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DESIGN AND BUILDING OF PEANUT CLEANING MACHINE WITH 1 PHASE ELECTRIC MOTOR DRIVE CENTRIFUGAL SYSTEM

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Abstract- *This peanut plant is a plant that is very useful in everyday life because of that this plant is widely cultivated which can later be used to meet human needs. With the development of an increasingly modern era, this also has an impact on people's lives who want everything practical and fast. The process of cleaning peanuts is very difficult and takes a lot of time. To improve the cleaning process so that it is more optimal, which can increase time efficiency and meet health standards, the peanut cleaning machine is made portable so that it can be easily moved which refers to better results than existing machines. The methodology used includes: criteria research, planning, preparation of tools and materials, measurement, material cutting, size checking, assembly, data analysis and conclusions. The main parts of this tool include: frame, washer tube, nylon brush, drive motor. The results of the evaluation of the introduction of a peanut cleaning machine with a centrifugal system driven by a single-phase electric motor show: (a) the operation of the machine is relatively easy, capable of speeding up the washing process and increasing the production capacity of peanuts, (b) improving product performance and hygiene, (c) functionally and the structure of the peanut washer functions optimally.*

Keywords: Brightness and cleanliness peanut cleaning machine.

INTRODUCTION

Indonesia is rich in wealth of natural resources. One of the sources of natural wealth is the peanut plant species. This plant is a leguminous leguminous plant belonging to the FABACEACE tribe. This peanut plant is a plant that is very useful in everyday life in Indonesia. Therefore, this plant is widely cultivated which can later be used to meet human needs. As a cultivated plant, peanuts are primarily harvested for their seeds which are rich in protein and fat. These peanut seeds can be eaten raw, can also be boiled, fried or roasted. In both developing and developed countries, peanut seeds are processed into a kind of jam for ready-to-eat dough or bread mixes. In Indonesia, the processing of peanut products is a profitable food industry. Production of peanut oil reached around 10% of the world cooking oil market in 2003 according to FAO *(Food And Culture Organization),* an organization under the United Nations which is authorized to manage various relations with food and agricultural products in the world.

In addition to harvesting the seeds or pods of peanuts, the forage (leaves and stems) is also harvested for animal feed or used as green manure. With the development of an increasingly modern era, this has also had an impact on people's lives who want everything practical and fast. In the case of washing the peanuts, the process of cleaning the peanuts was done manually, namely by trampling the peanuts with their feet or washing them in running water by rubbing them with their hands to remove the mud or soil adhering to the peanut shells.

The process of cleaning peanuts is very difficult and takes a lot of time. If the number of peanuts is small, the cleanliness of the mud and soil can be overcome, but if the number of peanuts is large, you can be sure that there is still a lot of mud or soil attached to the skin of the peanuts. It is different if we use tools that can save time and very efficient. Currently there are many peanut cleaning machines that can help human tasks. But these machines only exist and are operated in large factory industries with large sizes or dimensions as well, coupled with expensive operating costs. simplify the process of cleaning peanuts in everyday life.

With operation that is not difficult and the use of machines that are not too large, therefore a centrifugal system peanut cleaning tool is needed with electric motor drive power which can increase work efficiency in the peanut cleaning process in accordance with business life or home industry.

RESEARCH METHODS

The peanut cleaning machine is a tool that is used to help and facilitate human work, when it comes to washing peanuts. The main power source for this machine is an AC electric motor, where the motor power is used to move or rotate the washing machine, the operation of the tool is done manually, namely peanuts that are still dirty or peanuts that are still covered in mud, put into the washing tube machine and then add water in a capacity of approximately 1 to 2, namely peanuts weighing 5 kg and 10 liters of water, then the cleaning cylinder rotates nylon brushes centrifugally which will clean these nuts.

Product design or product drawings of a peanut cleaning machine with a single-phase electric motor-driven centrifugal system. The drawing is a planning drawing and a front view of the machine after its completion.

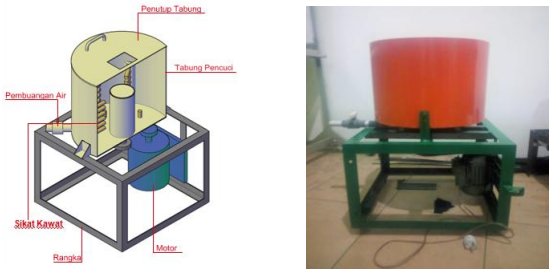

Figure 1. Planning Product Design Product Design

Machine Characteristics

This peanut cleaning machine has a frame dimension of 50 x 50 cm with a cleaning tube with dimensions of 30 x 41 cm with a total height of 65 cm. Peanuts that are still dirty in the form of mud and soil that are still attached to the outer shell of peanuts are put into the cleaning tube, then the cleaning tube is also filled with approximately 15 liters of clean water and then cleaned by a nylon brush attached to the cleaning cylinder and rotating centrifugally. The machine is driven using an AC electric motor as the main source of propulsion which has a power of ½ PK. The AC motor converts electrical energy into motion energy in the engine, the cleaning cylinder is connected to the connecting AS and connects the pulley, and the pulley is connected to the V-belt which connects directly to the motor to do the washing.

How the Machine Works

The peanuts that are still dirty are put into the cleaning tube and then clean water is also put into the tube. The machine is connected to the mains. The switch button is changed to the ON position and the driving motor will rotate according to the rotational speed. The main power source of the washing system is the motor power, where the motor rotation is forwarded to the V-belt and connected to the pulleys. The pulli is forwarded to the connecting AS, the connecting AS moves the cleaning cylinder then a nylon brush attached to the cleaning cylinder does the cleaning on the peanuts. The water from the cleaning results will come out through the bottom pipe when the valve stop is opened. When all the water has been removed from the cleaning tube as a result of washing the peanuts, it will come out of the cleaning tube door when the door is opened.

RESULTS AND DISCUSSIONS

Washer Power Analysis

Analysis of the mechanism and torque required for washing peanuts was carried out using a kinematics approach and a centrifugal washing mechanism. The washing mechanism determines that the torque required for washing depends on several factors, including: kinetic frictional efficiency between the brushes on the surface of the cylinder and the peanuts being cleaned, the force applied to washing the cleaning brush, the rotational speed of the cleaning cylinder, the radius of the cleaning cylinder, the normal force component (thrust) and the amount of water as a washing medium. The magnitude of the friction coefficient is approximately 25% smaller than the coefficient of sex static friction (Giancoli, 1992; Beer and Jhonston, 1990).

Cleaning power can be analyzed based on the washing torque requirement. Darma (2000) reports that the maximum torque needed is 1,395 Nm by using a cleaning cylinder with a diameter of 11 cm. The relationship between the rotating power (torque) that works and the transmitted *force* is formulated as follows: (Mabie and Ocvire, 1975; Shingley and Mitchell, 1983)

$T = \frac{d}{2} \text{x } F$

So that the washing force of peanuts can be formulated:

$F = \frac{2}{d} \text{x } T$

$F = \frac{2}{0{,}11} \text{x } 1.395$

$F = 25.36$ Newtons

While the power requirement can be calculated with the equation:

$P = 2\,\pi R(\frac{n}{60}) \text{x } F$

$P = 2\,\pi \text{x } 0.11\,(\frac{1200}{60}) \text{x } 25.36$

$= 2 \text{ x } 3.14 \text{ x } 0.11 \text{ x } (20) \text{ x } 25.36$

Obtained P = 0.35 kw or equivalent to 0.44 HP (according to cylinder constant 0.785). Then the required motor power is 0.44 HP so the motor used is 0.5 HP or ½ PK, according to the availability of motors on the market.

Technical TestingEquipmentWashing Peanuts

Technical tests are carried out to find out whether the tool that has been made has the desired goals and criteria, besides that it is for the success of a design process of the tool. The technical test of this peanut washing machine includes several tests, including:

a. Effective Capacity

The effective capacity of this peanut washing machine is calculated by directly recording the washing results at certain time intervals. From the test results obtained an average effective testing capacity of 3 Kg / 1 minute. The effective capacity of the test results was carried out by washing the peanuts 6 times with a duration of 10 seconds/test and consuming 90 liters of water. The level of cleanliness reaches 95%. Testing 2x washing of peanuts with a duration of 1 minute/trial, resulted in a cleanliness level of 90% and used more water-efficient, namely 30 liters of water.

b. Generated Cleanliness Level

Materials processed through the machine will undergo various processing processes in the machine. So that some will become materials that can be processed, some will become waste and some will be lost during the processing. The resulting level of cleanliness can be obtained from the difference in initial and final weight after going through the washing and drying processes.

The level of cleanliness produced can be known by calculating the weight of peanuts before washing or cleaning with the yield of peanuts after washing. If the weight of peanuts before washing is Kb, peanuts after washing is Kp, then the level of cleanliness after the drying process is Kh, which can be formulated:

$Kh = Kb - Kp$

Information :

Kh = Result of washing after drying process

Kb = Peanuts before washing (Kg)

Kp = Peanuts after washing

Kh = 3.030 – 2.780

= 250 gr

c. Peanut Cleaning Machine Efficiency

Cleaning efficiency can be obtained by comparing the amount of water needed with the time needed, or

Effectiveness = $\frac{\text{the number of liters of water needed}}{\text{time required}}$

$$E = \frac{30\ liter}{120\ second}$$

E = 0.25 l/s

By using this equation, the washing efficiency is 0.25 l/s. The efficiency of washing is greatly influenced by the loss of mud or soil attached to the skin of the peanuts resulting from washing. The greater the cleanliness of the washing results, the efficiency will increase.

Test Mechanism

The testing mechanism is carried out as follows:

Tests were carried out to determine the time and level of cleanliness needed to wash 3 kg of peanuts. 3 kg of peanuts for the washing process with the machine which was carried out 6 times washing trials with a duration of 10 seconds. The second test was carried out with an added time duration of 1 minute with 2 washing attempts.

a. Testing Results of Peanut Cleaning Machine

After the process of designing and manufacturing the peanut cleaning machine has been carried out, the next step is to test the performance of the machine. This performance test aims to find out the performance of the machine, according to or not in accordance with the planning concept. The materials needed to test the machine are:

1. Peanuts
2. Stopwatch
3. Clean water
4. Scales

b. Testing Procedure

Peanuts that are still dirty are first weighed, then put into the cleaning tube. Water is also put in the cleaning tube. The ON switch is turned on and the purge cylinder rotates. The stopwatch is started since the motor drives the purge cylinder. The first test with a duration of approximately 10 seconds for 6 tests. The stopwatch is used to calculate the time needed for the machine to wash the peanuts. The second test was carried out with 1 minute repetition of 2 times. With the same amount of weight of peanuts and water, namely 3 kg and 15 liters of water each time the test.

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a. Testing the results of the peanut cleaning machine

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CONCLUSIONS

The results of the testing of the peanut cleaning machine with a centrifugal system driven by an electric motor has the advantage that the dimensions of the machine are smaller than the peanut cleaning machines in factories and are suitable for use on a household scale as well as for middle class peanut farmers . This portable peanut cleaning machine can also wash root crops such as potatoes and shallots. The motor temperature during operation does not occur a significant increase in temperature. But the drawback of this machine is the power source, when the machine is moved to an agricultural area or field, there must be a source of electricity. Another drawback of this machine is the water factor where clean water is added manually.

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