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Review of Raw Mango Cutting Machine

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A B S T R A C T

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's 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.

Keywords: Mango, Cutting, Household, Small Scale Business, Affordable.

1. INDRODUCTION

Mangos are very popular fruits in the globe. They are the sweet, fragrant fruit of the evergreen tree (Mangiferaindica), 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 Mangiferiindica, 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

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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.

1.1 MANUAL MANGO CUTTING

The cutting raw mango by using traditional tool is time and lobor consuming operation also is not safe because it lead to injuries like cutting workers hand and fingers and also difficult to cut the mango because of presence of its hard seed. The mild steel blade used in traditional tool, so after cutting blackish colour was observed on cut portion of raw mango and in unhygienic ways

Handling of mango is done manually and in unhygienic ways, it's also dangerous to handling. Most of the raw mango pickle industries in Gujarat perform basic operations like peeling, cutting, slicing, grating, and dicing. All these operations are tedious and labor intensive, as it involves manual work.

1.1 MANGO CUTTING USING MACHINE

This is an era of automation where it is broadly defined as replacement of manual effort by mechanical power in all degrees of automation. The operation remains an essential part of the system although with changing demands on physical input as the degree of mechanization is increased.

Degrees of automation are of two types, viz.
1. Full automation.

2. Semi automation.

In semi automation a combination of manual effort and mechanical power is required whereas in full automation human participation is very negligible
There are various raw mango cutting machines currently available in market, 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.

2. Literature Review

2.1 Background study

The mango slicer slices the mango longitudinally. The mangoes are cut into 4, 6 or 8 slices based on the size. The cut slices fall on collecting tray and the cut pieces of mangoes are separated from flush. This machine is efficient but the cost of machine is very high .so, small scale industrialist not able to purchase at such high cost with Hugh maintenance, the costing of this type of machines goes to near about more than 4-5 lacs/piece

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- 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.

2.2 Literature Review

Literature available on design, physical and engineering properties of raw mango, need of this chapter contains review of published mechanization of raw mango processing, development and performance of different types of fruit slicer and cutter, and varies types of slicer and cube cutter developed by researchers.

So following literatures were studied for designing of our project model.

Physical and Engineering Properties of Mango

Pruthi and Bedekar (1963) - studied the physico-chemical characteristics and suitability of different varieties of pickling mangoes for pickle namely Beenj, Amlet and Amini varieties and found that Amlet variety scored highest for fruit weight (466 g) and the recovery of mango slices. The ascorbic acid, dehydro-ascorbic acid and ascorbigen content ranged from 69.6 to 86.2, 0 to 61 and 1.4 to 2.1 mg/100g respectively, and all the three varieties were found to be good in terms of pickling.

Sastry and Krishnamurthy (1975) performed a study on the physico-chemical variations of some important varieties of mangoes viz., Bogadi, Sakkalli, Amlet and Suvarnarekha and reported that small sized mangoes measured 6-8 cm in length, weighed about 120 g and had a flesh content of about 70 %, whereas big sized mangoes measured more than 10-13 cm in length, weighed 400-600 g and had a flesh content of about 70-80 %.

Shafqat Ali et al. (1992) carried out the study on physico-chemical characteristics of mango. Fruit of 32 varieties grown at Shujabad, were analyzed. Heaviest fruit in cultivar Fajri (460 g), followed by Samarbahistchaunsa (389 g), least peel (10.6 to 10.8%) in Baganpalli, Wadiamunasyed and Swarnareeka, smallest stone in Pohilot (7.6 %) and maximum pulp in Beganpalli(79.4%) were recorded.

Mizrach et al. (1999) studied physiological indices of mango by mechanical wave analysis. Puncture measurements were carried out on both whole fruit and pulp using a TA-XT2 texture analyzer (Stable Micro Systems Ltd.). Whole fruit firmness F (N) was estimated on both cheeks of the whole unpeeled mango using a cylindrical plunger (6.35 mm diameter) with a conical tip (600). F was the penetration force measured at 5.5 mm depth when the plunger penetrated the unpeeled fruit at a speed of 3 mm/s.

Mannan et al. (2003) carried out a study on firmness of mango fruit, measuring destructively using a texture analyzer (Model TA- XT2i, Stable Microsystems Ltd. UK) fitted with a standard penetrometer probe (SS, 5 mm diameter). The analyzer was linked to a computer that recorded the data via a software programme XTRA. Dimension (Version 3.7 h, Texture Technologies Corp., and Scarsdale, NY). The variety used for this study had a skin of about 2 mm thickness was peeled off the fruit using a knife. The probe was pushed in to the fruit flesh to a distance of 8 mm at two locations along the equator of the fruit and the average values were reported.

The mango slicer slices the mango longitudinally. The mangoes are cut into 4, 6 or 8 slices based on the size. The cut slices fall on nylon mesh and the cut pieces of kernels are separated from flush. This machine is efficient but the cost of machine is very high .so, small scale industrialist not able to purchase at such high cost with Hugh maintenance, the costing of this type of machines goes to near about more than 4-5 lac/piece

3. Calculations

Calculate Force exerted by double acting cylinder:-

Specifications:-

Cylinder bore diameter d_1 = 32mm

Piston rod diameter d_2 = 15mm

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 d12 / 4

= 1* π*(32)2/ 4

F = 804.24 N

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

$F = P * \pi (d_1^2 - d_2^2) / 4$

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.

4. Components and Working

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.

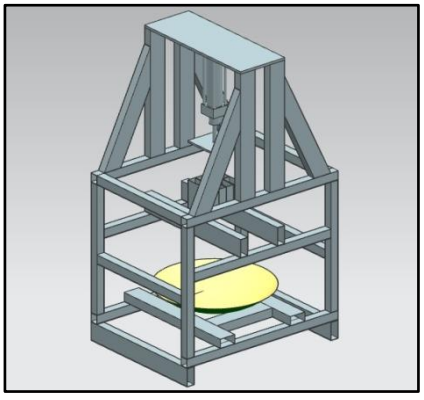
1 **Double acting cylinder**: - this device provides linear forward and backward motion to applying force on mango for cutting.
2 **Air compressor: -** this device is used to compressed air for create required amount of pressure to actuate the cylinder.
3 **Solenoid valve: -** it is used to control the 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.

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 transfers the force required to cut the raw mango.

- In this machine, the frame holds the 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 connect 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.



5. 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.

6.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.

- A Pneumatic machine is much faster than manual process.
- This machine worked 24*7.
- A pneumatic raw mango cutting machine is typically done in a much shorter time span than a manual mango cutting.
- The design of this machine is such that a single operator can do the mango cutting operation with ease.
- This machine has a limited number of moving parts and hence requires less maintenance.
- The machine is cheap and easily affordable by the small scale industrialist.

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