
Development of Fiber Stripping Machine for Eri Cocoon

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Abstract.

Eri silk has economic significance. It can make fibers into silk threads which shiny distinct, and unique. Producing silk fibers begins with the silk fiber peeling to prepare for the cutting process and silk carding. Silk stripping is currently stripping by hand. The survey found that it can peel an average of 150 grams per 1 hour. This research aims to create a silk fiber stripping machine from the eri cocoon to increase the rate of fiber stripping. The fiber stripping machine is 70 centimeters wide, 100 centimeters long, and 105 centimeters high. The cocoon conveyor belt is responsible for conveying the eri cocoon to the fiber stripping core. The fiber stripping core is used to peel the fibers that surround the cocoon. A motor is operated to transmit power to the spinning axis. And the cocoon flick core transports the cocoons that have been stripped into the support container. The rate of fiber removal is 1 kilogram of cocoon per hour from the experiments. The results showed that eri silk peeling using a machine could give a 6.66 times better rate of fiber removal than manual peeling. In addition, the development of this fiber peeling machine from this research can increase the rate of fiber removal from the nest, reducing the labor even more. Moreover, the cocoons that were still clean. Therefore, it can increase income for the farmer of silkworm community enterprise.

Keywords. eri, cocoon, fiber, peeling striping, machine.

1. INTRODUCTION

Eri silk has economic significance. The eri cocoon produces fibers surrounded by sericin, a sticky substance that binds the fibers into a silkworm cocoon. Eri cocoon has a long, slender,

white color. The cocoon is relatively flat, with an average width of 2.1 centimeters and an average length of 4 centimeters [1, 2, 3]. Eri fibers are shorter and looser than mulberry silk [4, 5, 6, 7]. Pulling threads from the cocoon uses a spinning method. There are both hand-spinning and machine-spinning. Fiber production begins by taking the eri cocoon to peel off the fiber. Then cut the cocoon to separate the pupa, boil it to degumming, and spin up the yarn. Spun yarn is a raw material that the industry needs a lot. Peeling fibers is essential for cleaning cocoons. In addition, it also separates the black and dirty parts to increase the price cocoons. Removing the silk fibers from the cocoon is similar to today's traditional wisdom. It is peeling by hand, using human labor, which requires a long time to remove silk fibers that can peel an average of only 150 grams per 1 hour. Therefore, the silk fiber peeler will help to prepare the cocoon into the cutter. From various data surveys and study the problems regarding cocoon preparation; accordingly, there is an idea of creating a silk stripping machine that can give the rate of fiber peeling better than fiber peeling by hand [8,9,10,11,12]. Moreover, farmers will get clean cocoons, increase income, and reduce human labor.

2. MATERIALS AND METHOD

The study of data on eri fiber production found that eri silk fiber removal by hand. The outer part of the cocoon has a section called the fiber wrap, causing the cocoons to clump together. Therefore, separating the pupa from the cocoon is difficult. By cutting the cocoon to separate the pupa, farmers need to use their hands to pull off the silk fiber. Therefore, removing fibers from the cocoon is essential in fiber production. The threads can be removed by hand, as shown in Fig. 1. The design of the stripping machine (as shown in Fig. 2) used the characteristics of eri fiber wrapped.

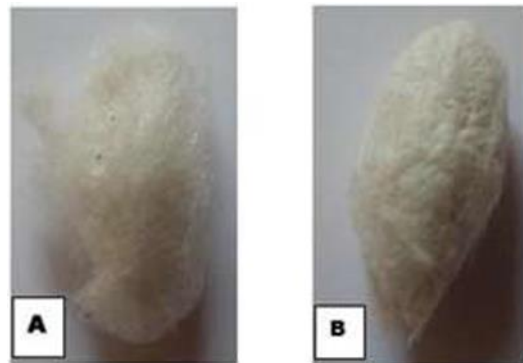


Figure 1 (A) The cocoon before stripping
(B) Cocoon after stripping

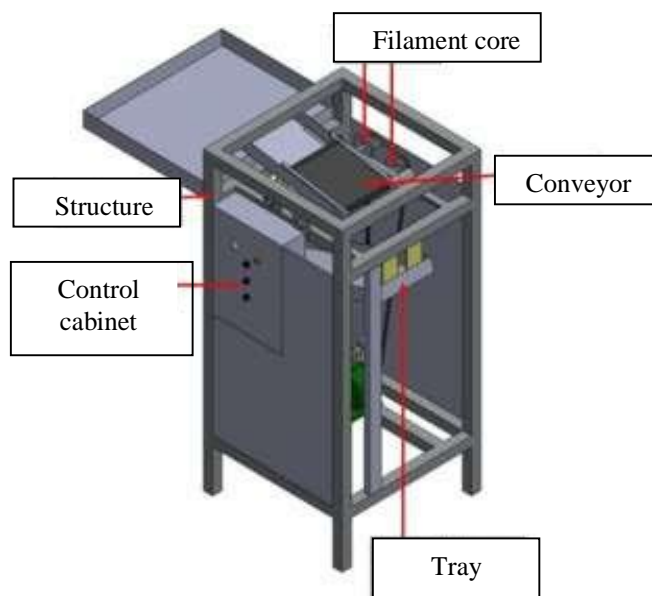


Figure 2 Design of the eri silk fiber stripping machine

The components of the machine are as follows: 1) structure of the device is made of 0.1 cm thick stainless steel. The dimension of the machine is the width of 60 centimeters, length of 60 centimeters, and height of 125 centimeters. The peeling device is covered with a stainless steel sheet on all four sides to increase safety for use. 2) The filament core has a diameter of 1.2 centimeters, 47 cm in length. The core is attached with anti-slip tape wrapped around the core. A gear motor is used to send power to the fiber stripping core. The engine can adjust the speed from 600-2500 rpm, responsible for peeling the silk fiber wrapped outside the cocoon. 3) Conveyor is transmitted by a gear motor. The velocity of the conveyor belt can be adjusted from 17.27 to 69.11 meters per minute. It is responsible for transporting the silkworm cocoon forward to the fiber stripping axis. 4) The control cabinet consists of an on-off switch to adjust the speed. 5) The silkworm trays are then peeled off and served as containers to support the cocoon eri.

3. EXPERIMENTAL DESIGN

In the experiment, to find the efficiency and working rate of the silk peeling machine, results are compared to fiber peeling by hand. Experiments are divided into three parts. In the first part, the speed of the stripping rod is adjusted to 600, 1250, 1800, and 2500 rpm. The second part is the conveyor speed adjusted by 5 rpm, 10 rpm, and 20 rpm. The third part is that the variety of cocoons is changing. There are two types of eri cocoons, 1) fresh eri cocoons. The appearance of the fresh cocoon is a stable, hard shell, with an average weight of 1.85 grams per nest, making it easier to transport on the belt. 2) Dry cocoons in which the outer shell is not hard. The nest will collapse according to the compression of the belt. The experiment will take one hour to remove fibers and check the quality of eri cocoons that have been

stripped. The results are used to find the average rate per hour and the cleanliness of the cocoon.

4. EXPERIMENTAL RESULTS

The eri silk fiber stripping machine is constructed (as shown in Fig. 3) to increase the rate of fiber removal from the nest and reduce human labor. Moreover, it can increase the income of the farmers. The comparison of the fiber stripping rates is shown in Fig.4-6. The rates of peeling by machine are presented in TABLE1. It can be analyzed as follows. The best rate of peeling is 1088.23 grams per hour when the speed of the belt is five revolutions per minute and the speed of the stripping axis 1800 revolutions per minute. On the other hand, the quality of the striated cocoon is 146.71 grams per hour when the belt speed is 20 rpm, and the speed of the fiber stripping core is 1250 rpm. From the experimental table, it can be seen that if the belt speed is too high, peeling fiber will not have good quality. The experiments of peeling the dry cocoons found that the rate of peeling is 18.51 grams per hour. The belt speed is adjusted at 20 revolutions per minute, and the speed of the fiber stripping axis is 2500 revolutions per minute. From the experiment, it can see that the cocoon is dry cocoons are not able to peel the fibers due to their lightweight. The dry cocoon has no hardness and soft appearance, so it is easily compressed. From TABLE 2, it was found that the fiber extract from fresh cocoon has the best efficiency, able to peel 96.1242 grams per hour when using the belt speed of 5 revolutions per minute, the fiber peeling axis speed of 1993. 66 rpm. The minimum peeling rate is 28. 9909 grams per hour. After adjusting the conveyor speed to 20 revolutions per minute and adjusting the revolving speed of the axis at 1610 revolutions per minute, the desirability value is 0.192. The best of the experiment is the machine can peel 28.132 grams per hour when the belt speed is 20 revolutions per minute, peeling axis speed of 2500 rpm. The minimum stripping rate is 4.735 grams per hour when adjusting the conveyor speed at five revolutions per minute and then adjusting the revolving speed of the silk stripping axis at 600 revolutions per minute.

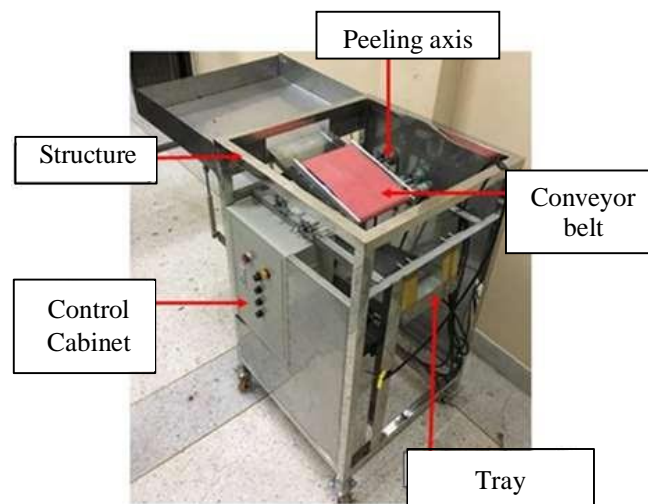


Figure 3 The eri silk fiber stripping machine



Figure 4 Dry cocoon before peeling fibers



Figure 5 Fresh cocoons before peeling fibers



Figure 6 The cocoons completely peel the fibers

Table 1 The results of the rate of peeling

Speed of conveyor (rpm)	Speed of peeling axis (rpm)	Rate of peeling (grams per hour)
5	600	404.7
	1250	944.18
	1800	1088.20
	2500	600.00
10	600	174.95
	1250	274.70
	1800	222.10
	2500	432.38
20	600	200
	1250	146.71
	1800	212.65
	2500	256.98

Table 2 The results of the rate of peeling in the various speed of the peeling axis

Speed of conveyor (rpm)	Speed of peeling axis (rpm)	Rate of peeling (grams per hour)
5	1993.66	962.24
	2015.08	962.19
	2022.13	962.16
	2089.02	960.32
10	1866.72	958.59
	1763.34	950.84
	1538.67	970.20
20	1595.82	28.99
	1610.00	28.99

5. CONCLUSIONS

The test of silk fiber removal by eri machine found that removing the fiber from the machine can give a 6.66 times better rate than the fiber removal by hand. The advantage of this

machine is that it can help solve the problem of cleaning pupae before boiling them for degumming. In addition, the stripped fibers can also use for spinning yarn. The disadvantage is that it is difficult to set the peeling axis distance because Eri cocoons are thin and soft. Therefore, the peel-axis setting must be set to suit the size of the cocoon. In further developments, suitable materials must be found to make the peel core and set the exact distance for the eri cocoon. In addition, it can increase farmers' income, reduce human labor, and obtain a clean eri cocoon.

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