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AUTOMATIC GROUNDNUT DECORTICATOR

Darshan Gowda C P¹, Venkatagiri H A², Govindaraj A S³

Student, Department of mechanical Engineering, SDMIT, Ujire-574240, India¹

Student, Department of mechanical Engineering, SDMIT, Ujire-574240, India²

Student, Department of mechanical Engineering, SDMIT, Ujire-574240, India³

darshangowdaccp199620@gmail.com¹, giriha81@gmail.com², graj827@gmail.com³

Abstract: Groundnut is the sixth most important oilseed crop in the world. Groundnut is a valuable source of edible oil (43-55%) and protein (25-28%) for human beings, and fodder for livestock. The major problem in groundnut production in country like India is the lack of groundnut processing machines available to farmers. In the beginning the peanuts were separated from its shells by the workers. The output from this method was very less and could not satisfy the market demand as it was very time consuming process. Numbers of groundnut Sheller machines are available in the market but they are large in size, costly and not suitable for domestic applications, they are best suitable for industrial applications where mass production is required. Hence it is essential to design and fabricate a portable groundnut decorticator machine for domestic application. In this project the process of designing the different parts of this shelling and separating machine considering all forces and ergonomic factor for people to use. The particular design of this project reduces all the causes and improves the efficiency. It consists of the hopper, crushing chamber, separation chamber, blower unit and the frame for support. The crushing chamber and blower unit is powered by electrically which save the time. The Output is about 20-25 kg/hour. The machine is also light weight, easy to operate and maintain.

Keywords: Groundnut decorticator, evaluation, fabrication.

I INTRODUCTION

India is an agriculture country. In India 70- 72% of the population are farmers. In India mostly farming is done with help of traditional equipment's and methods. Due to that traditional equipment and methods the earning of farmer is reduced. In India most of the rural population is engaged in agricultural land. Hence this project can of great use. Groundnut is the sixth most important oilseed crop in the world. Groundnut is a major oilseed crop grown in the state, it occupies about 10.8 percent of the total cultivated area and 56.5 percent of the total area under oilseed crop in Karnataka contributing 73 percent of total oilseed production in the state. Groundnut is a valuable source of edible oil (43-55%) and protein (25-28%) for human beings, and of fodder for livestock. About two thirds of world production is crushed for oil and the remaining one third is consumed as food. As the groundnut seed is contained in pod, which is usually developed underground, the pod is harvested by pulling or lifting the plant manually or by using a hoe as the mechanization system. The

pods are stripped from the haulms, dried stored and processed.

The major problem in groundnut production in country like India is the lack of groundnut processing machines available to farmers. In the beginning the peanuts were separated from its shells by the workers. The output from this method was very less and could not satisfy the market demand as it was very time consuming process. In traditional method, only one person can decorticate 2 to 4 kg of groundnut per hour that rate of production reduces the number of workers are increased. So we have an idea to create equipment for help of the farmers.

Hand operated groundnut decorticator consists of curved L" angle frame and four legs. A perforated sieve in a semi circular shape is provided. Seven cast iron peg assemblies are fitted in an oscillating sector. The groundnut pods are shelled between the oscillating sector and the perforated concave sieve. The peanuts and shell are collected at the bottom of the unit.

The clearance between the concave and oscillating sector is adjustable to decorticate pods of different varieties of groundnut. The sieve is also replaceable according to the variety of groundnut pods. Hand operated Sheller machines are suitable for domestic application but they only do shelling operation, separation of seeds we have to do manually by using traditional methods such as by using natural wind or by using sieve. So to avoid these difficulties, we have an idea to create machine which runs on motor and separating action takes place automatically.



Figure 1 Hand operated machine

Numbers of groundnut Sheller machines are available in the market but they are large in size, costly and not suitable for domestic applications, they are best suitable for industrial applications where mass production is required. Hence it is essential to design and fabricate a portable groundnut decorticator machine for domestic application. In this project the process of designing the different parts of this shelling and separating machine considering all forces and ergonomic factor for people to use. This project is mainly about generating a new concept of groundnut shell (crush) that would make easier to transport anywhere and suitable to crush groundnut.

The Output is about 20-25 kg/hour. But the particular design of this project reduces all the causes and

improves the efficiency. It consists of the hopper, crushing chamber, separation chamber, blower unit and the frame for support. The crushing chamber and blower unit is powered by electrically which save the time. The machine is also light weight and easy to operate and maintain, the spare parts are also available locally.

II LITERATURE SURVEY

A.N. Gitau, P.Mboya, B.N.K.Njoroge, M.Mburu conducted experiment on optimising the performance of a manually operated groundnut decorticator Shelling of groundnut pods using manual decorticators in Kenya is characterized by high kernel breakages and low shelling efficiencies. As a result, farmers get low income due to low cost of broken kernels and a lot of time is lost in the tedious shelling operation. To overcome this problem, pertinent parameters that influence shelling efficiency of manually operated groundnut decorticators were identified. Two manually operated decorticators were tested and modifications done on one of the decorticators to optimize its technical performance. Results of machine performance tests showed that for WBS (Wooden beater Sheller) at a feed rate of 30 kg/hr and 22.6 mm clearance, shelling efficiency increased with decrease in moisture content for all the groundnut varieties.

The highest shelling efficiency was 55.3% for ICGV 99568, 39.2% for ICRISAT Groundnut Variety (ICGV) 90704 and 29% for ICGV 12991 at moisture content of 5.92% wb. For RBS (Rod Beater Sheller) at a feed rate of 30 kg/hr and 22.6 mm clearance, the highest shelling efficiency was 58.3% for ICGV 99568, 42.7% for ICGV 90704 and 35% for ICGV 12991 at moisture content of 7% wb. Identification of the pertinent parameters showed that pod moisture content, clearance and sieve size influence performance of manually operated groundnut. Theoretical predictive models developed were optimized which showed that a maximum shelling efficiency of 88.73% can be achieved with percent damage of 4% when the sieve size is 11 mm and clearance is 16 mm with a regression coefficient of over 85%.

With the modifications done on the WBS decorticator, the highest shelling efficiency of 87% was obtained at a clearance of 10 mm for ICGV 99568 which is the largest in size from the three varieties. The shelling efficiency of the modified decorticator is far above those of the RBS and WBS because the sieve sizes and clearances of the later were not optimized. The results of the theoretical optimization of the manually operated groundnut decorticator implies that farmers who shell for seeds can now obtain more seeds shelled with low breakage and therefore will get more income.

Roshan P Ghodkhande, Nilesh D Dhote, Sandip J Kadam conducted experiment on Design and modification of groundnut decorticator. Decortication of groundnut is a tedious and time consuming process. Commercial available hand operated decorticators require more energy with less output. An attempt was made to develop and evaluate pedal operated groundnut decorticator. The study revealed that, the pedal operated decorticator gave an output of 25-30 kg/hr which was more than hand operated decorticator hand shelling. The difference in unit cost of operation for the unit was appreciably less than that of hand operated decorticator. By considering less fatigue to the operator and higher output, the pedal operated decorticator could be advantageously used for decortications of groundnut. Decortications of groundnut in which the pods is pressed between the thumb and first finger.

This process is a “traditional methods”. This method is mostly used in rural areas. This method is very tiresome. It has been observed that the efficiency and productivity with hand operated groundnut decorticator and the traditional method is less. Due to this tiresome working operation, Commercial available hand operated decorticators require more energy with less output. By considering this pedal operated groundnut decorticator is beneficial for decortications of groundnut pods.

III OBJECTIVE

- 1) The main objective is to make low cost groundnut shelling and separating machine.
- 2) The cost of a machine should be affordable to the farmers.
- 3) The machine shell maximum possible groundnut in shortest possible time.
- 4) The machine should be easy to operate and it should be portable.

IV COMPONENTS AND SPECIFICATION

Frame:

The frame is used to support all the components. Material of frame is cast iron.



Electric motor:

This motor is used to rotate the roller by using belt and pulley. It also drives the blower.



Input = 230 volt Current =3.5 amps Power =0.37kw/0.5 HP

Semi-circular net:



This semi-circular net is fitted beside the roller at very small distance so that shell of groundnut should be easily cracked and peanuts remain uncracked.

The material of semi-circular net is mild steel.

V-Belt:

V-Belt is used to transmit rotary motion of shaft of motor to the shaft of roller.

Material of the belt is rubber or polymer for strength and reinforcement.



Pulley:

Pulley is used to transmit the torque of motor to the roller. One pulley is directly mounted over the motor shaft and another pulley mounted on the shaft of roller. And both the pulleys are connected with the help of V-belt.



Pedestals Bearing:

It is used to provide support for a rotating shaft with the help of compatible bearings and various accessories.



Hopper:

Hopper contains groundnuts before and during shelling process. It is use to continuous supply of the groundnut to the crushing unit. Length=180mm Width= 120mm



Blower:

Fan is mounted on the shaft of the motor just in front of pulley at some distance. This fan separates the shell and the peanuts.



V ASSEMBLY

The arrangement of various component of “Groundnut SHELLER” is being done are as follows:

- (1)The foundation frame is being selected which carry the entire load of the machine.
- (2)The roller shaft is mounted on the top face of the foundation frame with the help of pedestals bearing which is fasten using nut and bolt.
- (3)The fan shaft is mounted at the back face of the foundation frame with the help of pedestals bearing which is fasten using nut and bolt.
- (4)The semi-circular net mounted on the support provided at inner side of the foundation frame.

(5)The hopper is mounted on foundation frame covering rolling shaft, and permanently fastened at one side using hinged, and other side is temporary fasten for time to time change of semi-circular net.

(6)Fan cover fastened using nut and bolt to back side of foundation frame, which cover fan shaft.

(7)End of foundation frame (top face) carry the electric motor, which provide necessary power.

(8)The 0.2m pulley is mounted on roller and 0.0762m pulley is mounted on both fan and motor shaft, over which belt is mounted for transmission of power.

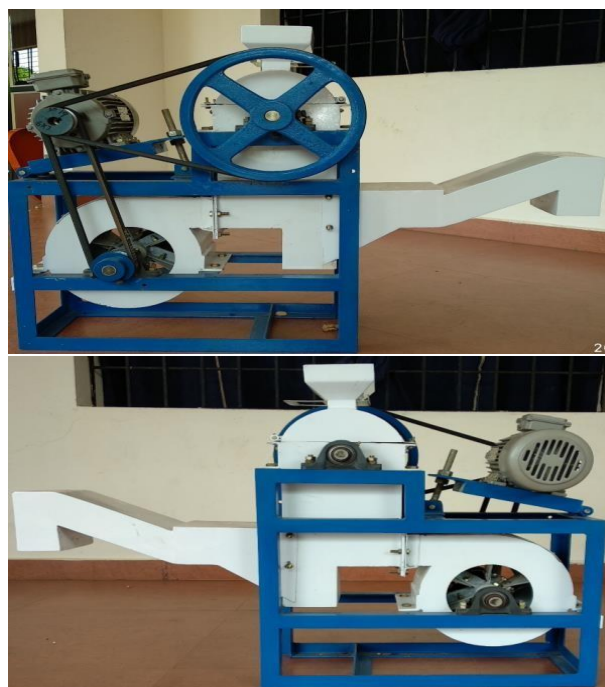


Figure 2 Full Assembled View Of Automatic Groundnut Decorticator

VI WORKING

- 1) Groundnut decorticator is operated on the shearing action blowing action and separating action.
- 2) Firstly, the inputs i.e. the groundnut are fed to the machine through the hopper. Then groundnuts come in contact with the two members, one is semi-circular net and another is roll shaft.
- 3) Semi-circular net is a stationary member while the roll shaft is rotating member. When the groundnut comes in contact with these two members then the shearing action takes place here.
- 4) Due to shearing action (crushing) the groundnuts gets shelled and divided into two parts. i.e. the peanut and outer shell.

5) The clearance is provided between the net and roll shaft. The clearance provided is depends upon the size of the groundnuts which is to be decocted.

6) After shelling the groundnut, the peanut and shells of the groundnut gets dropped from the semi-circular net, in downward direction then a centrifugal force is applied by a fan on the peanut and shell of the groundnut.

7) Due to more weight, the peanuts gets moved downward and collected in the separator. But due to lighter weight the shell of the groundnuts are thrown outside the machine.

8) From the shelling chamber the unshelled groundnuts also get dropped in the tray (5% to 6%). This groundnut gets dropped from the clearance made among the grill.

VII TESTING AND RESULT

1) The sample is taken and it is sun dried for one day if moisture content is present.

2) In testing table following parameters are mention like, wt. of sample, wt. of shelled nuts and time required to shelled groundnut.

3) After taking reading, calculating total sample reading and this total reading give mean reading.

4) This mean reading help us to calculating result of Sheller machine.

5) The testing of the system was done and the following results were observed.

SL NO	Total weight of Ground nut in Kg (Qt)	Weight of shelled ground nut in Kg (Qs)	Weight of undamag ed seed in Kg (Qu)	Weight of damaged Groundn ut seed in Kg (Qd)	Time to shelling operation in Sec (Tm)
1	1	0.94	0.86	0.08	146
2	1	0.95	0.85	0.1	150
3	1	0.96	0.86	0.08	150
4	1	0.94	0.88	0.08	148
5	1	0.96	0.88	0.08	150
Total	5	4.75	4.33	0.42	744
Mean	1	0.95	0.866	0.084	148.8

RESULTS

$$1) \text{ Shelling efficiency (\%)} = \left[\frac{Qs}{Qt} \right] \times 100$$

$$= \left[\frac{0.95}{1} \right] \times 100$$

$$= 95 \%$$

$$2) \text{ Material efficiency (\%)} = \left[\frac{Qu}{Qu+Qd} \right] \times 100$$

$$= \left[\frac{0.866}{0.866+0.084} \right] \times 100$$

$$= 91.15\%$$

$$3) \text{ Mechanical damage (\%)} = \left[\frac{Qd}{Qu+Qd} \right] \times 100$$

$$= \left[\frac{0.084}{0.866+0.084} \right] \times 100$$

$$= 0.088\%$$

$$4) \text{ Throughout capacity (kg/h)} = \left[\frac{Qs}{Tm} \right] \times 3600$$

$$= \left[\frac{0.95}{148.8} \right] \times 3600$$

$$= 22.98 \text{ Kg/h}$$

Above results can show that, our project can shell 95% groundnut with 0.088% damage. Groundnut Sheller machine capacity 22.98 kg per hr.

VIII CONCLUSION

- 1) This work represents the design of an electrically powered groundnut shelling machine.
- 2) The machine was fabricated using materials that were easily available.
- 3) It can be used for both household and industrial purposes.
- 4) This design gives major advantages in the case of power consumption.
- 5) It is easy to operate and it is portable.

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