AM-03

DEVELOPMENT OF FRUIT PEELING MACHINE USING A TWO-WAY BLADE

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ABSTRACT

This research presents the development of fruit peeling machine (FPM) using a two-way blade for improving the fruit production and reducing the working time consumption according to the lack of labors. Therefore, the objective of this study was to study on designing, fabricating and evaluating the FPM. In the performance test of the FPM, Holland variety of papaya and Sun Lady variety of cantaloupe were used as the samples. Selection of the proper shape was done to peel, the variables in the experiment. The speed of the blade was set at 200, 220, 240 rpm, fruit rotational speed at 180, 200, 220 rpm, and blade at 1300 rpm, The air pressure in peeling papaya and cantaloupe was maintained at 1.8, 2.0 kg/cm^2. A set of 6 fruits (peeling up - down) was determined the efficacy (Effect Throughput Capacity) loss after peeling up and down which checked by percentage of weight. The results showed that the suited adjustments of the FPM for papaya and cantaloupe were blade rotating at 220 rpm, fruit rotating at 200 rpm, the thickness of peeled skin at 2.45 and 6.08 mm, the weight of peeled fruit at 83.68% and 77.30%, the peeling time at 23.43 and 22.69 second per fruits and the capacity of peeling at 158 and 159 fruits per hour. Therefore, this device would help to solve the problems for working with difficulty and less of labor in the agricultural section.

Keywords: Peeling Machine; Fruit; Blade

INTRODUCTION

Papaya is considered one of important economic crops. It has been called in botanical terms as *Carica papaya* L. [1]. With its nature of tropical fruit growing nationwide of Thailand and generally well-known among Thais and foreigners, papaya consumption can be in forms of ripened or raw fruits.

Cantaloupe (Taeng thet – in Thai) is one kind of melons or *Cucumis melo* L. var. cantaloupensis in scientific name [3]. As popularity of papaya in both local markets and supermarkets, Thailand has opportunity to enlarge its sales volume. Cantaloupe contains high nutrition and useful nutrients needed by human body [4].

However, both papaya and cantaloupe require peeling before consumption by kitchen knife, peeling knife, or other peeling tools without any proper peeling facility. Specifically, fruit outlets or restaurants where daily manage huge amount of papayas and cantaloupes, they would consume times and labor for the purpose of peeling and sometimes causes exhaustion.

Therefore, researcher has developed fruit peeling machine by using two-way blade, which is able to operate with many kinds of fruit. This machine is help to increase working capability, to reduce time and labor required which is lack of that in present, and to cut importation cost from other countries. In addition, this research is aimed to design and create model of two-way processing blade machine and finally to conduct the test seeking for its efficiency.

MATERIALS AND METHODS

1.Design and operation

Major operations are included: 1)two-way processing blade (peeling up-down); 2)motor to control blade for clockwise and anticlockwise direction; 3)continuity of operation with minimizing damaged fruits; 4)low maintenance; and 5)simple operation by not complicated parts and mechanisms (Fig. 1)

Fig.1. Fruit peeling machine by using two-way blade
The developed peeling machine is consisted of important parts as followings:

1) Peeling blade set included: 1) peeling blade with edge diameter 27 mm; and 2) pneumatic cylinder as controller of peeling blade set closely adhered with fruits. Peeling blade set is able to move (peeling up-down) direction by turning around of screw's spiral (Fig. 2).

2) Handling fruit set is performed to catch head and bottom parts of fruit. Upper axle is directly connected to motor in order to spin fruit. On the other hand, lower axle is strictly connected to pneumatic cylinder in order to perfectly grab fruit.

3) Weight supporting structure sizes 40x 60 x 163 cm. which made from carbon steel tube 2.5 cm.

4) Two electric motors with 1 Hp are power sources provided for peeling blade set and fruit spinning set.

5) Controller set included: 1) inverter to adjust rotational speed of motor; and 2) PLC to control all operating parts within peeling machine (Fig. 3).

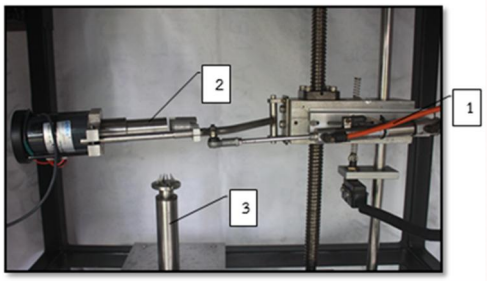

Fig. 2. 1) Pneumatic cylinder; 2) Peeling blade set; 3) Fruit holder module

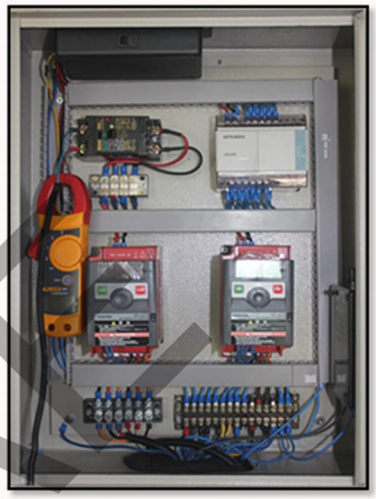

Fig. 3. Controller module set

2. Experimental variables

This research uses proper size of Holland papaya and Sun Lady cantaloupe. The experimental variables are rotational speed of peeling blade sets at 200, 220, and 240 rpm, fruit rotating at 180, 200, and 220 rpm, with blade speed 1300 rpm, the pressure air in peeling papaya and cantaloupe at 1.8 and 2.0 kg/cm^2. The test would conduct three times of each sample (peeling up-down) and indicating factors are efficiency of peeling machine (kg/hr) and thickness of peels off (mm).

3. Experimental method

First of all, papayas and cantaloupes were brought to measure their sizes and weights. The designed peeling machine had been adjusted rotational speed and Adjusted air pressure. Next, fruits were put in peeling machine with properly adhered by pneumatic holder module and press switch on to start operation. Timing between putting fruit into machine and taking fruit out from machine were recorded. Fruits after peeling were repetitively measured sizes, weights, and thickness of peels. Heads and bottoms of each fruits required cutting by labor. The testing data

calculated to find working efficiency of fruit peeling machine. (Fig. 4 and 5) The performance of the fruit peeling machine was evaluated according to the following calculations:

Effect Throughput Capacity = 1 hour/peeling time (Minute per Fruit) …(1)

Loss after peeling = Weight after peeling - Weight before peeling …(2)

(%) Percent weight after peeling = (Weight before peeling/ Weight after peeling) x100…(3)

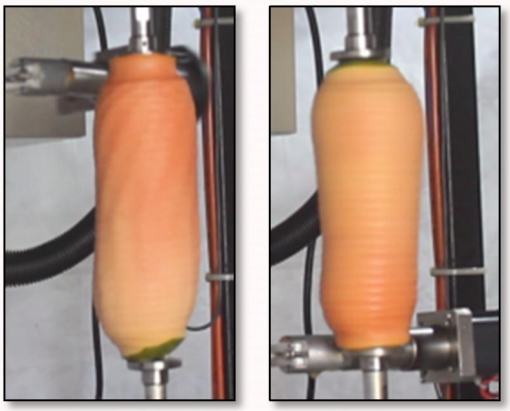

Fig.4. Papaya peeled (peeling up - down)

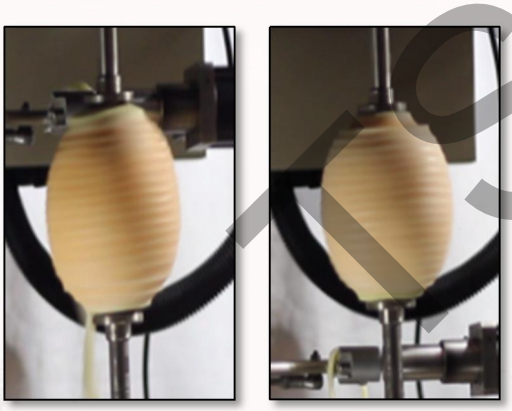

Fig.5. Cantaloupe peeled (peeling up - down)

RESULTS AND DISCUSSION

1. The experiment, the speed of the blade sets and fruit rotating for papaya

From three replications of the experiments of the blade sets at 200, 220, and 240 rpm, fruit rotating at 180, 200, and 220 rpm, speed blade 1300 rpm and using discharge pressures for peeling papaya 1.8 kg/cm^2, those suggest that:

The appropriate speed for blade set at 220 rpm and fruit rotating at 200 rpm. The thickness of peeled skin at 2.45 mm, the weight of peeled fruit at 83.68%, the peeling time at 23.43 seconds/fruit, and the capacity of peeling at 158 fruits/hr (Fig. 6).

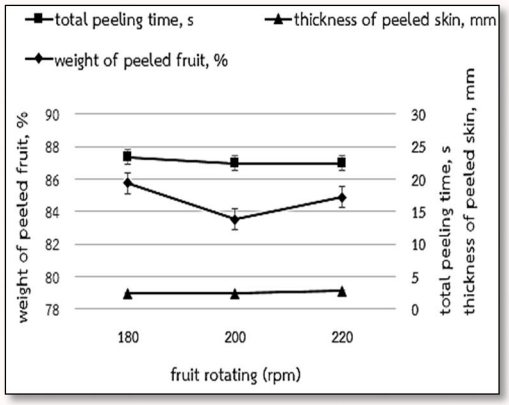

Fig.6. the relationship between rotating speed, weight of peeled fruit, total peeling time, and thickness of peeled skin

2. The experiment, the speed of the blade sets and fruit rotating for cantaloupe

From three replications of the experiments of the blade sets at 200, 220, and 240 rpm, fruit rotating at 180, 200, and 220 rpm, speed blade 1300 rpm and using discharge pressures for peeling cantaloupe 2.0 kg/cm^2, those suggest that:

The appropriate speed for blade set is 220 rpm and for spinning set is 200 rpm. The thickness of peeled skin at 6.08 mm, the weight of peeled fruit at 77.30%, the peeling time at 22.69 secon-ds/fruit, and the capacity of peeling at 159 fruits-/hr (Fig. 7).

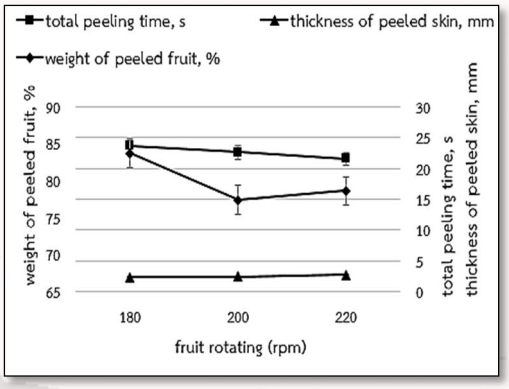

Fig.7. the relationship between rotating speed, weight of peeled fruit, total peeling time, and thickness of peeled skin

CONCLUSIONS

A new type of fruit peeling machine was development and tested. The peeler uses the lathe principle and achieved consistent peeling efficiencies higher than those produced previously as known by the authors. The machine was fabricated from locally available machine parts and raw materials.

The capacity of peeling at 158 and 159 fruits per hour. Therefore, this device will help solve the problems of working with difficulty and fruit of labor in the agricultural section.

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