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Development and cost estimation of pedal operated coconut dehusker

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Abstract

Coconut production plays an important role in the national economy of India. India produces about 6000 million nuts a year. Copra produced in the country is about 0.35 million tons and India accounts for about 55% of the world trade in coir. Dehusking the coconuts without damaging the useful coir is an art only skilled workers can perform. Generally, coconuts are de-husked manually using a pointed tool or called spike. These methods require skilled and hardworking labour. Attempts made so far in the development of de-husking tool have been only partially successful and not effective in replacing manual methods. The reasons quoted for the failure of this tool include unsatisfactory and incomplete de-husking, breakage of the coconut shell while de-husking, spoilage of useful coir. This project involves design of a women friendly coconut de-husker, which requires less labour and time than the traditional ones. Here the operator can de-husk comfortably by applying pedal. In this project the model was fabricated with proper measurement and cost estimation was also done. The developed model was simple, efficient, requires less time and cost.

Keywords: Coconut, dehusker, pedal, cost estimation

Introduction

Coconut production plays an important role in the national economy of India. Traditional areas of coconut cultivation are Kerala (45.22%), Tamil Nadu (26.56%), Karnataka (10.85%), Andhra Pradesh (8.93%) and also Goa, Orissa, West Bengal, Pondicherry, Maharashtra and the island territories of Lakshadweep and Andaman and Nicobar Coconut is one of the world's most important perennial plants. The coconut fruit is made up of an outer cover, a thick fibrous fruit coat known as husk; underneath is the hard protective endocarp or shell. The coconut palm is widely cultivated in the tropics. India is the world's third largest producer of coconuts after the Philippines and Indonesia. With coconut plantations extending over more than a million hectares, India produces about 6000 million nuts a year. Copra produced in the country is about 0.35 million tons and India accounts for about 55% of the world trade in coir. Almost all the parts of coconut are useful. Coconut oil is also very important in soap production. The shell is used for fuel purpose, shell gasified as an alternate source of heat energy. The husk yields fibers used in the manufacture of coir products such as coir carpets, coir geo-textile, coir composite, coir safety belts, coir boards, coir asbestos and coir pith. Coir is a versatile natural fiber extracted from monocarp tissue, or husk of the coconut fruit. Generally fiber is of golden color when cleaned after removing from coconut husk. Coir is the fibrous husk of the coconut shell.

Now a days, the use of natural fiber reinforced composite is gaining popularity in automotive, cosmetic and plastic rubber applications because it offers an economical and environmental advantage over traditional organic reinforcements and fillers. The features of coir fiber from coconut husk such as adorability, relatively water-proof and resistance to damage by salt water and microbial degradation makes it popular in fiber reinforced composite applications. It is also revealed that both fiber length and fiber orientation distribution play important role in its mechanical properties; increase in length of coir fiber, increases the flexibility of the composite product like seat cushions for automobiles. Thus, there is need for machines that can extract coconut husk/fiber without distorting its length. The processing of coconuts after they are harvested involved dehusking, which at present is labor-intensive.

Dehusking the coconuts without damaging the useful coir is an art only skilled workers can

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perform. The coconut de husking is post harvesting operation which is necessary step towards making the coconut ready for the further utilization. The coconut de husking process is complicated and studies are still continuing in all coconut cultivation countries all over the world. The coconut also has cultural and religious significance in certain societies, particularly in India, where it is used in Hindu ritual. Generally, coconuts are de-husked manually using a pointed tool or called spike. These methods require skilled and hardworking labour. Attempts made so far in the development of de-husking tool have been only partially successful and not effective in replacing manual methods.

The reasons quoted for the failure of this tool include unsatisfactory and incomplete de-husking, breakage of the coconut shell while de-husking, spoilage of useful coir. This project involves design of a women friendly coconut de-husker, which requires less labour and time than the traditional ones. Here the operator can de-husk comfortably by applying pedal.

Therefore in the present study, the effort has been made to develop a pedal operated coconut dehusking machine, which can be handled by women and also the cost estimation has been done.

Review of Literature

The study was undertaken by Roopashree *et al* (2017) [4] on "Design and Development of Coconut Dehusking Machine". According to the author, generally, coconuts are dehusked manually using a hand cutting tool. These methods require skilled labor which is difficult and painstaking process. Attempts made so far in the development of dehusking tools have only been partially successful and not effective in replacing manual methods. The reasons stated for the partial success of these tools includes unsatisfactory, incomplete dehusking, breakage of the coconut shell. Based on this a power-operated coconut dehusking machine is being designed and fabricated to solve the existing problems. To reduce the human efforts, the power operated machine is designed and developed. The new power operated de husking machine works on the principle of gear mechanism. Here the labor efforts and the time consumption for the de husking are reduced.

Nwankwojike *et al* (2012) [2] studied on "Development of a Coconut Dehusking Machine for Rural Small Scale Farm Holders" and found that a coconut dehusking machine comprising of two rollers with spikes, screw conveyor, barrier plates, conveyor belt, two spur gears and a handle was developed for small scale production in the rural areas. Performance test analysis conducted shows that the machine dehusks coconut fruits without nut breakage and distortion of the extracted fibre length and also that its average dehusking efficiency and capacity are 93.45% and 79 coconuts per hour. All materials used in the fabrication of this machine are of standard specifications and locally sourced. The estimated cost of producing one unit of the machine is thirty five thousand, six hundred and sixty-five naira (N35, 665.00). The machine also eliminated dependency on the epileptic public electric power supply in our rural areas which constitutes the major obstacle in the use of other mechanized coconut dehusking equipment in the rural areas.

Material and Methods

This chapter deals with description of different parts of pedal operated coconut dehusker and its constructional details. The material for different parts was chosen and measured and cut.

With proper measurement the frame was fabricated by welding the individual parts. Parts like lower base, upper base, pedal, stand, connecting rod, blade and different nuts and bolts were used in this dehusker. Stand and base for providing stability so that with the help of pedal one can apply force to dehusk the coconut. When one will apply force by pedal, at a time dehusking takes place with the help of blade. Here one blade is constant and other will dehusk the coconut. The principle involves that one has to hold the coconut and have to apply pedal force and dehusking will take place.

Table 1: Specification of pedal operated coconut dehusker

Type	Pedal operated
Number of blades	Two (one fixed type and another one movable type)
Number of operators	one
Weight	16.22Kg
Cost	Rs.2111/-
Efficiency	100 coconuts/hr

Different parts

1. Base
 - a) Lower base
 - b) Upper base
2. Pedal
3. Stand
4. Connecting rod

Base

a) Lower Base

It consists of 4 MS angles having specification (300x300x50mm) and weighing 3.52 kg. One MS flat of size (450x60 mm) and two MS flat (250x50 mm) are used for support of pedal and weighs 1.04 kg.

b) Upper Base

It consists of 4 MS angles having specification (300x300x50 mm) and weighing 2.25kg. It supports the flat over which the teeth are fixed.

Pedal

It consists of two MS flats of size (250x50 mm) and over it a 18 gauge sheet of length is welded. The total structure weighs around 1.02 kg. The pedal is slightly extended from frame for easy operation. The pedal is connected with a spring which is supported over a flat.

Stand

It consists of 4 MS angles having specification (300x 300x 50mm) and weighing 6.05 kg. Angles are welded in such a way that the lower base position will remain un-altered.

Connecting Rod

It is a (250 x 50 mm) MS flat of 0.65m length. It is directly attached with the pedal with the help of bush so as to operate the blade for proper de-husking.

Two ends of the connecting are holed to fix with nut and bolt. It consists of two MS flats (250x50x80 mm). They are pointed for proper penetration. Out of the two blades one is larger and other is smaller. The bigger one is fixed over a flat and tightened with nut and bolts, where as the smaller one is fixed over a shaft for its free movement. The connecting is directly attached with the small blade.

Different Views



Top View



Side View

Cost Estimation of coconut de-husker (without motor) (Year 2016):

Table 2: A. Raw material

Name of the raw materials	Specification	Quantity (in kg)	Unit Rates (Rs)	Unit Rates (Rs) (+5% VAT)	Amount (Rs)
1.M.S.Angle	30×30×5	10.2	53.5	56.175	572.485
2. M.S. Flat	25×5	4.1	52.80	55.44	227.30
3. M.S. Flat	45×6	1.5	53.80	56.49	84.74
4.M.S.Flat	40×10	1	56.00	58.80	58.80

Add 3% Transportation 28.31

Also Add 3% storage 28.31

Total=Rs.1000.445/-

Table 3: B. Brought out items:-

Name of the raw materials	Specification	Quantity (in kg)	Unit Rates (Rs)	Unit Rates (Rs) (+5% VAT)	Amount (Rs)
1.G.I.Nut and Bolts	3/8(2),1.5"(2),1"(2)	180 gm	100.08	105.084	18.91
2.Washer	1 inch	50gm	90	94.5	4.72
3.spring	3.2"×1.2"	1 no.	160.00	168.00	168
4.cutter pin	3/16×2"	1 no	1.75	1.75	168

Add 3% Transportation 5.80

Also Add 3% storage 5.80

Total=Rs.205.06/

Table 4: C. Consumables:-

Name of the raw materials	Specification	Quantity	Unit rates(Rs)	Amount(Rs)
1. Welding electrode	3.15×350mm	15 no.	5	75
2. Enamel paint	Phiroza Blue	.250 lit	270	67.5
3. Tarpetine oil	Ordinary	.015 lit	100	1.5
4. Emery paper	No.60	0.5	15	7.5

Total =Rs.151.50/-

Table 5: D. Machine Charges:-

Name of Machine	Time Utilised	Rate/hr	Amount(Rs)
1.Hand Shearing	20 min	48	16
2.Drilling Machine	15 min	60	15
3.Arc Welding Machine	40 min	84.32	56.31
4.Bench Grinding	10 min	26.75	4.45
5.Spray Painting	20 min	38.25	12.75
6.Power Hacksaw	20 min	60	20

Total =Rs.124.51/-

Table 6: E. Labour Charges:-

Types of labour engaged	Time utilised (hr)	Rate/Day	Amount(RS)
1.Highly skilled	3	250	93.75
2.Semi-skilled	2	200	50
3.Un-skilled	3	150	56.25

Total=RS.200/-

Material weight=17.535 kg

Machine weight=16.22kg

Scrap weight=17.535-16.22=1.315 kg

Scrap value @ 15/kg=1.315×15=Rs.19.725/-

Production

Cost=(A+B+C+D+E)=(1000.445+205.06+151.50+124.51+200)-19.72

=Rs.1661.79/-

Profit@ 12% over it=Rs.199.41/-

Ex-factory price becomes Rs1861.2/-

Add 3% Transportation over it=Rs 55.83/-

Add 5% handling charge over it=93.06/-

Cost becomes=Rs.2010.09/-

Add 5% vat=Rs.100.05/-

Selling price becomes,2010.09+100.50=Rs.2110.59/-

Or say Rs.2111/-

In words two thousand one hundred eleven only

Advantages

- In comparison to traditional ones it requires less effort and less time.
- Due to little heavy weight it is more stable.
- Blades and springs can be replaced if they are worn out.

Repair and Maintenance

- Tightening of nuts and bolts should be checked at frequent intervals.
- Friction area should be lubricated properly.

Table 7: Comparison between hand operated coconut dehusker and pedal operated coconut dehusker:

S. No	Parameters	Hand operated	Pedal operated
1.	Number of nuts dehusked per hour	125	170
2.	2. Dehusking efficiency (%)	83	85
3.	3. Cost of dehusking per nut	.20	15
4.	4. Stability	less	more
5.	5. Fatigueness	more	less
6.	6. Subsidy	nil	Upto 75%

Conclusion

In this modern world the time and cost has become more important for each and every operation. So a new model was fabricated. This pedal operated coconut dehusker is more suitable than hand operated dehusker as considering the above parameters. It can be concluded that this machine require less human effort and cost effective. But it is used for domestic purpose only.

- The developed model is simple, efficient, requires less time and cost.
- Importance is given towards user friendly in operation and mainly safety.
- The overall performance of coconut de husking machine is satisfactory by husking coconut effectively and economically.

Suggestion

Here in pedal operated, instead of flat rod if we use metal rope and pulley, operator can easily operate with less force applied, so that it gives more comfort and continuous operation can be done.

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