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Design and Fabrication Of Pomegranate Aril (PULP) Extractor

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Abstract - The Arils (Pulp) of the pomegranate is usually extracted by means of manual tapping method. The tapping force is provided over the fruit for the extraction of seeds. In juice shops and in hotels the seeds are extracted by means of manual hand tapping. This process involves more time and less hygienic. Until now, every pomegranate is handled manually. The purpose of extracting the arils of pomegranate is either to consume it directly or to be made in to juice. Since there is no domestic appliances for extracting the pomegranate arils and to overcome this difficulties and to make the fruit seeds free from germs this project is made. This project is designed in such a way to be used along with the available mixer setup. Until now there is no small scale aril extraction.
By this project the extraction of fruit seed will be highly efficient and will be hygienic since it is untouched by human hands during extraction process. This method works at an efficiency of 75% and only a small amount of seeds get wasted or damaged during extraction. As a result this project will be highly useful for the juice stalls and hotels since the extraction rate of seed is maximum.

Keywords – nylon material, ss304, motor speed, arils, extraction.

I. INTRODUCTION

Pomegranate is a red fruit with a tough outer layer; only the juice and the arils inside are edible. The pomegranate is a Nutrient dense food source rich in phytochemical compounds. Pomegranates contain high levels of flavonoids and polyphenols, potent antioxidants offering protection against heart disease and cancer. A glass of pomegranate juice has more antioxidants than red wine, green tea, blueberries, and cranberries.

In general, the common technique of extracting the arils of pomegranate is done by manual hand tapping. This process involves more time. Until now, every pomegranate is handled manually.

In mass production, the initiator and driver behind the development of Aril System is Juran Metal Works Ltd., a world leader in the design and development of innovative machinery and processes for industrial, agricultural and food processing applications. It can only be adapted for mass production because of its huge setup, complicated design and cost. It can be no way used for domestic purpose. Pomegranate juicers of large sizes are available but they cannot deseed the arils and are costly for the usage of the cause.

Since there are no domestic appliances for extracting the pomegranate arils and to overcome the difficulties, we have proposed this project. This project is designed in such a way to be used along with mixer setup. Until now small scale aril extraction methods were inefficient, unhygienic. By our proposal extraction of pomegranate arils will be highly efficient, nearly untouched by human hands, and offers a range of new benefits besides

II. EXPERIMENTATION

In order to check the possibility of the working of our project, a normal jar is taken; blade is covered with soft rubber and ran the mixer with cut pomegranates. The output was better than expected; the seeds were got but heavily damaged. This was the basic for our project to proceed forward. The outcome is shown in the fig.1

Figure 1 Outcome of the basic experiment

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III. THEORETICAL CALCULATIONANDEXPERIMENTAL CALCULATION

Usually the mixer motor runs at 15000 to 18000 rpm at no load. This speed is too high for extraction of seeds alone, for that we wanted to know the required speed for the purpose. Force and speed measurement was done. As there were no existing tests to measure this, we adapted a new but simpler testing with calculation.

A. *Load Calculation.*

- To find the force that is required for the extraction of arils in the pomegranate we performed an experiment using load sensor.
- Initially one half of the pomegranate is placed over the device.
- The tapping force needed on the fruit is applied over it as manual tapping.
- Due to the applied load the device will show the value of the applied load.
- From the obtained load value the force that is necessary for aril extraction is calculated using the formula.
- **F = ma**
- Where;
  m, is the mass of the fruitdropped
  a, is the acceleration due the gravity $=9.81 m/s^2$

Sl. No	Mass of the cut pomegranate	Load reading from the load cell output	Total load applied on the Pomegranate	Mean Force
Uni ts	A (gm)	B (gm)	A-B (gm)	(N)
1	110	4020	3910	38
2	110	4035	3925	
3	110	3750	3640	
4	110	3875	3765	
5	110	3935	3825	

Table 1 Load calculation table

Force = ma $= 3.813*9.81$ [$Kg*m/s^2$]

FORCE APPLIED ON THE POMEGRANATE, F = 37.4N

B. *Speed Calculation*

We know that,

Centrifugal force = $(mv^2)/r$

m – Mass of the fruit (gm)

v – Velocity (m/s) = $\pi dN/60$

r – Radius of curvature

Substituting the known values in the above equation we get,

SPEED OF THE STRIKER, N = 1500rpm

IV. SPEED SETTING IN MIXER MOTOR:

Originally the speed of the mixer is about 20000 rpm on load condition and 15000 rpm at loaded condition. The speed of the mixer is controlled otherwise reduced using the regulator. The regulator is connected with the motor externally. The required speed for our experiment is 1500 rpm. On regulator the first node gives the speed of about 400-600 rpm. On 2nd node the speed is about 2400-2500 rpm. On the 3rd node it gives the speed of 5000-6000 rpm.

V. DESIGN AND MODEL OF THE STRIKER

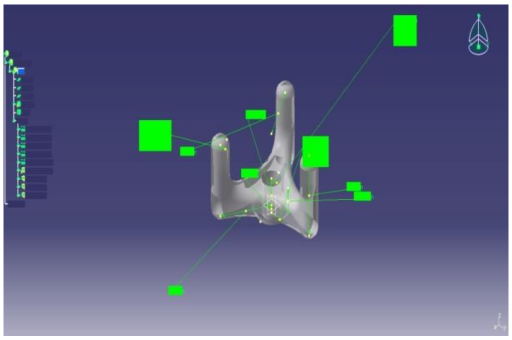

Figure 2 CATIA MODEL OF THE STRIKER

VI. MATERIAL SELECTION

A. *Nylon Material*

Striker of the project is made using nylon material. Nylon is a thermoplastic, silky material, first used commercially

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in a nylon-bristled toothbrush,followed more famously by women's stockings ("nylons"; 1940) after being introduced as a fabric. Nylon is made of repeating units linked by amide bonds and is frequently referred to as polyamide (PA). Nylon was the first commercially successful synthetic thermoplastic polymer. There are two common ways of making nylon for fibre applications. In one approach, molecules with an acid (-COOH) group on each end are reacted with molecules containing amine (-NH2) groups on each end. The resulting nylon is named on the basis of the number of carbon atoms separating the two acid groups and the two amines. These are formed into monomers of intermediate molecular weight, which are then reacted to form long polymer chains.

Nylon is used for mechanical parts such as machine screws, gears and other low- to medium-stress components previously cast in metal. Engineering-grade nylon is processed by extrusion, casting, and injection moulding. Type 6,6 Nylon 101 is the most common commercial grade of nylon, and Nylon 6 is the most common commercial grade of moulded nylon. For use in tools such as the Spurger, nylon is available in glass-filled variants which increase structural and impact strength and rigidity, and molybdenum sulfide-filled variants which increase lubricity.

B. *Stainless Steel*

The shaft material or the spindle is fabricated using the ss304 material. Stainless steel's resistance to corrosion and staining, low maintenance and familiar lustre make it an ideal material for many applications. There are over 150 grades of stainless steel, of which fifteen are most commonly used. The alloy is milled into coils, sheets, plates, bars, wire, and tubing to be used in cookware, cutlery, household hardware, surgical instruments, major appliances, industrial equipment (for example, in sugar refineries) and as an automotive and aerospace structural alloy and construction material in large buildings.

Some firearms incorporate stainless steel components as an alternative to blued or packetized steel. Some handgun models, such as the Smith & Wesson Model 60 and the Colt M1911 pistol, can be made entirely from stainless steel. This gives a high-lustre finish similar in appearance to nickel plating. Unlike plating, the finish is not subject to flaking, peeling, wear-off from rubbing (as when repeatedly removed from a holster), or rust when scratched.

VII. FABRICATION:

On fabrication process the machines used were the semi automatic lathe machine, the VMC milling machine and drilling machine. Before this machining process the design model is made using the softwares(Auto Cad, Pro-E and CATIA). After the 3D modelling the model is imported in the EDGECAM software and the machining sequence are made initially in that software itself. Then the NC codings are generated from it and fed to the CNC machine. Here the machine used is HAAS VMC machine. The machining operation is carried out and the striker is made from it.

Figure 3 A view of the striker machining process

A. *Cam Software*

The software used for simulation of the striker component is EDGECAM. The model was imported as a part into the software and the simulation techniques were carried out and the sequence of operation was chosen and the codings were generated.

B. *CNC Machine*

The machine used for the fabrication is HAAS Vertical Milling Machine. The tool used in the machining process is end mill tool of diameter 14 mm. Roughing and finishing operations are carried out over the striker.

The fabricated parts are shown in the Fig.4, 5, 6

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Figure 4 fabricated striker

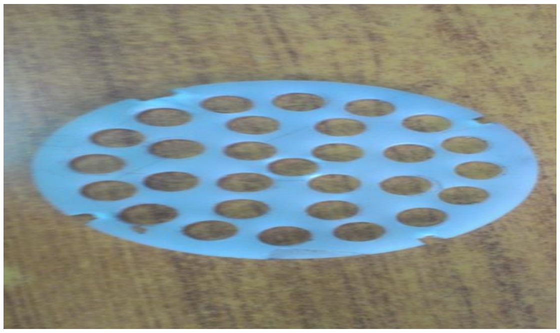


Figure 5 Fabricated grate

Figure 6 Whole Assembly of the Project

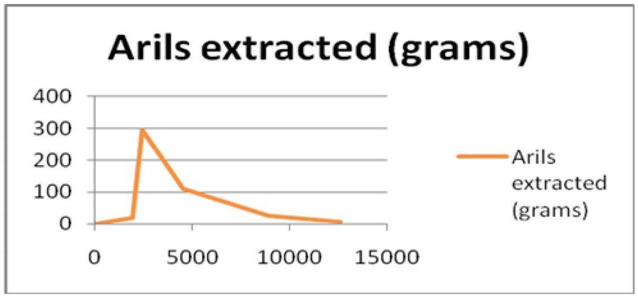
VIII. RESULT AND DISCUSSION

After the fabrication were done, a pomegranate fruit of 380 grams was taken and the process was done

Sl.No.	Node of regulator	Speed (rpm)	Arils extracted (grams)
1	0	0	0
2	1	10	0
3	2	1900	20
4	3	2400	296
5	4	4500	112
6	5	8900	25
7	6	12600	5

Table 2: Output of the extraction process tabulation

From the table the graph was drawn



Graph 1: speed vs arils extracted

From the above table and graph the maximum output of 296 grams were extracted at 2400 rpm approximately.Therefore in this setup 78% arils (pulps)were extracted effectively.

REFERENCES

[1] Jonathan M. Weaver, Nader Zamani, "CATIA *V5 Tutorials: Mechanism Design and Animation*".
[2] KirstiePlantenberg,"*Release 21, Introduction to CATIA V6 Release 2012*".
[3] "*Advanced Milling Training Document Revisions*", V7.0 – Novemeber 2007, General Update for Edge CAM Ver 12.0.
[4] "*StandardTurning Training Document Revisions*", July 2007, Update to include version 11.75 enhancements.
[5] Shigley, J.E. and Mischke, C.R. *Mechanical Engineering Design*, Fifth Edition. McGraw Hill book Company, 1989.
[6] R.S Khurmi, and J.K Gupta , "*A text book of Machine design*", 2008 edition S.Chand publications.
[7] From organic juice USA website (online). Available at http://www.organicjuiceusa.com/prod_pomseed.html
[8] From Youtube videos website (online). Available at https://www.youtube.com/watch?v=2Mkf7Y8cVf0