The OSCAR PUBLISHING Services
American Journal of Applied Science and Technology

VOLUME Vol.05 Issue 12 2025
PAGE NO. 147-151
DOI 10.37547/ajast/Volume05Issue12-24

From Local Silkworm Seeds Achievement Processed Fine-Fiber Cocoons Processing Of Low-Linear Density Raw Silk Release Technologye

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Received: 20 October 2025; **Accepted:** 12 November 2025; **Published:** 17 December 2025

Abstract: This article presents the results of laboratory tests conducted at the Uzbekistan Scientific Research Institute of Natural Fibers on creating a technology for producing raw silk with linear densities of 1.56 and 1.89 tex on FY-502 mechanical cocoon reeling machines manufactured in the People's Republic of China and KMS-10 mechanical cocoon reeling machines manufactured in the Republic of Uzbekistan from local mulberry silkworm eggs, and determining the quality indicators of raw silk obtained using this technology.

Keywords: Silkworm cocoon, cocoon thread, fine-fiber, raw silk, linear density, metric number, cocoon steaming, cocoon unwinding, "rose," holder, peony, spindle, drying cabinet, yarn, emulsification, rewinding.

INTRODUCTION:

Natural silk in the balance of textile fibers does not exceed 0.2%, and over 60 countries worldwide are engaged in cocoon cultivation and processing. Today, the Republic of Uzbekistan ranks fourth in the world in the production and processing of silkworm cocoons. Currently, our republic's cocoon-winding enterprises produce only 2.33, 3.23 and 4.65 tex assorted raw silk. However, the current State Standard of the Republic of Uzbekistan UzDSc3313:2018 provides for the production of raw silk in 9 assortments with linear density from 1.56 tex to 16.60 tex.

Currently, there is a high demand in the world, especially in the countries of Southeast Asia and the Middle East, for thin silk fabrics with high surface density. Such fabrics can be produced only from raw silk with low linear density. It is advisable to unwind raw silk with low linear density from fine-fibered cocoons, because the more elementary silk threads are present on the cross-sectional surface of the raw silk, the higher its quality indicators, especially the indicators of tensile strength and elongation at break. For this, it is necessary to select the optimal variety or hybrid of cocoons based on trials of cocoons grown from newly developed fine-fibered silkworm eggs created by Uzbek breeders. Based on the cultivation of cocoons from selected local silkworm eggs and the cultivation of the most promising cocoon variety by the overfeeding method and the production of raw silk from them, low linear density raw silk is produced and its production technology is created.

After the release of raw silk assortments with low linear density, they undergo comprehensive laboratory tests. Based on the analysis of the results of comprehensive laboratory tests, new assortments of fine, exquisite fabrics with high surface density are being created from low linear density raw silk.

In this research paper, theoretical and practical

research methods are used. The methodological basis of the research was the scientific work and mathematical analysis methods of scientists in the field of natural silk production and processing. The results of applied research were analyzed using mathematical statistics methods.

Initially, several local silkworm grains, created by the breeders of the Scientific Research Institute of Sericulture, were grown in the institute's silkworm factory. Then, the technological and qualitative parameters of the obtained cocoons were determined in the testing laboratory of the institute on a laboratory machine for piece unwinding of cocoons of the LC brand of the UZNIISHP system by the piece unwinding method. Table 1 below shows the results of the conducted laboratory tests.

Table 1. Results of laboratory tests to determine the technological and qualitative indicators of grown cocoons

№	Naming of indicators	A variety or hybrid of silkworm cocoons					
		L 65xGuzal	L 300	L 301	L 2 x L 3	Y- 66	Y-120
1	Average cocoon weight, g	0,895	0,745	0,697	0,885	0,720	0,745
2	Cocoon silkiness, %	50,45	50,54	50,35	50,50	51,73	51,15
3	The output of raw silk, %	43,17	43,74	42,25	42,82	44,05	44,25
4	Unwinding of cocoon shells, %	85,8	88,7	83,4	88,2	89,7	88,9
5	Linear density of cocoon thread, tex	0,308	0,273	0,282	0,308	0,256	0,255
6	Metric number of the cocoon thread	3247	3663	3546	3247	3906	3922
7	Continuously unwinding cocoon thread length, m	1215	1375	1350	1205	1350	1385
8	Total length of cocoon thread, m	1345	1450	1475	1320	1440	1450
9	Specific consumption of cocoons, kg/kg	2,32	2,29	2,37	2,33	2,27	2,26

As can be seen from the laboratory test results shown in Table 1, all tested cocoon varieties or hybrids have very high technological performance. Based on their analysis, the Ya-120 hybrid with the highest technological performance was selected for growing cocoons of the experimental batch. Cocoons of the experimental batch were grown in the innovative silkworm workshop of the Institute on multi-storey silkworm mattresses created by the institute's specialists [11, 12]. The practice of growing cocoons of an experimental batch was carried out without difficulty. As a result, a pilot batch of 112.5 kg cocoons was produced. The grown live cocoons were dried using the existing drying technology, with the drying coefficient being 2.2. As a result, 51.14 kg of dried cocoons were obtained from the grown 112.5 kg of live cocoons.

After the cocoons were dried, the dry cocoons were sorted, as a result, 3.58 kg of unsuitable cocoons were isolated from 51.14 kg of dry cocoons. After that, 47.56 kg of dry-sorted cocoons were unwound on mechanical cocoon winders in the production conditions of the silk-winding enterprise. At the same time, the unwinding of experimental batches of raw silk with linear densities of 1.56 and 1.89 tex was carried out on mechanical cocoon winding machines KMS-10 and FY-502. During the production of raw silk with a linear density of 1.56 tex, 6 cocoons were held under the trap, 4 of them new and 2 old. In the production of raw silk with a linear density of 1.89 tex, 8 cocoons were kept under the trap, 5 of them new and 3 old. On both mechanical cocoon winding machines, the production of experimental batches of raw silk was carried out without difficulty. At the same time, the cocoon unwinding speed on both machines was 140 m/min. Table 2 below shows the technological parameters of unwinding cocoons of the experimental batch on mechanical cocoon winding machines.

Table 2. Technological parameters of unwinding of raw silk with linear densities of 1.56 and 1.89 tax on mechanical cocoon winding machines.

№	Linear density of raw silk, tex	The output of silk products, %						Plasticity of the cocoon shell,%	Specific consumption of cocoons, kg/kg
		Raw silk	Pillamoose	Film shell	All silk products	Pupa	soluble substances		
KMS-10 mechanical cocoon winding machines									
1	1,89	38,65	6,75	2,70	48,10	47,15	4,75	89,55	2,59
2	1,56	38,05	7,10	2,55	47,70	47,40	4,90	89,75	2,63
FY-502 mechanical cocoon winding machines									
1	1,89	39,56	5,68	2,85	48,09	47,85	4,06	90,08	2,53
2	1,56	39,10	5,95	2,75	47,80	47,90	4,30	89,75	2,56

The laboratory test results shown in Table 2 show that both ranges of raw silk have good technological unwinding performance. The specific consumption of cocoons on the KMS-10 mechanical cocoon winding machine turned out to be slightly higher than on the FY-502 mechanical cocoon winding machine. This can be explained by the methods of cocoon unwinding technologies used on these machines. Because cocoons on KMS-10 cocoon winders are exposed to greater heat when they are steamed and single strands of cocoon are found. The FY-502 mechanical cocoon winding machines use the vacuum evaporation method to prepare cocoons for unwinding. Therefore, cocoons are exposed to less heat, which leads to an increase in the yield of raw silk. FINE-LOOP SILKWOR Cocoons

PR After the release of experimental batches of raw silk with a linear density of 1.89 and 1.56 tex, these raw silk threads passed comprehensive laboratory tests at the UzNIIH testing laboratory based on the requirements of the State Standard of the Republic of Uzbekistan. According to the State Standard, raw silk unwound from silkworm cocoons is rated in seven grades: 4A, 3A, 2A, A, B, C and D. At the same time, the highest grade of raw silk is designated as 4A, and the lowest as D. All indicators of raw silk were carried out according to the methods of existing State and Interstate standards. The results of complex laboratory tests of raw silk produced on KMS-10 mechanical cocoon winding machines are shown in Table 3.

Table 3. Results of complex laboratory tests of raw silk with linear densities of 1.56 and 1.89 tex, produced on a KMS-10 mechanical cocoon winding machine.

Signs	Assortment of raw silk					
	1,56 tex			1,89 tex		
	According to the standard	On tests	Variety	According to the standard	On tests	Variety
Deviation from the linear density of tex	0,10	0,08	4A	0,11	0,10	4A
Unevenness 1	150	140	4A	150	145	4A
Unevenness 2	10	5	4A	10	5	4A
Purity from major defects, not less than, %	97	98	4A	95	94	3A
Purity from minor defects, not less than, %	94	96	4A	92	90	3A
The worst cleanliness, no less, %	90	92	4A	87	85	3A

Maximum deviation, tex	0,27	0,20	4A	0,30	0,30	3A
Unevenness 3	0	0	4A	0	0	4A
Rewind capability, number of breaks, no more	5	-	4A	5	-	4A
Relative breaking load, cN/tex	30 and higher	35	4A	30 and higher	32	4A
Elongation at relative break, %	18 and higher	21	4A	18 and higher	20	4A
Density, frequency of carriage strokes	40 and higher	73	4A	40 and higher	65	3A

Table 4 below shows the results of comprehensive laboratory tests of raw silk produced on a mechanical cocoon winding machine FY-502 manufactured by the People's Republic of China.

Signs	Assortment of raw silk					
	1,56 tex			1,89 tex		
	According to the standard	On tests	Variety	According to the standard	On tests	Variety
Deviation from the linear density of tex	0,10	0,08	4A	0,10	0,08	4A
Unevenness 1	150	135	4A	150	140	4A
Unevenness 2	10	-	4A	10	5	4A
Purity from major defects, not less than, %	97	99	4A	97	98	4A
Purity from minor defects, not less than, %	94	98	4A	94	97	4A
The worst cleanliness, no less, %	90	94	4A	90	91	4A
Maximum deviation, tex	0,27	0,20	4A	0,27	0,20	4A
Unevenness 3	0	0	4A	0	0	4A
Rewind capability, number of breaks, no more	5	-	4A	5	-	4A
Relative breaking load, cN/tex	30 and higher	38	4A	30 and higher	34	4A
Elongation at relative break, %	18 and higher	20	4A	18 and higher	21	4A
Density, frequency of carriage strokes	40 and higher	75	4A	40 and higher	70	4A

An analysis of the laboratory test results presented in Tables 3 and 4 shows that the raw silk products produced have very good quality indicators, and they were mainly evaluated according to Class 4A quality indicators. Only raw silk with a linear density of 1.89 tex, produced on the KMS-10 machine, was rated with a Class 3A quality index according to laboratory test results, since according to the requirements of the State Standard O'z DSt 3313:2018, the quality of raw silk is rated with the worst indicator. The results of laboratory tests of the quality of raw silk with a linear density of 1.89 tex, produced on the KMS-10 machine, were evaluated according to 3 indicators with a quality index of 3A, based on this, the entire batch of silk was also evaluated with a quality index of 3A.

The results of the conducted research have shown the possibility of producing low-line raw silk on cocoon winding machines installed at cocoon winding enterprises of the Republic of Uzbekistan. However, cocoon winding machines of the FY 2000 EX, FY 2008 NT class, manufactured in the People's Republic of China and other foreign countries, are installed at the silk-winding enterprises of the Republic. The linear

density of raw silk produced on cocoon winding machines of this class is controlled by the calibres of the control apparatus, a separate gauge is used for each assortment of raw silk. Currently, the cocoon winding enterprises of the republic produce only raw silk with a linear density of 2.33, 3.23 tex, and cocoon winding machines are equipped with control calibers only for raw silk of this linear density.

Therefore, in order to produce raw silk with a linear density of 1.56 and 1.89 tex on existing cocoon winding machines, it is necessary to order the necessary calibers for raw silk with a linear density of 1.56 and 1.89 tex at the manufacturing plants of these cocoon winding machines. Based on the results of the research, it can be concluded that on mechanical cocoon winding machines installed at silk winding enterprises, it is possible to produce raw silk with a linear density of 1.56 and 1.89 tex, since the linear density of raw silk on mechanical cocoon winding machines is controlled by the organoleptic method, that is, by the number of cocoons under the trap.PR

Based on the above, a group of specialists from the Uzbek Scientific Research Institute of Natural Fibers has developed a technology for the production of raw silk with a linear density of 1.56 and 1.89 tex from local cocoons and tested it in the production conditions of a silk-winding enterprise. O

In the production of raw silk with a linear density of 1.56 tex from local cocoons on mechanical cocoon winders, it is recommended to keep 6 cocoons under the trap, of which 4 are new and 2 are old cocoons, in the production of raw silk with a linear density of 1.89 tex, 8 cocoons are kept under the trap, of which 5 are new and 3 are old cocoons.

The results of the conducted research have shown the possibility of producing low-line raw silk on cocoon winding machines installed at cocoon winding enterprises of the Republic of Uzbekistan. However, silk-winding machines manufactured by the People's Republic of China and other foreign countries are installed at the silk-winding enterprises of the Republic. The linear density of the raw silk produced on these cocoon winding machines is controlled by the calibres of the control apparatus, and a separate gauge is used for each assortment of raw silk. Therefore, in order to produce raw silk with a linear density of 1.56 and 1.89 tex on existing cocoon winding machines, it is necessary to order the necessary calibers for raw silk with a linear density of 1.56 and 1.89 tex at the manufacturing plants of these cocoon winding machines. SILK-R

REFERENCES

1. Approve O'DST 3313:2018 "Raw silk. Technical specifications," Tashkent, Uzstandart Agency, 2018, 40 p.
2. Dadazhonov Sh.D. - The current state of technology for the production and processing of natural silk and complex chemical yarns and the theory of twisting of textile yarns. The monograph//Fergana, Classic publishing house, 2022, 168 p.
3. Akilov U.H. and others. - Improving the reproductive performance of fine-fiber silkworm caterpillars/U.H.Akilov, E.A.Larkina, U.O.Akhunbabaev, S.Dadazhonov//Animal husbandry, breeding, Scientific and Practical Journal, Tashkent, 2024, No. 5, pp. 51-52. 4.
4. U.O.Akhunbabaev, S.Dadazhonov, A.M.Turgunbekov, A.M.Mukhtarov / A new technology for the production of raw silk of small linear densities on modern cocoon winding machines from local varieties of silkworm cocoons// FarPI NTZ, Fergana-2024, vol.28.special issue No18, pp.19-25.
5. U.O.Akhunbabaev, Sh.Dadazhonov, M.M.Niyazalieva, A.E.Gulamov / Prospects for the production of high-quality raw silk from local silkworm grains// FarPI NTZ, Fergana-2024, vol.28.special issue No. 21, pp. 12-18.I
6. Z.Yedulla Kodirov1, Khusankhon Bobozhanov2, Sharabidin Dadazhonov3 and Sabirjon Yusupov2 - Optimization process of filling the cocoons with process water in a universal vacuum-steaming device // BIO Web of Conferences 130, 01004 (2024) https://doi.org/10.1051/bioconf/202413001004 BFT-2024.