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Design and Construction of Peanut Peeling Machine with a Capacity of 100 kg/hour

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Abstract

This research aim For make Design and Construction Machine Peanut Skin Peeler as well Capacity 100 kg/hour. Based on the results of the peanut roasting and peeling experiments, it can be concluded that the roasting time affects the final weight of the peanuts, the peeling results, and the quality of the peanut seeds produced. and a roasting time of 10 minutes by a sand temperature of 30 °C, the weight of the peanuts decreased from 1 kg to 0.95 kg. After peeling, the weight of the peanut seeds was 0.60 kg and the weight of the peanut shell was 0.35 kg. The percentage of unbroken peanuts reached 97%, while only 3% were broken. After roasting for 20 minutes, the final peanut weight decreased to 0.90 kg. The peeling results proved that the weight of the seeds was 0.57 kg and the weight of the shell was 0.33 kg. The percentage of whole peanuts decreased to 80%, while the percentage of broken peanuts increased to 20%. The experimental results also proved that the capacity of the peanut peeling machine reached 100 kg/hour by both experiments. Longer hulling times reduce the moisture content and weight of the beans, but increase the level of damage during hulling. Therefore, a hulling time of 10 minutes at 30°C yields the best results, producing more accurate hulling of the beans and reducing the level of damage.

Keywords: Design, Construction, Peanut Peeling, Machine

INTRODUCTION

Indonesia is known as an agricultural country, where almost the entire population depends on the agricultural industry for their living. This is possible because the soil is fertile,

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allowing many plants to grow easily. In addition, agricultural production in Indonesia is not seasonal, making farming in Indonesia easier than in foreign countries (Juntara, 2019). Peanuts are one of the most popular and widely consumed products (Cholis, 2022).

Peanuts (Arachis hypoghea) are a secondary crop that has long been recognized as a productive crop by Indonesian farmers (Anderson et al., 2022). Peanuts are an important source of vegetable protein, second only to soybeans in the Indonesian diet (Agbonkhese & Afoegba, 2023). This food is primarily used for human consumption, but it can also be used as animal feed and as an industrial raw material. (Sutejo, 2012) suarasurabaya.net, fruits are rich in water-soluble fiber, vitamins, and minerals but low in fat, can help lower cholesterol and control blood sugar (Lim et al., 2020).

The FAO (Food and Agriculture Organization) estimates that average global per capita fruit consumption will increase from 7 kilograms per year by 2022 to 8.6 kilograms per year by 2023. The FAO also emphasizes the importance of public access to fruit in supporting healthy and sustainable diets (Chandrakumar et al., 2025).

Peanut peeling machines currently available still utilize traditional tools. Of course, there are several drawbacks to peeling peanuts and traditional methods, such as requiring more labor and inconsistent results, as well as time consumption (Download, 2026). Therefore, we tried to design a horizontal type peanut peeling machine (Ajeigbe et al., 2020). Using a gasoline engine as a driver, this machine is effective and efficient so that it can be used by the community in helping with the peanut peeling process (Olukunle & Akinnuli, 2022). The advantage of our machine design is that we changed the roller tube section, by adding rubber to cover the iron to reduce the impact between the peanuts and the roller tube, so that damaged peanuts will also be reduced. We also added a horizontal type blower to blow the peeled peanut skin (Osunleti, 2022). Based on the 5 backgrounds above, the author is interested in developing a final project entitled "Design and Construction of a Peanut Peeling Machine with a Capacity of 100 kg/hour".

LITERATURE REVIEW

Design is a creation involving a clear way to achieve an end result, or the creation of something having physical reality (Mizar et al., 2017). In engineering, design involves utilizing scientific principles and technical tools such as mathematics, computers, and languages to produce a design that, when implemented, meets human needs (Lawan et al., 2015). Machine design covers everything from system design to machine features, machine elements, structures, and equipment, thus covering all areas of mechanical engineering (Daniyan et al., 2016).

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Electric motor

An electric motor is a device that converts electrical energy into mechanical energy. An electric motor is considered an energy conversion device because it utilizes electrical energy to produce kinetic energy, or more simply, converts electrical energy into kinetic (mechanical) energy. Classically, electric motors can be divided into two types, namely DC (direct current) motors and AC (alternating current) motors (Okaiyeto et al., 2020). Direct current (DC) motors utilize direct current that is not completely unidirectional . DC motors are used in special applications where high starting torque or sustained acceleration over a wide speed range is required. Alternating current (AC) motors utilize electric current that regularly reverses its direction at certain intervals (Legesse & Bekele, 2021).

Electric motorcycles have many advantages over traditional motorcycles because they don't use fuel. Here are some reasons why you should consider using an electric motorcycle:

1. Smooth engine sound (Ferdaus et al., 2023). One of the reasons you should own or buy an electric motorcycle is its smooth sound. Besides being pollution-free, electric motorcycles are also quiet. A smooth engine sound will also give you confidence while working.
2. High Efficiency One of the advantages of electric motors is that their efficiency is much higher than that of motors that use fuel oil.
3. Environmentally friendly. Electric motors are clearly environmentally friendly because they utilize electrical technology and don't emit gases that cause air pollution in the workplace.

How an electric motor works Electric motor

By utilizing the properties of magnets, namely when two similar magnetic poles are brought close to each other, a repulsive force will occur, and when two different magnetic poles are brought close to each other, an attractive force will occur (Temesgen & Retta, 2015). This artificial magnet is usually installed inside a permanent magnet, or more simply, the permanent magnet is placed inside a tube and inside the tube there is an axis where the artificial magnet is located. Artificial magnets are produced electromagnetically, namely the magnet is produced and flows an electric current through the coil. The coil is electrified creating a magnetic field around the coil, and in strengthening this magnetic field, an iron core is installed inside the coil (Shah et al., 2022). When the coil is connected to the axis that is electrified, the coil will produce a magnetic force. The magnetic force by the coil attached to the axis will repel or attract each other and the magnetic force attached by the tube so that it rotates the axis. using **a 0.5 HP 220 volt electric motor and a capacity of 100 kg / hour in a peanut peeling machine.**

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Figure 1Electric dynamo machine

L-shaped steel

This type of profile steel is commonly used in building construction. This time, the author used it to design a peanut shelling machine, functioning like a frame. The author chose this material because it is durable and strong. The steel used is 4 mm thick and measures 50x50 mm.



Figure 2Bja Prifil

Steel sheet

In terms of shape, there are two types of sheet steel, namely sheet plate and rolled plate. Starting from the production aspect, it is divided into two parts, namely plates/rolls of hot rolled sheet and plates/rolls of cold rolled sheet (Wei et al., 2018). This sheet steel is used as a cover in prefabricated frame parts and is also used as a container for storing nuts and the sheet steel thickness is 1.2 mm.



2. axle

A shaft is a rotating, stationary member, usually circular in cross-section, to which gears, pulleys, cranks, and other transmission elements are attached. Axles can be subjected to

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bending, tension, compression, or torsion, acting singly or in combination with each other (Mandel & Mandel, 2020)

Plywood

A pulley is a pair of machine elements used to transmit power from one axis to another. The speed ratio between the driving and driven axes depends on the ratio of the pulley diameters used. In transmitting power, the pulley is connected to a V-belt and utilizes frictional contact between the pulley and the belt.



Figure 3Pulley

welding method

Welding is a method of permanently joining metals. A method of heating metal to its melting point, with or without the use of a torch. pressure, and as well as or without the use of filler materials. Heat is needed to melt the metal part to be connected to the electrode. worth the extras (Yusuf et al., 2020)

3. Types of welding

The next type of welding is gas metal arc welding. There are two types of this welding: MIG (metal inert gas) and MAG (metal active gas). The difference between the two lies in the gas used in the welding process. MIG uses only inert gases such as argon and helium, while MAG uses CO2 or a mixture of argon and helium (Balami et al., 2016).

peg

A key is a piece of mild steel that functions as a lock inserted between the axis and the hub of a pulley or gear so that the two are connected securely and are able to transmit rotational moment/torque [7]. Based on their position on the axis, they can be distinguished between saddle keys, flat keys, countersunk keys, and tangent keys, usually having a rectangular cross-section. In the longitudinal direction, the key can be prismatic or tapered. There are also inter-

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prismatic keys used specifically as shear keys (Ezeanya, 2020).

RESEARCH METHOD

Front view design

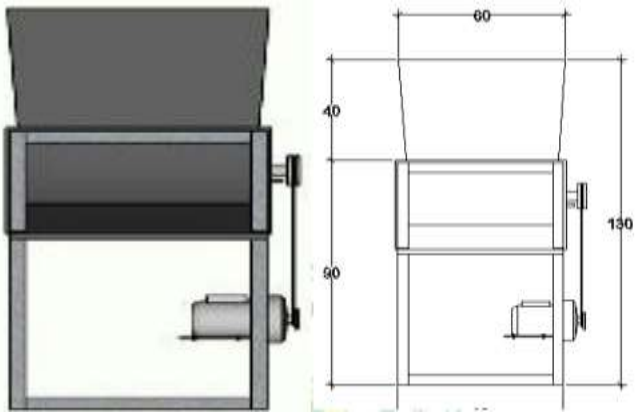


Figure 4. Front view design

The tools that will be used in designing a peanut peeling machine include the following:

1. Cutting grinder. The primary function of a grinding machine is to grind materials and smooth their surfaces. This machine can also be used to cut nut shelling machine frames using a 2000-watt cutting grinder (Ojolo et al., 2016).
2. Electric welding machine and electrodes (welding wire). This welding machine and electrode (welding wire) function to connect and unite broken or damaged metal materials. The frame of the peanut peeling machine and its 900 watt power act as a link in the material.
3. Measuring instruments. A meter is a portable measuring instrument that measures lengths ranging from 5 to 50 meters. This measuring instrument is typically used to measure the length and weight of materials.
4. Hand drills. Hand drills are generally used to drill holes in metal or wood. This depends on the type of drill bit used. Hand drills can also be used to loosen and tighten bolts (Fadeyibi & Faith Ajao, 2020).
5.

RESULTS AND DISCUSSION

Engine capacity test results

Based on the first objective, namely determining the machine capacity, a horizontal cylinder type peanut peeling machine using a 0.5 HP electric motor has been tested.

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Peanut data

Before being tested in the machine, the peanuts are roasted using sand to reduce the water content in them.

Table 1. Test Results

Sand temperature (°C)	Initial weight of peas (kg)	Final weight of granules (kg)	Time (minutes)
30 °C	1 kg	0.95	10
30 °C	1 kg	0.90	20

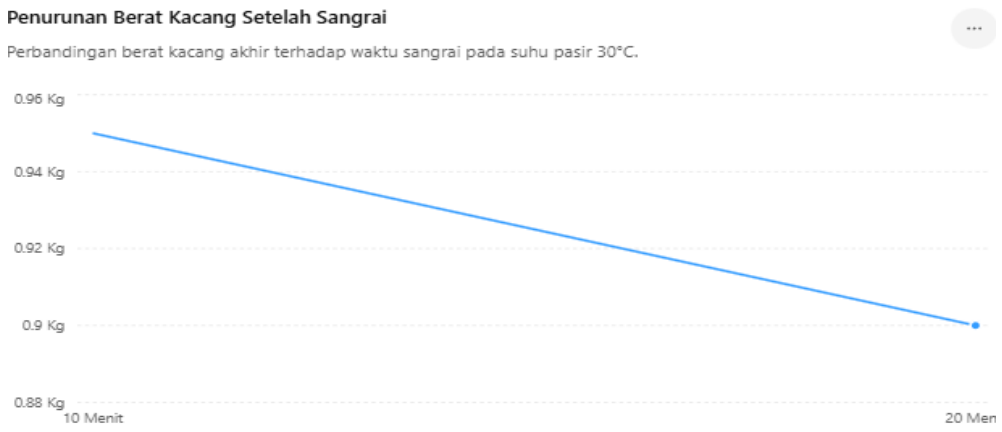


Figure 4. Comparison of Nut Weight Regarding Roasting Time

A. Weight loss formula

Weight loss = W0-Wt

Information:

Weight = Initial weight (kg)

Weight = Final weight (kg)

B. Weight loss percentage formula

Percentage reduction = $\frac{Wo-Wt}{Wo}$ × 100%

Information:

W0 = Initial weight

Wt = Final weight

C. Weight loss rate formula

Weight loss rate = $\frac{Wo-Wt}{t}$

Information:

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t = Drying time (minutes)

2. Completion of the first trial

It is known:

Sand temperature = 30°C

Initial weight = 1 kg

Final weight = 0.95 kg

Time = 10 minutes

A. Calculating weight loss

1−0.95=0.05 kg

Therefore, the weight loss of peanuts is **0.05 kg.**

B. Calculating the percentage reduction

$\frac{1-0,95}{1}$×100% = 5%

Therefore, the percentage of weight loss is **5%.**

C. Calculating the rate of weight loss

$\frac{0,05}{10}$ = 0.005 kg/minute

Therefore, the rate of weight loss for peanuts is **0.005 kg/minute.**

3. Completion of the second experiment

It is known:

Sand temperature = 30°C

Initial weight = 1 kg

Final weight = 0.90 kg

Time = 20 minutes

A. Calculating weight loss

1−0.90=0.10 kg

Therefore, the weight loss of peanuts is **0.10 kg.**

B. Calculating the percentage reduction

$\frac{1-0,9}{1}$× 100% = 10%

Therefore, the percentage of weight loss is **10%.**

C. Calculating the rate of weight loss

$\frac{0,10}{20}$= 0.005 kg/minute

Therefore, the rate of weight loss for peanuts is **0.005 kg/minute.**

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4. CONCLUSION

Based on the calculation results:

1. At a sand temperature of 30 degrees Celsius for 10 minutes, the weight of peanuts **decreases by 0.05 kg** or 5%.
2. At a sand temperature of 30 degrees Celsius for 20 minutes, the weight of peanuts **decreased by 0.10 kg** or 10%.
3. The longer the heating time, the more the weight of the vegetables will decrease because the water content in the vegetables decreases.
4. The rate of weight loss in both trials was the same, namely **0.05 kg/minute.**

Based on peanut data, after 10 minutes of heating, the weight of peanuts decreases by 0.05 kg and after 20 minutes of heating, the weight of peanuts decreases by 0.10 kg by the same temperature.

Table 2. Test result data

to try	Input weight (kilogram)	Weight of peanut seeds (kilogram)	Weight of peanut shell (kilogram)	Peeling time (Second)	Capacity (kg/hour)
1	0.95	0.60	0.35	36	100
2	0.90	0.57	0.33	34	100



Figure 2. Comparison of Peeling Results Peanut

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1. Formula in total weight of peeling results

WT + MK

Information:

Weight = Total weight of the product (kilograms)

Wb = Weight of peanut seeds (kg)

Wk = Weight of peanut shell (kg)

2. Percentage formula in peanut seeds

$$\% \text{ seed} = \frac{Wb}{Wi} \times 100\%$$

Information:

Wb = Weight of peanut seeds (kg)

Y = Input weight of peanuts (kg)

3. Formula for percentage of peanut skin

$$\% \text{ Volume} = \frac{Wk}{wi} \times 100\%$$

Information:

Wk = Weight of peanut shell (kg)

W = Input weight of peanuts (kg)

4. Peeling capacity formula

$$K = \frac{Wi}{t} \times 3600$$

Information:

K = Peeling capacity (kg/hour)

W = Input weight (kg)

t = extraction time (seconds)

3600 = Convert seconds to hours

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B. Completion of Experiment 1

That is already known.

Input weight = 0.95 kg

Weight of peanut seeds = 0.60 kg

Weight of peanut shell = 0.35 kg

Peeling time = 36 seconds

1. Calculate the total weight of the results

Using the formula:

WT = WB + WC

Value substitution:

Length = 0.60 + 0.35

Results:

Weight = 0.95 kg

Therefore, the total peeling yield is 0.95 kg.

2. Calculate the percentage of bean seeds

Using the formula:

% seed = $\frac{Wb}{Wi}$× 100%

Value substitution:

% seed = $\frac{o,60}{0,95}$× 100%

Results:

Seed = 63.16%

Therefore, the percentage of peanut seeds is 63.16%.

3. Calculate the percentage of peanut skin

Using the formula:

% Volume = $\frac{Wk}{Wi}$× 100%

Value substitution:

% Volume = $\frac{0,35}{0,95}$× 100%

Results:

% Skin = 36.84%

Therefore, the percentage of peanut shells is 36.84%.

4. Calculate the peeling capacity

Using the formula:

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K = $\frac{Wi}{t}$× 3600

Value substitution:

K = $\frac{0,95}{36}$× 3600

Results:

K = 95 kg/hour

Therefore, the peeling capacity by the first trial was 95 kg/hour.

C. Completion of Experiment 2

That is already known.

Input weight = 0.90 kg

Weight of peanut seeds = 0.57 kg

Weight of peanut shell = 0.33 kg

Peeling time = 34 seconds

1. Calculate the total weight of the results

Using the formula:

WT = WB + WC

Value substitution:

Length = 0.57 + 0.33

Results:

Weight = 0.90 kg

Therefore, the total peeling yield is 0.90 kg.

2. Calculate the percentage of bean seeds

Using the formula:

WB

% seed = $\frac{Wb}{Wi}$× 100%

Value substitution:

% seed = $\frac{0,,57}{0,90}$× 100%

Results:

Seed = 63.33%

Therefore, the percentage of peanut seeds is 63.33%.

3. Calculate the percentage of peanut skin

Using the formula:

% Skin = $\frac{Wk}{Wi}$× 100%

Value substitution:

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% Skin = $\frac{0,33}{0,90}$× 100%

Results:

% Skin = 36.67%

Therefore, the percentage of peanut shells is 36.67%.

4. Calculate the peeling capacity

Using the formula:

K = $\frac{Wt}{t}$× 3600

Value substitution:

K = $\frac{0,90}{34}$× 3600

Results:

K = 95.29 kg/hour

Therefore, the peeling capacity by the second trial was 95.29 kg/hour.

CONCLUSION

In the first experiment, starting with 0.95 kg of peanuts, 0.60 kg of seeds and 0.35 kg of total were obtained and the peeling capacity was 95 kg/hour (Putra Samitra et al., 2023). In the second experiment, starting with 0.90 kg of peanuts, 0.57 kg of seeds and 0.33 kg of total were obtained and the peeling capacity was 95.29 kg/hour. In both experiments, the percentage of peanut seeds was around 63%, while the percentage of peanut skin was around 36% (Vithu et al., 2020). The faster the peeling time, the better the tool's ability to work (Nordiana et al., 2020).

Based on test results, the machine can reach a capacity of 100 kg/hour, proving that the use of the peeling cylinder and peeling tube works well, meeting the initial target of nearly 100 kg/hour. (The weight of peanuts after peeling can be affected by peanut quality.) (Fadeyibi & Osunde, 2012).

Peanut peeling results data

Based on the second objective, namely producing high-quality peanut seeds, a horizontal cylinder type peanut shelling machine utilizing a 0.5 HP motor has been tested.

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Table 3. Result data peeling peanut land

Initial weight of peanuts	The temperature of the sand is hot.	It's sangria time!	Weight of peanut production	Weight of peeled seeds	Unbroken results	Bad results
1	30 °C	10	0.95	0.60	97	3
1	30 °C	20	0.90	0.57	80	20

1. Weight loss formula after baking

$\Delta W = W0 - Ws$

Information:

ΔW = Weight loss (kg)

W0 = Initial weight of peanuts (kg)

Ws = Weight loss (kg)

2. Weight Loss Percentage Formula

Percentage reduction = $\frac{Wa-Ws}{Wo} \times 100\%$

Information:

W0 = Initial weight of peanuts

Ws = Lose weight

3. Pea seed production formula

Product = $\frac{Wb}{Wo} \times 100\%$

Information:

Wb = Weight of peeled seeds (kg)

W0 = Initial weight of peanuts (kg)

4. Formula in percentage of unbroken seeds

Percentage not damaged = $\frac{Bpt}{Bt} \times 100\%$

Information:

BTP = Number of unbroken seeds

BT = Total Seeds

5. Formula in percentage of broken seeds

Percentage of damaged goods = $\frac{Bp}{Bt}$x 100%

Information:

BP = Number of broken seeds

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BT = Total Seeds

B. Completion of Experiment 1

That is already known.

Initial weight of peanuts = 1 kg

1. Calculate weight loss

Using the formula:

ΔW=W0−Ws

Value substitution:

ΔW=1−0.95

Results:

ΔW = 0.05 kg

Therefore, weight loss after consuming vegetables is **0.05 kg.**

2. Calculate the percentage of weight loss

Using the formula:

Percentage reduction = $\frac{Wo-Ws}{Wo}$× 100%

Value substitution:

Percentage reduction = $\frac{1-0,95}{1}$× 100%

Results:

Percentage decrease = 5%

Therefore, the percentage of weight loss is **5%.**

3. Calculating the yield of peanut seeds

Using the formula:

Product = $\frac{Wb}{Wo}$× 100%

Value substitution:

Product = $\frac{0,60}{1}$× 100%

Results:

Result = 60%

Therefore, the yield of peanut seeds is **60%.**

4. Percentage of unbroken results

Known data:

Percentage of not damaged = 97%

Therefore, the yield of unbroken seeds is **97%.**

5. Percentage of damaged results

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Known data:

Percentage of damaged goods = 3%

Therefore, the harvest yield from the time the seeds break is **3%.**

C. Completion of Experiment 2

D. Conclusion

1. At a temperature of 30 degrees Celsius for 10 minutes, the weight of lentils decreased by 0.95 kg, or **a decrease of 5%,** and the grain yield **decreased by 60%.**
2. At 30 degrees Celsius for 20 minutes, the weight of lentils was reduced to 0.90 kg, **a decrease of 10% and an increase in** grain yield **of 57%.**
3. The longer vegetables are cooked, the more they will lose weight because their water content decreases.
4. Overcooking increases the amount of broken lentils **by 3% to 20%.**
5. The best results are obtained with a roasting time of 10 minutes because the percentage of unbroken coffee beans is higher, namely **97%.**

Based on the test data above, it can be seen that the longer the peanuts are roasted, the less their weight will be. If the peanuts are too dry, the number of broken peanuts will increase, so it is best not to roast for more than 10 minutes to get quality peeling results.

Machine production cost analysis

This design emphasizes economical production costs and components that are easy to find on the market.

Table 4. Component price list

Ingredients	Information	Price (Rs.)
Electric motor	Motor power 0.5 HP / 373 watt 220 volt voltage	Rp. 2,385,000
Transmission (pulley and V-belt)	Type A Top Width 13 mm Height 8 mm Mask Power 1-3 HP Type B Top Width 17 mm Height 11 mm Mask Power 1-3 HP	Rp. 195,000 Rp. 141,750
Funnel	Truncated pyramid/free-bar: 4 sloping sides, uniform flow. Most commonly used. Truncated cone: Smooth flow, but difficult to build. Box and 2 sloping sides: Front	Rp. 880,000

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	and back sides are straight, left and right sides are sloping. Cheap and easy to build.	
Peeling cylinder	A grooved iron cylinder rotates inside a hollow, concave plate. Nuts slide through these holes and rub against each other, making it durable and easy to maintain.	Rp. 339,900
Peeling tube	Inside there is a rotor that rotates quickly and due to friction, the skin is peeled off starting from the cavity so that the result is clean.	Rp. 100,000
Blower	Blowing duct: 150-200 mm wide, 80-120 mm high. Install it below the peanuts falling from the shelling cylinder. Blowing angle: 20-30° upwards, opposite the direction of the peanuts falling. The kernels fall, the skins fly upwards. Separator chamber: Make a 300x300x400 mm box above the duct. The air velocity in the chamber is reduced to 1-2 m/s, so that the skins fall into the container while the kernels fall downwards. Distance from the blower to the duct: maximum 2 m. If it is too far, the pressure will drop.	Rp. 129,000
Vibrating sieve	Circular separation and vibration are better but the capacity is smaller.	Rp. 130,000
Frame	The most efficient framework Lifting engine, swing arm, suspension Determining wearing comfort Configure the electric motor type	Rp. 1,000,000
Outlet	The entire width of the peanut channel: 120-150 mm. Width = 8-10 times the size of the largest peanut. If it is too small, it is easy to get stuck. Channel wall height: 80-120 mm. Deep enough to hold the peanuts so they don't get stuck when pulled. Channel length: As much as possible <800 mm. The longer the length, the greater the risk of getting stuck. Cross-sectional area: Minimum 2 times the area of the sieve hole. Example: 100x80 mm sieve hole → minimum channel 150x100 mm.	Rp. 454,000

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Divider box	20 mm corners and radius: to prevent nuts from getting stuck in corners and easy to clean. 15° inclined base: Tilt the bottom of the box towards the exit, so that nuts can be removed without having to pry them out manually. Sliding exit: Install a 150 mm × 100 mm sliding door at the bottom. Use rubber gaskets to prevent leaks. Wheels + brakes: Boxes >100 liters must use Ø100 mm PU wheels and brakes. 200 liters of nuts = 130 kg, too heavy to be pushed manually. Tightly closed: All storage boxes must have a lid to prevent dust and insects from entering. Add a locking clamp. Ventilation: Leather boxes must have Ø50 mm air holes and 2 mm mesh. If tightly closed, the leather will become dirty and moldy.	Rp. 354,000
net worth		Rp. 6,108,650

Price performance discussion

The choice of a pulley and V-belt transmission system has proven effective in reducing costs due to its lower cost and easier maintenance compared to a gearbox system (Myers et al., 2016). The total production cost of Rp 6,108,650 is considered competitive on a home industry scale (Azargohar & Dalai, 2022).

CONCLUSION

Based on results test roasting and peeling peanut land, can concluded that time roasting influence heavy end peanut land, yield peeling, and quality seed peanut land produced. and time 10 minutes baking by temperature sand 30 °C, weight peanut land decrease from 1 kg to 0.95 kg. After peeling, the weight seed peanut land is 0.60 kg and the weight skin peanut land is 0.35 kg. Percentage peanut land No broken reached 97%, while only 3% broke.

After baking for 20 minutes, weight peanut land end reduce to 0.90 kg. Peeling results prove that heavy seed is 0.57 kg and weighs the skin is 0.33 kg. Percentage peanut land intact decrease to 80%, while percentage peanut land broken increase to 20%.

The results of the experiment also prove that that capacity machine peeler peanut reach 100 kg/hour by both experiment. Peeling time longer reduce water content and weight peanuts, but increase level damage peanut during peeling. Because of this that, time peeling for 10

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minutes at a temperature of 30 °C gives results best, produce peanut more accurate and reduce level damage.

Suggestion

1. Roasting time should No too long for quality peanut land still stay awake and minimize damage moment peeling.
2. For get results peeling best, temperature and time roasting need controlled in a way stable.
3. Required study more carry on as well as variation temperature sand and time roasting different in reach optimal conditions in method peeling peanut land.
4. Machine peeler peanut need cared for and cleaned in a way regular in ensure efficiency maximum and quality optimal stripping.
5. It is recommended that the study furthermore includes other parameters such as water content, performance tools, and levels lost product for study data more complete and accurate

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