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Design & Fabrication of Banana Fiber Extracting Machine

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Abstract

The present paper is aimed to design and develop a process to extract high quality natural fibers from the banana pseudo stems. Manual extraction of banana fiber produces good quality of fiber but it much time consuming. Labour expense is quite high and output is quite low. Hence efficient extraction of banana fiber can only be possible through mechanization. Now a day's machines exist for extracting banana fiber but are manually operated and cannot be applied for mass production. The other main disadvantages of existing machine are impurities present in rolled fiber. The efficiency of existing machine is average. It consumes time & the process is not safe. This project is specially designed for extracting banana fibre from the banana stem. The machine is designed in a very simple way such that it can be used by everyone, as the mechanism is very simple. The major components used are blade, belt and pulley, motor, and roller shaft. This model is helpful in fibre industries to extract the fibre from banana stem.

Key words: *Banana Fiber Extracting Machine*

I. INTRODUCTION

Banana fiber is environmentally friendly like jute fiber. It has large export demand from many countries like Japan, Australia, Germany and many. Fiber can be obtained from whole banana plant. After the fruit is obtained, the plant is thrown away giving rise to increase in waste. The proper disposal of this plant is another problem. By using a good fiber extractor machine, a large amount of fiber can be obtained which will give rise to additional income. Banana fiber is a best fiber with relatively good mechanical properties due to its high alpha cellulose and low lignin percentage. The Banana Fiber Extractor Machine is first of its kind invented for the extraction of fiber from waste portions of Banana such as stems, leaf stalks and peduncle. The manual (or) semi mechanical extraction of Banana Fiber was tedious, time consuming, and caused damage to the fiber. It is a low cost portable device developed for the benefit of the farming Community and Self-help women group Cost of the Machine varies basing on the iron and steel rates. 100% safety in machine operation with less maintenance cost. Respective State Governments offered subsidy on the machine due to its practical utility. Subsidiary is given by Khadi Village Industries Board and Horticulture Deportment. Production capacity of machine is 25 kg per 8 hrs. Chemical free natural fiber in terms of colour and quality. Special feature of fiber is light in weight and shiny in nature. Banana Fiber tested in production of eco-friendly, chemical free handmade paper and found successful. 100% Chemical free tissue paper, filter, craft paper, paper bags etc., and are some of the products made out of Banana Fiber. Paper made out of Banana Fiber is having very good export potential for European countries. Paper having longevity of 700 years can be made out of Banana Fiber. In some countries Banana Fiber is being used for making of currency paper. Even ladies can easily work on the machine. Banana Fiber extracting machines are of two

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varieties. 1. Single motor-single machine runs with 2 HP single phase motor. 2. Single Motor-Double machines runs with 2 HP single phase motor. They can be run with diesel engines also. You can also make it mobile with slight modifications with little investment.

II. LITERATURE REVIEW

Banana has long been considered a food, fruit and fodder crop. In addition to this, now a day, it is also gaining importance as a source of fibers. India is the largest producer of banana in the world with an estimated annual output of
13.5 million tons, of which 80% is generated from six states, namely, Tamilnadu, Maharashtra, Karnataka, Kerala Andhra Pradesh and Gujarat. Annually about 1.5 million tons of dry banana fibers can be produced from the outer sheath of pseudo stem. With the increasing demand for banana in both the Indian and International markets, the acreage and production are expected to increase in the coming years, thus generating more of the Pseudo stem biomass waste. Being a rich source of natural fibers, the pseudo stem can be profitably utilized for numerous applications and preparation of various products. Thus in order to get acquainted with the earlier reported details of banana fiber production and utilization and blending possibilities, an extensive literature review was carried out. In order to have a clear picture of the banana fiber utilization the literature collected has been further classified under three categories. This consists of studies related to banana fibers and its applications.

Sinha (1973)169 studied on the use of banana plant fiber as a substitute for Jute. Banana-plant fiber is strong, soft, and coarse and technique developed for processing the fiber on standard jute machinery is reported. In some trials the banana fiber was also blended with Mesta (cellulosic fiber). The banana 82 fiber spin ability and weaving performance were invested, so that it can be used as a good substitute for jute in making of sacks and packaging materials. The yarn composed of entirely of banana fiber can replace jute on weft, sacking warp yarn and still maintain the standard cloth characteristic Banana.

The study also affirmed that sacking fabrics woven with banana-fiber yarn as weft and with jute yarn in the other direction compiled with standard specifications and performed better than corresponding all-jute fabrics. Jute Technological Research Laboratories, (JTR Lab) Calcutta73, carried out an experiment work, (1974) on rope making with banana plant fiber. It was concluded that banana fiber can replace certain percentage of Mesta, a cellulosic fiber in the composition of agricultural opes

DIFFERENT DIAMETER UNTREATED BANANA FIBERS MECHANICAL PROPERTIES

Diameter Range(mm)	Diameter(mm)	Young's Modulus (Gpa)	Ultimate Strength(Mpa)	Strain(%)
0.07-0.105	0.0874	25.6	780.3	2.68
0.105-0.140	0.1328	13.7	300	1.93
0.140-0.175	0.1563	11.3	198.9	1.79
0.175-0.210	0.1925	6.6	222.3	3.27

EXTRACTION RATE FIBER IN SEVEERAL PLANT SPECIES

Fiber	Extraction(%)
Bagasse	4.00
Feuille de bananier	9.84
Tron de bananier	4.46
Coco	8.77
Tissu de coco	1.74
Eucalyptus	8.20
Sisal	1.33

Fig. 1:

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III. CURRENT PROBLEM

Fig. 2:

The current problem of this machine is feeding. The angle of feeding is somehow difficult and there is forced push also required. This may sometimes cause damage to the worker and also difficult for beginners. Another problem is the weight and portable difficulty.

In this casing is done by metal, so it is difficult to see inside what happening. It is replaced by fiber casing.so it is used to see inside and also reduces weight and cost.

IV. CONCLUSION

The major components involved in the design and the fabrication of the BANANA FIBER EXTRACTING MACHINE are as follows,

1) Roller
2) Frame
3) Motor
4) Bearing
5) Pulley

A. Roller

Roller is the most important element in this machine. It applies necessary squeezing force on pseudo stem of banana separating the pulp, leaving only the fiber. Type of the roller used mainly affect the quality of fiber. When comparedextraction fiber unit, the roller could separate a good texture of banana leaf sheath. While saw tooth bar type made damage to the texture. So in our model, we are going to use normal blade rollers**.** The clearance between the rollers is 5 to 8mm. The thickness of the pseudo stem is 10mm to 15mm.so, clearance is enough. There are two fixed rollers for feeding and another one is rotating roller in which the rotating
roller is the maximum size roller.

1) Roller outer diameter is 140mm (with blades)
2) Roller inner diameter is 120mm

To keep the torque constant, inner diameter is 80% of the outer diameter.

B. Frame

This is made of mild steel and sheet metal material. The whole parts are mounted on this frame structure with the suitable arrangement. Boring of bearing sizes and open bores done in one setting so as to align the bearings properly while assembling. Provisions are made to cover the bearings with grease.

C. Motor

An electric motor is a machine which converts electrical energy to mechanical energy. Its action is based on the principle that when a current-carrying conductor is placed in a magnetic field. It experiences a magnetic force whose direction is given by Fleming’s left hand rule.

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D. Ball Bearings

Ball bearings, as shown below, are probably the most common type of bearing. They are found in everything from inline skates to hard drives. These bearings can handle both radial and thrust loads, and are usually found in applications where the load is relatively small. In a ball bearing, the load is transmitted from the outer race to the ball, and from the ball to the inner race. Since the ball is a sphere, it only contacts the inner and outer race at a very small point, which helps it spin very smoothly. But it also means that there is not very much contact area holding that load, so if the bearing is overloaded, the balls can deform or squish, ruining the bearing.

E. Pulley

A fixed pulley has an axle mounted in bearings attached to a supporting structure. A fixed pulley changes the direction of the force on a rope or belt that moves along its circumference. Mechanical advantage is gained by combining a fixed pulley with a movable pulley or another fixed pulley of a different diameter. The material of the pulley is mild steel because during operation the pulley is out of the processing area. The processing area is covered by the fiber casing.

CONCEPT DRAWING

A. Banana Fiber Extracting Machine 2d Drawing

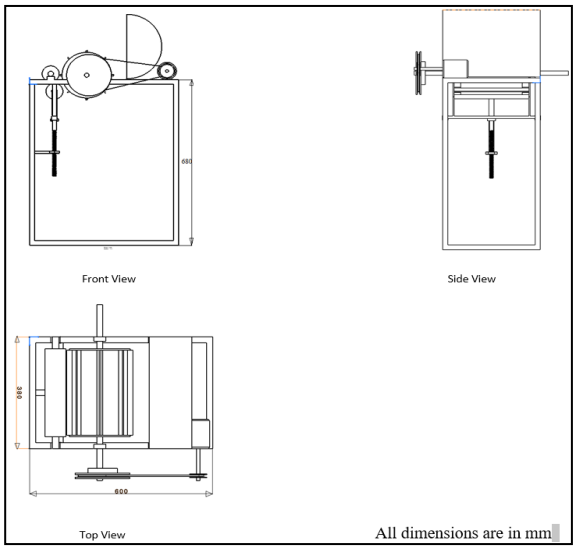

Fig. 3:

B. Isometric View

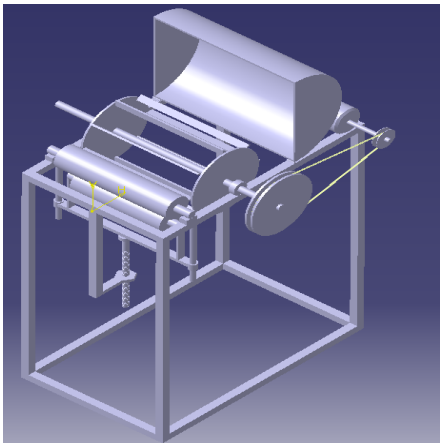

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Fig. 4:

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Fig. 5

V. WORKING

Its working is a very simple one and easy one. This is comparatively simple when compared to the previous model. It is weight less one and have an easy feeding process.it consists of two fixed rollers for feeding and a one rotating roller. Other than this, it consists of two pulleys, two bearing, one shaft, supports and cashing. It is simple machine consisting of single roller which rolls on fixed support. 1hp motor is used to provide input power to machine. The machine reduces labor work and increases fiber production by 20-25 times as compared to normal machine. The motor starts and rotate the driver pulley and power is transmitted to the driven pulley through the power transmission by belt. After, it rotates the roller. Now the sized stem is feed through the two rollers. The machine is constructed with a ac motor to rotate, attached with a rotating shaft and this is coupled with blades. When the banana stem is pushed into the fiber extractor with the help of two rotating shaft, when the banana stem is inserted into the extractor the blade which rotates with the help of motor.it continuously rotates and shattered the banana stem and extracts fiber. After shattering banana stem in the working area by using the blade attached with motor shaft after the process finished then banana fiber is carried out in the extractor. The fiber is then used for industries. *Full Picture*

VI. CONCLUSION

The new banana fiber extraction machine can be 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. The project carried out by us made an impressing task in fiber industries. It is very usefully for the workers. This project has also reduced the cost involved in the concern.

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