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Optimization of Angle Adjustment Between Two Cutters' Blades of Dry Areca Nut Peeling and Controlling Machine

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Abstract. The peeling-machine of dry areca nut is currently not working optimally. The nuts remained unpeeled properly since the machine is not equipped with an automatic power breaker as the peeler process has been completed or the machine life time is continuously. Undoubtedly, this is less efficient and wasteful of energy. From this point of views, it is necessary to conduct advanced research on appropriate technology to modify the peeling-machine so that it can peel dry areca nuts to the maximum for all available sizes. The research method includes the assembly of areca peeling-machine with a modification of the angle between the two cutters' blades, the dimensions of the main cutter shape 191 mm in diameter cylinders that can be arranged into 12 cutters function as a peeler and a second cutter 163 mm in diameter with 20 cutters function towards the skin through the exhaust channel, rotation in the equal direction of 800 rpm. The peeler process is set to the angle between the two cutters' blades and directed to the further process so that the dried areca nut that has been cut can be separated between the seeds and the skin. That is the expected result of the peeling-machine that can peel the dry areca nuts for all sizes optimally.

1. Introduction

A machine that can help peasants to peel areca nut is still manually used in the farm of areca nut in North Aceh territory. Obviously, the production is still less compare to the width of the farm area. Therefore, a machine that can peel the nut quickly must put into account. Areca nut peeling-machine is developed specifically in such way due to adjust the angle between the two cutters' blades which causes shear force in the drying of the areca nut that has dried so that it can improve the quality of stripping results. Areca nut peeling-machine is an equipment that can accelerate the process of peeling the areca nuts. Many models of areca peeling-machines are generally not equipped with an electronic system for setting the speed and time of the engine rotation. By utilizing the speed regulation system, the engine runs more effectively and efficiently according to the needs of the areca nut. The rotation and time settings is able to avoid the engine from overheating so that it can avoid damage that caused by the engine before it.

Further research on adjusting the angle between the two cutters' blades in such way that are suitable in order to peel the size of the dried areca nut, the speed and timing of rotation can be applied to the cutting. This study aims to obtain appropriate energy-saving technology that can improve the yield of dry areca nut on one machine.

According to [1], the analysis of the speed of the crank launcher props mechanism. A connecting rod affects the other connecting rods in different direction and large mechanism systems relative to each



other. The research that has been conducted by Darmein, et al in [2] and [3] is adjusting the spinning speed of areca nut machine that eventually produced 160 kg/hour at 670 rpm. The design of the areca nut huller by [4-5] produced peeled areca nut with the capacity of 270 kg/hour. The machine used a diameter of 100 mm of squeeze roll and a length of 400 mm peeler roll, and motor with a power of 0.5hp, 1420 rpm.

Based on the above studies, which mitigated the peeling-machine methods of areca nuts that varied in size can be peeled by adjusting the angle of the cutters' blades at the determined speed and rotation. Generally, the peeling-machine of the nut is not equipped with an automatic power breaker in any cases the peeling process has been completed or the machine overheats [6-7]. For this reason, it is necessary to use the areca nut peeler machine which can be used at once to peel the areca nut equipped with speed control settings to be able to peel the areca nut that has been dried.

2. Method

In this study adjusting the angle between the two cutters' blades at certain speed of the machine is needed for peeling the areca nut and controlling the speed. The parameters of the study included the effect of the size and quantity of the areca nuts toward the angle between the cutter's blades, and also the speed and rotation of the machine. Modification of areca peeler machine refers to the results of previous studies such as: the design of areca nut peeling machine, speed and time, and distance between gaps. At this stage, testing the system of adjusting the angle between the cutters' blades, controlling the speed and timing of the machine is based on the areca nut peeling system, for all sizes based on the quantity of areca nut peeled. Test of areca nut peeling-machine is done on areca nut milling machine without automatic adjustment and areca nut peeling-machine which has been equipped with speed and time regulating system based on adjusting the angle between two cutters' blades, quantity of the dried areca nut to be peeled, and the quantity of areca nuts that pouring into the machine.

2.1. Inside the machine

Modification of the main blade-cutter angle on the drum as shown in Figure 1, which can peel the dried areca nut and to be cut so that it is separated between the seed and the skin. The size of the cutter's blade is planned to be 300 mm in length as many as 12 pieces, the diameter of the flange is 150 mm with a shaft length of 460 mm, and assembled into the main drum with a diameter of 191 mm. The size of the cutter's blade is 18 pieces, the flange diameter is 120 mm and the shaft length is 460 mm strung together to form a cylindrical (second cutter's blade drum) 163 mm in diameter serves to lead the peeled peel through the exhaust channel.



Figure 1. Cylindric cutter's blade in the drum

2.2. Machine mechanism

In this study, the shape of the angle that is suitable for the results of the process of stripping the dried areca nut can be peeled properly. The generated data is as follow, i) the angle of both cutters' blades with a diameter of 191mm and 163mm, respectively; ii) hopper is adjusted; and iii) round areca nuts.

The areca nut peeling-machine is driven by a gasoline motor with a power of 6.5 HP and 2700 rpm through a 3 inches-pulley into 14 inches pulley transmission system so that the rotation is achieved on an 80-rpm engine. The 800-rpm conditions are used as a reference to limit the number of nuts that poured into the peeling drum. The main drum cutter is 191 mm diameter in a straight position and the second drum cutter is 163 mm in diameter set to vary in the same direction, then the dried areca nut is inserted through the hopper continuously for all types of areca nut to be peeled, the biggest areca nut is 46 mm in diameter and the smallest 14 mm entered the gap that has been arranged the revelation angle according to the diameter of the areca nut so that the skin are peeled in perfect, also the seeds are continuously peeled as well. After being cut, the separation process between the skin and the areca nut was done. In the peeling process, the separation of the areca nut seedlings which are peeled then channeled through the bottom funnel to be accommodated while the skin is directed by using a fan through the upper channel which has been provided so that all the dust and pulp are accommodated in its place. The pouring process of areca nuts is regulated continuously so that the peeling process can be done properly as it is shown in Figure 2.



Figure 2. Construction of peeling-machine and peeled areca nuts

3. Result and Discussion

This research is the development of the research that has been investigated, namely the distance between the drum cutter which is arranged straight is obtained a distance of 2 mm and the shape of the casing greatly affects the results of peeling and variations in rotation and time have also been studied. It is expected that the research will yield results that can peel all sizes of dried areca nuts.

From the conducted research, the results show that the areca nuts weighed 1.5 kg calculated the total number of 135 by the machined slowly and arranged the distance starting from 2-2.5 mm (0.96°), 1.5-2.5 mm (1.91°), 1-2.5 mm (2.87°) large angle with 3 times repetition. The data is listed and graphically illustrated in Table 1 and 2, respectively. However, 41 pieces areca nuts are not peeled for the small size of the nut.

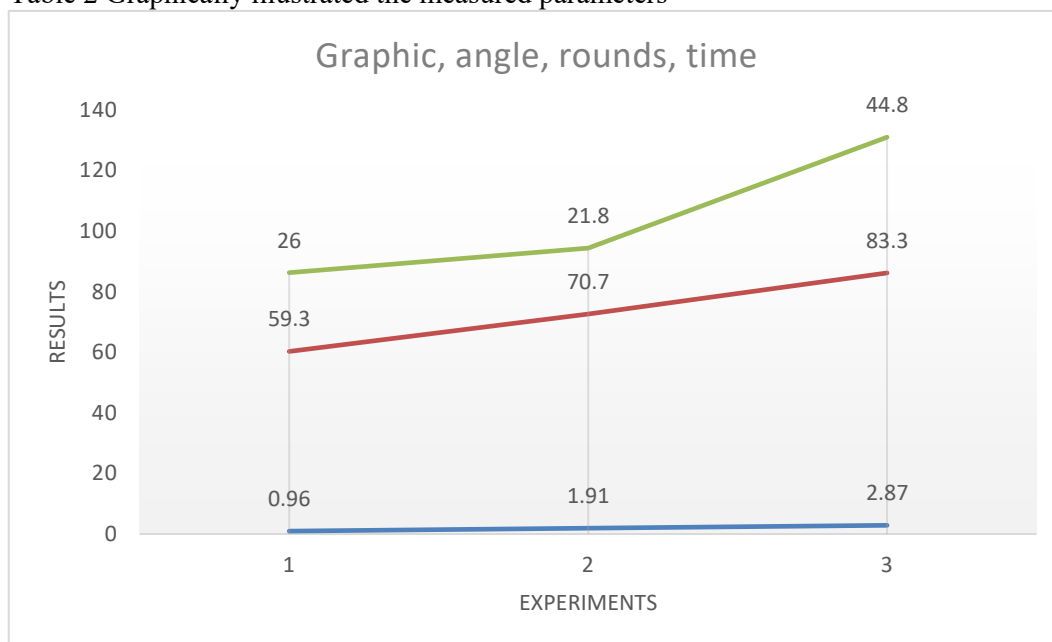
Table 1. Measured parameters

| Angle (0.96 °) | 1 | 2 | 3 |
|-------------------|-------|-------|-------|
| 1.5 kg areca nuts | 133 | 125 | 136 |
| Rounds | 50 | 60 | 68 |
| Cracked | 47 | 29 | 43 |
| Unpeeled | 36 | 36 | 25 |
| Time (second) | 33.81 | 22.73 | 21.28 |

| Angle (1.91 °) | 1 | 2 | 3 |
|-------------------|-------|-------|-------|
| 1.5 kg areca nuts | 138 | 132 | 135 |
| Rounds | 70 | 62 | 80 |
| Cracked | 28 | 22 | 20 |
| Unpeeled | 40 | 48 | 35 |
| Time (second) | 18.18 | 13.64 | 33.53 |

| Angle (2.87 °) | 1 | 2 | 3 |
|-------------------|-----|-------|-----|
| 1.5 kg areca nuts | 145 | 130 | 140 |
| Rounds | 80 | 78 | 92 |
| Cracked | 26 | 22 | 22 |
| Unpeeled | 39 | 30 | 26 |
| Time (second) | 45 | 41.35 | 48 |

Table 2 Graphically illustrated the measured parameters



From Table 2, whereas the results are illustrated graphically obtained by experimenting every time the angle of 3 repetitions and the achievement of peeling results by adjusting the distance between the main cutter and the second cutter is at constant rotation of 800 rpm. The average data is as follow:

1. Adjusting the cutter's blade by the angle of 0.96° with a distance between 2-2.5 mm and peeling time 26 seconds, and the number of round nut is 59.
2. Adjusting the cutter's blade by the angle of 1.91° with a distance between 1.5-2.5 mm and peeling time of 21 seconds, and the number of round nuts is 72.
3. Adjusting the cutter's blade by the angle of 2.87° with a distance between 1.0-2.5 mm and peeling time 45 seconds, and the number of round nuts is 83.

4. Conclusion

This research aims to adjust the angle between the two cutters' blades in such way that are suitable in order to peel the dried areca nut that are varied in size. The speed and timing of the motor rotation can be control from one drum to another. The results showed that the varied adjusting cutters' blade angle with varied distance and peeling time produced varied numbers of peeled dry areca nuts.

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