

# Design And Fabrication Of Groundnut Shelling Machine

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**Abstract:** Groundnut is having a higher importance in this world as an oilseed crop. Seeds contains the rich amount of edible oil (42-55%) and Protein (26-29%) for us and Fodder for the animals. Our country is facing the problems in the production of groundnuts. Less no. of processing machines for use is the major drawback. In market we could find a no. of groundnut shelling machine with larger sizes, higher cost and mostly for non-domestic applications. The machines are best suited for mass production. Therefore, it is necessary to design and fabricate the groundnut shelling machine. All the forces, factors and engineering principles are taken into consideration while designing the different part of the machine. The particular design of this project improves the separating efficiency and minimizes the errors. It contains hopper, crushing chamber, separation chamber, blower unit, motor, frame, pulley, belt, bearings and nut & bolts. The machine is easy to maintain and operate.

**Index Terms:** groundnut, crushing chamber, separation chamber, blower unit, quick return mechanism.

## 1. INTRODUCTION

India is an agricultural country which has 70-72% of the population as farmers. The farmer's works day and night for cultivating their crops. Mostly tradition equipment's and methods are used in farming. Because of these traditional equipment and methods the earning of farmers is reduced. The farmers cultivate different types of crops as per the seasonal conditions, in which groundnuts is one among them. The scientific name of groundnut is *Arachis hypogea*. It comes under the family of Fabaceae. Dry climate is the favourable condition for cultivating this crop. This crop is being cultivated around 7600 years ago. It was found in Peru because of its climatic conditions. The height of the plant is around 30cm to 50cm. The shell, cotyledon, seed coat, radicle and plumule are the main parts of the groundnut.

Groundnuts is the rich source of energy and proteins. They are used in food purposes such as peanut oil, peanut butter, peanut flour, boiled nuts, roasted peanut etc. They are having various industrial applications in lubrication oil, leather dressing, paints, vanish and emulsion for insect control and furniture polish. Groundnuts are used for producing the oils and for cooking oil purposes. When the oil is extracted from the groundnuts, the obtained waste (i.e. oilcakes) is given to the animals. Oilcakes serve as high protein livestock feed for animals.



**Fig 1: Manual shelling method**

The groundnut seeds are enclosed with in the pods, which are usually produced underground, the harvesting of the groundnuts is done by pulling the plants with the help of machine or manually by hands. The harvested groundnuts are stripped off from the plants, dried in the sunlight, stored in the container and then processed. Shelling of groundnuts is an important step in the groundnut processing. Shelling is done by hand or by machines.

### 1.1 Manual Shelling Method

In rural areas still the traditional cracking methods are used to break the hard groundnut pods. Depending upon the quantity of groundnut produced the cracking methods may change from one locality to other locality. In traditional methods on the flat ground the groundnut pods are beaten, some people put them into the cover and beat with sticks to shell the groundnut. Majority of the people press the groundnuts in between the thumb & the first finger to separate the kernel from the groundnuts. The hand shelling technique helps in maintaining the low breakage rate of the kernels. But the method is labour intensive, energy requirement is high and it leads to "sore thumb syndrome" when large quantities of groundnuts are shelled. These methods are slow and tiresome. Hand shelling output of shelled groundnuts per-man is as low as 1-2.5kg seeds/hr.



**Fig 2: Mechanized shelling method**

machine is 400 to 3300 kg/hr. But these machines are costlier to purchase for the farmers.

In this project, a small machine is designed and developed to shell or crushed the groundnuts so that farmers can reduce their labour cost and processing time and get high

### 1.2 Mechanized Shelling Method

The large machines are used for groundnut shelling in mechanization. In industries the machines are used when the mass production is necessary. The shelling capacity of the

profit in return by selling the shelled nuts. The aim of the designed machine is to separate the nuts from the groundnut pods. This equipment is eco-friendly and also have less maintenance cost.

The hopper is used to store and guide the groundnuts. Then beater is used to remove the shelled or crushed groundnuts by shearing action. Arc welding is used to weld the beater, from mild steel material. Fan is used to separate the mixture of shells and nuts. Then the nuts are collected through the bin hopper valve and the shells are blown away by the fan. The L angle is used as a frame in the project. The beater and fan is rotated with the help of 1 hp electric motor.

## 2. LITERATURE REVIEW

Santosh Mangave and Bhagyesh Deshmukh fabricated a groundnut Shelling machine which is easily movable. The parts of the machine are hopper, axle, main disc, front disc, handle etc. Thin metal sheet is used for hopper & wood is used for main disc and front disc. The axle is manufactured from the steel. Axle of the machine may be horizontal, vertical or inclined. From the hopper the groundnut falls in the crushing area i.e. between the front disc and the main disc. As we rotate the handle of the machine by hand, the front disc is rotated and the groundnuts get shelled and they falls down from the disc. The machine shells the dry groundnut and machine can be used for domestic application.

The groundnut separator machine was developed by Ashok. S. Andhale et.al. The machine works with the help of the robotic arm. Plucking up the groundnut crop from the field and placing it in the blades of rotor is the main function of the robotic arm. The components of the machine are motor, chassis, battery, spur gear, arm, gripper, rotating brush, rotating drum, worm gear. Spur and the worm gears will be attached on the gripper. The rotation of the motor in the clockwise and the anticlockwise direction, opens and closes the gripper moments. Power is supplied through the battery for the switches which works as a controller. Commands from the mechanical switches are used to operate the arm and the gripper. Through the robotic arm the groundnut crops are plucked and the roots containing the groundnuts is placed on the rotating spike drum. The contact between the groundnut and the spikes will separate the groundnuts from the crop and is stored at the bottom of casing.

The pedal operated groundnut crusher was designed and fabricated by Kulbhushan M. Shejole et.al. In the machine the groundnuts are separated manually. The groundnut decorticator machine works on quick return mechanism. Through the pedalling action the groundnuts get crushed. The pendulum is attached to the shaft. The rubber pad is placed on the pendulum in order to decrease the mechanical damage of the groundnuts. With the help of the rubber pad the groundnuts get crushed. A greater output rate is obtained if we continuously operates the machine. Output rates obtained by pedal operated groundnut decorticator (49 kg/hour) which is higher than hand operated decorticator. The maintenance cost, production cost and energy consumption was less in these machine.

The pedalling action is used to rotate the screw conveyor placed on the shaft through the sprockets of bicycle. This idea was used by Pratima G. Mungase et.al designed and

fabricate their machine. The rear sprocket is placed on the bicycle shaft, which is rotated with the help of a chain drive. The groundnuts are inserted through the hopper in the screw conveyor. The distance between the flights and the casing of the conveyor is enough to crush the groundnuts. At the end of the outlet the mixture of groundnuts and crushed shells are obtained.

The groundnut shelling machine was designed and fabricated by Ashish S. Raghtate et.al. The groundnuts are dispensed with the help of hopper. Then groundnuts get crushed when they are in contact with roller shaft and semi-circular net. The groundnuts are crushed with the help of shearing action between the rotating roller and a stationary semi-circular net. The crushed groundnuts are separated with the help of the centrifugal fan or blower running at higher speeds. Because of the higher weights, the nuts fall down and get collected in the tray. Whereas the shells are blown away due to their light weight. 7% to 10% of the unshelled groundnuts also get collected in the tray.

Shubham Deshmukh et.al designed and fabricated the machine with the output shelling rate of 400kg/hr. It has 95.25% of shelling efficiency and 91.67% of separating efficiency. Motor, main pulley, input shaft, output shaft, fork, base plate, flywheel, almond couplings are the component of the machines. The materials used for the machine is cheap and easily available. The weight of the machine is also low and it consists of the hopper, crushing chamber, separation chamber and the blower unit.

## 3. PROBLEM STATEMENT

### 3.1 Problem Definition

- (1) Traditional methods are time consuming, tiresome, high cost of labour and have low productivity.
- (2) Nuts & husk are not separated after crushing (shelling operation) in similar type of the machines.
- (3) Machines are of low capacity, less efficient, non-portable and costly to farmers.
- (4) Less efficient beater design and its material, increases the mechanical damage to the groundnuts.

### 3.2 Objectives

- (1) To minimize the manpower, time and human effort to shell or crush the ground nuts.
- (2) To simplify the process and improve the shelling efficiency by changing the beater design.
- (3) The cost of a machine should be affordable to the farmers.
- (4) Machine with less occupied space, less weight and should easily moveable.

### 3.3 Scope

- (1) Generally only dry groundnuts are shelled in the machine. The lesser the content of moisture, the more is the shelling efficiency.
- (2) Groundnut with a single seed in a pod and small two seeds in the pods are usually partially shelled or unshelled in the machine.
- (3) The machine runs on electrical energy, it can be operated

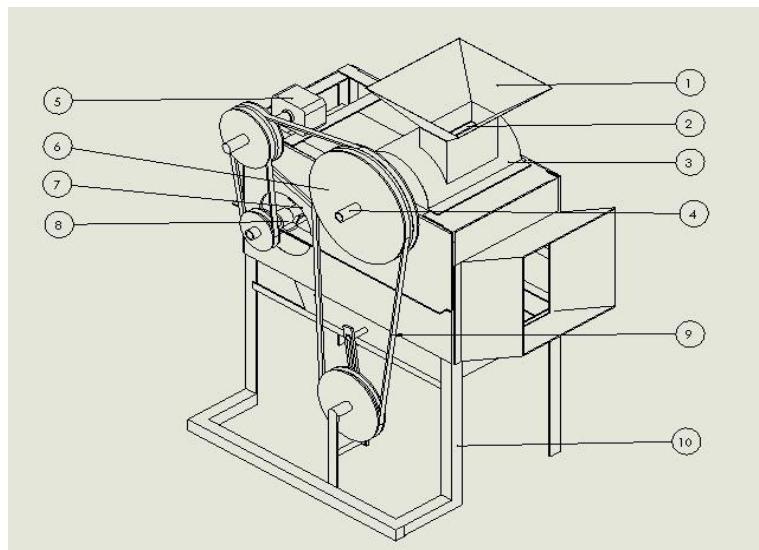
through solar energy.

(4) In the bottom part of the hopper, automatic flow control

devices can be installed to control the regular flow rate of the groundnuts.

#### 4. METHODOLOGY

##### 4.1 Concept Design

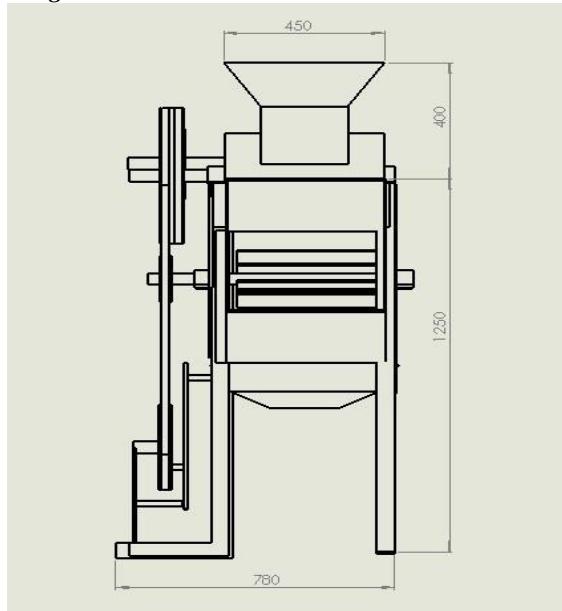


**Fig 3: Detailed View of Groundnut Shelling Machine**

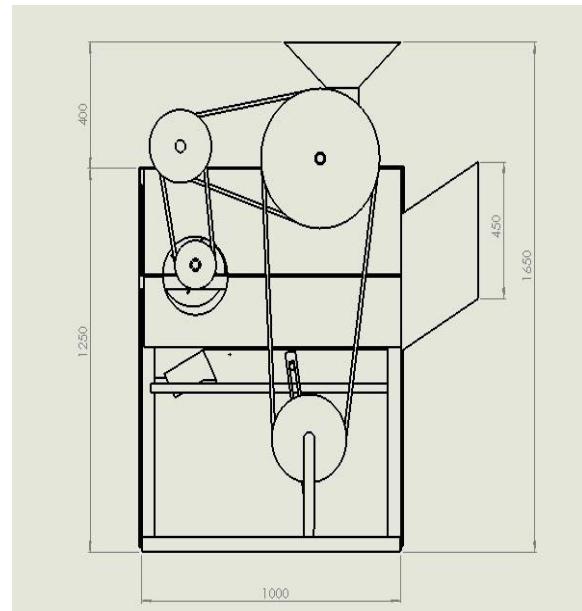
**Table 1: Part Description of Groundnut Shelling Machine**

Parts No.	Parts	Description / Make
1	Hopper	Temporary storage unit, used to maintain the flow rate of substances
2	Beater	Rotates at 305 rpm to shell the groundnuts in crushing chamber
3	Sieve	Placed below beater to shell the groundnuts, hole size of 11.2*11.2mm & thickness of 5mm
4	Shaft	Steel shaft rotates the beater at 305 rpm & fan at 2400 rpm
5	Motor	Power of 1 hp & 1440 rpm, convert electrical energy to mechanical energy
6	Pulley	placed on the shaft to support movement & transfers power between the shaft & the belt
7	Fan	Rotates at 2400 rpm to separate the shells from the nuts in separating chamber
8	Bearing	Supports the rotating shaft at its end
9	Belt	V belt of cross section 'A', nominal top width of 13mm & nominal thickness of 8 mm
10	L angle	Used to make frame, dimensions of L angle are 35*35*6 mm

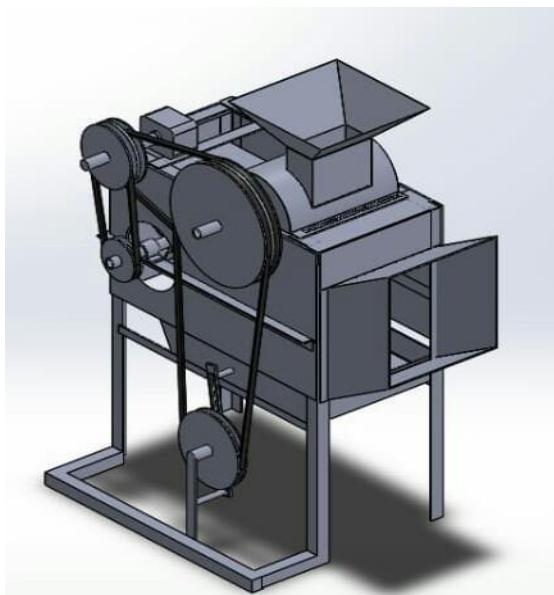
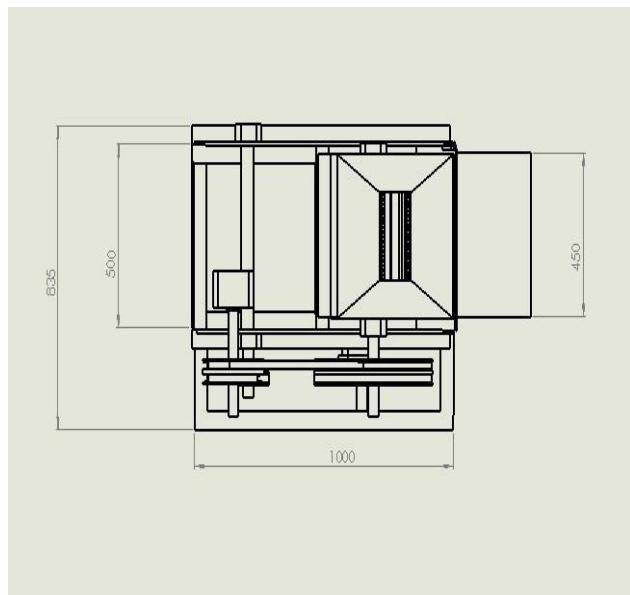
##### 4.2 CAD Design



**Fig 4: Right hand side view of the design**



**Fig 5: Front view of the design**

**Fig 6: Isometric view of the design****Fig 7: Top view of the design****Table 2: Technical Features of Groundnut Shelling Machine**

Recommended range of groundnut diameter	8.5- 13 mm
Hopper capacity	15 kg
Distance between beater and sieve	10 mm
Hole size of the sieve	11.2*11.2 mm
Adjustment of the sieve	manually
Speed of the beater, fan & mechanism	305 rpm, 2400 rpm & 485 rpm respectively
Shaft diameter for beater & fan	22mm & 18mm respectively
Pitch diameter of the pulleys for motor, fan, beater & mechanism	100mm, 60mm, 475mm & 300mm respectively
Belt type	V belt of cross-section A
Fan drive, beater drive & mechanism drive	Using 1 hp motor
Frame from L angle of dimensions	35*35*6 mm
Weight	170 kg approximately
Dimensions ( L*W*H )	1370*835*1650 mm

#### 4.3 Working

The various components used in the machine are: hopper, shaft, beater(roller), sieve, fan, pulley, belt, motor, hinges, Plummer block, L angle, nut and bolt. The dry groundnuts are poured in the hopper. From the hopper the groundnuts slide down into the crushing chamber. Crushing chamber consist of rotating beater and the stationary sieve. The critical distance between the beater and sieve is of 10mm. Groundnuts gets shelled when they are in contact of the beater and the sieve. The shelled groundnut mixture falls in the separating chamber, where the nuts and shells get separated by a radial fan rotating at 2400 rpm. Denser nuts, falls in that tray while the lighter shells are blown out through an outlet. The tray is placed below the separating chamber which oscillates by the quick return mechanism. The escaped shells from the separating chamber are removed when nuts are temporally stored in the oscillating tray. The groundnuts are collected once the tray is full. Different pitch diameter pulleys and v-belt drive is used to run the beater, the fan and the mechanism by 1hp motor.

#### 5. CONCLUSION

The following conclusion is drawn from the work. The manual shelling methods are time consuming, tiresome, low

productive and high cost of labour. Hence to increase the production rate the groundnut shelling machine is used. The dimensions of the machine are 1370\*835\*1650 mm. The machine is manufactured using the engineering principles. The machine is power operated, so less numbers of labour is required and it saves the time. The higher separating efficiency is obtained using these machine. The machine is portable because of its light weight. The procedure to operate the machine is simple, hence no skill labour is required to operate the machine. The machine can be used for domestic application as well as small scale industries. Additional features such as wheels, flow rate sensors can be added to modify the machine. The machine can be operated through solar energy.

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