. high-frequency and low-frequency elastic waves generated in this case can be used $f_{resonance} \leq 30kHz$

Oscillations of elastic waves inside the product create conditions for improving mass-heat transfer in the presence of a pressure and temperature gradient. Oscillations of elastic waves enhance the rate of formation of these waves using capillary moisture transfer. The use of these fluctuations in dehydration systems enhances the effects of moisture evaporation and carrot cocoons.

Oscillations of the elastic waves during carriage and drying of silkworm products in the frequency range 26-35 kHz allowed to accelerate the process. The working temperature in the process of carrot and drying of silkworm cocoons was maintained in the range of 70-80 °C (Fig. 1).



1-fan; 2-acoustic generator; 3-pallet; 4-vibrator; 5-body installation; 6-loading hopper; 7-infrared emitter; 8-guide raw materials (cocoons); 9-assembly hopper

Fig. 1. Installation diagram for carrots and drying silkworm cocoons using infrared radiation and elastic waves

One of the possible options for creating vibrational movements for carrots and drying products is the development of vibromechanism of all equipment, in particular the cabinet, together with the products. To solve this problem, it is necessary to create a vibro-mechanism device that creates mechanical low-frequency vibrations relative to a fixed platform.

To create low-frequency (τ <100 Hz) mechanical vibrations for carrots and drying raw materials in a stationary installation, various mechanisms can be proposed that create translational or rotational movements. The main purpose of these mechanisms should be the creation of vertical vibrations of horizontally located working shelves.

Infrared radiation is a type of electromagnetic radiation that occupies a range from 0.77 to 340 microns in the spectrum of electromagnetic waves. The range from 0.77 to 15 microns is considered to be short wave, from 15 to 100 microns medium-wave, and from 100 to 340 long-wave. The short-wavelength part of the spectrum is adjacent to visible light, and the long-wavelength part merges with the region of ultrashort radio waves. Therefore, infrared radiation has both the properties of visible light (propagates linearly, is reflected, refracted, like visible light), and the properties of radio waves (it can pass through some materials that are opaque to visible radiation).

The IR processing technology is based on the ability of water molecules to absorb a certain spectrum of IR radiation. In this case, the organics of the product with a certain degree of certainty can be considered transparent to IR rays. Thus, the infrared energy converted from electricity without loss is completely transferred to the product water, heating it and causing it to evaporate.

As generators of infrared radiation for industrial drying plants of raw materials in our country and abroad, heaters of various types and designs are used. They differ from other wavelengths, maximum radiation, depending on temperature and heating methods (electric, gas) and resistance element designs (metal, ceramic, silicate). The conversion of radiant energy into thermal energy is due to the thermoradiation spectral properties of the product, i.e. its transmittance, reflectivity and absorption. The energy of infrared radiation is converted into heat only if it is absorbed by the irradiated substance. For different materials, the degree of absorption and the penetration depth of infrared rays are different, since the materials selectively relate to the wavelength of the incident radiation. The wavelength, in turn, depends on the temperature of the IR radiation generator.

Thus, the spectral optical properties of the product and the spectral characteristics of the heaters are interconnected and are of paramount importance. With a reasonable choice of the type of emitter and the irradiation mode, infrared radiation penetrates deep into the product, which intensifies the processes of heat and mass transfer.

The proposed development of equipment and technology for carving and drying cocoons of silkworm - works with a low-temperature, infrared, vibration installation, using elastic waves and convective heat supply. Using this technique and technology, the process of accelerating carrots and drying, as well as improving the quality of the resulting silk, is provided.

The main advantages of the proposed equipment and technology are as follows:

- achieving energy savings through the use of infrared radiation, elastic waves, vibration and convective heat supply;
- obtaining high-quality final production of silkworm cocoons;
- ensuring uniform carrots and drying by dehydration of the product;
- due to the improvement of the installation, its productivity increases, the quality of carrots and drying is improved;

- improving the reliability of work due to the developed equipment and technology, reducing the complexity of work, which allows to reduce the number of staff;

- the use of the proposed equipment and technology significantly reduces the drying time and carrots of silkworm cocoons;

- due to the use of low temperature, the quality of the resulting silk, including its color scheme, is ensured.

References

1. Decree of the President of the Republic of Uzbekistan dated March 29, 2017 No. 2856 "On measures to organize the activities of the Uzbekipaksanoat Association".

2. Burlakov V.S. Improving the efficiency of sericulture based on new technologies using developed technical means. Diss. Doct. agricultural sciences. Belgorod, P.2005.275.

3. Norkulova K.T., Umarov V.F., Safarov Zh.E. Use of a vibrating mechanism in ovens. // News of KSTU. –Bishkek, 2009.-№17. P.135-136.

4. Safarov J.E., Sultanova Sh.A., Dadaev G.T. Mathematical modeling of the linear stationary process of drying with accuracy of evaporation and temperature relation on the surface of the layer in infrared heating. // Agricultural Research & Technology: Open Access Journal. USA, 2017. Vol.9, Issue 5. P.1-3.

5. Safarov J.E., Sultanova Sh.A., Dadaev G.T. A study of the processing of pupae of silkworm cocoons. // International scientific-practical conference "Modeling and analysis of complex technical and technological systems." Samara, 2018.

6. Safarov J.E. Nonlinear processes during heat distribution in a layer of a dehydrated object // Abstracts of the Lomonosov-2010 youth scientific conference. - Tashkent, 2010. P.43-45.