DEVELOPMENT OF VALUE ADDED PRODUCT FROM ARCANUT FIBRE

A PROJECT REPORT

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In partial fulfillment for the award of the degree

of

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KUMARAGURU COLLEGE OF TECHNOLOGY

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BONAFIDE CERTIFICATE

Certified that this project report "**DEVELOPMENT OF VALUE ADDED PRODUCT FROM ARCANUT FIBRE**" is bonafide work of

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12.4.12

(INTERNAL EXAMINER)

(EXTERNAL EXAMINER)

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ABSTRACT :

In the global warming increasing world even textile cloth also emits co2 from in it. the synthetics fibre pose major hazard to the environment is that many of them take more than five hundred years to decompose. Because of issues like rising costs of natural-based fibres and their impact on environment and sustainable development, Natural fibres are biodegradable and sustainable, provided that eco-friendly techniques are adopted at every stage of their production and disposal. Natural fibres have found a niche in the global textile market. Along with this, growing global population leading to increased demand for textiles is increasing the risk of greater environmental impact.

Industrialized nations have for long been looking for natural biodegradable alternatives for synthetics, Areca fibre make it the feel-good fibre of the future. It is an extremely strong hemi-cellulosic fibre with all the qualities of a natural fibre. It offers maximum tenacity, whether wet or dry, and is guaranteed to hold its shape during processing and washing. cotton despite being a natural fiber, is one of the most unsustainable crops owing to the extensive use of fertilizers and pesticides in its production. In this case, it becomes an urgent need to identify and promote natural fibres other than cotton and silk. Areca fibre cann be considered as one of the latest to be added in the list of possible commercial fibre, and the biggest advantage it holds is that it can be 100% sustainable.

Areca fibre contribute in sustainable development in the field of textiles, it can also help the rural population in terms of income generation, providing sustainable livelihood to many people. It offers manufacturers innumerable opportunities for developing new textures and looks. As it is soft on the skin, its main uses are in clothing, especially woven materials, and in home fabrics, particularly sleepwear and bedding. It is a eco-friendly product so it will help to make an eco friendly world. The main aim of the project is increase the rural farmer economical growth and bring a revaluation in textile and fashion industries.

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1. INTRODUCTION:

Natural fibers are at the heart of a fashion movement that goes by various names: sustainable, green, unicycle, ethical, eco-, even eco-environmental. It focuses fashion on concern for the environment, the well-being of fiber producers and consumers, and the conditions of workers in the textile industry. Young designers now offer "100% carbon neutral" collections that strive for sustainability at every stage of their garments' life cycle – from production, processing and packaging to transportation, retailing and ultimate disposal. Preferred raw materials include age-old fibres such as flax and hemp, which can be grown without agrochemicals and produce garments that are durable, recyclable and biodegradable..

With the growing global population, environmental problems are becoming more frequent. Environmental awareness, new rules, and legislation are forcing industries to seek new materials that are more environmentally friendly. Synthetics fibres pose major hazard to the environment as they many of them take more than five hundred years to decompose. Because of issues like this, demand and costs of natural-based fibres are increasing. Over the kopast two decades, plant fibres have been receiving considerable attention as substitutes for synthetics. Natural fibres are biodegradable and sustainable, provided that eco-friendly techniques are adopted at every stage of their production and disposal. Cotton despite being a natural fiber, is one of the most unsustainable crops owing to the extensive use of fertilizers and pesticides in its production. In this case, it becomes an urgent need to identify and promote natural fibres other than cotton and silk.

Even though there are lot of natural fibre known to human, the bulk availability of natural fibres like cotton , jute is available only after cultivation. But few fibres are available as it is and considered as agro waste .Here comes the role of areca nut fibre, a large quantity of areca nut fibre is wasted once the nuts are separated. If it is possible to use this bio waste into an effective product, lot of pollution can be reduced effectively. This point outs the need of this project. This project work is about efficient use of this rural bio waste, into a successful fabric formation and development of value added fashion products which are in highly demand as ecologically sound materials.

.1 ARECA NUT PLANT:

Areca catechu is the areca palm a species of palm which grows in much of the tropic and parts of east Africa. The palm is believed to have originated in either Malaysia or the Philippines. *Areca* is derived from a local name from the Malabar Coast of India and *catechu* is from another Malay name for this palm, *caccu*.

Habitat Tropical ever wet climates with evenly distributed rainfall of 1500–5000 mm (60–200in); prefers elevations 0–900 m (0–2950 ft).

Vegetation Generally found in cultivation together with other cultivated species or semi-wild together with wet climate flora.

Soils Adapted to a wide range of soil types, although thorough drainage and high moisture holding capacity are required.

Growth rate Moderate, about 0.5 m/yr (20 in/yr).

Main agro forestry uses Crop shade, home garden.

Main products Seeds.

Yields Kernel yield is estimated at 2.5–8 kg per palm (5.5–17.6 lb/palm) annually.

Intercropping Frequently grown together with short- and long-term crops.

Invasive potential Although it can spread by seed, it is not considered to be an invasive species.

This palm is often erroneously called the betel tree because its fruit, the areca nut, is often [illegible] leaf from a vine of the Piperaceae family. It is a medium-

diameter. The leaves are 1.5–2 m long, pinnate, with numerous, crowded leaflets. It is also known as *puga* in Sanskrit and *supari* in Marathi and Gujarati.*Areca catechu* is grown for its commercially important seed crop, the areca nut.

BOTANICAL DESCRIPTION

Preferred scientific name

Areca catechu Linnaeus

Family

Arecaceae (Palmae), palm family

Subfamily

Arecoideae

Non-preferred scientific names (synonyms)

Areca cathecu Burman, *Areca faufel* Gaertner, *Areca hortensis* Loureiro, *Areca himalayana* H. Wendland, *Areca nigra* H. Wendland

Common names

betel nut, areca, or areca-nut palm (English)

pugua (Guam)

poc (Pohnpei)

pu (Chuuk)

Areca farms

Chemical composition

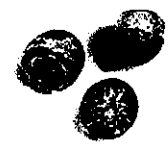
The seed contains alkaloids such as arecaine and arecoline, which, when chewed, are intoxicating and slightly addictive. Areca palms are grown in Bangladesh, India, Malaysia, Taiwan and many other Asian countries for their seeds.The seed also contains condensed tannins called areca tannins.

Uses of areca nut plant:

The areca palm is also used as an interior landscaping species. It is often used in large indoor areas such as malls and hotels. It will not fruit or reach full size. Indoors, it is a slow growing, low water, high light plant that is sensitive to spider mites and occasionally mealybugs. The areca nut is also popular for chewing throughout some Asian countries, such as Taiwan, Vietnam, Philippine, Malaysia, and India and the Pacific, notably Papua New Guinea, where it is very popular. Chewing areca nut is quite popular among working classes in TaiwanThe extract of *Areca catechu* has been shown to have antidepressant properties .

Areca

Areca plum



Areca Nut

1.2 ARECA NUT FIBRE:

Areca nut (or Betel nut) plays an important and popular part in Asian culture, especially in India. Areca nut is a widely grown cash crop. India produces a quantity of around 330000 metric tons of nuts annually and hence it is the largest areca nut producing in the world. It is grown in twelve states, most of which are either southern part of the country or in the north-eastern region.

Karnataka is the largest nut producing state in the country producing 40% of the country's produce. It is followed by Kerala, Assam, Meghalaya, West Bengal and many parts of Tamilnadu. India dominates the world in area (57%), production (53%) and productivity of

arecanut (0.379 million tons in 2002).Areca is taken up from the Malayan language that means cluster of nuts. When the nut is chewed along with the betel leaf, it increases the stimulating effect, though excessive consumption enhances the risk of cancer.

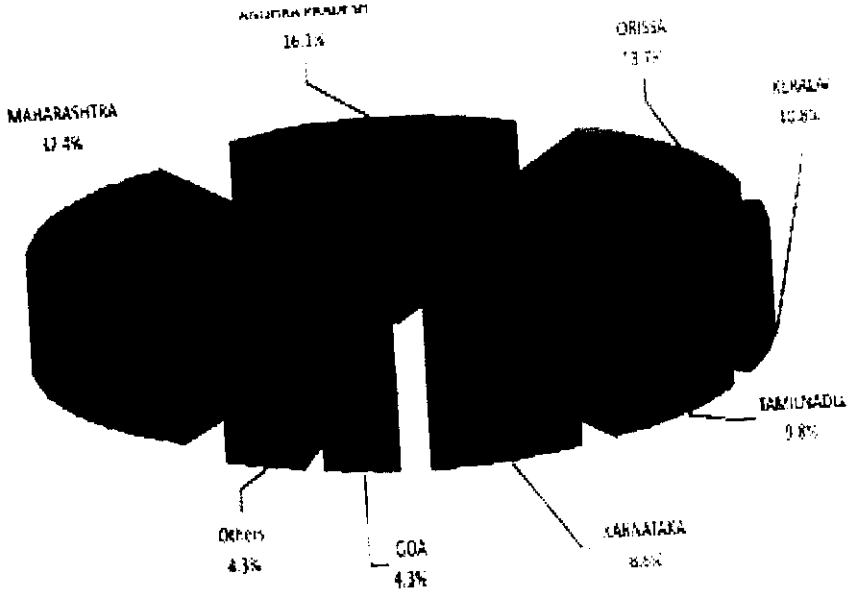


Figure 1.1 cultivation of areca nut in India

Areca nut husk is the outer cover of areca fruit. It constitutes 60-80 per cent of the total volume and weight of the fruits (fresh weight basis). It is now being largely wasted except for being used as an inferior fuel and mulch. The average filament length (4cm) of the areca husk fiber is too short compared to other bio-fibers .About 50 per cent of areca nut husk fibre was finer than other fibres and the remaining 50 per cent of fibre was coarser than those fibres. The tenacity value of areca nut husk fiber was comparable with that of goat hair and woollenised jute. Wet weight of arecanut husk fibre was comparable with that of other fibres. Palm trees are monocot trees grown along the coastal areas and yields commercially important products such as nuts, fiber and oil. Among the palm trees, coconut and arecanut palm are mainly exploited for economic purposes. The advantages of natural lignocellulosic fibers include acceptable specific strength properties, low cost, low density, and biodegradability [1]. Although natural fiber characteristics can vary somewhat with the environmental conditions under which the plants grow, the chemical constitution is mainly of cellulose, hemicellulose, lignins, pectins, waxes, water soluble substances and residual ash along with other organic materials.

Areca nut husk finds use in preparations of hard boards, paperboards, cushions etc. The areca nut leaf sheath could be used for preparation of throwaway cups, plates which are in great demand as

se of plastic cups and plates are being banned. It is noted that a huge quantity of areca fiber s found unutilized and wasted or simply used as fuel. If easy and effective processing nethods for these materials is developed it will make them more amenable to industrial and other applications. It will create more demand and will help farmer community.

1.3 PROBLEM IDENTIFICATION:

- The main problem faced during the product development from areca fibre is that more amount of dust and hard fibre in it.
- The separation of soft fibres from husk are slight difficult. More amount of husk is required for the production of fabric.
- The another main problem is there no specific machines for the separation of hard and soft fibre.
- Lack of research in the field of areca nut fibres is a one of problem.

1.4. OBJECTIVE OF THE PROJECT:

1. To separate soft fibres from dry husk of areca nut.
2. To produce yarn by blending areca nut fibre with cotton in different Proportion
3. To maken an attempt to produce yarn out of this blend.
4. to make fabric from this new yarn.
5. To take an attempt to use this blend yarn in saree embroidery .
6. To design a suitable garment and fashion accessories from fibre and yarn.

LITRATURE REVIEW

There is a lot of people work under the topic areca nut fibre all over the world. Lot of udies were done to develop new products from areca nut fibre such as composite boards. ckaging and other engineering and domestic applications etc. the different characteristics and roperties of areca nut fibre is studied by lot of researches. Al the inspiring topics for young esearches were discuses below.

2.1. Biosoftening.

Akhila Rajan etal have done biosoftening of the areca fiber using enzymes. They have done the research to achieve a bio-polishing effect using specific microorganism thereby improving color and softness of the fiber. They avoid use of caustic chemicals to reduce the pollutions. They found that the fiber treated with *P. chrysosporium* showed 35.1% and *Phanerochaete* sp. showed 25.7% increase in strength when compared to the untreated fiber. And the elongation of the fiber treated with *P. chrysosporium* was 5.0% and that treated with *Phanerochaete* sp. was 4.2% compared to the control fiber which had an elongation of 3.7%. From the experimentation they have done they found the biosoftened arecanut fibers can be exploited commercially for the production of furnishing fabrics, textiles etc by blending with cotton, viscose and polyester.

2.2 STUDIES OF COMPOSITE CHARACTERISTICS:

2.2.1 Experimental studies on biodegradable and swelling characteristics of natural fibers composites.

Bharath K.N et al examined the biodegradable property and swelling properties of different volume fraction of randomly distributed areca fibre and maize powder reinforced urea formaldehyde composite. They did the degradation of the areca fiber and maize powder composite to find the bond session reaction in the backbone of the polymer. They found in swelling, it absorbs about 30-40 % of its thickness. Compared to conventional wood based particle board it is very small where water absorption for wood-based particle board is more han 40%. From their experimentation they found that the areca composite exhibits an which have more than

atio 4:1 of areca fibres to maize powder was proved good than others. The composite xhibits good moisture resistance. The natural composites proved to be promising naterials for packaging and other engineering and domestic applications.

2.2.2 The acid catalyzed pretreatment of areca nut husk

Dr.Sasmal and etal they were applied the Taguchi robust design method of optimization (L9 orthogonal array) to this acid catalyzed pretreatment process. They pretreated the areca nut husk fibre using dilute sulphuric acid. They use the sulphuric acid concentration as the major during the pretreatment of areca nut husk (57% contribution) followed by the duration of operation (24.98% contribution) and solid loading (14.3% contribution). They found that The Taguchi method of optimization provides a systematic procedure that can effectively identify the optimum conditions for less crystalline amenable areca nut husk fibre yield in the pretreatment process. And that the optimized reduction in the crystallinity was found to be around 49.8%. The results of enzymatic hydrolysis vindicate that reduction of crystallinity due to pretreatment facilitates the sugar yield from the areca nut husk fibre. They given the result as the application of Taguchi methodology serves as another example for improvement of a bio-chemical process.

2.2.3 Fabrication and performance of hybrid Areca nut short fiber.

Dr.G. Ramachandra Reddy &etal extract the betel nut short fiber from the shell and done the hot press molding process to produce epoxy reinforced betel nut short fiber composites on mechanical properties. From the experimentation they found that the composite with 10% content of betal nut fiber have better mechanical properties. Dielectric strength was observed remarkable at 30% of Bn and the results indicate that it is possible to enhance mechanical performance of hybrid fiber reinforced composites through hybridization of betel nut fiber and Sansevieria cylindrica with EP matrix at optimized ratio (Bn10:Sc10: EP: 80) of the fiber matrix formulation.

2.2.4 Static bending and impact behaviour of areca fibers composites.

C.V. Srinivasa and etal they were alkali treated areca fibre with potassium better interfacial bonding between fiber and matrix. Then they fabricated by

ompression molding technique with varying process parameters. They characterized the leveloped composite by physical, bending and impact test. From the experimentations they done the surface modification enhance the properties of the rain forced –composites'. They found that the availability, cheaper and good strength of areca fiber composites can certainly be considered as a very promising material to fabrication of lightweight materials used in automobile body building, office furniture packaging industry, partition panels, etc. compared to conventional wood based plywood or particle boards.

2.2.5 Impact and Hardness Properties of Areca Fiber-Epoxy Reinforced Composites.

V. Srinivasa, K.N. Bharath were used areca fiber as new natural fiber reinforcement and epoxy resin as matrix. They were chemically treated areca husk to get better interfacial bonding between fiber and matrix. They prepared randomly orientated fibers with different proportions of fibers and matrix ratio. And mechanical tests i.e. impact and hardness tests were performed and they found that the fiber volume fraction and composite post curing time increases the mechanical properties of the composite increases. And they found that this is a very rare phenomenon which is not observed in many of the natural fiber composites.

2.2.6 Polyester composite based on betel nut fibre for tribological applications

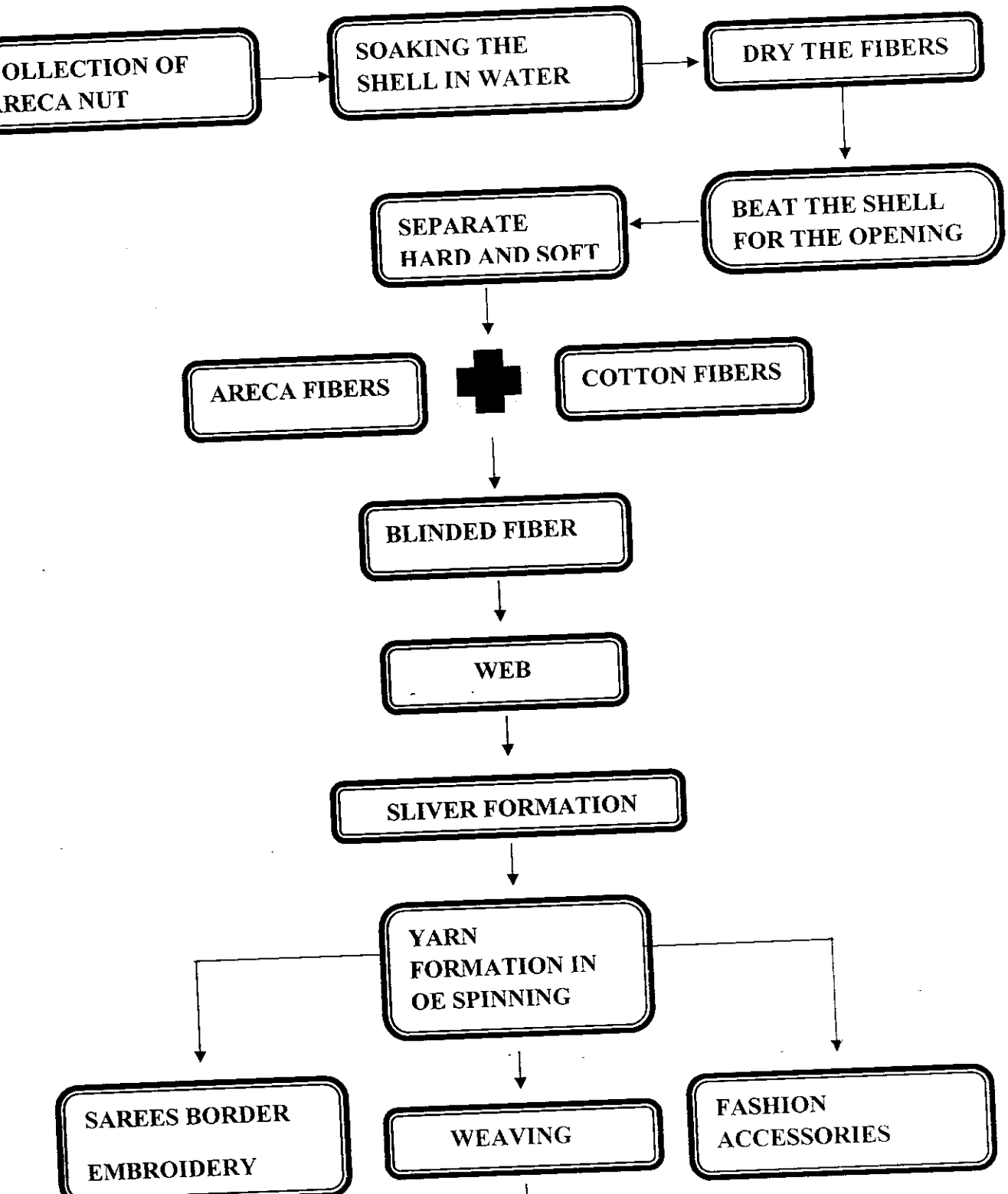
B.F.Yousif and etal they were examine the polyester composite based on betel nut fibre fabricated and its adhesive wear and frictional performance were found using a block on disk machine at different applied loads and sliding distances at 2.8 m/s sliding velocity under dry/wet contact conditions. The wear mechanism of the BFRP composite was predominated by micro and macro-cracks in the polyester regions and deboning of fibres. under wet condition they found that the tensile strength of the fibre reduced by about 17% compared to the dry. Under dry condition, the interfacial adhesion of the fibre is high compared to the wet, i.e. there was no pull out. They found that the presence of water improve the wear and frictional performance of BFRP composite by about 50% and 94%. respectively. This was due to the reduction in the thermo- mechanical loading during the sliding. Under dry contact conditions, the counter face roughness were increased

2.2.7 A Study of Short Areca Fiber Reinforced PF Composites

G. C. Mohan Kumar he examine the areca fibre mechanical properties by compare with the other natural fibres. Then he studied effect of chemically treated areca fibre strength. Areca fiber composite laminates were prepared with randomly distributed fibers in Maize stalk fine fiber and Phenol Formaldehyde. Composite laminates were prepared with different proportions of phenol formaldehyde and fibers. From the tests he found that the areca fibre strength as 101.85 MPa. And he found that the alkali treated Areca fibers have maximum tensile strength of 123.36 MPa and is more than the strength of natural fiber. The areca composite exhibits an excellent resistance to moisture absorption and is about 6–7% and very low compared to wood-based particle boards. The biodegradability of Areca fibers is very slow and hence better and longer life of composite.

3. METHODOLOGY

3.1 Process Flow Chart:



3.2. Fiber collection.

The dry husks were collected from different forms in Kerala. The collected shells are in dried form. The dried areca nut are opened by a sharp knife hold cutter to take the nuts .Once the nut is separated the shells are thrown out side .from this dry waist husks are collected and socked in the water tank.

Figure 3.1 Areca nut husk

3.3 Fiber separation.

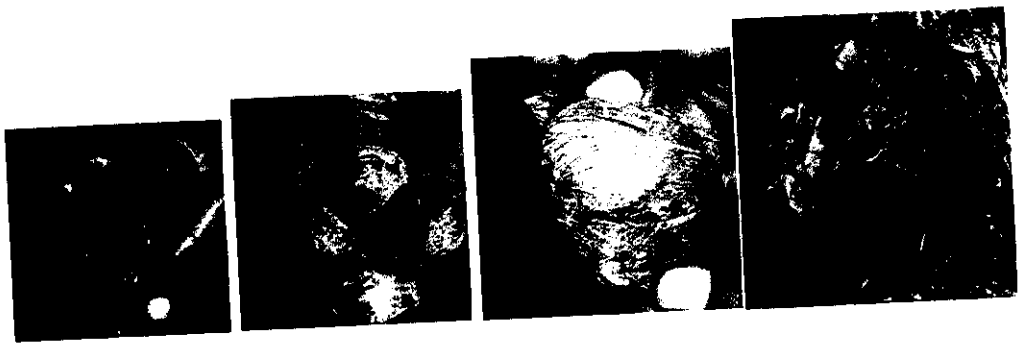


Figure 3.2 different stages of areca nut

The husk is about 15–30% of the weight of the raw nut. The socked dry husks are kept in the tank for seven days. During this time the dry husk are absorb water and start to decay by the activity of bacteria's. This decaying process helps to make the hard fiber soft and help to separate hard and soft fibers easily. After seven days of socking the husks in water the socked shells are spared on the surface and allow for sun dry.

Ones the shells are get dryad and the moister is removed completely the shell are given beating. The beating process helps for the opening of the fibers from the shell. After the beating process separation of hard and soft fiber is done manually. The soft fibers which are separated manually are used for the reaming process.

3.4 Web formation

The cleaned soft fibers are mixed with cotton at the ratio 70:30 are put in the carding machine and web is formed. Carding is a mechanical process that breaks up locks and unorganized clumps of fibre and then aligns the individual fibres so that they are more or less parallel with each other.

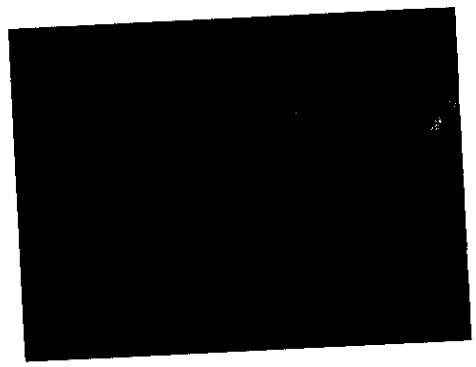


Figure 3.3 Materilas fed for carding

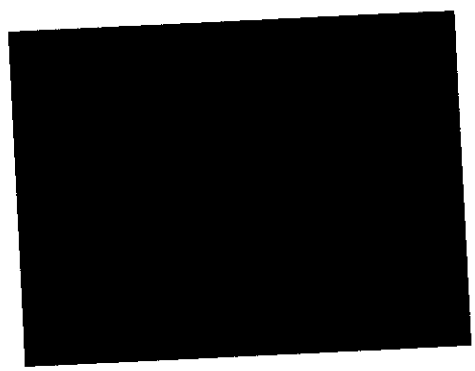


Figure 3.4 After carding (web)

The slowly turning doffer removes the firers from the swift and carries them to the fly comb where they are stripped from the doffer. A fine web of more or less parallel fiber, a few fibers thick and as wide as the carder's rollers, exits the carder at the fly comb by gravity or other mechanical means for storage or further processing.

During the web formation process the cleaning and opening of fibers are also will take place. The poses will be repeated two times for the better cleaning and mixing of the fibers. Finely the cleaned web with god mixing of cotton and areca fiber is optioned.

The setting of carding machine is as follows.

Feed - 602

Cylinder - 904

Doffer - 03.9

3.5 Sliver formation

The sliver is also formed from the same CARDING machine for this a special attachment called trumpet is fixed on the machine. The web which are maid early are placed one behind the other on conveyer belt. The conveyor belt will carry the webs to the carding machine and the opened fibers are passed through the trumpet and opened fibers come out of the trumpet in the form of slive

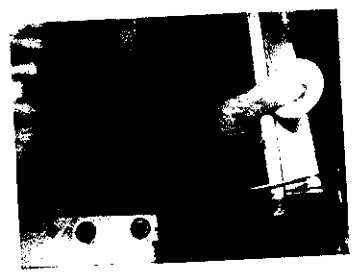


Figure 3.5 Sliver formation

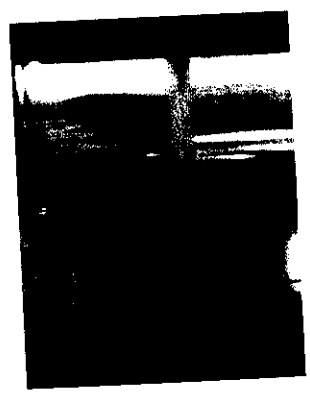


Figure 3.6 Sliver

The setting of carding machine is as follows.

Feed -.602

Cylindu-904

Doffer -03.5

3.6 Yarn formation.

The sliver from the carding machine is collected and fed into **Open end spinning.** open-end spinning is a technology for creating yarn without using a spindle. The principle behind open end spinning is similar to that of a clothes dryer spinning full of sheets. Sliver from the card goes into the rotor, is spun into yarn and comes out, wrapped up on a bobbin. There is no roving stage or re-packaging on an auto-coner.

Rotor speeds up to 140,000rpm. The Rotor design is the key to the operation of the open-ended spinners. Each type of fiber may require a different rotor design for optimum product quality and processing speed.

Speed	-20000.RPM
Yarn Count	-18 ne
Feed Hank	- 0.7ne
Twist	-2 TPI
Twist Direct	-Z
Open Roller Speed	- 8000Rpm
Yarn Length	- 5000M

Figure 3.7 Areca –cotton yarn

S.no	Combination of blend	Percentage of areca	Percentage of blended fibre	Yarn count
1	Areca and cotton	70	30	4's,5's,10's
2	Areca and bamboo	80	20	5's

Table 3.1 Different blend proportions achieved

3.7 Fabric Weaving:

The weaving of areca nut fabric is done in basic hand loom. Weaving is a method of fabric production in which two distinct sets of yarns or threads are interlaced at right angles to form a fabric or cloth. The way the warp and filling threads interlace with each other is called the weave. The majority of woven products are created with one of three basic weaves: plain weave, satin weave, or twill. Woven cloth can be plain (in one color or a simple pattern), or can be woven in decorative or artistic designs.

In general, weaving involves using a loom to interlace two sets of threads at right angles to each other: the warp which runs longitudinally and the weft that crosses it. One warp thread is called an end and one weft thread is called a pick. The warp threads are held taut and in parallel to each other, typically in a loom. There are many types of loom. Weaving can be summarised as a repetition of these three actions, also called the primary motion of the loom.

Fabric is weaved by weft as areca yarn and warp as cotton yarn. Two different areca fabrics are produced by keeping two different cotton yarns in warp such as 60's greige and 34's dyed cotton yarn. A different texture fabric is obtained by inserting areca and cotton alternatively in the weft direction in 5cm width. This method of weaving helped to made different texture in same fabric.

Figure 3.7 Fabric made by using areca nut fibre as weft and warp as cotton

3.8 Scouring:

Scouring is done to remove oils and natural colour from the arecanut fabric. It help to preparer areca fabric good dye absorber. It also help to reduce the hardness of the areca fabric to softer.

3.9 Fabric bleaching:

Bleaching is to remove the natural color and oil present in the areca nut fibre. Bleaching help to improvise the golden yellowish color of the areca nut yarn. The bleaching automatically help to improve the color without dyeing. This properties of areca nut fiber help to use as an organic fabric . the weaving of this bleached areca nut fibre with other colored yarn will helps to produce different aesthetic looks in the fabric.

Material liquor ratio:1:20

Type of bleaching: hydrogen peroxide

Time : 60 min

Temperature: 80 degree celcus

Figure 3.8 Bleached fabric

3.10 Fabric dyeing

Dyeing process is done to add color to areca nut/cotton blended fabric as per cotton fabrics. Dyeing is followed by scouring process.Dark colors are more effective in the areca fibre because of its natural yellowish color. Direct dyes have good colorfastness in areca nut fabric. Areca nut fibre consist of 64.8% hemicelluloses which helps in dye absorbsion and the presence of 24.8 % lignin resist dye absorbency.

Material liquor ratio: 1:20

Time: 1 hr

Temperature: 90

Type of dye: direct dye

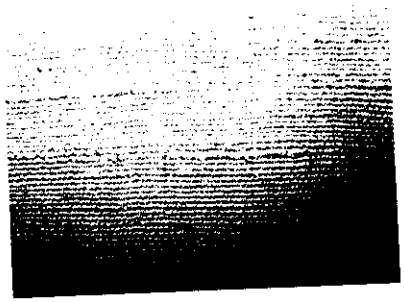


Figure 3.9 Dyed fabric sample

4. DESINING AND PRODUCTION OF VALUE ADDED PRODUCTS

4.1 Home textile:

The heaviness of the areca fabric has great role to play in the home textile industry. The roughness of the yarn help to produce different textures fabric. The natural yellowish color helps to give rich and vibrant looks to the interior . The absorbance of the fabric is quite good like cotton . Because of its good abrasion resistance it can be used as mats in home textiles. Because of its thick and rough features make it more suitable to used as curtains and blinders. Well cleaned Areca nut fibre can be efficiently used as stuffing material in home textile.

Figure 4.1 Curtains using areca fabric

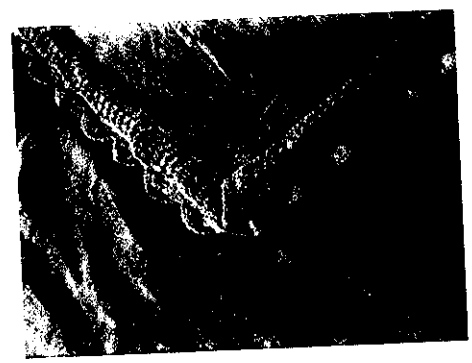


Figure 4.2 Bed spread using areca fabric

Figure 4.2 Dry flower using areca husk

Figure 4.5 table cloth using areca fabric

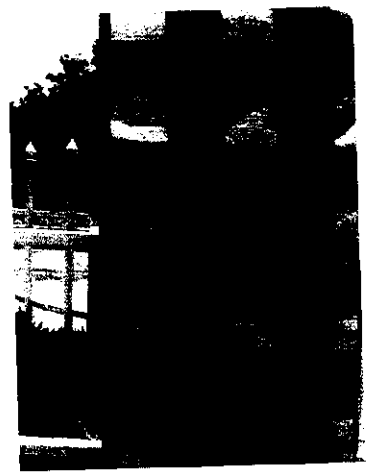


Figure 4.6 Blinders

4.2 Saree border embroidery:

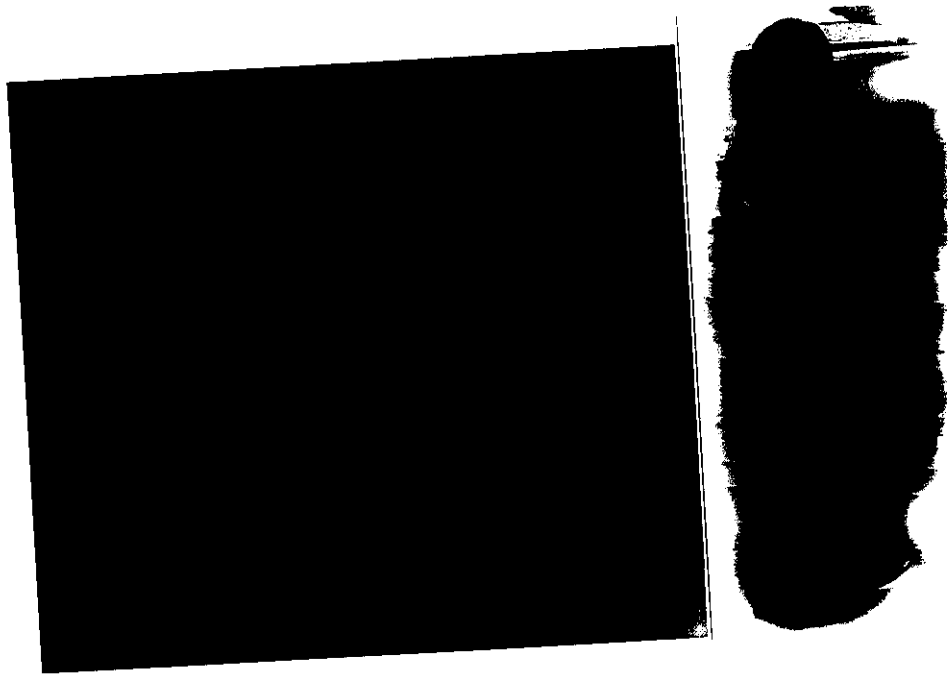


Figure 4.7 Saree embroidery using areca nut yarns

Saree is an elegant, charming dazzling dress. Saree is also a traditional dress in India. Many decoration methods are used in saree sequence,bead work,printing, hand embroidery. Hand embroidery is an important aesthetic method. Areca nut yarns are directly used in saree for hand embroidery. Simple running stitches are used for embroidery. There is lot of advantage such as cost effective, eco friendly because of its natural yellow color. This help to improve women's self employment in villages. Because of its eco friendly and natural color there may be lot of opportunity in the global fashion market in the future.

4.3 Fashion accessories:

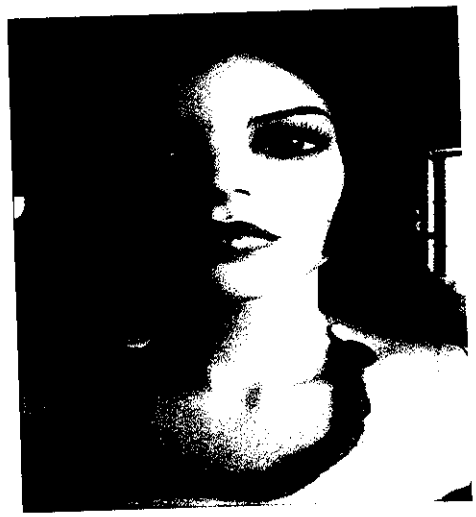


Figure 4.8 accessories using dyed areca yarn

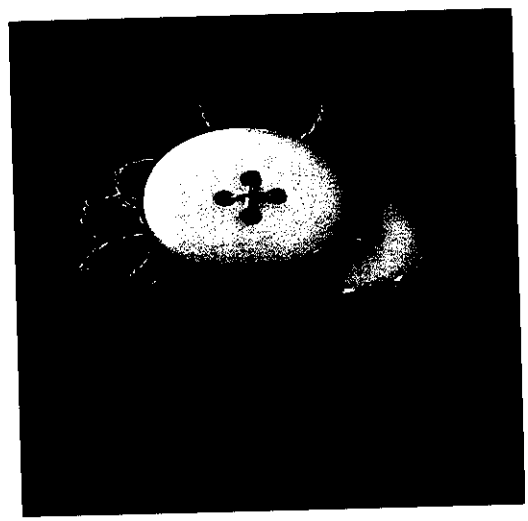


Figure 4.9 locket using dyed areca yarn

Eco friendly hand made accessories are developed from areca nut yarn. Dyeing of the yarn improvise the appearance look of the accessories . Areca nut accessories will help to progress self employment group.

4.4 FASHIONABLE GARMENT CONSTRUCTION:

MEASUREMENT CHART

S no	Chest size between	Measurement in cm
1	Chest	100
2	Arm Scye depth	24.6
3	Natural waist line	44.8
4	Neck size	41
5	Half back	20
6	Full length	76
7	Half sleeve length	32

The heavy texture of areca fibre have lot of scope in products like suiting's, shirt etc in men fashion industry . The natural golden yellowish color helps to create different heavy texture by weaving it with cotton, linen, wool etc. Use of areca fabric in shirting helps to create more growth in eco friendly fashion.

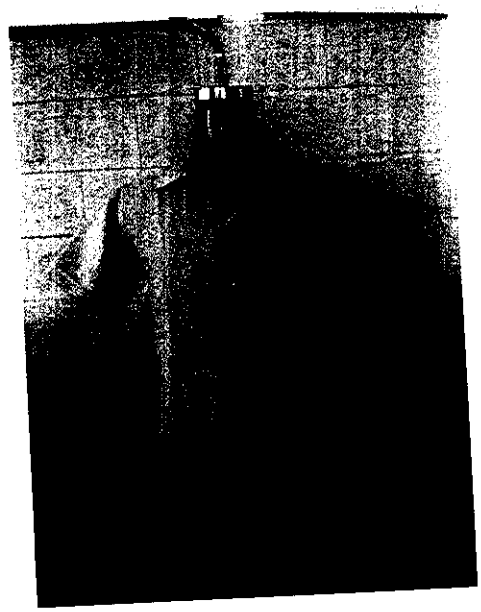


Figure 4.10 Areca Shirt

5. TESTING:

5.1 Fibre testing

5.1.1 Areca fibre length:

After soaking & cleaning ,the Areca fibres are combed with help of plastic comb. This Areca fibres are divided according to their length. It is then measured with help of scale. Areca fibre length ranged from are 4.5cm- 7cm.

The average length is 5.5 cm of the areca husk fiber. It is too short compared to other bio-fibers. Mainly two types of fibres are present – one is very coarse and the other is very fine. The coarse ones are about ten times as coarse as the jute fibers and the fine are similar to jute fiber. The hand stapling method used. This consist of selecting a sample and preparing the fibres by hand doubling and drawing to give fairly well straightened tuft.

5.1.2 Moisture content and regain:

a) Moisture Content:

Moisture and humidity influenced on the results of testing of textile materials. The amount of water take up by a textile fiber can be expressed in term of (μ)Moisture content. This is an expression of moisture as a percentage of the original sample weight.

$$\text{Moisture Content} = \frac{\text{(Original Weight – Oven Dry weight) x 100}}{\text{Original Weight}}$$

b) **Regain:**

The moisture present in a material, expressed as a percentage of the moisture-free weight, as determined under definite prescribed conditions. This indicates the amount of moisture that the oven dry areca has regained at the time of testing.

$$\text{Regain} = \frac{\text{(Original Weight – Oven Dry weight) x 100}}{\text{Oven Dry Weight}}$$

Oven dry method is common simple method to moisture content& moisture regain for all textile fibres. An oven thermostatically controlled heating chamber capable of maintaining a temperature of 110 ± 5°C.British *standard* BS EN 20287 is followed by this oven dry moisture contents & regain.

5.1.3 Microscopic view of Areca fibre

Figure 5.1 Microscopic view of hard areca nut fibre

Figure 5.2 Microscopic view of soft areca nut fibre

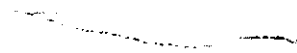


Figure 5.3 Microscopic view of cotton use for blending

5.2 Yarn Testing:

5.2.1 Yarn count:

Count is a number indicating the mass per unit length or length per unit mass of yarn. Count of a yarn is a numerical expression which defines its fineness of the yarn count be expressed in terms of diameter.

Beesley Balance used to calculate the yarn count. Beesley used to determine count of any type of yarns directly.

5.2.2 Tensile strength tester:

This test indicatesthat the strength of the fibres and fibres structure is commonly regarded as the criterion of the quality

The breaking strength is a measure of the resistance of the material to a tensile load. the tensile strength of fabric is usually measured instron universal tester with constant rate of loading. AATCC 15 Standard is followed in this tensile strength. Fix the sample in between two jaws and were the top jaw is movable one. After the sample is fixed the top jaw is moving at the principle of constant rate of loading.The instron universal tester shows the data in breaking load in gf/tex and elongation at break. This testing was done in TIFAC core.

5.2.3. Microscopic view of Areca yarn

Figure 5.4 Microscopic view of areca nut yarn

5.3 Fabric Testing:

5.3.1 Wick ability:

In this method wick up was observed by determining the rate of time at which the water moved upward on a strip of 5"*1"suspended vertically with its lower ends dipping into a dye solution (50g dye in 100mlof water)as per BS3424. The effect was observed for both wale and course directions at different height and the average were calculated. Higher wicking value show greater liquid water transport.

5.3.2 Air permeability

The volume of air passing through a fabric under pressure. The porosity of a fabric as estimated by the ease with which air passes through it. Air permeability measures the warmth

of woven fabric & knitted cloth, the wind resistance of soil cloth etc. Air permeability measured on standard testing equipment.

The permeability, or the ease with which air passes through material. Air porous-ness determines such factors as the wind resistance of woven fabric& knitted fabric. The degree to which a fabric, coating or laminate allows air to pass through its construction. ASTM 737 -96 standard is followed in this air permeability tester.

5.3.3 Water vapor permeability Test:

The water vapour permeability of the fabrics is in important property for those used in clothing systems intended to be worn during vigorous activity and hot climatic condition. ASTM E96/E 96m Standard followed in this testing. The human body cool itself by sweat production and evaporation during period of high activity. The clothing must be able to remove this moisture in order to maintain comfort and reduce the degradation of the thermal insulation caused by moisture build-up.

Figure 5.5 Water vapor permeability

5.3.4 Bursting strength tester:

The busting of woven fabric can be occur when high pressure is applied to it. The busting strength tester fellows the ASTM 3786 standard. Airpermeablilty & hydraulic pressure. In this test a 100mm diameter sample is fixed against rubber membrane in a ring clamp with inner diameter 30mm. the hydraulic pressure required to produced repture of the material when pressure is applied at a controlled increasing rate through a rubber diaphragm. A circular diaphragm of pure gum rubber is clamped between the lower clamping plate and a pressure cylinder. The diaphragm is stretched by pressure underneath it the center of its upper surface is below the plan of the clamping surface.

5.3.5 Tearing strength:

The force necessary to tear fabric measured by the force, measured by the force necessary to start or continue a tear in a fabric. Here, instron universal Tester is used to measure the tearing strength of the fabric. **ASTM 3786 /D 3786 Standard followed in this testing.** Fix the sample in between two jaws and top jaw is movable one. After the sample is fixed the top jaw is moving at the principle of constant rate of loading. Measurement taken from the fabric tearing start stage. Reading noted from the display. This testing done Fashion technology department lab.

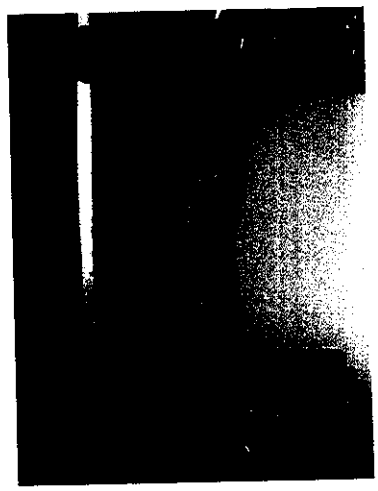


Figure 5.6 Tearing strength

5.3.6 Color Fastness to Rubbing:

The color fastness of the Areca fabric is find using crock meter. The instrument follows AATCC 16 standards

5.3.7.Pilling Test : (I C I Pillbox tester)

The Pilling Tester ASTM D3512, Standard is designed to test the pilling (hair ball) characteristic of fabric and knit fabric cloths. After rolling the specimen around a rubber tube and turning in a winding box for a period of time, it is then compared to a standard picture to determine its grade. Test results are usually determined after comparing with standard pictures, the average of four tests per specimen.

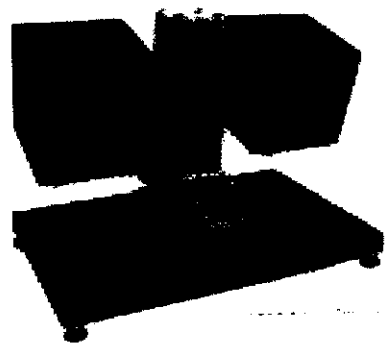


Figure 5.7 Pilling tester

5.3.8 Abrasion Resistance Test:

Martindale Abrasion test:

The resistance of textile materials to abrasion as measured by this test method. **BS 5690 Standard is followed in this testing**. While the abrasion resistance stated in terms of the number of cycles and durability (defined as the ability to withstand deterioration or wearing out in use, including the effects of abrasion) are frequently related, the relationship varies with different end uses. Different factors may be necessary in any calculation of predicted durability from specific abrasion data.

- **Applied weight: 400 g**

5.3.9 Fabric shrinkage:

Shrinkage is appear when a fabric becomes smaller than its original size, usually through the process of laundry.

- Weft wey shrinkage 0.5cm.
- Warp way shrinkage 0.4cm.

5.3.10 wales /inch &course /inch:

Wales /inch and course/inch of areca fabric is find manually using counting glass.

6. RESULT AND DICUSSION:

6.1 Areca fibre length:

The random sampling method is used to study the average length of Areca fibre .the fibre length is 4-5.5 cm. So it can be processed in short staple spinning system .

Cotton has staple length 1/8"-2.5" (0.32-6.35)mm it has a lot of characteristics, such as comfortable, good absorbency, color retention, dry cleanable easy to handle etc. so this fibre properties match with hemi-cellulose of areca nut fibre

6.2 Moisture content and Regain:

a) Moisture content:

Areca fibre has less moisture content compare with other natural fibre. After dry Areca fibre has good changes in its weight.

Natural fiber	Moisture content in %
Cotton	7.85 - 8.50
Flax	10.00 - 12.00
Hemp	10.00 - 12.00
Jute	12.50 - 14.00
Kapok	8.50
Coconut fiber	12.00
Palm fiber	12.00

Table 6.1 Standard moisture content chart

From the above standard moisture content chart, most of natural fibres have 8-12% moisture content. The moisture content of areca fibre is 9.24% which is a good value to use in textile applications

b)Moisture Regain:

From this result Areca fibre has good moisture regain capacity compare with other natural fibre. After dry Areca fibre has good changes in its weight

Fibers	Moisture Regain %
Nylon 6	4.1
PET	0.2-0.4
Rayon	11
PLA	0.4-0.6
Cotton	7.5
Silk	10
Wool	14-18

Table 6.2 Standard moisture regain chart

From the above standard Moisture Regain chart more natural fibres have 7-11% moisture Regain. So the result of areca fibre 8.6 is a good moisture Regain.

6.3 YARN TESTING:

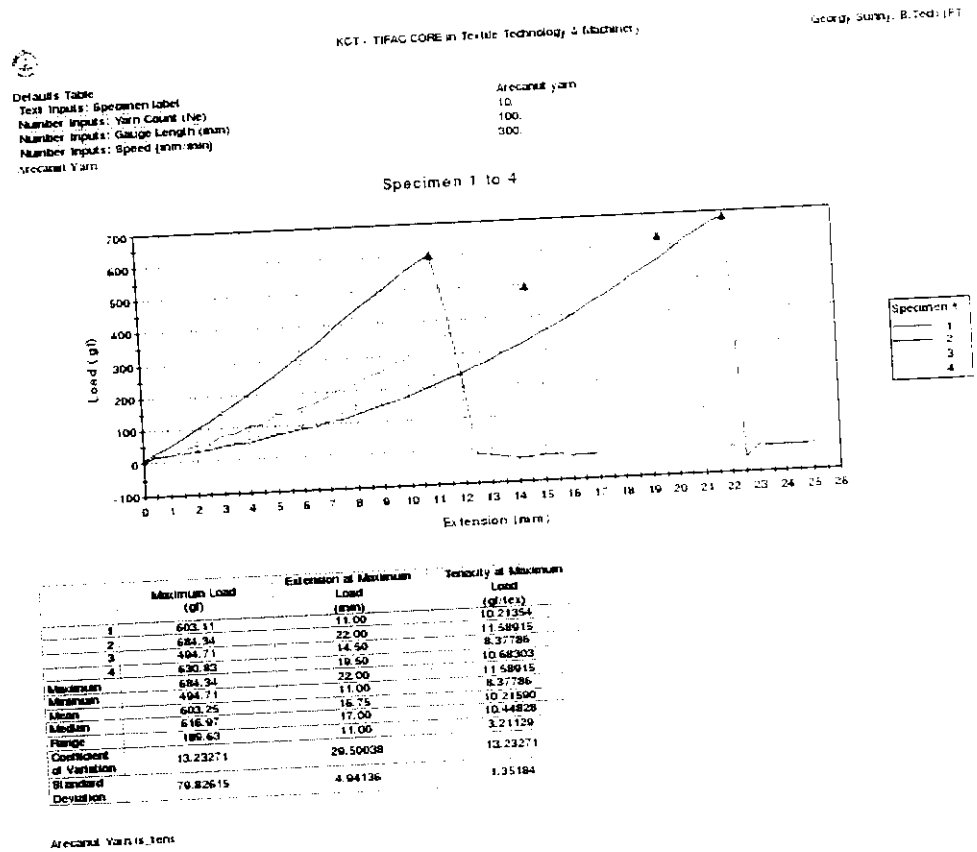
6.3.1 Yarn count:

Yarn count is an important dimension required to study the fabric structure, weave, and finish. The final count of the areca cotton blend (ratio 70:30) is 10's count.

Coarser count of 10's is suitable for home furnishing product. In this project to use coarser yarn use into winter season shirt.

S No	Count
1	10.5
2	9.5
3	9.5
4	10.5
Avg	10's

6.3.2Tensile strength tester:



	Maximum Load (gf)	Extension at Maximum Load (mm)	Tenacity at Maximum Load (gf/tex)
1	603.31	11.00	10.21354
2	684.34	22.00	11.58915
3	494.71	14.50	8.37786
4	630.83	19.50	10.68303
Maximum	684.34	22.00	11.58915
Minimum	494.71	11.00	8.37786
Mean	603.25	16.75	10.21590
Median	616.97	17.00	10.44828
Range	189.63	11.00	3.21129
Coefficient of Variation	13.23271	29.50038	13.23271
Standard Deviation	79.82615	4.94136	1.35184

From the graph it is clear that the composition made of areca/cotton posses good strength.

It is also clear that Maximum elongation load at (mm) mean is 16.75.It shows that it has a good elongation.

From the graph the result shows tenacity at maximum load (gf/tex) mean is 10.21575.That shows that it has good tenacity.

6.4 FABRIC TESTING

6.4.1 wick ability.

Sample no	Time
1	2.42
2	2.43
3	2.44
4	2.48
5	2.53
6	3.3
7	3.14
8	3.28
9	3.10

Table 6.4 wick ability

From the above result Areca cotton fabric is observed more water in warp and weft direction. Areca-cotton fabric have the good water absorbency because of presence of micro cellulose component which governs the liquid moisture transport through capillary interstices in fabrics, it may obviously the contributing factor for high wick ability.

6.4.2 Air permeability& Air Resistance :

S No	Average pressure Airflow
1	17.2
2	19.0
3	23.6
4	19.2
Avg	19.75

Table 6.5 Air permeability

Air Permeability in textiles was measured to provide an objective measure of the breathability of clothing. It was a means of evaluating whether a fabric would make a "cool" or "warm" garment. . This test found that it was a quick, convenient, nondestructive test for determining differences in the quality of a given fabric. it was an accurate, reliable indicator that changes had occurred. These changes can include tightness, additives, calendering, thickness, and arrangement of fibers in the fabric.

$$\text{Air permeability} = \frac{\text{Average pressure Airflow}}{5.07}$$

$$\text{Air Resistance} = \frac{5.07}{\text{Average pressure air}}$$

Air Permeability = 0.2567 cc/sec/sg.cm

From the above result of areca-cotton fabric has good air permeability &air resistance .

6.4.3 WATER VAPOUR PERMIBILITY TEST:

Sample no	Water vapour Permeability
1	3273.15
2	3246.54
3	3246.54
4	3273.15
Avg	3259.85

Table 6.6 Water vapour permeability

Average water vapor permeability- 3259.85. (gm/m2/day)

In the above case water vapor permeability increases within the increase in micro tencel component of the blends and it is even greater for fabric containing areca and cotton blends, it is due to the fact that the cross section of the fibre containing micro pores and micro

absorption and ventilation.

6.4.4 Bursting strength:

S no	Bursting strength lb' s/inch
1	150
2	125
3	140
4	120
5	150
Avg	137

Table 6.7 busting strength

In the case of busting strength test The Maximum uniformly distributed pressure, applied at right angles to surface, that a test piece will stand under the conditions. In this test, A test piece, placed over a circular elastic diaphragm, is rigidly clamped at the periphery but free to bulge with the diaphragm.

From the bursting strength test average bursting strength 137 lb' s/inch its comparatively good with natural fabric .

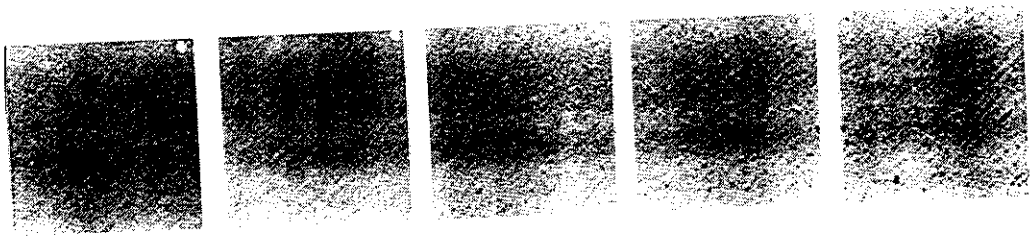
6.4.5 Tearing strength tester :

From the result co-efficient variation is 3.5%. so Areca-cotton fabric not has bad tearing strength compare with other fabric. To determine the tearing strength of woven fabrics. Tear strength or resistance to tearing is of importance in fabrics such as those used for shirting, blouses, dresses, interlining, etc. The aerca-cotton suitable for shirting material in apparel field.

6.4.6 Color Fastness to Wash:

From these standard color fastness chart. Areca- cotton fabric has no changes in dry fabric, slight change in wet fabric condition. So Areca-cotton fabric has good color fastness.

6.4.7 PILLING TEST



Grade 1 Grade 2 Grade 3 Grade 4 Grade 5

Figure 6.1 I.W.S standard template

I.W.S STANDARD RESULT

This result board contain 5 standard grade result for woven fabric. In the result of areca-cotton fabric

After 1800 revolution(5 hours) fabric has only light changes .In the result of areca-cotton fabric Compare with I.W.S pilling Standard

This Arca-Cotton fabric is match with grade 2. From the result it shows the pilling strength is poor .

6.4.8 Abrasion Resistant Test :

Formula:

Weight loss% = Initial weight- final weight/ Initial weight*100

Initial weight	Final weight	Number of revolution	Loss of weight	Abrasion resistance
32	30	50	2	96.875
35	34	50	1	97.142
35	33	50	2	96.875
33	32	50	1	97.142
Avg				97.008

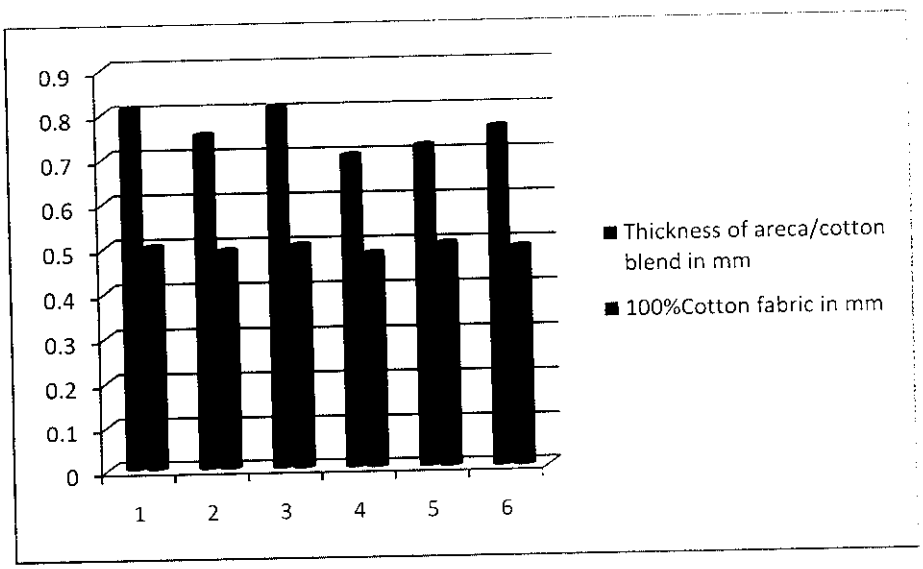
Table 6.8 Abrasion resistance

Martindale Abrasion test average result 97.008. This Areca-cotton fabric have good abrasion resistance. This proves that areca nut fabric will satiefy quality require ment of customer and it can role the globle textile market.

6.4.9 Fabric thickness

S.no	Thickness of areca/cotton blend in mm	100%Cotton fabric in mm
1	0.81	0.50
2	0.75	0.49
3	0.81	0.50
4	0.70	0.48
5	0.72	0.50
Avg	0.76	0.49

Table 6.9 Fabric thickness



6.4.10 wales /inch &course /inch

s.no	Wales/inch	Course/inch
1	28	33
2	29	32
3	28	30
4	27	33
5	29	33
avg	28.2	32.2

Table 6.10 wales /inch &course /inch

7 CONCLUTION:

From the arecanut husk hard and soft fibers are successfully separated. A uniform web is produced by blunting soft areca nut fibre with cotton in the ratio 70:30 with the help of open-end spinning method by using this web 10's count yarn is produced .by blinding this yarn with cotton we successfully different type of fabrics.

The newly produced fibre, yarn, and fabric parameters were studied and analyzed.From the result it's clear that it can be successfully used in textile and clothing industry by blending with other fibres like cotton, silk, bamboo etc.

There is wide scope in the field of areca nut fibre. Lot of research can be done by blending with natural and synthetic fibres similarly.The dyeing properties of the fibre can be improved by doing future researches. Different weave texture can be developed in future by using other synthetic fibres or natural fibre like silk, banana etc can have lot of scope in home textiles and fashion industry.

By the successful production of fabric from Areca nut husk ensures that this can be lead to big revolution in the textile and fashion industry and also help the farmer community by converting their agro waste into a valuable product for the global market.

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