

Design and Fabrication of Coco Pith Block Making Machine

Prasad M. Pawar, Pooja S. Gurav, Mrunali S. Raut, Pratik P. Shinde

Abstract: Small scale industries play a major role in the economic development of India. To enhance its growth and to effectively utilize the renewable energy, waste products to be reused one such product is coir pith. Coir is mainly used in exporting and in agricultural field, as it is good absorbent of the water. It maintains the moisture content of the pith to enhance the quality of the product. The Konkan as well as coastal region has a tremendous plantation of coconut trees. Coconut trees are known as 'Kalpavruksha' i.e each n every part of it is useful. The industries manufacturing coir ropes as their main output stores coco pith which is the left over product after the production of the coir ropes, as waste material and sold to the outer agencies at a very cheaper rate. We have designed and fabricated a machine to make the blocks of the coco pith. We have designed a machine in minimum possible cost, less work space, and portable which can be used in small scale and household use also. We have applied pressure of about 4bar using a lead screw, which is driven with the help of chain drive. Analysis for lead screw for static and torsional loading is done in which maximum stress intensity for static loading is $1.3684e+009$ Pa and for torsion loading $1.2467e+009$ Pa. Maximum equivalent stress in static loading is $1.1879e+009$ Pa and for torsional loading is $1.1732e+009$ Pa.

Index Terms: Coco Pith, Lead Screw, Portabl.,

I. INTRODUCTION

Highlight The intention of the proposed project is to develop a product that satisfies the society by its usage, less consumption of energy, development of the small scale industries and Agriculture. Coir pith is one such product mainly used in agriculture, exporting and in processing industries. Coir is made from the fiber found between the husk and the outer shell of coconuts. It is a relatively new growing medium that is becoming popular throughout the world in growing mixes and as a substrate for hydroponics. Small scale industries create innovative ideas to accompany the agricultural field to enhance its growth. The demand of coir and coir products is slowly decreasing and that other profitable markets have to be found for this commodity. The best way to bring the existing coir industry to a higher level is the development of new coir products with higher added value.

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One possible technology that could fulfill this goal is the use of coir fiber in exporting and in agricultural areas. Coir has high lignin content which prompt to fighting against the bacterial and fungal activities. So that it can be effectively utilized in the agricultural field as a well suited potting agent. Coir Pith briquetting is done with the help of pneumatic piston rod. Pneumatic source is effectively utilized in the briquetting

Technology, different type of pressing are Piston and Ram and Screw briquetting.

At present two main high pressure technologies: Ram or piston press and screw extrusion machines are used for briquetting. The briquettes produced by a piston press are completely solid, screw press briquettes on the other hand have a concentric hole which gives better combustion characteristics due to a larger specific area. The screw press briquettes are also homogeneous and do not disintegrate easily. The pollution problem is become so acute, that the State Government of Tamil Nadu has banned the burning of loose Coir in southern areas. It is very likely that other States in India will soon follow this policy. The users are advised to use coir either as briquetted material or in fluidised bed boilers with proper pollution control measures. On the basis of compaction, the briquetting technologies can be divided into:

- High pressure compaction
- Medium pressure compaction with a heating device
- Low pressure compaction with a binder.

1.1 COIR PITH:

India is the largest coir producer in the world accounting for more than 80 per cent of the total world production of coir fiber.



Figure 1: Coir Pith

The coir sector in India is very diverse and involves households, co-operatives, NGOs, manufacturers and exporters. The development of coir industry has all along been in areas where there is a concentration of coconut trees and availability of coconut husk. Historically, the coir industry started and flourished in Kerala which has a long coast line, lakes,

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lagoons and backwaters providing natural conditions required for retting. However, with the expansion of coconut cultivation, coir industry has picked up in the States of Tamil Nadu, Karnataka, Andhra Pradesh, Orissa, West Bengal, Assam, Tripura, Pondicherry and the Union Territories of Lakshadweep and Andaman & Nicobar Islands through the efforts of Coir Board. The production and processing methods in coir industry still continue to be mainly traditional. For instance, spinning is primarily carried out on traditional ratts which require repeated walking, forward and backward.

Coir Pith is purely a natural organic product and it is biodegradable and eco-friendly. It is a by-product gained during extraction of Coir fibre from coconut husk .It is free from any admixture heavy metals. It is a mixture of corky cellular material and short fibers and has both the appearance and feel of peatmoss. It is sometimes also called as Coco peat, Coir peat or Coco.

Coir Pith has remarkable capacity to absorb moisture. Its high water holding capacity is equalled to sphagnum peat and the drainage is similar to that of peat. Its qualities include absence of weed and pathogen besides being physically resilient capable of withstanding the compression associated with baling better than peat.

1.2 Advantage of Coco PITH:

A Superior Planting Medium

- Environmentally Safe
- Economical
- Organic
- Biodegradable
- High water holding capacity - i.e. upto 5 times its volume
- Provides better aeration and enhances strong and healthy root growth.
- Resistant to bacterial and fungal growth.
- Retains and releases nutrients for extended period of time.
- Uniform texture and consistency.
- Better yield.
- Odourless.
- Environment friendly.
- Enhances the organic content of the soil if mixed with soil.
- Free from pathogens, weed seeds and toxins.

1.3 Application:

As a substrate for floriculture and horticulture crops.

- As a potting mix.
- As a soil conditioner/improver
- As a rooting media
- For golf courses and nursery polybags
- As a mulch



Figure 2: Plantation in Coir Pith

1.4 Properties:

1. Increased Air Porosity.

Coir being fibrous in nature holds many air pockets which helps the crops to root easily and Profusely. This increases the surface area of root system thereby facilitating better absorption of nutrients from soil.

2. Good Water Retention

Absorbs water rapidly and holds it for longer periods preventing desiccation of plants during hotter climates especially in tropical areas.

3. ECO Friendly Component of Soil

Coir amended soil combats bacterial and fungal infections. Coir has a plant origin and therefore 100% bio degradable. Periodical release of nutrients from coir helps to keep the soil rich for all seasons.

4. Reduces Irrigation Frequency

Irrigation of coir-grown plants may be done at longer intervals as the moisture holding capability of coir is high.

5. Period of Use

It Can Be Reused For upto 4 Years.

1.5 Indian Demand

Coir pith, generally exported in brick form, has caught on well as a natural soil conditioner and has generated good demand from Australia, the UK and other Western countries .Compost and coir have different chemical and physical characteristics than peat. Supplemental fertilization will require some fine tuning. None of the peat substitutes tested, with the possible exception of coir, are suitable for producing certified nursery material for export. All are produced or stored on the ground, and this is not allowed for export media. The organic materials appear, however, to have good potential for production of nursery stock for local consumption.

Coir pith is sourced from various de-fibering units in South India and only low sodium sources of coir is selected to make the blocks. The coir pith is cleaned and sieved before it is briquetted into a 650gms or a 5 kg block. It is free from weeds and pathogens and are within safe EC and pH standards. Coir pith is free from all soil diseases

And it offers high resistance to most of the inherent root diseases. By using coir pith blocks it ensures high oxygen levels for drainage properties. Use of coir pith blocks will bring down seedling development production cycles rapidly. It can be used as a substitute for peat moss, for Horticultural purposes and it can also be used for green houses, commercial and domestic gardening. World over more and more growers have started using coir pith blocks in the place of peat moss.

Organic manures have been used successfully in enhancing the productivity and yield of various agricultural crops. India is one of the major coconut cultivating countries and the by product, coir pith, has gained importance owing to its properties for use as a growth medium in agriculture. Coir has come a long way from the ancient uses. It is still used for agricultural and domestic purposes. It has also become an article of use in modern life either as garden article, as bags for the tea leaves, for training hops, as brush mats at the door steps, as long-wearing carpets in the corridors of the bungalow veranda, as tastefully planned floor coverings in the drawing room or as the runner on the staircase, as geo-fabric for controlling landslide or soil erosion, for protection of embankments of roads, railway and canals.

II. OBJECTIVES

The project objectives as follows:

- To make blocks of peat which will be handy.
- To provides facility for small scale industries in minimum possible cost.
- Use less human efforts and impose max pressure.
- Portable.
- To design and analyse the prototype.

III. LITERATURE REVIEW

Several researches are done on the coir among which, The suitability of coir fibers as an alternative material in making pulp and paper were investigated and found that coir fiber has felting power comparable to hardwood, have good flexibility and Runkel ratios. [1], The fertile growth of plants during the summer season, in dry lands and also at the time of deficiency of minerals in the soil can be avoided using coir pith product. A new technique proposed for maintaining the growth of plants in the potting medium as coco pith is good absorbent of water [2], investigation was conducted to assess the effect of coir geotextiles on the performance of subgrade soil; coir fibers provide a reinforcement action to the subgrade soil [3]. The main objective of this fast track project was to determine the potential use of Coir Fiber in Composites by Delft University of Technology[4]. Coir is processed in an economical ecofriendly way, and friendly to the nature, Coir Board promoted the use of coir geotextiles in the field of soil erosion control. [5]. Coir pith being light in weight can be easily carries away with air, to avoid this making blocks and briquettes can help in storage as well as transportation.

IV. PROBLEM DEFINITION

The prototype we are manufacturing is enable to use in domestic as well as in industrial purpose by changing the

parameters. It is specially designed to make blocks of coco pith. The industry we visited stored the cocopeat as waste on the open grounds. The peat is light in weight and can be carried away easily by air. Block making reduces the storage space as well as the air pollution.

V. METHODOLOGY

5.1 Design Methodology

1. Establishing objectives.
2. Problem statement.
3. Scope of project.
4. Collecting data.
5. Basic structure of the model and drawing.
6. Design the required component of the model.
7. Collection of components.
8. Fabrication of model as per drawing.
9. Mounting of component and necessary connections.
10. Testing of model.
11. Conduct modification if required.
12. Plotting of results.

5.2 Working Methodology

5.2.1. Drying of Fiber:

Initially the fiber of the coco are dried so it will be easy to remove the powder from the fiber. Drying is done by means of sunlight instead of electrical energy by effectively using it without wasting the electricity. Clean coir has natural rooting hormones and anti-fungal properties.

5.2.2. Seperation of pith:

After drying the fibres are separated according to the quality, so that low quality fibres are used for the purpose of making the preserver sponge. Coir dust is the spongy, peat like residue from the processing of coconut husks for coir fibre. Also known as coco peat, it consists of short fibres around 2%-13% of the total and cork like particles ranging in size from granules to fine dust.

5.2.3. Powdering of the fiber:

Separated fibre is taken and dropped into the revolving drum studded with metal spikes that comb the fibres out. Then grinding the fibre to required consistency, filtering and pressing. Grinding mechanism consist of nested bowl with spikes attached to single phase induction motor so that motor rotates the bowl and the powered pith fall in to the filter.

5.2.4. Filtration:

Filtering of the sand dust and waste material is done in the filtering process and the powder is transferred to the die.

5.2.5. Compaction:

The pith in the die is pressed using the lead screw in which the downward stroke is used for compressing the coco pith and after getting the desired effect block is taken out from the bottom of the die.

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Figure 3: Coco Pith Blocks

VI. COMPONENTS USED



Figure 4: Project Model

6.1. Lead Screw:



Figure 5: Screw Jack

A lead screw also known as a power screw or translation screw, is a screw used as a linkage in a machine, to translate turning motion into linear motion. Because of the large area of sliding contact between their male and female members, screw threads have larger frictional energy losses compared to other linkages. They are not typically used to carry high power, but more for intermittent use in low power actuator and positioner mechanisms.

Square thread:

Square threads are named after their square geometry. They are the most efficient, having the least friction, so they are often used for screws that carry high power. But they are also the most difficult to machine, and are thus the most expensive.

Advantage:

- Maximum efficiency
- Minimum radial or bursting pressure on nut. As there is no side thrust, the motion of nut is uniform and life of nut is also increased.

6.2 Chain Drive:



Figure 6: Chain Drive

Chain drive is a way of transmitting mechanical power from one place to another. It is often used to convey power to the wheels of a vehicle, particularly bicycles and motorcycles. It is also used in a wide variety of machines besides vehicles. The power is conveyed by a roller chain, known as the drive chain or transmission chain,^[1] passing over a sprocket gear, with the teeth of the gear meshing with the holes in the links of the chain.

6.3 Motor:



Figure 7: Motor

An AC motor is an electric motor driven by an alternating current (AC). The AC motor commonly consists of two basic parts, an outside stationary stator having coils supplied with alternating current to produce a rotating magnetic field, and an inside rotor attached to the output shaft producing a second rotating magnetic field.

The rotor magnetic field may be produced by permanent magnets, reluctance saliency, or DC or AC electrical windings.

6.4 Switch:



Figure 8: LT control switch

In electrical engineering, a switch is an electrical component that can "make" or "break" an electrical circuit, interrupting the current or diverting it from one conductor to another. The mechanism of a switch removes or restores the conducting path in a circuit when it is operated. It may be operated manually, for example, a light switch or a keyboard button, may be operated by a moving object such as a door, or may be operated by some sensing element for pressure, temperature or flow.

LT control switch A-16 Reversing
AMPS: 16 440 VOLTS
PHASE 3 CYCLE: 50

VII. ANALYSIS AND TESTING RESULTS

In the stress analysis process, we define the material, the boundary conditions (consisting of loads and constraints), specify contact conditions, and optionally, mesh preferences. Once these criteria are entered, we can run the simulation and view the behavior relative to the conditions we defined. With Inventor Stress Analysis, we quickly perform various simulations using the break through adaptive technology. You can perform parametric dimension studies on models to examine the effects of geometric variables on your designs. Simulations help us identify performance issues and find better design alternatives.

7.1 Analysis on Lead screw:

Testing the power screw for static and torsional loading, to check the failure of the screw under loading conditions.

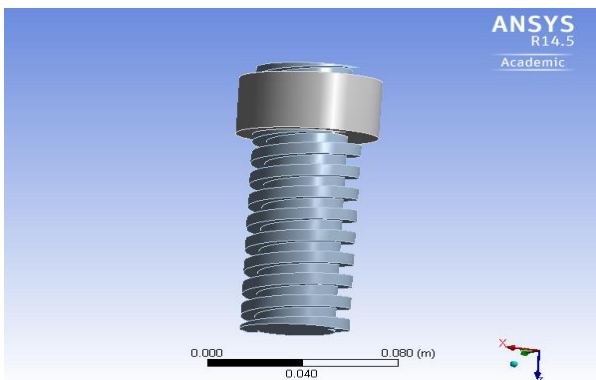


Figure 9: Lead Screw

7.1.1 Static loading:

Magnitude: 8.3kN

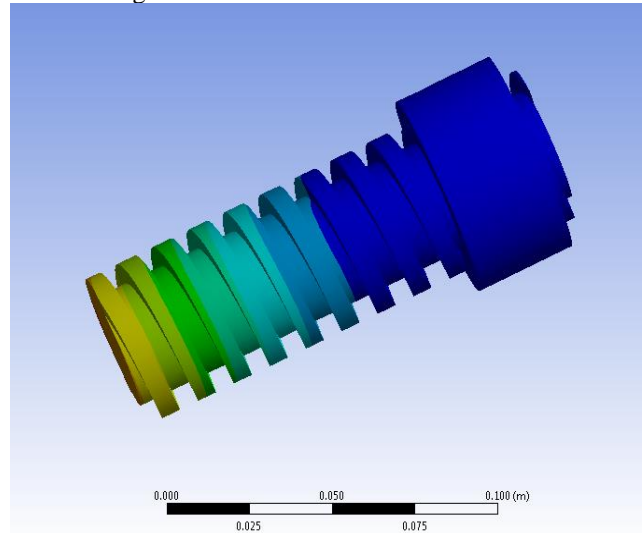


Figure 10: Directional Deformation

Result:

Definition				
Type	Directional Deformation	Equivalent (von-Mises) Stress	Stress Intensity	Maximum Principal Stress
Results				
Minimum	-4.293e-007 m	26697 Pa	29175 Pa	-6.3612e+007 Pa
Maximum	4.1697e-005 m	1.1879e+009 Pa	1.3684e+009 Pa	1.2265e+009 Pa

7.1.2 Torsional loading:

Magnitude: 536.88 Nm

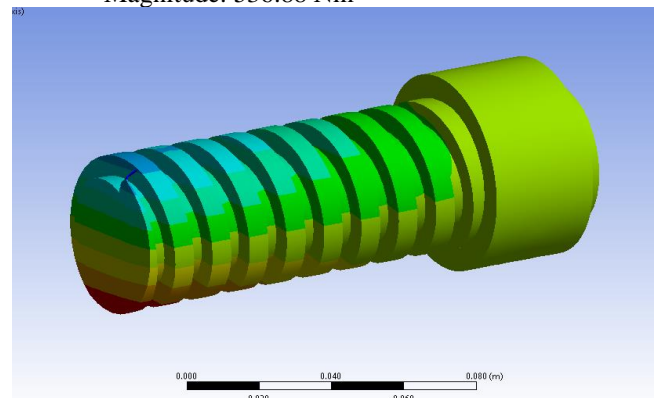


Figure 11: Torsional Deformation

Result:

Definition				
Type	Directional Deformation	Equivalent (von-Mises) Stress	Stress Intensity	Maximum Principal Stress
Results				
Minimum	-4.2732e-004 m	13814 Pa	15506 Pa	-4.9039e+006 Pa
Maximum	3.2847e-004 m	1.1732e+009 Pa	1.2467e+009 Pa	1.2906e+009 Pa

VIII. CONCLUSION

The technology proposed in this paper helps to develop the product with less consumption of electricity and labors. The fertile growth of plants during the summer season, in dry lands and also at the time of deficiency of minerals in the soil can be avoided using coir pith product.

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