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Identification of A Mechanism For Mechanical Deseeding Of Tamarind

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ABSTRACT
A suitable mechanism was identified for the removal of seed from tamarind. Model consists of a handle, oscillating sector with pegs, concave sieve, frame and stand. Shell removed tamarind fruits were used for the experiment. The oscillating sector will move over the tamarind and due to the rubbing action between tamarind and pegs the seeds get removed. The number of seeds removed will depend on moisture content of fruit, number of oscillations given and feed rate. A comparison test was done by tamarind with fiber and without fiber. From the comparison it is clear that tamarind without fiber is more suitable. Maximum amount of seeds get separated when the feed rate is 6kg and moisture content in the range of 6 to 8% (wet basis).ie. capacity of the machine is 100g/minute. The efficiency of machine is 87.17% when tamarind without fiber was used and 73.79% when tamarind with fiber was used. The commonly used traditional methods are very time consuming, less hygienic, less efficient, high structural damage, and required more number of labours. This mechanism is efficient enough to overcome all these problems

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I. INTRODUCTION

Tamarind (*Tamarindus indicia)* is a woody plant in the family *Fabaceae*. It is a long-lived, medium-growth, bushy tree, which attains a maximum crown height of 12 to 18 m. India and china are the largest producer of tamarind. The ripened fruit of tamarind is considered the more palatable, as it becomes sweeter and less sour (acidic) as it matures. It is used in desserts as a jam, blended into juices or sweetened drinks, sorbets, ice creams and other snacks. Processed tamarind can be used as beverages, soft drinks, alcoholic drinks, syrup or concentrate and jams. The fruits contain fiber sugars (namely, fructose, glucose, sucrose and maltose), acids, polysaccharides, small amounts of protein and lipid. Tamarind fruit is most valued for its high ascorbic acid content, minerals and sugar.

Since tamarind is a seasonal crop its preservation is very important. Generally preservation is done after removing seeds from the fruit. Because seed will be easily attacked by pets and it will badly affect the pulp. For the advantage of marketing and exporting it is better to remove the seed to reduce the total weight and the paste can be directly used for food preparation. More over pulp is the only material which we generally need for our purposes. So removal of seed from pulp is an important step in pre processing operation of tamarind. The objectives of this study is to identify a mechanism suitable for mechanical deseeding of tamarind and design and develop tamarind deseeding machine and evaluation of the performance of developed machine

II. MATERIALS AND METHODS

2.1 Oscillating type tamarind seed separator

This device is providing rubbing and shearing action on tamarind fruit and due to this action seeds are getting separated. The mechanism used for groundnut decorticator is considered for this operation. Overall size, sieve size and clearance between oscillating sector are modified.

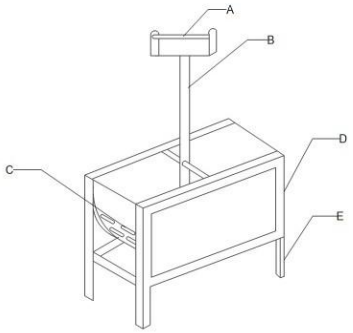

Fig.2.1 Oscillating type seed separator
(A,B)Handle(C) Sieve (D) Frame (E)Stand attached with frame

The oscillating type seed separator is used to separate seed from tamarind pulp. It

consists of L angle frame and 4 legs. A perforated sieve in a semi-circular shape is provided. Cast iron peg assemblies are fitted in three oscillating sectors. The oscillating sectors are connected to a long handle. The clearance between the concave and oscillating sectors are adjustable. In order to avoid corrosion all parts of the device is made of stainless steel. The important parts of this model are Handle, concave sieve, frame with stand, oscillating sector.

Handle of 44cm length and 3.4cm width and 0.6cm thickness is the longest part of device. To and fro motion is providing using the handle. Oscillating sector is attached to the lower end of the handle using nut and bolt. Concave sieve is an arrangement of 58 sieves of equal dimensions on a steel plate. Length and width of each sieve is 4cm, 1cm respectively. Steel plate is arranged in concave shape having a diameter of 36cm and width 16cm. It is the bottom most part and through this seeds is getting remove. Frame with stand is a supporting part of device to which all other parts get attached. Stands are also there to provide clearance between sieve and ground surface. Total height of the frame is 29cm and length is 36cm. Three oscillating sectors are attached to the stand and each contains 13 pegs. The scrubbing action between pegs and tamarind helps to separate seed from fruit. Average height of the peg is 1.3cm. Pegs are welded to the oscillating sector and peg's bottom diameter is 0.81cm and top diameter is 0.61cm.

2.2 Operation of oscillating type seed separator

Here also dried tamarinds are using for experiment. Particular amount of tamarind is fed into the concave sieve. Required amount of oscillations are provided using the handle. Oscillating sectors with peg which is welded to the handle will move over the tamarind. Due to the rubbing action between oscillating sector and tamarind, the seeds get separated. Most of the separated seeds will fall down through the sieve and the remaining will retain at the sieve. The handle is attached to the frame using nut and bolt.

2.3 Performance evaluation

Tamarind with different moisture content was selected . Different moisture contents are achieved by hot air oven drying method . Tamarind is kept in oven under 50 to 60℃ for 3 to 4 hours. Before and after oven drying weight of sample is noted from which we can find out the moisture content of the sample. The sample is divided into two parts, sample with fiber and without fiber. The test is conducted for different weight sample viz. 50g, 100g, 150g and 200g. Number of seeds present in tamarind were counted and noted. Then the samples were fed into the sieve. Oscillations are provided using handle in which oscillating sector with pegs are attached. The time for oscillation are kept constant. The time taken is 1 minute. Performance evaluation was done separately for fruits with fibres and fruits after removing fibres. As the moisture content was identified one of the important parameter, which influences deseeding performance, the testing was done at different moisture level of fruits. Tamarind fruit was dried in oven under 50 - 60° C for 3 – 4 hours and the moisture content of the sample was estimated.

Samples with different moisture content were prepared by changing the drying hours for testing. . The four levels of moisture content were 6.4%, 8.3%, 10% and 16.6% in wet basis. Moisture content below 6% is not considered because it will affect the quality of fruit due to over drying. When a fruit get over dried, physical deformation will occur and it cannot retain its actual structure. Considering the capacity of unit, samples of different volume was also used for testing. For this samples of different weight, ie. 50, 100, 150, 200g were used.

Samples with known moisture content and weight were fed to the unit. Number of seeds in the sample (n1) was counted before feeding into the machine. The handle of unit was pushed and pulled to give oscillatory motion. Oscillation was given for 1 minute for all the samples; so as to make number of oscillation uniform for all samples.

After oscillation, number of seeds separated from pulp is counted (n2). Number of non separated and broken seed is also counted. In first pass itself, most of the seeds were removed. For complete removal of seeds, second pass was given. Experiment is repeated for different moisture content, weight and comparison were done. Deseeding efficiency was calculated as

$$DSE = \frac{(n1-n2)}{n1} * 100$$

III. RESULTS AND DISCUSSION

3.1. Moisture Content

The moisture content of tamarind is fond out by oven drying method. 50g of samples from each type is taken in a bowl and placed in an oven at high temperature for 24 hrs. The moisture content of different samples of tamarind that are taken for experiment are 6.6%, 16.8%, 10%, 8.3%.

3.2 Weight

The weight of samples are measured using digital weighing machine .The sample weight that we used for experiment are 50g, 100g, 150g.

3.3. Performance Of Tamarind De seeder

From the observed values, line diagrams were prepared for the tamarind with fiber and non-fibrous tamarind.

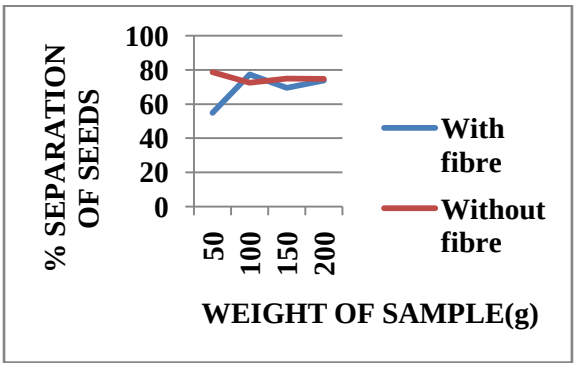

Fig. 3.1 Percentage separation at 16.6% moisture content

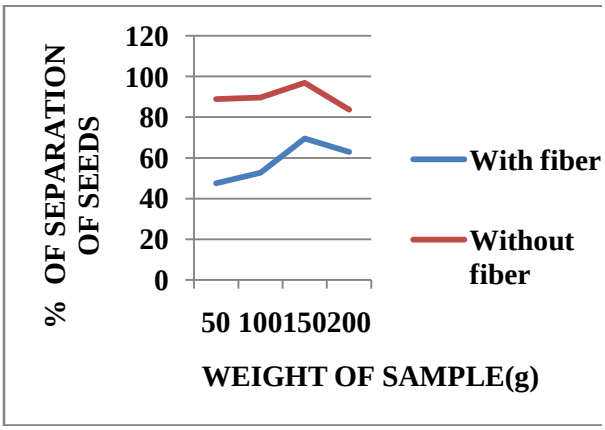

Fig.3.2 Percentage separation at 10% moisture content

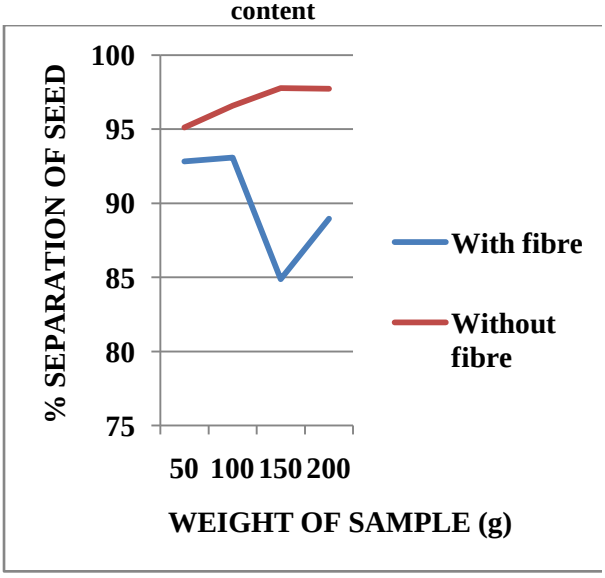

Fig.3.3 Percentage separation at 6.4% moisture content

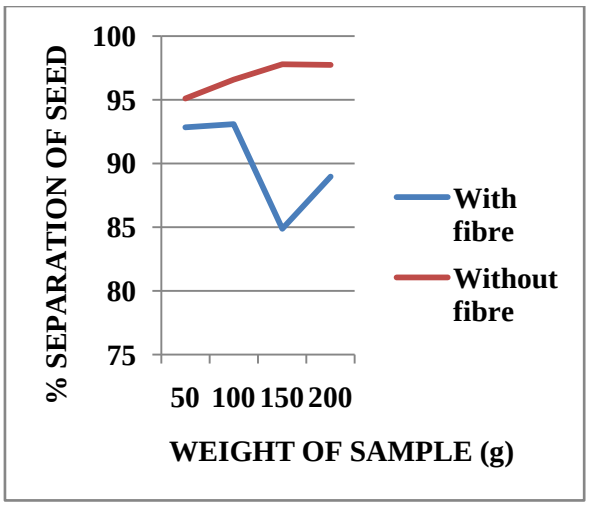

Fig.3.4 Percentage separation at 8.3% moisture content

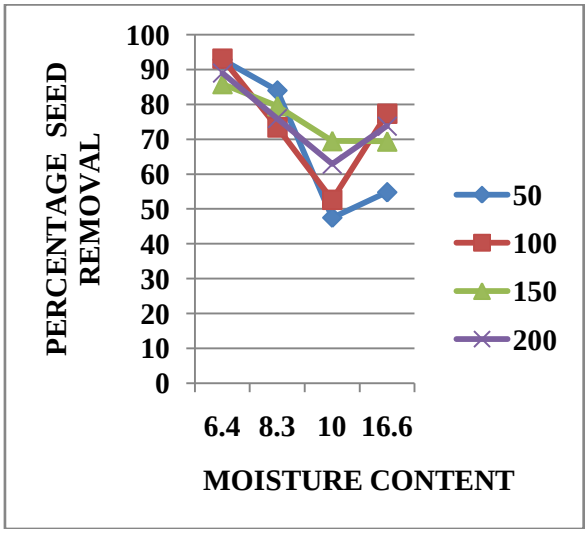

Fig 3.5.Percentage seed removal v/s moisture content for tamarind with fibre

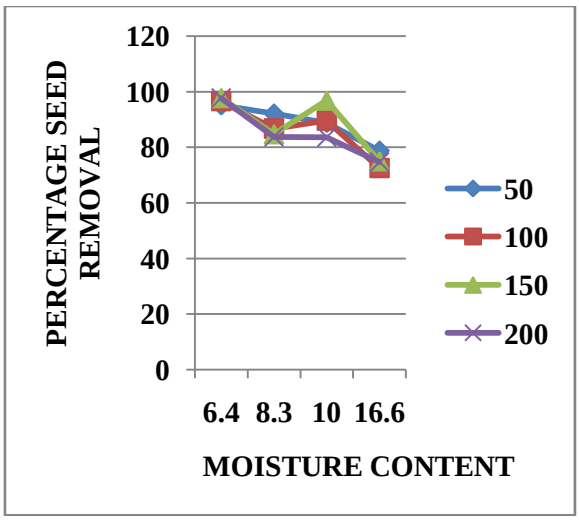

Fig 3.6. Percentage seed removal v/s moisture content for tamarind without fibre

IV. CONCLUSIONS

Tamarind is a seasonal crop hence, its preservation is very important. Mostly preservation is done after removing seed from fruit. For the processing of tamarind, seed removal is also very important. So far there is no efficient mechanism for seed separation. Traditional methods which are commonly used for this purpose are very time consuming, less hygienic, less efficient, causing high structural damage, and requires more number of labour. So the major objectives of this study are to identify a suitable machine for tamarind seed separation, overcome the drawbacks of traditional method, develop a machine which is compact enough to use for household purposes as well as small scale industries.

In order to achieve the above objectives, an experimental set-up was developed and tested. For the sake of convenience, the experimental set up was developed in the research workshop of the Kelappaji College of Agricultural Engineering and Technology, Tavanur..

The oscillating type mechanism consisted of a handle, oscillating sector with pegs, concave sieve, frame and stand. In this mechanism, major parts were made of stainless steel and pegs were made of cast iron.

The working of oscillating mechanism is simple. Tamarind with different moisture contents was selected. Different moisture contents were achieved by hot air oven drying method . Tamarind was kept in oven under 50 to 60̊ C for 3 to 4 hours. Before and after oven drying, weight of sample was noted from which we could find out the moisture content of the sample. The sample was divided into two parts, sample with fiber and without fiber. The test was conducted for different weight sample viz. 50g, 100g, 150g and 200g. Number of seeds present in tamarind were counted and noted. Then, the samples were fed into the sieve. Oscillations were provided using handle. Pegs were attached to the oscillating sector. The time for oscillation was kept constant. The time taken was 1 minute. After oscillation, number of seeds separated from the pulp was counted. Number of non-separated and broken seeds was also calculated. In the first pass itself, most of the seeds were removed. For complete removal of seeds, a second pass was given. Experiment was repeated for different moisture contents, weights and their comparison was done.

The results indicate that the machine has an average efficiency of 80% and has a capacity of 100g/minute. It is more efficient than the traditional method. Labour and time required was very less. This method is best suited for tamarind having moisture content in the range of 6 to 8% (wet basis).

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