International Journal on Recent and Innovation Trends in Computing and Communication
Volume: 3 Issue: 8

ISSN: 2321-8169
5161 - 5166

Design & Analysis of Almond De-Husking and De-Selling Machine

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Abstract: The problem that plague Indian agriculture at present are the capital and labour , especially in the rural areas. Problems related to irrigation, market and transport facility add significant cost to farmers' operations. Since long time, Indian farmers have been facing a number of socioeconomic problems, such as harassment by moneylenders, inability to repay debts following crop loss, inability to get medical treatment for the family, etc. The problem is compounded by lack of positive and cooperative support from banks especially in the face of inclement weather and market fluctuations.

There is no commercially available machines for De-husking manually operated have yet been developed that can reliably remove husk and selling with embedded shell after harvest remove hull promptly from the nut in the home orchard .Hull remove best done by hand for the Indian occurring almond. Other machine available only for the foreign seed almond in mass production level which is highly cost which is not suitable for the batch production as a side business for the former which is full-fill the defined requirement of basic condition.

There for my approaches to develop low cost portable alternative for almond seed processing for raw almond extraction process which is suitable for the low income former to maintain its live hood with the help of such side business. Side business play a important role if which is on the agriculture if failure in the farm which give economic support to the farmer.

Keywords: *Design tool, piston (punch) base, guide and its analysis.*

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Introduction:-There is need for a method to developed sustainable model for agricultural growth should be coupled with food processing industries to bring prosperity to the former.

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2. Literature Survey:

2.1Scenario of almond production-

Below are some of the commercial varieties of Almond cultivated in India. Non Pareil, California paper Shell, Merced, IXL, Shalimar, Makhdoom, Waris, Pranyaj, Other high yielding cultivars are Ne Plus Ultra , Primorskij, Peerless, Carmel, Thompson, Price, Butte, Monterey, Ruby, Fritz, Sonora, Padre and Le Grand.

Yield of Almond Crop:- Almond Average yields UP TO 1 to 2 tones /ha.

Table no 2.1- Indian almond supply scenario

In tonnes

Period (April to March)	Indian domestic demand	Export demand	Total demand	Indian production	Gap in supply to be met by import
2011-2012	18543	4000	22543	20000	2543
2012-2013	18164	3800	21964	20500	1464
2013-2014	19432	3380	22812	21000	1812
2014-2015	18130	4900	23030	22000	1030

3. ALMOND PROCESSING OPERATIONS-

Delivery. Trucks pick up harvested raw almonds from an orchard and deliver them to an almond processing plant. At the processing plant, the trucks are weighed and the almonds are unloaded either directly to a pre-cleaning facility, or to a stockpile area

Pre-Cleaning. During pre-cleaning, raw almonds are transferred through a series of equipment that mechanically removes dirt, rocks, vegetation, and other debris. To remove fine particles, the raw almonds may pass through the equipment several times.

Hulling and Shelling. The hulling and shelling process involves a friction, air-suction, and gravity-based system that mechanically removes the hull and shell from the almond meat through a series of shear rolls and collector decks. The hulls, shells, and almond kernels are separated, and each product type is conveyed to a separate storage bin. An aspirator collects and transfers the shells to the auger lines, which mechanically convey the shells to a storage pile.

Cleaning/Screening. The partially hulled and shelled almonds are moved to another aspirator and a gravity-table deck that vibrates to allow the kernel to separate from the hull, if the hull was not removed during the previous stage. This series of equipment also provides for quality control by separating out defective products. Non-defective almonds are advanced to stage.

ISSN: 2321-8169
5161 - 5166

Transfer/Storage. During the final stage, almonds are transferred into a vibratory pan and then into a chamber where compressed air draws dust and debris away from the product and into a baghouse1. At this point, the product is visually inspected prior to passing through a final conveyor that transfers the product into an aboveground hopper.

4. Project Design Procedures and methods-
There for we now design following part we explain as fallows-

Calculations are done on the basis of survey & paper references as per standard.
Base (frame)- Calculations are done on the basis of survey & paper references as per standard.

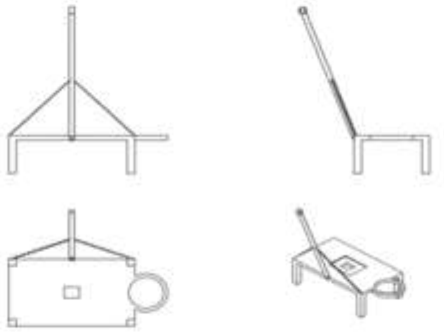

Fig no. 4.1 Base frame

- Base (frame)-

According to standard
Dimensions-
Leg –
h- calculated according to survey.-=600mm
t_l=5MM

Base plate-
l_b- 500mm
b_b-400mm
t_b -10mm
Material- mild steel

- Tool -

Almond Dmax = (D1+D2+D3+..............+D15) /15 ....(full matured almond within 2 day of harvesting)

=(34+35+36+35+34+36+35+33+37+35+34+34+36+36+35)/15
D_{max} =35mm

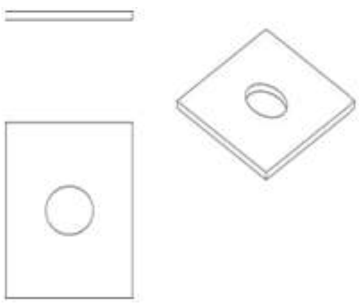

Fig no. 4.2 Tool

Almond Dmin =(d1+d2+d3+.........................+d15)/15............(full matured almond within 2 day of harvesting)

$D_{min=}$30mm

Husk thickness-4 mm max dia side
-2.5mm min dia side
Then tool dimension=D= Dmax – husk thickness
=35-8=27mm
d =Dmin=30-5=25mm

l_t-150mm
b_t-150mm
t_t= 5mm
Material – mild steel

- Guide –

L^1=Dmax +tolerance
D^1= 30mm+2mm=35

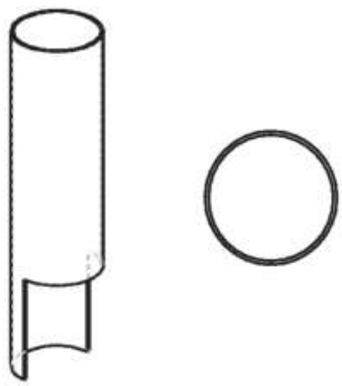

Fig no. 4.3 guide

Punch displacement= 10mm
L=almond hight +punch hight mm
Material – mild steel

- Piston (punch)–

D=35mm
L=50mm
Hole R=9mm
On observation =
Lever hight 500mm
Lever angle at pin point 30^0
Lever length =700mm

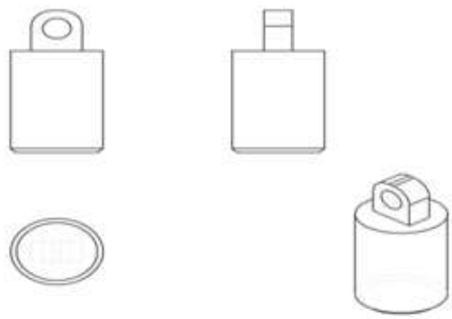

Fig no. 4.4 punch

Connecting point. On lever from man side fixed 400mm taken from practical base

Height of pin point of lever to stand at 500mm.

Also by taking general consideration select the lever, pulley, cable and wiper etc which is not necessary to design in operation point of view. As shown in fig.

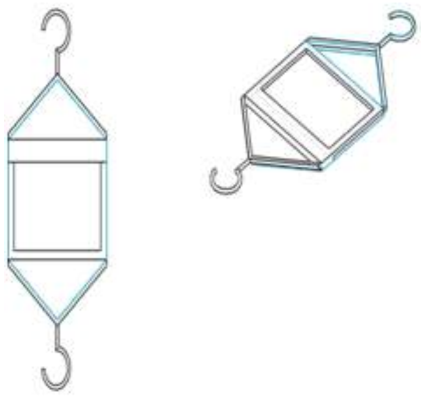

Fig no. 4.5 wiper

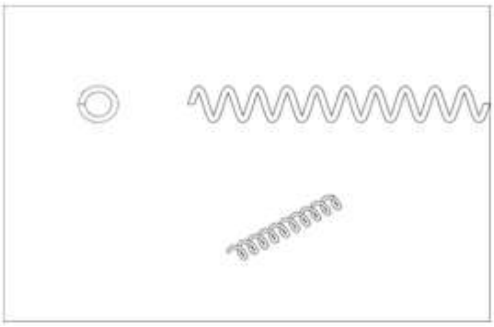

Fig no. 4.6 spring

One almond weight on avg .value =20grm

Then 1Kg =55 avg. Base almond

1 Kg almond seed gives 200grm almond on reference.

Force required for almond De-husking <130N

Time duration for 1 almond De-husking = Time req. to pull lever down ward to complete husk remove + push upward lever time + almond mounting time +other error

By theoretical and practical analysis

=4+1+2+1

= 8sec

Hence we conclude that on survey man can work 5-6 hour day at that load 130 N in sitting position then in one hour almond whole shift of 6 hour = (3600*6)/8

=2700 almond to be husk.

1 kg= 55 no. of almond

Total Kg almond husk = 2700/55

In one shift total Kg almond husk= 50 Kg avg.

Cost of all machine a\c to material market rate =3000-3500 Rs.

De-selling process-

After that we go to the De-selling which machine easily available at low cost.

After De-husk of almond we put the husk almond in sunlight for 7-8 days for drying After that we go to the De-selling which machine easily available at low cost.

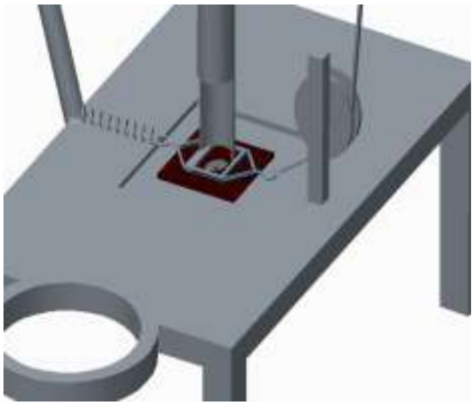

Fig no.4.7 Close view of design machine

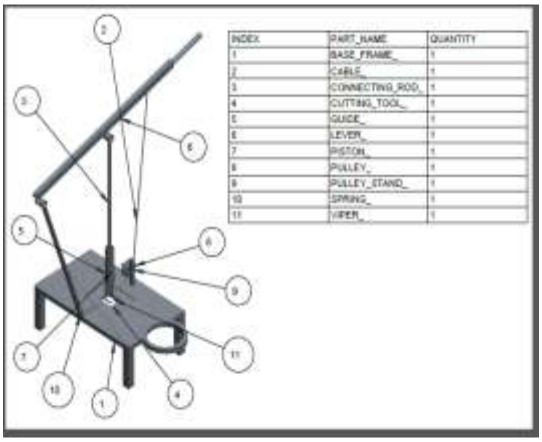

Fig no.4.8 Design with all components.

5. FEA Analysis-

5.1 Solution-

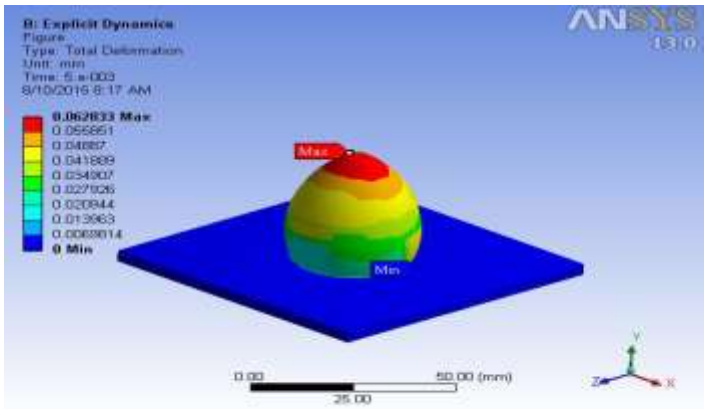

Fig no. 5.1 Stress Analysis

ISSN: 2321-8169
5161 - 5166

TABLE 5.1
Model (B4) > Explicit Dynamics (B5) > Solution (B6) > Results

Object Name	*Total Deformation*	*Equivalent Stress*	*Directional Deformation*	*Directional Deformation 2*	*Total Acceleration*
State	Solved				
Scope					
Scoping Method	Geometry Selection				
Geometry	All Bodies				
Definition					
Type	Total Deformation	Equivalent (von-Mises) Stress	Directional Deformation		Total Acceleration
By	Time				
Display Time	Last				
Calculate Time History	Yes				
Identifier					
Orientation			X Axis	Y Axis	
Coordinate System			Global Coordinate System		
Results					
Minimum	0. mm	1.2858e-004 MPa	-1.2257e-002 mm	-1.1864e-003 mm	0. mm/s^2
Maximum	6.2833e-002 mm	3.4871e-002 MPa	6.834e-003 mm	3.9886e-002 mm	1.9292e+005 mm/s^2
Minimum Occurs On	Part 1		Part 2		Part 1
Maximum Occurs On	Part 2	Part 1	Part 2		
Minimum Value Over Time					
Minimum	0. mm	0. MPa	-1.2257e-002 mm	-6.3744e-003 mm	0. mm/s^2
Maximum	0. mm	1.6619e-004 MPa	0. mm		0. mm/s^2
Maximum Value Over Time					
Minimum	0. mm	0. MPa	0. mm		0. mm/s^2
Maximum	6.2833e-002 mm	1.239 MPa	9.1562e-003 mm	3.9886e-002 mm	1.0295e+007 mm/s^2
Information					
Time	5.e-003 s				
Set	21				
Integration Point Results					
Display Option		Averaged			

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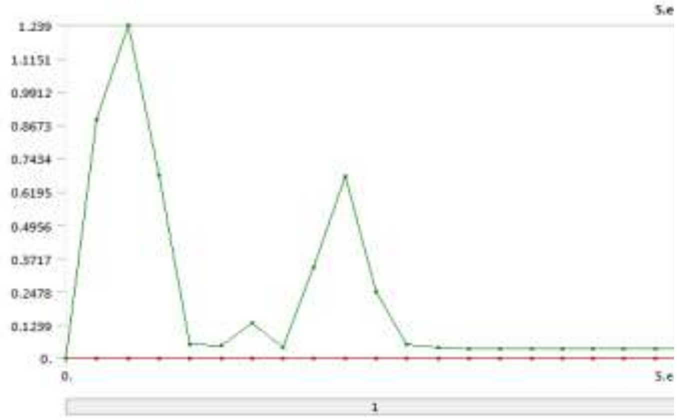
Stress observation –



Graoh no. 5.1 Model (B4) > Explicit Dynamics (B5) > Solution (B6) > Equivalent Stress

5.2 Material Data-

Structural Steel for tool-

TABLE no. 5.2
Structural Steel > Constants

Density	7.85e-006 kg mm^-3
Coefficient of Thermal Expansion	1.2e-005 C^-1
Specific Heat	4.34e+005 mJ kg^-1 C^-1
Thermal Conductivity	6.05e-002 W mm^-1 C^-1
Resistivity	1.7e-004 ohm mm

TABLE 5.3
Structural Steel > Compressive Ultimate Strength

Compressive Ultimate Strength MPa
0

TABLE 5.4
Structural Steel > Compressive Yield Strength

Compressive Yield Strength MPa
250

TABLE no.5.5
Structural Steel > Tensile Yield Strength

Tensile Yield Strength MPa
250

TABLE 5.6
Structural Steel > Tensile Ultimate Strength

Tensile Ultimate Strength MPa
460

TABLE 5.7
Structural Steel > Alternating Stress Mean Stress

Alternating Stress MPa	Cycles	Mean Stress MPa
3999	10	0
2827	20	0
1896	50	0
1413	100	0
1069	200	0
441	2000	0
262	10000	0
214	20000	0
138	1.e+005	0
114	2.e+005	0
86.2	1.e+006	0

TABLE 5.8
Structural Steel > Isotropic Elasticity

Temperature C	Young's Modulus MPa	Poisson's Ratio	Bulk Modulus MPa	Shear Modulus MPa
	2.e+005	0.3	1.6667e+005	76923

6. Conclusions & Recommendations for Future Work

6.1 Conclusions-

After completing design and analysis which is done in cad cam software. Design is made in creo-parametric2.0 analysis is done in Ansys 13.0

After performing different iteration and boundary condition we conclude that the design of De-husking of almond machine is robust in all parameters. Here explicit dynamics which is one of the module in ansys software. This module is help for evaluating forces are acting in specific direction with impressed load condition.

The stress which is obtained is in withen elastic limit and reliability of machine is good time period.

Following point achieve during this-

- Simple design and light duty construction provide year of trouble free operation.
- cleaning and maintenance feature reduce cost.
- Easy cleaning and maintenance feature reduce cost.
- Easy cleaning and maintenance feature reduce cost.

ISSN: 2321-8169
5161 - 5166

- Physical contaminants (foreign material) to the best of their ability.
- Fabrication cost economical.
- Easily one man operated machine.

6.2 Recommendations for Future Work-

Only one problem future work need to study and solve-

- Almond standing position in vertical in a guide if it incline the failure in process of almond de-husking .
- Need to bring almond within 2 to 3 day for machine operation after harvesting and after de-husking for de-selling keep to sunlight for 6 to 7 day.
- Only for the batch production we need to convert it into mass production
- All process are carried out by man failure in man whole production stop.

Above problem need to study and resolve it for good performance.

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