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Implementation of Raw Design of Mango Cutting Machine

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Abstract: ***Raw mangoes in India are mostly used as pickles and chutneys. Almost In every house, mangos are used for making pickles and chutneys .In Gujarat, many household manufactures have grown an prosper through pickle industries. Basic operations like, cutting, slicing, peeling and grating, dicing, and handling manually and in unhygienic way are performed in Gujrat. All these operations are done by men and women by hands only in the industry and they are also tedious and labor intensive. So, these operations are needed to be performed automatically and rapidly. Slicing and cube cutting is one of the most important steps in processing of raw mango fruits. Mechanical slicing and cube cutting is capable of more precise than manual mango cutting operation. It reduces the operation time and improves the efficiency and accuracy of raw mango slicing and cube cutting. However, only limited work have been done and published, on the development of slicing and cube cutting machines. Therefore, the present study was undertaken to develop an appropriate, efficient slicer and cube cutter for mechanizing the pickle processing industry. Various physical properties namely; size, shape, unit mass, sphericity and bulk density, and engineering properties namely firmness, of freshly harvested mango fruit of cultivar "Rajapuri" were determined.***
Keywords: Raw mango slicer, raw mango cube cutter, slicing efficiency, cube cutting efficiency, cost economics of slicing and cube cutting machine*.*

I. INTRODUCTION

Mango (Mangifera indica L) is one of the most important fruit worldwide and is cultivated in more than 100 countries at both tropical and subtropical latitudes, especially in Asia. India is a leading mango growing country and produces about 65 % of the world's total mango produced. It is considered as the most important fruit covering 35 % of area and 28 % of total production of fruits in the country. In India the area under mango cultivation was about 2500 thousand ha and about 18002.4 thousand metric tons of mango were produced during the year 2012-13. The Gujarat contributed 5.6 per cent on mango cultivation (Anon, 2013). In Gujarat state, the area under mango cultivation was about 141258 ha and about 1003706 metric tons of mango were produced during the year 2012-13 (Anon, 2013). The district wise area and production of mango in Gujarat during the year 2012-13 is given in Table 1.2. The major contributing districts of Gujarat are Valsad, Junagadh, Navsari, Surat, and Amreli (Anon, 2013). Mango is one of the most cherished fruits, not only in flavor and taste, but also for its nutritional value. Malik *et al.,* (1994) reported that mango is a good source of vitamin A and C and rich in carbohydrates, minerals potassium, and phosphorus. Ripe mango is mainly consumed as fresh fruit but due to its perishable nature it cannot be stored for long duration and consequently, substantial quantity of the crop is annually lost. Therefore, Mango is being processed into many products that include mango juice, mango nectar, squash, mango concentrates and jam (Husain *et al.*,2005).

Handling of mango is done manually and in unhygienic ways. 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. So it is essential to mechanize these operations by developing efficient machines which can reduce the processing time as well as cost of operation and make the process more hygienic. Mechanical operation of slicing and cube cutting of raw mango is advantageous as it involves more precise slicing and cube cutting than the manual cutting. It reduces fruit damage and improves the efficiency and accuracy. However, only limited work has been done and published on the development of slicing and cube cutting machines. Therefore, the present study was undertaken with specific objectives to develop an appropriate, efficient raw mango slicer and cube cutter for mechanizing the pickle processing industry.

II. LITERATURE SURVEY

and 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.

A. Physical and Engineering Properties of Mango

Pruthi and Bedekar (1963)[1] 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)[2] 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 %.

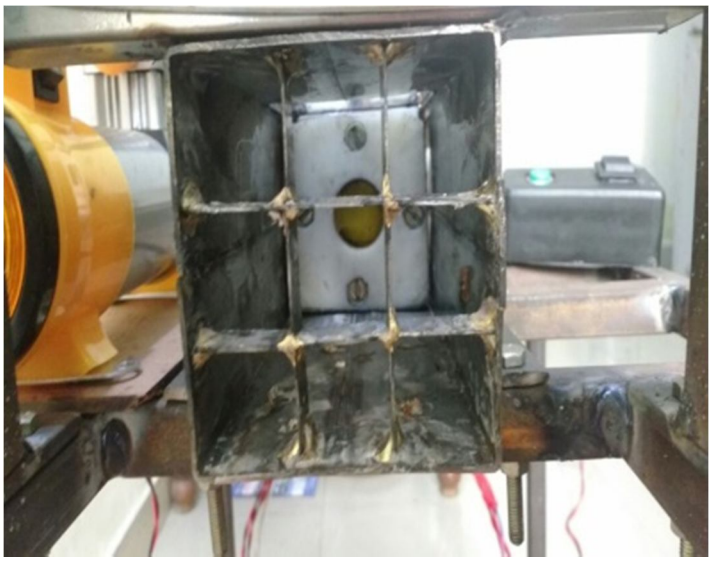
Shafqat Ali *et al.* (1992)[3] carried out the study on physico-chemical characteristics of mango. Fruit of 32 varieties grown at Shujabad, were analyzed. Heaviest fruit in cultivar Fajri (460 g), followed by Samarbahistchaunsa (389 g), least peel (10.6 to 10.8%) in Baganpalli, Wadiamunasyed and Swarnareeka, smallest stone in Pohilot (7.6 %) and maximum pulp in Beganpalli(79.4%) were recorded.

Mizrach *et al.* (1999)[4] 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)[5] 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 analyser 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.

III. COMPONENTS

1) *Feeding Hopper*:- Made by M.S. Sheet of 155mm*75mm for easy discharge.
2) *Cutting blade:-* The cutting blades are fixed which are made from hardened stainless steel with sharp 1mm cutting edge, 80mm length & 80mm width. Thickness of the blade was 3mm to bear the cutting pressure of mango slices.
3) *Collecting Unit:-* The collecting unit used to collect cubes discharged from inclined hopper provided below the cutting unit.
4) *Cube cutter frame:-* Height & width are decided based on the length of mango slide. Frame provides the strength to the cube cutter.

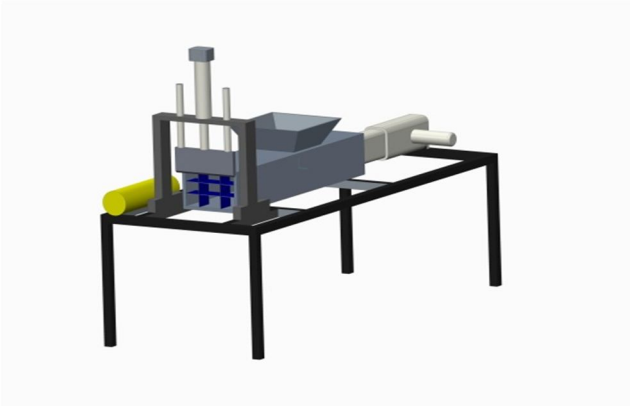


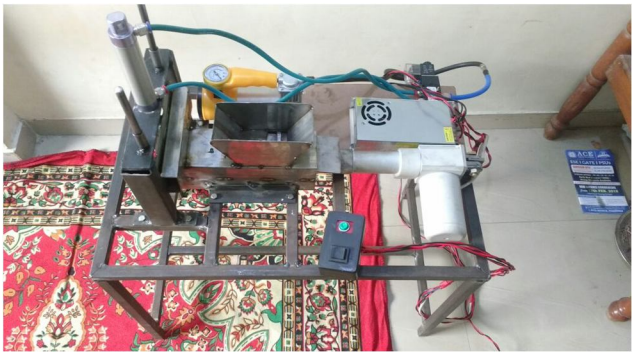
5) *Mechanical Actuator:* It is a device which here is providing linear forward and backward motion to the mangoes. It is being operated on 12V DC supply.

6) *Air Compressor:* It is device which converts low pressure air into high pressure air. It pressurize the air. There are two types of air compression, generally used. It may be divided into either positive or negative displacement compressors.

7) *Pneumatic Cylinder:* It is device in which piston can have its movement by the application of air. It can have reciprocating linear motion.

8) *Solenoid Valve:* It is used here, to control the flow of air. The valve is operated by an electric current through solenoid. It is 5/2 DC flow control valve.





IV. WORKING

A. First of all we will put mango through hopper.
B. Then we will press forward button on remote.
C. Then actuator will provide forward motion to inserted mango.
D. The mango will reach near 9 box cube shaped die.
E. Then we will press hit button on remote control.
F. The piston which was in initially at top position is driven down by pneumatic force obtained by compressor.
G. The piston is having vertical blade attached to it.
H. The motion of vertical blade cuts the mango into cube shape pieces.

V. CONCLUSION

The present study was undertaken with specific objectives to develop an appropriate, efficient slicer and cube cutter for mechanizing the pickle processing industry.

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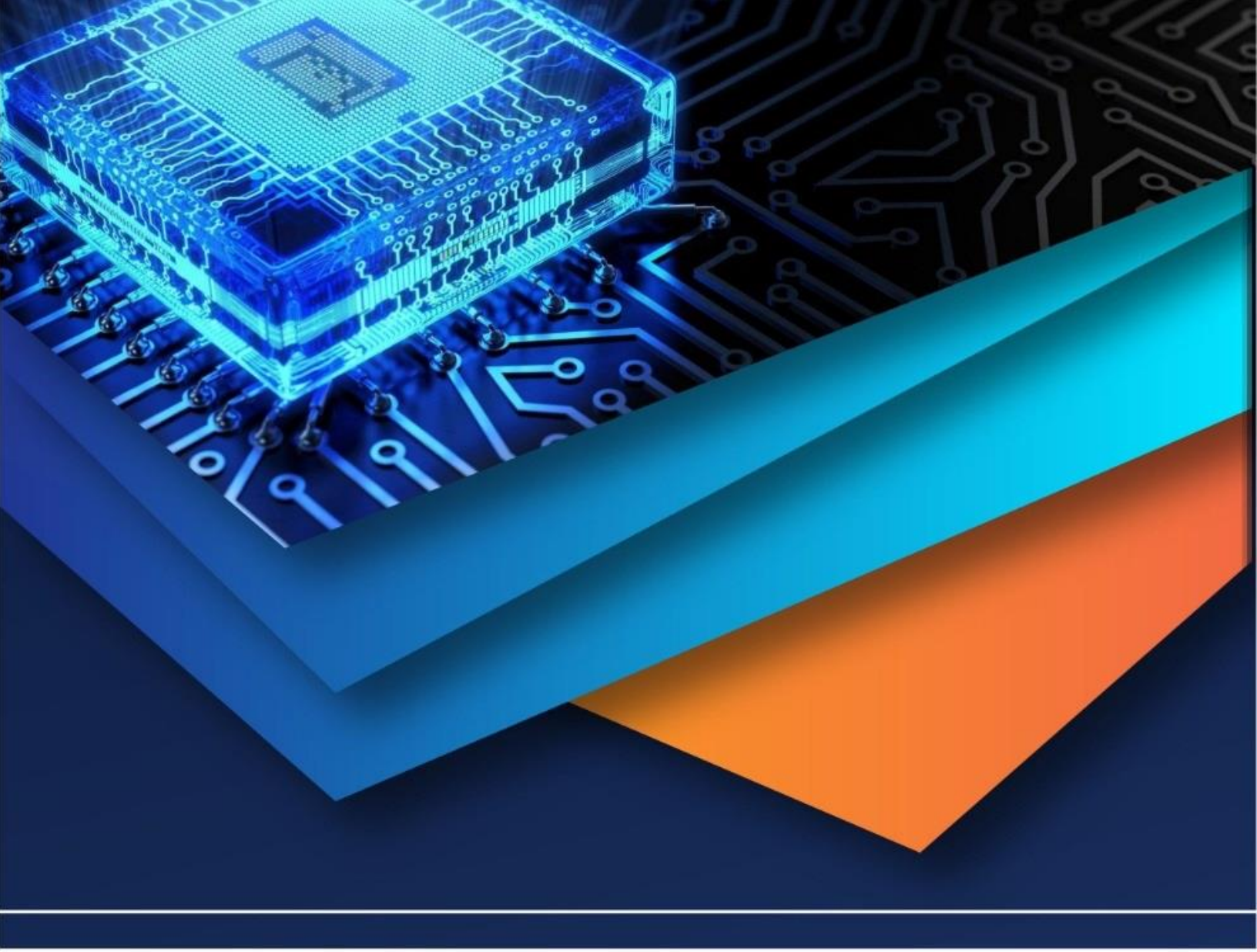

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