Design and Fabrication of Mango Cutting Machine

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Abstract **- In India traditionally the process of cutting mangoes for pickle, chutney, juice etc. is very time consuming, unhygienic and unsafe for operator as they are cut by using big sharp knife. In market there is lots of raw mango cutting machines available, but the price and size of that are more which is not affordable by households and small-scale industries. That is why this mango cutting machine comes in picture, the price of this machine is comparatively very much low as the machines which are available in market and this can be easily affordable for all small-scale businesses and households. The aim of this machine is providing the machine for household work, for small businesses in minimum price of machine and high production with less time.**

Index Terms**—mango cubes, high production, knife, household, hygiene, affordable, small scale industries.**

I.INTRODUCTION

Mangos are very popular fruits in the globe. They are the sweet, fragrant fruit of the evergreen tree (Mangifera indica), a member of the cashew family of flowering plants. Single seeds - also called stone fruit, such as plum, cherry, or peach. The name of the mango species is Mangiferi indica, meaning "Indian plant that breeds mangos." Mangos were first cultivated in India more than 5,000 years ago. The first attempt to import mangoes into the U.S. arrived in 1833 and went to Florida.

In India almost in every house the mango pickle, chutney, murrabba etc. is indispensable part of their cuisine. Therefore, Mango is processed into a variety of ingredients including mango juice, mango squash, and jam etc. Mango treatment is eliminated by hand and in dirty ways. Many mango pickle businesses make mango cuts into boring, large and hard-working process, as it involves handicrafts. It is therefore important to make these machines automated by developing cost-effective equipment that can reduce the current interval such as the operating cost and build a more efficient system. In this case the cutting cube of the green mango is very good as it incorporates a lot of efficient slices compared to cutting by using knife. It reduces fruit damage and improves strength and accuracy.

Most of the green mango industries in Gujarat do the basics activities such as peeling and cutting in cubes form. All of these tasks are tedious and require a lot of staff, as it involves handicraft. It is therefore important to make these machines mechanically by building efficient machines that can reduce processing time and operating costs and make the process cleaner.

In automatic machines the air machine offers simple and inexpensive ways to compress and actuate. A pneumatic system is a set of connected devices that use compressed air to perform the function of automatic equipment. Examples can be found in industrial production, in a home garage or in a dental office. This function is produced in the form of direct or indirect motion. Compressed air or compressed gas is usually filtered and dried to protect cylinders, actuators, tools and implements. So here we propose a pneumatic based cutting machine that uses pneumatic strength for instant cutting of small cubic shape mango pieces. Manual cutting machines required lots of manual efforts and also are not suitable for bulk cutting processes with accuracy. The pneumatic cutting machine ensures exact cutting speed each time to get the consistent cutting result without any break.

Therefore, the current study was conducted for specific purposes to develop a suitable, effective raw material mango skin and cube cutter for making raw mango cutting machine.

II. LITERATURE REVIEW

There are various raw mango cutting machines currently available in market, but these machines are not portable, bulky and of course of higher cost and

takes much space. Also, the existing machines are designed for greater capacity and hence are expensive. After analyzing lots of research papers and machines, in that we found the rate of production capacity of raw mango cutting machines varies from 100kg-500kg per hr. or more but the price of that are also very expensive and the size of that also very bulky, which cannot affordable by small scale businesses and households. Some researcher employs different stages operation by using different 1hp motors with 3 phase to every stage for only cutting the raw mangoes in cube slices, Due to that the size of machine is increases and looks very bulky in design.

III. PROBLEM IDENTIFICATION

- High machine costs.
- High power consumption.
- Time consuming.
- Wastage of mango slices.
- More staff is needed.
- Unclean.
- It is unsafe leading to injury while cutting yourself by hand.

IV. OBJECTIVE

1. For quick and swish operation.
2. Keeping clean.
3. Cut the mangos into pieces, this can be used to create the mango pickle.
4. Converting the manual cutting system into a machine-driven cutting system.
5. Increased productivity.
6. Overcoming time consuming.
7. Reducing job insecurity

V. CAD MODEL

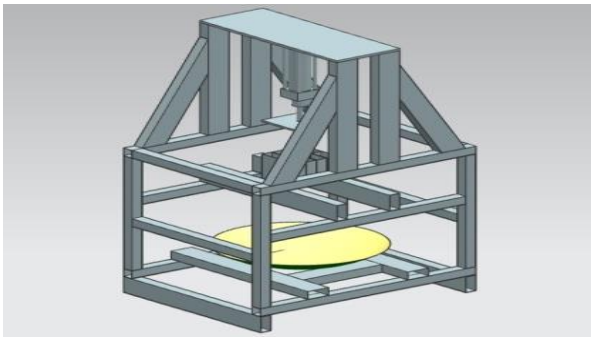

Fig. 1- Isometric View

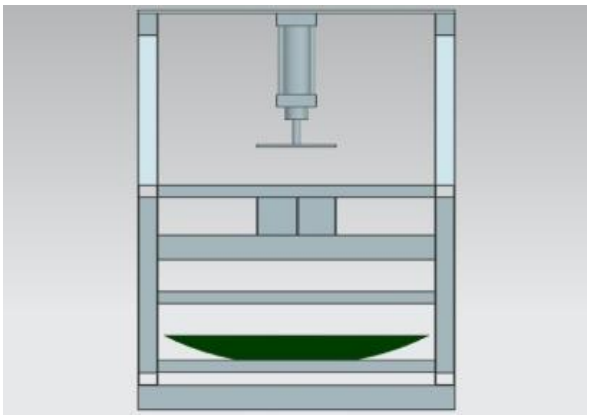

Fig. 2 -Front View

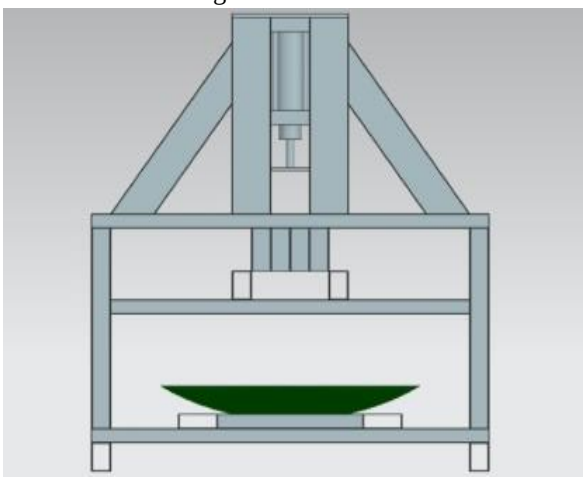

Fig. 3 - Side View

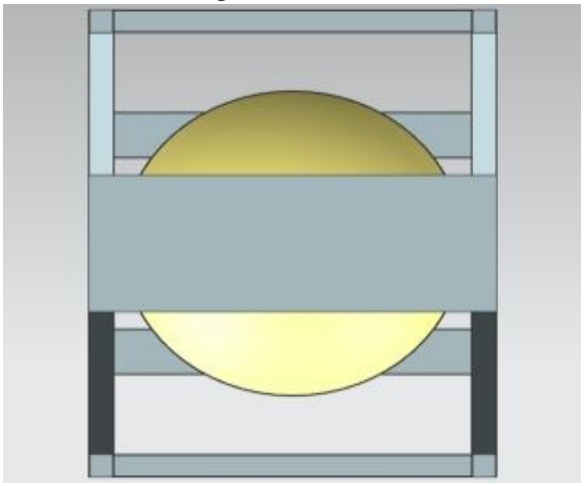

Fig. 4 - Top View

VI. CALCULATION

Calculate Force Exerted by cylinder:
Specifications:
Cylinder bore diameter d = 32mm
Radius r = 16mm

Cylinder stroke length l = 100mm
Maximum pressure capacity of cylinder p = 10bar
=1 N/mm^2
The force exerted by double acting pneumatic cylinder on forward stroke can be expressed as:
Force = Pressure*Area
F = P*A
= P*π d_1^2 / 4
= 1* π*$(32)^2$/ 4
F = 804.24 N
F = 804.23/9.81
F = 81.98 Kg (maximum force capacity of cylinder) for forward stroke.

The force exerted by double acting pneumatic cylinder on backward stroke can be expressed as:
As we know,
Force = Pressure*Area
$F = P * \pi (d_1^2 - d_2^2) / 4$
Where,
d_1 = full bore piston diameter (mm)
d_2 = piston rod diameter (mm)
$F = 1* \pi (32^2 - 15^2) / 4$
F = 627.53 N
F = 627.53/9.81
F = 63.96 Kg for Backward stroke.

VII. COMPONENTS

1 Double acting pneumatic cylinder.
2 Air compressor.
3 5/2 solenoid valve,
4 Push buttons.
5 Hose pipes.
6 Nipples.
7 Filter.
8 Muffler.
9 Frame.
10 Head block.
11 8 blocks Cutting blade.

1 Double acting cylinder: this device provides linear forward and backward motion to applying force on mango for cutting.
2 Air compressor: this device is used to compressed air for create required amount of pressure to actuate the cylinder.
3 Solenoid valve: it is used to control the flow of air for required movement of cylinder.
4 Push buttons: to operate the cylinder.
5 Frame: to carry the all assembly, made by cast iron.
6 Cutting blade block: to cut the mango into in the cube shape.
7 Head block: to applying the proper force on mango.
8 Hose pipes: which is used for proper air flowing from compressor to actuator.
9 Filter: this will help to remove foreign particles from compressed air stream.
10 Muffler: it is help to vent the pressurized air to the atmosphere. Provides noise free operation.

VIII. WORKING

This machine is essentially engaged on the principle of pneumatic cylinder; it transfers the power of compressed gas into the reciprocating linear motion to chop the raw mango into equal no. of cubes.
Like hydraulic cylinders, some medium forces a piston to move in required direction. The piston is a cylinder and piston rod transfer the force required to cut the raw mango.

- In this machine, the frame holds all components to perform the operation.
  In which the cylinder is mounted vertically downward on middle of the frame and the cutting blade is mounted exactly below to the cylinder. Then solenoid valve connects to the cylinder and 220v ac connection.
- The raw mango should be placed over the cutting blade by the operator after that the compressor will be started to compressed air and then air should be stored in tank, that stored air will be used in cylinder to forward stroke to cut the raw mango which is placed in cutting blade (8 blocks) by applying hammering effect on the mango by the help of push button which is operated by 5/2 solenoid valve due to that hammering effect the mango will cut into equal cube shape. And after forward stroke release that push button to backward stroke of cylinder to further operation.
- Engineers are basically prefer to use pneumatics as they are quieter, do not require large space to store fluid and cleaner.

- Because the working fluid gas, the problem of leakage from a pneumatic cylinder will be negligible.
- It should be used where cleanliness is required and for our process of operation hygiene is very important.

IX. FUTURE SCOPE

- This machine can also be used as a punch and aluminum can crusher machine by simply removing the blades.
- By changing the cylinder, we can use it in another fruit cutting machine.
- By changing the cutting tool, we can make it as juicer.
- In addition, the mango cutting machine was also powered by solar energy.

IX. CONCLUSION

By taking problems into consideration of the existing mango cutting machine, we need to design a machine that should not take lot of space in the sense compact, portable and versatile, inexpensive so that small scale industrialist and households can afford it and capable of making pickle in huge quantity without compromising rate of production with low cost, hygiene and safety of workers.

X. ACKNOWLEDGMENT

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