MedCrave
Step into the World of Research
Journal of Textile Engineering & Fashion Technology

Short Communication

Open Access
CrossMark

Technology of preparation of defective cocoons for reeling

Abstract

In this article, one of the ways to effectively use non-smooth defective cocoons that cannot be used in reeling is covered. An analysis of the development of the silk industry and the scientific work currently being carried out in this direction is presented. Water and air permeability of defective cocoons produced during cocoon sorting, evaporation regimes, influence of solution concentration on cocooning was studied by single cocooning. It is based on the fact that the amount of raw silk can be increased by introducing the spinning of defective cocoons. In order to achieve the set goal, separate cooking and water filling regimes of defective cocoons depending on the type of defect were determined based on experiments. A new processing method is recommended for cooking defective cocoons. Recommended technological parameters and modes for workshops are presented in the tables. Defective cocoons with a new concentration based on the type of defect recommended.

Keywords: defective cocoon, cooking, air permeability, silkiness, cocoon thread, stickiness, unevenness, regime

Volume 9 Issue 5 - 2023

Akhmedov Jakhongir,[1] Jumaboev Akmal,[2] Sharipov Jurabek,[1] Sobirov Quziboy,[3] Atabaev Izzatbek[4]

[1]Tashkent Textile and Light Industry Institute, Uzbekistan
[2]UMT global logistics company, Uzbekistan
[3]Urganch State University, Uzbekistan
[4]Silk Science Research Institute, Uzbekistan

Correspondence: Akhmedov Jakhongir Adkhamovich, Tashkent Textile and Light Industry Institute, Uzbekistan, Email umurzaqova_@mail.ru

Received: August 26, 2023 | **Published:** September 13, 2023

Introduction

In the world, scientific and research activities aimed at creating various effective technologies for processing unsorted cocoons and producing finished silk products from them are being carried out. In this direction, among others, researches on effective use of defective cocoons in sericulture, improvement of production technology of raw silk and spun silk threads, and development of raw material preparation technology for natural silk products are considered a priority. In this regard, it is of particular importance to solve problems such as setting parameters for the production of high-quality raw silk, spinning of silk waste combined with natural and chemical fibers, and creation of new methods that ensure high efficiency in the technological processes of obtaining woven yarn for silk carpets.

Making full use of the available opportunities in our republic, comprehensive measures are being taken for the production of ready-made silk products with added value, and certain results are being achieved. The Decree of the President of the Republic of Uzbekistan "On the Development Strategy of New Uzbekistan for 2022-2026" defines important tasks for improving the efficiency of the economy and improving techniques and technologies for the production of new types of competitive products from local raw materials. In the implementation of these tasks, among other things, it is a priority task to effectively use silk and its fiber waste, which is one of the local raw materials, to create a science-based technology for the preparation of a new type of raw material for silk products.

A lot of work has been done by scientists to expand the range of silk products, and they can be divided into three areas:

a. Production of new fabrics for special purposes with unusual linear density and structure from raw silk;

b. Production of new multi-component yarns obtained by strengthening artificial, synthetic fibers and yarns by mixing them with raw silk;

c. Partial replacement of warp and weft yarns of national silk fabrics with cheaper chemical yarns.

The first of this direction is mainly focused on the preparation of silk threads (4.6-10 tex) for the production of thick fabrics (atlas, chechucha) from substandard and defective cocoons.

In the second direction, it is necessary to rationally use natural silk, which is one of the raw materials of our republic, and its waste, mix them with other natural and chemical fibers, and improve the production technology of a new type of polycomponent spun yarn that meets the requirements of domestic and foreign markets.[1,2]

In this work, the electron-microscopic appearance of defective cocoons, the results of individual spinning and the exit of cocoon threads are presented.[3,4] The use of defective cocoons as raw material in silk spinning of certain types increases the efficiency of the production industry. This requires a comprehensive analysis of the technological properties of various types of waste, preparing them for the process of mixing them with different fibers, and developing a technology for processing individual fibers depending on their properties and condition.[5,6]

In this research, the production of bicomponent spun yarn, the properties of cotton and silk fibers used in the obtained yarn, the types of silk fiber waste and the method of their effective use are presented. It has been shown that silk fiber waste has higher hardness, elongation to break, elastic and elastic deformations than cotton fiber.[7,8]

As we know, when one kilogram of raw silk is produced, almost the same amount of fiber waste is produced. These fibers can be recycled to produce spun silk yarn, the price of one kilogram of which is equal to the price of one kilogram of raw silk spun from cocoons in world markets.[9–13]

Research results

Cocoon shell characteristics are an important factor in preparing cocoons for reeling and establishing cooking regimes. That is, it is necessary to determine the characteristics of the cocoon shell, including parameters such as thickness and porosity, shell cleanliness and granularity. Because the properties of cocoons grown in different regions differ from each other, the batch of cocoons is enlarged.

Correctly conducting the process of preparing cocoons for hatching has a significant impact on the quality of the product and the efficiency of the enterprise, affecting all subsequent processes. When cooking defective cocoons, insufficient cooking of the damaged areas in them will cause problems in hatching. Taking this into account, the water and air permeability of the cocoon shell was studied.

According to the results of the conducted experiments, it was found that the index of air and water permeability of cocoon shells is lower in satin-shaped cocoons and stalk-shaped cocoons. The main reason for this is the high density of fibers in the damaged areas of the cocoons.

In order to ensure continuity of technological processes, separate regimes should be developed and justified for each type of defective cocoon. In the research work, various experiments were conducted considering the above characteristics of defective cocoons grown from Chinese hybrids.

It is known that there must be a force of gravity that resists the force of gravity when spinning cocoons. This force of gravity is achieved by filling the cocoon with water. For this, it is necessary to process the cocoon with high temperature steam and water. It is known from experiments that sericin begins to melt at a temperature of 40°C. FY-522, Chibo-G, Chibo-DZ, KZ-2, KZ-4M, ZD-427 and ZD-800 machines are being used for steaming and cooking of cocoons according to the existing technology. From the information presented in Table 1 above, it is known that the characteristics of defective cocoons are significantly different from the characteristics of the quality cocoons, so it is necessary to improve their cooking mode.

Table 1 Water and air permeability of the cocoon shell

Type of cocoon	Air permeability of shell of cocoon ml/(sm2s)	
	Air permeability	Water permeability
Variety	2,0-2,4	0,7-0,9
Double dome	1,2-1,4	0,35-0,6
Spotted	0,7-0,9	0,2-0,4
Deformed	1,2-1,4	0,4-0,7
Atlas	0,5-0,8	0,2-0,4
The stack is traceable	0,6-0,9	0,3-0,5

During the experiments, the optimal cooking mode was selected in accordance with the characteristics of the defective cocoons shell, and all experiments were conducted based on them. The table below shows the optimal mode of cooking defective cocoons. In the control option, the actual mode of cooking of grade cocoons in silk factories was obtained and compared with the recommended experimental option. Under production conditions, 1000 liters of water are needed to cook 15 kg of dry cocoons. FY-522 cocoon cooking machine designed for laboratory was used for experiments. 100 g of cocoons were taken for each experiment.

The adhesive strength of cooked cocoon threads is of primary importance in the process of spinning. This indicator is on average in the range of 0,25-0,35 sN in grade cocoons. As the adhesion strength increases, yarn breakage increases and negatively affects the quality of raw silk. The cooking mode has been improved to reduce the adhesion force on defective cocoons. Hydrogen peroxide and 70 percent household soap (2 kg per 1000 liters of water) were used for this purpose. Hydrogen peroxide is a chemical found in every body. It is necessary for the regulation of bioorganic processes. It oxidizes toxins and bacteria, and also creates a barrier against viruses. This substance was selected as an assistant in the cooking of cocoons because it did not have a negative effect on the skin of the workers in the subsequent processes, and experiments were conducted by mixing it in different proportions.

The results of the experiments were analyzed by washing the cocoons individually, and comparing the quality of raw silk and the level of viscosity in the control and experimental options. In the control option, the cocoons were cooked through the actual cocoon cooking regime and the results after hatching were presented. In the experimental version, based on the cooking mode in Table 2, the results of cooking cocoons cooked in mixed water of different proportions are presented.

Table 2 Mode of cooking bad and defective cocoons

№	Unit of measurement and parameters	Mode	
		Control	Experience
1.	Cocoon processing time (min)	18	22
2.	Moisten with water		
	Bath °C	55	65-70
	Time, min	3-3,5	4-4,5
3.	First vacuum evaporation, °C	82	85
	Vacuum condition	0,4-0,5	0,4-0,5
	Time, min	3	4
4.	The Department of Sampling, °C	75	75
	Time, min	2,5-3	4-Mar
5.	Second vacuum evaporation, °C	99	99
	Vapor pressure, kPa	0,7-1,3	10-May
	Time, min	2-2,5	4-Mar
6.	Water filling department		
	Bath, °C	94-75	98-75
	Time, min	3-3,5	4-4,5
7.	Refrigeration department, °C	48	48
	Steam pressure, MPa	2,5-3,0	2,5-3,0
	Time, min	2	2

The Tables 3–5 show the results of individual soaking of cooked cocoons with the addition of hydrogen peroxide in different proportions to water. From the results of the experiment, it can be seen that with the increase of the mixture ratio, the shrinkage of the cocoon shell also increases in a positive direction. However, when the ratio of the mixture was increased from 1000÷3, there were cases where the cocoon thread became a package as a result of the melting of sericin in the shell. This situation increases the number of defects in raw silk and leads to a decrease in its quality.

Citation: Jakhongir A, Akmal J, Jurabek S, et al. Technology of preparation of defective cocoons for reeling. *J Textile Eng Fashion Technol.* 2023;9(5):124–127. DOI: 10.15406/jteft.2023.09.00345

Table 3 Reeling results of defective cocoons (1000÷1 ratio)

Type of cocoon	Raw silk yield, %		Silkiness, %		Number of breaks, pieces/hour		Comparison consumption, kg	
	Control	Experience	Control	Experience	Control	Experience	Control	Experience
Double dome	21	23	40	43	8	8	4,9	4,6
Spotted	25	26	44	45	7	7	4,8	4,6
Deformed	23	26	42	45	8	8	4,7	4,5
Atlas	22	26	41	43	10	9	4,9	4,8
The stack is traceable	22	25	41	43	11	9	4,9	4,8

Table 4 Reeling results of defective cocoons (1000÷2 ratio)

Type of cocoon	Raw silk yield, %		Silkiness, %		Number of breaks, pieces/hour		Comparison consumption, kg	
	Control	Experience	Control	Experience	Control	Experience	Control	Experience
Double dome	21	27	40	46	8	5	4,9	4,2
Spotted	25	29	44	50	7	4	4,8	4,2
Deformed	23	28	42	50	8	5	4,7	4,2
Atlas	22	28	41	49	10	7	4,9	4,3
The stack is traceable	22	28	41	49	11	7	4,9	4,3

Table 5 Reeling results of defective cocoons (1000÷3 ratio)

Type of cocoon	Raw silk yield, %		Silkiness, %		Number of breaks, pieces/hour		Comparison consumption, kg	
	Control	Experience	Control	Experience	Control	Experience	Control	Experience
Double dome	21	25	40	48	8	4	4,9	4,0
Spotted	25	27	44	51	7	2	4,8	3,7
Deformed	23	27	42	51	8	4	4,7	3,9
Atlas	22	25	41	51	10	4	4,9	4,0
The stack is traceable	22	26	41	51	11	5	4,9	4,0

In order to determine the adhesion strength of cocoon threads, using a machine for spinning cooked cocoons, the tip of the cocoon thread was placed in a horizontal position and attached to its hanger when the cocoon thread was spun for 100 meters. Then the indicator of the weight quadrant is slowly moved down. Under the influence of the pulling force of the indicator, the cocoon thread began to separate from the shell, and the tension in it continues until the force of adhesion that holds the thread in the cocoon is equal. When the tension force is equal to the adhesion force, the yarn exit from the cocoon stops.[14]

It can be seen from the graph (Figure 1) that with the increase in the mixture ratio, the adhesive force of the cocoon thread is decreasing significantly. As the ratio increases, more evaporation occurs in the cocoons and increases the likelihood that most of the raw silk to be spun will pass into the web. Also, the cocoon threads cause a decrease in the quality indicators of the raw silk, which is removed from the shell as a package, in terms of large and small defects.

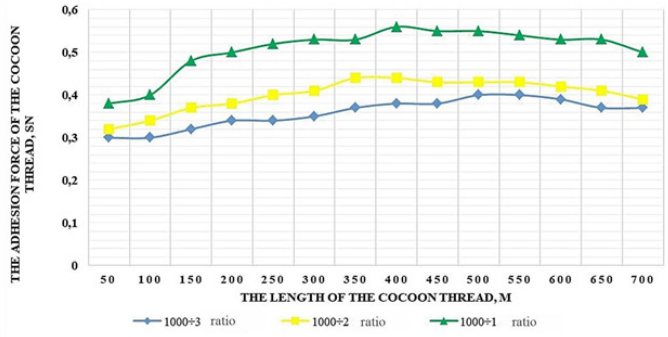

Figure 1 Variation of adhesion forces along the length of defective cocoon yarns cooked in different ratios in the experimental variant.

According to the results obtained from the experiments, it can be concluded that the silkiness index increased by 3, 6 and 8 percent, respectively, from the control variant with the increase in concentration when treated with the solution. Taking this into account, it was recommended to prepare and cook a mixture in the ratio of 1000÷2 depending on the characteristics of the shell of defective cocoons. Also, high shell hardness and satin-like cocoons can be cooked by preparing a mixture in the ratio of 1000÷3.

Acknowledgments

None.

Funding

None.

Conflicts of interest

Authors declare that there is no conflict of interest.

References

1. Leye H, Choi HY. Myungwoong Kim. Fabrication of nanofibers using fibroin regenerated by recycling waste silk selvage. *Polymer Bulletin part of Springer Nature*. 2020.
2. Sobirov QE, Mardonov BM, Akhmedov JA, et al. Investigation of the process of removing the thread from the surface of the cocoon in an aquatic environment. *J Phys: Conf Ser*. 2021;1889:042044.
3. Akhmedov JA, Bastamkulova HD. Study of the properties of natural silk fiber waste. *Composite materials*. 2016;2:71–74.
4. Alimova KhA, Bobatov UA, Akhmedov JA, et al. The formation of defects during the reeling of raw silk. *J Phys: Conf Ser*. 2021;1889:042049.

Citation: Jakhongir A, Akmal J, Jurabek S, et al. Technology of preparation of defective cocoons for reeling. *J Textile Eng Fashion Technol*. 2023;9(5):124–127. DOI: 10.15406/jteft.2023.09.00345

5. Aripdzhanova DU, Alimova HA, Akhunbabaev AO, et al. A new method of obtaining polycomponent yarn. *Composite materials*. 2015;4:68–70.
6. Khabibullaey DA, Aripjanova DU, Umurzakova Kh, et al. Producing yarn from mixed fibers. *International Journal of Innovative research (IJIRSET)*. 2021;10(3):1876–1879.
7. Umurzakova HK, Bolkiboev AB. Study of the quality of raw materials for obtaining bicomponent spun yarn. Textile problems. 2016;3:48–50.
8. Nabidjanova NN, Alimova KhA., Umurzakova Kh, et al. Dependence of the diameter of the thread on the parameters of the body structure andthe deformability of the knitwear. Proceedings of the II International Conference on Advances in Materials, Systems and Technologies *AIP Conf Proc*. 2022.
9. Akhmedov ZhA, Bastamkulova KhD, Alimova Kh, et al. Development of yarn production technology of natural silk. *European Sciences review Scientific journal*. 2016:176–179.
10. Khabibullaev DA, Umurzakova Kh. Properties of mixed fiber yarns. Problems of the textile industry and ways to solve them: Collection of scientific papers of the All-Russian round table with international participation (December 22, 2020). 2021. 271 p.
11. Umurzakova Kh, Alimova Kh, Holdarova S. The law of motion in determining the tension of the cocoon thread. *International Journal on Orange Technology.* 2022;4(7):33–41.
12. Habibullaev DA. Preparation of raw materials for the production of polycomponent yarn for costume fabrics. *Scientific and technical journal of Ferghana Polytechnic Institute*. 2021;25:204–209.
13. Umurzakova Kh, Alimova KhA, Tursunov TD. Raw Materials for a new range of silk bandages. *International Journal of Innovative Analyses and Emerging Technology*. 2022;2(11):12–16.
14. Sobirov QE. Improvement of the technology of spinning thin fiber cocoons of mulberry silkworm. Diss. Ph.D. TTESI. 2022. 84 p.

Citation: Jakhongir A, Akmal J, Jurabek S, et al. Technology of preparation of defective cocoons for reeling. *J Textile Eng Fashion Technol.* 2023;9(5):124–127. DOI: 10.15406/jteft.2023.09.00345