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# PROSPECTS FOR THE PRODUCTION OF HIGH-QUALITY RAW SILK FROM LOCAL SILKWORM GRAINS

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**ANNOTATION**

*This article presents the results of research carried out in the field of improving the quality of silkworm cocoons, increasing the yield and improving the quality of raw silk that meets the requirements of quality class 4A and 3A according to the criteria of international standards. New methods of preparing cocoons for unwinding are also presented, which ensure high quality of raw silk and reduce the specific consumption of cocoons during their production.*

**KYE WORDS:** *agrotechnology, cocoons, cocoon thread, zaparka, sericin, silk, fibroin, unwinding, cocoon winding, raw silk, quality, vacuum, technology, filling, tension.*

## INTRODUCTION

Natural silk is the most expensive and valuable raw material in the textile industry. The Republic of Uzbekistan is one of the leading countries in the world producing and processing natural silk. At present, it occupies a quarter of the place in the world. In recent years, the silk industry has been further developed, especially in the light of recent decisions of the top leadership of our state.

In a number of Decrees and Resolutions of the President of the Republic of Uzbekistan, the tasks of improving and strengthening the silk industry are defined. For this purpose, it is planned to expand the silkworm feed base by planting additional linear plantings and mulberry plantations, organizing the production and procurement of high-quality silkworm cocoons. It is necessary to improve the primary processing and processing of cocoons, modernize existing and create new capacities for the production of raw silk and silk yarn, and organize deep processing of silkworm cocoons. It is necessary to improve the effective organization of work to increase the volume of production and improve the quality of finished silk fabrics, develop its most popular ranges, increase the export potential of the industry, and ensure standardization that meets international requirements.

Today on the territory of the Republic in the system of the Association "Uzbekinprint" there are more than 40 salamatullah enterprises, and mounted and put into operation about 100 series (400 catches) high-performance reeling machines type of FEIYU 2000 EX, FEIYU 2008 NT production of China. The total capacity of silk-winding enterprises equipped with imported equipment is 38,800 catchers. There is a relatively large specific consumption of cocoons,

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despite the high level of mechanization and automation of technological processes, raw silk quality of CL. 4A and 3A is lower than expected. Therefore, improving the quality of raw silk produced and reducing the specific consumption of cocoons is a very urgent task facing the industry.

## PURPOSE OF RESEARCH

The aim of the work is to produce raw silk 4A, 3A, which meets the norms and requirements of international standards, ensuring the production of high-quality raw silk at a minimum cost of energy and labor resources. This goal is achieved by introducing a new agricultural technology created for growing mulberries and cocoons, creating a new type of steaming device based on pre-forced filling of the inner cavity of cocoons with water of a certain temperature and holding these cocoons in a barge with water of the required temperature to the state of softening sericin.

## METHOD OF RESEARCH

The paper uses theoretical and experimental research methods. The methodological basis of research is the work of scientists in this field and methods of mathematical analysis. The results of experimental studies are processed using mathematical statistics.

## MAIN PART

The quality of raw silk depends primarily on the technological and quality indicators of the cocoons used. It is no secret that the technological and quality indicators of cocoons from imported grain (Chinese, Japanese, Korean) significantly exceed the same indicators of cocoons from local grain. Therefore, scientists-breeders of our Republic create new breeds and hybrids of local cocoons, some of them even higher in quality than imported analogues. In the experimental section of Uzniinv, trial feeding of some new hybrids created in Uzniish was performed, using the created new agricultural technology of Uzniinv, mulberry growing and silkworm feeding [1,2]. Technological indicators of cocoons grown from newly created hybrids of local silkworm breeds, fed using the new agricultural technology of Uzniinv are shown in table 1.

**Table 1**

| № p/p | Name of indicators | Hybrids of silkworm cocoons | | | | | |
|---|---|---|---|---|---|---|---|
| | | Oltin vodiy 2 | Zarafshon | Istiqbol | Line 2m x Line 3m | Marvarid x Line 41 | Line 65 x Guzal |
| 1 | Average weight of cocoons, g | 1,007 | 0.934 | 0,972 | 0,884 | 0,915 | 0,892 |
| 2 | Silkiness of cocoons, % | 53.14 | 51,60 | 52,28 | 52,29 | 50,73 | 53,00 |
| 3 | The output of raw silk, % | 44,14 | 44,45 | 44,75 | 47,22 | 44,65 | 43,87 |
| 4 | Unwinding of the shell, % | 84,4 | 87,4 | 84,6 | 89,2 | 86,7 | 86,8 |
| 5 | Linear density of cocoon threads, Tex | 0,308 | 0,321 | 0,333 | 0,318 | 0,306 | 0,308 |
| 6 | Metric number of cocoon threads | 3246 | 3121 | 3006 | 3146 | 3278 | 3253 |
| 7 | Length of continuous-forming threads, m | 1345 | 1295 | 1287 | 1205 | 1200 | 1215 |
| 8 | The total length of the cocoon thread, м | 1522 | 1402 | 1366 | 1330 | 1352 | 1346 |
| 9 | Specific consumption of cocoons, kg/kg | 2,27 | 2,25 | 2,23 | 2,12 | 2,24 | 2,28 |

Analysis of the data shown in table. 1 it is clear that the technological indicators of cocoons of painted hybrids are very good, they are not inferior to imported analogues in all indicators. Zoning these hybrids in sericulture will improve the quality of raw silk produced and significantly reduce the specific consumption of cocoons.

The quality of raw silk produced depends largely on the technological parameters of cocoon processing at silk-winding enterprises. It is therefore necessary to scrutinize the entire process chain of production of raw silk, since pasportization cocoons and their selection in the batch and ending with the removal of raw silk from the reel, their testing in the production lab and baling, using all the new technology in the production of raw silk. Here, special attention should be paid to the process of steaming cocoons, since all the quality indicators of the raw silk produced depend on this technological operation. The purpose of sealing the cocoons is to fill the inner cavity of the cocoons with process water and to soften the sericin to relax the adhesion force of the sericin. Without performing this operation, it is impossible to unwind the cocoons. Cocoon steaming is performed on various types of steaming units with automatic cocoon winding.

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When the cocoons are steamed, the inner cavity of the cocoons is filled in a vapor-water environment, due to a large pressure drop inside the cocoon shell. Currently, many enterprises use a vacuum method for filling cocoons with water, and softening sericin in the cocoon shell is performed directly by searching the ends of the cocoon threads on a cocoon-shaking machine. The degree of filling of the cavity of the cocoons depends on the method of unwinding cocoons, there are three ways of unwinding of the cocoons: the first method of unwinding cocoons in a floating state, used when unwinding the cocoons of the mechanical reeling machine, with the cocoons filled with water to 75% of the inner cavity of the cocoon; second, a way of unwinding the cocoons in half-sunk condition, is used in the unwinding of the cocoons to the reeling machines of the type SKE-4-WU, SK-5, etc., with the cocoons filled with water to 92% of the internal cavity of the cocoon; the third way of unwinding in the submerged condition, used for

Cocoon steaming is a preparatory process that facilitates the separation of the silkworm (fibroin) of the cocoon shell to produce a silk thread, and for gluing together the individual silkworms that form the raw silk thread. The mulberry that makes up the shell of the cocoon is glued together with sericin and in order to separate it from the shell in order to frame it, it is necessary to soften this sericin. Moreover, sericin must be softened to such an extent that the silk can easily come off the cocoon shell when it is unwound. The complementary thread of raw silk is obtained by co-unwinding several cocoon threads into one thread, so it is necessary to ensure a tight bonding between the silks that descend from the separate cocoons. To soften sericin, there are various methods of processing cocoons, the most common of which is the method of processing cocoons in a vapor-water environment at high temperatures. The steaming of the cocoons before the unwinding and this is why this

The essence of the vacuum method of processing cocoons is that the cocoons are placed in a chamber, from which air is then pumped out by a vacuum pump. As the air in the chamber is rarefied, water begins to flow inside the cocoons. However, when using this method, the filling capacity of cocoons with water varies widely, since the filling capacity of cocoons is influenced by some technological indicators, such as the geometric dimensions of cocoons, the density of the shell, the linear density of cocoon threads, etc. Our experiments to determine the degree of filling of cocoons with process water show that the cocoons are filled gradually. After 2 minutes, the process of filling with water slows down, despite the fact that the vacuum pump continues to work, it takes at least 20 minutes for the cocoons to fill with water up to 97% of the internal volume.

In order to eliminate this disadvantage of the method, we have proposed a new method for filling cocoons with process water. The essence of the new method is that after the start of pumping air for 2 minutes, the camera cover opens, pulls out the cassettes with cocoons and leaves them in the air for 1.0 minutes. During this time, the air penetrates into the shell and the pressure inside the cocoon becomes equal to atmospheric pressure. After that, the cassettes with cocoons are placed in the chamber, the chamber cover is tightly closed and the air is pumped out of the chamber for 1.5-2.0 minutes. Indicators of the production capacity of the proposed method are shown in table 2.

**Table 2**

| № p/p | The parameters of the unwinding of the cocoons | Research options | |
|---|---|---|---|
| | | Experienced | Tested |
| 1 | Water-filled cocoons, % | 95-97 | 55-57 |
| 2 | The output of raw silk, % | 36,55 | 33,25 |
| 3 | Length of continuously unwinding cocoon thread, m | 1100 | 850 |
| 4 | Specific consumption of cocoons, kg/kg | 2,80 | 3,10 |
| 5 | The number of unwound cocoons,kg | 25,0 | 25,0 |

Analysis of the data shown in table. 2 shows that the unwinding of cocoons processed according to the proposed method gives better results for all major technological indicators due to the better filling capacity of cocoons with process water.

However, currently there are no instrumental methods for determining the quality of vaporization of the cocoon shell. In practice, for this purpose, use indirect prisms, the output of cocoons with hooked ends of cocoon threads and the multiplicity of their processing with a brush. The output of cocoons with hooked ends of threads does not give an objective assessment of the quality of vaporization of the cocoon shell. Even with a 100 % probability of cocoons with hooked ends coming out, a high breakage can be observed during the unwinding process, due to the unevenness of the vaporization along the layers of the shell. Therefore, it is necessary to propose criteria for evaluating the vaporization of cocoons. As such a criterion, you can

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use the forces of the silk thread when unwinding cocoons. It can be assumed that by determining the current value of the usulium of the cocoon thread of the shell, it is possible to judge the degree of vaporization of cocoons [5,6]. To measure the tension of a silk thread, we have developed an experimental setup (see Fig. 1).

The experimental setup consists of a winding basin-1 with a cocoon -2, a roller system -3,4,5, a hexagon motavila -6, the received movement from an electric motor -8 through a belt transmission -7. Technological testing of this installation was performed in production conditions by unwinding cocoons steamed (processed) by vacuum method for unwinding on mechanical machines KMS-10. In the experiment, the unwinding speed was assumed to be 100 m / min., as the unwinding speed on mechanical machines KMS-10. At the experimental installation, the measurement of the tension force of the cocoon thread is drained by a strain gauge method, a sensitive element made in the form of a plate-9 with a strain Converter with an oil bath-10. To convert the signal from the strain Converter-11, an amplifier-12 and an analog-to-digital Converter-13 are used. the Digital signal is processed by a computer-14.

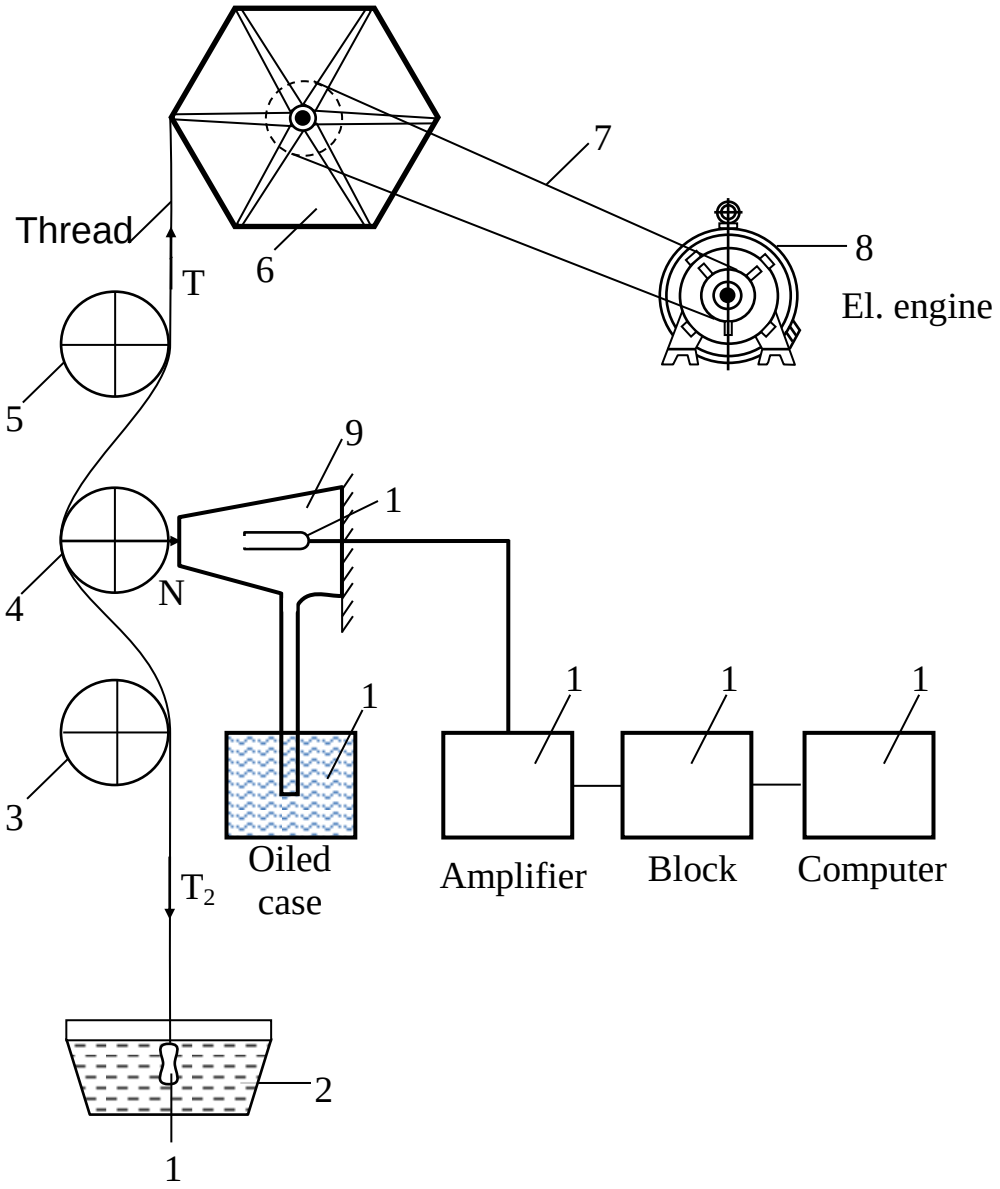


**Fig. 1. Diagram of an experimental setup for determining the dynamic force of the thread escaping from the cocoon shell.**

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The thread tension is measured as follows. The thread being wound from the cocoon shell passes through the guide rollers as shown in Fig.1. the cocoon thread Moving in the roller-4 zone acts on the plate with a force of N, the value of Which depends on the tension of the cocoon thread T1 and T2. To reduce the effect of the friction force in the guide roller supports on the thread tension, the rollers are mounted on rolling bearings.

It is known that the force of the thread escaping from the cocoon shell varies depending on the location of the thread in the layers of the cocoon shell [3,4]. In the upper layers of the shell, the winding force is the smallest, it gradually increases, and in the inner layers it falls again. Therefore, to assess the quality of cocoon steaming, it is necessary to study the dynamics of changes in the thread escapement force when unwinding the middle layers of the cocoon shell, for example, after unwinding the first 100 meters of the thread. Proceeding from this consideration, when conducting experimental research, cocoons steamed in different ways were unwound for 1 minute on a single unwinding machine, then the unwinding was continued on an experimental setup [5,6]. As a result of the experiments, numerical values of the cocoon thread escapement force are obtained, shown in table.3 and graphs showing the nature of the change in the forces of the cocoon thread escaping from the shell, shown in Fig. 2.

**Table 3**

| The method of steaming the cocoons | Moisture absorption of the cocoon, % | Thread tension (vanishing force), SN | |
|---|---|---|---|
| | | Max. when unwinding. with a speed of 100 m / min | Max. when static. measurement |
| Swimmed | 72-75 | 2,55 | 0,44 |
| Steeped | 95-97 | 0,72 | 0,06 |
| Vacuum | 100 | 0,60 | 0,04 |

Analysis of the research results shown in table.3 and in the graphs (see Fig.2) show. That the character of changes in the usuli of the cocoon threads coming off the shell is most uniform in cocoons steamed by submerged and vacuum methods. In cocoons steamed on mechanical cocoon-winding machines KMS-10, the thread escaping force changes with a greater ampletude, which indicates that the steaming of the cocoon shell is uneven. This once again confirms the imperfection of the method of preparing cocoons for unwinding on mechanical machines and opens up prospects for creating new types of equipment for sealing.

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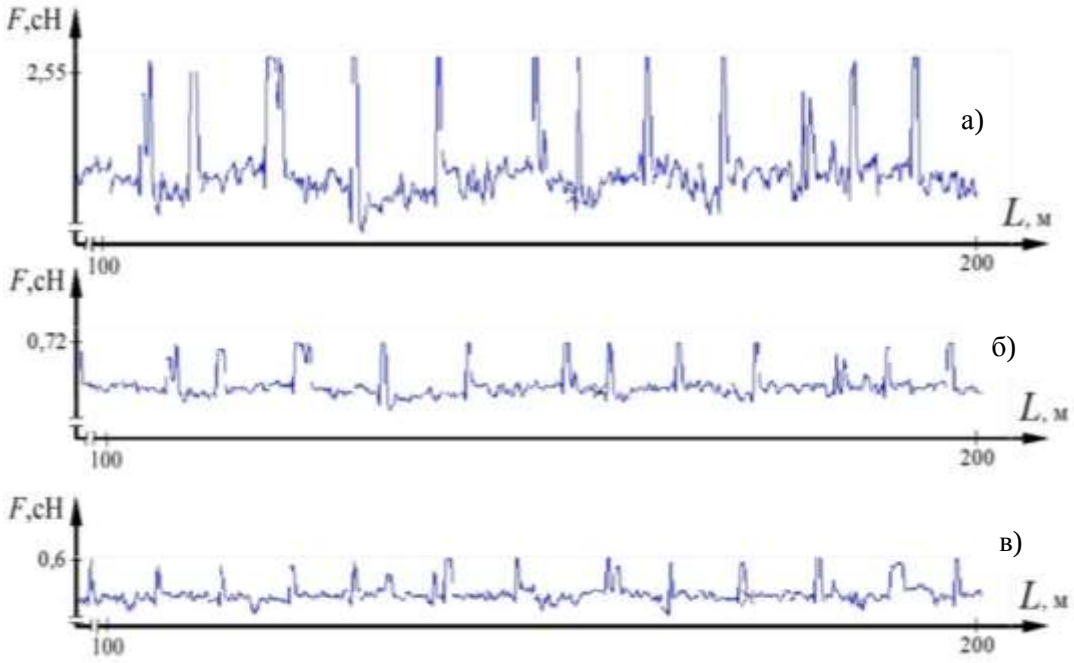


**Fig. 2 the Nature of changes in the forces of the thread escaping from cocoons steamed in various ways.**

a) - steamed on mechanical machines KMS-10;
b) - steamed by submerged method;
C) - vacuum-vaporized.

Thus, the new agrotechnology of mulberry growing and silkworm rearing, as well as new methods of preparing cocoons for unwinding, allow a sharp improvement in the quality of raw silk produced, while reducing the specific consumption of cocoons.

## ВЫВОДЫ

1. Has been created a new agrotechnology of mulberry growing and silkworm rearing, which allows the production of high-quality cocoons, which are introduced on farms when drawing silkworm cocoons.

2. New methods of preparing cocoons for unwinding have been Created and tested in the production conditions of cocoon-winding factories, ensuring high quality of the raw silk produced, reducing the specific consumption of cocoons.

3. A new instrumental method for determining the quality of cocoon vaporization has been Developed and a device for measuring the strength of cocoon threads has been created to assess the degree of cocoon vaporization.

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