iJRASET
International Journal For Research in Applied Science and Engineering Technology



INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 6 **Issue:** V **Month of publication:** May 2018

DOI: http://doi.org/10.22214/ijraset.2018.5137

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International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 6.887
Volume 6 Issue V, May 2018- Available at www.ijraset.com

Design and Fabrication of Mango Pulp Extraction Machine

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Abstract: ***The pulp of the mango is usually extracted by squeezing. The squeezing force is applied over the fruit for the extraction of the pulp with the help of the hands. If pulp extraction is for less quantity then it is done by hand squeezing. For mass production it is necessary to extract the pulp with greater rate. This pulp is then preserved for later use. With addition of some chemicals and flavors the pulp is packed for later use. There is no domestic appliances for extraction of mango pulp in mass production. To overcome this drawback we are designing this project. This project will overcome all the drawbacks of manual pulp extraction and give the hygienic pulp for processing.***

Keywords: feed rate, nylon brush, perforated sheet, motor speed, ss304 shell, seed receiver.

I. INTRODUCTION

Mango is one of the delicious seasonal fruits grown in the tropics. Mangoes are available in large quantities during their harvesting season. Around all the mangoes available 30% of mangoes are wasted due to lack of efficient storage facilities after harvesting. In addition to this, susceptibility of fruits to mechanical, chemical and environmental factor contributes to high wastage due to spoilage during the harvesting seasons of such fruits. However, rapid progresses have been made in fruit farming technology over the years with little success recorded in storage facilities of such fruits. All this contributes to enormous wastage of fruits all over India.

The only solution to fruit storage problem is the extraction of juice from fruits. After extraction, the juice may be stored in rubber bottle or any other neat packaging, with or without preservative chemicals. Fresh mango is a good source of potassium. 100 g fruit provides 156 mg of potassium while just 2 mg of sodium. In general, the common method of extracting the pulp of mango is done by manual squeezing by hands. This process involves more time and is not hygienic. Until now each mango is handled manually. For mass production it is not possible to extract pulp of each mango manually. To overcome this drawback this pulper machine will be highly efficient, nearly untouched by human hands. As there are no domestic appliances for extracting the pulp and to overcome the difficulties, we have proposed this project.

II. BACKGROUND OF THE PROBLEM

In today's era, world facing high nutritional and food crisis. An estimation reported that as many as 840 million people faces chronic hunger however the number is increasing day by day. Which implies that one-sixth of the world's population is facing hunger. To overcome this disadvantages a huge demand of food is required for long term use. This can be done by preserving the nutritional values of the fruits and vegetables for later use. Thus the need for alternate sources of food and nutrition has resulted in the production of food supplements. This food supplements will used to correct nutritional deficiencies and to maintain certain nutrients in the body.

III. PROBLEM STATEMENT

The deficiency of vital micronutrients and vitamins in the dietary system are a form of hidden hunger. In many countries this hunger is leading to foodborne diseases. This malnutrition and foodborne deseases are becoming burden on the country. Therefore the extraction of the pulp and their preservation will help to overcome this problem. Purpose of this study is to design and manufacture a brush type pulping machine for Mangifera indica (Mango fruit).

IV. MATERIALS AND METHODS

Fig.1 shows the assembly of machine. The average weight of this prototype was measured to be 65kg along with motor weight and base support. Careful selection of materials for each part of the pulp extractor was made with the aim of reducing the time of the

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pulp extraction. The rotor type can be described in three compartments: the hopper, the extracting compartment and the outlet compartment.

A. The Hopper

The hopper is essentially the part of the machine that contains and retains fruit to be process for a short time. The hopper acts as a container and at the same time helps in gradually introducing the fruit material in to the juice-extracting compartment. The trapezoidal shaped hopper is fabricated from stainless steel and welded to the barrel of the proto type. It contains the reduced cross-sectional area to maintain the flow of the fruits. The fig.1 shows the 2D views of hopper drawing along with dimwnsions.

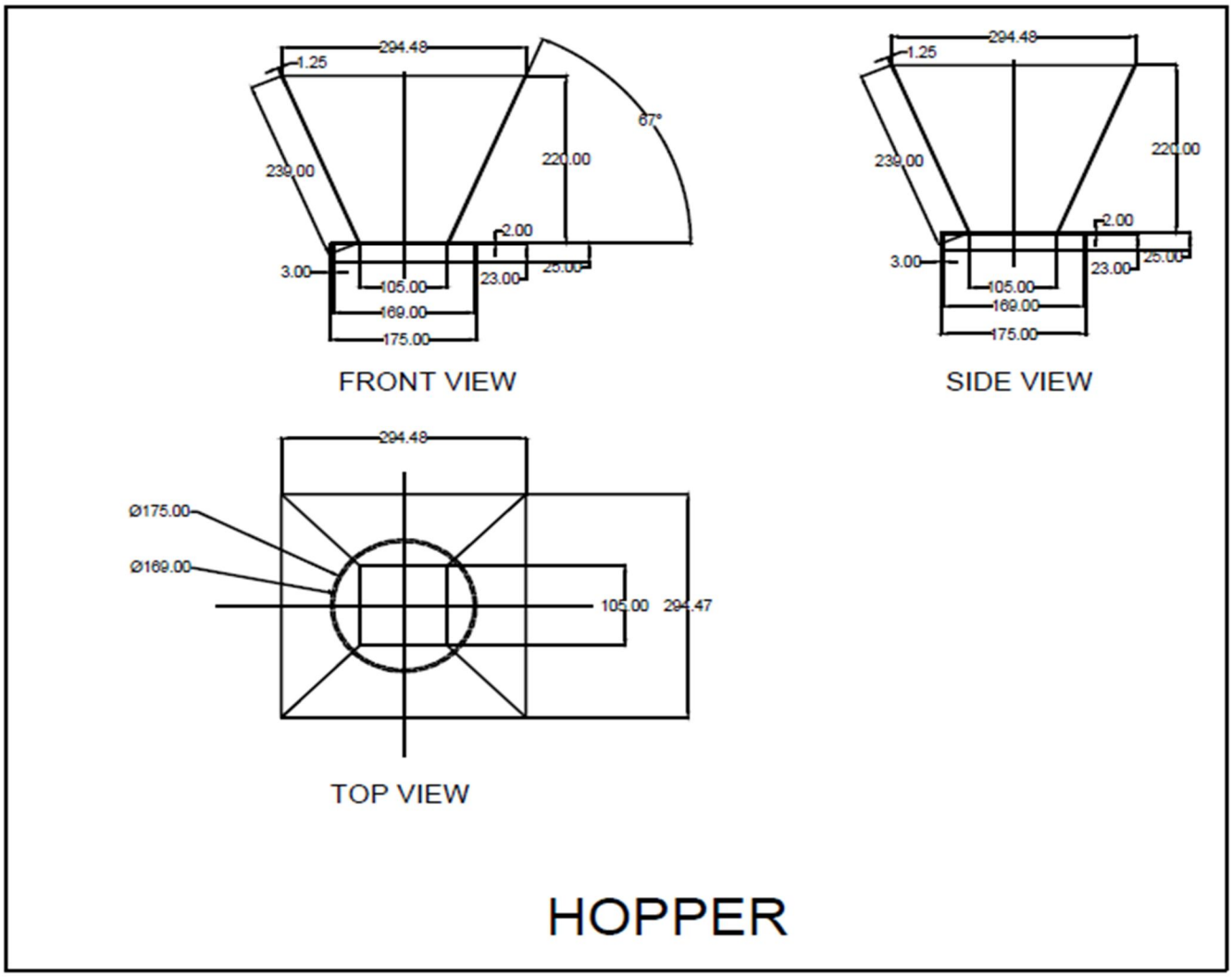


Fig. 1-CAD Drawing of Hopper

B. The Extracting Compartmen

The extracting compartment of this machine contains shaft, pulley, brush with brush holder, perforated sheet. The shaft is connected to electric motor through pulley and belt arrangement. Over the shaft the brush holder is mounted on which nylon brushes are bolted. After that perforated sheet is placed to separate the pulp and the seeds.

C. The Outlet Compartment Of The Pulp Extractor-

The outlet compartment comprises two major outlets, that is: the pulp outlet and the fruit seed Outlet. The pulp outlet is consist of a sloped channel connected to extractor drum through which pulp is extracted out in the barrel. The seed receiver is attached to the tail end of the machine through which the seeds are taken out from the machine.

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D. The Frame And Stand Of The Juice Extractor

The frame of the machine is made up of cast iron channels. 50*50*5 mm CI channels are used for frame of the machine. The total assembly of machine is covered with 1.6mm ss304 sheet to avoid accidents.

V. MATERIAL SELECTION

For the pulp extraction machine components required should have high corrosive, oxidation resistance. Along with this they should have high rusting resistance therefore stainless family is more advantageous for the machine components. While the frame is made with the material which is easily available and can be easily weld. For this cast iron is used.

A. Nylon Material

Brushes of the machine are made of nylon material. Nylon is a thermoplastic, silky material used in toothbrush bristles. Food processing brushes are Food Grade Brushes & are made in various sizes as per the clients' requirement. Fill material includes nylon bristles with base mostly polypropylene & nylon. PP base strip brushes are used for pulper machines and fruit juice extracting machines. We are using nylon brush with 10 bristles in each hole. Two nylon brushes are used on opposite side of arm for squeezing mangoes between sieves and brush.

B. Stainless Steel

The shaft and the shell of the machine is made up of SS304 material. As the stainless steel is corrosion resistant, is used for food processing units. Its low maintenance and luster make it familiar to use for many applications. Use of SS304 material make the machine hygienic and resistant from rust. Scratches doesn't affect the performance of the machine. The sieves, bushes, strips and bolts are also made from SS304 material.

C. Cast iron

The supporting base of the machine is made up of cast iron. As cast iron is easily available and cheap is used for base. It can be easily welded and available in various sizes. The frame like structure of the machine is made with the help of cast iron C channels.

VI. METHODOLOGY

In order to achieve the objective of the project, the methodology used is based on the project development life cycle. Three major steps were utilized for development of the project which are planning, implementation and testing. Planning was done on the basis of data collection. The data was collected in two forms, primary data (experiments) and secondary data (investigations). Different methods for pulp extraction were studied in which pulp extraction by sieving is selected. Sieving involves less time for pulp extraction and enables less loss of the pulp. In this method fruit is pressed against the sieve with the help of the brush.

VII.PRINCIPLE OF OPERATION OF THE JUICE EXTRACTOR

The mango fruit pulp extractor is powered by electric motor. Inside the pulp extractor is a brush linkage fitted on a shaft that rotates inside a fixed tube called the perforated sheet. When the fruit material comes into the extracting compartment via the hopper, the brush pushes the fruit-material against the wall of the perforated sheet. The forward motion caused due to the inclination angle of the extractor subjects the fruit-material to a certain degree of pressure sufficient to extract the pulp from the fruit. The pulp comes out from the pulp outlet, while the seeds comes out from the seed outlet. Advantage of this pulp extractor is that, it is a continuous feed extracting system capable of handling about 200 kg/hr fruit material continentally with good flowability characteristic of fruit like mango. The pulp extraction commences immediately after peeling and washing of the fruits.

VIII. DESIGN CONSIDERATIONS

The feed mechanism used for machine is hopper type with redusing cross-sectional area towards machine. This reduction in cross-sectional area enables constant and steady flow of the fruits. Due to machine inclination fruits doesn't need separate mechanism to flow forward. They moved forward by their self-weight and gravitational force. The main component of the project is the perforated sheet which contains holes of diameter of 4 mm throught its periferri. Mango is pressed against the sieves with the help of brush and squeezed between them. This squeezing results in removal of pulp in another side of perforated sheet which is then collected in barrels. Power to the brush shaft is given through motor and pulley arrangement. A 2 HP electric motor is attached to the machine. Pulleys are used for maintaining the reduction ratio of the speed.

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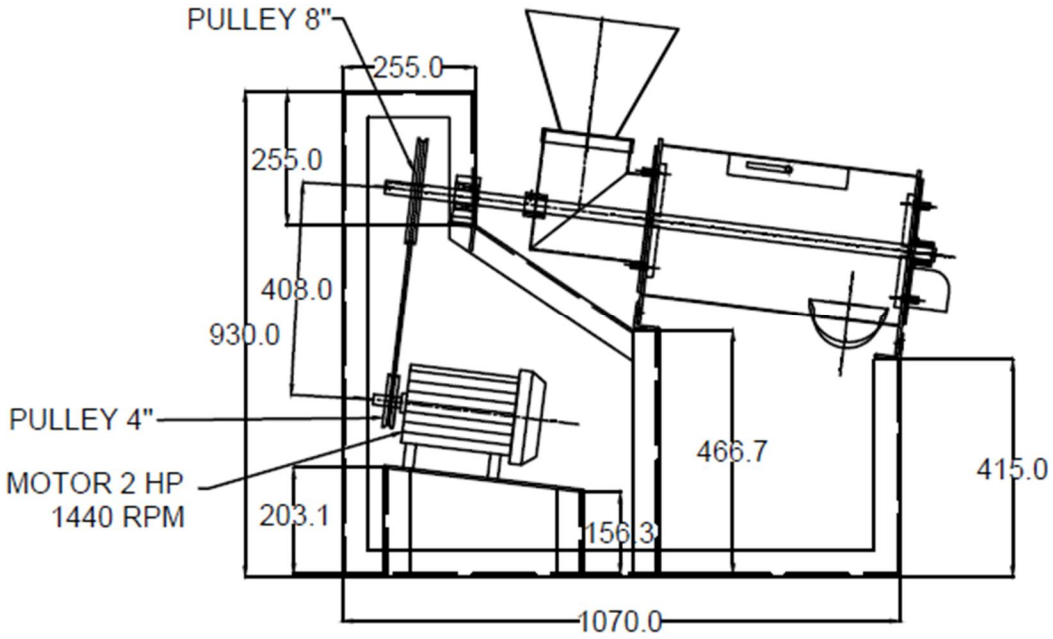


Fig.2- CAD model of mango pulp extraction machine

IX. CONCLUSION

The project aims to bring a new dimensions to the industry by implementing the smart means of separating the pulp from the seeds of Mangifera indica (Mango fruit), saving time of extraction. Also the machine provides an alternative source of food supplements and nutritional values without changing the taste. The machine capacity is as high as 200kg of pulp can be extracted per hour. This capacity can be increased with change in motor rpm and drum size. By adopting the pulp extraction by brush type pulping machine concept the pulp can be extracted due to friction between the brush and the perforated sheet sieves.

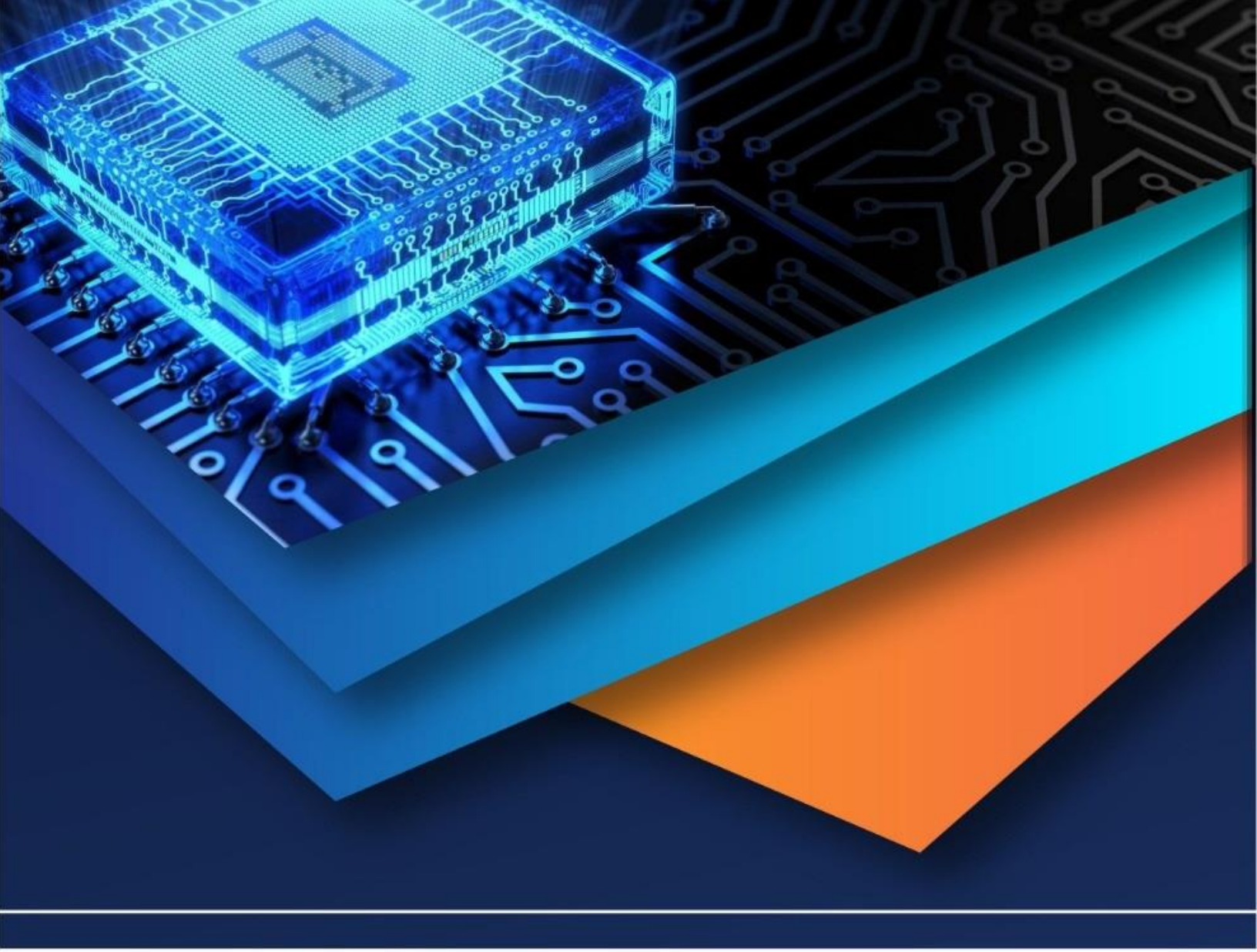
X. ACKNOWLEDGMENT

The following individuals provided the much needed support, in every aspect of the project and their assistance is gratefully acknowledged, Prof Kalase R. S.(project guide) , Prof Kalhapure A.(project co-ordinator). Special thanks to Engg. D. J. Sonar, CEO, Deepa Industries, Ahmednagar for their timely guidance and support.

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