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DESIGN AND ANALYSIS OF AMLA PUNCHING MACHINE

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Abstract—
In India, amlas are produced on a large scale which is used for various purposes such as making murraba, pickles, etc. But the method of making murabba by manual method is less efficient and not suitable to maker. The present work is about implementation of 3D tools in the optimum utilization of amla by punching it in appropriate manner.
In rural areas, such type of machine is very useful and demanded. The making of amla's murabba by manual method consumes more time. This machine is not yet manufactured or invented, so the present work is to design the machine which will reduce the time and increase efficiency. Also many industries (such as Agrosaw pvt limited) are working on this concept. The present work will be utilize small scale to medium scale food processing industries.

Keywords- Design; Machine; Punching;

I. INTRODUCTION

The Amla or Aonla (EmbJica OffiCinalis Gaertn) also known as Indian Gooseberry is a minor sub-tropical deciduous tree indigenous to Indian sub-continent and it can be grown successfully in dry and neglected regions owing to its hardy nature, suitability to various kinds of wasteland.

Amla has been in use for pickle and preserve since ages in India and the methods employed were based on traditional knowledge of grandmothers. Besides, amla has been an important

Ingredient for chavanprash, aayurvedic health tonics. The methods used previously were unhygienic in nature and time consuming. The nutrient loss in these methods was higher.

The current paper describes the use of amla for making murabba. The present work describes the use of manual method to punch the amla for making murabba .But, the problem is that, minor accidents have also been reported during manual seed removing, pricking and shredding. The shelf life of the manually prepared products was also less and the quality not up to the mark. So, that the amla punching machine concept was generated, The present work is about designing an machine to make it affordable for small scale industry .Till now most of the small scale industries used to punch amlas manually which can prove harmful to the workers. This process is much more time consuming, has less productivity.

Specially in rural areas most of the people does household business or many organizations in rural areas such as Mahila Bachat Gat does this business of punching the amlas and all the operations done there are manual which result in less production and thus less earning.

This paper shows that machine has the capability to overcome this problem and to make life better for the people doing this business in rural areas.

Objective to Design Machine

- Low cost
- High productivity
- Less harmful
- Less power consumption
- No supervision required
- Less man power required

II. PARTS SELECTION FOR MACNHINE

FRAME:- THE FRAME IS A RIGID STRUCTURE MADE UP OF STRUCTURAL STEEL. IT CONSISTS OF THREE CHAMBERS. THE TOP CHAMBER CONSISTS OF HOPPER. THE MIDDLE ONE IS USED FOR THE PAIR OF CYLINDRICAL ROLLING DRUMS, SHAFT AND BEARINGS. THE BOTTOM CHAMBER IS USED FOR PLACING COLLECTOR. AT THE BASE, MOTOR IS PLACED TO RUN THE MACHINE TO GET THE DESIRED RESULT. THE DIMENSIONS OF THE FRAME ARE 87.2X40X5.

It is made up of thick Structural steel sheet. It is located at the top of the frame; at the middle of the hopper cam shape device is located which allows the amla to flow in two or more rows sequentially.

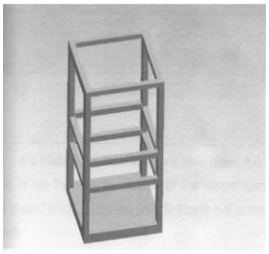


Figure 1. Frame of Punching Machine

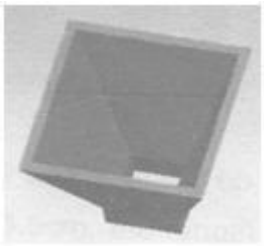


Figure 2. Hopper

The dimensions of the hopper are 34x34x2S and the thickness is of 2 cm. It is shown in Figure 1 and 2.

Cylindrical Drum: - It is of cylindrical in shape and is made up of structural. Diameter of drum is between 3.5cm. The length is of 25cm.the circumference of the drum the pointed needles are mounted which is used for punching the amlas. Drum is mounted the shaft which is driven by drives. It is located at the middle of machine. It is shown in figure 3.

Figure.3. Cylindrical Drums

Punching Needles :- It is made up of stainless steel which is located on the circumference of the drum. The needles are specially fabricated for which the screws are used to join the pointed needles with drum.Total number of needles on circumference of drum is 240. It is shown in figure 4.

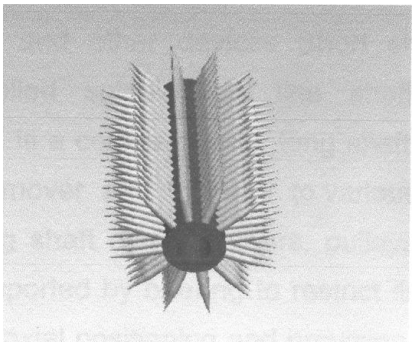


Figure 4. Punching Needle

Bearings :- Rolling element bearing involve separation of the shaft and outer member by balls or rollers and thus substitute rolling friction by sliding friction. Since the contact areas are small and the stresses high, loaded parts of rolling element bearings are normally made up of hard, high strength material, superior to those of the shaft and outer member. These parts include inner and outer rings and the balls or rollers.

A major advantage of rolling element bearing is low starting friction. Rolling bearings are ideally suited for application involving high starting loads. Rolling element bearing take up more radial space around the shaft, but fluid film bearings required greater axial space. Rolling element bearing generate and transmit a certain amount of noise whereas fluid film earing do not normally generate noise and may dampen noise from other sources. Another advantage of rolling element bearing is that they can be preloaded. This is important in application requiring precise positioning of the rotating member. The rolling element bearing are also called anti friction a bearing which is a misnomer because this bearing does not always provide a lower friction than fluid film bearings.

Flat Belt:- The flat belt consists of strong elastic core surrounded by chrome leather or rubber. The elastic core consists of number of thin plies, made up of cotton, rayon, or nylon. For special application textile belts or balata belts are used. Flat belts are very efficient for high speed, they are quite, they can transmit large power over long centre distances, they don't require large pulley and they can transmit power around corner or between pulleys at right angle to each other.

Pulleys :- A pulley can lift very large masses a short distance. To illustrate the way it works in our machine, both pulleys at the top are of the same size, a long pulley on the belt will raise the section of belt extending down to the lowermost pulley by a similar length to the amount of belt lowered by the other top pulley. The weight will therefore go nowhere. The diameter of the pulley is 4.7cm.

Amla removal tool: - There are various type of amla removal tool .The amla removal tool is made up of rubber pad or rubber fiber it is placed below the each pair of drum. It will work only when the amla get stuck in to the needle.

Safety Quard: - It's made up of thin aluminum sheet. It is used to keep the amla between two drums. As there is possibility of bouncing and misplacing of amlas at the time of falling from the hopper. It also reduces the manual accident.

Collector: - It is a tray which is made up of aluminum sheet and in the lower portion of the net is provided. It is fixed inclined at the base of the frame.

Working of Machine:-In this machine, the cylindrical needle platform punches the amla's on its whole circumference. A single amla is punched more than ten times on its whole surface .The depth of the punches are 10-15 mm. After getting punched, the amlas are discharged from the machine and can be connected on plastic cranes. The machine is complete with electric motor, starter, etc.Amla punching machine is simple machine which is used for punching the amla in proper way to prepare morraba.

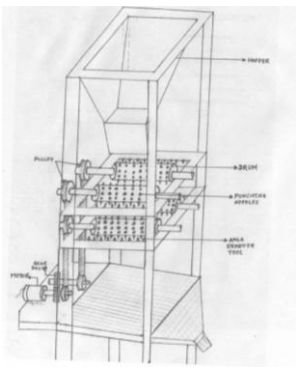


Figure 5.Line diagram of Punching Machine

Assembly of Machine:-

Computer Aided Assembly of amla punching machining and bill of machine is shown in figure 9 and 10.

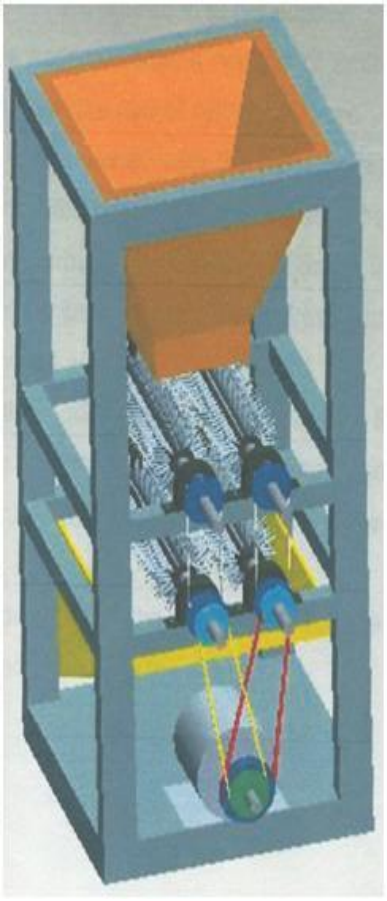
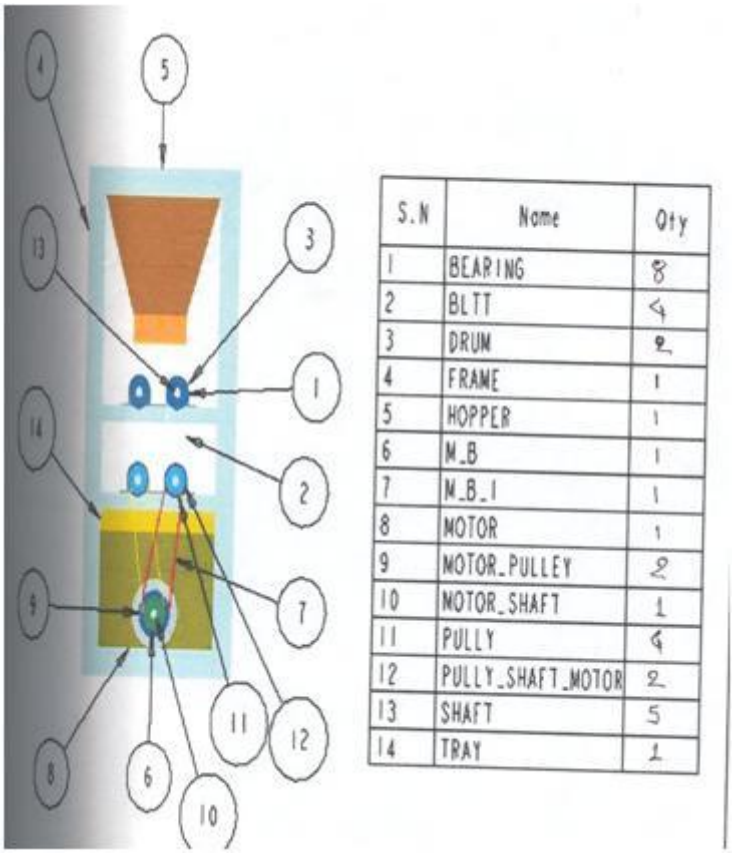


Fig.9.Model of punching machine



S.N	Name	Qty
1	BEARING	8
2	BLTT	4
3	DRUM	2
4	FRAME	1
5	HOPPER	1
6	M_B	1
7	M_B_1	1
8	MOTOR	1
9	MOTOR_PULLEY	2
10	MOTOR_SHAFT	1
11	PULLY	4
12	PULLY_SHAFT_MOTOR	2
13	SHAFT	5
14	TRAY	1

Fig.10.Bill of Machine Components

This machine works in the following way.

- First select the suitable numbers of amlas for punching.
- Selected amlas are poured in to the hopper.
- Through the hopper, suitable numbers of amlas are dropped below in between the pair of cylindrical drum.
- Amlas are then punched with the help of punching needles which are mounted on the circumference of the drum.
- After passing through the first pair of drum, then amlas are dropped on the second pair of cylindrical drum so that the amlas are punch again.
- In this way the numbers of holes are made on the amlas.
- If the amla are hanged in the punching needles. A special purpose amla removal tool is used to remove the hanged amlas.
- At last the punched amlas are collected in the collector and then it is used to prepare the morraba.

III. FINITE ELEMENT ANAYSIS OF MACHINE

FEA with differential equation of system and end with solving them approximately. It goes through a number of steps in between. It converts differential equation in to integral equation by using variation approach or weighted residual method. Next it divides the problem domain into elements and develops the elements equations. It assembles the element equation to obtain the global system matrix equations. The boundary condition and external loads are applied to this system before solving. The result of the solution are available at the nodes of the elements .finite element analysis can display them in graphical form to analyse them, to make design decisions and recommendations.Conventional analytical method for solving stress and strain becomes very complex. In such cases finite element modeling becomes very convenient means to carry out the analysis. Finite element process allow for discretizing the intricate geometries into small fundamental volumes called finite element. It is possible to write the governing equations and material properties for these elements. These elements are then assembled by taking proper care of constraints and loading, which result in set of equations .these equations when solved give the result that described the behavior of original complex body being analyzed. Mesh model of machine is shown in figure 11.

Figure 11. Discretization of Machine

Total no of nodes 118716 and elements 55753 are generated in above figure no 11.Fixed machine frame at end as shown in figure 12.

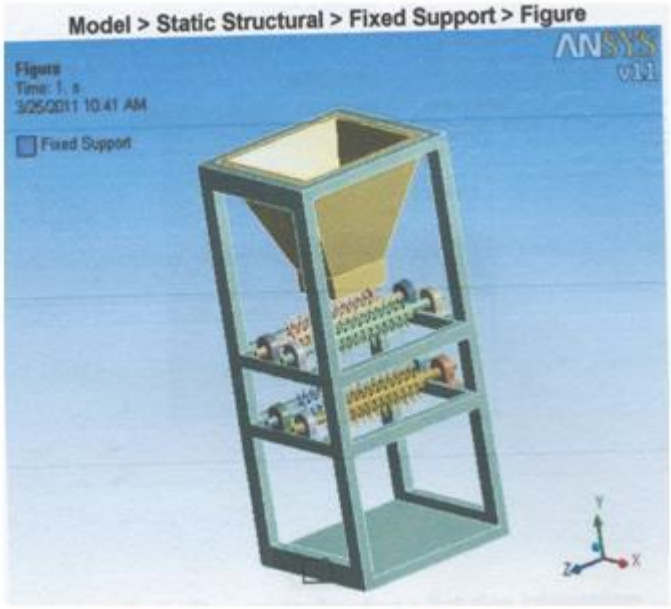


Figure 12.Boundary Condition

The finite element analysis of machine as per loading and boundary condition revealed the stress distribution in form of stress contours and total deformation as shown in figure no 13 and Figure 14.

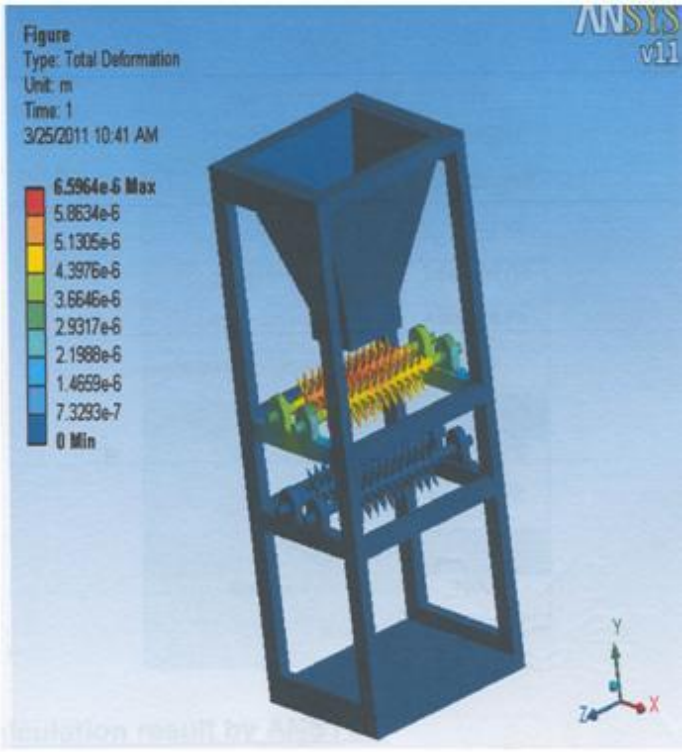


Figure 13. Total Deformation

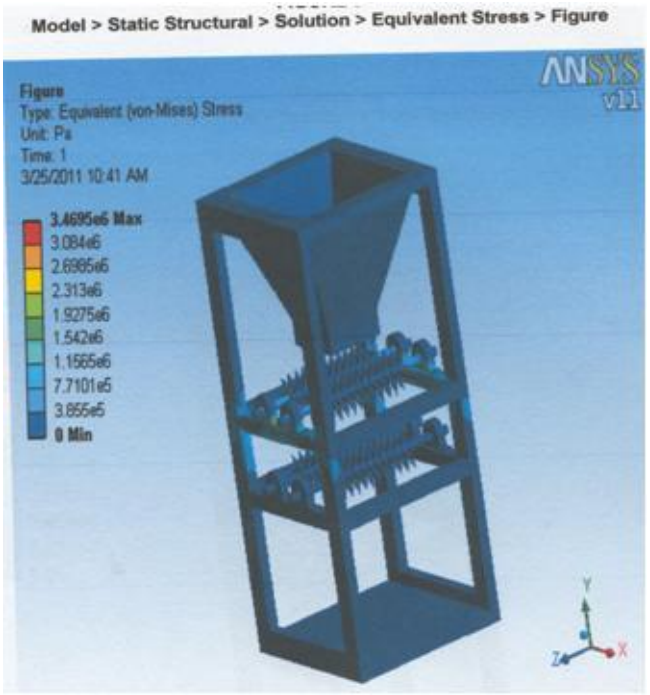


Fig.14.Equivalent stress

A. Salient Features

- Robust machine of all steel construction.
- All contact parts are made up of Stainless Steel or other food grade material.
- Speciaf1y designed S .S need1e platform to punch the amlas.
- Uniquely designed drive in order to convey the amlas in forward direction as well as to run the needle platform.
- Manual feeding of the amlas.
- Arrangement for pricking of amlas of all sizes.
- No damage of the seed.

B. Advantages

- It increases the production rate.
- It reduces the time consumption.
- It is compact in shape.
- The efficiency of machine is more.
- No skilled labour is required.
- It is cheaply for mass production.
- It can punch all the size of amlas easily.
- It requires less power for operating.
- It minimizes the problem of manual accident.

C. *Disadvantages*

- Possibility of corrosion &wearing of needle

IV. CONCLUSION

Amla punching machine is efficient to punch the amlas which is used for prepare the murraba. This is the modern technology mentioned in the study for preparation of amla's murabba is hygienic, consume lesser time and provide maximum retention of nutrients. On the basis of design and analysis by PRO-E and ANSYS software we conclude that the stresses occurred on the machine is under control. Hence this machine is safe with in respect of operators and environment.

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