

DESIGN AND FABRICATION OF BANANA FIBER EXTRACTION MACHINE

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Abstract - Now a days there is a rapid growth towards the natural fibers. The natural fibers are preferable than artificial fibers because they are highly disposable, mechanical properties and appropriate stiffness. The younger Generation is more concerned about the environment and pollution cost by artificial fibers. The natural fibers like banana fiber are completely decomposable and eco-friendly.

The traditional techniques for extracting plantain Fibers faces various limitations such as more extraction time and fiber productivity rate is poor. The study aims to overcome the limitations faced by using traditional method of extracting plantain Fibers by developing electric machine capable of doing the manual process of extracting plantain fiber. The process used includes selecting suitable design, Materials, selecting, and manufacturing of various components for assembling machine parts.

1. INTRODUCTION

Interest in using natural fiber has increased significantly in recent years. The abundance of nature combined with exquisite craftsmanship is an attractive attribute that makes it an important alternative to potentially toxic synthetic fibers. Natural pant leg fibers have many properties that make them advantageous: low cost, low density, biodegradable, renewable, good mechanical properties and non-toxic.

Today, natural fibers are favored for their reasonable stiffness, mechanical properties and high usability. Pay special attention to machinery Skills; Processing and Automation Mechanisms Involved in plantain fiber extraction Eliminate manual methods and increase Quality and improvement of processing time .Therefore, the purpose of this study was to develop and manufacture one electrical Power Plantain fiber Extractor. This extractor will help reduce the extraction rate of plantain fiber and the human body Work.

1.1 CHEMICAL AND PHYSICAL PROPERTIES OF BANANA FIBER:

- It is biodegradable and has no harmful effects environment, make it eco-friendly fiber.
- Its appearance is similar to bamboo and ramie fibers, But banana fibers are finer and easier to spin.

- According to the extraction and spinning process, it is Has a shiny side
- Available in ring spinning, open-end spinning, the best fiber spinning and semi-worsted spinning Skill.
- It releases and absorbs moisture.
- It has a highly strong fiber with a 3-percentage elongation and light in weight.

1.2 PHYSICAL PROPERTIES OF BANANA FIBER :

S. No	PROPERTIES	VALUES
1	DENSITY	1350 Kg/m ³
2	MOISTURE CONTENT	11%
3	TENSILE STRENGTH	56MPa
4	ELONGATION AT BREAK	2.60%
5	YOUNGS MODULUS	3.5 MPa
6	FINENESS	17.15

Table -1: Physical properties

1.3 BANANA FIBER CHARACTERISTICS:

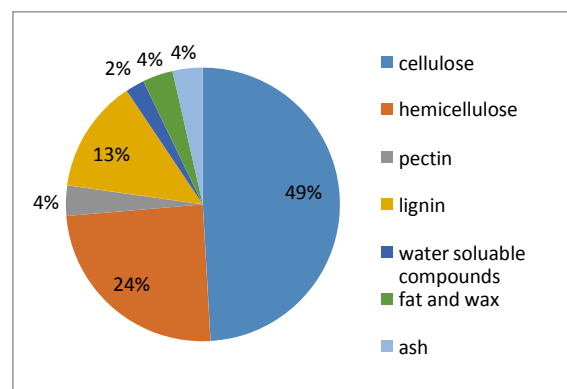
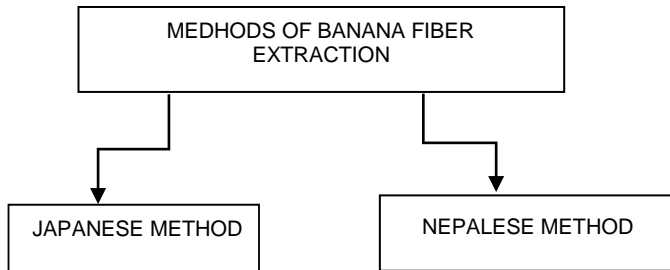


Chart -1: characteristics

2 EXTRACTION METHODS:

The various method of spinning banana fiber into Yarn Differ from one stage to the next. The most widely used methods are those used by Japanese and Nepalese.



2.1 JAPANESE METHOD:

Banana plantings for cloth and other uses were used back in 13th century in Japan. The Japanese method was very intense of taking care right from the stage of land cultivation. The leaves and shoots or cut on regular basis to maintain the banana stem. First the shoots are gathered and cooked in lye to manufacture Yarn. Due to this the fiber is softened in varied degrees. Due to this different kinds of yarn are produced which is used for different purposes. The outer shoot are coarsest which is used for home furnishings like tablecloths, Rugs, etc. The softer section is the inner core of the banana tree which produces elegant fibers which were used in traditional Japanese clothes. This process of manufacturing clothes is expensive, and each stage is done by hand.

2.2 NEPALESE METHOD:

In Nepal instead of using the shoot the trunk is used to extract fibre. yeah, small quantity of the Trunk Are soft Mechanically followed by bleaching and dying Which results To fiber Similar To silk Known as banana silk fibre yarn. In this process the refining, processing and seining the fiber is done by women. To speed up the process the aged bark or Road outer layers of the banana plant are plugged and immersed in water. Now the cellulose remains and all the chlorophyll is dissolved. After Yarn is hand dyed and they have yeah texture similar to silk which is used to Make High end rugs. The traditional rugs are hand Knitted by Nepal women's.

VARIETIES OF BANANA TREES GROWN IN DIFFERENT STATES OF INDIA:

- Ney Poovan- Tamil Nadu, Kerala and Karnataka
- Karpuravalli-Assam, Andhra Pradesh, Tamil Nadu
- Virupakshi-Himachal Pradesh, Assam, Andhra Pradesh, Kerala and Tamil Nadu

- Rasthali- Tamil Nadu, West Bengal, Kerala, Andhra Pradesh, Assam and Mizoram
- Nendran-Kerala, Tamil Nadu
- Robusta-Tamil Nadu, Karnataka, Bihar, Kerala, Jharkhand and Maharashtra
- Red Banana-Gujarat, Madhya Pradesh, Kerala, Jharkhand, Karnataka and Tamil Nadu.

2.3 PROFITS OF BANANA FIBER:

The main source of income in banana tree is Branches and leaves, which can be also used as an organic plate for serving food at Functions, parties and public gatherings. Although they were available methods for extracting such fibers and papermaking from Pseudostem, Companies has yet to utilize them due to high levels transportation fee. However, the potential for extracting fibers from the Pseudostem Are huge. It is predicted that 17,500 ton's of fiber worth of 900 crores can extract annually from banana waste of the banana factory is approximately Rs.50,000 per ton. Due to its restricted use in cottage industries, this fiber is Not able to find a market. This fiber appears a huge potential for commercial use in textiles and paper industry. The banana stem can also be used to make various of high quality products such as bags, rugs, baskets and They have various forms of crafts. In conclusion, banana fibre has a promising future and a wide range of applications in the next years.

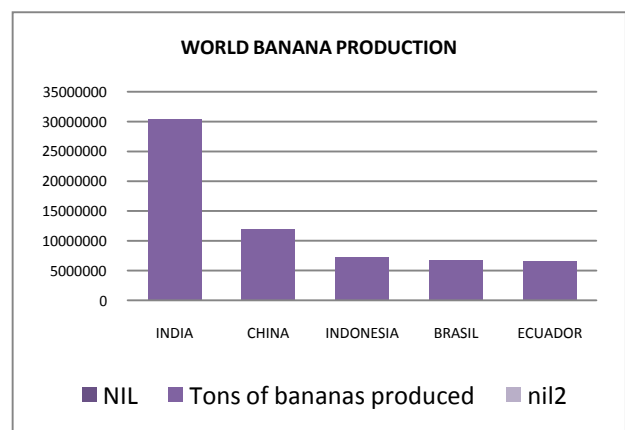


Chart -2 world banana production

3 DESCRIPTIONS OF COMPONENTS:

3.1 STRIPPING DRUM:

Stripping drum is one of the important components in this machine. it is the key component of the machine. The no of blades and type of blades used is also very important as it affects the quality of the fiber. This roller design can easily separate the banana fiber from the banana stem. The diameter of the roller drum is 280mm and has 10 blades.

3.2 MOTOR:

An AC motor of 1.5hp is connected to the shaft which drives the shaft to the roller drum.

3.3 SUPPORTING ROLLER:

It plays the role of guiding the banana stem to the right position. So, it can be even called as guide roller. It is made of mild steel. We need two rollers which is used in the machine. It is 30mm diameter of length 40mm.

3.4 BEARING HOLDER:

It is used to hold the bearing of inner diameter 62mm. it has two holes which is clamped to the stand.

3.5 BEARING

Bearing is selected from the 6206 bearing of outer diameter 62mm and inner diameter 30mm and width 18mm.



Fig -1 : 3d model of machine

4 WORKING PRINCIPLE:

This machine consists of a 1.5HP motor which is connected to a small pulley. The stripping drum is fixed with two bearings in both the end and one side of the shaft is connected to a large pulley. Now both the pulleys are connected to each other using a B type V- belt. It also consists of Guiding roller through which the banana stem is inserted and reaches the stripping drum in an inclined position. Due to the inclination of the slot the pulp generated falls apart from the fiber.

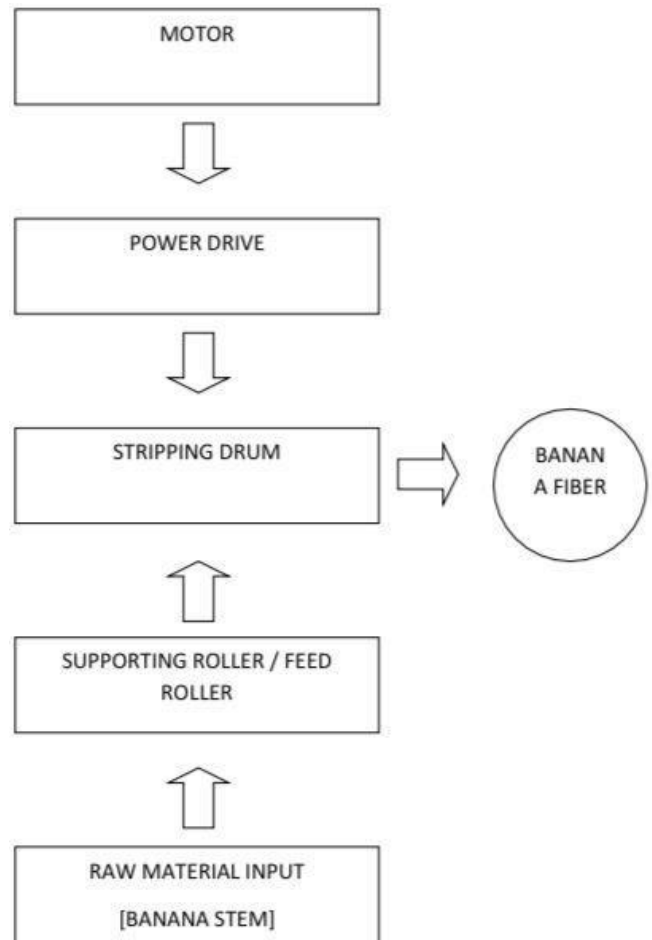


Fig -2 : working chart

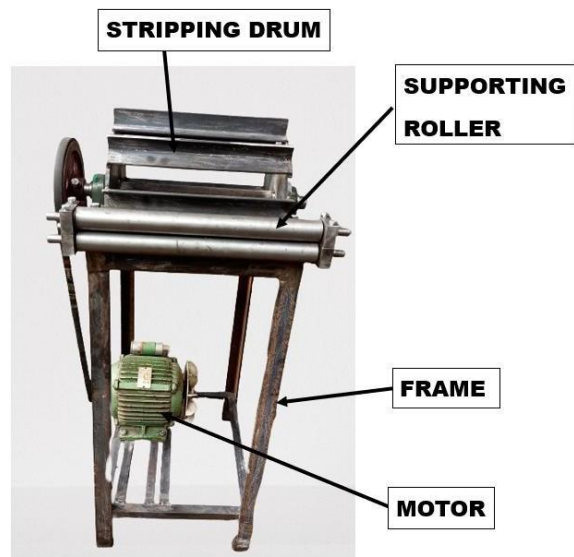


Fig -3: Assembled machine

5 DESIGN CALCULATION

5.1 CALCULATION OF VELOCITY RATIO OF BELT DRIVE:

$$N_2/N_1 = d_1/d_2$$

N1 = rpm of smaller pulley

N2= rpm of larger pulley

d1= Diameter of smaller pulley

d2= Diameter of large pulley

$$d_1 = 0.08\text{m}$$

$$d_2 = 0.2\text{m}$$

As,

$$N_1 = 1440 \text{ rpm of motor}$$

$$N_2/1440 = 0.08/0.2,$$

$$N_2 = 576 \text{ rpm}$$

5.2 CALCULATION OF BELT LENGTH:

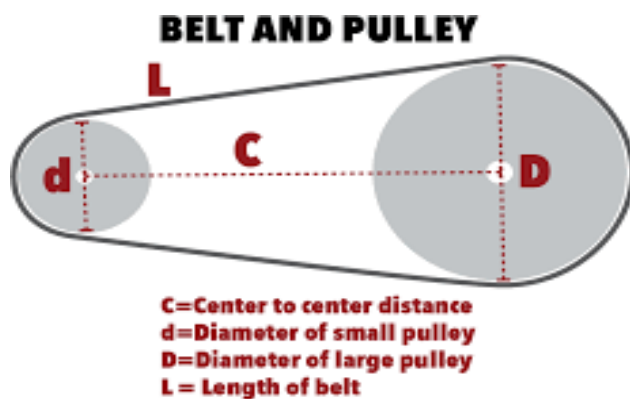


Fig -4: Belt and pulley calculation

$$L = 2C + \pi \left(\frac{D+d}{2} \right) + \left(\frac{D-d}{4C} \right)^2$$

$$L = 2 \times 630 + \pi \left(\frac{200+80}{2} \right) + \left(\frac{200-80}{630} \right)^2$$

$$L = 1260 + 439.823 + 31.111$$

$$L = 1730.933\text{mm}$$

5.3 LENGTH OF AN ARC:

$$L = \frac{360}{\theta} \times 2\pi r$$

But

$$N = \frac{360}{\theta}$$

$$N = \frac{360}{36}$$

$$N = 10$$

6 FINAL REPORT

S.NO	SPECIFICATION	DESCRIPTION
1	MACHINE NAME	BANANA FIBER EXTRACTION MACHINE
2	USES	EXTRACT FIBER FROM BANANA STEM
3	CURRENT TYPE	AC CURRENT
4	NUMBER OF OPERATOR	1 PERSON/ MACHINE
5	MATERIAL INPUT	BANANA STEM
6	OUTPUT MATERIAL	BANANA FIBER
7	MAINTANCE	APPLY OIL AND CLEAN
8	POWER	1.5 hp
9	LENGTH OF MACHINE	470
10	WIDTH OF MACHINE	480
11	HEIGHT OF MACHINE	805
12	DRIVING TYPE	AC MOTOR

Table -2: Specification of machine

6.1 MERITS:

- It has a Simple design
- Machine cost is low
- Low maintains cost
- It requires less area
- Easy handling

6.2 APPLICATION:

- Rope, matting, and other composite materials are
- Banana fiber composite materials are utilized in building and fire-resistant boards.

- Automobile manufacturers employ polypropylene reinforced with banana fiber to make underfloor protection panels in high-end vehicles such as Mercedes-Benz
- Banana fiber is commonly used in handicrafts and home décor

6.3 ASSEMBLED VIEW:

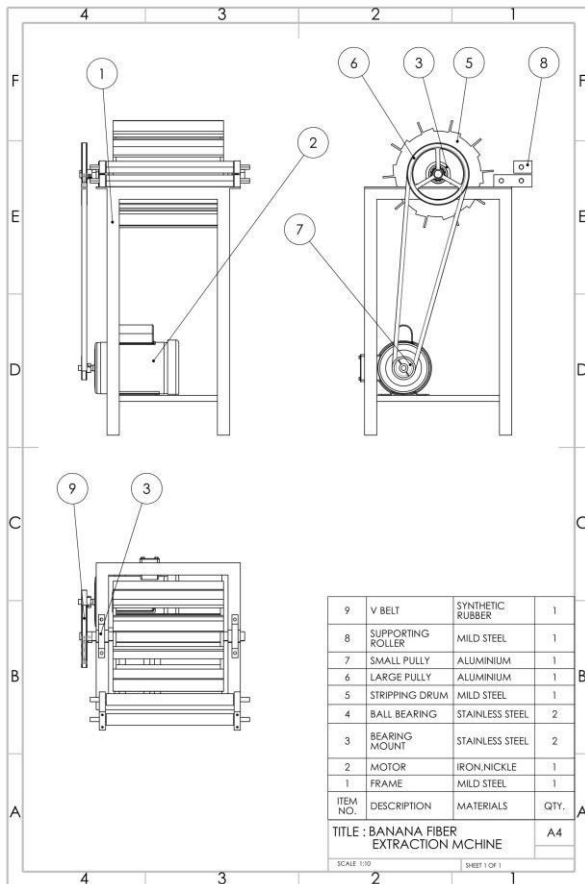


Fig -5: Assembled design



Fig -6: fiber produced by machine

8 CONCLUSION

The new banana fiber extraction machine is designed with higher efficiency. This machine will reduce manual work and is suitable for mass production. Compact structure and easy disassembling will be another advantage. The problem of impurities and knots can be solved with this kind of design. The factors affecting quality of fiber are roller speed; feed angle and clearance also affect the production quantity of fiber. By choosing these factors, correctly quality and production of fiber can be increased.

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