



PRODUCTION OF YARN FROM ARECA NUT FIBRE



AND CHARACTERIZATION

PROJECT REPORT

Submitted By

ADITYA SINGHANIA	0810102002
JASMIN BANU.L	0810102015
SURESH KUMAR.C	0810202313
TAMIL SELVAN.K	0810202314

BONAFIDE CERTIFICATE

Certified that this project report entitled "PRODUCTION OF YARN FROM ARECA NUT FIBRE AND CHARACTERIZATION" is the bonafide work of

ADITYA SINGHANIA	0810102002
JASMIN BANU.L	0810102015
SURESH KUMAR.C	0810202313
TAMIL SELVAN.K	0810202314

Who carried out the project work under my supervision.

In Partial Fulfillment For The Award Of Degree

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ANNA UNIVERSITY COIMBATORE-641049

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(Dr. BHAARATHI DHURAI)

(Dr.M.DHINAKARAN)

HEAD OF THE DEPARTMENT,

PROJECT GUIDE

Textile Technology,
Kumaraguru College of Technology
Technology Coimbatore-641049.

Textile Technology,
Kumaraguru College of
Coimbatore-641049.

INTERNAL EXAMINER

EXTERNAL EXAMINER

ACKNOWLEDGEMENT

The objective of our project is to produce yarn from areca nut fibre with the blend of cotton in the ratio of 30:70 respectively.

The areca nut husk was collected and then the fibres are separated from the husk.

The areca fibre softened and mixed with cotton. Then the mixtures were passed through the preparatory processes of carding to obtain a card sliver. The sliver was then processed through the open end spinning machine to produce a yarn.

Various tests were carried out for the produced yarn.

We the students of this project give our entire honor to 'THE ALMIGHTY' for blessing this combined works of our hand.

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ABSTRACT

TABLE OF CONTENTS

CHAPTER NO	TITLE	PAGE NO
	ABSTRACT	iii
	LIST OF TABLES	vi
	LIST OF FIGURES	vii
1.	PROJECT AIM	1
2.	INTRODUCTION	1
	2.1 About Areca Fibre	2
	2.1.1 Chemical Properties	2
	2.1.2 Strength Of Areca Fibers	4
	2.1.3 Dimensions And Density Of Areca Fibre	4
	2.1.4 Physical Properties Of Areca Fiber	5
	2.2 About Cotton Fibre	6
	2.2.1 Charateristics Of Cotton	6
	2.2.2 End Uses Of Cotton	6
	2.2.3 Physical Properties Of Cotton	6
	2.2.3.1 Fiber Length	6
	2.2.3.2 Fiber Strength	7
	2.2.3.3 Micronaire	7
	2.2.3.4 Color	8
	2.2.3.5 Trash	8
	2.3.4 Chemical Properties Of Cotton	8
	2.3.5 Optical Properties Of Cotton	8
3.	LITERATURE REVIEW	10
	3.1 Natural Fiber Reinforced Polymer Bio composites and blend.	11
	3.2 Crop Residue, The alternate raw material of tomorrow for the preparation of composite board.	12
	3.3 A Study of short areca fiber reinforced composites.	12
	3.4 Atmospheric air plasma treatment of polyester textile material.	12
	3.5 Experimental determination of tensile properties of okra and	

LIST OF TABLES

TABLE NO	TITLE	PAGE NO
1	Elements Of Areca And Cotton Fibre	9
2	Card Settings	19
3	Open End Spinning Settings	21
4	Single Yarn Tenacity and Elongation	22
5	TPI Of OE Single Yarn	22
6	Lea Count With CV%	22

	banana fiber reinforced polyester composites.	13
	3.6 Optimization of ultrasound-assisted extraction of total phenol from betel nut seed	13
	3.7 Tensile properties characterization of okra woven fiber reinforced polyester composites.	14
	3.8 Properties of untreated areca reinforced plastic composites.	14
	3.9 Effect of hydroxyethyl methacrylate on the performance of areca nut fiber reinforced polyethylene composites	15
	3.10 Treatment of textile fibers.	15
	3.11 Study on the performance of hybrid betel nut fiber reinforced.	16
	3.12 Physico-mechanical performance of hybrid betel nut short fiber polypropylene composites.	16
	3.13 Study on the performance of hybrid betel nut fiber reinforced polypropylene composites.	
4.	MATERIALS AND METHODS	
	4.1 Materials	17
	4.2 Methods	17
	4.2.1 Process Sequence	18
	4.2.2 Fiber Extraction	18
	4.2.3 Fiber Surface Treatment	18
	4.2.4 Blow Room Process	18
	4.2.5 Carding Process	19
	4.2.6 Open End Spinning	19
5.	RESULTS AND DISCUSSIONS	
	5.1 Test Report	23,24
6.	CONCLUSION	25
7.	REFERENCE	26

LIST OF FIGURES

FIGURE NO	TITLE	PAGE NO
1	Areca Husk	1
2	Areca Fibre	2
3	Stress-Strain Diagram of Areca & Coir Fibre	3
4	Sem Image of Areca Fibre Surface	4
5	Mechanism Of OE Spinning	20
6	Open End Spinning Machine	21

1. PROJECT AIM

To produce a yarn from areca nut fiber with the blending of cotton and analyzing the characters of produced yarn.

2. INTRODUCTION

2.1 ABOUT ARECA NUT FIBRE

Among all the natural fiber-reinforcing materials, areca appears to be a promising material because it is inexpensive, availability is abundant and a very high potential perennial crop. It 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. In India, areca nut cultivation is coming up on a large scale basis with a view to attaining self sufficiency in medicine, paint, chocolate, Gutka, etc. It is estimated that about 6 Lakh tonnes of areca husk are available in south West-India. The husk of the Areca is a hard fibrous portion covering the endosperm. It constitutes 30–45% of the total volume of the fruit. Areca husk fibers are predominantly composed of hemicelluloses and not of cellulose.



Fig 1. Areca Husk

with the paper support was fixed in the specially designed jaws of the machine. Then a wing of the paper support was cut off so that the force developed in the machine will be acting totally on the fiber specimen. The gauge length, limiting load, displacement, speed of moving platform in the direction of loading and return and other data required for the testing were assigned and stored. The fiber was loaded gradually and was observed till the end of break. The experimental data were recorded for further analysis. In order to compare the results of Areca, similar tensile tests were carried out for natural coir also. A seasoned coconut was taken and coir were removed and dried for about 5 days and tested in the same testing conditions of Areca. The diameters of the areca fibers vary from 0.3188 to 0.465 mm. About 150 samples were carried out and average values of the properties are reported.

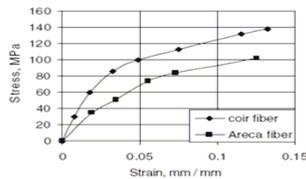


Fig 3. Stress-Strain Diagram of Areca & Coir Fibre

Tensile strength, Young's modulus, and elongation at break were evaluated. The results shows that the ultimate stress is around 85–101.85 MPa with 11–12.5% elongation at break. The curve of this stress-strain diagram for the areca fibers is identical and the nature of fracture exhibit like a ductile fracture. The Scanning electron microscope picture of the fracture surface is shown in the figure. It appears like a honey comb structure with micro vascular tubules. The Young's modulus varies in the range of 1100–1240MPa. Whereas the tensile experiment conducted on coir shows that the ultimate stress is around 110–138 MPa with 11.5–13.25% elongation at break. The Young's modulus for the coir is 2560–3620 MPa for the region up to the approximate linearity on graph. The ultimate strength and Areca elongation at break of Areca fiber is slightly lesser than the coir fiber.

2.1.1 CHEMICAL PROPERTIES

Areca fibers contain 13 to 24.6% of lignin, 35 to 64.8% of hemicelluloses, 4.4% of ash content and remaining 8 to 25% of water content. The fibers adjoining the inner layer are irregularly lignified group of cells called hard fibers and the portions of the middle layer contain soft fibers. Table 1 compares the chemical composition of Areca fiber with some other important natural fibers. Areca fiber is highly hemi cellulose and is much greater than that of any other fibers. Coir has a higher lignin content than fibers. And sisal fiber has higher cellulosic content compared to Banana, sisal, and other fibers. Lignin and hemicelluloses in maize stalk fibers are considerable to cellulose with areca fibers. Properties of natural fibers depend mainly on the nature of the plant, locality in which it has grown, age of the plant, and fiber extraction method used. Areca fibers are hard and show similarity to coir fibers in cellular structure. The unmanaged green Areca husks left in the plantation lead to bad odors and other decay-related environmental problems. Therefore extensive planning for the disposal of this material is required. The present use of this highly hemi cellulose material is as a boiler fuel when sufficiently dried.



Fig 2. Areca Nut Fibre

2.1.2 STRENGTH OF ARECA NUT FIBERS

For any structural material the strength must be confirmed in order to satisfy the requirements of application. In nature, most of the natural fibers exhibit better tensile strength than flexural strength. Here, the tensile strength of Areca fiber is determined and compared with the other well-known natural coir fibers. A variable load of 0.1N to 50N with adjustable platform speed from 5 to 200 mm/min. Separated Areca fiber was fixed in a paper support so that the Areca fiber should not be twisted or broken during fixing into the jaws. The gauge length of test specimen was maintained at 20 mm in all the experiments. The specimen along

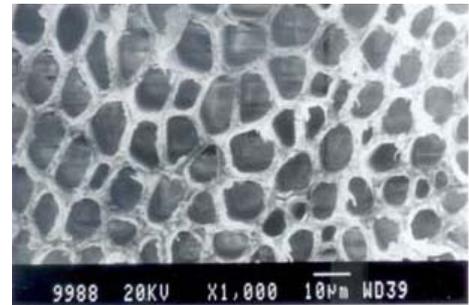


Fig 4. Sem Image of Areca Fibre Surface

2.1.3 DIMENSIONS AND DENSITY OF ARECA NUT FIBRE

Natural fibers exhibit considerable variation in diameter along with the length of individual filaments. Quality and other properties of fibers depend on factors such as size, maturity, and processing methods adopted for the extraction of fiber. Properties such as density, electrical resistivity, ultimate tensile strength and initial modulus are related to the internal structure and chemical composition of fibers. Desirable properties for fibers include excellent tensile strength and modulus, high durability, low bulk density, good mold ability and recyclability. The density of areca fibers was determined by measuring the mass and volume of a bunch of fibers.

2.1.4 PHYSICAL PROPERTIES OF ARECA NUT FIBER

Diameter (mm) - 0.285 to 0.89

Length of fiber (mm)

Short - 18 to 29

Medium - 30 to 38

Long - 39 to 46

Average - 29 to 38

2.2 ABOUT COTTON FIBRE

Cotton today is the most used textile fiber in the world. Its current market share is 56 percent for all fibers used for apparel and home furnishings and sold in the U.S. Another contribution is attributed to nonwoven textiles and personal care items.

It is generally recognized that most consumers prefer cotton personal care items to those containing synthetic fibers. World textile fiber consumption in 1998 was approximately 45 million tons. Of this total, cotton represented approximately 20 million tons.

2.2.1 CHARACTERISTICS OF COTTON

Cotton, as a natural cellulosic fiber, has a lot of characteristics, such as;

- Comfortable Soft hand
- Good absorbency
- Color retention
- Prints well
- Machine-washable
- Dry-cleanable
- Good strength
- Drapes well
- Easy to handle and sew

2.2.2 END USES OF COTTON

- Apparel - Wide range of wearing apparel: blouses, shirts, dresses, childrenswear, active wear, separates, swimwear, suits, jackets, skirts, pants, sweaters, hosiery, neckwear.
- Home Fashion - curtains, draperies, bedspreads, comforters, throws, sheets, towels, table cloths, table mats, napkins

2.2.3.3 MICRONAIRE

Micronaire measurements reflect fiber fineness and maturity. A constant mass (2.34 grams) of cotton fibers is compressed into a space of known volume and air permeability measurements of this compressed sample are taken. These, when converted to appropriate number, denote Micronaire values.

COTTON RANGE	MICRONAIRE READING
Premium	3.7-4.2
Base Range	4.3-4.9
Discount Range	>5.0

2.2.3.4 COLOR

The color of cotton samples is determined from two parameters: degree of reflectance (Rd) and yellowness (+b). Degree of reflectance shows the brightness of the sample and yellowness depicts the degree of cotton pigmentation. A defined area located in a Nickerson-Hunter cotton colorimeter diagram represents each color code. The color of the fibers is affected by climatic conditions, impact of insects and fungi, type of soil, storage conditions etc. There is five recognized groups of color: white, gray, spotted, tinged, and yellow stained. As the color of cotton deteriorates, the process ability of the fibers decreases.

2.2.3.5 TRASH

A trash measurement describes the amount of non-lint materials (such as parts of cotton plant) in the fiber. Trash content is assessed from scanning the cotton sample surface with a video camera and calculating the percentage of the surface area occupied by trash particles. The values of trash content should be within the range from 0 to 1.6%. Trash content is highly correlated to leaf grade of the sample.

2.3.4 CHEMICAL PROPERTIES OF COTTON

2.2.3 PHYSICAL PROPERTIES OF COTTON

2.2.3.1 FIBER LENGTH

Fiber length is described as "the average length of the longer one-half of the fibers (upper half mean length)" This measure is taken by scanning a "beard " of parallel fibers through a sensing region. The beard is formed from the fibers taken from the sample, clasped in a holding clamp and combed to align the fibers. Typical lengths of Upland cottons might range from 0.79 to 1.36in.

Length uniformity or uniformity ratio is determined as " a ratio between the mean length and the upper half mean length of the fibers and is expressed as a percentage". Typical comparisons are illustrated below.

LENGTH UNIFORMITY	UNIFORMITY INDEX [%]
Very High	>85
High	83-85
Intermediate	80-82
Low	77-79
Very Low	<77

2.2.3.2 FIBER STRENGTH

Fiber strength is measured in grams per denier. It is determined as the force necessary to break the beard of fibers, clasped in two sets of jaws, (1/8 inch apart). Typical tensile levels are illustrated. The breaking strength of cotton is about 3.0-4.9 g/denier, and the breaking elongation is about 8-10%.

DEGREE OF STRENGTH	FIBER STRENGTH [g/tex]
Very Strong	>31
Strong	29-30
Average	26-28
Intermediate	24-25

Cotton swells in a high humidity environment, in water and in concentrated solutions of certain acids, salts and bases. The swelling effect is usually attributed to the sorption of highly hydrated ions. The moisture regain for cotton is about 7.1-8.5% and the moisture absorption is 7-8%.

Cotton is attacked by hot dilute or cold concentrated acid solutions. Acid hydrolysis of cellulose produces hydro-celluloses. Cold weak acids do not affect it. The fibers show excellent resistance to alkalis. There are a few other solvents that will dissolve cotton completely. One of them is a copper complex of cupramonium hydroxide and cupriethylene diamine (Schweitzer's reagent)

Cotton degradation is usually attributed to oxidation, hydrolysis or both. Oxidation of cellulose can lead to two types of so-called oxy-cellulose, depending on the environment, in which the oxidation takes place.

2.3.5 OPTICAL PROPERTIES OF COTTON

Cotton fibers show double refraction when observed in polarized light. Even though various effects can be observed, second order yellow and second order blue is characteristic colors of cellulosic fibers. [10] A typical birefringence value as shown in the table of physical properties, is 0.047.

Table 1. Elements Of Areca And Cotton Fibre

COMPONENTS	ARECA FIBRE	COTTON FIBRE
Cellulose	-	80-90%
Alpha cellulose	53.20%	-
Hemi cellulose	32.98%	4-6%
Proteins	-	0-1.5%
Fats and waxes	0.64%	0.5-1%
Lignin	7.20%	-
Water	-	6-8%
Ash	1.05%	1-1.8%
Other materials	3.12%	-

3. LITERATURE REVIEW

The rapidly changing economic and environmental needs of society are putting ever increasing pressures on the forest industry to "do more with less". In practical terms this means, increasing the conversion and efficient use of wood fibre resources, producing more fibre on a shrinking land base, using environmentally friendly processes and technologies considering the use of non-wood ligno-cellulosic fibres for industrial products. One of the ways the forest industry has responded to the global challenges in fibre utilization and processing efficiency was through the accelerated development of composites. A new environmentally friendly technology for turning agricultural residues like bamboo, rice husk, jute, coconut coirs, bagasse, wheat straw, chir pine needles, cotton stalks, casuarinas leaves, banana stem etc., into quality value-added composite products using conventional formaldehyde-based resins have been developed. The new technology highly favours environmental protection and sustainable development by recovering and re-utilizing organic wastes such as crop residue. Adoption of these technologies also leads to implementation of a green solution as an alternative to crop residues being burnt and disposed into soil. Composites from crop residues eliminates the release of carbon from decaying crop residues into air, which contributes to the global warming through greenhouse effect and also decreases the constantly growing pressure over the forests for wood resources. The crop residues were not being utilized earlier for board production with the use of conventional formaldehyde based resins due to its fibre cells being surrounded by a layer of wax/silica. This layer prevents the water based formaldehyde resins which are widely used today in all plywood industries from forming a sufficiently strong bond between the fibres. However, the new technology enables the destruction of the wax/silica layer by using mechanical high shear forces accompanied by a thermal and chemical treatment. This combined chemi-thermo-mechanical process allows the formaldehyde resins to penetrate and adhere the individual fibres. The panel products produced meets the requirement of strength properties as per the relevant specifications.

3.3 A STUDY OF SHORT ARECA FIBER REINFORCED PF COMPOSITES

3.1 NATURAL FIBER REINFORCED POLYMER BIOCOSITES AND BLENDS: SYNTHESIS, CHARACTERIZATION AND APPLICATIONS.

Polymer natural fibers blends and composites are replacing a number of conventional plastic materials. Betel nut fiber is extracted from the seeds and their composites and blends are prepared with synthetic polymer. Finally their properties and applications were studied with the help of different sophisticated analytical instruments.

Natural fibers are being increasingly used as reinforcement in polymer composites and blends primarily due to their low cost, low density and good sets of mechanical properties. A huge quantity of biowaste such as betel nut (Areca catechu) fiber is found unutilized. The present work reports the use of this rural biowaste, for the first time, as reinforcement in developing polymer composites and blends. The search for more durable and ecologically sound materials is very prominent in a process of technological change that is enveloping the industry. Natural fiber offer many technological and environmental benefits when used to reinforce composites such as high strength and stiffness quality in low density materials.

Betel nut fiber (Areca nut hush fiber) is characterized as extremely strong and light weight. The fibers are predominantly composed of cellulose and varying proportions of hemi cellulose, lignin, pectin and protopectin. Natural fibers are replacing glass fiber in many applications and are achieving equal strength, increased flexibility and low weight. These fibers have special advantages in comparison to other synthetic fiber in that they are abundantly available from a renewable resource and also biodegradable. At the same time they have low density, high toughness and acceptable specific strength properties and good thermal property. The fiber is alkali treated for better result.

3.2 "CROP RESIDUES, THE ALTERNATE RAW MATERIALS OF TOMORROW FOR THE PREPARATION OF COMPOSITE BOARD"

Mechanical properties of the fibers extracted from the areca are determined and compared with the other known natural fiber coir. Further these Areca fibers were chemically treated and the effect of this treatment on fiber strength is studied. 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. Tensile test, moisture absorption test, and biodegradable tests on these laminates were carried out. Properties of these areca-reinforced phenol formaldehyde composite laminates were analyzed and reported.

3.4 ATMOSPHERIC AIR PLASMA TREATMENT OF POLYESTER TEXTILE MATERIALS. TEXTILE STRUCTURE INFLUENCE ON SURFACE OXIDATION AND SILICON RESIN ADHESION

Atmospheric air plasma treatment based on Dielectric Barrier Discharge (DBD) technology has been used to oxidise various polyester material such as film, nonwoven and woven fabric. Oxidation level was studied by wettability in order to follow the polyester polar and dispersive surface energy components. The polyester surface chemical composition was investigated by X-ray Photoelectron Spectroscopy (XPS). Polar groups created at the polyester surface by atmospheric plasma treatment enhance adhesion with silicon resin containing adhesive primer.

For each material structure, a critical treatment power (TP_c) is necessary to obtain the best

3.5 EXPERIMENTAL DETERMINATION OF TENSILE PROPERTIES OF OKRA, SISAL AND BANANA FIBER REINFORCED POLYESTER COMPOSITES

Increasing the needs for different engineering applications invite the development of new materials. In the present research new natural fiber okra was introduced for the preparation of okra fiber reinforced polyester (FRP) composites. Already established fibers sisal and banana were also extracted for the preparation of sisal and banana FRP composites and to determine tensile properties. The tensile properties of okra FRP composites were compared with sisal and banana FRP composites. Hand lay-up technique was used for the preparation of composites. Chemically treated okra fiber reinforced polyester composites at maximum volume fraction showed tensile strength, modulus of 154.17%, 114.13% and specific tensile strength and modulus of 12.26%, 129.82% higher than that of the pure polyester specimen, respectively.

Keywords: Okra fiber, hand-lay up, density, tensile strength, tensile modulus, specific tensile strength, specific tensile modulus.

3.6 OPTIMIZATION OF ULTRASOUND-ASSISTED EXTRACTION OF TOTAL PHENOL FROM BETEL (ARECA CATECHU L.) NUT SEED AND EVALUATION OF ANTIOXIDANT ACTIVITY IN VITRO

Optimization of the ultrasound-assisted extraction technology for total phenol from betel (*Areca catechu* L.) nut seed was carried out. On the basis of one factor tests, the method of response surface analysis with 3 factors including extracting temperature, time and solvent-material ratio on the content of total phenol was adopted. The optimal extracting conditions are as follows: extraction temperature 58°C, extraction time 42 min and solvent-material ratio 53 ml/g. The predicted value and measured value of total phenol was 164.74 mg catechin equivalents/g of betel nut seed (mg CE/g BNS) and 160.95 mg CE/g BNS under this condition, respectively. The results indicate that the obtained model developed by response surface methodology is feasible for practical prediction. The experiments of antioxidant activity showed that the betel nut seed extract presents the strong antioxidant activities to the DPPH

3.7 TENSILE PROPERTIES CHARACTERIZATION OF OKRA WOVEN FIBER REINFORCED POLYESTER COMPOSITES

The present research exploits a new natural fiber namely okra for the preparation of okra fiber reinforced polyester composites. Chemically treated (chemical treatment-2) okra woven FRP composites showed the highest tensile strength and modulus of 64.41 MPa and 946.44 MPa respectively than all other composites investigated in the present research. Specific tensile strength and modulus of untreated and treated okra FRP composites is 34.31% and 39.84% higher than pure polyester specimen respectively.

3.8 PROPERTIES OF UNTREATED ARECA REINFORCED PLASTIC COMPOSITES.

Low-temperature plasma technology—both glow discharge under reduced pressure as well as barrier discharge under normal pressure—are well established in different industrial applications. Since recently, however, the plasma technology is being introduced in textile industry as well. Fields of application are desizing, functionalizing, and design of surface properties of textile fibers. Plasma technology is suitable to modify the chemical structure as well as the topography of the surface of the material. Examples of natural as well as man-made fibers prove the enormous potential of plasma treatment of textile materials. It has proven to be successful in shrink-resist treatment of wool with a simultaneously positive effect on the dyeing and printing. Not only is the chemical structure of the surface modified using different plasma gases but also the topography of the surface. A highly hydrophobic surface with a particular surface topography in contact with water is extremely dust- and dirt-repellent and hence should be also repellent to bacteria and fungi. Man-made fibers to be used under chemical stress are modified with diffusion-barrier layers on their surfaces without modifying the bulk properties; hence, the stability of those fibers is significantly improved.

3.11 STUDY ON THE PERFORMANCE OF HYBRID JUTE/BETEL NUT FIBER REINFORCED POLYPROPYLENE COMPOSITES

The newest research and development results dealing with natural short fiber composites show new possibilities for environmentally-friendly materials. Current production trends clearly indicate the increased use of structural, nonstructural and molded natural fiber based composite panels for many applications. In our present work, two types of short natural fibers, namely jute and betel nut fibers, are employed as fillers for the formation of short fiber reinforced polypropylene composites in difference ratios (fiber content: 3, 5, 10 and 20 wt%) by hot-press moulding technique. Different jute-betel nut reinforced polypropylene hybrid composites were prepared in the ratio of 10:5, 10:10 and 10:15 wt% fiber contents with 85% PP, 80% PP and 75% PP, respectively. Mechanical properties of the composites, i.e., tensile, bending and impact strengths, were investigated. For better compatibility, jute and betel nut fibers were subjected to alkalization and the hybrid composites of alkalized jute/betel nut and PP showed much improved performance with respect to other composites. Water absorption capacity and degradation behavior of the different composites were also studied.

3.12 PHYSICO-MECHANICAL PERFORMANCE OF HYBRID BETEL NUT (ARECA CATECHU) SHORT FIBER/SEAWEED POLYPROPYLENE COMPOSITE

The fiber reinforced plastic composite made of fibres extracted from areca, were prepared using phenol formaldehyde and urea formaldehyde. The composites were prepared with different proportions of phenol formaldehyde or urea formaldehyde and variations in their strengths were analyzed. The cost estimate for the production of composite plates was carried out. Mechanical properties were determined using adhesion tensile test, static bending test and thermal conductivity test.

3.9 EFFECT OF 2-HYDROXYETHYL METHACRYLATE (HEMA) ON THE PERFORMANCE OF ARECA NUT FIBER-REINFORCED LINEAR LOW DENSITY POLYETHYLENE COMPOSITES

Naturally occurring polymers are both abundant and biodegradable. In recent years greater emphasis has been rendered in the development of fiber filled composites based on natural fiber with a view to replacing glass fiber either solely or imparting them for various applications. Areca nut fiber reinforced linear low density polyethylene (LLDPE) based composites (35 wt% fiber) were fabricated by compression molding and the mechanical properties were evaluated. To improve the interfacial adhesion as well as physico-mechanical properties of the composites, the areca nut fiber were treated with 5% solution of 2-hydroxyethyl methacrylate (HEMA) in methanol along with photoinitiator (Darocur-4043, 2%) for 5 min and subjected to various characterization tests. Mechanical properties of HEMA treated areca nut composites were found significantly higher than that of untreated one. Degradation tests of the composites (treated and untreated) were performed in soil at ambient conditions for up to 24 weeks. It was revealed that HEMA treated composite retained much of its original integrity while the untreated one degraded significantly. The interfacial shear strength of the treated and untreated composites was investigated using the single-fiber fragmentation test and it was found to be 7.0 MPa and 4.2 MPa, respectively. The SEM study showed the better dispersion of HEMA treated fiber in LLDPE and increased interfacial adhesion between areca nut fiber and LLDPE with compared to untreated areca nut fiber.

3.10 TREATMENT OF TEXTILE FIBERS

The objective of this research was to investigate the mechanical performance (tensile, bending, and impact properties) of polypropylene (PP) composites filled with betel nut (*Areca catechu*) short fiber (Bn) at different compositions (3, 5, 10, 20, 30wt%), using extruding and hot press moulding technique. Results showed that Bn10:PP90 mixture composite (BnPP) had better performance among the composites prepared. Because of the suitability of seaweed (Sw) as a filler in PP composite, as shown in our previous work, seaweed is subjected to hybridize with betel nut short fiber in PP composite to achieve superior mechanical performance. Water sorption capacity, degradation behavior such as simulating weathering and soil buried test of different composites were also performed.

3.13 STUDY ON THE PERFORMANCE OF HYBRID JUTE/BETEL NUT FIBER REINFORCED POLYPROPYLENE COMPOSITES

The newest research and development results dealing with natural short fiber composites show new possibilities for environmentally-friendly materials. Current production trends clearly indicate the increased use of structural, nonstructural and molded natural fiber based composite panels for many applications. In our present work, two types of short natural fibers, namely jute and betel nut fibers, are employed as fillers for the formation of short fiber reinforced polypropylene composites in difference ratios (fiber content: 3, 5, 10 and 20 wt%) by hot-press moulding technique. Different jute-betel nut reinforced polypropylene hybrid composites were prepared in the ratio of 10:5, 10:10 and 10:15 wt% fiber contents with 85% PP, 80% PP and 75% PP, respectively. Mechanical properties of the composites, i.e., tensile, bending and impact strengths, were investigated. For better compatibility, jute and betel nut fibers were subjected to alkalization and the hybrid composites of alkalized jute/betel nut and PP showed much improved performance with respect to other composites. Water absorption capacity and degradation behavior of the different composites were also studied.

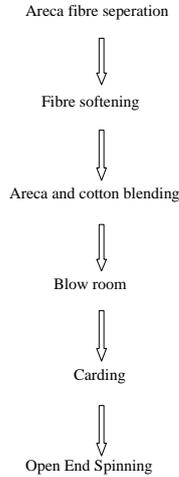
4. MATERIALS AND METHODS

4.1 MATERIALS

1. Areca nut fibre
2. SHANKAR 6 cotton fibre
3. Softening agent (KOH)

4.2 METHODS

4.2.1 PROCESS SEQUENCE



4.2.2 FIBER EXTRACTION

Licker in speed	0.600 rpm
Cylinder speed	900 rpm
Doffer speed	03.6 rpm
Sliver hank	0.7

4.2.6 OPEN END SPINNING

In rotor spinning a continuous supply of fibres is delivered from delivery rollers off a drafting system or from an opening unit. The fibres are sucked down a delivery tube and deposited in the groove of the rotor as a continuous ring of fibre. The fibre layer is stripped off the rotor groove and the resultant yarn wound onto a package. The twist in the yarn being determined by the ratio of the rotational speed of the rotor and the linear speed of the yarn.

Sliver is fed into the machine and combed and individualized by the opening roller. The fibres are then deposited into the rotor where air current and centrifugal force deposits them along the groove of the rotor where they are evenly distributed. The fibres are twisted together by the spinning action of the rotor, and the yarn is continuously drawn from the centre of the rotor. The resultant yarn is cleared of any defects and wound onto packages.

The production rates of rotor spinning is 6-8 times higher than that of ring spinning and as the machines are fed directly by sliver and yarn is wound onto packages ready for use in fabric formation the yarn is a lot cheaper to produce. Rotor spun yarns are more even, somewhat weaker and have a harsher feel than ring spun yarns. Rotor spun yarns are mainly produced in the medium count (30 Ne, 20 tex) to coarse count (10 Ne, 60 tex) range. End uses include denim, towels, blankets socks, t-shirts, shirts and pants.

Selected areca fruit husks were used to prepare the composites. Dried areca husk was soaked in deionised water for about 5 days. The soaking process loosens the fibers and can be extracted out easily. Finally, the fibers were washed again with deionised water and dried at room temperature for about 15 days. The dried fibers are designated as untreated fibers.

4.2.3 FIBER SURFACE TREATMENT

First the extracted areca fibers were treated in a solution of 10% KOH (potassium hydroxide) where the total volume of solution was 15 times the weight of areca fibers. The fibers were kept in this alkaline solution for 36 h at a temperature of 30 °C; it was then thoroughly washed in running water then neutralized with a 2% acetic acid solution. Lastly it was again washed in running water to remove the last traces of acid sticking to it, so that the pH of the fibers is approximately 7 (neutral). Then they were dried at room temperature for 48 h to get alkali treated fibers.

4.2.4 BLOW ROOM PROCESS

The softened areca nut fibre and Shankar 6 cotton fibres were blended at a ratio of 30:70 respectively. And they were mixed thoroughly in blow room and we produced a lap of 20 inches width and 75 inches length from the blow room machine.

4.2.5 CARDING PROCESS

Before the raw stock can be made into yarn, the remaining impurities must be removed, the fibers must be disentangles, and they must be straightened. The straightening process puts the fibers into somewhat parallel CARDING. The work is done by carding machine The lap from pucker unrolls and feed roll passes cotton licker in roll (covered with saw toothed wire).The licker in roll passes fiber against cleaner bars and gives it up to large cylinder which passes between the thousands of fine wires on surface of cylinder and on flats. The doffer comb vibrates against doffer cylinder and takes lint off in a filmy web that passes through condenser rolls, coiler head, and then into can.

Table2. Card Parameters

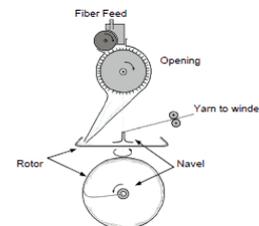


Fig 5. Mechanism Of OE Spinning

Open-end spinning produces a different type of yarn to ringframe spinning. Open-end yarns tend to be more uniform, lower in strength, more extensible, bulkier, more abrasion resistant and more absorbent. It is likely then with all of these differences, only some of which are beneficial, that open-end spinning will not replace ringspun yarn as originally thought, but will be a complimentary product.

Open-end spinning operates at a rate up to five times that of ring spinning and can be effectively used for cotton, polyester-cotton blends, as well as other short and medium staple systems. So we decided to process these medium staple areca nut fiber through Open-end spinning to produce a yarn at a count of 10s Ne.



Fig 6. Open End Spinning Machine

Table 3. Open End Spinning Settings

Rotor speed	25,000 rpm
Count	10s Ne
Feed hank	0.7 Ne
Twist	26 TPI
Twist direction	'Z'
Open roller speed	8000 rpm
Yarn length	5000 m

5. RESULTS AND DISCUSSIONS

Table 4 Single Yarn Tenacity and Elongation (UTR)

(As Per Uster Standard Methods)

Sample Particulars	10s 70:30 cotton Arecanut Fibre
Actual Strength (g)	710.2
CV% Of Strength	27.91
%Elongation	21.07
CV% Of Elongation	18.13
RKm(g/tex)	12.02

Table 5 TPI Of OE Single Yarn

TPI	21.68
CV% Of TPI	8.67
Direction	Z

Table 6 Lea Count With CV%

(As Per ASTM D 1907-01)

Actual Count (Ne)	6.68
CV% Of Count	7.3

5.1 Test Report

THE SOUTH INDIA TEXTILE RESEARCH ASSOCIATION
SITRA PHYSICAL LABORATORY
 13/37, Avanashi Road, Aerodrome P.O., Coimbatore - 641 014, INDIA.
 Ph : (0422) 2574367-9, 6544188, 4215333 Fax : (0422) 2571896, 4215300
 E-mail : sitraindia@dataone.in sitra@vsnl.com Website : http://www.sitra.org.in
 Address all correspondence to the Director ISO/IEC 17025 : 2005 NABL ACCREDITED Cert. Number : 1-358

Yarn Report No. : 31 Mr. Aditya Singhania

Samples Tested at : R.H. 60% +/- 2% and Temp. 21 Degree C +/- 1 Degree C

Sample No. Y_38

Sample Particulars	10s 70:30 COTTON ARECANUT FIBRE ONE CHEESE			
Single Yarn Tenacity and Elongation (UTR) (As per Uster Standard Method)				
Actual Strength (g)	710.2			
CV% of Strength	27.91			
% Elongation	21.07			
CV% of Elongation	18.13			
RKm (g/tex)	12.02			

End of Report

Page 2 of 2

R. Manjath

THE SOUTH INDIA TEXTILE RESEARCH ASSOCIATION
SITRA PHYSICAL LABORATORY
 13/37, Avanashi Road, Aerodrome P.O., Coimbatore - 641 014, INDIA.
 Ph : (0422) 2574367-9, 6544188, 4215333 Fax : (0422) 2571896, 4215300
 E-mail : sitraindia@dataone.in sitra@vsnl.com Website : http://www.sitra.org.in
 Address all correspondence to the Director

Yarn Report No. : 31 Mr. Aditya Singhania

Samples Tested at : R.H. 60% +/- 2% and Temp. 21 Degree C +/- 1 Degree C

Sample No. Y_38

Sample Particulars	10s 70:30 COTTON ARECANUT FIBRE ONE CHEESE			
TPI of OE Single Yarn				
TPI	21.68			
CV% of TPI	8.67			
Direction	Z			
Lea Count with CV% (As per ASTM D 1907-01)				
Actual Count (Ne)	6.68			
CV% of Count	7.3			

End of Report

Page 2 of 2

R. Manjath

6.CONCLUSION

Hence we come to an conclusion with the successful fulfillment of our objectives for the project, in the production of yarn from Cotton and Areca nut fibre blend (70:30 ratio) and also the testing of the resulting yarn.

The 70% cotton and 30% of Arecanut fibre combination gives better yarn

Arecanut fibre gives less stress strain curve compared to coir fibre

The blended (70:30) C/A yarn gives good strength

The blended C/A yarn gives high strength cv%(27.91)

The blended C/A yarn gives good elongation (21.07) and elongation cv%(18.13).

7.REFERENCE

1. Andrzej K. Bledzki, Wenyang Zhang. *Journal of Reinforced Plastics and Composites*, 20 (2001) 1263-1274.
2. Kaleemullah, S., John Gunasekhar, J. *Biosystems Engineering*, 82 (2002) 338.
3. Rasheed, S., Dasti, A.A. Pak. *J. Biological Science*, 6 (2003) 840-843.
4. Akhila Rajan, Jayalakshmi Gopinadha Kurup. *Biochemical Engineering Journal*, 25 (2005) 237-242.
5. Guinez, D., C. proceeding of the 8th polymers for advanced technologies, Hungria (2005).
6. Abdullah-Al-Kafi. *Journal of Reinforced Plastics and Composites*, 25 (2006) 575-588.
7. Prasad, S.V., Pavithran, C., Rohatgi, P.K. *Journal of Material Science*, 18 (1983) 1443-1454.
8. Mohanty, A.K., M. Misra, L.T. Drzal. *Composite Interfaces*, 8 (2001) 313-343.
9. Kalaprasad, W.G., Bejoy Francis, Selvin Thomas. *Polymer International*. 53 (2004)1624 – 1638.
10. R.P Swamy, C. Mohan Kumar, Y. Vrushabhendrappa, *Journal of Reinforced Plastics and Composites*. 23 (2004) 1372-1382.
11. Natural Fiber Based Hybridized Composites, An Overview .K.G.Saytanarayan et al Proc. ACUN-5 ,2006, 438-451.
12. Mechanical Properties of Composites Made of Pineapple Leaf Fiber and Polyester. R. Ladchumanandavisavam et al Proc. ACUN-5, 2006, 452-461.
13. Banana Fiber as Potential Reinforcement in Polymer Matrix, Sabu Thomas, et al Proc. ICCP-2007, 335-349.