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Stifling Cocoons Silkworms Using Butane Gas Mechanical Dryer

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ABSTRACT

Silk is an important economic fiber, its producing not related only to the method of producing but also preparing processes after productions such as stifling cocoons silkworms. The mechanical performance of dryer locally fabricated using butane gas was tested for stifling cocoons silkworms. The study parameters were the heating air temperature 60, 65, 70 and 75 °C; air velocity through the cocoons 1.5, 2.0 and 2.5 m/sec. and treatment times of 20, 25, 30 and 35 min. These parameters were examined and evaluated on cocoons moisture contents;; cocoon weight; shell weight; shell ratio; stifling pupae's and determination of some quality parameters of silk filament like (length of silk filament; reel-ability of cocoons; tenacity and elongation of silk filaments; and cocoon drying). The obtaned results indicated that, the minimum value of cocoons moisture content was 30, maximum value of cocoons weight, cocoon shell weight and cocoon shell ratio were 2.42g, 1.55g and 68.8% respectively. Stifling pupae's was 100% at decreasing cocoons moisture content to a level less than 45%. Also for quality evaluation tests of silk filament, the maximum value of length of silk filament; reel-ability of cocoons; tenacity and elongation of silk filaments; were 955m, 78.9%, 4.89 g/denier, and 15.78%, respectively.

Keywords: *cocoons silkworms; stifling; dryer; butane gas; cocoon weight; quality silk tests*

INTRODUCTION

Cocoon-making behavior is the most highly developed in Lepidoptera (moths and butterflies). The silkworm Bombyx mori is a typical cocoon-making insect. Silkworms have been reared for more than 5,000 years for silk production, and more than 1,000 strains including geographical and mutant strains have been collected. Among them, many cocoon color mutants, including white, yellow, golden yellow, orange, pinkish, and green. Silkworm cocoons are biological composite structures protecting the silkworms against environmental damage and physical attack by natural predators. Also, killing of pupae without damaging the cocoons is called stifling. After purchasing the silk cocoons from the cocoon market, reelers require to stifle the cocoons. Drying of cocoons is essential to kill the pupa from transforming into a moth, which otherwise is killed and comes out of the cocoon by piercing through the shell. Thus the cocoon shell becomes useless. Cocoons can be stifled either through steam or hot air stifling methods, to kill the pupae. Many studies have demonstrated that, the purpose of cocoon drying is to prevent the emergence of maggots and moths, remove the moisture contained in the cocoon shell and pupae and thereby make cocoons capable of being preserved for a long time under normal temperature and humidity. (Narasaiah, 1992) Several methods of artificial drying have been tried to kill the pupae, by spread cocoons on perforated mats or in a wire box where they are exposed to steam of water for three hours. After that, cocoons are subjected to drying but the method most commonly used for pupae killing and drying cocoons involves blowing heated air at 50 to 102 $\pm$ 2°C vertically through a grill on which the cocoons placed in mesh bags. S.E.S., (1992) indicated that fresh cocoons contain alive pupae which, in the natural cycle, will moth, breaking the cocoon and making it useless for silk production. To control the cycle the pupae must be killed and the cocoons treated so that they can be stored and used in the reeling process as required. The percentage of moisture content varies with silkworm variety, rearing season, male or female, etc. The majority of water is contained in the pupae body (75-79%) while the fresh cocoon shell contains (11–12%). For this reason, the fans should be sized to provide air velocity of 1.0 m/s, air heated to 102 $\pm$ 2 °C is sufficient for rapid drying. Air temperatures above 115 $\pm$ 5°C will damage the sericin content. So that in the reeling process, the groping ends efficiency and reel-ability decline, with resultant decrease in raw silk percentage of cocoon. Wu *et al*. (1992) showed that the main purpose of drying cocoons silkworms is to kill the pupae and reduce the potentially harmful moisture content, enabling them to be stored up to a year in proper conditions. Therefore, silkworm cocoons must be dried as soon as harvested because of the possibility of moths emerging from the pupae they contain and spoiling there important feature, reel-ability. A proper drying enables cocoons to stand a long storage (6-12 months) without growing molds. A whole dried cocoon has moisture content about (8 - 12%) and (6 – 8%) in cocoon shell while the dried pupae body contains about (7-13%). Nguku *et al* (2009) showed that, sun drying is still the most common method to preserve cocoons. Due to lack of sufficient preservation methods, rearer's have to spread the yield of cocoons to be dried in thin layers on paved grounds or mats where they are exposed to the sun's rays and wind from 3-5 successive days. Considerable losses may be occurred during natural sun drying due to various effects such as rodents, insects, rain and microorganisms. This method has a negative effect on the sericin layers of these cocoons and decreases the quality characteristics due to expose cocoons to ultraviolet and infrared rays, which in turn, increase the total reeling losses of cocoons. She also indicated that the silk filament lose about 50% from its strength if exposed to ultraviolet rays for 6 hours. Yong-woo, (1999) added that in the case of artificial drying, the initial drying temperature has the largest effect on the cocoon shell. and when the temperature exceeds the highest limits, sericin is sharply degenerated leading to a decrease in raw silk percentage. If the initial temperature for cocoon drying is lowered too much, it is apt to deteriorate the neatness and cleanness result of the raw silk quality. Morohoshi (2001) indicated that cocoons should be dried after harvesting and before storage or marketing. Drying helps reduces water level, and prevents entry of decay causing organisms during storage and helps in killing the pupae inside cocoons. Nguku *et al* (2009) studid the effects of three silk cocoon-stifling processes on the reeling performance and quality of raw silk of the silkworm Bombyx mori. Sun drying killed the pupae but showed inferior reeling performance and raw silk quality compared with hot water stifling and oven drying. Cocoons dried using hot water stifling and the oven had improved reel-ability and raw silk percentage. Raw silk elongation was the highest in hot water stifled cocoons, whereas neatness and cleanliness was high in cocoons dried using hot water stifling and oven. All treatments were significantly different. Zhang *et al*. (2015) revealed some outdoor reared silk cocoons exhibit outstanding mechanical properties that are relevant to the higher level protection required to enhance the survival chance of silkworms while supporting their metabolic activity. The performance of composite materials strongly depends on the adhesion between the fiber reinforcement and matrix, with the surface properties of the fibers playing a key role in determining the level of adhesion achieved. For this reason it is important to study the surface properties of silk fibroin to further understand the composite properties of the cocoons. The general objective of this research work was to study the effect of heating air temperature, forced air velocity through the cocoons and treatment time of cocoons silkworms so by: determine the change in moisture contents, cocoon weight, shell weight, shell ratio of cocoons silkworms; determine stifling pupae's and; evaluate quality of silk filament during stifling cocoons silkworms after heat treatment process.

MATERIALS AND METHODS

During the spring seasons of 2015 - 2016, about 25 kg of silkworm, *Bombyx mori* L, strain was collected and used for this investigation. Mechanical dryer was designed and structured by Awad (2005) and used for stifling cocoons silkworms. The mechanical dryer consists of four diffrrent parts; main frame, drying bed, air heating unit and temperature control system, drying air supply and distribution as shown in Fig.(1).

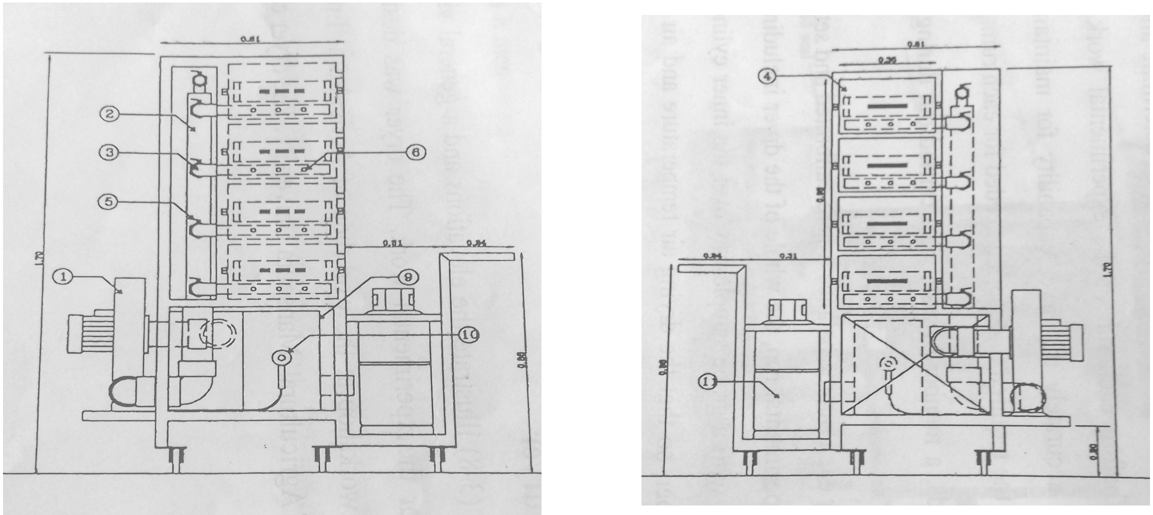
The dryer main frame:

Iron angles (50×50 mm) were used to construct the main frame of the dryer with dimensions of 600 mm long, 600 mm wide, and 1750 mm high. Three sides of the dryer walls were covered with 2 mm thickness iron sheets and filled with fiberglass insulation to reduce heat loss. The fourth side represent the dryer door which was doubled and insulated also. The main frame was attached with a small frame 810 mm high × 500 mm wide by two iron hinges for the gas cylinder. The dryer was carried with four caster rubber wheels for free movement from place to other.

Drying bed

Drying bed consists of four drying trays which constructed of an iron frames with dimensions 540 mm long, 275 mm wide, and 80 mm high. And the sides of each tray were covered with double aluminum sheet while the base was made of stainless steel wire net. The four drying trays were vertically located inside the dryer body.

Fig. 1. General view of the mechanical dryer used for the experimental work.



1.Centrifugal fan 2. Main air duct 3.Air duct branch
4.Drying trays 5.Air valve 6.Air entrance holes
9.Air heating unit 10.Gas nozzle 11.Gas pump

Fig. 2. Side view and elevation section view of the mechanical dryer.

Air heating unit and temperature control system:

The air heating unit and temperature control consist of a butane-gas source with ignition system for heating a double heat exchanger. The heat exchanger has two openings for air inlet and outlet, and a gas ignition nozzle was fixed at the front side. The drying air was passed throuh the surface of the sheel cylinder until reaching the required level of drying air temperature. Re-ignition nozzle was fixed in the position of gas ignition nozzle to keep continuaus ignition during the drying process.

Drying air supply and distribution:

Drying air supply and distribution consists of air centrifugal fan model IC 98 ZB for air supply to the dryer and main vertical PVC pipe with four side branches. Each branch was accompanied with a control valve, to uniformally distribute the heating air for each tray in same amount.

Experimental Treatment:

The experimental treatments included four different levels of heating air temperature 60, 65, 70 and 75°C, three different levels of air velocity forced through the cocoons 1.5, 2.0 and 2.5 m/sec. and four different levels of treatment times 20, 25, 30 and 35 min.

Experimental Procedure:

The tested levels of heating air temperature were adjusted to be constant during each experimental run at different levels of 60, 65, 70 and 75°C, respectively. and air velocity also was adjusted. Before each experimental run the dryer was adjusted for the required heating air temperature using the temperature control electric thermostat and the required air velocity (1.5, 2.0, and 2.5 m/sec.) using the air control valves. The fresh cocoons were distributed uniformly in a single layer in all trays. The experimental runs were continued for the required time of each tretment. Each experimental runs was repeated three times, and the heat treated cocoons were taken after stifling process and left to cool. After cooling they were kept in bags to measure the quality attributes of the resulting silk.

Measurements:

A) Determination of the cocoon specifications:

1- Cocoons moisture contents:

Moisture content of the cocoons was measured according to AOAC (1996). Cocoons samples were dried at 105°C using drying oven until reaching a constant weight.

2- Air temperature:

Copper-constantan thermocouples were used to measure the air temperature at different points inside the dryer. They were calibrated at both boiling and freezing points. Thirty thermocouples (copper–constantan) were used and evenly distributed in three parallel planes (top, middle and bottom) in order to measure the air temperature inside the dryer and one thermocouple was used to measure the ambient air temperature outside the dryer. The measurements were conducted using digital thermometer (model Omega-type J,USA).

3- Air flow rate:

A hot wire anemometer model (Testo 425, Germany) with accuracy of (0.01 m/sec.) was used to measure the air velocity at the dryer trays in m/sec.

4- Cocoon weight :

Cocoon weight indicates the approximate quantity of raw silk that could be reeled from the cocoons (Mahadevappa *et al.,*2000). In the present experiment a sample is drawn from each replicate comprising around 10 cocoons. The sample drawn represents the entire quality of each replicate. Individual cocoon weight was taken from each sample of 10 cocoons and the mean cocoon weight was calculated. The weights were taken in grams.

5- Shell weight :

This parameter represents the total quantity of silk in a cocoon. Average single shell weight was calculated from 10 shells used for the assessment of cocoon weight.

6- Shell ratio :

It denotes the total amount of silk available in a single cocoon and is expressed in percentage. It was calculated using the following formula.

$$\text{Cocoon shell ratio, (\%)} = \frac{\text{Weight of the cocoon shell}}{\text{Weight of the entire cocoon}} \times 100.(1)$$

7- Stifling pupae's determination, %:

Stifling pupae's inside cocoons were determined in the laboratories of Plant Protection Department - Agric. Res. Center (ARC), Sakha Station, Kafr Elsheikh governorate,. According to Wu *et al.* (1992) as follows: 100 cocoons were randomly taken from each treatment and opened carefully using a sharp scissor. The died pupae were observed and expressed as percentage of the original number of cocoons.

B) Quality evaluation tests of silk filament :

The quality characteristics of the silk filaments included total length of cocoon filaments, and cocoons reel-ability. The tests were accomplished in the laboratories of Sericultural Department., Plant Protection Res., Institute, branch of Sharkhia. Agric. Res. Center (ARC),. While, tenacity and elongation of silk filaments were performed in the laboratories of the Egyptian cotton quality control center, spinning research department. Cotton Res., Institute; (ARC), Egypt.

For measuring the total length of silk filament, 10 cocoons were randomly taken from each treatment and softened by soaking in boiling water. The rated silk filament of every cocoon was measured and determined using the flowing equation:

$$\textbf{Length of cocoon filament, (m)} = \frac{\textbf{Raw silk length(m)} \times \textbf{Ave. reeling cocoon number per thread}}{\textbf{Total reeled cocoon number}} \quad \textbf{.(2)}$$

2- Reel-ability of cocoons, % :

The reel-ability of cocoons *(Rc)* was determined using the following formula:

$$\textbf{Rc,(\%)} = \frac{\textbf{Reeled cocoon number}}{\textbf{Number of ends feeding}} \times 100 \quad \textbf{.(3)}$$

3-Tenacity and elongation of silk filaments :

They were measured using stelometer instrument at fiber testing laboratory, CRI, ARC according to (ASTM, designated D-1445-75, 1984). Where, this instrument give elongation reading directly, the silk tenacity can be determined using the following formula:

$$SL = Wc\, x \frac{1.5}{Ws} x 100, \% \quad \textbf{......................(4)}$$

Where:

SL tenacity for length unit, %;

Wc cutting mass, kg and

Ws mass of sample, mg.

RESULTS AND DISCUSSION

A) Determination of the cocoon specifications:

1-Effect of heating air temperature on cocoons moisture content:

The average cocoons moisture content are presented in Fig. 3. The cocoons moisture content was decreased with increasing of heating air temperature, treatment time and air velocity. The effect of heating air temperature on cocoons moisture content revealed that, increasing heating air temperature from 60 to 75˚C, at treatment time of 20 min and air velocity of 1.5 m/sec. decreased the cocoons moisture content from 71 to 55% (*reduction of 16 %*) also increasing treatment time from 20 to 35 min at air temperature of 60 ˚C and air velocity of 1.5 m/sec. cocoons moisture content decreased from 71 to 54% (*reduction of 17%*). While increasing air velocity from 1.5 to 2.5 m/sec. at heating air temperature of 60˚C and treatment time of 20 min cocoons moisture content decreased from 71 to 60 % (*reduction of11 %*). Results also revealed that, the highest and lowest percentage value of cocoons moisture content were 71 and 30%, respectively.

2- Cocoons weight:

Data of cocoons weight affected by heating air temperature, treatment time and air flow rate are plotted in Fig. 4 It is clear that, increasing the heating air temperature, treatment time and air velocity tended to decrease cocoons weight. Increasing heating air temperature from 60 to 75˚C resulting in decreasing cocoons weight from 2.41to 1.52g (36.9%) at treatment time of 20 min and air flow rate of 1.5 m/sec. Also increasing treatment time from 20 to 35 min at air temperature of 60˚C and air flow rate of 1.5 m/sec. decreased cocoons weight from 2.41 to 1.93g (*19.9%*). Meanwhile increasing air flow rate from 1.5 to 2.5 m/sec. at heating air temperature of 60˚C and treatment time of 20 min decreased cocoons weight from 2.41 to 2.07g *(14.1%*). The maximum cocoons weight values of 2.41 g was recorded at heating air temperature of 60˚C, treatment time of 20 min and air velocity of 1.5 m/sec. Also, the minimum value of cocoons weight of 0.81 g was recorded at heating air temperature of 75˚C, treatment time of 35 min and air flow rate of 2.5 m/sec.

3- Shell weight:

The obtained results of shell weight shawed that, by heating air temperature, treatment time and air velocity are clearing affecting the shell weight as presented in Fig. 5. Increasing heating air temperature, treatment time and air velocity tended to decrease shell weight. Increasing heating air temperature from 60 to 75˚C resulting in decreasing shell weight from 1.55 to 1.07g (31%) at treatment time of 20 min and air velocity of 1.5 m/sec. Also increasing treatment time from 20 to 35 min at air temperature of 60˚C and air velocity of 1.5 m/sec. shell weight decreased from 1.55 to 1.26g (18.7%). Increasing air flow rate from 1.5 to 2.5 m/sec. at heating air temperature of 60˚C and treatment time of 20 min shell weight decreased from 1.55 to 1.34g (13.5%). In general the maximum shell weight values of 1.55 g was recorded at heating air temperature of 60˚C, treatment time of 20 min and air velocity of 1.5 m/sec. Also, the minimum value of shell weight of 0.65 g was recorded at heating air temperature of 75˚C, treatment time of 35 min and air velocity of 2.5 m/sec.

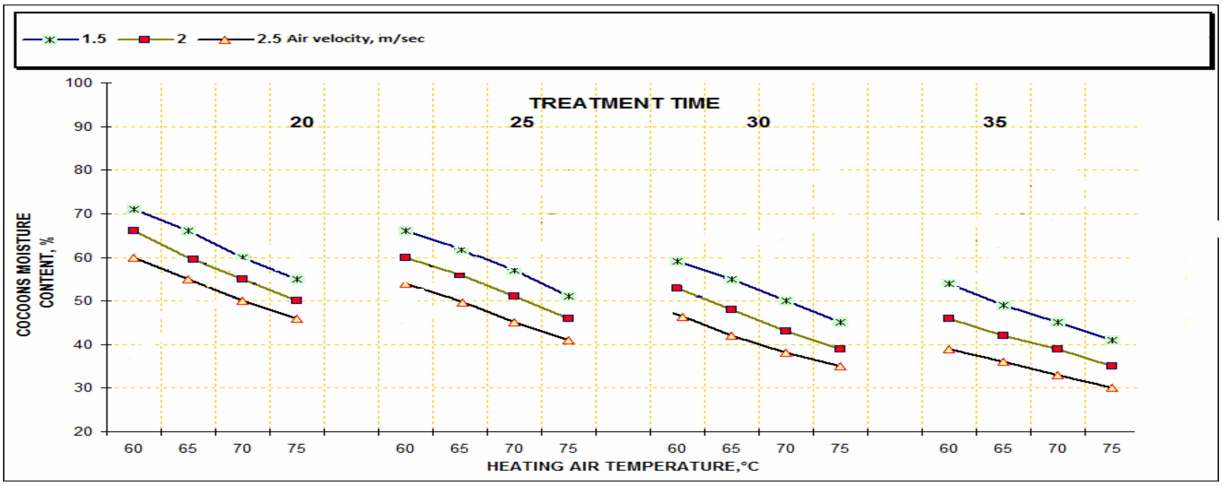


Fig.3 . Effects of heating air temperature, treatment time and air velocity on cocoons moisture content, % (w.b.).

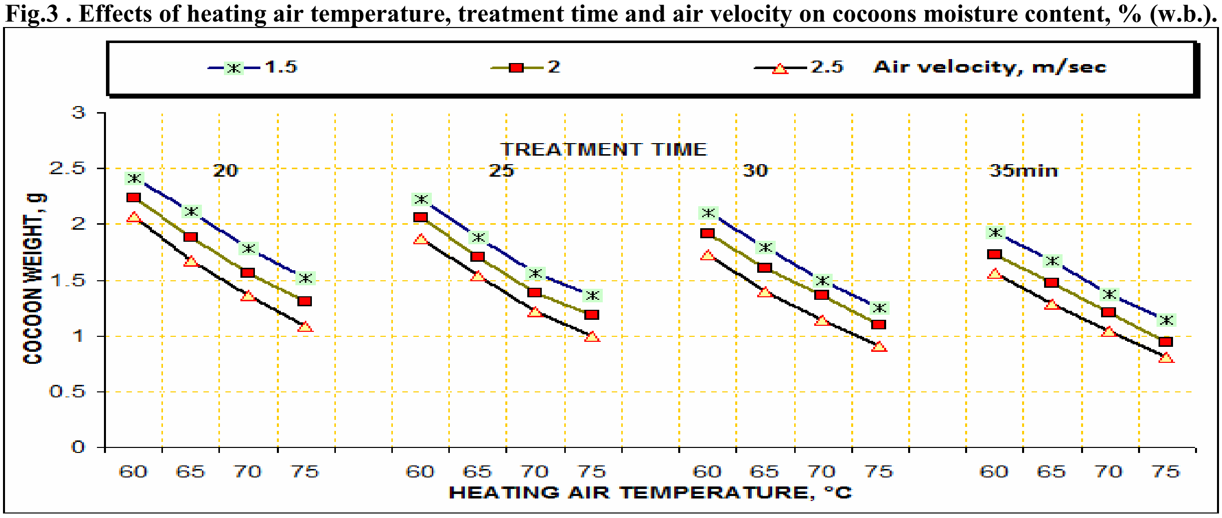


Fig.4 . Effects of heating air temperature, treatment time and air velocity on cocoons weight, g.

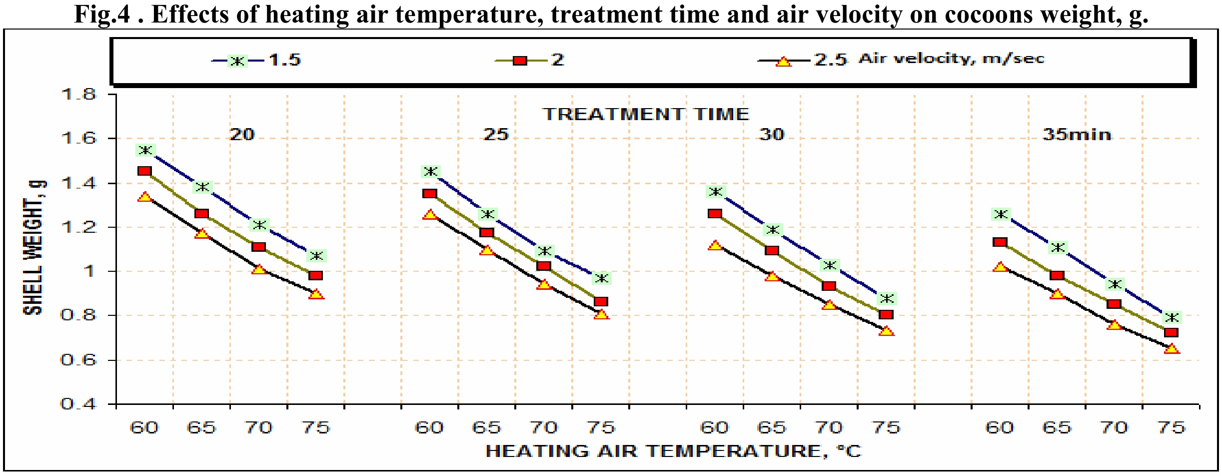


Fig.5 .Effects of heating air temperature, treatment time and air velocity on shell weight, g.

4- Shell ratio:

Results of shell ratio as shown in Fig. 6 illustrate that, shell ratio increased as heating air temperature, treatment time and air flow rates increased. Increasing heating air temperature from 60 to 75˚C resulting in increasing shell ratio from 64.4 to 66.3% (1.9%) at treatment time of 20 min and air velocity of 1.5 m/sec. also increasing treatment time from 20 to 35 min at air temperature of 60˚C and air velocity of 1.5 m/sec. shell ratio increased from 64.4 to 65.7% (1.3%). Increasing air velocity from 1.5 to 2.5 m/sec. at heating air temperature of 60˚C and treatment time of 20 min shell ratio increased from 64.4 to 66.4 *(2%)*. The maximum shell ratio of 68.8% was recorded at heating air temperature of 75˚C, treatment time of 35 min and air velocity of 2.5 m/sec.. While, the minimum shell ratio of 64.4% was recorded at heating air temperature of 60˚C, treatment time of 20 min and air velocity of 1.5 m/sec..

5- Effect of heating air temperature and air velocity on Stifling pupae percentage:

The obtained results indicated that, stifling pupae's percentage was increased with increasing of heating air temperature, treatment time and air velocity as shown in Fig. 7. The maximum value of stifling pupae's percentage was 100% which recorded at decreasing cocoons moisture content lower than 45%, while, the minimum stifling pupae's percentage was recorded at increasing cocoons moisture content higher than 45%. From the above it is clear that, cocoons moisture content was more influential parameter on stifling pupae's percentage.

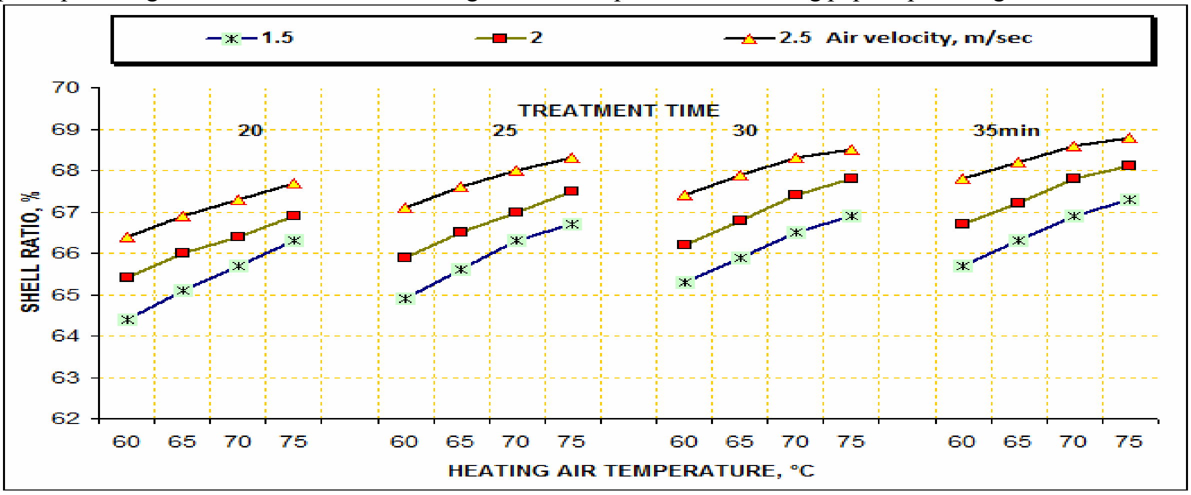


Fig. 6 . Effects of heating air temperature, treatment time and air velocity on shell ratio, %.

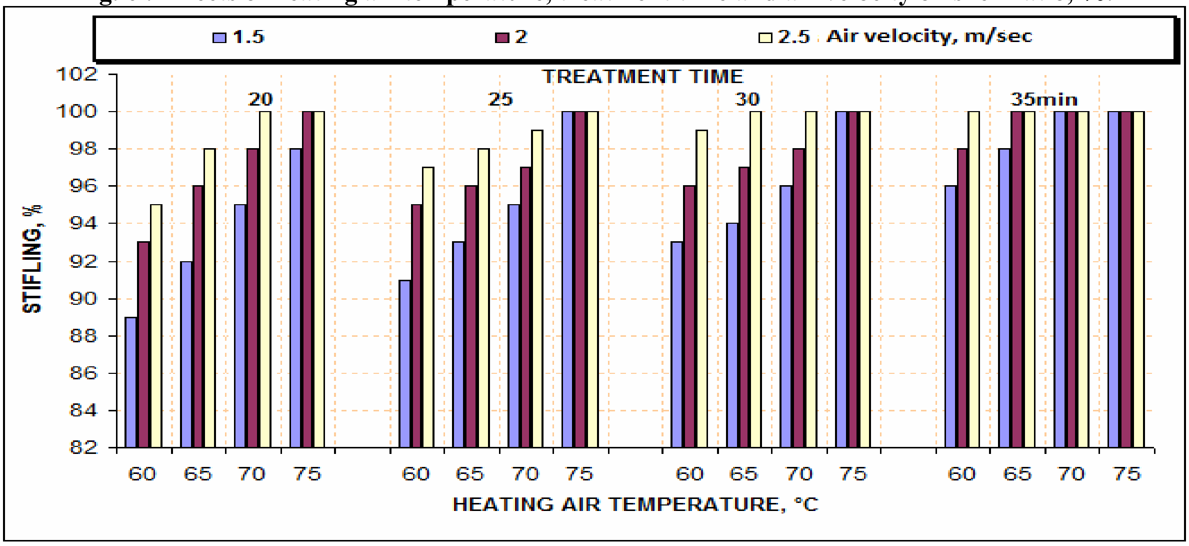


Fig. 7. Effects of heating air temperature, treatment time and air velocity on stifling ratio, %.

B) Quality evaluation tests of silk filament :

1- Length of cocoon filament:

Fig. 8 indicates that, length of cocoon filament tended to increase with increasing heating air temperature, treatment time and air velocity. It's clear that, at treatment time of 20 min, air velocity of 1.5 m/sec. and increase heating air temperature from 60 to 75˚C, length of cocoon filament increase from 902 to 936 m (+3.77%). Also, at heating air temperature of 60˚C, air velocity of 1.5 m/sec. and increasing treatment time from 20 to 35 min. length of cocoon filament increase from 902 to 916 m (+ 1.55%). Length of cocoon filament increased too from 902 m to 914m (+1.33%) at heating air temperature of 60˚C, treatment time of 20 min and increase air velocity from 1.5 m/sec. to 2.5 m/sec. The maximum length of cocoon filament of 955 m was achieved at heating air temperature of 75˚C, treatment time of 35 min and air velocity of 2.5 m/sec.

2- Reel-ability of cocoons, %:

Fig. 9 shows the effect of heating air temperature, treatment time and air velocity on reel-ability of cocoons. It was observed that, increasing heating air temperature, treatment time and air flow rates tended to increase reel-ability of cocoons. Increasing heating air temperature from 60 to 75˚C resulting in increasing reel-ability of cocoons from 54.3 to 70% (15.7%) at treatment time of 20 min and air velocity of 1.5 m/sec. Increasing treatment time from 20 to 35 min at air temperature of 60˚C and air velocity of 1.5 m/sec. increased reel-ability of cocoons from 54.3 to 61.3 (7.0%). While increasing air velocity from 1.5 to 2.5 m/sec. at heating air temperature of 60˚C and treatment time of 20 min increased reel-ability of cocoons from 54.3 to 60 (5.7%). The maximum reel-ability of cocoons of 78.9% was recorded at heating air temperature of 75˚C, treatment time of 35 min and air velocity of 2.5 m/sec.. while, the minimum value of reel-ability of cocoons of 54.3% was recorded at heating air temperature of 60˚C, treatment time of 20 min and air velocity of 1.5 m/sec.

3-Tenacity and elongation of silk filaments:

Fig. 10 revals the average of tenacity of silk filaments and elongation of silk filaments. The, tenacity of silk filaments was decreased with increasing heating air temperature, treatment time and air velocity. Increasing heating air temperature from 60 to 75˚C, at treatment time of 20 min and air velocity of 1.5 m/sec. tenacity of silk filaments decreased from 4.89 to 3.93 g/denier (*19.6%*). Also increasing treatment time from 20 to 35 min at air temperature of 60˚C and air velocity of 1.5 m/sec. tenacity of silk filaments decreased from 4.89 to 4.56 g/denier (*6.7%*). While increasing air velocity from 1.5 to 2.5 m/sec. at heating air temperature of 60˚C and treatment time of 20 min tenacity of silk filaments decreased from 4.89 to 4.55g/denier (*6.9%*). Results also revealed that, the highest and lowest values of tenacity of silk filaments were 4.89 and 3.33 g/denier, which recorded at heating air temperature of 60˚C, treatment time of 20 min and air velocity of 1.5 m/sec., and at heating air temperature of 75˚C, treatment time of 35 min and air velocity of 2.5 m/sec. respectively. On the contrary, elongation of silk filaments was increased with increasing heating air temperature, treatment time and air velocity. The obtained results also revealed that, increasing heating air temperature from 60 to 75˚C, at treatment time of 20 min and air velocity of 1.5 m/sec. the elongation of silk filaments increased from 11.31 to 13.73% (*2.42%*). Also increasing treatment time from 20 to 35 min at air temperature of 60 ˚C and air velocity of 1.5 m/sec. elongation of silk filaments increased from 11.31 to 11.81% (0.5*%*). While increasing air velocity from 1.5 to 2.5 m/sec. at heating air temperature of 60˚C and treatment time of 20 min the elongation of silk filaments increased from 11.31 to 12.3 % (0.99*%*). Results also revealed that, the highest and lowest value of elongation of silk filaments were 15.78 and 11.31% which recorded at heating air temperature of 75˚C, treatment time of 35 min and air velocity of 2.5 m/sec. for the highest value and at heating air temperature of 60˚C, treatment time of 20 min and air velocity of 1.5 m/sec.for the lowest value.

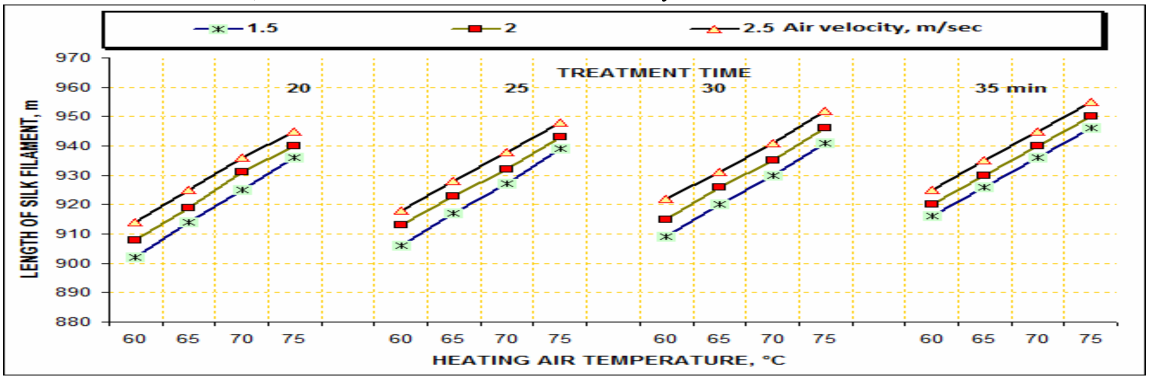


Fig. 8 . Effects of heating air temperature, treatment time and air velocity on length of silk filament, m.

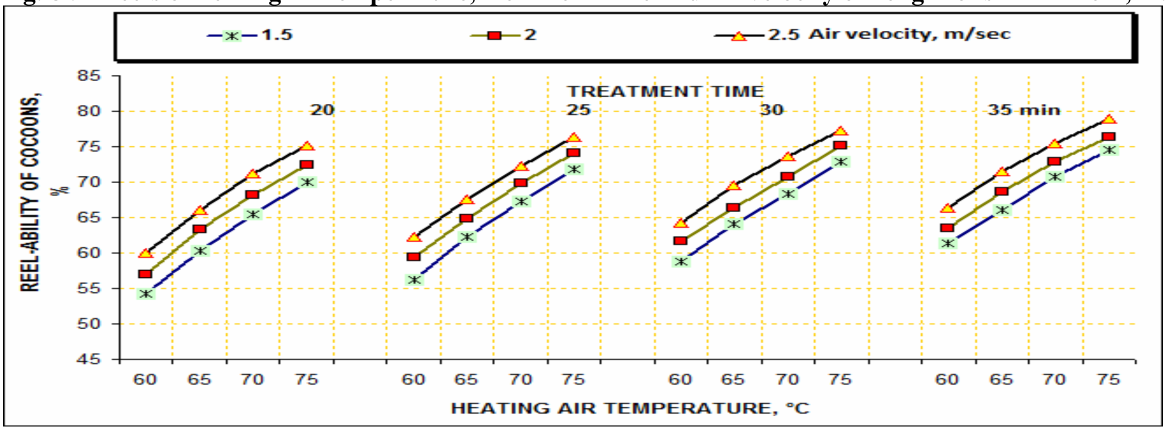


Fig. 9. Effects of heating air temperature, treatment time and air velocity on reel- ability of cocoons, %.

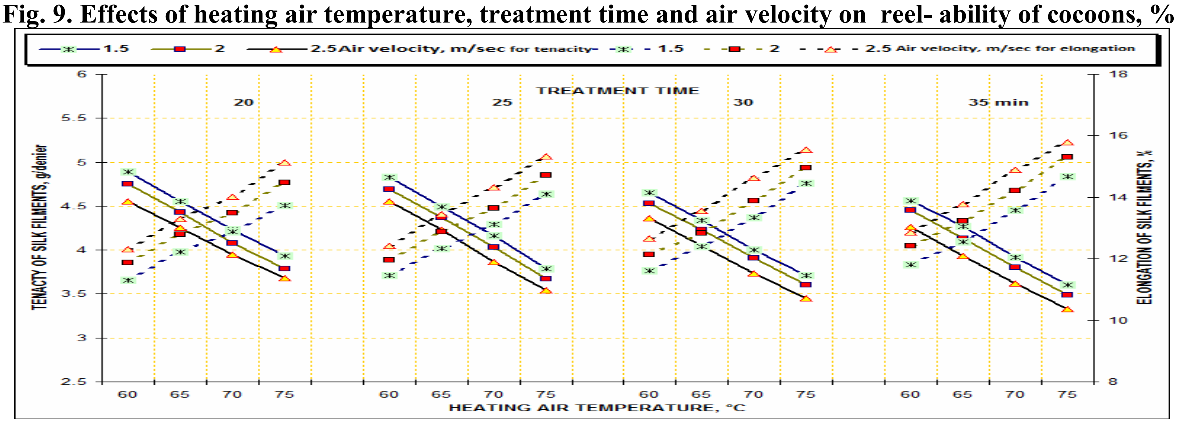


Fig. 10. Effects of heating air temperature, treatment time and air velocity on tenacity of silk filaments, g/denier and elongation of silk filaments, %

CONCLUSION

The aim of the present study is to test the mechanical dryer using butane gas for stifling cocoons silkworms. Also this study aims tomechanical performance of dryer included the effects of heating air temperature, treatment time and air velocity on some of the cocoon specifications and some of quality tests of silk filament at stifling cocoons silkworms. Results led to the following conclusion:

1- Cocoons moisture content was decreased with increasing heating air temperature, treatment time and air velocity.
2- The highest and lowest values of cocoons moisture content were 71 and 30%, respectively.
3- The maximum cocoons weight value (2.41g) was recorded at heating air temperature of 60˚C, treatment time of 20 min and air velocity of 1.5 m/sec. While, the minimum value of cocoons weight (0.81g) was recorded at heating air temperature of 75˚C, treatment time of 35 min and air velocity of 2.5 m/sec.
4- The maximum shell ratio of (68.8%) was recorded at heating air temperature of 75˚C, treatment time of 35 min and air velocity of 2.5 m/sec. While, minimum shell ratio of (64.4%) was recorded at heating air temperature of 60˚C, treatment time of 20 min and air velocity of 1.5 m/sec.
5- The maximum of stifling pupae's percentage was 100% which recorded at decreasing cocoons moisture content lower than 45%, while, the minimum stifling pupae's percentage was recorded when increasing cocoons moisture content higher than 45%.
6- The maximum amount of length of cocoon filament (955m) was achieved heating air temperature of 75˚C, treatment time of 35 min and air velocity of 2.5 m/sec.
7- The maximum reel-ability of cocoons (78.9%) was recorded at heating air temperature of 75˚C, treatment time of 35 min and air velocity of 2.5 m/sec. while, the minimum value of reel-ability of cocoons (54.3%) was recorded at heating air temperature of 60˚C, treatment time of 20 min and air velocity of 1.5 m/sec.
8- The highest and lowest values of tenacity of silk filaments were 4.89 and 3.33 g/denier, recorded at heating air temperature of 60˚C, treatment time of 20 min and air velocity of 1.5 m/sec. and at heating air temperature of 75˚C, treatment time of 35 min and air velocity of 2.5 m/sec., respectively.
9- The highest and lowest percentage values of elongation of silk filaments were 15.78 and 11.31% which recorded at heating air temperature of 75˚C, treatment time of 35 min and air velocity of 2.5 m/sec. and at heating air temperature of 60˚C, treatment time of 20 min and air velocity of 1.5 m/sec., respectively.

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خنق عذارى ديدان الحرير باستخدام مجفف ميكانيكي يعمل بغاز البيوتان

ياسر طلبة هنداوى

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تعتبر الياف الحرير الطبيعى من اهم الالياف الاقتصادية الهامة عالميا وعملية إنتاجه ودرجة جودتة لا تعتمد فقط على الطريقة المستخدمة في استخلاصة من الشرانق بل تعتمد أيضا على عمليات عدة أهمها عملية خنق عذاري ديدان الحرير . وقد تم تقيم أداء مجفف ميكانيكي يعمل بغاز البيوتان تم تصنيعة محليا (عوض 2005) ليستخدم في خنق عذاري ديدان الحرير في مصر بهدف تحديد الظروف المثلى لقتل عذاري ديدان الحرير وتقدير بعض صفات الجودةعلى الالياف الناتجة. وكانت عوامل الدراسة هي:-1- درجة حرارة هواء التجفيف 60, 65, 70, and 75˚C. 2- سرعة هواء التجفيف 1.5, 2.0, 2.5 m/sec. 3- زمن المعاملة 20, 25, 30, and 35 min. وتم اجراء القياسات التالية:-1- المحتوي الرطوبى للعذارى. 2- الرطوبة النسبية للهواء. 3- وزن الشرانق. 4- وزن الغلاف (وزن الحرير للشرنقة الواحدة). 5- معامل الغلاف. 6- نسبة قتل الحوريات. 7- تقدير بعض صفات الجودة لالياف الحرير(طول خيط الحرير - قابلية الشرانق للتحلل - تماسك واستطالة خيوط الحرير). وقد أوضحت النتائج المتحصل عليها أن: 1- أقل قيمة للمحتوي الرطوبى للعذري 30 % فى حين كانت اعلى قيمة 71%. 2- أقصى قيمة لوزن الشرنقة ، وزن الغلاف، ومعامل الغلاف كانت 2.42 جرام ، 1.55 جرام و 68.8 % على الترتيب.3- نسبة قتل الحوريات كانت 100% عند انخفاض المحتوي الرطوبى لأقل من 45 %.4- أيضا بالنسبة لاختبارات تقييم الجودة لخيوط الحرير كانت أقصى قيمة لطول خيط الحرير، قابلية الشرانق للتحلل ، تماسك واستطالة خيوط الحرير هي 955 م، 78.9% ، 4.89 جرام / دنير و 15.78% على الترتيب.