

Development of Cloth Bag from Areca Cotton Blended Fabric - An Alternative to Plastic Bag

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Abstract:- Nowadays, natural fibre has become a matter of discussion in the research field amongst various scientists instead of the use of synthetic fibres. This is due to various advantages associated with natural fibres like eco-friendly, low cost, availability in abundance and its biodegradability. Areca catechu is commonly known as areca nut or betel nut. It is widely grown as a cash crop. It is cultivated plant in eastern countries like India, Bangladesh, Malaya, Philippines and Japan. It had an important place as a pharmaceutical in Ayurveda – the ancient Indian system of medicine also in Chinese medical practices. Here is an attempt made on the making of cotton and areca blended cloth bag, a replacement for the plastic bags. It is beneficiary for the farmers, as the unused areca husk is used for the fabric formation. Areca nut is processed in dry condition by peeling the outer shell completely. The present research work emphasizes the development of cloth bag instead of plastic bags. Yarn is formed from the cotton and areca fibre blend. Fabric is woven with different weave structure and with the same proportion, suitable for making a cheaper cloth bag.

Keywords:- Arecanut, Natural Fibre, Cotton, Cheaper, Cloth Bag.

I. INTRODUCTION

Areca belongs to the species *Areca catechu* L., under the family palmecea and originated in the Malaya peninsular, East India. Major industrial cultivation is in East India and other countries in Asia (1). It is now everywhere in India being largely wasted except for being used as an inferior fuel, mulching and manure. These natural fibres are essentially composed of cellulose, hemicellulose, lignin, pectin, wax, and ash. The compositions basically depend on the geographic origin, agricultural condition, fibre extraction, and processing technique (2). Both fine and coarse fibres are available in the husk. Different properties of fine areca fibre have been analyzed for qualifying its ability to convert into spun yarn. Fine areca fibre has good physical properties in terms of length, water absorption, maturity level which makes it suitable for spinning (3). Tamil Nadu's ban on plastic items came into effect from January 1, 2019. The Tamil Nadu Pollution Control Board (TNPCB) has listed plastic products, including plates, cups, bags, plastic packaging material, plastic-coated items etc. So, it is mandatory to use cloth bags. If an easy and effective processing method for these materials is developed, it will make them more

amenable to industrial and other applications. It will create more demand and will help the farmer community. The present proposed work is about efficient use of this rural biowaste, into a successful fabric formation and development of cloth bags which are in highly demanding as ecologically sound materials.

II. MATERIALS

➤ *Areca Nut*

Areca nut is cultivated in Thondamthur block, Coimbatore. Sumangala (VTL- 11) variety was collected. A quantity of 5 kilograms of areca nut was purchased. The fibre was later separated from the nut.

➤ *Cotton Fibre*

The cotton was purchased in the local market of Tiruppur district. Around 5 kilograms of cotton fibres were purchased.

• *Specifications:*

Type: MCU-5, Mic: 4, Length: 32.5-33 mm, Strength: 23.77(G/Tex), Grade: Fine.

III. METHODS

➤ *Fibre Collection From Outer Shell*

Outer shells after removal of nuts were collected from the farmers. The collected shells were kept inside a water tank for degrading of the shells for about 20 days. During this period, the hard shells became soft by absorbing water. The shells were taken from the water tank, and dried. Then they were beaten up in Areca extraction machine which helps the fibre to open well. The open fibres were kept under the sunlight for dry. The collected fibres have both hard and soft fibres.



Fig 1:- Areca fibre extraction machine

The areca husk is beaten using extraction machine shown in Fig 1. The hard and soft fibres are separated using a screening machine which removes hard coarser fibres and soft fibre materials. The soft fibres were collected for this work.



Fig 2:- Soft fibre Extraction

➤ *Yarn Formation*

Areca fibre & cotton fibres were blended in 50:50 ratio. The carding process was done to make slivers. The slivers were fed to rotor machine for yarn formation. Pilot scale machines for spinning in KCT TIFAC CORE facility were used for this process.

• *Rotor Machine Parameter:*

- Rotor speed : 26000RPM
- Feed hank : 0.58 Ne
- Twist direction : Z
- Open roller speed : 10000 RPM



Fig 3:- Yarn formation process

➤ *Weaving*

The yarn was given required preparatory treatment to use as warp yarn and used to make plain weave fabric. Fabrics were made with two different weave structures like plain weave and waffle weave with the same proportion to analyse for cost and fabric consumption.



Fig 4:- Power loom



Fig 5:- Plain weave



Fig 6:- Waffle weave

Plain Weave is also called as Tabby weave. It consists of interlacing warp and weft yarns in a pattern of over one and under one. Waffle Weave is made up of warp and weft floats of varying lengths arranged around a plain weave centre.

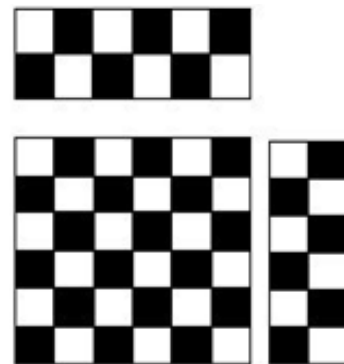


Fig 7:- Plain weave

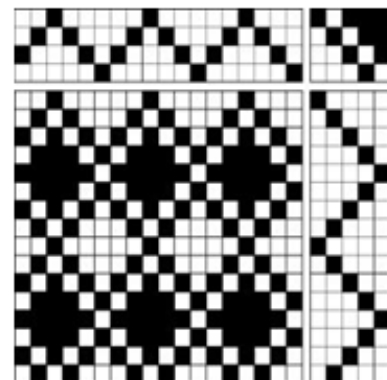


Fig 8:- Waffle weave

➤ *Cloth Bag:*

Cloth bags have become a popular alternative to plastic and paper shopping bags because cloth bags do not cause the environmental harm of plastic bags. However, cloth bags are not only for environmentally conscious consumer. Cloth bags are thicker than plastic bags, which makes them strong enough to be used again and again. The areca-cotton blended cloth bag is stitched in both plain and waffle weaves fabrics. The bag with plain weave has a dimension of 12" x 10" (height x width) and the bag with waffle weave has a dimension of 9" x 10" (height x width). A handle is also attached with the bags.



Fig 9:- Cloth bag

IV. RESULTS AND DISCUSSION

Two different types of woven fabric have been developed in power loom. Around 120 tex areca cotton blended yarns of single ply has been used both in warp and weft directions to develop the reusable carry bag. Chemical composition of fibre refers to the identity and a relative number of the chemical elements present in a compound. The chemical composition properties of areca, coir, jute and cotton are compared in table1. Here, Areca has cellulose content (57.77%) is more than coir and lesser than jute and cotton. The lignin, wax, ash and moisture content percentage are more than the coir, jute and cotton. The density of the areca fibre is 1.33 g/cm³, which is greater than coir. Hence, the chemical composition properties of areca fibre are better than coir for spinning with modification. Due to higher lignin content, it needs special bleaching and dyeing conditions. Since the present work is aimed to make a cheaper and eco-friendly product, fibre treatments were evaded.

FIBRE	CELLULOSE CONTENT %	LIGNIN CONTENT %	WAX CONTENT %	ASH CONTENT %	MOISTURE CONTENT%	DENSITY g/cm ³
ARECA	57.77	24.84	1.08	5.74	10.39	1.33
COIR	26.6	20.5	-	0.6	8	0.67-1.00
JUTE	64.4	11.8	0.5	0.5-2	1.1	1.46
COTTON	88	20.99	0.6	1.2	8	1.5-1.6

Table 1:- Fibre Chemical Composition Properties

The result of the yarn tests carried out is given in Table II. The table shows hairiness is more in cotton areca blended yarn due to rigidity of fibres. Yarn strength is sufficient to produce fabrics. It has better elongation in blended yarn due to more TPI in the yarn.

YARN	LEA COUNT	HARINESS (H)	SD	ACTUAL STRENGTH (gf)	CV%	ELONGATION %	CV%	TPI	CV%
COTTON ARECA BLEND	4.9	11.55	2.76	426.2	14.09	11.15	16.56	18.79	7.08

Table 2:- Physical properties of the yarn

FABRIC	TENSILE STRENGTH Kg/cm ²	CV%	TEARING STRENGTH Kg/cm ²	CV%	GSM	EPI	PPI	SHRINKAGE %	
								WARP	WEFT
PLAIN WEAVE	26.46	8.286	4.72	39.25	1237	22	25	4.85	4.09
WAFFLE WEAVE	28.22	4.796	7.53	21.87	1668	35	36	7.11	7.13

Table 3:- Areca – cotton blended fabric properties

The results of the fabric tests carried out are given in Table III. Here the two weaves – plain weave and waffle weave fabrics are compared. The result shows that the waffle weave tends to be more reliable than plain weave as its tensile and tearing strength is higher. The structure of waffle weave appears to be close on seeing its EPI and PPI. The GSM value of the waffle weave is also high. However, the shrinkage percentage of the waffle weave is quite higher than the plain weave.

V. CONCLUSION

Areca fibres are abundant and low cost natural cellulosic fibre with properties suitable for textile applications. It is found that areca fibres are compatible with cotton and processable on the conventional spinning machinery. The rotor spinning system is suitable to spin the areca fibre blends. The properties of blended yarn of areca fibre in the ratio of 50:50 show that it is possible to produce 5's count yarn. However, the count is low, and the application of fabric development would be suitable for the carry bags. The yarn results show that it has better elongation and strength to make a fabric. Development of fabric in two different weave structures is suitable to weave in power loom. The fabric properties show that the tensile strength is sufficient for carrying the load in the carry bag for Purchase. Cost wise this bag is cheaper than the cotton bags. The bag is designed in 10"x 12" which is suitable for effective carrying. The developed fabric is dimensionally and quality-wise stable.

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