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Effects of Elastic Waves in Processing of Cocons of the Type Silk Process

Safarov J.E., SultanovaSh.A., Samandarov D.I.

Dean, Faculty of Engineering, Doctor of Technical Sciences, Tashkent State Technical University 100095, University str., 2, Tashkent, Uzbekistan;

Head of department, department technique of rendering services, PhD, Tashkent State Technical University 100095, University str., 2, Tashkent, Uzbekistan;

Teacher, department technique of rendering services, Tashkent State Technical University 100095, University str., 2, Tashkent, Uzbekistan;

ABSTRACT: In the article the results of investigation of the effect of elastic waves during primary processing of silkworm cocoons are considered. A qualitative silkworm product was obtained in the drying process at a temperature of 650 °C for 50 minutes using a vibration of 1 m/s² for 2 minutes. Based on the results obtained, it can be concluded that the proposed technology makes it possible to obtain high-quality final products for use in the textile industry.

KEY WORDS: drying, infrared radiation, carrot, vibration, cocoon of silkworm, silk.

I.INTRODUCTION

Silkworming worldwide still remains the most mechanized sector of agriculture. The main reasons for this have always been the specificity of the industry, cheap labor in the countries of traditional silkworm breeding and the difficulties in creating technical means that ensure high-quality work with a living biological product.

One of the important ways to increase the importance of silkworm breeding as an industry is the authors consider the improvement of the technology of production of silkworm genes and cocoons on the basis of complex mechanization of the main processes in the industry.

In the world of silkworming, there are also many problems. These are periodic ups and downs in demand for products made from natural silk, as well as a low level of mechanization of labor-intensive processes.

The main manufacturer of cocoon raw materials - China, does not have serious technical means used in basic technological processes. Despite this unique diligence of the Chinese, quality, strict implementation of technological requirements, allows them to maintain world leadership in the production of cocoons and raw silk. The same situation with the mechanization in Korea, Vietnam, India, Bulgaria, etc. This is another prerequisite for the need for widespread introduction of our technology and advanced technology, which will advantageously compete with other countries.

Narrow seasonality, fragmentation, complexity of technological processes, lack of training bases for technical specialists, and others - the reasons for the low level of mechanization and automation of sericulture. For such a short (15-30 days) service life, it is inefficient and sometimes economically unprofitable to acquire relatively complex and expensive machines, to keep on the farms that carry out one fattening per year, the appropriate equipment that should be serviced by qualified specialists. The material-technical base of silkworms has not changed much in the past 40 years, and since the 1990s it has worsened even more. Therefore, the growth of cocoon production is not accompanied by a decrease in the cost of production and an increase in its quality, but on the contrary, since these indicators are directly dependent on the level of mechanization of the industry [1].

Currently, on the bases for primary processing, live cocoons are pretreated with hot air. The main operating part of the cocoon-dampers is the SK-150K unit, which is used in the mashing mode (under drying) at a temperature of 110-120 °C for 1.5-2.0 hours [2-3].

II. MATERIALS AND METHODS

For the carrot and drying of silkworm cocoons using low temperature using infrared radiation and vibration is one of the most modern and more acceptable methods of drying. For carrots and drying cocoons, vibration can be used in combination with other basic technologies in the process. Vibration affects the process as a physical factor, the action of mechanical energy from the source of oscillations.

Vibration, as well as sound, infra- and ultrasound, shock waves are constantly acting physical factors accompanying the evolution of life on Earth, during which special structures-mechano receptors-emerged and improved in the living organism. The vibrations acting on biological objects are of a dual nature. In some cases, they stimulate life processes, while in others they depress them [4]. The researchers pay special attention to the study of physiological effects on living organisms of infrasonic vibrations, which cause oppression, unreasonable fear, panic state, inadequate response to what is happening, etc.

One of the possible variants of creating vibratory movements for carrots and drying cocoons of silkworm is the development of vibro-mechanism of pallets of a drying cabinet with infrared irradiators for heating products [5-8]. A mechanism for generating low-frequency oscillations at the expense of an electromechanical drive to pallets has been developed at the Tashkent State Technical University. In the laboratory of the department a full-scale test was carried out for carrots and drying cocoons of silkworm. Experimental studies are given in table 1 “Results of the obtained data of carrot and drying of silkworm cocoons” and in table 2 “Results of the obtained data of carrots and drying cocoons of silkworm with the use of vibration”.

Table 1.
The results of the obtained data of carrots and drying cocoons of silkworm

No	Initial mass, g	Weight after treatment, g	Weight after 10 days, g	Processing temperature, °C	Time of treatment, min
1	48.5	41.2	28.5	55	80
2	49.7	41.4	28.2	60	75
3	50.2	41.2	27.9	65	70
4	50.1	42.5	29.0	70	65
5	49.5	42.0	28.7	75	60
6	49.2	40.3	26.2	80	55

Table 2
The results of the obtained data of carrots and drying of silkworm cocoons using vibration

No	Initial weight, g	Weight after treatment, g	Weight after 10 days, g	Processing temperature, °C	Time spent handling, min	Frequency of vibration, m/sec ² (meters per second squared)
1	50.2	43.6	28.2	55	60	1
2	49.6	43.5	28.5	60	55	1
3	49.2	42.0	28.0	65	50	1
4	50.1	41.5	27.2	70	45	1
5	48.7	41.0	27.4	75	40	1
6	49.5	40.1	26.5	80	35	1

As can be seen from the tables, the carrot and drying of the silkworm passed faster with the use of vibration. In addition, also the weight of the cocoons of these same variants treated with vibration has remained relatively much larger, and this indicates that the heavier cocoons retained more moisture than the first variant, treated without vibration. Such raw materials, when used further in textile production, will yield an effective result.



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III. CONCLUSION

On the basis of the results obtained, it can be stated that further improvement of the installation developed by the authors to ensure the acceleration of the process of carrots and drying by using 65 °C hot air for this purpose with vibration combinations of 1 m/s² for 2 minutes creates an opportunity for good preservation of natural physico-mechanical and technological characteristics of the cocoon shell.

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