Proceedings of International Conference on Modern Science and Scientific Studies
Hosted online from Paris, France.
Date: 19th May - 2024
ISSN: 2835-3730 **Website:** econferenceseries.com

DEVELOPMENT OF TECHNOLOGY FOR DRYING AND COMPLETE DRYING OF SILKWORM COCOONS

Mirsaatov Ravshanbek Muminovich
Doctor of Technical Sciences, Professor,
Tashkent State Transport University

Sultankhojaeva Gulnoza Shukhratovna
Senior Teacher, Applicant, Tashkent State Transport University

Abstract:
Primary processing processes using direct and indirect exposure to solar energy on living cocoons have been studied. The technical parameters of an improved device for drying silkworm cocoons, as well as a device for complete drying of cocoons using solar energy, have been determined and a comparison of the experimental results obtained has been considered.

Keywords: solar energy, cocoon moisture/ live and dry cocoons cocoon pupa, pickling, semi-dry, fully dried, spotted cocoons, mixed varieties, thermocouples.

The Republic of Uzbekistan occupies a strong place among the countries that grow silkworm cocoons. To produce high-quality silk that meets the requirements of world standards, when using methods of primary processing of cocoons, it is necessary to pay attention to maintaining the characteristics and maintaining the important physical and mechanical properties of cocoons.

Energy efficiency and energy saving are a priority direction in the development of science, technology and engineering. To reduce energy consumption during primary processing - mowing and drying live cocoon pupae, it is necessary to develop and implement modern technologies. The development and creation of inexpensive and high-performance devices for soaking and drying silkworm cocoons is one of the urgent tasks at the present time.

In the conditions of our republic, the use of solar energy, which serves as an environmentally friendly renewable source, is one of the main ways to reduce energy consumption during the primary processing of silkworm cocoons.

According to analyzes of methods for processing cocoons and devices when using installations that process hot air for pickling and completely drying cocoons,

their non-stop operation is observed for 4-5 hours, as a result of which a large amount of liquid fuel, natural gas and electrical energy is consumed.

Certain results have been achieved based on research to improve cocoon processing devices using solar energy, the creation of an experimental sample of devices for pickling and completely drying cocoons in this way, as well as the development of a new technology for drying cocoons.

The time spent to completely freeze the cocoon pupae and the thickness of the cocoons inside the drying chamber are the main technical parameters of the device.

To compare the results obtained in the experiment, the thickness of the cocoon was chosen to be 15 cm, as in the SK-150K installation, which is currently used for drying cocoons. The complete freezing of living cocoon pupae inside the device is influenced by two factors: the temperature inside the chamber where the living cocoons are located and the time required for the complete freezing of living cocoons inside the chamber.

In experiments to determine these indicators, cocoons with a thickness of 15 centimeters were placed in bags made of breathable material and placed in 4 different places in the chamber. According to agrotechnical requirements, cocoons must be 100% frozen. After closing the lid and reaching the temperature inside the chamber of 60°C, one of the bags is removed and the cocoons are cut. Depending on the condition of the pupae, it is visually assessed whether they are alive or dead. If inspection reveals at least one living cocoon pupa, the cocoon sample is placed back into the chamber. These steps are repeated every 15 minutes until all cocoons in the sample are completely frozen.

The air temperature inside the devices was measured using thermo-electric meters - thermocouples with chromel-copper. The reason is that, compared to other thermometers, it has the largest thermo-EMF [E(1000C, 00C)=6.88 mV]. One of the thermocouples was installed on the upper surface of the cocoon thickness, the second on the lower surface, the third in the middle of the cocoon thickness, and another one under light-absorbing double-layer glass. Ambient temperature and relative humidity were measured using an Assmann aspiration psychrometer.

Direct and indirect (using a solar battery) use of solar energy was used to pickle cocoons.

According to the results obtained, when using solar energy together, both directly and indirectly, in a device for pickling cocoons, its main technical indicators are as follows:

- time for dressing the cocoon pupae - 60 minutes;

- productivity - 100 kg/hour;
- maximum temperature inside the chamber 85^0C – 90^0C.

A version of a complete dryer for cocoons has been created and tested, allowing to speed up the entire drying process and ensure their uniform drying. This device consists of a solar fan, electric air heaters and a pipe supplying hot air under pressure.

Heat-treated cocoons are placed in a special round drum. The drum is made in the form of a ring, the inner and outer rings are separated by a mesh, and the cocoons to be processed are placed between them on the open surface of the drum, which is closed with a lid. The drum is mounted on two rotating shafts and is rotated at a certain point in time during the drying process. Due to the rotation of the drum, the cocoons placed in it change their position and are constantly mixed, resulting in uniform drying of the cocoons.

Hot air is forced under pressure through a pipe using a fan, the pipe is connected to the central channel of the drum, and the other side of this channel is closed with a lid. Hot air under high pressure in the central channel passes through the cocoons to the outside, and the cocoons are dried evenly.

The results of complete drying of the treated cocoons are presented in Table 1. In the experiments, the hot air temperature was controlled no higher than 95^0C (recommended). According to the results, it takes 3 hours to completely dry the cocoons (at a humidity of 12%) if the hot air temperature is not raised above the standard +95^0C.

Table 1 Results of complete drying of treated cocoons

Experiment date (day, month, year)	Number of petitions	Start time of the drying process (hours, minutes)	Ambient temperature, 00C	Temperature inside the device, 00C	Weight of cocoon sample, g.	Humidity of cocoons, %
3.06.2023	1	10^{00} 11^{00} 12^{00} 13^{00}	33 35 36 39	85 88 90 88	200 150 110 80	186 125 86,0 11,8
4.06.2023	2	10^{00} 11^{00} 12^{00} 13^{00}	33 35 36 39	85 88 90 88	400 125 30 40	192 130 90 12,1
5.06.2023	3	10^{00} 11^{00} 12^{00} 13^{00}	33 35 36 39	85 88 90 88	200 128 85 38	192 125 35,0 12,0

Completely dried cocoon samples that had reached condensation (12%) humidity were unwound on a KMS-10 cocoon-making machine, and their main technological (quality) indicators were determined.

The method of processing cocoons using new technology is an effective method, and in the experiments carried out, 4 pieces of 0.5 kW were used, a total of 8 electric heaters. Accordingly, a 10 kW solar photovoltaic installation was selected. This device consists of 24 panels of 450 W each. Accordingly, the total power of the station will be 10.8 kW. Electrical energy is collected in batteries. To put devices for primary processing of cocoon pickling using solar energy into working condition, they are connected to an energy source, which consists of solar panels, an inverter and batteries.

Solar panels convert energy from sunlight into electricity and collect this energy in batteries. The device for mowing and drying living cocoon pupae is connected to batteries. The device is equipped with an automatic control system that automatically maintains the required temperature at the same level.

Table 2 Technological indicators of cocoons processed using existing and new technology

Processing method	Options	Weight of one dry cocoon, g	Raw silk yield, %	Yield of silk products, %	Continuous unwinding length, m	Total length of silk fiber, m	Metric fiber number m/g
Solar energy	1	0,752	43,53	50,41	1079	1083	3445
	2	0,718	44,97	54,87	1183	1183	3205
	3	0,740	44,68	51,84	1092	1104	3468
	Average value	0,736	44,4	52,4	1118	1124	3372
SK-150K	1	0,651	50,26	51,21	1258	1258	4184
	2	0,770	42,37	49,54	1046	1076	3284
	3	0,575	35,56	50,56	1233	1233	5180
	Average value	0,66	4305	50,12	1179	1189	4216

Table 2 shows the technological indicators of cocoons processed using existing and new technology, as well as the average values of indicators in triplicate in each experimental variant.

CONCLUSION

Coconut drying plants of the type SK-150K with pre-treatment of cocoons with Russian-made hot air. However, as a result of rising prices for fuel and energy resources used in these units, various problems arise. These units have now been discontinued; due to the lack of spare parts and components, almost 70-80 percent of them have become unusable. However, there are no domestic devices that can replace them and save energy resources.

In the course of research aimed at solving these problems, devices have been created for the primary processing of living silkworm cocoon pupae using solar energy. As a result of testing these devices, positive results were obtained and they were put into production.

Solar batteries are used to operate the devices. Considering the fact that when the cocoons are not processed, they can be used to illuminate offices, premises and electrical appliances, and the benefits and economic efficiency of the new technology will increase even more.

The developed device, designed for drying silkworm cocoons using solar energy, is aimed at saving energy resources, as well as solving practical issues of accelerating the complete drying process for the purpose of long-term preservation of processed cocoons. As a result, coco-winding enterprises operating on a cluster system will be provided with high-quality dry cocoons and will expand the production of competitive products and save about 1,700-1,800 tons of diesel fuel and 1.4-1.5 million kW of electricity.

REFERENCES:

1. Mirsaatov R.M., Abdullayev J.E. Tut ipak qurti pillalariga dastlabki ishlov berish // 05.06.2022y., 19-son, 263-272 b.
2. Э.Б.Рубинов, Справочник. Шелк сырьё и кокономатание,М:Легпромбытиздат, 1986г.
3. Yuldashev Sh., Umarov S., Avezov R.R. Temperature and humidity regimes of a solar plant for silkworm cocoon destruction. Geliotekhnika. No. 4, 2000. Pp.35-39. New York.
4. Р.Мирсаатов, Х.Джабборов, С.Арипов, Ж.Абдуллаев, Д.Содиков. Исследования процессов замаривания коконов в солнечной установке // Agro ilm – O'zbekiston qisloq va suv xo'jaligi. Махсус сон, 2022

5. Xusniddinov F.S., Sultanxodjayeva,G. Sh.,Solar energy as a source of electric energy, *Innovative Development in Educational Activities*, *2*(7), 2023, Pages:444–448. openidea.uz/index.php/idea/article/view/1058

6. R.Mirsaatov, S.Khudoyberganov, and A.Akhmedov, "Uncertainty estimation in determination of Cocoons silkiness by thickness of their shell", AIP Conference Proceedings 2612, 050010 (2023) https://doi.org/10.1063/5.0114683.

7. Мирсалихов, Б. А., & Сайтджанов, Ш. Н. (2022). ЗНАЧЕНИЕ ПРИНЦИПА ОРГАНИЗАЦИИ В ПРЕПОДАВАНИИ СТРОЕНИЯ АТОМА И ЯДРА НА ОСНОВЕ МЕЖДИСЦИПЛИНАРНЫХ ИНФОРМАЦИОННЫХ ТЕХНОЛОГИЙ. SCIENTIFIC ASPECTS AND TRENDS IN THE FIELD OF SCIENTIFIC RESEARCH, 1(4), 72-76.

8. Юсупов, Ш. Б., & Сайтджанов, Ш. Н. (2021). ФИЗИКА МАСАЛАЛАРИНИ ЕЧИШДА МАТЕМАТИКАНИНГ ЎРНИ. Журнал Физико-математические науки, 2(1).

9. С.З. Арипов, С.Ф. Умаров, Р.М.Мирсаатов. Исследование влияния технологии заготовки и первичной обработки коконов на возникновение мятых и поверхностно-пятнистых коконов, журнал РУз. Наука и инновационное развитие, 2020, №3, стр. 83.

10. Yuldashev Sh., Umarov S., Avezov R.R. Temperature and humidity regimes of a solar plant for silkworm cocoon destruction. Geliotekhnika. No. 4, 2000. Pp.35-39. New York.

11. Mirsaatov, R., Abdullaev, J., Urolova, G., ”Research primary processing of live of silk cocoons in a solar installation”, E3S Web of Conferences, 2023, 383, 04029.

12. Burkhanov, S.D. Relationship of parameters that characterize the quality of live cocoons / Burkhanov, S.D., Mirsaatov, R.M., Khudoyberganov, S.B., Kadyrov, B.H. // IOP Conference Series: Earth and Environmental Sciencethis link is disabled, 2021, 677(4), 042032.

13. Ravshanbek Mirsaatov and Sardorbek Khudoyberganov, "Development of a non-destructive method determination of the maturity of Mulberry cocoons", AIP Conference Proceedings 2432, 040018 (2022) https://doi.org/10.1063/5.0089646.