

## Developing Cost Effective Automation for Cotton Seed Delinting

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**ABSTRACT:** A low cost automation system for removal of lint from cottonseed is to be designed and developed. The setup consists of stainless steel drum with stirrer in which cottonseeds having lint is mixed with concentrated sulphuric acid. So lint will get burn. This lint free cottonseed treated with lime water to neutralize acidic nature. After water washing this cottonseeds are used for agriculter purpose.

**Keywords:** Automation,cottonseed,lime water, stainless steel,sulphuric acid

### I. Introduction

An object of this paper is to provide an improved means for treating of cotton seeds for the purpose of assisting in the germination therefore and to remove disease germs adhering to the exterior of the seeds. Another object of this invention is, in the provision of means for removing the lint or other particles, including germs, from the exterior of the seeds, the seeds progressing through different treatment zones or chambers and finally emerging as a thoroughly cleansed seed which is free from disease germs on the hull therefore and is capable of germinating quickly and with much less moisture than seeds treated in other ways. Still another object of this invention includes the treatment of seeds with relatively hot sulphuric acid, the seeds being initially discharged into a chamber containing substantially undiluted hot sulphuric acid, and then passing through a series of chambers containing sulphuric acid of varying degrees of dilution, and finally emerging as seeds thoroughly cleaned of acid, lint and disease germs. Cottonseed delinting machine mechanically delints the cottonseed by a rotating stirrer system. The period of time for the delinting operation is controlled by a door operating system. The temperature of the cottonseeds is controlled dependent on airflow through the machine and length of time the cottonseeds are subjected to the delinting process. The machine also provides for the recovery of the lint after separation from the cottonseed. The movement and path of travel of the cottonseeds during the delinting process is controlled to ensure a high degree of efficiency in the removal of the lint.

### II. Automation Principle

The preceding discussion leads us to conclude that automation is not always right answer for given production situation. A certain caution and respect must be observed in applying automation technologies. In this section, we offer three approaches for dealing with automation projects

#### 2.1. Understand the existing process

#### 2.2. Simplify the process

#### 2.3. Automate the process

2.1. Understand the existing process- The obvious purpose of the first in the USA approach is the current process in all of its details. What are the inputs? What are the outputs? What exactly happens to the work unit step between input and output? What is the function of process? How does it add value to product?

2.2. Simplify the process- Once the existing process is understand, then the search can being for ways to simplify. This often involves a checklist of questions about the existing process. What is purpose of this step or this transport? In this step necessary? Can this step be eliminated? Is the most appropriate technology being used in this step? How can this step be simplified? Are there unnecessary steps in the process that might be eliminates without detracting from function?

2.3. Automate the process-Once the process has been reduced to its simplest form, the automation can be considered.

### **III. Need Of This Machine**

To provide the low cost automation in cotton seed delinting machine.

- To increase productivity.
- Useful to every type of farmer.
- To provide superior work.
- To reduce manpower.
- To avoid human accidents.

### **IV. Aims And Objective**

The aim of this research is development of low cost cottonseed delinting machine and study a low cost system, for the treatment of cotton seed to remove lint from cottonseeds .The technology disclosed by the present invention simplifies the delinting process and eliminates the use of hazardous chemicals. The seed is less likely to be damaged and it eliminates a source of air and water pollution. Additionally, less energy is required and the operator has much more precise control over the machine during the delinting process. Objectives are as follows:

- To study existing systems
- To design and fabricate economically low cost cottonseed delinting machine
- To increase employment in rural areas
- To validate suggested solution by fabricating and by taking field trial
- To increase productivity
- To reduce production cost by automation
- To reduce initial investment by using low cost atomization technique
- To solve real life problem of farmers

### **V. Problem Identification**

The most common methods used today for delinting cottonseed all relate to the use of various chemical processes. The earliest chemical process was to saturate the cottonseed with concentrated sulfuric acid. The short cotton fibers on the seed would quickly disintegrate while generating heat from the reaction of the acid with the moisture in the seed. The residue would be washed away with water. Subsequent to washing, the seed would be required to be neutralized with soda ash, lime or anhydrous ammonia. This method is referred to as the wet acid method. As can be recognized, problems are related to the use of concentrated sulfuric acid since it is extremely corrosive to machinery and dangerous to handle. Further, a large amount of energy is utilized in order to dry the seed. The use of concentrated sulfuric acid also causes soil and water pollution. Problems identified are as follows -

- Concentrated sulfuric acid is extremely corrosive to machinery and dangerous to handle.
- The use of concentrated sulfuric acid also causes soil and water pollution.
- An improved sulfuric acid delinting method was developed using dilute sulfuric acid.
- This chemical process had the disadvantage of using a corrosive acid which causes human accident.

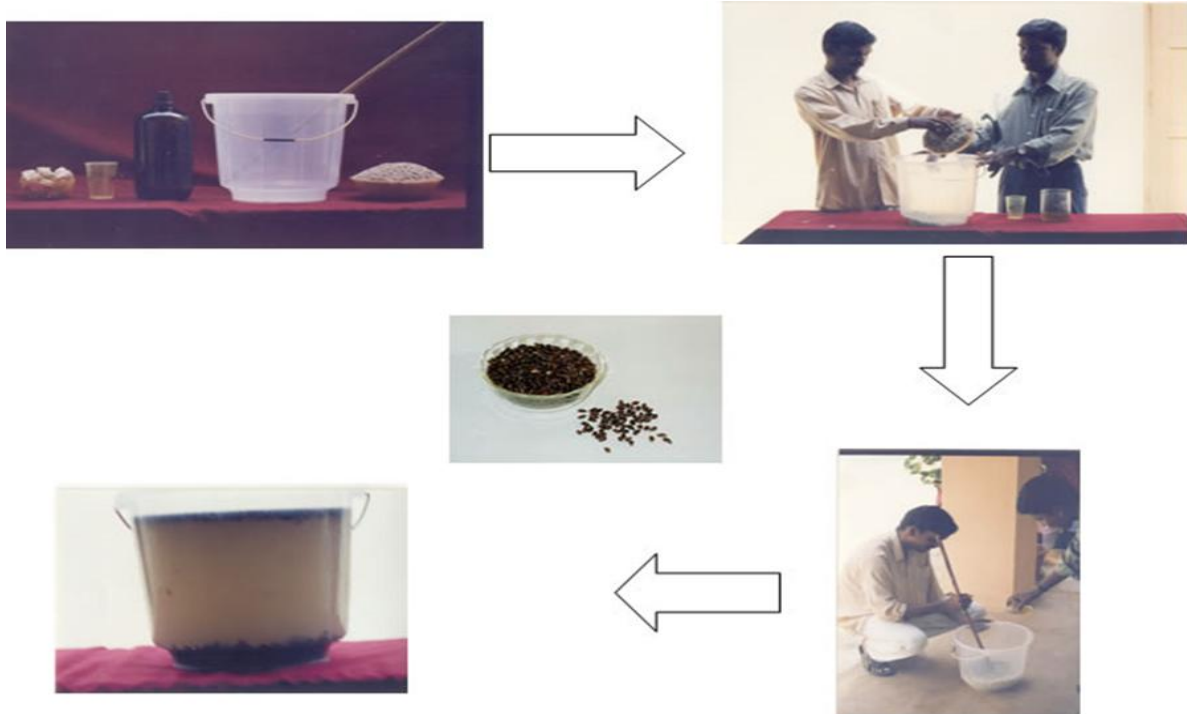
### **VI. Concept**

Giving various field visits, we found out many aspects that can be used to give employment to villagers, that will easy and earn them wages too. One of the idea is to make low cost automated machine that can be used to remove lint from cottonseed. We know ,automation cuts down employment rate and also the initial capital investment required is high , so in order to make it possible for villagers and also too farmer , we have LOW COST idealogy. We found that process of removal of lint from cotton seed is time consuming, dangerous for worker/farmer because of direct use of sulphuric acid by hand. Problems are related to the use of concentrated sulfuric acid since it is extremely corrosive to machinery and dangerous to handle.

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The solution to above problem like accident, time consuming, productivity is solved in this project where a low cost automated cottonseed delinting machine is fabricated so as to afford by common man as well as common farmer too.

### VII. Manual Process



**Fig1: Manual Process of cottonseed Delinting**

Delinting is the process of removal of fuzz from the seed coat in cotton i.e. it is a crop specific seed management technique.

Manual Process is as follows:

- Take one kg of the cotton (fuzzy seeds) in a plastic bucket
- Add concentration  $H_2SO_4$  at the rate of 100ml / kg of seed
- While additions it should be constant stirring by using wooden stick for 2-3 minutes to facilitate uniform coverage and better treatment effect.
- After 3 minutes all seeds will turn into coffee brown in colour.
- Wash the seeds immediately for 4-5 times with cold water until the acid nature of the seed is removed.
- Care should be taken while washing the improper washing will affect the viability of the seed.
- After thorough washing the entire seed should be placed in water in 1: 10 ratio to remove floaters.
- For complete removal of acid seeds can be dipped in 0.5% calcium chloride solution for 10-15 minutes.
- The sinkers seeds can be used for sowing purpose.
- For large scale delinting of cotton, cotton delinting machine can be used.

### VIII. Cottonseed Delinting Machine

This machine consists of a stainless steel container, agitator, slurry outlet and a power drive. Five kg of cotton seeds are fed into the stainless steel drum. The agitator is rotated. Half a litre of commercial sulphuric acid is poured slowly into the container having the cotton seeds through its periphery. Due to the churning action, the cotton fuzz is uniformly subjected to the acid reaction. At the end of 90 seconds, the acid treated seed and the slurry are washed with the water. The process of washing with water is repeated three to four times. Then, the seeds are collected and dried.

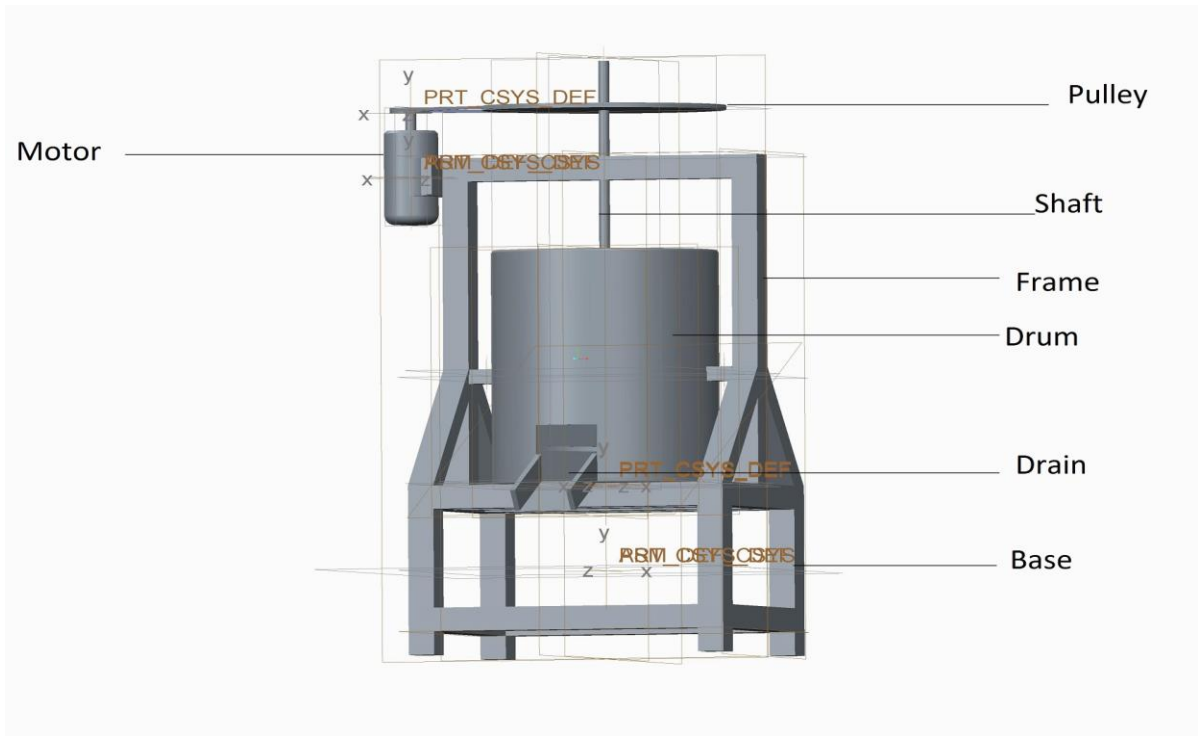


Fig2: Cottonseed Delinting Machine

IX. Steps in Automation Process

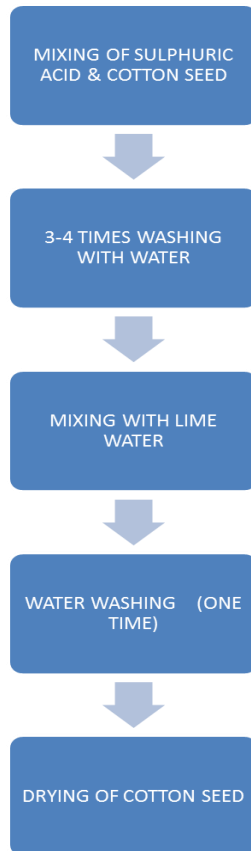


Fig 3:-Steps Followed in Automation Process

## IX. Design Parameters

### X.1 Stainless steel Drum

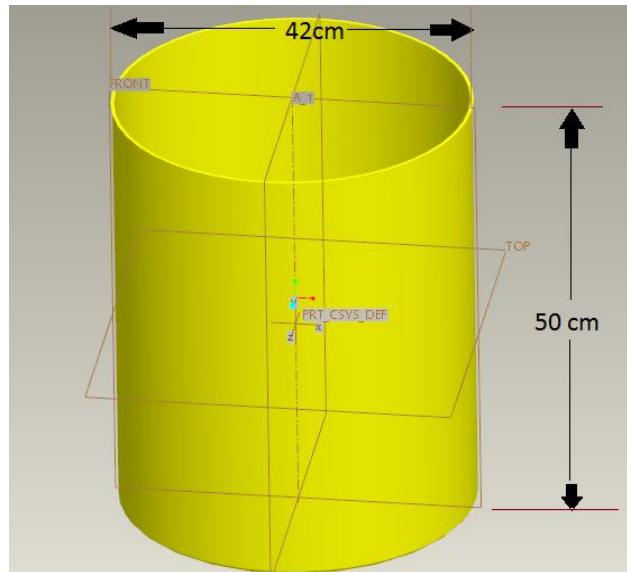


Fig 4: Stainless steel Drum

Specifications:

Material-Stainless Steel 304

Hight of Drum=50cm

Radius of Drum=21cm

Thickness of Drum=2mm

Volume of drum= $68000\text{cm}^3$

### X.2. Motor Design



Fig 5: Electrical Motor

Specifications for motor:

1) Torque =  $F \cdot R = 15 \cdot 9.81 \cdot 21$   
= 3090.15 N-cm

2) Angular Velocity  
= 26.2 rad/sec

3) Power Developed =  $T \cdot \omega$

=809.61 watt  
But 1Hp=748.7watt  
4)  $P=809.61/748.7=$   
1.08Hp

### X. 3 Pulley Design-

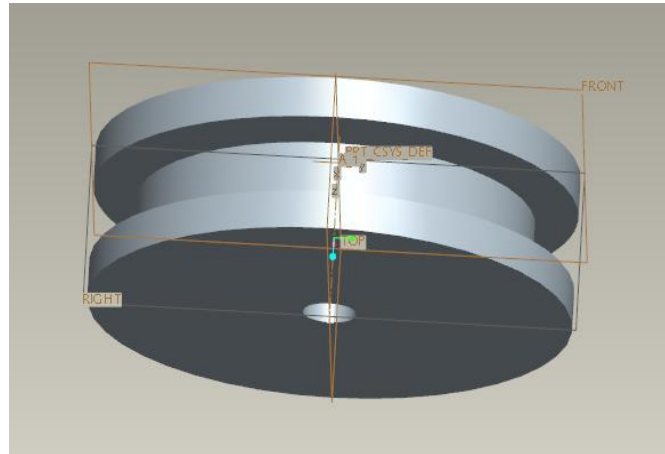


Fig 6: Pulley

Specifications:

- 1) 1Hp=745.69watt
- 2) Design Power= $P_r * K_1 = 0.820$  k- watt
- 3) Smaller Pulley Dia=75 mm
- 4) Speed of Motor =1440rpm
- 5) Speed of Pulley=250rpm
- 6) Dia. Of bigger pulley= 432mm( $N_1 * D_1 = N_2 * D_2$ )

### X.4. V Belt Design

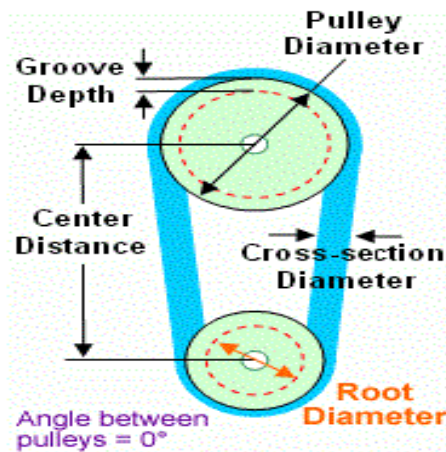


Fig 7: V Belt

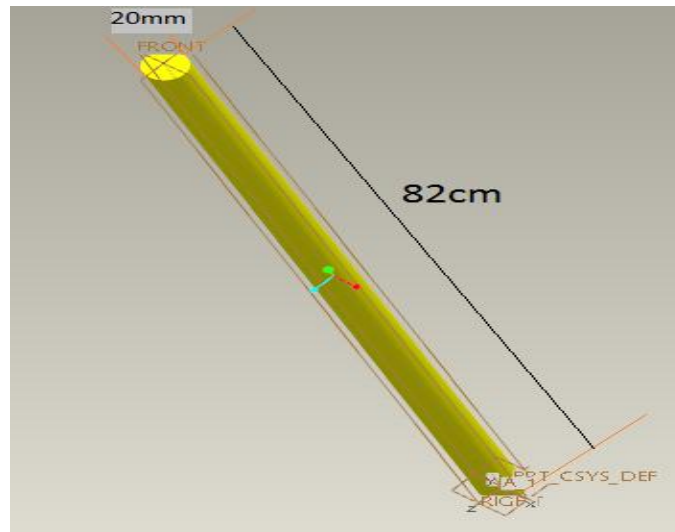
Specifications:

- 1) Peripheral Velocity=5.65 m/sec
- 2) Angle of Lap On smaller Pulley=2.43degree
- 3) Designation of Belt=A
- 4) Groove Angle=19degree
- 5) Power /belt=836.74 watt



- 6) No. of Belt=0.82025/0.836=1
- 7) Length of Belt=1.87m
- 8) Centre Distance= $D1+D2=75+432=507\text{mm}$

#### **X.5. Shaft Design**



**Fig 8: Stainless Steel Shaft**

Specifications:

- Pulley Dia. Mounted on shaft=432mm
- $\mu=0.24$
- Material for shaft= stainless steel 304
- SAE 30304
- Length=82 cm
- Dia. Of shaft=2 cm

#### **X.6. Bearing Design**



**Fig 9: Deep Groove Ball Bearing**

Specifications:

- 1) Axial Force  $F_a=25.64\text{ N}$
- 2) Radial Force  $F_r=179.7\text{ N}$
- 3)  $e = F_a/F_r=0.14 > e$
- 4) Bearing type=Deep Groove Ball Bearing

- 5) Bore Dia = 20mm
- 6) Outside Dia =47 mm
- 7) Width=14mm
- 8) Bearing No=04

### **X. Conclusion**

- 1) This automation machine can help to avoid the human accident.
- 2) It also reduces time.
- 3) Most important is that it Provide employment in rural area easily.
- 4) It requires very low investment to start cottonseed related agriculture based job by using this machine.
- 5) It helps to separate lint from cottonseeds easily
- 6) It reduces human effort and it is easy to operate.

### **REFERENCES**

#### **Journal Papers:**

- [1] Joseph G. Reid, Cotton Seed Delinting Machine ,IEEE Journals Research,164,2007,36-66
- [2] NISCATR, Indian journal or engineering & material science, vol-21,June.2014,PD249-250

#### **Books:**

- [3] M. P. Groover, automation in industrial production (New Delhi, Prentice-Hall of India, 2002)