Automated Simarouba Seed Extracting Machine

[1]Kiran Kumar GN, [2]Suman G, [3]Vaseem M, [4]Vinay B C, [5]Pradeep Kumar Ilay
[1,2,3,4] UG Scholar, [5]Assistant Professor
Department of Mechanical Engineering,
Jain Institute of Technology, Davanagere, Karnataka, India

***Abstract*—New era focuses on solving the problem faced by the farmers in separating the seeds from the Simarouba. Farmers use the manual methods due to inaccessibility of suitable machinery for Simarouba threshing. By manual method of Simarouba seed extraction process, the most of time consuming and labor cost of operation is highly involved. Which involves, by beating the Simarouba heads with a stick, rubbing wear heads against a rough metal surface. The proposal design carried in order to automated seed extraction process. Work is based on modelling by using CAD. A machine which will separate the shell and kernel of the Simarouba seed.**

Index Terms— Modelling, Simarouba seed, Kernel and shell, extraction.

I. INTRODUCTION

Simarouba belongs to the family SimaroubaceaeQuasia. Simarouba (Simarouba glauca DC) is commonly known as paradise tree. It is also known as Simaba, Maruba, Lakshmitaru, Acceituno, Dysentery bark, Pitombaetc, in different country. It is an evergreen multiutility tree that grows up to 150 cm height with tap root system and cylindrical stem. Its native is North America & introduced in India in 1960s.The Simarouba is being promoted in the country as the latest wonder tree which is a source of edible oil that has wide utility. At the village level the plant is cost effective as its farming is nearly zero budget and completely organic, yielding good harvest for almost 70 years the average life span of a full ground tree. The trees usually begin to produce seeds at four to six years of age, while the tree begins to fruit at an early age some plantations have not seen the full potential of about 20kg-50kg of seed until approximately the tenth year. Estimations are that a one hectare plantation of Simarouba glauca can yield about 6000kg of seeds that would provide over a ton of oil. The estimated yield compares well to the yield of current feedstock with exception to Oil Palm that produces about 5 tons per hectare. Table 1 gives a good comparison of S. glauca with other popular feedstock used for the production ofBiodiesel.

Fig.1: Simarouba leaves

Table 1. Comparison of oil yields between common oilseed crops

Type of oil	Oil Yield (kg oil/ha)	Oil Yield (wt %)
Simarouba glauca	>1000	55-65 (seed kernel)
Jatropha curcas	1590	50-60 (seed kernel)
Soybean	375	20
Oil Palm	5000	20

It has shown a very wide adaptability to diverse soil and climate conditions; it also has to its credit other desirable traits such as drought tolerance, non-browsing by animals, and quick recovery from shock. Plus, researchers have reported that the fatty acid composition does not significantly differ from seeds of one country to another. The major fatty acid composition for Simarouba

glauca is between 52-54% oleic acid, 27-33% stearic acid, and 11-12% palmitic acid, a composition that is very similar to that of several feedstock already being used like Jatropha curcas and soybean. Table 2 shows a comparison of popular feedstock fatty acid composition and the fatty acid composition of Simarouba glauca.

Table 2. The major fatty acid composition of Simarouba and popular feedstock

Feedstock				
Fatty Acid	Simarouba glauca	Jatropha Curcas	Soybean	Oil Palm
Oleic	52-54%	43.10%	23.00%	40.00%
Linoleic	-	34.30%	51.00%	10.00%
Palmitic	11-12%	14.20%	10.00%	45.00%
Stiaric	27-33%	6.90%	4.00%	5.00%

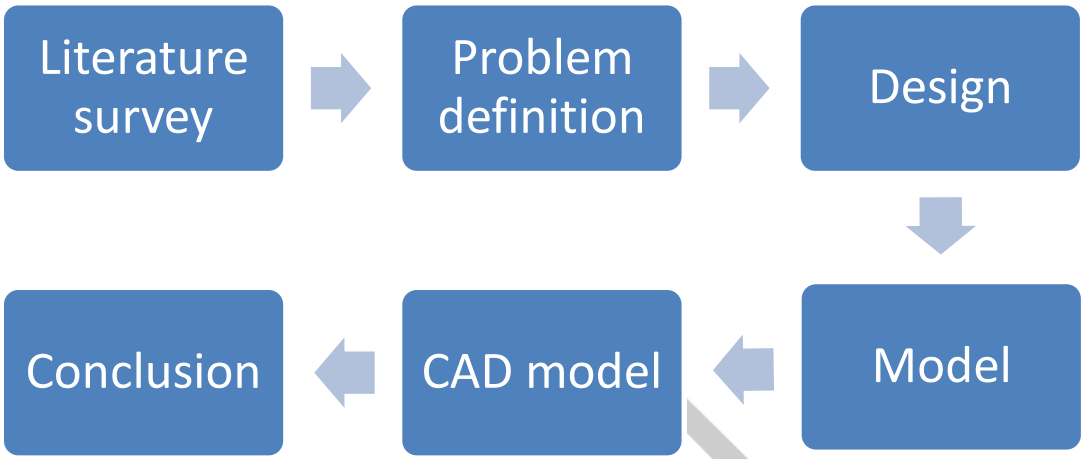
Application of extracting machine

- Extracting of Simarouba seed grains, used for Biofuel purpose.
- Can be used in small scale production of seed extracting.
- The waste shell can be used as manure.

II. LITERATURE SURVEY

According to the experimental analysis conducted by **paper [1]**. The problems which Jatropha curcas seeds (JCS) oil extraction industry is facing in the Northern part of Nigeria; the lack of efficient small scale oil extraction machines. Jatropha curcas seeds oil is essential for production of an environmental friendly fuel that can substitute fossil fuel, a cost effective small scale JCS oil extraction machine was designed, developed and evaluated. So that, the targeted users of the developed prototype machine are the cottage industries. Cottage industries are targeted because they require minimal investment to set up, production is flexible, and it is a possible answer to the unemployment problem plaguing many Nigerians. **Paper [2]**, has designed and fabricated melon depodding machine. This machine was designed for the purpose of manual depodding of melon pods for extracting the edible seeds is a time consuming and tedious operation. The depodding efficiency of the machine varies from 31.9 percent to 82.1 percent while the overall efficiency varies between 13.1 percent and 68.8 percent. At operating speed of 300 rpm, the overall efficiency of the machine is high (68.8%). The machine performed smoothly during the period of operation. **Paper [3]**, did the project on fabrication and testing of combined groundnut roaster oil expeller machine, which was fabricated using locally available materials is portable and efficient. The combination of the roasting and expelling units into one single unit led to an efficient and effective production of groundnut oil, because it reduces drudgery, saves time and improves the quality of the oil produced compared to when there are separate units of these operations. The performance evaluation shows that the roasting and expelling efficiencies were 66.9% and 66.7% respectively. **Paper [4]**, in his paper he had find an effective, drudgery free and less expensive means of groundnut oil production. A combined groundnut roaster and oil extractor for medium scale expression of groundnut oil was designed, fabricated and tested to establish the influence of moisture content, heating time and temperature on percentage oil yield. The machine has a power rating of 5.5KW and extraction capacity of 4kg/hr. with the screw shaft rotating at 60 revolutions per minute and a reduction gear to step down the speed of rotation to ratio of 25:1. The roaster was equipped with; a thermostat calibrated from 0-400^{o}C, a stirrer to create even distribution of heat. Four moisture content levels (6, 7, 8 and 9% wet basis) and heating duration (10, 20, 25 and 30 minutes) were used for the evaluation at four temperature settings 70, 80, 90 and 100^{o}C. The highest percentage oil yields were 41.6, 31.3, 25.5 and 21.2% at 6, 7, 8 and 9% moisture content wet basis respectively were all observed at 1000C with exception of 21.2% observed at 70^{0}C. The machine gave the highest oil yield of 41.6%, an equivalent of 92% when compared to 45% oil content of groundnut, at 100^{o}C, 6% moisture content and heating time of 25 minutes. The observed differences in percentage oil yield were found to be significant at 5% significance level.

III. PROPOSED METHODOLOGY



PROBLEM DEFINITION

In the present scenario an automated seed extraction of Simarouba seeds has been developed by using software CAD. The major advantage of this modelling is to provide overall functioning and essential equipment's needed for extraction of seeds and also by using this modelling an attempt can be further designing process.

DESIGN

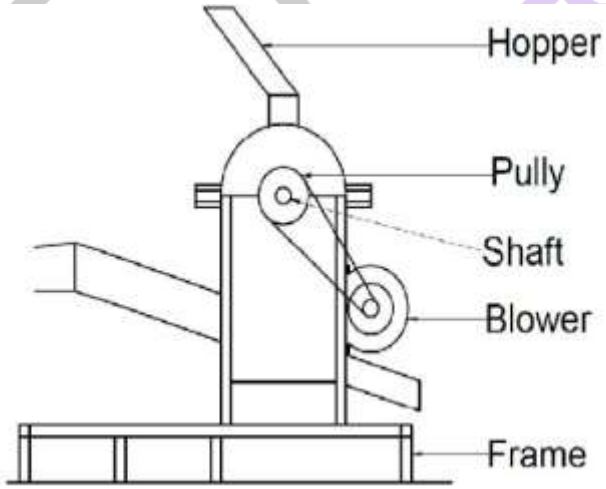


Fig.2: 2-D model of Simarouba seed extracting machine

COMPONENTS OF THE MACHINE (3-D MODEL)

FRAME

Frame is the major support structure of the machine it withstands the load acting on the machine. All the components fabricated are assembled over the frame. The frame is made by using standard sections available i.e. the angle plates which are 81mm×31mm, 25 mm thick and the angle is 90˚ between the adjacent plates. The angle plates are cut to the requirement and welded together for housing the machine components. The figure 3 shows the angle plate and frame fabricated for Simarouba seed extracting machine using them.

Fig.3: Frame

MESH

Figure 4 shows the mesh (sieve plate), which is the major part of the machine helps to crush the seeds, meanwhile it expels the separated kernel and shell with the perfectly dimensioned holes provided on the plate. It has 135mm length and 125mm width, with that the hole has 6 mm width.

Fig.4: Mesh

THRESHING ROTOR

Figure 5 shows the threshing rotor of the Simarouba seed extracting machine. It is the most important part of the machine used to beat and thresh the Simarouba. Here, we are using rubber stripes with an open threshing rotor. 5 sets each welded on the drum which are placed at 72˚ around the circular drum as shown. The length of the each blade is 180mm and its thickness is 10mm.

Fig.5: Threshing rotor

HOPPER WITH CASING COVER

It is the primary part of the machine which is placed on the top of the machine, in this the seeds are fed into the hopper which helps the seeds to flow into the crushing chamber. It is also known as feeding unit.

Fig.6: Hopper

PULLEY

It is a transmitting part which transmits the power from motor pulley to the shaft pulley to rotate the shaft for crushing the seeds. Here 4 pulleys are used to transmit the power and to rotate the blower.

Fig.7: Pulley

With the help of above components and some minor components such has fasteners, the complete assembly of the machine has been showed in the below figure.

The each color indicates the each part of the machine,

Blue ----Hopper with casing cover
Red------Pulleys
Green---Frame
Grey----Fasteners

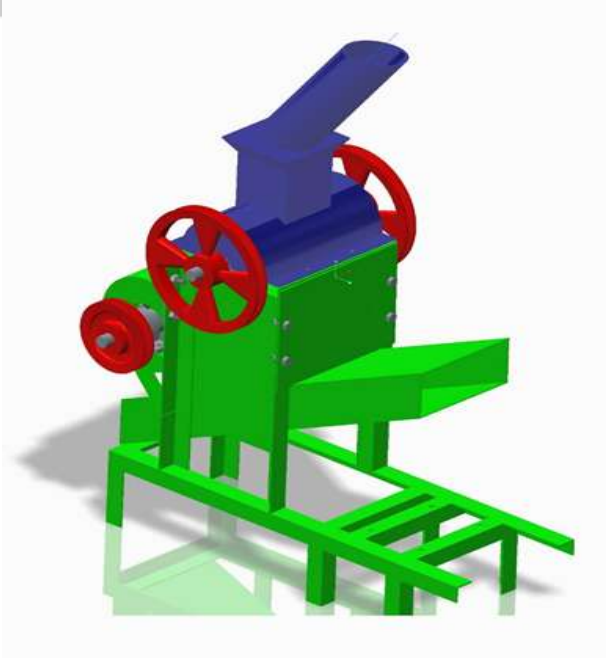


Fig.8: Assembled 3-D model of Simarouba seed extracting machine

IV. Conclusion

In this research work particularly for Simarouba seed extracting machine modelling were developed. The automated machine contains high end performance which meets customer's satisfaction after the fabrication. The modelling of extraction machine which contains easy way to develop and standardized parts which are available readily in the market. Each individual modelling contains standardized material. Simarouba seed oil have good nutritional profile and other physic-chemical properties which got improved after the process of refining, therefore it can be used as potential seed resource for edible purpose and bio-fuel production.

Reference

[1] A. T. Salawu, M. Isiaka and M. L. Suleiman, "Development of an Oil Extraction Machine for Jatropha curcas Seeds",Department of Agricultural Engineering, Ahmadu Bello University, Zaria, Nigeria.Journal of Scientific Research & Reports(4): 313-328, 2015; Article no.JSRR.2015.157.

[2] S. Oloko and L. Agbetoye. "Development and Performance Evaluation of a Melon DepoddingMachine". Agricultural Engineering International: the CIGR E journal. Manuscript PM 06 018.Vol. VIII. August, 2006.

[3] Olawale J. OkegbileAbdulkadir B. Hassan, Abubakar Mohammed, OsigbodiObajulu, ''Design of a Combined Groundnut Roaster and Oil Expeller Machine''.Department of Mechanical Engineering, Federal University of Technology,Minna, Nigeria.International Journal of Science and Engineering Investigations, Volume 3, Issue 26, March 2014.

[4] Olatunde O. B,E. AAjav and Fatukasi S.O, "Design and Fabrication of Groundnut (ArachisHypogaea) Roaster cum Expeller'', International Journal of Science and Technology Volume 3 No. 3, March, 2014.

[5] Zinash D. OSUNDE and KWAYA Philip Vandi, "DEVELOPMENT OF EGUSI MELON SEED EXTRACTOR'',International Conference on Agricultural and Food Engineering for Life (Cafei2012) 26-28 November 2012