Impact Factor: 9.9 ISSN-L: 2544-980X

Processing Cocoons in Water of Variable Hardness and Alkalinity

Nigora Murtozayevna Islambekova [1], *Nargiza Fayzullayevna Rasulova* [2], *Jamila Mamajonova* [3]

Annotation: The article examines the processing of cocoons in water of varying hardness and alkalinity. It has been established that when steaming cocoons in softened water, the temperature should be slightly lower than when steaming in source water. It was found that when water hardness and alkalinity were reduced to 2 mg eel/l for any cocoons, the yield of raw silk increased by approximately 1%. According to the data obtained, it is recommended to use water with a hardness of about 2 mg eel/l when processing cocoons .

Keywords: Cocoons, water, steaming, hardness, alkalinity, shaking, unwinding, raw silk.

Introductions. All processes associated with the preparation of cocoons for unwinding and the unwinding itself are carried out in water, which has a number of properties valuable for the cocoon reeling process . Water is electrolytic dissociates into H and OH $^{-}$ ions and actively participates in redox reactions that occur during cocooning processes during the softening of sericin and its subsequent coagulation during drying of raw silk. In addition, it is needed to weigh down the cocoon, which facilitates its correct unwinding and is the best liquid medium that provides the necessary mobility of the cocoon in all directions during unwinding.

With automatic In cocoon reeling, a current of water is used to transport cocoons and shells in the process of preparing them for unwinding and the actual unwinding. Under natural conditions, there is no technically pure water. Spring, well, artesian, lake, river and other water used in cocooning always contains a certain amount of various suspended and soluble substances of organic and mineral origin.

The quality of water is determined by its turbidity, transparency, color, dissolved substances, oxidability, hardness, active reaction and bacterial content. Turbidity is characterized by the amount of suspended substances contained in water (clay, sand), as well as particles of animal and plant origin that precipitate during settling and is expressed in mg/l. Clarity is the inverse of water turbidity; it is characterized by the minimum height of the water column, through which a standard font (Snelling font) or a black cross against the background of a white disk is visible. The color of natural water is due to the organic compounds dissolved in it and substances present in suspension, i.e. colloidal. The color of water is determined by comparing the test sample with standards of different colors and is expressed in degrees of the platinum-cobalt scale - one degree of color exists for the content of 1 mg/l of platinum in the standard. The taste and smell of water are determined by the content of organic colloids and are determined by organoleptic properties.

The total amount of mineral substances dissolved in water - grams of ipsum, sodium chloride, iron, magnesium, aluminum and other salts is determined by the residue obtained after evaporation of 1 liter of filtered water and dried at a temperature of 110 ^{0}C to constant weight. Dry residue is expressed in mg/l. Oxidability is an indicator characterizing the content of organic substances in water, determined by the amount of oxygen spent on their complete oxidation.

[1]Doctor of technical sciences, Professor
[2]Foundation Doctoral Student
[3]Student , Tashkent Institute of Textile and Light Industry (Uzbekistan)

Hardness is determined by the properties that the calcium and magnesium ions it contains give water. Quantitatively, water hardness is measured in milligram equivalents of calcium ion and magnesium - and it is per 1 liter of water.

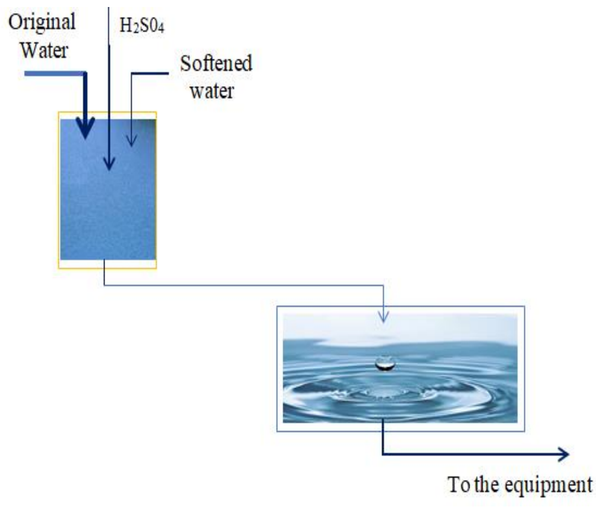
The alkalinity of water is determined by the content of sodium carbonate and potassium carbonate in it. It is determined by titration, litmus reaction and pH indicators. The pH value is one of the most important characteristics of water. At pH=7, water is neutral, at pH above 7, water is alkaline, and at pH below 7, it is acidic.

The results obtained and their analysis . During the processes of boiling, searching for ends of threads and unwinding cocoons, water activity changes within significant limits. At the beginning of unwinding, the alkalinity of the water increases due to its heating. As the fatty and other organic substances of the shell and pupa dissolve, magnesium and calcium salts combine with them to form insoluble precipitates. As the concentration of sericin in water increases, the pH decreases, the water becomes acidic, the solubility of sericin and the unwinding of the shells decrease. Therefore, regulating the composition of water when steaming and unwinding cocoons is of great importance.

Due to the roughness of the surface, silk is able to retain various substances contained in water in a suspended state. These substances, precipitated from water onto cocoon threads, prevent them from gluing during the process of forming raw silk threads.

The question of the optimal quality of process water for cocoon reeling has not yet been finally resolved. The number of works and recommendations to improve water quality is extremely limited and does not provide clear conclusions.

We unwound cocoons of the 2023 harvest of medium caliber of a mixture of 1+2 varieties and spotted and a mixture of 2 varieties and spotted in water with different hardness (W), alkalinity (A) and pH. Cocoons were unwound on one basin in samples of 1 kg in triplicate. Water was prepared at the installation (Figure).



The upper tank was supplied with water from the water supply (W=12 mg eel/l) and softened water from the boiler room (W=0.1 mg eel/l). By mixing these waters in certain proportions, water of a given hardness was obtained. To neutralize the alkalinity of the water to the required level, sulfuric acid was supplied to the upper tank. Then the water was poured into the lower tank, which feeds the coco-winding equipment.

The water parameters in the cooking zones of the cocoon steaming machine, in the brush head, shaking machine and cocoon winding basin were constantly monitored during the processing of cocoons, since the water parameters installed in the tanks change noticeably in the equipment under the influence of temperature and dissolved substances of the cocoons (Table 1). For submerged unwinding, the cocoons were steamed centrally. The steaming mode for each option is individual.

Table 1 Water parameters in the cooking zones of the cocoon steaming machine, in the brush head, shaking machine and cocoon winding basin

Installed options			Actual water parameters									
pH	AND	SCH	When steaming						When shaking		Kokonomotalno pelvis	
			AND			SCH			AND	SCH		
			sections									
			1	2	3	1	2	3			AND	SCH
8.0	11.8	4.7	9.8	10.0	10.9	4.0	4.05	4.1	9.8	4.0	11.3	4.3
5.1	12.0	0.2	11.2	11.6	11.8	1.2	1.0	0.6	10.6	2.6	11.8	0.6
7.75	5.9	4.8	5.3	5.5	5.8	4.3	4.4	4.7	5.5	4.1	5.8	4.8
4.45	6.1	0.1	6.1	6.1	6.1	0.4	0.3	0.4	6.1	0.1	6.0	0.5
7.7	3.0	4.8	2.6	2.6	2.7	4.5	4.4	4.3	3.0	4.2	3.0	4.7
4.5	2.9	0.1	3.3	3.0	3.0	1.2	0.9	0.8	3.4	0.7	3.0	0.7
8.0	0.2	4.8	1.0	0.9	0.7	4.5	4.4	4.3	1.0	4.2	0.35	4.7
5.5	0.3	0.2	1.5	1.0	0.8	1.3	0.9	0.7	1.6	1.6	0.3	0.35

It has been established that when steaming cocoons in softened water, the temperature should be slightly lower than when steaming in source water.

In all variants, the cocoons were shaken and the ends of the threads were found using a shaking machine at 18-20 brush strokes per working cycle and 2.5 revolutions of the brush head per minute.

The cocoons were unwound on one basin of an FY coco-winding machine under the same conditions for all variants of the experiment: unwinding speed 100 m/min, water temperature in the coco-winder basin 35-36 ^{0} C, in the drying cabinet 38-42 ^{0} C, leno 8-10 cm . Raw silk with a thickness of 2.23 tex was produced. The shaking machine and the front of the cocoon-winding machine were adapted for unwinding cocoons in a submerged state. The established regimes were constantly monitored. Cocoon peeling , silk of one-pieces and unwinding were dried separately in a drying cabinet at a temperature of 105 ^{0}C for 48 hours, then kept at temperature 20±1 ^{0} C and relative humidity 70±2% for two days. A total of 20 variants of water were tested, the hardness of which varied from 0 to 12 mEq / l, and the alkalinity varied from 0 to 5. Comparative results of unwinding cocoons for the variant closest to the optimal water quality and the control are shown in Table 2.

Table 2 The influence of water parameters on the yield of raw silk and the unwinding of cocoons

Variety cocoons	Options water			Exit %			Unwinding of cocoons in one step	Average length of cocoon thread before the first break, m
	AND	SCH	pH	Raw silk	Kokonny rip off	Silks Odonkov		
1+2	12	5	8.0	32.9	8.0	5.7	52	475
	2	2	6.5	34.0	7.3	5.1	62	505
1+2+spotted	12	5	8.0	31.6	9.2	6.2	50	460
	2	2	6.5	33.0	8.0	5.7	56	495
2 + spotted	12	5	8.0	27.5	11.0	7.9	42	390
	2	2	6.5	28.6	10.0	7.7	45	400

When water hardness and alkalinity are reduced to 2 *mg eel/l* for any cocoons, the yield of raw silk increases by approximately 1% (abs .), mainly due to better film rewind ability and reduced cocoon stripping . The quality indicators of raw silk are given in Table 3.

Table 3 Quality indicators of raw silk

Variety cocoons	F, mg *mg eel/l*	Shch, *mg eel/l*	Rewinding capacity , arr./kg	Relative explosive load ,	Elongation before gap %	Purity cond . %	Number of listed defects, pcs.	Connectivity , moves carriages
1+2	12 2	5 2	47.2 46	32.3 33.3	18.2 20.9	90 92	17 13	48 50
1+2+spotted	12 2	5 2	51 50	32.8 33.0 33.2	18.3 19.0	90 88	25 23	42 48
2 + Friday ty	12 2	5 2	57 49	33.2 33.2	18.4 19.1	87 88	29 24	38 40

With harder water, the amount of calcium and magnesium ions precipitated and adsorbed on raw silk increases, and the silk becomes hard and sticky.

The results obtained give grounds to recommend that industry use water with a hardness of about 2 *mg eel/l* when breaking in cocoons .

Conclusions.

It has been established that when steaming cocoons in softened water, the temperature should be slightly lower than when steaming in source water.

When water hardness and alkalinity are reduced to 2 mg eq /l for any cocoons, the yield of raw silk increases by approximately 1% (abs .), mainly due to better film rewindability and reduced cocoon stripping .

According to the data obtained, the industry is recommended to use water with a hardness of about 2 mg eq /l when processing cocoons .

Literature

1. Рубинов Э.Б. Технология шелка. М.легкаяпищевая промышленность, 389 ст. 1981 год.
2. Петрова Л.В. Химия воды. Учебное пособие / сост.: Л. В. Петрова, Е. Н. Калюкова – Ульяновск: УлГТУ, 2004. – 48 с.
3. Рябчиков Б.Е. Современные методы подготовки воды для промышленного и бытового использования. М.: ДеЛи принт, 2004. - 328 с.
4. Технический справочник по обработке воды. В 2 т. Том 1. перевод с французского. СПб. Новый журнал. 2007г.